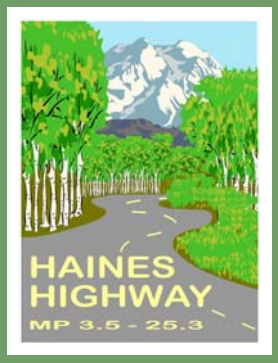

HAINES HIGHWAY

MILEPOST 3.5 to 25.3

PRELIMINARY ENGINEERING REPORT

FEBRUARY 2010

DOT&PF PROJECT NO. 68606
HAINES, ALASKA

PRELIMINARY ENGINEERING REPORT

HAINES HIGHWAY MILEPOST 3.5 to 25.3

Project Numbers 68606/SHAK-095-6(28)

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LIST OF ACRONYMS

3R ..... Resurfacing, Restoration, and Rehabilitation
AADT ..... annual average daily traffic
AASHTO ..... American Association of State Highway and Transportation Officials
ADF&G ..... Alaska Department of Fish and Game
ADT ..... average daily traffic
A_h ..... historical accident rate
AHPM ..... Alaska Highway Preconstruction Manual
A_p ..... predicted rate
AP&T ..... Alaska Power and Telephone
ATS ..... average travel speed
CFR ..... Code of Federal Regulations
CIP ..... cast-in-place
DEC ..... State of Alaska Department of Environmental Conservation
DNR ..... State of Alaska Department of Natural Resources
DOT&PF ..... State of Alaska Department of Transportation and Public Facilities
DOWL HKM ..... previously doing business as DOWL Engineers
FHWA ..... Federal Highway Administration
HEC-RAS ..... Hydrologic Engineering Centers River Analysis System
IPEC ..... Inside Passage Electric Cooperative
LOS ..... level of service
MEV ..... million entering vehicles
MP ..... milepost
mph ..... miles per hour
MVM ..... million vehicle miles
NEPA ..... National Environmental Policy Act
PER ..... Preliminary Engineering Report
PTSF ..... percent time-spent-following
ROW ..... right-of-way
STIP ..... State Transportation Improvement Plan
USACE ..... United States Army Corps of Engineers
USCG ..... United States Coast Guard
vpd ..... vehicles per day

1.0 INTRODUCTION

1.1 Objective and Purpose

This Preliminary Engineering Report (PER) was prepared in support of the Haines Highway Mileposts (MP) 3.5 to 25.3 project (see Figure 1 for Location and Vicinity Map). The State of Alaska Department of Transportation and Public Facilities (DOT&PF) is proposing to upgrade the Haines Highway from MP 3.5 to 25.3. Haines Highway connects the Alaska Marine Highway System in Haines with Interior Alaska and Canada. The goal of this project is to bring this portion of the Haines Highway up to National Highway System standards for design speed 55 miles per hour (mph) by realigning, widening, and straightening portions of the roadway. These upgrades will improve the safety and flow of the roadway and will make this segment of the road consistent with the rest of the Haines Highway. This project is being completed in accordance with Federal Highway Administration (FHWA) guidelines in order to qualify for federal funding.

The purpose of this PER is to evaluate the preferred alternative that was established as part of the previously Updated Alignment Study, April 2009. This project will be analyzed following the DOT&PF *Alaska Highway Preconstruction Manual* (AHPM) guidelines for Resurfacing, Restoration, and Rehabilitation (3R) projects that are applicable to upgrades of an existing roadway on the same or modified alignment.

1.2 History and Project Background

Haines Highway, also known as Highway 7, was originally built in 1943. The highway stretches 160 miles from Haines to Haines Junction, Yukon Territory, of which 42 miles are in Alaska. In conjunction with the Alaska State Ferry System, Haines Highway is one of three vehicular routes between Alaska and the Continental United States. Haines Highway is one of two major highways (the other being Klondike Highway out of Skagway) that connects the Alaska Marine Highway System with Interior Alaska. The project corridor starts at MP 3.5 located just north of Haines Airport and generally follows the north bank of the Chilkat River. The project length is 21.8 miles and ends approximately 1.5 miles past Wells Bridge that crosses the Chilkat River. Haines Highway is one of three Scenic Byways in Alaska and has an average daily traffic (ADT) of approximately 460 vehicles per day (vpd).

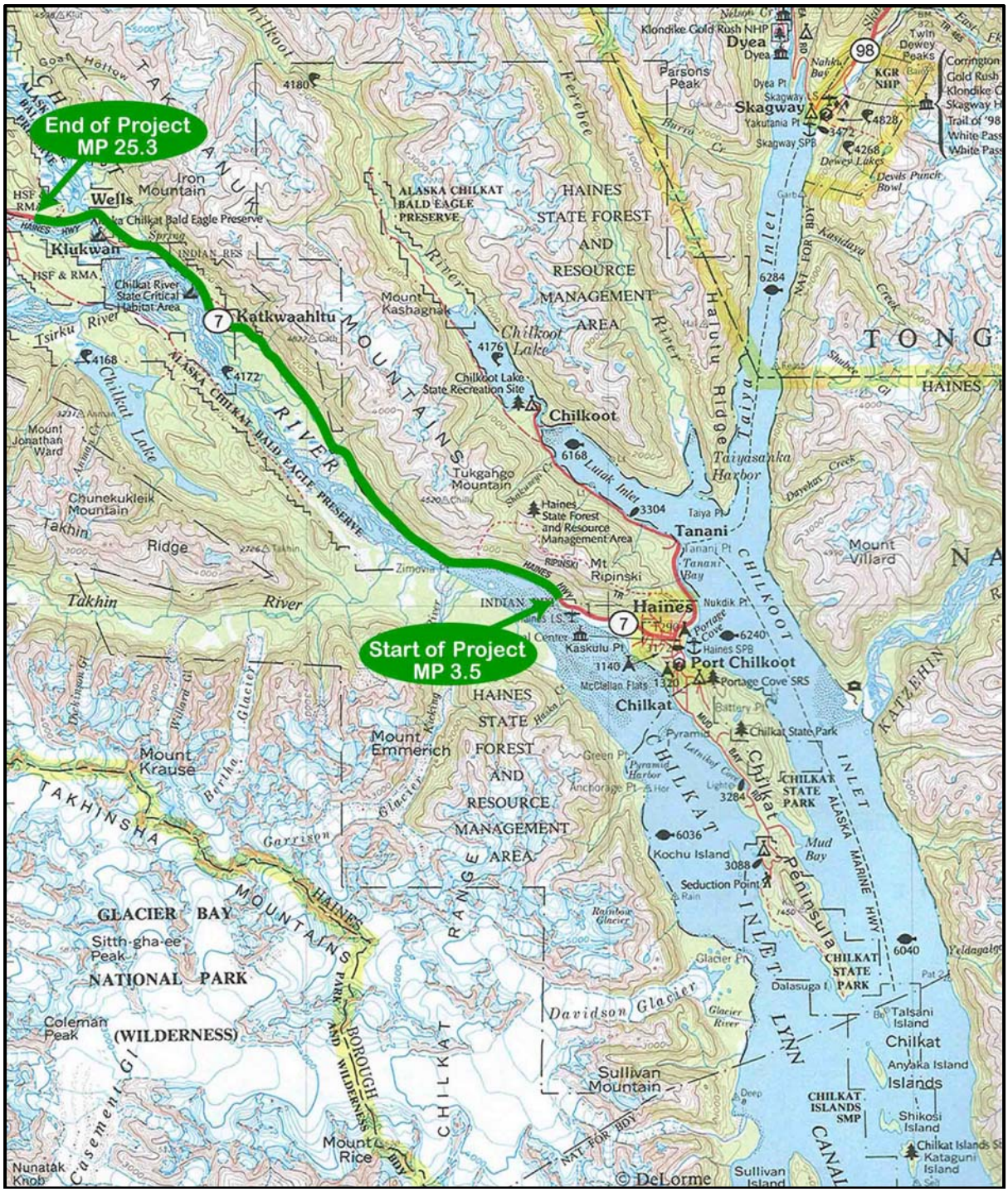

Figure 1: Location and Vicinity Map

Haines Highway routes through the Chilkat Bald Eagle Preserve created in 1982 to protect the world's largest concentration of Bald Eagles. MP 18 to 24 is the main viewing area for eagle watchers and is considered critical habitat in the preserve. A turnoff at MP 21.5 leads to Klukwan, a village of approximately 130 residents.

The segment from Union Street (within Haines proper) to the airport was upgraded in 1998; the segment between MP 25.5 to Little Boulder Creek was upgraded in 2000; the segment between Little Boulder Creek and Big Boulder Creek was upgraded in 1993; and the segment from Big Boulder Creek to the border was upgraded in 2001. This project will upgrade the last segment of Haines Highway (on the United States side of the border) to current design standards. Construction will likely be phased to accommodate available funding.

2.0 EXISTING CONDITIONS

2.1 Facilities

Haines Highway from MP 3.5 to 25.3 is designated as a rural principal arterial highway. The existing roadway consists of two 12-foot-wide paved travel lanes with 2-foot-wide paved shoulders (see Figure 2). No separate facilities are provided for pedestrians or bicycles, except for a separated pathway on the river side of the road near the Bald Eagle Council Grounds viewing areas.

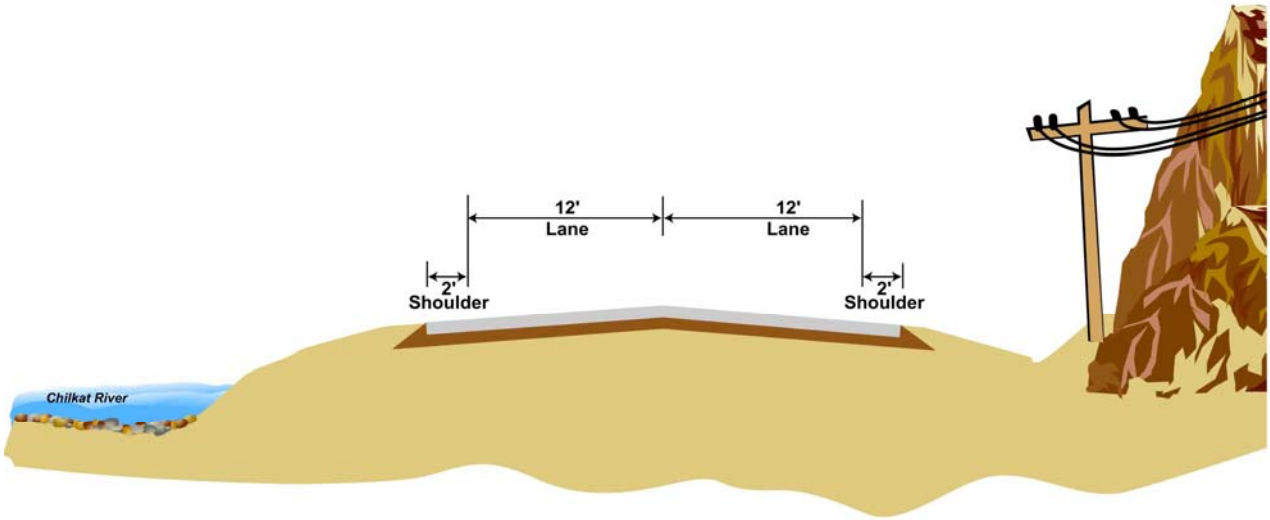

Figure 2: Haines Highway MP 3.5 to 25.3 Existing Typical Section

The terrain is considered rolling. The alignment is posted at 55 mph, although most aspects of the roadway and shoulder widths, and most horizontal and vertical curves, tangents between curves, clear zones, and horizontal and vertical sight distances do not meet current criteria for a 55-mph design speed. Drainage is collected in roadside swales and outfalls to the Chilkat River.

2.2 Pavement Condition

The existing pavement is in fair condition. The first half-mile of the project, MP 3.5 to 4, shows signs of fatigue and cracking. The 2003 Road Pavement Report gives this section a Pavement Serviceability Rating of 1.6 that indicates major rehabilitation or reconstruction is needed. The Road Pavement Report also notes the wearing course life varies from 0 to 7 years with approximately 60% having a wearing course life of 3 to 4 years.

2.3 Traffic Conditions

The 2007 ADT for the corridor, based on DOT&PF traffic data, is 460 vpd.

A level of service (LOS) analysis was performed on the Haines Highway MP 3.5 to 25.3 segment using the *Highway Capacity Manual* and software, HCS2000. Two criteria define LOS for a two-lane rural highway; percent time-spent-following (PTSF) and average travel speed (ATS). PTSF represents the freedom to maneuver and the comfort and convenience of travel. It is the average percent of travel time that vehicles must travel behind slower vehicles due to the inability to pass. ATS reflects the mobility.

The following base conditions assumed in the LOS analysis were:

- 12- foot travel lanes,
- 2-foot paved shoulders,
- 84% no-passing zones,
- No passing lanes,
- 15% trucks, and 2% recreational vehicles,
- Rolling terrain,
- One access point per mile, and
- A base free-flow speed of 60-mph.

The above base conditions were then evaluated to determine ATS and PTSF, the key factor in LOS. LOS can be determined as two-way and directional (LOS for each direction). The existing corridor was analyzed using two-way analysis. A directional LOS analysis is only needed when passing lanes exist. Appendix C shows the detailed work sheet for the LOS analysis. Table 1 summarizes the 2007 LOS.

Table 1: 2007 Existing Corridor Level of Service

Analysis	AADT	% No-Passing Zones	ATS	PTSF	LOS
2007	460	84%	56.1 mph	6.2%	A

2.4 Right-of-Way

The existing right-of-way (ROW) throughout the corridor varies from 120 or 300 feet wide and traverses low-density residential/commercial areas as well as state forest and preserve areas.

2.5 Existing Utilities

The present roadway corridor also serves as a corridor for existing utilities that provide power and telecommunications to the City of Haines and the Chilkat Valley. The following is a list of the primary utilities and their major segments that may be affected within the project corridor:

2.5.1 Alaska Power and Telephone (AP&T)

- MP 3-5
  - Overhead power, overhead telephone, and fiber-optic telephone
- MP 5-10
  - 100 pair buried copper cable in conduit
  - 12-strand fiber-optic cable in conduit
- MP 10-22
  - 24-strand fiber-optic cable in conduit
- MP 22-25
  - 200/300 pair buried copper cable in conduit
- Central telecommunication offices are in Haines and at MP 22

2.5.2 Inside Passage Electric Cooperative (IPEC)

- MP 10-25
  - 7,200 kilovolts buried electric cable in conduit

2.5.3 Haines Cable

- MP 3-5
  - Overhead coaxial cable television

Vertical or horizontal realignment may result in cut or fill conflicts with existing utilities. Relocation of utilities will require coordination during the project design and construction phases. Impacts to fiber-optic lines often require long stretches to be replaced to minimize splicing. For purposes of this PER, the fiber-optic line was assumed to have to be relocated if the new road alignment was incident to the utility line.

3.0 DESIGN STANDARDS

The analysis standards that were used in analyzing the Haines Highway corridor were based on many sources including the following publications and documents:

- *"A Policy on Geometric Design of Highways and Streets,"* American Association of State Highway and Transportation Officials (AASHTO), 2001.
- *"Highway Capacity Manual,"* Transportation Research Board, National Research Council, 2000.
- *"Highway Preconstruction Manual,"* DOT&PF, January 2005.
- *"Alaska Traffic Manual Supplement"*, DOT&PF, 2005.
- *"Manual on Uniform Traffic Control Devices, 2003 Edition,"* United States Department of Transportation, FHWA, 2003.
- *"Roadside Design Guide,"* AASHTO, 2006.

3.1 Design Speed

The design speed is defined by AASHTO as "the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern" (AASHTO, 2001). AASHTO recommends design speeds to be designed with respect to the functional classification of the highway, anticipated operating speed, and topography. The design speed along adjacent road segments was also taken into consideration for purposes of road continuity. For these reasons, the design speed for the Haines Highway has been established at 55 mph.

3.2 Design Criteria

The criteria used in the design for these alternatives can be found in Appendix A.

4.0 SAFETY ANALYSIS

A safety analysis evaluating the existing and future traffic conditions was performed at all intersections within the project corridor. The analysis consisted of the following aspects:

- Intersection crash history,
- Segment crash history,
- Geometric analysis, and
- Moose crash history.

4.1 Intersection Crash History and Analysis

This analysis was used to identify areas of high crash rates and to categorize the types of crashes that most commonly occur. A summary of all reported crashes over a 10-year period from January 1, 1998, through December 31, 2007, was obtained from the DOT&PF Southeast Region and is listed in Appendix D. Table 2 summarizes the crash histories for all the intersections with reported crashes from 1998 to 2007. Note from MP 21 to 25, 1994, through 2003 crash data was used as newer data was not available.

As shown in Table 2, the majority of the crashes during the 10-year study period were either overturn crashes or collisions with objects such as ditches and embankments.

In addition to collision types, the crash data lists the governing environmental conditions at the time of each collision. The environmental conditions stated include lighting and roadway surface conditions. Table 3 summarizes the number of crashes that occurred for each of the environmental conditions noted above.

Intersection accident rates are expressed in accidents per million entering vehicles (MEV). The following equation is used to calculate the actual intersection accident rate:

Accident Rate (Accidents/MEV) = (Total Accidents*1,000,000)/[AADT*365* # of Years]

Table 2: Intersection Crash History
(January 1, 1998, through December 31, 2007)

Intersection Summary															
Intersection	MP	Number of Crashes	Collision Type									Alcohol Related	Severity		
			Rear-End		Angle	Other							Property Damage Only	Personal Injury	Fatality
			Rear-End	Back Up	Sideswipe	Head-On	Overturn	Pedestrian/ Bicycle	Object						
									Animal	Ditch	Other				
MP 6	5.1	1			1								1		
MP 6.5	5.6	1					1							1	
MP 7	6.2	1					1							1	
MP 8	7.0	1									1		1		
MP 16	15.2	1									1		1		
Klukwan Road	18.0	1					1					1			1
Lower Klukwan Road	21.0	2							1		1	1	1	1	
Wells Bridge	23.2	6					4				2		3	3	
Gilliams Drive	23.3	1					1						1		
MP 25	24.4	1								1			1		
Total		**16**	**0**	**0**	**1**	**0**	**8**	**0**	**1**	**1**	**5**	**2**	**9**	**6**	**1**

Table 3: Intersection Accidents History - Environmental Conditions

Haines Highway Intersection	No. of Crashes	Lighting Conditions				Roadway Conditions					
		Daylight		Dark		Dry		Wet		Snow/Ice	
		No.	%	No.	%	No.	%	No.	%	No.	%
MP 6	1	1	100%	0	0%	0	0%	0	0%	1	100%
MP 6.5	1	1	100%	0	0%	1	100%	0	0%	0	0%
MP 7	1	1	100%	0	0%	0	0%	0	0%	1	100%
MP 8	1	1	100%	0	0%	1	100%	0	0%	0	0%
MP 16	1	1	100%	0	0%	0	0%	0	0%	1	100%
Klukwan Road	1	0	0%	1	100%	0	0%	1	100%	0	0%
Lower Klukwan Road	2	0	0%	2	100%	1	33%	2	67%	0	0%
Wells Bridge	6	5	83%	1	17%	3	50%	0	0%	3	50%
Gilliams Drive	1	1	100%	0	0%	1	100%	0	0%	0	0%
MP 25	1	1	100%	0	0%	1	100%	0	0%	0	0%
	Average		**78%**		**22%**		**50%**		**17%**		**33%**

The average annual average daily traffic (AADT) for the 10-year time frame was calculated as 570 vpd. Table 4 summarizes the crash rates for all intersections that had reported crashes.

Table 4: Number of Reported Crashes
(January 1, 1994, through December 31, 2003)

Intersection	Mile	No. of Crashes	Crash Rate
MP 6	5.122	1	0.48
MP 6.5	5.622	1	0.48
MP 7	6.187	1	0.48
MP 8	7.026	1	0.48
MP 16	15.199	1	0.48
Klukwan Road	17.956	1*	0.48
Lower Klukwan Road	20.978	2	0.96
Wells Bridge	23.233	6	**2.88**
Gilliams Drive	23.263	1	0.48
MP 25	24.445	1	0.48

*Fatality involved alcohol

Table 4 shows the Lower Klukwan Road and the driveways near the Wells Bridge have rather high crash rates for a road with ADT below 600. The Lower Klukwan Road intersection is located in the middle of a horizontal curve. Four out of six crashes at the Wells Bridge were overturn crashes and involved collisions with bridge components. These crashes may also have been influenced by the close proximity of two intersections located at the south entrance to the bridge. The intersections and bridge are also located at the end of a horizontal curve that does not meet standards for a 55-mph design speed.

4.2 Segment Crash History and Analysis

All crashes outside of the intersection influence zones (200 feet) are categorized as segment crashes. Table 5 summarizes the total number, type, and severity of accidents for the Haines Highway MP 3.5 to 25.3 segment.

Table 5: Segment Crash History - Collision Type and Severity

Collision Type											Alcohol Related	Severity		
Rear-End		Angle	Other									Property Damage Only	Personal Injury	Fatality
Rear-End	Back Up	Sideswipe	Head-On	Overturn	Pedestrian/ Bicycle	Object								
						Animal	Ditch	Embank	Guardrail	Other				
3	0	2	0	19	0	11	9	3	5	5	10	38	19	0
5%	0%	4%	0%	33%	0%	19%	16%	5%	9%	9%	18%	67%	33%	0%
57 reported crashes from MP 3.5 to 25.3														

Table 6 summarizes the number of crashes that occurred under various lighting and roadway conditions.

Table 6: Segment Crash History - Environmental Conditions

Lighting Conditions						Roadway Conditions							
Daylight		Dark		Twilight		Dry		Wet		Snow/Ice		Slush	
#	%	#	%	#	%	#	%	#	%	#	%	#	%
34	60%	20	35%	2	4%	20	35%	5	9%	26	46%	6	11%
57 reported crashes from MP 3.5 to 25.3													

The collision types and crash rates were evaluated to identify trends and abnormalities that indicate possible design elements that may be contributing to the number/type of crashes. The segment crash rates are below mitigation levels in the corridor. However, it is worthy of note that 46% of the crashes that occurred were under snow/ice conditions. Upgrading the corridor to meet 55 mph design criteria should improve driver contact on slippery roads and further reduce the crash rate.

Segment crash rates take into account the overall length and AADT of the road segments. Segment crash rates are expressed in crashes per million vehicle miles (MVM). The following equation is used to calculate the segment crash rate:

Crash Rate (Crashes/MVM) = (Total Crashes*1,000,000)/[AADT* # of Years * Link Length]

Historic AADT volumes split into three segments were available for the 10-year period for Haines Highway MP 3.5 to 25.3. Crash rates were evaluated for segments; MP 3.5 to MP 13, MP 13 to MP 21, and MP 21 to MP 25.3. See Table 7 for a summary of the segment crash rates.

Table 7: Segment Crash Rates

Haines Highway Link	Number of Crashes	% Alcohol Related	Crashes Per Year	AADT	Link Length (miles)	Crash Rates
MP 3.5 to MP 13	0	0%	0.00	626	9.03	0.00
MP 13 to MP 21	11	55%	1.22	595	7.40	0.68
MP 21 to MP 25.3	4	25%	0.44	489	5.20	0.43

4.3 Lane and Shoulder Widths

The AHPM evaluates the lane and shoulder widths based on the number of same direction sideswipes, opposite direction sideswipes, and run off road accidents (excluding all intersection accidents) since these type of accidents may be attributed to substandard lane and shoulder widths.

A 3R analysis of the lane and shoulder widths for a rural two-lane paved roadway was performed as outlined in Section 1160.3.2 of the AHPM. The Case I outline for existing roadway widths that are less than required for new construction was followed. Improvements were evaluated based on historical crash rates for a 10-year period (1998 to 2007) versus a predicted rate A_p. The predicted rate was determined using the following formula:

$$A_p = 0.0019\ ADT^{0.882} \times 0.879^{W} \times 0.919^{PA} \times 0.932^{UP} \times 1.236^{H} \times 0.882^{TER1} \times 1.322^{TER2}$$

If the historical crash rate is equal to or less than the predicted rate A_p, then the existing total lane and shoulder width does not require modifications. If the historical crash rate exceeds the predicted rate A_p, then the total lane and shoulder width design is widened by 1 foot on each side for every 10% increment the historical crash rate exceeds the predicted rate A_p. The initial evaluation of pavement widths is shown in Table 8 and in Appendix E.

Table 8: Predicted Rate (A_p) versus Historical Rate (A_h)

Segment	Predicted Accident Rate (A_p) (accidents/month/year)	Historical Accident Rate (A_h) (accidents/month/year)	% Historical Rate Exceeds Predicted Rate A
MP 3.5 to MP 13	0.46	0.00	0%
MP 13 to MP 21	0.44	0.68	50%
MP 21 to MP 25.3	0.37	0.43	20%

The new pavement width was then revaluated using the "3R" analysis with new pavement section. If the adjusted accident rate A_a is equal or less than the predicted rate A_p then no further evaluation is needed. If the adjusted accident rate is greater than the predicted rate A_p then the pavement width requires evaluation under Section 1130 of the AHPM (see Appendix E).

Based on the Table 9 results in comparison with the requirements listed in Section 1130 of the AHPM, the minimum cross-section for this road is 11-foot lanes and 4-foot shoulders. Since these minimum dimensions are below the criteria established by regional policy for Haines Highway, the regional policy of 12-foot lanes and 6-foot shoulders will govern the criteria. This will improve safety in the corridor by constructing MP 3.5 to 25.3 to a standard that is both intuitive to motorists and consistent with the rest of Haines Highway.

Table 9: Predicted Rate (A_p) versus Adjusted Rate (A_h)

Segment	Predicted Accident Rate (A_p) (accidents/month/year)	Adjusted Accident Rate (A_a) (accidents/month/year)	A_a Exceeds A_p
MP 13 to MP 21	0.28	0.34	Yes
MP 21 to MP 25.3	0.30	0.34	Yes

4.4 Moose-Vehicle Collision Analysis

The following moose-vehicle collision analysis was performed based on the Central Region DOT&PF Design Policy dated December 5, 2003. The DOT&PF policy requires a moose-vehicle collision analysis of any rural two-lane highway. Data from the 10-year crash history analysis shows 11 moose-vehicle-collisions (10 within segments and one intersection) in the project corridor.

Moose collisions along one-mile "sliding" segments were analyzed along Haines Highway from MP 3.5 to 25.3 using methods from the DOT&PF 1995 Moose-Vehicle Accident on Alaska's Rural Highways study. Collisions for each 5-year block are listed in Table 10. This data was

then analyzed using 5-year blocks separated by 1 year to average for variable winters. Average daily traffic for the segments range from 460 to 550 vpd.

Table 10: Moose Related Crashes, 1994 to 2003

CDS MP	5-Year Block					
	1994 to 1998	1995 to 1999	1996 to 2000	1997 to 2001	1998 to 2002	1999 to 2003
3.0 to 4.0	0	0	0	0	0	1
8.1 to 9.1	0	1	1	1	1	1
12.7 to 13.7	1	1	1	1	1	1
13.1 to 14.1	1	1	1	1	1	1
13.7 to 14.7	2	2	1	1	1	1
14.6 to 15.6	1	1	0	1	1	1
16.7 to 17.7	2	1	1	2	2	1
17.1 to 18.1	1	0	0	0	0	0
20.7 to 21.7	0	0	0	0	1	2

The rates in Table 10 were compared to the threshold moose-vehicle collision values established by the DOT&PF in 1995 (see Table 11).

Table 11: Moose-Vehicle Collision Threshold

Percentile	Frequency (crashes/mile/5-years)
75	8
95	15

Based on Table 10, no segments meet or exceed the moose-vehicle collision threshold. Therefore, mitigation for moose collisions is not required.

4.5 Safety Analysis Observations and Recommendations

An analysis of 1993 through 2004 crash data, coupled with a geometric analysis of the existing roadway, indicates the following features. Design team recommendations (*shown in italics*) follow each observation.

- Most intersections have relatively low crash rates. The intersections at MP 6.5, Lower Klukwan Road, and the driveways near the Wells Bridge have elevated crash rates for a road with ADT below 600. *3R criteria suggest that the curve (C94) to the Wells Bridge be reconstructed to 55-mph design criteria.*

- All segments have relatively low crash rates. *No safety improvements are required by 3R criteria to improve segment operations.*
- Lane and shoulder widening is required between MP 13 and MP 25.3 based on Case I of the 3R procedure. *Regional policy calls for widening the lanes to 12 feet and shoulders to 6 feet.*
- Two driveways do not meet minimum sight distance criteria due to vertical and horizontal alignment, trees, and other obstructions. *The proposed improvements should strive to clear existing trees and obstructions within the sight triangle of each driveway.*
- No segments between MP 3.5 and MP 25.3 meet or exceed the moose-vehicle collision threshold. *Mitigation is not required.*

5.0 DESIGN ALTERNATIVES

Two alignment alternatives for accommodating the proposed traffic volumes and design speed were developed based on analysis of the existing conditions, crash data, design criteria, future traffic volumes, and estimated construction cost.

5.1 Alternative 1 - No-Build Alternative

Alternative 1 consists of maintaining the existing roadway. No improvements or modifications would be made under this alternative.

5.2 Alternative 2 - Build Alternative

This alternative includes upgrades to the existing cross-section to meet design criteria for a 55-mph design speed. It widens the existing 28-foot-wide section (12-foot lanes and 2-foot shoulders) to a 36-foot-wide section (12-foot lanes and 6-foot shoulders) as shown in Figure 3. See Appendix J for more detailed typical sections.

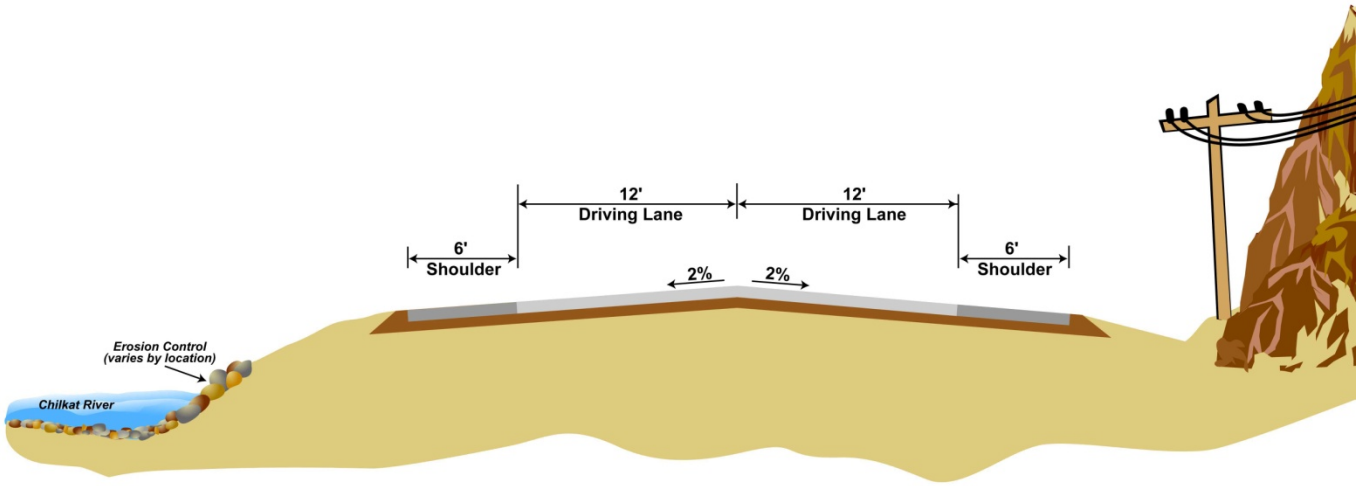

Figure 3: Haines Highway MP 3.5 to 25.3 - Alternative 2 Rendering

The Alternative 2 alignment follows the existing corridor except where criteria for a 55-mph design speed require the road to extend outside of the existing footprint. All existing horizontal and vertical curves were checked for minimum required curve radius, length, and tangents between curves. Roughly 80% of the existing curves require modifications to meet the proposed design criteria (see the Updated Alignment Study, April 2009). However, due to historical village remains found between Stations 657+00 to 665+00, right, the proposed alignment closely follows the existing curves and does not meet 55 mph design speed criteria. Therefore, the section of roadway between approximate Stations 632+70 to 660+45 will have curves with advisory speeds posted at 45 mph.

Major features of Alternative 2 include the following (see conceptual design documents in Appendix J):

- New pavement and structural road section,
- Reconstruct or replace the bridge over the Chilkat River,
- Upgraded access to vehicle pullouts,
- New culverts or bridges at debris flow areas,
- New drainage structures, and
- New signage and striping.

Several design changes to the alignment have occurred since the Updated Alignment Study Report in April 2009. The horizontal and vertical alignment was reevaluated to look at further

potential cost savings by minimizing extreme rock cuts, impacts to environmentally sensitive areas (i.e. eagle nests, the Bald Eagle Preserve designated Critical Habitat Area, Chilkat River, and historical sites).

Curve straightening and tangent lengths (as required for superelevation runoff between curves) to meet the 55 mph design criteria resulted in several realignments that impact the Chilkat River and others that are realigned away from the river. With a few exceptions, most river impact locations occur where riprap/bank stabilization already exists, the river is wide, there is minimal bank vegetation, and/or the realignment is not located within the designated Critical Habitat Area of the Bald Eagle Preserve. Major revisions to the alignment are summarized in the Table 12.

Table 12: Summary of Alignment Changes

April 2009 Alignment Stationing		Current Alignment Stationing		Explanation Of Change
From	To	From	To	
315+00	337+00	288+00	310+00	Moved alignment toward river to reduce rock cut
380+00	385+00	353+00	360+00	Moved alignment toward river to reduce rock cut
437+00	465+00	410+00	438+00	Moved alignment to reduce clearing of eagle roosting trees
471+00	491+00	444+00	464+00	Moved alignment toward river to reduce rock cut
538+00	556+00	512+00	528+00	Moved alignment toward river to lessen impact on private property
785+00	815+00	758+00	788+00	Moved alignment toward river to reduce rock cut
993+00	1002+00	965+00	975+00	Increased curve radius to keep fill limits within ROW
1023+00	1038+00	995+00	1010+00	Moved alignment to reduce clearing of eagle roosting trees
1043+00	1060+00	1015+00	1032+00	Moved alignment to minimize encroachment on eagle nest buffer
1155+00	1180+00	1127+00	1152+00	Moved alignment to minimize encroachment on eagle nest buffer
315+00	337+00	288+00	310+00	Moved alignment toward river to reduce rock cut
380+00	385+00	353+00	360+00	Moved alignment toward river to reduce rock cut
437+00	465+00	410+00	438+00	Moved alignment to reduce clearing of eagle roosting trees
471+00	491+00	444+00	464+00	Moved alignment toward river to reduce rock cut
538+00	556+00	512+00	528+00	Moved alignment toward river to lessen impact on private property
785+00	815+00	758+00	788+00	Moved alignment toward river to reduce rock cut

6.0 CAPACITY ANALYSIS

This capacity analysis compares the No-Build versus the Build Alternative for the design year 2032 based on the standard that the two criteria that define LOS for a two-lane rural highway are PTSF and ATS.

A sight distance analysis was conducted for the design year 2032 for all alternatives to figure what percentage of the corridor has no-passing zones based on 55-mph design criteria. The percentage of corridor with no passing zones is shown in Table 13 along with the LOS summary. See Appendix C for detailed work sheets of the LOS analysis.

Table 13: 2032 LOS Analysis

Alternative	AADT	% No-Passing Zones	ATS	PTSF	LOS
Alternative 1 - No Build	1,000	84%	47.2 mph	34.7%	C
Alternative 2 - Build	1,000	75%	56.1 mph	34.0%	A

Alternative 2 operates at LOS A due to widening of the existing pavement and straightening some segments of the road. It is important to note that although the PTSF slower vehicles is about the same, the ATS increases significantly (closely matching the posted speed) under the Build Alternative.

7.0 MAJOR STRUCTURES

7.1 Wells Bridge

Three bridge options were evaluated by the DOT&PF Bridge Design Section for comparison and review as part of this PER. The options included:

- Option 1: Widen and rehabilitate the existing bridge.
- Option 2: Replace the existing bridge on a parallel roadway alignment.
- Option 3: Replace the existing bridge on the existing alignment.

The review included developing preliminary construction costs and targeted a 75-year design life. The general conclusions of the review are:

- Option 1 is not recommended since the cost to reconstruct the existing structure is higher than the cost to replace it with a new structure.

- Option 2 constructs a parallel bridge approximately 35 feet downstream of the existing bridge. Downstream is the preferred side of the existing bridge to build a new bridge because the crossing is shorter and the scour conditions are more favorable.
- Option 3 removes the existing bridge, constructs a temporary detour/construction staging bridge, and rebuilds the bridge in its existing alignment.
- Option 2 is the lowest cost option because the existing bridge can be used as the detour during construction saving approximately $400,000 in traffic maintenance during construction.
- Option 2 avoids impacts to a potentially historical structure located adjacent to the east side of the south abutment.

The existing bridge can remain during construction as a temporary detour route for the traveling public, but it does not have sufficient capacity to stage construction off of it. Thus, a temporary bridge is required under all options. During construction there are a variety of "means and methods" that can be employed to build bridges. It is often difficult to predict how exactly a contractor will proceed. For purposes of this PER estimate and in support of the environmental document, a temporary work structure and its possible impacts was estimated. The temporary work structure was assumed to include 40-foot long spans with each bent supported by three 24-inch diameter pipe piles. No fill would be placed within ordinary high water, but temporary fill would be required at each end for the contractor to access the temporary work structure.

A Technical Memorandum detailing the review findings and conceptual design plans is included as Appendix H. For the purposes of this PER, Option 2 is assumed to be the preferred alternative since it is the lowest cost alternative and avoids impacts to the adjacent historic structure.

7.2 Other Significant Structures

Haines Highway crosses large alluvial fans at about MP 19 and again at about MP 23. These fans were produced by creeks that normally flow in well-defined channels at low volumes and low velocities. However, periodic rain storms occur over the barren watersheds or remnant snow packs above these fans. These storms increase flow in the streams dramatically and can produce debris flows that cross the highway. Flows that overtop the road occur every 3 to 5 years on

average. The debris flows plug the drain culverts, leave sand and gravel several feet deep on the road surface, and reroute the stream channel.

A geotechnical analysis considered the debris flow mitigation options (DOWL HKM, 2009; see Appendix G). The geotechnical analysis recommended options to achieve two objectives. First, make the road embankment as porous as economically feasible to reduce the potential for material to overtop the road. And second, give the DOT&PF a debris underpass that is more economical to maintain. The DOT&PF needs to be able to push material through the underpass from the upstream side of the roadway to the downstream side. Whichever underpass alternative is chosen, the clear height should be at least 12 feet to allow heavy equipment to transport material through the underpass. The horizontal span should be as wide as reasonably possible to provide the maximum passage during a debris flow event. Three alternatives were evaluated as part of this PER:

1. Multiple-Cell Modular Precast Culvert
2. Cast-In-Place (CIP) Concrete Box Culvert
3. Single-Span Precast Concrete Bridge

These alternatives were compared for their expected performance, initial cost, and ongoing maintenance costs due to debris flows.

Each alternative is summarized below and is discussed in detail in Appendix H.

7.2.1 Conceptual Structure Costs, Ongoing Maintenance Costs, and Recommendations

7.2.1.1 Conceptual Construction Costs

Assumptions for the conceptual costs of each alternative are listed below with the conceptual costs summarized in Table 14. These conceptual costs are per site location.

The multiple-span modular precast culvert alternative consists of the following:

- Two 32-foot span precast concrete arches placed side by side, total transverse length approximately 64 feet;
- Precast concrete wingwalls at upstream and downstream openings;
- A precast headwall on each side;
- Approaches will require approximately 16 feet of fill above existing ground; and

- CIP footing and/or pedestal.

The CIP Concrete Box Culvert alternative consists of the following:

- Two 20-foot span CIP concrete box culverts placed side by side, total transverse length approximately 40 feet;
- Approaches will require approximately 16 feet of fill above existing ground; and
- CIP wingwalls at both openings.

The bridge alternative consists of the following:

- An 85-foot span precast/prestressed concrete girder deck;
- Pile supported foundation;
- Approaches will require approximately 17 feet of fill above existing ground; and
- CIP abutments and wingwalls.

Table 14: Conceptual Structure Costs

Structure Description (per site locus)	Construction Cost
Multiple-Cell Modular Precast Culvert	$ 900,000
CIP Culvert	$ 738,000
Bridge	$ 968,000

7.2.1.2 Conceptual Ongoing Maintenance Costs Due to Debris Flows

The cost of ongoing maintenance due to debris flows is difficult to estimate accurately. These ongoing costs are related to many highly variable factors. These factors include amounts of future rainfall, the future course of existing streams, soil conditions upstream of the roadway, the return interval of future storms, escalation costs of future construction, and many other highly variable factors. Estimates of ongoing maintenance costs are even more difficult to calculate in this case, because of the positive effects of the proposed higher roadway elevation and the proposed expansion of the catchment areas upstream of the highway. DOT&PF Southeast Maintenance and Operations estimates cleanup costs for the worst case slides to be approximately $120,000.

The cost of ongoing maintenance due to debris flows will be significantly reduced no matter which of the three structural alternatives is installed.

7.3 Recommendations

The goal of this project is to keep the traveling public safe, minimize disruptions to traffic, and lower the level of maintenance required after a debris flow event. With this in mind, three significant actions are recommended. First, elevate the roadway by about 13 feet in the debris flow areas. Second, increase the size of the catchment area upstream from the highway in size by widening, lengthening, and deepening the area. Material excavated from the catchment areas can be used to increase the roadway elevation. And third, provide a larger underpass.

Since the highest priority in mitigating the likelihood of a debris flow covering the highway is to elevate the road and the second priority is to provide through capacity, the recommended alternative is the CIP culvert option. This option has the lowest initial cost of approximately $1.5 million for the two sites. This enables the remainder of the funding to be used to raise the road surface an average of 13 feet. The estimated cost of fill to raise the roadway profile is $1.7 million for both sites. The total estimated cost is $3.2 million for the structures and fill at both debris flow sites.

In addition, the CIP culvert option will allow a 12-foot-clear height and two 20-foot-wide openings. This will improve hydraulic capacity and also allow adequate space for heavy maintenance equipment to clean up the debris following a flow event.

Note the cost of the multiple-cell modular precast culvert is estimated to be less than $200,000 higher than the cast-in-place option. While this is significantly more costly on a percentage basis, the $200,000 is relatively small compared to the project's overall costs. The precast option also provides 50% +/- more through width than the CIP option. Although the bridge cost is only $230,000 more than the CIP culvert, the bridge's ability to withstand the horizontal loads and uplift forces of a slide event could result in significant future maintenance or reconstruction cost and is therefore, not recommended.

Future construction phasing and traffic control studies might show that the precast culvert option is preferable due to potential reductions in construction duration and easier ongoing maintenance.

8.0 MATERIAL SITES, DISPOSAL SITES, AND ACCESS ROADS

A site visit was conducted on June 8, 2009, to identify areas along the corridor that may be used as waste disposal sites. It is assumed that borrow material and disposal sites will be located at roughly 5-mile intervals along the road corridor in order to maintain reasonable hauling operations for the contractor. Sites for both borrow and disposal of waste material are envisioned to occur on uplands and previously disturbed areas. The alignment and profile have been adjusted to balance the excavation and fill to the extent practicable, thereby reducing the number of material sites since the majority of the excavated material will be useable for building the road sub-base and can be crushed to produce the base course material as well. Turnouts may also provide an opportunity to dispose of excess material.

The project has been divided into fourths for the purpose of establishing reasonable hauling distances to and from the project site. The proposed new highway is approximately 21 miles long, so each section is 5.25 miles. Each segment has been analyzed to determine overall cut and fill quantities. A summary of the projected cut and fill volumes are shown in Table 15.

Table 15: Material Balance Summary

Segment	Milepost	Cut Volume (cubic yard)	Fill Volume (cubic yard)	Balance (cubic yard)
1	MP 3.5 to 8.75	76,000	225,000	-149,000
2	MP 8.75 to 14	412,000	264,000	148,000
3	MP 14 to 19.25	615,000	351,000	259,000
4	MP 19.25 to 25.3	101,000	213,000	-112,000

The excess material from segment two can be used to fill the difference in segment one. The two segments balance out very closely. The excess from segment three can be used in segment four to make up the difference, but there will still be a surplus of approximately 147,000 cubic yards of material. Several options have been looked at for disposal of this material. Approximately 80,000 cubic yards can be used up at the debris flow sites by widening the road prism 30 feet. The resulting turnout has also been requested by DNR for eagle view parking and picnic sites. Another 40,000 cubic yards can be used between Stations 720+00 and 904+00. These select stations currently are fill areas of anywhere from 4 to 15 feet that can be widened without impacting additional wetland areas or eagle preserve areas. Any additional material that cannot be used on-site can be hauled to the university property located at Mile 24. This property has

been used for a material source and storage site in the past. During the public involvement efforts, several property owners along the project expressed interest in talking to the contractor to receive excess material that may be available.

9.0 EROSION AND SEDIMENT CONTROL

The construction contractor will be required to formulate a Stormwater Pollution Prevention Plan and keep it on-site at all times during construction. The contractor will be required to preserve existing vegetation where practicable and will be required to stabilize all disturbed areas. Stabilization techniques will include seeding, temporary seeding, mulching, geotextiles, and other approved methods. The construction contractor will be required to initiate stabilization measures as soon as practicable.

10.0 HYDROLOGY AND DRAINAGE

The proposed Haines Highway improvement project between MP 3.5 and 25.3 follows the main stem and side channels of the Chilkat River and has 109 culvert crossings, including 6 with twin pipes. A hydrologic and hydraulic study included in Appendix F was completed to evaluate and prepare preliminary designs for stream bank erosion control along the main stem and side channels of the Chilkat River and flood conveyance and fish passage at 15 large diameter culverts and 13 smaller diameter culverts on fish-bearing streams crossing the highway. The Preliminary Hydrology and Hydraulics Report provided information for preliminary design and environmental and permitting actions and was prepared in accordance with the AHPM 1120.5 and the *Alaska Highway Drainage Manual*. Fish passage design followed guidelines in the 2001 DOT&PF and the Alaska Department of Fish and Game (ADF&G) memorandum of agreement for fish passage at culverts. Final designs will be prepared and documented in a final hydrology report that will be submitted during the design phase of this project. A companion Stream and Habitat Inventory was completed in 2006 for the Chilkat River shoreline and fish-bearing stream habitat conditions in areas co-located with or that might be impacted by the highway corridor.

Fieldwork was completed in October 2005 with updates through 2009, to areas experiencing significant change. Locations where the road embankment connected with the main stem or side channels of the Chilkat River were investigated for bank erosion and bed scour conditions. Bed scour depths were estimated using a depth sounder. Scour locations and extents were

approximated using a jet boat where accessible or by wading from shore for the smaller side channels and noted onto project mapping and aerial imagery. A rapid assessment was completed to document the size, length, and condition of each of the 115 culverts located in the field. Topographic survey data were collected at fifteen culverts 48-inch in size and larger, or along streams with high aquatic habitat values, to determine culvert size, length, slope, and upstream and downstream conditions for further hydraulic evaluation. Four of these culverts are located along debris slides at MP 19 and 23 that are addressed in Section 7.2. An additional thirteen smaller culverts are along fish-bearing streams and were evaluated for fish passage as well as flood conveyance.

Estimates of river and tributary hydrologic conditions were made following methods defined in *Alaska Highway Drainage Manual*. These estimates provided design input for fish passage and flood conveyance preliminary designs.

Hydraulic conditions along the main stem and side channels of the Chilkat River were modeled using the United States Army Corps of Engineers' (USACE) one-dimensional Hydrologic Engineering Centers River Analysis System (HEC-RAS) hydraulic model in areas identified to have scour and high energy conditions of concern. Project topography, LiDAR, and scour soundings were used to approximate model cross-sections. The hydraulic modeling results were used to estimate velocity and tractive force for preliminary sizing of erosion protection revetments.

Hydraulic conditions along tributary crossings were modeled using HEC-RAS and the FHWA HY-8 culvert hydraulic analysis program. Fish passage conditions for some of the smaller streams included use of the ADF&G FISHPASS Fish Passage Improvement Program. Hydraulic analysis of some of these smaller culverts indicates that they have insufficient capacity to convey the estimated flows. The flow estimate values are suspect based on the anecdotal reports by DOT&PF maintenance staff that no culvert has flooded since installation in the 1980s due to insufficient capacity. Flooding was reported to be the results of inlets blocked by debris. Considering drainage basin elevation and slope conditions, localized weather conditions, limitations of the methods used to estimate flows and reported satisfactory performance of

existing culverts for flood conveyance, the hydraulic design for replacement culverts included a criterion of providing equal or greater conveyance to existing culverts.

11.0 GEOTECHNICAL RECOMMENDATIONS

An in-depth geotechnical investigation was conducted for this project. The geotechnical efforts included approximately 100 boring locations and 50 test pits. The complete Geotechnical Report is included in Appendix G. A summary of the findings is included below.

11.1 Existing Roadway Section

Along the route, the thickness of the pavement section varied depending on the subsurface conditions. The road section was founded on one or more of the following soil conditions; floodplain deposits of soft silts and loose sands, alluvial deposits of sands and gravels, and bedrock. On average, the road section appeared to consist of the following:

- three inches of asphalt pavement, over
- three feet of Selected Material, Type A, over
- Selected Material, Type B as needed.

No crushed aggregate base course was encountered during the field explorations. In a number of areas, it appeared that Type A material had degraded to Type B. The road embankment appears to have been constructed after the removal of the surficial organics. Any settlement that likely occurred over the years due to the soft, floodplain deposit was probably addressed during pavement repairs over the years.

11.2 New Embankment

The proposed cross-section will follow what was previously constructed on other sections of the highway. The overall design follows the procedure in the AASHTO Guide for Design of Pavement Structures in conjunction with an analysis using BERG2, developed by DOT&PF. The design is based on the project design life and anticipated traffic loads for that period, the roadbed material at the site, and the annual depth of frost, estimated to be a maximum of two feet. Since the roadbed material will vary from bedrock to frost susceptible silts, the thickness of the road section will vary.

11.3 Summary of Observations

The following summarize the major points of the materials analysis. For more detail and station-by-station recommendations, see Appendix G.

- For embankment construction the existing peat can either be removed and replaced with structural fill or overlain with structural fill. Long-term settlement and increased maintenance could be associated with leaving the peat in place. Removal of all the peat from below the embankment is more expensive, but removes the concerns. During the design phases, removal of peat beyond a five-foot depth should be evaluated to determine feasibility of removing all peat or doing an overlay and surcharge.
- Much of the existing fill along the alignment will be reusable in deeper excavations as Selected Material, Type B embankment.
- A separation/stabilization geotextile should be used where Selected Material will overlie soft silts.
- Rock catchment ditches will be needed in areas of steep cut slopes. Blasting may be required. Rock slopes were assumed to be 0.25H:1.0V for purposes of this PER.
- Dewatering will likely be necessary to address surface and subsurface flow into excavated areas.

12.0 PAVEMENT DESIGN

The following pavement design is recommended for this project based on the geotechnical recommendations and for sake of consistency with the segment of Haines Highway from Big Boulder Creek to the Border (Project Number SHAK-095-6(20)):

- 2 inches of Asphalt Concrete, Type II, Class B;
- STE-1 Asphalt for Tack Coat;
- 4 inches of Asphalt Treated Base Course, two 2-inch lifts;
- 12-inch sub-base grading “C”;
- Borrow, Type A, to variable depths up to 3 feet (new alignments and culvert replacements); and
- Shot Rock or Type C Borrow to within 3 feet of the finished road elevation.

13.0 PULLOUTS

The project team coordinated with the DOT&PF and the State of Alaska Department of Natural Resources (DNR) to determine whether existing pullouts should remain or be removed and to determine if new or expanded pullouts were necessary. Appendix I contains figures showing the disposition of the pullout locations and their existing uses, ownership, and design recommendations.

14.0 PEDESTRIAN ACCOMMODATIONS

Pedestrian accommodations in the Haines Highway corridor consist of a short section of roadside trail in the Bald Eagle Council Grounds. This trail is approximately 6 feet wide and is offset from the road by an additional 6 feet from edge of pavement. The trail links the roadside pullouts, rest areas, boardwalks, and interpretive signage at the Council Grounds. The only additional pedestrian accommodations in the corridor are related to the multiple pullouts in the corridor. Each one is designed for vehicles to stop and for pedestrians to be able to get out of their car outside of the Haines Highway traveled way, but no new trails or walkways are associated with these turnouts. Furthermore, no expansions to the existing pedestrian facilities at the Bald Eagle Council Grounds are proposed as part of this project. The road alignment was selected such that the existing trail and buffer will either remain intact or be replaced in similar design.

The Village of Klukwan requested, as part of the public scoping effort, that a trail connection from Klukwan to the roadside trail at the Council Grounds be considered in the design to improve access to the Council Grounds and adjacent subsistence areas. Other than widening the roadway shoulder to accommodate pedestrian safety the scope of the Haines Highway project does not include construction of new pedestrian facilities; however, to keep the trail as an economic possibility pending future funding, the road alignment was shifted slightly away from the river from Station 1062 to 1103 (see conceptual drawings and Figure 4). Assuming a similar design of the trail as exists in the Council Grounds, this shift will enable the future design and construction of a trail connection without significant river fill and clearing of eagle roosting trees between the road and the river. Figure 4 illustrates the area of the requested trail and the minor road realignment to accommodate the future trail.

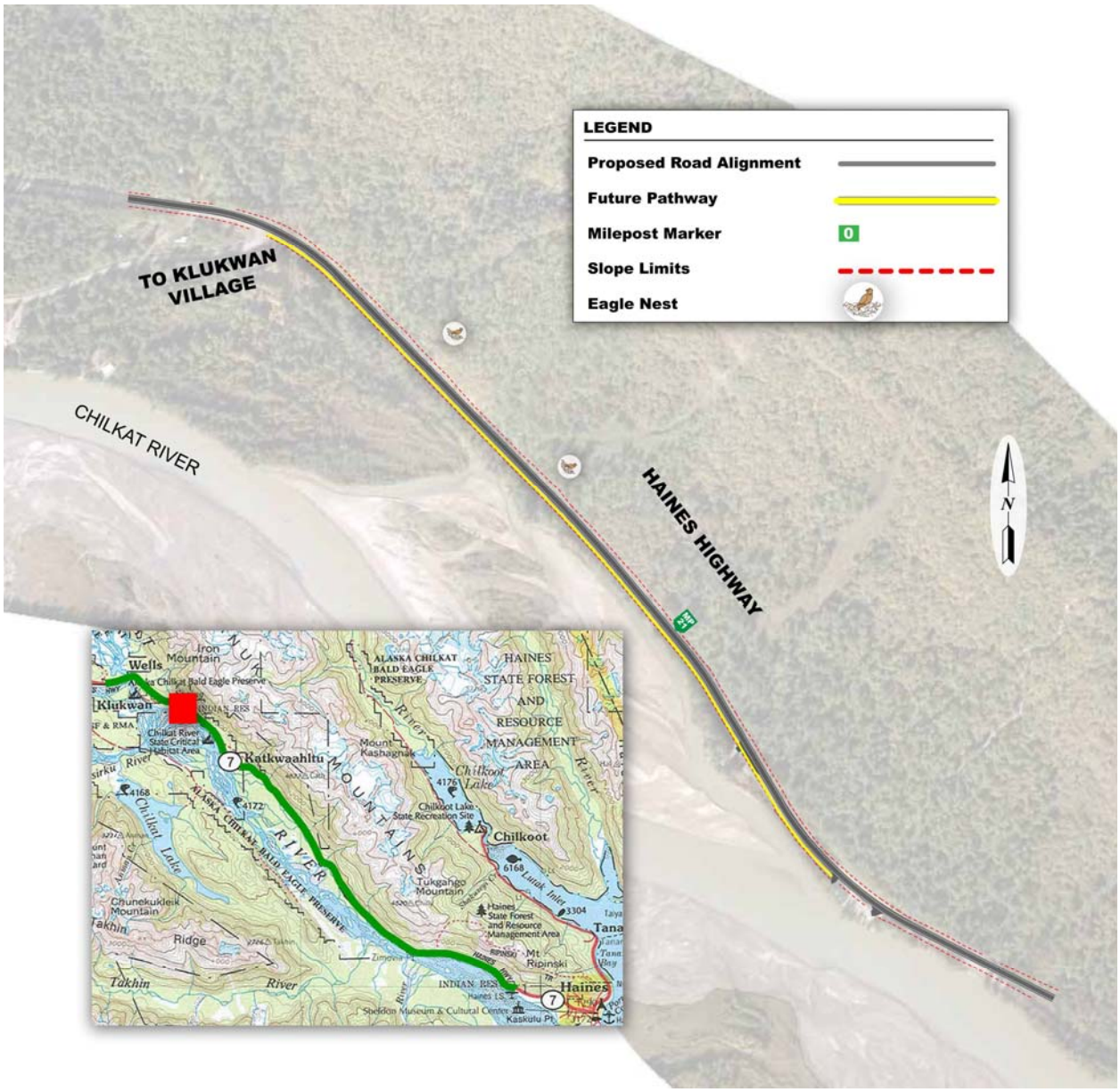

Figure 4: Pedestrian Accommodations

15.0 UTILITY RELOCATION AND COORDINATION

The identified utility conflicts that require relocations are summarized below.

15.1 Existing Utilities

Overhead power, telephone, and fiber-optic telephone belonging to AP&T run from MP 3 to MP 5. Haines cable has overhead coaxial cable television on the AP&T's utility poles that are under built.

From MP 5 to 10, AP&T has a 100 pair buried copper cable and 12-strand fiber-optic cable in the 8-inch steel conduit (previously a military fuel oil line). IPEC also has 7,200 kilovolts buried electric cable from MP 10 to 25 in the 8-inch steel conduit. Also using the 8-inch steel conduit from MP 10 to 22, AP&T has a 24-strand fiber-optic cable; and from MP 22 to 25, AP&T has a 200/300 pair buried copper cable. AP&T has a telecommunications central office in Haines and at MP 22.

15.2 Utility Conflicts

The present roadway corridor serves as a corridor for existing utilities that provide power and telecommunications to the city of Haines and the Chilkat Valley. Due to the design requirements of this project, the roadway alignment will change from the existing alignment requiring relocation or replacement of the utilities. Table 16 shows the stations with the most significant roadway re-alignment areas and the utilities that are impacted.

Table 16: Utility Conflicts

Station Begin	Station End	Utility Affected
192+00	204+00	AP&T, Haines Cable
378+00	496+00	AP&T
500+00	510+00	AP&T, IPEC
588+00	598+00	AP&T, IPEC
680+00	752+00	AP&T, IPEC
808+00	906+00	AP&T, IPEC
962+00	996+00	AP&T, IPEC
1038+00	1074+00	AP&T, IPEC
1162+00	1232+00	AP&T, IPEC

16.0 RIGHT-OF-WAY REQUIREMENTS

The existing ROW throughout the corridor is either 120 or 300 feet wide and traverses low-density residential/commercial areas as well as state forest and preserve areas. From the beginning of project (Station 182+00) to Station 331+00, the ROW width is primarily 120 feet with a few short sections that are 300 feet wide. The remainder of the project is primarily a 300-foot ROW with a few stretches of privately owned land that narrows the ROW to 120 feet wide. The proposed road alignment follows the existing corridor except where criteria for a 55-mph design speed require the road to extend outside of the existing footprint. Many of these locations necessitate the take of additional ROW. A summary of the major ROW requirements

is included in Table 17; however, the DOT&PF's ROW section is still compiling accurate ROW information for this project.

Table 17: Right-of-Way Requirements

Stations	Description
219+00 to 226+00	Eliminated reverse curve
433+00 (near Eagle Preserve)	Straightened roadway
501+00 to 508+00	Adjusted curve to 55 mph design speed
876+00 to 911+00	Realigned roadway
1045+00 to 1050+00	Adjusted curve to 55 mph design speed
1187+00 to 1222+00	Adjusted curve to 55 mph design speed

17.0 COST ESTIMATE

The conceptual cost estimate for Alternative 2, the Build Alternative, is summarized in Table 18. A detailed cost breakdown will be developed during the design process. Due to the overall size of this project, it was assumed for purposes of this PER that the project would be constructed in four phases, each similar in size to what is shown in the draft State Transportation Improvement Plan (STIP) for MP 21 to 25.3. Mobilization costs would decrease and other economies of scale would be achieved if the project were constructed in fewer phases.

Table 18: Engineer's Estimate of Conceptual Construction Costs

PREFERRED ALIGNMENT				
Item	**MP 3.5 TO 10[2]**	**MP 10 TO 16[2]**	**MP 16 TO 21[2]**	**MP 21 TO 25.3[1,3]**
Construction Cost	$23,450,000	$21,790,000	$20,480,000	$24,720,000
15% Contingency	$3,517,500	$3,268,500	$3,072,000	$3,708,000
Construction Cost Subtotal	$26,967,500	$25,058,500	$23,552,000	$28,428,000
10% Construction Engineering[5]	$2,696,750	$2,505,850	$2,355,200	$2,842,800
Subtotal	$29,664,250 (6.5 Miles)	$27,564,350 (6.0 Miles)	$25,907,200 (5.0 Miles)	$31,270,800 (4.3 Miles)
IPEC Utility Relocation	$0	$2,081,026	$1,387,350	$589,624
ROW[4]	TBD	TBD	TBD	TBD
Preconstruction Engineering	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Environmental Mitigation	$322,018	$297,248	$247,706	$213,028
Subtotal	$2,322,018	$4,378,273	$3,635,057	$2,802,651
TOTAL	$31,986,000	$31,943,000	$29,542,000	$34,073,000
4.24% ICAP	$1,356,000	$1,354,000	$1,253,000	$1,445,000
GRAND TOTAL[3]	$33,342,000	$33,297,000	$30,795,000	$35,518,000

Cost Estimate Assumptions:

[1] MP 21 to 25.3 is included in the STIP as a future project.

[2] The project segment assumed.

[3] Assumes Chilkat Bridge Option 2 (replace the existing bridge on a parallel alignment, 35 feet downstream).

[4] ROW acquisition costs are not known at this time since the ROW mapping has not been performed and the utility locations are approximate.

[5] Construction engineering reduced from 15% to 10% based on size of the project.

18.0 ENVIRONMENTAL REQUIREMENTS AND COORDINATION

18.1 Environmental Documentation Requirements

An important part of project development for transportation facilities is consideration of a project's potential environmental impacts. Because the project will receive funding from the Federal Highway Administration (FHWA), an environmental document will be prepared in conformance with the National Environmental Policy Act (NEPA), Code of Federal Regulations 23 CFR 771 (FHWA's NEPA regulations), and DOT&PF's Alaska Environmental Procedures Manual (April 1, 2002).

An environmental assessment is being drafted concurrently to this PER and discusses potential impacts of the proposed project.

18.2 Preliminary Research Results

The following preliminary information has been compiled based upon research of existing data available for the project area.

18.2.1 Air Quality

According to Alaska Administrative Code 18 AAC 50, the community of Haines and Klukwan Village are considered a Class II area for air quality (State of Alaska Department of Environmental Conservation [DEC], 2006). As such, there are air quality standards and maximum allowable increases for regulated air pollutants: particulate matter 10 micrometers or less in diameter, PM10 (dust); particulate matter 2.5 micrometers or less in diameter, PM2.5 (smoke); nitrogen dioxide, oxides of sulfur, carbon dioxide, ozone, and lead. Activities in these areas must operate in such a way that they do not exceed listed air quality standards and increments for these compounds.

18.2.2 Coastal Zone Management

The project is located within the Coastal Zone boundary in the Haines Coastal District. A Coastal Project Questionnaire will be completed and submitted to the DNR Department of Ocean and Coastal Management during the permitting process.

18.2.3 Land Ownership and Use

The existing road ROW is owned and maintained by the State of Alaska and is designated for use as a roadway. The highway travels through lands primarily owned and managed by the State of Alaska, including the Haines State Forest Resource Management Area and State Parks. As planned, reconstruction of the road will require partial acquisitions of private lands, native allotments, and public lands.

18.2.4 Local and State Land Use Plans

Existing state, federal, and borough land use plans that specifically apply to the project area are listed below:

- Haines Borough Comprehensive Plan
- Haines State Forest Resource Management Plan
- Bureau of Land Management, Special Recreation Management Area
- Haines State Forest Management Plan
- State of Alaska, Northern Southeast Area Plan
- State of Alaska, Scenic Byway Management Plan

- Alaska State Parks, Chilkat Bald Eagle Preserve Management Plan

The environmental assessment will evaluate the compatibility of the proposed project with the area's land use management plans. Preliminary review indicates that the project is compatible with the local land plans.

18.2.5 4(f) and 6(f) Resources

Several 4(f) resources, as defined in the United States Department of Transportation (USDOT) Act of 1966, are present in the vicinity of the project, and are associated with the Chilkat Bald Eagle Preserve and various historic properties. Impacts to these properties will be summarized and detailed in the 4(f) Evaluation Section. Measures to avoid and minimize any impacts on 4(f) property will be incorporated into the project design.

There are no 6(f) properties within the Project area.

18.2.6 Historical, Archeological, and Cultural Properties

An archeological and historical site survey is being conducted for the project area. Draft findings suggest there may be several historical sites within the project area that are eligible for the National Historical Register, including a former native village site, a wagon trail, graveyard, and cabins. Where possible, alignment changes were made to avoid and minimize impacts to these properties.

Further research and analysis is being conducted for the Fairbanks - Haines Highway Pipeline and the Wells Bridge.

FHWA has initiated Section 106 consultation with the State Historical Preservation Office, tribal entities, and other interested parties for this project. Additionally, a tribal consultation meeting was held on December 7, 2005, with the Chilkat Indian Association of Haines and Klukwan, Inc., to discuss the highway project improvements. A second meeting was held in February 2009.

18.2.7 Anadromous Fish Stream/Essential Fish Habitat

The ADF&G *Atlas to the Catalog of Waters Important to the Spawning, Rearing, or Migration of Anadromous Fishes* identified the Chilkat River and several of its tributaries as anadromous

streams. Stream hydrology and fish habitat in the project area were studied by Inter-Fluve, whose findings were presented in the *Stream Habitat Inventory Assessment*. This document provides an inventory and mapping record of the stream habitat in the project area. Consultation with the ADF&G has been initiated.

18.2.8 Threatened and Endangered Species

There are no listed or proposed species that occur within the project area nor are there any designated or proposed critical habitats near the project area.

18.2.9 Bald Eagles

Consultation with United States Fish and Wildlife Service has been initiated. Approximately twenty-four Bald Eagle nests have been identified within the vicinity of the project. The DOT&PF and USFWS have conducted a survey of eagle nests for the purposes of identifying nests within the 330 feet of the project area (the primary zone) as well as those within 1/2 mile (potential area of effect from blasting.) Initially, nine nests were identified to be within 330 feet of the existing road foot print. Where possible, alignment changes were made to avoid decreasing the distance to nests that are 330 feet or less from the highway. Measures to avoid and minimize any adverse effects on Bald Eagle will be incorporated into the project design and discussed in the environmental document.

18.2.10 Navigability, Floodplain Management, and Wetlands

The Chilkat River is listed as navigable water under the State of Alaska navigability criteria; however, additional consultation with the United States Coast Guard (USCG) and the USACE will be necessary for determining whether the Chilkat River is classified as navigable water under their criteria. The project includes the construction of a new bridge over the Chilkat River. Navigability requirements will be incorporated into the bridge design.

The Haines Borough has participated in the National Flood Insurance Program since 2004, and Haines has been mapped by the Federal Emergency Management Agency. Much of the proposed work will occur within the Chilkat River floodplain. The highway into Haines has been severely damaged by flooding from the rivers and streams in the past. The new highway design will estimate the 100-year flood flows and design the road accordingly. Proper culvert

placement has been studied to include culverts with adequate size to accommodate high water periods and to address impacts from the large debris flows.

In 2005, a wetlands delineation was performed for the project; wetlands were determined to comprise 235 acres (28%) of the study area. A total of seven National Wetlands Inventory wetland classifications were documented in the project area. While it does not appear possible to avoid wetland impacts entirely, measures to avoid, minimize, and compensate for adverse effects on wetlands have been incorporated into the project design. Wetland mitigation plans have been drafted, and consultations with the USACE have been initiated.

Federal wetland policy, as expressed in the 404(b)(1) guidelines (40 CFR Part 230), establishes a mitigation sequence to ensure that environmental impacts of permitting projects meet Clean Water Act requirements.

18.2.11 Contaminated Sites, Spills, and Underground Storage Tanks

An All-Appropriate Inquire/Phase I Environmental Site Assessment was performed for the project (DOWL HKM, September 2005). Key results of the investigation indicated the following:

- One contaminated site is located within the project corridor. This site, Northern Timber Corporation, is a gravel pit of stockpiled contaminated soil from three Haines service stations. The site cleanup was completed, and confirmation sample results met DEC cleanup levels. A site closure letter was sent on June 19, 2002.
- Several locations along the highway where the Haines-to-Fairbanks pipeline is located were investigated for the presence of hydrocarbons. The investigation was conducted by the USACE with DEC providing oversight and determined the following:
  - Hydrocarbon Sampling included two locations within the vicinity of the study area, referred to as Release 19.5 and Valve 25.5. Hydrocarbon contamination was found at Valve 25.5, near the Wells Bridge at the second site near MP 17.5. Hydrocarbon product was detected, but not at DEC action levels. The USACE will also revisit Release 19.5 to determine if additional product is present, as this site also has a historic spill associated with it.

- Leaks associated with the pipeline are part of the formerly used defense site program, and due to priority funding, it would take time before this site can be cleaned up. The USACE and the DOT&PF would excavate and stockpile the contaminated soils, and the USACE would haul the material away and handle the remediation of those soils. The USACE would also most likely provide a monitor during excavation to direct the contractor in separating the contaminated soils from the clean soils.

18.3 Environmental Permitting Requirements

The following environmental permits and approvals may be required for this project:

- State of Alaska Department of Natural Resource Office of Project Management and Permitting Alaska Coastal Management Program Consistency Review.
- USACE Section 404 permit for fill in wetlands and streams, and Section 10 and 404 permits for fill in navigable waters.
- DEC Section 401 Water Quality Certification.
- National Pollutant Discharge Elimination System General Permit for Construction Activities.
- State Historic Preservation Office Section 106 consultation under the National Historic Preservation Act.
- Title 16 Fish Habitat Permit.
- ADF&G Magnuson-Stevens Fishery Conservation and Management Act consultation for Essential Fish Habitat.
- USCG Navigation Permit.

18.4 Environmental Coordination

Agency scoping letters and the Section 106 Initiation of Consultation letters were sent on December 2005. The project team has met with agency representatives four times; in December 2005 for the general scoping meeting; in April 2006 and June 2006 for two Interdisciplinary Team meetings; and again in February 2009 to discuss the wetland mitigation plan.

Further correspondence with agencies and the public occurred as part of the NEPA and Section 106 process.

The following specialty studies and analyses are or will be completed in association with the environmental document:

- All-Appropriate Inquiry/Phase I Environmental Site Assessment
- Historical/Cultural Resources Report
- 4(f) Evaluation (contingent on impacts to public parks, recreational areas, or historic sites)
- Wetland Delineation
- Stream and Wetland Mitigation Plans
- Stream Habitat Inventory Assessment
- Hydrology and Hydraulics Report
- Essential Fish Habitat Assessment
- Bald Eagle Nest Survey

APPENDIX A

State of Alaska
Department of Transportation and Public Facilities

Design Criteria

FIGURE 2.1 - PROJECT DESIGN CRITERIA

Project	HNS Hwy MP 3.5 to MP 25.3 – Airport to Bluffs. SHAK-095-6(28)			
Project Funding (~~Primary~~, ~~Secondary~~, 3R, etc.)	3-R			
Functional Classification	Rural Principal Arterial			
Design Year (Usually 5-year increment at least 20 years after construction)	2032			
Present ADT (2007)	620			
Design Year ADT (2032)	700			
Mid Design Period ADT (2020)	660			
DHV (%)	100			
Directional Split (%D)	55/45			
Trucks (%T)	9.6%			
Equivalent Axle Loading (EAL)	350,000, HS25			
Pavement Design Year (Construction Year + N)	2032			
Design Vehicle (Usually AASHTO WB-50)	WB-50			
Design Speed	55 mph			
Stopping Sight Distance	495'			
Passing Sight Distance	1,985'			
Maximum Allowable Grade	5%			
Minimum Allowable Grade	0			
Minimum Allowable Degree of Curvature	5.25			
Minimum K-value for Vertical Curves: Sag	115	Crest	114	
Number of Roadways	1			
Width of Traveled Way	12' lanes			
Width of Shoulders: Outside	6' plus 9' @6:1	Inside	-	
Surface Treatment: T/W	Asphalt Concrete	Shoulders	Asphalt Concrete	
Side Slope Ratios: Foreslopes	1½:1	Backslopes	Varies	
Degree of Access Control	Driveway			
Median Treatment (If applicable)	None			
Illumination	No			
Curb Usage and Type	Standard type for existing curbing at Bald Eagle Preserve, at select locations (to remain). No curb elsewhere on project.			
Bicycle Provisions	Shoulders			
Pedestrian Provisions	Shoulders. A 10'? path exists at the Bald Eagle Preserve (to remain).			
Miscellaneous Criteria	Horizontal Curves- Min Radius = 1,065', Min Length = 825' Super Max = 6%			

APPENDIX B

State of Alaska
Department of Transportation and Public Facilities

Design Designations

DESIGN DESIGNATION

A.D.T. 2007	620
A.D.T. 2032	700
D.H.V. 2032	100
%T	9.6%
V	55
E.A.L.	350,000

PROJECT SUMMARY

WIDTH OF PAVING =	36 FEET
LENGTH OF GRADING =	20.3 MILES
LENGTH OF PAVING =	20.3 MILES
LENGTH OF PROJECT =	20.4 MILES

APPENDIX C

Level of Service Work Sheets

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst MDS
Agency/Co. DOWL HKM
Date Performed 10/27/2009
Analysis Time Period Peak Hour
Highway Haines Highway
From/To MP 3.5 to 25.3
Jurisdiction AK DOT&PF
Analysis Year 2007
Description

Input Data

Highway class Class 1
Shoulder width 2.0 ft Peak-hour factor, PHF 0.92
Lane width 12.0 ft % Trucks and buses 15 %
Segment length 24.8 mi % Recreational vehicles 2 %
Terrain type Rolling % No-passing zones 84 %
Grade: Length mi Access points/mi 1 /mi
Up/down %

Two-way hourly volume, V 46 veh/h
Directional split 55 / 45 %

Average Travel Speed

Grade adjustment factor, fG 0.71
PCE for trucks, ET 2.5
PCE for RVs, ER 1.1
Heavy-vehicle adjustment factor, 0.815
Two-way flow rate,(note-1) vp 86 pc/h
Highest directional split proportion (note-2) 47 pc/h

Free-Flow Speed from Field Measurement:
Field measured speed, SFM - mi/h
Observed volume, Vf - veh/h
Estimated Free-Flow Speed:
Base free-flow speed, BFFS 60.0 mi/h
Adj. for lane and shoulder width, fLS 2.6 mi/h
Adj. for access points, fA 0.3 mi/h

Free-flow speed, FFS 57.2 mi/h

Adjustment for no-passing zones, fnp 1.2 mi/h
Average travel speed, ATS 55.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG 0.77
PCE for trucks, ET 1.8
PCE for RVs, ER 1.0
Heavy-vehicle adjustment factor, fHV 0.893
Two-way flow rate,(note-1) vp 73 pc/h
Highest directional split proportion (note-2) 40
Base percent time-spent-following, BPTSF 6.2 %
Adj.for directional distribution and no-passing zones, fd/np 22.0
Percent time-spent-following, PTSF 28.3 %

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.03	
Peak 15-min vehicle-miles of travel, VMT15	310	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1141	veh-mi
Peak 15-min total travel time, TT15	5.6	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS2000: Two-Lane Highways Release 4.1c

Roger Garcia
DOWL LLC
4040 B St
Anchorage, AK 99503

Phone: (907) 562-2000 Fax:
E-Mail: snoble@dowl.com

Two-Way Two-Lane Highway Segment Analysis

Analyst Kelly Suchodolski, P.E.
Agency/Co. DOWL Engineers
Date Performed 10/18/2005
Analysis Time Period 2032
Highway Haines Highway
From/To MP 3.5 to 25.3
Jurisdiction
Analysis Year 2032
Description 2032 - Alternative 1 - No Build-Two-way Analysis

Input Data

Highway class Class 1
Shoulder width 2.0 ft Peak-hour factor, PHF 0.90
Lane width 12.0 ft % Trucks and buses 8 %
Segment length 21.8 mi % Recreational vehicles 2 %
Terrain type Rolling % No-passing zones 84 %
Grade: Length mi Access points/mi 1 /mi
Up/down %

Two-way hourly volume, V 100 veh/h
Directional split 55 / 45 %

Average Travel Speed

Grade adjustment factor, fG 0.71
PCE for trucks, ET 2.5
PCE for RVs, ER 1.1
Heavy-vehicle adjustment factor, 0.891
Two-way flow rate,(note-1) vp 176 pc/h
Highest directional split proportion (note-2) 97 pc/h

Free-Flow Speed from Field Measurement:
Field measured speed, SFM - mi/h
Observed volume, Vf - veh/h
Estimated Free-Flow Speed:
Base free-flow speed, BFFS 55.0 mi/h
Adj. for lane and shoulder width, fLS 2.6 mi/h
Adj. for access points, fA 0.3 mi/h

Free-flow speed, FFS 52.2 mi/h

Adjustment for no-passing zones, fnp 2.4 mi/h
Average travel speed, ATS 48.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG 0.77
PCE for trucks, ET 1.8
PCE for RVs, ER 1.0
Heavy-vehicle adjustment factor, fHV 0.940
Two-way flow rate,(note-1) vp 154 pc/h
Highest directional split proportion (note-2) 85
Base percent time-spent-following, BPTSF 12.7 %

Adj.for directional distribution and no-passing zones, fd/np 22.0
Percent time-spent-following, PTSF 34.7 %

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.05	
Peak 15-min vehicle-miles of travel, VMT15	606	veh-mi
Peak-hour vehicle-miles of travel, VMT60	2180	veh-mi
Peak 15-min total travel time, TT15	12.5	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS2000: Two-Lane Highways Release 4.1c

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Phone: (907) 562-2000 Fax:
E-Mail: snoble@dowl.com

Two-Way Two-Lane Highway Segment Analysis

Analyst Kelly Suchodolski, P.E.
Agency/Co. DOWL HKM
Date Performed 04/03/2009
Analysis Time Period 2032
Highway Haines Highway
From/To MP 3.5 to 25.3
Jurisdiction
Analysis Year 2032-Preferred Alignment
Description 2032-Preferred Alignment

Input Data

Highway class Class 1
Shoulder width 6.0 ft Peak-hour factor, PHF 0.90
Lane width 12.0 ft % Trucks and buses 8 %
Segment length 21.8 mi % Recreational vehicles 2 %
Terrain type Rolling % No-passing zones 75 %
Grade: Length mi Access points/mi 1 /mi
Up/down %

Two-way hourly volume, V 100 veh/h
Directional split 55 / 45 %

Average Travel Speed

Grade adjustment factor, fG 0.71
PCE for trucks, ET 2.5
PCE for RVs, ER 1.1
Heavy-vehicle adjustment factor, 0.891
Two-way flow rate,(note-1) vp 176 pc/h
Highest directional split proportion (note-2) 97 pc/h

Free-Flow Speed from Field Measurement:
Field measured speed, SFM - mi/h
Observed volume, Vf - veh/h
Estimated Free-Flow Speed:
Base free-flow speed, BFFS 60.0 mi/h
Adj. for lane and shoulder width, fLS 0.0 mi/h
Adj. for access points, fA 0.3 mi/h

Free-flow speed, FFS 59.8 mi/h

Adjustment for no-passing zones, fnp 2.2 mi/h
Average travel speed, ATS 56.1 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG 0.77
PCE for trucks, ET 1.8
PCE for RVs, ER 1.0
Heavy-vehicle adjustment factor, fHV 0.940
Two-way flow rate,(note-1) vp 154 pc/h
Highest directional split proportion (note-2) 85
Base percent time-spent-following, BPTSF 12.7 %
Adj.for directional distribution and no-passing zones, fd/np 21.4

Percent time-spent-following, PTSF	34.0 %

Level of Service and Other Performance Measures

Level of service, LOS	A
Volume to capacity ratio, v/c	0.05
Peak 15-min vehicle-miles of travel, VMT15	606 veh-mi
Peak-hour vehicle-miles of travel, VMT60	2180 veh-mi
Peak 15-min total travel time, TT15	10.8 veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

APPENDIX D

State of Alaska
Department of Transportation and Public Facilities

Summary of all Reported Crashes
from
January 1, 1998
through
December 31, 2007

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	Case ID	Street 1	Street 2	Intersection	rd jct	Mile 1	Date	time	Day	Num veh	fatalities	maj inj	min inju	acc severity	traffic control	type	road char	road surf	lighting	Veh1 dir	veh 1 2nd event	veh 1 action	Veh 1 human circumstance
2	199915041	Haines Hwy	MILE 3.5	N	13	2.768	Nov-99	8:26	Wednesday	1	0	0	0	Property damage	No Controls	Ditch	Curve lvl	Snow rdsurf	Daylight	Unknown	Uncoded	Skidding	27
3	199404928	Haines Hwy	HAINES HWY (4)	N	13	3.052	Mar-94	21:15	Wednesday	1	0	0	0	Property damage	No Controls	Overturn	Curve grd	Wet	Dark, Roadway not Lighted	North	Uncoded	Turning Left	Unsafe Speed
4	200309786	Haines Hwy	4 MILE PULLOUT	N	13	3.132	Aug-03	21:00	Wednesday	1	0	0	1	Minor injury	Unknown trafcont	Moose	7	Dry	Daylight	North	Uncoded	Avioding Objects in Road	Uncoded
5	199813332	Haines Hwy	MILE 5.7	N	13	4.847	Nov-98	10:00	Thursday	1	0	0	0	Property damage	No Controls	Overturn	Straight lvl	Snow rdsurf	Daylight	North	Uncoded	Skidding	Uncoded
6	200013855	Haines Hwy	MILEPOST 6.7	N	13	5.822	Oct-00	5:00	Saturday	1	0	0	0	Property damage	No Controls	Angle	Straight lvl	Dry	Dark, Roadway not Lighted	North	Other Fixed Object	Out of Control	Unsafe Speed
7	200211387	Haines Hwy	MILE 7 1/4	N	13	6.376	Oct-02	17:30	Thursday	1	0	0	1	Minor injury	No Controls	Guardrail Face	7	Dry	Dark, Roadway not Lighted	North	Uncoded	Straight Ahead	Uncoded
8	199400052	Haines Hwy	MP 7.5	N	13	6.629	Jan-94	15:40	Sunday	2	0	0	0	Property damage	No Controls	Angle	Straight lvl	Snow rdsurf	Twilight	South	Uncoded	Turning Left	27
9	199504030	Haines Hwy	MP 8	N	13	7.121	Feb-95	15:00	Saturday	1	0	0	1	Minor injury	No Controls	Overturn	Curve lvl	Snow rdsurf	Daylight	East	Uncoded	Passing	27
10	200119704	Haines Hwy	MP 8	N	13	7.121	Nov-01	11:00	Saturday	1	0	0	0	Property damage	No Controls	Guardrail Face	Straight lvl	Snow rdsurf	Not Reported light	North	Unknown v1secevent	Out of Control	27
11	199617544	Haines Hwy	MP 9	N	13	8.146	Nov-96	16:30	Saturday	2	0	0	1	Minor injury	No Controls	Utility Pole	Straight lvl	Snow rdsurf	Dark, Roadway not Lighted	North	Parked Vehicle	Out of Control	Uncoded
12	199910715	Haines Hwy	MP 9	N	13	8.146	Aug-99	12:30	Friday	1	0	0	0	Property damage	No Controls	Animal	Curve lvl	Wet	Not Reported light	North	Unknown v1secevent	Straight Ahead	27
13	199916932	Haines Hwy	MP 10	N	13	8.146	Dec-99	13:05	Wednesday	1	0	0	0	Property damage	Unknown trafcont	Other type	7	Uncoded	Not Reported light	Unknown	Unknown v1secevent	Unknown veh1act	27
14	200210567	Haines Hwy	MILE POINT 9.5	N	13	8.646	Sep-02	11:20	Sunday	2	0	0	0	Property damage	No Controls	Rear End	Curve lvl	Dry	Daylight	North	Uncoded	Stopped	Driver Inexperience
15	199414608	Haines Hwy	MP 10	N	13	9.211	Nov-94	8:00	Friday	1	0	0	0	Property damage	Unknown trafcont	Overturn	7	Uncoded	Not Reported light	Unknown	Unknown v1secevent	Unknown veh1act	27
16	199815797	Haines Hwy	MP 10	N	13	9.211	Dec-98	13:40	Friday	1	0	0	0	Property damage	Unknown trafcont	Guardrail Face	Curve lvl	Slush	Daylight	North	Uncoded	Out of Control	27
17	200014745	Haines Hwy	MP 10	N	13	9.211	Oct-00	17:00	Friday	1	0	0	0	Property damage	No Controls	Overturn	Curve grd	Snow rdsurf	Dark, Roadway not Lighted	North	Uncoded	Straight Ahead	27
18	200318129	Haines Hwy	MP 10	N	13	9.211	Nov-03	8:00	Friday	1	0	0	0	Property damage	No Controls	Ditch	Curve lvl	Slush	Dark, Roadway not Lighted	North	Overturn	Skidding	No Improper Driving
19	199409222	Haines Hwy	10 MILE MARKER	N	13	9.231	Jul-94	18:50	Sunday	1	0	0	0	Property damage	Unknown trafcont	Overturn	Curve lvl	Dry	Daylight	North	Uncoded	Skidding	Driver Inattention
20	199410766	Haines Hwy	11 MILE MARKER	N	13	10.025	Aug-94	14:10	Saturday	1	0	0	1	Minor injury	No Controls	Overturn	Curve lvl	Dry	Daylight	West	Uncoded	Straight Ahead	Driver Inattention
21	199701873	Haines Hwy	MILEPOST 12	N	13	11.16	Feb-97	23:00	Wednesday	1	0	0	1	Minor injury	No Controls	Ditch	Straight lvl	Snow rdsurf	Not Reported light	South	Unknown v1secevent	Skidding	27
22	199510986	Haines Hwy	MILEPOST 12	N	4way Int	11.26	Jul-95	:10	Friday	1	0	0	2	Minor injury	Unknown trafcont	Overturn	Curve lvl	Dry	Dark, Roadway not Lighted	North	Uncoded	Straight Ahead	Driver Inattention
23	199915730	Haines Hwy	MILE 12.5	N	4way Int	11.66	Nov-99	15:30	Tuesday	1	0	0	0	Property damage	No Controls	Ditch	Straight lvl	Snow rdsurf	Not Reported light	South	Unknown v1secevent	Straight Ahead	27
24	200117302	Haines Hwy	MILE 12.6	N	13	11.76	Dec-01	12:00	Monday	1	0	0	1	Minor injury	No Controls	Guardrail Face	Curve lvl	Snow rdsurf	Daylight	North	Uncoded	Out of Control	Unsafe Speed
25	199813374	Haines Hwy	MP 13	N	13	11.965	Nov-98	18:15	Friday	1	0	0	0	Property damage	No Controls	Overturn	Curve lvl	Snow rdsurf	Dark, Roadway not Lighted	South	Uncoded	Skidding	27
26	199813409	Haines Hwy	MP 13	N	13	12.145	Nov-98	11:40	Saturday	1	0	0	0	Property damage	No Controls	Overturn	Curve lvl	Snow rdsurf	Daylight	North	Uncoded	Skidding	27
27	200112828	Haines Hwy	MILE 13	N	13	12.165	Sep-01	10:30	Friday	1	0	0	0	Property damage	No Controls	Moose	Curve lvl	Wet	Dark, Roadway not Lighted	North	Uncoded	Skidding	Uncoded
28	200115172	Haines Hwy	MILE 14	N	13	13.179	Nov-01	17:30	Sunday	1	0	0	0	Property damage	No Controls	Moose	Straight lvl	Wet	Not Reported light	North	Unknown v1secevent	Straight Ahead	27
29	200314219	Haines Hwy	MILE 14	N	13	13.179	Nov-03	10:10	Wednesday	1	0	0	0	Property damage	No Controls	Embankment	7	Ice	Daylight	North	Uncoded	Skidding	Uncoded
30	199509467	Haines Hwy	MP 14.1	N	13	13.28	Jul-95	14:00	Saturday	1	0	0	1	Minor injury	Unknown trafcont	Overturn	Curve lvl	Dry	Daylight	North	Uncoded	Straight Ahead	Unsafe Speed
31	200114842	Haines Hwy	MILE 14.5	N	Not a junction	13.679	Oct-01	8:40	Tuesday	1	0	0	0	Property damage	Unknown trafcont	Overturn	7	Uncoded	Not Reported light	Unknown	Unknown v1secevent	Unknown veh1act	27
32	199604030	Haines Hwy	MP 15.5	N	Not a junction	13.682	Feb-96	10:30	Friday	1	0	0	0	Property damage	No Controls	Moose	7	Uncoded	Not Reported light	Unknown	Unknown v1secevent	Straight Ahead	27
33	199414760	Haines Hwy	MILE 15	N	13	14.184	Nov-94	12:30	Sunday	1	0	0	0	Property damage	No Controls	Guardrail Face	Straight lvl	Snow rdsurf	Daylight	South	Uncoded	Starting in Traffic	Unsafe Speed
34	199810344	Haines Hwy	MILE 15	N	13	14.284	Sep-98	3:00	Friday	1	0	0	1	Minor injury	No Controls	Overturn	Straight lvl	Dry	Dark, Roadway not Lighted	South	Uncoded	Straight Ahead	27
35	200117441	Haines Hwy	MILE 15.5	N	13	14.584	Dec-01	17:15	Wednesday	1	0	0	0	Property damage	No Controls	Moose	Curve lvl	Snow rdsurf	Not Reported light	North	Unknown v1secevent	Avioding Objects in Road	27
36	199516390	Haines Hwy	MP 15.5	N	Not a junction	14.697	Nov-95	17:30	Tuesday	1	0	0	0	Property damage	No Controls	Moose	Straight lvl	Snow rdsurf	Dark, Roadway not Lighted	North	Uncoded	Straight Ahead	Uncoded
37	199509109	Haines Hwy	16 MILE SIGN	N	Not a junction	15.209	Jun-95	18:15	Friday	1	0	1	0	Major injury	Unknown trafcont	Overturn	Curve lvl	Dry	Daylight	South	Tree/Shrub	Straight Ahead	Loss of Consciousness
38	200207092	Haines Hwy	MILE 16.1	N	Not a junction	15.299	Jun-02	6:00	Saturday	1	0	0	0	Property damage	No Controls	Ditch	Curve lvl	Dry	Daylight	North	Uncoded	Avioding Objects in Road	Unknown veh1humcirc1
39	199511311	Haines Hwy	ORIGIN	N	Not a junction	16.204	Aug-95	2:00	Saturday	1	0	0	1	Minor injury	Unknown trafcont	Overturn	Curve lvl	Dry	Dark, Roadway not Lighted	North	Uncoded	Straight Ahead	27
40	199614377	Haines Hwy	17 MI MARKER	N	Not a junction	16.274	Oct-96	11:55	Thursday	1	0	0	1	Minor injury	Unknown trafcont	Tree/Shrub	Curve lvl	Slush	Daylight	North	Uncoded	Straight Ahead	Unsafe Speed
41	199906591	Haines Hwy	17 MILE MARKER	N	Other junc	16.668	May-99	3:30	Sunday	1	0	0	0	Property damage	Unknown trafcont	Embankment	Curve grd	Wet	Dark, Roadway not Lighted	North	Uncoded	Avioding Objects in Road	Unsafe Speed
42	199802016	Haines Hwy	MILE 17 1/2	N	13	16.699	Feb-98	20:30	Wednesday	1	0	0	0	Property damage	No Controls	Moose	Curve lvl	Snow rdsurf	Not Reported light	North	Unknown v1secevent	Straight Ahead	27
43	200111184	Haines Hwy	MILE 17.5	N	Not a junction	16.699	Aug-01	4:45	Tuesday	1	0	0	0	Property damage	No Controls	Animal	Straight lvl	Dry	Twilight	South	Uncoded	Avioding Objects in Road	27
44	199417988	Haines Hwy	MP 18	N	13	17.168	Dec-94	9:30	Sunday	1	0	0	0	Property damage	No Controls	Moose	Straight grd	Snow rdsurf	Not Reported light	South	Unknown v1secevent	Avioding Objects in Road	27
45	199814880	Haines Hwy	MILE 18	N	13	17.168	Nov-98	19:30	Sunday	1	0	0	1	Minor injury	No Controls	Overturn	Curve grd	Snow rdsurf	Not Reported light	South	Unknown v1secevent	Skidding	27
46	200015911	Haines Hwy	MILE 18	N	Not a junction	17.168	Oct-00	10:00	Wednesday	1	0	1	0	Major injury	No Controls	Other Fixed Object	Straight lvl	Dry	Daylight	North	Uncoded	Straight Ahead	Other veh1humcirc1
47	200318023	Haines Hwy	18 MILES	N	13	17.168	Mar-03	15:00	Sunday	1	0	0	0	Property damage	No Controls	Jackknife	Curve lvl	Dry	Daylight	South	Cargo Loss/Shift	Avioding Objects in Road	No Improper Driving
48	200008357	Haines Hwy	MP 17.5	N	13	17.699	Jun-00	16:20	Friday	1	0	0	0	Property damage	No Controls	Ditch	Curve lvl	Dry	Daylight	North	Tree/Shrub	Straight Ahead	Fell asleep
49	199813727	Haines Hwy	MP 19	N	13	18.058	Nov-98	12:15	Thursday	2	0	0	1	Minor injury	Unknown trafcont	Rear End	Curve lvl	Slush	Daylight	North	Uncoded	Straight Ahead	Driver Inattention
50	199717513	Haines Hwy	MILE 20	N	Not a junction	19.18	Nov-97	7:30	Wednesday	1	0	0	0	Property damage	Unknown trafcont	Overturn	7	Snow rdsurf	Not Reported light	South	Unknown v1secevent	Skidding	27
51	199503797	Haines Hwy	MP 20	N	13	19.188	Feb-95	15:00	Thursday	2	0	0	0	Property damage	No Controls	Rear End	Curve lvl	Snow rdsurf	Not Reported light	North	Unknown v1secevent	Slowing	27
52	200102286	Haines Hwy	MILE 20	N	Not a junction	19.188	Feb-01	13:13	Wednesday	1	0	0	1	Minor injury	No Controls	Overturn	Curve lvl	Snow rdsurf	Daylight	South	Uncoded	Out of Control	27
53	200311862	Haines Hwy	MILE 22	N	13	20.715	Sep-03	16:00	Sunday	1	0	0	0	Property damage	No Controls	Moose	7	Dry	Daylight	South	Uncoded	Straight Ahead	Uncoded
54	199804248	Haines Hwy	MILE 23.5	N	Not a junction	22.874	Mar-98	16:00	Sunday	1	0	0	2	Minor injury	Unknown trafcont	Ditch	Curve grd	Slush	Daylight	North	Uncoded	Straight Ahead	27
55	200015440	Haines Hwy	MILE 23.5	N	13	22.874	Nov-00	14:15	Saturday	1	0	0	0	Property damage	No Controls	Ditch	Curve lvl	Slush	Daylight	South	Overturn	Out of Control	Improper Lane Usage/Change
56	200104872	Haines Hwy	MILE 23.5	N	13	22.874	Mar-01	8:15	Tuesday	1	0	0	0	Property damage	No Controls	Embankment	Curve grd	Snow rdsurf	Daylight	North	Uncoded	Out of Control	27
57	199405532	Haines Hwy	MP 23.5	N	Not a junction	23.043	Apr-94	12:00	Sunday	1	0	0	0	Property damage	Unknown trafcont	Overturn	Curve grd	Dry	Daylight	North	Uncoded	Straight Ahead	Unsafe Speed
58	200007616	Haines Hwy	MP 23	N	Not a junction	23.374	May-00	15:40	Sunday	1	0	0	2	Minor injury	No Controls	Ditch	Curve grd	Dry	Daylight	North	Overturn	Out of Control	Driver Inattention
59																							
60	199417535	Haines Hwy	MP 6	Y	13	5.122	Dec-94	12:00	Tuesday	1	0	0	2	Minor injury	Unknown trafcont	Ditch	7	Uncoded	Not Reported light	Unknown	Unknown v1secevent	Unknown veh1act	27
61	200014467	Haines Hwy	MP 6.5	Y	13	5.622	Jul-00	20:30	Sunday	1	0	1	0	Major injury	No Controls	Overturn	Curve lvl	Dry	Daylight	North	Ditch	Turning Left	Loss of Consciousness
62	199606280	Haines Hwy	MP 6.5	Y	13	5.624	Apr-96	9:03	Wednesday	1	0	0	2	Minor injury	No Controls	Overturn	Curve lvl	Dry	Daylight	North	Uncoded	Straight Ahead	Unsafe Speed
63	199515117	Haines Hwy	7 MI	Y	13	6.187	Nov-95	8:00	Thursday	1	0	0	1	Minor injury	No Controls	Overturn	Straight lvl	Snow rdsurf	Daylight	North	Uncoded	Straight Ahead	Unsafe Speed
64	199913021	Haines Hwy	MILE 7.9	Y	13	7.026	Sep-99	16:00	Thursday	1	0	0	0	Property damage	Unknown trafcont	Guardrail Face	Curve lvl	Dry	Daylight	South	Uncoded	Straight Ahead	Driver Inattention
65	199604768	Haines Hwy	MI 16 MARKER	Y	13	15.199	Mar-96	15:45	Monday	2	0	0	0	Property damage	Unknown trafcont	Angle	Curve lvl	Snow rdsurf	Daylight	South	Uncoded	Out of Control	Unsafe Speed
66	200014462	Haines Hwy	KLUKWAN RD	Y	13	17.956	Jun-00	1:34	Saturday	1	1	0	0	Fatality	No Controls	Overturn	Straight lvl	Wet	Dark, Roadway not Lighted	North	Uncoded	Out of Control	Unsafe Speed
67	199914285	Haines Hwy	KLUKWAN LWR RD	Y	13	20.656	Sep-99	4:00	Sunday	1	0	1	0	Major injury	Unknown trafcont	Embankment	Curve grd	Wet	Dark, Roadway not Lighted	South	Overturn	Straight Ahead	Fell asleep
68	200212257	Haines Hwy	KLUKWAN LWR RD	Y	13	20.956	Nov-02	18:00	Saturday	1	0	0	0	Property damage	No Controls	Animal	7	Wet	Dark, Roadway not Lighted	South	Uncoded	Straight Ahead	Uncoded
69	199607783	Haines Hwy	KLUKWAN LWR RD	Y	13	20.978	May-96	18:55	Monday	1	0	0	1	Minor injury	Unknown trafcont	Overturn	Curve grd	Dry	Daylight	South	Uncoded	Straight Ahead	Loss of Consciousness
70	199512986	Haines Hwy	WELLS BRIDGE	Y	13	23.144	Sep-95	14:00	Friday	1	0	1	0	Major injury	Unknown trafcont	Overturn	Curve grd	Dry	Daylight	North	Uncoded	Straight Ahead	Unsafe Speed
71	199517990	Haines Hwy	WELLS BRIDGE	Y	13	23.211	Dec-95	18:45	Monday	1	0	0	0	Property damage	Unknown trafcont	Overturn	Curve grd	Snow rdsurf	Dark, Roadway not Lighted	North	Uncoded	Straight Ahead	Unsafe Speed
72	199600126	Haines Hwy	WELLS BRIDGE	Y	13	23.233	Jan-96	9:30	Wednesday	1	0	0	1	Minor injury	Unknown trafcont	Overturn	Curve grd	Snow rdsurf	Daylight	South	Uncoded	Turning Right	Unsafe Speed
73	199604690	Haines Hwy	WELLS BRIDGE	Y	13	23.233	Mar-96	16:30	Sunday	1	0	1	0	Major injury	No Controls	Overturn	7	Uncoded	Daylight	North	Uncoded	Straight Ahead	27
74	200005976	Haines Hwy	WELLS BRIDGE	Y	13	23.233	Apr-00	16:00	Thursday	1	0	0	0	Property damage	Unknown trafcont	Guardrail Face	Curve grd	Dry	Daylight	West	Uncoded	Straight Ahead	27
75	200119770	Haines Hwy	WELLS BRIDGE	Y	13	23.233	Nov-01	11:19	Friday	1	0	0	0	Property damage	No Controls	Bridge/Overpass	Curve grd	Snow rdsurf	Daylight	North	Bridge/Overpass	Out of Control	Driver Inexperience
76	199508503	Haines Hwy	GILLIAMS DR	Y	13	23.263	Jun-95	19:15	Thursday	1	0	0	0	Property damage	Unknown trafcont	Overturn	Curve grd	Dry	Daylight	North	Uncoded	Straight Ahead	27
77	199904905	Haines Hwy	MILE 25	Y	13	24.445	Mar-99	16:45	Tuesday	1	0	0	0	Property damage	No Controls	Ditch	Curve lvl	Sand/mud/dirt/oil/gravel	Daylight	North	Embankment	Slowing	Driver Inexperience

	A	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
1	Case ID	veh human circ 2	veh 1 circum	veh 1 rdwy circum	Srvr 1 alc/drugs	Veh 2 dir	veh 2 2nd event	veh 2 action	2 human circumstanh	2 human cicur	veh 2 veh circum	2 rdwy circ	Dri 2 Alc/drugs	event location	cit 1
2	199915041	Uncoded	Uncoded	Road Surface Condition	5									Bike Lane	
3	199404928	Uncoded	Uncoded	Uncoded	5									Bike Lane	
4	200309786	Uncoded	Uncoded	None veh1rdwy	5									Roadway	FTY ROW after stop or to ped
5	199813332	Uncoded	Uncoded	Road Surface Condition	5									Bike Lane	
6	200013855	Uncoded	Uncoded	Uncoded	Alcohol									Bike Lane	
7	200211387	Uncoded	Tire Failure/Inadequate	Unknown veh1rdwy	5									Outside Trafficway	Fail to exercise due care or cause damage to hwy
8	199400052	Uncoded	Other Lighting Defect	Uncoded	5	South	Uncoded	Passing	27	27	Uncoded	Uncoded	5	Outside Trafficway	
9	199504030	Uncoded	Uncoded	Road Surface Condition	5									Roadway	
10	200119704	27	Uncoded	Uncoded	5									Roadway	
11	199617544	Uncoded	Uncoded	Road Surface Condition	5	Unknown	Uncoded	Parked	27	27	Uncoded	Uncoded		Roadway	
12	199910715	27	Uncoded	Uncoded	5									Bike Lane	
13	199916932	27	Uncoded	Uncoded	5									Outside Trafficway	Fail to exercise due care or cause damage to hwy
14	200210587	Uncoded	Other veh1circ	None veh1rdwy	None Alc/Drugs	North	Other Fixed Object	Straight Ahead	No Improper Driving	Uncoded	None veh2circ	None veh2rdw	None Alc/Drugs	Outside Trafficway	
15	199414608	27	Uncoded	Uncoded	5									Outside Trafficway	Fail to wear safety belt
16	199815797	27	Uncoded	Uncoded	5									Outside Trafficway	
17	200014745	Uncoded	Tire Failure/Inadequate	Uncoded	5									Roadway	Fail to exercise due care or cause damage to hwy
18	200318129	Uncoded	None veh1circ	None veh1rdwy	None Alc/Drugs									Bike Lane	
19	199409222	Uncoded	Uncoded	Uncoded	Alcohol									Outside Trafficway	
20	199410766	27	Uncoded	Uncoded	5									Roadway	
21	199701873	27	Uncoded	Uncoded	5									Roadway	FTY ROW after stop or to ped
22	199510986	Uncoded	Uncoded	Uncoded	Alcohol									Roadway	
23	199915730	Uncoded	Tire Failure/Inadequate	Uncoded	5									Roadway	FTY ROW after stop or to ped
24	200117302	Uncoded	Uncoded	Road Surface Condition	5									Bike Lane	
25	199813374	Uncoded	Uncoded	Road Surface Condition	5									Outside Trafficway	
26	199813409	Uncoded	Uncoded	Road Surface Condition	5									Roadway	Speed too fast for cond
27	200112828	Uncoded	Uncoded	Road Surface Condition	5									Outside Trafficway	
28	200115172	27	Uncoded	Uncoded	5									Roadway	Negligent driving
29	200314219	Uncoded	Uncoded	Road Surface Condition	5									Outside Trafficway	
30	199509467	Uncoded	Uncoded	Uncoded	Alcohol									Bike Lane	
31	200114842	27	Uncoded	Uncoded	5									Roadside	
32	199504030	27	Uncoded	Uncoded	5									Roadside	
33	199414760	Uncoded	Uncoded	Uncoded	5									Roadway	
34	199810344	Uncoded	Tire Failure/Inadequate	Uncoded	5									Roadway	Alcohol rel or driving while intox
35	200117441	27	Uncoded	Uncoded	5									Roadway	
36	199516390	Uncoded	Uncoded	Road Surface Condition	5									Shoulder eventloc	Negligent driving
37	199509109	Physical Disability	Uncoded	Uncoded	5									Roadway	
38	200207092	Uncoded	None veh1circ	None veh1rdwy	None Alc/Drugs									Roadway	
39	199511311	Uncoded	Uncoded	Uncoded	Alcohol									Roadway	
40	199614377	Uncoded	Uncoded	Road Surface Condition	5									Roadway	Leaving the scene of accident PDO
41	199906591	Uncoded	Uncoded	Uncoded	Alcohol									Roadway	
42	199802016	27	Uncoded	Uncoded	5									Outside Trafficway	
43	200111184	Uncoded	Uncoded	Uncoded	5									Roadway	
44	199417988	27	Uncoded	Uncoded	5									Outside Trafficway	
45	199814880	27	Uncoded	Uncoded	5									Outside Trafficway	Reckless endangerment
46	200015911	27	Uncoded	Uncoded	5									Roadway	
47	200318023	Uncoded	None veh1circ	Shoulder rdwycirc	None Alc/Drugs									Outside Trafficway	
48	200008357	27	Uncoded	Uncoded	5									Bike Lane	
49	199813727	27	Uncoded	Uncoded	5	North	Uncoded	Turning Left	27	27	Uncoded	Uncoded	5	Bike Lane	
50	199717513	27	Uncoded	Uncoded	5									Roadway	
51	199503797	27	Uncoded	Uncoded	5	North	Unknown v2secevent	Passing	27	27	Uncoded	Uncoded	5	Roadway	
52	200102286	Uncoded	Uncoded	Road Surface Condition	5									Shoulder eventloc	
53	200311862	Uncoded	Uncoded	None veh1rdwy	5									Bike Lane	
54	199804248	Uncoded	Uncoded	Road Surface Condition	5									Roadside	
55	200015440	Uncoded	Uncoded	Road Surface Condition	5									Bike Lane	
56	200104872	Uncoded	Uncoded	Road Surface Condition	5									Bike Lane	
57	199405532	Uncoded	Uncoded	Uncoded	5									Roadway	
58	200007616	27	Uncoded	Uncoded	5									Roadway	
59															
60	199417535	27	Uncoded	Uncoded	5									Roadway	FTY ROW after stop or to ped
61	200014467	Uncoded	Uncoded	Uncoded	Alcohol									Roadway	
62	199606280	Uncoded	Uncoded	Uncoded	5									Roadway	
63	199515117	Uncoded	Uncoded	Road Surface Condition	5									Outside Trafficway	
64	199913021	27	Uncoded	Uncoded	5									Roadway	Fail to exercise due care or cause damage to hwy
65	199604768	Uncoded	Uncoded	Road Surface Condition	5	South	Uncoded	Straight Ahead	27	27	Uncoded	Uncoded	5	Bike Lane	
66	200014462	Uncoded	Uncoded	Other veh1rdwy	Alcohol									Bike Lane	
67	199914286	Uncoded	Uncoded	Uncoded	Alcohol									Roadway	
68	200212257	Uncoded	Uncoded	None veh1rdwy	5									Roadway	
69	199607783	27	Uncoded	Uncoded	5									Bike Lane	
70	199512986	Driver Inexperience	Uncoded	Uncoded	5									Outside Trafficway	Negligent driving
71	199517990	Uncoded	Uncoded	Uncoded	5									Roadway	
72	199600126	Uncoded	Uncoded	Road Surface Condition	5									Outside Trafficway	
73	199604690	27	Uncoded	Uncoded	5									Shoulder eventloc	
74	200005976	Uncoded	Tire Failure/Inadequate	Uncoded	5									Outside Trafficway	Negligent driving
75	200119770	Uncoded	Other veh1circ	Uncoded	5									Outside Trafficway	
76	199508503	Uncoded	Other veh1circ	Uncoded	5									Roadway	
77	199904905	27	Uncoded	Uncoded	5									Bike Lane	Negligent driving

APPENDIX E

3R Evaluation of Pavement Widths

Project Parameters

Location: Haines Highway MP = 3.5 to 13

Project Length=	9.0 miles
Design Speed=	55 mph
Design Period=	25-yrs
10-yr Average ADT=	626
Existing lane width (W)=	12 feet
Existing width of paved shoulder (PA)=	2 feet
Existing width of unpaved shoulder (UP)=	0 feet
Median roadside hazard rating (H)=	5
1 for flat, 0 otherwise (TER1)=	0
1 for mountainous, 0 otherwise (TER2)=	0

Existing Pavement width is 24-ft.

New construction minimum requirements of 30-ft paved width (11-ft lanes and 4-ft shoulders). Therefor follow 3R procedure outline for Case 1.

Perdicted Accident Rate "A"

$$A = 0.0019\ ADT^{0.882} \times 0.879^{W} \times 0.919^{PA} \times 0.932^{UP} \times 1.236^{H} \times 0.882^{TER1} \times 1.322^{TER2}$$

Predicted Accident Rate A is 0.29 acc/mi/yr

Recorded Accidents within link 1998-2007 (10-yr period)

Historical Accident Rate

Accident rate = 0.30

Summary

Historical Accidents = **Ah= 0.30 acc/mi/yr**
Predicted = **Ap= 0.29 acc/mi/yr**

Widen total lane and shoulder width, in each direction, by 1 foot on each side for every 10 percent increment the historical accident rate exceeds Ap

Percent above Historical Accident Rate = 1

Add 1 feet to each side of roadway
2 feet total

	Existing	Addition	Proposed
Lane width	12 feet	0 feet	12 feet
Lane width	12 feet	0 feet	12 feet
Paved shoulder width	2 feet	1 ft each side	3 feet
Unpaved shoulder width	0 feet	0 ft each side	0 feet
Total section width	28 feet	2 feet	30 feet

Date of Analysis: 10/27/2009 Analysis by: KLS

Project Parameters

Location: Haines Highway MP = 13 to 21

Project Length=	7.4 miles
Design Speed=	55 mph
Design Period=	25-yrs
10-yr Average ADT=	595
Existing lane width (W)=	12 feet
Existing width of paved shoulder (PA)=	2 feet
Existing width of unpaved shoulder (UP)=	0 feet
Median roadside hazard rating (H)=	5
1 for flat, 0 otherwise (TER1)=	0
1 for mountainous, 0 otherwise (TER2)=	0

Existing Pavement width is 24-ft.

New construction minimum requirements of 30-ft paved width (11-ft lanes and 4-ft shoulders). Therefor follow 3R procedure outline for Case 1.

Perdicted Accident Rate "A"

$$A = 0.0019\ ADT^{0.882} \times 0.879^{W} \times 0.919^{PA} \times 0.932^{UP} \times 1.236^{H} \times 0.882^{TER1} \times 1.322^{TER2}$$

Predicted Accident Rate A is 0.28 acc/mi/yr

Recorded Accidents within link 1998-2007 10-yr period

Historical Accident Rate

Accident rate = 0.34

Summary

Historical Accidents = **Ah= 0.34 acc/mi/yr**
Predicted = **Ap= 0.28 acc/mi/yr**

Widen total lane and shoulder width, in each direction, by 1 foot on each side for every 10 percent increment the historical accident rate exceeds Ap

Percent above Historical Accident Rate = 20%

Add 2 feet to each side of roadway
4 feet total

	Existing	Addition	Proposed
Lane width	12 feet	0 feet	12 feet
Lane width	12 feet	0 feet	12 feet
Paved shoulder width	2 feet	2 ft each side	4 feet
Unpaved shoulder width	0 feet	0 ft each side	0 feet
Total section width	28 feet	4 feet	32 feet

See following page for adjusted cross sectional analysis

Date of Analysis: 10/27/2009 Analysis by: KLS

Project Parameters

Location: Haines Highway MP = 13 to 21

Project Length=	7.4 miles
Design Speed=	55 mph
Design Period=	25-yrs
10-yr Average ADT=	595
Proposed lane width (W)=	12 feet
Proposed width of paved shoulder (PA)=	4 feet
Proposed width of unpaved shoulder (UP)=	0 feet
Median roadside hazard rating (H)=	6
1 for flat, 0 otherwise (TER1)=	0
1 for mountainous, 0 otherwise (TER2)=	0

Existing Pavement width is 24-ft.

New construction minimum requirements of 30-ft paved width (11-ft lanes and 4-ft shoulders). Therefor follow 3R procedure outline for Case 1.

Perdicted Accident Rate "A"

$$A = 0.0019\ ADT^{0.882} \times 0.879^{W} \times 0.919^{PA} \times 0.932^{UP} \times 1.236^{H} \times 0.882^{TER1} \times 1.322^{TER2}$$

Predicted Accident Rate A is 0.29 acc/mi/yr

Recorded Accidents within link 1998-2007 | 10-yr period

Historical Accident Rate

Accident rate = 0.34

Summary

Historical Accidents =	**Ah= 0.34 acc/mi/yr**	**Cross sectional evaluation is not required**
Adjusted accident rate= (10% per foot widening each side)	**Aa= 0.27 acc/mi/yr**	
Predicted =	**Ap= 0.29 acc/mi/yr**	

Section 1130 requirements for new construction are as follows:

Lane width = 11 feet
Shoulder width = 4 feet

Minimum Requirements: Widen to 11-ft lanes with 4-ft paved shoulders. (AASHTO calls for 11-ft lanes and 6-ft shoulders)

Date of Analysis: 10/27/2009 Analysis by: KLS

Project Parameters

Location: Haines Highway MP = 21 to 25.3

Project Length=	4.3 miles
Design Speed=	55 mph
Design Period=	25-yrs
10-yr Average ADT=	489
Existing lane width (W)=	12 feet
Existing width of paved shoulder (PA)=	2 feet
Existing width of unpaved shoulder (UP)=	0 feet
Median roadside hazard rating (H)=	5
1 for flat, 0 otherwise (TER1)=	0
1 for mountainous, 0 otherwise (TER2)=	0

Existing Pavement width is 24-ft.

New construction minimum requirements of 30-ft paved width (11-ft lanes and 4-ft shoulders). Therefor follow 3R procedure outline for Case 1.

Perdicted Accident Rate "A"

$$A = 0.0019\ ADT^{0.882} \times 0.879^{W} \times 0.919^{PA} \times 0.932^{UP} \times 1.236^{H} \times 0.882^{TER1} \times 1.322^{TER2}$$

Predicted Accident Rate A is 0.23 acc/mi/yr

Recorded Accidents within link 1994-2003 10-yr period

Historical Accident Rate

Accident rate = 0.12

Summary

Historical Accidents = **Ah= 0.12 acc/mi/yr**
Predicted = **Ap= 0.23 acc/mi/yr**

Existing total lane and shoulder width may remain unchanged

Percent above Historical Accident Rate = 0%

Add 0 feet to each side of roadway

0 feet total

	Existing	Addition	Proposed
Lane width	10 feet	0 feet	10 feet
Lane width	10 feet	0 feet	10 feet
Paved shoulder width	2 feet	0 ft each side	2 feet
Unpaved shoulder width	0 feet	0 ft each side	0 feet
Total section width	24 feet	0 feet	24 feet

See following page for adjusted cross sectional analysis

Date of Analysis: 10/27/2009 Analysis by: KLS

Project Parameters

Location: Haines Highway MP = 13 to 21

Project Length=	4.3 miles
Design Speed=	55 mph
Design Period=	25-yrs
10-yr Average ADT=	489
Proposed lane width (W)=	12 feet
Proposed width of paved shoulder (PA)=	4 feet
Proposed width of unpaved shoulder (UP)=	0 feet
Median roadside hazard rating (H)=	6
1 for flat, 0 otherwise (TER1)=	0
1 for mountainous, 0 otherwise (TER2)=	0

Existing Pavement width is 24-ft.

New construction minimum requirements of 30-ft paved width (11-ft lanes and 4-ft shoulders). Therefor follow 3R procedure outline for Case 1.

Perdicted Accident Rate "A"

$$A = 0.0019\ ADT^{0.882} \times 0.879^{W} \times 0.919^{PA} \times 0.932^{UP} \times 1.236^{H} \times 0.882^{TER1} \times 1.322^{TER2}$$

Predicted Accident Rate A is 0.24 acc/mi/yr

Recorded Accidents within link 1994-2003 | 10-yr period

Historical Accident Rate

Accident rate = 0.12

Summary

Historical Accidents =	**Ah= 0.12 acc/mi/yr**
Adjusted accident rate= (10% per foot widening each side)	**Aa= 0.12 acc/mi/yr**
Predicted =	**Ap= 0.24 acc/mi/yr**

Cross sectional evaluation is not required

Section 1130 requirements for new construction are as follows:

Lane width = 11 feet
Shoulder width = 4 feet

Minimum Requirements: Widen to 11-ft lanes with 4-ft paved shoulders. (AASHTO calls for 11-ft lanes and 6-ft shoulders)

Date of Analysis: 10/27/2009 Analysis by: KLS

APPENDIX F

Hydrologic and Hydraulic Study

Location Hydraulic Study
and
Preliminary Hydrology and Hydraulics Report
Haines Highway Milepost 3.5 to 25.3

ADOT&PF Project No. 68606 / SHAK-095-6(28)

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DRAFT

October 30, 2009

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2. Executive summary

This report presents design concepts for roadway embankment erosion protection along the Chilkat River; and, flood conveyance and fish passage at a number of culverts along tributary streams. Design features are in support of the Preliminary Engineering Report (PER) and are based on the 2009 design alignment provided by DOWL HKM. There is a companion Stream and Habitat Inventory (S&HI) prepared by Inter-Fluve, Inc. (Inter-Fluve, July, 2006) based on a 2006 version of the design alignment which provides a graphical overview of the project.

The proposed Haines Highway realignment project between mileposts 3.5 and 25.3 follows the Chilkat River and crosses 106 culvert locations. The highway embankment along the Chilkat River was conceptually designed for erosion and depth of scour protection. The analysis and design follow methods in the Highway Preconstruction Manual and Highway Drainage Manual and are presented in Section 4.

All culverts located in the field were evaluated in the field by rapid assessment methods and are summarized in tabular format in the appendices. A total of 28 culverts are discussed in greater detail in this report. Of these culvert crossings, eleven are either 48-inch diameter or larger, or of approximately equivalent size, along fish bearing streams with desirable upstream habitats. An additional four large culverts are located on the two active debris flows at MP 19 and 23. Geotechnical recommendations by DOWL HKM to accommodate debris flows consist of large box culverts to enable equipment access to clean out the occasional debris flow deposits. Details of the design are scheduled for the Draft DSR phase. Thirteen smaller pipes were identified that had fish presence and will require fish passage for the replacement culverts. Analysis and design of large culverts and culverts along fish bearing streams follow methods in the Highway Preconstruction Manual and Highway Drainage Manual and are presented in Sections 5 through 20. Analysis and design of the smaller fish pipes are discussed in Section 21.

A summary table of culverts considered in this report is presented on the following page.

Culvert Summary.

2009 Station	Proposed fish passage design method (MOA, 2001)	Proposed Culvert	
		size	type
Large culverts			
222+51	tier 1	6'-9"x4'-11"	pipe arch
319+13	tier 1	6'-9"x4'-11"	pipe arch
324+79	tier 1	7'-3"x5'-3"	pipe arch
483+18	tier 1	7'-3"x5'-3"	pipe arch
512+24	tier 1	14'-1"x6'-2"	alum box
589+12	tier 1	7'-3"x5'-3"	pipe arch
647+20	tier 1	8'-10"x6'-1"	pipe arch
652+70	tier 1	pending	pending
710+75	tier 1	12'-7"x8'-4"	pipe arch
865+88	tier 1	11'-7"x7'-5"	pipe arch
887+60	tier 1	9'-4"x6'-3"	pipe arch
962+06	Debris flow	pending	pending
973+30	Debris flow	pending	pending
1102+19	tier 1	7'-3"x5'-3"	pipe arch
1179+75	Debris flow	pending	pending
1187+25	Debris flow	pending	pending
Smaller Culverts			
228+95	tier 2 - no baffles	2’	cmp
240+38	tier 2 - no baffles	2’	cmp
245+19	tier 1	4’	cmp
248+45	tier 1	3’	cmp
292+90	tier 2 - baffled pipe	4’	cmp
314+72	tier 2 - no baffles	3’	cmp
366+36	tier 1	3'-6"x2'-5"	pipe arch
382+07	tier 2	3’	cmp
419+95	tier 2 - baffled pipe	3.5’	cmp
530+70	tier 1	3’	cmp
606+68	tier 2	2’	cmp
736+83 – option 1	tier 1	7'-4"x5'-4"	pipe arch
option 2	tier 2 - baffled pipe	3’	cmp
767+14	tier 2 - baffled pipe	3.5’	cmp

3. Introduction

The Haines Highway realignment study involves the Resurfacing, Rehabilitation and Restoration (3R) reconstruction of the highway between mileposts 3.5 and 25.3. This work is necessary to improve safety by bringing the highway into compliance with current design standards. Completion of this stretch will connect with previously constructed improvements for an improved highway between Haines and the border with Canada.

This study is a preliminary level hydrologic and hydraulic evaluation of the Chilkat River and tributary drainages that cross the Haines Highway between mileposts 3.5 and 25.3. Conceptual level designs and drawings for erosion protection along the highway embankment and preliminary design of fish passage and flood conveyance at larger culverts are included in this study. This report is submitted in support of the Preliminary Engineering Report (PER). This report was prepared in accordance with the Highway Preconstruction Manual (HPM) 1120.5 and the Alaska Highway Drainage Manual (HDM). Final designs will require detailed survey for each stream crossing and will be prepared and documented in a final design report to be submitted with Plans-in-Hand. This report provides information for preliminary design and environmental/permitting actions.

A companion Stream and Habitat Inventory Study (S&HI) was prepared by Inter-Fluve, Inc. (July 2006) which is included herein by reference for a graphical overview of the project.

3.1 Objective

The objective of this report is to characterize hydrologic and hydraulic conditions of the Chilkat River and tributary crossings of the highway. Further, conceptual level designs for typical erosion protection and passage of flood flows and fish through larger culverts were prepared for environmental/permitting actions. Full designs will be prepared at a later phase for submittal with the Plans-in-Hand.

3.1.1 Objective - Chilkat River

The Chilkat River is a large, dynamic, glacially fed river. There is a complex network of side channels between mileposts 10 and 19. Further, the Chilkat River discharges to the Lynn Canal which experiences 16.5-ft tidal fluctuations. No Federal Emergency Management Agency (FEMA) Flood Insurance Study for the project reach was identified. The Haines Highway follows the northeast bank of the river, with river flows along the embankment toe for long stretches of highway. In a number of locations, side channels impinge directly into the highway embankment then turn downstream at sharp angles.

The objective of this study along the Chilkat River and its side channels was to estimate the erosive forces acting on the proposed road embankment for conceptual design of bank revetments. Depths and locations of scour were investigated in the field and conceptually

analyzed to aid in estimating depth of scour along the toe of the proposed embankment. The impacts on flood water surface elevations by the proposed project are approximately evaluated.

These objectives were approached through field investigations; interviews with Alaska Department of Transportation and Public Facilities (ADOT&PF) maintenance personnel and long time residents; and, conceptual level analysis and design. Design level analysis and modeling will be completed and documented at a later phase for the Plans-in-Hand submittal.

3.1.2 Objective - Tributaries

Between mileposts 3.5 and 25.3, 106 existing culvert crossings were located in the field. Eight culverts listed in the as-built drawings were not found in the field. An inventory of pipe size and general site conditions was made through a rapid assessment and tabulated (see Appendix Section 23.1).

Of the culverts found, fifteen crossings were identified for this Summary Hydraulic Report. Eleven of the existing crossings are comprised of either 48-inch or larger diameter pipes, or fish bearing streams with ample upstream habitats. An additional four large culverts are located along debris fans - flood runoff and fish passage design will be coordinated with geotechnical design in progress by DOWL HKM for passage of debris torrent sediments. In addition, thirteen smaller pipes are either included in the anadromous waters catalog (AWC) or were identified by Inter-Fluve or Alaska Department of Natural Resources, Office of Habitat Management and Permitting (OHMP) staff to have fish present. A brief narrative of each of these smaller pipes is included in this report. The associated analysis, designs and drawings were prepared to a conceptual level for inclusion in the Preliminary Engineering Report for environmental/permitting actions. Final designs and hydraulic reports will be prepared for submittal with the Plans-in-Hand.

3.2 Field Investigations

On October 5 through 10, 2005, Inter-Fluve conducted field investigations of the hydrologic and hydraulic conditions of the Chilkat River and tributary crossings. The field investigation included: 1) investigation of Chilkat River main stem and side channel scour and bank erosion conditions; 2) inventory and rapid assessment of existing culverts; 3) identification of culverts requiring more detailed study; and 4) cursory total station survey for conceptual design of a number of larger/fish bearing culverts. Conditions immediately following the flood of November 2005 were observed by Inter-Fluve staff and incorporated into the S&HI and this study. In response to design refinements and adjustments of the highway alignment, additional survey was collected in November 2008, May 2009 and October 2009 near Station 888+00 (S&HI station 908+00) and a number of proposed mitigation sites .

Details of the field investigation along the Chilkat River are provided in Section 4.2.

All culverts shown on the 1980 as-built drawings were searched for. A total of 109 crossings, including six with twin pipes, were located. Of the crossings shown on the as-built drawings, eight were not found. A rapid assessment of all found culverts was conducted. The rapid assessment included: size and condition of culvert, inlet/outlet conditions, height to stain line, degree of sedimentation/debris, and photo documentation of inlet/outlet conditions. An inventory of the culverts found in the field with a summary of rapid assessment results is included in a table in Appendix Section 23.1, along with those culverts listed on the as-built drawings that were not found. Based on height to stain line, the majority of the surveyed pipes appeared to be adequately sized. Further, interviews with ADOT&PF maintenance personnel indicated that except for flooding caused by hillside debris flows blocking culvert inlets, to date there has been satisfactory conveyance through the existing pipes. A large magnitude flood occurred during November 2005 and was reported to be as large a flood as recalled. Observations by Mark Sogge (Inter-Fluve, Haines) and Roger Ingledue (ADOT&PF Haines maintenance supervisor) indicate that all occurrences of road overtopping were the result of culverts plugged with sediment and debris (personal communication, March 8, 2006). No evidence of unobstructed pipes having insufficient conveyance capacity was reported.

In preparation for environmental and permitting actions, preliminary designs for flood conveyance and fish passage were prepared for eleven of the larger crossings and thirteen smaller fish bearing pipes identified for more intensive analysis. As noted above, study and design efforts at the four large culverts located along the two debris flows at MP 19 and 23 will be coordinated with geotechnical design during the design phase by DOWL HKM for passage of debris torrent sediments. Detailed site topographic survey, design and final Summary Hydraulic Report for each pipe will be prepared during a later phase and submitted with Plans-in-Hand.

Basic site survey data were collected at the fifteen large culverts identified for more detailed study. As survey coverage was unknown at the time and results of ongoing survey efforts would not be available within the timeframe of the preliminary phase of this study (October-November, 2005), Inter-Fluve used a total station survey gun and rod with prism to collect cursory relative location and elevation survey data including stream profile, typical cross section, culvert invert and crown elevations at the inlet and outlet and typical roadway elevations. The purpose of this survey data collection was to provide the essential site topographic data required to develop conceptual designs. Final design will require site-specific detailed topographic, cross section and profile survey data. The thirteen smaller fish pipes were identified after the field investigations and subsequently added to this study. Survey data from the additional thirteen smaller fish pipes were obtained from the ground based survey of the road embankment by ADOT&PF or Toner-Nordling surveyors (now DOWL HKM) or from the project LIDAR.

3.3 Hydrology - General Methods

3.3.1 Chilkat River

Hydrologic analysis methods for the Chilkat River are presented in Section 4.4.

3.3.2 Tributary Basins

Hydrologic analysis methods conducted in common for the tributary basins are included here, with tributary-specific information included in the individual tributary summaries.

3.3.2.1 Hydrology

Hydrologic analyses were performed for eleven streams with major crossings of the Haines Highway between mileposts 3.5 and 25.3. All streams flow through culverts under the Haines Highway shortly before entering the main stem of the Chilkat River or major Chilkat side channels. These streams have culverts at least 48 inches in diameter and/or contain significant fish habitat. Peak flow estimates for various return periods were estimated in order to analyze flood conveyance and fish passage conditions. As stated in the 2001 *Memorandum of Agreement between the Alaska Department of Fish and Game and the Alaska Department of Transportation and Public Facilities for the Design Permitting and Construction of Culverts for Fish Passage* (MOA),fish passage design flow is 40 percent of the 2-year peak flow. At this time, hydrologic analysis was not performed for the four streams that are located on debris fans. For these streams, flood runoff and fish passage design will be coordinated with geotechnical recommendations for conveyance of debris flow sediments.

The thirteen smaller fish pipes all drain areas ranging from 0.05- to 0.49-sq. mi. All are smaller than the 0.72-sq mi lower limit for the USGS regional regression estimates for flood runoff flows. Estimates of flows along the additional thirteen smaller fish pipe streams were extrapolated based on area weighting from neighboring larger basins. However, the high degree of variance in hydrologic predictions was suspected to incur unacceptable error. Therefore, an alternate approach was taken: while providing fish passage to meet MOA criteria, the flood conveyance of the proposed structures was verified to be either equal or greater to existing conditions. Details of this analysis are presented in Section 21 – Small Fish Culverts.

The eleven streams for which hydrologic analyses were performed originate in the Takshanuk Mountains northwest of Haines, AK. A map of the basin locations can be found in Figure 1. Basin sizes range from 0.47 mi^2 to 2.26 mi^2. Basin elevations range from sea level to over 5,000 feet. The watersheds are steep, with average watershed slopes ranging between 44 and 64 percent. Spruce-dominated forests with poorly-drained soils reach up to approximately 3,000 feet. Unforested alpine slopes characterize the higher elevations. Annual precipitation is approximately 60 inches, with most of the precipitation falling as snow in the winter months (Western Regional Climate Center). Seasonal hydrographs are unavailable for these basins; however, based on elevation and precipitation regimes, peak stream flows would be expected to result from spring and summer snowmelt with occasional peaks generated by rain and rain-on-snow events.

Debris flows dominate channel and valley morphology for some streams in this area; however, the eleven streams addressed in this section do not exhibit frequent debris flows.

Peak flows for various return periods were estimated for each of the eleven basins using USGS regional regression equations (Curran et al. 2003), the SCS Unit Hydrograph Method (SCS 1984), and the Rational Method. For the reasons discussed below, peak flow estimates generated from the regional regression equations are believed to be the most appropriate for stream crossing design purposes.

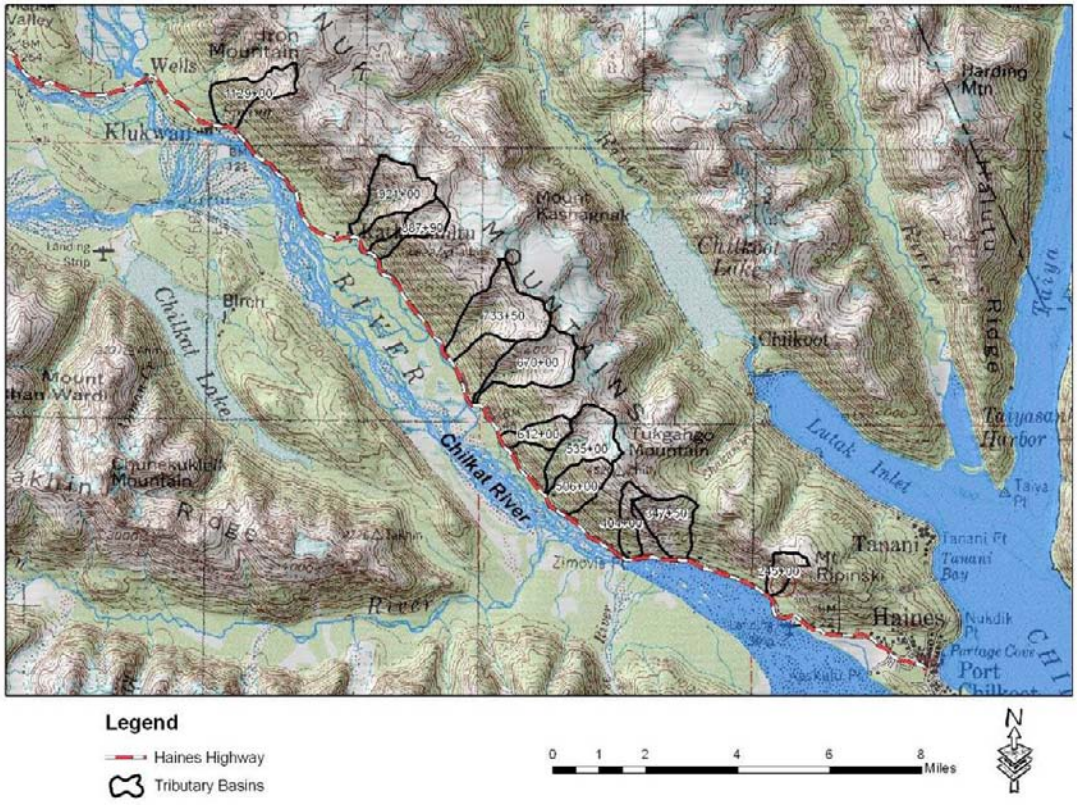


Figure 1. Map of Tributary Basins.

3.3.2.2 Regional Regression Analysis

The regression equations for southeast Alaska utilize drainage area (A), storage (ST), mean annual precipitation (P), and mean minimum January temperature (J) as predictor variables. Curran et al. (2003) used stream flow data from a total of 93 gaging stations to develop the regression equations. The equations and accuracy information are displayed in Table 3-1. Drainage area for each tributary basin was obtained by manually digitizing watershed boundaries on USGS 1:24,000 (7.5 minute) topographic maps in a Geographic Information System (GIS). Percent storage for each basin was obtained in GIS by digitizing surface water areas on the topographic maps. Mean minimum January temperature was obtained from values mapped by Jones and Fahl (1994). Values for basins located between isothermal lines were estimated through visual interpolation.

Mean annual precipitation values were obtained in GIS using a digitized version of the Jones and Fahl (1994) annual precipitation map - all of the basins fall within the 60 inch annual precipitation zone. **It should be noted, however, that this precipitation value is higher than actual annual precipitation measurements at Haines of 47.77 inches based on a period of record from June 1973 through December 2005 (Western Regional Climate Center).**

Table 3-1. USGS Regional Regression equations for estimating flood magnitude for various recurrence intervals. Equations are applicable to southeast Alaska (Curran et al. 2003).

Regression Equation for Specified Recurrence Interval (93 gaging stations)	Average standard error of prediction (percent)	Average equivalent years of record*
$Q_2 = 0.004119\, A^{0.8361}\,(ST+1)^{-0.3590}\,P^{\,0.9110}\,(J+32)^{1.635}$	38	0.88
$Q_5 = 0.009024\, A^{0.8322}\,(ST+1)^{-0.3670}\,P^{\,0.8128}\,(J+32)^{1.640}$	37	1.3
$Q_{10} = 0.01450\, A^{0.8306}\,(ST+1)^{-0.3691}\,P^{\,0.7655}\,(J+32)^{1.622}$	37	1.8
$Q_{25} = 0.02522\, A^{0.8292}\,(ST+1)^{-0.3697}\,P^{\,0.7165}\,(J+32)^{1.588}$	38	2.4
$Q_{50} = 0.03711\, A^{0.8286}\,(ST+1)^{-0.3693}\,P^{\,0.6847}\,(J+32)^{1.559}$	40	2.8
$Q_{100} = 0.05364\, A^{0.8281}\,(ST+1)^{-0.3683}\,P^{\,0.6556}\,(J+32)^{1.527}$	41	3.1
$Q_{200} = 0.07658\, A^{0.8276}\,(ST+1)^{-0.3669}\,P^{\,0.6284}\,(J+32)^{1.495}$	43	3.4
$Q_{500} = 0.1209\, A^{0.8272}\,(ST+1)^{-0.3646}\,P^{\,0.5948}\,(J+32)^{1.449}$	45	3.6

A=drainage area, in square miles; ST= area of lakes and ponds (storage), in percent; P=mean annual precipitation, in inches; J=mean minimum January temperature, in degrees Fahrenheit
Applicable range of variables: A: 0.720-571; ST: 0-26; P: 70-300; J: 0-32
**The number of years of systematic stream flow data that would have to be collected for a given site to estimate the stream flow statistic with accuracy equivalent to the estimate from the regression equation*

Basin characteristics for the eleven basins were within the range of values used to develop the regression equations with a number of exceptions. Three of the basins had drainage areas below the range; the smallest of which has a drainage area of 0.466 mi^2 compared to the range of 0.720 – 571 mi^2. According to the Jones and Fahl (1994) precipitation map, all of the basins have a mean annual precipitation of 60 inches, compared to the range of 70 – 300 inches. The violation of these criteria will affect the accuracy of the flow predictions. In general, the 11 tributary basins are smaller, lower elevation, drier, and warmer than the basins used to generate the regression equations. The study basins may exhibit proportionally larger peak flows than the basins used to generate the regression equations because of quicker times of concentration (less attenuation) due to high gradient and small size. Actual peak flow volumes could also be lower than those reported if precipitation levels are closer to the 47.77 inches measured at Haines, compared to the 60 inches reported by Jones and Fahl (1994).

Compared to the SCS Unit Hydrograph Method and the Rational Method, the regional regression equations are believed to represent the most appropriate flow estimates for

design purposes. The regression estimates are included in Table 3-2. Estimates from the SCS and Rational Method are presented in Appendix, Section 23.2.

Table 3-2. Flow estimates for tributary basins using USGS Regional Regression Equations (Curran et al. 2003).

Station ID	Drainage Area (mi^2)	40% of 2-year flood[1]	Flow Estimate for Indicated Return Period (ft^3/second)							
			2	5	10	25	50	100	200	500
222+51	0.47	17	42	64	79	99	114	130	147	171
319+13	0.60	20	50	75	93	117	135	154	175	202
324+79	1.23	37	92	137	169	212	246	280	317	368
483+18	1.07	30	76	113	139	175	203	232	263	305
512+30	1.46	29	73	107	130	166	193	220	250	290
589+20	0.65	21	52	78	96	121	140	160	181	210
647+20	1.75	38	96	142	174	220	255	291	331	384
710+70	2.26	50	125	186	228	288	334	381	432	502
865+88	0.80	22	55	82	101	127	148	169	192	224
887+60	1.55	38	95	141	175	219	255	291	331	385
1102+19	1.26	29	73	109	135	170	198	227	258	301

[1] *Interim fish passage design flow (ADFG/ADOT&PF Memorandum of Agreement 2001)*

3.3.2.3 SCS Unit Hydrograph Method

The SCS (now NRCS-Natural Resources Conservation Service) Unit Hydrograph Method (SCS 1984) was also applied to these 11 basins. The SCS Method calculates the volume of runoff per area of the basin according to soil and land use conditions. Information on time of concentration of stream flow and initial abstraction of storm precipitation are then used to calculate a unit hydrograph, which is applied to the runoff volume to calculate peak flow rates (SCS 1984). The hydrologic soil group was obtained in GIS using the NRCS State Soil Geographic (STATSGO) layer (NRCS 1979). The hydrologic soil group and land use conditions were then used to determine runoff curve numbers, which for all the basins were estimated at a value of 79. Time of concentration was obtained using flow length and average watershed slope, according to the procedures described for the method. Flow lengths were obtained in GIS by measuring the flow path from the stream outlet to the watershed divide using digitized versions of the USGS 7.5 minute topographic maps. Average watershed slopes were obtained by performing map calculations on the 30-meter Digital Elevation Models (DEMs) for the basins.

Basin characteristics yielded values outside the range for the initial abstraction to precipitation ratio that is used in the model. This is due to high intensity storms and low permeability soils. These results suggest that conditions in the study basins are outside the range of basin characteristics used to develop the SCS Method, which is primarily geared towards lowland agricultural basins. Final runoff volumes were substantially higher than those predicted with the regional regression equations. For these reasons, the SCS Method values were considered unreasonable estimates and were not incorporated into the final estimates for design flow. SCS Method flow estimates can be found in Appendix, Section 23.2.

3.3.2.4 Rational Method

The Rational Method was also applied to the study basins. The rational method simply uses rainfall intensity, watershed area, and a runoff coefficient to predict peak flow levels. Rainfall intensities for the 1-hour storm were used due to the short times of concentration of the basins. A runoff coefficient of 0.25 was selected based on watershed slopes and hydrologic soil groups. The Rational Method is best suited for small urban catchments and results for larger, rural basins should be viewed with caution. Nevertheless, the peak flow estimates are similar to the regional regression estimates, though slightly lower on average. These values are not used as recommended design flows because of the violation of basin size criteria specified in the Alaska Highway Drainage Manual (ADOT&PF, 1995), but they do increase confidence in the regional regression estimates because of their similar magnitude. Rational Method flow estimates can be found in Appendix, Section 23.2.

4. Chilkat River

4.1 Introduction

The project reach extends from highway milepost 3.5 to 25.3. The highway runs roughly parallel with the Chilkat River, crossing at the Wells Bridge near milepost 25.

The Chilkat River is a large, glacial fed river. Drainage area at the Wells Bridge is 791-square miles. Near the Haines airport the drainage area increases to 1,602-square miles. The Chilkat River varies in width from about 1,000-ft up to 1.1-miles near the airport. Bed materials range from silt/sand at the mouth to gravel/cobble near the upstream end of the study area. The active river channels shift dramatically over a short time period. From the mouth to milepost 10 the main stem parallels and fronts much of the highway. From milepost 10 to 19 there are a number of side channels and back water sloughs near the highway. A map of the Chilkat River watershed is included in Figure 2.

This study addresses, at a conceptual level, erosion protection of the highway embankment adjacent to the Chilkat River or its side channels. Included are estimates of depths of scour through field investigations and analysis. Further, incorporation of habitat while providing engineered stability to the highway is addressed.

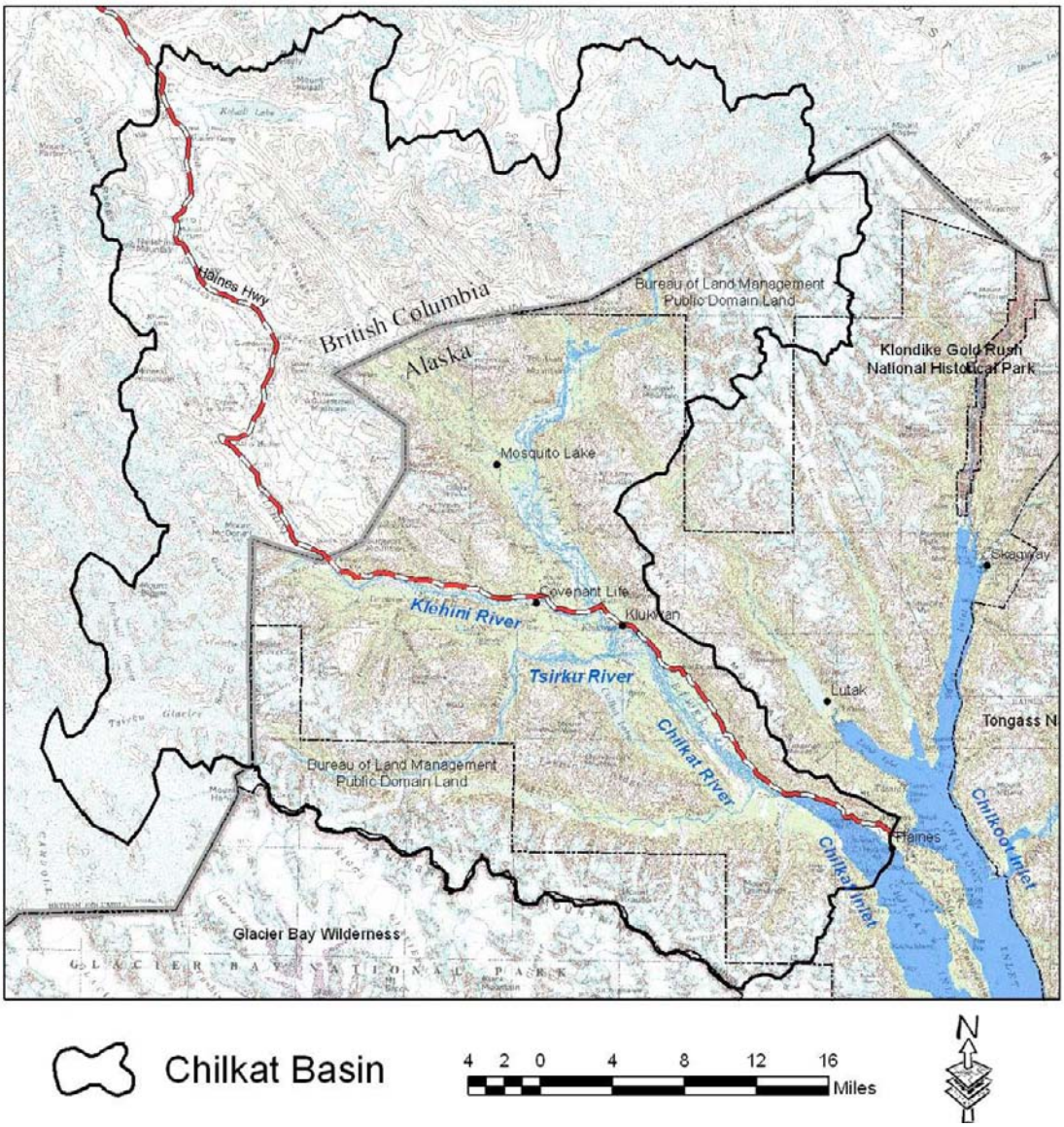


Figure 2. Map of the Chilkat Basin.

4.2 Chilkat River Field Investigations

Field investigations of the Chilkat River included visual inspection of existing roadway embankments, revetment and vegetation conditions, and estimates of existing scour depth conditions. Main areas of concern along the Chilkat River included reaches where the Chilkat River makes moderate to sharp bends, where points of land jut into the river and side channels of the Chilkat River impinge directly on the highway embankment.

4.2.1 Chilkat River Main Stem

Scour investigations were based on depth sounder measurements of scour holes along the main stem and side channels: An 18.5-ft jet boat was used to access portions of the main

stem of the Chilkat River. An Eagle, SuperPro ID portable depth sounder was attached to the boat to estimate depths to bottom. The depth sounder readings were periodically compared against depths manually probed with a rod to develop a correction factor. Typical areas where river scour were expected to occur were investigated by slowly ferrying across the river, depth sounder readings were called out and noted on site aerial photos. These depth readings are likely accurate to no better than 1- to 2-ft. Reading distance from shore was visually estimated and likely accurate to no better than 5- to 10-ft. The objective was to gain an understanding of relative magnitude of scour at different river conditions.

ADF&G maintains a staff gage near highway Station 395+00 (S&HI station 418+00) as noted in Section 4.3.1. At the time of the boat based investigations, the staff gage read approximately 29.03-ft elevation. No river flow information is associated with elevation readings.

Depths measured on October 7, 2005 ranged from 2- to 3-ft along straight wide sections to as deep as 15.5-ft in areas of bends and obstructions. Specific areas noted to have deep scour holes include:

- Off a point of land near Station315+00 (S&HI station 338+00) scour depths range from 9- to 15.5-ft approximately 25-ft from shore.
- Near Station 394+00 (S&HI station 417+00), scour depths range from 8- to 14-ft with maximum depth about 30-ft from shore.
- Near Station 454+00 (S&HI station 477+00) above the lower ADF&G fish wheel flow depths are between 4.5 and 6.0-ft deep, evidence of little scouring along this locally straight reach.
- Near Station 462+00 (S&HI station 485+00) above the upper ADF&G fish wheel flow depths range from 6.0- to 9.5-ft. Flows impinge on the road embankment at the outside of a bend.

Scour conditions appeared to be localized at predictable locations, yet extend for several hundred feet in an upstream-downstream direction. It is anticipated that the location of scour holes will change dramatically in response to flood conditions and changes in channel plan form. It must be noted that scour holes typically reach their greatest depth at or shortly before a flood peak. As the flood recedes, bed load begins to deposit in the scour hole, reducing the depth observed following the flood. Thus, the maximum depth of scour during floods is typically greater than those observed following the flood. Maximum depths of scour during flooding vary dependent on a number of factors including magnitude of flood, rate of flow increase/decrease, debris, sediment and water temperature.

During the boat based investigations, visual observations were made of the existing riprap revetment and adjacent vegetative condition. In general, the existing rock along the main stem of the Chilkat River appeared to be performing satisfactorily for erosion protection. Woody vegetation growth was typically vigorous above a well-defined elevation on the bank and sporadic or absent below this elevation.

4.2.2 Chilkat River Side Channel

Side channels impinge directly on the highway and turn away at sharp angles; notably near stations: 640+00, 703+00, 751+00, 816+00 and 830+00 (S&HI stations 663+00, 724+00, 772+00, 837+00 and 851+00, respectively). Depth of scour at sharp bends along side channels impinging on the highway were also investigated by jet boat, where accessible, using the portable depth sounder. Areas inaccessible to the jet boat were investigated with the portable depth sounder and floating boom. The transducer was taped to a crab pot buoy which was attached to the end of a 14-ft long aluminum pruning saw handle. The 15-ft long depth sounder cable allowed readings to be taken from a wadeable depth along shore to a distance of about 15-ft into the channel. A guy line attached to the buoy was held from an upstream location to maintain the boom in position in areas of higher flow velocities. The boom was manually extended out from the bank and depth soundings read off and recorded. These depth readings are likely accurate to no better than 1- to 2-ft. Distance from shore was estimated in relation to reference marks along the pole and likely accurate to 1- to 3-ft. The objective was to gain an understanding of relative magnitude of scour at sharp bends.

Depths measured along the side channels on October 7 and 8, 2005 ranged from 4-ft along straight sections to as deep as 12-ft at sharp bends. Specific areas noted to have deep scour holes include:

- At a bend in the side channel near Station 623+00 (S&HI station 646+00) depths range from 4- to 9.5-ft.
- At a sharp bend in the side channel near Station 640+00 (S&HI station 663+00) depths range from 6- to 11-ft.
- Along a straight reach of the side channel from Station 672+00 to 699+00 (S&HI stations 693+00 and 720+00, respectively) depths range from 4- to 9.5-ft. Average depths appear to range from 5- to 6-ft.
- At a bend in the side channel near Station 703+00 (S&HI station 724+00) depths range from 6.5- to 11-ft. Deepest scour appears to occur approximately 10- to 15-ft off shore.
- At a bend in the side channel near Station 751+00 (S&HI station 772+00) depths range from 6- to 9-ft.
- At bends in a minor side channel near Stations 816+00 and 830+00 (S&HI stations 837+00 and 851+00, respectively) scour depths range from 6- to 11-ft deep.

Scour conditions appeared to be localized at predictable locations yet extend for a few hundred feet in the upstream-downstream direction. Commonly, vegetated banks opposite the highway dropped vertically 7- to 8-ft below water level to the stream bottom. Trees toppled into the channel are not uncommon along these locations. As noted earlier, scour holes typically reach their greatest depth at or shortly before a flood peak. As the flood recedes, bed load begins to deposit in the scour hole, reducing the depth observed following the flood. Depths of scour during floods are expected to be greater than those observed following the flood event.

Visual observations of riprap conditions along the side channels indicated that the majority of the existing rock was in satisfactory condition. Some erosion was noted along the bank where the rock was small, banks were steep, and flow impingement most likely. These areas were located at: 700+50-704+00, 750+00-752+00, and 777+00-779+00 (S&HI stations 721+50-725+00, 771+00-771+00, and 798+00-800+00, respectively). Areas of vegetated riprap generally appeared to be in satisfactory condition for erosion protection. Typically there is a distinct elevation of persistent vegetation with vigorous plant growth above and little to no plant growth below. These observable conditions provide useful guidelines for what is feasible for bioengineering solutions.

4.3 Hydraulic History

4.3.1 Tidal and Non-Tidal

Tidal range of the Lynn Canal at the Chilkat Inlet gage (6.9-miles southeast (true) of the Haines airport) is 16.5-ft between mean lower low water (MLLW) and mean higher high water (MHHW) (http://www.co-ops.nos.noaa.gov/benchmarks/9452421.html).

An inquiry was submitted to ADOT&PF surveyors regarding conversion from the tidal datum to land based elevation datum. The following response was provided (T. Reed, personal communication May 22, 2006):

> "ADOT&PF has benchmark ties to the NAVD 88 datum in the Haines area for the subject project. Based on other ADOT&PF survey work (specifically GPS ties to tidal benchmarks at Taiyasanka Harbor, AK station 9452434) in the area a conversion from tidal to NAVD 88 datum was determined to be NAVD 88 + 7.4-ft = MLLW tidal datum. MHHW tide elevation along the Chilkat Inlet is 16.76-ft (MLLW). This elevation converted to NAVD 88 is approximately 9.4-ft (NAVD 88). Based on existing conditions LIDAR topographic mapping, elevation 14.7-ft (NAVD 88) occurs along the Chilkat River sand flats at the downstream end of the Haines Airport, downstream of the project beginning. The lowest LIDAR elevation observed at the upper end of the runway is 17.3-ft NAVD88."

The extent of tidal influence along the Chilkat River was approximately estimated by extrapolating the HEC-RAS model developed for the scour hole at station 394+00 (S&HI station 417+00) to downstream from the airport. The most downstream cross section synthesized for the Station 394+00 (S&HI station 417+00) outcropping was copied downstream to the airport and also copied to 14,045-ft downstream of the airport to the end of the flats indicated on the USGS topographic map. The elevations of these cross sections were adjusted based on the LIDAR contour elevation (14-ft) at the airport and at the downstream end of the flats based on extrapolation of the lower LIDAR coverage. Though extremely approximate in nature, this provided a rough comparison of water surface elevations generated along the river with the one-dimensional HEC-RAS model and MHHW. From this modeling it was seen that the elevation of MHHW is lower than the flood water surface elevation for the 2- through 100-year events that were considered in the model. Therefore, high tide will not have a hydraulic affect on river

during the 2-year or higher flows. Results of the approximate HEC-RAS model are shown in Appendix 23.5.1.

Fluctuations in the Chilkat River discharge and associated water surface elevations will affect the project and backwater many of the tributary crossings of the highway. Typical summer water level fluctuations are observed at a staff gage maintained and monitored by ADF&G near station 395+00 (S&HI station 418+00). The gage has been read for a period of record from 1994 through 2005 from June through September or October. The gage readings include only water surface elevation. The top of the piling elevation, 36.185-ft, was surveyed by ADOT&PF in 2005 with the associated staff gage elevations subsequently tied to that temporary bench mark elevation (M. Sogge, personal communication, Sept 2006). River water surface levels range from about 31.0- to 33.0-ft for June through July. Levels begin to decrease starting in August. In September the river levels range from an average low of about 29.0- to 31.5-ft. September minimum water levels are about 28.5-ft while maximum values are about 33.5-ft. These levels reflect the impact of fall rains. No river discharge measurements or calculations are associated with these stage data. A chart of these data are provided in Figure 3

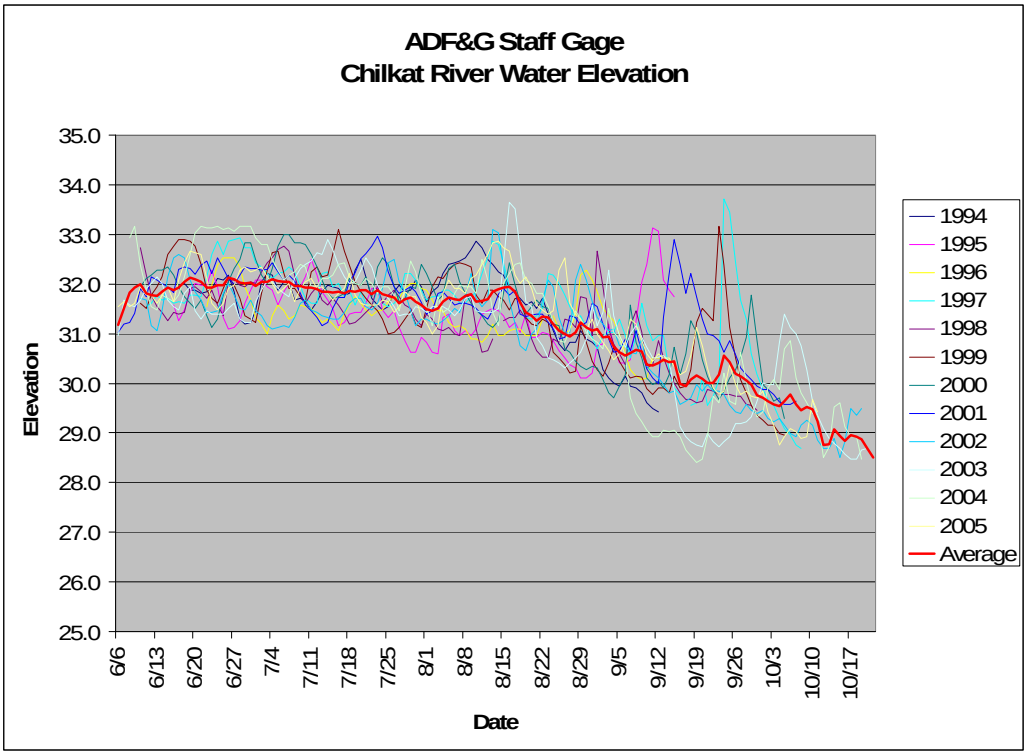


Figure 3. ADF&G staff gage readings near Sta 395+00

4.3.2 Navigation

Navigation is limited to recreational, commercial tour and ADF&G research jet boat use along the length of the project. In addition, commercial raft float trips are conducted from the Tsirku River through the Chilkat Bald Eagle Preserve to about milepost 15.

Recreational canoes, kayaks and rafts are also used along the river. The Chilkat River dynamically shifts its course with extensive gravel bars, shallow flow depths over riffles and extensive sand and silt flats. Other than tourism and sport and subsistence fishing, little commercial activity presently occurs along the Chilkat River. Therefore, no other navigational use is anticipated.

4.3.3 Confluence

The Chilkat River discharges to the Chilkat Inlet of Lynn Canal. Within the project reach, the Chilkat River has confluences with the Kicking Horse River, the Tahkin River, the Tsirku River and the Klehini River. All these rivers discharge into the Chilkat River from the southwest side, opposite the highway. No impact is foreseen to these confluences by the proposed action.

4.3.4 Mining

Approximately 500,000-cy of gravel was mined from the river near the Haines airport runway during the winter of 1990-91 for construction of the Haines airport. Otherwise, mining activity within the Chilkat River has not been identified to exist. No in stream mining of gravel material is reportedly planned for this project.

Iron, gold, copper, platinum and palladium deposits exist within the Chilkat River watershed along the project length. However, economics have not justified mining these deposits. No plans for mining these deposits are publicly available. (M. Sogge, personal communication)

4.3.5 Debris and Icing Problems

Debris load along the Chilkat River consists of large woody debris load typical of this scale of southeast Alaskan glacial rivers. This debris forms occasional logjams but has not been observed to have a significant impact on the Haines Highway.

The timing of ice-up of the Chilkat River depends on the severity of the winter. In general, there is a section of the river near the Tsirku River alluvial fan that remains open at least through November, but more often December. There have been many times around Christmas when the river has been observed to be open between 19 mile and the Wells Bridge. It is not uncommon for most of the river to freeze over in January and February. Channels of the river can open up in March, but the main breakup does not typically occur until the beginning of April. (M. Sogge, personal communication)

Glaciers occupy approximately 20 percent of the upper watershed (based on the 1:250,000 USGS map). Glaciers do not directly encroach into the project area. No glacial outburst flooding was recalled in the anecdotal record. USGS Atlas HA-455 (Post and Mayo, 1971) indicates no significant glacial outburst floods in the Chilkat River Basin. Glacial outburst flooding from the headwaters of the Tsirku River is implied by hatch pattern on Sheet 1 in the Post and Mayo report. However, there is no discussion of

the Tsirku River in the report. The Tsirku River discharges into the Chilkat River opposite the village of Klukwan. Based on the anecdotal record and cursory reference in the Post and Mayo report, it is assumed that glacial outburst flooding has insignificant influence on flows along the Chilkat River.

4.3.6 Geomorphology

Geomorphology of the Chilkat River can be characterized as a large dynamic glacially fed river. The river is braided throughout the project length and the active flow path shifts significantly and dramatically over short time periods; typically in response to higher magnitude and longer duration flows. As an anecdotal example, along a side channel adjacent to the road near milepost 14, an exposed sand bar observed in 1999 by Inter-Fluve was absent and found to be replaced by a 12-ft deep scour hole during the October 2005 field investigation. The braided main stem is adjacent to the road or separated by a narrow band of forest from the Haines airport to milepost 10. From milepost 10 to 19, there is a complex system of side channels close to the road with the main river further from the road. Along the project length, the Klehini, Tsirku, Tahkin and Kicking Horse Rivers are tributary to the Chilkat River entering from the southwest side opposite the highway.

4.3.7 Bed Load

Based on ocular investigation, bed load varies in size from sands and silts near the downstream end, transitioning to gravels and cobbles at the Wells Bridge near milepost 25. Above the Wells Bridge, the Chilkat River widens with extensive sand bars noted.

4.3.8 Environmental

Environmental considerations along the Chilkat River include the presence of Chinook, coho, pink, chum and sockeye salmon, eulachon and bald eagles. Proposed bank revetments strive to maximize the use of habitat elements while maintaining engineered stability.

4.4 Hydrology

The Chilkat River originates in the Datlasaka and Kusawak Mountains of northwest coastal British Columbia, flows into northern southeast Alaska, and empties into the Chilkat Inlet branch of the Lynn Canal near Haines, AK. Total basin size is approximately 1,600 square miles; just over half (54 percent) lying within the United States. Major tributaries include the Kelsall River, the Klehini River, the Tsirku River, and the Takhin River. Elevations in the basin range from sea level at the mouth to approximately 9,000 feet in the headwaters of the Tsirku Basin. Precipitation is snow-dominated with summer rains common in the lower elevations. The higher elevations are covered with expansive glaciers. The main stem and major tributaries exhibit a glacial melt water hydrologic regime, with peak flows typically occurring in the early summer

(snowmelt) or in late summer/early fall (rain plus snowmelt). Low flows typically occur during winter months. Occasional large peak flows result from rain-on-snow events.

Flood frequency analysis was conducted for five locations along the main stem Chilkat River. Flow estimates were made for various return periods in support of channel hydraulic assessments at various locations where the main stem Chilkat or major side channels flow adjacent to the Haines Highway. Flow estimates are for the entire Chilkat River and do not account for flow separation into branching channels.

Peak flow estimates for various return periods were estimated using a combination of USGS regional regression equations (Curran et al. 2003) and watershed expansion of nearby available gage data. Nearby gages used in the watershed expansion include the Klehini Gage (USGS Station #15056560) and the Upper Chilkat Gage (USGS #15056400).

4.4.1 Regional Regression Analysis

The regression equations for southeast Alaska utilize drainage area (A), storage (ST), mean annual precipitation (P), and mean minimum January temperature (J) as predictor variables. Curran et al. (2003) used stream flow data from a total of 93 gaging stations to develop the equations. The equations and accuracy information are displayed in Table 3-1. Basin delineations were performed manually in a Geographic Information System (GIS) using the USGS 1:250,000 topographical map (Skagway) and shaded relief images derived from 30-meter Digital Elevation Models (DEMs). Percent storage for each basin was obtained in GIS by digitizing surface water areas on topographic maps. Mean annual precipitation values were obtained in GIS using a digitized version of the Jones and Fahl (1994) annual precipitation map. Average precipitation values for each basin were weighted by the amount of area in each precipitation zone. Precipitation zones were not available for the Canadian portions of the basins; US data was therefore proportionally expanded into the Canadian portion. Mean minimum January temperature was obtained by geo-referencing and digitizing the temperature isothermal map in Jones and Fahl (1994). Average temperature values for each basin were weighted by the amount of area in each temperature zone. The regression estimates for the main stem Chilkat are included in Table 4-2.

4.4.2 Watershed Expansion Using Gage Data

Flow records are available for several years at two locations in the Chilkat Basin. These include the Upper Chilkat Gage (1962-1968) and the Klehini Gage (1982-1993). Curran et al. (2003) recommend a procedure for estimating peak flows where gage data is available. The method involves conducting Log Pearson III analysis on the gage data and weighting these results with those obtained using regional regression equations. Weighting is conducted according to the number of years of record of gage data and the Equivalent Years of Record (EYR) of the regression equation. This analysis was conducted by Curran et al. (2003) for many streams in Alaska, including the Klehini. The values for the Klehini included in Table 4-2 were obtained by expanding the reported Klehini values to the basins of interest.

Curran et al. (2003) performed stream flow analysis for stations with at least eight years of record and therefore did not perform analysis for the Upper Chilkat Gage, which has seven years of peak flow records. The procedure they describe, however, is suitable for stations with as few as five years of record due to the weighting with regression equations. Their procedure was therefore performed for the Upper Chilkat Gage location in order to obtain additional data points for final peak flow estimates.

A Log Pearson Type III analysis was first performed on the gage data following the methods described in Bulletin 17B of the IACW (1982). Instantaneous peaks were used for all years except one, where only the average daily peak was available. A weighted skew coefficient was obtained by weighting the derived station skew with the generalized skew for southeast Alaska using the procedures described in Curran et al. (2003). The values obtained through Log Pearson III analysis are included in Table 4-1. Regional regression analysis was then performed for the station location. The Log Pearson III values and the regression values were weighted using the following equation from Curran et al. (2003):

$$\log Q_{Twtd} = \frac{\log Q_{Tsta} N + \log Q_{Treg} EYR}{N + EYR}$$

where Q_{Twtd} is the weighted peak flow estimate, Q_{Tsta} is the value obtained from the Log Pearson III analysis with weighted skew, Q_{Treg} is the value obtained using the regional regression equation, N is the number of years of record of station data, and EYR is the Equivalent Years of Record for the regional regression equation. The weighted flow estimates for the Chilkat Gage location are included in Table 4-1.

Table 4-1. Results of flow calculations for the Upper Chilkat Gage location using Log Pearson Type III Analysis and USGS regional regression equations.

	Log Pearson III		Regional Regression		
Return Period	Q (ft^3/second)	Years of Record (Gage)	Q (ft^3/second)	Equivalent Years of Record[1]	Weighted Q (ft^3/second)
2	8,985	7	6,521	0.88	8,669
5	12,712	7	8,880	1.30	12,017
10	15,649	7	10,485	1.80	14,418
25	19,949	7	12,922	2.40	17,856
50	23,610	7	14,766	2.80	20,647
100	27,697	7	16,633	3.10	23,684
200	32,269	7	18,678	3.40	26,987

[1] *From Curran et al. (2003)*

4.4.3 Final Flow Estimates

In order to obtain final flood flow estimates, values from the following analyses were averaged: 1) regional regression, 2) watershed expansion using Klehini Gage, and 3) watershed expansion using Upper Chilkat Gage. All of these results are included in Table 4-2.

Table 4-2. Final flow estimates for locations along the lower mainstem Chilkat River. Values in cubic feet per second.

Return Period	Chilkat at Mouth (1,602 mi^2)	Chilkat below Tahkin River (1,526 mi^2)	Chilkat below Tsirku River (1,364 mi^2)	Chilkat below Klehini River (1,080 mi^2)	Chilkat above Klehini River (791 mi^2)
2-Year					
Regional Regression	32,837	30,932	25,465	18,327	12,375
Klehini Expansion	40,106	38,204	34,148	27,038	19,803
Upper Chilkat Expansion	57,869	55,123	49,272	39,013	28,573
Average	43,604	41,420	36,295	28,126	20,250
5-Year					
Regional Regression	45,167	42,552	35,173	25,506	17,260
Klehini Expansion	47,327	45,081	40,296	31,906	23,368
Upper Chilkat Expansion	80,213	76,408	68,297	54,076	39,606
Average	57,569	54,681	47,922	37,163	26,745
10-Year					
Regional Regression	53,375	50,300	41,637	30,368	20,523
Klehini Expansion	51,839	49,380	44,138	34,948	25,596
Upper Chilkat Expansion	96,242	91,677	81,944	64,882	47,520
Average	67,152	63,786	55,906	43,399	31,213
25-Year					
Regional Regression	66,004	62,231	51,731	37,896	25,763
Klehini Expansion	57,537	54,807	48,989	38,789	28,409
Upper Chilkat Expansion	119,186	113,532	101,479	80,350	58,849
Average	80,909	76,856	67,399	52,345	37,674
50-Year					
Regional Regression	75,469	71,180	59,301	43,610	29,708
Klehini Expansion	61,485	58,568	52,351	41,451	30,359
Upper Chilkat Expansion	137,818	131,280	117,343	92,911	68,049
Average	91,591	87,010	76,332	59,324	42,705
100-Year					
Regional Regression	85,007	80,209	66,969	49,436	33,748
Klehini Expansion	65,434	62,330	55,713	44,113	32,308
Upper Chilkat Expansion	158,093	150,593	134,606	106,579	78,060
Average	102,845	97,710	85,763	66,710	48,039
200-Year					
Regional Regression	95,425	90,074	75,366	55,839	38,200
Klehini Expansion	69,382	66,091	59,075	46,775	34,258
Upper Chilkat Expansion	180,138	171,592	153,376	121,441	88,944
Average	114,982	109,252	95,939	74,685	53,801

4.5 Local input

The Haines area ADOT&PF maintenance supervisor, Roger Ingledue, was interviewed about existing conditions, past performance and areas of concern. In general, the existing Chilkat River and Haines Highway system was reported to be functioning satisfactorily. No flood overtopping of the road either by the Chilkat River main stem or side channels or tributary crossings along the project reach was reported. Overtopping of the road by some tributaries during the November 2005 flood was reported in cases where the culverts were blocked by debris or sediment. No problems with icing were recalled. And no problem areas of revetment erosion were noted.

A flood occurred in November, 2005 that caused sediment and debris accumulations in some tributaries that blocked culverts. Mr. Ingledue reported that flows overtopping the road during the November 2005 flood were a result of debris and sediment plugging the culvert. No overtopping was reported at culverts that were not obstructed. (Personal communication to Mark Sogge, Inter-Fluve, March 8, 2006)

4.6 Backwater

4.6.1 Main stem

No FEMA Flood Insurance Studies were located for the Chilkat River. Anecdotal information indicates that this stretch of highway has not been overtopped during the period of record, since about 1980. Reports of overtopping of the highway during the November 2005 flood were determined to be mountainside flows blocked by sediment and debris accumulations at culvert inlets and subsequently overtopping the road.

The hydraulic and geomorphic conditions of this river and system of side channels are extremely dynamic and complex. The Chilkat River is a braided sand, gravel and cobble bed river with rapidly changing active channels. An extensive sand flats area is located at the mouth where the sediment load deposits as the Chilkat River enters the tidal Lynn Canal. Existing data consists of LIDAR coverage along the highway corridor extending up to approximately one-third, but no more than 1,000-ft, across the active river. The LIDAR does not capture below water topography (bathymetry). The active river ranges from 1,000-ft to over a mile in width. USGS maps have a contour interval of 100-ft and are inadequate to extend the topographic coverage for the hydraulic analysis. Further, the USGS 1:63,360 topographic maps were created in 1954 and revised/inspected in 1977. In addition to the coarse resolution of the topography, it is impacted by isostatic rebound anecdotally reported to be approximately 0.9-inches/year as noted in Section 4.9. There is extremely limited availability of river flow-water surface elevation data for calibration of a hydraulic model.

Given the dynamic nature and complexity of the Chilkat River system and scale of the several miles of river paralleling the road; determination of a jurisdictional 100-year water surface elevation along the length of the project is beyond the scope of this study.

Therefore, an alternate approach was adopted for this conceptual level evaluation. This approximate approach is site specific to enable a semi-quantitative modeling approach for design values. In addition, the relative impact of the proposed action on water surface elevations can be approximated. For preliminary design of bank erosion protection and depth of scour, areas of greatest concern were considered. The area selected for this simplified approach was near Station 394+00 (S&HI station 417+00). A scour hole with depths to 15.5-ft is located at the outside of a bend in the river off a point of land. ADF&G maintains a seasonal staff gage near this location.

Model cross sections were approximately synthesized from the dearth of available data. The LIDAR surface topographic information was used in conjunction with depth sounder readings to approximate bathymetry. Active river width was approximated from the USGS topographic map with a southwest flood plain elevation assumed. Distance between sections was measured from the respective location of the sections superimposed on the LIDAR topography. Downstream boundary conditions were determined by normal depth calculations using a slope of 0.00066-ft/ft determined from the portion of LIDAR topography for the river. For this conceptual phase, values of Manning's n roughness coefficient were estimated based on engineering judgment. Values for the channel and overbank areas were 0.038 and 0.055, respectively.

To model proposed conditions, the existing conditions model was copied and modified to reflect a 2H:1V bank. Comparison of the existing and proposed conditions models indicates 0.02-ft of increase in elevation. However, it must be noted that the Chilkat River is dynamically changing location and bed form with corresponding changes in water surface elevations. Further, the model did not account for changes in cross sectional shape as silts/sands/gravels will transport and deposit in response to river flows.

As noted in Section 4.3.1, this model was used to approximately estimate the upstream limit of tidal influence. The downstream most cross section near station 394+00 (S&HI station 417+00) was copied to near the airport and the limit of the sand flats indicated on the USGS topographic map. Cross section elevations were adjusted based on LIDAR elevations at the airport and extrapolation to the edge of the sand flats. Low tide conditions were modeled using a normal depth as a downstream boundary condition. High tide conditions were modeled using MHHW converted to NAVD 88 project datum as a constant downstream water surface elevation boundary condition. The results of this approximate model indicated that high tide elevations are lower than river water surface elevations generated from the model using normal depth boundary conditions. Thus MHHW do not create a back water condition (hydraulic M1 curve) on river flows at the downstream end of the model below the Haines airport and do not impact the river hydraulics through the project reach.

Summary results from the modeling effort are included in Appendix 23.5.1.

4.6.2 Side Channels

A modeling approach similar to the main stem was taken for the side channels. Representative sites near Stations 640+00, 672+00 to 709+00, 749+00 and 792+00 (S&HI stations 663+00, 693+00, 730+00, 770+00, 813+00, respectively) were selected for evaluation. The LIDAR topographic data included the full side channel width at these locations. Boat and wading based depth sounding readings were used to synthesize below water portions of the cross section. Wading based depth soundings extended only partially across the side channel. Depths across the un-sounded width were extrapolated by assumption.

A range of flows were included in the model in an effort to determine the worst case condition for design of revetment and scour depth protection. As described in the preceding section, the river system is extremely dynamic and complex. The percent of flow diverting from the main Chilkat River along the side channel and flood plains is not known. Therefore, it is not possible to determine a return period event for the various flows.

Summary results from the modeling effort are included in Appendix 23.5.1.

4.7 Scour

As described in Section 4.2, areas where scour would be expected to occur were investigated using a portable depth sounder. These areas were accessed with a jet boat or by wading. These readings provide the scour conditions at the time of the field investigation; October 7 and 8, 2005. Floods typically form the deepest scour at or near the peak of the flood hydrograph. As the flood recedes, the scour hole begins to fill in with bed load. Therefore, maximum scour depth would be expected to be deeper than that measured in October.

4.7.1 Main Stem

Scour depths were observed using the jet boat and depth sounder. Locations of depth readings from the bank were noted by landmarks and visual estimates of distance from the bank. Readings and location were noted onto the project air photo. Main stem depths ranged from 2- to 3- feet in shallow straight riffles to scour holes with depths of 14- to 15.5-ft. Scour holes typically occurred at bends or points of land extending into the active flow path. Scour holes extended for several hundred feet in the upstream-downstream direction.

The Chilkat River system is highly dynamic with flow paths and channel geometry changing quickly and dramatically. As a result, the location, depth and mechanism of scour should be expected to change with scour depths in excess of observed values potentially occurring at nearly any location along the embankment.

4.7.2 Side Channels

Locations of scour holes along the side channels are likely to be more static in their location than those occurring within the main river channel. The scour holes were typically located at bends or local scour at obstructions. Observed scour depths ranged from 8- to 12-ft or more.

4.8 Hydraulic Design

4.8.1 Main Stem

Field observations and the results of the hydraulic modeling were used for conceptual design of road embankment protection. In the field it was noted that there was a distinct elevation on the bank of persistent woody vegetation. Woody vegetation was generally robust above this elevation. Below this elevation, the vegetation was either altogether absent or sporadic. This very obvious field indicator provides a guideline about the applicability of bioengineering techniques for erosion protection. Below this elevation rock is the most suitable material to provide the level of erosion protection required for the highway. Above this elevation, vegetation may provide a satisfactory measure for erosion protection. Non-living vegetation may be incorporated into the lower bank if properly designed for scour and stability of the road, road embankment, and materials. Concepts are shown in the drawings. Final design of these features will be completed at a later stage for submittal with Plans-in-Hand.

Rock to protect the lower bank was sized for flows up to the 100-year event based on bed tractive force, adjusted for increases if along a bend, using the moment stability method (Julien, 1995). The moment stability method accounts for the angularity and specific gravity of rock and provides results that compare well against conditions observed in the field. For relatively straight reaches an average rock size of 18-inches (sound and angular rock with a minimum specific gravity equal to 2.65) laid at a 2H:1V slope will be required. A layer of filter gravel (or fabric) will be required between the rock and the bank slope.

Scour depth is most accurately estimated from field observations. As noted in the preceding section, scour at bends and points of land jutting into the channel were observed in early October, 2005 to have depths to 15.5-ft. These depths will be greater during flood peaks. The observed scour holes occur in predictable isolated locations and tend to extend for several hundred feet in the upstream – downstream direction. Areas at higher risk of erosion include places where the river impinges the road embankment with flows turning at an angle or where land juts into the flow. Straight flow paths were observed to have flow depths of 3- to 6-ft deep with a relatively flat bed surface. However, the river is dynamic and continually changing flow path. Any portion of the road embankment may become subject to aggressive scour from river flows. Following project completion, monitoring and adaptive management of the road embankment is highly recommended.

From the hydraulic analysis, bed shears appear low enough that vegetation may perform satisfactorily for bank erosion protection above the field observed elevation of persistent woody vegetation. Basic concepts are included in the concept drawings. Details will be prepared at final design.

4.8.2 Side Channels

Similar to the main stem, field observations and the results of the hydraulic modeling were used for conceptual design of road embankment protection along the side channels of the Chilkat River. A distinct elevation of persistent woody vegetation was noted for side channels as well.

The side channels represent a complex network of flow paths. It was not possible without extensive topographic data and modeling efforts to determine the percentage of flow for each return period flood event that is conveyed along the side channels or flood plains. Therefore, a worst case condition, corresponding to bank full flow, was used as the design condition along the side channels. Flows greater than bank full are expected to spill onto the flood plain and dissipate the energy associated with the additional flow. Rock to protect the lower bank was sized for flows up to the worst case condition based on bed tractive force, and the moment stability method (Julien, 1995). A bend coefficient was used to account for greater shear forces along bends (FHWA, 1988). For sharp bends (e.g. Station 640+00 - S&HI station 663+00) the coefficient doubles the bed tractive force. The moment stability method accounts for the angularity of rock and provides results that compare well against conditions observed in the field. Average rock size of about 18-inch diameter will be required along straight reaches, below the tangent of bends. At moderate bends average rock size will need to be between 21- and 27-inches. At sharp bends with high tractive forces and turbulence, average rock size may need to be 30-inches and laid at 2.5H:1V or flatter. All rock is to be sound and angular with sizes based on a minimum specific gravity equal to 2.65. A layer of filter gravel (or fabric) will be required between the rock and the bank slope.

Scour depth is based on observations in the field. As noted in the preceding section, scour at bends and points of land jutting into the Chilkat side channels were observed in early October, 2005 to have depths to 11.5-ft. These depths will be greater during flood peaks. The scour holes occur in predictable isolated locations and tend to extend for a few hundred feet in the upstream – downstream direction. Areas at higher risk of erosion include outsides of bends. The severity of scour increases with tighter bends. Straight flow paths were observed to have flow depths of 4- to 6-ft deep with a relatively flat bed surface. Locations of scour are not expected to change from current locations. Fallen trees or debris accumulations will also initiate local scour. Following project completion, ongoing monitoring and adaptive management of the road embankment is highly recommended.

From the hydraulic analysis, bed shears appear low enough that vegetation may perform satisfactorily for bank erosion protection above the field observed elevation of persistent

woody vegetation. Basic concepts are included in the concept drawings. Details will be prepared at final design.

4.9 23 CFR

An internet search turned up no indication that a FEMA Flood Insurance Study exists for the Chilkat River. Communication with Haines Borough Planner Scott Hansen indicated that no FEMA Flood Insurance Study (FIS) is known to exist for the Chilkat River system. An FIS for the immediate Haines area dating back to the 1970's is available but is likely obsolete as isostatic rebound is anecdotally reported to be approximately 0.9-inches/year (S. Hansen, email communication).

As described in Section 4.6, representative conditions at Station 394+00 (S&HI station 417+00) were modeled to compare estimated water surface elevations associated with existing and with project conditions. The existing conditions run was copied and modified to represent bank conditions. There is 0.02-ft of increase in water surface elevation for the with-project condition. However, it must be noted that the river changes dynamically with shifting bed forms. Changes in cross section and flow roughness by these natural processes are anticipated to cause greater changes in water surface elevations. Further, the dynamic shifting of the river bed and bar forms will likely adjust in response to roadway encroachment. A detailed analysis of this bed shifting and corresponding adjustements to water surface elevations is beyond the scope of this study.

Risks associated with the proposed action are considered to be similar in scale to those of the existing roadway. The road embankment is subject to forces of the Chilkat River and changes in channel form, such as scour depths and locations. The existing road is subject to much the same forces. Through field observations and design calculations similar or greater levels of protection are an objective. Following project implementation monitoring and maintenance are recommended.

4.10 Conclusion

The hydraulic features of the proposed action have been developed to a conceptual level in support of permitting and environmental activities. The design features will be revised as appropriate and final designs and report will be prepared for the Plans-in-Hand submittal.

Conceptual designs of revetments follow industry standard methods. Bioengineering has no nationally established engineering design methods. Design of vegetative erosion protection is based on current knowledge in the industry and Inter-Fluve's experience from 1983 to the present in this field. Further, reference reach conditions are used as a design template.

4.11 Riprap

Existing riprap was observed to be mostly stable and reported to be performing satisfactorily. Hydraulic analysis was used to preliminarily size rock for road embankment erosion protection as described in Section 4.8.

4.12 Flood Hazard Area

The project is not located within a defined flood hazard area.

5. Culvert Replacement at Station 222+51

5.1 Introduction

The unnamed tributary crossing the highway at station 222+51 (S&HI station 245+50) is comprised of an existing circular 48-inch corrugated metal pipe (CMP). The bottom of the pipe is rusted and the pipe should be replaced. At this Preliminary Engineering Report phase, the pipe was preliminarily designed based on Tier 1 stream simulation fish passage design [1] methods outlined in the MOA. Tier 1 methods were selected based on the high quality of upstream habitats. This project will replace the existing pipe with a larger 6'-9" by 4'-11" pipe arch to convey flood flows and provide fish passage.

5.2 Hydraulic History

This unnamed tributary crosses the Haines Highway at about elevation 21-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling, tidal backwater will not extend to this location.

Field indicators of Chilkat River backwater (i.e. deposition of fine sediments) were not seen to extend upstream along the tributary to the location of the existing culvert. Therefore, it is not likely that the culvert is impacted by backwater effects from frequently occurring Chilkat River flows. Large Chilkat River floods would be expected to have a backwater influence extending to the culvert.

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 7, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culvert is a 48-inch CMP with no stream substrate material in the bottom of the pipe. The bottom of the pipe is rusted. The pipe should be replaced for longevity. From the site survey, the existing pipe is approximately 66-ft long at approximately 0.0215-ft/ft slope. A small amount of flow was observed. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field.

The creek is too small for navigation. This project will not impact navigation. The confluence with the Chilkat River is approximately 1,000-ft downstream. No upstream

[1] As stated in the MOA - **Tier 1 stream simulation** fish passage design attempts to replicate natural stream channel conditions within the culvert. Culvert width at the ordinary high water (OHW) stage is 90-percent or greater than the channel width at OHW. Slope varies by no more than 1-percent from adjacent stream reaches. Substrate is placed within the culvert and designed to remain dynamically stable for flows up to the 50-year event and contain a sufficient volume of fines to limit subsurface flow. Culvert inverts are buried to 40-percent of the diameter for circular culverts or 20-percent of the rise for arch pipes. (ADFG and ADOT&PF, 2001)

confluences were observed in the vicinity. Therefore, no impacts to confluences are expected. This stream runs through a portion of the Southeast Road builder gravel pit upstream of the highway.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) from observations and simple tape measurements by hand. On the reach scale, the upstream channel is a 3-6' wide, E type channel with a substrate of mixed sand and organics. There is a small pool at the culvert inlet. Downstream of the culvert the stream winds along the toe of the road fill slope back to station 234+50. The upstream half of this reach is also an E type channel 3-6' wide with a sandy/organic substrate. Stream banks are grassy, woody debris is present and alder often overhangs the stream. The lower half of this reach is influenced by the river backwater, wider (6-10'), more open and 6-18" deep. Substrate is silt, sand, fine gravels and organic matter. Aquatic weeds shape the stream meander and banks are grassy or vegetated with alder and willow.

The S&HI indicates that this stream is used by coho as spawning and rearing habitat. Dolly Varden use this stream for rearing. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2004.

5.3 Hydrology

The contributing basin has a drainage area of approximately 0.47 square miles and extends up to near the summit of Mount Ripinski (3,679 feet). The watershed is steep, with an average watershed slope of 63 percent. There is no perennial channel depicted on the USGS 7.5 minute topographical map. The perennial flow present on the valley floor may be largely contributed by seeps at the toe of the hill slope. There is very little storage in the basin and there are no glaciers. The watershed is largely undeveloped, with slight industrial use in the lower portion of the basin.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 42 cfs for the 2-year event to 130 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 17 cfs. There is no local input to report for this basin.

5.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 6'-9" by 4'-11" pipe arch is recommended as the replacement at this crossing. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 6.7-ft wide reference stream channel width averaged from cross sections 53 feet upstream and 45 feet downstream of the existing pipe measured by the Inter-Fluve survey

(October, 2005) and representative of stream conditions locally at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20 percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.02.

Table 5-1. 222+51 Hydrologic and Hydraulic Summary

Drainage Area = 0.47-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	79	114	130
Flow depth at inlet (ft)	2.82	3.98	4.59
Hw/D	0.72	1.02	1.17

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

5.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

5.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert meets ADOT&PF's requirements for conveyance of the 50-year event. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 5-1.

5.7 Riprap

The culvert was designed to provide fish passage using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

5.8 Station 222+51 – Existing conditions photos

Existing Culvert: 48-inch cmp
Catalog Number: 115-32-10250-2004
Fish Use: Rearing coho and Dolly Varden. Spawning coho
Description: This location was referenced as Station 245+50 in the S&HI. Based on hand measurements, upstream of the culvert the stream is a 3-6' wide, E type channel with a substrate of mixed sand and organics. There is a small pool at the culvert inlet. Downstream of the culvert the stream winds along the toe of the road fill slope back to (S&HI) station 234+50. The upstream half of this reach is also an E type channel 3-6' wide with a sandy/organic substrate. Stream banks are grassy, woody debris is present and alder often overhangs the stream. The lower half of this reach is influenced by the river backwater, wider (6-10'), more open and 6-18" deep. Substrate is silt, sand, fine gravels and organic matter. Aquatic weeds shape the stream meander and banks are grassy or vegetated with alder and willow.

6. Culvert Replacement at Station 319+13

6.1 Introduction

The unnamed tributary crossing the highway at station 319+13 (S&HI Station 342+00) is comprised of an existing circular 36-inch corrugated metal pipe (CMP). The bottom of the pipe is rusted with the outlet unraveled. It is recommended that the pipe be replaced. At this Preliminary Engineering Report phase, the pipe was preliminarily designed based on Tier 1 stream simulation methods outlined in the MOA. Tier 1 methods were selected based on the high quality of upstream habitats. This project will replace the existing pipe with a larger 6'-9" by 4'-11" pipe arch to convey flood flows and provide fish passage.

6.2 Hydraulic History

This unnamed tributary crosses the Haines Highway at about elevation 26.5-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location.

Field indicators of Chilkat River backwater (i.e. deposition of fine sediments) extend upstream along the tributary to the location of the existing culvert. Therefore, the culvert is impacted by frequently occurring Chilkat River backwater effects.

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 7, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culvert is a 36-inch CMP with no sediment in the bottom of the pipe. The bottom of the pipe is rusted with a section of the outlet unraveled. The pipe should be replaced for longevity. From the site survey, the existing pipe is approximately 53-ft long at approximately 0.0137-ft/ft slope. The outlet is perched approximately 0.25- to 0.6-ft above the scour pool water surface. The pool is about 1.1-ft deep. A small amount of flow was observed.

The creek is too small for navigation. This project will not impact navigation. The confluence with the Chilkat River is approximately 290-ft downstream. No upstream confluences were observed in the vicinity. No impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) based on observations and simple tape measurements by hand. Upstream of the culvert the complex channel of the stream meanders among alder roots and downfall. On the reach scale, the upstream channel is 1-3' wide with a substrate of gravel and organics. Depth is 6-8" and overhanging cover is dense. Periodically, hillside

processes deliver sediments to this site. No problems with conveyance through the existing culvert were reported in the anecdotal record or indicators observed in the field. The downstream end of the culvert is perched 3-4" and unraveled. The stream meanders along the road back to station 316+50 before entering the Chilkat River. The river backwaters the stream and deposits silt over the gravel bed. On the reach scale, the downstream channel is 4-6' wide and 3-4" deep. It lies in an old flood channel of the river. Stream banks are grass covered.

The S&HI indicates that this stream is used by coho and Dolly Varden as rearing habitat. The stream is not listed in the Anadromous Waters Catalog.

6.3 Hydrology

The contributing basin has a drainage area of approximately 0.6 square miles. The basin extends up to Seven Mile Saddle, which connects into the Shakasevi drainage on the east side of the divide. The high point of the basin is at 3,904 feet at the summit of an unnamed peak. The watershed has an average slope of 42 percent. The USGS 7.5 minute topographical map depicts a perennial stream channel that is believed to be within the contributing area for the culvert. The bulk of the perennial flow present on the valley floor may be largely contributed by seeps at the toe of the hill slope and possibly by hyporheic flow from the main stem Chilkat. There is virtually no storage in the basin and there are no glaciers. The watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 50 cfs for the 2-year event to 154 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 20 cfs. There is no local input to report for this basin.

6.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 6'-9" by 4'-11" pipe arch is recommended as the replacement at this crossing to satisfy requirements of the Tier 1 (stream simulation) design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 5.1-ft wide reference stream channel measured 17 feet upstream of the culvert by the Inter-Fluve survey (October, 2005) and representative of stream conditions locally at the culvert. November, 2008 survey measured 4 to 5 ft wide channel widths approximately 100 feet downstream of the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.16.

Table 6-1. 319+13 Hydrologic and Hydraulic Summary

Drainage Area = 0.60-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	93	135	154
Flow depth at inlet (ft)	3.36	4.54	5.09
Hw/D	0.86	1.16	1.30

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

6.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

6.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 6-1.

6.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

6.8 Station 319+13 – Existing conditions photos

Existing Culvert: 36-inch cmp
Fish Use: Rearing coho and Dolly Varden
Description: This location was referenced as Station 342+00 in the S&HI. Based on hand measurements, upstream of the culvert the complex channel of the stream meanders among alder roots and downfall. The stream is 1-3' wide with a substrate of gravel and organics. Depth is 6-8" and overhanging cover is dense. The downstream end of the culvert is perched 3-4" and unraveled. The stream meanders along the road back to station 316+50 before entering the Chilkat River. The river backwaters the stream and deposits silt over the gravel bed. The stream is 4-6' wide and 3-4" deep. It lies in an old flood channel of the river. Stream banks are grass covered.

7. Culvert Replacement at Station 324+79

7.1 Introduction

The unnamed tributary crossing the highway at station 324+79 (S&HI station 347+50) is comprised of an existing circular 48-inch corrugated metal pipe (CMP). The pipe bottom is rusted and the inlet is damaged; the pipe should be replaced. At this Preliminary Engineering Report phase, the pipe was conceptually designed based on Tier 1 stream simulation methods outlined in the MOA. Tier 1 methods were selected based on the high quality of upstream habitats. This project will replace the existing pipe with a larger 7'-3" by 5'-3" pipe arch to convey flood flows without overtopping the road and provide fish passage.

7.2 Hydraulic History

This unnamed tributary crosses the Haines Highway at about elevation 28-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88 and based on approximate modeling tidal backwater will not extend to this location.

Field indicators of Chilkat River backwater (i.e. deposition of fine sediments) extend upstream along the tributary to the location of the existing culvert. Therefore, the culvert is impacted by frequently occurring Chilkat River backwater effects.

No historical flood data are available for this tributary. Water surface elevations for flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 7, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culvert is a 48-inch CMP with no stream substrate material observed in the bottom of the pipe. The pipe bottom is rusted and the inlet is damaged. The pipe should be replaced for longevity. From the site survey, the existing pipe is approximately 60-ft long laid at approximately 0.0194-ft/ft slope. The rim of the downstream scour pool is 1.2-ft higher than the culvert outlet invert and 0.03-ft lower than the culvert inlet effectively backwatering most of the pipe length. No flow was observed. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field.

The creek is too small for navigation. This project will not impact navigation. The confluence with the Chilkat River is approximately 350-ft downstream. No upstream confluences were observed in the vicinity. No impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) from observations and simple tape measurements by hand. The culvert appears to be fairly recently replaced yet the bottom of the pipe is rusted. , On the reach

scale, the upstream channel is a 1-2' wide E type channel with a fine silt and gravel substrate. The stream drains a swamp fed by numerous springs along the toe of the mountain. The culvert outlet empties into a short section of gravel bottomed stream with a width of 2-3' and grassy banks. The stream then turns into a 3-6' wide backwatered slough with a silt substrate. Springs feed this section of the stream.

The S&HI indicates that this stream is used by coho and Dolly Varden as rearing habitat. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2014.

7.3 Hydrology

The contributing basin has a drainage area of approximately 1.23 square miles. The basin extends up to Seven Mile Saddle, which connects into the Shakasevi drainage on the east side of the divide. The high point of the basin is at 4,088 feet on the ridge leading north to Tukgahgo Mountain. The watershed has an average slope of 55 percent. The USGS 7.5 minute topographical map depicts two perennial stream channels that have their confluence 150 meters upstream of the culvert. Some of the perennial flow present on the valley floor may possibly be from hyporheic flow from the main stem Chilkat. There is virtually no storage in the basin and no glaciers. A pack trail heading to Seven mile Saddle follows the eastern edge of the basin; otherwise, the watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 92 cfs for the 2-year event to 280 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 37 cfs. Hydraulic analysis for the existing pipe indicates that the 2-year event will over top the road. Given that the anecdotal record of culverts along the Haines Highway has not identified this culvert to be a problem, the flows from the hydrology estimates are suspected to be too large and in error. This is the only tributary with estimated flows being suspiciously high. Therefore, an alternate approach was taken where the hydraulic capacity of the existing culvert was used to back calculate the flow that meets design criteria (HW/D < 1.5). In addition, the culvert configuration required to provide fish passage was analyzed to confirm that the flood conveyance was equal to or greater than existing conditions.

For existing conditions the flow corresponding to a HW/D ~ 1.5 is approximately 169-cfs (10-year event predicted flow). Prorating the predicted flows to the ADOT&PF criteria of HW/D < 1.5 for the 50-year design event would approximate the Q2-yr ~ 63-cfs, Q10-yr ~ 116-cfs, Q50-yr ~ 169-cfs and Q100-yr ~ 192-cfs. These flows are approximately 70-percent of the estimates using regional regression equations. As noted in Section 3, precipitation values recorded in Haines are 80-percent of regional regression values providing a possible explanation for this reduction in flows. The corresponding fish passage flow is roughly 25-cfs. Based on this hydrology and hydraulic analysis, a 7'-3"x5'-3" pipe arch would be required to prevent overtopping of the road. This is a significantly larger pipe than the existing structure which has not been reported in the

anecdotal record to be a problem. The hydrology remains suspect and will be further scrutinized during final design.

There is no local input to report for this basin.

7.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 7'-3" by 5'-3" pipe arch is recommended as the replacement at this crossing to provide sufficient flood conveyance for the estimated stream flows and prevent overtopping of the road by the estimated 50-year flow. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the average 6.9-ft wide reference stream channel width measured 20 feet upstream and 42 feet downstream of the culvert by the Inter-Fluve survey (October, 2005) and representative of stream conditions locally at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will provide greater conveyance capacity than currently exists. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.08.

Table 7-1. 324+79 Hydrologic and Hydraulic Summary

Drainage Area = 1.23-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	116	169	192
Flow depth at inlet (ft)	3.34	4.22	5.09
Hw/D	0.85	1.08	1.30

Notes:

1. Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.
2. Through the hydraulic analysis a 7.25'x5.25' pipe arch is required to prevent the estimated 50-year flood from overtopping the road. This is a significantly larger pipe than the existing structure which has not been reported in the anecdotal record to be a problem. The hydrology remains suspect and will be further scrutinized during final design.

7.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

7.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert meets ADOT&PF's requirements for conveyance of the 50-year event. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

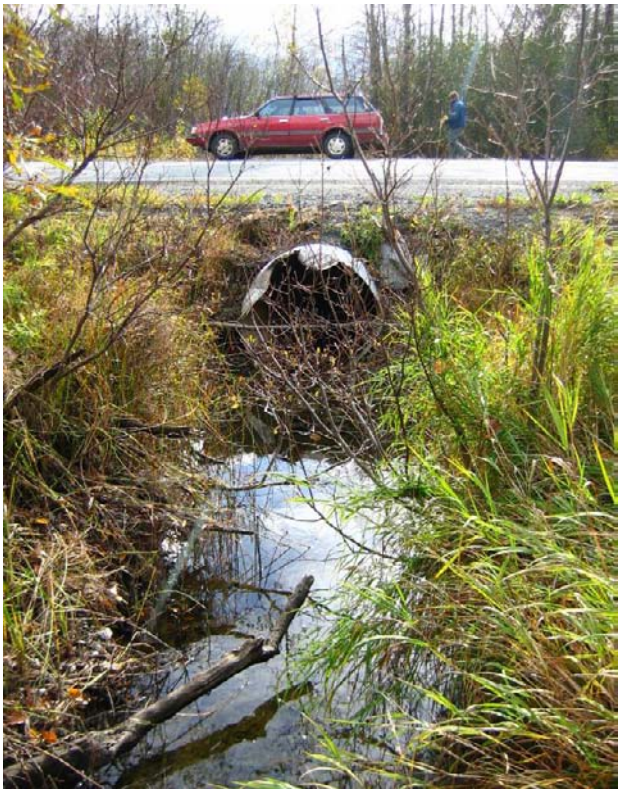
The hydrologic and hydraulic summary for the proposed culvert are presented in Table 7-1.

7.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

7.8 Station 324+79 – Existing conditions photos

Existing Culvert: 48-inch cmp
Catalog Number: 115-32-10250-2014
Fish Use: Rearing coho and Dolly Varden
Description: This location was referenced as Station 347+50 in the S&HI. The culvert appears to be fairly recently replaced. Based on hand measurements, upstream of the culvert the stream is a 1-2' wide E type channel with a fine silt and gravel substrate. The stream drains a swamp fed by numerous springs along the toe of the mountain. The culvert outlet empties into a short section of gravel bottomed stream with a width of 2-3' and grassy banks. The stream then turns into a 3-6' wide backwatered slough with a silt substrate. Springs feed this section of the stream.



8. Culvert Replacement at Station 483+18

8.1 Introduction

The unnamed tributary crossing the highway at station 483+18 (S&HI station 506+25) is comprised of an existing circular 48-inch corrugated metal pipe (CMP) with a rusted bottom and outlet apron. It is recommended that the pipe be replaced. At this Preliminary Engineering Report phase, the pipe was preliminarily designed based on Tier 1 stream simulation methods outlined in the MOA. Tier 1 methods were selected based on the high quality of upstream habitats. This project will replace the existing pipe with a larger 7'-3" by 5'-3" pipe arch to convey flood flows and provide fish passage.

8.2 Hydraulic History

This unnamed tributary crosses the Haines Highway at about elevation 35-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location.

Field indicators of Chilkat River backwater (i.e. deposition of fine sediments) extend upstream along the tributary to the location of the existing culvert. Therefore, the culvert is impacted by frequently occurring Chilkat River backwater effects.

No historical flood data are available for this tributary. Water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 7, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culvert is a 48-inch CMP with no stream substrate material observed in the bottom of the pipe. The bottom of the pipe and outlet apron is rusted. The pipe should be replaced for longevity. From the site survey, the existing pipe is approximately 65-ft long laid at approximately 0.0091-ft/ft slope. The outlet of the downstream scour pool is 0.13-ft lower than the culvert outlet invert. Low flows appear able to backwater the culvert outlet invert. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field.

The creek is too small for navigation. This project will not impact navigation. The confluence with the Chilkat River is approximately 125-ft downstream. No upstream confluences were observed in the vicinity. No impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) from observations and simple tape measurements by hand. On the reach scale, the upstream channel is about 8' wide and flows over a silt/organic substrate. The stream is backwatered by the Chilkat River and had a depth of 6-8" at the time of the

survey. Banks are muddy and grassy, with willow and alder growing close to the water on one side. The culvert empties into a 30' diameter pool with a depth of 3'. Banks are silty up to the level of frequent river backwater and then formed of grass and young willow/alder. Substrate is silt. Downstream of the pool the channel is 10' wide but terminates abruptly at a sandbar about 125' from the road. A small trickle flows over the sandbar and into an isolated pool. Fish access is dependent on the river water level.

The S&HI indicates that this stream is used by coho and Dolly Varden as rearing habitat. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2024.

8.3 Hydrology

The contributing basin has a drainage area of approximately 1.07 square miles. The basin extends up to a ridge leading northeast toward Tukgahgo Mountain. The high point of the basin is at 4,490 feet. The watershed has an average slope of 57 percent. The USGS 7.5 minute topographical map depicts a single perennial stream channel with its headwaters at a small lake. A portion of the perennial flow present on the valley floor may be contributed by seeps at the toe of the hill slope and possibly by hyporheic flow from the main stem Chilkat. There is very little storage in the basin and there are no glaciers. The watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 76 cfs for the 2-year event to 232 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 30 cfs. There is no local input to report for this basin.

8.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

By Tier 1 methods, a 7'-4" by 5'-4" pipe arch would be required to accommodate stream width at this crossing. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 8-ft wide reference stream channel width measured 104 feet upstream of the existing culvert by the Inter-Fluve survey (October, 2005) and representative of stream conditions locally at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe arch to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will provide greater conveyance capacity than currently

exists. The proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.29.

Table 8-1. 483+18 Hydrologic and Hydraulic Summary

Drainage Area = 1.07-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	139	203	232
Flow depth at inlet (ft)	3.92	5.49	6.41
Hw/D	0.92	1.29	1.51

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

8.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

8.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 8-1.

8.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

8.8 Station 483+18– Existing conditions photos

Existing Culvert: 48-inch cmp
Catalog Number: 115-32-10250-2024
Fish Use: Rearing coho and Dolly Varden
Description: This location was referenced as Station 506+25 in the S&HI. Based on hand measurements, upstream of the culvert the stream is about 8’ wide and flows over a silt/organic substrate. The stream is backwatered by the Chilkat River and had a depth of 6-8” at the time of the survey. Banks are muddy and grassy, with willow and alder growing close to the water on one side. The culvert empties into a 30’ diameter pool with a depth of 3’. Banks are silty up to the level of frequent river backwater and then formed of grass and young willow/alder. Substrate is silt. Downstream of the pool the channel is 10’ wide but terminates abruptly at a sandbar about 125’ from the road. A small trickle flows over the sandbar and into an isolated pool. Fish access is dependent on the river water level.

9. Culvert Replacement at Station 512+24

9.1 Introduction

This tributary is referred to locally as 10-Mile Creek. The tributary crosses the highway at station 512+24 (S&HI station 535+50) near a hydroelectric plant. The existing crossing is comprised of one 24-inch and one 36-inch circular corrugated metal pipes (CMP). At this Preliminary Engineering Report phase, the replacement pipe was preliminarily designed to meet Tier 1 stream simulation fish passage design methods outlined in the MOA. Tier 1 methods were selected based on the high quality of upstream habitats. This project will replace the existing pipes with one larger 14'-1" by 6'-2" aluminum box culvert to convey flood flows, provide fish passage and meet site cover restrictions.

9.2 Hydraulic History

10-Mile Creek crosses the Haines Highway at about elevation 37-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location.

10-Mile Creek discharges into 10-Mile Slough, then enters the main stem of the Chilkat River approximately 800-ft downstream of the culverts. Field indicators of Chilkat River backwater (i.e. deposition of fine sediments) extend upstream along 10-Mile Slough to the confluence with 10-Mile Creek. The culverts appear to be above the Chilkat River backwater. Therefore, it appears that the new culvert will not be impacted by frequently occurring Chilkat River backwater effects.

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 7, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culverts are one 24-inch and one-36-inch diameter circular CMP. The majority of the flows pass through the 36-inch pipe. Approximately 0.6-ft of material was measured in the bottom of the 36-inch pipe. No perching of the pipe or formation of a scour pool was observed. From survey measurements on the 36-inch CMP, the length is approximately 73-ft long at approximately 0.0087-ft/ft slope. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field.

The creek is too small for navigation. This project will not impact navigation. The confluence with the Chilkat River is approximately 800-ft downstream of the culverts. The confluence with 10-Mile Slough is approximately 100-ft downstream. No upstream confluences were observed in the vicinity. No impacts to confluences are expected. No mining occurs on this stream.

Reach scale, geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) from observations and simple tape measurements by hand. On the reach scale, the upstream channel is about 15' wide and flows in riffles over ideal spawning gravels. The banks are well vegetated and overhang the stream. A run of the river hydroelectric plant is upstream. Downstream of the culverts, the stream varies in width from 15-20', the bottom is gravel and the stream is heavily utilized by spawning salmon. Stream banks are fully vegetated with grasses. Further downstream the stream meanders through a wide, old river channel that is frequently backwatered by the river.

The S&HI indicates that this stream is used by coho and Dolly Varden as rearing habitat. Pink and chum use this stream for spawning habitat. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2028-3002.

9.3 Hydrology

10-Mile Creek has a drainage area of approximately 1.46 square miles. The high point of the basin is at 4,441 feet at the summit of Tukgahgo Mountain. The watershed has an average slope of 44 percent. The USGS 7.5 minute topographical map depicts a perennial stream channel that is fed by several lakes in the upper basin. This storage comprises just under 2 percent of the basin area. Glaciers on the north side of Tukgahgo Mountain lie within the basin but comprise less than 5 percent of the basin area. The basin is narrow at the outlet, with little more than 500 hundred feet of stream channel between the culvert and the toe of the hill slope. A small hydroelectric operation is located on the stream at the hill slope toe and a small staging area is located on the north side of the stream upstream of the culvert. The hydropower plant is a run-of-the-river facility and does not impact the flow hydrograph (J. Floreski, personal communication to M. Sogge, March 2006). The remainder of the watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 73 cfs for the 2-year event to 220 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 29 cfs. There is no local input to report for this basin.

9.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

By Tier 1 methods, a 14'-1" by 6'-2" aluminum box culvert would be required to accommodate stream width at this crossing and to meet site cover restrictions. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 15.3-ft wide reference stream channel width measured 30 feet upstream of the culvert by the Inter-Fluve survey (October, 2005) and representative of stream conditions locally

at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 0.79.

Table 9-1. 512+24 Hydrologic and Hydraulic Summary

Drainage Area = 1.46-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	130	193	220
Flow depth at inlet (ft)	2.78	3.51	3.77
Hw/D	0.63	0.79	0.85

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

9.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

9.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert meets ADOT&PF's requirements for conveyance of the 50-year event. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 9-1.

9.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

9.8 Station 512+24 – Existing conditions photos

Existing Culverts: 30-inch cmp, 24-inch cmp
Catalog Number: 115-32-10250-2028-3002
Fish Use: Rearing coho and Dolly Varden. Spawning pink and chum
Description: This location was referenced as Station 535+50 in the S&HI. Based on hand measurements, upstream of the culverts the stream is about 15' wide and flows in riffles over ideal spawning gravels. The banks are well vegetated and overhang the stream. A hydroelectric plant is upstream. Downstream of the culverts the stream varies in width from 15-20', the bottom is gravel and the stream is heavily utilized by spawning salmon. Stream banks are fully vegetated with grasses. Further downstream the stream meanders through a wide, old river channel that is frequently backwatered by the river.

10. Culvert Replacement at Station 589+12

10.1 Introduction

The unnamed tributary crossing the highway at station 589+12 (S&HI station 612+40) is comprised of two existing circular 24-inch corrugated metal pipes (CMP). The bottoms of the pipes are rusted and the pipes should be replaced. At this Preliminary Engineering Report phase, the replacement pipe was preliminarily designed based on Tier 1 stream simulation methods outlined in the MOA. Tier 1 methods were selected based on the high quality of upstream habitats. This project will replace the existing pipes with a larger 7'-3" by 5'-3" pipe arch to convey flood flows and provide fish passage.

10.2 Hydraulic History

This unnamed tributary crosses the Haines Highway at about elevation 44-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location.

This tributary discharges into a major side channel of the Chilkat River approximately 45 feet downstream of the culvert. Field indicators of Chilkat River backwater (i.e. deposition of fine sediments) extend upstream along the tributary to the location of the existing culvert. The culvert is impacted by frequently occurring Chilkat River backwater effects.

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 7, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culverts are two 24-inch CMPs with no stream substrate material observed in the bottom of the pipes. The bottoms of the pipes are rusted and the pipes should be replaced for longevity. From the site survey, the two pipes are approximately 63-ft long at an average slope of 0.006-ft/ft. The pipes are higher than the adjacent streambed. No flow was observed. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field.

The creek is too small for navigation. This project will not impact navigation. The confluence with a side channel of the Chilkat River is 45 feet downstream. No upstream confluences were observed in the vicinity. Therefore, no impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) based on observations and simple tape measurements by hand. On the reach scale the upstream channel averages 2' wide E type channel with a very low

gradient. It is infrequently backwatered by the Chilkat River. The banks are thickly vegetated with grasses and the substrate is a blend of organics and silt. The stream leads into a broad wetland. Downstream of the culvert the stream banks are bare sand and the stream is heavily backwatered by the river. The substrate is silt/gravel and there is no cover.

The S&HI indicates that this stream is used by coho, Dolly Varden and cutthroat as rearing habitat. The stream is listed as catalog number: 115-32-10250-2032.

10.3 Hydrology

The contributing basin has a drainage area of approximately 0.65 square miles. The basin extends up to 4,035 feet. The watershed has an average slope of 49 percent. The USGS 7.5 minute topographical map does not depict a perennial stream channel. The perennial flow present on the valley floor is likely contributed by seeps at the toe of the hillslope as well as by hyporheic flow from a side channel of the mainstem Chilkat. There is virtually no storage in the basin and there are no glaciers. The watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 52 cfs for the 2-year event to 160 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 21 cfs. There is no local input to report for this basin.

10.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 6’-9 by 4’-11” pipe arch is recommended as the replacement at this crossing. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 5.9-ft wide reference stream channel width measured 35 feet upstream of the culvert by the Inter-Fluve survey (October, 2005) and representative of stream conditions locally at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.05.

Table 10-1. 589+12 Hydrologic and Hydraulic Summary

Drainage Area = 0.65-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	96	140	160
Flow depth at inlet (ft)	3.36	4.40	4.92
Hw/D	0.80	1.05	1.17

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

10.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

10.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

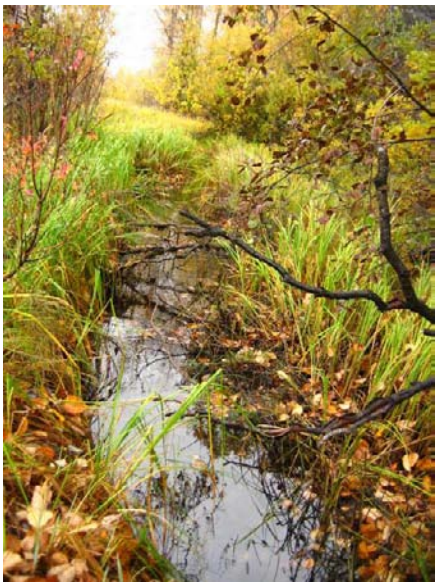
The hydrologic and hydraulic summary for the proposed culvert are presented in Table 10-1.

10.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

10.8 Station 580+12 – Existing conditions photos

Existing Culverts: 2 - 24-inch cmps
Catalog Number: 115-32-10250-2032
Fish Use: Rearing coho, Dolly Varden and cutthroat
Description: This location was referenced as Station 612+40 in the S&HI. Based on hand measurements, upstream of the culverts the stream is a 2' wide E type channel with a very low gradient. It is infrequently backwatered by the Chilkat River. The banks are thickly vegetated with grasses and the substrate is a blend of organics and silt. The stream leads into a broad swamp. Downstream of the culvert the stream banks are bare sand and the stream is heavily backwatered by the river. The substrate is silt/gravel and there is no cover.



11. Culvert Replacement at Station 647+20

11.1 Introduction

This tributary is referred to locally as 13-Mile Creek. The tributary crossing of the highway at station 647+20 (S&HI station 670+00) is comprised of two existing circular 36-inch corrugated metal pipes (CMP). The bottoms of the pipes are stained. To provide fish passage and accommodate potential flows and debris loads these pipes should be replaced with a larger pipe arch. At this Preliminary Engineering Report phase, the replacement pipe was preliminarily designed based on Tier 1 stream simulation methods outlined in the MOA. Tier 1 methods were selected based on the good quality of upstream habitats. This project will replace the existing pipe with a larger 8'-10" by 6'-1" pipe arch to convey potential flood flows and provide fish passage.

The proposed highway alignment closely follows the existing alignment. Though this culvert is located on a debris flow fan, the volume of sediment observed to have deposited at the road following a flood in November 2005 is anticipated to either pass through a culvert inline with the approach stream alignment or can be managed by periodic maintenance operations. The larger impact of debris flow events at this site appears to be the dynamic history of the stream changing course and the point where the stream meets the road. The replacement culvert is sized to pass anticipated flood flows and provide fish passage.

11.2 Hydraulic History

This unnamed tributary currently crosses the Haines Highway at about elevation 48-ft As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD) 88 and based on approximate modeling, tidal backwater will not extend to this location.

This tributary discharges into a major side channel of the Chilkat River approximately 700 feet downstream of the culvert. Field indicators of Chilkat River backwater (deposition of fine sediments) extend upstream along the tributary to the location of the existing culvert. The culvert appears to be impacted by frequently occurring Chilkat River backwater effects.

No historical flood data are available for this tributary. Water surface elevations for flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 7, 2005. A rapid assessment and cursory site survey of the existing culverts were conducted for this phase as described in Section 3.2. Detailed survey of the tributary between the culverts and Chilkat River side channel was conducted in November 2008. The existing culverts are two 36-inch CMP with no material in the bottom of the pipes. Measurements on one pipe, as a typical condition, indicates a length of approximately 59-ft long at approximately 0.016-ft/ft slope. Flow

was observed along the creek. No flooding problems with the existing culverts were reported in the anecdotal record or indicators observed in the field.

Following the November 2005 flood, the stream occupied a new channel uphill of the road. The stream currently encounters the road at Station 652+70 and splits, with the majority of flows going towards Haines to the 647+20 culvert, the remainder of flows go north and pass the highway through a 24-inch CMP at station 655+35. Flood conveyance of 13-Mile Creek past the highway can be improved by adding a culvert at station 652+70,routing the stream along the downhill side of the road and returning to the existing stream approximately 30 feet downstream of the existing culvert. This new culvert will be designed in conjunction with a mitigation concept at a later phase. The existing culvert at 647+20 will be replaced to pass overland flows and accommodate the full tributary flows should debris flows move the stream back into its alignment prior to the November 2005 flood.

The creek is too small for navigation. This project will not impact navigation. The confluence with the side channel of the Chilkat River is approximately 700 feet downstream. No upstream confluences were observed in the vicinity. Therefore, no impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI). Upstream of the culverts the stream splits almost immediately. The majority of flows follow a branch which runs in a roadside ditch up to near station 652+70 where it turns up the hill from the road. The section along the road is an E type channel 2’ wide and +1’ deep. The banks are vegetated with grasses that frequently overhang the full width of the stream. Substrate is gravel. The major branch of the stream is gravel bottomed and meanders away from the road in a stable bed where the stream broadens and winds through established forest with well forested banks. Downstream, the culverts empty into a broad 15’ by 20’ pool that leads into a reach scale average 4-8’ wide E-channel backwatered at times by a beaver dam and the influence of a side channel of the river. The stream empties into the river near station 641+00. The stream banks are predominantly grass, with some willow. At times, the stream flows directly along the toe of the road fill. The lower section of the stream is much less well vegetated that the upper portion.

The S&HI indicates that this stream is used by coho and Dolly Varden as rearing habitat. This stream is used by pink salmon as spawning habitat. The stream is listed as catalog number: 115-32-10250-2040.

11.3 Hydrology

This stream has a drainage area of approximately 1.75 square miles. The high point of the basin is at 5,265 feet at the summit of an unnamed peak. The watershed has an average slope of 53 percent. The USGS 7.5 minute topographical map depicts a perennial stream channel with several branches midway up the basin. The southern branch is fed by lakes in the upper basin. This storage comprises less than 1 percent of the basin area. A small

glacier is depicted on the southeast side of the basin (map data is circa 1991) but the current status of this glacier is unknown. The basin is narrow at the outlet, with only a couple of hundred feet of stream channel between the culvert and the toe of the hill slope. The watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 96 cfs for the 2-year event to 291 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 38 cfs. There is no local input to report for this basin.

11.4 Hydraulic Design

This stream occasionally experiences debris flows which shift the location of the stream. The flood of November 2005 caused a shift of alignment with the stream currently encountering the road near station 652+70. A new culvert is proposed for Station 652+70 in conjunction with proposed mitigation and to convey the tributary flows. However, the potential for the stream to reoccupy the pre-November 2005 flood alignment - which is tributary to the existing culverts - is anticipated to occur within the service life of the culvert. Therefore, it is recommended that this culvert be sized to convey all flows from this tributary. The moderate volume of sediment observed to have deposited at station 652+70 from the November 2005 flood is anticipated to be conveyed through the proposed pipe arch. If necessary, periodic maintenance may be required to clear deposited sediments. At a minimum, a culvert at this location is required to convey overland flows collected by the roadside ditch.

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 8’-10 by 6’-1” pipe arch is recommended as the replacement at this crossing. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the downstream channel which varies in width from 8.5 to 9.3 feet measured by the Inter-Fluve survey (November, 2008) and representative of stream conditions locally at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20 percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.15.

Table 11-1. 647+20 Hydrologic and Hydraulic Summary

Drainage Area = 1.75-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs) full tributary flow	174	255	291
Flow depth at inlet (ft)	4.06	5.58	6.20
Hw/D	0.84	1.15	1.28

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on site survey data collected by DOWL HKM and Inter-Fluve based on a project horizontal and vertical datum.

11.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culverts. The location of the tributary is dynamic therefore it is assumed that during its service life this culvert will once again need to convey full tributary flows. Hydraulic analysis of full tributary flows indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. Volumes of sediment deposition near the road are considered to be moderate enough that they will pass through the proposed culvert or can be managed with periodic maintenance. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

11.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 11-1.

11.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

11.8 Station 647+20 – Existing conditions photos

Existing Culverts: 2 – 36-inch cmp
Catalog Number: 115-32-10250-2040
Fish Use: Rearing coho and Dolly Varden. Spawning pink salmon
Description: This location was referenced as Station 670+00 in the S&HI. Based on hand measurements, upstream of the culverts the stream splits almost immediately. The minor branch runs in a roadside ditch up to near (S&HI) station 680+30 where it turns away from the road. The section along the road is an E type channel 2' wide and +1' deep. The banks are vegetated with grasses that frequently overhang the full width of the stream. Substrate is gravel. Where it cuts away from the road, this section of the stream broadens and winds through established forest. The major branch of the stream is gravel bottomed and meanders away from the road in a stable bed with well forested banks. Downstream, the culverts empty into a broad 15' by 20' pool that leads into a 4-8' wide E-channel backwatered at times by a beaver dam and the influence of a side channel of the river. The stream joins the river near (S&HI) station 668+40. The stream banks are predominantly grass, with some willow. At times, the stream flows directly along the toe of the road fill. The lower section of the stream is much less well vegetated than the upper portion.

12. Culvert Installation at Station 652+70

The crossing structure at this site is pending design of a mitigation channel that will extend through the culvert to provide fish passage and conveyance of flood and debris along 13-Mile Creek.

12.1 Introduction

This tributary is referred to locally as 13-Mile Creek. The existing culvert crossing of the highway for this tributary is located at station 647+20 (S&HI station 670+00). A flood in November 2005 relocated the creek alignment to impinge the highway at station 652+70. At the highway, flows split to both the north and the south along the roadside ditch. It is proposed to place a culvert at station to convey flow and debris across the highway into a mitigation channel to be constructed and connect to the existing stream exiting the station 647+20 culvert. The mitigation channel is under development and will have an affect on the hydraulics through the proposed culvert. Thus, the details of the proposed culvert crossing are pending. Considering that the proposed 8'-10" by 6'-1" pipe arch culvert at station 647+20 was designed to convey full stream flows and meet Tier 1 stream simulation criteria; it is anticipated a similar structure will be required at this site..

12.2 Hydraulic History

This section will be completed pending finalizing the mitigation channel design.

12.3 Hydrology

This section will be completed pending finalizing the mitigation channel design.

12.4 Hydraulic Design

This section will be completed pending finalizing the mitigation channel design.

Table 12-1. 973+30 Hydrologic and Hydraulic Summary

This section will be completed pending finalizing the mitigation channel design.

12.5 23 CFR

This section will be completed pending resolution of debris flow considerations.

12.6 Conclusion

This section will be completed pending finalizing the mitigation channel design.

12.7 Riprap

This section will be completed pending finalizing the mitigation channel design.

13. Culvert Replacement at Station 710+75

13.1 Introduction

This tributary is referred to locally as 14-Mile Creek. The tributary crosses the highway at station 710+75 (S&HI station 731+00) near a local unimproved boat ramp. The crossing is comprised of two 36-inch circular corrugated metal pipes (CMP). The bottoms of the pipes are rusted and the pipes should be replaced. At this Preliminary Engineering Report phase, the replacement pipe was preliminarily designed to meet Tier 1 stream simulation fish passage methods as outlined in the MOA and site cover restrictions. Tier 1 methods were selected based on the high quality of upstream habitats. This project will replace the existing pipes with a larger 12'-7" by 8'-4" pipe arch to convey flood flows, provide fish passage and meet site cover restrictions.

13.2 Hydraulic History

14-Mile Creek crosses the Haines Highway at about elevation 49.5-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location.

14-Mile Creek flows 150-ft from the culvert outlet before entering a side channel of the Chilkat River. The culvert is actively backwatered and frequently submerged by flows along this side channel

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 8, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culverts are two 36-inch diameter circular CMP pipes. Both culverts are at similar elevations and at the time of the survey were nearly submerged by backwater from the Chilkat River side channel. The pipes were clear of debris. The bottoms of the pipes are rusted and the pipes should be replaced for longevity. From the site survey, the pipes are approximately 94-ft long, laid at approximately 0.017-ft/ft slope. Though the culverts were observed to be nearly submerged by backwater, no problems of flooding over the road with the existing culverts were reported in the anecdotal record or indicators observed in the field.

The creek at the culverts and upstream is too small for navigation. The culvert replacement will not impact navigation at the culverts and upstream. No upstream confluences were observed in the vicinity. The confluence with a side channel of the Chilkat River is approximately 150-ft downstream of the culverts. An unimproved boat launch ramp is located immediately downstream of the culverts to provide access to the side channel of the Chilkat River. Maintaining the existing launch conditions, removal of the launch and restoration of the stream and relocation or improvement of the launch

facilities are currently under consideration. No other impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) based on observations and simple tape measurements by hand. On the reach scale, the upstream channel is 8-10' wide and leads into a vegetated meadow. Stream banks are stable and vegetated with grasses and willow. The substrate is loose silt and organic matter. There is some backwatering by the river. The outlets of the culverts are nearly submerged even at low river levels and empty into a large, deep pool that acts as both a rearing area for fish and a boat launch site. The pool empties into the river via a short channel. There is some overhanging vegetation on one side of the pool. Substrate is sand and silt.

The S&HI indicates that this stream is used by coho and Dolly Varden as spawning and rearing habitat. Pink and chum use this stream for spawning habitat. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2044.

13.3 Hydrology

14-Mile Creek has a drainage area of approximately 2.26 square miles, the largest of the tributary basins. The high point of the basin is at 5,664 feet at the summit of an unnamed peak. The watershed has an average slope of 51 percent. The USGS 7.5 minute topographical map depicts a perennial stream with two major forks extending to the headwaters. Each branch is fed by lakes in the upper basin. Lake storage comprises less than 1 percent of the basin area. Expansive glaciers cover the east side of the divide, but no glaciers are located on the west side in the basin area. The stream enters the Chilkat side channel further south than depicted on the USGS map. Flow on the valley floor is likely supplemented by hill slope seeps and possibly by hyporheic flow from the Chilkat side channel. The watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 125 cfs for the 2-year event to 381 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 50 cfs. There is no local input to report for this basin.

13.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 12'-7" by 8'-4" pipe arch is recommended as the replacement to accommodate stream width at this crossing and to meet site cover restrictions. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 14-ft wide reference stream channel width measured 18 feet upstream of the culvert by the Inter-

Fluve survey (October, 2005)) and representative of stream conditions locally at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe arch to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Model boundary conditions assumed normal flow depth based on downstream gradient (slope = 0.002-ft/ft) with no backwater by the Chilkat River. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 0.71.

Table 13-1. 710+75 Hydrologic and Hydraulic Summary

Drainage Area = 2.26-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	228	334	381
Flow depth at inlet (ft)	3.09	4.76	5.34
Hw/D	0.46	0.71	0.80

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

13.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

13.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert meets ADOT&PF's requirements for conveyance of the 50-year event. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. Tier 1 methods were selected based on the high quality of upstream habitats. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 13-1.

13.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. This stream has a very flat gradient and low energy. No riprap is proposed at this time.

13.8 Station 710+75 – Existing conditions photos

Existing Culverts: 2 – 36-inch cmp
Catalog Number: 115-32-10250-2044
Fish Use: Rearing and spawning coho and Dolly Varden
Description: This location was referenced as Station 731+00 in the S&HI. Based on hand measurements, upstream of the culverts the stream is 8-10' wide and leads into a vegetated meadow. Stream banks are stable and vegetated with grasses and willow. The substrate is loose silt and organic matter. There is some backwatering by the river. The outlets of the culverts are nearly submerged even at low river levels and empty into a large, deep pool that acts as both a rearing area for fish and a boat launch site. The pool empties into the river via a short channel. There is some overhanging vegetation on one side of the pool. Substrate is sand and silt.

14. Culvert Replacement at Station 865+88

14.1 Introduction

This tributary, locally referred to as 17-Mile Creek, crosses the highway at station 865+88 (S&HI station 886+00). The crossing is comprised of an existing 6'-1"x4'7" pipe arch. The bottom of the pipe is stained and rusted and the pipe should be replaced for longevity. At this Preliminary Engineering Report phase, the pipe was preliminarily designed to meet Tier 1 stream simulation fish passage methods and site cover restrictions. Tier 1 methods were selected based on the high quality of upstream habitats and ground water source. The stream immediately above the road is ponded through an excavated area along the road embankment with a free flowing reach immediately upstream that is an average of 12.6-ft wide. This project will replace the existing pipe with a larger 11'-7" by 7'-5" pipe arch to convey flood flows, provide fish passage and site cover restrictions. The location of the culvert will be moved to approximately station 869+00 to accommodate a new stream alignment as one component of project mitigation.

14.2 Hydraulic History

17-Mile Creek crosses the Haines Highway at about elevation 67-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location. This tributary flows approximately 60-ft to a minor side channel of the Chilkat River. The culvert experiences some backwater by flows along this side channel

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 8, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culvert is a 6'-1"x4'7" pipe arch. The outlet is perched about 0.25-ft above the water surface elevation in the downstream scour pool. The pipe appears to have no accumulated sediment in the bottom. The pipe is approximately 72-ft long laid at approximately 0.015-ft/ft slope. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field.

The creek is too small for navigation. This project will not impact navigation. The confluence with a minor side channel of the Chilkat River is approximately 60-ft downstream. No upstream confluences were observed in the vicinity. No impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI). The stream upstream of the culvert is a man-made complex consisting of two distinct branches. The main branch is a spring fed channel that runs along the toe

of the road embankment up to station 871+75 where it ends in a beaver dam or man-made berm. From observations and simple tape measurements by hand, the lower half of this channel is excavated and consistently 8-10' wide and forms a slow moving pool 1-2' deep. The steep banks are vegetated with overhanging grasses. Several springs feed into the channel from under the bank on the mountain side The upper half of the channel is a 2-3' wide riffle winding through boulders and thickly vegetated with grasses. The second branch of the complex feeds into the main branch about 100' upstream of the culvert inlet. This branch is fed by a series of springs, as well as a mountain stream, and rises in a series of pools and riffles up to a chum salmon incubation box facility operated by the Northern Southeast Regional Aquaculture Association. The stream substrate is gravel/cobble and the banks are well vegetated. Downstream the culvert outlet empties into a large pool used as a holding area for adult chum salmon. Pool substrate is silt covered gravel. A short channel connects the pool to a minor side channel of the Chilkat River.

The S&HI indicates that this stream is used by coho and Dolly Varden as rearing habitat. Chum and coho use this stream as spawning habitat. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2060-3002.

14.3 Hydrology

This stream has a drainage area of approximately 0.8 square miles. The high point of the basin is at 5,608 feet at the summit of an unnamed peak. The watershed has an average slope of 57 percent. The USGS 7.5 minute topographical map depicts a perennial stream that branches midway up the basin. There is virtually no storage in the basin and there are no glaciers. The man-made channel running along the road is fed by hill slope seeps and possibly by hyporheic flow from the Chilkat side channel. The watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 55 cfs for the 2-year event to 169 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 22 cfs. There is no local input to report for this basin.

14.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 11'-7" by 7'-5" pipe arch would be required to accommodate stream width for Tier 1 stream simulation fish passage per the MOA at this crossing and meet site cover restrictions. This culvert will provide sufficient span to accommodate the 12.6-ft wide reference stream channel width measured along a free flowing reach approximately 105 feet upstream of the existing culvert by the Inter-Fluve survey (October, 2005) and representative of stream conditions locally at the culvert under the relocated mitigation channel conditions. The culvert would be set at a slope to match the existing stream

system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise equal to 0.43.

Table 14-1. 865+88 Hydrologic and Hydraulic Summary

Drainage Area = 0.80-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	101	148	169
Flow depth at inlet (ft)	1.61	2.11	2.33
HW/D	0.33	0.43	0.47

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

14.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert and proposed channel relocation for mitigation will improve stream process and provide more natural flood plain connectivity.

14.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert meets ADOT&PF's requirements for conveyance of the 50-year event. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 14-1.

14.7 Riprap

The culvert was designed to provide fish passage using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

14.8 Station 865+88 – Existing conditions photos

Existing Culvert: 6’-1” x 4’-7” pipe arch
Catalog Number: 115-32-10250-3002
Fish Use: Rearing coho and Dolly Varden. Spawning chum and coho
Description: This location was referenced as Station 886+00 in the S&HI. The stream upstream of the culvert is a man-made complex consisting of two distinct branches. The main branch is a spring fed channel that runs up to 2009 station 871+75 where it ends in a beaver dam or man-made berm. Based on hand measurements, the lower half of this channel is excavated with a consistent 8-10’ width and forms a slow moving pool 1-2’ deep. The steep banks are vegetated with overhanging grasses. Several springs feed into the channel from under the bank on the mountain side The upper half of the channel is a 2-3’ wide riffle winding through boulders and thickly vegetated with grasses. The second branch of the complex feeds into the main branch about 100’ upstream of the culvert inlet. This branch is fed by a series of springs, as well as a mountain stream, and rises in a series of pools and riffles up to a chum salmon incubation box facility operated by the Northern Southeast Regional Aquaculture Association. The stream substrate is gravel/cobble and the banks are well vegetated. Downstream, the culvert outlet empties into a large pool used as a holding area for adult chum salmon. The pipe is perched 4”. Pool substrate is silt covered gravel. A short channel connects the pool to a side channel of the Chilkat River.

15. Culvert Replacement at Station 887+60

15.1 Introduction

This tributary, locally known as Horse Farm Creek, crosses the new highway alignment approximately at station 895+75 (S&HI station 917+00) near a private grass airstrip. The existing crossing is comprised of two 36-inch circular corrugated metal pipes (CMP) along a stream averaging 4 to 6 feet wide. The highway will be realigned with the new crossing at (2009) station 887+60 approximately 1,000 feet downstream of the existing crossing. The stream at the new location is approximately 9 feet wide about 125 feet upstream of the confluence with Eighteen Mile Slough, a minor side channel of the Chilkat River. At this Preliminary Engineering Report phase, the replacement pipe was preliminarily designed to meet Tier 1 stream simulation fish passage methods and site cover restrictions. Tier 1 methods were selected based on the heavy utilization of high quality upstream habitats. This project will place a 9'-4" by 6'-3" pipe arch at the stream crossing of the new highway alignment to convey flood flows and provide fish passage. The existing pipes may be removed and the stream day lighted as part of project mitigation.

15.2 Hydraulic History

Horse Farm Creek will cross the new Haines Highway location at about elevation 65-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location. The new highway alignment is approximately 70 feet upstream of the confluence of, and is backwatered by, Eighteen Mile Slough, a minor side channel of the Chilkat River.

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. This reach of Horse Farm Creek is directly backwatered by Eighteen Mile Slough. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

During a flood in November 2005, a significant volume of sand was deposited at the existing culvert and along the stream. During a site visit in May 2008 the sand was observed to have largely been transported from the system.

A site visit of the existing culverts was conducted on October 8, 2005. A rapid assessment and cursory site survey of the existing culverts were conducted for this phase as described in Section 3.2. The existing culverts are two 36-inch diameter circular CMPs. Both culverts are at similar elevations and at the time of the survey were nearly submerged. Approximately 0.8- to 1.4-ft of material was measured in the bottom of the 36-inch pipes. The bottoms of the pipes are rusted and - should this road be kept in service for access to private property – the pipes should be replaced for longevity. A decision on access and fate of this culvert has not been made at this time. Therefore, a replacement pipe to provide access has not been designed at this time. From the site

survey, the pipes are approximately 58-ft long and average 0.015-ft/ft slope. The culverts were observed to have no scour pool or be perched. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field. The proposed highway alignment is located downstream approximately 1,000 feet. Additional survey in this area was collected in November 2008 and May 2009. The current design alignment is similar to that shown in the companion 2006 Stream and Habitat Inventory (S&HI).

The creek is too small for navigation. This project will not impact navigation. The confluence with Eighteen Mile Slough, a minor side channel of the Chilkat River, is approximately 70 feet downstream of the proposed highway alignment. No upstream confluences were observed in the vicinity. No impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) from observations and simple tape measurements by hand. The channel upstream of the existing highway crossing is a fast 4-6% continuous riffle with a rocky substrate. The stream is 4-6' wide and meanders through a young forest. Downstream of the culverts the stream meanders along the existing road, intersecting the new alignment centerline at station 887+60. The roughly 1200' of stream between the culvert outlet and the confluence with Eighteen Mile Slough can be approximately divided by habitat type into three reaches. The first 400' section, measured from the culvert outlet downstream, is a 4-6' wide E-channel composed primarily of riffles, with a substrate of gravel. Although it is of similar width, the second 400' section is flatter in gradient and more complex, composed of riffles combined with numerous deep pools associated with the root structures of well established vegetation. The substrate of this reach is more silt/organic, although the November 2005 flood did deposit a good deal of gravel. The downstream reach connecting to the slough widens to a maximum width of 15' and is subject to backwatering when the Chilkat River is high. The stream substrate is silt, and the banks are steep and well vegetated. Two small streams draining adjacent wetlands enter Horse Farm Creek from the west.

The S&HI indicates that this stream is used by coho and Dolly Varden as spawning and rearing habitat. Pink and coho use this stream for spawning habitat. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2060-3001.

15.3 Hydrology

This stream has a drainage area of approximately 1.55 square miles. The high point of the basin is at 5,621 feet at the summit of an unnamed peak. The watershed is steep, with an average slope of 64 percent. The USGS 7.5 minute topographical map depicts a perennial stream with 3 branches midway up the basin. There is virtually no storage and there are no glaciers. The lower 500 meters of stream channel flows along the eastern edge of the large Nineteen-Mile Debris Fan and possibly loses flow to this feature. There is a small airstrip adjacent to the lower portion of the stream downstream of the existing culvert and

upstream of the proposed crossing, but no development within the drainage area contributing to the culvert itself.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 95 cfs for the 2-year event to 291 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 38 cfs. There is no local input to report for this basin.

15.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Basic topographic data at the new alignment stream crossing was surveyed in November 2008. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 9'-4" by 6'-3" pipe arch is recommended for the stream crossing of the proposed highway alignment. This size pipe will satisfy site cover restrictions and requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 8.3-ft wide reference stream channel width measured along a free flowing reach approximately 90 feet upstream of the new highway crossing by the Inter-Fluve survey (November 2008) and is representative of stream conditions locally to the new crossing. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.17.

Table 15-1. 887+60 Hydrologic and Hydraulic Summary

Drainage Area = 1.55-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	175	255	291
Flow depth at inlet (ft)	4.06	5.86	6.65
Hw/D	0.81	1.17	1.33

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on basic topographic survey data collected November 2008 and based on project horizontal and vertical datum. Final design may require additional site topographic survey.

15.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert to be placed where none currently exists. Hydraulic modeling

based on total station topography indicate that water surface elevations for the 50- and 100-year events will increase by nearly 1.62 and 2.26 feet, respectively. The site survey and, LIDAR topography and aerial photography indicate that adjacent land uses is low-lying undeveloped forest and wetland. The 100-year water surface elevation at the inlet of the proposed culvert is 72.2 feet, 4.8 feet lower than the end of the nearby runway. Increases in water surface elevations are not expected to encroach onto the nearby air strip. Risks of the proposed culvert are considered minimal.

15.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 15-1.

15.7 Riprap

No riprap is proposed at this time.

15.8 Station 887+60 – Existing conditions photos

Existing Culverts: 2 – 36-inch cmp
Catalog Number: 115-32-10250-2060-3001
Fish Use: Rearing coho and Dolly Varden. Spawning pink and coho
Description: The existing location of stream crossing of the highway was referenced as Station 917+00 in the S&HI. Upstream of the culverts the stream is a fast 4-6% continuous riffle with a rocky substrate. The stream is 4-6' wide and meanders through a young forest. Downstream of the culverts the stream meanders along the existing road, intersecting the new alignment centerline at (2009) station 887+60. The roughly 1200' of stream between the culvert outlet and the confluence with Eighteen Mile Slough can be approximately divided by habitat type into three reaches. The first 400' section, measured from the culvert outlet downstream, is a 4-6' wide E-channel composed primarily of riffles, with a substrate of gravel. Although it is of similar width, the second 400' section is flatter in gradient and more complex, composed of riffles combined with numerous deep pools associated with the root structures of well established vegetation. The substrate of this reach is more silt/organic, although the November 2005 flood did deposit a good deal of gravel. The downstream reach connecting to the slough widens to a maximum width of 15' and is subject to backwatering when the Chilkat River is high. The stream substrate is silt, and the banks are steep and well vegetated. Two small streams draining adjacent wetlands enter Horse Farm Creek from the west.

Station 917+00 – Existing conditions photos (cont'd)

16. Culvert Replacement at Station 962+06

The crossing structure at this site is pending design during the Draft DSR phase and is anticipated to consist of a large box culvert to facilitate removal of deposited sediment utilizing equipment.

16.1 Introduction

This tributary is located along a debris flow at highway station 962+06 (S&HI station 983+25). The existing crossing is comprised of an 8'-2" by 5'-9" pipe arch. Design will be completed by DOWL HKM during the Draft DSR phase to facilitate equipment access for clearing of debris flow sediments and is anticipated to include a large box culvert. Hydrology and Hydraulic design for flood conveyance and fish passage will be completed accordingly during the Draft DSR phase.

16.2 Hydraulic History

This section will be completed pending resolution of debris flow considerations.

16.3 Hydrology

This section will be completed pending resolution of debris flow considerations.

16.4 Hydraulic Design

This section will be completed pending resolution of debris flow considerations.

Table 16-1. 962+06 Hydrologic and Hydraulic Summary

This section will be completed pending resolution of debris flow considerations.

16.5 23 CFR

This section will be completed pending resolution of debris flow considerations.

16.6 Conclusion

This section will be completed pending resolution of debris flow considerations.

16.7 Riprap

This section will be completed pending resolution of debris flow considerations.

16.8 Station 962+06 – Existing conditions photos

Existing Culvert: 8'– 2" x 5'– 9" pipe arch
Fish Use: Rearing coho and Dolly Varden
Description: This location was referenced as Station 983+25 in the S&HI. This stream is part of the 19 mile slide area and is subject to alteration by the periodic influx and mechanical removal of large quantities of slide material. This material consists of fine decomposed rock and gravels mixed with cobbles. The stream above the culvert runs in an open ditch along the road back to (2009) station 958+00. No vegetation is present yet numerous juvenile fish were seen in the stream. The stream turns away from the road and runs toward the mountain for about 75' before any upstream movement of fish is prevented by a barrier falls. Downstream of the culvert the stream is braided and open until it intersects the woods several hundred feet below the pipe. The substrate is slide material and initially there is little vegetation. Once the stream enters the woods it is a 2-3' wide fast riffle until it empties into a series of riverside pools fed by upwelling water.

17. Culvert Replacement at Station 973+30

The crossing structure at this site is pending design during the Draft DSR phase and is anticipated to consist of a large box culvert to facilitate removal of deposited sediment utilizing equipment.

17.1 Introduction

This tributary is located along a debris flow at highway station 973+30 (S&HI station 994+50). The crossing is comprised of a 9'-9" by 6'-9" pipe arch. Design will be completed by DOWL HKM during the Draft DSR phase to facilitate equipment clearing debris flow sediments and is anticipated to include a large box culvert. Hydrology and Hydraulic design for flood conveyance and fish passage will be completed accordingly during the Draft DSR phase.

17.2 Hydraulic History

This section will be completed pending resolution of debris flow considerations.

17.3 Hydrology

This section will be completed pending resolution of debris flow considerations.

17.4 Hydraulic Design

This section will be completed pending resolution of debris flow considerations.

Table 17-1. 973+30 Hydrologic and Hydraulic Summary

This section will be completed pending resolution of debris flow considerations.

17.5 23 CFR

This section will be completed pending resolution of debris flow considerations.

17.6 Conclusion

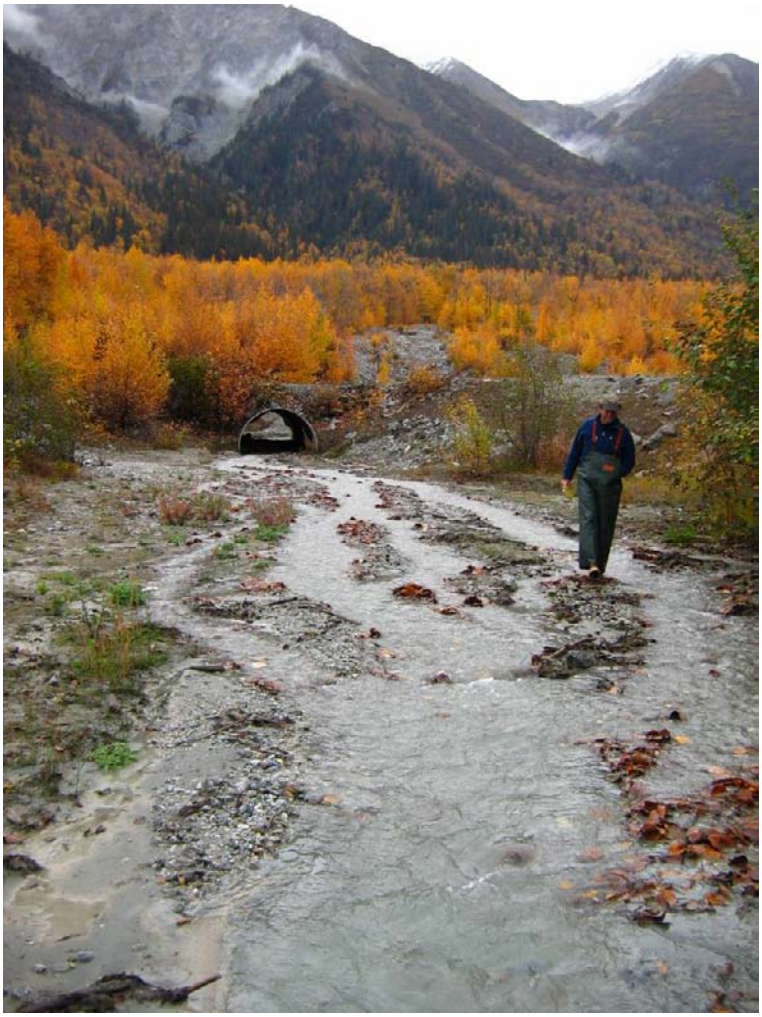
This section will be completed pending resolution of debris flow considerations.

17.7 Riprap

This section will be completed pending resolution of debris flow considerations.

17.8 Station 973+30– Existing conditions photos

Existing Culvert: 9'– 9" x 5'– 9" pipe arch
Fish Use: Unknown
Description: This location was referenced as Station 994+50 in the S&HI. The stream above the culvert of this 19 mile slide stream is very unstable and often excavated by heavy equipment. Substrate is mobile slide material. Some vegetation is beginning to be established on the banks. Fish passage above the culvert is blocked by a headcut upstream 200'. Downstream of the culvert the stream is initially a braided riffle with little sign of viable fish habitat. Two hundred feet downstream of the culvert outlet the stream becomes a steep cascade through boulders until it enters the river.



18. Culvert Replacement at Station 1102+19

18.1 Introduction

This tributary is locally referred to as 21-1/2 Mile Creek and crosses the highway at station 1102+19 (S&HI station 1123+25). The crossing, immediately downriver of the turn off to the village of Klukwan, is comprised of an existing circular 36-inch corrugated metal pipe (CMP). At this Preliminary Engineering Report phase, the pipe was preliminarily designed based on Tier 1 stream simulation methods outlined in the MOA. Tier 1 methods were selected based on fair to good upstream habitats and to provide continuity of flow, sediment and debris through the pipe. This project will replace the existing pipe with a larger 7'-3" by 5'-3" pipe arch to convey flood flows and provide fish passage.

18.2 Hydraulic History

This unnamed tributary crosses the Haines Highway at about elevation 117-ft. As described in Section 4.3.1, MHHW is at elevation 9.4-ft (NAVD 88) and based on approximate modeling tidal backwater will not extend to this location. The low flow water level in adjacent reaches of the Chilkat River are at approximately elevation 108-ft. It is unlikely that Chilkat River flows will have a backwater impact extending to the culvert location.

No historical flood data are available for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies were identified for the Chilkat River or its tributaries, including this one.

A site visit was conducted on October 8, 2005. A rapid assessment and cursory site survey were conducted for this phase as described in Section 3.2. The existing culvert is a 36-inch CMP with no stream substrate material in the bottom of the pipe. From the site survey, the existing pipe is approximately 66-ft long at approximately 0.057-ft/ft slope. The tributary streambed slope is 0.038-ft/ft upstream and 0.007-ft/ft downstream of the culvert. A small amount of flow was observed. No flooding problems with the existing culvert were reported in the anecdotal record or indicators observed in the field.

The creek is too small for navigation. This project will not impact navigation. The confluence with the Chilkat River is approximately 1,500-ft downstream. No upstream confluences were observed in the vicinity. Therefore, no impacts to confluences are expected. No mining occurs on this stream.

Reach scale geomorphic conditions were summarized in the Stream and Habitat Inventory (S&HI) from observations and simple tape measurements by hand. The channel upstream of the existing highway crossing is 1-2' wide and composed of riffle habitat. The stream runs alongside the road up to (2009) station 1107+00 before the channel turns away from the road. For the first 150' above the culvert the stream lies

away from the toe of the road fill slope and cover is provided by adjacent willow and alder. The stream then runs tight along the toe and the banks are vegetated with grasses. Downstream of the culvert the stream flows through a manipulated habitat with patches of willow and grasses beginning to be established. For both portions of the stream the substrate is small gravel.

The S&HI indicates that this stream is used by coho and Dolly Varden as rearing habitat. Chum and coho use this stream for spawning habitat. The stream is listed in the Anadromous Waters Catalog as catalog number: 115-32-10250-2070.

18.3 Hydrology

This stream has a drainage area of approximately 1.26 square miles. The high point of the basin is at 5,477 feet on a ridge leading north toward Iron Mountain. The watershed has an average slope of 54 percent. The USGS 7.5 minute topographical map depicts a single perennial stream channel extending only one third of the way up the basin. There is no storage and there are no glaciers. The lower 1,000 yards of stream flows along the eastern edge of the large Twenty-three mile debris fan and likely loses flow to this feature. There is a water tank in the lower portion of the basin that supplies the village of Klukwan. Otherwise, the watershed is undeveloped.

There is no known gage information for this stream. Peak flow estimates using regional regression equations ranged from 73 cfs for the 2-year event to 227 cfs for the 100-year flood. The fish passage design flow, which is 40 percent of the 2-year event, is 29 cfs. There is no local input to report for this basin.

18.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. Final designs will require detailed stream cross section and profile survey. Final culvert designs will be prepared and documented for submittal with the Plans-in-Hand.

A 7’-3” by 5’-3” pipe arch is recommended as the replacement at this crossing. This size pipe will satisfy requirements of the Tier 1 stream simulation design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the 6.6-ft wide reference stream channel width measured 60 feet upstream of the culvert by the Inter-Fluve survey (October, 2005) and is representative of stream conditions locally at the culvert. The culvert would be set at a slope to match the existing stream system. Stream substrate will be placed in the bottom of the pipe to fill a minimum of 20-percent of the rise. Concepts are shown in Section 23.3.

Existing and proposed conditions were modeled with HEC-RAS. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise ratio equal to 1.46.

Table 18-1. 1102+19 Hydrologic and Hydraulic Summary

Drainage Area = 1.26-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	135	198	227
Flow depth at inlet (ft)	4.55	6.15	6.81
Hw/D	1.08	1.46	1.62

Note: Design was completed to preliminary level in support of the Preliminary Engineering Report based on cursory survey data collected by Inter-Fluve based on a relative horizontal and vertical datum. Final design will include site topographic survey.

18.5 23 CFR

There is no known FEMA Flood Insurance Study for the existing culvert. The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert than currently exist. Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipe. There is less likelihood of debris blocking the culvert. The proposed culvert will improve stream process and provide more natural flood plain connectivity.

18.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culvert is not expected to impact the flood plain or environment. The proposed culvert meets ADOT&PF's requirements for conveyance of the 50-year event. The proposed culvert was designed for fish passage using the Tier 1 method to simulate adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed culvert are presented in Table 18-1.

18.7 Riprap

The culvert was designed using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No riprap is proposed at this time.

18.8 Station 1102+19 – Existing conditions photos

Existing Culvert: 36-inch cmp
Catalog Number: 115-32-10250-2070
Fish Use: Rearing coho and Dolly Varden. Spawning chum and coho
Description: This location was referenced as Station 1123+25 in the S&HI. Based on hand measurements, upstream of the culverts the stream is 1-2' wide and composed of riffle habitat. The stream runs alongside the road up to (2009) station 1107+00 before the channel turns away from the road. For the first 150' above the culvert the stream lies away from the toe of the road fill slope and cover is provided by adjacent willow and alder. The stream then runs tight along the toe and the banks are vegetated with grasses. Downstream of the culvert the stream flows through a manipulated habitat with patches of willow and grasses beginning to be established. For both portions of the stream the substrate is small gravel.

19. Culvert Replacement at Station 1179+75

The crossing structure at this site is pending design during the Draft DSR phase and is anticipated to consist of a large box culvert to facilitate removal of deposited sediment utilizing equipment

19.1 Introduction

This tributary is located along a debris flow at highway station 1179+75. The crossing is comprised of a corrugated metal pipe (CMP) about 13-ft in diameter. Design will be completed by DOWL HKM during the Draft DSR phase to facilitate equipment clearing debris flow sediments and is anticipated to include a large box culvert. Hydrology and Hydraulic design for flood conveyance and fish passage will be completed accordingly during the Draft DSR phase

19.2 Hydraulic History

This section will be completed pending resolution of debris flow considerations.

19.3 Hydrology

This section will be completed pending resolution of debris flow considerations.

19.4 Hydraulic Design

This section will be completed pending resolution of debris flow considerations.

Table 19-1. 1179+75 Hydrologic and Hydraulic Summary

This section will be completed pending resolution of debris flow considerations.

19.5 23 CFR

This section will be completed pending resolution of debris flow considerations.

19.6 Conclusion

This section will be completed pending resolution of debris flow considerations.

19.7 Riprap

This section will be completed pending resolution of debris flow considerations.

20. Culvert Replacement at Station 1187+25

The crossing structure at this site is pending design during the Draft DSR phase and is anticipated to consist of a large box culvert to facilitate removal of deposited sediment utilizing equipment

20.1 Introduction

This tributary is located along a debris flow at highway station 1187+25 (approximate S&HI station 1208+25). The crossing is comprised of an 8'-2" by 5'-9" pipe arch. Design will be completed by DOWL HKM during the Draft DSR phase to facilitate equipment clearing debris flow sediments and is anticipated to include a large box culvert. Hydrology and Hydraulic design for flood conveyance and fish passage will be completed accordingly during the Draft DSR phase.

20.2 Hydraulic History

This section will be completed pending resolution of debris flow considerations.

20.3 Hydrology

This section will be completed pending resolution of debris flow considerations.

20.4 Hydraulic Design

This section will be completed pending resolution of debris flow considerations.

Table 20-1. 1187+25 Hydrologic and Hydraulic Summary

This section will be completed pending resolution of debris flow considerations.

20.5 23 CFR

This section will be completed pending resolution of debris flow considerations.

20.6 Conclusion

This section will be completed pending resolution of debris flow considerations.

20.7 Riprap

This section will be completed pending resolution of debris flow considerations.

20.8 Station 1187+25 – Existing conditions photos

Existing Culvert: 8’-2” x 5’-9” pipe arch

21. Small Fish Culverts

21.1 Introduction

Following completion of the field investigations and submittal of the preliminary draft H&H report (November 2005), a number of smaller pipes with fish present were identified. These pipes were either included in the Anadromous Waters Catalog or seen to have fish present by Inter-Fluve or OHMP staff. These pipes are all 36-inches or less in diameter, two sites have double 24-inch CMPs, and are not required to have a hydraulic summary report. However, culvert replacements may require ADF&G Title 16 Fish Habitat Permits. At the request of ADOT&PF, discussion of these culverts and recommendation of design method and culvert size were subsequently added to this report. Therefore, each of these smaller pipes with fish present are identified, existing conditions discussed, H&H analysis/preliminary design presented and size of pipe to meet fish passage and flood conveyance requirements discussed. This section describes methods for providing fish passage and providing flood conveyance equal to or greater than the existing culverts.

21.2 Hydraulic History

Through the anecdotal record and interviews with ADOT&PF maintenance personnel, no culverts were identified that had problems with icing or conveyance of flood flows through unobstructed pipes. Therefore, it is assumed that existing conditions of each pipe discussed below are performing satisfactorily.

21.3 Hydrology

No stream gaging data were identified or known to be available for these streams. Furthermore, the basins range in size from 0.05- to 0.49-sq. mi, all of which fall below the 0.72 sq. mi. threshold to be appropriately evaluated using USGS regression equations for this region. Initially, peak flow estimates were obtained by applying flow per unit area values from neighboring basins. Subsequent hydraulic analysis suggested that these flow estimates were unrealistically large in comparison to the size of the culverts and anecdotal reports of satisfactory flood conveyance. An alternate approach was therefore applied, whereby the discharge associated with a HW/D ratio of 1.5 was loosely approximated as a surrogate for the 50-year flow. Fish passage flows estimated from forty percent of the 2-year USGS regression flow estimate were then prorated based on the ratio of this surrogate and USGS regression estimated 50-year event. In most cases the fish passage flow estimated with this approach had a favorable comparison to the stainline observed on the culvert, an indicator of a frequently occurring flow. Tier 1 stream simulation or Tier 2 FISHPASS program design [2] fish passage designs were

[2] Tier 2 FISHPASS program design. This method uses the ADF&G FISHPASS software to determine hydraulic conditions passable by species and age class (size) of fish with sufficiently deep and slow flow to enable fish to pass the full length of culvert within their swimming capabilities (ADF&G and ADOT&PF MOA, 2001).

developed. Lastly, the culvert hydraulic capacity was checked to ensure that flood conveyance equaled or exceeded existing conditions.

21.4 Hydraulic Design

Existing hydraulic capacity was calculated using Federal Highway Administration's HY-8 culvert hydraulic analysis software.

Fish passage was based on Tier 1 stream simulation or Tier 2 FISHPASS program design methods based on recommendations and discussion with ADOT&PF and agency personnel. Tier 2 calculations utilized ADF&G's FISHPASS program for baffled and unbaffled pipes. Design fish were selected as either adults or juvenile Coho or Cutthroat through prior discussion and agreement with ADOT&PF and Agency personnel. A summary of design method used and design fish for Tier 2 applications is included in the culvert summary shown in Appendix 23.4.

A new culvert that would meet fish passage criteria was identified and then resized if necessary to provide equal or greater conveyance capacity than the existing structure. Hydraulic analysis was completed using FHWA HY-8. A comparison of hydraulic capacity for the existing and proposed culverts at each site is presented in Appendix 23.5.3.

Four of the smaller fish pipes are recommended to be integrated with stream improvements during a mitigation phase. These measures will improve fish passage and aquatic habitat (e.g. spawning and rearing). Fish passage and hydraulics of these culverts will be revised at the mitigation phase to incorporate these stream enhancements.

A summary discussion of each site follows.

Station 228+95 (S&HI station 252+00). Tier 2 FISHPASS no baffles
The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 22-ft. Upstream and downstream conditions are described in the companion Stream and Habitat Inventory (S&HI) and summarized in the following paragraph. Fish passage is designed using Tier 2 FISHPASS methods given the relatively flat gradient and observed ability of fish to pass the existing culvert. FISHPASS analysis indicates that juvenile Coho are able to pass the existing culvert. Therefore, the culvert replacement can be of similar type and elevation as the existing culvert - hydraulic capacity would remain unchanged.

As stated in the S&HI:

> Catalog Number: 115-32-10250-2006
> Stream Name: Schnabel Creek
> Fish Use: Rearing coho, Dolly Varden and cutthroat
> Description: Based on observations and hand measurements, upstream of the culvert the stream is 1-2' wide and 1' deep. The stream banks are thickly vegetated with grasses that tend to grow over most of the stream surface. Substrate is organic matter over gravel. The stream runs along the toe of the Southeast Road Builders' fill,

crossing the access driveway at station 269+00 and then connecting to the artificial ponds near S&HI station 260+50. The downstream end of the culvert is submerged in a small pool, with a 2-3' wide E type channel forming almost immediately at the outlet and meandering through the wetlands to connect to another stream. The outlet channel has a very low gradient, a silty bottom and low, vertical banks vegetated with marigolds, sedges and willows.

Station 240+38 (S&HI station 263+50). Tier 2 FISHPASS no baffles
The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 22-ft. Upstream and downstream conditions are described in the companion S&HI and summarized in the following paragraph. Fish passage is designed using Tier 2 FISHPASS methods given the relatively flat gradient and observed ability of fish to pass the existing culvert. FISHPASS analysis indicates that juvenile Coho are able to pass the existing culvert. Therefore, the culvert replacement can be of similar type and elevation as the existing culvert - hydraulic capacity would remain unchanged.

As stated in the S&HI:

Catalog Number: 115-32-10250-2006-3003
Stream Name: none, listed as tributary to Schnabel Creek
Fish Use: Rearing coho, Dolly Varden and cutthroat
Description: Although the ADFG Catalog lists this stream as a tributary to Schnabel Creek, it is actually a separate system fed by a wetland and spring complex cut off from the upper reaches of Schnabel Creek by the driveway at station 263+60. Upstream of the culvert the inlet stream flows from both directions along the toe of the road embankment. Flow is dispersed through a broad wetland area with little in the way of a defined channel. Based on observations and hand measurements, depth is usually less than 0.5' over a saturated organic base. Downstream of the culvert outlet is a 10' by 15' pool, with a depth of 3'. The pool leads into a 2' wide, 1' deep silt bottomed channel that meanders through willow and alder root systems. This channel winds roughly parallel to the road, swinging tight to the existing embankment toe between S&HI stations 260+50 and 261+00.

Station 245+19 (S&HI station 268+00). Tier 1 stream simulation
The existing pipe is a 36-inch CMP with a rusted bottom. Elevation is approximately 23-ft. Upstream and downstream conditions are described in the companion S&HI and summarized in the following paragraph. Fish passage is designed using Tier 1 stream simulation methods given good upstream habitats which include wetlands. Based on hand measurements of the existing stream, the representative channel is approximately 2-ft wide. In order to incorporate stream substrate material to Tier 1 standards and provide equal or greater conveyance to what exists, a 4-ft diameter CMP will be required.

As stated in the S&HI:

Catalog Number: 115-32-10250-2008
Stream Name: Waterfall Creek

Fish Use: Rearing coho, Chinook and Dolly Varden. Coho Spawning
Description: The ADFG catalog lists this pipe as the primary conduit of Waterfall Creek. This is no longer the case. The culvert at station S&HI station 275+66 now passes the majority of the flow that leads from the waterfall the creek is named for. Based on observations and hand measurements, upstream of the inlet there is a short, 2'wide, shallow stream segment leading into an emergent marsh. The stream substrate is organic matter over gravel. The outlet stream is a short, 2' wide, 0.7' deep section leading into the main stream that flows from the S&HI station 275+66 culvert. The stream banks are well vegetated with grasses.

Station 248+45 (S&HI station 271+40). Tier 1 stream simulation
The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 22-ft. Upstream and downstream conditions are described in the companion S&HI and summarized in the following paragraph. Fish passage is designed using Tier 1 methods given excellent upstream habitats which include wetlands. Based on hand measurements of the existing stream the representative channel is approximately 3-ft wide. In order to incorporate stream substrate material to Tier 1 standards and provide equal or greater conveyance to what exists, a 3-ft diameter CMP will be required.

As stated in the S&HI:
Catalog Number: 115-32-10250-2008-3005
Stream Name: none listed, tributary to Waterfall Creek
Fish Use: Rearing coho, Dolly Varden, Chinook and cutthroat
Description: Upstream of the culvert the stream disperses immediately into thickly vegetated marsh in a broad remnant channel. Based on observations and hand measurements, there are a number of pools with depth of up to 3'. The pools are fed in part by a small mountain stream about 100' from the road. However, the majority of the flow comes from the stream and wetland complex that stretches ahead on line up to the waterfall near S&HI station 305+40. Downstream of the culvert the stream meanders along the road to S&HI station 273+00 before turning toward the river. The stream flows through a marsh in a defined channel, with the banks composed of thick vegetation. Substrate is organic; depth is 0.5 - 1'.

Station 292+90 (S&HI station 316+00). Tier 2 FISHPASS baffles
The existing crossing is two 24-inch CMPs with rusted bottoms. Elevation is approximately 26-ft. Upstream and downstream conditions are described in the companion S&HI and summarized in the following paragraph. Of note, upstream of the culverts is a gravel lined pool that was excavated following heavy sedimentation during the November 2005 flood. The pool is approximately 15-ft by 35-ft, and presently bare of vegetation. A few redds were observed during the October field investigations, prior to the November 2005 flood, thus fish have been seen to utilize upstream habitats and passage is to be provided. Fish passage was designed by Tier 2 FISHPASS methods given the poor quality of upstream habitats. The Tier 2 culvert was then analyzed for

conveyance capacity using HY-8 to exceed existing conditions. A 4-ft diameter CMP is required with baffles to a height of 0.6-ft.

As stated in the S&HI:

Fish Use: Rearing coho, cutthroat, Chinook and Dolly Varden. Spawning redds present

Description: Upstream of the culvert there is a large, shallow, gravel bottomed pool excavated after the November 2005 flood. Based on observations and hand measurements, this pool is fed primarily by a 4' wide cascade that passes through a culvert in the adjacent driveway. Another mountain stream near S&HI station 321+00 provides another 10% of the flow. All fish habitat above the culvert has been scoured to gravel. Redds were present in this section in October 2005. This stream is used for a small hydropower system. Downstream of the culvert is a 10' wide gravel bottomed plunge pool with redds present (October 2005) at the tailout. The stream then flows directly to the river in a 6-10' wide, rocky cascade channel, the lower end of which is influenced by the river backwater.

Station 314+72 (S&HI station 337+70). Tier 2 FISHPASS no baffles

The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 28-ft. Upstream and downstream conditions are described in the companion S&HI and summarized in the following paragraph. Of note, upstream of the culverts is a gravel lined pool that was excavated following heavy sedimentation during the November 2005 flood. The pool is approximately 10- by 30-ft, and presently bare of vegetation. Some habitat value was noted during the October 2005 field investigations, prior to the November 2005 flood, thus fish passage is to be provided. Fish passage was designed by Tier 2 FISHPASS methods given the limited value of upstream habitats. The Tier 2 culvert was then analyzed for conveyance capacity using HY-8 to exceed existing conditions. A 3-ft diameter CMP is required to meet Tier 2 FISHPASS criteria.

As stated in the S&HI:

Fish Use: Rearing coho and Dolly Varden below culvert outlet

Description: Based on observations and hand measurements, upstream of the culvert there is a 10' by 30' pool created by ditch cleaning activity in the spring of 2006. This shallow pool is fed by a stream cascading down the cut slope adjacent to the pool. The inlet stream averages 4' wide and 0.1' deep and is well defined further upstream. Downstream of the culvert is an 8' diameter plunge pool 1.5' deep. The culvert was not perched in late May of 2006. The stream meanders the 140' to the Chilkat River through an 8' wide, high banked channel. The channel banks are thickly vegetated with alder and cottonwood. The stream meanders within this channel, with width varying from 1-3', and depth 0.2' to 0.8'. It is composed of pools and riffles over gravel.

Station 366+36 (S&HI station 389+25). Tier 1 stream simulation

The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 30-ft. Upstream and downstream conditions are described in the companion S&HI and

summarized in the following paragraph. There is excellent juvenile rearing habitat upstream of the culvert. Therefore, fish passage was designed by Tier 1 stream simulation methods. Based on hand measurements in the S&HI and approximations from the project survey, channel width was assumed to be 4 feet wide. A 42 inch by 29 inch pipe arch was selected. Substrate will be placed in the culvert to 6-inch depth with slope set to accommodate adjacent stream slopes.

As stated in the S&HI:

Fish Use: Rearing coho, cutthroat and Dolly Varden
Description: Upstream of the culvert the 2-4' wide stream provides 40' of excellent rearing habitat for juvenile fish after it cascades down the hillside. Substrate is gravel and the cover is dense. Downstream of the culvert the stream runs through a channel incised in a river deposited sandbar and empties directly into the Chilkat River.

Station 382+07 (S&HI station 405+00). Tier 2 FISHPASS no baffles

The existing pipe is a 36-inch CMP with a rusted bottom. Elevation is approximately 30-ft. Upstream of the culvert is an extensive wetland that could provide excellent rearing habitat. The outlet of the existing culvert is perched, discharging directly to the Chilkat River. Periodic fish passage is enabled when the Chilkat River levels are sufficiently high to back water the culvert. The existing pipe meets Tier 2 FISHPASS fish passage requirements when the tailwater is 0.75-ft or greater over the outlet invert. Therefore, the culvert replacement can be of similar type and elevation as the existing culvert - hydraulic capacity would remain unchanged. The dynamic nature of the Chilkat River poses more risk to a constructed fish passage channel downstream of the culvert than is desirable. Therefore, the proposed culvert will have an outlet condition similar to existing; with periodic fish passage during Chilkat River high flow conditions backwatering the culvert.

As stated in the S&HI:

Catalog Number: 115-32-10250-2016
Stream Name: Lily Pad Creek
Fish Use: Rearing coho and Dolly Varden
Description: Based on observations and hand measurements, upstream of the culvert the first 50' of the stream consists of a 2' wide E type channel. The stream then disperses into a swamp and loses any defined channel. At the downstream end of the culvert the stream plunges directly onto a sandbar. There is an intermittent pool and shallow exit stream over the sandbar. Rearing fish access to the swamp is controlled by the river water level.

Station 419+95 (S&HI station 443+00). Tier 2 baffles

The existing pipe is two 24-inch CMPs with rusted bottoms. Elevation is approximately 39-ft. Upstream and downstream conditions are described in the companion S&HI and summarized in the following paragraph. Of note, upstream of the culverts is a gravel lined pool at the toe of a steep cascade. Fish passage was designed by Tier 2 FISHPASS

methods given the poor quality of upstream habitats. The Tier 2 culvert was then analyzed for conveyance capacity using HY-8 to exceed existing conditions. A 3.5-ft diameter CMP is required with baffles to a height of 0.6-ft.

As stated in the S&HI:

Fish Use: Rearing coho, cutthroat, steelhead and Dolly Varden. Possible spawning
Description: Based on observations and hand measurements, upstream of the culverts there is a 20' diameter gravel lined pool fed by a quickly steepening, 3-5' wide, rocky cascade/step pool section of stream. The culverts empty into a 6-8' diameter plunge pool. The active culvert is perched 4-6". The stream below the outlet pool is composed of riffles interspersed with step pools and is 3-6' wide. Substrate is small rocks and gravel. Mature vegetation overhangs the stream.

Station 530+70 (S&HI station 554+00). Tier 1 stream simulation

The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 40-ft. Upstream of the culvert is 10-1/2 Mile Pond that could provide excellent rearing habitat. Fish passage is designed using Tier 1 stream simulation methods given excellent upstream habitats. Based on hand measurements of existing stream the representative channel is approximately 2-ft wide. In order to incorporate stream substrate material to Tier 1 standards and provide equal or greater conveyance to what exists, a 3-ft diameter CMP will be required.

As stated in the S&HI:

Catalog Number:115-32-10250-2028-0010 (Pond is catalogued, stream not identified)
Stream Name: 10 1/2 Mile Pond, outlet stream
Fish Use: Coho and steelhead rearing
Description: Although this creek is not specifically shown on the ADF&G catalogue maps, it is directly connected to the 10 ½ Mile Pond. Based on observations and hand measurements, upstream of the culvert is a 15' stream that then disperses into the pond. The stream is 2-3' wide and 0.3'deep. Stream substrate is organic, and vegetation grows throughout. Below the culvert outlet the stream runs for 6' in a 2' wide, 0.2' deep channel, then disperses into a 10-20' wide wetland full of grasses and willows. Flow in this wetland is visible, depth is 0.8 to 1.3'. There are some open water areas. This wetland continues along the road for about 175', then becomes more channelized (3' wide, 0.3' deep) and turns away from the road. Near station 551+00 the stream broadens to 8-10' wide. Many fish were noted to be present (June 2006).

Station 606+68 (S&HI station 630+00). Tier 2 FISHPASS no baffles

The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 45-ft. The outlet of the existing culvert is perched, discharging directly to the Chilkat River. Periodic fish passage is enabled when the Chilkat River levels are sufficiently high to backwater the culvert. The existing pipe meets Tier 2 FISHPASS fish passage requirements when the tailwater is 0.6-ft or greater over the outlet invert. Therefore, the culvert replacement can be of similar type and elevation as the existing culvert -

hydraulic capacity would remain unchanged. The dynamic nature of the Chilkat River poses more risk to a constructed fish passage channel downstream of the culvert than is desirable. Therefore, the proposed culvert will have an outlet condition similar to existing; with periodic fish passage during Chilkat River high flow conditions backwatering the culvert.

As stated in the S&HI:

Fish Use: Rearing cutthroat and Dolly Varden

Description: The flood of November 2005 directed approximately two-thirds of the flow from the waterfall at S&HI station 629+50 towards this culvert. The rest of the flow exits through the culvert at S&HI station 612+50. Based on observations and hand measurements, above the culvert inlet the stream divides into a 6-8' wide, 1-2' riffle, pool, glide complex running through an established alder and birch forest. The stream substrate is silt and organics for the first 100', then changes to recently deposited alluvial material. The culvert empties directly into the Chilkat River and is perched at low water.

Station 736+83 (S&HI station 757+50). Either Tier 1 stream simulation or Tier 2 FISHPASS

The existing pipe is a 24-inch CMP with a rusted bottom. Elevation is approximately 57-ft. Upstream of the culvert is a pool and stream system that could provide excellent rearing habitat. The outlet of the existing culvert is perched, and discharges to a side channel of the Chilkat River with a surveyed width of about 8-ft wide – possibly a result of human disturbance. Based on preliminary methods either a 7'-4" by 5'4" pipe arch for Tier 1 stream simulation design method or 3-ft diameter CMP for Tier 2 FISHPASS design method is likely to be required. This area is recommended for mitigation opportunities. The proposed replacement culvert will be integrated into a fish passage channel to connect the pipe to the Chilkat River for a greater range of flows.

As stated in the S&HI:

Fish Use: Rearing coho, Chinook and Dolly Varden

Description: Based on observations and hand measurements, upstream of the culvert there is a small waterfall fed pool that extends about 50' back on line. The stream branch leading to north is 5-8' wide and 0.3' deep for the first 35', where the main flow enters as a waterfall. This 35' riffle section is shallow, littered with organic debris, and has a gravel substrate. The water extends in a roadside ditch up to S&HI station 760+00 where there is another small waterfall. This reach is an 8' wide, 0.8' deep pool. Standing water with little flow extends another 100' ahead on line. Fish are present throughout. Downstream, the perched culvert empties into a silty channel backwatered by the river. Grass grows on the banks above the river level, but bare silt is exposed lower down. There is no cover. The river gravel bars near the outlet are actively used for spawning.

Station 767+14 (S&HI station 788+00). Tier 2 FISHPASS baffles

The existing pipe is one 36-inch CMP with a rusted bottom. Elevation is approximately 56-ft. Upstream and downstream conditions are described in the companion S&HI and summarized in the following paragraph. Of note, upstream of the culvert is a small stream that drains from the hill side. The outlet of the pipe is perched to a side channel of the Chilkat River. Given the poor quality of upstream habitats, the proposed culvert will have an outlet condition similar to existing; with periodic fish passage during Chilkat River high flow conditions backwatering the culvert. Fish passage was designed by Tier 2 FISHPASS methods for high river flow conditions given the poor quality of upstream habitats. The Tier 2 culvert was then analyzed for conveyance capacity using HY-8 to exceed existing conditions. A 3.5-ft diameter CMP is required with baffles to a height of 0.6-ft.

As stated in the S&HI:

> Fish Use: Rearing coho, Chinook and Dolly Varden. Possible redd observed (October, 2005)
> Description: The culvert is fed by two mountain streams that join together about 20' upstream of the inlet. One of the streams runs 100' back on line in a shallow, 2-3'wide, gravel bottomed roadside ditch which ends in a waterfall. The second branch runs for a distance of 120' away from the road and along the toe of the mountain before turning upslope as a waterfall. This 120' of stream is composed of 2-3' wide pool/riffle habitat with rock and gravel substrate. It is well vegetated. The culvert outlet empties directly into the river.

21.5 23 CFR

There is no known FEMA Flood Insurance Study for any of these existing culverts. The proposed action for each site includes replacement with a culvert that provides fish passage to either Tier 1 stream simulation or Tier 2 FISHPASS requirements and has flow capacity equal to or greater than the existing pipe. Risks of the proposed culverts are considered less than the existing structures. There is a reduction in upstream backwater effects and more efficient conveyance of flows through the pipes. There is less likelihood of sediment or debris blocking the culverts. The proposed culverts will improve stream process and provide more natural flood plain connectivity.

21.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. Design will be completed for submittal with Plans-in-Hand. The proposed culverts were designed for fish passage using the Tier 1 stream simulation or Tier 2 FISHPASS method based on prior discussion and agreement with ADOT&PF and agency personnel. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches. The proposed culverts will meet or exceed the conveyance of existing structures. The proposed culverts are not expected to impact the flood plain or environment.

The hydraulic summary for the proposed culvert are presented in Appendix 23.5.3.

21.7 Riprap

The culverts were designed using Tier 1 or Tier 2 stream simulation to maintain continuity of flow of water and sediment. Each culvert was designed to provide equal or greater flood capacity than currently exists. At this preliminary phase, the reduction in flow restriction is assumed to reduce any scour potential that may exist. Therefore, no riprap is proposed at this time.

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23. Appendices:

23.1 Culvert Inventory Table

Haines Highway - MP 3-25 Culvert Inventory

S&HI stationing
Multiple pipes
Big fish pipe
Small fish pipe

as-built summary field

Notes: reference to 'emergent wetland' areas is used loosely by non-botanist and does not necessarily comply with strict wetland definition
Stainline height above invert refers to low point of metal culvert; does not reference accumulations of material within pipe

Criteria used for determining if waters of the U.S.: drains stream, waterfall, or hillslope seeps; drains wetland or connected to wetland with evidence of flowing water; fish present.
If notes indicate lack of channel (downstream or upstream), then did not consider a Water of the U.S.

count	As-built	Centerline stationing			QA'd	Culvert	Culv Size	Culvert	As-Built	Eng. Survey	Height to Stainline at:		fish bearing	Waters of the U.S.	Upstream	Inlet	Outlet	Downstream
09	Station	Design 9/2005	S&HI June/06	Design 10/2009		Size (in)		Length (ft)	Comment		inlet(ft)[1]	outlet(ft)[1]			conditions	Conditions	Conditions	conditions
	Haines Highway MP 4 - 12.77 As-Builts																	
1	212+58	212+50	212+53	189+51	dm	24	24	70			0.3			N	drains ditch; no water present	clear of debris/sediment at inlet; crimping of inlet from maintenance; gravel present in barrel 0.2 ft	opens to voids in large riprap	discharges to ditch
2	219+08	218+80	218+92	195+90	dm	24	24	74						N	drains ditch; no water present	partially obstructed by grass/debris; pipe invert filled 0.25-0.5 ft with gravel/sediment	could not locate; either hidden by riprap, sand dunes, or veg.	u/s of airport berm
3	235+52	234+90	235+12	212+10	dm	24	24	60			0.5	1		N	flowing water present discharge from u/s pipe to short open channel into road culvert	undamaged; slight sediment and veg obstruction	invert perched 0.8 ft abv channel ws; outlet damaged but open	discharges to Chilkat trib/slough. Mostly runoff or GW drainage.
4	237+51	236+87	237+09	214+07	dm	24	24	60			1			N		inlet and barrel clear of debris/ sediment; bottom 0.2-0.3 ft rusted out	perched 0.45 ft abv scour pool ws	scour pool = 6 ft wide x 7 ft long x 1.4 ft depth. Trickle of water.
5	246+02	245+30	245+52	222+51	dm	48	48	SeeSurv.		Yes	1		Yes	Y	juvenile salmonids present	undamaged; clear of debris/sediment	slight damage; backwatered 50-66% of barrel	scour pool = 15 ft wide x 20 ft long x 1-1.5 ft depth; pool backfilled with fines; metal debris (55 gal drum and outlet apron) in outlet pool
6	252+55	251+75	251+96	228+95	dm	24	24	60			0.75			N	drains ditch @ SE Road Builders	undamaged; partially obstructed by grass	could not locate; likely covered by veg and backwater at wet meadow/wetland complex	discharges to wet meadow/wetland complex
7	263+93	263+20	263+40	240+38	dm	24	24	60			0.65			Y		undamaged; clear of debris/sediment; flowing water present	backwatered from wetland area	discharges to wet meadow/wetland complex
8	268+75	268+00	268+20	245+19	dm	36	36	60			0.65			Y		undamaged; some veg on streambed	no scour hole; outlet damaged, no perching	discharges to standing water in wetland area
9	272+00	271+25	271+45	248+45	dm	24	24	58			1.1		YES - S&HI	Y	drains wetland area (rushes)	undamaged	undamaged	discharges to standing water in wetland area; no scour pool; juvenile salmonids present
10	316+46	315+71	315+91	292+90	dm	24	24	50			0.7		YES - S&HI	Y	clean gravels <= 0.25 ft	inlet slightly crimped; flowing water present; drains stream (hydropower plant upstream)	outlet moderately crimped; backwatered 0.45 ft to stainline	flowing water
11	316+50	315+75	315+95	292+94	dm	24	24	50			0.7		YES - S&HI	Y	clean gravels <= 0.25 ft	inlet slightly crimped; flowing water present; drains stream (hydropower plant upstream)	outlet slightly crimped; backwatered 0.45 ft to stainline	flowing water
12	322+19	321+44	321+64	298+62	dm	24	24	56			0.4	0.6		Y	drains flowing water in ditch supplied from small cascades on adjacent hillslope	inlet slightly crimped	freefall discharge to Chilkat	discharges direct to Chilkat
13	323+54	322+80	32300	299+97	dm	24	24	56			0.5 (rust line 1 ft)			Y	drains flowing water in ditch supplied from hillslope seeps	undamaged; flowing water	silt in outlet from Chilkat backwater; discharges to Chilkat bank; perched	discharges direct to Chilkat
14	331+30	could not locate	could not locate		dm	24	24	56						N/A				
15	338+30	337+50	337+70	314+72		24		52			1.2	0.5			Drains stream and ditch. Cascade 12' from inlet.	culvert slightly crushed; flowing water present; bottom 0.5' filled with gravel	Slightly damaged but fully open	discharges into 10' by 10' pool, which connect to a 140' channel feeding into the Chilkat River
16	342+73	341+92	342+12	319+13		36	36	SeeSurv.		Yes	see survey data		Yes	Y	water present	undamaged; stainline may be from Chilkat backflow	damaged; stainline may be from Chilkat backflow	water present
17	348+30	could not locate	could not locate		48"?	24	24	48						N/A				
18	348+57	347+58	347+77	324+79	MB	48	48	SeeSurv.		Yes	see survey data		YES - S&HI	Y	drains stream	inlet crimped; backwatered	undamaged; backwatered	small channel backwatered by Chilkat
19	373+55	372+00	372+20	349+25	dm	24	24	56			1 (rust line)			N	rel. dry forested area; drains wet drainage ditch	inlet crushed and covered with grasses	undamaged; 0.5 ft of silt	drains to rocklined outfall
20	390+09	389+25	389+30	366+36	dm	24	24	56			0.5		YES - S&HI	Y	drains stream (4 ft wide x 1 ft depth x 30 ft to hillslope); flowing water	inlet slightly crimped	outlet slightly crimped	silt lined channel (3 to 6 ft wide x 1.5 ft depth)
21	392+69	391+75	391+91	368+94	dm	24	24					0.3 (rust line 0.5)	YES - S&HI	Y	drains pool below waterfall	inlet crimped; flowing water present; slight debris obstruction	undamaged	discharges through silt deposits along Chilkat
22	396+07	395+20	395+34	372+37	dm	24	24	56				0.6 (rust line)		n	drains damp meadow area	obstructed by silt and veg; slightly crimped	freefall discharge to Chilkat; full of silt	
23	405+81	404+90	405+04	382+07	dm	36	36	56		No			YES - S&HI	Y				
24	427+27	426+30	426+52	403+57	dm	24	24	64			0.1	0.1		N	small dry forested hillslope	damaged; dry	damaged; clear of silt; discharges to steep grass bank at Chilkat	discharges direct to Chilkat bank

Haines Highway - MP 3-25 Culvert Inventory

S&HI stationing
Multiple pipes
Big fish pipe
Small fish pipe

as-built summary field

Notes: reference to 'emergent wetland' areas is used loosely by non-botanist and does not necessarily comply with strict wetland definition
Stainline height above invert refers to low point of metal culvert; does not reference accumulations of material within pipe

Criteria used for determining if waters of the U.S.: drains stream, waterfall, or hillslope seeps; drains wetland or connected to wetland with evidence of flowing water; fish present.
If notes indicate lack of channel (downstream or upstream), then did not consider a Water of the U.S.

count	As-built	Centerline stationing			QA'd	Culvert	Culv Size	Culvert	As-Built	Eng. Survey	Height to Stainline at:		fish bearing	Waters of the U.S.	Upstream	Inlet	Outlet	Downstream
09	Station	Design 9/2005	S&HI June/06	Design 10/2009		Size (in)		Length (ft)	Comment		inlet(ft)[1]	outlet(ft)[1]			conditions	Conditions	Conditions	conditions
25	431+39	430+40	430+60	407+65	dm	24	24	58			no stainline/no rust line	no stainline/no rust line		N	dry ditch at hillslope toe	slightly bent; clear; dry	crimped at top; freefall 0.5 ft to Chilkat bank	discharges direct to Chilkat bank
26	434+51	433+50	433+70	410+72	dm	24	24				0.3 (rust line)	0.3 (rust line)		N	ditchline maintained to drain 'dry' grassy area	crimped; phone line cable exposed at inlet	freefall discharge to Chilkat bank; silt extends 5 ft into pipe to meet rustline elev	discharges direct to Chilkat bank
27	443+80	442+72	442+98	419+95	dm	24	24					0.5 (rust line)	YES - S&HI	Y	steep boulder cascade stream	torn, crimped, and crushed; inlet located at 15 ft diam pool below steep boulder cascade; flowing water	perched 0.5 ft; scour pool = 8 ft long x 12 ft wide x 1.5-2 ft depth	cobble / small boulder stream
28	443+84	442+76	443+02	419+99	dm	24	24					0.6 (rust line)	YES - S&HI	Y	steep boulder cascade stream	torn, crimped, and crushed; inlet located at 15 ft diam pool below steep boulder cascade; flowing water	perched 0.5 ft; scour pool = 8 ft long x 12 ft wide x 1.5-2 ft depth	cobble / small boulder stream
29	457+01	456+00	456+23	433+00	dm	24	24				0.4 (rust line)	0.4		Y	drains damp ditchline immediately below steep cascade (4 x 1 ft seep)	1 ft diam rock at inlet (slight obstruction); inlet slightly crimped	slight silt/organics obstruction	shalllow channel approx 10 ft to top of Chilkat bank; no siltation
30	473+16	471+80	472+09	449+03	dm	24	24	58				0.1		N	drains rocky hillslope below switchback driveway; dry	torn and crushed	clear; discharges to riprapped Chilkat bank	discharges direct to Chilkat bank
31	477+44	476+10	476+41	453+34	dm	24	24	62				0.2		Y	drains small waterfall 50 ft updtich; hillslope mostly dry	moderately crushed; flowing water	3 ft freefall to Chilkat riprap bank; pipe outlet located at Chilkat bank veg line	discharges direct to Chilkat bank
32	486+74	485+35	485+73	462+55	dm	24	24	52			1.2	0.3 (rust line)		Y	drains small waterfalls	0.3 ft sediment in inlet	1 ft freefall to Chilkat bank	discharges direct to Chilkat bank
33	493+85	491+50	491+90	468+70	dm	24	24	60			no stainline (rust line = 0.7 ft)	0.8 (rust line)		N	drains damp forested area	undamaged; no water present	pipe outlet located at Chilkat bank veg line	discharges to Chilkat sandbar at wood debris elev. Drainage pipe; no defined channel upstream; discharge dumps onto gravel bar.
34	497+63	502+00	502+38	479+18	dm	24	24	60						N		obstructed by veg and organic debris; no water present	undamaged; 0.8 ft blocked by debris	
35	507+36	506+00	506+37	483+18	dm	48	48	SeeSurv.		Yes	see survey data	see survey data	YES - S&HI	Y	drains stream that drains wetland complex; juvenile salmonids observed	sheet flow at inlet apron (fish passage barrier); debris blocking passage inside pipe	drains into large outlet pool; undamaged; clear of debris	juvenile salmonids observed; imperceptive flow; no surface connection with Chilkat at d/s end
36	536+86	535+08	535+49	512+24	dm	24	24	SeeSurv.		Yes	see survey data	see survey data	Yes	Y	flowing stream; redds located just upstream of inlet; juvenile salmonids and a dolly varden adult observed	undamaged	undamaged	many pink carcasses; drains into flowing stream with good spawning gravels; long slough to Chilkat confluence
37	536+91	535+15	535+56	512+32	dm	36	36	SeeSurv.		Yes	see survey data	see survey data	Yes	Y	flowing stream; redds located just upstream of inlet; juvenile salmonids and a dolly varden adult observed	undamaged	undamaged	many pink carcasses; drains into flowing stream with good spawning gravels; long slough to Chilkat confluence
38	542+31	540+60	541+00	517+67	dm	24	24	60				0.4 & 1		Y	drains emergent wetland	inlet base rusted out; veg obstructing inlet	backwatered by Chilkat	discharges to wetland area; perched
39	548+88	547+00	547+50	524+10	dm	24	24	60						Y	drains flat emergent wetland/wet meadow area	0.5 ft obstructed by silt and organics	obstructed by veg; 0.5 ft open pipe; 1.5 ft obstructed by silt/organics	no defined channel
40	555+36	553+60	554+06	530+70	dm	24	24	60			0.5 (rust line)			Y		torn; obstructed by silt and emergent veg; trickle of flowing water present	0.9 ft silt/organics; encroaching veg	discharges to emergent wetland
41	564+41	562+70	563+14	539+77	dm	24	24				0.3			N	drains roadside ditch/ gen'l dry forested area	slightly torn; clear of debris	unraveled 0.5 ft; gravel deposition in outlet	drains to wet roadside ditch
42	571+31	569+60	570+02	546+65	dm	24	24	58				0.8 (rust line)		N	drains mostly dry forested area	obstructed by alders, grass, sediment	d/s berm approx. 0.8 ft causing rust line @ 0.8 ft	drains to flat wet meadow/emergent area
43	581+53	579+75	580+25	556+84	dm	24	24	56			no stainline	no stainline		N	drains dry hillslope and roadside ditch	water stains in base of corrugations	slight berm at outlet; no stainline	grasses laid flat
44	593+79	591+98	592+40	569+06	dm	24	24	60			rustline 0.4-ft ***WIDE*** (convert to H)	1 (backwatered by river?)		N	drains dry forested area	rust line 0.4 ft wide; 0.3 ft obstructed by organic debris	backwatered by Chilkat (?)	drains to standing water
45	596+62	594+80	595+25	571+88	dm	24	24	60			0.2	0.7 (rust line)		N	drains dry hillslope and roadside ditch	slightly crimped; invert above upstream sump	0.3 ft organic matter	drains to roadside ditch/emergent wetland
46	601+08	599+30	599+72	576+36	dm	24	24	54			0.4 (rust line)	1 (rust line)		Y	drains dry hillslope and small emergent wetland area		berm of organics 0.7 ft	drains to pond/emergent wetland
47	604+50	602+70	603+14	579+78	dm	24	24	60			1	1.5 (rust line)		Y	drains emergent wetland	undamaged; water level 0.2 ft	undamaged	drains to pond/emergent wetland; channel = 1.5 ft wide x 0.5 ft depth; water 0.5 ft deep

Haines Highway - MP 3-25 Culvert Inventory

S&HI stationing
Multiple pipes
Big fish pipe
Small fish pipe

as-built summary field

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count	As-built	Centerline stationing			QA'd	Culvert	Culv Size	Culvert	As-Built	Eng. Survey	Height to Stainline at:		fish bearing	Waters of the U.S.	Upstream	Inlet	Outlet	Downstream
09	Station	Design 9/2005	S&HI June/06	Design 10/2009		Size (in)		Length (ft)	Comment		inlet(ft)[1]	outlet(ft)[1]			conditions	Conditions	Conditions	conditions
48	613+80	612+10	612+47	589+12	mb	24	24	SeeSurv.		Yes	entire pipe stained	entire pipe stained	Yes	Y	juvenile salmonids observed	perched above inlet pool	perched	dominated by glacial silt from Chilkat
49	613+85	612+20	612+57	589+22	mb	24	24	SeeSurv.		Yes	entire pipe stained	entire pipe stained	Yes	Y	juvenile salmonids observed	undamaged; see survey for additional info	1.5 ft cascade to ws of outlet pool	dominated by glacial silt from Chilkat
50	621+37	619+30	619+53	596+17	dm	24	24	58			0.7	0.3		Y	drains emergent wetland	0.3 ft veg/silt	undamaged; 0.1 ft organics	drains to emergent wetland
51	631+88	629+81	630+04	606+68	dm	24	24	64			1.1	1		Y	drains stream = 6 ft wide x 1 ft depth with lots of small woody debris	sides bent inward (vertical orientation); flowing water present	perched 1 ft above toe of stream bank; middle of outlet located at Chilkat bank veg line	discharges direct to Chilkat bank
52	651+18	648+25	648+47	625+12	dm	24	24	60			1.2 (backwater?)			Y	drains emergent wetland	obstructed by organics	0.8 ft berm of organics; discharges to sump; surrounding ground is above pipe crown	no outlet channel
53	667+57	665+50	665+42	642+37	dm	24	24	66			0.7			Y	drains small stream (dry) from ephemeral swamp area; channel 2 ft wide x 0.75 ft deep	inlet crimped	fully rusted; 1.5 ft freefall to channel bottom; scour pool (wet) = 10 ft wide x 5 ft long (recessed)	discharges direct to Chilkat side-channel
54	672+37	670+32	670+25	647+16	mb	36	36	SeeSurv.		Yes			YES - S&HI	Y		perched		Fairly active flow - see SH&I
55	672+47	670+41	670+34	647+26	mb	36	36	SeeSurv.		Yes	see survey data	see survey data	YES - S&HI	Y	stream (see survey data)	see survey data	entire pipe stained	stream (see survey data)
	Haines Highway MP 12.5 - 25.3 As-Builts																	
56	680+80	678+45	677+70	655+35	dm	24	24	52			0.2 ft moss line			N	drains sump from low depression/swale	crimped; moss line 0.2 ft	0.2 ft organics in outlet	no d/s channel
57	690+50	688+30	686+09	665+04	dm	24	24	54						N		slightly crimped; crown is below surrounding grade; 3 ft diam sump down to pipe inlet; 0.4 ft material in inlet	buried by silt to 0.75 ft above crown (by Chilkat river); 1 ft diam exit hole.	discharges direct to Chilkat bank
58	695+20	694+00	691+46	670+70	mb	24	24	66						N	drains meadow area	90% plugged; dry	100% plugged; non-functional	discharges direct to Chilkat bank
59				681+50		18	18	unknown							Drains ditch	intact and dry; filled with 0.5' organics	Not found	would discharge directly into river
60	711+18	709+00	706+48	685+71	mb	24	24	54						N	drains road ditch	clear of debris; no stainline; no water present	80% plugged; 1.2 ft silt in outlet	discharges direct to Chilkat bank
61	718+78	718+00	715+44	694+68	mb	24	24	58						N	drains road ditch at hillslope base	clear of debris; no stainline; no water present	damaged from riprap; 100% plugged with silt; located at Chilkat bank	discharges direct to Chilkat bank
62	729+50	727+30	724+80	704+04	mb	24	24	56						N	drains road ditch at hillslope base	clear of debris; no stainline; no water present	outlet filled with 1.6 ft sand from Chilkat backflow	discharges direct to Chilkat bank
63	733+96	731+70	729+25	708+49	mb	24	24	60			0.9			N		clear of debris but debris encroaching; no water present	stainline covers entire pipe (backwater effect); filled with 1 ft sediment (sand and gravels); no water present	discharges into road ditch that connects with oultet pool of 734 culvert. Fairly dry; road maint.
64	735+80	733+60	731+46	710+70	mb	36	36	See surv.		Yes	entire inlet stained (backwater effect)	entire inlet stained (backwater effect)	YES - S&HI	Y	drains stream	clear of debris; see survey data	clear of debris; see survey data	discharges to backwater slough of Chilkat
65	735+86	733+68	731+52	710+76	mb	36	36	See surv.		Yes	entire inlet stained (backwater effect)	entire inlet stained (backwater effect)	YES - S&HI	Y	drains stream	clear of debris; see survey data	clear of debris; see survey data	discharges to backwater slough of Chilkat
66	26+30	755+08	752+69	731+92	mb	24	24	72						N	drains road ditch/swale	filled with organics 0.5 ft	could not locate; buried with Chilkat sediment	if not buried would discharge direct to Chilkat bank
67	31+07	759+97	757+62	736+83	mb	24	24	60			0.7	0.6	YES - S&HI	Y	drains ditch fed by hillslope waterfall	clear of debris; flowing water; avg chan width = 7 ft	clear of debris; freefall 0.7 ft to outlet pool ws	outlet pool depth 0.7 ft; avg chan width 4 ft; channel incised through silt prior to entering Chilkat
68	34+12	763+00	760+70	739+85	mb	24	24	72			0.7	0.7		y	drains ditch at base of hillslope	filled with 0.1 ft sediment; flowing water present	clear of debris	discharges direct to Chilkat side channel bank
69	35+88	764+72	762+46	741+64	mb	24	24	64			0.7	1.2		Y	drains road ditch fed by hillslope seeps/falls	filled with sediment 0.1 ft	filled with sediment 0.4 ft; 15% plugged	discharges direct to Chilkat bank
70	36+92	765+80	763+55	742+72	mb	24	24	62						Y	hillslope waterfall nearly at inlet; 1.5 ft riffle (cobbles) to river level	filled with sediment 0.8 ft; culvert half filled with water; inlet pool = 3 ft wide x 3 ft long x 0.3 depth	filled with sediment 0.7 ft	discharges direct to Chilkat bank

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Multiple pipes
Big fish pipe
Small fish pipe

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count	As-built	Centerline stationing			QA'd	Culvert	Culv Size	Culvert	As-Built	Eng. Survey	Height to Stainline at:		fish bearing	Waters of the U.S.	Upstream	Inlet	Outlet	Downstream
09	Station	Design 9/2005	S&HI June/06	Design 10/2009		Size (in)		Length (ft)	Comment		inlet(ft)[1]	outlet(ft)[1]			conditions	Conditions	Conditions	conditions
71	39+79	768+60	766+33	745+50	mb	24	24	58			0.8			Y	upstream channel = 5 ft wide x 0.3 ft depth	clear of debris; flowing water present	clear of debris; 1/3 fileld with Chilkat backwater; no obvious stainline	discharges direct to Chilkat bank
72	48+50	778+40	776+04	755+29	mb	24	24	62						N		clear of debris; no stainline; no water present	does not reach river; plugged with silt	30 ft of river bank between outlet and Chilkat. Appears to be a cross drainage ditch; really no defined channel.
73	61+38	790+28	788+00	767+14	mb	36	36	52			1	1.4	YES - S&HI	Y	upstream channel fed by hillslope waterfall; upstream channel 4.5 ft avg width	filled with sediment 0.3 ft; flowing water present	filled with sediment (Chilkat silt) 0.2 ft	discharges direct to Chilkat bank
74	65+16	793+88	791+60	770+74	mb	24	24	52						Y	drains wall-based slough/wetland	clear of debris; stain covers entire pipe (backwater effects); 1/2 full of water	clear of debris; 1/3 full of standing water; water depth in pipe 1 ft; stainline covers entire outlet (backwater effects)	outlet pool = 4.5 ft wide x 25 ft long x 1.2 ft depth; juvenile salmonids present
75	83+28	811+97	809+68	788+83	mb	24	24	50						N	drains roadside ditch at base of hillslope	filled with sediment 0.3 ft; 15% plugged; no water present	90% buried with Chilkat silt	6 ft of river bank between outlet and Chilkat braid
76	89+55	818+00	815+70	794+86	mb	24	24	50						Y	drains south end of wetland complex	filled with organic sediment 0.6 ft; 80% plugged	could not locate; buried or under water	discharges into large wetland complex
77	94+00	823+00	820+80	800+00	mb	24	24	52						Y	standing water; drains wetland area	filled with sediment 0.5 ft; only 1.5 ft width open	could not locate; buried	discharges into large wetland complex
78	119+15	847+77	845+54	824+68	mb	24	24	50						N	drains roadside ditch/swale at hillslope base	filled with sediment 0.6 ft; inlet top bent; 10% plugged; no water present	filled with sediment 0.4 ft; 15% plugged	no well-defined channel
79	130+05	858+55	856+36	835+52	mb	24	24	52						N		filled with sediment 0.2 ft; open width 1.8 ft; 25% plugged with organics; no water present	filled with sediment 0.7 ft; 20% plugged; no water present	
80	136+02	864+51	862+33	841+48	mb	24	24	52						N		filled with sediment 0.4 ft; 1.5 ft width open; 25% plugged; no water present	filled with sediment 0.2 ft; 10% plugged; no water present	
81	138+70	867+10	864+92	844+10	mb	24	24	64			0.1			N	drains road ditch	clear of debris/sediment; no water present	filled with sand 1 ft; 50% plugged	
82	152+23	880+00	877+89	857+45	mb	36	36	98			1.7	2.5 (backwater effects)		Y	stagnate pool at inlet 15 ft x 15 ft x 1 ft depth	filled with organic sediment 0.4 ft; backwatered; standing water present	small amount of flowing water;	60 ft from outlet to Chilkat braid. Silty muck
83	160+50	888+25	886+29	865+88	mb	6'-1"x4'-7"	6'-1"x4'-7"	See surv.		Yes	see survey data	see survey data	Yes	Y	drains roadside ditch (2-15 ft width) created by excavation for road fill; ditch filled with 2 ft organicy silt; ditch supplied by high gradient stream (egg boxes)	good condition; see survey data	clear of sediment; small drop to outlet pool water surface; see survey data	short distance to Chilkat braid (<50 ft); adult chum present; redds observed at outlet
84	168+10	895+91	894+36	873+49	mb	24	24	68						Y	u/s bfw = 12 ft; backwatered; water present but no discernable flow; connects with 887+70 ditch	filled with 0.8 ft sediment; 1 ft width open; barely functional	filled with sediment 1.4 ft	small stagnate pool near outlet 3 ft x 3 ft; dead and dying juvenile coho present
85	187+25	915+15	911+92	890+91	mb	24	24	56			0.4	0.2		Y		clear of debris/sediment; flowing water draining ditchline	0.6 ft freefall to cobble riffle; 3.5 ft long riffle to pool; pool 0.8 ft depth; fish passage barrier at this flow	20 ft to confluence with Chilkat tributary
86	193+85	921+16	916+81	887+60	mb	36	36 (2)	See surv.	Stream realignment	Yes	see survey data	see survey data	Yes	Y	stream appears near bankfull	2 36 inch culverts; water level near stainline; appears to be spring fed system	gradient steepens above inlet pool; see survey data	E channel; see survey data
87		921+21	916+81	887+60	mb	36		see surv.		Yes			YES - S&HI	Y		One of two see above		
88	199+90	927+54	921+66	900+76	dm	24	24	60			none			N	drains roadside ditch	inlet slightly crimped; no stainline	undamaged; scour hole = 3 ft long x 3.5 ft wide x 0.7 ft depth	falls away steeply; filled with organic debris (leaves)
89	207+36	933+10	927+22	906+00	dm	24	24	62			none			N	drains roadside ditch	80% crimped; no stainline	15-20% plugged with organics; no scour pool	no d/s channel; slight swale
90	223+41	949+02	943+08	921+91	dm	24	24	52			none			N	drains roadside ditch	slightly crimped; no stainline; slight gravel build-up	slightly crimped; no scour pool	no discernable channel
91	239+38	965+08	959+14	937+97	dm	24	24	68			none			N	drains roadside ditch	inlet torn and crimped; no stainline; clear of debris/sediment	could not locate; buried by leaves, wood, or gravel	no discernable channel
92		973+53	967+58	946+42		18	18				none				drains roadside ditch, no flow	filled 0.7' with sand/organics, in good condition	outlet is buried by road widening fill material	
93	263+52	989+18	983+24	962+06	mb	8'-2"x5'-9"	8'-2"x5'-9"	see surv.		Yes	see survey data	see survey data	YES - S&HI	Y	debris flow; stream flowing in from south (re-routed to prevent frequent culvert plugging)	silt and cobble base (debris flow material); see survey data	see survey data	debris flow path
94	270+68	could not locate	could not locate			8'-2"x5'-9"		60						N/A				

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95	274+68	1000+33	994+50	973+30	mb	9'-9"x6'-9"	9'-9"x6'-9"	see surv.		Yes	see survey data	see survey data	Unknown - S&HI	Y	debris flow; stream flowing in from north (re-routed to prevent frequent culvert plugging); main slide path to south	silt and cobble/boulder base (debris flow material; see survey data	see survey data	debris flow path
96	277+96	1003+55	997+82	976+60	dm	36	36	52			0.4			Y	drains north end of 21 mile fan and ditch	inlet slightly torn and crimped; slight gravel accumulation	slight obstruction by sapling; filled with sand 0.3 ft	discharges to road side drainate channel with cobble substrate
97	299+51	1025+15	1019+52	998+31	dm	24	24	48						n		80% filled with gravel from upstream headcut	d/s channel aggraded to above pipe crown; pressure flow has maintained a 1 x 2 ft opening	
98	309+20	1034+85	1029+22	1008+00	dm	36	36	54				0.5		Y	along relic debris flow channel; 50 x 75 ft excavated (trap) area at base of debris flow path	slightly crimped; nearly plugged by sediment	filled with sediment to 0.2 ft	discharges to Chilkat along 15 ft channel (filled with salmon bones)
99	321+76	1047+37	1041+78	1020+52	dm	24	24	60						N	possibly a relic debris flow path	obstructed by wood waste; area above possibly relic debris flow path	d/s channel aggraded to pipe crown; scour has kept outlet clear	no defined channel; 30 ft to Chilkat
100	339+68	1065+33	1059+68	1038+52	dm	24	24	60			0.6			Y	drains small waterfall area; active flow	Recent pipe; obstructed by veg and sediment	free discharge to Chilkat riprap bank	discharges direct to Chilkat bank
101	343+46	1069+11	1063+49	1042+32	dm	24	24	62			0.7			N	drains roadside ditch; wet but no flow	filled with debris 0.4 ft; slightly crimped; sump at inlet; excavated ditchline above crown	free discharge to Chilkat riprap bank	discharges direct to Chilkat bank
102	346+00	1071+64	1066+02	1044+85	dm	24	24	54			0.85	0.2		Y	adjacent ditch is wet seep; flowing water present	filled with gravel 0.5 ft; flowing water present	clear of debris; perched 0.1-0.2 ft; discharges to moderately steep channel to Chilkat; no Chilkat silt dep.	mod steep channel section to Chilkat
103	348+24	1073+85	1068+21	1047+05	dm	24	24	54				0.7		Y		filled with debris 1 ft; slightly crimped	filled with sediment 0.6 ft	short channel to top of Chilkat bank above siltation. Flowing water; a number of seeps.
104	350+43	1075+92	1070+30	1049+14	dm	24	24	62			0.6	0.2		Y		some gravel accumulation; flowing water present	clear of debris, has end section	mod steep channel to top of Chilkat bank; no siltation. Flowing water; a number of seeps.
105	352+50	1077+95	1072+31	1051+16	dm	24	24	56			1.1 stainline (0.3 rust line)			Y		rust line 0.3 ft; flowing water present; slight sediment accumulation	outlet apron direct to Chilkat bank	discharges direct to Chilkat bank approx 5 ft above veg line. Flowing water; a number of seeps. GW coming out of hillside.
106	355+09	1080+50	1074+92	1053+75	dm	24	24	64			0.5 (rust line)			Y	small waterfall u/s of inlet	inlet crimped; flowing water present	discharges to Chilkat riprap bank	discharges direct to Chilkat bank
107	360+08	1085+00	1079+88	1058+72	dm	24	24	52		could not locate				y				
108	372+75	1098+16	1092+52	1071+35	dm	24	24	50			0.8	0.9	no access - S&HI	Y		filled with gravel 0.25 ft; water depth 0.3 ft above gravel	no outlet apron	steep channel. Active water flow.
109	380+94	1106+38	1100+68	1079+57	dm	24	24	56			0.2			Y	small waterfall direct to inlet	slightly crimped; filled with gravel 0.1-0.2 ft	1/2 filled with gravel and rock	discharges to waterfall to Chilkat River
110	383+11	1108+56	1102+85	1081+75	dm	24	24	54			0.3			Y	active flow from seeps	undamaged and clear of debris; flowing water present	obstructed by organics - no adequate flushing flow	discharges to steep cascade (1:1) to Chilkat
111	397+60	1123+05	1117+35	1096+25	dm	24	24	54				0.2		Y	drains waterfall/seeps aloing debris flow path	obstructed by rocks and veg to 1.6 ft; undamaged	undamaged; clear of debris	discharges to steep bank waterfall 1.8 ft to gully
112	403+58	1129+00	1123+25	1102+19		36	36	see surv.		Yes	see survey data	see survey data	YES - S&HI	Y	small stream; very little flow	good condition; see survey data	good condition; see survey data	small channel; area has been heavily altered
113	403+62					36		66						Y				paired with 1129 culvert
114	418+59	could not locate	could not locate			36		64						N/A				
115	420+79	could not locate	could not locate			36		60						N/A				
116	454+17	could not locate	could not locate			24		56						N/A				
117	466+88	1192+33	1186+58	1165+44	dm	24	24	62			none	none		N	drains roadside ditch (dry)	good condition; no stainline	moss in bottom 0.3 ft; no stainline	no defined d/s channel
118	472+18	1197+66	1191+92	1170+78	dm	24	24	64						N	drains ditch (dry)	crimped; 50% obstructed; inlet perched 0.5 ft above ditch	some organics in bottom; good condition; possibly a recent extension; no stainline	
119	476+64	could not locate	could not locate			24		60						N/A				
120	480+47	1206+60	1200+73	1179+75		About 13'	About 13'	see surv.		Yes	see survey data	see survey data	Unknown - S&HI	Y	large debris flow path; stream and debris flow path to north of inlet; excavated sediment trap at base of debris path; see survey data	concrete base; flowing water present; sheet flow over inlet apron; approx half of width with silt/cobble debris flow material; machinery able to drive through to clear culvert; see survey data	concrete base; approx half of width with silt/cobble debris flow material	debris path; see survey data

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121	488+60	1214+20	1208+26	1187+25		8'-2"x5'-9"	8'-2"x5'-9"	see surv.		Yes	see survey data	see survey data	Unknown - S&HI	Y	large sediment trap excavated u/s of inlet; large headcut at base of debris flow path; see survey data	partially obstructed with fill material from maintenance; no water present	perched; no water present; see survey data	debris path; see survey data
122	511+95	could not locate	could not locate			24		56						N/A				
123	536+93	not surveyed	not surveyed			24	24	54						N				flooplain relief only
124	537+89	1263+00	1259+44	1238+45	dm	24	24	58			none			N		no slope; north end slightly crimped; no stainline; pipe likely to equalize floodplain flood waters on either side of road embankment		

23.2 Hydrology - Table of flow estimates for tributary basins.

Flow estimates include those obtained by: 1) USGS regional regression equations, 2) SCS Unit Hydrograph Method, and 3) the Rational Method. The estimates from the USGS regional regression estimates are the recommended flow estimates for flood conveyance and fish passage design assessments.

	Culvert Station										
Return Period	**222+51 (0.47mi²)**	**319+13 (0.6 mi²)**	**324+79 (1.23mi²)**	**483+18 (1.07 mi²)**	**512+24 (1.46 mi²)**	**589+12 (0.65 mi²)**	**647+20 (1.75 mi²)**	**710+75 92.26 mi²)**	**865+88 (0.8 mi²)**	**887+60 (1.55 mi²)**	**1102+19 (1.26 mi²)**
2-Year											
Regional Regression	42	50	92	76	73	52	96	125	55	95	73
SCS Unit Hydrograph Method	119	141	304	333	397	196	471	637	294	558	496
Rational Method	37	48	98	86	117	52	140	181	64	124	101
5-Year											
Regional Regression	64	75	137	113	107	78	142	186	82	141	109
SCS Unit Hydrograph Method	250	295	628	603	714	358	851	1,137	451	857	693
Rational Method	47	60	124	108	147	66	177	228	81	156	127
10-Year											
Regional Regression	79	93	169	139	130	96	174	228	101	175	135
SCS Unit Hydrograph Method	274	323	689	670	793	398	946	1,263	531	1,009	817
Rational Method	56	71	147	129	175	78	210	272	96	186	152
25-Year											
Regional Regression	99	117	212	175	166	121	220	288	127	219	170
SCS Unit Hydrograph Method	357	422	898	905	1,070	537	1,276	1,704	677	1,286	1,041
Rational Method	64	82	169	147	201	90	241	312	110	213	174
50-Year											
Regional Regression	114	135	246	203	193	140	255	334	148	255	198
SCS Unit Hydrograph Method	429	507	1,079	1,003	1,187	596	1,416	1,890	760	1,445	1,169
Rational Method	69	88	180	158	215	96	258	333	118	228	186
100-Year											
Regional Regression	130	154	280	232	220	160	291	381	169	291	227
SCS Unit Hydrograph Method	471	556	1,183	1,120	1,325	665	1,580	2,109	833	1,583	1,281
Rational Method	74	95	196	171	234	104	280	362	128	247	202

23.3 Drawings

State of Alaska
Department of Transportation and Public Facilities

Haines Highway - MP 3.5 to MP 25.3
Hydrology and Hydraulic Summary
Chilkat River and Select Tributaries

STATE OF ALASKA VICINITY MAP

SHEET INDEX

1	Hydrology and Hydraulics Vicinity Map and Sheet Index
2	Chilkat River – Biotechnical Bank Protection Concepts
3	Culvert Analysis STA 222+51 Plan View, Section and Profile
4	Culvert Analysis STA 319+13 Plan View, Section and Profile
5	Culvert Analysis STA 324+79 Plan View, Section and Profile
6	Culvert Analysis STA 483+18 Plan View, Section and Profile
7	Culvert Analysis STA 512+24 Plan View, Section and Profile
8	Culvert Analysis STA 589+12 Plan View, Section and Profile
9	Culvert Analysis STA 647+20 Plan View, Section and Profile
10	Culvert Analysis STA 710+75 Plan View, Section and Profile
11	Culvert Analysis STA 865+88 Plan View, Section and Profile
12	Culvert Analysis STA 887+60 Plan View, Section and Profile
13	Culvert Analysis STA 1102+19 Plan View, Section and Profile

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DRAWN	DESIGNED	CHECKED
DM	10/28/09	
APPROVED	DATE	PROJECT

State of Alaska Department of Transportation and Public Facilities – Haines, Alaska
Haines Highway – MP 3.5 to 25.3

Prepared By:
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www.interfluve.com

Hydrology and Hydraulics
Vicinity Map and Sheet Index

SHEET
1 OF 13

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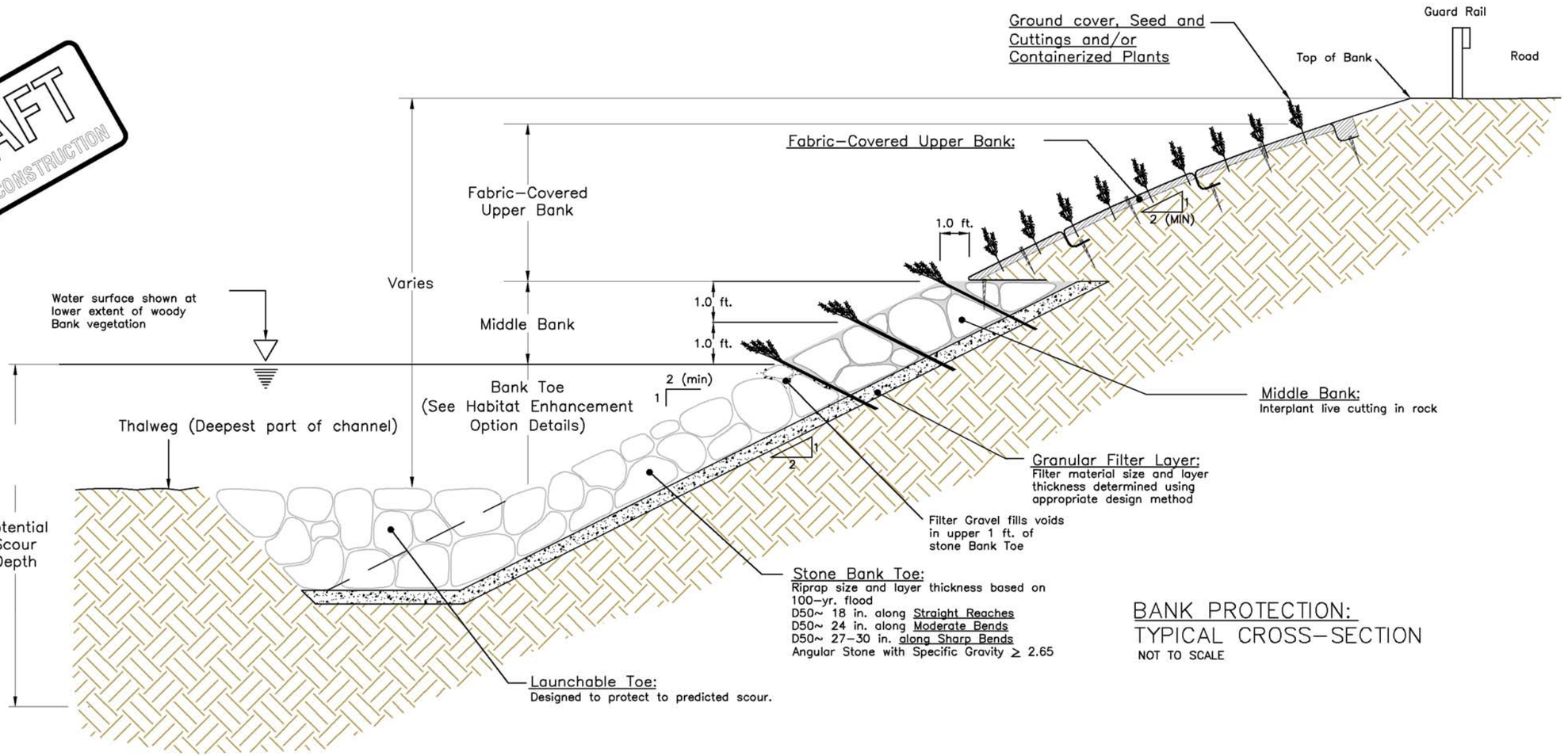

BANK PROTECTION: TYPICAL CROSS–SECTION

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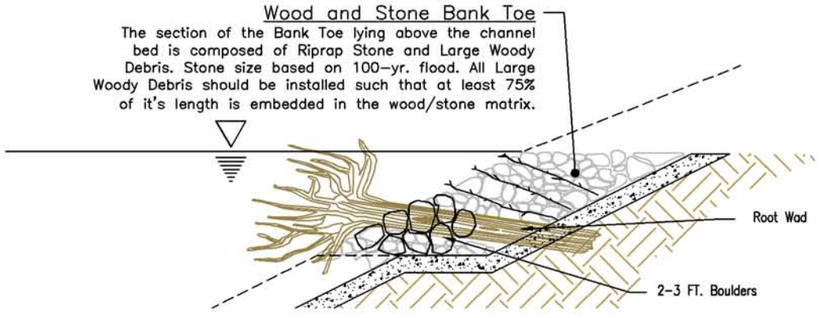
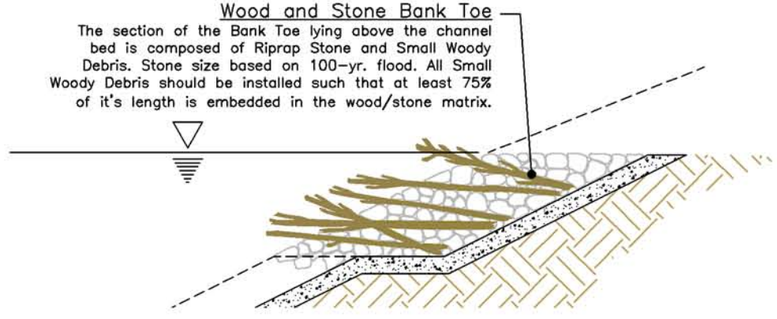


1. LARGE WOODY DEBRIS



2. SMALL WOODY DEBRIS

BANK TOE HABITAT ENHANCEMENT OPTIONS

These options recommended only along straight reaches, not at outside of bends.

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Haines Highway – MP 3.5 to 25.3

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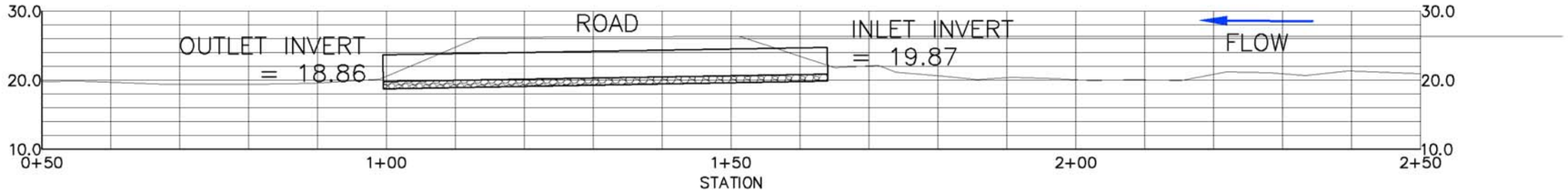
Chilkat River – Biotechnical Bank Protection Concepts

SHEET 2 OF 13



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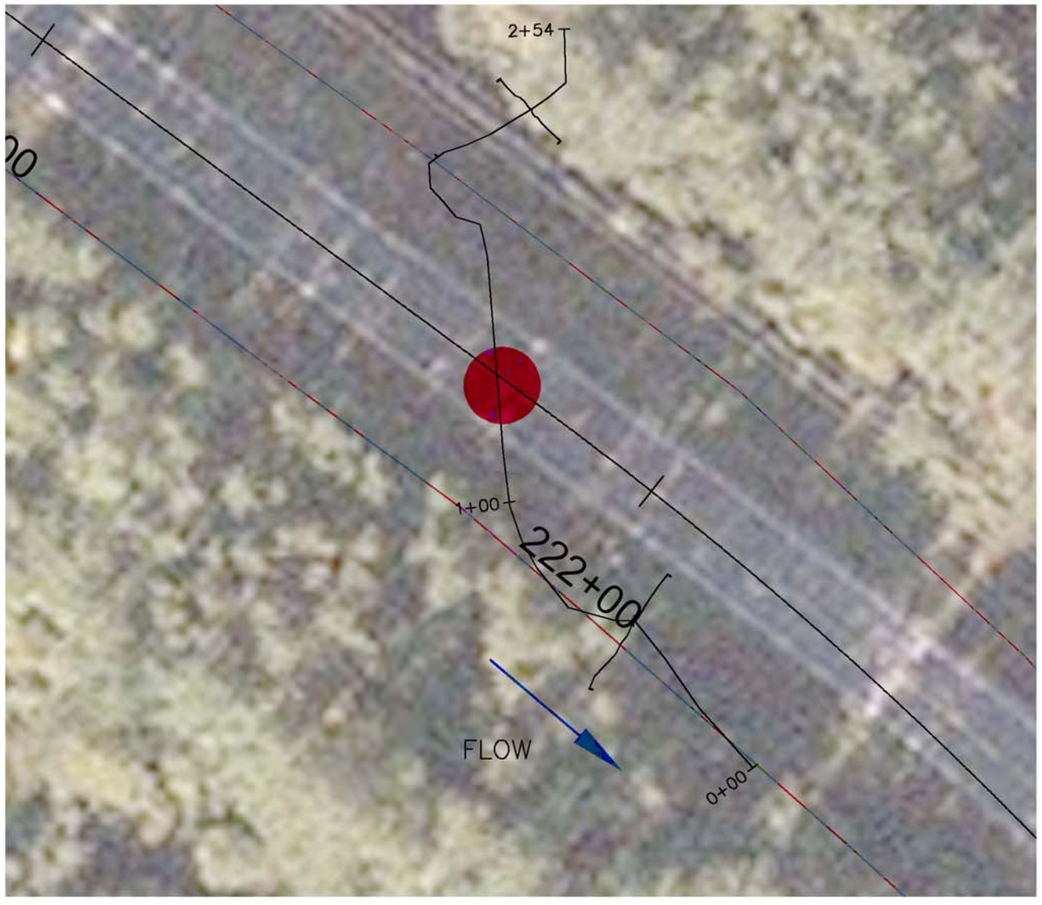

PLAN VIEW

0 40 80

SCALE IN FEET

REPRESENTATIVE SECTION VIEW

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Haines Highway – MP 3.5 to 25.3

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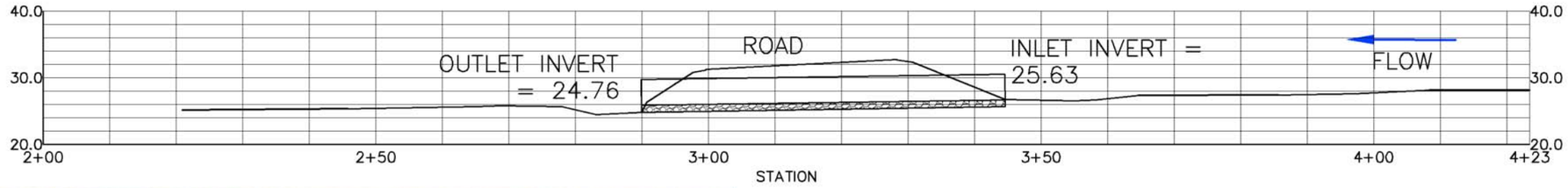
Culvert Analysis STA 222+51
Plan View, Section and Profile

SHEET
3 OF 13



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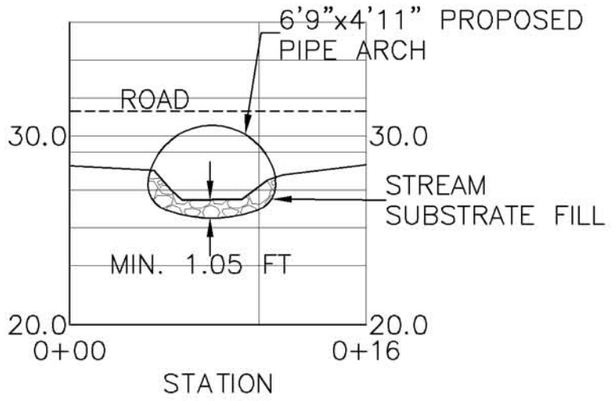
PLAN VIEW



REPRESENTATIVE SECTION VIEW

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Haines Highway – MP 3.5 to 25.3

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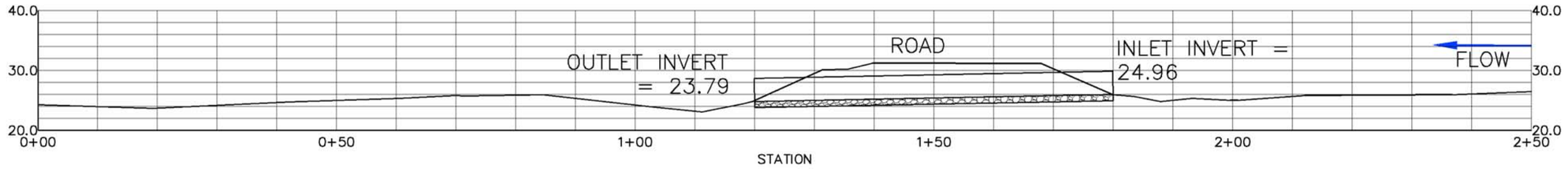
Culvert Analysis STA 319+13
Plan View, Section and Profile

SHEET
4 OF 13



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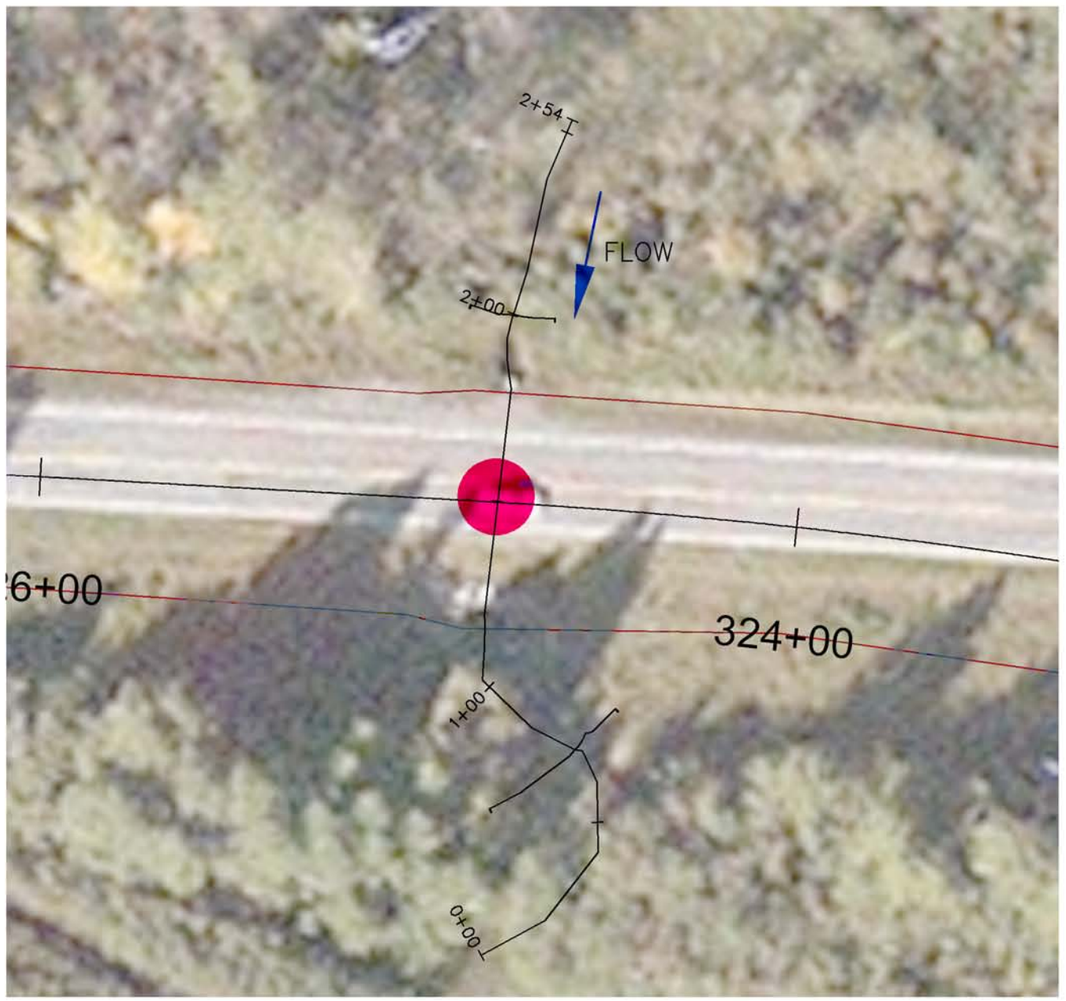

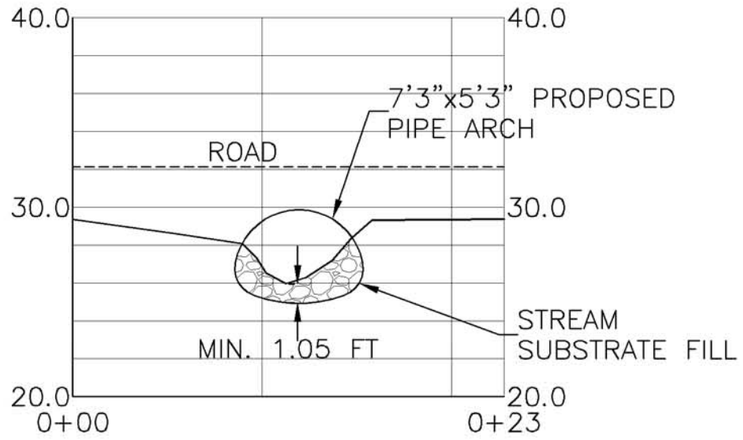

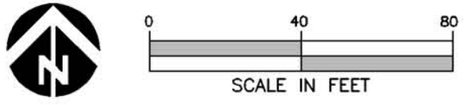

PLAN VIEW

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Haines Highway – MP 3.5 to 25.3

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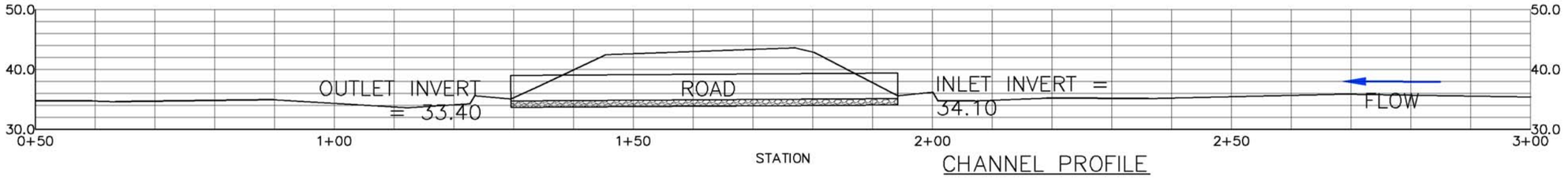
Culvert Analysis STA 324+79
Plan View, Section and Profile

SHEET
5 OF 13



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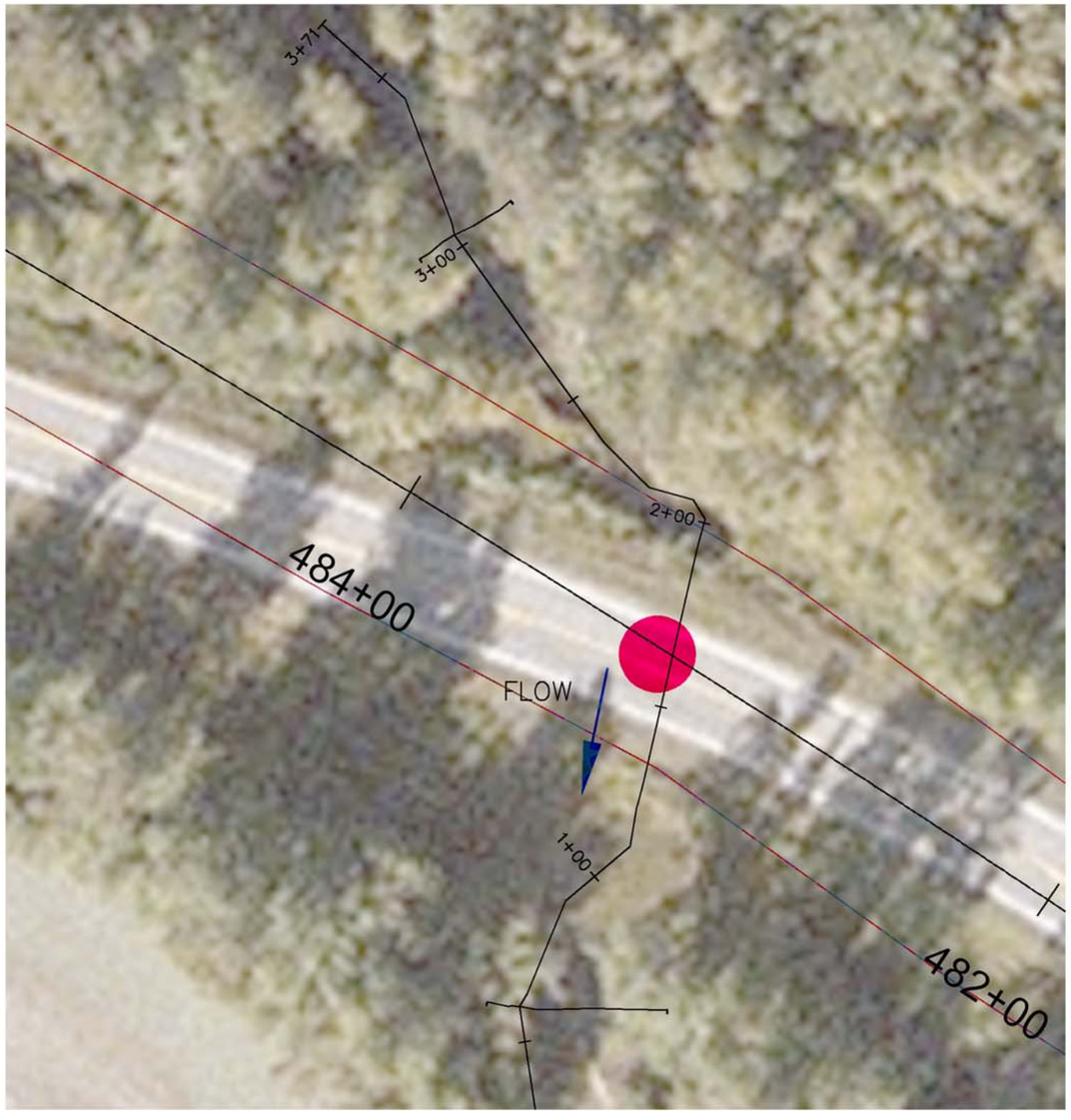

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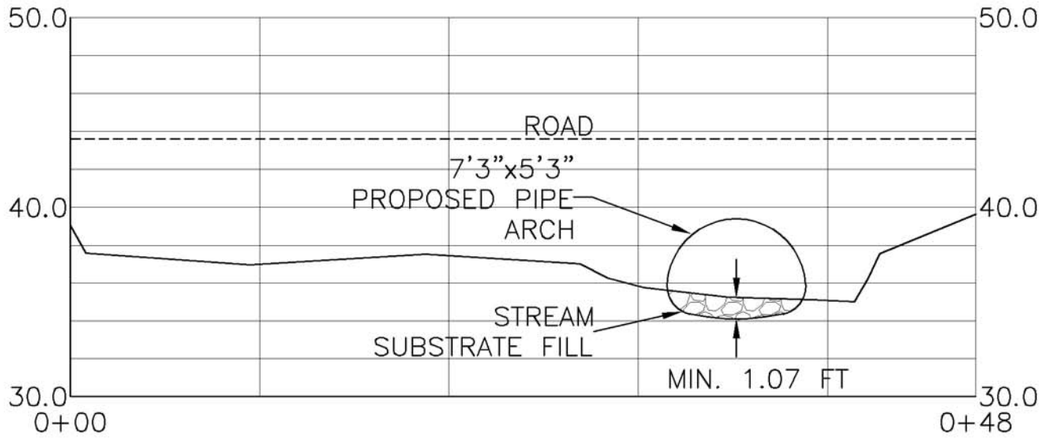

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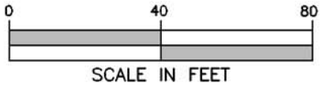

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Haines Highway – MP 3.5 to 25.3

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Culvert Analysis STA 483+18
Plan View, Section and Profile

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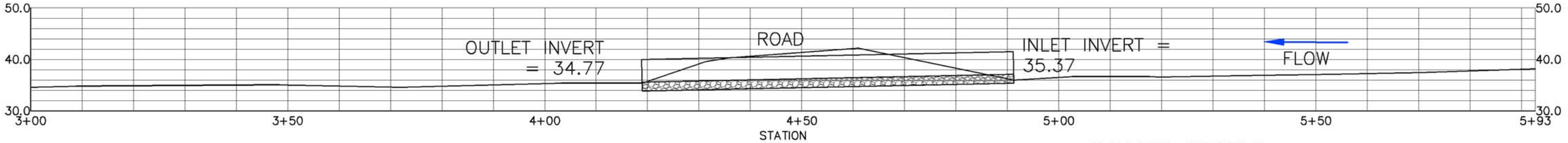
6 OF 13



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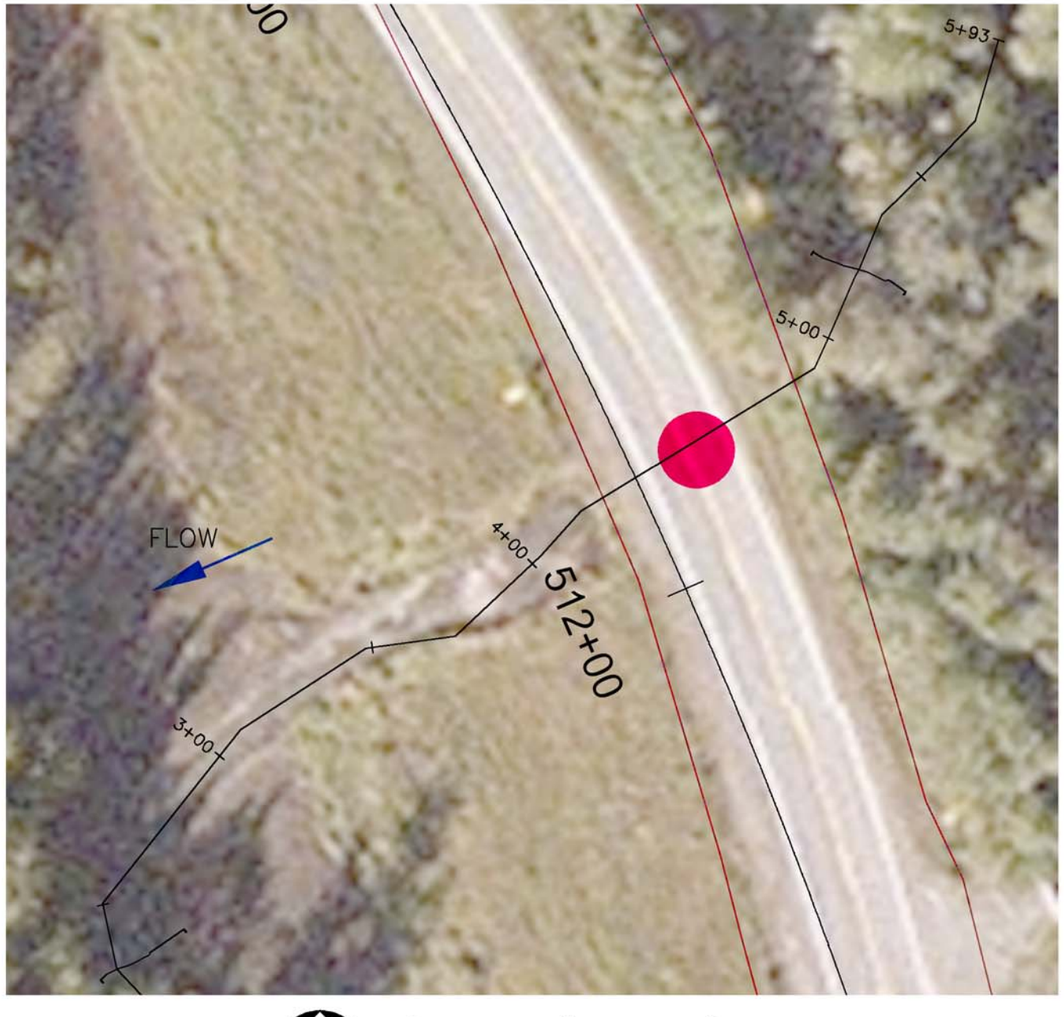
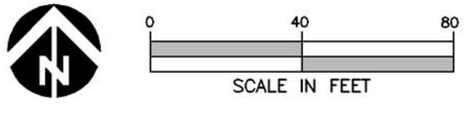
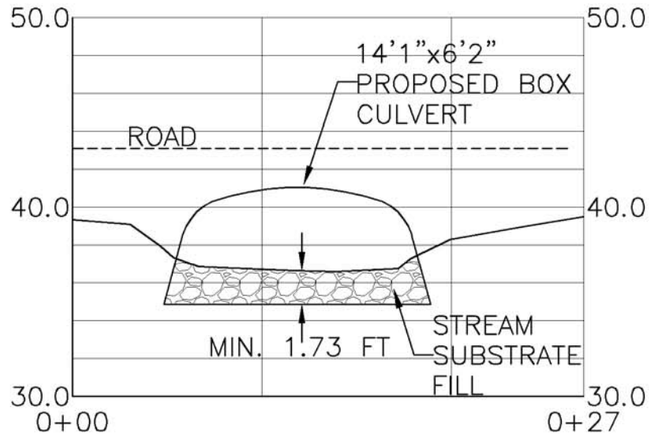




PLAN VIEW



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State of Alaska Department of Transportation and Public Facilities – Haines, Alaska
Haines Highway – MP 3.5 to 25.3

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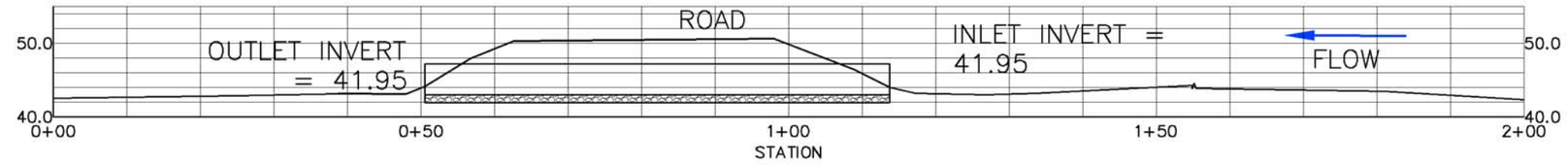
Culvert Analysis STA 512+24
Plan View, Section and Profile

SHEET
7 OF 13



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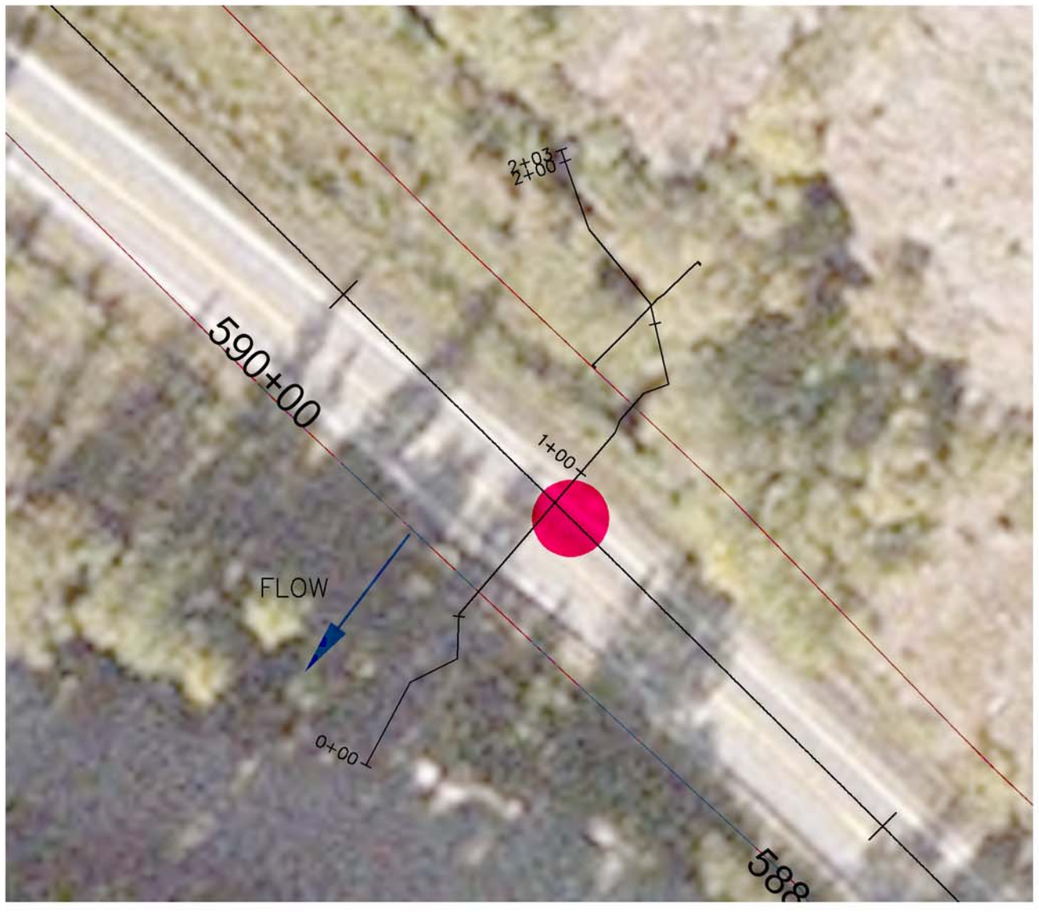

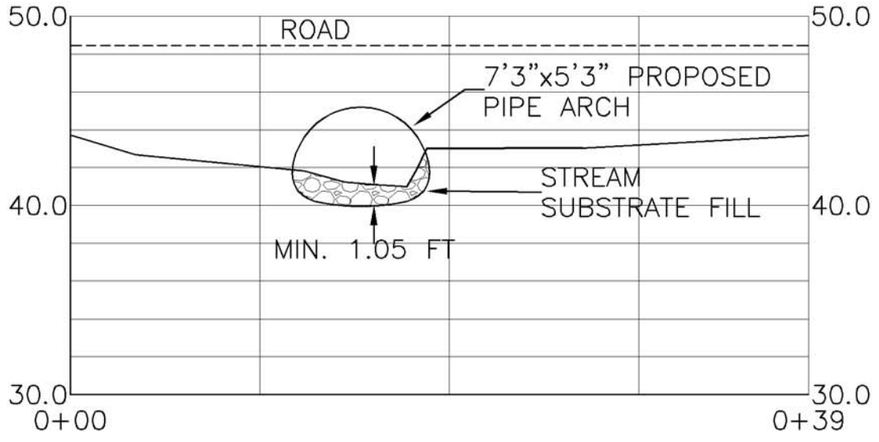

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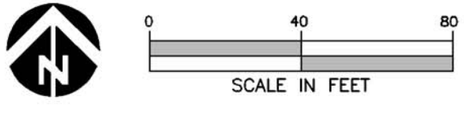

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Haines Highway – MP 3.5 to 25.3

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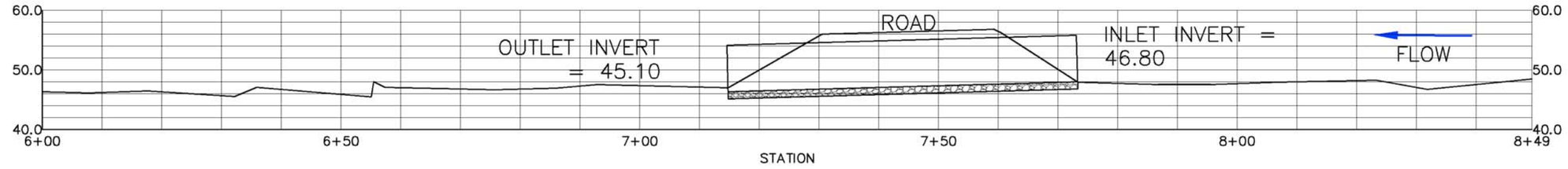
Culvert Analysis STA 589+12
Plan View, Section and Profile

SHEET 8 OF 13



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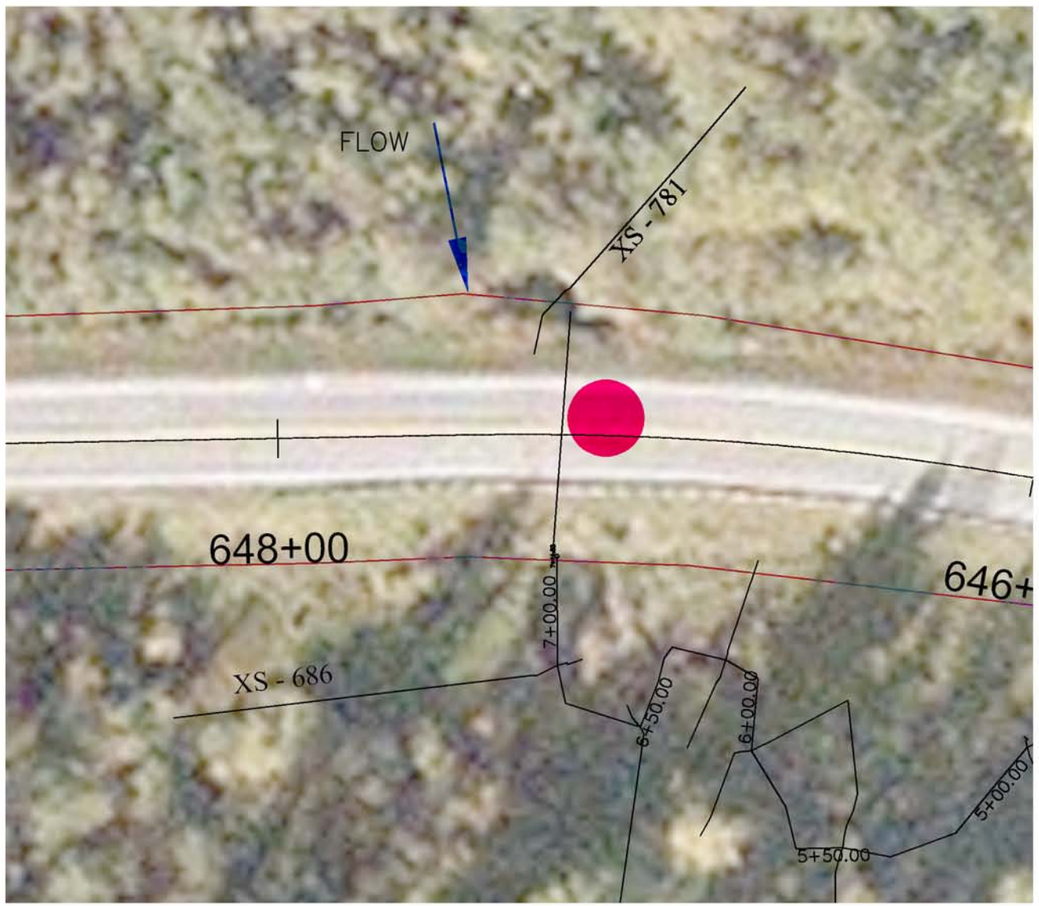
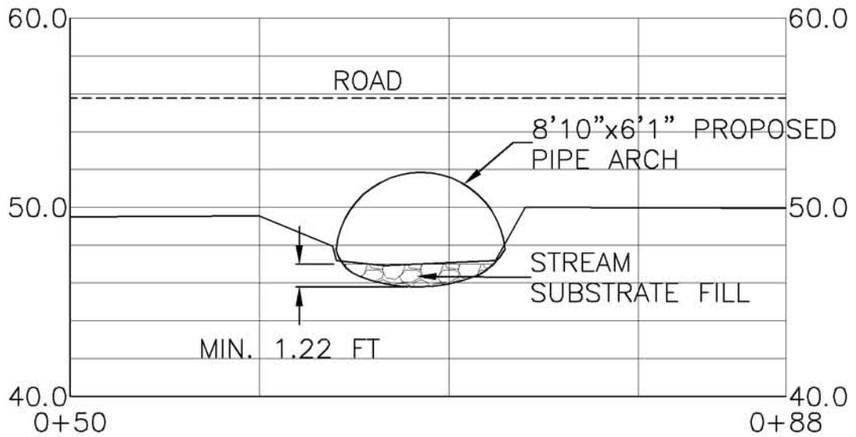
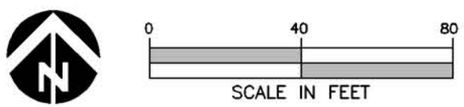




REPRESENTATIVE SECTION VIEW



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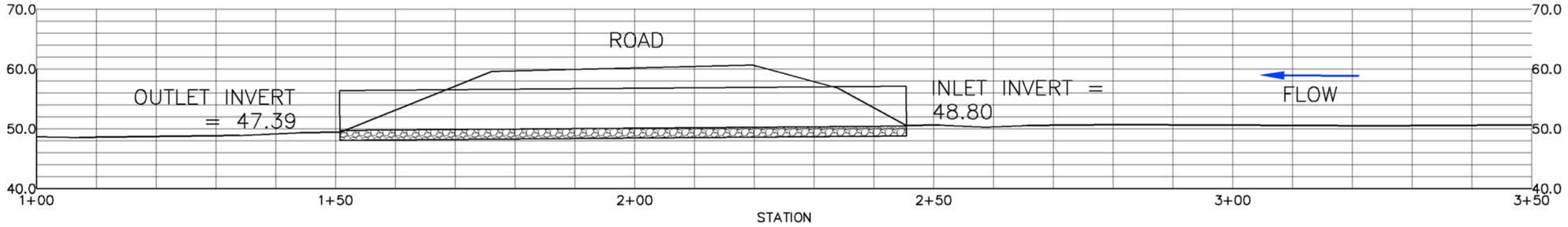
Culvert Analysis STA 647+20
Plan View, Section and Profile

SHEET
9 OF 13



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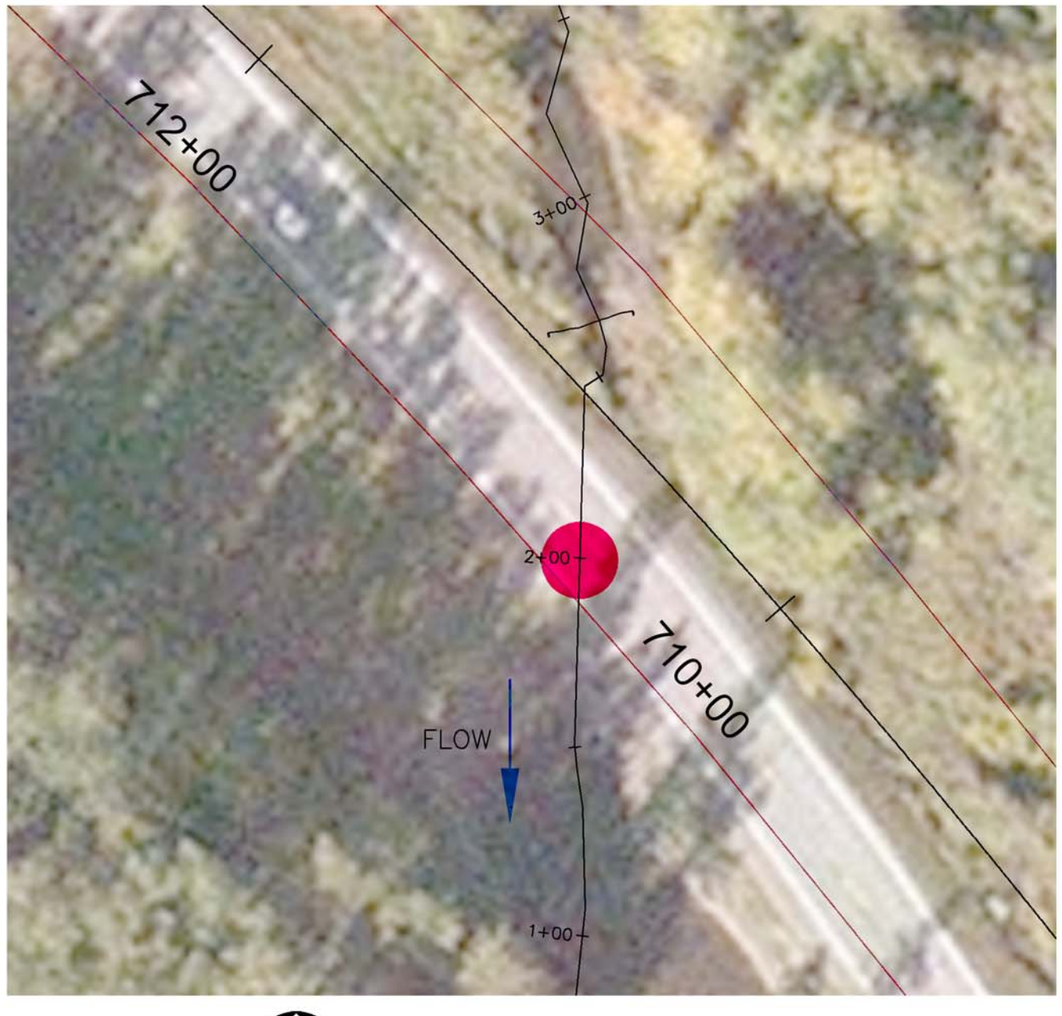
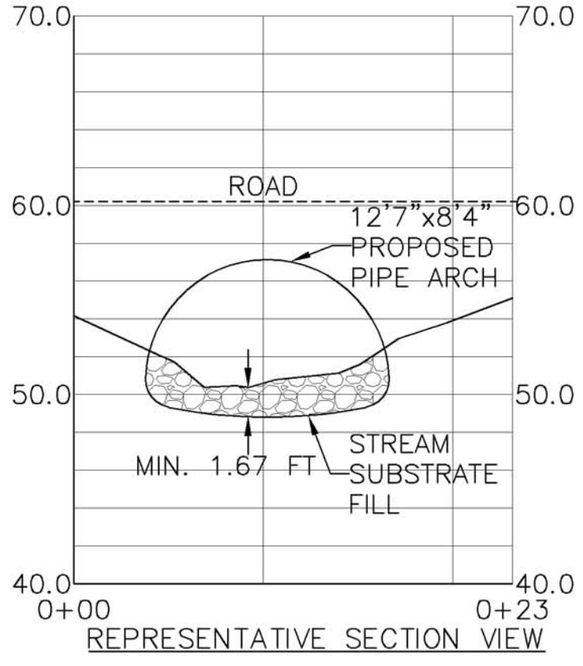


PLAN VIEW



REPRESENTATIVE SECTION VIEW

DRAFT
NOT FOR CONSTRUCTION

NOTE:
INCLUDE BY REFERENCE – ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES (ADOT&PF).
1. STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION.
2. STANDARD DRAWINGS:
D–DRAINAGE–CULVERTS AND SEWERS.
3. ALIGNMENT PROVIDED BY DOWL HKM (APRIL 2009)
4. CONCEPTUAL DESIGN BASED ON PROFILE AND CROSS SECTION DATA RECORDED BY INTER–FLUVE. RELATIVE DATUM = 100 FT. SITE SURVEY WILL BE REQUIRED FOR FINAL DESIGN.

0 40 80
SCALE IN FEET

NO.	BY	DATE	REVISION DESCRIPTION

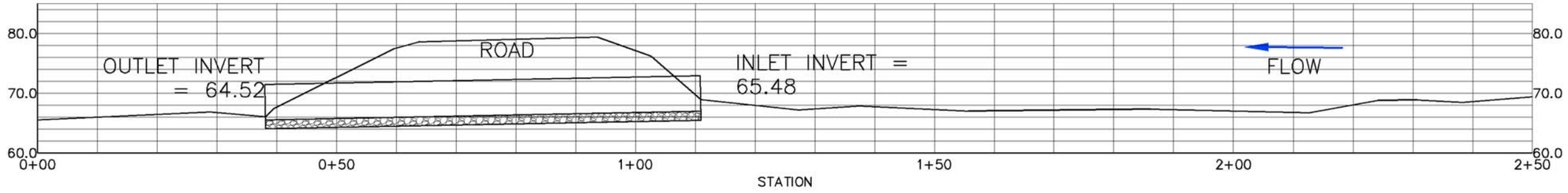
RP	DM	DM,MS
DRAWN	DESIGNED	CHECKED
DM	10/28/09	
APPROVED	DATE	PROJECT

State of Alaska Department of Transportation and Public Facilities – Haines, Alaska
Haines Highway – MP 3.5 to 25.3

Prepared By:
Inter–Fluve, Inc.
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
www.interfluve.com

Culvert Analysis STA 710+75
Plan View, Section and Profile

SHEET
10 OF 13



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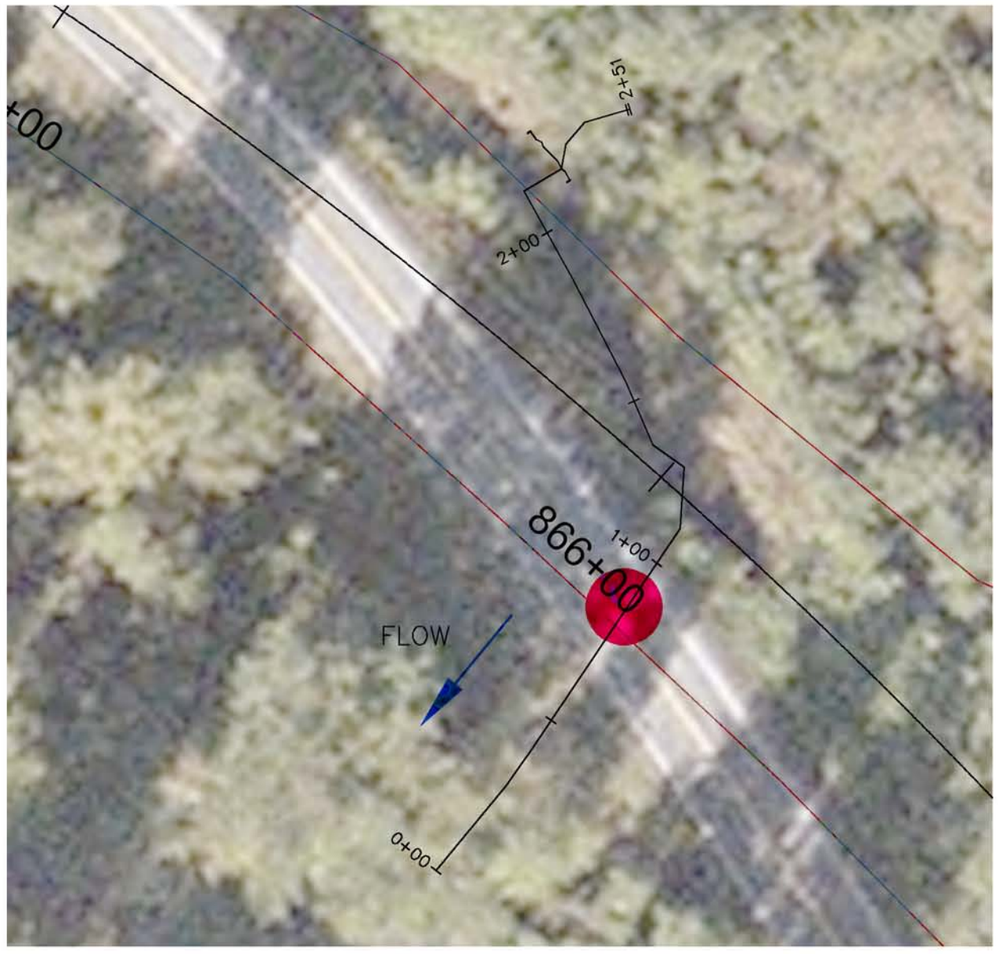

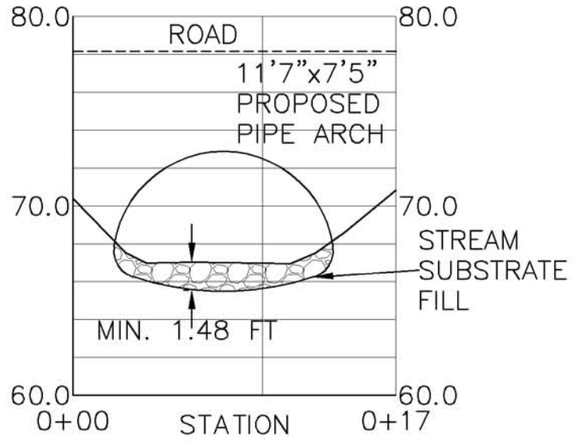

REPRESENTATIVE SECTION VIEW

PLAN VIEW

NOTE:
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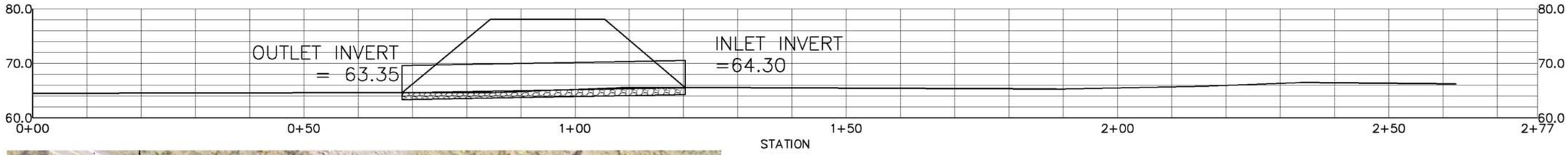
Culvert Analysis STA 865+88
Plan View, Section and Profile

SHEET
11 OF 13



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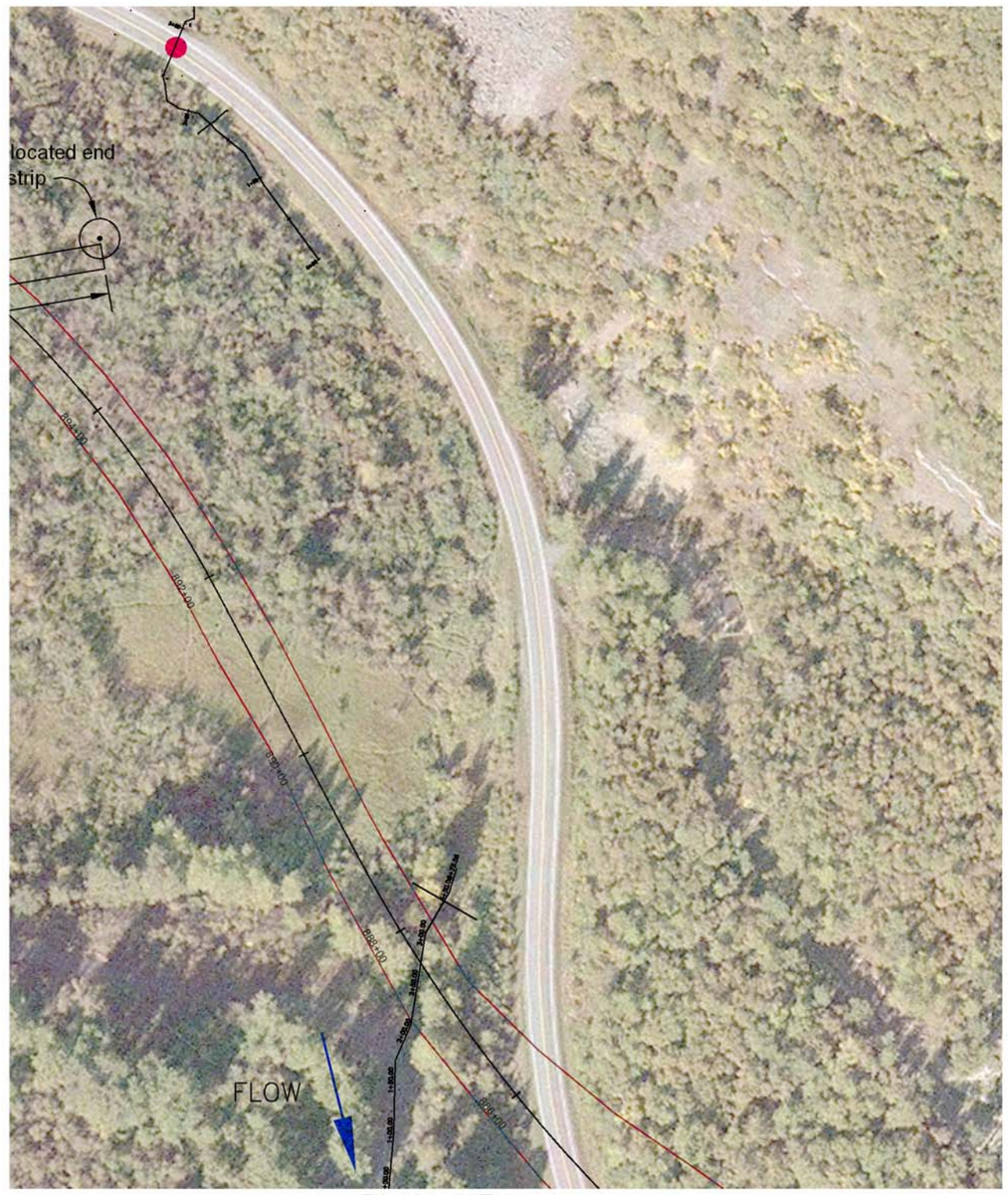
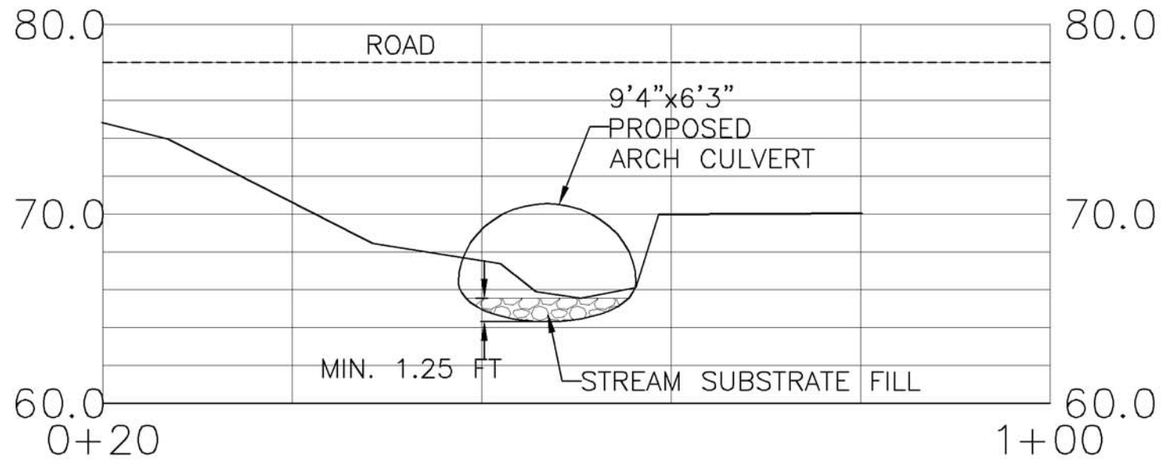


PLAN VIEW



REPRESENTATIVE SECTION VIEW

DRAFT
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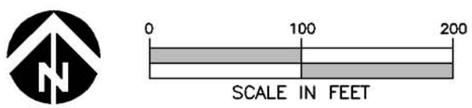
3. ALIGNMENT PROVIDED BY DOWL HKM (APRIL 2009)
4. SURVEY BASED ON ADOT&PF PROJECT DATUM.



NO.	BY	DATE	REVISION DESCRIPTION

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DRAWN	DESIGNED	CHECKED
DM	10/28/09	
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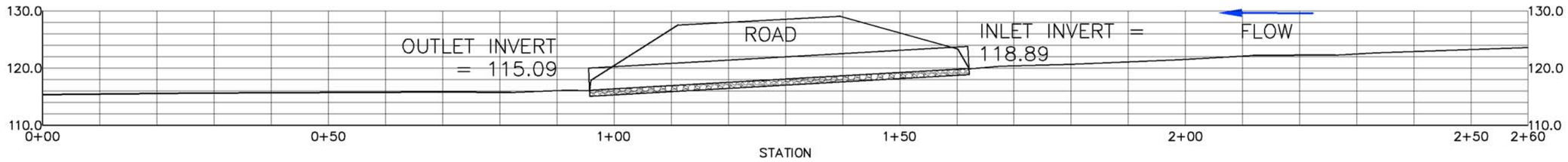
Culvert Analysis STA 887+60
Plan View, Section and Profile

SHEET
12 OF 13



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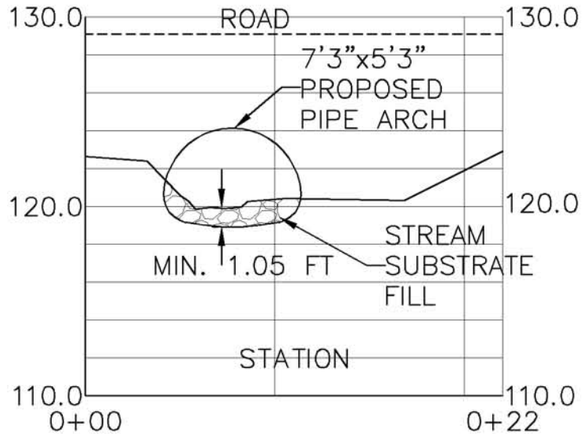
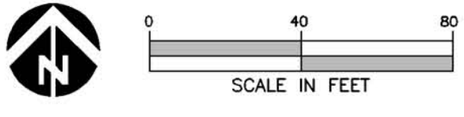


REPRESENTATIVE SECTION VIEW



PLAN VIEW

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DRAWN	DESIGNED	CHECKED
DM	10/28/09	
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State of Alaska Department of Transportation and Public Facilities – Haines, Alaska
Haines Highway – MP 3.5 to 25.3

Prepared By:
Inter–Fluve, Inc.
1020 Wasco Street, Suite I
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541.386.9003
www.interfluve.com

Culvert Analysis STA 1102+19
Plan View, Section and Profile

SHEET
13 OF 13

23.4 Culvert Summary

Haines Hwy H&H report - Culvert summary

October 30, 2009

Ref: Handbook of Steel Drainage & Highway Construction Products, 1983, AIS

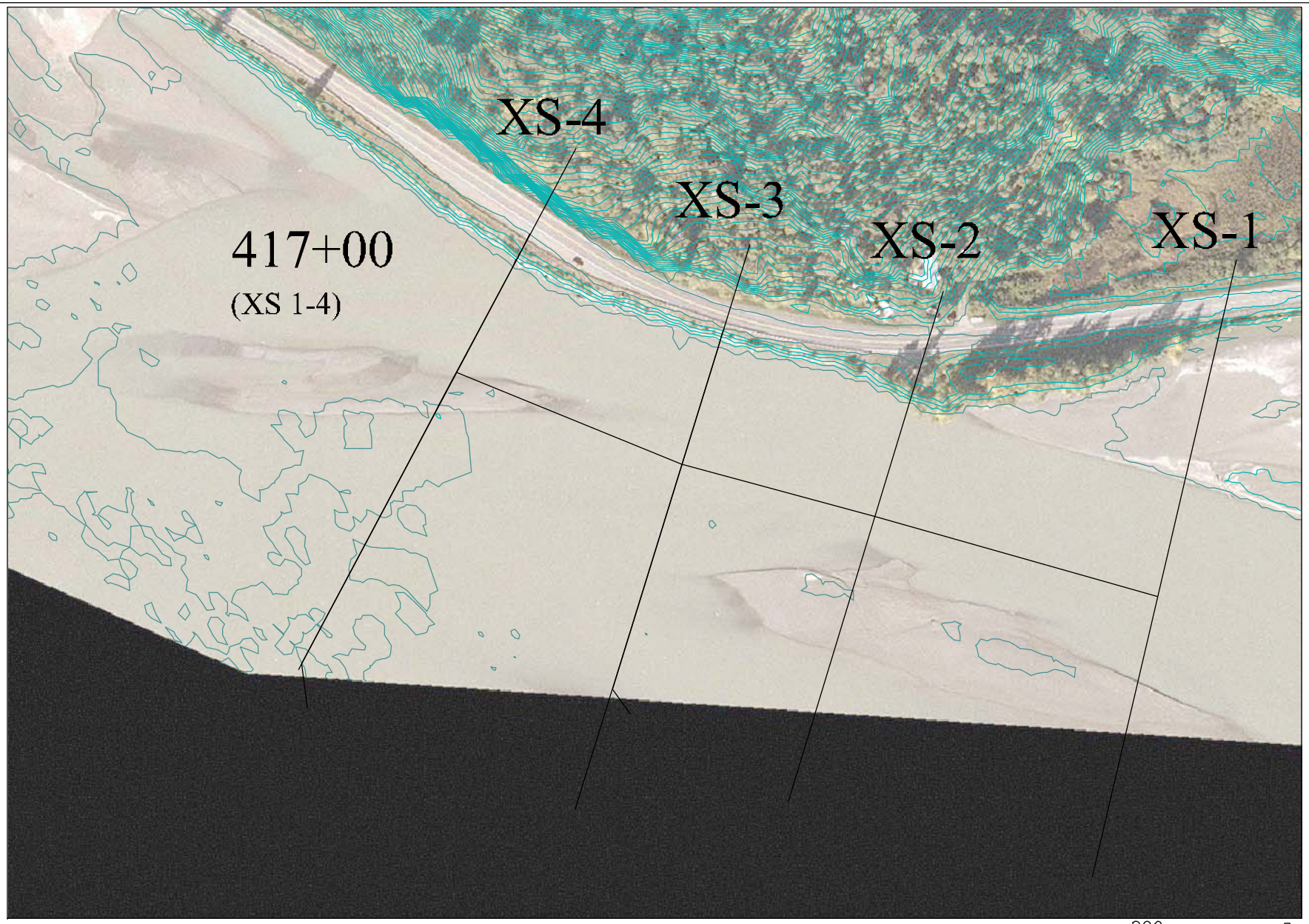
0.20*rise (pipe arch)

Station S&HI - 2006	Station 2009	Prop. Road CL elev	~ Cover (ft) based on prop rd elev	cover (H 20 Live load) min (in)	cover (H 20 Live load) max (ft)	cover (H 20 Live load) Table	Length (ft)	Pipe Invert - (Preliminary design) inlet	Pipe Invert - (Preliminary design) outlet	Pipe Invert - (Preliminary design) datum	min bury depth	bury depth	50-yr HW/d	Proposed design method	Design fish	justification	Wch	Dch	- method	Comment	span	rise	size	type
245+50	222+51	29.14	4.35	12	17	HC-8	85	19.87	18.86	~dot&pf datum	0.98	1.05	1.02	tier 1		habitat	6.0		total station		6.75	4.92	6'-9"x4'-11"	pipe arch
342+00	319+13	31.39*	**	12	17	HC-8	65	25.63	24.76	~dot&pf datum	0.98	1.05	1.16	tier 1		habitat	4.6		total station		6.75	4.92	6'-9"x4'-11"	pipe arch
347+50	324+79	32.11	1.90	12	17	HC-8	63	24.96	23.79	~dot&pf datum	0.98	1.05	1.08	tier 1		habitat	6.3		total station		7.25	5.25	7'-3"x5'-3"	pipe arch
506+25	483+18	42.28	2.93	12	17	HC-8	67	34.10	33.40	~dot&pf datum	1.07	1.05	1.29	tier 1		habitat	7.2		total station		7.25	5.25	7'-3"x5'-3"	pipe arch
535+25	512+24	43.14	1.61	16.9	5	T1-31	64	35.37	34.77	~dot&pf datum	1.23	1.73	<1.0	tier 1		habitat	13.8		total station		14.083	6.167	14'-1"x6'-2"	alum box
														--			--		--				--	--
612+50	589+12	50.12	2.92	12	17	HC-8	64	41.95	41.95	dot&pf	1.07	1.05	1.05	tier 1		habitat	5.3		total station		7.25	5.25	7'-3"x5'-3"	pipe arch
														--			--		--				--	--
670+00	647+20	56.45	3.56	18	13	HC-11	59	46.8	45.1	dot&pf	1.22	1.22	1.15	tier 1		habitat, sediment & de	8.5-9.3		total station		8.83	6.083	8'-10"x6'-1"	pipe arch
														--			--		--				--	--
731+00	710+75	61.34*	**	24	6	HC-11	98	48.8	47.39	dot&pf	1.67	1.67	<1.0	tier 1		habitat	14.0		total station		12.58	8.33	12'-7"x8'-4"	pipe arch
														--			--		--				--	--
886+00	865+88	76.49	4.58	24	16	HC-8	72	64.48	63.52	dot&pf	2.48	2.48	<1.0	tier 1		habitat	12.6		total station		11.58	7.42	11'-7"x7'-5"	pipe arch
908+50	887+60	77.97	7.42	18	12	HC-11	65	64.3	63.35	dot&pf	1.25	1.25	1.17	tier 1	juv coho	habitat	8.3		total station		9.33	6.25	9'-4"x6'-3"	pipe arch
														--			--		--				--	--
983+25	962+06						debris flow							debris flow					total station				debris flow	
994+50	973+30						debris flow							debris flow					total station				debris flow	
1123+25	1102+19	128.74	4.60	12	17	HC-8	90	118.89	115.09	dot&pf	1.05	1.05	1.46	tier 1		habitat	6.0		total station		7.25	5.25	7'-3"x5'-3"	pipe arch
1200+60	1179+75						debris flow							debris flow					total station				debris flow	
1208+20	1187+25						debris flow							debris flow					total station				debris flow	
Smaller fish pipes												**comment 1**	**comment 2**											
252+00	228+95	28.82	4.53	12	99	HC-1	63	22.29	21.43	dot&pf	0		no baffles	tier 2 (no bfl)	juv coho	Lo S, FISHPASS	*3.0*	*1.0*	*hand- d/s*		2	2	2	cmp
263+50	240+38	28.24	3.58	12	99	HC-1	66	22.66	21.49	dot&pf	0		no baffles	tier 2 (no bfl)	juv coho	Lo S, FISHPASS	*2.0*	*1.0*	*hand- d/s*		2	2	2	cmp
268+90	245+19	28.22	2.58	12	62	HC-1	61	21.64	20.11	dot&pf	1.6			tier 1			2.0	0.7	hand- d/s	4ft: Q(t1)>Q(ex)	4	4	4	cmp
271+40	248+45	27.42	3.15	12	66	HC-1	64	21.27	21.00	dot&pf	1.2			tier 1			3.0	1.0	hand- d/s	3ft: Q(t1)>Q(ex)	3	3	3	cmp
316+00	292+90	29.50*	**	12	62	HC-1	60	27.23	25.55	dot&pf	0	u/s pool excvt'd after 11/05	0.15D baffles	tier 2 - baffled pipe	Adult (& juv) coho	BW~12-ft	flooded		DOT	4ft: Q(t1)>Q(ex)	4	4	4	cmp
														--			--		--				--	--
337+70	314+72	30.83*	**	12	66	HC-1	56	28.20	27.33	dot&pf	0	u/s pool excvt'd after 11/05	no baffles - Juv r	tier 2 (no bfl)	Adult (& juv) coho	BW~10-ft	4.3	0.8	hand- d/s	3ft: Q(t1)>Q(ex)	3	3	3	cmp
389+30	366+36	30.78*	**	12	10	HC-7	56	30.98	29.23	dot&pf	0.5	excellent u/s rearing habitat		tier 1		good u/s habitat	4.0		hand		3.5	2.42	3'-6"x2'-5"	pipe arch
405+00	382+07	30.76*	**				81	30.50	30.47	dot&pf		exist pipe meets fish pass with TW > 0.75-ft	Outlet perched to active Chilkat	tier 2		Perched to Chilkat	3.5		DOT survey	Large, high quality wetland	3	3	3	cmp
443+00	419+95	41.62*	**	12	57	HC-1	65	40.38	38.75	dot&pf	0		0.15D baffles	tier 2 - baffled pipe	juv coho	BW~10-ft	9.0		hand- d/s		3.5	3.5	3.5	cmp
														--		--	--		--				--	--
554+00	530+70	43.55	1.79	12	66	HC-1	63	38.76	37.71	dot&pf	1.2			tier 1			2.0	0.2	hand	3ft: Q(t1)>Q(ex)	3	3	3	cmp
630+00	606+68	51.00	3.19	12	99	HC-1	63	45.81	45.36	dot&pf	0	exist pipe meets fish pass with TW > 0.6-ft		tier 2	juv coho or cutthroat	Perched to Chilkat	< 8'-10'		hand		2	2	2	cmp
757+50	736+83	70.73	9.03	12	17-34	HC-8	77	56.45	53.43	dot&pf	1.07	incorp into mitigation ch	**option 1**	tier 1		BW~6.8-ft			hand		7.25	5.25	7'-4"X5'-4"	pipe arch
757+50		70.73	11.28	12	66	HC-1	77	57.52	54.50	dot&pf	0	incorp into mitigation ch	**option 2**	tier 2 - baffled pipe	Adult & juv coho	3ft: Q(t1)>Q(ex)				3ft: Q(t1)>Q(ex)	3	3	3	cmp
787+50	767+14	60.95*	**	12	57	HC-1	71	56.72	55.16	dot&pf	0	exist pipe meets fish pass with TW > **0.75**-ft	0.15D baffles	tier 2 - baffled pipe		Perched to Chilkat & poor u/s habitats	3.0		hand		3.5	3.5	3.5	cmp

Note: * Road CL and culvert elevations are pending adjustments to meet cover requirements

23.5 Hydraulic Output

23.5.1 Hydraulic Output – Chilkat River



−200 0 100 200

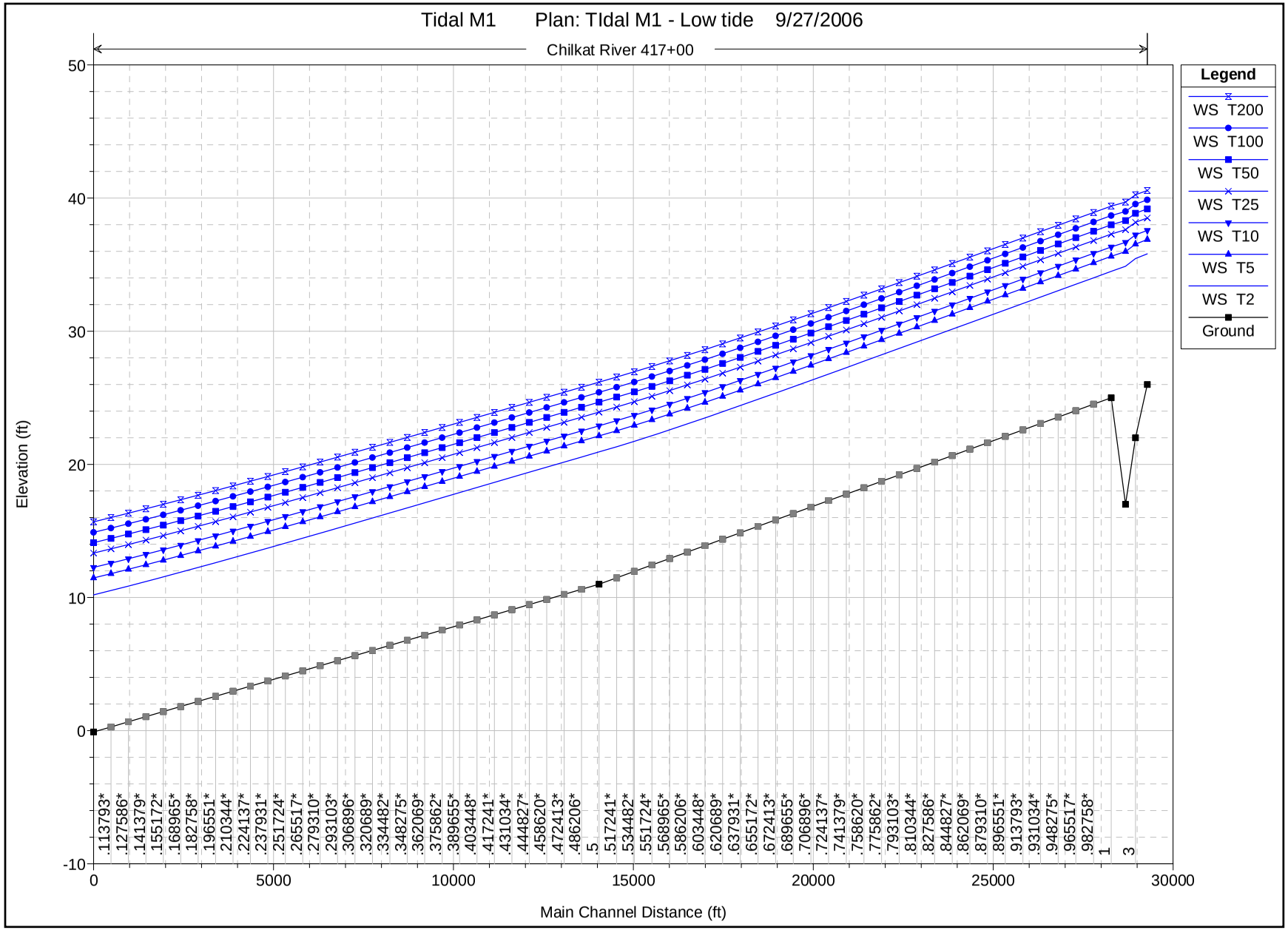
1 inch = 200 ft.

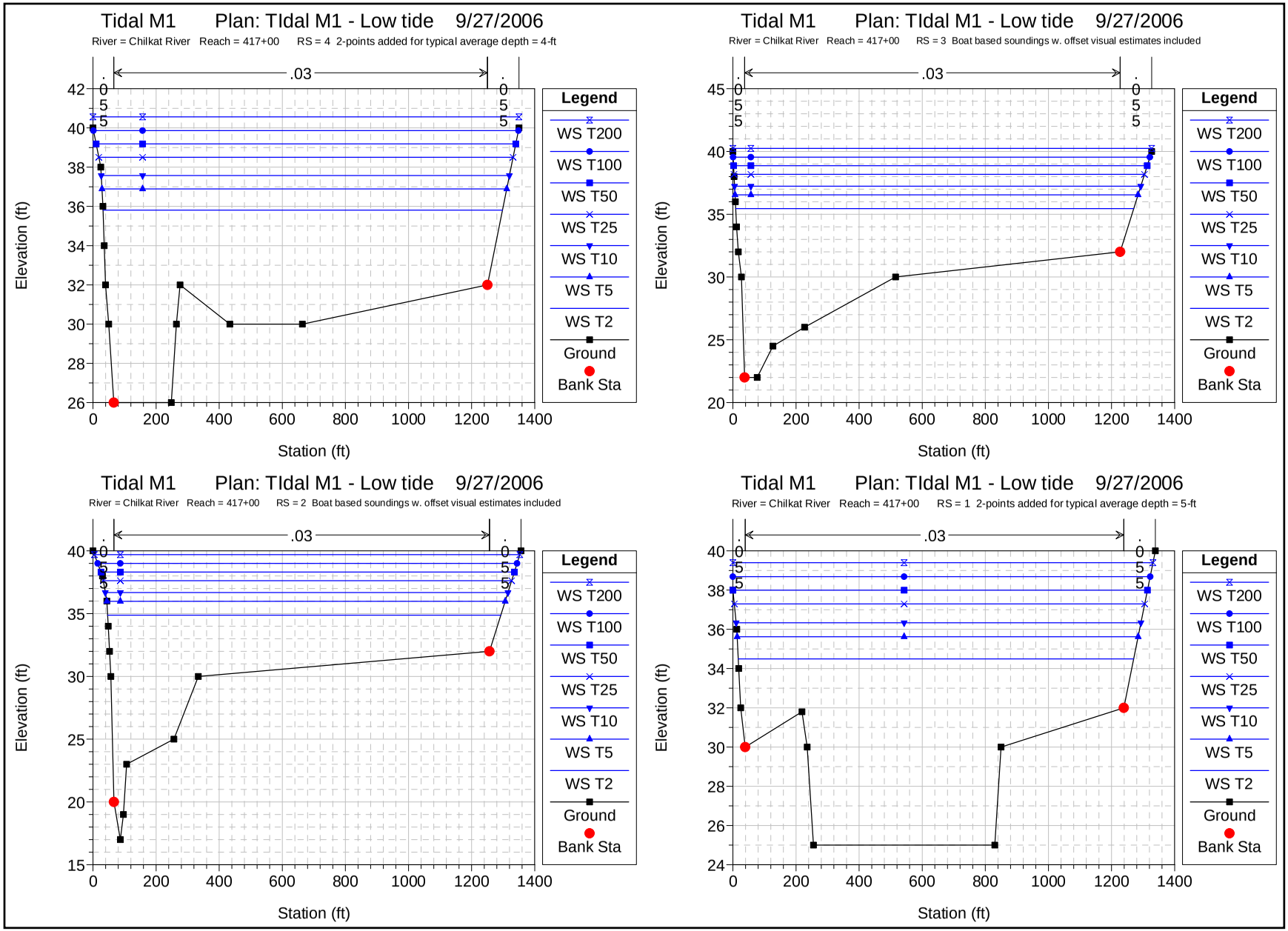
Haines Highway – HEC–RAS Schematic

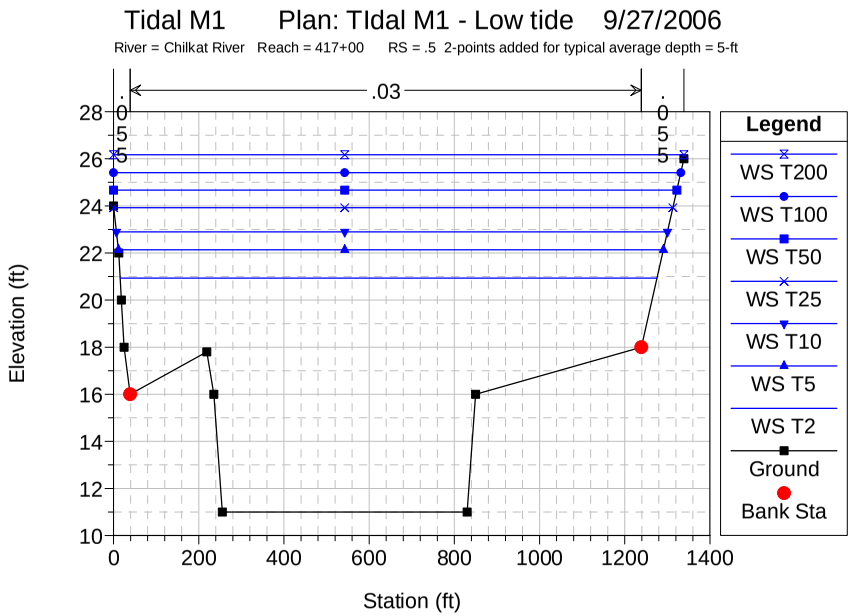
S&HI Station 417+00

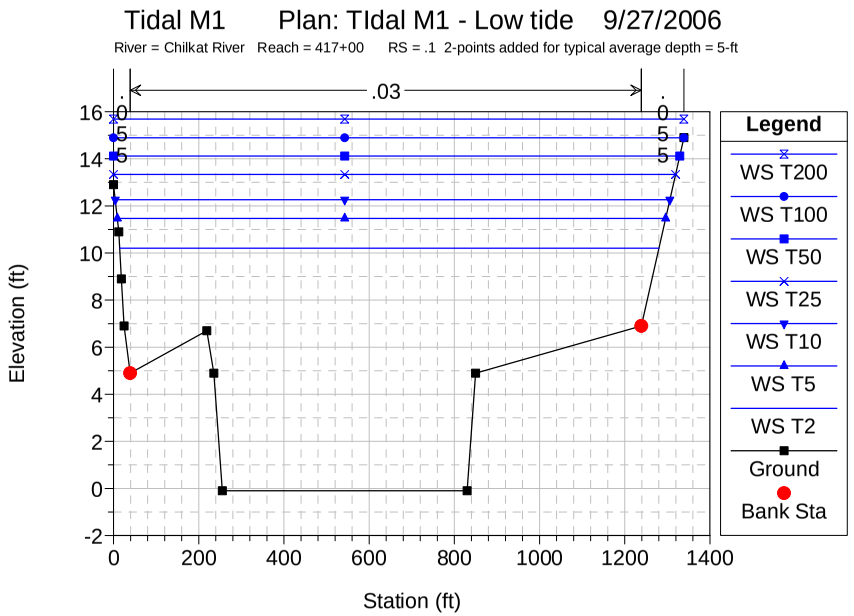
inter·fluve, inc.
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.4591
www.interfluve.com

F-132


Tidal M1 Plan: TIdal M1 - Low tide 9/27/2006
Chilkat River 417+00
Legend
WS T200
WS T100
WS T50
WS T25
WS T10
WS T5
WS T2
Ground
Elevation (ft)
Main Channel Distance (ft)
50
40
30
20
10
0
-10
0
5000
10000
15000
20000
25000
30000

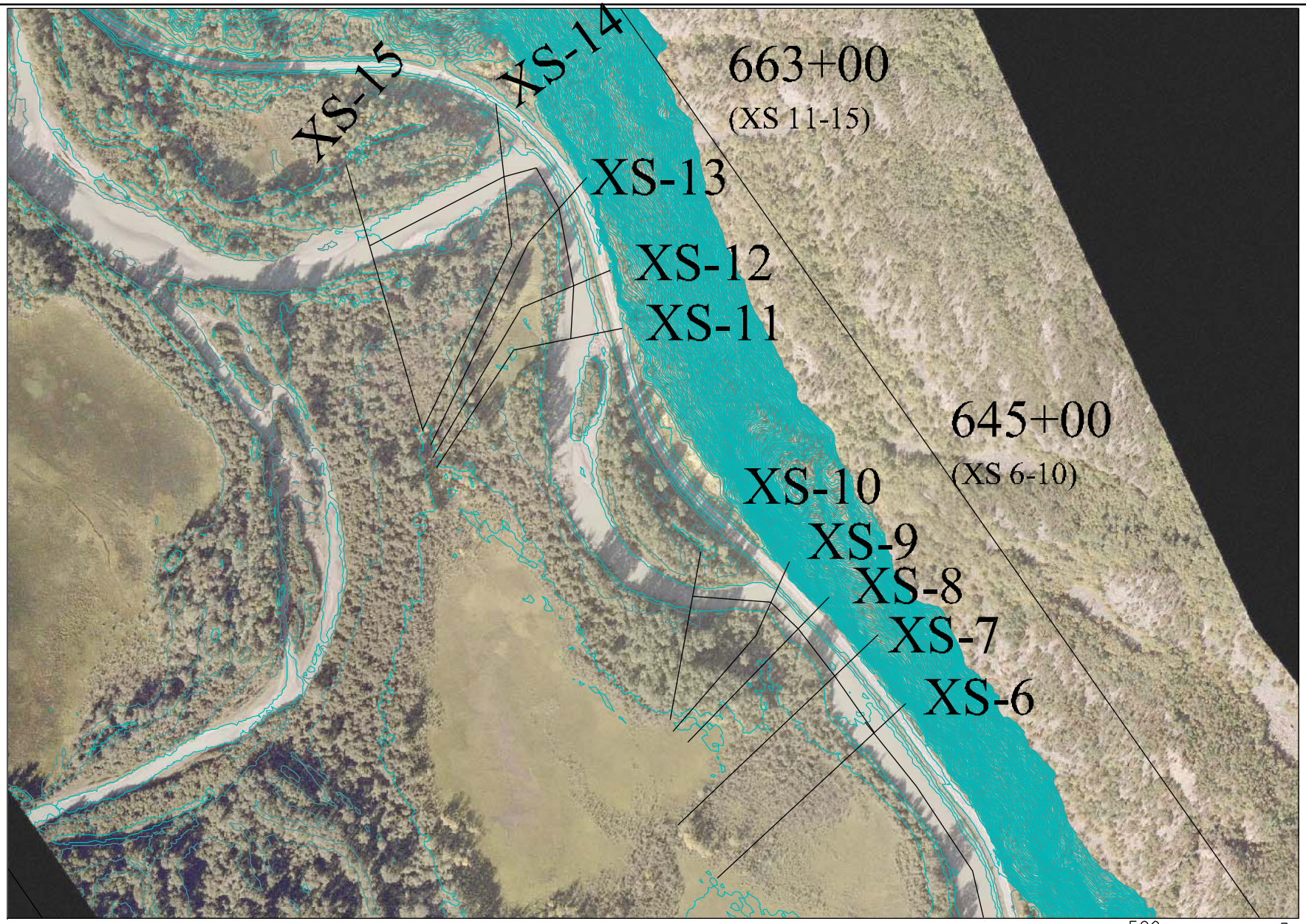

Tidal M1 Plan: TIdal M1 - Low tide 9/27/2006
River = Chilkat River Reach = 417+00 RS = 4 2-points added for typical average depth = 4-ft
.03
.055
Elevation (ft)
Station (ft)
Legend
WS T200
WS T100
WS T50
WS T25
WS T10
WS T5
WS T2
Ground
Bank Sta
Tidal M1 Plan: TIdal M1 - Low tide 9/27/2006
River = Chilkat River Reach = 417+00 RS = 3 Boat based soundings w. offset visual estimates included
.03
.055
Elevation (ft)
Station (ft)
Legend
WS T200
WS T100
WS T50
WS T25
WS T10
WS T5
WS T2
Ground
Bank Sta
Tidal M1 Plan: TIdal M1 - Low tide 9/27/2006
River = Chilkat River Reach = 417+00 RS = 2 Boat based soundings w. offset visual estimates included
.03
.055
Elevation (ft)
Station (ft)
Legend
WS T200
WS T100
WS T50
WS T25
WS T10
WS T5
WS T2
Ground
Bank Sta
Tidal M1 Plan: TIdal M1 - Low tide 9/27/2006
River = Chilkat River Reach = 417+00 RS = 1 2-points added for typical average depth = 5-ft
.03
.055
Elevation (ft)
Station (ft)
Legend
WS T200
WS T100
WS T50
WS T25
WS T10
WS T5
WS T2
Ground
Bank Sta


Tidal M1 Plan: TIdal M1 - Low tide 9/27/2006
River = Chilkat River Reach = 417+00 RS = .5 2-points added for typical average depth = 5-ft
.03
.055
Elevation (ft)
Station (ft)
Legend
WS T200
WS T100
WS T50
WS T25
WS T10
WS T5
WS T2
Ground
Bank Sta


Tidal M1 Plan: TIdal M1 - Low tide 9/27/2006
River = Chilkat River Reach = 417+00 RS = .1 2-points added for typical average depth = 5-ft
.03
.055
Elevation (ft)
Station (ft)
Legend
WS T200
WS T100
WS T50
WS T25
WS T10
WS T5
WS T2
Ground
Bank Sta

HEC-RAS Plan: TIdalM1Lo River: Chilkat River Reach: 417+00

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
417+00	.1	T2	42300.00		-0.10	10.20	5.84	10.56	0.000664	10.30	7.31	4.80	8914.86	1265.64	1200.00	0.31	0.30
417+00	.1	T5	55300.00		-0.10	11.47	6.91	11.91	0.000664	11.57	8.57	5.34	10528.34	1287.01	1200.00	0.32	0.36
417+00	.1	T10	64200.00		-0.10	12.26	7.36	12.76	0.000664	12.36	9.37	5.67	11558.89	1301.94	1200.00	0.33	0.39
417+00	.1	T25	77100.00		-0.10	13.33	7.93	13.91	0.000665	13.43	10.44	6.10	12963.40	1319.31	1200.00	0.33	0.43
417+00	.1	T50	87100.00		-0.10	14.12	8.35	14.75	0.000664	14.22	11.22	6.40	14003.47	1329.13	1200.00	0.34	0.46
417+00	.1	T100	97500.00		-0.10	14.89	8.78	15.58	0.000664	14.99	12.00	6.69	15038.15	1338.83	1200.00	0.34	0.50
417+00	.1	T200	108700.00		-0.10	15.69	9.23	16.43	0.000664	15.79	12.79	6.98	16100.49	1338.90	1200.00	0.34	0.53
417+00	.5	T2	42300.00	14044.99	11.00	20.93		21.33	0.000790	9.93	6.94	5.06	8450.33	1259.98	1200.00	0.34	0.34
417+00	.5	T5	55300.00	14044.99	11.00	22.14		22.63	0.000789	11.14	8.14	5.63	9978.27	1278.97	1200.00	0.35	0.40
417+00	.5	T10	64200.00	14044.99	11.00	22.90		23.45	0.000789	11.90	8.90	5.97	10954.01	1293.20	1200.00	0.35	0.44
417+00	.5	T25	77100.00	14044.99	11.00	23.92		24.56	0.000788	12.92	9.93	6.42	12291.90	1312.45	1200.00	0.36	0.49
417+00	.5	T50	87100.00	14044.99	11.00	24.67		25.37	0.000787	13.67	10.68	6.73	13276.50	1322.28	1200.00	0.36	0.52
417+00	.5	T100	97500.00	14044.99	11.00	25.41		26.17	0.000786	14.41	11.42	7.04	14259.53	1331.54	1200.00	0.37	0.56
417+00	.5	T200	108700.00	14044.99	11.00	26.17		27.00	0.000785	15.17	12.18	7.34	15277.96	1338.90	1200.00	0.37	0.60
417+00	1	T2	42300.00	28279.06	25.00	34.49		34.95	0.000983	9.49	6.50	5.41	7898.19	1253.21	1200.00	0.37	0.40
417+00	1	T5	55300.00	28279.06	25.00	35.62		36.18	0.000983	10.62	7.63	6.01	9320.42	1270.57	1200.00	0.38	0.47
417+00	1	T10	64200.00	28279.06	25.00	36.33		36.96	0.000983	11.33	8.34	6.38	10226.35	1282.61	1200.00	0.39	0.51
417+00	1	T25	77100.00	28279.06	25.00	37.29		38.02	0.000982	12.29	9.30	6.86	11467.69	1300.63	1200.00	0.40	0.57
417+00	1	T50	87100.00	28279.06	25.00	37.99		38.79	0.000982	12.99	10.00	7.20	12382.67	1313.75	1200.00	0.40	0.61
417+00	1	T100	97500.00	28279.06	25.00	38.68		39.56	0.000982	13.68	10.69	7.52	13295.25	1322.45	1200.00	0.41	0.65
417+00	1	T200	108700.00	28279.06	25.00	39.40		40.34	0.000981	14.40	11.40	7.85	14241.21	1331.37	1200.00	0.41	0.70
417+00	2	T2	42300.00	28679.06	17.00	34.88		35.53	0.001835	17.88	5.39	6.52	6589.87	1246.25	1190.00	0.49	0.62
417+00	2	T5	55300.00	28679.06	17.00	35.98		36.75	0.001685	18.98	6.49	7.07	7972.23	1262.50	1190.00	0.49	0.68
417+00	2	T10	64200.00	28679.06	17.00	36.68		37.52	0.001617	19.68	7.19	7.41	8856.30	1275.86	1190.00	0.49	0.72
417+00	2	T25	77100.00	28679.06	17.00	37.62		38.57	0.001542	20.62	8.14	7.86	10071.71	1294.11	1190.00	0.49	0.78
417+00	2	T50	87100.00	28679.06	17.00	38.31		39.34	0.001498	21.31	8.83	8.18	10969.52	1310.02	1190.00	0.49	0.82
417+00	2	T100	97500.00	28679.06	17.00	39.00		40.10	0.001462	22.00	9.51	8.49	11870.48	1328.87	1190.00	0.49	0.87
417+00	2	T200	108700.00	28679.06	17.00	39.70		40.89	0.001428	22.70	10.21	8.80	12813.35	1348.31	1190.00	0.49	0.91
417+00	3	T2	42300.00	28954.06	22.00	35.45		35.93	0.001094	13.45	6.29	5.58	7716.34	1261.50	1190.00	0.39	0.43
417+00	3	T5	55300.00	28954.06	22.00	36.54		37.14	0.001095	14.54	7.38	6.21	9099.48	1277.21	1190.00	0.40	0.50
417+00	3	T10	64200.00	28954.06	22.00	37.23		37.90	0.001093	15.23	8.07	6.59	9986.54	1287.18	1190.00	0.41	0.55
417+00	3	T25	77100.00	28954.06	22.00	38.17		38.94	0.001089	16.17	9.01	7.08	11203.05	1300.72	1190.00	0.42	0.61
417+00	3	T50	87100.00	28954.06	22.00	38.86		39.71	0.001085	16.86	9.70	7.42	12100.49	1310.66	1190.00	0.42	0.66
417+00	3	T100	97500.00	28954.06	22.00	39.54		40.46	0.001082	17.54	10.38	7.75	12996.76	1320.50	1190.00	0.42	0.70
417+00	3	T200	108700.00	28954.06	22.00	40.25		41.24	0.001079	18.25	11.08	8.09	13927.56	1327.10	1190.00	0.43	0.75
417+00	4	T2	42300.00	29284.06	26.00	35.81		36.37	0.001425	9.81	5.81	6.04	7160.78	1265.78	1184.00	0.44	0.52
417+00	4	T5	55300.00	29284.06	26.00	36.89		37.57	0.001377	10.89	6.89	6.65	8536.97	1282.71	1184.00	0.45	0.59
417+00	4	T10	64200.00	29284.06	26.00	37.57		38.33	0.001350	11.57	7.58	7.02	9420.53	1293.62	1184.00	0.45	0.64
417+00	4	T25	77100.00	29284.06	26.00	38.51		39.36	0.001321	12.51	8.51	7.50	10634.26	1312.96	1184.00	0.45	0.70
417+00	4	T50	87100.00	29284.06	26.00	39.19		40.13	0.001303	13.19	9.19	7.84	11534.99	1329.90	1184.00	0.46	0.75
417+00	4	T100	97500.00	29284.06	26.00	39.86		40.88	0.001286	13.86	9.87	8.17	12440.35	1346.71	1184.00	0.46	0.79
417+00	4	T200	108700.00	29284.06	26.00	40.56		41.66	0.001267	14.56	10.57	8.49	13384.57	1350.10	1184.00	0.46	0.84



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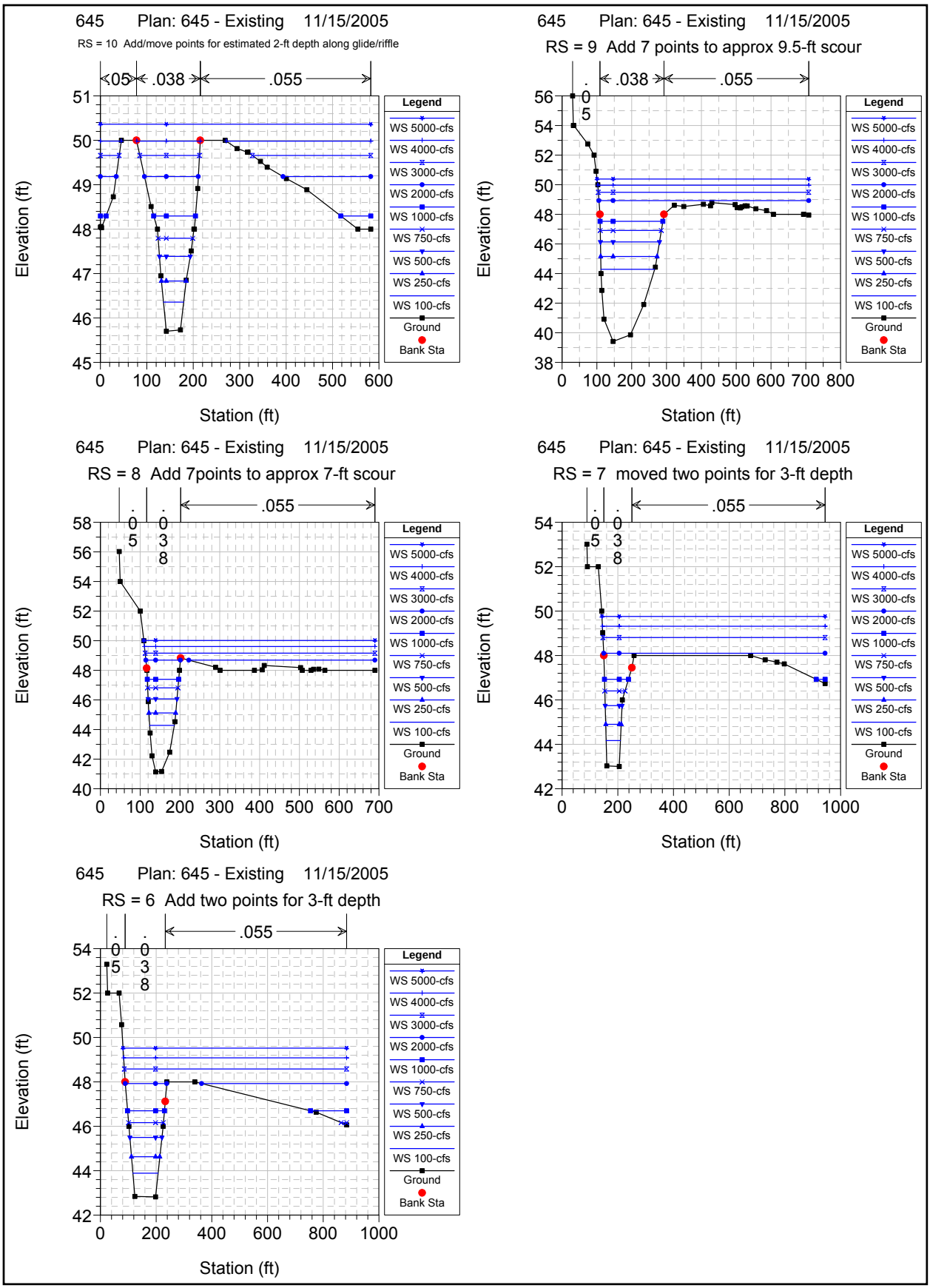
Haines Highway – HEC–RAS Schematic

S&HI Stations 645+00 and 663+00

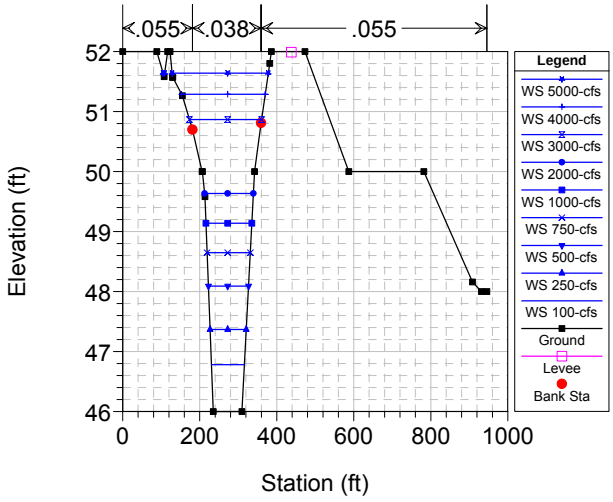

645 Plan: 645 - Existing 11/15/2005
RS = 10 Add/move points for estimated 2-ft depth along glide/riffle
.05
.038
.055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
645 Plan: 645 - Existing 11/15/2005
RS = 9 Add 7 points to approx 9.5-ft scour
.05
.038
.055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
645 Plan: 645 - Existing 11/15/2005
RS = 8 Add 7points to approx 7-ft scour
.05
.038
.055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
645 Plan: 645 - Existing 11/15/2005
RS = 7 moved two points for 3-ft depth
.05
.038
.055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
645 Plan: 645 - Existing 11/15/2005
RS = 6 Add two points for 3-ft depth
.05
.038
.055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta

HEC-RAS Plan: 645 River: Chilkat Reach: 645+00

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
645+00	6	100-cfs	100.00		42.82	43.89	43.21	43.91	0.000901	1.07	0.96	1.14	87.39	90.61	90.61	0.21	0.05
645+00	6	250-cfs	250.00		42.82	44.63	43.52	44.67	0.000901	1.81	1.56	1.57	158.75	101.94	101.94	0.22	0.09
645+00	6	500-cfs	500.00		42.82	45.50	43.90	45.56	0.000901	2.68	2.19	1.98	252.78	115.18	115.18	0.24	0.12
645+00	6	750-cfs	750.00		42.82	46.17	44.22	46.24	0.000901	3.35	2.66	2.25	334.36	144.77	125.15	0.24	0.15
645+00	6	1000-cfs	1000.00		42.82	46.70	44.50	46.79	0.000902	3.88	3.03	2.45	440.47	261.92	132.42	0.25	0.17
645+00	6	2000-cfs	2000.00		42.82	47.92	45.39	48.04	0.000901	5.10	3.98	2.94	1012.20	669.79	143.67	0.26	0.22
645+00	6	3000-cfs	3000.00		42.82	48.58	46.11	48.70	0.000901	5.76	4.62	3.25	1525.76	798.19	144.18	0.27	0.26
645+00	6	4000-cfs	4000.00		42.82	49.08	47.04	49.21	0.000901	6.26	5.13	3.48	1926.51	800.62	144.18	0.27	0.29
645+00	6	5000-cfs	5000.00		42.82	49.52	47.62	49.66	0.000900	6.70	5.57	3.67	2279.87	802.76	144.18	0.27	0.31
645+00	7	100-cfs	100.00	236.00	43.00	44.17		44.22	0.001945	1.17	1.08	1.80	55.43	51.40	51.40	0.31	0.13
645+00	7	250-cfs	250.00	236.00	43.00	44.90		45.01	0.002282	1.90	1.70	2.64	94.69	55.68	55.68	0.36	0.24
645+00	7	500-cfs	500.00	236.00	43.00	45.74		45.93	0.002566	2.74	2.37	3.48	143.53	60.58	60.58	0.40	0.37
645+00	7	750-cfs	750.00	236.00	43.00	46.40		46.65	0.003067	3.40	2.57	4.02	186.45	72.49	72.49	0.44	0.48
645+00	7	1000-cfs	1000.00	236.00	43.00	46.93		47.23	0.003490	3.93	2.65	4.38	231.11	117.87	86.05	0.47	0.57
645+00	7	2000-cfs	2000.00	236.00	43.00	48.10		48.51	0.003772	5.10	3.39	5.37	558.59	794.66	100.79	0.51	0.79
645+00	7	3000-cfs	3000.00	236.00	43.00	48.81		49.07	0.002473	5.81	4.10	4.93	1122.16	797.56	100.79	0.43	0.62
645+00	7	4000-cfs	4000.00	236.00	43.00	49.32		49.55	0.002071	6.32	4.61	4.88	1529.81	799.51	100.79	0.40	0.59
645+00	7	5000-cfs	5000.00	236.00	43.00	49.76		49.97	0.001852	6.76	5.05	4.90	1883.74	801.09	100.79	0.38	0.58
645+00	8	100-cfs	100.00	440.00	41.14	44.28		44.29	0.000122	3.14	2.21	0.73	136.98	61.85	61.85	0.09	0.02
645+00	8	250-cfs	250.00	440.00	41.14	45.12		45.14	0.000282	3.98	2.84	1.31	191.40	67.36	67.36	0.14	0.05
645+00	8	500-cfs	500.00	440.00	41.14	46.07		46.13	0.000462	4.93	3.56	1.94	258.15	72.56	72.56	0.18	0.10
645+00	8	750-cfs	750.00	440.00	41.14	46.81		46.90	0.000584	5.67	4.12	2.39	313.24	76.10	76.10	0.21	0.15
645+00	8	1000-cfs	1000.00	440.00	41.14	47.39		47.52	0.000698	6.25	4.54	2.79	358.30	78.88	78.88	0.23	0.19
645+00	8	2000-cfs	2000.00	440.00	41.14	48.68		48.91	0.001105	7.54	5.46	3.96	726.58	554.68	84.94	0.30	0.37
645+00	8	3000-cfs	3000.00	440.00	41.14	49.16		49.47	0.001521	8.02	5.91	4.90	1001.40	577.63	85.50	0.36	0.55
645+00	8	4000-cfs	4000.00	440.00	41.14	49.61		49.96	0.001721	8.47	6.35	5.47	1259.50	579.36	85.50	0.38	0.67
645+00	8	5000-cfs	5000.00	440.00	41.14	50.01		50.39	0.001837	8.87	6.76	5.89	1493.68	580.93	85.50	0.40	0.76
645+00	9	100-cfs	100.00	570.00	39.42	44.29		44.29	0.000005	4.87	3.39	0.19	523.85	154.33	154.33	0.02	0.00
645+00	9	250-cfs	250.00	570.00	39.42	45.15		45.15	0.000015	5.73	4.08	0.38	660.19	161.87	161.87	0.03	0.00
645+00	9	500-cfs	500.00	570.00	39.42	46.14		46.14	0.000030	6.72	4.86	0.61	824.09	169.52	169.52	0.05	0.01
645+00	9	750-cfs	750.00	570.00	39.42	46.91		46.92	0.000042	7.49	5.46	0.78	957.73	175.51	175.51	0.06	0.01
645+00	9	1000-cfs	1000.00	570.00	39.42	47.53		47.54	0.000055	8.11	5.92	0.94	1067.29	180.27	180.27	0.07	0.02
645+00	9	2000-cfs	2000.00	570.00	39.42	48.93		48.96	0.000105	9.51	7.20	1.48	1546.00	602.69	183.91	0.10	0.05
645+00	9	3000-cfs	3000.00	570.00	39.42	49.49		49.55	0.000171	10.07	7.76	1.98	1885.56	604.41	183.91	0.13	0.08
645+00	9	4000-cfs	4000.00	570.00	39.42	49.97		50.05	0.000231	10.55	8.24	2.40	2175.78	605.88	183.91	0.15	0.12
645+00	9	5000-cfs	5000.00	570.00	39.42	50.39		50.49	0.000287	10.97	8.66	2.76	2430.04	608.08	183.91	0.17	0.15
645+00	10	100-cfs	100.00	838.00	45.70	46.36	46.36	46.63	0.026149	0.66	0.55	4.22	23.71	43.47	43.47	1.01	0.89
645+00	10	250-cfs	250.00	838.00	45.70	46.83	46.83	47.28	0.022378	1.13	0.88	5.36	46.68	53.18	53.18	1.01	1.22
645+00	10	500-cfs	500.00	838.00	45.70	47.39	47.39	48.00	0.020146	1.69	1.20	6.27	79.75	66.26	66.26	1.01	1.51
645+00	10	750-cfs	750.00	838.00	45.70	47.79	47.79	48.54	0.018992	2.09	1.46	6.91	108.58	74.61	74.61	1.01	1.72
645+00	10	1000-cfs	1000.00	838.00	45.70	48.30	48.30	48.96	0.014408	2.60	1.66	6.57	165.05	166.57	89.98	0.90	1.49
645+00	10	2000-cfs	2000.00	838.00	45.70	49.18	49.18	49.82	0.011832	3.48	2.08	6.92	387.97	339.08	116.06	0.85	1.53
645+00	10	3000-cfs	3000.00	838.00	45.70	49.66	49.66	50.34	0.011885	3.96	2.33	7.48	569.99	423.86	128.42	0.86	1.73
645+00	10	4000-cfs	4000.00	838.00	45.70	49.98	49.98	50.75	0.012843	4.28	2.50	8.15	718.85	492.86	136.85	0.91	2.00
645+00	10	5000-cfs	5000.00	838.00	45.70	50.36	50.36	51.10	0.010787	4.66	2.88	8.19	939.47	582.35	137.32	0.85	1.93

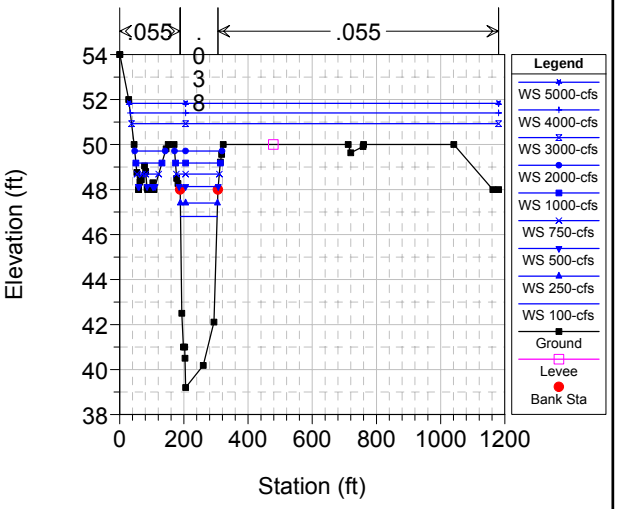
663 Plan: 663 Lidar w soundings 11/16/2005

RS = 15 adjust from toe of bank to 2-ft depth



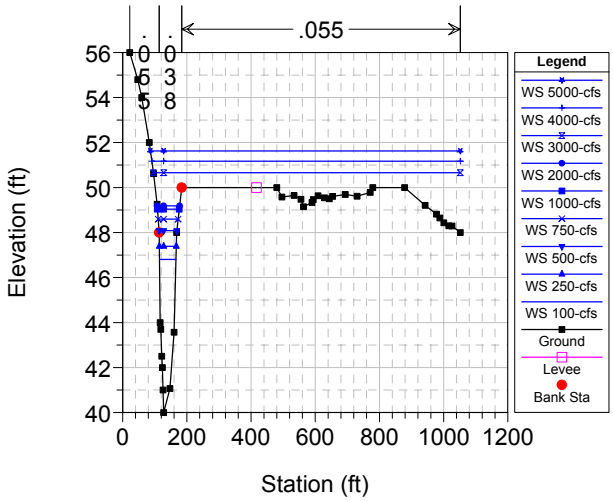
663 Plan: 663 Lidar w soundings 11/16/2005

RS = 14 Depth sounder readings (to ~15' from left bank) included, XS app



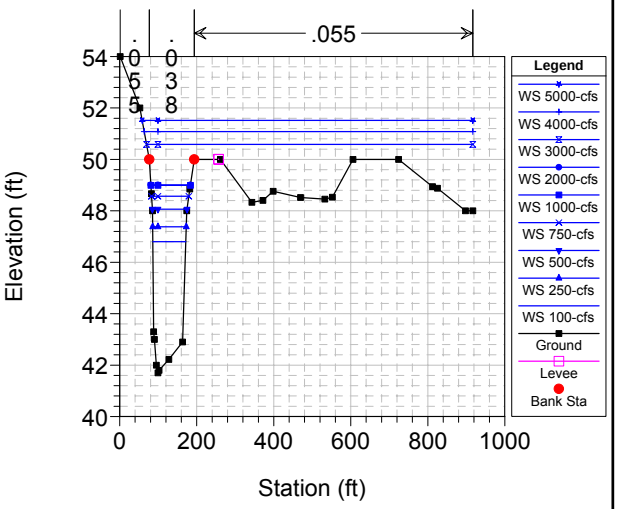
663 Plan: 663 Lidar w soundings 11/16/2005

RS = 13 Depth sounder readings (to ~15' from left bank) included, XS app



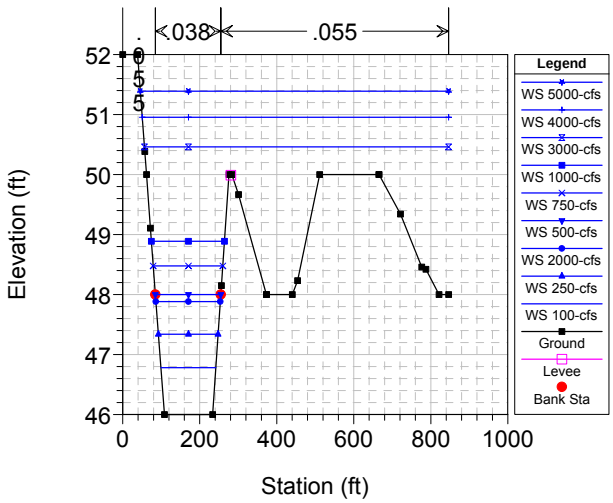
663 Plan: 663 Lidar w soundings 11/16/2005

RS = 12 Depth sounder readings (to ~15' from left bank) included, XS app



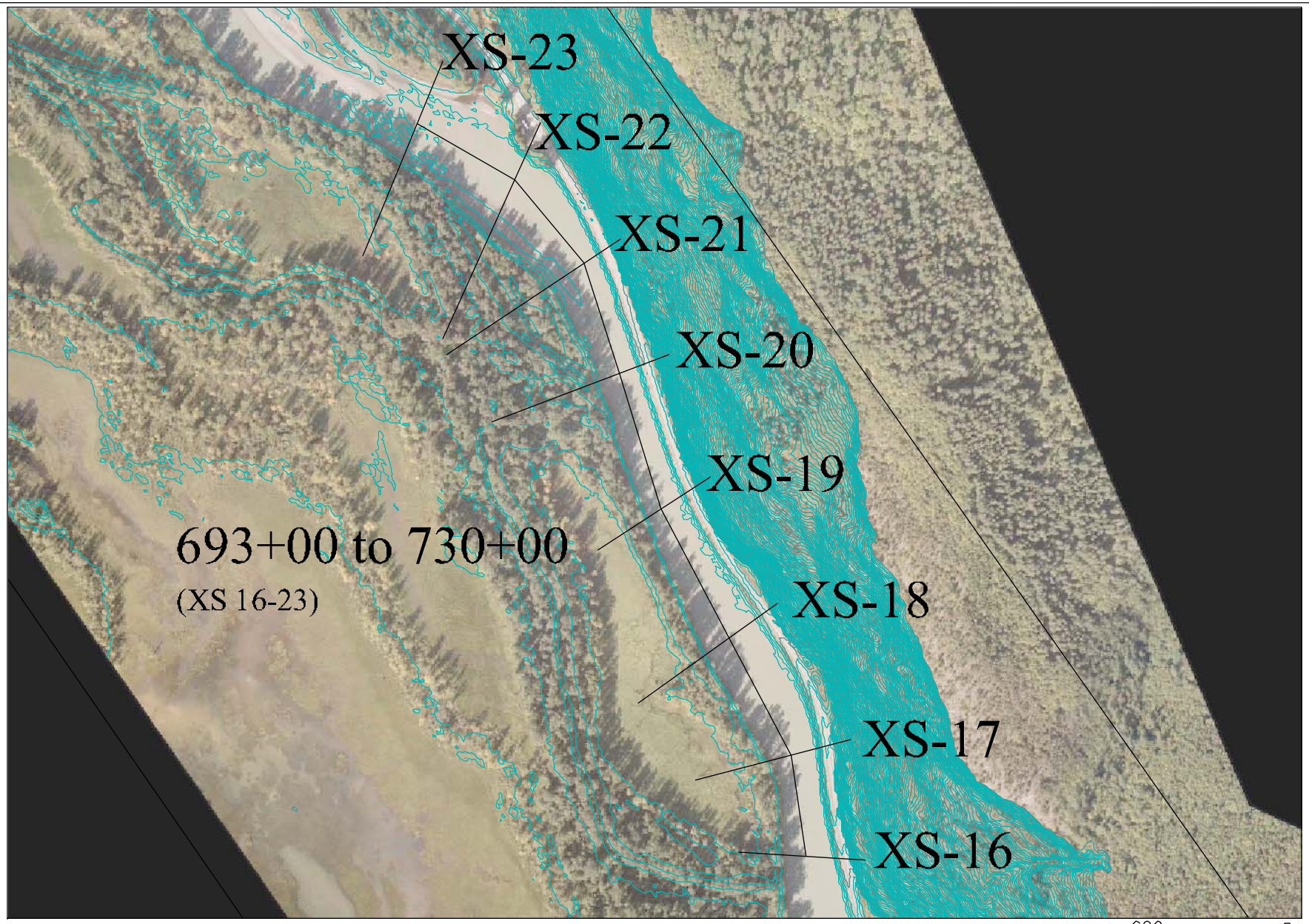
663 Plan: 663 Lidar w soundings 11/16/2005

RS = 11 add two points for 2-ft depth at riffle



HEC-RAS Plan: 663 w sndgs River: Chilkat Reach: 663+00

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
663+00	11	100-cfs	100.00		46.00	46.78	46.27	46.80	0.000902	0.78	0.73	0.95	104.71	142.68	142.68	0.20	0.04
663+00	11	250-cfs	250.00		46.00	47.34	46.49	47.37	0.000901	1.34	1.21	1.33	187.74	155.22	155.22	0.21	0.07
663+00	11	500-cfs	500.00		46.00	48.00	46.77	48.04	0.000900	2.00	1.74	1.69	295.24	170.09	170.08	0.23	0.10
663+00	11	750-cfs	750.00		46.00	48.48	47.00	48.54	0.000901	2.48	2.21	1.99	378.79	180.77	170.08	0.24	0.12
663+00	11	1000-cfs	1000.00		46.00	48.89	47.21	48.97	0.000900	2.89	2.62	2.23	455.22	190.00	170.08	0.24	0.15
663+00	11	2000-cfs	2000.00		46.00	47.88	47.88	48.70	0.017813	1.88	1.64	7.27	275.28	167.43	167.43	1.00	1.83
663+00	11	3000-cfs	3000.00		46.00	50.46	48.40	50.57	0.000900	4.46	4.20	3.05	1548.17	790.02	170.08	0.26	0.24
663+00	11	4000-cfs	4000.00		46.00	50.95	48.87	51.07	0.000901	4.95	4.69	3.29	1939.03	795.70	170.08	0.27	0.26
663+00	11	5000-cfs	5000.00		46.00	51.39	49.29	51.52	0.000900	5.39	5.13	3.49	2286.53	800.71	170.08	0.27	0.29
663+00	12	100-cfs	100.00	181.00	41.70	46.80	42.61	46.80	0.000008	5.10	4.17	0.28	357.17	85.69	85.69	0.02	0.00
663+00	12	250-cfs	250.00	181.00	41.70	47.38	43.01	47.39	0.000033	5.68	4.67	0.61	407.26	87.29	87.29	0.05	0.01
663+00	12	500-cfs	500.00	181.00	41.70	48.07	43.43	48.08	0.000088	6.37	5.20	1.07	467.86	89.93	89.93	0.08	0.03
663+00	12	750-cfs	750.00	181.00	41.70	48.57	43.78	48.60	0.000158	6.87	5.31	1.46	514.39	96.88	96.88	0.11	0.05
663+00	12	1000-cfs	1000.00	181.00	41.70	48.99	44.08	49.04	0.000233	7.29	5.42	1.80	557.08	102.74	102.74	0.14	0.08
663+00	12	2000-cfs	2000.00	181.00	41.70	49.01	45.10	49.21	0.000925	7.31	5.43	3.58	558.80	102.98	102.98	0.27	0.30
663+00	12	3000-cfs	3000.00	181.00	41.70	50.59	45.96	50.69	0.000515	8.89	6.30	2.96	1787.24	847.03	116.85	0.21	0.20
663+00	12	4000-cfs	4000.00	181.00	41.70	51.08	46.71	51.19	0.000567	9.38	6.79	3.26	2207.90	853.06	116.85	0.22	0.23
663+00	12	5000-cfs	5000.00	181.00	41.70	51.52	47.38	51.64	0.000602	9.82	7.23	3.50	2582.39	858.39	116.85	0.23	0.26
663+00	13	100-cfs	100.00	450.00	40.00	46.80	41.42	46.81	0.000015	6.80	4.72	0.42	240.90	51.03	51.03	0.03	0.00
663+00	13	250-cfs	250.00	450.00	40.00	47.39	42.14	47.40	0.000068	7.39	5.17	0.92	271.15	52.47	52.47	0.07	0.02
663+00	13	500-cfs	500.00	450.00	40.00	48.08	42.96	48.12	0.000189	8.08	5.64	1.62	308.32	55.11	54.66	0.12	0.06
663+00	13	750-cfs	750.00	450.00	40.00	48.59	43.58	48.67	0.000346	8.59	5.74	2.22	338.23	61.97	58.78	0.16	0.12
663+00	13	1000-cfs	1000.00	450.00	40.00	49.04	44.08	49.15	0.000512	9.04	5.84	2.74	366.83	67.89	62.34	0.20	0.17
663+00	13	2000-cfs	2000.00	450.00	40.00	49.19	45.60	49.63	0.001926	9.19	5.88	5.35	377.17	69.91	63.55	0.39	0.66
663+00	13	3000-cfs	3000.00	450.00	40.00	50.66	46.84	50.90	0.001160	10.66	6.76	4.57	1372.13	956.19	70.12	0.31	0.46
663+00	13	4000-cfs	4000.00	450.00	40.00	51.17	47.91	51.39	0.001106	11.17	7.28	4.69	1866.31	961.31	70.12	0.31	0.47
663+00	13	5000-cfs	5000.00	450.00	40.00	51.62	49.10	51.82	0.001057	11.62	7.73	4.77	2299.87	965.79	70.12	0.30	0.48
663+00	14	100-cfs	100.00	724.00	39.20	46.81	40.15	46.81	0.000001	7.61	5.96	0.15	678.98	114.01	114.01	0.01	0.00
663+00	14	250-cfs	250.00	724.00	39.20	47.40	40.55	47.41	0.000006	8.20	6.46	0.33	747.67	115.83	115.83	0.02	0.00
663+00	14	500-cfs	500.00	724.00	39.20	48.13	41.06	48.14	0.000018	8.93	7.08	0.60	836.15	147.28	117.64	0.04	0.01
663+00	14	750-cfs	750.00	724.00	39.20	48.69	41.42	48.70	0.000032	9.49	7.63	0.83	930.93	191.32	117.64	0.05	0.01
663+00	14	1000-cfs	1000.00	724.00	39.20	49.18	41.73	49.19	0.000045	9.98	8.12	1.03	1031.68	220.24	117.64	0.06	0.02
663+00	14	2000-cfs	2000.00	724.00	39.20	49.71	42.66	49.76	0.000142	10.51	8.66	1.92	1155.19	243.29	117.64	0.11	0.07
663+00	14	3000-cfs	3000.00	724.00	39.20	50.93	43.40	50.99	0.000149	11.73	9.88	2.14	2456.52	1143.35	117.64	0.12	0.09
663+00	14	4000-cfs	4000.00	724.00	39.20	51.41	44.03	51.48	0.000189	12.21	10.35	2.49	3002.37	1147.44	117.64	0.14	0.12
663+00	14	5000-cfs	5000.00	724.00	39.20	51.83	44.62	51.92	0.000221	12.63	10.78	2.77	3487.66	1151.06	117.64	0.15	0.14
663+00	15	100-cfs	100.00	1238.00	46.00	46.78	46.38	46.82	0.002558	0.78	0.73	1.60	62.41	85.50	85.50	0.33	0.12
663+00	15	250-cfs	250.00	1238.00	46.00	47.37	46.69	47.44	0.002369	1.37	1.22	2.18	114.94	93.88	93.88	0.35	0.18
663+00	15	500-cfs	500.00	1238.00	46.00	48.09	47.08	48.20	0.002162	2.09	1.79	2.68	186.78	104.27	104.27	0.35	0.24
663+00	15	750-cfs	750.00	1238.00	46.00	48.65	47.41	48.79	0.002119	2.65	2.20	3.04	246.87	112.22	112.22	0.36	0.29
663+00	15	1000-cfs	1000.00	1238.00	46.00	49.14	47.68	49.31	0.002046	3.14	2.55	3.29	303.87	119.27	119.27	0.36	0.32
663+00	15	2000-cfs	2000.00	1238.00	46.00	49.63	48.59	50.10	0.004841	3.63	2.87	5.49	364.61	126.85	126.85	0.57	0.87
663+00	15	3000-cfs	3000.00	1238.00	46.00	50.87	49.31	51.33	0.004311	4.87	3.09	5.44	552.40	187.47	178.43	0.54	0.83
663+00	15	4000-cfs	4000.00	1238.00	46.00	51.29	49.95	51.92	0.004989	5.29	3.51	6.37	637.33	217.08	178.43	0.60	1.09
663+00	15	5000-cfs	5000.00	1238.00	46.00	51.64	50.64	52.44	0.005609	5.64	3.87	7.20	720.44	253.85	178.43	0.65	1.35



inter·fluve, inc.
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.4591
www.interfluve.com

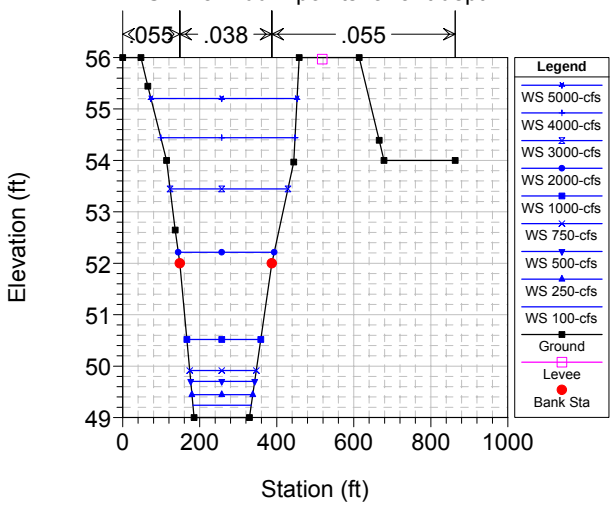
Haines Highway – HEC–RAS Schematic

S&HI Station 693+00 to 730+00

F-142

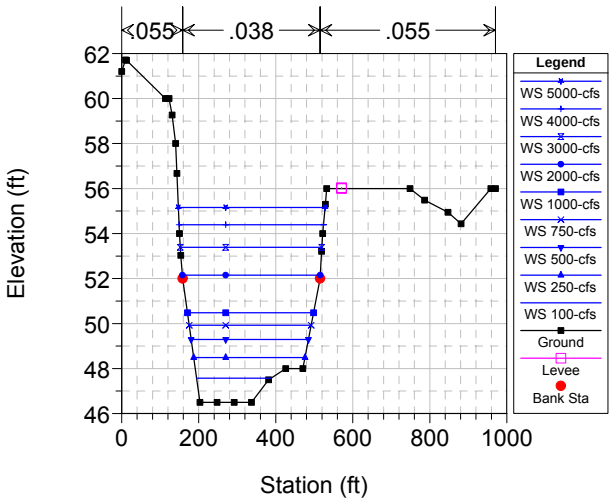
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 23 Add 2-points for 3-ft depth



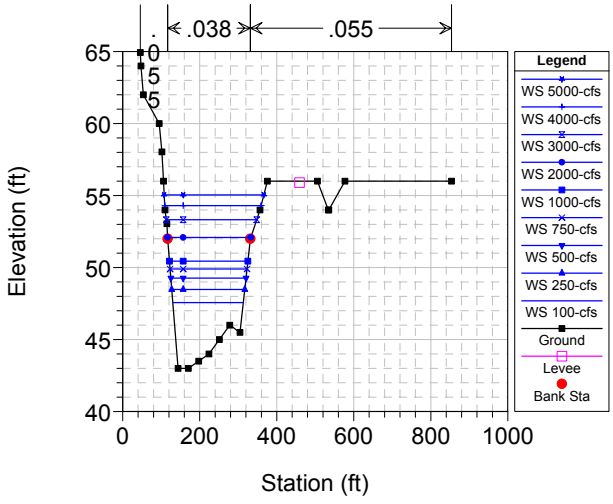
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 22 Boat based soundings proportioned across XS included



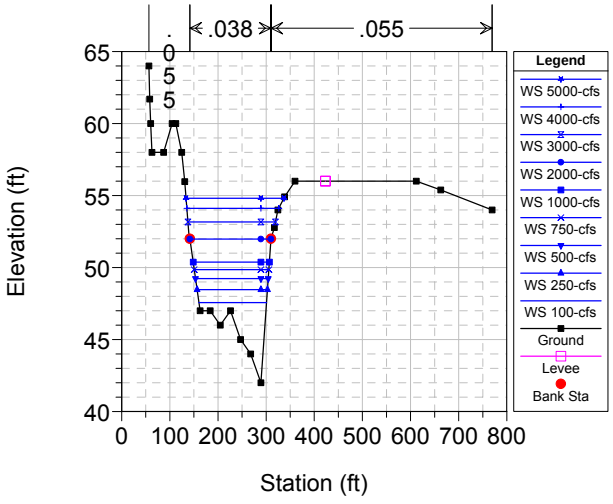
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 21 Boat based soundings proportioned across XS included



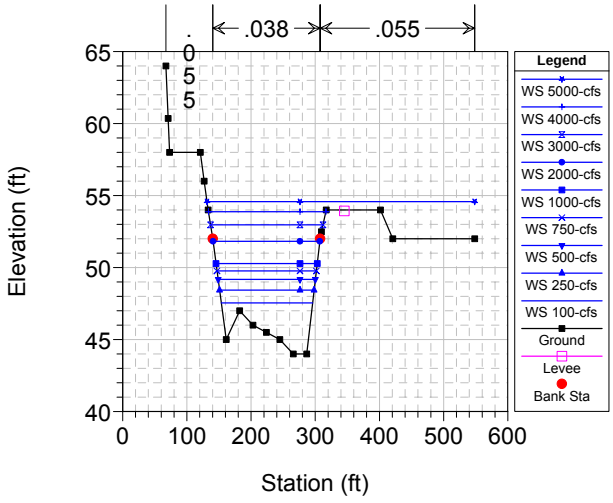
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 20 Boat based soundings proportioned across XS included



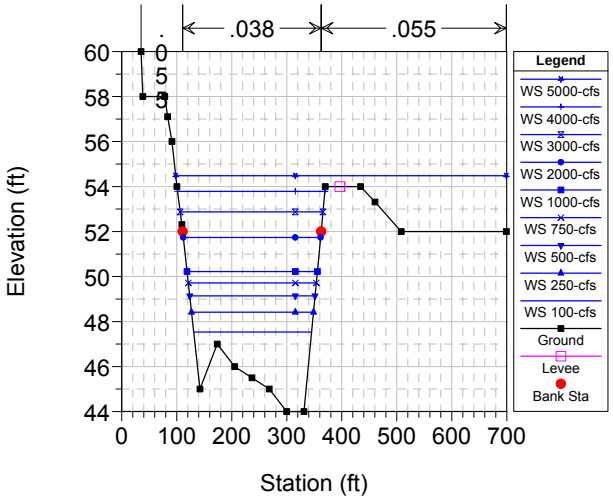
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 19 Boat based soundings proportioned across XS included



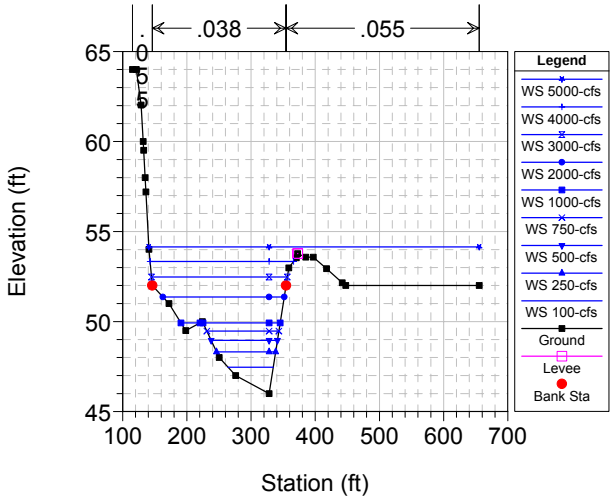
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 18 Boat based soundings proportioned across XS included



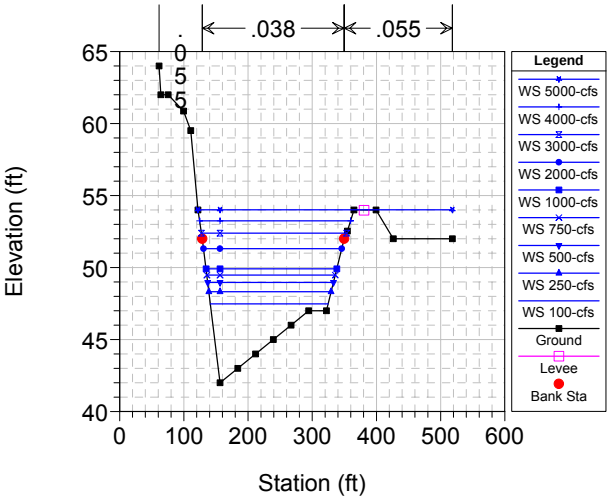
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 17 Boat based soundings proportioned across XS included



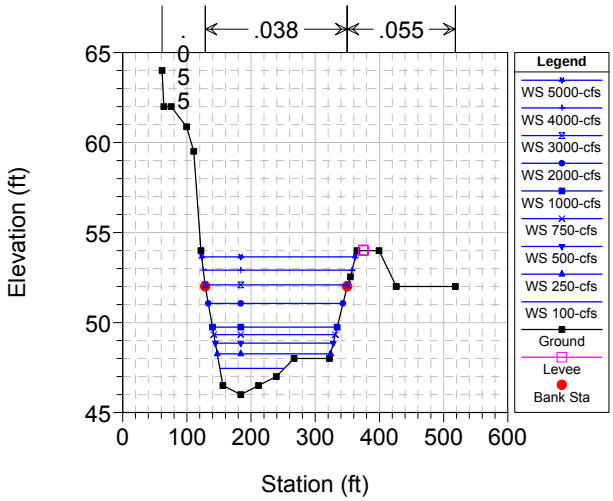
693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 16 Boat based soundings proportioned across XS included



693-730+00 Plan: 700+00 LIDAR w. Soundings 11/16/2005

RS = 15.5 Boat based soundings proportioned across XS included

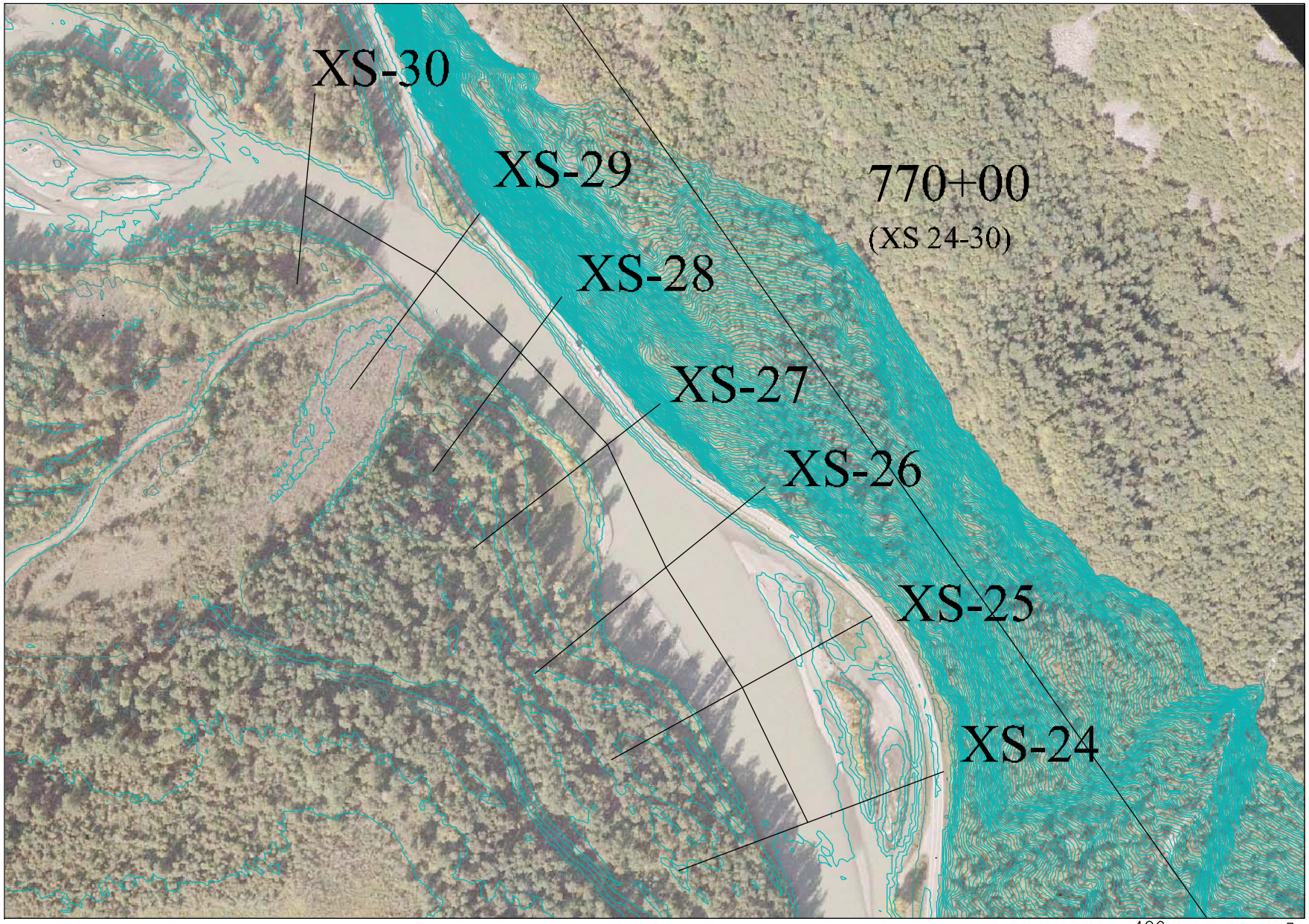


HEC-RAS Plan: 700 bathym River: Chilkat Reach: 700+00

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
700+00	15.5	100-cfs	100.00		46.00	47.45	46.73	47.47	0.000901	1.45	0.91	1.10	91.02	100.41	100.41	0.20	0.05
700+00	15.5	250-cfs	250.00		46.00	48.27	47.07	48.29	0.000901	2.27	1.12	1.26	197.73	176.59	176.59	0.21	0.06
700+00	15.5	500-cfs	500.00		46.00	48.86	47.46	48.90	0.000901	2.86	1.66	1.64	304.45	183.63	183.63	0.22	0.09
700+00	15.5	750-cfs	750.00		46.00	49.33	47.76	49.39	0.000901	3.33	2.08	1.91	393.07	189.28	189.28	0.23	0.12
700+00	15.5	1000-cfs	1000.00		46.00	49.75	48.14	49.82	0.000900	3.75	2.43	2.12	472.14	194.18	194.18	0.24	0.14
700+00	15.5	2000-cfs	2000.00		46.00	51.06	48.74	51.18	0.000901	5.06	3.52	2.71	738.19	209.84	209.84	0.25	0.20
700+00	15.5	3000-cfs	3000.00		46.00	52.10	49.23	52.25	0.000901	6.10	4.35	3.12	961.45	222.21	220.98	0.26	0.24
700+00	15.5	4000-cfs	4000.00		46.00	52.91	49.68	53.10	0.000902	6.91	5.17	3.50	1147.13	231.74	220.98	0.27	0.29
700+00	15.5	5000-cfs	5000.00		46.00	53.65	50.07	53.88	0.000901	7.65	5.90	3.82	1320.59	239.36	220.98	0.28	0.33
700+00	16	100-cfs	100.00	500.00	42.00	47.48	43.22	47.48	0.000009	5.48	2.55	0.21	467.46	183.54	183.54	0.02	0.00
700+00	16	250-cfs	250.00	500.00	42.00	48.32	43.76	48.32	0.000022	6.32	3.28	0.40	624.39	190.49	190.49	0.04	0.00
700+00	16	500-cfs	500.00	500.00	42.00	48.96	44.32	48.97	0.000049	6.96	3.82	0.67	747.76	195.79	195.79	0.06	0.01
700+00	16	750-cfs	750.00	500.00	42.00	49.47	44.73	49.48	0.000075	7.47	4.24	0.88	848.93	200.03	200.03	0.08	0.02
700+00	16	1000-cfs	1000.00	500.00	42.00	49.91	45.07	49.93	0.000098	7.91	4.61	1.07	938.00	203.68	203.68	0.09	0.03
700+00	16	2000-cfs	2000.00	500.00	42.00	51.31	46.04	51.35	0.000171	9.31	5.72	1.63	1230.35	215.25	215.25	0.12	0.06
700+00	16	3000-cfs	3000.00	500.00	42.00	52.39	46.75	52.45	0.000222	10.39	6.64	2.04	1468.05	225.96	220.98	0.14	0.09
700+00	16	4000-cfs	4000.00	500.00	42.00	53.25	47.39	53.34	0.000263	11.25	7.49	2.41	1665.44	235.17	220.98	0.16	0.12
700+00	16	5000-cfs	5000.00	500.00	42.00	54.01	47.79	54.12	0.000283	12.01	8.26	2.67	2061.60	396.15	220.98	0.16	0.14
700+00	17	100-cfs	100.00	917.00	46.00	47.46	46.95	47.51	0.002580	1.46	0.82	1.74	57.64	70.41	70.41	0.34	0.13
700+00	17	250-cfs	250.00	917.00	46.00	48.31	47.37	48.37	0.001634	2.31	1.39	1.96	127.53	92.02	92.02	0.29	0.14
700+00	17	500-cfs	500.00	917.00	46.00	48.95	47.84	49.06	0.002014	2.95	1.84	2.63	190.09	103.20	103.20	0.34	0.23
700+00	17	750-cfs	750.00	917.00	46.00	49.47	48.18	49.61	0.002156	3.47	2.19	3.05	245.66	112.20	112.20	0.36	0.29
700+00	17	1000-cfs	1000.00	917.00	46.00	49.93	48.48	50.09	0.002736	3.93	2.04	3.28	304.99	149.72	149.72	0.40	0.35
700+00	17	2000-cfs	2000.00	917.00	46.00	51.37	49.42	51.57	0.002082	5.37	2.91	3.63	551.09	189.24	189.24	0.37	0.38
700+00	17	3000-cfs	3000.00	917.00	46.00	52.47	50.25	52.70	0.001708	6.47	3.72	3.87	776.13	211.74	208.47	0.35	0.39
700+00	17	4000-cfs	4000.00	917.00	46.00	53.34	50.76	53.61	0.001510	7.34	4.58	4.18	962.82	223.52	208.47	0.34	0.43
700+00	17	5000-cfs	5000.00	917.00	46.00	54.15	51.21	54.35	0.001014	8.15	5.40	3.82	1677.42	514.68	208.47	0.29	0.34
700+00	18	100-cfs	100.00	1461.00	44.00	47.54	44.60	47.54	0.000012	3.54	2.13	0.22	455.55	214.33	214.33	0.03	0.00
700+00	18	250-cfs	250.00	1461.00	44.00	48.42	45.03	48.42	0.000024	4.42	2.92	0.39	647.12	221.74	221.74	0.04	0.00
700+00	18	500-cfs	500.00	1461.00	44.00	49.14	45.52	49.15	0.000046	5.14	3.56	0.62	810.01	227.85	227.85	0.06	0.01
700+00	18	750-cfs	750.00	1461.00	44.00	49.72	45.83	49.73	0.000064	5.72	4.05	0.80	943.30	232.73	232.73	0.07	0.02
700+00	18	1000-cfs	1000.00	1461.00	44.00	50.22	46.06	50.23	0.000079	6.22	4.48	0.94	1060.91	236.96	236.96	0.08	0.02
700+00	18	2000-cfs	2000.00	1461.00	44.00	51.74	46.75	51.77	0.000126	7.74	5.73	1.40	1429.86	249.74	249.74	0.10	0.04
700+00	18	3000-cfs	3000.00	1461.00	44.00	52.88	47.23	52.92	0.000156	8.88	6.81	1.75	1720.22	259.65	251.97	0.12	0.07
700+00	18	4000-cfs	4000.00	1461.00	44.00	53.78	47.63	53.85	0.000183	9.78	7.72	2.05	1959.13	267.81	251.97	0.13	0.09
700+00	18	5000-cfs	5000.00	1461.00	44.00	54.48	47.99	54.55	0.000185	10.48	8.42	2.19	2763.08	600.97	251.97	0.13	0.10
700+00	19	100-cfs	100.00	2058.00	44.00	47.55	44.77	47.55	0.000026	3.55	2.13	0.33	303.65	142.31	142.31	0.04	0.00
700+00	19	250-cfs	250.00	2058.00	44.00	48.43	45.32	48.44	0.000053	4.43	2.93	0.58	432.16	147.29	147.29	0.06	0.01
700+00	19	500-cfs	500.00	2058.00	44.00	49.17	45.83	49.19	0.000103	5.17	3.58	0.92	542.83	151.44	151.44	0.09	0.02
700+00	19	750-cfs	750.00	2058.00	44.00	49.77	46.17	49.79	0.000143	5.77	4.09	1.18	633.31	154.76	154.76	0.10	0.04
700+00	19	1000-cfs	1000.00	2058.00	44.00	50.28	46.44	50.31	0.000175	6.28	4.52	1.40	712.99	157.62	157.62	0.12	0.05
700+00	19	2000-cfs	2000.00	2058.00	44.00	51.82	47.24	51.88	0.000277	7.82	5.79	2.08	962.71	166.28	166.28	0.15	0.10
700+00	19	3000-cfs	3000.00	2058.00	44.00	52.97	47.82	53.07	0.000343	8.97	6.91	2.60	1159.03	175.27	167.30	0.17	0.15
700+00	19	4000-cfs	4000.00	2058.00	44.00	53.88	48.34	54.03	0.000401	9.88	7.82	3.05	1322.67	183.05	167.30	0.19	0.19
700+00	19	5000-cfs	5000.00	2058.00	44.00	54.58	48.81	54.74	0.000410	10.58	8.52	3.27	1861.52	417.18	167.30	0.20	0.21
700+00	20	100-cfs	100.00	2637.00	42.00	47.56	43.73	47.56	0.000032	5.56	2.02	0.35	283.63	140.49	140.49	0.04	0.00
700+00	20	250-cfs	250.00	2637.00	42.00	48.47	44.52	48.47	0.000061	6.47	2.83	0.61	413.12	146.20	146.20	0.06	0.01
700+00	20	500-cfs	500.00	2637.00	42.00	49.24	45.23	49.25	0.000113	7.24	3.49	0.95	527.63	151.08	151.08	0.09	0.02
700+00	20	750-cfs	750.00	2637.00	42.00	49.85	45.72	49.87	0.000152	7.85	4.01	1.21	621.58	154.96	154.96	0.11	0.04
700+00	20	1000-cfs	1000.00	2637.00	42.00	50.38	46.21	50.41	0.000184	8.38	4.45	1.42	704.37	158.30	158.30	0.12	0.05
700+00	20	2000-cfs	2000.00	2637.00	42.00	51.98	47.38	52.05	0.000280	9.98	5.73	2.07	965.82	168.43	168.43	0.15	0.10
700+00	20	3000-cfs	3000.00	2637.00	42.00	53.17	47.98	53.27	0.000336	11.17	6.92	2.57	1175.23	182.02	168.56	0.17	0.14

HEC-RAS Plan: 700 bathym River: Chilkat Reach: 700+00 (Continued)

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
700+00	20	4000-cfs	4000.00	2637.00	42.00	54.12	48.49	54.26	0.000387	12.12	7.87	3.01	1351.54	190.93	168.56	0.19	0.19
700+00	20	5000-cfs	5000.00	2637.00	42.00	54.81	48.97	55.00	0.000453	12.81	8.56	3.44	1489.07	203.13	168.56	0.21	0.24
700+00	21	100-cfs	100.00	3113.00	43.00	47.57	43.61	47.57	0.000005	4.57	3.10	0.18	567.90	183.27	183.27	0.02	0.00
700+00	21	250-cfs	250.00	3113.00	43.00	48.48	43.99	48.48	0.000012	5.48	3.89	0.34	738.14	189.76	189.76	0.03	0.00
700+00	21	500-cfs	500.00	3113.00	43.00	49.27	44.39	49.27	0.000028	6.27	4.56	0.56	889.95	195.37	195.37	0.05	0.01
700+00	21	750-cfs	750.00	3113.00	43.00	49.90	44.71	49.91	0.000041	6.90	5.08	0.74	1014.47	199.85	199.85	0.06	0.01
700+00	21	1000-cfs	1000.00	3113.00	43.00	50.44	44.98	50.46	0.000054	7.44	5.52	0.89	1124.03	203.71	203.71	0.07	0.02
700+00	21	2000-cfs	2000.00	3113.00	43.00	52.09	45.90	52.12	0.000095	9.09	6.84	1.36	1469.86	216.15	214.78	0.09	0.04
700+00	21	3000-cfs	3000.00	3113.00	43.00	53.32	46.45	53.37	0.000123	10.32	8.07	1.73	1746.21	234.92	214.78	0.11	0.06
700+00	21	4000-cfs	4000.00	3113.00	43.00	54.31	46.89	54.37	0.000148	11.31	9.06	2.05	1985.85	250.27	214.78	0.12	0.08
700+00	21	5000-cfs	5000.00	3113.00	43.00	55.05	47.31	55.13	0.000176	12.05	9.80	2.36	2174.76	258.76	214.78	0.13	0.11
700+00	22	100-cfs	100.00	3557.00	46.50	47.57	46.76	47.58	0.000250	1.07	0.90	0.58	173.73	193.42	193.42	0.11	0.01
700+00	22	250-cfs	250.00	3557.00	46.50	48.49	46.97	48.50	0.000159	1.99	1.40	0.62	405.37	289.05	289.05	0.09	0.01
700+00	22	500-cfs	500.00	3557.00	46.50	49.29	47.23	49.30	0.000147	2.79	2.11	0.78	642.33	304.44	304.44	0.09	0.02
700+00	22	750-cfs	750.00	3557.00	46.50	49.93	47.43	49.94	0.000142	3.43	2.65	0.89	840.39	316.72	316.72	0.10	0.02
700+00	22	1000-cfs	1000.00	3557.00	46.50	50.48	47.62	50.49	0.000140	3.98	3.11	0.98	1017.21	327.30	327.30	0.10	0.03
700+00	22	2000-cfs	2000.00	3557.00	46.50	52.15	48.22	52.17	0.000141	5.65	4.46	1.26	1590.87	357.81	356.63	0.10	0.04
700+00	22	3000-cfs	3000.00	3557.00	46.50	53.39	48.59	53.43	0.000140	6.89	5.70	1.47	2041.90	367.31	356.63	0.11	0.05
700+00	22	4000-cfs	4000.00	3557.00	46.50	54.39	48.91	54.44	0.000144	7.89	6.71	1.67	2413.56	374.77	356.63	0.11	0.06
700+00	22	5000-cfs	5000.00	3557.00	46.50	55.16	49.21	55.21	0.000157	8.66	7.47	1.87	2701.53	380.95	356.63	0.12	0.07
700+00	23	100-cfs	100.00	4016.00	49.00	49.24	49.24	49.36	0.036322	0.24	0.23	2.83	35.40	151.64	151.64	1.03	0.53
700+00	23	250-cfs	250.00	4016.00	49.00	49.45	49.45	49.66	0.028268	0.45	0.43	3.72	67.25	158.15	158.15	1.00	0.75
700+00	23	500-cfs	500.00	4016.00	49.00	49.70	49.70	50.03	0.023980	0.70	0.66	4.58	109.29	166.36	166.36	0.99	0.98
700+00	23	750-cfs	750.00	4016.00	49.00	49.91	49.91	50.33	0.022173	0.91	0.84	5.17	144.96	173.02	173.02	1.00	1.16
700+00	23	1000-cfs	1000.00	4016.00	49.00	50.52	50.11	50.76	0.006884	1.52	1.33	3.92	255.18	192.13	192.13	0.60	0.57
700+00	23	2000-cfs	2000.00	4016.00	49.00	52.21	50.70	52.37	0.001853	3.21	2.62	3.20	626.88	249.21	239.06	0.35	0.30
700+00	23	3000-cfs	3000.00	4016.00	49.00	53.44	51.18	53.60	0.001127	4.44	3.85	3.22	968.82	305.98	239.06	0.29	0.27
700+00	23	4000-cfs	4000.00	4016.00	49.00	54.44	51.60	54.61	0.000891	5.44	4.85	3.34	1295.67	348.47	239.06	0.27	0.27
700+00	23	5000-cfs	5000.00	4016.00	49.00	55.20	51.98	55.39	0.000822	6.20	5.61	3.54	1573.30	379.55	239.06	0.26	0.29



−400 0 200 400

1 inch = 400 ft.

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541.386.4591
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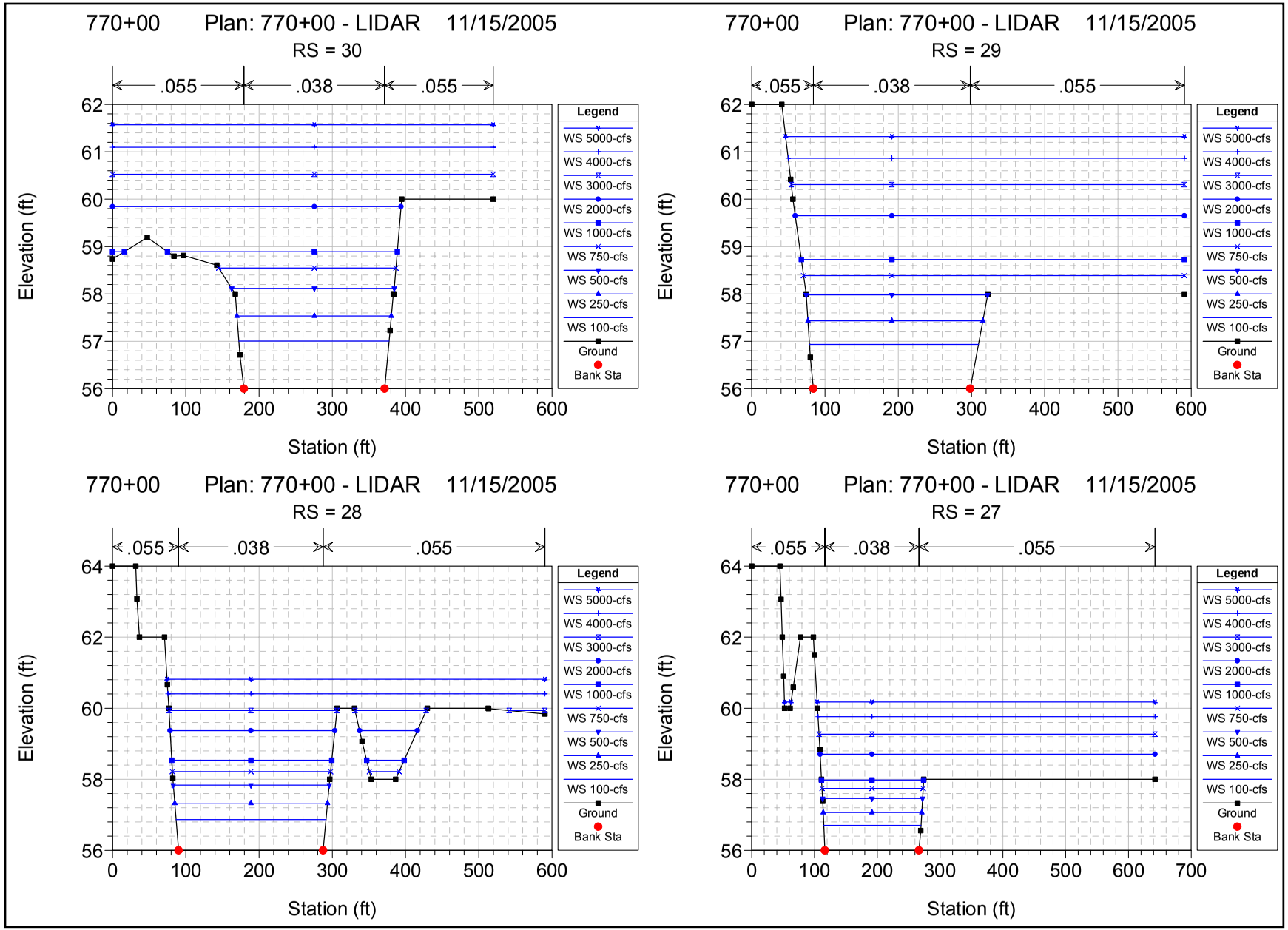
Haines Highway – HEC–RAS Schematic

S&HI Station 770+00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WS 250-cfs
WS 100-cfs
Ground
Bank Sta
770+00 Plan: 770+00 - LIDAR 11/15/2005
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Elevation (ft)
Station (ft)
Legend
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WS 250-cfs
WS 100-cfs
Ground
Bank Sta
770+00 Plan: 770+00 - LIDAR 11/15/2005
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Station (ft)
Legend
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Bank Sta
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Station (ft)
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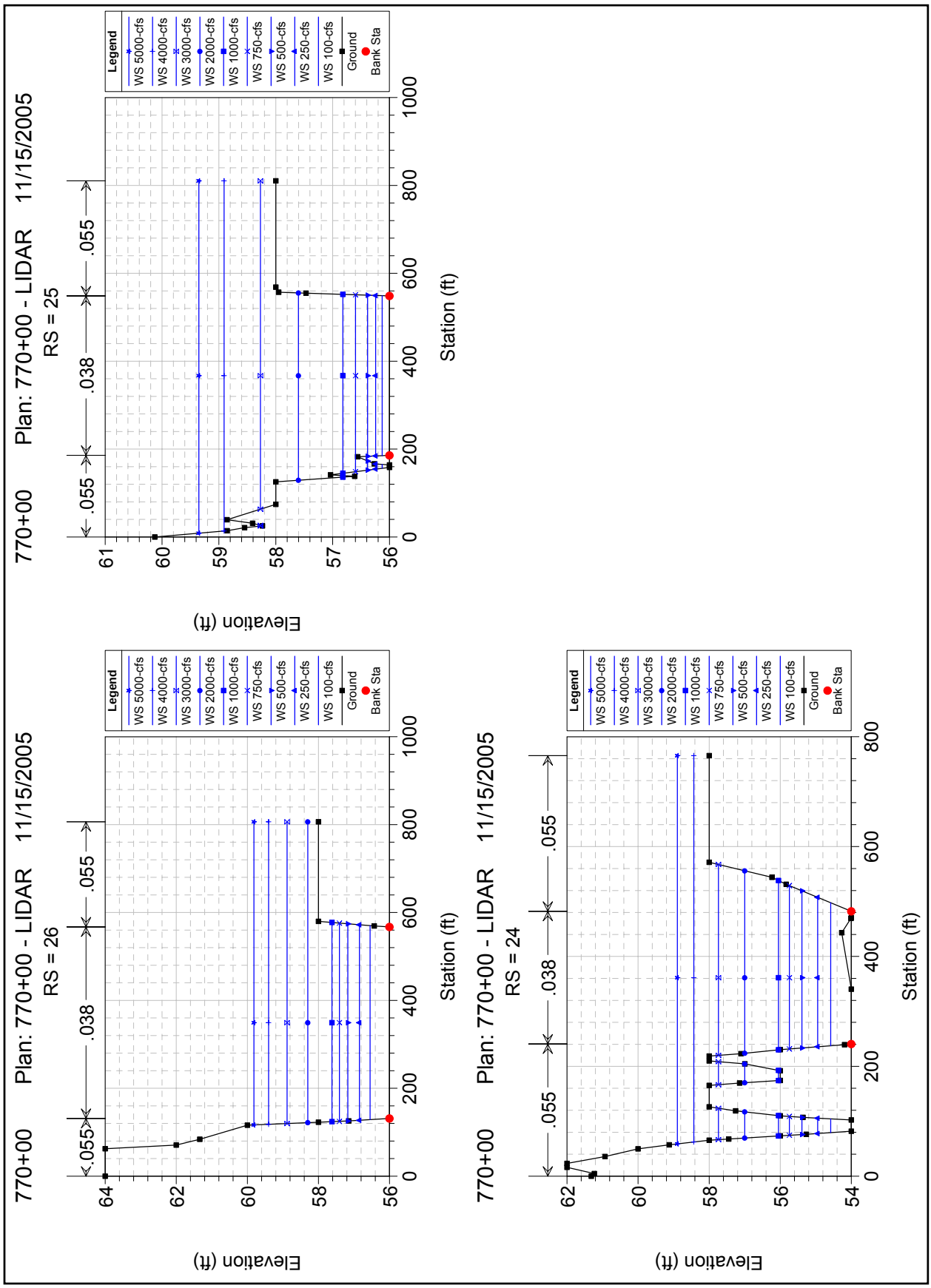
Bank Sta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WS 100-cfs
Ground
Bank Sta
Elevation (ft)
Station (ft)
770+00
Plan: 770+00 - LIDAR
11/15/2005
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Elevation (ft)
Station (ft)
770+00
Plan: 770+00 - LIDAR
11/15/2005
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.038
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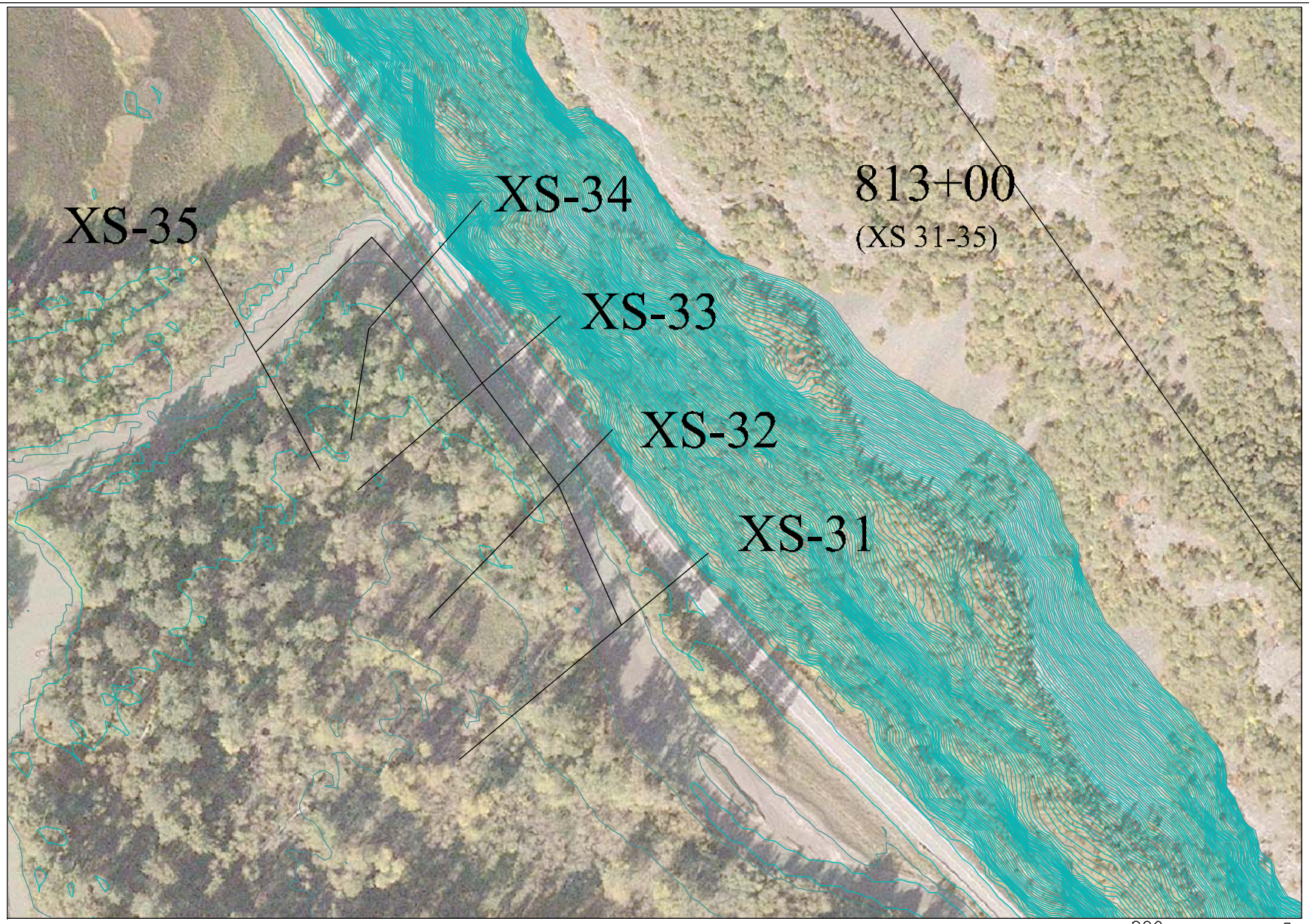
Elevation (ft)
Station (ft)

HEC-RAS Plan: 770 LIDAR River: Chilkat Reach: 770+00

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
770+00	24	100-cfs	100.00		54.00	54.58	54.22	54.59	0.000902	0.58	0.51	0.75	140.85	285.28	241.56	0.18	0.03
770+00	24	250-cfs	250.00		54.00	54.95	54.37	54.96	0.000901	0.95	0.87	1.07	248.63	299.88	241.56	0.20	0.05
770+00	24	500-cfs	500.00		54.00	55.39	54.54	55.42	0.000901	1.39	1.32	1.41	385.05	317.32	241.56	0.22	0.07
770+00	24	750-cfs	750.00		54.00	55.74	54.69	55.78	0.000901	1.74	1.67	1.65	499.65	331.42	241.56	0.23	0.09
770+00	24	1000-cfs	1000.00		54.00	56.05	54.82	56.10	0.000901	2.05	1.97	1.85	603.64	363.52	241.56	0.23	0.11
770+00	24	2000-cfs	2000.00		54.00	57.00	55.26	57.08	0.000900	3.00	2.93	2.40	974.70	414.23	241.56	0.25	0.16
770+00	24	3000-cfs	3000.00		54.00	57.74	55.62	57.84	0.000901	3.74	3.66	2.79	1292.48	446.59	241.56	0.26	0.21
770+00	24	4000-cfs	4000.00		54.00	58.43	55.93	58.56	0.000901	4.43	4.36	3.13	1713.72	703.39	241.56	0.26	0.25
770+00	24	5000-cfs	5000.00		54.00	58.90	56.25	59.04	0.000900	4.90	4.82	3.35	2041.28	706.86	241.56	0.27	0.27
770+00	25	100-cfs	100.00	407.00	56.00	56.13	56.13	56.20	0.044458	0.13	0.13	2.11	47.88	372.86	362.68	1.03	0.36
770+00	25	250-cfs	250.00	407.00	56.00	56.24	56.24	56.36	0.033779	0.24	0.24	2.80	90.47	376.87	362.68	1.00	0.51
770+00	25	500-cfs	500.00	407.00	56.00	56.38	56.38	56.58	0.029101	0.38	0.38	3.53	144.53	387.26	362.68	1.00	0.70
770+00	25	750-cfs	750.00	407.00	56.00	56.60	56.50	56.77	0.014831	0.60	0.60	3.38	228.81	402.35	362.68	0.77	0.55
770+00	25	1000-cfs	1000.00	407.00	56.00	56.82	56.61	56.98	0.008984	0.82	0.82	3.25	319.27	410.45	362.68	0.63	0.46
770+00	25	2000-cfs	2000.00	407.00	56.00	57.60		57.76	0.003680	1.60	1.60	3.25	647.77	426.17	362.68	0.45	0.37
770+00	25	3000-cfs	3000.00	407.00	56.00	58.27		58.44	0.002538	2.27	2.27	3.40	1018.33	748.76	362.68	0.40	0.36
770+00	25	4000-cfs	4000.00	407.00	56.00	58.91		59.06	0.001699	2.91	2.91	3.28	1514.20	796.83	362.68	0.34	0.31
770+00	25	5000-cfs	5000.00	407.00	56.00	59.35		59.50	0.001489	3.35	3.35	3.38	1869.56	801.80	362.68	0.33	0.31
770+00	26	100-cfs	100.00	794.00	56.00	56.55		56.55	0.000255	0.55	0.55	0.42	240.23	441.38	435.54	0.10	0.01
770+00	26	250-cfs	250.00	794.00	56.00	56.85		56.85	0.000374	0.85	0.85	0.68	371.97	444.90	435.54	0.13	0.02
770+00	26	500-cfs	500.00	794.00	56.00	57.17		57.19	0.000498	1.17	1.17	0.97	519.07	448.74	435.54	0.16	0.04
770+00	26	750-cfs	750.00	794.00	56.00	57.41		57.43	0.000609	1.41	1.41	1.21	624.74	451.08	435.54	0.18	0.05
770+00	26	1000-cfs	1000.00	794.00	56.00	57.62		57.65	0.000680	1.62	1.62	1.41	719.42	453.17	435.54	0.19	0.07
770+00	26	2000-cfs	2000.00	794.00	56.00	58.30		58.36	0.000823	2.30	2.30	1.95	1097.38	684.37	435.54	0.23	0.12
770+00	26	3000-cfs	3000.00	794.00	56.00	58.88		58.96	0.000803	2.88	2.88	2.24	1497.83	686.38	435.54	0.23	0.14
770+00	26	4000-cfs	4000.00	794.00	56.00	59.40		59.49	0.000771	3.40	3.40	2.46	1853.99	688.17	435.54	0.23	0.16
770+00	26	5000-cfs	5000.00	794.00	56.00	59.81		59.92	0.000788	3.81	3.81	2.68	2138.51	689.59	435.54	0.24	0.19
770+00	27	100-cfs	100.00	1163.00	56.00	56.70		56.72	0.000930	0.70	0.70	0.94	107.12	154.88	149.91	0.20	0.04
770+00	27	250-cfs	250.00	1163.00	56.00	57.07		57.10	0.001435	1.07	1.07	1.55	163.90	156.96	149.91	0.26	0.10
770+00	27	500-cfs	500.00	1163.00	56.00	57.46		57.54	0.002012	1.46	1.46	2.26	225.76	159.25	149.91	0.33	0.18
770+00	27	750-cfs	750.00	1163.00	56.00	57.74		57.86	0.002489	1.74	1.74	2.82	271.26	161.12	149.91	0.38	0.27
770+00	27	1000-cfs	1000.00	1163.00	56.00	57.98		58.15	0.002887	1.98	1.98	3.31	309.45	162.67	149.91	0.41	0.36
770+00	27	2000-cfs	2000.00	1163.00	56.00	58.71		58.93	0.002914	2.71	2.71	4.10	688.64	533.38	149.91	0.44	0.49
770+00	27	3000-cfs	3000.00	1163.00	56.00	59.27		59.50	0.002657	3.27	3.27	4.44	989.60	535.16	149.91	0.43	0.54
770+00	27	4000-cfs	4000.00	1163.00	56.00	59.76		60.01	0.002460	3.76	3.76	4.69	1254.14	536.77	149.91	0.43	0.58
770+00	27	5000-cfs	5000.00	1163.00	56.00	60.17		60.44	0.002406	4.17	4.17	4.97	1476.99	548.51	149.91	0.43	0.63
770+00	28	100-cfs	100.00	1507.00	56.00	56.87		56.87	0.000266	0.87	0.87	0.58	174.35	204.70	197.38	0.11	0.01
770+00	28	250-cfs	250.00	1507.00	56.00	57.33		57.34	0.000398	1.33	1.33	0.94	269.47	208.59	197.38	0.14	0.03
770+00	28	500-cfs	500.00	1507.00	56.00	57.83		57.86	0.000537	1.83	1.83	1.36	376.37	212.87	197.38	0.18	0.06
770+00	28	750-cfs	750.00	1507.00	56.00	58.22		58.26	0.000636	2.22	2.22	1.68	466.22	256.48	197.38	0.20	0.09
770+00	28	1000-cfs	1000.00	1507.00	56.00	58.54		58.59	0.000707	2.54	2.54	1.93	550.45	269.65	197.38	0.21	0.11
770+00	28	2000-cfs	2000.00	1507.00	56.00	59.37		59.48	0.001033	3.37	3.37	2.82	788.57	303.60	197.38	0.27	0.22
770+00	28	3000-cfs	3000.00	1507.00	56.00	59.93		60.11	0.001325	3.93	3.93	3.55	969.21	375.37	197.38	0.32	0.33
770+00	28	4000-cfs	4000.00	1507.00	56.00	60.41		60.65	0.001568	4.41	4.41	4.16	1203.85	514.69	197.38	0.35	0.43
770+00	28	5000-cfs	5000.00	1507.00	56.00	60.82		61.10	0.001671	4.82	4.82	4.56	1415.43	515.97	197.38	0.37	0.50
770+00	29	100-cfs	100.00	1823.00	56.00	56.94		56.94	0.000172	0.94	0.94	0.49	208.31	230.71	214.17	0.09	0.01
770+00	29	250-cfs	250.00	1823.00	56.00	57.43		57.44	0.000256	1.43	1.43	0.79	324.77	238.79	214.17	0.12	0.02
770+00	29	500-cfs	500.00	1823.00	56.00	57.98		58.00	0.000342	1.98	1.98	1.14	457.64	247.69	214.17	0.14	0.04
770+00	29	750-cfs	750.00	1823.00	56.00	58.39		58.41	0.000382	2.39	2.39	1.36	663.66	519.76	214.17	0.16	0.06
770+00	29	1000-cfs	1000.00	1823.00	56.00	58.73		58.76	0.000389	2.73	2.73	1.50	840.59	522.83	214.17	0.16	0.07
770+00	29	2000-cfs	2000.00	1823.00	56.00	59.65		59.70	0.000457	3.65	3.65	1.98	1327.57	531.19	214.17	0.18	0.10
770+00	29	3000-cfs	3000.00	1823.00	56.00	60.31		60.38	0.000521	4.31	4.31	2.36	1678.55	536.60	214.17	0.20	0.14

HEC-RAS Plan: 770 LIDAR River: Chilkat Reach: 770+00 (Continued)

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
770+00	29	4000-cfs	4000.00	1823.00	56.00	60.86		60.95	0.000569	4.86	4.86	2.68	1977.45	540.83	214.17	0.21	0.17
770+00	29	5000-cfs	5000.00	1823.00	56.00	61.32		61.42	0.000622	5.32	5.32	2.97	2225.05	544.34	214.17	0.23	0.21
770+00	30	100-cfs	100.00	2236.00	56.00	57.01		57.01	0.000169	1.01	1.01	0.51	199.99	205.14	192.13	0.09	0.01
770+00	30	250-cfs	250.00	2236.00	56.00	57.54		57.55	0.000253	1.54	1.54	0.83	310.26	210.79	192.13	0.12	0.02
770+00	30	500-cfs	500.00	2236.00	56.00	58.12		58.14	0.000344	2.12	2.12	1.20	434.98	221.90	192.13	0.14	0.05
770+00	30	750-cfs	750.00	2236.00	56.00	58.55		58.58	0.000414	2.55	2.55	1.48	534.45	242.02	192.13	0.16	0.07
770+00	30	1000-cfs	1000.00	2236.00	56.00	58.89		58.94	0.000478	2.89	2.89	1.73	630.45	329.87	192.13	0.18	0.09
770+00	30	2000-cfs	2000.00	2236.00	56.00	59.84		59.93	0.000639	3.84	3.84	2.43	994.40	393.87	192.13	0.22	0.15
770+00	30	3000-cfs	3000.00	2236.00	56.00	60.53		60.64	0.000750	4.53	4.53	2.93	1328.63	519.66	192.13	0.24	0.21
770+00	30	4000-cfs	4000.00	2236.00	56.00	61.10		61.23	0.000798	5.10	5.10	3.27	1624.97	519.66	192.13	0.26	0.25
770+00	30	5000-cfs	5000.00	2236.00	56.00	61.57		61.73	0.000852	5.57	5.57	3.59	1871.53	519.66	192.13	0.27	0.30



−200 0 100 200

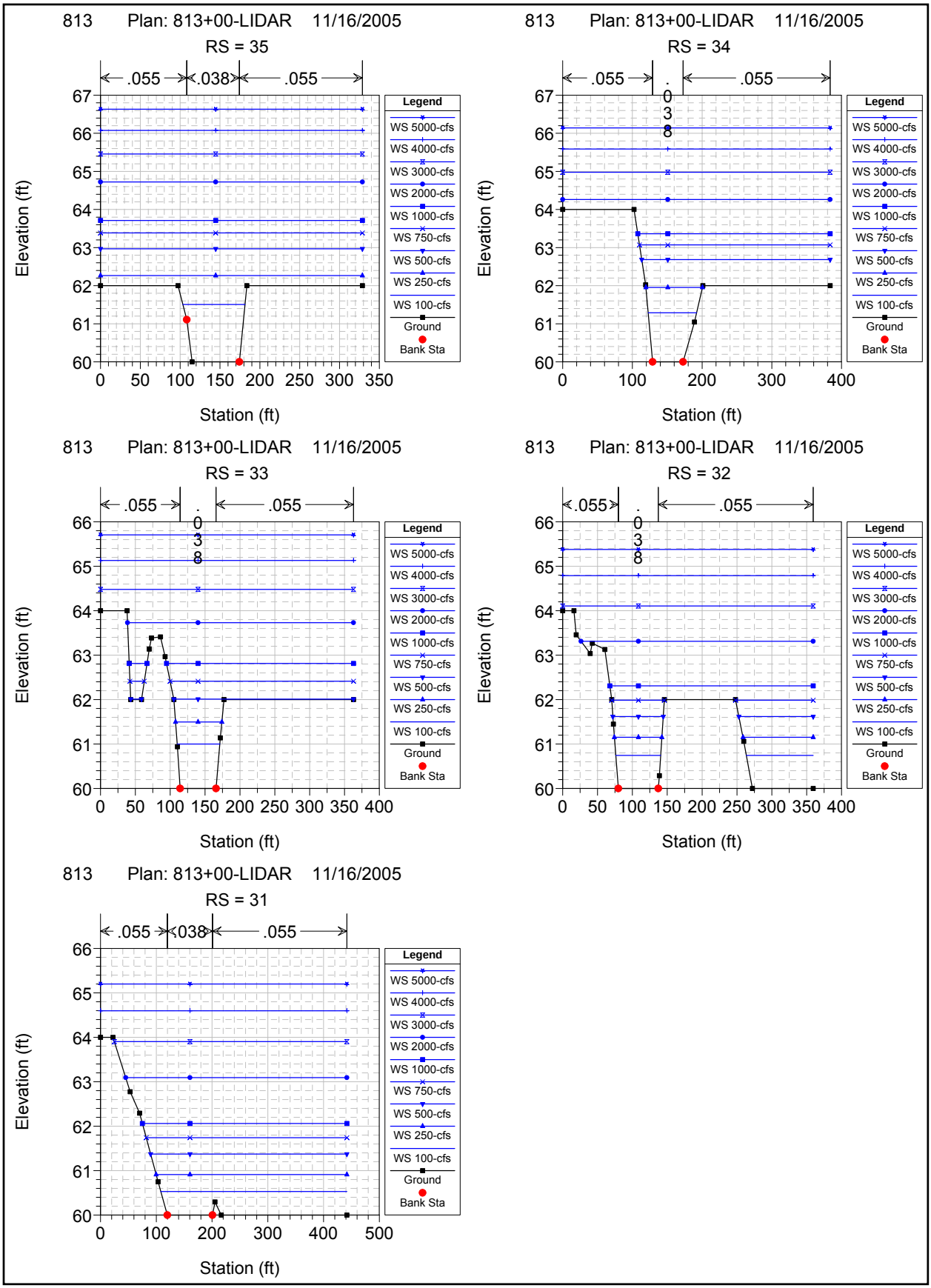
1 inch = 200 ft.

inter·fluve, inc.
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.4591
www.interfluve.com

Haines Highway – HEC–RAS Schematic

S&HI Station 813+00

F-152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Station (ft)
Legend
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WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
813 Plan: 813+00-LIDAR 11/16/2005
RS = 34
.055 .038 .055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
813 Plan: 813+00-LIDAR 11/16/2005
RS = 33
.055 .038 .055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
813 Plan: 813+00-LIDAR 11/16/2005
RS = 32
.055 .038 .055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta
813 Plan: 813+00-LIDAR 11/16/2005
RS = 31
.055 .038 .055
Elevation (ft)
Station (ft)
Legend
WS 5000-cfs
WS 4000-cfs
WS 3000-cfs
WS 2000-cfs
WS 1000-cfs
WS 750-cfs
WS 500-cfs
WS 250-cfs
WS 100-cfs
Ground
Bank Sta

HEC-RAS Plan: 813 LIDAR River: Chilkat Reach: 813+00

Reach	River Sta	Profile	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
813+00	31	100-cfs	100.00		60.00	60.53	60.15	60.54	0.000901	0.53	0.53	0.77	171.75	333.76	80.92	0.19	0.03
813+00	31	250-cfs	250.00		60.00	60.91	60.28	60.92	0.000901	0.91	0.91	1.10	300.43	342.10	80.92	0.20	0.05
813+00	31	500-cfs	500.00		60.00	61.37	60.44	61.39	0.000900	1.37	1.37	1.45	460.20	351.95	80.92	0.22	0.08
813+00	31	750-cfs	750.00		60.00	61.74	60.58	61.77	0.000901	1.74	1.74	1.70	591.74	359.85	80.92	0.23	0.10
813+00	31	1000-cfs	1000.00		60.00	62.06	60.69	62.10	0.000900	2.06	2.06	1.90	708.19	366.71	80.92	0.23	0.12
813+00	31	2000-cfs	2000.00		60.00	63.09	61.09	63.15	0.000901	3.09	3.09	2.49	1101.13	396.63	80.92	0.25	0.17
813+00	31	3000-cfs	3000.00		60.00	63.90	61.42	63.98	0.000900	3.90	3.90	2.91	1431.83	417.03	80.92	0.26	0.22
813+00	31	4000-cfs	4000.00		60.00	64.60	61.72	64.70	0.000901	4.60	4.60	3.25	1736.04	441.79	80.92	0.27	0.26
813+00	31	5000-cfs	5000.00		60.00	65.20	61.99	65.31	0.000901	5.20	5.20	3.52	2001.32	441.79	80.92	0.27	0.29
813+00	32	100-cfs	100.00	209.00	60.00	60.74		60.76	0.001222	0.74	0.74	1.12	113.37	160.32	57.37	0.23	0.06
813+00	32	250-cfs	250.00	209.00	60.00	61.15		61.19	0.001740	1.15	1.15	1.79	180.50	168.88	57.37	0.29	0.13
813+00	32	500-cfs	500.00	209.00	60.00	61.62		61.69	0.002180	1.62	1.62	2.52	261.91	178.96	57.37	0.35	0.22
813+00	32	750-cfs	750.00	209.00	60.00	61.99		62.08	0.002436	1.99	1.99	3.05	328.87	186.69	57.37	0.38	0.30
813+00	32	1000-cfs	1000.00	209.00	60.00	62.31		62.45	0.003099	2.31	2.31	3.80	421.50	291.70	57.37	0.44	0.45
813+00	32	2000-cfs	2000.00	209.00	60.00	63.31		63.48	0.002502	3.31	3.31	4.34	721.98	332.96	57.37	0.42	0.52
813+00	32	3000-cfs	3000.00	209.00	60.00	64.11		64.30	0.002216	4.11	4.11	4.72	994.85	359.39	57.37	0.41	0.57
813+00	32	4000-cfs	4000.00	209.00	60.00	64.79		65.00	0.002034	4.79	4.79	5.01	1240.06	359.39	57.37	0.40	0.61
813+00	32	5000-cfs	5000.00	209.00	60.00	65.38		65.62	0.001953	5.38	5.38	5.31	1452.26	359.39	57.37	0.40	0.66
813+00	33	100-cfs	100.00	383.00	60.00	61.00		61.05	0.002276	1.00	1.00	1.87	56.29	61.02	51.61	0.33	0.14
813+00	33	250-cfs	250.00	383.00	60.00	61.50		61.64	0.003579	1.50	1.50	3.06	87.88	66.35	51.61	0.44	0.33
813+00	33	500-cfs	500.00	383.00	60.00	62.01	61.39	62.33	0.005503	2.01	2.01	4.62	125.49	273.31	51.61	0.57	0.69
813+00	33	750-cfs	750.00	383.00	60.00	62.41		62.73	0.004907	2.41	2.41	4.93	237.69	283.60	51.61	0.56	0.74
813+00	33	1000-cfs	1000.00	383.00	60.00	62.81		63.07	0.003722	2.81	2.81	4.75	353.07	293.81	51.61	0.50	0.65
813+00	33	2000-cfs	2000.00	383.00	60.00	63.73		64.00	0.003286	3.73	3.73	5.39	637.42	324.13	51.61	0.49	0.77
813+00	33	3000-cfs	3000.00	383.00	60.00	64.48		64.77	0.002948	4.48	4.48	5.77	898.61	362.90	51.61	0.48	0.82
813+00	33	4000-cfs	4000.00	383.00	60.00	65.13		65.43	0.002643	5.13	5.13	5.98	1134.86	362.90	51.61	0.47	0.85
813+00	33	5000-cfs	5000.00	383.00	60.00	65.71		66.02	0.002476	5.71	5.71	6.21	1343.71	362.90	51.61	0.46	0.88
813+00	34	100-cfs	100.00	554.00	60.00	61.29		61.32	0.001149	1.29	1.29	1.57	73.26	69.51	43.70	0.24	0.09
813+00	34	250-cfs	250.00	554.00	60.00	61.95		62.03	0.001600	1.95	1.95	2.44	123.42	81.21	43.70	0.31	0.20
813+00	34	500-cfs	500.00	554.00	60.00	62.68		62.77	0.001361	2.68	2.68	2.79	310.10	270.16	43.70	0.30	0.23
813+00	34	750-cfs	750.00	554.00	60.00	63.07		63.17	0.001446	3.07	3.07	3.14	414.99	273.41	43.70	0.32	0.28
813+00	34	1000-cfs	1000.00	554.00	60.00	63.36		63.47	0.001577	3.36	3.36	3.49	495.45	275.88	43.70	0.33	0.33
813+00	34	2000-cfs	2000.00	554.00	60.00	64.26		64.44	0.001962	4.26	4.26	4.55	773.85	383.62	43.70	0.39	0.52
813+00	34	3000-cfs	3000.00	554.00	60.00	64.98		65.18	0.001947	4.98	4.98	5.03	1047.78	383.62	43.70	0.40	0.60
813+00	34	4000-cfs	4000.00	554.00	60.00	65.59		65.81	0.001930	5.59	5.59	5.41	1281.67	383.62	43.70	0.40	0.67
813+00	34	5000-cfs	5000.00	554.00	60.00	66.14		66.39	0.001905	6.14	6.14	5.72	1494.05	383.62	43.70	0.41	0.73
813+00	35	100-cfs	100.00	855.00	60.00	61.50		61.52	0.000414	1.50	1.45	1.02	101.99	78.01	66.11	0.15	0.04
813+00	35	250-cfs	250.00	855.00	60.00	62.27		62.30	0.000542	2.27	2.21	1.54	230.14	328.74	66.11	0.18	0.07
813+00	35	500-cfs	500.00	855.00	60.00	62.97		63.00	0.000486	2.97	2.91	1.76	461.31	328.74	66.11	0.18	0.09
813+00	35	750-cfs	750.00	855.00	60.00	63.38		63.43	0.000547	3.38	3.33	2.04	597.63	328.74	66.11	0.20	0.11
813+00	35	1000-cfs	1000.00	855.00	60.00	63.71		63.76	0.000609	3.71	3.66	2.29	705.40	328.74	66.11	0.21	0.14
813+00	35	2000-cfs	2000.00	855.00	60.00	64.72		64.81	0.000772	4.72	4.67	3.03	1037.31	328.74	66.11	0.25	0.22
813+00	35	3000-cfs	3000.00	855.00	60.00	65.46		65.57	0.000910	5.46	5.40	3.63	1278.92	328.74	66.11	0.28	0.31
813+00	35	4000-cfs	4000.00	855.00	60.00	66.08		66.23	0.001018	6.08	6.02	4.13	1482.86	328.74	66.11	0.30	0.38
813+00	35	5000-cfs	5000.00	855.00	60.00	66.63		66.82	0.001102	6.63	6.58	4.55	1665.84	328.74	66.11	0.31	0.45

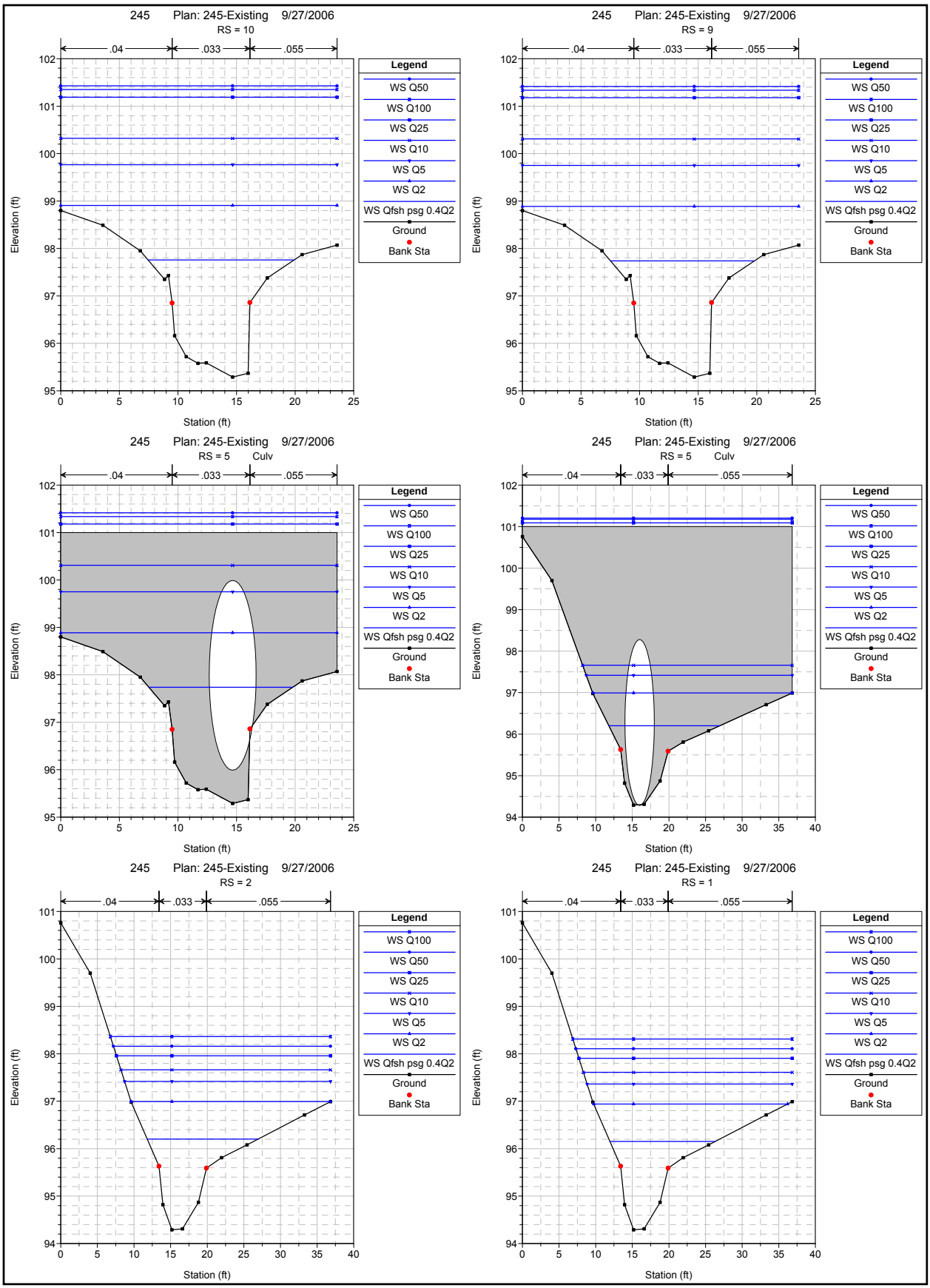
23.5.2 Hydraulic Output – Tributaries

Conversion from relative datum: As described in Section 3.2 cursory survey was collected as part of Inter-Fluve's October 2005 field investigations. These survey data were used for the preliminary HEC-RAS hydraulic modeling shown in this appendix. Approximate conversions to ADOT&PF datum was obtained by comparing elevations of features at each site surveyed by Inter-Fluve and ADOT&PF or Toner-Nordling. The approximate datum conversion is noted below. Subtract the elevation difference noted in the table from the Inter-Fluve survey and models for stations noted in the table to obtain approximate ADOT&PF elevations. Elevations for culverts not noted in the table are based on ADOT&PF datum. Design level survey of stream cross sections, topography, bathymetry and profiles – based on ADOT&PF project datum - will be required at all culverts to finalize designs for submittal at Plans-in-Hand.

Culvert (2009 Stationing)	Datum conversion elevation difference (IFI interim datum) – (elevation difference) ~ (ADOT&PF datum)
222+51	74.42-ft
319+13	68.83-ft
324+79	69.17-ft
483+18	57.63-ft
512+24	57.88-ft

Tributary 222+51 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 245+50
Model based on relative datum. Subtract 74.42-ft for approximate conversion to ADOT&PF project datum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.033
.055
Elevation (ft)
Station (ft)
Legend
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WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245-Existing 9/27/2006
RS = 9
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q50
WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245-Existing 9/27/2006
RS = 5 Culv
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q50
WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245-Existing 9/27/2006
RS = 5 Culv
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q50
WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245-Existing 9/27/2006
RS = 2
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245-Existing 9/27/2006
RS = 1
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
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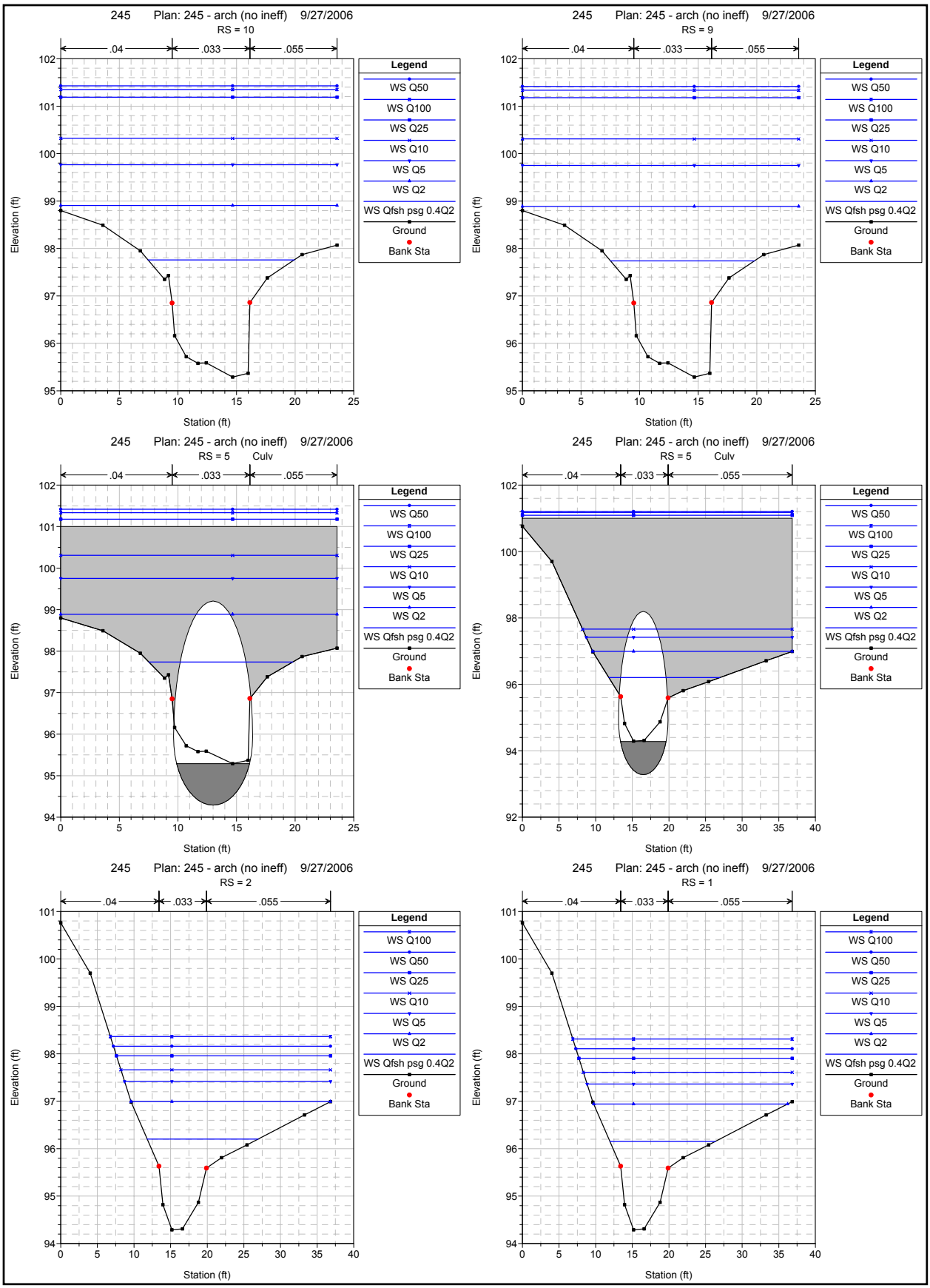
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta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.055
Elevation (ft)
Station (ft)
Legend
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WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245 - arch (no ineff) 9/27/2006
RS = 9
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q50
WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245 - arch (no ineff) 9/27/2006
RS = 5 Culv
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q50
WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245 - arch (no ineff) 9/27/2006
RS = 5 Culv
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q50
WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245 - arch (no ineff) 9/27/2006
RS = 2
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta
245 Plan: 245 - arch (no ineff) 9/27/2006
RS = 1
.04
.033
.055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfsh psg 0.4Q2
Ground
Bank Sta

HEC-RAS River: Trib 245 Reach: 245

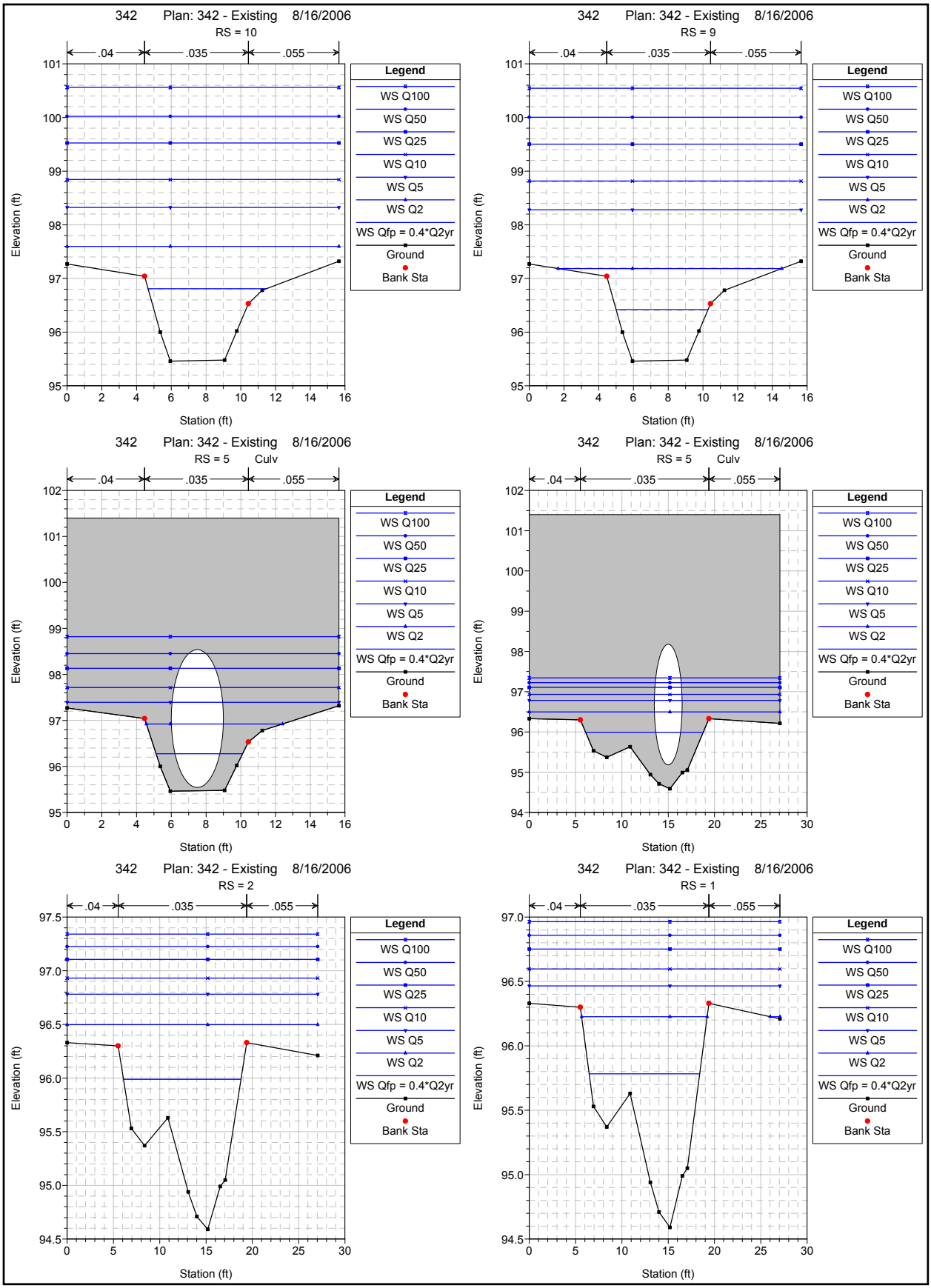
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
245	1	Lo	Arch -noinef	5.00		94.29	95.37	94.81	95.39	0.001001	1.08	0.76	1.11	4.51	5.97	5.97	0.22	0.04
245	1	Lo	245-Ex	5.00		94.29	95.37	94.81	95.39	0.001001	1.08	0.76	1.11	4.51	5.97	5.97	0.22	0.04
245	1	Lo	Arch -noinef	10.00		94.29	95.78	95.01	95.81	0.001001	1.49	1.10	1.40	7.32	8.67	6.48	0.24	0.06
245	1	Lo	245-Ex	10.00		94.29	95.78	95.01	95.81	0.001001	1.49	1.10	1.40	7.32	8.67	6.48	0.24	0.06
245	1	Qfsh psg 0.4Q2	Arch -noinef	17.00		94.29	96.15	95.23	96.20	0.001001	1.86	1.47	1.70	11.61	14.40	6.48	0.25	0.08
245	1	Qfsh psg 0.4Q2	245-Ex	17.00		94.29	96.15	95.23	96.20	0.001001	1.86	1.47	1.70	11.61	14.40	6.48	0.25	0.08
245	1	Lo	Arch -noinef	30.00		94.29	96.62	95.54	96.68	0.001002	2.33	1.94	2.05	20.06	21.57	6.48	0.26	0.11
245	1	Lo	245-Ex	30.00		94.29	96.62	95.54	96.68	0.001002	2.33	1.94	2.05	20.06	21.57	6.48	0.26	0.11
245	1	Q2	Arch -noinef	42.00		94.29	96.94	95.79	97.00	0.001000	2.65	2.26	2.26	27.68	26.48	6.48	0.27	0.13
245	1	Q2	245-Ex	42.00		94.29	96.94	95.79	97.00	0.001000	2.65	2.26	2.26	27.68	26.48	6.48	0.27	0.13
245	1	Q5	Arch -noinef	64.00		94.29	97.36	96.22	97.44	0.001001	3.07	2.68	2.54	39.36	28.02	6.48	0.27	0.15
245	1	Q5	245-Ex	64.00		94.29	97.36	96.22	97.44	0.001001	3.07	2.68	2.54	39.36	28.02	6.48	0.27	0.15
245	1	Q10	Arch -noinef	79.00		94.29	97.61	96.43	97.69	0.001001	3.32	2.93	2.69	46.29	28.52	6.48	0.28	0.16
245	1	Q10	245-Ex	79.00		94.29	97.61	96.43	97.69	0.001001	3.32	2.93	2.69	46.29	28.52	6.48	0.28	0.16
245	1	Q25	Arch -noinef	99.00		94.29	97.90	96.66	97.99	0.001001	3.61	3.22	2.87	54.79	29.13	6.48	0.28	0.18
245	1	Q25	245-Ex	99.00		94.29	97.90	96.66	97.99	0.001001	3.61	3.22	2.87	54.79	29.13	6.48	0.28	0.18
245	1	Q50	Arch -noinef	114.00		94.29	98.11	96.80	98.20	0.001002	3.82	3.43	2.99	60.72	29.54	6.48	0.28	0.19
245	1	Q50	245-Ex	114.00		94.29	98.11	96.80	98.20	0.001002	3.82	3.43	2.99	60.72	29.54	6.48	0.28	0.19
245	1	Q100	Arch -noinef	130.00		94.29	98.31	96.98	98.41	0.001001	4.02	3.63	3.10	66.80	29.96	6.48	0.29	0.20
245	1	Q100	245-Ex	130.00		94.29	98.31	96.98	98.41	0.001001	4.02	3.63	3.10	66.80	29.96	6.48	0.29	0.20
245	2	Lo	Arch -noinef	5.00	49.00	94.29	95.42		95.43	0.000840	1.13	0.79	1.04	4.80	6.07	6.07	0.21	0.04
245	2	Lo	245-Ex	5.00	49.00	94.29	95.42		95.43	0.000840	1.13	0.79	1.04	4.80	6.07	6.07	0.21	0.04
245	2	Lo	Arch -noinef	10.00	49.00	94.29	95.83		95.86	0.000862	1.54	1.15	1.34	7.75	9.32	6.48	0.22	0.05
245	2	Lo	245-Ex	10.00	49.00	94.29	95.83		95.86	0.000862	1.54	1.15	1.34	7.75	9.32	6.48	0.22	0.05
245	2	Qfsh psg 0.4Q2	Arch -noinef	17.00	49.00	94.29	96.20		96.24	0.000879	1.91	1.52	1.63	12.36	15.16	6.48	0.23	0.07
245	2	Qfsh psg 0.4Q2	245-Ex	17.00	49.00	94.29	96.20		96.24	0.000879	1.91	1.52	1.63	12.36	15.16	6.48	0.23	0.07
245	2	Lo	Arch -noinef	30.00	49.00	94.29	96.67		96.73	0.000893	2.38	1.99	1.97	21.20	22.36	6.48	0.25	0.10
245	2	Lo	245-Ex	30.00	49.00	94.29	96.67		96.73	0.000893	2.38	1.99	1.97	21.20	22.36	6.48	0.25	0.10
245	2	Q2	Arch -noinef	42.00	49.00	94.29	96.99		97.05	0.000900	2.70	2.31	2.18	29.09	27.26	6.48	0.25	0.12
245	2	Q2	245-Ex	42.00	49.00	94.29	96.99		97.05	0.000900	2.70	2.31	2.18	29.09	27.26	6.48	0.25	0.12
245	2	Q5	Arch -noinef	64.00	49.00	94.29	97.42		97.48	0.000910	3.13	2.74	2.45	40.85	28.13	6.48	0.26	0.14
245	2	Q5	245-Ex	64.00	49.00	94.29	97.42		97.48	0.000910	3.13	2.74	2.45	40.85	28.13	6.48	0.26	0.14
245	2	Q10	Arch -noinef	79.00	49.00	94.29	97.66		97.74	0.000919	3.37	2.98	2.61	47.80	28.63	6.48	0.27	0.15
245	2	Q10	245-Ex	79.00	49.00	94.29	97.66		97.74	0.000919	3.37	2.98	2.61	47.80	28.63	6.48	0.27	0.15
245	2	Q25	Arch -noinef	99.00	49.00	94.29	97.96		98.04	0.000928	3.67	3.28	2.79	56.32	29.24	6.48	0.27	0.17
245	2	Q25	245-Ex	99.00	49.00	94.29	97.96		98.04	0.000928	3.67	3.28	2.79	56.32	29.24	6.48	0.27	0.17
245	2	Q50	Arch -noinef	114.00	49.00	94.29	98.16		98.24	0.000934	3.87	3.48	2.92	62.28	29.65	6.48	0.28	0.18
245	2	Q50	245-Ex	114.00	49.00	94.29	98.16		98.24	0.000934	3.87	3.48	2.92	62.28	29.65	6.48	0.28	0.18
245	2	Q100	Arch -noinef	130.00	49.00	94.29	98.36		98.45	0.000937	4.07	3.68	3.03	68.39	30.07	6.48	0.28	0.19
245	2	Q100	245-Ex	130.00	49.00	94.29	98.36		98.45	0.000938	4.07	3.68	3.03	68.38	30.07	6.48	0.28	0.19
245	5			Culvert														
245	9	Lo	Arch -noinef	5.00	121.00	95.29	95.77	95.77	95.92	0.026851	0.48	0.29	3.12	1.60	5.44	5.44	1.01	0.46
245	9	Lo	245-Ex	5.00	121.00	95.29	96.94	95.77	96.94	0.000147	1.65	1.35	0.56	8.96	6.90	6.63	0.08	0.01
245	9	Lo	Arch -noinef	10.00	121.00	95.29	95.95	95.95	96.18	0.024210	0.66	0.45	3.83	2.61	5.86	5.86	1.01	0.61
245	9	Lo	245-Ex	10.00	121.00	95.29	97.32	95.95	97.33	0.000252	2.03	1.73	0.87	11.85	8.21	6.63	0.12	0.02
245	9	Qfsh psg 0.4Q2	Arch -noinef	17.00	121.00	95.29	96.15	96.15	96.46	0.022221	0.86	0.61	4.43	3.84	6.33	6.33	1.00	0.74
245	9	Qfsh psg 0.4Q2	245-Ex	17.00	121.00	95.29	97.74	96.15	97.76	0.000339	2.45	2.15	1.16	16.13	12.28	6.63	0.14	0.04
245	9	Lo	Arch -noinef	30.00	121.00	95.29	96.67	96.43	96.94	0.010352	1.38	1.09	4.18	7.18	6.56	6.56	0.70	0.56
245	9	Lo	245-Ex	30.00	121.00	95.29	98.37	96.43	98.40	0.000373	3.08	2.78	1.44	26.50	19.29	6.63	0.15	0.05
245	9	Q2	Arch -noinef	42.00	121.00	95.29	97.07	96.65	97.35	0.007521	1.78	1.48	4.27	9.91	7.36	6.63	0.62	0.54
245	9	Q2	245-Ex	42.00	121.00	95.29	98.89	96.65	98.92	0.000340	3.60	3.30	1.54	37.62	23.58	6.63	0.15	0.05
245	9	Q5	Arch -noinef	64.00	121.00	95.29	97.68	97.01	97.99	0.005310	2.39	2.09	4.51	15.44	11.74	6.63	0.55	0.53
245	9	Q5	245-Ex	64.00	121.00	95.29	99.75	97.01	99.78	0.000260	4.46	4.16	1.58	57.97	23.58	6.63	0.14	0.05
245	9	Q10	Arch -noinef	79.00	121.00	95.29	98.11	97.25	98.40	0.003956	2.82	2.52	4.41	21.66	17.75	6.63	0.49	0.48
245	9	Q10	245-Ex	79.00	121.00	95.29	100.31	97.25	100.34	0.000225	5.02	4.72	1.60	71.13	23.58	6.63	0.13	0.05
245	9	Q25	Arch -noinef	99.00	121.00	95.29	98.75	97.57	98.95	0.002330	3.46	3.16	3.93	34.27	22.94	6.63	0.39	0.35
245	9	Q25	245-Ex	99.00	121.00	95.29	101.18	97.57	101.20	0.000173	5.89	5.59	1.57	91.63	23.58	6.63	0.12	0.05
245	9	Q50	Arch -noinef	114.00	121.00	95.29	99.27	97.79	99.41	0.001476	3.98	3.68	3.46	46.55	23.58	6.63	0.32	0.26
245	9	Q50	245-Ex	114.00	121.00	95.29	101.42	97.79	101.45	0.000193	6.13	5.83	1.70	97.24	23.58	6.63	0.12	0.05
245	9	Q100	Arch -noinef	130.00	121.00	95.29	99.88	98.04	99.99	0.000932	4.59	4.29	3.05	61.05	23.58	6.63	0.26	0.19
245	9	Q100	245-Ex	130.00	121.00	95.29	101.34	98.04	101.38	0.000266	6.05	5.75	1.98	95.33	23.58	6.63	0.15	0.07

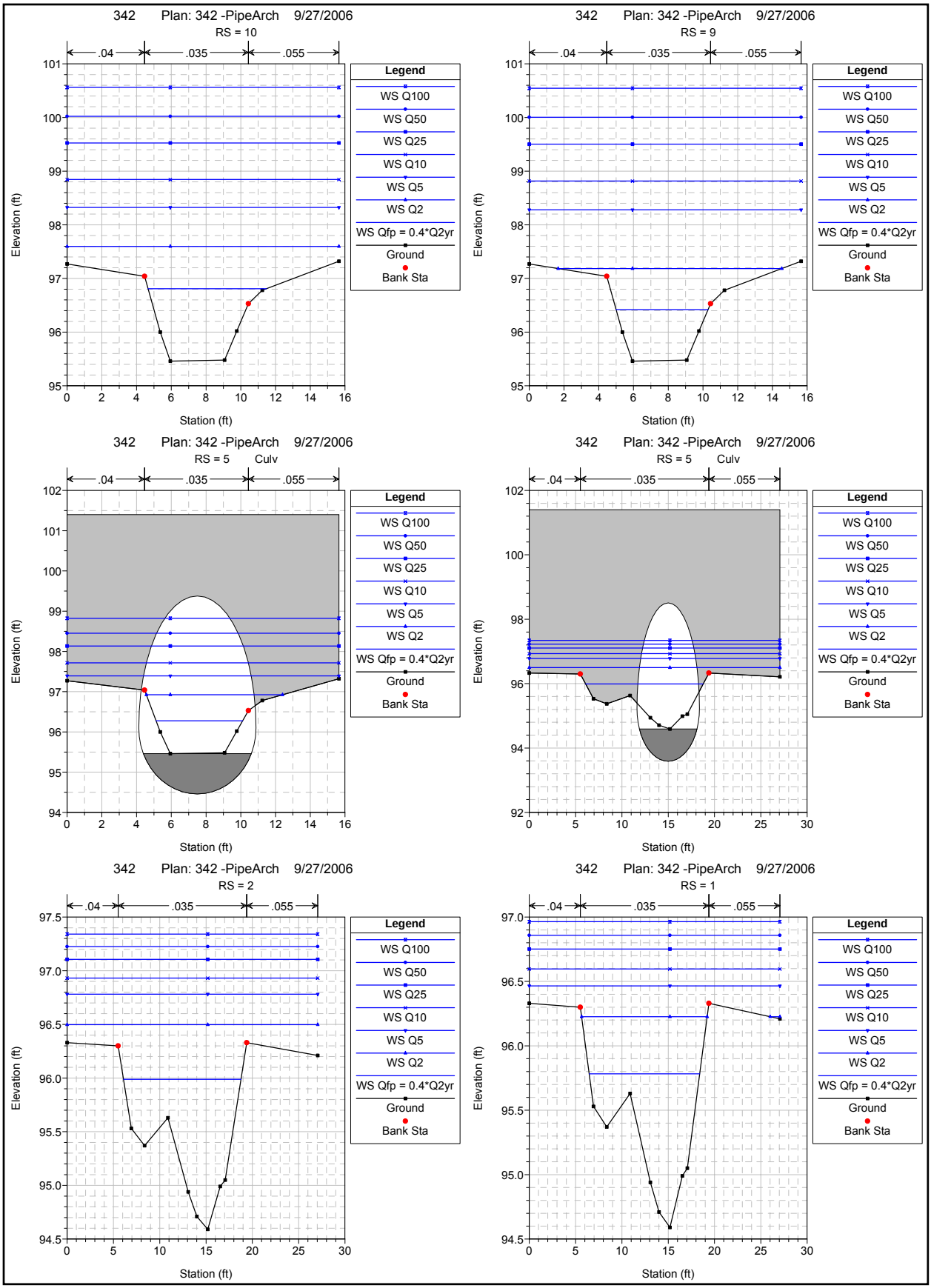
HEC-RAS River: Trib 245 Reach: 245 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
245	10	Lo	Arch -noinef	5.00	178.00	95.29	96.17		96.19	0.001802	0.88	0.62	1.27	3.92	6.35	6.35	0.29	0.06
245	10	Lo	245-Ex	5.00	178.00	95.29	96.95		96.95	0.000144	1.66	1.36	0.56	9.01	6.93	6.63	0.08	0.01
245	10	Lo	Arch -noinef	10.00	178.00	95.29	96.45		96.50	0.002247	1.16	0.89	1.74	5.74	6.47	6.47	0.33	0.10
245	10	Lo	245-Ex	10.00	178.00	95.29	97.34		97.35	0.000245	2.05	1.75	0.86	11.97	8.26	6.63	0.11	0.02
245	10	Qfsh psg 0.4Q2	Arch -noinef	17.00	178.00	95.29	96.74		96.82	0.002752	1.45	1.16	2.22	7.65	6.59	6.59	0.36	0.16
245	10	Qfsh psg 0.4Q2	245-Ex	17.00	178.00	95.29	97.76		97.78	0.000328	2.47	2.17	1.15	16.37	12.47	6.63	0.14	0.03
245	10	Lo	Arch -noinef	30.00	178.00	95.29	97.13		97.27	0.003349	1.84	1.54	2.92	10.37	7.57	6.63	0.41	0.25
245	10	Lo	245-Ex	30.00	178.00	95.29	98.40		98.42	0.000360	3.11	2.81	1.43	26.92	19.42	6.63	0.15	0.05
245	10	Q2	Arch -noinef	42.00	178.00	95.29	97.47		97.64	0.003349	2.18	1.88	3.33	13.17	9.72	6.63	0.43	0.30
245	10	Q2	245-Ex	42.00	178.00	95.29	98.91		98.94	0.000330	3.62	3.32	1.53	38.09	23.58	6.63	0.15	0.05
245	10	Q5	Arch -noinef	64.00	178.00	95.29	98.02		98.22	0.003043	2.73	2.43	3.77	19.99	16.36	6.63	0.43	0.35
245	10	Q5	245-Ex	64.00	178.00	95.29	99.77		99.79	0.000256	4.48	4.18	1.57	58.32	23.58	6.63	0.14	0.05
245	10	Q10	Arch -noinef	79.00	178.00	95.29	98.38		98.58	0.002544	3.09	2.79	3.78	26.69	19.35	6.63	0.40	0.34
245	10	Q10	245-Ex	79.00	178.00	95.29	100.32		100.35	0.000223	5.03	4.73	1.59	71.44	23.58	6.63	0.13	0.05
245	10	Q25	Arch -noinef	99.00	178.00	95.29	98.90		99.07	0.001845	3.61	3.31	3.61	37.97	23.58	6.63	0.35	0.29
245	10	Q25	245-Ex	99.00	178.00	95.29	101.19		101.21	0.000171	5.90	5.60	1.56	91.86	23.58	6.63	0.12	0.05
245	10	Q50	Arch -noinef	114.00	178.00	95.29	99.36		99.49	0.001308	4.07	3.77	3.31	48.77	23.58	6.63	0.30	0.24
245	10	Q50	245-Ex	114.00	178.00	95.29	101.43		101.46	0.000192	6.14	5.84	1.70	97.51	23.58	6.63	0.12	0.05
245	10	Q100	Arch -noinef	130.00	178.00	95.29	99.94		100.04	0.000878	4.65	4.35	2.99	62.39	23.58	6.63	0.25	0.18
245	10	Q100	245-Ex	130.00	178.00	95.29	101.35		101.39	0.000263	6.06	5.76	1.97	95.69	23.58	6.63	0.14	0.07

Tributary 319+13 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 342+00
Model based on relative datum. Subtract 68.83-ft for approximate conversion to ADOT&PF project datum


342 Plan: 342 - Existing 8/16/2006
RS = 10
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 - Existing 8/16/2006
RS = 9
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 - Existing 8/16/2006
RS = 5 Culv
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 - Existing 8/16/2006
RS = 5 Culv
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 - Existing 8/16/2006
RS = 2
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 - Existing 8/16/2006
RS = 1
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta


342 Plan: 342 -PipeArch 9/27/2006
RS = 10
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 -PipeArch 9/27/2006
RS = 9
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 -PipeArch 9/27/2006
RS = 5 Culv
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 -PipeArch 9/27/2006
RS = 5 Culv
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 -PipeArch 9/27/2006
RS = 2
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
342 Plan: 342 -PipeArch 9/27/2006
RS = 1
.04 .035 .055
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta

HEC-RAS River: Trib 342 Reach: 342

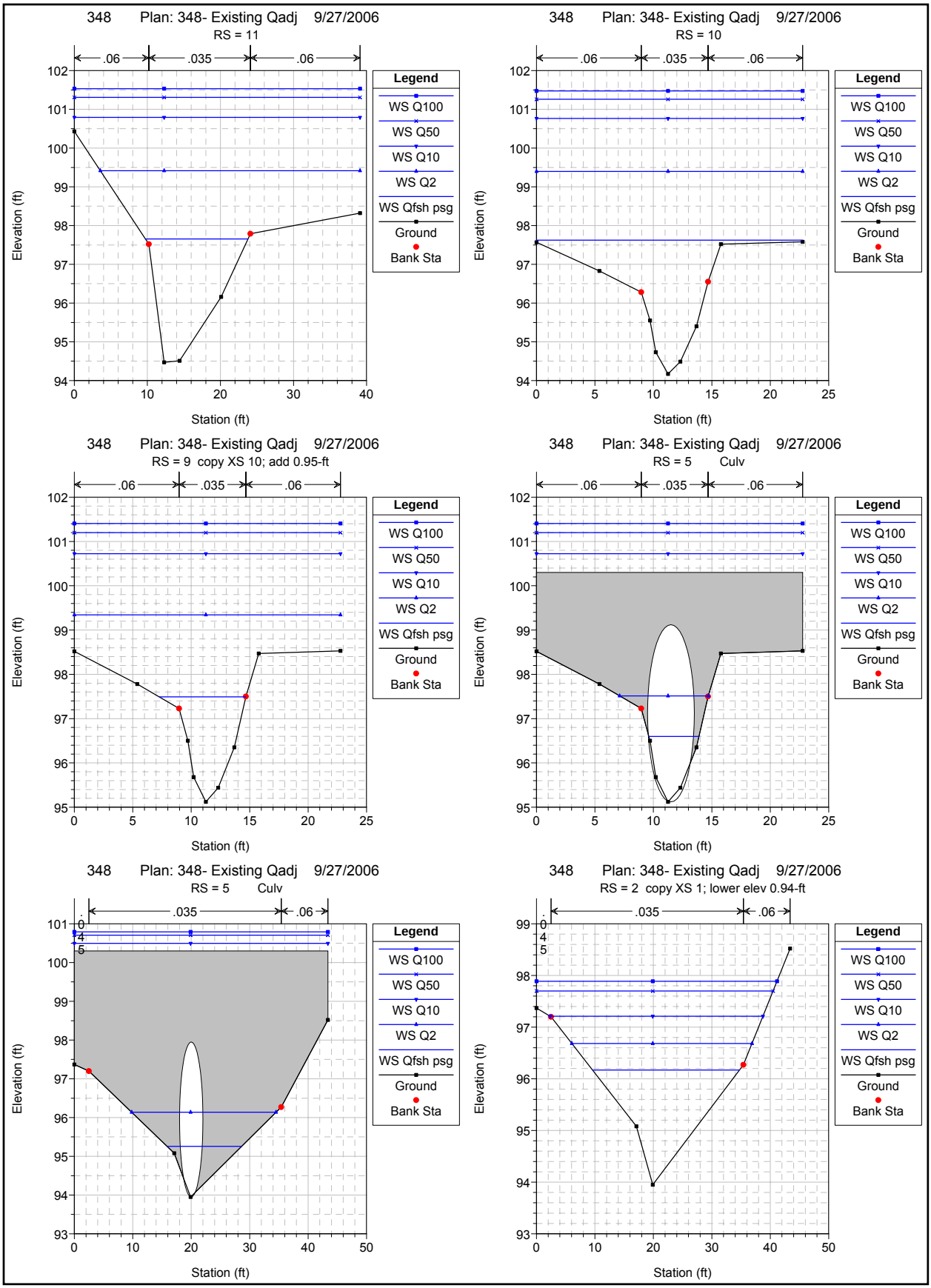
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
342	1	Lo	342-Sim	10.00		94.59	95.55	95.35	95.64	0.010703	0.96	0.41	2.39	4.19	10.09	10.09	0.65	0.27
342	1	Lo	342-Ex	10.00		94.59	95.55	95.35	95.64	0.010703	0.96	0.41	2.39	4.19	10.09	10.09	0.65	0.27
342	1	Qfp = 0.4*Q2yr	342-Sim	20.00		94.59	95.78	95.64	95.92	0.010703	1.19	0.57	2.94	6.80	11.93	11.93	0.69	0.37
342	1	Qfp = 0.4*Q2yr	342-Ex	20.00		94.59	95.78	95.64	95.92	0.010703	1.19	0.57	2.94	6.80	11.93	11.93	0.69	0.37
342	1	Lo	342-Sim	30.00		94.59	95.95	95.79	96.13	0.010719	1.36	0.71	3.39	8.86	12.54	12.54	0.71	0.45
342	1	Lo	342-Ex	30.00		94.59	95.95	95.79	96.13	0.010719	1.36	0.71	3.39	8.86	12.54	12.54	0.71	0.45
342	1	Lo	342-Sim	40.00		94.59	96.10	95.92	96.31	0.010701	1.51	0.82	3.73	10.73	13.08	13.08	0.73	0.52
342	1	Lo	342-Ex	40.00		94.59	96.10	95.92	96.31	0.010701	1.51	0.82	3.73	10.73	13.08	13.08	0.73	0.52
342	1	Q2	342-Sim	50.00		94.59	96.23	96.03	96.48	0.010708	1.64	0.92	4.02	12.46	14.60	13.55	0.74	0.58
342	1	Q2	342-Ex	50.00		94.59	96.23	96.03	96.48	0.010708	1.64	0.92	4.02	12.46	14.60	13.55	0.74	0.58
342	1	Q5	342-Sim	75.00		94.59	96.47	96.37	96.79	0.010709	1.88	1.14	4.62	18.08	27.06	13.87	0.76	0.72
342	1	Q5	342-Ex	75.00		94.59	96.47	96.37	96.79	0.010709	1.88	1.14	4.62	18.08	27.06	13.87	0.76	0.72
342	1	Q10	342-Sim	93.00		94.59	96.60	96.53	96.96	0.010705	2.01	1.27	4.97	21.64	27.06	13.87	0.78	0.80
342	1	Q10	342-Ex	93.00		94.59	96.60	96.53	96.96	0.010705	2.01	1.27	4.97	21.64	27.06	13.87	0.78	0.80
342	1	Q25	342-Sim	117.00		94.59	96.75	96.69	97.16	0.010716	2.16	1.42	5.37	25.83	27.06	13.87	0.79	0.90
342	1	Q25	342-Ex	117.00		94.59	96.75	96.69	97.16	0.010716	2.16	1.42	5.37	25.83	27.06	13.87	0.79	0.90
342	1	Q50	342-Sim	135.00		94.59	96.86	96.79	97.30	0.010712	2.27	1.53	5.63	28.72	27.06	13.87	0.80	0.97
342	1	Q50	342-Ex	135.00		94.59	96.86	96.79	97.30	0.010712	2.27	1.53	5.63	28.72	27.06	13.87	0.80	0.97
342	1	Q100	342-Sim	154.00		94.59	96.96	96.88	97.44	0.010710	2.37	1.63	5.89	31.58	27.06	13.87	0.81	1.04
342	1	Q100	342-Ex	154.00		94.59	96.96	96.88	97.44	0.010710	2.37	1.63	5.89	31.58	27.06	13.87	0.81	1.04
342	2	Lo	342-Sim	10.00	22.00	94.59	95.73		95.77	0.003570	1.14	0.53	1.61	6.19	11.74	11.74	0.39	0.11
342	2	Lo	342-Ex	10.00	22.00	94.59	95.73		95.77	0.003570	1.14	0.53	1.61	6.19	11.74	11.74	0.39	0.11
342	2	Qfp = 0.4*Q2yr	342-Sim	20.00	22.00	94.59	95.99		96.06	0.004077	1.40	0.74	2.14	9.33	12.68	12.68	0.44	0.18
342	2	Qfp = 0.4*Q2yr	342-Ex	20.00	22.00	94.59	95.99		96.06	0.004063	1.40	0.74	2.14	9.34	12.68	12.68	0.44	0.18
342	2	Lo	342-Sim	30.00	22.00	94.59	96.18		96.28	0.004458	1.59	0.89	2.53	11.86	13.39	13.39	0.47	0.23
342	2	Lo	342-Ex	30.00	22.00	94.59	96.18		96.28	0.004457	1.59	0.89	2.53	11.86	13.39	13.39	0.47	0.23
342	2	Lo	342-Sim	40.00	22.00	94.59	96.35		96.47	0.004611	1.76	1.02	2.82	14.89	27.06	13.87	0.49	0.28
342	2	Lo	342-Ex	40.00	22.00	94.59	96.35		96.47	0.004610	1.76	1.02	2.82	14.89	27.06	13.87	0.49	0.28
342	2	Q2	342-Sim	50.00	22.00	94.59	96.50		96.63	0.004267	1.91	1.17	2.97	18.95	27.06	13.87	0.48	0.30
342	2	Q2	342-Ex	50.00	22.00	94.59	96.50		96.63	0.004260	1.91	1.17	2.97	18.97	27.06	13.87	0.48	0.29
342	2	Q5	342-Sim	75.00	22.00	94.59	96.78		96.94	0.004055	2.19	1.45	3.35	26.64	27.06	13.87	0.49	0.35
342	2	Q5	342-Ex	75.00	22.00	94.59	96.78		96.94	0.004062	2.19	1.45	3.35	26.62	27.06	13.87	0.49	0.35
342	2	Q10	342-Sim	93.00	22.00	94.59	96.93		97.12	0.004225	2.34	1.60	3.65	30.70	27.06	13.87	0.51	0.40
342	2	Q10	342-Ex	93.00	22.00	94.59	96.93		97.12	0.004228	2.34	1.60	3.65	30.69	27.06	13.87	0.51	0.40
342	2	Q25	342-Sim	117.00	22.00	94.59	97.11		97.33	0.004461	2.52	1.78	4.02	35.43	27.06	13.87	0.53	0.47
342	2	Q25	342-Ex	117.00	22.00	94.59	97.11		97.32	0.004465	2.52	1.78	4.02	35.41	27.06	13.87	0.53	0.47
342	2	Q50	342-Sim	135.00	22.00	94.59	97.22		97.47	0.004627	2.63	1.89	4.27	38.63	27.06	13.87	0.55	0.52
342	2	Q50	342-Ex	135.00	22.00	94.59	97.22		97.47	0.004631	2.63	1.89	4.27	38.61	27.06	13.87	0.55	0.52
342	2	Q100	342-Sim	154.00	22.00	94.59	97.34		97.61	0.004787	2.75	2.01	4.52	41.78	27.06	13.87	0.56	0.57
342	2	Q100	342-Ex	154.00	22.00	94.59	97.34		97.61	0.004791	2.75	2.01	4.52	41.77	27.06	13.87	0.56	0.57
342	5			Culvert														
342	9	Lo	342-Sim	10.00	77.00	95.46	96.09	96.09	96.36	0.025408	0.63	0.53	4.14	2.42	4.59	4.59	1.00	0.76
342	9	Lo	342-Ex	10.00	77.00	95.46	97.14	96.09	97.16	0.000647	1.68	1.36	1.19	9.18	11.69	5.98	0.18	0.05
342	9	Qfp = 0.4*Q2yr	342-Sim	20.00	77.00	95.46	96.42	96.42	96.80	0.023537	0.96	0.76	4.98	4.02	5.30	5.30	1.01	0.98
342	9	Qfp = 0.4*Q2yr	342-Ex	20.00	77.00	95.46	97.91	96.42	97.93	0.000385	2.45	2.14	1.24	21.00	15.65	5.98	0.15	0.04
342	9	Lo	342-Sim	30.00	77.00	95.46	96.67	96.67	97.15	0.021856	1.21	0.96	5.54	5.45	6.12	5.66	1.00	1.13
342	9	Lo	342-Ex	30.00	77.00	95.46	98.59	96.67	98.61	0.000278	3.13	2.81	1.27	31.57	15.65	5.98	0.13	0.04
342	9	Lo	342-Sim	40.00	77.00	95.46	96.90	96.90	97.44	0.019710	1.44	1.15	5.90	6.99	7.65	5.86	0.97	1.21
342	9	Lo	342-Ex	40.00	77.00	95.46	99.29	96.90	99.31	0.000210	3.83	3.51	1.28	42.48	15.65	5.98	0.12	0.04
342	9	Q2	342-Sim	50.00	77.00	95.46	97.18	97.13	97.68	0.014403	1.72	1.41	5.75	9.71	12.87	5.98	0.85	1.08
342	9	Q2	342-Ex	50.00	77.00	95.46	100.31	97.13	100.32	0.000130	4.85	4.53	1.19	58.44	15.65	5.98	0.10	0.03
342	9	Q5	342-Sim	75.00	77.00	95.46	98.28	97.56	98.45	0.002794	2.82	2.50	3.72	26.70	15.65	5.98	0.41	0.37
342	9	Q5	342-Ex	75.00	77.00	95.46	101.83	97.56	101.85	0.000108	6.37	6.05	1.32	82.29	15.65	5.98	0.09	0.03
342	9	Q10	342-Sim	93.00	77.00	95.46	98.82	97.73	98.97	0.001974	3.36	3.04	3.56	35.10	15.65	5.98	0.36	0.32
342	9	Q10	342-Ex	93.00	77.00	95.46	102.16	97.73	102.18	0.000139	6.70	6.38	1.55	87.38	15.65	5.98	0.11	0.05
342	9	Q25	342-Sim	117.00	77.00	95.46	99.50	97.93	99.64	0.001441	4.04	3.73	3.48	45.86	15.65	5.98	0.32	0.29
342	9	Q25	342-Ex	117.00	77.00	95.46	102.51	97.93	102.55	0.000184	7.05	6.73	1.85	92.91	15.65	5.98	0.13	0.07
342	9	Q50	342-Sim	135.00	77.00	95.46	100.00	98.07	100.14	0.001211	4.54	4.23	3.47	53.71	15.65	5.98	0.30	0.27
342	9	Q50	342-Ex	135.00	77.00	95.46	102.74	98.07	102.78	0.000220	7.28	6.96	2.06	96.44	15.65	5.98	0.14	0.08

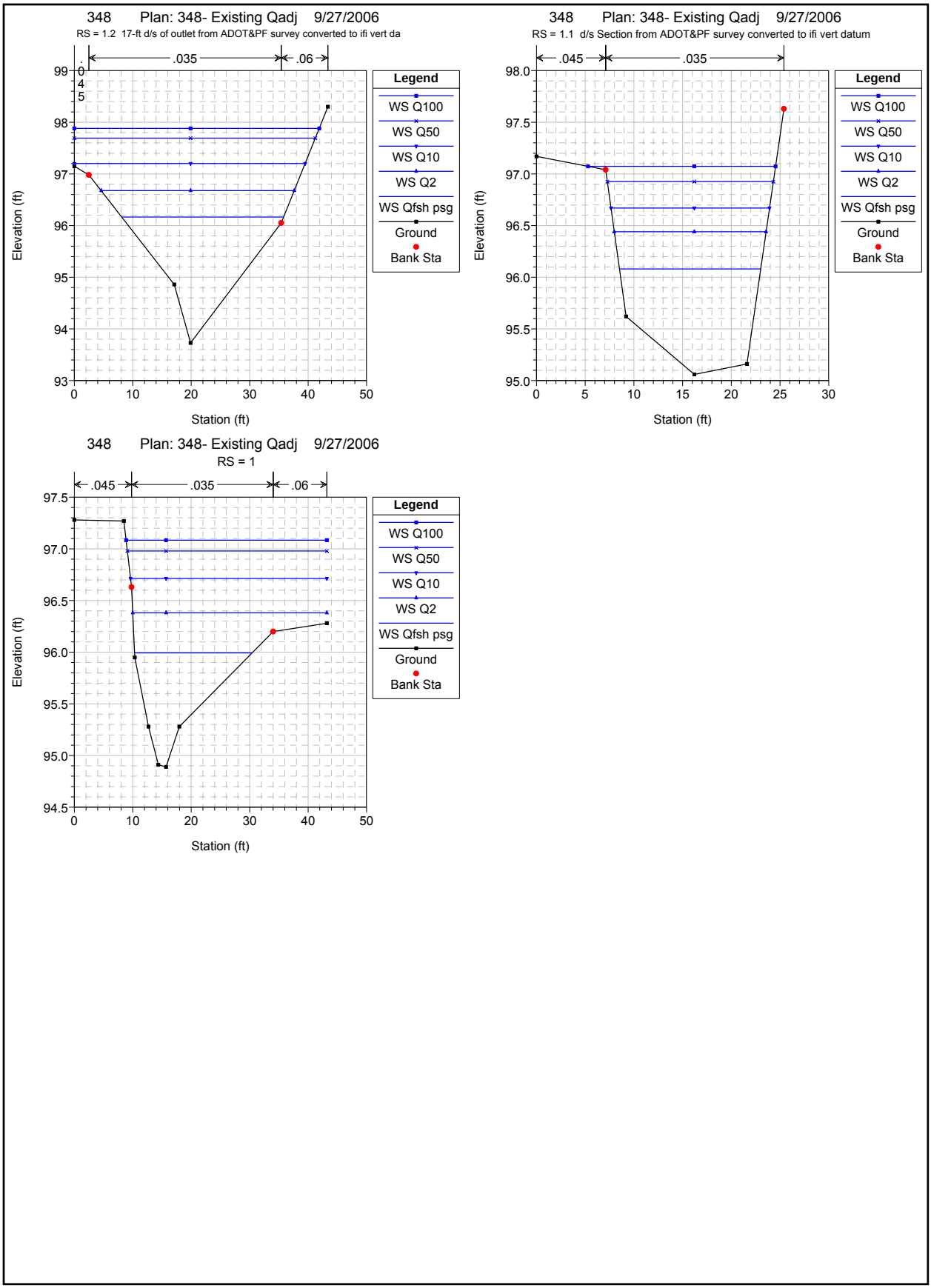
HEC-RAS River: Trib 342 Reach: 342 (Continued)

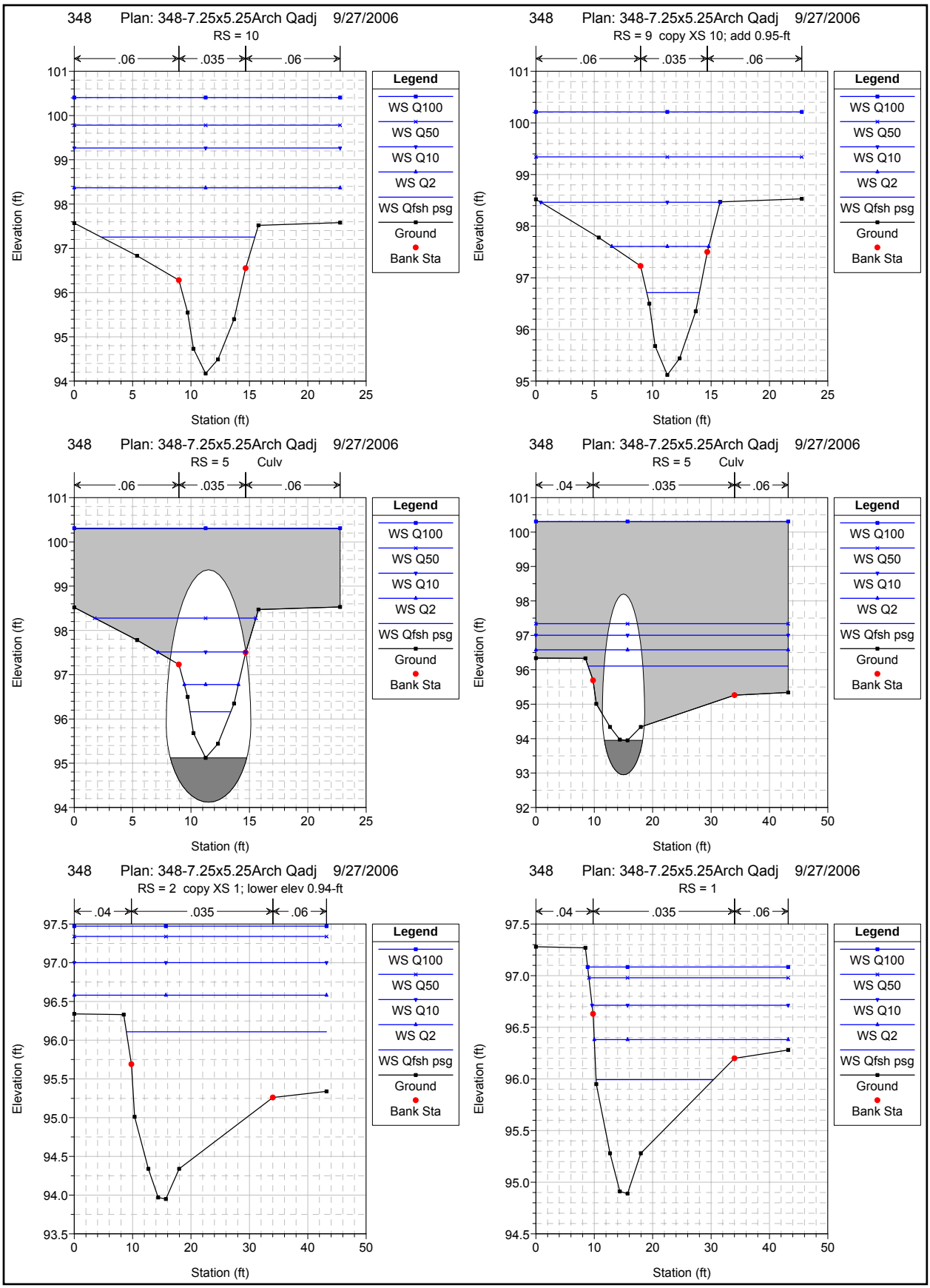
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
342	9	Q100	342-Sim	154.00	77.00	95.46	100.55	98.20	100.68	0.001029	5.09	4.77	3.47	62.18	15.65	5.98	0.28	0.26
342	9	Q100	342-Ex	154.00	77.00	95.46	102.97	98.20	103.03	0.000257	7.51	7.19	2.28	100.12	15.65	5.98	0.15	0.10
342	10	Lo	342-Sim	10.00	90.00	95.46	96.42		96.52	0.005847	0.96	0.76	2.48	4.03	5.30	5.30	0.50	0.24
342	10	Lo	342-Ex	10.00	90.00	95.46	97.15		97.17	0.000632	1.69	1.37	1.18	9.29	11.93	5.98	0.18	0.05
342	10	Qfp = 0.4*Q2yr	342-Sim	20.00	90.00	95.46	96.81		96.97	0.006377	1.35	1.07	3.21	6.33	6.82	5.78	0.55	0.37
342	10	Qfp = 0.4*Q2yr	342-Ex	20.00	90.00	95.46	97.92		97.94	0.000381	2.46	2.14	1.24	21.08	15.65	5.98	0.15	0.04
342	10	Lo	342-Sim	30.00	90.00	95.46	97.11		97.31	0.006383	1.65	1.33	3.69	8.80	10.76	5.98	0.56	0.45
342	10	Lo	342-Ex	30.00	90.00	95.46	98.59		98.61	0.000277	3.13	2.82	1.27	31.63	15.65	5.98	0.13	0.04
342	10	Lo	342-Sim	40.00	90.00	95.46	97.38	96.90	97.59	0.005468	1.92	1.60	3.86	12.57	15.65	5.98	0.54	0.47
342	10	Lo	342-Ex	40.00	90.00	95.46	99.29		99.31	0.000210	3.83	3.51	1.28	42.52	15.65	5.98	0.12	0.04
342	10	Q2	342-Sim	50.00	90.00	95.46	97.60	97.13	97.81	0.004843	2.14	1.82	3.96	16.03	15.65	5.98	0.52	0.47
342	10	Q2	342-Ex	50.00	90.00	95.46	100.31		100.32	0.000130	4.85	4.53	1.19	58.46	15.65	5.98	0.10	0.03
342	10	Q5	342-Sim	75.00	90.00	95.46	98.32		98.49	0.002599	2.86	2.55	3.63	27.40	15.65	5.98	0.40	0.35
342	10	Q5	342-Ex	75.00	90.00	95.46	101.83		101.85	0.000108	6.37	6.06	1.32	82.31	15.65	5.98	0.09	0.03
342	10	Q10	342-Sim	93.00	90.00	95.46	98.85		98.99	0.001901	3.39	3.07	3.51	35.56	15.65	5.98	0.35	0.31
342	10	Q10	342-Ex	93.00	90.00	95.46	102.16		102.18	0.000139	6.70	6.38	1.55	87.41	15.65	5.98	0.11	0.05
342	10	Q25	342-Sim	117.00	90.00	95.46	99.52		99.66	0.001412	4.06	3.75	3.46	46.18	15.65	5.98	0.31	0.28
342	10	Q25	342-Ex	117.00	90.00	95.46	102.51		102.55	0.000184	7.05	6.74	1.85	92.95	15.65	5.98	0.13	0.07
342	10	Q50	342-Sim	135.00	90.00	95.46	100.02		100.16	0.001194	4.56	4.25	3.46	53.98	15.65	5.98	0.30	0.27
342	10	Q50	342-Ex	135.00	90.00	95.46	102.74		102.78	0.000220	7.28	6.96	2.06	96.48	15.65	5.98	0.14	0.08
342	10	Q100	342-Sim	154.00	90.00	95.46	100.56		100.69	0.001018	5.10	4.78	3.45	62.40	15.65	5.98	0.28	0.26
342	10	Q100	342-Ex	154.00	90.00	95.46	102.97		103.03	0.000257	7.51	7.20	2.28	100.17	15.65	5.98	0.15	0.10

Tributary 324+79 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 347+50
Model based on relative datum. Subtract 69.17-ft for approximate conversion to ADOT&PF project datum


348 Plan: 348- Existing Qadj 9/27/2006
RS = 11
.06 .035 .06
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
348 Plan: 348- Existing Qadj 9/27/2006
RS = 10
.06 .035 .06
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
348 Plan: 348- Existing Qadj 9/27/2006
RS = 9 copy XS 10; add 0.95-ft
.06 .035 .06
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
348 Plan: 348- Existing Qadj 9/27/2006
RS = 5 Culv
.06 .035 .06
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
348 Plan: 348- Existing Qadj 9/27/2006
RS = 5 Culv
.035 .06
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
348 Plan: 348- Existing Qadj 9/27/2006
RS = 2 copy XS 1; lower elev 0.94-ft
.035 .06
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
Elevation (ft)
Station (ft)


348 Plan: 348- Existing Qadj 9/27/2006
RS = 1.2 17-ft d/s of outlet from ADOT&PF survey converted to ifi vert da
.045
.035
.06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
348 Plan: 348- Existing Qadj 9/27/2006
RS = 1.1 d/s Section from ADOT&PF survey converted to ifi vert datum
.045
.035
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
348 Plan: 348- Existing Qadj 9/27/2006
RS = 1
.045
.035
.06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta


348 Plan: 348-7.25x5.25Arch Qadj 9/27/2006
RS = 10
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
348 Plan: 348-7.25x5.25Arch Qadj 9/27/2006
RS = 9 copy XS 10; add 0.95-ft
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
348 Plan: 348-7.25x5.25Arch Qadj 9/27/2006
RS = 5 Culv
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
348 Plan: 348-7.25x5.25Arch Qadj 9/27/2006
RS = 5 Culv
.04 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
348 Plan: 348-7.25x5.25Arch Qadj 9/27/2006
RS = 2 copy XS 1; lower elev 0.94-ft
.04 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta
348 Plan: 348-7.25x5.25Arch Qadj 9/27/2006
RS = 1
.04 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
WS Q2
WS Qfsh psg
Ground
Bank Sta

HEC-RAS River: 348 Trib Reach: 348

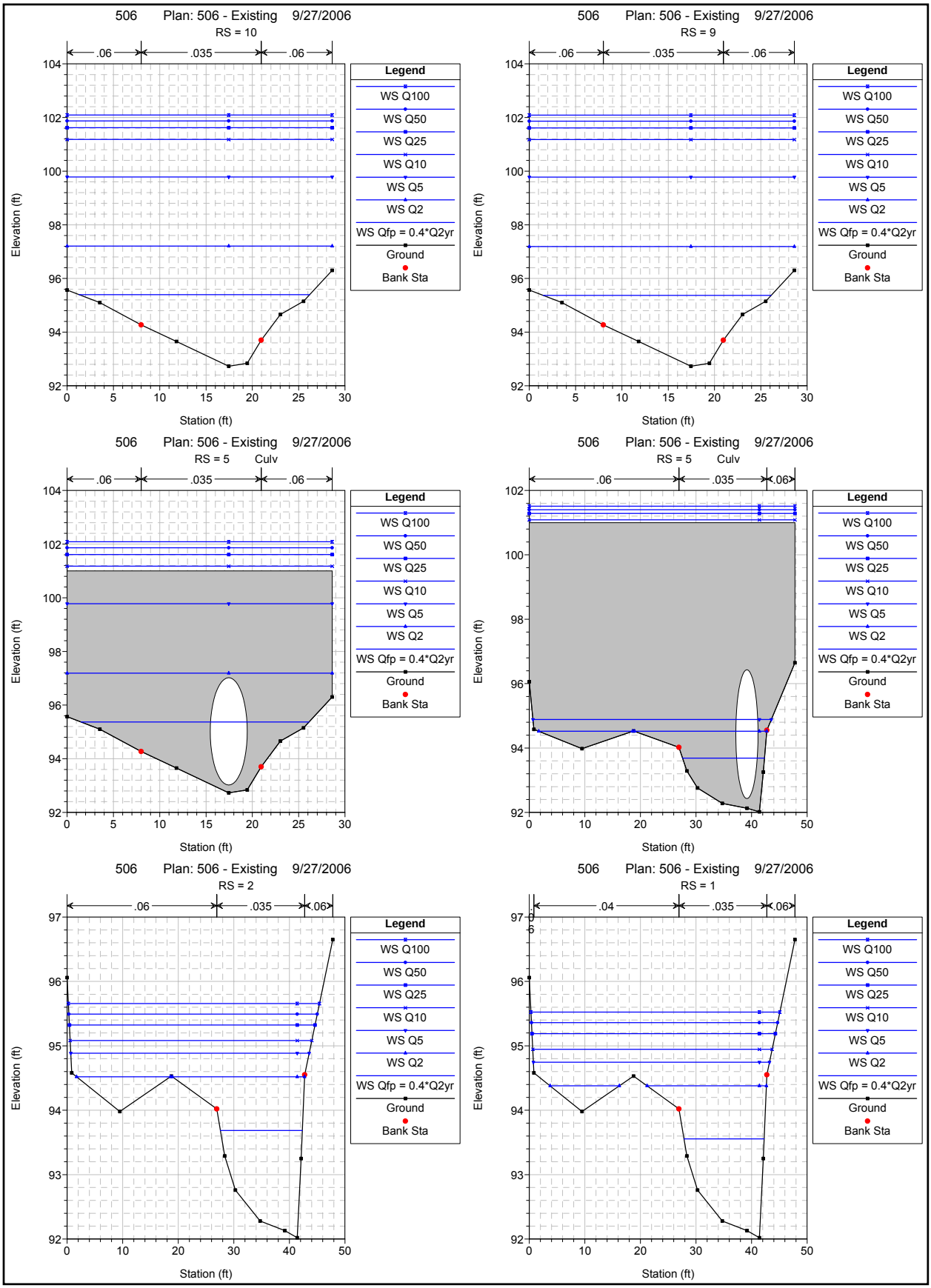
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
348	1	Qfsh psg	348-7.25Qadj	25.00		94.89	95.99	95.79	96.08	0.008009	1.10	0.51	2.42	10.33	20.09	20.09	0.60	0.25
348	1	Qfsh psg	348exQadj	25.00		94.89	95.99	95.79	96.08	0.008009	1.10	0.51	2.42	10.33	20.09	20.09	0.60	0.25
348	1	Q2	348-7.25Qadj	63.00		94.89	96.38	96.16	96.54	0.008010	1.49	0.80	3.24	20.51	33.21	24.03	0.64	0.39
348	1	Q2	348exQadj	63.00		94.89	96.38	96.16	96.54	0.008010	1.49	0.80	3.24	20.51	33.21	24.03	0.64	0.39
348	1	Q10	348-7.25Qadj	116.00		94.89	96.71	96.49	96.96	0.008001	1.82	1.12	4.05	31.60	33.59	24.24	0.67	0.55
348	1	Q10	348exQadj	116.00		94.89	96.71	96.49	96.96	0.008001	1.82	1.12	4.05	31.60	33.59	24.24	0.67	0.55
348	1	Q50	348-7.25Qadj	169.00		94.89	96.98	96.73	97.30	0.008000	2.09	1.39	4.66	40.61	34.13	24.24	0.70	0.68
348	1	Q50	348exQadj	169.00		94.89	96.98	96.72	97.30	0.008000	2.09	1.39	4.66	40.61	34.14	24.24	0.70	0.68
348	1	Q100	348-7.25Qadj	192.00		94.89	97.08	96.81	97.43	0.008001	2.19	1.49	4.89	44.17	34.35	24.24	0.71	0.73
348	1	Q100	348exQadj	192.00		94.89	97.08	96.82	97.43	0.008001	2.19	1.49	4.89	44.18	34.35	24.24	0.71	0.73
348	1.1	Qfsh psg	348exQadj	25.00	13.10	95.06	96.08		96.16	0.004020	1.02	0.77	2.23	11.23	14.50	14.50	0.45	0.19
348	1.1	Q2	348exQadj	63.00	13.10	95.06	96.44		96.66	0.007680	1.38	1.07	3.78	16.65	15.58	15.58	0.65	0.49
348	1.1	Q10	348exQadj	116.00	13.10	95.06	96.67	96.57	97.18	0.014375	1.61	1.25	5.71	20.30	16.28	16.28	0.90	1.07
348	1.1	Q50	348exQadj	169.00	13.10	95.06	96.93	96.93	97.66	0.017362	1.87	1.44	6.88	24.55	17.05	17.05	1.01	1.48
348	1.1	Q100	348exQadj	192.00	13.10	95.06	97.07	97.07	97.85	0.016686	2.01	1.55	7.08	27.14	19.25	17.44	1.00	1.53
348	1.2	Qfsh psg	348exQadj	25.00	28.10	93.73	96.17		96.18	0.000316	2.44	1.13	0.81	30.90	27.70	27.29	0.13	0.02
348	1.2	Q2	348exQadj	63.00	28.10	93.73	96.68		96.71	0.000633	2.95	1.48	1.37	46.40	33.03	30.81	0.20	0.06
348	1.2	Q10	348exQadj	116.00	28.10	93.73	97.20		97.25	0.000804	3.47	1.91	1.83	65.41	39.50	32.90	0.23	0.09
348	1.2	Q50	348exQadj	169.00	28.10	93.73	97.69		97.76	0.000777	3.96	2.40	2.10	85.20	41.24	32.90	0.24	0.11
348	1.2	Q100	348exQadj	192.00	28.10	93.73	97.88		97.95	0.000772	4.15	2.58	2.20	93.03	41.91	32.90	0.24	0.12
348	2	Qfsh psg	348-7.25Qadj	25.00	48.00	93.95	96.11		96.11	0.000148	2.16	1.46	0.65	42.96	34.28	24.24	0.10	0.01
348	2	Qfsh psg	348exQadj	25.00	48.10	93.95	96.17		96.19	0.000558	2.22	1.00	0.99	25.19	25.14	25.14	0.17	0.03
348	2	Q2	348-7.25Qadj	63.00	48.00	93.95	96.58		96.60	0.000343	2.63	1.93	1.20	61.41	43.21	24.24	0.15	0.04
348	2	Q2	348exQadj	63.00	48.10	93.95	96.68		96.72	0.000983	2.73	1.34	1.60	39.64	30.82	29.35	0.24	0.08
348	2	Q10	348-7.25Qadj	116.00	48.00	93.95	97.00		97.04	0.000558	3.05	2.35	1.75	79.61	43.21	24.24	0.20	0.08
348	2	Q10	348exQadj	116.00	48.10	93.95	97.21		97.28	0.001196	3.26	1.70	2.07	57.36	36.42	32.90	0.28	0.12
348	2	Q50	348-7.25Qadj	169.00	48.00	93.95	97.34		97.40	0.000719	3.39	2.69	2.17	94.22	43.21	24.24	0.23	0.12
348	2	Q50	348exQadj	169.00	48.10	93.95	97.70		97.78	0.001070	3.75	2.18	2.31	76.53	40.49	32.90	0.28	0.14
348	2	Q100	348-7.25Qadj	192.00	48.00	93.95	97.47		97.55	0.000778	3.52	2.82	2.33	99.93	43.21	24.24	0.24	0.13
348	2	Q100	348exQadj	192.00	48.10	93.95	97.89		97.98	0.001039	3.94	2.37	2.41	84.19	41.15	32.90	0.28	0.15
348	5			Culvert														
348	9	Qfsh psg	348-7.25Qadj	25.00	111.00	95.12	96.71	96.71	97.21	0.025040	1.59	0.98	5.67	4.41	4.51	4.51	1.01	1.21
348	9	Qfsh psg	348exQadj	25.00	111.10	95.12	97.49	96.71	97.63	0.004077	2.37	1.48	2.95	8.67	7.41	5.71	0.43	0.29
348	9	Q2	348-7.25Qadj	63.00	111.00	95.12	97.61	97.61	98.33	0.019952	2.49	1.59	6.85	9.59	8.30	5.72	0.96	1.52
348	9	Q2	348exQadj	63.00	111.10	95.12	99.34	97.61	99.41	0.000943	4.22	3.33	2.43	39.40	22.77	5.72	0.24	0.15
348	9	Q10	348-7.25Qadj	116.00	111.00	95.12	98.46	98.46	99.26	0.013401	3.34	2.45	7.48	19.67	15.36	5.72	0.84	1.57
348	9	Q10	348exQadj	116.00	111.10	95.12	100.72	98.48	100.79	0.000684	5.60	4.71	2.61	70.86	22.77	5.72	0.21	0.15
348	9	Q50	348-7.25Qadj	169.00	111.00	95.12	99.34	99.04	99.85	0.006794	4.22	3.33	6.53	39.38	22.77	5.72	0.63	1.08
348	9	Q50	348exQadj	169.00	111.10	95.12	101.20	99.04	101.31	0.000977	6.08	5.19	3.33	81.71	22.77	5.72	0.26	0.24
348	9	Q100	348-7.25Qadj	192.00	111.00	95.12	100.21	99.18	100.50	0.003052	5.09	4.20	5.11	59.25	22.77	5.72	0.44	0.61
348	9	Q100	348exQadj	192.00	111.10	95.12	101.41	99.18	101.54	0.001079	6.29	5.39	3.59	86.41	22.77	5.72	0.27	0.28
348	10	Qfsh psg	348-7.25Qadj	25.00	128.00	94.17	97.25		97.30	0.000975	3.08	2.19	1.87	15.95	13.17	5.72	0.22	0.10
348	10	Qfsh psg	348exQadj	25.00	128.10	94.17	97.62		97.65	0.000520	3.45	2.56	1.52	21.89	22.77	5.72	0.17	0.06
348	10	Q2	348-7.25Qadj	63.00	128.00	94.17	98.37		98.44	0.000977	4.20	3.30	2.46	38.84	22.77	5.72	0.24	0.15
348	10	Q2	348exQadj	63.00	128.10	94.17	99.40		99.43	0.000287	5.23	4.33	1.60	62.30	22.77	5.72	0.14	0.06
348	10	Q10	348-7.25Qadj	116.00	128.00	94.17	99.27		99.37	0.001111	5.10	4.20	3.09	59.32	22.77	5.72	0.27	0.22
348	10	Q10	348exQadj	116.00	128.10	94.17	100.76		100.80	0.000316	6.59	5.70	2.02	93.42	22.77	5.72	0.15	0.09
348	10	Q50	348-7.25Qadj	169.00	128.00	94.17	99.78		99.93	0.001441	5.61	4.72	3.80	71.04	22.77	5.72	0.31	0.33
348	10	Q50	348exQadj	169.00	128.10	94.17	101.26		101.33	0.000487	7.09	6.20	2.65	104.70	22.77	5.72	0.19	0.14
348	10	Q100	348-7.25Qadj	192.00	128.00	94.17	100.41		100.54	0.001119	6.24	5.34	3.63	85.28	22.77	5.72	0.28	0.29
348	10	Q100	348exQadj	192.00	128.10	94.17	101.47		101.55	0.000553	7.30	6.41	2.88	109.56	22.77	5.72	0.20	0.17
348	11	Qfsh psg	348exQadj	25.00	161.10	94.47	97.65		97.67	0.000259	3.18	1.92	0.96	26.12	14.04	13.57	0.12	0.03
348	11	Q2	348exQadj	63.00	161.10	94.47	99.42		99.43	0.000139	4.95	3.64	1.07	77.30	35.55	13.90	0.10	0.03
348	11	Q10	348exQadj	116.00	161.10	94.47	100.79		100.81	0.000126	6.32	5.01	1.27	129.32	39.10	13.90	0.10	0.03

HEC-RAS River: 348 Trib Reach: 348 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
348	11	Q50	348exQadj	169.00	161.10	94.47	101.31		101.34	0.000180	6.84	5.53	1.62	149.51	39.10	13.90	0.12	0.05
348	11	Q100	348exQadj	192.00	161.10	94.47	101.53		101.57	0.000199	7.06	5.75	1.75	158.22	39.10	13.90	0.13	0.06

Tributary 483+18 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 506+25
Model based on relative datum. Subtract 57.63-ft for approximate conversion to ADOT&PF project datum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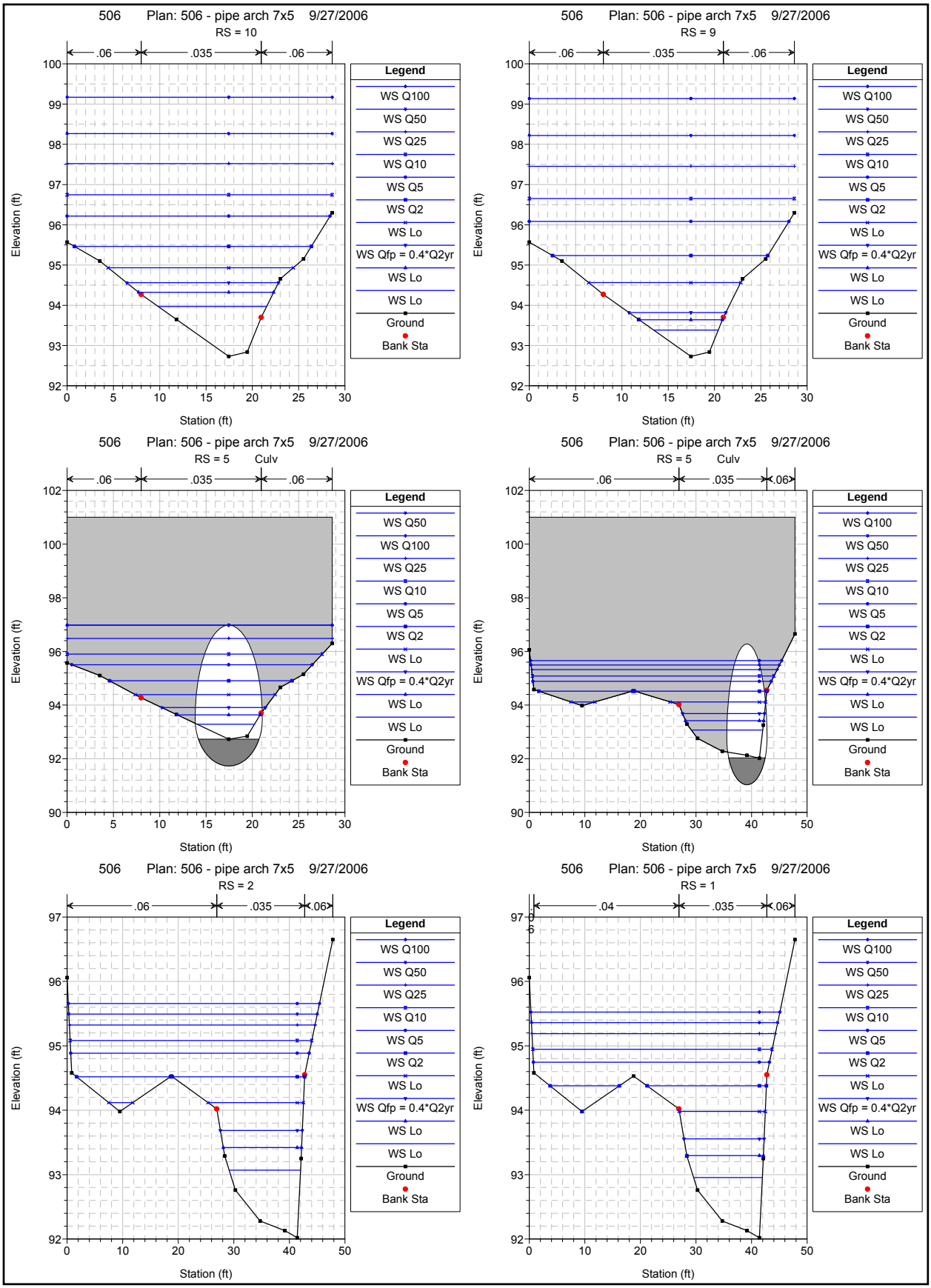
RS = 10
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
506 Plan: 506 - Existing 9/27/2006
RS = 9
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
506 Plan: 506 - Existing 9/27/2006
RS = 5 Culv
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
506 Plan: 506 - Existing 9/27/2006
RS = 5 Culv
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
506 Plan: 506 - Existing 9/27/2006
RS = 2
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta
506 Plan: 506 - Existing 9/27/2006
RS = 1
.04 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp = 0.4*Q2yr
Ground
Bank Sta


506 Plan: 506 - pipe arch 7x5 9/27/2006
RS = 10
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Lo
WS Qfp = 0.4*Q2yr
WS Lo
WS Lo
Ground
Bank Sta
506 Plan: 506 - pipe arch 7x5 9/27/2006
RS = 9
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Lo
WS Qfp = 0.4*Q2yr
WS Lo
WS Lo
Ground
Bank Sta
506 Plan: 506 - pipe arch 7x5 9/27/2006
RS = 5 Culv
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q50
WS Q100
WS Q25
WS Q10
WS Q5
WS Q2
WS Lo
WS Qfp = 0.4*Q2yr
WS Lo
WS Lo
Ground
Bank Sta
506 Plan: 506 - pipe arch 7x5 9/27/2006
RS = 5 Culv
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Lo
WS Qfp = 0.4*Q2yr
WS Lo
WS Lo
Ground
Bank Sta
506 Plan: 506 - pipe arch 7x5 9/27/2006
RS = 2
.06 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Lo
WS Qfp = 0.4*Q2yr
WS Lo
WS Lo
Ground
Bank Sta
506 Plan: 506 - pipe arch 7x5 9/27/2006
RS = 1
.04 .035 .06
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Lo
WS Qfp = 0.4*Q2yr
WS Lo
WS Lo
Ground
Bank Sta

HEC-RAS River: 506 Trib Reach: 506

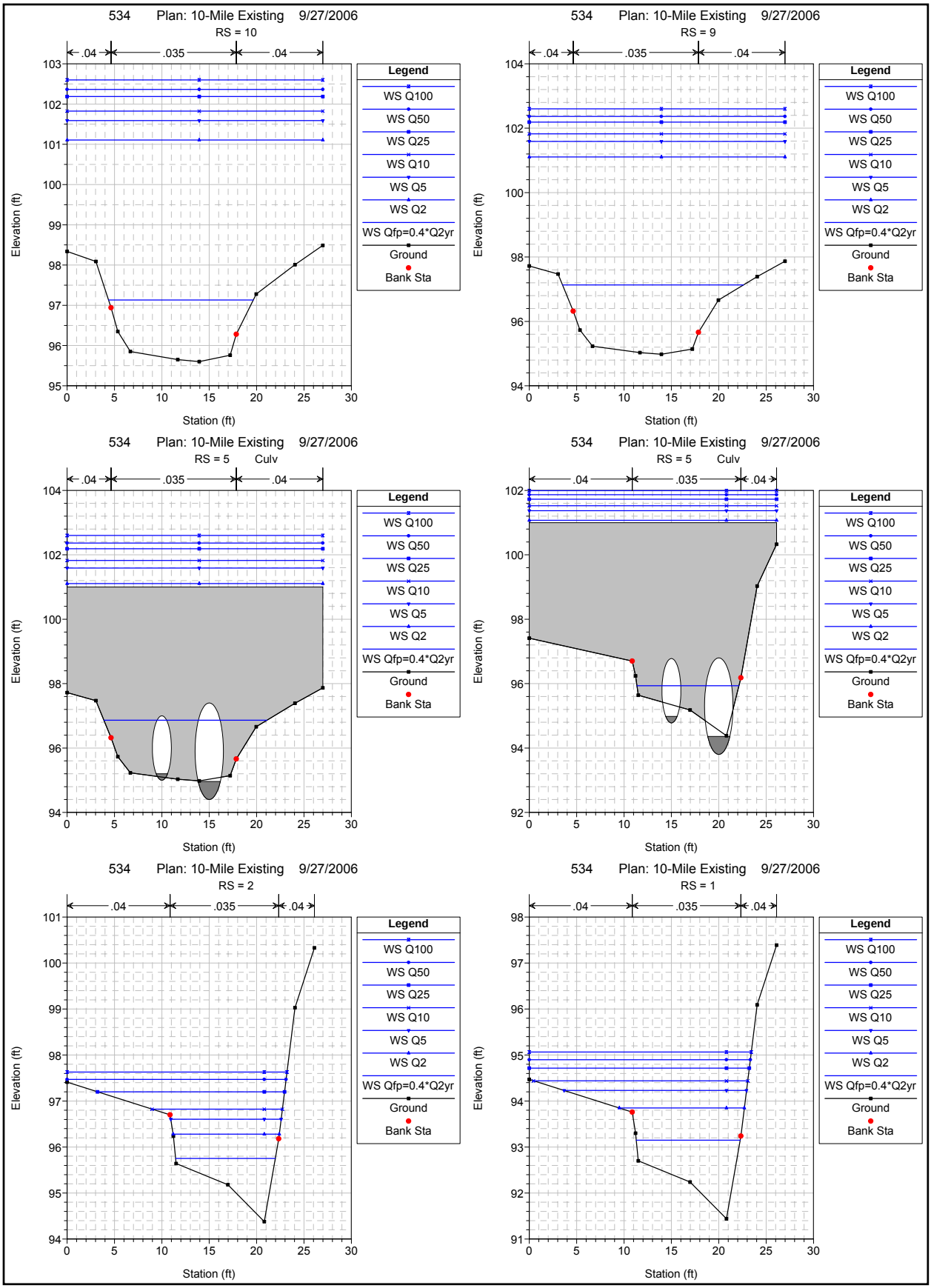
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
506	1	Lo	506-parch	10.00		92.02	92.95	92.56	92.98	0.002001	0.93	0.61	1.32	7.55	12.37	12.37	0.30	0.07
506	1	Lo	506-Ex	10.00		92.02	92.95	92.56	92.98	0.002001	0.93	0.61	1.32	7.55	12.37	12.37	0.30	0.07
506	1	Lo	506-parch	20.00		92.02	93.30	92.76	93.34	0.002001	1.28	0.87	1.66	12.01	13.79	13.79	0.31	0.10
506	1	Lo	506-Ex	20.00		92.02	93.30	92.76	93.34	0.002001	1.28	0.87	1.66	12.01	13.79	13.79	0.31	0.10
506	1	Qfp = 0.4*Q2yr	506-parch	30.00		92.02	93.56	92.91	93.61	0.002002	1.54	1.09	1.91	15.67	14.43	14.43	0.32	0.13
506	1	Qfp = 0.4*Q2yr	506-Ex	30.00		92.02	93.56	92.91	93.61	0.002002	1.54	1.09	1.91	15.67	14.43	14.43	0.32	0.13
506	1	Lo	506-parch	50.00		92.02	93.98	93.15	94.06	0.002001	1.96	1.43	2.27	22.06	15.54	15.47	0.33	0.16
506	1	Lo	506-Ex	50.00		92.02	93.98	93.15	94.06	0.002001	1.96	1.43	2.27	22.06	15.54	15.47	0.33	0.16
506	1	Q2	506-parch	76.00		92.02	94.38	93.41	94.48	0.002002	2.36	1.80	2.62	31.77	33.94	15.74	0.34	0.20
506	1	Q2	506-Ex	76.00		92.02	94.38	93.41	94.48	0.002002	2.36	1.80	2.62	31.77	33.94	15.74	0.34	0.20
506	1	Q5	506-parch	113.00		92.02	94.75	93.71	94.87	0.002004	2.73	2.15	2.95	46.54	42.47	15.82	0.35	0.24
506	1	Q5	506-Ex	113.00		92.02	94.75	93.71	94.87	0.002004	2.73	2.15	2.95	46.54	42.47	15.82	0.35	0.24
506	1	Q10	506-parch	139.00		92.02	94.95	93.89	95.08	0.002000	2.93	2.35	3.13	55.10	43.06	15.82	0.36	0.26
506	1	Q10	506-Ex	139.00		92.02	94.95	93.89	95.08	0.002000	2.93	2.35	3.13	55.10	43.06	15.82	0.36	0.26
506	1	Q25	506-parch	175.00		92.02	95.19	94.24	95.33	0.002001	3.17	2.60	3.34	65.65	43.79	15.82	0.37	0.29
506	1	Q25	506-Ex	175.00		92.02	95.19	94.24	95.33	0.002001	3.17	2.60	3.34	65.65	43.79	15.82	0.37	0.29
506	1	Q50	506-parch	203.00		92.02	95.36	94.56	95.51	0.002000	3.34	2.77	3.48	73.19	44.30	15.82	0.37	0.31
506	1	Q50	506-Ex	203.00		92.02	95.36	94.56	95.51	0.002000	3.34	2.77	3.48	73.19	44.30	15.82	0.37	0.31
506	1	Q100	506-parch	232.00		92.02	95.52	94.69	95.69	0.002002	3.50	2.93	3.62	80.51	44.79	15.82	0.37	0.33
506	1	Q100	506-Ex	232.00		92.02	95.52	94.69	95.69	0.002002	3.50	2.93	3.62	80.51	44.79	15.82	0.37	0.33
506	2	Lo	506-parch	10.00	70.00	92.02	93.07		93.09	0.001181	1.05	0.70	1.11	9.00	12.85	12.85	0.23	0.05
506	2	Lo	506-Ex	10.00	70.00	92.02	93.07		93.09	0.001181	1.05	0.70	1.11	9.00	12.85	12.85	0.23	0.05
506	2	Lo	506-parch	20.00	70.00	92.02	93.42		93.45	0.001326	1.40	0.97	1.46	13.74	14.10	14.10	0.26	0.08
506	2	Lo	506-Ex	20.00	70.00	92.02	93.42		93.45	0.001326	1.40	0.97	1.46	13.74	14.10	14.10	0.26	0.08
506	2	Qfp = 0.4*Q2yr	506-parch	30.00	70.00	92.02	93.69		93.73	0.001420	1.67	1.19	1.71	17.57	14.74	14.74	0.28	0.10
506	2	Qfp = 0.4*Q2yr	506-Ex	30.00	70.00	92.02	93.69		93.73	0.001420	1.67	1.19	1.71	17.57	14.74	14.74	0.28	0.10
506	2	Lo	506-parch	50.00	70.00	92.02	94.12		94.18	0.001499	2.10	1.55	2.07	24.54	21.48	15.61	0.29	0.13
506	2	Lo	506-Ex	50.00	70.00	92.02	94.12		94.18	0.001499	2.10	1.55	2.07	24.54	21.48	15.61	0.29	0.13
506	2	Q2	506-parch	76.00	70.00	92.02	94.52		94.61	0.001545	2.50	1.93	2.41	37.04	40.69	15.81	0.31	0.17
506	2	Q2	506-Ex	76.00	70.00	92.02	94.52		94.61	0.001545	2.50	1.93	2.41	37.04	40.69	15.81	0.31	0.17
506	2	Q5	506-parch	113.00	70.00	92.02	94.89		95.00	0.001653	2.87	2.29	2.79	52.52	42.89	15.82	0.33	0.21
506	2	Q5	506-Ex	113.00	70.00	92.02	94.89		95.00	0.001652	2.87	2.29	2.79	52.53	42.89	15.82	0.32	0.21
506	2	Q10	506-parch	139.00	70.00	92.02	95.08		95.21	0.001757	3.06	2.49	3.04	61.03	43.47	15.82	0.34	0.25
506	2	Q10	506-Ex	139.00	70.00	92.02	95.08		95.21	0.001758	3.06	2.49	3.04	61.03	43.47	15.82	0.34	0.25
506	2	Q25	506-parch	175.00	70.00	92.02	95.32		95.47	0.001880	3.30	2.73	3.35	71.53	44.19	15.82	0.36	0.29
506	2	Q25	506-Ex	175.00	70.00	92.02	95.32		95.47	0.001880	3.30	2.73	3.35	71.53	44.19	15.82	0.36	0.29
506	2	Q50	506-parch	203.00	70.00	92.02	95.49		95.65	0.001956	3.47	2.90	3.55	79.09	44.69	15.82	0.37	0.32
506	2	Q50	506-Ex	203.00	70.00	92.02	95.49		95.65	0.001956	3.47	2.90	3.55	79.09	44.69	15.82	0.37	0.32
506	2	Q100	506-parch	232.00	70.00	92.02	95.66		95.83	0.002026	3.64	3.06	3.75	86.41	45.18	15.82	0.38	0.35
506	2	Q100	506-Ex	232.00	70.00	92.02	95.66		95.83	0.002026	3.64	3.06	3.75	86.41	45.18	15.82	0.38	0.35
506	5			Culvert														
506	9	Lo	506-parch	10.00	135.00	92.73	93.38	93.38	93.59	0.025747	0.65	0.40	3.61	2.77	6.96	6.96	1.01	0.62
506	9	Lo	506-Ex	10.00	135.00	92.73	94.32	93.38	94.33	0.000394	1.59	0.95	0.80	12.78	14.55	12.96	0.14	0.02
506	9	Lo	506-parch	20.00	135.00	92.73	93.64	93.64	93.91	0.023084	0.91	0.53	4.16	4.81	8.98	8.98	1.00	0.75
506	9	Lo	506-Ex	20.00	135.00	92.73	94.89	93.64	94.91	0.000313	2.16	1.53	0.98	22.45	19.55	12.96	0.14	0.03
506	9	Qfp = 0.4*Q2yr	506-parch	30.00	135.00	92.73	93.82	93.82	94.15	0.021972	1.09	0.64	4.59	6.56	10.46	10.20	1.01	0.85
506	9	Qfp = 0.4*Q2yr	506-Ex	30.00	135.00	92.73	95.37	93.82	95.39	0.000264	2.64	2.01	1.08	32.99	24.60	12.96	0.13	0.03
506	9	Lo	506-parch	50.00	135.00	92.73	94.56	94.11	94.72	0.004505	1.83	1.20	3.16	16.59	16.41	12.96	0.51	0.33
506	9	Lo	506-Ex	50.00	135.00	92.73	96.21	94.11	96.22	0.000194	3.48	2.84	1.17	55.64	28.37	12.96	0.12	0.03
506	9	Q2	506-parch	76.00	135.00	92.73	95.24	94.38	95.36	0.002184	2.51	1.87	2.96	29.81	23.24	12.96	0.38	0.25
506	9	Q2	506-Ex	76.00	135.00	92.73	97.19	94.38	97.21	0.000144	4.46	3.83	1.23	83.83	28.62	12.96	0.11	0.03
506	9	Q5	506-parch	113.00	135.00	92.73	96.08	94.69	96.19	0.001172	3.35	2.72	2.78	52.22	28.04	12.96	0.30	0.19
506	9	Q5	506-Ex	113.00	135.00	92.73	99.78	94.69	99.79	0.000050	7.05	6.41	1.02	157.84	28.62	12.96	0.07	0.02
506	9	Q10	506-parch	139.00	135.00	92.73	96.65	94.90	96.75	0.000857	3.92	3.29	2.70	68.37	28.62	12.96	0.26	0.17
506	9	Q10	506-Ex	139.00	135.00	92.73	101.18	94.90	101.19	0.000039	8.45	7.81	1.02	197.92	28.62	12.96	0.06	0.02
506	9	Q25	506-parch	175.00	135.00	92.73	97.45	95.16	97.54	0.000598	4.72	4.09	2.61	91.34	28.62	12.96	0.23	0.15
506	9	Q25	506-Ex	175.00	135.00	92.73	101.61	95.16	101.63	0.000052	8.88	8.25	1.22	210.37	28.62	12.96	0.07	0.03
506	9	Q50	506-parch	203.00	135.00	92.73	98.22	95.35	98.29	0.000432	5.49	4.85	2.49	113.20	28.62	12.96	0.20	0.13
506	9	Q50	506-Ex	203.00	135.00	92.73	101.86	95.35	101.89	0.000063	9.13	8.50	1.38	217.57	28.62	12.96	0.08	0.03

HEC-RAS River: 506 Trib Reach: 506 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
506	9	Q100	506-parch	232.00	135.00	92.73	99.14	95.54	99.20	0.000306	6.41	5.77	2.35	139.49	28.62	12.96	0.17	0.11
506	9	Q100	506-Ex	232.00	135.00	92.73	102.09	95.54	102.11	0.000075	9.36	8.72	1.53	223.91	28.62	12.96	0.09	0.04
506	10	Lo	506-parch	10.00	245.00	92.73	93.97		93.99	0.001324	1.24	0.73	1.23	8.20	11.69	11.11	0.25	0.06
506	10	Lo	506-Ex	10.00	245.00	92.73	94.36		94.37	0.000342	1.63	0.99	0.77	13.38	14.86	12.96	0.14	0.02
506	10	Lo	506-parch	20.00	245.00	92.73	94.32		94.36	0.001550	1.59	0.96	1.60	12.85	14.58	12.96	0.29	0.09
506	10	Lo	506-Ex	20.00	245.00	92.73	94.93		94.94	0.000290	2.20	1.56	0.96	23.12	19.91	12.96	0.13	0.03
506	10	Qfp = 0.4*Q2yr	506-parch	30.00	245.00	92.73	94.56		94.62	0.001635	1.83	1.20	1.90	16.55	16.38	12.96	0.31	0.12
506	10	Qfp = 0.4*Q2yr	506-Ex	30.00	245.00	92.73	95.40		95.41	0.000251	2.67	2.03	1.06	33.71	24.89	12.96	0.13	0.03
506	10	Lo	506-parch	50.00	245.00	92.73	94.93		95.02	0.001775	2.20	1.57	2.37	23.29	20.00	12.96	0.33	0.17
506	10	Lo	506-Ex	50.00	245.00	92.73	96.23		96.25	0.000189	3.50	2.86	1.16	56.25	28.42	12.96	0.12	0.03
506	10	Q2	506-parch	76.00	245.00	92.73	95.46		95.56	0.001428	2.73	2.10	2.58	35.38	25.57	12.96	0.31	0.18
506	10	Q2	506-Ex	76.00	245.00	92.73	97.21		97.23	0.000142	4.48	3.84	1.22	84.28	28.62	12.96	0.11	0.03
506	10	Q5	506-parch	113.00	245.00	92.73	96.22		96.31	0.000978	3.49	2.85	2.62	55.94	28.39	12.96	0.27	0.17
506	10	Q5	506-Ex	113.00	245.00	92.73	99.78		99.80	0.000050	7.05	6.42	1.02	157.99	28.62	12.96	0.07	0.02
506	10	Q10	506-parch	139.00	245.00	92.73	96.75		96.84	0.000767	4.02	3.38	2.60	71.14	28.62	12.96	0.25	0.16
506	10	Q10	506-Ex	139.00	245.00	92.73	101.18		101.19	0.000039	8.45	7.82	1.02	198.04	28.62	12.96	0.06	0.02
506	10	Q25	506-parch	175.00	245.00	92.73	97.52		97.60	0.000563	4.79	4.16	2.56	93.28	28.62	12.96	0.22	0.14
506	10	Q25	506-Ex	175.00	245.00	92.73	101.62		101.64	0.000051	8.89	8.25	1.22	210.54	28.62	12.96	0.07	0.03
506	10	Q50	506-parch	203.00	245.00	92.73	98.27		98.34	0.000417	5.54	4.90	2.46	114.59	28.62	12.96	0.20	0.12
506	10	Q50	506-Ex	203.00	245.00	92.73	101.87		101.89	0.000063	9.14	8.51	1.37	217.77	28.62	12.96	0.08	0.03
506	10	Q100	506-parch	232.00	245.00	92.73	99.17		99.24	0.000300	6.44	5.81	2.33	140.47	28.62	12.96	0.17	0.11
506	10	Q100	506-Ex	232.00	245.00	92.73	102.09		102.12	0.000075	9.36	8.73	1.53	224.15	28.62	12.96	0.09	0.04

Tributary 512+24 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 535+50
Model based on relative datum. Subtract 57.88-ft for approximate conversion to ADOT&PF project datum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Elevation (ft)
Station (ft)
Legend
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WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 10-Mile Existing 9/27/2006
RS = 9
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 10-Mile Existing 9/27/2006
RS = 5 Culv
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 10-Mile Existing 9/27/2006
RS = 5 Culv
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 10-Mile Existing 9/27/2006
RS = 2
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 10-Mile Existing 9/27/2006
RS = 1
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
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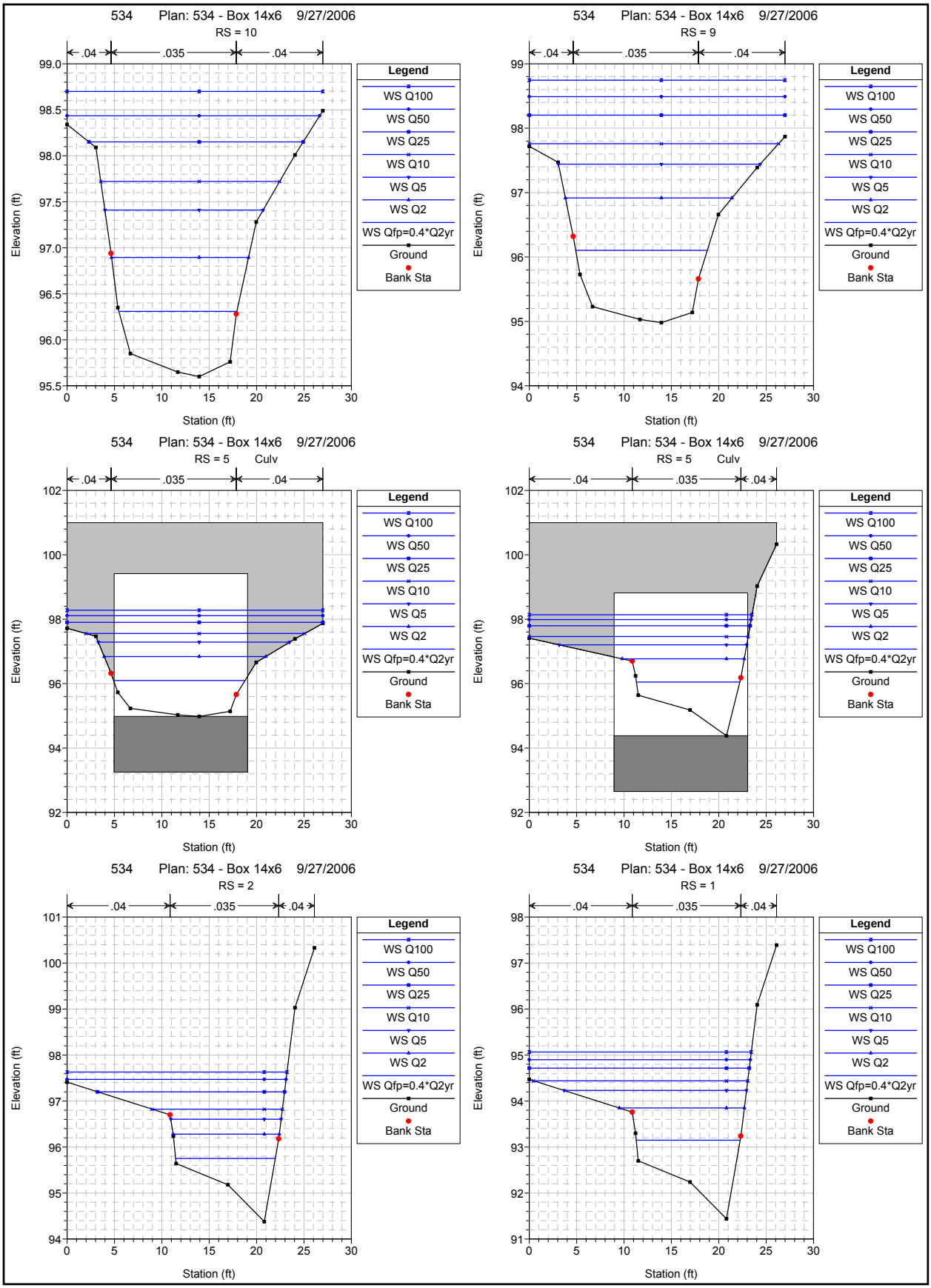
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta


534 Plan: 534 - Box 14x6 9/27/2006
RS = 10
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 534 - Box 14x6 9/27/2006
RS = 9
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 534 - Box 14x6 9/27/2006
RS = 5 Culv
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 534 - Box 14x6 9/27/2006
RS = 5 Culv
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 534 - Box 14x6 9/27/2006
RS = 2
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta
534 Plan: 534 - Box 14x6 9/27/2006
RS = 1
.04 .035 .04
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q25
WS Q10
WS Q5
WS Q2
WS Qfp=0.4*Q2yr
Ground
Bank Sta

HEC-RAS River: 10-Mile Ck Reach: 534

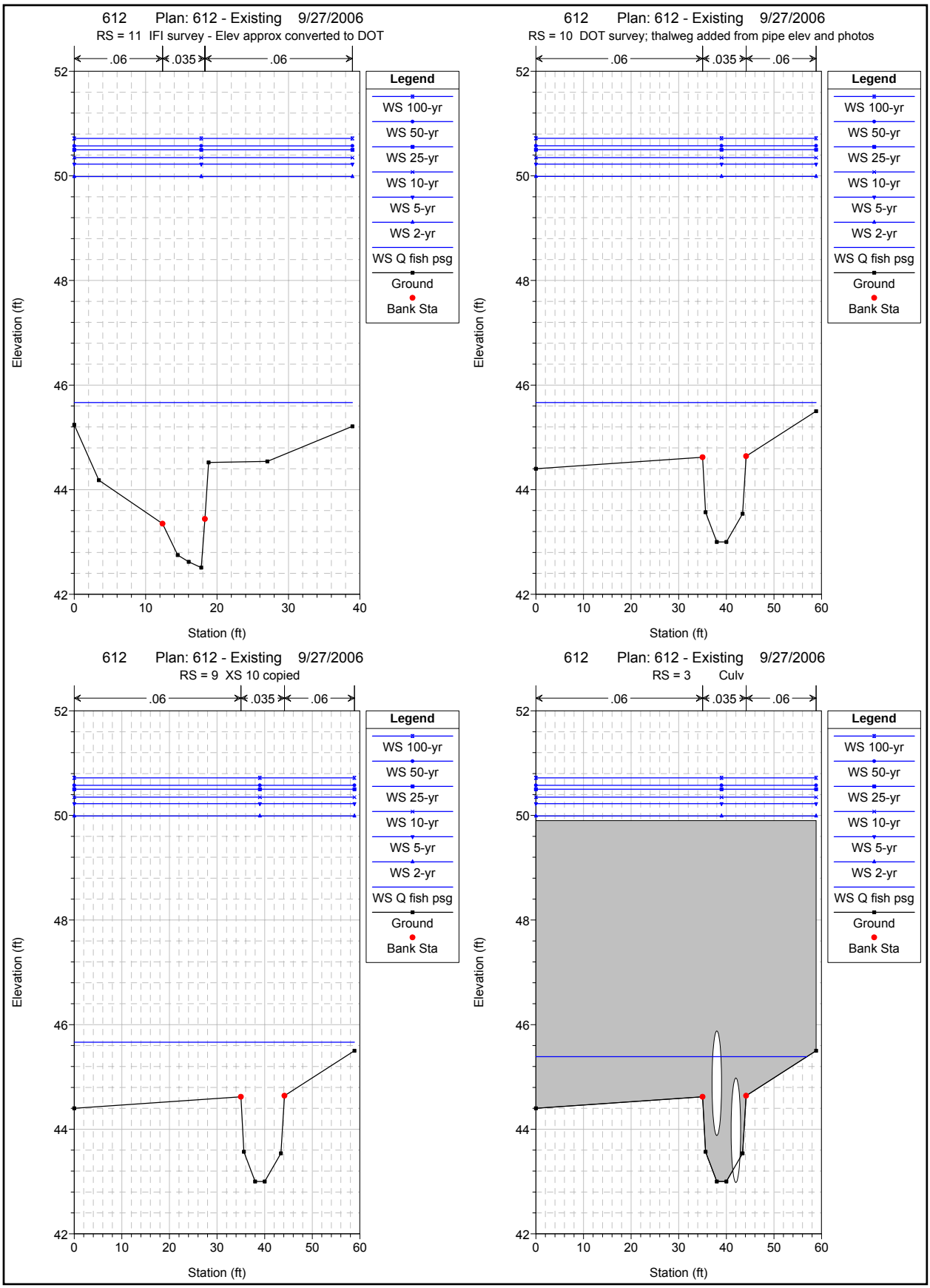
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
534	1	Lo	534-box	10.00		91.44	92.68	92.40	92.74	0.006006	1.24	0.50	1.98	5.05	10.14	10.14	0.49	0.18
534	1	Lo	10Mi - Ex	10.00		91.44	92.68	92.40	92.74	0.006006	1.24	0.50	1.98	5.05	10.14	10.14	0.49	0.18
534	1	Lo	534-box	20.00		91.44	92.95	92.67	93.05	0.006000	1.51	0.74	2.53	7.89	10.70	10.70	0.52	0.25
534	1	Lo	10Mi - Ex	20.00		91.44	92.95	92.67	93.05	0.006000	1.51	0.74	2.53	7.89	10.70	10.70	0.52	0.25
534	1	Qfp=0.4*Q2yr	534-box	29.00		91.44	93.15	92.81	93.28	0.006006	1.71	0.91	2.89	10.02	10.96	10.96	0.53	0.31
534	1	Qfp=0.4*Q2yr	10Mi - Ex	29.00		91.44	93.15	92.81	93.28	0.006006	1.71	0.91	2.89	10.02	10.96	10.96	0.53	0.31
534	1	Lo	534-box	50.00		91.44	93.52	93.09	93.71	0.006006	2.08	1.25	3.53	14.17	11.45	11.28	0.56	0.42
534	1	Lo	10Mi - Ex	50.00		91.44	93.52	93.09	93.71	0.006006	2.08	1.25	3.53	14.17	11.45	11.28	0.56	0.42
534	1	Q2	534-box	73.00		91.44	93.85	93.34	94.11	0.006004	2.41	1.56	4.07	18.07	13.20	11.46	0.57	0.52
534	1	Q2	10Mi - Ex	73.00		91.44	93.85	93.34	94.11	0.006004	2.41	1.56	4.07	18.07	13.20	11.46	0.57	0.52
534	1	Q5	534-box	107.00		91.44	94.23	93.67	94.57	0.006002	2.79	1.94	4.71	24.25	19.26	11.46	0.60	0.64
534	1	Q5	10Mi - Ex	107.00		91.44	94.23	93.69	94.57	0.006002	2.79	1.94	4.71	24.25	19.26	11.46	0.60	0.64
534	1	Q10	534-box	130.00		91.44	94.44	93.89	94.82	0.006010	3.00	2.15	5.04	28.65	22.60	11.46	0.61	0.71
534	1	Q10	10Mi - Ex	130.00		91.44	94.44	93.89	94.82	0.006011	3.00	2.15	5.04	28.65	22.60	11.46	0.61	0.71
534	1	Q25	534-box	166.00		91.44	94.71	94.26	95.14	0.006002	3.27	2.43	5.46	34.99	23.22	11.46	0.62	0.80
534	1	Q25	10Mi - Ex	166.00		91.44	94.71	94.26	95.14	0.006002	3.27	2.43	5.46	34.99	23.22	11.46	0.62	0.80
534	1	Q50	534-box	193.00		91.44	94.90	94.53	95.36	0.006001	3.46	2.61	5.73	39.24	23.33	11.46	0.63	0.86
534	1	Q50	10Mi - Ex	193.00		91.44	94.90	94.53	95.36	0.006001	3.46	2.61	5.73	39.24	23.33	11.46	0.63	0.86
534	1	Q100	534-box	220.00		91.44	95.07	94.69	95.56	0.006009	3.63	2.78	5.98	43.20	23.43	11.46	0.63	0.92
534	1	Q100	10Mi - Ex	220.00		91.44	95.07	94.68	95.56	0.006009	3.63	2.78	5.98	43.20	23.43	11.46	0.63	0.92
534	2	Lo	534-box	10.00	186.00	94.38	95.34	95.34	95.55	0.027269	0.96	0.41	3.68	2.72	6.60	6.60	1.01	0.65
534	2	Lo	10Mi - Ex	10.00	186.00	94.38	95.34	95.34	95.55	0.027269	0.96	0.41	3.68	2.72	6.60	6.60	1.01	0.65
534	2	Lo	534-box	20.00	186.00	94.38	95.61	95.61	95.87	0.025530	1.23	0.49	4.06	4.93	9.99	9.99	1.02	0.74
534	2	Lo	10Mi - Ex	20.00	186.00	94.38	95.61	95.61	95.87	0.025530	1.23	0.49	4.06	4.93	9.99	9.99	1.02	0.74
534	2	Qfp=0.4*Q2yr	534-box	29.00	186.00	94.38	95.75	95.75	96.07	0.024355	1.37	0.61	4.53	6.40	10.51	10.51	1.02	0.86
534	2	Qfp=0.4*Q2yr	10Mi - Ex	29.00	186.00	94.38	95.75	95.75	96.07	0.024355	1.37	0.61	4.53	6.40	10.51	10.51	1.02	0.86
534	2	Lo	534-box	50.00	186.00	94.38	96.03	96.03	96.47	0.022092	1.65	0.86	5.35	9.35	10.88	10.88	1.02	1.08
534	2	Lo	10Mi - Ex	50.00	186.00	94.38	96.03	96.03	96.47	0.022092	1.65	0.86	5.35	9.35	10.88	10.88	1.02	1.08
534	2	Q2	534-box	73.00	186.00	94.38	96.28	96.28	96.84	0.020825	1.90	1.09	6.02	12.14	11.20	11.14	1.02	1.26
534	2	Q2	10Mi - Ex	73.00	186.00	94.38	96.28	96.28	96.84	0.020825	1.90	1.09	6.02	12.14	11.20	11.14	1.02	1.26
534	2	Q5	534-box	107.00	186.00	94.38	96.61	96.61	97.32	0.019382	2.23	1.39	6.77	15.85	11.64	11.39	1.01	1.48
534	2	Q5	10Mi - Ex	107.00	186.00	94.38	96.61	96.61	97.32	0.019382	2.23	1.39	6.77	15.85	11.64	11.39	1.01	1.48
534	2	Q10	534-box	130.00	186.00	94.38	96.82	96.82	97.60	0.017672	2.44	1.60	7.09	18.54	13.75	11.46	0.99	1.55
534	2	Q10	10Mi - Ex	130.00	186.00	94.38	96.82	96.82	97.60	0.017672	2.44	1.60	7.09	18.54	13.75	11.46	0.99	1.55
534	2	Q25	534-box	166.00	186.00	94.38	97.20	97.20	97.98	0.013654	2.82	1.97	7.17	24.83	19.73	11.46	0.90	1.48
534	2	Q25	10Mi - Ex	166.00	186.00	94.38	97.20	97.20	97.98	0.013654	2.82	1.97	7.17	24.83	19.73	11.46	0.90	1.48
534	2	Q50	534-box	193.00	186.00	94.38	97.47	97.47	98.21	0.011253	3.09	2.24	7.09	30.70	23.11	11.46	0.83	1.39
534	2	Q50	10Mi - Ex	193.00	186.00	94.38	97.47	97.47	98.21	0.011253	3.09	2.24	7.09	30.70	23.11	11.46	0.83	1.39
534	2	Q100	534-box	220.00	186.00	94.38	97.63	97.63	98.41	0.010979	3.25	2.40	7.34	34.44	23.21	11.46	0.83	1.45
534	2	Q100	10Mi - Ex	220.00	186.00	94.38	97.63	97.63	98.41	0.010979	3.25	2.40	7.34	34.44	23.21	11.46	0.83	1.45
534	5			Culvert														
534	9	Lo	534-box	10.00	261.00	94.98	95.56	95.38	95.62	0.005905	0.58	0.45	1.88	5.32	11.94	11.94	0.50	0.16
534	9	Lo	10Mi - Ex	10.00	261.00	94.98	96.09	95.38	96.10	0.000439	1.11	0.93	0.83	12.21	13.86	12.95	0.15	0.02
534	9	Lo	534-box	20.00	261.00	94.98	95.89	95.56	95.96	0.003914	0.91	0.74	2.13	9.43	13.18	12.70	0.44	0.18
534	9	Lo	10Mi - Ex	20.00	261.00	94.98	96.66	95.56	96.68	0.000349	1.68	1.48	1.00	20.65	15.82	13.22	0.15	0.03
534	9	Qfp=0.4*Q2yr	534-box	29.00	261.00	94.98	96.10	95.69	96.19	0.003575	1.12	0.94	2.38	12.33	13.89	12.96	0.43	0.20
534	9	Qfp=0.4*Q2yr	10Mi - Ex	29.00	261.00	94.98	97.13	95.69	97.15	0.000280	2.15	1.94	1.08	28.84	19.10	13.22	0.14	0.03
534	9	Lo	534-box	50.00	261.00	94.98	96.53	95.93	96.64	0.003055	1.55	1.34	2.78	18.49	15.32	13.22	0.42	0.25
534	9	Lo	10Mi - Ex	50.00	261.00	94.98	98.65	95.93	98.67	0.000089	3.67	3.47	0.90	66.79	26.99	13.22	0.08	0.02
534	9	Q2	534-box	73.00	261.00	94.98	96.92	96.16	97.06	0.002693	1.94	1.73	3.10	24.87	17.59	13.22	0.42	0.28
534	9	Q2	10Mi - Ex	73.00	261.00	94.98	101.11	96.16	101.11	0.000025	6.13	5.92	0.68	132.94	26.99	13.22	0.05	0.01
534	9	Q5	534-box	107.00	261.00	94.98	97.44	96.46	97.61	0.002233	2.46	2.25	3.37	35.08	21.29	13.22	0.40	0.30
534	9	Q5	10Mi - Ex	107.00	261.00	94.98	101.59	96.46	101.60	0.000041	6.61	6.40	0.92	145.98	26.99	13.22	0.06	0.02
534	9	Q10	534-box	130.00	261.00	94.98	97.76	96.62	97.93	0.002023	2.78	2.57	3.50	42.64	26.31	13.22	0.38	0.31
534	9	Q10	10Mi - Ex	130.00	261.00	94.98	101.83	96.62	101.84	0.000054	6.85	6.64	1.07	152.37	26.99	13.22	0.07	0.02
534	9	Q25	534-box	166.00	261.00	94.98	98.20	96.89	98.38	0.001727	3.22	3.02	3.59	54.62	26.99	13.22	0.36	0.31
534	9	Q25	10Mi - Ex	166.00	261.00	94.98	102.19	96.89	102.21	0.000073	7.21	7.00	1.29	162.16	26.99	13.22	0.09	0.03
534	9	Q50	534-box	193.00	261.00	94.98	98.49	97.08	98.67	0.001620	3.51	3.30	3.70	62.33	26.99	13.22	0.36	0.32
534	9	Q50	10Mi - Ex	193.00	261.00	94.98	102.37	97.08	102.39	0.000090	7.39	7.18	1.46	166.95	26.99	13.22	0.10	0.04
534	9	Q100	534-box	220.00	261.00	94.98	98.75	97.26	98.94	0.001560	3.77	3.56	3.81	69.27	26.99	13.22	0.36	0.33
534	9	Q100	10Mi - Ex	220.00	261.00	94.98	102.60	97.26	102.63	0.000105	7.62	7.41	1.61	173.27	26.99	13.22	0.10	0.05

HEC-RAS River: 10-Mile Ck Reach: 534 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
534	10	Lo	534-box	10.00	290.00	95.60	96.00	96.00	96.15	0.027776	0.40	0.29	3.07	3.25	11.24	11.24	1.01	0.50
534	10	Lo	10Mi - Ex	10.00	290.00	95.60	96.08		96.17	0.013703	0.48	0.35	2.46	4.07	11.52	11.52	0.73	0.30
534	10	Lo	534-box	20.00	290.00	95.60	96.18	96.18	96.40	0.024435	0.58	0.44	3.80	5.26	11.92	11.92	1.01	0.66
534	10	Lo	10Mi - Ex	20.00	290.00	95.60	96.66		96.71	0.002119	1.06	0.88	1.76	11.48	13.69	12.88	0.33	0.11
534	10	Qfp=0.4*Q2yr	534-box	29.00	290.00	95.60	96.31	96.31	96.59	0.022481	0.71	0.55	4.23	6.86	12.46	12.40	1.00	0.76
534	10	Qfp=0.4*Q2yr	10Mi - Ex	29.00	290.00	95.60	97.13		97.17	0.001066	1.53	1.32	1.63	18.28	15.27	13.22	0.25	0.08
534	10	Lo	534-box	50.00	290.00	95.60	96.55	96.55	96.94	0.020059	0.95	0.78	5.01	10.04	13.33	12.76	1.00	0.95
534	10	Lo	10Mi - Ex	50.00	290.00	95.60	98.65		98.67	0.000199	3.05	2.84	1.17	50.00	26.99	13.22	0.12	0.03
534	10	Q2	534-box	73.00	290.00	95.60	96.89	96.78	97.28	0.013095	1.29	1.09	5.03	14.77	14.46	13.17	0.85	0.86
534	10	Q2	10Mi - Ex	73.00	290.00	95.60	101.11		101.11	0.000038	5.51	5.30	0.77	116.20	26.99	13.22	0.06	0.01
534	10	Q5	534-box	107.00	290.00	95.60	97.41		97.78	0.007529	1.81	1.60	4.92	22.71	16.70	13.22	0.69	0.73
534	10	Q5	10Mi - Ex	107.00	290.00	95.60	101.59		101.60	0.000059	5.99	5.78	1.03	129.24	26.99	13.22	0.08	0.02
534	10	Q10	534-box	130.00	290.00	95.60	97.72		98.09	0.005972	2.12	1.91	4.93	28.23	18.88	13.22	0.63	0.69
534	10	Q10	10Mi - Ex	130.00	290.00	95.60	101.83		101.84	0.000076	6.23	6.02	1.19	135.62	26.99	13.22	0.09	0.03
534	10	Q25	534-box	166.00	290.00	95.60	98.15		98.52	0.004674	2.55	2.34	5.00	37.02	22.61	13.22	0.58	0.66
534	10	Q25	10Mi - Ex	166.00	290.00	95.60	102.19		102.21	0.000100	6.59	6.38	1.43	145.40	26.99	13.22	0.10	0.04
534	10	Q50	534-box	193.00	290.00	95.60	98.43		98.80	0.004099	2.83	2.63	5.05	44.12	26.65	13.22	0.55	0.65
534	10	Q50	10Mi - Ex	193.00	290.00	95.60	102.36		102.40	0.000123	6.76	6.56	1.61	150.19	26.99	13.22	0.11	0.05
534	10	Q100	534-box	220.00	290.00	95.60	98.70		99.06	0.003601	3.10	2.89	5.05	51.27	26.99	13.22	0.52	0.63
534	10	Q100	10Mi - Ex	220.00	290.00	95.60	102.60		102.64	0.000142	7.00	6.79	1.77	156.50	26.99	13.22	0.12	0.06

Tributary 589+12 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 612+40
Model based on ADOT&PF project datum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RS = 11 IFI survey - Elev approx converted to DOT
612 Plan: 612 - Existing 9/27/2006
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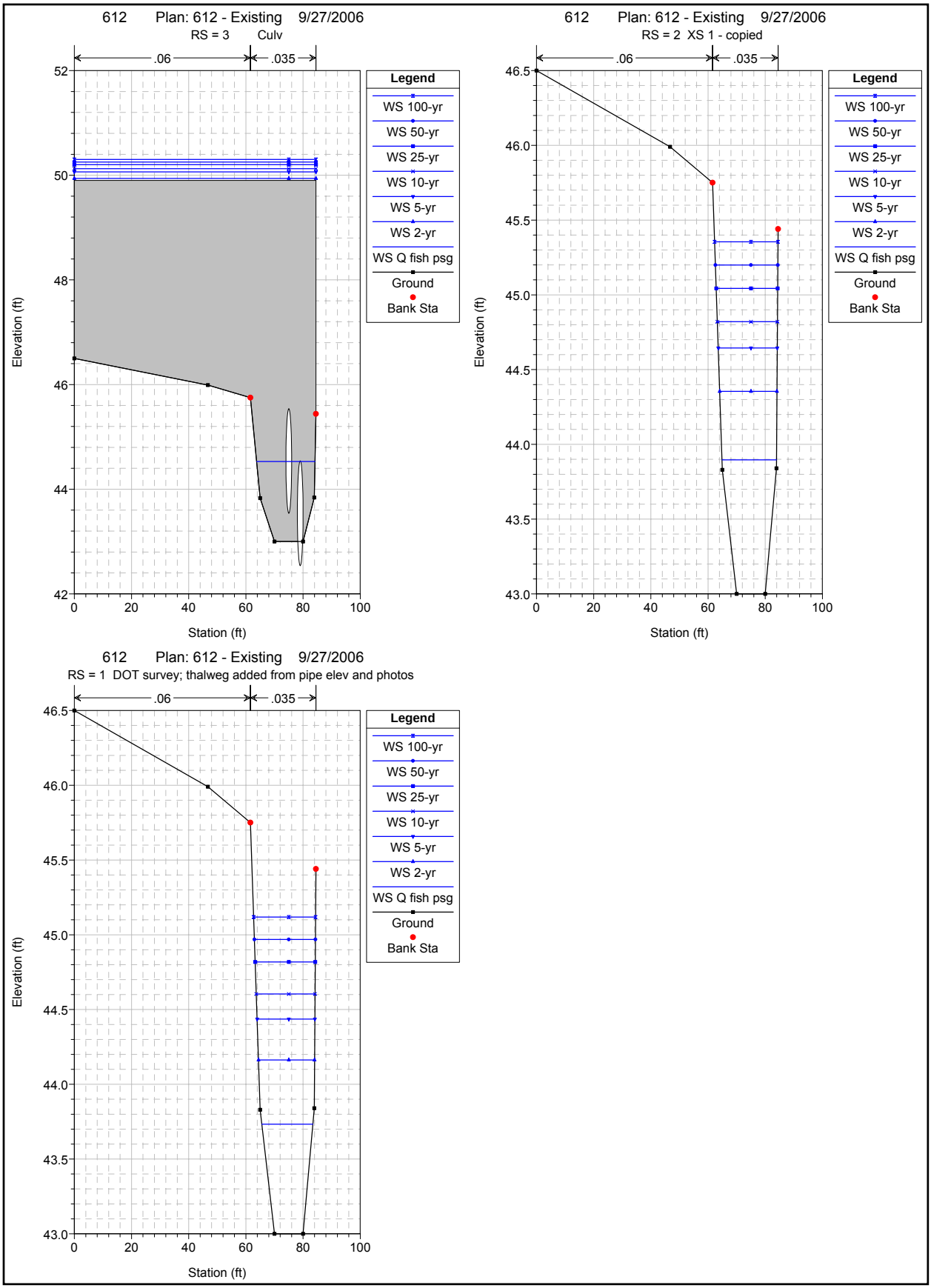
612 Plan: 612 - Existing 9/27/2006
RS = 9 XS 10 copied
612 Plan: 612 - Existing 9/27/2006
RS = 3 Culv
.06
.035
.06
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
Elevation (ft)
Station (ft)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RS = 3 Culv
.06
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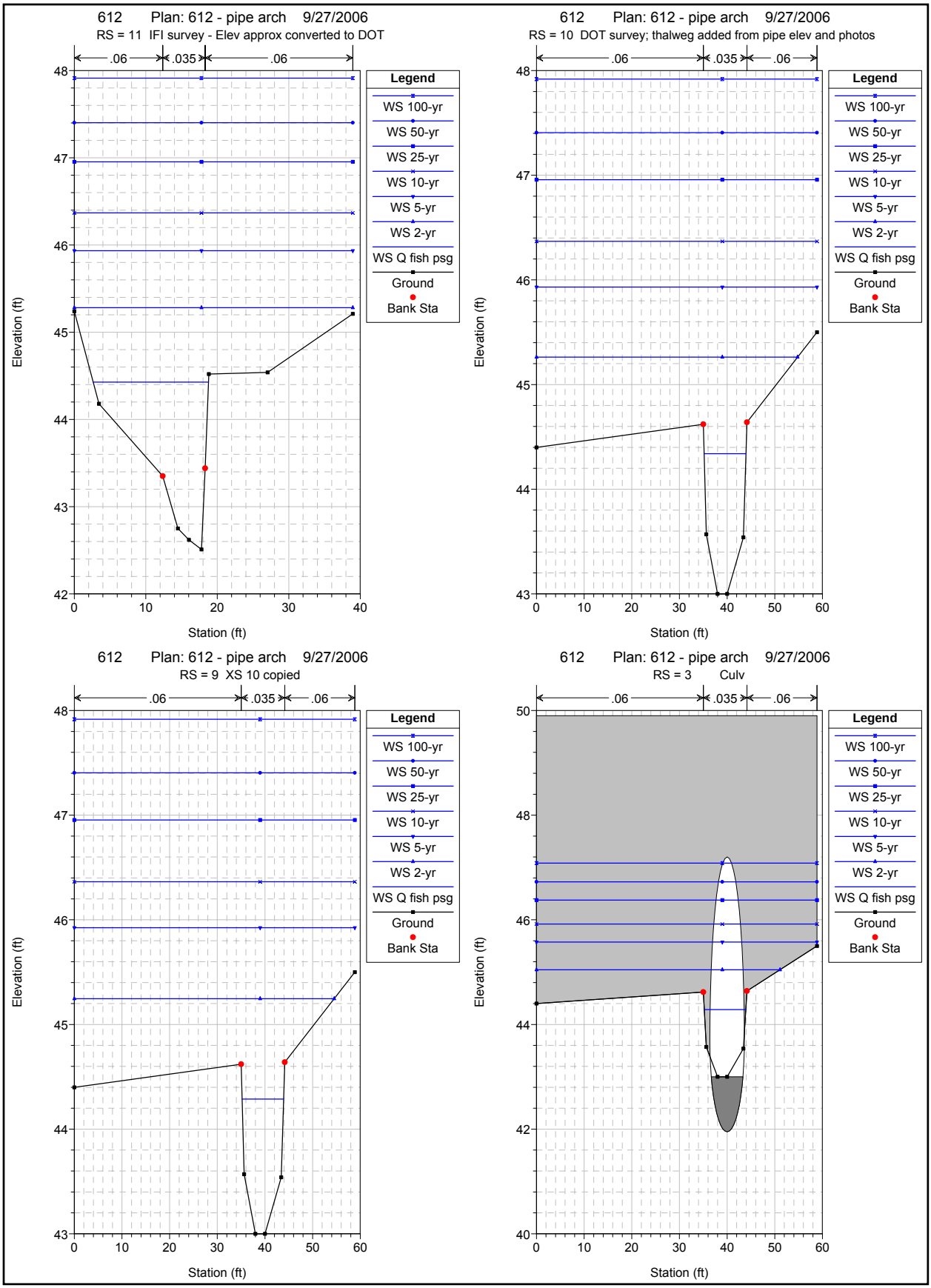
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
612 Plan: 612 - Existing 9/27/2006
RS = 2 XS 1 - copied
.06
.035
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
612 Plan: 612 - Existing 9/27/2006
RS = 1 DOT survey; thalweg added from pipe elev and photos
.06
.035
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta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RS = 11 IFI survey - Elev approx converted to DOT
.06 .035 .06
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
612 Plan: 612 - pipe arch 9/27/2006
RS = 10 DOT survey; thalweg added from pipe elev and photos
.06 .035 .06
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
612 Plan: 612 - pipe arch 9/27/2006
RS = 9 XS 10 copied
.06 .035 .06
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
Elevation (ft)
Station (ft)
612 Plan: 612 - pipe arch 9/27/2006
RS = 3 Culv
.06 .035 .06
Legend
WS 100-yr
WS 50-yr
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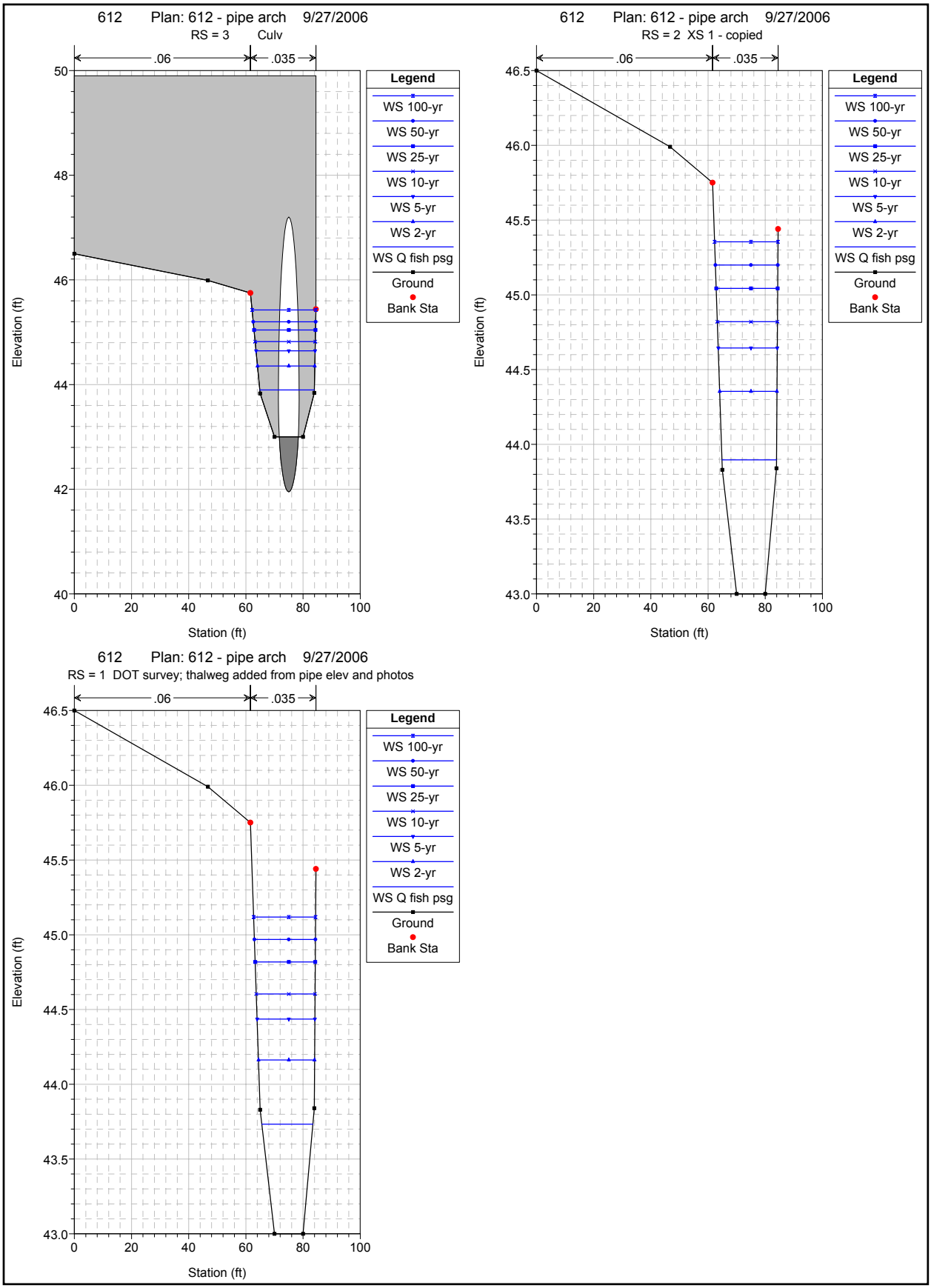
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
Elevation (ft)
Station (ft)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RS = 3 Culv
.06
.035
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
612 Plan: 612 - pipe arch 9/27/2006
RS = 2 XS 1 - copied
.06
.035
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta
612 Plan: 612 - pipe arch 9/27/2006
RS = 1 DOT survey; thalweg added from pipe elev and photos
.06
.035
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
WS Q fish psg
Ground
Bank Sta

HEC-RAS River: 612 Reach: 612

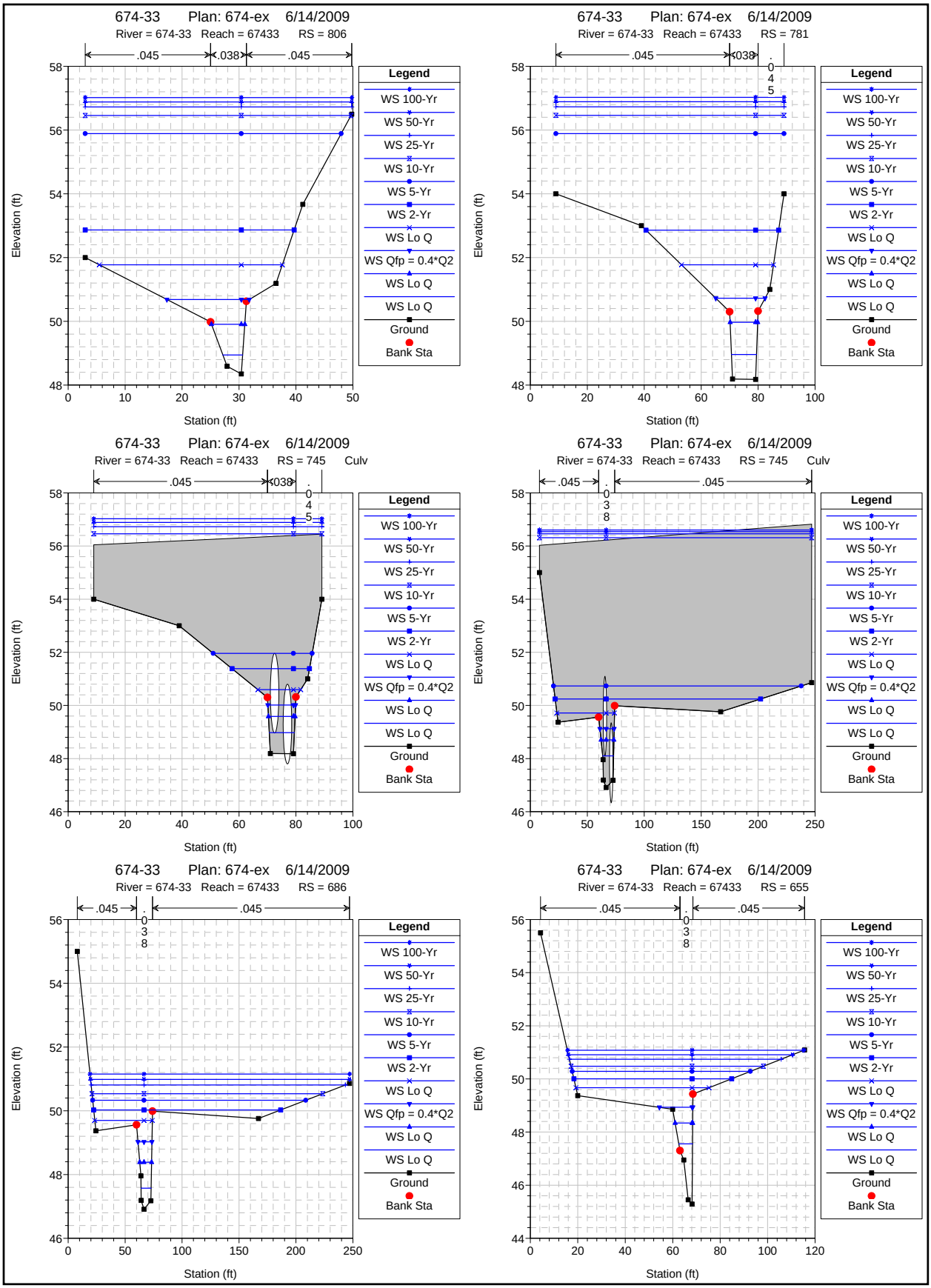
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
612	1	Lo	612 - Parch	2.00		43.00	43.19	43.11	43.21	0.005000	0.19	0.18	0.94	2.12	12.05	12.05	0.40	0.05
612	1	Lo	612-Ex	2.00		43.00	43.19	43.11	43.21	0.005000	0.19	0.18	0.94	2.12	12.05	12.05	0.40	0.05
612	1	Lo	612 - Parch	10.00		43.00	43.49	43.30	43.53	0.005001	0.49	0.40	1.63	6.13	15.19	15.19	0.45	0.13
612	1	Lo	612-Ex	10.00		43.00	43.49	43.30	43.53	0.005001	0.49	0.40	1.63	6.13	15.19	15.19	0.45	0.13
612	1	Q fish psg	612 - Parch	21.00		43.00	43.73	43.47	43.80	0.005004	0.73	0.57	2.06	10.20	17.82	17.82	0.48	0.18
612	1	Q fish psg	612-Ex	21.00		43.00	43.73	43.47	43.80	0.005004	0.73	0.57	2.06	10.20	17.82	17.82	0.48	0.18
612	1	Lo	612 - Parch	35.00		43.00	43.95	43.64	44.05	0.005004	0.95	0.75	2.45	14.30	19.16	19.16	0.50	0.23
612	1	Lo	612-Ex	35.00		43.00	43.95	43.64	44.05	0.005004	0.95	0.75	2.45	14.30	19.16	19.16	0.50	0.23
612	1	2-yr	612 - Parch	52.00		43.00	44.16	43.81	44.29	0.005003	1.16	0.94	2.83	18.37	19.61	19.61	0.52	0.29
612	1	2-yr	612-Ex	52.00		43.00	44.16	43.81	44.29	0.005003	1.16	0.94	2.83	18.37	19.61	19.61	0.52	0.29
612	1	5-yr	612 - Parch	78.00		43.00	44.44	44.00	44.60	0.005001	1.44	1.18	3.27	23.83	20.20	20.20	0.53	0.36
612	1	5-yr	612-Ex	78.00		43.00	44.44	44.01	44.60	0.005001	1.44	1.18	3.27	23.83	20.20	20.20	0.53	0.36
612	1	10-yr	612 - Parch	96.00		43.00	44.60	44.13	44.80	0.005004	1.60	1.33	3.52	27.25	20.56	20.56	0.54	0.40
612	1	10-yr	612-Ex	96.00		43.00	44.60	44.13	44.80	0.005004	1.60	1.33	3.52	27.25	20.56	20.56	0.54	0.40
612	1	25-yr	612 - Parch	121.00		43.00	44.82	44.28	45.04	0.005000	1.82	1.51	3.82	31.70	21.02	21.02	0.55	0.45
612	1	25-yr	612-Ex	121.00		43.00	44.82	44.29	45.04	0.005000	1.82	1.51	3.82	31.70	21.02	21.02	0.55	0.45
612	1	50-yr	612 - Parch	140.00		43.00	44.97	44.39	45.22	0.005003	1.97	1.63	4.01	34.88	21.34	21.34	0.55	0.48
612	1	50-yr	612-Ex	140.00		43.00	44.97	44.39	45.22	0.005003	1.97	1.63	4.01	34.88	21.34	21.34	0.55	0.48
612	1	100-yr	612 - Parch	160.00		43.00	45.12	44.50	45.39	0.005001	2.12	1.76	4.20	38.11	21.66	21.66	0.56	0.52
612	1	100-yr	612-Ex	160.00		43.00	45.12	44.50	45.39	0.005001	2.12	1.76	4.20	38.11	21.66	21.66	0.56	0.52
612	2	Lo	612 - Parch	2.00	41.00	43.00	43.29		43.30	0.001217	0.29	0.26	0.60	3.36	13.10	13.10	0.21	0.02
612	2	Lo	612-Ex	2.00	41.00	43.00	43.29		43.30	0.001217	0.29	0.26	0.60	3.36	13.10	13.10	0.21	0.02
612	2	Lo	612 - Parch	10.00	41.00	43.00	43.63		43.65	0.001969	0.63	0.50	1.19	8.42	16.72	16.72	0.29	0.06
612	2	Lo	612-Ex	10.00	41.00	43.00	43.63		43.65	0.001974	0.63	0.50	1.19	8.42	16.72	16.72	0.30	0.06
612	2	Q fish psg	612 - Parch	21.00	41.00	43.00	43.90		43.94	0.002301	0.90	0.70	1.59	13.24	19.04	19.04	0.34	0.10
612	2	Q fish psg	612-Ex	21.00	41.00	43.00	43.90		43.94	0.002301	0.90	0.70	1.59	13.24	19.04	19.04	0.34	0.10
612	2	Lo	612 - Parch	35.00	41.00	43.00	44.13		44.19	0.002533	1.13	0.91	1.97	17.73	19.54	19.54	0.37	0.14
612	2	Lo	612-Ex	35.00	41.00	43.00	44.13		44.19	0.002532	1.13	0.91	1.97	17.74	19.54	19.54	0.37	0.14
612	2	2-yr	612 - Parch	52.00	41.00	43.00	44.35		44.44	0.002774	1.35	1.11	2.34	22.19	20.02	20.02	0.39	0.19
612	2	2-yr	612-Ex	52.00	41.00	43.00	44.35		44.44	0.002774	1.35	1.11	2.34	22.19	20.02	20.02	0.39	0.19
612	2	5-yr	612 - Parch	78.00	41.00	43.00	44.64		44.76	0.003015	1.64	1.36	2.78	28.07	20.64	20.64	0.42	0.24
612	2	5-yr	612-Ex	78.00	41.00	43.00	44.64		44.76	0.003015	1.64	1.36	2.78	28.07	20.64	20.64	0.42	0.24
612	2	10-yr	612 - Parch	96.00	41.00	43.00	44.82		44.96	0.003136	1.82	1.51	3.02	31.74	21.02	21.02	0.43	0.28
612	2	10-yr	612-Ex	96.00	41.00	43.00	44.82		44.96	0.003136	1.82	1.51	3.02	31.74	21.02	21.02	0.43	0.28
612	2	25-yr	612 - Parch	121.00	41.00	43.00	45.04		45.21	0.003264	2.04	1.70	3.32	36.48	21.50	21.50	0.45	0.33
612	2	25-yr	612-Ex	121.00	41.00	43.00	45.04		45.21	0.003263	2.04	1.70	3.32	36.48	21.50	21.50	0.45	0.33
612	2	50-yr	612 - Parch	140.00	41.00	43.00	45.20		45.39	0.003343	2.20	1.83	3.51	39.86	21.83	21.83	0.46	0.36
612	2	50-yr	612-Ex	140.00	41.00	43.00	45.20		45.39	0.003343	2.20	1.83	3.51	39.86	21.83	21.83	0.46	0.36
612	2	100-yr	612 - Parch	160.00	41.00	43.00	45.35		45.57	0.003413	2.35	1.95	3.70	43.27	22.17	22.17	0.47	0.39
612	2	100-yr	612-Ex	160.00	41.00	43.00	45.35		45.57	0.003413	2.35	1.95	3.70	43.27	22.17	22.17	0.47	0.39
612	3			Culvert														
612	9	Lo	612 - Parch	2.00	105.00	43.00	43.38	43.25	43.41	0.006033	0.38	0.25	1.31	1.52	6.00	6.00	0.46	0.09
612	9	Lo	612-Ex	2.00	105.00	43.00	43.80	43.25	43.81	0.000220	0.80	0.58	0.42	4.71	8.12	8.12	0.10	0.01
612	9	Lo	612 - Parch	10.00	105.00	43.00	43.87	43.57	43.93	0.003931	0.87	0.64	1.91	5.25	8.20	8.20	0.42	0.15
612	9	Lo	612-Ex	10.00	105.00	43.00	44.74	43.57	44.75	0.000204	1.74	1.40	0.70	20.97	45.86	9.16	0.10	0.02
612	9	Q fish psg	612 - Parch	21.00	105.00	43.00	44.29	43.81	44.38	0.003597	1.29	1.01	2.39	8.78	8.73	8.73	0.42	0.20
612	9	Q fish psg	612-Ex	21.00	105.00	43.00	45.66	43.81	45.67	0.000061	2.66	2.33	0.53	70.46	58.86	9.16	0.06	0.01
612	9	Lo	612 - Parch	35.00	105.00	43.00	44.73	44.06	44.81	0.002598	1.73	1.39	2.47	20.48	45.68	9.16	0.37	0.20
612	9	Lo	612-Ex	35.00	105.00	43.00	47.45	44.06	47.45	0.000012	4.45	4.11	0.35	175.33	58.86	9.16	0.03	0.00
612	9	2-yr	612 - Parch	52.00	105.00	43.00	45.25	44.30	45.29	0.001064	2.25	1.91	1.95	46.41	54.53	9.16	0.25	0.11
612	9	2-yr	612-Ex	52.00	105.00	43.00	49.99	44.30	49.99	0.000004	6.99	6.65	0.27	324.96	58.86	9.16	0.02	0.00
612	9	5-yr	612 - Parch	78.00	105.00	43.00	45.92	44.82	45.95	0.000493	2.92	2.59	1.63	85.80	58.86	9.16	0.18	0.07
612	9	5-yr	612-Ex	78.00	105.00	43.00	50.22	44.82	50.23	0.000008	7.22	6.89	0.39	338.89	58.86	9.16	0.03	0.00
612	9	10-yr	612 - Parch	96.00	105.00	43.00	46.36	44.92	46.38	0.000350	3.36	3.03	1.52	111.66	58.86	9.16	0.15	0.06
612	9	10-yr	612-Ex	96.00	105.00	43.00	50.35	44.92	50.35	0.000011	7.35	7.01	0.48	346.21	58.86	9.16	0.03	0.00
612	9	25-yr	612 - Parch	121.00	105.00	43.00	46.95	45.07	46.97	0.000248	3.95	3.62	1.44	146.38	58.86	9.16	0.13	0.05
612	9	25-yr	612-Ex	121.00	105.00	43.00	50.50	45.07	50.50	0.000016	7.50	7.16	0.58	355.15	58.86	9.16	0.04	0.01
612	9	50-yr	612 - Parch	140.00	105.00	43.00	47.40	45.13	47.42	0.000200	4.40	4.07	1.40	172.89	58.86	9.16	0.12	0.04
612	9	50-yr	612-Ex	140.00	105.00	43.00	50.58	45.15	50.58	0.000021	7.58	7.24	0.67	359.52	58.86	9.16	0.04	0.01
612	9	100-yr	612 - Parch	160.00	105.00	43.00	47.92	45.22	47.93	0.000160	4.92	4.58	1.36	203.03	58.86	9.16	0.11	0.04
612	9	100-yr	612-Ex	160.00	105.00	43.00	50.72	45.22	50.72	0.000026	7.72	7.38	0.75	367.95	58.86	9.16	0.05	0.01

HEC-RAS River: 612 Reach: 612 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
612	10	Lo	612 - Parch	2.00	118.00	43.00	43.45		43.46	0.003074	0.45	0.29	1.02	1.95	6.71	6.71	0.33	0.06
612	10	Lo	612-Ex	2.00	118.00	43.00	43.81		43.81	0.000217	0.81	0.58	0.42	4.73	8.12	8.12	0.10	0.01
612	10	Lo	612 - Parch	10.00	118.00	43.00	43.92		43.97	0.003057	0.92	0.69	1.76	5.69	8.27	8.27	0.37	0.12
612	10	Lo	612-Ex	10.00	118.00	43.00	44.74		44.75	0.000202	1.74	1.41	0.69	21.10	45.91	9.16	0.10	0.02
612	10	Q fish psg	612 - Parch	21.00	118.00	43.00	44.34		44.42	0.003093	1.34	1.05	2.27	9.23	8.79	8.79	0.39	0.18
612	10	Q fish psg	612-Ex	21.00	118.00	43.00	45.67		45.67	0.000061	2.67	2.33	0.53	70.50	58.86	9.16	0.06	0.01
612	10	Lo	612 - Parch	35.00	118.00	43.00	44.77		44.85	0.002210	1.77	1.44	2.33	22.51	46.44	9.16	0.34	0.17
612	10	Lo	612-Ex	35.00	118.00	43.00	47.45		47.45	0.000012	4.45	4.11	0.35	175.34	58.86	9.16	0.03	0.00
612	10	2-yr	612 - Parch	52.00	118.00	43.00	45.26		45.30	0.001020	2.26	1.92	1.92	47.24	54.79	9.16	0.24	0.11
612	10	2-yr	612-Ex	52.00	118.00	43.00	49.99		49.99	0.000004	6.99	6.65	0.27	324.96	58.86	9.16	0.02	0.00
612	10	5-yr	612 - Parch	78.00	118.00	43.00	45.93		45.95	0.000486	2.93	2.59	1.62	86.19	58.86	9.16	0.18	0.07
612	10	5-yr	612-Ex	78.00	118.00	43.00	50.22		50.23	0.000008	7.22	6.89	0.39	338.89	58.86	9.16	0.03	0.00
612	10	10-yr	612 - Parch	96.00	118.00	43.00	46.37		46.39	0.000347	3.37	3.03	1.52	111.93	58.86	9.16	0.15	0.06
612	10	10-yr	612-Ex	96.00	118.00	43.00	50.35		50.35	0.000011	7.35	7.01	0.48	346.22	58.86	9.16	0.03	0.00
612	10	25-yr	612 - Parch	121.00	118.00	43.00	46.96		46.97	0.000247	3.96	3.62	1.44	146.57	58.86	9.16	0.13	0.05
612	10	25-yr	612-Ex	121.00	118.00	43.00	50.50		50.50	0.000016	7.50	7.16	0.58	355.16	58.86	9.16	0.04	0.01
612	10	50-yr	612 - Parch	140.00	118.00	43.00	47.41		47.42	0.000200	4.41	4.07	1.40	173.04	58.86	9.16	0.12	0.04
612	10	50-yr	612-Ex	140.00	118.00	43.00	50.58		50.58	0.000021	7.58	7.24	0.67	359.53	58.86	9.16	0.04	0.01
612	10	100-yr	612 - Parch	160.00	118.00	43.00	47.92		47.93	0.000160	4.92	4.58	1.36	203.15	58.86	9.16	0.11	0.04
612	10	100-yr	612-Ex	160.00	118.00	43.00	50.72		50.72	0.000026	7.72	7.38	0.75	367.96	58.86	9.16	0.05	0.01
612	11	Lo	612 - Parch	2.00	146.00	42.51	43.48		43.48	0.000267	0.97	0.67	0.50	4.09	7.34	5.93	0.11	0.01
612	11	Lo	612-Ex	2.00	146.00	42.51	43.81		43.81	0.000065	1.30	1.01	0.32	7.14	11.06	5.93	0.06	0.00
612	11	Lo	612 - Parch	10.00	146.00	42.51	43.99		44.02	0.000874	1.48	1.19	1.31	9.31	13.07	5.93	0.21	0.06
612	11	Lo	612-Ex	10.00	146.00	42.51	44.75		44.75	0.000113	2.24	1.94	0.66	23.39	29.14	5.93	0.08	0.01
612	11	Q fish psg	612 - Parch	21.00	146.00	42.51	44.43		44.47	0.001087	1.92	1.62	1.81	15.88	16.13	5.93	0.25	0.10
612	11	Q fish psg	612-Ex	21.00	146.00	42.51	45.67		45.67	0.000072	3.16	2.86	0.68	56.85	38.96	5.93	0.07	0.01
612	11	Lo	612 - Parch	35.00	146.00	42.51	44.84		44.89	0.001122	2.33	2.03	2.13	26.09	31.03	5.93	0.26	0.13
612	11	Lo	612-Ex	35.00	146.00	42.51	47.45		47.45	0.000021	4.94	4.64	0.51	126.20	38.96	5.93	0.04	0.01
612	11	2-yr	612 - Parch	52.00	146.00	42.51	45.28		45.33	0.000937	2.77	2.48	2.22	41.86	38.96	5.93	0.25	0.13
612	11	2-yr	612-Ex	52.00	146.00	42.51	49.99		49.99	0.000008	7.48	7.18	0.42	225.24	38.96	5.93	0.03	0.00
612	11	5-yr	612 - Parch	78.00	146.00	42.51	45.93		45.98	0.000628	3.42	3.13	2.13	67.34	38.96	5.93	0.21	0.11
612	11	5-yr	612-Ex	78.00	146.00	42.51	50.22		50.23	0.000017	7.71	7.42	0.61	234.44	38.96	5.93	0.04	0.01
612	11	10-yr	612 - Parch	96.00	146.00	42.51	46.37		46.41	0.000510	3.86	3.56	2.09	84.22	38.96	5.93	0.20	0.10
612	11	10-yr	612-Ex	96.00	146.00	42.51	50.35		50.35	0.000024	7.84	7.54	0.74	239.28	38.96	5.93	0.05	0.01
612	11	25-yr	612 - Parch	121.00	146.00	42.51	46.95		46.99	0.000406	4.44	4.15	2.06	107.04	38.96	5.93	0.18	0.09
612	11	25-yr	612-Ex	121.00	146.00	42.51	50.50		50.51	0.000035	7.99	7.69	0.91	245.17	38.96	5.93	0.06	0.02
612	11	50-yr	612 - Parch	140.00	146.00	42.51	47.40		47.44	0.000349	4.89	4.60	2.05	124.50	38.96	5.93	0.17	0.09
612	11	50-yr	612-Ex	140.00	146.00	42.51	50.57		50.58	0.000045	8.06	7.77	1.04	248.04	38.96	5.93	0.07	0.02
612	11	100-yr	612 - Parch	160.00	146.00	42.51	47.91		47.94	0.000294	5.40	5.11	2.02	144.39	38.96	5.93	0.16	0.08
612	11	100-yr	612-Ex	160.00	146.00	42.51	50.72		50.73	0.000055	8.21	7.91	1.17	253.60	38.96	5.93	0.07	0.02

Tributary 647+20 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 670+00
Model based on ADOT&PF project datum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Ground
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Station (ft)
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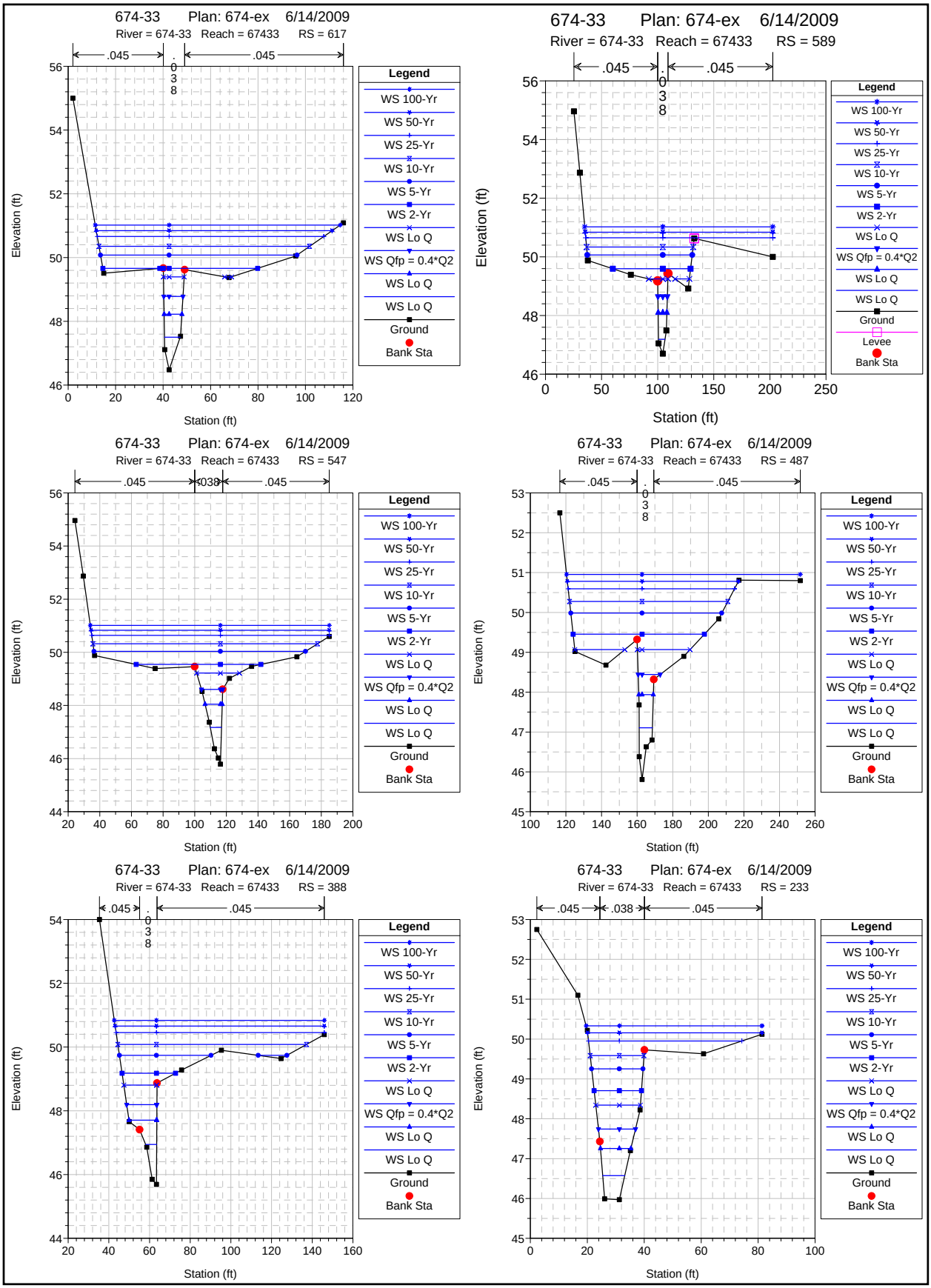
Ground
Bank Sta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Station (ft)
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Ground
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Station (ft)
Legend
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Ground
Bank Sta
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Station (ft)
Legend
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Station (ft)
Legend
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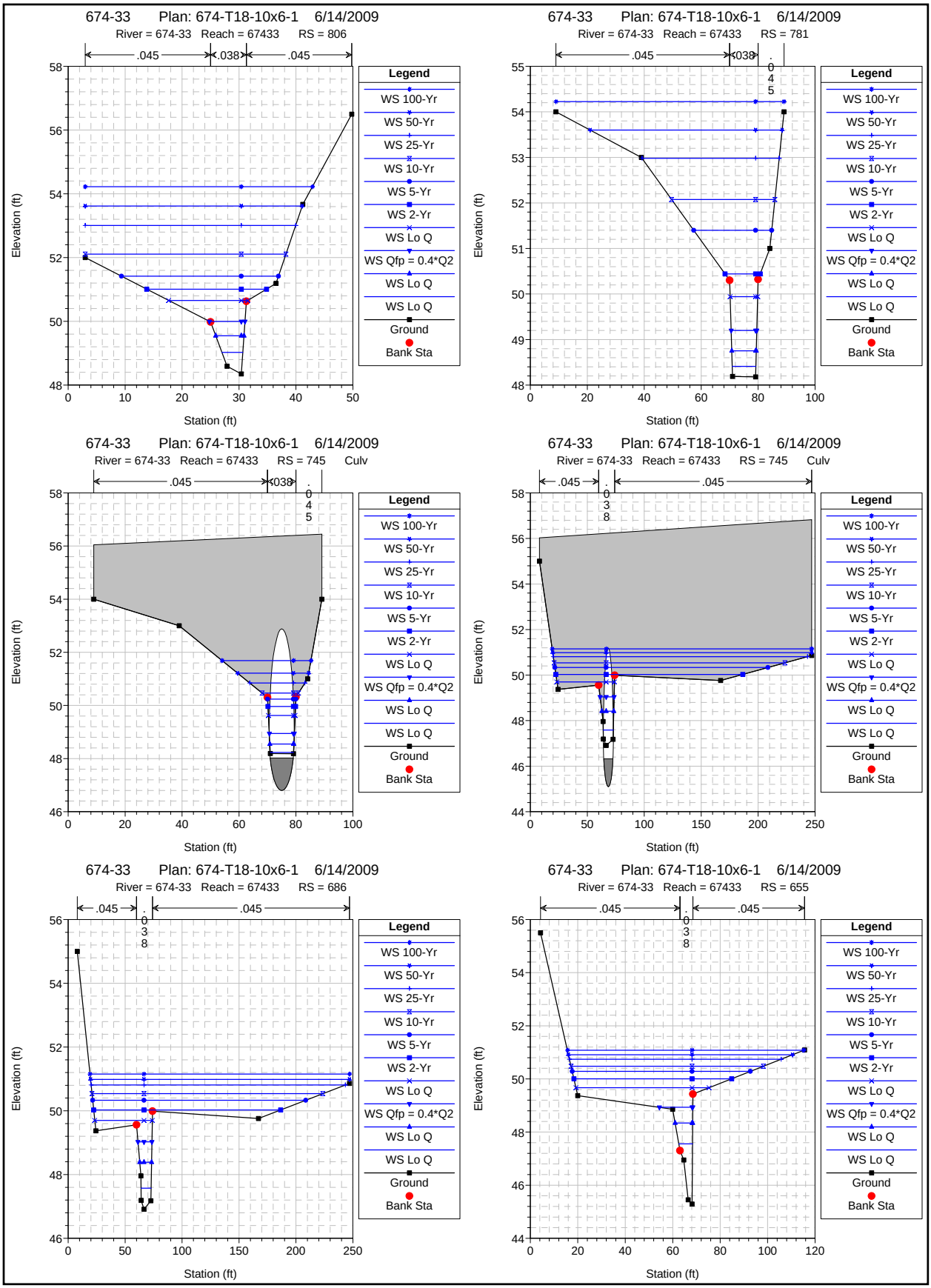
Ground
Bank Sta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Station (ft)
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Ground
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Elevation (ft)
Station (ft)
Legend
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WS Lo Q
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Ground
Bank Sta
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Elevation (ft)
Station (ft)
Legend
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Elevation (ft)
Station (ft)
Legend
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Elevation (ft)
Station (ft)
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Ground
Bank Sta
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Elevation (ft)
Station (ft)
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WS Qfp = 0.4*Q2
WS Lo Q
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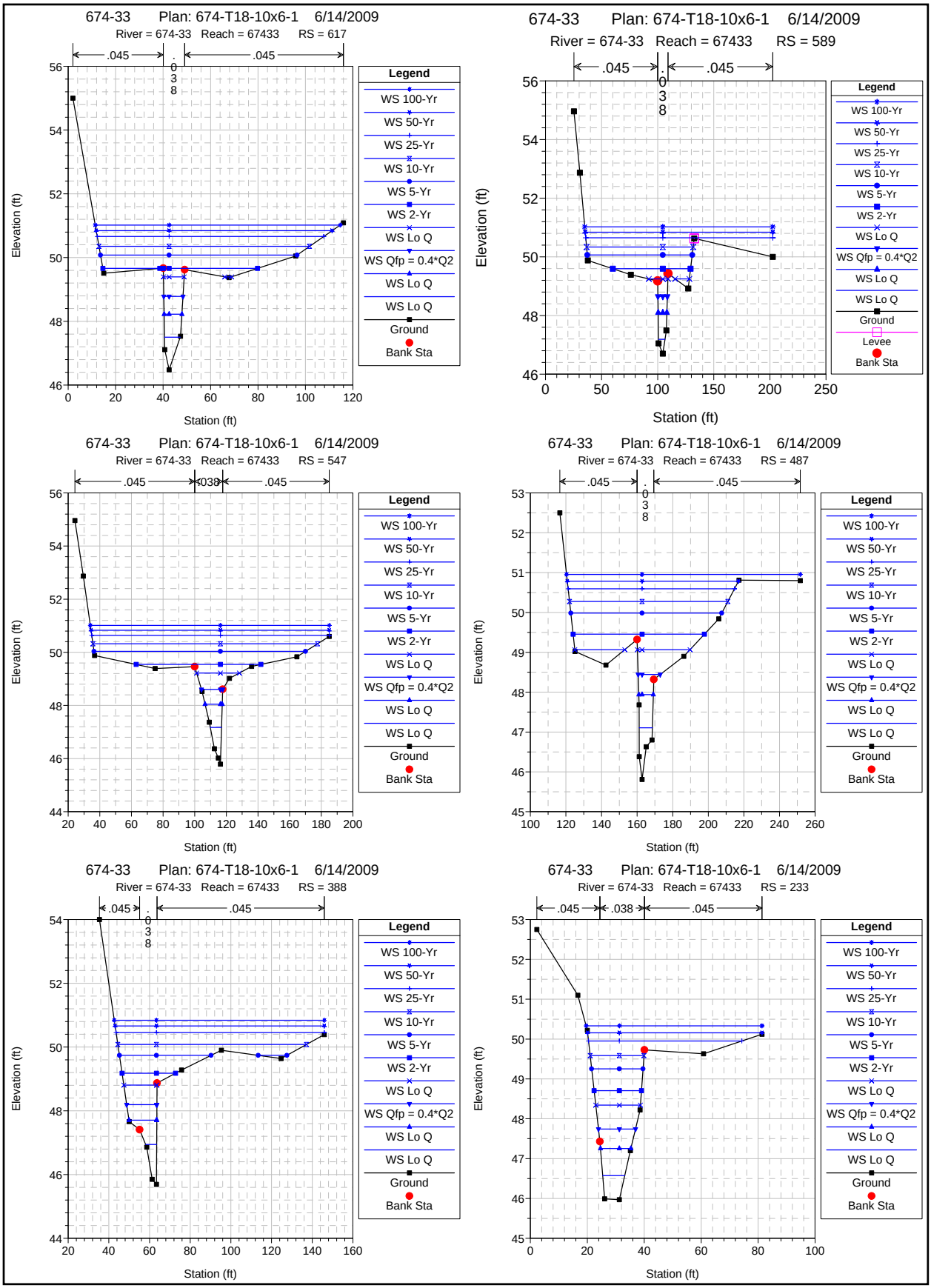
Ground
Bank Sta


674-33 Plan: 674-T18-10x6-1 6/14/2009
River = 674-33 Reach = 67433 RS = 617
.045
.038
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
674-33 Plan: 674-T18-10x6-1 6/14/2009
River = 674-33 Reach = 67433 RS = 589
.045
.038
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Levee
Bank Sta
674-33 Plan: 674-T18-10x6-1 6/14/2009
River = 674-33 Reach = 67433 RS = 547
.045
.038
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
674-33 Plan: 674-T18-10x6-1 6/14/2009
River = 674-33 Reach = 67433 RS = 487
.045
.038
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
674-33 Plan: 674-T18-10x6-1 6/14/2009
River = 674-33 Reach = 67433 RS = 388
.045
.038
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
674-33 Plan: 674-T18-10x6-1 6/14/2009
River = 674-33 Reach = 67433 RS = 233
.045
.038
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta

HEC-RAS River: 674-33 Reach: 67433

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
67433	233	Lo Q	674-ex	5.00		45.97	46.57	46.27	46.60	0.003002	0.60	0.49	1.31	3.83	7.74	7.74	0.33	0.09
67433	233	Lo Q	674-T1	5.00		45.97	46.57	46.27	46.60	0.003002	0.60	0.49	1.31	3.83	7.74	7.74	0.33	0.09
67433	233	Lo Q	674-ex	20.00		45.97	47.25	46.68	47.31	0.003002	1.28	0.94	1.98	10.10	10.70	10.70	0.36	0.17
67433	233	Lo Q	674-T1	20.00		45.97	47.25	46.68	47.31	0.003002	1.28	0.94	1.98	10.10	10.70	10.70	0.36	0.17
67433	233	Qfp = 0.4*Q2	674-ex	38.00		45.97	47.74	47.00	47.83	0.003002	1.77	1.26	2.40	15.90	13.04	12.54	0.38	0.22
67433	233	Qfp = 0.4*Q2	674-T1	38.00		45.97	47.74	47.00	47.83	0.003001	1.77	1.26	2.40	15.90	13.04	12.54	0.38	0.22
67433	233	Lo Q	674-ex	70.00		45.97	48.34	47.42	48.47	0.003004	2.37	1.68	2.90	24.57	15.70	14.26	0.39	0.30
67433	233	Lo Q	674-T1	70.00		45.97	48.34	47.42	48.47	0.003004	2.37	1.68	2.90	24.57	15.70	14.26	0.39	0.30
67433	233	2-Yr	674-ex	96.00		45.97	48.71	47.69	48.87	0.003001	2.74	1.99	3.24	30.46	16.65	14.63	0.40	0.35
67433	233	2-Yr	674-T1	96.00		45.97	48.71	47.69	48.87	0.003001	2.74	1.99	3.24	30.46	16.65	14.63	0.40	0.35
67433	233	5-Yr	674-ex	142.00		45.97	49.25	48.10	49.46	0.003000	3.28	2.46	3.70	39.97	18.06	15.18	0.42	0.42
67433	233	5-Yr	674-T1	142.00		45.97	49.25	48.10	49.46	0.003000	3.28	2.46	3.70	39.97	18.06	15.18	0.42	0.42
67433	233	10-Yr	674-ex	174.00		45.97	49.59	48.33	49.82	0.003006	3.62	2.74	3.95	46.11	18.92	15.51	0.42	0.47
67433	233	10-Yr	674-T1	174.00		45.97	49.59	48.33	49.82	0.003006	3.62	2.74	3.95	46.11	18.92	15.51	0.42	0.47
67433	233	25-Yr	674-ex	220.00		45.97	49.95	48.62	50.22	0.003002	3.98	3.07	4.26	60.96	53.87	15.66	0.43	0.53
67433	233	25-Yr	674-T1	220.00		45.97	49.95	48.62	50.22	0.003002	3.98	3.07	4.26	60.96	53.87	15.66	0.43	0.53
67433	233	50-Yr	674-ex	255.00		45.97	50.16	48.82	50.43	0.003002	4.19	3.28	4.45	72.86	61.27	15.66	0.43	0.56
67433	233	50-Yr	674-T1	255.00		45.97	50.16	48.82	50.43	0.003002	4.19	3.28	4.45	72.86	61.27	15.66	0.43	0.56
67433	233	100-Yr	674-ex	291.00		45.97	50.33	49.02	50.62	0.003004	4.36	3.46	4.61	83.75	61.79	15.66	0.44	0.59
67433	233	100-Yr	674-T1	291.00		45.97	50.33	49.02	50.62	0.003004	4.36	3.46	4.61	83.75	61.79	15.66	0.44	0.59
67433	388	Lo Q	674-ex	5.00	155.00	45.69	46.95		46.97	0.001883	1.26	0.76	1.22	4.10	5.40	5.40	0.25	0.07
67433	388	Lo Q	674-T1	5.00	155.00	45.69	46.95		46.97	0.001883	1.26	0.76	1.22	4.10	5.40	5.40	0.25	0.07
67433	388	Lo Q	674-ex	20.00	155.00	45.69	47.71		47.77	0.002853	2.02	1.16	2.00	10.67	13.67	8.40	0.33	0.17
67433	388	Lo Q	674-T1	20.00	155.00	45.69	47.71		47.77	0.002851	2.02	1.16	2.00	10.67	13.67	8.40	0.33	0.17
67433	388	Qfp = 0.4*Q2	674-ex	38.00	155.00	45.69	48.19		48.28	0.002777	2.50	1.64	2.41	17.62	14.84	8.45	0.33	0.22
67433	388	Qfp = 0.4*Q2	674-T1	38.00	155.00	45.69	48.19		48.28	0.002783	2.50	1.64	2.41	17.61	14.83	8.45	0.33	0.22
67433	388	Lo Q	674-ex	70.00	155.00	45.69	48.81		48.92	0.002863	3.12	2.24	2.92	27.15	16.30	8.50	0.34	0.29
67433	388	Lo Q	674-T1	70.00	155.00	45.69	48.81		48.92	0.002865	3.12	2.24	2.92	27.15	16.30	8.50	0.34	0.29
67433	388	2-Yr	674-ex	96.00	155.00	45.69	49.18		49.32	0.002909	3.49	2.62	3.25	34.83	26.31	8.51	0.35	0.35
67433	388	2-Yr	674-T1	96.00	155.00	45.69	49.18		49.32	0.002911	3.49	2.62	3.25	34.82	26.29	8.51	0.35	0.35
67433	388	5-Yr	674-ex	142.00	155.00	45.69	49.74		49.89	0.002571	4.05	3.18	3.48	55.48	59.16	8.51	0.34	0.37
67433	388	5-Yr	674-T1	142.00	155.00	45.69	49.74		49.89	0.002571	4.05	3.18	3.48	55.46	59.13	8.51	0.34	0.37
67433	388	10-Yr	674-ex	174.00	155.00	45.69	50.08		50.20	0.002077	4.39	3.52	3.34	83.49	92.75	8.51	0.31	0.33
67433	388	10-Yr	674-T1	174.00	155.00	45.69	50.08		50.20	0.002076	4.39	3.52	3.34	83.52	92.75	8.51	0.31	0.33
67433	388	25-Yr	674-ex	220.00	155.00	45.69	50.45		50.54	0.001550	4.76	3.89	3.09	120.14	102.33	8.51	0.28	0.28
67433	388	25-Yr	674-T1	220.00	155.00	45.69	50.45		50.54	0.001549	4.76	3.89	3.09	120.18	102.33	8.51	0.28	0.27
67433	388	50-Yr	674-ex	255.00	155.00	45.69	50.66		50.74	0.001390	4.97	4.10	3.03	141.21	102.81	8.51	0.26	0.26
67433	388	50-Yr	674-T1	255.00	155.00	45.69	50.66		50.74	0.001388	4.97	4.10	3.03	141.31	102.81	8.51	0.26	0.26
67433	388	100-Yr	674-ex	291.00	155.00	45.69	50.84		50.92	0.001308	5.15	4.27	3.02	159.61	103.22	8.51	0.26	0.26
67433	388	100-Yr	674-T1	291.00	155.00	45.69	50.84		50.92	0.001307	5.15	4.28	3.02	159.66	103.22	8.51	0.26	0.25
67433	487	Lo Q	674-ex	5.00	254.00	45.81	47.11		47.12	0.001339	1.30	0.67	1.00	4.99	7.40	7.40	0.22	0.05
67433	487	Lo Q	674-T1	5.00	254.00	45.81	47.11		47.12	0.001339	1.30	0.67	1.00	4.99	7.40	7.40	0.22	0.05
67433	487	Lo Q	674-ex	20.00	254.00	45.81	47.94		47.99	0.001778	2.13	1.40	1.75	11.40	8.14	8.14	0.26	0.12
67433	487	Lo Q	674-T1	20.00	254.00	45.81	47.94		47.99	0.001777	2.13	1.40	1.75	11.40	8.14	8.14	0.26	0.12
67433	487	Qfp = 0.4*Q2	674-ex	38.00	254.00	45.81	48.45		48.54	0.002517	2.64	1.80	2.42	15.91	12.38	8.74	0.32	0.22
67433	487	Qfp = 0.4*Q2	674-T1	38.00	254.00	45.81	48.44		48.54	0.002519	2.63	1.80	2.42	15.91	12.37	8.74	0.32	0.22
67433	487	Lo Q	674-ex	70.00	254.00	45.81	49.07		49.17	0.002459	3.26	2.32	2.80	35.10	57.65	9.17	0.32	0.27
67433	487	Lo Q	674-T1	70.00	254.00	45.81	49.07		49.17	0.002460	3.26	2.32	2.81	35.09	57.64	9.17	0.32	0.27
67433	487	2-Yr	674-ex	96.00	254.00	45.81	49.45		49.52	0.001669	3.64	2.66	2.52	61.03	73.77	9.35	0.27	0.21
67433	487	2-Yr	674-T1	96.00	254.00	45.81	49.45		49.52	0.001671	3.64	2.66	2.52	61.00	73.76	9.35	0.27	0.21
67433	487	5-Yr	674-ex	142.00	254.00	45.81	49.98		50.03	0.001013	4.17	3.19	2.22	103.32	84.81	9.35	0.22	0.15
67433	487	5-Yr	674-T1	142.00	254.00	45.81	49.98		50.03	0.001013	4.17	3.19	2.22	103.31	84.80	9.35	0.22	0.15
67433	487	10-Yr	674-ex	174.00	254.00	45.81	50.28		50.32	0.000839	4.47	3.48	2.14	128.73	88.96	9.35	0.20	0.14
67433	487	10-Yr	674-T1	174.00	254.00	45.81	50.28		50.32	0.000839	4.47	3.48	2.14	128.75	88.96	9.35	0.20	0.14
67433	487	25-Yr	674-ex	220.00	254.00	45.81	50.59		50.63	0.000764	4.78	3.80	2.17	157.70	93.47	9.35	0.20	0.14
67433	487	25-Yr	674-T1	220.00	254.00	45.81	50.59		50.63	0.000764	4.78	3.80	2.16	157.73	93.47	9.35	0.20	0.14
67433	487	50-Yr	674-ex	255.00	254.00	45.81	50.78		50.82	0.000761	4.97	3.99	2.23	175.52	96.13	9.35	0.20	0.14
67433	487	50-Yr	674-T1	255.00	254.00	45.81	50.78		50.82	0.000760	4.97	3.99	2.23	175.59	96.14	9.35	0.20	0.14
67433	487	100-Yr	674-ex	291.00	254.00	45.81	50.95		51.00	0.000886	5.14	4.16	2.48	197.14	131.27	9.35	0.21	0.17
67433	487	100-Yr	674-T1	291.00	254.00	45.81	50.95		51.00	0.000886	5.14	4.16	2.48	197.19	131.27	9.35	0.21	0.17
67433	547	Lo Q	674-ex	5.00	314.00	45.79	47.17		47.18	0.000827	1.38	0.79	0.88	5.66	7.13	7.13	0.17	0.04

HEC-RAS River: 674-33 Reach: 67433 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
67433	547	Lo Q	674-T1	5.00	314.00	45.79	47.17		47.18	0.000827	1.38	0.79	0.88	5.66	7.13	7.13	0.17	0.04
67433	547	Lo Q	674-ex	20.00	314.00	45.79	48.04		48.08	0.001312	2.25	1.24	1.49	13.46	10.86	10.86	0.24	0.09
67433	547	Lo Q	674-T1	20.00	314.00	45.79	48.04		48.08	0.001312	2.25	1.24	1.49	13.46	10.86	10.86	0.24	0.09
67433	547	Qfp = 0.4*Q2	674-ex	38.00	314.00	45.79	48.60		48.66	0.001616	2.81	1.51	1.88	20.24	13.43	13.43	0.27	0.13
67433	547	Qfp = 0.4*Q2	674-T1	38.00	314.00	45.79	48.60		48.66	0.001617	2.81	1.51	1.88	20.23	13.42	13.42	0.27	0.13
67433	547	Lo Q	674-ex	70.00	314.00	45.79	49.22		49.30	0.001931	3.43	1.79	2.33	31.84	27.03	16.50	0.31	0.19
67433	547	Lo Q	674-T1	70.00	314.00	45.79	49.22		49.30	0.001931	3.43	1.79	2.33	31.83	27.02	16.49	0.31	0.19
67433	547	2-Yr	674-ex	96.00	314.00	45.79	49.54		49.64	0.002008	3.75	1.98	2.56	46.41	78.79	17.68	0.32	0.22
67433	547	2-Yr	674-T1	96.00	314.00	45.79	49.54		49.64	0.002009	3.75	1.98	2.56	46.39	78.75	17.68	0.32	0.22
67433	547	5-Yr	674-ex	142.00	314.00	45.79	50.04		50.10	0.001184	4.25	2.47	2.28	102.39	133.71	17.68	0.26	0.16
67433	547	5-Yr	674-T1	142.00	314.00	45.79	50.04		50.10	0.001184	4.25	2.47	2.28	102.38	133.71	17.68	0.26	0.16
67433	547	10-Yr	674-ex	174.00	314.00	45.79	50.32		50.36	0.000840	4.53	2.76	2.06	141.76	141.98	17.68	0.22	0.13
67433	547	10-Yr	674-T1	174.00	314.00	45.79	50.32		50.37	0.000840	4.53	2.76	2.06	141.78	141.98	17.68	0.22	0.13
67433	547	25-Yr	674-ex	220.00	314.00	45.79	50.64		50.67	0.000652	4.85	3.08	1.96	188.22	150.10	17.68	0.20	0.11
67433	547	25-Yr	674-T1	220.00	314.00	45.79	50.64		50.67	0.000651	4.85	3.08	1.95	188.26	150.10	17.68	0.20	0.11
67433	547	50-Yr	674-ex	255.00	314.00	45.79	50.83		50.86	0.000588	5.04	3.27	1.93	216.80	150.56	17.68	0.19	0.11
67433	547	50-Yr	674-T1	255.00	314.00	45.79	50.83		50.86	0.000587	5.04	3.27	1.93	216.91	150.56	17.68	0.19	0.11
67433	547	100-Yr	674-ex	291.00	314.00	45.79	51.01		51.04	0.000543	5.22	3.45	1.92	244.12	150.99	17.68	0.18	0.10
67433	547	100-Yr	674-T1	291.00	314.00	45.79	51.01		51.04	0.000542	5.22	3.45	1.92	244.17	150.99	17.68	0.18	0.10
67433	589	Lo Q	674-ex	5.00	356.00	46.70	47.19	47.19	47.33	0.032570	0.49	0.29	3.02	1.66	5.77	5.77	0.99	0.57
67433	589	Lo Q	674-T1	5.00	356.00	46.70	47.19	47.19	47.33	0.032570	0.49	0.29	3.02	1.66	5.77	5.77	0.99	0.57
67433	589	Lo Q	674-ex	20.00	356.00	46.70	48.10	47.61	48.19	0.004545	1.40	1.04	2.47	8.09	7.76	7.76	0.43	0.26
67433	589	Lo Q	674-T1	20.00	356.00	46.70	48.10	47.61	48.19	0.004544	1.40	1.04	2.47	8.09	7.76	7.76	0.43	0.26
67433	589	Qfp = 0.4*Q2	674-ex	38.00	356.00	46.70	48.65	47.95	48.79	0.004525	1.95	1.50	3.02	12.56	8.40	8.40	0.44	0.35
67433	589	Qfp = 0.4*Q2	674-T1	38.00	356.00	46.70	48.65	47.95	48.79	0.004528	1.95	1.50	3.03	12.56	8.40	8.40	0.44	0.35
67433	589	Lo Q	674-ex	70.00	356.00	46.70	49.25	48.43	49.47	0.005399	2.55	1.97	3.84	20.17	29.66	9.06	0.48	0.52
67433	589	Lo Q	674-T1	70.00	356.00	46.70	49.25	48.43	49.47	0.005400	2.55	1.97	3.84	20.16	29.64	9.06	0.48	0.52
67433	589	2-Yr	674-ex	96.00	356.00	46.70	49.59	48.75	49.78	0.004276	2.89	2.28	3.76	38.29	69.30	9.20	0.44	0.48
67433	589	2-Yr	674-T1	96.00	356.00	46.70	49.59	48.75	49.78	0.004279	2.89	2.28	3.76	38.28	69.29	9.20	0.44	0.48
67433	589	5-Yr	674-ex	142.00	356.00	46.70	50.06	49.66	50.16	0.002294	3.36	2.75	3.12	78.52	93.55	9.20	0.33	0.31
67433	589	5-Yr	674-T1	142.00	356.00	46.70	50.06	49.66	50.16	0.002295	3.36	2.75	3.12	78.51	93.55	9.20	0.33	0.31
67433	589	10-Yr	674-ex	174.00	356.00	46.70	50.34	49.79	50.41	0.001653	3.64	3.02	2.82	104.27	95.06	9.20	0.29	0.24
67433	589	10-Yr	674-T1	174.00	356.00	46.70	50.34	49.79	50.41	0.001652	3.64	3.02	2.82	104.28	95.06	9.20	0.29	0.24
67433	589	25-Yr	674-ex	220.00	356.00	46.70	50.65	49.96	50.70	0.001294	3.95	3.33	2.67	157.72	166.73	9.20	0.26	0.21
67433	589	25-Yr	674-T1	220.00	356.00	46.70	50.65	49.96	50.70	0.001293	3.95	3.33	2.67	157.76	166.73	9.20	0.26	0.21
67433	589	50-Yr	674-ex	255.00	356.00	46.70	50.84	50.04	50.89	0.001057	4.14	3.53	2.50	189.61	167.18	9.20	0.23	0.18
67433	589	50-Yr	674-T1	255.00	356.00	46.70	50.84	50.04	50.89	0.001055	4.14	3.53	2.50	189.72	167.18	9.20	0.23	0.18
67433	589	100-Yr	674-ex	291.00	356.00	46.70	51.02	50.11	51.06	0.000902	4.32	3.71	2.39	219.98	167.61	9.20	0.22	0.16
67433	589	100-Yr	674-T1	291.00	356.00	46.70	51.02	50.11	51.06	0.000902	4.32	3.71	2.39	220.04	167.61	9.20	0.22	0.16
67433	617	Lo Q	674-ex	5.00	384.00	46.48	47.50		47.53	0.002857	1.02	0.56	1.35	3.70	6.60	6.60	0.32	0.09
67433	617	Lo Q	674-T1	5.00	384.00	46.48	47.50		47.53	0.002857	1.02	0.56	1.35	3.70	6.60	6.60	0.32	0.09
67433	617	Lo Q	674-ex	20.00	384.00	46.48	48.22		48.30	0.003423	1.74	1.18	2.27	8.80	7.49	7.49	0.37	0.21
67433	617	Lo Q	674-T1	20.00	384.00	46.48	48.22		48.30	0.003423	1.74	1.18	2.27	8.80	7.49	7.49	0.37	0.21
67433	617	Qfp = 0.4*Q2	674-ex	38.00	384.00	46.48	48.78		48.91	0.003885	2.30	1.63	2.89	13.16	8.09	8.09	0.40	0.31
67433	617	Qfp = 0.4*Q2	674-T1	38.00	384.00	46.48	48.78		48.91	0.003886	2.30	1.63	2.89	13.16	8.09	8.09	0.40	0.31
67433	617	Lo Q	674-ex	70.00	384.00	46.48	49.40		49.62	0.005196	2.92	2.09	3.82	18.38	11.69	8.76	0.46	0.51
67433	617	Lo Q	674-T1	70.00	384.00	46.48	49.40		49.62	0.005196	2.92	2.09	3.82	18.37	11.69	8.76	0.46	0.51
67433	617	2-Yr	674-ex	96.00	384.00	46.48	49.66	48.78	49.95	0.006307	3.18	2.30	4.42	27.36	63.73	9.02	0.51	0.67
67433	617	2-Yr	674-T1	96.00	384.00	46.48	49.66	48.78	49.95	0.006309	3.18	2.30	4.42	27.35	63.70	9.02	0.51	0.67
67433	617	5-Yr	674-ex	142.00	384.00	46.48	50.08		50.26	0.004202	3.60	2.71	4.03	58.47	82.82	9.02	0.43	0.53
67433	617	5-Yr	674-T1	142.00	384.00	46.48	50.08		50.26	0.004204	3.60	2.71	4.03	58.46	82.82	9.02	0.43	0.53
67433	617	10-Yr	674-ex	174.00	384.00	46.48	50.35		50.48	0.002958	3.87	2.99	3.60	81.86	88.73	9.02	0.37	0.41
67433	617	10-Yr	674-T1	174.00	384.00	46.48	50.35		50.48	0.002957	3.87	2.99	3.60	81.87	88.74	9.02	0.37	0.41
67433	617	25-Yr	674-ex	220.00	384.00	46.48	50.66		50.76	0.002249	4.18	3.29	3.35	110.22	95.42	9.02	0.33	0.34
67433	617	25-Yr	674-T1	220.00	384.00	46.48	50.66		50.76	0.002248	4.18	3.29	3.35	110.25	95.42	9.02	0.33	0.34
67433	617	50-Yr	674-ex	255.00	384.00	46.48	50.84		50.93	0.002048	4.36	3.48	3.32	127.95	99.37	9.02	0.31	0.33
67433	617	50-Yr	674-T1	255.00	384.00	46.48	50.84		50.94	0.002045	4.36	3.48	3.32	128.01	99.38	9.02	0.31	0.33
67433	617	100-Yr	674-ex	291.00	384.00	46.48	51.02		51.11	0.001885	4.54	3.65	3.29	145.76	103.18	9.02	0.30	0.32
67433	617	100-Yr	674-T1	291.00	384.00	46.48	51.02		51.11	0.001884	4.54	3.65	3.29	145.80	103.19	9.02	0.30	0.32
67433	655	Lo Q	674-ex	5.00	422.00	45.29	47.56		47.56	0.000384	2.27	1.33	0.71	7.12	5.81	5.30	0.11	0.02
67433	655	Lo Q	674-T1	5.00	422.00	45.29	47.56		47.56	0.000384	2.27	1.33	0.71	7.12	5.81	5.30	0.11	0.02

HEC-RAS River: 674-33 Reach: 67433 (Continued)

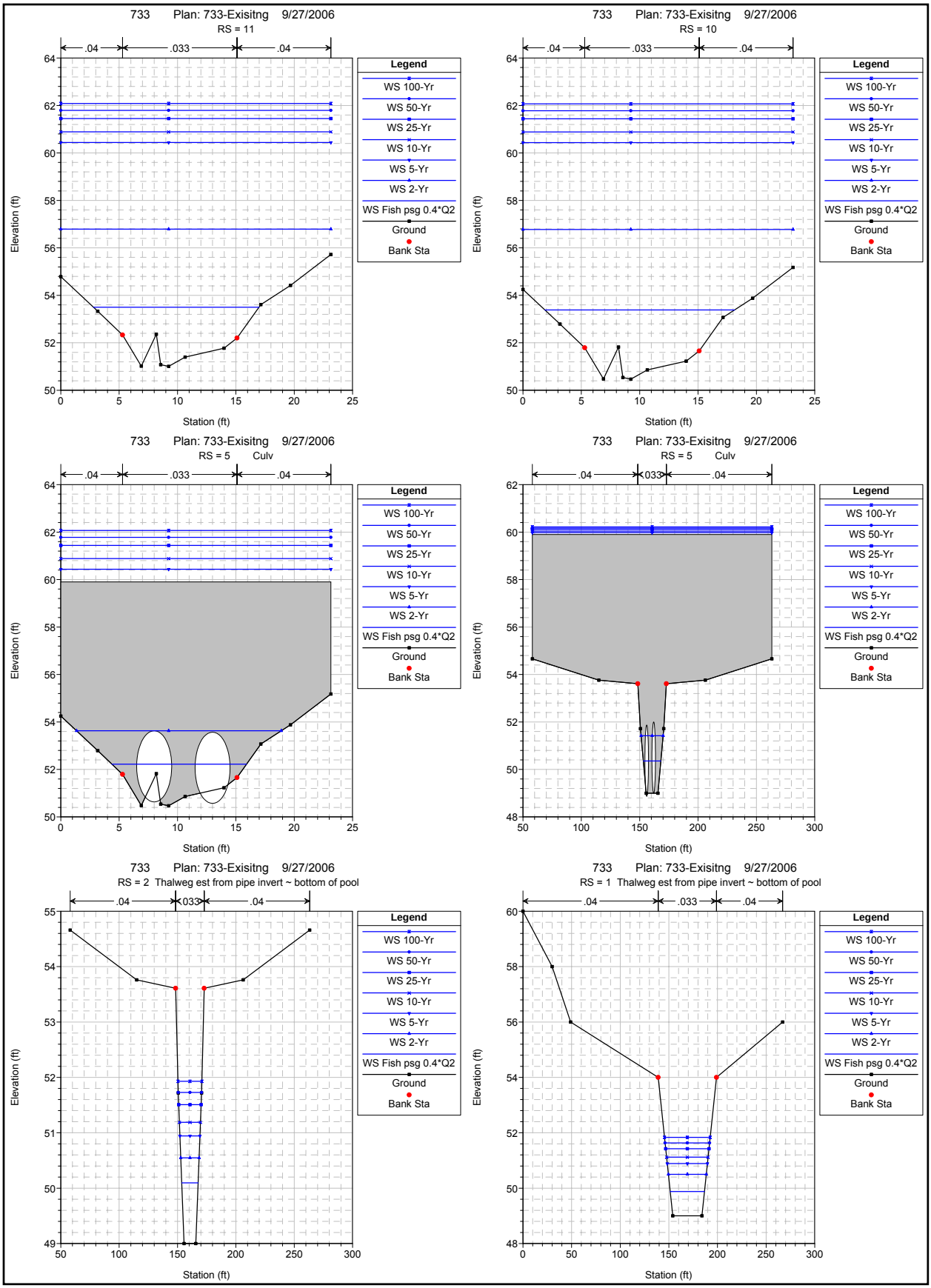
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
67433	655	Lo Q	674-ex	20.00	422.00	45.29	48.34		48.38	0.001373	3.05	2.09	1.71	12.29	7.41	5.37	0.21	0.11
67433	655	Lo Q	674-T1	20.00	422.00	45.29	48.34		48.38	0.001373	3.05	2.09	1.71	12.29	7.41	5.37	0.21	0.11
67433	655	Qfp = 0.4*Q2	674-ex	38.00	422.00	45.29	48.93		49.02	0.002276	3.64	2.66	2.49	17.25	14.13	5.42	0.27	0.22
67433	655	Qfp = 0.4*Q2	674-T1	38.00	422.00	45.29	48.93		49.02	0.002276	3.64	2.66	2.49	17.24	14.12	5.42	0.27	0.22
67433	655	Lo Q	674-ex	70.00	422.00	45.29	49.67		49.73	0.001596	4.38	3.38	2.38	46.46	56.10	5.46	0.23	0.19
67433	655	Lo Q	674-T1	70.00	422.00	45.29	49.67		49.73	0.001596	4.38	3.38	2.38	46.45	56.09	5.46	0.23	0.19
67433	655	2-Yr	674-ex	96.00	422.00	45.29	50.01		50.05	0.001288	4.72	3.71	2.27	67.02	66.46	5.46	0.21	0.17
67433	655	2-Yr	674-T1	96.00	422.00	45.29	50.01		50.05	0.001288	4.72	3.71	2.27	67.01	66.46	5.46	0.21	0.17
67433	655	5-Yr	674-ex	142.00	422.00	45.29	50.28		50.34	0.001503	4.99	3.99	2.58	86.71	75.06	5.46	0.23	0.21
67433	655	5-Yr	674-T1	142.00	422.00	45.29	50.28		50.34	0.001503	4.99	3.99	2.58	86.71	75.06	5.46	0.23	0.21
67433	655	10-Yr	674-ex	174.00	422.00	45.29	50.48		50.54	0.001510	5.19	4.19	2.66	101.85	81.05	5.46	0.23	0.22
67433	655	10-Yr	674-T1	174.00	422.00	45.29	50.48		50.54	0.001509	5.19	4.19	2.66	101.85	81.05	5.46	0.23	0.22
67433	655	25-Yr	674-ex	220.00	422.00	45.29	50.74		50.81	0.001456	5.45	4.45	2.73	124.36	89.22	5.46	0.23	0.22
67433	655	25-Yr	674-T1	220.00	422.00	45.29	50.74		50.81	0.001455	5.45	4.45	2.73	124.38	89.23	5.46	0.23	0.22
67433	655	50-Yr	674-ex	255.00	422.00	45.29	50.91		50.98	0.001449	5.62	4.62	2.79	139.88	94.44	5.46	0.23	0.23
67433	655	50-Yr	674-T1	255.00	422.00	45.29	50.91		50.98	0.001448	5.62	4.62	2.79	139.93	94.46	5.46	0.23	0.23
67433	655	100-Yr	674-ex	291.00	422.00	45.29	51.08		51.15	0.001427	5.79	4.79	2.83	156.00	99.57	5.46	0.23	0.24
67433	655	100-Yr	674-T1	291.00	422.00	45.29	51.08		51.15	0.001426	5.79	4.79	2.83	156.03	99.58	5.46	0.23	0.24
67433	686	Lo Q	674-ex	5.00	453.00	46.91	47.57		47.59	0.002104	0.66	0.51	1.10	4.53	8.79	8.79	0.27	0.06
67433	686	Lo Q	674-T1	5.00	453.00	46.91	47.57		47.59	0.002104	0.66	0.51	1.10	4.53	8.79	8.79	0.27	0.06
67433	686	Lo Q	674-ex	20.00	453.00	46.91	48.39		48.43	0.001712	1.48	1.17	1.65	12.14	10.34	10.34	0.27	0.11
67433	686	Lo Q	674-T1	20.00	453.00	46.91	48.39		48.43	0.001712	1.48	1.17	1.65	12.14	10.34	10.34	0.27	0.11
67433	686	Qfp = 0.4*Q2	674-ex	38.00	453.00	46.91	49.03		49.09	0.001674	2.12	1.58	1.96	19.35	12.24	12.24	0.28	0.14
67433	686	Qfp = 0.4*Q2	674-T1	38.00	453.00	46.91	49.03		49.09	0.001675	2.12	1.58	1.96	19.35	12.24	12.24	0.28	0.14
67433	686	Lo Q	674-ex	70.00	453.00	46.91	49.70		49.78	0.001711	2.79	2.03	2.32	36.75	50.56	13.91	0.29	0.18
67433	686	Lo Q	674-T1	70.00	453.00	46.91	49.70		49.78	0.001711	2.79	2.03	2.32	36.74	50.56	13.91	0.29	0.18
67433	686	2-Yr	674-ex	96.00	453.00	46.91	50.03		50.09	0.001334	3.12	2.34	2.24	70.35	164.12	14.06	0.26	0.16
67433	686	2-Yr	674-T1	96.00	453.00	46.91	50.03		50.09	0.001334	3.12	2.34	2.24	70.35	164.11	14.06	0.26	0.16
67433	686	5-Yr	674-ex	142.00	453.00	46.91	50.33		50.38	0.001044	3.42	2.64	2.15	123.75	187.10	14.06	0.23	0.14
67433	686	5-Yr	674-T1	142.00	453.00	46.91	50.33		50.38	0.001044	3.42	2.64	2.15	123.75	187.09	14.06	0.23	0.14
67433	686	10-Yr	674-ex	174.00	453.00	46.91	50.54		50.57	0.000836	3.63	2.85	2.02	163.78	202.62	14.06	0.21	0.12
67433	686	10-Yr	674-T1	174.00	453.00	46.91	50.54		50.57	0.000836	3.63	2.85	2.02	163.79	202.62	14.06	0.21	0.12
67433	686	25-Yr	674-ex	220.00	453.00	46.91	50.81		50.84	0.000640	3.90	3.12	1.88	221.78	223.20	14.06	0.19	0.10
67433	686	25-Yr	674-T1	220.00	453.00	46.91	50.81		50.84	0.000640	3.90	3.12	1.88	221.81	223.21	14.06	0.19	0.10
67433	686	50-Yr	674-ex	255.00	453.00	46.91	50.98		51.01	0.000553	4.07	3.29	1.81	261.19	227.37	14.06	0.18	0.10
67433	686	50-Yr	674-T1	255.00	453.00	46.91	50.98		51.01	0.000552	4.07	3.29	1.81	261.30	227.37	14.06	0.18	0.10
67433	686	100-Yr	674-ex	291.00	453.00	46.91	51.15		51.17	0.000484	4.24	3.46	1.75	299.76	227.86	14.06	0.17	0.09
67433	686	100-Yr	674-T1	291.00	453.00	46.91	51.15		51.17	0.000483	4.24	3.46	1.75	299.82	227.86	14.06	0.17	0.09
67433	745			Culvert														
67433	781	Lo Q	674-ex	5.00	548.00	48.18	48.96	48.41	48.97	0.000653	0.78	0.74	0.76	6.55	8.79	8.79	0.16	0.03
67433	781	Lo Q	674-T1	5.00	548.00	48.18	48.41	48.41	48.52	0.036180	0.23	0.22	2.68	1.86	8.30	8.30	1.00	0.49
67433	781	Lo Q	674-ex	20.00	548.00	48.18	49.97	48.75	50.00	0.000712	1.79	1.64	1.26	15.90	9.70	9.70	0.17	0.06
67433	781	Lo Q	674-T1	20.00	548.00	48.18	48.75	48.75	49.03	0.028990	0.57	0.55	4.23	4.73	8.61	8.61	1.01	0.92
67433	781	Qfp = 0.4*Q2	674-ex	38.00	548.00	48.18	50.73	49.05	50.77	0.000749	2.55	2.34	1.60	24.93	17.34	10.00	0.18	0.09
67433	781	Qfp = 0.4*Q2	674-T1	38.00	548.00	48.18	49.20	49.05	49.50	0.015821	1.02	0.96	4.38	8.68	9.01	9.01	0.79	0.83
67433	781	Lo Q	674-ex	70.00	548.00	48.18	51.77	49.47	51.81	0.000535	3.59	3.39	1.73	51.35	32.29	10.00	0.17	0.09
67433	781	Lo Q	674-T1	70.00	548.00	48.18	49.94	49.47	50.25	0.009229	1.76	1.61	4.49	15.60	9.67	9.67	0.62	0.75
67433	781	2-Yr	674-ex	96.00	548.00	48.18	52.86	49.76	52.88	0.000254	4.68	4.47	1.44	94.26	46.59	10.00	0.12	0.06
67433	781	2-Yr	674-T1	96.00	548.00	48.18	50.44	49.76	50.78	0.007559	2.26	2.05	4.67	20.70	12.34	10.00	0.57	0.76
67433	781	5-Yr	674-ex	142.00	548.00	48.18	55.89	50.22	55.89	0.000028	7.71	7.50	0.67	316.57	80.10	10.00	0.04	0.01
67433	781	5-Yr	674-T1	142.00	548.00	48.18	51.40	50.22	51.65	0.003756	3.22	3.01	4.25	40.18	27.36	10.00	0.43	0.55
67433	781	10-Yr	674-ex	174.00	548.00	48.18	56.46	50.57	56.46	0.000028	8.28	8.07	0.70	362.26	80.10	10.00	0.04	0.01
67433	781	10-Yr	674-T1	174.00	548.00	48.18	52.08	50.57	52.25	0.002194	3.90	3.69	3.72	61.76	36.28	10.00	0.34	0.40
67433	781	25-Yr	674-ex	220.00	548.00	48.18	56.73	51.11	56.73	0.000037	8.55	8.34	0.83	383.74	80.10	10.00	0.05	0.02
67433	781	25-Yr	674-T1	220.00	548.00	48.18	52.98	51.11	53.09	0.001165	4.80	4.59	3.14	99.93	48.17	10.00	0.26	0.26
67433	781	50-Yr	674-ex	255.00	548.00	48.18	56.89	51.36	56.89	0.000045	8.71	8.50	0.93	396.45	80.10	10.00	0.06	0.02
67433	781	50-Yr	674-T1	255.00	548.00	48.18	53.60	51.36	53.69	0.000849	5.42	5.21	2.91	135.59	67.40	10.00	0.22	0.22
67433	781	100-Yr	674-ex	291.00	548.00	48.18	57.03	51.57	57.04	0.000054	8.85	8.64	1.03	407.62	80.10	10.00	0.06	0.02
67433	781	100-Yr	674-T1	291.00	548.00	48.18	54.22	51.57	54.29	0.000559	6.04	5.84	2.55	183.07	80.10	10.00	0.19	0.16
67433	806	Lo Q	674-ex	5.00	572.00	48.35	48.95	48.95	49.15	0.034232	0.60	0.40	3.59	1.39	3.48	3.48	1.00	0.75

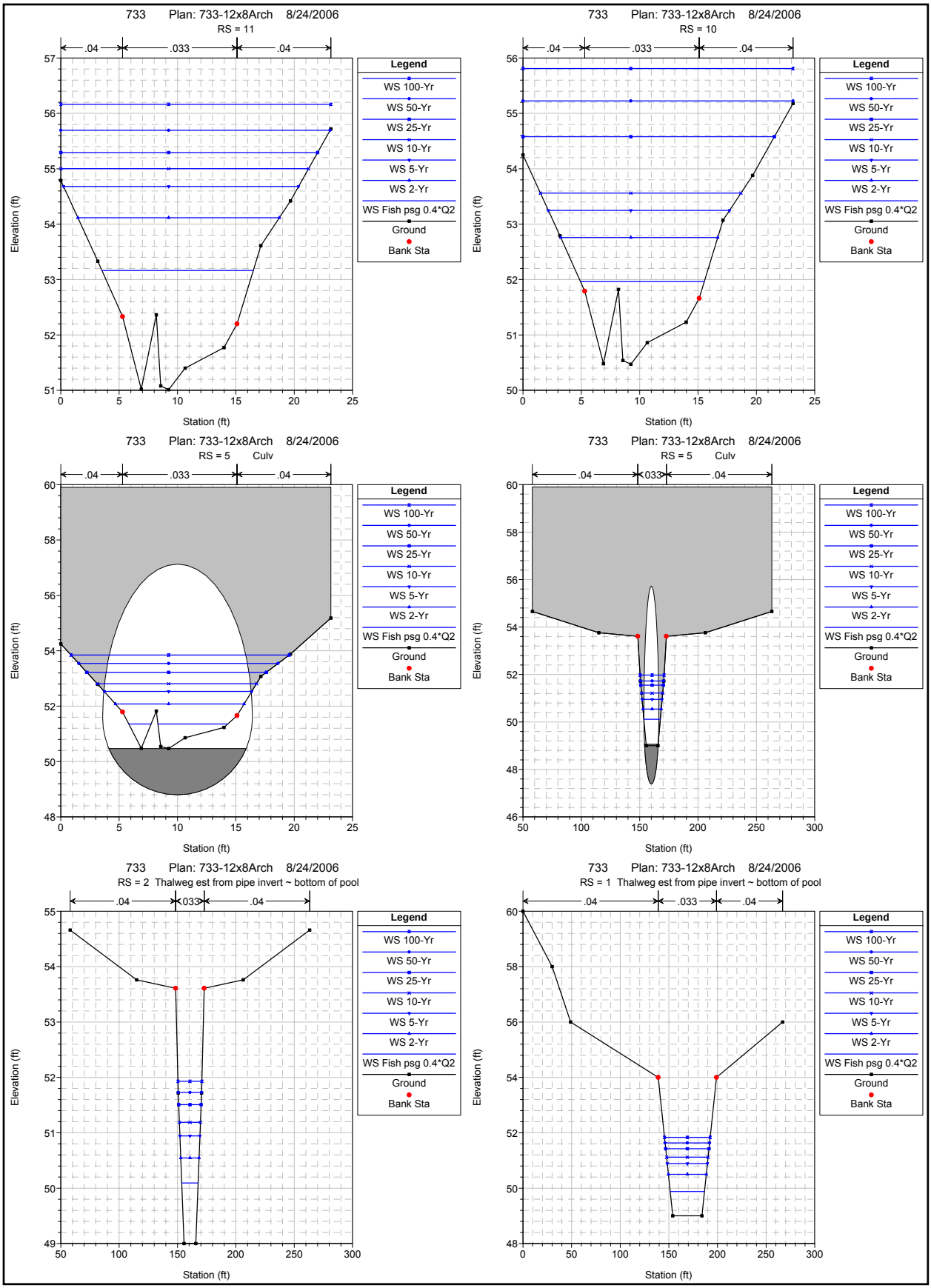
HEC-RAS River: 674-33 Reach: 67433 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
67433	806	Lo Q	674-T1	5.00	572.00	48.35	49.03	48.95	49.16	0.019797	0.68	0.46	2.97	1.68	3.68	3.68	0.77	0.49
67433	806	Lo Q	674-ex	20.00	572.00	48.35	49.91		50.09	0.009977	1.56	1.00	3.40	5.88	5.86	5.86	0.60	0.51
67433	806	Lo Q	674-T1	20.00	572.00	48.35	49.55	49.55	49.95	0.029852	1.20	0.79	5.09	3.93	4.97	4.97	1.01	1.22
67433	806	Qfp = 0.4*Q2	674-ex	38.00	572.00	48.35	50.68		50.84	0.004912	2.33	1.69	3.27	13.38	14.47	6.30	0.44	0.40
67433	806	Qfp = 0.4*Q2	674-T1	38.00	572.00	48.35	50.00	50.00	50.54	0.028163	1.65	1.06	5.92	6.42	6.24	6.05	1.01	1.51
67433	806	Lo Q	674-ex	70.00	572.00	48.35	51.77		51.84	0.001503	3.42	2.78	2.52	39.85	32.14	6.30	0.27	0.20
67433	806	Lo Q	674-T1	70.00	572.00	48.35	50.65	50.65	51.21	0.017900	2.30	1.66	6.17	12.96	13.88	6.30	0.84	1.43
67433	806	2-Yr	674-ex	96.00	572.00	48.35	52.87		52.89	0.000448	4.52	3.87	1.72	78.50	36.68	6.30	0.15	0.08
67433	806	2-Yr	674-T1	96.00	572.00	48.35	51.01	51.01	51.55	0.014525	2.66	2.02	6.32	19.15	21.03	6.30	0.78	1.41
67433	806	5-Yr	674-ex	142.00	572.00	48.35	55.89		55.90	0.000065	7.54	6.90	0.96	200.82	44.94	6.30	0.06	0.02
67433	806	5-Yr	674-T1	142.00	572.00	48.35	51.42	51.42	51.96	0.012778	3.07	2.43	6.70	29.19	27.57	6.30	0.76	1.49
67433	806	10-Yr	674-ex	174.00	572.00	48.35	56.46		56.47	0.000069	8.11	7.47	1.04	226.91	46.67	6.30	0.07	0.02
67433	806	10-Yr	674-T1	174.00	572.00	48.35	52.11		52.36	0.004951	3.76	3.12	4.93	51.23	35.24	6.30	0.49	0.74
67433	806	25-Yr	674-ex	220.00	572.00	48.35	56.72		56.74	0.000094	8.37	7.73	1.25	239.39	46.80	6.30	0.08	0.04
67433	806	25-Yr	674-T1	220.00	572.00	48.35	53.01		53.14	0.001952	4.66	4.02	3.67	83.67	36.94	6.30	0.32	0.38
67433	806	50-Yr	674-ex	255.00	572.00	48.35	56.88		56.90	0.000116	8.53	7.89	1.40	246.75	46.80	6.30	0.09	0.04
67433	806	50-Yr	674-T1	255.00	572.00	48.35	53.62		53.72	0.001289	5.27	4.63	3.27	106.57	38.10	6.30	0.27	0.29
67433	806	100-Yr	674-ex	291.00	572.00	48.35	57.02		57.04	0.000140	8.67	8.03	1.56	253.21	46.80	6.30	0.10	0.05
67433	806	100-Yr	674-T1	291.00	572.00	48.35	54.22		54.31	0.000939	5.87	5.23	3.03	130.25	39.88	6.30	0.23	0.24

Tributary 710+75 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 731+00
Model based on ADOT&PF project datum


733 Plan: 733-Exisitng 9/27/2006
RS = 11
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-Exisitng 9/27/2006
RS = 10
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-Exisitng 9/27/2006
RS = 5 Culv
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-Exisitng 9/27/2006
RS = 5 Culv
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-Exisitng 9/27/2006
RS = 2 Thalweg est from pipe invert ~ bottom of pool
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-Exisitng 9/27/2006
RS = 1 Thalweg est from pipe invert ~ bottom of pool
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta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RS = 11
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-12x8Arch 8/24/2006
RS = 10
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-12x8Arch 8/24/2006
RS = 5 Culv
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-12x8Arch 8/24/2006
RS = 5 Culv
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-12x8Arch 8/24/2006
RS = 2 Thalweg est from pipe invert ~ bottom of pool
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta
733 Plan: 733-12x8Arch 8/24/2006
RS = 1 Thalweg est from pipe invert ~ bottom of pool
.04 .033 .04
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish psg 0.4*Q2
Ground
Bank Sta

HEC-RAS River: 733 Reach: 733

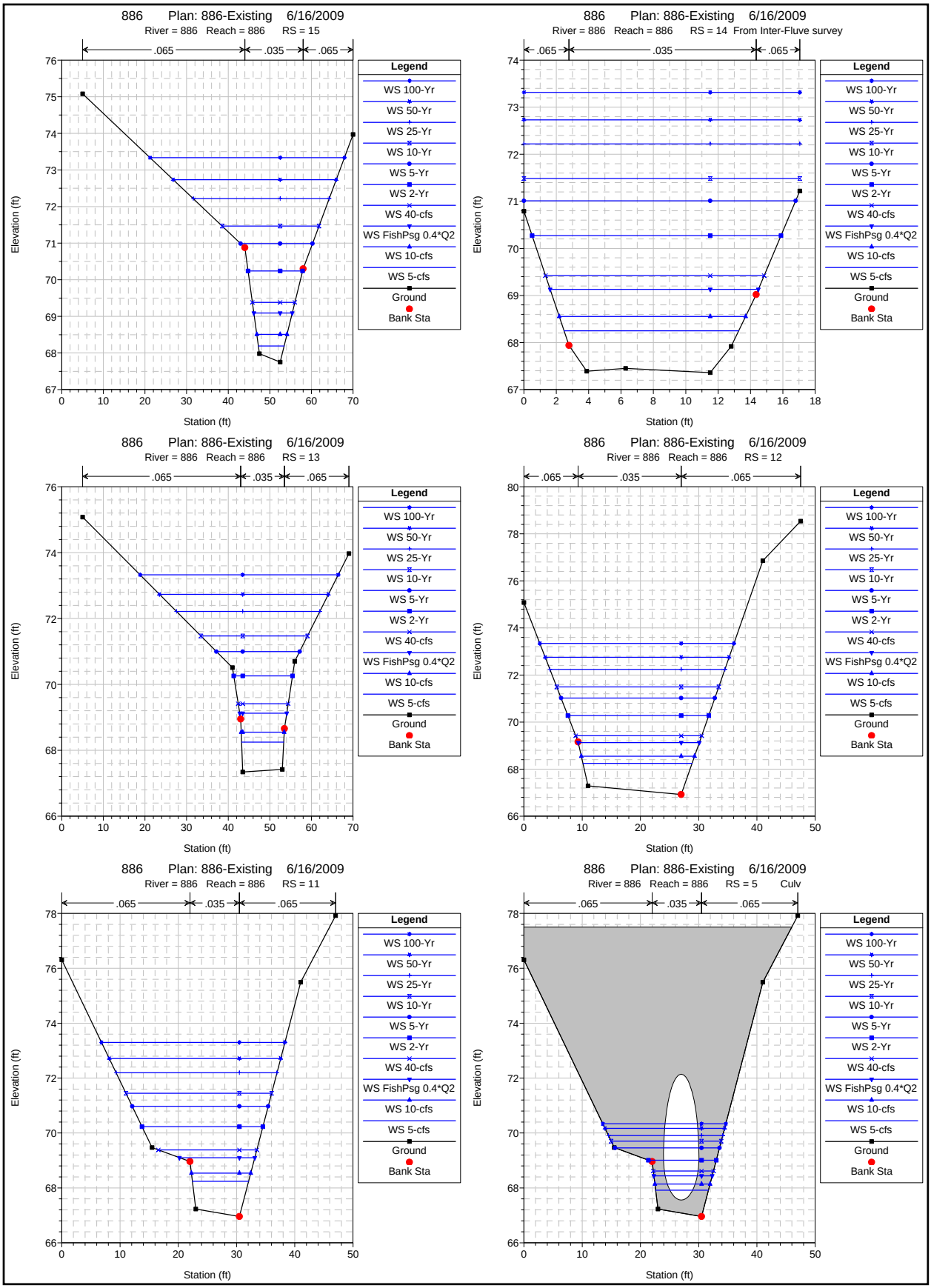
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
733	1	5-cfs	733-Arch	5.00		49.00	49.22	49.09	49.23	0.002001	0.22	0.22	0.73	6.85	31.34	31.34	0.28	0.03
733	1	5-cfs	733-Ex	5.00		49.00	49.22	49.09	49.23	0.002001	0.22	0.22	0.73	6.85	31.34	31.34	0.28	0.03
733	1	25-cfs	733-Arch	25.00		49.00	49.58	49.28	49.61	0.002001	0.58	0.55	1.35	18.50	33.50	33.50	0.32	0.07
733	1	25-cfs	733-Ex	25.00		49.00	49.58	49.28	49.61	0.002001	0.58	0.55	1.35	18.50	33.50	33.50	0.32	0.07
733	1	Fish psg 0.4*Q2	733-Arch	50.00		49.00	49.88	49.43	49.93	0.002002	0.88	0.81	1.74	28.65	35.27	35.27	0.34	0.10
733	1	Fish psg 0.4*Q2	733-Ex	50.00		49.00	49.88	49.43	49.93	0.002002	0.88	0.81	1.74	28.65	35.27	35.27	0.34	0.10
733	1	100-cfs	733-Arch	100.00		49.00	50.32	49.68	50.40	0.002000	1.32	1.18	2.23	44.78	37.91	37.91	0.36	0.15
733	1	100-cfs	733-Ex	100.00		49.00	50.32	49.68	50.40	0.002000	1.32	1.18	2.23	44.78	37.91	37.91	0.36	0.15
733	1	2-Yr	733-Arch	125.00		49.00	50.50	49.79	50.59	0.002001	1.50	1.33	2.41	51.80	39.01	39.01	0.37	0.16
733	1	2-Yr	733-Ex	125.00		49.00	50.50	49.79	50.59	0.002001	1.50	1.33	2.41	51.80	39.01	39.01	0.37	0.16
733	1	5-Yr	733-Arch	186.00		49.00	50.89	50.02	51.01	0.002002	1.89	1.63	2.76	67.34	41.33	41.33	0.38	0.20
733	1	5-Yr	733-Ex	186.00		49.00	50.89	50.02	51.01	0.002002	1.89	1.63	2.76	67.34	41.33	41.33	0.38	0.20
733	1	10-Yr	733-Arch	228.00		49.00	51.12	50.16	51.26	0.002000	2.12	1.81	2.95	77.16	42.73	42.73	0.39	0.22
733	1	10-Yr	733-Ex	228.00		49.00	51.12	50.16	51.26	0.002000	2.12	1.81	2.95	77.16	42.73	42.73	0.39	0.22
733	1	25-Yr	733-Arch	288.00		49.00	51.42	50.35	51.58	0.002002	2.42	2.03	3.19	90.29	44.54	44.54	0.39	0.25
733	1	25-Yr	733-Ex	288.00		49.00	51.42	50.35	51.58	0.002002	2.42	2.03	3.19	90.29	44.54	44.54	0.39	0.25
733	1	50-Yr	733-Arch	334.00		49.00	51.63	50.48	51.81	0.002000	2.63	2.18	3.34	99.87	45.81	45.81	0.40	0.27
733	1	50-Yr	733-Ex	334.00		49.00	51.63	50.48	51.81	0.002000	2.63	2.18	3.34	99.87	45.81	45.81	0.40	0.27
733	1	100-Yr	733-Arch	381.00		49.00	51.84	50.62	52.02	0.002003	2.84	2.32	3.49	109.21	47.02	47.02	0.40	0.28
733	1	100-Yr	733-Ex	381.00		49.00	51.84	50.61	52.02	0.002003	2.84	2.32	3.49	109.20	47.02	47.02	0.40	0.28
733	2	5-cfs	733-Arch	5.00	95.00	49.00	49.41		49.43	0.002294	0.41	0.39	1.13	4.43	11.52	11.52	0.32	0.05
733	2	5-cfs	733-Ex	5.00	95.00	49.00	49.41		49.43	0.002294	0.41	0.39	1.13	4.43	11.52	11.52	0.32	0.05
733	2	25-cfs	733-Arch	25.00	95.00	49.00	49.82		49.93	0.005482	0.82	0.73	2.64	9.47	13.02	13.02	0.55	0.24
733	2	25-cfs	733-Ex	25.00	95.00	49.00	49.82		49.93	0.005486	0.82	0.73	2.64	9.47	13.02	13.02	0.55	0.24
733	2	Fish psg 0.4*Q2	733-Arch	50.00	95.00	49.00	50.09		50.32	0.008190	1.09	0.94	3.80	13.15	14.02	14.02	0.69	0.46
733	2	Fish psg 0.4*Q2	733-Ex	50.00	95.00	49.00	50.09		50.32	0.008187	1.09	0.94	3.80	13.15	14.02	14.02	0.69	0.46
733	2	100-cfs	733-Arch	100.00	95.00	49.00	50.43	50.33	50.91	0.012801	1.43	1.18	5.53	18.08	15.26	15.26	0.90	0.90
733	2	100-cfs	733-Ex	100.00	95.00	49.00	50.43		50.91	0.012874	1.43	1.18	5.54	18.05	15.25	15.25	0.90	0.91
733	2	2-Yr	733-Arch	125.00	95.00	49.00	50.55	50.53	51.16	0.015251	1.55	1.27	6.30	19.85	15.68	15.68	0.99	1.15
733	2	2-Yr	733-Ex	125.00	95.00	49.00	50.55	50.53	51.16	0.015166	1.55	1.27	6.29	19.89	15.69	15.69	0.98	1.14
733	2	5-Yr	733-Arch	186.00	95.00	49.00	50.94	50.94	51.72	0.014908	1.94	1.54	7.06	26.36	17.14	17.14	1.00	1.35
733	2	5-Yr	733-Ex	186.00	95.00	49.00	50.94	50.94	51.72	0.014907	1.94	1.54	7.06	26.36	17.14	17.14	1.00	1.35
733	2	10-Yr	733-Arch	228.00	95.00	49.00	51.19	51.19	52.05	0.014498	2.19	1.70	7.42	30.71	18.05	18.05	1.00	1.45
733	2	10-Yr	733-Ex	228.00	95.00	49.00	51.19	51.19	52.05	0.014499	2.19	1.70	7.42	30.71	18.05	18.05	1.00	1.45
733	2	25-Yr	733-Arch	288.00	95.00	49.00	51.51	51.51	52.47	0.014058	2.51	1.91	7.86	36.63	19.22	19.22	1.00	1.57
733	2	25-Yr	733-Ex	288.00	95.00	49.00	51.51	51.51	52.47	0.014059	2.51	1.91	7.86	36.63	19.22	19.22	1.00	1.57
733	2	50-Yr	733-Arch	334.00	95.00	49.00	51.73	51.73	52.76	0.013810	2.73	2.05	8.15	40.96	20.02	20.02	1.00	1.65
733	2	50-Yr	733-Ex	334.00	95.00	49.00	51.73	51.73	52.76	0.013809	2.73	2.05	8.15	40.96	20.02	20.02	1.00	1.65
733	2	100-Yr	733-Arch	381.00	95.00	49.00	51.93	51.93	53.04	0.013592	2.93	2.20	8.46	45.05	20.50	20.50	1.01	1.73
733	2	100-Yr	733-Ex	381.00	95.00	49.00	51.93	51.93	53.04	0.013589	2.93	2.20	8.46	45.06	20.50	20.50	1.01	1.73
733	5			Culvert														
733	10	5-cfs	733-Arch	5.00	228.00	50.47	51.08	51.08	51.23	0.029474	0.61	0.29	3.08	1.62	5.53	5.53	1.00	0.46
733	10	5-cfs	733-Ex	5.00	228.00	50.47	51.39	51.08	51.41	0.002940	0.92	0.47	1.32	3.78	8.05	8.05	0.34	0.07
733	10	25-cfs	733-Arch	25.00	228.00	50.47	51.59	51.59	51.91	0.024397	1.12	0.61	4.49	5.57	9.11	9.11	1.01	0.78
733	10	25-cfs	733-Ex	25.00	228.00	50.47	52.47	51.59	52.51	0.001198	2.00	1.43	1.74	15.02	12.41	9.81	0.26	0.09
733	10	Fish psg 0.4*Q2	733-Arch	50.00	228.00	50.47	51.96	51.96	52.43	0.021169	1.49	0.93	5.47	9.22	10.61	9.81	1.00	1.01
733	10	Fish psg 0.4*Q2	733-Ex	50.00	228.00	50.47	53.38	51.96	53.44	0.000815	2.91	2.35	1.99	28.01	16.25	9.81	0.23	0.10
733	10	100-cfs	733-Arch	100.00	228.00	50.47	52.52	52.52	53.20	0.016863	2.05	1.49	6.68	15.69	12.60	9.81	0.96	1.28
733	10	100-cfs	733-Ex	100.00	228.00	50.47	54.92	52.52	54.97	0.000460	4.45	3.89	2.09	58.42	22.44	9.81	0.19	0.09
733	10	2-Yr	733-Arch	125.00	228.00	50.47	52.76	52.76	53.51	0.015545	2.29	1.73	7.08	18.81	13.46	9.81	0.95	1.37
733	10	2-Yr	733-Ex	125.00	228.00	50.47	56.78	52.76	56.81	0.000153	6.31	5.74	1.56	101.33	23.14	9.81	0.11	0.04
733	10	5-Yr	733-Arch	186.00	228.00	50.47	53.25	53.25	54.17	0.014009	2.78	2.22	7.94	25.86	15.53	9.81	0.94	1.59
733	10	5-Yr	733-Ex	186.00	228.00	50.47	60.43	53.25	60.45	0.000058	9.96	9.40	1.34	185.98	23.14	9.81	0.08	0.03
733	10	10-Yr	733-Arch	228.00	228.00	50.47	53.56	53.56	54.55	0.012943	3.09	2.53	8.33	30.95	17.18	9.81	0.92	1.68
733	10	10-Yr	733-Ex	228.00	228.00	50.47	60.88	53.56	60.91	0.000075	10.41	9.85	1.57	196.37	23.14	9.81	0.09	0.04
733	10	25-Yr	733-Arch	288.00	228.00	50.47	54.58	53.96	55.20	0.005504	4.11	3.55	6.81	50.99	21.54	9.81	0.64	1.00
733	10	25-Yr	733-Ex	288.00	228.00	50.47	61.44	53.96	61.48	0.000099	10.97	10.40	1.87	209.19	23.14	9.81	0.10	0.05
733	10	50-Yr	733-Arch	334.00	228.00	50.47	55.23	54.24	55.74	0.003775	4.76	4.19	6.30	65.46	23.14	9.81	0.54	0.81
733	10	50-Yr	733-Ex	334.00	228.00	50.47	61.78	54.24	61.83	0.000119	11.31	10.75	2.10	217.11	23.14	9.81	0.11	0.07

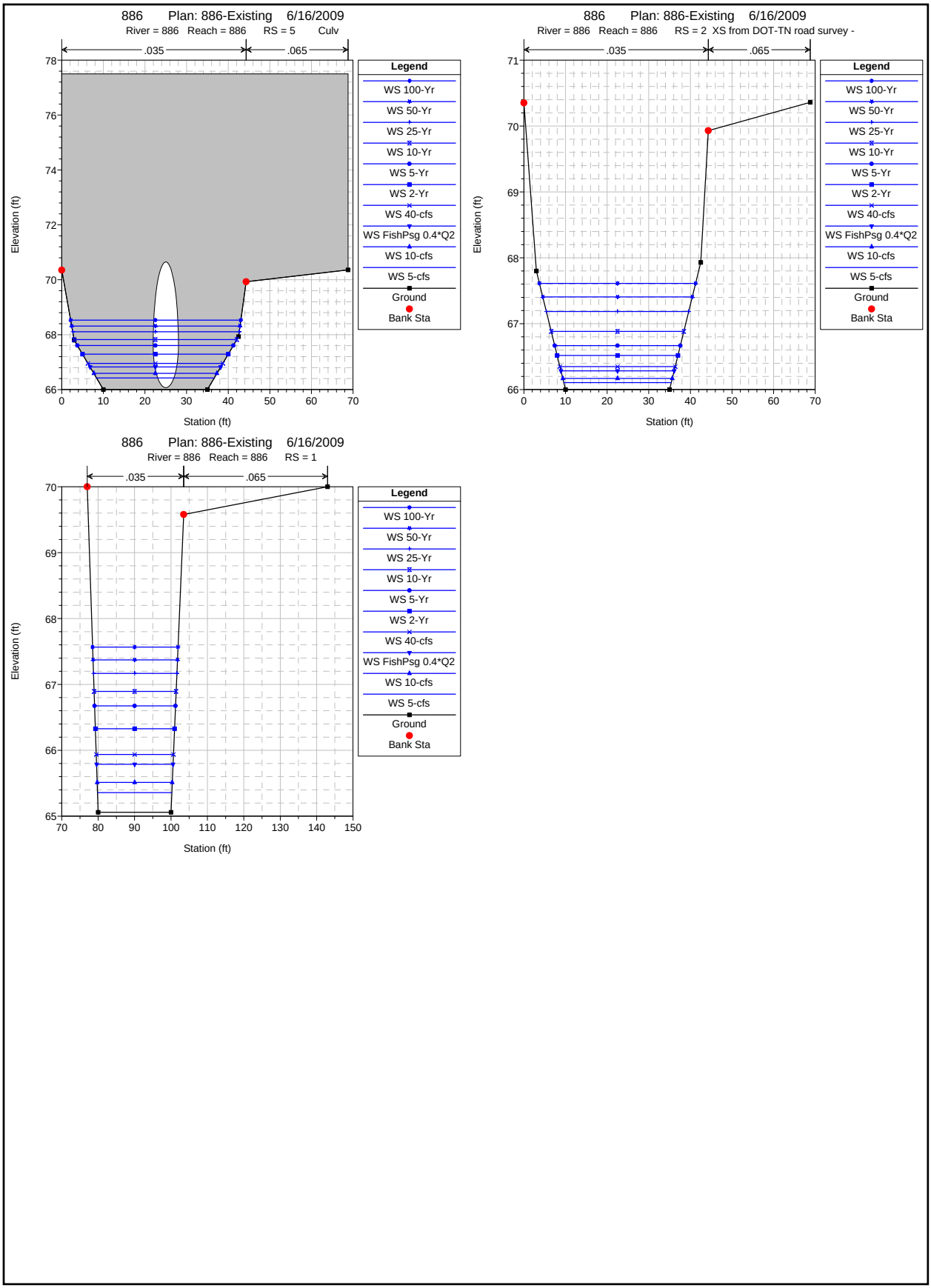
HEC-RAS River: 733 Reach: 733 (Continued)

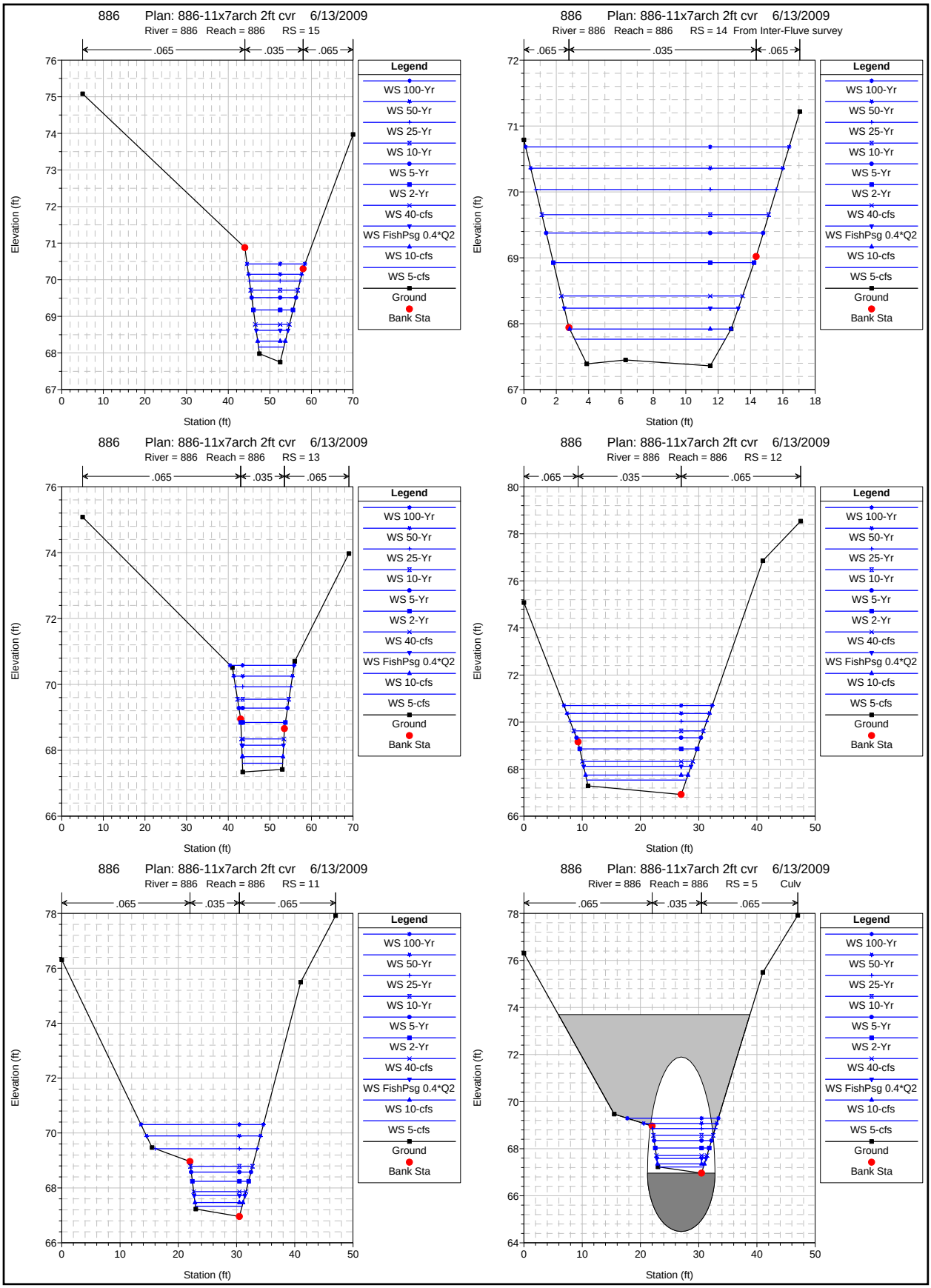
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
733	10	100-Yr	733-Arch	381.00	228.00	50.47	55.81	54.46	56.27	0.002895	5.34	4.78	6.02	78.99	23.14	9.81	0.49	0.71
733	10	100-Yr	733-Ex	381.00	228.00	50.47	62.07	54.46	62.13	0.000143	11.60	11.03	2.33	223.73	23.14	9.81	0.12	0.08
733	11	5-cfs	733-Arch	5.00	353.00	51.01	51.95	51.62	51.98	0.002492	0.94	0.49	1.25	4.01	8.19	8.19	0.31	0.06
733	11	5-cfs	733-Ex	5.00	353.00	51.01	51.84		51.88	0.005066	0.83	0.41	1.59	3.14	7.64	7.64	0.44	0.11
733	11	25-cfs	733-Arch	25.00	353.00	51.01	52.67	52.13	52.75	0.003008	1.66	1.10	2.30	11.06	11.21	9.81	0.39	0.17
733	11	25-cfs	733-Ex	25.00	353.00	51.01	52.67		52.75	0.003043	1.66	1.09	2.31	11.02	11.20	9.81	0.39	0.17
733	11	Fish psg 0.4*Q2	733-Arch	50.00	353.00	51.01	53.16	52.50	53.31	0.003328	2.15	1.59	3.10	17.01	12.97	9.81	0.43	0.27
733	11	Fish psg 0.4*Q2	733-Ex	50.00	353.00	51.01	53.50		53.59	0.001675	2.49	1.93	2.50	21.60	14.18	9.81	0.32	0.17
733	11	100-cfs	733-Arch	100.00	353.00	51.01	53.85	53.06	54.10	0.003680	2.84	2.28	4.14	26.78	15.84	9.81	0.48	0.43
733	11	100-cfs	733-Ex	100.00	353.00	51.01	54.97		55.06	0.000787	3.96	3.40	2.50	47.84	21.15	9.81	0.24	0.14
733	11	2-Yr	733-Arch	125.00	353.00	51.01	54.11	53.30	54.41	0.003809	3.10	2.54	4.54	31.20	17.26	9.81	0.50	0.50
733	11	2-Yr	733-Ex	125.00	353.00	51.01	56.79		56.83	0.000220	5.78	5.22	1.76	89.22	23.14	9.81	0.14	0.06
733	11	5-Yr	733-Arch	186.00	353.00	51.01	54.68	53.79	55.06	0.003898	3.67	3.11	5.25	41.79	20.13	9.81	0.52	0.62
733	11	5-Yr	733-Ex	186.00	353.00	51.01	60.44		60.46	0.000071	9.43	8.87	1.42	173.63	23.14	9.81	0.08	0.03
733	11	10-Yr	733-Arch	228.00	353.00	51.01	55.00	54.10	55.43	0.003954	3.99	3.43	5.64	48.46	21.23	9.81	0.54	0.69
733	11	10-Yr	733-Ex	228.00	353.00	51.01	60.89		60.92	0.000090	9.88	9.32	1.66	184.05	23.14	9.81	0.10	0.04
733	11	25-Yr	733-Arch	288.00	353.00	51.01	55.29		55.83	0.004549	4.28	3.72	6.39	54.73	22.00	9.81	0.58	0.87
733	11	25-Yr	733-Ex	288.00	353.00	51.01	61.45		61.49	0.000118	10.44	9.87	1.97	196.93	23.14	9.81	0.11	0.06
733	11	50-Yr	733-Arch	334.00	353.00	51.01	55.70		56.23	0.004045	4.69	4.12	6.45	63.84	23.08	9.81	0.56	0.85
733	11	50-Yr	733-Ex	334.00	353.00	51.01	61.79		61.85	0.000141	10.78	10.22	2.21	204.90	23.14	9.81	0.12	0.07
733	11	100-Yr	733-Arch	381.00	353.00	51.01	56.16		56.67	0.003397	5.15	4.59	6.35	74.66	23.14	9.81	0.52	0.80
733	11	100-Yr	733-Ex	381.00	353.00	51.01	62.08		62.15	0.000168	11.07	10.51	2.45	211.58	23.14	9.81	0.13	0.09

Tributary 865+88 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 886+00
Model based on ADOT&PF project datum


886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 15
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 14 From Inter-Fluve survey
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 13
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 12
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 11
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 5 Culv
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta


886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 5 Culv
.035
.065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 2 XS from DOT-TN road survey -
.035
.065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-Existing 6/16/2009
River = 886 Reach = 886 RS = 1
.035
.065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta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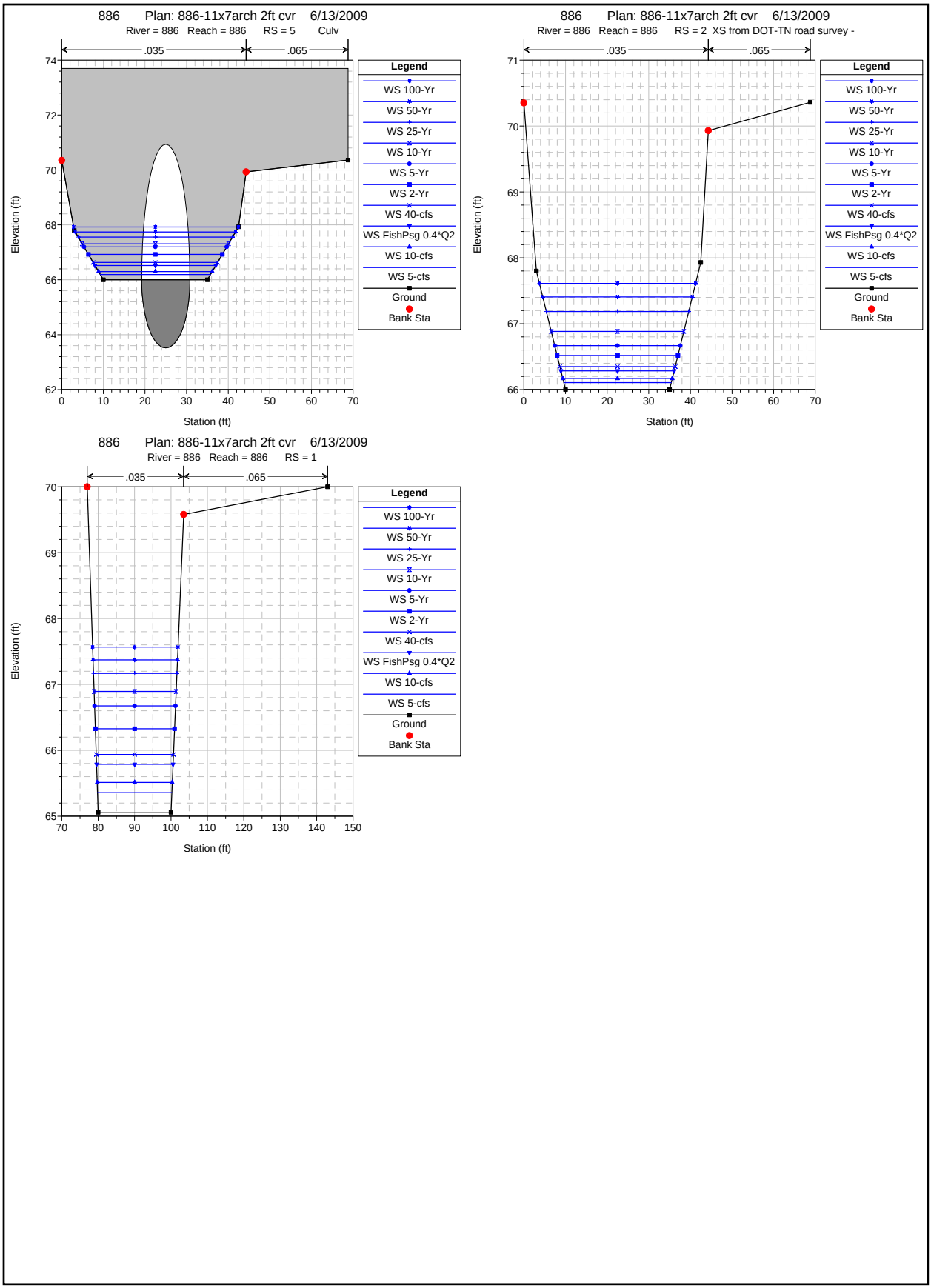
River = 886 Reach = 886 RS = 15
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 14 From Inter-Fluve survey
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 13
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 12
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 11
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 5 Culv
.065 .035 .065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta


886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 5 Culv
.035
.065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 2 XS from DOT-TN road survey -
.035
.065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta
886 Plan: 886-11x7arch 2ft cvr 6/13/2009
River = 886 Reach = 886 RS = 1
.035
.065
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS 40-cfs
WS FishPsg 0.4*Q2
WS 10-cfs
WS 5-cfs
Ground
Bank Sta

HEC-RAS River: 886 Reach: 886

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
886	1	5-cfs	886-11x7cvr	5.00		65.06	65.36	65.18	65.37	0.002001	0.30	0.29	0.83	6.01	20.41	20.41	0.27	0.04
886	1	5-cfs	886-Ex	5.00		65.06	65.36	65.18	65.37	0.002001	0.30	0.29	0.83	6.01	20.41	20.41	0.27	0.04
886	1	10-cfs	886-11x7cvr	10.00		65.06	65.51	65.26	65.53	0.002000	0.45	0.44	1.09	9.18	20.62	20.62	0.29	0.05
886	1	10-cfs	886-Ex	10.00		65.06	65.51	65.26	65.53	0.002000	0.45	0.44	1.09	9.18	20.62	20.62	0.29	0.05
886	1	FishPsg 0.4*Q2	886-11x7cvr	22.00		65.06	65.79	65.39	65.82	0.002002	0.73	0.71	1.48	14.91	21.00	21.00	0.31	0.09
886	1	FishPsg 0.4*Q2	886-Ex	22.00		65.06	65.79	65.39	65.82	0.002002	0.73	0.71	1.48	14.91	21.00	21.00	0.31	0.09
886	1	40-cfs	886-11x7cvr	30.00		65.06	65.94	65.47	65.98	0.002000	0.88	0.85	1.66	18.08	21.21	21.21	0.32	0.10
886	1	40-cfs	886-Ex	30.00		65.06	65.94	65.47	65.98	0.002000	0.88	0.85	1.66	18.08	21.21	21.21	0.32	0.10
886	1	2-Yr	886-11x7cvr	55.00		65.06	66.33	65.67	66.39	0.002001	1.27	1.22	2.08	26.45	21.75	21.75	0.33	0.14
886	1	2-Yr	886-Ex	55.00		65.06	66.33	65.67	66.39	0.002001	1.27	1.22	2.08	26.45	21.75	21.75	0.33	0.14
886	1	5-Yr	886-11x7cvr	82.00		65.06	66.68	65.86	66.76	0.002000	1.62	1.53	2.40	34.10	22.23	22.23	0.34	0.18
886	1	5-Yr	886-Ex	82.00		65.06	66.68	65.85	66.76	0.002000	1.62	1.53	2.40	34.10	22.23	22.23	0.34	0.18
886	1	10-Yr	886-11x7cvr	101.00		65.06	66.89	65.97	67.00	0.002001	1.83	1.73	2.59	38.98	22.53	22.53	0.35	0.20
886	1	10-Yr	886-Ex	101.00		65.06	66.89	65.97	67.00	0.002001	1.83	1.73	2.59	38.98	22.53	22.53	0.35	0.20
886	1	25-Yr	886-11x7cvr	127.00		65.06	67.17	66.12	67.29	0.002003	2.11	1.97	2.81	45.19	22.91	22.91	0.35	0.22
886	1	25-Yr	886-Ex	127.00		65.06	67.17	66.12	67.29	0.002003	2.11	1.97	2.81	45.19	22.91	22.91	0.35	0.22
886	1	50-Yr	886-11x7cvr	148.00		65.06	67.37	66.23	67.51	0.002000	2.31	2.15	2.96	49.95	23.20	23.20	0.36	0.24
886	1	50-Yr	886-Ex	148.00		65.06	67.37	66.23	67.51	0.002000	2.31	2.15	2.96	49.95	23.20	23.20	0.36	0.24
886	1	100-Yr	886-11x7cvr	169.00		65.06	67.57	66.34	67.72	0.002001	2.51	2.32	3.10	54.48	23.46	23.46	0.36	0.26
886	1	100-Yr	886-Ex	169.00		65.06	67.57	66.34	67.72	0.002001	2.51	2.32	3.10	54.48	23.46	23.46	0.36	0.26
886	2	5-cfs	886-11x7cvr	5.00	22.00	66.00	66.11	66.11	66.16	0.039151	0.11	0.10	1.86	2.69	25.82	25.82	1.01	0.25
886	2	5-cfs	886-Ex	5.00	22.00	66.00	66.11	66.11	66.16	0.039151	0.11	0.10	1.86	2.69	25.82	25.82	1.01	0.25
886	2	10-cfs	886-11x7cvr	10.00	22.00	66.00	66.17	66.17	66.25	0.032688	0.17	0.16	2.31	4.34	26.31	26.31	1.00	0.34
886	2	10-cfs	886-Ex	10.00	22.00	66.00	66.17	66.17	66.25	0.032688	0.17	0.16	2.31	4.34	26.31	26.31	1.00	0.34
886	2	FishPsg 0.4*Q2	886-11x7cvr	22.00	22.00	66.00	66.28	66.28	66.42	0.027783	0.28	0.27	2.97	7.41	27.21	27.21	1.00	0.47
886	2	FishPsg 0.4*Q2	886-Ex	22.00	22.00	66.00	66.28	66.28	66.42	0.027783	0.28	0.27	2.97	7.41	27.21	27.21	1.00	0.47
886	2	40-cfs	886-11x7cvr	30.00	22.00	66.00	66.35	66.35	66.51	0.025798	0.35	0.33	3.26	9.20	27.71	27.71	1.00	0.53
886	2	40-cfs	886-Ex	30.00	22.00	66.00	66.35	66.35	66.51	0.025798	0.35	0.33	3.26	9.20	27.71	27.71	1.00	0.53
886	2	2-Yr	886-11x7cvr	55.00	22.00	66.00	66.52	66.52	66.76	0.022852	0.52	0.48	3.93	13.99	29.03	29.03	1.00	0.68
886	2	2-Yr	886-Ex	55.00	22.00	66.00	66.52	66.52	66.76	0.022852	0.52	0.48	3.93	13.99	29.03	29.03	1.00	0.68
886	2	5-Yr	886-11x7cvr	82.00	22.00	66.00	66.67	66.67	66.98	0.021462	0.67	0.61	4.46	18.40	30.19	30.19	1.01	0.81
886	2	5-Yr	886-Ex	82.00	22.00	66.00	66.67	66.67	66.98	0.021462	0.67	0.61	4.46	18.40	30.19	30.19	1.01	0.81
886	2	10-Yr	886-11x7cvr	101.00	22.00	66.00	66.88		67.13	0.012450	0.88	0.79	4.02	25.11	31.87	31.87	0.80	0.61
886	2	10-Yr	886-Ex	101.00	22.00	66.00	66.88		67.13	0.012450	0.88	0.79	4.02	25.11	31.87	31.87	0.80	0.61
886	2	25-Yr	886-11x7cvr	127.00	22.00	66.00	67.19		67.39	0.007096	1.19	1.03	3.62	35.11	34.22	34.22	0.63	0.45
886	2	25-Yr	886-Ex	127.00	22.00	66.00	67.19		67.39	0.007095	1.19	1.03	3.62	35.11	34.22	34.22	0.63	0.45
886	2	50-Yr	886-11x7cvr	148.00	22.00	66.00	67.41		67.59	0.005304	1.41	1.19	3.45	42.85	35.93	35.93	0.56	0.39
886	2	50-Yr	886-Ex	148.00	22.00	66.00	67.41		67.59	0.005304	1.41	1.19	3.45	42.85	35.93	35.93	0.56	0.39
886	2	100-Yr	886-11x7cvr	169.00	22.00	66.00	67.61		67.79	0.004277	1.61	1.34	3.35	50.38	37.53	37.53	0.51	0.35
886	2	100-Yr	886-Ex	169.00	22.00	66.00	67.61		67.79	0.004277	1.61	1.34	3.35	50.38	37.53	37.53	0.51	0.35
886	5			Culvert														
886	11	5-cfs	886-11x7cvr	5.00	142.00	66.96	67.33	67.33	67.45	0.029368	0.37	0.24	2.76	1.86	8.02	7.56	1.00	0.43
886	11	5-cfs	886-Ex	5.00	142.00	66.96	68.24	67.33	68.25	0.000158	1.28	1.10	0.54	9.90	9.66	8.08	0.09	0.01
886	11	10-cfs	886-11x7cvr	10.00	142.00	66.96	67.47	67.47	67.65	0.026309	0.51	0.37	3.49	2.97	8.26	7.64	1.01	0.59
886	11	10-cfs	886-Ex	10.00	142.00	66.96	68.54	67.47	68.55	0.000293	1.58	1.37	0.85	12.84	10.20	8.26	0.13	0.02
886	11	FishPsg 0.4*Q2	886-11x7cvr	22.00	142.00	66.96	67.72	67.72	68.03	0.022368	0.76	0.61	4.48	5.15	8.73	7.79	1.01	0.83
886	11	FishPsg 0.4*Q2	886-Ex	22.00	142.00	66.96	69.10	67.72	69.13	0.000462	2.14	1.89	1.29	19.00	12.93	8.50	0.17	0.05
886	11	40-cfs	886-11x7cvr	30.00	142.00	66.96	67.87	67.87	68.24	0.021209	0.91	0.75	4.95	6.40	8.98	7.87	1.01	0.95
886	11	40-cfs	886-Ex	30.00	142.00	66.96	69.39	67.87	69.42	0.000525	2.43	2.17	1.51	23.24	16.91	8.50	0.18	0.06
886	11	2-Yr	886-11x7cvr	55.00	142.00	66.96	68.24	68.24	68.77	0.019210	1.28	1.10	5.97	9.88	9.66	8.08	1.01	1.23
886	11	2-Yr	886-Ex	55.00	142.00	66.96	70.23	68.24	70.28	0.000509	3.27	3.02	1.86	39.49	20.75	8.50	0.19	0.09
886	11	5-Yr	886-11x7cvr	82.00	142.00	66.96	68.58	68.58	69.25	0.018081	1.62	1.40	6.74	13.23	10.27	8.28	1.00	1.45
886	11	5-Yr	886-Ex	82.00	142.00	66.96	70.97	68.58	71.03	0.000481	4.01	3.76	2.09	55.80	23.34	8.50	0.19	0.10
886	11	10-Yr	886-11x7cvr	101.00	142.00	66.96	68.79	68.79	69.55	0.017541	1.83	1.59	7.17	15.45	10.65	8.40	1.00	1.58
886	11	10-Yr	886-Ex	101.00	142.00	66.96	71.45	68.79	71.51	0.000456	4.49	4.23	2.20	67.30	25.00	8.50	0.19	0.11
886	11	25-Yr	886-11x7cvr	127.00	142.00	66.96	69.43	69.05	70.00	0.008752	2.47	2.22	6.27	23.99	17.51	8.50	0.74	1.08
886	11	25-Yr	886-Ex	127.00	142.00	66.96	72.19	69.05	72.25	0.000379	5.23	4.98	2.24	86.96	27.61	8.50	0.18	0.11
886	11	50-Yr	886-11x7cvr	148.00	142.00	66.96	69.90	69.28	70.37	0.005801	2.94	2.68	5.80	32.73	19.58	8.50	0.62	0.87
886	11	50-Yr	886-Ex	148.00	142.00	66.96	72.71	69.28	72.77	0.000347	5.75	5.50	2.29	101.70	29.42	8.50	0.17	0.11
886	11	100-Yr	886-11x7cvr	169.00	142.00	66.96	70.31	69.53	70.72	0.004356	3.35	3.10	5.52	41.11	21.02	8.50	0.55	0.75
886	11	100-Yr	886-Ex	169.00	142.00	66.96	73.30	69.53	73.36	0.000301	6.34	6.09	2.28	119.69	31.49	8.50	0.16	0.10

HEC-RAS River: 886 Reach: 886 (Continued)

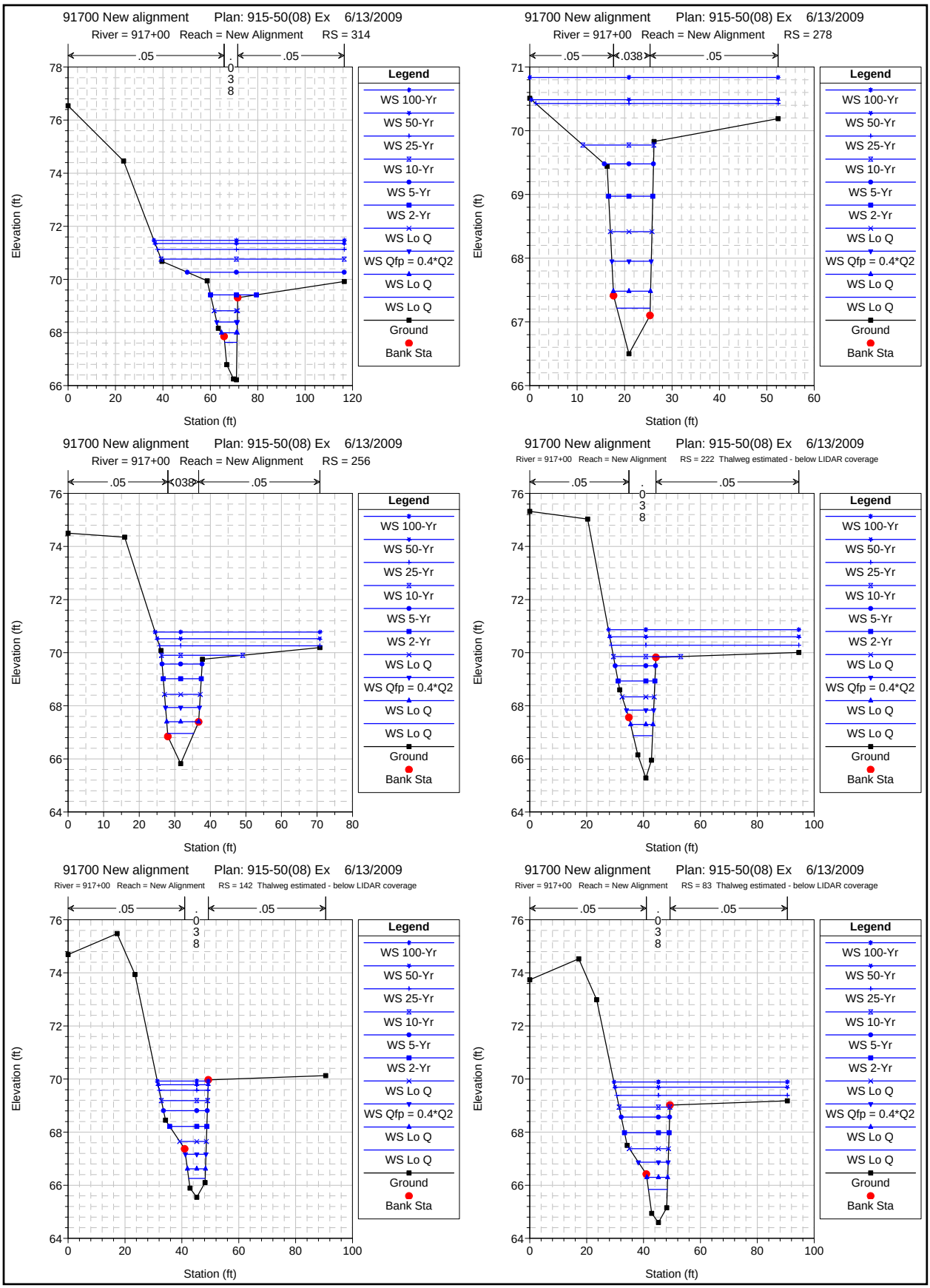
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
886	12	5-cfs	886-11x7cvr	5.00	175.00	66.92	67.53		67.54	0.000894	0.61	0.43	0.71	7.16	17.09	16.22	0.19	0.02
886	12	5-cfs	886-Ex	5.00	175.00	66.92	68.25		68.25	0.000034	1.33	1.11	0.26	19.93	18.74	16.87	0.04	0.00
886	12	10-cfs	886-11x7cvr	10.00	175.00	66.92	67.75		67.76	0.000942	0.83	0.63	0.95	10.83	17.58	16.41	0.21	0.04
886	12	10-cfs	886-Ex	10.00	175.00	66.92	68.55		68.55	0.000062	1.63	1.39	0.41	25.72	19.44	17.15	0.06	0.01
886	12	FishPsg 0.4*Q2	886-11x7cvr	22.00	175.00	66.92	68.12		68.15	0.000984	1.20	0.99	1.30	17.56	18.44	16.75	0.23	0.06
886	12	FishPsg 0.4*Q2	886-Ex	22.00	175.00	66.92	69.13		69.13	0.000097	2.21	1.92	0.63	37.33	20.78	17.67	0.08	0.01
886	12	40-cfs	886-11x7cvr	30.00	175.00	66.92	68.33		68.36	0.000988	1.41	1.18	1.46	21.41	18.92	16.94	0.24	0.07
886	12	40-cfs	886-Ex	30.00	175.00	66.92	69.42		69.43	0.000112	2.50	2.21	0.74	43.53	21.63	17.70	0.09	0.01
886	12	2-Yr	886-11x7cvr	55.00	175.00	66.92	68.86		68.91	0.000983	1.94	1.67	1.83	31.84	20.16	17.43	0.25	0.10
886	12	2-Yr	886-Ex	55.00	175.00	66.92	70.27		70.29	0.000124	3.35	3.06	0.97	63.08	24.17	17.70	0.10	0.02
886	12	5-Yr	886-11x7cvr	82.00	175.00	66.92	69.33		69.40	0.000964	2.41	2.12	2.11	41.63	21.37	17.70	0.26	0.12
886	12	5-Yr	886-Ex	82.00	175.00	66.92	71.02		71.04	0.000130	4.10	3.81	1.14	81.91	26.39	17.70	0.10	0.03
886	12	10-Yr	886-11x7cvr	101.00	175.00	66.92	69.62		69.70	0.000944	2.70	2.41	2.27	48.01	22.24	17.70	0.26	0.14
886	12	10-Yr	886-Ex	101.00	175.00	66.92	71.50		71.52	0.000131	4.58	4.28	1.24	94.84	27.81	17.70	0.11	0.03
886	12	25-Yr	886-11x7cvr	127.00	175.00	66.92	70.03		70.12	0.000882	3.11	2.81	2.44	57.20	23.44	17.70	0.26	0.15
886	12	25-Yr	886-Ex	127.00	175.00	66.92	72.24		72.26	0.000118	5.32	5.03	1.31	116.34	30.03	17.70	0.10	0.04
886	12	50-Yr	886-11x7cvr	148.00	175.00	66.92	70.37		70.46	0.000811	3.45	3.15	2.52	65.31	24.45	17.70	0.25	0.15
886	12	50-Yr	886-Ex	148.00	175.00	66.92	72.75		72.78	0.000113	5.83	5.54	1.37	132.20	31.56	17.70	0.10	0.04
886	12	100-Yr	886-11x7cvr	169.00	175.00	66.92	70.70		70.80	0.000745	3.78	3.49	2.59	73.73	25.45	17.70	0.24	0.15
886	12	100-Yr	886-Ex	169.00	175.00	66.92	73.34		73.37	0.000103	6.42	6.13	1.40	151.24	33.31	17.70	0.10	0.04
886	13	5-cfs	886-11x7cvr	5.00	225.00	67.34	67.61		67.69	0.021920	0.27	0.23	2.28	2.19	9.66	9.66	0.85	0.30
886	13	5-cfs	886-Ex	5.00	225.00	67.34	68.25		68.25	0.000281	0.91	0.84	0.59	8.51	10.12	10.12	0.11	0.01
886	13	10-cfs	886-11x7cvr	10.00	225.00	67.34	67.81		67.90	0.011385	0.47	0.42	2.44	4.10	9.80	9.80	0.66	0.28
886	13	10-cfs	886-Ex	10.00	225.00	67.34	68.55		68.56	0.000430	1.21	1.12	0.86	11.61	10.33	10.33	0.14	0.03
886	13	FishPsg 0.4*Q2	886-11x7cvr	22.00	225.00	67.34	68.15		68.29	0.007869	0.81	0.75	2.91	7.56	10.05	10.05	0.59	0.33
886	13	FishPsg 0.4*Q2	886-Ex	22.00	225.00	67.34	69.12		69.15	0.000549	1.78	1.68	1.25	17.76	11.29	10.50	0.17	0.05
886	13	40-cfs	886-11x7cvr	30.00	225.00	67.34	68.35		68.50	0.007173	1.01	0.93	3.16	9.50	10.19	10.19	0.58	0.37
886	13	40-cfs	886-Ex	30.00	225.00	67.34	69.41		69.45	0.000597	2.07	1.97	1.45	21.13	12.02	10.50	0.18	0.06
886	13	2-Yr	886-11x7cvr	55.00	225.00	67.34	68.84		69.06	0.006245	1.50	1.40	3.75	14.69	10.69	10.47	0.56	0.46
886	13	2-Yr	886-Ex	55.00	225.00	67.34	70.26		70.31	0.000591	2.92	2.81	1.83	32.19	14.14	10.50	0.19	0.09
886	13	5-Yr	886-11x7cvr	82.00	225.00	67.34	69.28		69.56	0.005644	1.94	1.83	4.25	19.56	11.69	10.50	0.55	0.54
886	13	5-Yr	886-Ex	82.00	225.00	67.34	71.00		71.06	0.000584	3.66	3.55	2.12	44.20	20.02	10.50	0.20	0.11
886	13	10-Yr	886-11x7cvr	101.00	225.00	67.34	69.55		69.87	0.005389	2.21	2.10	4.55	22.80	12.36	10.50	0.55	0.59
886	13	10-Yr	886-Ex	101.00	225.00	67.34	71.47		71.55	0.000556	4.13	4.02	2.25	55.03	25.64	10.50	0.20	0.12
886	13	25-Yr	886-11x7cvr	127.00	225.00	67.34	69.93		70.28	0.004854	2.59	2.48	4.82	27.64	13.31	10.50	0.54	0.63
886	13	25-Yr	886-Ex	127.00	225.00	67.34	72.22		72.29	0.000446	4.88	4.77	2.26	77.44	34.48	10.50	0.18	0.11
886	13	50-Yr	886-11x7cvr	148.00	225.00	67.34	70.25		70.62	0.004315	2.91	2.80	4.93	32.09	14.12	10.50	0.52	0.63
886	13	50-Yr	886-Ex	148.00	225.00	67.34	72.73		72.80	0.000391	5.39	5.29	2.26	96.88	40.61	10.50	0.17	0.11
886	13	100-Yr	886-11x7cvr	169.00	225.00	67.34	70.58		70.96	0.003844	3.24	3.13	5.01	36.86	15.40	10.50	0.50	0.63
886	13	100-Yr	886-Ex	169.00	225.00	67.34	73.33		73.39	0.000317	5.99	5.88	2.19	122.99	47.63	10.50	0.16	0.10
886	14	5-cfs	886-11x7cvr	5.00	235.00	67.36	67.77	67.64	67.81	0.006837	0.41	0.33	1.64	3.04	9.32	9.32	0.51	0.14
886	14	5-cfs	886-Ex	5.00	235.00	67.36	68.25		68.26	0.000335	0.89	0.76	0.63	7.97	10.79	10.49	0.13	0.02
886	14	10-cfs	886-11x7cvr	10.00	235.00	67.36	67.92		67.99	0.008062	0.56	0.45	2.21	4.52	9.98	9.98	0.58	0.22
886	14	10-cfs	886-Ex	10.00	235.00	67.36	68.55		68.57	0.000451	1.19	1.02	0.89	11.37	11.52	10.92	0.16	0.03
886	14	FishPsg 0.4*Q2	886-11x7cvr	22.00	235.00	67.36	68.23		68.36	0.006916	0.87	0.74	2.83	7.81	10.76	10.47	0.58	0.31
886	14	FishPsg 0.4*Q2	886-Ex	22.00	235.00	67.36	69.13		69.15	0.000510	1.77	1.53	1.23	18.40	12.87	11.57	0.18	0.05
886	14	40-cfs	886-11x7cvr	30.00	235.00	67.36	68.42		68.57	0.006268	1.06	0.91	3.07	9.85	11.20	10.73	0.57	0.34
886	14	40-cfs	886-Ex	30.00	235.00	67.36	69.42		69.45	0.000527	2.06	1.82	1.41	22.24	13.51	11.57	0.18	0.06
886	14	2-Yr	886-11x7cvr	55.00	235.00	67.36	68.93		69.12	0.005084	1.57	1.34	3.56	15.80	12.40	11.44	0.54	0.41
886	14	2-Yr	886-Ex	55.00	235.00	67.36	70.27		70.32	0.000481	2.91	2.67	1.73	34.51	15.38	11.57	0.19	0.08
886	14	5-Yr	886-11x7cvr	82.00	235.00	67.36	69.38		69.61	0.004302	2.02	1.77	3.95	21.61	13.41	11.57	0.52	0.45
886	14	5-Yr	886-Ex	82.00	235.00	67.36	71.01		71.07	0.000459	3.65	3.41	1.99	46.47	16.79	11.57	0.19	0.09
886	14	10-Yr	886-11x7cvr	101.00	235.00	67.36	69.65		69.92	0.003982	2.29	2.05	4.18	25.43	14.02	11.57	0.51	0.49
886	14	10-Yr	886-Ex	101.00	235.00	67.36	71.48		71.55	0.000444	4.12	3.88	2.14	54.50	17.05	11.57	0.19	0.10
886	14	25-Yr	886-11x7cvr	127.00	235.00	67.36	70.04		70.33	0.003516	2.68	2.44	4.41	30.96	14.86	11.57	0.50	0.51
886	14	25-Yr	886-Ex	127.00	235.00	67.36	72.22		72.29	0.000385	4.86	4.62	2.24	67.04	17.05	11.57	0.18	0.11
886	14	50-Yr	886-11x7cvr	148.00	235.00	67.36	70.36		70.67	0.003115	3.00	2.76	4.51	35.87	15.57	11.57	0.48	0.51
886	14	50-Yr	886-Ex	148.00	235.00	67.36	72.73		72.81	0.000366	5.37	5.13	2.33	75.75	17.05	11.57	0.18	0.11
886	14	100-Yr	886-11x7cvr	169.00	235.00	67.36	70.68		71.00	0.002767	3.32	3.08	4.57	41.05	16.29	11.57	0.46	0.51
886	14	100-Yr	886-Ex	169.00	235.00	67.36	73.31		73.40	0.000331	5.95	5.71	2.39	85.70	17.05	11.57	0.18	0.11
886	15	5-cfs	886-11x7cvr	5.00	245.00	67.75	68.16	68.16	68.30	0.028205	0.41	0.28	2.97	1.68	6.11	6.11	1.00	0.47
886	15	5-cfs	886-Ex	5.00	245.00	67.75	68.19		68.30	0.020408	0.44	0.30	2.67	1.87	6.21	6.21	0.86	0.37

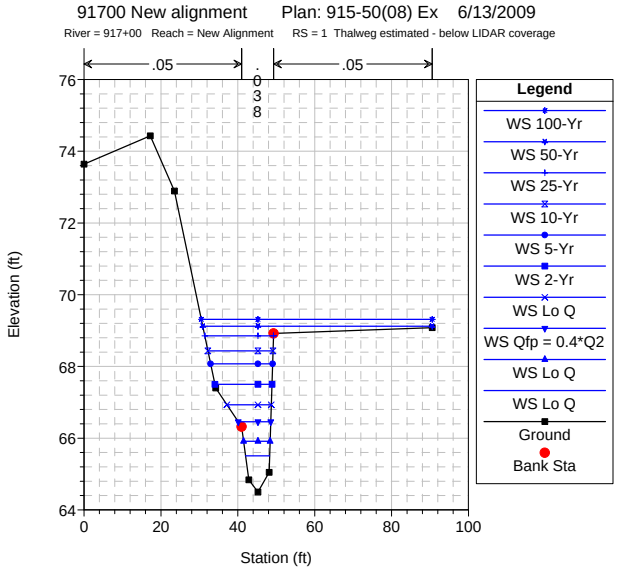
HEC-RAS River: 886 Reach: 886 (Continued)

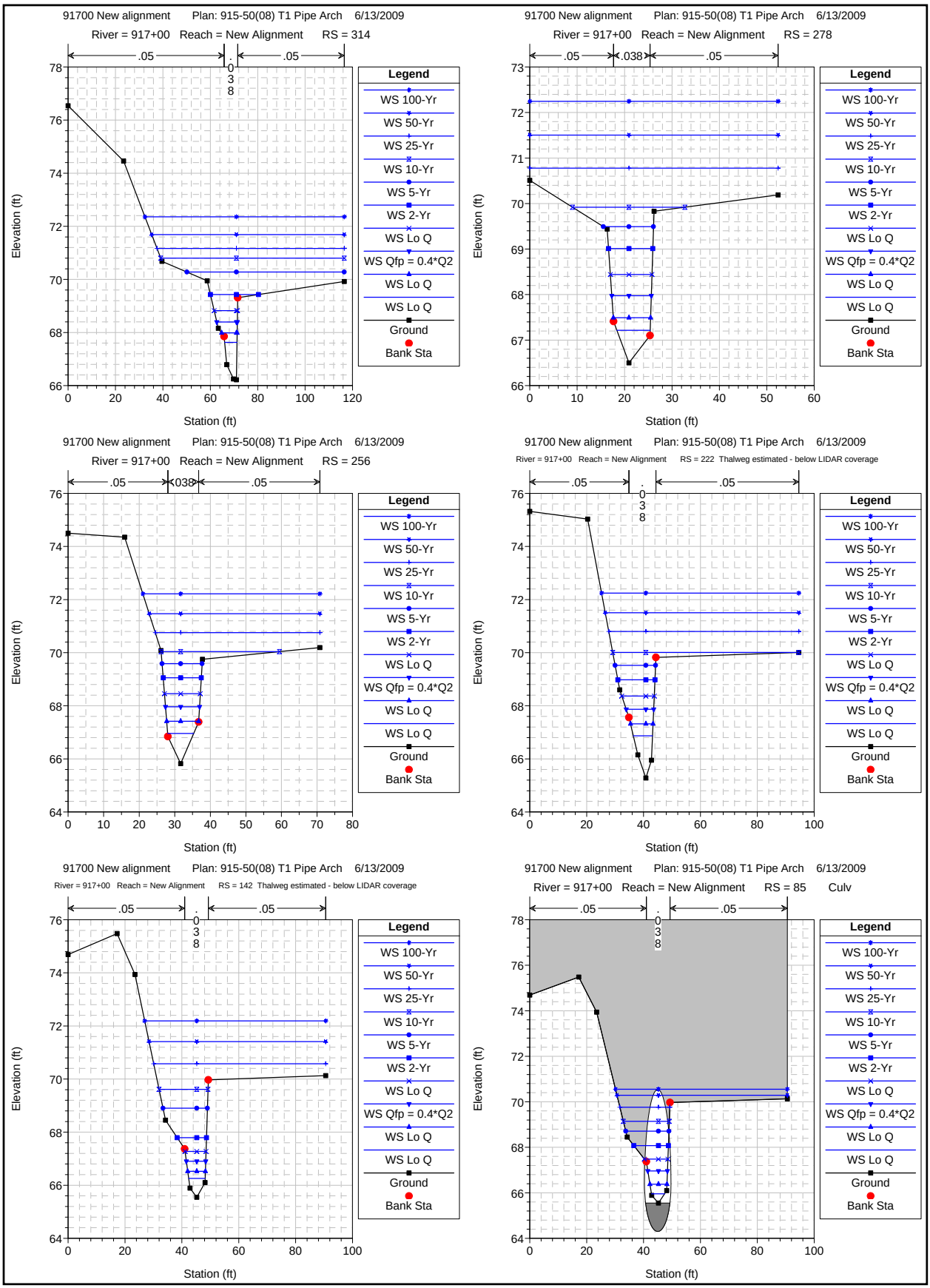
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
886	15	10-cfs	886-11x7cvr	10.00	245.00	67.75	68.32	68.32	68.53	0.025769	0.57	0.41	3.67	2.73	6.66	6.66	1.01	0.63
886	15	10-cfs	886-Ex	10.00	245.00	67.75	68.51		68.60	0.008219	0.76	0.55	2.50	4.00	7.27	7.27	0.59	0.27
886	15	FishPsg 0.4*Q2	886-11x7cvr	22.00	245.00	67.75	68.62	68.62	68.94	0.022745	0.87	0.63	4.55	4.84	7.65	7.65	1.01	0.85
886	15	FishPsg 0.4*Q2	886-Ex	22.00	245.00	67.75	69.09		69.19	0.004044	1.34	0.96	2.49	8.82	9.24	9.24	0.45	0.22
886	15	40-cfs	886-11x7cvr	30.00	245.00	67.75	68.78	68.78	69.15	0.021587	1.03	0.75	4.92	6.10	8.18	8.18	1.00	0.94
886	15	40-cfs	886-Ex	30.00	245.00	67.75	69.38		69.49	0.003442	1.63	1.14	2.57	11.65	10.21	10.21	0.42	0.23
886	15	2-Yr	886-11x7cvr	55.00	245.00	67.75	69.17	69.17	69.68	0.019914	1.42	1.01	5.73	9.60	9.52	9.52	1.01	1.16
886	15	2-Yr	886-Ex	55.00	245.00	67.75	70.24		70.34	0.002087	2.49	1.65	2.54	21.67	13.10	13.10	0.35	0.20
886	15	5-Yr	886-11x7cvr	82.00	245.00	67.75	69.51	69.51	70.13	0.018987	1.76	1.22	6.31	12.99	10.65	10.65	1.01	1.33
886	15	5-Yr	886-Ex	82.00	245.00	67.75	70.99		71.09	0.001405	3.24	2.28	2.56	32.72	17.27	14.00	0.30	0.18
886	15	10-Yr	886-11x7cvr	101.00	245.00	67.75	69.72	69.72	70.40	0.018535	1.97	1.34	6.63	15.23	11.33	11.33	1.01	1.42
886	15	10-Yr	886-Ex	101.00	245.00	67.75	71.47		71.57	0.001102	3.72	2.75	2.58	42.39	23.26	14.00	0.27	0.17
886	15	25-Yr	886-11x7cvr	127.00	245.00	67.75	69.96	69.96	70.72	0.018044	2.21	1.49	6.99	18.16	12.17	12.17	1.01	1.53
886	15	25-Yr	886-Ex	127.00	245.00	67.75	72.21		72.30	0.000719	4.46	3.50	2.44	63.30	32.65	14.00	0.23	0.14
886	15	50-Yr	886-11x7cvr	148.00	245.00	67.75	70.15	70.15	70.96	0.017652	2.40	1.60	7.23	20.47	12.79	12.79	1.01	1.60
886	15	50-Yr	886-Ex	148.00	245.00	67.75	72.73		72.81	0.000567	4.98	4.02	2.38	81.98	39.18	14.00	0.21	0.13
886	15	100-Yr	886-11x7cvr	169.00	245.00	67.75	70.43	70.32	71.19	0.014188	2.68	1.80	6.98	24.23	13.89	13.46	0.92	1.44
886	15	100-Yr	886-Ex	169.00	245.00	67.75	73.33		73.40	0.000419	5.58	4.62	2.24	107.74	46.71	14.00	0.18	0.11

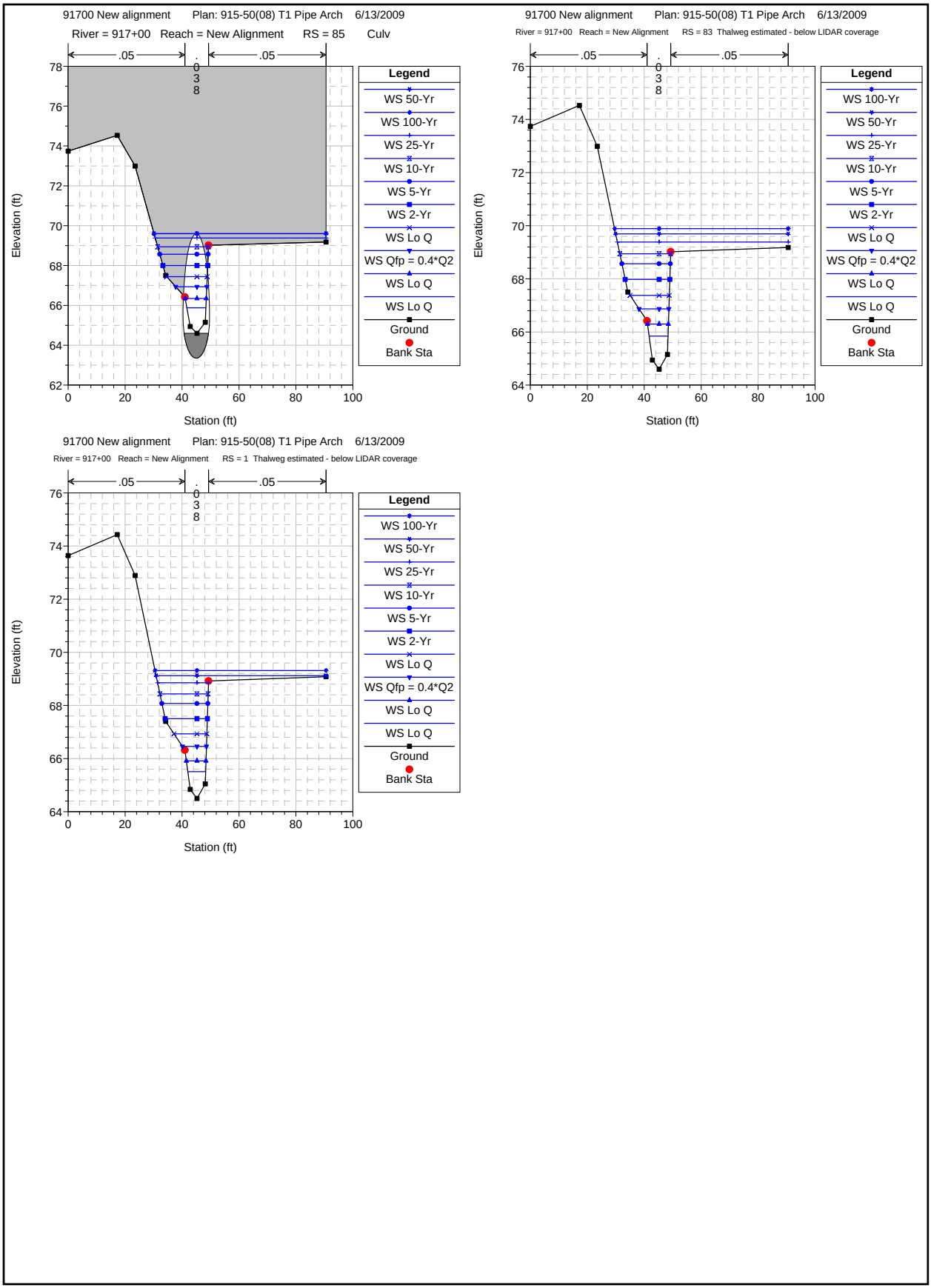
Tributary 887+60 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 917+00
Model based on ADOT&PF project datum


91700 New alignment Plan: 915-50(08) Ex 6/13/2009
River = 917+00 Reach = New Alignment RS = 314
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
91700 New alignment Plan: 915-50(08) Ex 6/13/2009
River = 917+00 Reach = New Alignment RS = 278
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
91700 New alignment Plan: 915-50(08) Ex 6/13/2009
River = 917+00 Reach = New Alignment RS = 256
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
91700 New alignment Plan: 915-50(08) Ex 6/13/2009
River = 917+00 Reach = New Alignment RS = 222 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
91700 New alignment Plan: 915-50(08) Ex 6/13/2009
River = 917+00 Reach = New Alignment RS = 142 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
91700 New alignment Plan: 915-50(08) Ex 6/13/2009
River = 917+00 Reach = New Alignment RS = 83 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta


91700 New alignment Plan: 915-50(08) Ex 6/13/2009
River = 917+00 Reach = New Alignment RS = 1 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta


91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 314
.05
.038
.05
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
Elevation (ft)
Station (ft)
91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 278
.05
.038
.05
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
Elevation (ft)
Station (ft)
91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 256
.05
.038
.05
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
Elevation (ft)
Station (ft)
91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 222 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
Elevation (ft)
Station (ft)
91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 142 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
Elevation (ft)
Station (ft)
91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 85 Culv
.05
.038
.05
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
Elevation (ft)
Station (ft)


91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 85 Culv
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 50-Yr
WS 100-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 83 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta
91700 New alignment Plan: 915-50(08) T1 Pipe Arch 6/13/2009
River = 917+00 Reach = New Alignment RS = 1 Thalweg estimated - below LIDAR coverage
.05
.038
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Lo Q
WS Qfp = 0.4*Q2
WS Lo Q
WS Lo Q
Ground
Bank Sta

HEC-RAS River: 917+00 Reach: New Alignment

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
New Alignment	1	Lo Q	915(08)-Ex	10.00		64.50	65.51	65.21	65.59	0.006004	1.01	0.71	2.25	4.44	6.27	6.27	0.47	0.24
New Alignment	1	Lo Q	915(08)-T1PA	10.00		64.50	65.51	65.21	65.59	0.006004	1.01	0.71	2.25	4.44	6.27	6.27	0.47	0.24
New Alignment	1	Lo Q	915(08)-Ex	20.00		64.50	65.92	65.47	66.04	0.006010	1.42	1.03	2.81	7.13	6.91	6.91	0.49	0.33
New Alignment	1	Lo Q	915(08)-T1PA	20.00		64.50	65.92	65.47	66.04	0.006010	1.42	1.03	2.81	7.13	6.91	6.91	0.49	0.33
New Alignment	1	Qfp = 0.4*Q2	915(08)-Ex	38.00		64.50	66.46	65.85	66.64	0.006001	1.96	1.46	3.43	11.15	8.44	7.59	0.50	0.45
New Alignment	1	Qfp = 0.4*Q2	915(08)-T1PA	38.00		64.50	66.46	65.85	66.64	0.006001	1.96	1.46	3.43	11.15	8.44	7.59	0.50	0.45
New Alignment	1	Lo Q	915(08)-Ex	60.00		64.50	66.93	66.23	67.17	0.006004	2.43	1.90	4.00	15.88	11.54	7.73	0.51	0.57
New Alignment	1	Lo Q	915(08)-T1PA	60.00		64.50	66.93	66.23	67.17	0.006004	2.43	1.90	4.00	15.88	11.54	7.73	0.51	0.57
New Alignment	1	2-Yr	915(08)-Ex	95.00		64.50	67.50	66.74	67.81	0.006001	3.00	2.43	4.58	23.50	14.84	7.90	0.52	0.70
New Alignment	1	2-Yr	915(08)-T1PA	95.00		64.50	67.50	66.74	67.81	0.006001	3.00	2.43	4.58	23.50	14.84	7.90	0.52	0.70
New Alignment	1	5-Yr	915(08)-Ex	141.00		64.50	68.07	67.32	68.43	0.006003	3.57	2.94	5.09	32.33	16.13	8.07	0.52	0.82
New Alignment	1	5-Yr	915(08)-T1PA	141.00		64.50	68.07	67.32	68.43	0.006003	3.57	2.94	5.09	32.33	16.13	8.07	0.52	0.82
New Alignment	1	10-Yr	915(08)-Ex	175.00		64.50	68.43	67.65	68.82	0.006001	3.93	3.26	5.37	38.33	16.94	8.18	0.52	0.89
New Alignment	1	10-Yr	915(08)-T1PA	175.00		64.50	68.43	67.65	68.82	0.006001	3.93	3.26	5.37	38.33	16.94	8.18	0.52	0.89
New Alignment	1	25-Yr	915(08)-Ex	219.00		64.50	68.85	67.96	69.28	0.006012	4.35	3.62	5.69	45.60	17.88	8.31	0.53	0.96
New Alignment	1	25-Yr	915(08)-T1PA	219.00		64.50	68.85	67.96	69.28	0.006012	4.35	3.62	5.69	45.60	17.88	8.31	0.53	0.96
New Alignment	1	50-Yr	915(08)-Ex	255.00		64.50	69.12	68.19	69.58	0.006007	4.62	3.89	5.94	55.57	59.67	8.33	0.53	1.03
New Alignment	1	50-Yr	915(08)-T1PA	255.00		64.50	69.12	68.19	69.58	0.006007	4.62	3.89	5.94	55.57	59.67	8.33	0.53	1.03
New Alignment	1	100-Yr	915(08)-Ex	291.00		64.50	69.31	68.40	69.77	0.006010	4.81	4.08	6.13	66.92	60.04	8.33	0.54	1.08
New Alignment	1	100-Yr	915(08)-T1PA	291.00		64.50	69.31	68.40	69.77	0.006010	4.81	4.08	6.13	66.92	60.04	8.33	0.54	1.08
New Alignment	83	Lo Q	915(08)-Ex	10.00	80.00	64.60	65.84		65.89	0.002521	1.24	0.90	1.68	5.96	6.64	6.64	0.31	0.12
New Alignment	83	Lo Q	915(08)-T1PA	10.00	80.00	64.60	65.84		65.89	0.002521	1.24	0.90	1.68	5.96	6.64	6.64	0.31	0.12
New Alignment	83	Lo Q	915(08)-Ex	20.00	80.00	64.60	66.30		66.37	0.002969	1.70	1.24	2.19	9.13	7.35	7.35	0.35	0.19
New Alignment	83	Lo Q	915(08)-T1PA	20.00	80.00	64.60	66.30		66.37	0.002969	1.70	1.24	2.19	9.13	7.35	7.35	0.35	0.19
New Alignment	83	Qfp = 0.4*Q2	915(08)-Ex	38.00	80.00	64.60	66.87		66.99	0.003222	2.27	1.75	2.79	14.10	10.48	7.68	0.37	0.28
New Alignment	83	Qfp = 0.4*Q2	915(08)-T1PA	38.00	80.00	64.60	66.87		66.99	0.003222	2.27	1.75	2.79	14.10	10.48	7.68	0.37	0.28
New Alignment	83	Lo Q	915(08)-Ex	60.00	80.00	64.60	67.38		67.54	0.003385	2.78	2.22	3.28	20.26	13.80	7.83	0.39	0.37
New Alignment	83	Lo Q	915(08)-T1PA	60.00	80.00	64.60	67.38		67.54	0.003385	2.78	2.22	3.28	20.26	13.80	7.83	0.39	0.37
New Alignment	83	2-Yr	915(08)-Ex	95.00	80.00	64.60	67.98		68.18	0.003503	3.38	2.77	3.76	29.26	15.69	8.02	0.40	0.45
New Alignment	83	2-Yr	915(08)-T1PA	95.00	80.00	64.60	67.98		68.18	0.003503	3.38	2.77	3.76	29.26	15.69	8.02	0.40	0.45
New Alignment	83	5-Yr	915(08)-Ex	141.00	80.00	64.60	68.57		68.81	0.003744	3.97	3.29	4.27	38.92	17.02	8.19	0.41	0.56
New Alignment	83	5-Yr	915(08)-T1PA	141.00	80.00	64.60	68.57		68.81	0.003744	3.97	3.29	4.27	38.92	17.02	8.19	0.41	0.56
New Alignment	83	10-Yr	915(08)-Ex	175.00	80.00	64.60	68.94		69.22	0.003879	4.34	3.62	4.56	45.41	17.86	8.31	0.42	0.62
New Alignment	83	10-Yr	915(08)-T1PA	175.00	80.00	64.60	68.94		69.22	0.003879	4.34	3.62	4.56	45.41	17.86	8.31	0.42	0.62
New Alignment	83	25-Yr	915(08)-Ex	219.00	80.00	64.60	69.38		69.66	0.003551	4.78	4.05	4.69	65.15	59.99	8.33	0.41	0.63
New Alignment	83	25-Yr	915(08)-T1PA	219.00	80.00	64.60	69.38		69.66	0.003551	4.78	4.05	4.69	65.14	59.99	8.33	0.41	0.63
New Alignment	83	50-Yr	915(08)-Ex	255.00	80.00	64.60	69.69		69.93	0.003090	5.09	4.35	4.60	83.69	60.59	8.33	0.39	0.59
New Alignment	83	50-Yr	915(08)-T1PA	255.00	80.00	64.60	69.69		69.93	0.003090	5.09	4.35	4.60	83.69	60.59	8.33	0.39	0.59
New Alignment	83	100-Yr	915(08)-Ex	291.00	80.00	64.60	69.89		70.13	0.003038	5.29	4.55	4.70	95.77	60.97	8.33	0.39	0.61
New Alignment	83	100-Yr	915(08)-T1PA	291.00	80.00	64.60	69.89		70.13	0.003038	5.29	4.55	4.70	95.77	60.97	8.33	0.39	0.61
New Alignment	142	Lo Q	915(08)-Ex	10.00	155.00	65.55	66.26	66.26	66.48	0.029765	0.71	0.45	3.83	2.61	5.80	5.80	1.00	0.79
New Alignment	142	Lo Q	915(08)-T1PA	10.00	155.00	65.55	66.26	66.26	66.48	0.029765	0.71	0.45	3.83	2.61	5.80	5.80	1.00	0.79
New Alignment	142	Lo Q	915(08)-Ex	20.00	155.00	65.55	66.62		66.89	0.018874	1.07	0.76	4.15	4.81	6.37	6.37	0.84	0.80
New Alignment	142	Lo Q	915(08)-T1PA	20.00	155.00	65.55	66.52	66.52	66.87	0.027676	0.97	0.68	4.73	4.23	6.22	6.22	1.01	1.07
New Alignment	142	Qfp = 0.4*Q2	915(08)-Ex	38.00	155.00	65.55	67.17		67.47	0.012854	1.62	1.18	4.44	8.56	7.23	7.23	0.72	0.80
New Alignment	142	Qfp = 0.4*Q2	915(08)-T1PA	38.00	155.00	65.55	66.90	66.90	67.40	0.026031	1.35	0.98	5.68	6.69	6.81	6.81	1.01	1.39
New Alignment	142	Lo Q	915(08)-Ex	60.00	155.00	65.55	67.65		68.02	0.011162	2.10	1.59	4.92	12.40	9.37	7.63	0.69	0.90
New Alignment	142	Lo Q	915(08)-T1PA	60.00	155.00	65.55	67.27	67.27	67.92	0.025040	1.72	1.26	6.43	9.34	7.39	7.39	1.01	1.65
New Alignment	142	2-Yr	915(08)-Ex	95.00	155.00	65.55	68.21		68.67	0.010158	2.66	2.12	5.52	18.75	13.07	7.80	0.67	1.05
New Alignment	142	2-Yr	915(08)-T1PA	95.00	155.00	65.55	67.79	67.79	68.57	0.021166	2.24	1.73	7.10	13.82	10.31	7.67	0.95	1.84
New Alignment	142	5-Yr	915(08)-Ex	141.00	155.00	65.55	68.81		69.31	0.009080	3.26	2.66	5.93	27.41	15.42	7.98	0.64	1.14
New Alignment	142	5-Yr	915(08)-T1PA	141.00	155.00	65.55	68.90	68.37	69.35	0.008012	3.35	2.74	5.66	28.82	15.63	8.01	0.60	1.03
New Alignment	142	10-Yr	915(08)-Ex	175.00	155.00	65.55	69.19		69.70	0.008511	3.64	3.00	6.12	33.41	16.28	8.09	0.62	1.17
New Alignment	142	10-Yr	915(08)-T1PA	175.00	155.00	65.55	69.61	68.70	69.96	0.005209	4.06	3.37	5.10	40.50	17.23	8.22	0.49	0.79
New Alignment	142	25-Yr	915(08)-Ex	219.00	155.00	65.55	69.57		70.13	0.008498	4.02	3.34	6.48	39.86	17.15	8.21	0.62	1.28
New Alignment	142	25-Yr	915(08)-T1PA	219.00	155.00	65.55	70.58	69.01	70.77	0.002501	5.03	4.29	4.09	79.78	60.46	8.33	0.35	0.47
New Alignment	142	50-Yr	915(08)-Ex	255.00	155.00	65.55	69.79	69.24	70.42	0.009165	4.24	3.53	6.92	43.57	17.63	8.27	0.65	1.44
New Alignment	142	50-Yr	915(08)-T1PA	255.00	155.00	65.55	71.41	69.24	71.50	0.001111	5.86	5.12	3.07	130.84	62.09	8.33	0.24	0.25
New Alignment	142	100-Yr	915(08)-Ex	291.00	155.00	65.55	69.93		70.66	0.010367	4.38	3.64	7.49	46.02	17.94	8.32	0.69	1.67
New Alignment	142	100-Yr	915(08)-T1PA	291.00	155.00	65.55	72.19	69.45	72.25	0.000615	6.64	5.91	2.51	180.05	63.62	8.33	0.18	0.16
New Alignment	222	Lo Q	915(08)-Ex	10.00	235.00	65.28	66.87		66.91	0.001997	1.59	0.96	1.55	6.47	6.75	6.75	0.28	0.10

HEC-RAS River: 917+00 Reach: New Alignment (Continued)

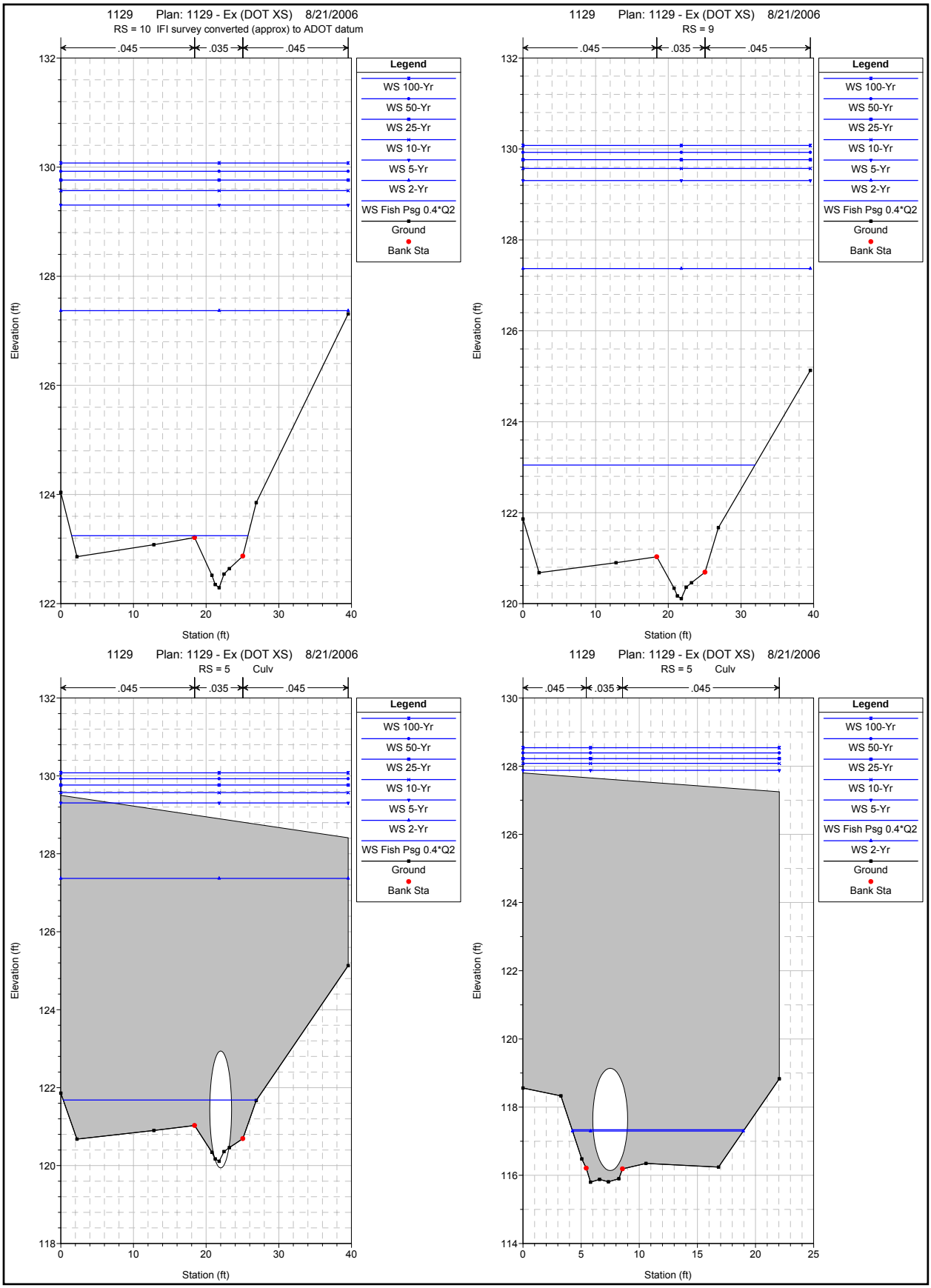
Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
New Alignment	222	Lo Q	915(08)-T1PA	10.00	235.00	65.28	66.87		66.91	0.002009	1.59	0.96	1.55	6.45	6.75	6.75	0.28	0.10
New Alignment	222	Lo Q	915(08)-Ex	20.00	235.00	65.28	67.30		67.37	0.002723	2.02	1.22	2.09	9.59	7.88	7.88	0.33	0.18
New Alignment	222	Lo Q	915(08)-T1PA	20.00	235.00	65.28	67.32		67.39	0.002590	2.04	1.23	2.05	9.77	7.94	7.94	0.33	0.17
New Alignment	222	Qfp = 0.4*Q2	915(08)-Ex	38.00	235.00	65.28	67.84		67.95	0.003184	2.56	1.63	2.69	14.23	9.54	8.68	0.37	0.27
New Alignment	222	Qfp = 0.4*Q2	915(08)-T1PA	38.00	235.00	65.28	67.87		67.98	0.002989	2.59	1.66	2.63	14.55	9.65	8.69	0.36	0.26
New Alignment	222	Lo Q	915(08)-Ex	60.00	235.00	65.28	68.34		68.49	0.003354	3.06	2.08	3.20	19.44	11.30	8.88	0.39	0.35
New Alignment	222	Lo Q	915(08)-T1PA	60.00	235.00	65.28	68.37		68.52	0.003191	3.09	2.11	3.14	19.81	11.41	8.90	0.38	0.34
New Alignment	222	2-Yr	915(08)-Ex	95.00	235.00	65.28	68.93		69.15	0.003643	3.65	2.62	3.80	26.77	12.95	9.13	0.41	0.47
New Alignment	222	2-Yr	915(08)-T1PA	95.00	235.00	65.28	68.98		69.19	0.003449	3.70	2.66	3.73	27.34	13.05	9.15	0.40	0.45
New Alignment	222	5-Yr	915(08)-Ex	141.00	235.00	65.28	69.51		69.80	0.004142	4.23	3.12	4.48	34.52	14.19	9.36	0.45	0.61
New Alignment	222	5-Yr	915(08)-T1PA	141.00	235.00	65.28	69.52		69.81	0.004076	4.24	3.13	4.45	34.73	14.22	9.37	0.44	0.61
New Alignment	222	10-Yr	915(08)-Ex	175.00	235.00	65.28	69.85		70.20	0.004462	4.57	3.42	4.90	39.72	23.68	9.49	0.47	0.72
New Alignment	222	10-Yr	915(08)-T1PA	175.00	235.00	65.28	70.01		70.31	0.003702	4.73	3.58	4.60	46.75	65.43	9.49	0.43	0.62
New Alignment	222	25-Yr	915(08)-Ex	219.00	235.00	65.28	70.28	68.97	70.60	0.003828	5.00	3.85	4.91	64.60	65.91	9.49	0.44	0.69
New Alignment	222	25-Yr	915(08)-T1PA	219.00	235.00	65.28	70.80		70.94	0.001694	5.52	4.37	3.55	98.85	66.81	9.49	0.30	0.35
New Alignment	222	50-Yr	915(08)-Ex	255.00	235.00	65.28	70.60		70.86	0.003131	5.32	4.16	4.68	85.47	66.46	9.49	0.40	0.61
New Alignment	222	50-Yr	915(08)-T1PA	255.00	235.00	65.28	71.50		71.58	0.000873	6.22	5.07	2.82	146.45	68.05	9.49	0.22	0.21
New Alignment	222	100-Yr	915(08)-Ex	291.00	235.00	65.28	70.87		71.09	0.002701	5.59	4.43	4.53	103.40	66.93	9.49	0.38	0.56
New Alignment	222	100-Yr	915(08)-T1PA	291.00	235.00	65.28	72.24		72.29	0.000500	6.96	5.81	2.34	197.31	69.34	9.49	0.17	0.14
New Alignment	256	Lo Q	915(08)-Ex	10.00	269.00	65.82	66.96		67.04	0.007293	1.14	0.60	2.30	4.34	7.33	7.26	0.53	0.26
New Alignment	256	Lo Q	915(08)-T1PA	10.00	269.00	65.82	66.96		67.04	0.007348	1.14	0.60	2.31	4.33	7.33	7.26	0.53	0.26
New Alignment	256	Lo Q	915(08)-Ex	20.00	269.00	65.82	67.40		67.50	0.005063	1.58	0.91	2.54	7.96	8.99	8.66	0.47	0.28
New Alignment	256	Lo Q	915(08)-T1PA	20.00	269.00	65.82	67.42		67.51	0.004762	1.60	0.93	2.49	8.11	9.01	8.66	0.46	0.26
New Alignment	256	Qfp = 0.4*Q2	915(08)-Ex	38.00	269.00	65.82	67.93		68.07	0.003858	2.11	1.44	3.01	12.92	9.55	8.66	0.44	0.33
New Alignment	256	Qfp = 0.4*Q2	915(08)-T1PA	38.00	269.00	65.82	67.96		68.10	0.003631	2.14	1.47	2.96	13.17	9.57	8.66	0.43	0.32
New Alignment	256	Lo Q	915(08)-Ex	60.00	269.00	65.82	68.43		68.62	0.003554	2.61	1.94	3.52	17.77	10.06	8.66	0.45	0.41
New Alignment	256	Lo Q	915(08)-T1PA	60.00	269.00	65.82	68.46		68.64	0.003392	2.64	1.97	3.47	18.04	10.09	8.66	0.44	0.40
New Alignment	256	2-Yr	915(08)-Ex	95.00	269.00	65.82	69.02		69.29	0.003618	3.20	2.53	4.24	23.87	10.67	8.66	0.47	0.55
New Alignment	256	2-Yr	915(08)-T1PA	95.00	269.00	65.82	69.06		69.32	0.003442	3.24	2.56	4.18	24.27	10.71	8.66	0.46	0.53
New Alignment	256	5-Yr	915(08)-Ex	141.00	269.00	65.82	69.57		69.97	0.004041	3.75	3.08	5.12	29.96	11.24	8.66	0.51	0.74
New Alignment	256	5-Yr	915(08)-T1PA	141.00	269.00	65.82	69.59		69.98	0.003984	3.77	3.10	5.09	30.10	11.26	8.66	0.51	0.74
New Alignment	256	10-Yr	915(08)-Ex	175.00	269.00	65.82	69.90		70.39	0.004421	4.08	3.41	5.72	34.55	22.88	8.66	0.55	0.90
New Alignment	256	10-Yr	915(08)-T1PA	175.00	269.00	65.82	70.04		70.48	0.003796	4.22	3.55	5.45	38.42	33.29	8.66	0.51	0.81
New Alignment	256	25-Yr	915(08)-Ex	219.00	269.00	65.82	70.26		70.81	0.004550	4.44	3.77	6.21	47.36	45.09	8.66	0.56	1.03
New Alignment	256	25-Yr	915(08)-T1PA	219.00	269.00	65.82	70.76		71.05	0.002329	4.94	4.26	4.82	70.11	46.28	8.66	0.41	0.59
New Alignment	256	50-Yr	915(08)-Ex	255.00	269.00	65.82	70.53		71.07	0.004278	4.71	4.04	6.30	59.65	45.73	8.66	0.55	1.03
New Alignment	256	50-Yr	915(08)-T1PA	255.00	269.00	65.82	71.47		71.65	0.001325	5.65	4.98	4.03	103.70	47.99	8.66	0.32	0.39
New Alignment	256	100-Yr	915(08)-Ex	291.00	269.00	65.82	70.78		71.29	0.003999	4.96	4.29	6.34	71.09	46.33	8.66	0.54	1.02
New Alignment	256	100-Yr	915(08)-T1PA	291.00	269.00	65.82	72.22		72.34	0.000804	6.40	5.73	3.45	140.27	49.78	8.66	0.25	0.28
New Alignment	278	Lo Q	915(08)-Ex	10.00	291.00	66.50	67.22	67.22	67.42	0.030409	0.72	0.39	3.62	2.76	7.03	6.99	1.02	0.74
New Alignment	278	Lo Q	915(08)-T1PA	10.00	291.00	66.50	67.22	67.22	67.42	0.030409	0.72	0.39	3.62	2.76	7.03	6.99	1.02	0.74
New Alignment	278	Lo Q	915(08)-Ex	20.00	291.00	66.50	67.48	67.45	67.76	0.022808	0.98	0.62	4.22	4.76	7.85	7.68	0.95	0.86
New Alignment	278	Lo Q	915(08)-T1PA	20.00	291.00	66.50	67.49	67.45	67.76	0.021823	0.99	0.63	4.16	4.83	7.86	7.68	0.93	0.83
New Alignment	278	Qfp = 0.4*Q2	915(08)-Ex	38.00	291.00	66.50	67.95		68.27	0.012413	1.45	1.09	4.54	8.55	8.30	7.68	0.77	0.82
New Alignment	278	Qfp = 0.4*Q2	915(08)-T1PA	38.00	291.00	66.50	67.97		68.28	0.011562	1.47	1.11	4.44	8.74	8.33	7.68	0.74	0.78
New Alignment	278	Lo Q	915(08)-Ex	60.00	291.00	66.50	68.42		68.80	0.009317	1.92	1.55	4.98	12.51	8.76	7.68	0.71	0.88
New Alignment	278	Lo Q	915(08)-T1PA	60.00	291.00	66.50	68.44		68.81	0.008801	1.94	1.58	4.90	12.74	8.78	7.68	0.69	0.85
New Alignment	278	2-Yr	915(08)-Ex	95.00	291.00	66.50	68.97		69.48	0.008257	2.47	2.11	5.76	17.53	9.30	7.68	0.70	1.06
New Alignment	278	2-Yr	915(08)-T1PA	95.00	291.00	66.50	69.01		69.50	0.007766	2.51	2.14	5.65	17.89	9.34	7.68	0.68	1.02
New Alignment	278	5-Yr	915(08)-Ex	141.00	291.00	66.50	69.48		70.19	0.008750	2.98	2.61	6.84	22.39	10.37	7.68	0.75	1.40
New Alignment	278	5-Yr	915(08)-T1PA	141.00	291.00	66.50	69.49		70.19	0.008612	2.99	2.63	6.81	22.53	10.57	7.68	0.74	1.38
New Alignment	278	10-Yr	915(08)-Ex	175.00	291.00	66.50	69.78	69.35	70.64	0.009309	3.28	2.91	7.58	26.14	14.98	7.68	0.78	1.66
New Alignment	278	10-Yr	915(08)-T1PA	175.00	291.00	66.50	69.92	69.35	70.69	0.007839	3.42	3.05	7.18	28.76	23.72	7.68	0.72	1.46
New Alignment	278	25-Yr	915(08)-Ex	219.00	291.00	66.50	70.43	70.43	71.05	0.005779	3.93	3.56	6.83	50.06	51.12	7.68	0.64	1.26
New Alignment	278	25-Yr	915(08)-T1PA	219.00	291.00	66.50	70.78		71.13	0.003239	4.28	3.91	5.45	68.36	52.39	7.68	0.49	0.77
New Alignment	278	50-Yr	915(08)-Ex	255.00	291.00	66.50	70.49		71.26	0.007098	3.99	3.62	7.66	53.19	52.04	7.68	0.71	1.57
New Alignment	278	50-Yr	915(08)-T1PA	255.00	291.00	66.50	71.50		71.68	0.001554	5.00	4.64	4.23	106.42	52.39	7.68	0.35	0.44
New Alignment	278	100-Yr	915(08)-Ex	291.00	291.00	66.50	70.84		71.40	0.005205	4.34	3.97	6.97	71.46	52.39	7.68	0.62	1.26
New Alignment	278	100-Yr	915(08)-T1PA	291.00	291.00	66.50	72.25		72.36	0.000878	5.75	5.38	3.51	145.31	52.39	7.68	0.27	0.29
New Alignment	314	Lo Q	915(08)-Ex	10.00	327.00	66.22	67.63		67.68	0.002958	1.41	1.05	1.84	5.45	5.21	5.21	0.32	0.15
New Alignment	314	Lo Q	915(08)-T1PA	10.00	327.00	66.22	67.63		67.68	0.002958	1.41	1.05	1.84	5.45	5.21	5.21	0.32	0.15

HEC-RAS River: 917+00 Reach: New Alignment (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
New Alignment	314	Lo Q	915(08)-Ex	20.00	327.00	66.22	67.99		68.10	0.004850	1.77	1.35	2.70	7.47	6.60	5.49	0.41	0.30
New Alignment	314	Lo Q	915(08)-T1PA	20.00	327.00	66.22	67.99		68.10	0.004887	1.77	1.34	2.71	7.44	6.58	5.49	0.41	0.30
New Alignment	314	Qfp = 0.4*Q2	915(08)-Ex	38.00	327.00	66.22	68.40		68.61	0.007269	2.18	1.73	3.81	10.68	8.66	5.56	0.51	0.55
New Alignment	314	Qfp = 0.4*Q2	915(08)-T1PA	38.00	327.00	66.22	68.39		68.61	0.007296	2.17	1.73	3.82	10.66	8.66	5.56	0.51	0.56
New Alignment	314	Lo Q	915(08)-Ex	60.00	327.00	66.22	68.82		69.12	0.008396	2.60	2.13	4.58	14.60	9.84	5.64	0.55	0.76
New Alignment	314	Lo Q	915(08)-T1PA	60.00	327.00	66.22	68.82		69.13	0.008347	2.60	2.13	4.57	14.64	9.85	5.64	0.55	0.75
New Alignment	314	2-Yr	915(08)-Ex	95.00	327.00	66.22	69.42		69.79	0.008450	3.20	2.69	5.22	21.40	19.38	5.72	0.56	0.92
New Alignment	314	2-Yr	915(08)-T1PA	95.00	327.00	66.22	69.43		69.80	0.008298	3.21	2.71	5.18	21.63	20.26	5.72	0.56	0.91
New Alignment	314	5-Yr	915(08)-Ex	141.00	327.00	66.22	70.27	69.32	70.43	0.003558	4.05	3.55	4.07	62.41	66.22	5.72	0.38	0.51
New Alignment	314	5-Yr	915(08)-T1PA	141.00	327.00	66.22	70.28	69.32	70.44	0.003514	4.06	3.55	4.05	62.79	66.36	5.72	0.38	0.51
New Alignment	314	10-Yr	915(08)-Ex	175.00	327.00	66.22	70.76		70.85	0.001906	4.54	4.04	3.25	98.06	77.27	5.72	0.28	0.31
New Alignment	314	10-Yr	915(08)-T1PA	175.00	327.00	66.22	70.80		70.88	0.001766	4.58	4.08	3.14	100.89	77.43	5.72	0.27	0.29
New Alignment	314	25-Yr	915(08)-Ex	219.00	327.00	66.22	71.13		71.20	0.001470	4.91	4.41	3.02	126.76	78.85	5.72	0.25	0.26
New Alignment	314	25-Yr	915(08)-T1PA	219.00	327.00	66.22	71.17		71.23	0.001382	4.95	4.44	2.94	129.55	79.00	5.72	0.25	0.25
New Alignment	314	50-Yr	915(08)-Ex	255.00	327.00	66.22	71.35		71.42	0.001370	5.13	4.63	3.01	144.46	79.80	5.72	0.25	0.26
New Alignment	314	50-Yr	915(08)-T1PA	255.00	327.00	66.22	71.69		71.73	0.000830	5.47	4.97	2.46	171.56	81.24	5.72	0.19	0.17
New Alignment	314	100-Yr	915(08)-Ex	291.00	327.00	66.22	71.47		71.54	0.001492	5.25	4.74	3.20	153.66	80.29	5.72	0.26	0.29
New Alignment	314	100-Yr	915(08)-T1PA	291.00	327.00	66.22	72.36		72.39	0.000473	6.14	5.63	2.02	226.68	84.10	5.72	0.15	0.11

Tributary 1102+19 HEC-RAS

Companion 2006 Stream and Habitat Inventory (S&HI) station 1123+25
Model based on ADOT&PF project datum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WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1129 Plan: 1129 - Ex (DOT XS) 8/21/2006
RS = 9
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Legend
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WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1129 Plan: 1129 - Ex (DOT XS) 8/21/2006
RS = 5 Culv
.045 .035 .045
Legend
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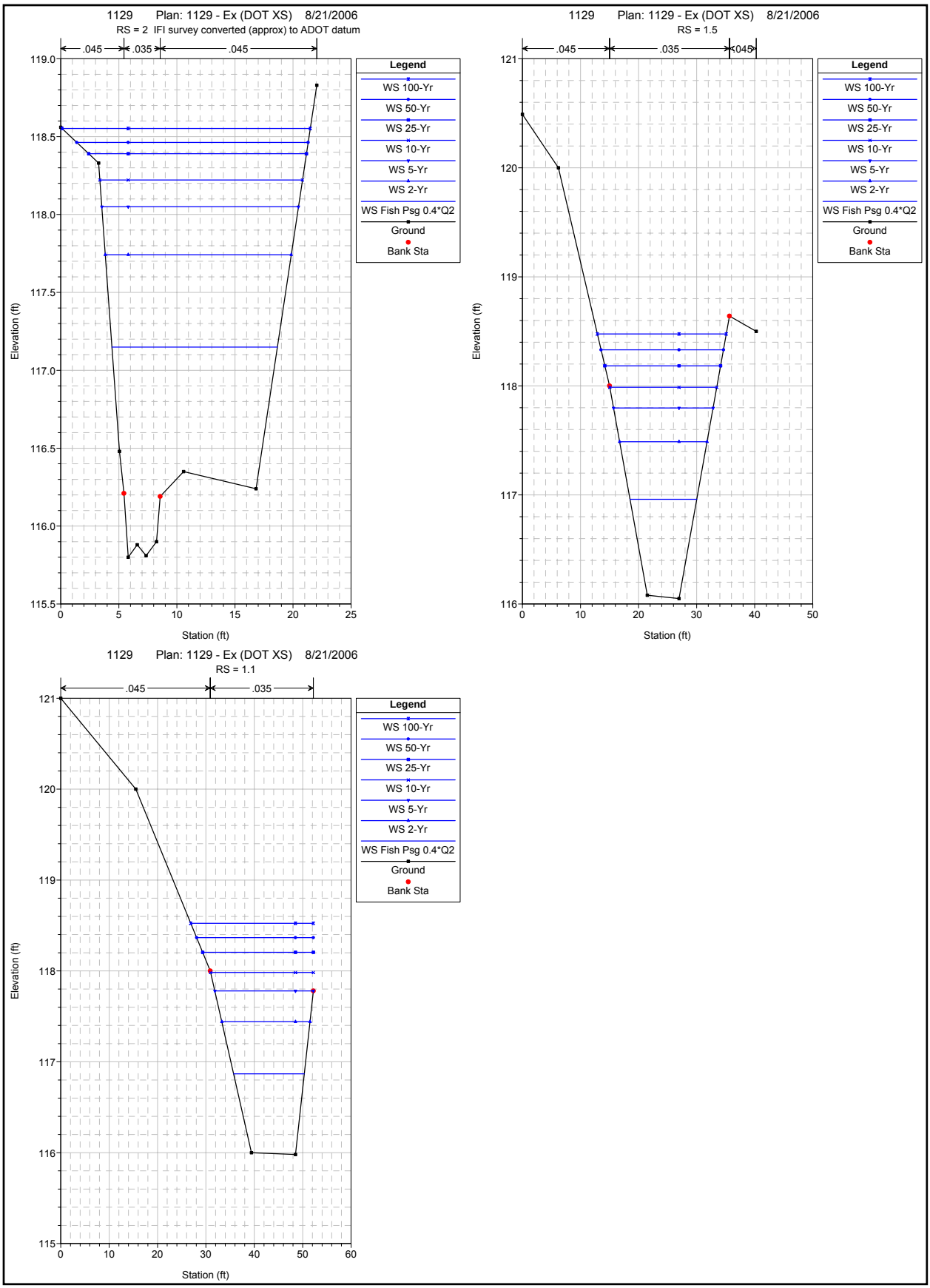
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1129 Plan: 1129 - Ex (DOT XS) 8/21/2006
RS = 5 Culv
.045 .035 .045
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS Fish Psg 0.4*Q2
WS 2-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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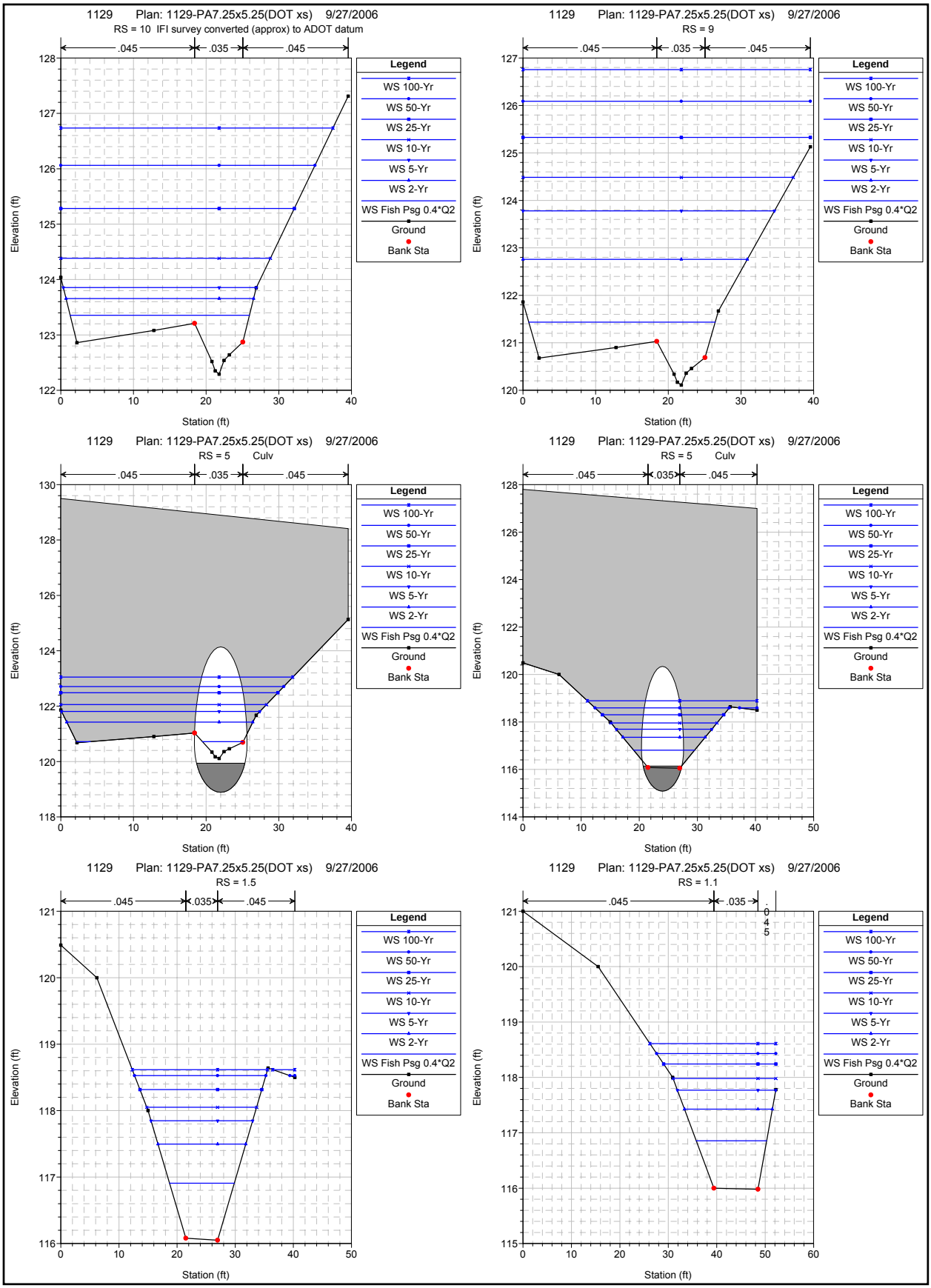
.035
.045
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1129 Plan: 1129 - Ex (DOT XS) 8/21/2006
RS = 1.5
.045
.035
.045
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1129 Plan: 1129 - Ex (DOT XS) 8/21/2006
RS = 1.1
.045
.035
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)


1129 Plan: 1129-PA7.25x5.25(DOT xs) 9/27/2006
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Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
1129 Plan: 1129-PA7.25x5.25(DOT xs) 9/27/2006
RS = 9
.045 .035 .045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
1129 Plan: 1129-PA7.25x5.25(DOT xs) 9/27/2006
RS = 5 Culv
.045 .035 .045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
1129 Plan: 1129-PA7.25x5.25(DOT xs) 9/27/2006
RS = 5 Culv
.045 .035 .045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
1129 Plan: 1129-PA7.25x5.25(DOT xs) 9/27/2006
RS = 1.5
.045 .035 .045
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta
1129 Plan: 1129-PA7.25x5.25(DOT xs) 9/27/2006
RS = 1.1
.045 .035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
WS 50-Yr
WS 25-Yr
WS 10-Yr
WS 5-Yr
WS 2-Yr
WS Fish Psg 0.4*Q2
Ground
Bank Sta

HEC-RAS River: 1129 Reach: 1129

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
1129	1.1	5-cfs	1129pa7dot	5.00		115.98	116.31	116.20	116.35	0.007001	0.33	0.32	1.65	3.19	11.08	9.10	0.52	0.14
1129	1.1	5-cfs	1129Ex(dot)	5.00		115.98	116.31	116.20	116.35	0.007001	0.33	0.29	1.55	3.23	11.10	11.10	0.51	0.13
1129	1.1	10-cfs	1129pa7dot	10.00		115.98	116.46	116.32	116.53	0.006992	0.48	0.47	2.16	5.01	12.06	9.10	0.55	0.21
1129	1.1	10-cfs	1129Ex(dot)	10.00		115.98	116.47	116.31	116.53	0.007005	0.49	0.42	1.97	5.07	12.10	12.10	0.54	0.18
1129	1.1	Fish Psg 0.4*Q2	1129pa7dot	29.00		115.98	116.86	116.63	117.00	0.007004	0.88	0.87	3.23	10.22	14.54	9.10	0.61	0.38
1129	1.1	Fish Psg 0.4*Q2	1129Ex(dot)	29.00		115.98	116.87	116.62	116.99	0.007001	0.89	0.71	2.79	10.39	14.61	14.61	0.58	0.30
1129	1.1	50-cfs	1129pa7dot	50.00		115.98	117.16	116.90	117.37	0.007004	1.18	1.17	3.95	14.94	16.46	9.10	0.64	0.51
1129	1.1	50-cfs	1129Ex(dot)	50.00		115.98	117.17	116.87	117.34	0.007004	1.19	0.92	3.30	15.16	16.54	16.54	0.61	0.39
1129	1.1	2-Yr	1129pa7dot	73.00		115.98	117.43	117.13	117.70	0.007001	1.45	1.44	4.52	19.56	18.14	9.10	0.67	0.63
1129	1.1	2-Yr	1129Ex(dot)	73.00		115.98	117.44	117.09	117.65	0.007001	1.46	1.09	3.69	19.80	18.22	18.22	0.62	0.46
1129	1.1	5-Yr	1129pa7dot	109.00		115.98	117.77	117.45	118.12	0.007008	1.79	1.78	5.22	26.13	20.30	9.10	0.69	0.78
1129	1.1	5-Yr	1129Ex(dot)	109.00		115.98	117.78	117.38	118.05	0.007005	1.80	1.29	4.14	26.35	20.37	20.37	0.64	0.55
1129	1.1	10-Yr	1129pa7dot	135.00		115.98	117.98	117.64	118.38	0.006999	2.00	1.99	5.62	30.51	21.21	9.10	0.70	0.87
1129	1.1	10-Yr	1129Ex(dot)	135.00		115.98	117.98	117.56	118.29	0.007009	2.00	1.44	4.42	30.57	21.23	21.23	0.65	0.61
1129	1.1	25-Yr	1129pa7dot	170.00		115.98	118.24	117.89	118.70	0.007004	2.26	2.25	6.10	36.31	23.16	9.10	0.72	0.98
1129	1.1	25-Yr	1129Ex(dot)	170.00		115.98	118.20	117.77	118.56	0.007004	2.22	1.66	4.81	35.45	22.87	21.30	0.66	0.69
1129	1.1	50-Yr	1129pa7dot	198.00		115.98	118.43	118.01	118.93	0.007002	2.45	2.44	6.44	40.81	24.61	9.10	0.73	1.07
1129	1.1	50-Yr	1129Ex(dot)	198.00		115.98	118.37	117.92	118.77	0.007002	2.39	1.82	5.10	39.26	24.12	21.30	0.67	0.75
1129	1.1	100-Yr	1129pa7dot	227.00		115.98	118.61	118.20	119.15	0.007001	2.63	2.62	6.75	45.35	25.99	9.10	0.73	1.14
1129	1.1	100-Yr	1129Ex(dot)	227.00		115.98	118.52	118.06	118.97	0.007001	2.54	1.98	5.36	43.16	25.34	21.30	0.67	0.81
1129	1.5	5-cfs	1129pa7dot	5.00	17.00	116.05	116.43		116.50	0.010703	0.38	0.37	2.25	2.46	7.93	5.46	0.65	0.25
1129	1.5	5-cfs	1129Ex(dot)	5.00	17.00	116.05	116.44		116.50	0.010445	0.39	0.31	1.99	2.51	7.98	7.98	0.63	0.20
1129	1.5	10-cfs	1129pa7dot	10.00	17.00	116.05	116.58		116.71	0.013208	0.53	0.51	3.12	3.67	8.90	5.46	0.77	0.42
1129	1.5	10-cfs	1129Ex(dot)	10.00	17.00	116.05	116.59		116.70	0.012378	0.54	0.42	2.63	3.80	9.01	9.01	0.71	0.32
1129	1.5	Fish Psg 0.4*Q2	1129pa7dot	29.00	17.00	116.05	116.91	116.91	117.24	0.017815	0.86	0.84	5.05	6.99	11.14	5.46	0.97	0.94
1129	1.5	Fish Psg 0.4*Q2	1129Ex(dot)	29.00	17.00	116.05	116.96		117.19	0.014518	0.91	0.66	3.82	7.59	11.50	11.50	0.83	0.59
1129	1.5	50-cfs	1129pa7dot	50.00	17.00	116.05	117.22	117.22	117.66	0.015979	1.17	1.16	5.91	10.82	13.26	5.46	0.97	1.15
1129	1.5	50-cfs	1129Ex(dot)	50.00	17.00	116.05	117.24	117.15	117.56	0.015144	1.19	0.83	4.52	11.05	13.37	13.37	0.88	0.76
1129	1.5	2-Yr	1129pa7dot	73.00	17.00	116.05	117.50	117.50	118.01	0.014891	1.45	1.43	6.58	14.71	15.11	5.46	0.97	1.33
1129	1.5	2-Yr	1129Ex(dot)	73.00	17.00	116.05	117.49	117.40	117.88	0.014992	1.44	0.97	5.00	14.60	15.06	15.06	0.90	0.88
1129	1.5	5-Yr	1129pa7dot	109.00	17.00	116.05	117.85	117.85	118.46	0.013863	1.80	1.78	7.35	20.44	17.48	5.46	0.97	1.54
1129	1.5	5-Yr	1129Ex(dot)	109.00	17.00	116.05	117.80	117.72	118.28	0.014962	1.75	1.14	5.57	19.58	17.15	17.15	0.92	1.04
1129	1.5	10-Yr	1129pa7dot	135.00	17.00	116.05	118.05	118.05	118.74	0.013736	2.00	1.99	7.86	24.15	18.91	5.46	0.98	1.70
1129	1.5	10-Yr	1129Ex(dot)	135.00	17.00	116.05	117.99	117.91	118.52	0.014893	1.94	1.25	5.88	22.96	18.42	18.42	0.93	1.12
1129	1.5	25-Yr	1129pa7dot	170.00	17.00	116.05	118.32	118.32	119.06	0.013114	2.27	2.25	8.35	29.42	20.96	5.46	0.98	1.84
1129	1.5	25-Yr	1129Ex(dot)	170.00	17.00	116.05	118.18	118.13	118.82	0.015079	2.13	1.39	6.37	26.73	19.94	19.13	0.95	1.27
1129	1.5	50-Yr	1129pa7dot	198.00	17.00	116.05	118.53	118.53	119.30	0.012268	2.48	2.46	8.57	34.02	23.46	5.46	0.96	1.89
1129	1.5	50-Yr	1129Ex(dot)	198.00	17.00	116.05	118.33	118.29	119.03	0.015067	2.28	1.50	6.70	29.74	21.08	19.62	0.96	1.37
1129	1.5	100-Yr	1129pa7dot	227.00	17.00	116.05	118.62	118.62	119.52	0.013876	2.57	2.55	9.34	36.27	27.08	5.46	1.03	2.21
1129	1.5	100-Yr	1129Ex(dot)	227.00	17.00	116.05	118.48	118.45	119.23	0.014943	2.43	1.61	6.99	32.89	22.21	20.11	0.97	1.46
1129	2	5-cfs	1129Ex(dot)	5.00	24.00	115.80	116.50		116.55	0.004119	0.70	0.62	1.86	3.84	12.33	3.12	0.42	0.14
1129	2	10-cfs	1129Ex(dot)	10.00	24.00	115.80	116.70		116.75	0.004336	0.90	0.81	2.28	6.26	12.90	3.12	0.45	0.20
1129	2	Fish Psg 0.4*Q2	1129Ex(dot)	29.00	24.00	115.80	117.15		117.25	0.004938	1.35	1.26	3.27	12.40	14.25	3.12	0.51	0.35
1129	2	50-cfs	1129Ex(dot)	50.00	24.00	115.80	117.47		117.63	0.005594	1.67	1.59	4.06	17.20	15.22	3.12	0.57	0.50
1129	2	2-Yr	1129Ex(dot)	73.00	24.00	115.80	117.74		117.96	0.006305	1.94	1.86	4.78	21.39	16.02	3.12	0.62	0.66
1129	2	5-Yr	1129Ex(dot)	109.00	24.00	115.80	118.05		118.37	0.007581	2.25	2.16	5.81	26.45	16.94	3.12	0.70	0.93
1129	2	10-Yr	1129Ex(dot)	135.00	24.00	115.80	118.22		118.62	0.008562	2.42	2.34	6.50	29.41	17.45	3.12	0.75	1.14
1129	2	25-Yr	1129Ex(dot)	170.00	24.00	115.80	118.39		118.91	0.010396	2.59	2.51	7.50	32.42	18.75	3.12	0.83	1.48
1129	2	50-Yr	1129Ex(dot)	198.00	24.00	115.80	118.46		119.12	0.012679	2.66	2.58	8.44	33.82	19.92	3.12	0.93	1.86
1129	2	100-Yr	1129Ex(dot)	227.00	24.00	115.80	118.55	118.29	119.34	0.014591	2.75	2.67	9.26	35.66	21.37	3.12	1.00	2.21
1129	5			Culvert														
1129	9	5-cfs	1129pa7dot	5.00	112.00	120.11	120.74	120.74	120.87	0.025093	0.63	0.30	2.95	1.76	8.48	5.61	0.95	0.46
1129	9	5-cfs	1129Ex(dot)	5.00	112.00	120.11	121.10	120.74	121.11	0.000834	0.99	0.60	0.85	8.33	24.39	6.63	0.19	0.03
1129	9	10-cfs	1129pa7dot	10.00	112.00	120.11	120.91	120.91	121.05	0.016991	0.80	0.44	3.13	4.14	18.24	6.23	0.83	0.45
1129	9	10-cfs	1129Ex(dot)	10.00	112.00	120.11	121.63	120.91	121.63	0.000196	1.52	1.12	0.63	21.74	26.38	6.63	0.10	0.01
1129	9	Fish Psg 0.4*Q2	1129pa7dot	29.00	112.00	120.11	121.44	121.18	121.50	0.003673	1.33	0.93	2.41	16.71	25.65	6.63	0.44	0.21
1129	9	Fish Psg 0.4*Q2	1129Ex(dot)	29.00	112.00	120.11	123.05	121.18	123.05	0.000065	2.94	2.54	0.63	63.26	31.93	6.63	0.07	0.01
1129	9	50-cfs	1129pa7dot	50.00	112.00	120.11	122.13	121.34	122.16	0.001104	2.02	1.62	1.91	35.49	28.57	6.63	0.26	0.11
1129	9	50-cfs	1129Ex(dot)	50.00	112.00	120.11	124.42	121.34	124.42	0.000039	4.31	3.91	0.64	110.44	36.94	6.63	0.06	0.01
1129	9	2-Yr	1129pa7dot	73.00	112.00	120.11	122.76	121.48	122.79	0.000655	2.65	2.25	1.83	54.24	30.87	6.63	0.21	0.09
1129	9	2-Yr	1129Ex(dot)	73.00	112.00	120.11	127.37	121.48	127.37	0.000010	7.26	6.86	0.48	226.31	39.55	6.63	0.03	0.00

HEC-RAS River: 1129 Reach: 1129 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Cum Ch Len	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Max Chl Dpth	Hydr Depth C	Vel Chnl	Flow Area	Top Width	Top W Chnl	Froude # Chl	Shear Chan
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft/s)	(sq ft)	(ft)	(ft)		(lb/sq ft)
1129	9	5-Yr	1129pa7dot	109.00	112.00	120.11	123.78	121.67	123.81	0.000356	3.67	3.27	1.73	87.63	34.61	6.63	0.17	0.07
1129	9	5-Yr	1129Ex(dot)	109.00	112.00	120.11	129.31	121.67	129.31	0.000010	9.20	8.80	0.55	302.86	39.55	6.63	0.03	0.01
1129	9	10-Yr	1129pa7dot	135.00	112.00	120.11	124.49	121.81	124.51	0.000263	4.38	3.98	1.70	113.06	37.20	6.63	0.15	0.06
1129	9	10-Yr	1129Ex(dot)	135.00	112.00	120.11	129.57	121.81	129.57	0.000013	9.46	9.07	0.66	313.33	39.55	6.63	0.04	0.01
1129	9	25-Yr	1129pa7dot	170.00	112.00	120.11	125.33	121.97	125.35	0.000203	5.22	4.82	1.69	145.50	39.55	6.63	0.14	0.06
1129	9	25-Yr	1129Ex(dot)	170.00	112.00	120.11	129.76	121.97	129.77	0.000020	9.65	9.26	0.81	320.99	39.55	6.63	0.05	0.01
1129	9	50-Yr	1129pa7dot	198.00	112.00	120.11	126.09	122.09	126.11	0.000158	5.98	5.58	1.65	175.62	39.55	6.63	0.12	0.05
1129	9	50-Yr	1129Ex(dot)	198.00	112.00	120.11	129.93	122.09	129.93	0.000025	9.82	9.42	0.93	327.38	39.55	6.63	0.05	0.01
1129	9	100-Yr	1129pa7dot	227.00	112.00	120.11	126.76	122.21	126.78	0.000137	6.64	6.25	1.65	202.00	39.55	6.63	0.12	0.05
1129	9	100-Yr	1129Ex(dot)	227.00	112.00	120.11	130.08	122.21	130.09	0.000031	9.97	9.57	1.05	333.41	39.55	6.63	0.06	0.02
1129	10	5-cfs	1129pa7dot	5.00	168.00	122.29	122.92	122.92	123.05	0.025081	0.63	0.30	2.95	1.76	8.48	5.61	0.95	0.46
1129	10	5-cfs	1129Ex(dot)	5.00	168.00	122.29	122.88	122.92	123.06	0.038451	0.59	0.27	3.40	1.48	6.39	5.48	1.16	0.63
1129	10	10-cfs	1129pa7dot	10.00	168.00	122.29	123.09	123.09	123.23	0.016991	0.80	0.44	3.13	4.14	18.24	6.23	0.83	0.45
1129	10	10-cfs	1129Ex(dot)	10.00	168.00	122.29	123.01	123.09	123.27	0.038429	0.72	0.37	4.23	2.78	13.58	5.93	1.22	0.87
1129	10	Fish Psg 0.4*Q2	1129pa7dot	29.00	168.00	122.29	123.36	123.36	123.53	0.016063	1.07	0.67	4.04	10.15	24.67	6.63	0.87	0.65
1129	10	Fish Psg 0.4*Q2	1129Ex(dot)	29.00	168.00	122.29	123.24	123.36	123.60	0.038412	0.95	0.56	5.54	7.43	24.25	6.63	1.31	1.30
1129	10	50-cfs	1129pa7dot	50.00	168.00	122.29	123.52	123.52	123.77	0.017505	1.23	0.84	4.89	14.28	25.29	6.63	0.94	0.89
1129	10	50-cfs	1129Ex(dot)	50.00	168.00	122.29	124.40	123.52	124.43	0.000882	2.11	1.72	1.77	38.22	28.91	6.63	0.24	0.09
1129	10	2-Yr	1129pa7dot	73.00	168.00	122.29	123.66	123.66	123.99	0.019299	1.37	0.97	5.68	17.78	25.81	6.63	1.01	1.14
1129	10	2-Yr	1129Ex(dot)	73.00	168.00	122.29	127.37	123.66	127.37	0.000042	5.08	4.68	0.75	140.04	39.55	6.63	0.06	0.01
1129	10	5-Yr	1129pa7dot	109.00	168.00	122.29	123.85	123.85	124.28	0.019781	1.56	1.17	6.50	22.95	26.56	6.63	1.06	1.40
1129	10	5-Yr	1129Ex(dot)	109.00	168.00	122.29	129.30	123.86	129.31	0.000026	7.01	6.62	0.74	216.61	39.55	6.63	0.05	0.01
1129	10	10-Yr	1129pa7dot	135.00	168.00	122.29	124.38		124.62	0.006729	2.09	1.70	4.86	37.65	28.84	6.63	0.66	0.69
1129	10	10-Yr	1129Ex(dot)	135.00	168.00	122.29	129.57	123.99	129.58	0.000034	7.28	6.88	0.88	227.07	39.55	6.63	0.06	0.01
1129	10	25-Yr	1129pa7dot	170.00	168.00	122.29	125.28		125.41	0.002067	2.99	2.60	3.58	65.08	32.13	6.63	0.39	0.33
1129	10	25-Yr	1129Ex(dot)	170.00	168.00	122.29	129.76	124.15	129.77	0.000049	7.47	7.08	1.08	234.72	39.55	6.63	0.07	0.02
1129	10	50-Yr	1129pa7dot	198.00	168.00	122.29	126.06		126.15	0.001046	3.77	3.38	3.03	91.21	34.98	6.63	0.29	0.21
1129	10	50-Yr	1129Ex(dot)	198.00	168.00	122.29	129.92	124.27	129.94	0.000062	7.63	7.24	1.22	241.08	39.55	6.63	0.08	0.03
1129	10	100-Yr	1129pa7dot	227.00	168.00	122.29	126.74		126.81	0.000697	4.45	4.05	2.79	115.62	37.45	6.63	0.24	0.17
1129	10	100-Yr	1129Ex(dot)	227.00	168.00	122.29	130.08	124.39	130.09	0.000075	7.79	7.39	1.37	247.10	39.55	6.63	0.09	0.03

23.5.3 Hydraulic Output – Small Fish Pipes

2009 Alignment Station: 228+95

1 2006 S&HI Station 252+00 Existing conditions

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 11:28:57 FILE NAME: 252-EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C U L V NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET SHAPE MATERIAL	BARRELS SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	22.29	21.43	70.01	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 252-EX DATE: 08-17-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
22.29	0	0	0	0	0	0	0	0	1
23.31	3	3	0	0	0	0	0	0	1
23.6	5	5	0	0	0	0	0	0	1
24.12	9	9	0	0	0	0	0	0	1
24.45	12	12	0	0	0	0	0	0	1
24.81	15	15	0	0	0	0	0	0	1
25.44	18	18	0	0	0	0	0	0	1
26.56	21	21	0	0	0	0	0	0	1
26.81	24	21.6	0	0	0	0	0	2.22	9
26.89	27	21.9	0	0	0	0	0	4.96	5
26.96	30	22.1	0	0	0	0	0	7.71	4
26.7	21.4	21.4	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 252-EX DATE: 08-17-2006

HEAD ELEV (ft)	HEAD ERROR (ft	TOTAL FLOW (cfs	FLOW ERROR (c	% FLOW ERROR
22.29	0	0	0	0
23.31	0	3	0	0
23.6	0	5	0	0
24.12	0	9	0	0
24.45	0	12	0	0
24.81	0	15	0	0

25.44	0	18	0	0
26.56	0	21	0	0
26.81	-0.004	24	0.13	0.54
26.89	-0.004	27	0.15	0.56
26.96	-0.007	30	0.21	0.7

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 11:28:57 FILE NAME: 252-EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)
0	22.29	0	0	0-NF	0	0	0	-0.8	0
3	23.31	0.89	1.02	2-M2c	0.63	0.6	0.6	0.32	3.75
5	23.6	1.18	1.31	2-M2c	0.84	0.79	0.79	0.44	4.36
9	24.12	1.69	1.83	2-M2c	1.19	1.07	1.07	0.57	5.28
12	24.45	2.08	2.16	2-M2c	1.46	1.24	1.24	0.64	5.85
15	24.81	2.52	2.52	2-M2c	2	1.4	1.4	0.69	6.41
18	25.44	3.04	3.15	2-M2c	2	1.52	1.52	0.74	7.03
21	26.56	3.66	4.27	2-M2c	2	1.63	1.63	0.78	7.63
21.65	26.8	3.81	4.51	2-M2c	2	1.65	1.65	0.82	7.82
21.89	26.89	3.86	4.6	2-M2c	2	1.66	1.66	0.86	7.88
22.08	26.95	3.91	4.66	2-M2c	2	1.67	1.67	0.89	7.92

El. inlet face invert 22.29 ft El. outlet invert 21.43 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 22.29 ft
OUTLET STATION 70.00 ft
OUTLET ELEVATION 21.43 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0123
CULVERT LENGTH ALONG SLOPE 70.01 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL

INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 11:28:57 FILE NAME: 252-EX

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 252-TW
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-16-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0020 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	23.00
2	100.00	21.63
3	100.50	20.63
4	102.50	20.63
5	103.00	21.63
6	203.00	23.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	20.63	0.000	-0.80	0.00	0.00
3.00	21.75	0.243	0.32	1.34	0.08
5.00	21.87	0.248	0.44	1.45	0.09
9.00	22.00	0.253	0.57	1.57	0.11
12.00	22.07	0.255	0.64	1.63	0.11
15.00	22.12	0.257	0.69	1.68	0.12
18.00	22.17	0.258	0.74	1.72	0.12
21.00	22.21	0.260	0.78	1.75	0.13
24.00	22.25	0.261	0.82	1.78	0.13
27.00	22.29	0.262	0.86	1.81	0.13
30.00	22.32	0.263	0.89	1.84	0.14

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	22.00 ft
CREST LENGTH	20.00 ft
OVERTOPPING CREST ELEVATION	26.70 ft

2009 Alignment Station: 228+95

2006 S&HI Station 252+00 Tier 2 FISH PASS design

Analysis of **Existing conditions**

no baffles

Juvenile Coho

C:\Client\ALASKA~1\ADFGFI~1\fishpass.exe

Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Fish Length (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
96	70	1.2	.024	0	3	2	0	.7

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Energy (joules) Possible Power	Outlet	Inlet
4.4 ft/sec	0.54 ft	0.42 watts	0.77	0.77

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.64	0.60
Avg., cross-section, water velocity (ft/sec)	3.44	3.75
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)	0.21	
Fish energy required at inlet (joules)	0.43	

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

Adult Coho 600-mm

C:\Client\ALASKA~1\ADFGFI~1\fishpass.exe

Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Fish Length (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
600	70	1.2	.024	0	3	2	0	.7

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Energy (joules) Possible Power	Outlet	Inlet
6.0 ft/sec	0.43 ft	38.11 watts	187.50	187.50

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.64	0.60
Avg., cross-section, water velocity (ft/sec)	3.44	3.75
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)	9.84	
Fish energy required at inlet (joules)	19.68	

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

Adult Coho 600 1.57 942

Note: L * 1.57 converts swimming ability to 'equivalent' grayling

Assume depth based on actual body size of 600-mm fish above

C:\Client\ALASKA~1\ADFGFI~1\fishpass.exe

Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Fish Length (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
942	70	1.2	.024	0	3	2	0	.7

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Energy (joules) Possible Power	Outlet	Inlet
6.4 ft/sec	0.41 ft	115.59 watts	725.60	

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.64	0.60
Avg., cross-section, water velocity (ft/sec)	3.44	3.75
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)		
Fish energy required at inlet (joules)		

Normal Depth too shallow

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

2009 Alignment Station: 240+38

1 2006 S&HI Station 263+50 Existing conditions

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 12:26:58 FILE NAME: 26350

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
U								
L	INLET	OUTLET	CULVERT	BARRELS				
V	ELEV.	ELEV.	LENGTH	SHAPE	SPAN	RISE	MANNING	INLET
NO.	(ft)	(ft)	(ft)	MATERIAL	(ft)	(ft)	n	TYPE
1	22.66	21.49	59.01	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 26350 DATE: 08-17-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
22.66	0	0	0	0	0	0	0	0	1
23.83	5	5	0	0	0	0	0	0	1
24.74	12	12	0	0	0	0	0	0	1
25.69	18	18	0	0	0	0	0	0	1
27.32	24	24	0	0	0	0	0	0	1
28.95	30	28.3	0	0	0	0	0	1.54	8
29.19	36	28.9	0	0	0	0	0	6.96	4
29.36	42	29.3	0	0	0	0	0	12.34	3
29.52	48	29.7	0	0	0	0	0	18.02	3
29.66	54	30	0	0	0	0	0	23.83	3
29.79	60	30.2	0	0	0	0	0	29.57	3
28.81	28	28	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 26350 DATE: 08-17-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
22.66	0.000	0.00	0.00	0.00
23.83	0.000	5.00	0.00	0.00
24.74	0.000	12.00	0.00	0.00
25.69	0.000	18.00	0.00	0.00
27.32	0.000	24.00	0.00	0.00
28.95	-0.005	30.00	0.14	0.47

29.19	-0.005	36.00	0.19	0.53
29.36	-0.008	42.00	0.39	0.93
29.52	-0.006	48.00	0.32	0.67
29.66	-0.003	54.00	0.17	0.31
29.79	-0.004	60.00	0.20	0.33

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 12:26:58 FILE NAME: 26350

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)
0	22.66	0	0	0-NF	0	0	0	0.16	0
5	23.83	1.17	1.17	1-S2n	0.73	0.79	0.73	1.31	4.84
12	24.74	2.08	2.08	5-S2n	1.23	1.24	1.14	1.52	6.48
18	25.69	3.03	2.89	3-M2t	1.75	1.52	1.62	1.62	6.6
24	27.32	4.38	4.66	2-M2c	2	1.72	1.72	1.69	8.37
28.32	28.97	5.66	6.31	2-M2c	2	1.85	1.85	1.76	9.38
28.85	29.19	5.83	6.53	2-M2c	2	1.87	1.87	1.81	9.52
29.28	29.36	5.98	6.7	2-M2c	2	1.88	1.88	1.86	9.62
29.66	29.52	6.11	6.86	3-M2t	2	1.89	1.9	1.9	9.7
30	29.7	6.22	7.04	3-M2t	2	1.9	1.94	1.94	9.71
30.24	29.8	6.31	7.14	3-M2t	2	1.91	1.98	1.98	9.69

El. inlet face invert 22.66 ft El. outlet invert 21.49 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 22.66 ft
OUTLET STATION 59.00 ft
OUTLET ELEVATION 21.49 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0198
CULVERT LENGTH ALONG SLOPE 59.01 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL

INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 12:26:58 FILE NAME: 26350

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 263-TW
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-17-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0036 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	24.00
2	100.00	22.65
3	100.50	21.65
4	102.50	21.65
5	103.00	22.65
6	203.00	24.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	21.65	0.000	0.16	0.00	0.00
5.00	22.80	0.328	1.31	1.85	0.16
12.00	23.01	0.338	1.52	2.10	0.19
18.00	23.11	0.343	1.62	2.21	0.21
24.00	23.18	0.346	1.69	2.30	0.22
30.00	23.25	0.349	1.76	2.37	0.23
36.00	23.30	0.351	1.81	2.42	0.24
42.00	23.35	0.353	1.86	2.47	0.24
48.00	23.39	0.354	1.90	2.52	0.25
54.00	23.43	0.356	1.94	2.56	0.26
60.00	23.47	0.357	1.98	2.60	0.26

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	22.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	28.81 ft

2009 Alignment Station: 240+38

2006 S&HI Station 263+50 Tier 2 FISH PASS design

Analysis of **Existing conditions**

no baffles

Juvenile Coho

C:\Client\ALASKA~1\ADFGFI~1\fishpass.exe

Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Length Fish (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
96	66	1.4	.024	0	3	2	0	.65

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Power	Possible Energy (joules) Outlet	Inlet
4.4 ft/sec	0.54 ft	0.42 watts	0.77	0.77

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.62	0.60
Avg., cross-section, water velocity (ft/sec)	3.64	3.75
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)	0.23	
Fish energy required at inlet (joules)	0.46	

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

Adult Coho 600-mm Adult Coho

C:\Client\ALASKA~1\ADFGFI~1\fishpass.exe

Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Length Fish (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
600	66	1.4	.024	0	3	2	0	.65

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Power	Possible Energy (joules) Outlet	Inlet
6.0 ft/sec	0.43 ft	38.11 watts	187.50	187.50

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.62	0.60
Avg., cross-section, water velocity (ft/sec)	3.64	3.75
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)	10.69	
Fish energy required at inlet (joules)	21.39	

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

Adult Coho 600 1.57 942

Note: L * 1.57 converts swimming ability to 'equivalent' grayling

Assume depth based on actual body size of 600-mm fish above

C:\Client\ALASKA~1\ADFGFI~1\fishpass.exe

Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Length Fish (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
942	66	1.4	.024	0	3	2	0	.65

Calculated Fish Parameters

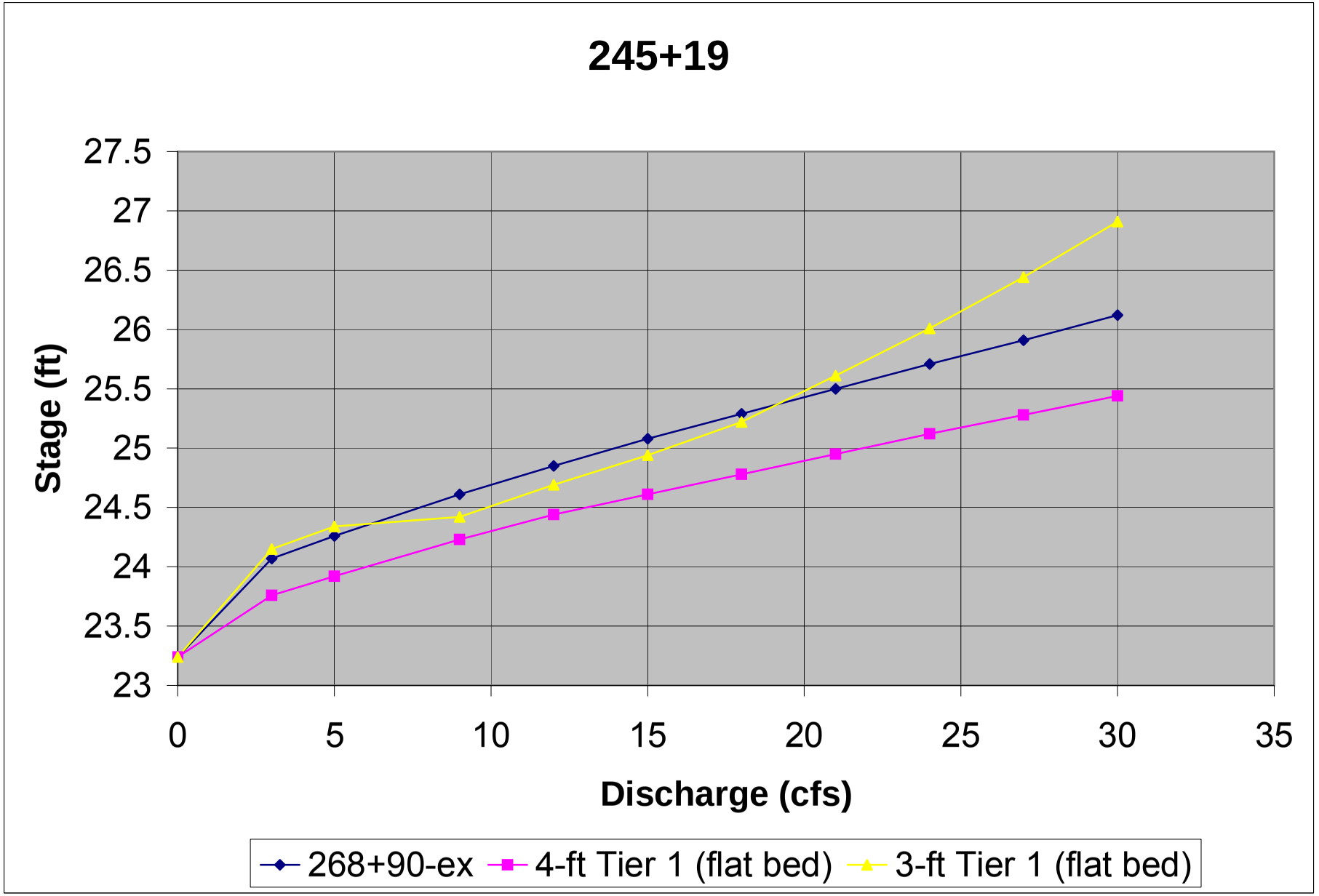
--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Power	Possible Energy (joules) Outlet	Inlet
6.3 ft/sec	0.42 ft	115.59 watts	725.60	

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.62	0.60
Avg., cross-section, water velocity (ft/sec)	3.64	3.75
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)		
Fish energy required at inlet (joules)		

Normal Depth too shallow

Alt = Menu <F1 = Current Field Help> <Esc = Exit>


245+19
Stage (ft)
27.5
27
26.5
26
25.5
25
24.5
24
23.5
23
0
5
10
15
20
25
30
35
Discharge (cfs)
268+90-ex
4-ft Tier 1 (flat bed)
3-ft Tier 1 (flat bed)

2009 Alignment Station: 245+19

1 2006 S&HI Station 268+90 Existing conditions

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 11:17:47 FILE NAME: 26890EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET SHAPE MATERIAL	BARRELS SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	23.24	21.71	58.02	1 CSP	3.00	3.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 26890EX DATE: 08-25-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
23.24	0	0	0	0	0	0	0	0	1
24.07	3	3	0	0	0	0	0	0	1
24.26	5	5	0	0	0	0	0	0	1
24.61	9	9	0	0	0	0	0	0	1
24.85	12	12	0	0	0	0	0	0	1
25.08	15	15	0	0	0	0	0	0	1
25.29	18	18	0	0	0	0	0	0	1
25.5	21	21	0	0	0	0	0	0	1
25.71	24	24	0	0	0	0	0	0	1
25.91	27	27	0	0	0	0	0	0	1
26.12	30	30	0	0	0	0	0	0	1
27.64	48.2	48.2	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 26890EX DATE: 08-25-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
23.24	0.000	0.00	0.00	0.00
24.07	0.000	3.00	0.00	0.00
24.26	0.000	5.00	0.00	0.00
24.61	0.000	9.00	0.00	0.00
24.85	0.000	12.00	0.00	0.00
25.08	0.000	15.00	0.00	0.00
25.29	0.000	18.00	0.00	0.00
25.50	0.000	21.00	0.00	0.00
25.71	0.000	24.00	0.00	0.00
25.91	0.000	27.00	0.00	0.00

26.12 0.000 30.00 0.00 0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 11:17:47 FILE NAME: 26890EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) CSP

DIS-CHARGE (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	23.24	0.00	0.00	0-NF	0.00	0.00	0.00	-0.56	0.00	0.00
3.00	24.07	0.83	0.83	1-S2n	0.44	0.52	0.32	0.33	8.21	1.85
5.00	24.26	1.02	1.02	1-S2n	0.59	0.69	0.49	0.39	6.52	1.96
9.00	24.61	1.37	1.37	1-S2n	0.78	0.94	0.78	0.47	6.09	2.10
12.00	24.85	1.61	1.61	1-S2n	0.92	1.09	0.79	0.52	8.00	2.17
15.00	25.08	1.84	1.84	1-S2n	1.03	1.23	0.93	0.56	8.04	2.23
18.00	25.29	2.05	2.05	1-S2n	1.13	1.35	1.05	0.60	8.13	2.29
21.00	25.50	2.26	2.26	1-S2n	1.24	1.47	1.17	0.63	8.22	2.34
24.00	25.71	2.47	2.47	1-S2n	1.33	1.57	1.27	0.65	8.39	2.38
27.00	25.91	2.67	2.67	1-S2n	1.42	1.67	1.37	0.68	8.56	2.42
30.00	26.12	2.88	2.88	1-S2n	1.52	1.77	1.51	0.70	8.40	2.45

El. inlet face invert 23.24 ft El. outlet invert 21.71 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 23.24 ft
OUTLET STATION 58.00 ft
OUTLET ELEVATION 21.71 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0264
CULVERT LENGTH ALONG SLOPE 58.02 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 3.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006

CURRENT TIME: 11:17:47 FILE NAME: 26890EX

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 26890TW
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-25-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0053 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	23.00
2	100.00	21.85
3	100.50	21.15
4	101.50	21.15
5	102.00	21.85
6	202.00	23.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	21.15	0.000	-0.56	0.00	0.00
3.00	22.04	0.386	0.33	1.85	0.17
5.00	22.10	0.392	0.39	1.96	0.19
9.00	22.18	0.398	0.47	2.10	0.21
12.00	22.23	0.402	0.52	2.17	0.22
15.00	22.27	0.405	0.56	2.23	0.23
18.00	22.31	0.407	0.60	2.29	0.24
21.00	22.34	0.409	0.63	2.34	0.25
24.00	22.36	0.411	0.65	2.38	0.25
27.00	22.39	0.413	0.68	2.42	0.26
30.00	22.41	0.414	0.70	2.45	0.26

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 24.00 ft
CREST LENGTH 10.00 ft
OVERTOPPING CREST ELEVATION 27.64 ft

2009 Alignment Station: 272+40

1 2006 S&HI Station 268+90 Tier 1 fish passage - 4-ft CMP

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 19:31:05 FILE NAME: 268-TW

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	23.24	21.71	58.02	1 ICMP	4.00	2.40	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 268-TW DATE: 08-29-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
23.24	0	0	0	0	0	0	0	0	1
23.76	3	3	0	0	0	0	0	0	1
23.92	5	5	0	0	0	0	0	0	1
24.23	9	9	0	0	0	0	0	0	1
24.44	12	12	0	0	0	0	0	0	1
24.61	15	15	0	0	0	0	0	0	1
24.78	18	18	0	0	0	0	0	0	1
24.95	21	21	0	0	0	0	0	0	1
25.12	24	24	0	0	0	0	0	0	1
25.28	27	27	0	0	0	0	0	0	1
25.44	30	30	0	0	0	0	0	0	1
27.64	57.4	57.4	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 268-TW DATE: 08-29-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
23.24	0.000	0.00	0.00	0.00
23.76	0.000	3.00	0.00	0.00
23.92	0.000	5.00	0.00	0.00
24.23	0.000	9.00	0.00	0.00
24.44	0.000	12.00	0.00	0.00
24.61	0.000	15.00	0.00	0.00
24.78	0.000	18.00	0.00	0.00
24.95	0.000	21.00	0.00	0.00
25.12	0.000	24.00	0.00	0.00
25.28	0.000	27.00	0.00	0.00
25.44	0.000	30.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006

CURRENT TIME: 19:31:05 FILE NAME: 268-TW

PERFORMANCE CURVE FOR CULVERT 1 - 1(4.00 (ft) BY 2.40 (ft)) ICMP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	23.24	0.00	0.00	0-NF	0.00	0.00	0.00	-0.56	0.00	0.00
3.00	23.76	0.52	0.52	1-S2n	0.21	0.26	0.16	0.33	3.59	1.85
5.00	23.92	0.68	0.68	1-S2n	0.30	0.36	0.30	0.39	4.25	1.96
9.00	24.23	0.99	0.99	1-S2n	0.44	0.54	0.34	0.47	6.73	2.10
12.00	24.44	1.20	1.20	1-S2n	0.53	0.65	0.45	0.52	6.70	2.17
15.00	24.61	1.37	1.37	1-S2n	0.61	0.76	0.56	0.56	6.79	2.23
18.00	24.78	1.54	1.54	1-S2n	0.70	0.85	0.69	0.60	6.58	2.29
21.00	24.95	1.71	1.71	1-S2n	0.78	0.95	0.65	0.63	8.23	2.34
24.00	25.12	1.88	1.88	1-S2n	0.85	1.03	0.73	0.65	8.33	2.38
27.00	25.28	2.04	2.04	1-S2n	0.93	1.11	0.81	0.68	8.45	2.42
30.00	25.44	2.20	2.20	1-S2n	1.00	1.19	0.89	0.70	8.54	2.45

El. inlet face invert 23.24 ft El. outlet invert 21.71 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 23.24 ft
OUTLET STATION 58.00 ft
OUTLET ELEVATION 21.71 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0264
CULVERT LENGTH ALONG SLOPE 58.02 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE USER DEFINED
BARREL SPAN 4.00 ft
BARREL RISE 2.40 ft
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S n 0.024 FOR SIDES AND TOP
0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 19:31:05 FILE NAME: 268-TW

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	73.20	23.64	23.64
2	73.21	24.04	23.24
3	73.60	24.88	23.24
4	74.00	25.26	23.24
5	74.40	25.48	23.24
6	74.80	25.60	23.24

7	75.20	25.64	23.24
8	75.60	25.60	23.24
9	76.00	25.48	23.24
10	76.30	25.26	23.24
11	76.70	24.88	23.24
12	77.10	24.04	23.24
13	77.20	23.64	23.64

4

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 19:31:05 FILE NAME: 268-TW

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 268TW4
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-29-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0053 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	23.00
2	100.00	21.85
3	100.50	21.15
4	101.50	21.15
5	102.00	21.85
6	202.00	23.00

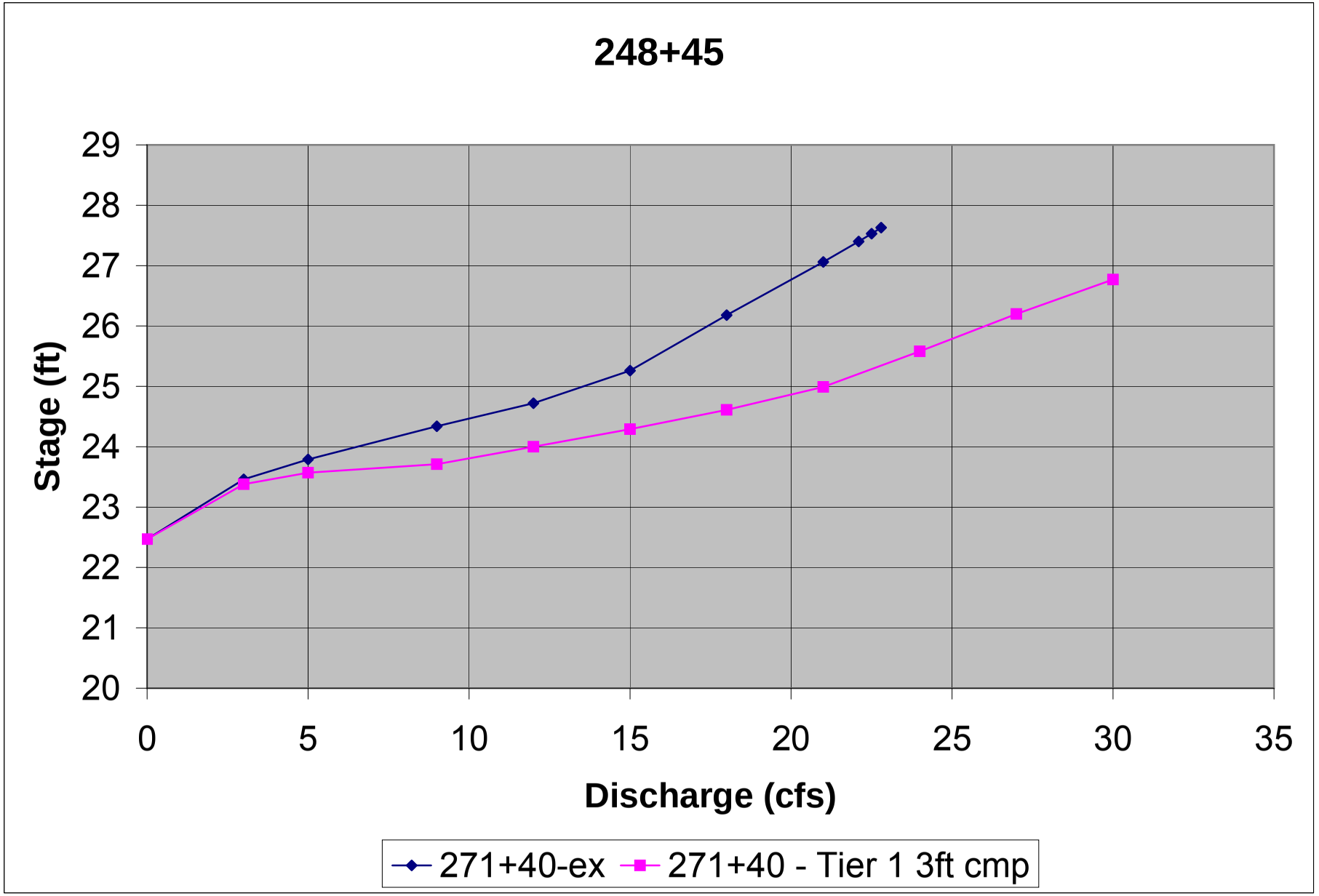
******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	21.15	0.000	-0.56	0.00	0.00
3.00	22.04	0.386	0.33	1.85	0.17
5.00	22.10	0.392	0.39	1.96	0.19
9.00	22.18	0.398	0.47	2.10	0.21
12.00	22.23	0.402	0.52	2.17	0.22
15.00	22.27	0.405	0.56	2.23	0.23
18.00	22.31	0.407	0.60	2.29	0.24
21.00	22.34	0.409	0.63	2.34	0.25
24.00	22.36	0.411	0.65	2.38	0.25
27.00	22.39	0.413	0.68	2.42	0.26
30.00	22.41	0.414	0.70	2.45	0.26

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 24.00 ft
CREST LENGTH 10.00 ft
OVERTOPPING CREST ELEVATION 27.64 ft


248+45
Stage (ft)
29
28
27
26
25
24
23
22
21
20
0
5
10
15
20
25
30
35
Discharge (cfs)
271+40-ex
271+40 - Tier 1 3ft cmp

2009 Alignment Station: 248+45

1 2006 S&HI Station 271+40 Existing conditions

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 11:21:00 FILE NAME: 27140EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C U L V NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	22.47	22.20	58.00	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 27140EX DATE: 08-25-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
22.47	0	0	0	0	0	0	0	0	1
23.46	3	3	0	0	0	0	0	0	1
23.79	5	5	0	0	0	0	0	0	1
24.34	9	9	0	0	0	0	0	0	1
24.72	12	12	0	0	0	0	0	0	1
25.26	15	15	0	0	0	0	0	0	1
26.18	18	18	0	0	0	0	0	0	1
27.06	21	21	0	0	0	0	0	0	1
27.4	24	22.1	0	0	0	0	0	1.7	6
27.53	27	22.5	0	0	0	0	0	4.33	4
27.63	30	22.8	0	0	0	0	0	7.08	4
27.25	21.6	21.6	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 27140EX DATE: 08-25-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
22.47	0.000	0.00	0.00	0.00
23.46	0.000	3.00	0.00	0.00
23.79	0.000	5.00	0.00	0.00
24.34	0.000	9.00	0.00	0.00
24.72	0.000	12.00	0.00	0.00
25.26	0.000	15.00	0.00	0.00
26.18	0.000	18.00	0.00	0.00
27.06	0.000	21.00	0.00	0.00

27.40	-0.007	24.00	0.22	0.92
27.53	-0.004	27.00	0.18	0.67
27.63	-0.008	30.00	0.09	0.30

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 11:21:00 FILE NAME: 27140EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET TW DEPTH (ft)	OUTLET TW DEPTH (ft)	VEL. (fps)	VEL. (fps)
0.00	22.47	0.00	0.00	0-NF	0.00	0.00	0.00	-0.54	0.00	0.00
3.00	23.46	0.90	0.99	2-M2c	0.82	0.60	0.60	0.22	3.75	2.00
5.00	23.79	1.19	1.32	2-M2c	1.11	0.79	0.79	0.31	4.36	2.17
9.00	24.34	1.70	1.87	2-M2c	2.00	1.07	1.07	0.39	5.28	2.34
12.00	24.72	2.09	2.25	2-M2c	2.00	1.24	1.24	0.43	5.85	2.42
15.00	25.26	2.53	2.79	2-M2c	2.00	1.40	1.40	0.47	6.41	2.48
18.00	26.18	3.05	3.71	2-M2c	2.00	1.52	1.52	0.50	7.03	2.54
21.00	27.06	3.67	4.59	2-M2c	2.00	1.63	1.63	0.53	7.63	2.59
22.09	27.40	3.92	4.93	2-M2c	2.00	1.67	1.67	0.55	7.92	2.63
22.49	27.52	4.02	5.05	2-M2c	2.00	1.68	1.68	0.57	8.02	2.67
22.83	27.63	4.10	5.16	2-M2c	2.00	1.69	1.69	0.59	8.10	2.71

El. inlet face invert 22.47 ft El. outlet invert 22.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 22.47 ft
OUTLET STATION 58.00 ft
OUTLET ELEVATION 22.20 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0047
CULVERT LENGTH ALONG SLOPE 58.00 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 11:21:00 FILE NAME: 27140EX

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 27140TW
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-25-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.035
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0053 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	23.00
2	100.00	22.36
3	100.50	21.66
4	102.50	21.66
5	103.00	22.36
6	203.00	23.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	21.66	0.000	-0.54	0.00	0.00
3.00	22.42	0.439	0.22	2.00	0.17
5.00	22.51	0.448	0.31	2.17	0.19
9.00	22.59	0.456	0.39	2.34	0.22
12.00	22.64	0.460	0.43	2.42	0.23
15.00	22.67	0.463	0.47	2.48	0.24
18.00	22.70	0.466	0.50	2.54	0.25
21.00	22.73	0.468	0.53	2.59	0.25
24.00	22.75	0.470	0.55	2.63	0.26
27.00	22.77	0.472	0.57	2.67	0.27
30.00	22.79	0.473	0.59	2.71	0.27

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 24.00 ft
CREST LENGTH 10.00 ft
OVERTOPPING CREST ELEVATION 27.25 ft

2009 Alignment Station: 248+45

1 2006 S&HI Station 271+40 Tier 1 fish passage - 3-ft CMP

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 20:14:01 FILE NAME: 271-T3

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C U L V NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	22.47	22.20	58.00	1 ICMP	3.10	1.80	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 271-T3 DATE: 08-29-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
22.47	0	0	0	0	0	0	0	0	1
23.38	3	3	0	0	0	0	0	0	1
23.57	5	5	0	0	0	0	0	0	1
23.71	9	9	0	0	0	0	0	0	1
24	12	12	0	0	0	0	0	0	1
24.29	15	15	0	0	0	0	0	0	1
24.61	18	18	0	0	0	0	0	0	1
24.99	21	21	0	0	0	0	0	0	1
25.58	24	24	0	0	0	0	0	0	1
26.2	27	27	0	0	0	0	0	0	1
26.77	30	30	0	0	0	0	0	0	1
27.25	32	32	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 271-T3 DATE: 08-29-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
22.47	0.000	0.00	0.00	0.00
23.38	0.000	3.00	0.00	0.00
23.57	0.000	5.00	0.00	0.00
23.71	0.000	9.00	0.00	0.00
24.00	0.000	12.00	0.00	0.00
24.29	0.000	15.00	0.00	0.00

24.61	0.000	18.00	0.00	0.00
24.99	0.000	21.00	0.00	0.00
25.58	0.000	24.00	0.00	0.00
26.20	0.000	27.00	0.00	0.00
26.77	0.000	30.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 20:14:01 FILE NAME: 271-T3

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.10 (ft) BY 1.80 (ft)) ICMP

DIS-CHARGE (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	22.47	0.00	0.00	0-NF	0.00	0.00	0.00	-0.54	0.00	0.00
3.00	23.38	0.91	0.57	2-M2c	0.46	0.31	0.31	0.24	3.22	1.88
5.00	23.57	1.10	0.82	2-M2c	0.66	0.44	0.44	0.32	3.81	2.02
9.00	23.71	1.18	1.24	2-M2c	1.06	0.64	0.64	0.40	4.70	2.16
12.00	24.00	1.44	1.53	2-M2c	1.43	0.78	0.78	0.44	5.23	2.24
15.00	24.29	1.69	1.82	2-M2c	1.80	0.90	0.90	0.47	5.70	2.30
18.00	24.61	1.97	2.14	2-M2c	1.80	1.02	1.02	0.50	6.16	2.35
21.00	24.99	2.35	2.52	2-M2c	1.80	1.13	1.13	0.53	6.56	2.39
24.00	25.58	2.75	3.11	2-M2c	1.80	1.23	1.23	0.55	6.99	2.43
27.00	26.20	3.18	3.73	2-M2c	1.80	1.31	1.31	0.58	7.46	2.47
30.00	26.77	3.64	4.30	2-M2c	1.80	1.39	1.39	0.60	7.94	2.50

El. inlet face invert 22.47 ft El. outlet invert 22.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 22.47 ft
OUTLET STATION 58.00 ft
OUTLET ELEVATION 22.20 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0047
CULVERT LENGTH ALONG SLOPE 58.00 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE USER DEFINED
BARREL SPAN 3.10 ft
BARREL RISE 1.80 ft
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S n 0.024 FOR SIDES AND TOP

0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 20:14:01 FILE NAME: 271-T3

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	73.30	22.77	22.77
2	73.40	23.07	22.47
3	73.70	23.70	22.47
4	74.00	23.98	22.47
5	74.30	24.15	22.47
6	74.60	24.24	22.47
7	74.80	24.27	22.47
8	75.10	24.24	22.47
9	75.40	24.15	22.47
10	75.70	23.98	22.47
11	76.00	23.70	22.47
12	76.30	23.07	22.47
13	76.40	22.77	22.77

4

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 20:14:01 FILE NAME: 271-T3

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 271-T3
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-29-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0053 ft/ft

CROSS-SECTION X Y

COORD. NO.	(ft)	(ft)
1	0.00	23.00
2	100.00	22.36
3	100.50	21.66
4	102.50	21.66
5	103.00	22.36
6	203.00	23.00

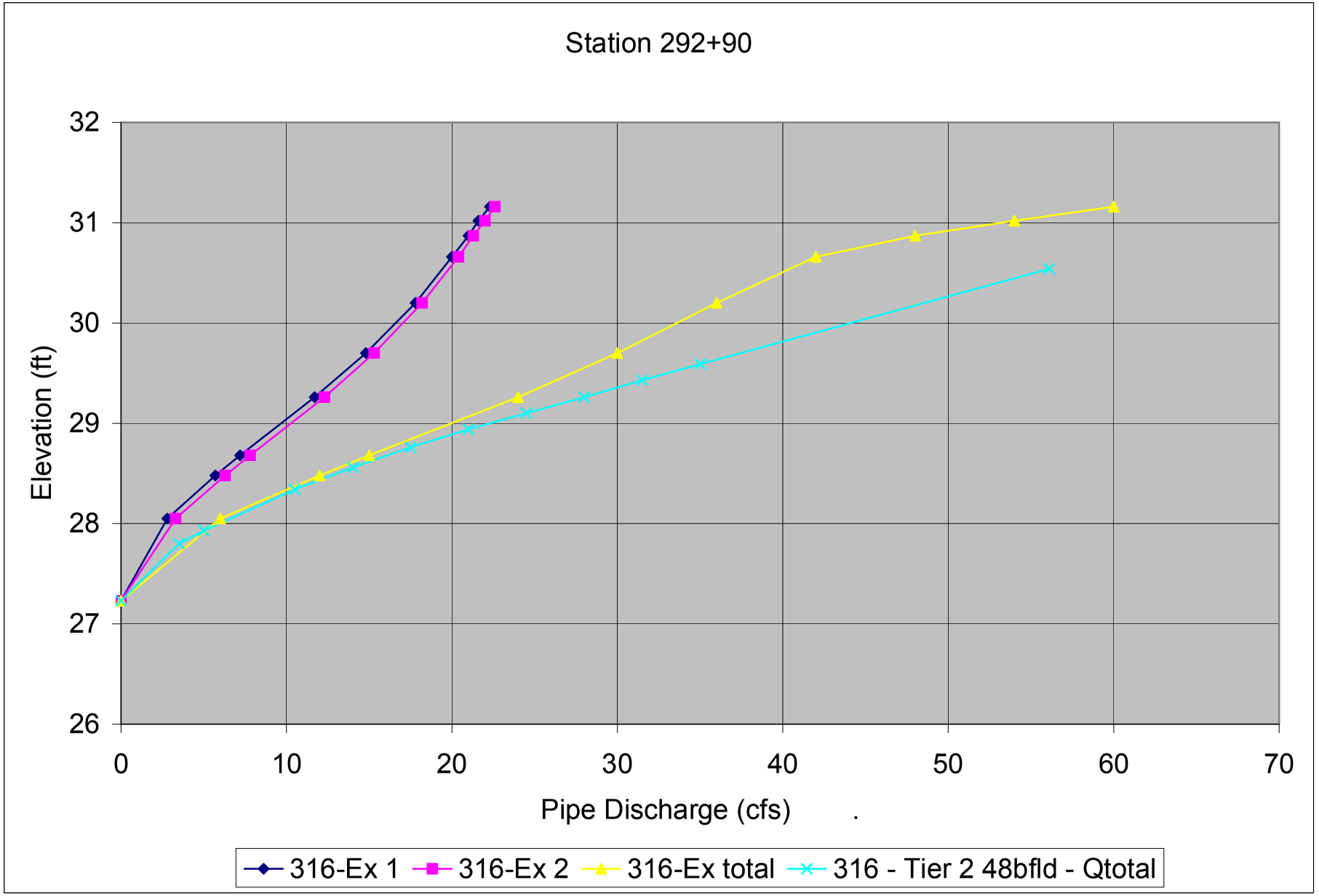
******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	21.66	0.000	-0.54	0.00	0.00
3.00	22.44	0.406	0.24	1.88	0.18
5.00	22.52	0.413	0.32	2.02	0.20
9.00	22.60	0.421	0.40	2.16	0.22
12.00	22.64	0.424	0.44	2.24	0.23
15.00	22.67	0.427	0.47	2.30	0.24
18.00	22.70	0.429	0.50	2.35	0.25
21.00	22.73	0.431	0.53	2.39	0.25
24.00	22.75	0.433	0.55	2.43	0.26
27.00	22.78	0.435	0.58	2.47	0.27
30.00	22.80	0.436	0.60	2.50	0.27

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	27.25 ft


Station 292+90
Elevation (ft)
32
31
30
29
28
27
26
0
10
20
30
40
50
60
70
Pipe Discharge (cfs)
316-Ex 1
316-Ex 2
316-Ex total
316 - Tier 2 48bfld - Qtotal

2009 Alignment Station: 292+90

1 2006 S&HI Station 316+00 Existing conditions

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 13:41:30 FILE NAME: 316-EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: SHAPE MATERIAL	BARRELS: SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	27.23	25.55	49.03	1 CSP	2.00	2.00	.024	CONVENTIONAL
2	27.15	25.52	50.03	1 CSP	2.00	2.00	.024	CONVENTIONAL
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 316-EX DATE: 08-17-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
27.23	0	0	0	0	0	0	0	0	0
28.05	6	2.8	3.3	0	0	0	0	0	4
28.48	12	5.7	6.3	0	0	0	0	0	3
28.68	15	7.2	7.8	0	0	0	0	0	2
29.26	24	11.7	12.3	0	0	0	0	0	3
29.7	30	14.8	15.3	0	0	0	0	0	3
30.2	36	17.8	18.2	0	0	0	0	0	3
30.66	42	20	20.4	0	0	0	0	1.2	5
30.87	48	21	21.3	0	0	0	0	5.55	4
31.02	54	21.6	22	0	0	0	0	10.05	3
31.16	60	22.3	22.6	0	0	0	0	14.9	3
30.54	39.3	19.5	19.9	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 316-EX DATE: 08-17-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
27.23	0.000	0.00	0.00	0.00
28.05	-0.005	6.00	0.00	0.00
28.48	0.001	12.00	-0.01	-0.08
28.68	0.003	15.00	-0.05	-0.33
29.26	0.002	24.00	-0.03	-0.13
29.70	0.004	30.00	-0.05	-0.17
30.20	-0.006	36.00	0.09	0.25
30.66	-0.010	42.00	0.35	0.83
30.87	-0.004	48.00	0.19	0.40
31.02	-0.006	54.00	0.33	0.61
31.16	-0.005	60.00	0.26	0.43

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 13:41:30 FILE NAME: 316-EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0	27.23	0	0	0-NF	0	0	0	0.02	0	0
2.75	28.06	0.83	0.83	1-S2n	0.46	0.57	0.37	0.34	6.69	1.75
5.73	28.49	1.26	1.26	1-S2n	0.68	0.84	0.67	0.48	6.16	2.19
7.22	28.68	1.45	1.45	1-S2n	0.77	0.95	0.65	0.54	8.12	2.37
11.73	29.26	2.03	2.03	5-S2n	1.02	1.23	0.93	0.69	8.22	2.78
14.78	29.7	2.47	2.47	5-S2n	1.17	1.38	1.08	0.78	8.5	3
17.75	30.2	2.97	2.97	5-S2n	1.33	1.51	1.21	0.87	8.91	3.19
20.04	30.66	3.43	3.43	5-S2n	1.46	1.61	1.41	0.95	8.49	3.36
20.95	30.86	3.63	3.63	5-S2n	1.52	1.63	1.43	1.02	8.69	3.51
21.64	31.01	3.78	3.78	5-S2n	1.56	1.65	1.45	1.09	8.87	3.65
22.26	31.16	3.93	3.93	5-S2n	1.6	1.67	1.59	1.15	8.31	3.77

El. inlet face invert 27.23 ft El. outlet invert 25.55 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 1.00 ft
INLET ELEVATION 27.23 ft
OUTLET STATION 50.00 ft
OUTLET ELEVATION 25.55 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0343
CULVERT LENGTH ALONG SLOPE 49.03 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 13:41:30 FILE NAME: 316-EX

PERFORMANCE CURVE FOR CULVERT 2 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	INLET CONTROL FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET TW DEPTH (ft)	OUTLET TW DEPTH (ft)	VEL. (fps)	VEL. (fps)
0.00	27.15	0.00	0.00	0-NF	0.00	0.00	0.00	0.05	0.00	0.00
3.25	28.06	0.91	0.91	1-S2n	0.51	0.63	0.43	0.37	6.70	1.75
6.28	28.48	1.33	1.33	1-S2n	0.72	0.88	0.72	0.51	6.13	2.19
7.83	28.68	1.53	1.53	1-S2n	0.82	0.99	0.69	0.57	8.04	2.37
12.30	29.25	2.10	2.10	5-S2n	1.06	1.26	0.96	0.72	8.28	2.78
15.27	29.70	2.55	2.55	5-S2n	1.22	1.41	1.11	0.81	8.56	3.00
18.16	30.20	3.05	3.05	5-S2n	1.38	1.53	1.37	0.90	7.93	3.19
20.41	30.66	3.51	3.51	5-S2n	1.52	1.62	1.42	0.98	8.57	3.36
21.30	30.86	3.71	3.71	5-S2n	1.58	1.64	1.44	1.05	8.76	3.51
21.98	31.01	3.86	3.86	5-S2n	1.63	1.66	1.56	1.12	8.36	3.65
22.58	31.16	4.01	3.59	2-M2c	1.69	1.68	1.68	1.18	8.04	3.77

El. inlet face invert 27.15 ft El. outlet invert 25.52 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 27.15 ft
OUTLET STATION 50.00 ft
OUTLET ELEVATION 25.52 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0326
CULVERT LENGTH ALONG SLOPE 50.03 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

4

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 13:41:30 FILE NAME: 316-EX

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 316-TW
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-17-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050

MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0100 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	29.32
2	17.50	28.65
3	23.50	25.57
4	35.50	25.57
5	40.50	28.02
6	58.50	29.30

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	25.57	0.000	0.02	0.00	0.00
6.00	25.89	0.560	0.34	1.75	0.19
12.00	26.03	0.592	0.48	2.19	0.26
15.00	26.09	0.603	0.54	2.37	0.29
24.00	26.24	0.626	0.69	2.78	0.37
30.00	26.33	0.637	0.78	3.00	0.42
36.00	26.42	0.646	0.87	3.19	0.46
42.00	26.50	0.654	0.95	3.36	0.50
48.00	26.57	0.661	1.02	3.51	0.53
54.00	26.64	0.667	1.09	3.65	0.56
60.00	26.70	0.672	1.15	3.77	0.59

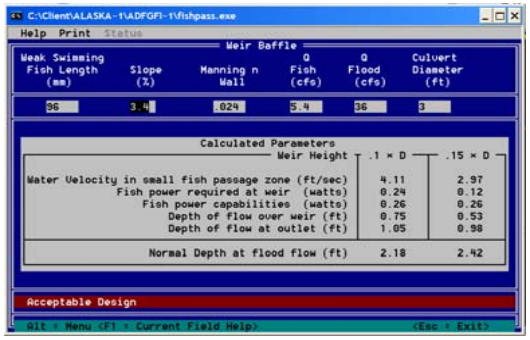
Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

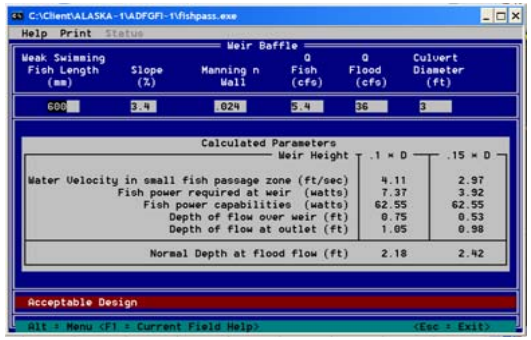
ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 24.00 ft
CREST LENGTH 10.00 ft
OVERTOPPING CREST ELEVATION 30.54 ft

2009 Alignment Station: 292+90
2006 S&HI Station 316+00 Tier 2 FISH PASS design

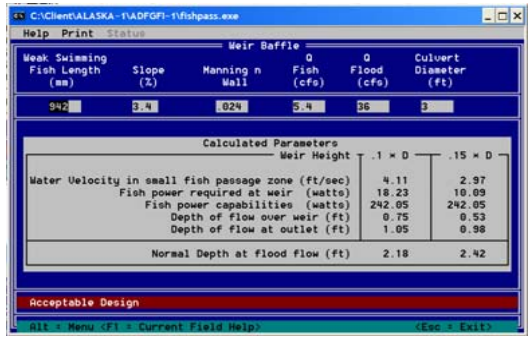
Baffle design: Juvenile Fish



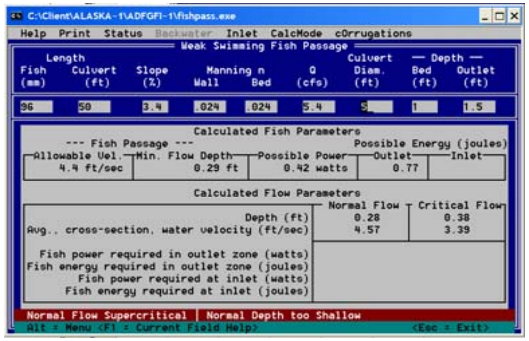
Adult fish - 600-mm

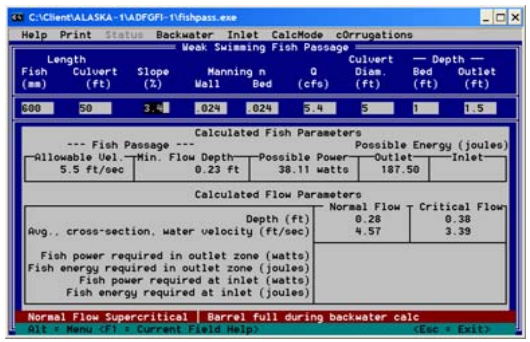


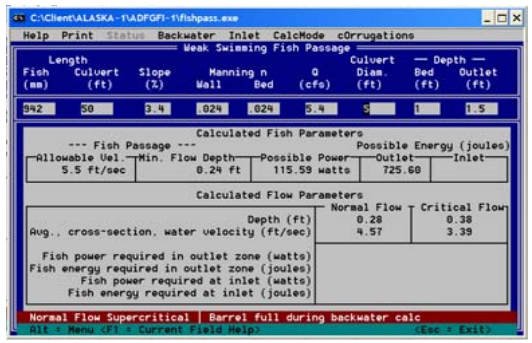
Adult fish - adjusted to 'equivalent' grayling



non-baffle design big pipe:







2009 Alignment Station: 292+90

1 2006 S&HI Station 316+00 Tier 2 fish passage - 4-ft baffled CMP

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 16:17:10 FILE NAME: 316T2-4B

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	27.23	25.55	50.03	1 ICMP	4.00	3.40	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 316T2-4B DATE: 09-07-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
27.23	0	0	0	0	0	0	0	0	1
27.8	3.5	3.5	0	0	0	0	0	0	1
27.93	5	5	0	0	0	0	0	0	1
28.34	10.5	10.5	0	0	0	0	0	0	1
28.56	14	14	0	0	0	0	0	0	1
28.76	17.5	17.5	0	0	0	0	0	0	1
28.94	21	21	0	0	0	0	0	0	1
29.1	24.5	24.5	0	0	0	0	0	0	1
29.26	28	28	0	0	0	0	0	0	1
29.43	31.5	31.5	0	0	0	0	0	0	1
29.59	35	35	0	0	0	0	0	0	1
30.54	56.1	56.1	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 316T2-4B DATE: 09-07-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
27.23	0.000	0.00	0.00	0.00
27.80	0.000	3.50	0.00	0.00
27.93	0.000	5.00	0.00	0.00
28.34	0.000	10.50	0.00	0.00
28.56	0.000	14.00	0.00	0.00
28.76	0.000	17.50	0.00	0.00
28.94	0.000	21.00	0.00	0.00
29.10	0.000	24.50	0.00	0.00
29.26	0.000	28.00	0.00	0.00
29.43	0.000	31.50	0.00	0.00
29.59	0.000	35.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 16:17:10 FILE NAME: 316T2-4B

PERFORMANCE CURVE FOR CULVERT 1 - 1(4.00 (ft) BY 3.40 (ft)) ICMP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	27.23	0.00	0.00	0-NF	0.00	0.00	0.00	0.02	0.00	0.00
3.50	27.80	0.57	0.57	1-S2n	0.23	0.35	0.15	0.26	4.89	1.50
5.00	27.93	0.70	0.70	1-S2n	0.32	0.42	0.22	0.31	5.35	1.67
10.50	28.34	1.11	1.11	1-S2n	0.50	0.69	0.39	0.44	8.37	2.13
14.00	28.56	1.33	1.33	1-S2n	0.60	0.82	0.52	0.51	8.18	2.35
17.50	28.76	1.53	1.53	1-S2n	0.70	0.95	0.65	0.58	8.07	2.53
21.00	28.94	1.71	1.71	1-S2n	0.78	1.07	0.67	0.64	9.40	2.69
24.50	29.10	1.87	1.87	1-S2n	0.86	1.17	0.77	0.69	9.32	2.84
28.00	29.26	2.03	2.03	1-S2n	0.94	1.28	0.88	0.75	9.25	2.97
31.50	29.43	2.20	2.20	1-S2n	1.02	1.38	1.03	0.80	8.81	3.09
35.00	29.59	2.36	2.36	1-S2n	1.09	1.47	1.10	0.85	9.05	3.20

El. inlet face invert 27.23 ft El. outlet invert 25.55 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 27.23 ft
OUTLET STATION 50.00 ft
OUTLET ELEVATION 25.55 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0336
CULVERT LENGTH ALONG SLOPE 50.03 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE USER DEFINED
BARREL SPAN 4.00 ft
BARREL RISE 3.40 ft
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S n 0.024 FOR SIDES AND TOP
0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006

CURRENT TIME: 16:17:10 FILE NAME: 316T2-4B

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDIN NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	0	28.63	28.63
2	0.19	29.48	27.78
3	0.38	29.8	27.46
4	0.57	30.03	27.23
5	0.93	30.32	27.23
6	1.29	30.5	27.23
7	1.64	30.6	27.23
8	2	30.63	27.23
9	2.36	30.6	27.23
10	2.71	30.5	27.23
11	3.07	30.32	27.23
12	3.43	30.03	27.23
13	3.62	29.8	27.46
14	3.81	29.48	27.78
15	4	28.63	28.63

4

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 16:17:10 FILE NAME: 316T2-4B

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 316T2-4
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 09-07-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0104 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	29.32
2	17.50	28.65
3	23.50	25.57
4	35.50	25.57
5	40.50	28.02
6	58.50	29.30

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

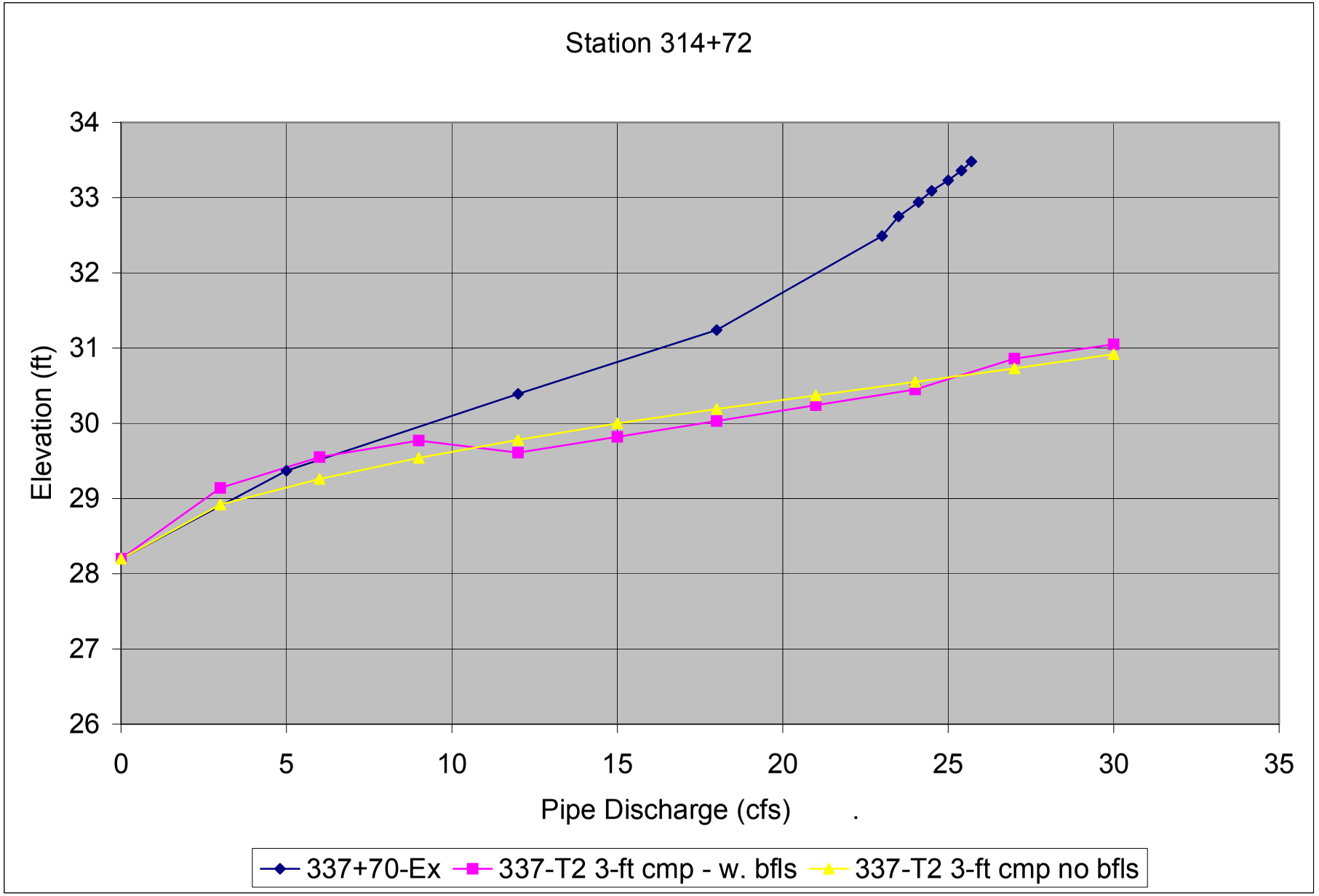
FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	25.57	0.000	0.02	0.00	0.00

3.50	25.81	0.548	0.26	1.50	0.15
5.00	25.86	0.562	0.31	1.67	0.18
10.50	25.99	0.596	0.44	2.13	0.25
14.00	26.06	0.610	0.51	2.35	0.29
17.50	26.13	0.622	0.58	2.53	0.33
21.00	26.19	0.631	0.64	2.69	0.36
24.50	26.24	0.638	0.69	2.84	0.39
28.00	26.30	0.645	0.75	2.97	0.42
31.50	26.35	0.651	0.80	3.09	0.44
35.00	26.40	0.657	0.85	3.20	0.47

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	30.54 ft


Station 314+72
Elevation (ft)
34
33
32
31
30
29
28
27
26
0
5
10
15
20
25
30
35
Pipe Discharge (cfs)
337+70-Ex
337-T2 3-ft cmp - w. bfls
337-T2 3-ft cmp no bfls

2009 Alignment Station: 314+72

1 2006 S&HI Station 337+70 Existing conditions

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 13:50:32 FILE NAME: 33770

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	28.20	27.33	52.01	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 33770 DATE: 08-17-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
28.2	0	0	0	0	0	0	0	0	1
29.37	5	5	0	0	0	0	0	0	1
30.39	12	12	0	0	0	0	0	0	1
31.24	18	18	0	0	0	0	0	0	1
32.49	24	23	0	0	0	0	0	0.82	8
32.75	30	23.5	0	0	0	0	0	6.28	4
32.94	36	24.1	0	0	0	0	0	11.85	4
33.09	42	24.5	0	0	0	0	0	17.2	3
33.23	48	25	0	0	0	0	0	22.79	3
33.36	54	25.4	0	0	0	0	0	28.44	3
33.48	60	25.7	0	0	0	0	0	34.1	3
32.4	22.7	22.7	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 33770 DATE: 08-17-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
28.20	0.000	0.00	0.00	0.00
29.37	0.000	5.00	0.00	0.00
30.39	0.000	12.00	0.00	0.00
31.24	0.000	18.00	0.00	0.00
32.49	-0.007	24.00	0.22	0.92
32.75	-0.006	30.00	0.25	0.83

32.94	-0.009	36.00	0.09	0.25
33.09	-0.005	42.00	0.26	0.62
33.23	-0.004	48.00	0.23	0.48
33.36	-0.003	54.00	0.19	0.35
33.48	-0.003	60.00	0.16	0.27

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 13:50:32 FILE NAME: 33770

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)
0	28.2	0	0	0-NF	0	0	0	-0.05	0
5	29.37	1.17	1.17	1-S2n	0.77	0.79	0.69	0.23	5.23
12	30.39	2.08	2.19	2-M2c	1.3	1.24	1.24	0.36	5.85
18	31.24	3.04	2.88	2-M2c	2	1.52	1.52	0.46	7.03
22.96	32.49	4.12	4.29	2-M2c	2	1.69	1.69	0.54	8.13
23.47	32.75	4.25	4.55	2-M2c	2	1.71	1.71	0.61	8.25
24.06	32.93	4.4	4.73	2-M2c	2	1.72	1.72	0.68	8.38
24.54	33.08	4.53	4.88	2-M2c	2	1.74	1.74	0.74	8.49
24.98	33.23	4.65	5.03	2-M2c	2	1.75	1.75	0.8	8.59
25.37	33.35	4.76	5.15	2-M2c	2	1.76	1.76	0.85	8.67
25.74	33.47	4.87	5.27	2-M2c	2	1.77	1.77	0.91	8.75

El. inlet face invert 28.20 ft El. outlet invert 27.33 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 28.20 ft
OUTLET STATION 52.00 ft
OUTLET ELEVATION 27.33 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0167
CULVERT LENGTH ALONG SLOPE 52.01 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL

INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 13:50:32 FILE NAME: 33770

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 33770-TW
MAIN CHANNEL ONLY FILE DATE: 08-17-2006
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.040
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0290 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	31.19
2	7.00	27.36
3	17.20	27.28
4	30.20	31.04

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	27.28	0.000	-0.05	0.00	0.00
5.00	27.56	0.865	0.23	2.32	0.40
12.00	27.69	0.926	0.36	3.08	0.62
18.00	27.79	0.957	0.46	3.54	0.76
24.00	27.87	0.979	0.54	3.88	0.87
30.00	27.94	0.996	0.61	4.18	0.97
36.00	28.01	1.011	0.68	4.44	1.07
42.00	28.07	1.023	0.74	4.67	1.15
48.00	28.13	1.033	0.80	4.88	1.22
54.00	28.18	1.043	0.85	5.06	1.29
60.00	28.24	1.051	0.91	5.24	1.36

Note: Shear stress was calculated using R.

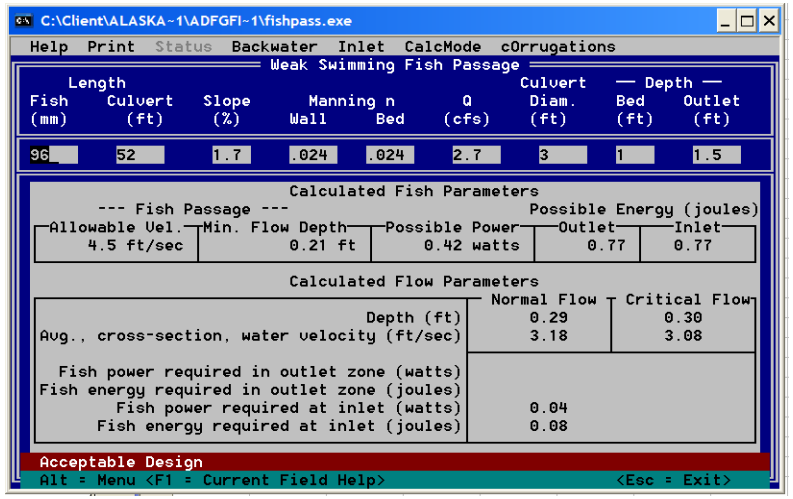
ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED

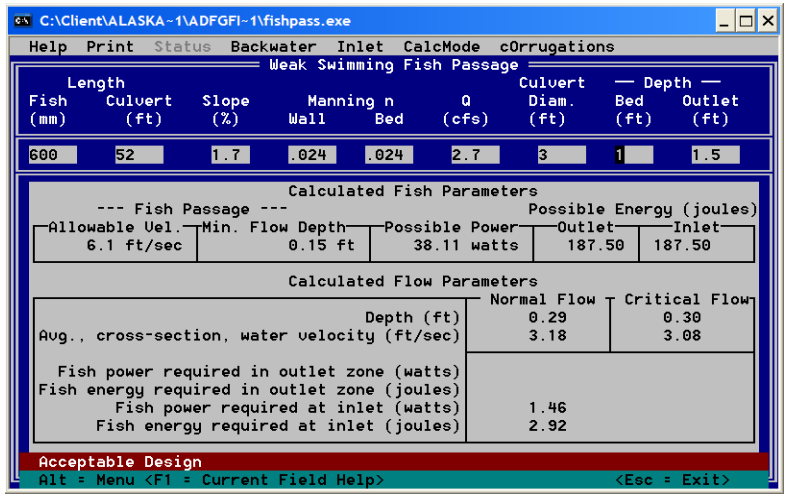
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	32.40 ft

2009 Alignment Station: 314+72
2006 S&HI Station 337+70 Tier 2 FISH PASS design

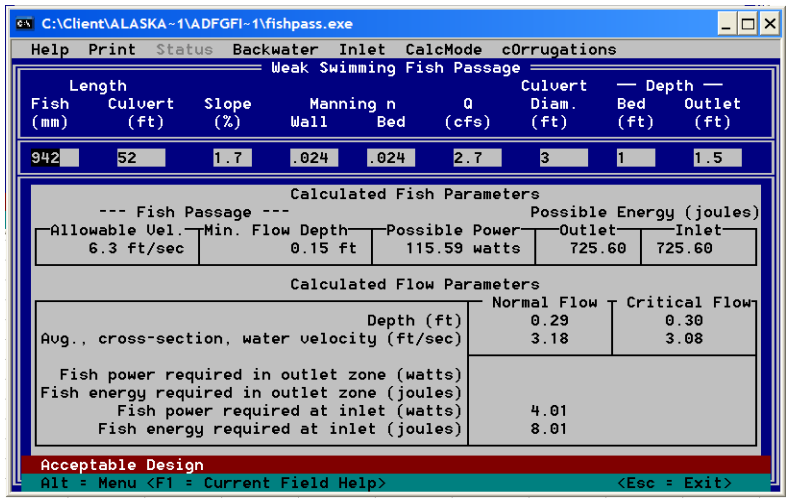
non-baffle design: Juvenile Coho



adult coho - 600mm



Adult coho - adjusted to 'equivalent' grayling



2009 Alignment Station: 314+72

1 2006 S&HI Station 337+70 Tier 2 fish passage - 3-ft CMP

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 16:53:01 FILE NAME: 337T2-3

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C U L V NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS	CULVERT SHAPE, MATERIAL, INLET SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	28.20	27.33	52.01	1	CSP	3.00	3.00	.024	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: 337T2-3 DATE: 09-07-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWA`	ITR
28.2	0	0	0	0	0	0	0	0	1
28.92	3	3	0	0	0	0	0	0	1
29.26	6	6	0	0	0	0	0	0	1
29.54	9	9	0	0	0	0	0	0	1
29.78	12	12	0	0	0	0	0	0	1
30	15	15	0	0	0	0	0	0	1
30.19	18	18	0	0	0	0	0	0	1
30.37	21	21	0	0	0	0	0	0	1
30.55	24	24	0	0	0	0	0	0	1
30.73	27	27	0	0	0	0	0	0	1
30.92	30	30	0	0	0	0	0	0	1
32.4	48.5	48.5	0	0	0	0	0	OVERTOF	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 337T2-3 DATE: 09-07-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
28.20	0.000	0.00	0.00	0.00
28.92	0.000	3.00	0.00	0.00
29.26	0.000	6.00	0.00	0.00
29.54	0.000	9.00	0.00	0.00
29.78	0.000	12.00	0.00	0.00
30.00	0.000	15.00	0.00	0.00

30.19	0.000	18.00	0.00	0.00
30.37	0.000	21.00	0.00	0.00
30.55	0.000	24.00	0.00	0.00
30.73	0.000	27.00	0.00	0.00
30.92	0.000	30.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 16:53:01 FILE NAME: 337T2-3

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	CONTROL TYPE <F4>	FLOW DEPTH (ft)	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW VEL. (fps)	OUTLET TW VEL. (fps)
0.00	28.20	0.00	0.00	0-NF	0.00	0.00	0.00	-0.05	0.00	0.00
3.00	28.92	0.72	0.72	1-S2n	0.49	0.52	0.42	0.17	4.75	2.07
6.00	29.26	1.06	1.06	1-S2n	0.71	0.76	0.66	0.24	5.22	2.55
9.00	29.54	1.34	1.34	1-S2n	0.89	0.94	0.88	0.30	5.18	2.91
12.00	29.78	1.58	1.58	1-S2n	1.03	1.09	1.03	0.35	5.56	3.20
15.00	30.00	1.80	1.80	1-S2n	1.17	1.23	1.03	0.40	6.95	3.45
18.00	30.19	1.99	1.99	1-S2n	1.29	1.35	1.15	0.44	7.20	3.66
21.00	30.37	2.17	2.17	1-S2n	1.41	1.47	1.27	0.48	7.37	3.86
24.00	30.55	2.35	2.35	1-S2n	1.52	1.57	1.47	0.52	6.94	4.04
27.00	30.73	2.53	2.53	1-S2n	1.63	1.67	1.57	0.56	7.20	4.20
30.00	30.92	2.72	2.72	1-S2n	1.75	1.77	1.67	0.59	7.41	4.35

El. inlet face invert 28.20 ft El. outlet invert 27.33 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 28.20 ft
OUTLET STATION 52.00 ft
OUTLET ELEVATION 27.33 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0167
CULVERT LENGTH ALONG SLOPE 52.01 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 3.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL

INLET EDGE AND WALL MITERED TO CONFORM TO SLOPE
INLET DEPRESSION NONE

3

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 16:53:01 FILE NAME: 337T2-3

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 337T2-3
MAIN CHANNEL ONLY FILE DATE: 09-07-2006
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0294 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	31.19
2	7.00	27.36
3	17.20	27.28
4	30.20	31.04

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

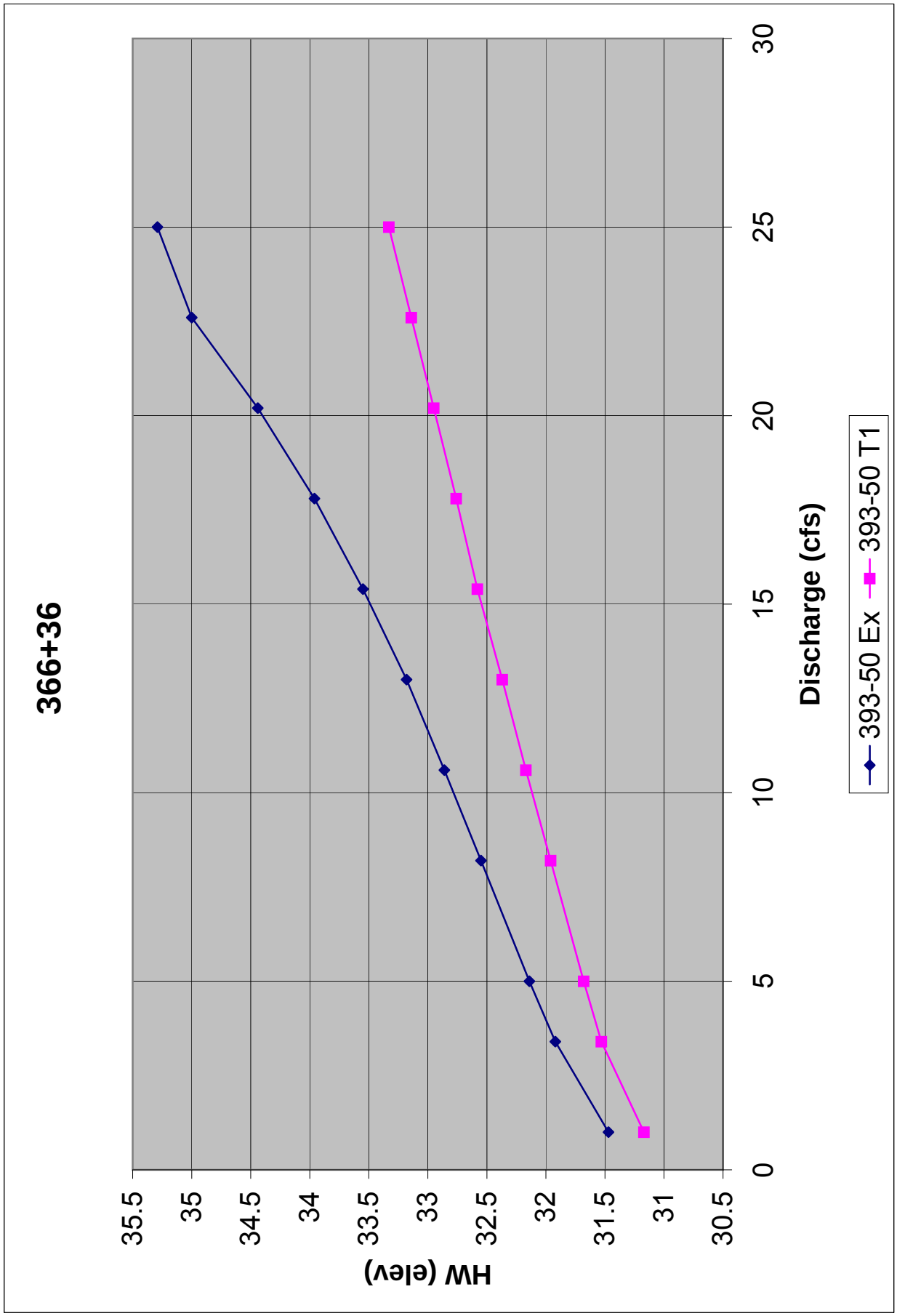
FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	27.28	0.000	-0.05	0.00	0.00
3.00	27.50	0.878	0.17	2.07	0.31
6.00	27.57	0.924	0.24	2.55	0.43
9.00	27.63	0.954	0.30	2.91	0.52
12.00	27.68	0.977	0.35	3.20	0.61
15.00	27.73	0.994	0.40	3.45	0.68
18.00	27.77	1.009	0.44	3.66	0.74
21.00	27.81	1.022	0.48	3.86	0.80
24.00	27.85	1.033	0.52	4.04	0.86
27.00	27.89	1.043	0.56	4.20	0.91
30.00	27.92	1.051	0.59	4.35	0.96

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED

EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	32.40 ft


366+36
HW (elev)
35.5
35
34.5
34
33.5
33
32.5
32
31.5
31
30.5
0
5
10
15
20
25
30
Discharge (cfs)
393-50 Ex
393-50 T1

HY-8 Culvert Analysis Report

2009 Alignment Station 366+36
Existing conditions

Table 1 - Summary of Culvert Flows at Crossing: 39350-ex

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
31.47	1.00	1.00	0.00	1
31.92	3.40	3.40	0.00	1
32.14	5.00	5.00	0.00	1
32.55	8.20	8.20	0.00	1
32.86	10.60	10.60	0.00	1
33.18	13.00	13.00	0.00	1
33.55	15.40	15.40	0.00	1
33.96	17.80	17.80	0.00	1
34.44	20.20	20.20	0.00	1
35.00	22.60	22.60	0.00	1
35.29	25.00	23.78	1.09	18

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	31.47	0.488	0.000	1-S2n	0.276	0.332	0.282	0.128	3.581	1.886
3.40	3.40	31.92	0.938	0.000	1-S2n	0.528	0.640	0.530	0.269	5.057	2.956
5.00	5.00	32.14	1.160	0.000	1-S2n	0.649	0.786	0.655	0.340	5.571	3.385
8.20	8.20	32.55	1.575	0.000	1-S2n	0.850	1.018	0.852	0.456	6.420	4.038
10.60	10.60	32.86	1.879	0.000	1-S2n	0.986	1.164	0.987	0.532	6.857	4.396
13.00	13.00	33.18	2.204	0.000	5-S2n	1.115	1.293	1.122	0.600	7.171	4.707
15.40	15.40	33.55	2.567	0.000	5-S2n	1.246	1.413	1.246	0.664	7.481	4.975
17.80	17.80	33.96	2.983	0.000	5-S2n	1.379	1.514	1.383	0.724	7.683	5.208
20.20	20.20	34.44	3.463	0.000	5-S2n	1.533	1.611	1.535	0.779	7.825	5.422
22.60	22.60	35.00	4.016	3.511	2-M2c	1.744	1.681	1.681	0.832	8.043	5.623
25.00	23.78	35.29	4.314	3.860	7-M2c	2.000	1.716	1.716	0.882	8.316	5.802

****
****
****

Inlet Elevation (invert): 30.98 ft, Outlet Elevation (invert): 29.23 ft

Culvert Length: 56.03 ft, Culvert Slope: 0.0313

****
****
****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 30.98 ft

Outlet Station: 56.00 ft

Outlet Elevation: 29.23 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: 39350-ex)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.00	29.36	0.13	1.89	0.30	0.94
3.40	29.50	0.27	2.96	0.64	1.03
5.00	29.57	0.34	3.39	0.81	1.06
8.20	29.69	0.46	4.04	1.08	1.11
10.60	29.76	0.53	4.40	1.26	1.12
13.00	29.83	0.60	4.71	1.42	1.14
15.40	29.89	0.66	4.97	1.57	1.15
17.80	29.95	0.72	5.21	1.72	1.16
20.20	30.01	0.78	5.42	1.85	1.17
22.60	30.06	0.83	5.62	1.97	1.18
25.00	30.11	0.88	5.80	2.09	1.18

Tailwater Channel Data - 39350-ex

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 1.00 (_:1)

Channel Slope: 0.0380

Channel Manning's n: 0.0380

Channel Invert Elevation: 29.23 ft

Roadway Data for Crossing: 39350-ex

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 35.27 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

HY-8 Culvert Analysis Report

2009 Alignment Station 366+36
Tier 1 Fish Passage

42”x29” pipe arch
20-percent fill with substrate modeled with user defined coordinates

Table 1 - Summary of Culvert Flows at Crossing: 39350-T1user

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
31.17	1.00	1.00	0.00	1
31.53	3.40	3.40	0.00	1
31.68	5.00	5.00	0.00	1
31.96	8.20	8.20	0.00	1
32.17	10.60	10.60	0.00	1
32.37	13.00	13.00	0.00	1
32.58	15.40	15.40	0.00	1
32.76	17.80	17.80	0.00	1
32.95	20.20	20.20	0.00	1
33.14	22.60	22.60	0.00	1
33.33	25.00	25.00	0.00	1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	31.17	0.190	0.190	1-S2n	0.087	0.121	0.090	0.128	2.178	1.886
3.40	3.40	31.53	0.549	0.549	1-S2n	0.246	0.311	0.250	0.269	4.079	2.956
5.00	5.00	31.68	0.704	0.704	1-S2n	0.315	0.410	0.324	0.340	4.618	3.385
8.20	8.20	31.96	0.980	0.980	1-S2n	0.440	0.567	0.446	0.456	5.483	4.038
10.60	10.60	32.17	1.186	1.186	1-S2n	0.522	0.670	0.529	0.532	5.973	4.396
13.00	13.00	32.37	1.392	0.000	1-S2n	0.602	0.769	0.602	0.600	6.433	4.707
15.40	15.40	32.58	1.596	0.000	1-S2n	0.675	0.856	0.675	0.664	6.816	4.975
17.80	17.80	32.76	1.783	0.000	1-S2n	0.748	0.940	0.749	0.724	7.114	5.208
20.20	20.20	32.95	1.970	0.000	5-S2n	0.821	1.020	0.821	0.779	7.378	5.422
22.60	22.60	33.14	2.158	0.000	5-S2n	0.893	1.097	0.896	0.832	7.616	5.623
25.00	25.00	33.33	2.351	0.000	5-S2n	0.966	1.173	0.967	0.882	7.835	5.802

****
****
****

Inlet Elevation (invert): 30.98 ft, Outlet Elevation (invert): 29.23 ft

Culvert Length: 56.03 ft, Culvert Slope: 0.0313

****
****
****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 30.98 ft

Outlet Station: 56.00 ft

Outlet Elevation: 29.23 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: User Defined

Barrel Span: 3.42 ft

Barrel Rise: 1.97 ft

Barrel Material: Corrugated Metal Riveted or Welded

Barrel Manning's n: 0.0240 (top and sides)

Manning's n: 1.4lf (bottom)

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: 39350-T1user)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.00	29.36	0.13	1.89	0.30	0.94
3.40	29.50	0.27	2.96	0.64	1.03
5.00	29.57	0.34	3.39	0.81	1.06
8.20	29.69	0.46	4.04	1.08	1.11
10.60	29.76	0.53	4.40	1.26	1.12
13.00	29.83	0.60	4.71	1.42	1.14
15.40	29.89	0.66	4.97	1.57	1.15
17.80	29.95	0.72	5.21	1.72	1.16
20.20	30.01	0.78	5.42	1.85	1.17
22.60	30.06	0.83	5.62	1.97	1.18
25.00	30.11	0.88	5.80	2.09	1.18

Tailwater Channel Data - 39350-T1user

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 1.00 (_:1)

Channel Slope: 0.0380

Channel Manning's n: 0.0380

Channel Invert Elevation: 29.23 ft

Roadway Data for Crossing: 39350-T1user

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 35.27 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

HY-8 Culvert Analysis Report

2009 Alignment Station 382+07
Existing conditions

Table 1 - Summary of Culvert Flows at Crossing: 409-25ex

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
31.12	1.00	1.00	0.00	1
31.94	6.90	6.90	0.00	1
32.47	12.80	12.80	0.00	1
32.94	18.70	18.70	0.00	1
33.03	20.00	20.00	0.00	1
33.80	30.50	30.50	0.00	1
34.29	36.40	36.40	0.00	1
34.89	42.30	42.30	0.00	1
35.57	48.20	48.20	0.00	1
36.29	54.10	54.10	0.00	1
36.67	60.00	57.08	2.77	16

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	31.12	0.461	0.616	3-M2t	0.705	0.306	0.530	3.000	1.166	0.000
6.90	6.90	31.94	1.224	1.437	2-M2c	2.163	0.816	0.816	3.000	4.408	0.000
12.80	12.80	32.47	1.713	1.972	2-M2c	3.000	1.131	1.131	3.000	5.242	0.000
18.70	18.70	32.94	2.139	2.437	2-M2c	3.000	1.378	1.378	3.000	5.896	0.000
20.00	20.00	33.03	2.230	2.528	2-M2c	3.000	1.430	1.430	3.000	6.014	0.000
30.50	30.50	33.80	2.957	3.295	2-M2c	3.000	1.789	1.789	3.000	6.940	0.000
36.40	36.40	34.29	3.397	3.791	7-M2c	3.000	1.955	1.955	3.000	7.472	0.000
42.30	42.30	34.89	3.885	4.395	7-M2c	3.000	2.117	2.117	3.000	7.933	0.000
48.20	48.20	35.57	4.436	5.070	7-M2c	3.000	2.252	2.252	3.000	8.489	0.000
54.10	54.10	36.29	5.062	5.792	7-M2c	3.000	2.387	2.387	3.000	8.974	0.000
60.00	57.08	36.67	5.410	6.175	7-M2c	3.000	2.439	2.439	3.000	9.263	0.000

****
****
****

Inlet Elevation (invert): 30.50 ft, Outlet Elevation (invert): 30.47 ft

Culvert Length: 62.00 ft, Culvert Slope: 0.0005

****
****
****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 30.50 ft

Outlet Station: 62.00 ft

Outlet Elevation: 30.47 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: 409-25ex)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	31.00	3.00
6.90	31.00	3.00
12.80	31.00	3.00
18.70	31.00	3.00
20.00	31.00	3.00
30.50	31.00	3.00
36.40	31.00	3.00
42.30	31.00	3.00
48.20	31.00	3.00
54.10	31.00	3.00
60.00	31.00	3.00

Tailwater Channel Data - 409-25ex

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 31.00 ft

Roadway Data for Crossing: 409-25ex

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 36.63 ft

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

2009 Alignment Station: 382+07
2006 S&HI Station 405+00 Tier 2 FISH PASS design

non-baffle design: Juvenile Coho

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Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Length Fish (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
96	62	.5	.02	0	5.2	3	0	.75

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Power	Possible Energy (joules) Outlet	Inlet
4.5 ft/sec	0.66 ft	0.42 watts	0.77	0.77

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.84	0.71
Avg., cross-section, water velocity (ft/sec)	3.23	4.03
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)	0.19	
Fish energy required at inlet (joules)	0.38	

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

adult coho - 600mm

C:\DOCUME~1\DAN~1.HOO\MYDOCU~1\Client\ALASKA~1\ADFG\fishpass.exe

Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Length Fish (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
600	62	.5	.02	0	5.2	3	0	.75

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Power	Possible Energy (joules) Outlet	Inlet
6.3 ft/sec	0.52 ft	38.11 watts	187.50	187.50

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.84	0.71
Avg., cross-section, water velocity (ft/sec)	3.23	4.03
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)	9.41	
Fish energy required at inlet (joules)	18.83	

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

Adult coho - adjusted to 'equivalent' grayling

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Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Length Fish (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
942	62	.5	.02	0	5.2	3	0	.75

Calculated Fish Parameters

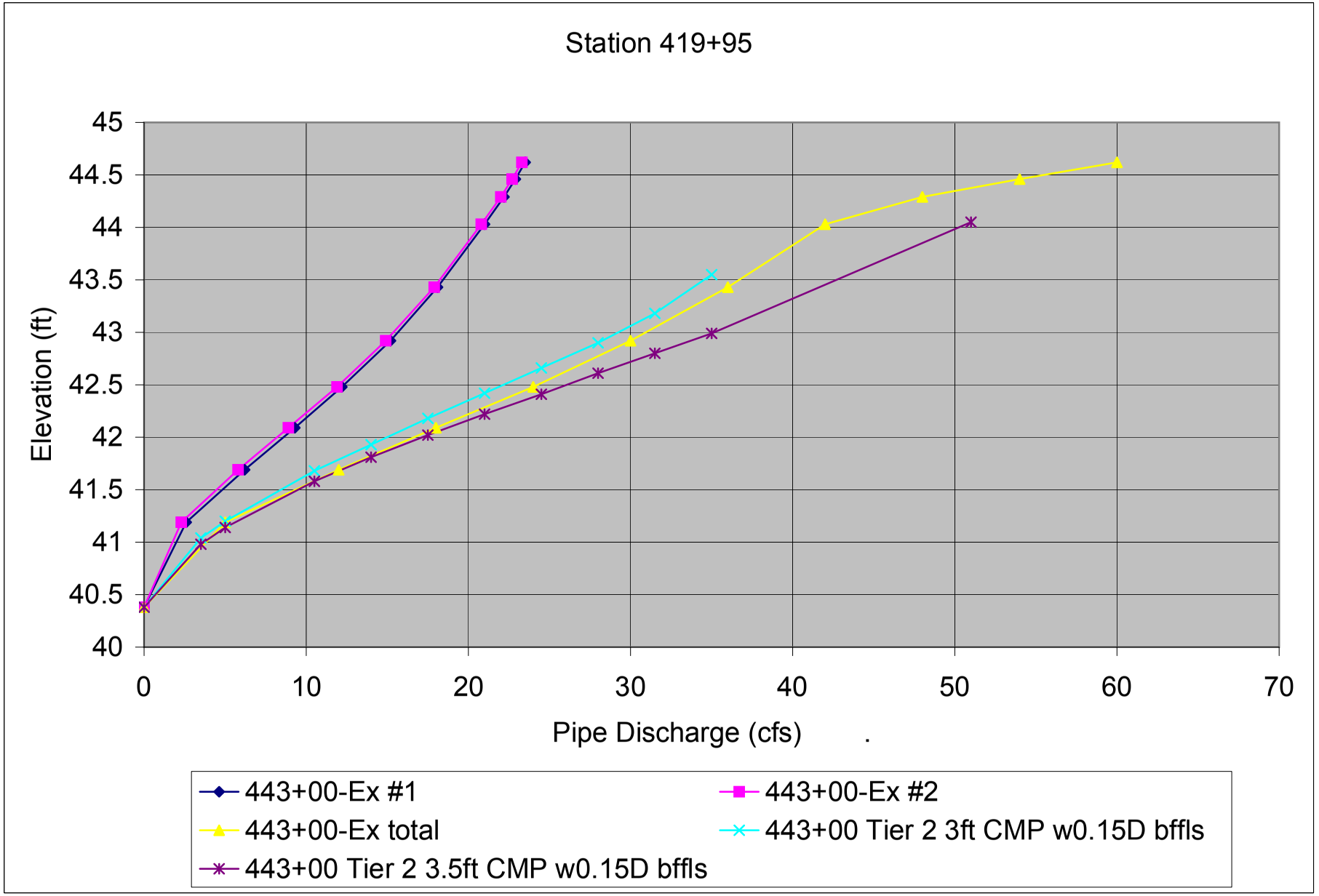
--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Power	Possible Energy (joules) Outlet	Inlet
6.9 ft/sec	0.49 ft	115.59 watts	725.60	725.60

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.84	0.71
Avg., cross-section, water velocity (ft/sec)	3.23	4.03
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)	28.93	
Fish energy required at inlet (joules)	57.86	

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>


Station 419+95
Elevation (ft)
45
44.5
44
43.5
43
42.5
42
41.5
41
40.5
40
0
10
20
30
40
50
60
70
Pipe Discharge (cfs)
443+00-Ex #1
443+00-Ex #2
443+00-Ex total
443+00 Tier 2 3ft CMP w0.15D bffls
443+00 Tier 2 3.5ft CMP w0.15D bffls

2009 Alignment Station: 419+95

1 2006 S&HI Station 443+00 Existing conditions

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 14:33:05 FILE NAME: 44300-EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	40.38	38.75	55.17	1	CSP	2.00	2.00	.024	CONVENTIONAL
2	40.43	38.67	55.03	1	CSP	2.00	2.00	.024	CONVENTIONAL
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: 44300-EX DATE: 08-17-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
40.38	0	0	0	0	0	0	0	0	0
41.19	5	2.6	2.3	0	0	0	0	0	4
41.69	12	6.2	5.8	0	0	0	0	0	3
42.09	18	9.3	8.9	0	0	0	0	0	2
42.48	24	12.2	11.9	0	0	0	0	0	3
42.92	30	15.2	14.9	0	0	0	0	0	3
43.43	36	18.1	17.9	0	0	0	0	0	3
44.03	42	21	20.8	0	0	0	0	0	7
44.29	48	22.2	22	0	0	0	0	3.57	4
44.46	54	22.9	22.7	0	0	0	0	8.03	3
44.62	60	23.5	23.3	0	0	0	0	12.92	3
44.05	42	21.1	20.9	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 44300-EX DATE: 08-17-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
40.38	0.000	0.00	0.00	0.00
41.19	-0.006	5.00	0.01	0.20
41.69	0.000	12.00	0.00	0.00
42.09	0.008	18.00	-0.13	-0.72
42.48	0.005	24.00	-0.08	-0.33
42.92	0.003	30.00	-0.05	-0.17
43.43	0.002	36.00	-0.03	-0.08
44.03	-0.007	42.00	0.19	0.45
44.29	-0.007	48.00	0.30	0.63
44.46	-0.009	54.00	0.43	0.80
44.62	-0.006	60.00	0.32	0.53

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 14:33:05 FILE NAME: 44300-EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0	40.38	0	0	0-NF	0	0	0	-0.6	0	0
2.64	41.2	0.82	0.82	1-S2n	0.47	0.56	0.36	-0.28	6.74	2.24
6.18	41.7	1.32	1.32	1-S2n	0.74	0.88	0.68	-0.14	6.61	2.95
9.25	42.09	1.71	1.71	1-S2n	0.92	1.08	0.92	-0.04	6.53	3.37
12.2	42.47	2.09	2.09	5-S2n	1.09	1.25	1.08	0.04	7.04	3.7
15.17	42.91	2.53	2.53	5-S2n	1.26	1.4	1.2	0.12	7.68	3.97
18.14	43.43	3.05	3.05	5-S2n	1.43	1.53	1.33	0.19	8.2	4.21
21.01	44.02	3.64	3.35	2-M2c	1.64	1.63	1.63	0.25	7.63	4.42
22.16	44.29	3.91	3.45	2-M2c	1.76	1.67	1.67	0.31	7.94	4.61
22.87	44.46	4.08	2.43	2-M2c	2	1.69	1.69	0.36	8.11	4.78
23.47	44.62	4.24	3.48	2-M2c	2	1.71	1.71	0.42	8.25	4.94

El. inlet face invert 40.38 ft El. outlet invert 38.75 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 40.38 ft
OUTLET STATION 55.15 ft
OUTLET ELEVATION 38.75 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0296
CULVERT LENGTH ALONG SLOPE 55.17 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 14:33:05 FILE NAME: 44300-EX

PERFORMANCE CURVE FOR CULVERT 2 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS- HEAD- INLET OUTLET
CHARGE WATER CONTROL CONTROL FLOW NORMAL CRIT. OUTLET TW OUTLET TW

FLOW (cfs)	ELEV. (ft)	DEPTH (ft)	DEPTH (ft)	TYPE <F4>	DEPTH (ft)	DEPTH (ft)	DEPTH (ft)	DEPTH (ft)	VEL. (fps)	VEL. (fps)
0.00	40.43	0.00	0.00	0-NF	0.00	0.00	0.00	-0.52	0.00	0.00
2.35	41.20	0.77	0.77	1-S2n	0.44	0.53	0.33	-0.20	6.90	2.24
5.82	41.70	1.27	1.27	1-S2n	0.70	0.85	0.65	-0.06	6.64	2.95
8.88	42.09	1.66	1.66	1-S2n	0.88	1.06	0.76	0.04	8.10	3.37
11.88	42.48	2.05	2.05	5-S2n	1.05	1.24	0.94	0.12	8.24	3.70
14.87	42.91	2.48	2.48	5-S2n	1.21	1.39	1.09	0.20	8.51	3.97
17.89	43.43	3.00	3.00	5-S2n	1.37	1.52	1.32	0.27	8.16	4.21
20.80	44.02	3.59	3.59	5-S2n	1.56	1.63	1.43	0.33	8.66	4.42
21.96	44.29	3.86	3.86	5-S2n	1.65	1.66	1.56	0.39	8.35	4.61
22.67	44.46	4.03	3.60	2-M2c	1.72	1.68	1.68	0.44	8.06	4.78
23.29	44.62	4.19	3.60	2-M2c	1.79	1.70	1.70	0.50	8.20	4.94

El. inlet face invert 40.43 ft El. outlet invert 38.67 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 40.43 ft
OUTLET STATION 55.00 ft
OUTLET ELEVATION 38.67 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0320
CULVERT LENGTH ALONG SLOPE 55.03 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

4

CURRENT DATE: 08-17-2006 FILE DATE: 08-17-2006
CURRENT TIME: 14:33:05 FILE NAME: 44300-EX

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 44300-TW
MAIN CHANNEL ONLY FILE DATE: 08-17-2006
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.040
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0260 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)

1	0.00	41.52
2	7.00	38.15
3	17.20	38.30
4	30.20	41.20

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	38.15	0.000	-0.60	0.00	0.00
5.00	38.47	0.822	-0.28	2.24	0.37
12.00	38.61	0.880	-0.14	2.95	0.56
18.00	38.71	0.909	-0.04	3.37	0.69
24.00	38.79	0.929	0.04	3.70	0.79
30.00	38.87	0.945	0.12	3.97	0.88
36.00	38.94	0.959	0.19	4.21	0.96
42.00	39.00	0.970	0.25	4.42	1.03
48.00	39.06	0.979	0.31	4.61	1.09
54.00	39.11	0.988	0.36	4.78	1.16
60.00	39.17	0.996	0.42	4.94	1.21

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	44.05 ft

2009 Alignment Station: 419+95
2006 S&HI Station 443+00 Tier 2 FISH PASS design

baffle design: 3.5-ft pipe / Juvenile Coho

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Help Print Status

Weir Baffle

Weak Swimming Fish Length (mm)	Slope (%)	Manning n Wall	Q Fish (cfs)	Q Flood (cfs)	Culvert Diameter (ft)
96	3	.024	5.3	35	3.5

Calculated Parameters

	Weir Height	.1 × D	.15 × D
Water Velocity in small fish passage zone (ft/sec)		3.85	2.62
Fish power required at weir (watts)		0.21	0.09
Fish power capabilities (watts)		0.26	0.26
Depth of flow over weir (ft)		0.77	0.55
Depth of flow at outlet (ft)		1.12	1.07
Normal Depth at flood flow (ft)		2.16	2.40

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

3.5-ft pipe / Adult Coho

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Help Print Status

Weir Baffle

Weak Swimming Fish Length (mm)	Slope (%)	Manning n Wall	Q Fish (cfs)	Q Flood (cfs)	Culvert Diameter (ft)
600	3	.024	5.3	35	3.5

Calculated Parameters

	Weir Height	.1 × D	.15 × D
Water Velocity in small fish passage zone (ft/sec)		3.85	2.62
Fish power required at weir (watts)		6.31	3.05
Fish power capabilities (watts)		62.55	62.55
Depth of flow over weir (ft)		0.77	0.55
Depth of flow at outlet (ft)		1.12	1.07
Normal Depth at flood flow (ft)		2.16	2.40

Acceptable Design

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

non-baffle design:

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Help Print Status Backwater Inlet CalcMode cOrrugations

Weak Swimming Fish Passage

Length Fish (mm)	Culvert (ft)	Slope (%)	Manning n Wall	Manning n Bed	Q (cfs)	Culvert Diam. (ft)	Depth Bed (ft)	Depth Outlet (ft)
96	55	3	.024	0	5.3	3.5	0	.8

Calculated Fish Parameters

--- Fish Passage --- Allowable Vel.	Min. Flow Depth	Possible Power	Possible Energy (joules) Outlet	Inlet
4.4 ft/sec	0.64 ft	0.42 watts	0.77	

Calculated Flow Parameters

	Normal Flow	Critical Flow
Depth (ft)	0.56	0.69
Avg., cross-section, water velocity (ft/sec)	5.29	3.94
Fish power required in outlet zone (watts)		
Fish energy required in outlet zone (joules)		
Fish power required at inlet (watts)		
Fish energy required at inlet (joules)		

Normal Flow Supercritical | Normal Depth too Shallow

Alt = Menu <F1 = Current Field Help> <Esc = Exit>

2009 Alignment Station: 419+95

1 2006 S&HI Station 443+00 Tier 2 fish passage - 3.5-ft baffled CMP

CURRENT DATE: 09-05-2006 FILE DATE: 09-05-2006
CURRENT TIME: 17:16:59 FILE NAME: 443T42

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	40.38	38.75	55.02	1	ICMP	3.50	2.98	.024	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: 443T42 DATE: 09-05-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
40.38	0	0	0	0	0	0	0	0	1
40.98	3.5	3.5	0	0	0	0	0	0	1
41.14	5	5	0	0	0	0	0	0	1
41.58	10.5	10.5	0	0	0	0	0	0	1
41.81	14	14	0	0	0	0	0	0	1
42.02	17.5	17.5	0	0	0	0	0	0	1
42.22	21	21	0	0	0	0	0	0	1
42.41	24.5	24.5	0	0	0	0	0	0	1
42.61	28	28	0	0	0	0	0	0	1
42.8	31.5	31.5	0	0	0	0	0	0	1
42.99	35	35	0	0	0	0	0	0	1
44.05	51	51	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 443T42 DATE: 09-05-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
40.38	0.000	0.00	0.00	0.00
40.98	0.000	3.50	0.00	0.00
41.14	0.000	5.00	0.00	0.00
41.58	0.000	10.50	0.00	0.00
41.81	0.000	14.00	0.00	0.00
42.02	0.000	17.50	0.00	0.00
42.22	0.000	21.00	0.00	0.00
42.41	0.000	24.50	0.00	0.00
42.61	0.000	28.00	0.00	0.00
42.80	0.000	31.50	0.00	0.00
42.99	0.000	35.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 09-05-2006 FILE DATE: 09-05-2006
CURRENT TIME: 17:16:59 FILE NAME: 443T42

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.50 (ft) BY 2.98 (ft)) ICMP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	40.38	0.00	0.00	0-NF	0.00	0.00	0.00	-0.60	0.00	0.00
3.50	40.98	0.60	0.60	1-S2n	0.30	0.36	0.16	-0.32	5.38	2.08
5.00	41.14	0.76	0.76	1-S2n	0.36	0.46	0.26	-0.29	6.24	2.31
10.50	41.58	1.20	1.20	1-S2n	0.58	0.74	0.58	-0.17	6.16	2.92
14.00	41.81	1.43	1.43	1-S2n	0.69	0.90	0.60	-0.12	8.02	3.21
17.50	42.02	1.64	1.64	1-S2n	0.80	1.03	0.73	-0.06	8.06	3.45
21.00	42.22	1.84	1.84	1-S2n	0.90	1.16	0.90	-0.01	7.70	3.66
24.50	42.41	2.03	2.03	1-S2n	0.99	1.27	1.00	0.03	7.95	3.85
28.00	42.61	2.23	2.23	1-S2n	1.08	1.37	0.97	0.08	9.40	4.03
31.50	42.80	2.42	2.42	1-S2n	1.17	1.47	1.07	0.12	9.46	4.18
35.00	42.99	2.61	2.61	1-S2n	1.26	1.57	1.17	0.15	9.59	4.32

El. inlet face invert 40.38 ft El. outlet invert 38.75 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 40.38 ft
OUTLET STATION 55.00 ft
OUTLET ELEVATION 38.75 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0296
CULVERT LENGTH ALONG SLOPE 55.02 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE USER DEFINED
BARREL SPAN 3.50 ft
BARREL RISE 2.98 ft
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S n 0.024 FOR SIDES AND TOP
0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 09-05-2006 FILE DATE: 09-05-2006

CURRENT TIME: 17:16:59 FILE NAME: 443T42

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDIN NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	0	41.61	41.61
2	0.17	42.35	40.86
3	0.33	42.63	40.58
4	0.5	42.83	40.38
5	0.81	43.08	40.38
6	1.13	43.24	40.38
7	1.44	43.33	40.38
8	1.75	43.36	40.38
9	2.06	43.33	40.38
10	2.37	43.24	40.38
11	2.69	43.08	40.38
12	3	42.83	40.38
13	3.17	42.63	40.58
14	3.33	42.35	40.86
15	3.5	41.61	41.61

4

CURRENT DATE: 09-05-2006 FILE DATE: 09-05-2006
CURRENT TIME: 17:16:59 FILE NAME: 443T42

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 443T42BF
MAIN CHANNEL ONLY FILE DATE: 09-05-2006
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0260 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	41.52
2	7.00	38.15
3	17.20	38.30
4	30.20	41.20

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

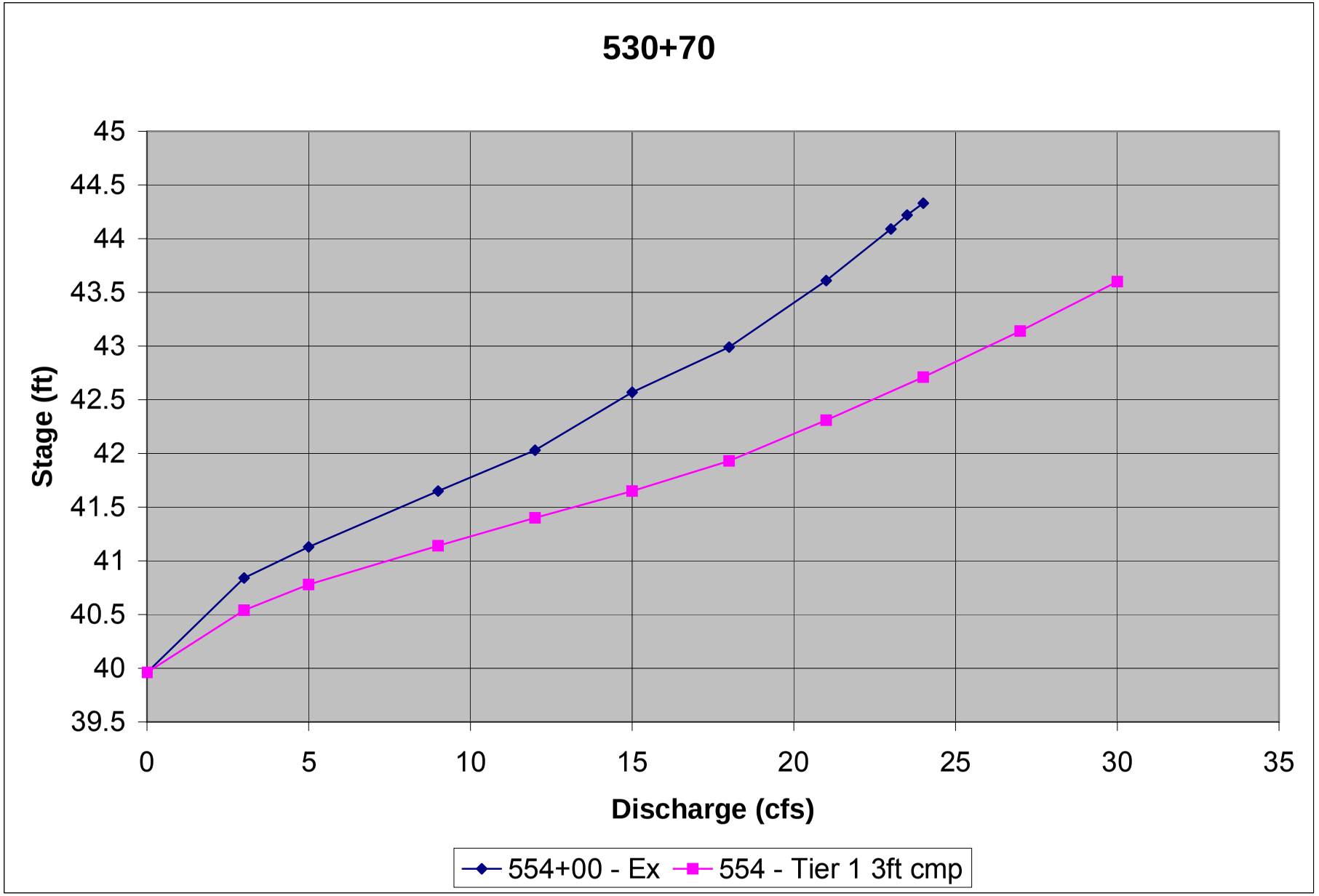
FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	38.15	0.000	-0.60	0.00	0.00
3.50	38.43	0.839	-0.32	2.08	0.31
5.00	38.46	0.862	-0.29	2.31	0.36

10.50	38.58	0.912	-0.17	2.92	0.51
14.00	38.63	0.933	-0.12	3.21	0.59
17.50	38.69	0.950	-0.06	3.45	0.66
21.00	38.74	0.964	-0.01	3.66	0.72
24.50	38.78	0.975	0.03	3.85	0.77
28.00	38.83	0.986	0.08	4.03	0.83
31.50	38.87	0.995	0.12	4.18	0.87
35.00	38.90	1.003	0.15	4.32	0.92

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	44.05 ft


530+70
Stage (ft)
45
44.5
44
43.5
43
42.5
42
41.5
41
40.5
40
39.5
0
5
10
15
20
25
30
35
Discharge (cfs)
554+00 - Ex
554 - Tier 1 3ft cmp

2009 Alignment Station: 530+70

1 2006 S&HI Station 554+00 Existing conditions

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:36:43 FILE NAME: 55400EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
U								
L	INLET	OUTLET	CULVERT	BARRELS				
V	ELEV.	ELEV.	LENGTH	SHAPE	SPAN	RISE	MANNING	INLET
NO.	(ft)	(ft)	(ft)	MATERIAL	(ft)	(ft)	n	TYPE
1	39.96	38.91	49.01	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 55400EX DATE: 08-25-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWA`	ITR
39.96	0	0	0	0	0	0	0	0	1
40.84	3	3	0	0	0	0	0	0	1
41.13	5	5	0	0	0	0	0	0	1
41.65	9	9	0	0	0	0	0	0	1
42.03	12	12	0	0	0	0	0	0	1
42.57	15	15	0	0	0	0	0	0	1
42.99	18	18	0	0	0	0	0	0	1
43.61	21	21	0	0	0	0	0	0	1
44.09	24	23	0	0	0	0	0	0.88	8
44.22	27	23.5	0	0	0	0	0	3.29	4
44.33	30	24	0	0	0	0	0	5.95	4
43.99	22.6	22.6	0	0	0	0	0	OVERTOF	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 55400EX DATE: 08-25-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
39.96	0.000	0.00	0.00	0.00
40.84	0.000	3.00	0.00	0.00
41.13	0.000	5.00	0.00	0.00
41.65	0.000	9.00	0.00	0.00
42.03	0.000	12.00	0.00	0.00
42.57	0.000	15.00	0.00	0.00
42.99	0.000	18.00	0.00	0.00
43.61	0.000	21.00	0.00	0.00
44.09	-0.010	24.00	0.12	0.50
44.22	-0.005	27.00	0.21	0.78
44.33	-0.008	30.00	0.10	0.33

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:36:43 FILE NAME: 55400EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	39.96	0.00	0.00	0-NF	0.00	0.00	0.00	0.59	0.00	0.00
3.00	40.84	0.88	0.88	1-S2n	0.55	0.60	0.40	1.04	6.63	1.63
5.00	41.13	1.17	1.17	1-S2n	0.72	0.79	0.59	1.10	6.51	1.76
9.00	41.65	1.69	1.69	1-S2n	1.00	1.07	0.87	1.17	6.89	1.94
12.00	42.03	2.07	2.07	5-S2n	1.20	1.24	1.14	1.22	6.48	2.04
15.00	42.57	2.51	2.61	2-M2c	1.40	1.40	1.40	1.26	6.41	2.13
18.00	42.99	3.03	2.90	2-M2c	1.66	1.52	1.52	1.29	7.03	2.21
21.00	43.61	3.65	3.06	2-M2c	2.00	1.63	1.63	1.32	7.63	2.27
23.01	44.09	4.13	3.92	2-M2c	2.00	1.69	1.69	1.35	8.14	2.33
23.50	44.21	4.25	4.23	2-M2c	2.00	1.71	1.71	1.37	8.25	2.39
23.95	44.33	4.37	4.36	2-M2c	2.00	1.72	1.72	1.40	8.36	2.44

El. inlet face invert 39.96 ft El. outlet invert 38.91 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 39.96 ft
OUTLET STATION 49.00 ft
OUTLET ELEVATION 38.91 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0214
CULVERT LENGTH ALONG SLOPE 49.01 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:36:43 FILE NAME: 55400EX

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 55400-TW
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-25-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.035
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0050 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	41.00
2	100.00	39.70
3	100.25	39.50
4	101.75	39.50
5	102.00	39.70
6	203.00	41.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	39.50	0.000	0.59	0.00	0.00
3.00	39.95	0.439	1.04	1.63	0.13
5.00	40.01	0.447	1.10	1.76	0.14
9.00	40.08	0.459	1.17	1.94	0.16
12.00	40.13	0.465	1.22	2.04	0.17
15.00	40.17	0.469	1.26	2.13	0.19
18.00	40.20	0.474	1.29	2.21	0.20
21.00	40.23	0.477	1.32	2.27	0.20
24.00	40.26	0.480	1.35	2.33	0.21
27.00	40.28	0.483	1.37	2.39	0.22
30.00	40.31	0.486	1.40	2.44	0.23

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 24.00 ft
CREST LENGTH 10.00 ft
OVERTOPPING CREST ELEVATION 43.99 ft

2009 Alignment Station: 530+70

1 2006 S&HI Station 554+00 Tier 1 fish passage - 3-ft CMP

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 20:53:14 FILE NAME: 554-T3

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	39.96	38.91	49.01	1	ICMP	3.10	1.80	.024	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: 554-T3 DATE: 08-29-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
39.96	0	0	0	0	0	0	0	0	1
40.54	3	3	0	0	0	0	0	0	1
40.78	5	5	0	0	0	0	0	0	1
41.14	9	9	0	0	0	0	0	0	1
41.4	12	12	0	0	0	0	0	0	1
41.65	15	15	0	0	0	0	0	0	1
41.93	18	18	0	0	0	0	0	0	1
42.31	21	21	0	0	0	0	0	0	1
42.71	24	24	0	0	0	0	0	0	1
43.14	27	27	0	0	0	0	0	0	1
43.6	30	30	0	0	0	0	0	0	1
43.99	32.3	32.3	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 554-T3 DATE: 08-29-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
39.96	0.000	0.00	0.00	0.00
40.54	0.000	3.00	0.00	0.00
40.78	0.000	5.00	0.00	0.00
41.14	0.000	9.00	0.00	0.00
41.40	0.000	12.00	0.00	0.00
41.65	0.000	15.00	0.00	0.00
41.93	0.000	18.00	0.00	0.00
42.31	0.000	21.00	0.00	0.00
42.71	0.000	24.00	0.00	0.00
43.14	0.000	27.00	0.00	0.00
43.60	0.000	30.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 20:53:14 FILE NAME: 554-T3

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.10 (ft) BY 1.80 (ft)) ICMP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	39.96	0.00	0.00	0-NF	0.00	0.00	0.00	0.59	0.00	0.00
3.00	40.54	0.58	0.58	1-S2n	0.28	0.31	0.21	1.05	5.79	1.51
5.00	40.78	0.82	0.82	1-S2n	0.39	0.44	0.34	1.10	4.95	1.63
9.00	41.14	1.18	1.18	1-S2n	0.58	0.64	0.44	1.17	6.77	1.79
12.00	41.40	1.44	1.44	1-S2n	0.72	0.78	0.72	1.22	5.63	1.89
15.00	41.65	1.69	1.69	1-S2n	0.86	0.90	0.80	1.26	6.35	1.97
18.00	41.93	1.97	1.97	5-S2n	1.00	1.02	0.92	1.29	6.73	2.04
21.00	42.31	2.35	2.27	3-M1t	1.15	1.13	1.32	1.32	5.78	2.10
24.00	42.71	2.75	2.47	3-M1t	1.32	1.23	1.35	1.35	6.50	2.15
27.00	43.14	3.18	2.72	3-M2t	1.60	1.31	1.38	1.38	7.21	2.20
30.00	43.60	3.64	2.92	3-M2t	1.80	1.39	1.40	1.40	7.91	2.25

El. inlet face invert 39.96 ft El. outlet invert 38.91 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 39.96 ft
OUTLET STATION 49.00 ft
OUTLET ELEVATION 38.91 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0214
CULVERT LENGTH ALONG SLOPE 49.01 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE USER DEFINED
BARREL SPAN 3.10 ft
BARREL RISE 1.80 ft
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S n 0.024 FOR SIDES AND TOP
0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006

CURRENT TIME: 20:53:14 FILE NAME: 554-T3

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDIN NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	73.3	40.26	40.26
2	73.4	40.56	39.96
3	73.7	41.19	39.96
4	74	41.47	39.96
5	74.3	41.64	39.96
6	74.6	41.73	39.96
7	74.8	41.76	39.96
8	75.1	41.73	39.96
9	75.4	41.64	39.96
10	75.7	41.47	39.96
11	76	41.19	39.96
12	76.3	40.56	39.96
13	76.4	40.26	40.26

4

CURRENT DATE: 08-29-2006 FILE DATE: 08-29-2006
CURRENT TIME: 20:53:14 FILE NAME: 554-T3

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 554-T3
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 08-29-2006
LEFT CHANNEL BOUNDARY 2
RIGHT CHANNEL BOUNDARY 5
MANNING n LEFT OVER BANK 0.050
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.050
SLOPE OF CHANNEL 0.0050 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	41.00
2	100.00	39.70
3	100.25	39.50
4	101.75	39.50
5	102.00	39.70
6	203.00	41.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	39.50	0.000	0.59	0.00	0.00
3.00	39.96	0.405	1.05	1.51	0.13
5.00	40.01	0.413	1.10	1.63	0.14

9.00	40.08	0.423	1.17	1.79	0.16
12.00	40.13	0.428	1.22	1.89	0.18
15.00	40.17	0.433	1.26	1.97	0.19
18.00	40.20	0.436	1.29	2.04	0.20
21.00	40.23	0.440	1.32	2.10	0.21
24.00	40.26	0.443	1.35	2.15	0.21
27.00	40.29	0.445	1.38	2.20	0.22
30.00	40.31	0.447	1.40	2.25	0.23

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	43.99 ft

2009 Alignment Station: 606+68

1 2006 S&HI Station 630+00 Existing conditions

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:39:00 FILE NAME: 63000

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
U								
L	INLET	OUTLET	CULVERT	BARRELS				
V	ELEV.	ELEV.	LENGTH	SHAPE	SPAN	RISE	MANNING	INLET
NO.	(ft)	(ft)	(ft)	MATERIAL	(ft)	(ft)	n	TYPE
1	45.81	45.36	59.00	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 63000 DATE: 08-25-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
45.81	0	0	0	0	0	0	0	0	1
46.78	3	3	0	0	0	0	0	0	1
47.1	5	5	0	0	0	0	0	0	1
47.63	9	9	0	0	0	0	0	0	1
48.03	12	12	0	0	0	0	0	0	1
48.34	15	15	0	0	0	0	0	0	1
49.31	18	18	0	0	0	0	0	0	1
50.23	21	21	0	0	0	0	0	0	1
51.11	24	23.6	0	0	0	0	0	0.33	6
51.27	27	24	0	0	0	0	0	2.84	5
51.38	30	24.4	0	0	0	0	0	5.49	4
51.06	23.4	23.4	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 63000 DATE: 08-25-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
45.81	0.000	0.00	0.00	0.00
46.78	0.000	3.00	0.00	0.00
47.10	0.000	5.00	0.00	0.00
47.63	0.000	9.00	0.00	0.00
48.03	0.000	12.00	0.00	0.00
48.34	0.000	15.00	0.00	0.00
49.31	0.000	18.00	0.00	0.00
50.23	0.000	21.00	0.00	0.00
51.11	-0.005	24.00	0.08	0.33
51.27	-0.008	27.00	0.12	0.44
51.38	-0.009	30.00	0.12	0.40

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:39:00 FILE NAME: 63000

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	45.81	0.00	0.00	0-NF	0.00	0.00	0.00	0.14	0.00	0.00
3.00	46.78	0.89	0.97	2-M2c	0.72	0.60	0.60	0.14	3.75	0.00
5.00	47.10	1.18	1.29	2-M2c	0.96	0.79	0.79	0.14	4.36	0.00
9.00	47.63	1.70	1.82	2-M2c	1.41	1.07	1.07	0.14	5.28	0.00
12.00	48.03	2.09	2.22	2-M2c	2.00	1.24	1.24	0.14	5.85	0.00
15.00	48.34	2.53	2.41	2-M2c	2.00	1.40	1.40	0.14	6.41	0.00
18.00	49.31	3.04	3.50	2-M2c	2.00	1.52	1.52	0.14	7.03	0.00
21.00	50.23	3.66	4.42	2-M2c	2.00	1.63	1.63	0.14	7.63	0.00
23.59	51.12	4.29	5.31	2-M2c	2.00	1.71	1.71	0.14	8.27	0.00
24.05	51.27	4.41	5.46	2-M2c	2.00	1.72	1.72	0.14	8.38	0.00
24.39	51.38	4.50	5.57	2-M2c	2.00	1.73	1.73	0.14	8.46	0.00

El. inlet face invert 45.81 ft El. outlet invert 45.36 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 45.81 ft
OUTLET STATION 59.00 ft
OUTLET ELEVATION 45.36 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0076
CULVERT LENGTH ALONG SLOPE 59.00 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:39:00 FILE NAME: 63000

TAILWATER

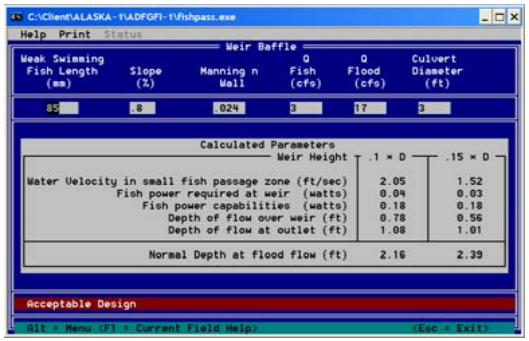
CONSTANT WATER SURFACE ELEVATION
45.5

ROADWAY OVERTOPPING DATA

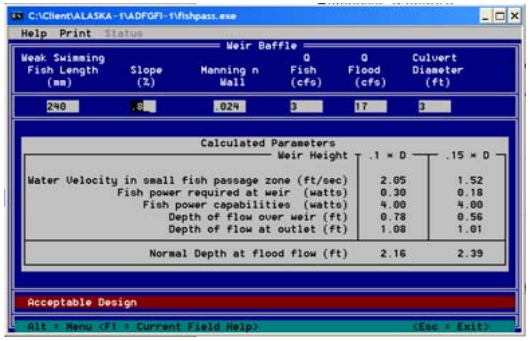
ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	51.06 ft

2009 Alignment Station: 606+68
2006 S&HI Station 630+00 Tier 2 FISH PASS design

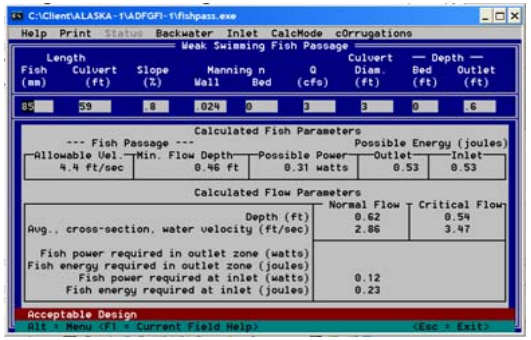
baffle design: 3-ft pipe / Juvenile Cutthroat
Juvenile Cutthroat trout assumed equal to Dolly Varden - equivalent length to input to Fish Pass is 85mm



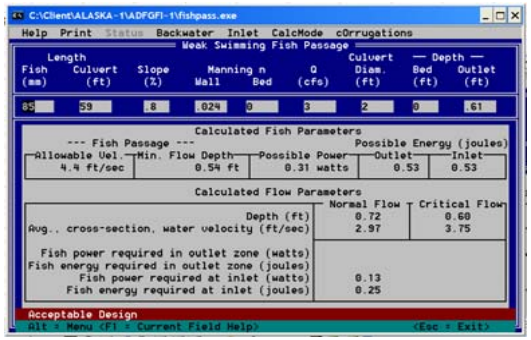
3-ft pipe / Adult Cutthroat
Adult Cutthroat trout assumed equal to Arctic Grayling - equivalent length to input to Fish Pass is 240 mm



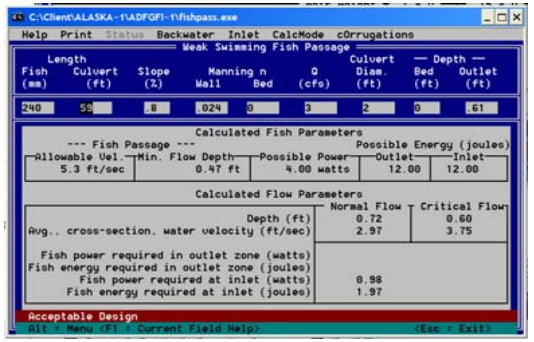
non-baffle design: 3-ft pipe / Juvenile Coho
Need to maintain 0.6-ft of TW



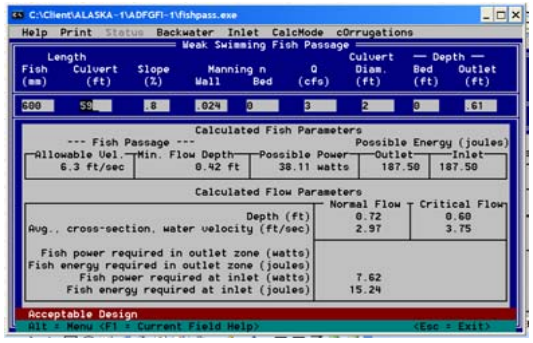
2-ft pipe / Juvenile Coho



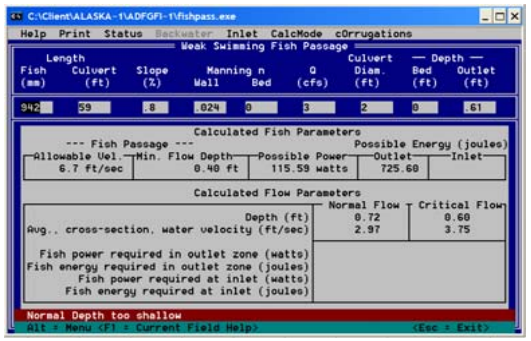
2-ft pipe / Adult Cutthroat
Adult Cutthroat trout assumed equal to Arctic Grayling - equivalent length to input to Fish Pass is 240 mm

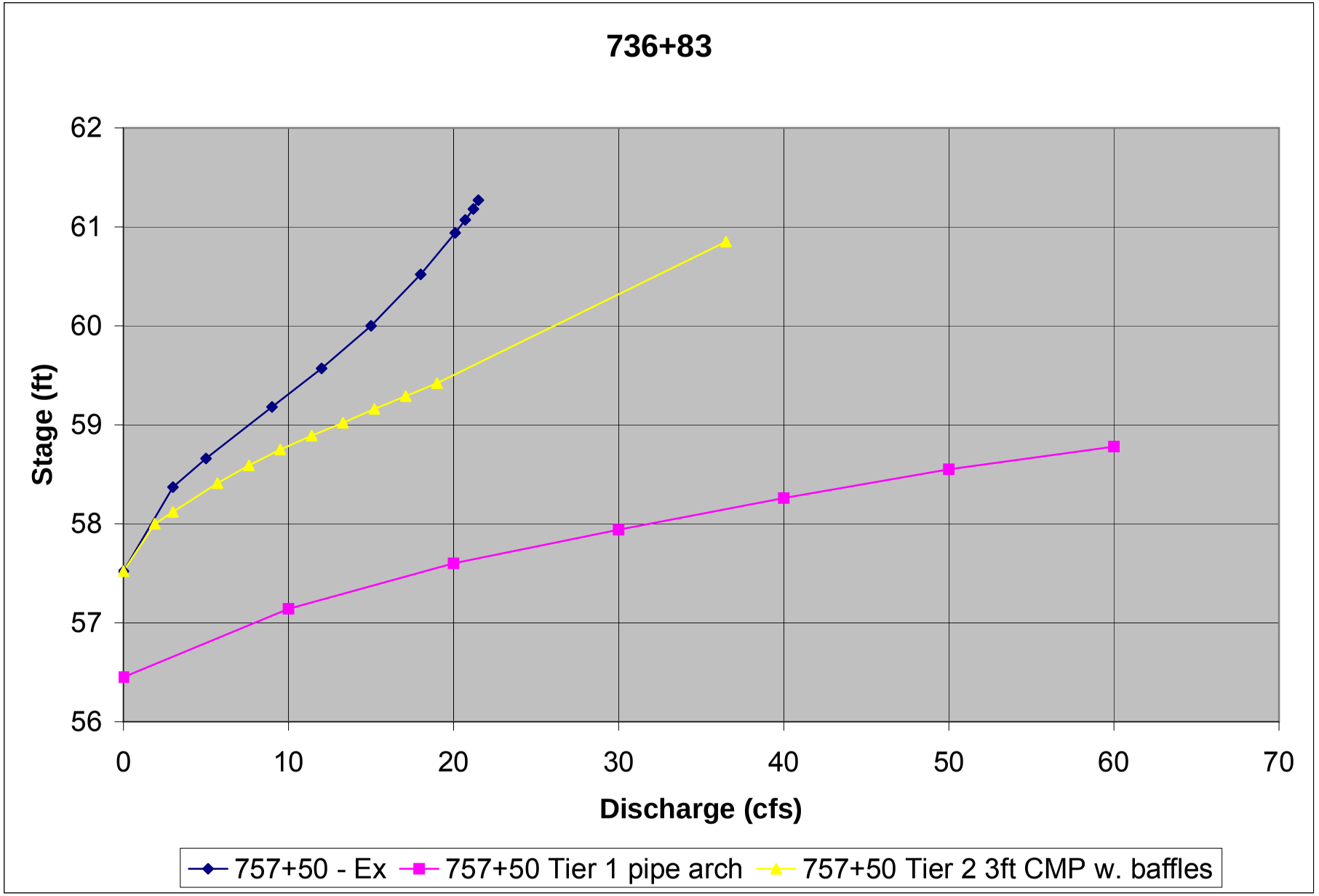


2-ft pipe / Adult Coho



Adult Coho
Note: L * 1.57 converts swimming ability to 'equivalent' grayling
Assume depth based on actual body size o600-mm fish shown to adjacen




736+83
62
61
60
59
58
57
56
Stage (ft)
0
10
20
30
40
50
60
70
Discharge (cfs)
757+50 - Ex
757+50 Tier 1 pipe arch
757+50 Tier 2 3ft CMP w. baffles

2009 Alignment Station: 736+83

1 2006 S&HI Station 757+50 Existing conditions

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:42:47 FILE NAME: 75750EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C U L V NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET SHAPE MATERIAL	BARRELS SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	57.52	54.50	60.48	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 75750EX DATE: 08-25-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
57.52	0	0	0	0	0	0	0	0	1
58.37	3	3	0	0	0	0	0	0	1
58.66	5	5	0	0	0	0	0	0	1
59.18	9	9	0	0	0	0	0	0	1
59.57	12	12	0	0	0	0	0	0	1
60	15	15	0	0	0	0	0	0	1
60.52	18	18	0	0	0	0	0	0	1
60.94	21	20.1	0	0	0	0	0	0.8	8
61.07	24	20.7	0	0	0	0	0	3.12	4
61.18	27	21.2	0	0	0	0	0	5.72	4
61.27	30	21.5	0	0	0	0	0	8.21	3
60.85	19.6	19.6	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 75750EX DATE: 08-25-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
57.52	0.000	0.00	0.00	0.00
58.37	0.000	3.00	0.00	0.00
58.66	0.000	5.00	0.00	0.00
59.18	0.000	9.00	0.00	0.00
59.57	0.000	12.00	0.00	0.00
60.00	0.000	15.00	0.00	0.00
60.52	0.000	18.00	0.00	0.00
60.94	-0.008	21.00	0.12	0.57
61.07	-0.005	24.00	0.21	0.88
61.18	-0.009	27.00	0.12	0.44
61.27	-0.006	30.00	0.26	0.87

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:42:47 FILE NAME: 75750EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

DIS-CHARGE (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	57.52	0.00	0.00	0-NF	0.00	0.00	0.00	-0.74	0.00	0.00
3.00	58.37	0.85	0.85	1-S2n	0.44	0.60	0.30	-0.41	9.65	2.21
5.00	58.66	1.14	1.14	1-S2n	0.57	0.79	0.49	-0.34	8.39	2.58
9.00	59.18	1.66	1.66	1-S2n	0.79	1.07	0.67	-0.22	9.78	3.11
12.00	59.57	2.05	2.05	5-S2n	0.92	1.24	0.84	-0.15	9.58	3.42
15.00	60.00	2.48	2.48	5-S2n	1.05	1.40	1.00	-0.08	9.60	3.68
18.00	60.52	3.00	3.00	5-S2n	1.18	1.52	1.12	-0.01	9.92	3.92
20.09	60.94	3.42	3.42	5-S2n	1.27	1.61	1.21	0.05	10.13	4.12
20.67	61.07	3.55	3.55	5-S2n	1.30	1.62	1.22	0.11	10.25	4.30
21.17	61.18	3.66	3.66	5-S2n	1.32	1.64	1.24	0.16	10.35	4.48
21.53	61.26	3.74	3.74	5-S2n	1.34	1.65	1.25	0.22	10.42	4.63

El. inlet face invert 57.52 ft El. outlet invert 54.50 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 57.52 ft
OUTLET STATION 60.40 ft
OUTLET ELEVATION 54.50 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0500
CULVERT LENGTH ALONG SLOPE 60.48 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:42:47 FILE NAME: 75750EX

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 75750TW
MAIN CHANNEL ONLY FILE DATE: 08-25-2006
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.035
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0180 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	57.61
2	3.40	53.76
3	6.50	53.82
4	10.20	53.91
5	12.80	57.07

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	53.76	0.000	-0.74	0.00	0.00
3.00	54.09	0.780	-0.41	2.21	0.27
5.00	54.16	0.807	-0.34	2.58	0.34
9.00	54.28	0.840	-0.22	3.11	0.45
12.00	54.35	0.857	-0.15	3.42	0.52
15.00	54.42	0.870	-0.08	3.68	0.58
18.00	54.49	0.881	-0.01	3.92	0.64
21.00	54.55	0.890	0.05	4.12	0.69
24.00	54.61	0.897	0.11	4.30	0.74
27.00	54.66	0.904	0.16	4.48	0.78
30.00	54.72	0.910	0.22	4.63	0.82

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 24.00 ft
CREST LENGTH 10.00 ft
OVERTOPPING CREST ELEVATION 60.85 ft

2009 Alignment Station: 736+83

1 2006 S&HI Station 757+50 Tier 1 fish passage - Pipe arch

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 18:39:05 FILE NAME: 757T1AR

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	56.45	53.43	60.48	1	ICMP	7.26	4.18	.028	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: 757T1AR DATE: 09-07-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
56.45	0	0	0	0	0	0	0	0	1
57.14	10	10	0	0	0	0	0	0	1
57.6	20	20	0	0	0	0	0	0	1
57.94	30	30	0	0	0	0	0	0	1
58.26	40	40	0	0	0	0	0	0	1
58.55	50	50	0	0	0	0	0	0	1
58.78	60	60	0	0	0	0	0	0	1
59.02	70	70	0	0	0	0	0	0	1
59.25	80	80	0	0	0	0	0	0	1
59.49	90	90	0	0	0	0	0	0	1
59.72	100	100	0	0	0	0	0	0	1
60.85	149.4	149.4	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 757T1AR DATE: 09-07-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
56.45	0.000	0.00	0.00	0.00
57.14	0.000	10.00	0.00	0.00
57.60	0.000	20.00	0.00	0.00
57.94	0.000	30.00	0.00	0.00
58.26	0.000	40.00	0.00	0.00
58.55	0.000	50.00	0.00	0.00

58.78	0.000	60.00	0.00	0.00
59.02	0.000	70.00	0.00	0.00
59.25	0.000	80.00	0.00	0.00
59.49	0.000	90.00	0.00	0.00
59.72	0.000	100.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 18:39:05 FILE NAME: 757T1AR

PERFORMANCE CURVE FOR CULVERT 1 - 1(7.26 (ft) BY 4.18 (ft)) ICMP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	CONTROL TYPE <F4>	FLOW DEPTH (ft)	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET TW DEPTH (ft)	OUTLET TW VEL. (fps)
0.00	56.45	0.00	0.00	0-NF	0.00	0.00	0.00	0.33	0.00
10.00	57.14	0.69	0.69	1-S2n	0.23	0.39	0.09	0.88	8.78
20.00	57.60	1.15	1.15	1-S2n	0.44	0.61	0.31	1.10	7.27
30.00	57.94	1.49	1.49	1-S2n	0.55	0.82	0.56	1.29	7.54
40.00	58.26	1.81	1.81	1-S2n	0.66	0.98	0.58	1.45	9.67
50.00	58.55	2.10	2.10	1-S2n	0.78	1.14	0.79	1.59	8.93
60.00	58.78	2.33	2.33	1-S2n	0.88	1.29	0.79	1.73	10.63
70.00	59.02	2.57	2.57	1-S2n	0.97	1.43	0.93	1.85	10.60
80.00	59.25	2.80	2.80	1-S2n	1.06	1.56	0.96	1.97	11.68
90.00	59.49	3.04	3.04	1-S2n	1.15	1.69	1.09	2.09	11.57
100.00	59.72	3.27	3.27	1-S2n	1.24	1.81	1.25	2.19	11.28

El. inlet face invert	56.45 ft	El. outlet invert	53.43 ft
El. inlet throat invert	0.00 ft	El. inlet crest	0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	56.45 ft
OUTLET STATION	60.40 ft
OUTLET ELEVATION	53.43 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0500
CULVERT LENGTH ALONG SLOPE	60.48 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	USER DEFINED
BARREL SPAN	7.26 ft
BARREL RISE	4.18 ft
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S n	0.028 FOR SIDES AND TOP

0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 18:39:05 FILE NAME: 757T1AR

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	0.00	58.26	58.26
2	0.17	59.16	57.52
3	0.86	60.42	57.52
4	1.55	61.05	57.52
5	2.24	61.43	57.52
6	2.94	61.63	57.52
7	3.63	61.70	57.52
8	4.32	61.63	57.52
9	5.01	61.43	57.52
10	5.71	61.05	57.52
11	6.40	60.42	57.52
12	7.09	59.16	57.52
13	7.26	58.18	58.18

4

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 18:39:05 FILE NAME: 757T1AR

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 75750TW
MAIN CHANNEL ONLY FILE DATE: 08-25-2006
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.035
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0180 ft/ft

CROSS-SECTION X Y

COORD. NO.	(ft)	(ft)
1	0.00	57.61
2	3.40	53.76
3	6.50	53.82
4	10.20	53.91
5	12.80	57.07

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	53.76	0.000	0.33	0.00	0.00
10.00	54.31	0.847	0.88	3.22	0.48
20.00	54.53	0.887	1.10	4.05	0.67
30.00	54.72	0.910	1.29	4.63	0.82
40.00	54.88	0.925	1.45	5.09	0.95
50.00	55.02	0.937	1.59	5.47	1.06
60.00	55.16	0.946	1.73	5.79	1.15
70.00	55.28	0.954	1.85	6.07	1.24
80.00	55.40	0.960	1.97	6.33	1.32
90.00	55.52	0.965	2.09	6.56	1.39
100.00	55.62	0.970	2.19	6.78	1.46

Note: Shear stress was calculated using R.

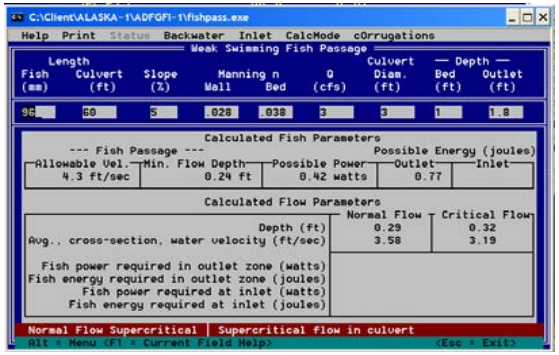
ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	60.85 ft

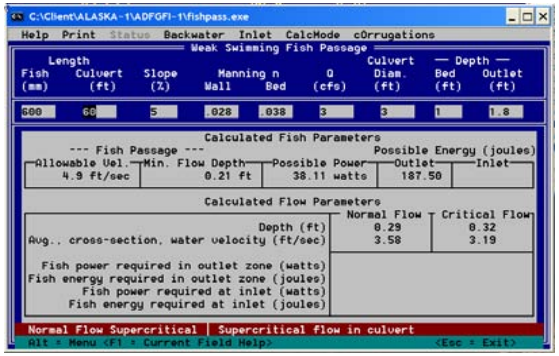
2009 Alignment Station: 736+83
2006 S&HI Station 757+50 Tier 2 FISH PASS design

non baffled design: 3-ft pipe at slope of existing pipe

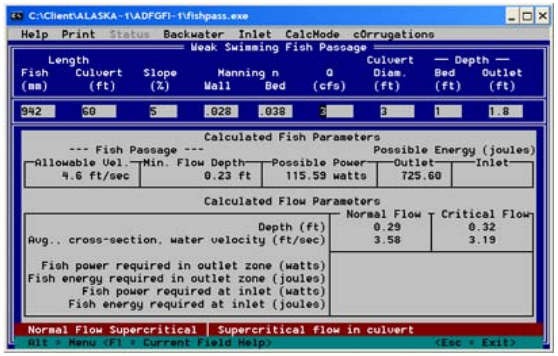
Juvenile Coho



Adult Coho

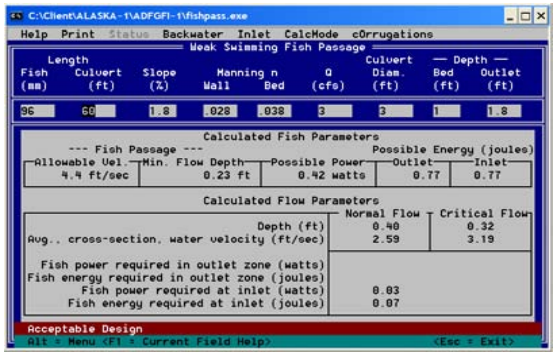


Adult coho - adjusted to 'equivalent' grayling

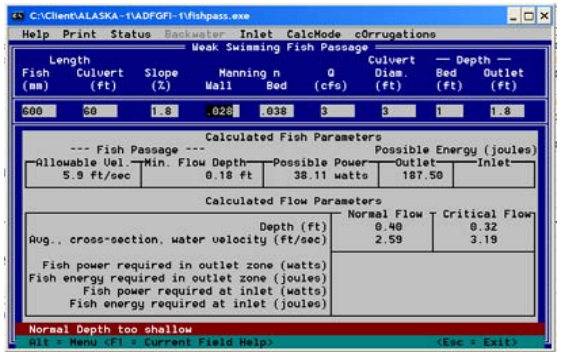


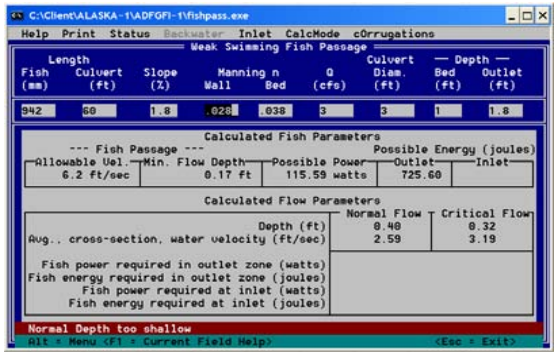
3-ft pipe at slope of existing d/s channel

Juvenile Coho



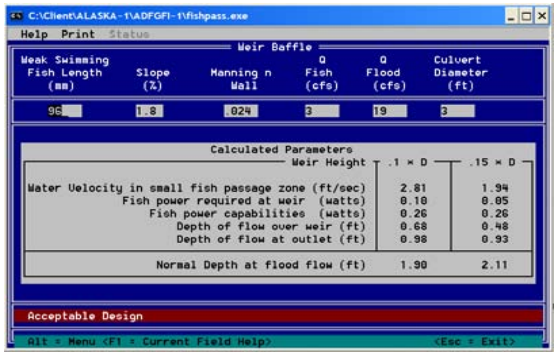
Adult Coho



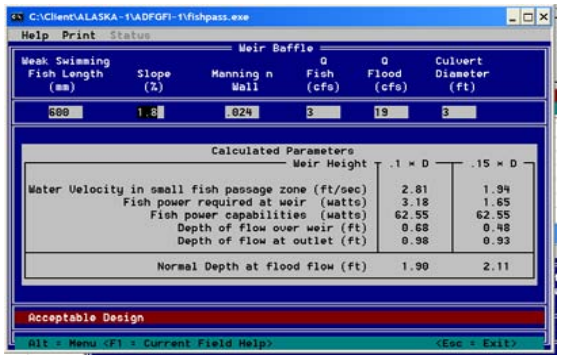


baffle design:

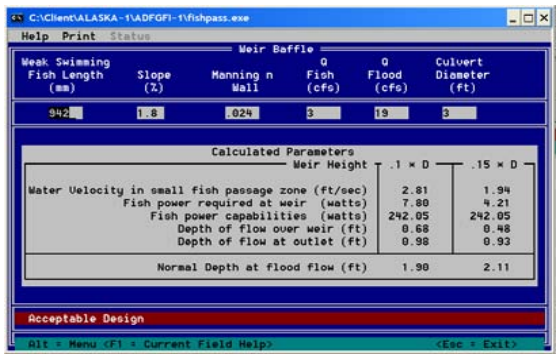
3-ft pipe at slope of existing d/s channel
Juvenile Coho



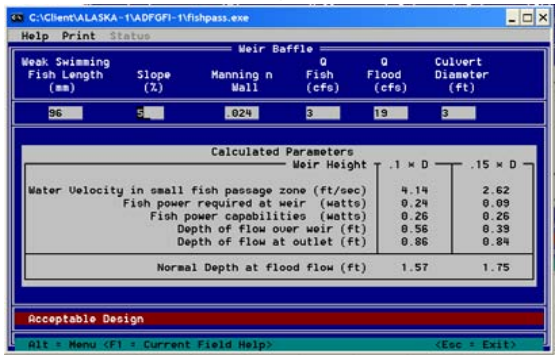
Adult Coho

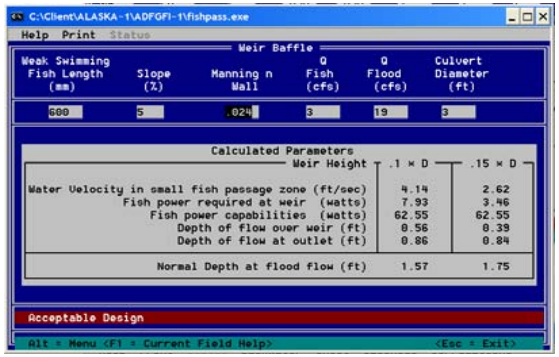


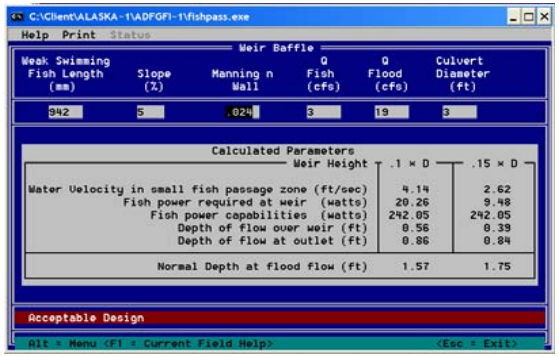
Adult coho - adjusted to 'equivalent' grayling



3-ft pipe at slope of existing pipe







2009 Alignment Station: 736+83

1 2006 S&HI Station 757+50 Tier 2 fish passage - 3-ft baffled CMP

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 19:05:25 FILE NAME: 757T2-3B

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET SHAPE MATERIAL	BARRELS SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	57.52	54.50	60.08	1 ICMP	3.00	2.55	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 757T2-3B DATE: 09-07-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
57.52	0	0	0	0	0	0	0	0	1
58	1.9	1.9	0	0	0	0	0	0	1
58.12	3	3	0	0	0	0	0	0	1
58.41	5.7	5.7	0	0	0	0	0	0	1
58.59	7.6	7.6	0	0	0	0	0	0	1
58.75	9.5	9.5	0	0	0	0	0	0	1
58.89	11.4	11.4	0	0	0	0	0	0	1
59.02	13.3	13.3	0	0	0	0	0	0	1
59.16	15.2	15.2	0	0	0	0	0	0	1
59.29	17.1	17.1	0	0	0	0	0	0	1
59.42	19	19	0	0	0	0	0	0	1
60.85	36.5	36.5	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 757T2-3B DATE: 09-07-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
57.52	0.000	0.00	0.00	0.00
58.00	0.000	1.90	0.00	0.00
58.12	0.000	3.00	0.00	0.00
58.41	0.000	5.70	0.00	0.00
58.59	0.000	7.60	0.00	0.00
58.75	0.000	9.50	0.00	0.00
58.89	0.000	11.40	0.00	0.00
59.02	0.000	13.30	0.00	0.00
59.16	0.000	15.20	0.00	0.00
59.29	0.000	17.10	0.00	0.00
59.42	0.000	19.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 19:05:25 FILE NAME: 757T2-3B

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 2.55 (ft)) ICMP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	57.52	0.00	0.00	0-NF	0.00	0.00	0.00	-0.74	0.00	0.00
1.90	58.00	0.48	0.48	1-S2n	0.16	0.27	0.07	-0.45	6.38	1.86
3.00	58.12	0.60	0.60	1-S2n	0.26	0.36	0.16	-0.40	5.83	2.10
5.70	58.41	0.89	0.89	1-S2n	0.36	0.55	0.25	-0.30	9.54	2.55
7.60	58.59	1.07	1.07	1-S2n	0.44	0.66	0.36	-0.24	8.64	2.79
9.50	58.75	1.23	1.23	1-S2n	0.51	0.77	0.51	-0.19	7.47	3.01
11.40	58.89	1.37	1.37	1-S2n	0.57	0.86	0.46	-0.13	10.05	3.19
13.30	59.02	1.50	1.50	1-S2n	0.63	0.94	0.54	-0.08	9.71	3.36
15.20	59.16	1.64	1.64	1-S2n	0.68	1.03	0.63	-0.04	9.40	3.51
17.10	59.29	1.77	1.77	1-S2n	0.74	1.10	0.75	0.00	8.80	3.65
19.00	59.42	1.90	1.90	1-S2n	0.79	1.17	0.67	0.04	10.97	3.78

El. inlet face invert 57.52 ft El. outlet invert 54.50 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 57.52 ft
OUTLET STATION 60.00 ft
OUTLET ELEVATION 54.50 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0503
CULVERT LENGTH ALONG SLOPE 60.08 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE USER DEFINED
BARREL SPAN 3.00 ft
BARREL RISE 2.55 ft
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S n 0.024 FOR SIDES AND TOP
0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006

CURRENT TIME: 19:05:25 FILE NAME: 757T2-3B

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	0.00	58.57	58.57
2	0.14	59.21	57.93
3	0.29	59.45	57.69
4	0.43	59.62	57.52
5	0.70	59.84	57.52
6	0.96	59.97	57.52
7	1.23	60.05	57.52
8	1.50	60.07	57.52
9	1.77	60.05	57.52
10	2.04	59.97	57.52
11	2.30	59.84	57.52
12	2.57	59.62	57.52
13	2.71	59.45	57.69
14	2.86	59.21	57.93
15	3.00	58.57	58.57

4

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 19:05:25 FILE NAME: 757T2-3B

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 757T2-3B
MAIN CHANNEL ONLY FILE DATE: 09-07-2006
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0180 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	57.61
2	3.40	53.76
3	6.50	53.82
4	10.20	53.91
5	12.80	57.07

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

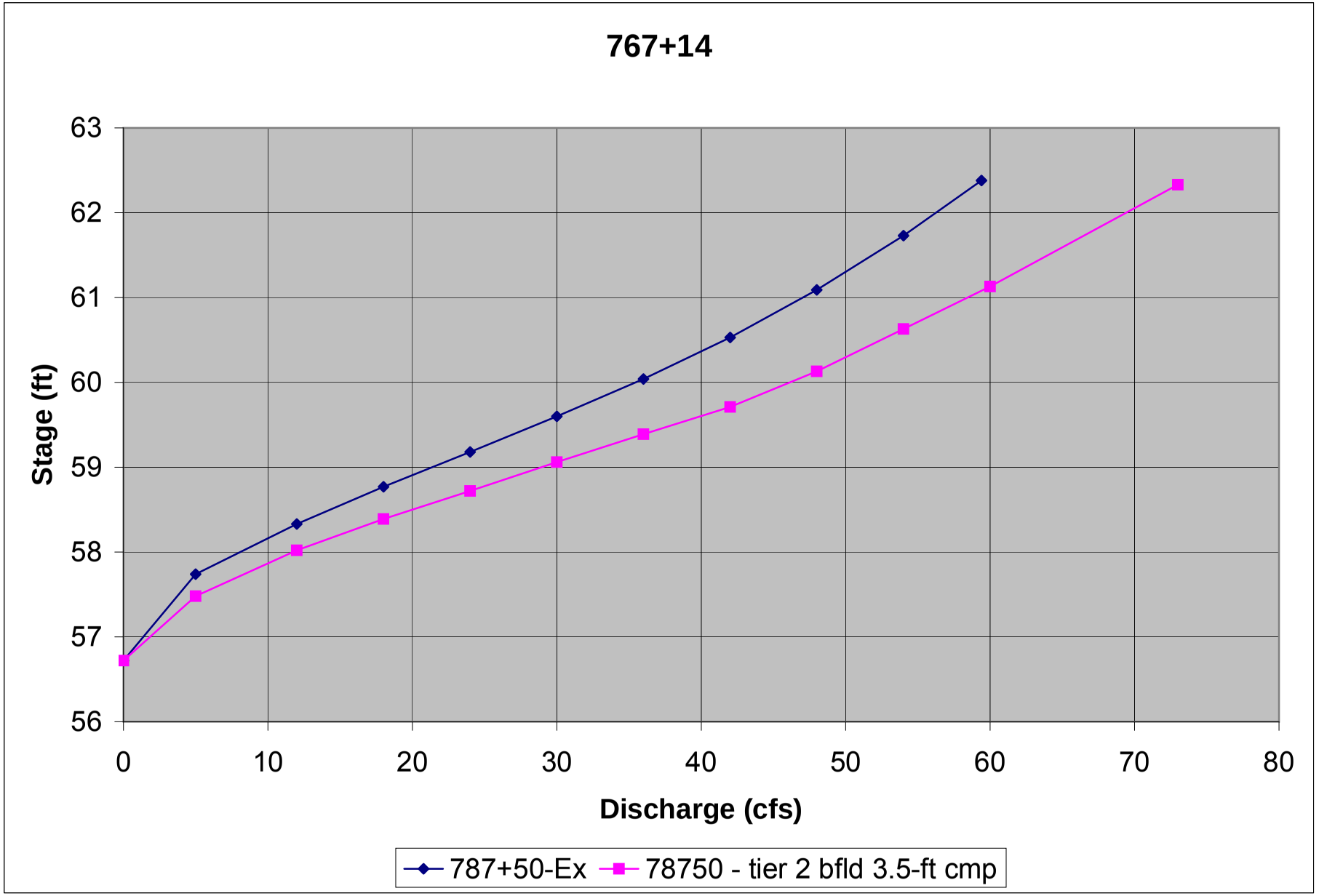
FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	53.76	0.000	-0.74	0.00	0.00
1.90	54.05	0.704	-0.45	1.86	0.24

3.00	54.10	0.724	-0.40	2.10	0.28
5.70	54.20	0.755	-0.30	2.55	0.38
7.60	54.26	0.770	-0.24	2.79	0.44
9.50	54.31	0.782	-0.19	3.01	0.49
11.40	54.37	0.792	-0.13	3.19	0.53
13.30	54.42	0.800	-0.08	3.36	0.58
15.20	54.46	0.807	-0.04	3.51	0.61
17.10	54.50	0.813	0.00	3.65	0.65
19.00	54.54	0.819	0.04	3.78	0.69

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	60.85 ft


767+14
63
62
61
60
59
58
57
56
Stage (ft)
0
10
20
30
40
50
60
70
80
Discharge (cfs)
787+50-Ex
78750 - tier 2 bfld 3.5-ft cmp

2009 Alignment Station: 767+14

1 2006 S&HI Station 787+50 Existing conditions

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:45:22 FILE NAME: 78750EX

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	56.72	55.16	52.02	1	CSP	3.00	3.00	.024	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: 78750EX DATE: 08-25-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
56.72	0	0	0	0	0	0	0	0	1
57.74	5	5	0	0	0	0	0	0	1
58.33	12	12	0	0	0	0	0	0	1
58.77	18	18	0	0	0	0	0	0	1
59.18	24	24	0	0	0	0	0	0	1
59.6	30	30	0	0	0	0	0	0	1
60.04	36	36	0	0	0	0	0	0	1
60.53	42	42	0	0	0	0	0	0	1
61.09	48	48	0	0	0	0	0	0	1
61.73	54	54	0	0	0	0	0	0	1
62.38	60	59.4	0	0	0	0	0	0.32	6
62.33	59	59	0	0	0	0	0	OVERTOPP	ING

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 78750EX DATE: 08-25-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
56.72	0.000	0.00	0.00	0.00
57.74	0.000	5.00	0.00	0.00
58.33	0.000	12.00	0.00	0.00
58.77	0.000	18.00	0.00	0.00
59.18	0.000	24.00	0.00	0.00
59.60	0.000	30.00	0.00	0.00
60.04	0.000	36.00	0.00	0.00
60.53	0.000	42.00	0.00	0.00
61.09	0.000	48.00	0.00	0.00
61.73	0.000	54.00	0.00	0.00
62.38	-0.008	60.00	0.23	0.38

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:45:22 FILE NAME: 78750EX

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) CSP

DIS-CHARGE (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	56.72	0.00	0.00	0-NF	0.00	0.00	0.00	0.34	0.00	0.00
5.00	57.74	1.02	1.02	1-S2n	0.56	0.69	0.49	0.34	6.52	0.00
12.00	58.33	1.61	1.61	1-S2n	0.89	1.09	0.79	0.34	8.00	0.00
18.00	58.77	2.05	2.05	1-S2n	1.09	1.35	1.10	0.34	7.64	0.00
24.00	59.18	2.46	2.46	1-S2n	1.28	1.57	1.17	0.34	9.36	0.00
30.00	59.60	2.88	2.88	1-S2n	1.46	1.77	1.37	0.34	9.51	0.00
36.00	60.04	3.32	3.32	5-S2n	1.63	1.94	1.54	0.34	9.82	0.00
42.00	60.53	3.81	3.81	5-S2n	1.80	2.11	1.71	0.34	10.10	0.00
48.00	61.09	4.37	4.37	5-S2n	1.97	2.25	1.98	0.34	9.72	0.00
54.00	61.73	5.01	5.01	5-S2n	2.15	2.38	2.08	0.34	10.30	0.00
59.44	62.38	5.66	5.66	5-S2n	2.34	2.48	2.28	0.34	10.35	0.00

El. inlet face invert 56.72 ft El. outlet invert 55.16 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 56.72 ft
OUTLET STATION 52.00 ft
OUTLET ELEVATION 55.16 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0300
CULVERT LENGTH ALONG SLOPE 52.02 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 3.00 ft
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S n 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

3

CURRENT DATE: 08-25-2006 FILE DATE: 08-25-2006
CURRENT TIME: 16:45:22 FILE NAME: 78750EX

TAILWATER

CONSTANT WATER SURFACE ELEVATION
55.5

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	24.00 ft
CREST LENGTH	10.00 ft
OVERTOPPING CREST ELEVATION	62.33 ft

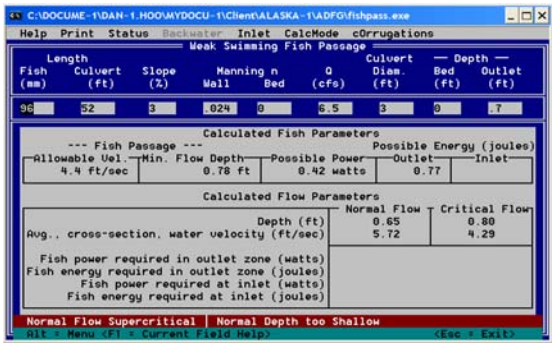
767+14 Tier 2 FISH PASS design

2006 S&HI XS 787+50 Tier 2 FISH PASS design

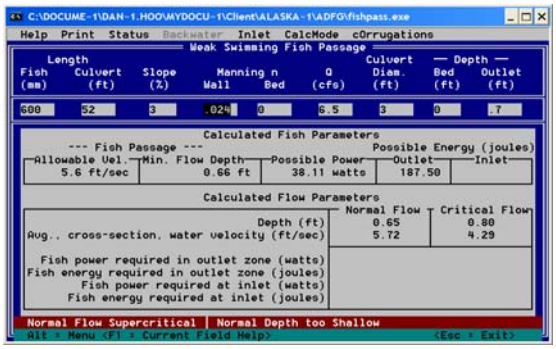
June 16, 2009

Non baffle design

Juvenile coho in 3-ft CMP

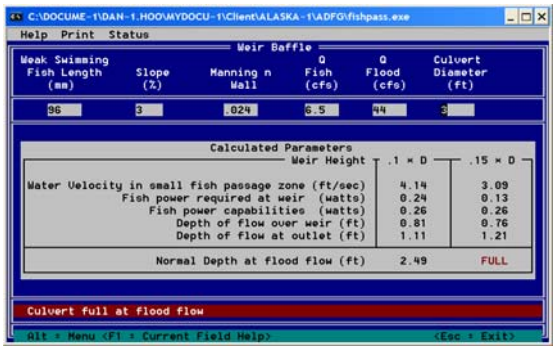


adult coho

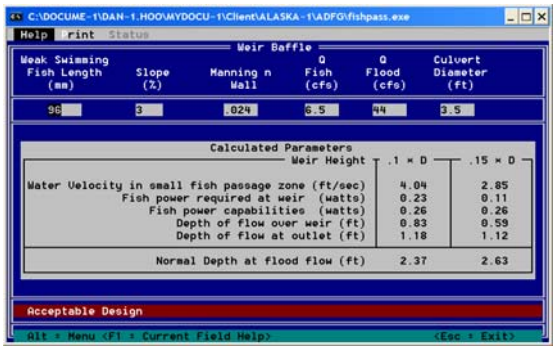


Baffle design

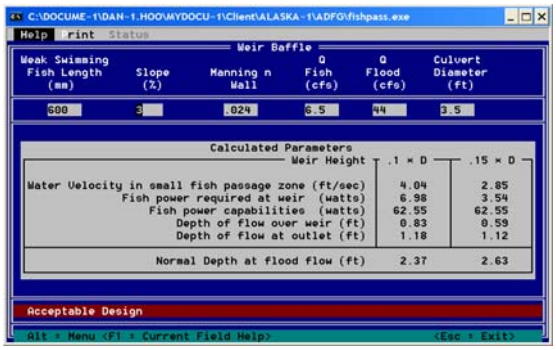
Juvenile coho in 3-ft CMP



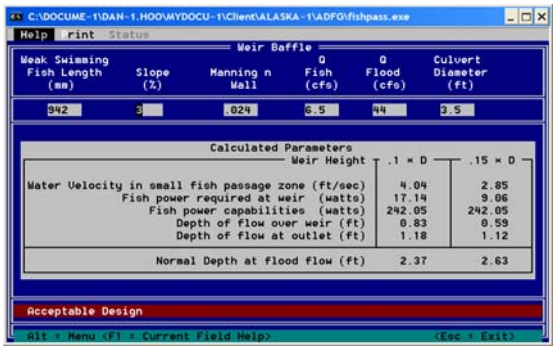
Juvenile coho in 3.5-ft CMP



Adult coho in 3.5-ft CMP



Adult coho adjusted to 'equivalent' grayling



2009 Alignment Station: 767+14

1 2006 S&HI Station 787+50 Tier 2 fish passage - 3.5-ft baffled CMP

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 19:53:59 FILE NAME: 787T2-42

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	56.72	55.16	52.02	1	ICMP	3.50	2.98	.024	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: 787T2-42 DATE: 09-07-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
56.72	0	0	0	0	0	0	0	0	1
57.48	5	5	0	0	0	0	0	0	1
58.02	12	12	0	0	0	0	0	0	1
58.39	18	18	0	0	0	0	0	0	1
58.72	24	24	0	0	0	0	0	0	1
59.06	30	30	0	0	0	0	0	0	1
59.39	36	36	0	0	0	0	0	0	1
59.71	42	42	0	0	0	0	0	0	1
60.13	48	48	0	0	0	0	0	0	1
60.63	54	54	0	0	0	0	0	0	1
61.13	60	60	0	0	0	0	0	0	1
62.33	73	73	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 787T2-42 DATE: 09-07-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
56.72	0.000	0.00	0.00	0.00
57.48	0.000	5.00	0.00	0.00
58.02	0.000	12.00	0.00	0.00
58.39	0.000	18.00	0.00	0.00
58.72	0.000	24.00	0.00	0.00
59.06	0.000	30.00	0.00	0.00
59.39	0.000	36.00	0.00	0.00
59.71	0.000	42.00	0.00	0.00
60.13	0.000	48.00	0.00	0.00
60.63	0.000	54.00	0.00	0.00
61.13	0.000	60.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

2

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 19:53:59 FILE NAME: 787T2-42

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.50 (ft) BY 2.98 (ft)) ICMP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	56.72	0.00	0.00	0-NF	0.00	0.00	0.00	0.34	0.00	0.00
5.00	57.48	0.76	0.76	1-S2n	0.36	0.46	0.26	0.34	6.24	0.00
12.00	58.02	1.30	1.30	1-S2n	0.63	0.81	0.51	0.34	8.17	0.00
18.00	58.39	1.67	1.67	1-S2n	0.81	1.04	0.74	0.34	8.07	0.00
24.00	58.72	2.00	2.00	1-S2n	0.97	1.25	0.97	0.34	8.04	0.00
30.00	59.06	2.34	2.34	1-S2n	1.13	1.43	1.03	0.34	9.44	0.00
36.00	59.39	2.67	2.67	1-S2n	1.27	1.59	1.19	0.34	9.63	0.00
42.00	59.71	2.99	2.99	5-S2n	1.41	1.75	1.35	0.34	9.81	0.00
48.00	60.13	3.41	3.41	5-S2n	1.56	1.89	1.49	0.34	10.06	0.00
54.00	60.63	3.91	3.91	5-S2n	1.70	2.03	1.63	0.34	10.33	0.00
60.00	61.13	4.41	4.41	5-S2n	1.84	2.15	1.75	0.34	10.66	0.00

El. inlet face invert 56.72 ft El. outlet invert 55.16 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 56.72 ft
OUTLET STATION 52.00 ft
OUTLET ELEVATION 55.16 ft
NUMBER OF BARRELS 1
SLOPE (V/H) 0.0300
CULVERT LENGTH ALONG SLOPE 52.02 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE USER DEFINED
BARREL SPAN 3.50 ft
BARREL RISE 2.98 ft
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S n 0.024 FOR SIDES AND TOP
0.038 FOR BOTTOM
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL MITERED
INLET DEPRESSION NONE

3

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006

CURRENT TIME: 19:53:59 FILE NAME: 787T2-42

***** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (ft)	Y-TOP (ft)	Y-BOTTOM (ft)
1	0.00	57.95	57.95
2	0.17	58.69	57.20
3	0.33	58.97	56.92
4	0.50	59.17	56.72
5	0.81	59.42	56.72
6	1.13	59.58	56.72
7	1.44	59.67	56.72
8	1.75	59.70	56.72
9	2.06	59.67	56.72
10	2.37	59.58	56.72
11	2.69	59.42	56.72
12	3.00	59.17	56.72
13	3.17	58.97	56.92
14	3.33	58.69	57.20
15	3.50	57.95	57.95

4

CURRENT DATE: 09-07-2006 FILE DATE: 09-07-2006
CURRENT TIME: 19:53:59 FILE NAME: 787T2-42

TAILWATER

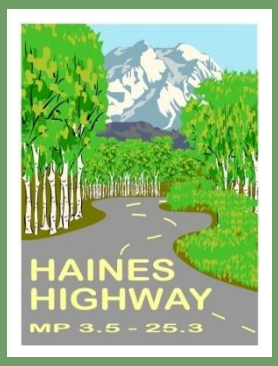
CONSTANT WATER SURFACE ELEVATION
55.5

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 24.00 ft
CREST LENGTH 10.00 ft
OVERTOPPING CREST ELEVATION 62.33 ft

APPENDIX G

Geotechnical Investigation Report



HAINES HIGHWAY

MILEPOST 3.5-25.3

FINAL GEOTECHNICAL REPORT

VOLUME I OF II

SUBSURFACE INVESTIGATION AND GEOTECHNICAL RECOMMENDATIONS

January 2009

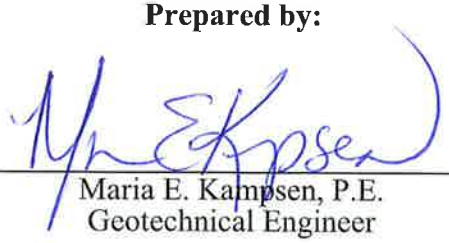
DOT&PF PROJECT NO. 68606
HAINES, ALASKA

FINAL GEOTECHNICAL REPORT
HAINES HIGHWAY, MP 3.5 TO 25.3
VOLUME I OF II
STATE PROJECT NO. 68606
HAINES, ALASKA

Prepared for:

State of Alaska
Department of Transportation and Public Facilities
6860 Glacier Highway
Juneau, Alaska 99801-7999

Prepared by:



Maria E. Kampsen, P.E.
Geotechnical Engineer

FINAL
GEOTECHNICAL REPORT
HAINES HIGHWAY, MP 3.5 TO 25.3
VOLUME I OF II
STATE PROJECT NO. 68606
HAINES, ALASKA

Prepared for:

State of Alaska
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6860 Glacier Highway
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Area 6
Report No. 4584

January 2009

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Appendix B....Test Boring/Pit Logs and Descriptive Guide
Appendix C....Laboratory Test Results
Appendix D....Debris Flows

1.0 INTRODUCTION

This report presents the results of the geotechnical field exploration and laboratory soil-testing program in support of the Haines Highway, Milepost (MP) 3.5 to 25.3 project near Haines, Alaska (Figure 1). This work was performed for the State of Alaska Department of Transportation and Public Facilities (DOT&PF).

1.1 Planned Development

The DOT&PF, in partnership with the Federal Highway Administration, plans to upgrade the Haines Highway from MP 3.5 to 25.3. The Haines Highway, a designated Scenic Byway, connects the communities of Haines, Alaska and Haines Junction, Yukon Territory. This highway is one of only several major highways out of the Southeast Alaska region, and is an important international transportation system, as it connects the Alaska Marine Highway in Haines with Canada.

The highway, which was originally constructed in 1943, has been periodically upgraded over the years, with the section from the Bluffs (MP 25.3) to the Canadian border (MP 40) having been most recently completed. During the last upgrades, the design speed for the Haines Highway was designated as 55 miles per hour (mph) in order to make the U.S. and Canadian highways compatible.

The project goal is to bring the MP 3.5 to 25.3 section of the Haines Highway up to National Highway System standards for a design speed of 55 mph by realigning, widening, and straightening portions of the roadway. DOT&PF is also considering possible relocation of the existing Chilkat River Bridge, and potential long-term solutions to debris flow problems near MPs 19 and 23. The upgrades are to provide a safe, consistent, and efficient roadway.

This report documents observed subsurface geotechnical conditions, and provides analyses and interpretations of anticipated subsurface conditions along the alignment. It also presents recommendations for design and construction of the project elements. This report and subsequent recommendations are based on and valid only for, the planned development, as it is currently understood as of August 17, 2006. Any changes to the planned development may

impact the recommendations contained herein and should be evaluated by the project geotechnical engineer.

1.2 Purpose of Investigation

The purpose of this investigation was to determine soil and rock stratigraphy along the existing road and proposed realignment areas. This information was compiled and interpreted to make design and construction recommendations for the project.

1.3 Scope of Work

DOWL HKM began this phase of the project by obtaining historical documents from DOT&PF. The information was compiled and reviewed and a scope of work/exploration plan developed. The plan was submitted to DOT&PF in early August 2005 for review and comment. Upon receipt of the comments, a final plan was developed and submitted to DOT&PF on September 19, 2005.

The scope of work for the geotechnical investigation included:

- Permitting
- Geologic mapping
- Evaluation of debris flows
- Subsurface investigation

1.3.1 Permitting

Due to the project location, multiple permits were required to conduct the geotechnical investigation. The required permits included a U.S. Army Corps of Engineers (USACE) Nationwide 6 permit, State of Alaska Department of Natural Resources Title 41 permit, State of Alaska Parks Special Park Use permit, State of Alaska Department of Natural Resources Coastal Consistency Review, and Rights-of-Entry for all privately owned parcels. All permits were obtained prior to conducting the subsurface investigation.

Coordination and Section 106 consultation with the State Historic Preservation Office (SHPO) and tribes was also required, resulting in an archaeological monitor being present during Phase II of the geotechnical investigation.

1.3.2 Geologic Mapping

Geologic mapping of bedrock exposures was conducted in areas of proposed realignments or widening. Information to include strikes, dips, trends, plunges, bedrock type, and fracture frequency was obtained. Stereonets were created and kinematic analyses performed. The information was analyzed for maximum rock slopes, access, and related construction issues.

1.3.3 Evaluation of Debris Flows

Two recurring debris flow areas exist along the alignment, at MP 19 and MP 23. As part of this project, documents pertaining to these two areas were reviewed. In addition, a site visit was conducted with the Haines DOT&PF Maintenance Foreman, Mr. Roger Ingledue. This task required an evaluation of the site conditions, development of construction options and corresponding cost estimates, and recommendations.

1.3.4 Subsurface Investigation

The subsurface investigation was planned to be completed in two phases; truck accessible test borings, test pits, and hand probes followed by tracked drill rig test borings. An estimated 100 test borings and 50 test pits were planned. The use of flaggers and the subsequent laboratory testing program was also outlined in the scope of work. Due to archeological concerns in selected areas, some of the test borings and pits have not yet been completed. A third phase has been proposed for completion in the near future.

A separate phase of fieldwork for the proposed bridge site at MP 24 was also included in the exploration plan. Test borings and penetrometers were planned at each abutment to depths of 100 feet. This phase was later removed from the project scope due to budget issues and not completed.

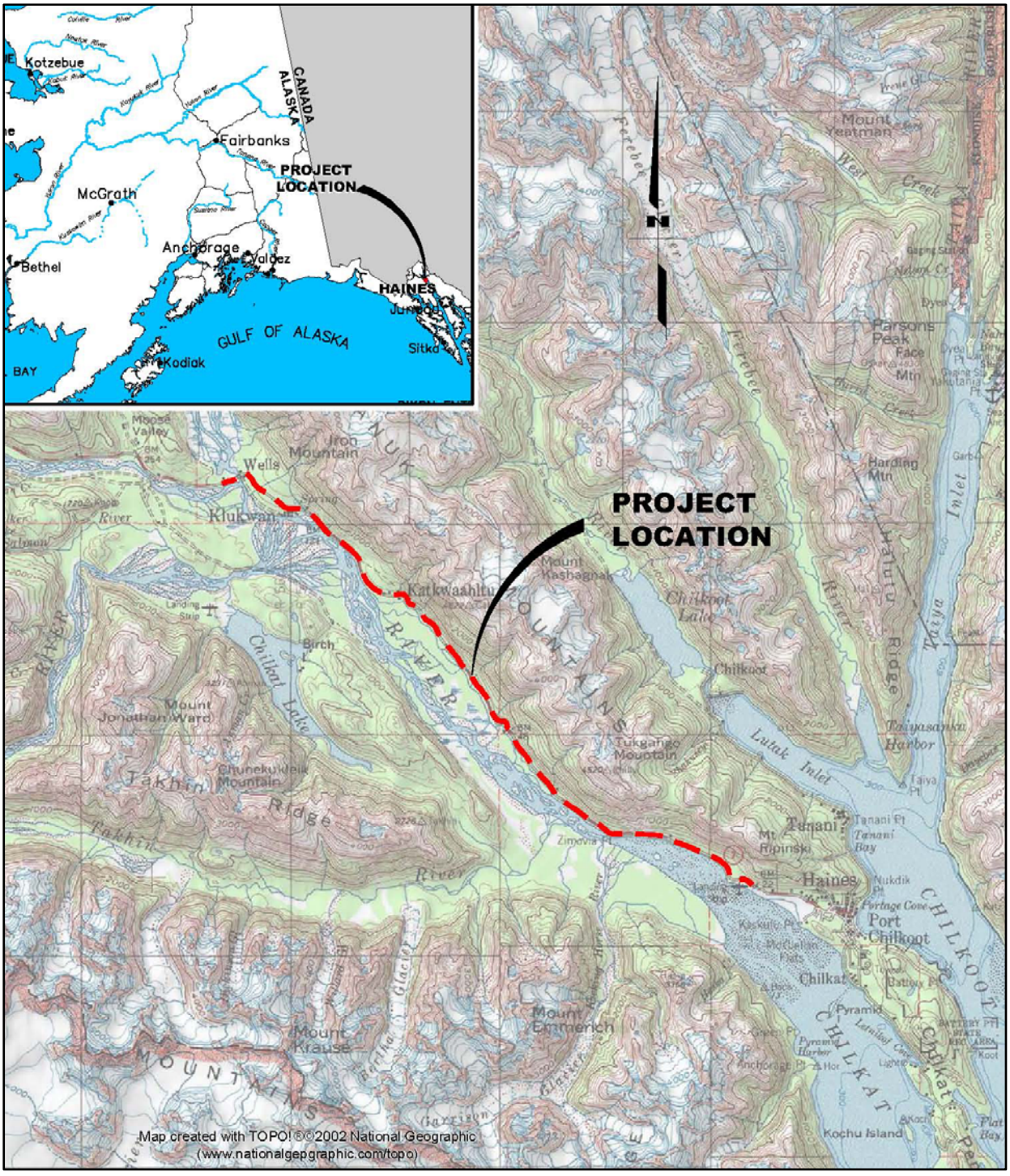

Figure 1: Vicinity Map

2.0 REGIONAL INFORMATION

Haines is located on the western shore of the Lynn Canal, at the northern end of the Chilkat Peninsula between Chilkat and Chilkoot Inlets in Southeast Alaska, approximately 75 air miles northwest of Juneau. The Haines Highway, MP 3.5 to 25.3 project spans from the airport (MP 3.5) to the Bluffs (MP 25.3) near Haines, Alaska.

2.1 Regional Geology

The Haines Highway lies within the Chatham Trough physiographic province of southeast Alaska. The area is dominated by the steep glaciated mountains and deep glacially scoured fjords. Haines occupies a low saddle area bounded by the bedrock slopes of Mount Ripinski to the north and the bedrock hills of the Chilkat Peninsula to the south. The dominant geologic feature of the region is the Chilkat River valley, which follows the Chilkat River Fault and divides the geologic terrains. The project area is on the east side of the fault and composed of ultramafic and igneous rocks of Cretaceous (Mzm/Mzp) and Tertiary age. The rock includes metamorphosed ultramafics with varying amounts of pyroxene, hornblende, gabbro, dunite, magnetite bearing pyroxenite and metamorphosed basalt. Younger intrusive veins and bodies of igneous rocks such as quartz diorite and mixed felsic volcanics are also present.

The existing road and proposed realignments follow the toe of the steep mountains with slope faces and foliation trends dipping 60 to 85 degrees westward toward the Chilkat River and the Haines Highway. The ultramafic complex trends in a northerly direction, and extends eastward from the Chilkat River Fault to the eastern mountain peaks of 4,000 to 6,000 feet high and beyond into unmapped territory.

The surficial geology of the Haines area has previously been mapped by Richard W. Lemke and Lynn A. Yehle of the U.S. Geological Survey (USGS) as part of a study on geologic hazards in communities in Southeast Alaska.

The surficial deposits are dominated by a unit designated “Qem” and described as “elevated fine-grained marine deposits”. These deposits are thought to have been deposited in a fjord environment by the settling of fine-grained silts and clays derived from glacial action. Subsequent to the retreat of the last glaciation from the Haines area, the land has been rebounding from the effect of loading by glacial ice 5,000 feet or more in thickness. The USGS

estimates that the land has been uplifted by as much as 600 feet in the last 10,000 years, and that uplift is still occurring at a rate of about 1 inch per year.

Thus, the upper surface of the fine-grained fjordal sediments in the Haines area has now been elevated to a position well above sea level. The USGS report points out that one to several feet of muskeg commonly overlies these fine-grained marine deposits.

The "Qem" unit is also capped in some places by a "Qeb" unit, which is a veneer of elevated beach deposits consisting of well-sorted and stratified gravel, sand, and cobbles.

2.2 Climate

Haines is located in a maritime climate zone characterized by cool summers and mild winters. The climatological data presented below was taken from a range of sources; including the Department of Commerce, Community, and Economic Development Community Database and the Environmental Atlas of Alaska.

Mean Annual Precipitation	52 in
Mean Annual Snowfall	133 in
Mean Maximum Temperature July	65.9°F
Mean Maximum Temperature January	28.2°F
Mean Minimum Temperature July	51.1°F
Mean Minimum Temperature January	18.4°F
Average Summer Temperature Range	46°F - 66°F
Average Winter Temperature Range	10°F - 36°F
Haines Freezing Degree Days (°F-day)	900
Haines Thawing Degree Days (°F-day)	3,000
Haines Heating Degree Days (°F-day)	8,638

Average monthly temperatures and precipitation amounts for Haines and the vicinity, for the period between 1971 and 2000 are shown in Table 1.

Table 1: Average Monthly Temperatures and Precipitation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°F)	23.3	27.7	33.3	41.6	49.5	56.0	58.5	57.0	50.4	41.6	30.8	26.0
Precipitation (including snowfall) (in)	5.45	4.56	2.91	2.40	1.55	1.36	1.36	2.45	5.21	9.13	5.98	5.27

2.3 Topography and Drainage

The roadway was constructed at or near the base of the Takshanuk Mountains adjacent to the Chilkat River. The initial few miles of the project are largely flat, following the river floodplain at the base of the mountains. The road then transitions to rolling topography reflective of the undulating nature of the lower mountainside. Looking toward the end of the project, the overall slope of the road trends to the left across the roadway. Drainage from the mountains flows south to the river, crossing the roadway. Runoff is accommodated by the numerous creeks and culverts that provide cross drainage along the alignment. A hydrology study of the alignment was completed by Interfluve of Hood River, Oregon, under separate cover.

2.4 Notable Features

The road passes through previously developed areas as well as undeveloped areas. Residential structures are periodically present on the both sides of the road, pullouts and eagle-viewing areas have been developed, recreational and subsistence-fishing areas are accessible, and the village of Klukwan is located just past MP 21. Other notable features include archaeological sites, debris flows, the Wells Bridge, a pedestrian walking trail, buried utilities, and an abandoned fuel oil pipeline.

2.4.1 Archaeological Sites

As part of the Haines Highway Improvements, an archaeological survey was performed along the project corridor. Numerous areas of historical significance were identified and are addressed in the report Haines Highway Archaeological Reconnaissance Report, dated October 31, 2005, by Cultural Resource Consultants, LLC.

2.4.2 Debris Flows

Two debris flows are present along the alignment at MP 19 and MP 23. The two flows are considered active with the most recent large flow movement occurring at MP 19 in October 2005. Over 50,000 cubic yards of material were transported over the road, resulting in road closures and a significant cleanup effort.

2.4.3 Wells Bridge

At MP 23.8, the Wells Bridge crosses the Chilkat River. The bridge is a two-lane, concrete-decking, multi-span structure about 500 feet in length. The bridge replaced a wooden structure and was completed in 1958.

2.4.4 Pedestrian Walking Trail

From Station 1010+00 to 1082+00, there is an asphalt paved walking trail situated between the highway and the river. The trail is designed to allow pedestrians to observe the eagles, safely move between designated rest areas, and access eagle viewing platforms that have been constructed.

2.4.5 Haines Military Pipeline

In 1953, the military constructed a petroleum pipeline parallel to the highway. The purpose of the pipeline was to supply fuel to the military bases in the Interior. The fuel line still exists although portions of the pipeline are now used as a conduit to house telephone and electric utility lines.

2.4.6 Buried Utilities

Along the alignment, electric and telephone utilities are present. These utilities serve the residents of Haines and the Chilkat Valley. Alaska Power and Telephone is responsible for the fiber optic and telephone cable along the entire project corridor and for the electric service to MP 10. From MP 10 to MP 25, Inside Passage Electric Company maintains the electrical service. Cable television is also present along the alignment from MP 3 to MP 5 as an overhead coaxial cable.

2.5 Permafrost

No permafrost was encountered in any of the test borings, nor is any known to exist in the general vicinity of the project corridor. In addition, no unusually cold soil temperatures were observed in the samples. Therefore, the risk of permafrost being present along the alignment is low. The contractor should be aware that if any evidence of frozen soil is encountered in any of the excavations, we should be notified immediately to evaluate the situation.

3.0 RESEARCH AND FIELD EXPLORATION

This section presents the technical data obtained from office research and the field investigation. The methods and procedures used in obtaining the data are presented. The data should be considered accurate only at the locations specified and only to the degree implied by the methods used.

3.1 Research

Several subsurface investigations have been conducted along the project corridor over the last several decades. These investigations included an environmental assessment, reconnaissance level investigations, bridge investigation, and a geologic evaluation of the debris flows. These investigations were reviewed in order to obtain information on original construction methods, subsurface conditions and to help establish an appropriate drilling program, and are not included in this report. Refer to Section 7.0, References for a list of publications reviewed.

3.2 Field Exploration

The field investigation completed to date was performed between September 2005 and May 2006. The project was divided into three phases as detailed below.

- Geologic Mapping and Alignment Observations,
- Phase I Test Boring Exploration, and
- Phase II Test Boring/Test Pit Exploration

The information obtained during the field explorations is presented graphically on the test pit and test boring logs found in Appendix B. The Test Hole Explanation Guide presented prior to the test boring/pit logs, should be reviewed to help understand the information presented on the test pit/test boring logs. Abbreviated versions of the logs are shown on the plan and profile sheets, Appendix A.

The test boring locations were staked and painted prior to drilling or excavating. In some instances, site conditions necessitated offsetting the test boring/pit locations from the previously staked locations. The offsets were measured and the elevations were estimated from a topographic map. The test borings and test pit locations have not been surveyed but their approximate locations are shown on Figures 1 through 44, Plan and Profile Sheets, Appendix A.

3.2.1 Geologic Mapping/Alignment Observations

There are a number of locations along the alignment, where road widening or relocation will result in rock cuts. At these locations, the existing bedrock exposures were mapped in general accordance with DOT&PF's "*Alaska Field Rock Classification and Structural Mapping Guide.*" It is important to note that during the mapping phase, the presence of snow limited observations. Fifty-five baselines were established and the following information obtained:

- strikes, dips, trends, plunges,
- type of bedrock, fracture frequency,
- presence of water/runoff,
- digital photographs, and
- recorded observations.

The information obtained was used to complete stereonets and kinematic analyses of rock cuts. Details regarding the geologic mapping are located in Volume II, Geologic Mapping, Haines Highway, MP 3.5 to MP 25.3.

Observations were recorded along the alignment and probable realignment areas as identified in the Alignment Study dated October 2005 by DOWL HKM. These observations began in October and continued throughout the duration of the fieldwork. Tasks included photographs of outcrops, exploring potential access routes to the top of bedrock exposures, walking realignments, and hand probes. Hand probes were completed along the entire alignment and along potential realignments in an effort to delineate the depth and extent of surface organics. The probes were performed by hand probing with a steel rod until an unyielding surface was encountered. The average depth of organics encountered in each area was recorded and is shown on the plan sheets.

3.2.2 Phase I Test Boring Exploration Program

The Phase I investigation was initially planned to address all truck accessible test borings and test pits adjacent to the road where flaggers and traffic control would be required. Due to a delayed start to the fieldwork and winter weather conditions, some of the road test borings were not completed during Phase I. In addition, archaeological concerns moved the test pit program to Phase II, pending completion of the archaeological survey.

During October and November 2005, a total of 43 test borings were drilled along the alignment. The test borings were drilled using a Mobile B-61, truck-mounted drill rig fitted with hollow-stem auger. The drill rig is owned and operated by Denali Drilling, Inc. of Anchorage, Alaska. The test borings were drilled to explore and sample the existing road section and underlying material, while minimizing damage to the existing section. The samples collected were evaluated for their potential for reuse. The test borings ranged in depth from 2.5 feet to 16.5 feet and were logged by Mr. John Rego, Jr., a geologist with DOWL HKM.

Several types of sampling were conducted; bulk, grab, and disturbed. Bulk samples were obtained from selected test borings from below the asphalt pavement to a depth of three feet. These samples were typically 15,000 to 30,000 gram samples obtained for proctor tests. In some instances, grab samples were obtained at a depth of two feet or two and a half feet from the auger flights. These samples were typically 3,000 to 6,000 gram samples for mechanical analyses. Split spoon samples were typically obtained at depths of two and a half feet, five feet, and then at five-foot intervals thereafter.

The sampling intervals and frequency were dictated by the test boring location and conditions encountered and determined in the field. Either Standard Penetration Tests (SPT) or modified penetration tests were performed in each of the test borings. The results are an indication of the relative density or consistency of the subsoil.

The SPT was performed in 20 of the test borings by driving a two-inch outside-diameter, split-spoon sampler a distance of 18 inches ahead of the auger with a 140-pound hammer falling 30 inches in accordance with American Society for Testing and Materials (ASTM) D1586. The standard penetration resistance (N) value shown on the test boring logs indicates the number of blows required to drive the sampler the last 12 inches. The N-values shown in the logs are raw data from the field and have not been adjusted for overburden pressure.

The penetration test is a modification of the SPT in that the hammer weight and sampler are larger and are often used to retrieve larger samples of soil. The penetration test was performed in the remainder of the test borings. The penetration test is performed by driving a two and one-half inch inside-diameter, split-spoon sampler a distance of 18 inches ahead of the auger with a 340-pound hammer falling 30 inches. The blow counts shown on the test boring logs indicate

the number of blows required to drive the sampler for each six-inch interval. N-values are not shown in the logs, as there is not a direct accepted correlation between the larger sampler/hammer and the SPT.

As the soil samples were recovered, they were visually classified and sealed in plastic bags to preserve the natural water content. The samples were then transported to DOWL HKM's laboratory, Alaska Testlab, in accordance with ASTM 4220, for further testing.

Slotted PVC pipe was installed in the majority of the test borings and the depth to the groundwater was measured after the water levels appeared to have stabilized.

3.2.3 Phase II Test Boring/Pit Exploration Program

The Phase II investigation was initially planned to address all test borings requiring track-mounted rig access. Due to changes during Phase I, truck accessible test borings that were not completed during Phase I were also drilled during Phase II and test pits were completed. Flaggers and traffic control were required for most of the second phase. The number of test pits planned was reduced due to utilities, accessibility, and budgetary concerns. With the completion of the archaeological survey, several test pits were changed to test borings and a number of test borings were not drilled, pending approval/permission from native corporations. These test borings requiring approval were moved into a Phase III, which has not been completed.

Test Borings. During April and May 2006, a total of 63 test borings were drilled along the alignment. The test borings were drilled utilizing two drill rigs:

- Mobile B-61 truck-mounted drill rig
- CME-45 skid-mounted drill rig on a Nodwell

Both drill rigs were fitted with continuous flight, hollow-stem auger. The rigs are owned and operated by Denali Drilling, Inc. The drilling was supervised and the samples logged by Ms. Keri Nutter, a geologist with DOWL HKM.

The test borings in the road and shoulder areas were drilled to explore and sample the existing road section and underlying material while minimizing damage to the existing section. The samples collected were evaluated for their potential for reuse. The test borings drilled outside of

the road prism were used to determine depths of peat and soil conditions where road realignments would occur. The test borings ranged in depth from 2.5 feet to 17 feet. Sampling intervals and frequencies were consistent with what occurred in Phase I.

Slotted PVC pipe was installed in the majority of the test borings and the depth to the groundwater was measured after the water levels appeared to have stabilized.

Test Pits. During April 2006, a total of 21 test pits were excavated along the alignment. Each test pit was excavated to rock, to competent mineral soils, or to the limits of the excavator. The test pits varied in depth with a maximum depth of 14.5 feet.

The test pits were excavated using a Hitachi Z-Axis 135 backhoe owned and operated by Mr. Donnie Turner of Turner Construction, Haines, Alaska. Ms. Nutter supervised the test pit exploration and obtained samples of the distinct soil layers.

As the soil samples were recovered, they were visually classified and sealed in plastic bags to preserve the natural water content. The samples were then transported to DOWL HKM's Anchorage laboratory for further testing.

No environmental testing or monitoring was conducted as a part of this investigation. However, a strong hydrocarbon odor and sheen were encountered in two test borings (101 and 102) located at Stations 825+00 and 828+50, respectively.

It was later discovered that this is a known previous fuel spill site, and the USACE is investigating it as part of their Formerly Used Defense Site (FUDS) program. The USACE plans to take responsibility of any cleanup necessary at this site.

4.0 LABORATORY TESTING

This section of the report presents the technical data obtained during the soil laboratory testing in narrative, tabular, and graphic form. The methods and procedures used in obtaining the data are described herein. The data should be considered accurate only to the degree implied by the methods used.

An engineering technician visually classified each sample recovered and the natural water content was measured. Index tests were performed on selected samples and consisted of grain size analyses, plasticity index tests, organic content tests, and maximum soil density tests.

4.1 Visual Classification

In the laboratory, an engineering technician visually classified each soil sample obtained from the field exploration. The visual classification procedure consists of:

- identifying the color of the soil,
- estimating the percentages of gravel, sand, and minus No. 200 particle sizes,
- estimating the maximum particle size,
- estimating the size range of the sand particles,
- identifying the shape of the particles,
- estimating the dry strength of the soil when a water content test is performed,
- estimating the plasticity description of the soil and plasticity index,
- comparing the natural water content with respect to the Atterberg limits, and
- identifying the Unified Soil Classification System group.

4.2 Moisture Content

The natural water content of each sample was determined in accordance with ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock. The water contents are reported on the graphic test boring/pit logs, Appendix B.

4.3 Particle Size Distribution

Ninety particle-size distribution tests were performed on selected soil samples in accordance with ASTM D422, Standard Test Method for Particle-Size Analysis of Soils. These tests consisted of mechanical sieving, the results of which are presented graphically as Appendix C.

4.4 Plasticity Index

Seven plasticity index tests were performed in accordance with ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. The liquid limit, plastic limit, and plasticity index numbers obtained from the test are plotted and used to classify the cohesive soil as silts or clays. In addition, the limits are used to estimate strength and settlement characteristics of these soils.

The liquid limit is the water content (in percent) of a soil passing the boundary between the liquid and plastic states. If the *in situ* moisture content of the soil is higher than the liquid limit, the soil will be difficult to properly compact.

The plastic limit of a soil is the lowest water content at which the soil is plastic. The difference between the liquid and plastic limits is the plasticity index or the range of water contents where a soil will behave plastically. All of the plasticity index tests determined the material to be "nonplastic" and the selected samples tested are identified in the table below.

Table 2: Plasticity Index Tests

Test Boring No.	Sample No.	Depth (ft)	Measured Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Classification of Finer Fraction
10	1	0.5-2	34	Non-Plastic		----	Silt
25	3	5-6.5	36	Non-Plastic		----	Silt
43	1	0-2	62	Non-Plastic		----	Silt
49	3	7.5-9.5	44	Non-Plastic		----	Silt
50	2	5-7	37	Non-Plastic		----	Silt
84	1	0-2	53	Non-Plastic		----	Silt
91	4	10-11.5	36	Non-Plastic		----	Silt

4.5 Organic Content

Three organic content tests were performed on selected soil samples in accordance with ASTM D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic

Soils. These tests were conducted to determine the ***quantity*** of organic matter in the material ***by weight***. The results of these tests are presented on the test boring logs. The percentage of organics shown in the narrative on the test boring logs is the percentage ***by volume,*** visually estimated in the field.

Table 3: Organic Content Tests

Test Boring/Pit No.	Sample No.	Sample Depth (ft)	Organic Content (%)
52	1A	1.0-2.0	4
86	1A	0.5-2	16
110	2	3-3.5	62

4.6 Maximum Soil Density (Proctor)

Twelve modified proctors were performed in accordance with one of three test methods:

AASHTO T-180B - Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop, Method B

ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

ASTM D4253 - Maximum Index Density of Soils - Vibratory Table

These tests are designed to determine the relationship between water content and dry unit weight of soils using laboratory compaction procedures. These tests provide the basis for determining the percent compaction and water content needed to achieve the required engineering properties for the project.

Table 4: Proctor Tests

Test Boring No.	Sample No.	Depth (ft)	Maximum Index Density (pcf)	Optimum Moisture Content (%)	*In-Situ* Moisture Content (%)
15	1	0.5-3	156.5	4	5
31	1	0-3	115	13	7
55	1	0.3-2.5	148.5	4	6
90	1	0.3-3	148.5	5	6
103	1	0-3	154.5	3.5	4
116	1	0.3-3	142	6	10
122	1	0-3	141	5.5	13
129	1	0.2-3	147	5	6
134	1	0.2-3	151	5.5	6
146	1	0.3-3	159	4.5	6
150	1	0-3	150	----	5
155	1	0.6-3	147.5	3.5	7

5.0 ENGINEERING ANALYSIS AND GENERAL RECOMMENDATIONS

This section of the report includes interpretations and opinions concerning the interaction of the planned development with the surface and subsurface conditions detected by the field exploration and laboratory tests. It reflects an evaluation of the data collected during the field exploration and soil laboratory tests, and an understanding of the planned development. The analysis is valid for the data collected within the scope of work. The collection of additional data, or a change in the development plans, could provide information, which would alter some or all the interpretations and opinions expressed herein.

These general recommendations are based on professional judgment and experience and the data collected during the site exploration and soil laboratory tests. These recommendations generally are not the only design options available; there may be several acceptable alternatives. These recommendations are not intended to represent the only way, but rather to indicate one appropriate option based on the information available.

5.1 Existing Roadway Section

The existing roadway consists of two 10-foot-wide paved travel lanes with two-foot-wide paved shoulders. Along the majority of the alignment, vegetation has been cleared along both sides of the road with guardrail in areas lacking sufficient safety area.

Along the route, the thickness of the pavement section varied depending on the subsurface conditions. The road section was founded on one or more of the following soil conditions; floodplain deposits of soft silts and loose sands, alluvial deposits of sands and gravels, and bedrock. On average, the road section appeared to consist of the following:

- three inches of asphalt pavement, over
- three feet of Selected Material, Type A, over
- Selected Material, Type B as needed.

No crushed aggregate base course was encountered during the field explorations. In a number of areas, it appeared that Type A material had degraded to Type B. The road embankment appears to have been constructed after the removal of the surficial organics. Any settlement that likely

occurred over the years due to the soft, floodplain deposit was probably addressed during pavement repairs over the years.

5.2 New Embankment

The new embankment should be designed and constructed utilizing appropriate procedures that account for anticipated traffic loads that may increase during the life of the road, as well as variable soil conditions along the alignment. The method should account for the reduction in subgrade soil strength during annual spring thaw, acknowledging that differential frost heave may not be eliminated.

Current plans for the flexible pavement design for this project will follow what was previously done on other sections of the highway for design continuity. The overall design follows the procedure in the AASHTO Guide for Design of Pavement Structures in conjunction with an analysis using BERG2, developed by DOT&PF. The design is based on the project design life and anticipated traffic loads for that period, the roadbed material at the site, and the annual depth of frost, estimated to be a maximum of two feet. Since the roadbed material will vary from bedrock to frost susceptible silts, the thickness of the road section will vary. Figure 2 shows the typical section for the roadway.

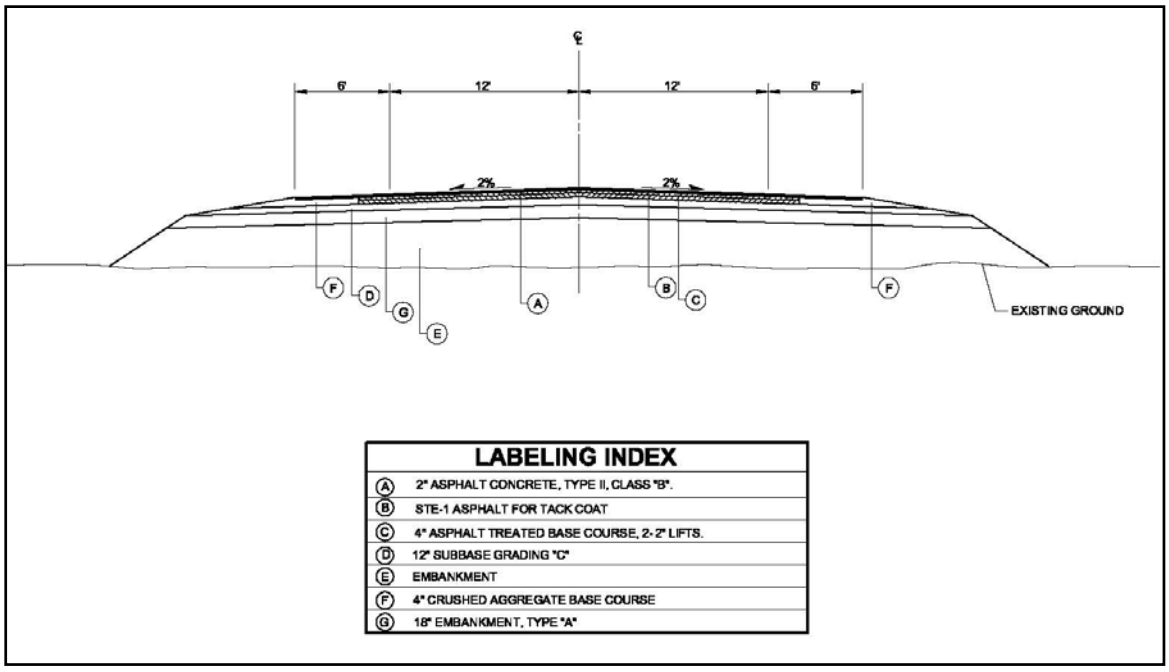

Figure 2: Typical Pavement Section

5.3 Excavation

Excavation. All existing fill, peat, organic silt, and frozen soil should be removed from beneath the embankment and replaced with Selected Material. In some locations, fill material varies in depth from less than three feet to more than eight feet. Much of this fill has been in place for decades. The blow counts in the fill material are generally 20 or higher, and the material appears to meet or exceed the requirements for Selected Material Type B. Therefore, it does not appear to be advantageous or economical to remove all of the existing fill, nor does it appear that complete removal and replacement of all fill will significantly improve the long-term performance of the road section. Therefore, where site grades remain close to existing grades, we recommend that fill material sufficient to construct a three-foot pavement section be removed. The exposed underlying fill material should then be scarified and compacted as specified herein and viewed as the subgrade.

Reuse of Material. Much of the existing fill along the alignment will be reusable in deeper excavations as Selected Material, Type B embankment. The peat, organic silt, and any debris are not reusable and should be wasted off-site. Some of these materials might be suitable for processing to provide topsoil for use within the project.

Surcharge. In some areas, the roadway embankment will be constructed over soft floodplain deposits and elastic settlement is likely. In order to reduce the potential for settlement, one option is to surcharge these areas. This generally requires the placement of sufficient gravel to bring the traffic area to grade (estimated to be about three to six feet) plus an additional two to three feet of gravel. The additional gravel would remain in place for one to two months and the amount of settlement monitored. Once the surcharge is removed, final grading and paving could occur.

Settlement monuments consisting of rebar placed after the surcharge in place can be used to monitor the rate of settlement of the soft material during the construction window. By monitoring actual settlements, reasonable decisions regarding paving and annual maintenance can be made.

Excavation in Sands/Gravels. For excavations where the pavement section is expected to be founded on sands and gravels (GP, GM, SP, SM), the excavation should be made utilizing a

backhoe with a smooth-bladed bucket from outside the excavation to minimize disturbance of the subgrade soils. Soils, which are disturbed, pumped, or rutted by the construction activity, should be re-densified as outlined herein, if possible, or completely removed and replaced with structural fill.

Excavation in Silts. For excavations where the pavement section is expected to be founded on silty soils (ML), the approach to excavation is similar to what was previously described. However, pumped or rutted silts are difficult to impossible to recompact when wet or disturbed. There were a number of samples recovered that classified as "non-plastic" yet had very high moisture contents. The soils will be difficult to impossible to compact, will not be able to support heavy loads, will settle, and will have a tendency to pump. In most cases, once disturbed, these soils must be over excavated. These types of soils will be encountered on both sides of the road from the start of the project to about MP 17.5.

Running Sands. Clean sands can present difficulties when excavating below the water table. The sands may be stable when confined by surrounding soils, but seepage forces can create a "quick" condition and wash the sands into the excavation, resulting in slumping and caving of the sides. This phenomenon is locally referred to as a *running sand* or *heaving sand* condition, and can greatly increase the size of an excavation. Deeper excavations may encounter this condition.

The condition can be controlled by drawing the elevation of the water table down to below the bottom of the planned excavation, and with an appropriate dewatering system prior to excavation, maintain the dewatering until the backfill is above the level of the water table.

Clearing and Grubbing. Cut all trees and brush to a maximum height of six inches above the existing ground surface, and a distance of 10 feet beyond slope limits. Remove all woody debris, organics and other objectionable material to an appropriate disposal site outside the project area. Any holes due to extraction of stumps, roots, or other material should be backfilled with Selected Material.

Geotextiles. A geotextile is used to permanently separate two distinct layers of soil in a roadway. For this project, a separation/stabilization geotextile such as LINQ GTF-300, Propex 2006, or equivalent could be used where Selected Material will overlie soft silts.

Frozen Soils. Do not place fill or asphalt pavement over frozen soils. Do not fill or backfill with frozen soils. All frozen soils encountered within the roadway section must be removed.

Selected Material. Two different materials may be used to construct portions of the road embankment; Selected Material Type A and Type B.

At a minimum, the upper 2.5 feet of the subbase should meet the gradation shown in the DOT&PF Standard Specifications for Highway Construction, Table 703-2.07, Selected Material, Type A.

In deeper excavations, Selected Material Type B may be used, as outlined in the DOT&PF Specifications Book, Section 703-2.07, Selected Material, Type B.

Fill Placement. Selected Material should be placed and compacted in lifts not exceeding eight inches in thickness. Each lift of structural fill should be compacted throughout its entire depth to a density of at least 95 percent of the laboratory maximum index density determined in accordance with AASHTO T 180, Method D (Modified Proctor) or Alaska T-12. All excavations should be dewatered before placement of structural fill.

Where the initial lift of fill is situated on soft silts, the lift thickness should be increased to a minimum of 18 inches. The compactive effort should also be reduced to 90 percent. This thicker lift and lower compactive effort helps to reduce the potential for pumping of the soils.

Fill Limits. Structural fill beneath the pavement section is constructed as a prism. The structural fill should extend laterally from the edge of the pavement one foot for each foot of fill beneath the pavement.

Fill Testing. Frequent, in-place density tests (Alaska T-3 or T-11) should be performed in each lift of fill to verify that the fill has been properly compacted prior to placing subsequent lifts. The number of tests performed in each lift should be commensurate with the size of the area

worked by the contractor, the variability of the soil types used as fill, and the amount of time an inspector spends on site observing the work.

5.4 Dewatering and Drainage

The reconstruction of the alignment and the construction of realignment areas must take surface drainage into account. As the Haines area receives more than 50 inches of rain a year, surface drainage is a significant concern as runoff can interfere with traffic, cause erosion, or damage the subgrade.

Dewatering. Depending on the measured depth of the groundwater table, the planned construction, and the weather at the time of construction, construction dewatering may be necessary in deeper excavations. Groundwater can likely be removed from excavations with the use of pumps. High infiltration rates of groundwater may require the use of well points or alternate techniques. It is essentially impossible to adequately place and compact structural fill if there is standing water in an excavation. Therefore, it is important that water be removed from excavations until they are properly backfilled. It should be the contractor's responsibility to determine the appropriate dewatering techniques for construction methods he chooses to use and for the soil and water conditions encountered.

Drainage. The surface water gradient follows the topography. Culverts should be installed periodically along the toe of the embankment to allow for passage of surface runoff. The designer should verify that the culverts could accommodate flood flows to avoid damming along the embankment. Surface drainage should be designed to collect and to carry precipitation and snowmelt away from the road surface.

Surface runoff will likely be present around most excavations and may impact construction efforts. Small shallow trenches or soil berms on the up-slope sides of the excavation can be used to help channel water away from the excavation area.

5.4.1 Runoff

Runoff can be removed from the sides of the alignment by the use of ditch lines, ditch relief culverts, or in-sloping or out-sloping the road surface.

Ditch lines. Surface runoff is a significant consideration for construction of the roadway. The existing alignment typically has a drainage ditch parallel to the road on the up-slope side. The depth and width of the ditch line varies depending on terrain. In areas of the alignment where a hill or cut face abuts the road section, drainage ditches should be constructed to accommodate higher quantities of runoff and should be a minimum of one foot deep. Areas where the topography is flat and more open could have shallower ditch lines. The ditch lines would then parallel the road until a ditch relief culvert in encountered.

Ditch Relief Culverts. Ditch relief culverts are placed periodically along the alignment to intercept the flow of water in the ditch lines. These culverts pipe water to the opposite side of the road where the flow disperses away from the pavement section. The spacing of ditch relief culverts depends on the road gradient, road surface and ditch soil types, runoff characteristics, and the effect of water concentrations on slopes below the road.

5.4.2 Groundwater

Some test pits and test borings encountered shallow groundwater along the existing road alignment. It should be anticipated that locally low areas where the vegetation consists of muskeg, would have a high water table. Some of these areas include:

- Stations 280+00 - 290+00 (Plan Sheets 3 and 4),
- Stations 510+00 – 532+00 (Plan Sheets 12 and 13),
- Stations 732+-00 to 740+00 (Plan Sheet 21), and
- Stations 813+00 – 828+00 (Plan Sheet 24)

In general, along the alignment, groundwater will tend to flow in one of three areas:

- along the peat/soil interface in areas of poor drainage (TB 38 – Plan Sheet 12)
- through the alluvium (sands and gravels) (TPs 159 and 156 – Plan Sheet 41)
- along the soil/bedrock interface

The water level will tend to fluctuate by several feet seasonally, especially during periods of heavy precipitation and spring “break-up.”

5.5 Soil Slope Stability

Temporary cut slopes and trenches in both granular and fine-grained soils have been known to stand temporarily at very steep angles; however, they also have been known to fail suddenly and without warning thereby claiming lives. It is the responsibility of the contractor to determine appropriate temporary cut slopes or shoring for excavations and trenches for the site soils, water conditions, and surface loading conditions. As a minimum, the contractor should be in full compliance with all appropriate federal, state, and local safety requirements for trenching and shoring.

Permanent cut slopes in soil should be no steeper than 2:1 (horizontal:vertical), and should be protected from surface erosion as soon as possible after cutting. Permanent erosion protection may be accomplished with healthy landscaping such as grass, plants, or coarse gravel. Temporary protection with plastic sheets, straw, wood cellulose fiber mulch, or jute matting may be required if heavy rains occur before the plants are established.

5.6 Excavations in Rock

There are a significant number of areas where bedrock will require removal along the alignment. This investigation indicates that the bedrock will require blasting. Much of the blasted material should be reusable as roadbed material, if care is exercised during blasting. It is important that the blasting be done by a qualified licensed blaster with at least three years experience in the Haines and Southeast Alaska.

The blasting program should be designed to produce a neat cut face with minimal over-blast and loosening of the finished rock face. The blasting program should be designed to generally produce shot rock with a gradation that varies from sand sized particles to stones no larger than 12 inches. Pre-split blasting may be necessary. Any rock in the finished face of the cut loosened by blasting should be removed to control the potential for falling rock and debris at the toe of the slope before the excavation progresses downward. A plan should be in place for the control of flyrock to ensure the safety of the workers.

5.6.1 Cut Slopes in Rock

Fifty baselines were mapped. In addition, kinematic analyses were performed on the existing slopes and on 0.5:1 and 0.25:1 (H:V) slopes. The analyses show that in some areas there is a potential for planar, wedge, or toppling failures to occur as the slopes become steeper. Discussions with DOT&PF personnel were held to identify general practices in Southeast regarding back slopes, catchment widths, and benching. Based on these discussions, the rock type encountered along the alignment, and examples of similar rock cuts across Southeast, we recommend the following:

- Back slope - 0.25:1
- Catchment Widths - varies based on slope height and 80 percent retention
- Benching - 1.5- to 2-foot benches every 30 feet

Slopes cut into the competent bedrock should stand nearly vertical with pre-splitting. However, the bedrock is variable in its quality and fracture frequency. A rock slope cut in highly fractured bedrock may not have the integrity to stand nearly vertical. Each rock cut, after blasting, will need to be evaluated for its stability and appropriateness of the selected slope. The contractor should be prepared to employ stabilization methods, if necessary.

Any overburden at the top of the rock cut should be removed for a minimum distance of 10 feet from the face of the rock and then laid back at a 2:1 slope. A clear zone should be maintained at the toe of the rock cut to protect the public from falling rock and debris. All overburden exposed at the top of the cut should be seeded as soon as is practical after the cut is made to control erosion of the soil.

5.6.2 Rock Slope Stability

Several modes of slope instability were evaluated using Rockpack III, including sliding out of the plane of the cut face and toppling. The bedding planes of the rock units and joint sets were also evaluated to determine if sliding of the rock along those planes is possible or if wedge-type failure modes were possible. The analyses were performed on the existing slope angle as well as slope angles of 63º and 76º. The results of these analyses are provided in Volume II, Geologic Mapping and specific recommendations are provided in Section 6.0, Station-to-Station

Descriptions. It should be noted that the kinematic analyses performed only indicate the potential for rockfalls, are based on generalized data, and are subjective.

There may be local areas of instability at the face of the cuts due to joints and fractures that may become exposed during blasting and excavation. If subsequent investigations show these local areas of instability, the face of the cut should be laid back to safe slope as determined. With cuts in rock, there is also a possibility of local wedge-type failures at the intersection of joint sets and fractures as the rock is excavated. Any zones of local instability should be removed as the excavation progresses or stabilized with rock anchors drilled into stable rock behind loose zones.

5.6.3 Rock Catchment Ditches

At the base of slopes, rock catchment ditches should be constructed (Figure 3). The appropriate width and depth of the ditch depends on the discontinuities of the rock slope, the height of the rock face, and the percentage of rocks retained. Table 5 provides general recommendations based on 0.25:1 slopes, but it should be recognized that some site-specific changes may be required, depending on the resultant rock face. Recommendations based on maximum slopes are provided in the Station-to-Station Descriptions.

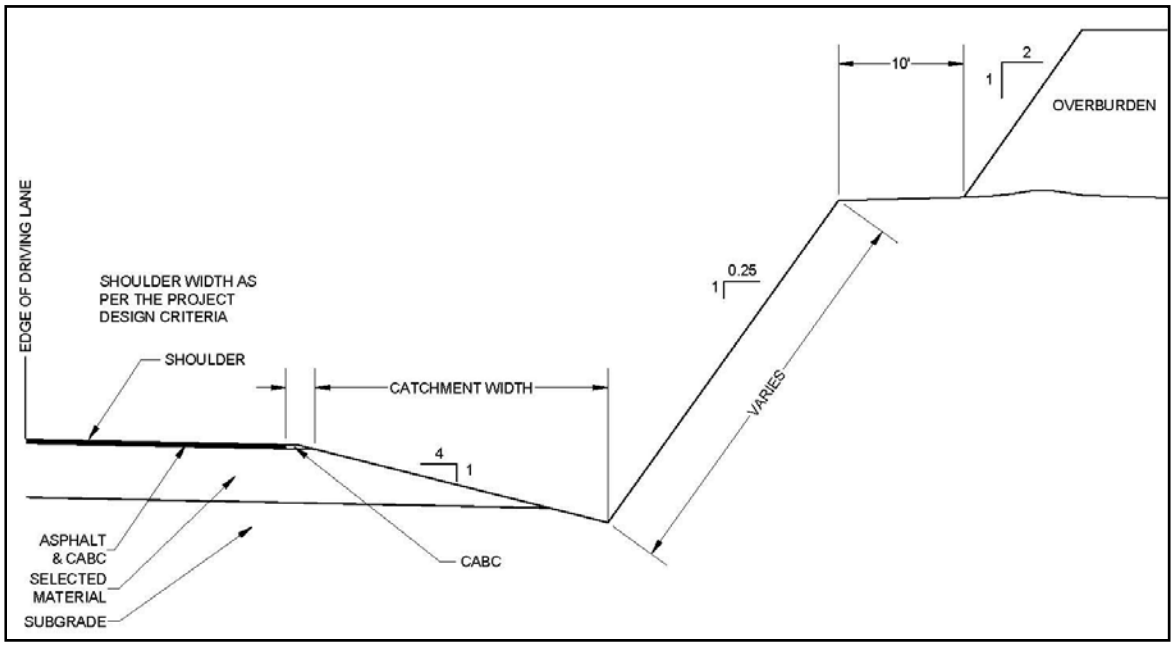

Figure 3: Rock Catchment Ditch

Table 5: Catchment Ditches

Slope Ratio (H:V)	Rock Slope Height (ft)	(80% Retained) Catchment Width (ft)	Catchment Depth at 4:1 (ft)
0.25:1	40	7*	1.75
0.25:1	50	10*	2.5
0.25:1	60	12.5	3.13
0.25:1	70	15	3.75
0.25:1	80**	18	4.5***

* Catchment widths less than 12 feet require guardrail per design criteria for clear zones.
** Add three feet of catchment width for every 10 feet of rock slope height over 80 feet.
*** Catchment depth increases 0.75 feet for every 10 feet of rock slope height (i.e., 200-foot rock slope height = catchment 54 feet wide and 13.5 feet deep.

5.6.4 Access

During the geologic mapping phase, each baseline area was investigated for equipment access routes to the top of the slopes. It was assumed that access would be required for blasting. Areas where potential routes were identified are shown on the Plan and Profile Sheets as arrows.

5.7 Rock Stabilization Methods

Once the slopes have been laid back to their design slopes, the new rock face may indicate localized areas of instability. Stabilization of these areas may be required however; the method of stabilization will likely vary from one location to the next. In general, there are three categories of stabilization:

- Reinforcement
- Rock removal
- Protection

The decision regarding which method to use must address construction issues such as cost, required equipment, access, as well as topography and environmental issues. There is no one method that addresses all instabilities.

5.7.1 Reinforcement

If the cause of instability is potentially loose rock, reinforcement may be required. There are a number of different methods to use. Each has its own advantages and disadvantages and is appropriate under certain circumstances. Figure 4 shows the different methods that can be used for reinforcement to include:

- Rock Bolts – Tensioned to prevent further movement or sliding along the fracture face. Installed across potential failure areas or anchored into competent rock.
- Dowels – Untensioned bolts grouted at the crest of a cut before excavation. Adds stability beforehand to help prevent the rock from moving along the fracture zones. Quicker installation and lower cost than rock bolts.
- Tieback Walls – These types of walls are good for areas where there is a sliding failure in fractured rock. A reinforced concrete wall is constructed over the fracture area and then reinforced rock bolts are placed through the wall and into competent rock. This prevents raveling of the fractured rock over time.
- Shotcrete – The primary purpose of shotcrete is to protect the face of the slope from degrading rock or very closely spaced fractured areas. However, it does not protect against sliding failure. The use of shotcrete should include reinforcement with either welded-wire mesh or steel fibers. Weepholes must be drilled to prevent the buildup of water.
- Buttresses – There are areas where weak rock may fall, creating a cavity. Buttresses can be constructed, where concrete is used to fill the cavity. This protects the weak rock and supports the overhanging rock, preventing further failure. In order for the buttress to perform well, the top of the buttress must be in contact with the rock above and the buttress must be formed such that the rock above supports the buttress in compression.
- Drainage – One of the most common causes of slope failure is groundwater. The typical method of addressing drainage is to drill weepholes into the rock at specified intervals. The weepholes are drilled at the toe of the slope in order to catch water flowing through the fractures and provide an outlet for the water. The angle of the weepholes will vary from exposure to exposure and should be drilled so that they intersect the discontinuities dipping from the rock face.

If excessive runoff flows from the top of the slope and into large fractures, other methods to control drainage could include filling the cracks with shotcrete, or constructing lined drainage ditches at the top of the slope to intercept water and route away from the area.

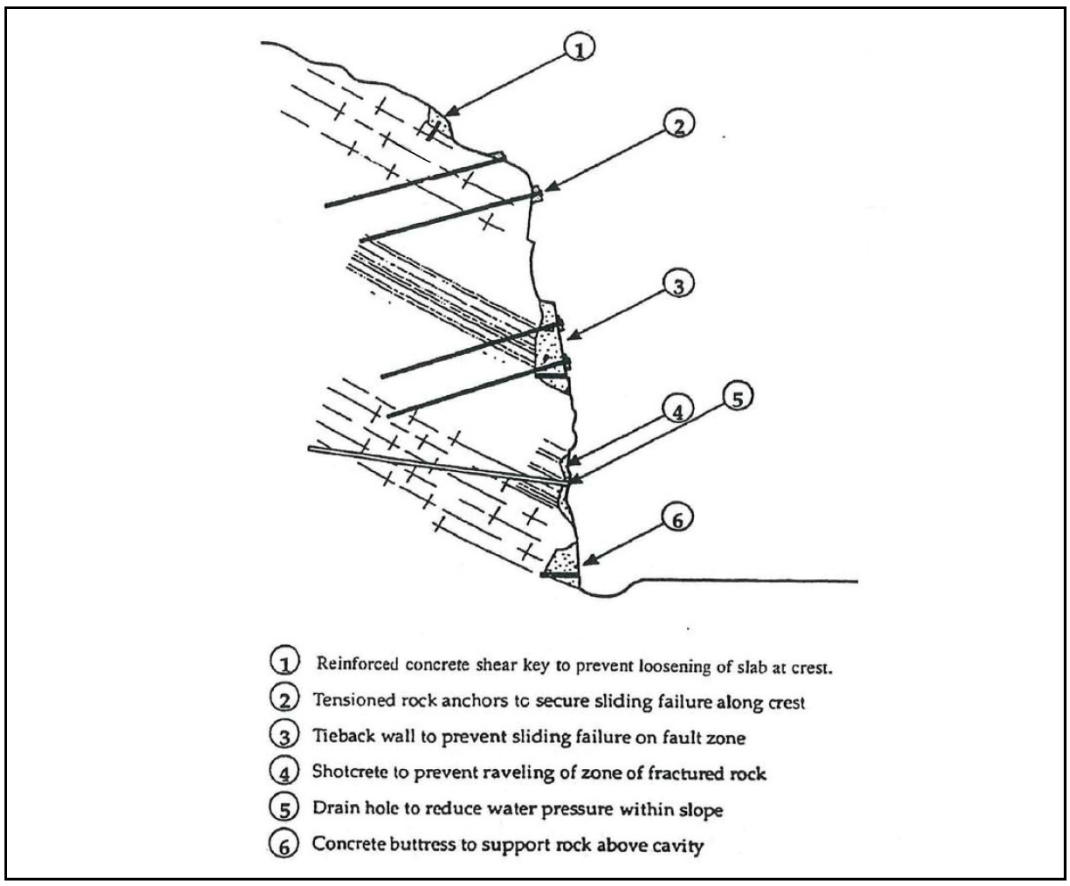

Figure 4: Reinforcement Methods (Wyllie and Mah, 1998)

5.7.2 Rock Removal

There may be areas where there is potential unstable rock and removal is the best option. Typically this can be done in one of three ways and depends of the cause for the instability:

- Resloping. This is primarily done on the upper portions of slopes where weathered rock or overburden is present. If material is not removed for a sufficient distance back from the slope, this adds an unnecessary load to the rock face.
- Trimming. There are occasions where rock will form an overhang on a rock face due to previous failures or weathering. In this case, removal of the rock should be done to prevent future failure. This can be done with controlled, cushioned blasting that only removes small areas of rock.
- Scaling. In areas where there is small rock raveling or vegetation that must be removed, personnel with chain saws and bars can scale from the top of the slope using ropes to

remove these areas. On short slopes, mechanical lifts from the base of the slope can be used.

These methods are shown on Figure 5 below.

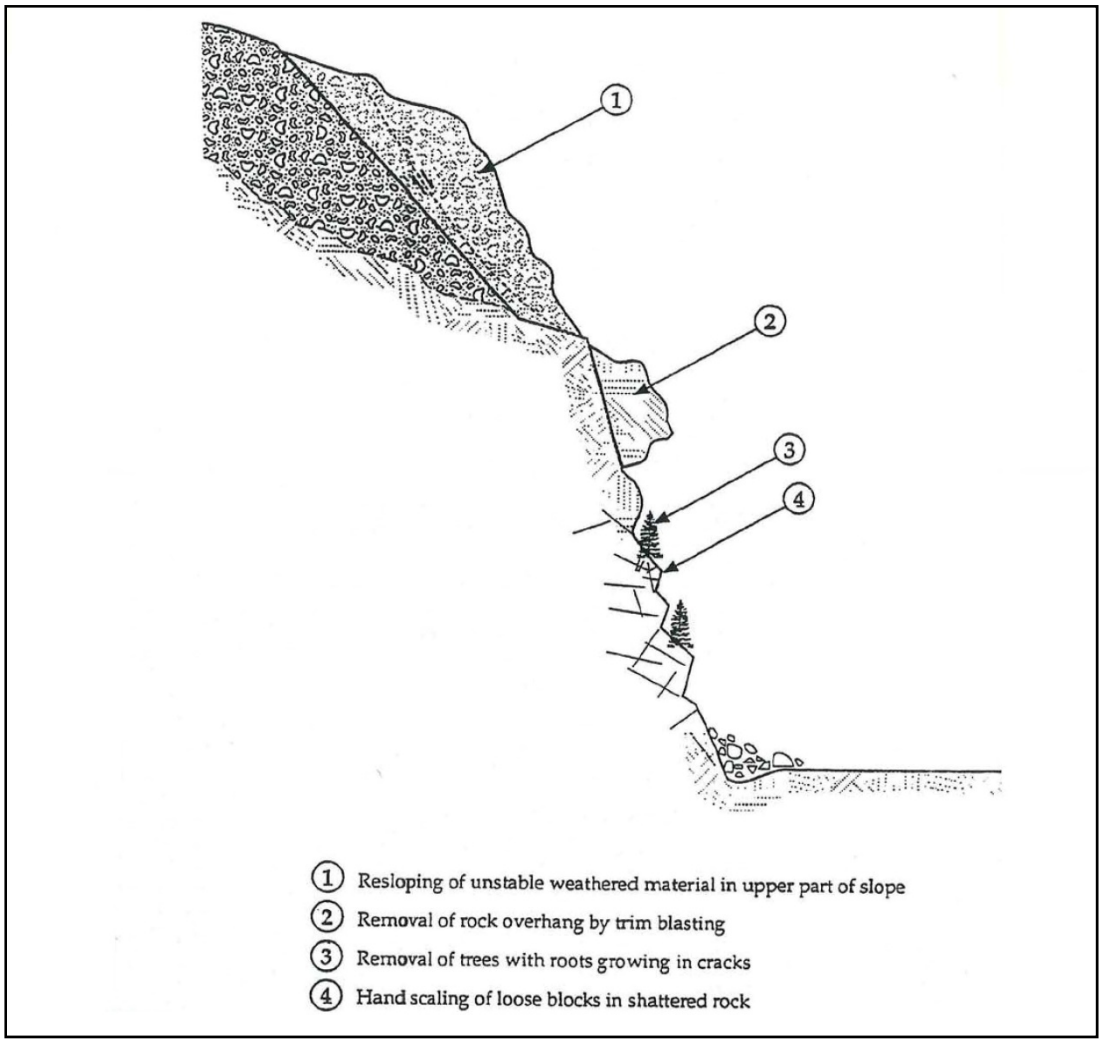

Figure 5: Rock Removal (Wyllie and Mah, 1998)

5.7.3 Protection

In many instances, allowing the rock to fall, but preventing it from impacting traffic or moving too far from the slope is the best option. There are numerous methods that can be used to protect the public from the rock falls. Methods include catchment ditches, mesh hanging from the slope, and barriers some distance from the toe of the slope. The use of the protection must include an analysis into the type of rockfall in order to determine the most appropriate protection measure to employ.

6.0 STATION TO STATION DESCRIPTIONS

6.1 Station 204+00 (BOP) to 235+00 (Sheets 1 and 2 of 44)

This section of the roadway falls within a culturally sensitive area. Permission to access the area for drilling or excavating was not obtained before the Phase I and Phase II fieldwork were completed, and to date, no subsurface exploration has been performed. Test Borings/Pits 1 through 5 have been moved to a future Phase III.

6.1.1 Topography

This section is level and the road extends around a bedrock hill, adjacent to the Chilkat River.

6.1.2 Vegetation

Both sides of the road have been previously cleared. The cleared distance varies depending on which side of the road and topographical features, such as bedrock outcrops, but in general, the cleared setback is at least ten feet. Grass and occasional low shrubs were observed.

6.1.3 Surface Drainage

Ditchlines are present on both sides of the road although occasionally overgrown. Drainage tends to flow from the north to the south.

6.1.4 Proposed Alignment

The new road section will be widened but will still follow the current alignment through a majority of this section. At Station 220+00, the roadway will deviate to the north from the existing section, and cut into the bedrock hill.

6.1.5 Bedrock

Baselines 1 and 2 were completed in this section. The measured discontinuities are as follows:

Table 6: Baseline Data (Station 204+00 – 235+00)

Baseline No.	No. of Joints	Dip Direction (Degrees)	Dip Angle (Degrees)
1	4	125 - 324	25 - 72
2	8	55 - 230	12 - 50

Kinematic analyses indicate that the potential for wedge, sliding, or toppling failures increases for slopes steeper than 50 degrees. Large pieces of rock do fall from the face periodically. A rockfall was observed this spring when a boulder approximately two feet in diameter fell from a distance of about 15 feet at Station 225+00. The rockfall was an impact type fall and retained by the existing catchment.

Recommendations

1. At least one or two test borings should be drilled in this area to confirm suspected subsurface conditions below the roadway.

2. The rock slope angles and catchment depths for this section of the alignment are as follows:

Table 7: Rock Slopes/Catchment Depths (Station 204+00 – 235+00)

Begin Station	End Station	Existing Rock Slope Height (ft)	Existing Slope Angle (degrees)	Existing Slope Ratio (H:V)	Maximum Proposed Rock Slope Height (ft)	Proposed Slope Ratio (H:V)	(80% Retained) Catchment Width (ft)
220+50	226+50	40	49 - 69	0.75:1 to 0.50:1	35	0.25:1	7

3. Water seeps were not observed in the rock faces so weephole locations have not been specified. New rock slopes should be carefully examined for water seeps after a heavy rainfall. As a precaution, weepholes could be installed every 20 to 30 feet along the base of the slope face.

6.2 Station 235+00 to 400+00 (Sheets 2 through 8 of 44)

Within this section, 10 test borings (TBs 9–14, 16, 17, 22, and 23) were completed off both sides of the existing roadway, five test borings (TBs 15, 18–20, and 29) were drilled in the roadway, and TB 25 was drilled on the gravel road shoulder. Test Borings 6–8, 21, 24 and 27 were not drilled and Test Pits 26 and 28 were not excavated.

6.2.1 Topography

This section is level and winds along the Chilkat River at the base of the hills between elevation 25 feet and 35 feet.

6.2.2 Vegetation

Both sides of the road have been previously cleared for a distance of about 10 to 20 feet. Secondary brush is present in some areas.

6.2.3 Surface Drainage

Ditchlines are present in select areas. However, the road section is built up such that the road slopes away from centerline. Drainage tends to flow from the north to the south. At Stations 316+00 and 338+00, heavy flood flows during the winter-transported gravels, sands, and silts down the mountainside and onto the roadway. Remnants of the debris are evident as clogged ditchlines adjacent to the road and newly deposited gravels on the opposite side of the roadway.

Waterfalls over the rock face at Stations 313+08 and 324+34 were observed. Water seeps in the rock face were observed at Station 331+05.

6.2.4 Proposed Alignment

This section of the new roadway is a series of minor realignments while still generally following the current roadway. At Station 301+00, the widening of the road will result in scaling the rock face back less than five feet. At Station 325+00, the roadway deviates slightly to the north from the existing section, and cuts into the bedrock slope a distance of about 30 feet. At Station 375+00, the roadway deviates slightly to the north from the existing section, and cuts into the bedrock hill about 15 feet.

6.2.5 Subgrade Soils

The existing road is a fill section. Poorly and well-graded gravels ranging in thickness from three feet to seven feet have been placed over the floodplain deposits of silts, sands, and silty sands. Off the sides of the road section, peat is present to depths not observed to exceed two feet. The floodplain deposits in the upper five feet of the soil column have low (less than 10) N –values, and more often, less than five.

6.2.6 Bedrock

Baselines 3 through 11 were completed in this section. A ditchline is located at the bases of the rock faces. The measured discontinuities are as follows:

Table 8: Baseline Data (Station 235+00 – 400+00)

Baseline No.	No. of Joints	Dip Direction (Degrees)	Dip Angle (Degrees)
3	10	0 - 30	42 - vertical
4	8	60 - 336	55 - 85
5	5	140 -336	60 - 77
6	11	36 - 336	28 - 81
7	3	225 - 331	50 - 76
8	6	254 - 320	50 - 82
9	9	251 - 340	48 - 86
10	3	50 - 330	62 - 75
11	6	15 - 304	55 - vertical

Kinematic analyses indicate that the potential for wedge, sliding, or toppling failures increases for slopes steeper than 56 degrees. Large pieces of rock fall from the face periodically.

6.2.7 Groundwater Conditions

Within the existing roadway, the groundwater elevations were observed or measured within the upper five feet of the soil column.

Table 9: Groundwater Measurements (Station 235+00 – 400+00)

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (Nov. 16, 2005 April 24, 2006 April 29, 2006) Depth to Water (ft)	Measured Depth (Nov. 22, 2005 April 27, 2006 May 1, 2006) Depth to Water (ft)
9	19.5	5.5	No PVC
10	19.5	5.5	1
11	25	0	0
12	23	4	No PVC
13	28	1' above ground surface	No PVC
14	27	0	No PVC
15	24	4	1
16	27	0	No PVC
17	22	5	1.5
18	23	5	5.5
19	23	7	2
20	22	8	5
22	28	0	No PVC
23	28	0	No PVC
25	24	9	7
29	29	5	6.5

Recommendations

1. Drainage should be improved in the vicinity of Stations 316+00 and 338+00, where heavy rainfall transports large quantities of water and soil into the ditchline and across the road. This could be accomplished with oversized culverts and deeper ditches.

2. In the vicinity of Stations 240+00, 260+00, 345+00 and 390+00, much of the new roadway will be constructed over soft floodplain deposits with the overall site grades raised by three feet or more. Settlement on the order of two to four inches could occur due to the placement of the gravels. In order to reduce the potential for cracking of the asphalt, fill should be placed early during the construction sequence and paving should be one of the last items completed. This will allow as much settlement as possible to occur before the pavement is placed. It should be assumed that about half of the total settlement would occur before the paving is placed if this sequence is followed. An alternate method of construction is to surcharge with two to three feet of gravel until monitoring indicates the surcharge can be removed.

3. The rock slope angles and catchment depths for this section of the alignment are as follows:

Table 10: Rock Slopes/Catchment Depths (Station 235+00 – 400+00)

Begin Station	End Station	Existing Rock Slope Height (ft)	Existing Slope Angle (degrees)	Existing Slope Ratio (H:V)	Maximum Proposed Rock Slope Height (ft)	Proposed Slope Ratio (H:V)	(80% Retained) Catchment Width (ft)
301+50	304+00	60	63 - 65	0.50:1	70	0.25:1	15
306+00	308+50	30	45 - 56	0.75:1 to 1:1	30	0.25:1	5
312+00	315+00	50	70	0.33:1	45	0.25:1	10
319+00	321+50	45	55	0.75:1	55	0.25:1	12
322+00	334+00	40 - 50	54 - 69	0.75:1 to 0.50:1	65	0.25:1	14
376+00	384+00	25 - 35	51 - 68	0.75:1 to 0.50:1	65	0.25:1	14

4. Water is seeping through the rock near the base of the existing slope at Station 331+05. Weepholes should be installed through this section. The weepholes should be spaced at 10-foot intervals at least 10 feet deep at a shallow angle that intersects the discontinuities. The holes should be lined with perforated casing.

5. In areas where water seeps were not observed in the rock faces, weepholes could be installed every 20 – 30 feet along the base of the slope face as a precaution. New rock slopes should be carefully examined for water seeps after a heavy rainfall.

6.3 Station 400+00 to 520+00 (Sheets 8 through 13 of 44)

Within this section, six test borings (TBs 38–43) were completed off both sides of the existing roadway, five test borings (TBs 30, 32–34, and 37) were drilled in the roadway, and two test borings (TBs 31 and 35) were drilled on the gravel road shoulder. Test Pit 36 was not excavated.

6.3.1 Topography

The topography of this section is similar to the previous section, winding along the Chilkat River at the base of the hills between elevation 35 feet and 45 feet.

6.3.2 Vegetation

Both sides of the road have been previously cleared for a distance of about 10 to 20 feet. Secondary brush is present in some areas. Beyond the road prism and clear zones, the area is well forested with old growth trees.

6.3.3 Surface Drainage

Ditchlines are present in select areas. However the road section is built up such that the sides slope away from both sides of the road. Drainage tends to flow from the north to the south. Between Station 453+00 and 454+00, heavy flood flows during the winter-transported gravels, sands, and silts down the mountainside and onto the roadway in this area. Remnants of this debris are evident as clogged ditchlines adjacent to the road and newly deposited gravels on the opposite side of the roadway.

A waterfall over the rock face at Station 461+00 was observed. No water seeps in the rock face were noted through this section of the alignment.

6.3.4 Planned Alignment

The new road section will be widened but will still follow the current alignment through a majority of this section. Between Stations 402+00 and 413+00, the road begins to deviate to the

south about 30 feet into the Chilkat River. Other minor alignments where the road cuts into the bedrock to the north occur:

- Between Station 428+00 and 436+00, cutting into the bedrock a maximum distance of about 60 feet,
- Between Station 457+00 and 484+00, cutting in the bedrock a maximum of 50 feet, and on average, less than 30 feet.

6.3.5 Subgrade Soils

The existing road is a fill section. Poorly and well-graded gravels ranging in thickness from 2.5 feet (Test Boring 32) to 10 feet (Test Boring 30) have been placed over the floodplain deposits of silts, sands, and silty sands. Off the sides of the road section, peat is present to depths from two or three inches to five feet (Test Boring 38), but averages less than one foot. The floodplain deposits in the upper five feet of the soil column have low (less than 10) N –values, and more often, less than five. Bedrock was encountered in several of the test borings as shallow as 2.5 feet.

6.3.6 Bedrock

Baselines 12 through 23 were completed in this section. The slope of the bedrock varies from 37 degrees to 71 degrees. Ditchlines are located at the base of the rock faces. The measured discontinuities are as follows:

Table 11: Baseline Data (Station 400+00 – 520+00)

Baseline No.	No. of Joints	Dip Direction (degrees)	Dip Angle (degrees)
12	7	45 - 350	40 - 70
13	7	5 - 330	10 - 81
14	3	40 - 325	50 - 85
15	10	12 - 355	15 - 70
16	6	269 - 345	15 - 74
17	3	185 - 340	37 - 51
18	13	40 - 340	18 - 78
19	7	0 - 305	40 - 85
20	10	234 - 325	17 - 88
21	11	35 - 326	20 - 75
22	3	55 - 338	50 - 87
23	14	157 - 322	38 - 75

Kinematic analyses indicate that the potential for wedge, sliding, or toppling failures increases for slopes steeper than 56 degrees. Large pieces of rock periodically fall from the face.

6.3.7 Groundwater

Within the existing roadway, the groundwater elevations were observed or measured within the upper five feet of the soil column. In the table below, "N.O." signifies that groundwater was "not observed" while drilling.

Table 12: Groundwater Measurements (Station 400+00 – 520+00)

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (Nov. 17, 2005, April 23, 2006 through May 1, 2006) Depth to Water (ft)	Measured Depth (Nov. 22, 2005 and April 23, 2006) Depth to Water (ft)
30	28	8	8.5
31	26	4	No PVC
32	----	N.O.	No PVC
33	----	N.O.	N.O.
34	----	N.O.	No PVC
35	----	N.O.	No PVC
37	----	N.O.	No PVC
38	35	N.O.	5
39	35	5	No PVC
40	35	5	No PVC
41	35	5	No PVC
42	35	5	No PVC
43	35	5	No PVC

Recommendations

1. Drainage should be improved between Stations 453+00 and 454+00, where heavy rainfall transports large quantities of water and soil into the ditchline and across the road.

2. The rock slope angles and catchment depths for this section of the alignment are as follows:

Table 13: Rock Slopes/Catchment Depths (Station 400+00 – 520+00)

Begin Station	End Station	Existing Rock Slope Height (ft)	Existing Slope Angle (degrees)	Existing Slope Ratio (H:V)	Maximum Proposed Rock Slope Height (ft)	Proposed Slope Ratio (H:V)	(80% Retained) Catchment Width (ft)
426+00	436+00	35	27 - 61	2:1 to 0.50:1	80	0.25:1	18
458+00	462+00	25 - 35	51 - 60	0.75:1	120	0.25:1	30
462+00	468+00	30	45 - 60	1:1 to 0.75:1	60	0.25:1	12.5
468+00	483+00	35 - 60	37 - 71	1:1 to 0.50:1	130	0.25:1	33

3. Between Stations 402+00 and 413+00, 448+00 and 456+00, and 490+00 and 517+00, much of the new roadway will be constructed over soft floodplain deposits with the overall site grades raised by one to five feet. Settlement on the order of two to four inches could occur due to the placement of the gravels. In order to reduce the potential for cracking of the asphalt, fill should be placed early during the construction sequence and paving should be one of the last items completed. This will allow as much settlement as possible to occur before the pavement is placed. It should be assumed that about half of the total settlement would occur before the paving is placed if this sequence is followed. An alternate method of construction is to surcharge with two to three feet of gravel until monitoring indicates the surcharge can be removed.

4. From Stations 402+00 to 413+00, armor or the use of riprap should be considered for the river side of the embankment to reduce the potential for scour from the river. In addition, the planned alignment shows a low road elevation of about 27 feet, which is very close to the elevation of the water in the river. Raising the road grade through this realignment area should be considered.

5. Water seeps were not observed in the rock faces so weephole locations have not been specified. New rock slopes should be carefully examined for water seeps after a heavy rainfall. As a precaution, weepholes could be installed every 20 – 30 feet along the base of the slope face.

6.4 Station 520+00 to 906+00 (Sheets 13 through 27 of 44)

Within this section, 26 test borings (TBs 45–53, 62–67, 76–78, 82–87, 101, 102,) were completed off both sides of the existing roadway, 16 test borings (TBs 55, 57, 60, 61, 71, 74, 81, 88, 90-93, 104, and 107-109) were drilled in the roadway, three test borings (TBs 44, 68, and 103) were drilled on the gravel road shoulder, and two test pits (TP 80, 106) were excavated.

Test Borings 56, 58, 59, 70, 89, and 95 – 100 were not drilled. Test Pits 54, 56, 58, 59, 69, 72 – 75, and 94 were not excavated.

6.4.1 Topography

This section of the roadway deviates from the main channel of the Chilkat River and begins to gain elevation from elevation 45 feet to about elevation 80. The roadway is situated between the mountains and an overflow branch of the river.

6.4.2 Vegetation

Both sides of the road have been previously cleared for a distance of about 10 to 20 feet. Secondary brush is present in some areas. Beyond the road prism and clear zones, the area is well forested with old growth trees.

6.4.3 Surface Drainage

Ditchlines are present in select areas. However the road section is built up such that the sides slope away from both sides of the road. Drainage tends to flow from the north to the south.

No waterfalls or water seeps were noted through this section of the alignment.

6.4.4 Planned Alignment

In this area, the new roadway contains numerous minor realignments and two major realignments required to meet the new design criteria while still generally following the current roadway. Minor realignments are planned at the following stations:

- Between Station 524+00 and 533+00, crossing a low-lying area,
- Between Station 534+00 and 552+00, with a segment cutting into the bedrock a maximum distance of about 30 feet,

- Between Station 612+00 and 623+00, crossing a low-lying area,
- Between Station 643+00 and 662+00, cutting into the bedrock ,
- Between Station 703+00 and 753+00, with some bedrock cuts and crossing a low-lying area,
- Between Station 758+00 and 780+00, cutting into the bedrock,
- Between Station 785+00 and Station 812+00, cutting into the rock about 20 feet,
- Between Station 830+00 and 837+00, cutting into the rock about 30 feet,
- Between Station 840+00 and 851+00, cutting into the rock about 40 feet, and
- Between Station 861+00 and 876+00, cutting into the talus slope.

Major Realignments are planned at the following locations:

- Between Station 665+00 and 692+00, and
- Between Station 879+00 and 906+00.

6.4.5 Subgrade Soils

The existing road through this area continues to be a fill section. Poorly and well-graded gravels ranging in thickness from 2.5 feet to seven feet have been placed over the floodplain deposits of silts, sands, and silty sands. Off the sides of the road section, peat is present to depths from two or three inches to five feet, but averages less than one foot. The floodplain deposits in the upper five feet of the soil column have low (less than 10) N –values, and more often, less than five. Bedrock was encountered in two of the test borings as shallow as 2.5 feet.

6.4.6 Bedrock

Baselines 24 through 55 were completed in this section. The bedrock has a variable slope throughout this area. Ditchlines are located at the base of the rock. The measured discontinuities are as follows:

Table 14: Baseline Data (Station 520+00 – 906+00)

Baseline No.	No. of Joints	Dip Direction (degrees)	Dip Angle (degrees)
24	13	0 - 339	26 - vertical
25	10	3 - 320	28 - 87
26	5	6 - 319	40 - 81
27	12	19 - 325	32 - vertical
28	18	10 - 350	31 - vertical
29	10	195 - 355	51 - 83
30	9	12 - 320	20 - 75
31	14	0 - 350	49 - 81
32	22	0 - 355	17 - vertical
33	4	0 - 331	26 - 89
34	3	55 - 345	59 - 75
35	15	0 - 355	15 - 87
36	22	0 - 358	15 - vertical
37	4	5 - 284	60 - vertical
38	12	45 - 358	27 - vertical
39	14	45 - 334	1 - vertical
40	7	52 - 353	55 - vertical
41	9	98 - 350	5 - 88
42	7	187 - 343	32 - vertical
43	24	17 - 347	32 - vertical
44	4	30 - 333	30 - 75
45	11	4 -338	6 - vertical
46	12	5 - 338	35 - 87
47	4	210 - 355	32 - 77
48	10	18 - 340	36 - 83
49	10	245 - 348	34 - 79
50	11	15 - 359	51 - vertical
51	3	265 - 353	41 - 76
52	10	45 - 350	33 - 87
53	1	333	82
54	22	11 - 343	6 - vertical
55	1	340	50

Kinematic analyses indicate that the potential for wedge, sliding, or toppling failures increases for slopes steeper than 56 degrees. Large pieces of rock periodically fall from the face.

6.4.7 Groundwater

Within the existing roadway, the groundwater elevations were observed or measured within the upper five feet of the soil column. In the table below, "N.O." signifies that groundwater was "not observed" while drilling/excavating.

Table 15: Groundwater Measurements (Station 520+00 – 906+00)

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (Nov. 17, 2005, April 25, 2006 through May 1, 2006) Depth to Water (ft)	Measured Depth (Nov. 22, 2005, April 23, 2006 through May 1, 2006) Depth to Water (ft)
44	37	N.O.	5
45	35	5	4.5
46	34	6	No PVC
47	35.5	4.5	No PVC
48	35	5	3
49	40	0	No PVC
50	35.5	4.5	0
51	35	5	No PVC
52	40	5	0.3
53	40.5	4.5	No PVC
55	36	9	9
57	41	5	6.5
60	----	N.O.	No PVC
61	46	N.O.	4
62	41	4	4.5
63	37.5	7.5	4.3
64	40	5	No PVC
65	40	5	PVC not found
66	44	6	No PVC
67	39.5	5.5	6.5
68	42	8	8
71	49.7	N.O.	4.3
76	54	6	No PVC
77	54	6	0.3
78	55	5	0
79	----	N.O.	No PVC
80	53.5	6.5	No PVC
81	46	14	8.5
82	59.5	5.5	2.5
83	52.5	7.5	No PVC
84	54.5	5.5	4.5
85	53	7	No PVC
86	52	8	5
87	----	N.O.	No PVC
88	----	N.O.	No PVC
90	----	N.O.	PVC obstructed
91	49	11	9
92	55	7	9
93	55	5	PVC obstructed
101	----	N.O.	No PVC
102	55	5	1
103	----	N.O.	PVC not found
104	----	N.O.	PVC obstructed
106	----	N.O.	No PVC
107	----	N.O.	No PVC
108	72	8	8
109	----	N.O.	PVC obstructed

Recommendations

1. Between Stations 525+00 and 531+00, 539+00 and 543+00, 614+00 and 620+50, 686+00 and 690+00, and 730+00 and 734+00, much of the new roadway will be constructed over soft floodplain deposits with the overall site grades raised by one to five feet. Settlement on the order of two to four inches could occur due to the placement of the gravels. In order to reduce the potential for cracking of the asphalt, fill should be placed early during the construction sequence and paving should be one of the last items completed. This will allow as much settlement as possible to occur before the pavement is placed. It should be assumed that about half of the total settlement would occur before the paving is placed if this sequence is followed. An alternate method of construction is to surcharge with two to three feet of gravel until monitoring indicates the surcharge can be removed.

2. The rock slope angles and catchment depths for this section of the alignment are as follows:

Table 16: Rock Slopes/Catchment Depths (Station 520+00 – 906+00)

Begin Station	End Station	Existing Rock Slope Height (ft)	Existing Slope Angle (degrees)	Existing Slope Ratio (H:V)	Maximum Proposed Rock Slope Height (ft)	Proposed Slope Ratio (H:V)	(80% Retained) Catchment Width (ft)
543+50	547+50	20 - 30	38	2:1	50	0.25:1	10
564+50	569+50	25 - 35	34 - 54	2:1 to 0.75:1	55	0.25:1	12
573+50	601+50	15 - 40	30 - 50	2:1 to 0.75:1	55	0.25:1	12
608+00	612+00	30	58	0.75:1	55	0.25:1	12
635+50	640+50	30 - 60	45 - 56	1:1 to 0.75:1	55	0.25:1	12
640+50	651+00	70 - >150	49 - 62	1:1 to 0.50:1	220	0.25:1	60
651+00	662+50	25 - 40	33 - 43	3:1 to 2:1	45	0.25:1	9
662+50	685+00	0	10	N/A	90	0.25:1	21
692+50	698+00	20 - 40	40	3:1 to 2:1	85	0.25:1	20
703+50	706+50	20	15	3:1	25	0.25:1	5
706+50	714+00	20 - 80	53 - 59	0.75:1	100	0.25:1	24
714+00	729+50	20 - 80	49	1:1	50	0.25:1	10
762+00	772+00	15 - 50	40 - 53	2:1 to 0.75:1	80	0.25:1	18
772+00	777+50	15	30	3:1	60	0.25:1	12.5
777+50	780+50	20	45	1:1	120	0.25:1	30
780+50	782+00	150	63	0.50:1	225	0.25:1	62
782+00	794+50	60	63	0.50:1	85	0.25:1	20
794+50	799+00	80	63	0.50:1	100	0.25:1	24
799+00	808+50	30	45	1:1	40	0.25:1	7
808+50	812+00	60	63	0.50:1	100	0.25:1	24
830+00	836+50	50	59	0.75:1	120	0.25:1	30
841+00	850+00	50-60	45-57	1:1 to 0.75:1	120	0.25:1	30

3. Water seeps were not observed in the rock faces so weephole locations have not been specified. New rock slopes should be carefully examined for water seeps after a heavy rainfall. As a precaution, weepholes could be installed every 20 to 30 feet along the bases of the rock slopes.

6.5 Station 906+00 to 1020+00 (Sheets 27 through 32 of 44)

Within this section, four test borings (TBs 116–120) were drilled in the roadway, one test boring (TB 122) was drilled on the gravel road shoulder, and ten test pits (TP 110-115, 121, 123, 124 and 126) were excavated. Test Pits 119, 125 and 127 were not excavated.

6.5.1 Topography

This section of the roadway begins with a major realignment from the main roadway across a low lying area about 10 feet lower in elevation that the existing roadway. After the realignment, the roadway climbs in elevation to about elevation 130 while crossing an alluvial fan. The fan contains the MP 19 debris flow, which the roadway crosses before sloping down to elevation 110 feet and the Chilkat River below.

6.5.2 Vegetation

Both sides of the road have been previously cleared for a distance of about 10 to 20 feet. Secondary brush is present in some areas. Beyond the road prism and clear zones, the area is well forested with old growth trees.

6.5.3 Surface Drainage

Ditchlines are present and the roadway is crowned such that water drains away from the roadway and side slopes. Drainage tends to flow from the north to the south.

6.5.4 Planned Alignment

At the start of this segment, the planned alignment deviates to the northwest in a substantial realignment that extends from Station 906+00 to 928+00. The new roadway then generally follows the current alignment throughout the rest of this section. There is a minor realignment at the Mile 19 debris flow, where the planned roadway shifts to the west about 60 feet.

6.5.5 Subgrade Soils

The existing road through this area continues to be a fill section. Gravels and sands ranging in thickness from 2.5 feet to eight feet have been placed over the alluvial deposits of gravels and sands. The thickness of the fill material is difficult to determine due to the similarity of the "native" soils below.

In the vicinity of the planned realignment, the soils consist of silts, organic silts, and silty sands that are soft and loose and covered in as much as two feet of peat. Bedrock should not be encountered through this section, although cobbles and boulders will be present.

6.5.6 Groundwater

Within the existing roadway, the groundwater elevations were observed or measured within the upper five feet of the soil column. In the table below, "N.O." signifies that groundwater was "not observed" while drilling/excavating.

Table 17: Groundwater Measurements (Station 906+00 – 1020+00)

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (Nov. 20, 2005, April 18, 2006) Depth to Water (ft)	Measured Depth Depth to Water (ft)
110	65	7	No PVC
111	----	N.O.	No PVC
112	72	4	No PVC
113	75	3	No PVC
114	82	3	No PVC
115	88	7	No PVC
116	----	N.O.	PVC frozen at 4 ft
117	----	N.O.	PVC frozen at 4 ft
118	----	N.O.	No PVC
120	----	N.O.	N.O.
121	----	N.O.	No PVC
122	----	N.O.	N.O.
123	----	N.O.	No PVC
124	----	N.O.	No PVC
126	----	N.O.	No PVC

Recommendations

1. Between Stations 906+00 and 924+00, a new roadway will be constructed over soft floodplain deposits consisting of silts, organic silts, and sands. In some areas, the site grades will be raised by about three feet. Settlement on the order of two to six inches could occur due to the placement of the gravels. In order to reduce the potential for cracking of the asphalt, fill should be placed early during the construction sequence and paving should be one of the last items completed. This will allow as much settlement as possible to occur before the pavement is placed. It should be assumed that about half of the total settlement would occur before the paving is placed if this sequence is followed. An alternate method of construction is to surcharge with two to three feet of gravel until monitoring indicates the surcharge can be removed.

2. Improvements to the MP 19 debris flow area have been evaluated and are addressed in Appendix D, Debris Flows.

6.6 Station 1020+00 to 1100+00 (Sheets 32 through 35 of 44)

Within this section, one test boring (TB 135) were completed off the side of the existing roadway, and four test borings (TBs 129, 131, 133, and 134) were drilled in the roadway. Test Boring 128 was not drilled and Test Pits 130 and 132 were not excavated.

6.6.1 Topography

This section of the roadway generally follows the existing roadway and steadily climbs in elevation from about elevation 110 to elevation 130. The roadway is situated at the base of the hills and adjacent to the Chilkat River.

6.6.2 Vegetation

Both sides of the road have been previously cleared for a distance of about 10 to 20 feet. Secondary brush is present in some areas. Beyond the road prism and clear zones, the area is well forested with old growth trees.

6.6.3 Surface Drainage

Ditchlines are present in select areas. However, the road section is built up such that the sides slope away from both sides of the road. Drainage tends to flow from the north to the south. At Station 1021+50 and 1065+00, heavy flood flows during the winter transported gravels, sands, and silts down the mountainside and onto the roadway in these areas. Remnants of the debris are evident as clogged ditchlines adjacent to the road and newly deposited gravels on the opposite side of the roadway.

6.6.4 Planned Alignment

The planned alignment generally follows the current alignment throughout this section with minor modifications at curves. The largest realignment occurs between Station 1062+00 and 1079+00 where the road shifts inland approximately 100 feet.

6.6.5 Subgrade Soils

The existing road through this area continues to be a fill section. Gravels and sands ranging in thickness from 2.5 feet to five feet have been placed over alluvial deposits of gravels and sands.

In the vicinity of the planned realignment (Station 1062+00 and 1079+00), no excavations were completed. However, it appears that this area consists of alluvial soils and bedrock is not expected to be encountered. Cobbles and boulders will be present.

6.6.6 Groundwater

Within the existing roadway, the groundwater elevations were observed or measured within the upper five feet of the soil column. In the table below, “N.O.” signifies that groundwater was “not observed” while drilling/excavating.

Table 18: Groundwater Measurements (Station 1020+00 – 1100+00)

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (Nov. 20, 2005) Depth to Water (ft)	Measured Depth (April 17, 2006) Depth to Water (ft)
129		N.O.	No PVC
131	100	----	8
133	113	----	3
134	----	N.O.	No PVC
135	----	N.O.	No PVC

Recommendations

1. Drainage should be improved in the vicinity of Stations 1021+50 and 1065+00, where heavy rainfall transports large quantities of water and soil into the ditchline and across the road.

6.7 Station 1100+00 to 1220+00 (Sheets 35 through 40 of 44)

Within this section, eight test borings (TBs 137, 139, 142–144, and 146-148) were drilled in the roadway, and two test pits (TPs 138 and 149) were excavated. Test Boring 145 was not drilled and Test Pits 136, 140, and 141 were not excavated.

6.7.1 Topography

This section of the roadway moves away from the Chilkat River at elevation 135 and begins a steep winding climb to elevation 168, drops down to elevation 130, and then begins to climb again, passing above the village of Klukwan and the MP 23 debris flow to elevation 318 feet. The roadway then descends to the river crossing below.

6.7.2 Vegetation

Both sides of the road have been previously cleared for a distance of about 10 to 20 feet. Secondary brush is present in some areas. Beyond the road prism and clear zones, the area is well forested with old growth trees.

6.7.3 Surface Drainage

Ditchlines are present in select areas. However, the road section is built up such that the sides slope away from both sides of the road. Drainage tends to flow from the north to the south. At Station 1103+50 and 1208+00, heavy flood flows during the winter transported gravels, sands,

and silts down the mountainside and onto the roadway in these areas. Remnants of the debris are evident as clogged ditchlines adjacent to the road and newly deposited gravels on the opposite side of the roadway. At Station 1208+00, the amount of debris carried adjacent to the road extended to the river (next section) and across the road at the curve before the river.

6.7.4 Planned Alignment

The planned alignment follows the current alignment throughout this section.

6.7.5 Subgrade Soils

The existing road through this area continues to be a fill section. Gravels and sands ranging in thickness from 2.5 feet to four feet have been placed over alluvial deposits of gravels and sands with the occasional silt layer.

Test Pit 138, excavated at the intersection of the Haines Highway and Village of Klukwan Road indicted about four feet of sandy fill material over four feet of organic silt. It is unlikely that bedrock will be encountered through this segment; however, cobbles and boulders will be present.

6.7.6 Groundwater

Within the existing roadway, the groundwater elevations were observed or measured within the upper five feet of the soil column.

Table 19: Groundwater Measurements (Station 1100+00 – 1220+00)

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (Nov. 21, 2005, April 22, 2006) Depth to Water (ft)	Measured Depth (Nov. 22, 2005) Depth to Water (ft)
137	----	N.O.	N.O.
139	----	N.O.	N.O.
142	----	N.O.	PVC obstructed
143	249	N.O.	15
144	----	N.O.	No PVC
146	----	N.O.	N.O.
147	----	N.O.	N.O.
148	----	N.O.	N.O.
149	----	N.O.	No PVC

Recommendations

1. Drainage should be improved in the vicinity of Stations 1103+50 and 1208+00, where heavy rainfall transports large quantities of water and soil into the ditchline and across the road.

6.8 Station 1220+00 to 1260+00 (Sheets 40 through 42 of 44)

Within this section, one test boring (TB 154) was drilled in the roadway, one test boring (TB 150) was drilled on the gravel road shoulder, and seven test pits (TPs 151–153, 156–159) were excavated.

6.8.1 Topography

This section of the roadway continues sloping down to the river from elevation 220 to elevation 130. Across the river, the area is at a relatively constant elevation of about 130 feet.

6.8.2 Vegetation

This area is undeveloped and is well forested with old growth trees.

6.8.3 Surface Drainage

On both sides of the river, the areas naturally slope down towards the river. Design of the realignment should incorporate a similar sloping condition as well as ditchlines. The ditchlines on the east side of the river should be designed to incorporate some of the debris that will flow from MP 23 to the river.

6.8.4 Planned Alignment

The planned alignment is a proposed realignment that descends to and crosses the Chilkat River before merging with the existing roadway.

6.8.5 Subgrade Soils

The soils through this area will be a combination of alluvial material and outwash deposits of sands and gravels with near surface silts below the organic mat. Bedrock is unlikely; however, cobbles and boulders will be present.

6.8.6 Groundwater

Within the existing roadway, the groundwater elevations were observed or measured within the upper five feet of the soil column. In the table below, "N.O." signifies that groundwater was "not observed" while drilling/excavating.

Table 20: Groundwater Measurements (Station 1220+00 – 1260+00)

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (April 19, 2006 through April 22, 2006) Depth to Water (ft)	Measured Depth (April 3, 2006) Depth to Water (ft)
150	----	N.O.	N.O.
151	----	N.O.	No PVC
152	----	N.O.	No PVC
153	----	N.O.	No PVC
154	----	N.O.	PVC frozen at 4 ft
156	116	9	No PVC
157	117	8	No PVC
158	119	6	No PVC
159	115	10	No PVC

Recommendations

1. Drainage should be constructed to allow for debris from MP23 to flow towards the river.

6.9 Station 1260+00 to 1317+59 (EOP) (Sheets 42 through 44 of 44)

Within this section, one test boring (TB 155) was drilled in the roadway.

6.9.1 Topography

This section of the roadway generally follows the existing roadway and steadily climbs in elevation. The roadway is situated at the base of the hills away from the river.

6.9.2 Vegetation

Both sides of the road have been previously cleared for a distance of about 10 to 20 feet. Secondary brush is present in some areas. Beyond the road prism and clear zones, the area is well forested with old growth trees.

6.9.3 Surface Drainage

Currently drainage is to the east. No ditchlines are present within the undeveloped area. Ditchlines are present on both sides of the roadway from Station 1265+00 to the end of the project.

6.9.4 Planned Alignment

The planned alignment extends from the river, about 400 feet downstream of Wells Bridge and merges with the existing highway at Station 1265+00.

6.9.5 Subgrade Soils

The existing road through this area continues to be a fill section about seven feet thick and comprised of gravels and sands over alluvial and floodplain deposits of silty sands and silts.

Based on the limited subsurface information collected, it appears that this area consists of alluvial/floodplain soils and bedrock is not expected to be encountered. Cobbles and boulders will be present.

6.9.6 Groundwater

Within the existing roadway, the groundwater elevation was observed or measured within the upper ten feet of the soil column.

Table 21: Groundwater Measurements (Station 1260+00 – 1317+60 (EOP))

Test Boring No.	Estimated Groundwater Elevation (ft)	While Drilling (Nov. 22, 2005) Depth to Water (ft)	Measured Depth (April 3, 2006) Depth to Water (ft)
155	124	7	PVC obstructed

Recommendations

1. Drainage should be constructed to allow for runoff to flow towards the river.

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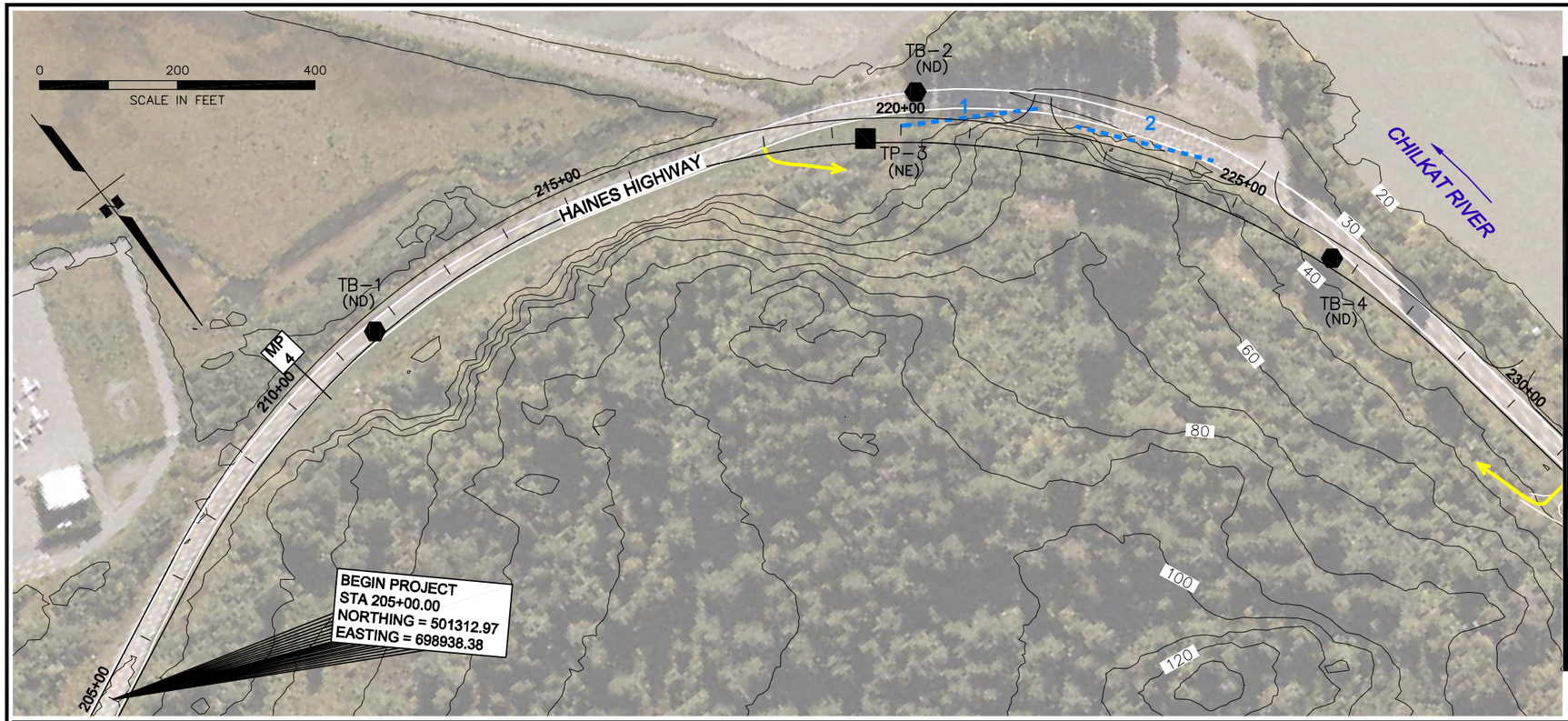
APPENDIX A

Plan and Profile Sheets



MATCHLINE STA 231+00

PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

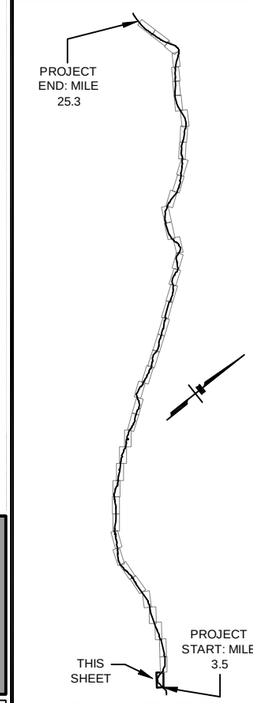
BRIAN P. O'QUINN
TAB: 1 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



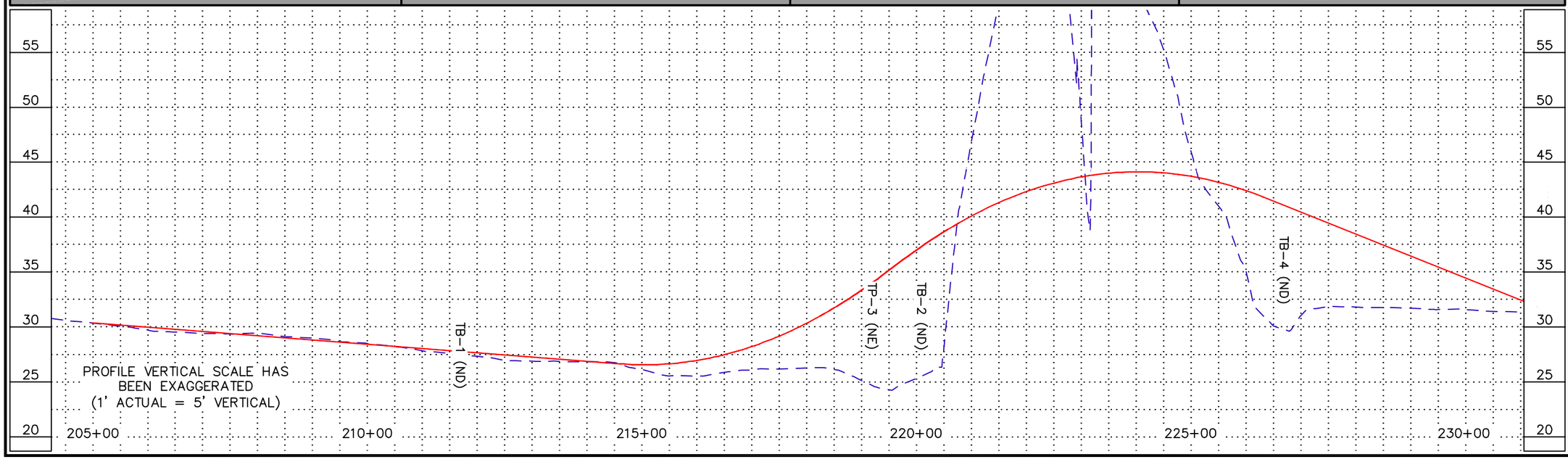
PLAN LEGEND

LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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DESIGNED BY: KAN

DRAWN BY: BPO

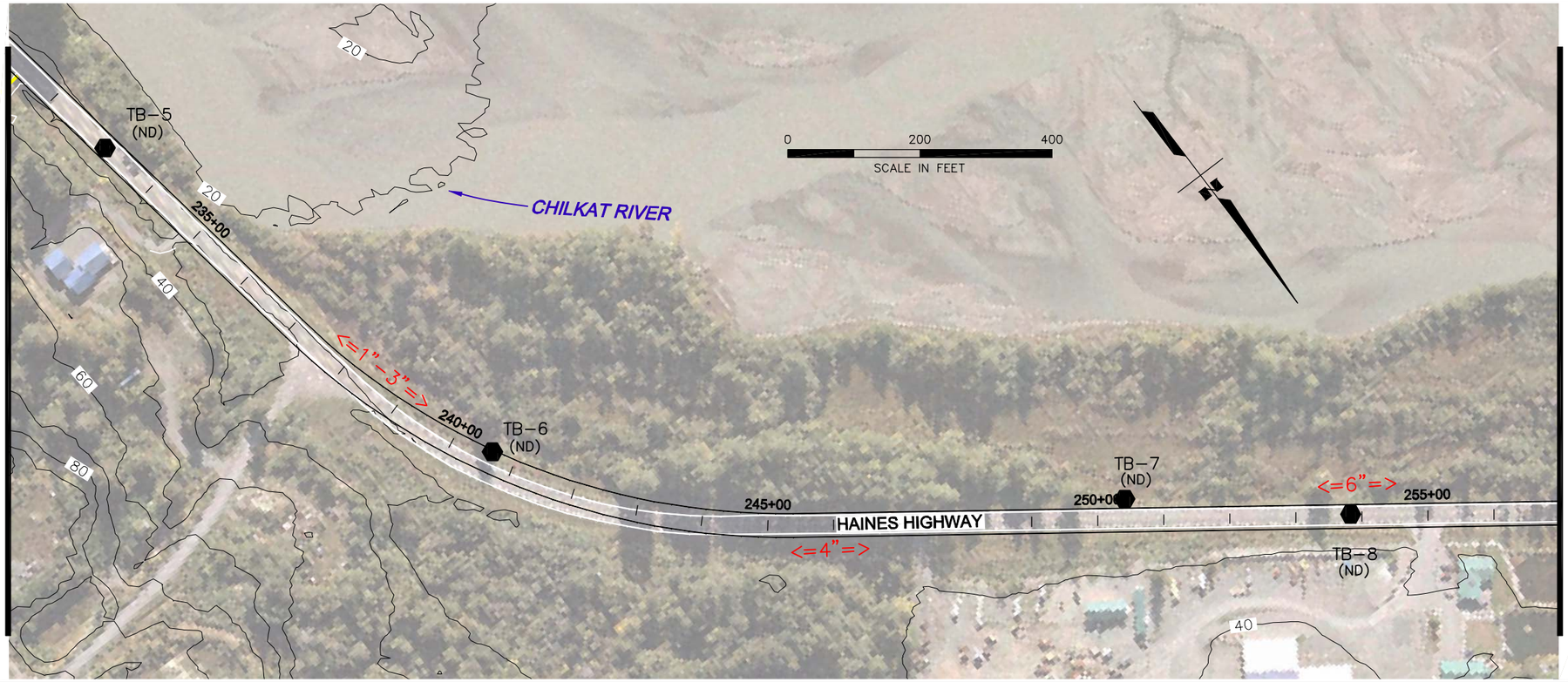
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
1	44

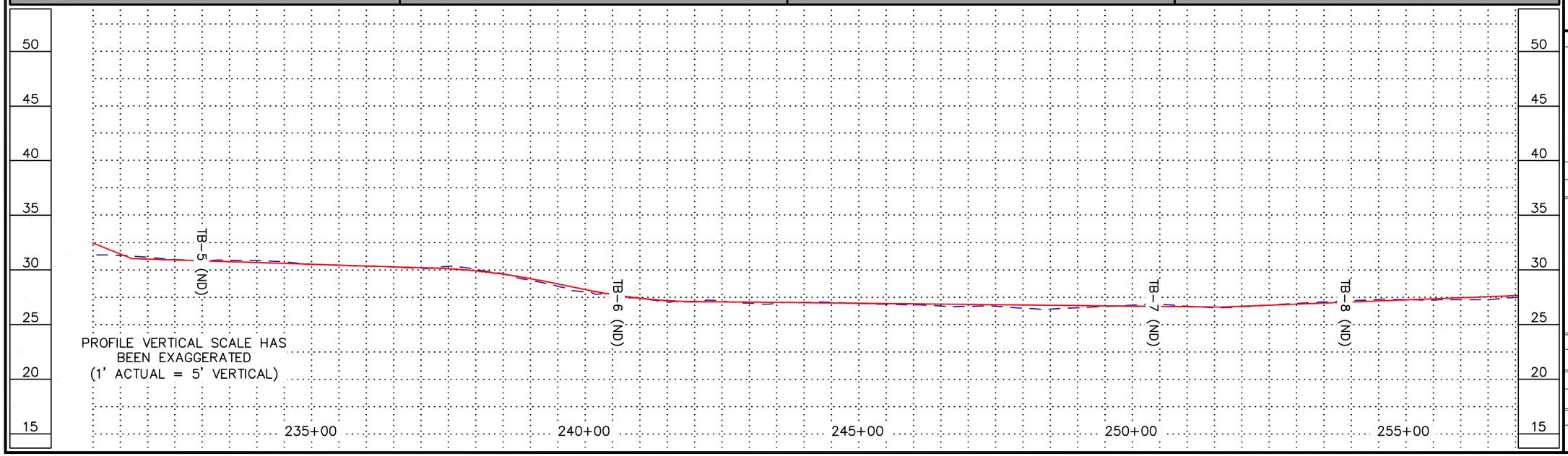


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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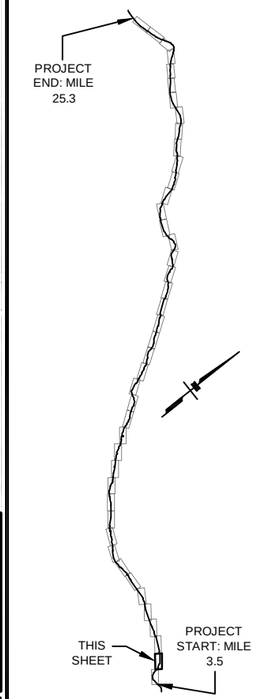
MICHAEL J. BAUER
TAB: 2 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

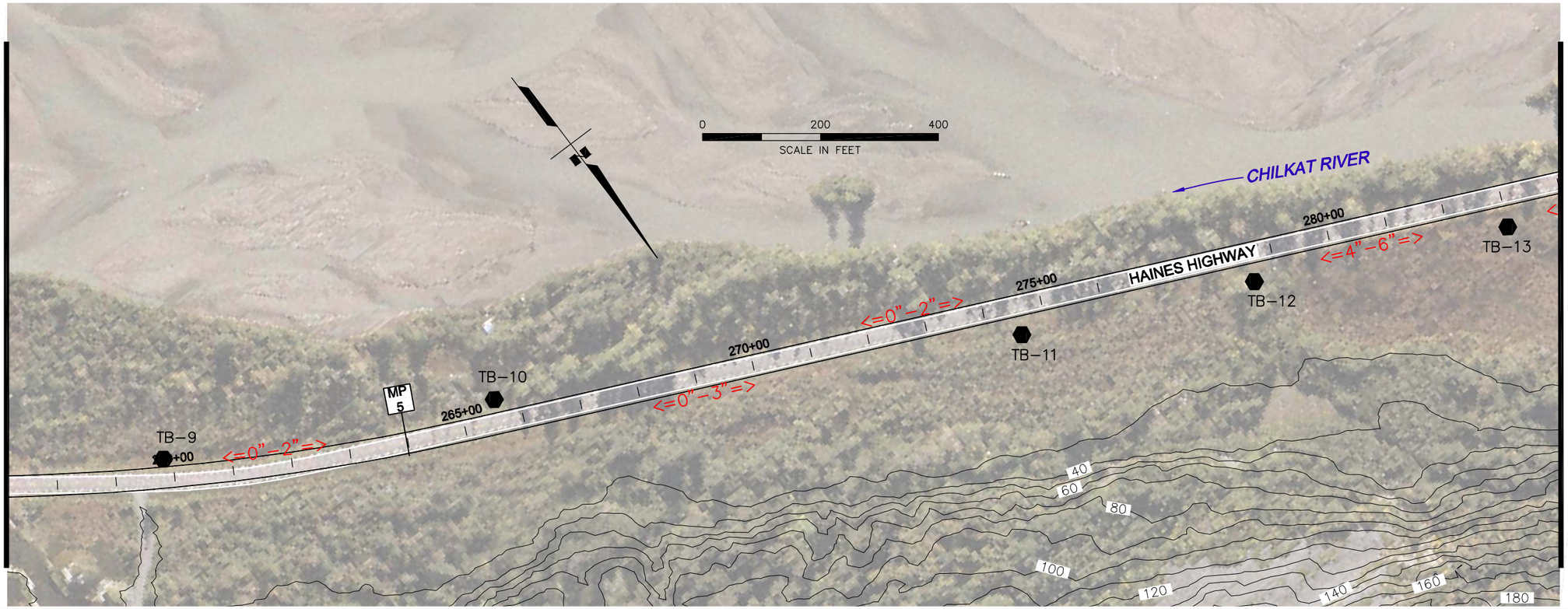
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
2	44

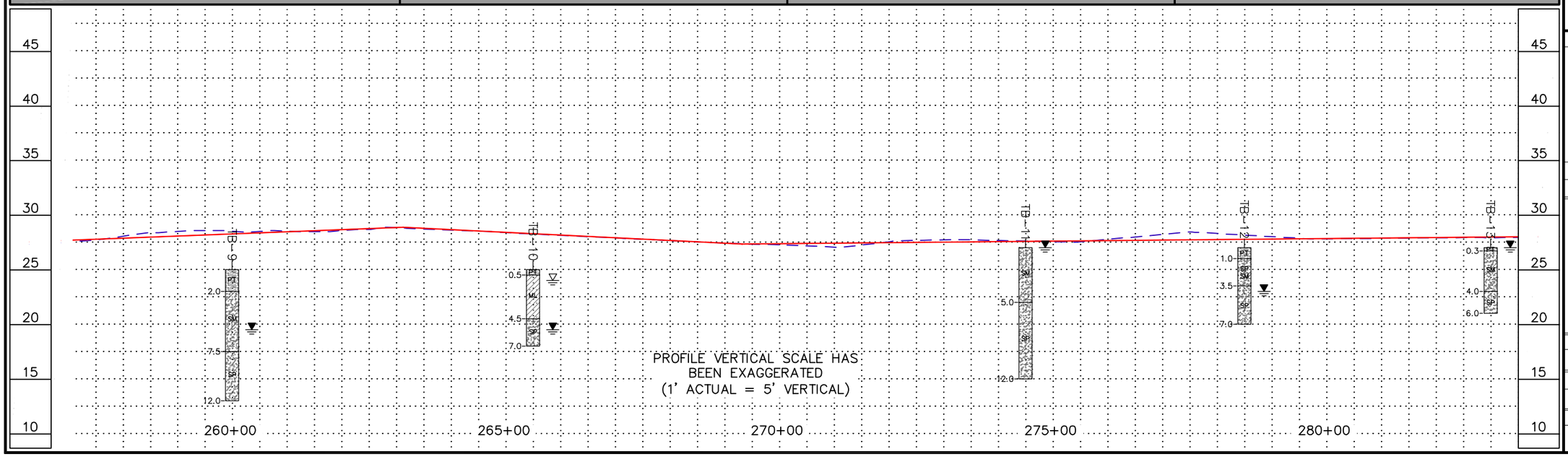


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



PROFILE VERTICAL SCALE HAS BEEN EXAGGERATED (1' ACTUAL = 5' VERTICAL)

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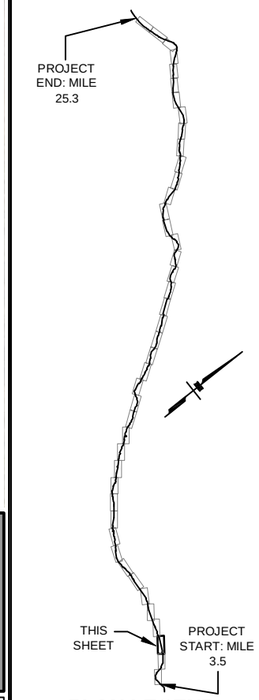
MICHAEL J. BAUER
TAB: 3 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

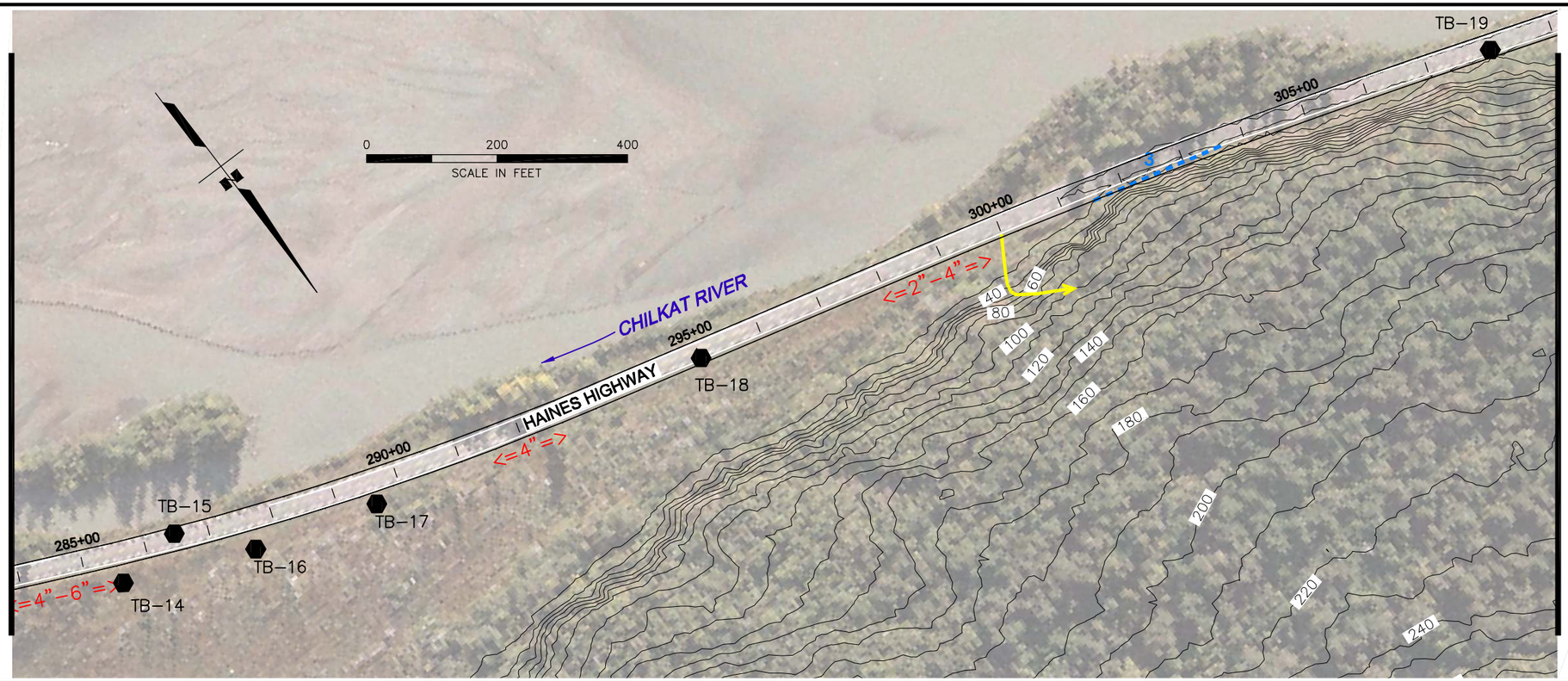
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
3	44

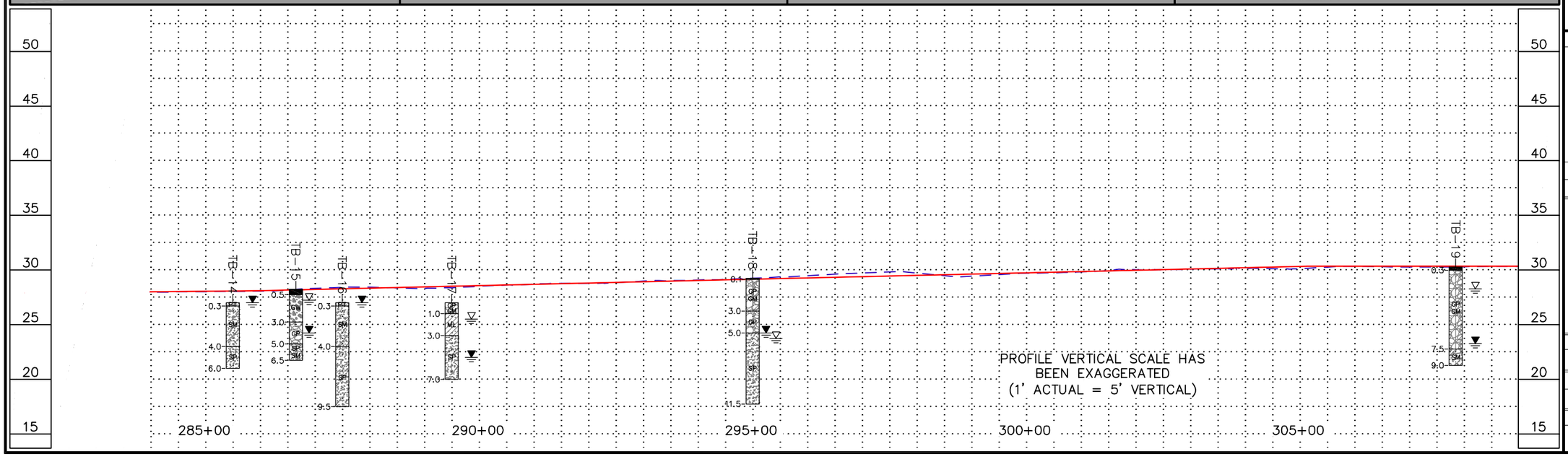


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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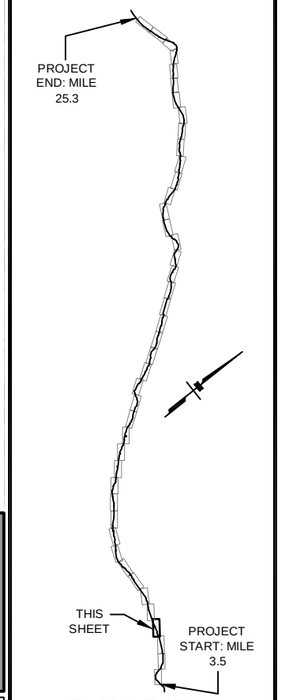
MICHAEL J. BAUER
TAB: 4 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

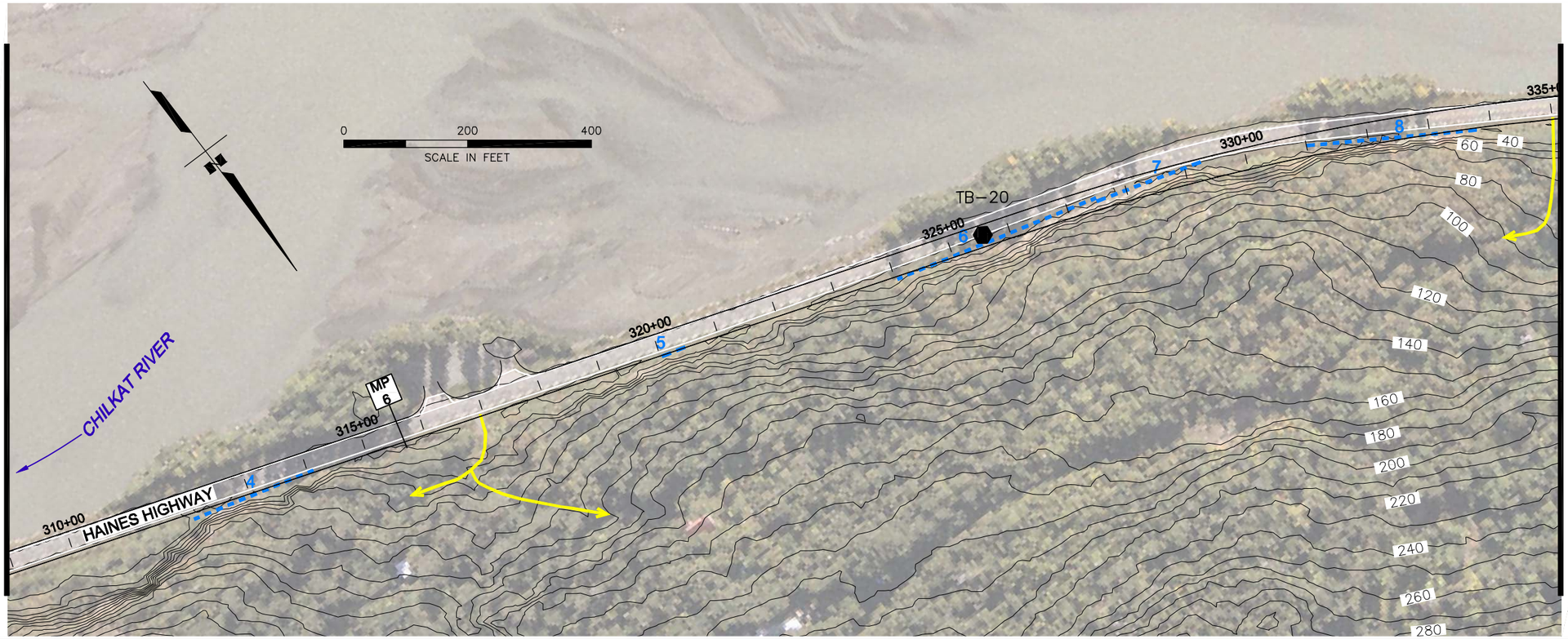
HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008

SHEET NUMBER	TOTAL SHEETS
4	44

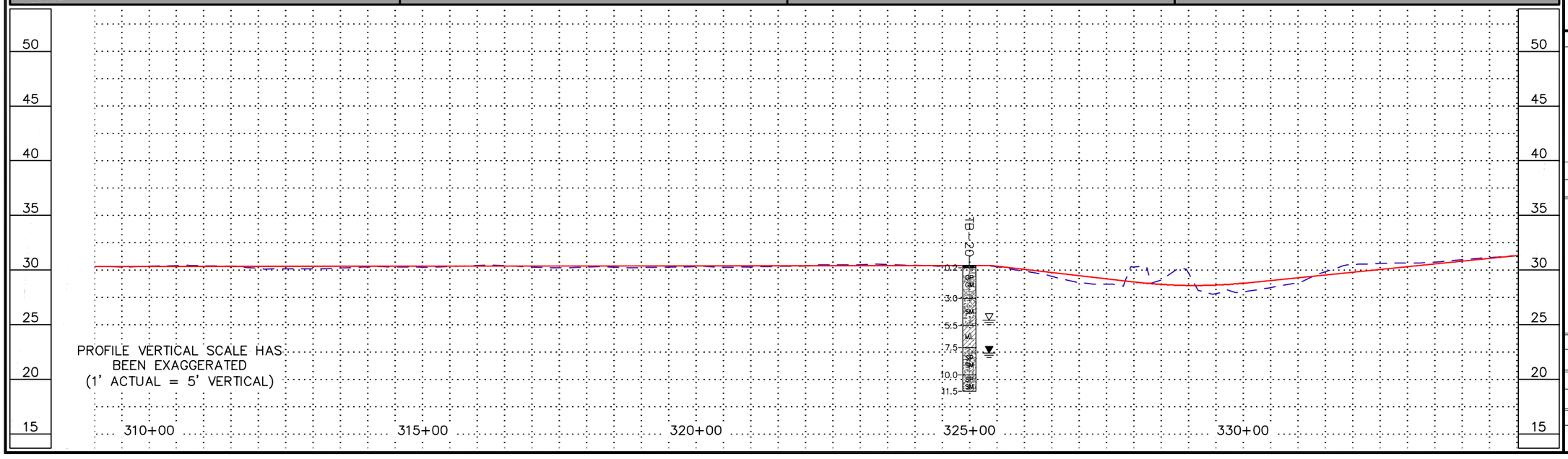


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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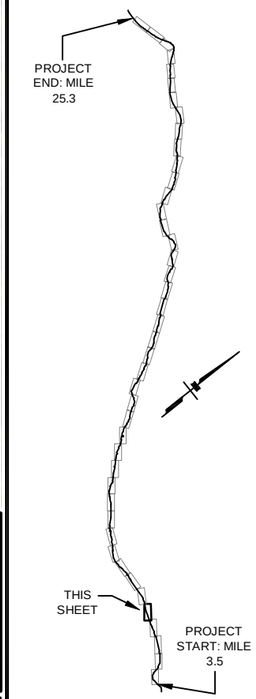
MICHAEL J. BAUER
TAB: 5 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

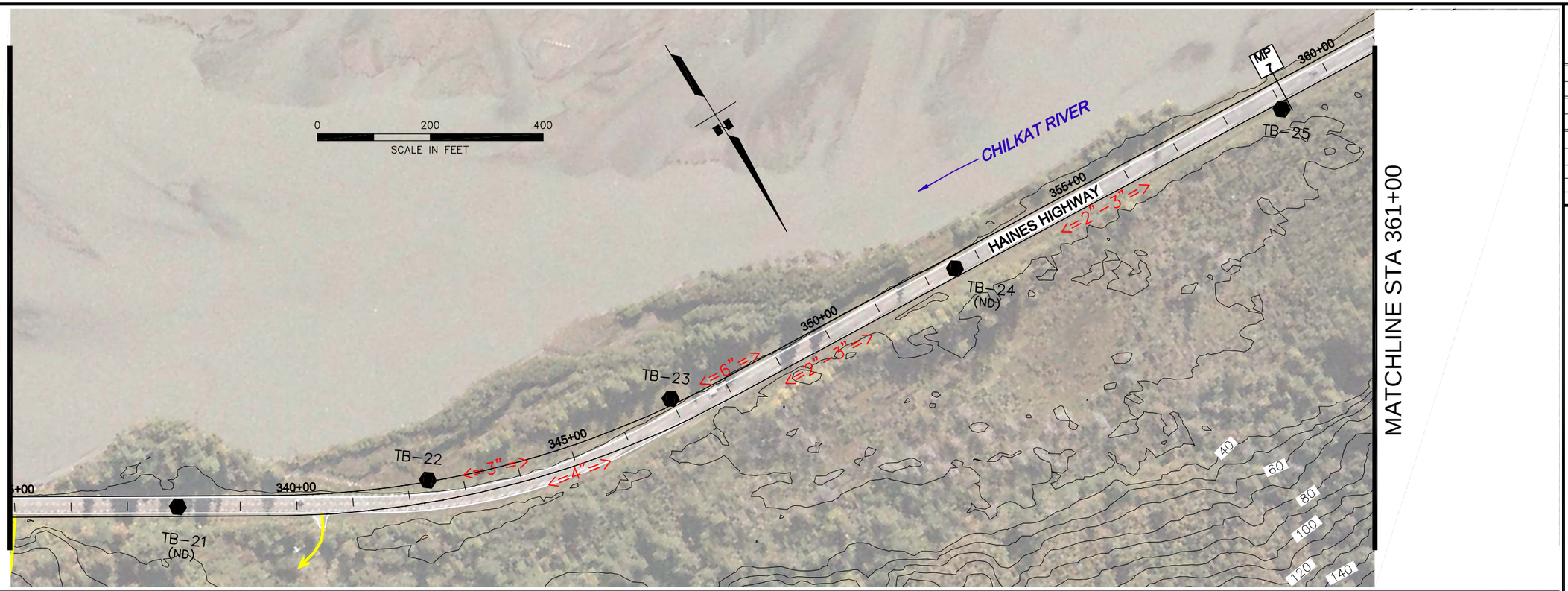
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
5	44

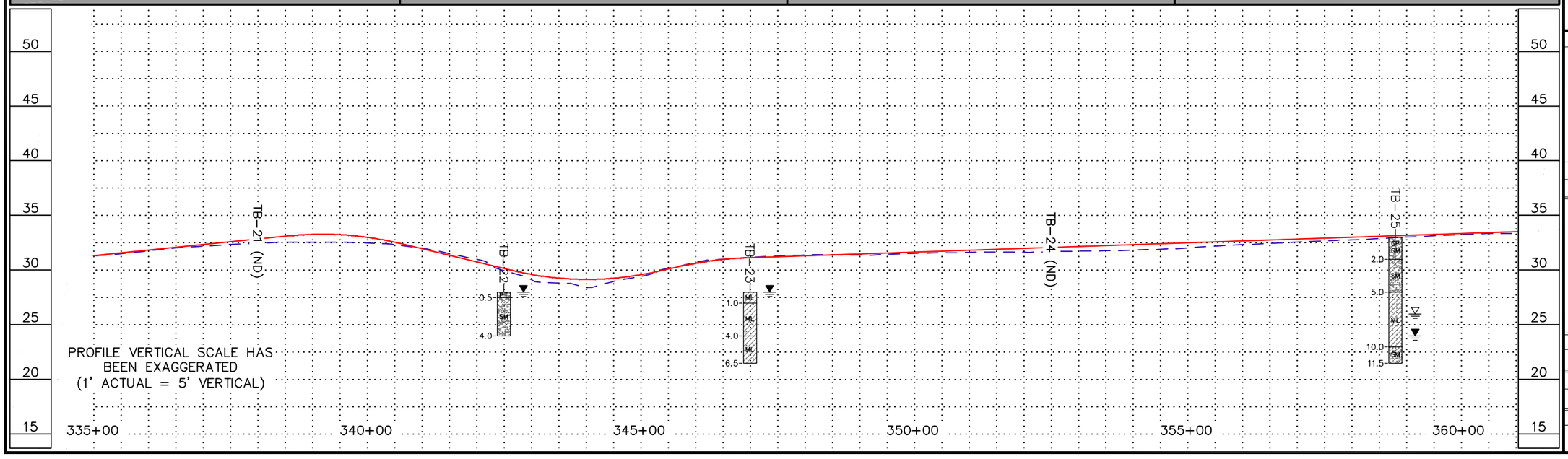


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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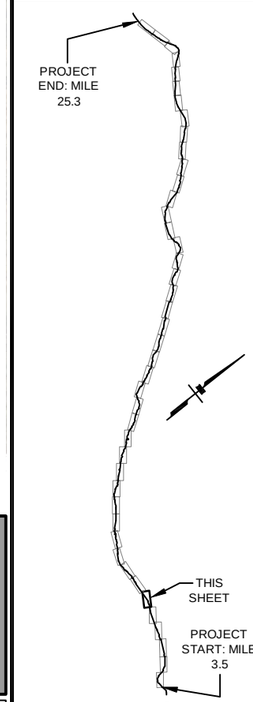
MICHAEL J. BAUER
TAB: 6 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

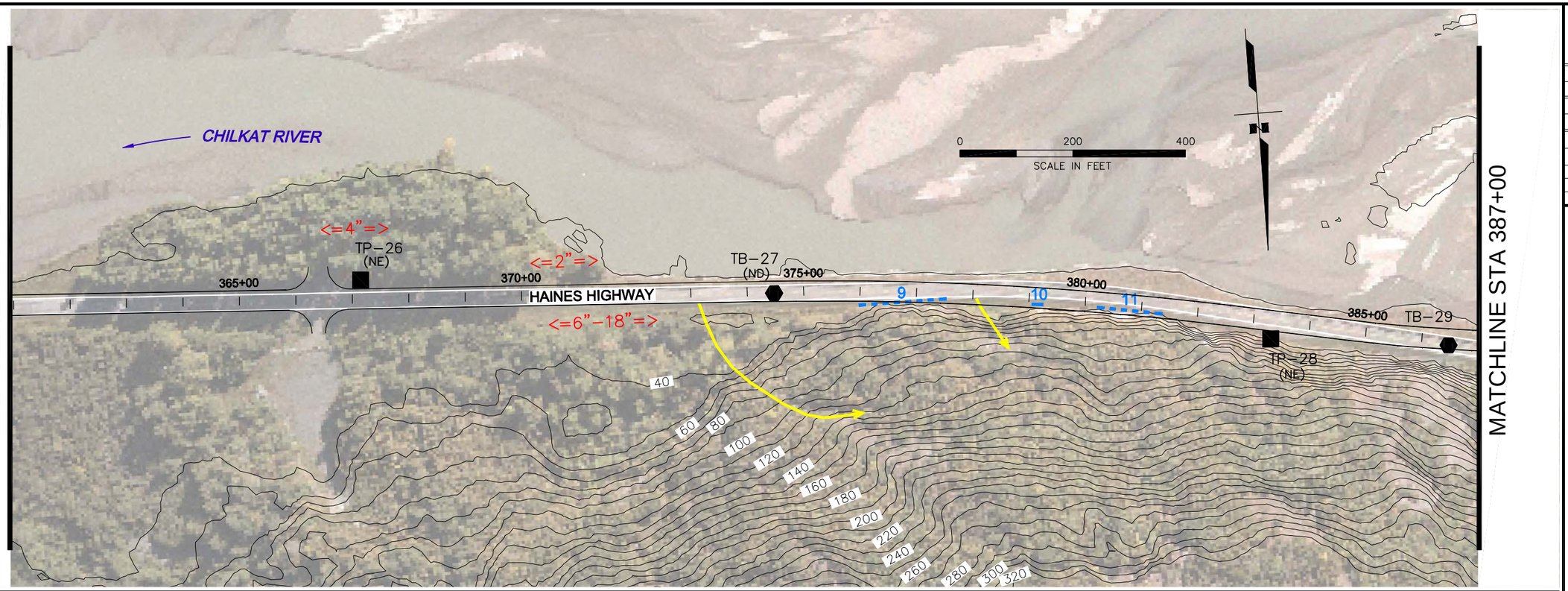
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
6	44

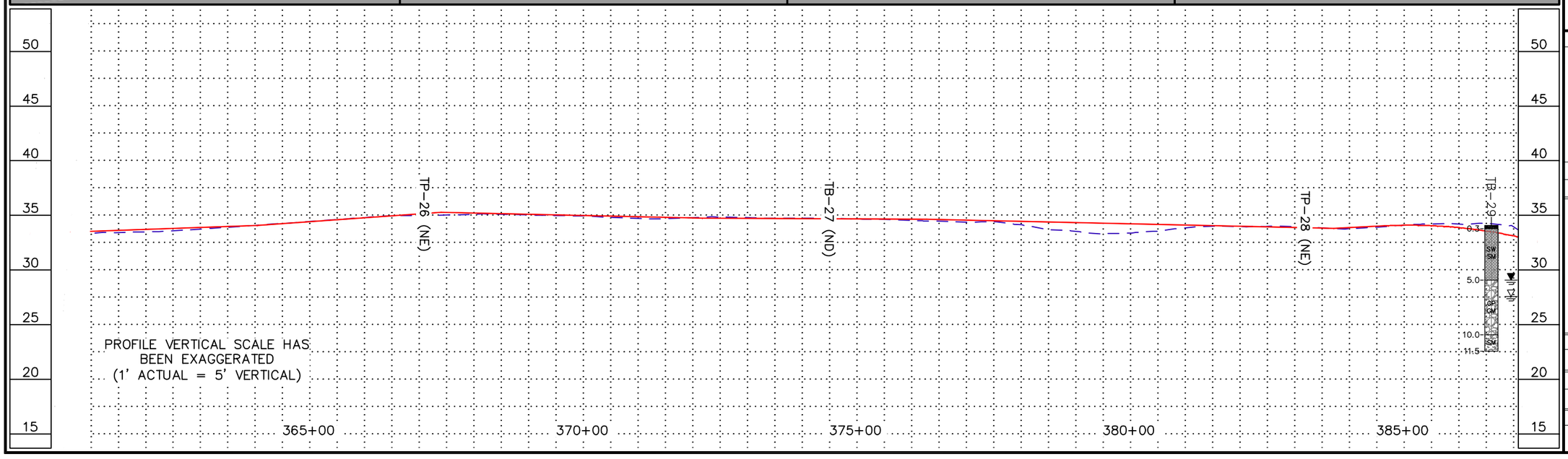


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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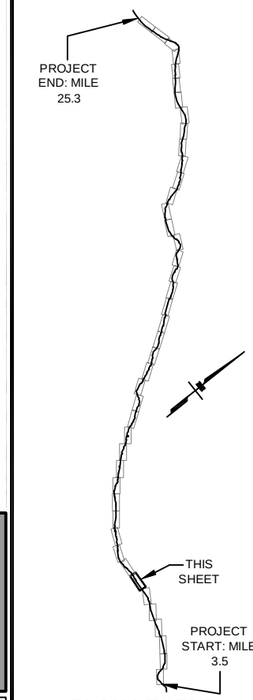
MICHAEL J. BAUER
TAB: 7 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

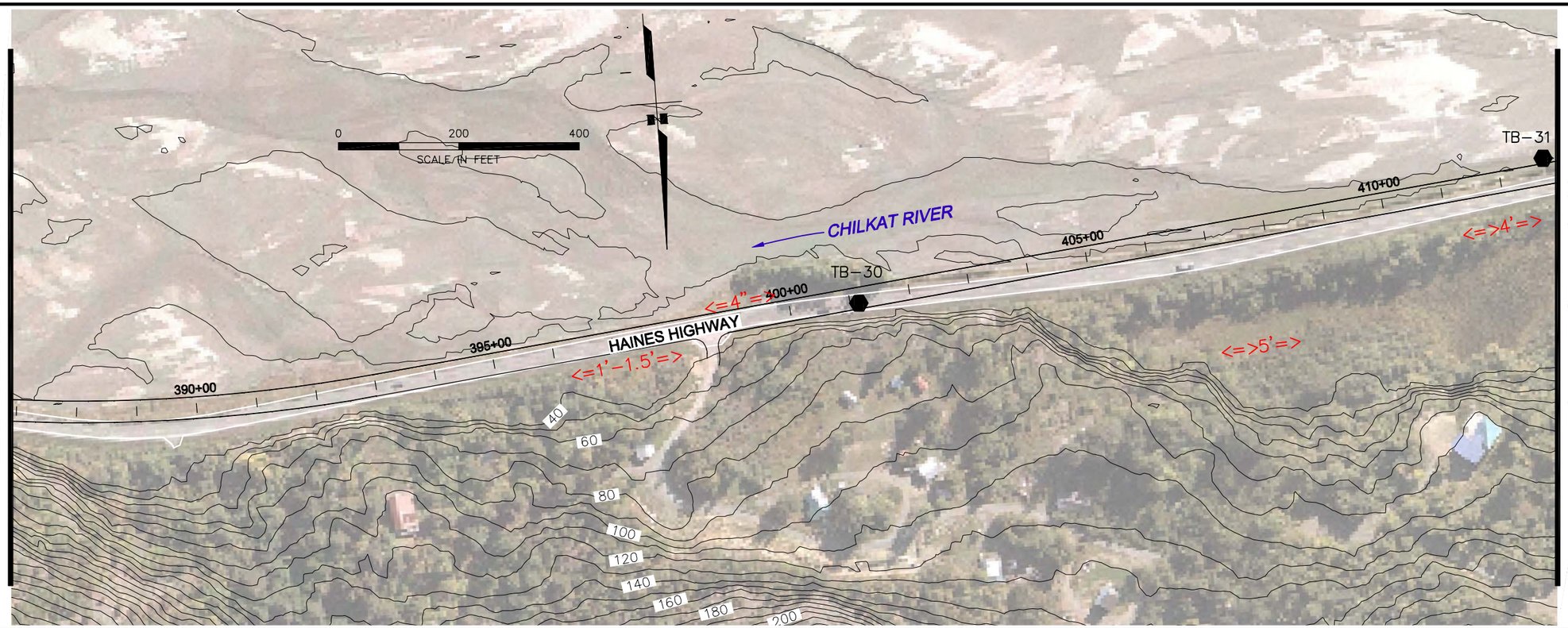
DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
7	44

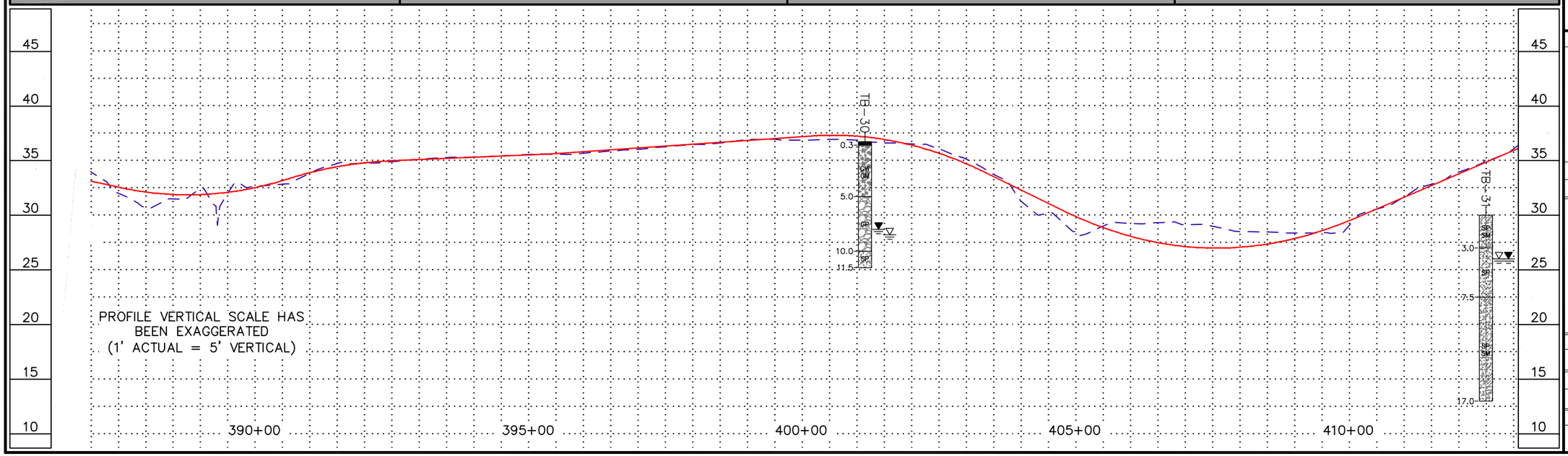


LEGEND

- CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 — 220+00)
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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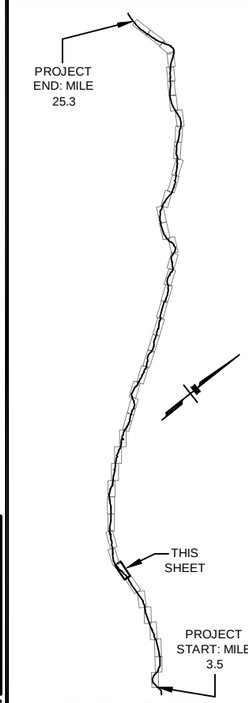
MICHAEL J. BAUER
TAB: 8 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

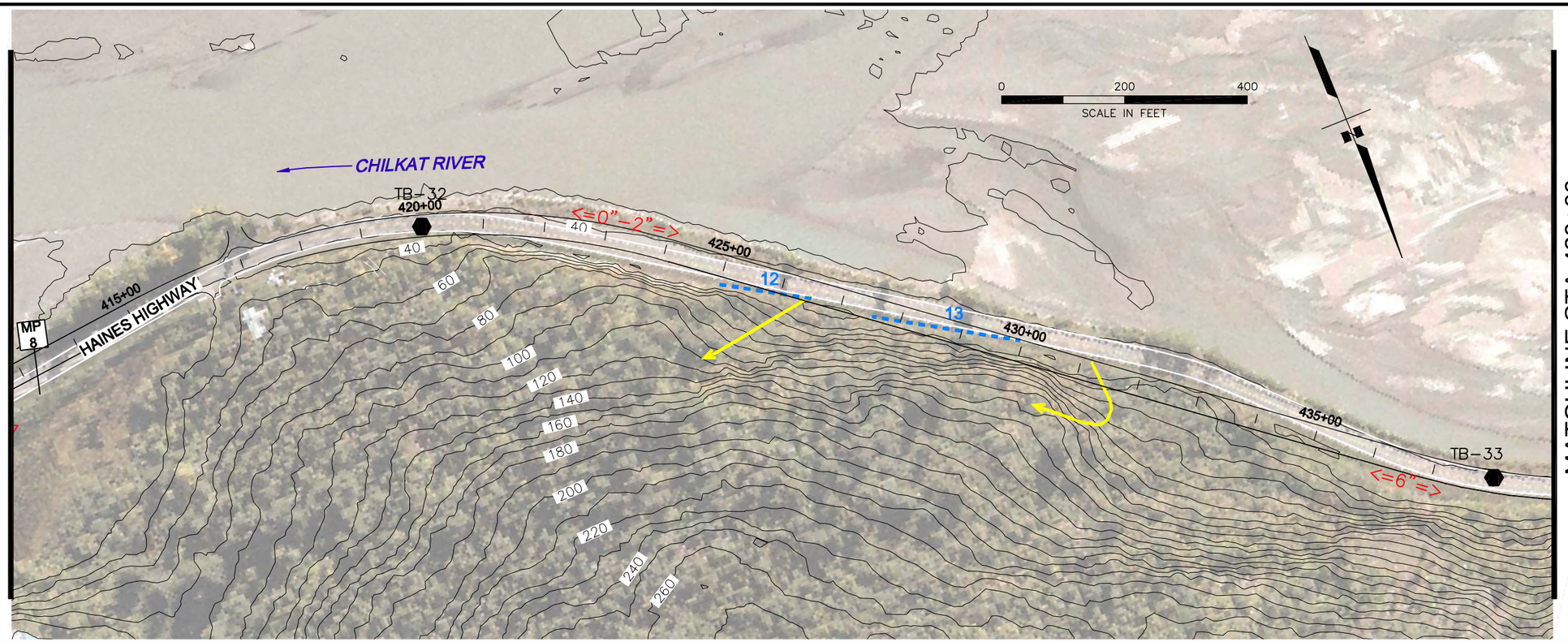
DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
8	44

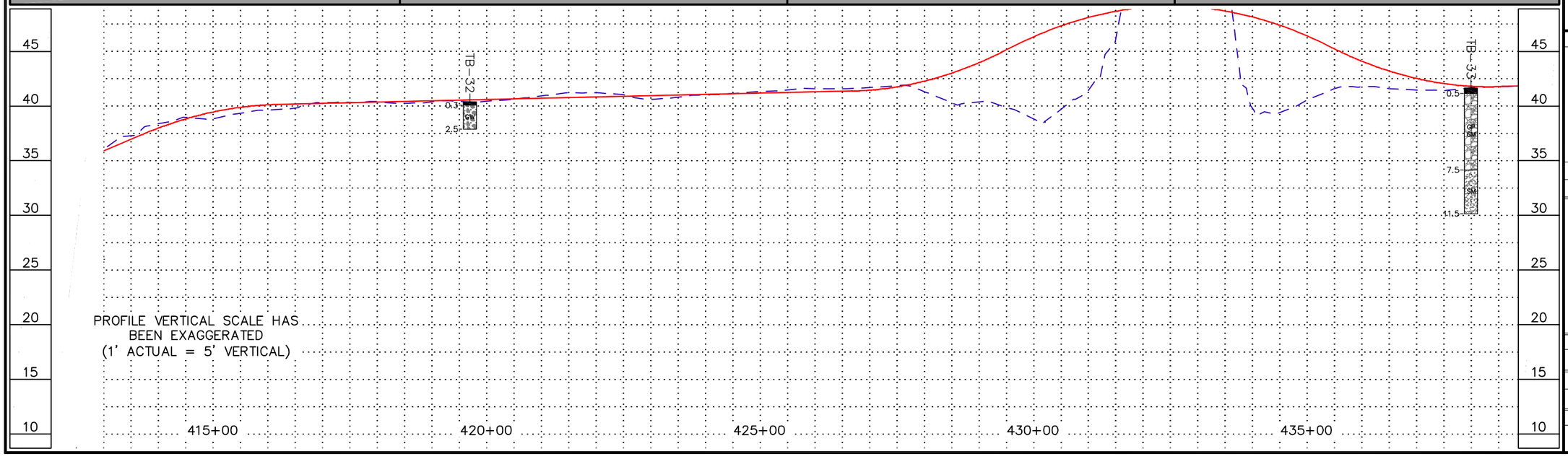


LEGEND

- CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 – 220+00)
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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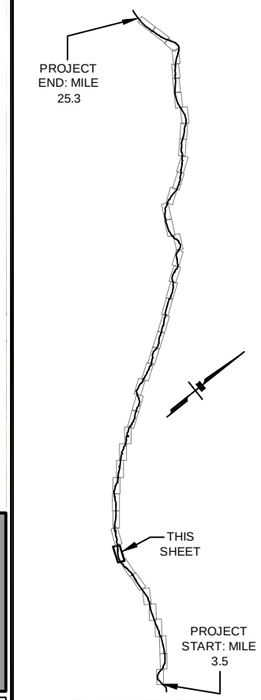
MICHAEL J. BAUER
TAB: 9 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

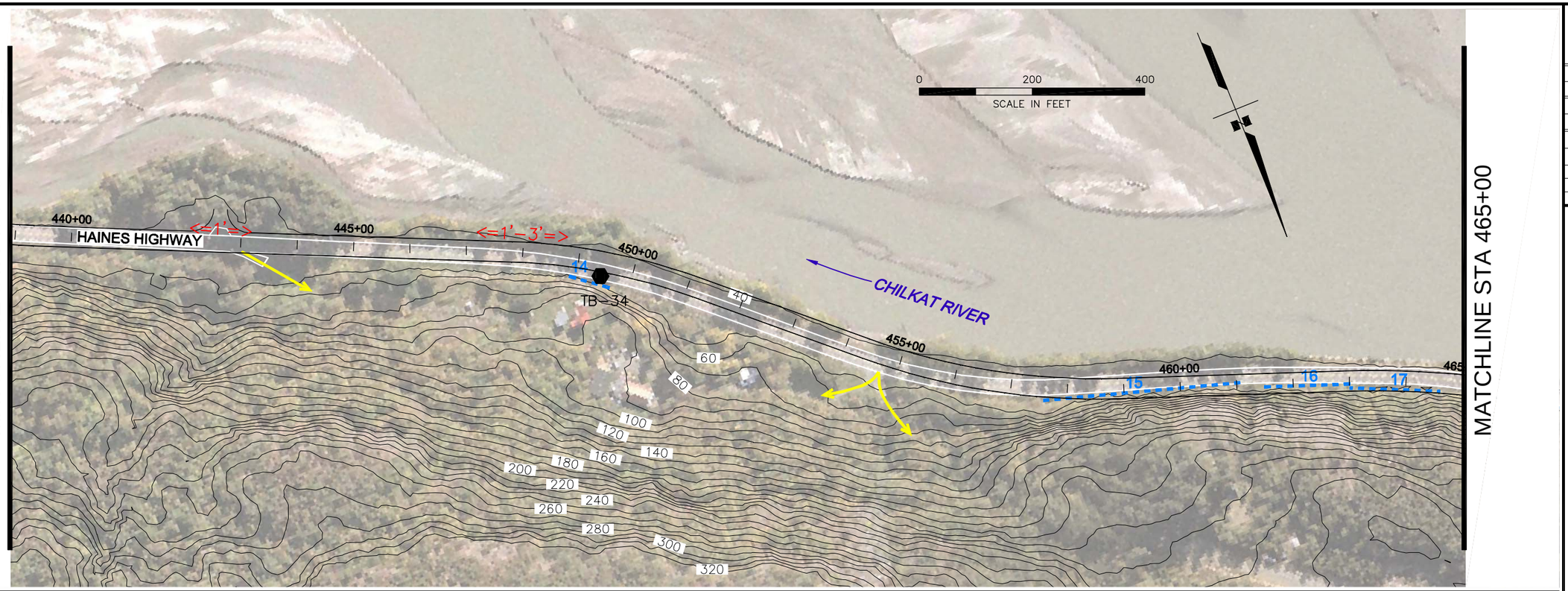
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
9	44

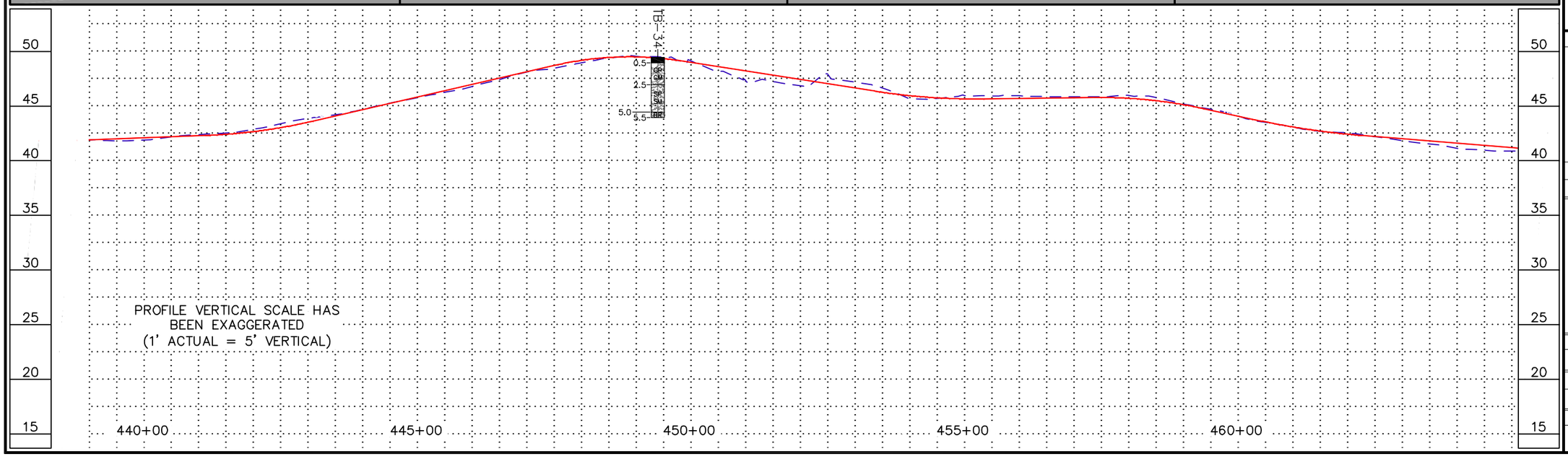


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



PROFILE VERTICAL SCALE HAS BEEN EXAGGERATED
(1' ACTUAL = 5' VERTICAL)

PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

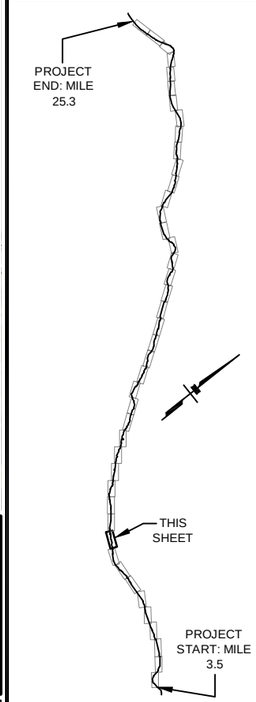
MICHAEL J. BAUER
TAB: 10 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

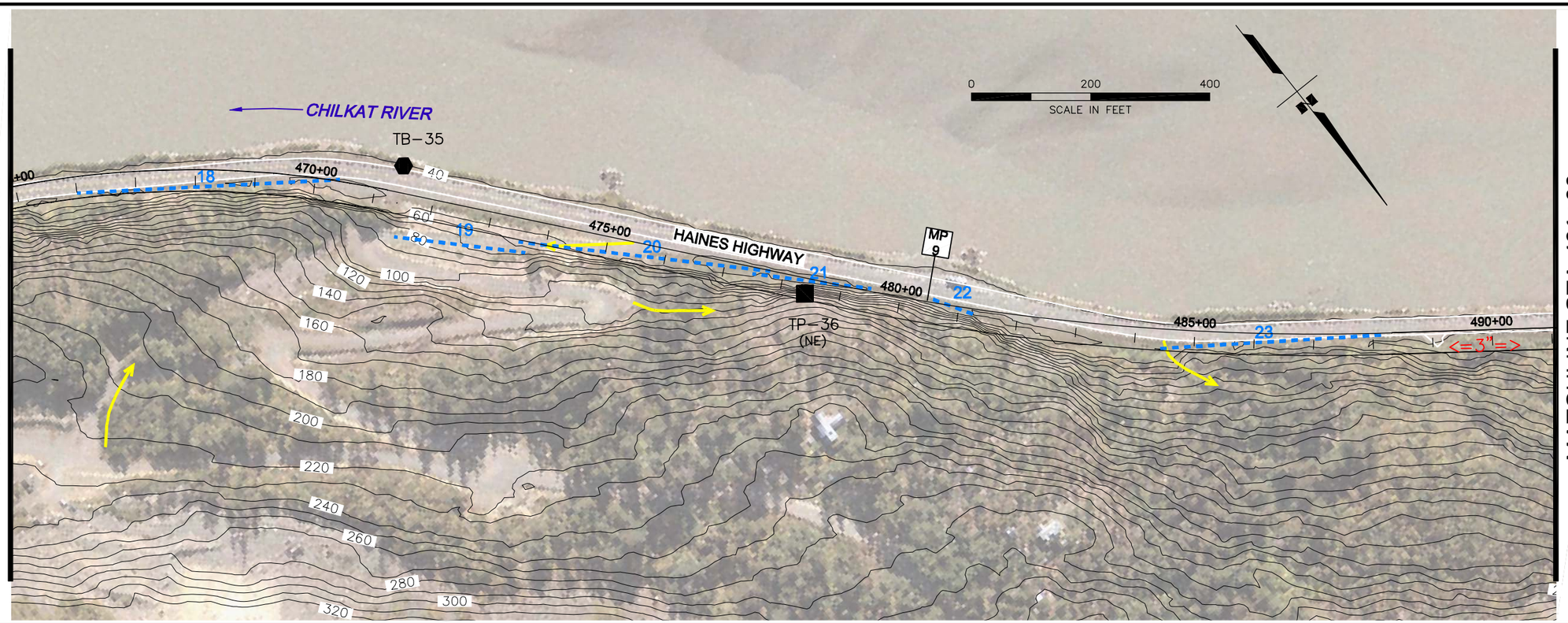
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
10	44

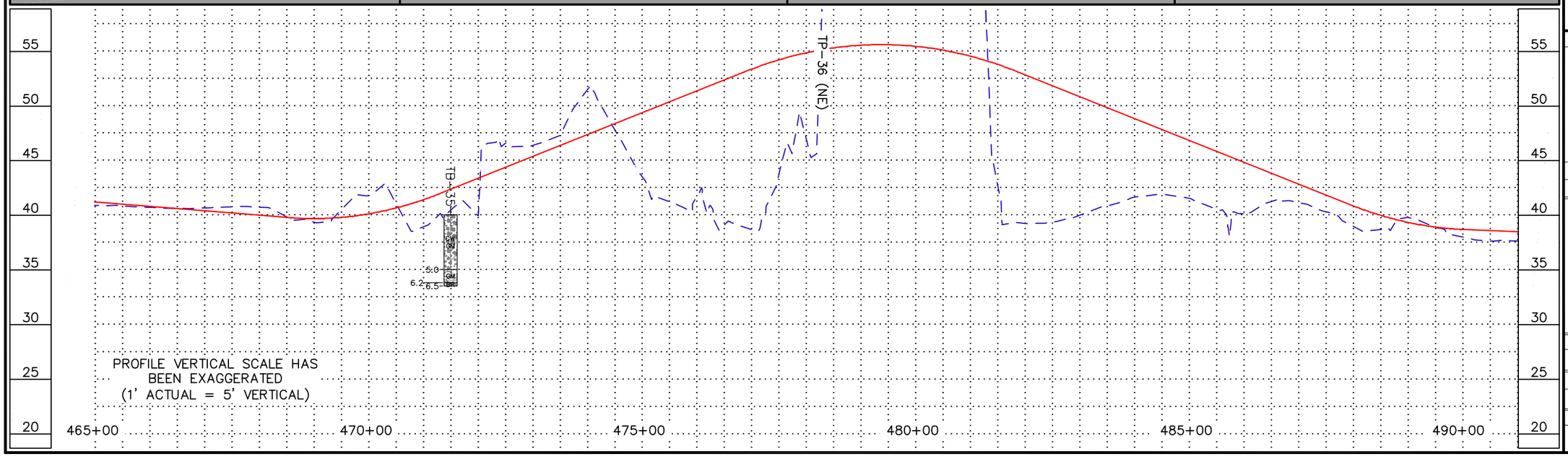


LEGEND

- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 — 220+00)
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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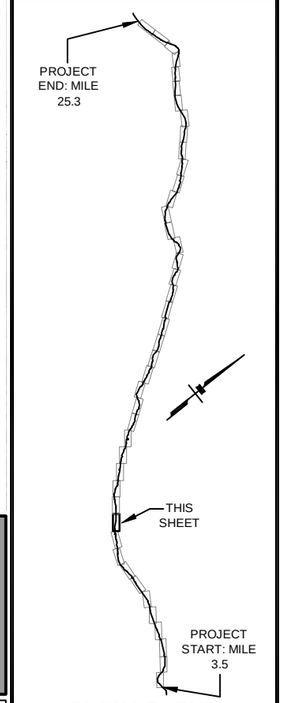
MICHAEL J. BAUER
TAB: 11 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

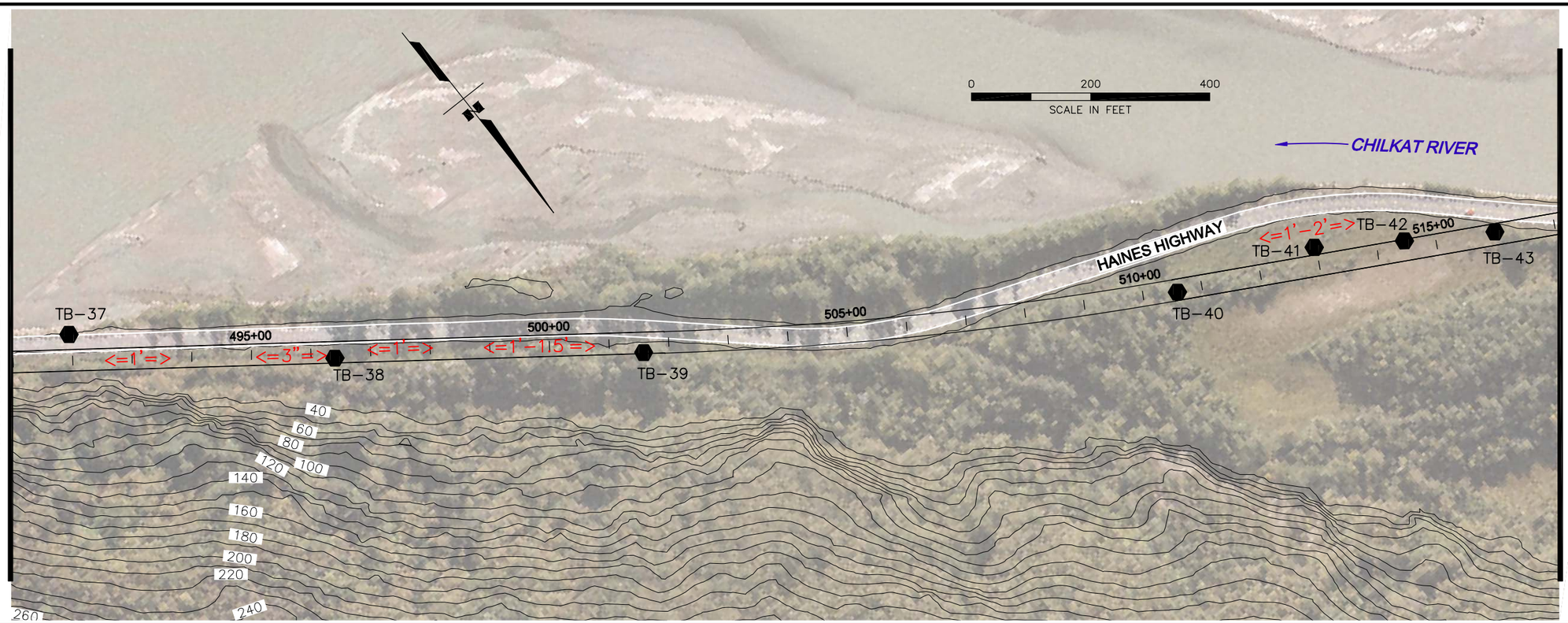
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
11	44

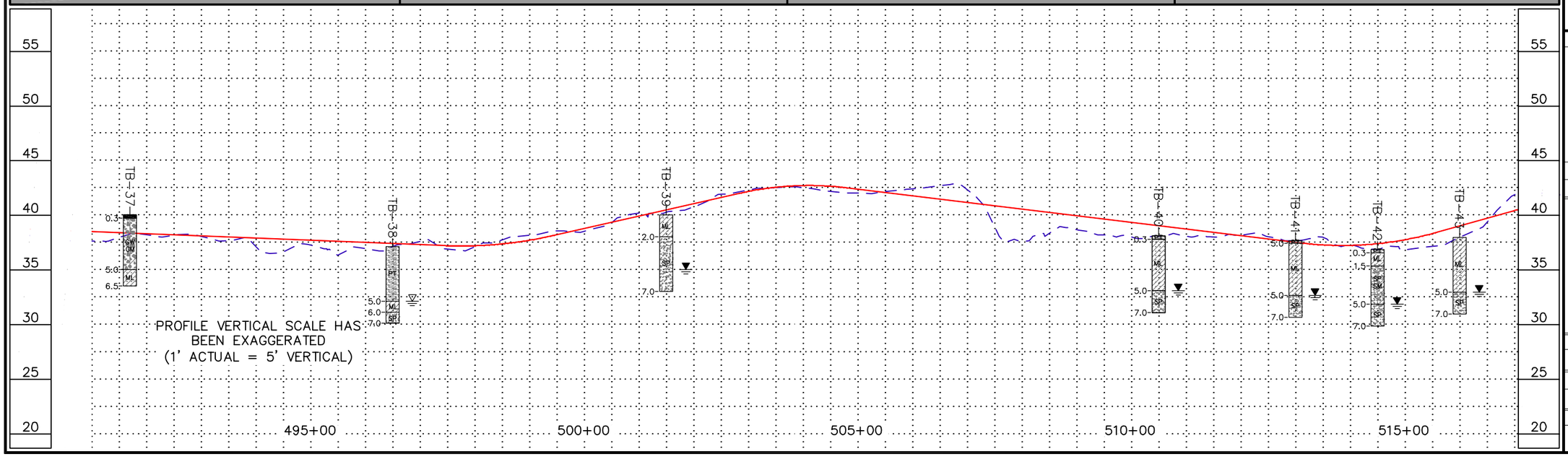


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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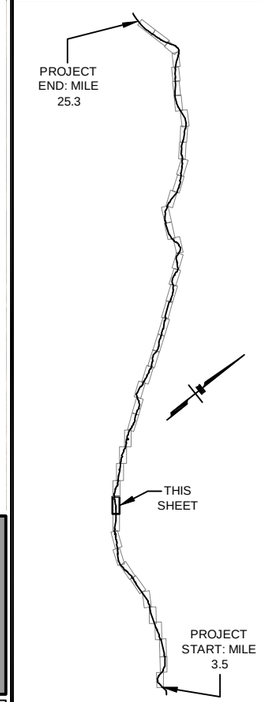
MICHAEL J. BAUER
TAB: 12 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

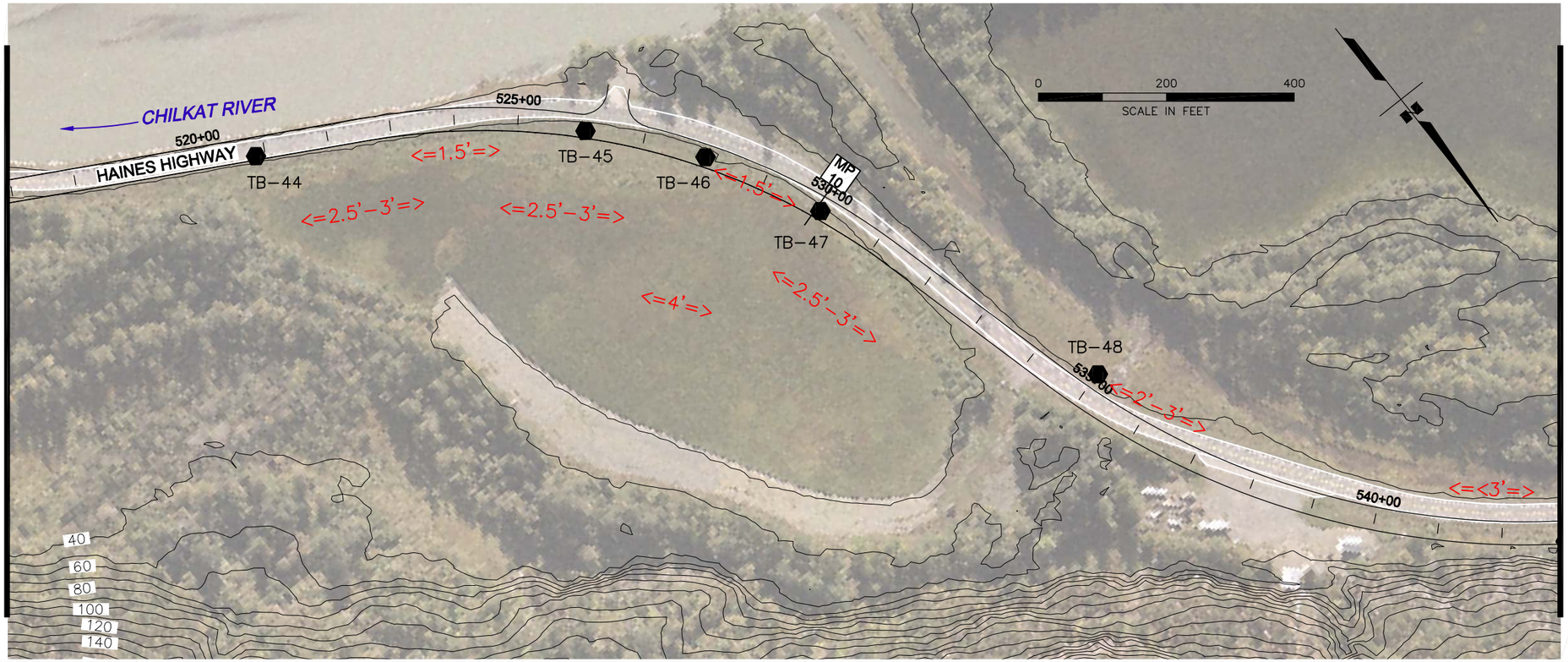
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
12	44

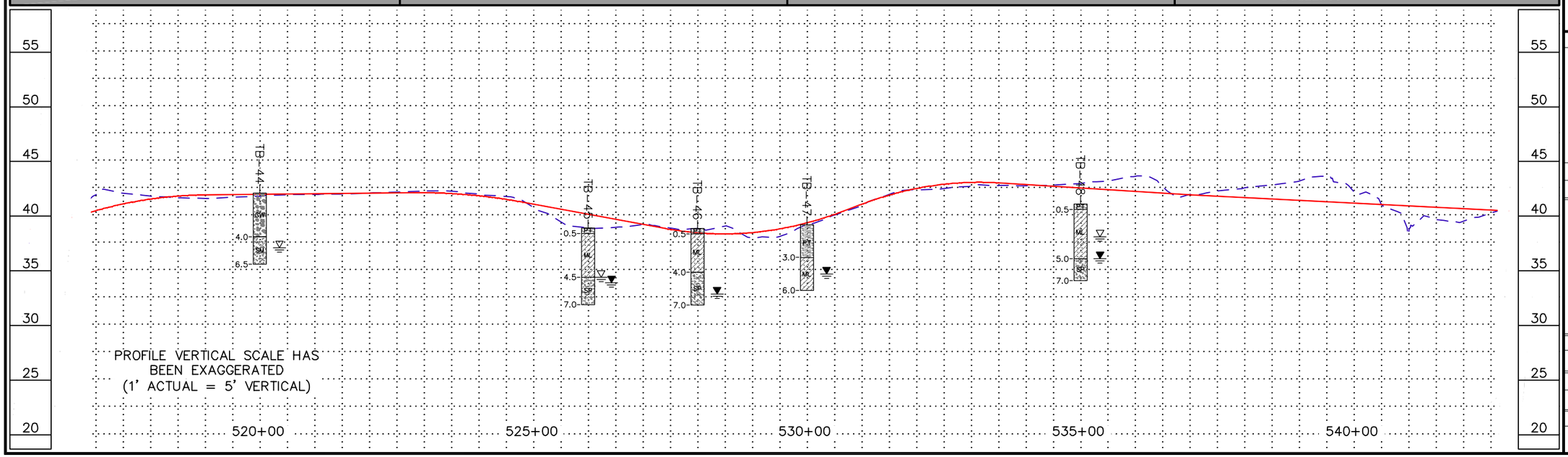


LEGEND

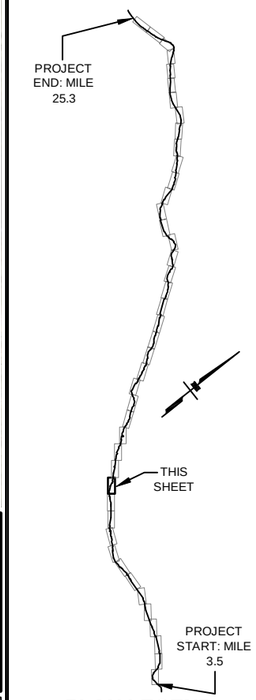
- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 – 220+00)
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE (1)
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



PROFILE VERTICAL SCALE HAS BEEN EXAGGERATED (1' ACTUAL = 5' VERTICAL)



PLAN LEGEND

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MICHAEL J. BAUER
TAB: 13 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

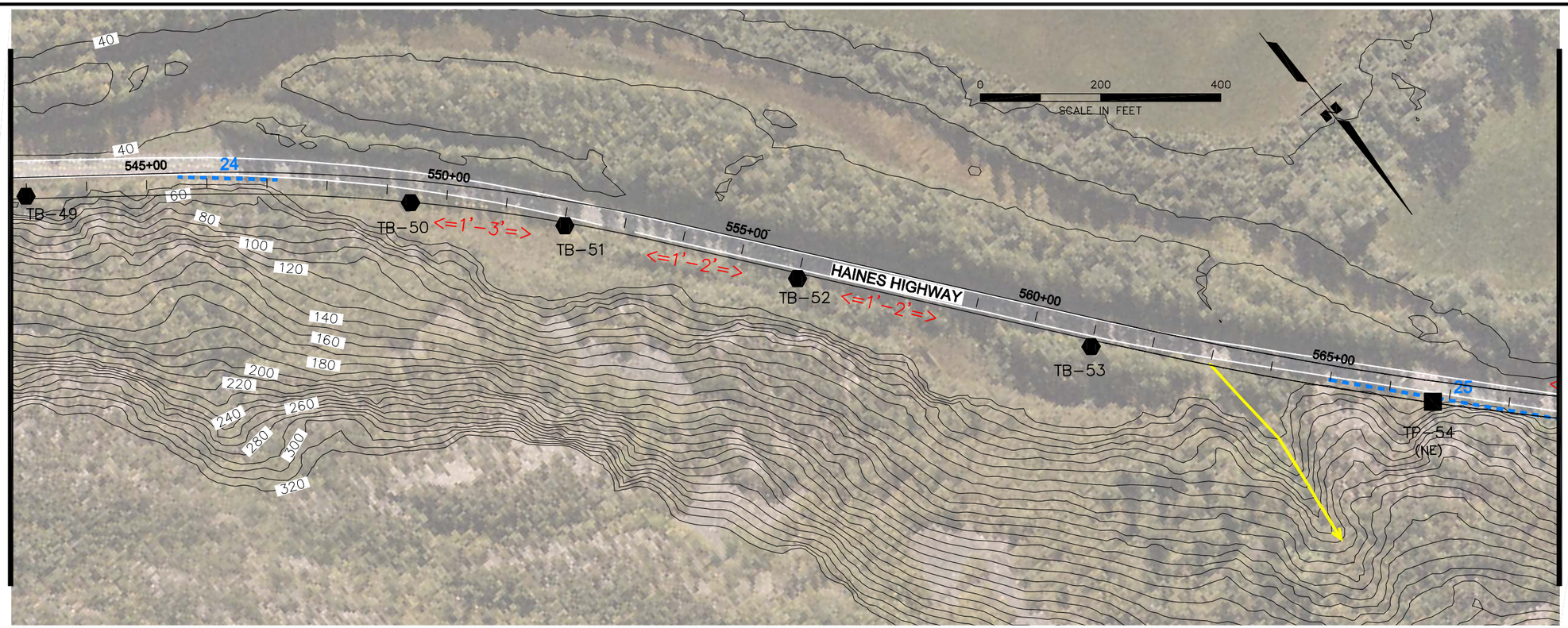
HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008

SHEET NUMBER	TOTAL SHEETS
13	44

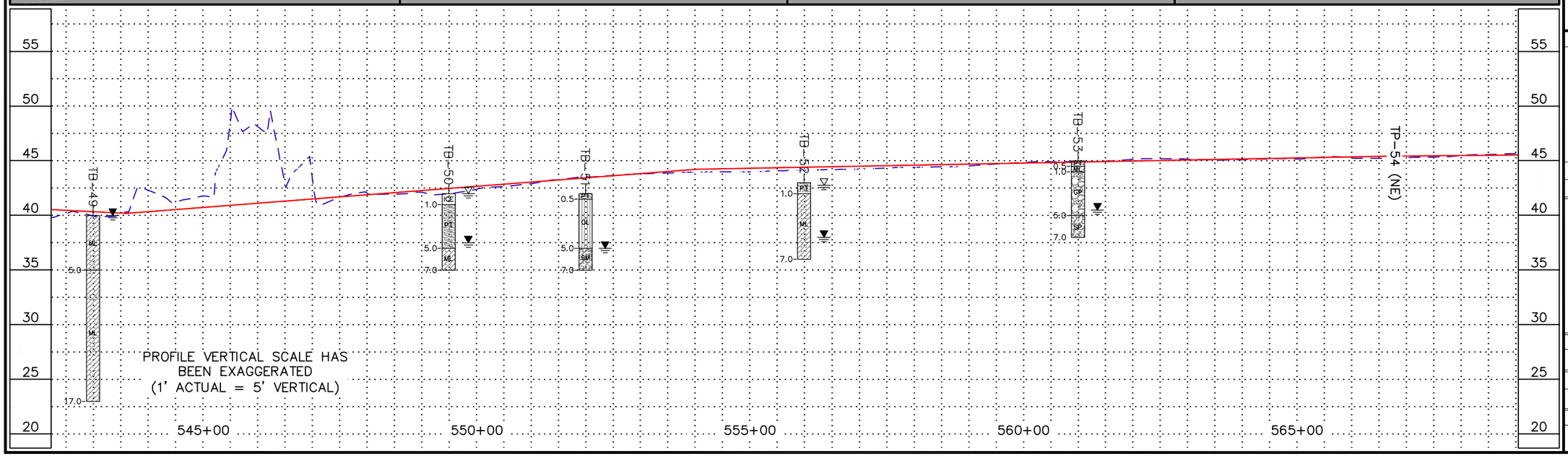


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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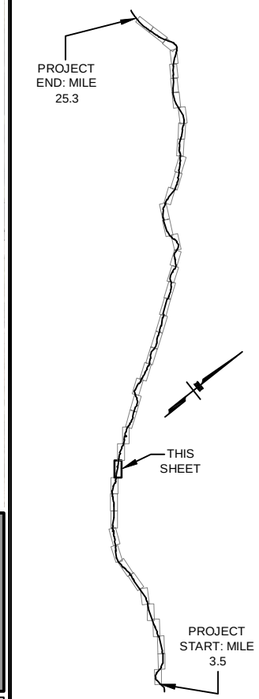
MICHAEL J. BAUER
TAB: 14 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

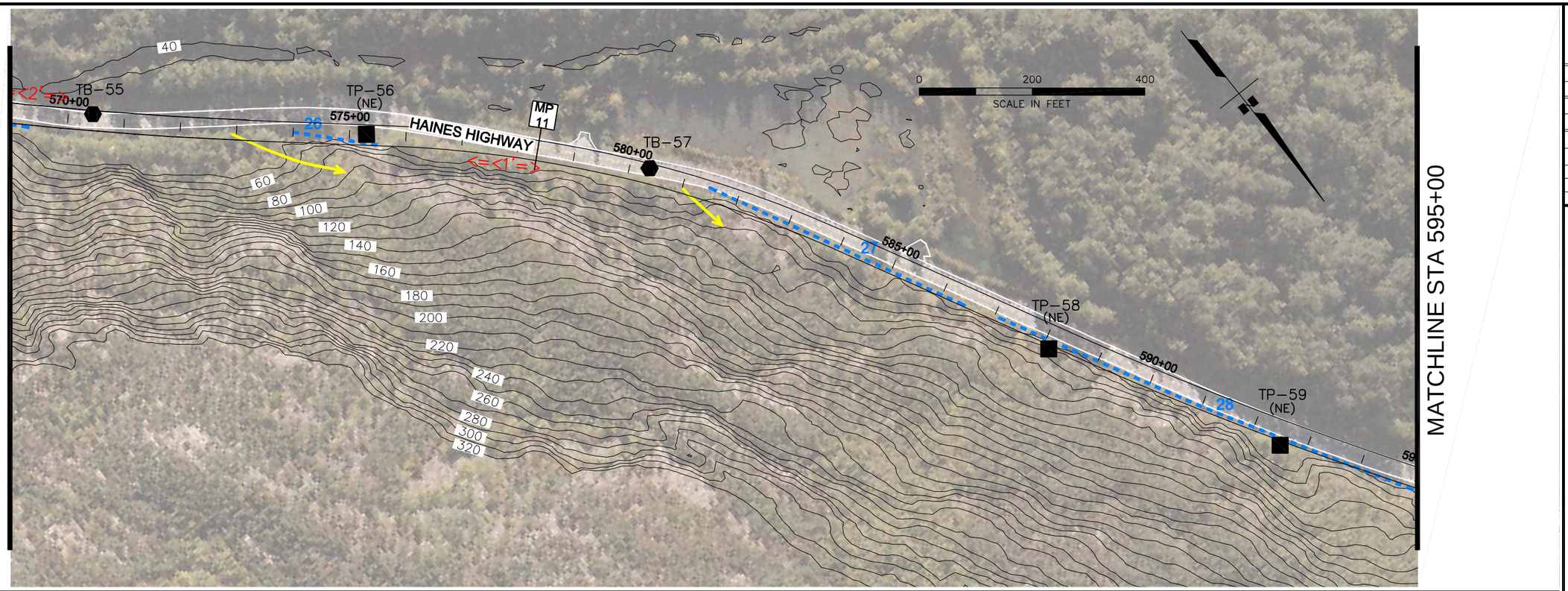
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
14	44

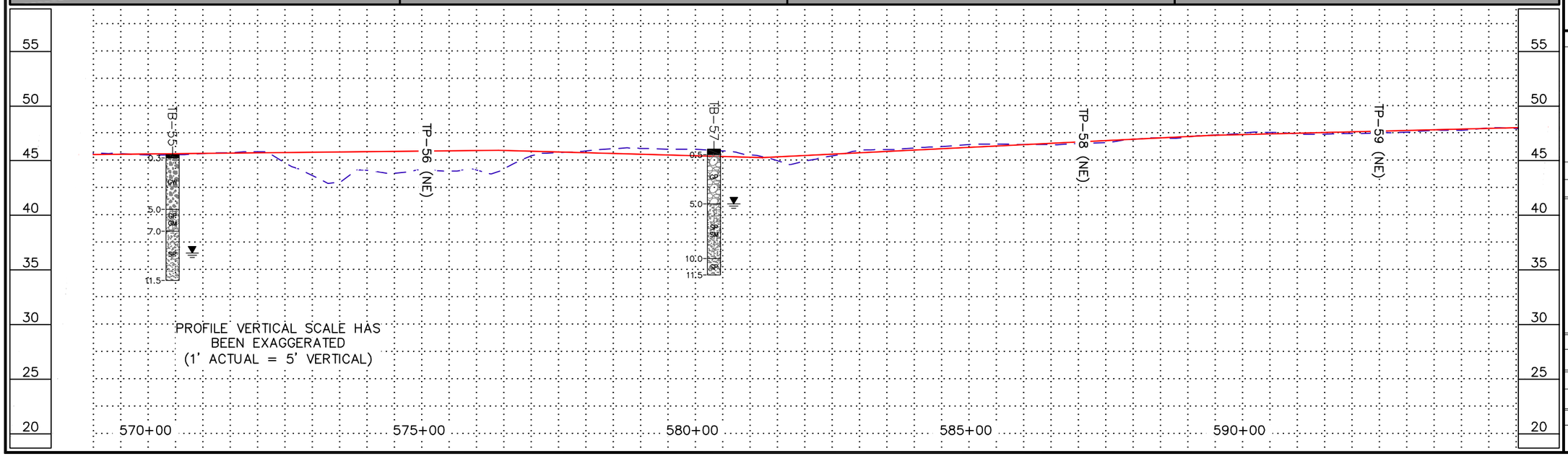


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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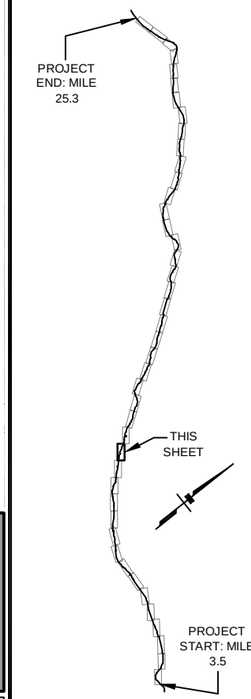
MICHAEL J. BAUER
TAB: 15 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

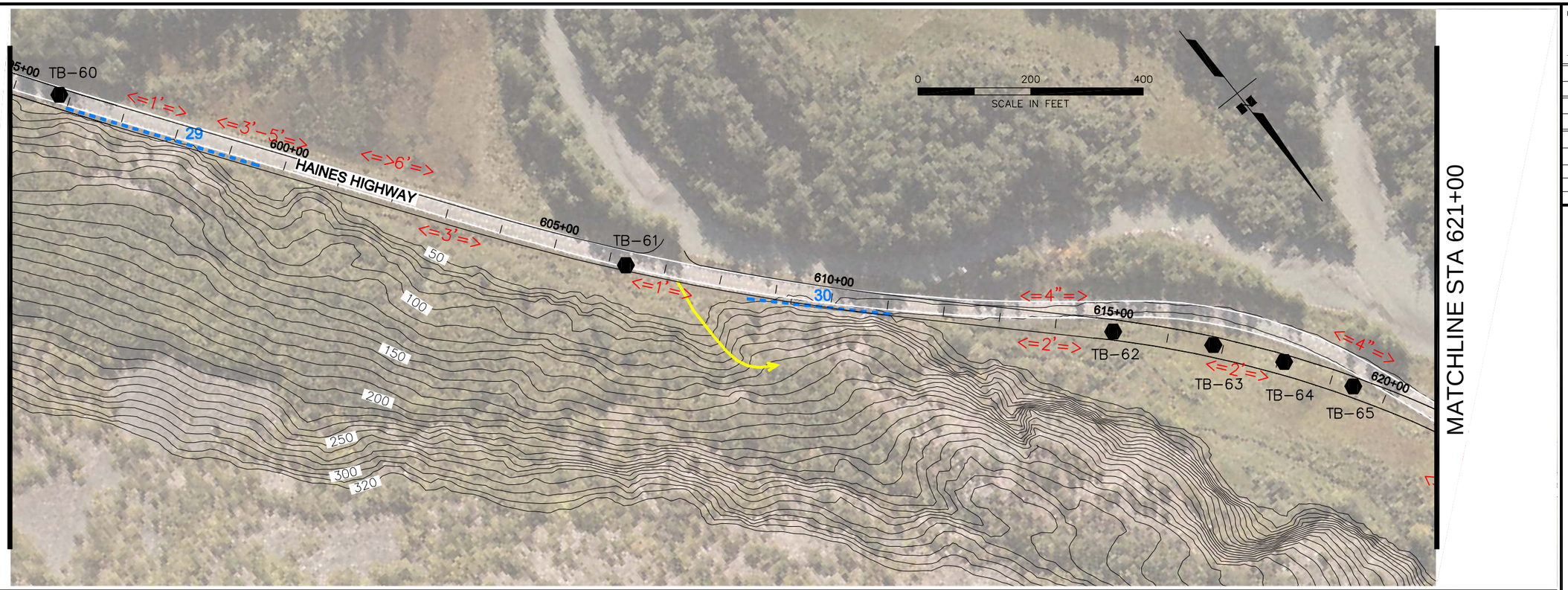
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
15	44



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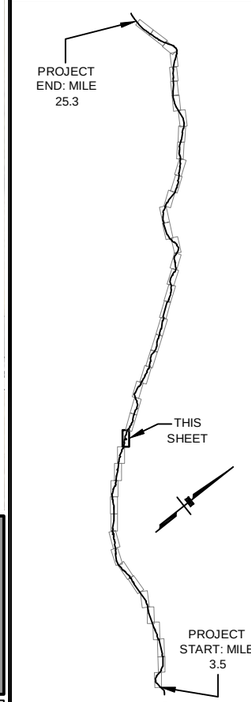
MICHAEL J. BAUER
TAB: 16 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



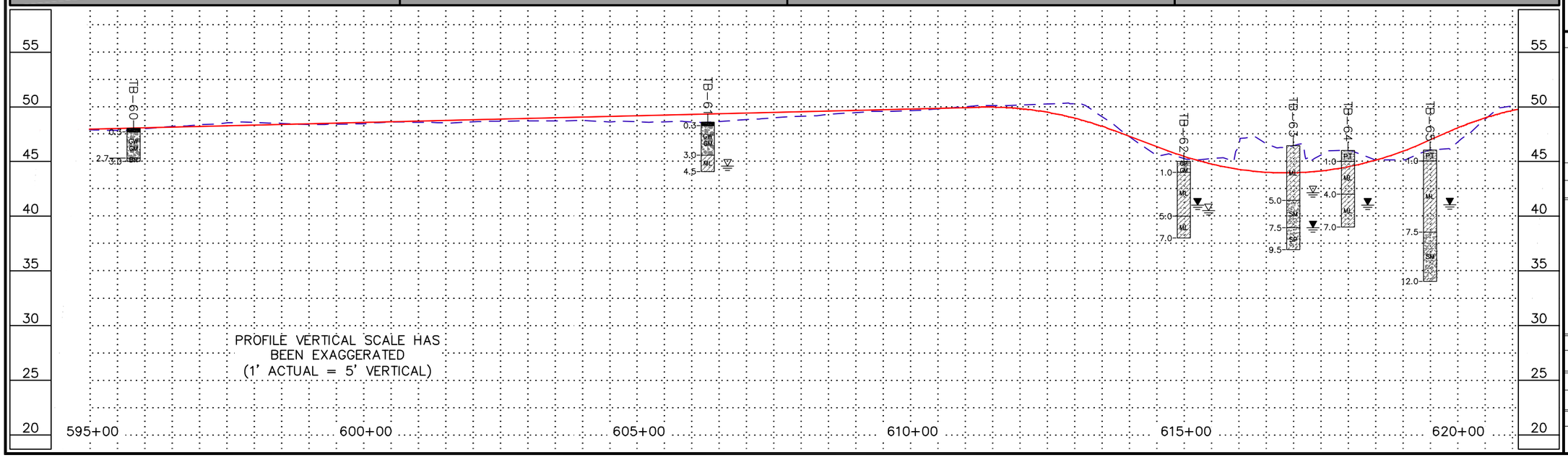
PLAN LEGEND

LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

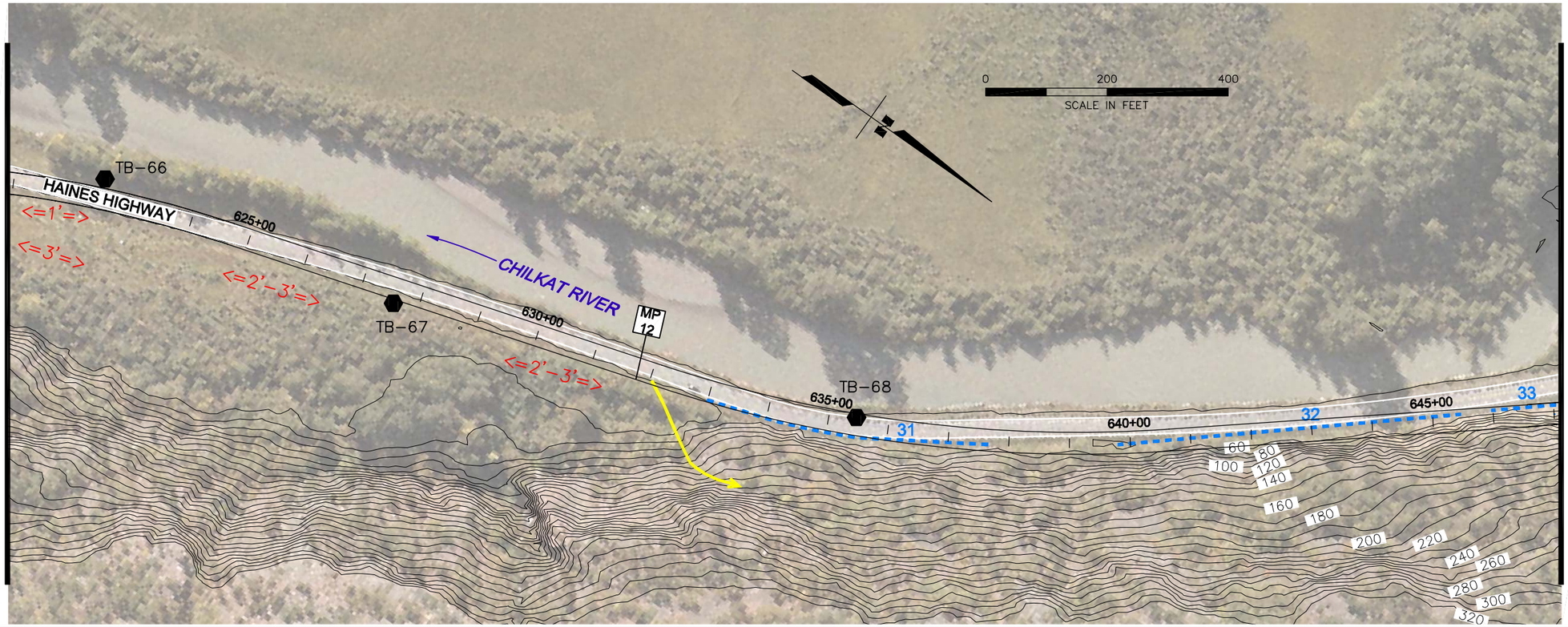
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
16	44

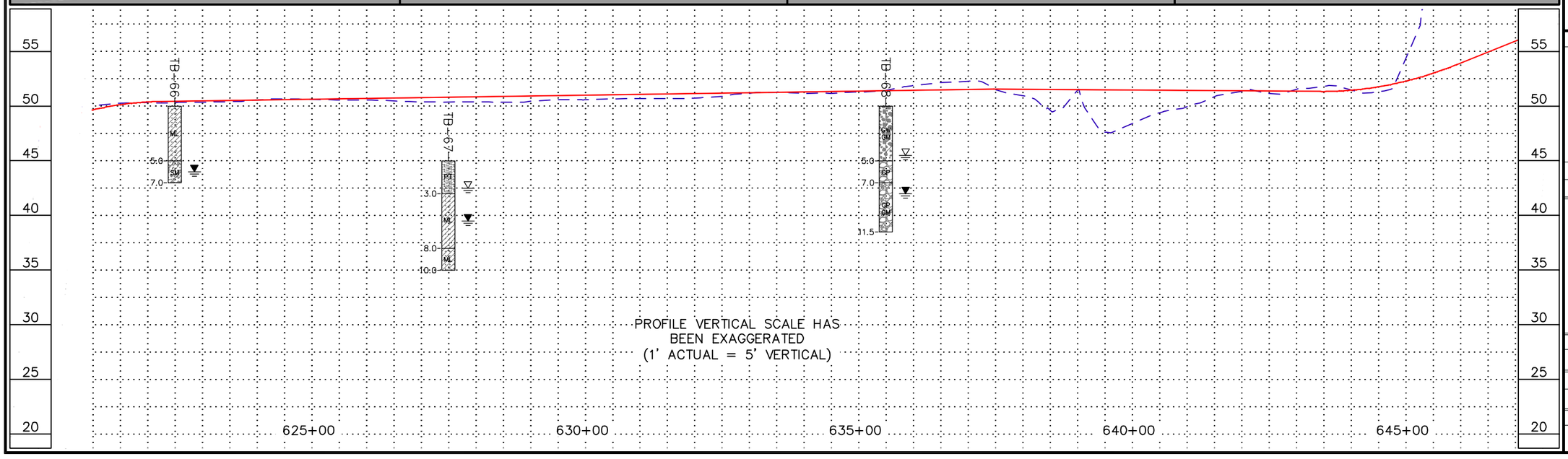


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



PROFILE VERTICAL SCALE HAS BEEN EXAGGERATED (1' ACTUAL = 5' VERTICAL)

PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

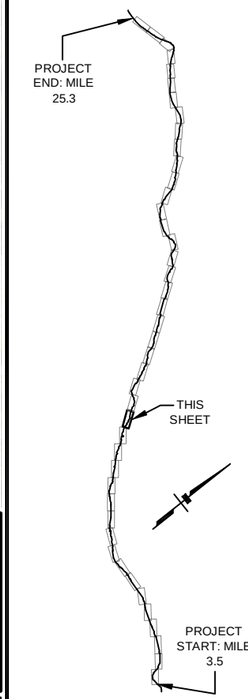
MICHAEL J. BAUER
TAB: 17 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

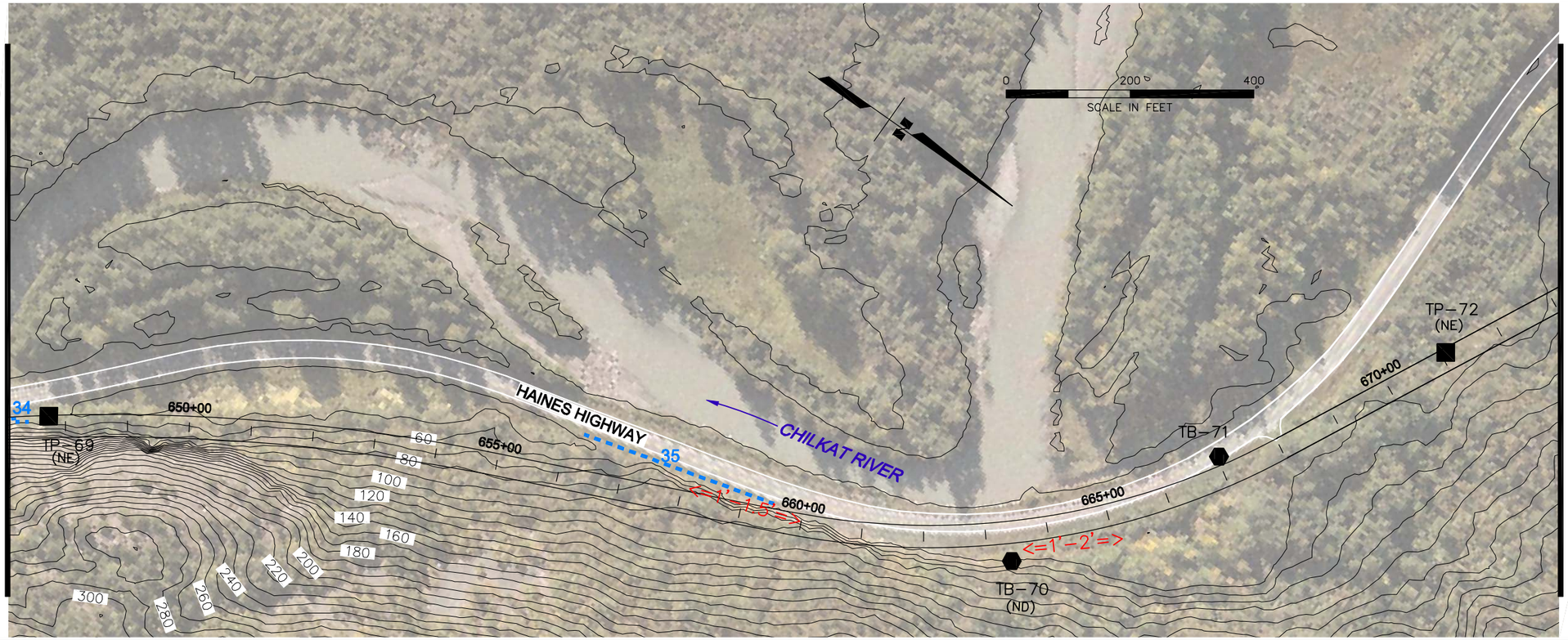
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
17	44

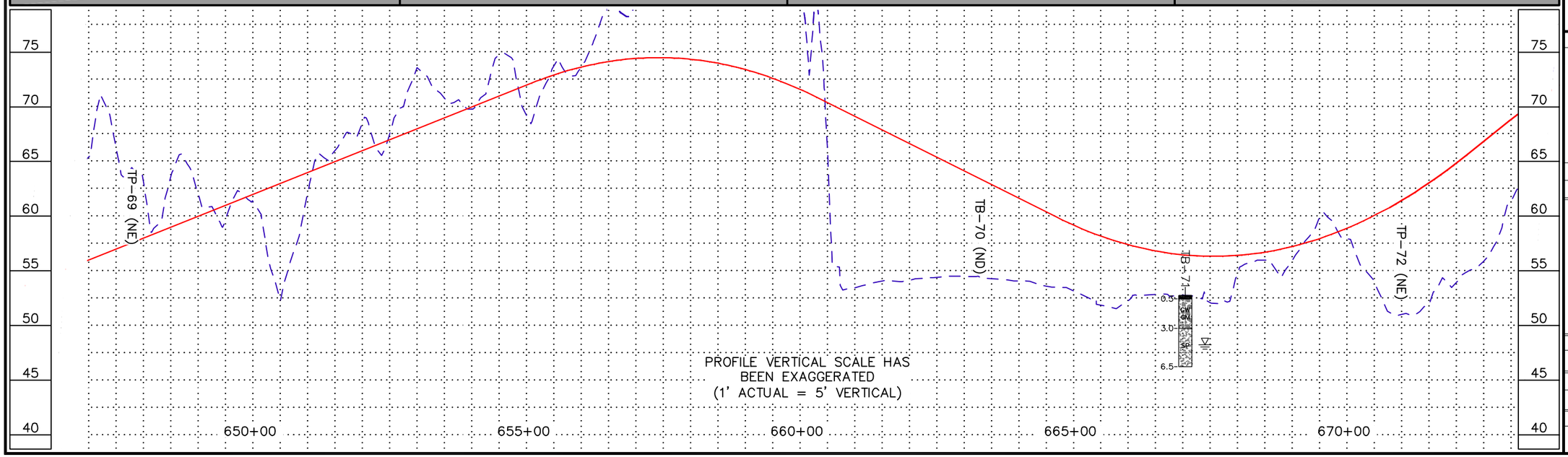


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



PROFILE VERTICAL SCALE HAS BEEN EXAGGERATED (1' ACTUAL = 5' VERTICAL)

PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

MICHAEL J. BAUER

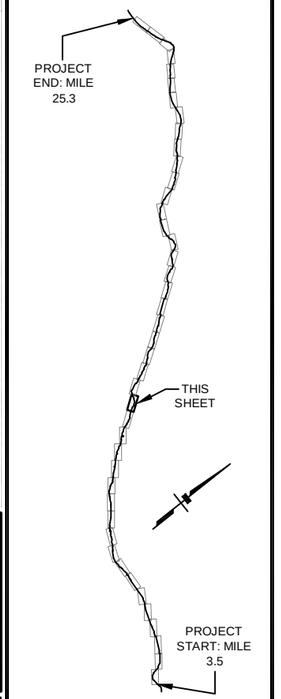
TAB: 18 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

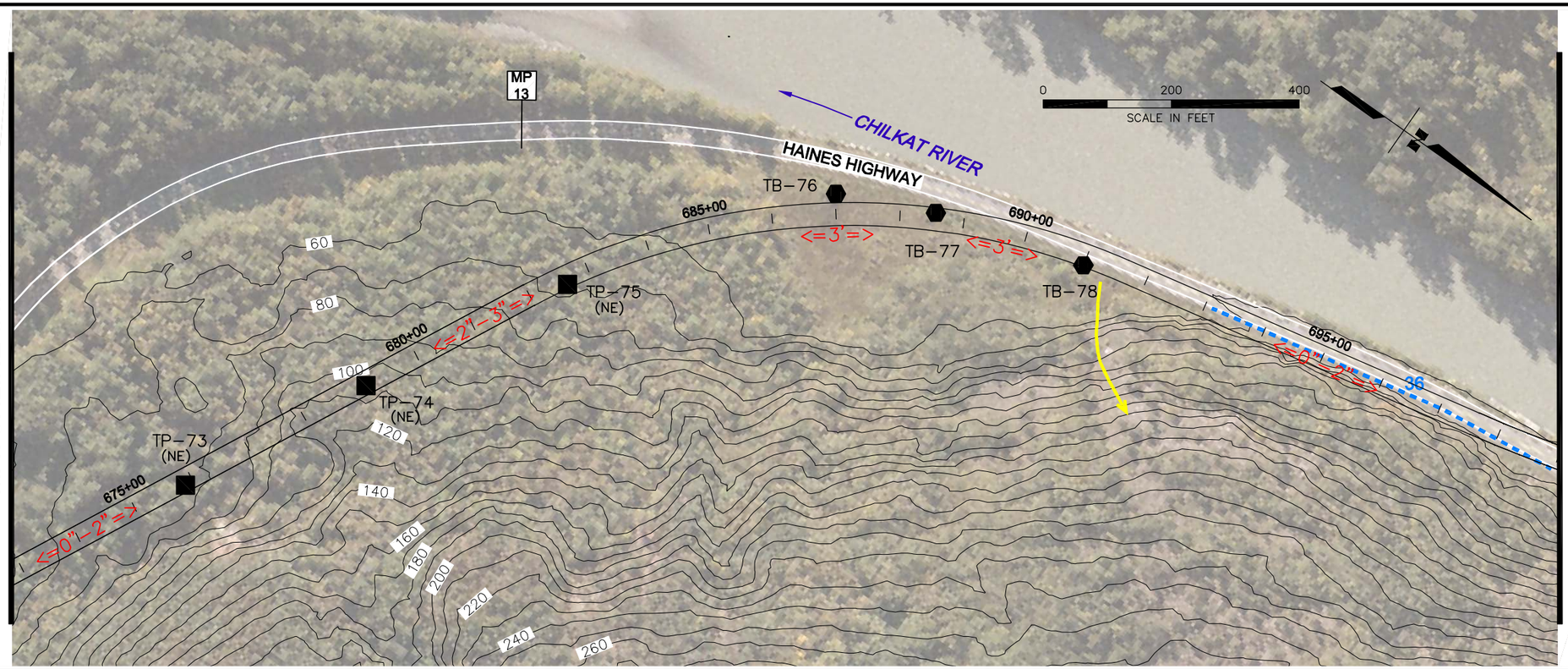
HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION

68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
18	44

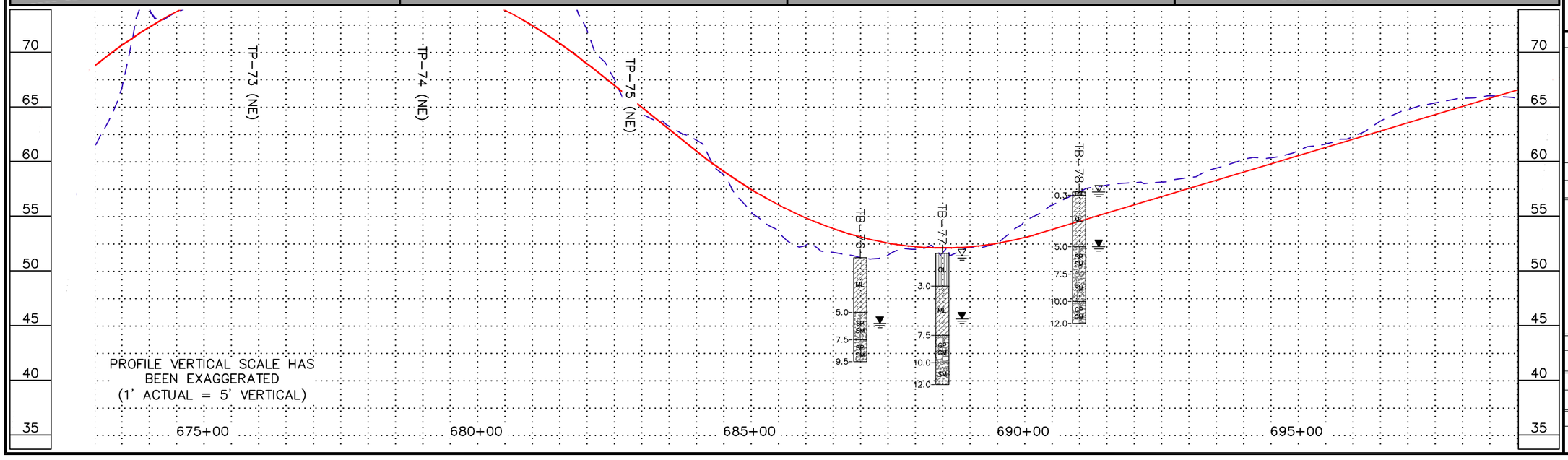


LEGEND

40 / 60	CONTOUR INTERVAL IS 10 FEET
	EXISTING ROAD ALIGNMENT
210+00 220+00	PROPOSED ROAD ALIGNMENT WITH STATIONING
TB–5 (ND)	APPROXIMATE TEST BORING LOCATION NOT DRILLED
TP–28 (NE)	APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
<=2"=>	HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
1	GEOLOGIC MAPPING BASELINE
MP 4	POSSIBLE ACCESS TO TOP OF OUTCROP HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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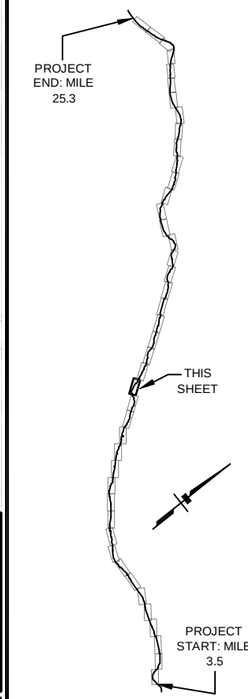
MICHAEL J. BAUER
TAB: 19 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

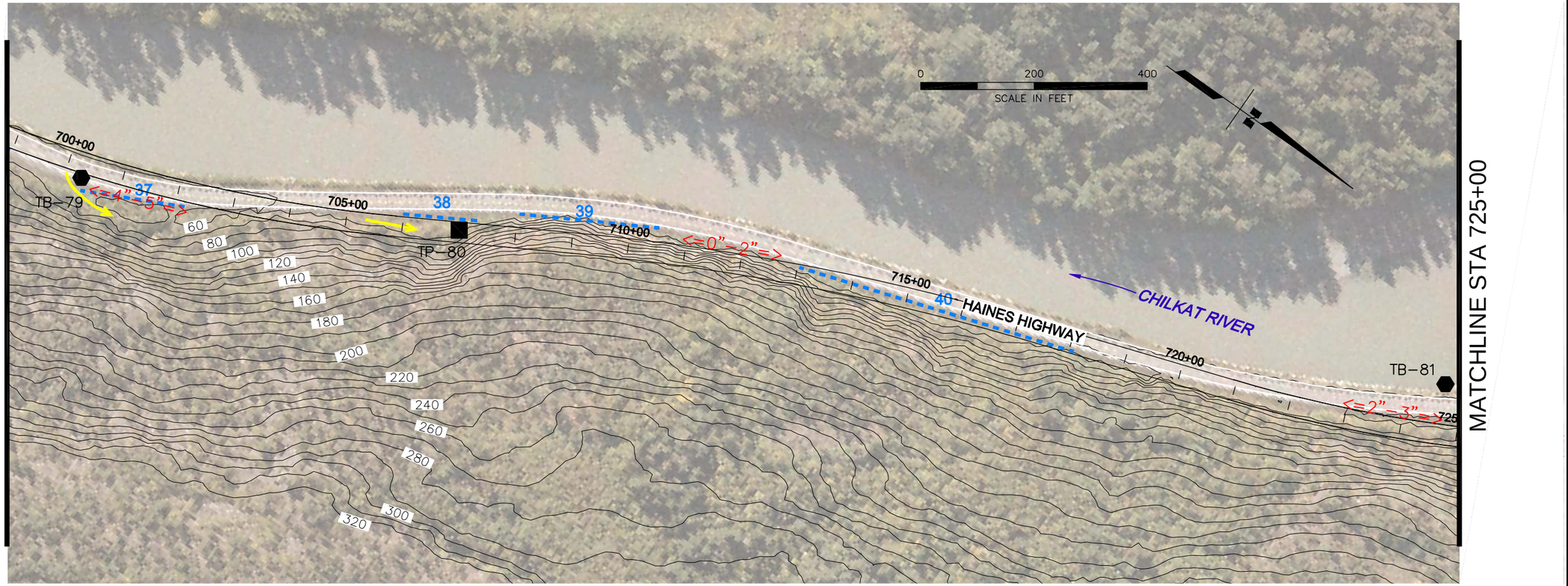
DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
19	44

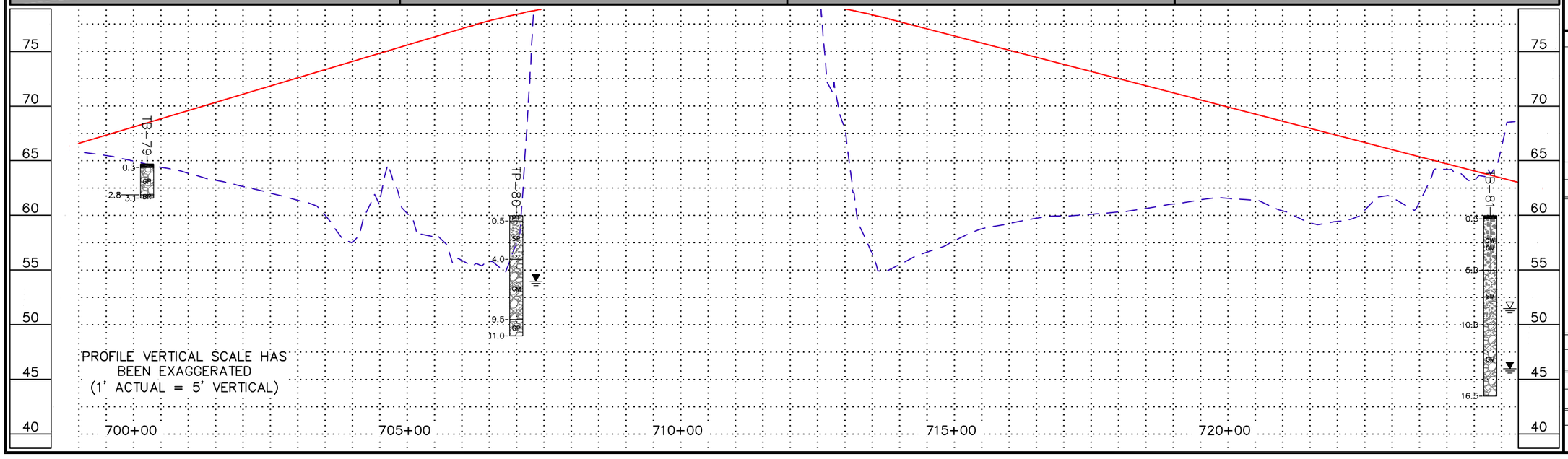


LEGEND

- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 — 220+00)
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE (1)
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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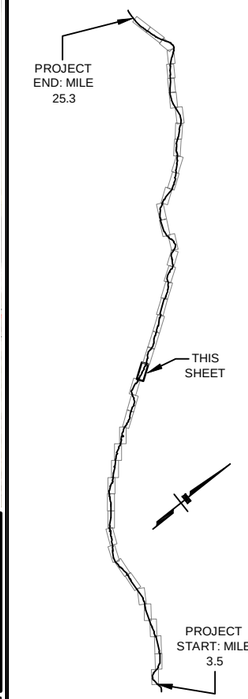
MICHAEL J. BAUER
TAB: 20 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

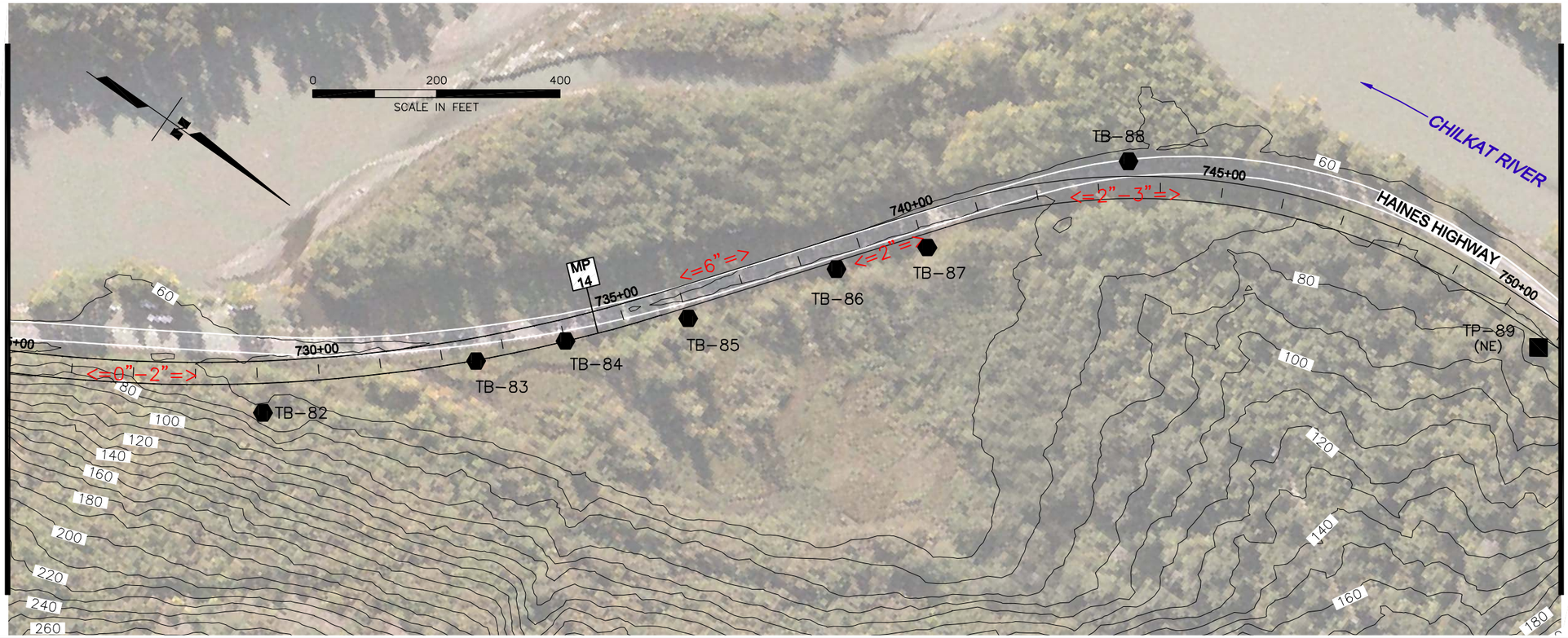
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
20	44

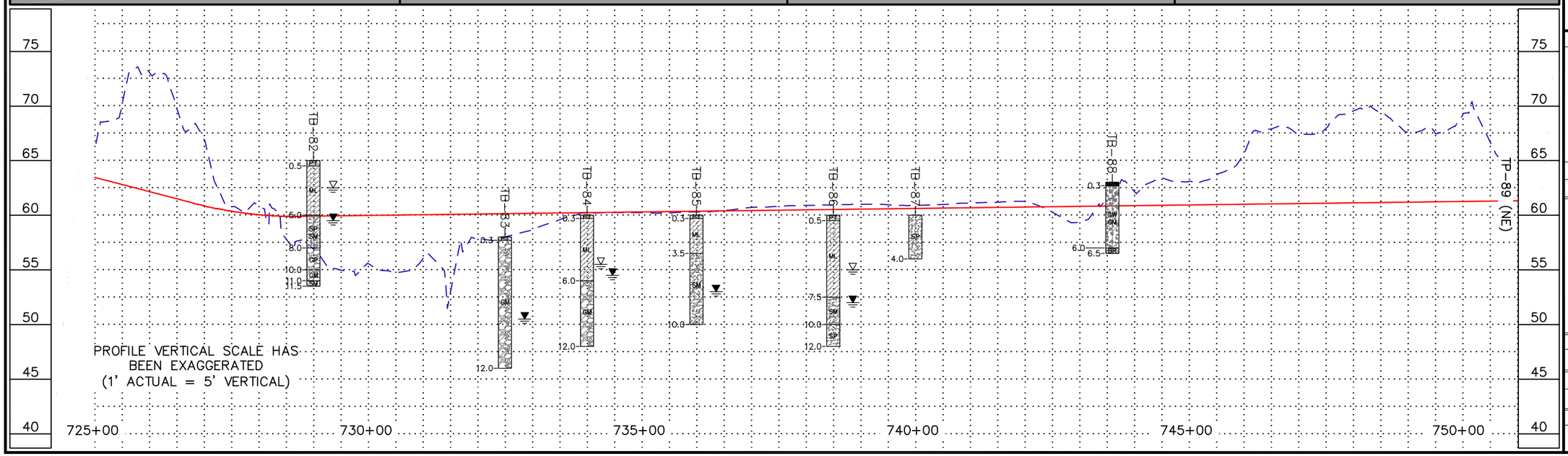


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE
- 1 — POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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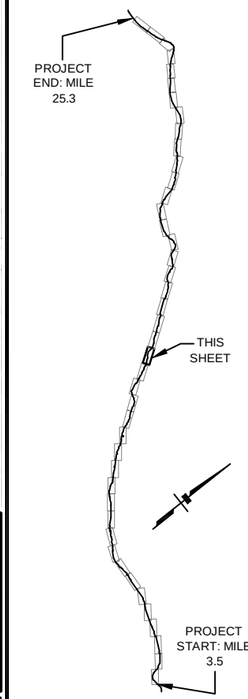
MICHAEL J. BAUER
TAB: 21 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

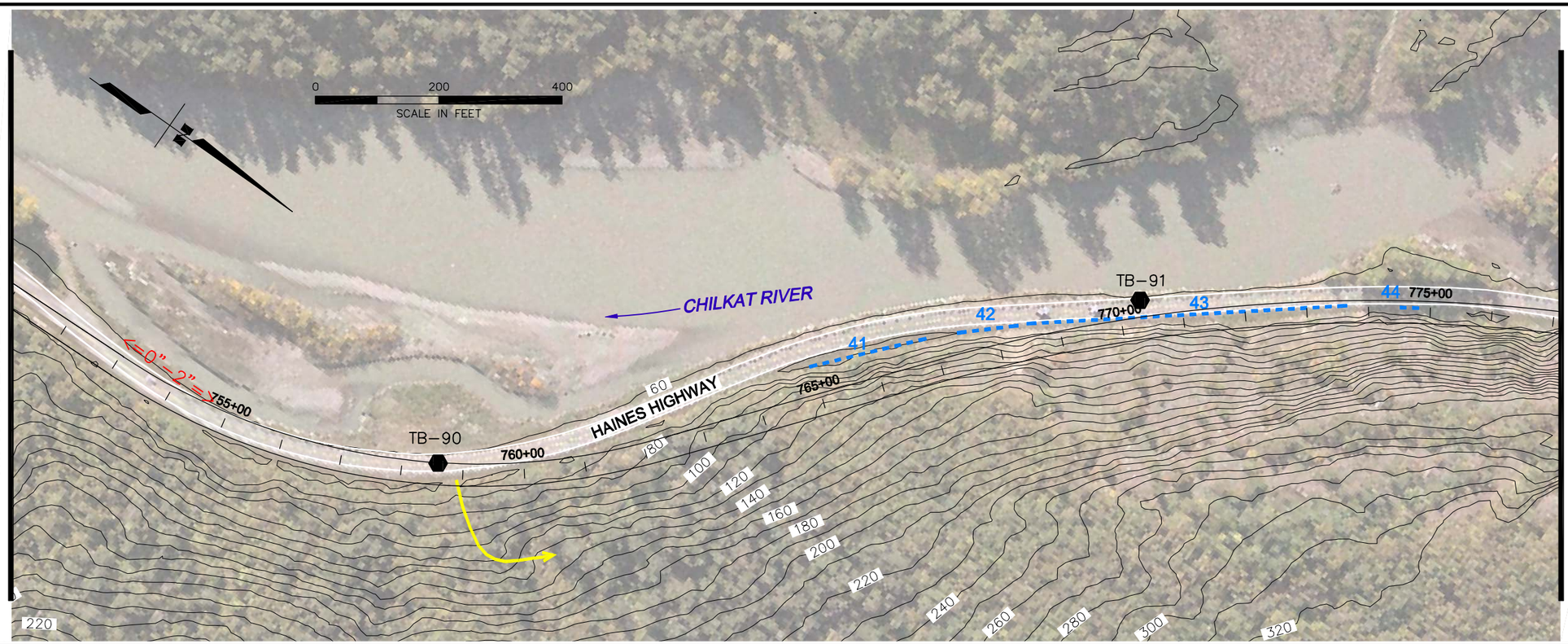
HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

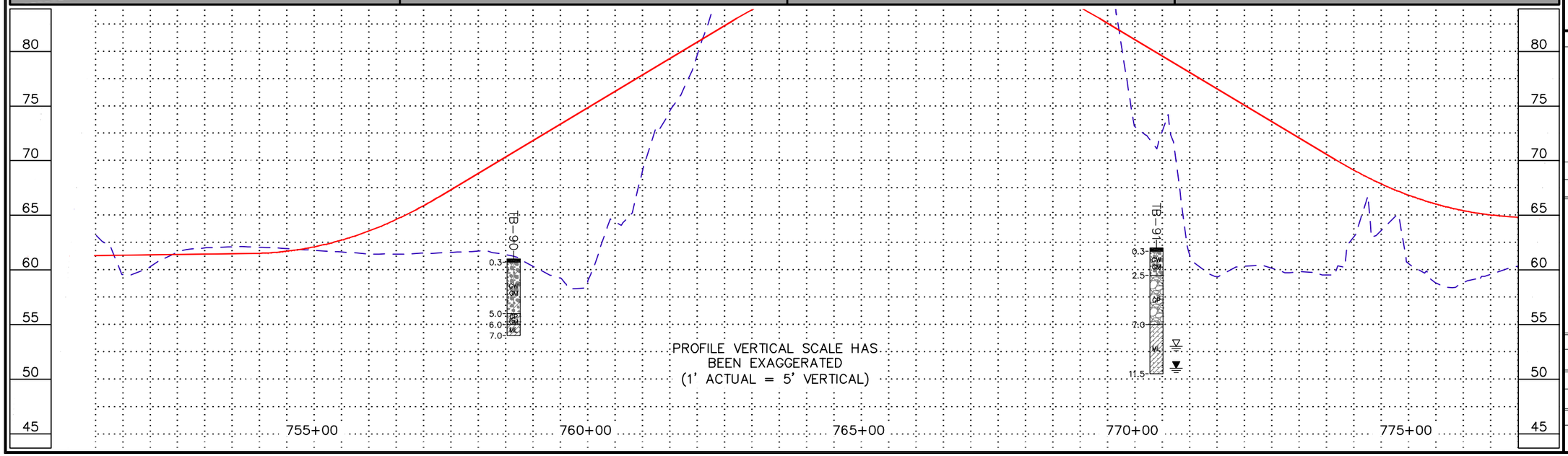
STATE	YEAR
ALASKA	2008

SHEET NUMBER	TOTAL SHEETS
21	44



LEGEND			
40 / 60 — CONTOUR INTERVAL IS 10 FEET	TB–5 (ND)	APPROXIMATE TEST BORING LOCATION NOT DRILLED	1 — GEOLOGIC MAPPING BASELINE
EXISTING ROAD ALIGNMENT	TP–28 (NE)	APPROXIMATE TEST PIT LOCATION NOT EXCAVATED	POSSIBLE ACCESS TO TOP OF OUTCROP
210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING	<=2"=>	HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS	MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE	
	EXISTING GROUND
	PROPOSED ROAD CENTERLINE
	GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
	GROUNDWATER MEASURED AFTER DRILLING



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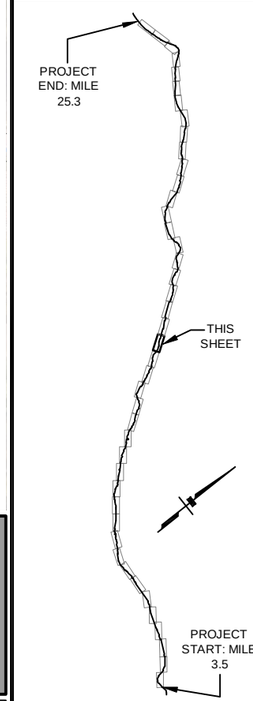
MICHAEL J. BAUER
TAB: 22 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

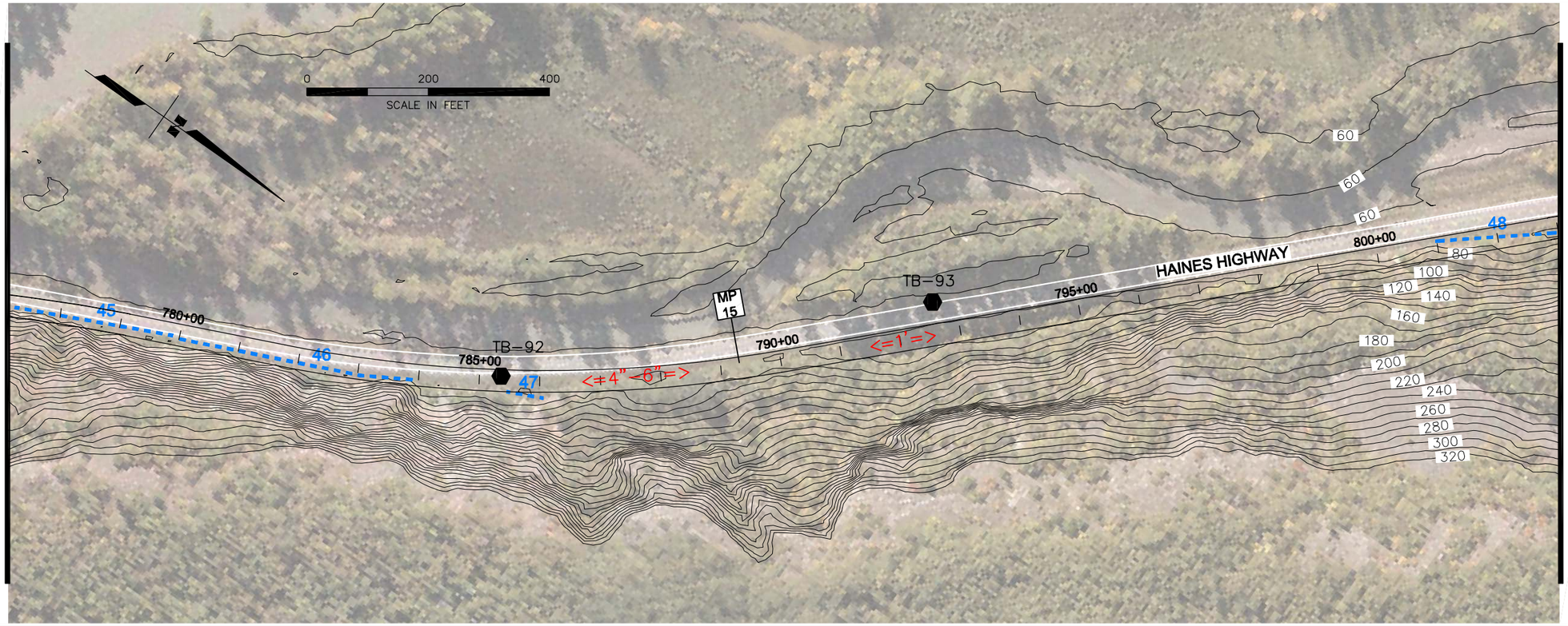
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
22	44

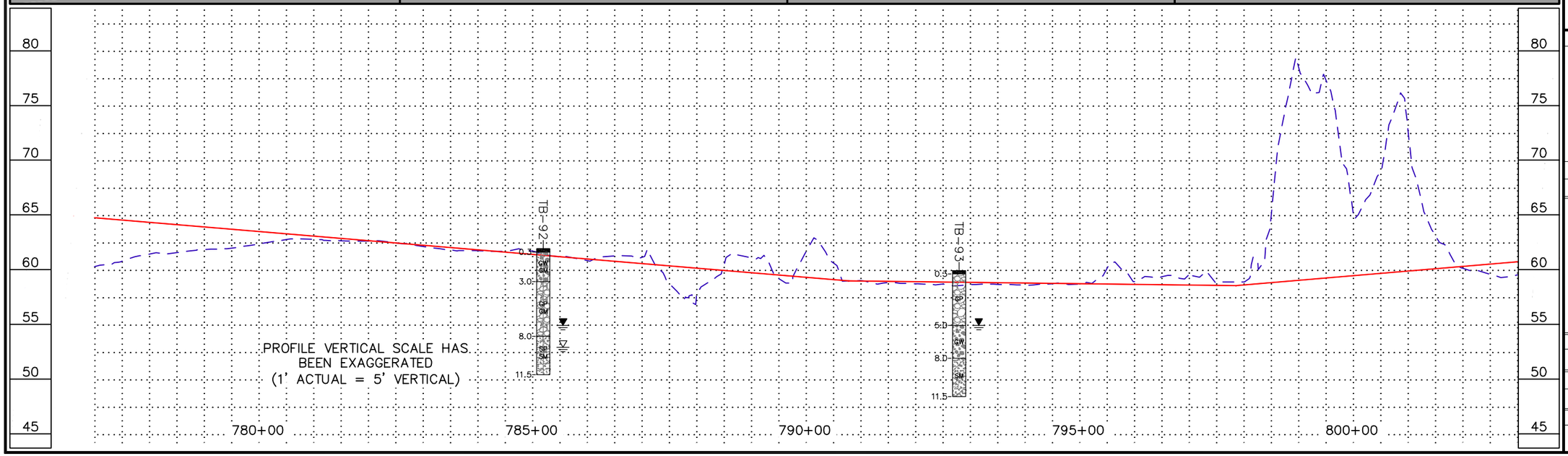


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- MP 4 — POSSIBLE ACCESS TO TOP OF OUTCROP; HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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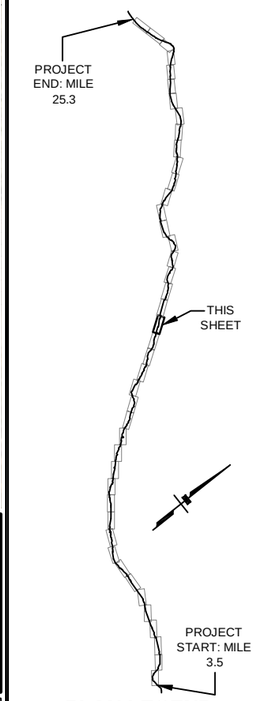
MICHAEL J. BAUER
TAB: 23 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

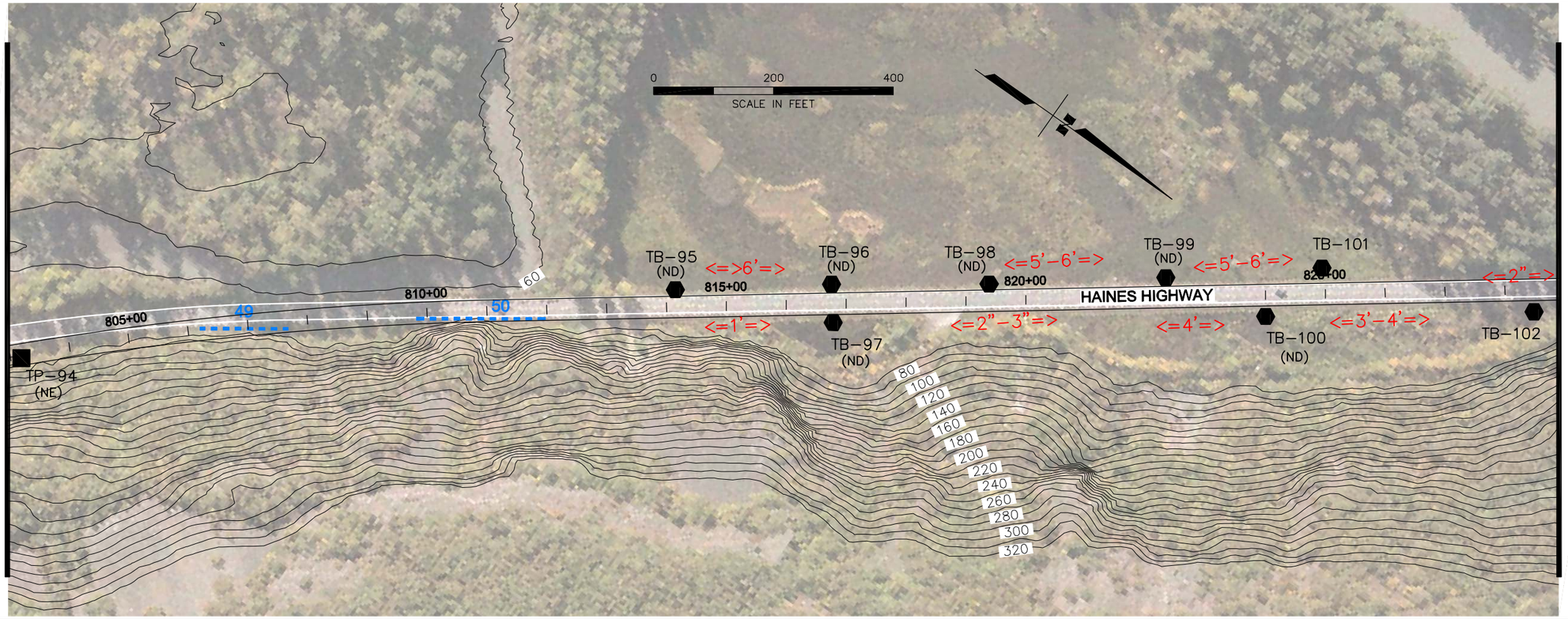
HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008

SHEET NUMBER	TOTAL SHEETS
23	44

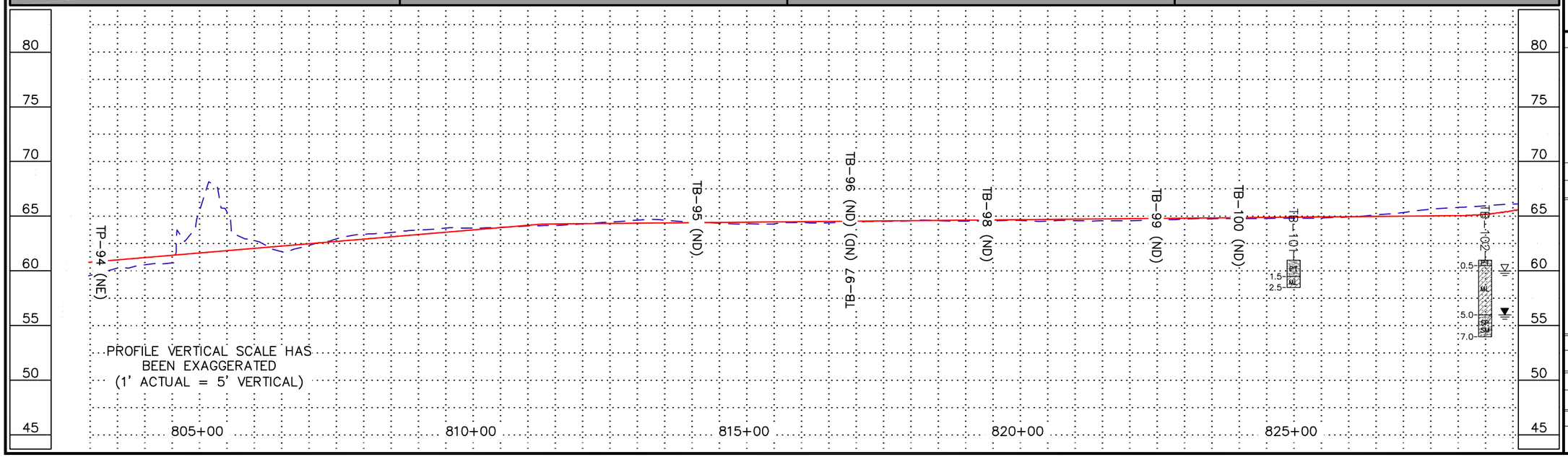


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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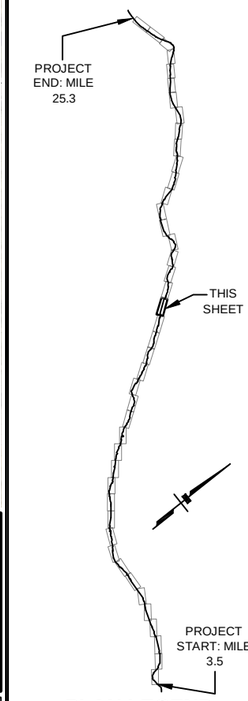
MICHAEL J. BAUER
TAB: 24 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

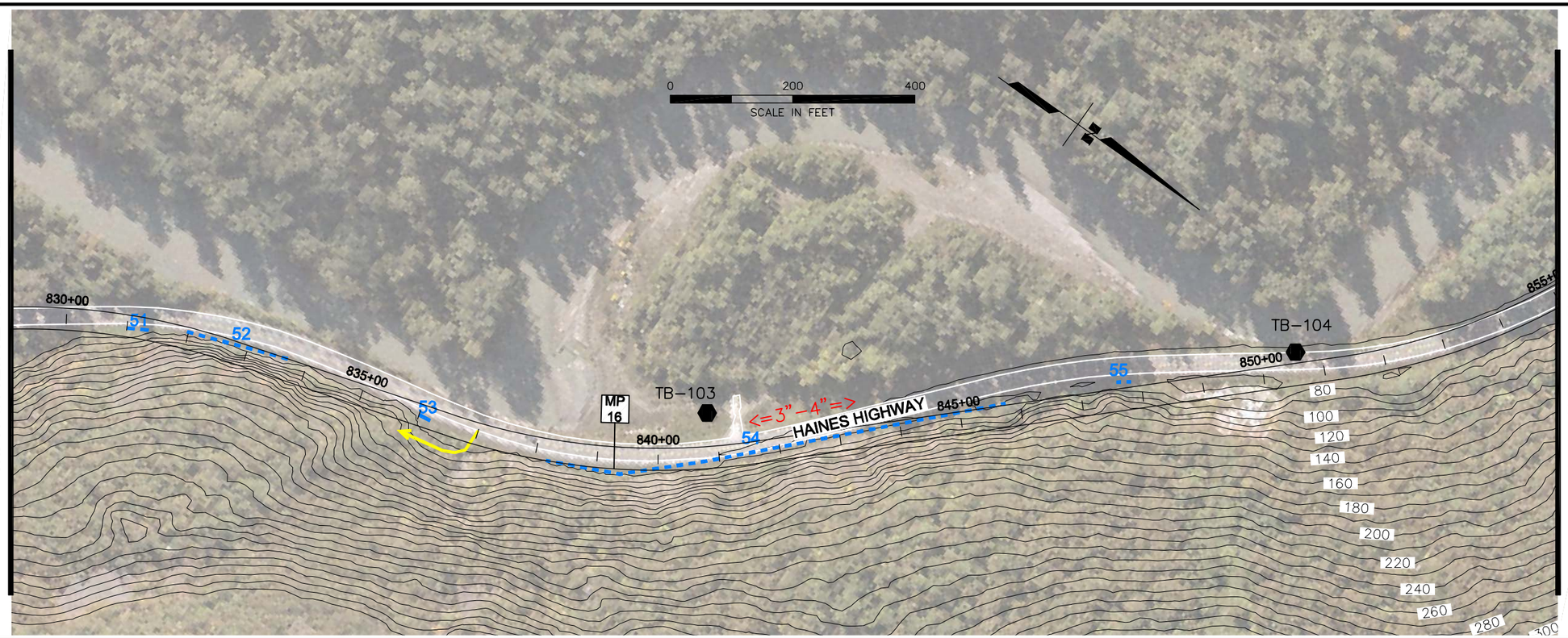
DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
24	44

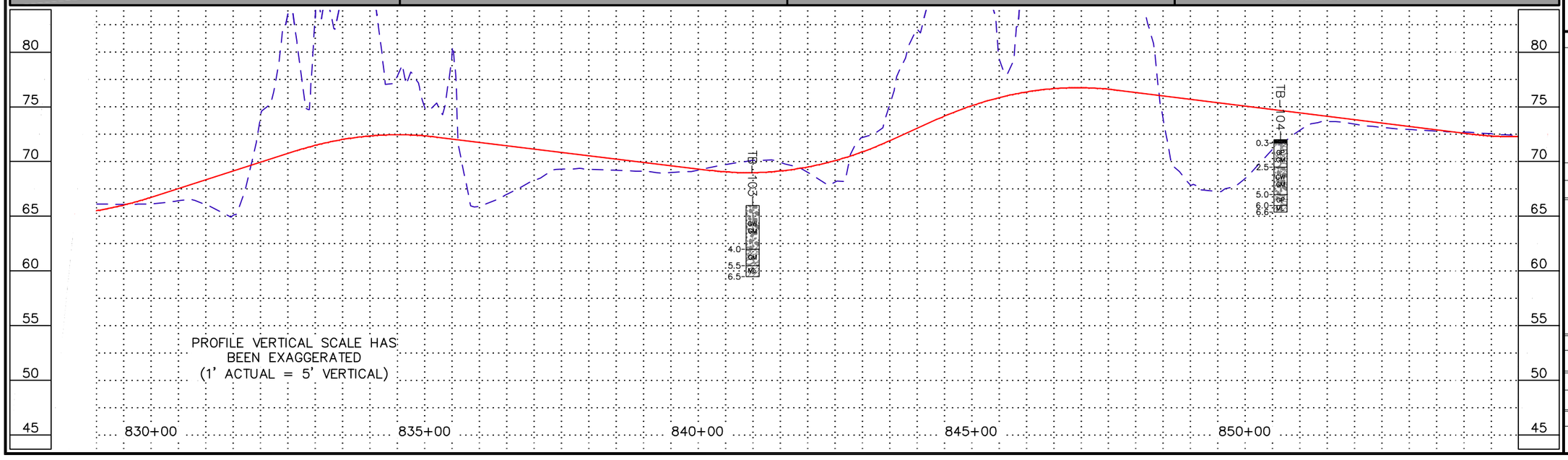


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE
- 1 — POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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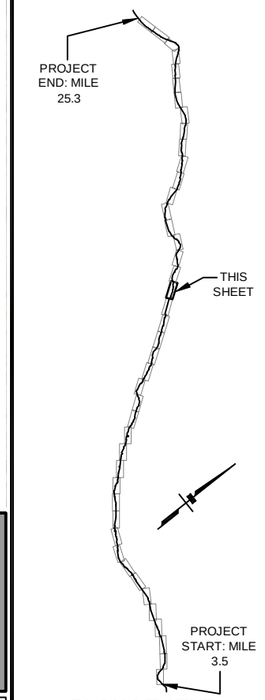
MICHAEL J. BAUER
TAB: 25 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

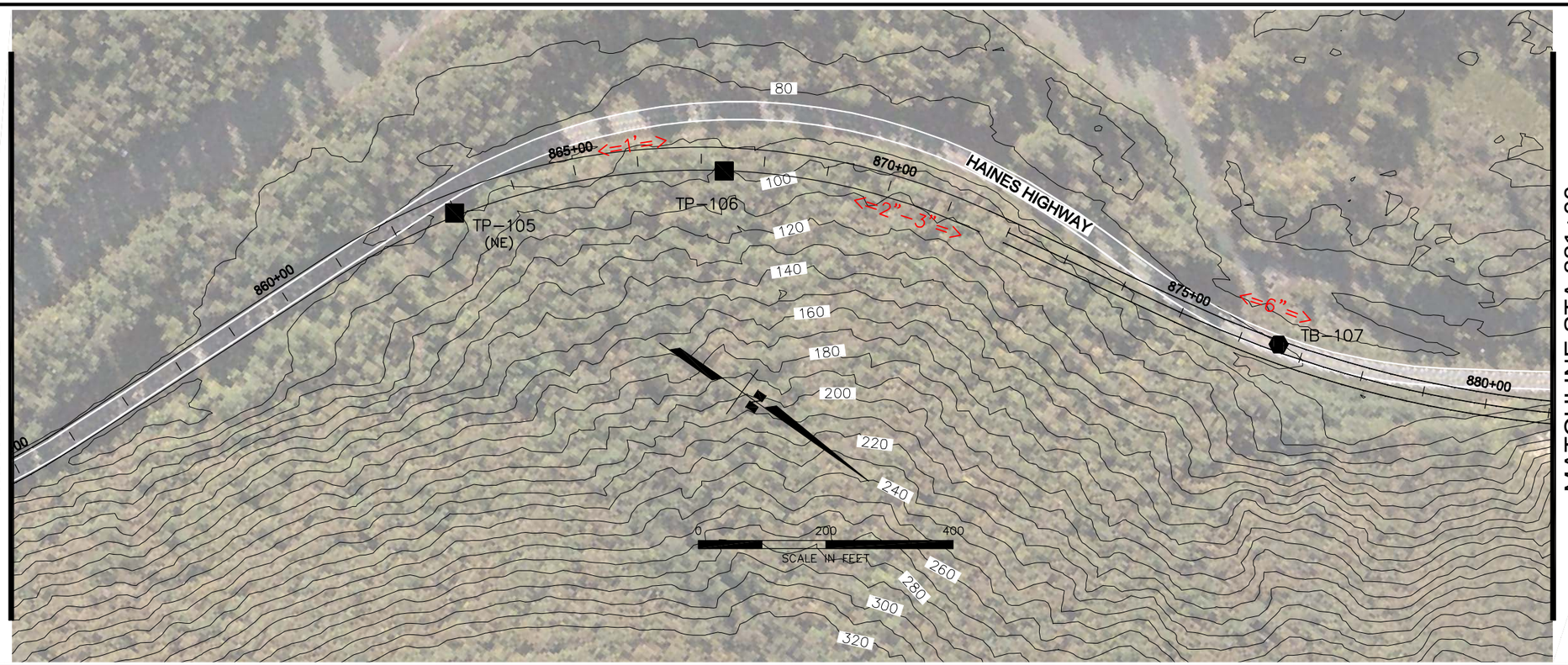
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
25	44

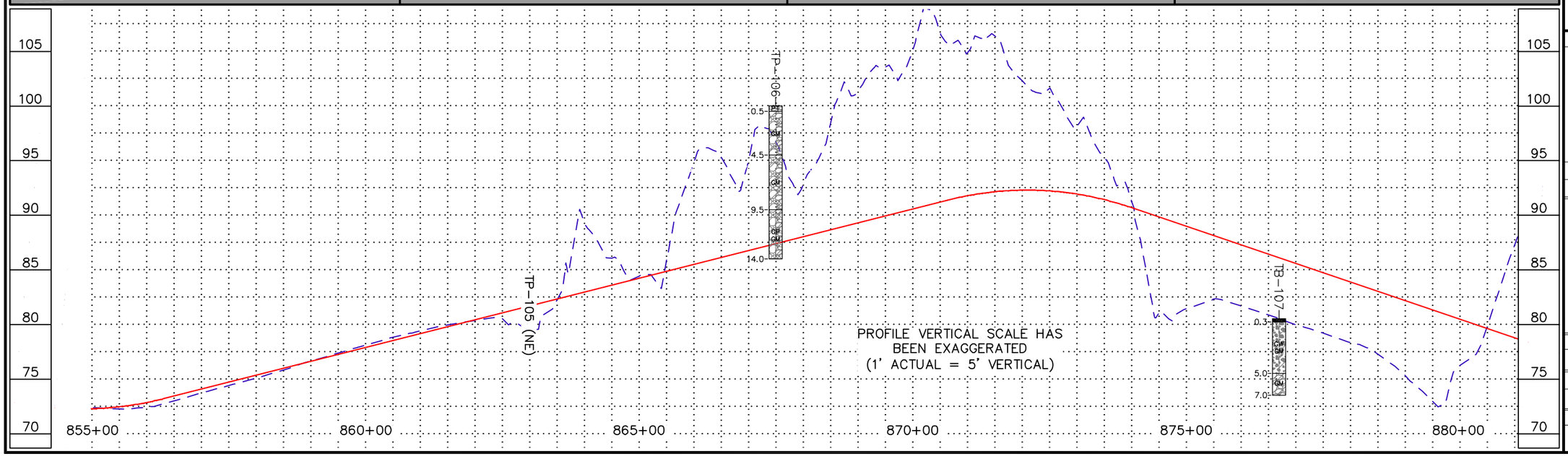


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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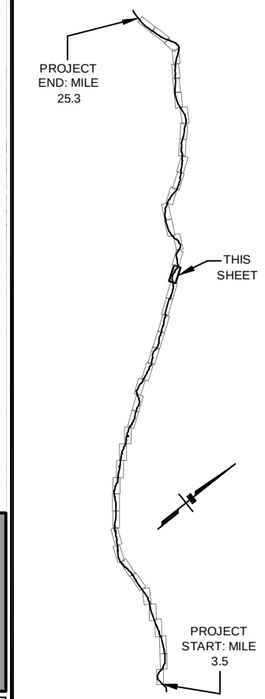
MICHAEL J. BAUER
TAB: 26 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008

SHEET NUMBER	TOTAL SHEETS
26	44

PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

MICHAEL J. BAUER

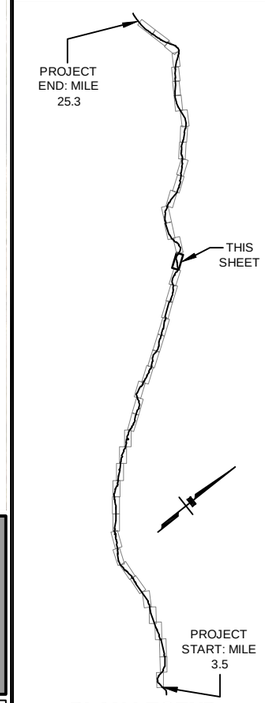
TAB: 27 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



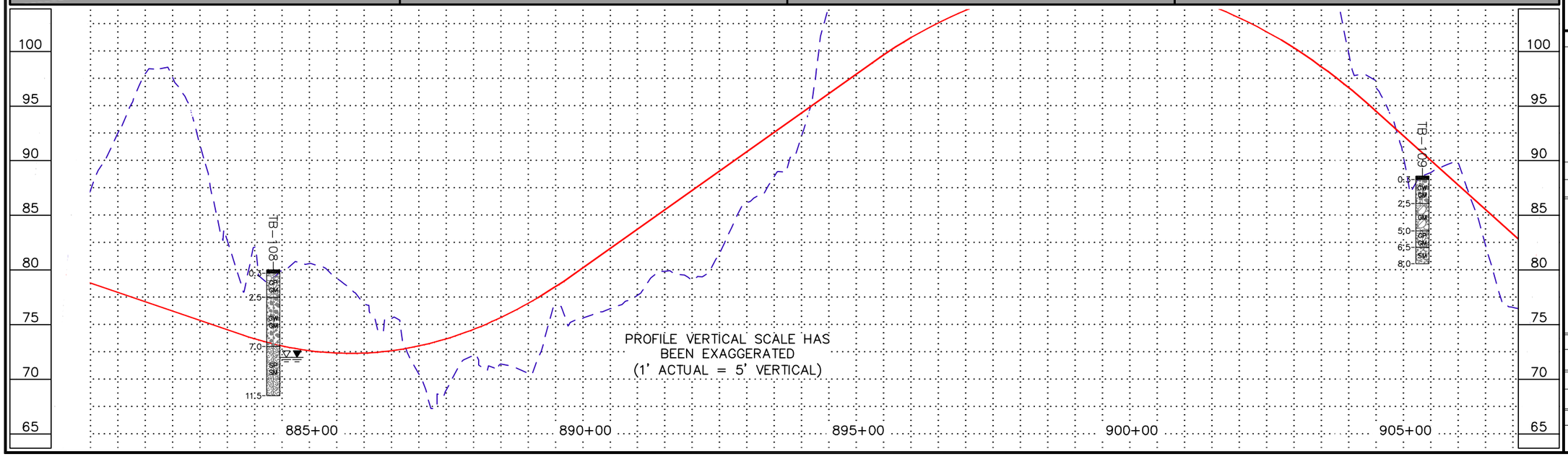
PLAN LEGEND

LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

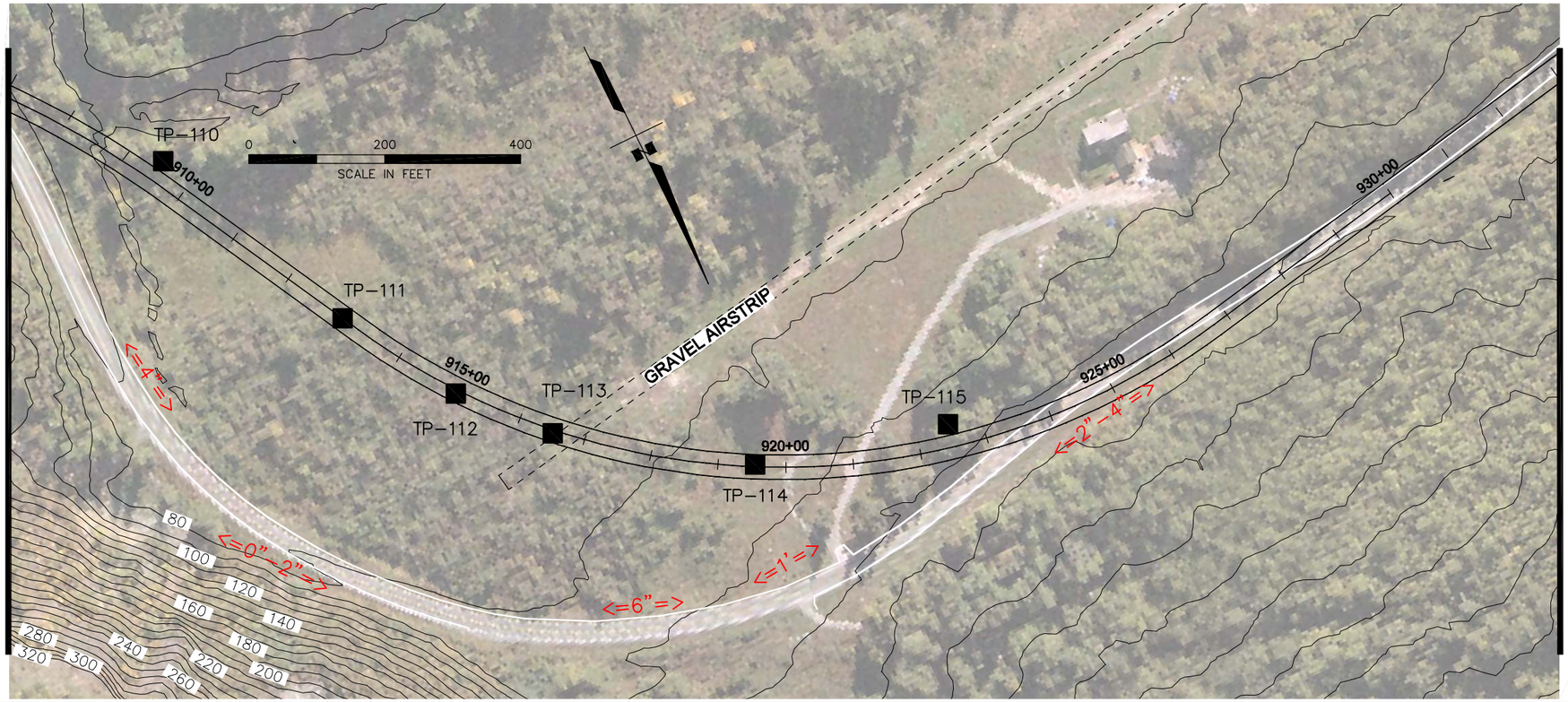
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
27	44

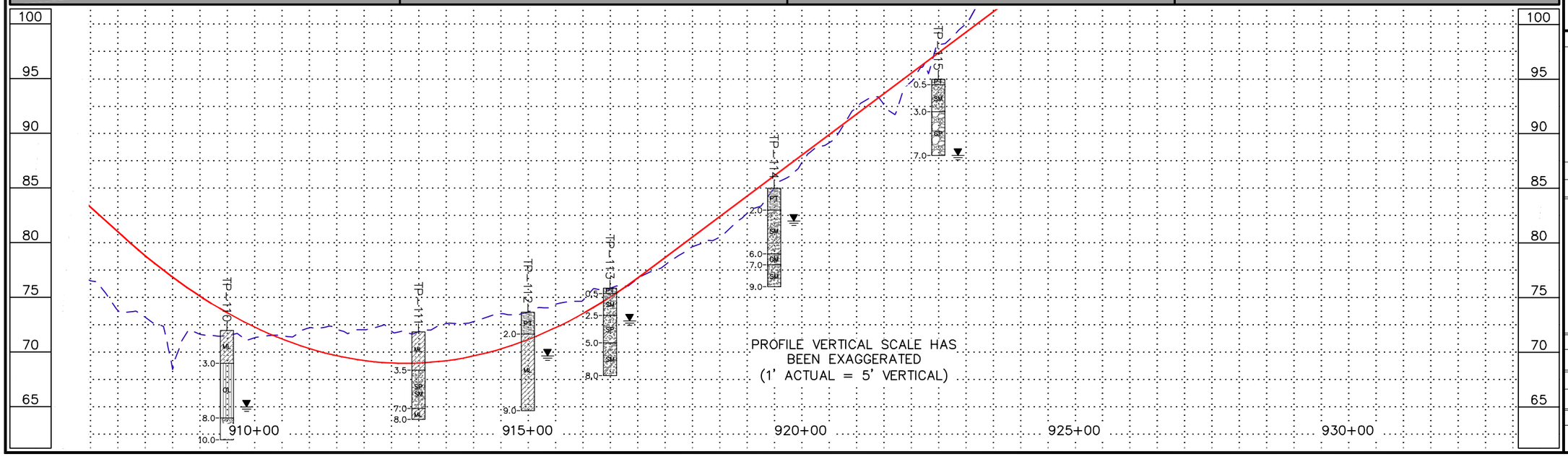


LEGEND

- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 – 220+00)
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE (1)
- POSSIBLE ACCESS TO TOP OF OUTCROP (MP 4)
- HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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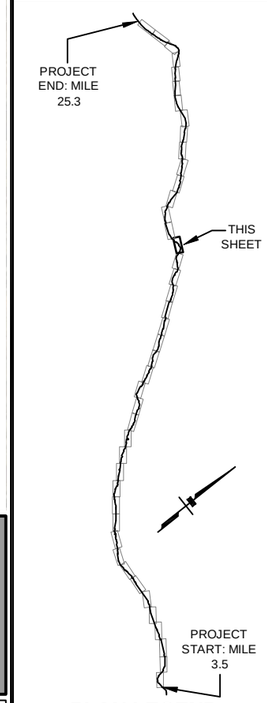
MICHAEL J. BAUER
TAB: 28 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

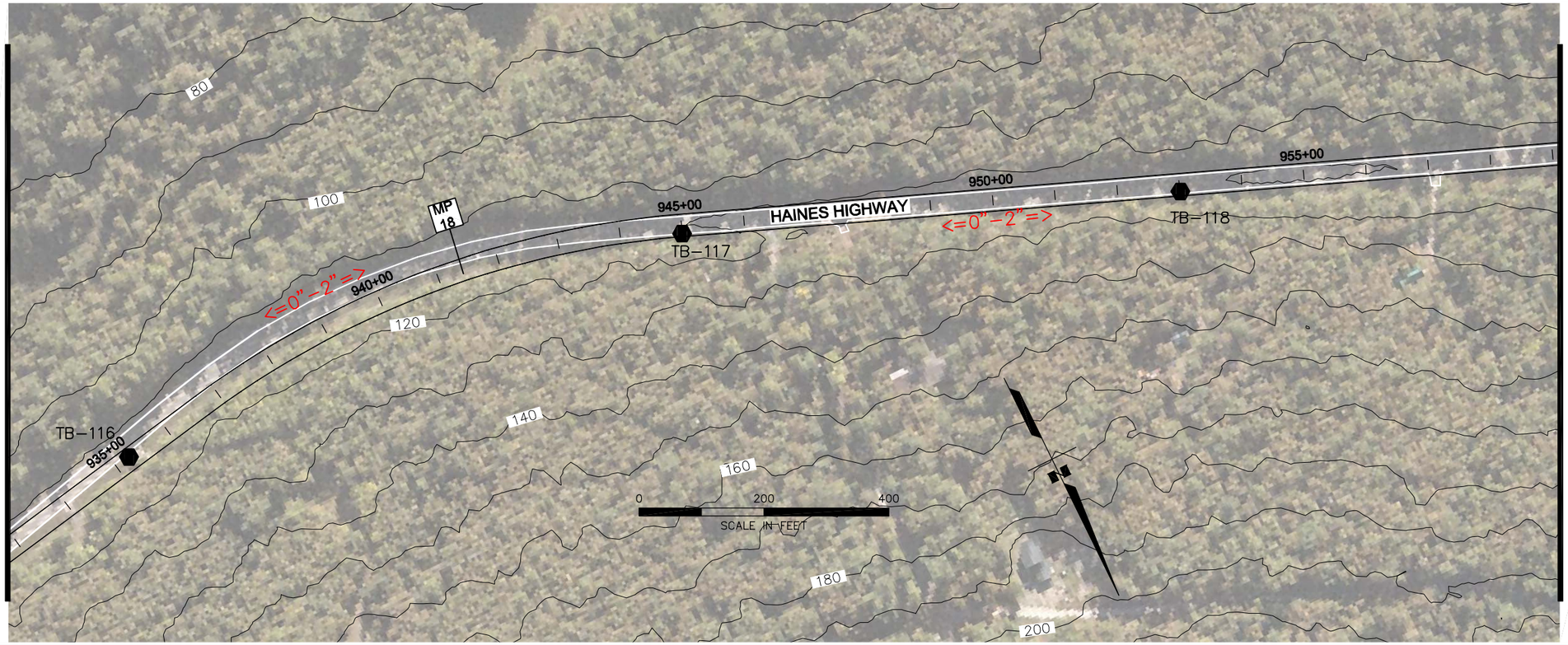
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
28	44

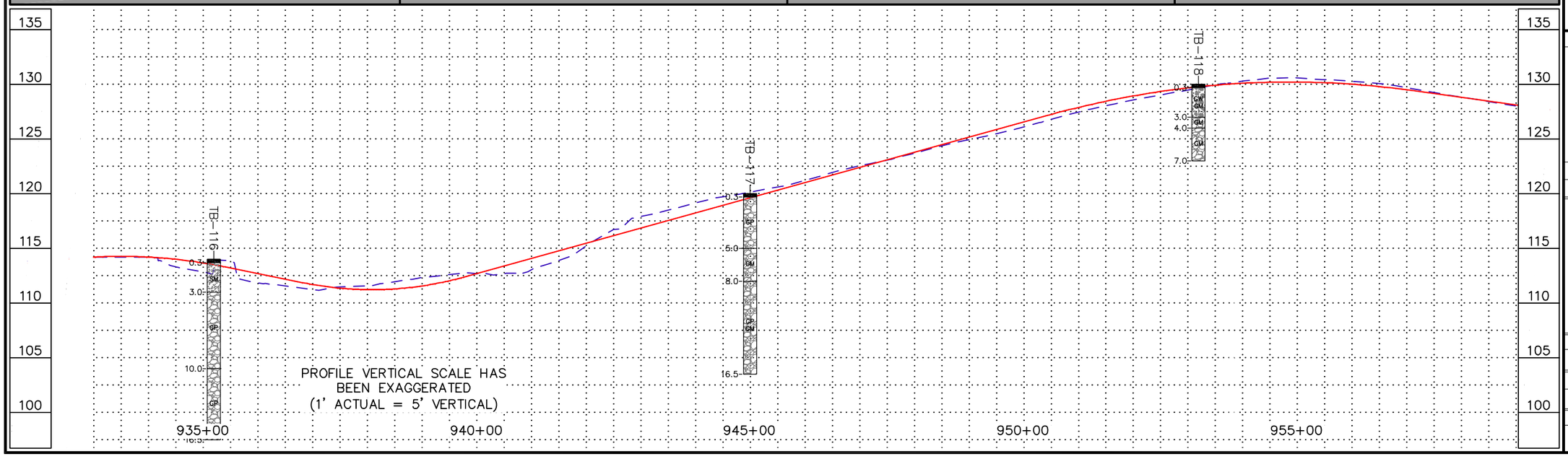


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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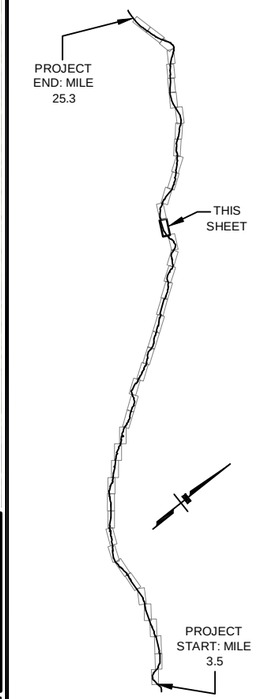
MICHAEL J. BAUER
TAB: 29 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

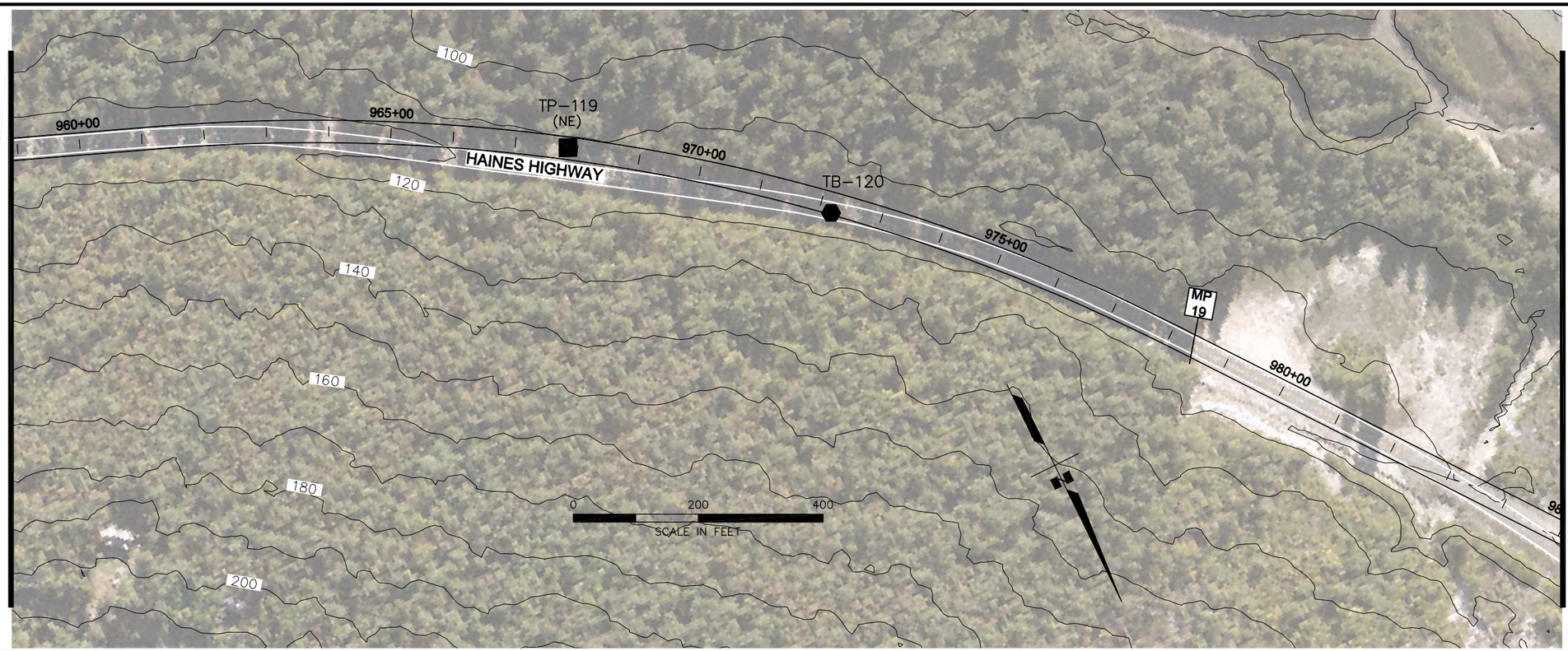
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
29	44

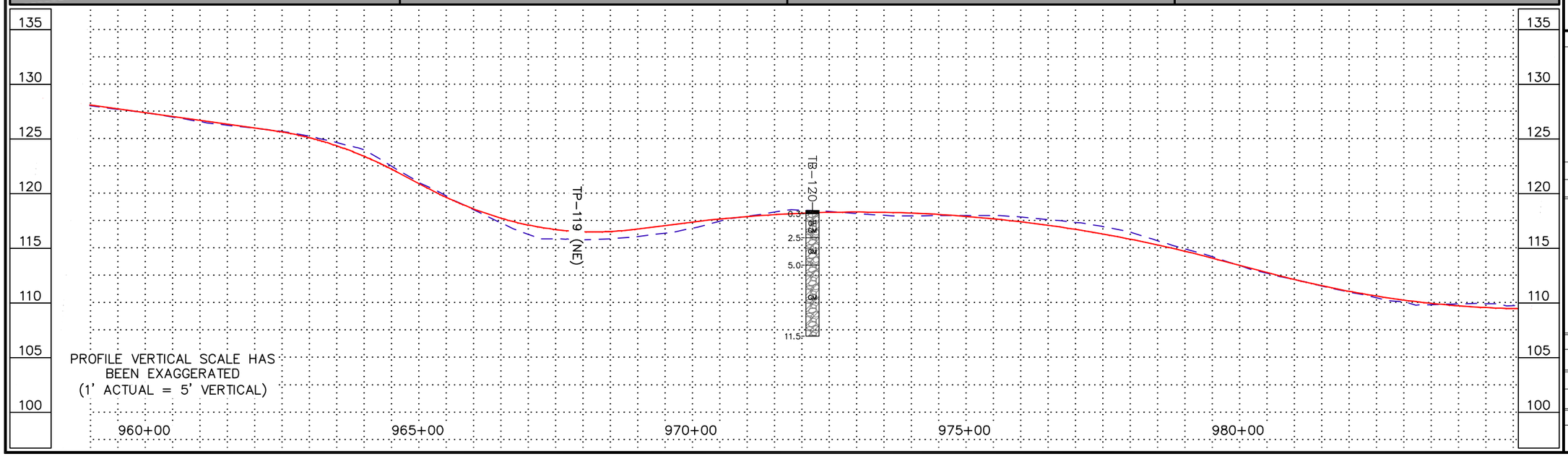


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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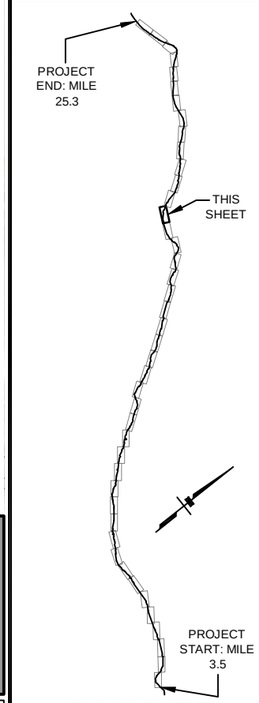
MICHAEL J. BAUER
TAB: 30 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

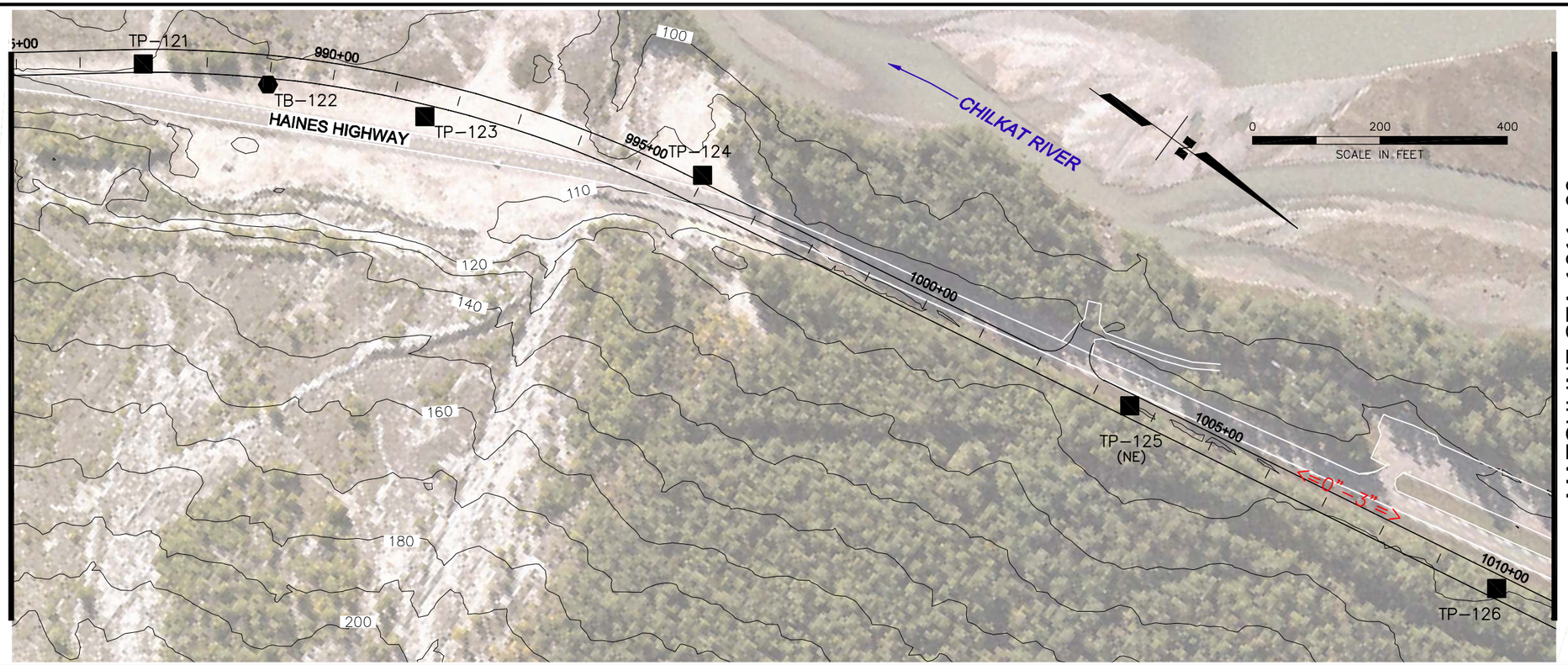
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
30	44

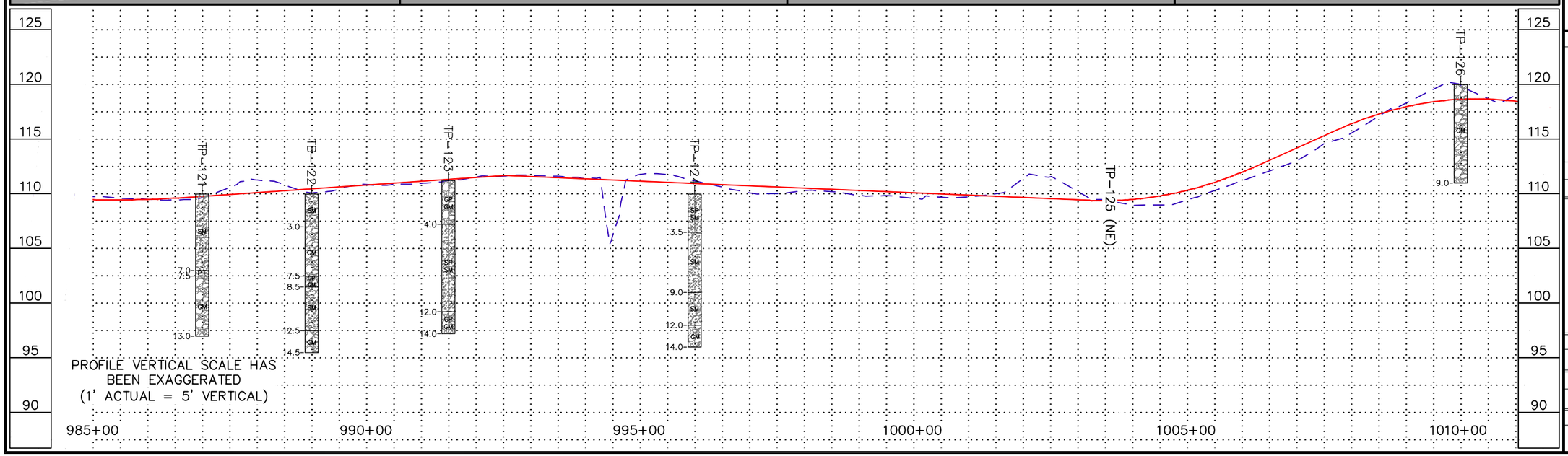


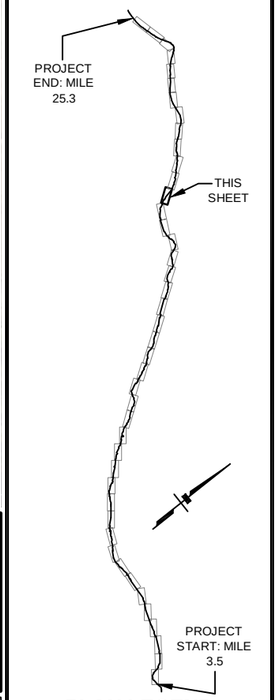
LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING





PLAN LEGEND

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MICHAEL J. BAUER
TAB: 31 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

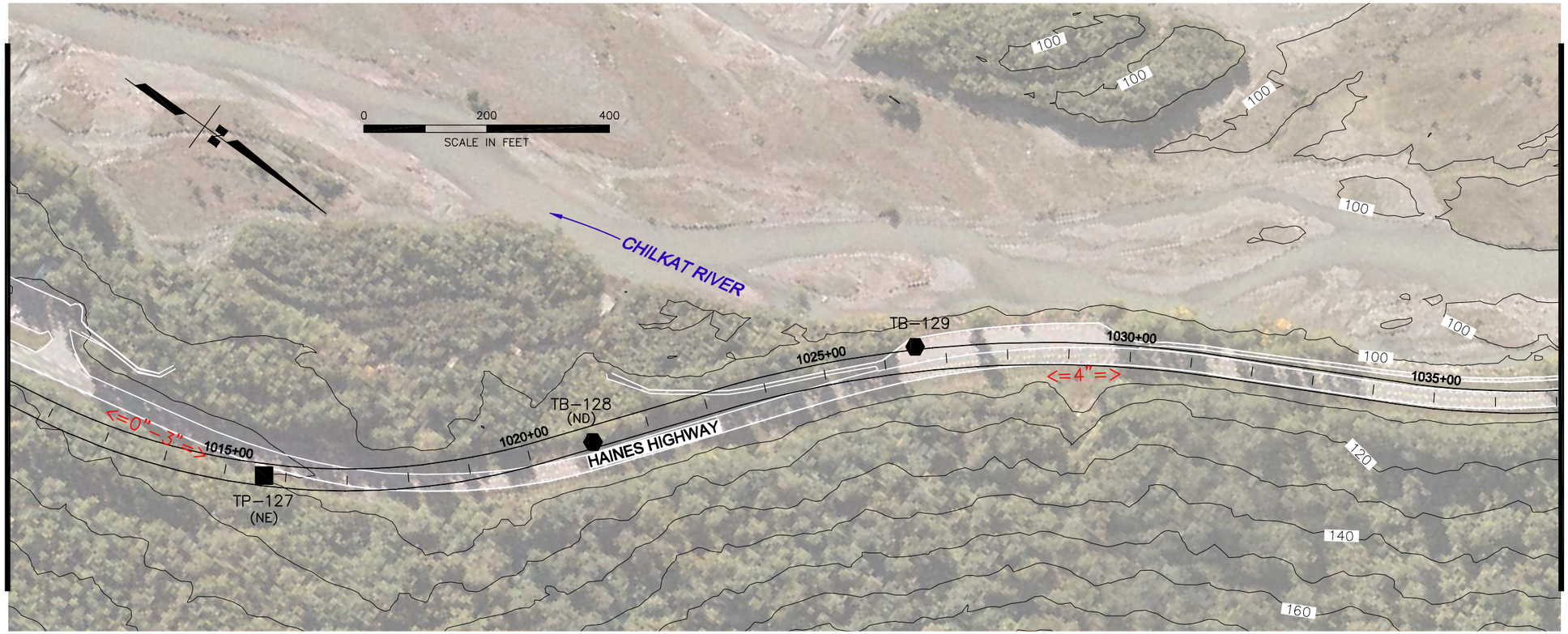
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
31	44

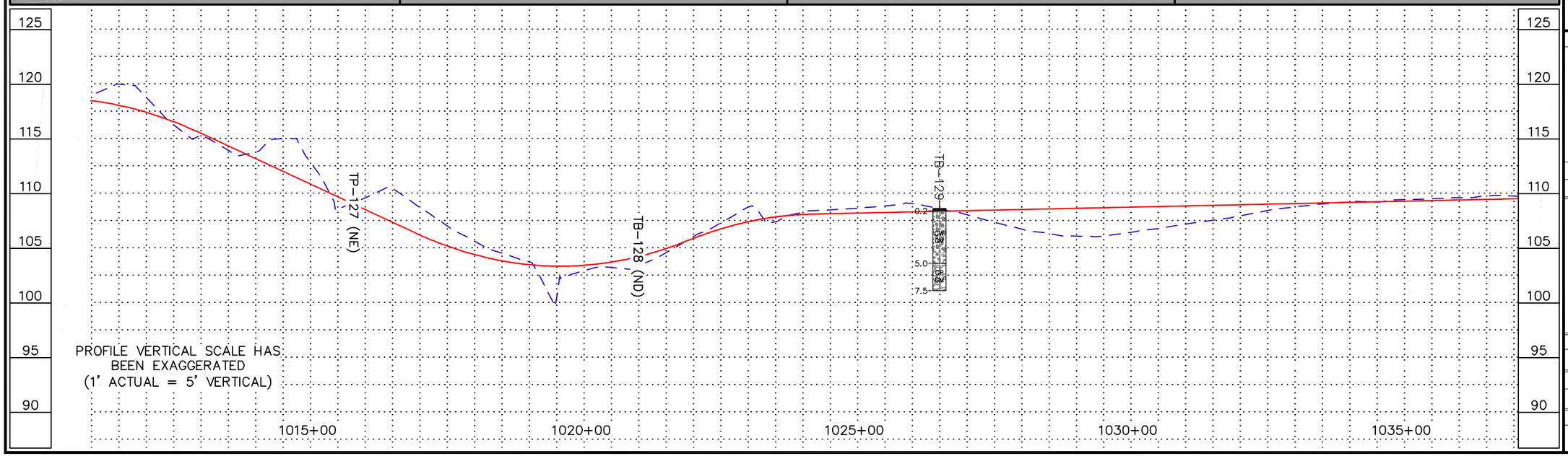


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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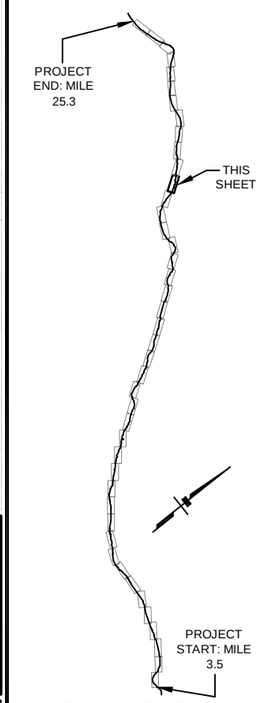
MICHAEL J. BAUER
TAB: 32 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

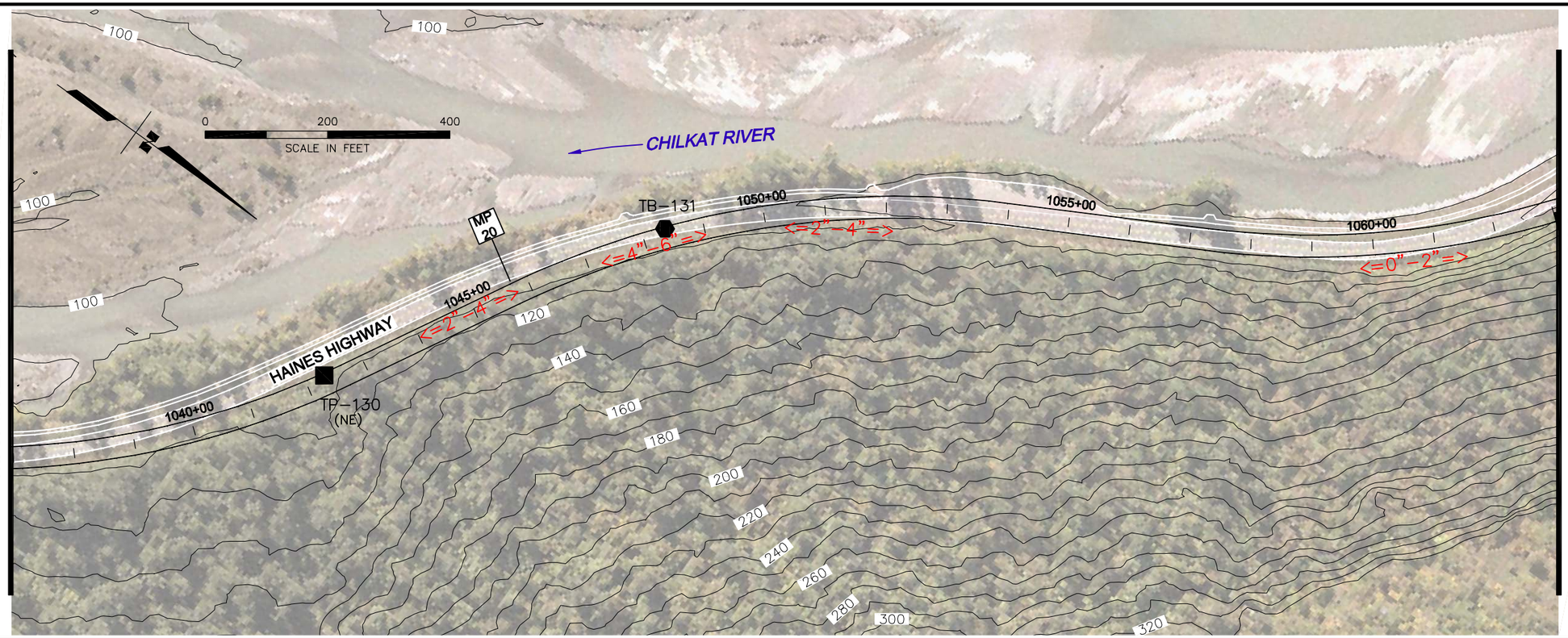
DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
32	44

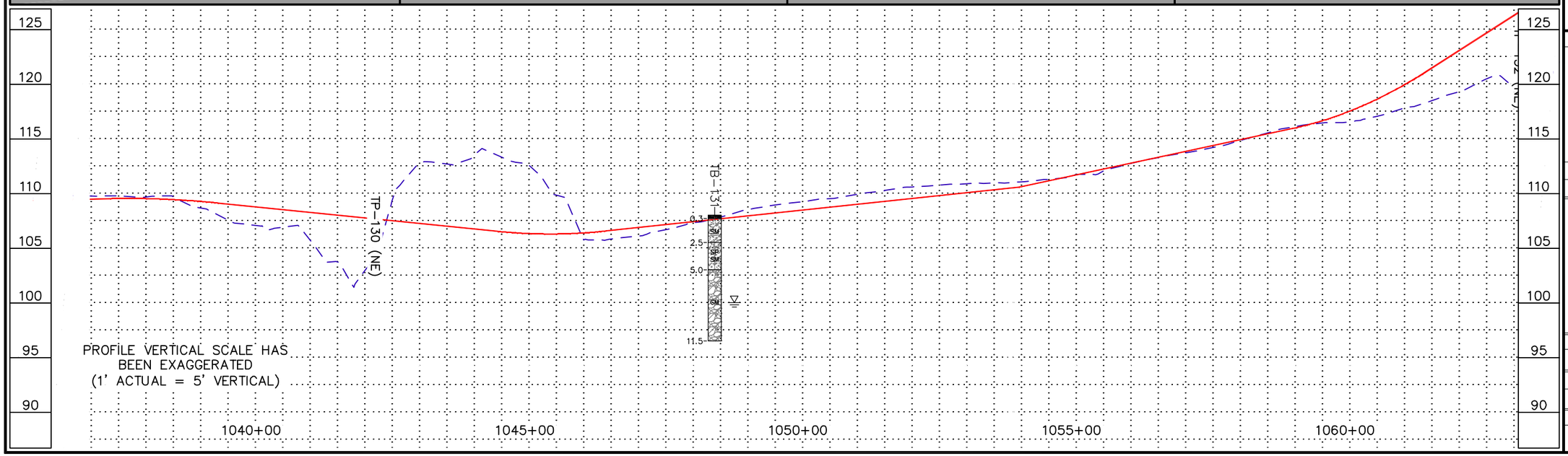


LEGEND

- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 — 220+00)
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP-28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE (1)
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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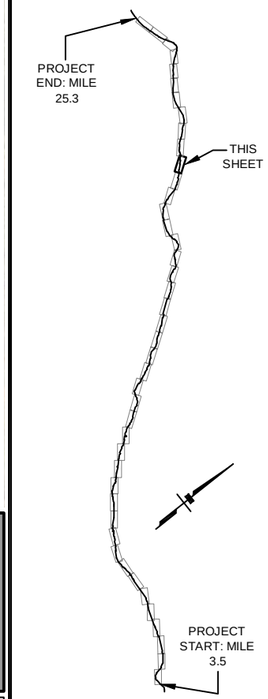
MICHAEL J. BAUER
TAB: 33 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

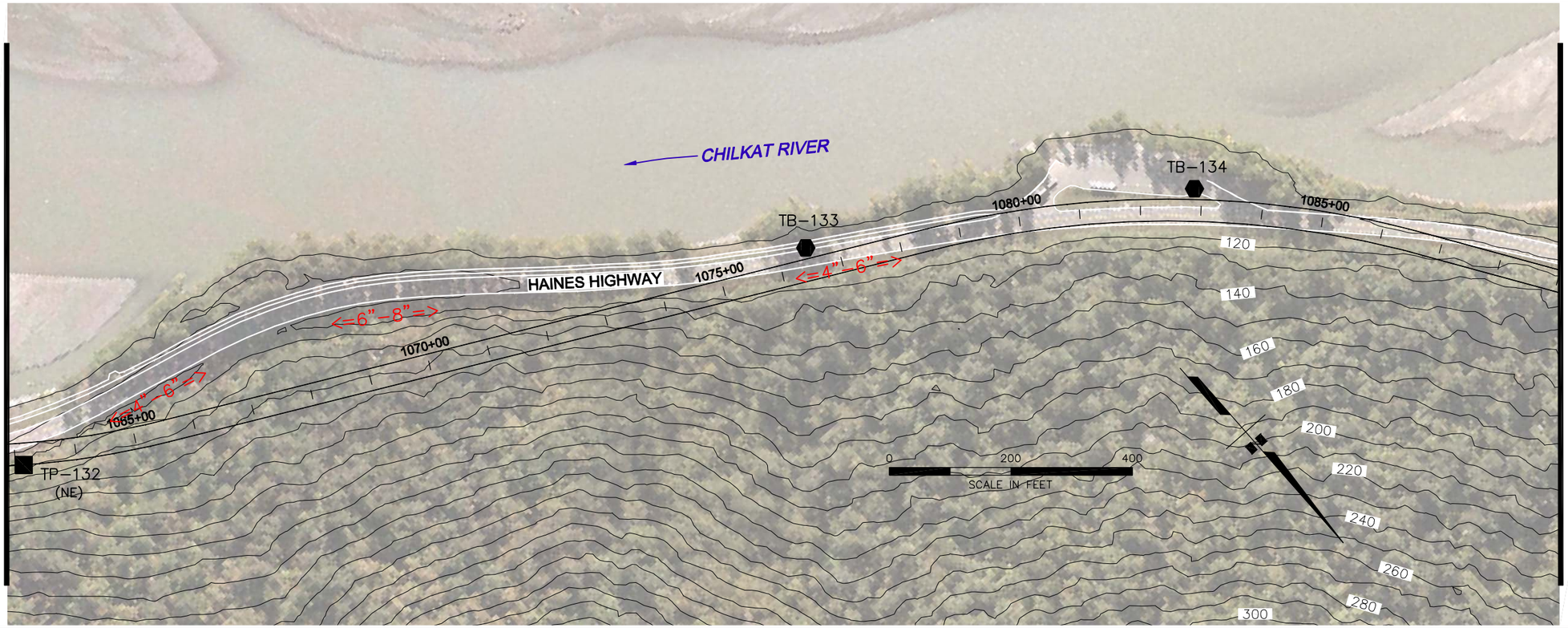
DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
33	44

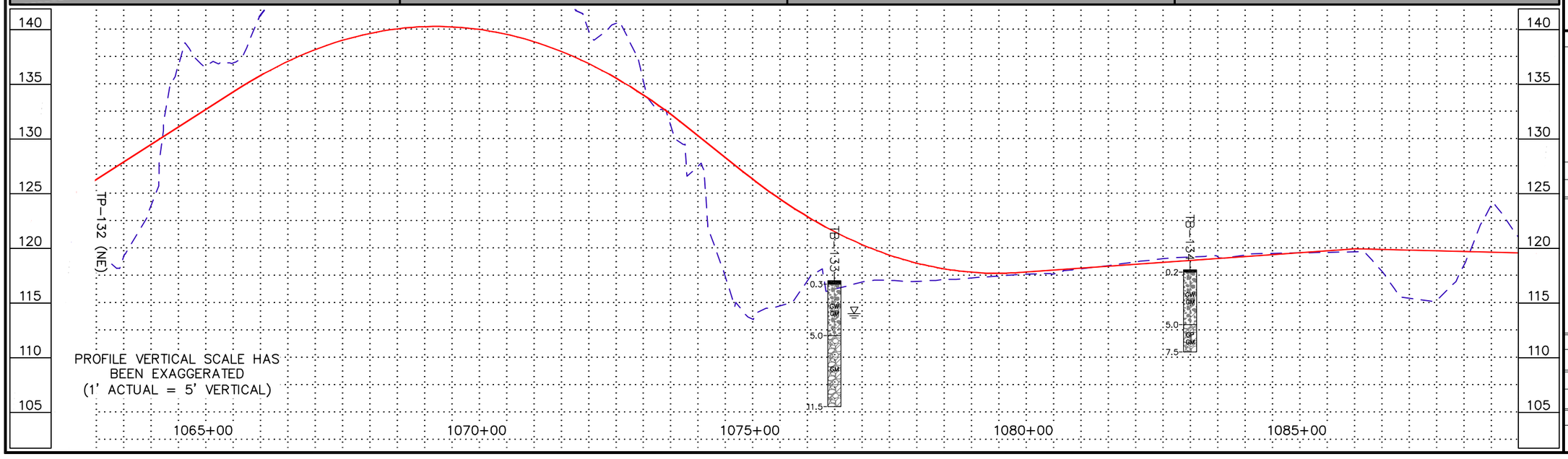


LEGEND

- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 – 220+00)
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE (1)
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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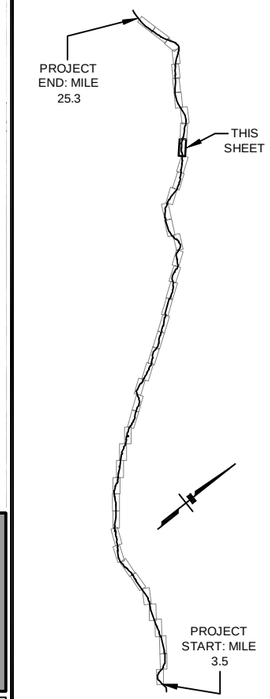
MICHAEL J. BAUER
TAB: 34 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

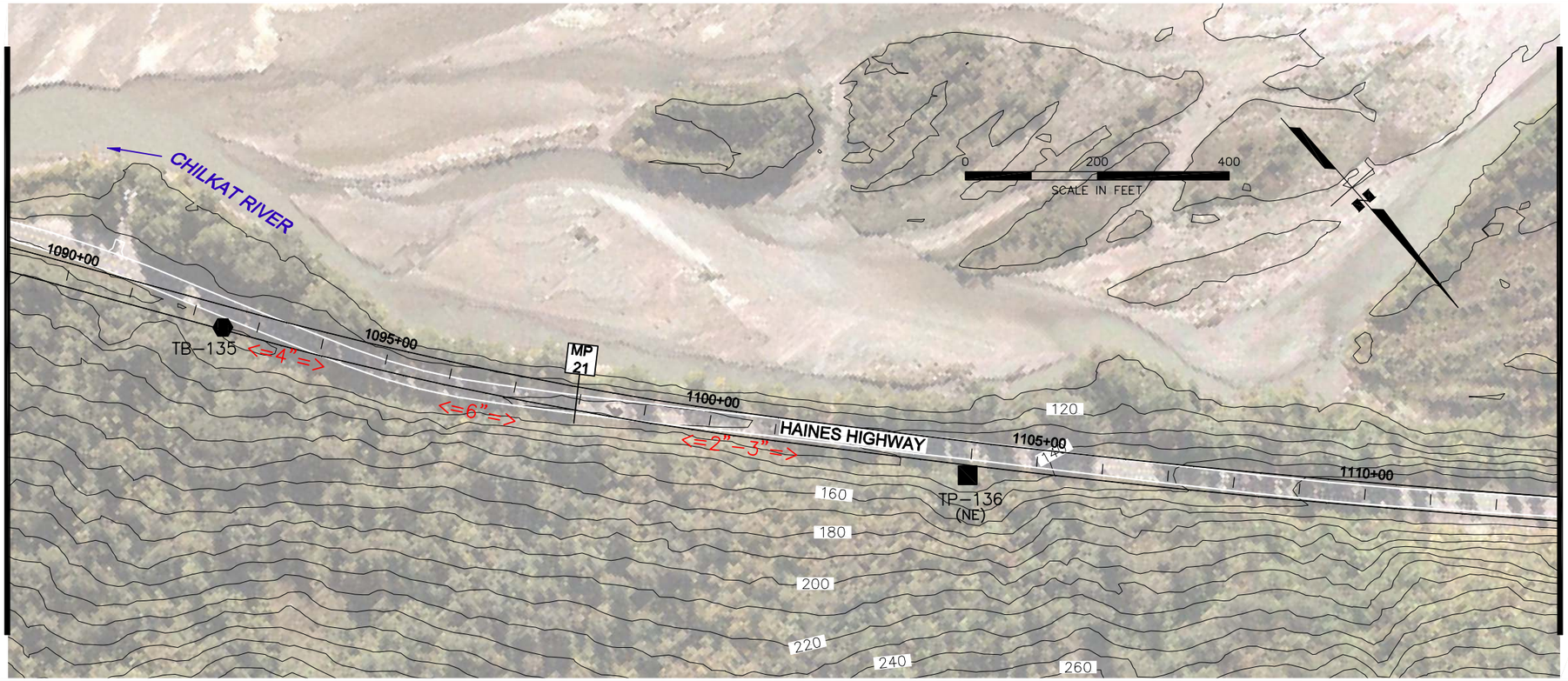
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
34	44

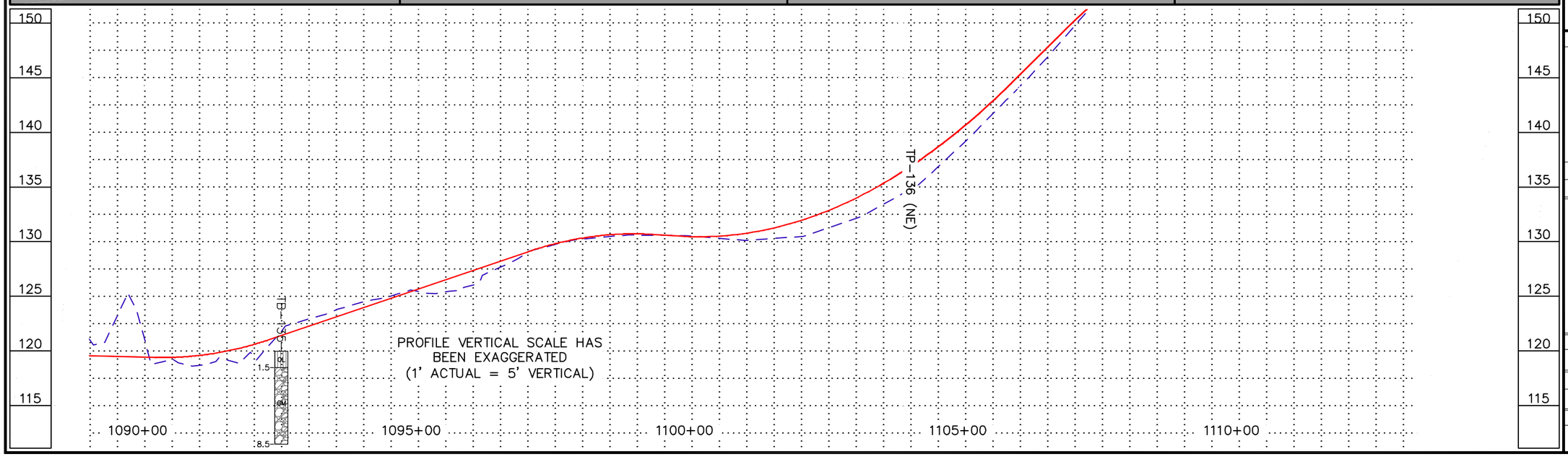


LEGEND

- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 – 220+00)
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



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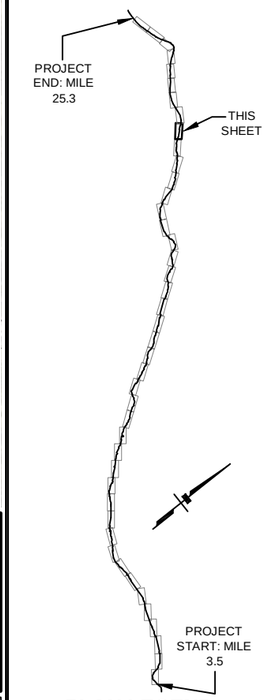
MICHAEL J. BAUER
TAB: 35 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

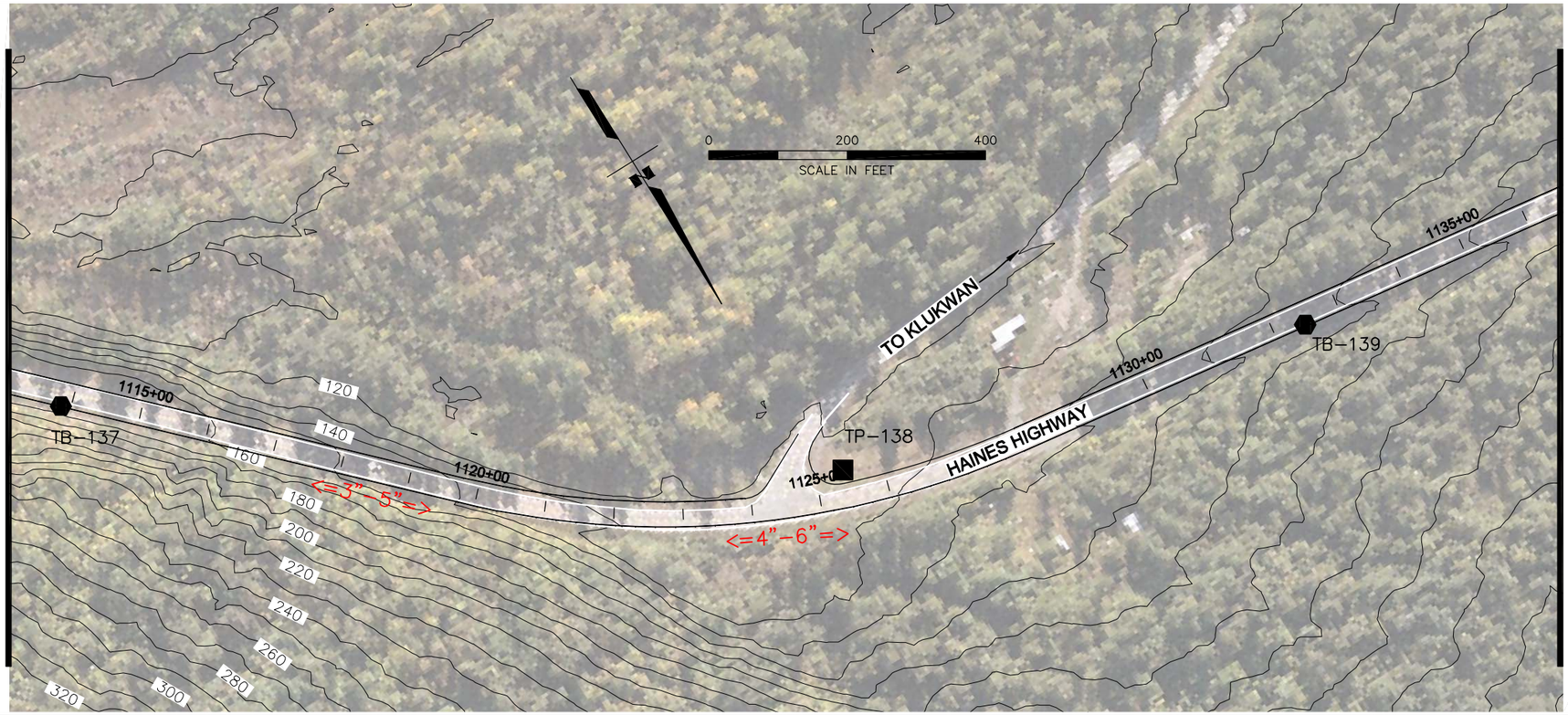
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
35	44

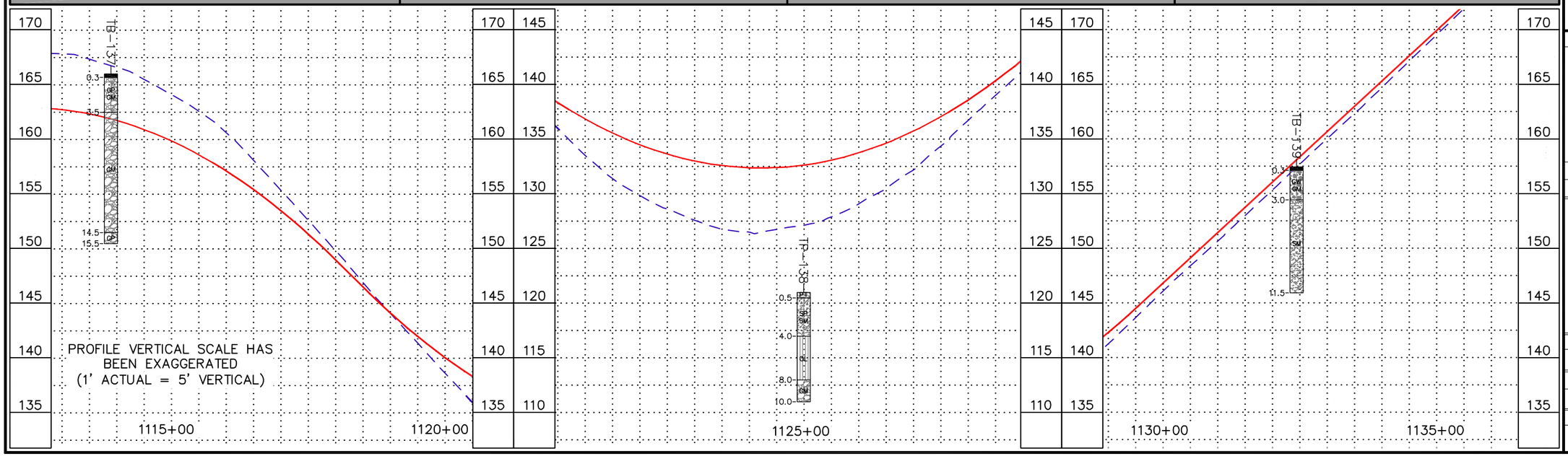


LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE
- 1 — POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

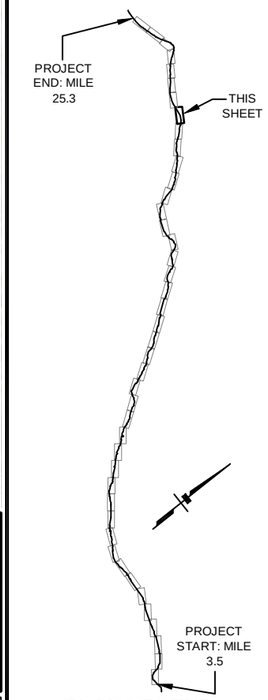
MICHAEL J. BAUER
TAB: 36 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

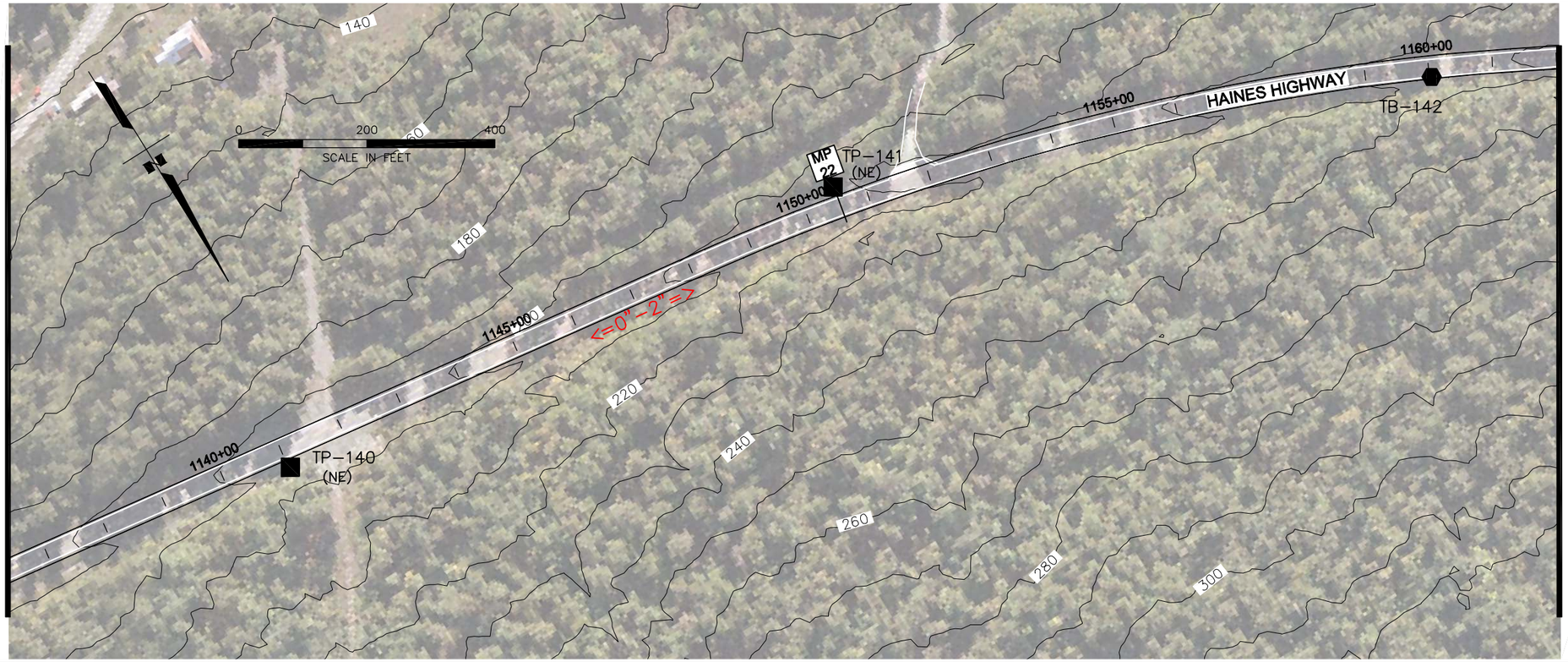
DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
36	44



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MICHAEL J. BAUER

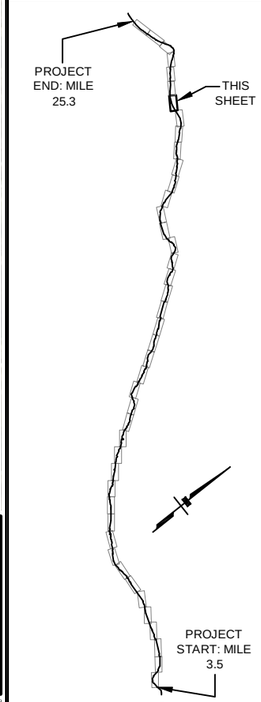
TAB: 37 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



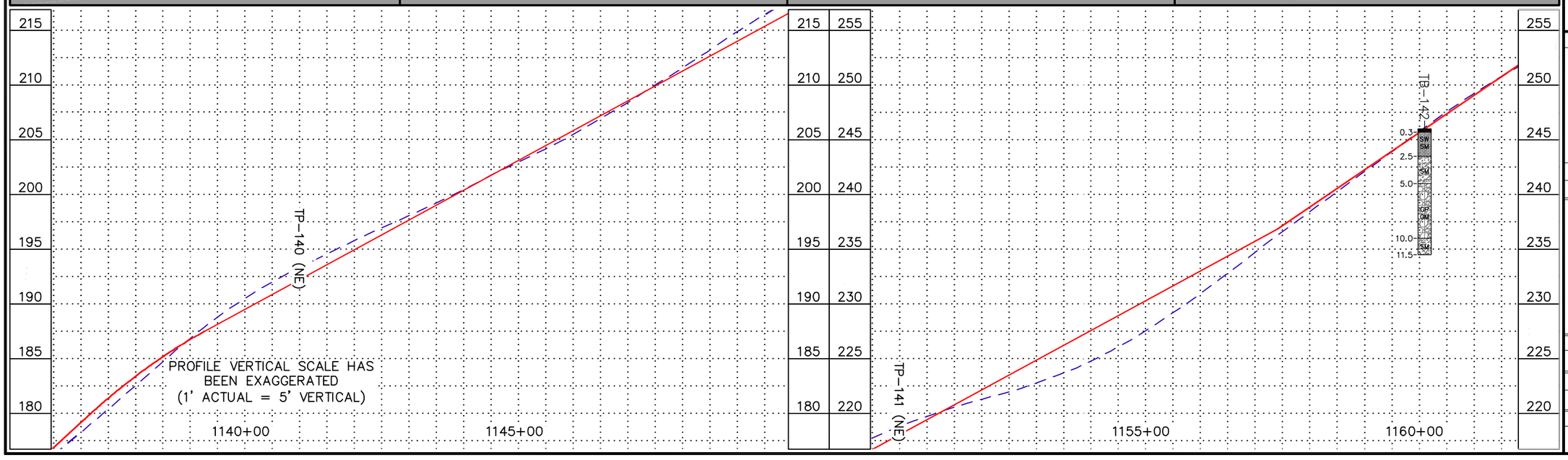
PLAN LEGEND

LEGEND

- CONTOUR INTERVAL IS 10 FEET (40 / 60)
- EXISTING ROAD ALIGNMENT
- PROPOSED ROAD ALIGNMENT WITH STATIONING (210+00 – 220+00)
- TB–5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
- TP–28 (NE) — APPROXIMATE TEST PIT LOCATION NOT EXCAVATED
- <=2"=> — HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS
- GEOLOGIC MAPPING BASELINE (1)
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

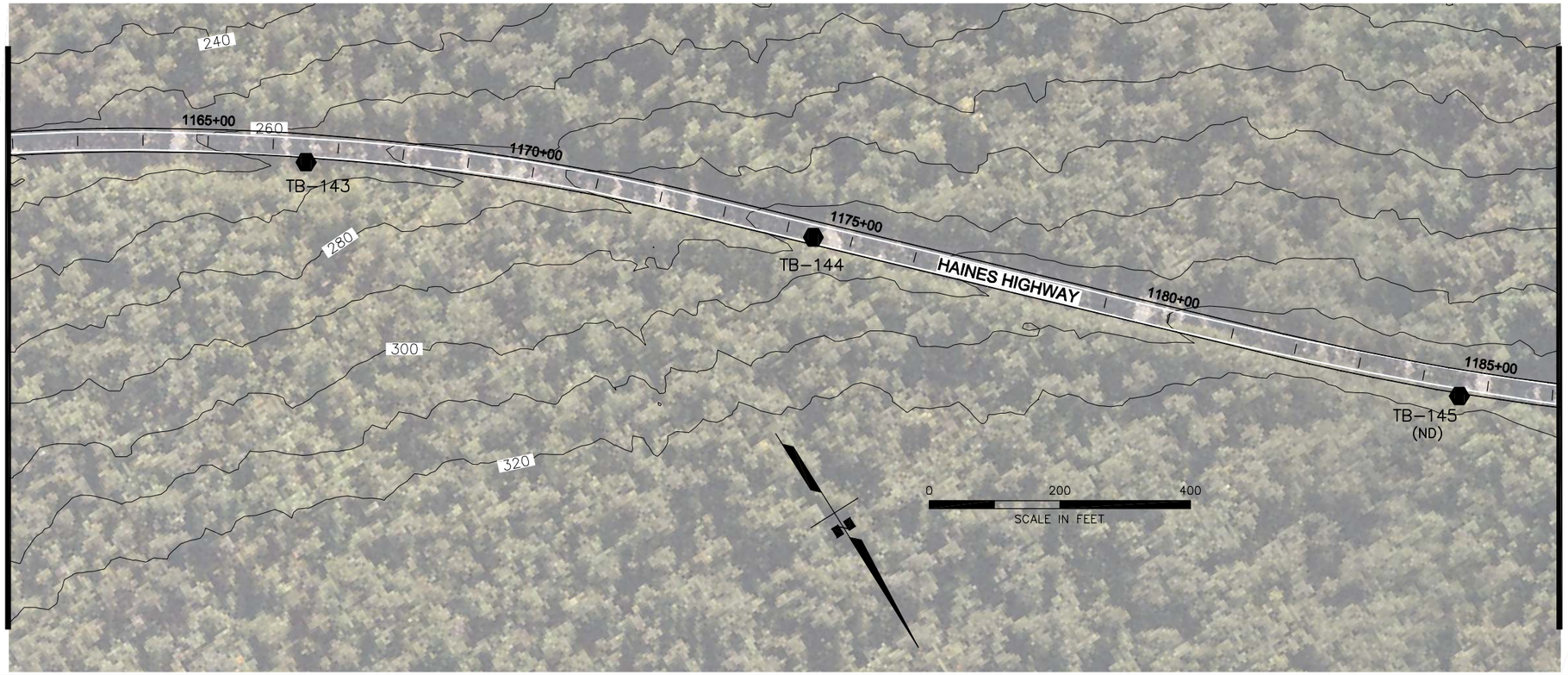
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
37	44



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MICHAEL J. BAUER

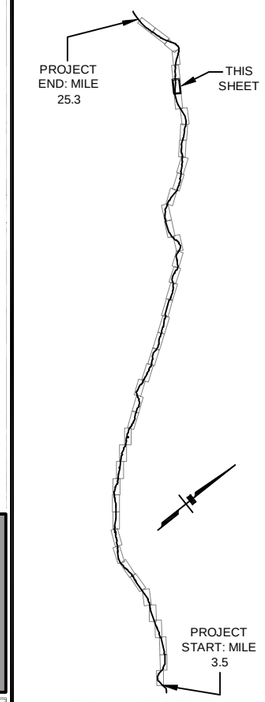
TAB: 38 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
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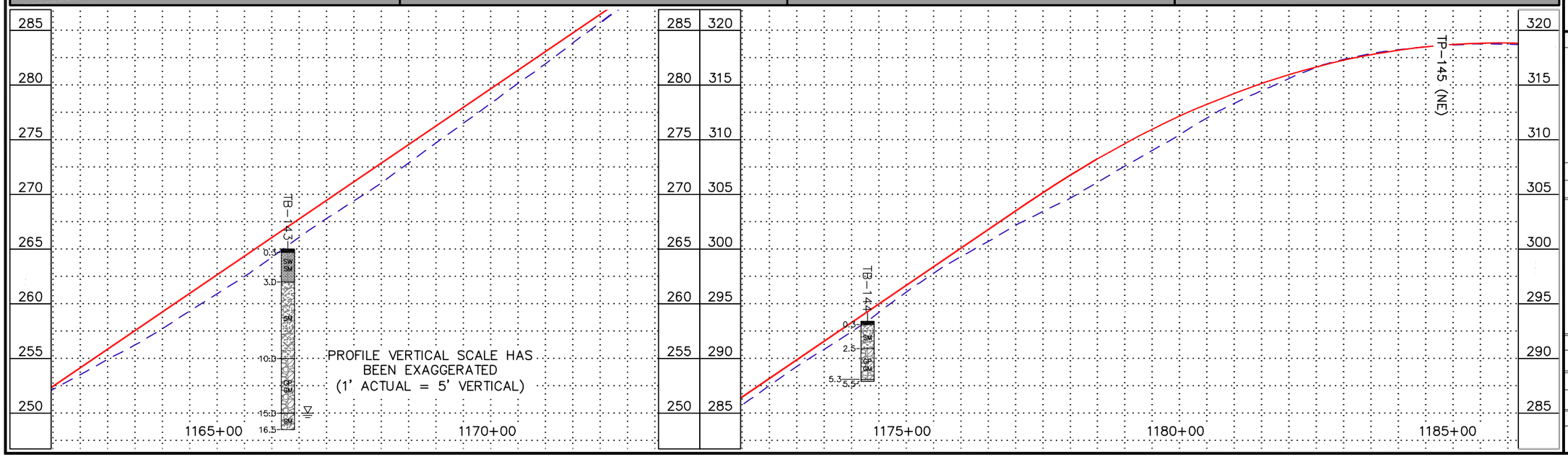
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

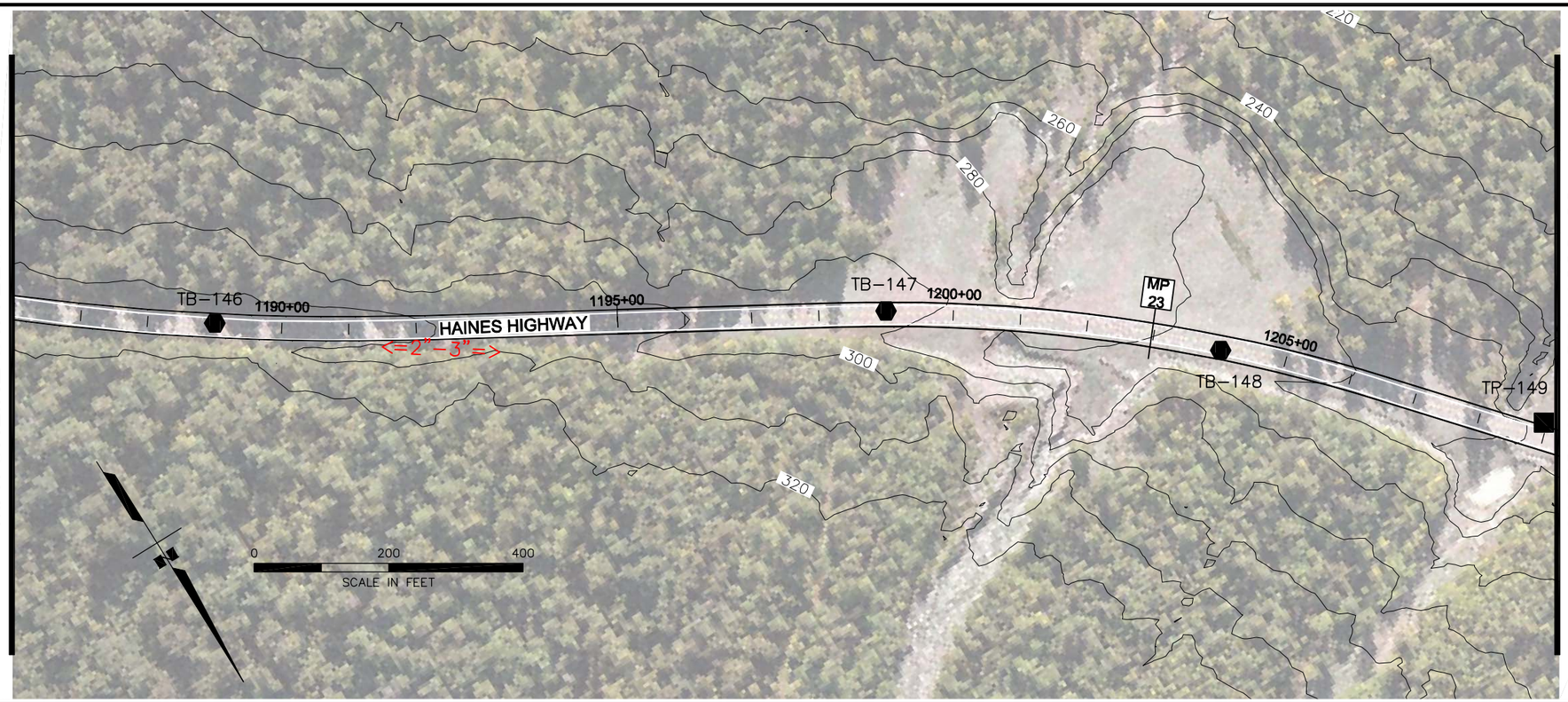
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

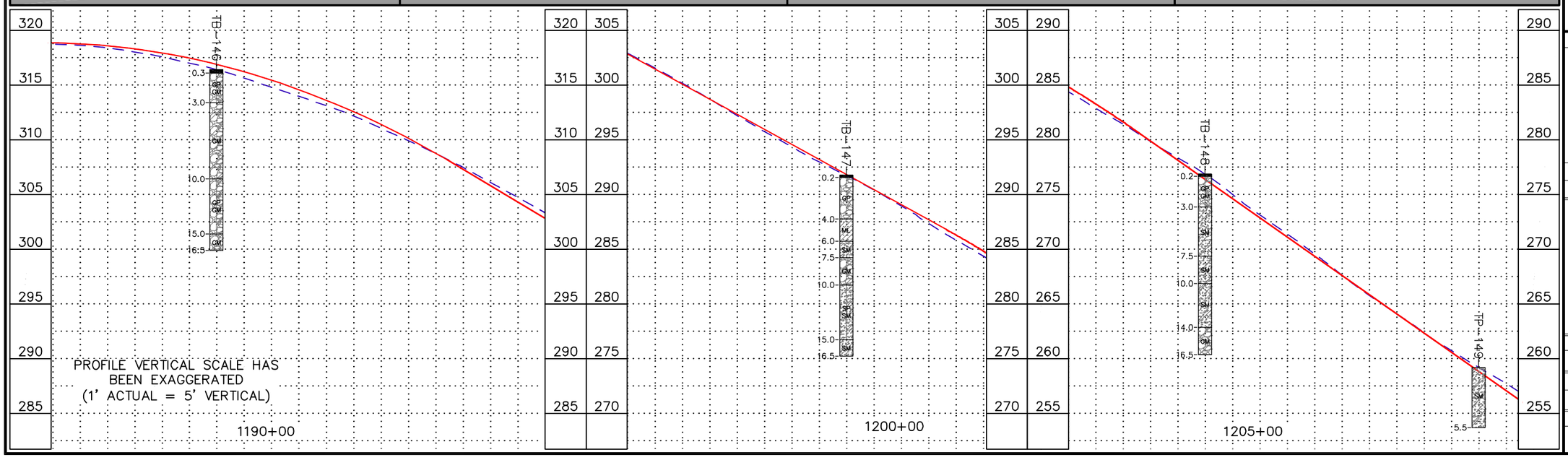
FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
38	44



LEGEND				PROFILE	
40 / 60	CONTOUR INTERVAL IS 10 FEET	TB–5 (ND)	APPROXIMATE TEST BORING LOCATION NOT DRILLED	1	GEOLOGIC MAPPING BASELINE
	EXISTING ROAD ALIGNMENT	TP–28 (NE)	APPROXIMATE TEST PIT LOCATION NOT EXCAVATED		POSSIBLE ACCESS TO TOP OF OUTCROP
210+00 220+00	PROPOSED ROAD ALIGNMENT WITH STATIONING	<=2"=>	HAND PROBE AREA - APPROXIMATE DEPTH OF ORGANICS	MP 4	HAINES HIGHWAY MILEPOST MARKERS
					EXISTING GROUND
					PROPOSED ROAD CENTERLINE
					GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
				295	GROUNDWATER MEASURED AFTER DRILLING



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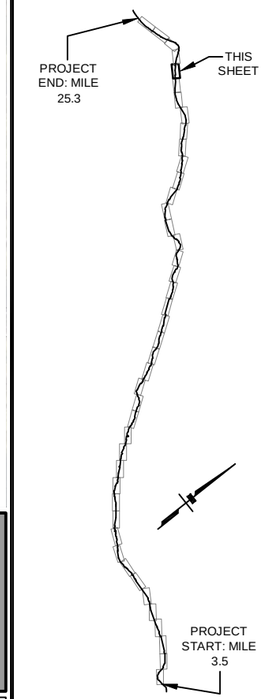
BRIAN P. O'QUINN
TAB: 39 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
39	44

PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

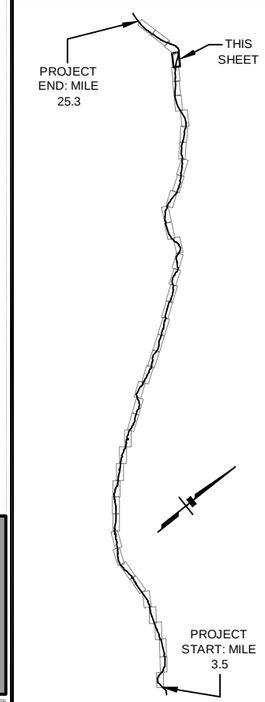
MICHAEL J. BAUER
TAB: 40 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
- EXISTING ROAD ALIGNMENT
- 210+00 220+00 — PROPOSED ROAD ALIGNMENT WITH STATIONING
- TB-5 (ND) — APPROXIMATE TEST BORING LOCATION NOT DRILLED
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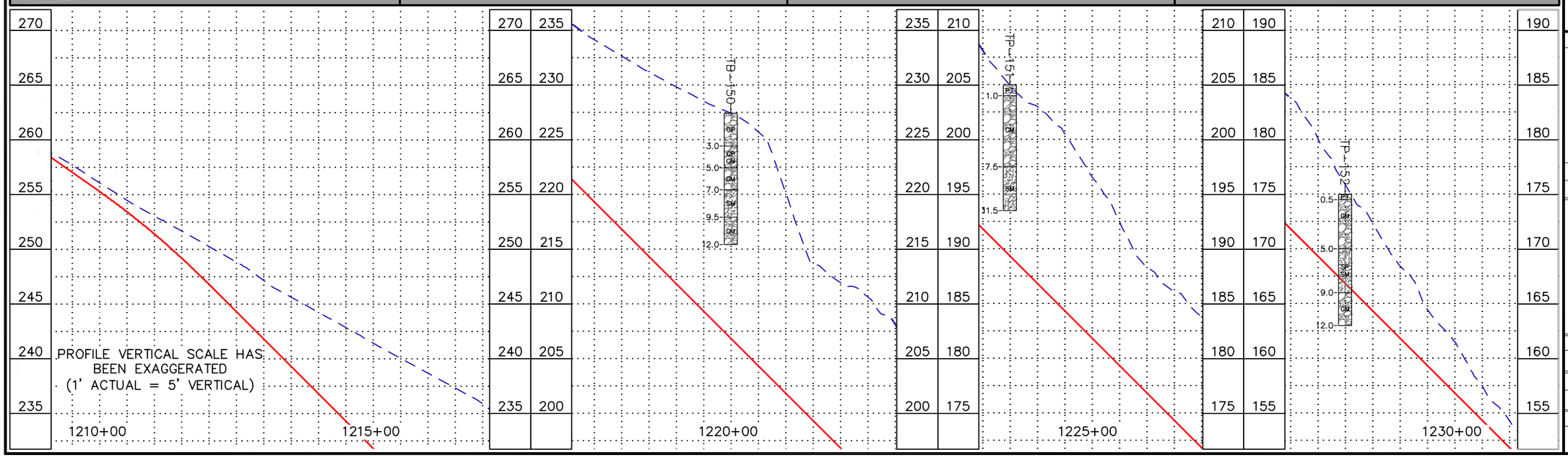
- 1 — GEOLOGIC MAPPING BASELINE
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

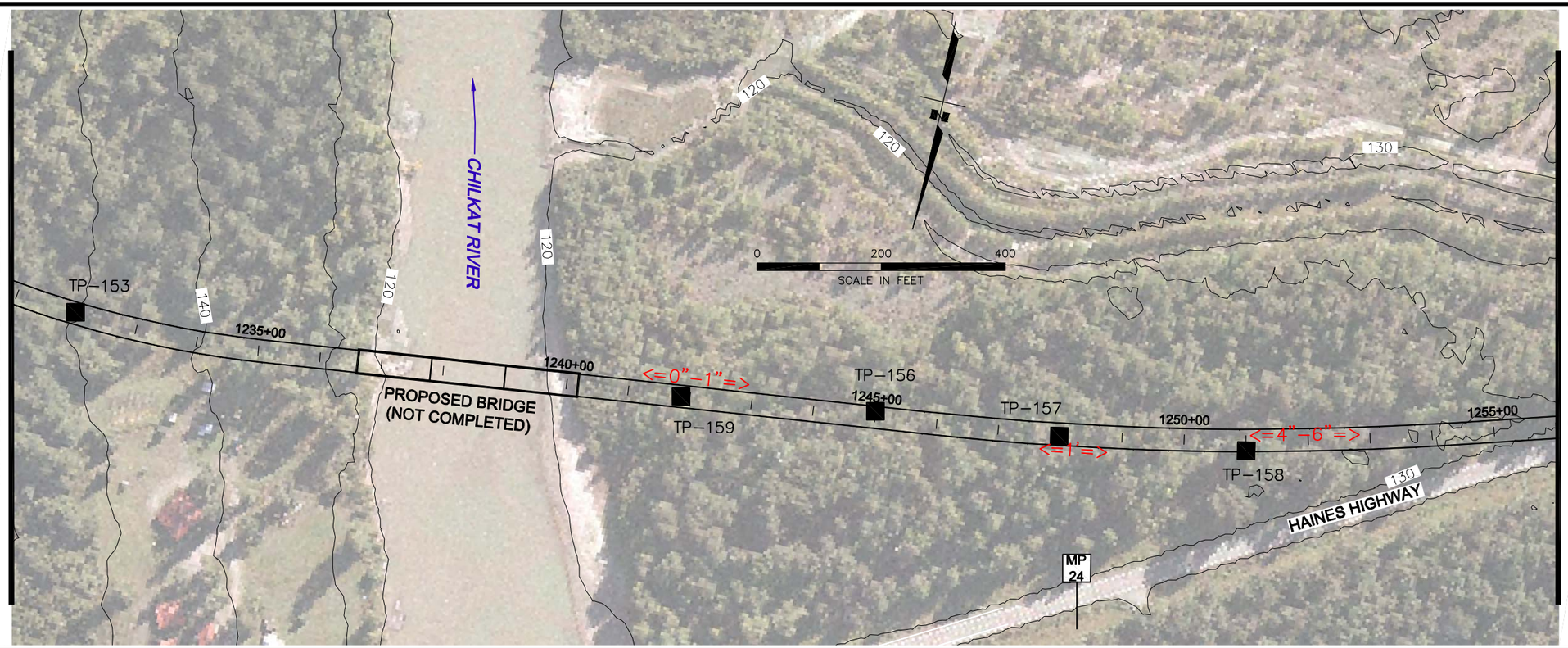
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
40	44



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MICHAEL J. BAUER
TAB: 41 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

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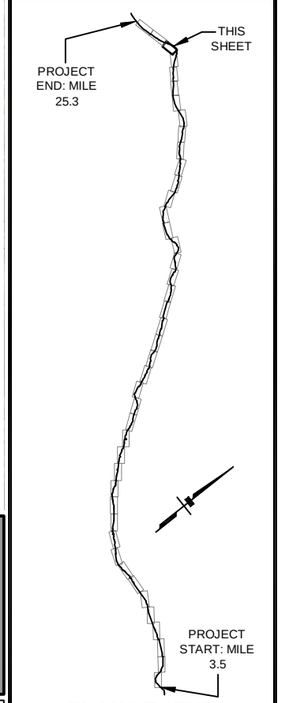

PLAN LEGEND

LEGEND

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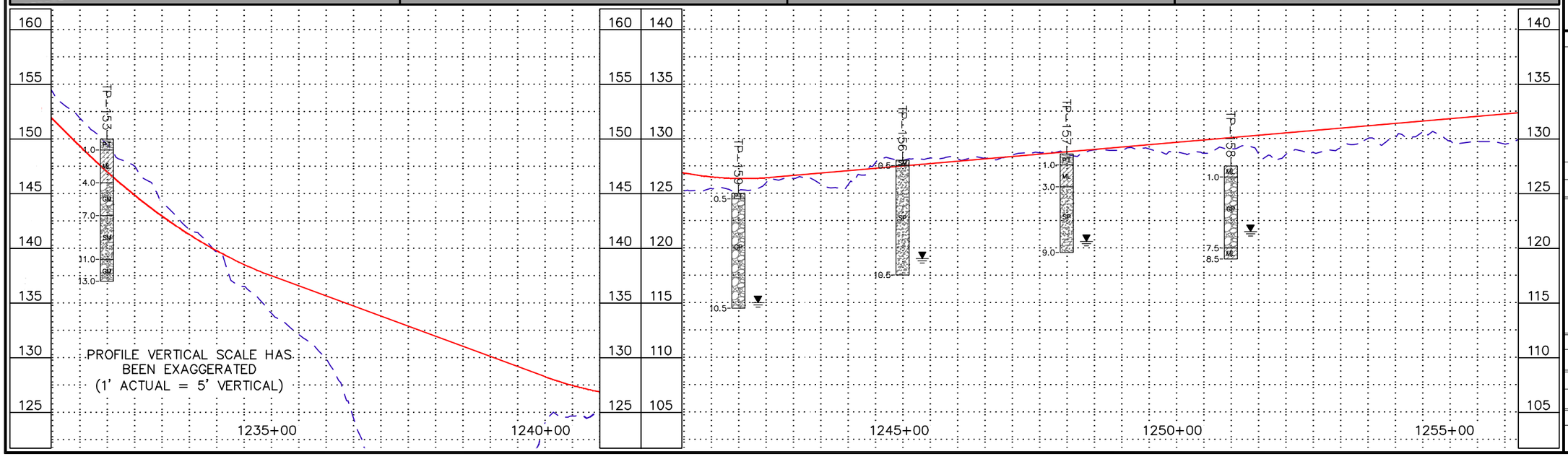
- POSSIBLE ACCESS TO TOP OF OUTCROP
- MP 4 — HAINES HIGHWAY MILE POST MARKERS

PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



CHECKED BY: MEK

DESIGNED BY: KAN

DRAWN BY: BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
41	44

PATH: P:\PROJECTS\D59119\GEO\GTB-HN.DWG

MICHAEL J. BAUER

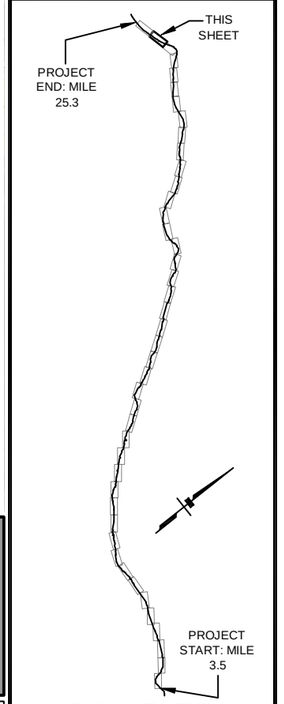
TAB: 42 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

LEGEND

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PROFILE

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- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
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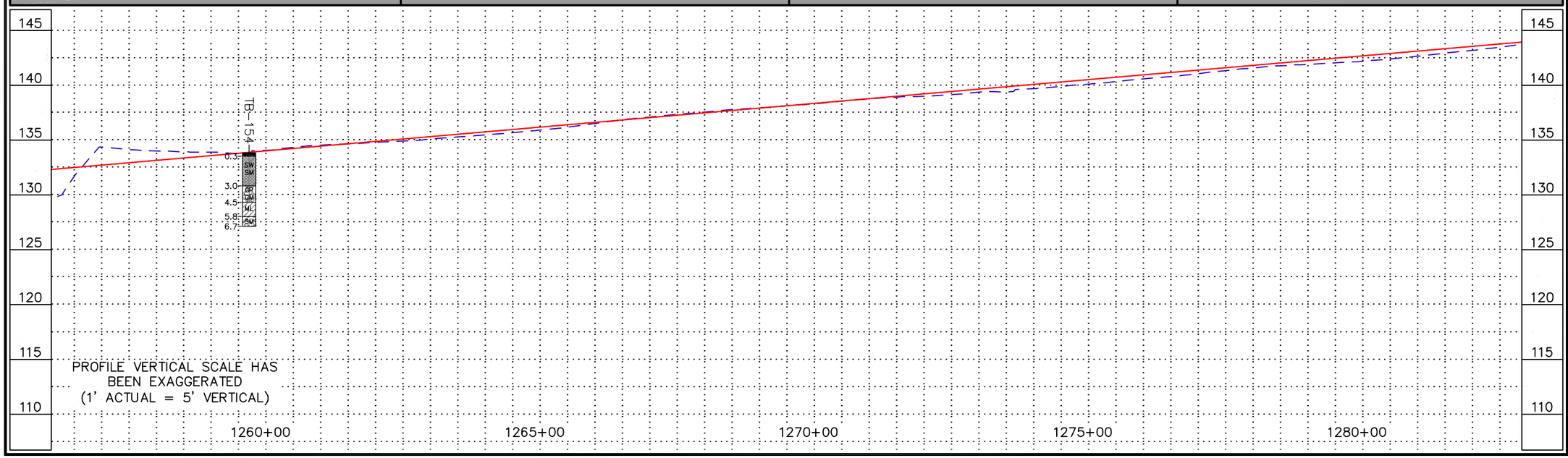


CHECKED BY: MEK

DESIGNED BY: KAN

BPO

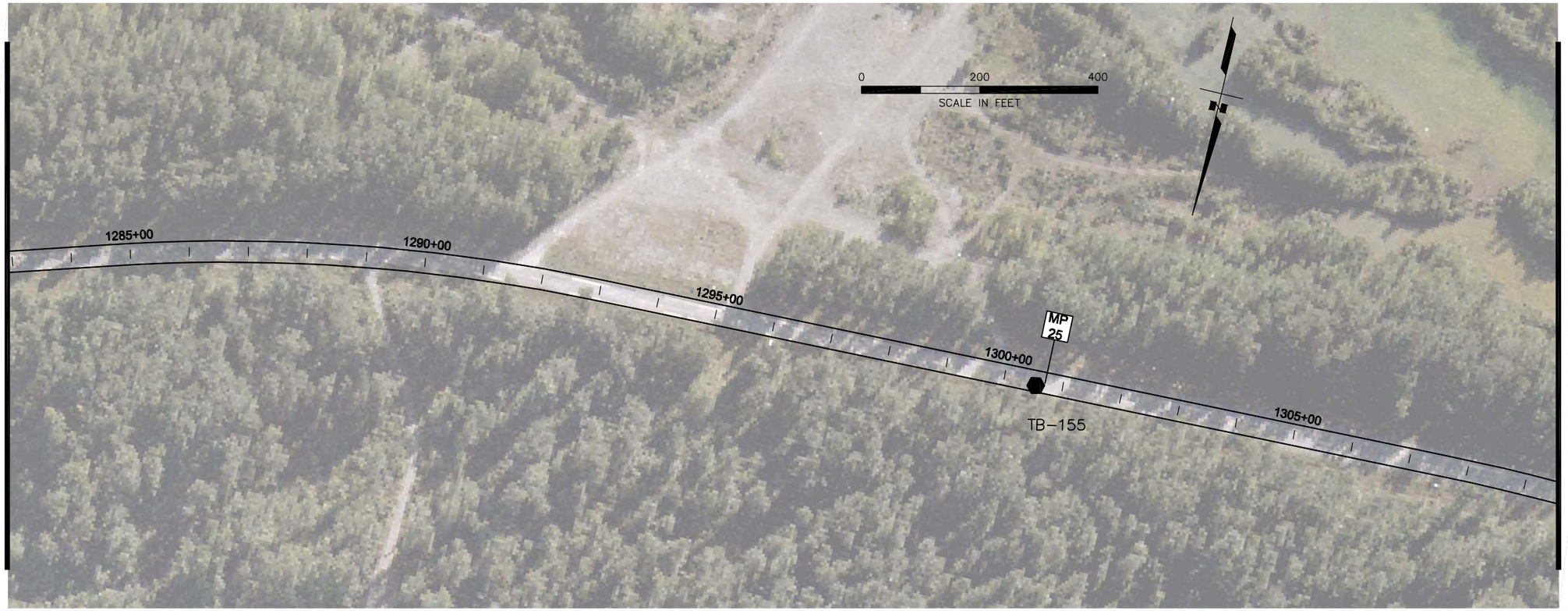
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
42	44



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MICHAEL J. BAUER
TAB: 43 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

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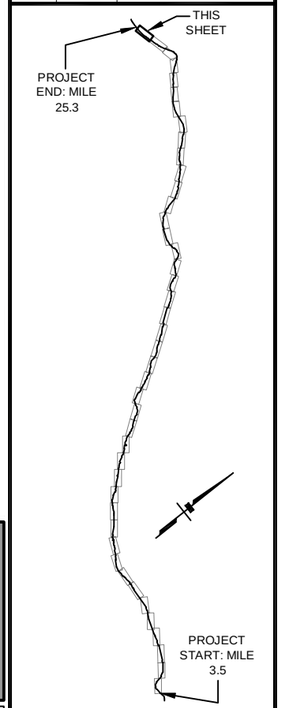

PLAN LEGEND

LEGEND

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PROFILE

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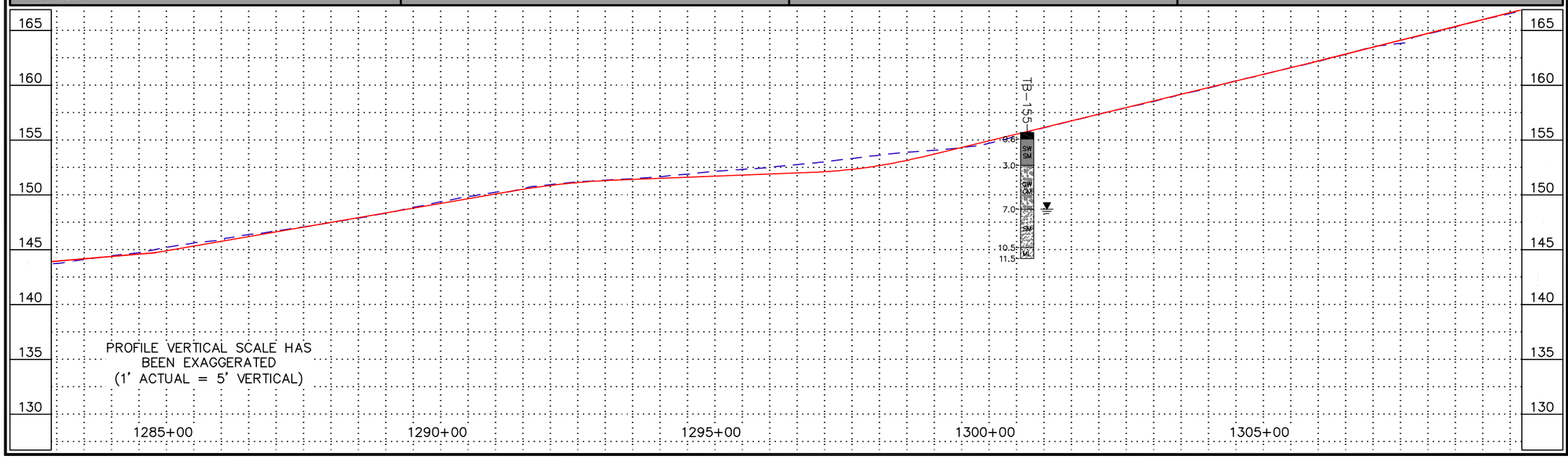


CHECKED BY: MEK

DESIGNED BY: KAN

BPO

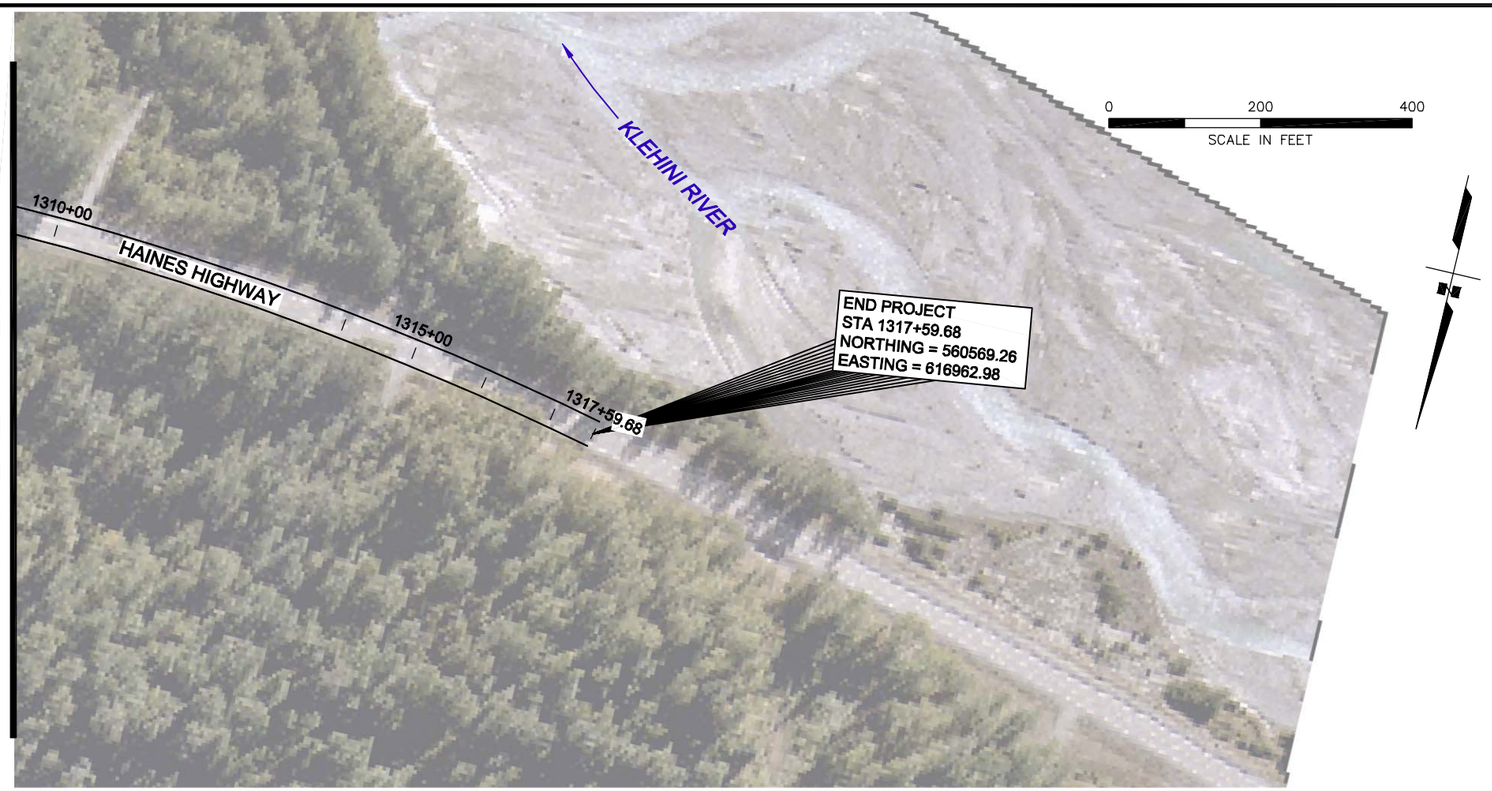
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
43	44



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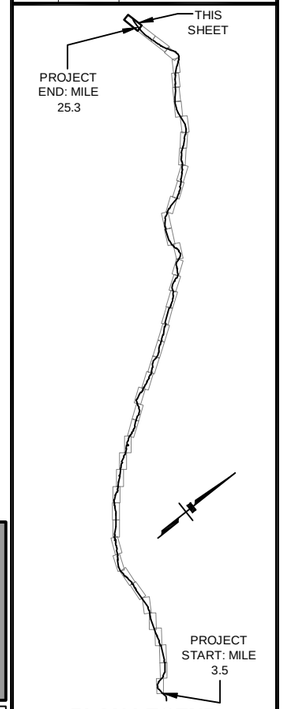
BRIAN P. O'QUINN
TAB: 44 TUESDAY, JANUARY 06, 2008

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION



PLAN LEGEND

LEGEND

- 40 / 60 — CONTOUR INTERVAL IS 10 FEET
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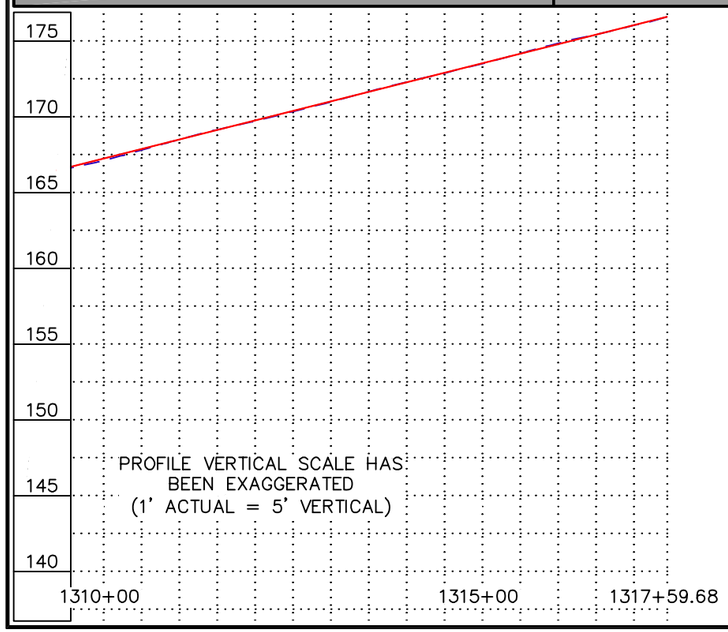
PROFILE

- EXISTING GROUND
- PROPOSED ROAD CENTERLINE
- GROUNDWATER OBSERVED DURING DRILLING/EXCAVATION
- GROUNDWATER MEASURED AFTER DRILLING



CHECKED BY: MEK

DESIGNED BY: KAN

BPO

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MILEPOST 3.5 TO
MILEPOST 25.3
PROJECT #68606

FINAL PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2008
SHEET NUMBER	TOTAL SHEETS
44	44

APPENDIX B

Test Hole Explanation Guide and Test Boring/Pit Logs

LOG OF TEST HOLE

HOLE # 9

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *260+00*
Offset: *30L*
Elevation: *25.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5.5	
Time		
Date	4/29/06	
Symbol	▼	

Weather: Overcast

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification / Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									
1	SPT	1	5 1 0 2	X	■	1	PT		**Peat** (PT) dark brown, Vx 1 Moisture=310%
2									2.0 — unfrozen sand at tip of shoe
3									
4									
5			4 2 3 4	X	■	5	SM		5.0 — **SILTY SAND** (SM) fine gravel, nonplastic, no dry strength, gray, moist to wet, loose, Groundwater encountered at 5.5' while drilling 2 p200=15%, Sa=81%, Gr=4%, Moisture=34%
6	SPT	2							
7									7.5 — float spoon - ~1' of heave
8	SPT		11 35/3"	X					8.0 — no sample recovered , sampler full with heaving sand - blow counts may not be representative
9									9.5 — float spoon - ~1' of heave
10			19 12	X	■	23	SP		10.0 — **SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=95%, Gr=0%
11	SPT	3	11 11						3 Moisture=26%
12							BOH 12		12.0 — Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

Sheet Number 1 of 1

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 10

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *265+50*
Offset: *40L*
Elevation: *25.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5.5	1.0
Time		
Date	4/29/06	5/1/06
Symbol	▼	▽

Weather: Overcast

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT		**Peat** (PT) brown, moist, fibrous — 0.0
0.5							ML		**SANDY SILT** (ML) coarse gravel, nonplastic, low dry strength, gray brown, moist, field observation indicates p200=60%, Sa=35%, Gr=5% — 0.5
1	SPT	1	2			20			1 Moisture=34%
2			11						
3			9						
4			6						
4.5									cuttings change to gray and sandier — 4.5
5			3				SP		Groundwater observed at 5.5' while drilling — 5.0
6	SPT	2	5			9			**SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, moist to wet, loose, field observation indicates p200=5%, Sa=95%, Gr=0%
7			4						2 Moisture=21%
			5						
7.0							BOH 7		Notes: PVC standpipe installed Groundwater measured at 1' on 05/01/06 — 7.0

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 11

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *274+50*
Offset: *50R*
Elevation: *27.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	0	0.0
Time		
Date	4/29/06	5/1/06
Symbol	▼	▽

Weather: Overcast

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									2" standing water, 1" **ORGANIC mat** 0.0
0.5									
1	SPT	1	2 2 2 2			4	SM		**SILTY SAND** (SM) medium grained sand, nonplastic, low dry strength, dark gray, wet, very loose, field observation indicates p200=20%, Sa=80%, Gr=0%, trace of **ORGANICS** (roots) 1 Moisture=39%
2									
2.5									becoming sandier, loose, field observation indicates p200=15%, Sa=85%, Gr=0% 2 Moisture=38%
3	SPT	2	6 5 4 4			9			
4									
5									5.0
	SPT	3	6 20 50/4"				SP		**SAND** (SP) medium grained sand, poorly graded, no dry strength, gray brown, wet, very dense, field observation indicates p200=5%, Sa=95%, Gr=0% 3 Moisture=20%
6.5									Sampler filled with heave - blow counts may not be representative
9.5									Float spoon - ~1' of heaving sand
10.0									medium dense 4 Moisture=22%
11	SPT	4	20 9 10 50/4"			19			
12							BOH 12		12.0 Notes: PVC standpipe installed Groundwater measured at the surface on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 12

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *278+50*
Offset: *50R*
Elevation: *27.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	4	
Time		
Date	4/29/06	
Symbol	▼	

Weather: Overcast

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									0.0
			6				PT		**Peat** (PT) brown, fibrous, **FROZEN Ice as Vx** (~10% ice by volume)
1			20						1 Moisture=126%
	SPT	1							1.0
		1A	7				SP-SM		**SAND** (SP-SM) medium grained sand, poorly graded, no dry strength, brown, field observation indicates p200=10%, Sa=90%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~30% by volume (plants, rootlets)
2			6						1A Moisture=31%
3									3.5
4	▼								4.0 Groundwater encountered at 4' while drilling
5			8				SP		5.0 **SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, wet, loose, field observation indicates p200=5%, Sa=95%, Gr=0%
	SPT	2	6			10			2 Moisture=26%
6			4						
7			4					BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 13

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *283+00*
Offset: *55R*
Elevation: *27.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *6.0 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Overcast

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT		**Peat** (PT) brown — 0.0
0.3							SM		**SILTY SAND** (SM) fine grained sand, nonplastic, low dry strength, gray, wet, very loose, field observation indicates p200=35%, Sa=65%, Gr=0%
1	SPT	1	2 1 1 2	X	■	2			1 Moisture=38%
4.0							SP		**SAND** (SP) medium grained sand, no dry strength, gray, wet, very loose, field observation indicates p200=5%, Sa=95%, Gr=0%
5	SPT	2	1 1 2 2	X	■	3			2 Moisture=29%
6.0							BOH 6		Notes: Groundwater observed 1' above ground surface

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 14

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *285+50*
Offset: *50R*
Elevation: *27.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *6.0 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	0	
Time		
Date	4/29/06	
Symbol	▼	

Weather: Overcast

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						PT		**Peat** (PT) brown, Groundwater encountered at the surface while drilling — 0.0
0.3						SM		**SILTY SAND** (SM) fine grained sand, no dry strength, gray, wet, very loose, field observation indicates p200=25%, Sa=75%, Gr=0%
1	SPT	1	1 1 2 2					1 Moisture=40%
4.0						SP		**SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, wet, loose, field observation indicates p200=5%, Sa=95%, Gr=0%
5	SPT	2	3 3 3 5		6			2 Moisture=31%
6.0						BOH 6		Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 15

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *286+65*
Offset: *10L*
Elevation: *28.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/16/2005 - 11/16/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	4	1.0
Time		
Date	11/16/05	11/22/05
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**6" Asphalt Concrete** (no CABC observed) 0.0
0.5									
1	▽						GW		**GRAVEL with Sand** (GW) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL**
2	GRAB	1							1 p200=4%, Sa=36%, Gr=60%, Moisture=5%, Max. Dry Dens=156.5pcf, Opt. Moisture=4%
3									3.0
			16				GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist to wet, dense, **FILL**, field observation indicates p200=5%, Sa=15%, Gr=80%
4	▼ SPT	2	11			36			2 Moisture=6% 4.0
			25						Groundwater encountered at 4' while drilling
5									5.0
			2				SP-SM		**SAND with Silt** (SP-SM) medium grained sand, poorly graded, nonplastic, no dry strength, brown, wet, medium dense, field observation indicates p200=10%, Sa=85%, Gr=5%
6	SPT	3	6			15			3 Moisture=25%
			9						6.5
								BOH 6.5	Notes: PVC standpipe installed Groundwater measured at 1' on 11/22/05

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 16

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *287+50*
Offset: *50R*
Elevation: *27.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *9.5 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	0	
Time		
Date	4/29/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT		**Peat** (PT) brown, wet, Groundwater encountered at the surface while drilling — 0.0
0.3							SM		**SILTY SAND** (SM) medium grained sand, nonplastic, no dry strength, gray, wet, very loose, field observation indicates p200=20%, Sa=80%, Gr=0%, **ORGANICS** present to ~20% by volume (roots, wood, plants)
1	SPT	1	2 1/12" 2	X	■				1 Moisture=70%
4.0									
5.0	SPT		3 3 3 3	X		6			no sample recovered
7.5							SP		**SAND** (SP) medium grained sand, poorly graded, no dry strength, dark gray, wet, medium dense, field observation indicates p200=5%, Sa=95%, Gr=0%
8	SPT	2	4 5 9 24	X	■	14			2 Moisture=23%
9.5							BOH 9.5		Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 17

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *289+50*
Offset: *50R*
Elevation: *27.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/29/2006 - 4/29/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	1.5
Time		
Date	4/29/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									0.0
			5				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, no dry strength, gray, moist, medium dense, **FILL,** field observation indicates p200=10%, Sa=35%, Gr=55%, trace of **ORGANICS** (roots, plants), cobbles to 10" (~5%)
			14						0.5
1	SPT	1							1 Moisture=7%
		1A	4				ML		1.0
			20						**SANDY SILT with Gravel** (ML) fine gravel, nonplastic, low dry strength, brown, field observation indicates p200=50%, Sa=35%, Gr=15%, **FROZEN Ice as Vc** (~10% ice by volume), **ORGANICS** present to ~25% by volume (roots, plants)
2									1A Moisture=26%
3									3.0
4									
									4.5
5									Groundwater encountered at 5' while drilling
			5				SP		5.0
			4						**SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, wet, loose, field observation indicates p200=5%, Sa=95%, Gr=0%
6	SPT	2	4			8			2 Moisture=26%
			5						
7							BOH 7		7.0

Notes:
PVC standpipe installed to 5.5'
Groundwater measured at 1.5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 18

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *295+00*
Offset: *10R*
Elevation: *28.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *11.5 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	5.5
Time		
Date	4/24/06	4/27/06
Symbol	▼	▽

Weather: Partly Cloudy

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**1.5" Asphalt Concrete** (no CABC observed) 0.0 / 0.1
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, no dry strength, gray, moist, **FILL**
2									1 p200=8%, Sa=40%, Gr=52%, Moisture=3%
3									3.0
4	SS	2	12 / 10 / 8				GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, no dry strength, gray, moist, medium dense, **FILL,** field observation indicates p200=5%, Sa=25%, Gr=70%
5									2 Moisture=5%
									5.0
									Groundwater encountered at 5' while drilling
6	SS		10 / 13 / 10						5.5 no sample recovered - driving a rock ahead of sampler
7									7.5
8	SS	3	5 / 8 / 10				SP		**SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=95%, Gr=0%
9									3 Moisture=22%
10									10.0
	SS	4	3 / 4 / 6						loose, sampler full with heave
11									4 Moisture=18%
							BOH 11.5		11.5

Notes:
PVC standpipe installed to 11'
Groundwater measured at 5.5' on 04/27/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 19

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *307+85*
Offset: *10R*
Elevation: *30.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *9.0 feet*
Date: *11/16/2005 - 11/16/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	7	2.0
Time		
Date	11/16/05	11/22/05
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3	GRAB	1					GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL** 1 p200=8%, Sa=38%, Gr=54%, Moisture=6%
2.5	SPT	2	11 19 22			41			Becoming more gravelly dense, **FILL**, field observation indicates p200=10%, Sa=30%, Gr=60% 2 Moisture=7%
5.0	SPT	3	9 11 15			26			dense, **FILL**, field observation indicates p200=10%, Sa=30%, Gr=60% 3 Moisture=14%
7.0									Groundwater encountered at 7' while drilling
7.5	SPT	4	6 13 17			30	SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, brown, wet, medium dense, field observation indicates p200=15%, Sa=45%, Gr=40% 4 Moisture=14%
9.0								BOH 9	Notes: PVC standpipe installed Groundwater measured at 2' on 11/22/05

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 20

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *325+50*
Offset: *10R*
Elevation: *30.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *11.5 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	8	5.0
Time		
Date	4/24/06	4/27/06
Symbol	▼	▽

Weather: Partly Cloudy

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0		1					GP-GM		**2.5" Asphalt Concrete** (no CABC observed) 0.0 **GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, low dry strength, gray, moist, **FILL,** field observation indicates p200=10%, Sa=40%, Gr=50% 0.2
1	GRAB								1 Moisture=5%
2									
3			5				SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, gray, **FROZEN Ice as Vc** 3.0
4	SS	2	21						2 p200=13%, Sa=45%, Gr=42%, Moisture=10%
5		3	30						moist, loose, field observation indicates p200=15%, Sa=45%, Gr=40% 4.8 3 Moisture=21%
6	SS		6 2 4				ML		**SILT** (ML) fine grained sand, low plasticity, low dry strength, gray, moist, firm, field observation indicates p200=90%, Sa=10%, Gr=0%, **ORGANICS** present to ~30% by volume 5.5
7		3A							3A Moisture=59%
8	SS	4	3 5 6				SP-SM		**SAND with Silt** (SP-SM) fine grained sand, poorly graded, no dry strength, gray, moist to wet, medium dense, field observation indicates p200=10%, Sa=90%, Gr=0% 7.5 4 Moisture=30% 8.5 Groundwater encountered at 8' while drilling
9									
10			12				SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, no dry strength, gray, wet, dense, field observation indicates p200=10%, Sa=45%, Gr=45%, sampler full with heave - blow counts may not be representative 10.0
11	SS	5	20 23						5 Moisture=10% 11.5 BOH 11.5 Notes: PVC standpipe installed to 10' Groundwater measured at 5' on 04/27/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 22

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *342+50*
Offset: *40L*
Elevation: *28.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *4.0 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	0	
Time		
Date	4/24/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT		**Peat** (PT) brown, wet, 0.0
									Groundwater encountered at the surface while drilling 0.5
1									
2									
3	SPT	1	8 6 5			11	SM		**SILTY SAND** (SM) medium grained sand, no dry strength, gray, wet, medium dense, field observation indicates p200=40%, Sa=60%, Gr=0%, trace of **ORGANICS** (roots) 2.5 1 Moisture=30%
4							BOH 4		4.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 23

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *347+00*
Offset: *35L*
Elevation: *28.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *6.5 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
1	SPT	1	11 7 7	X	■		ML	■		**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, brown gray, field observation indicates p200=85%, Sa=15%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~30% by volume (rootlets), Groundwater encountered at the surface while drilling
		1A					ML			1.0 1 Moisture=36% **SANDY SILT** (ML) fine grained sand, nonplastic, low dry strength, brown, wet, field observation indicates p200=60%, Sa=40%, Gr=0%, **ORGANICS** present to ~15% by volume (rootlets) 1A Moisture=33%
4										4.0
5	SPT	2	3 3 3	X	■	6	ML			5.0 **SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, brown, wet, field observation indicates p200=75%, Sa=25%, Gr=0%, **ORGANICS** present to ~10% by volume (rootlets) 2 Moisture=39%
6									BOH 6.5	6.5 Notes:

Groundwater Data		
Depth in (ft.)	0	
Time		
Date	4/24/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 25

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *358+80*
Offset: *30R*
Elevation: *33.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/14/2005 - 11/14/2005*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	9	7.0
Time		
Date	11/14/05	4/23/06
Symbol	▼	▽

Weather: Snow

Gravel Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0	GRAB	1					GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL**, trace of **organics** (grass, rootlets) 0.0
1									1 p200=7%, Sa=29%, Gr=64%, Moisture=9%
2									2.0
3	SPT	2	5 7 8			15	SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, brown, moist, medium dense, **FILL**, field observation indicates p200=15%, Sa=50%, Gr=35%, trace of **ORGANICS** (rootlets)
4									2 Moisture=17%
5									5.0
6	SPT	3	3 3 3			6	ML		**SANDY SILT** (ML) fine to medium grained sand, low plasticity, low dry strength, slow dilatancy, gray, moist to wet, firm, field observation indicates p200=65%, Sa=35%, Gr=0%, trace of *in situ* **ORGANICS** (rootlets, interbedded)
7									3 Moisture=36%
8									
9									Groundwater encountered at 9' while drilling 9.0
10									10.0
11	SPT	4	5 6 8			14	SM		**SILTY SAND** (SM) medium grained sand, nonplastic, low dry strength, gray, wet, medium dense, field observation indicates p200=25%, Sa=75%, Gr=0%
									4 Moisture=31%
								BOH 11.5	11.5

Notes:
PVC standpipe installed
Groundwater measured at 7' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 29

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *386+60*
Offset: *0*
Elevation: *34.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/16/2005 - 11/16/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	5	6.5
Time		
Date	11/16/05	4/23/06
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							SW-SM		**SAND with Silt and Gravel** (SW-SM) coarse gravel, well graded, nonplastic, no dry strength, brown, dry, **FILL**
1	GRAB	1							1 p200=8%, Sa=47%, Gr=45%, Moisture=6%
2									
2.5									Becoming sandier dense, **FILL**, field observation indicates p200=10%, Sa=60%, Gr=30%
3	SPT	2	17 18 16			34			2 Moisture=5%
4									
4.6									Groundwater encountered at 5' while drilling
5									
5.0			6				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, wet, medium dense, **FILL**, field observation indicates p200=10%, Sa=30%, Gr=60%
6	SPT	3	13 11			24			3 Moisture=6%
7									
8									
9									
10									
10.0			8				SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, brown, wet, medium dense, field observation indicates p200=20%, Sa=50%, Gr=30%, trace of *in situ* **ORGANICS** (rootlets, interbedded)
11	SPT	4	12 14			26			4 Moisture=14%
11.5							BOH 11.5		Notes: PVC standpipe installed Groundwater measured at 6.5' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 30

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *401+15*
Offset: *0*
Elevation: *36.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	8	8.5
Time		
Date	11/17/05	4/23/06
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL** 1 p200=6%, Sa=28%, Gr=66%, Moisture=6%
2									
3	SPT	2	13 15 21			36	GW-GM		Becoming more gravelly (GW-GM) dense, **FILL**, field observation indicates p200=10%, Sa=30%, Gr=60% 2.5 2 Moisture=5%
4									
5									
5	SPT	3	15 11 9			20	GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, medium dense, **FILL**, field observation indicates p200=5%, Sa=30%, Gr=65% 5.0 3 Moisture=4%
7									gravel increasing to 3", subangular, indicated by cuttings 7.0
8									Groundwater encountered at 8' while drilling 8.0
9									
10									
10	SPT	4	4 8 13			21	SP		**SAND with Gravel** (SP) coarse gravel, poorly graded, nonplastic, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=65%, Gr=30% 10.0 4 Moisture=22%
11							BOH 11.5		11.5 Notes: PVC standpipe installed Groundwater measured at 8.5' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 31

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *412+50*
Offset: *45L*
Elevation: *30.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *17.0 feet*
Date: *5/1/2006 - 5/1/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	4	
Time		
Date	5/1/06	
Symbol	▼	

Weather: Partly Cloudy

Sand Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							SP-SM		**SAND with Silt** (SP-SM) fine gravel, poorly graded, no dry strength, gray, moist 0.0
1	GRAB	1							1 p200=6%, Sa=81%, Gr=13%, Moisture=7%, Max. Dry Dens=115pcf, Opt. Moisture=13%
2									
3			3				SP		**SAND** (SP) fine gravel, poorly graded, gray, moist to wet, very loose, field observation indicates p200=5%, Sa=85%, Gr=10% 3.0
4	SPT	2	2 2 2			4			2 Moisture=22% 4.0 Groundwater encountered at 4' while drilling
5			4						becoming sandier, wet, loose, field observation indicates p200=5%, Sa=90%, Gr=5% 5.0
6	SPT	3	3 3 0			6			3 Moisture=23%
7									7.5
8			2				SP-SM		**SAND with Silt** (SP-SM) medium grained sand, poorly graded, no dry strength, gray, wet, loose, field observation indicates p200=10%, Sa=90%, Gr=0%
9	SPT	4	4 5 6			9			4 Moisture=28%
10			3						5 Moisture=37%
11	SPT	5	2 5 7			7			
12									
13									
14									
15			5						15.0 medium dense, sampler full with heave - blow counts may not be representative
16	SPT	6	5 9 10			14			6 Moisture=23%
17								BOH 17	17.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 32

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *419+70*
Offset: *5R*
Elevation: *40.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *2.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
									GRAVEL with Sand (GW) coarse gravel, well graded, nonplastic, no dry strength, brown, dry, **FILL** 0.3
1	GRAB	1					GW		1 p200=5%, Sa=35%, Gr=60%, Moisture=5%
									Difficulty while drilling 1.8
2									Auger refusal at 2.5' in competent **Bedrock** 2.5
								BOH 2.5	Notes: No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 33

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *438+00*
Offset: *10L*
Elevation: *43.0 feet*

Equipment Type: *Mobile B-61 Nodwell*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *11.5 feet*
Date: *4/23/2006 - 4/23/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**5" Asphalt Concrete** (no CABC observed) 0.0
0.5							GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, low dry strength, gray brown, moist, **FILL**
1	GRAB	1							1 p200=7%, Sa=39%, Gr=54%, Moisture=6%
3			7				GP		**GRAVEL with Sand** (GP) medium dense, **FILL,** field observation indicates p200=5%, Sa=40%, Gr=55% 3.0
4	SS	2	18						2 Moisture=4%
5			7						becoming more gravelly, **FILL,** field observation indicates p200=5%, Sa=30%, Gr=65% 5.0
6	SS	3	11 9 7						3 Moisture=3%
7.5							SM		**SILTY SAND with Gravel** (SM) coarse gravel, loose, field observation indicates p200=15%, Sa=45%, Gr=40%, trace of **ORGANICS** (rootlets)
8	SS	4	4 4 3						4 Moisture=12%
10			3						becoming siltier, field observation indicates p200=20%, Sa=45%, Gr=35% 10.0
11	SS	5	4 4						5 Moisture=14%
11.5							BOH 11.5		Notes: No groundwater observed while drilling PVC standpipe installed No measurable groundwater to 11.5' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 34

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *449+40*
Offset: *35R*
Elevation: *48.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *5.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**6" Asphalt Concrete** (no CABC observed) 0.0
0.5									
1	GRAB	1					GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, no dry strength, gray, moist, **FILL**
									1 p200=7%, Sa=35%, Gr=58%, Moisture=4%
2									
2.5									
3			30				SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, no dry strength, gray, moist, very dense, field observation indicates p200=10%, Sa=55%, Gr=35%
	SPT	2	21			51			2 Moisture=6%
4			30						
4.5									difficulty drilling
5	SPT	3							
5.0			50/1"				BR		**Bedrock,** (BR) no sample recovered, auger refusal at 5.5'
5.5								BOH 5.5	Notes: No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 35

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *471+50*
Offset: *20L*
Elevation: *40.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Gravel Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, gray, moist, **FILL** 0.0
1	GRAB	1							1 p200=9%, Sa=43%, Gr=48%, Moisture=8%
2									
3	SPT	2	31 / 50/1"						No sample recovered -bouncing on a cobble, **FILL** 2.5
4									
5	SPT	3	3 / 5 / 50/3"				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray brown, moist, very dense, blow counts not representative -bouncing on **Bedrock** 5.0
6									3 p200=35%, Sa=32%, Gr=33%, Moisture=4%
							BR	BOH 6.5	**Bedrock,** (BR) auger refusal at 6.5' 6.2 / 6.5

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 37

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *491+70*
Offset: *15L*
Elevation: *40.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, gray, moist, **FILL** 1 p200=7%, Sa=39%, Gr=54%, Moisture=6%
2									
3	SPT	2	32 35 23			58			becoming siltier very dense, **FILL**, field observation indicates p200=10%, Sa=35%, Gr=55% 2 Moisture=4% 2.5
4									
5			7				ML		**SANDY SILT** (ML) fine gravel, low plasticity, no dry strength, no to slow dilatancy, gray, moist, stiff, contains **ORGANICS** ~5% by volume (plants) 5.0
6	SPT	3	12 14			26			3 **F4** from sieve analysis, p200=65%, Sa=28%, Gr=7%, Moisture=29% 6.5
								BOH 6.5	Notes: No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 38

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *496+50*
Offset: *40R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/30/2006 - 4/30/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		5.0
Time		
Date		5/1/06
Symbol		▽

Weather: Partly Cloudy

Alder Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT			**Peat** (PT) dark brown, **Frozen Ice as Vx** (~25% ice by volume, crystals ~1/8" diameter) 0.0
1	SPT	1	8, 17, 7, 3			24				1 Moisture=107%
2		1A								1A Moisture=99%
3										
4										
5			4, 4				ML			**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, gray light brown, moist, soft, field observation indicates p200=75%, Sa=25%, Gr=0% 5.0
6	SPT	2	5, 5				SP			2 Moisture=36% 6.0 **SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, moist, loose 2A p200=3%, Sa=94%, Gr=3%, Moisture=21%
7		2A							BOH 7	7.0 Notes: No groundwater observed while drilling PVC standpipe installed Groundwater measured at 5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 39

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *501+50*
Offset: *40R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/30/2006 - 4/30/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/30/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									0.0
1	SPT	1	1 1 2 4			3	ML		**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, light brown, moist, soft, field observation indicates p200=80%, Sa=20%, Gr=0% 1 Moisture=33%
2									2.0 cuttings becoming sandier
3									
4									4.5 Groundwater encountered at 5' while drilling
5									5.0
6	SPT	2	5 7 6 6			13	SP		**SAND with Gravel** (SP) poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=80%, Gr=15% 2 Moisture=13%
7								BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 40

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *510+50*
Offset: *80R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/24/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										**Peat** (PT) brown, **FROZEN Ice as Vx** (~5% ice by volume) 0.0
							PT			0.3
1	SPT	1	6 13 9 5				ML			**SILT with Sand** (ML) fine grained sand, nonplastic, no dry strength, gray brown, field observation indicates p200=75%, Sa=25%, Gr=0%, **FROZEN Ice as Vx** (~5% ice by volume), **ORGANICS** present to ~10% by volume (rootlets) 1 Moisture=67%
2										
3										
4										
										Groundwater encountered at 5' while drilling 4.5
5										5.0
			6				SP			**SAND with Gravel** (SP) fine gravel, poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=60%, Gr=35%
6	SPT	2	9 8 6			17				2 Moisture=17%
7									BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 41

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *513+00*
Offset: *70R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/24/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									0.0
							PT		**Peat** (PT) brown, **FROZEN Ice as Vx** (~10% ice by volume) 0.3
1	SPT	1	7 5 2 4				ML		**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, brown gray, field observation indicates p200=75%, Sa=25%, Gr=0%, **FROZEN Ice as Vx** (~10% ice by volume), **ORGANICS** present to ~10% by volume (rootlets)
2									1 Moisture=56%
3									
4									
5									Groundwater encountered at 5' while drilling 4.5
							SP		**SAND with Gravel** (SP) coarse gravel, poorly graded, no dry strength, gray, wet, medium dense 5.0
6	SPT	2	5 5 8 7			13			2 p200=3%, Sa=63%, Gr=34%, Moisture=13%
7								BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 42

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *514+500*
Offset: *65R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/24/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification / Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									
	SPT	1	1				PT		**Peat** (PT) brown, **FROZEN Ice** — 0.0
			6				ML		**SILT with Sand** (ML) fine grained sand, nonplastic, gray brown, field observation indicates p200=85%, Sa=15%, Gr=0%, **FROZEN Ice as Vr** (~50% ice by volume, crystals ~1/4" thick), **ORGANICS** present to 5% by volume — 0.3
1		1A	3						1 Moisture=63% — 1.5
			4				SP-SM		**SAND with Silt** (SP-SM) fine grained sand, poorly graded, nonplastic, no dry strength, brown, moist, loose, field observation indicates p200=10%, Sa=90%, Gr=0%, trace of **ORGANICS** (rootlets)
2									
									1A Moisture=11%
3									
4									
									Groundwater encountered at 5' while drilling — 4.5
5			7				SP		**SAND with Gravel** (SP) fine gravel, poorly graded, nonplastic, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=50%, Gr=45% — 5.0
	SPT	2	8			15			2 Moisture=14% — 6.0
6			7						
			7						
7								BOH 7	Notes: — 7.0

CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 43

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *516+00*
Offset: *40R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/24/2006 - 4/24/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/24/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
1	SPT	1	10 8 4 6	X	■	12	ML	■		**SANDY SILT** (ML) fine grained sand, nonplastic, medium dry strength, gray brown, field observation indicates p200=70%, SA=30%, Gr=0%, **FROZEN Ice as Vx** (~5% ice by volume), **ORGANICS** present to 10% by volume (roots) 1 Moisture=62%
2										
3										
4										
5	▼									Groundwater observed at 5' while drilling 4.5 5.0
6	SPT	2	6 9 8 6	X	■	17	SP			**SAND with Gravel** (SP) coarse gravel, poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=75%, Gr=20% 2 Moisture=14%
7									BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 44

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *520+80*
Offset: *10R*
Elevation: *42.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		5.0
Time		
Date		11/22/05
Symbol		▽

Weather: Rain

Gravel Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							GW		**GRAVEL with Sand** (GW) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL** 0.0
1	GRAB	1							1 p200=5%, Sa=38%, Gr=57%, Moisture=5%
2									
3	SPT	2	14 20 14			34			becoming sandier no dry strength, dense, **FILL**, field observation indicates p200=5%, Sa=40%, Gr=55%, SP-SM present bottom 1" of sample 2.5 2 Moisture=7%
4									4.0
5 ▽			6				SM		**SILTY SAND** (SM) fine gravel, nonplastic, no dry strength, brown, moist, medium dense 5.0
6	SPT	3	8 7			15			3 p200=38%, Sa=60%, Gr=2%, Moisture=22%
								BOH 6.5	6.5 Notes: No groundwater observed while drilling PVC standpipe installed Groundwater measured at 5' on 11/22/05

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 45

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *526+00*
Offset: *35R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	4.5
Time		
Date	4/25/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic
0									
1	SPT	1	1				PT		
		1A	8				ML		
2			15						
3			6						
4									
5			4				SP		
6	SPT	2	5			13			
7			8						
			7						BOH 7

SUBSURFACE MATERIAL

0.0 — **Peat** (PT) dark brown, moist, fibrous
0.5 — 1 Moisture=55%

SANDY SILT (ML) fine grained sand, nonplastic, low dry strength, gray brown, field observation indicates p200=70%, Sa=30%, GR=0%, **FROZEN Ice as Nb, ORGANICS** present to ~15% by volume (roots, rootlets)
1A Moisture=34%

4.5 — Groundwater encountered at 5' while drilling

5.0 — **SAND with Gravel** (SP) fine gravel, poorly graded, 3/4, no dry strength, dark gray, wet, medium dense, field observation indicates p200=5%, Sa=65%, Gr=30%
2 Moisture=14%

7.0

Notes:
PVC standpipe installed to 7'
Groundwater measured at 4.5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 46

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *528+00*
Offset: *35R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	6	
Time		
Date	4/25/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification / Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0		1	1				PT		**Peat** (PT) dark brown, moist — 0.0
0.5			3				ML		**SANDY SILT** (ML) fine grained sand, nonplastic, no dry strength, gray brown, field observation indicates p200=70%, Sa=30%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~10% by volume (rootlets) — 0.5
1	SPT		14						1 Moisture=31%
2			5						
3									
4									cuttings becoming sandier at 4' — 4.0
5			4				SP		**SAND** (SP) medium grained sand, poorly graded, no dry strength, dark gray, moist to wet, loose, field observation indicates p200=5%, Sa=95%, Gr=0% — 5.0
6	SPT	2	3			8			2 Moisture=22%
			5						Groundwater encountered at 6' while drilling — 6.0
7			7					BOH 7	— 7.0

Notes:

CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 47

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *530+00*
Offset: *30R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *6.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	4.5	
Time		
Date	4/25/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
1	SPT	1	5 1 1 1	X	■	2	PT	■		**Peat** (PT) dark brown, **FROZEN Ice as Vx** (~10% ice by volume), fibrous (rootlets present to ~30% by volume) 1 Moisture=817%
2										
3										3.0 change in cuttings at 3'
4			1	X	■		ML			4.0 **SANDY SILT** (ML) fine grained sand, nonplastic, no dry strength, gray, moist to wet, firm
5	SPT	2	1 4 3			5				2 p200=54%, Sa=46%, Gr=0%, Moisture=44% 4.5 Groundwater encountered at 4.5' while drilling
6									BOH 6	6.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 48

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *535+00*
Offset: *40L*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	3.0
Time		
Date	4/25/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
		1	1				OL			**ORGANIC SILT** (OL) fine grained sand, nonplastic, low dry strength, dark brown, moist, very soft, field observation indicates p200=80%, Sa=20%, Gr=0%, **ORGANICS** present (roots, peat)
1	SPT	1A	12				ML			0.5
			23							1 Moisture=56%
2			18							**SANDY SILT** (ML) fine grained sand, nonplastic, low dry strength, gray brown, field observation indicates p200=65%, Sa=35%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~5% by volume (rootlets)
3	▽									1A Moisture=33%
4										
	▼									Groundwater encountered at 5' while drilling
5			6				SP			4.5
			6							5.0
6	SPT	2	10			16				**SAND with Gravel** (SP) fine gravel, poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=70%, Gr=25%
			9							2 Moisture=14%
7									BOH 7	7.0

Notes:
PVC standpipe installed to 7'
Groundwater measured at 3' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 49

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *543+00*
Offset: *40R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *17.0 feet*
Date: *5/1/2006 - 5/1/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	0	
Time		
Date	5/1/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
1	SPT	1	1/18"				ML			**SILT** (ML) fine grained sand, low plasticity, medium dry strength, gray, wet, very soft, field observation indicates p200=90%, Sa=10%, Gr=0%, **ORGANICS** present to ~15% by volume (rootlets, plants)
2			2							1 Moisture=65%
										1.5
										Groundwater encountered at the surface while drilling
5										5.0
6	SPT	2	4 2 3 3			5	ML			**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, gray, wet, soft, field observation indicates p200=80%, Sa=20%, Gr=0% 2 Moisture=36%
7										7.0 sampler sank 6" under weight of hammer
										7.5
8	SPT	3	1/18"							becoming siltier, medium dry strength, very soft, field observation indicates p200=85%, Sa=15%, Gr=0% 3 Moisture=44%
9			1							
10										10.0 very soft, pushed auger to 15'
15										15.0
16	SPT	4	2 2 4 4			6	ML			**SILT with Sand** (ML) fine grained sand, nonplastic, no dry strength, gray, wet, soft, field observation indicates p200=75%, Sa=25%, Gr=0% 4 Moisture=23%
17									BOH 17	17.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 50

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *549+50*
Offset: *30R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	4.5	0.0
Time		
Date	4/25/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										**Ice,** soft, cloudy, colorless, trace roots and peat — 0.0
1	SPT	1	6 11 1 1				PT			**Peat** (PT) dark brown, **FROZEN Ice as Vx** (~25% ice by volume, random crystals) — 1.0 1 Moisture=295%
2										
3										pushed auger to 5' — 3.5
4										Groundwater encountered at 4.5' while drilling — 4.5
5			4				ML			**SILT** (ML) fine grained sand, nonplastic, low dry strength, gray, wet, soft, field observation indicates p200=90%, Sa=10%, Gr=0% — 5.0
6	SPT	2	2 2 3			4				2 Moisture=37%
7									BOH 7	7.0

Notes:
PVC standpipe installed to 7'
Groundwater measured at the surface on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 51

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *552+00*
Offset: *30R*
Elevation: *40.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/25/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
		1	3				PT			**Peat** (PT) dark brown, moist, fibrous
										1 Moisture=374% 0.5
1	SPT	1A	25				OL			**ORGANIC SILT** (OL) coarse gravel, nonplastic, low dry strength, brown gray, field observation indicates p200=60%, Sa=30%, Gr=10%, **FROZEN Ice as Nb, ORGANICS** present to ~50% by volume (rootlets)
			18							
2			7							1A Moisture=33%
3										
4										
										Groundwater encountered at 5' while drilling 4.5
5			7				SM			5.0 **SILTY SAND** (SM) fine grained sand, nonplastic, low dry strength, gray, wet, field observation indicates p200=40%, Sa=60%, Gr=0%
			5							
6		2	4							2 Moisture=45%
			4							
7									BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 52

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *556+00*
Offset: *30R*
Elevation: *45.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	0.3
Time		
Date	4/25/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0			6				PT			**Peat** (PT) brown, **FROZEN Ice as Nb** 0.0
1	SPT	1	5							1 Moisture=323%
		1A	1				ML			**SILT with Sand** (ML) fine grained sand, no to low plasticity, low dry strength, gray, moist, very soft 1.0
2			1							1A p200=84%, Sa=16%, Gr=0%, Moisture=34%, Org=4%
3										
4										
5										Groundwater encountered at 5' while drilling 4.5
			3							low plasticity, medium dry strength, wet, firm, field observation indicates p200= 80%, Sa=20%, Gr=0%, trace of **ORGANICS** (rootlets) 5.0
6	SPT	2	5							2 Moisture=34%
			4			9				
7			5						BOH 7	7.0

Notes:
PVC standpipe installed to 9'
Groundwater measured at 3" on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 53

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *561+00*
Offset: *30R*
Elevation: *45.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/25/2006 - 4/25/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	4.5	
Time		
Date	4/25/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									
		1	4				PT		**Peat** (PT) brown, moist, fibrous — 0.0
			3				ML		**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, gray brown, field observation indicates p200=75%, Sa=325%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~20% by volume (roots) — 0.5
1	SPT	1A	8				GP		— 1.0
			8						1 Moisture=54%
2									**GRAVEL with Sand** (GP) fine gravel, poorly graded, no dry strength, brown, moist, medium dense, field observation indicates p200=5%, Sa=45%, Gr=50%
3									1A Moisture=9%
4									Groundwater encountered at 4.5' while drilling — 4.5
5			6				SP		**SAND with Gravel** (SP) fine gravel, poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=55%, Gr=45% — 5.0
			7						
6	SPT	2	6			13			2 Moisture=15%
			5						
7								BOH 7	Notes: — 7.0

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 55

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *570+45*
Offset: *10L*
Elevation: *45.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	9	9.0
Time		
Date	11/17/05	4/23/06
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							GW		**GRAVEL with Sand** (GW) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL**
1	GRAB	1							1 p200=4%, Sa=43%, Gr=53%, Moisture=6%, Max. Dry Dens=148.5pcf, Opt. Moisture=4%
2									
2.5									becoming sandier medium dense, **FILL**, field observation indicates p200=5%, Sa=40%, Gr=55%
3	SPT	2	11 13 10			23			2 Moisture=2%
4									
5.0							GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, medium dense, **FILL**, field observation indicates p200=10%, Sa=30%, Gr=60%
6	SPT	3	6 6 5			11			3 Moisture=9%
7.0									drilling becoming easier
8									
9.0									Groundwater encountered at 9' while drilling
10.0							SP		**SAND with Gravel** (SP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, wet, medium dense, field observation indicates p200=5%, Sa=80%, Gr=15%
10			6						
11	SPT	4	7 9			16			4 Moisture=13%
11.5								BOH 11.5	Notes: PVC standpipe installed Groundwater measured at 9' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 57

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *580+35*
Offset: *0*
Elevation: *46.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/17/2005 - 11/17/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	5	6.5
Time		
Date	11/17/05	4/23/06
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**6" Asphalt Concrete** (no CABC observed) 0.0
0.5									
1	GRAB	1					GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL**, field observation indicates p200=5%, Sa=30%, Gr=65%
									1 Moisture=5%
2									
2.5									becoming sandier dense, **FILL**, field observation indicates p200=5%, Sa=40%, Gr=55%
3	SPT	2	12 23 24			47			2 Moisture=4%
4									
4.6									Groundwater encountered at 5' while drilling
5									
5.0									
6	SPT	3	7 8 9			17	SP-SM		**SAND with Silt and Gravel** (SP-SM) fine gravel, poorly graded, nonplastic, no dry strength, brown, wet, medium dense, field observation indicates p200=10%, Sa=55%, Gr=35% **HYDROCARBON ODOR**
									3 Moisture=9%
7									
8									
9									
10									
10.0									
11	SPT	4	2 6 35			41	SP		**SAND** (SP) fine gravel, poorly graded, nonplastic, no dry strength, brown, wet, dense
									4 **NFS** from sieve analysis, p200=2%, Sa=86%, Gr=12%, Moisture=18%
11.5								BOH 11.5	

Notes:
PVC standpipe installed
Groundwater measured at 6.5' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 60

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *595+80*
Offset: *0*
Elevation: *48.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *3.0 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL**
2									1 p200=8%, Sa=40%, Gr=52%, Moisture=6%
3	SPT	2	30/0"				BR	BOH 3	difficulty drilling 2.3 / 2.7 **Bedrock,** (BR) no sample recovered, auger refusal at 3' 3.0

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 61

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *606+30*
Offset: *10R*
Elevation: *50.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *4.5 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		4.0
Time		
Date		4/23/06
Symbol		▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, gray, moist, **FILL**
1	GRAB	1							1 p200=7%, Sa=39%, Gr=54%, Moisture=6%
3.0			10				ML		**SANDY SILT** (ML) fine gravel, low plasticity, no dry strength, no to slow dilatancy, gray, moist, very stiff, contains **ORGANICS** ~5% by volume (plants)
4	▽SPT	2	9 9			18			2 **F4** from sieve analysis, p200=67%, Sa=32%, Gr=1%, Moisture=28%
4.5								BOH 4.5	

Notes:
No groundwater observed while drilling
PVC standpipe installed
Groundwater measured at 4' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 62

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *615+00*
Offset: *40R*
Elevation: *45.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/26/2006 - 4/26/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	4	4.5
Time		
Date	4/26/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									3" **ORGANIC mat** (roots, grass) 0.0
0.5									
1	SPT	1	3 9				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, no dry strength, brown, moist, medium dense, field observation indicates p200=10%, Sa=35%, Gr=50% 1.0
		1A	5 5				ML		1 Moisture=8%
2									**SANDY SILT** (ML) fine grained sand, nonplastic, low dry strength, brown gray, moist, stiff, field observation indicates p200=60%, Sa=40%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~10% (rootlets)
3									1A Moisture=52%
4									Groundwater encountered at 4' while drilling 4.0
5									becoming sandier, wet, firm, field observation indicates p200=55%, Sa=45%, Gr=0% 5.0
6	SPT	2	3 3 3 5			6			2 Moisture=24%
7								BOH 7	7.0

Notes:
PVC standpipe installed to 7'
Groundwater measured at 4.5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 63

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *617+00*
Offset: *45R*
Elevation: *45.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *9.5 feet*
Date: *4/26/2006 - 4/26/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	7.5	4.3
Time		
Date	4/26/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
1	SPT	1	4 7 1 1	X		8	ML			**SANDY SILT** (ML) medium grained sand, nonplastic, low dry strength, brown gray, moist, firm, **FROZEN Ice as Vx** (~10% ice by volume), **ORGANICS** present to ~15% by volume (rootlets) 1 p200=67%, Sa=33%, Gr=0%, Moisture=65%
2										
3										
4										
5										5.0
6	SPT	2	3 2 2 3	X		4	SM			**SILTY SAND** (SM) medium grained sand, nonplastic, no dry strength, gray, moist to wet, loose, field observation indicates p200=35%, Sa=65%, Gr=0%, wood at tip of shoe 2 Moisture=32%
7										7.0 Groundwater encountered at 7.5' while drilling
8	SPT	3	3 2 4 4	X		6	SP			7.5 **SAND with Gravel** (SP) fine gravel, poorly graded, no dry strength, gray, wet, loose, field observation indicates p200=5%, Sa=70%, Gr=25% 3 Moisture=14%
9									BOH 9.5	9.5 Notes: PVC standpipe installed to 9' Groundwater measured at 4.3' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 64

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *618+00*
Offset: *50R*
Elevation: *45.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/26/2006 - 4/26/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/26/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
			10				PT			**Peat** (PT) dark brown, **FROZEN Ice as Vx** (~10% ice by volume), fibrous
1	SPT	1	14							1 Moisture=233%
		1A	4				ML			1.0 **SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, brown gray, field observation indicates p200=80%, Sa=20%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to 20% by volume (rootlets)
2			2							1A Moisture=44%
3										
4										4.0
										4.5 Groundwater encountered at 5' while drilling
5			2				ML			5.0 **SILT** (ML) fine grained sand, low plasticity, low dry strength, gray, moist, soft, field observation indicates p200=10%, Sa=90%, Gr=0%, **ORGANICS** present to ~30% (rootlets) by volume
			2							
6	SPT	2	1			3				2 Moisture=38%
			5							
7									BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 65

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *619+50*
Offset: *35R*
Elevation: *45.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/26/2006 - 4/26/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	4/26/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0			5 17				PT			**Peat** (PT) brown, **FROZEN Ice as Vx** (~10% ice by volume) 1 Moisture=141%
1	SPT	1 1A	13 2				ML			**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, gray brown, field observation indicates p200=80%, Sa=20%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~30% by volume (roots, plants) 1A Moisture=45%
2										
3										
4										
5			5							Groundwater encountered at 5' while drilling becoming sandier, low plasticity, gray, wet, firm, field observation indicates p200=75%, Sa=25%, Gr=0% 2 Moisture=35%
6	SPT	2	4 2 2			6				
7										
8			3 4				SM			**SILTY SAND** (SM) fine grained sand, nonplastic, no dry strength, gray, wet, loose, field observation indicates p200=45%, Sa=55%, Gr=0% 3 Moisture=31%
9	SPT	3	4 6			8				
10										becoming sandier, nonplastic, field observation indicates p200=35%, Sa=65%, Gr=0% 4 Moisture=35%
11	SPT	4	4 3 4			7				
12							BOH 12			Notes: PVC standpipe installed to 10' PVC not found - no measurement obtaned

4.8
5.0
7.5
10.0
12.0

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 66

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *622+50*
Offset: *35L*
Elevation: *50.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/26/2006 - 4/26/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	6	
Time		
Date	4/26/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0
1	SPT	1	3 6 5 6			11	ML			**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, brown gray, field observation indicates p200=85%, Sa=15%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to 15% by volume (rootlets, plants) 1 Moisture=37%
2										
3										
4										
5										5.0
6	SPT	2	5 6 9 13			15	SM			**SILTY SAND** (SM) coarse gravel, nonplastic, no dry strength, brown gray, wet, medium dense, field observation indicates p200=25%, Sa=70%, Gr=5%, **ORGANICS** present to ~5% by volume (plants, wood) Groundwater encountered at 6' while drilling 2 Moisture=32%
7									BOH 7	7.0 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 67

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *627+50*
Offset: *40R*
Elevation: *45.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *10.0 feet*
Date: *4/26/2006 - 4/26/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5.5	2.5
Time		
Date	4/26/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0			2				PT		**Peat** (PT) brown, moist, 6" **FROZEN Ice as Nb** 0.0
1	SPT	1	1 2 2			3			1 Moisture=79%
2									
3									3.0
4									
5			3				ML		**SANDY SILT** (ML) fine grained sand, nonplastic, no dry strength, gray, moist to wet, 5.0
6	SPT	2	3 2 2			5			firm, **ORGANICS** present to ~20% by volume (roots, plants) 5.5 2 p200=61%, Sa=39%, Gr=0%, Moisture=29% Groundwater encountered at 5.5' while drilling
7									
8			1						fine grained sand, wet, soft, field observation indicates p200=60%, Sa=40%, Gr=0%, 8.0
9	SPT	3	1 2 3			3			**ORGANICS** present to 20% by volume (plants, rootlets) 3 Moisture=47%
10							BOH 10		10.0 Notes: PVC standpipe installed to 10' Groundwater measured at 2.5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 68

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *635+50*
Offset: *15L*
Elevation: *50.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	8	8.0
Time		
Date	11/18/05	4/23/06
Symbol	▼	▽

Weather: Rain

Gravel Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									0.0
	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL** 1 p200=12%, Sa=39%, Gr=49%, Moisture=7%
1									
2									2.5
									difficulty drilling auger action indicates cobbles
3									
4									
5			8						5.0
	SPT	2	17			32	GP		**GRAVEL with Sand** (GP) coarse grained sand, poorly graded, nonplastic, no dry strength, brown, moist, dense, **FILL**, field observation indicates p200=5%, Sa=25%, Gr=70% 2 Moisture=9%
6			15						
7									7.0 Drilling becoming easier
8	▼								8.0 Groundwater encountered at 8' while drilling
9									
10			13						10.0
	SPT	3	22			42	GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse grained sand, poorly graded, nonplastic, no dry strength, gray, wet, dense, field observation indicates p200=10%, Sa=20%, Gr=70% 3 Moisture=10%
11			20						
							BOH 11.5		11.5 Notes: PVC standpipe installed Groundwater measured at 8' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 71

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *667+05*
Offset: *20L*
Elevation: *54.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		4.3
Time		
Date		4/23/06
Symbol		▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3									
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL**
2									1 p200=9%, Sa=45%, Gr=46%, Moisture=7%
3			13				SP		**SAND with Gravel** (SP) coarse grained sand, poorly graded, nonplastic, no dry strength, brown, moist, dense, field observation indicates p200=5%, Sa=55%, Gr=40% 3.0
4	SPT	2	26			45			2 Moisture=10%
			19						
5									no sample recovered -rock stuck in end of sampler 5.0
	SPT	3	14						
6			23						difficulty drilling 5.8
			50/3"						auger refusal at 6.5' in competent **Bedrock** 6.5
								BOH 6.5	

Notes:
No groundwater observed while drilling
PVC standpipe installed
Groundwater measured at 4.3' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 76

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *687+00*
Offset: *50R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *9.5 feet*
Date: *4/30/2006 - 4/30/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	6	
Time		
Date	4/30/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									0.0
1	SPT	1	2 3 1 1			4	ML		**SILT** (ML) fine grained sand, low plasticity, low dry strength, gray, moist, soft, field observation indicates p200=95%, Sa=5%, Gr=0% 1 Moisture=44%
2									
3									
4									
5									5.0
6	SPT	2	1 1 4 1			5	SP-SM		**SAND with Silt** (SP-SM) fine gravel, poorly graded, no dry strength, gray, moist to wet, loose, field observation indicates p200=10%, Sa=85%, Gr=5% 2 Moisture=21% Groundwater encountered at 6' while drilling 6.0
7									
8	SPT	3	8 8 9 4			17	SP-SM		7.5 **SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, nonplastic, low dry strength, gray, wet, medium dense 3 p200=7%, Sa=71%, Gr=22%, Moisture=19%
9								BOH 9.5	9.5 Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 77

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *688+50*
Offset: *40R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/30/2006 - 4/30/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	6	0.3
Time		
Date	4/30/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic
0									
1	SPT	1	9, 5, 2, 9			7	OL		
2									
3									
4									
5			3, 3, 4, 5				ML		
6	SPT	2				7			
7									
8	SPT	3	6, 3, 5, 7			8	GP-GM		
9									
10									
11	SPT	4	7, 6, 4, 5			10	SM		
12							BOH 12		

SUBSURFACE MATERIAL

ORGANIC SILT (OL) fine grained sand, nonplastic, dark brown, field observation indicates p200=75%, Sa=10%, Gr=15%, **FROZEN Ice as VC** (~10% ice by volume), **ORGANICS** present to ~35% by volume (roots, plants, wood) — 0.0
1 Moisture=161%

3.0

SILT (ML) fine grained sand, low plasticity, low dry strength, gray, moist to wet, stiff, field observation indicates p200=90%, Sa=10%, Gr=0%, **ORGANICS** present to ~20% by volume (rootlets) — 5.0
2 Moisture=42%

Groundwater encountered at 6' while drilling — 6.5

7.5

GRAVEL with Silt and Sand (GP-GM) fine gravel, poorly graded, low dry strength, gray, wet, loose, field observation indicates p200=10%, Sa=40%, Gr=50%
3 Moisture=16%

10.0

SILTY SAND with Gravel (SM) fine gravel, low dry strength, gray, wet, loose
4 p200=15%, Sa=70%, Gr=15%, Moisture=20%

12.0

Notes:
PVC standpipe installed to 10'
Groundwater measured at 0.3' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 78

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *691+00*
Offset: *30R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/30/2006 - 4/30/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	0.0
Time		
Date	4/30/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT		**Peat** (PT) brown, moist — 0.0
			1				ML		**SILT with Sand** (ML) fine gravel, nonplastic, low dry strength, gray, moist, soft, field observation indicates p200=80%, Sa=15%, Gr=5%, **ORGANICS** present to ~20% by volume (rootlets) — 0.3
1	SPT	1	1						1 Moisture=60%
			2						
2			1						
3									
4									
									Groundwater encountered at 5' while drilling — 4.5
5			2				SP-SM		**SAND with Silt** (SP-SM) medium grained sand, poorly graded, nonplastic, low dry strength, gray, wet, loose, field observation indicates p200=10%, Sa=90%, Gr=0% — 5.0
			3						
6	SPT	2	3			6			2 Moisture=40%
			3						
7									
			3				SM		**SILTY SAND with Gravel** (SM) fine gravel, nonplastic, low dry strength, brown, wet, very loose, field observation indicates p200=15%, Sa=50%, Gr=35% — 7.5
8			3						
	SPT	3	1			4			3 Moisture=20%
9			11						
10									
			11				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, no dry strength, gray, wet, medium dense, field observation indicates p200=10%, Sa=40%, Gr=50% — 10.0
			16						
11	SPT	4	12			28			4 Moisture=17%
			11						
12								BOH 12	12.0

Notes:
PVC standpipe installed to 10'
Groundwater measured at the surface on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 79

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *700+25*
Offset: *15R*
Elevation: *66.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *3.0 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL** 1 p200=4%, Sa=45%, Gr=51%, Moisture=4%
2									
3	SPT	2	50/4"				BR	BOH 3	No sample recovered -bouncing on **Bedrock** 2.4 / 2.8 **Bedrock** (BR) auger refusal at 3' 3.0 Notes: No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST PIT

TEST PIT # 80

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *707+00*
Offset: *50R*
Elevation: *60.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *11.0 feet*
Date: *4/21/2006 - 4/21/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	6.5	
Time		
Date	4/21/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) dark brown, moist
0.5						
1	GRAB	1		SP		**SAND with Gravel** (SP) coarse gravel, poorly graded, medium dry strength, brown gray, moist p200=4%, Sa=52%, Gr=44%, Moisture=6%
4				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, brown, moist to wet, field observation indicates p200=25%, Sa=20%, Gr=55%
6						Groundwater encountered at 6.5' while excavating
7	GRAB	2				becoming siltier, no dry strength, wet, field observation indicates p200=35%, Sa=15%, Gr=50%, cobbles to 4" (~2%) Moisture=39%
9.5						
10	GRAB	3		GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, no dry strength, brown, wet, field classification indicates p200=5%, Sa=15%, Gr=75% Moisture=14%
11					BOH 11	Notes:

LOG OF TEST HOLE

HOLE # 81

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *724+80*
Offset: *45L*
Elevation: *60.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *16.5 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	14	8.5
Time		
Date	11/18/05	11/22/05
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL** 1 p200=7%, Sa=40%, Gr=53%, Moisture=6%
2									
3	SPT	2	17 55 23			78			becoming siltier no dry strength, very dense, **FILL**, field observation indicates p200=10%, Sa=40%, Gr=50% 2 Moisture=7% 3.0
4									
5	SPT	3	6 8 6			14	SM		**SILTY SAND with Gravel** (SM) fine gravel, nonplastic, low dry strength, brown, moist, medium dense, field observation indicates p200=15%, Sa=65%, Gr=20% 3 Moisture=14% 5.0
6									
7									
8									
9									
10	SPT	4	9 7 5			12	GM		**SILTY GRAVEL with Sand** (GM) fine gravel, nonplastic, no dry strength, brown, moist, medium dense, field observation indicates p200=20%, Sa=15%, Gr=65% 4 Moisture=13% 10.0
11									
12									
13									
14									Groundwater encountered at 14' while drilling 14.0
15	SPT	5	11 10 11			21	GM		becoming sandier (GM) no dry strength, wet, field observation indicates p200=15%, Sa=20%, Gr=65% 5 Moisture=13% 15.0
16								BOH 16.5	Notes: PVC standpipe installed Groundwater measured at 8.5' on 11/22/05 16.5

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 82

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *729+00*
Offset: *110R*
Elevation: *65.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *11.5 feet*
Date: *4/26/2006 - 4/26/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5.5	2.5
Time		
Date	4/26/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT		**Peat** (PT) dark brown, moist — 0.0 / 0.5
1									drill action indicates cobbles — 1.5
2									
3	SPT	1	2 7 29			36	ML		**SILT with Sand** (ML) coarse gravel, medium plasticity, medium dry strength, light brown, moist, hard, field observation indicates p200=75%, Sa=20%, Gr=5% 1 Moisture=31% — 2.5
4									
5									— 5.0
6	SPT	2	16 14 16			30	SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, no dry strength, brown, moist to wet, dense 2 p200=8%, Sa=58%, Gr=34%, Moisture=13% Groundwater encountered at 5.5' while drilling — 6.0
7									
8									— 8.0
9	SPT	3	16 31 54			85	GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, low dry strength, brown, wet, very dense, field observation indicates p200=5%, Sa=40%, Gr=55%, sampler full with heave - blow counts may not be representative 3 Moisture=9%
10									— 10.0
11	SPT	4 4A	17 16 12				GM		**SILTY GRAVEL with Sand** (GM) fine gravel, medium dry strength, brown, wet, medium dense, field observation indicates p200=15%, Sa=40%, Gr=45% 4 Moisture=10% — 11.0
							SM	BOH 11.5	**SILTY SAND** (SM) fine gravel, no dry strength, brown, wet, medium dense, field observation indicates p200=15%, Sa=75%, Gr=10% 4A Moisture=23% — 11.5

Notes:
PVC standpipe installed to 11'
Groundwater measured at 2.5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

Sheet Number 1 of 1

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LOG OF TEST HOLE

HOLE # 83

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *732+50*
Offset: *40R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/28/2006 - 4/28/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	7.5	
Time		
Date	4/28/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**Peat** (PT) brown — 0.0
1	SPT	1	5 7 1 2				PT GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, low dry strength, brown, field observation indicates p200=35%, Sa=30%, Gr=35%, **FROZEN Ice as Nb** — 0.3
2									1 Moisture=46%
3									
4									
5			3						no sample recovered - driving a rock ahead of sampler — 5.0
6	SPT		2 4 3			6			
7									
8			6						Groundwater encountered at 7.5' while drilling — 7.5
9	SPT		7 6 3			13			no sample recovered - driving a rock ahead of sampler — 8.5
10									
11	SPT	2	2 5 4 3			9			becoming sandier, field observation indicates p200=25%, Sa=35%, Gr=40% — 10.0 2 Moisture=36%
12								BOH 12	Notes: — 12.0

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 84

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *734+00*
Offset: *30R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/28/2006 - 4/28/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5.5	4.5
Time		
Date	4/28/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT		**Peat** (PT) brown 0.0
							ML		**SILT** (ML) fine grained sand, nonplastic, low dry strength, brown gray, moist, very soft, field observation indicates p200=90%, Sa=10%, Gr=0% 0.3
1	SPT	1	2 1 1 4						1 Moisture=53%
2									
3									
4									
5			2 9 7 5						no sample recovered - driving a rock ahead of sampler 5.0
									Groundwater encountered at 5.5' while drilling 5.5
6	SPT								6.0
7			3 1 6 6			7			drilling action indicates gravel 6.5
8	SPT								no sample recovered - driving a rock ahead of sampler 8.0
9									
10			3 4 5 6			9	GM		**SILTY GRAVEL with Sand** (GM) fine grained sand, nonplastic, low dry strength, brown, wet, loose, field observation indicates p200=25%, Sa=40%, Gr=45% 10.0
11	SPT	2							2 Moisture=19%
12								BOH 12	12.0

Notes:
PVC standpipe installed to 9.5'
Groundwater measured at 4.5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 85

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *736+00*
Offset: *40R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *10.0 feet*
Date: *4/28/2006 - 4/28/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	7	
Time		
Date	4/28/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							PT			**Peat** (PT) brown 0.0
1	SPT	1	10 2 2 2				ML			**SANDY SILT** (ML) fine grained sand, nonplastic, low dry strength, brown, **FROZEN Ice as Vx** (~5% ice by volume), **ORGANICS** present to ~10% by volume (roots, plants) 0.3 1 p200=66%, Sa=34%, Gr=0%, Moisture=73%
2										
3										3.5
4										
5			2				SM			**SILTY SAND** (SM) fine grained sand, nonplastic, low dry strength, gray, moist to wet, field observation indicates p200=45%, Sa=55%, Gr=0% 5.0
6	SPT	2	3 3 4			6				2 Moisture=29%
7										Groundwater encountered at 7' while drilling 7.0
8			3							becoming sandier, wet, field observation indicates p200=25%, Sa=75%, Gr=0%, trace of **ORGANICS** (plants) 8.0
9	SPT	3	3 3 4			6				3 Moisture=32%
10									BOH 10	10.0

Notes:

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 86

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *738+50*
Offset: *30R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/28/2006 - 4/28/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	8	5.0
Time		
Date	4/28/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0		1	9			PT		**Peat** (PT) brown, 0.0
		1A						1 Moisture=180% 0.5
1	SPT		16			ML		**SANDY SILT** (ML) fine grained sand, nonplastic, low dry strength, brown gray, **FROZEN Ice as Nb, ORGANICS** present to ~15% by volume (roots, plants)
			8					1A p200=64%, Sa=36%, Gr=0%, Moisture=77%, Org=16%
2			3					2.0
3								grinding on a boulder at 3' - moved hole 2' to the east 3.0
4								
5			2					5.0
			3					becoming sandier, moist, stiff, field observation indicates p200=55%, Sa=45%, Gr=0%, **ORGANICS** present to ~5% by volume (plants)
6	SPT	2	4		7			2 Moisture=30%
			5					
7								7.5
			3			SM		**SILTY SAND** (SM) fine grained sand, nonplastic, no dry strength, gray brown, moist to wet, loose, field observation indicates p200=20%, Sa=80%, Gr=0%, trace of **ORGANICS** (rootlets)
8			4					Groundwater encountered at 8' while drilling
	SPT	3	5		9			3 Moisture=31%
9			5					
10								10.0
			8			SP		**SAND with Gravel** (SP) medium grained sand, poorly graded, nonplastic, no dry strength, gray, wet, medium dense, field observation indicates p200=5%, Sa=65%, Gr=30%
			8					4 Moisture=13%
11	SPT	4	6		14			
			4					
12							BOH 12	12.0

Notes:
PVC standpipe installed to 9.5'
Groundwater measured at 5' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 87

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *740+00*
Offset: *35R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *4.0 feet*
Date: *4/27/2006 - 4/27/2006*
Geologist: *Keri A. Nutter*

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL	
0									0
1	SPT	1	6 16 5 9		21	SP		**SAND** (SP) medium grained sand, poorly graded, nonplastic, low dry strength, brown, field observation indicates p200=5%, Sa=95%, Gr=0%, **FROZEN Ice as Nb** 1 Moisture=19%	0.0
2									
3								grinding on a rock, moved hole 2' to the east	3.0
								grinding on a rock at 4', no sample attempted	3.5
4							BOH 4		4.0

Groundwater Data

Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Grass Surface

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

Sheet Number 1 of 1

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 88

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *743+60*
Offset: *25L*
Elevation: *62.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL	
0									**4" Asphalt Concrete** (no CABC observed)	0.0
	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL**	0.3
1									1 p200=8%, Sa=38%, Gr=54%, Moisture=3%	
2										
	SPT	2	50/3"						no sample recovered -bouncing on a cobble auger action indicates cobbles	2.5 2.7
3										
4										
5										5.0
	SPT	3	28 50/4"						becoming siltier very dense, **FILL**, field observation indicates p200=10%, Sa=35%, Gr=55%, blow counts not representative -bouncing on a cobble 3 Moisture=9%	
6							BR		**Bedrock,** (BR) auger refusal at 6.5'	6.0
								BOH 6.5		6.5

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 90

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *758+65*
Offset: *0*
Elevation: *61.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *7.0 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3									
1							GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL**
2	GRAB	1							1 p200=7%, Sa=43%, Gr=50%, Moisture=6%, Max. Dry Dens=148.5pcf, Opt. Moisture=5%
3	SPT	2	55						no sample recovered -bouncing on a cobble 3.0
4									
5			8				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse grained sand, poorly graded, nonplastic, medium dry strength, brown, moist, field observation indicates p200=10%, Sa=30%, Gr=60%, 3 Moisture=8% 5.0
6	SPT	3	9						
		3A	7				ML		**SILT with Sand** (ML) medium grained sand, medium plasticity, medium dry strength, gray, moist, field observation indicates p200=80%, Sa=20%, Gr=0%, **ORGANICS** present ~5% by volume (plants), 3A Moisture=36% 6.0
7			2					BOH 7	7.0

Notes:
No groundwater observed while drilling
PVC standpipe installed
PVC obstructed -no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 91

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *770+40*
Offset: *20L*
Elevation: *62.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/18/2005 - 11/18/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	11	9.0
Time		
Date	11/18/05	4/23/06
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**Asphalt Concrete** (no CABC observed) 0.0
0.3	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, no dry strength, brown, moist, **FILL**
1									1 p200=5%, Sa=36%, Gr=59%, Moisture=6%
2									
2.5	SPT	2	38 58/3"				GP		**GRAVEL with Sand** (GP) fine gravel, poorly graded, no dry strength, brown, moist, very dense, **FILL,** field observation indicates p200=5%, Sa=40%, Gr=55%, blow counts not representative - bouncing on a cobble
3									2 Moisture=6%
4									
5			9						becoming sandier, coarse gravel, dense, **FILL,** field observation indicates p200=5%, Sa=45%, Gr=50% 5.0
6	SPT	3	17 15			32			3 Moisture=6%
7									drilling becoming easier 7.0
8									
9	▽								
10			1				ML		**SILT with Sand** (ML) medium grained sand, medium plasticity, medium dry strength, gray, moist to wet, firm, field observation indicates p200=85%, Sa=15%, Gr=0% 10.0
11	SPT	4	3 4			7			4 Moisture=36%
									Groundwater encountered at 11' while drilling 11.0
11.5							BOH 11.5		Notes: PVC standpipe installed Groundwater measured at 9' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 92

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *785+20*
Offset: *20L*
Elevation: *62.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/19/2005 - 11/19/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	7	9.0
Time		
Date	11/19/05	4/23/06
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3									
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL**
2									1 p200=8%, Sa=37%, Gr=55%, Moisture=5%
3									3.0
3	SS	2	27 23 14				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, dense, **FILL**, field observation indicates p200=10%, Sa=25%, Gr=65%
4									2 Moisture=9%
5									5.0
5	SS	3	10 13 6						becoming sandier medium dense, **FILL**
6									3 p200=8%, Sa=33%, Gr=59%, Moisture=11%
7									7.0
7									Groundwater encountered at 7' while drilling
8									8.0
8									drilling becoming easier
9									
10									10.0
10	SS	4	7 3 1				SP-SM		**SAND with Silt and Gravel** (SP-SM) fine gravel, poorly graded, nonplastic, low dry strength, brown, wet, very loose, field observation indicates p200=10%, Sa=60%, Gr=30%
11									4 Moisture=16%
11.5								BOH 11.5	11.5

Notes:
PVC standpipe installed
Groundwater measured at 9' on 04/23/2006

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 93

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *792+80*
Offset: *20L*
Elevation: *60.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/19/2005 - 11/19/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	5	
Time		
Date	11/19/05	
Symbol	▼	

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, low dry strength, gray, moist, **FILL**, field observation indicates p200=5%, Sa=40%, Gr=55%
1	GRAB	1							1 Moisture=4%
2									
2.5									becoming sandier no dry strength, medium dense, **FILL**, field observation indicates p200=5%, Sa=45%, Gr=50%
3	SS	2	8 7 6						2 Moisture=7%
4									
4.6									Groundwater observed at 5' while drilling
5									
5.0	SS	3	4 6 10				GW		**GRAVEL with Sand** (GW) coarse gravel, well graded, nonplastic, no dry strength, gray, wet, medium dense
6									3 p200=3%, Sa=25%, Gr=72%, Moisture=10%
7									
8									8.0
9									drilling becoming easier SM indicated by cuttings
10									10.0
10	SS	4	2 4 5				SM		**SILTY SAND** (SM) coarse gravel, nonplastic, low dry strength, gray, wet, loose 4 p200=16%, Sa=77%, Gr=7%, Moisture=19%
11									11.5
								BOH 11.5	Notes: PVC standpipe installed PVC obstructed at 4' - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 101

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *825+00*
Offset: *40L*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *2.5 feet*
Date: *4/30/2006 - 4/30/2006*
Geologist: *Keri A. Nutter*

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									0.0
			2						no sample recovered, grab sample from auger flights attempted 0.5
1	SPT		1/12"				PT		**Peat** (PT) brown, **FROZEN Ice as Vx** (~10% ice by volume) 1.0
									1.5
2	GRAB		2				ML		**SANDY SILT** (ML) fine grained sand, nonplastic, gray, moist, very soft, trace of **ORGANICS** very strong **HYDROCARBON ODOR,** no sample obtained 2.5
								BOH 2.5	

Notes:
No groundwater observed while drilling

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Grass Surface

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 102

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *828+50*
Offset: *40R*
Elevation: *60.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *7.0 feet*
Date: *4/30/2006 - 4/30/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	5	1.0
Time		
Date	4/30/06	5/1/06
Symbol	▼	▽

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									
		1A	1				PT		**Peat** (PT) dark brown, **FROZEN Ice as Vx** (~10% ice by volume) 0.0
			1						1 Moisture=488% 0.5
1	▽SPT	1	1				ML		**SILT with Sand** (ML) fine grained sand, low plasticity, low dry strength, gray brown, moist, very soft, field observation indicates p200=85%, Sa=15%, Gr=0%, **ORGANICS** present to ~15% by volume (plants, rootlets)
			4						~~1A~~ Moisture=32%
2									drill action indicates cobbles 2.0
3									
4									
									Groundwater encountered at 5' while drilling 4.5
5	▼		10				SP-SM		**SAND with Silt and Gravel** (SP-SM) fine gravel, poorly graded, gray, wet, medium dense, field observation indicates p200=10%, Sa=75%, Gr=15% 5.0
			9						very strong **HYDROCARBON ODOR**, rainbow sheen on sample observed
6	SPT	2	5			14			
			13						
7								BOH 7	7.0

Notes:
PVC standpipe installed
Groundwater measured at 1' on 05/01/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

Sheet Number 1 of 1

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 103

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *841+00*
Offset: *60L*
Elevation: *66.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/19/2005 - 11/19/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Gravel Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							GW-GM		**GRAVEL with Silt** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL** 0.0
1	GRAB	1							1 p200=5%, Sa=28%, Gr=67%, Moisture=4%, Max. Dry Dens=154.5pcf, Opt. Moisture=3.5%
2									
3									
4									drilling becoming easier, cuttings indicate GM 4.0
5			2				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, brown, moist, medium dense, field observation indicates p200=30%, Sa=25%, Gr=45% 4.4
	SS	2	4						2 Moisture=10%
6		2A	8				ML		**SILT with Sand** (ML) coarse gravel, low plasticity, medium dry strength, gray brown, moist, stiff, 5.5
								BOH 6.5	2A **F4** from sieve analysis, p200=78%, Sa=13%, Gr=9%, Moisture=35% 6.5

Notes:
No groundwater observed while drilling
PVC standpipe installed
PVC not found - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

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LOG OF TEST HOLE

HOLE # 104

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *850+65*
Offset: *10L*
Elevation: *72.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/19/2005 - 11/19/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 – 0.3
1	GRAB	1					GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL**, field observation indicates p200=10%, Sa=30%, Gr=60% 1 Moisture=5%
2									
3	SS	2	14 9 7				GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, medium dense, **FILL** 2.5 2 p200=9%, Sa=29%, Gr=62%, Moisture=5%
4									
5	SS	3	8 8				GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, dense, **FILL**, field observation indicates p200=5%, Sa=45%, Gr=50% 5.0 3 Moisture=7%
6		3A	35				ML	BOH 6.5	**SILT with Sand** (ML) fine gravel, low plasticity, no dry strength, gray brown, moist, hard, field observation indicates p200=80%, Sa=15%, Gr=5% 6.0 – 6.5 3A Moisture=44%

Notes:
No groundwater observed while drilling
PVC standpipe installed
PVC obstructed - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 106

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *867+50*
Offset: *90R*
Elevation: *100.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *14.0 feet*
Date: *4/21/2006 - 4/21/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) dark brown
0.5				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, low dry strength, brown, moist, field observation indicates p200=15%, Sa=30%, Gr=55%, trace of **ORGANICS** (roots), cobbles to 12" (~15%), boulders to 28" (~5%)
1	GRAB	1				Moisture=16%
4.0						boulder to 5' in diameter
4.5						4" **ORGANIC mat** (peat, roots)
6.0				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, light brown, moist, field observation indicates p200=15%, Sa=25%, Gr=60%, cobbles to 12" (~15%), boulders to 24" (~5%)
9.5						1" **ORGANIC mat** (roots)
10.0	GRAB	2		GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, low dry strength, brown, moist p200=8%, Sa=25%, Gr=67%, Moisture=7%
14.0					BOH 14	Notes: No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 107

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *876+70*
Offset: *0*
Elevation: *80.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *7.0 feet*
Date: *11/19/2005 - 11/19/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									~4" **Asphalt Concrete** (no CABC observed) 0.0
0.3									
1							GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, no dry strength, brown, moist, **FILL**
2	GRAB	1							1 p200=7%, Sa=41%, Gr=52%, Moisture=6%
3									3.0
			10				GW-GM		becoming sandier (GW-GM) low dry strength, dense, **FILL**, field observation indicates p200=10%, Sa=45%, Gr=45%
4	SS	2	18						2 Moisture=12%
			26						
5									5.0
			10				GM		**GRAVEL with Sand** (GM) coarse gravel, low dry strength, brown, moist, medium dense, **FILL**
6	SS	3	13						3 p200=19%, Sa=40%, Gr=41%, Moisture=18%
			14						
6.6									auger refusal at 7' in competent **Bedrock**
7								BOH 7	7.0

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 108

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *884+35*
Offset: *45L*
Elevation: *80.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/19/2005 - 11/19/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	8	8.0
Time		
Date	11/19/05	4/23/06
Symbol	▼	▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3									
1	GRAB	1					GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL**, field observation indicates p200=10%, Sa=40%, Gr=50%
2									1 Moisture=6%
2.5									
3	SS	2	11 9 20				GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, medium dense, **FILL**
4									2 p200=6%, Sa=32%, Gr=62%, Moisture=6%
5									becoming siltier, dense, field observation indicates p200=10%, Sa=30%, Gr=60% 5.0
6	SS	3	24 20 15						3 Moisture=8%
7									SP-SM indicated by cuttings 7.0
8									Groundwater encountered at 8' while drilling 8.0
9									
10	SS	4	5 9 10				SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, wet, medium dense 10.0
11									4 p200=6%, Sa=53%, Gr=41%, Moisture=12%
11.5								BOH 11.5	Notes: PVC standpipe installed Groundwater measured at 8' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 109

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *905+35*
Offset: *0*
Elevation: *88.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *8.0 feet*
Date: *11/19/2005 - 11/19/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL** 1 p200=9%, Sa=43%, Gr=48%, Moisture=8%
2									
3	SS	2	9 12 7				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, brown, moist, medium dense, **FILL**, field observation indicates p200=15%, Sa=15%, Gr=70% 2 Moisture=13% — 2.5
4									
5	SS	3	8 22 11				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, dense, **FILL**, field observation indicates p200=10%, Sa=40%, Gr=50% 3 Moisture=11% — 5.0
6									SM observed in cuttings — 6.5
7	GRAB	4					SM		**SILTY SAND with Gravel** (SM) coarse gravel, low plasticity, medium dry strength, light brown, moist, very dense — 6.7 4 p200=25%, Sa=47%, Gr=28%, Moisture=14% — 7.6
8	SS		50/0"					BOH 8	no SS sample obtained, auger refusal at 8' in competent **Bedrock** — 8.0

Notes:
No groundwater observed while drilling
PVC standpipe installed
PVC obstructed at 7' - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 110

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *909+50*
Offset: *200L*
Elevation: *72.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *10.0 feet*
Date: *4/18/2006 - 4/18/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	7	
Time		
Date	4/18/06	
Symbol	▼	

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							2" **ORGANIC mat**
1	GRAB	1		ML			**SILT with Sand** (ML) fine grained sand, nonplastic, no dry strength, brown gray, moist, field classification indicates p200=85%, Sa=15%, Gr=0%, **FROZEN Ice as Vx** (~20% ice by volume, free ice to ~5%), **ORGANICS** present to ~15% (roots, branches to 4" in diameter) Moisture=45%
2							
3	GRAB	2		OL			**ORGANIC SILT** (OL) fine grained sand, nonplastic, brown, moist to wet p200=95%, Sa=4%, Gr=1%, Moisture=129%, Org=62%
4							
5							
6							
7							Groundwater encountered at 7' while excavating
8							
9	GRAB	3		SP			**SAND** (SP) medium grained sand, poorly graded, no dry strength, gray, wet, trace of **ORGANICS** (wood) Moisture=19%
10						BOH 10	Notes:

0.0 1.0 3.0 7.0 8.0 9.0 10.0

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 111

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *913+00*
Offset: *310L*
Elevation: *74.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *8.0 feet*
Date: *4/18/2006 - 4/18/2006*
Geologist: *Keri A. Nutter*

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification / Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						0.0 Water flowing into pit from surface
2	GRAB	1		ML		2.0 **SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, brown gray, moist, field observation indicates p200=80%, Sa=20%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~30% (roots, branches to ~3" in diameter) Moisture=44%
3.5						3.5
4	GRAB	2		SP-SM		4.0 **SAND with Silt** (SP-SM) medium grained sand, poorly graded, no dry strength, gray, moist, trace of **ORGANICS** (wood, bark) p200=7%, Sa=92%, Gr=1%, Moisture=25%
7	GRAB	3		ML		7.0 **SILT with Sand** (ML) fine grained sand, low plasticity, medium dry strength, gray, moist, field observation indicates p200=85%, Sa=15%, Gr=0%, **ORGANICS** present to ~ 10% by volume (rootlets)
8					BOH 8	8.0 Moisture=34%

Groundwater Data

Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Forest Surface

Notes:
No groundwater observed while excavating

LOG OF TEST PIT

TEST PIT # 112

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *915+00*
Offset: *310L*
Elevation: *76.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *9.0 feet*
Date: *4/18/2006 - 4/18/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	4	
Time		
Date	4/18/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification / Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						0.0
1	GRAB	1		PT		**Peat** (PT) brown, **FROZEN Ice as Vx** (~30% ice by volume, crystals ~1/4" in diameter) Moisture=178% — 1.0
2	GRAB	2		ML		**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, gray, moist to wet, field observation indicates p200=75%, Sa=25%, Gr=0%, **ORGANICS** present to ~30% by volume (rootlets) — 2.0
3						Moisture=44%
4	▼					Groundwater encountered at 4' while excavating — 4.0
5						
6						
7						test pit walls collapsing at 7' — 7.0
8	GRAB	3				**ORGANICS** present to ~20% by volume (rootlets) Moisture=28% — 8.0
9					BOH 9	Notes: — 9.0

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 113

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *916+50*
Offset: *290L*
Elevation: *78.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *8.0 feet*
Date: *4/18/2006 - 4/18/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	3	
Time		
Date	4/18/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) brown, **FROZEN Ice as Nb** — 0.0
0.5						— 0.5
1	GRAB	1		SM		**SILTY SAND** (SM) fine and coarse grained sand, nonplastic, no dry strength, light brown gray, field observation indivates p200=20%, Sa=80%, Gr=0%, **FROZEN Ice as Nb, ORGANICS** present to ~25% by volume (rootlets) — 1.0
2						Moisture=28% — 2.5
3						Groundwater encountered at 3' while excavating — 3.0
3.5						— 3.5
4				SP		**SAND** (SP) medium grained sand, poorly graded, light brown, wet, field observation indicates p200=5%, Sa=95%, Gr=0%, **ORGANICS** present to ~10% by volume (rootlets, bark)
5						test pit walls collapsing at 5' — 5.0
6						
7	GRAB	2		SM		**SILTY SAND** (SM) fine grained sand, nonplastic, no dry strength, gray, wet, trace of **ORGANICS** present (rootlets) — 7.0
8				BOH 8		p200=26%, Sa=74%, Gr=0%, Moisture=20% — 8.0

Notes:

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 114

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *919+50*
Offset: *200L*
Elevation: *85.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *9.0 feet*
Date: *4/18/2006 - 4/18/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	3	
Time		
Date	4/18/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) brown, **FROZEN Ice as Nb,** fibrous
2.0						
2	GRAB	1		SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, brown gray, moist to wet, **ORGANICS** present to ~15% by volume (rootlets)
3						p200=26%, Sa=57%, Gr=17%, Moisture=30%
3.0						Groundwater encountered at 3' while excavating
6.0						
6	GRAB	2		GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray brown, wet, field observation indicates p200=15%, Sa=40%, Gr=45%, cobbles to 4" (~2%)
7						Moisture=15%
7.0						
8.0						
8	GRAB	3		SM		**SILTY SAND** (SM) fine grained sand, nonplastic, no dry strength, gray, wet, field observation indicates p200=15%, Sa=85%, Gr=0%
9						Moisture=18%
9.0					BOH 9	

Notes:

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 115

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *922+50*
Offset: *100L*
Elevation: *95.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *7.0 feet*
Date: *4/18/2006 - 4/18/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	7	
Time		
Date	4/18/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Type	Field Number	Sample	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT			**Peat** (PT) brown, **FROZEN Ice as Nb** — 0.0
0.5				SM			**SILTY SAND with Gravel** (SM) fine gravel, nonplastic, light brown, moist, field observation indicates p200=20%, Sa=60%, Gr=20%, 6" **FROZEN Ice as Nb, ORGANICS** present to ~20% by volume (roots, plants)
2.5							
3.0							**ORGANIC mat** (roots)
4.0	GRAB	1		GP			**GRAVEL with Sand** (GP) coarse gravel, no dry strength, brown gray, moist, cobbles to 4" (~5%) p200=3%, Sa=35%, Gr=62%, Moisture=8%
6.5							Groundwater encountered at 7' while excavating
7.0						BOH 7	Notes:

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 116

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *935+20*
Offset: *20R*
Elevation: *114.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *16.5 feet*
Date: *11/20/2005 - 11/20/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, light brown, moist, **FILL**
1	GRAB	1							1 p200=13%, Sa=46%, Gr=41%, Moisture=10%, Max. Dry Dens=142pcf, Opt. Moisture=6%
2									
3									3.0
4	SS	2	10 28 18				GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, dense, field observation indicates p200=5%, Sa=40%, Gr=55% 2 Moisture=13%
5									5.0
6	SS	3	15 20 6						becoming sandier medium dense, field observation indicates p200=5%, Sa=45%, Gr=50% 3 Moisture=7%
7									drill action indicates cobbles 7.0
8									
9									
10									10.0
11	SS	4	7 6 6				GP		**GRAVEL** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, medium dense, field observation indicates p200=5%, Sa=10%, Gr=85% 4 Moisture=10%
12									
13									
14									
15									no sample recovered -driving cobble ahead of sampler, cuttings indicate same 15.0
16	SS	5	19 36 27						
								BOH 16.5	16.5

Notes:
No groundwater observed while drilling
PVC standpipe installed
PVC frozen at 4' - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 117

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *945+00*
Offset: *15R*
Elevation: *120.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *16.5 feet*
Date: *11/20/2005 - 11/20/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3	GRAB	1					GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL**, field observation indicates p200=5%, Sa=35%, Gr=60%
1									1 Moisture=4%
2									
2.5									no sample recovered -driving cobble ahead of sampler
3	SS		13 19 25						
4									
5									5.0
	SS	2	7 12 18				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, brown, moist, medium dense, **FILL**
6									2 p200=13%, Sa=36%, Gr=51%, Moisture=7%
7									
8									8.0
									drilling becoming easier
9									
10									10.0
	SS	3	1 2 6				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, loose, field observation indicates p200=10%, Sa=60%, Gr=30%
11									3 Moisture=11%
12									12.0
									drill action indicates cobbles
13									
14									
15									15.0
	SS		22 23 12						no sample recovered -driving cobble ahead of sampler, cuttings indicate same
16									
16.5							BOH 16.5		

Notes:
No groundwater observed while drilling
PVC standpipe installed
PVC frozen at 4' - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

Sheet Number 1 of 1

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 118

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *953+20*
Offset: *10R*
Elevation: *130.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *7.0 feet*
Date: *11/20/2005 - 11/20/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, gray, moist, **FILL**
1	GRAB	1							1 p200=12%, Sa=42%, Gr=46%, Moisture=6%
3			15				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, very dense, **FILL**, field observation indicates p200=15%, Sa=35%, Gr=50% 3.0
4	SS	2	30						2 Moisture=5% 4.0
5			45						
5			11				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, brown, moist, dense, field observation indicates p200=15%, Sa=15%, Gr=70% 5.0
6	SS	3	31						3 Moisture=12%
6.6			19						auger refusal at 7' in competent **Bedrock** 6.6
7								BOH 7	7.0

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 120

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *972+20*
Offset: *25R*
Elevation: *115.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/20/2005 - 11/20/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, **FILL**, field observation indicates p200=10%, Sa=35%, Gr=55% 1 Moisture=4%
2									
3	SS	2	23 26 20				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, brown, moist, dense, **FILL** 2.5 2 p200=13%, Sa=30%, Gr=57%, Moisture=3%
4									
5	SS	3	11 22 13				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, brown, moist, dense, field observation indicates p200=15%, Sa=20%, Gr=65% 5.0 3 Moisture=7%
6									
7									cuttings change to light brown 7.0
8									
9									
10	SS	4	33 16 14						becoming sandier coarse gravel, nonplastic, no dry strength, light brown, moist, medium dense 10.0 4 p200=16%, Sa=40%, Gr=44%, Moisture=12%
11								BOH 11.5	11.5

Notes:
No groundwater observed while drilling
PVC standpipe installed
No measurable groundwater to 10' on 04/23/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 121

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *987+00*
Offset: *55L*
Elevation: *110.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *13.0 feet*
Date: *4/20/2006 - 4/20/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Gravel Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						0.0
1	GRAB	1		SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, medium dry strength, gray, moist, trace of **ORGANICS** present (wood, roots), cobbles to 12" (~15%), boulders to 34" (~5%) p200=20%, Sa=44%, Gr=36%, Moisture=9%
7				PT		7.0 **Peat** (PT) brown, branches 7.5
8	GRAB	2		GM		8.0 **SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, field observation indicates p200=15%, Sa=35%, Gr=50%, cobbles to 4" (~10) Moisture=7%
12	GRAB	3		GM		12.0 becoming siltier, (GM) field observation indicates p200=20%, Sa=30%, Gr=50%, cobbles to 4" (~5%) Moisture=14%
13					BOH 13	13.0 Notes: No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 122

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *989+00*
Offset: *50L*
Elevation: *110.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *14.5 feet*
Date: *4/22/2006 - 4/22/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Gravel Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, medium dry strength, gray, moist, trace of **ORGANICS** (roots) 0.0
1	GRAB	1							1 p200=22%, Sa=44%, Gr=34%, Moisture=13%, Max. Dry Dens=141pcf, Opt. Moisture=5.5%
2									
3			12				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, dense, field observation indicates p200=15%, Sa=40%, Gr=45% 3.0
4	SS	2	26						2 Moisture=6%
			19						
5									becoming more gravelly, field observation indicates p200=15%, Sa=30%, Gr=55%, drill action indicates cobbles 5.0
6	SS	3	13						3 Moisture=6%
			14						
7			20						
8			7				SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, no dry strength, gray, moist, loose, field observation indicates p200=10%, Sa=60%, Gr=30% 7.5
	SS	4	5						4 Moisture=4% 8.5
9		4A	5				SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, gray, moist, loose, field observation indicates p200=30%, Sa=50%, Gr=20%, **ORGANICS** present to ~10% by volume (roots)
10			5						4A Moisture=14% 10.0
	SS	5	12						becoming more gravelly, dense, field observation indicates p200=15%, Sa=50%, Gr=35%
11			20						5 Moisture=8%
12									
13			10				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, very dense, field observation indicates p200=15%, Sa=40%, Gr=45% 12.5
	SS	6	38						6 Moisture=6%
14			15						grinding on a boulder - auger refusal 14.0
								BOH 14.5	14.5

Notes:
No groundwater observed while drilling
PVC standpipe installed to 14.5'
No measureable groundwater to 14.5' on 04/27/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 123

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *991+50*
Offset: *50L*
Elevation: *110.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *14.0 feet*
Date: *4/20/2006 - 4/20/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Gravel Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						0.0
2	GRAB	1		GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, no dry strength, gray, moist, field observation indicates p200=10%, Sa=35%, Gr=55%, cobbles to 12", boulders to 24" Moisture=6%
4						4.0
5	GRAB	2		SP-SM		**SAND with Silt** (SP-SM) coarse gravel, poorly graded, no dry strength, gray, moist, field observation indicates p200=10%, Sa=80%, Gr=10%, **FROZEN Ice as Nb** Moisture=5%
9						**DEBRIS** present (aluminum can) 9.0
12				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, gray, moist, field observation indicates p200=10%, Sa=30%, Gr=60% 12.0
13						**DEBRIS** present (aluminum can) 13.5
14					BOH 14	14.0

Notes:
No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 124

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *996+00*
Offset: *40L*
Elevation: *110.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *14.0 feet*
Date: *4/20/2006 - 4/20/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Gravel Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						0.0
1	GRAB	1		SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, no dry strength, gray, moist, field observation indicates p200=10%, Sa=60%, Gr=30%, cobbles to 10" (~20%) Moisture=9%
2						1.0
3						3.5
4	GRAB	2		SM		roots **SILTY SAND** (SM) coarse gravel, nonplastic, no dry strength, gray, moist, **FROZEN Ice as Nb,** trace of **ORGANICS** (roots) p200=19%, Sa=71%, Gr=10%, Moisture=4%
5						4.0
6						
7						
8						
9				SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, gray, moist, field observation indicates p200=20%, Sa=60%, Gr=20% 9.0
10						
11						
12						12.0
13				GM		12.5 **SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, gray, moist, field observation indicates p200=20%, Sa=25%, Gr=55%, cobbles to 8" (~10%)
14					BOH 14	14.0 Notes: No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 126

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1010+00*
Offset: *50R*
Elevation: *120.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *9.0 feet*
Date: *4/19/2006 - 4/19/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						0.0
3	GRAB	1		GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, low dry strength, gray, moist, trace of **ORGANICS** present to 2' (roots), cobbles to 12" (~20%) p200=15%, Sa=34%, Gr=51%, Moisture=8%
3.0						
6						boulders to 36"
6.0						
9					BOH 9	9.0

Notes:
No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 129

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1026+50*
Offset: *40L*
Elevation: *108.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *7.5 feet*
Date: *11/20/2005 - 11/20/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**2" Asphalt Concrete** (no CABC observed) 0.0 / 0.2
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, brown, moist, **FILL** 1 p200=8%, Sa=42%, Gr=50%, Moisture=6%, Max. Dry Dens=147pcf, Opt. Moisture=5%
2									
3	SS	2	11 17 13						becoming sandier medium dense, **FILL**, field observation indicates p200=10%, Sa=45%, Gr=45% 2 Moisture=13% 3.0
4									
5	SS	3	12 14 10				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, medium dense, field observation indicates p200=10%, Sa=40%, Gr=50% 3 Moisture=5% 5.0
6									difficulty drilling 6.5
7									auger refusal at 7.5' in competent **Bedrock** 7.1 / 7.5 BOH 7.5

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

Sheet Number 1 of 1

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 131

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1048+40*
Offset: *5L*
Elevation: *108.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/20/2005 - 11/20/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		8.0
Time		
Date		4/17/06
Symbol		▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3	GRAB	1					SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, brown, moist, **FILL** 0.3
1									1 p200=14%, Sa=43%, Gr=43%, Moisture=5%
2.5	SS	2	5 14 29				SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, nonplastic, no dry strength, brown, moist, dense, **FILL**, field observation indicates p200=10%, Sa=35%, Gr=55% 2.5 2 Moisture=10%
5.0	SS	3	14 13 10				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, brown, moist, medium dense, field observation indicates p200=15%, Sa=35%, Gr=50% 5.0 3 Moisture=8%
10.0	SS	4	3 11 6						no sample recovered -driving cobble ahead of sampler, cuttings indicate same 10.0
11.5							BOH 11.5		Notes: No groundwater observed while drilling PVC standpipe installed Groundwater measured at 8' on 04/17/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 133

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1076+50*
Offset: *15L*
Elevation: *116.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/21/2005 - 11/21/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		3.0
Time		
Date		4/17/06
Symbol		▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, Gray, moist, **FILL**
1	GRAB	1							1 p200=7%, Sa=38%, Gr=55%, Moisture=4%
3 ▽									3.0
	SS	2	13 22 23						becoming more gravelly dense, **FILL**, Field observation indicates p200=10%, Sa=30%, Gr=60% 2 Moisture=16%
5									5.0
	SS	3	19 13 10				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, Gray, moist, medium dense, Field observation indicates p200=15%, Sa=35%, Gr=50% 3 Moisture=9%
10									10.0
	SS	4	12 22 19						becoming siltier Field observation indicates p200=25%, Sa=30%, Gr=45% 4 Moisture=18%
11									11.5
							BOH 11.5		Notes: No groundwater observed while drilling PVC standpipe installed Groundwater measured at 3' on 04/17/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 134

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1083+00*
Offset: *45L*
Elevation: *116.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *7.5 feet*
Date: *11/20/2005 - 11/20/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**2" Asphalt Concrete** (no CABC observed) 0.0 / 0.2
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, Gray, moist, **FILL**
2									1 p200=11%, Sa=41%, Gr=48%, Moisture=6%, Max. Dry Dens=151pcf, Opt. Moisture=5.5%
3	SS	2	60						becoming more gravelly very dense, **FILL**, Field observation indicates p200=10%, Sa=35%, Gr=55% 3.0
4			20/0"						2 Moisture=5% Blowcounts not representative -bouncing on a cobble 4.0
5			14				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, Gray, moist, dense, Field observation indicates p200=10%, Sa=30%, Gr=60% 5.0
6	SS	3	21						3 Moisture=10% Difficulty drilling 6.0
7			21						Auger refusal at 7.5' in competent **Bedrock** 7.1 / 7.5
								BOH 7.5	Notes: No groundwater observed while drilling

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

LOG OF TEST HOLE

HOLE # 135

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1092+50*
Offset: *30R*
Elevation: *120.0 feet*

Equipment Type: *CME Skid - 45*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *8.5 feet*
Date: *5/1/2006 - 5/1/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0								0.0
1	SPT	1	2, 10, 20, 31			OL		**ORGANIC SILT** (OL) fine gravel, nonplastic, medium dry strength, brown, field observation indicates p200=70%, Sa=20%, Gr=10%, **FROZEN Ice as Nb, ORGANICS** present (roots, peat) 1 Moisture=59%
2								1.5 drill action indicates cobles 2.0
3								
4								drill action indicates cobles 4.0
5			12, 17					
6	SPT		10, 5		27			no sample recovered - driving a rock ahead of sampler 6.0
7			6			GM		7.0 **SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, medium dry strength, brown, moist, dense, field observation indicates p200=15%, Sa=35%, Gr=50%
8	SPT	2	10, 15		25			2 Moisture=6% 8.5 BOH 8.5 Notes: No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☒ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 137

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1113+90*
Offset: *20R*
Elevation: *166.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *15.5 feet*
Date: *11/21/2005 - 11/21/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, Gray, moist, **FILL**, Field observation indicates p200=10%, Sa=25%, Gr=65%
1	GRAB	1							1 Moisture=7%
2									
2.5									becoming sandier dense, **FILL**, Field observation indicates p200=10%, Sa=40%, Gr=50%
3	SS	2	17 18						2 Moisture=8%
3.5		2A	15				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, no to low plasticity, low dry strength, Brown, moist, dense, Field observation indicates p200=15%, Sa=35%, Gr=50%
4									2A Moisture=17%
5									5.0
6	SS	3	9 13 6						becoming sandier nonplastic, no dry strength, medium dense 3 p200=16%, Sa=39%, Gr=45%, Moisture=13%
7									
8									
9									
10	SS	4	50/0"						No sample recovered -driving cobble ahead of sampler 10.0
11									
12									
13									
14									
14.5							GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, nonplastic, no dry strength, Brown, moist, very dense, Field observation indicates p200=5%, Sa=15%, Gr=80%
15	SS	5	62						5 Moisture=16%
15.5								BOH 15.5	

Notes:
No groundwater observed while drilling
PVC standpipe installed
No measurable groundwater to 14.8' on 04/17/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 138

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1125+00*
Offset: *50L*
Elevation: *120.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Drilling Method: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *10.0 feet*
Date: *4/19/2006 - 4/19/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0								**6" ORGANIC MAT** — 0.0
0.5	GRAB	1				SP-SM		**SAND with Silt** (SP-SM) fine gravel, poorly graded, no dry strength, gray, moist, **FILL,** field observation indicates p200=10%, Sa=85%, Gr=5%, trace of **ORGANICS** (roots)
1								1 Moisture=4%
3								boulders to 24" in diameter (~2%) — 3.0
3.5								**ORGANIC mat** (roots) — 3.5
4	GRAB	2				OL		**ORGANIC SILT** (OL) fine gravel, nonplastic, brown, moist, field observation indicates p200=65%, Sa=30%, Gr=5%, **ORGANICS** present to ~30% by volume — 4.0
5								2 Moisture=73%
8	GRAB	3				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, low dry strength, brown, moist, field observation indicates p200=15%, Sa=25%, Gr=60% — 8.0
9								3 Moisture=9%
9.5								boulders to 2.5' in diameter
10							BOH 10	Notes: No groundwater observed while excavating — 10.0

☐ CME Auto Hammer ☐ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☐ 340 lb. hammer with 30 in. drop

Sheet Number 1 of 1

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 139

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1132+45*
Offset: *15R*
Elevation: *158.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/21/2005 - 11/21/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**3" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, Gray, moist, **FILL**
2									1 p200=7%, Sa=43%, Gr=50%, Moisture=5%
3	SS	2	13 / 20 / 19				SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, Gray, moist, dense, Field observation indicates p200=15%, Sa=50%, Gr=35% — 3.0
4									2 Moisture=6%
5	SS	3	9 / 21 / 20						becoming siltier low dry strength, dense — 5.0
6									3 p200=18%, Sa=51%, Gr=31%, Moisture=10%
7									
8									
9									
10	SS	4	47 / 19 / 20						becoming siltier dense, Field observation indicates p200=20%, Sa=50%, Gr=30% — 10.0
11									4 Moisture=12%
								BOH 11.5	11.5

Notes:
No groundwater observed while drilling
PVC standpipe installed
No measurable groundwater to 11' on 11/22/05

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 142

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1160+10*
Offset: *20R*
Elevation: *246.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/21/2005 - 11/21/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					SW-SM		**SAND with Silt and Gravel** (SW-SM) coarse gravel, well graded, nonplastic, low dry strength, Brown, moist, **FILL** 1 p200=9%, Sa=51%, Gr=40%, Moisture=10%
2									
3	SS	2	8 7 23				SM		**SILTY SAND** (SM) fine gravel, nonplastic, no dry strength, Brown, moist, medium dense 2.5 2 p200=24%, Sa=71%, Gr=5%, Moisture=14%
4									
5	SS	3	17 18 7				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, Brown, moist, medium dense, Field observation indicates p200=10%, Sa=15%, Gr=75% 5.0 3 Moisture=9%
6									
7									
8									
9									
10	SS	4	11 39 39				SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, medium dry strength, Brown, moist, very dense, Field observation indicates p200=15%, Sa=65%, Gr=20% 10.0 4 Moisture=15%
11							BOH 11.5		11.5 Notes: No groundwater observed while drilling PVC standpipe installed PVC obstructed -no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 143

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1166+30*
Offset: *15R*
Elevation: *264.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *16.5 feet*
Date: *11/21/2005 - 11/21/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		15.0
Time		
Date		11/22/05
Symbol		▽

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0 / 0.3
1	GRAB	1					SW-SM		**SAND with Silt and Gravel** (SW-SM) coarse gravel, well graded, nonplastic, no dry strength, Brown, moist, **FILL**
2									1 p200=10%, Sa=54%, Gr=36%, Moisture=6%
3	SS	2	11 14 15				SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, Brown, moist, medium dense, Field observation indicates p200=15%, Sa=50%, Gr=35% — 3.0
4									2 Moisture=12%
5									No sample recovered -rock stuck in end of sampler — 5.0
6	SS	3	45 45 29						
7									
8									
9									
10	SS	4	32 32 32				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, Brown, moist, very dense, Field observation indicates p200=10%, Sa=40%, Gr=50% — 10.0
11									4 Moisture=5%
12									
13									
14									
15 ▽	SS	5	11 6 20				SM		**SILTY SAND with Gravel** (SM) coarse gravel, no to low plasticity, low dry strength, Brown, moist, medium dense, Field observation indicates p200=20%, Sa=55%, Gr=25% — 15.0
16									5 Moisture=10%
							BOH 16.5		16.5

Notes:
No groundwater observed while drilling
PVC standpipe installed
Groundwater measured at 15' on 11/22/05

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 144

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1174+30*
Offset: *10R*
Elevation: *294.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *5.5 feet*
Date: *11/21/2005 - 11/21/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL	
0									**4" Asphalt Concrete** (no CABC observed)	0.0
							SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, Gray, moist, **FILL**	0.3
1	GRAB	1							1 p200=14%, Sa=43%, Gr=43%, Moisture=6%	
2										
										2.5
3	SS	2	15 80				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, Gray, moist, very dense, field observation indicates p200=10%, Sa=15%, Gr=75%,	3.3
4									2 Moisture=15% blowcounts not representative -bouncing on a cobble	
5	SS	3	~~95/4"~~						no sample recovered -bouncing on a boulder	4.9
									boulder encountered - auger refusal at 5.5'	5.3 5.5
								BOH 5.5		

Notes:
No groundwater observed while drilling

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 146

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1189+00*
Offset: *10L*
Elevation: *315.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *16.5 feet*
Date: *4/22/2006 - 4/22/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										**3" Asphalt Concrete** (no CABC observed) 0.0
0.3							GW-GM			**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, medium dry strength, gray, **FROZEN Ice as Vx** (~10% ice by volume)
1	GRAB	1								1 p200=10%, Sa=43%, Gr=47%, Moisture=6%, Max. Dry Dens=159pcf, Opt. Moisture=4.5%
2										harder drilling at 3' 2.5
3			22				GM			**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, very dense, field observation indicates p200=15%, Sa=35%, Gr=50% 3.0
4	SS	2	27							2 Moisture=3%
5			13							dark gray 5.0
6	SS	3	11							3 Moisture=6%
7			26							
8	SS	4	55							becoming sandier, field observation indicates p200=15%, Sa=40%, Gr=45% 7.5
9			25							4 Moisture=2%
10			38							
11	SS	5	26/1"				GP-GM			**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, no dry strength, dark gray, moist, very dense, field observation indicates p200=10%, Sa=40%, Gr=50% 10.0
12			28							5 Moisture=2%
13			26							
14			35							
15										
16	SS	6	9				GM			**SILTY GRAVEL with Sand** (GM) coarse gravel, no dry strength, dark gray, moist, medium dense, field observation indicates p200=20%, Sa=35%, Gr=45% 15.0
			6							6 Moisture=7%
			18						BOH 16.5	16.5

Notes:
No groundwater observed while drilling
PVC standpipe installed to 16.5'
No measurable groundwater observed on 04/27/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 147

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1199+00*
Offset: *10L*
Elevation: *295.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *16.5 feet*
Date: *4/22/2006 - 4/22/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0										0.0 **2.5" Asphalt Concrete** (no CABC observed)
0.2	GRAB	1					GW			**GRAVEL with Sand** (GW) coarse gravel, well graded, no dry strength, gray, **FILL, FROZEN Ice as Nb**
1										1 p200=3%, Sa=34%, Gr=63%, Moisture=5%
2										
2.5										low dry strength, moist, medium dense, **FILL,** field observation indicates p200=5%, Sa=40%, Gr=55%
3	SS	2	19 12 6							2 Moisture=6%
4										4.0 easier drilling
4.5							ML			**SILT with Sand** (ML) fine gravel, nonplastic, low dry strength, brown, moist, firm, field observation indicates p200=75%, Sa=20%, Gr=5%, trace of **ORGANICS** present (rootlets)
5			6							
6	SS	3 3A	7 29				SM			3 Moisture=37% 6.0 **SILTY SAND with Gravel** (SM) fine gravel, nonplastic, low dry strength, gray, moist, dense, field observation indicates p200=20%, Sa=45%, Gr=35%
7										3A Moisture=5%
7.5							GM			**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, low dry strength, gray, moist, dense, field observation indicates p200=15%, Sa=40%, Gr=45%
8	SS	4	25 23 16							4 Moisture=4%
9										
9.5										grinding on a boulder
10										10.0
10	SS	5	4 12 14				SP-SM			**SAND with Silt and Gravel** (SP-SM) coarse gravel, no dry strength, gray, moist, medium dense, field observation indicates p200=10%, Sa=60%, Gr=30%
11										5 Moisture=5% 11.0
12										12.0
13										drill action indicates cobbles between 10' and 15' 13.0
14										14.0
15										15.0
15	SS	6	23 34 39				SM			**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, gray, moist, very dense, field observation indicates p200=15%, Sa=45%, Gr=40%
16										6 Moisture=4%
16.5									BOH 16.5	16.5

Notes:
No groundwater observed while drilling
PVC standpipe installed to 16.5'
No measurable groundwater observed on 04/27/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 148

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1204+00*
Offset: *10R*
Elevation: *275.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *16.5 feet*
Date: *4/22/2006 - 4/22/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification	Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							GP-GM			**2.5" Asphalt Concrete** (no CABC observed) 0.0
0.2										**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, low dry strength, gray, moist, **FILL,** field observation indicates p200=10%, Sa=40%, Gr=50%, **FROZEN Ice as Nb,** trace of **ORGANICS** (roots)
1	GRAB	1								1 Moisture=7%
3			7				SM			**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, gray, moist, loose, **FILL,** field observation indicates p200=20%, Sa=55%, Gr=25%, trace of **ORGANICS** (peat, wood, roots) 3.0
4	SS	2	4 5							2 Moisture=10%
5			8							becoming more gravelly, medium dense, **FILL,** field observation indicates p200=15%, Sa=50%, Gr=35% 5.0
6	SS	3	10 8							3 Moisture=10%
7.5			4				SM			**SILTY SAND** (SM) fine gravel, nonplastic, no dry strength, gray, moist, very loose, field observation indicates p200=15%, Sa=80%, Gr=5%, **ORGANICS** present to ~10% by volume (roots) 7.5
8	SS	4	2 2							4 Moisture=16%
10			56				SM			**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, gray, moist, very dense, field observation indicates p200=20%, Sa=65% Gr=15%, **ORGANICS** present to ~10% by volume (roots) 10.0
11	SS	5	10 52/5"							5 Moisture=9%
14										14.0
15			55				GM			**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, dense, field observation indicates p200=15%, Sa=35%, Gr=50% 15.0
16	SS	6	27 18							6 Moisture=5%
16.5									BOH 16.5	16.5

Notes:
No groundwater observed while drilling
PVC standpipe installed to 16.5'
No measurable groundwater observed on 04/27/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 149

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1209+00*
Offset: *20L*
Elevation: *260.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *5.5 feet*
Date: *4/19/2006 - 4/19/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Gravel Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0						0.0
2						boulders to 15" in diameter — 2.0
3	GRAB	1		SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, low dry strength, gray, moist, trace of **ORGANICS** (roots) — 3.0 p200=16%, Sa=53%, Gr=31%, Moisture=8%
5						very difficult excavating — 5.0
					BOH 5.5	5.5

Notes:
No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 150

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1220+00*
Offset: *25L*
Elevation: *220.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/S. Anderson*

Total Depth: *12.0 feet*
Date: *4/22/2006 - 4/22/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Gravel Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0							GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, no dry strength, gray, moist 1 p200=3%, Sa=25%, Gr=72%, Moisture=5%, Max. Dry Dens=150pcf
1	GRAB	1							
2									
3									3.0
4	SS	2	5 5 4				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, no dry strength, gray, moist, loose, field observation indicates p200=10%, Sa=35%, Gr=55% 2 Moisture=3%
5									5.0
6	SS	3	6 23 15				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, dense, field observation indicates p200=15%, Sa=30%, Gr=55% 3 Moisture=8%
7									7.0 drilling action indicates cobbles
8	SS	4	50				SM		7.5 **SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, gray, moist, very dense, field observation indicates p200=25%, Sa=40%, Gr=35% 4 Moisture=6%
9									9.0 grinding on a boulder
10	SS	5	16 14 6				GM		9.5 **SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, medium dense, field observation indicates p200=25%, Sa=35%, Gr=40% 5 Moisture=3%
11									
12							BOH 12		11.5 grinding on a boulder at 12' - auger refusal 12.0 Notes: No groundwater observed while drilling PVC standpipe installed to 12' No measurable groundwater observed on 04/27/06

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 151

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1223+50*
Offset: *110L*
Elevation: *205.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *11.5 feet*
Date: *4/20/2006 - 4/20/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) brown, moist
1						**ORGANIC mat** (roots)
2	GRAB	1		GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, field observation indicates p200=20%, Sa=25%, Gr=55%, trace of **ORGANICS** (roots), boulders to 36" (~5%) Moisture=9%
3						
4						
5						
6						
7						
8						2" **ORGANIC mat**
9						
10	GRAB	2		SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, gray, moist, trace of **COAL,** cobbles to 6" (~15%) p200=16%, Sa=43%, Gr=41%, Moisture=11%
11					BOH 11.5	Notes: No groundwater observed while excavating

0.0
1.0
2.0
7.5
10.0
11.5

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 152

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1228+00*
Offset: *520L*
Elevation: *175.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *12.0 feet*
Date: *4/20/2006 - 4/20/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) brown, **FROZEN Ice as Vx**
0.0						
0.5						
2.0				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, gray, moist, field observation indicates p200=15%, Sa=35%, Gr=50%, cobbles to 8" (~15%), boulders to 24" (~10%)
5.0						2" **ORGANIC mat** (branches and roots)
6.0	GRAB	1		SP-SM		**SAND with Silt and Gravel** (SP-SM) coarse gravel, poorly graded, no dry strength, gray, moist, cobbles to 8" (~5%) p200=9%, Sa=54%, Gr=37%, Moisture=7%
9.0						2" **ORGANIC mat** (branches and roots)
10.0				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, gray, moist, field observation indicates p200=15%, Sa=40%, Gr=45%, cobbles to 10" (~10%), boulders to 14" (~2%)
12.0					BOH 12	Notes: No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 153

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1232+00*
Offset: *800L*
Elevation: *150.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *13.0 feet*
Date: *4/20/2006 - 4/20/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification / Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) brown, **FROZEN Ice as Vx** (~20% ice by volume), branches and roots to 4" in diameter
1	GRAB	1		ML		**SANDY SILT** (ML) fine gravel, nonplastic, low dry strength, gray, field classification indicates p200=55%, Sa=35%, Gr=10%, **FROZEN Ice as Nb, ORGANICS** present to ~15% by volume (roots) Moisture=29%
4						2" **ORGANIC mat** (roots)
5				GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, gray, moist, field observation indicates p200=15%, Sa=40%, Gr=45%, boulders to 24" (~5%)
7						1" **ORGANIC mat** (roots)
8	GRAB	2		SM		**SILTY SAND with Gravel** (SM) coarse gravel, nonplastic, no dry strength, dark gray, moist p200=17%, Sa=77%, Gr=6%, Moisture=10%
11						1" **ORGANIC mat** (roots)
12	GRAB	3		GM		**SILTY GRAVEL with Sand** (GM) coarse gravel, nonplastic, no dry strength, gray, moist, field observation indicates p200=15%, Sa=30%, Gr=55%, cobbles to 6" (~10%) Moisture=9%
13					BOH 13	Notes: No groundwater observed while excavating

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 154

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1259+70*
Offset:
Elevation: *132.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *6.5 feet*
Date: *11/22/2005 - 11/22/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)		
Time		
Date		
Symbol		

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Data: Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**4" Asphalt Concrete** (no CABC observed) 0.0
0.3							SW-SM		**SAND with Silt and Gravel** (SW-SM) coarse gravel, well graded, nonplastic, no dry strength, Brown, moist, **FILL**
1	GRAB	1							1 p200=8%, Sa=47%, Gr=45%, Moisture=6%
3.0			13				GP-GM		**GRAVEL with Silt and Sand** (GP-GM) coarse gravel, poorly graded, nonplastic, no dry strength, Brown, moist, dense, **FILL**, Field observation indicates p200=10%, Sa=45%, Gr=45%
4	SS	2	24						2 Moisture=4%
4.5			18				ML		**SILT with Sand** (ML) low plasticity, low dry strength, Gray Brown, moist, stiff, Field observation indicates p200=75%, Sa=25%, Gr=0%, **Organics** present ~5% by volume (rootlets)
5			5						3 Moisture=42%
5.8	SS	3	7				SM		**SILTY SAND** (SM) medium grained sand, nonplastic, no dry strength, Light brown, moist, medium dense, Field observation indicates p200=25%, Sa=75%, Gr=0%
6		3A	8					BOH 6.5	3A Moisture=19% 6.5

Notes:
No groundwater observed while drilling
PVC standpipe installed
PVC frozen at 4' on 04/17/06 - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST HOLE

HOLE # 155

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *MP 25*
Offset:
Elevation: *131.0 feet*

Equipment Type: *Mobile B-61 Truck*
Drilling Method: *Hollow-Stem Auger*
Field Crew: *N. Braeutigam/T. McMichael*

Total Depth: *11.5 feet*
Date: *11/22/2005 - 11/22/2005*
Geologist: *John Rego*

Groundwater Data		
Depth in (ft.)	7	
Time		
Date	11/22/05	
Symbol	▼	

Weather: Rain

Asphalt Surface

Depth (Feet)	Sample Type	Number	Blow Count	Sample	Recovery	N-Value	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0									**7" Asphalt Concrete** (no CABC observed) 0.0
									0.6
1							SW-SM		**SAND with Silt and Gravel** (SW-SM) coarse gravel, well graded, nonplastic, no dry strength, Brown, moist, **FILL**
2	GRAB	1							1 p200=10%, Sa=49%, Gr=41%, Moisture=7%, Max. Dry Dens=147.5pcf, Opt. Moisture=3.5%
3									3.0
			15				GW-GM		**GRAVEL with Silt and Sand** (GW-GM) coarse gravel, well graded, nonplastic, no dry strength, Brown, moist, dense, **FILL**, field observation indicates p200=10%, Sa=35%, Gr=55%
4	SS	2	27						2 Moisture=12%
			21						
5									5.0
			11						becoming more gravelly dense, **FILL**
6	SS	3	17						3 p200=7.5%, Sa=31.5%, Gr=61%, Moisture=13%
			14						
7									6.6 Groundwater observed at 7' while drilling 7.0
									drilling becoming easier
8									SM indicated by cuttings
9									
									9.5
10							SM		**SILTY SAND with Gravel** (SM) fine gravel, nonplastic, no dry strength, Light brown, wet, loose, field observation indicates p200=20%, Sa=65%, Gr=15%
			4						4 Moisture=13%
		4							10.5
11	SS	4A	3				ML		**SILT with Sand** (ML) low plasticity, low dry strength, slow dilatancy, Gray, wet, firm, field observation indicates p200=65%, Sa=35%, Gr=0%, **ORGANICS** present ~5% by volume (rootlets), 4A Moisture=52%
			4						11.5
								BOH 11.5	Notes: PVC standpipe installed PVC obstructed at 3.5' on 04/17/06 - no measurement obtained

☐ CME Auto Hammer ☒ Cathead Rope Method ☐ 140 lb. hammer with 30 in. drop ☒ 340 lb. hammer with 30 in. drop

A USCS LOG OF TEST HOLE 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 156

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1245+00*
Offset: *440L*
Elevation: *125.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *10.5 feet*
Date: *4/19/2006 - 4/19/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	9	
Time		
Date	4/19/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				SM		**SILTY SAND** (SM) medium grained sand, nonplastic, light brown, moist, field observation indicates p200=20%, Sa=80%, Gr=0%, trace of **ORGANICS** (roots) — 0.0 / 0.5
2	GRAB	1		SP		**SAND with Gravel** (SP) coarse gravel, poorly graded, no dry strength, gray, moist p200=1%, Sa=65%, Gr=34%, Moisture=4% — 2.0
7						becoming more gravelly, field observation indicates p200=5%, Sa=50%, Gr=45%, cobbles to 6" (~10%) — 7.0
9 ▼						Groundwater encountered at 9' while excavating — 9.0
10.5					BOH 10.5	Notes: — 10.5

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 157

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1248+00*
Offset: *280L*
Elevation: *125.0 feet*

Equipment Type:
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *9.0 feet*
Date: *4/19/2006 - 4/19/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	8	
Time		
Date	4/19/06	
Symbol	▼	

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) brown, **FROZEN Ice as Vx** (~5% ice by volume)
1	GRAB	1		ML		**SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, brown, moist, field observation indicates p200=75%, Sa=25%, Gr=0%, **ORGANICS** present to ~15% by volume (roots)
2						Moisture=41%
3						
4				SP		**SAND with Gravel** (SP) coarse gravel, poorly graded, gray, moist, field observation indicates p200=5%, Sa=40%, Gr=55%, cobbles to 5" (~5%)
5						
6						
7						
8	GRAB	2				Groundwater encountered at 8' while excavating becoming more gravelly, field observation indicates p200=5%, Sa=30%, Gr=65%, cobbles to 6" (~2%)
9					BOH 9	Moisture=6% Notes:

0.0 | 1.0 | 3.0 | 4.0 | 7.5 | 8.0 | 9.0

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 158

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1251+00*
Offset: *150L*
Elevation: *125.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *8.5 feet*
Date: *4/19/2006 - 4/19/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	6	
Time		
Date	4/19/06	
Symbol	▼	

Weather: Partly Cloudy

Forest Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				ML		**SILT with Sand** (ML) fine grained sand, nonplastic, brown gray, field observation indicates p200=80%, Sa=20%, Gr=0%, **FROZEN Ice as Vx** (~30% ice by volume) 0.0
1	GRAB	1		GP		1.0 **GRAVEL with Sand** (GP) coarse gravel, poorly graded, no dry strength, brown gray, moist, cobbles to 4" (~10%) p200=3%, Sa=39%, Gr=58%, Moisture=6%
2						
3						
4						
5						5.5 Groundwater encountered at 6' while excavating
6	GRAB	2				6.0 becoming more gravelly, wet, field observation indicates p200=5%, Sa=30%, Gr=65% Moisture=6%
7						
8	GRAB	3		ML		7.5 **SILT with Sand** (ML) fine grained sand, nonplastic, low dry strength, gray, wet, field observation indicates p200=75%, Sa=25%, Gr=0%, **ORGANICS** present to 25% by volume (rootlets) Moisture=32% 8.5 BOH 8.5

Notes:

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

LOG OF TEST PIT

TEST PIT # 159

STATE OF ALASKA DOT&PF
Central Region Materials
Geology Section

PROJECT NUMBER: *68606*
PROJECT: *Haines Highway, MP 3.5 to MP 25.3*

Station / Location: *1242+00*
Offset: *560L*
Elevation: *125.0 feet*

Equipment Type: *Hitachi Z-Axis 135 Backhoe*
Hole Type: *Test Pit*
Field Crew: *Donnie Turner*

Total Depth: *10.5 feet*
Date: *4/19/2006 - 4/19/2006*
Geologist: *Keri A. Nutter*

Groundwater Data		
Depth in (ft.)	10	
Time		
Date	4/19/06	
Symbol	▼	

Weather: Partly Cloudy

Grass Surface

Depth (Feet)	Sample Data: Sample Type	Sample Data: Field Number	Sample Data: Sample	USCS Classification Frozen Zone	Soil Graphic	SUBSURFACE MATERIAL
0				PT		**Peat** (PT) brown — 0.0
0.5	GRAB	1		GP		**GRAVEL with Sand** (GP) coarse gravel, poorly graded, no dry strength, gray, moist, field observation indicates p200=5%, Sa=35%, Gr=60%, cobbles to 4" (~5%) — 0.5
1						Moisture=5%
7.0						becoming more gravelly, field observation indicates p200=5%, Sa=20%, Gr=75% — 7.0
10 ▼						Groundwater encountered at 10' while excavating — 10.0
10.5					BOH 10.5	Notes: — 10.5

B USCS LOG OF TEST PIT 59119DADOT.GPJ 2006DATATEMPLATE.GDT 1/8/09

APPENDIX C

Laboratory Test Results

ALASKA TESTLAB
A Division of DOWL LLC

Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 9

Sample 2

Depth 5' - 7'

Engineering Classification: Silty SAND , SM

Frost Classification: Not Measured

PARTICLE-SIZE

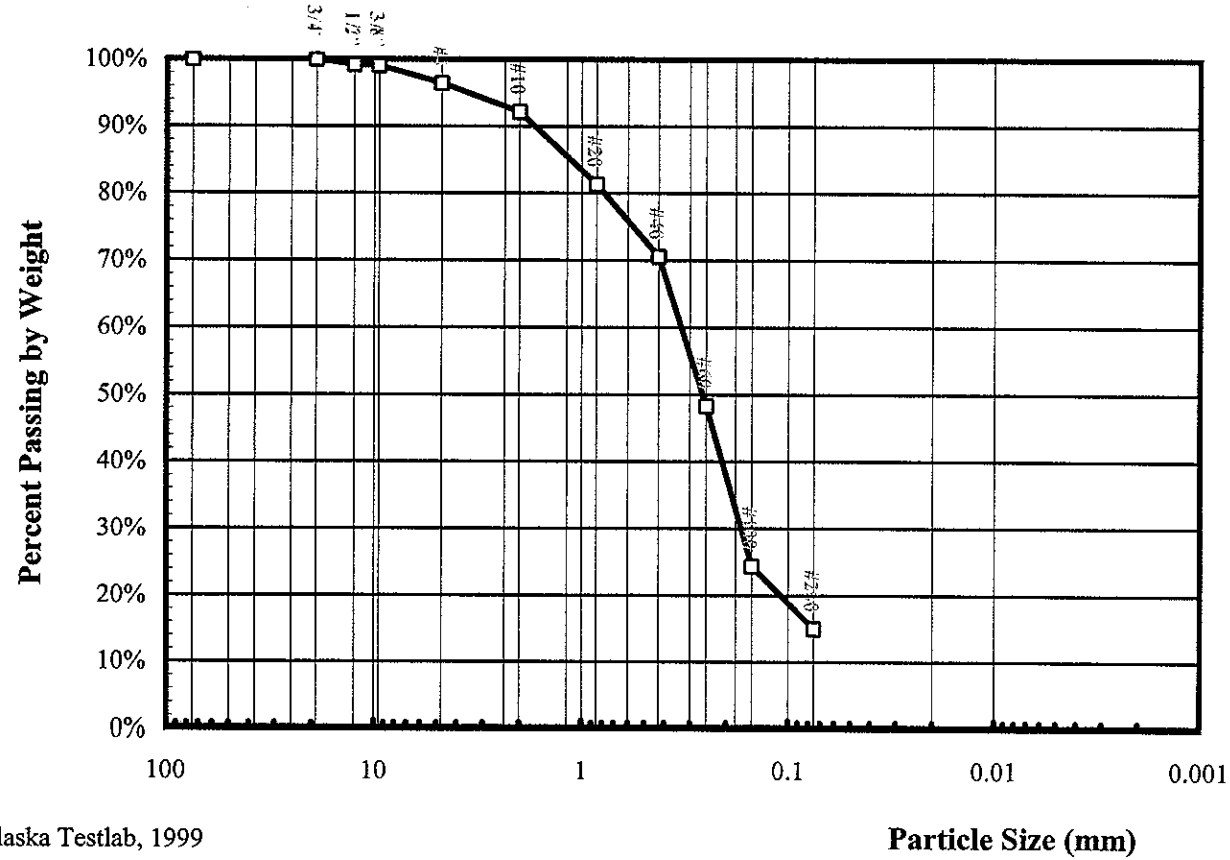
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-684

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	99%	
No. 4	96%	
Total Wt. = 317.2g		
No. 8		
No. 10	92%	
No. 16		
No. 20	81%	
No. 30		
No. 40	71%	
No. 50		
No. 60	48%	
No. 80		
No. 100	24%	
No. 200	15%	
Total Wt. of Fine Fraction = 305.6g		
0.02 mm		

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ALASKA TESTLAB
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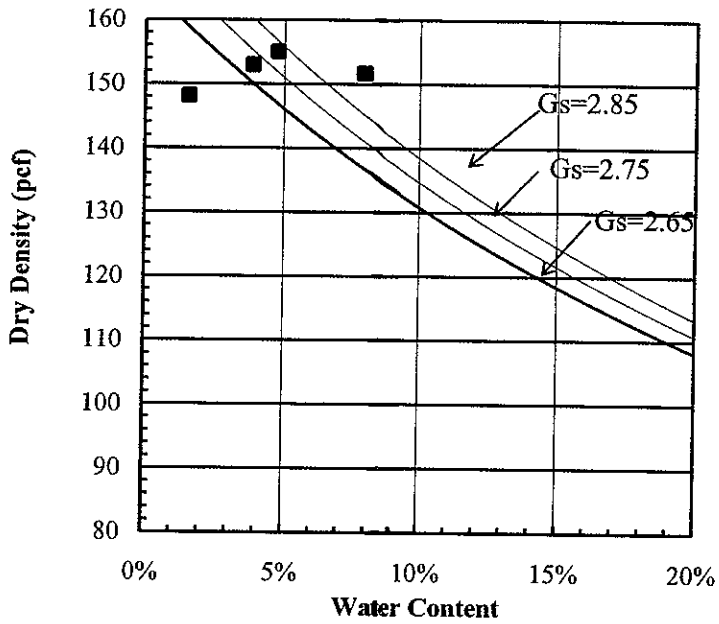
MODIFIED PROCTOR
AASHTO T-180 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 15
Sample 1
Depth 0.5'-3'

W.O. D59119D
Lab No. 2005-2940
Received: 12/2/05
Reported: 12/19/05

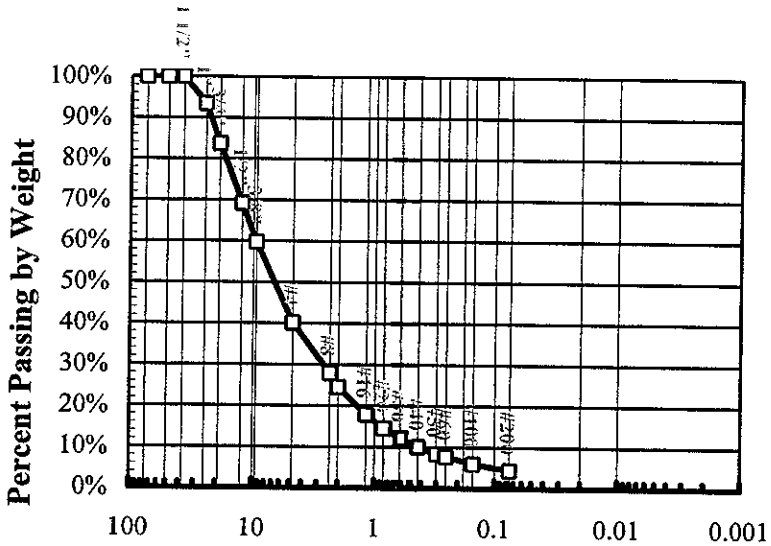
Engineering Classification: Well Graded GRAVEL with Sand, GW
Frost Classification: Not Measured



Uncorrected
Maximum Density: 155.1 pcf
Optimum Water Content: 4.8 %

Corrected Density: 156.5 pcf
Corrected Optimum: 4 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"		
1 1/2"	100%	
1"	93%	
3/4"	84%	
1/2"	69%	
3/8"	60%	
No. 4	40%	
Total Wt. = 16065g		
No. 8	28%	
No. 10		
No. 16	18%	
No. 20	15%	
No. 30	12%	
No. 40	10%	
No. 50	8%	
No. 60	8%	
No. 80		
No.100	6%	
No.200	4.4%	
Total Wt. of Fine Fraction = 566.2g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 18

Sample 1

Depth 0.1' - 3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

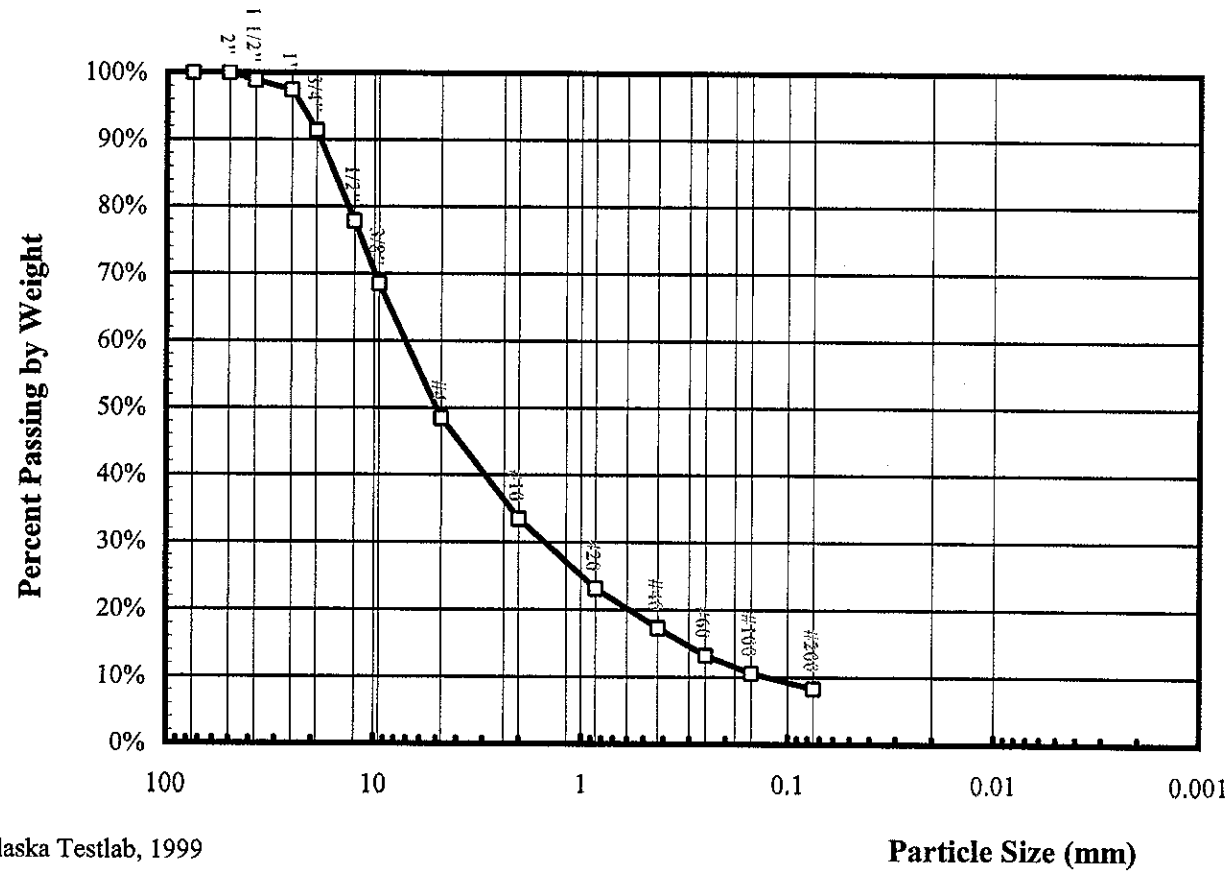
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-686

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	99%	
1"	97%	
3/4"	91%	
1/2"	78%	
3/8"	69%	
No. 4	48%	
Total Wt. = 29371g		
No. 8		
No. 10	33%	
No. 16		
No. 20	23%	
No. 30		
No. 40	17%	
No. 50		
No. 60	13%	
No. 80		
No. 100	11%	
No. 200	8.3%	
Total Wt. of Fine Fraction = 353g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 19

Sample 1

Depth 0.3'-1'

Engineering Classification: Poorly Graded GRAVEL with Silt and Sand, GP-GM

Frost Classification: Not Measured

PARTICLE-SIZE

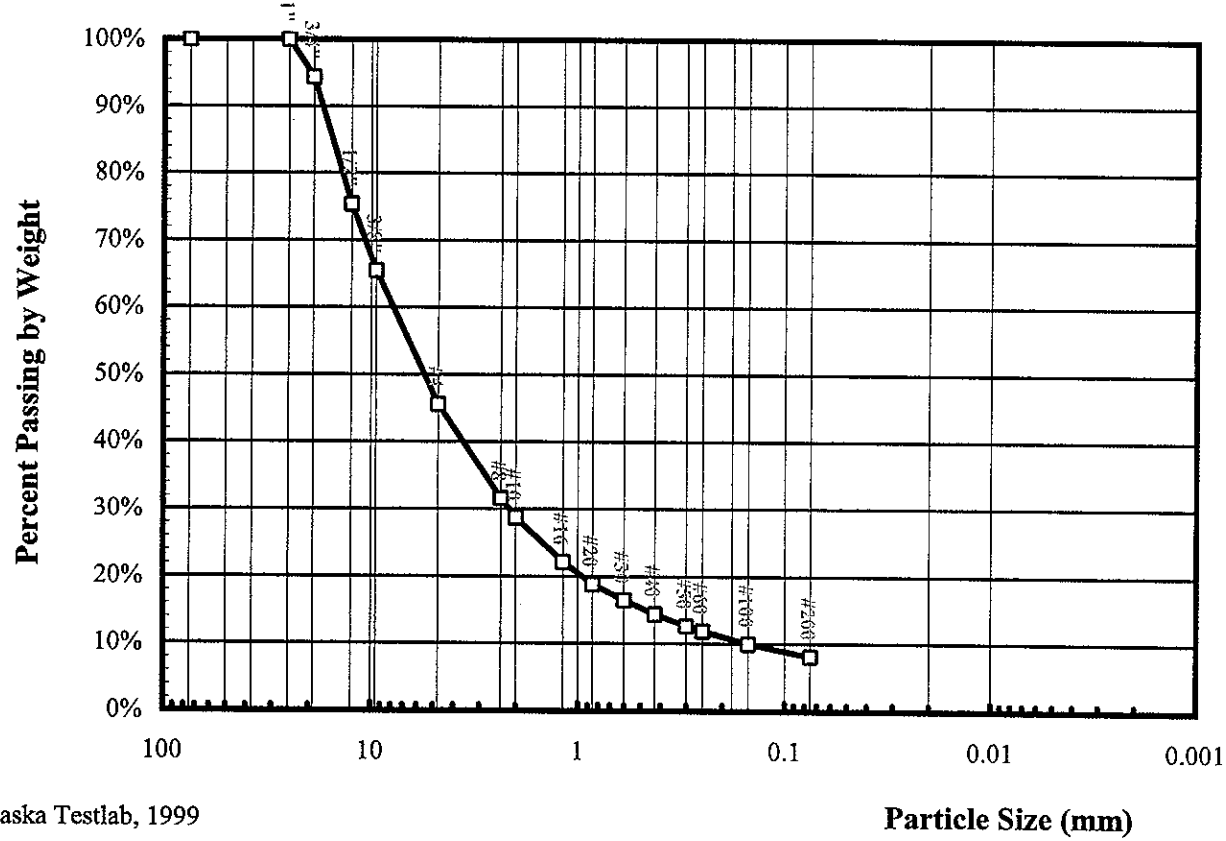
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2941

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	94%	
1/2"	75%	
3/8"	65%	
No. 4	46%	
Total Wt. = 2636g		
No. 8	32%	
No. 10	29%	
No. 16	22%	
No. 20	19%	
No. 30	16%	
No. 40	14%	
No. 50	13%	
No. 60	12%	
No. 80		
No. 100	10%	
No. 200	8.1%	
Total Wt. of Fine Fraction = 558.1g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

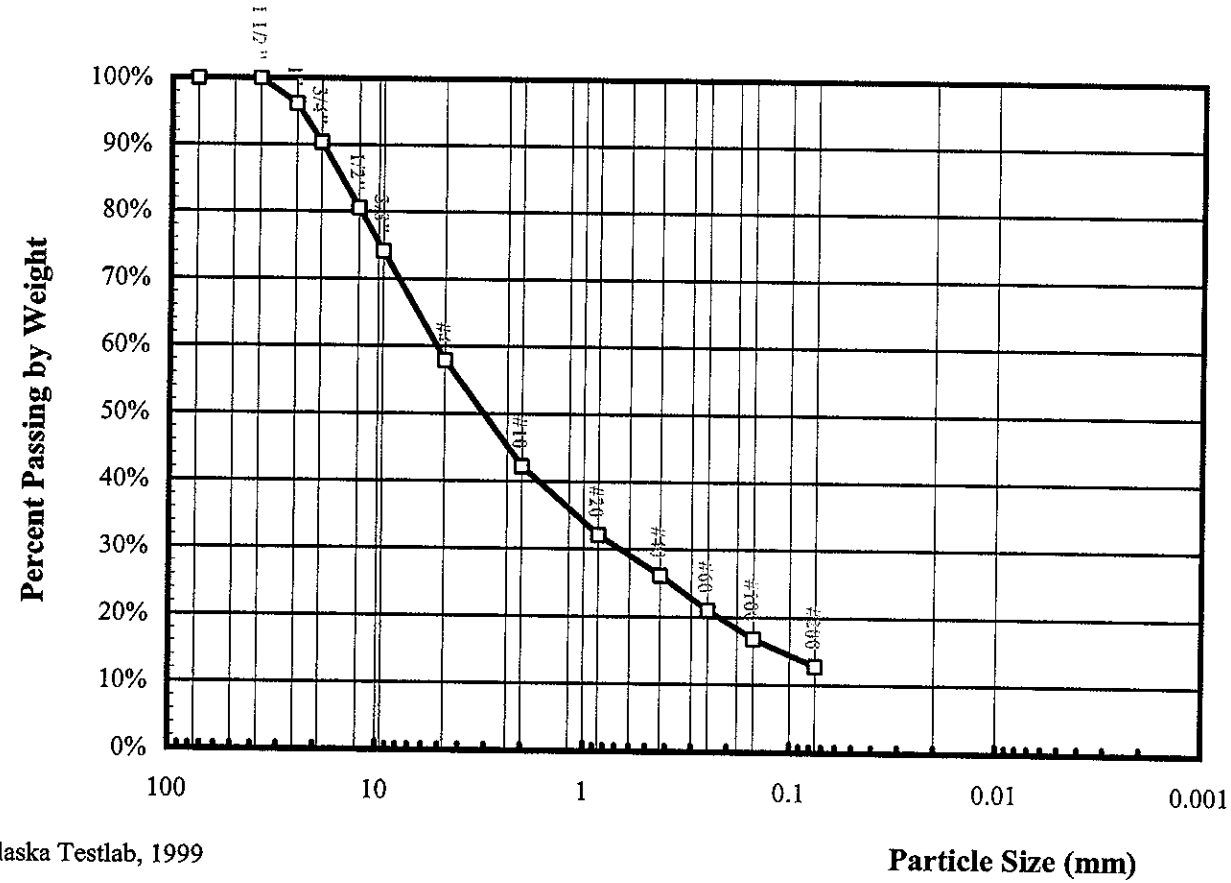
Project: Haines Highway

Location: Test Boring 20
Sample 2
Depth 3' - 4.5'

Engineering Classification: Silty SAND with Gravel, SM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2006-687
Received: 6/1/06
Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	96%	
3/4"	90%	
1/2"	81%	
3/8"	74%	
No. 4	58%	
Total Wt. = 1392g		
No. 8		
No. 10	42%	
No. 16		
No. 20	32%	
No. 30		
No. 40	26%	
No. 50		
No. 60	21%	
No. 80		
No. 100	17%	
No. 200	13%	
Total Wt. of Fine Fraction = 381.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

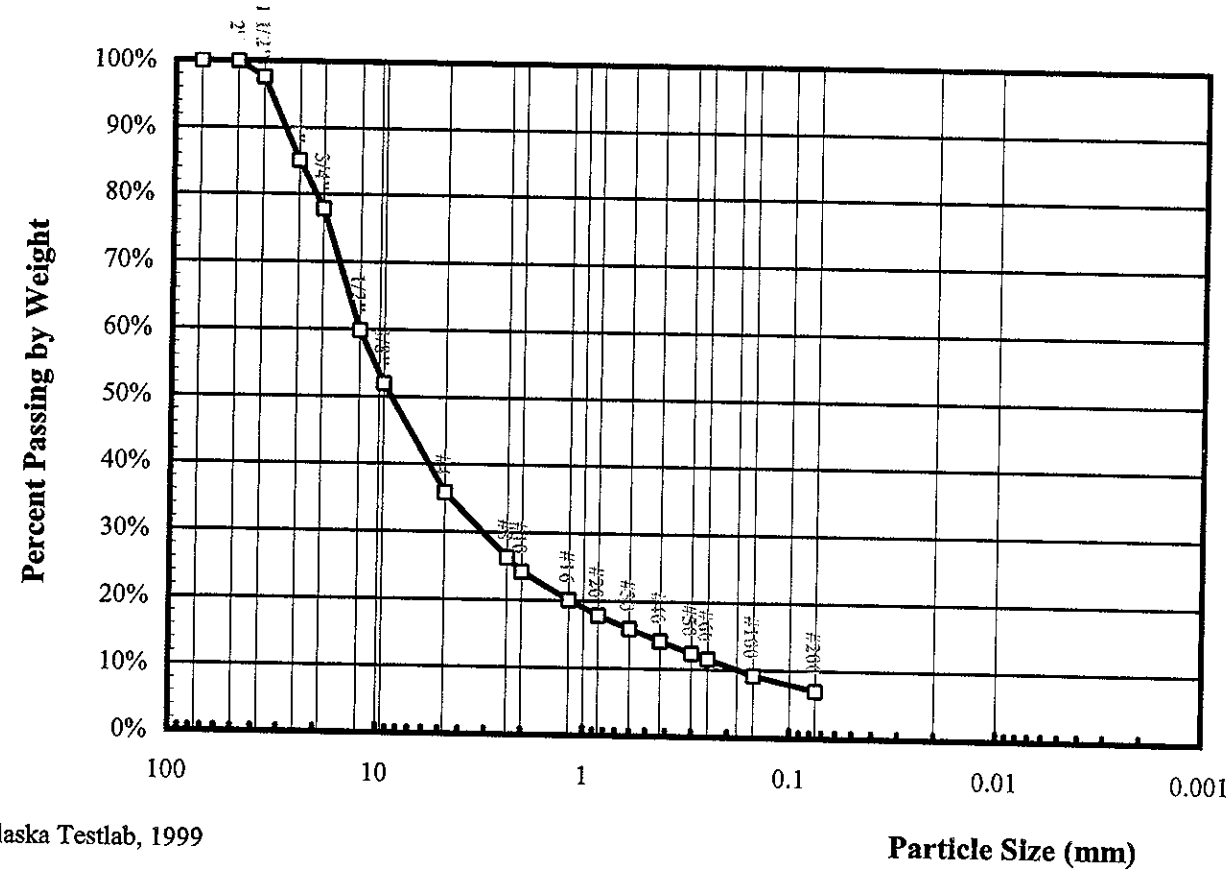
Project: Haines Highway

Location: Test Boring 25
Sample 1
Depth 0'-1'

Engineering Classification: Poorly Graded GRAVEL with Silt and Sand, GP-GM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2942
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	98%	
1"	85%	
3/4"	78%	
1/2"	60%	
3/8"	52%	
No. 4	36%	
Total Wt. = 4931g		
No. 8	26%	
No. 10	24%	
No. 16	20%	
No. 20	18%	
No. 30	16%	
No. 40	14%	
No. 50	12%	
No. 60	12%	
No. 80		
No. 100	9%	
No. 200	7%	
Total Wt. of Fine Fraction = 510.6g		
0.02 mm		

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ALASKA TESTLAB
A Division of DOWL LLC

Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 29

Sample 1

Depth 0.3' - 2.5'

Engineering Classification: Well Graded SAND with Silt and Gravel, SW-SM

Frost Classification: Not Measured

PARTICLE-SIZE

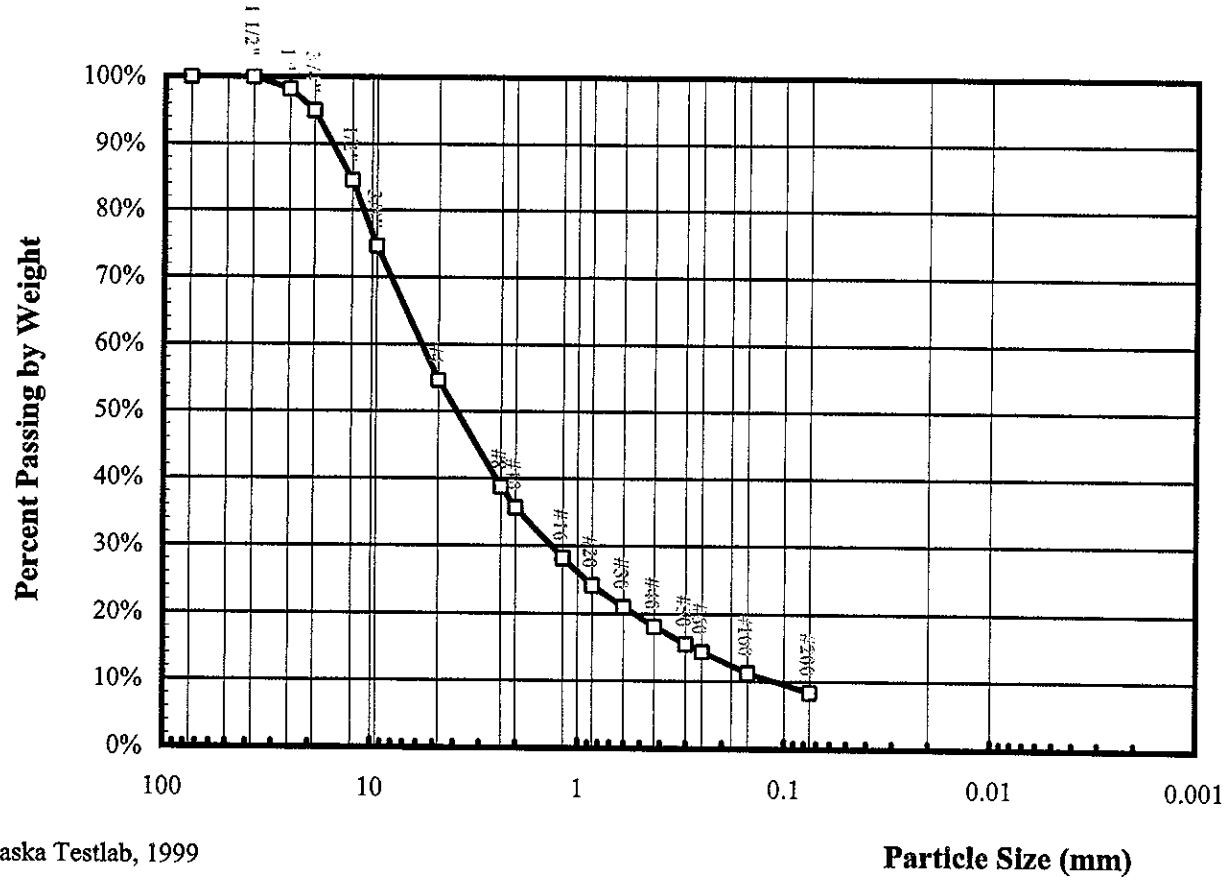
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2944

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	95%	
1/2"	85%	
3/8"	75%	
No. 4	55%	
Total Wt. = 18909g		
No. 8	39%	
No. 10	36%	
No. 16	28%	
No. 20	24%	
No. 30	21%	
No. 40	18%	
No. 50	16%	
No. 60	14%	
No. 80		
No. 100	11%	
No. 200	8.4%	
Total Wt. of Fine Fraction = 566.6g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 30

Sample 1

Depth 0.3'-1'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

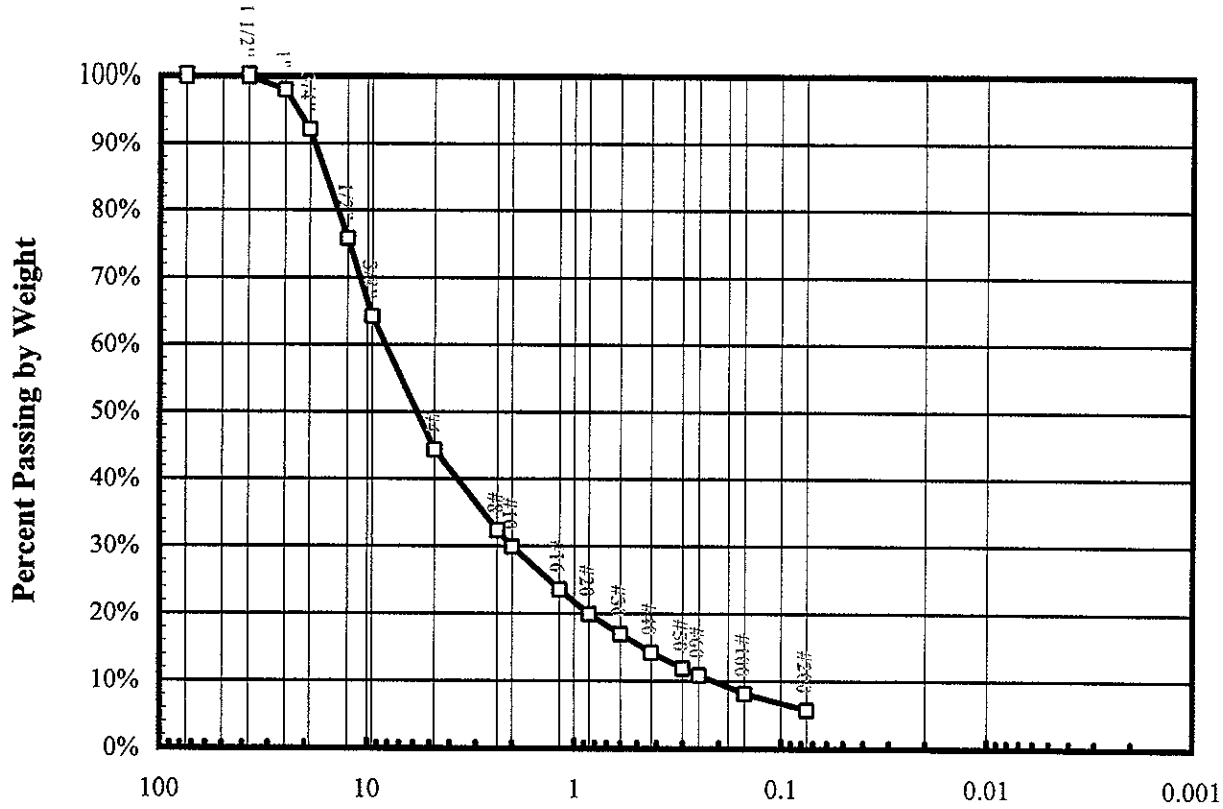
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2945

Received: 12/2/05

Reported: 12/19/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	92%	
1/2"	76%	
3/8"	64%	
No. 4	44%	
Total Wt. = 4063g		
No. 8	32%	
No. 10	30%	
No. 16	24%	
No. 20	20%	
No. 30	17%	
No. 40	14%	
No. 50	12%	
No. 60	11%	
No. 80		
No. 100	8%	
No. 200	5.7%	
Total Wt. of Fine Fraction = 547.1g		
0.02 mm		

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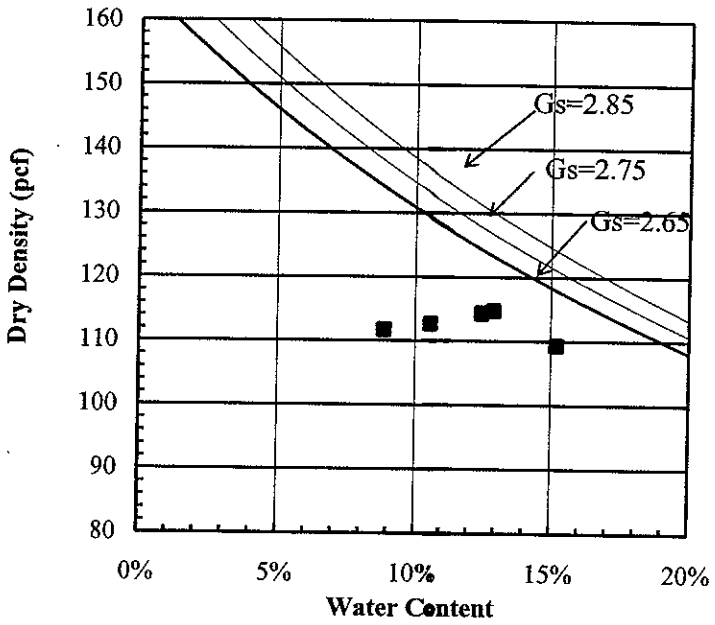
MODIFIED PROCTOR
ASTM D 1557 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 31
Sample 1
Depth 0' - 3'

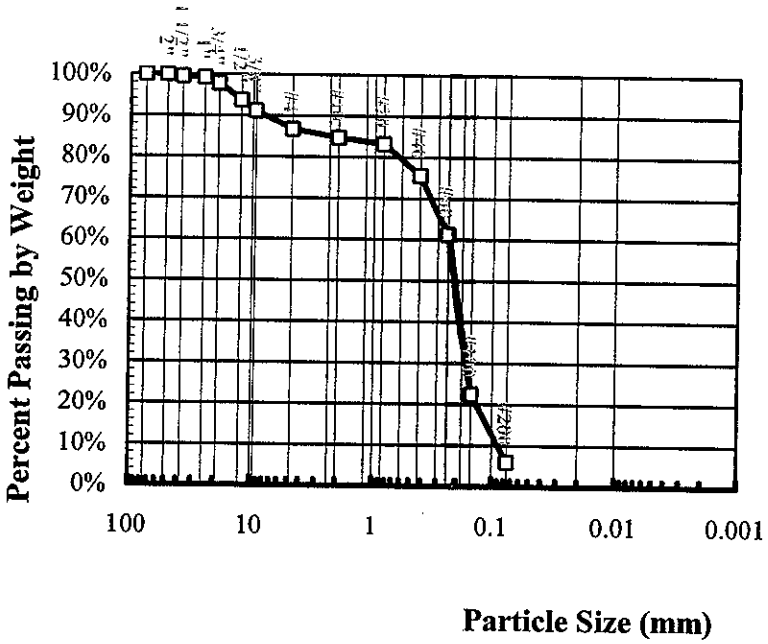
W.O. D59119D
Lab No. 2006-688
Received: 6/1/06
Reported: 6/8/06

Engineering Classification: Poorly Graded SAND with Silt , SP-SM
Frost Classification: Not Measured



Uncorrected
Maximum Density: 115 pcf
Optimum Water Content: 13 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"	100%	
1 1/2"	100%	
1"	99%	
3/4"	98%	
1/2"	94%	
3/8"	91%	
No. 4	87%	
Total Wt. = 32015g		
No. 8		
No. 10	85%	
No. 16		
No. 20	83%	
No. 30		
No. 40	76%	
No. 50		
No. 60	61%	
No. 80		
No.100	22%	
No.200	6%	
Total Wt. of Fine Fraction = 401.4g		
0.02 mm		

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Client: ADOT&PF Southeast Region

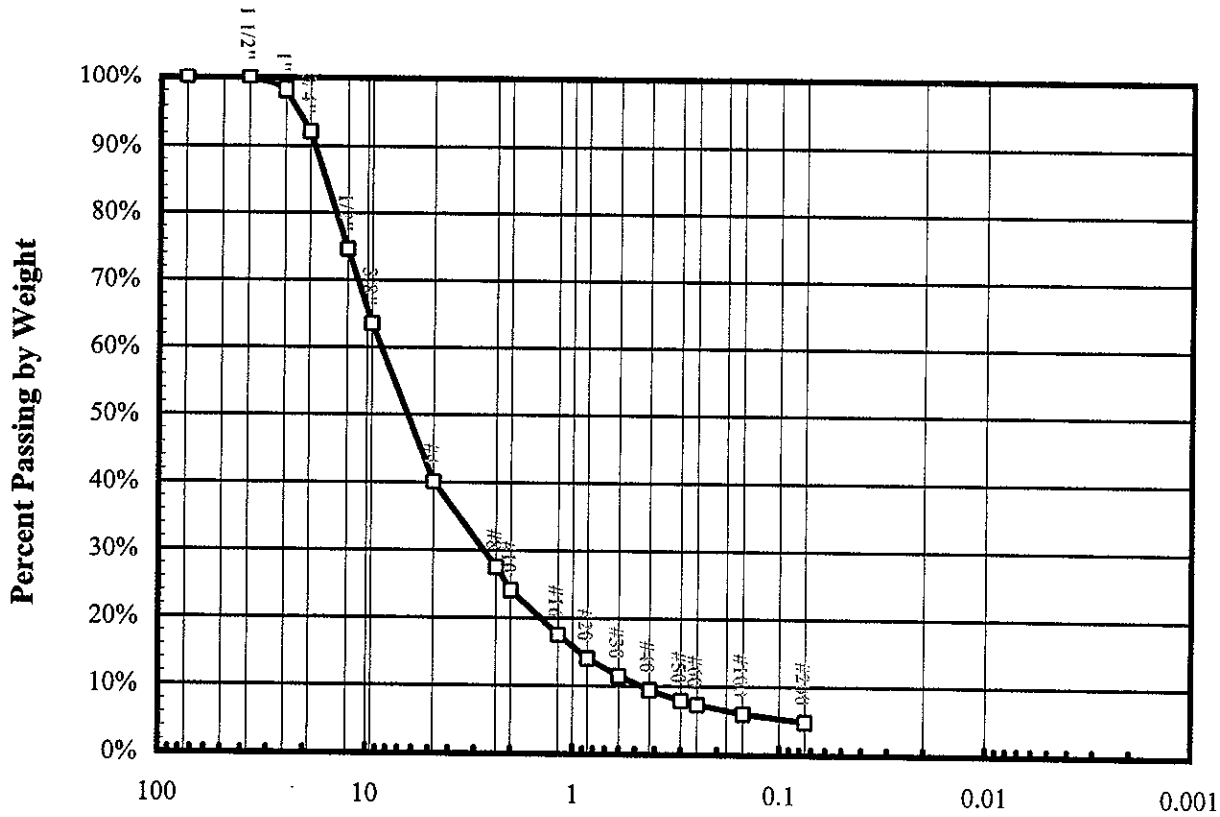
Project: Haines Highway

Location: Test Boring 32
Sample 1
Depth 0.3'-2.5'

Engineering Classification: Well Graded GRAVEL with Sand, GW
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2946
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	92%	
1/2"	75%	
3/8"	64%	
No. 4	40%	
Total Wt. = 23976g		
No. 8	27%	
No. 10	24%	
No. 16	18%	
No. 20	14%	
No. 30	11%	
No. 40	9%	
No. 50	8%	
No. 60	7%	
No. 80		
No. 100	6%	
No. 200	4.8%	
Total Wt. of Fine Fraction = 505.8g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 33

Sample 1

Depth 0.5' - 3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

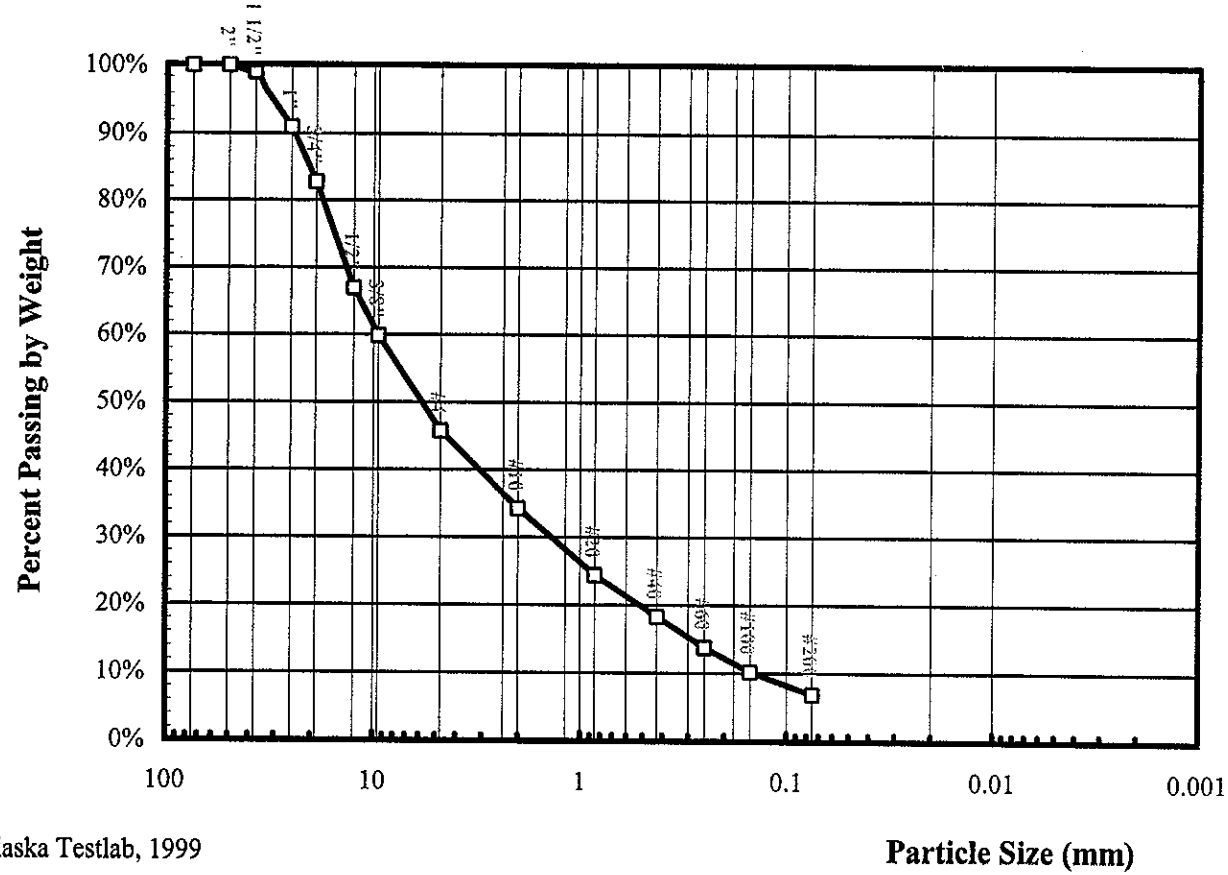
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-689

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	99%	
1"	91%	
3/4"	83%	
1/2"	67%	
3/8"	60%	
No. 4	46%	
Total Wt. = 22683g		
No. 8		
No. 10	34%	
No. 16		
No. 20	24%	
No. 30		
No. 40	18%	
No. 50		
No. 60	14%	
No. 80		
No. 100	10%	
No. 200	6.9%	
Total Wt. of Fine Fraction = 575g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 34

Sample 1

Depth 0.5'-1.5'

Engineering Classification: Poorly Graded GRAVEL with Silt and Sand, GP-GM

Frost Classification: Not Measured

PARTICLE-SIZE

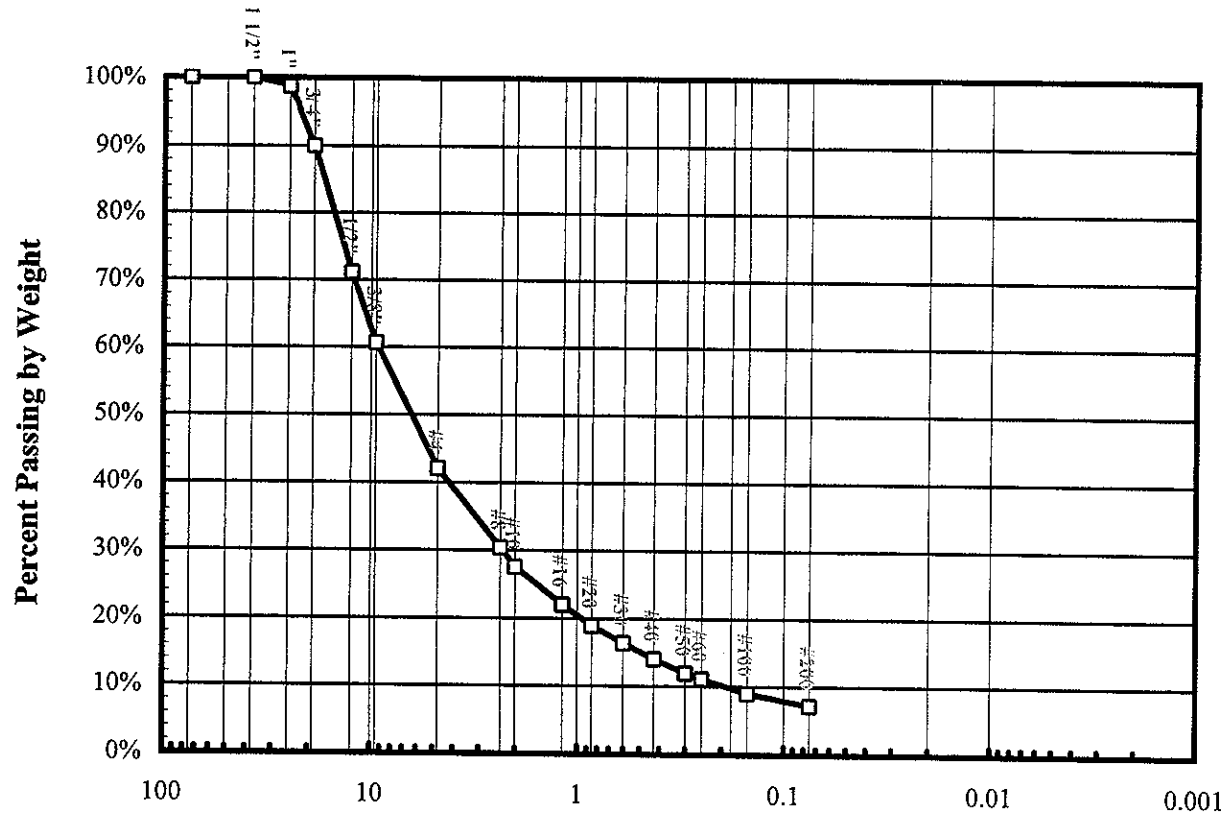
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2947

Received: 12/2/05

Reported: 12/19/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	99%	
3/4"	90%	
1/2"	71%	
3/8"	61%	
No. 4	42%	
Total Wt. = 5135g		
No. 8	30%	
No. 10	28%	
No. 16	22%	
No. 20	19%	
No. 30	16%	
No. 40	14%	
No. 50	12%	
No. 60	11%	
No. 80		
No. 100	9%	
No. 200	7.2%	
Total Wt. of Fine Fraction = 606.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 35

Sample 1

Depth 0'-2.5'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

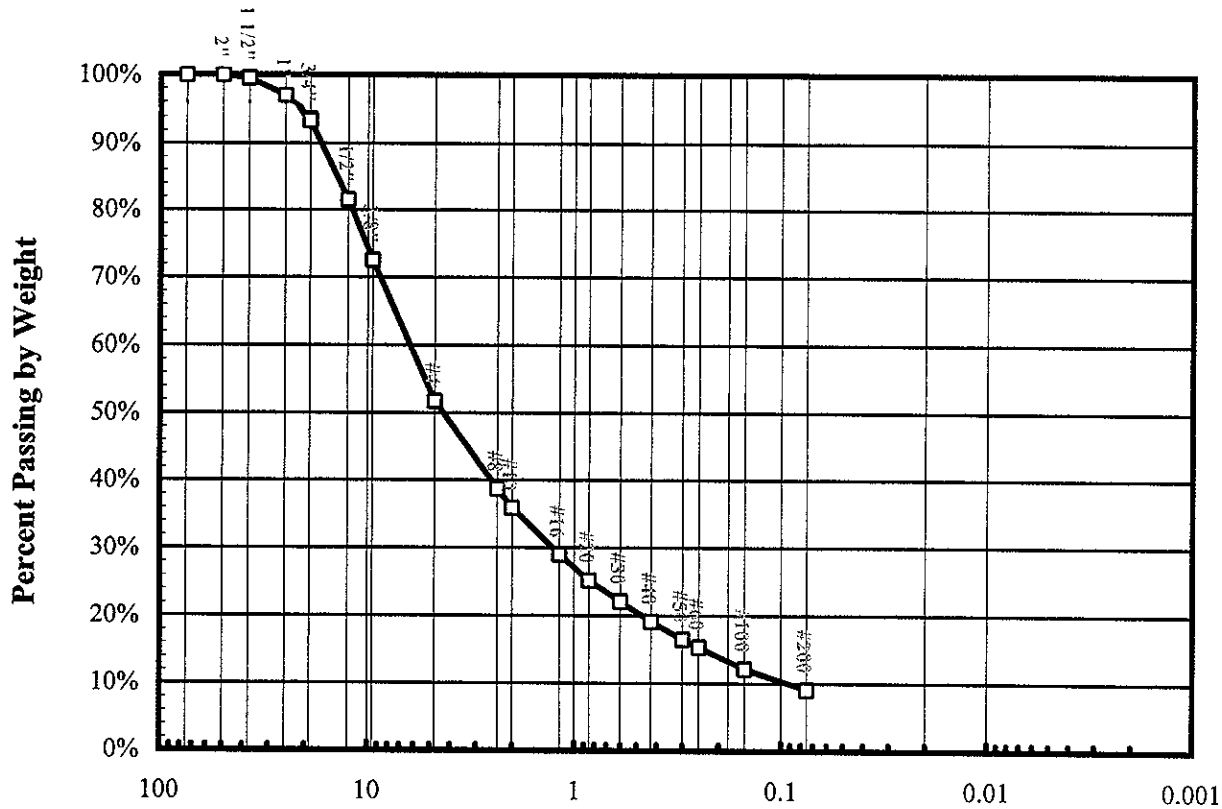
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2948

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	100%	
1"	97%	
3/4"	93%	
1/2"	82%	
3/8"	73%	
No. 4	52%	
Total Wt. = 27599g		
No. 8	39%	
No. 10	36%	
No. 16	29%	
No. 20	25%	
No. 30	22%	
No. 40	19%	
No. 50	17%	
No. 60	15%	
No. 80		
No. 100	12%	
No. 200	9.1%	
Total Wt. of Fine Fraction = 527.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 35

Sample 2

Depth 5'-6.2'

Engineering Classification: Silty GRAVEL with Sand, GM

Frost Classification: Not Measured

PARTICLE-SIZE

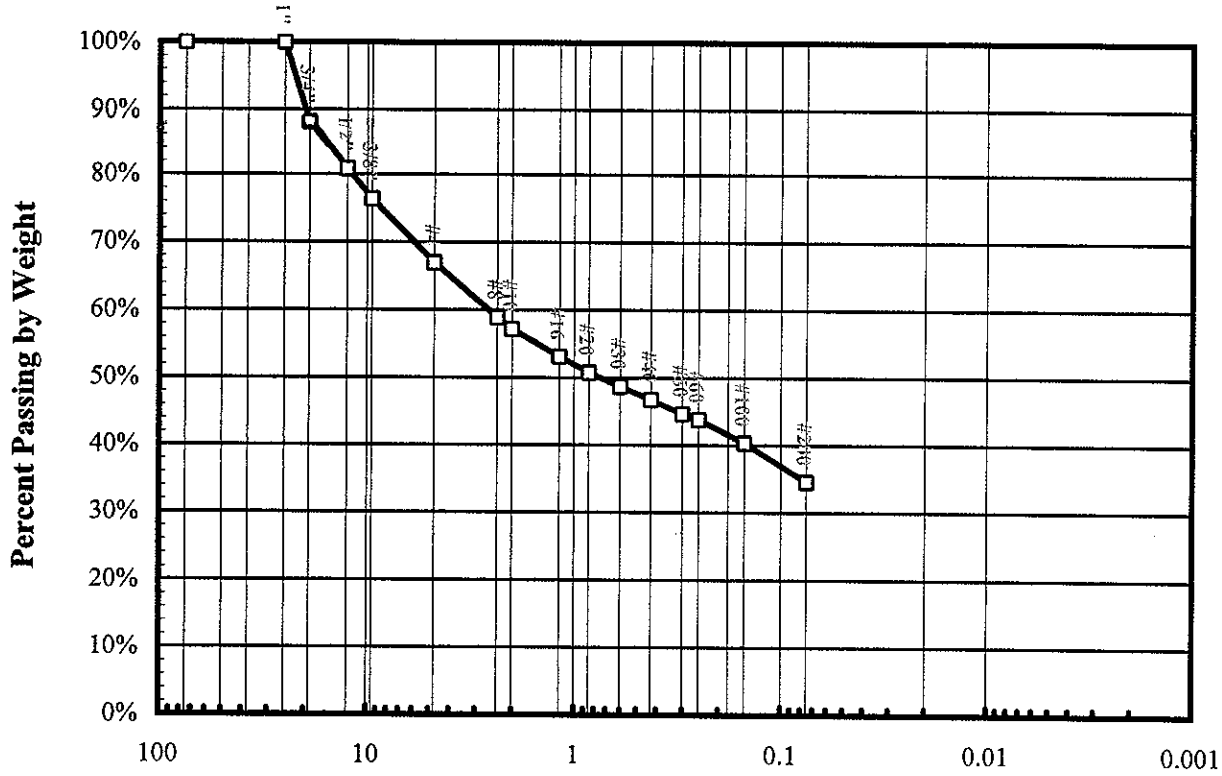
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2949

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	88%	
1/2"	81%	
3/8"	76%	
No. 4	67%	
Total Wt. = 245g		
No. 8	59%	
No. 10	57%	
No. 16	53%	
No. 20	51%	
No. 30	49%	
No. 40	47%	
No. 50	45%	
No. 60	44%	
No. 80		
No. 100	40%	
No. 200	35%	
Total Wt. of Fine Fraction = 163.7g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 37

Sample 1

Depth 0.5'-1.5'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

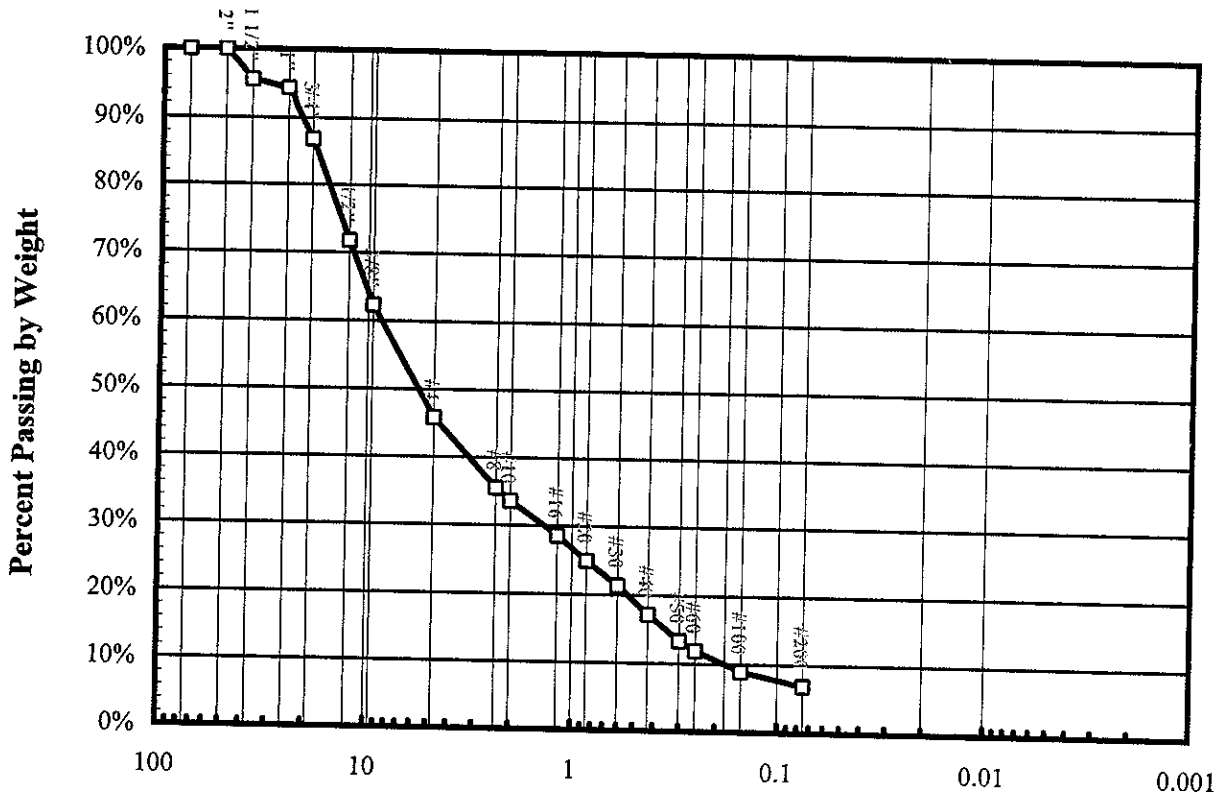
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2950

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	95%	
1"	94%	
3/4"	87%	
1/2"	72%	
3/8"	62%	
No. 4	46%	
Total Wt. = 5353.2g		
No. 8	36%	
No. 10	34%	
No. 16	29%	
No. 20	25%	
No. 30	21%	
No. 40	17%	
No. 50	13%	
No. 60	12%	
No. 80		
No. 100	9%	
No. 200	6.9%	
Total Wt. of Fine Fraction = 510.7g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 37
Sample 3
Depth 5'-6.5'

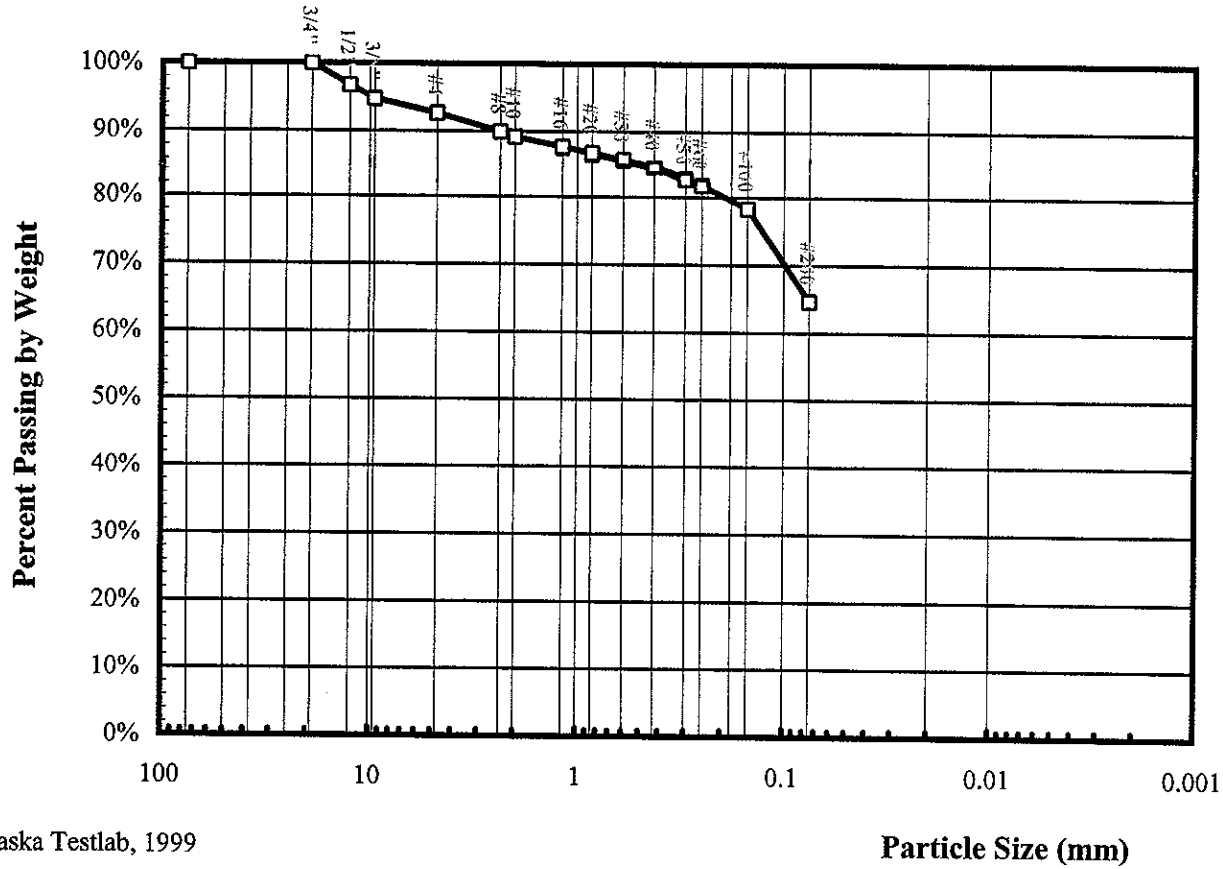
Engineering Classification: Sandy SILT, ML

Frost Classification: F4

PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2951
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	97%	
3/8"	95%	
No. 4	93%	
Total Wt. = 378.1g		
No. 8	90%	
No. 10	89%	
No. 16	88%	
No. 20	87%	
No. 30	86%	
No. 40	85%	
No. 50	83%	
No. 60	82%	
No. 80		
No. 100	78%	
No. 200	65%	
Total Wt. of Fine Fraction = 350.3g		
0.02 mm		

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Client: ADOT&PF Southeast Region

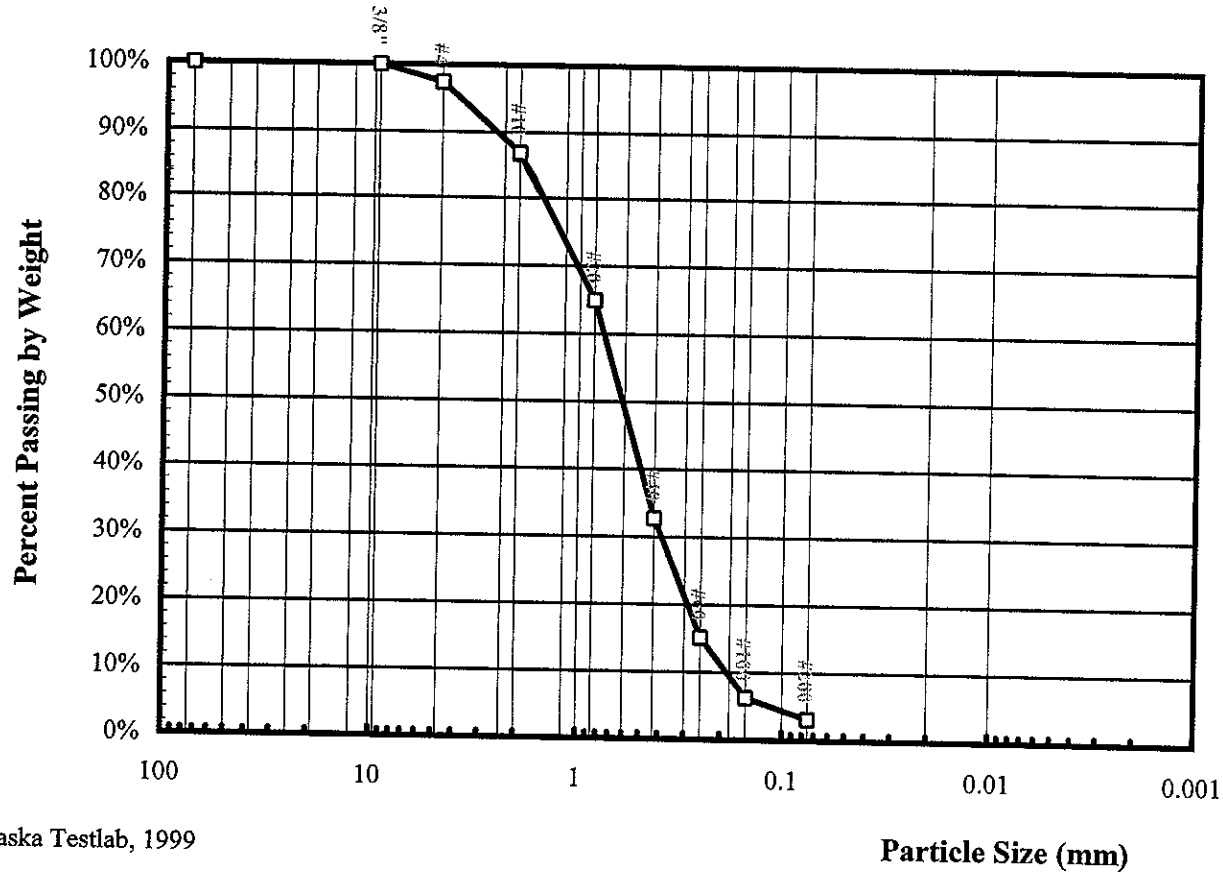
Project: Haines Highway

Location: Test Boring 38
Sample 2A
Depth 6' - 7'

Engineering Classification: Poorly Graded SAND , SP
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2006-690
Received: 6/1/06
Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"	100%	
No. 4	97%	
Total Wt. = 359.5g		
No. 8		
No. 10	87%	
No. 16		
No. 20	65%	
No. 30		
No. 40	33%	
No. 50		
No. 60	15%	
No. 80		
No. 100	6%	
No. 200	3.1%	
Total Wt. of Fine Fraction = 350.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 41

Sample 2

Depth 5' - 7'

Engineering Classification: Poorly Graded SAND with Gravel, SP

Frost Classification: Not Measured

PARTICLE-SIZE

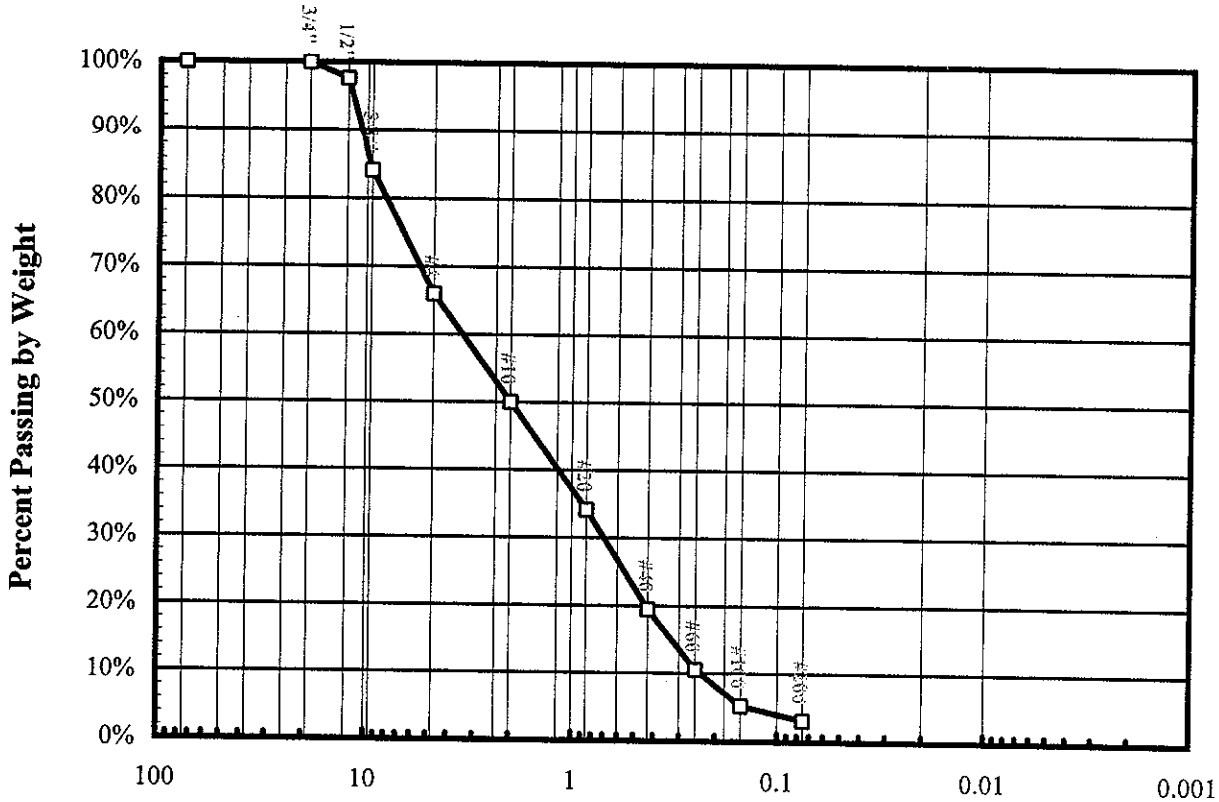
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-691

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	98%	
3/8"	84%	
No. 4	66%	
Total Wt. = 270.9g		
No. 8		
No. 10	50%	
No. 16		
No. 20	34%	
No. 30		
No. 40	19%	
No. 50		
No. 60	11%	
No. 80		
No. 100	5%	
No. 200	3.1%	
Total Wt. of Fine Fraction = 178.7g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 44

Sample 1

Depth 0.5'-1.5'

Engineering Classification: Well Graded GRAVEL with Sand, GW

Frost Classification: Not Measured

PARTICLE-SIZE

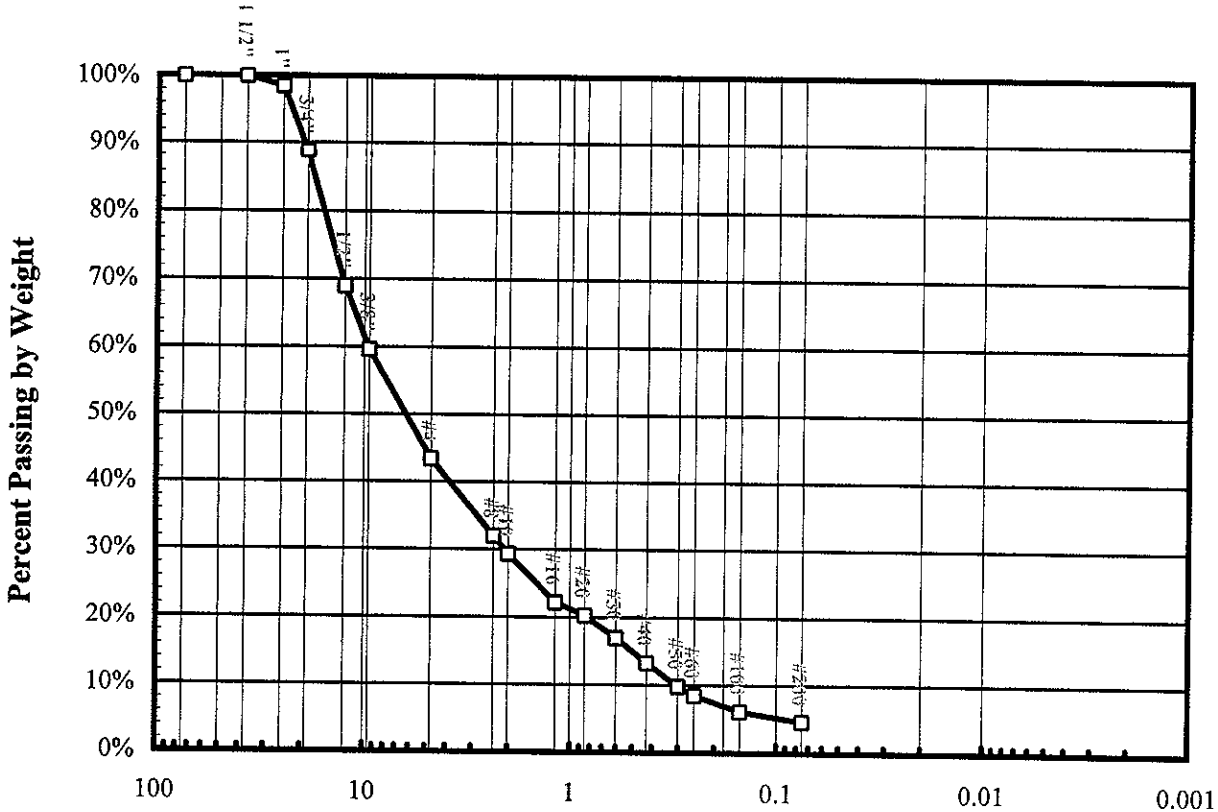
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2952

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	89%	
1/2"	69%	
3/8"	60%	
No. 4	43%	
Total Wt. = 7353g		
No. 8	32%	
No. 10	29%	
No. 16	22%	
No. 20	20%	
No. 30	17%	
No. 40	13%	
No. 50	10%	
No. 60	8%	
No. 80		
No. 100	6%	
No. 200	4.6%	
Total Wt. of Fine Fraction = 541.7g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 44

Sample 3

Depth 5'-6.5'

Engineering Classification: Silty SAND , SM

Frost Classification: Not Measured

PARTICLE-SIZE

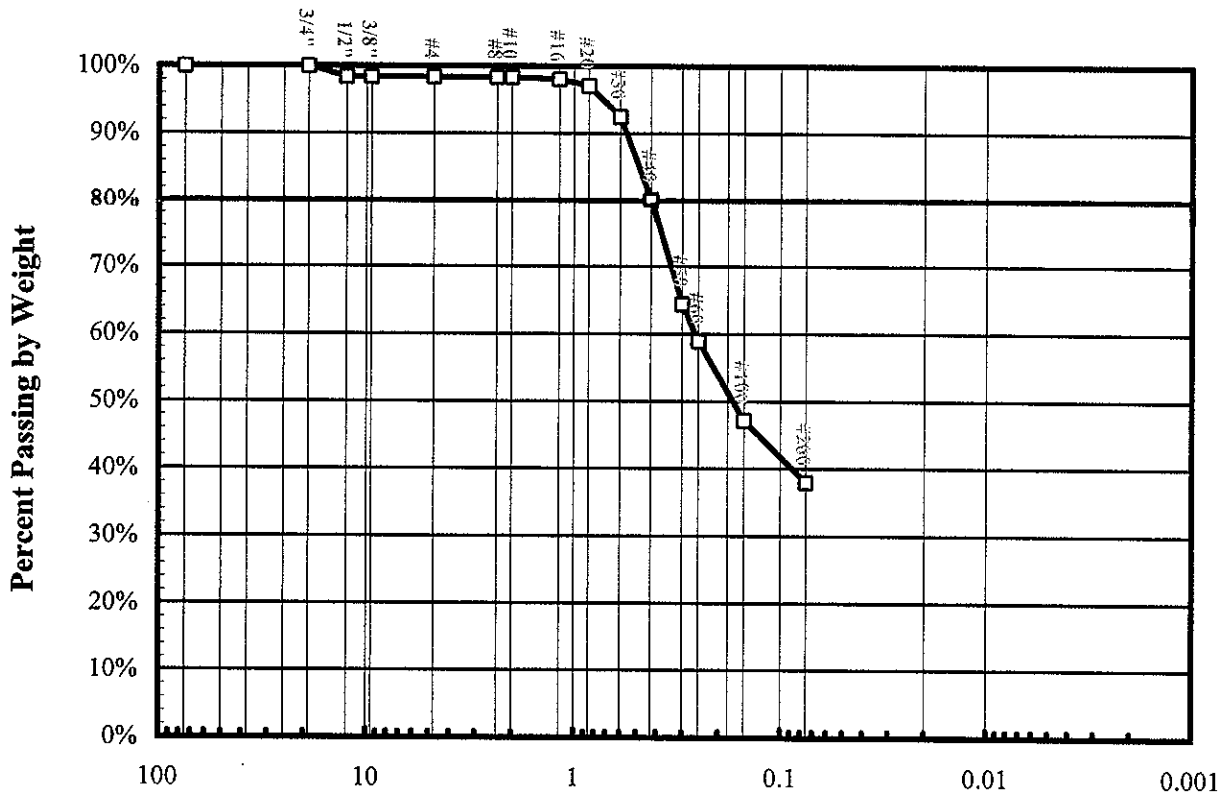
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2953

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	98%	
3/8"	98%	
No. 4	98%	
Total Wt. = 424.1g		
No. 8	98%	
No. 10	98%	
No. 16	98%	
No. 20	97%	
No. 30	92%	
No. 40	80%	
No. 50	64%	
No. 60	59%	
No. 80		
No. 100	47%	
No. 200	38%	
Total Wt. of Fine Fraction = 416.8g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 47

Sample 2

Depth 4' - 6'

Engineering Classification: Sandy SILT, ML

Frost Classification: F4

PARTICLE-SIZE

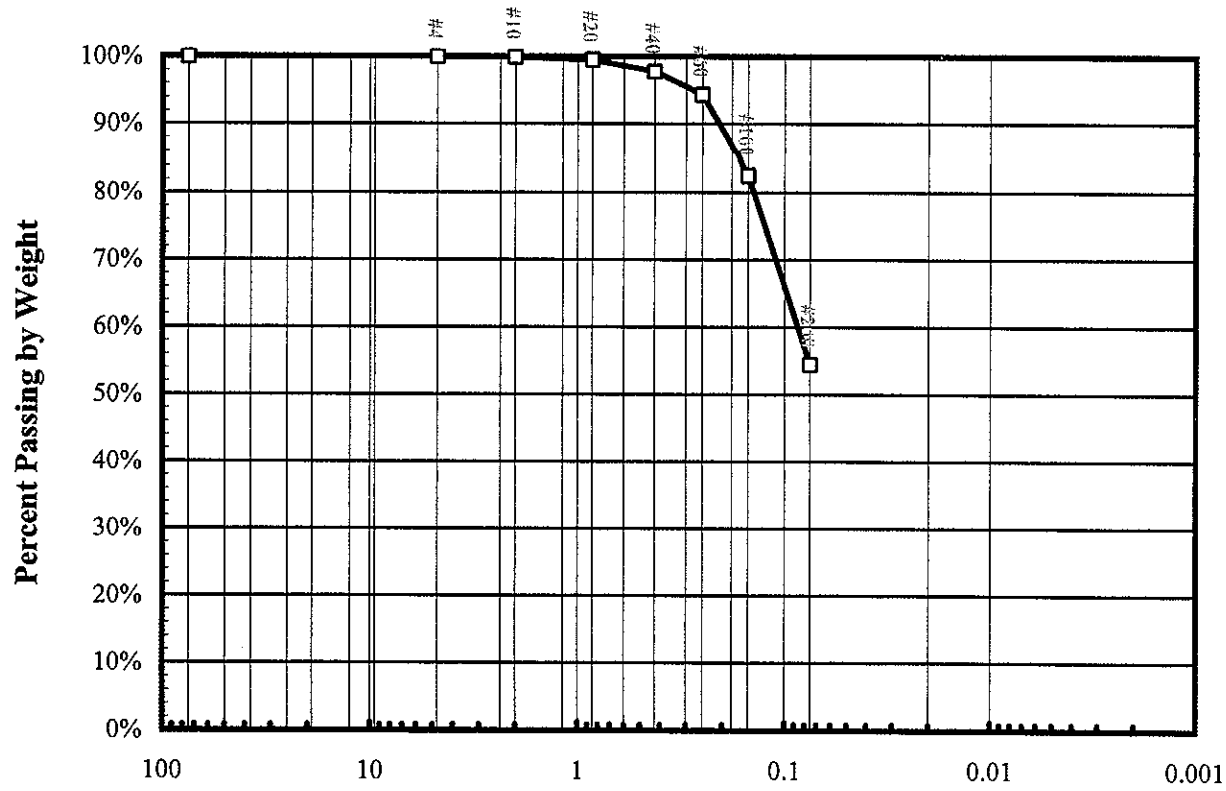
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-693

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"		
No. 4	100%	
Total Wt. = 333.6g		
No. 8		
No. 10	100%	
No. 16		
No. 20	100%	
No. 30		
No. 40	98%	
No. 50		
No. 60	94%	
No. 80		
No. 100	83%	
No. 200	54%	
Total Wt. of Fine Fraction = 333.6g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

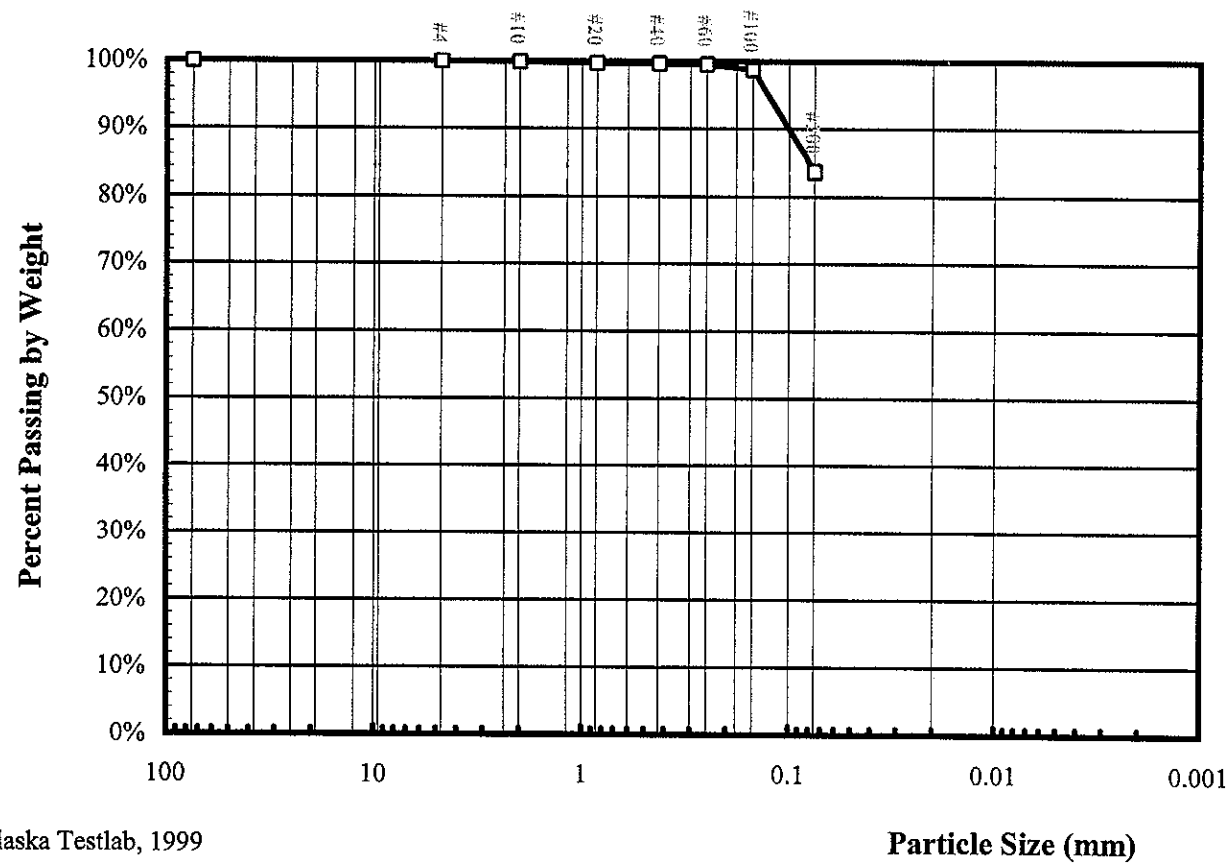
Location: Test Boring 52
Sample 1A
Depth 1' - 2'

Engineering Classification: SILT with Sand, ML
Frost Classification: F4

PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D
Lab No. 2006-696
Received: 6/1/06
Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"		
No. 4	100%	
Total Wt. = 301.8g		
No. 8		
No. 10	100%	
No. 16		
No. 20	100%	
No. 30		
No. 40	100%	
No. 50		
No. 60	100%	
No. 80		
No. 100	99%	
No. 200	84%	
Total Wt. of Fine Fraction = 112.5g		
0.02 mm		

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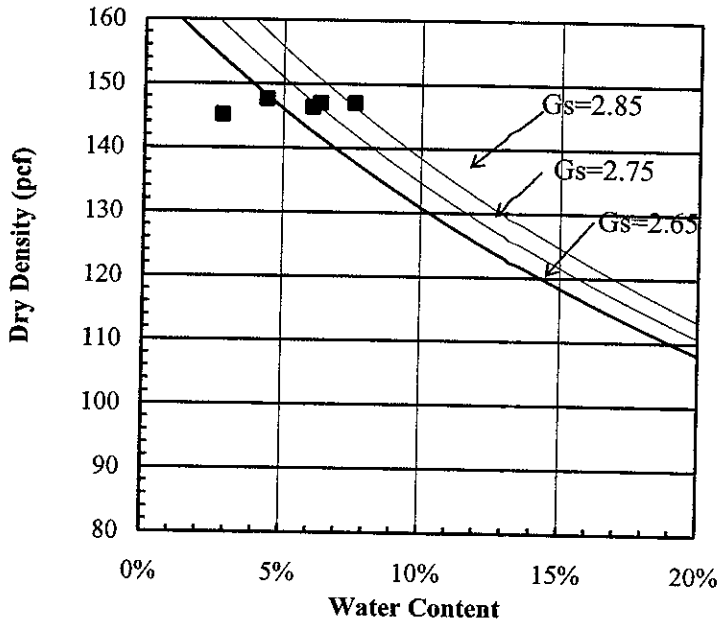
MODIFIED PROCTOR

AASHTO T-180 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 55
Sample 1
Depth 0.3'-2.5'

W.O. D59119D
Lab No. 2005-2954
Received: 12/2/05
Reported: 12/20/05

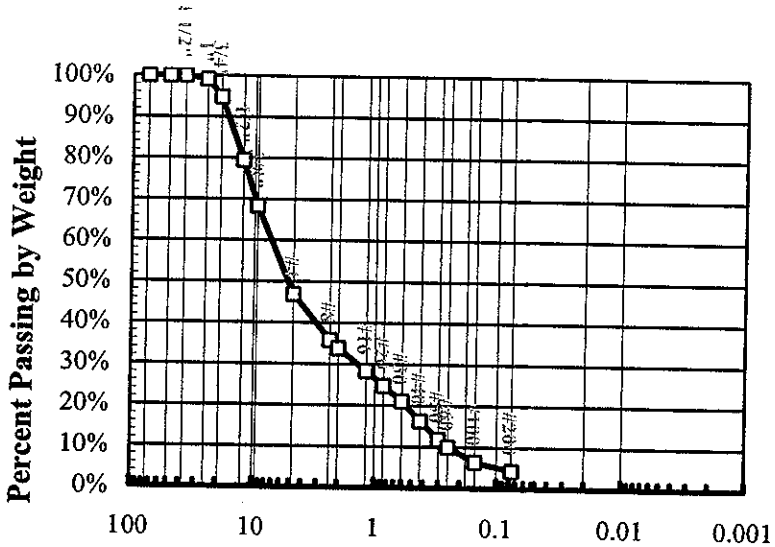
Engineering Classification: Well Graded GRAVEL with Sand, GW
Frost Classification: Not Measured



Uncorrected
Maximum Density: 147.7 pcf
Optimum Water Content: 4.4 %

Corrected Density: 148.5 pcf
Corrected Optimum: 4 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"		
1 1/2"	100%	
1"	99%	
3/4"	95%	
1/2"	79%	
3/8"	68%	
No. 4	47%	
Total Wt. = 13665g		
No. 8	36%	
No. 10		
No. 16	28%	
No. 20	25%	
No. 30	21%	
No. 40	16%	
No. 50	12%	
No. 60	10%	
No. 80		
No.100	6%	
No.200	4.3%	
Total Wt. of Fine Fraction = 556.2g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

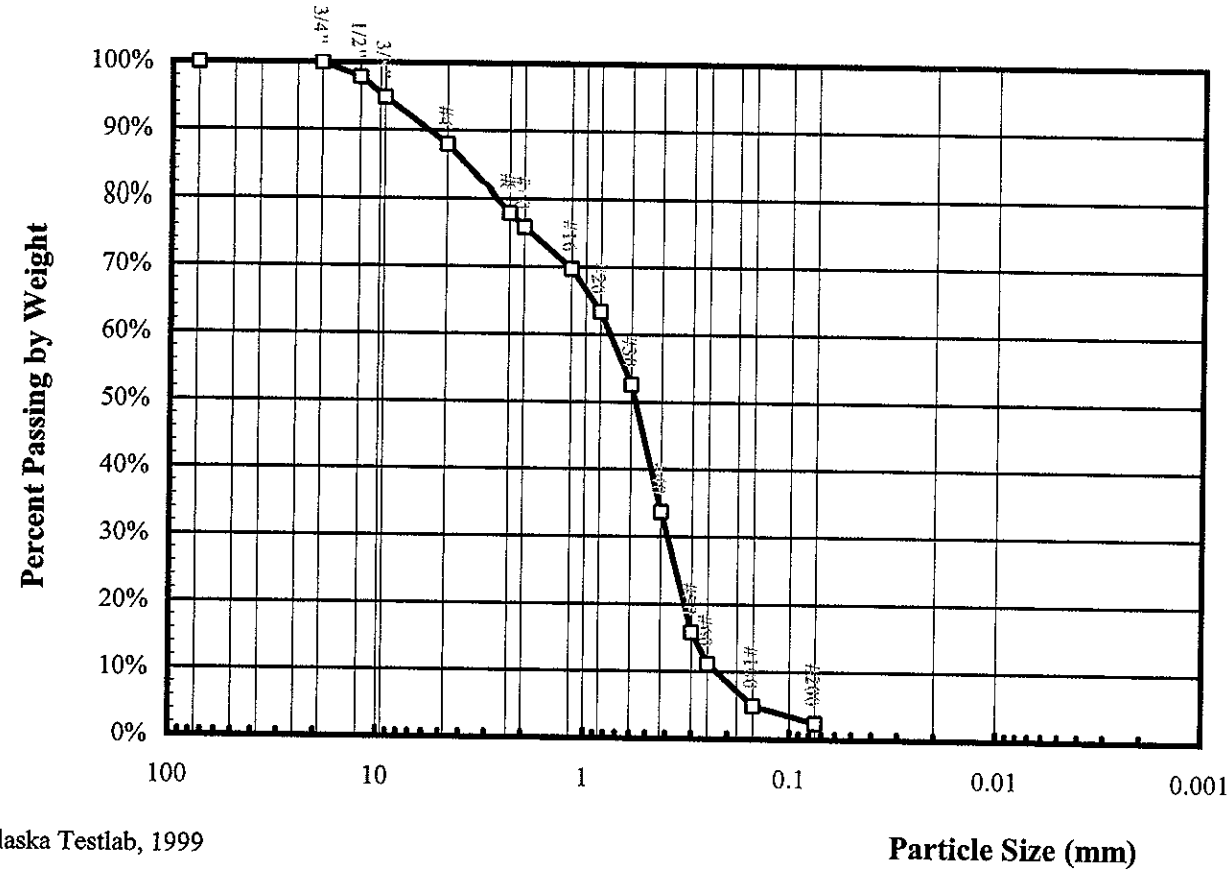
Location: Test Boring 57
Sample 4
Depth 10'-11.5'

Engineering Classification: Poorly Graded SAND , SP

Frost Classification: NFS MOA

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2955
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	98%	
3/8"	95%	
No. 4	88%	
Total Wt. = 495.9g		
No. 8	78%	
No. 10	76%	
No. 16	70%	
No. 20	63%	
No. 30	53%	
No. 40	34%	
No. 50	16%	
No. 60	11%	
No. 80		
No. 100	5%	
No. 200	2.4%	
Total Wt. of Fine Fraction = 435.8g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 60

Sample 1

Depth 0.3'-1'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

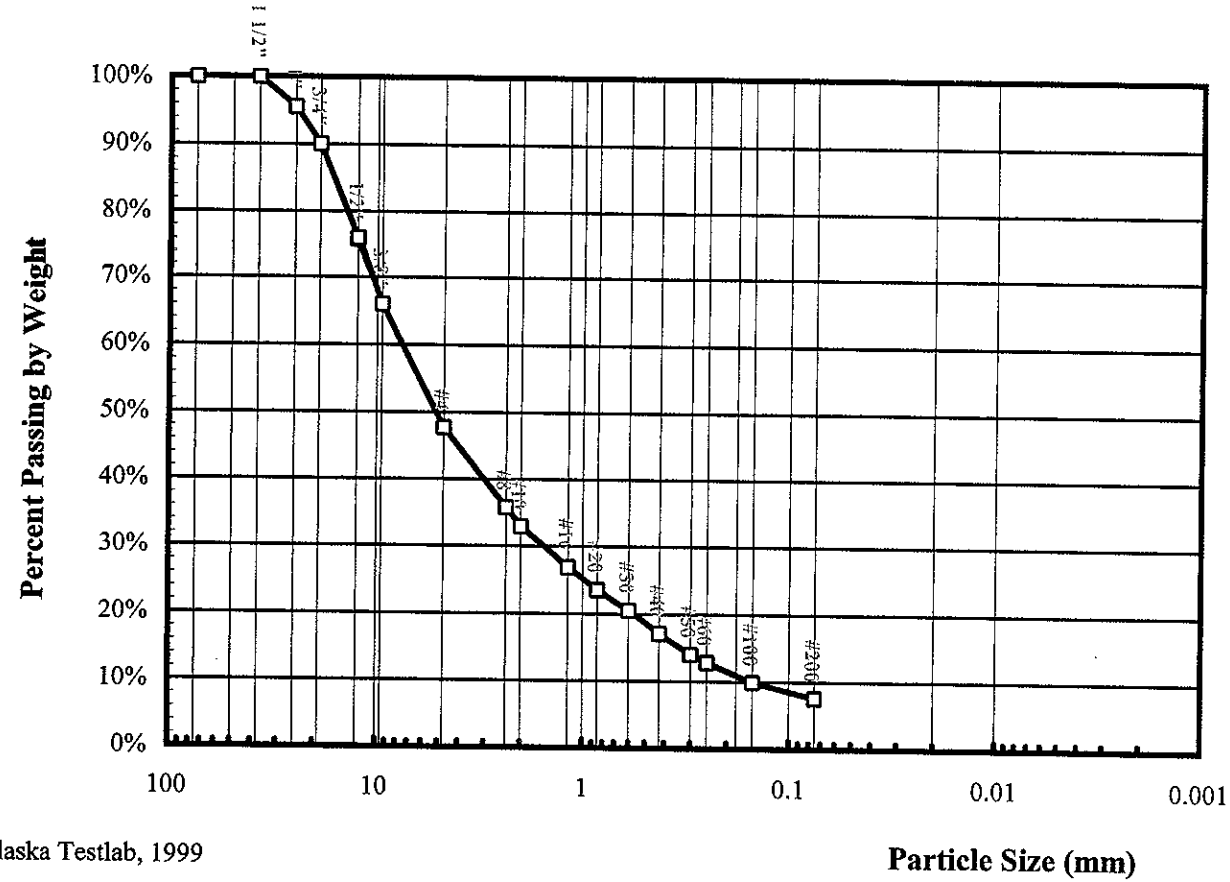
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2956

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	95%	
3/4"	90%	
1/2"	76%	
3/8"	66%	
No. 4	48%	
Total Wt. = 4727g		
No. 8	36%	
No. 10	33%	
No. 16	27%	
No. 20	24%	
No. 30	21%	
No. 40	17%	
No. 50	14%	
No. 60	13%	
No. 80		
No. 100	10%	
No. 200	7.6%	
Total Wt. of Fine Fraction = 564.1g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 61

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

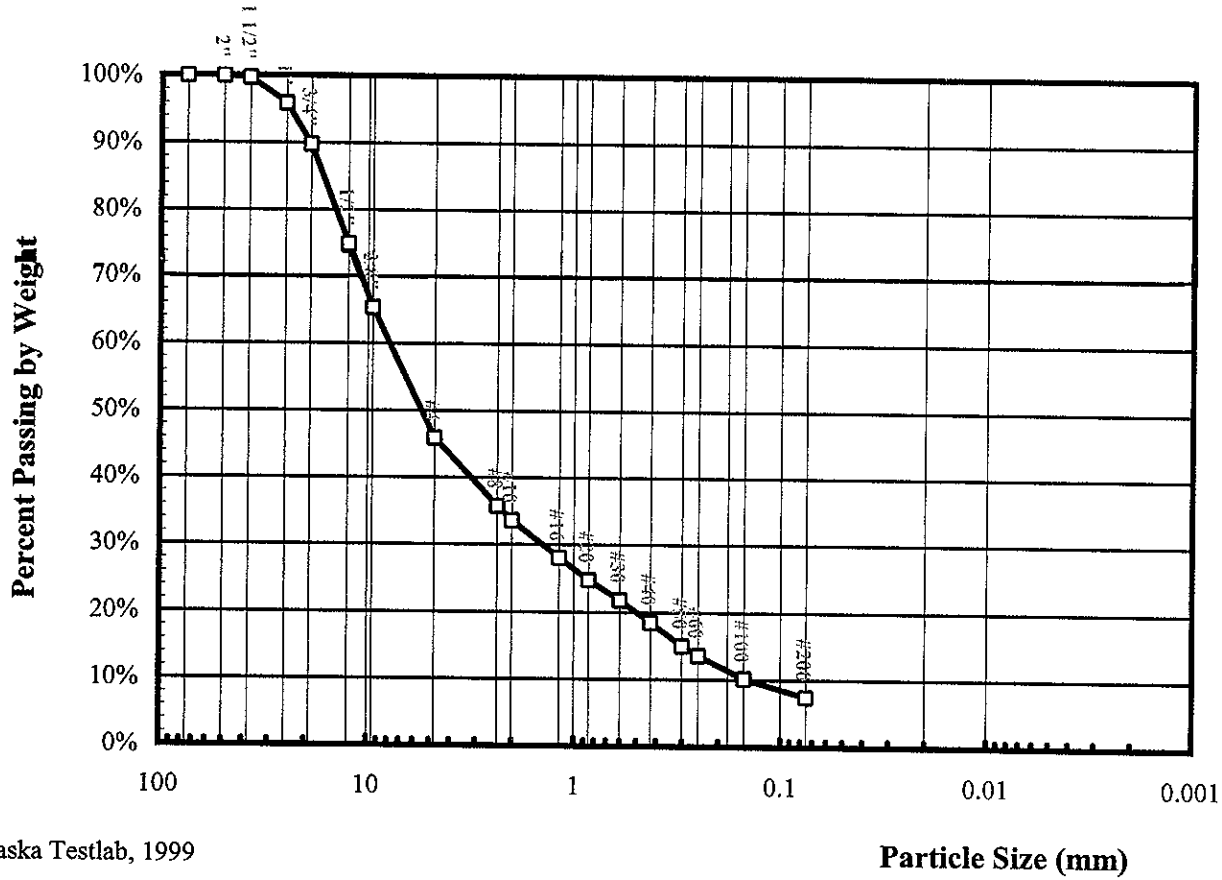
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2957

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	100%	
1"	96%	
3/4"	90%	
1/2"	75%	
3/8"	65%	
No. 4	46%	
Total Wt. = 32873g		
No. 8	36%	
No. 10	34%	
No. 16	28%	
No. 20	25%	
No. 30	22%	
No. 40	18%	
No. 50	15%	
No. 60	14%	
No. 80		
No. 100	10%	
No. 200	7.4%	
Total Wt. of Fine Fraction = 509.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 61

Sample 2

Depth 3'-4.5'

Engineering Classification: Sandy SILT, ML

Frost Classification: F4

PARTICLE-SIZE

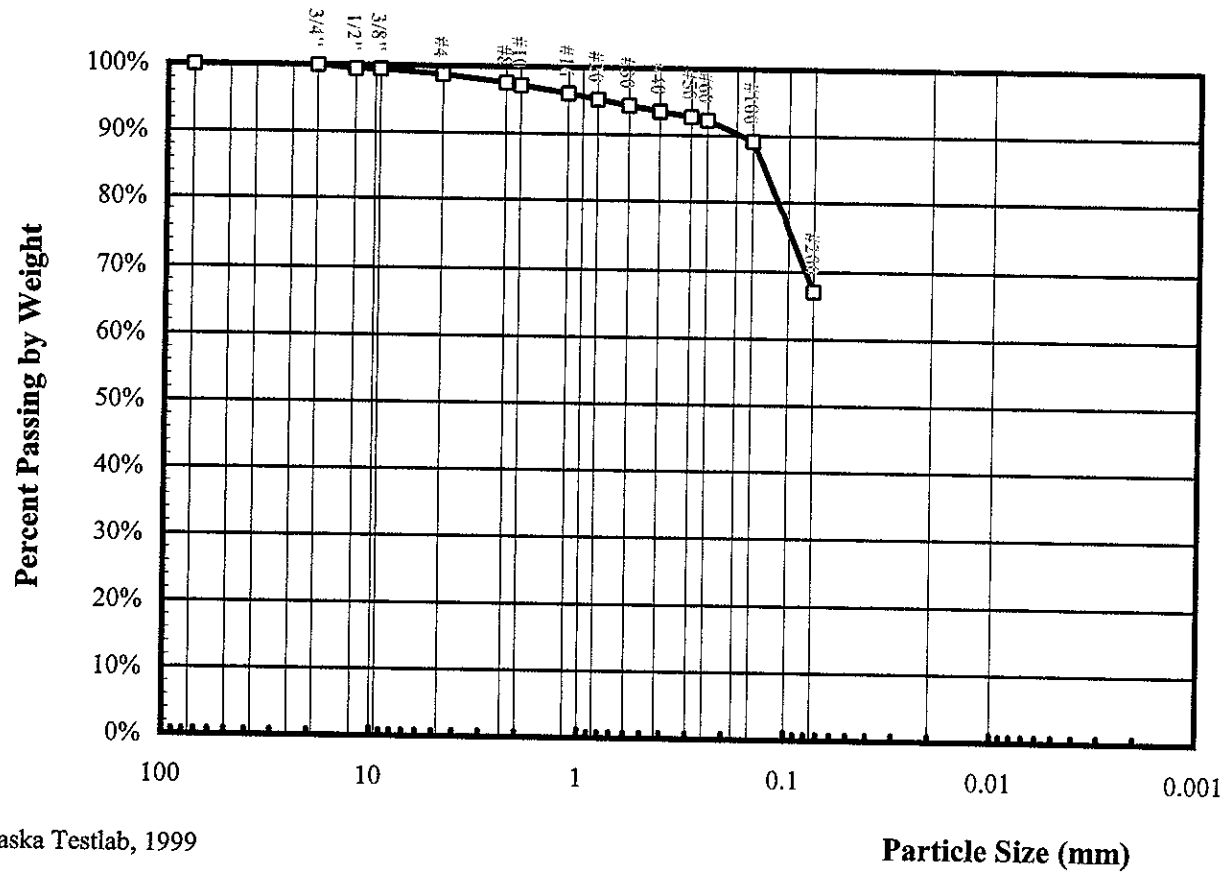
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2958

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	99%	
No. 4	99%	
Total Wt. = 245.1g		
No. 8	98%	
No. 10	97%	
No. 16	96%	
No. 20	95%	
No. 30	94%	
No. 40	94%	
No. 50	93%	
No. 60	92%	
No. 80		
No. 100	89%	
No. 200	67%	
Total Wt. of Fine Fraction = 241.7g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 63

Sample 1

Depth 0' - 2'

Engineering Classification: Sandy SILT, ML

Frost Classification: F4

PARTICLE-SIZE

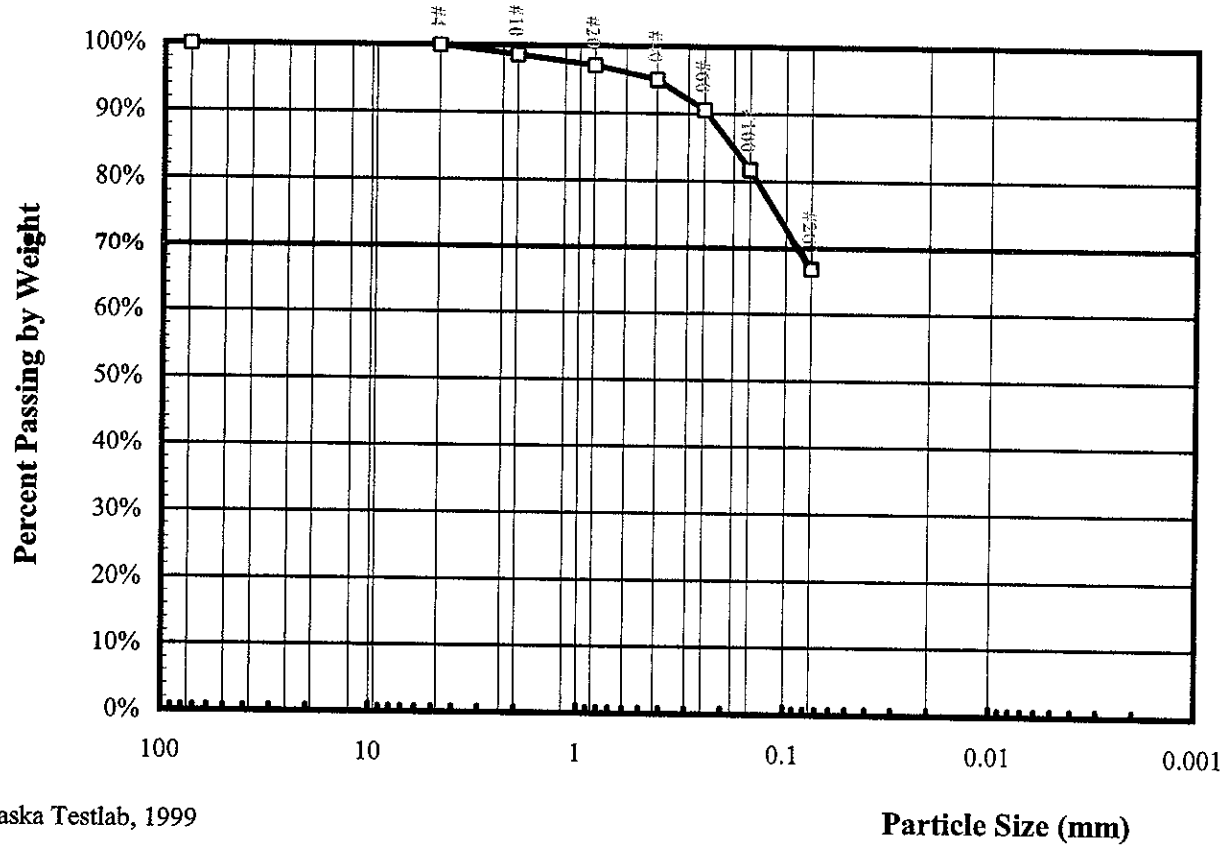
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-697

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"		
No. 4	100%	
Total Wt. = 131.5g		
No. 8		
No. 10	99%	
No. 16		
No. 20	97%	
No. 30		
No. 40	95%	
No. 50		
No. 60	91%	
No. 80		
No. 100	82%	
No. 200	67%	
Total Wt. of Fine Fraction = 131.5g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 67

Sample 2

Depth 5' - 7'

Engineering Classification: Sandy SILT, ML

Frost Classification: F4

PARTICLE-SIZE

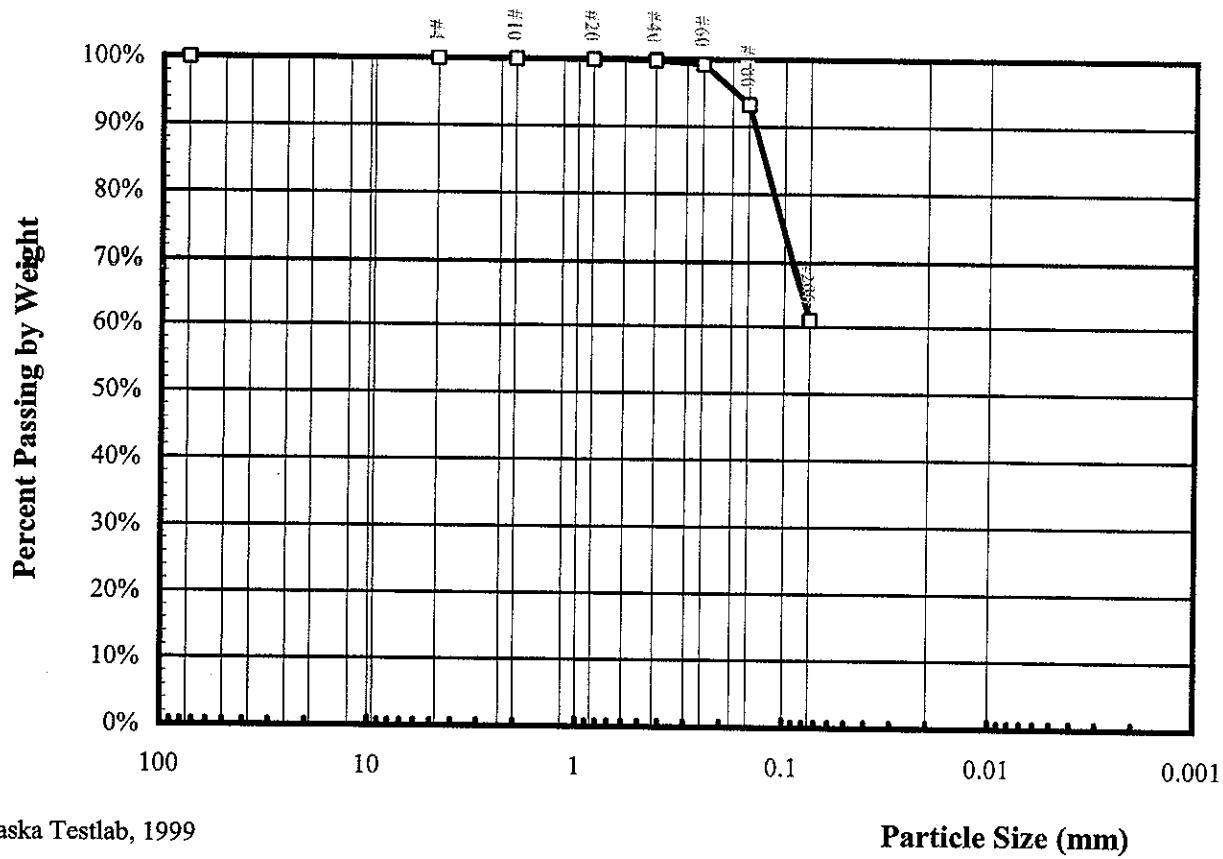
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-698

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"		
No. 4	100%	
Total Wt. = 329.8g		
No. 8		
No. 10	100%	
No. 16		
No. 20	100%	
No. 30		
No. 40	100%	
No. 50		
No. 60	99%	
No. 80		
No. 100	93%	
No. 200	61%	
Total Wt. of Fine Fraction = 327.5g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 68

Sample 1

Depth 0'-1'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

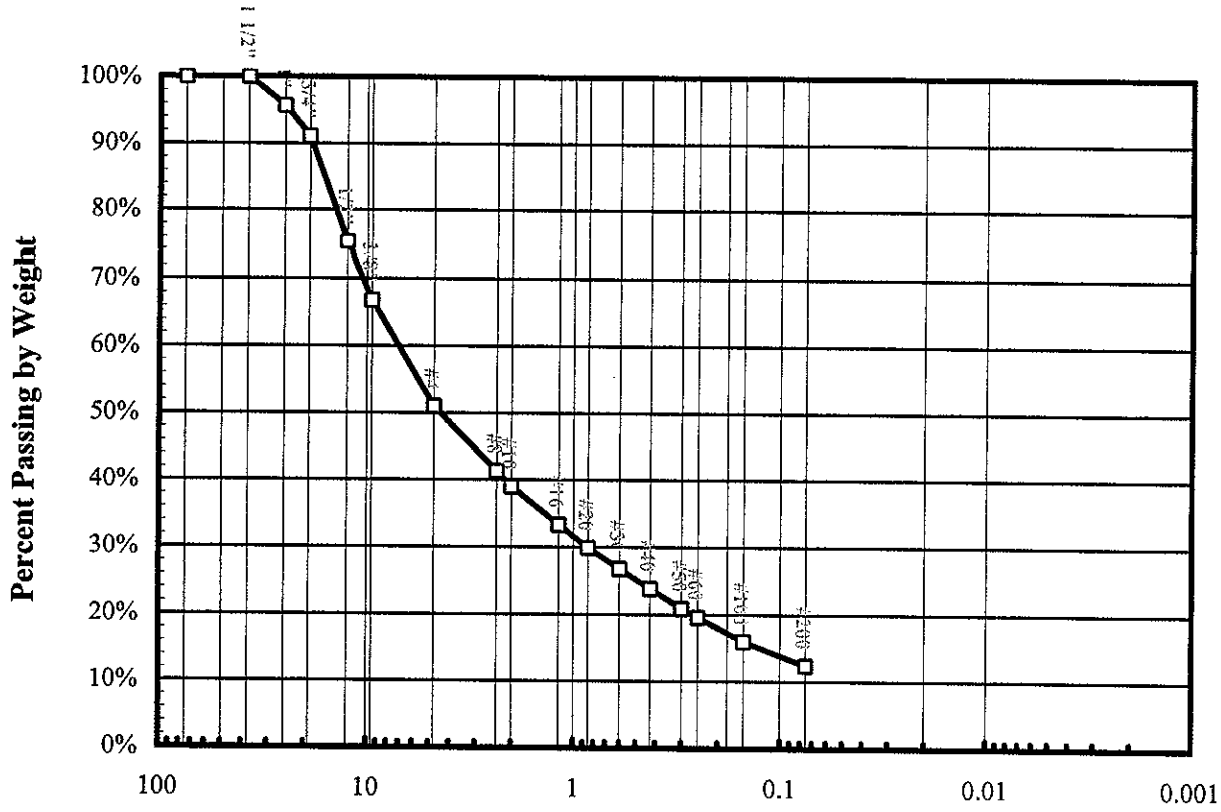
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2959

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	96%	
3/4"	91%	
1/2"	75%	
3/8"	67%	
No. 4	51%	
Total Wt. = 3572g		
No. 8	41%	
No. 10	39%	
No. 16	33%	
No. 20	30%	
No. 30	27%	
No. 40	24%	
No. 50	21%	
No. 60	20%	
No. 80		
No. 100	16%	
No. 200	12%	
Total Wt. of Fine Fraction = 549.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 71

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

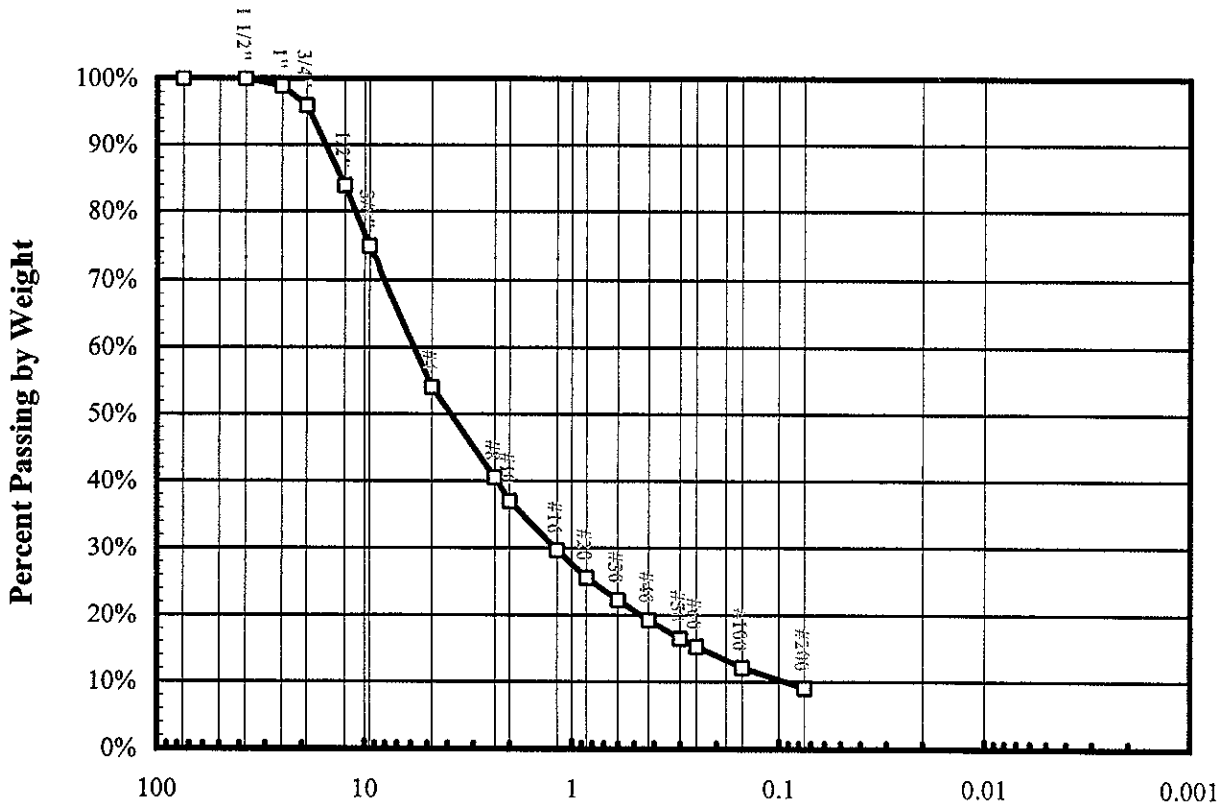
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2960

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	99%	
3/4"	96%	
1/2"	84%	
3/8"	75%	
No. 4	54%	
Total Wt. = 23764g		
No. 8	41%	
No. 10	37%	
No. 16	30%	
No. 20	26%	
No. 30	22%	
No. 40	19%	
No. 50	16%	
No. 60	15%	
No. 80		
No. 100	12%	
No. 200	9.1%	
Total Wt. of Fine Fraction = 619.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 76

Sample 3

Depth 7.5' - 9.5'

Engineering Classification: Poorly Graded SAND with Silt and Gravel, SP-SM

Frost Classification: Not Measured

PARTICLE-SIZE

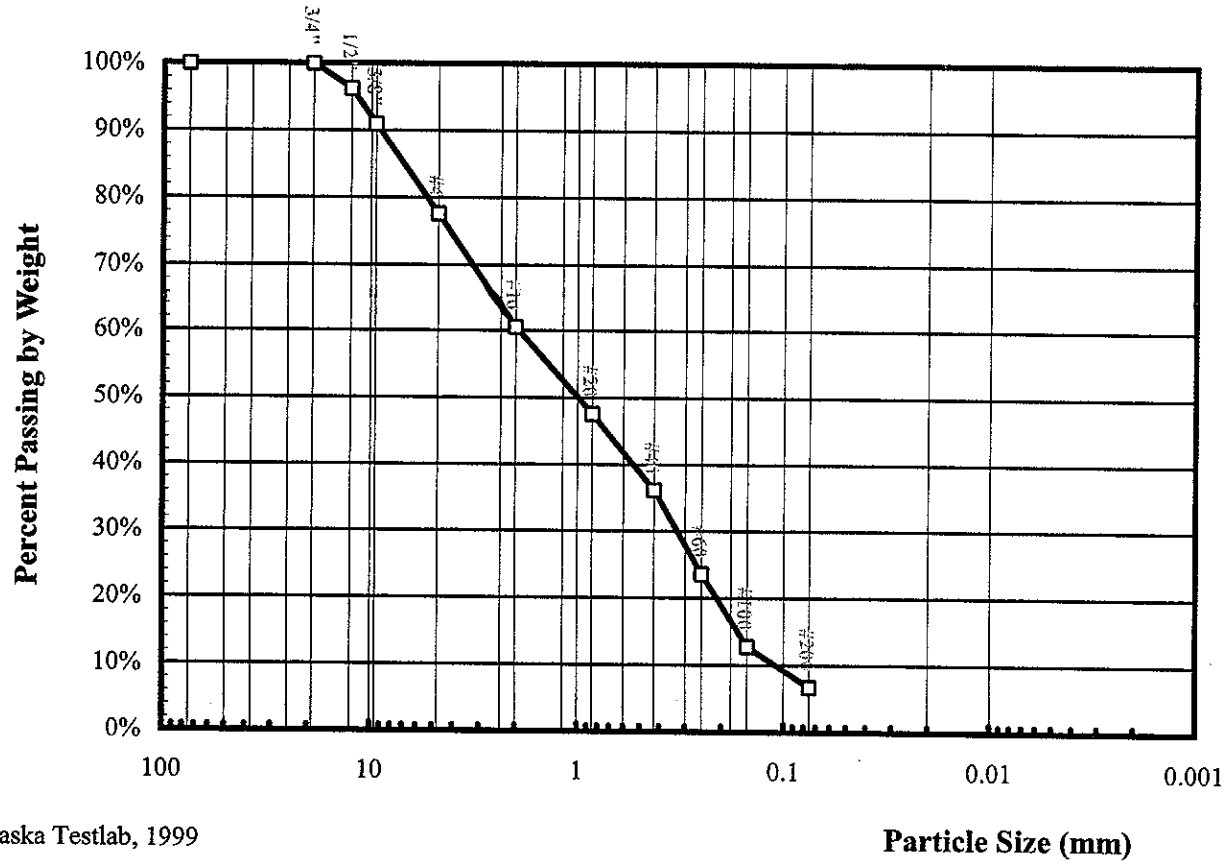
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-699

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	96%	
3/8"	91%	
No. 4	78%	
Total Wt. = 425.4g		
No. 8		
No. 10	61%	
No. 16		
No. 20	48%	
No. 30		
No. 40	36%	
No. 50		
No. 60	24%	
No. 80		
No. 100	13%	
No. 200	6.7%	
Total Wt. of Fine Fraction = 329.9g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 77

Sample 4

Depth 10' - 12'

Engineering Classification: Silty SAND with Gravel, SM

Frost Classification: Not Measured

PARTICLE-SIZE

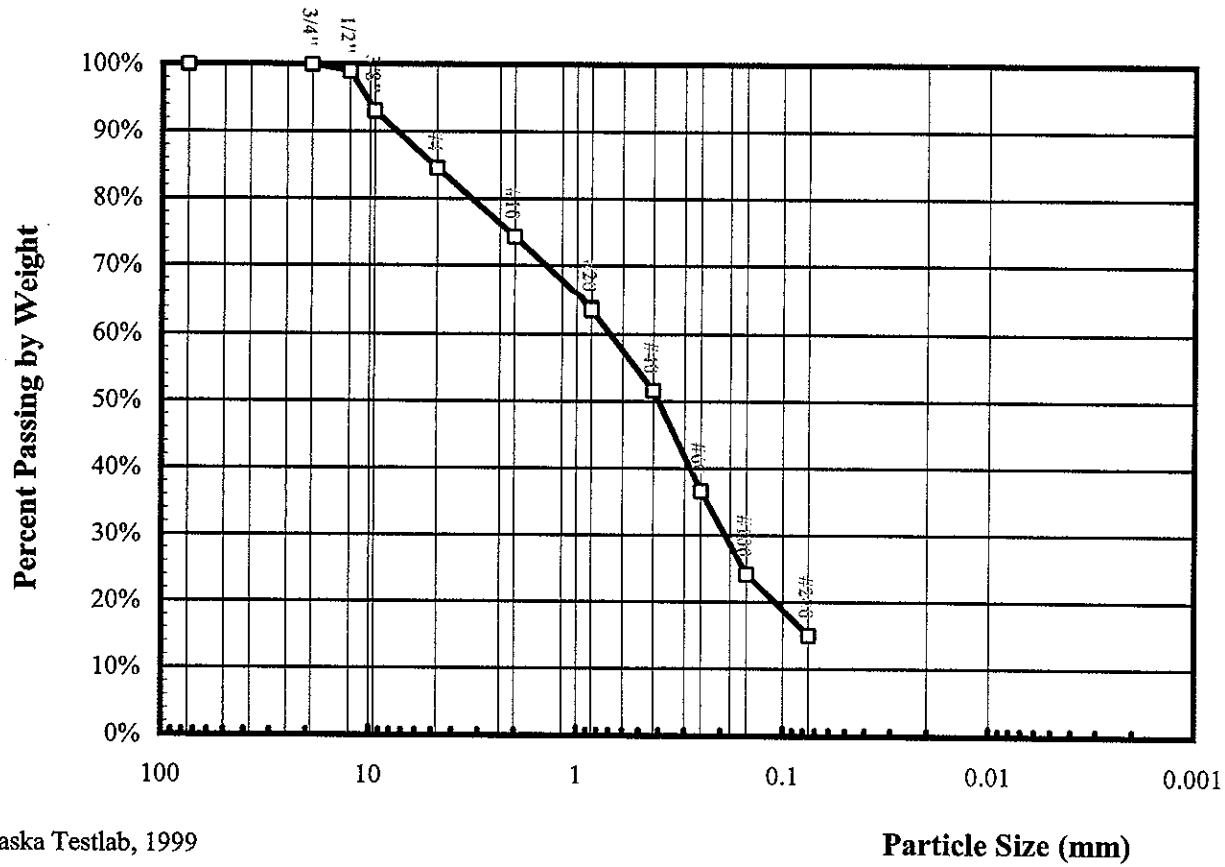
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-700

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	93%	
No. 4	85%	
Total Wt. = 347.2g		
No. 8		
No. 10	74%	
No. 16		
No. 20	64%	
No. 30		
No. 40	52%	
No. 50		
No. 60	37%	
No. 80		
No. 100	24%	
No. 200	15%	
Total Wt. of Fine Fraction = 293.5g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 79

Sample 1

Depth 0.5'-1.5'

Engineering Classification: Poorly Graded GRAVEL with Sand, GP

Frost Classification: Not Measured

PARTICLE-SIZE

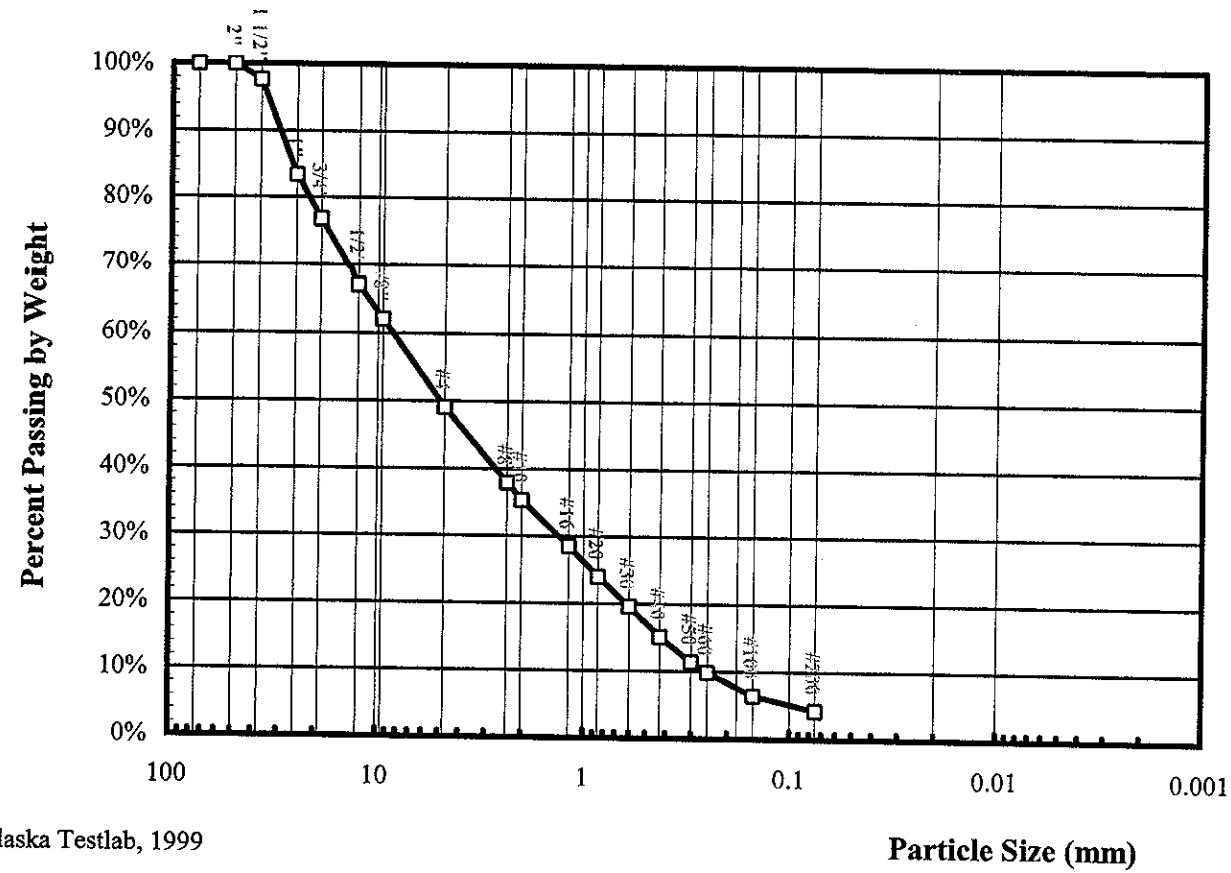
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2961

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	98%	
1"	83%	
3/4"	77%	
1/2"	67%	
3/8"	62%	
No. 4	49%	
Total Wt. = 3860g		
No. 8	38%	
No. 10	35%	
No. 16	29%	
No. 20	24%	
No. 30	20%	
No. 40	15%	
No. 50	11%	
No. 60	10%	
No. 80		
No. 100	6%	
No. 200	4.3%	
Total Wt. of Fine Fraction = 553.4g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 80

Sample 1

Depth 1' - 2'

Engineering Classification: Poorly Graded SAND with Gravel, SP

Frost Classification: Not Measured

PARTICLE-SIZE

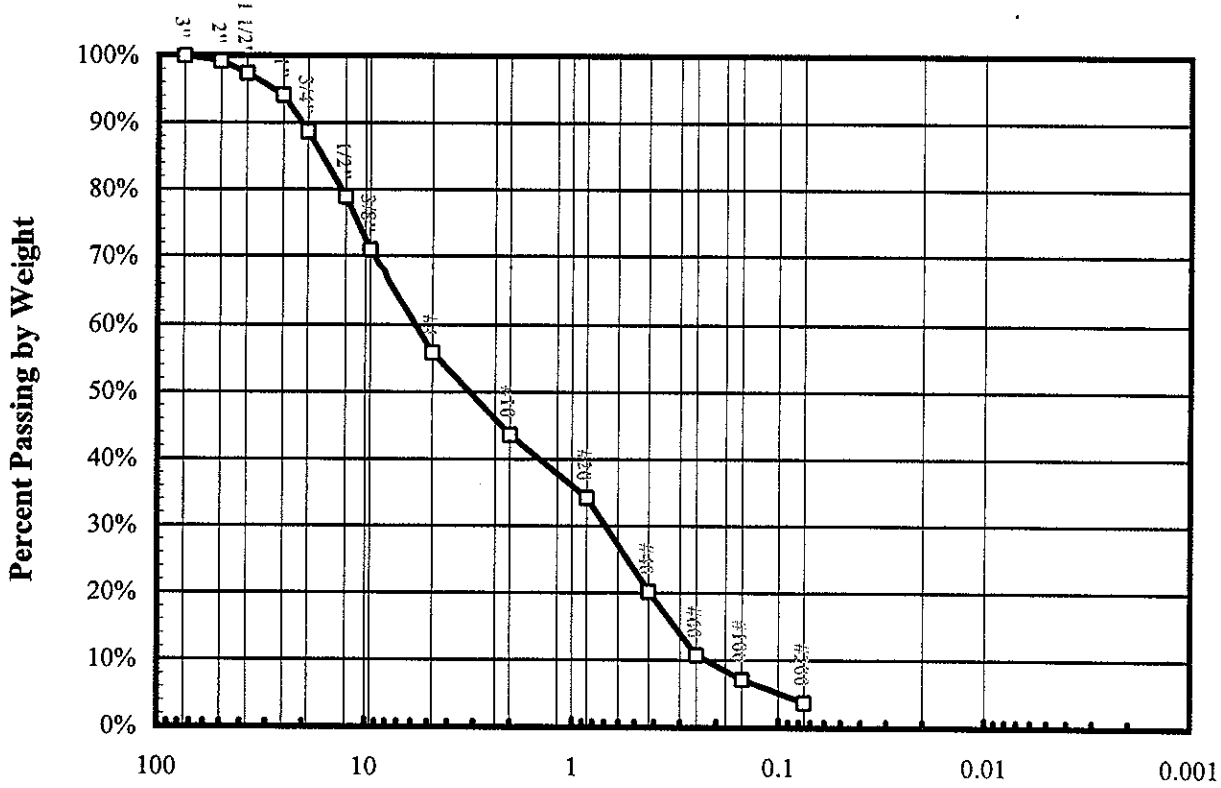
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-701

Received: 6/1/06

Reported: 6/12/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	99%	
1 1/2"	97%	
1"	94%	
3/4"	89%	
1/2"	79%	
3/8"	71%	
No. 4	56%	
Total Wt. = 28912g		
No. 8		
No. 10	44%	
No. 16		
No. 20	34%	
No. 30		
No. 40	20%	
No. 50		
No. 60	11%	
No. 80		
No. 100	7%	
No. 200	3.7%	
Total Wt. of Fine Fraction = 426g		
0.02 mm		

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ALASKA TESTLAB
A Division of DOWL LLC

Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 81

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

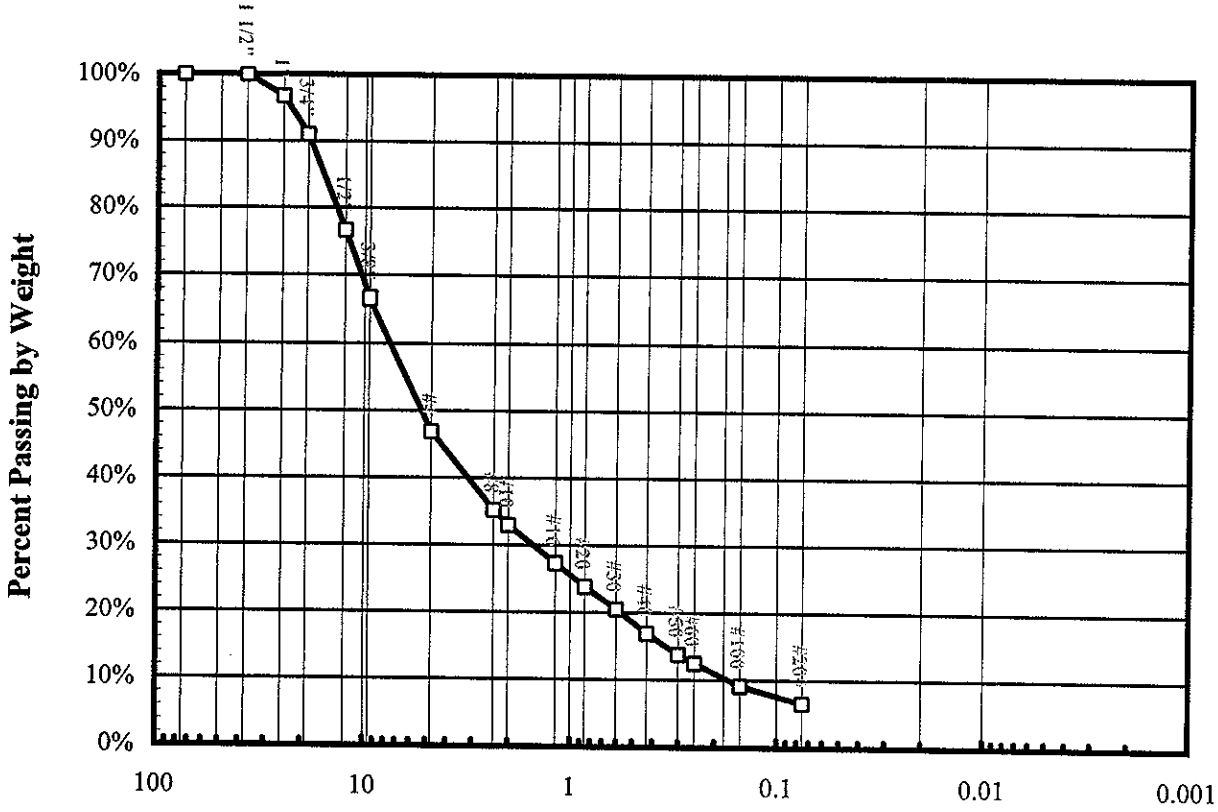
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2962

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	97%	
3/4"	91%	
1/2"	77%	
3/8"	67%	
No. 4	47%	
Total Wt. = 26287g		
No. 8	35%	
No. 10	33%	
No. 16	27%	
No. 20	24%	
No. 30	20%	
No. 40	17%	
No. 50	14%	
No. 60	12%	
No. 80		
No. 100	9%	
No. 200	6.6%	
Total Wt. of Fine Fraction = 548.3g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 82

Sample 2

Depth 5' - 6.5'

Engineering Classification: Well Graded SAND with Silt and Gravel, SW-SM

Frost Classification: Not Measured

PARTICLE-SIZE

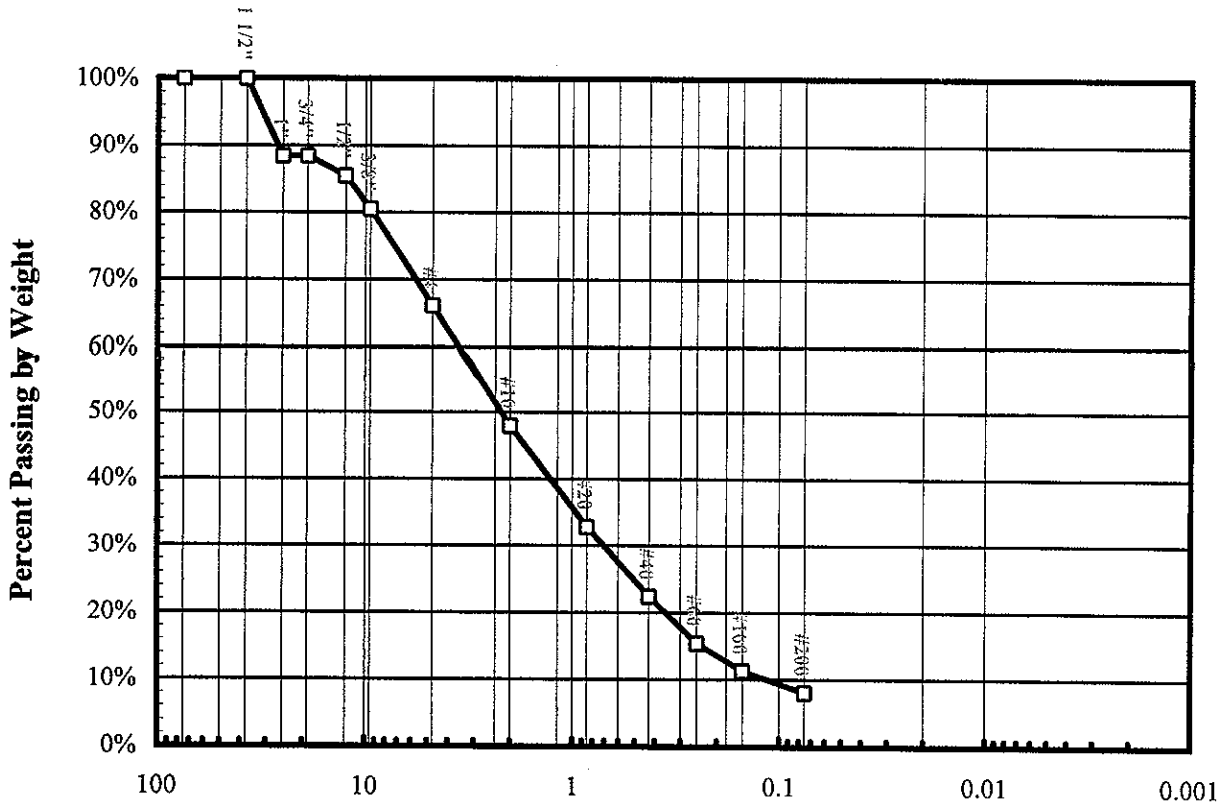
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-702

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	88%	
3/4"	88%	
1/2"	85%	
3/8"	81%	
No. 4	66%	
Total Wt. = 337.1g		
No. 8		
No. 10	48%	
No. 16		
No. 20	33%	
No. 30		
No. 40	22%	
No. 50		
No. 60	15%	
No. 80		
No. 100	11%	
No. 200	8.1%	
Total Wt. of Fine Fraction = 223.1g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

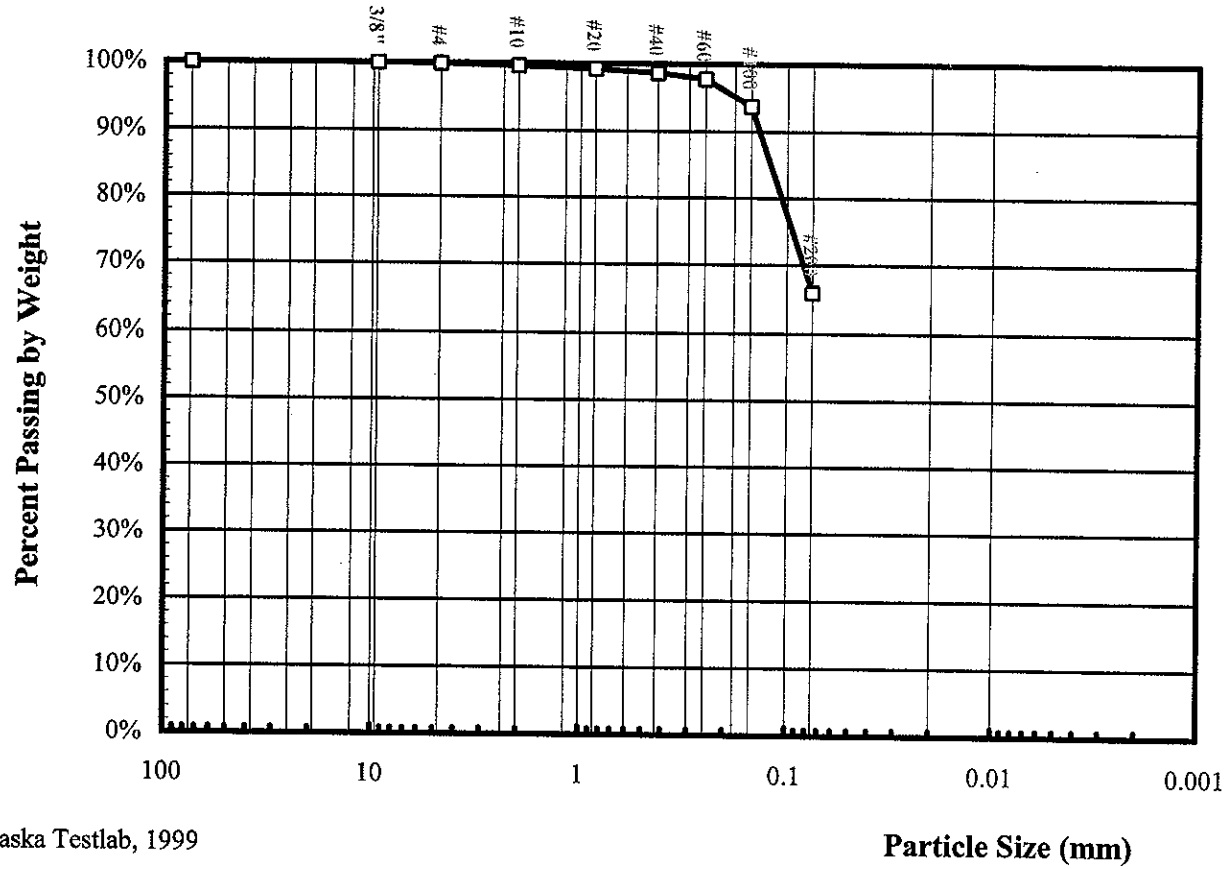
Project: Haines Highway

Location: Test Boring 85
Sample 1
Depth 0.3' - 2'

Engineering Classification: Sandy SILT, ML
Frost Classification: F4

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2006-704
Received: 6/1/06
Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"	100%	
No. 4	100%	
Total Wt. = 108.2g		
No. 8		
No. 10	100%	
No. 16		
No. 20	99%	
No. 30		
No. 40	99%	
No. 50		
No. 60	98%	
No. 80		
No. 100	94%	
No. 200	66%	
Total Wt. of Fine Fraction = 107.9g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

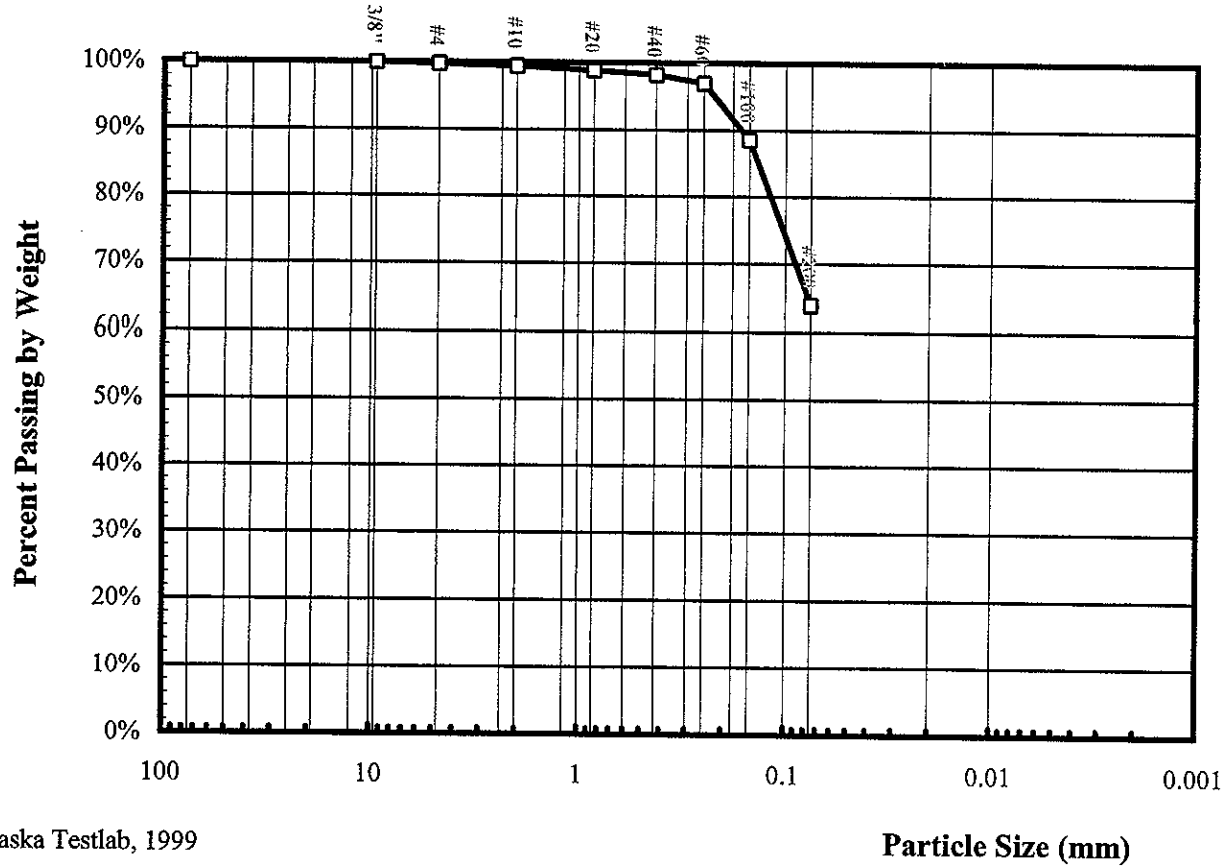
Project: Haines Highway

Location: Test Boring 86
Sample 1A
Depth 0.5' - 2'

Engineering Classification: Sandy SILT, ML
Frost Classification: F4

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2006-705
Received: 6/1/06
Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"	100%	
No. 4	100%	
Total Wt. = 261.7g		
No. 8		
No. 10	99%	
No. 16		
No. 20	99%	
No. 30		
No. 40	98%	
No. 50		
No. 60	97%	
No. 80		
No. 100	89%	
No. 200	64%	
Total Wt. of Fine Fraction = 118.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 88

Sample 1

Depth 0.3'-1'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

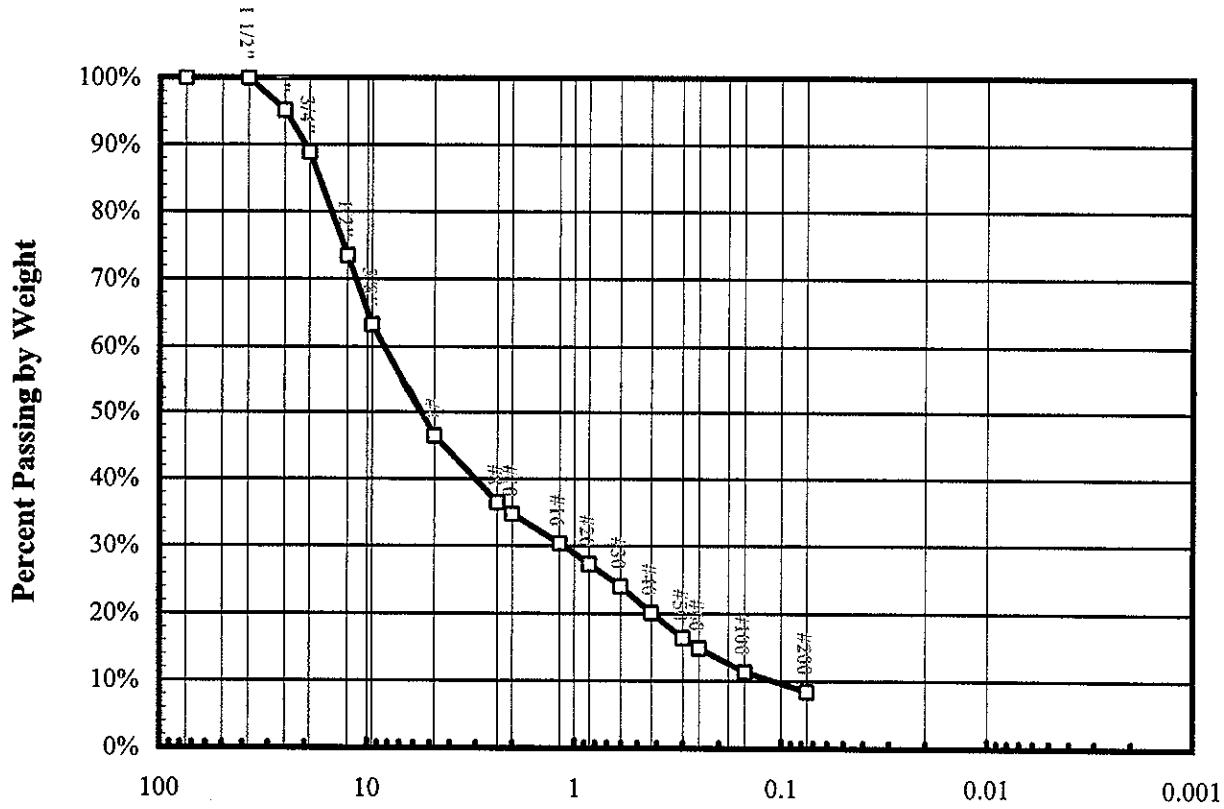
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2963

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	95%	
3/4"	89%	
1/2"	74%	
3/8"	63%	
No. 4	46%	
Total Wt. = 3929g		
No. 8	**36%**	
No. 10	35%	
No. 16	30%	
No. 20	27%	
No. 30	24%	
No. 40	20%	
No. 50	16%	
No. 60	15%	
No. 80		
No. 100	11%	
No. 200	8.4%	
Total Wt. of Fine Fraction = 529.5g		
0.02 mm		

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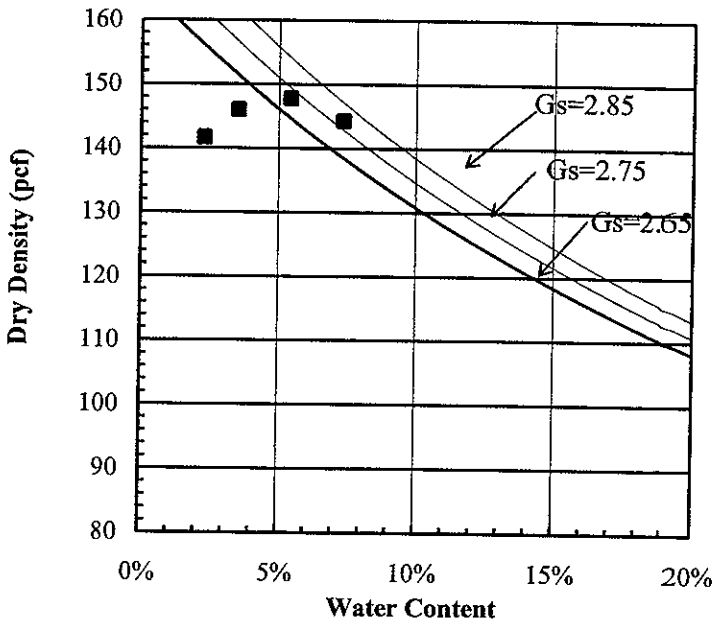
MODIFIED PROCTOR

AASHTO T-180 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 90
Sample 1
Depth 0.3'-3'

W.O. D59119D
Lab No. 2005-2964
Received: 12/2/05
Reported: 12/19/05

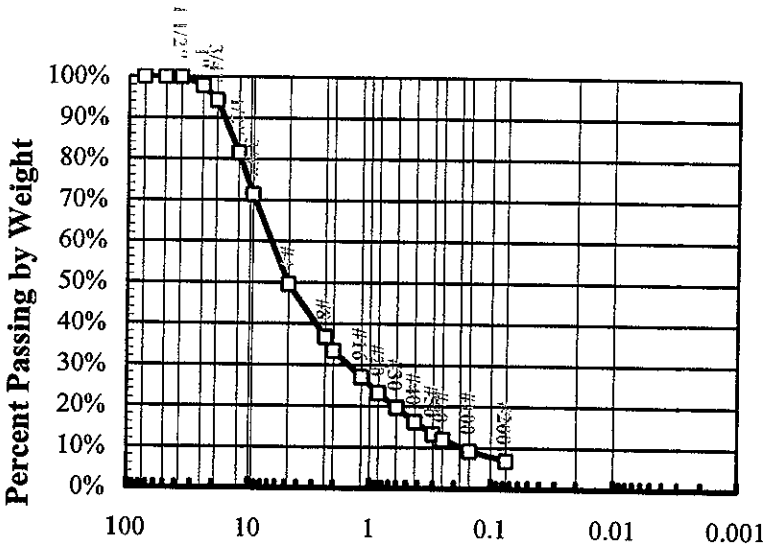
Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM
Frost Classification: Not Measured



Uncorrected
Maximum Density: 147.8 pcf
Optimum Water Content: 5.4 %

Corrected Density: 148.5 pcf
Corrected Optimum: 5 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	94%	
1/2"	81%	
3/8"	71%	
No. 4	50%	
Total Wt. = 24979g		
No. 8	37%	
No. 10		
No. 16	27%	
No. 20	23%	
No. 30	20%	
No. 40	16%	
No. 50	13%	
No. 60	12%	
No. 80		
No.100	9%	
No.200	6.8%	
Total Wt. of Fine Fraction = 530.2g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 91

Sample 1

Depth 0.3'-1'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

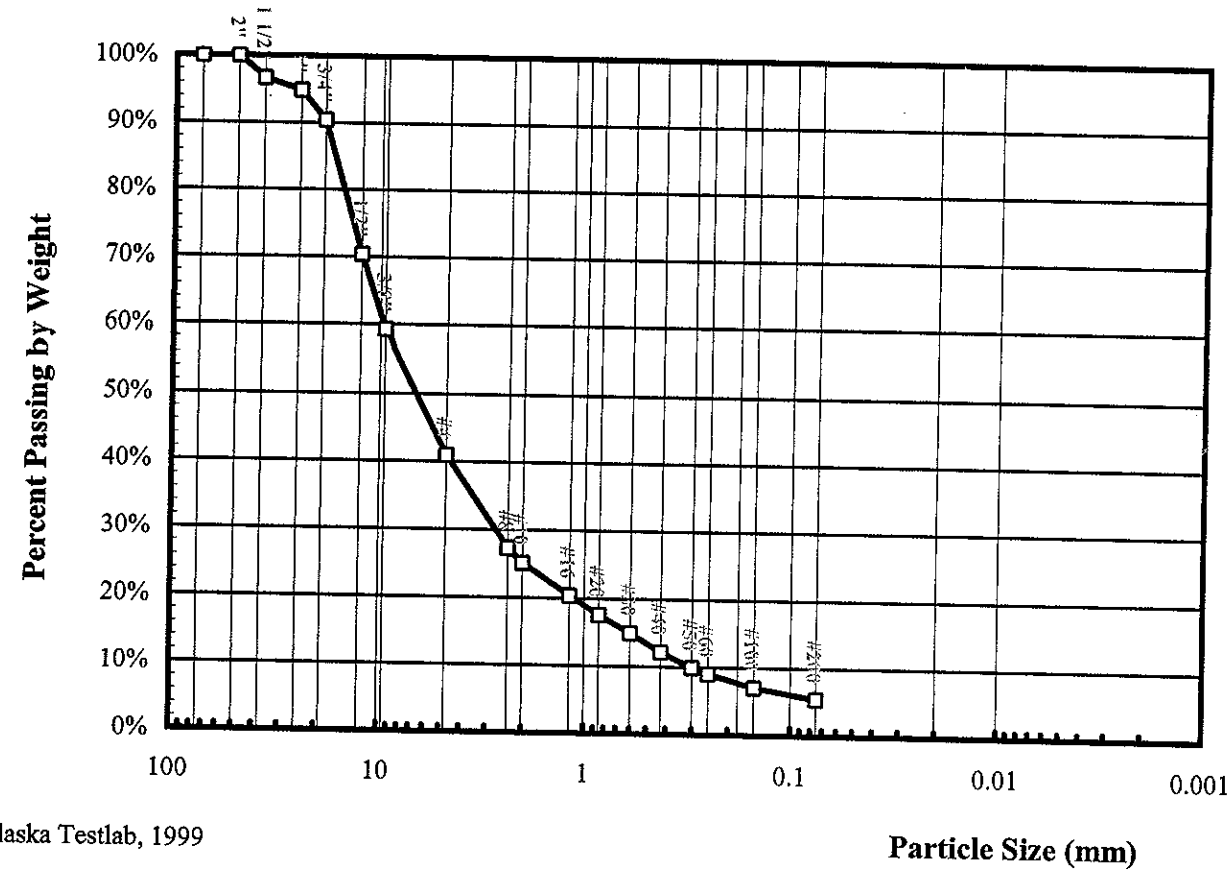
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2965

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	97%	
1"	95%	
3/4"	90%	
1/2"	70%	
3/8"	59%	
No. 4	41%	
Total Wt. = 5222.1g		
No. 8	27%	
No. 10	25%	
No. 16	20%	
No. 20	18%	
No. 30	15%	
No. 40	12%	
No. 50	10%	
No. 60	9%	
No. 80		
No. 100	7%	
No. 200	5.4%	
Total Wt. of Fine Fraction = 517g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 92

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

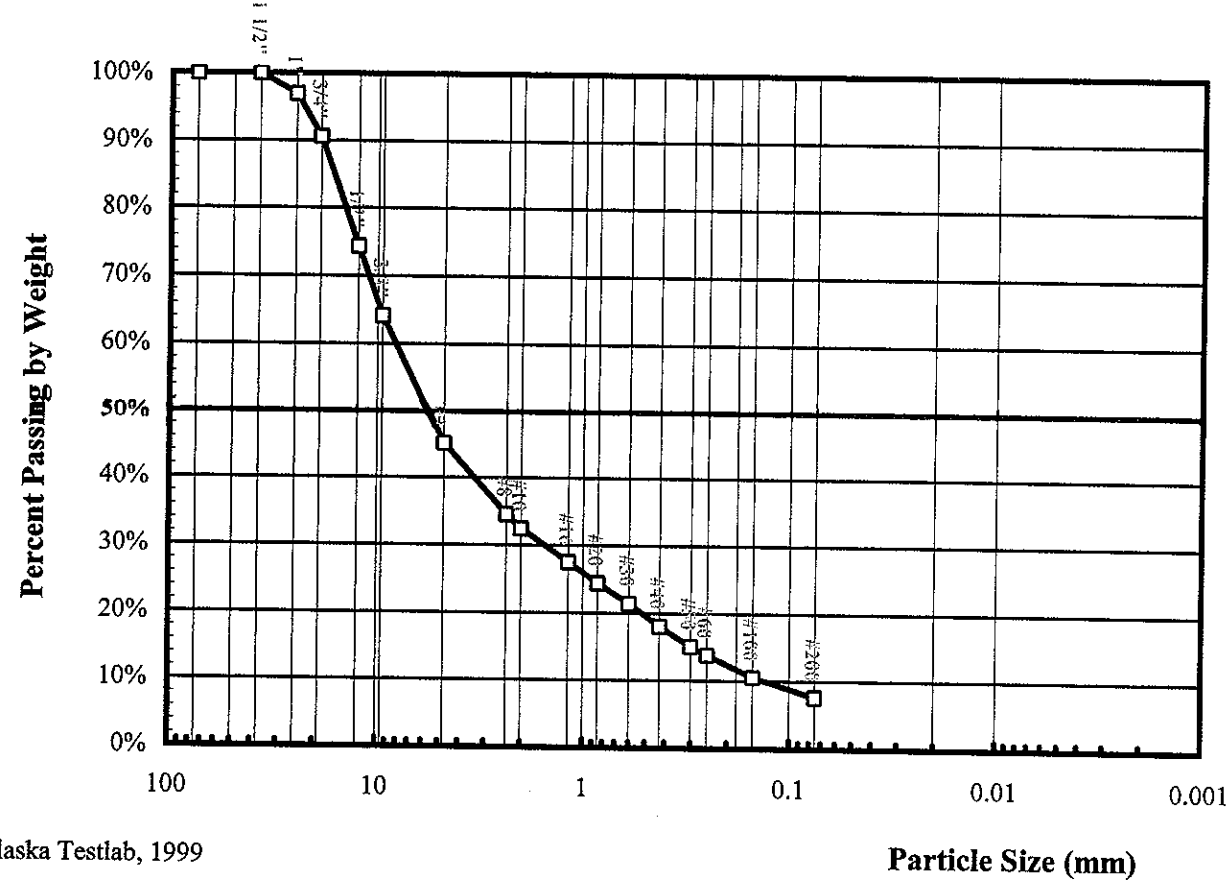
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2967

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	97%	
3/4"	91%	
1/2"	74%	
3/8"	64%	
No. 4	45%	
Total Wt. = 27623g		
No. 8	35%	
No. 10	32%	
No. 16	28%	
No. 20	24%	
No. 30	21%	
No. 40	18%	
No. 50	15%	
No. 60	14%	
No. 80		
No. 100	11%	
No. 200	7.6%	
Total Wt. of Fine Fraction = 606.9g		
0.02 mm		

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Client: ADOT&PF Southeast Region

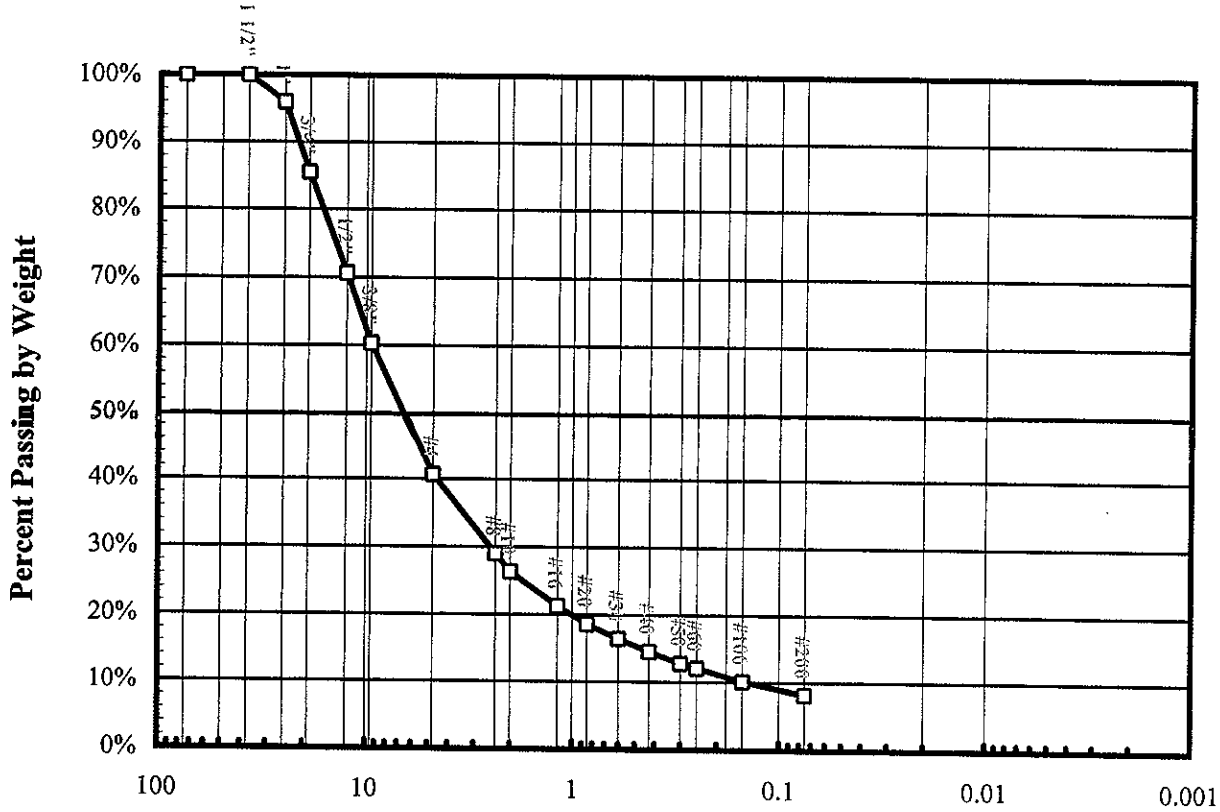
Project: Haines Highway

Location: Test Boring 92
Sample 3
Depth 5'-6.5'

Engineering Classification: Poorly Graded GRAVEL with Silt and Sand, GP-GM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2968
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	96%	
3/4"	86%	
1/2"	71%	
3/8"	60%	
No. 4	41%	
Total Wt. = 1143.9g		
No. 8	29%	
No. 10	26%	
No. 16	21%	
No. 20	19%	
No. 30	16%	
No. 40	15%	
No. 50	13%	
No. 60	12%	
No. 80		
No. 100	10%	
No. 200	8.2%	
Total Wt. of Fine Fraction = 464.5g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 93

Sample 3

Depth 5'-6.5'

Engineering Classification: Well Graded GRAVEL with Sand, GW

Frost Classification: Not Measured

PARTICLE-SIZE

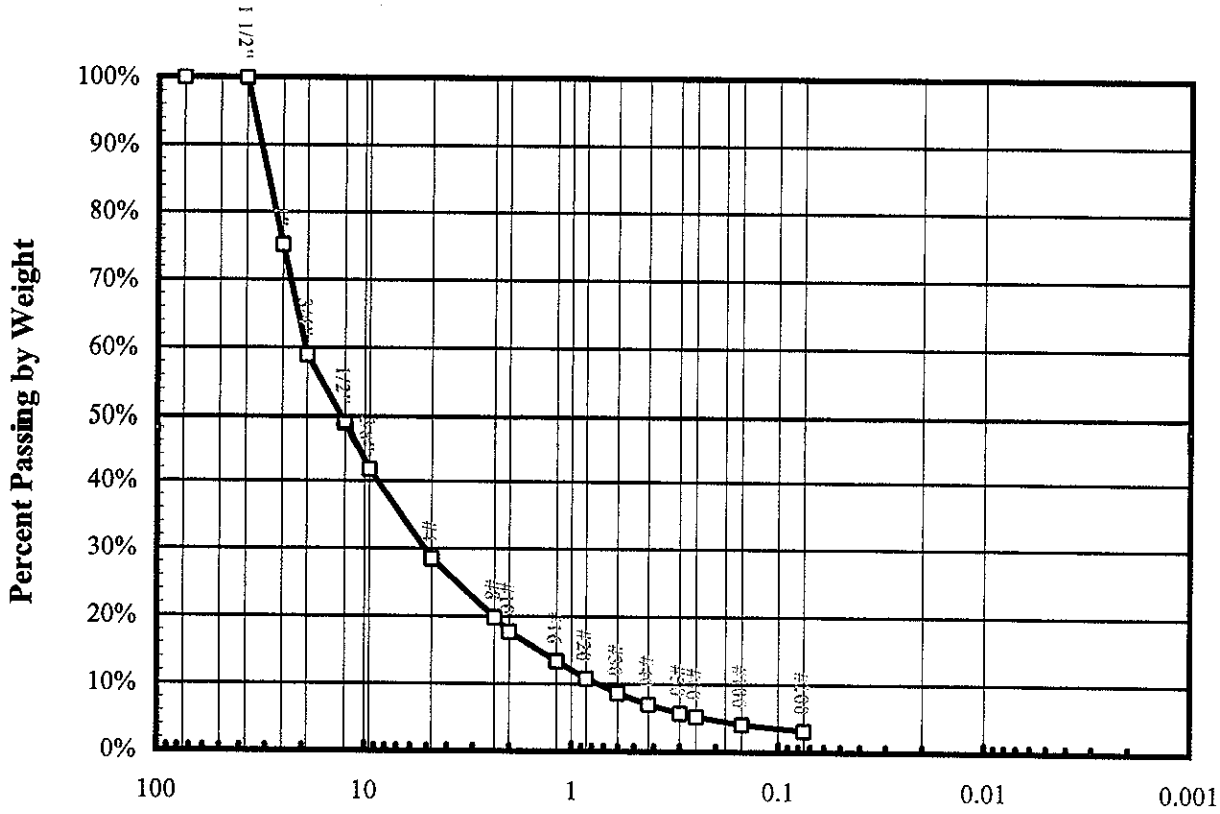
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2969

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	75%	
3/4"	59%	
1/2"	49%	
3/8"	42%	
No. 4	28%	
Total Wt. = 1072g		
No. 8	20%	
No. 10	18%	
No. 16	13%	
No. 20	11%	
No. 30	9%	
No. 40	7%	
No. 50	6%	
No. 60	5%	
No. 80		
No. 100	4%	
No. 200	3.1%	
Total Wt. of Fine Fraction = 304.7g		
0.02 mm		

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Client: ADOT&PF Southeast Region

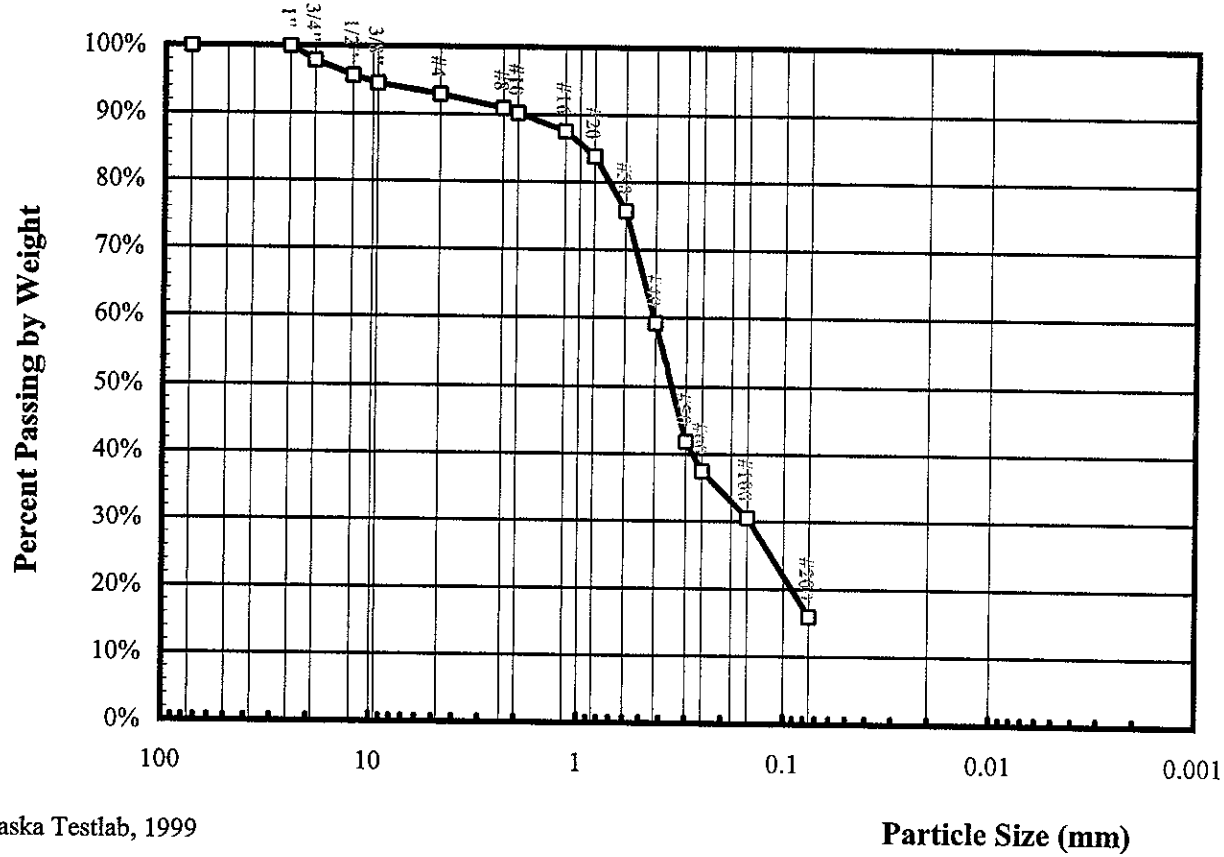
Project: Haines Highway

Location: Test Boring 93
Sample 4
Depth 10'-11.5'

Engineering Classification: Silty SAND , SM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2970
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	98%	
1/2"	96%	
3/8"	95%	
No. 4	93%	
Total Wt. = 1341.9g		
No. 8	91%	
No. 10	90%	
No. 16	88%	
No. 20	84%	
No. 30	76%	
No. 40	59%	
No. 50	42%	
No. 60	37%	
No. 80		
No. 100	31%	
No. 200	16%	
Total Wt. of Fine Fraction = 517.6g		
0.02 mm		

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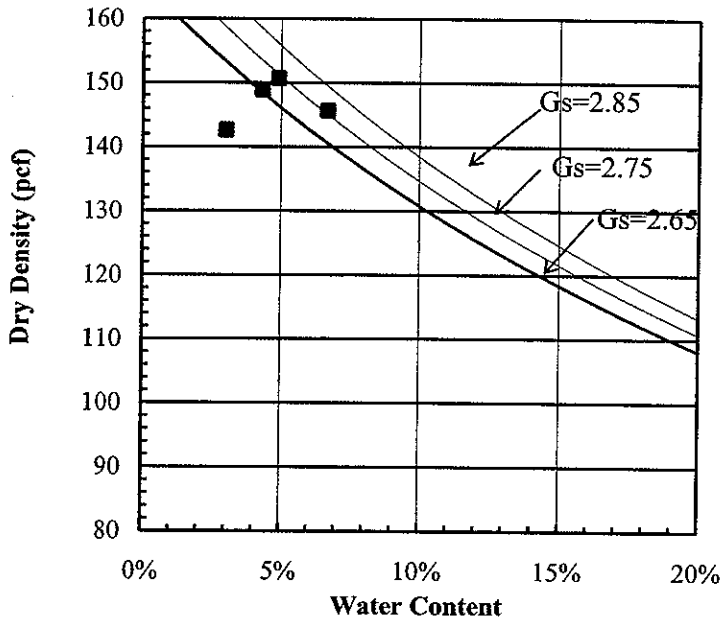
MODIFIED PROCTOR
AASHTO T-180 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 103
Sample 1
Depth 0'-3'

W.O. D59119D
Lab No. 2005-2971
Received: 12/2/05
Reported: 12/19/05

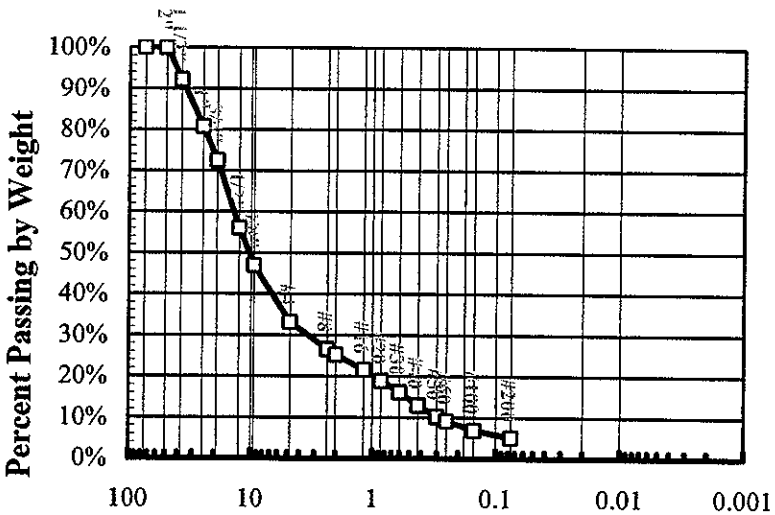
Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM
Frost Classification: Not Measured



Uncorrected
Maximum Density: 150.7 pcf
Optimum Water Content: 4.9 %

Corrected Density: 154.5 pcf
Corrected Optimum: 3.5 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"	100%	
1 1/2"	92%	
1"	81%	
3/4"	72%	
1/2"	56%	
3/8"	47%	
No. 4	33%	
Total Wt. = 19860g		
No. 8	27%	
No. 10		
No. 16	22%	
No. 20	19%	
No. 30	16%	
No. 40	13%	
No. 50	10%	
No. 60	9%	
No. 80		
No.100	7%	
No.200	5.1%	
Total Wt. of Fine Fraction = 549.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 103
Sample 2A
Depth 5.5'-6.5'

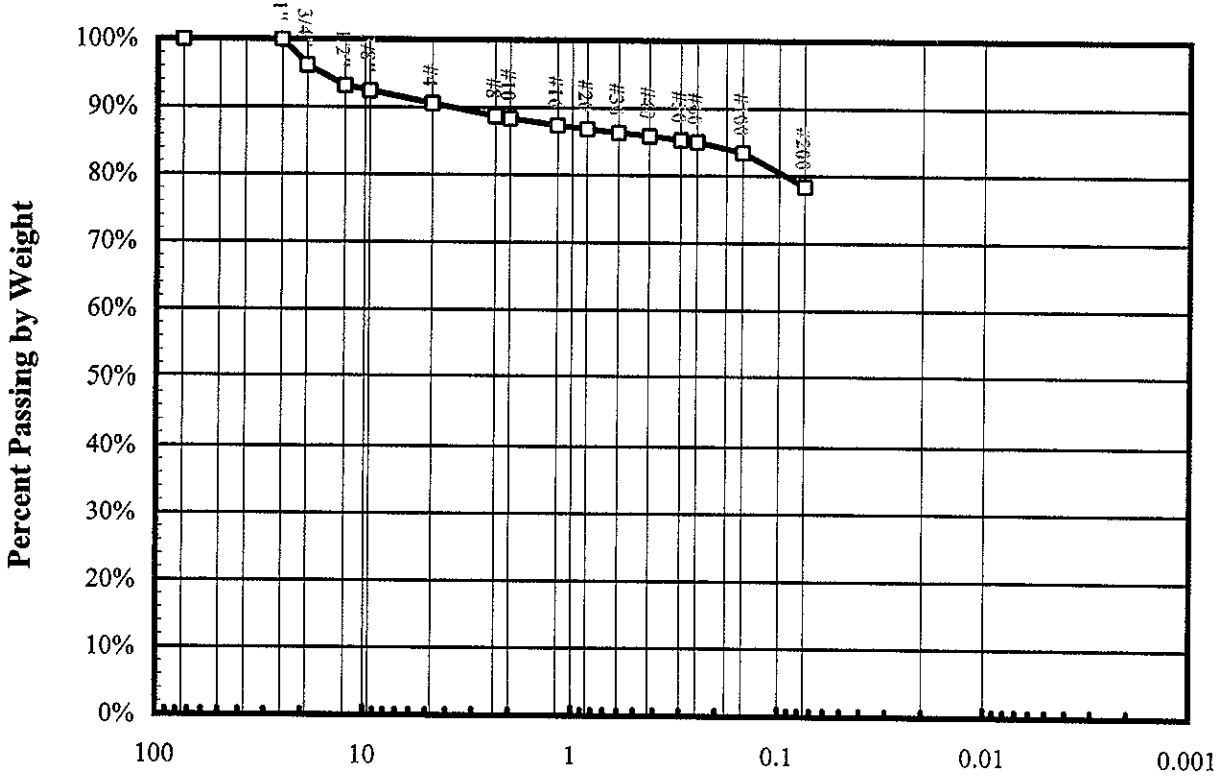
Engineering Classification: SILT with Sand, ML

Frost Classification: F4

PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2972
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	96%	
1/2"	93%	
3/8"	92%	
No. 4	91%	
Total Wt. = 553.5g		
No. 8	89%	
No. 10	88%	
No. 16	87%	
No. 20	87%	
No. 30	86%	
No. 40	86%	
No. 50	85%	
No. 60	85%	
No. 80		
No. 100	83%	
No. 200	78%	
Total Wt. of Fine Fraction = 499.7g		
0.02 mm		

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Client: ADOT&PF Southeast Region

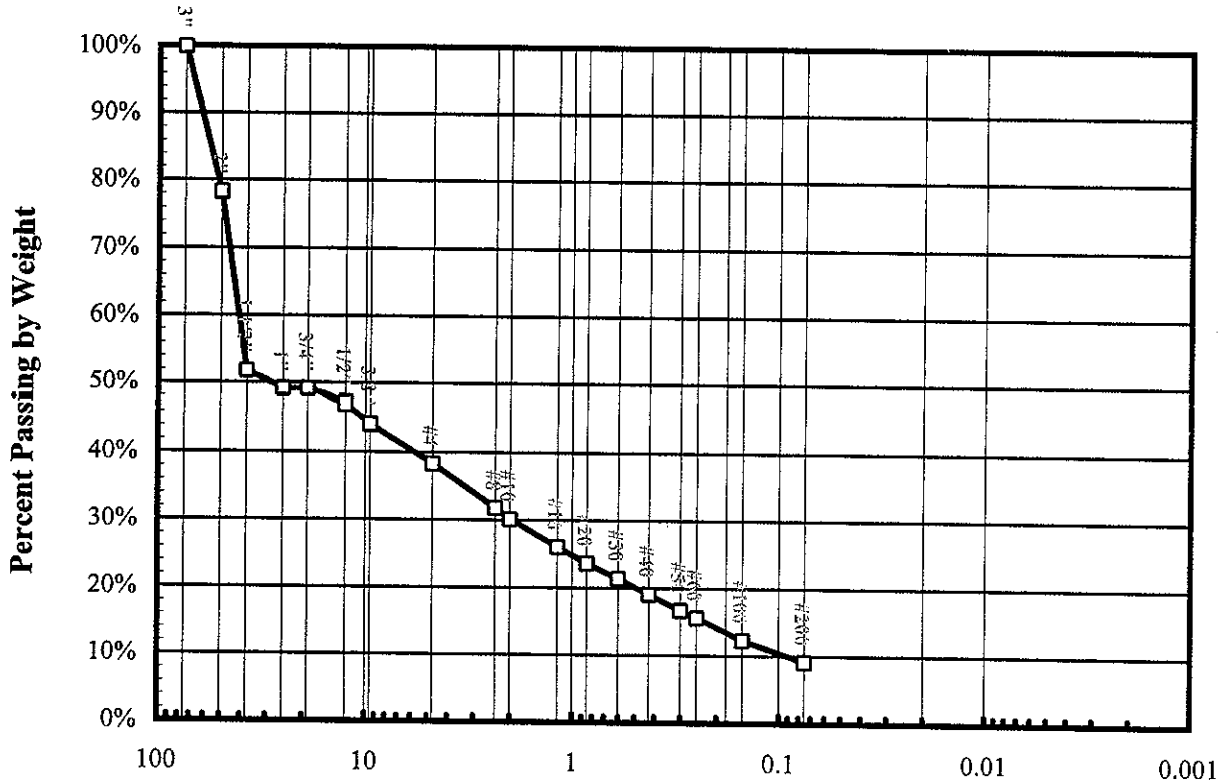
Project: Haines Highway

Location: Test Boring 104
Sample 2
Depth 2.5'-4'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2973
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	78%	
1 1/2"	52%	
1"	49%	
3/4"	49%	
1/2"	47%	
3/8"	44%	
No. 4	38%	
Total Wt. = 1317.2g		
No. 8	32%	
No. 10	30%	
No. 16	26%	
No. 20	24%	
No. 30	21%	
No. 40	19%	
No. 50	17%	
No. 60	16%	
No. 80		
No. 100	12%	
No. 200	9.2%	
Total Wt. of Fine Fraction = 503g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 106

Sample 2

Depth 10' - 11'

Engineering Classification: Poorly Graded GRAVEL with Silt and Sand, GP-GM

Frost Classification: Not Measured

PARTICLE-SIZE

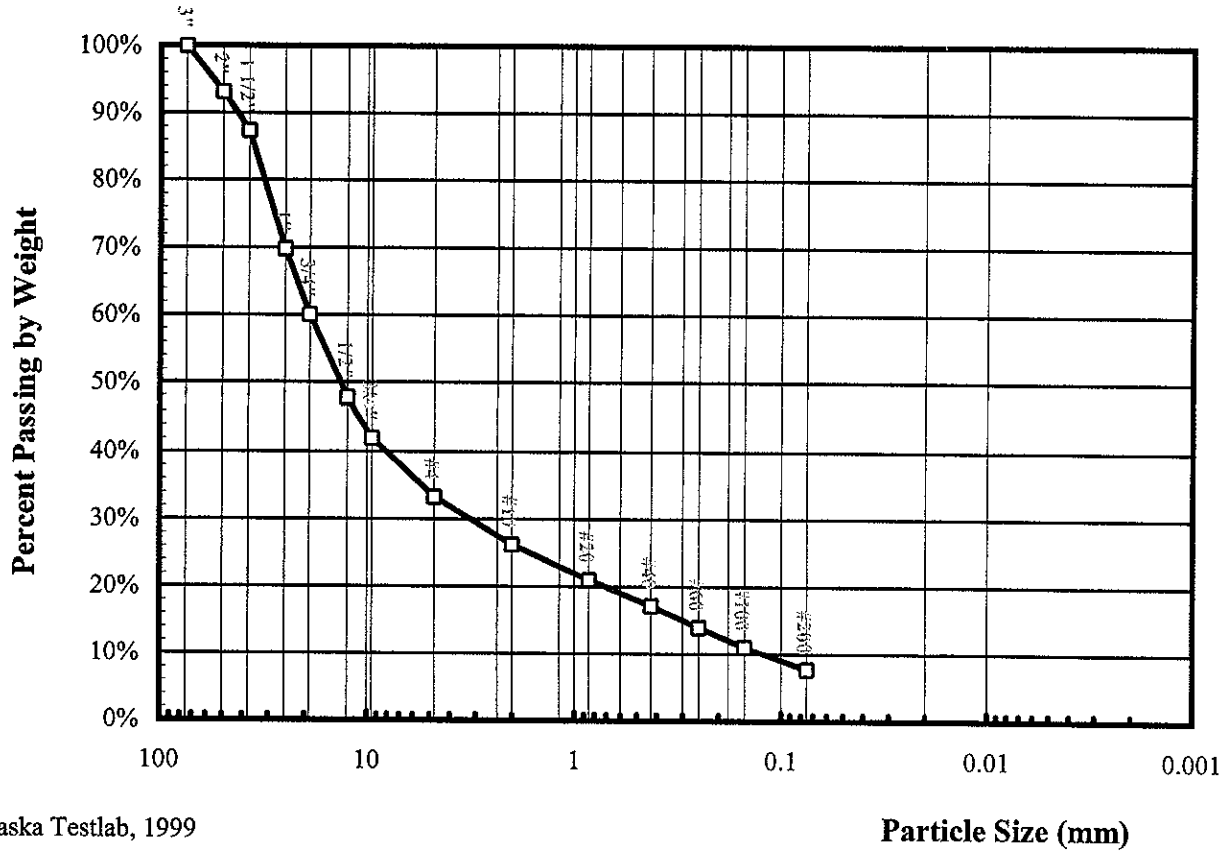
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-706

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	93%	
1 1/2"	87%	
1"	70%	
3/4"	60%	
1/2"	48%	
3/8"	42%	
No. 4	33%	
Total Wt. = 23935g		
No. 8		
No. 10	26%	
No. 16		
No. 20	21%	
No. 30		
No. 40	17%	
No. 50		
No. 60	14%	
No. 80		
No. 100	11%	
No. 200	7.7%	
Total Wt. of Fine Fraction = 370.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 107

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

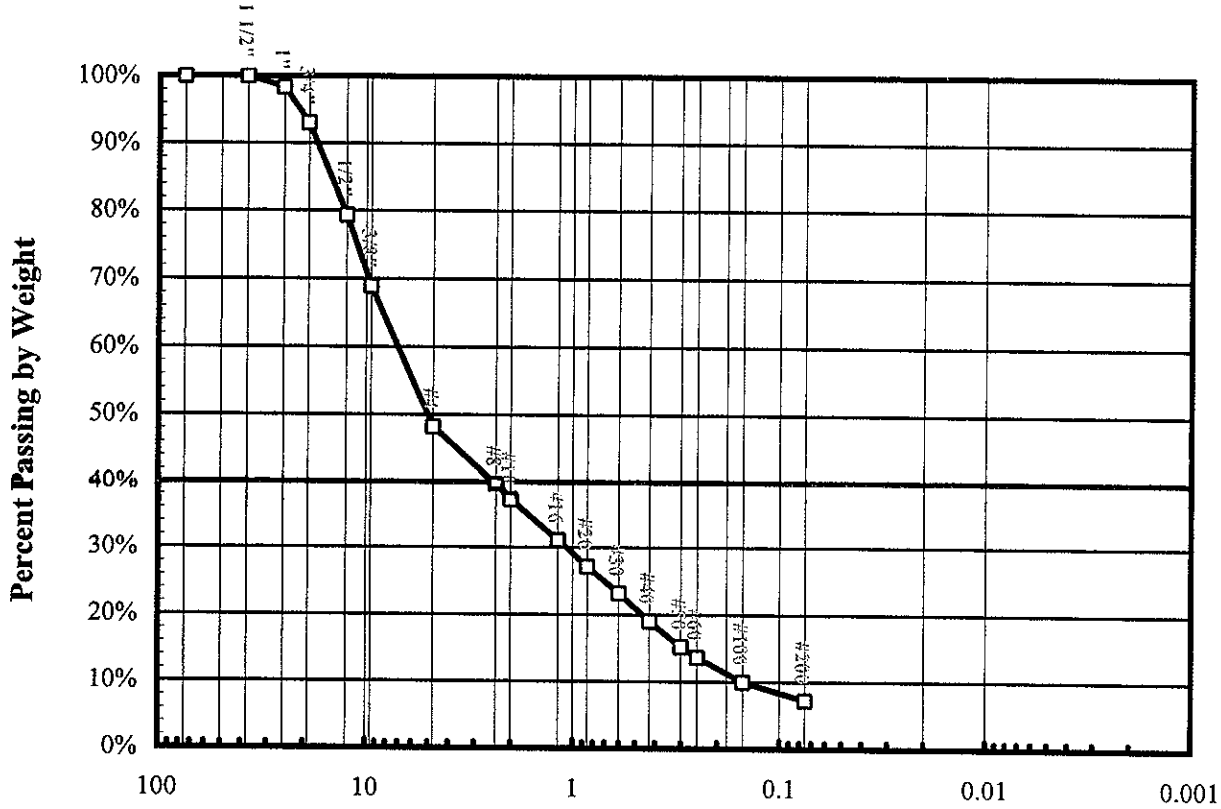
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2974

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	93%	
1/2"	79%	
3/8"	69%	
No. 4	48%	
Total Wt. = 21607g		
No. 8	40%	
No. 10	37%	
No. 16	31%	
No. 20	27%	
No. 30	23%	
No. 40	19%	
No. 50	15%	
No. 60	14%	
No. 80		
No. 100	10%	
No. 200	7.2%	
Total Wt. of Fine Fraction = 563.5g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 107

Sample 3

Depth 5'-6.5'

Engineering Classification: Silty GRAVEL with Sand, GM

Frost Classification: Not Measured

PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2975

Received: 12/2/05

Reported: 12/19/05

SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	89%	
1"	79%	
3/4"	75%	
1/2"	69%	
3/8"	67%	
No. 4	59%	
Total Wt. = 1399g		
No. 8	52%	
No. 10	50%	
No. 16	45%	
No. 20	41%	
No. 30	38%	
No. 40	35%	
No. 50	31%	
No. 60	30%	
No. 80		
No. 100	25%	
No. 200	19%	
Total Wt. of Fine Fraction = 539.2g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 108

Sample 2

Depth 2.5'-4'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

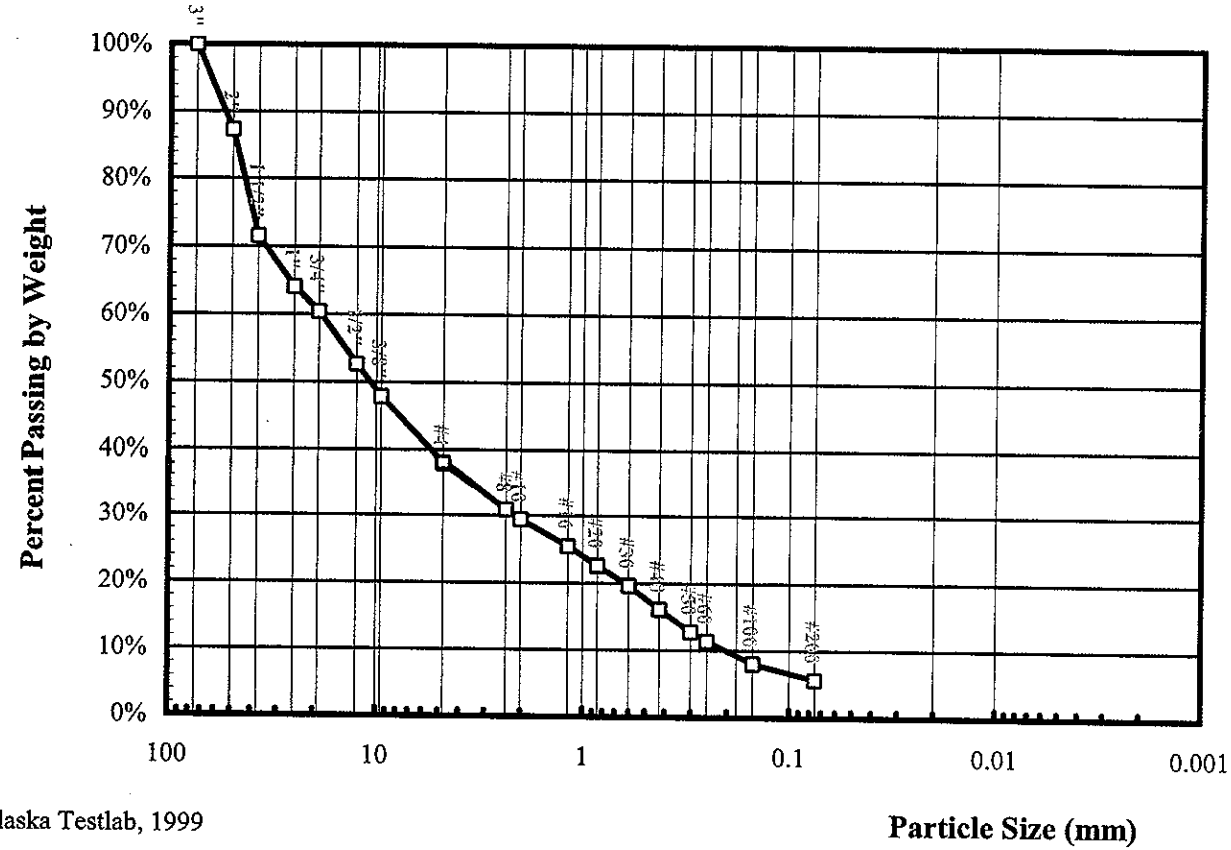
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2976

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	87%	
1 1/2"	72%	
1"	64%	
3/4"	60%	
1/2"	53%	
3/8"	48%	
No. 4	38%	
Total Wt. = 1660.1g		
No. 8	31%	
No. 10	29%	
No. 16	25%	
No. 20	23%	
No. 30	20%	
No. 40	16%	
No. 50	13%	
No. 60	11%	
No. 80		
No. 100	8%	
No. 200	5.7%	
Total Wt. of Fine Fraction = 631.9g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

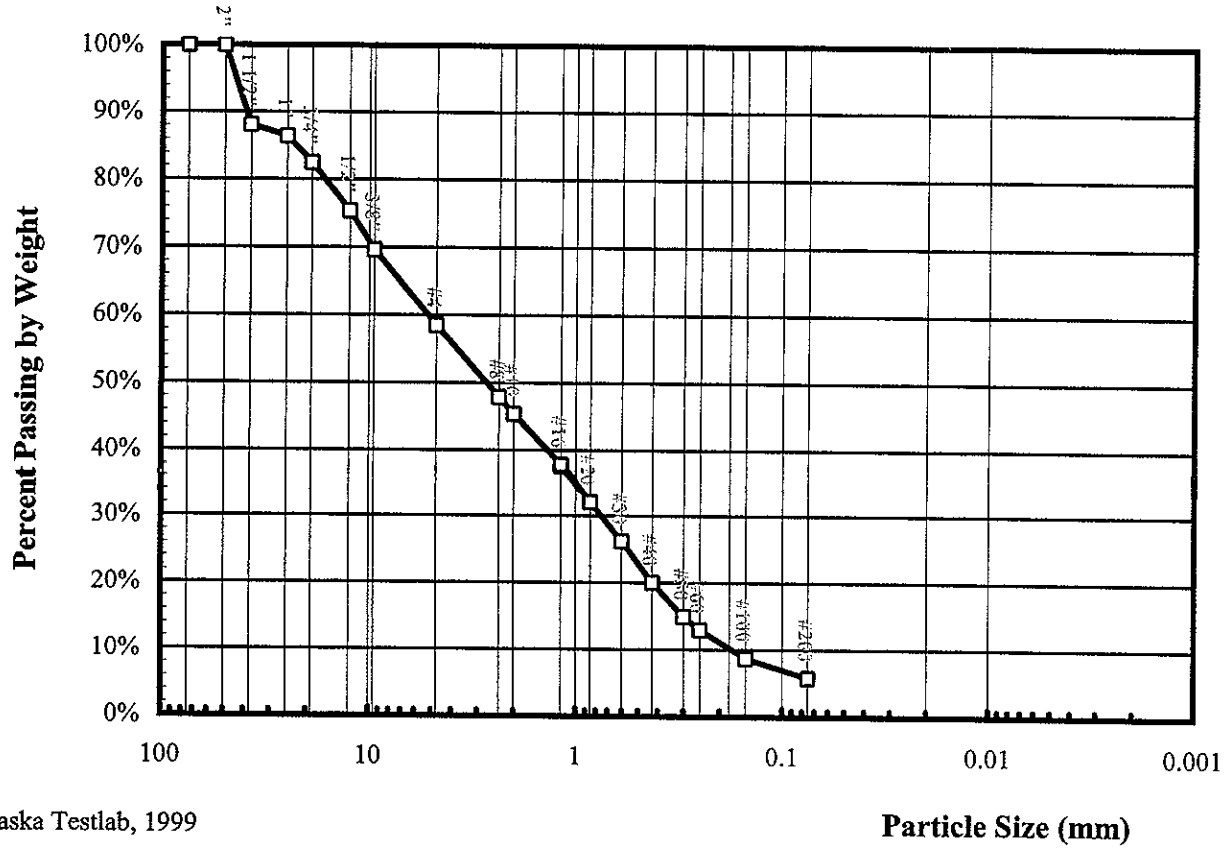
Location: Test Boring 108
Sample 4
Depth 10'-11.5'

Engineering Classification: Poorly Graded SAND with Silt and Gravel, SP-SM
Frost Classification: Not Measured

PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2977
Received: 12/2/05
Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	88%	
1"	86%	
3/4"	82%	
1/2"	75%	
3/8"	70%	
No. 4	59%	
Total Wt. = 2214.2g		
No. 8	48%	
No. 10	45%	
No. 16	38%	
No. 20	32%	
No. 30	26%	
No. 40	20%	
No. 50	15%	
No. 60	13%	
No. 80		
No. 100	9%	
No. 200	5.8%	
Total Wt. of Fine Fraction = 528.2g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 109

Sample 1

Depth 0.5'-1.5'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

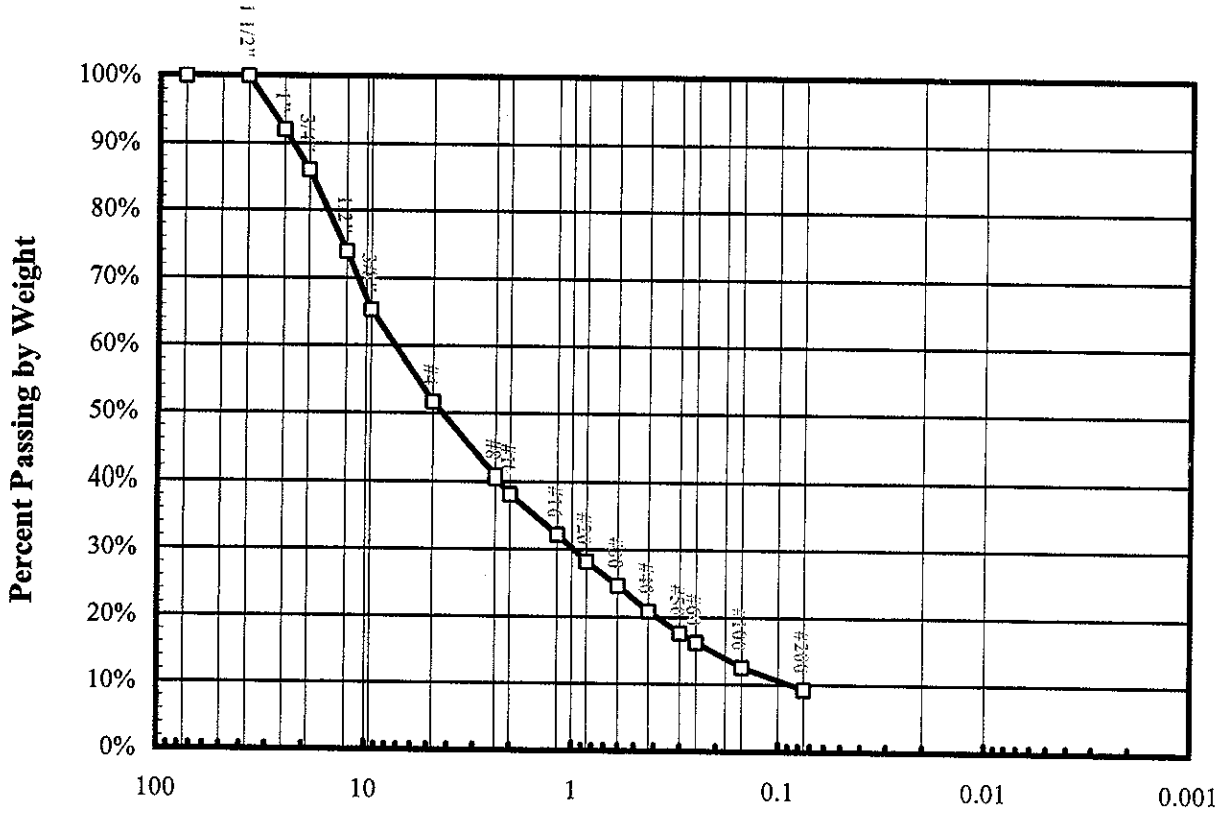
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2978

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	92%	
3/4"	86%	
1/2"	74%	
3/8"	65%	
No. 4	52%	
Total Wt. = 4857g		
No. 8	41%	
No. 10	38%	
No. 16	32%	
No. 20	28%	
No. 30	25%	
No. 40	21%	
No. 50	18%	
No. 60	16%	
No. 80		
No. 100	13%	
No. 200	9.3%	
Total Wt. of Fine Fraction = 521.6g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 109

Sample 4

Depth 7'-8'

Engineering Classification: Silty SAND with Gravel, SM

Frost Classification: Not Measured

PARTICLE-SIZE

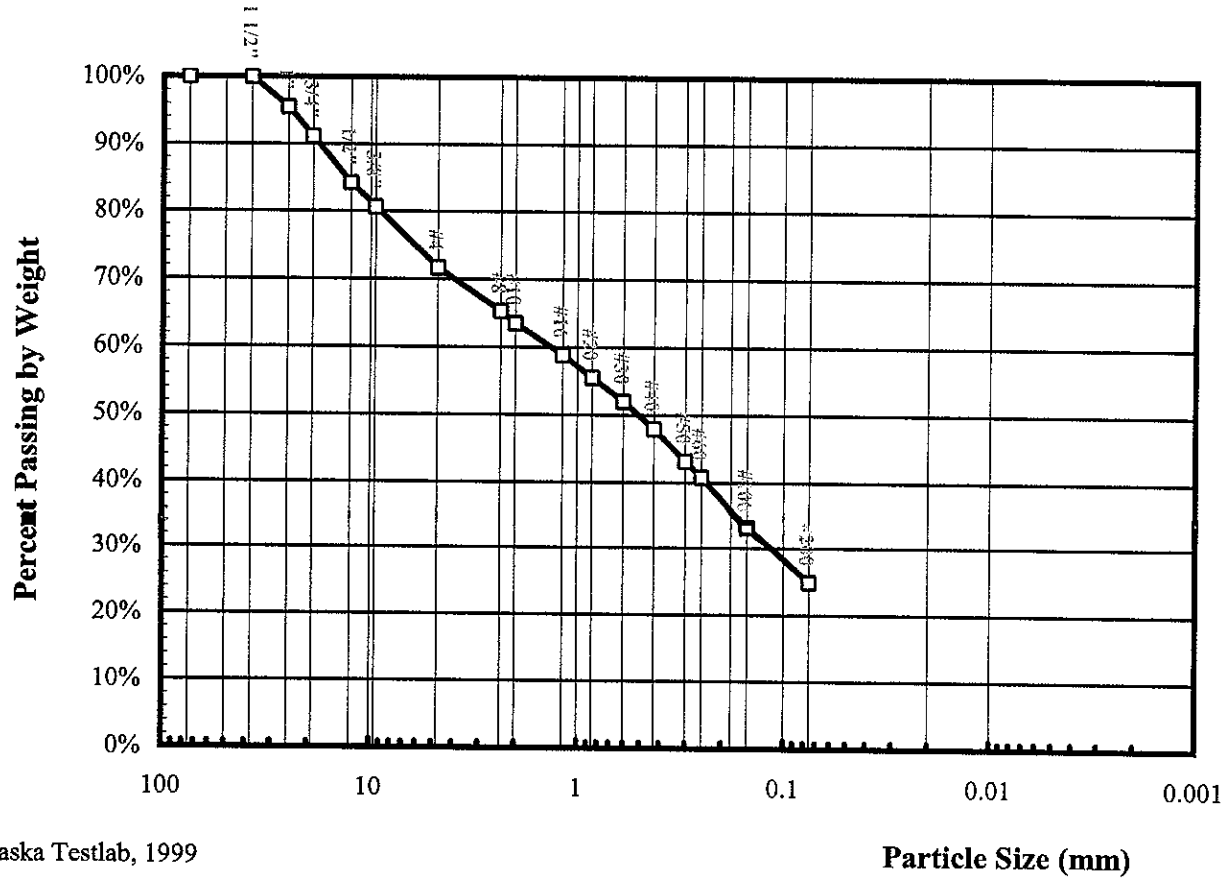
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2979

Received: 12/2/05

Reported: 12/19/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	95%	
3/4"	91%	
1/2"	84%	
3/8"	81%	
No. 4	72%	
Total Wt. = 3664.4g		
No. 8	65%	
No. 10	64%	
No. 16	59%	
No. 20	55%	
No. 30	52%	
No. 40	48%	
No. 50	43%	
No. 60	41%	
No. 80		
No. 100	33%	
No. 200	25%	
Total Wt. of Fine Fraction = 518.3g		
0.02 mm		

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Client: ADOT&PF Southeast Region

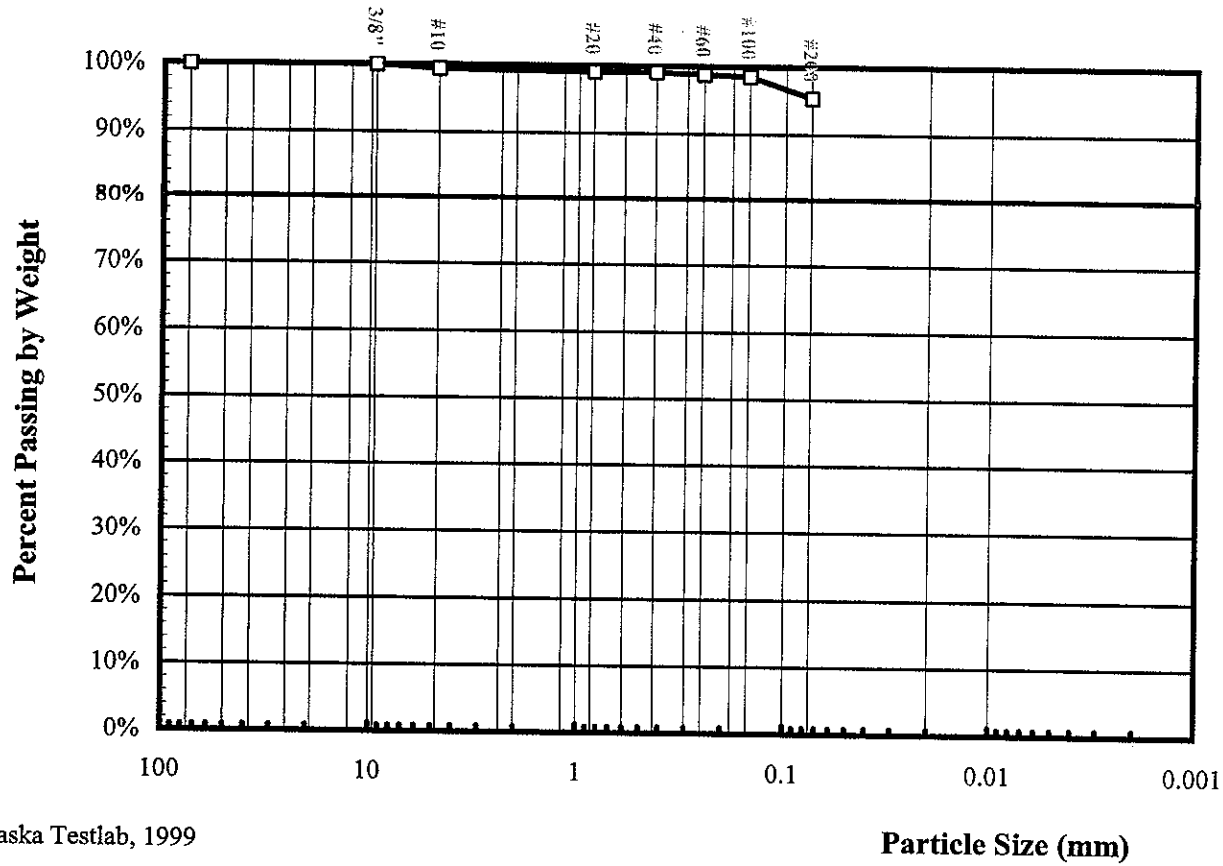
Project: Haines Highway

Location: Test Boring 110
Sample 2
Depth 3' - 3.5'

Engineering Classification: Organic SILT (OL)
Frost Classification: F4

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2006-707
Received: 6/1/06
Reported: 6/08/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"	100%	
No. 4		
Total Wt. = 432.1g		
No. 8		
No. 10	99%	
No. 16		
No. 20	99%	
No. 30		
No. 40	99%	
No. 50		
No. 60	99%	
No. 80		
No. 100	99%	
No. 200	95%	
Total Wt. of Fine Fraction = 34.4g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 111
Sample 2
Depth 4' - 5'

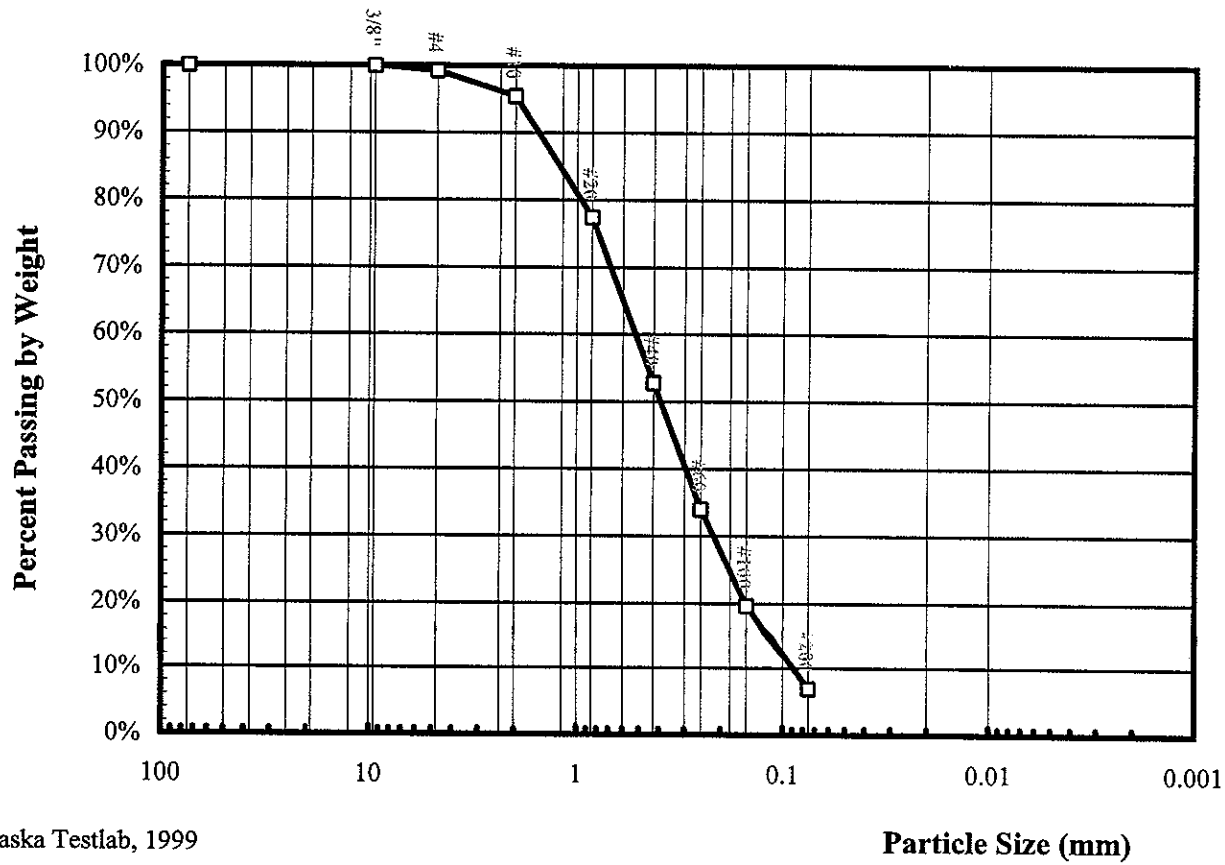
Engineering Classification: Poorly Graded SAND with Silt , SP-SM

Frost Classification: Not Measured

PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D
Lab No. 2006-708
Received: 6/1/06
Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"	100%	
No. 4	99%	
Total Wt. = 1975g		
No. 8		
No. 10	95%	
No. 16		
No. 20	77%	
No. 30		
No. 40	53%	
No. 50		
No. 60	34%	
No. 80		
No. 100	20%	
No. 200	6.9%	
Total Wt. of Fine Fraction = 483.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 113

Sample 2

Depth 7' - 8'

Engineering Classification: Silty SAND , SM

Frost Classification: Not Measured

PARTICLE-SIZE

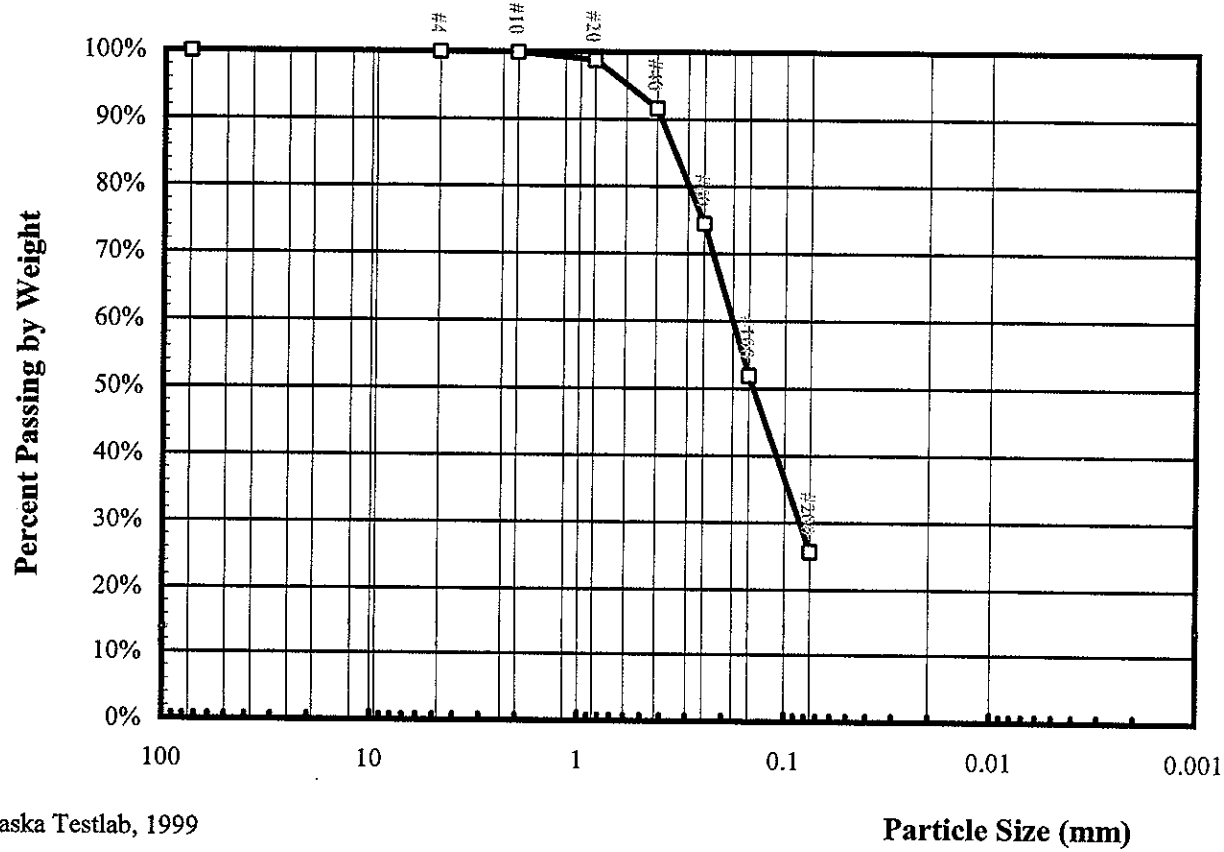
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-709

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"		
No. 4	100%	
Total Wt. = 1723g		
No. 8		
No. 10	100%	
No. 16		
No. 20	99%	
No. 30		
No. 40	92%	
No. 50		
No. 60	74%	
No. 80		
No. 100	52%	
No. 200	26%	
Total Wt. of Fine Fraction = 462.3g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 114

Sample 1

Depth 2' - 3'

Engineering Classification: Silty SAND with Gravel, SM

Frost Classification: Not Measured

PARTICLE-SIZE

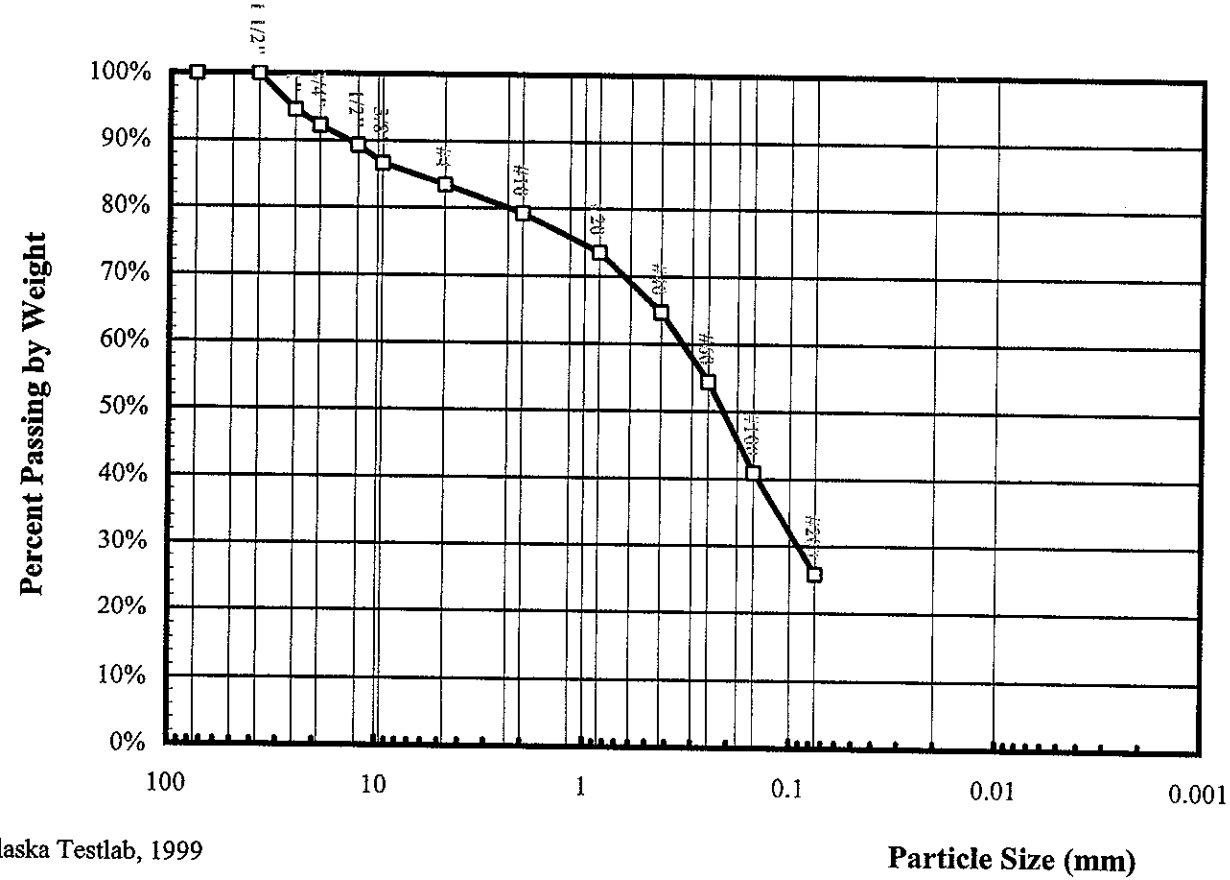
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-710

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	95%	
3/4"	92%	
1/2"	89%	
3/8"	87%	
No. 4	83%	
Total Wt. = 2148g		
No. 8		
No. 10	79%	
No. 16		
No. 20	74%	
No. 30		
No. 40	65%	
No. 50		
No. 60	54%	
No. 80		
No. 100	41%	
No. 200	26%	
Total Wt. of Fine Fraction = 436.5g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 115

Sample 1

Depth 4' - 5'

Engineering Classification: Poorly Graded GRAVEL with Sand, GP

Frost Classification: Not Measured

PARTICLE-SIZE

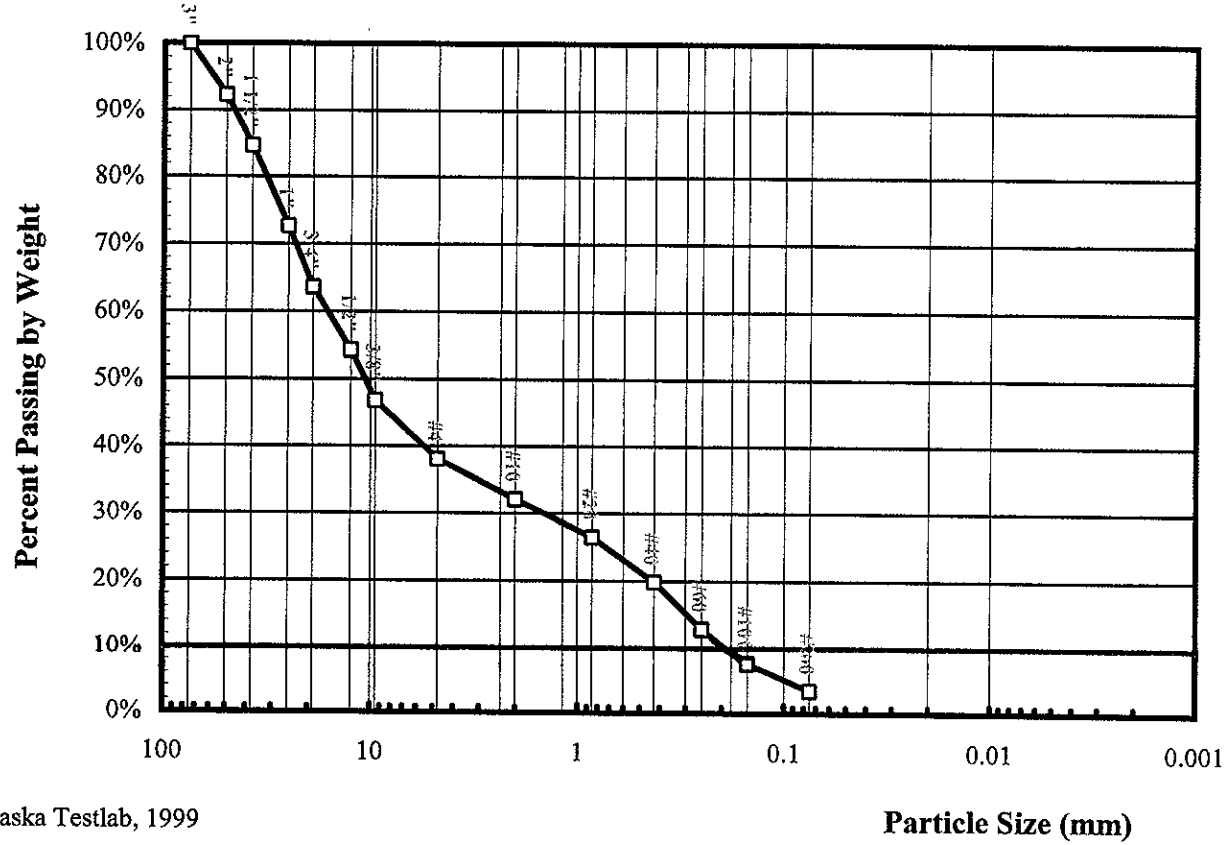
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-711

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	92%	
1 1/2"	85%	
1"	73%	
3/4"	64%	
1/2"	54%	
3/8"	47%	
No. 4	38%	
Total Wt. = 685.21g		
No. 8		
No. 10	32%	
No. 16		
No. 20	26%	
No. 30		
No. 40	20%	
No. 50		
No. 60	13%	
No. 80		
No. 100	7%	
No. 200	3.4%	
Total Wt. of Fine Fraction = 386.3g		
0.02 mm		

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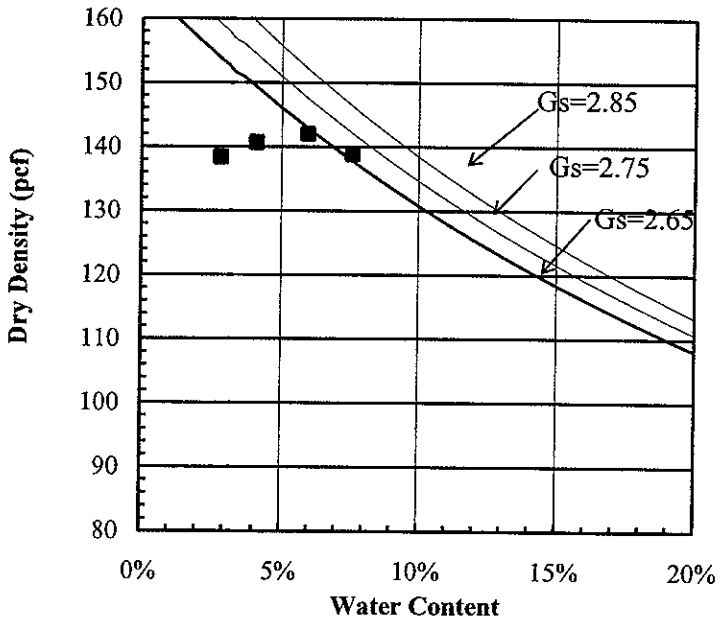
MODIFIED PROCTOR
AASHTO T-180 B

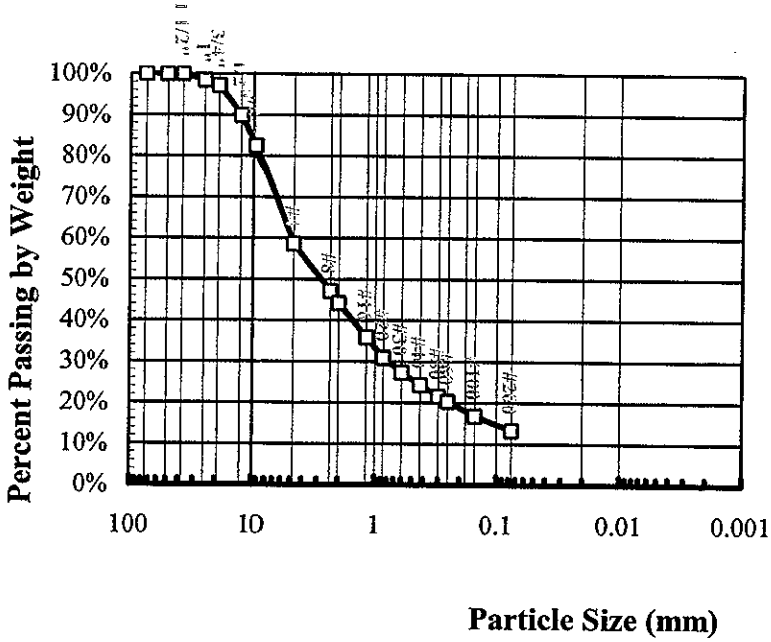
Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 116
Sample 1
Depth 0'-3'
Engineering Classification: Silty SAND with Gravel, SM
Frost Classification: Not Measured

W.O. D59119D
Lab No. 2005-2980
Received: 12/2/05
Reported: 12/20/05



Uncorrected
Maximum Density: 142 pcf
Optimum Water Content: 6 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	97%	
1/2"	90%	
3/8"	82%	
No. 4	59%	
Total Wt. = 21453g		
No. 8	47%	
No. 10		
No. 16	36%	
No. 20	31%	
No. 30	27%	
No. 40	24%	
No. 50	22%	
No. 60	20%	
No. 80		
No.100	17%	
No.200	13%	
Total Wt. of Fine Fraction = 597.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 117

Sample 2

Depth 5'-6.5'

Engineering Classification: Silty GRAVEL with Sand, GM

Frost Classification: Not Measured

PARTICLE-SIZE

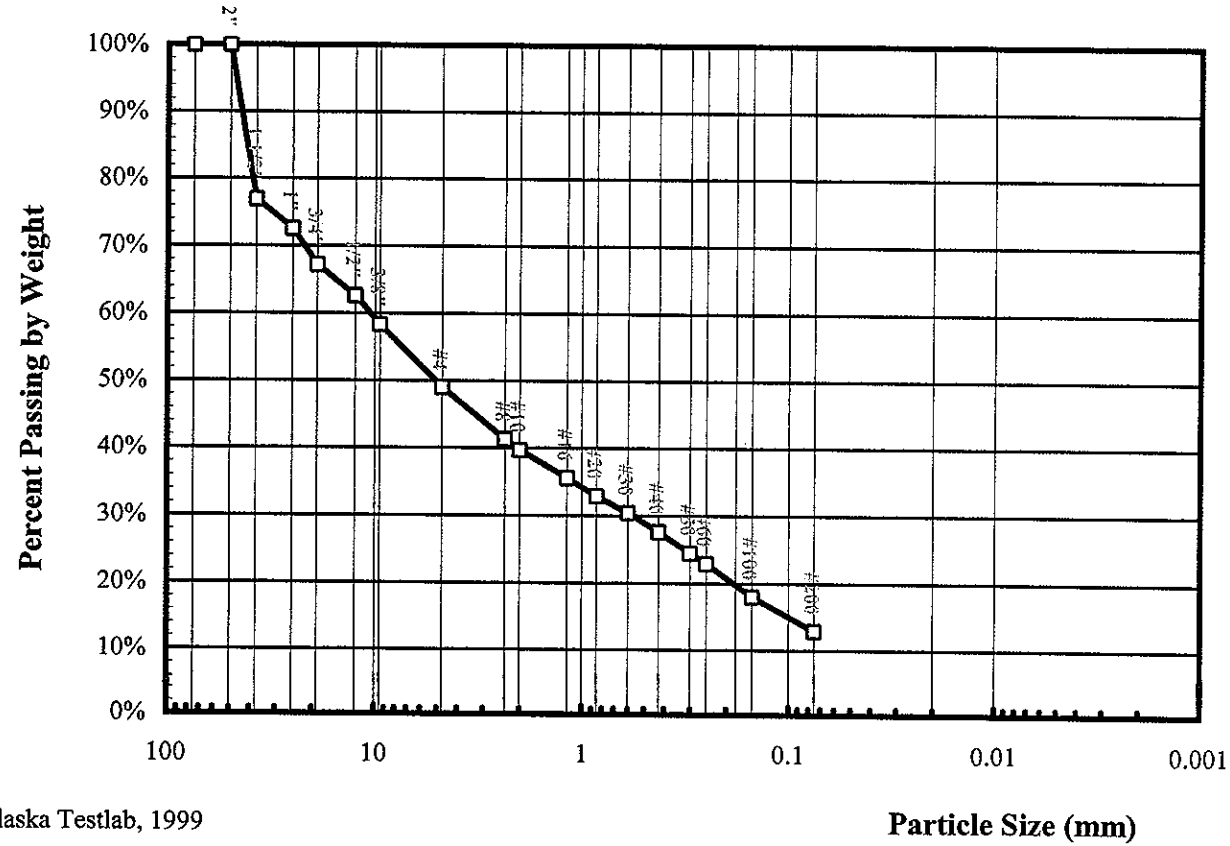
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2981

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	77%	
1"	73%	
3/4"	67%	
1/2"	63%	
3/8"	58%	
No. 4	49%	
Total Wt. = 1893.6g		
No. 8	41%	
No. 10	40%	
No. 16	36%	
No. 20	33%	
No. 30	30%	
No. 40	28%	
No. 50	25%	
No. 60	23%	
No. 80		
No. 100	18%	
No. 200	13%	
Total Wt. of Fine Fraction = 530.3g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 118
Sample 1
Depth 0.3'-3'

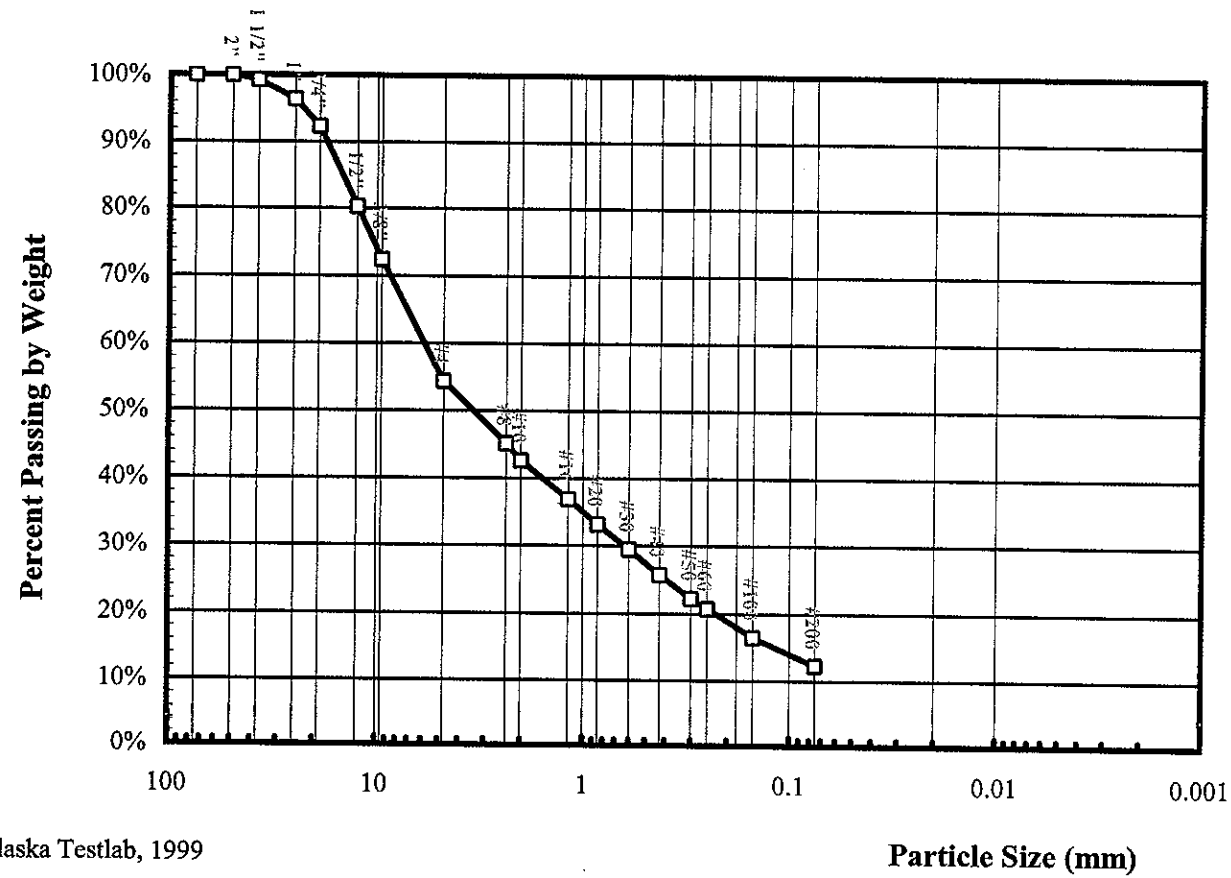
Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2982
Received: 12/2/05
Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	99%	
1"	96%	
3/4"	92%	
1/2"	80%	
3/8"	72%	
No. 4	54%	
Total Wt. = 16739g		
No. 8	45%	
No. 10	43%	
No. 16	37%	
No. 20	33%	
No. 30	29%	
No. 40	26%	
No. 50	22%	
No. 60	21%	
No. 80		
No. 100	16%	
No. 200	12%	
Total Wt. of Fine Fraction = 512.4g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 120

Sample 2

Depth 2.5'-4'

Engineering Classification: Silty GRAVEL with Sand, GM

Frost Classification: Not Measured

PARTICLE-SIZE

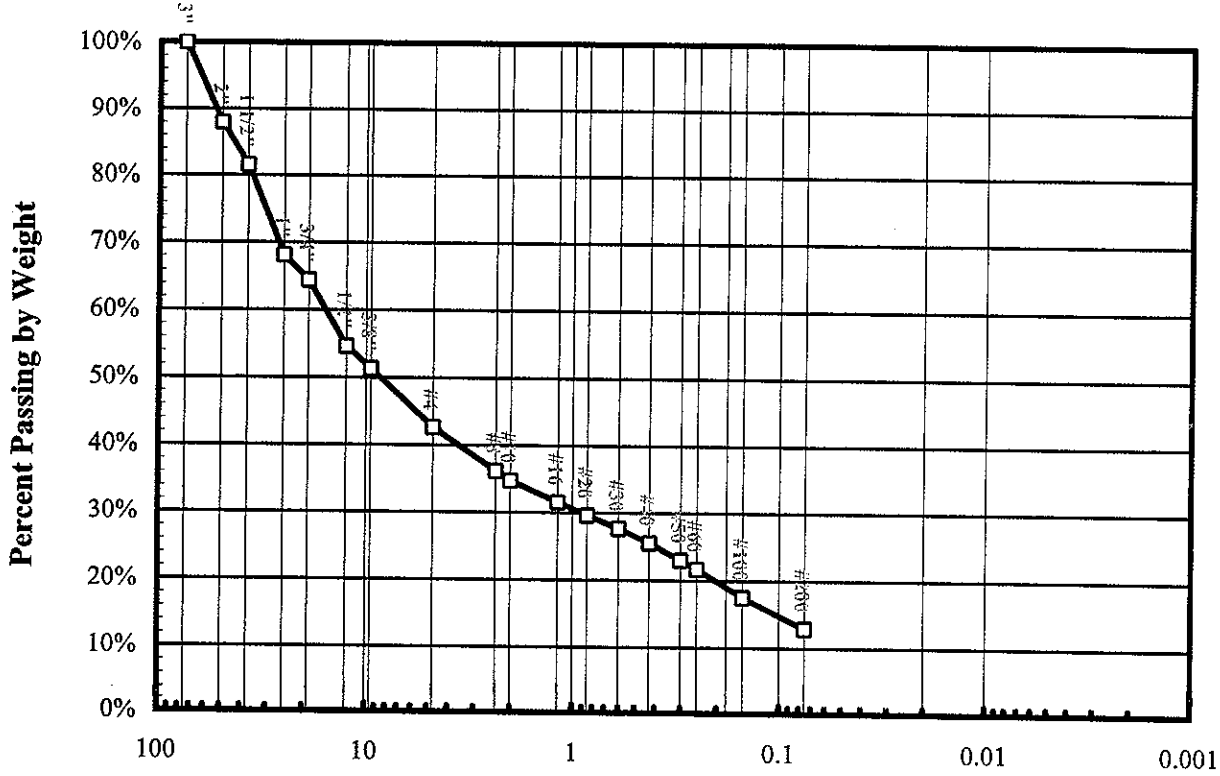
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2983

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	88%	
1 1/2"	82%	
1"	68%	
3/4"	64%	
1/2"	55%	
3/8"	51%	
No. 4	43%	
Total Wt. = 2537g		
No. 8	36%	
No. 10	35%	
No. 16	32%	
No. 20	30%	
No. 30	28%	
No. 40	26%	
No. 50	23%	
No. 60	22%	
No. 80		
No. 100	18%	
No. 200	13%	
Total Wt. of Fine Fraction = 559g		
0.02 mm		

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Client: ADOT&PF Southeast Region

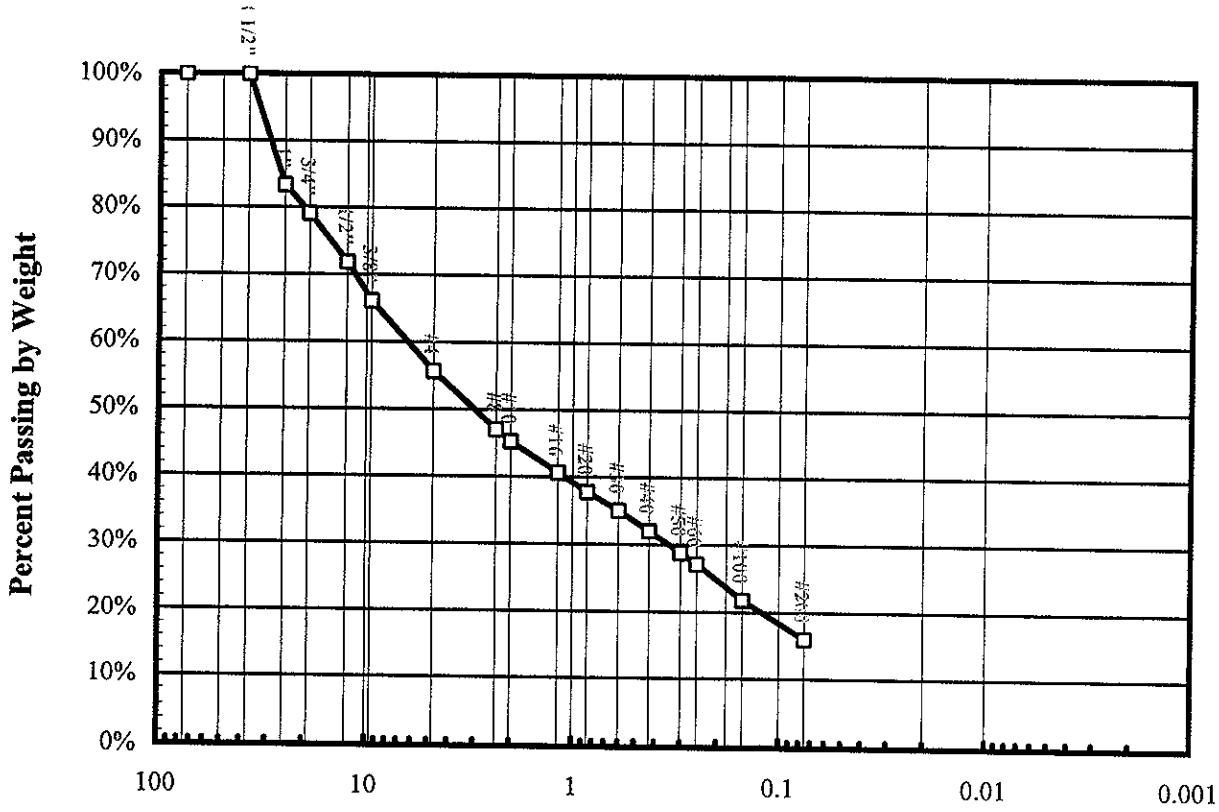
Project: Haines Highway

Location: Test Boring 120
Sample 4
Depth 10'-11.5'

Engineering Classification: Silty GRAVEL with Sand, GM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2984
Received: 12/2/05
Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	83%	
3/4"	79%	
1/2"	72%	
3/8"	66%	
No. 4	56%	
Total Wt. = 2066g		
No. 8	47%	
No. 10	45%	
No. 16	41%	
No. 20	38%	
No. 30	35%	
No. 40	32%	
No. 50	29%	
No. 60	27%	
No. 80		
No. 100	22%	
No. 200	16%	
Total Wt. of Fine Fraction = 564.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 121

Sample 1

Depth 1' - 2'

Engineering Classification: Silty SAND with Gravel, SM

Frost Classification: Not Measured

PARTICLE-SIZE

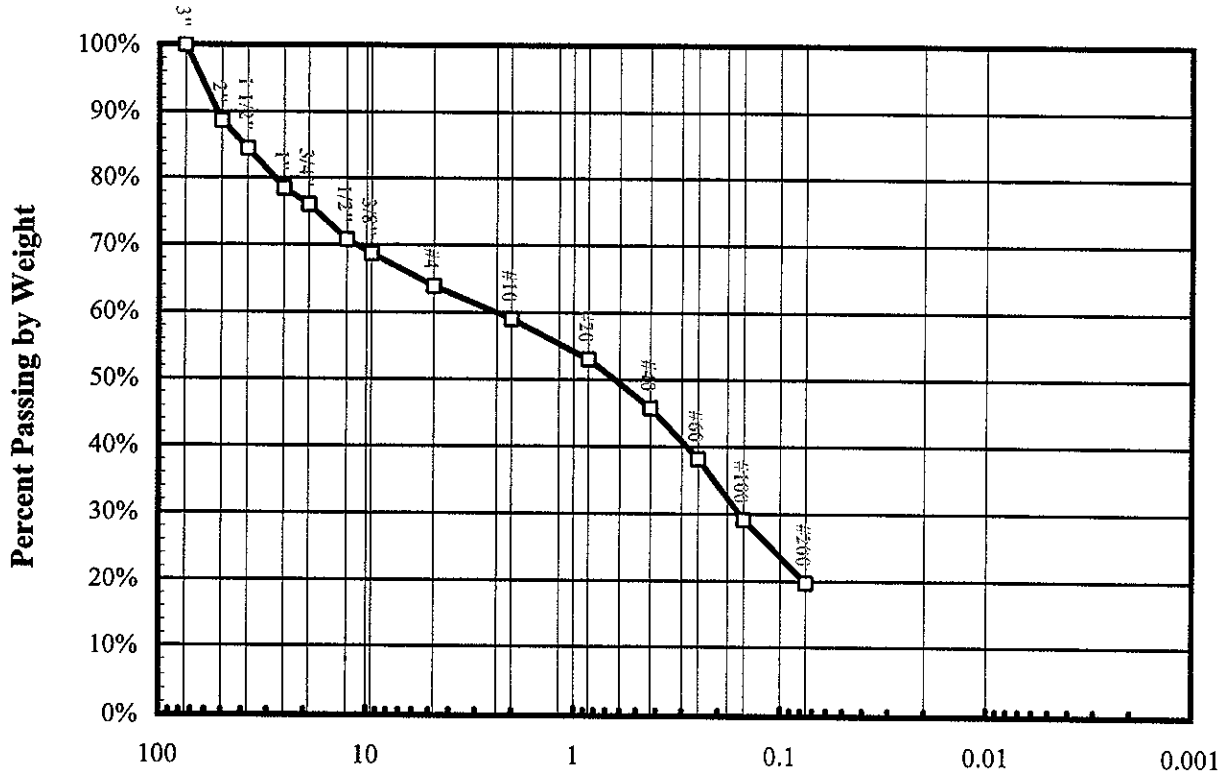
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-712

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	89%	
1 1/2"	84%	
1"	78%	
3/4"	76%	
1/2"	71%	
3/8"	69%	
No. 4	64%	
Total Wt. = 18241g		
No. 8		
No. 10	59%	
No. 16		
No. 20	53%	
No. 30		
No. 40	46%	
No. 50		
No. 60	38%	
No. 80		
No. 100	29%	
No. 200	20%	
Total Wt. of Fine Fraction = 375.6g		
0.02 mm		

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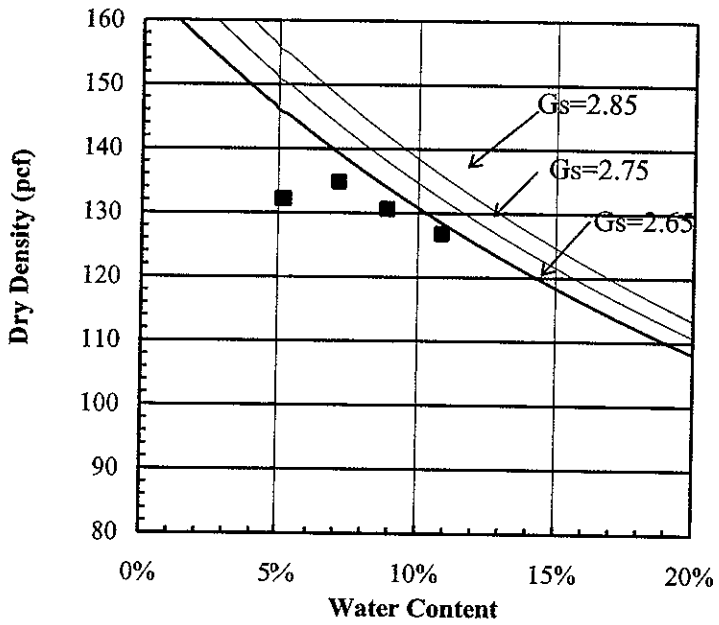
MODIFIED PROCTOR
ASTM D 1557 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Pit 122
Sample 1
Depth 0' - 3'
Engineering Classification: Silty SAND with Gravel, SM
Frost Classification: Not Measured

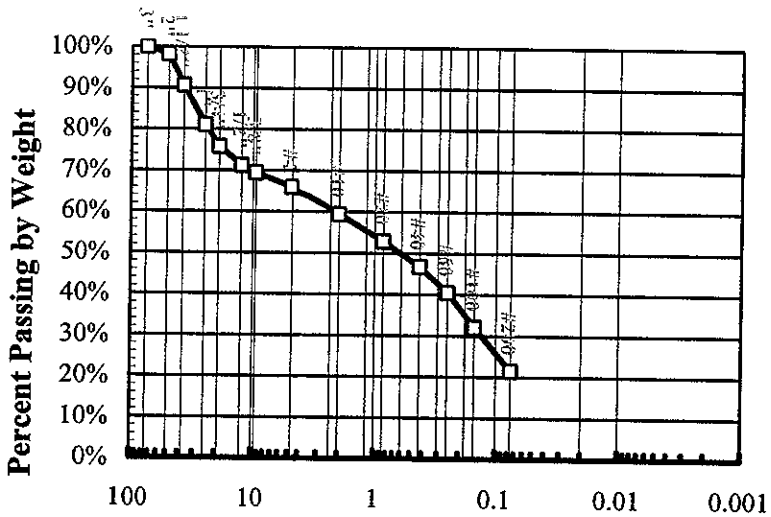
W.O. D59119D
Lab No. 2006-713
Received: 6/1/06
Reported: 6/8/06



Uncorrected
Maximum Density: 134.9 pcf
Optimum Water Content: 7.1 %

Corrected Density: 141 pcf
Corrected Optimum: 5.5 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"	100%	
2"	98%	
1 1/2"	91%	
1"	81%	
3/4"	76%	
1/2"	71%	
3/8"	69%	
No. 4	66%	
Total Wt. = 14489g		
No. 8		
No. 10	59%	
No. 16		
No. 20	53%	
No. 30		
No. 40	47%	
No. 50		
No. 60	40%	
No. 80		
No.100	32%	
No.200	22%	
Total Wt. of Fine Fraction = 752.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

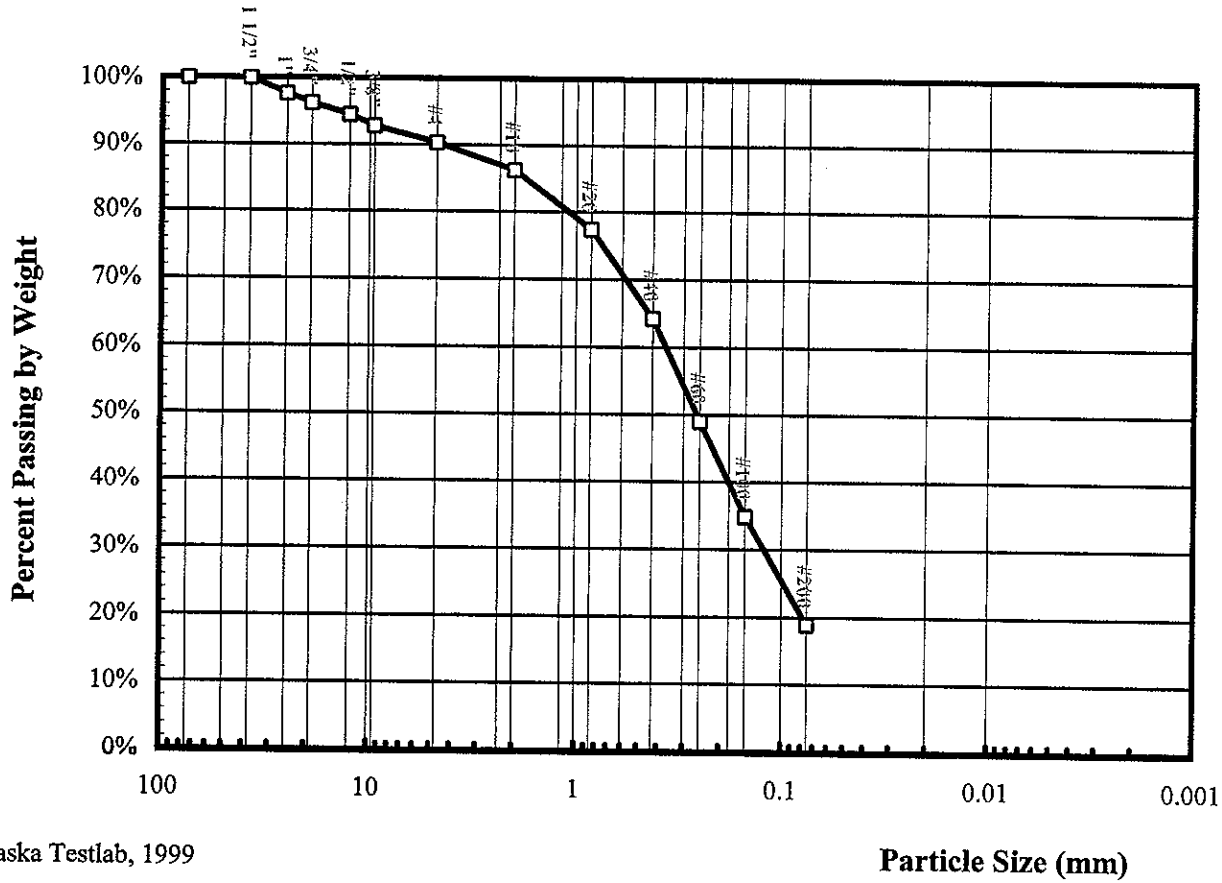
Project: Haines Highway

Location: Test Boring 124
Sample 2
Depth 4' - 5'

Engineering Classification: Silty SAND , SM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2006-673
Received: 6/1/06
Reported: 6/7/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	96%	
1/2"	94%	
3/8"	93%	
No. 4	90%	
Total Wt. = 3088g		
No. 8		
No. 10	86%	
No. 16		
No. 20	77%	
No. 30		
No. 40	64%	
No. 50		
No. 60	49%	
No. 80		
No. 100	35%	
No. 200	19%	
Total Wt. of Fine Fraction = 421.4g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 126

Sample 1

Depth 3' - 4'

Engineering Classification: Silty GRAVEL with Sand, GM

Frost Classification: Not Measured

PARTICLE-SIZE

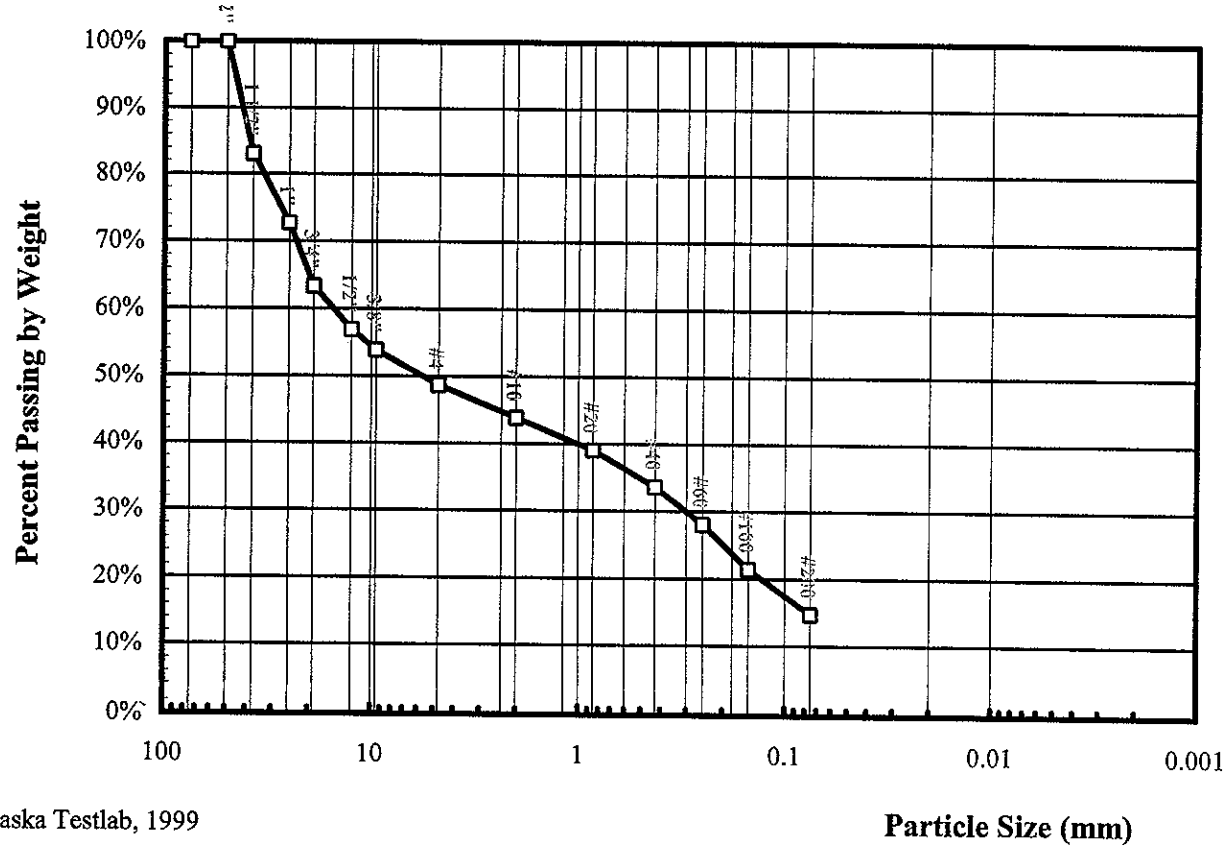
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-674

Received: 6/1/06

Reported: 6/7/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	83%	
1"	73%	
3/4"	63%	
1/2"	57%	
3/8"	54%	
No. 4	49%	
Total Wt. = 4251g		
No. 8		
No. 10	44%	
No. 16		
No. 20	39%	
No. 30		
No. 40	34%	
No. 50		
No. 60	28%	
No. 80		
No. 100	21%	
No. 200	15%	
Total Wt. of Fine Fraction = 314.8g		
0.02 mm		

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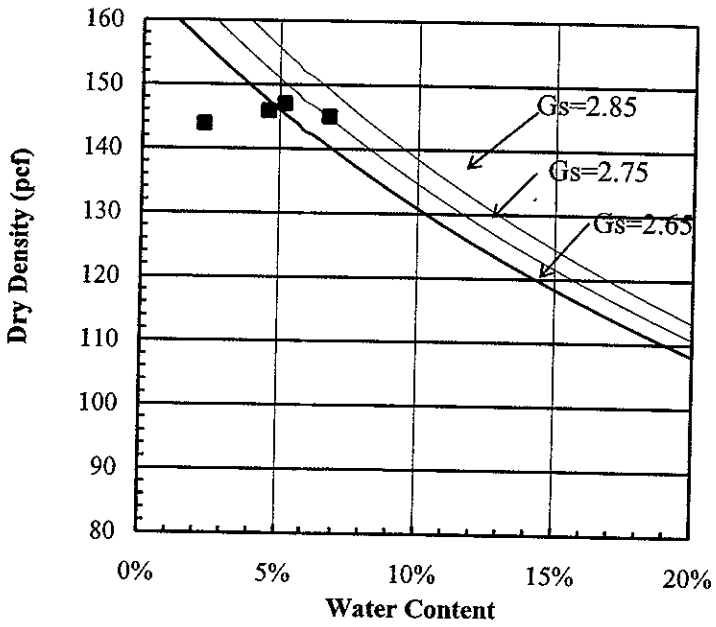
MODIFIED PROCTOR

AASHTO T-180 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 129
Sample 1
Depth 0.2'-3'

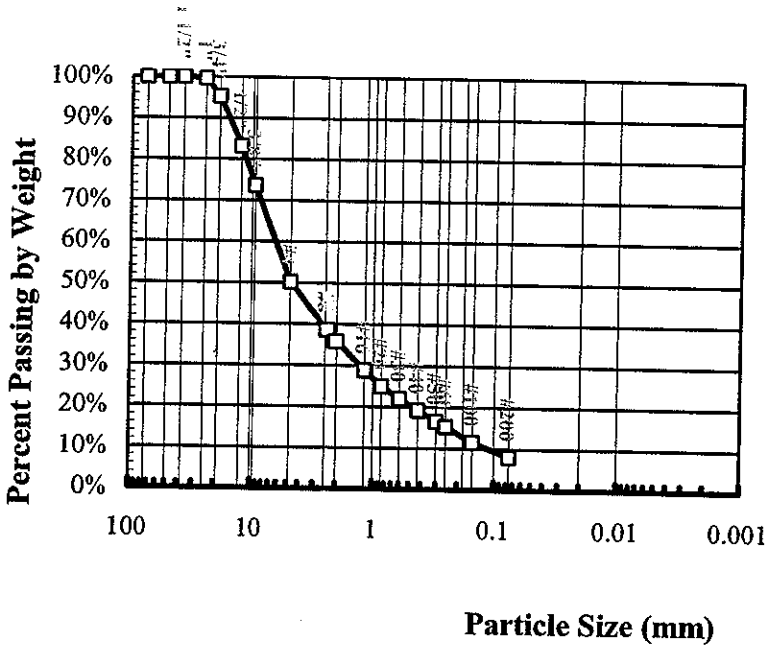
W.O. D59119D
Lab No. 2005-2985
Received: 12/2/05
Reported: 12/20/05

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM
Frost Classification: Not Measured



Uncorrected
Maximum Density: 147 pcf
Optimum Water Content: 5 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = 0%		
3"		
2"		
1 1/2"	100%	
1"	100%	
3/4"	95%	
1/2"	83%	
3/8"	74%	
No. 4	50%	
Total Wt. = 2097.4g		
No. 8	39%	
No. 10		
No. 16	29%	
No. 20	25%	
No. 30	22%	
No. 40	19%	
No. 50	17%	
No. 60	15%	
No. 80		
No.100	12%	
No.200	8%	
Total Wt. of Fine Fraction = 615.8g		
0.02 mm		

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Client: ADOT&PF Southeast Region

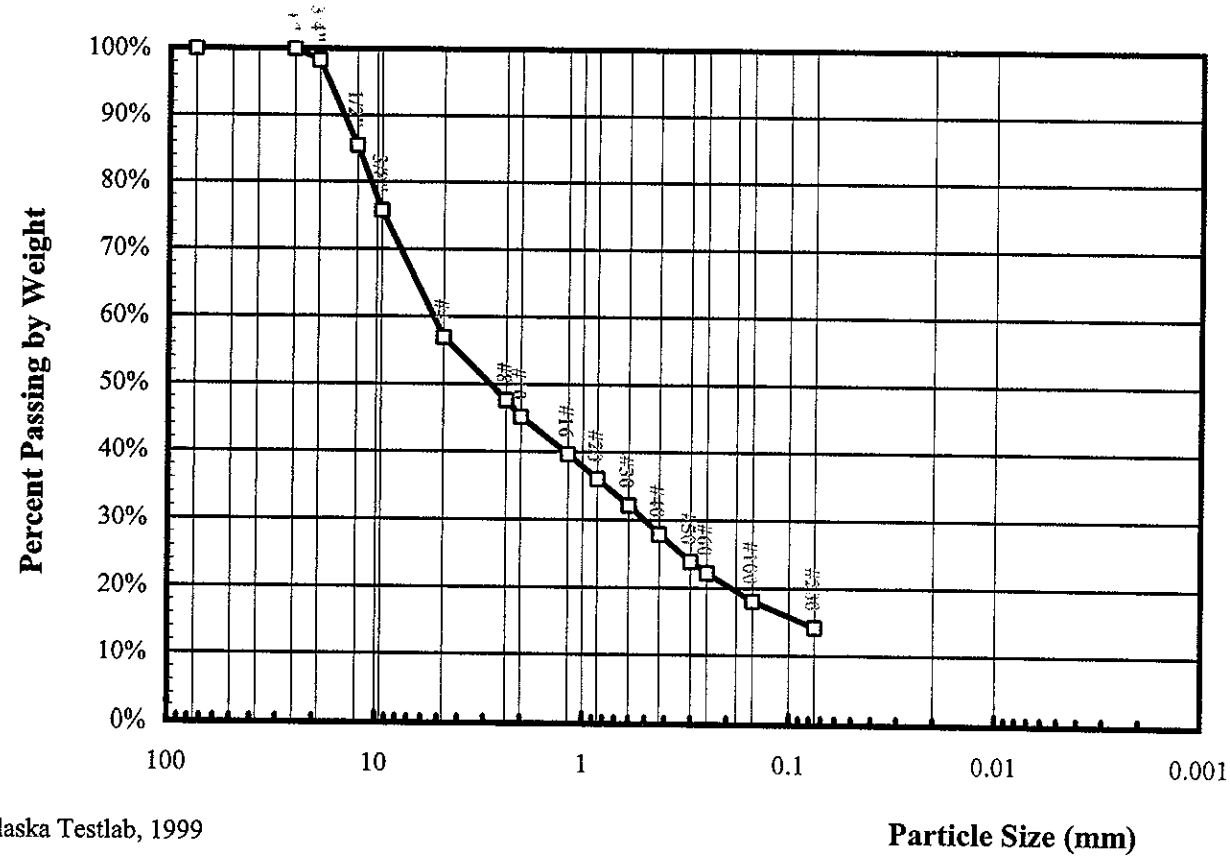
Project: Haines Highway

Location: Test Boring 131
Sample 1
Depth 0.3'-1'

Engineering Classification: Silty SAND with Gravel, SM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2986
Received: 12/2/05
Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	98%	
1/2"	85%	
3/8"	76%	
No. 4	57%	
Total Wt. = 3746.9g		
No. 8	48%	
No. 10	45%	
No. 16	40%	
No. 20	36%	
No. 30	32%	
No. 40	28%	
No. 50	24%	
No. 60	22%	
No. 80		
No. 100	18%	
No. 200	14%	
Total Wt. of Fine Fraction = 531.2g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 133

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

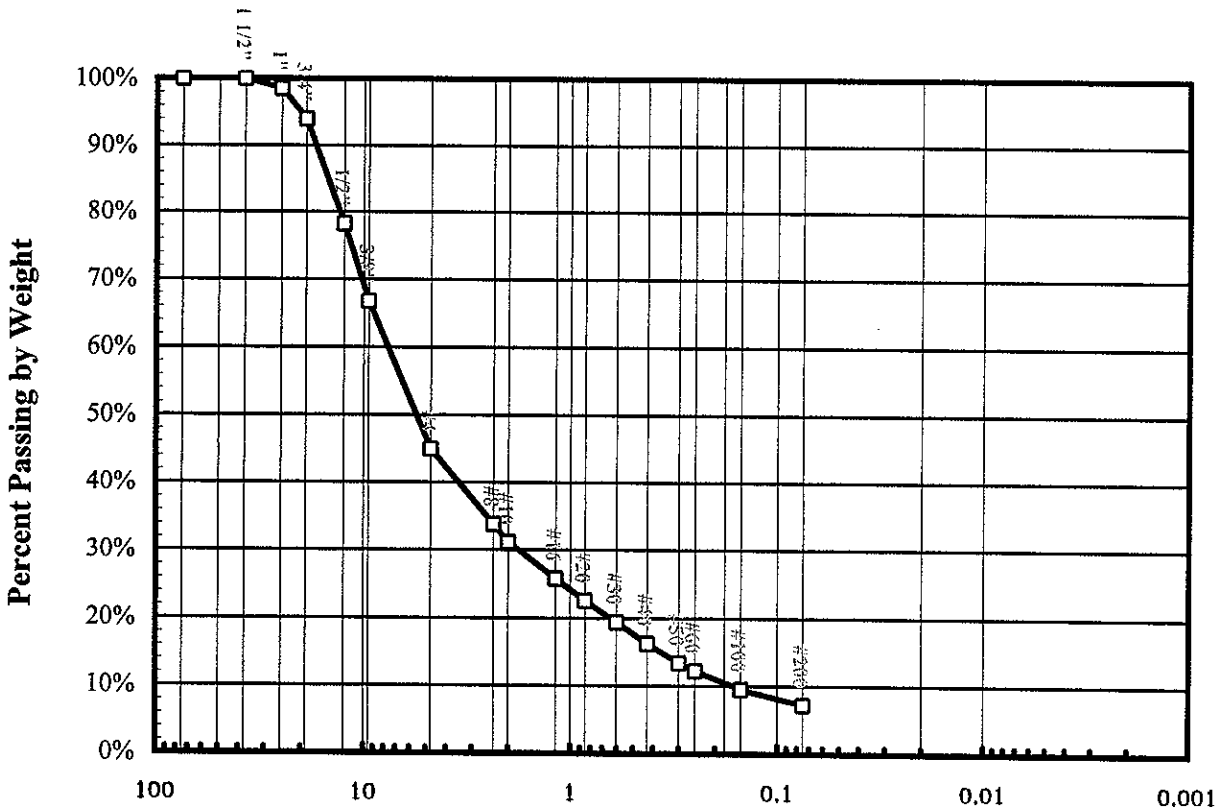
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2987

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	99%	
3/4"	94%	
1/2"	78%	
3/8"	67%	
No. 4	45%	
Total Wt. = 21867g		
No. 8	34%	
No. 10	31%	
No. 16	26%	
No. 20	23%	
No. 30	19%	
No. 40	16%	
No. 50	13%	
No. 60	12%	
No. 80		
No. 100	10%	
No. 200	**7.3%**	
Total Wt. of Fine Fraction = 584.7g		
0.02 mm		

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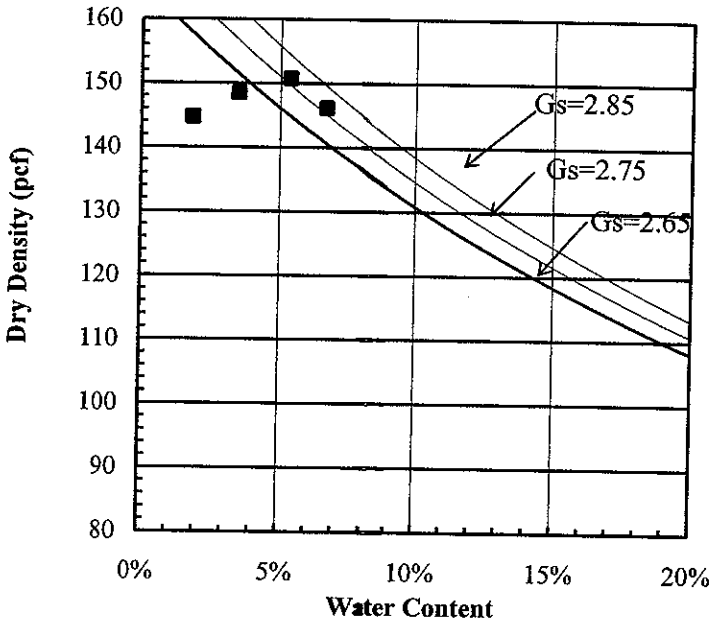
MODIFIED PROCTOR
AASHTO T-180 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 134
Sample 1
Depth 0.2'-3'

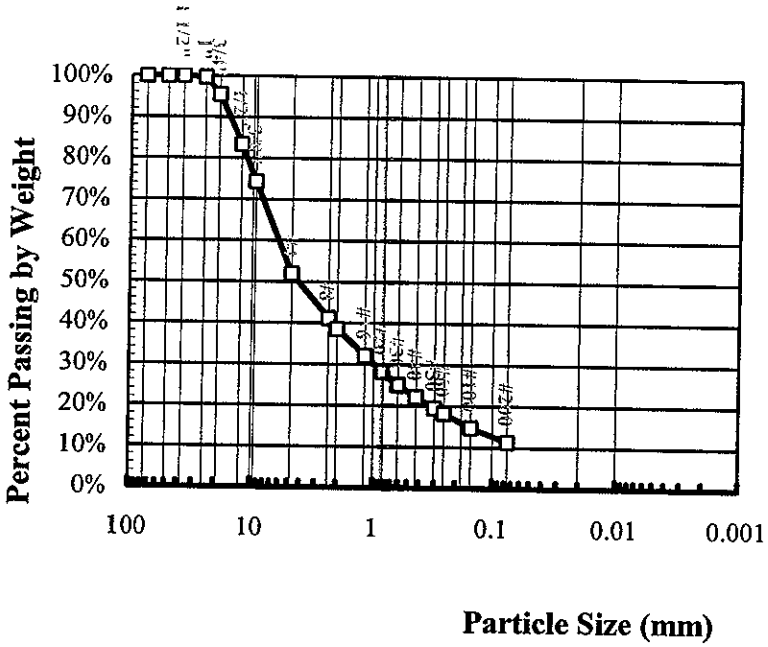
W.O. D59119D
Lab No. 2005-2988
Received: 12/12/05
Reported: 12/16/05

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM
Frost Classification: Not Measured



Uncorrected
Maximum Density: 151 pcf
Optimum Water Content: 5.5 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"		
1 1/2"	100%	
1"	100%	
3/4"	95%	
1/2"	83%	
3/8"	74%	
No. 4	52%	
Total Wt. = 21702g		
No. 8	41%	
No. 10		
No. 16	32%	
No. 20	28%	
No. 30	25%	
No. 40	22%	
No. 50	19%	
No. 60	18%	
No. 80		
No.100	15%	
No.200	11%	
Total Wt. of Fine Fraction = 559.9g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 137

Sample 3

Depth 5'-6.5'

Engineering Classification: Silty GRAVEL with Sand, GM

Frost Classification: Not Measured

PARTICLE-SIZE

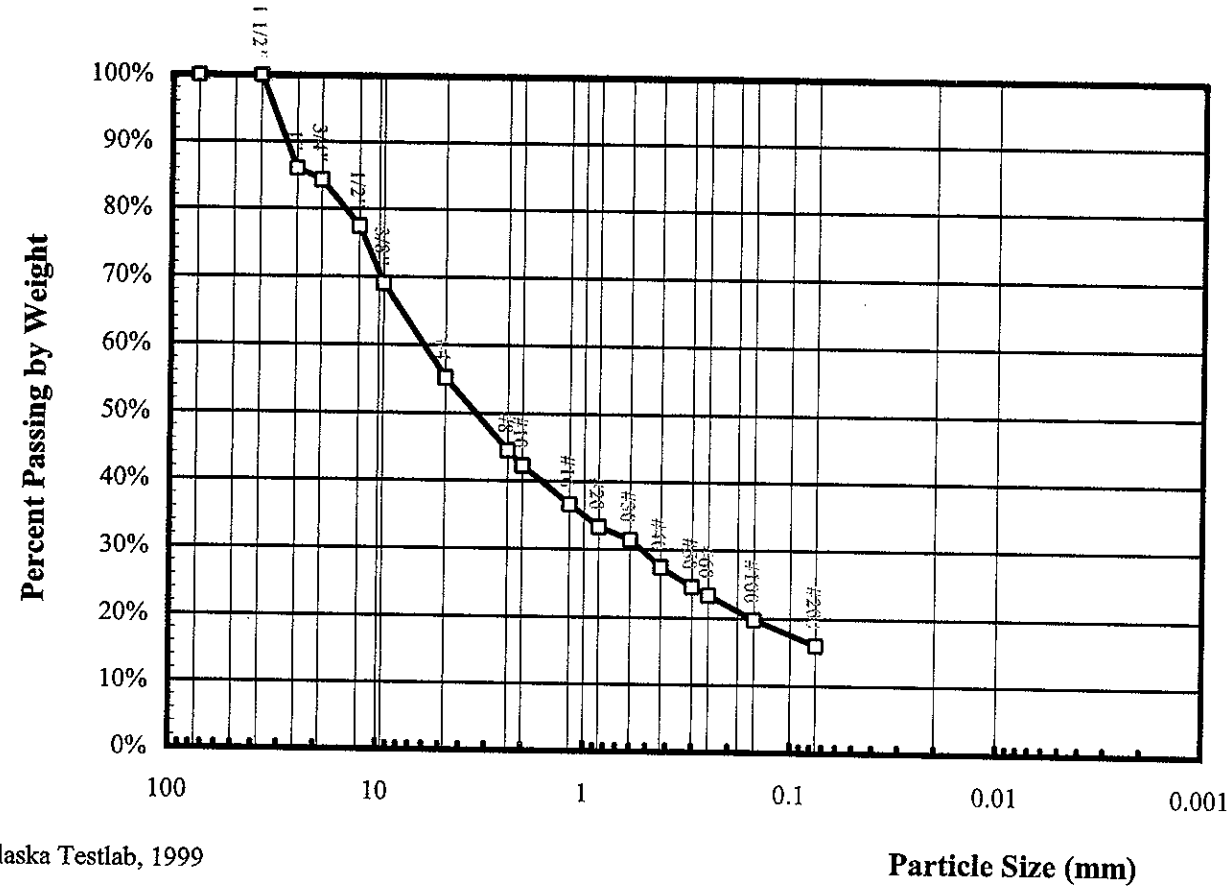
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2989

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	86%	
3/4"	84%	
1/2"	77%	
3/8"	69%	
No. 4	55%	
Total Wt. = 1034g		
No. 8	45%	
No. 10	42%	
No. 16	37%	
No. 20	33%	
No. 30	31%	
No. 40	27%	
No. 50	25%	
No. 60	23%	
No. 80		
No. 100	20%	
No. 200	16%	
Total Wt. of Fine Fraction = 570.4g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 139

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

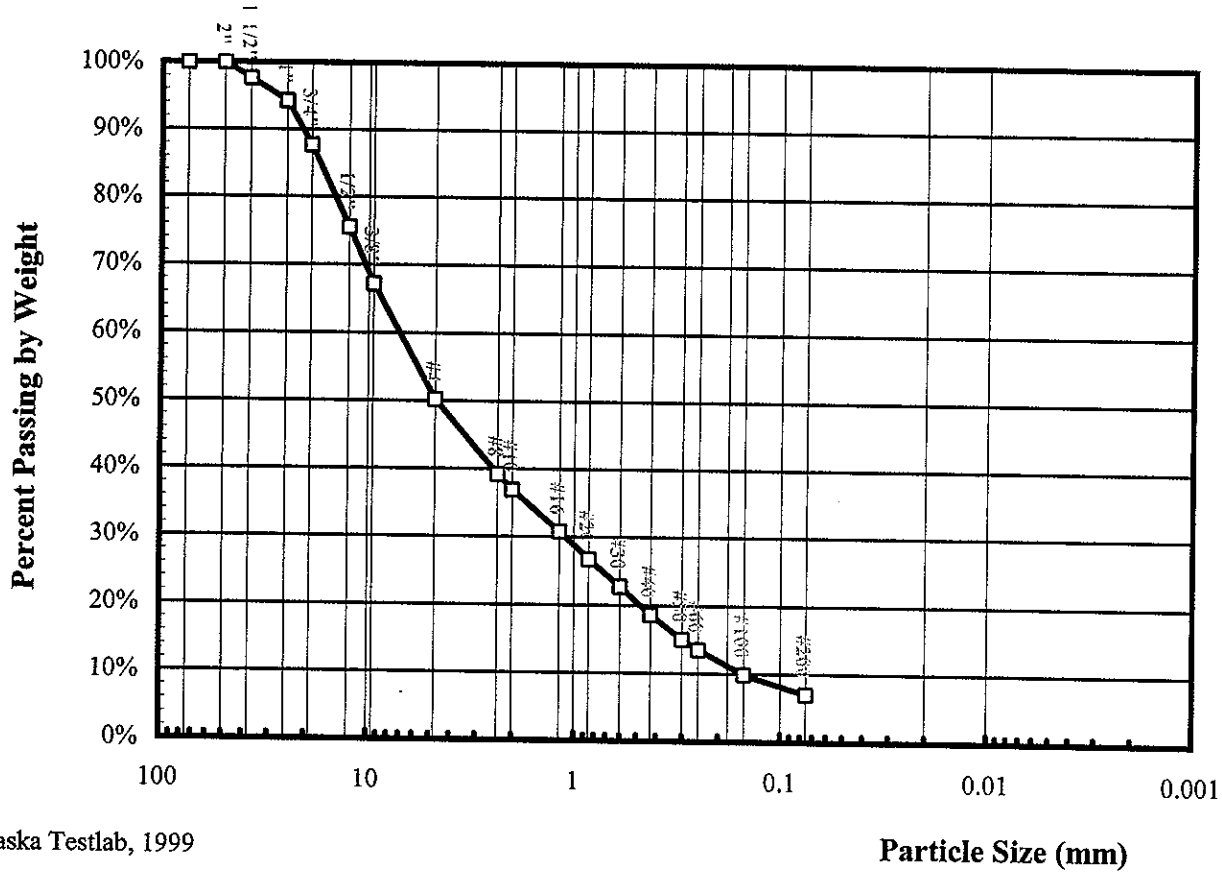
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2990

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	98%	
1"	94%	
3/4"	88%	
1/2"	76%	
3/8"	67%	
No. 4	50%	
Total Wt. = 22119g		
No. 8	39%	
No. 10	37%	
No. 16	31%	
No. 20	27%	
No. 30	23%	
No. 40	19%	
No. 50	15%	
No. 60	13%	
No. 80		
No. 100	10%	
No. 200	7%	
Total Wt. of Fine Fraction = 531.3g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 139

Sample 3

Depth 5'-6.5'

Engineering Classification: Silty SAND with Gravel, SM

Frost Classification: Not Measured

PARTICLE-SIZE

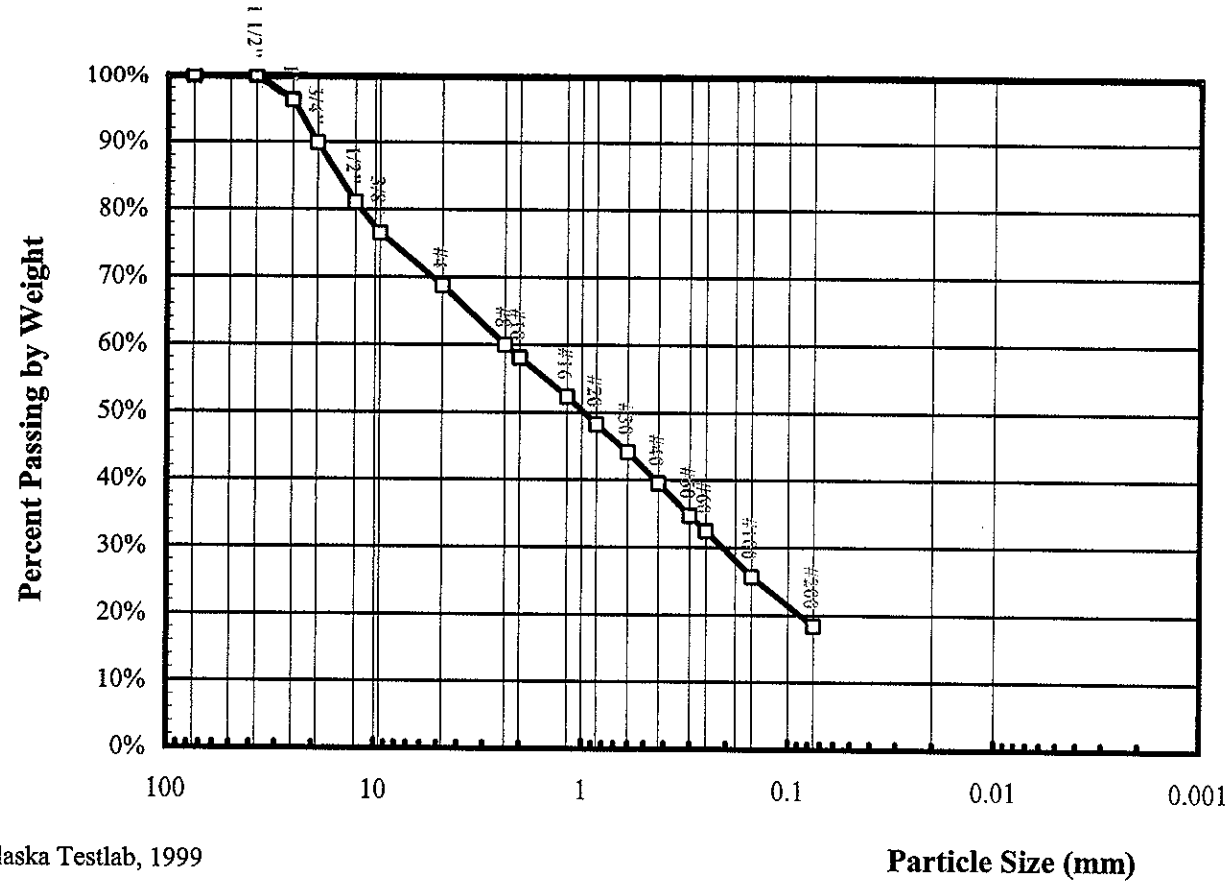
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2991

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	96%	
3/4"	90%	
1/2"	81%	
3/8"	77%	
No. 4	69%	
Total Wt. = 1954g		
No. 8	60%	
No. 10	58%	
No. 16	52%	
No. 20	48%	
No. 30	44%	
No. 40	40%	
No. 50	35%	
No. 60	32%	
No. 80		
No. 100	26%	
No. 200	18%	
Total Wt. of Fine Fraction = 505.1g		
0.02 mm		

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ALASKA TESTLAB
A Division of DOWL LLC

Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 142

Sample 1

Depth 0.5'-1.5'

Engineering Classification: Well Graded SAND with Silt and Gravel, SW-SM

Frost Classification: Not Measured

PARTICLE-SIZE

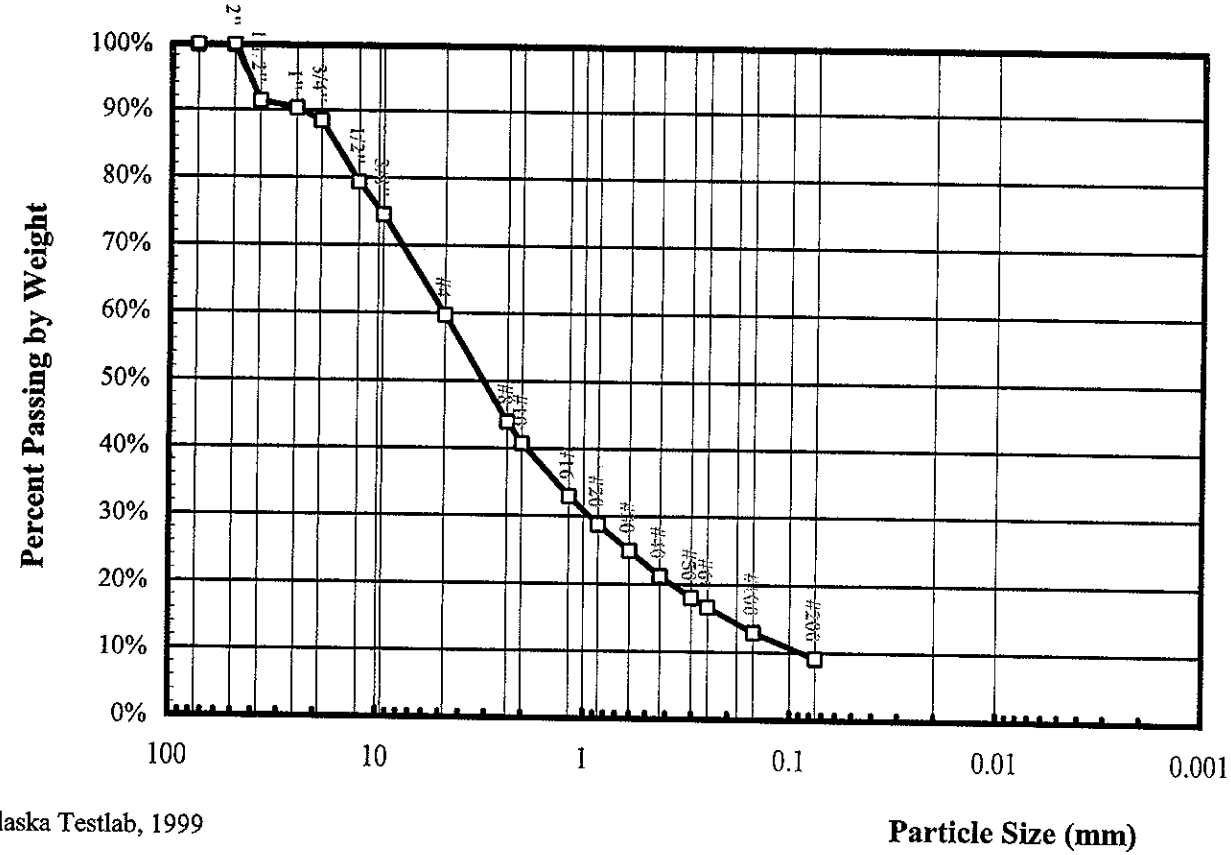
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2992

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	91%	
1"	90%	
3/4"	88%	
1/2"	79%	
3/8"	75%	
No. 4	60%	
Total Wt. = 2909g		
No. 8	44%	
No. 10	41%	
No. 16	33%	
No. 20	29%	
No. 30	25%	
No. 40	21%	
No. 50	18%	
No. 60	17%	
No. 80		
No. 100	13%	
No. 200	9.2%	
Total Wt. of Fine Fraction = 529.1g		
0.02 mm		

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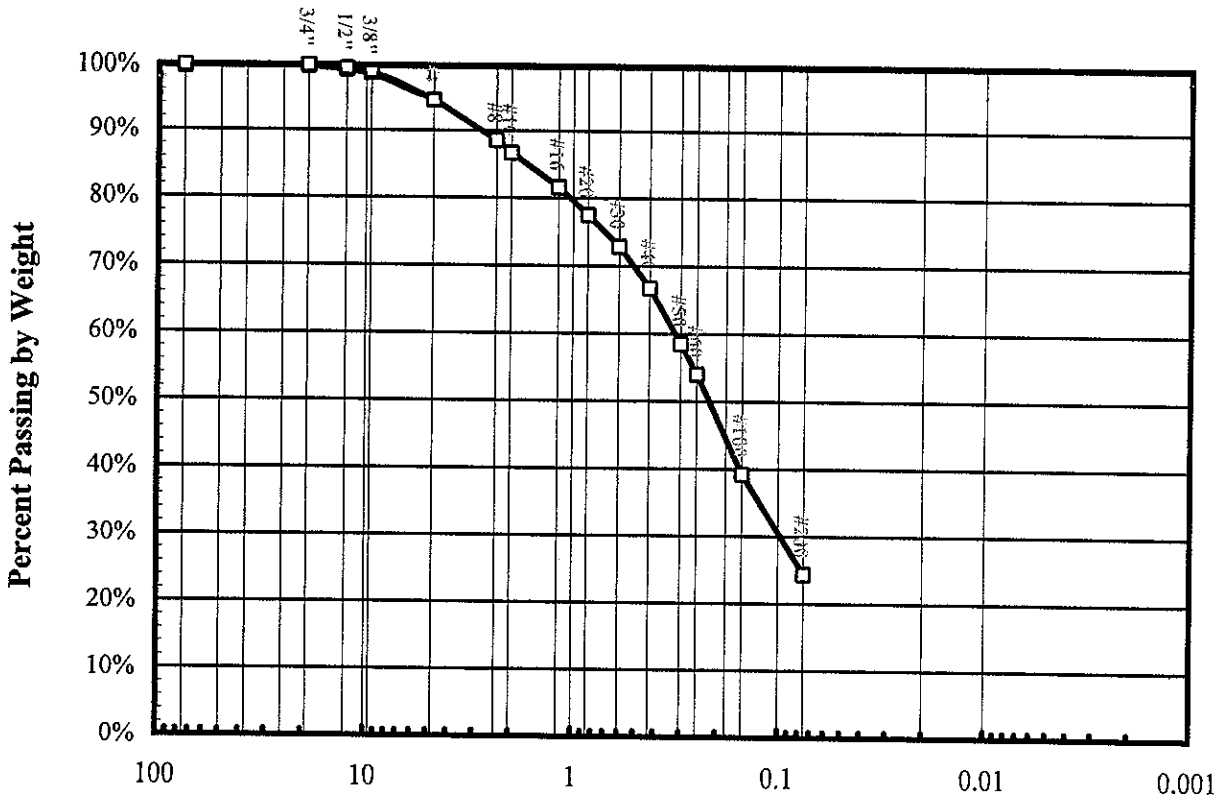
Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 142
Sample 2
Depth 2.5'-4'

Engineering Classification: Silty SAND , SM
Frost Classification: Not Measured



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PARTICLE-SIZE

DIST. ASTM D422

W.O. D59119D
Lab No. 2005-2993
Received: 12/2/05
Reported: 12/20/05

SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	99%	
No. 4	95%	
Total Wt. = 1413.8g		
No. 8	89%	
No. 10	87%	
No. 16	82%	
No. 20	78%	
No. 30	73%	
No. 40	67%	
No. 50	58%	
No. 60	54%	
No. 80		
No. 100	39%	
No. 200	24%	
Total Wt. of Fine Fraction = 501.2g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 143

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded SAND with Silt and Gravel, SW-SM

Frost Classification: Not Measured

PARTICLE-SIZE

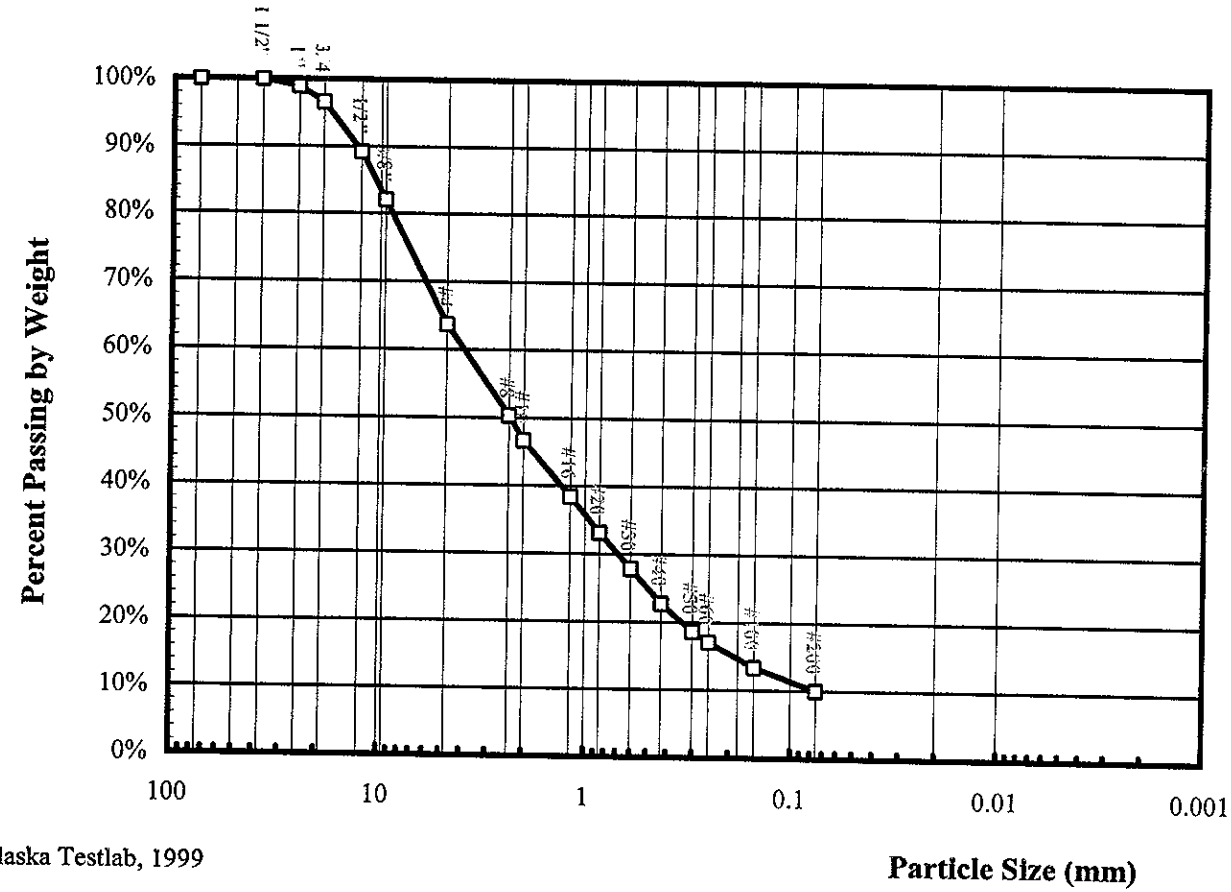
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2994

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	99%	
3/4"	97%	
1/2"	89%	
3/8"	82%	
No. 4	64%	
Total Wt. = 1828.1g		
No. 8	50%	
No. 10	47%	
No. 16	38%	
No. 20	33%	
No. 30	28%	
No. 40	23%	
No. 50	19%	
No. 60	17%	
No. 80		
No. 100	13%	
No. 200	10%	
Total Wt. of Fine Fraction = 595.1g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 144

Sample 1

0.5'-2'

Engineering Classification: Silty SAND with Gravel, SM

Frost Classification: Not Measured

PARTICLE-SIZE

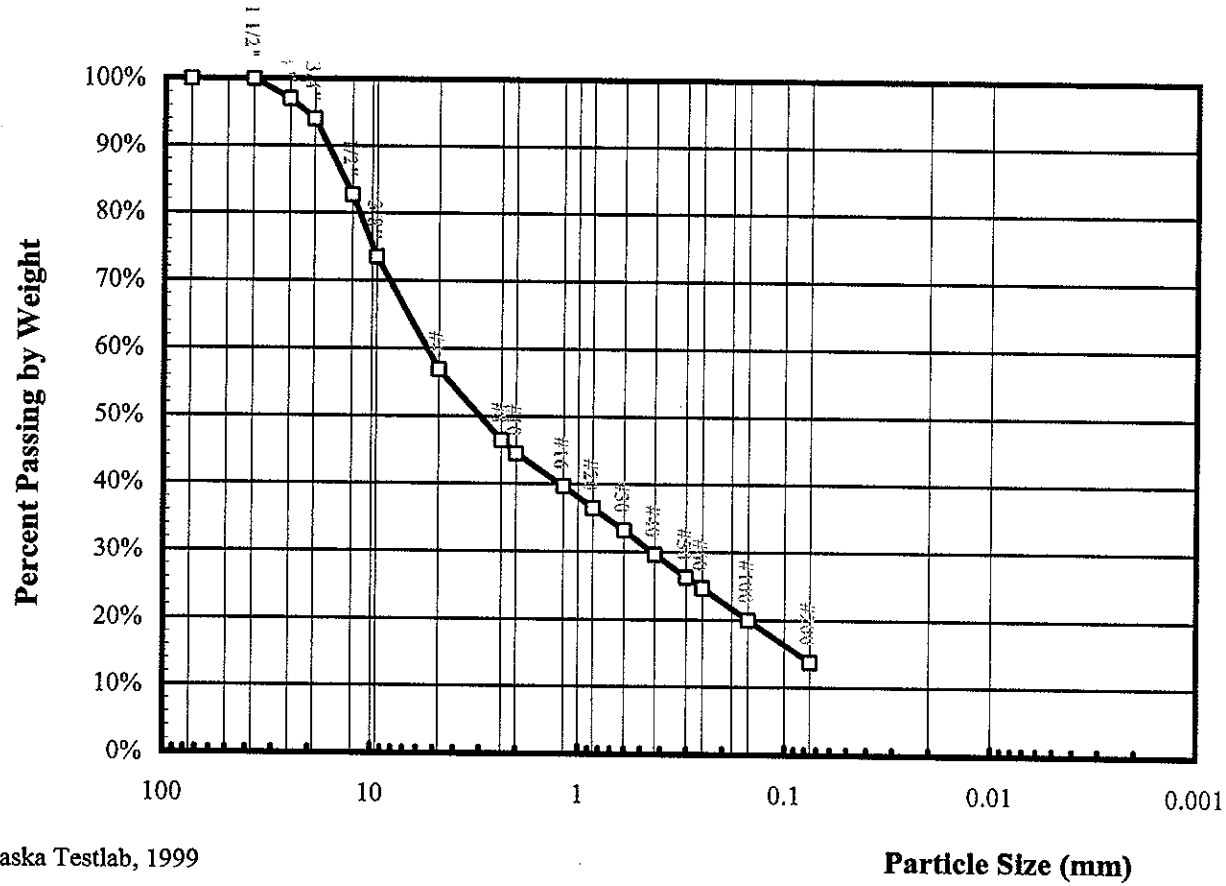
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2995

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	97%	
3/4"	94%	
1/2"	83%	
3/8"	74%	
No. 4	57%	
Total Wt. = 3348.7g		
No. 8	46%	
No. 10	44%	
No. 16	40%	
No. 20	36%	
No. 30	33%	
No. 40	30%	
No. 50	26%	
No. 60	25%	
No. 80		
No. 100	20%	
No. 200	14%	
Total Wt. of Fine Fraction = 565.1g		
0.02 mm		

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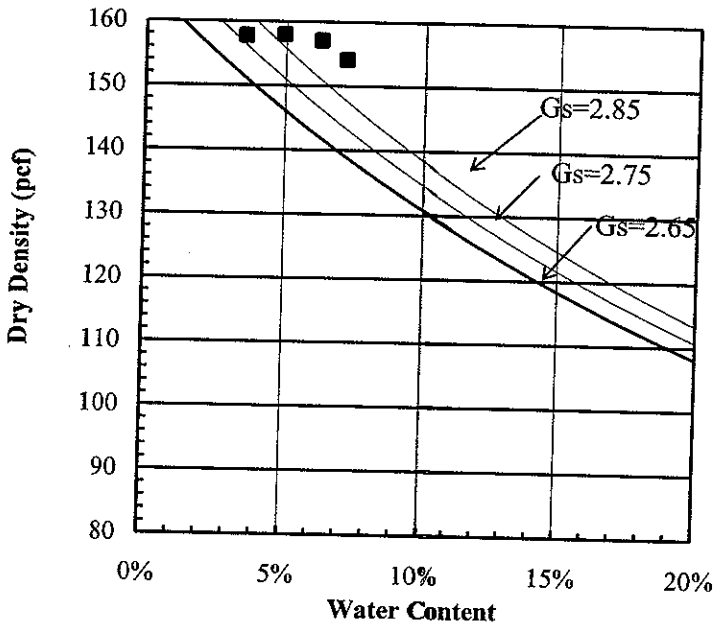
MODIFIED PROCTOR
ASTM D 1557 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 146
Sample 1
Depth 0.3' - 3'

W.O. D59119D
Lab No. 2006-675
Received: 6/1/06
Reported: 6/7/06

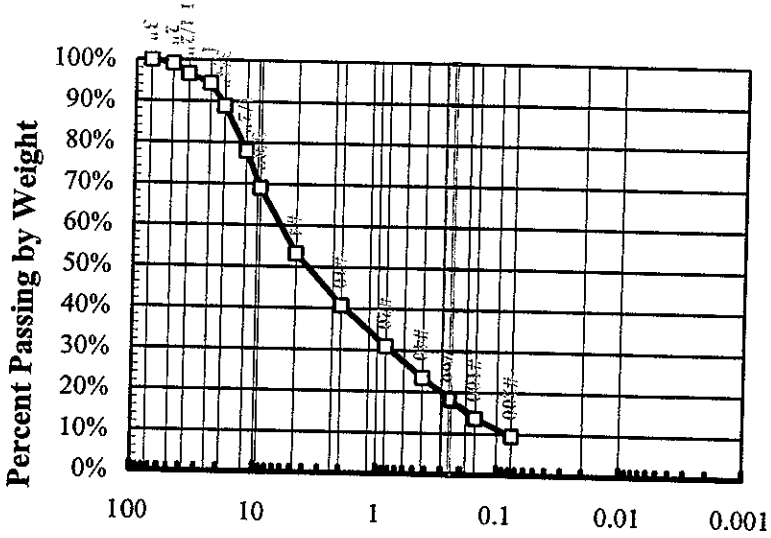
Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM
Frost Classification: Not Measured



Uncorrected
Maximum Density: 158 pcf
Optimum Water Content: 4.9 %

Corrected Density: 159 pcf
Corrected Optimum: 4.5 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"	100%	
2"	99%	
1 1/2"	97%	
1"	94%	
3/4"	89%	
1/2"	78%	
3/8"	69%	
No. 4	53%	
Total Wt. = 29865g		
No. 8		
No. 10	41%	
No. 16		
No. 20	31%	
No. 30		
No. 40	23%	
No. 50		
No. 60	18%	
No. 80		
No.100	14%	
No.200	9.5%	
Total Wt. of Fine Fraction = 788.7g		
0.02 mm		

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ALASKA TESTLAB
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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 147

Sample 1

Depth 0.2' - 1.2'

Engineering Classification: Well Graded GRAVEL with Sand, GW

Frost Classification: NFS MOA

PARTICLE-SIZE

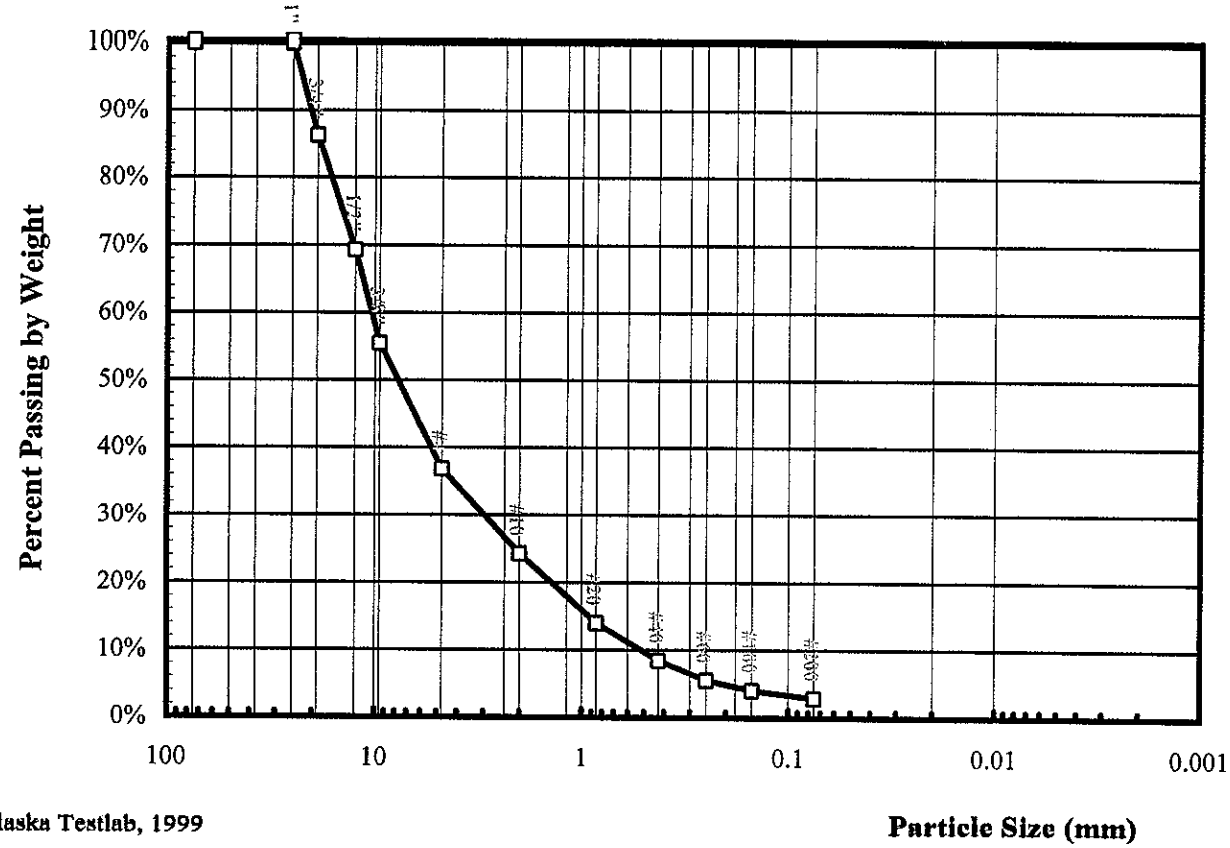
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-676

Received: 6/1/06

Reported: 6/9/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	86%	
1/2"	69%	
3/8"	55%	
No. 4	37%	
Total Wt. = 6475g		
No. 8		
No. 10	24%	
No. 16		
No. 20	14%	
No. 30		
No. 40	8%	
No. 50		
No. 60	6%	
No. 80		
No. 100	4%	
No. 200	2.9%	
Total Wt. of Fine Fraction = 543.6g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 149

Sample 1

Depth 3' - 4'

Engineering Classification: Silty SAND with Gravel, SM

Frost Classification: Not Measured

PARTICLE-SIZE

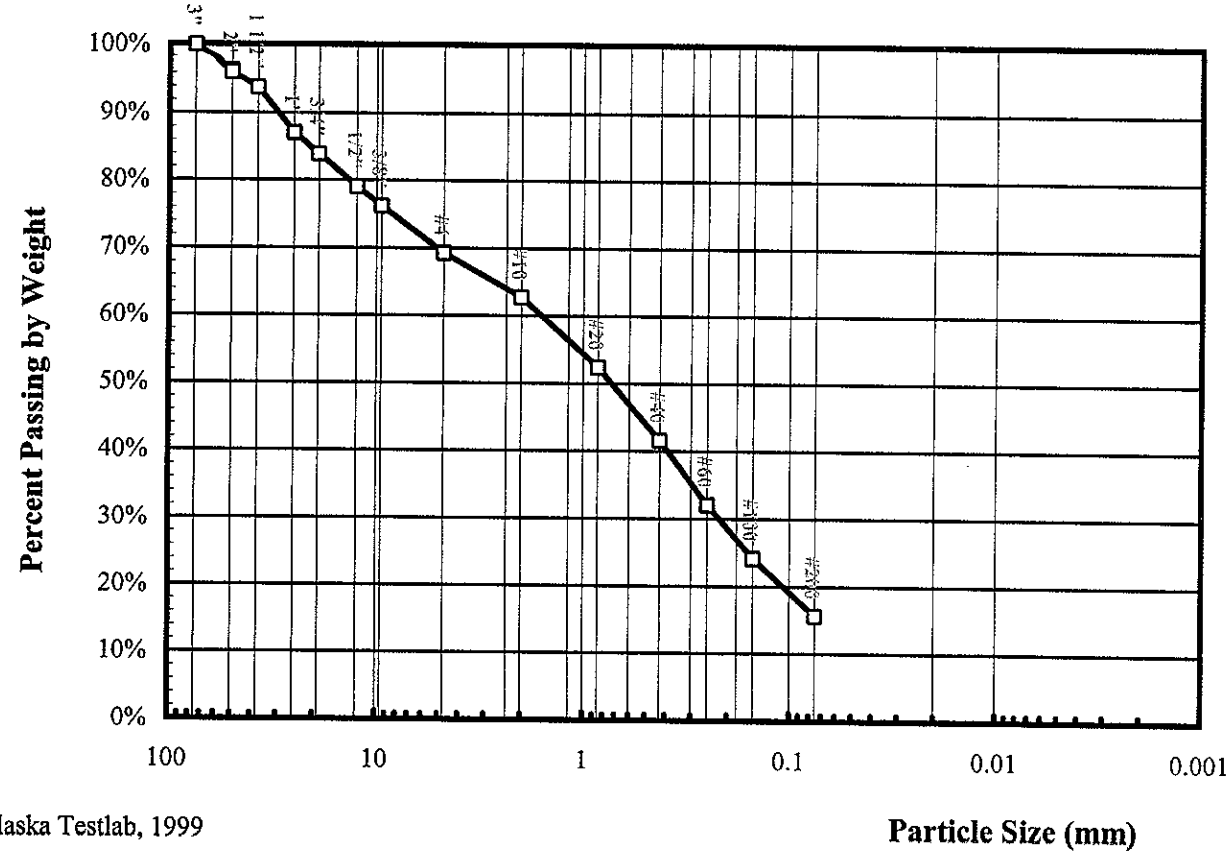
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-677

Received: 6/1/06

Reported: 6/7/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	96%	
1 1/2"	94%	
1"	87%	
3/4"	84%	
1/2"	79%	
3/8"	76%	
No. 4	69%	
Total Wt. = 46218g		
No. 8		
No. 10	63%	
No. 16		
No. 20	52%	
No. 30		
No. 40	42%	
No. 50		
No. 60	32%	
No. 80		
No. 100	24%	
No. 200	16%	
Total Wt. of Fine Fraction = 730.9g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 150

Sample 1, Depth 0' - 3'

Maximum Index Density ASTM D4253 = 150.0 pcf

Engineering Classification: Poorly Graded GRAVEL with Sand, GP

Frost Classification: NFS MOA

PARTICLE-SIZE

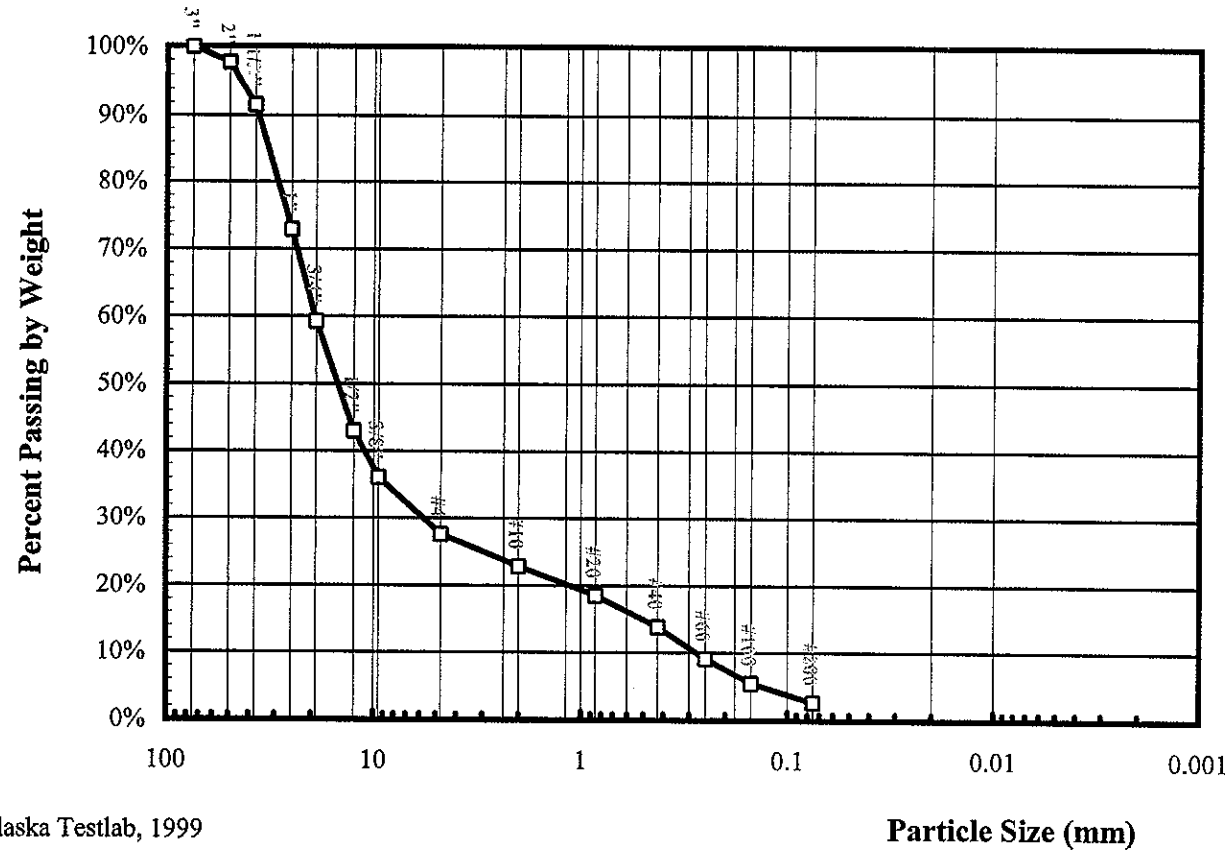
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-678

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"	100%	
2"	98%	
1 1/2"	92%	
1"	73%	
3/4"	59%	
1/2"	43%	
3/8"	36%	
No. 4	28%	
Total Wt. = 25722g		
No. 8		
No. 10	23%	
No. 16		
No. 20	19%	
No. 30		
No. 40	14%	
No. 50		
No. 60	9%	
No. 80		
No. 100	6%	
No. 200	2.7%	
Total Wt. of Fine Fraction = 519g		
0.02 mm		

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Client: ADOT&PF Southeast Region

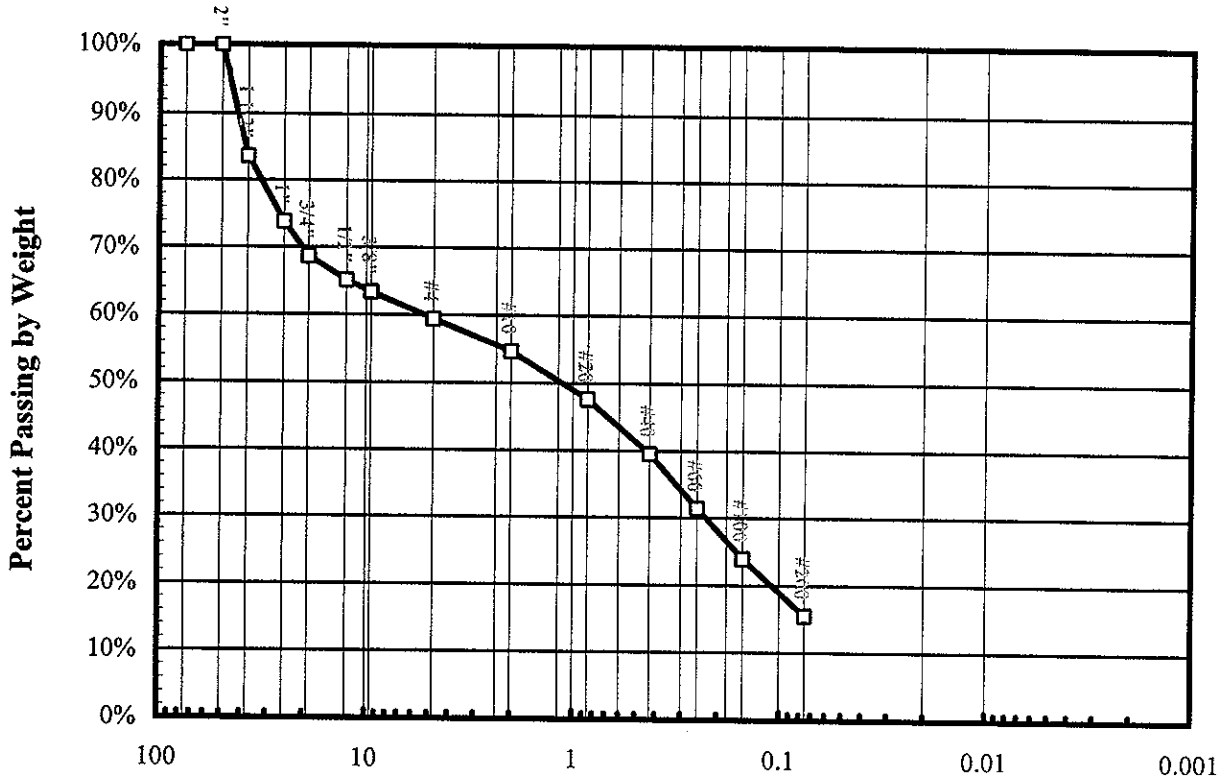
Project: Haines Highway

Location: Test Boring 151
Sample 2
Depth 10' - 11'

Engineering Classification: Silty SAND with Gravel, SM
Frost Classification: Not Measured

PARTICLE-SIZE
DIST. ASTM D422

W.O. D59119D
Lab No. 2006-679
Received: 6/1/06
Reported: 6/7/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	84%	
1"	74%	
3/4"	69%	
1/2"	65%	
3/8"	63%	
No. 4	59%	
Total Wt. = 3164g		
No. 8		
No. 10	55%	
No. 16		
No. 20	48%	
No. 30		
No. 40	40%	
No. 50		
No. 60	31%	
No. 80		
No. 100	24%	
No. 200	16%	
Total Wt. of Fine Fraction = 334g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 152

Sample 1

Depth 6' - 7'

Engineering Classification: Poorly Graded SAND with Silt and Gravel, SP-SM

Frost Classification: Not Measured

PARTICLE-SIZE

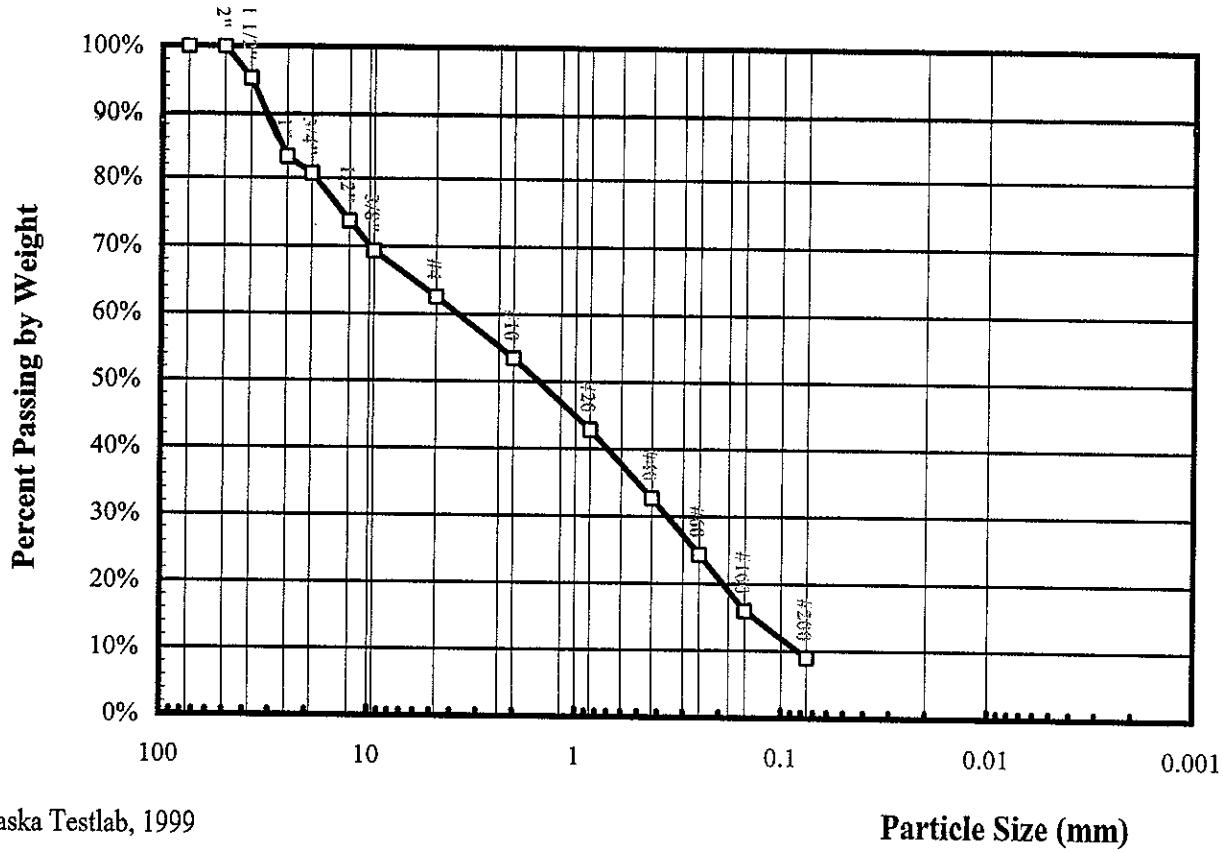
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-680

Received: 6/1/06

Reported: 6/7/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	95%	
1"	83%	
3/4"	81%	
1/2"	74%	
3/8"	69%	
No. 4	63%	
Total Wt. = 3979g		
No. 8		
No. 10	53%	
No. 16		
No. 20	43%	
No. 30		
No. 40	33%	
No. 50		
No. 60	24%	
No. 80		
No. 100	16%	
No. 200	9%	
Total Wt. of Fine Fraction = 326.6g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 153

Sample 2

Depth 8' - 9'

Engineering Classification: Silty SAND , SM

Frost Classification: Not Measured

PARTICLE-SIZE

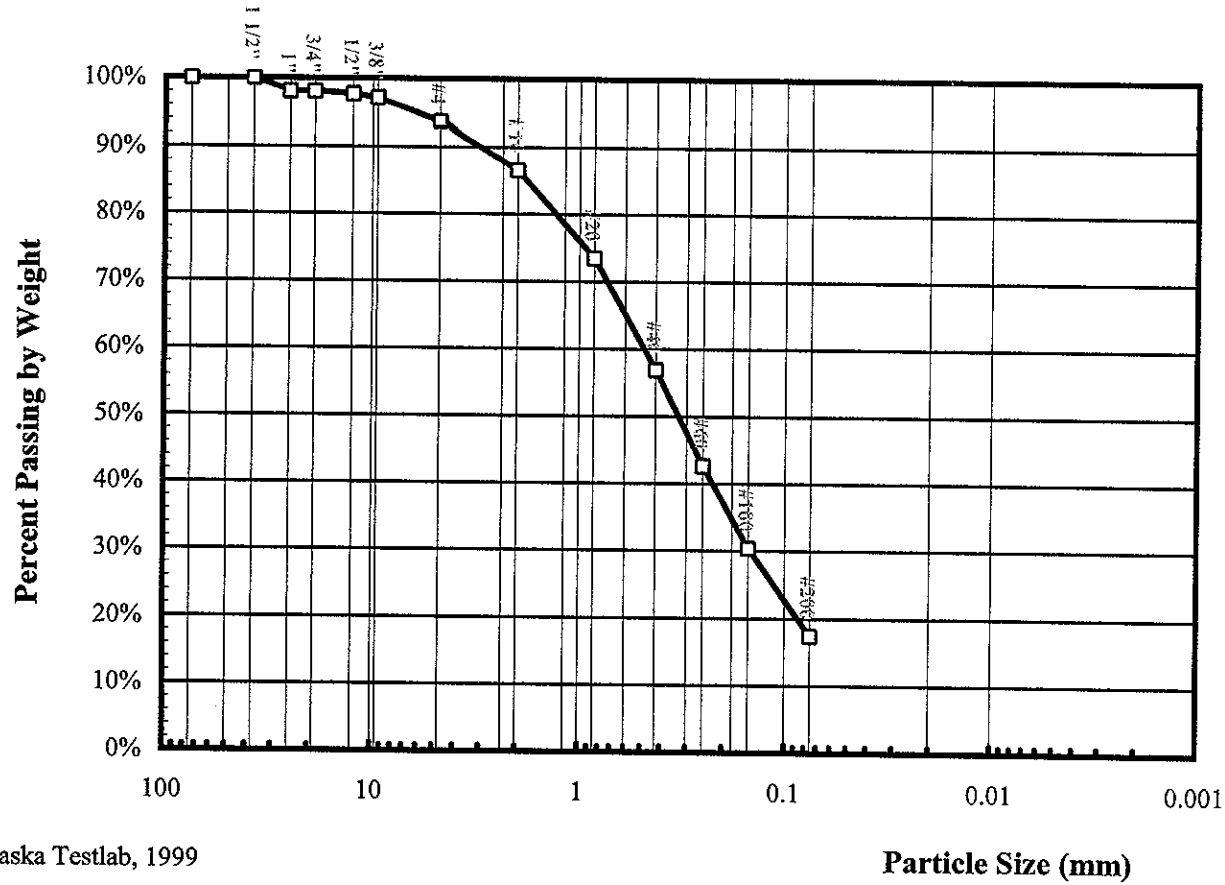
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-681

Received: 6/1/06

Reported: 6/7/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	98%	
1/2"	98%	
3/8"	97%	
No. 4	94%	
Total Wt. = 3104g		
No. 8		
No. 10	87%	
No. 16		
No. 20	73%	
No. 30		
No. 40	57%	
No. 50		
No. 60	43%	
No. 80		
No. 100	30%	
No. 200	17%	
Total Wt. of Fine Fraction = 363.7g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 154

Sample 1

Depth 0.3'-3'

Engineering Classification: Well Graded SAND with Silt and Gravel, SW-SM

Frost Classification: Not Measured

PARTICLE-SIZE

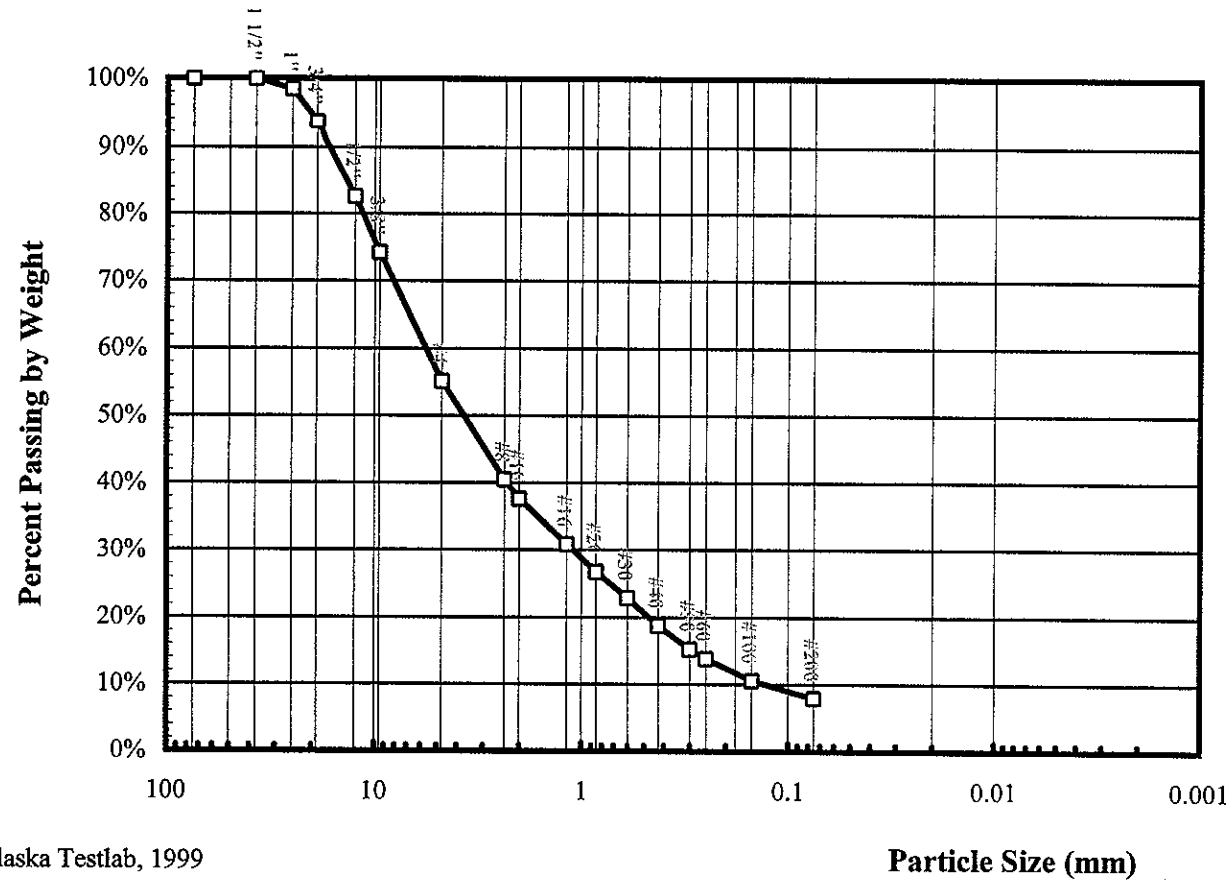
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2996

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	98%	
3/4"	93%	
1/2"	83%	
3/8"	74%	
No. 4	55%	
Total Wt. = 21660g		
No. 8	41%	
No. 10	38%	
No. 16	31%	
No. 20	27%	
No. 30	23%	
No. 40	19%	
No. 50	15%	
No. 60	14%	
No. 80		
No. 100	11%	
No. 200	8%	
Total Wt. of Fine Fraction = 565.9g		
0.02 mm		

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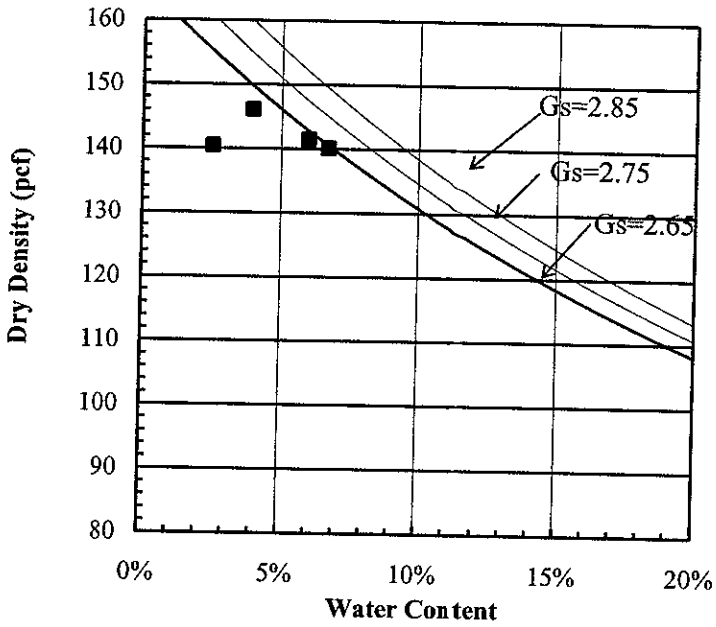
MODIFIED PROCTOR
AASHTO T-180 B

Client: ADOT&PF Southeast Region
Project: Haines Highway
Location: Test Boring 155
Sample 1
Depth 0.6'-3'

W.O. D59119D
Lab No. 2005-2997
Received: 12/2/05
Reported: 12/19/05

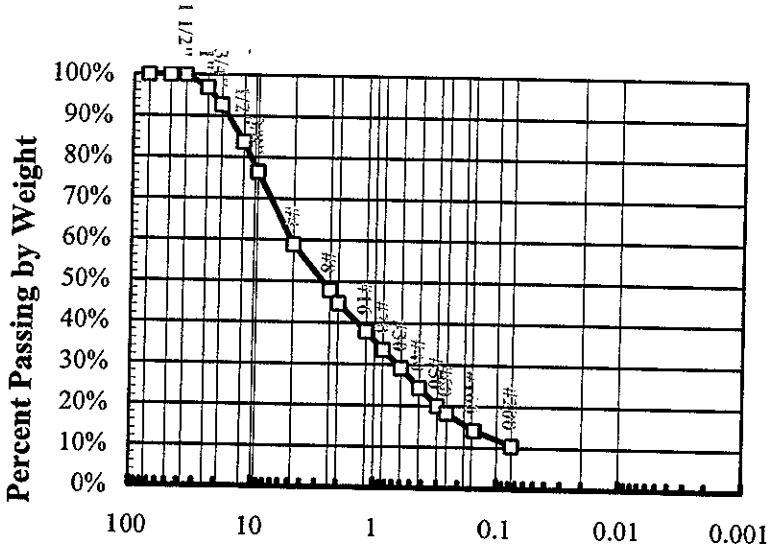
Engineering Classification: Well Graded SAND with Silt and Gravel, SW-SM
Frost Classification: Not Measured



Uncorrected
Maximum Density: 146.1 pcf
Optimum Water Content: 4 %

Corrected Density: 147.5 pcf
Corrected Optimum: 3.5 %

Moist Preparation
Mechanical Compaction



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"		
1 1/2"	100%	
1"	97%	
3/4"	93%	
1/2"	84%	
3/8"	76%	
No. 4	59%	
Total Wt. = 22618g		
No. 8	48%	
No. 10		
No. 16	38%	
No. 20	33%	
No. 30	29%	
No. 40	24%	
No. 50	20%	
No. 60	18%	
No. 80		
No.100	14%	
No.200	10%	
Total Wt. of Fine Fraction = 577g		
0.02 mm		

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Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 155

Sample 3

Depth 5'-6.5'

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM

Frost Classification: Not Measured

PARTICLE-SIZE

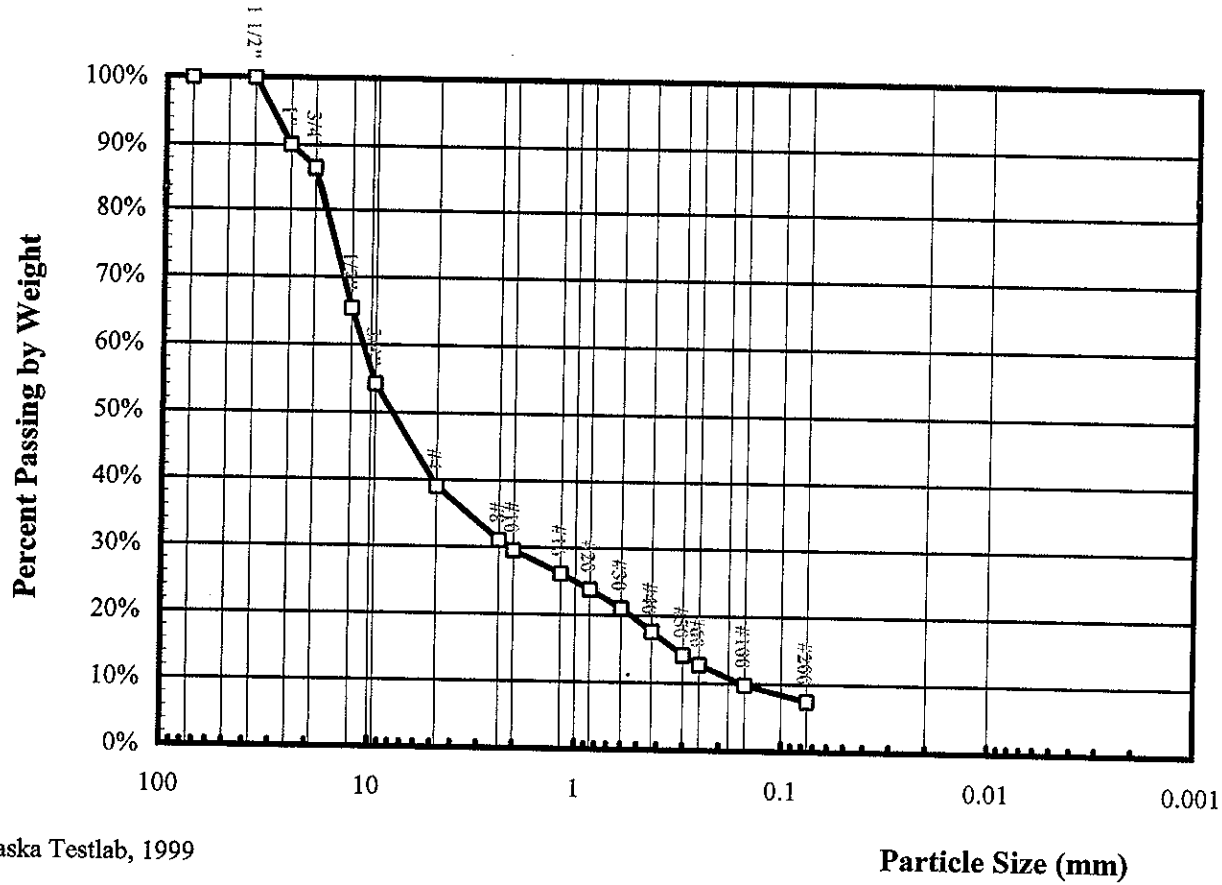
DIST. ASTM D422

W.O. D59119D

Lab No. 2005-2998

Received: 12/2/05

Reported: 12/20/05



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	90%	
3/4"	87%	
1/2"	65%	
3/8"	54%	
No. 4	39%	
Total Wt. = 1471.7g		
No. 8	31%	
No. 10	30%	
No. 16	26%	
No. 20	24%	
No. 30	21%	
No. 40	18%	
No. 50	14%	
No. 60	13%	
No. 80		
No. 100	10%	
No. 200	7.5%	
Total Wt. of Fine Fraction = 574.3g		
0.02 mm		

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David L Andersen

David L. Andersen, P.E., Technical Advisor

4040 B Street Anchorage Alaska 99503 • 907/562-2000 • 907/563-3953

ALASKA TESTLAB
A Division of DOWL LLC

Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 156

Sample 1

Depth 2' - 3'

Engineering Classification: Poorly Graded SAND with Gravel, SP

Frost Classification: NFS MOA

PARTICLE-SIZE

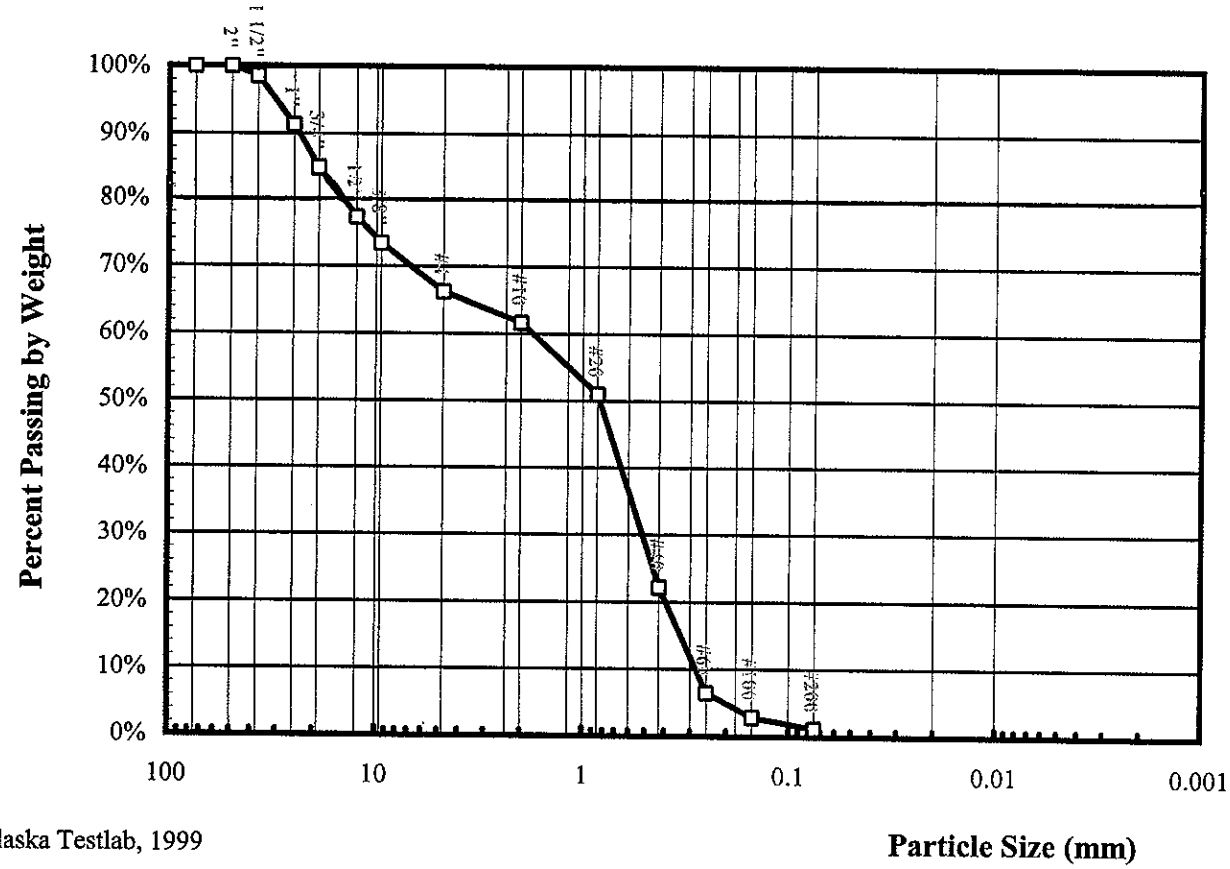
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-682

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"	100%	
1 1/2"	98%	
1"	91%	
3/4"	85%	
1/2"	77%	
3/8"	73%	
No. 4	66%	
Total Wt. = 19712g		
No. 8		
No. 10	62%	
No. 16		
No. 20	51%	
No. 30		
No. 40	22%	
No. 50		
No. 60	6%	
No. 80		
No. 100	3%	
No. 200	1.2%	
Total Wt. of Fine Fraction = 363.1g		
0.02 mm		

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ALASKA TESTLAB
A Division of DOWL LLC

Client: ADOT&PF Southeast Region

Project: Haines Highway

Location: Test Boring 158

Sample 1

Depth 1' - 2'

Engineering Classification: Poorly Graded GRAVEL with Sand, GP

Frost Classification: Not Measured

PARTICLE-SIZE

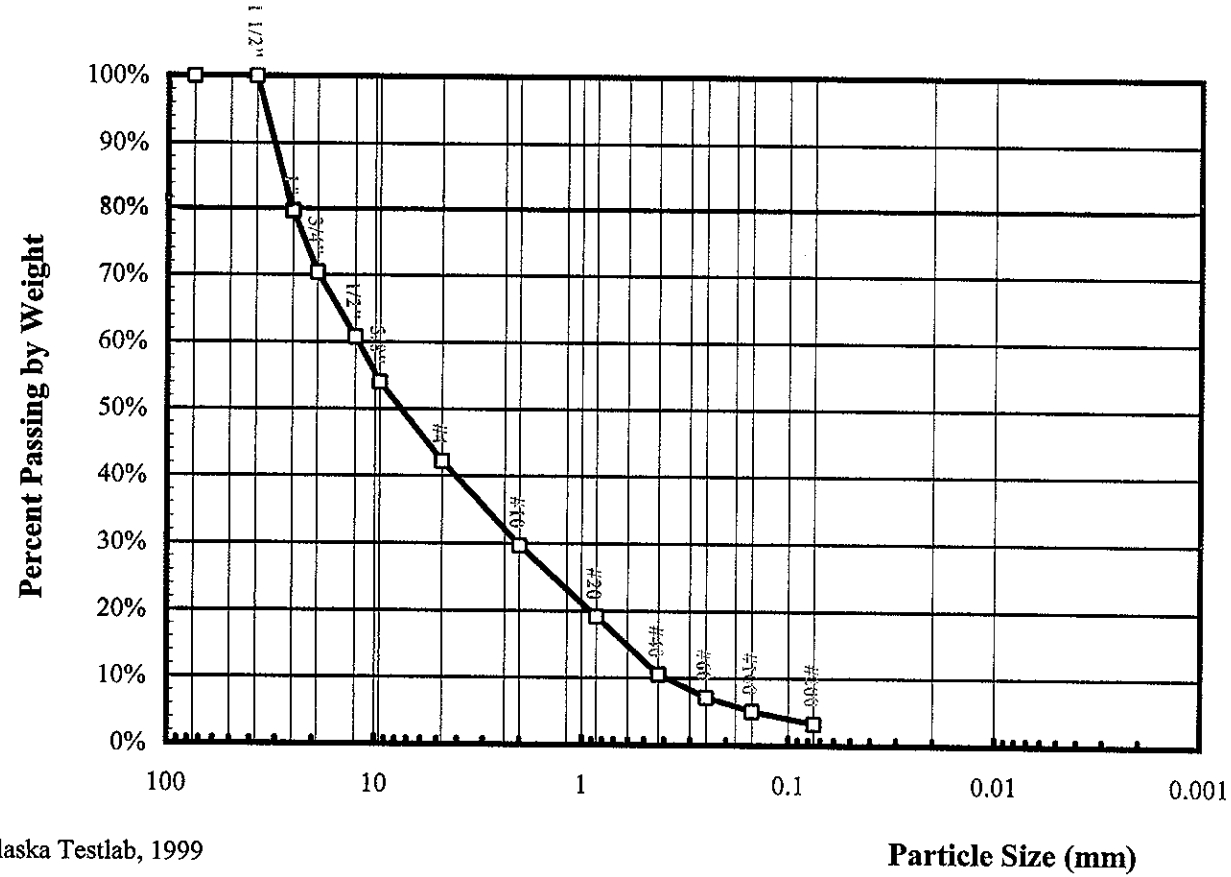
DIST. ASTM D422

W.O. D59119D

Lab No. 2006-683

Received: 6/1/06

Reported: 6/8/06



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -%		
3"		
2"		
1 1/2"	100%	
1"	80%	
3/4"	70%	
1/2"	61%	
3/8"	54%	
No. 4	42%	
Total Wt. = 5399g		
No. 8		
No. 10	30%	
No. 16		
No. 20	19%	
No. 30		
No. 40	11%	
No. 50		
No. 60	7%	
No. 80		
No. 100	5%	
No. 200	3.3%	
Total Wt. of Fine Fraction = 494.1g		
0.02 mm		

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APPENDIX D

Debris Flows

HAINES HIGHWAY DEBRIS FLOWS
MP 19 AND MP 23

Debris Flow Areas

The section of the Haines Highway currently planned for upgrades traverses two alluvial fans – one at about Milepost (MP) 19 and one at about MP 23. Both fans began to form after the last retreat of the glaciers that formed the Chilkat River valley, and are active geologic features that periodically produce large flow slides that cover portions of the highway. The fans were formed by deposition of eroded materials whose sources are in the valleys and cirques above the steep walls of the Chilkat River valley. This valley is bordered on the east by the steep walls of the Takshanuk Mountains, which rise abruptly from an elevation of about 100 feet to over 5,000 feet above sea level in a distance of about 9,000 feet. The surface slopes of the cones are fairly gentle and vary from about 10 percent to about 15 percent. The apexes of the cones are at about elevation 1,000 feet. The base of the fan at MP 19 is about 1.5 miles wide, and the fan at MP 23 is about 2.0 miles wide at its base. Both fans terminate on the banks of the Chilkat River (Figure 1).

The soils that comprise the alluvial deposits of the fans come from the steep rock walls of the incised valleys above the fans. They generally are loose and well graded, and are composed of particles that range in size from fine sand and silt to boulders up to six feet or more in diameter. The creeks that produced the fans normally flow at low volumes and velocities in well defined channels (Figure 2). However, during periodic storms that occur over the barren watersheds above the fans or on the remnants of winter snow packs in those areas, the flows of the streams increase dramatically can produce flow slides that reach the highway. The forces developed in the floodway during those times are large enough to dislodge and transport boulders up to six feet in diameter. This process has been occurring since the retreat of the glaciers in the Chilkat River valley, and will continue to occur for the foreseeable future. The amount of material that reaches the highway during these annual events typically is constrained within the catchment areas and does not impact the normal use of the highway. However, occasionally large slides occur and significant volumes (100,000+ cubic yards) of soil and rock scoured from the stream channels flow down the fans and across

the highway. Debris flows which have crossed the highway during those rare events have been reported to reach depths of six to twelve feet at the center of their leading edge and have had breadths of up to 900 feet.

State of Alaska, Department of Transportation and Public Facilities (DOT&PF) personnel responsible for maintenance of the highway indicate minor flow slides, of which limited quantities of material may overtop the road, generally are annual occurrences. However, major slides, such as the November 2005 event, where as much as 12 feet of debris covered the road, are rare – perhaps on the order of 30 to 50 years between occurrences.

Effects of Slides

The effects of flow slides on the highway are threefold:

1. Safety to the traveling public,
2. Disruption of surface transportation, and
3. Costs of clean up and repairs to the highway.

When debris flows are large enough to overtop and cross the highway, it is possible that vehicles could be struck causing injury to the occupants and damage to vehicles. Apparently this occurred during the last major slide at MP 23 (November 2005). A passenger car was caught in the slow moving debris flow and its lone occupant was barely able to get out of the car and reach safety with help of other travelers stopped near the perimeter of the slide. It is our understanding that no one has been seriously injured to date, but the unpredictability of the slides suggests that debris being suddenly washed onto the road could cause a danger to motorists.

When flow slides cross the road embankment, traffic is disrupted until the debris is removed. Disruption of traffic on this highway can have serious impact on the normal flow of people and goods in Alaska.

Current Control Measures

During recent years the DOT&PF has made attempts to control the flooding and periodic debris flows in these areas by excavating catchments upstream of and adjacent to the highway and by installing large diameter culverts below the highway (Figure 3). The arch

culvert at MP 19 is about 10' by 6.5" and the culvert at MP 23 is about 8' by 6'. They also created a catchment berm (Figure 4) near the top of the fan at MP 23 in hopes of reducing the amount of debris that would reach the highway. Reportedly, these measures have been successful in stopping the smaller, more frequent debris flows from covering the highway. However, an unusually large event in November 2005, filled the roadside catchment at Mile 23 and covered the highway to depths up to 12 feet (Figure 5).

When small events occur, DOT&PF personnel remove the accumulated debris adjacent to the road embankment and within the pipe culverts. The culverts in these areas are significantly oversized to allow equipment to remove the debris that may fill and plug the culverts. Generally, it only takes a few days to remove the slide material, and there is little or no impact to the traveling public. However, during the major slide that occurred in November 2005, it took maintenance crews two and a half days to reopen just one lane of the highway. Moreover, it took another two to three weeks to clear the rest of the debris from the highway because of the onset of freezing weather. Removal of material within the catchment area took about three months because of weather constraints.

Optional Control Measures

There are four options for dealing with the debris flows that periodically cross the highway:

1. Do nothing more than continue with the current mitigation and control measures,

2. Improve the size and extent of the catchments and increase the number and size of culverts,

3. Elevate the road along its current alignment where it crosses the areas susceptible to debris slides, and

4. Relocate the road upslope from its current alignment and construct a bridge over the streams that are the sources of the flow slides.

Each option has different initial costs and long-term maintenance costs. Typically the options with the lower initial construction costs will have higher maintenance costs.

Option 1 – Continue with Current Control Measures

This option would be limited to incorporating the current mitigation measures into the new highway improvements with little or no change to the current configuration of catchments and culverts. Maintenance of the upper and lower catchment areas would remain essentially the same as the current program.

Option 2 – Improve Catchments and Culverts

The current single culverts at MP 19 and MP 23 are in place only to allow passage of the streams below the road. They are not intended to allow passage of slide materials and to protect the road from being overtopped. They were sized principally to allow maintenance crews to use small equipment to remove debris that fills the culverts when slides occur. The performance of culverts during debris flows could be improved by including cast-in-place concrete headwalls at the upstream ends of the culverts. However, this improvement would only be a help in cleaning out the culvert after a slide.

Installation of additional culverts likely would only make cleanup after a slide more difficult and more costly, since small equipment would be required to remove the debris out of the additional culverts. The additional culverts would have little effect on mitigating the potential for a large debris slide to overtop the road.

Two measures could be taken to lessen the chance of debris slides overtopping the road during construction of the new highway improvements. The catchments adjacent to the road could be extended in length, widened and perhaps deepened to accommodate a larger volume of debris, and the centerline grade of the road could be raised as much as is practical in the areas currently subject to debris slides. These two improvements would be relatively inexpensive to construct and would allow larger volumes of slide debris to accumulate before crossing the road. These simple measures would lessen the probability of overtopping the road during the more frequent, smaller events, but still would require removal of slide debris after each event.

Option 3 – Elevated Road

The surest way to mitigate the likelihood of slide debris covering the highway in the future would be to elevate the road in the areas subject to debris flows. This approach would have high initial construction costs, but could be designed to allow future debris flows to pass below the highway and not pose a danger to the traveling public nor close the road to traffic.

Two approaches to elevating the sections of the road subject to overtopping by flow slides are:

Option 3A - Conventional bridge structures, and

Option 3B - Precast component arch bridges.

Option 3A. If a conventional bridge were utilized to allow the passage of flow slides, the bridge span(s) would have to be long enough to accommodate potentially large slides. It is likely bridges would have to span 100 to 200 feet to allow large slides to pass. Furthermore, some stream training and long-term maintenance of those improvements likely would be required to insure flow slides would remain in a path directed to the elevated section of the road.

Bridge supports (piers and abutments) would have to be continuous walls essentially perpendicular to the direction of potential debris flow to minimize the dynamic forces of flowing slide debris on the structures. Individual column supports are not recommended because of the potential for damage during the passage of slide debris. Furthermore, bridge piers of this nature and location would have to be founded deep enough below grade to mitigate the potential for scour of their foundations during passage of debris flows. For this reason pile foundations may have to be used to support the bridge abutments and piers.

It is likely the bottom of bridge deck components would have to be on the order of 12 to 15 feet above the surrounding ground to allow passage of slide debris. This situation would require approach ramps at each end of the elevated sections. The sides of the approach ramps might have to be supported by retaining walls if the available right-of-way and/or the surrounding topography limit the width of ramp embankment fills. In addition to high construction costs this approach also would significantly lengthen the time of construction beyond that of an earthwork only approach.

Option 3B. Precast concrete arch structures (Figure 6) would serve the same purposes as conventional bridges; however, they would have advantages of somewhat lower costs and much shorter construction periods. The other elements of conventional bridge design and construction also would apply to the precast arch approach.

Option 4 – Realign Road Upslope

Another way to control the likelihood of debris flows crossing the highway would be to realign the road well upslope from its current location at both areas affected by debris flows, and to construct bridges across the streams that flow down the alluvial fans. We do not believe this approach has practical merit for several reasons:

- The length of bridges would not be significantly shorter that those at the current location of the road;
- This approach would require hundreds of feet of new road up and down the alluvial fans;
- It is likely new right-of-way would have to be acquired; and
- Construction costs of both the bridges and the approaches likely would be significantly more than those along the current alignment.

Each option also would have to account for any environmental factors and restrictions that might affect construction of planned improvements.

Recommendations

Table D-1 compares the relative costs and impacts on maintenance costs and on public safety of the four options discussed above. Based on this summary, we recommend Option 2. This option requires a substantial amount of earthwork, but by raising the elevation of the roadway and increasing the catchment size, the frequency of debris flowing across the road should decrease, thus increasing public safety.

Whichever option is selected, we recommend:

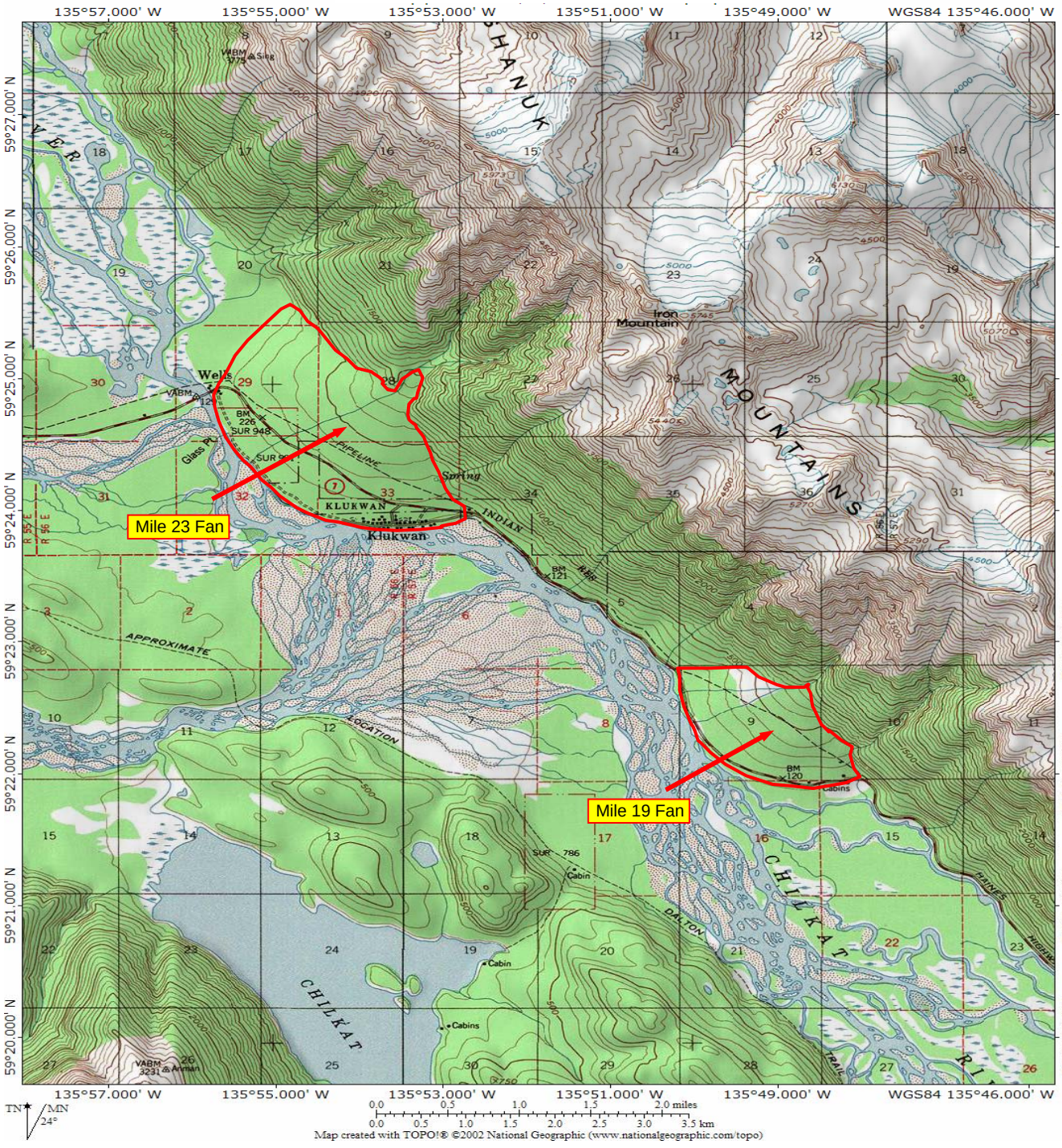
1. The catchment areas on the upstream side of the highway be expanded in length and breadth to allow larger storage areas for slide debris, and

2. A topographic survey (aerial) of the two alluvial fans be provided to evaluate the need and the practicality of performing stream training upslope from the highway. Stream training may be required to control the path of future flows to insure they reach the catchment areas.

Table D-1

	Option	Initial Costs	Annual O&M Costs	Earthwork and Construction	Additional Construction Time (weeks)	Closure Time (per Slide) (days)	Safety Improvement Over Existing
1.	Do Nothing	$0	$50,000 to $100,000	$0	None	1 to 2	None
2.	Improve Catchments and Culverts	$50,000	$50,000	$250,000	2	1 to 2	Minor
3.	Elevate Road (Bridges) A. Conventional Bridge (100 ft to 200 ft) B. Precast Arch Bridges (100 ft to 200 ft)	 $3,000,000 to $6,000,000 $1,500,000 to $3,000,000	 $25,000 $25,000	$500,000	 4 to10 2 to 4	0	 Higher Higher
4.	Realign Road Upslope and Bridge Creeks	$10,000,000+	Unknown	$1,000,000	12 to 16	0	Higher

FIGURES



HAINES HIGHWAY PROJECT #68606

W.O. D59119D

Alluvial Fan Locations

Figure D-1

A. Creek Floodway and Channel Upstream of Mile 23 Fan.

B. Creek at Period of Low Flow.

	HAINES HIGHWAY PROJECT #68606	W.O. D59119D
	Creek at Mile 23 Fan	**Figure D-2**

A. Creek Passing through Culvert Below Highway (Upstream).

B. Creek Passing through Culvert Below Highway (Downstream).

	HAINES HIGHWAY PROJECT #68606	W.O. D59119D
	Creek at Mile 23 Fan	**Figure D-3**

A. Catchment Berm (Note Size of Boulder Left of Center).

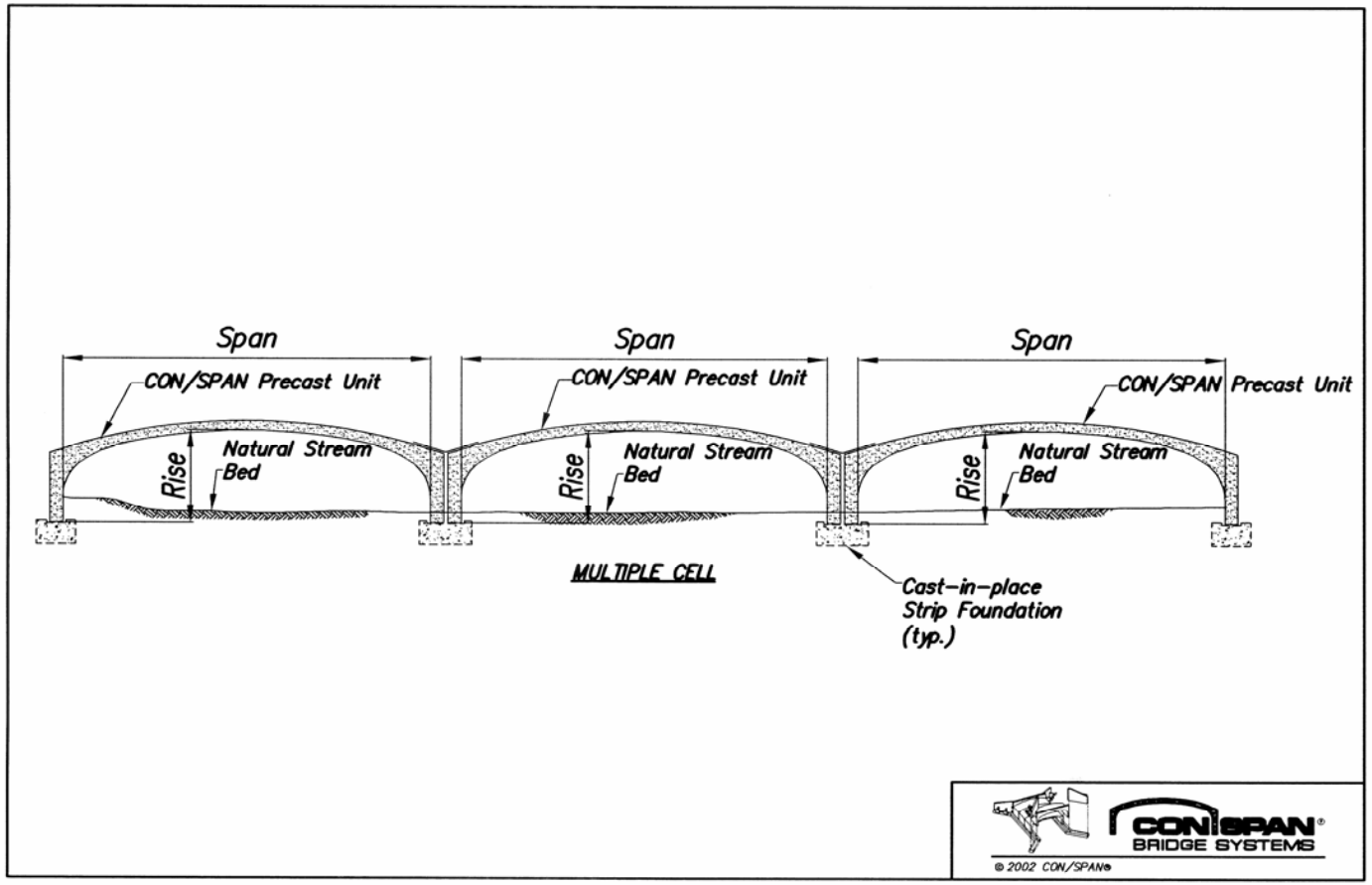
B. Catchment Berm (Nearby View).

	HAINES HIGHWAY PROJECT #68606	W.O. D59119D
	Up-valley Catchment Berm Above Mile 23 Fan	**Figure D-4**

A. Culvert Plugged with Debris and Flood Waters Overtopping Road.

B. Roadside Catchment Filled with Flow Slide Debris and Road Buried.

	HAINES HIGHWAY PROJECT #68606	W.O. D59119D
	2005 Flooding at Mile 23 Fan	**Figure D-5**

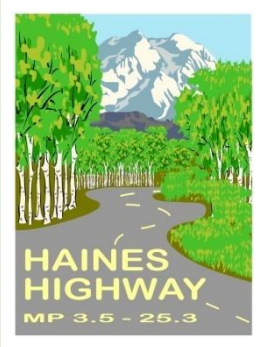


HAINES HIGHWAY PROJECT #68606

W.O. D59119D

Arch Bridge Cross Section

Figure D-6


HAINES
HIGHWAY
MP 3.5 - 25.3

APPENDIX H

Structural Memorandums

DOWL HKM

MEMORANDUM

TO: Reuben Yost, P.E. W.O. D59119G
Project Manager, Southeast Region Design
State of Alaska Department of Transportation and Public Facilities

FROM: Steven K. Noble, P.E., PTOE

DATE: January 26, 2010

SUBJECT: Haines Highway 3R Project from Milepost 3.5 to 25.3
REVISED Debris Flow Mitigation Options

Haines Highway crosses large alluvial fans near MP 19 and 23. These fans were produced by creeks that normally flow in well-defined channels at low volumes and low velocities. However, periodic rain or rain-on-snow events occur over the barren watersheds above these fans. These events increase the flow in the streams dramatically and have produced debris flows that cross the highway. Flows overtop the existing road every 3 to 5 years on average. The debris flows plug the stream culverts, deposit sand and gravel several feet deep on the road surface, and reroute the stream channels.

A geotechnical analysis considered debris flow mitigation options (DOWL HKM, 2009). The following measures were recommended to minimize the impacts of the periodic debris flows:

- Improve Catchments and Culverts - The report states, "*The catchments adjacent to the road could be extended in length, widened, and perhaps deepened to accommodate a larger volume of debris, and the centerline grade of the road could be raised as much as is practical in the areas currently subject to debris flows.*"

The geotechnical analysis recommended options to achieve two objectives. First, make the road embankment as porous as economically feasible to reduce the potential for material to overtop the road. Second, provide a debris underpass that is more economical to maintain. DOT&PF needs to be able to push material through the underpass from the upstream side of the roadway to the downstream side. Whichever underpass alternative is chosen, the clear height should be at least 12 feet to allow a medium-heavy sized piece of equipment to transport material through the underpass. The horizontal span should be as wide as reasonably possible to provide the maximum passage during a debris flow event. Three alternatives were evaluated for this project:

1. Multiple-Cell Modular Precast Culvert
2. Cast-In-Place (CIP) Concrete Box Culvert
3. Single-Span Precast Concrete Bridge

These alternatives were compared for their expected performance, initial cost, and ongoing maintenance costs due to debris flows. Each alternative is discussed below.

Multiple-Cell Modular Precast Culvert

The multiple-cell modular precast culvert option consists of several concrete culvert sections that would be fabricated in the contiguous United States (Lower 48) and shipped to Haines. The precast sections will then be hauled by truck to the construction site and installed by a large crane. The builder could adjust the size of the precast units to match the size of the available crane. Once the footings have been cast and cured, the precast culvert sections could be placed. Backfilling could begin immediately.

Speed of construction is one advantage of this alternative. This alternative should also have a high level of quality since the culvert sections would be cast under well-controlled plant conditions.

Since the existing ground under the culverts would remain undisturbed, this alternative should reduce unclassified excavation by about 500 cubic yards. In addition, about 2,400 cubic yards of roadway fill would be saved between the culverts' arches.

The estimated construction cost for this structure is approximately $900,000 per location.

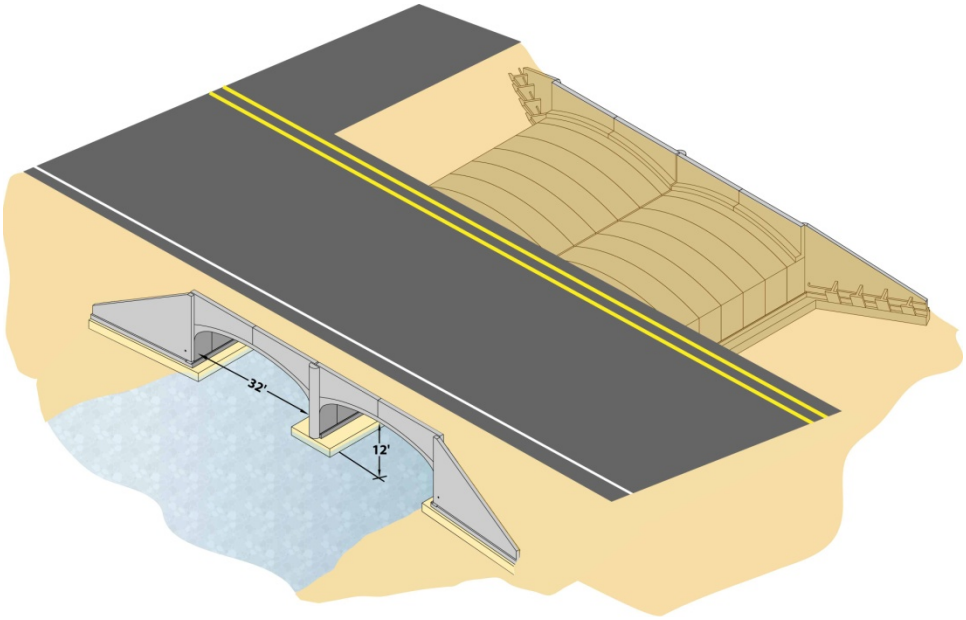


Figure 1: Multiple-Cell Modular Precast Culvert

CIP Concrete Box Culvert

The CIP concrete box culvert alternative consists of a concrete box culvert(s) that would be formed of high-quality-ready-mix concrete from a concrete batch plant located near the work area. This alternative might also include floodplain relief culverts on each side of the new CIP culverts. These relief culverts would be set at a somewhat higher elevation than the main CIP culverts and they

would allow secondary flow paths if the main CIP culverts become partially blocked. During construction, water from the existing stream could also be diverted through the relief culverts, thus simplifying construction of the CIP culverts.

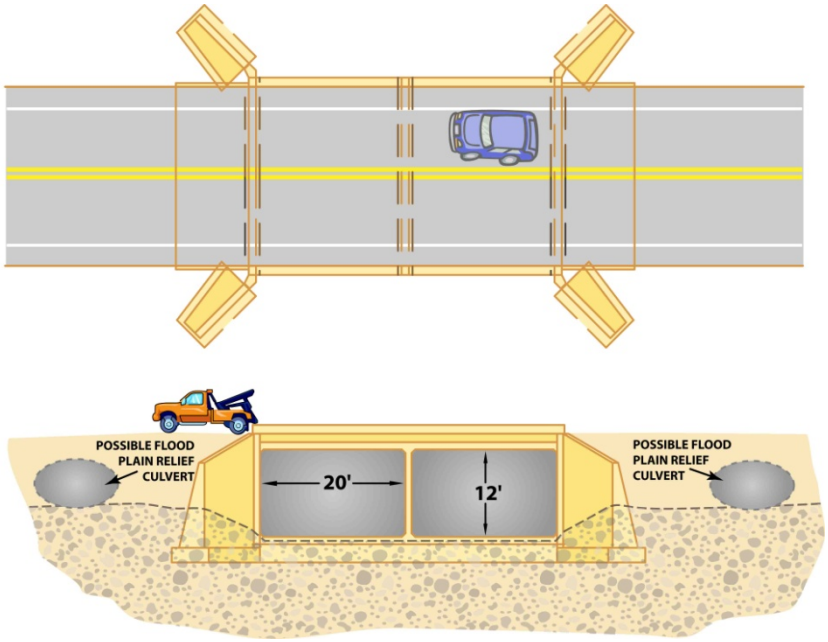


Figure 2: CIP Concrete Box Culvert

Shipping costs for this CIP alternative should be lower than for the precast option, as smaller units of cement and reinforcing steel would be shipped to Haines rather than large precast culverts. The CIP culvert could be built with a small crane or perhaps no crane at all, and this would reduce construction costs. It is likely the CIP culvert would be cast in multiple sections, with the sizes of the sections selected by the contractor. The quality of the CIP concrete may be somewhat lower than the precast concrete since it would be cast in the field.

This alternative would require significantly more construction time than the precast culvert alternative. Backfilling could not begin until the concrete has reached a predetermined strength (usually after 3 to 7 days of curing time). This differs from the precast option in which backfilling can begin immediately after the last section is installed and connected to previously placed sections. During design, the structural engineers could investigate construction options that would increase or decrease the clear span. For example, if a flat constant-thickness top deck as shown in Figure 2 is used, the CIP box culvert's clear span would be less than a precast culvert or the bridge. On the other hand, engineers might select a longer-span arched roof culvert in which inexpensive timber trusses could be used as formwork for the arches.

Since all organic material would need to be removed below the CIP culvert and replaced with structural fill, there would be no savings in unclassified excavation. However, there will be a reduction of approximately 1,500 cubic yards of roadway fill along the alignment between culvert ends.

The estimated construction cost for this structure is approximately $738 thousand per location.

Bridge

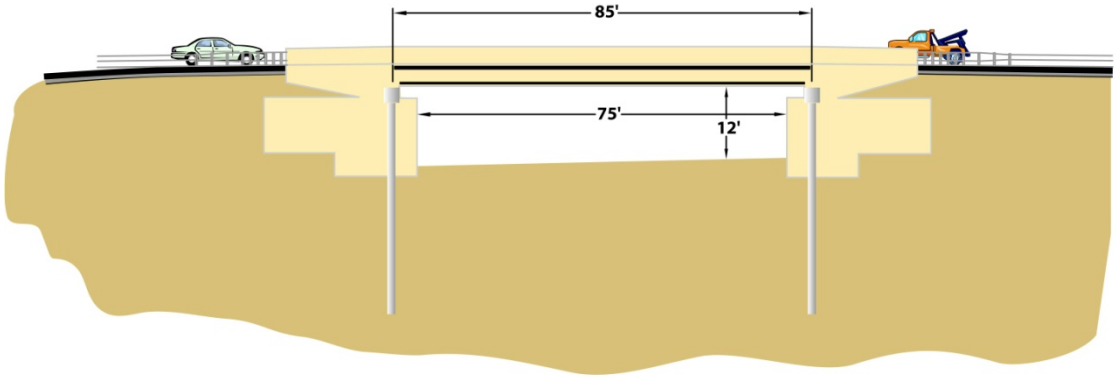


Figure 3: Bridge

The bridge alternative consists of a single-span precast/prestressed bridge superstructure built with bulb-tee girders. Bridges of this type are common in Alaska for spans of up to 150 feet. For this study, a 3.5-foot-deep girder spanning 85 feet was selected to fit the local topography. This alternative appears to have the greatest hydraulic opening with the fewest obstructions. The debris flow would pass through more easily than with the other alternatives. The precast/prestressed concrete girders would be built in either Anchorage or Seattle and shipped to Haines.

The specifics of the bridge foundations would need to be confirmed by a detailed geotechnical investigation. However, the bridge foundations would probably be CIP concrete abutments and wing walls built on steel pipe piles. This alternative would have a higher initial expense compared to the culvert options. But because of the larger opening under the bridge, it would likely require less frequent maintenance due to debris flows. This alternative could save about 1,000 cubic yards of unclassified excavation and about 3,100 cubic yards of roadway fill between abutments. The construction time may be about equal to the CIP Alternative 2, but would be longer than precast Alternative 1.

The estimated construction cost for this structure is approximately $968,000 per location.

Maintenance Costs

The ongoing costs due to maintenance from debris flows are subject to many factors. These factors include the amount of precipitation, the future course of existing streams, soil conditions, the return interval of the storms, the amount of inflation for future costs, and numerous other variables. Estimates of ongoing maintenance costs are even more difficult to calculate in this case, because of the positive effects of the proposed higher roadway elevation and the proposed expansion of the upstream catchment areas. It is expected that all of the proposed alternatives will significantly reduce the current maintenance costs at these locations.

Recommendations

The goals of this project are to preserve and enhance the safety of the traveling public, to minimize disruptions to traffic, and to lower the maintenance requirements following debris flow events. Three recommended actions are therefore proposed:

- Elevate the roadway by approximately 13 feet in the debris flow areas.
- Increase the size of the upstream catchment areas.
- Increase the size of the underpass areas.

Since the highest priority in mitigating the likelihood of a debris flow covering the highway is to elevate the roadway, and the second priority is to provide through capacity, the recommended alternative is the CIP Culvert option. This option has the lowest initial cost of approximately $1.5 million for the two sites. This enables the remainder of the allocated funding to be used to raise the road surface an average of 13 feet. The estimated cost of fill to raise the roadway profile is $1.7 million for both sites. Therefore, the total estimated cost is $3.2 million for the structures and fill at both locations.

In addition, the CIP Culvert option will allow a 12-foot-clear height and two 20-foot-wide openings. This will both improve the hydraulic capacity and allow adequate space for heavy maintenance equipment.

MEMORANDUM

State of Alaska

Department of Transportation & Public Facilities
Statewide Design & Engineering Services Division /Bridge Section

TO: Reuben Yost
Project Manager
Southeast Region Design

DATE: October 29, 2009

BRIDGE NO: 742
TELEPHONE NO: 465-2975
FAX NUMBER: 465-6947
TEXT TELEPHONE: 465-3652

FROM: Richard A Pratt, P.E.
Chief Bridge Engineer

CONTACT: Elmer E. Marx, P.E.
465-6941
elmer.marx@alaska.gov

RE: Revised Preliminary Bridge Plans and Cost Estimates

SUBJECT: Chilkat River Bridge
Haines Highway

As requested, we have prepared some additional preliminary bridge alternatives for the subject project. Three bridge options are presented. Specifically, we have examined the following:

Option 1	Widen and rehabilitate the existing bridge
Option 2	Replace the existing bridge on a parallel roadway alignment
Option 3	Replace the existing bridge on the existing roadway alignment

The preliminary bridge cost estimates are attached. They include all bridge-related pay items (including temporary work structures) as well as an 11% mobilization allowance (10% of subtotal cost including mobilization and demobilization pay item), a 15% construction engineering allowance, and a 4.24% ICAP allowance.

We have very little foundation, hydraulic, topographic, or other design information for this site. Consequently, a 25% contingency is included. Due to the unpredictable nature of rehabilitation work, we recommend using a 30% contingency for Option 1. As information becomes available, we will incrementally decrease the contingency value (percentage) until we provide the final bridge cost estimate.

The bridge is located in a high seismic zone. Based upon the USGS/AASHTO seismic hazard maps and the anticipated soil classification, we anticipate the bridge will be classified as Seismic Design Category "D" requiring the most stringent seismic detailing. Although this is not particularly onerous for the replacement options, it does add substantial cost to the rehabilitation option.

A brief summary and list of the advantages and disadvantages for each option is provided on the following sheets.

If you have any questions, please contact Elmer.

Attachments

Option 1 – Widen and rehabilitate the existing bridge

503.75 FT long, ten-span, steel girder bridge
Maximum span length = 50 FT
Vertical clearance under bridge (navigation) ~ 9 FT
Bridge related pay items (w/o mobilization, CE, ICAP, or contingency) = $7.6M
Bridge related pay items (w/ mobilization, CE, ICAP, and 30% contingency) = $13.1M

ADVANTAGES	DISADVANTAGES
Does not require any significant changes in the existing roadway alignment in the vicinity near the bridge.	Most expensive bridge option.
Navigation can be maintained under the bridge during construction although some intermittent closures would likely be required.	The bridge was built in 1958 for 50-year design life. The life expectancy of the rehabilitated bridge would not be as great as the replacement bridge options.
	Although not verified by physical testing, bridges of this vintage are typically coated in lead-based paint. Repainting of the bridge is likely required and is included in the cost estimate. Full containment of the bridge is required during painting to satisfy environmental requirements.
	The existing bridge is not capable of accommodating construction equipment. Thus, a temporary work structure will be required in order to install pier piles and to set bridge girders. The existing bridge piers must be widened and strengthened to accommodate the wider superstructure.
	It has been suggested that the navigation clearance below the existing bridge is inadequate. This option does not change the existing navigational clearances.
	The rehabilitated bridge would include new crash-tested railing, a new stronger deck, two new lines of steel girders, and significantly improved piers. Nonetheless, it is likely that the rehabilitated bridge would not meet all of the current code requirements.

In order to widen and rehabilitate the bridge, many new bridge components are required including the railing, deck, exterior girders, pier cap, and pier piles. Therefore, only the existing steel girders and portions of the concrete abutments and piers are retained in the completed structure. Although technically feasible, this option is more expensive than the replacement options while offering no significant advantages. We do not recommend that this option be advanced for further consideration.

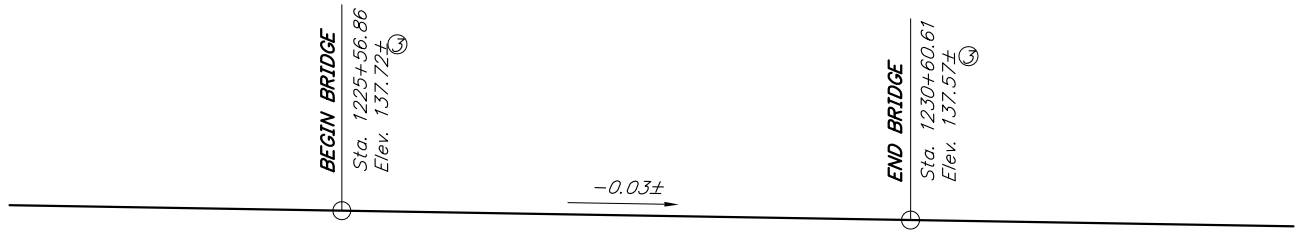
STATE OF ALASKA DOT/PF
COMPUTATIONS
Chilkat River Bridge Widening

DATE 10/29/2009
BRIDGE No. 742
By EEM

Option 1
Widen and Rehabilitate Existing Bridge
ESTIMATE OF QUANTITIES AND COST

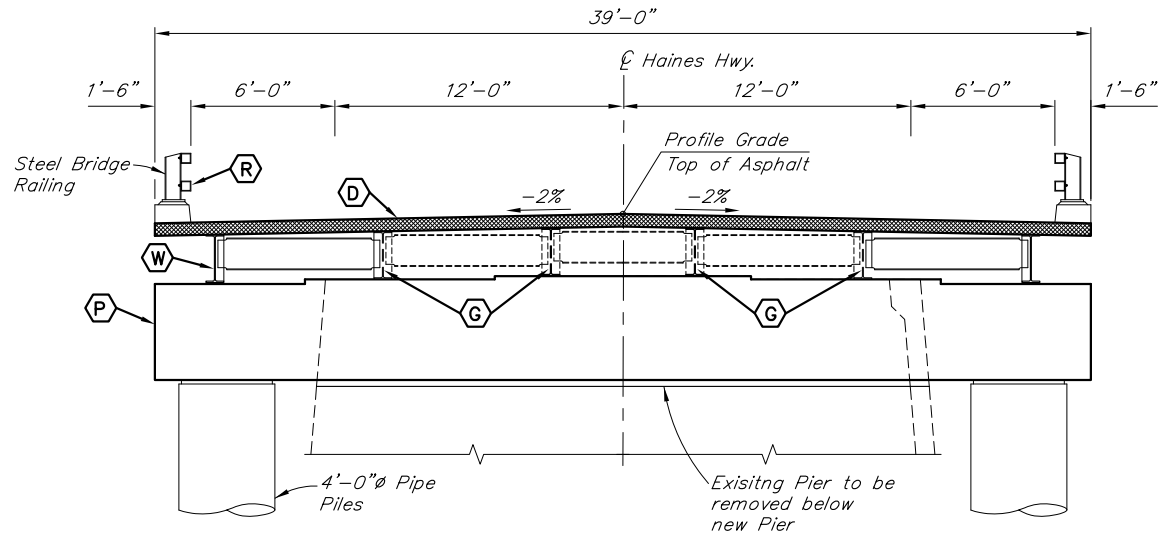
Item No.	ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
202(1)	Removal of Structures and Obstructions	LS-SF	$25	2,535	$63,375
205(3)	Foundation Fill	CY	$50	100	$5,000
501(1)	Class A Concrete	LS-CY	$1,200	700	$840,000
501(2)	Class A-A Concrete	LS-CY	$1,400	625	$875,000
503(1)	Reinforcing Steel	LS-LBS	$2.25	215,000	$483,750
503(2)	Epoxy Coated Reinforcing Steel	LS-LBS	$2.50	270,000	$675,000
504(1)	Structural Steel	LS-LBS	$3.00	120,000	$360,000
505(5A)	Furnish Structural Steel Piles (HP14x117)	LF	$100	800	$80,000
505(6A)	Drive Structural Steel Piles (HP14x117)	LF	$25	800	$20,000
505(5B)	Furnish Structural Steel Piles (48"x 1" PIPE)	LF	$450	2,160	$972,000
505(6B)	Drive Structural Steel Piles (48" x 1" PIPE)	LF	$75	2,160	$162,000
505(7)	Pile Driving Equipment	LS	$100,000	1	$100,000
505(11)	Pile Restrike	DAY	$3,000	33	$99,000
507(1)	Steel Bridge Railing	LF	$225	1,067.5	$240,188
510(1)	Removal of Concrete Bridge Deck	SF	$25	13,100	$327,500
512(x)	Temporary Work Structure	LS-SF	$100	17,000	$1,700,000
513(1)	Field Painting Steel Structures	LS-SF	$25	17,500	$437,500
606(12)	Guardrail / Bridge Rail Connection	EACH	$3,000	4	$12,000
611(1)	Riprap, Class II	CY	$50	2,500	$125,000
631(2)	Geotextile, Erosion Control, Class 2	SY	$2.50	2,500	$6,250
	SUBTOTAL				**$7,583,563**
	Mobilization & Demobilization	LS	11%		$842,618
	SUBTOTAL				**$8,426,181**
	Construction Engineering	LS	15%		$1,263,927
	SUBTOTAL				**$9,690,108**
	ICAP	LS	4.24%		$410,861
	SUBTOTAL				**$10,100,968**
	Contingency	LS	30%		$3,030,290
	TOTAL				**$13,131,259**

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA		2008		



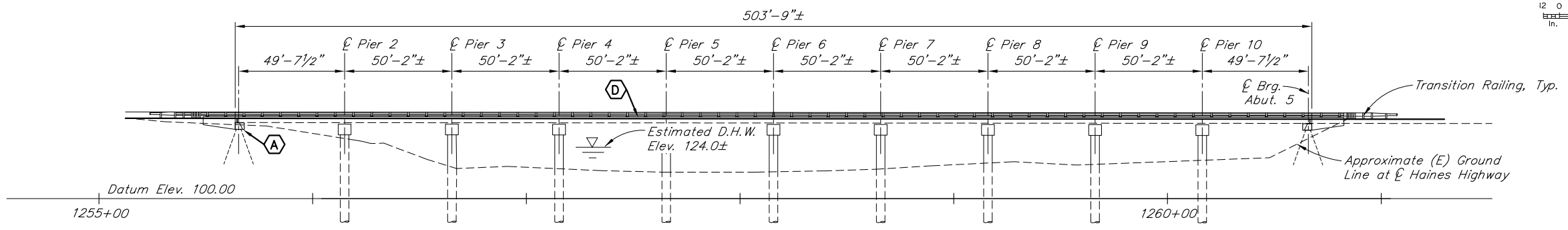
EXISTING PROFILE GRADE DATA

No Scale



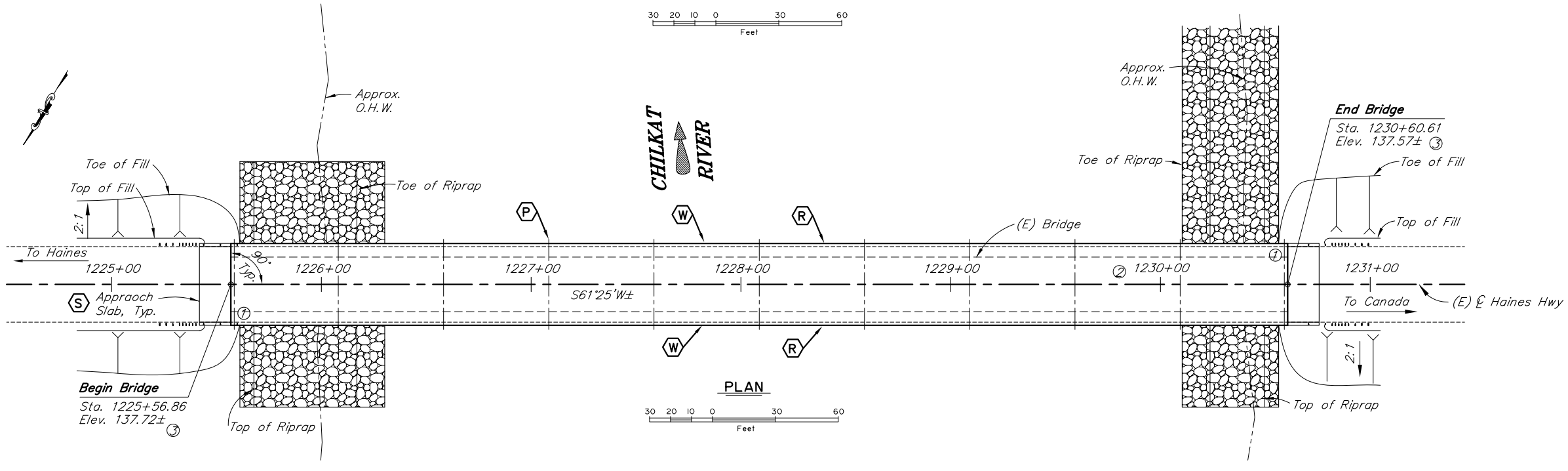
TYPICAL SECTION

12 0 4 8
In. Feet



ELEVATION

30 20 10 0 30 60
Feet



LEGEND

- (A) – Abutment widening
- (D) – New Deck
- (G) – Repaint (E) Girders
- (P) – New pier Cap and Piles, Typ.
- (R) – New Railing
- (S) – Approach Slab
- (W) – New Girder Widening

BRIDGE DRAWING INDEX

TITLE	DWG. NO.
GENERAL LAYOUT	1
SITE PLAN	2

PRELIMINARY PLAN

REHABILITATION

OPTION 1

① *Approximate location of Bridge Number Plate.*

② *Proposed Station 1230+00 is equal to the existing station 1260+06.89.*

③ *Elevations are for existing Bridge.*

DESIGNED BY: *Elmer Marx*	CHECKED: *Engineer*	LAYOUT BY: *Elmer Marx*	CHECKED BY: *Engineer*
DRAWN BY: *Sam Sollie*	CHECKED: *Elmer Marx*	SPECIFICATIONS BY: *Elmer Marx*	P S & E COMPARED: *Engineer*
QUANTITIES BY: *Elmer Marx*	CHECKED: *Engineer*	APPROVAL RECOMMENDED BY: *Rich Pratt*	

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
BRIDGE SECTION

CHILKAT RIVER BRIDGE

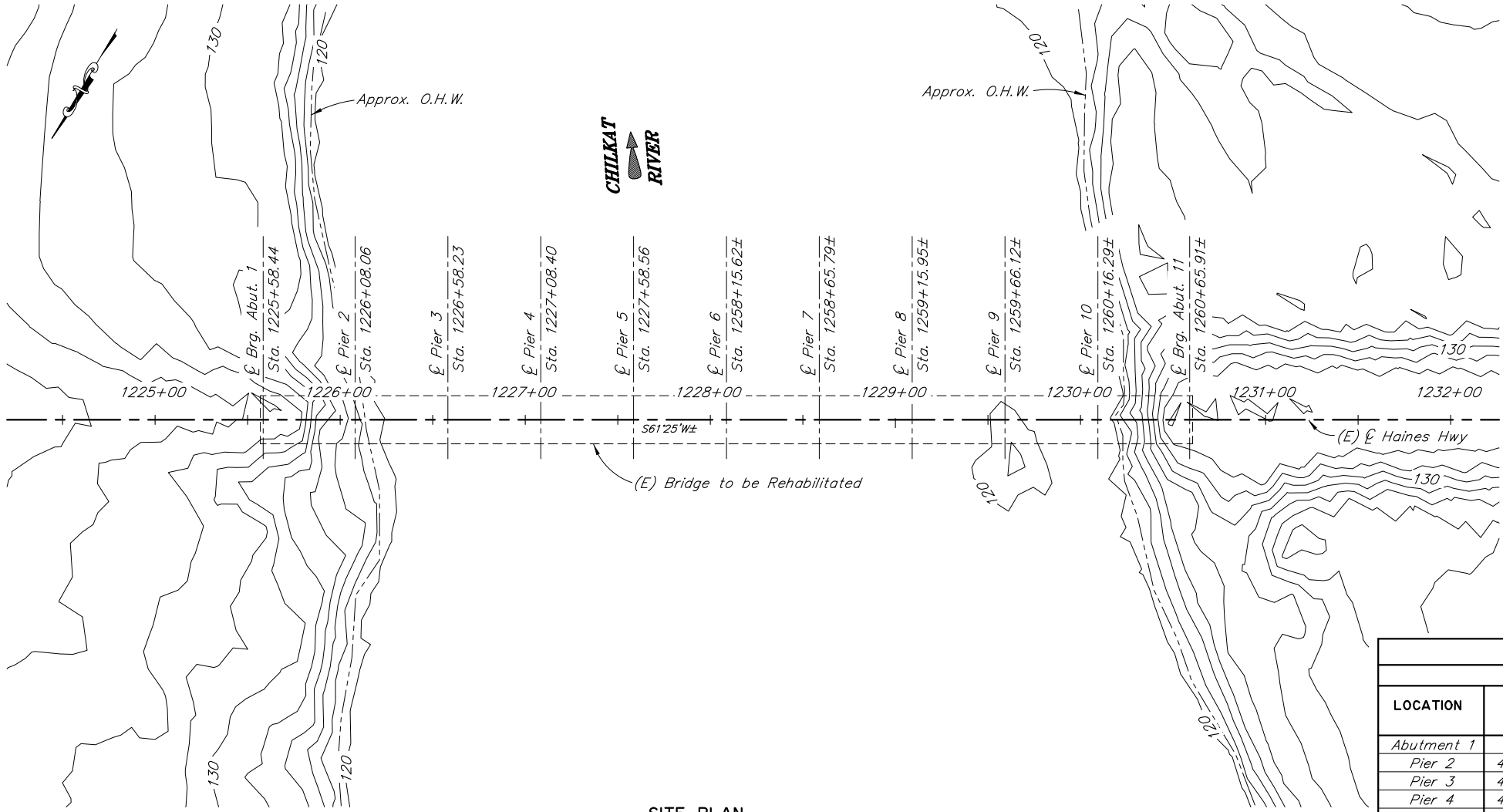
HAINES HIGHWAY

GENERAL LAYOUT

BRIDGE NO. 742

DWG. NO. 1

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA		2008		



GENERAL NOTES

DESIGN: ..... AASHTO LRFD Bridge Design Specifications, Fourth Edition, 2007, with latest interim specifications.
Seismic design per AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2009

LIVE LOAD:..... HL-93

DEAD LOAD:..... Includes 50 psf for all wearing surfacing.

SEISMIC PARAMETERS:.....PGA = 0.322
Ss = 0.744
S1 = 0.287
Site Class = D
Liquefaction Potential = Low
AASHTO 7% probability of exceedance in 75 years.

ICE LOAD:..... Effective ice crushing strength = 16 ksf
Design ice thickness = 1 ft.

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

PRESTRESSED CONCRETE:..... See "GIRDERS" Dwg.

CONCRETE:..... Class A Concrete, f'c = 4000 psi.
Class A-A Concrete – approach slabs, f'c = 5000 psi.

STRUCTURAL STEEL:..... ASTM A709, Grade 36T3, Fy = 36,000 psi, unless otherwise noted.

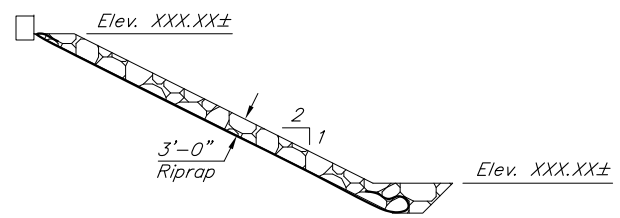
STRUCTURAL STEEL PILING:... H-Piles – ASTM A709, Grade 50T3, Fy = 50,000 psi.
Pipe Piles – API 5L X52 PSL2, Fy = 52,000 psi.
Pile Tip reinforcing is required.

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							
Pier 2	4'-0"ø x 1" Pipe						
Pier 3	4'-0"ø x 1" Pipe						
Pier 4	4'-0"ø x 1" Pipe						
Pier 5	4'-0"ø x 1" Pipe						
Pier 6	4'-0"ø x 1" Pipe						
Pier 7	4'-0"ø x 1" Pipe						
Pier 8	4'-0"ø x 1" Pipe						
Pier 9	4'-0"ø x 1" Pipe						
Pier 10	4'-0"ø x 1" Pipe						
Abutment 11							

SITE PLAN

10 0 40 80
Feet



RIPRAP DETAIL

240 4 8 12 16 20 24
In. Feet

HYDRAULIC & HYDROLOGIC SUMMARY

Flood Frequency (Yr.)	50	100	500
Exceedance Probability (%)	2	1	0.2
Design Discharge (ft³/sec)			
Design High Water (ft)			
Anticipated Add'l Backwater (ft)			
Contraction Scour (ft)			
Abutment Scour (ft)			
Pier Scour (ft)			

Drainage Area for this crossing: XX.X square miles.

Hydraulic Capacity: cfs at Low Superstructure Elevation
which has an exceedance probability of equal to or less than 0.2 percent.

Total scour equals contraction scour + local scour.

BRIDGE BASIS OF ESTIMATE

ITEM NO.	ITEM	UNIT	SUBST.	SUPERST.	TOTAL

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

ABBREVIATIONS:

℄	= Centerline	f.f.	= far face
ℙ	= Plate	Hwy.	= highway
&	= and	LB	= pound
@	= at	LF	= linear foot
ø	= diameter	LS	= lump sum
Approx.	= approximate	Lt.	= left
Abut.	= Abutment	max.	= maximum
bot.	= bottom	min.	= minimum
Br.	= bridge	MSE	= mechanically stabilized earth
btwn.	= between	n.a.	= not applicable
Brg.	= Bearings	n.c.	= not calculated
C.I.P.	= cast in place	n.f.	= near face
Clr.	= clear, clearance	No.	= number
Col.	= column	O.H.W.	= ordinary high water
CSL	= crosshole sonic logging	PT	= Post Tensioned
CY	= cubic yard	PVC	= point of vertical curve
dia.	= diameter	PVI	= point of vertical intersection
D.H.W.	= Design High Water	PVT	= point of vertical tangent
Dwg.	= drawing	Rt.	= right
(E)	= existing	spc.	= space, spaces
EA	= each	Sta.	= station
Elev.	= elevation	SY	= square yard
e.f	= each face	Symm.	= symmetric
E.O.W.	= edge of water	Typ.	= typical
e.w	= each way		

PRELIMINARY PLAN

REHABILITATION

OPTION 1

DESIGNED BY:	Elmer Marx	CHECKED:	Engineer	HYDRAULICS BY:	Engineer	CHECKED BY:	Engineer
DRAWN BY:	Sam Sollie	CHECKED:	Elmer Marx	FOUNDATIONS REVIEWED BY:			Engineer
QUANTITIES BY:	Elmer Marx	CHECKED:	Engineer				

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
BRIDGE SECTION

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

SITE PLAN

BRIDGE NO. 742

DWG. NO. 2

Option 2 – Replace the existing bridge on a parallel roadway alignment

540 FT long, four-span, precast concrete girder bridge
Maximum span length = 135 FT
Minimum centerline roadway elevation on bridge ~ 146.0 FT
Vertical clearance under bridge (navigation) ~ 15 FT
Bridge related pay items (w/o mobilization, CE, ICAP, or contingency) = $6.7M
Bridge related pay items (w/ mobilization, CE, ICAP, and 25% contingency) = $11.1M

ADVANTAGES	DISADVANTAGES
Least expensive bridge option.	The existing bridge is not capable of accommodating construction equipment. Thus, a temporary work structure will be required in order to install pier piles and to set bridge girders.
Significantly improves the navigational clearance below the bridge, from a 48-ft by 9-ft opening to a 128-ft by 15-ft opening.	Although we do not have the existing Right of Way (ROW) boundaries at this time, it may be that the parallel roadway alignment would require the acquisition of additional ROW.
The existing bridge can be used to maintain vehicular traffic during construction of the new bridge. Thus, the cost of traffic maintenance (not included in the bridge cost) would be less than the other options.	In order to provide additional navigational clearance below the bridge, a roadway profile grade raise is required. Thus, the width of the approach roadway embankment will be greater than that of the existing structure and, in this case, relocated on a new roadway alignment offset from the existing alignment. Additional cost associated with the approach roadway fill and possible ROW acquisition will need to be considered.
Navigation can be maintained under the bridge during construction although some intermittent closures would likely be required.	
The proposed bridge will satisfy all current code requirements and provide for a 75-year life.	

The Alaska DOT&PF has successfully used precast concrete decked bulb-tee girder bridges throughout the state. This style of bridge has proven to be a very cost-effective, durable structure in most environments.

At this time, there is no proposed roadway alignment for this option. For convenience, the preliminary bridge plans provide stationing values based upon station 0+00.00 at the begin bridge location. If this option is developed, the stationing will be modified to reflect the revised roadway plan and profile.

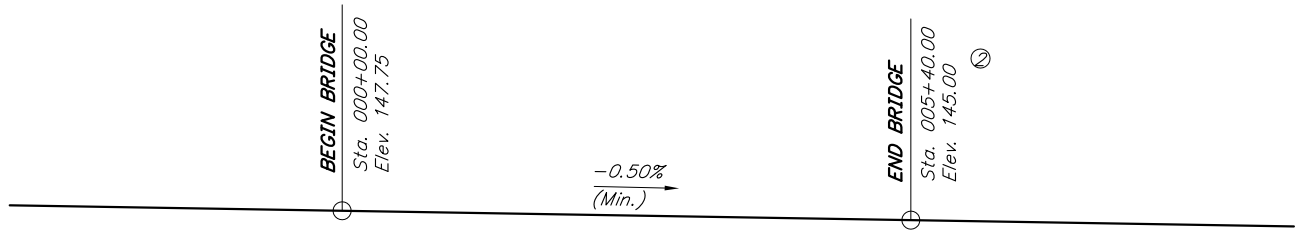
STATE OF ALASKA DOT/PF
COMPUTATIONS
Chilkat River Bridge Replacement

Option 2
540 ft long four span bridge - Parallel Alignment
ESTIMATE OF QUANTITIES AND COST

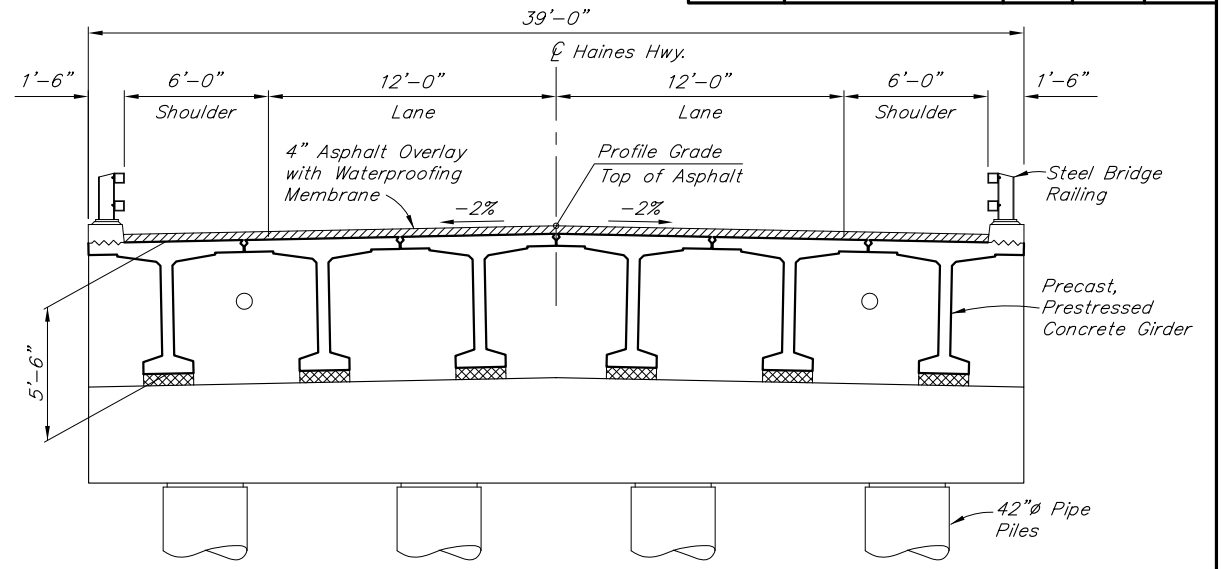
DATE 10/29/2009
BRIDGE No. 742
By EEM

Item No.	ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
202(1)	Removal of Structures and Obstructions	LS-SF	$25	13,223	$330,586
205(3)	Foundation Fill	CY	$50	1,200	$60,000
501(1)	Class A Concrete	LS-CY	$1,200	655	$786,000
501(2)	Class A-A Concrete	LS-CY	$1,400	55.2	$77,287
501(7)	Precast Concrete Member	EACH	$75,000	24	$1,800,000
503(1)	Reinforcing Steel	LS-LBS	$2.25	110,000	$247,500
503(2)	Epoxy Coated Reinforcing Steel	LS-LBS	$2.50	82,500	$206,250
505(5A)	Furnish Structural Steel Piles (HP14x117)	LF	$100	1,200	$120,000
505(6A)	Drive Structural Steel Piles (HP14x117)	LF	$25	1,200	$30,000
505(5B)	Furnish Structural Steel Piles (42" x 1" PIPE)	LF	$400	1,440	$576,000
505(6B)	Drive Structural Steel Piles (42" x 1" PIPE)	LF	$75	1,440	$108,000
505(7)	Pile Driving Equipment	LS	$100,000	1	$100,000
505(11)	Pile Restrike	DAY	$3,000	15	$45,000
507(1)	Steel Bridge Railing	LF	$225	1,160	$261,000
508(1)	Waterproofing Membrane	LS-SF	$3.00	20,880	$62,640
512(x)	Temporary Work Structure	LS-SF	$100	17,000	$1,700,000
606(12)	Guardrail / Bridge Rail Connection	EACH	$3,000	4	$12,000
611(1)	Riprap, Class II	CY	$50	2,500	$125,000
631(2)	Geotextile, Erosion Control, Class 2	SY	$2.50	2,500	$6,250
	SUBTOTAL				**$6,653,513**
	Mobilization & Demobilization	LS	11%		$739,279
	SUBTOTAL				**$7,392,793**
	Construction Engineering	LS	15%		$1,108,919
	SUBTOTAL				**$8,501,711**
	ICAP	LS	4.88%		$414,884
	SUBTOTAL				**$8,916,595**
	Contingency	LS	25%		$2,229,149
	TOTAL				**$11,145,744**

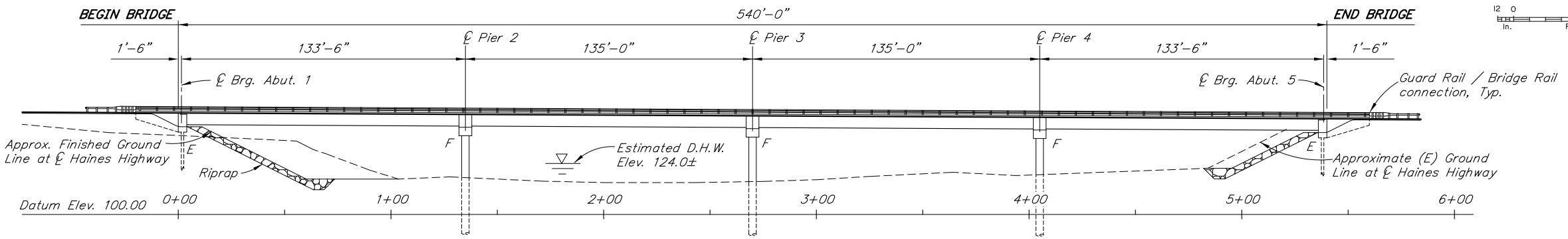
STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA		2008		



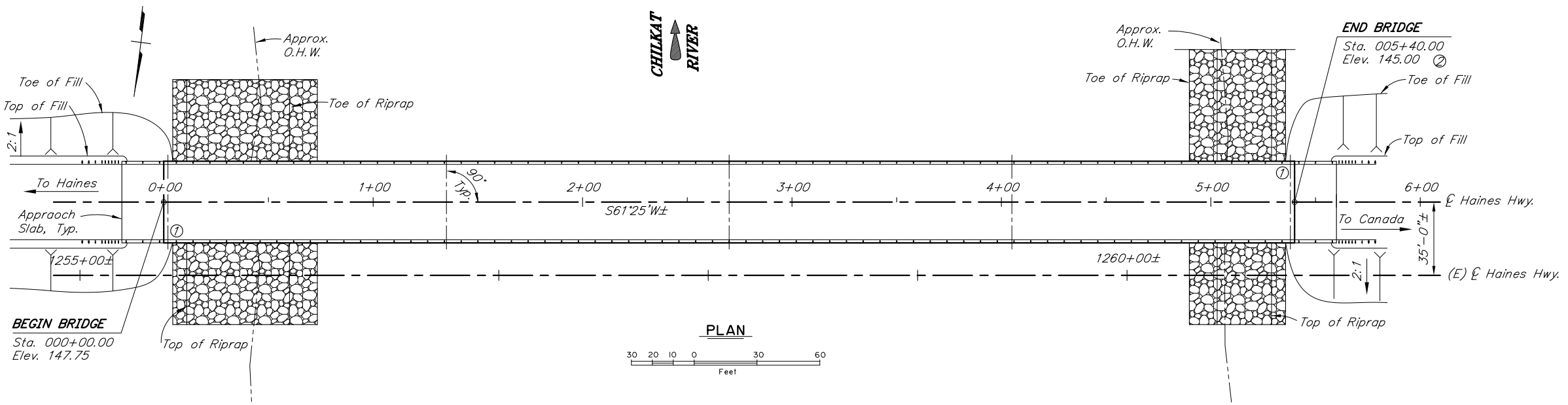
PROFILE GRADE DATA
No Scale



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	
TITLE	DWG. NO.
GENERAL LAYOUT	1
SITE PLAN	2

PRELIMINARY PLAN

OPTION 2

① *Approximate location of Bridge Number Plate.*

② *Minimum elevation to provide 15'−0" navigation clearance.*

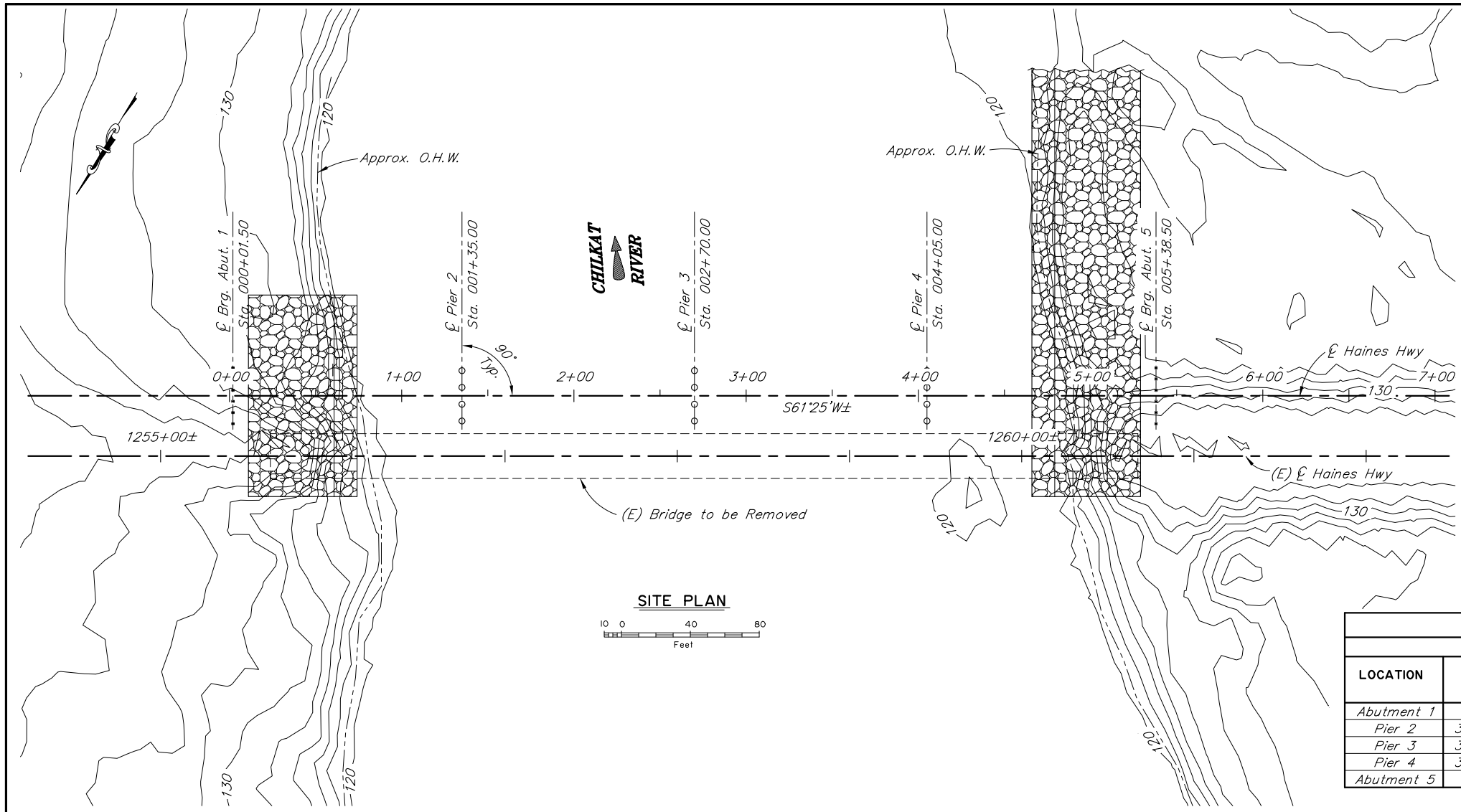
DESIGNED BY: *Elmer Marx*	CHECKED: *Engineer*	LAYOUT BY: *Elmer Marx*	CHECKED BY: *Engineer*
DRAWN BY: *Sam Sollie*	CHECKED: *Elmer Marx*	SPECIFICATIONS BY: *Elmer Marx*	P S & E COMPARED: *Engineer*
QUANTITIES BY: *Elmer Marx*	CHECKED: *Engineer*	APPROVAL RECOMMENDED BY: *Rich Pratt*	

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
BRIDGE SECTION

CHILKAT RIVER BRIDGE
HAINES HIGHWAY
GENERAL LAYOUT

BRIDGE NO. 742
DWG. NO. 1

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA		2008		



SITE PLAN

10 0 40 80
Feet

GENERAL NOTES

DESIGN: ..... AASHTO LRFD Bridge Design Specifications, Fourth Edition, 2007, with latest interim specifications.
Seismic design per AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2009

LIVE LOAD:..... HL-93

DEAD LOAD:..... Includes 50 psf for all wearing surfacing.

SEISMIC PARAMETERS:..... PGA = 0.322
Ss = 0.744
S1 = 0.287
Site Class = D
Liquefaction Potential = Low
AASHTO 7% probability of exceedance in 75 years.

ICE LOAD:..... Effective ice crushing strength = 16 ksf
Design ice thickness = 1 ft.

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

PRESTRESSED CONCRETE:..... See "GIRDERS" Dwg.

CONCRETE:..... Class A Concrete, f'c = 4000 psi.
Class A-A Concrete – approach slabs, f'c = 5000 psi.

STRUCTURAL STEEL:..... ASTM A709, Grade 36T3, Fy = 36,000 psi, unless otherwise noted.

STRUCTURAL STEEL PILING:... H-Piles – ASTM A709, Grade 50T3, Fy = 50,000 psi.
Pipe Piles – API 5L X52 PSL2, Fy = 52,000 psi.
Pile Tip reinforcing is required.

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	HP14x117						
Pier 2	3'-6"Øx1" Pipe						
Pier 3	3'-6"Øx1" Pipe						
Pier 4	3'-6"Øx1" Pipe						
Abutment 5	HP14x117						

HYDRAULIC & HYDROLOGIC SUMMARY

Flood Frequency (Yr.)	50	100	500
Exceedance Probability (%)	2	1	0.2
Design Discharge (ft³/sec)			
Design High Water (ft)			
Anticipated Add'l Backwater (ft)			
Contraction Scour (ft)			
Abutment Scour (ft)			
Pier Scour (ft)			

Drainage Area for this crossing: XX.X square miles.

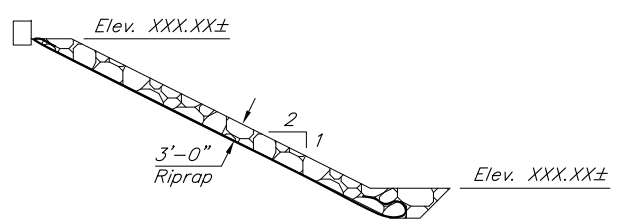
Hydraulic Capacity: cfs at Low Superstructure Elevation
which has an exceedance probability of equal to or less than 0.2 percent.

Total scour equals contraction scour + local scour.

BRIDGE BASIS OF ESTIMATE

ITEM NO.	ITEM	UNIT	SUBST.	SUPERST.	TOTAL

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



RIPRAP DETAIL

2 0 4 8 12 16 20 24
In. Feet

ABBREVIATIONS:

℄	= Centerline	f.f.	= far face
℔	= Plate	Hwy.	= highway
&	= and	LB	= pound
@	= at	LF	= linear foot
ø	= diameter	LS	= lump sum
Approx.	= approximate	Lt.	= left
Abut.	= Abutment	max.	= maximum
bot.	= bottom	min.	= minimum
Br.	= bridge	MSE	= mechanically stabilized earth
btwn.	= between	n.a.	= not applicable
Brg.	= Bearings	n.c.	= not calculated
C.I.P.	= cast in place	n.f.	= near face
Clr.	= clear, clearance	No.	= number
Col.	= column	O.H.W.	= ordinary high water
CSL	= crosshole sonic logging	PT	= Post Tensioned
CY	= cubic yard	PVC	= point of vertical curve
dia.	= diameter	PVI	= point of vertical intersection
D.H.W.	= Design High Water	PVT	= point of vertical tangent
Dwg.	= drawing	Rt.	= right
(E)	= existing	spc.	= space, spaces
EA	= each	Sta.	= station
Elev.	= elevation	SY	= square yard
e.f	= each face	Symm.	= symmetric
E.O.W.	= edge of water	Typ.	= typical
e.w	= each way		

OPTION 2

PRELIMINARY PLAN

DESIGNED BY:	Elmer Marx	CHECKED:	Engineer	HYDRAULICS BY:	Engineer	CHECKED BY:	Engineer
DRAWN BY:	Sam Sollie	CHECKED:	Elmer Marx	FOUNDATIONS REVIEWED BY:			Engineer
QUANTITIES BY:	Elmer Marx	CHECKED:	Engineer				

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
BRIDGE SECTION

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

SITE PLAN

BRIDGE NO. 742

DWG. NO. 2

Option 3 – Replace the bridge on the existing roadway alignment

540 FT long, four-span, precast concrete girder bridge
Maximum span length = 135 FT
Minimum centerline roadway elevation on bridge ~ 146.0 FT
Vertical clearance under bridge (navigation) ~ 15 FT
Bridge related pay items (w/o mobilization, CE, ICAP, or contingency) = $7.1M
Bridge related pay items (w/ mobilization, CE, ICAP, and 25% contingency) = $11.9M

ADVANTAGES	DISADVANTAGES
Significantly improves the navigational clearance below the bridge, from a 48-ft by 9-ft opening to a 128-ft by 15-ft opening.	The existing bridge cannot be used to maintain vehicular traffic during construction of the new bridge. In order to accommodate vehicular traffic, a temporary detour bridge will be required.
* Since a temporary work structure is required to construct a replacement bridge, the added cost of building a combination detour/work structure is not particularly great (about $400,000)	In order to provide additional navigational clearance below the bridge, a roadway profile grade raise is required. Thus, the width of the approach roadway embankment will be greater than that of the existing structure. Additional cost associated with the approach roadway fill will need to be considered.
Because this bridge would replace the existing bridge on the existing roadway alignment, it is assumed that no work outside of the existing ROW would be required. This assumption will need to be verified as information becomes available.	* A separate work structure may also be required if it is unacceptable to work from the temporary detour bridge. The cost of a separate work structure is about $1.7M. The additional of a work structure would make this the most expensive option.
Navigation can be maintained under the bridge during construction although some intermittent closures would likely be required.	
The proposed bridge will satisfy all current code requirements and provide for a 75-year life.	

* The preliminary cost estimate for this bridge is based upon the assumption that the a dual work bridge / detour bridge is used rather than a separate structure for each function.

Other than the location, this option is very nearly the same bridge as that presented in Option 2. However, because this bridge is located on the existing alignment, a temporary detour bridge would be required thereby increasing the overall bridge cost.

Also, the proposed roadway profile grade will need to be raised approximately four feet near the bridge in order to provide the desired 15 feet vertical navigation clearance.

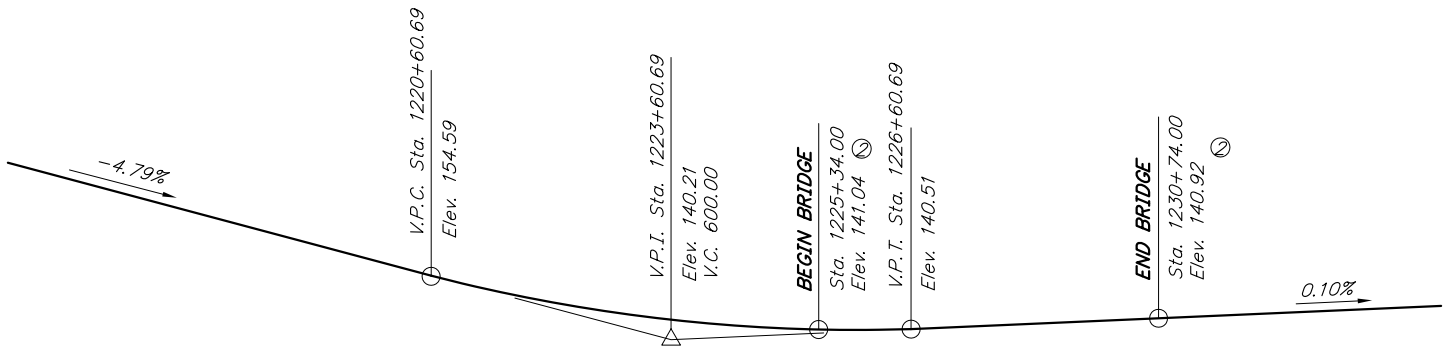
STATE OF ALASKA DOT/PF
COMPUTATIONS
Chilkat River Bridge Replacement

Option 3
540 ft long four span bridge - Existing Alignment
ESTIMATE OF QUANTITIES AND COST

DATE 10/29/2009
BRIDGE No. 742
By EEM

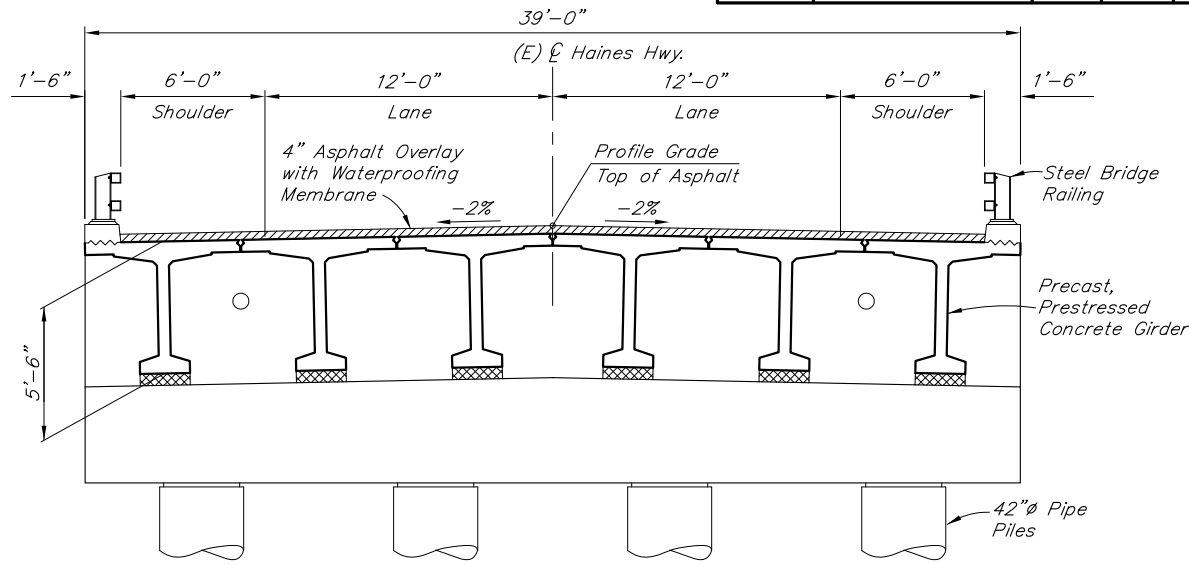
Item No.	ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
202(1)	Removal of Structures and Obstructions	LS-SF	$25	13,223	$330,586
205(3)	Foundation Fill	CY	$50	1,200	$60,000
501(1)	Class A Concrete	LS-CY	$1,200	655	$786,000
501(2)	Class A-A Concrete	LS-CY	$1,600	55.2	$88,328
501(7)	Precast Concrete Member	EACH	$75,000	24	$1,800,000
503(1)	Reinforcing Steel	LS-LBS	$2.25	110,000	$247,500
503(2)	Epoxy Coated Reinforcing Steel	LS-LBS	$2.50	82,500	$206,250
505(5A)	Furnish Structural Steel Piles (HP14x117)	LF	$100	1,200	$120,000
505(6A)	Drive Structural Steel Piles (HP14x117)	LF	$25	1,200	$30,000
505(5B)	Furnish Structural Steel Piles (42" x 1" PIPE)	LF	$400	1,440	$576,000
505(6B)	Drive Structural Steel Piles (42" x 1" PIPE)	LF	$75	1,440	$108,000
505(7)	Pile Driving Equipment	LS	$100,000	1	$100,000
505(11)	Pile Restrike	DAY	$3,000	15	$45,000
507(1)	Steel Bridge Railing	LF	$250	1,160	$290,000
508(1)	Waterproofing Membrane	LS-SF	$3.00	20,880	$62,640
520(1)	Temporary Crossing (work structure)	LS-SF	$125	17,000	$2,125,000
606(12)	Guardrail / Bridge Rail Connection	EACH	$3,000	4	$12,000
611(1)	Riprap, Class II	CY	$50	2,500	$125,000
631(2)	Geotextile, Erosion Control, Class 2	SY	$2.50	2,500	$6,250
	SUBTOTAL				**$7,118,554**
	Mobilization & Demobilization	LS	11%		$790,950
	SUBTOTAL				**$7,909,505**
	Construction Engineering	LS	15%		$1,186,426
	SUBTOTAL				**$9,095,931**
	ICAP	LS	4.88%		$443,881
	SUBTOTAL				**$9,539,812**
	Contingency	LS	25%		$2,384,953
	TOTAL				**$11,924,765**

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA		2008		



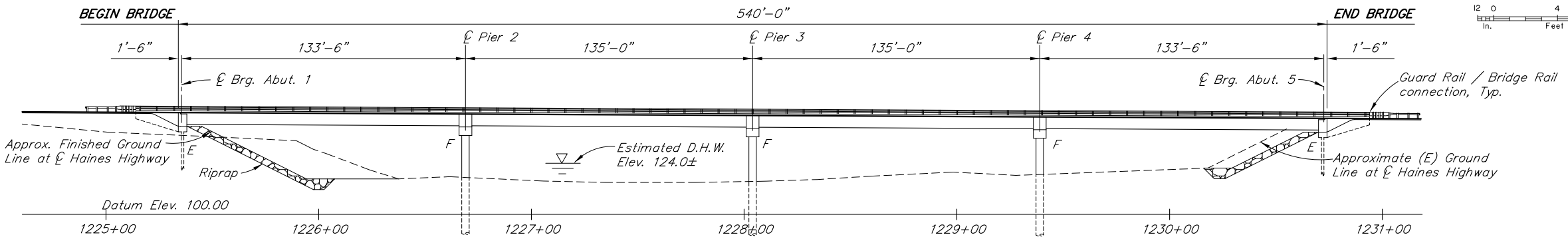
PROFILE GRADE DATA

No Scale



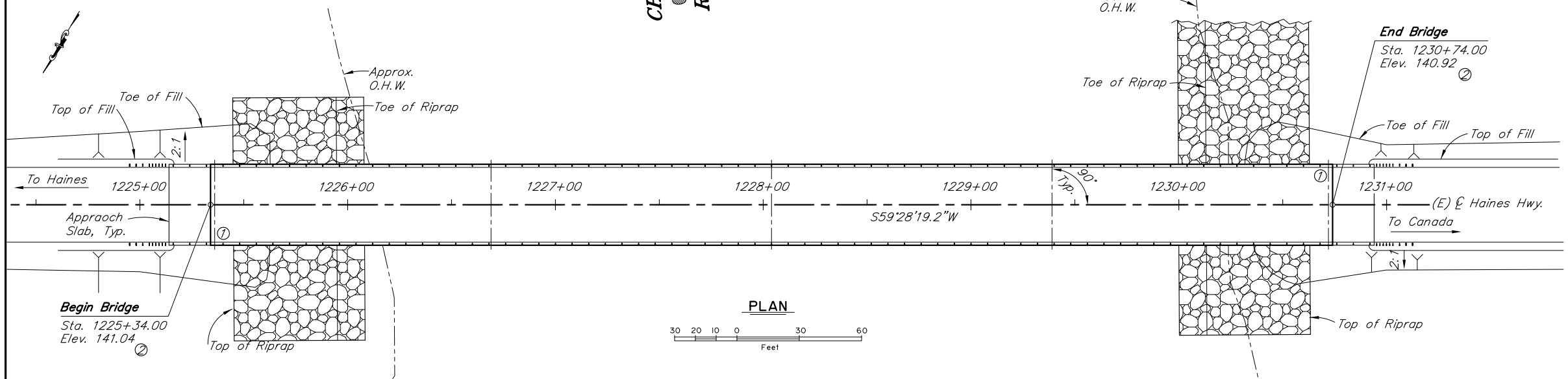
TYPICAL SECTION

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	
TITLE	DWG. NO.
GENERAL LAYOUT	1
SITE PLAN	2

PRELIMINARY PLAN

OPTION 3

① Approximate location of Bridge Number Plate.

② 4'-0" Grade raise required to provide 15'-0" navigation clearance.

DESIGNED BY: Elmer Marx	CHECKED: Engineer	LAYOUT BY: Elmer Marx	CHECKED BY: Engineer
DRAWN BY: Sam Sollie	CHECKED: Elmer Marx	SPECIFICATIONS BY: Elmer Marx	P S & E COMPARED: Engineer
QUANTITIES BY: Elmer Marx	CHECKED: Engineer	APPROVAL RECOMMENDED BY: Rich Pratt	

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
BRIDGE SECTION

CHILKAT RIVER BRIDGE

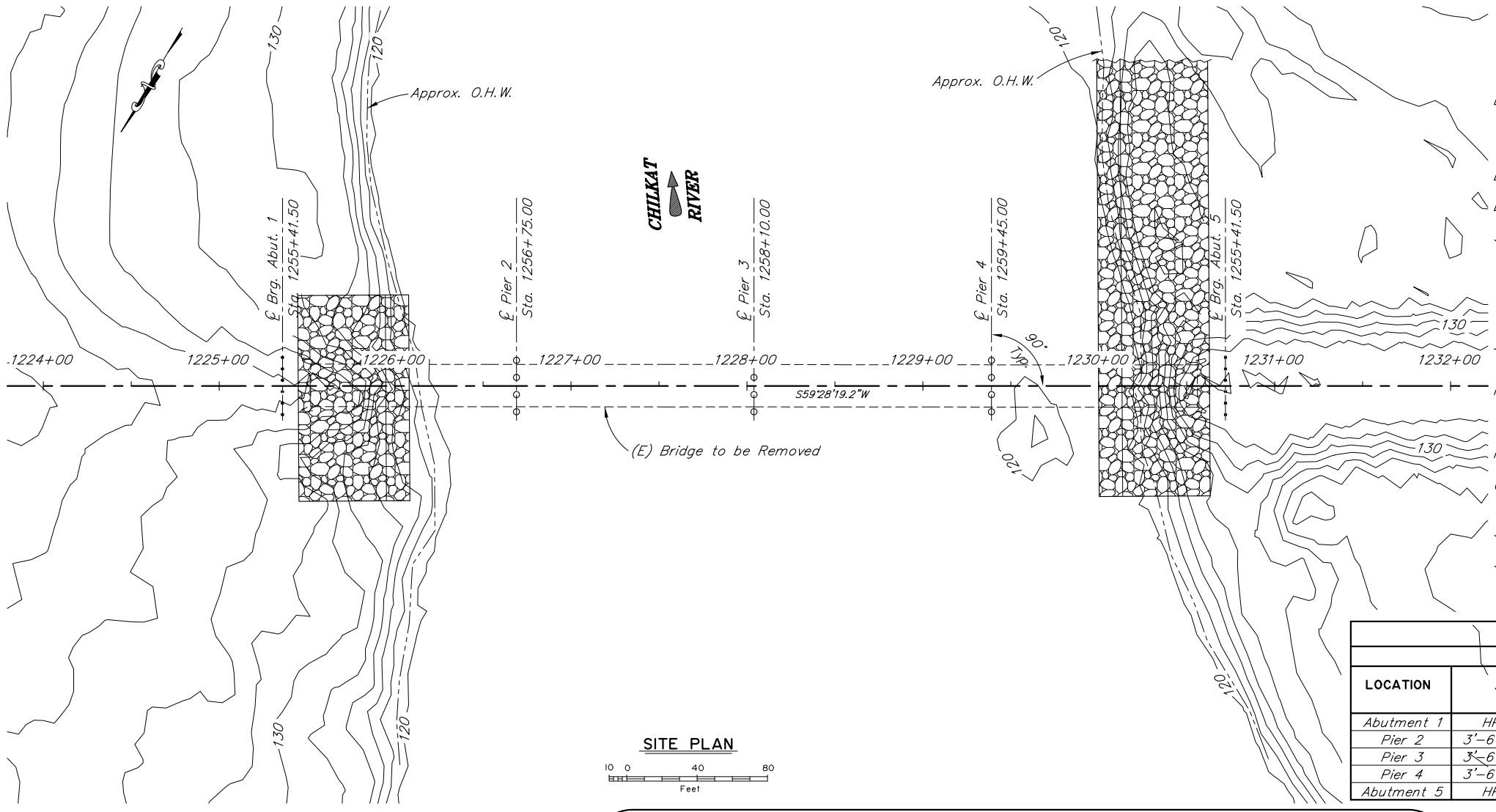
HAINES HIGHWAY

GENERAL LAYOUT

BRIDGE NO. 742

DWG. NO. 1

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA		2008		



SITE PLAN

10 0 40 80
Feet

GENERAL NOTES

DESIGN: ..... AASHTO LRFD Bridge Design Specifications, Fourth Edition, 2007, with latest interim specifications.
Seismic design per AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2009

LIVE LOAD:..... HL-93

DEAD LOAD:..... Includes 50 psf for all wearing surfacing.

SEISMIC PARAMETERS:..... PGA = 0.322
Ss = 0.744
S1 = 0.287
Site Class = D
Liquefaction Potential = Low
AASHTO 7% probability of exceedance in 75 years.

ICE LOAD:..... Effective ice crushing strength = 16 ksf
Design ice thickness = 1 ft.

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

PRESTRESSED CONCRETE:..... See "GIRDERS" Dwg.

CONCRETE:..... Class A Concrete, f'c = 4000 psi.
Class A-A Concrete – approach slabs, f'c = 5000 psi.

STRUCTURAL STEEL:..... ASTM A709, Grade 36T3, Fy = 36,000 psi, unless otherwise noted.

STRUCTURAL STEEL PILING:... H-Piles – ASTM A709, Grade 50T3, Fy = 50,000 psi.
Pipe Piles – API 5L X52 PSL2, Fy = 52,000 psi.
Pile Tip reinforcing is required.

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	HP14x117						
Pier 2	3'-6"Øx1" Pipe						
Pier 3	3'-6"Øx1" Pipe						
Pier 4	3'-6"Øx1" Pipe						
Abutment 5	HP14x117						

HYDRAULIC & HYDROLOGIC SUMMARY

Flood Frequency (Yr.)	50	100	500
Exceedance Probability (%)	2	1	0.2
Design Discharge (ft³/sec)			
Design High Water (ft)			
Anticipated Add'l Backwater (ft)			
Contraction Scour (ft)			
Abutment Scour (ft)			
Pier Scour (ft)			

Drainage Area for this crossing: XX.X square miles.

Hydraulic Capacity: cfs at Low Superstructure Elevation which has an exceedance probability of equal to or less than 0.2 percent.

Total scour equals contraction scour + local scour.

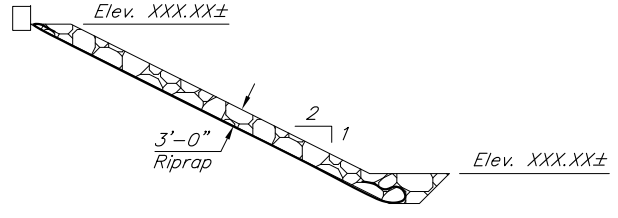
BRIDGE BASIS OF ESTIMATE

ITEM NO.	ITEM	UNIT	SUBST.	SUPERST.	TOTAL

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

OPTION 3

PRELIMINARY PLAN



RIPRAP DETAIL

24 0 4 8 12 16 20 24
in. Feet

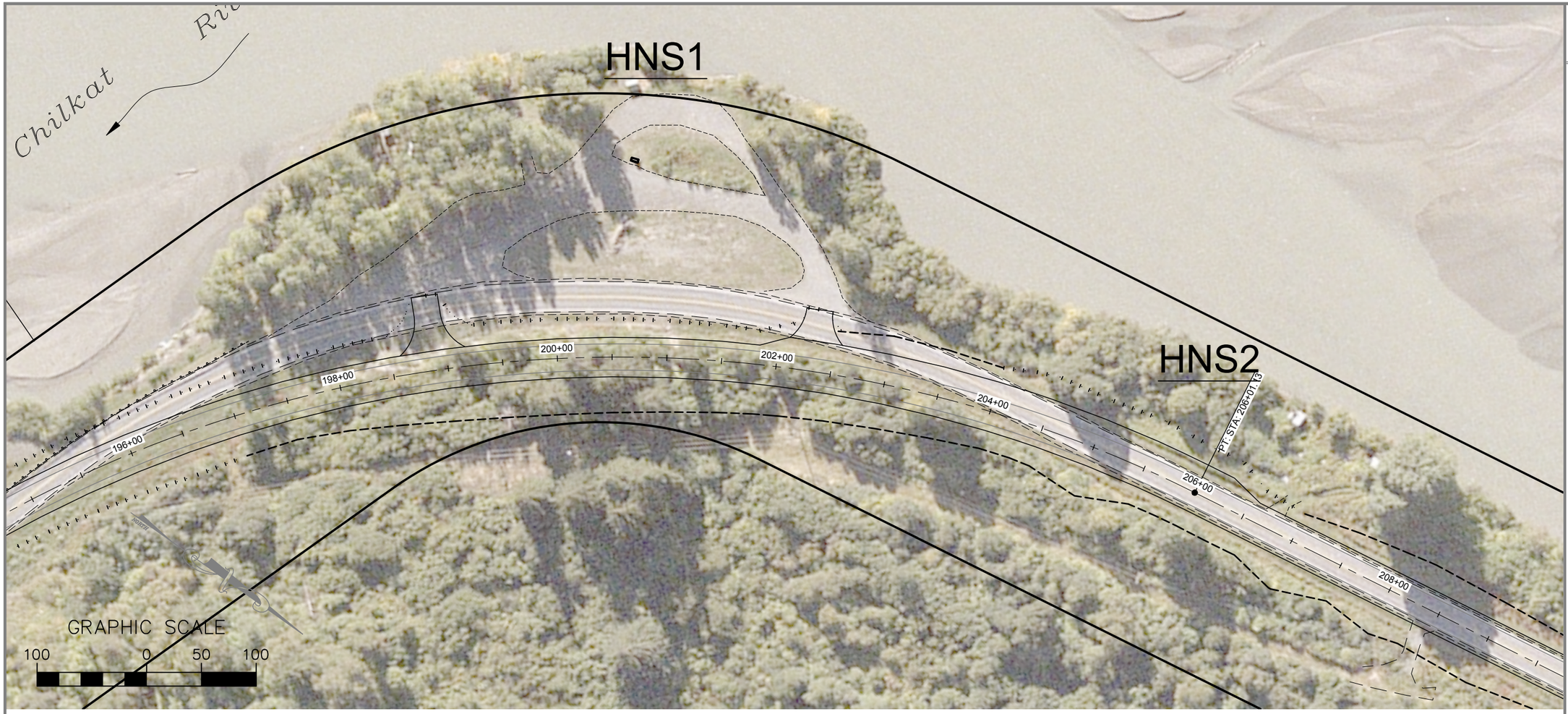
ABBREVIATIONS:

℄	= Centerline	f.f.	= far face
ℙ	= Plate	Hwy.	= highway
&	= and	LB	= pound
@	= at	LF	= linear foot
ø	= diameter	LS	= lump sum
Approx.	= approximate	Lt.	= left
Abut.	= Abutment	max.	= maximum
bot.	= bottom	min.	= minimum
Br.	= bridge	MSE	= mechanically stabilized earth
btwn.	= between	n.a.	= not applicable
Brg.	= Bearings	n.c.	= not calculated
C.I.P.	= cast in place	n.f.	= near face
Clr.	= clear, clearance	No.	= number
Col.	= column	O.H.W.	= ordinary high water
CSL	= crosshole sonic logging	PT	= Post Tensioned
CY	= cubic yard	PVC	= point of vertical curve
dia.	= diameter	PVI	= point of vertical intersection
D.H.W.	= Design High Water	PVT	= point of vertical tangent
Dwg.	= drawing	Rt.	= right
(E)	= existing	spc.	= space, spaces
EA	= each	Sta.	= station
Elev.	= elevation	SY	= square yard
e.f	= each face	Symm.	= symmetric
E.O.W.	= edge of water	Typ.	= typical
e.w	= each way		

DESIGNED BY: Elmer Marx	CHECKED: Engineer	HYDRAULICS BY: Engineer	CHECKED BY: Engineer	STATE OF ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES BRIDGE SECTION	CHILKAT RIVER BRIDGE HAINES HIGHWAY SITE PLAN
DRAWN BY: Sam Sollie	CHECKED: Elmer Marx	FOUNDATIONS REVIEWED BY: Engineer			BRIDGE NO. 742 DWG. NO. 2
QUANTITIES BY: Elmer Marx	CHECKED: Engineer				

APPENDIX I

Pullout Conceptual Plans



NEAREST MILEPOST: MP 4

HNS1 - STA. 198+80 & 202+60

EXISTING USES:
CAMPING, SPORT FISHING, AND SUBSISTENCE FISHING - PRIME SUBSISTENCE FISHING AREA FOR THE HARVEST OF EULACHON - FISHING CAMPS

DNR RECOMMENDATION:
ACCESS NEEDS TO BE PROVIDED

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH TWO 24-FOOT-WIDE ENTRANCES. PAVE TO CURVE RETURN. THIS AREA MAY BE USED AS A STAGING AREA DURING CONSTRUCTION. WORK ON M & O AGREEMENT WITH DNR.

HNS2 - STA. 202+60 TO 206+50

EXISTING USES:
EULACHON SUBSISTENCE FISHING - FISH PROCESSING - SEVERAL PERMANENT STRUCTURES EXIST

DNR RECOMMENDATION:
ACCESS MUST BE PROVIDED

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE A WIDENED SHOULDER FOR PARKING.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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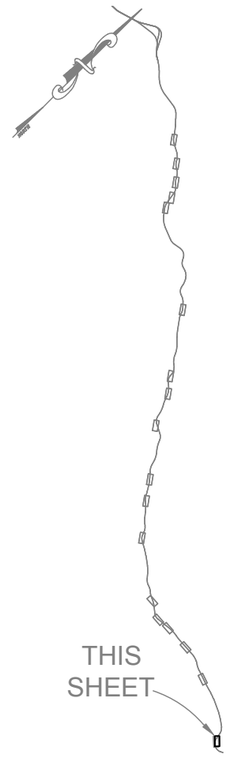

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
1	19

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TAB: 2 TODD L. KATTELMAN

NEAREST MILEPOST: MP 6

HNS3 - STA. 293+50

EXISTING USES:
INFORMAL PARKING/CAMPING AREA -SPORT FISHING FOR SALMON - PRIVATE PROPERTY

DNR RECOMMENDATION:
PROVIDE ACCESS

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: PRIVATE

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH ONE 24-FOOT-WIDE DRIVEWAY.
PAVE TO CURVE RETURN. ELIMINATE SECOND DRIVEWAY.

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
2	19

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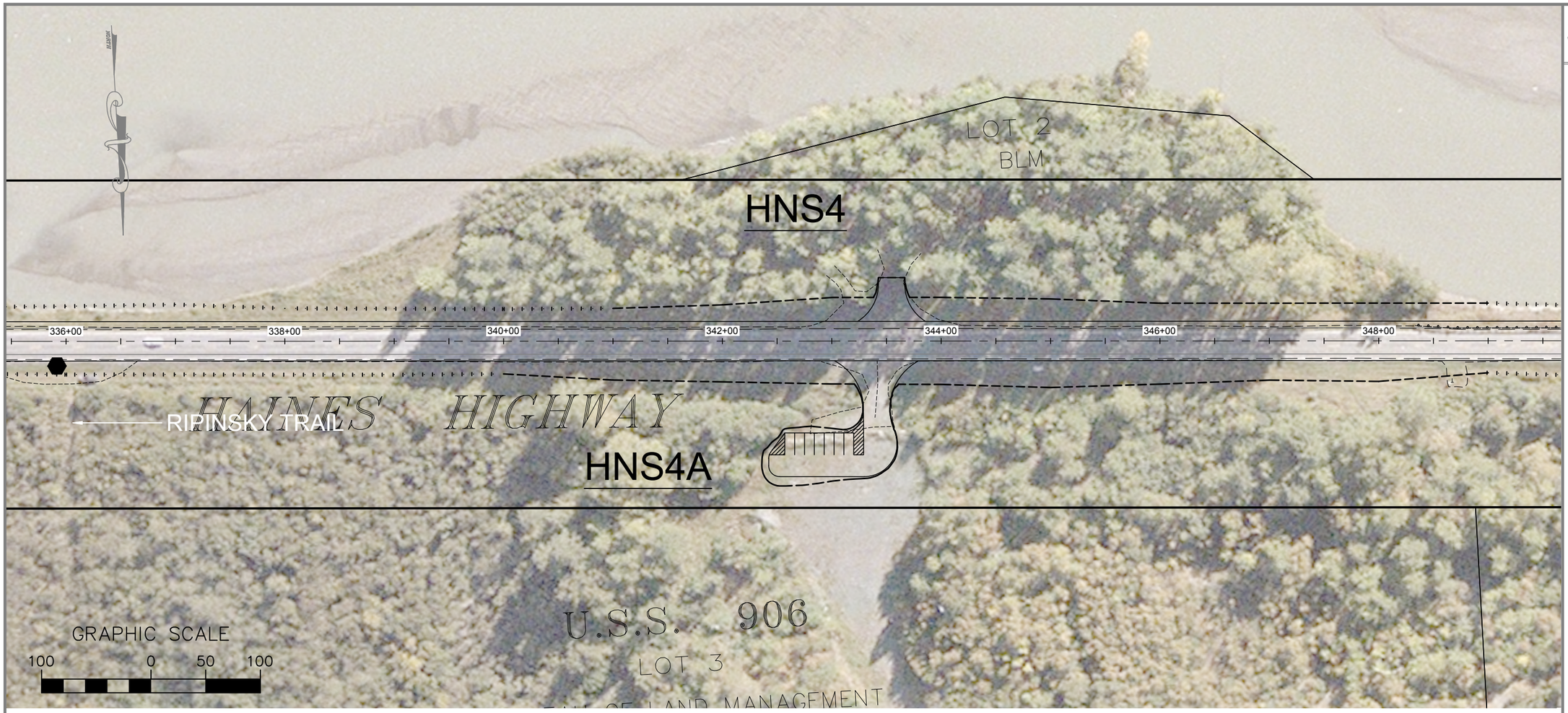

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TAB: 3 TODD L. KATTELMAN

NEAREST MILEPOST: MP 7

HNS4 - STA. 343+50

EXISTING USES:
CAMPING AREA (LONG AND SHORT TERM) - NO FACILITIES - PRIME SUBSITENCE AREA FOR SALMON FISHERS (SHORT SET GILLNETS)

DNR RECOMMENDATION:
ACCESS NEEDS TO BE PROVIDED

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: BLM

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH ONE 24-FOOT-WIDE DRIVEWAY. CREATE PARKING ACROSS STREET FOR RIPINSKY TRAIL. SEE HNS4A.

HNS4A - NEW

PROPOSED USES:
RIPINSKY RIDGE TRAIL PARKING. SUMMER AND WINTER USE?

DNR RECOMMENDATION:
PROVIDE PARKING NEAR TRAIL HEAD

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: BLM

DESIGN RECOMMENDATION:
CREATE PARKING AREA FOR RIPINSKY TRAIL. AREA IS ALREADY FILLED AND IS NOT WETLANDS.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
3	19

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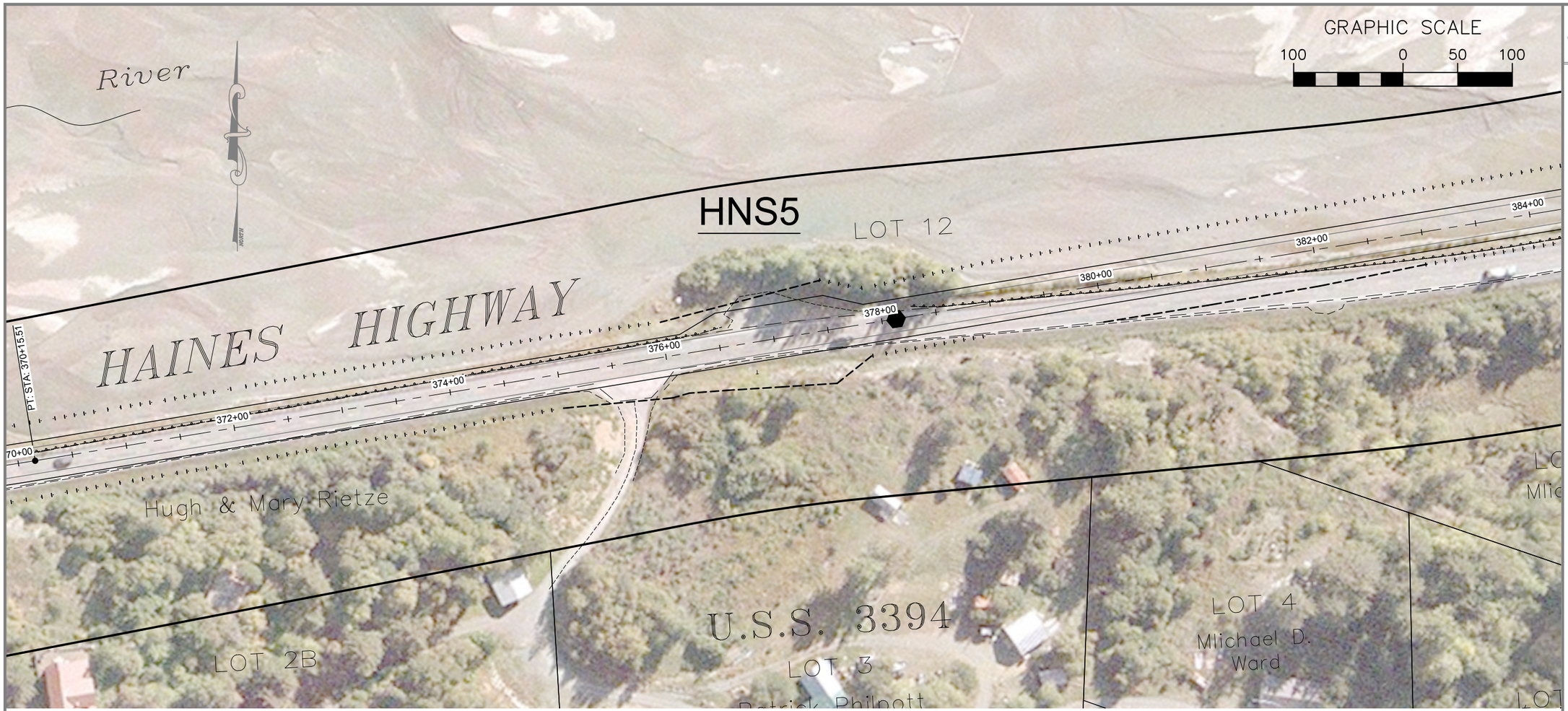

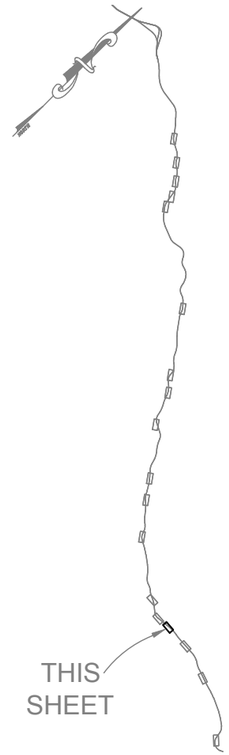

NEAREST MILEPOST: MP 8

HNS5 - STA. 376+00 TO 378+00

EXISTING USES:
RIVER FLATS ACCESS - BOAT LAUNCHING AT HIGH WATER

DNR RECOMMENDATION:
DO NOT PROVIDE ACCESS

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE WIDENED SHOULDER.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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Wednesday, October 14, 2009 10:52:33 AM
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PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
4	19

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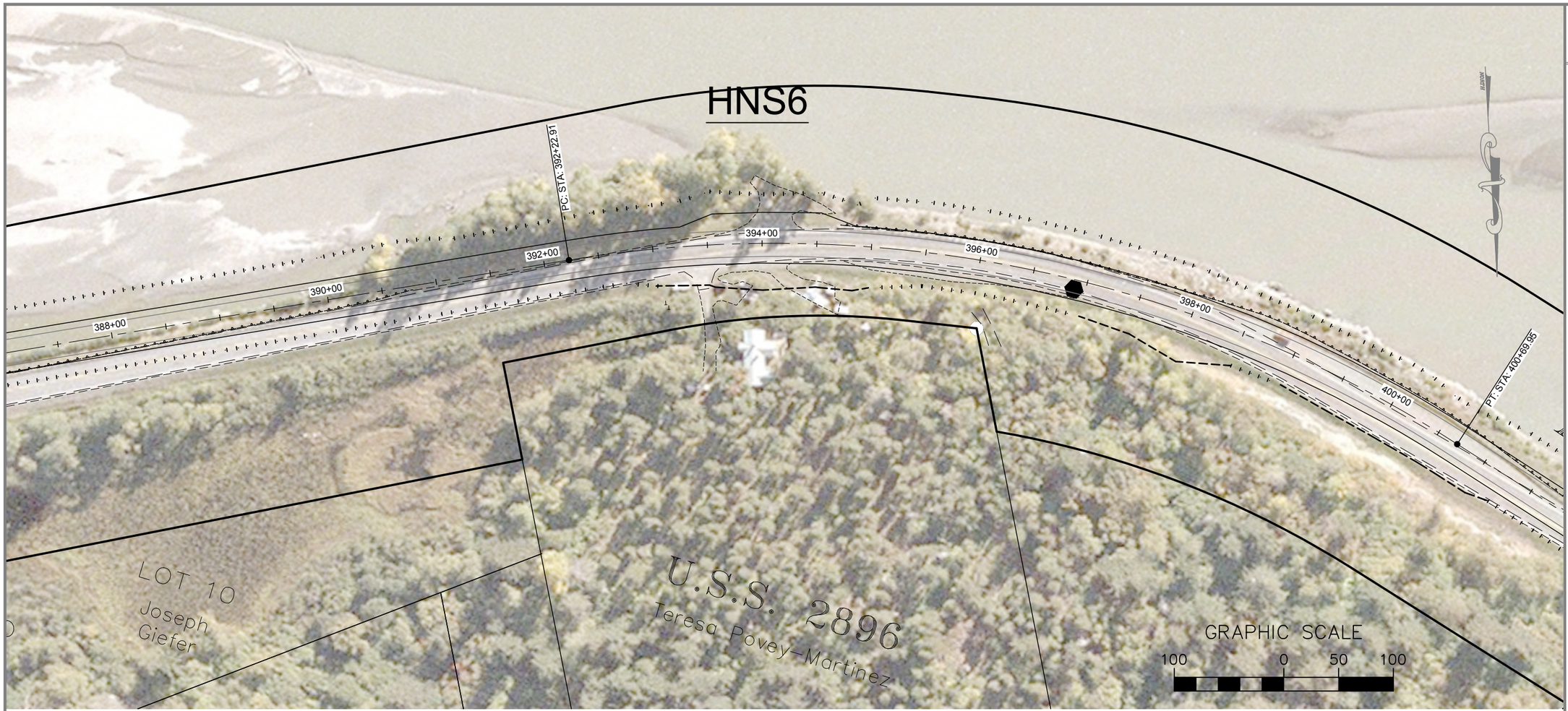

NEAREST MILEPOST: MP 8

HNS6 - STA. 393+25 TO 394+80

EXISTING USES:
PARKING AREA FOR A SALMON SUBSISTENCE FISHING

DNR RECOMMENDATION:
PROVIDE ACCESS

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE WIDENED SHOULDER

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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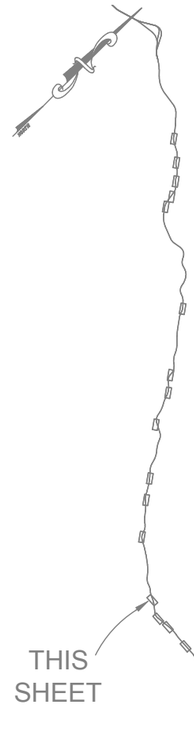

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
5	19

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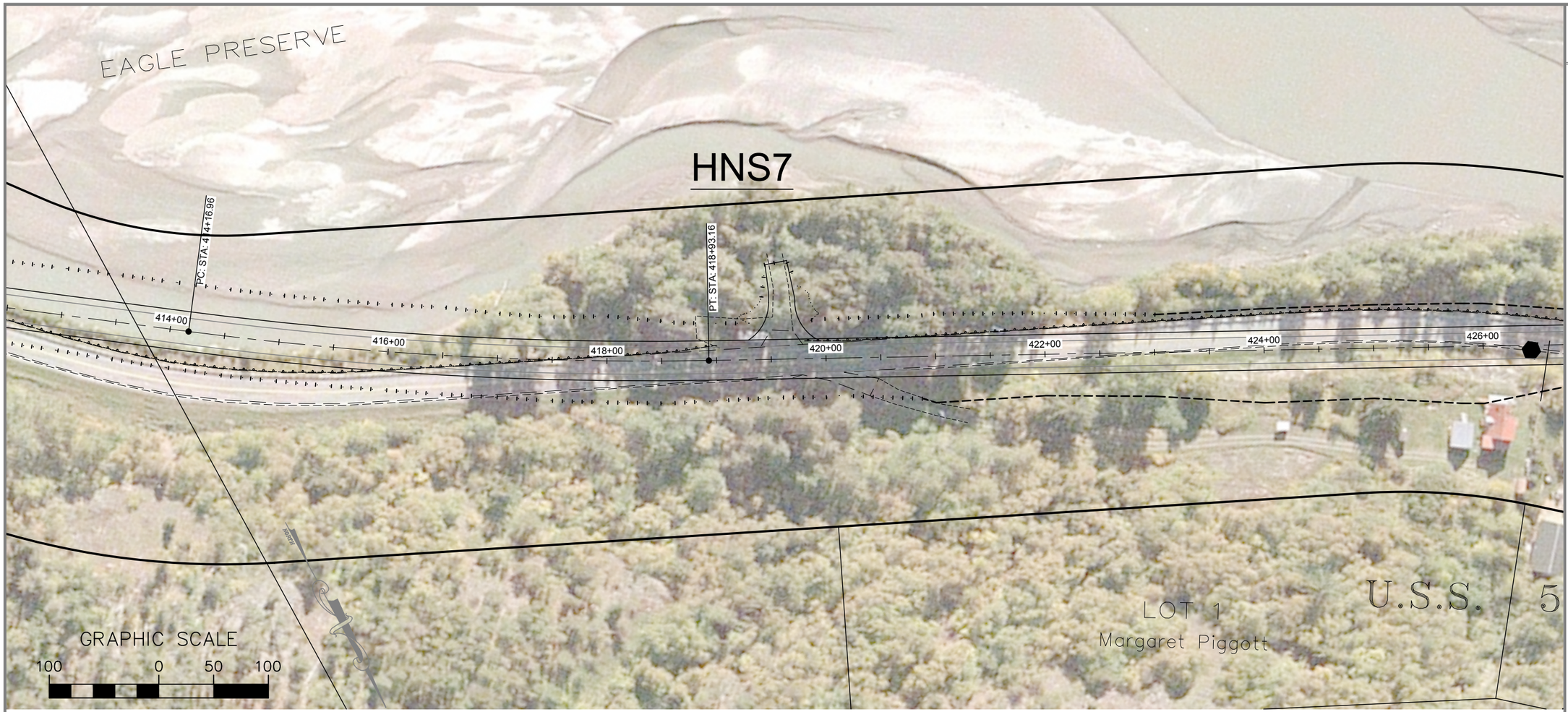

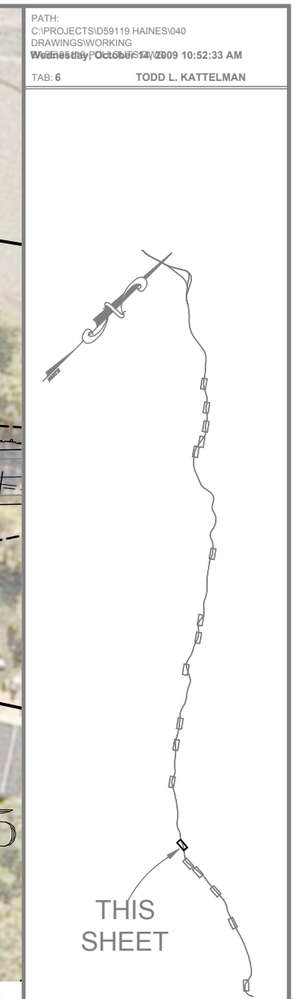

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TAB: 6 TODD L. KATTELMAN

NEAREST MILEPOST: MP 8.5

HNS7 - STA. 419+50

EXISTING USES:
BOAT LAUNCH - THE ALASKA DEPT. OF FISH AND GAME (ADFG) ACCESS THEIR FISH WHEELS - MOOSE HUNTERS ACCESS THE KICKING HORSE RIVER - PARKING FOR BOATS AND TRAILERS

DNR RECOMMENDTAION:
PROVIDE ACCESS AND PARKING

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR- EAGLE PRESERVE

DESIGN RECOMMENDATION:
PROVIDE DRIVEWAY ON RIVER SIDE FOR BOAT LAUNCH ONLY

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
6	19

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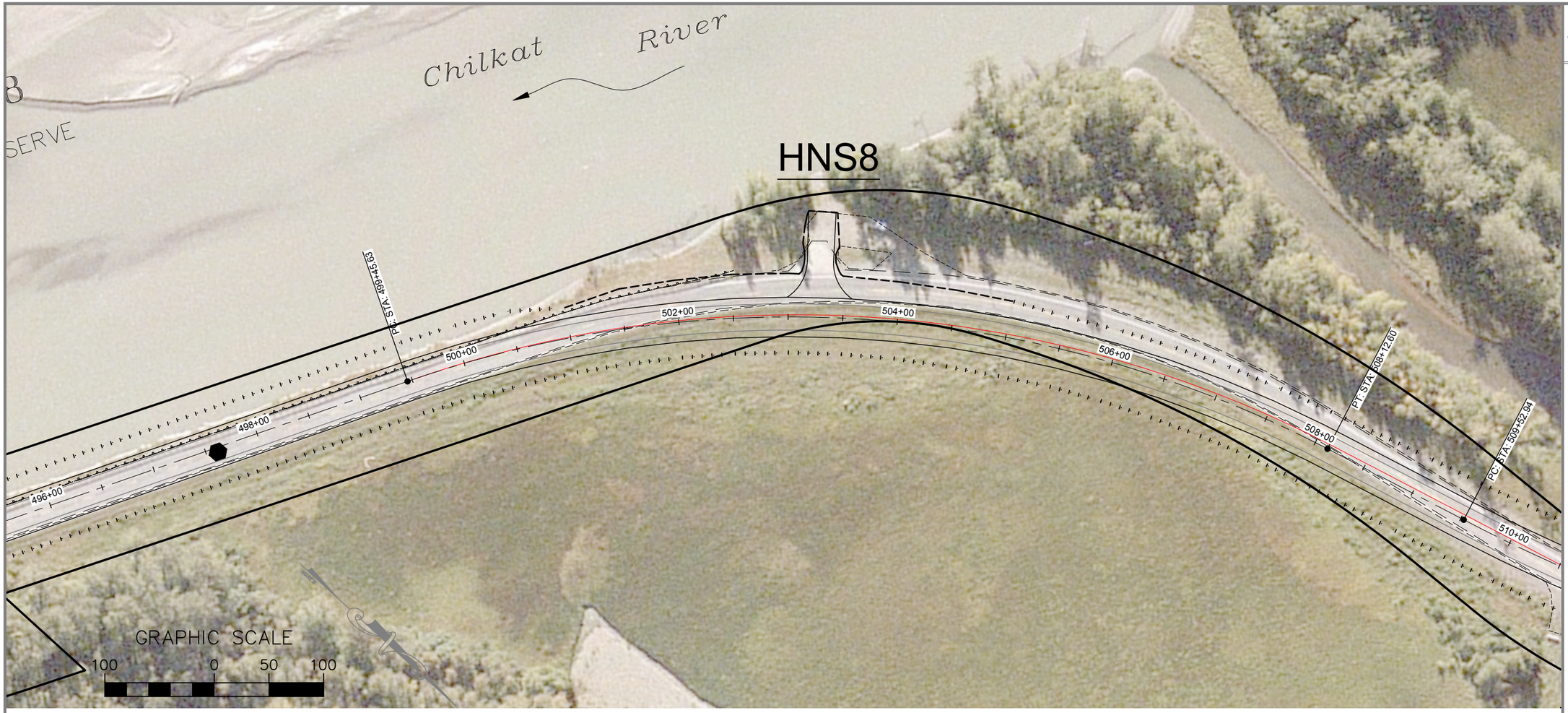

NEAREST MILEPOST: MP 10

HNS8 - STA. 503+25

EXISTING USES:
BOAT LAUNCH - ADFG, MOOSE HUNTERS AND FISHERS - STORAGE FOR ADFG FISH WHEELS

DNR RECOMMENDATION:
PROVIDE ACCESS AND PARKING FOR BOAT TRAILERS

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH ONE 24-FOOT-WIDE APPROACH.
DO NOT USE AS A CONSTRUCTION STAGING AREA.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
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Wednesday, October 14, 2009 10:52:33 AM
TAB: 7 TODD L. KATTELMAN

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
7	19

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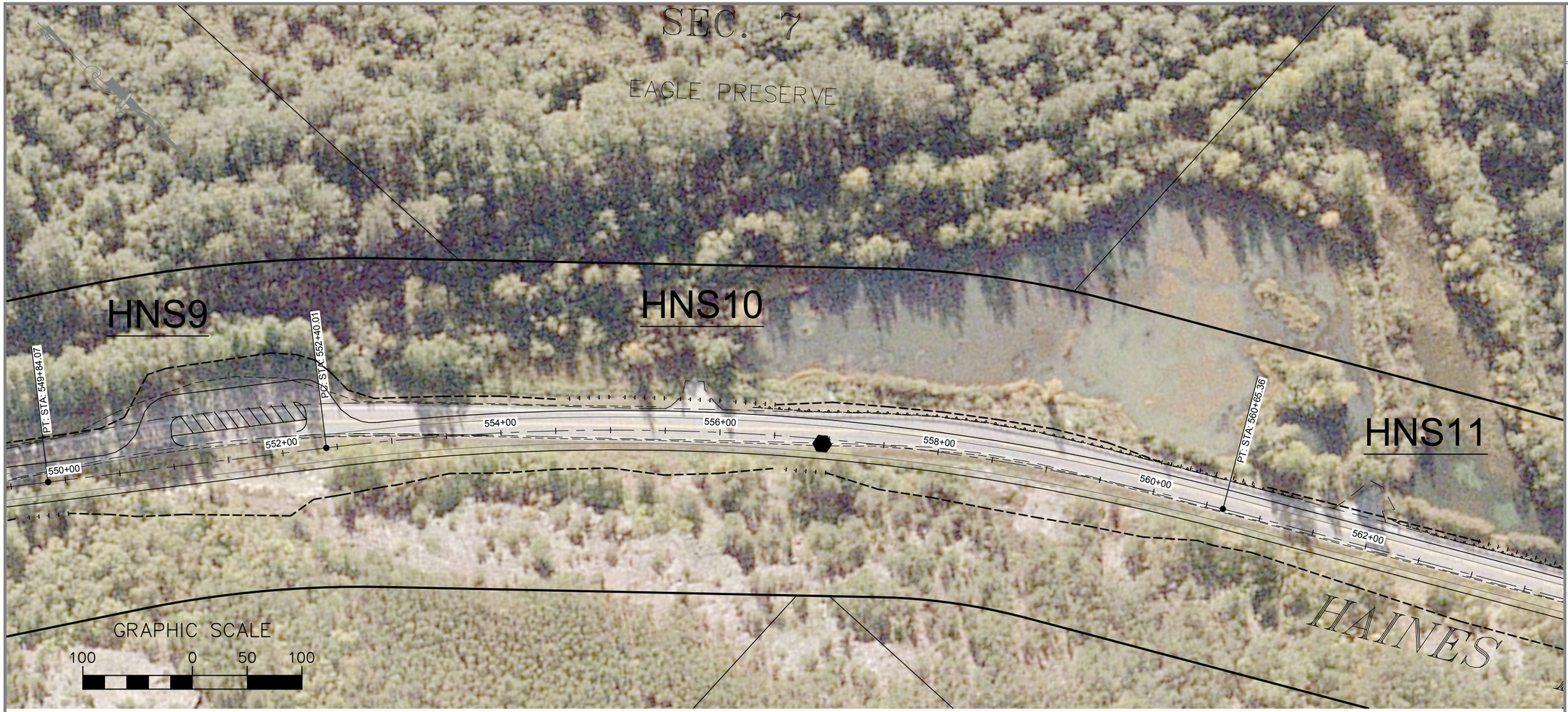

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Wednesday, October 14, 2009 10:52:33 AM
TAB: 8 TODD L. KATTELMAN

NEAREST MILEPOST: MP 11

HNS9 - STA. 550+50 TO 552+50

EXISTING USES:
TRASH DUMP

DNR RECOMMENDATION:
REMOVE BERM AND PULL OUT

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

RECOMMENDED IMPROVEMENTS:
BERM HAS BEEN REMOVED. USE THIS FILL AREA FOR NEW PARKING FOR POND USE.

HNS10 & HNS11 - STA. 556+00 & 562+00

EXISTING USES:
POND ACCESS DURING WINTER

DNR RECOMMENDATION:
BOTH APPROACHES SHOULD BE CLOSED OFF. DEVELOP A PULLOUT TO ALLOW ACCESS TO THE POND.

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
REMOVE ACCESS. DEVELOP HNS9 INTO PARKING AREA FOR POND USE.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
8	19

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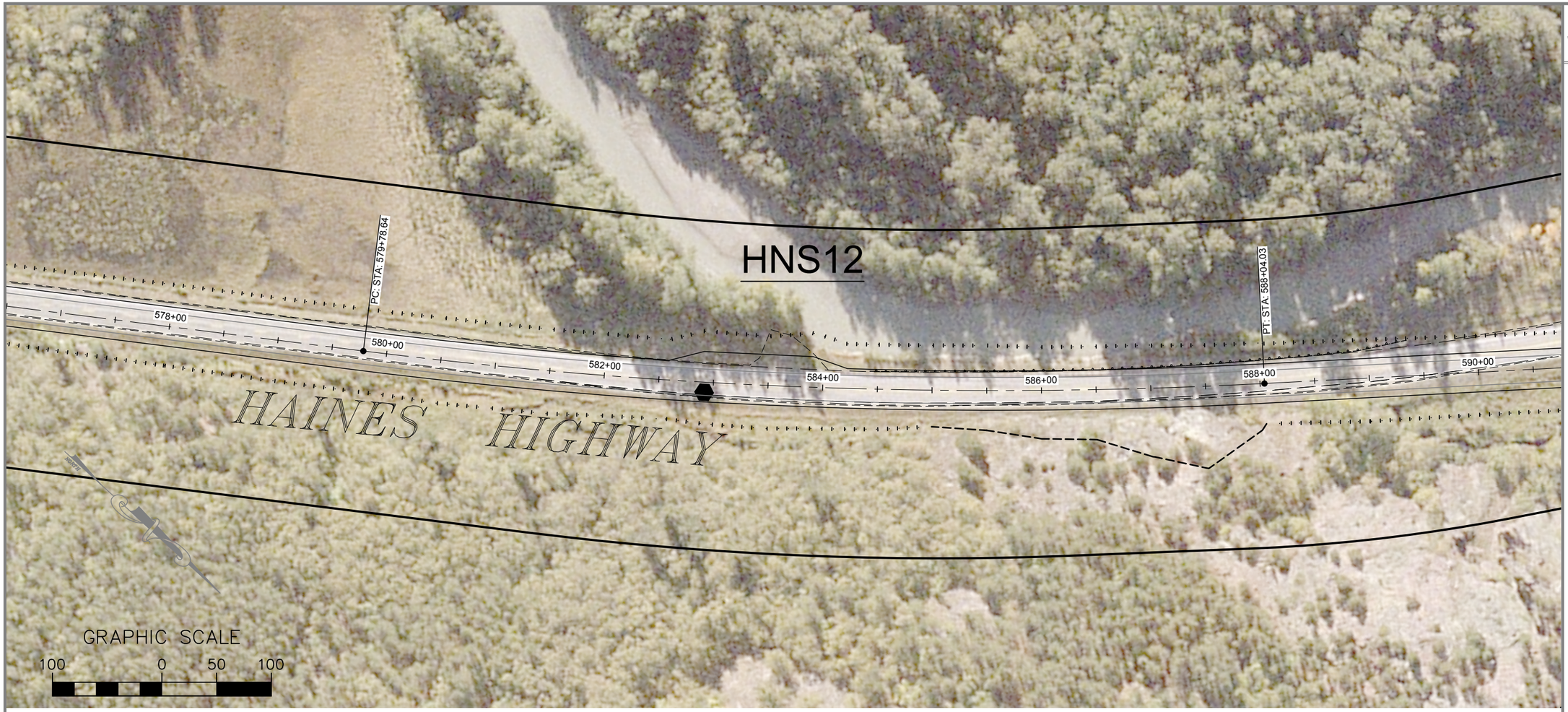

NEAREST MILEPOST: MP 11.5

HNS12 - STA. 582+50 TO 584+25

EXISTING USES:
SPORT FISHERS - HUNTERS

DNR RECOMMENDATIONS:
PROVIDE ACCESS

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE WIDENED SHOULDER

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
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Wednesday, October 14, 2009 10:52:33 AM
TAB: 9 TODD L. KATTELMAN

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
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STATE OF ALASKA
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HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
9	19

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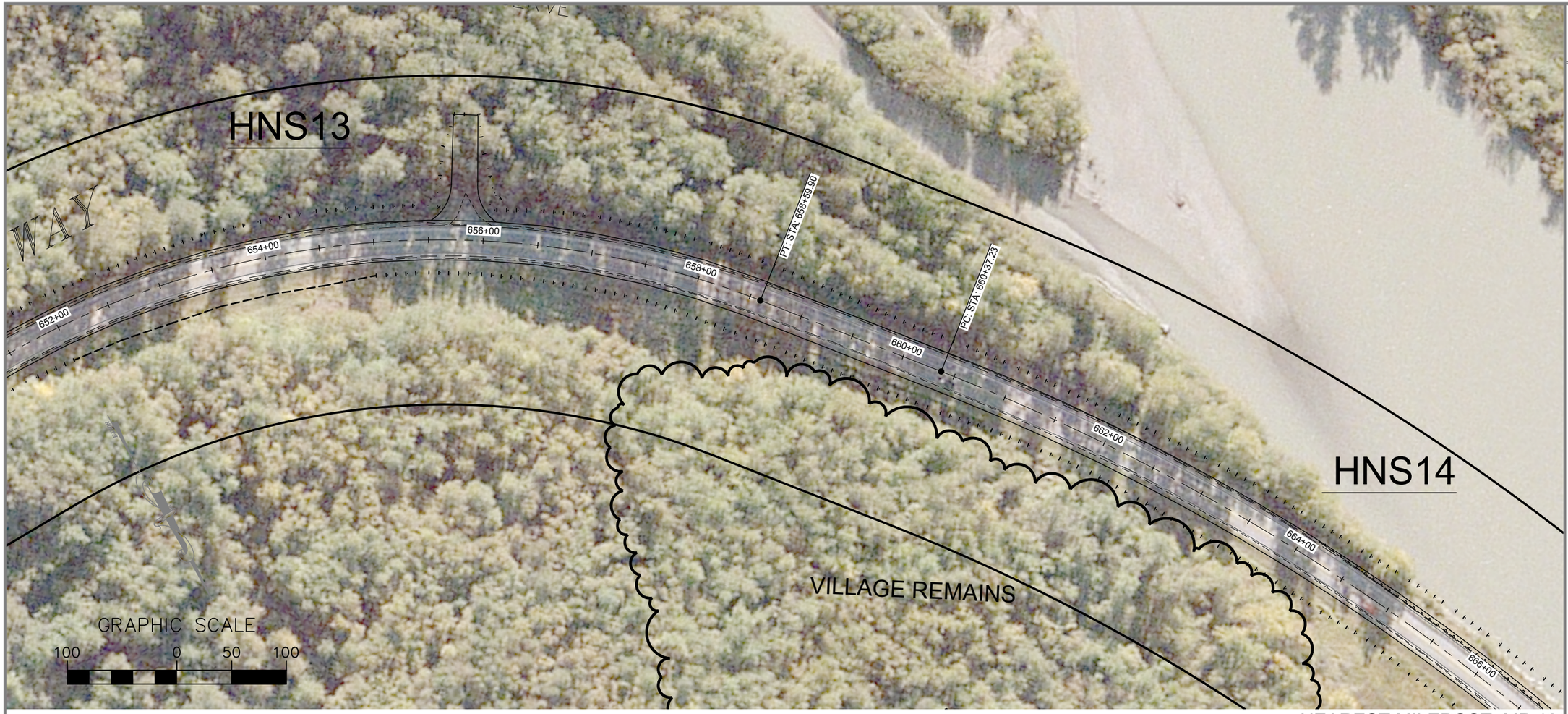

NEAREST MILEPOST: MP 13

HNS13 - STA. 655+75

EXISTING USES:
RIVER ACCESS - BOAT LAUNCHING - SPORT FISHERS - GARBAGE DUMP

DNR RECOMMENDATION:
PROVIDE NEW APPROACH AND BOAT LAUNCH AT HNS14 AND ABANDON HNS13 DUE TO STEEP ACCESS.

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE FILL TO REDUCE SLOPE AND RESURFACE HNS13 INSTEAD OF CREATING NEW ACCESS AT HNS14.

HNS14 - STA. 662+00

PROPOSED USE:
PROVIDE NEW BOAT LAUNCH TO REPLACE HNS13

DNR RECOMMENDATION:
SEE HNS13

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
SEE HNS13

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
C:\PROJECTS\D59119 HAINES\040 DRAWINGS\WORKING
Wednesday, October 14, 2009 10:52:33 AM
TAB: 10 TODD L. KATTELMAN

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
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STATE OF ALASKA
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HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
10	19

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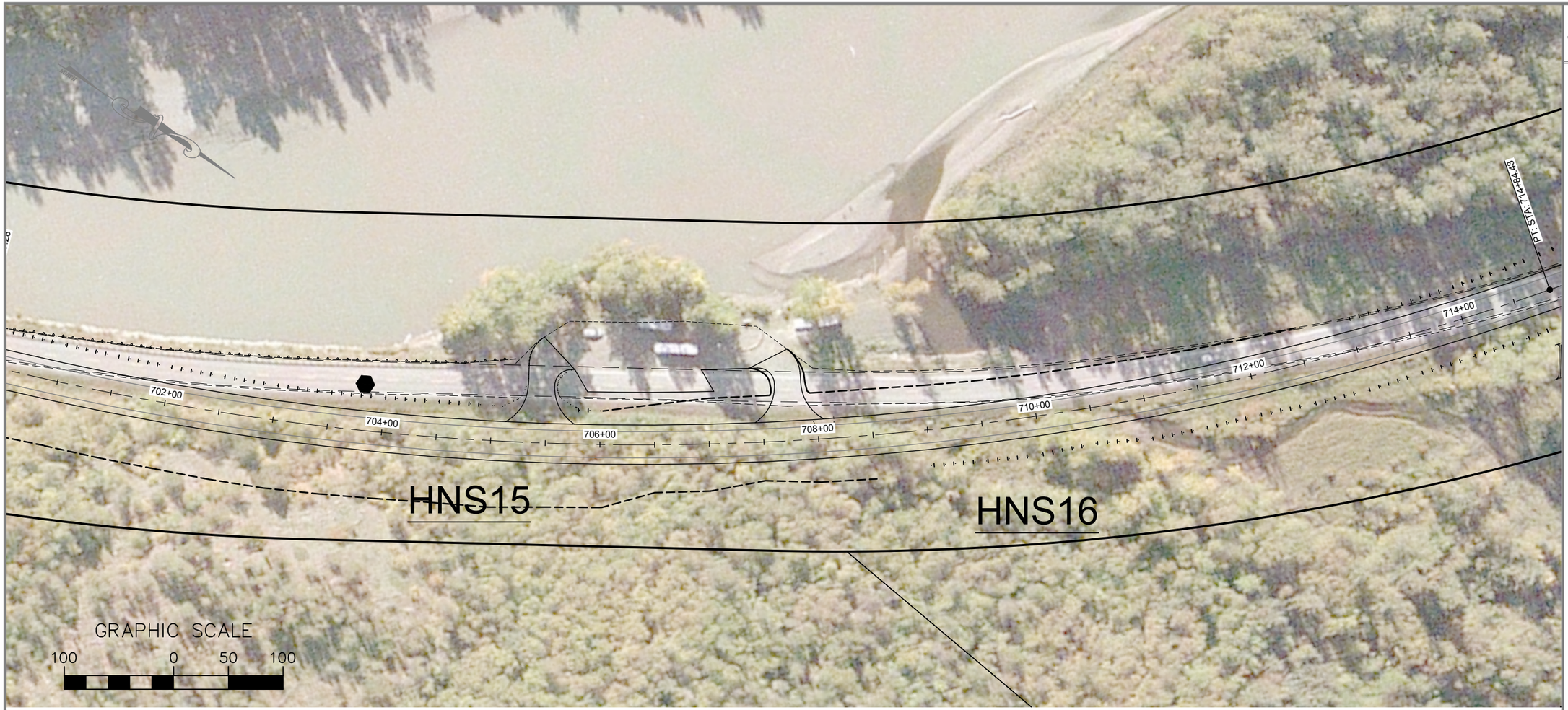

NEAREST MILEPOST: MP 14

HNS15 - STA. 705+50 TO 707+75

EXISTING USES:
HIGH USE SALMON SUBSISTENCE FISHING

DNR RECOMMENDATION:
PROVIDE ACCESS AND EXPAND PARKING

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH TWO 24-FOOT-WIDE APPROACHES. PAVE TO CURVE RETURN. DNR WILL ACCEPT O&M. LIMIT PARKING TO 10 VEHICLES AND PROVIDE GRAVEL SURFACE.

HNS16 - STA. 708+00

EXISTING USES:
BOAT LAUNCH (NO COMMERCIAL OPERATORS) - SPORT FISHING

DNR RECOMMENDATION:
DO NOT IMPROVE

OWNERSHIP:
DOT ROW

DESIGN RECOMMENDATION:
PROVIDE ACCESS. NO IMPROVEMENTS AT THIS TIME.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
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Wednesday, October 14, 2009 10:52:33 AM
TAB: 11 TODD L. KATTELMAN

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
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- EXISTING GUARDRAIL
- CENTERLINE
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STATE OF ALASKA
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HAINES HIGHWAY
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TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
11	19

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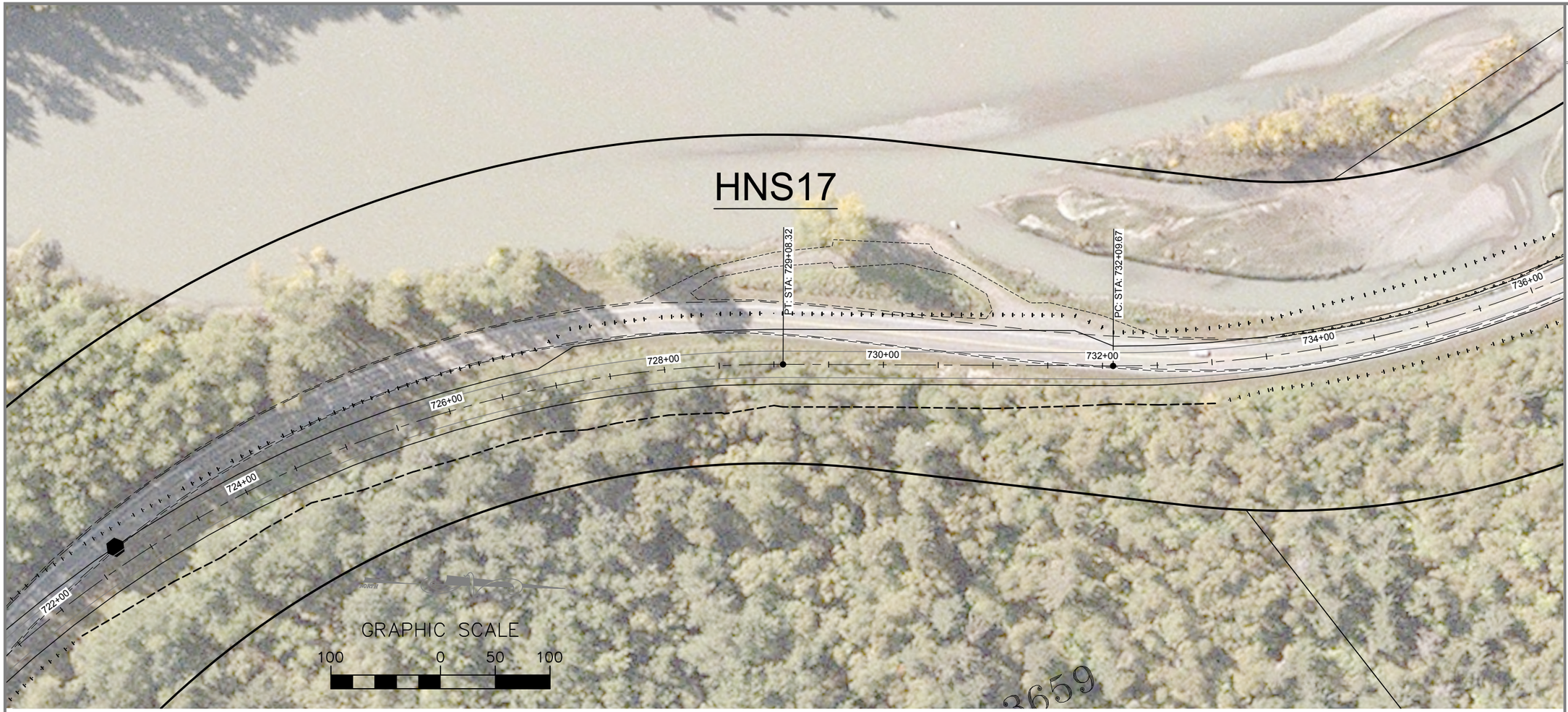

NEAREST MILEPOST: MP 14

HNS17 - STA. 727+00 TO 732+00

EXISTING USES:
COMMERCIAL RAFTING OPERATIONS

DNR RECOMMENDATIONS:
DO NOT CHANGE THE GRADE OR DISTURB THE VEGETATED ISLAND. THE EXITS TO THE AREA NEED TO BE DESIGNED FOR THE TRANSIT OF BUS TRAFFIC. DNR WILL MAINTAIN.

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE WIDENED SHOULDER AND REGRADE FROM EDGE OF PAVEMENT TO EXISTING DRIVEWAY TO IMPROVE SLOPE FOR BUS TRAFFIC. OBLITERATE AND VEGETATE OLD HIGHWAY.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
C:\PROJECTS\D59119 HAINES\040 DRAWINGS\WORKING
Wednesday, October 14, 2009 10:52:33 AM
TAB: 12 TODD L. KATTELMAN

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
12	19

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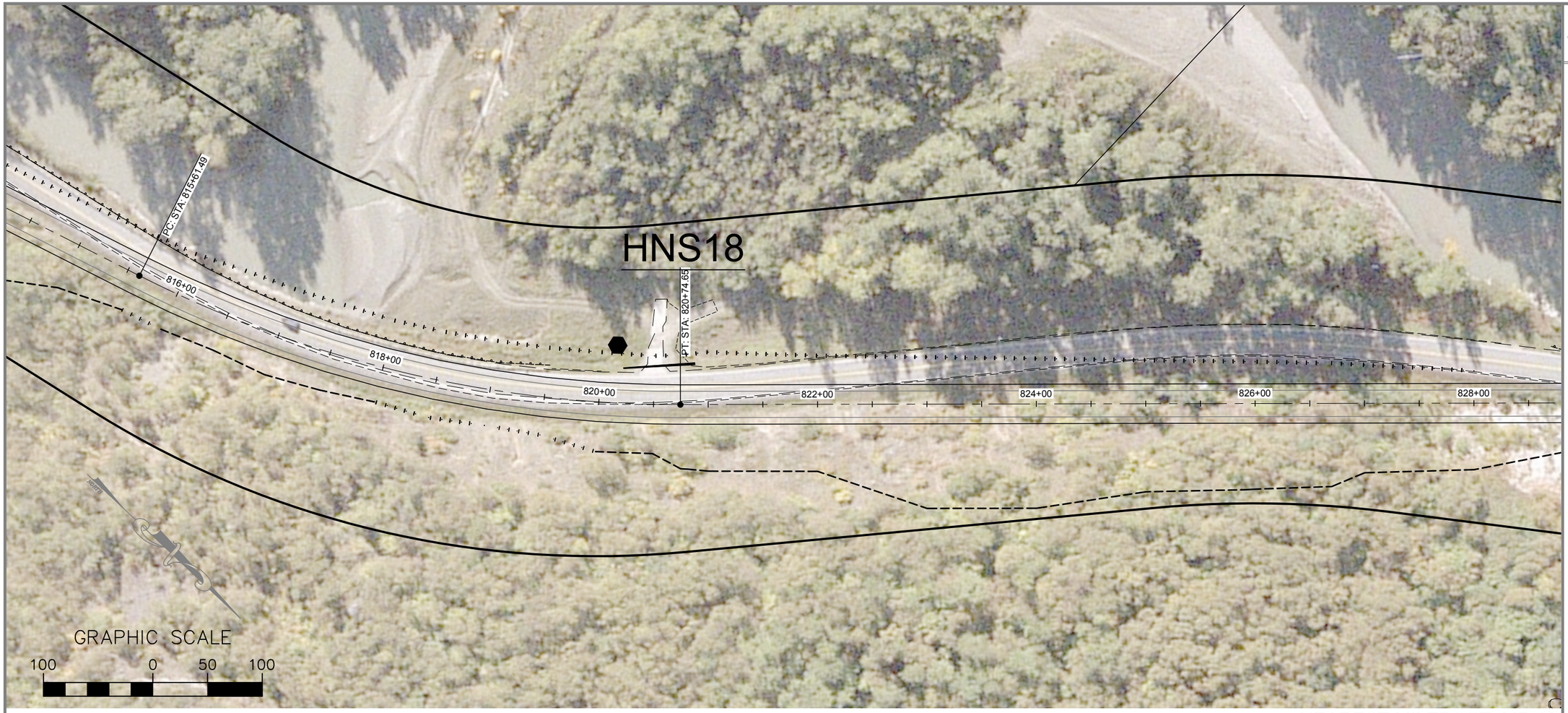

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Wednesday, October 14, 2009 10:52:33 AM

TAB: 13 TODD L. KATTELMAN

NEAREST MILEPOST: MP 16

HNS18 - STA. 820+50

EXISTING USES:
PARTIES - GARBAGE DUMP

DNR RECOMENDATION:
CLOSE OFF WITH GUARDRAIL

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR - EAGLE PRESERVE

DESIGN RECOMMENDATION:
DITCH ACROSS ACCESS DRIVEWAY TO REMOVE ACCESS.

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
13	19

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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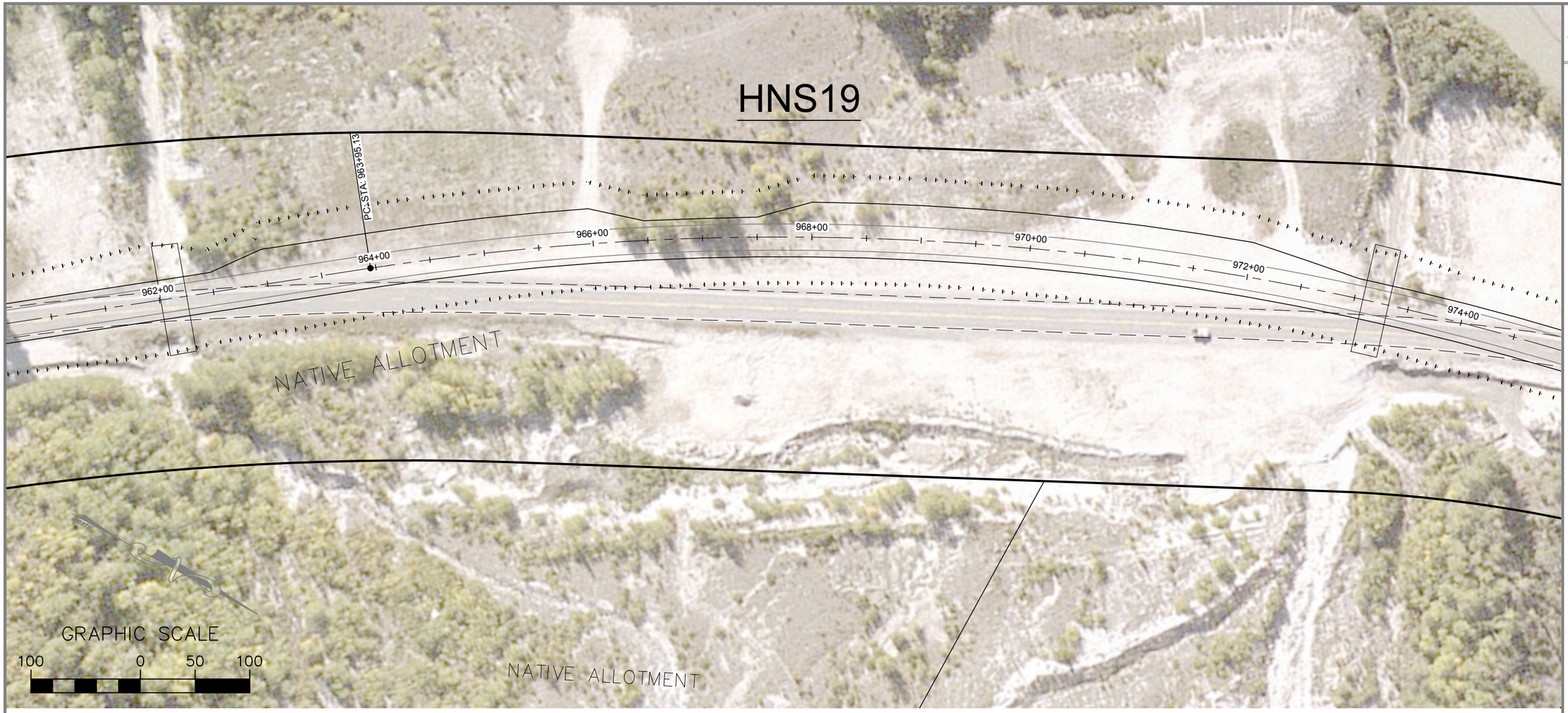
HNS19



NEAREST MILEPOST: MP 19

HNS19 - STA. 966+00 TO 972+50

EXISTING USES:
EAGLE VIEWING

DNR RECOMMENDATION:
PROVIDE PARKING ALONG HIGHWAY AND PROVIDE ACCESS TO SLIDE AREA FOR MAINTENANCE

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR - EAGLE PRESERVE

DESIGN RECOMMENDATION:
THE HIGHWAY WILL BE RAISED APPROXIMATELY-15 FEET THROUGH THIS AREA AND PARKING WILL BE PROVIDED ALONG THE HIGHWAY WITH A SERVICE DRIVE TO THE SLIDE AREA FOR MAINTENANCE.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
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Wednesday, October 14, 2009 10:52:33 AM
TAB: 14 TODD L. KATTELMAN

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
14	19

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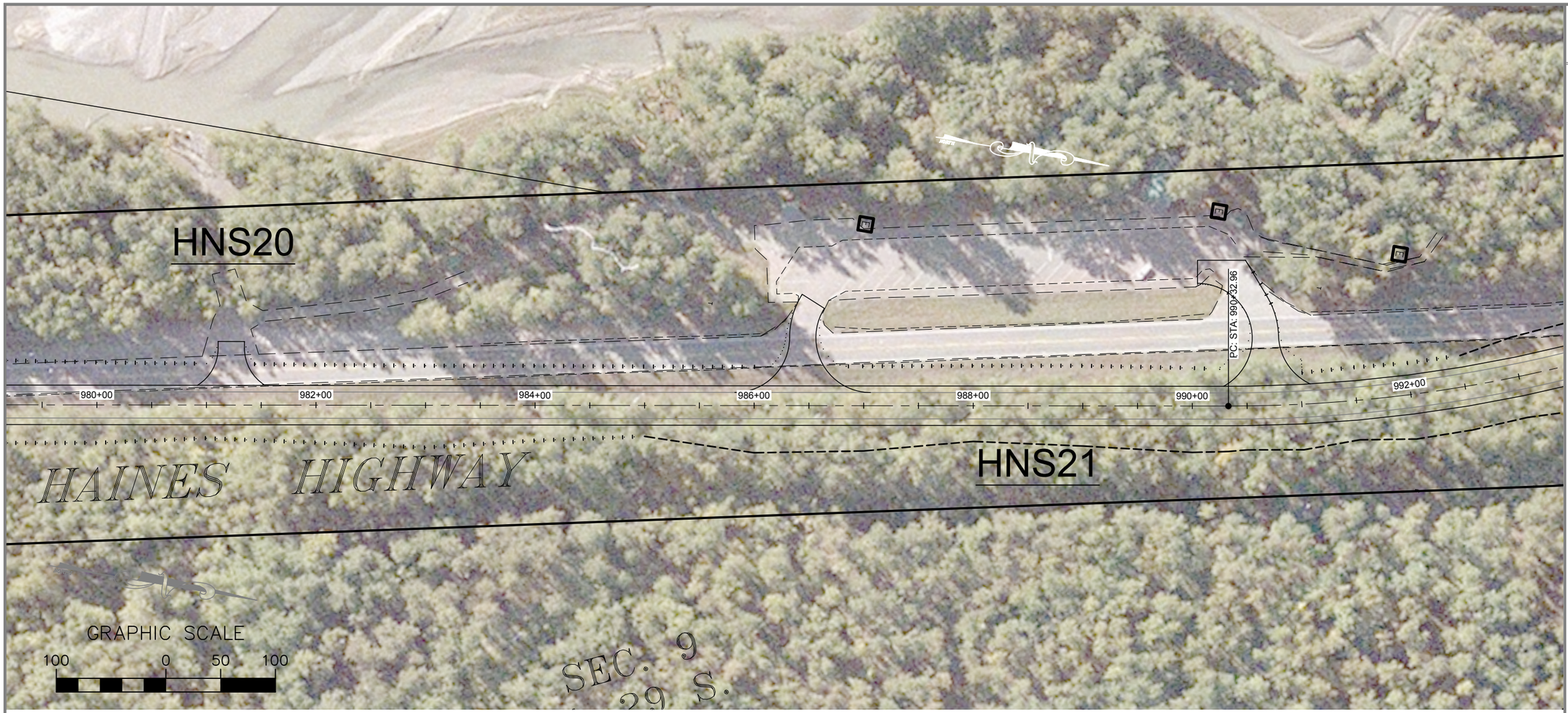

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Wednesday, October 14, 2009 10:52:33 AM
TAB: 15 TODD L. KATTELMAN

NEAREST MILEPOST: MP 19.5

HNS20 - STA. 981+25

EXISTING USES:
COMMERCIAL RAFTING OPERATIONS - LAUNCH SITE

DNR RECOMMENDATION:
PROVIDE ACCESS. PROVIDE PARKING FOR ONE VAN WITH BOAT TRAILER AND ONE BUS. LAUNCH SITE DOES NOT NEED IMPROVEMENTS

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR- EAGLE PRESERVE

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH ONE 24-FOOT-WIDE APPROACH. PAVE TO CURVE RETURN. THERE IS ROOM FOR PARKING ONE VAN WITH TRAILER AND ONE BUS ALONG THE EXISITNG GRAVEL DRIVE.

HNS21 - STA. 986+40 TO 990+75

EXISTING USES:
SCENIC VIEW POINT PARKING AREA

DNR RECOMMENDATION:
IMPROVE DESIGN FOR SNOW PLOWING AND EXPAND VEGETATED ISLAND.

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE IMPROVED ACCESS WITH TWO 24-FOOT-WIDE PLOW FRIENDLY APPROACHES. PAVE TO CURVE RETURN. OBLITERATE AND VEGETATE EXISITNG HIGHWAY.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
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DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
15	19

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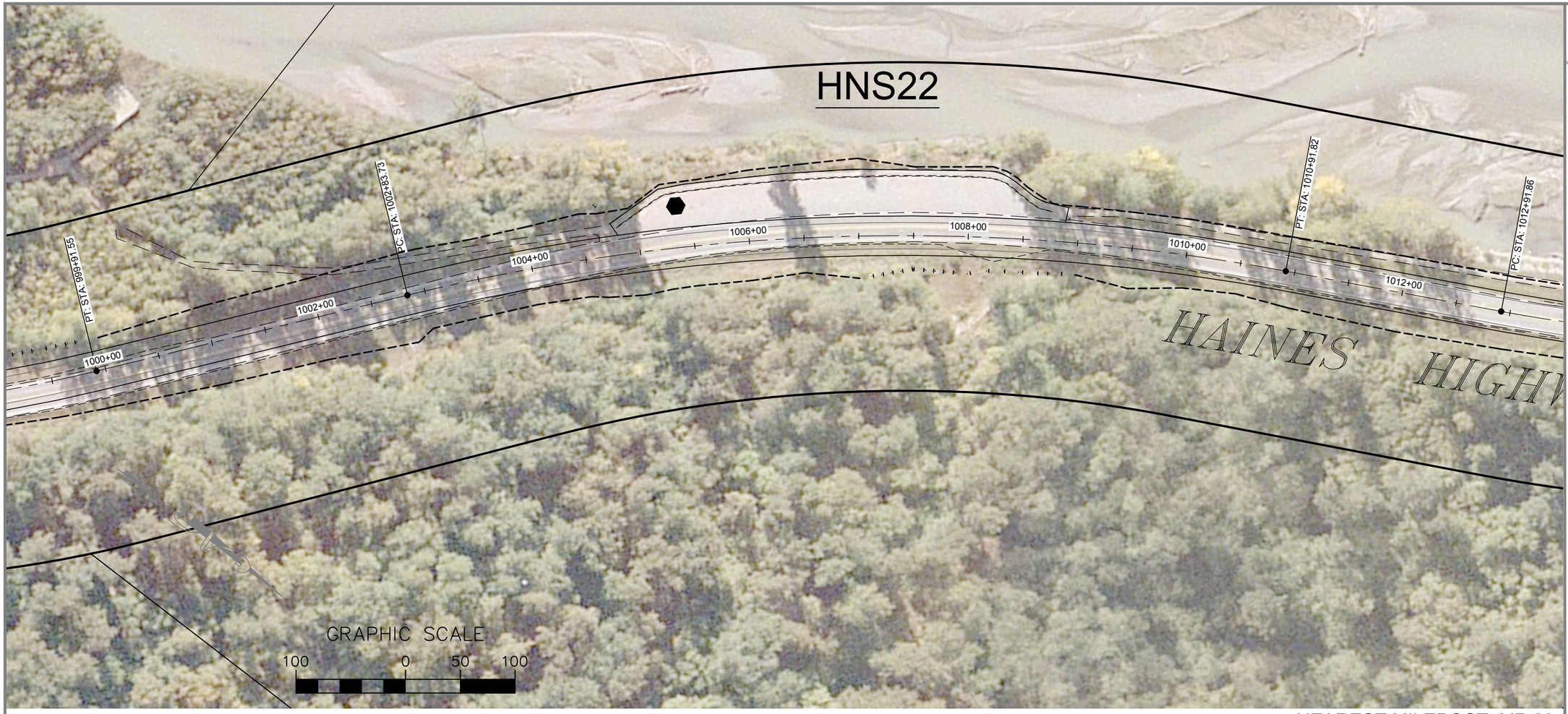

NEAREST MILEPOST: MP 20

HNS22 - STA. 1004+75 TO 1008+75

EXISTING USES:
SCENIC VIEW POINT PARKING AREA

DNR RECOMMEDATIONS:
INCREASE PARKING IF POSSIBLE, DO NOT REDUCE PARKING AREA

OWNERSHIP:
DOT ROW - ADJACENT LAND ONWER: DNR - EAGLE PRESERVE

DESIGN RECOMMENDATION:
PROVIDE ACCESS TO PULL OUT

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
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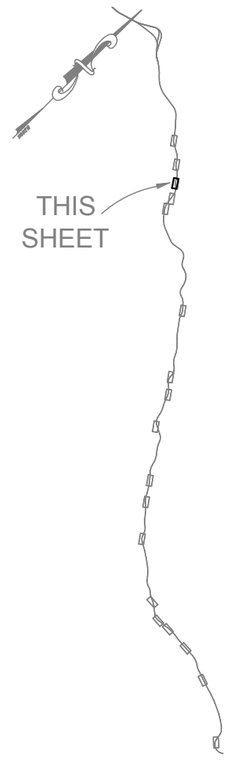
Wednesday, October 14, 2009 10:52:33 AM
TAB: 16 TODD L. KATTELMAN



PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
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HAINES HIGHWAY
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TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
16	19

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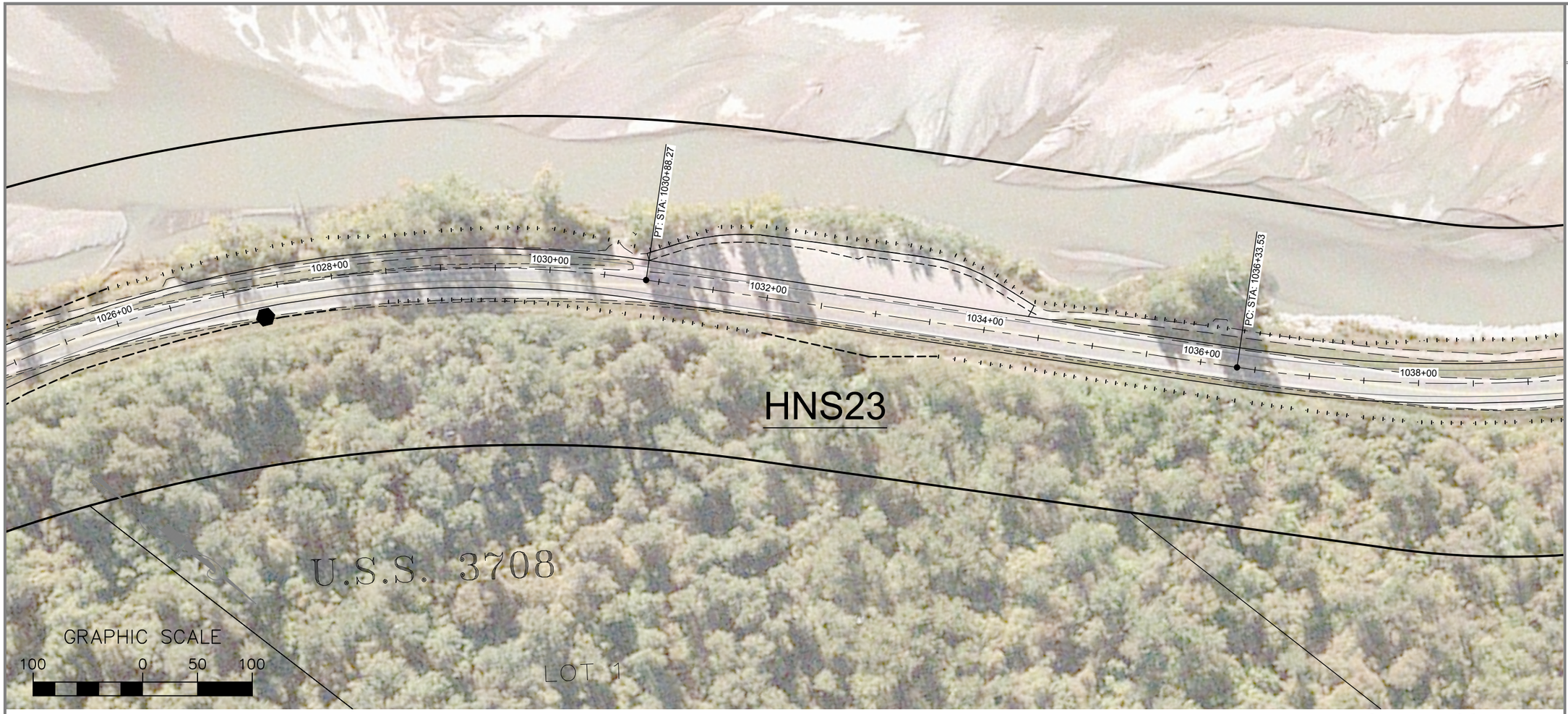

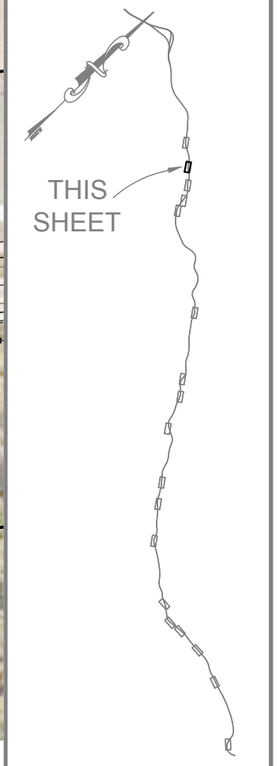

PATH:
C:\PROJECTS\D59119 HAINES\040 DRAWINGS\WORKING
Wednesday, October 14, 2009 10:52:33 AM

TAB: 17 TODD L. KATTELMAN

NEAREST MILEPOST: MP 20

HNS23 - STA. 1030+75 TO 1034+40

EXISTING USES:
SCENIC VIEW POINT PARKING AREA

DNR RECOMMENDATION:
DO NOT REDUCE PARKING AREA, EXPAND IF POSSIBLE.

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR - EAGLE PRESERVE

DESIGN RECOMMENDATION:
PROVIDE ACCESS TO PULL OUT

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
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- FILL LIMITS

STATE OF ALASKA
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HAINES HIGHWAY
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TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
17	19

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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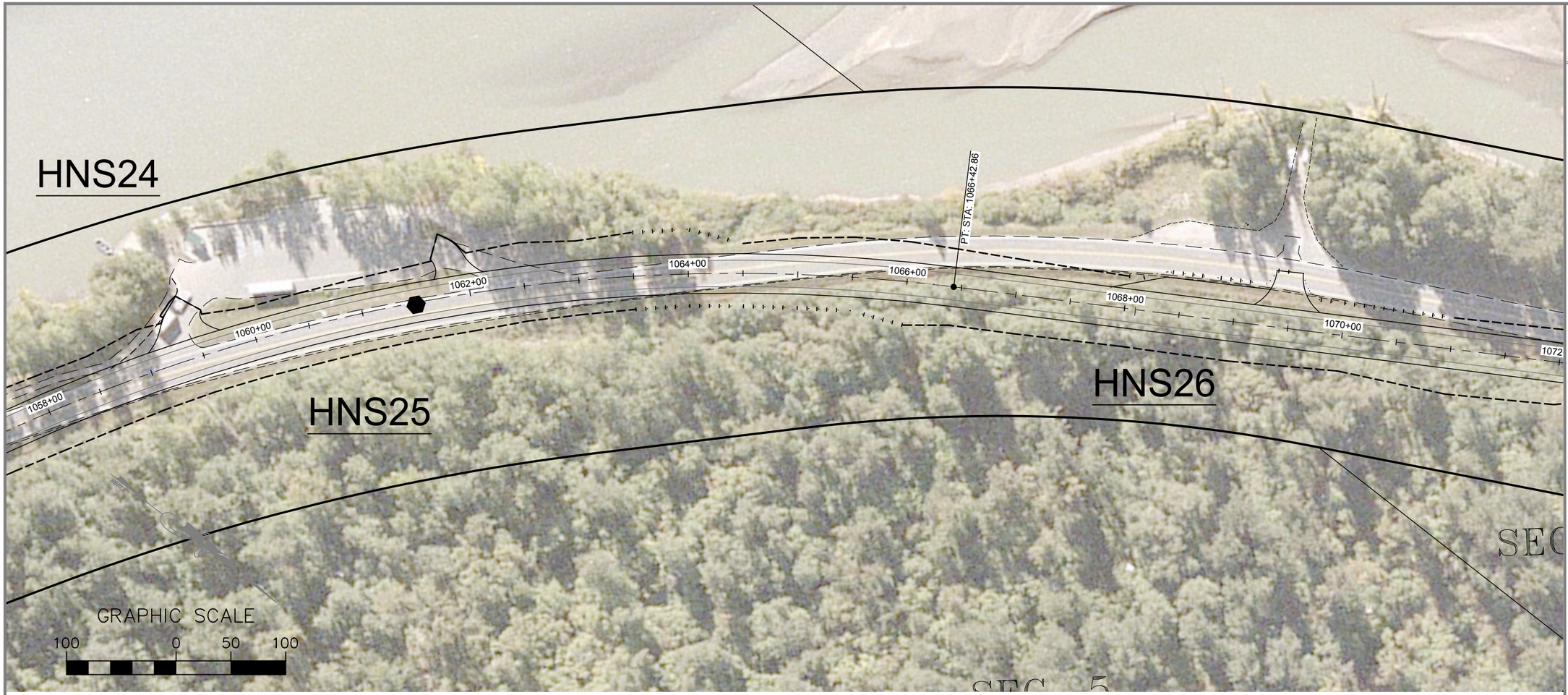

NEAREST MILEPOST: MP 21

HNS24 - STA. 1059+50

EXISTING USES:
BOAT LAUNCH - SALMON SUBSISTENCE - SPORT FISHING ACCESSED BY HNS25

DNR RECOMMENDATION:
DOES NOT NEED TO BE IMPROVED

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
NO MODIFICATIONS AT THIS TIME.

HNS25 - STA. 1059+00 TO 1062+50

EXISITNG USES:
SCENIC VIEW POINT PARKING AREA

DNR RECOMMENDATION:
IMPROVE FOR SNOW PLOWING AND BUS ACCESS

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH TWO 24-FOOT-WIDE APROACHES. IMPROVE EXIT/ENTRANCE RETURN RADII TO BE SNOW PLOW FRIENDLY.

HNS26 - STA. 1062+50

EXISTING USES:
PULLOUT (HEAVILY USED BY THE VILLAGE OF KLUKWAN) - SPORT FISHERS - BIRD WATCHERS - SALMON SUBSISTENCE FISHERS

DNR RECOMMENDATION:
AN ADDED PULL OUT WOULD ALLOW ACCESS TO PROPOSED TRAIL EXTENSION.

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
PROVIDE ACCESS WITH ONE 24-FOOT-WIDE APPROACH.

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH:
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Wednesday, October 14, 2009 10:52:33 AM
TAB: 18 TODD L. KATTELMAN

PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
18	19

C:\PROJECTS\D59119 Haines\040 Drawings\Working Base\95119-PULLOUTS.dwg 2009-10-27 10:09:26

NEAREST MILEPOST: MP 24

HNS27 - NA

EXISTING USES:
BOAT LAUNCH - HUNTER, FISHER AND ADFG

DNR RECOMMENDATION:
PROVIDE BOAT LAUNCH AT NEW BRIDGE SITE

OWNERSHIP:
DOT ROW - ADJACENT LAND OWNER: DNR

DESIGN RECOMMENDATION:
NO IMPROVEMENTS AT THIS TIME

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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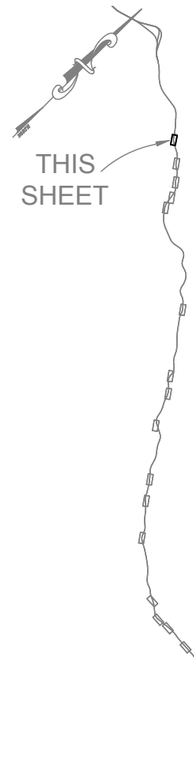
TAB: 19 TODD L. KATTELMAN



PLAN LEGEND
- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES
DIVISION-SOUTHEAST REGION

HAINES HIGHWAY
MP 3.5 TO 25.3

TURNOUT / RECREATION FACILITITES

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2009
SHEET NUMBER	TOTAL SHEETS
19	19

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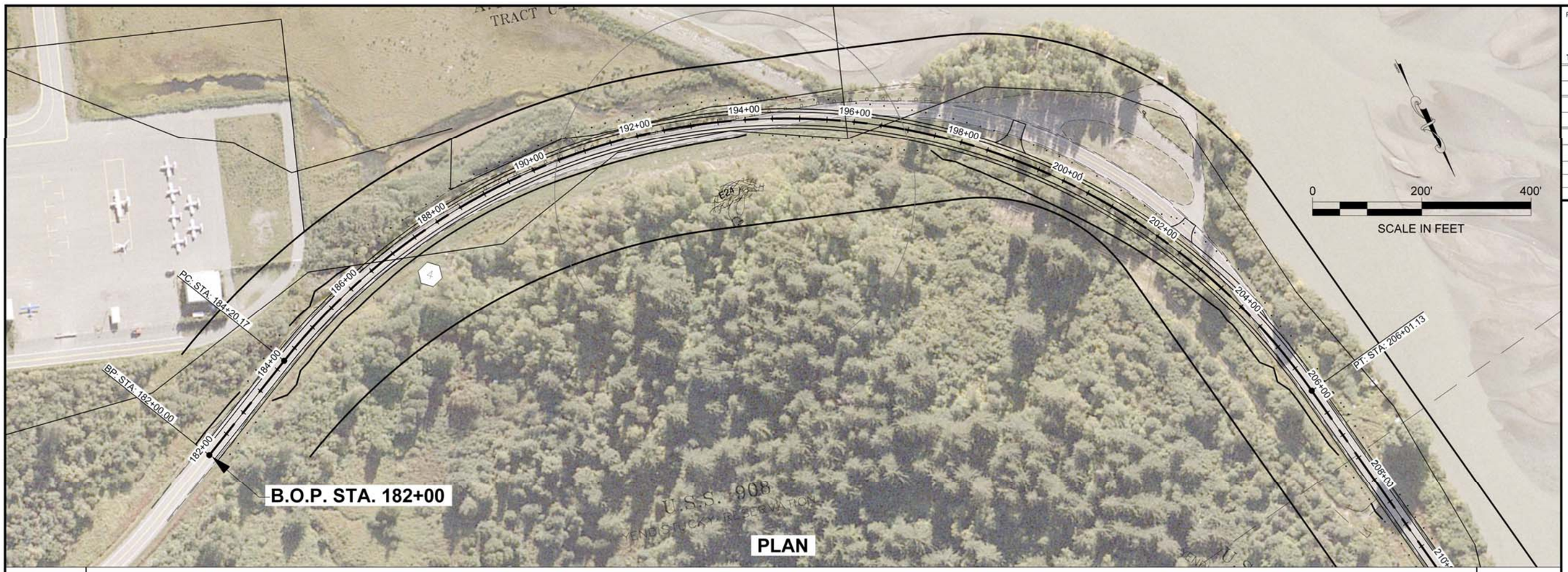
APPENDIX J

Conceptual Design Plans



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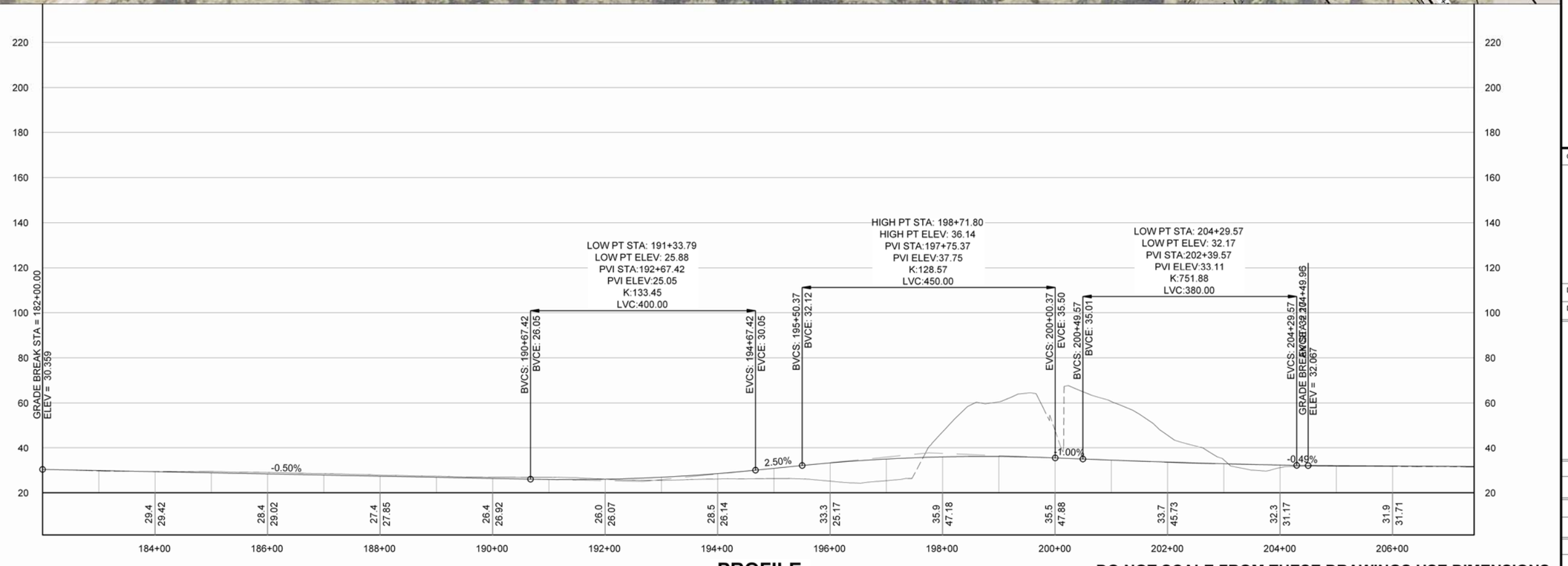

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 1 Friday, September 03, 2010 9:58:58 A

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- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
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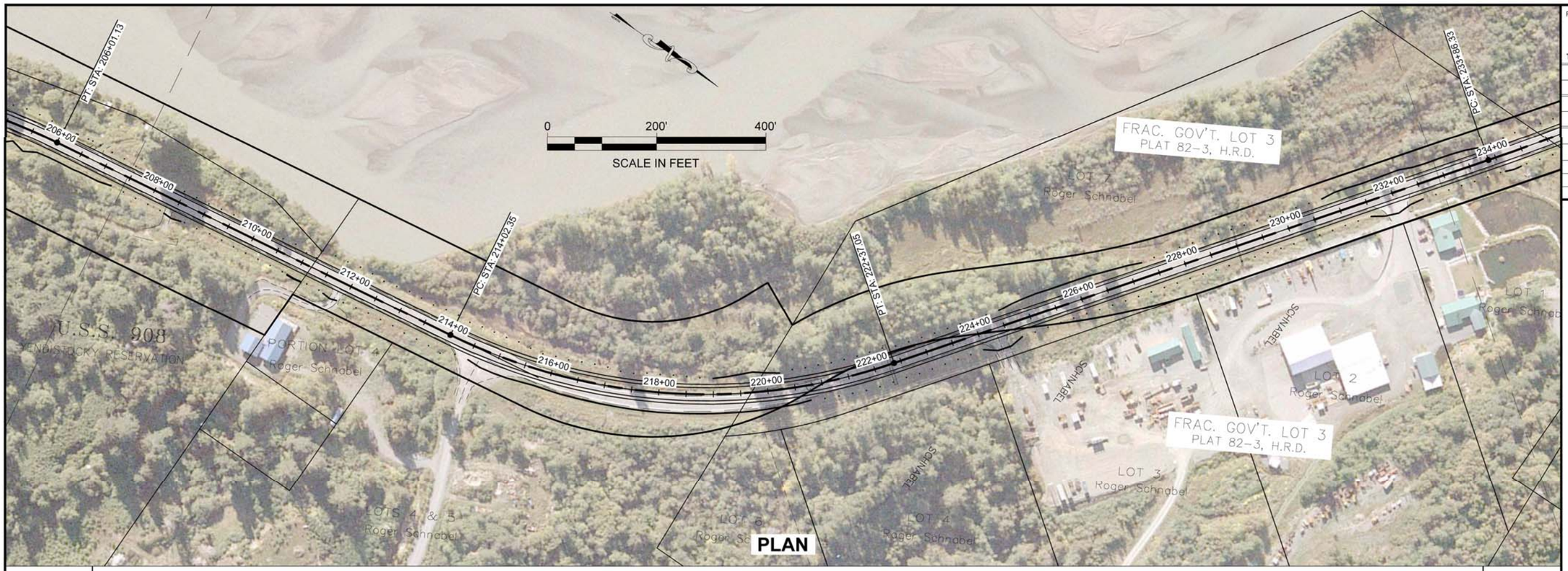

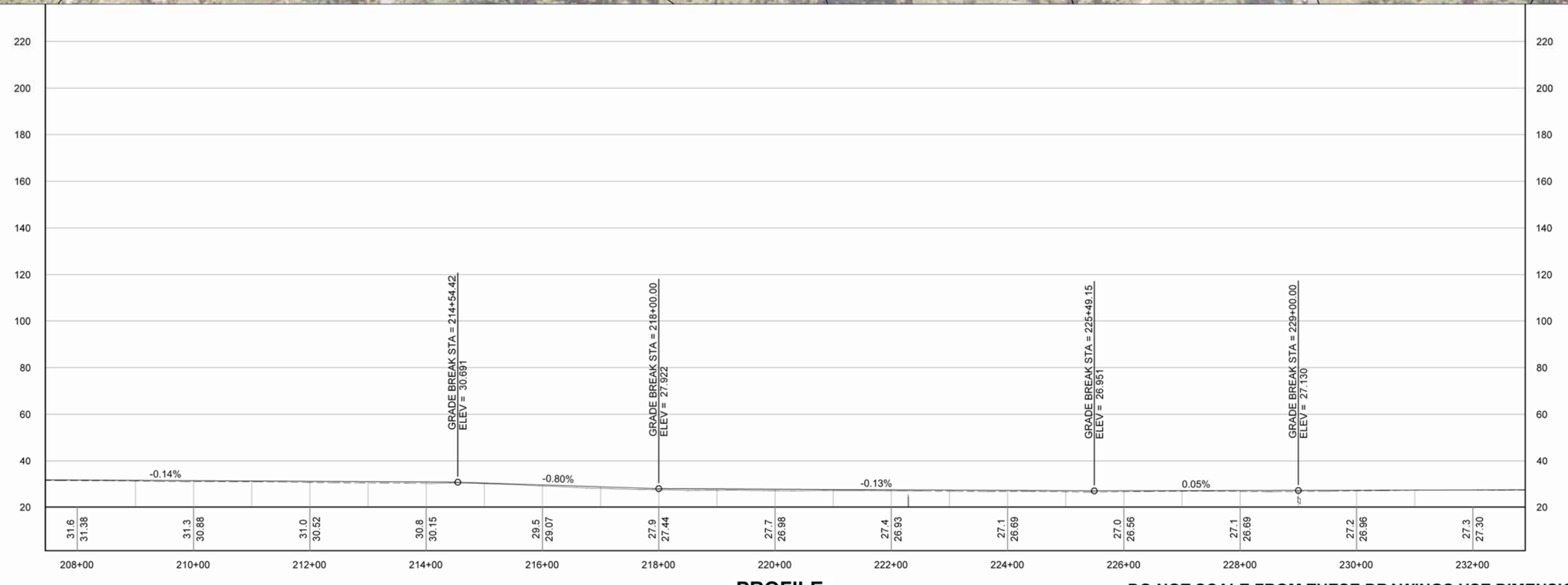

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HOBBS, NAOMI

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- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
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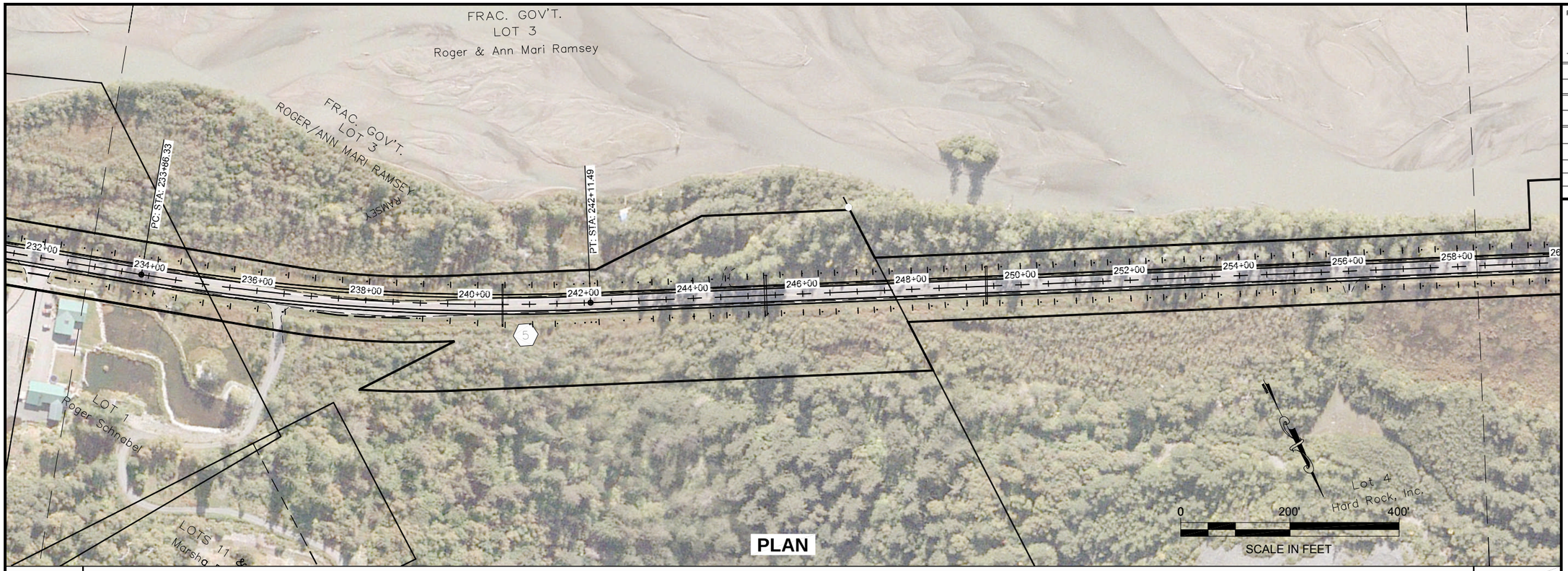

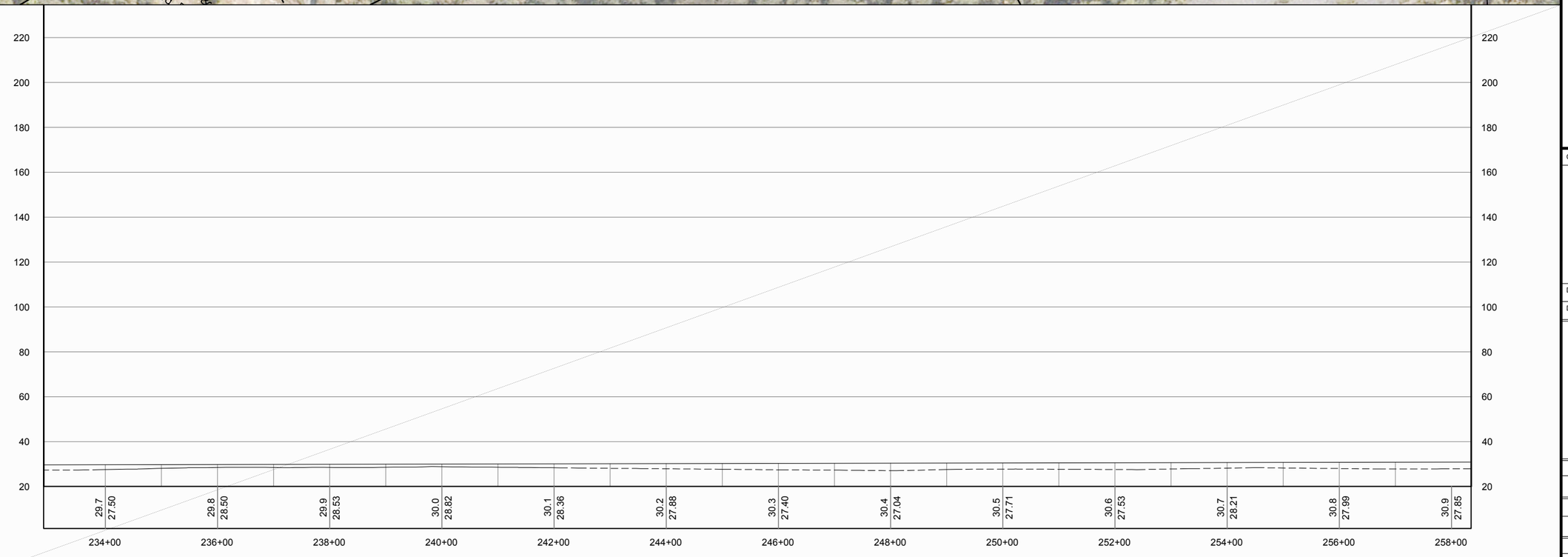

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HOBBS, NAOMI

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- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

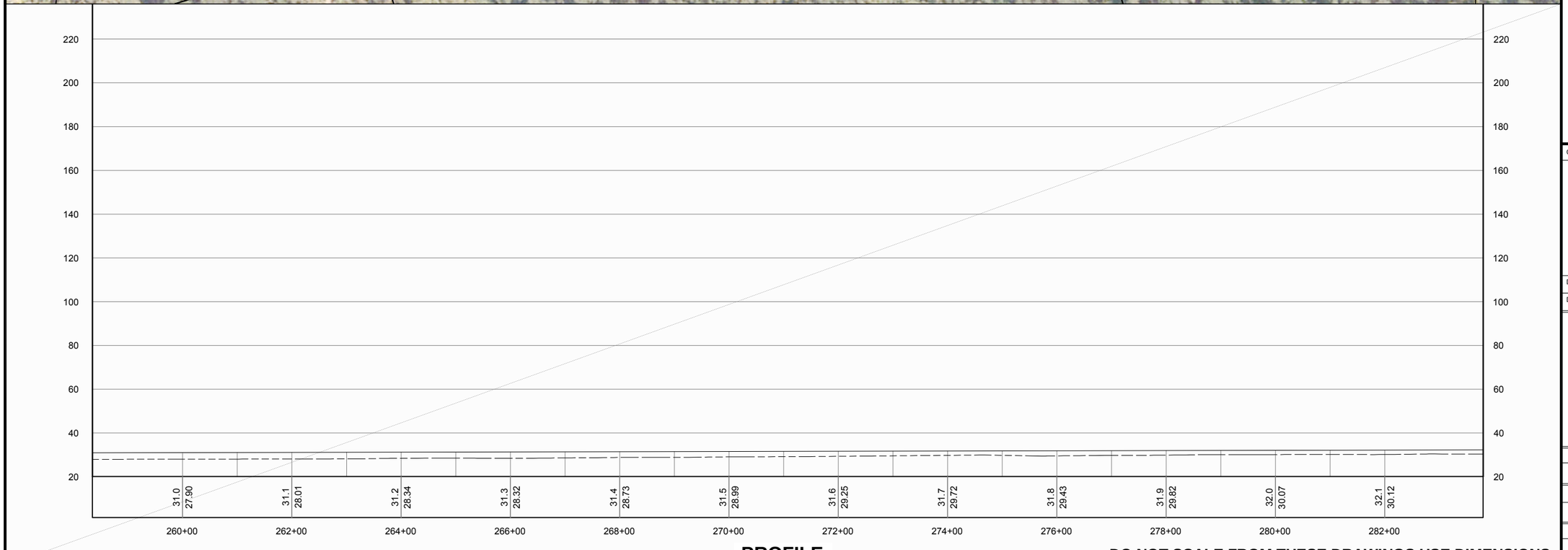
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
3	44

PLAN



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DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 4 Thursday, February 18, 2010 12:49:17

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ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010

SHEET NUMBER	TOTAL SHEETS
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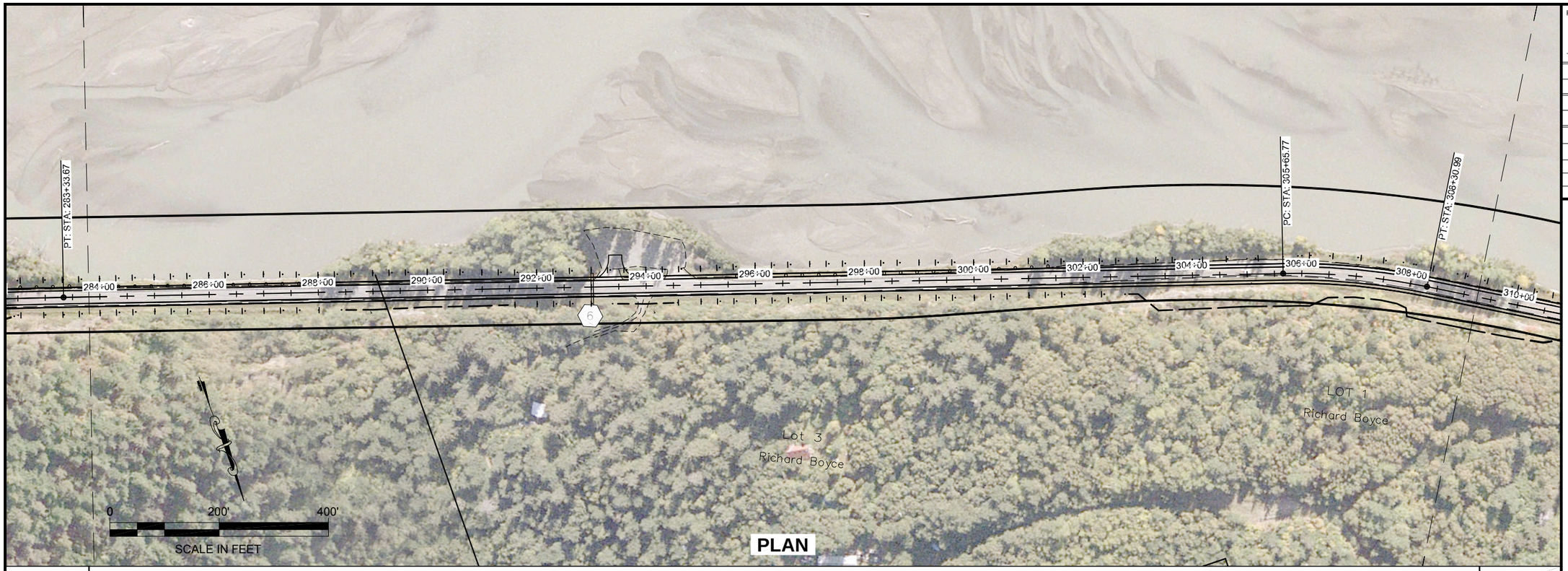

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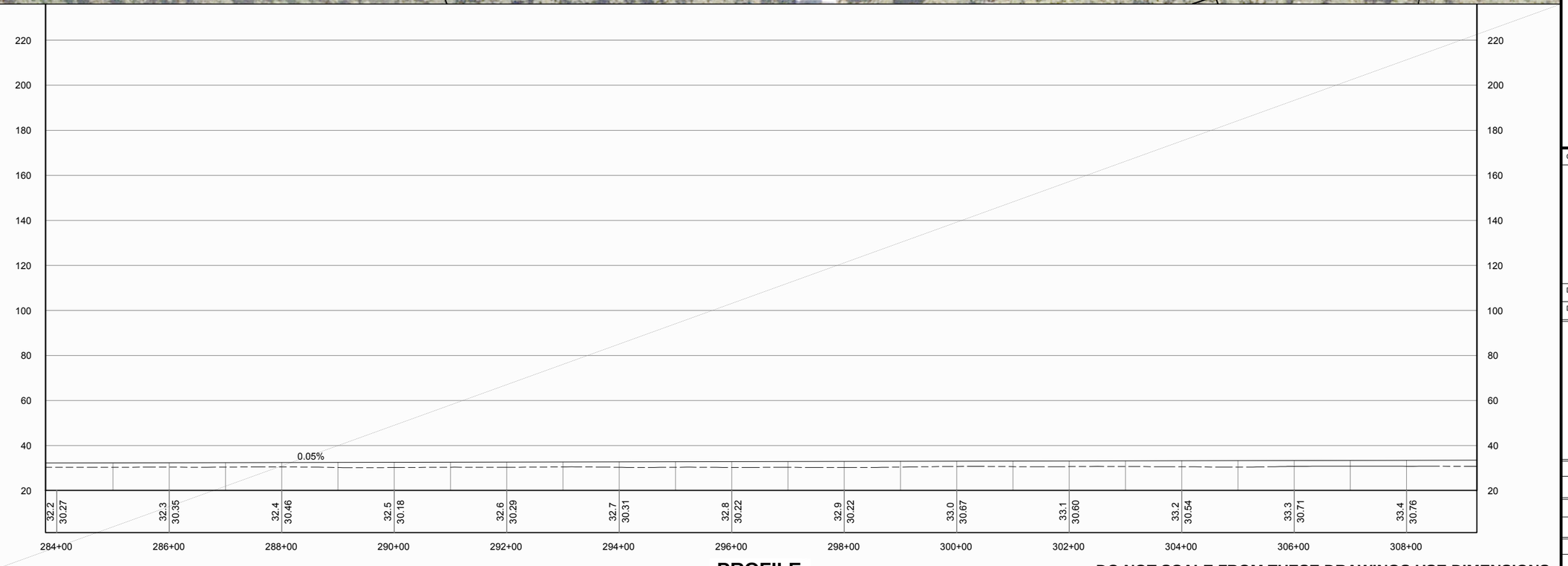

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HOBBS, NAOMI

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ATTACHMENT NUMBER

RECORD OF REVISIONS

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- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
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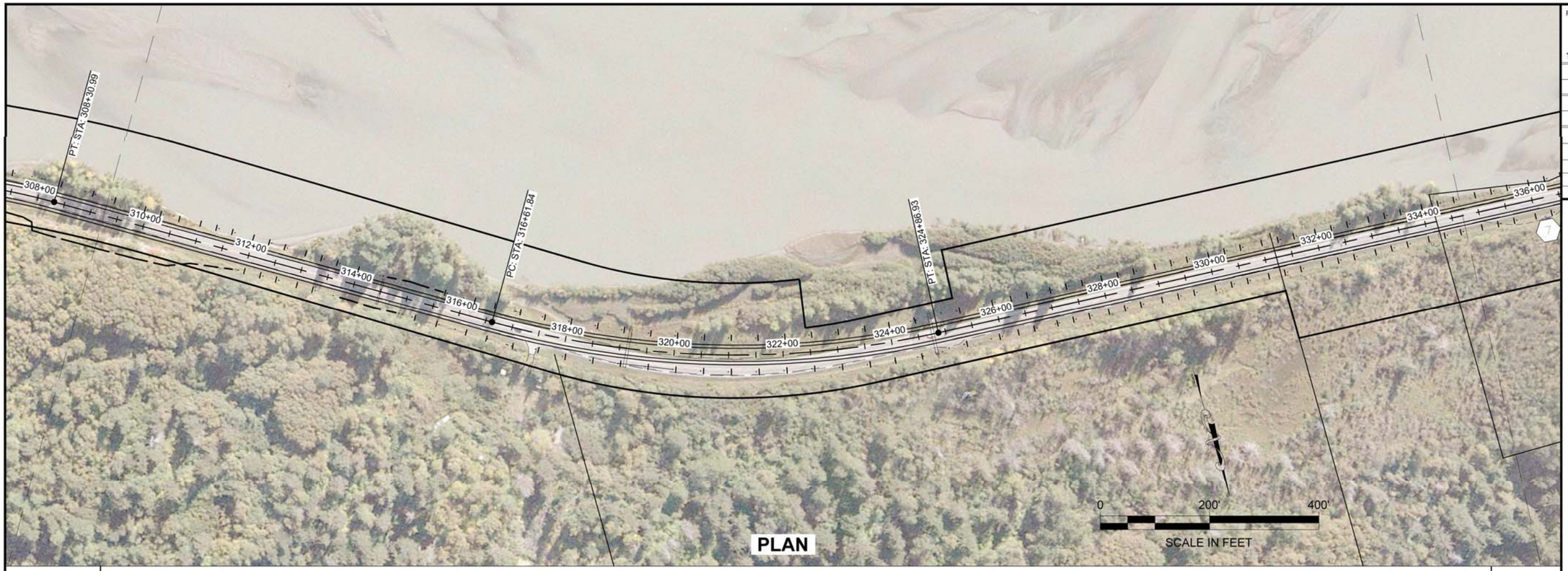

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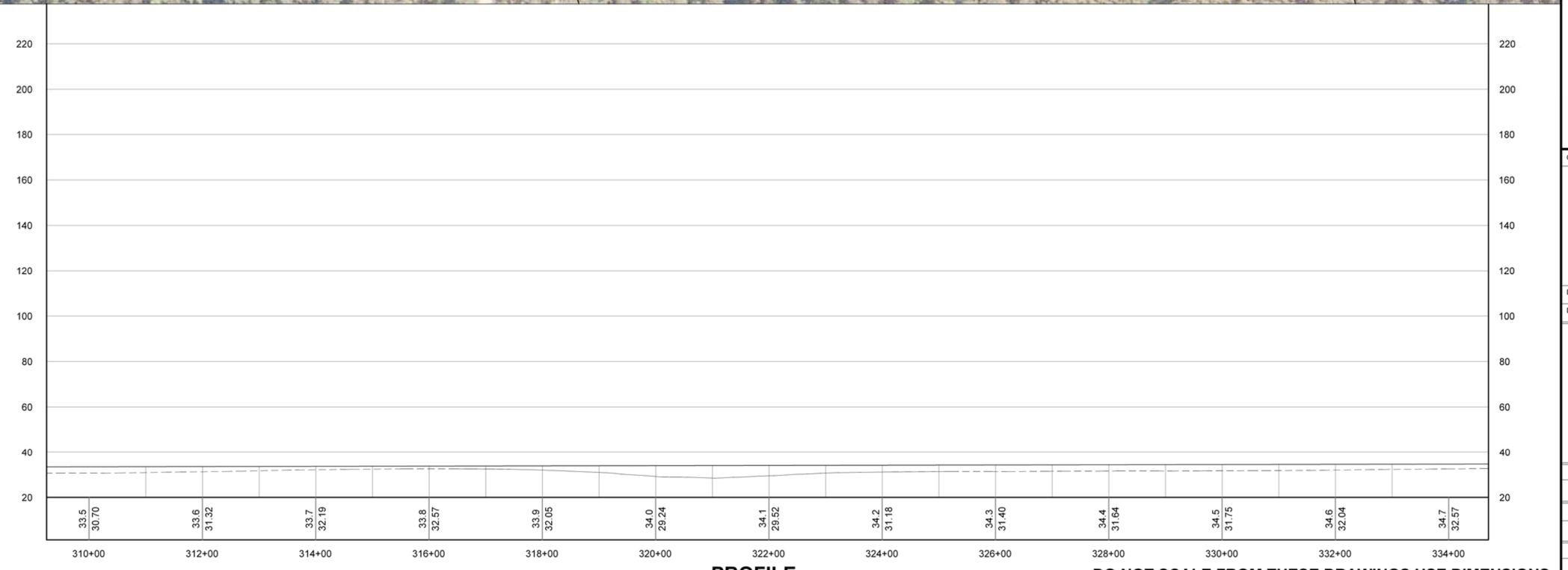

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HOBBS, NAOMI

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- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

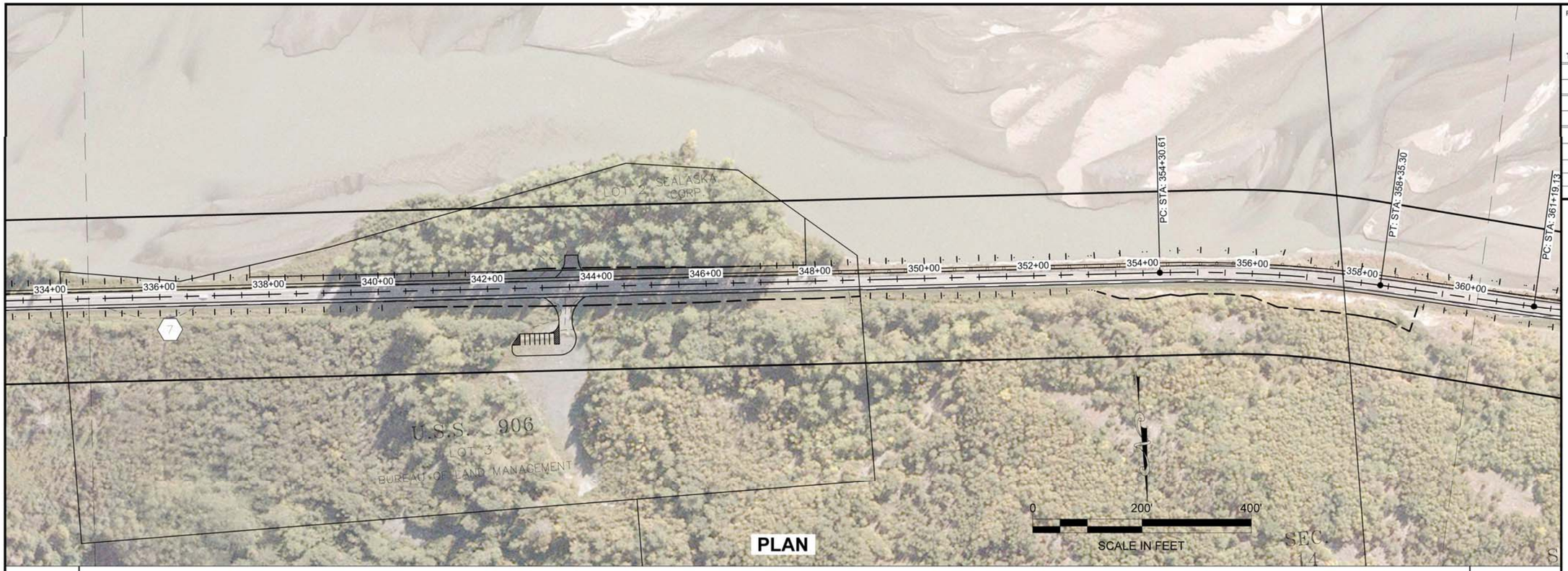
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
6	44



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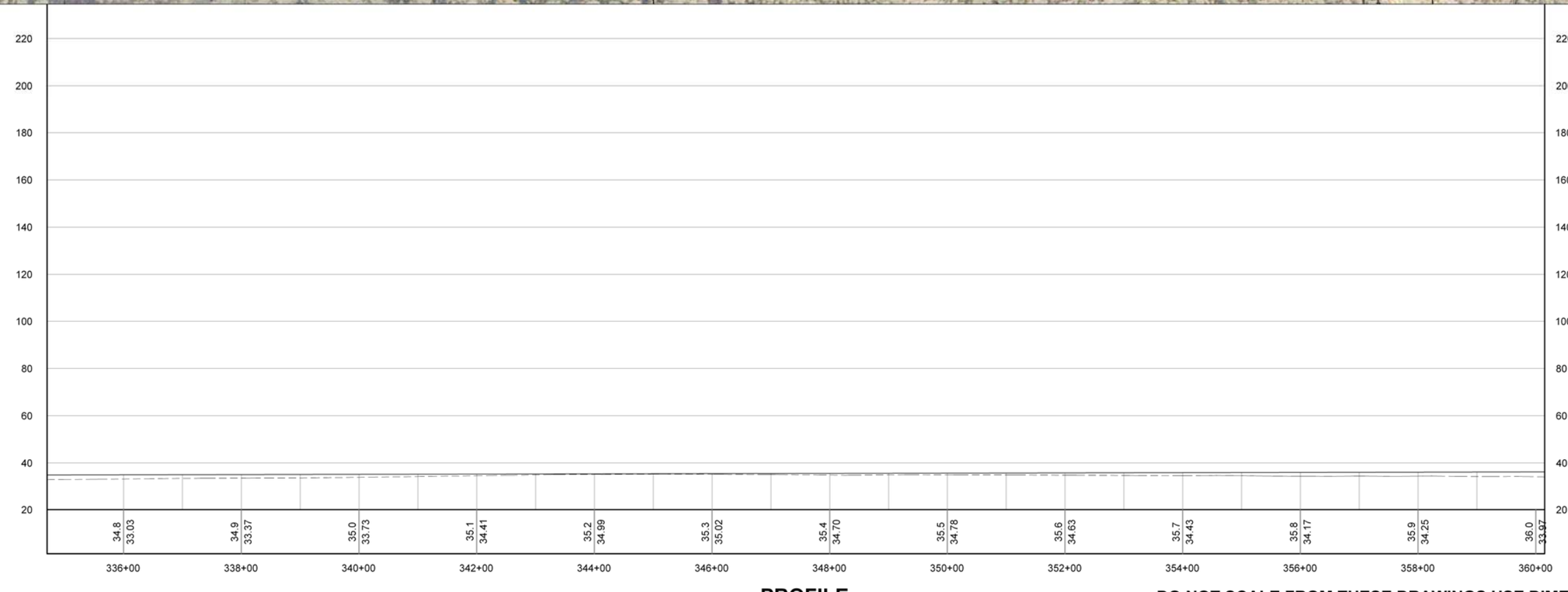

PROFILE

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HOBBS, NAOMI

TAB: 7 Thursday, February 18, 2010 1:09:15

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ATTACHMENT NUMBER

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- EXISTING GUARDRAIL
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- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

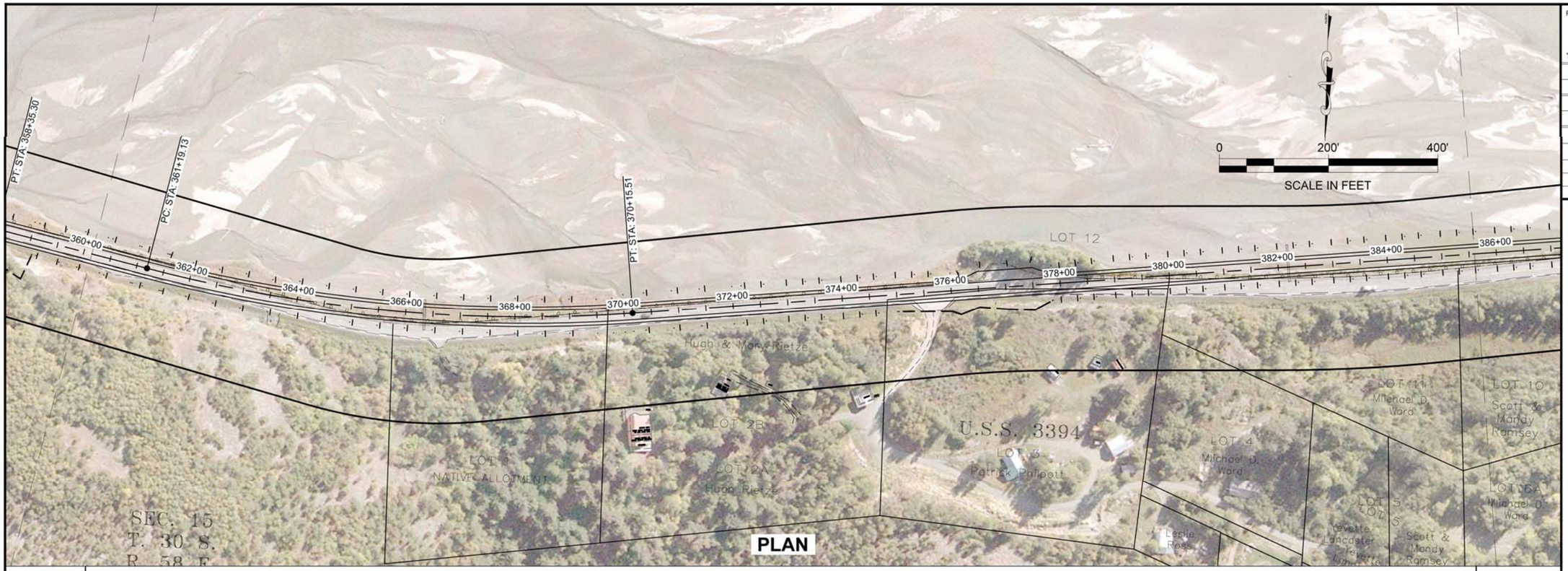
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
7	44



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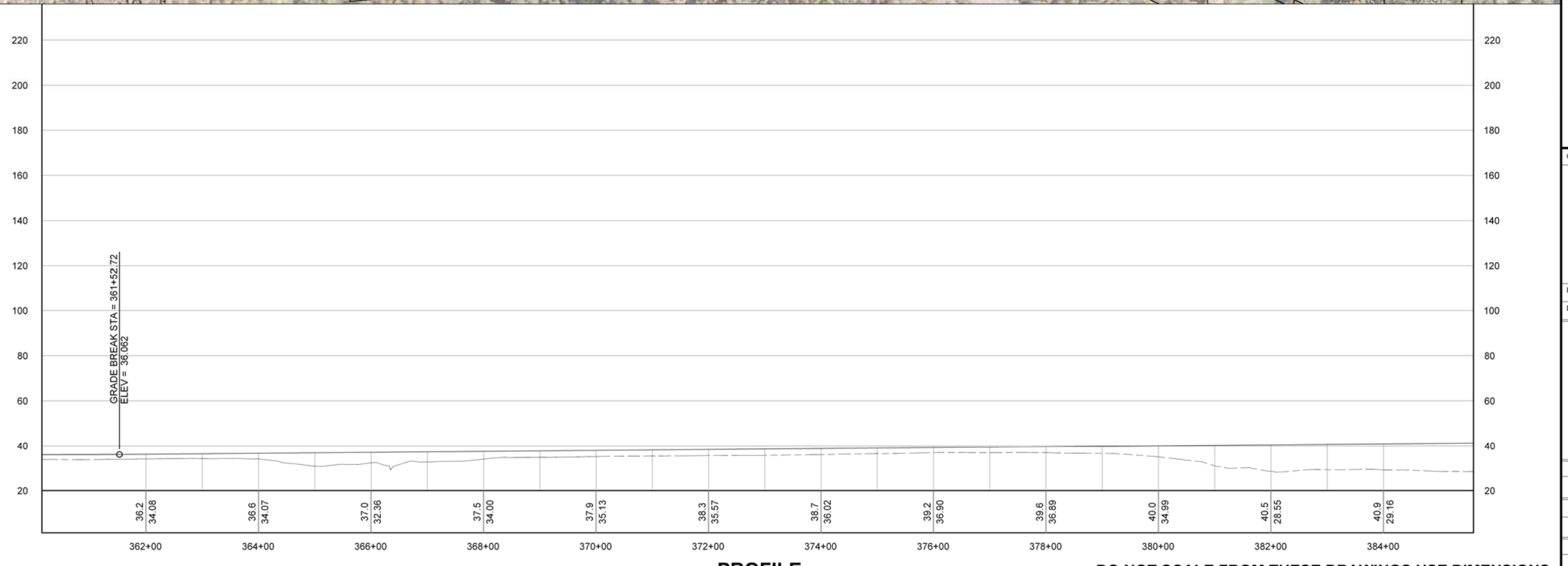

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 8 Thursday, February 18, 2010 1:10:09

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

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- PROPERTY LINE
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- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
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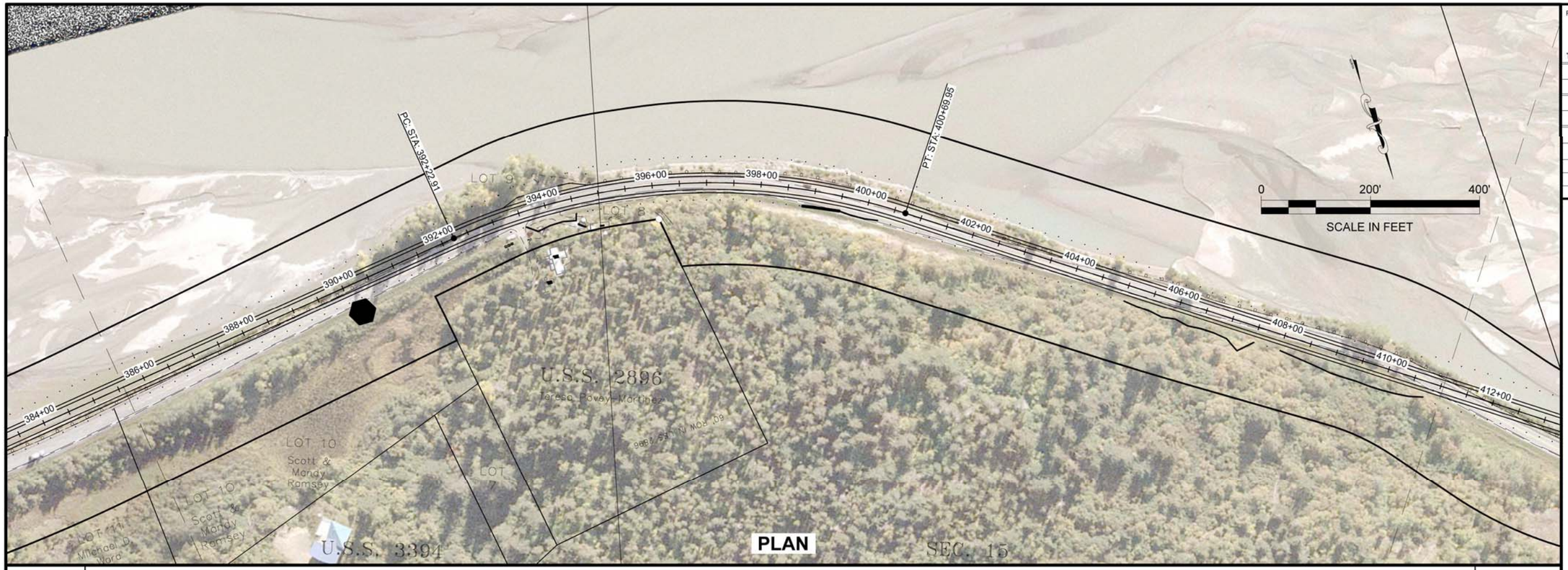

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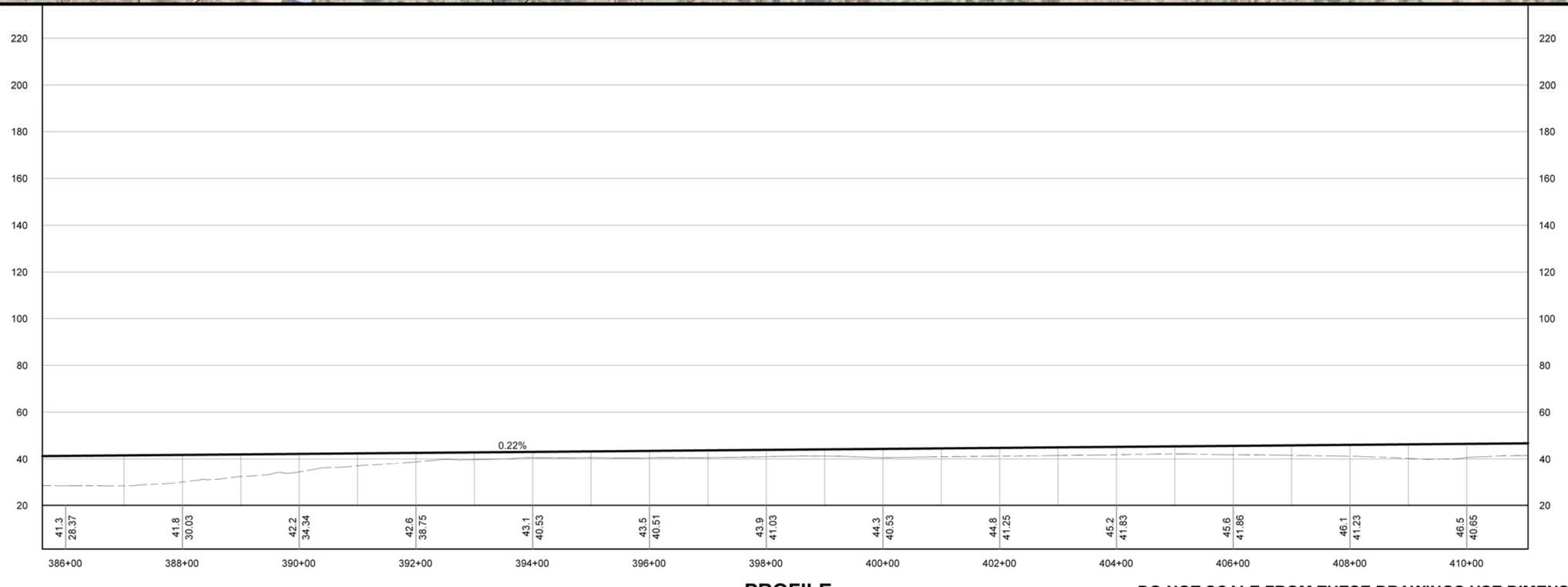

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DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 9 Thursday, September 02, 2010 5:49:3

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- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

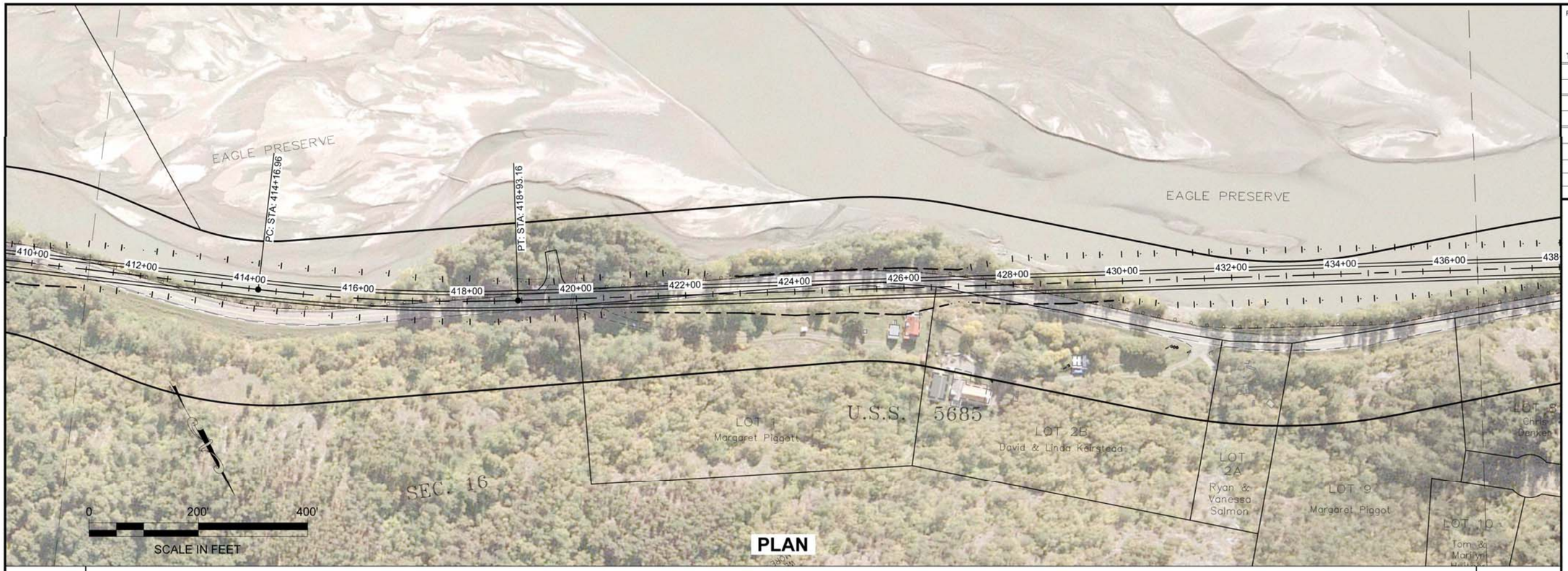
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
9	44



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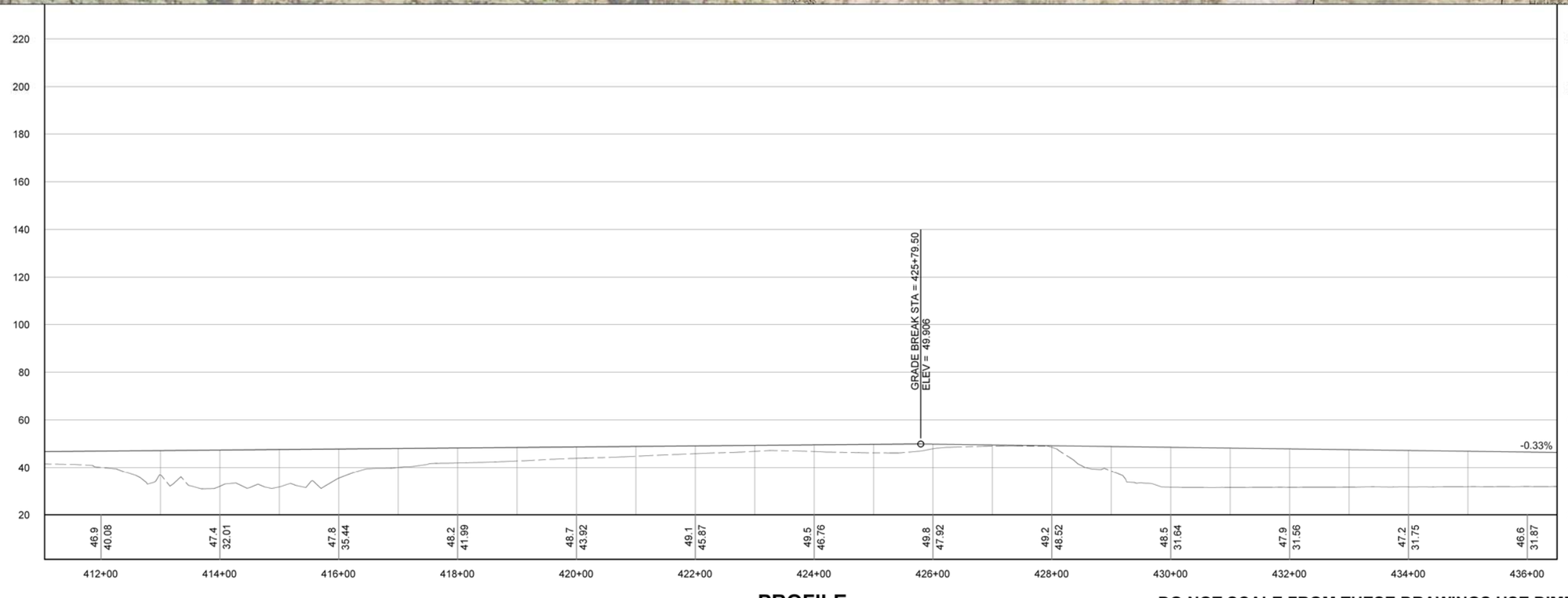

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 10 Thursday, February 18, 2010 1:12:05

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RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

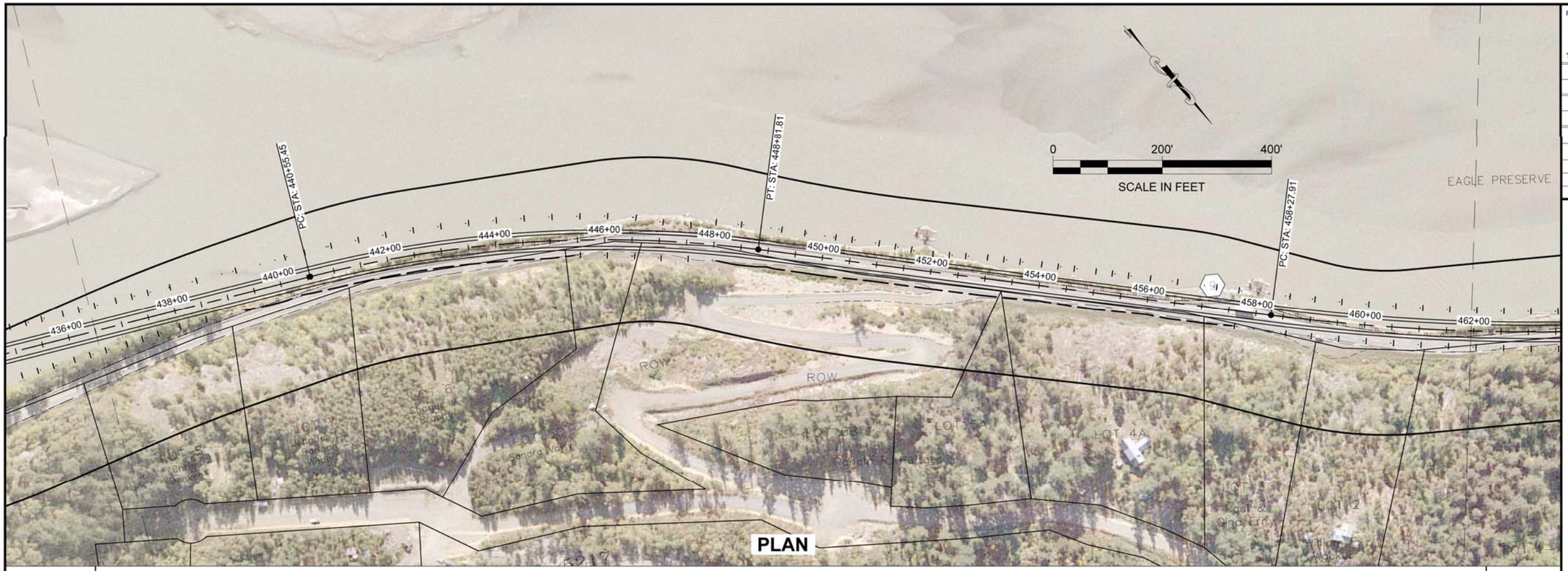
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

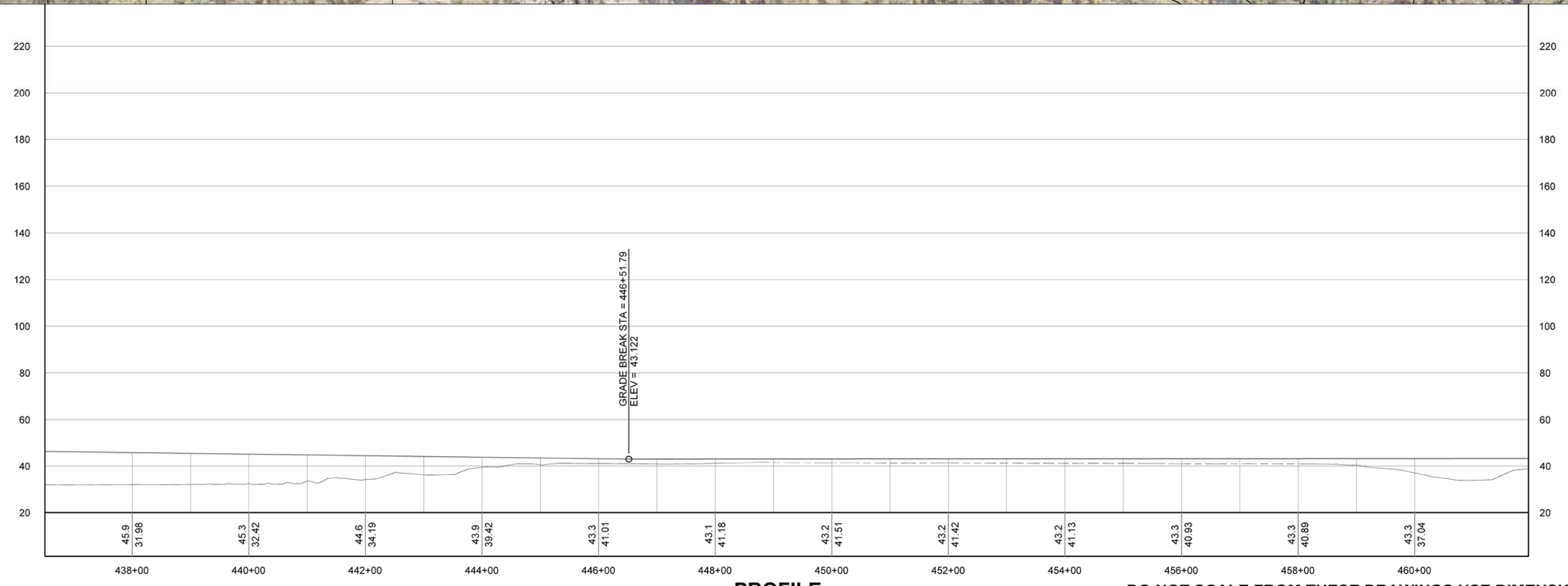
PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
10	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (12).DWG

HOBBS, NAOMI

TAB: 11 Thursday, February 18, 2010 9:45:19

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

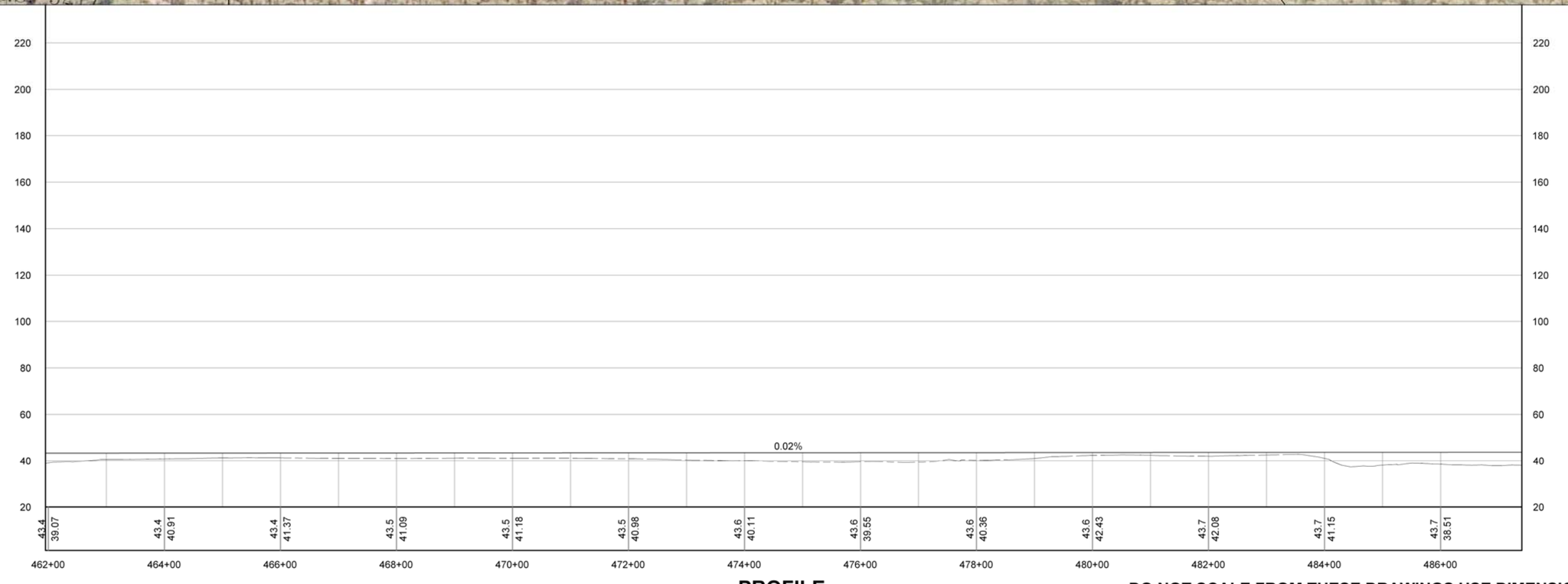
PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010

SHEET NUMBER	TOTAL SHEETS
11	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 12 Thursday, February 18, 2010 9:46:33

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th
STEVEN K. NOBLE CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

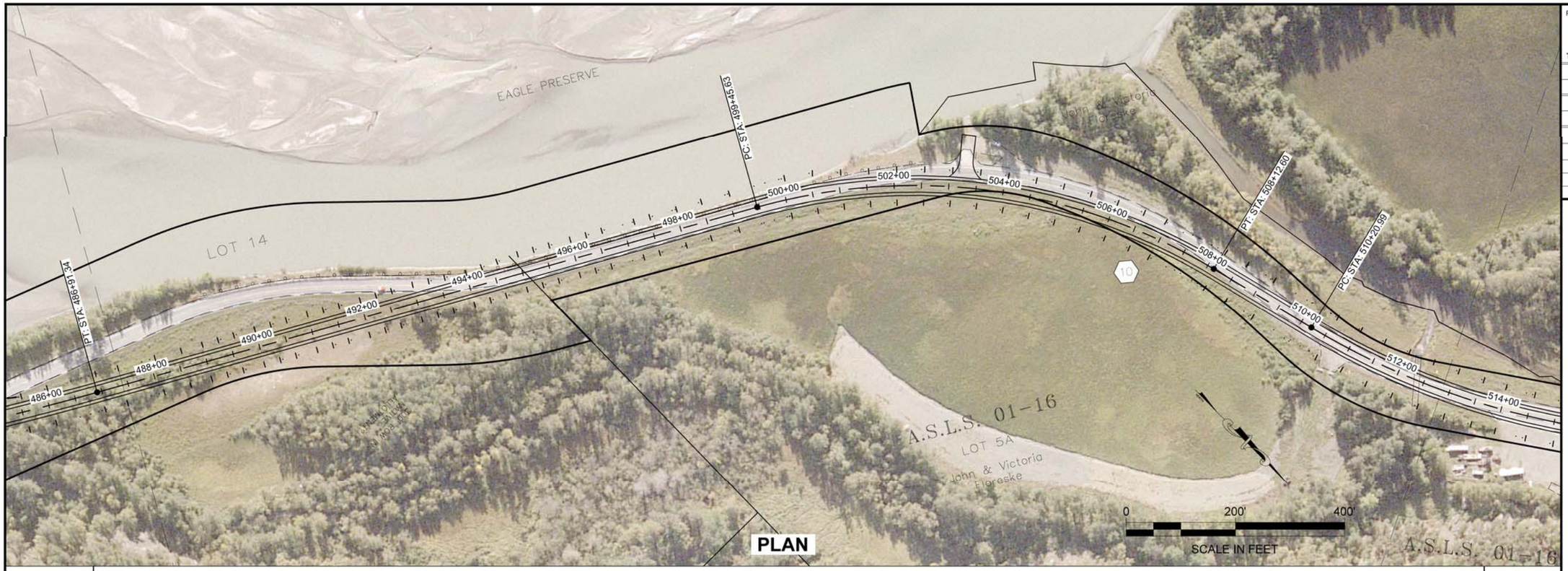
PLAN & PROFILE

PROJECT DESIGNATION

68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010

SHEET NUMBER	TOTAL SHEETS
12	44



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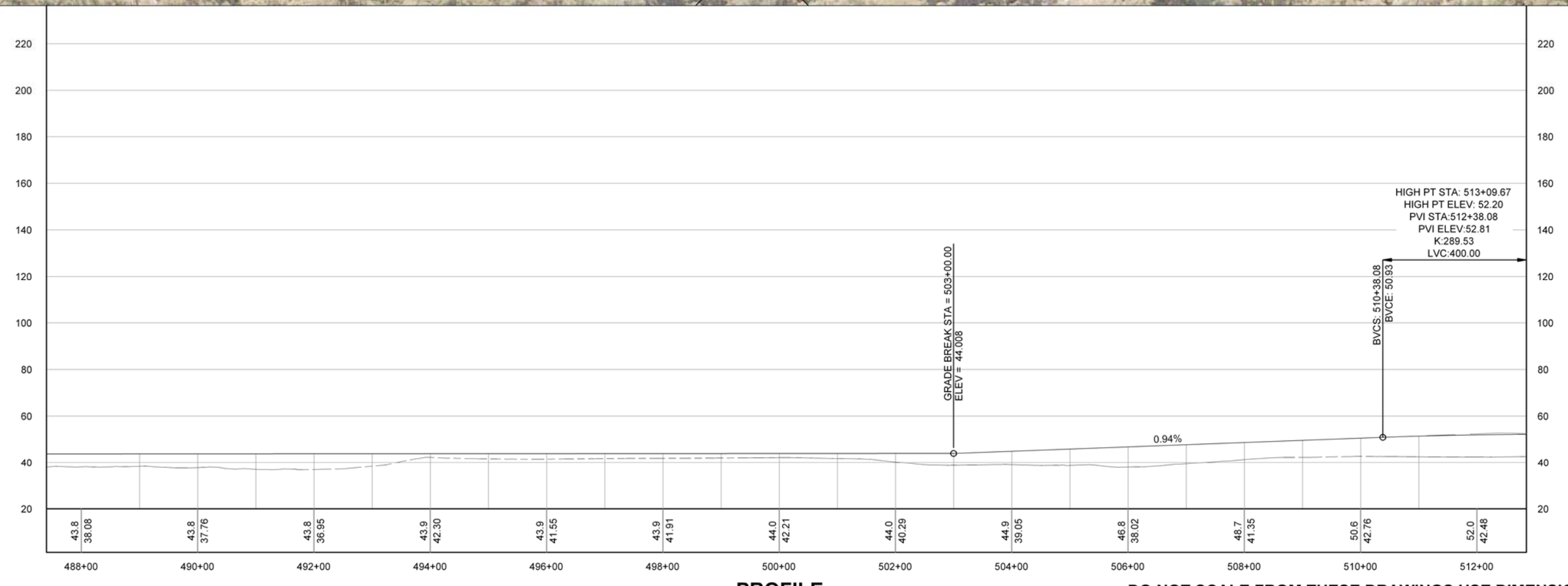

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 13 Thursday, February 18, 2010 9:47:40

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

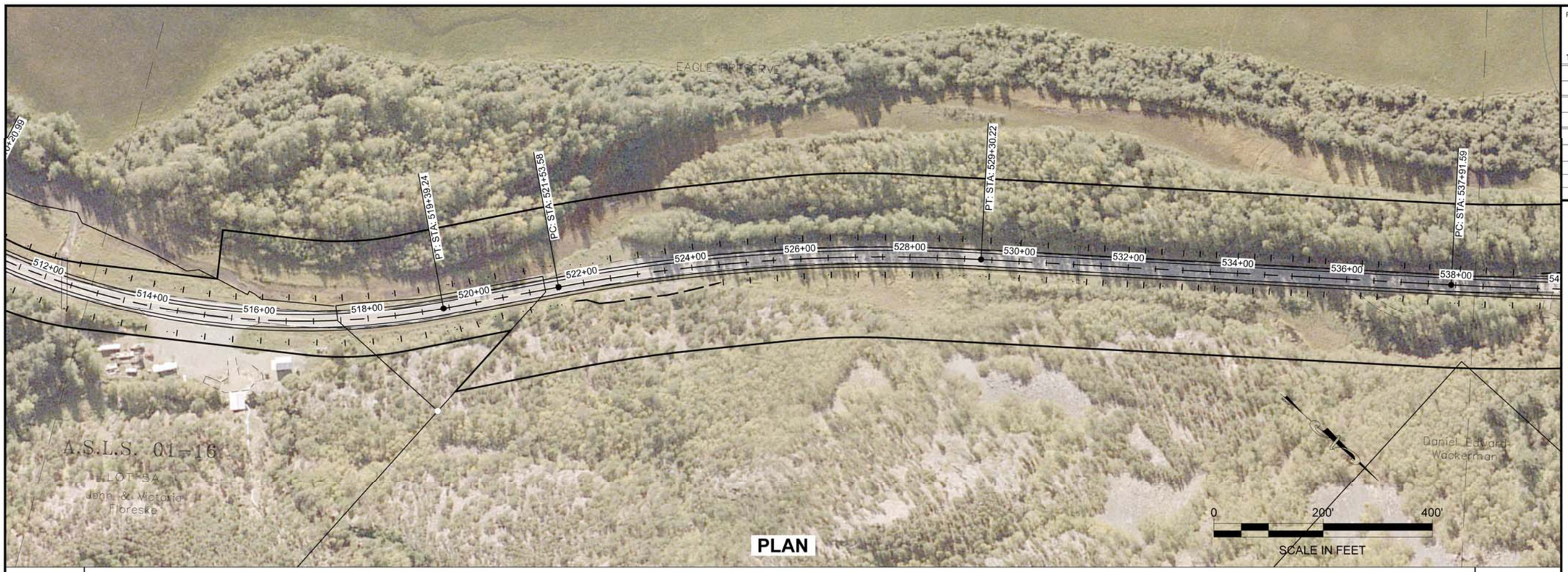
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
13	44



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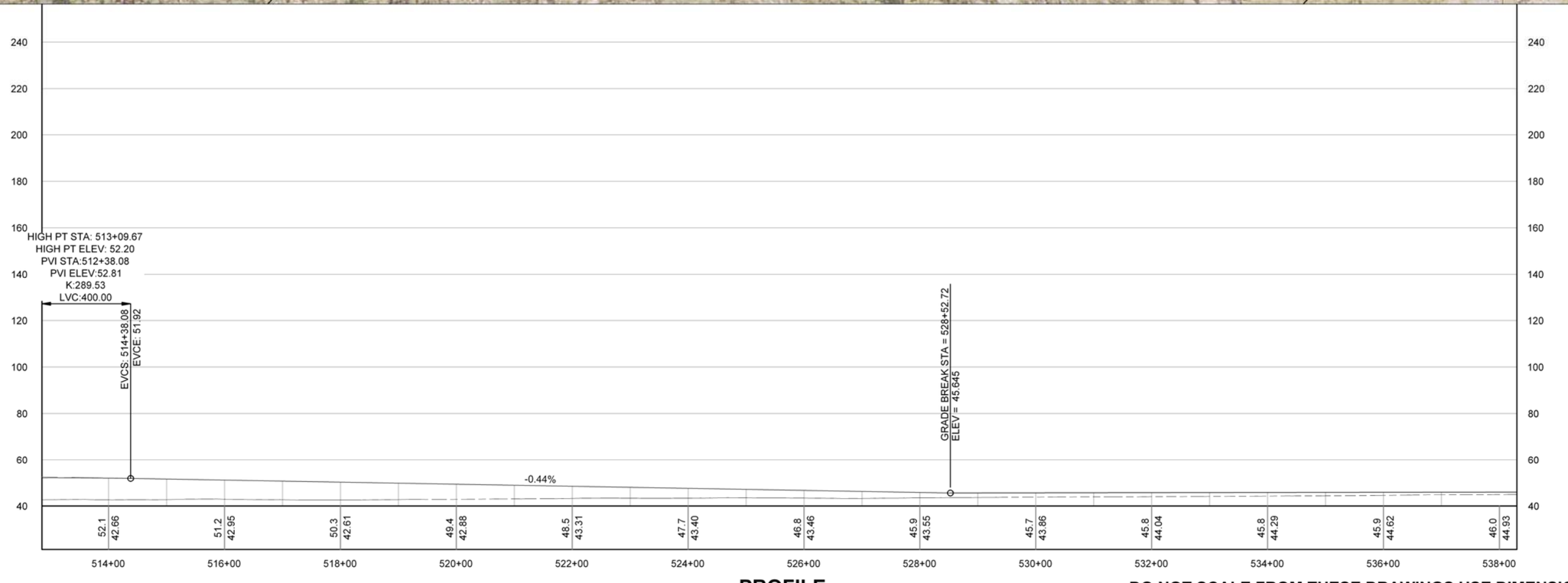

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 14 Thursday, February 18, 2010 9:48:49

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

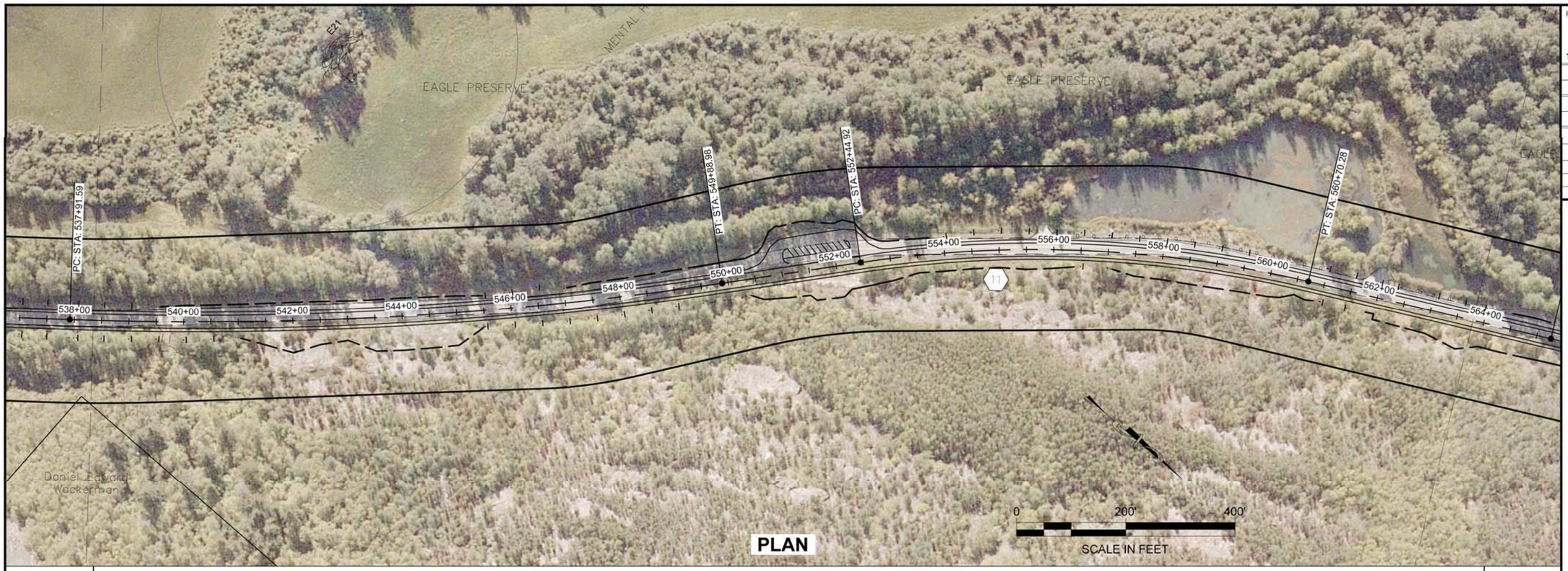
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010

SHEET NUMBER	TOTAL SHEETS
14	44



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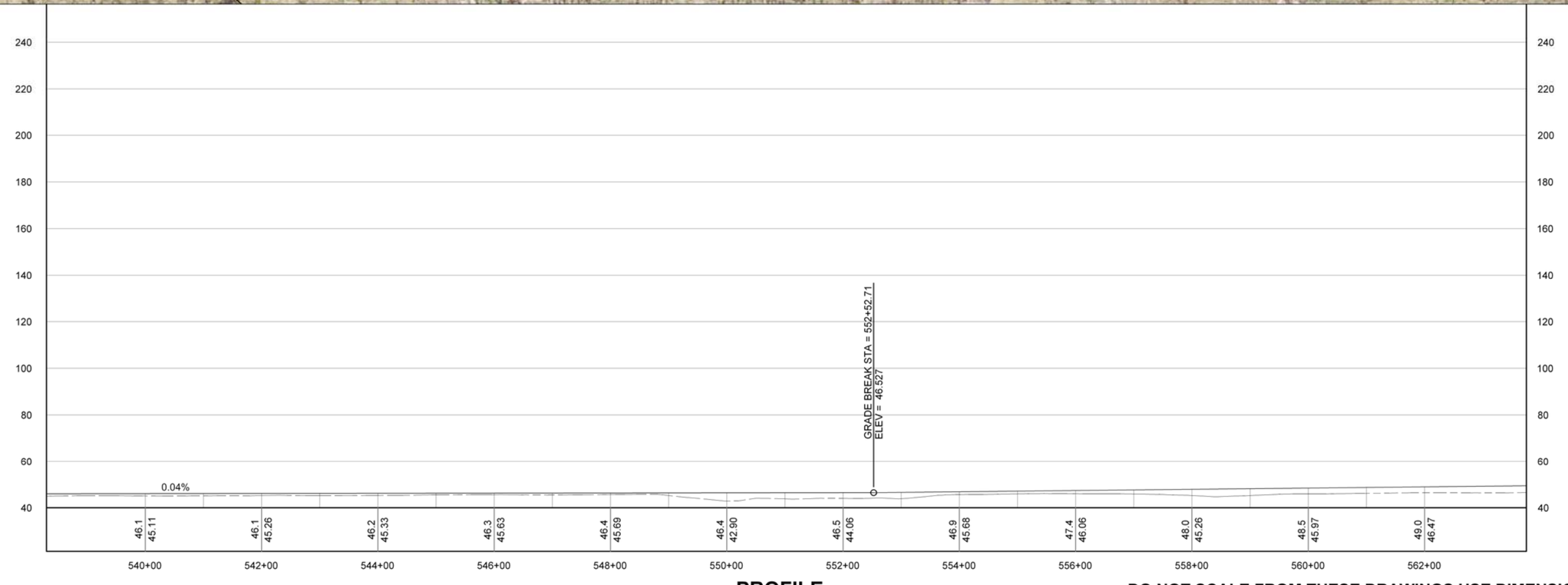

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 15 Thursday, February 18, 2010 9:49:57

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

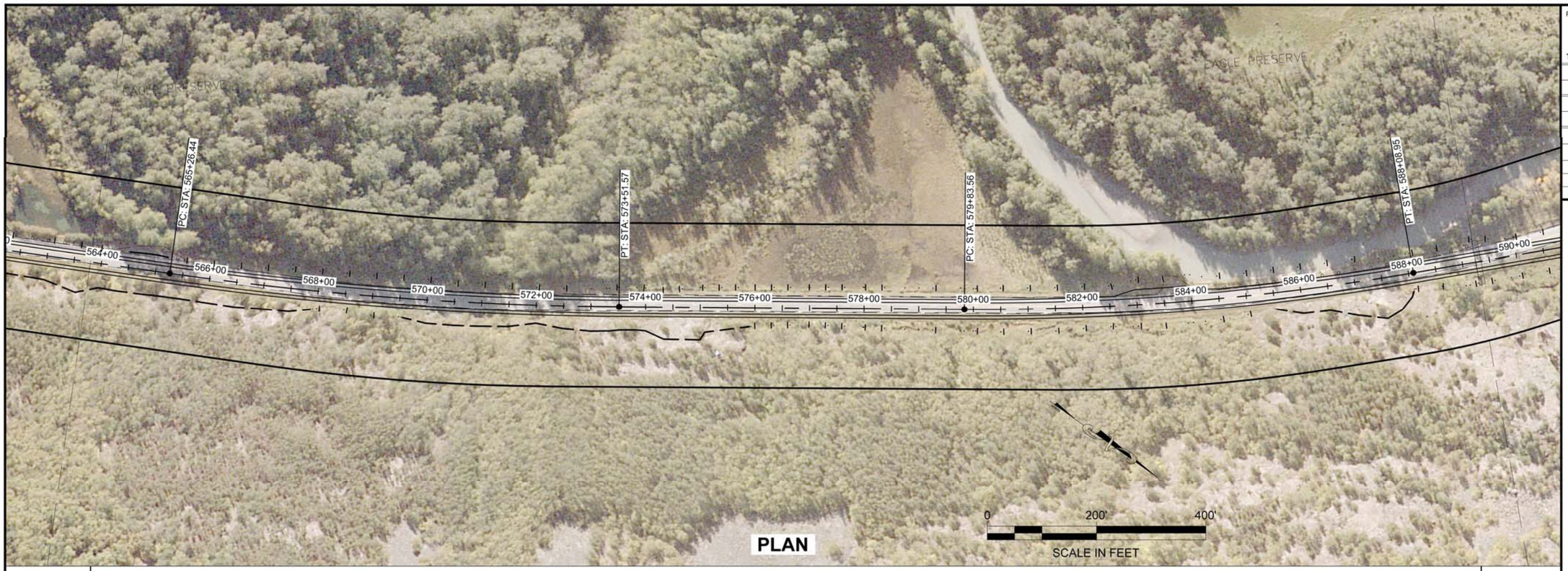
PLAN & PROFILE

PROJECT DESIGNATION

68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010

SHEET NUMBER	TOTAL SHEETS
15	44



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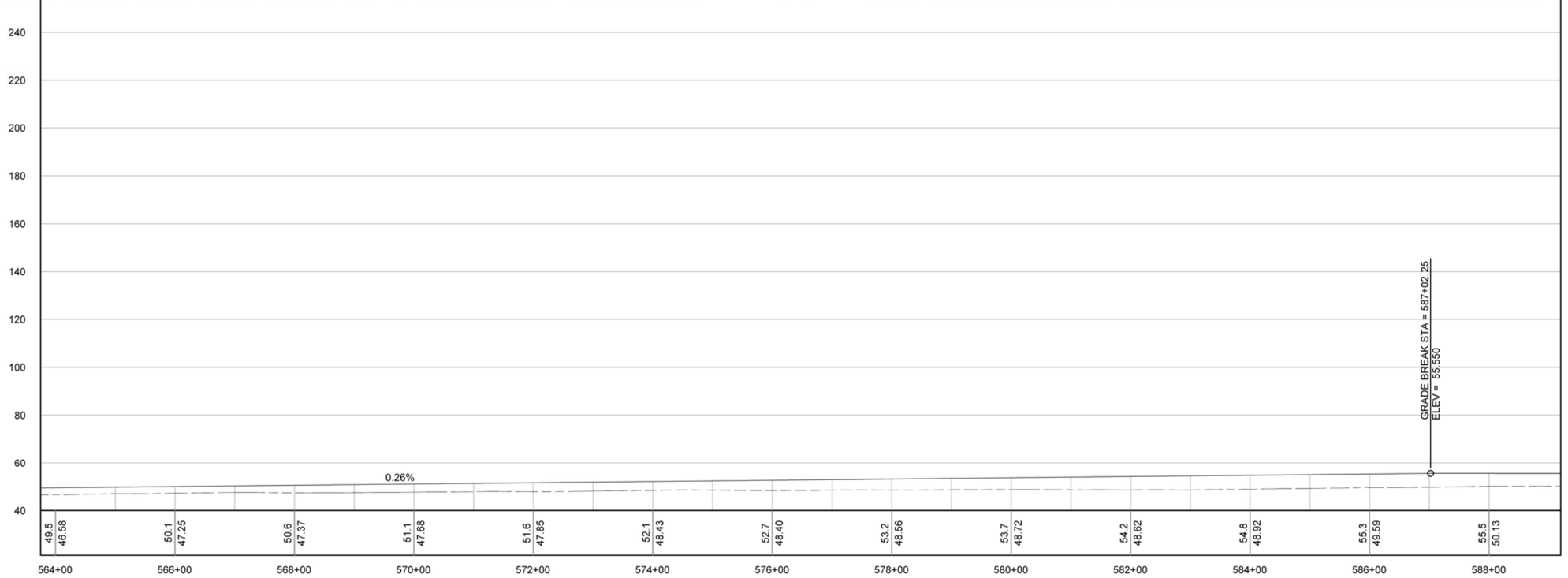

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 16 Thursday, February 18, 2010 10:05:0

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

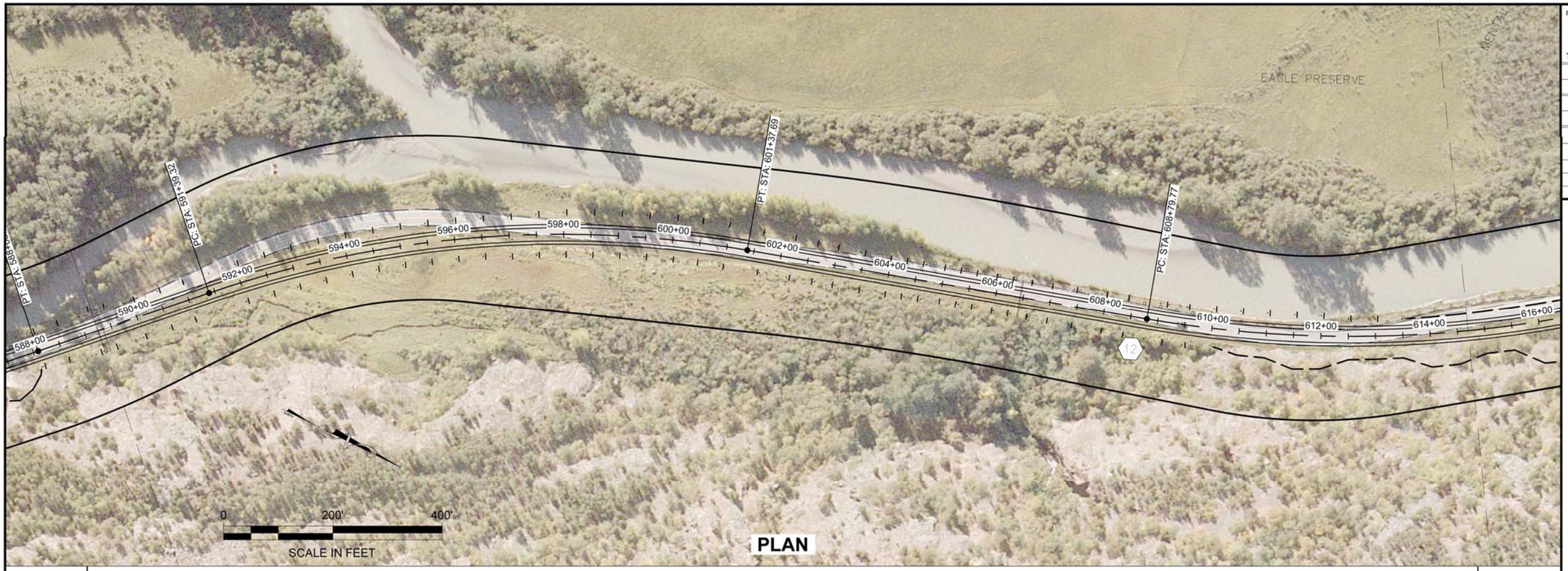
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
16	44



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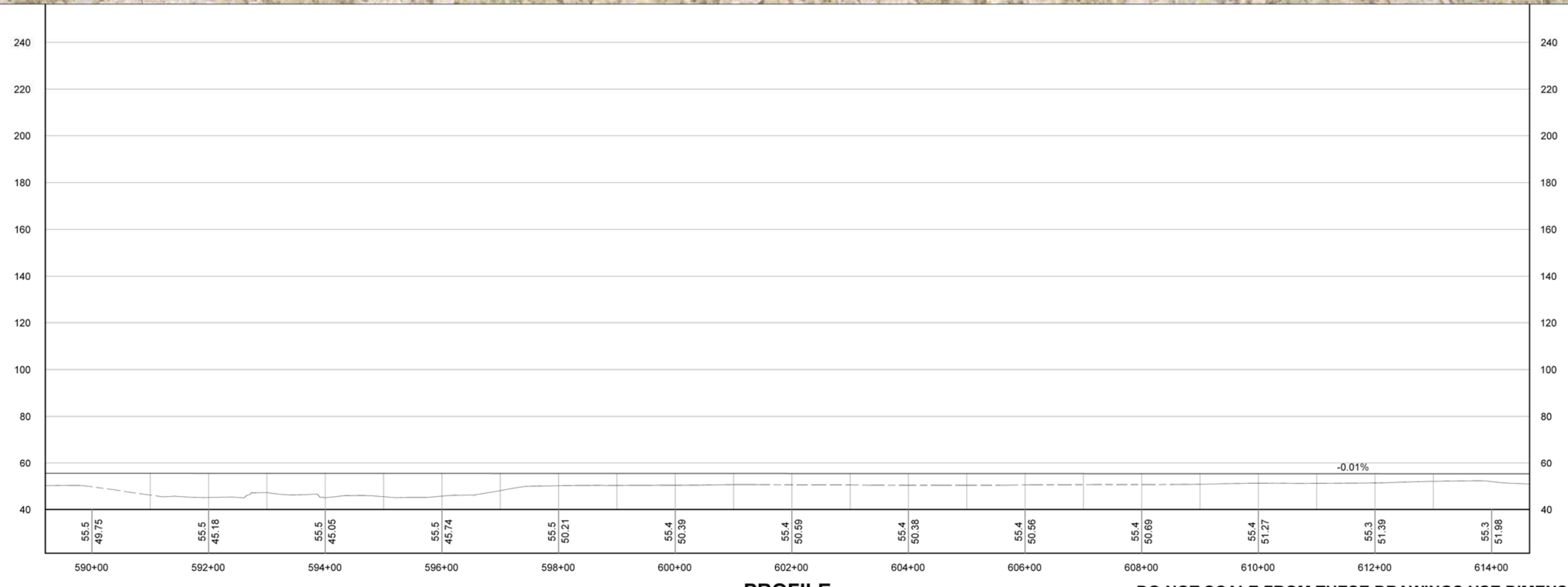


PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (13).DWG

HOBBS, NAOMI

TAB: 17 Thursday, February 18, 2010 10:06:0

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

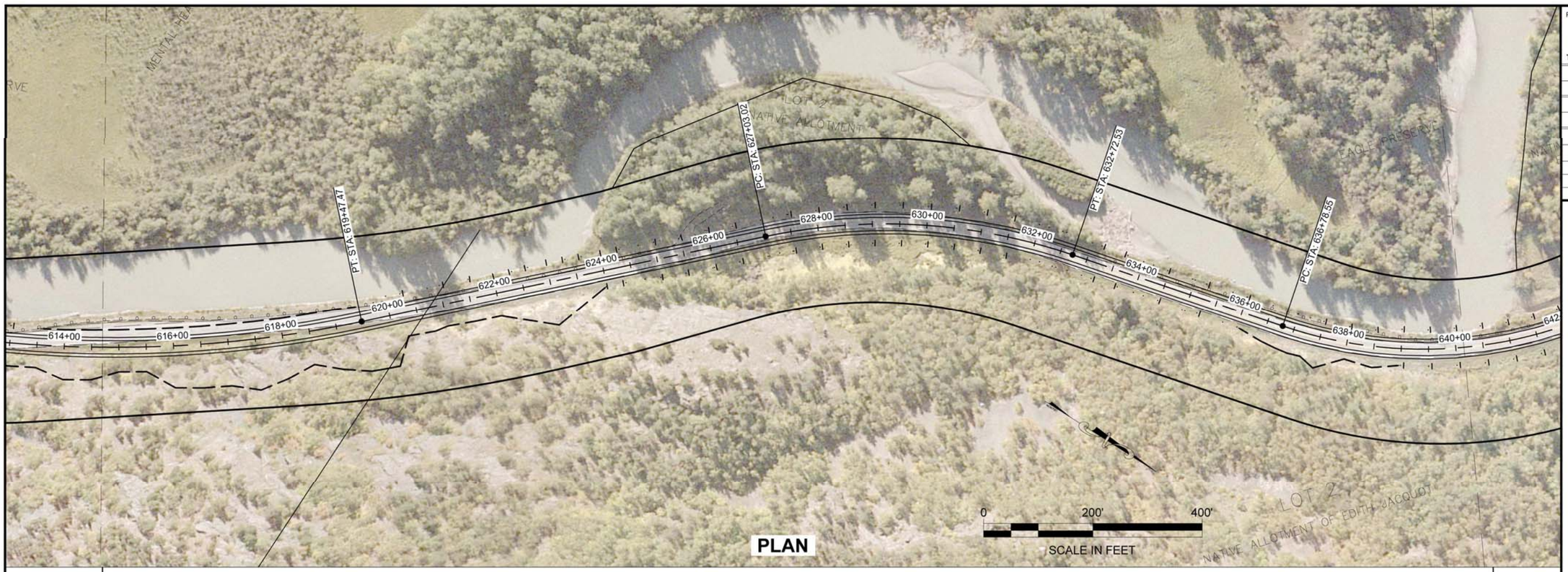
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION

68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
17	44



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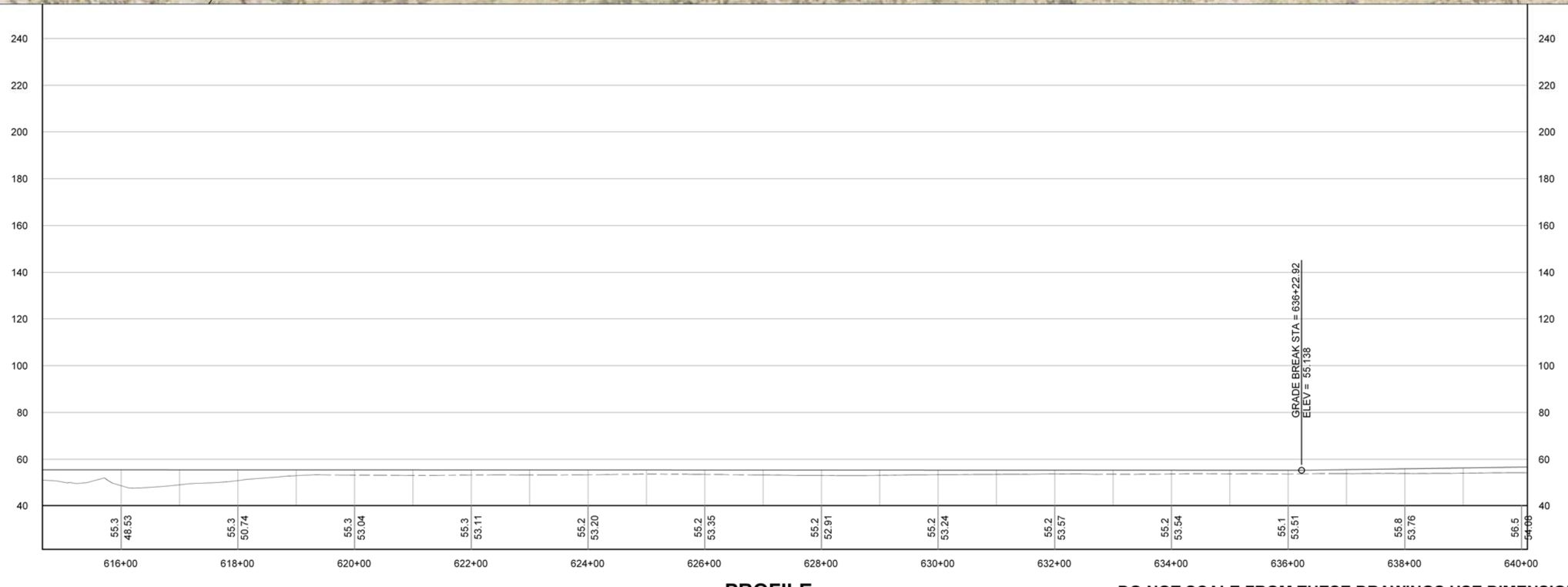

PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

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HOBBS, NAOMI

TAB: 18 Thursday, February 18, 2010 10:07:1

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

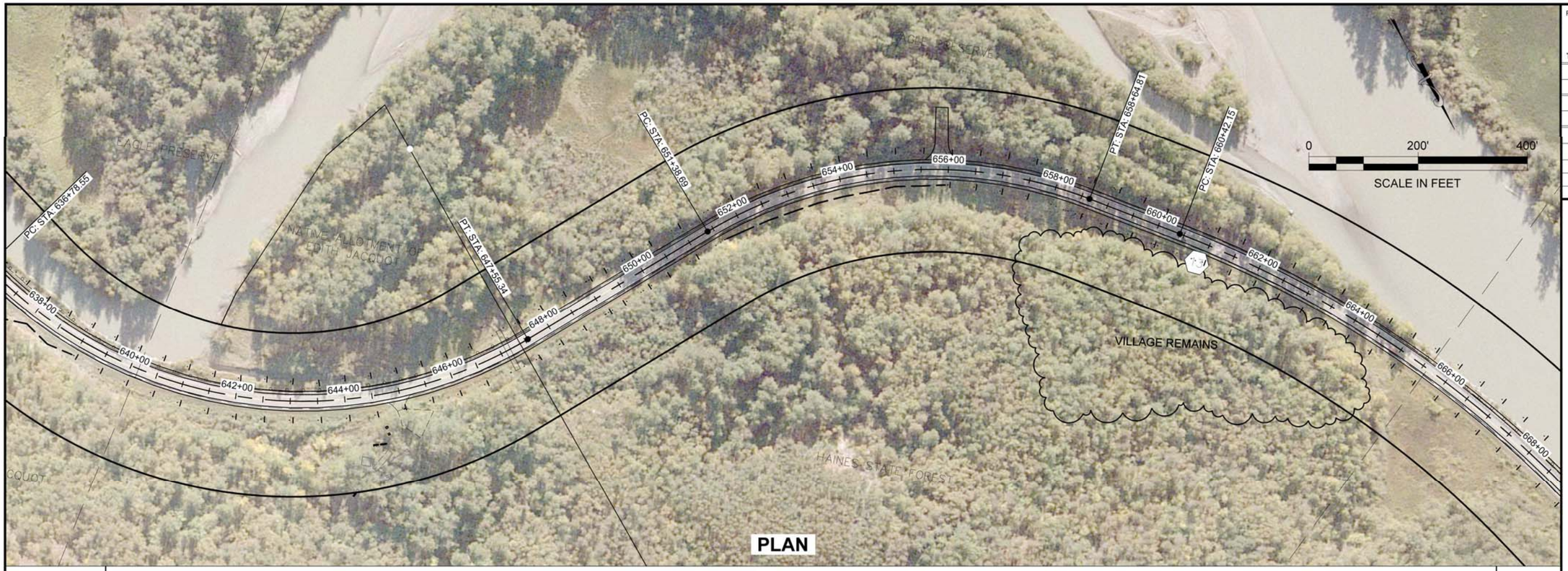
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
18	44



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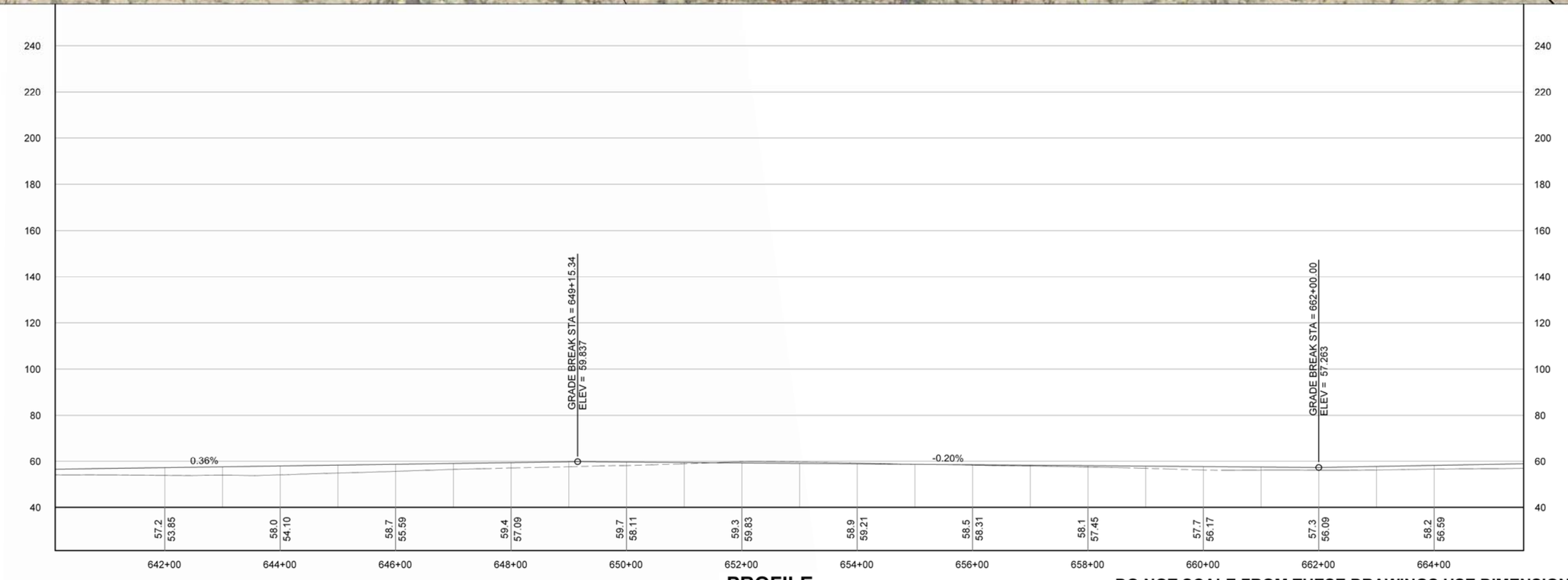


PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (13).DWG

HOBBS, NAOMI

TAB: 19 Thursday, February 18, 2010 10:08:17

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

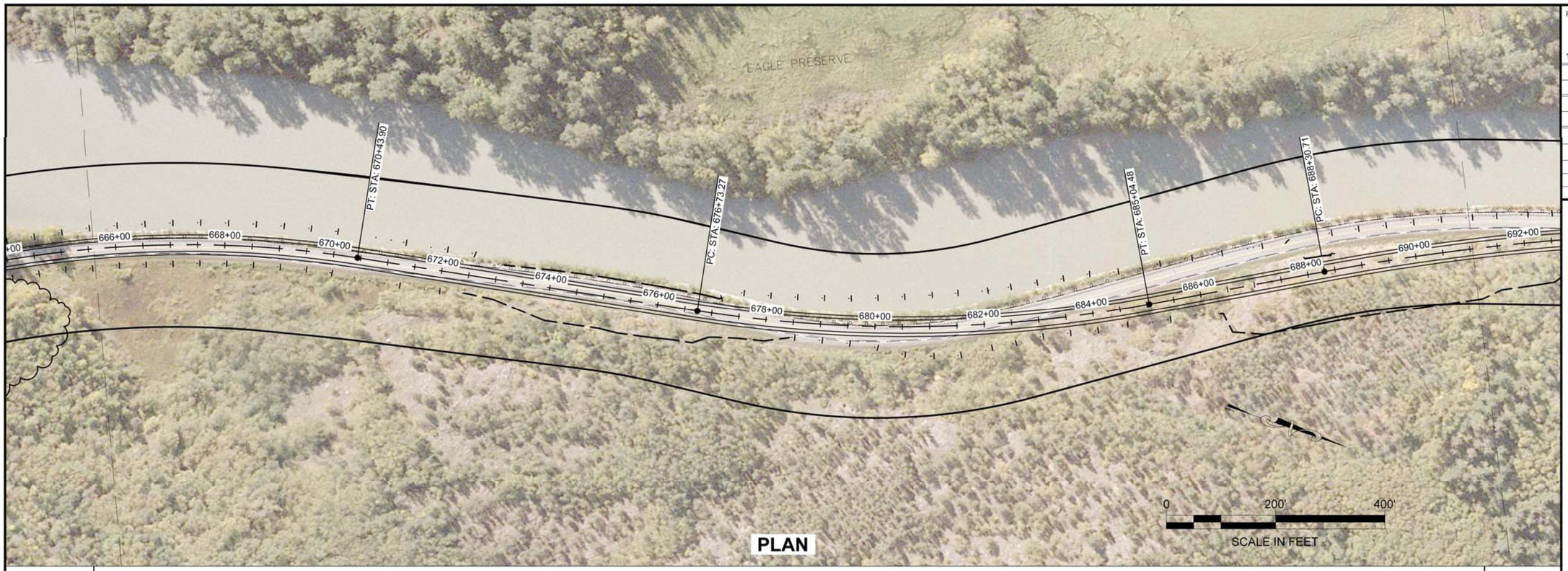
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

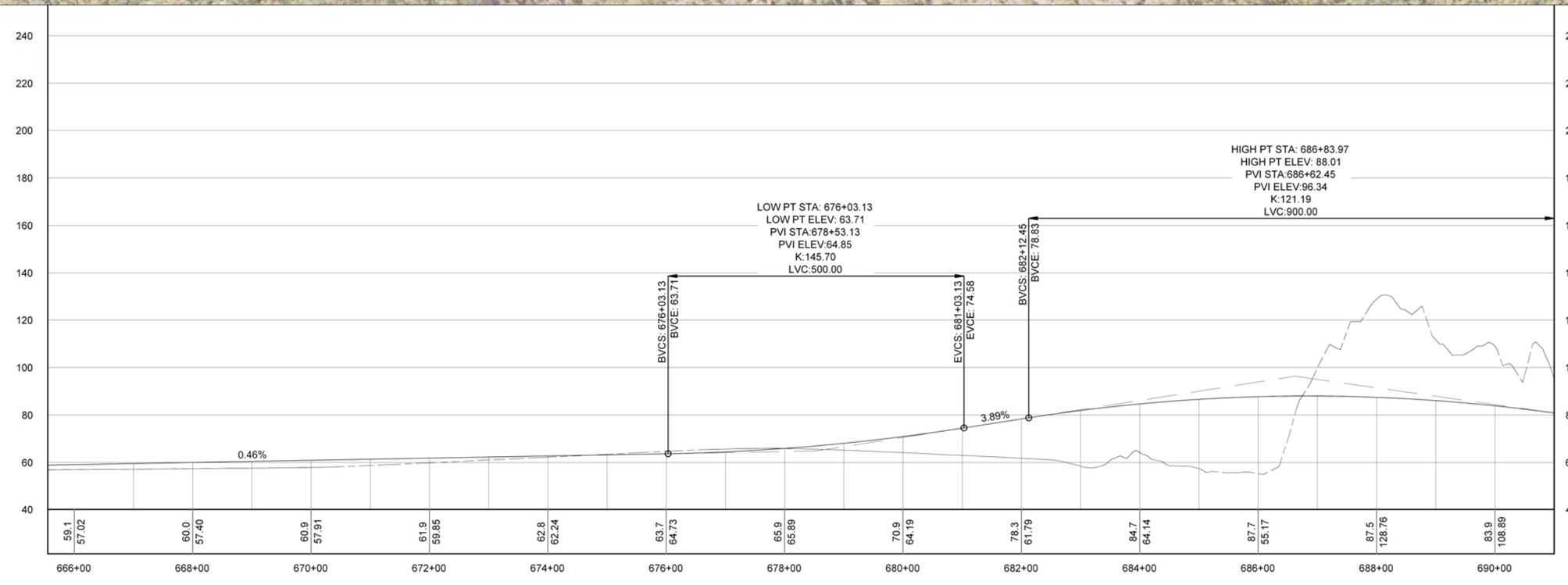
PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
19	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (13).DWG

HOBBS, NAOMI

TAB: 20 Thursday, February 18, 2010 10:09:1

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

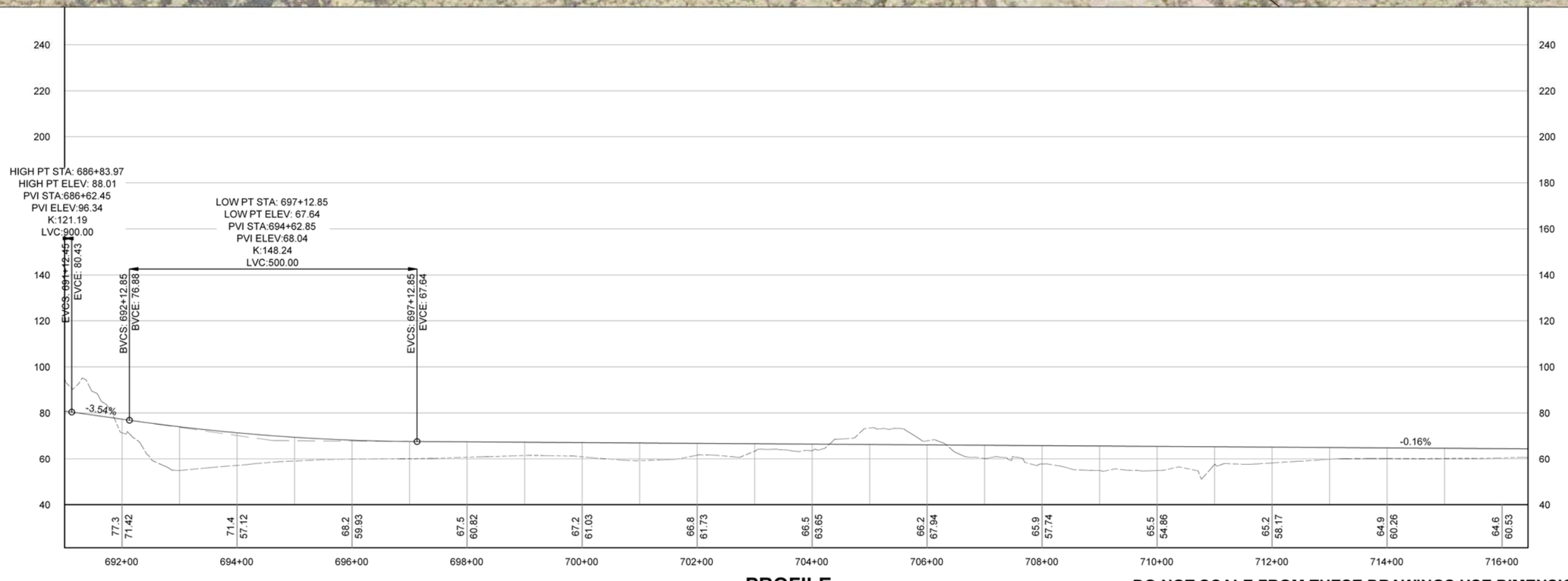
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
20	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (14).DWG

HOBBS, NAOMI

TAB: 21 Thursday, February 18, 2010 10:25:51

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

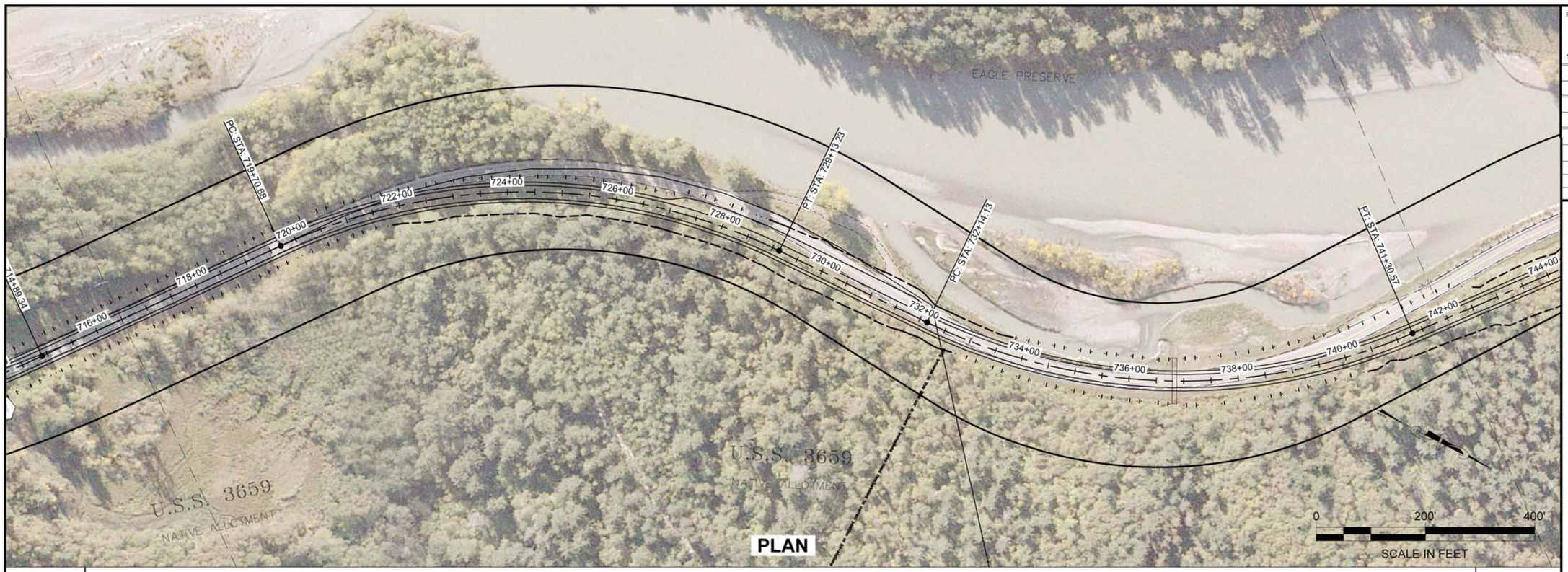
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

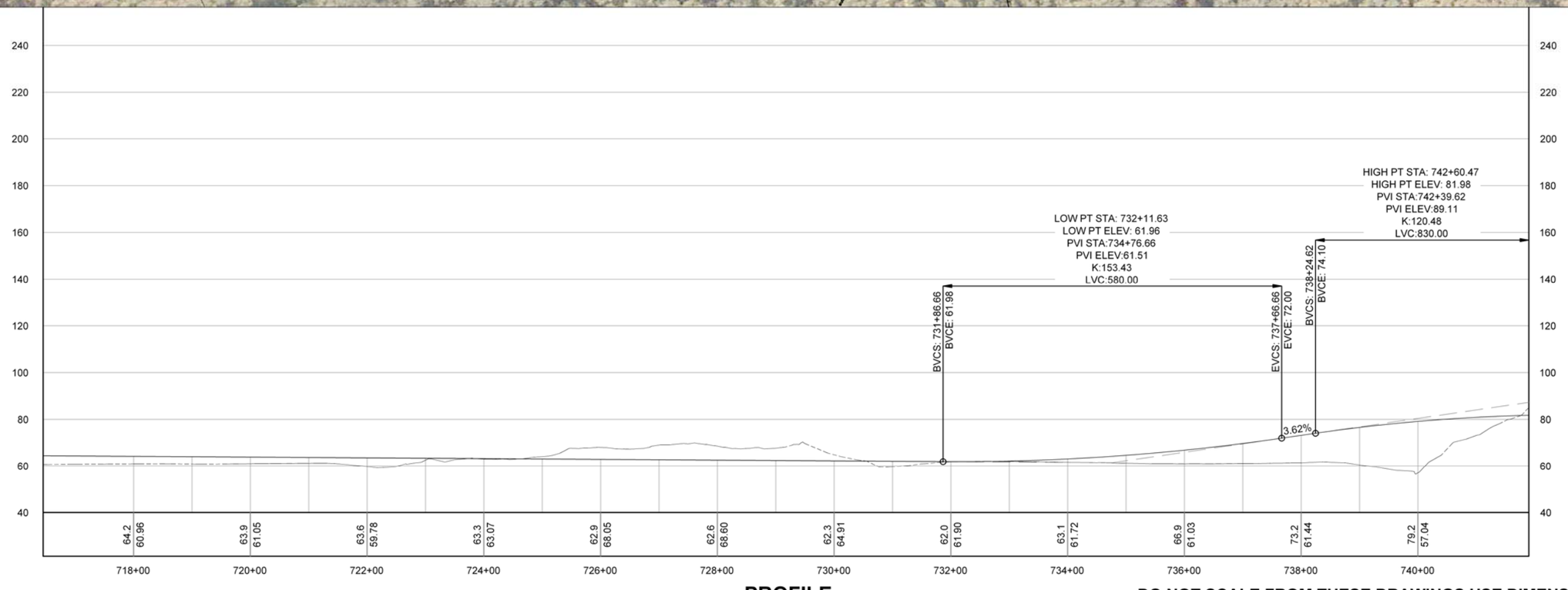
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
21	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (14).DWG

HOBBS, NAOMI

TAB: 22 Thursday, February 18, 2010 10:26:4

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

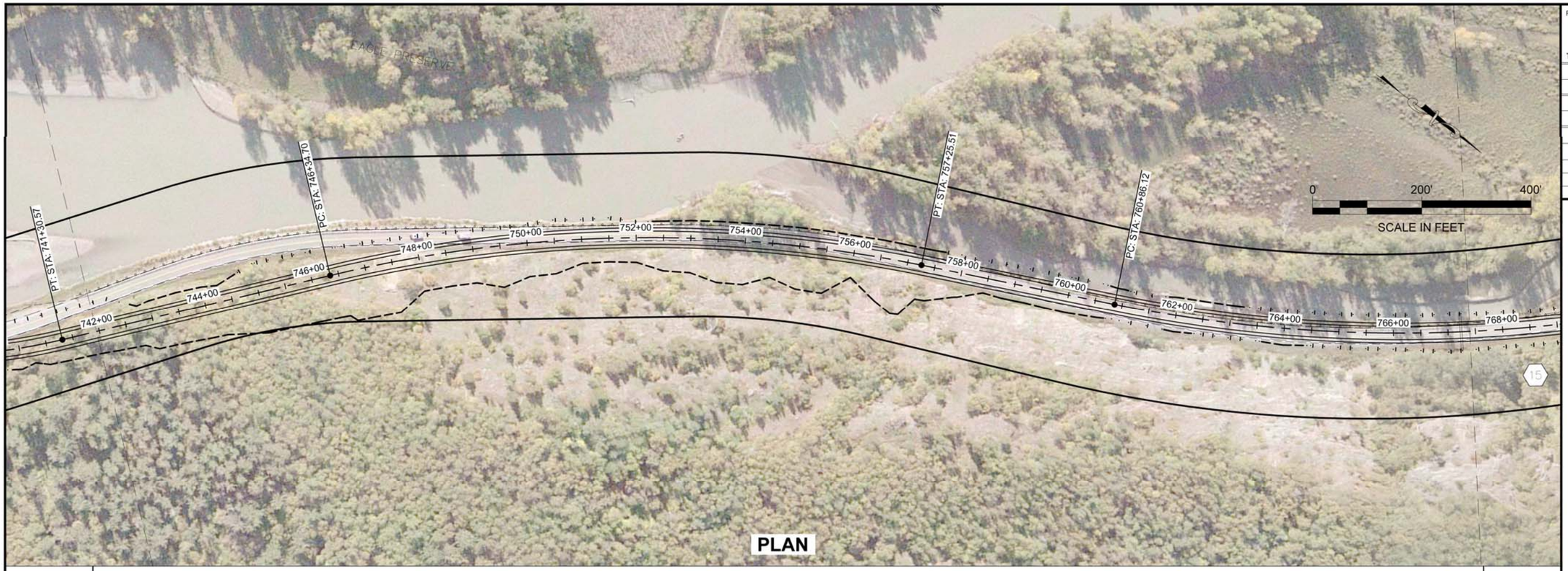
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

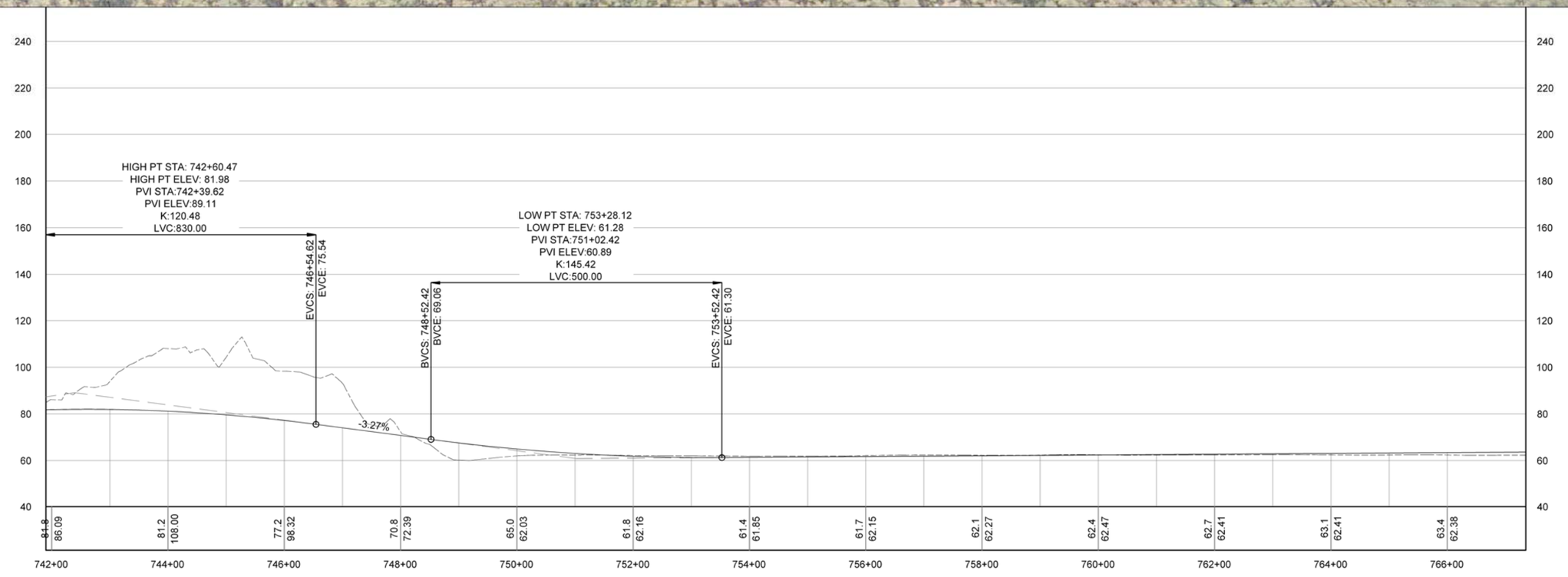
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
22	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (14).DWG

HOBBS, NAOMI

TAB: 23 Thursday, February 18, 2010 10:27:4

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

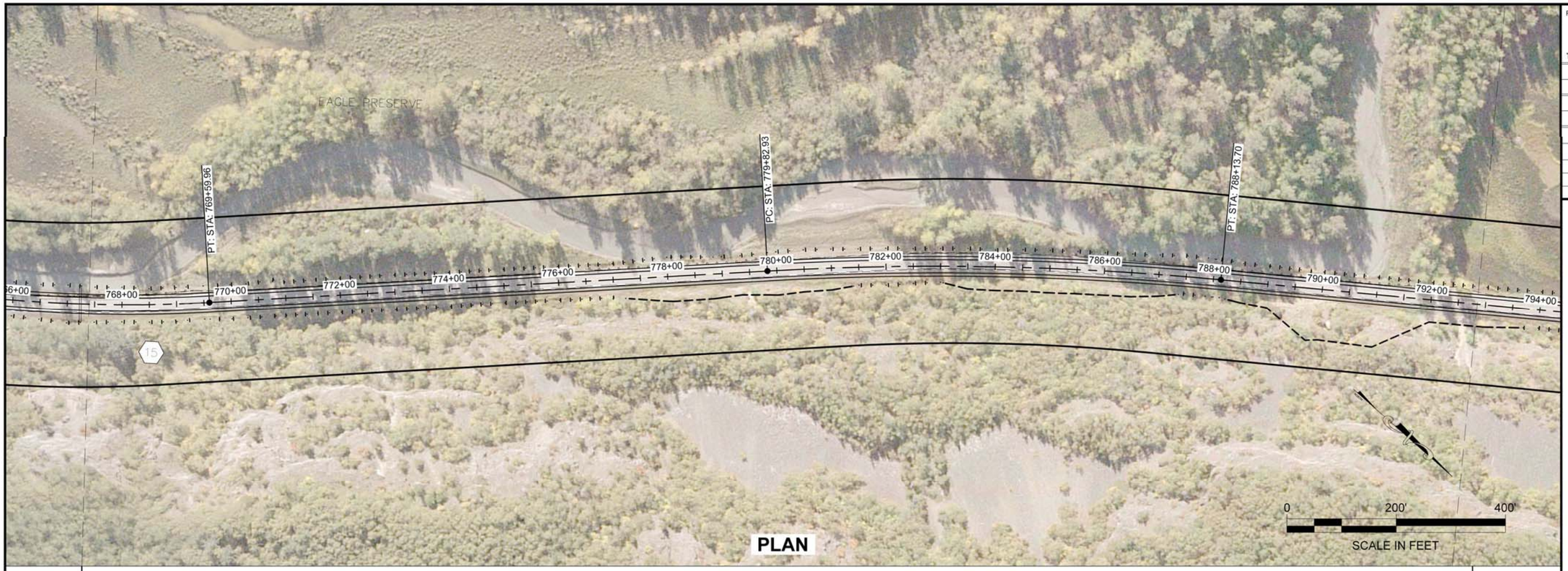
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

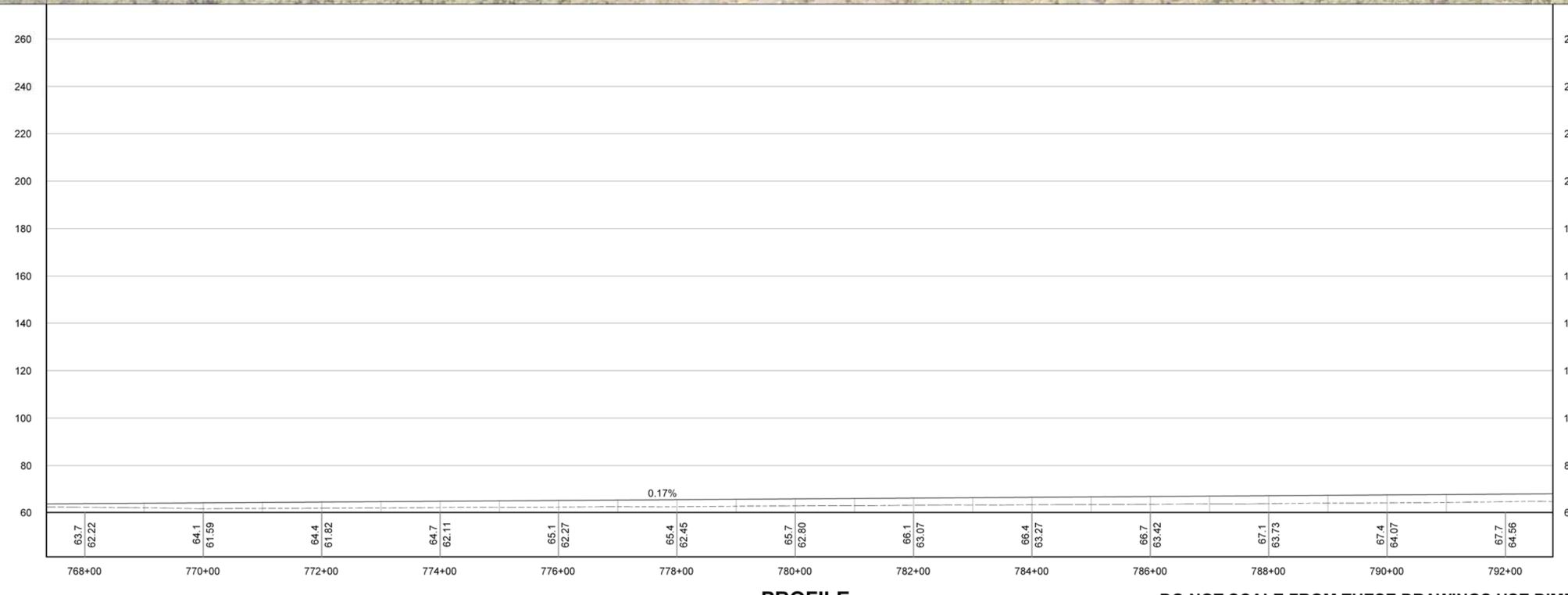
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
23	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (14).DWG

HOBBS, NAOMI

TAB: 24 Thursday, February 18, 2010 10:28:4

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

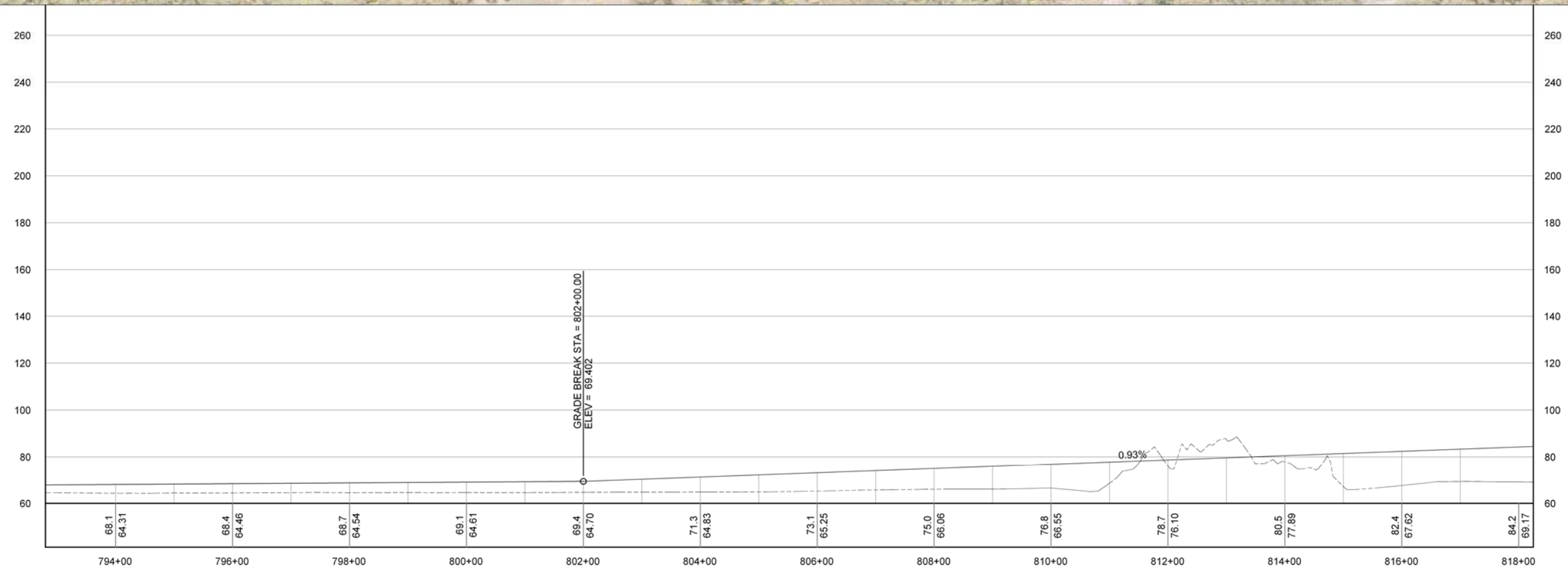
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
24	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (14).DWG

HOBBS, NAOMI

TAB: 25 Thursday, February 18, 2010 10:29:57

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S.NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

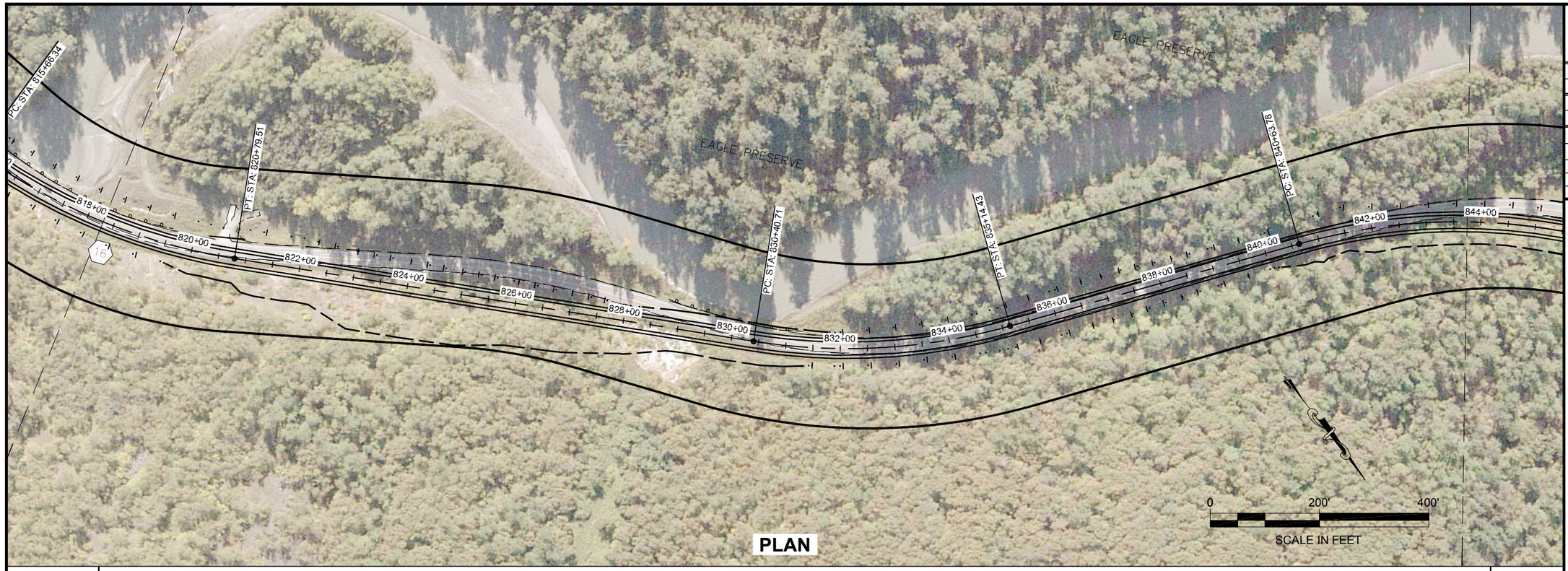
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION

68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
25	44



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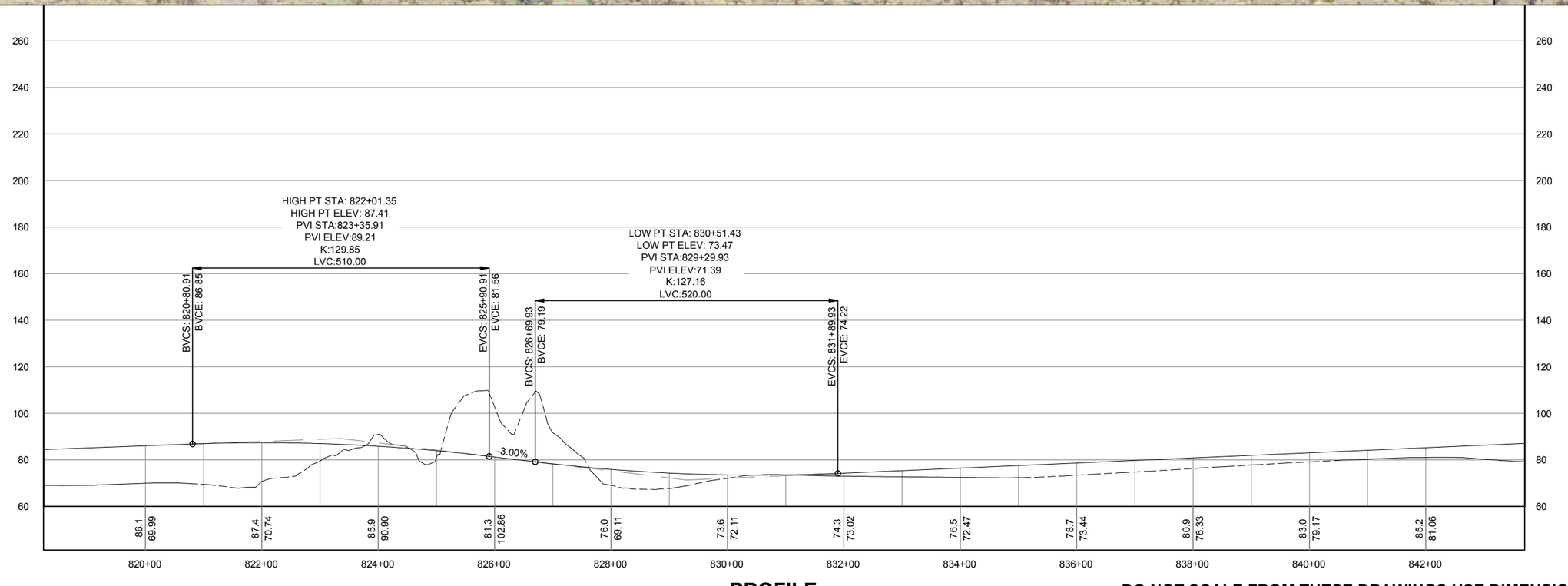


PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (15).DWG

HOBBS, NAOMI

TAB: 26 Thursday, February 18, 2010 10:43:2

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

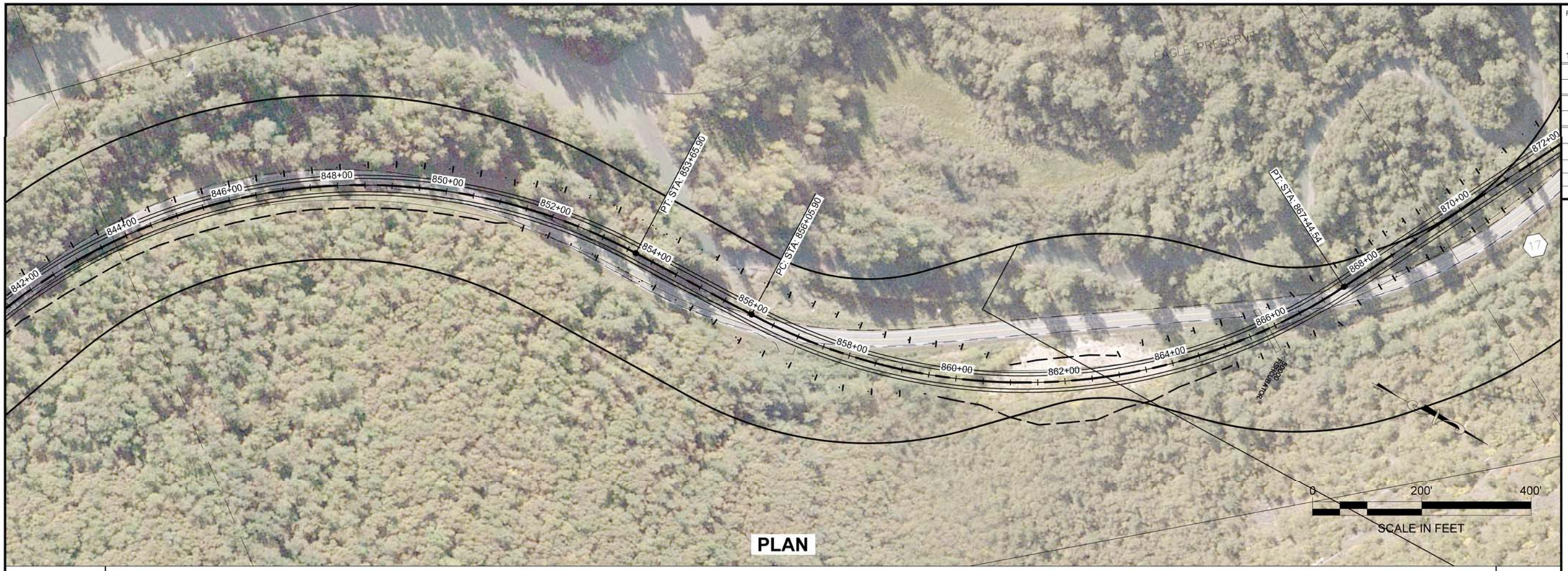
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	**2010**
SHEET NUMBER	TOTAL SHEETS
26	**44**



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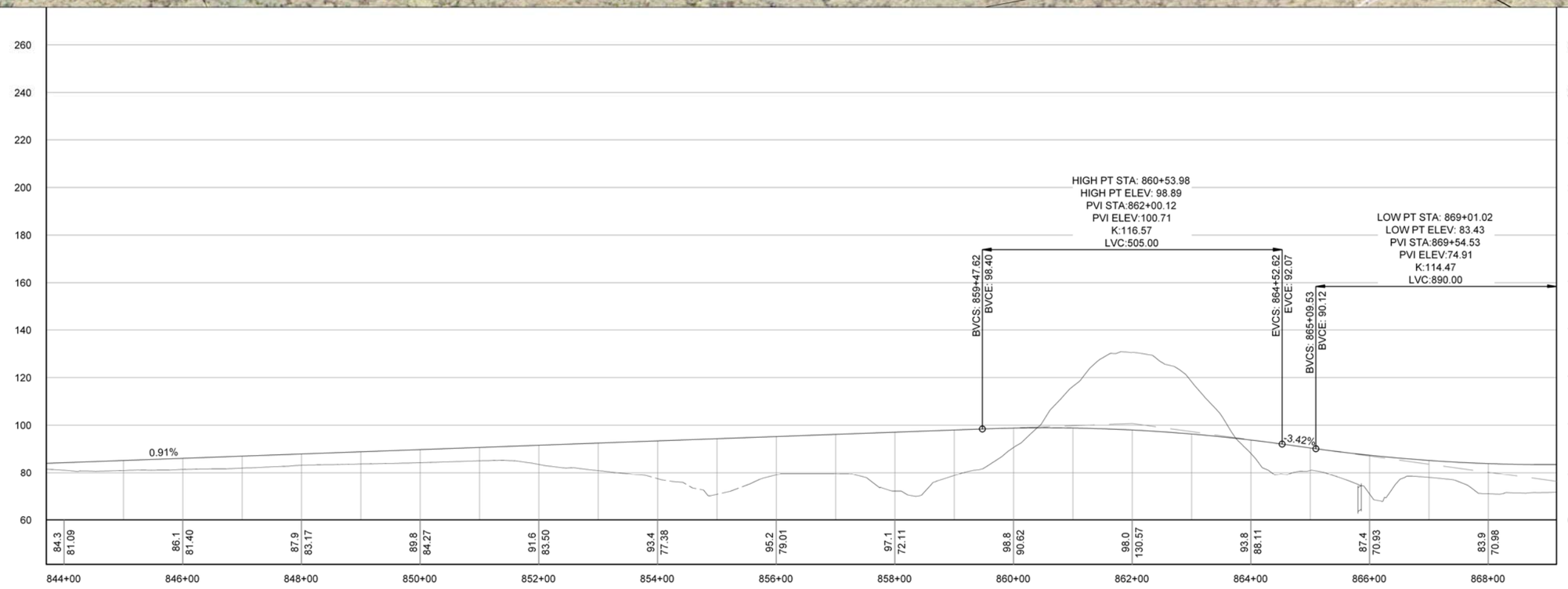


PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (15).DWG

HOBBS, NAOMI

TAB: 27 Thursday, September 02, 2010 3:52:

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

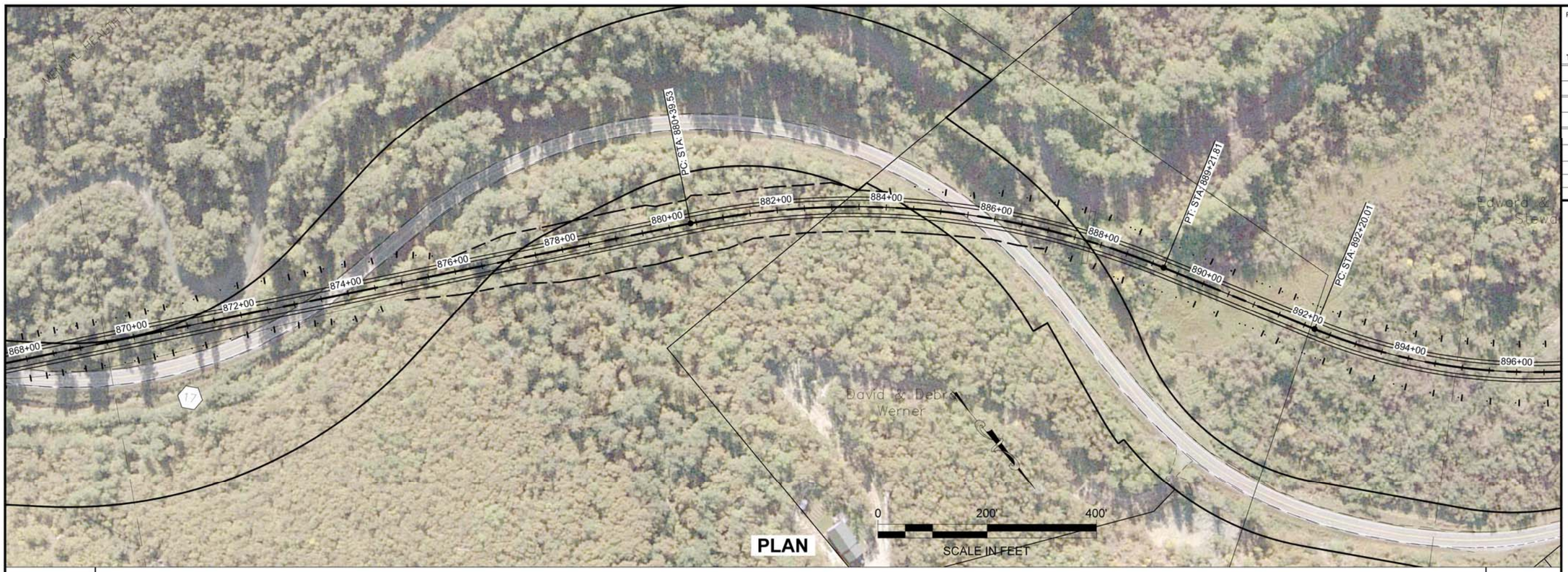
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

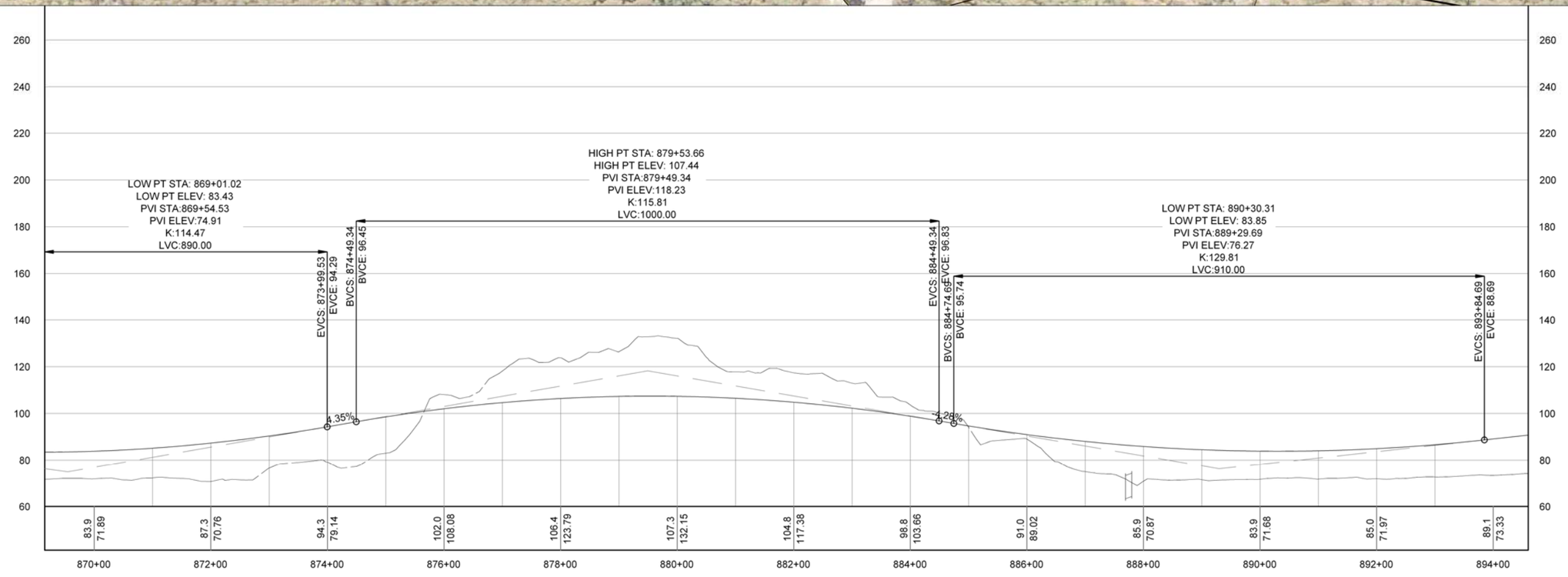
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
27	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (15).DWG

HOBBS, NAOMI

TAB: 28 Thursday, September 02, 2010 3:54:

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

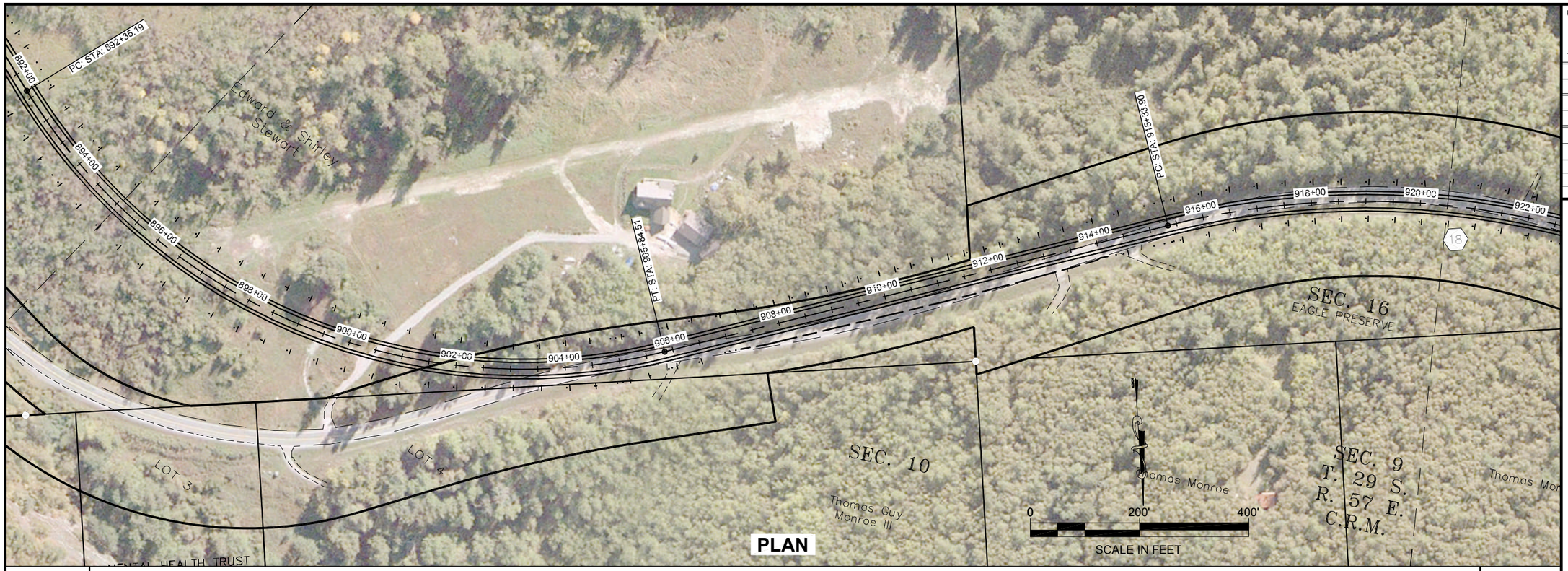
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
28	44



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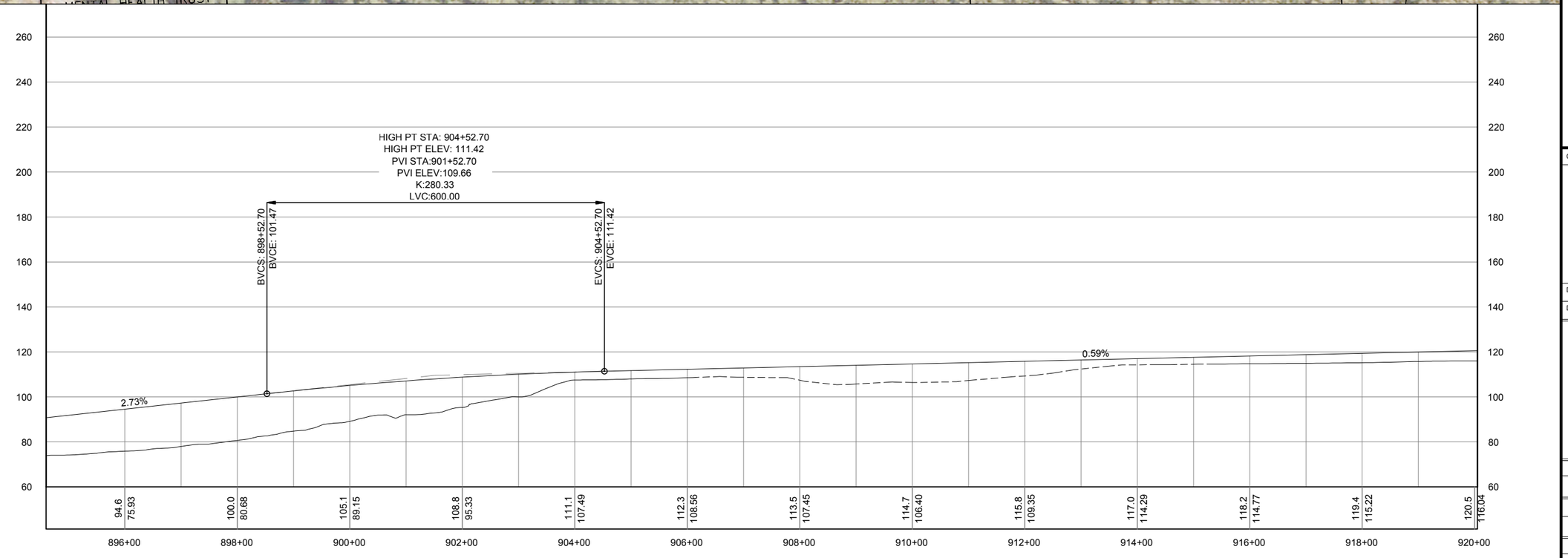


PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (15).DWG

HOBBS, NAOMI

TAB: 29 Thursday, February 18, 2010 10:46:28

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
S. STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

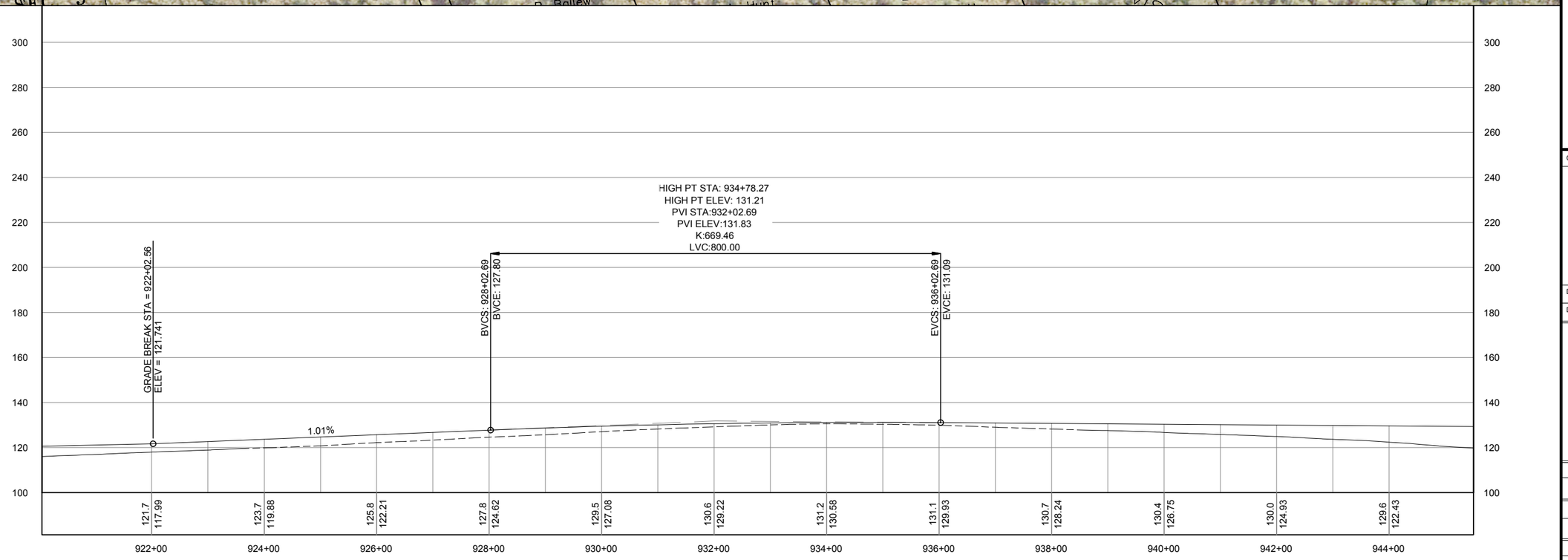
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
29	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (15).DWG

HOBBS, NAOMI

TAB: 30 Thursday, February 18, 2010 10:47:23

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

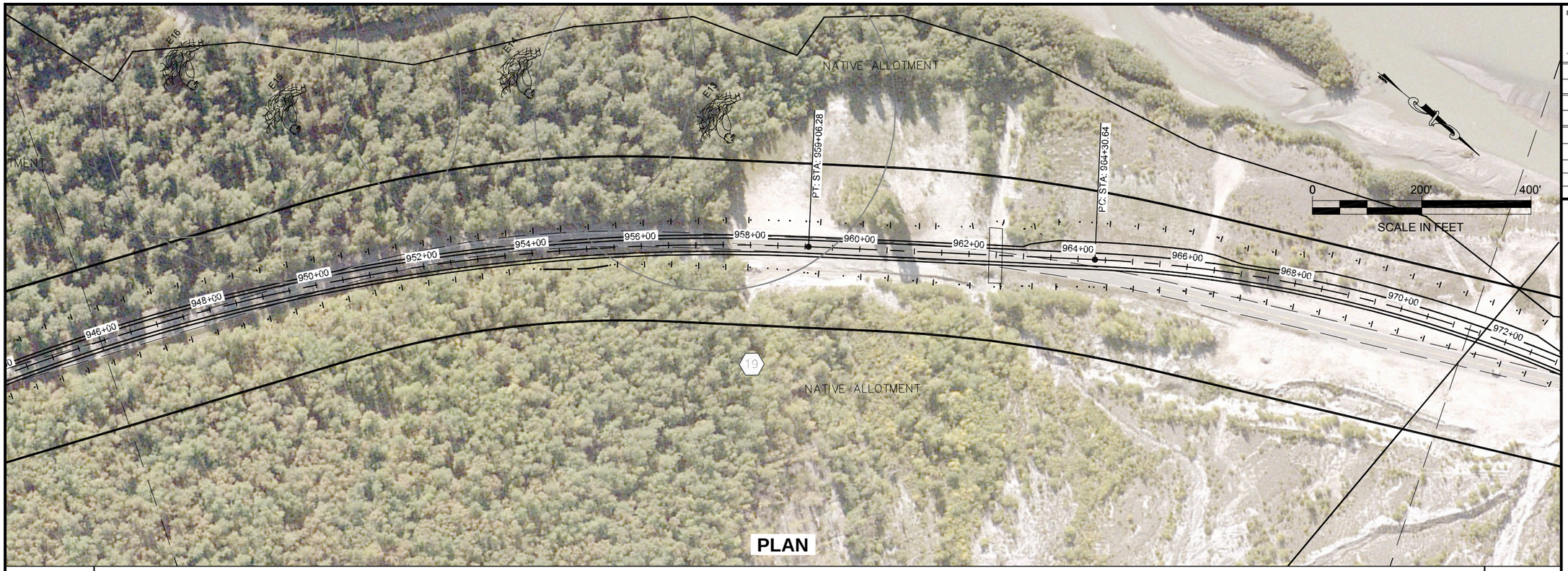
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
30	44



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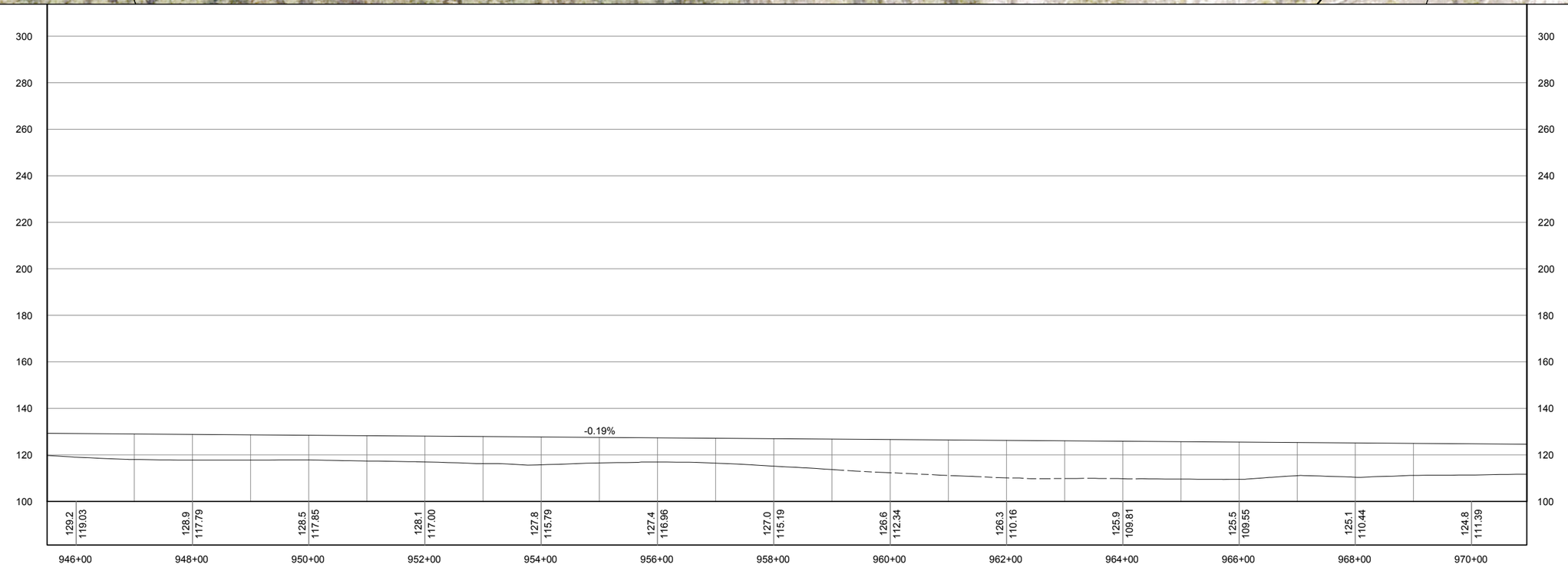


PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (16).DWG

HOBBS, NAOMI

TAB: 31 Thursday, February 18, 2010 12:27:01

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

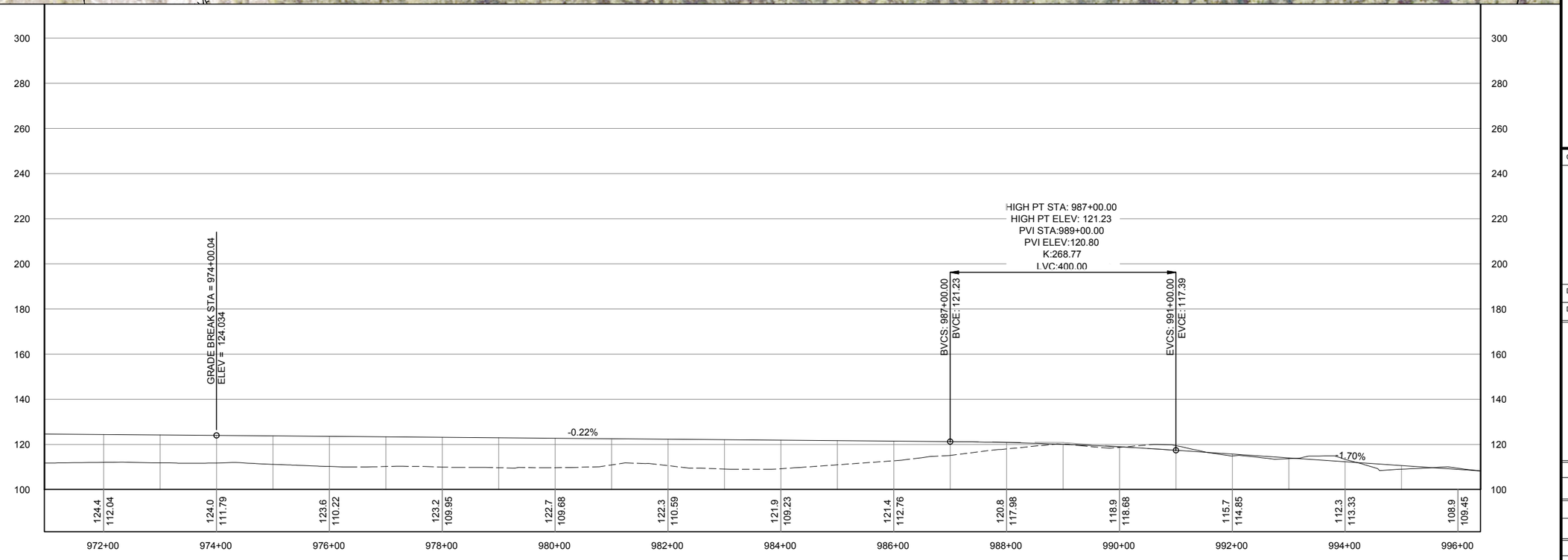
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
31	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (16).DWG

HOBBS, NAOMI

TAB: 32 Thursday, February 18, 2010 12:27:53

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

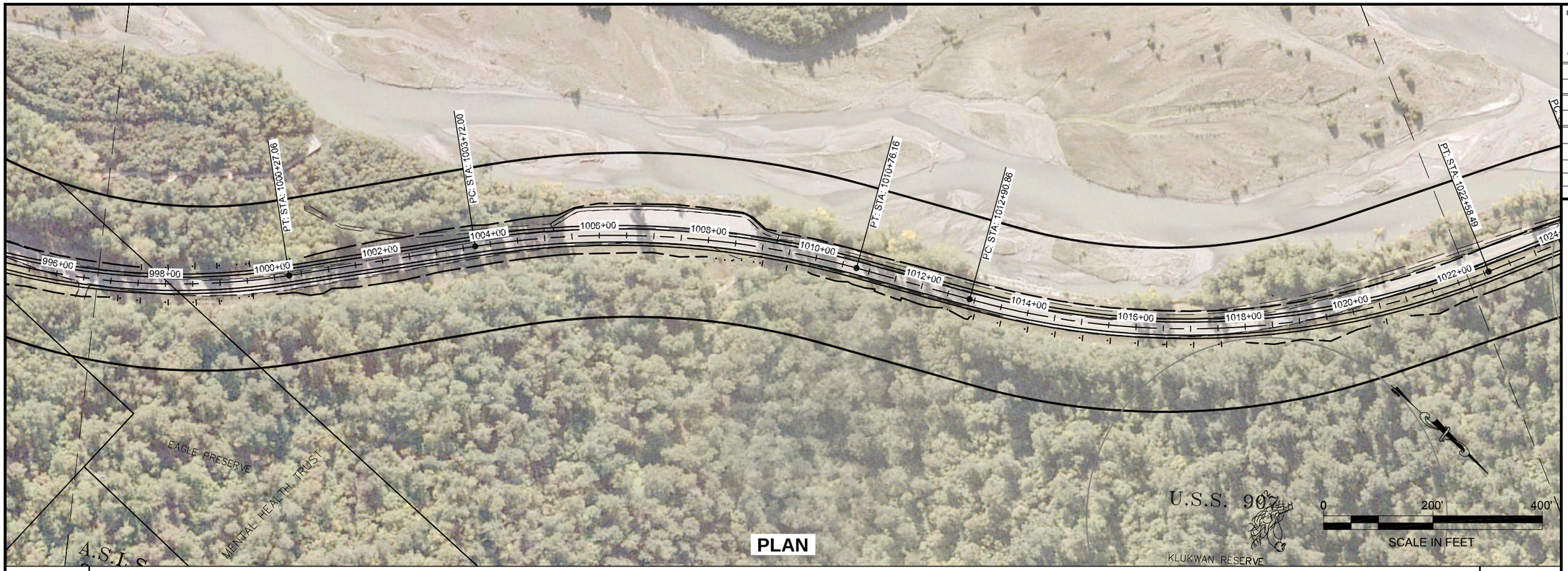
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

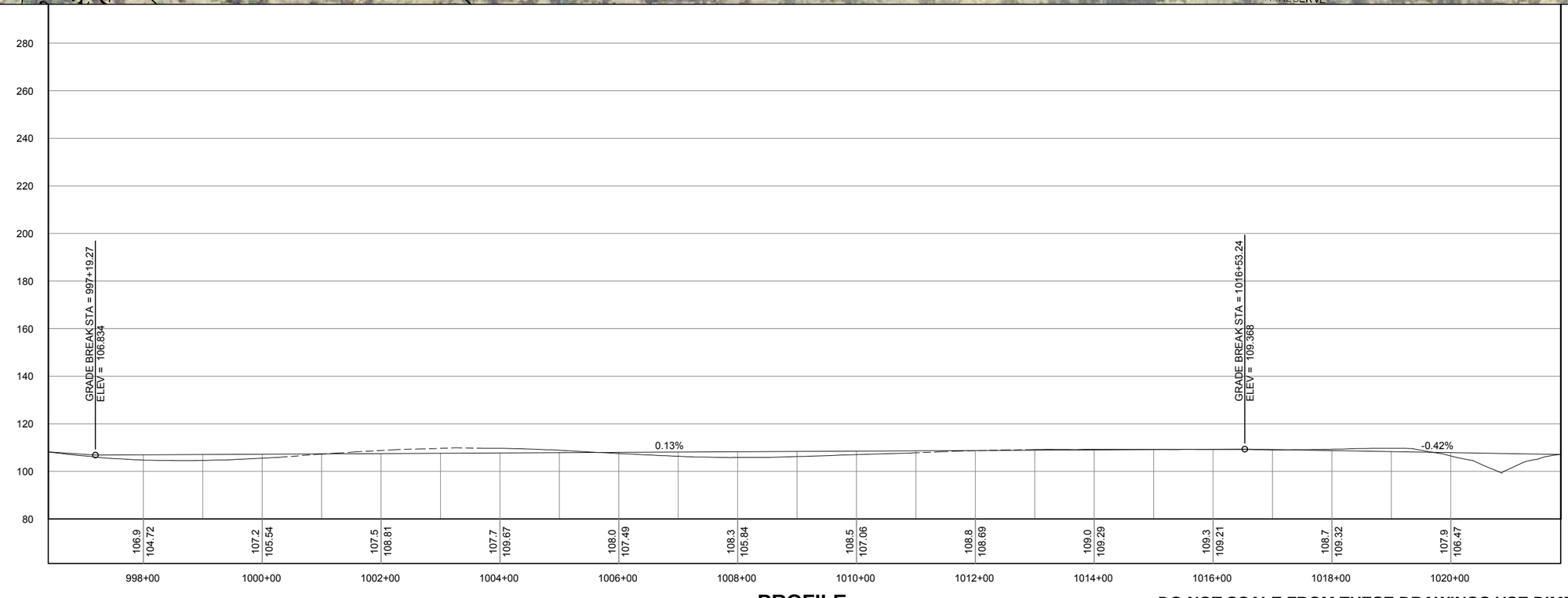
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
32	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (16).DWG

HOBBS, NAOMI

TAB: 33 Thursday, February 18, 2010 12:28:59

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

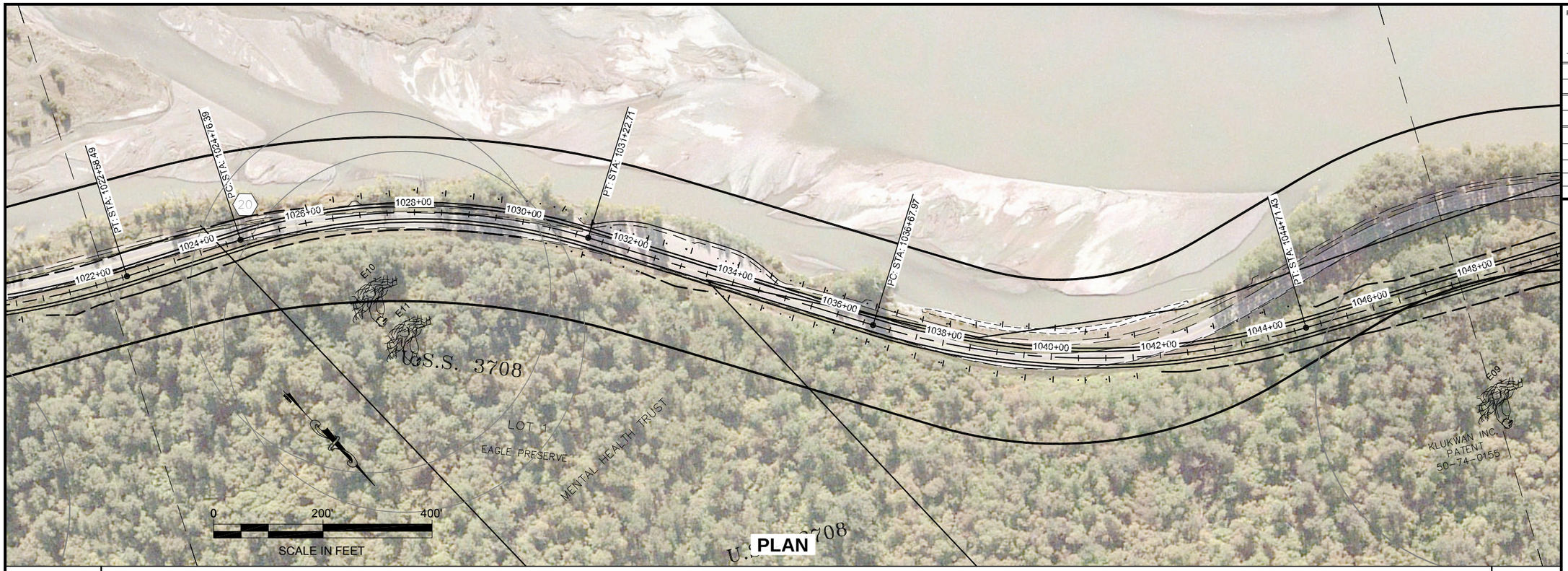
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

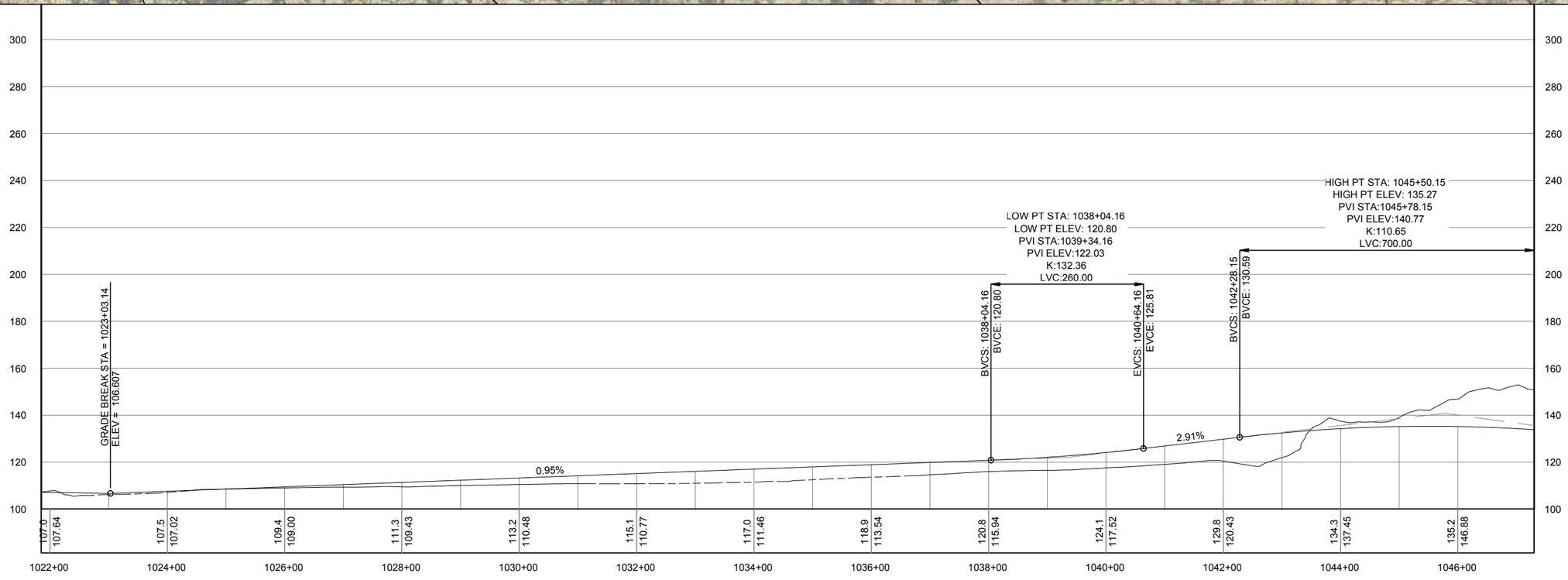
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
33	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (16).DWG

HOBBS, NAOMI

TAB: 34 Thursday, February 18, 2010 12:29:57

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

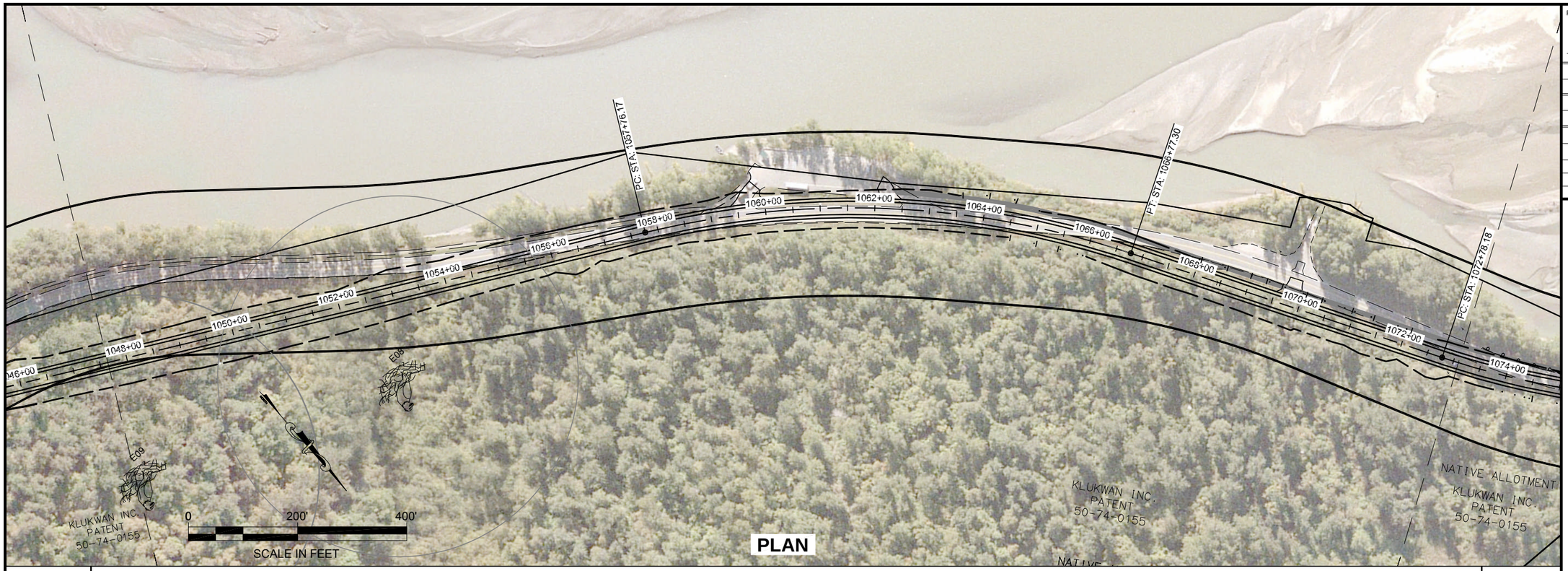
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

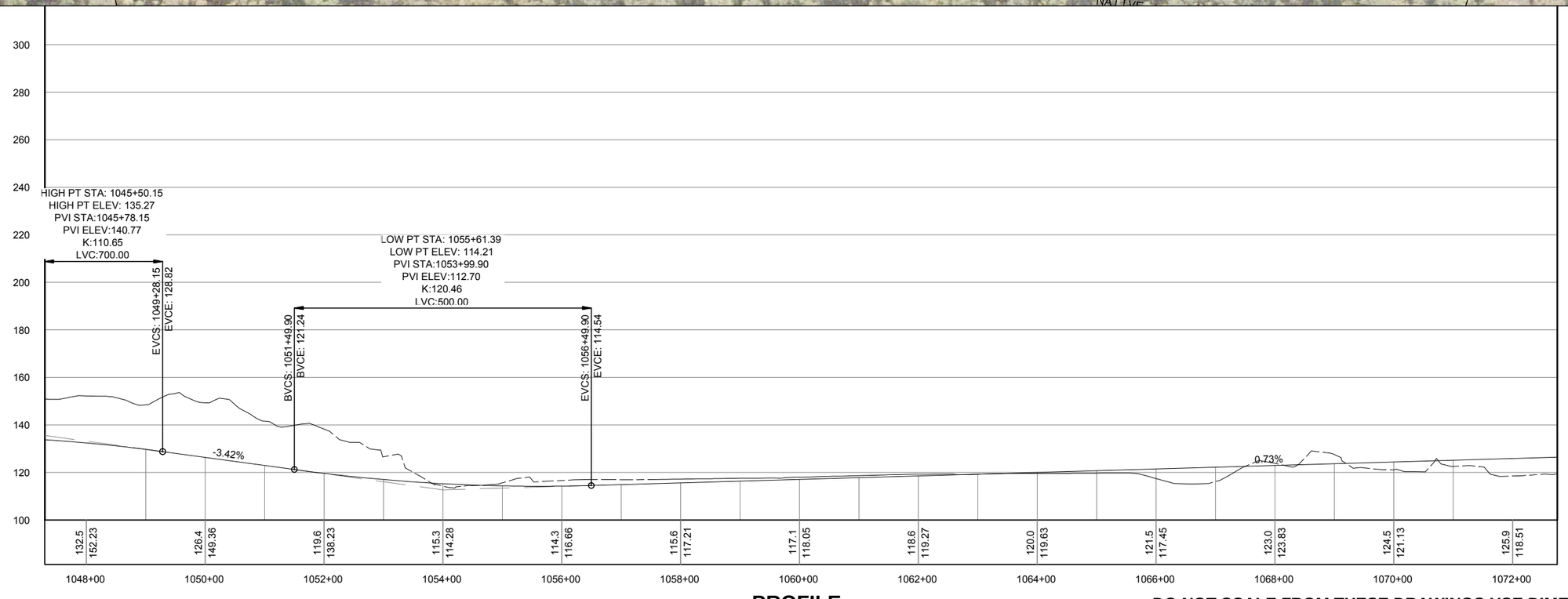
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
34	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (16).DWG

HOBBS, NAOMI

TAB: 35 Thursday, February 18, 2010 12:30:51

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING GRAVEL DRIVE
- EXISTING GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
S. STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

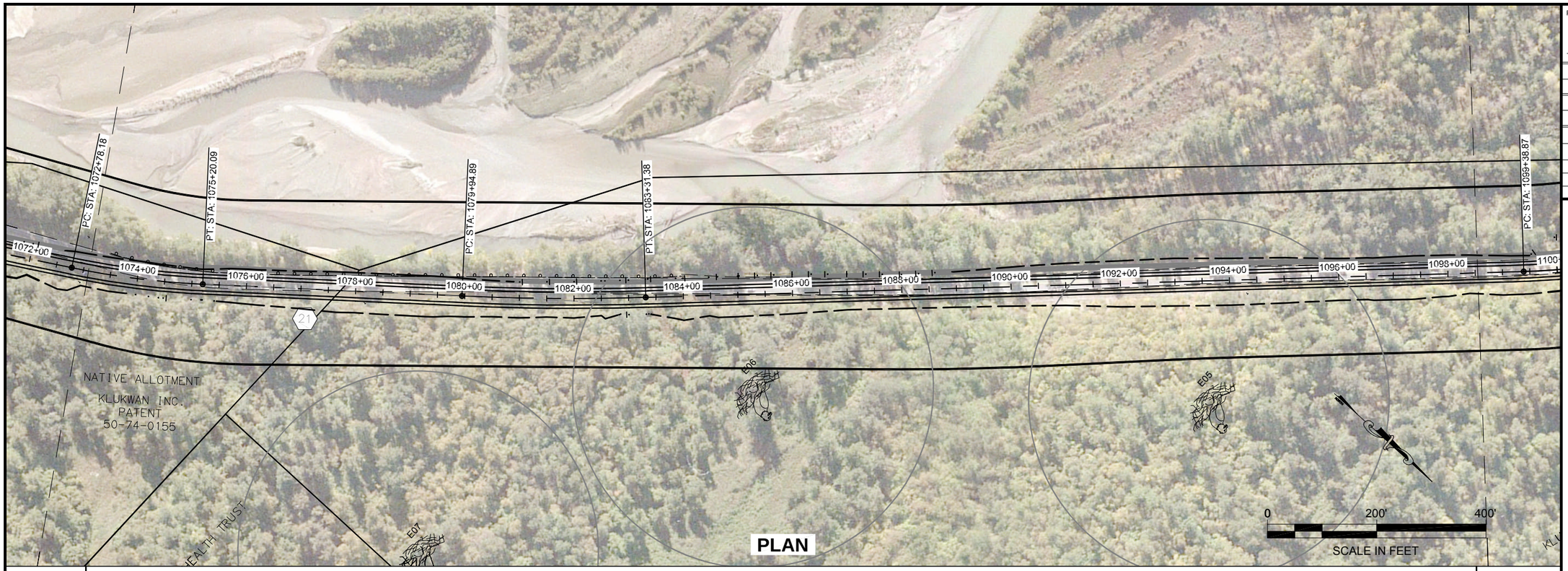
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

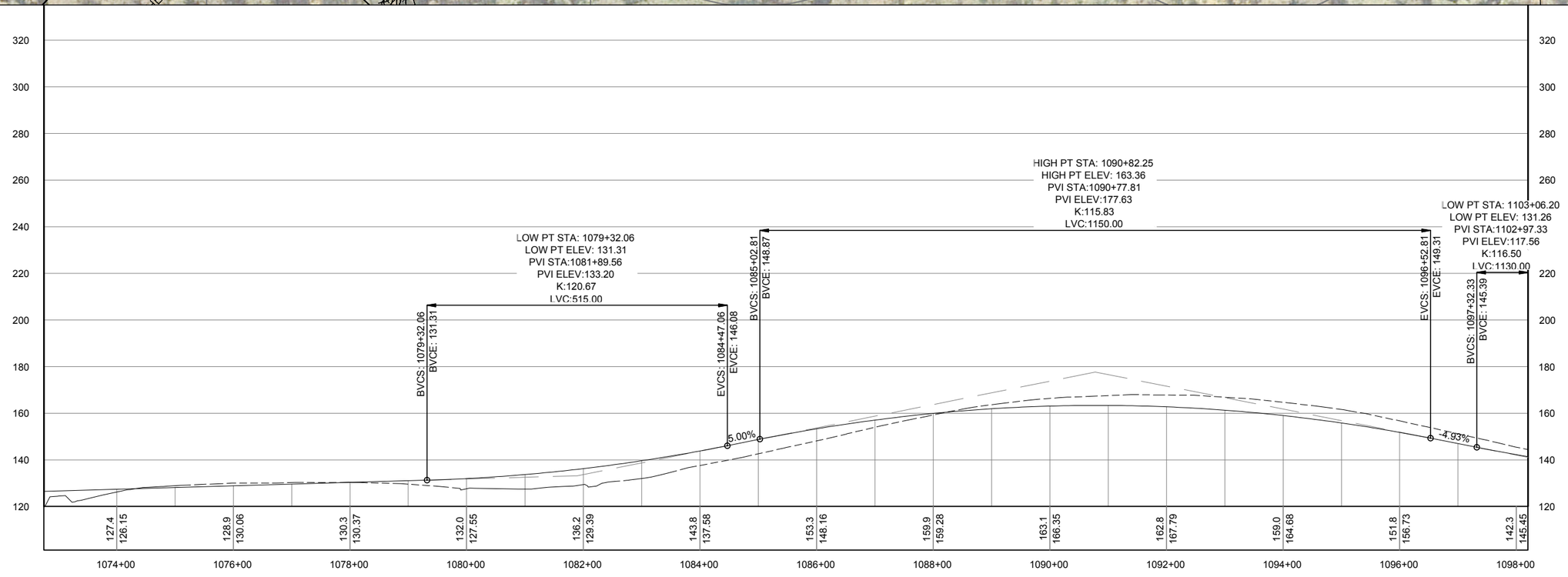
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
35	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (17).DWG

HOBBS, NAOMI

TAB: 36 Thursday, February 18, 2010 10:55:14

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

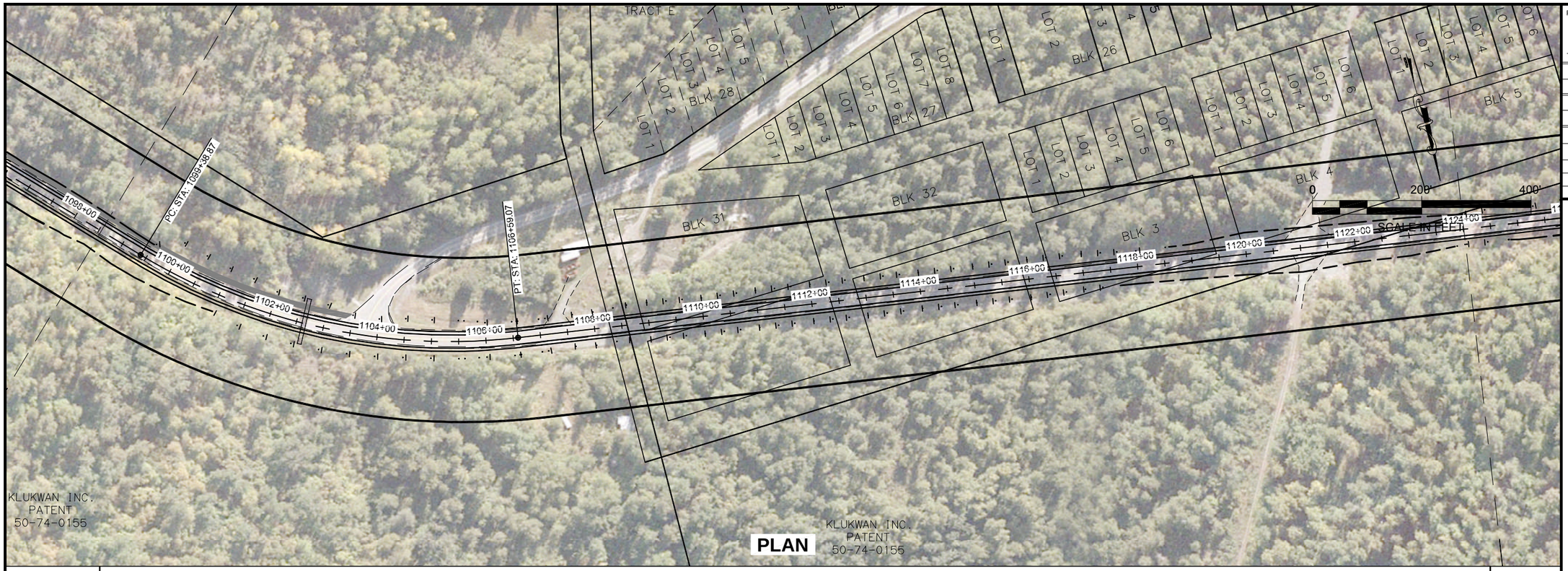
DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

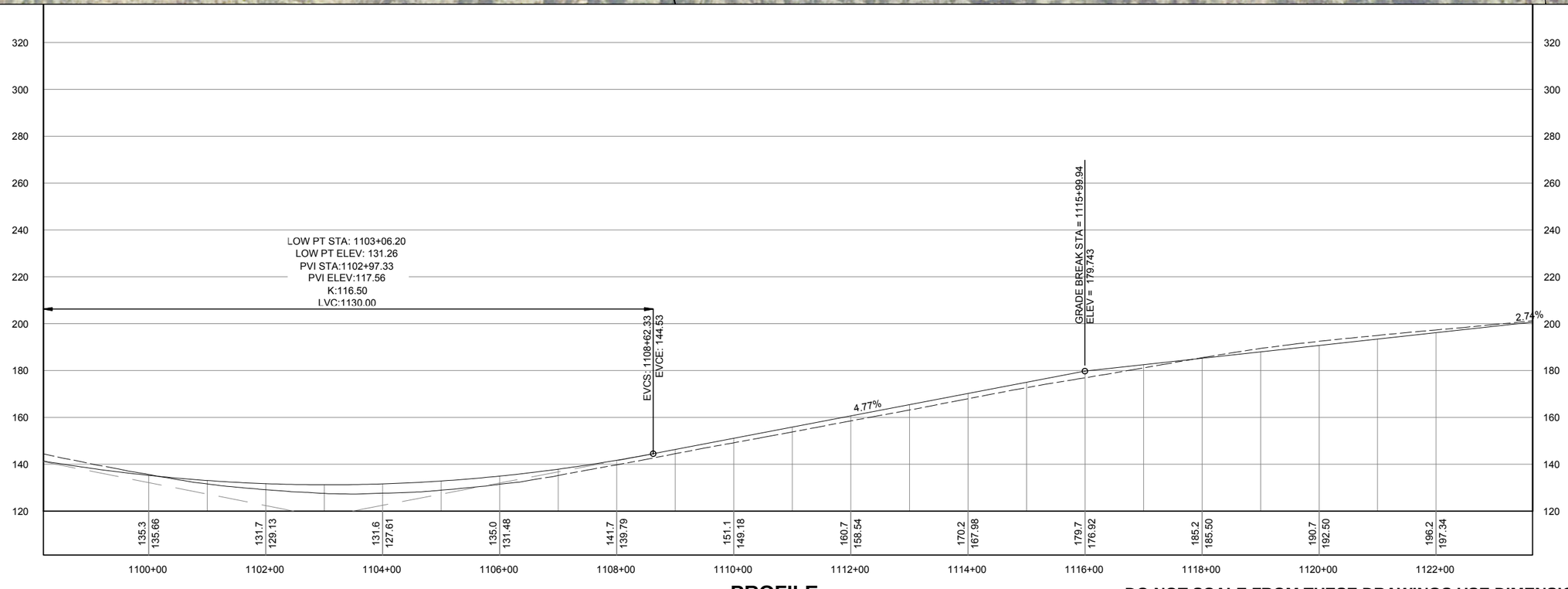
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
36	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (17).DWG

HOBBS, NAOMI

TAB: 37 Thursday, February 18, 2010 10:56:07

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

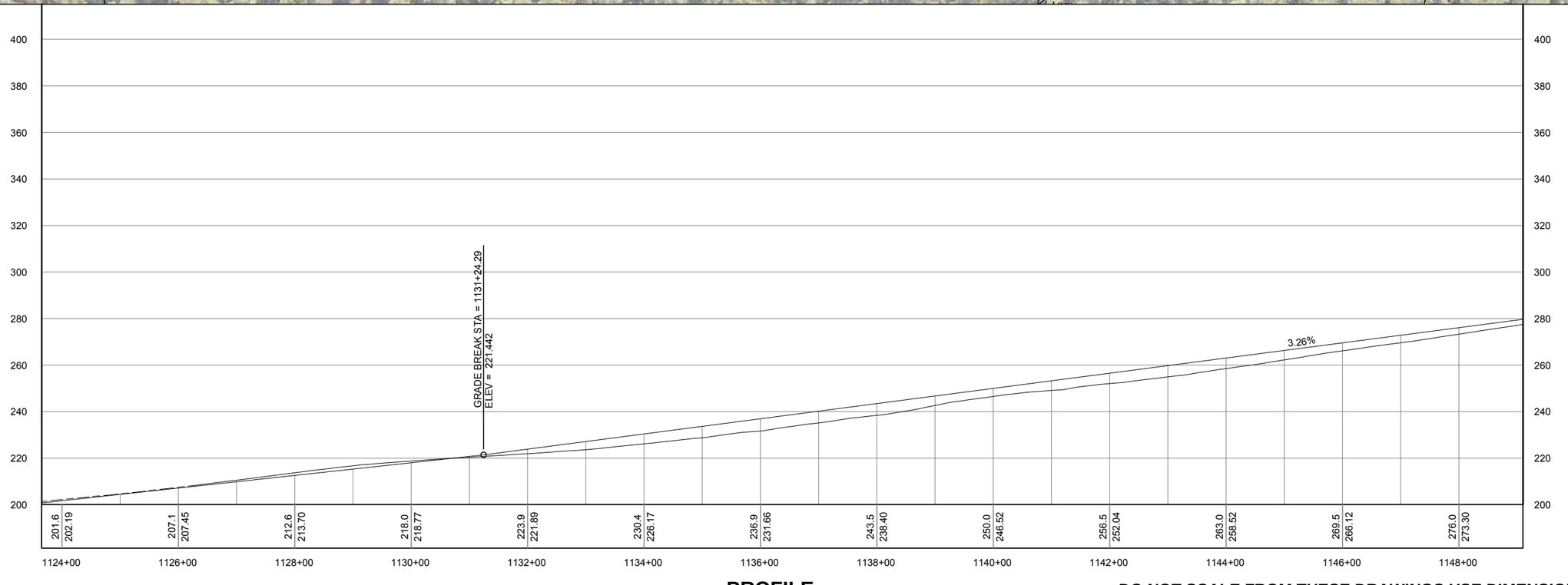
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
37	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (17).DWG

HOBBS, NAOMI

TAB: 38 Thursday, February 18, 2010 10:57:02

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

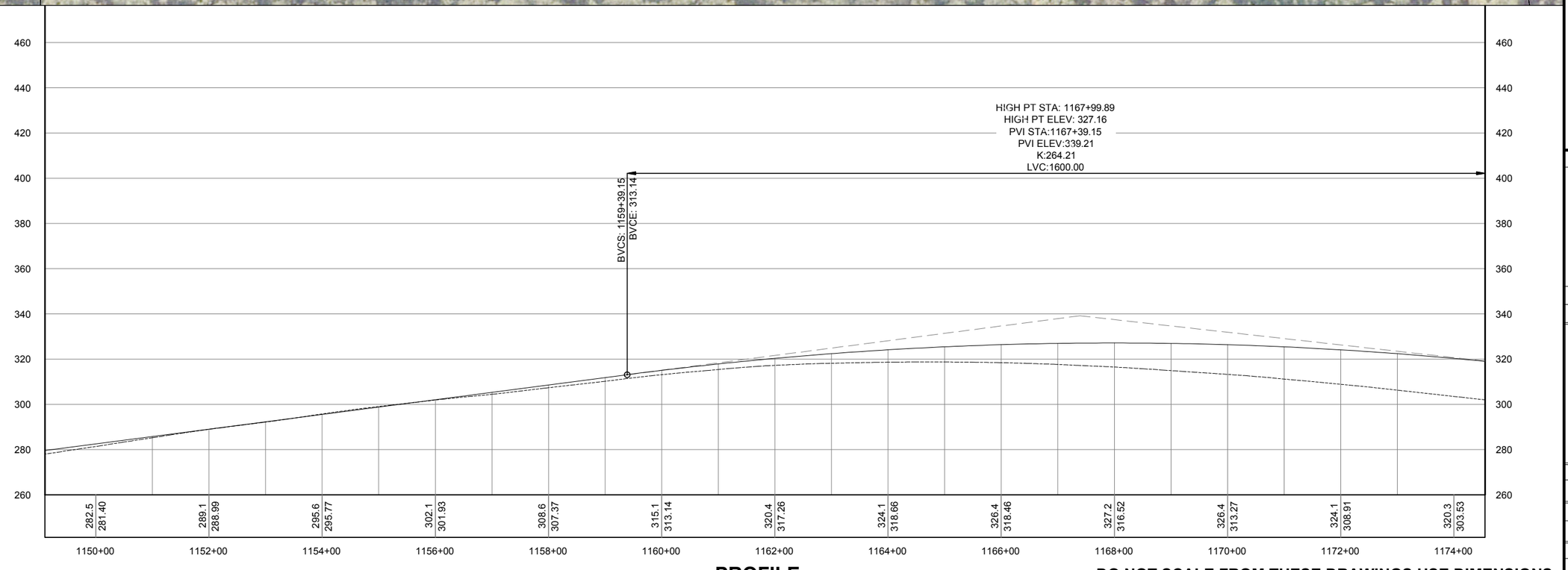
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
38	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (17).DWG

HOBBS, NAOMI

TAB: 39 Wednesday, October 06, 2010 9:06:26 AM

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

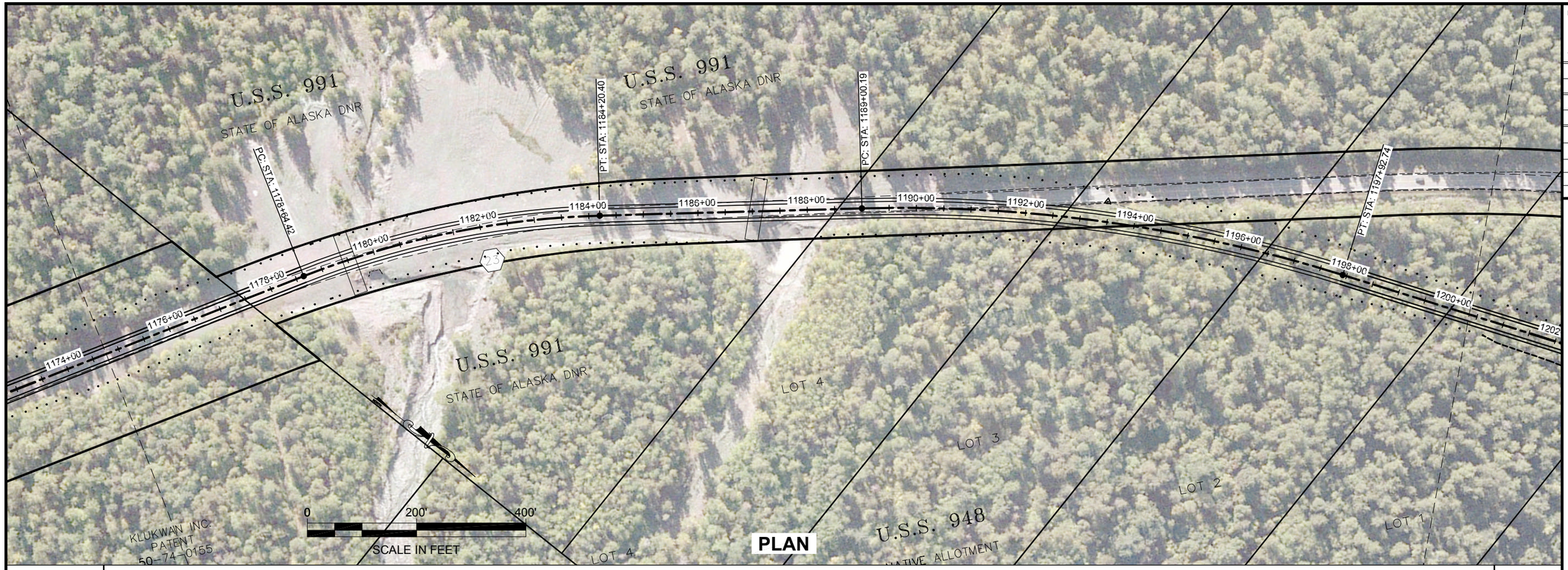
DRAWN BY: N. HOBBS

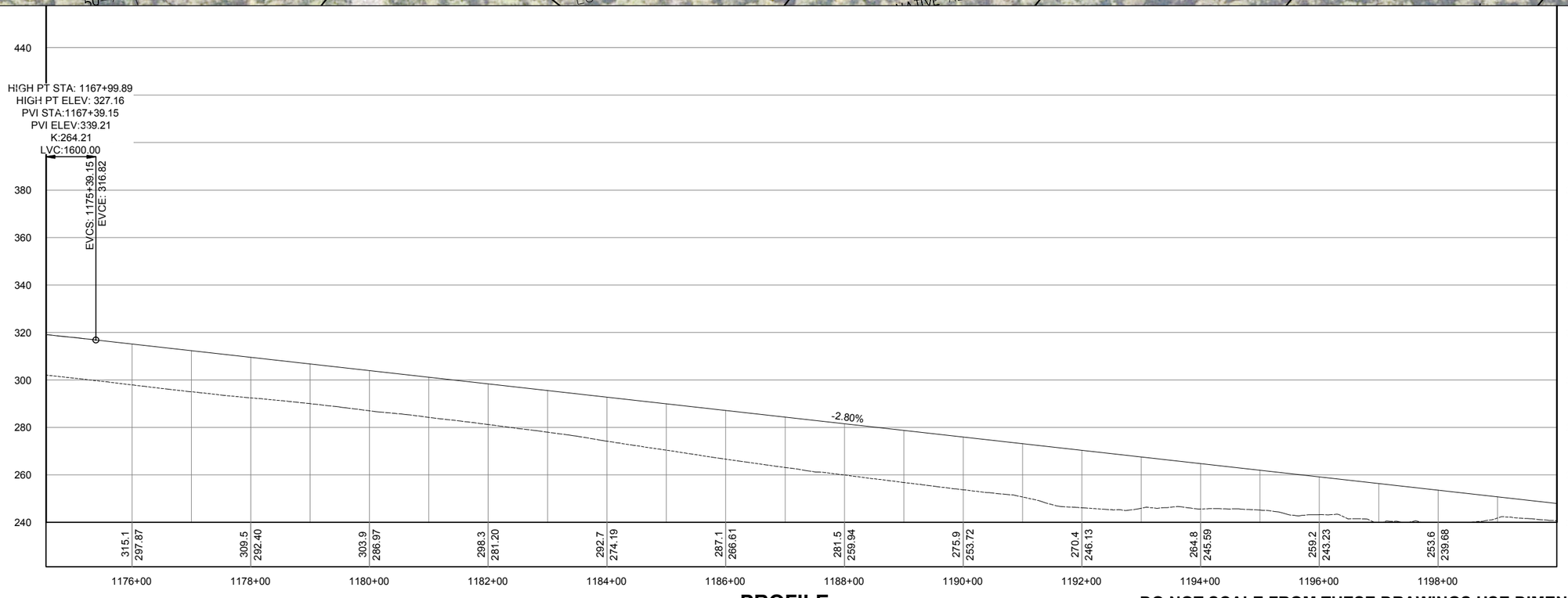
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
39	44





DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (17).DWG

HOBBS, NAOMI

TAB: 40 Wednesday, October 06, 2010 10:23:13 AM

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

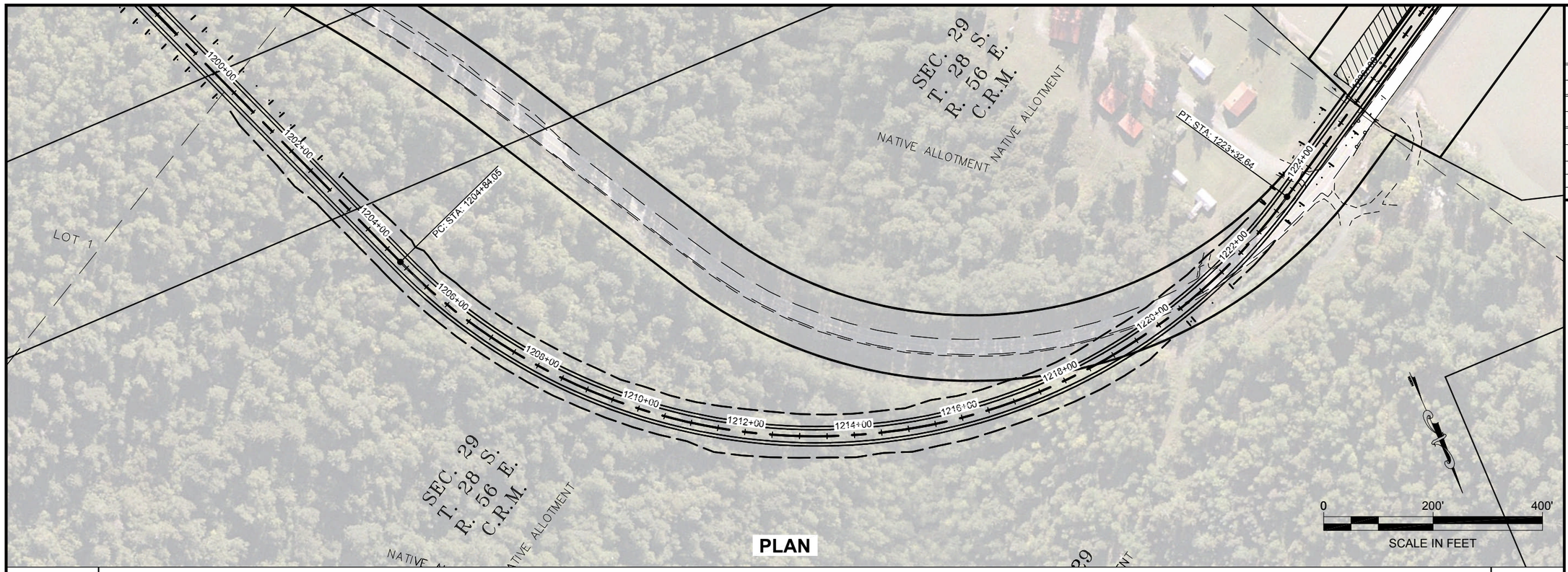
PLAN & PROFILE

PROJECT DESIGNATION

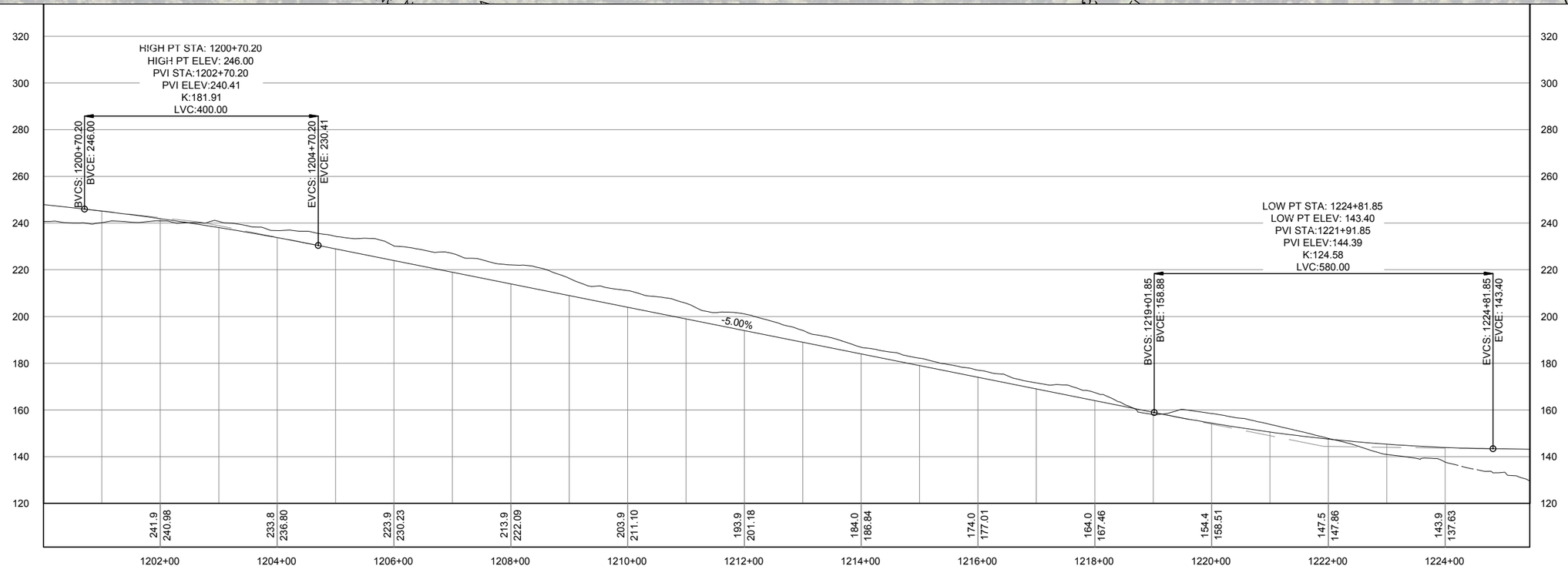
68606

STATE	YEAR
ALASKA	2010

SHEET NUMBER	TOTAL SHEETS
40	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (18)-A.DWG

HOBBS, NAOMI

TAB: 41 Wednesday, October 06, 2010 8:58:22 AM

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER
49th

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

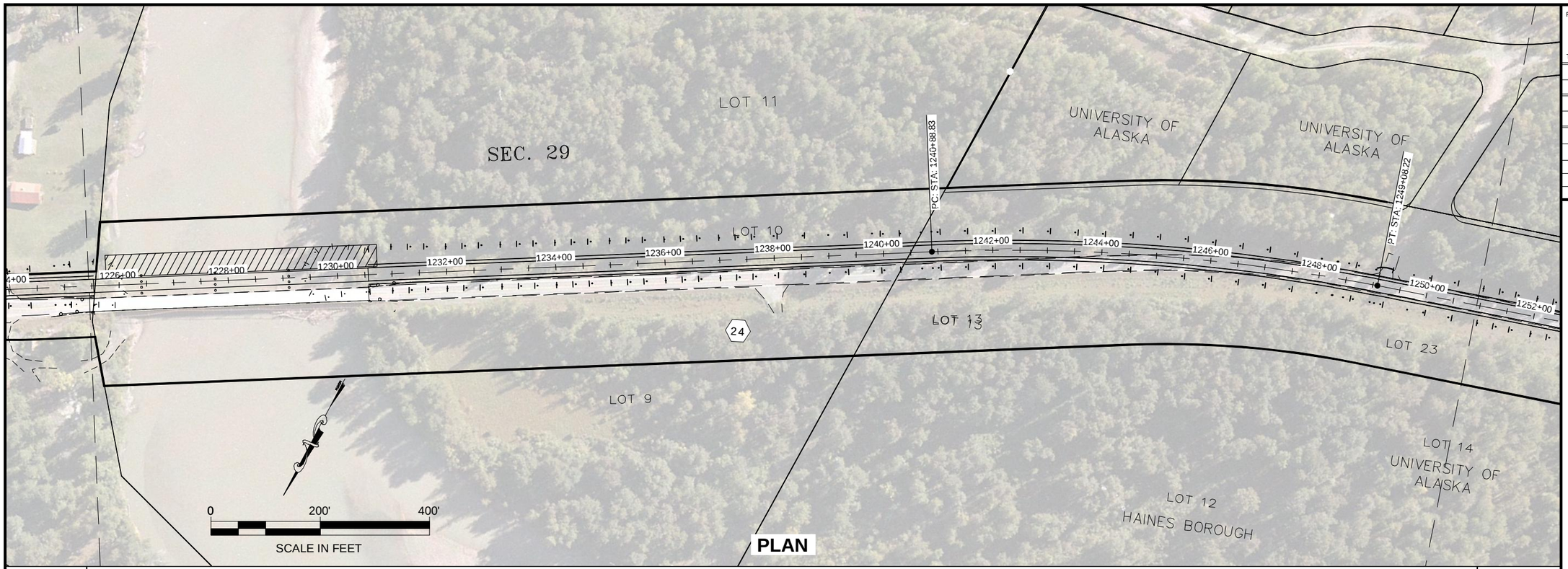
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

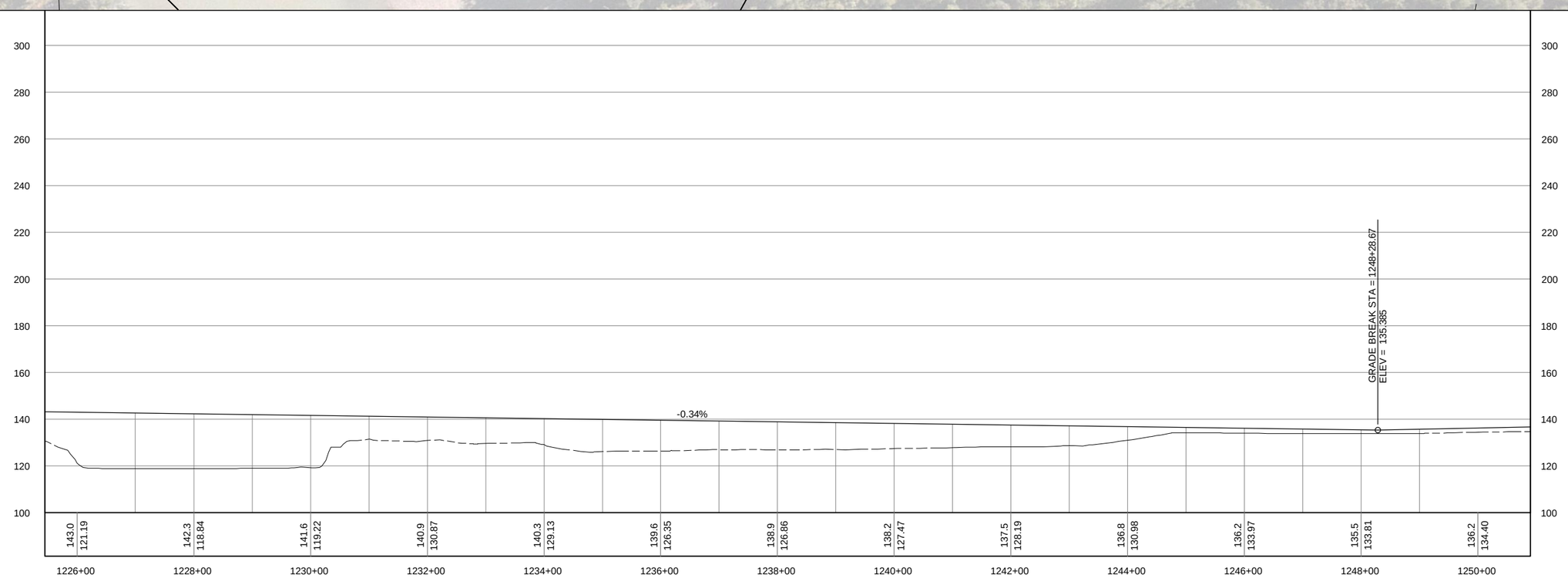
PROJECT DESIGNATION

68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
41	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (18)-A.DWG

HOBBS, NAOMI

TAB: 42 Thursday, February 18, 2010 2:54:40

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

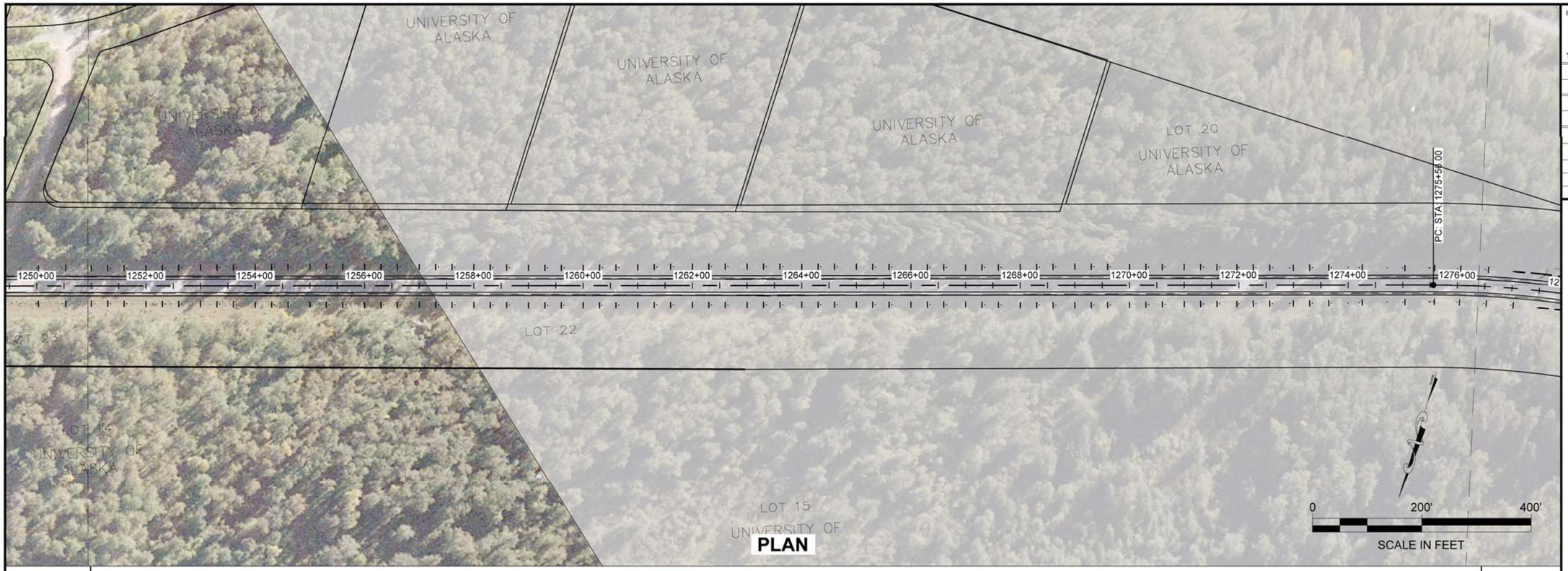
PLAN & PROFILE

PROJECT DESIGNATION

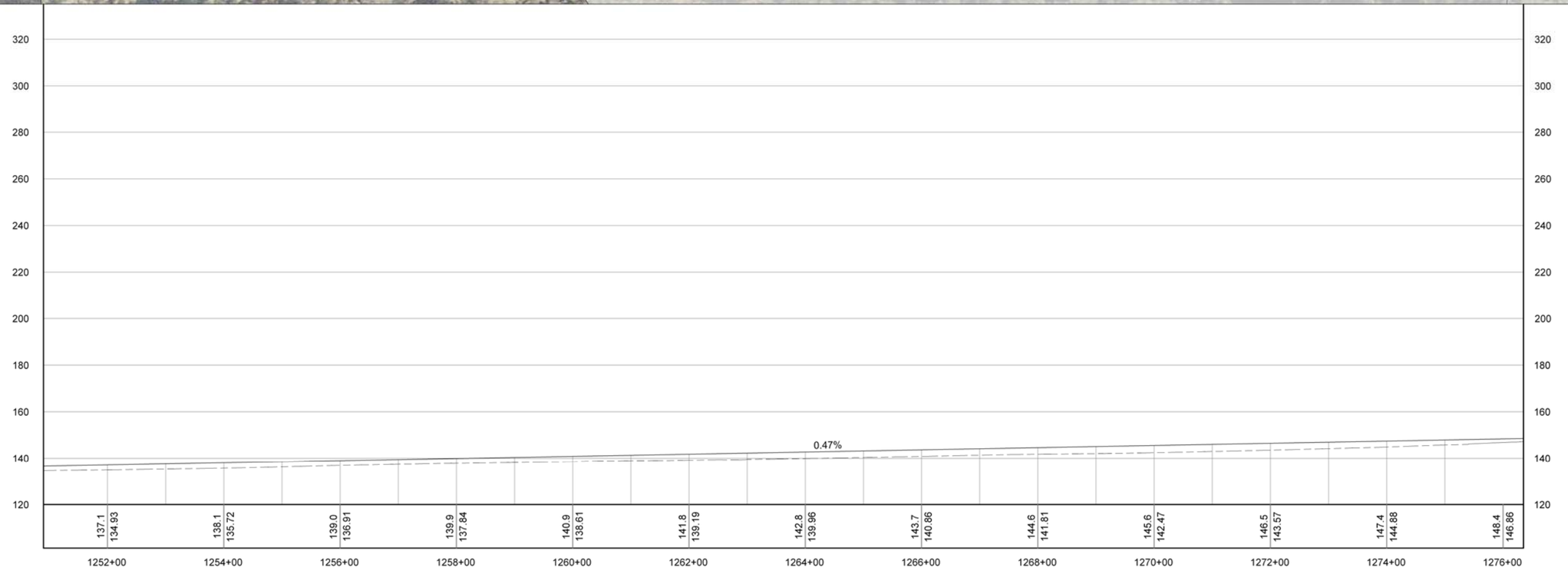
68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010

SHEET NUMBER	TOTAL SHEETS
42	44



PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (18).DWG

HOBBS, NAOMI

TAB: 43 Thursday, February 18, 2010 1:32:49

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA 49th STEVEN K. NOBLE CE-10051 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

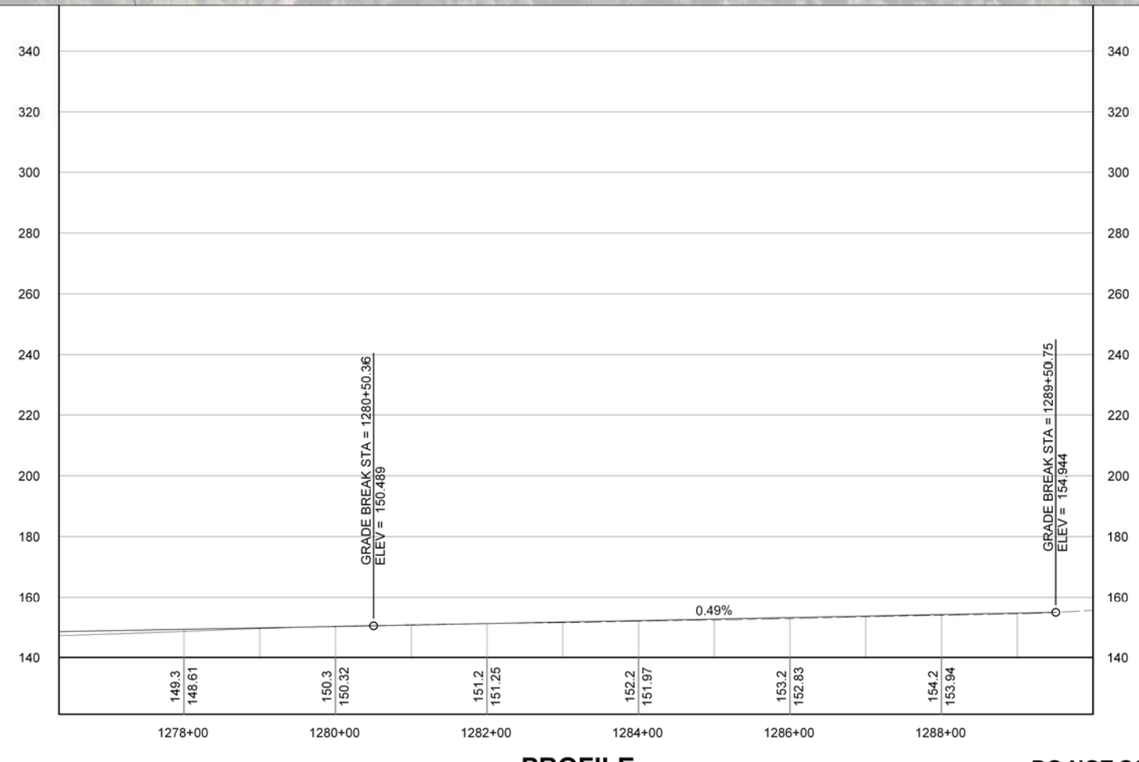
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION	
68606/SHAK-095-6(28)	
STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
43	44

PLAN



PROFILE

DO NOT SCALE FROM THESE DRAWINGS USE DIMENSIONS

PATH: S:\LIB\D59119 HAINES\040 DRAWINGS\WORKING BASE\95119-PANDP (18).DWG

HOBBS, NAOMI

TAB: 44 Thursday, February 18, 2010 1:27:19

ADDENDUM NUMBER

ATTACHMENT NUMBER

RECORD OF REVISIONS

No.	DATE	DESCRIPTION

PLAN LEGEND

- ROW
- PROPERTY LINE
- EXISITNG EDGE OF PAVEMENT
- EXISITNG GRAVEL DRIVE
- EXISITNG GUARDRAIL
- CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF TRAVELED WAY
- CUT LIMITS
- FILL LIMITS

CHECKED BY: K. SUCHODOLSKI

STATE OF ALASKA
49th
STEVEN K. NOBLE
CE-10051
REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY: S. NOBLE

DRAWN BY: N. HOBBS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHEAST REGION

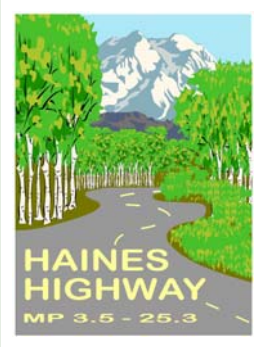
HAINES
HIGHWAY
MP 3.5 TO MP 25.3
PROJECT #68606

PLAN & PROFILE

PROJECT DESIGNATION

68606/SHAK-095-6(28)

STATE	YEAR
ALASKA	2010
SHEET NUMBER	TOTAL SHEETS
44	44


HAINES
HIGHWAY
MP 3.5 - 25.3