

**Technical Report No. 11-10**

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# **Haines Highway Mile 25 to the Border: 10-Year Mitigation Monitoring**

by

**Joseph P. Hitselberger**

and

**Matthew J. Kern**



January 2012

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Alaska Department of Fish and Game

Division of Habitat



## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the *Système International d'Unités* (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

<b>Weights and measures (metric)</b>		<b>General</b>		<b>Measures (fisheries)</b>	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-fork	MEF
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	mid-eye-to-tail-fork	METF
hectare	ha	at	@	standard length	SL
kilogram	kg	compass directions:		total length	TL
kilometer	km	east	E		
liter	L	north	N	<b>Mathematics, statistics</b>	
meter	m	south	S	<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	west	W	alternate hypothesis	H <sub>A</sub>
millimeter	mm	copyright	©	base of natural logarithm	<i>e</i>
		corporate suffixes:		catch per unit effort	CPUE
<b>Weights and measures (English)</b>		Company	Co.	coefficient of variation	CV
cubic feet per second	ft <sup>3</sup> /s	Corporation	Corp.	common test statistics	(F, t, $\chi^2$ , etc.)
foot	ft	Incorporated	Inc.	confidence interval	CI
gallon	gal	Limited	Ltd.	correlation coefficient (multiple)	R
inch	in	District of Columbia	D.C.	correlation coefficient (simple)	r
mile	mi	et alii (and others)	et al.	covariance	cov
nautical mile	nmi	et cetera (and so forth)	etc.	degree (angular)	°
ounce	oz	exempli gratia		degrees of freedom	df
pound	lb	(for example)	e.g.	expected value	<i>E</i>
quart	qt	Federal Information Code	FIC	greater than	>
yard	yd	id est (that is)	i.e.	greater than or equal to	≥
		latitude or longitude	lat. or long.	harvest per unit effort	HPUE
<b>Time and temperature</b>		monetary symbols		less than	<
day	d	(U.S.)	\$, ¢	less than or equal to	≤
degrees Celsius	°C	months (tables and figures): first three letters	Jan, ..., Dec	logarithm (natural)	ln
degrees Fahrenheit	°F	registered trademark	®	logarithm (base 10)	log
degrees kelvin	K	trademark	™	logarithm (specify base)	log <sub>2</sub> , etc.
hour	h	United States (adjective)	U.S.	minute (angular)	'
minute	min	United States of America (noun)	USA	not significant	NS
second	s	U.S.C.	United States Code	null hypothesis	H <sub>0</sub>
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	percent	%
<b>Physics and chemistry</b>				probability	P
all atomic symbols				probability of a type I error (rejection of the null hypothesis when true)	α
alternating current	AC			probability of a type II error (acceptance of the null hypothesis when false)	β
ampere	A			second (angular)	"
calorie	cal			standard deviation	SD
direct current	DC			standard error	SE
hertz	Hz			variance	
horsepower	hp			population	Var
hydrogen ion activity (negative log of)	pH			sample	var
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

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MITIGATION MONITORING**

by

Joseph P. Hitselberger and Matthew J. Kern

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Juneau, AK

January 2012

This investigation was funded by the Alaska Department of Transportation & Public Facilities.

Cover Photos: (1) Habitat biologist Joseph Hitselberger at the mouth of 37 Mile Creek with a Dolly Varden char (*Salvelinus malma*); (2) Mouth of 37 Mile Creek and outlet of culvert CV-7. Copyright Alaska Department of Fish and Game. Photos by Matthew Kern.

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## ABSTRACT

The Alaska Department of Transportation and Public Facilities (ADOT&PF) reconstructed portions of the Haines Highway between Mileposts 25 and 40 (the U.S./Canada border) to improve public safety. Within the project area, the Klehini River and its tributaries support a number of salmonid species, including Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), pink (*O. gorbuscha*) and coho (*O. kisutch*) salmon; Dolly Varden char (*Salvelinus malma*); and cutthroat trout (*O. clarkii*).

ADOT&PF created 22.6 acres of wetlands, 3945 lineal feet of relocated stream, and 10,000 lineal feet of new stream to mitigate the impacts of the reconstruction project to fish and wildlife resources and habitats. The highway reconstruction and mitigation projects were completed in 2001. The Alaska Department of Fish and Game (ADF&G) completed a 10-year monitoring survey in 2011 to determine if the various sites have achieved their mitigation objectives. Most wetland, stream channel and culvert installation sites achieved the mitigation objectives that were outlined in the original mitigation plan (Inter-Fluve Inc. 2000). Stream channels CH-16 and CH-18 require additional monitoring before ADF&G can determine if mitigation objectives are met. Minor modifications are needed at the outlet of culvert CV-6 to maintain fish passage. Culverts CV-9, CV-10, CV-11, CV-12 and CV-13 require additional surveys at higher flows to determine if mitigation objectives are met.

## INTRODUCTION

The ADOT&PF reconstructed portions of the Haines Highway between Mileposts 25 and 40 (the U.S./Canada border) to improve public safety. This section of the highway lies between the Klehini River to the south and a steep hillside to the north. Within the project area, the Klehini River and its tributaries support a number of salmonid species, including Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), pink (*O. gorbuscha*) and coho (*O. kisutch*) salmon; Dolly Varden char (*Salvelinus malma*); and cutthroat trout (*O. clarkii*).

To mitigate the impacts of the reconstruction project to fish and wildlife resources and habitats, ADOT&PF created 22.6 acres of wetlands, 3945 lineal feet of relocated stream, and 10,000 lineal feet of new stream. The highway reconstruction and mitigation projects were completed in 2001.

ADOT&PF committed to monitoring the mitigation sites for up to 10 years after construction beginning in 2000. An analysis of the monitoring data will allow ADOT&PF to determine if the mitigation objectives are met and to document the long-term effectiveness of the mitigation techniques for potential use in future mitigation design. The ADF&G agreed to conduct the fieldwork for the mitigation monitoring and completed annual monitoring reports until 2006. To satisfy permit requirements, ADOT&PF requested the ADF&G Division of Habitat monitor 17 of the original 45 mitigation sites (Table 1) in 2011 and provide a report similar to prior annual reports, included as Appendix A.

## PURPOSE

Determine if the mitigation objectives for the Haines Highway reconstruction are met. Document the long-term effectiveness of the mitigation program for use in future mitigation design.

## LOCATION

Mitigation sites are located between milepost 25 and the U.S./Canada border at milepost 40 along the Haines Highway, near Haines, Alaska (Figure 1).

## METHODS

The major indicator of project success is salmonid use of all 17 mitigation sites. We conducted fieldwork during the historic run timing of adult coho salmon in the area to document the

presence of spawning salmonids visually, without capture. We trapped juvenile salmonids using the methods described in Magnus et al. (2006) using two-piece galvanized steel minnow traps (42×23 cm, 22 mm openings, 6.4 mm mesh; Aquatic Eco-Systems Apopka, FL<sup>a</sup>) baited with cured salmon eggs contained in a punctured or opened plastic bag (118 ml Whirl-Pak; Nasco, Fort Atkinson, WI<sup>b</sup>). We identified juveniles according to Pollard et al. (1997) and then released them back into the water body from which they were captured.

## MITIGATION SITES

Table 1.—Mitigation sites monitored in this study.

Site ID	Type	Year Completed	Year Monitored
WT-5	Wetland	2000 & 2001	2001 thru 2006, 2011
WT-6	Wetland	2001	2001 thru 2006, 2011
CH-12	Stream Channel	2000	2001 thru 2006, 2011
CH-13	Stream Channel	2000	2001 thru 2006, 2011
CH-14	Stream Channel	2001	2001 thru 2006, 2011
CH-15	Stream Channel	2000	2001 thru 2006, 2011
CH-16	Stream Channel	2001	2001 thru 2006, 2011
CH-17	Stream Channel	2001	2001 thru 2006, 2011
CH-18	Stream Channel	2000	2001 thru 2006, 2011
CV-6	Culvert	2000	2001 thru 2006, 2011
CV-7	Culvert	2006	2001 thru 2006, 2011
CV-8	Culvert	2000	2001 thru 2006, 2011
CV-9	Culvert	2000	2001 thru 2006, 2011
CV-10	Culvert	2000 & 2001	2001 thru 2006, 2011
CV-11	Culvert	2000 & 2001	2001 thru 2006, 2011
CV-12	Culvert	2000	2001 thru 2006, 2011
CV-13	Culvert	2000	2001 thru 2006, 2011

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<sup>a</sup> Product names used in this publication are included for completeness but do not constitute product endorsement.

<sup>b</sup> Ibid.

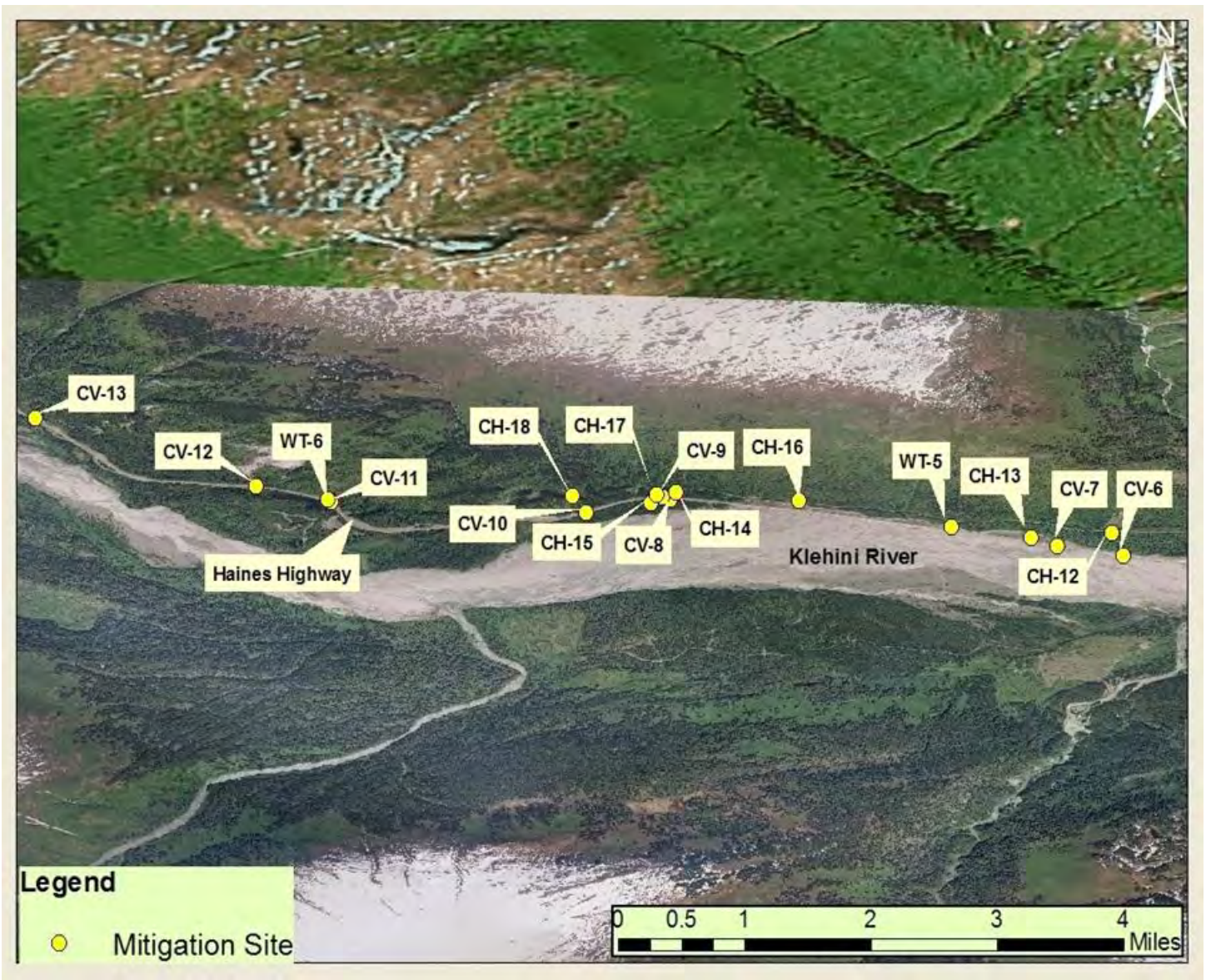


Figure 1.—Approximate location of mitigation sites.

## **PROJECT PERMIT SUMMARY**

### US Army Corps of Engineers

- Permit No. 2-920515 10/1995 (modified 6/10/98, 6/11/99 and 7/7/00)
- Authorization D-920515 for Nationwide Permit 3-slope repair 6/21/00
- Permit No. 2-920515 10/26/99 (modified 1/26/00)

### Alaska Department of Environmental Conservation

- Certificate of Reasonable Assurance 10/23/95
- Approval to Open Burn 11/2/98
- NPDES Storm Water General Permit # AKRI OA 704
- Letter of No Objection, Storm Water Management Plan No. 2021-WW-266-017 10/11/99

### Alaska Department of Fish and Game

- Fish Habitat Permit FG-98-I(J)-35 4/20/98
- Fish Habitat Permit FG-98-I(J)-36 4/20/98 (amended 6/7/99, 9/21/99 and 7/7/00)
- Fish Habitat Permit FG-98-I(J)-52 6/26/98 (amended 11/18/98, 9/21/99 and 5/5/00)
- Fish Habitat Permit FG-99-I(J)-13 4/16/99
- Fish Habitat Permit FG-99-I(J)-54 10/25/99 (amended 11/15/99, 1/11/00 and 1/12/00)
- Fish Habitat Permit FG-99-I(J)-55 10/25/99 (amended 11/15/99, 2/15/00 and 3/13/00)
- Fish Habitat Permit FG-99-I(J)-56 10/25/99 (amended 11/15/99)
- Fish Habitat Permit FG-99-I(J)-57 10/25/99 (amended 11/15/99)
- Fish Habitat Permit FG-00-I(J)-03 1/5/00 (amended 1/7/00 and 1/28/00)
- Fish Habitat Permit FG-00-I(J)-08 3/13/00
- Fish Habitat Permit FG-01-I(J)-20 5/25/01

### Alaska Department of Natural Resources

- Park Use Permit SEP 95-5-7
- Temporary Water Use Permit #SE95-16
- Temporary Water Use Permit #TWUP-J99-10 10/6/99
- Material Sale contract ADL#106605 9/30/99
- Final Consistency Determination ID No. AK9505-06JJ 10/2/95
- Final Consistency Determination 9/30/99

## **WETLANDS**

### **Mitigation Site WT-5**

**Location: 59.4363, -136.2486**

**Dates Surveyed: 6/18/11, 10/8/11, and 10/9/11**

### **Description**

Wetland WT-5 is split into four sections: wetland 5-A (Figure 2 and 3), wetland 5-B (Figure 4), wetland 5-C (Figure 5), and wetland 5-D (Figure 5 and 6). These sections combine to create 15.7 acres of wetland located between the new highway alignment and the north valley wall of the old Klehini River floodplain. These wetlands were created by excavating portions of the Klehini River floodplain to the surface of the low water table during the growing season. One foot of specified wetland soil was placed on this surface after grading, and planted with wetland seed mix. The 37 Mile Creek (Stream No. 115-32-10250-2077-3136) flows along the north perimeter of all four sections of WT-5. To separate 37 Mile Creek from WT-5, a large riparian berm has been constructed along much of the perimeter.

Approximately 18,000 linear feet of small channels (Figure 2, 3, 4, 5, and 6) were constructed within the wetlands. Groundwater from the wetland areas flow through these channels into 37 Mile Creek. These channels are all uniform in their construction (4–5 feet wide, 1–2 feet deep), and the streambed material consists of a mix of small gravel, sand, and organics. Large woody debris has been placed throughout the channels, and logs have been used to stabilize various sections of the streambank. Small shrubs and wetland grasses have also been planted along the riparian area of these channels (refer to Appendix A for specific plant species information). Other manmade features in the channels include small pools and riffles.



Figure 2.–WT-5 (Section A) looking west.

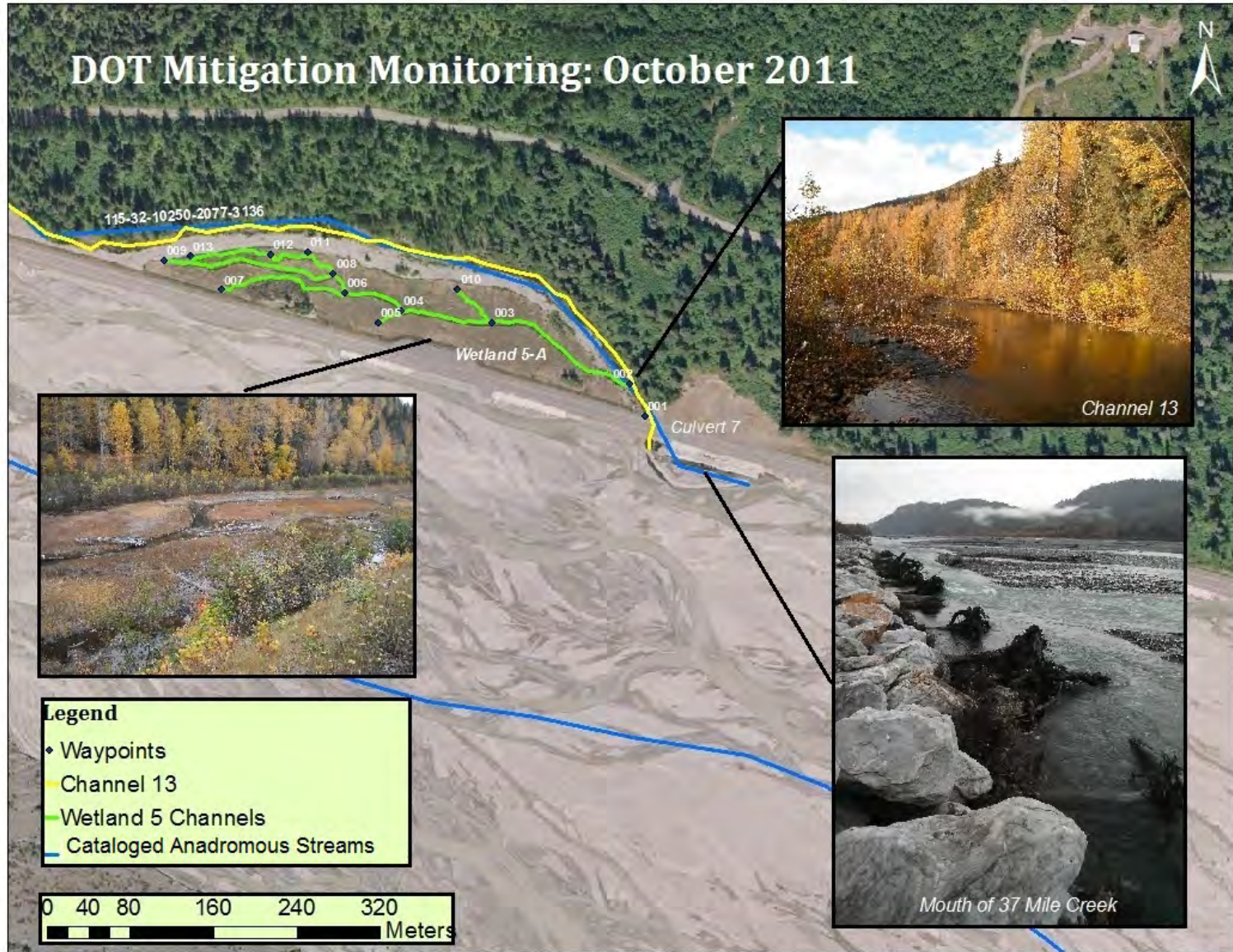


Figure 3.-WT-5 Section A map.

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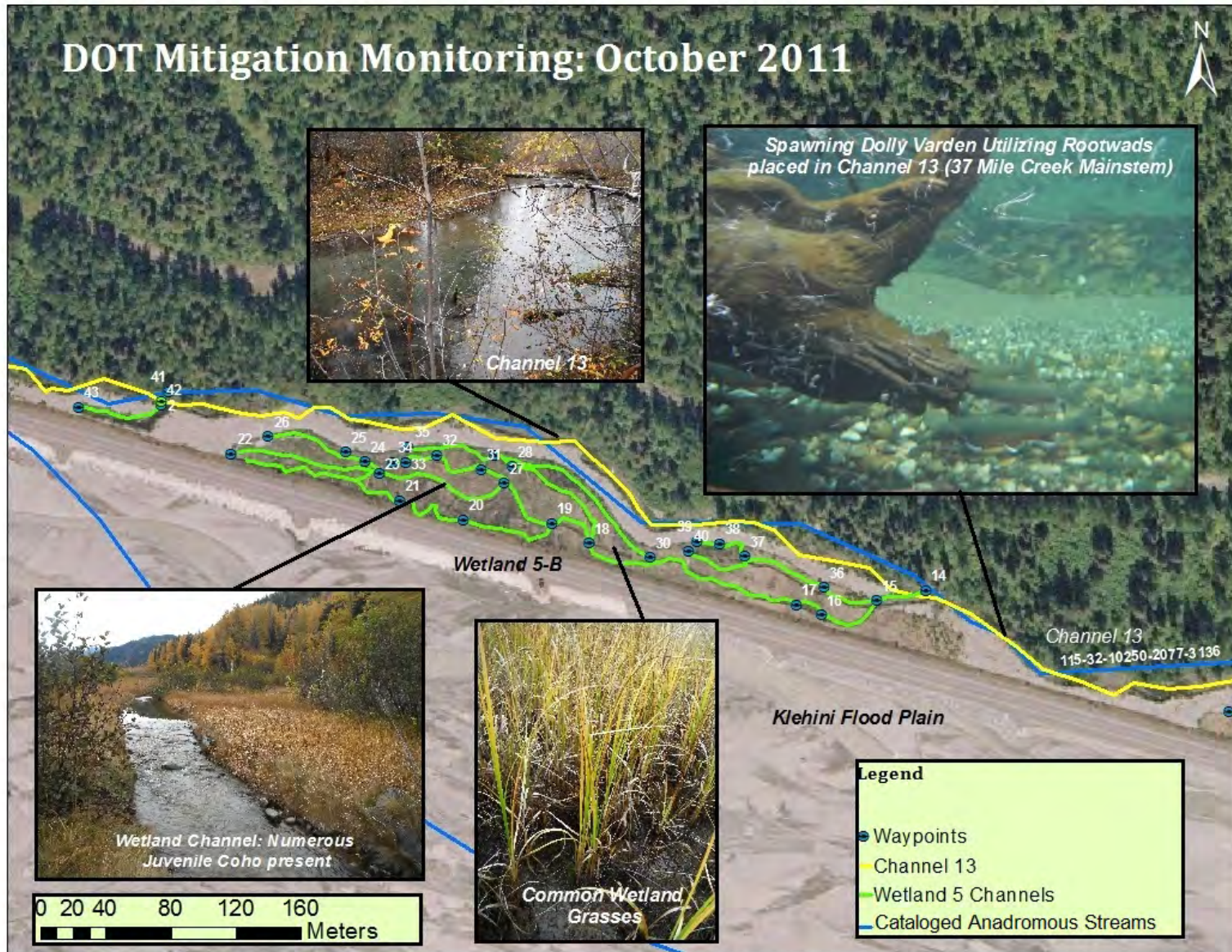


Figure 4.-WT-5 Section B map.

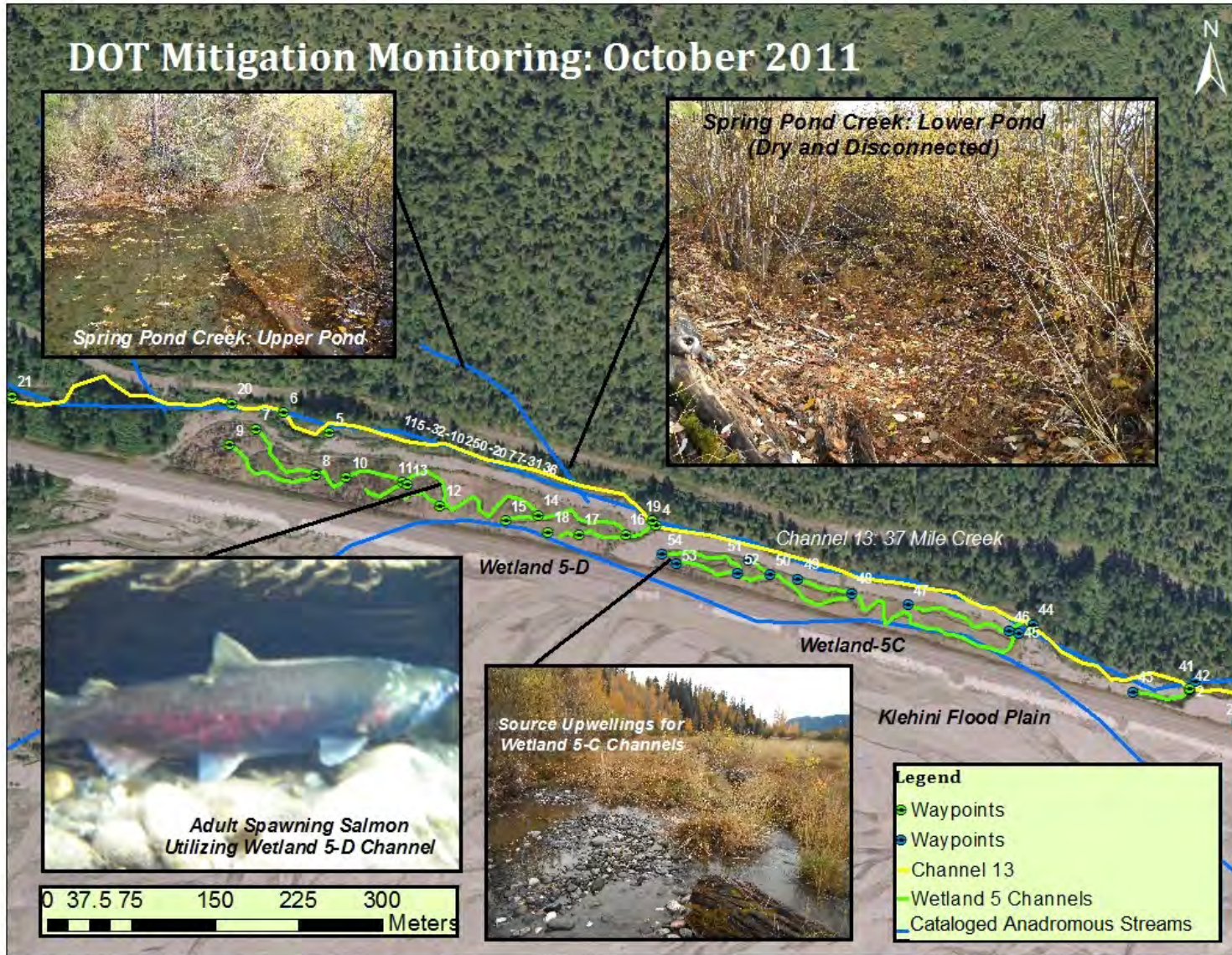


Figure 5.-WT-5 Section C and D map.





Figure 6.–WT-5 (Section D) looking east.

### **Mitigation Objectives**

The mitigation objective of wetland WT-5 is to create 15.7 acres of emergent wetland. There is no commitment with regard to the functioning of the small channels constructed in WT-5.

### **Observations**

Previous monitoring of WT-5 has been based on U.S. Army Corps of Engineers wetland delineation methodology. Current monitoring focuses on salmonid use and vegetation cover. Although the habitat function of the small channels within WT-5 was not identified as an original mitigation objective, current monitoring documents salmonid use of the channels. We documented vegetation cover and habitat use during the October survey. On June 18, 2011, Fish and Game Wildlife Technicians and interns Tess Quinn, Matthew Kern, Nolin Ainsworth and Rick Hoffman surveyed and mapped all of the stream channels within WT-5.

During the October survey, ADF&G staff documented well established plant communities throughout WT-5. The majority of WT-5 is heavily vegetated with annual and perennial grasses prescribed in the ADOT&PF vegetation planting plan. Riparian areas along the constructed stream channels contain a healthy mix of grasses and deciduous trees and shrubs that will continue developing. Log placement and root structure within the riparian area has provided for stable banks along the stream channels. The riparian berm along 37 Mile Creek is also well vegetated with willow, alder, and small coniferous trees. The established trees and shrubs along this berm are providing beneficial riparian habitat.

We did not collect soil pit and piezometer data during either survey, though we did note ground saturation and areas of surface water. Throughout WT-5, the soil was well saturated with surface

water generally restricted to the stream channels. We typically observed surface water in the eastern section of each wetland area (5-A, 5-B, 5-C, and 5-D).

We documented fish presence in WT-5 in all of the stream channels during both the June and October surveys. During the October survey, we observed thousands of juvenile salmonids in the channels. We observed one adult coho salmon in a stream channel of wetland 5-D (Figure5). During the June survey, we captured juvenile fish with a net for identification. We visually observed salmonids in the stream channels during October foot surveys. Table 2 outlines fish capture data from the June survey.

**Recommendations**

According to Cowardin et al., 1979, the emergent wetland class is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. All water regimes are included except subtidal and irregularly exposed.

WT-5 is split into four sections. All four sections of WT-5 contain well established perennial plant communities and have a water regime typical of an emergent wetland. Wetland vegetation in WT-5 will continue to develop in the riparian areas. Juvenile salmonid presence in the stream channels of WT-5 is well documented. All of the stream channels provide excellent rearing habitat. The mitigation objective for WT-5 has been achieved, and ADF&G does not recommend further monitoring.

Table 2.–Capture data from WT-5 on 6/18/2011.

Waypoint	Latitude	Longitude	Date/ Time	Sample Result
11	59.4356	-136.2423	18-JUN-11 9:18:37AM	1 coho, 40 mm
12	59.4356	-136.2429	18-JUN-11 9:20:28AM	1 coho, 35 mm; 1 Dolly Varden, 60 mm
16	59.4360	-136.2491	18-JUN-11 9:34:53AM	7 coho, 25–30 mm
17	59.4360	-136.2494	18-JUN-11 9:36:15AM	7 coho, 25–30 mm
20	59.4365	-136.2530	18-JUN-11 9:44:28AM	1 Dolly Varden, 30 mm
21	59.4366	-136.2537	18-JUN-11 9:48:10AM	1 coho, 25 mm
24	59.4368	-136.2541	18-JUN-11 9:56:55AM	1 Dolly Varden
25	59.4368	-136.2543	18-JUN-11 9:58:18AM	1 coho, 55 mm
28	59.4368	-136.2525	18-JUN-11 10:08:46AM	2 coho, 40 mm
32	59.4368	-136.2533	18-JUN-11 10:18:27AM	1 coho, 40 mm
33	59.4368	-136.2537	18-JUN-11 10:19:45AM	1 coho, 35 mm
36	59.4361	-136.2491	18-JUN-11 10:33:47AM	5 coho, 25–30 mm
38	59.4364	-136.2502	18-JUN-11 10:38:05AM	24 coho, 25–30 mm
40	59.4363	-136.2506	18-JUN-11 10:42:27AM	1 coho, 30 mm
42	59.4371	-136.2563	18-JUN-11 10:50:12AM	7 coho, 25–30 mm
45	59.4375	-136.2590	18-JUN-11 10:57:56AM	4 coho, 25–30 mm
46	59.4375	-136.2592	18-JUN-11 10:59:17AM	5 coho, 25–30 mm

## **Mitigation Site WT-6**

**Location: 59.4391, -136.3203**

**Date Surveyed: 10/10/11**

### **Description**

Wetland WT-6 (Figure 7) was created by excavating 0.1 acres of the abandoned highway embankment. ADOT&PF placed soil on the excavated area and planted a wetland seed mix.

### **Mitigation Objectives**

The mitigation objective of wetland WT-6 is to create 0.1 acres of wetland.



Figure 7.—Map of WT-6.

### **Observations**

We documented vegetation cover and ground saturation during our survey of wetland WT-6. Grasses and deciduous shrubs are well established in WT-6 (Figure 8). A smooth walled plastic culvert (approximately 24 inches) under the highway drains a small pond in the center of WT-6. The culvert drains into another wetland/ pond area (37 Mile Creek) on the southwest side of the highway. WT-6 is separated from 37 Mile Creek by a large berm, and groundwater is the primary source of water in the wetland.

### **Recommendations**

The mitigation objective of wetland WT-6 has been achieved. Wetland vegetation is well established and ground saturation indicates a typical wetland water regime. The culvert (Figure

9) and channel that drain the pond in WT-6 are not identified in the original mitigation monitoring plan (Inter-Fluve, 2000) and it is not clear when ADOT&PF installed the culvert designed for water conveyance rather than fish passage.



Figure 8.—WT-6.



Figure 9.—Culvert draining WT-6.

## STREAM CHANNELS

### Mitigation Site CH-12

**Location:** 59.4351, -136.2303

**Date Surveyed:** 10/8/11

### **Description**

Approximately 150 feet of a small tributary (uncataloged) to the Klehini River was filled in to construct the new highway embankment. Stream channel CH-12 was constructed to reconnect the tributary with the Klehini River. CH-12 is approximately 200 feet of channel upstream of culvert CV-6. The channel is between 3 and 4 feet wide and up to 2 feet deep (at bank full capacity) in some areas.

### **Mitigation Objectives**

The mitigation objective of CH-12 is to replace the 150 feet of stream channel that was filled.

### **Observations**

We tracked stream channel CH-12, and set two minnow traps in the channel for a period of 24 hours; one trap near the inlet of culvert CV-6 and the other near the upper extent of the constructed channel, at the base of a small water fall. We documented riparian vegetation and streambed material.

We observed juvenile salmonids (> 200) while we tracked the stream, though the water level in CH-12 was low. We captured 45 Dolly Varden char (50–120 mm) in the minnow trap near the inlet of culvert CV-6, and no fish near the upper extent of CH-12. The riparian area along both sides of the channel slopes gradually and is well vegetated with grasses and deciduous trees and shrubs (Figure 10). The streambed material in CH-12 consists of organics and sand, with a few areas of small gravel. Though woody debris and large rocks are present in a few areas of the channel, they are limited. The majority of the channel consists of shallow, slow moving water with a few small pools.



### **Recommendations**

Stream channel CH-12 provides fish habitat and the mitigation objective has been achieved, as riparian vegetation is well established and contributes to in-stream cover and woody debris.

Figure 10.—CH-12.

## **Mitigation Site CH-13**

**Location: 59.4351, -136.2398**

**Dates Surveyed: 10/8/11, 10/9/11 and 10/10/11**

### **Description**

Stream Channel CH-13 is a 7,000-foot long extension of 37 Mile Creek. The channel includes pools, runs and riffles, large woody debris, and spawning habitat. Stream channel CH-13 is adjacent to wetland WT-5, and is directly upstream of culvert CV-7. The riparian area along channel CH-13 river-right has been constructed and revegetated.

### **Mitigation Objectives**

The mitigation objective of stream channel CH-13 is to create coho spawning and rearing habitat. An additional mitigation objective is that natural processes limit riparian vegetation encroachment, and sediment accumulation in pools and embedded gravels.

### **Observations**

We conducted foot surveys on stream channel CH-13 to document adult fish presence, redds, riparian area vegetation, large woody debris placement and constructed pools, glides, riffles and runs. We set minnow traps in CH-13, near the inlet of culvert CV-7.

During our survey, we observed adult salmonids throughout CH-13. We saw adult Dolly Varden char and coho salmon holding near almost every river-right rootwad structure (Figure 11). While walking the bank of CH-13, we flushed fish out of holding areas for identification. We observed over 250 adult salmonids while surveying CH-13, the majority of which (80%) were Dolly Varden char. Though our survey was early in the season, we observed a few adult coho salmon carcasses along the banks of CH-13.

We observed large salmon redds in multiple areas along CH-13, with the majority in the riffle/run area near the inlet of culvert CV-7 (Figure 12). Division of Habitat and Sport Fish staff reported adult Chinook salmon actively spawning in this reach of CH-13. We soaked minnow traps for 24 hours and captured 7 Dolly Varden char (40–95 mm) and 3 coho salmon (60 mm). We observed juvenile salmonids throughout CH-13 during our streambank survey.

Riparian area vegetation is well established on the river-right berm along the entire length of CH-13. Alder, willow and small coniferous trees are interspersed with small shrubs and grasses. The river-left bank is steeper and naturally vegetated with large Sitka Spruce, deciduous trees and overhanging shrubs. Anchored root-wad structures (as seen in Figure 11) and engineered log jams create instream pools and glides.

### **Recommendations**

The mitigation objectives for stream channel CH-13 have been achieved. The channel provides coho spawning and rearing habitat. We observed adult and juvenile coho salmon and spawning redds in the channel during our survey. The large woody debris in the channel creates riffle/run and pool/glide areas. Anchored root-wads along river-right provide milling/holding habitat for adult and juvenile salmonids.

Riparian area vegetation is well established and does not appear to be encroaching into the channel. Sediment deposition throughout the channel imitates a natural stream channel and does not accumulate in pools or spawning gravels. The design and construction of CH-13 will continue to provide spawning and rearing habitat.



Figure 11.—Multiple Dolly Varden char under large woody debris.

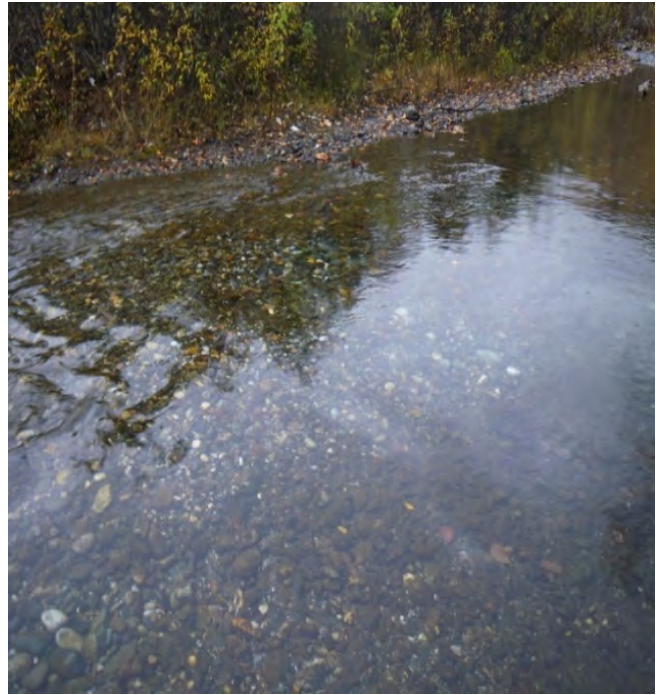


Figure 12. Redds upstream of CV-7.

## **Mitigation Site CH-14**

**Location: 59.4399, -136.2800**

**Date Surveyed: 10/8/11 and 10/9/11**

### **Description**

Stream channel CH-14 is 2,500 feet of natural channel in 37 Mile Creek, downstream of culvert CV-9. Large woody debris and spawning gravels were placed in CH-14 to enhance habitat.

### **Mitigation Objective**

The mitigation objective for stream channel CH-14 is to enhance existing coho salmon rearing and spawning habitat.

### **Observations**

We conducted a foot survey along stream channel CH-14 and documented large woody debris and spawning gravels. We used minnow traps to document juvenile fish presence within CH-14. Large woody debris is present in CH-14, especially near the outlet of culvert CV-9 (Figure 13).

We observed adult Dolly Varden char as we did in stream channel CH-13, holding under the woody debris. Spawning gravels are located in small sections throughout CH-14. The majority of the spawning gravels, however, are located within 100 feet of the outlet of culvert CV-9. We noted that gravel and large woody debris placement in other sections of CH-14 help create habitat diversity, including riffle/run and pool habitat. Juvenile fish trapping, near the outlet of culvert CV-9, produced 7 Dolly Varden char and 3 coho salmon ranging in size from 60 to 170 mm (trap set for 24 hours). We observed juvenile salmonids throughout the survey area.

### **Recommendations**

The mitigation objectives for stream channel CH-14 have been achieved. Large woody debris and spawning gravels have enhanced channel diversity, and rearing and spawning capacity in CH-14. We did not observe adult coho salmon or redds during our survey, but the habitat within CH-14 contains multiple areas with suitable spawning gravels (Kondolf and Wolman, 1993). The structures constructed in CH-14 are stable.



Figure 13.—Large woody debris and spawning gravels in CH-14.



## **Mitigation Site CH-15**

**Location: 59.4386, -136.2831**

**Dates Surveyed: 10/8/11 and 10/9/11**

### **Description**

Stream channel CH-15 is 700 feet of relocated and reconstructed 37 Mile Creek. This channel is directly upstream of culvert CV-9 and is a sequence of pools and riffles. ADOT&PF placed large woody debris and spawning gravels in the channel to provide habitat diversity.

### **Mitigation Objective**

The mitigation objective for stream channel CH-15 is to replace the section of channel that was filled in during construction of the highway embankment, and to provide additional coho rearing and spawning habitat.

### **Observations**

We surveyed stream channel CH-15 on foot, and documented large woody debris and areas with suitable spawning gravel. We minnow trapped to document juvenile salmonid presence within CH-15. We documented a secondary over flow channel near the inlet of culvert CV-9. ADOT&PF constructed this channel to limit flows entering stream channel CH-14 via culvert CV-9 to no greater than a 10-year flood discharge.

Large woody debris within CH-15 appears to be stable and provides habitat diversity with areas of slower moving water where we observed juvenile salmonids. The streambed material is also stable. Pool/riffle habitat CH-15 is as specified in the design plans, as seen in Figure 14. We observed adult Dolly Varden char in CH-15, especially near the inlet to culvert CV-9. Minnow trapping near the inlet of culvert CV-9 produced 4 Dolly Varden char and 3 juvenile coho salmon ranging in size from 40 to 150 mm (trap set for 24 hours). We also observed multiple juvenile salmonids throughout CH-15 during the survey. However, we did not observe adult coho salmon or redds in CH-15 during our survey.



### **Recommendations**

The mitigation objectives for stream channel CH-15 have been achieved. Large woody debris and spawning gravels are stable and provide spawning and rearing habitat. Juvenile salmonids are rearing in the channel, and the spawning habitat should support adult salmonid reproduction (Kondolf and Wolman, 1993).

Figure 14.–Stream channel CH-15.

## **Mitigation Site CH-16**

**Location: 59.4392, -136.2663**

**Date Surveyed: 10/10/11**

### **Description**

A 24-inch diameter culvert was removed from the abandoned highway. Spring Pond Creek (Stream No. 115-32-10250-2077-3136-4002) originally flowed through the culvert from an uphill pond to a smaller pond near the old highway embankment. Spring Pond Creek is cataloged for coho salmon and cutthroat trout rearing. Originally, flows from the lower pond discharged into 37 Mile Creek as undefined seeps through the streambank, and fish passage was undocumented. Stream channel CH-16 is two section— one upstream section connecting the two ponds, and one downstream section conveying flow into 37 Mile Creek.

### **Mitigation Objective**

The mitigation objective for stream channel CH-16 is to restore a segment of Spring Pond Creek from a culvert to an open channel. There is no commitment to establish fish passage but the channel is expected to improve passage from pre-project conditions.

### **Observations**

During our survey, both sections of CH-16 were dry. Therefore we did not sample for adult or juvenile salmonids. Vegetation in the channel is established, especially in the lower section of CH-16 (Figure 15), indicating that the channel is dry most of the year. Surface water was only present in the upper pond (Figure 16), where we observed an adult Dolly Varden char.

### **Recommendations**

Spring Pond Creek was included in the *Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes* (AS 16.05.871(a)) in 2004 (Johnson, 2011). Juvenile coho salmon and Dolly Varden char were documented in the upper pond during a survey in 2006 (Appendix A). The construction of stream channel CH-16 initially enhanced fish passage into both of the ponds. Vegetation in the channel, seasonal flows dependant on snow pack, and precipitation all influence fish passage through CH-16.

By removing the culvert and establishing channel CH-16, the mitigation objective has been achieved. However it is not clear if the design features of the channel contribute to the seasonal flows of Spring Pond Creek. Therefore, we recommend that habitat biologists return to survey the site during a period of high water so we can determine if a modification is required.



Figure 15.—Lower section of stream channel CH-16.



Figure 16—Upper pond of CH-16.

## **Mitigation Site CH-17**

**Location: 59.4409, -136.2813**

**Date Surveyed: 10/10/11**

### **Description**

McKenzie Creek (Stream No. 115-32-10250-2077-3136-4010) originally flowed through a pair of 6-foot 6-inch by 7-foot culverts, under the old Haines Highway. Stream channel CH-17 is a 64-foot long cobble bed stream section that replaces the culverts. CH-17 will have a pool/riffle feature and a 50-foot wide floodplain terrace.

### **Mitigation Objective**

The mitigation objective for stream channel CH-17 is to restore a segment of McKenzie Creek from culverts to an open channel. The stream channel will have improved fish passage conditions over the previous culverts.

### **Observations**

Stream channel CH-17 flows into 37 Mile Creek near stream channel CH-14. The slow to moderate velocity flow in the channel suggests that fish are able to pass through this area. A pool/riffle feature in the upper section of CH-17 is stable and functioning (Figure 17). Streambed material in the channel is made up of sand, organics and some areas of small gravel. The streambanks along CH-17 are gradually sloping, except for a few areas where undercut banks are starting to develop. Riparian vegetation is established, and the channel appears to provide rearing habitat. Though we did not set minnow traps in the channel, we observed juvenile salmonids. We did not observe adult salmonids during our survey. Anecdotally, area residents report that adult coho salmon pass through CH-17 to access upstream spawning habitat.



Figure 17.–Pool/riffle habitat in CH-17.

### **Recommendations**

The mitigation objectives for stream channel CH-17 have been achieved. Riparian vegetation and undercut banks contribute to the habitat quality of the channel and will continue to develop. We did not observe design features that will limit fish passage during our survey. We did not measure water velocity through CH-17. The channel is typical to what we observed in unmodified sections of the creek. The log and rocks used in the design of the pool/riffle habitat are stable.

## **Mitigation Site CH-18**

**Location: 59.4404, -136.2923**

**Date Surveyed: 10/10/11**

### **Description**

Stream channel CH-18 is a 150-foot channel that was created to replace a section of 37½ Mile Creek (Stream No. 115-32-10250-2077-3136-4018) that was filled in to construct the new highway embankment. Stream channel CH-18 is directly upstream of culvert CV-10.

### **Mitigation Objective**

The mitigation objective for stream channel CH-17 is to replace the habitat covered by fill.

### **Observations**

During our survey the water level in CH-18 was very low (Figure 18), and we did not observe salmonids. We placed a baited minnow trap in the channel for approximately 4 hours and did not capture any salmonids. Riparian vegetation along CH-18 is very thick with deciduous trees and shrubs. The streambed in CH-18 is comprised of sand and organics, except for a gravel area near the inlet to culvert CV-10. The channel drains 37½ Mile Pond (Stream No. 115-32-10250-2077-3136-4018-0010; Figure 19) located just upstream.

### **Recommendations**

The mitigation objective for stream channel CH-18 is too vague. Stream channel CH-18 does convey water flow to culvert CV-10, but we were unable to document fish passage through the channel. The 37½ Mile Creek is cataloged for coho salmon and Dolly Varden char. When replacing a section of a cataloged stream, fish passage needs to be maintained. We recommend that habitat biologists return to survey the channel when water levels are higher.



Figure 18.—Low water in stream channel CH-18.



Figure 19.—37½ Mile Pond upstream of CH-18.

## CULVERTS

### **Mitigation Site CV-6**

**Location: 59.4330, -136.2290**

**Dates Surveyed: 10/8/11 and 10/9/11**

### **Description**

Culvert CV-6 is a 78-foot long by 48-inch wide corrugated metal pipe (CMP). An uncataloged tributary flows through culvert CV-6 into the Klehini River. Stream channel CH-12 is directly upstream of the culvert. Design specifications for the culvert indicate that one foot of streambed material was placed in the culvert during installation.

### **Mitigation Objective**

The mitigation objective for culvert CV-6 is to provide passage for fish upstream and downstream for all flows up to the design flow.

### **Observations**

The culvert is well bedded at the inlet (Figure 20), where multiple juvenile salmonids were observed. The streambed within the culvert is comprised of sand, gravel and organic material that is stable. The size of the culvert is appropriate for the size of the stream, and there is no visual change in water velocity as the stream enters the culvert. We set a baited minnow trap near the inlet of CV-6 and soaked it for 24 hours.



Figure 20.—Inlet to culvert CV-6.

Culvert CV-6 is located in a section of the Haines Highway that is directly adjacent to the Klehini River (Stream No. 115-32-10250-2077). Fill material has been placed along this section of the highway (1–2 miles) to help stabilize the highway embankment and protect against erosion. This project is not identified in the original mitigation plan. It is not clear when the

material was placed; it was not present during the 2006 mitigation monitoring event (Appendix A), and I was unable to locate any Fish Habitat Permit history on the project.

The outlet of culvert CV-6 may have been set to design specifications, but it is slowly filling up with sediment (Figure 21). The boulders placed near the outlet of the culvert may compound sediment accumulation (Figure 22). We observed juvenile salmonids near the outlet of CV-6, and set a baited minnow trap near the outlet, soaking it for 24 hours. We captured 15 Dolly Varden char (60–100 mm) and 7 coho salmon (60–80 mm) near the inlet of culvert CV-6. The trap set near the outlet of CV-6 produced 7 Dolly Varden char (60–100 mm) and 26 coho salmon (50–75 mm).



Figure 21—Outlet of culvert CV-16.



Figure 22.—Fill material placed near CV-6.

### **Recommendations**

Culvert CV-6 has met the mitigation objective by providing fish passage; however the accumulation of sediment near the culvert outlet will need to be addressed. The accumulation may restrict adult fish passage through CV-6, and it may become a problem for juvenile fish passage in the future. We recommend that ADOT&PF work with Habitat Division to address this issue as soon as possible.

### **Mitigation Site CV-7**

**Location: 59.4340, -136.2364**

**Dates Surveyed: 10/8/11 and 10/9/11**

### **Description**

Culvert CV-7 is 76-foot 6-inch long by 20-foot 3-inch wide by 8-foot 5-inch high aluminum culvert. The culvert is located on 37 Mile Creek near the confluence with the Klehini River, directly downstream of stream channel CH-13. ADOT&PF placed streambed material in the culvert and constructed a pool near the outlet of CV-7. The project was completed in September 2006.

### **Mitigation Objective**

The mitigation objective for culvert CV-7 is to provide passage for fish upstream and downstream for all flows up to the design flow.

### **Observations**

Streambed material within culvert CV-7 is stable (spawning sized gravel; Kondolf and Wolman, 1993), and the culvert is the appropriate size for the stream (Figure 23). Water velocity through the culvert does not appear to change or represent a fish passage barrier. We set two baited minnow traps near the culvert inlet allowed them to soak for 24 hours, capturing 7 Dolly Varden char (40–95 mm) and 1 coho salmon (60 mm). We observed multiple redds approximately 20 feet upstream of the culvert inlet, and Divisions of Habitat Sport Fish staff observed adult Chinook salmon actively spawning within the culvert earlier in the season.



Figure 23.—Inlet to culvert CV-7.

Approximately 50 adult salmonids (coho salmon and Dolly Varden char) were holding in the constructed pool just downstream of the culvert (Figure 24). Fill material has also been placed along the highway near the outlet of culvert CV-7 and is placed in a way that prevents sediment accumulation from the Klehini River. We observed adult coho salmon holding under rootwad structures associated with the fill project along the highway (Figure 25).

### **Recommendations**

The mitigation objectives for culvert CV-7 have been achieved. The culvert provides fish passage, and the modifications associated with the culvert provide suitable fish habitat.



Figure 24.—Outlet pool and fill material near CV-7.

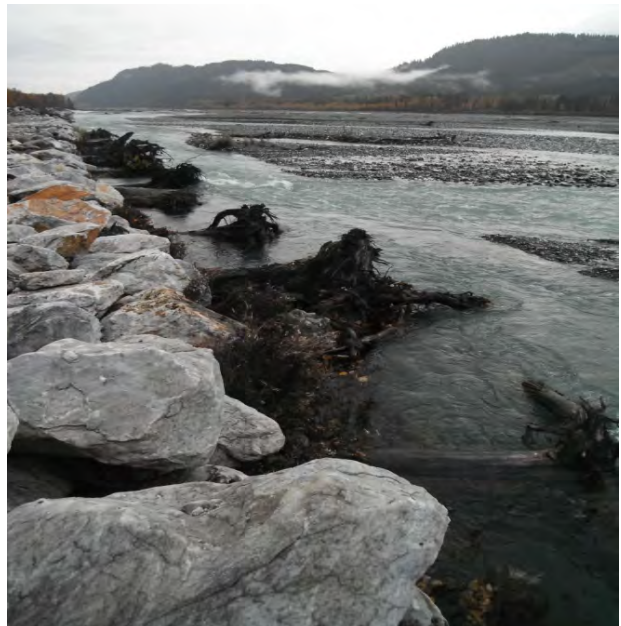


Figure 25.—Rootwad structures near CV-7.



## **Mitigation Site CV-8**

**Location: 59.4390, -136.2808**

**Dates Surveyed: 10/8/11 and 10/9/11**

### **Description**

Culvert CV-8 is a 200-foot long by 48-inch wide CMP. The culvert conveys flows of an uncataloged stream through the new highway embankment to 37 Mile Creek. Design specifications for the culvert indicate that one foot of streambed material was placed in the culvert during installation.

### **Mitigation Objective**

The mitigation objective for culvert CV-8 is to provide passage for fish upstream and downstream for all flows up to the design flow.

### **Observations**

Streambed material within culvert CV-8 (Figure 26 and 27) is comprised of sand and organics, and appears to be stable. The culvert is the appropriate size for the stream, and water velocity through the culvert does not appear to change or represent a fish passage barrier. We set baited minnow traps near the culvert inlet and outlet for 24 hours and captured 5 Dolly Varden char (45–100 mm) and 2 coho salmon (50 mm) near the inlet, and 41 coho salmon (40–75 mm) near the outlet.

### **Recommendations**

The mitigation objective for culvert CV-8 has been achieved. The culvert provides fish passage, and currently there are no recommendations to modify the CMP.



Figure 26.–Culvert CV-8 inlet.



Figure 27.–Culvert CV-8 outlet.

## **Mitigation Site CV-9**

**Location: 59.4392, -136.2819**

**Dates Surveyed: 10/8/11 and 10/9/11**

### **Description**

Culvert CV-9 is a 126-foot long by 14-foot 3-inch wide by 9-foot 7-inch high aluminum structural plate pipe arch culvert (Figure 28 and 29). The culvert is located on 37 Mile Creek, connecting stream channels CH-14 and CH-15. ADOT&PF placed approximately 1 foot 6 inches of class I riprap topped with 6 inches of gravel in the culvert. A bypass channel located near the inlet to CV-9 (stream channel CH-15) limits flood flows through the culvert.

### **Mitigation Objective**

The mitigation objective for culvert CV-9 is to provide passage for fish upstream and downstream for all flows up to the design flow.

### **Observations**

Streambed material within culvert CV-9 is stable is comprised of spawning-sized gravel (Kondolf and Wolman, 1993). Water velocity appears to slightly increase through the culvert, but there is no evidence of streambed scouring. There is little habitat complexity within the culvert. We set baited minnow traps near the culvert inlet and outlet for 24 hours capturing 4 Dolly Varden char (60–150 mm) and 3 coho salmon (50 mm) near the inlet, and 7 Dolly Varden char (70–170 mm) 3 coho salmon (60–80 mm) near the outlet. We observed adult Dolly Varden char inside the culvert.

### **Recommendations**

The mitigation objective for culvert CV-9 has been achieved. There is a potential for increased water velocity during high water to limit juvenile fish passage through the culvert. We recommend habitat biologists return to culvert CV-9 during high flows to re-survey the culvert.



Figure 28.–Culvert CV-9 inlet.



Figure 29.–Culvert CV-9 outlet.

**Mitigation Site CV-10**

**Location: 59.4373, -136.2908**

**Date Surveyed: 10/10/11**

**Description**

Culvert CV-10 is a 100-foot long by 54-inch wide CMP (Figure 30 and 31). The culvert is located on 37½ Mile Creek, directly downstream of stream channel CH-18. ADOT&PF placed approximately 1 foot of class I riprap topped with 6 inches of gravel in the culvert.

**Mitigation Objective**

The mitigation objective for culvert CV-10 is to provide passage for fish upstream and downstream for all flows up to the design flow.

**Observations**

The culvert appears to be installed to the design specifications; however, the water level was too low to determine fish passage through the CMP. Stream bed material within the culvert is stable, and the water velocity remains unchanged through the CMP. We set a baited minnow trap near the culvert inlet and outlet for 3½ hours capturing one coho salmon (50 mm) near the culvert outlet. Thick vegetation around both the culvert inlet and outlet suggests water flow is seasonal in this stream.

**Recommendations**

During our survey we were unable to determine if the mitigation objective for culvert CV-10 has been achieved. We recommend habitat biologists return to survey the culvert when water levels are higher.



Figure 30.–Culvert CV-10 inlet.



Figure 31.–Culvert CV-10 outlet.

## **Mitigation Site CV-11**

**Location: 59.4385, -136.3195**

**Date Surveyed: 10/10/11**

### **Description**

Culvert CV-11 is a 100-foot long by 9-foot wide CMP (Figure 32 and 33). The culvert is located on 37 Mile Creek, adjacent to wetland WT-6. ADOT&PF placed approximately 2 feet of class I riprap topped with gravel in the culvert.

### **Mitigation Objective**

The mitigation objective for culvert CV-11 is to provide passage for fish upstream and downstream for all flows up to the design flow.

### **Observations**

The culvert appears to be installed to the design specifications; however there is evidence of sediment movement through the culvert. The stream flows against river-right as it passes through the culvert. This section of the stream appears to have a steeper gradient and higher velocity compared to other sections of 37 Mile Creek. We set a baited minnow trap near the culvert inlet and outlet for 3½ hours. We did not observe or capture fish during our survey of culvert CV-11.

### **Recommendations**

During our survey we were unable to determine if the mitigation objective for culvert CV-11 has been achieved. We recommend habitat biologists return to the site to survey the culvert again before we determine if the mitigation objective has been met.



Figure 32.—Culvert CV-11 inlet.



Figure 33.—Culvert CV-11 outlet.

## **Mitigation Site CV-12**

**Location: 59.4408, -136.3284**

**Date Surveyed: 10/10/11**

### **Description**

Culvert CV-12 is an aluminum box culvert (Figure 34 and 35) 58-foot 6-inch long by 13-foot 3-inch wide by 6-foot 9-inch high. The culvert is located on Stream No. 115-32-10250-2077-3136-4053. ADOT&PF placed approximately 1 foot of streambed material in the culvert.

### **Mitigation Objective**

The mitigation objective for culvert CV-12 is to provide passage for fish upstream and downstream for all flows up to the design flow.

### **Observations**

The culvert appears to be installed to the design specifications, and streambed material (sand) within the culvert is stable. Water velocity through the culvert is low and the culvert appears to be the appropriate size for the stream. We set a baited minnow trap near the culvert inlet and outlet for 3½ hours. We did not observe or capture fish during our survey of culvert CV-12.

### **Recommendations**

During our survey we were unable to determine if the mitigation objective for culvert CV-12 have been achieved. We recommend habitat biologists return to the site to survey the culvert again before we determine if the mitigation objective has been met.



Figure 34.–Culvert CV-12 inlet.



Figure 35.–Culvert CV-12 outlet.

### **Mitigation Site CV-13**

**Location: 59.4483, -136.3538**

**Date Surveyed: 10/10/11**

#### **Description**

Culvert CV-13 is a 100-foot long by 8-foot wide by 6-foot high aluminum structural plate pipe arch culvert (Figure 36 and 37). The culvert is located on 40 Mile Creek (Stream No. 115-32-10250-2077-3180). Due to the steep gradient of the culvert, ADOT&PF installed baffles to improve fish passage.

#### **Mitigation Objective**

The mitigation objective for culvert CV-13 is to improve fish passage conditions over the previous culvert. Streambed accumulation behind the baffles helps to achieve this objective.

#### **Observations**

The culvert appears to be installed to design specifications, and streambed material is being deposited behind the baffles in the culvert. Due to the steep gradient, water velocity is high, but similar velocity was observed in the stream channel. We set baited minnow traps near the culvert inlet and outlet for four hours, capturing one Dolly Varden char (40 mm) in each trap. Adult Dolly Varden char were observed upstream of the culvert, and a local resident reports observing adult coho salmon moving through the culvert.

#### **Recommendations**

During our survey we were unable to determine if the mitigation objective for culvert CV-12 has been achieved. The culvert does appear to be installed to the design specifications; however fish passage cannot be confirmed. We recommend that habitat biologists return to survey the culvert so we can determine if the mitigation objective has been met.



Figure 36.–Culvert CV-13 inlet.



Figure 37.–Culvert CV-13 outlet.

## CONCLUSION

Most mitigation sites have achieved the objectives described in the original monitoring plan (Inter-Fluve Inc., 2000). Both wetland sites are functioning well and we do not propose any modifications. Most stream channels meet the mitigation objectives. We will need to re-survey stream channel CH-16 and CH-18 to determine if the mitigation objectives have been met.

Many of the culverts within the project area will need to be re-surveyed at high flows before we can determine if the mitigation objectives have been achieved. Fish passage was not documented at culverts CV-10, CV-11, CV-12, and CV-13. Culvert CV-9 will need to be surveyed again to determine if water velocity through the structure restricts fish passage. Though juvenile salmonids are currently able to pass culvert CV-6, sediment accumulation near the outlet needs to be addressed.

Habitat Division looks forward to working with ADOT&PF staff to address outstanding issues on this important project.

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## **APPENDIX A**

Appendix A.–Haines Highway Mitigation Monitoring Report 2006 Annual Report.