Proposed Stetson Creek Diversion
2005 Studies Technical Memoranda

Cooper Lake Project (FERC No. 2170)

Prepared by
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Cultural Resource Consultants
Land Design North
Northern Ecological Services

Prepared for
Chugach Electric Association, Inc.

August 2005

Introduction

This document, including the attached the technical memoranda, describes the results of the study program to evaluate resources in the vicinity of Stetson Creek, the major tributary to Cooper Creek, and the potential impacts on those resources that may occur with development and/or operation of a proposed diversion of Stetson Creek under the new license for the Cooper Lake Project (Project). The Stetson Creek studies were undertaken as part of the Agreement in Principle (AIP) reached in March 2005 and to support the comprehensive Settlement Agreement (SA) which will be filed with FERC not later than August 31, 2005. These agreements were negotiated by Chugach Electric Association, Inc. (Chugach) and a number of federal and state agencies, a Native American tribe, and non-governmental organizations.

The proposed measures outlined in the SA include establishment of an instream flow regime to increase stream temperatures in Cooper Creek, which will expand the area of suitable spawning, incubation, and rearing habitat for salmon and trout. The stream flow and temperature modifications will be accomplished by diverting relatively cold flow from Stetson Creek into Cooper Lake and releasing warmer water from Cooper Lake into Cooper Creek. The SA provides that, within six years after issuance of a new license, Chugach will construct and begin operating the following new facilities to establish the proposed instream flow regime in Cooper Creek (see Figure 1):

- Diversion structure with manual controls on Stetson Creek approximately 7,000 upstream feet from Stetson Creek's confluence with Cooper Creek. A conceptual diagram of this diversion structure is shown in Figure 2. Such diversion structure will allow for minimum instream flow releases and flushing flows as described in the SA.
- Pipeline (approximately 11,000 feet) from the Stetson Creek diversion structure to an outflow point in Cooper Lake, approximately 1,000 feet from the Cooper Lake Dam. The pipeline will accommodate flows up to a maximum of 110 cfs. A conceptual map of the pipeline is shown in Figure 3.
- Cooper Lake Dam outlet structure to allow for the release of water from Cooper Lake into Cooper Creek through the existing Project dam from a manually controlled, screened diversion structure within Cooper Lake (about 600 feet from the crest of the dam) to an outflow energy dissipation structure downstream of the dam, with the ability to maintain a flow capacity of up to 30 cfs. A conceptual diagram of the Cooper Lake Dam outlet structure is shown in Figure 4.

This Stetson Creek study program comprised a total of eight separate study components, as follows:

- Fish and Macroinvertebrates (Attachment I)
- Accretion Flows (Attachment II)
- Terrestrial Wildlife (Attachment III)
- Vegetation and Wetlands (Attachment IV a and Attachment IV b, respectively)
- Sensitive Plants (Attachment V)

- Cultural Resources (Attachment VI)
- Recreation and Visual Resources (Attachment VII)
- Pipeline/Access Route Erosion Potential (Attachment VIII)

These studies were conducted in May–August 2005 by biologists and other professionals on staff at HDR Alaska, Land Design North, Northern Ecological Services, and Cultural Resource Consultants. The Proposed Stetson Creek Diversion Final 2005 Study Plans document follows as Attachment IX.

Agency Consultation and Coordination

The study planning and implementation were undertaken in consultation and coordination with resource experts from the USDA Forest Service Chugach National Forest (USFS), the U.S. Fish and Wildlife Service (USFWS), the Alaska Department of Fish and Game (ADF&G), the Alaska Department of Natural Resources (ADNR), the Alaska State Historic Preservation Officer (SHPO), the Kenaitze Indian Tribe, the Native Village of Eklutna, and interested non-governmental organizations.

Conceptual Diagram of the Stetson Creek Diversion Pipeline

Cooper Lake Project
FERC #2170

LEGEND

- Pipeline and Access Road
- Outlet Structure
- Diversion Dam

1. Mapping completed by HDR Alaska, Inc.
2. All data shown is projected in Alaska stateplane zone 4, North American datum of 1927

0 250 500 1,000
Feet

HDR Alaska

Date: 4/28/2005
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Author: JS

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FIGURE
1

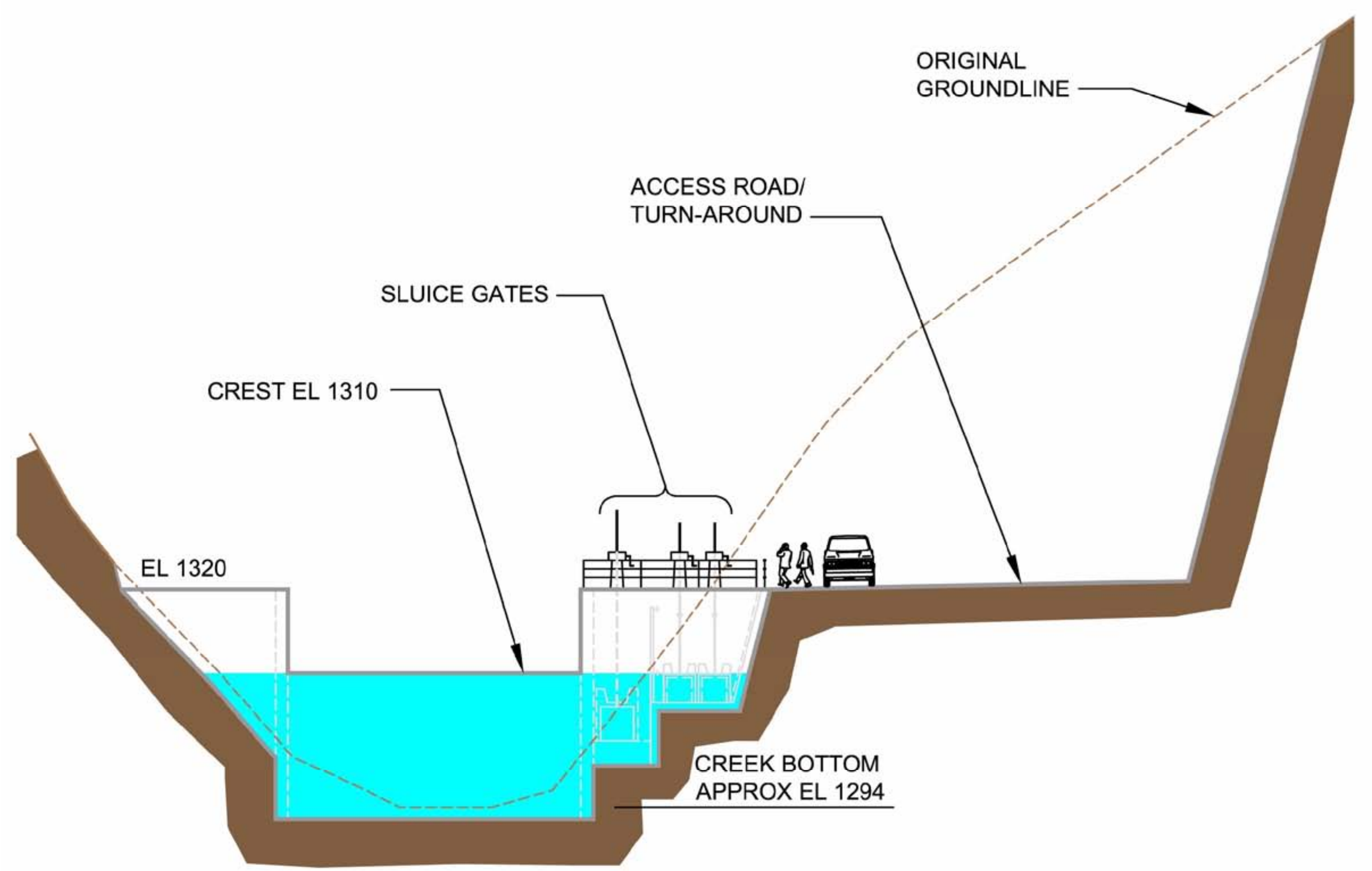

FIGURE 2

Conceptual Diagram of the Stetson Creek Diversion Structure

Cooper Lake Project
FERC #2170

1. Data compiled by MWH, Inc.
2. Figure Compiled by HDR Alaska, Inc.

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Author: JS

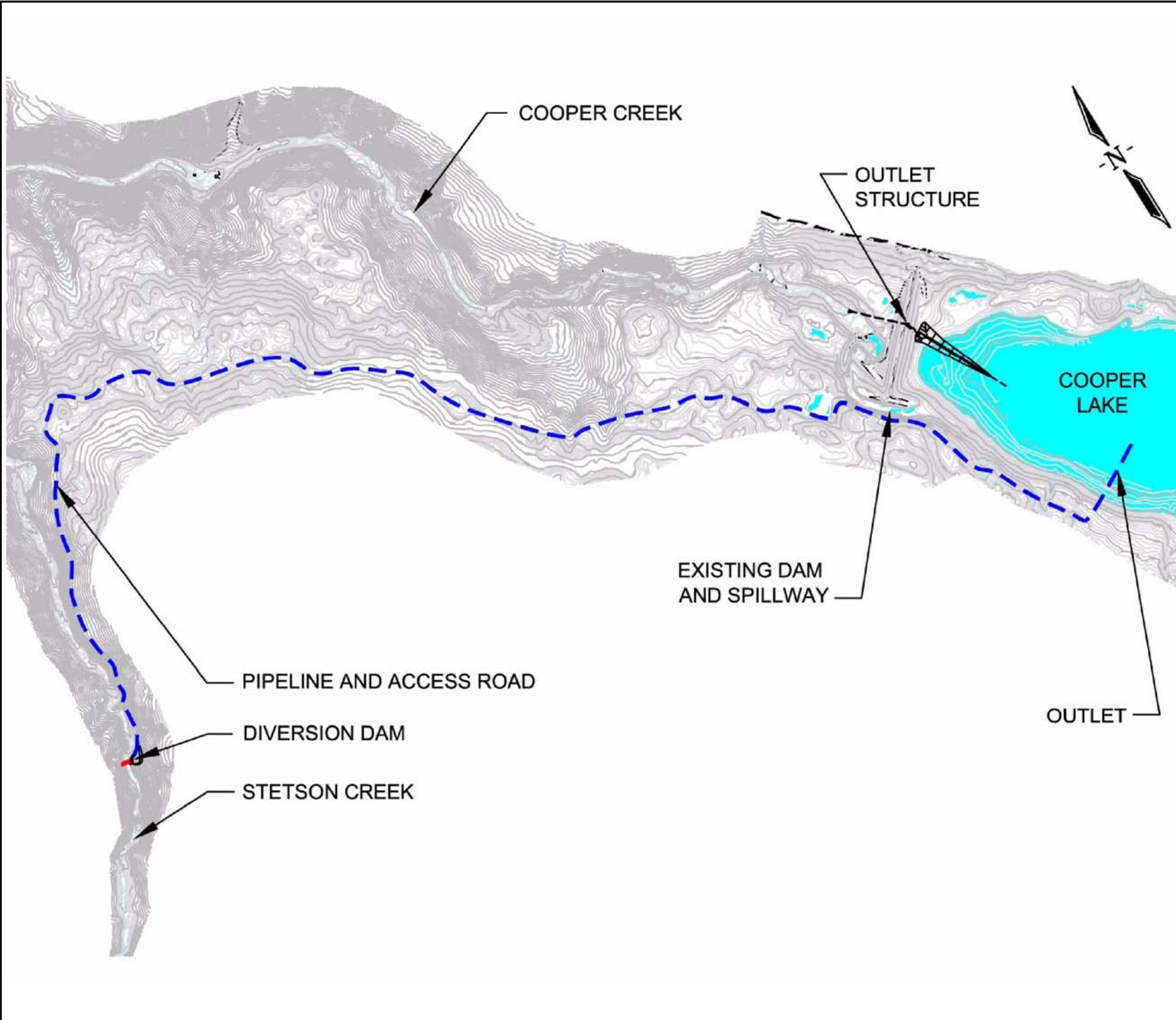

FIGURE 3

Conceptual Diagram of the Stetson Creek Diversion Pipeline

Cooper Lake Project
FERC #2170

1. Data compiled by MWH, Inc.
2. Figure Compiled by HDR Alaska, Inc.

Date: 5/11/2005
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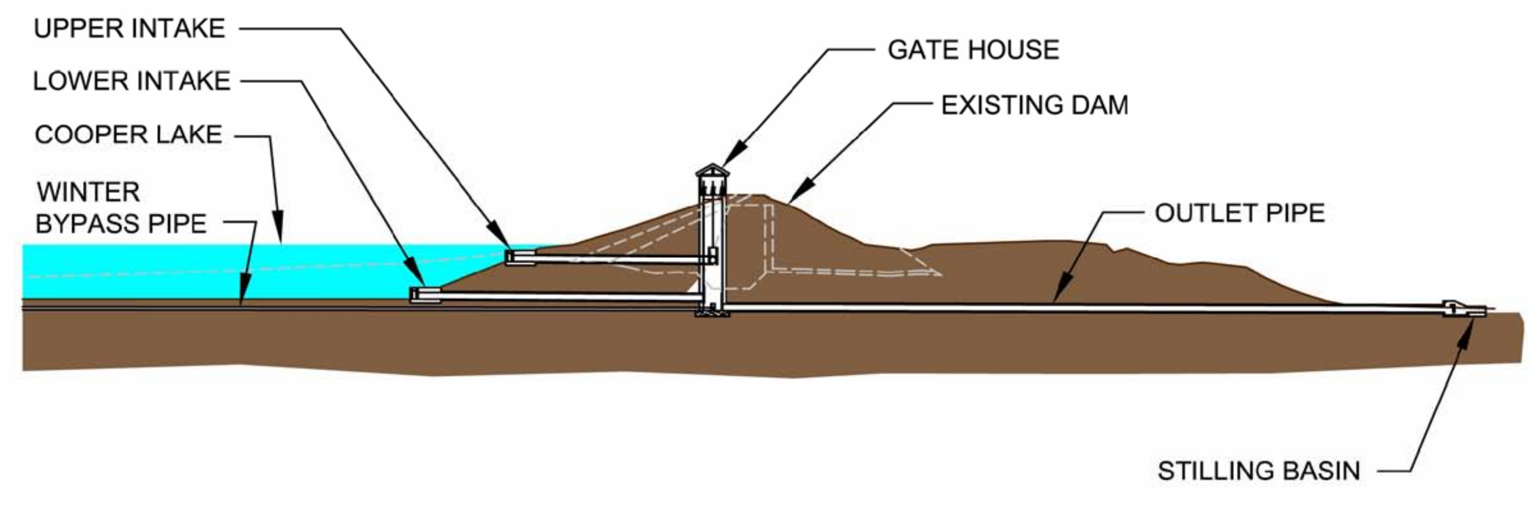

FIGURE 4

Conceptual Diagram of the Cooper Lake Diversion Structure

Cooper Lake Project
FERC #2170

1. Data compiled by MWH, Inc.
2. Figure Compiled by HDR Alaska, Inc.

Date: 5/11/2005
File: Stetson_figure1.mxd
Author: JS

Attachment I

Fish and Macroinvertebrate Study Technical Memorandum
Northern Ecological Services and HDR Alaska

Study Purpose and Objectives

The overall objective of this study was to document fish resources and assess fish habitat values within Stetson Creek relative to potential effects of the Stetson Creek diversion. Aquatic habitat values were investigated in detail within the short section of Stetson Creek between the confluence with Cooper Creek and the impassable falls on Stetson Creek. Upstream from the falls the presence or absence of resident fish was investigated and macroinvertebrate samples were collected.

Methods

Fish - Downstream Segment

The very short segment of Stetson Creek between the confluence with Cooper Creek and the impassable falls (about 200 ft.) is accessible to fish from Cooper Creek and was evaluated in detail. Stream habitats were surveyed using methods adapted from the United States Forest Service's FSH 2090-Aquatic Habitat Management Handbook (R-10 Amendment 2090.21-2001-1) Chapter 20 – Fish and Aquatic Stream Habitat Survey, which establishes standard techniques for fish biologists, hydrologists and aquatic ecologists conducting fish and aquatic stream habitat surveys in coastal Alaska (USFS, 2001). Method protocols are described in detail in the above handbook and summarized in the Cooper Creek Aquatic Habitat Analysis Study Report (Chugach Electric Association, 2004). The survey was conducted to a modified Tier III level which included identifying microhabitat types.

Additionally, a snorkel survey was conducted within accessible portions of the study segment to assess fish presence and to provide a semi-quantitative estimate of the amount of potential Dolly Varden spawning habitat. Area of potential spawning habitat was estimated by the diver using professional judgment combined with general suitability criteria (e.g., gravel substrate, moderate velocity, minimum depth).

The downstream survey was conducted as early in the summer as flow permitted following the normally high flows associated with spring snow melt.

Fish - Upstream Segment

Reconnaissance-level surveys were conducted in mid-summer to assess the presence or absence of fish resources in the portion of Stetson Creek between the impassible falls and just upstream of the proposed diversion structure (Figure 1). Selected areas within accessible stream segments were sampled using both baited minnow traps and backpack electroshocker. Much of Stetson Creek between the mouth and the proposed diversion

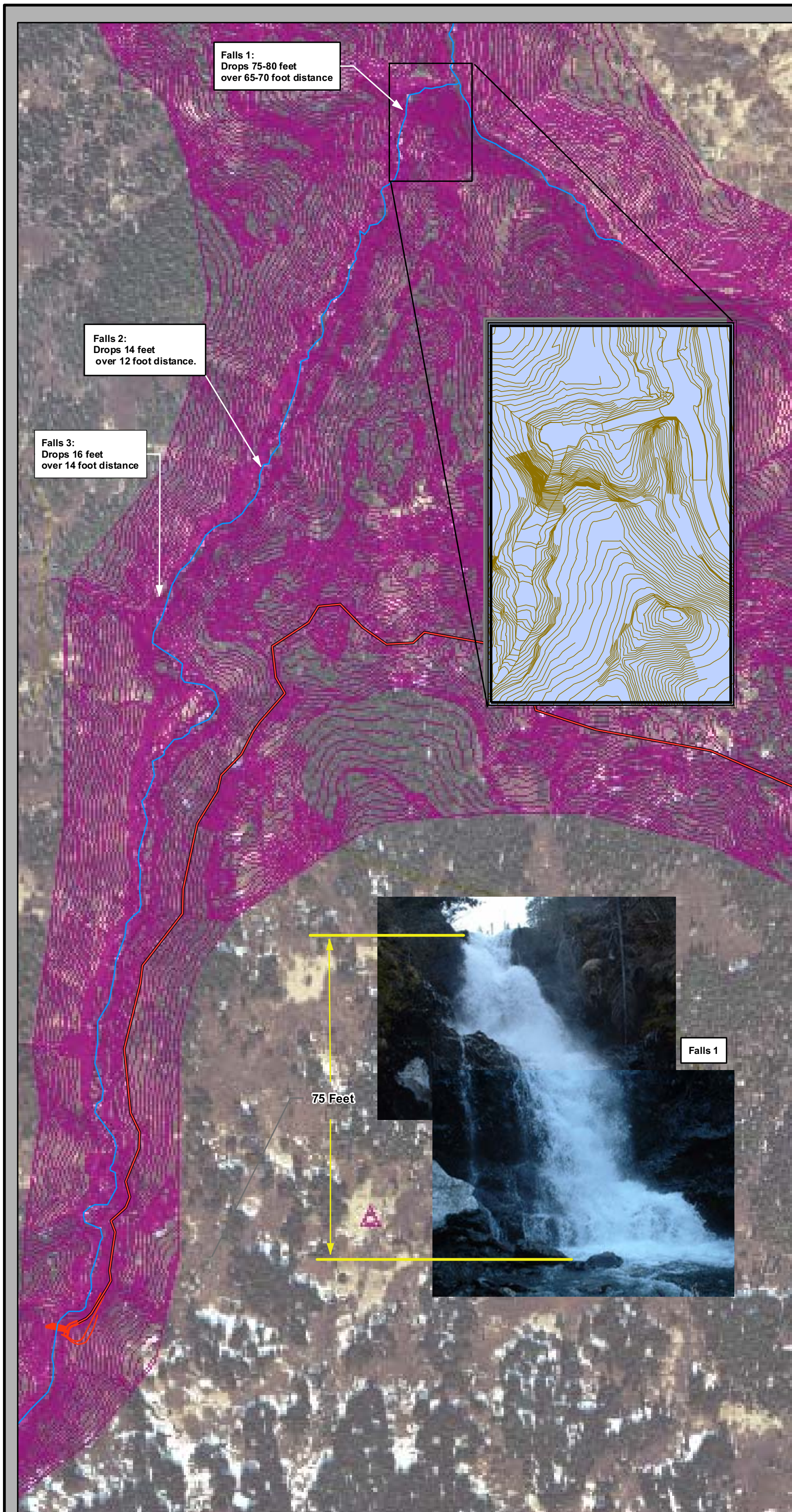

Figure 1

Stetson Creek Falls

LEGEND

- Proposed Diversion Structure
- Proposed Pipeline/Access Road
- 10 foot elevation contours with 2 foot intermittant

1. Mapping completed by HDR Alaska, Inc.
2. All data shown is projected in Alaska stateplane zone 4, North American datum of 1927

Feet
0 85 170 340

Date: 8//2005

File: Stetson_crk_falls.mxd

Author: DW

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structure is inaccessible due to steep canyon walls and dangerous stream conditions. Stream investigations were, therefore, limited to areas where the stream could be safely accessed and where gradient was not too extreme to prevent fish sampling.

Macroinvertebrates

Although the study plan called for collecting macroinvertebrate samples at three locations in Stetson Creek above the falls, conditions made it too difficult to do this. As a result, one site was accessed below the proposed diversion (above the falls). Two samples, of one kick net effort each, were collected: one in low velocity habitat and one in high velocity habitat. Samples were collected using a D-frame kick net with 350 µm mesh net. Samples were preserved with alcohol for later processing and analysis. All macroinvertebrates were sorted from each sample and identified to genus when possible (excluding chironomidae).

Results

Fish - Downstream Segment

The site was investigated on July 12, 2005. Geomorphological and habitat characteristics of the 159 ft. segment of Stetson Creek between the mouth and the lowermost waterfall are described in Table 1 and illustrated in Figure 2. The lineal distance measurements reported in Table 1 begin at the mouth of Stetson Creek, just above the pool at the Cooper/Stetson confluence, and continue upstream to the base of the falls.

Table 1.

Begin. Station (ft.)	Ending Station (ft.)	Habitat Type	Max Depth (ft.)	Av. Width (ft.)	Pool Area (sq. ft.)	Substrate Type
0	61	Cascade	1.9	17.3		Bedrock/Boulder/Cobble/Gravel
(0)			(1.6)	(14)		
(19)			(1.4)	(17)		
(34)			(1.8)			
(47)			(1.9)	(21)		
62	89	Plunge Pool	6	15.8	442	Bedrock/Boulder/Cobble
90	129	Cascade				Bedrock/Boulder/Cobble
(105)	(118)	Backwater Pool	1.8	5.5	72	Bedrock/Fine Gravel
130	159	Plunge Pool	4	40 (est.)	1200	Boulders/Flat, Angular Shale Cobbles

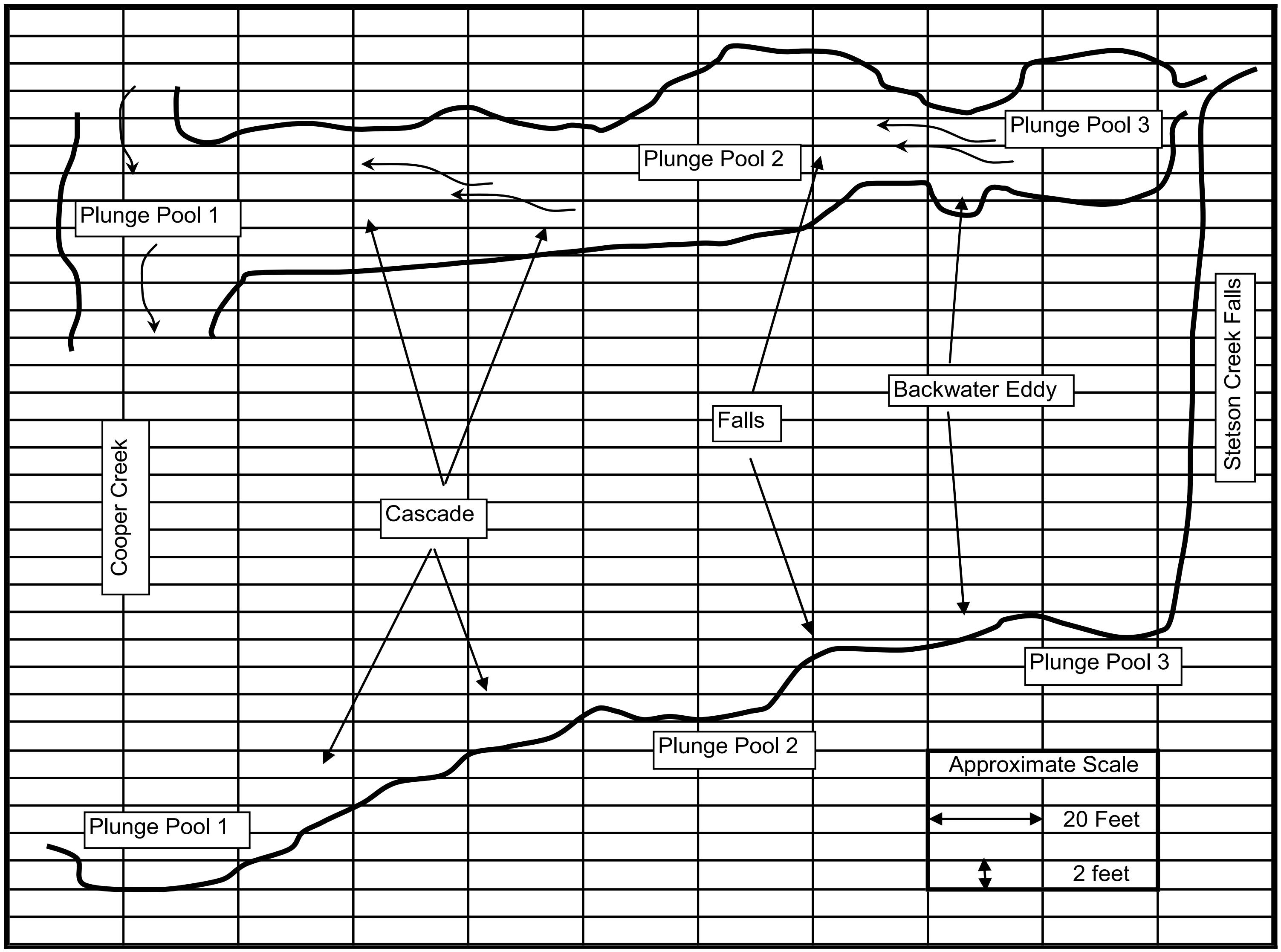


Figure 2. Stetson Creek below the falls: plan view and cross section.

In general, this reach of Stetson Creek is straight and steep with a gradient of 5-6 percent. It is characterized primarily by cascade type habitats with two significant plunge pools (not including the pool at the confluence with Cooper Creek) and one small backwater pool. The channel would be classified as HC3 per the USFS handbook based on the gradient and dominant boulder/cobble/bedrock substrate. Gravel exists in limited areas where the velocity is slow enough to allow it to remain, especially in the backwater pool and downstream from boulders within the lower cascade area. The large plunge pool at the base of the falls (Station 130-159) is exposed to extreme turbulence during high flow periods.

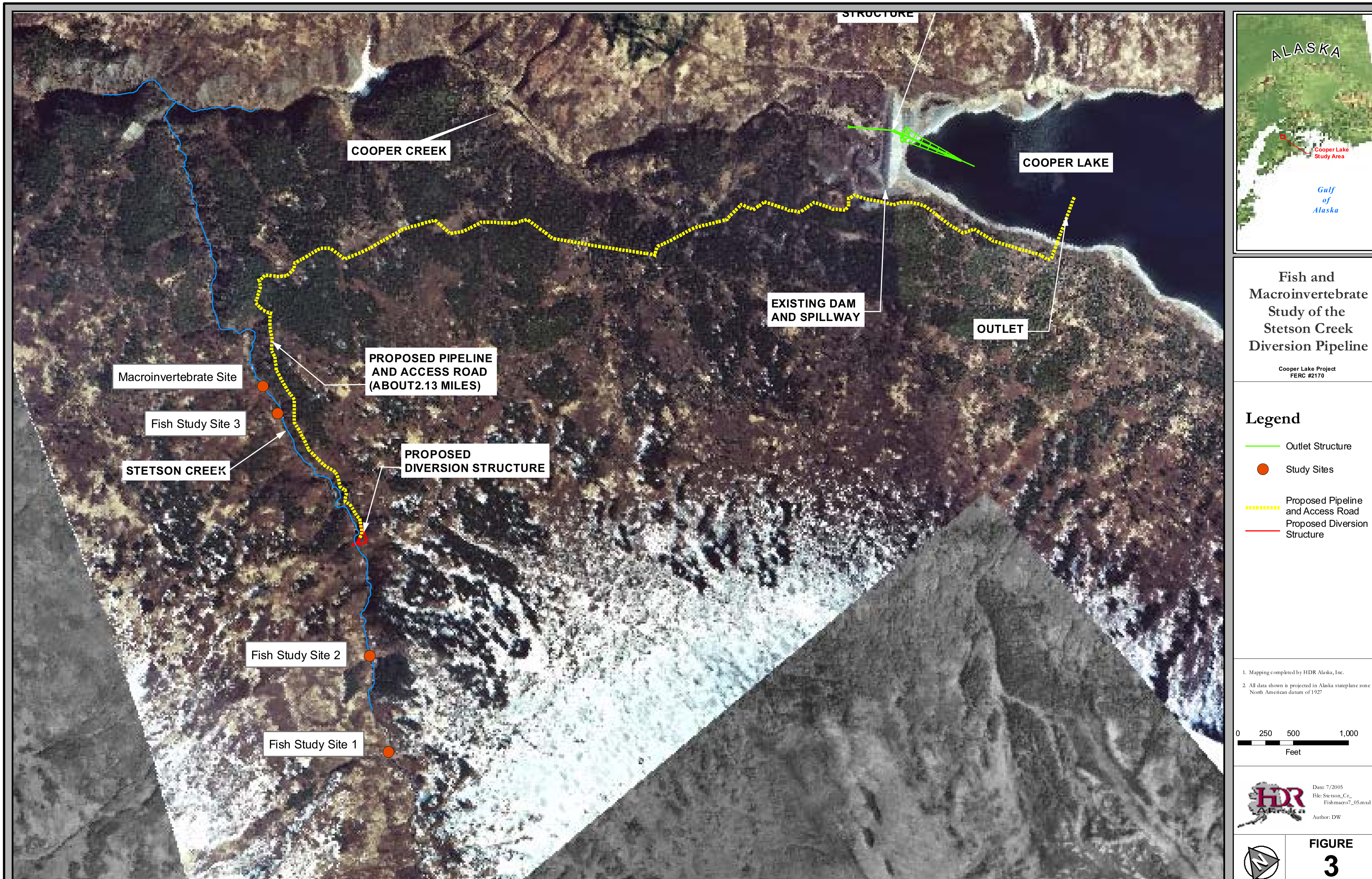
Snorkel surveys were conducted within pool habitats. Only one fish was observed in the study segment, a 14-18 inch Dolly Varden within the downstream plunge pool (Station 62-89). Additionally, a 10-12 inch Dolly Varden and an 8-10 inch rainbow trout were observed in the pool within Cooper Creek at the mouth of Stetson Creek. Area of potential Dolly Varden spawning habitat was difficult to estimate because of the possible use of pockets of gravel deposited downstream from boulders within cascade habitats. Obvious areas of potential spawning habitat within pools were estimated by the diver at about 100 sq. ft. based on the presence of gravel combined with suitable depth and velocity.

Fish - Upstream Segment

Fish presence reconnaissance investigations were conducted on June 13 and 14, 2005 at two accessible sites on Stetson Creek near the proposed diversion location. Sites were accessed by landing a helicopter within a clearing at the top of the Stetson Creek gorge and walking down to the stream, taking advantage of trails and roped access points utilized by placer miners. Study reach lengths at Sites 1 and 2 were about 300 ft. and 500 ft. long, respectively. Because of the high flow and steep canyon, block points along the stream prevented the investigators from accessing longer reaches. Site locations were marked using GPS coordinates. Locations of the study sites are indicated on Figure 3. At each location, selected habitats were sampled using a backpack electroshocker. Additionally, ten steel mesh minnow traps baited with salmon eggs were set in selected slow water areas within each sample reach. At Site 1 the traps were allowed to fish overnight, and at Site 2 the traps were checked after four hours in the water.

Both study sites were characterized primarily by riffles and cascades. Stream width was 15-20 ft. and depth ranged from a few inches up to 1.5 ft. Discharge at Site 2 was estimated at 34 cfs. Substrate primarily consisted of cobble and boulder with some limited areas of gravel. Sparse backwaters, side channel scour pools, and short runs provided enough slow water so that electrofishing could be conducted and minnow traps could be effectively set. No fish were captured or observed at Sites 1 and 2.

An additional site was investigated on August 12 in order to incorporate an area farther downstream. The location of Site 3 is shown on Figure 3. A 400 ft. stream reach was



Fish and Macroinvertebrate Study of the Stetson Creek Diversion Pipeline

Cooper Lake Project
FERC #2170

Legend

- Outlet Structure
- Study Sites
- Proposed Pipeline and Access Road
- Proposed Diversion Structure

1. Mapping completed by HDR Alaska, Inc.
2. All data shown is projected in Alaska stateplane zone 4, North American datum of 1927

0 250 500 1,000
Feet

HDR Alaska

Date: 7/2005
File: Stetson_Cr_ Fishmacro7_05.mxd
Author: DW

FIGURE 3

intensively sampled; 13 minnow traps were set and fished for 2.5 hours, and all accessible portions of the stream within the reach were electroshocked. Gradient of the Site 3 study reach was 7 percent and habitat consisted primarily of cascading step pools with mixed boulder, cobble, and gravel substrate. No fish were captured or observed at Site 3.

Macroinvertebrates

Two habitat types were sampled at one site on Stetson Creek: high velocity habitat and low velocity habitat. Both habitats sampled contained macroinvertebrate populations. The results of sampling are presented in Table 2 below.

Table 2.

Taxon			Number per Sample/Habitat	
			High Velocity	Low Velocity
Ephemeroptera	Baetidae	Baetis	299	20
Ephemeroptera	Heptageniidae	Cinygmula	65	11
Ephemeroptera	Heptageniidae	Epeorus	45	2
Plecoptera	Chloroperlidae	Plumiperla	121	25
Plecoptera	Nemouridae	Zapada	8	2
Trichoptera	Limnephilidae	Chyranda	0	1
Trichoptera	Rhyacophillidae	Rhyacophilla	17	1
Diptera	Chironomidae	unid	80	72
Diptera	Empididae	Clinocera	0	2
Diptera	Empididae	Oreogeton	3	3
Diptera	Simulidae	Simulium	121	3
Diptera	Tipulidae	Dicranota	2	3
Hydracarina	unid		1	0
Ostracoda	unid		1	0
Oligochaeta	unid		18	9
Hirundinea	unid		5	0

In the high velocity habitat 411 Ephemeroptera, 129 Plecoptera, 17 Trichoptera, and 206 Diptera were collected and identified. The low velocity habitat had fewer numbers identified in all orders: 31 Ephemeroptera, 27 Plecoptera, 2 Trichoptera, and 83 Diptera.

Discussion

Fish - Downstream Segment

This short segment of Stetson Creek is accessible to fish from Cooper Creek and, consequently, the Kenai River Drainage. Some utilization by fish undoubtedly occurs. However, steep gradient, coarse substrate, cold water, and turbulence from the falls all act to limit habitat value. Dolly Varden would be expected to feed in the limited pool habitats. Potential spawning habitat is limited to a few areas where gravel is present, especially in the backwater pool. Surface area of potential salmonid spawning habitat is small, probably less than 100 sq. ft.

Fish - Upstream Segment

The fish presence reconnaissance at Sites 1 and 2 occurred prior to survey work marking the diversion corridor. Consequently, investigators were uncertain whether the locations selected for sampling were upstream or downstream from the diversion. Subsequent to the field survey, sample site coordinates were plotted on project maps and it was concluded that the sample sites were most likely upstream from the proposed diversion. The downstream study site was probably 500-600 ft. upstream from the currently proposed diversion location and the upstream study site was 1200-1500 ft. upstream from the diversion. An additional area (Site 3) was investigated specifically to add a site downstream from the proposed diversion structure. The investigators believe that the habitats sampled, both upstream and downstream from the diversion, were representative of conditions in lower Stetson Creek.

Most of Stetson Creek is isolated from Cooper Creek and the Kenai River drainage by waterfalls near the mouth, and, upstream from the falls, the stream is uniformly steep with cascades and additional falls, further limiting fish movement. Figure 3 shows the principal falls near the mouth of Stetson Creek and illustrates the topography of the Stetson Creek drainage. Potential fish use is limited by a combination of factors including sparse slow water habitats, lack of downstream accessibility due to the impassible falls, limited fish passage between other reaches above the falls, extreme flow variation between summer and winter, and very cold water. Based on the characteristics of the stream and the results of this study, it is reasonable to conclude that fish use of Stetson Creek above the falls is unlikely.

Macroinvertebrates

The presence of the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddis flies), and Diptera (true flies, midges) can be used as indicators of stream health. The numbers of macroinvertebrates in the orders of interest indicate a high ratio of Ephemeroptera, Plecoptera, and Trichoptera to Diptera, which is an accepted indicator of good stream health and water quality. Previous sampling completed in lower Cooper Creek in 1998 also indicated that stream health there was “very good” (Major et al., 2000).

Overall habitat quality requires more than good water quality, however. A stream entering the south west corner of Cooper Lake was sampled in 2003 for the Cooper Lake Macroinvertebrate Study (HDR, 2004). The habitat in this stream was more diverse than that encountered in Stetson Creek, including slow, fast, deep and shallow habitats. Of the two habitats were sampled in Stetson Creek, the type characterized by steep gradient and high velocities is predominant, thus limiting the overall habitat diversity in Stetson Creek. Limited habitat diversity is reflected in the lower macroinvertebrate taxa diversity seen in Stetson Creek (16) as compared to the Cooper Lake tributary (82) or lower Cooper Creek

(>20). Virtually all of the taxa identified in Stetson Creek were also represented in the macroinvertebrate populations of the southwest tributary to Cooper Lake.

References:

Major, E., A. Prussian, and D. Rinella. 2000. 1999 Alaska Biological Monitoring and Water Quality Assessment Program Report. Prepared by Environment and Natural Resources Institute, University of Alaska, Anchorage. Prepared for the Alaska Department of Environmental Conservation. August 2000.

HDR Alaska, Inc. (HDR). 2004. Cooper Lake Macroinvertebrates Study, Final Report, Cooper Lake Project (FERC No. 2170). Prepared for Chugach Electric Association. September 2004.

Attachment II

Accretion Flows Evaluation Technical Memorandum
HDR Alaska

Study Purpose and Objective
This analysis was conducted to characterize the flows entering Stetson Creek downstream of the proposed diversion structure. The objective of the analysis is an estimation of how much water will remain in the stream between the proposed diversion and the mouth of the creek during low flow conditions.

Field Reconnaissance
Bob Butera and Bill Spencer of HDR Alaska, Inc. completed a reconnaissance of the study site on July 6, 2005. Weather at the time was 70^{o} F and overcast with no rain. A surveyed and flagged alignment for the proposed pipeline / access road was walked from Cooper Lake Dam to a point overlooking Stetson Creek. Beyond this point the route was not yet flagged, so the diversion site was located using aerial photo mapping. Flow measurements were made at the proposed diversion site and at the mouth of Stetson Creek.

Stetson Creek General Hydrology
Stetson Creek drains the northwest face of Cooper Mountain to the west of Cooper Landing. The Stetson Creek basin ranges from 5000 foot high peaks to the confluence of the creek with Cooper Creek at approximately 840 feet. The basin is mountainous and steep.

The basin characteristics of Stetson Creek at Cooper Creek are listed in Table 1.

Table 1. Stetson Creek at Cooper Creek Basin Characteristics

Drainage Area	9.1	square miles
Main Channel Length	5.4	miles
Main Channel Slope	460	Feet per mile
Mean Basin Elevation	3200	feet
Area of Lakes and Ponds	0	%
Area of Forest	17	%
Area of Glaciers	0	%
Area above Treeline	83	%
Mean Annual Precipitation	50	inches
Mean Minimum January Temp	8	F

The USGS collected a continuous streamflow record on Stetson Creek (Stetson Creek near Cooper Landing, station number 15260500) from May 1958 to Sept 1963. The gaging site was located 0.3 miles upstream from the mouth at elevation 1100 feet. Mean monthly flows for this period of record are shown in Table 2.

Table 2. Stetson Creek near Cooper Landing, Mean Monthly Flows 1958-1963

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1958						90.6	52.8	37.7	27.0	19.1	11.4	7.58
1959	6.00	5.46	5.35	6.80	30.8	84.2	43.3	32.4	27.6	16.2	12.6	8.71
1960	7.00	5.59	4.32	4.80	46.8	65.3	49.4	41.6	38.3	21.0	12.5	15.5
1961	18.5	9.43	5.48	6.40	45.6	98.4	70.1	46.5	60.5	33.6	9.77	8.03
1962	7.00	5.00	5.00	5.90	19.0	74.5	47.2	21.4	19.5	15.1	16.4	7.90
1963	5.87	5.00	4.45	5.17	29.4	51.1	54.8	24.8	15.2			
Mean of monthly streamflows	8.87	6.10	4.92	5.81	34.3	77.4	52.9	34.1	31.3	21.0	12.5	9.54

Based on a review of the USGS record, the flow regime of Stetson Creek is divided into three open water flow regimes. In mid-May, June and early July the predominant source of streamflow is the melting of the winter snow pack in the upper mountainous part of the basin. In late July and early August, the snowmelt contribution decreases, leading to lower base flows. From late August until the end of September, declining temperatures and freeze up in the upper basin lead to a further reduction in base flow, but the largest rainstorms and corresponding highest peak flows will likely occur during this period. The peak flows for the period of record are shown in Table 3.

Table 3. Stetson Creek near Cooper Landing, Peak Flows 1958-1963

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1958	Jun. 21, 1958	3.13	193
1959	Jun. 18, 1959	2.75	150
1960	May 23, 1960	2.99	197

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1961	Sep. 12, 1961	3.00	291
1962	Jun. 16, 1962	2.60	157
1963	Jul. 01, 1963	2.25	89.0

Table 4 provides an estimate of Stetson Creek flood flows based on the Area 4 regression equations and methodology contained in "Estimating the Magnitude and Frequency of Peak Streamflows for Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada" (USGS Water Resources Investigations Report 03-4188, 2003).

Table 4. Estimated Flood Flows Stetson Creek at Cooper Creek

Recurrence Interval (years)	Flow (cfs)
2	225
5	360
10	470
25	620
50	740
100	860
200	990
500	1180

During our field reconnaissance a previous high water level was marked by brush in the vegetation alongside the creek. This high water mark was 2 feet above the existing water level. The flow that created this high water mark was estimated at 700 cfs using a simplified slope area methodology.

Stetson Creek Hydrology Downstream of Proposed Diversion

Stetson Creek between the proposed diversion at elevation 1300 feet and the mouth at Cooper Creek has a drainage basin of approximately 0.7 square miles and a stream length of approximately 7000 feet. The drainage basin for this reach of Stetson Creek is primarily on the west side of the creek. The approximate basin characteristics of this subbasin of Stetson Creek are listed in Table 5. This subbasin contains approximately 8% of the drainage area of Stetson Creek and has a lower mean basin elevation than the Stetson Creek drainage.

Table 5. Subbasin of Stetson Creek between proposed diversion and Cooper Creek, Basin Characteristics

Drainage Area	0.7	square miles
Main Channel Length	1.5	miles
Main Channel Slope	2300	Feet per mile
Mean Basin Elevation	2000	feet
Area of Lakes and Ponds	0	%
Area of Forest	43	%
Area above Treeline	57	%
Area of Glaciers	0	%
Mean Annual Precipitation	50	inches
Mean Minimum January Temp	8	F

Stetson Creek in this reach has a bedrock substrate with numerous waterfalls. The average gradient is 12%.

Table 6 provides an estimate of monthly low-duration flow statistics for July, August and September for the subbasin of Stetson Creek below the proposed diversion point. These estimates are based on the Area 4 regression equations and methodology contained in "Estimating Annual High-Flow Statistics and Seasonal Low Flow Statistics for Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada" (USGS Water Resources Investigations Report 03-41114, 2003).

Table 6. Subbasin of Stetson Creek between proposed diversion and Cooper Creek, monthly low-duration flow statistics for July, August and September

Month	Percent low-duration flow	Daily Mean Discharge (cfs)
July	98	1.0
July	95	1.1
July	90	1.4
July	85	1.6
July	80	1.7
July	70	2.0
July	60	2.4
July	50	2.7
August	98	0.7
August	95	0.8
August	90	0.9
August	85	1.0
August	80	1.1
August	70	1.3
August	60	1.5
August	50	1.7
September	98	0.5
September	95	0.6
September	90	0.7
September	85	0.8
September	80	0.9
September	70	1.1
September	60	1.3
September	50	1.6

On July 6, 2005 flow measurements were made at the diversion site and at the mouth of Stetson Creek. Measurements were made using a Marsh McBirney flow meter with a wading rod. Measurements were made at 0.6 depth with 23 subsections made at the proposed diversion site,17 in Cooper Creek upstream of the confluence with Stetson Creek (narrow channel with very smooth flow), and 21 in Cooper Creek downstream of the confluence with Stetson Creek. Sections were modified to improve uniformity of flow and flows were fairly uniform across the channel. All measured flows were rated good (plus or minus 5% of actual flow).

(The calculation of the flow at the mouth of Stetson Creek was made by a subtraction of flows measured in Cooper Creek immediately upstream and downstream of the mouth of Stetson Creek as there is no suitable gaging location in Stetson Creek at the mouth.) Results are shown in table 7.

Table 7. July 6, 2005 Stetson Creek flow measurements

Location	**Flow (cfs)**
Stetson Creek at Proposed Diversion Site	46.1
Stetson Creek at Mouth	45.3
(Difference)	(-0.8)

The Stetson Creek channel is bedrock, and it is therefore very unlikely that this reach is a losing reach. Based on the expertise and professional judgment of the study authors, in actuality there is not a loss of flow between the diversion point and the mouth; rather, the lower measured flow at the downstream station is attributed to the error margin of the flow measurements, as the sites chosen could be expected to give an accuracy for the flow measurements within +/-5%, or about +/-2 cfs. At the high end, if the diversion site measurement was low by 2 cfs and the mouth measurement was high by 2 cfs, there could be as much as a 4 cfs flow accretion in the intervening channel. The field measurements thus provide only a rough estimate of accretion flow. In this instance, the statistical low duration flow estimates likely provide a better estimate of accretion flows.

Attachment III

Terrestrial Wildlife Study Technical Memorandum
HDR Alaska

Study Purpose and Objectives

The purpose of this study was to gain knowledge of the wildlife resources in the Stetson Creek drainage and along the corridor of the proposed pipeline / access road. The potential effects to terrestrial wildlife from development of a Stetson Creek diversion and increased flows in upper Cooper Creek (above the confluence with Stetson Creek) were assessed by conducting field observations of existing habitat and wildlife in the vicinity of the proposed pipeline / access road. In addition, the field observations were supplemented by information gained through interviews with knowledgeable members of the public and resource agency personnel.

Field Reconnaissance

Sirena Brownlee and Melanie Oldford, HDR Alaska, Inc., surveyed the 2.13 mile proposed pipeline and access road corridor on June 17 and July 7, 2005. Presence of bird and mammal species observed in the vicinity of the proposed pipeline / access road corridor was recorded during the surveys (Table 1). Locations of bird nests and fledglings, mammals, tracks, and scat were entered into a hand-held global positioning system (GPS) (Figure 1). General habitat types in which wildlife were observed were recorded and are included in Table 1. Detailed vegetation characteristics such as canopy height, community composition, and density were identified from aerial photography and ground truthed in order to delineate vegetation communities as part of the Vegetation and Wetland Study (see Vegetation Technical Memorandum).

An aerial survey was conducted on April 25, 2005 along the proposed pipeline and access road corridor and along the entire Stetson Creek Watershed to locate bear dens and bald eagle nests. A fixed wing aircraft was used for the surveys. The pilot, Jose DeCreeft, is a skilled pilot and observer with extensive experience conducting wildlife surveys for the U.S. Forest Service and U.S. Fish and Wildlife Service (USFWS). Jeff Schively, Biologist, HDR Alaska, Inc. accompanied him on the flight. The aerial survey entailed scanning terrain 0.5 miles on both sides of the centerline of the proposed pipeline and access road and along the upper watershed of Stetson Creek for bald eagle nests and bear dens. The pilot went over the alignment twice to ensure thorough coverage of the area.

In addition to field observations, local residents of Cooper Landing and Anchorage who are familiar with the Stetson Creek watershed and the vicinity of Cooper Mountain were interviewed to obtain information about wildlife presence in these areas.

Brown Bears

Habitat variables such as salmon bearing streams, berry resources, cover type and density, and existing human disturbance (trails, developments, recreation) were documented. In addition, agency biologists were consulted to determine if sensitive areas or travel corridors are present along Stetson Creek that may be affected by development of the proposed diversion, pipeline, and access road in the Stetson Creek drainage. The Alaska Department of Fish and Wildlife (ADF&G) and the USFS are currently developing a model to determine brown bear travel corridors on the Kenai Peninsula (Goldstein 2004). However, according to Sean Farley (ADF&G 2005) the Stetson Creek diversion/access study area is not included in the model as a potential travel corridor, and therefore, information from the model is not evaluated in this technical memorandum.

Results

Habitat

The proposed pipeline and access road alignment provides habitat for a wide variety of bird and mammal species. There are 7 cover types, including 5 vegetated and 2 unvegetated types that were identified in the 53.4-acre study area. These vegetation types include Hemlock, Hemlock-Spruce, Alder Tall Scrub, Low Scrub, Graminoid-Forb, Free Water, and Barren/Sparsely Vegetated (See Vegetation Technical Memorandum for description of each habitat type). Hemlock forest is the most abundant and widespread habitat type in the study area, covering approximately 50% of the study area. Table 1 details the habitat type for each species observed.

Birds

The proposed pipeline and access road study area supports many of the same bird species that were documented in the 2003 Terrestrial Wildlife Study for the Cooper Lake Project. A total of 27 species of birds were identified along the proposed pipeline and access road alignment during the surveys in June and July 2005. See Table 1 for a list of all bird species detected and the habitat type(s) they were detected in. The habitat types in the study area provide habitat used by both resident and breeding species that are common to southcentral Alaska. The majority of bird sightings occurred within the Hemlock habitat type.

Two bird nests were found during the survey. A Wilson's snipe nest was found in Low-Scrub habitat approximately 30 feet northeast of the flagged survey line. The nest was located on the ground near a clump of grass and contained 2 nestlings (Figure 1 – Point 3). A pine siskin nest was located in a hemlock tree, approximately 10 feet above the ground. The nest was approximately 15 feet north of the flagged survey route. Fledglings could be heard in the nest (Figure 1 – Point 8).


COOPER CREEK
OUTLET
COOPER LAKE
EXISTING DAM AND SPILLWAY
PIPELINE AND ACCESS ROAD (APPROXIMATELY 2.13 MILES)
Game Trail
DIVERSION DAM
STETSON CREEK
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Terrestrial Wildlife Sightings
1. Spotted Sandpiper nest
2. Varied Thrush fledglings
3. Wilson's Snipe nest
4. Bear tracks; sow and cub
5. Spruce Grouse Hen with chicks
6. Coyote scat
7. Bear scat
8. Pine Siskin nest
9. Moose bedding area
10. Moose bedding area
11. Porcupine sighting; adult with young
12. Red Backed Vole sighting
13. Bear scat
14. Bear scat
15. Bear scat, on game trail
16. Mountain goat sighting, incidental, 7/13/05
ALASKA
Cooper Lake Study Area
Gulf of Alaska
Terrestrial Wildlife Sign
Stetson Creek Diversion Pipeline
Cooper Lake Project
FERC #2170
Bird
Bear
Coyote
Mountain Goat
Moose
Vole
Porcupine
Pipeline and Access Road
0 125 250 500
Feet
HDR Alaska
Date: 7/2005
File: Stetson_Wildlife_7_05.mxd
Author: DW
FIGURE
1

Bald Eagles

An aerial survey for bald eagle nests along the proposed pipeline and access road corridor was conducted on April 25 prior to leaf out of deciduous trees. Prior to the survey, Joe Connor, Biologist, USFWS, was contacted to obtain existing data on nests in the study area. Mr. Connor responded that no eagle nests have been documented in the study area (Connor 2005).

No bald eagle nests were located during the April 25, 2005 aerial surveys. The proposed pipeline / access road alignment does not contain old growth cottonwood trees that are preferred by bald eagles for nest placement in southcentral Alaska (ADF&G 2002).

Table 1 - Avian Species Observed in Study Area During June/July 2005

Common Name[1]	Latin Name	Habitat[2]
Alder flycatcher	*Empidonax alnorum*	Alder Tall Scrub
American Robin	*Turdus migratorius*	Hemlock
Black-billed magpie	*Pica pica*	Alder Tall Scrub
Black-capped chickadee	*Poecile atricapillus*	Hemlock-Spruce, Alder Tall Scrub
Common raven	*Corvus corax*	Hemlock, Graminoid-Forb
Common redpoll	*Carduelis flammea*	Hemlock
Dark-eyed junco	*Junco hyemalis*	Hemlock-Spruce, Hemlock
Downy woodpecker	*Picoides pubescens*	Hemlock-Spruce
Fox sparrow	*Passerella iliaca*	Low Scrub
Golden-crowned sparrow	*Zonotrichia atricapilla*	Graminoid-Forb, Alder Tall Scrub
Gray jay	*Perisoreus canadensis*	Hemlock-Spruce
Hermit thrush	*Catharus guttatus*	Hemlock-Spruce, Hemlock
Lincoln’s sparrow	*Melospiza lincolnii*	Graminoid-Forb
Olive-sided flycatcher	*Contopus cooperi*	Hemlock-Spruce
Orange crowned warbler	*Vermivora celata*	Hemlock, Alder Tall Scrub
Pine siskin	*Carduelis pinus*	Hemlock
Ruby-crowned kinglet	*Regulus calendula*	Alder Tall Scrub
Sharp-shinned hawk	*Accipiter striatus*	Hemlock
Spruce grouse	*Falcipennis canadensis*	Hemlock
Steller’s jay	*Cyanocitta stelleri*	Hemlock-Spruce
Townsend’s warbler	*Dendroica townsendi*	Hemlock
Varied thrush	*Ixoreus naevius*	Hemlock
White-crowned sparrow	*Zonotrichia leucophrys*	Alder Tall Scrub
Wilson’s warbler	*Wilsonia pusilla*	Hemlock, Alder Tall Scrub
Wilson's snipe	*Gallinago gallinago*	Low Scrub
Yellow warbler	*Dendroica petechia*	Alder Tall Scrub
Yellow-rumped warbler	*Dendroica coronata*	Hemlock, Alder Tall Scrub

[1] Common Name and Latin Name: Armstrong 1995

[2] Habitat that species was observed in as delineated on the Vegetation cover Types Figure (Vegetation Technical Memorandum 2005)

Mammals

A total of 7 mammal species were observed along the proposed pipeline / access road alignment. The majority of observations consisted of tracks, scat or other signs (i.e. moose bedding areas). See Table 2 for a list of all mammal species detected and the habitat type(s) they were detected in. Mammals are typically underrepresented in wildlife surveys because of their secretive, nocturnal nature, and because they typically occur in low densities. The most commonly detected mammal sign along the study area alignment was red squirrel cone cuttings. Tracks and scat of black bear were also observed in the study area (see Figure 1).

Table 2 - Mammal Species Observed During June/July 2005 (See Figure 1 for locations of detections)

Common Name[1]	**Latin Name**	**Habitat and Detection[2]**
Black bear	*Ursus americanus*	Tracks and scat observed in Graminoid-Forb, Hemlock, Alder Tall Scrub,
Coyote	*Canis latrans*	Scat observed in Hemlock
Moose	*Alces alces*	Bedding Areas observed in Hemlock and Alder Tall Scrub
Mountain goat	*Oreamnos americanus*	Visual observation outside of study area on Cooper Lake shoreline
Northern red-backed vole	*Clethrionomys rutilus*	Visual observation in Hemlock
Porcupine	*Erethizon dorsatum*	Visual observation of adult and young in Hemlock
Red squirrel	*Tamiasciurus hudsonicus*	Visual observations and cone cuttings in Hemlock and Hemlock-spruce

[1] Common Name and Latin Name: ADF&G 2002

[2] Habitat that species was observed in as delineated on the Vegetation cover Types Figure (Vegetation Technical Memorandum 2005)

Brown Bears

No brown bears were documented within the study area during the aerial spring denning surveys or during the June/July survey period. Existing brown bear habitat resources in the immediate vicinity of the study area are limited by the absence of salmon-bearing streams and large berry patches. Cover type and density were documented during the vegetation mapping task (see Vegetation Technical Memorandum). The vegetation study did not find any significant berry patches or other indicators of potential food resources such as devil’s club, skunk cabbage or cow parsnip.

The Kenai River is the closest significant salmon bearing river in the study area. Brown bears may use the study area as a travel corridor to the Kenai River and Juneau Creek areas during salmon spawning (Mitchell 2005). Gary Mitchell, Cooper Landing resident and miner in Cooper Creek, stated that he has never seen a brown bear in the Cooper Creek watershed during his many years mining in Cooper Creek. However, he mentioned that black bears are quite common along Cooper Creek because of the abundance of devil's club berries along the creek (Mitchell 2005). Ruben Hanke, local resident and trapper in the Stetson Creek and Cooper Creek area, stated that he has seen both black and brown bears in the Stetson and Cooper Creek watersheds but that neither were abundant (Hanke 2005). Bill Stockwell, Cooper Landing resident and Fish and Game Advisory Committee member, was contacted regarding wildlife sightings in the Stetson Creek area and he responded that the wildlife in the Stetson Creek area is similar to what was documented around Cooper Lake and Cooper Creek during the 2003 and 2004 field studies. Mr. Stockwell mentioned that there was a black bear baiting station near Cooper Lake Dam this summer (Stockwell 2005).

Dall Sheep and Mountain Goats

One mountain goat was observed on the shoreline of Cooper Lake approximately 500 feet north of the proposed outlet on 7/13/05 by Jeff Schively, HDR Alaska (Location shown on Figure 1). The goat swam across the lake to the other side and proceeded to travel up Cecil Rhode Mountain. No other observations of goats or sheep were documented by survey crews.

Conclusion

Development of the Stetson Creek diversion structure and associated pipeline / access road would result in temporary construction related disturbances to wildlife species and direct loss of habitat within the footprint of the pipeline and access road. Road maintenance and vegetation clearing activities may cause a temporary disturbance to wildlife species. A cleared road corridor may increase the value of the habitat for some species by creating edge habitat. The periodic clearings would create habitat similar to that found on the Project's existing powerline and access road corridors such as scrub thickets, forb meadows, and graminoid meadows. These communities provide valuable forage species to many birds and provide more cover and habitat diversity than would be present without the periodic clearing of vegetation. Moose and snowshoe hare may benefit by the increase in forb and herbaceous growth along the cleared corridor. However, increased flows above the Stetson Creek confluence with Cooper Creek could potentially reduce browsing habitat for moose and other browsing mammals, due to removal of vegetation by higher stream flows.

Motorized public access into the Stetson Creek diversion portion of the access road would be limited by the existing gate on the existing Cooper Lake Dam access road. However, the increased potential for access into the study area that could be created by the development of this extension of the existing access road (including the potential linkage to the existing Stetson Creek trail; see Recreation Study, Attachment VII) could increase recreational uses, such as snowmobiles, hunting, hiking, and all terrain vehicle use, in the study area. Currently there is very little human disturbance in the study area. Increase in human access into this area may create a disturbance factor for some wildlife species such as brown bears and mountain goats. Dall sheep and mountain goats could potentially be impacted by increased human access into the study area. Cooper Mountain is a popular hunting area for both sheep and goats and is currently accessed via Snug Harbor Road or Cooper Creek. The 2004 survey total by ADF&G for Cooper Mountain was 14 mountain goats and 34 Dall sheep (Selinger 2005).

Noise and disturbance during construction activity could disturb sheep and goats during the lambing season in spring (Selinger 2005). Sheep and goats would most likely move out of the area where construction disturbance is occurring during other times of the year. Springtime construction should be avoided if possible (Selinger 2005).

The possibility of increasing human access into the study area is a major concern of wildlife management personnel working with Kenai Brown bears. Increased human-bear contact in the area could result in brown bear mortality and/or displacement of bears using the area for travel or denning. An increase in brown bear mortality from Defense of Life of Property (DLP) kills or poaching, could affect the population level of brown bears on the Kenai Peninsula (Farley 2005). The extent to which a 70 foot wide clearing for the proposed access road and pipeline right-of-way would increase human activity is not known.

Disturbance to denning bears during construction or maintenance activities could result in human/bear conflicts and abandonment of dens and/or cubs. Brown bears are known to den at all elevations, from alpine snow chutes in the Kenai Mountains down to small upland areas scattered around the Kenai Lowlands. Brown bears may potentially den on Cooper Mountain and could be disturbed by the development of an access road and pipeline alignment. Denning bears could also be disturbed by helicopter flights during maintenance activities. There are collared bears that have denned on Cooper Mountain in the past (Brna 2005). However, since bears use different dens each year there is no specific data for the study area (Goldstein 2005). No bear dens were sighted within the study area or along Cooper Mountain during the April 2005 aerial denning surveys.

Potential impacts on brown bears from construction of the proposed Stetson Creek diversion and associated pipeline / access road would primarily result from short-term disturbances expected from construction activities and long term disturbance from increased human access. Disturbance from construction activities could cause temporary displacement of bears; however, this would be expected to be a minor impact due to the low density of brown bears that potentially use the study area.

The presence of an access road and pipeline is not expected to impede brown bear movement or other activities. According to Sean Farley, ADF&G (2005), the area is not currently a travel corridor for brown bears. Clearing of the access road could result in minimal loss of foraging habitat, and the loss of overstory cover used by brown bears for travel. Loss of devil’s club could impact foraging opportunities for brown bears, but the study area contains only a small amount of devil’s club in creek drainages.

References:

Alaska Department of Fish and Game. 2000. *Kenai Peninsula Brown Bear Conservation Strategy*. Alaska Department of Fish and Game, Division of Wildlife Conservation Anchorage, Alaska.

Alaska Department of Fish and Game ADFG. 2002. Alaska Department of Fish and Game's Wildlife Notebook Series. Published by the Public Communications Section. Juneau, Alaska.

Brna, Phil. 2005. USFWS. Telephone conversation with Sirena Brownlee, HDR Alaska, on April 4, 2005 regarding brown bear denning surveys in the Study area.

Connor, Joseph. 2005. USFWS Biologist. Telephone conversation with Sirena Brownlee regarding bald eagle surveys in the Study area on April 4, 2005.

Farley, Sean. 2005. Alaska Department of Fish and Wildlife Service. Telephone conversation with Sirena Brownlee, HDR Alaska, regarding brown bear resources and travel corridors within the Study area on April 26, 2005.

Hanke, Ruben. 2005. Cooper Landing Resident and Trapper. Telephone conversation with Sirena Brownlee, HDR Alaska, regarding brown bear sightings and other wildlife in the Cooper Creek and Stetson Creek Watershed on July 19, 2005.

Goldstein, Mike. 2004. United States Department of Agriculture Forest Service, Wildlife Ecologist. Telephone conversation with Sirena Brownlee, HDR Alaska, regarding bear denning surveys and brown bears in the Study area on November 4, 2004.

Mitchell, Gary. 2005. Cooper Landing Resident and Miner in Cooper Creek. Telephone conversation with Sirena Brownlee, HDR Alaska, regarding wildlife sighting in the Cooper Creek and Stetson Creek Watersheds on July 19, 2005.

Selinger, Jeff. 2005. ADF&G Area Biologist. Telephone conversation with Sirena Brownlee, HDR Alaska, regarding Dall sheep and mountain goats on Cooper Mountain on July 22, 2005.

Stockwell, Bill. 2005. Anchorage resident and participant in the Settlement Working Group. Telephone conversation with Sirena Brownlee, HDR Alaska, on July 19, 2005.

Suring, L.H., G. Del Frate. In preparation. Spatial analysis of locations of brown bears killed in defense of life or property on the Kenai Peninsula, Alaska, USA.

USFWS. *Bald Eagle Basics Brochure.* Alaska Region U.S. Fish and Wildlife Service.

Attachments IV a and IV b

Vegetation and Wetland Assessment Studies Technical Memoranda

IVa. **Terrestrial Vegetation Assessment**
HDR Alaska

Study Purpose And Objective

The objectives of this study are to identify vegetation cover types in the proposed Stetson Creek Diversion study area (Figure 1, see description below) and evaluate potential future impacts to those cover types. The study area covers vegetation and terrestrial wildlife habitat that may be affected by the proposed Project. The 53.4-acre study area is defined as follows:

1. ***Diversion Structure.*** Plant communities were mapped along an area extending 200 feet upstream and downstream of the proposed location of the diversion structure within Stetson Creek and 100 feet either side of the creeks floodplain.
2. ***Pipeline and Access Road Alignment.*** Plant communities were mapped along a 200 foot swath surrounding the proposed pipeline alignment, defined as 100 feet on either side of alignment centerline.

Methods

Vegetation mapping and characterization was completed using three primary steps: (1) review existing information and complete office-based preliminary vegetation mapping; (2) collect field data to verify preliminary vegetation mapping and inventory plant community characteristics; and (3) prepare final vegetation cover type mapping and plant community characterization using field data, aerial photography, and existing documentation.

The methodology used to map and describe plant communities in the study area was selected using a combination of USFS vegetation mapping protocols (DeVelice et al. 1999; USDA Forest Service 1993; Viereck et al. 1992; and USDA Forest Service 2002) and through agency coordination and input (contributing agencies include the USFS, U.S. Fish and Wildlife Service [USFWS], and Alaska Department of Fish and Game [ADFG]). This methodology follows the same protocol used for the 2003-04 HDR Terrestrial Vegetation Study completed for the Project (HDR 2004). The primary objective of completing this study was to produce the most accurate, up-to-date mapping and database reasonably possible that is consistent with the needs of other project resource studies.

Review existing information and complete office-based preliminary mapping

Project scientists gathered existing vegetation information for the Project area. Three datasets exist for the Project study area, but do not describe the communities with enough detail to understand community structure and habitat characteristics. Datasets reviewed are detailed in Table 1.

Table 1. Existing Vegetation Mapping for the Project Area

STUDY	YEAR	DECSRIPTION	USEFULLNESS TO STUDY
Cover Type Mapping	1978	Using source data from 1950-1970, the USFS categorized vegetation cover in Chugach National Forest. A sub-set of data from the USFS timber type mapping.	Low- minimum size of mapped plant communities is 10 acres. Too large for the purpose of this study.
Land Cover Classification	1997	Using source data from 1977-1991, the USGS categorized vegetation communities throughout Southcentral Alaska using satellite imagery.	High- minimum size of mapped plant communities is 30^2 meters. Limited ground truthing. Good descriptions of Level II/III communities.
Timber Type Mapping	1978	Using source data from 1950-1970, the USFS categorized timber production areas in Chugach National Forest.	Low- mapping is oriented to timber activities and does not accurately describe plant communities.

Color aerial photograph contact prints (taken May 7, 2003 at 1”=700’ scale) were inspected under a stereoscope to delineate different vegetation cover types. Vegetation cover type boundaries were then digitized into the Project’s GIS database. Vegetation characteristics such as cover type, canopy height, cover class, and community type were identified from aerial photography and were the primary basis for determining vegetation boundaries. Communities were mapped to a minimum scale of 0.5 acres and classified using the system shown in Table 2.

Table 2. Vegetation Cover Type Mapping Codes

VEGETATION COVER TYPE		
• Spruce • Hemlock • Hemlock-spruce • birch • cottonwood • aspen • spruce-birch	• spruce-cottonwood • spruce-aspen • hemlock-birch • alder tall scrub • willow tall scrub • low scrub • dwarf scrub	• graminoid herbaceous • forb herbaceous • free water • frozen water • barren/sparsely vegetated
VEGETATION COMMUNITY TYPE GROUP		
Forest Types	**Scrub Types**	**Herbaceous Types**
• alder • bluejoint • devil’s club • dwarf scrub • fern • menziesia • moss • tall blueberry • not differentiated	• alder • cassiope • crowberry • dwarf birch • salmonberry • sweet gale • willow • not differentiated	• bluejoint • fern • fireweed • horsetail • rough fescue • sedge • not differentiated
FOREST CANOPY COVER CLASS		
• Closed - 60 %	• Open - 25-59 %	• Woodland - 10-24 %

HEIGHT CLASS		
Upper Canopy		**Subcanopy**
• 0-5 feet • 5-10 feet • 10-20 feet • 20-30 feet • 30-40 feet • 40-50 feet • 50-60 feet	• 60-70 feet • 70-80 feet • 80-90 feet • 90-100 feet • 100-110 feet • >110 feet	• 0-1 feet • 1-5 feet • 5-10 feet • >10 feet

Collect field data to verify preliminary vegetation mapping and inventory plant community characteristics

Biologists ground truthed representative cover types defined from aerial photograph interpretation during July 11-15, 2005. Vegetation data forms were collected from sampling plots that represent a homogeneous 50m^2 vegetated area that is encompassed by a larger (2-acre minimum size) plant community polygon mapped by aerial photographic interpretation. The shape of the plot was circular except in locations where a narrow, linear stand required the plot to be rectangular. The location of each plot was identified using a hand-held global positioning system (GPS) unit. Sampling locations were distributed over a full range of environmental and physical conditions (i.e., elevation, slope). Observational and incidental data describing habitat potential were collected as well. Specific parameters measured at each plot included:

a. Dominant vascular plant species in the canopy and sub canopy. Dominance was determined by a visual estimate of a plant's percent cover in the plot.
b. Average height and basal trunk diameter of dominant tree species.
c. Observations on fruit production.
d. Wildlife usage signs - droppings, browsing, bird singing, carcasses, tracks and burrows.
e. Individual plant communities were attributed for vegetation structure and composition based on the coding system outlined in Table 2.

Prepare final vegetation mapping and plant community characterization using field data, aerial photography, and existing documentation.

Preliminary mapping was modified to address new information gained during the field verification. This included extrapolating findings from the representative sites we visited to others we did not visit. Field data collection sites were added to the Project's GIS database. GIS technology was used to analyze plant community abundance, quantify changes associated with future project developments, and summarize results of the mapping.

Results

A total of 7 cover types, including 5 vegetated and 2 unvegetated types were identified in the 53.4-acre study area (Table 4). These types are briefly described below and generally match communities that DeVelice et al. (1999) described in the publication "Plant Community Types of the Chugach National Forest: Southcentral Alaska." Figures showing the cover types mapped in the study area, overlaid on aerial photographs, are included on attached Figure 2. Representative photographs of each mapped cover type are included in Appendix IVa-A. A total of 29 data forms were collected during the field investigation; these are not included in this report but may be requested from HDR or Chugach.

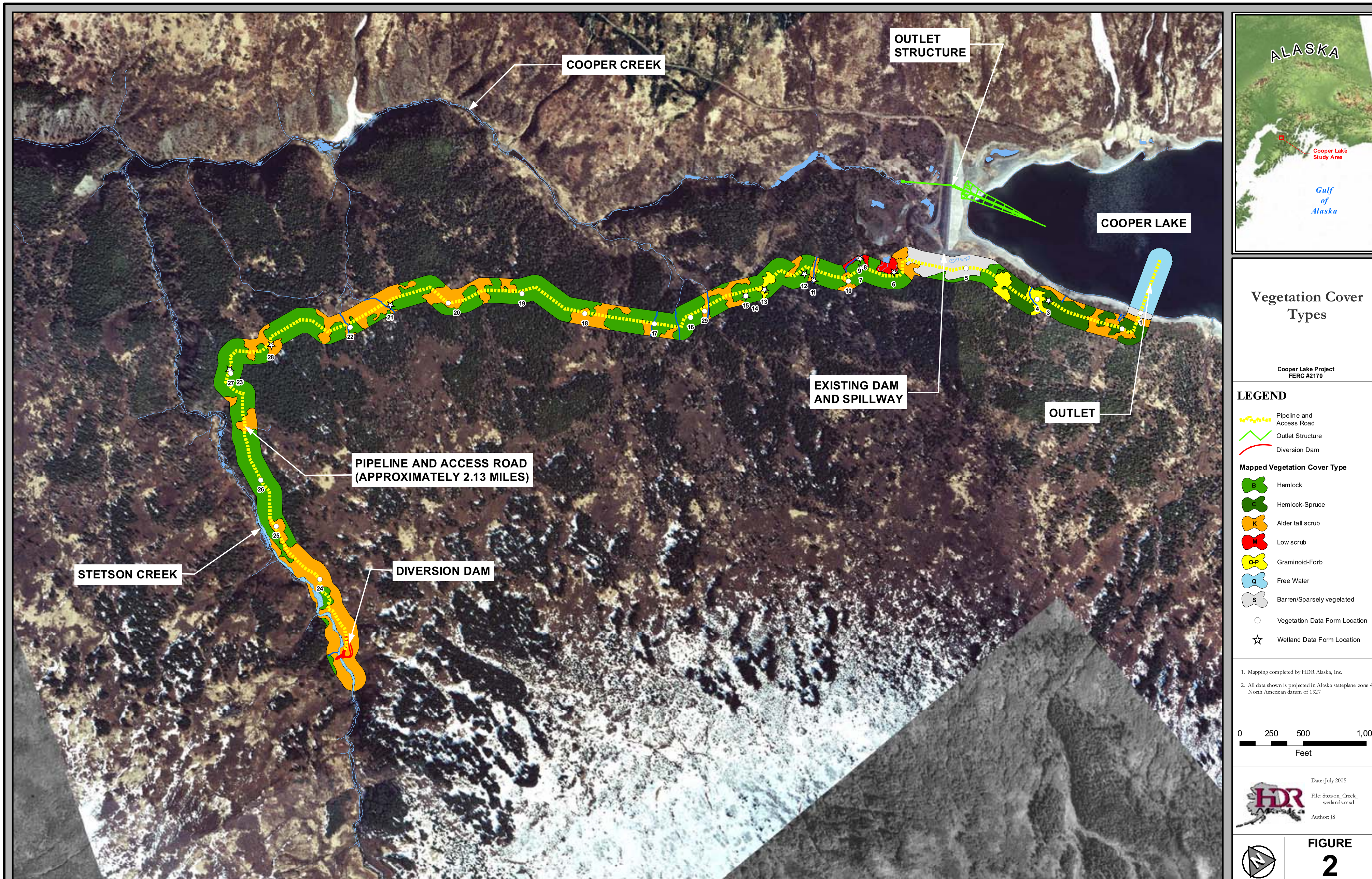
Table 4. Summary of Mapped Cover Types

Cover Type	Acres Mapped	% Area Mapped
Needleleaf Forest Type	**30.1**	**56.3%**
Hemlock	*26.5*	*49.6%*
Hemlock-Spruce	*3.6*	*6.7%*
Scrub Cover Type	**16.3**	**30.7%**
Alder Tall Scrub	*15.8*	*29.7%*
Low Scrub	*0.5*	*1.0%*
Herbaceous Cover Type	**1.3**	**2.4%**
Graminoid	*1.3*	*2.4%*
Unvegetated Areas	**5.7**	**10.6%**
Free Water	*3.0*	*5.6%*
Barren/Sparsely Vegetated	*2.7*	*5.0%*
Total mapped area (acres)	**53.4**	**100%**

Needleleaf Forest Type

Hemlock Cover Type

General Characteristics*:* Hemlock forest is the most abundant and widespread cover type in the study area, covering approximately 26.5 acres (49.6 percent of the mapped area) (Table 4). This forest type extends from Cooper Lake to approximately 1,000 feet northeast of the proposed diversion site along Stetson Creek, covering most of the study area. General characteristics of this cover type include an overstory of mountain hemlock with an understory dominated by false azalea, early blueberry, Labrador tea, crowberry, northern comandra, and five-leaved bramble. Occasional plants occurring in this cover type are listed on Table 5.



Vegetation Cover Types

Cooper Lake Project
FERC #2170

LEGEND

- Pipeline and Access Road
- Outlet Structure
- Diversion Dam

Mapped Vegetation Cover Type

- B Hemlock
- C Hemlock-Spruce
- K Alder tall scrub
- M Low scrub
- O-P Graminoid-Forb
- Q Free Water
- S Barren/Sparsely vegetated
- Vegetation Data Form Location
- Wetland Data Form Location

1. Mapping completed by HDR Alaska, Inc.
2. All data shown is projected in Alaska stateplane zone 4, North American datum of 1927

0 250 500 1,000
Feet

Date: July 2005
File: Stetson_Creek_wetlands.mxd
Author: JS

FIGURE 2

Table 5. Plant Species Summary for Hemlock Cover Type

COMMON PLANT SPECIES	
• crowberry (*Empetrum nigrum*) • northern comandra (*Geocaulon lividum*) • Labrador tea (*Ledum decumbens*) • false azalea (*Menziesia ferruginea*)	• five-leaved bramble (*Rubus pedatus*) • mountain hemlock (*Tsuga mertensiana*) • tall blueberry (*Vaccinium alaskensis*)
OCCASIONAL PLANT SPECIES	
• Kenai birch (*Betula kenaica*) • dwarf birch (*Betula nana*) • bunchberry (*Cornus canadensis*) • tall fireweed (*Epilobium angustifolium*) • wood fern (*Dryopteris dilatata*) • oak fern (*Gymnocarpium dryopteris*) • twinflower (*Linnaea borealis*) • stiff clubmoss (*Lycopodium annotinum*)	• single delight (*Moneses uniflora*) • Lutz spruce (*Picea lutzii*) • one-sided wintergreen (*Pyrola secunda*) • northern red current (*Ribes triste)* • bog blueberry (*Vaccinium uliginosum)* • lowbush cranberry (*Vaccinium vitis-idaea)* • highbush cranberry (*Viburnum edule*)

***Mapping Codes**:* Hemlock forests have a cover type code of "B". Nine data forms were completed for this cover type (data form ID numbers 7, 12, 14, 15, 16, 19, 23, 26, and 27). Representative photographs of this cover type are included in Appendix IVa-A, photographs 1 and 2.

Hemlock-Spruce Mix Cover Type

***General Characteristics**:* Hemlock-spruce mix forest occurs near the north end of Cooper Lake (southern end of proposed Project), covering approximately 3.6 acres (6.7 percent of the study area) (Table 4). General characteristics of this forest type include an overstory of Lutz spruce and mountain hemlock with an understory dominated by Sitka alder, false azalea, mountain ash, five-leaved bramble, stiff clubmoss, oak fern, and wood fern. Occasional plants occurring in this cover type are listed on Table 6.

Table 6. Plant Species Summary for Hemlock-Spruce Mix Cover Type

COMMON PLANT SPECIES	
• Sitka alder (*Alnus sinuata*) • wood fern (*Dryopteris dilatata*) • oak fern (*Gymnocarpium dryopteris*) • stiff clubmoss (*Lycopodium annotinum*) • false azalea (*Menziesia ferruginea*)	• Lutz spruce (*Picea lutzii*) • five-leaved bramble (*Rubus pedatus*) • mountain ash (*Sorbus sitchensis*) • mountain hemlock (*Tsuga mertensiana*)
OCCASIONAL PLANT SPECIES	
• lady fern (*Athyrium filix-femina*) • Kenai birch (*Betula kenaica*) • bluejoint grass (*Calamagrostis canadensis*) • bunchberry (*Cornus canadensis*) • tall fireweed (*Epilobium angustifolium*) • common horsetail (*Equisetum sylvaticum*) • northern comandra (*Geocaulon lividum*) • twinflower (*Linnaea borealis*)	• devil's club (*Oplopanax horridus*) • one-sided wintergreen (*Pyrola secunda*) • Stink current (*Ribes bracteosum*) • northern black current (*Ribes hudsonianum*) • red elderberry (*Sambucus racemosa*) • Sitka burnet (*Sanguisorba stipulata*) • beech fern (*Thelypteris phegopteris*) • starflower (*Trientalis europaea*)

***Mapping Codes**:* Hemlock-spruce forests have a cover type code of "C". One data form was completed for this cover type (data form ID number 2). Representative photographs of this cover type are included in Appendix IVa-A, photographs 3 and 4.

Scrub Community Types

Alder Tall Scrub Cover Type

***General Characteristics**:* Alder scrub thicket is one of the most common and widespread cover types in the study area, covering approximately 15.8 acres (29.7 percent of mapped area) (Table 4). This tall scrub cover type is common along drainage swales, stream corridors, steep slopes, and along the lakeshore of Cooper Lake. General characteristics of this cover type include a dense (60-80 percent cover) overstory dominated by Sitka alder, with an understory dominated by devil's club, lady fern, oak fern, northern black current, and wood fern (Table 7). Occasional plants occurring in this cover type are listed on Table 7.

Table 7. Plant Species Summary for Alder Tall Scrub Cover Type

COMMON PLANT SPECIES	
• Sitka alder (*Alnus sinuata*)	• oak fern (*Gymnocarpium dryopteris*)
• lady fern (*Athyrium filix-femina*)	• devil's club (*Oplopanax horridus*)
• wood fern (*Dryopteris dilatata*)	• northern black current (*Ribes hudsonianum*)
OCCASIONAL PLANT SPECIES	
• monkshood (*Aconitum delphinifolium*)	• five-leaved bramble (*Rubus pedatus*)
• Kenai birch (*Betula kenaica*)	• salmonberry (*Rubus spectabilis*)
• bluejoint grass (*Calamagrostis canadensis*)	• Barclay's willow (*Salix barclayi*)
• closedhead sedge (*Carex media*)	• red elderberry (*Sambucus racemosa*)
• bunchberry (*Cornus canadensis*)	• Sitka burnet (*Sanguisorba stipulata*)
• fragile fern (*Cystopteris fragilis*)	• heart-leaved saxifrage (*Saxifraga punctata*)
• common horsetail (*Equisetum arvense*)	• mountain ash (*Sorbus sitchensis*)
• northern bedstraw (*Galium triflorum*)	• Beauverd spirea (*Spirea beauverdiana*)
• northern geranium (*Geranium erianthum*)	• twisted stalk (*Streptopus amplexifolius*)
• cow parsnip (*Heracleum lanatum*)	• star gentian (*Swertia perennis*)
• alpine heuchera (*Huechera glabra*)	• fewflower meadowrue (*Thalictrum sparsiflorum*)
• twinflower (*Linnaea borealis*)	• beech fern (*Thelypteris phegopteris*)
• stiff clubmoss (*Lycopodium annotinum*)	• starflower (*Trientalis europaea*)
• false azalea (*Menziesia ferruginea*)	• mountain hemlock (*Tsuga mertensiana*)
• Lutz spruce (*Picea lutzii*)	• tall blueberry (*Vaccinium alaskensis*)
• alpine bistort (*Polygonum viviparum*)	• Sitka valerian (*Valeriana sitchensis*)
• pink wintergreen (*Pyrola asarifolia*)	• highbush cranberry (*Viburnum edule*)
• nagoonberry (*Rubus arcticus*)	• Alaska violet (*Viola langsdorffi*)

***Mapping Codes**:* Alder thickets have a cover type code of "K". Ten data forms were completed for this cover type (data form ID numbers 3, 10, 17, 18, 20, 22, 24, 25, 28, and 29). Representative photographs of this cover type are included in Appendix IVa-A, photographs 5 and 6.

Low Scrub Cover Type

***General Characteristics**:* Low scrub plant communities cover approximately 0.5 acres (1.0 percent of the mapped area) of the study area (Table 4). This cover type is present within two wetland areas located approximately 500 feet northwest of the Cooper Lake Dam. General characteristics of this cover type include an open field dominated by dwarf birch, Labrador tea, bog blueberry, cloudberry, and fewflower sedge (Table 8). Occasional plants occurring in this cover type are listed on Table 8.

Table 8. Plant Species Summary for Low Scrub Cover Type

COMMON PLANT SPECIES	
• dwarf birch (*Betula nana*)	• cloudberry (*Rubus chamaemorus*)
• fewflower sedge (*Carex pauciflora*)	• bog blueberry (*Vaccinium uliginosum)*
• Labrador tea (*Ledum decumbens*)	
OCCASIONAL PLANT SPECIES	
• Sitka alder (*Alnus sinuata*)	• red cottengrass (*Eriophorum russeolum*)
• bog rosemary (*Andromeda polifolia*)	• round-leaf sundew (*Drosera rotundifolia*)
• bluejoint grass (*Calamagrostis canadensis*)	• arctic rush (*Juncus arcticus*)
• pale sedge (*Carex canescens*)	• mountain sorrel (*Oxyria digyna*)
• mud sedge (*Carex limosa*)	• Lutz spruce (*Picea lutzii*)
• ryegrass sedge (*Carex loliacea*)	• shrubby cinquefoil (*Potentilla fruticosa*)
• closedhead sedge (*Carex media*)	• pink wintergreen (*Pyrola asarifolia*)
• manyflower sedge (*Carex pluriflora*)	• nagoonberry (*Rubus arcticus*)
• bladder sedge (*Carex utriculata*)	• Barclay's willow (*Salix barclayi*)
• bunchberry (*Cornus canadensis*)	• Sitka burnet (*Sanguisorba stipulata*)
• crowberry (*Empetrum nigrum*)	• Beauverd spirea (*Spirea beauverdiana*)
• common horsetail (*Equisetum arvense*)	• star gentian (*Swertia perennis*)
• swamp horsetail (*Equisetum fluviatile*)	• starflower (*Trientalis europaea*)
• marsh horsetail (*Equisetum palustre*)	• bog cranberry (*Vaccinium oxycoccus*)
• tall cottengrass (*Eriophorum angustifolium*)	• lowbush cranberry (*Vaccinium vitis-idaea)*

***Mapping Codes**:* Low scrub communities have a cover type code of "M". Four data forms were completed for this cover type (data form ID numbers 6, 8, 9, and 11). Representative photographs of this cover type are included in Appendix IVa-A, photographs 7 and 8.

Forb and Graminoid Community Types

Graminoid-Forb Mix Cover Type

***General Characteristics**:* Graminoid-forb mix communities cover approximately 1.3 acres (2.4 percent of the mapped area) of the study area (Table 4). Three areas of this cover type were encountered in the study area, two which are located south of the Cooper Lake Dam and one which is located approximately 1,400 feet northwest of the dam. General characteristics of this cover type includes an open meadow community dominated by bluejoint grass, tall fireweed, cow parsnip, Beauverd spirea, stink currant, common horsetail, woodland horsetail, wood fern, oak fern, Lutz spruce, Barclay's willow, and mountain ash. Occasional plants occurring in this cover type are listed on Table 9.

Table 9. Plant Species Summary for Graminoid-Forb Mix Cover Type

COMMON PLANT SPECIES	
• bluejoint grass (*Calamagrostis canadensis*)	• cow parsnip (*Heracleum lanatum*)
• tall fireweed (*Epilobium angustifolium*)	• Lutz spruce (*Picea lutzii*)
• common horsetail (*Equisetum arvense*)	• Barclay's willow (*Salix barclayi*)
• woodland horsetail (*Equisetum sylvaticum*)	• mountain ash (*Sorbus sitchensis*)
• wood fern (*Dryopteris dilatata*)	• Beauverd spirea (*Spirea beauverdiana*)
• oak fern (*Gymnocarpium dryopteris*)	• stink currant (*Ribes bracteosum*)
OCCASIONAL PLANT SPECIES	
• lady fern (*Athyrium filix-femina*)	• salmonberry (*Rubus spectabilis*)
• Kenai birch (*Betula kenaica*)	• western dock (*Rumex fenestratus*)
• water sedge (*Carex aquatilis*)	• red elderberry (*Sambucus racemosa*)
• mud sedge (*Carex limosa*)	• Sitka burnet (*Sanguisorba stipulata*)
• ryegrass sedge (*Carex loliacea*)	• twisted stalk (*Streptopus amplexifolius*)
• tall cottengrass (*Eriophorum angustifolium*)	• fewflower meadowrue (*Thalictrum sparsiflorum*)
• marsh horsetail (*Equisetum palustre*)	• beech fern (*Thelypteris phegopteris*)
• northern bedstraw (*Galium triflorum*)	• starflower (*Trientalis europaea*)
• alpine heuchera (*Huechera glabra*)	• mountain hemlock (*Tsuga mertensiana*)
• common woodrush (*Luzela multiflora*)	• tall blueberry (*Vaccinium alaskensis*)
• false azalea (*Menziesia ferruginea*)	• bog blueberry (*Vaccinium uliginosum)*
• grass-of-parnassa (*Parnassia palustris*)	• highbush cranberry (*Viburnum edule*)
• northern black current (*Ribes hudsonianum*)	• Alaska violet (*Viola langsdorffi*)

***Mapping Codes**:* Graminoid-forb mix communities have a cover type code of "O-P". Three data forms were completed for this cover type (data form ID numbers 4, 13, and 21). Representative photographs of this cover type are included in Appendix IVa-A, photographs 9 and 10.

Unvegetated Cover Types

Barren/Sparsely Vegetated

***General Characteristics**:* This cover type identifies areas that are unvegetated or sparsely vegetated. In the study area, this cover type occurs along the gravel shoreline of Cooper Lake and throughout disturbed, cleared areas adjacent to the Cooper Lake Dam. Barren/sparsely vegetated areas cover approximately 2.7 acres (5.0 percent of the mapped area) of the study area (Table 4). Plant species seen in these areas are listed in Table 10.

Table 10. Plant Species Summary for Barren/Sparsely Vegetated Cover Type

OCCASIONAL PLANT SPECIES	
• Alaska bentgrass (*Agrostis alaskana*)	• common mustard (*Leslia paniculata*)
• Sitka alder (*Alnus sinuata*)	• smallflowered woodrush (*Luzula parviflora*)
• pendant grass (*Arctophila fulva*)	• yellow monkey-flower (*Mimulus guttatus*)
• bluejoint grass (*Calamagrostis canadensis*)	• white spruce (*Picea glauca*)
• Hornemann's willow herb (*Epilobium hornemanni*)	• balsam poplar (*Populus balsmifera*)

- dwarf fireweed (*Epilobium latifolium*)
- common horsetail (*Equisetum arvense*)
- marsh horsetail (*Equisetum palustre*)
- northern comandra (*Geocaulon lividum*)
- alpine heuchera (*Huechera glabra*)
- one-sided wintergreen (*Pyrola secunda*)
- Barclay's willow (*Salix barclayi*)
- Sitka starwort (*Stellaria sitchana*)
- mountain hemlock (*Tsuga mertensiana*)

***Mapping Codes**:* Barren/sparsely vegetated areas have a cover type code of "S". Two data forms were completed for these areas (data form ID numbers 1 and 5). Representative photographs of this cover type are included in Appendix IVa-A, photographs 11 and 12.

Open Water

***General Characteristics**:* This cover type includes inundated areas that are generally void of vegetation. Mapped areas include Cooper Lake and Stetson Creek.

***Mapping Codes**:* Open water areas have a cover type code of "Q". No data forms were completed for open water sites. Representative photographs of this cover type are included in Appendix IVa-A, photographs 13 and 14.

Conclusion

Approximately 90 percent of the mapped study area is currently undisturbed, natural plant communities. Development of the proposed Stetson Creek diversion would result in construction related disturbances and direct loss of portions of plant communities which are located within the footprint of the proposed diversion structure and pipeline/access corridor. Future periodic disturbances (i.e. clearing, road maintenance, etc.) associated with the long term maintenance of the corridor would likely be frequent enough to not permit the natural vegetation communities from repopulating the impacted areas. Measures will be used to prevent the spread of exotic plant species during contruction, maintenance, or other Project activities.

Vegetation cover type impacts associated with construction and operation of the proposed Stetson Creek diversion would likely be similar to those seen along the Cooper Lake Hydroelectric powerline corridor and access roads. Each is used as a linear corridor subject to periodic clearings, which results in development of early succession communities such as scrub thickets, forb meadows, and graminoid meadows. Plant communities within these corridors have experienced regular periodic clearing for decades. The scrub thickets, forb meadows, and graminoid meadows that are the dominant plant communities in cleared areas along the powerline and access roads today are expected to be the same communities occurring in these areas in the future. A similar pattern would most likely be seen within the proposed Stetson Creek diversion pipeline/access corridor if developed.

All of the vegetation cover types mapped in the study area are common to the surrounding area (as discussed in the 2004 Terrestrial Vegetation Study (HDR 2004)); therefore it is likely that the incremental loss of plant communities associated with the proposed diversion will not have any appreciable adverse affects on area wide plant community characteristics.

References:

DeVelice, R.L., C.J. Hubbard, K. Boggs, S. Boudreau, M. Potkin, T. Boucher, and C. Wertheim. 1999. Plant community types of the Chugach National Forest, southcentral Alaska. USDA Forest Service, Chugach National Forest, Alaska Region Technical Publication R10-TP-76. Anchorage, Alaska. 375 pp.

HDR Alaska, Inc. 2004. Terrestrial Vegetation Study, Final Report. Cooper Lake Project (FERC No. 2170). June 2004.

USDA Forest Service, Chugach National Forest. 1993. Vegetation Reconnaissance Level Sampling Procedure; Version 93A. Chugach National Forest, Anchorage, Alaska.

USDA Forest Service, Chugach National Forest. 2002. Cooper Lake Hydroelectric Project (FERC #2170). Forest Service Response to Chugach Electric Associations, Inc.'s First Stage Consultation Package and Preliminary Study Concepts and Forest Service Recommended Studies. September 5, 2002.

Viereck L. A., C. T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification. U. S. Department of Agriculture.

Appendix A

REPRESENTATIVE VEGETATION COVER TYPE PHOTOGRAPHS

Proposed Stetson Creek Diversion - 2005
Terrestrial Vegetation Assessment

Photograph 1. Needleleaf Forest Type – Hemlock Forest

Photograph 2. Needleleaf Forest Type – Hemlock Forest

Photograph 3. Needleleaf Forest Type – Hemlock-Spruce Mix Forest

Photograph 4. Needleleaf Forest Type – Hemlock-Spruce Mix Forest

Photograph 5. Scrub Cover Type – Alder Tall Scrub

Photograph 6. Scrub Cover Type – Alder Tall Scrub

Photograph 7. Scrub Cover Type – Low Scrub

Photograph 8. Scrub Cover Type – Low Scrub

Photograph 9. Herbaceous Cover Type – Graminoid-Forb Mix

Photograph 10. Herbaceous Cover Type – Graminoid-Forb Mix

Photograph 11. Unvegetated Areas – Free Water (Cooper Lake)

Photograph 12. Unvegetated Areas – Free Water (Stetson Creek)

Photograph 13. Unvegetated Areas – Barren/Sparsely Vegetated

Photograph 14. Unvegetated Areas – Barren/Sparsely Vegetated

IVb. Wetland Assessment

HDR Alaska, Inc.

Study Purpose And Objective

The objectives of this study are to identify wetlands and waterbodies in the proposed Stetson Creek diversion study area (Figure 1, see description below) and evaluate potential future impacts to those areas. The study area covers areas that may be affected by the proposed Stetson Creek diversion. The 53.4-arce study area is defined as follows:

3. ***Diversion Structure.*** Wetlands and waterbodies were mapped along an area extending 200 feet upstream and downstream of the proposed location of the diversion structure within Stetson Creek and 100 feet either side of the creek floodplain.
4. ***Pipeline and Access Road Alignment.*** Wetlands and waterbodies were mapped along a 200 foot swath surrounding the proposed pipeline alignment, defined as 100 feet on either side of alignment centerline.

This assessment describes areas that are subject to the jurisdiction of the U.S. Army Corps of Engineers (USACOE) under authority of Section 404 of the Clean Water Act or under authority of Section 10 of the Rivers and Harbors Act of 1899. The USACOE has authority over certain work in "waters of the U.S.," including wetlands, and in "navigable" waters. By federal law (Clean Water Act) and associated policy, it is necessary to avoid project impacts to wetlands wherever practicable, minimize impact where impact is not avoidable, and in some cases compensate for the impact. Wetlands, waterbodies, and upland locations were identified to determine if any developments associated with the proposed Stetson Creek diversion would impact areas that are federally protected under the Clean Water Act (*Federal Register* 1986). This report describes the mapping process, briefly describes the extent and types of waterbodies and wetlands found in the study area, and identifies areas potentially subject to impacts. Wetlands, waters of the U.S., and uplands (non-wetlands), as referenced in this report, are defined as:

Wetlands. "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 Code of Federal Regulations [CFR] Part 328.3(b)). Wetlands are a subset of "waters of the U.S." Note that the "wetlands" definition does not include unvegetated areas such as streams and ponds.

Waters of the U.S. Waters of the U.S. include other waterbodies regulated by the U.S. Army Corps of Engineers (USACOE), including lakes, ponds, and streams, in addition to wetlands. The ponds mapped in the Project area are "waters of the U.S." but not "wetlands".

Uplands. Non-water and non-wetland areas are called uplands.

Methods

Three steps were used to evaluate and produce an inventory of wetlands and waterbodies in the study area. Those steps include (1) Preliminary office-based mapping, (2) Field investigation, and (3) Final mapping.

Preliminary office-based mapping
All available wetland, stream, and waterbody GIS datasets for the study area were collected. U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) mapping provided the most complete dataset for the study area. This mapping is generally an effective tool for large-scale planning and analysis of wetlands but is not suitable for smaller site-specific projects, such as the detail needed for this study. National Wetland Inventory mapping is primarily based on aerial photographic interpretation with limited ground truthing, and therefore wetland boundaries tend to be oversimplified with many smaller wetland complexes not included in the mapping. This dataset was identified and analyzed for the purposes of this study; however it was not included in the final analysis because of the coarse scale and resolution of the mapping in the study area.

To acquire finer resolution mapping, HDR scientists stereoscopically analyzed color aerial photography and digitized wetland and waterbodies discernable on the aerial photographs into the Project's Geographic Information System (GIS) database. This digitization process used existing photogrammetric derived topographic mapping and orthorectified aerial photography collected by Kodiak Mapping, Inc. (taken at a 1"=700' scale, May 7, 2003). Delineating wetlands from aerial photography included using the following methods:

a. Vegetation clues: On aerial photography, scientists looked for saturation-adapted vegetation communities, open canopy structure, low plant height, and presence of hydrophytic plant species. A common example included dwarf spruce trees, which are indicative of a limitation to growth such as excessively wet soils.

b. Evidence of soil saturation: Visible evidence of wetland hydrology was sought, including surface water and darker areas of photos indicating surface saturation. A site's proximity to streams, open water habitat, and marshes can be indicative of shallow subsurface water.

c. Topography: Evidence of topographic high points and sloped surfaces that would allow soils to drain was used to support classifying those areas as upland. Topographic depressions, toes of slopes, and flat topography served as indicators of potentially poor soil drainage.

Field investigation
A wetland site investigation was completed by HDR during July 11-15, 2005 to collect data at characteristic plant communities occurring at different landform positions. Specific data

collected included detailed information on soil conditions, hydrology, and plant community composition. Sites were studied using the U.S. Corps of Engineers 1987 wetland delineation manual's three-parameter method of determining an area's wetland status (USACOE, 1987). Standard Corps of Engineers data sheets were completed at each site. Each location visited during the field visit was logged into a handheld global positioning system (GPS) unit. Streams and waterbodies were identified in the field and marked on the aerial photography. Representative photographs, detailed plant community information (coinciding with the Terrestrial Vegetation Study), and observational data were collected in conjunction with wetland delineation data form plots.

Final mapping

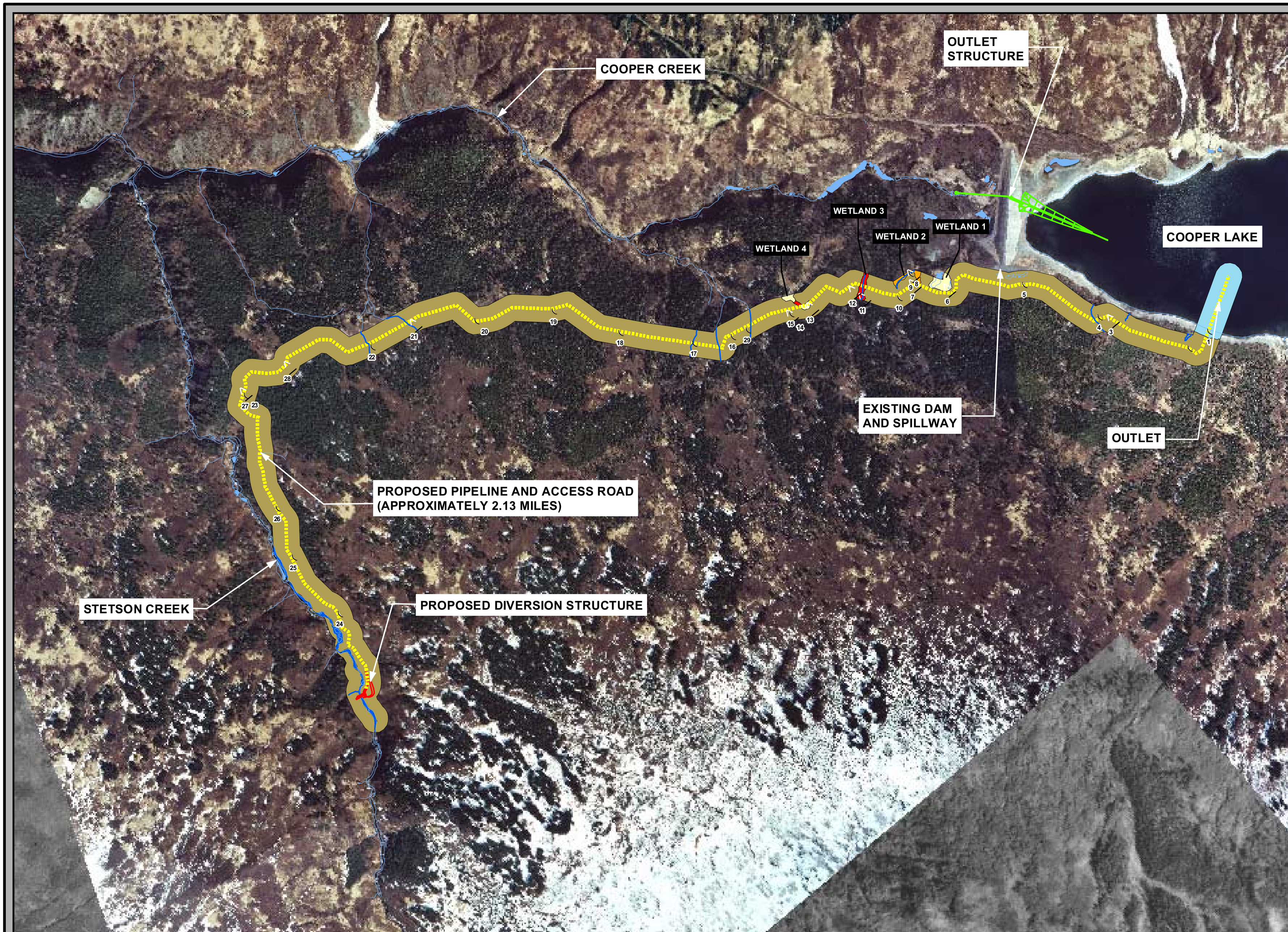
Upon return from the field, wetland scientists amended the office-delineated wetland boundaries. Preliminary mapping and field-derived data were reviewed to complete digitizing of wetland-upland boundaries using GIS. Wetlands types were characterized based on the U.S. Fish and Wildlife Service Classification of Wetlands and Waterbodies (Cowardin et al., 1979).

Results

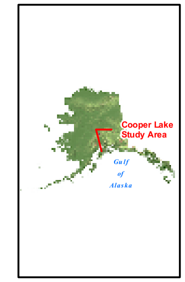
A total of 4 individual wetlands and 2 types of "Waters of the U.S." were identified in the 53.4-acre study area (Table 1). These types are briefly described below. Figures showing wetland and waterbodies mapped in the study area, overlaid on aerial photographs, are included on Figure 2. Representative photographs of each mapped wetland and waterbody type are included in Appendix IVb-A.

Table 1. Wetland, Waterbody, and Upland Areas in the Study Area

System	Subsystem	Acres Mapped	% of Area Mapped
Palustrine System		**1.0**	**1.9%**
	Seasonally Flooded Emergent Wetland	*0.5*	*0.9%*
	Saturated Broadleaf Scrub-Shrub/Emergent Wetland	*0.2*	*0.4%*
	Seasonally Flooded Broadleaf Scrub-Shrub Wetland	*0.3*	*0.6%*
Riverine System		**0.7**	**1.3%**
	Upper Perennial	*0.7*	*1.3%*
Lacustrine System		**2.5**	**4.7%**
	Limnetic	*2.5*	*4.7%*
Upland		**49.2**	**92.1%**
Total mapped area		**53.4**	**100.0%**



KEYMAP



Wetland, Waterbody, and Upland Areas

Cooper Lake Project
FERC #2170

LEGEND

- Pipeline and Access Road
- Outlet Structure
- Proposed Diversion Structure

Mapped Wetlands, Waterbodies, and Uplands

- PEM1C — Seasonally Flooded Emergent Wetland
- PSS1/EM1B — Saturated Broadleaf Shrub-Scrub/ Emergent Wetland
- PSS1C — Seasonally Flooded Broadleaf Scrub-Shrub Wetland
- R3UBH — Riverine - Upper Perennial
- L1UBH — Lacustrine - Limnetic
- U — Upland
- Riverine - Upper Perennial Stream
- (Vegetation Data Form Location
- — Wetland Data Form Location

1. Mapping completed by HDR Alaska, Inc.
2. All data shown is projected in Alaska stateplane zone 4, North American datum of 1927

0 250 500 1,000
Feet

Date: July 2005
File: Stetson_Creek_wetlands.mxd
Author: JS

FIGURE 2

Palustrine System

Seasonally Flooded Emergent Wetland

***General Characteristics**:* Two sites in the study area meet the criteria to be classified as seasonally flooded emergent wetland. The first area (0.3 acres in size) is located approximately 400 feet northwest of the Cooper Lake Dam. This wetland is identified as Wetland 1 on attached Figure 2. Dominant plant species in Wetland 1 include fewflower sedge (*Carex pauciflora* – OBL), tall cottongrass (*Eriophorum angustifolium* - OBL), cloudberry (*Rubus chamaemorus* – FACW), bog blueberry (*Vaccinium uliginosum* – FAC), dwarf birch (*Betula nana* – FAC), and sphagnum moss (NI). This plant community is hydrophytic. This wetland's soil was identified as a saturated histosol, having greater than 22 inches of saturated fibric and hemic organic horizon in the soil profile. This wetland can be characterized as a depressional bog wetland that likely outputs its water either downstream to Cooper Creek, recharges it into the groundwater system, or loses it through evapotranspiration. A wetland determination data form (data form number 6) was completed for this wetland.

The second seasonally flooded emergent wetland area (0.2 acres in size) is located approximately 1,500 feet northwest of Cooper Lake Dam. This wetland is identified as Wetland 4 on attached Figure 2. Dominant plant species in Wetland 4 include bluejoint grass (*Calamagrostis canadensis* – FAC), common horsetail (*Equisetum arvense* – FACU), and Barclay's willow (*Salix barclayi* – FAC). Lutz spruce (*Picea lutzii* – NI) and mountain hemlock (*Tsuga mertensiana* – FAC) are sparsely distributed throughout the wetland. This plant community is hydrophytic. Soils investigated in this wetland have saturated histosol characteristics, having greater than 16 inches of fibric, hemic, and sapric organic horizon. Sulfidic odor was present at a depth of 4 inches below the ground surface indicating anaerobic soil conditions. A small perennial stream flows through the central portion of this wetland. A wetland determination data form (data form number 13) was completed for this wetland.

Seasonally flooded emergent wetland has a NWI mapping code of "PEM1C". Representative photographs of Wetland 1 and Wetland 4 are included in Appendix IVb-A, photographs 1, 2, 3, and 4.

Saturated Broadleaf Scrub-Shrub/Emergent Wetland

***General Characteristics**:* One site within the study area meets the criteria to be classified as a saturated broadleaf scrub-shrub/emergent wetland type. This wetland is identified as wetland 2 on attached Figure 2. Dominant plant species in this wetland type include Lutz spruce (NI), Labrador tea (*Ledum decumbens* – FACW), bog blueberry (FAC), cloudberry (FACW), fewflower sedge (OBL), ryegrass sedge (*Carex loliacea* – OBL), and sphagnum moss (NI). This plant community is hydrophytic. Soils investigated in this wetland type have saturated histosol characteristics, having greater than 20 inches of fibric and hemic organic horizon. Sulfidic odor was present at 6 inches below the ground surface indicating anaerobic soil conditions. Small inundated areas occur in low-lying depressions throughout the site. A small stream originating at the western end of the wetland flows through the area, this stream begins at a groundwater discharge site. A wetland determination data form (data form number 9) was completed for this wetland.

Saturated broadleaf scrub-shrub/emergent wetland has a NWI mapping code of "PSS1/EM1B". Representative photographs of Wetland 2 are included in Appendix IVb-A, photographs 5 and 6.

Seasonally Flooded Broadleaf Scrub-shrub Wetland

***General Characteristics**:* One site within the study area meets the criteria to be classified as a seasonally flooded broadleaf scrub-shrub wetland type. This wetland is identified as wetland 3 on attached Figure 2. Dominant plant species in this wetland type include Barclay's willow (FAC), common horsetail (FACU), and bluejoint grass (FAC). This plant community is hydrophytic. Soils investigated in this wetland type have a deep saturated organic horizon throughout the entire soil profile (17 inches) with a suspended mineral horizon occurring 7 inches below the ground surface. Below the suspended mineral horizon is a thick hemic organic horizon. It is likely that the suspended mineral horizon could have been deposited during a historical flood event of the small perennial stream that flows through the site. Sulfidic odor was present at 5 inches below the ground surface indicating anaerobic soil conditions. Evidence of periodic flood events, including water marks, drift lines, sediment deposits, scour marks, and water stained leaves were present throughout the site. A wetland determination data form (data form number 11) was completed within this wetland.

Seasonally flooded broadleaf scrub-shrub wetland has a NWI mapping code of "PSS1C". Representative photographs of Wetland 3 are included in Appendix IVb-A, photographs 7 and 8.

Riverine System

Upper Perennial

***General Characteristics**:* Within the study area, thirteen perennial streams were observed. These include Stetson Creek and twelve unnamed smaller creeks. The streams are delineated on attached figure 2. Stetson Creek has a high gradient and high velocity stream flow. The other twelve streams generally have a high gradient but are much smaller and size and flow.

Upper perennial streams have a NWI mapping code of "R3UB1". Representative photographs of Stetson Creek are included in Appendix IVb-A, photographs 9 and 10. Representative photographs of two unnamed streams are included in Appendix IVb-A, photographs 11 and 12.

Lacustrine System

Limnetic

***General Characteristics**:* Limnetic waterbodies are the deep, permanently flooded, open water areas of lakes. Aquatic vegetation is typically absent or sparse in the limnetic portion of a lake (USFWS 1997). Within the study area, Cooper Lake meets the criteria to be classified as a limnetic waterbody.

Limnetic waterbodies have a NWI mapping code of "L1UBH". Representative photographs of Cooper Lake are included in Appendix IVb-A, photographs 13 and 14.

Upland

***General Characteristics**:* Approximately 92% (49.2 acres) of the study area lacks one or more of the required three parameters to support classifying an area as wetland. Developed areas such as road embankments and the Cooper Lake Dam foundation and spillway were judged to be upland. These areas would not be subject to jurisdiction under Section 404. Uplands have a NWI mapping code of "U" and are shown on attached figure 2. Five wetland determination data forms (data form numbers 3, 12, 14, 21, and 23) were completed within upland sites.

Conclusion

Based on the findings above, it has been determined that areas displayed as wetlands on attached Figure 2 meet the criteria established by the Corps of Engineers' 1987 Wetland Delineation Manual for being classified as wetland. These areas are subject to jurisdiction under Section 404. Within the study area, the USACOE also has jurisdiction over all of the streams shown on Figure 2. The streams are subject to both Section 404 and Section 10.

Most of the study area, 49.2 acres (92%), does not meet the required three parameters needed to classify an area as wetland. Approximately 4.2 acres (8%) of the study area would require a Section 404 Permit to allow discharge of material into jurisdictional wetlands or waterbodies during construction of the proposed diversion structure and pipeline / access road. Federal regulations and guidelines associated with Section 404 of the Clean Water Act would require that Chugach eliminate or reduce adverse impacts on wetlands by taking certain specific steps. These steps, each of which is to be implemented to the extent feasible before moving on to the next, are in order: (1) Design the project to *avoid adverse impacts*; (2) Incorporate measures to *minimize adverse impacts*; (3) Plan to *restore sites* that must be temporarily adversely affected by the project; and (4) *Compensate for unavoidable adverse impacts* through preservation, restoration, or creation of wetlands. Together, these steps mitigate (i.e., reduce) the overall adverse effects of a project.

Reference:

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, U.S. Fish and Wildlife Service. Washington, DC.

U.S. Federal Register. November 13, 1986 Part II. Rules and Regulations, Vol. 51, No. 219. U.S. Department of Defense. Corps of Engineers, Department of the Army. 33 CFR Parts 320-330, Regulatory Programs of the Corps of Engineers; Final Rule.

U.S. Army Corps of Engineers Environmental Laboratory (USACOE). 1987. Corps of Engineers Wetlands Delineation Manual. Vicksburg, MS.

U.S. Department of the Interior, Fish and Wildlife Service. 1978. National Wetlands Inventory. Seward B8 USGS Topographic Map. Scale: 1:63,360.

Appendix A

PHOTOGRAPHS OF STUDY AREA WETLANDS AND WATERBODIES

Proposed Stetson Creek Diversion - 2005
Wetland Assessment

Photograph 1. Wetland 1 (PEM1C) - Vegetation

Photograph 2. Wetland 1 (PEM1C) – Soil Profile

Photograph 3. Wetland 4 (PEM1C) – Vegetation

Photograph 4. Wetland 4 (PEM1C) – Soil Profile

Photograph 5. Wetland 2 (PSS1/EM1B) – Vegetation

Photograph 6. Wetland 2 (PSS1/EM1B) – Soil Profile

Photograph 7. Wetland 3 (PSS1C) – Vegetation

Photograph 8. Wetland 3 (PSS1C) – Soil Profile

Photograph 9. Stetson Creek (R3UB1)

Photograph 10. Stetson Creek (R3UB1)

Photograph 11. Unnamed Stream (R3UB1)

Photograph 12. Unnamed Stream (R3UB1)

Photograph 13. Cooper Lake (L1UBH)

Photograph 14. Cooper Lake (L1UBH)

Attachment A. Plant Community Mapping Codes

Vegetation cover type	
a. spruce	k. alder tall scrub
b. hemlock	l. willow tall scrub
c. hemlock-spruce	m. low scrub
d. birch	n. dwarf scrub
e. cottonwood	o. graminoid herbaceous
f. aspen	p. forb herbaceous
g. spruce-birch	q. free water
h. spruce-cottonwood	r. frozen water
i. spruce-aspen	s. barren/sparsely vegetated
j. hemlock-birch	

Forest canopy cover class
a. Closed - ≥60 percent
b. Open - 25-59 percent
c. Woodland - 10-24 percent

Vegetation community type group		
Forest Types	**Scrub Types**	**Herbaceous Types**
a. alder	j. alder	r. bluejoint
b. bluejoint	k. cassiope	s. fern
c. devil's club	l. crowberry	t. fireweed
d. dwarf scrub	m. dwarf birch	u. horsetail
e. fern	n. salmonberry	v. rough fescue
f. menziesia	o. sweet gale	w. sedge
g. moss	p. willow	x. not differentiated
h. tall blueberry	q. not differentiated	
i. not differentiated		

Vegetation community type group: The appropriate indicator of the undergrowth community type group is appended to the vegetation cover type name. Determinations of the indicator species will be made using *Plant Community Types of the Chugach National Forest: Southcentral Alaska* (Technical Publication R1O-TP-76).

Height Class	
Upper Canopy	**Subcanopy**
a. 0-5 feet	a. 0-1 feet
b. 5-10 feet	b. 1-5 feet
c. 10-20 feet	c. 5-10 feet
d. 20-30 feet	d. >10 feet
e. 30-40 feet	
f. 40-50 feet	
g. 50-60 feet	
h. 60-70 feet	

Height Class	
i. 70-80 feet	
j. 80-90 feet	
k. 90-100 feet	
l. 100-110 feet	
m. >110 feet	

Attachment V

Sensitive Plants Survey Technical Memorandum
HDR Alaska

Study Purpose and Objectives

The purpose of this study was to develop the information necessary for the USDA Forest Service (USFS) to meet its goals and objectives related to sensitive plant species. Specifically, this study was designed to determine the locations and abundance of sensitive plants in the area of the proposed Stetson Creek diversion and associated pipeline/access corridor. This information will be used to prepare a Biological Evaluation for Plants for the Cooper Lake Project as a whole. The objectives of the Biological Evaluation for Plants will be: (1) to ensure that actions do not contribute to loss of viability of any native or desired non-native plant or animal species; (2) to incorporate concerns for sensitive species throughout the planning process; and (3) to ensure that ongoing and potential future Project-related activities will not cause a species to move toward federal listing as a threatened or endangered species. The primary objectives of this study were twofold: (1) to survey the study area to determine whether it supports any plants currently identified by Region 10 of the USFS as "sensitive plants"; and (2) if any sensitive plants are found, to collect the information needed to evaluate the potential effects on those plants and to develop any necessary mitigation measures.

Study Area

The study area for the sensitive plant survey was intended to cover habitats that may be affected by the proposed Project. The study area was defined as follows:

1. ***Diversion Structure.*** An area extending 200 feet upstream and downstream of the proposed location of the diversion structure within Stetson Creek and extending to 100 feet to either side of the creek's floodplain was surveyed for sensitive plants. This area is approximately 2.5 acres in size.
2. ***Stetson Creek below Diversion.*** Riparian areas along Stetson Creek between the diversion site and the confluence with Cooper Creek, limiting the survey to areas that could be examined safely.
3. ***Pipeline and Access Road Alignment.*** An area defined as 100 feet on either side of alignment centerline. This area is approximately 52 acres in size.
4. ***Cooper Lake Dam Area.*** The area downstream of the dam that might be disturbed during construction of the lake discharge structure, including the permanent disturbance area.

Methods

The preliminary review of sensitive plant information and selection of suitable survey areas was done by Anne Leggett of HDR Alaska, Inc. The field surveys were completed by botanist Michael Duffy of Michael Duffy Biological Consulting Services and Malcolm Salway of HDR Alaska, Inc.

Areas of focus for the sensitive plant survey were habitats known or suspected to support sensitive plants in Chugach National Forest, as directed in the "Procedures for Sensitive Plant Biological Evaluations" section of the USFS sensitive plant manual (Stensvold 2002; appended to the April 2003 Study Plan, HDR 2003). These may include heath, alpine and subalpine areas, wet meadows, shallow fresh water, forest edges, rock outcrops, well drained open areas, open forests, waterfalls, and stream banks. The exact areas of focus were based on a review of pertinent information (habitat descriptions and USFS data), the surveyors' understanding of habitat preferences of each of the suspected species, and on surveyors' judgment about where those habitats might exist within the study area. Thus, professional judgment was exercised in the field to select areas for close examination.

The study methods were based on the "Procedures for Sensitive Plant Biological Evaluations" (Stensvold 2002). The methods are summarized below.

Scientists had previously reviewed and compiled existing information on known locations, habitat preferences, and general geographic distributions of sensitive vascular plant species for the Cooper Lake Project Sensitive Plant Survey (HDR 2003). This information was reevaluated with regard to the Stetson Creek diversion study area.

The following existing information was used:

- List of Alaska Region Sensitive Vascular Plants (June 2002).
- Forest Service protocols for sensitive plant surveys and Biological Evaluations (Stensvold 2002).
- Known geographic locations of sensitive species on the Kenai Peninsula (USFS digital records, conversation with forest ecologist). [None are known to exist in the project area.]
- Known habitat preferences and general geographic distributions of listed sensitive plants (Forest Service sensitive plant manual [Stensvold 2002]).
- Vegetation maps produced as part of other studies conducted in conjunction with the Project.
- 2003 aerial photography of Cooper Creek, Cooper Lake, and the transmission line.

Through stereoscopic interpretation of aerial photographs of the Project area, scientists identified potential habitat based on the reevaluation of the information summarized in Table 1.

Table 1. Sensitive Plants Suspected in the Project Area

Latin Name	Common Name	Potential Habitats
Aphragmus eschscholtzianus	Eschscholtz's little nightmare	Wet areas of tundra and heath, areas of slow water flowage, moist mossy areas, solifluction slopes, seeps and scree slopes
Arnica lessingii ssp. norbergii	Norberg arnica	Meadows, open forest, tall shrubland, willow-alder openings, tundra, heath
Carex lenticularis var. dolia	Goose-grass sedge	Wet meadows, edges of snow beds, near glaciers, pond and lake margins
Draba kananaskis	Tundra whitlow-grass	Rocky alpine, scree slopes, rock ledges
Isoetes truncata	Truncate quillwort	Shallows of lakes, ponds, and streams, immersed in fresh water
Ligusticum calderi	Calder's lovage	Meadows in alpine and subalpine, margins of subalpine mixed conifer forest. Wet to moist areas. Limestone, often rocky habitats, rocky cliffs, open boggy or rocky slopes
Papaver alboroseum	Pale poppy	Well drained sandy and gravelly soil, rocky, open habitats, recently deglaciated areas, rock outcrops, riparian areas, disturbed gravels
Puccinellia glabra	Smooth alkali grass	Coastal flats frequently flooded by tides; stabilized sandy, shingle, or muddy beaches in upper tide zone
Puccinellia kamtschatica	Kamchatka alkali grass	Wet places on coast
Romanzoffia unalaschensis	Unalaska mist-maid	Moist places, wet rock outcrops, shorelines, riverbanks, beach terraces
Stellaria ruscifolia ssp. aleutica	Circumpolar starwort	Moist gravelly habitats, along streams in lowlands and in the mountains

Sources: Stensvold 2002, Lipkin and Murray 1997.

Because previously undisturbed ground would be affected at the Stetson Creek diversion study area, the biologists chose to survey at an intensity level of 5 (survey intensity levels are defined in Appendix A). Level 5 entails a complete examination of specific high-probability or unique areas after examining the study area intensively enough to locate any such habitats. Therefore, sensitive plant surveys of the diversion structure, the pipeline and access road route, and the location of the discharge structure below the Cooper Lake Dam were performed at intensity level 5. The Stetson Creek stream corridor below the diversion structure was not surveyed at intensity level 5 because of steep, unstable slopes leading to the creek and the steep gradient of the creek. On July 28, the biologists flew over the entire creek in a helicopter and returned to study three representative reaches of the creek. The three reaches were located upstream (~600 feet) of the diversion structure site, from the diversion structure site to 200 feet downstream, and at the confluence of Stetson Creek with Cooper Creek. These three areas were similar and contained similar plant species. All surveys were conducted between June 27 and July 1, 2005.

Records of field surveys were kept according to current USFS protocols for sensitive species surveys, including use of the R-10 Daily Sensitive Plant Survey Forms and the R-

6 Threatened, Endangered, and Sensitive Plant Sighting Form. Locations of surveys were recorded in the field on georeferenced aerial photography and recorded using a GPS receiver.

Habitats likely to support sensitive plants were thoroughly searched. The searches were conducted following the concepts of the timed meander method (Goff et al. 1982). Searches in each unit were timed, and all species encountered were recorded. Surveyors remained in each survey unit until they thought that no new species would be encountered with further searching, or until they deemed the habitat unsuitable for the sensitive species. A list of species encountered in each survey area was developed.

Results and Conclusions

The 2005 sensitive plant survey of the Stetson Creek diversion study area found no "sensitive plants" designated by Region 10 of the U.S. Forest Service. The intensive survey of the study sites suggests that construction in these areas would have no effect on sensitive plant species. All surveys were conducted at the appropriate time of year to identify sensitive species.

The survey areas are shown on topographic maps. These maps and the daily sensitive plant survey forms, which include a list of all plant species found, will be transmitted to the U.S. Forest Service.

References:

Goff, F.G., G.A. Dawson, and J.J. Rochow. 1982. Site Examination for Threatened and Endangered Plant Species. Environmental Management, Vol. 6, No. 4. pp. 307-316.

HDR Alaska, Inc. (HDR). 2003. Sensitive and Exotic Plants Survey, Final 2003 Study Plan, Cooper Lake Project (FERC No. 2170). Prepared for Chugach Electric Association. April 2003.

Lipkin, R., and D.F. Murray. 1997. Alaska Rare Plant Field Guide. Alaska Natural Heritage Program, University of Alaska Anchorage, and University of Alaska Museum, University of Alaska Fairbanks, Alaska.

Stensvold, M. 2002. Sensitive Plants, Chugach National Forest, July 2002 (in-house training publication).

Appendix A

SURVEY INTENSITY LEVELS FOR PLANTS

LEVEL 1 = "FIELD CHECK"
The surveyor gives the area a quick "once-over" but does not walk completely through the project area. The entire project area has not been examined.

LEVEL 2 = "CURSORY"
The surveyor gives the area a "once-over" by walking through the project area. The entire project area has not been examined.

LEVEL 3 = "LIMITED FOCUS"
The surveyor closely examines one or more habitat-specific locations within the project area, but does not look at the rest of the area.

LEVEL 4 = "GENERAL"
The surveyor gives the area a closer look by walking through the project area and walking around the perimeter of the area or by walking more than once through the area. Most of the project area is examined.

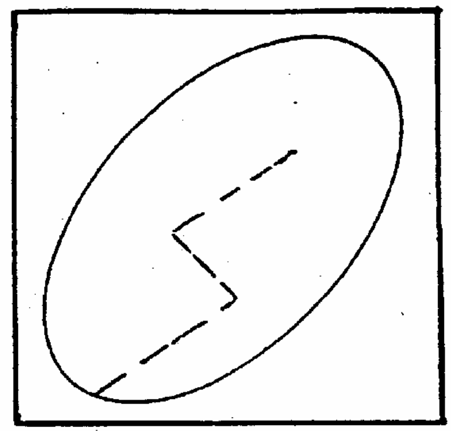
LEVEL 5 = "INTUITIVE CONTROLLED"
The surveyor has closer look by conducting a complete examination of specific areas of the project after walking through the project area and perimeter or by walking more than once through the area.

LEVEL 6 = "COMPLETE"
The surveyor has walked throughout the area being examined until nearly all nearly all of the area has been examined.

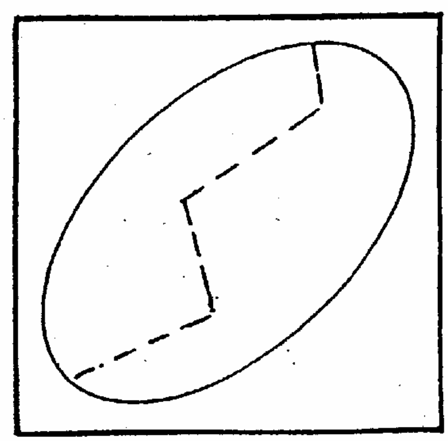
Survey Intensity Levels Used In Sensitive Plant Surveys

The following types of surveys are linked with the completion of the Biological Evaluation:

Field Check
The surveyor gives the area a quick "once-over" but does not walk completely through the project area. The entire project area has not been examined.

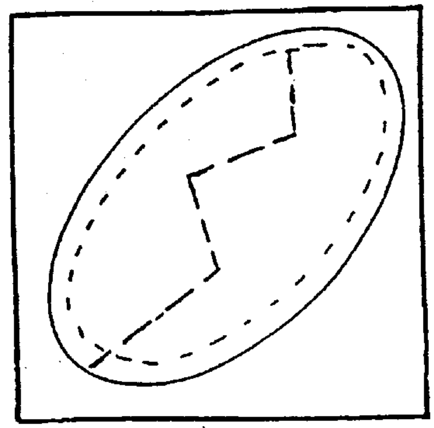


Cursory/Limited Focus
The surveyor gives the area a "once-over" by walking through the project area. The entire project area has not been examined.



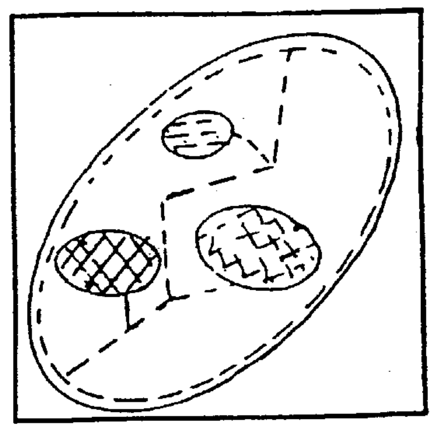
General

The surveyor gives the area a closer look by walking through the project area and perimeter or by walking more than once through the area. Most of the project area is examined.



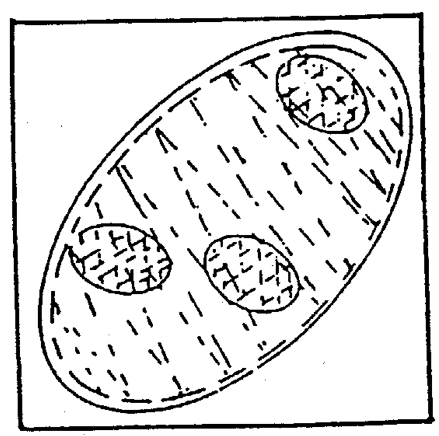
Intuitive Controlled

The surveyor has given the area a closer look by conducting a complete reconnaissance through a specific area of the project after walking through the project area and perimeter or by walking more than once through the area.



Complete

The surveyor has walked throughout the area being examined until nearly all of the area has been examined.



Attachment VI

Cultural Resources Study Technical Memorandum
Cultural Resource Consultants LLC

Study Purpose and Objectives

The Federal Energy Regulatory Commission (FERC) requires applicants to address historic properties along with other environmental resources in a license application (18 CFR 4.51.f.4). Section 106 of the National Historic Preservation Act (NHPA) requires that FERC take into account the effects of its relicensing decision on historic properties and provide the Advisory Council on Historic Preservation a reasonable opportunity to comment. This report addresses the potential future effects of the proposed Stetson Creek diversion on cultural resources.

All aspects of this cultural resources study for the Cooper Lake Project (Project) relicensing have been done in accordance with the implementing regulations of Section 106 of the NHPA (36 CFR Part 800), FERC's hydropower licensing regulations (18 CFR Chapter 1, Part 4), the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716), the Secretary of the Interior's Professional Qualifications Standards (48 FR 22716), the Advisory Council on Historic Preservation's general guidelines for identification and testing procedures as set forth in *Treatment of Archaeological Properties, A Handbook*, and the standards stated in the Programmatic Agreement Among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation and the Alaska State Historic Preservation Officer Regarding Heritage Resource Management on National Forests in Alaska. Unless otherwise specified, field notes, samples, artifacts and other collected data will be curated with the University of Alaska Museum in Fairbanks in accordance with the requirements set forth in 36 CFR Part 79. All site information, other than its Alaska Heritage Resources Survey (AHRS) number and National Register of Historic Places (National Register) eligibility, will be confidential as stipulated in Section 304 of the NHPA, as amended (16 USC 470w-3).

Inventory and Assessment of Archeological and Historical Resources

The goal of the inventory that has been conducted for relicensing of the Project is the identification of historical and archeological resources in the Project's area of potential effect (APE). The focus of the supplemental inventory described in this technical memorandum is the portion of the APE associated with the proposed Stetson Creek diversion structure and approximately 2-mile long pipeline and access road to Cooper Lake. "Identification" includes identifying properties and determining whether or not they are listed on, or eligible for inclusion in, the National Register. The standard for identification is a reasonable and good faith effort, including (as necessary) background research, consultation, oral history interviews, reconnaissance investigations, and intensive field surveys. Field methods included systematic pedestrian surveys of lands in the APE and archaeological test excavations to sample possible cultural deposits. The results of this work will be incorporated into the Project's Historic Properties Management Plan (HPMP).

Area of Potential Effect (APE)

The APE for the Project includes lands that could be affected (directly or indirectly) by operations or ground-disturbing activities required by or permitted under the new FERC license. The APE consists of lands within the FERC-licensed Project boundary, as well as areas where potential Project-related activities might affect cultural resources.

The 2005 fieldwork described herein focused specifically on accessible areas that could be affected by diversion of water from Stetson Creek to Cooper Lake. The survey area consisted of a 100-foot wide corridor along the roughly 2-mile long route of the proposed pipeline and access road from Stetson Creek to Cooper Lake. At the time of the fieldwork, the centerline of the pipeline / access road had been brushed and marked with survey stakes. The location of the proposed diversion structure on Stetson Creek was not accessible at the time of the survey.

Background Research

Much of the available archeological and historical information about the study area was reviewed prior to the 2003 field season (Cultural Resource Consultants 2003). However, additional research was undertaken to identify and determine the possible significance of historic resources in the upper Stetson Creek drainage. This information is summarized below.

Study Area

Cooper Creek is roughly 4.5 miles long from Cooper Lake to its confluence with the Kenai River. Stetson Creek, the largest tributary of Cooper Creek, "occupies a very steep, narrow avalanche debris-filled valley with a bedrock gorge developed along its lower section" (Jansons et al. 1984).

History

Cooper and Stetson creeks are primarily associated with late nineteenth and early twentieth century gold mining and produced more gold than any other mining area in the upper Kenai River valley (Painter 1998:1-2). Over the years, miners worked the gravel in both creek canyons and on the flat at the lower end of Cooper Creek, first with pick and shovel and later with hydraulic equipment (Johnson 1915:199; Jansons et al. 1984). Areas of Stetson Creek were reportedly mined before break-up to access gravel under the falls.

Charles H. Sickles and James Stetson were the first to file mining claims on Cooper and Stetson creeks (Barry 1997:34). Sickles staked four claims on Cooper Creek in the fall of

1895 and made the first discovery of gold on S. D. No. 1, a 160-acre claim that straddled the lower portion of Cooper Creek (Johnson 1911:3). In 1896, Stetson located claims on the tributary of Cooper Creek later named for him (Barry 1997:76). He was "quite successful" during the two seasons he worked his claims, but ultimately abandoned them (Johnson 1915:182-183).

Joseph Cooper brought a party to Cooper Creek in 1896 where he had found gold fourteen years earlier and staked placer claims along the creek (Barry 1997:58). In 1897, a group led by George Towle and James Stetson journeyed to the confluence of Cooper and Stetson creeks (Barry 1997:76). They set up a hydraulic plant in 1898 but had to shut down soon after due to supply problems. In 1899, landing at Resurrection Bay, their crew pioneered a trail to the Kenai River and up to their claims on Stetson Creek. They also cut enough lumber to build a 400-foot long flume on Stetson Creek and "twelve or more sluice boxes one foot high, one foot wide and twelve feet long." Although the Towles worked their claims on Stetson Creek for several years, they failed to recover enough gold to cover expenses and they ultimately abandoned their efforts (Barry 1997:77, 111). Towle's sons, Frank and Tom, continued mining for a few years "with modest success" (Barry 1997:77, 111).

Other miners working in the vicinity in the late 1890s included Mat Ostman who recovered "about an ounce of gold a day" from the mouth of the Cooper Creek canyon in 1898, and "Lennox, Hunter and Whorf, who owned three claims above Ostman's" (Barry 1997:111). The last work in the canyon was done about 1903. Thereafter, operations were confined to the wide flat at the lower end of Cooper Creek (Johnson 1915:199).

After discovering gold in an old river channel on Cooper Creek in 1901, Fred Bryant, along with several officials of the Alaska Central Railroad, incorporated the Kenai Mining Company late in 1905. The company's claims included 100 acres on Cooper Creek staked by Alaska Central Railroad paymaster and Kenai Mining Company officer Frank E. Youngs (Johnson 1911:1, 3, 7 and 1915:200; Barry 1997:111-112). In 1906 and 1907, the company—now operating as the Kenai Mining and Milling Company—built a sawmill, bunkhouse, cookhouse, and "other buildings;" cut 40,000 feet of lumber; installed a Ruble elevator, a No. 2 giant hydraulic outfit, and 4,000 feet of steel pipe; and dug four miles of ditch to bring water from Stetson Creek to the mining area (Barry 1997:111, 144).

Labor shortages shut down the Kenai Mining and Milling operation during World War I, although work on Cooper and Stetson creeks continued, "quietly but satisfactorily," into the late 1930s (Barry 1997:112). Various miners, including Harry Revell, Ben Sweazey, Anton Eide, Jerome Hatchey, Bill Knaak, Vern Saxton, and Jack Lincke mined the creeks during the 1910s, 1920s, and 1930s (Barry 1997:112, 165).

After arriving in the Kenai River area in 1910, Charles G. Hubbard purchased C. D. Cunningham's claims at the confluence of Cooper Creek and the Kenai River in 1911, forming the Kenai Dredging Company (Barry 1997:141). He conducted dredging operations until 1914 when he sold his claims to a German syndicate, but the syndicate's members returned to Germany at the outbreak of World War I and the claims were never transferred. Hubbard restaked and worked his claims between 1935 and 1939 (Nicholson n.d.).

After World War I, mining on the Kenai Peninsula was mainly the work of individual miners since "interest in large consolidations and corporate financing…faded with the changes in [the] economy" (Barry 1997:164). Clarence J. "Jack" Lincke mined Stetson Creek and had four placer claims at the mouth of Cooper Creek in the late 1930s where he dug "a few test pits" and did "a little sluicing" (Roehm 1938:4). Vern Saxton and Bill Knaak mined Stetson Creek in 1937, producing 40 ounces of gold, and they "began prospecting on higher grounds" (Barry 1997:165). Knaak was one of the founders of Stetson Placers, Inc. that worked fourteen claims on Stetson Creek "with a crew of seven men and a two-giant hydraulic plant" (Barry 1997:165).

World War II brought a virtual end to commercial gold mining in all of Alaska (Barry 1997:210). In the 1970s, the price of gold began to rise, peaking in 1980 at over $800 an ounce on the London market (Barry 1997:223, 224). With the rise of gold prices, many new mining claims were opened, and some "claims that had lain dormant for years" were reopened (Barry 1997:225). Most of the mining was done on placer claims because it "involved smaller investments in equipment" (Barry 1997:225). In 1979, partners Steve Herschbach and Dudley Benesch recovered "about an ounce a day of gold—about $2,000 worth a week" with the use of a suction dredge (Barry 1997:226). According to Bureau of Land Management (1984) Mining Claim Location Notices, Herschbach and Benesch filed several placer mining claims on Cooper and Stetson creeks in 1978. Among the miners producing gold in 1989 was Frank Couch on Stetson Creek (Barry 1997:228).

Previous Archeological Surveys

In 1982, Charles Diters mapped sites south of the Cooper Creek Campground that he named *Tasdliht* and "Huecker's Hovels." John Mattson recorded a historic mining site near the confluence of Stetson and Cooper Creeks in 1983 and surveyed areas south and southwest of Cooper Creek Campground in 1991. Also in 1991, Berkley Bailey surveyed Stetson Creek by way of the Stetson Creek Trail and found a mining ditch and flume. In 1998, Stefanie Ludwig and Myra Gilliam surveyed the Stetson Creek Trail and ditch. In 2002, Douglas Reger surveyed the Cooper Creek Alternative and the Kenai River Wall Variant routes for a proposed realignment of the Sterling Highway. In 2004, Cultural Resource Consultants (2005) recorded several prospect pits, tailings and boulder piles, active mining claims, and two diversion dikes during a survey from the mouth of Cooper Creek canyon to the Cooper Lake Dam.

Sites Listed in the Alaska Heritage Resources Survey (AHRS)

Stetson Creek Cabin (SEW-1022) is a complex of mining buildings, equipment, and "visible results of massive placer mining activity" at the confluence of Stetson and Cooper Creeks. Recorded by John Mattson in 1983, the site consists of a cabin, an outhouse and open work shed, remains of a Quonset hut, stacks of large and small diameter hydraulic pipes, hydraulically mined areas, and a garbage dump. The cabin dates to at least 1940 (Bailey 1991:253) and may be the same structure shown on a 1910 map (Mattson 1983).

The Stetson Creek Trail (SEW-868; RST 619[1]) is a historic route to mining areas along Cooper and Stetson Creeks. Although it probably originally began at the mouth of Cooper Creek, the trail now starts at the southern end of the Cooper Creek campground and heads uphill in a southerly direction, roughly parallel to Cooper Creek for 3 miles and Stetson Creek for 2 miles. The trail includes a section of corduroy where it crosses an unnamed stream 1.5 miles south of the Sterling Highway. Just south of this stream, is the beginning of a hydraulic mining ditch (see below) that both parallels and crosses the trail. After about 4 miles, the trail turns into a barely visible vehicle track route (Ludwig and Gilliam 1998).

In his 1991 survey of the trail, Bailey (1991:215) reported that it "appears to have only remnant berms and troughs associated with equestrian travel. Very few original corduroys could be seen in place along the route." Above Stetson Creek, a modern hiking trail follows the historic trail for about 0.5 miles, paralleling a large hydraulic ditch that is covered in alders. Once past the alders, the trail continues "inside the mining ditch for its duration into Stetson Creek Valley." Bailey (1991:216) found a 3-foot section of early twentieth century hydraulic pipe in the ditch section nearest to Stetson Creek.

The ditch paralleling the trail along Cooper Creek is referred to as the "lower" ditch, while the one extending up-slope parallel to Stetson Creek is the "upper ditch." Both ditches were reportedly hand excavated between 1898 and 1902 (Bailey 1991:253). The remnants of a collapsed metal flume and wood supports, dating to Bill Knaak and Nick Lean's operations of the early 1940s, lie in an unnamed creek where it was crossed by the upper ditch. The original flume was made of wood (Bailey 1991:253). A pulley system, consisting of pulley, steel cable, and two narrow gauge rails, was probably used to transport equipment across the drainage (Bailey 1991:217-218). The ditch ends about 50 feet beyond this drainage, although it probably once had a wooden flume that extended into Stetson Creek (Bailey 1991:219).

Field Survey

The field survey was accomplished on July 5, 12, and 13, 2005, by archeologists Dan Stone, Shawna Rider, and Catherine Pendleton. High sensitivity locations within the APE were intensively surveyed. These surveys included systematic pedestrian examinations of the ground surface and subsurface testing.

The shoreline of Cooper Lake, including the location of the pipeline outlet and the pipeline / access road route as far northwest as Cooper Lake Dam, was surveyed in 2003

[1] "RST" numbers are right-of-way identification numbers assigned by the Alaska Department of Natural Resources in their Historic Trails Database.

(see Cultural Resource Consultants 2005). From the dam, the route heads northwest, skirting the western side of a marsh north of the dam before heading into an old growth hemlock and spruce forest with a ground cover that includes ferns, berry bushes, and moss. The forest is interspersed with alder thickets, patches of devils club, and grassy clearings. The proposed route crosses several small drainages that flow into Cooper Creek, including a roughly 100-foot deep stream gorge near survey station TP 215.

The road generally follows the sloping bench west of Cooper Creek until it turns to the southwest above the eastern side of the Stetson Creek canyon. As surveyed, the route is down slope from a relatively flat bench, along the edge of the steep drop-off—including sheer rock faces—into the canyon. This portion of the route runs both through dense stands of hemlock and spruce and areas choked with alder. The systematic survey ended at survey station TP 260, the end of the cleared survey line, although one of the archeologists did continue for about 1,000 feet along the steep, alder-covered slope before turning back at a sheer rock face above the falls.

Cut stumps were the only cultural features found during the survey. There are eight to ten moss-covered stumps in a small clearing north of survey station TP 220 that could be 80 to 100 years old. There is another cut stump south of this station and another east of TP 228. None of the stumps are associated with fallen trees. No cultural features were found along the segment of the route above Stetson Creek.

Conclusions

No significant cultural remains were discovered during the survey of the pipeline and access road route from Cooper Lake to Stetson Creek. The cut stumps certainly bear evidence of past human activity in the area, but have little potential to yield much additional archeological information. In general, this route has little to no archeological potential. Conversely, Stetson Creek canyon —an area that was intensively mined during the early 1900s—should still be considered a high sensitivity area; however, it is anticipated that the ground disturbance associated with the proposed construction of the diversion will affect a relatively small portion of the canyon.

Future Considerations

Cultural resources will continue to be considered through all phases of the proposed development of the Stetson Creek diversion and associated pipeline / access road. In accordance with provisions in the HPMP, the State Historic Preservation Officer (SHPO) and/or Chugach National Forest could require additional monitoring at the construction site during construction-related ground-disturbing activities. Cultural resources identified during construction monitoring, if any, will be identified and evaluated in accordance with the requirements of 36 CFR 800.4. If necessary, in consultation with the Chugach National Forest and the SHPO, specific measures would be developed and implemented to mitigate any possible effects.

References:

Bailey, Berkley. 1991 *Survey of Stetson Creek (MPO Claim #A905588) for Cultural Resources*. Ms. on file, USDA Forest Service, Chugach National Forest, Anchorage.

Barry, Mary J. 1997 *A History of Mining on the Kenai Peninsula, Alaska*. Privately published, Anchorage, Alaska.

Bureau of Land Management. 1984 Minerals Availability System, Sequence Number 20950181

Cultural Resource Consultants. 2003 *Cultural Resources Study: Final 2003 Study Plan*. Cooper Lake Project (FERC No. 2170). Prepared for Chugach Electric Association, Inc. Cultural Resource Consultants, Anchorage.

Cultural Resource Consultants. 2004 Cultural Resources Study: Draft 2003 Inventory and Assessment of Archeological and Historical Resources. Prepared for Chugach Electric Association, Inc. Cultural Resource Consultants, Anchorage.

Diters, Charles. 1982 Field notes, May 25, 1982. Ms. on file, USDA Forest Service, Chugach National Forest, Anchorage.

Jansons, Uldis, Robert B. Hoekzema, Joseph M. Kurtak, and Steven A. Fechner. 1984 *Mineral Occurrences in the Chugach National Forest, Southcentral Alaska*. USDI Bureau of Mines, Anchorage.

Johnson, Bertrand L. 1911 Unpublished Field Notes. On file, U.S. Geological Survey, Anchorage.

Johnson, Bertrand L. 1915 *The Central and Northern Parts of Kenai Peninsula. In Geology and Mineral Resources of Kenai Peninsula, Alaska*. U.S. Geological Survey Bulletin 587, pp. 113-208. Government Printing Office, Washington, D.C.

Ludwig, Stefanie, and Myra Gilliam
1998 *Site Inventory Record for SEW-868*. USDA Forest Service, Chugach National Forest, Anchorage.

Mattson, John L. 1983 Archaeological Reconnaissance Report, Stetson Creek. Ms. on file, USDA Forest Service, Chugach National Forest, Anchorage.

Mattson, John L. 1991 Unpublished field notes for the Lower Stetson Creek Timber Salvage Sale, August 31, 1991. Ms. on file, USDA Forest Service, Chugach National Forest, Anchorage.

Nicholson, Helen. n.d. Letters concerning Charles G. Hubbard. Correspondence between Helen Nicholson (nee Hubbard) and Mona Painter. In the personal collection of Mona Painter, Cooper Landing.

Painter, Mona. 1998 Gravel Singing Through the Sluices, A Summary of the History of Cooper Creek. Ms. on file, USDA Forest Service, Chugach National Forest, Anchorage.

Reger, Douglas R. 2002 *Archaeology along the Sterling Highway Project: Cooper Creek Alternative*. Report to Cultural Resources Consultants and HDR Alaska, Inc., Reger Archaeological Consulting, Anchorage.

Roehm, J. C. 1938 *Summary Report of Mining Investigations in the Crow Creek and Moose Pass-Hope Districts to B. D. Stewart, Commissioner of Mines and Itinerary of J. C. Roehm, Associate Engineer, Territorial Department of Mines, October 3 to October 11*. Ms. on file, USDA Forest Service, Chugach National Forest, Anchorage.

Attachment VII

Recreation and Visual Resources

Purpose and Objectives

The purpose of this study was to estimate the recreational and visual resource opportunities and constraints that could be created by a new diversion facility and pipeline / access road that would extend from Stetson Creek to Cooper Lake. The study assesses and describes potential changes, including potential opportunities for extending the recreational uses within the Cooper Creek drainage, as well as potential conflicts with existing recreational activities and impacts to visual resources.

The objectives are specifically:

For Recreation Resources:

A. Determine the potential opportunities that a new cleared corridor may provide for recreation.
B. Determine whether decreased water flow in Stetson Creek may have an impact on existing recreational mining activity.

For Visual Resources:

A. Determine whether the diversion clearing will be visible from locations within the Chugach National Forest from where they would be viewed by the visiting public, including the Cooper Lake Dam access road.
B. Determine whether the cleared right-of-way for the pipeline / access road provides an appropriate visual setting if used as a hiking trail.

Methods

Trail Opportunities

The proposed access road was assessed for potential use as a trail including evaluation of whether it could provide a loop when combined with the existing Cooper Lake Dam access road and Stetson Creek Trail. Specific investigation focused on physical characteristics of the proposed pipeline / access road corridor, including topography, soils, and hazards such as avalanche. Topographic mapping was used for a "macro" evaluation of attributes. The Cooper Lake Dam access road, Stetson Creek Trail, and proposed pipeline / access road corridor were hiked to determine whether these trails might in combination be a suitable hiking loop.

Mining

A list of mining claims on Stetson Creek was obtained. A suction dredge miner and current owner of Alaska Mining and Diving Supply, Dudley Benesch, was interviewed to determine whether proposed flows for Stetson Creek might provide opportunities or constraints to continued mining of Stetson Creek.

Clearing Effects to Views

Areas with views to the corridor were analyzed in terms of USFS Handbook Number 701, "Landscape Aesthetics-A Handbook for Scenery Management." Landscape character, scenic integrity, and landscape visibility were documented and analyzed.

Cooper Lake Dam Access Road

Views to the new cleared corridor were photographed from the Cooper Lake Dam access road. The clearing for the new corridor was modeled in a computer simulation in order to depict how views of the area proposed might change.

Trail as a Visual Resource

The corridor was evaluated via topographic mapping and photography to determine whether it might provide experiences that would be highlights of a trail experience and appropriate for hikers.

Results

Land Design North personnel hiked the Cooper Lake Dam access road on July 5, 2005, the Stetson Creek Trail up to the proposed diversion structure on July 10, 2005, and the proposed pipeline / access road corridor on August 19, 2005. Photos were taken along the trails to characterize the area and to identify locations where a person could potentially view the pipeline and access road.

Trail Opportunities

<u>Cooper Lake Dam Access Road</u>

The access road to Cooper Lake Dam is located 0.5 mile south of the Cooper Creek Campground, off the south side of the Sterling Highway at an unmarked turnoff. A yellow gate is located on the access road approximately 1 mile south of the Sterling Highway. No motorized vehicles are allowed past the gate; however, snowmobile use of the road reportedly occurs in the winter months. Up to the gate, the road is fairly rough, gains approximately 300 feet in elevation (from 500 to 800 feet), and is about 8 feet wide and gravel-surfaced. There are no viewpoints along this stretch of road due to the dense and tall Alder-Tall Scrub cover type (alder, cottonwood, willow, spruce saplings, horsetail, twisted stalk, devil's club, red elderberry, ferns, and bluejoint grasses (HDR 2004)). The road is approximately 3.5 miles long from the gate to Cooper Lake.

Four other hikers were encountered on the Cooper Lake Dam access road during the hike. Also encountered was a Chugach Electric Association (Chugach) maintenance staff person, who said the trail experiences, "a pretty good amount of use." No USFS records are available that would indicate the level of use of this road.

The road remains wide and clear of vegetation for the full length of the road. The first 0.5 mile after the gate continues to climb to 1400 feet in the same dense and tall vegetation with no opportunity for views (Figure 1).

Figure 1: Gate at the Cooper Lake Dam access road, facing south.

For the next mile the road gradually descends 100 feet in elevation and the vegetation remains consistent. The vegetation begins to thin out as the road cuts through a steeper slope, but the alder and shrubs are still tall and dense enough to limit southerly views, although taller (3900 foot) mountains to the west can be seen (Figures 2 and 3).

Figure 2: Location 0.75 miles from Cooper Lake Dam access road gate, facing west (north of proposed pipeline / access road).

Figure 3: Location 0.75 miles from Cooper Lake Dam access road gate, facing southwest (north of proposed pipeline / access road).

There are several small streams and one small waterfall approximately 2 miles from the gate as well as snowmelt (Figure 4) from an avalanche that create variety in the otherwise consistent landscape. There are possibly four separate avalanche chutes that may cross the road on a given winter season.

Figure 4: Snow melt from an avalanche located on the eastern side of the Cooper Lake Dam access road, halfway between the gate and the Cooper Lake Dam.

Approximately 2.9 miles from the gate (Figure 5), the vegetation opens up and Cooper Lake, the Cooper Lake Dam, and most of the Cooper Lake / Cooper Creek valley can be seen providing unique scenery, including views to distant peaks and snowfields. For the next 0.3 mile, the vegetation thickens and very little of the surroundings can be seen until approximately 0.4 mile from the Cooper Lake Dam, where intermittent and partial views of the study area can be seen through the comparatively sparse vegetation. After another 0.1 mile, the vegetation opens up completely with full views of the surroundings all the way to the dam (see Figure 11).

Figure 5: A view of Cooper Lake on the Cooper Lake Dam access road, 2.9 miles from the trailhead and 0.5 mile from the dam.

The shoreline of Cooper Lake is accessible from the end of the dam access road, at the dam. When the reservoir is drawn down, the exposed shoreline of gravel and sand offers opportunities to hike along the less steep portions of the perimeter of Cooper Lake (Figure 6).

Figure 6: A view from the western shore of Cooper Lake facing north in the vicinity of the proposed pipeline / access road entrance.

<u>Stetson Creek Trail</u>

The Stetson Creek Trail begins at the southern end of the Cooper Creek Campground (south side of the Sterling Highway). The trailhead is unmarked and provides no parking other than that available at a vehicular gate. The trail is approximately 4.5 miles long from the trailhead to the proposed site of the diversion structure.

The first 0.5 mile is located within the alluvial fan and valley of the lower reaches of Cooper Creek with vegetation mostly composed of cottonwood, alder, willow, and low groundcover. The trail climbs a bluff and for the next 3.5 miles follows the shoulder of the western hillside overlooking Cooper Creek and, in the last 0.5 mile, Stetson Creek.

The trail is primarily used as access to mining claims in the Cooper Creek and Stetson Creek watersheds. It has not been maintained to meet needs of the public for hiking. The trail passes through a progression of alder/grasslands, closed spruce/hemlock forests, and wet, muddy channels (Figure 7).

Figure 7. Several sections of the Stetson Creek Trail exhibit muddy conditions.

The first portion (1.5 miles) of the trail appears to receive relatively heavy use, as evidenced by footprints in dirt and mud. However, use appears to drop quickly after the 1.5 mile point, where the trail becomes increasingly muddy with little opportunity for avoidance. At that point the trail appears to be used primarily by 4-wheelers seeking access to mining claims. No other hikers were seen on the trail even though the day of the hike was a weekend and was warm and sunny. Similarly, no hikers were encountered on the trail during a weekend in July 2004 when previously hiked by Land Design North personnel. Steve Hennig of the USDA Forest Service (personal communication, 04-05-05) indicated that the trail is not one that the Forest Service actively promotes when the Forest Service receives inquiries regarding available hiking trails.

There are few views outside of the immediate vegetated trail sides, excepting the northern 1 mile of the trail, where there are occasional views of the surrounding landscape (Figure 8). Additionally, some views are available at the southern portion of the trail where the trail reaches subalpine areas with views towards Stetson Creek (Figure 9).

Figure 8. Views to mountains from northern 1 mile of Stetson Creek Trail.

Figure 9. View towards Cooper Mountain from Stetson Creek Trail, near where trail begins to parallel Stetson Creek.

Proposed Pipeline / Access Road

The alignment for the proposed pipeline / access road was surveyed and flagged prior to the August 19 site visit. The majority of the surveyed alignment passes through vegetation consisting of Hemlock/Hemlock Spruce forest with a soft sphagnum moss walking surface, but the alignment also passes through short thickets of Alder Tall Scrub mixed with bogs and graminoid. Most of the hemlock areas have decent traction/footing but with frequent tripping hazards, snags, and short, steep (0.5H:1V) slopes.

The surveyed route follows the center of a ledge along the mountain. For the most part, the surveyed route maintains a steady, gradual climb towards Stetson Creek, although the grade locally changes abruptly. A map of slopes in the Stetson Creek / Cooper Creek area is shown in Figure 10.[2]

[2] The terrain can be steeper than shows up in the figure because the slope is calculated over a minimum horizontal distance or pixel size of 17 ft. Therefore, the slope of a pixel will be the average of the slopes in the 17 ft pixel.

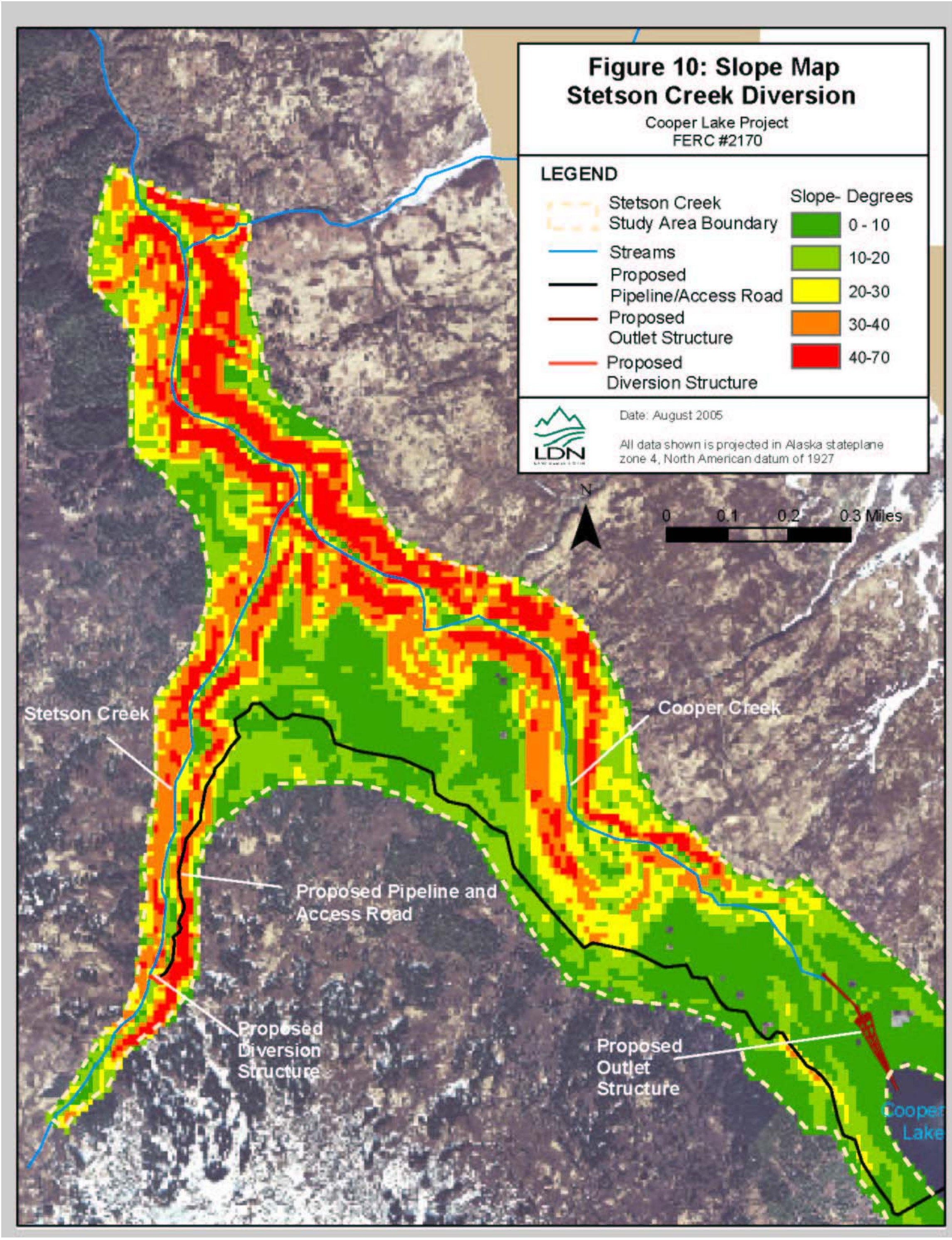


Figure 10. Slope map of the Stetson Creek/Cooper Creek area.

The route crosses several streams. At the time of the site visit, the flow of the streams was low and did not present a major obstacle for crossing. The flow of these streams is probably significantly greater in the spring and may then present a greater obstacle for hikers. The slopes at the stream crossing have an average steepness of 1H:1V to 0.5H:1V or steeper. Fallen trees and shallow roots provided better traction/footing and hand holds that made it easier to climb these slopes, but the eroding slopes, patches of moss, mud, and loose rock make the slopes unstable, and therefore unsuitable, for frequent foot traffic in the present condition. However, the proposed access road will need to be constructed to allow vehicles to negotiate the steep stream channels and allow passage of flows, and thus it will also be suitable for foot traffic.

While portions of the pipeline/access alignment near the Cooper Lake Dam provide good views of the reservoir, the surrounding mountains, and the Cooper Creek canyon below, most of the surveyed route provides only sporadic views of the canyon and the surrounding mountains because of the presence of tall trees and/or thick vegetation along the route. Most of the creek crossings offered views to the Cooper Creek canyon and surrounding mountains. From the top of the Stetson Creek canyon the route provided good northerly views to the Cooper Creek canyon and views of Stetson Creek.

Mining

There are 15 (11 Federal and 4 State) mining claims in the Cooper Lake watershed. In the study area, 4 are on Cooper Creek and 5 are on Stetson Creek. Currently, sluice and suction dredge mining are the methods used to extract sediment from the creeks. Dudley Benesch was contacted regarding potential impacts to mining from diversion of water from Stetson Creek. Mr. Benesch previously operated a suction dredge operation and is the current owner of Alaska Mining and Diving Supply. He stated that he thinks that lower water levels in Stetson Creek would make the creek easier to dredge. He recalled that working during high water periods was very difficult and felt that current mine owners would welcome the lower flows that would accompany the proposed Stetson Creek diversion.

Existing Views and Potential Changes to Views

<u>Views from the Cooper Lake Dam Access Road and Stetson Creek Trail</u>

Views to the proposed corridor are only available from the southern 0.5 mile of the dam access road (near the Cooper Lake Dam) and the last 0.5 mile of the Stetson Creek Trail before the site of the proposed diversion structure. Figure 11 illustrates areas of both the dam access road and the Stetson Creek Trail that provide view opportunities to the proposed corridor.

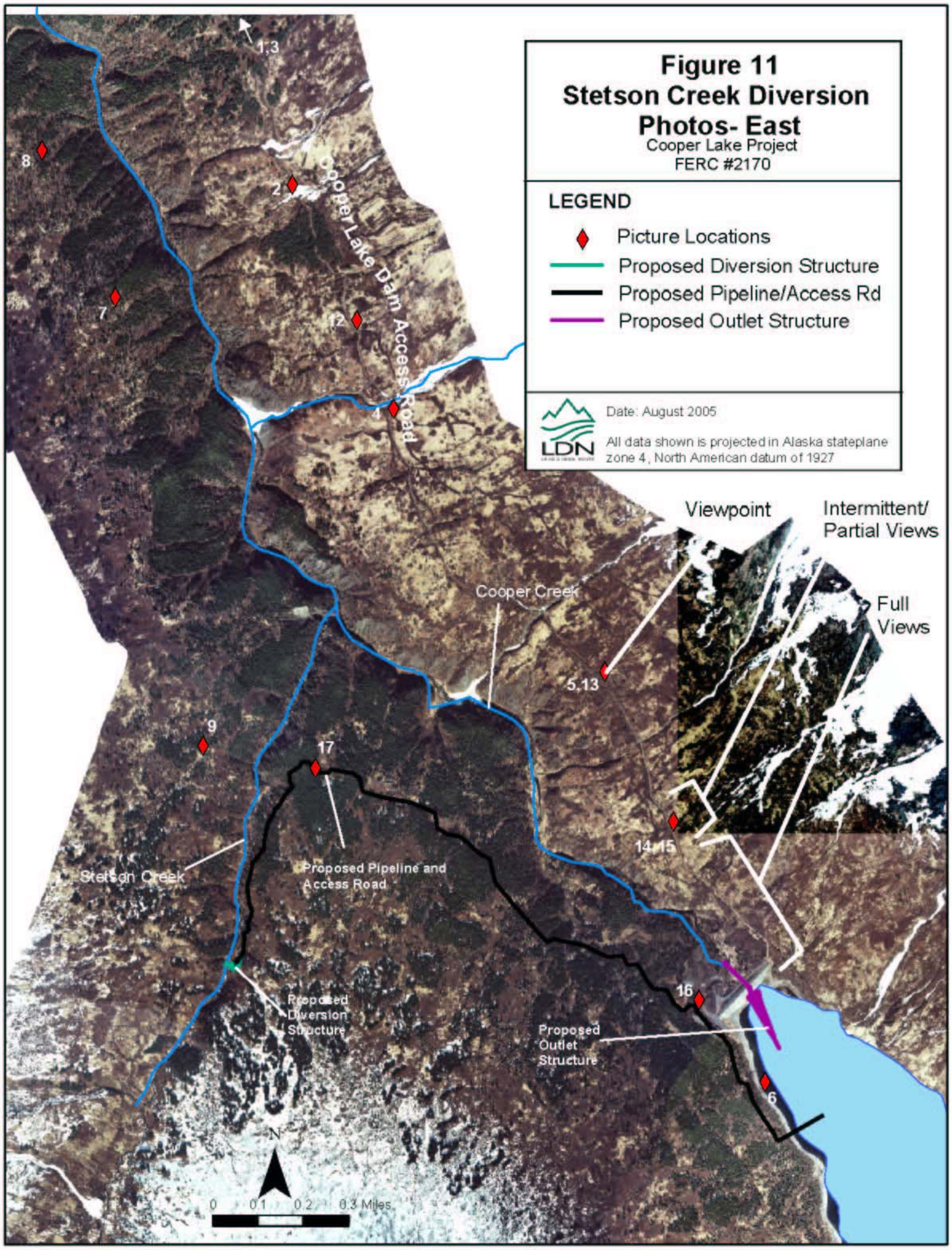


Figure 11. Photo and view locations.

Thus, the analysis of effects to existing views is limited to analysis of views from these areas only. Because of the size and character of the area, the analysis considers the corridor as one landscape unit.

Wide open views from the Cooper Lake Dam access road were approximately 3 miles from the gate and approximately 0.5 mile from the Cooper Lake Dam. There are some openings prior to this location, but the openings are higher in the canopy, limiting the view to higher elevations across the valley (Figure 12).

Figure 12. A view toward the proposed pipeline / access from the Cooper Lake Dam access road, approximately one mile from the Cooper Lake Dam.

The clearing at the 3 mile point from the gate on the dam access road gives way to vistas of a large portion of the Cooper Creek Valley. The elevation at this viewpoint is about 1600 feet, and this location offers a view of the proposed pipeline / access road corridor (Figure 13), which will be at an elevation of 1300 feet.

Figure 13. A panoramic view of Cooper Lake and the proposed pipeline / access road area from the Cooper Lake Dam access road, approximately 0.5 mile from the Cooper Lake Dam.

For the next 0.25 mile toward the dam, vegetation borders the road and prevents valley views, but allows the northern portion of Cooper Lake to be seen. For the last approximately 0.25 mile of the road, the vegetation opens up and views are available to the reservoir and Cooper Lake / Cooper Creek valley, with the viewer at a lower elevation than the location of the proposed corridor. Thus there would be views to the proposed corridor (Figure 14), including disruptions in vegetative patterns.

From the Stetson Creek Trail, views to the proposed corridor are available for approximately 1/4 of the 0.5 mile length of the trail, where it parallels Stetson Creek and the proposed corridor. Where visible, the corridor would be near elevation 1300, while the Stetson Creek Trail is located at elevation 1500 to 1650. Thus, the elevated position of the viewer would increase the ability to view the cleared vegetative patterns that would be created by the corridor.

<u>Visual Character of the Proposed Pipeline / Access Corridor</u>

Vegetation in the area of the proposed pipeline / access road is consistent and typical of the area. From elevations of 1000 to 1500 feet, near the south end of the proposed corridor (northern Cooper Lake), the cover type is a Hemlock-Spruce Mix, consisting of mountain hemlock, Sitka alder, Lutz spruce, mountain ash, wood fern, oak fern, stiff clubmoss, false azalea, and five-leaved bramble (HDR, 2005). On the northern end of the proposed pipeline / access route the vegetation is a Hemlock cover type consisting of mountain hemlock, crowberry, Kenai birch, dwarf birch, Lutz Spruce, northern comandra, Labrador tea, false azalea, five-leaved bramble, and tall blueberry. There is evidence of considerable amounts of beetle killed spruce throughout the area, toning down the green colored vegetation to green-gray hues. There are natural breaks of low shrubs and immature spruce/alder amongst taller spruce and birch in the landscape, giving the valley and hillside a patchy appearance.

The proposed diversion structure in Stetson Creek would be located in a ravine approximately 200 feet deep. The first 0.6 mile of the proposed corridor starting from the diversion structure would climb from the ravine to the shelf overlooking the ravine. The clearing related to this portion of the corridor would be visible from locations shown on Figure 11, where the clearing would contrast with vegetative patterns.

The middle 1.5 miles of the pipeline / access road corridor roughly follows the 1200 foot contour of the hillside, remaining amongst the thick/vertical hemlock-spruce vegetation. Because views from the Cooper Lake Dam access road are approximately 300 feet higher than the pipeline / access road, the proposed corridor would be visible from the dam access road at viewpoints and sections of the road shown on Figure 11.

In the vicinity of the Cooper Lake Dam, the pipeline corridor is located approximately 50 feet higher than the dam and 200 feet from the dam site. The pipeline / access road corridor would be visible from the viewpoints on the dam access road shown on Figure 11 but views would be limited due to elevation, topography and vegetation.

For the 1500 foot length of the proposed corridor along the Cooper Lake shoreline, the pipeline would be located at a distance of 200 feet from the shoreline and an elevation of 1200 feet, approximately 50 feet higher than the reservoir. It crosses a rocky outcrop just north of the dam.

The proposed pipeline / access road corridor descends to the reservoir through a thickly vegetated 250 foot embankment. Because of the tall and thick vegetation as well as the angle of the pipeline / access road alignment to the Cooper Lake access road, the visibility of this portion of the alignment would be limited.

Of the 2.13 miles of proposed corridor, 52% is mixed open vegetation (mottled) and 44% is treed. A 1.5-mile section of the proposed corridor is located on the east side of Cooper Mountain and would be visible from the Stetson Creek Trail and the Cooper Lake Dam access road. Of this 1.5 mile of road, 55% is mottled and 45% is treed. Clearing in the "mottled" vegetation of the proposed corridor would be less visible because of the already varied appearance when viewed from the Cooper Lake Dam access road across the valley (Figure 11).

Potential Changes to Views

Given the character of the affected area, the landscape is characterized as "Common" (USFS Handbook 701, 1995) within Chugach National Forest and the surrounding area (Table 1).

Table 1: Scenic Attractiveness classification definitions as described by the USFS Handbook Number 701, "Landscape Aesthetics-A Handbook for Scenery Management."

Scenic Attractiveness Class	**Definition**
A- Distinctive	Areas where landscape character combine to provide unique, unusual, or outstanding scenic quality.
B- Common	Areas where landscape character combine to provide ordinary or common scenic quality.
C- Indistinctive	Areas where landscape character combine to have low scenic quality.

However, the landscape is fully intact and undisturbed by the presence of humans, and thus scenic integrity is high. Views of the proposed pipeline / access road corridor are available from certain limited locations along the Cooper Lake Dam access road and the Stetson Creek Trail. Views from the dam access road and the Stetson Creek trail to the proposed pipeline/access corridor are approximately 0.25 to 0.5 mile distant, providing "foreground" visibility zone, or just outside the immediate views to the corridor from view locations.

Construction of the proposed pipeline / access road will require clearing a corridor approximately 70 feet wide. It is expected that the roadside would experience grow-in by vegetation including bluejoint grasses, Sitka alder, mountain ash, and other shrubs/trees. Figure 15 provides a simulation of the expected change to the view from the key view locations located on the dam access road.

Figure 14. A panoramic view of Cooper Lake and the proposed pipeline / access road area from the Cooper Lake Dam access road, approximately 0.25 mile from the Cooper Lake Dam.

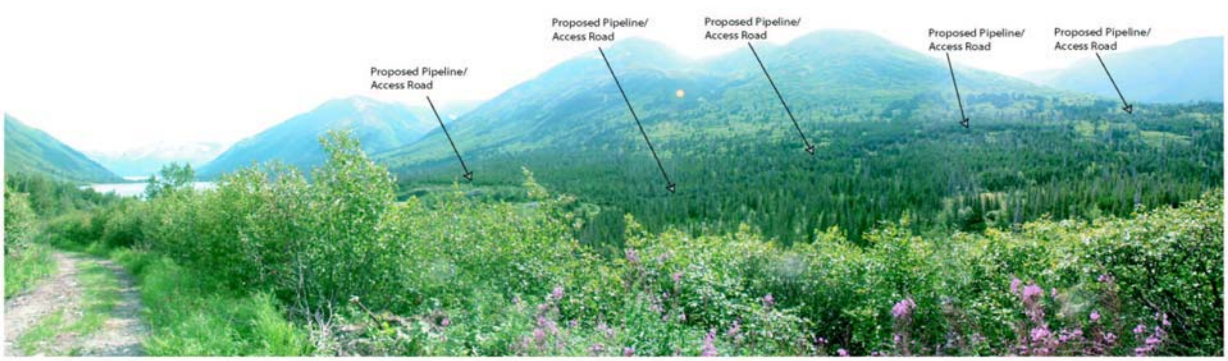


Figure 15. A simulated panoramic view of the proposed pipeline / access road area from the Cooper Lake Dam access road, approximately 0.25 mile from the Cooper Lake Dam.

The change to the landscape is slightly more apparent in closed spruce forest than in open or mottled portions of the landscape. In general, because slopes are approximately 20%, locations of the corridor within forested areas provide a coniferous backdrop (as opposed to open grass or shrubs), which lessens the apparent visual impact. Where the corridor drops into or climbs out of ravines, the steep ravine slope is generally parallel to the view direction; thus there is not a marked vegetation change. The corridor could potentially be more visible in the winter when vegetation that is exposed by the corridor clearing could hold snow, making the corridor more visible with snow cover.

Table 2 shows the length of corridor within specific landscape types.

Table 2: Amount of vegetative cover along the proposed pipeline / access road.

Character	**Length**	**Total**	**Percentage**
mottled	feet	5827.26	52%
	miles	1.10	52%
treed	feet	4951.43	44%
	miles	0.94	44%
water	feet	484.93	4%
	miles	0.09	4%
Total Sum of Length (feet)		11263.62	
Total Sum of Length (miles)		2.13	

<u>Pipeline / Access Road Trail as a Visual and Recreation Resource</u>

The forest where the proposed pipeline/access corridor would be located is similar in vegetation, slope, aspect, and landforms to the forest along the Stetson Creek Trail. The character of the forest is common within the area, and no views are provided that are markedly dramatic or distinctive; a characteristic example view is shown in Figure 16. While the ravine in which Stetson Creek is located houses a water feature (the creek) and topographic contrast from the rest of the Stetson Creek Trail or the proposed corridor, it does not provide a distinctive landscape within the forest. One view opportunity of note is at the shoulder of the Stetson Creek ravine where views are provided to valleys and peaks to the north (Figure 17). While this is distinctive with respect to the trail as a unit, it is not distinctive within Chugach National Forest.

Figure 16. A view of the proposed pipeline / access road landscape character, facing north.


Figure 17. A view from the shoulder of Stetson Creek ravine, looking north.

The remainder of the corridor would not offer distinctive views relative to other opportunities within Chugach National Forest. Intermittent views are provided to Stetson Peak and Cooper Lake; however these are not unique since they are available from other locations. While Cooper Lake, due to its size, is distinctive, Stetson Peak is a common landscape feature within the forest.

Due to the generally moderate slope of the terrain, views from the proposed corridor would not be available where the terrain is forested. For approximately one half the length of the proposed corridor there are some views of Cooper Lake and Stetson Creek. Also, where the corridor would descend from the shoulder of Cooper Mountain to the ravine, some views would be available across the Stetson Creek and Cooper Creek canyons but would be to areas of common to non-distinctive landscape. The number of trails within Chugach National Forest with more dramatic scenery would probably limit the preference of the proposed pipeline / access road corridor as a hiking trail.

Conclusions

Recreation

The primary opportunity presented by the construction of the proposed pipeline / access road corridor would be use of the access road as a new trail within Chugach National Forest. Of some benefit may be the possibility to link the proposed corridor with the existing Stetson Creek Trail, allowing access to the Cooper Lake Dam using the Stetson Creek Trail from the Cooper Lake Campground, located approximately 0.5 mile west of the start of the dam access road. The dam access road would become part of a loop trail when combined with the Stetson Creek Trail and new corridor. Users would have the opportunity to hike or snowmobile to the reservoir without having to backtrack.

While the pipeline / access road corridor may be appropriate for recreation use such as hiking, it would not provide a unique setting. Other than Cooper Lake and a view of some distinction from the Stetson Creek ravine shoulder, there is no dramatic or unique element of the potential trail loop that would entice widespread public use.

The existence of the new corridor could be provide additional opportunity for snowmobile users. Snowmobiles currently use the dam access road (though not allowed by USFS) as a method of gaining access to Cooper Lake; however the road receives avalanche runout throughout the winter, which poses a hazard to users and may sometimes curtail access. The north and east facing slopes where the Stetson Creek Trail and the proposed corridor are located, are avalanche free and may offer safer access if motorized access is appropriate.

The diversion of Stetson Creek water may be of benefit to recreational miners. This group would possibly benefit by lower flow volumes.

In summary, the development of a loop trail incorporating the proposed corridor would be of some, but limited, benefit to hikers, providing terrain that is generally level but punctuated by steep ravine descents and ascents. There are few views of any distinction relative to views from other trails in Chugach National Forest. Use of the loop route also assumes that hikers would travel along the Sterling Highway from the dam access road intersection, or could ford Cooper Creek. The proposed pipeline / access road corridor and potential loop route may best be suitable as a winter access by snowmobiles, providing a safer access than that provided by the dam access road during winter conditions.

Visual

The area where the diversion structure and proposed pipeline/access corridor would be located is of common character, lacking defining, and/or unique elements that separate this area from other locations in Chugach National Forest. Thus the proposed facilities would not affect areas of distinctive landscape character.

In general, landscape changes are considered to be more apparent where lines are interjected into homogenous, uninterrupted landscapes. Changes generally provide less apparent contrast when such changes occur in "mottled landscapes." For the proposed route, fully treed, homogenous landscapes comprise slightly less than half of the proposed corridor length. Because of the generally low slope (0-20%), the background provided to the changed landscape would generally be of the same color values as the landscape in front of the changed landscape. Thus the changed landscape would generally be seen as a "crease" in the forest, not a distinct hard color change and would not be of major significance. The change would be even less evident in the mottled areas.

Another factor limiting the significance of the visual impact of the proposed pipeline/access corridor is that views to the changed landscape would be available for only the last 0.5 mile of the dam access roadway, near Cooper Lake. While hikers are in general sensitive to disturbances to viewsheds, the number of hikers that use the dam access road for hiking is relatively low, and winter use is relegated only to that of snowmobilers. Snowmobilers in general tend to have a higher threshold of tolerance to changes to landscape, given the speeds at which they travel and thus the lower exposure period to views of the disturbed areas. Further, if the proposed pipeline/access corridor were integrated into a "loop" system with the existing dam access road and Stetson Creek Trail, the corridor would then be part of the trail system itself and would presumably be less objectionable to recreation users as a visual feature than if access to the corridor were restricted.

References

HDR Alaska, Inc. 2004. Terrestrial Vegetation Study, Cooper lake Project (FERC No. 2170). February 2004.

HDR Alaska, Inc. 2005. Draft Terrestrial Vegetation Assessment, Cooper Lake Hydroelectric Relicensing Project (FERC 2170). June 2005.

USDA Forest Service. 1995. Landscape Aesthetics, A Handbook for Scenery Management. Agriculture Handbook Number 701. December 1995.

Attachment VIII

Pipeline/Access Route Erosion Potential Evaluation Technical Memorandum
HDR Alaska

Study Purpose

The purpose of this study was to evaluate potential erosion issues that may result from the construction of the pipeline / access road.

Field Reconnaissance

Bob Butera and Bill Spencer of HDR Alaska, Inc. completed a reconnaissance of the proposed Stetson Creek Diversion pipeline / access road alignment on July 6, 2005. A brushed alignment for the proposed pipeline / access road was walked from Cooper Lake Dam to a point overlooking Stetson Creek. Beyond this point the route was not yet brushed, but topographic mapping showed it to traverse a steep hillside leading into the canyon of Stetson Creek. This impassible section of the alignment was observed from up-slope prior to entering the canyon at the diversion site. Figure 1 illustrates the slopes encountered within the pipeline / access road corridor.[3]

Observations

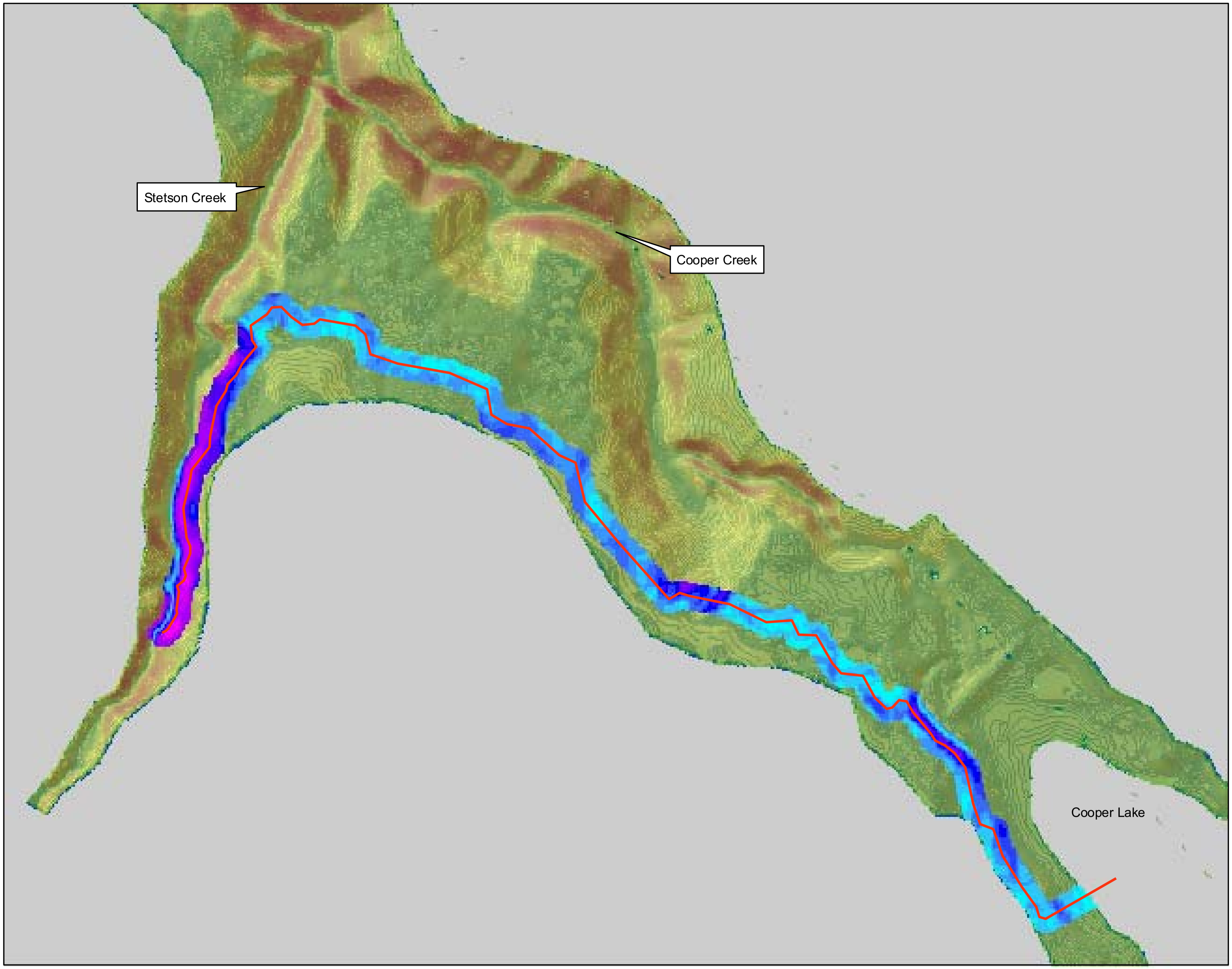
The segment of the proposed pipeline / access road alignment from Cooper Lake Dam to a point overlooking Stetson Creek was generally along a contour (1200 ft elevation) through heavy vegetation (see Attachment IV a, Vegetation Study). It crossed two small streams in steep ravines. If the intent of the road is to keep a straight alignment, then crossing these ravines would require a large amount of fill. Large amounts of fill would pose a greater risk of sediment being carried into the watershed during runoff events. Other than these two ravines, this portion of the route was straightforward and no conditions were observed that would lead to unusual erosion potential.

The segment of the proposed pipeline / access road alignment that enters the Stetson Creek canyon will be more difficult to construct. However, bedrock was noted in the ravine walls, which will mitigate some road construction difficulties as the road can be benched into the rock with a steep back slope. For this segment of road, side casting of material should not be allowed as it will likely slide into Stetson Creek increasing the potential for sedimentation downstream in Cooper Creek.

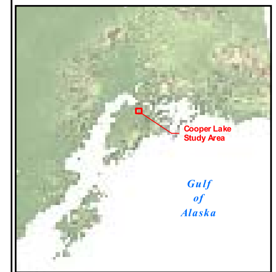
Conclusions

Based on what was observed of the slopes and materials in the area of the proposed pipeline / access road, there is little potential for erosion or downstream sedimentation.

[3] The terrain can be steeper than shows up in the figure because the slope is calculated over a minimum horizontal distance or pixel size of 17 ft. Therefore, the slope of a pixel will be the average of the slopes in the 17 ft pixel.



KEYMAP



Slopes of the Stetson Creek Diversion Pipeline Corridor

Cooper Lake Project
FERC #2170

LEGEND

Contours, 10 Foot Interval with intermittant 2 foot

0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65

Degrees of Slope Along Proposed Corridor

0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55

Proposed Pipe/Access Road

1. Mapping completed by HDR Alaska, Inc.
2. All data shown is projected in Alaska stateplane zone 4, North American datum of 1927

0 250 500 1,000
Feet

Date: 8/2005
File: Stetson_slope
Author: DW

FIGURE
1

The vegetation on surrounding slopes and the use of Best Management Practices (BMPs) during and after construction will help to mitigate erosion potential along the proposed pipeline / access road alignment. Three areas identified at this time for special consideration during final project design are the two ravines crossed by the alignment between Cooper Lake and Stetson Creek and the traverse of the steep canyon side into Stetson Creek itself. Design of the pipeline / access road as it crosses the ravines should consider contouring into the ravines to minimize the amount of fill required. At the traverse into Stetson Creek canyon, sidecasting of excavated material should be avoided to keep sediment from sliding into Stetson Creek. It is recommended that the pipeline / access road exit the ravine as quickly as possible from the diversion site.

A geotechnical survey will be done prior to final design and construction to determine soil types and depth to bedrock along the proposed alignment and will be used refine the route and further identify material related issues.

<u>Attachment IX</u>

Proposed Stetson Creek Diversion Final 2005 Study Plans

Proposed Stetson Creek Diversion
2005 Study Plan

Cooper Lake Project (FERC No. 2170)

Prepared by
HDR Alaska, Inc.
Cultural Resource Consultants
Land Design North
Northern Ecological Services

Prepared for
Chugach Electric Association, Inc.

June 16, 2005

Introduction

This document presents the plan for a study program to evaluate resources in the vicinity of Stetson Creek, the major tributary to Cooper Creek, and the potential impacts on those resources that may occur with development and/or operation of a proposed diversion of Stetson Creek under the new license for the Cooper Lake Project (Project). The planned Stetson Creek studies are being undertaken as part of the Agreement in Principle (AIP) for relicensing of the Project reached in March 2005 by Chugach Electric Association, Inc. (Chugach) and a number of federal and state agencies, a Native American tribe, and non-governmental organizations.

The AIP includes establishment of an instream flow regime to increase stream temperatures in Cooper Creek, which will expand the area of suitable spawning, incubation, and rearing habitat for salmon and trout. The stream flow and temperature modifications will be accomplished by diverting flow from Stetson Creek into Cooper Lake and releasing near-surface water from Cooper Lake into Cooper Creek. The AIP provides that, within six years after issuance of a new license, Chugach will construct and begin operating the following new facilities to establish the proposed instream flow regime in Cooper Creek (see Figure 1):

- Diversion structure with manual controls on Stetson Creek approximately 7,000 upstream feet from Stetson Creek's confluence with Cooper Creek. A conceptual diagram of this diversion structure is shown in Figure 2. Such diversion structure will allow for minimum instream flow releases and flushing flows as described in the AIP.
- Pipeline (approximately 11,000 feet) from the Stetson Creek diversion structure to an outflow point in Cooper Lake, approximately 1,000 feet from the Cooper Lake Dam. The pipeline will accommodate flows up to a maximum of 110 cfs. A conceptual map of the pipeline is shown in Figure 3.
- Cooper Lake Dam outlet structure to allow for the release of water from Cooper Lake into Cooper Creek through the existing Project dam from a manually controlled, screened diversion structure within Cooper Lake (about 600 feet from the crest of the dam) to an outflow energy dissipation structure downstream of the dam, with the ability to maintain a minimum flow capacity of up to 10 cfs and a maximum flow capacity of 30 cfs. A conceptual diagram of the Cooper Lake dam outlet structure is shown in Figure 4.

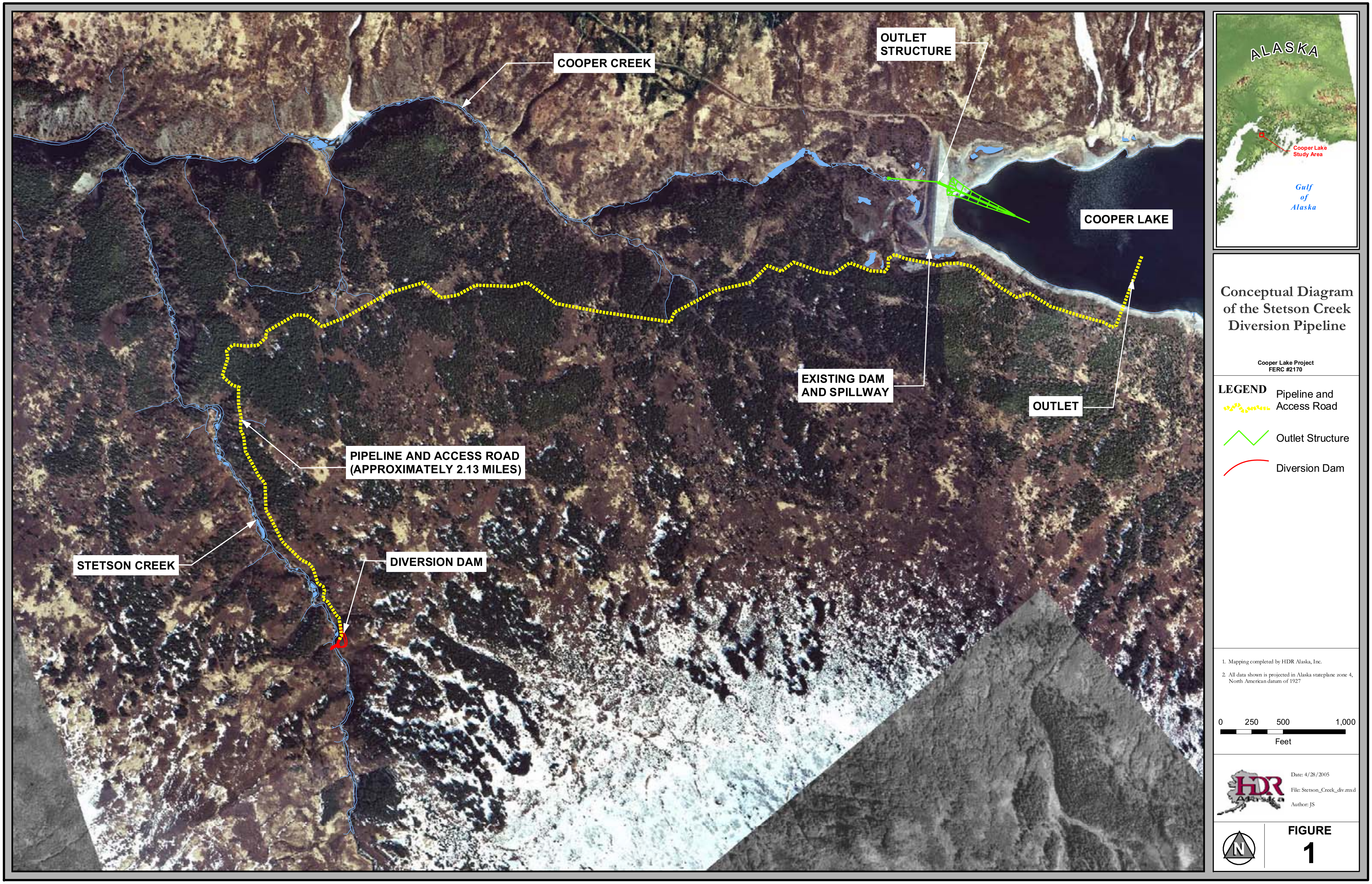
This study program described in this plan comprises a total of six separate study plan components, as follows:

- Fish and Macroinvertebrates
- Accretion Flows
- Terrestrial Wildlife
- Vegetation and Wetlands
- Sensitive Plants
- Cultural Resources
- Recreation and Visual Resources
- Pipeline/Access Route Erosion Potential

These studies will be conducted in May–July 2005 by biologists and other professionals on staff at HDR Alaska, Land Design North, Northern Ecological Services, and Cultural Resource Consultants. The results of the studies outlined in this study plan will be presented in technical memoranda that will inform and accompany the final relicensing Settlement Agreement, which will be filed with the Federal Energy Regulatory Commission (FERC) no later than August 31, 2005.

Agency Consultation and Coordination

The study program described in this study plan will include continued consultation and coordination with the USDA Forest Service Chugach National Forest (USFS), the U.S. Fish and Wildlife Service (USFWS), the Alaska Department of Fish and Game (ADF&G), the Alaska Department of Natural Resources (ADNR), the Alaska State Historic Preservation Officer (SHPO), the Kenaitze Indian Tribe, the Native Village of Eklutna, and interested non-governmental organizations.


COOPER CREEK
OUTLET STRUCTURE
COOPER LAKE
EXISTING DAM AND SPILLWAY
OUTLET
PIPELINE AND ACCESS ROAD (APPROXIMATELY 2.13 MILES)
STETSON CREEK
DIVERSION DAM
ALASKA
Cooper Lake Study Area
Gulf of Alaska
Conceptual Diagram of the Stetson Creek Diversion Pipeline
Cooper Lake Project
FERC #2170
LEGEND
Pipeline and Access Road
Outlet Structure
Diversion Dam
1. Mapping completed by HDR Alaska, Inc.
2. All data shown is projected in Alaska stateplane zone 4, North American datum of 1927
0
250
500
1,000
Feet
Date: 4/28/2005
File: Stetson_Creek_div.mxd
Author: JS
N
FIGURE
1

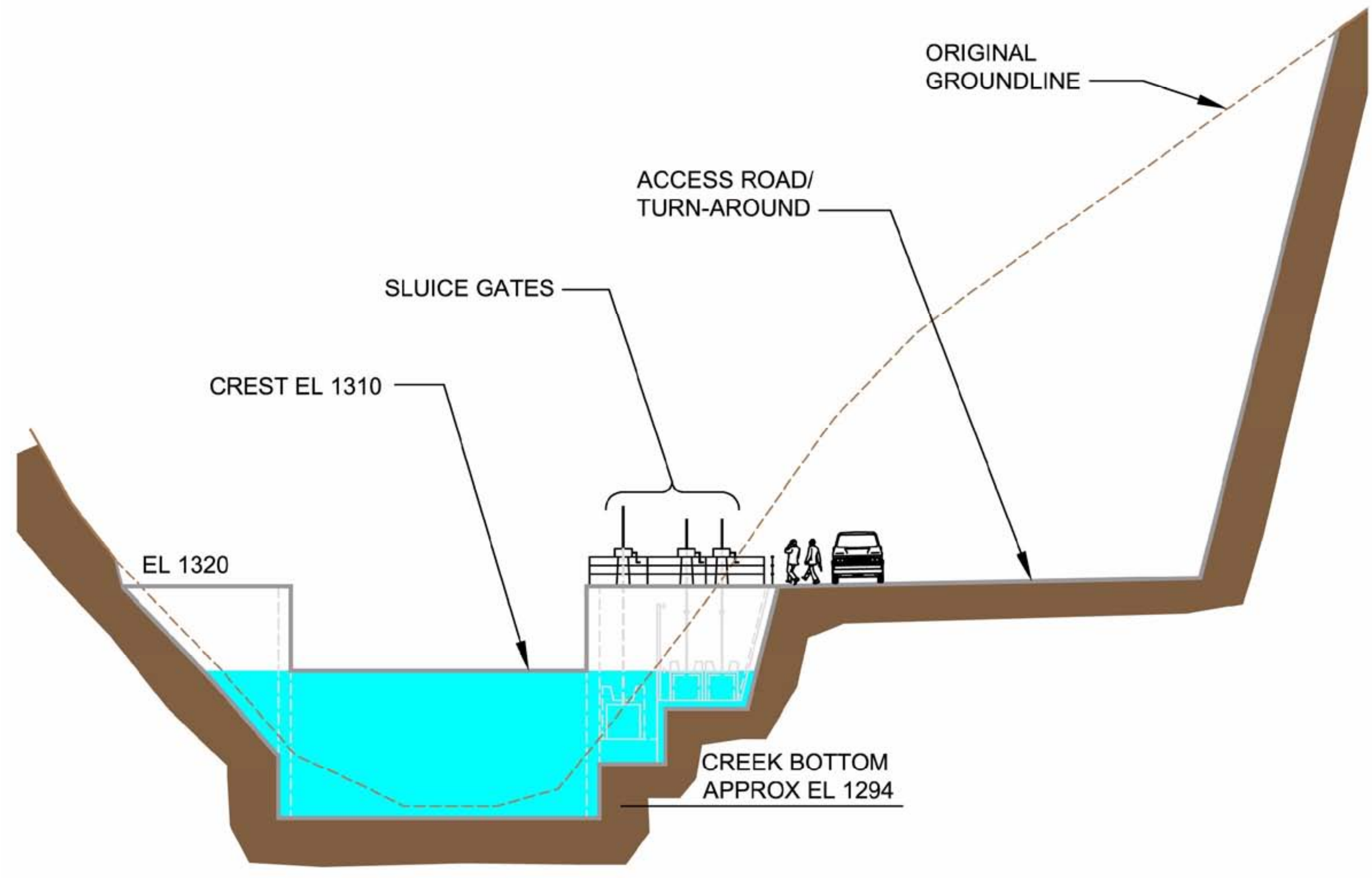


FIGURE 2

Conceptual Diagram of the Stetson Creek Diversion Structure

Cooper Lake Project
FERC #2170

1. Data compiled by MWH, Inc.
2. Figure Compiled by HDR Alaska, Inc.

MWH

HDR Alaska

Date: 5/11/2005
File: Stetson_figure1.mxd
Author: JS

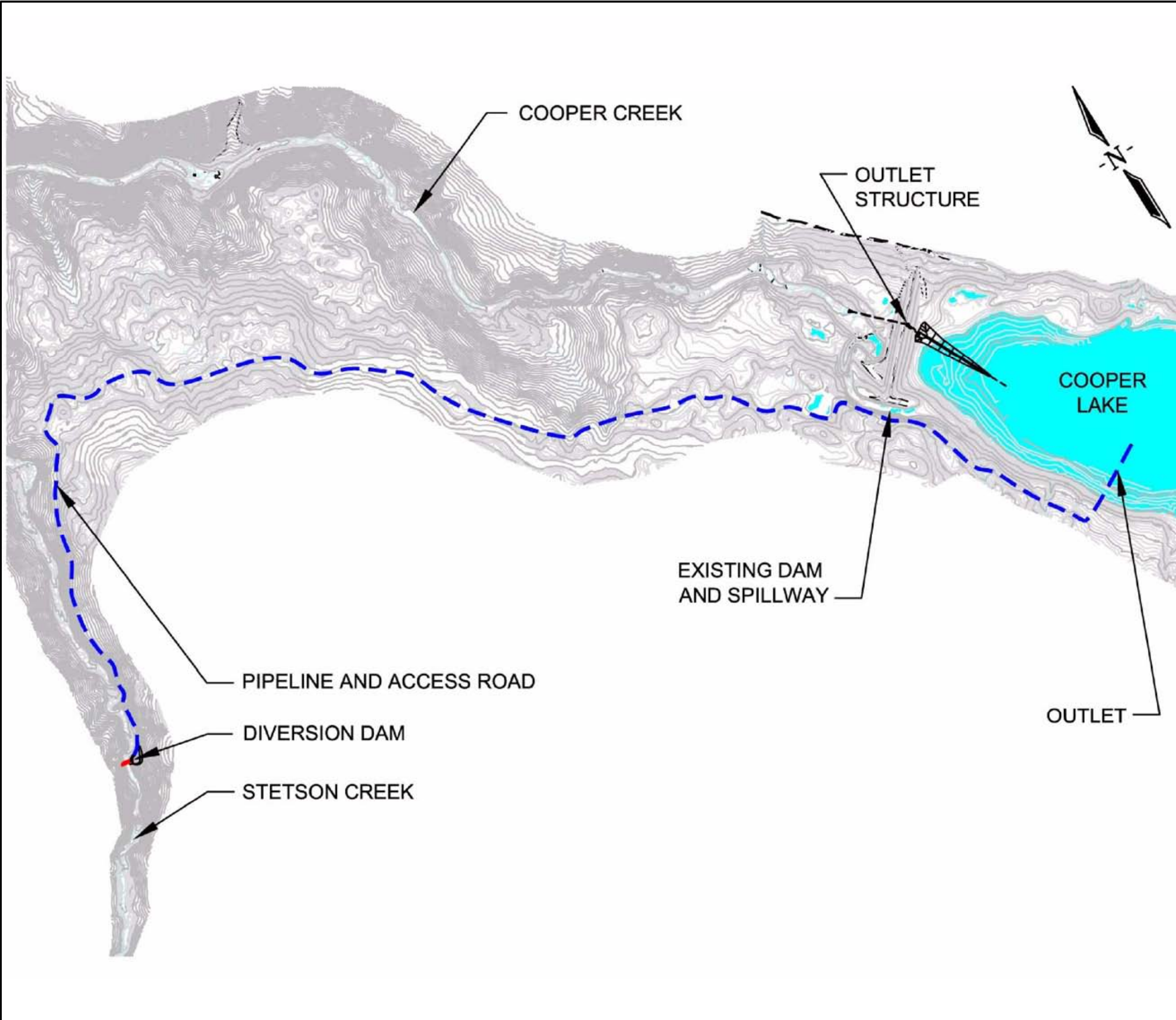


FIGURE 3

Conceptual Diagram of the Stetson Creek Diversion Pipeline

Cooper Lake Project
FERC #2170

1. Data compiled by MWH, Inc.
2. Figure Compiled by HDR Alaska, Inc.

MWH

HDR Alaska

Date: 5/11/2005
File: Stetson_figure1.mxd
Author: JS

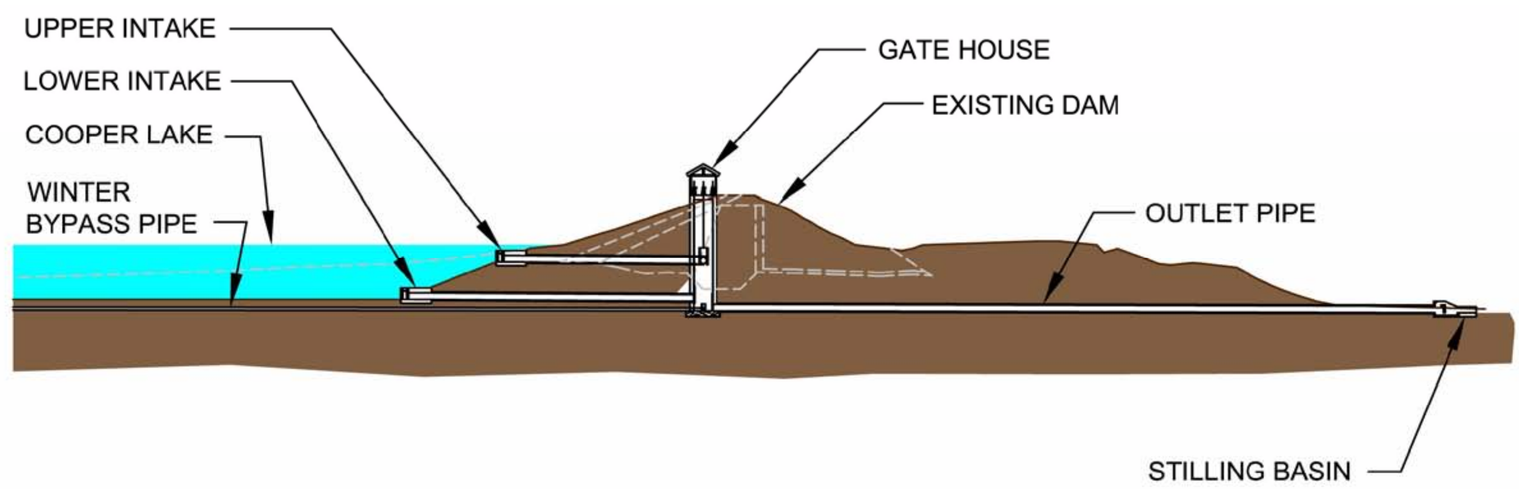


FIGURE 4

Conceptual Diagram of the Cooper Lake Diversion Structure

Cooper Lake Project
FERC #2170

1. Data compiled by MWH, Inc.
2. Figure Compiled by HDR Alaska, Inc.

Date: 5/11/2005
File: Stetson_figure1.mxd
Author: JS

Fish and Macroinvertebrate Study Plan
Northern Ecological Services and HDR

Study Purpose and Objectives

The overall objective of this study will be to document fish resources and assess fish habitat values within Stetson Creek relative to potential effects of the Stetson Creek diversion. Aquatic habitat values will be investigated in detail within the short section of Stetson Creek between the confluence with Cooper Creek and the impassable falls. Upstream from the falls the presence or absence of resident fish will be established and macroinvertebrate samples will be collected. If fish are present, then abundance will be estimated within the portion of Stetson Creek downstream from the proposed diversion structure.

Methods

Downstream Segment

The very short segment of Stetson Creek between the confluence with Cooper Creek and the impassable waterfall (about 200 ft.) is accessible to fish from Cooper Creek and will be considered in substantial detail. Stream habitats will be surveyed using methods adapted from the United States Forest Service's FSH 2090-Aquatic Habitat Management Handbook (R-10 Amendment 2090.21-2001-1) Chapter 20 – Fish and Aquatic Stream Habitat Survey, which establishes standard techniques for fish biologists, hydrologists and aquatic ecologists conducting fish and aquatic stream habitat surveys in coastal Alaska (USFS, 2001). Method protocols are described in detail in the above handbook and summarized in the Cooper Creek Aquatic Habitat Analysis Study Report (Chugach Electric Association, 2004). The survey will be conducted to a modified Tier III level which includes identifying and measuring the surface area of microhabitat types.

Additionally, a snorkel survey will be conducted within the entire segment to assess fish presence and to provide a semi-quantitative estimate of the amount of potential Dolly Varden spawning habitat. Area of potential spawning habitat will be estimated by the diver using professional judgment combined with general suitability criteria (e.g., gravel substrate, moderate velocity, minimum depth, etc.).

The habitat and snorkel surveys will be conducted in late May, weather permitting. Relatively low water level is required to access this portion of stream and the intent will be to conduct the survey prior to normal high flows resulting from snow melt that normally occur in early June.

Upstream Segment

A single mid-summer survey will be conducted to assess fish resources in the portion of Stetson Creek between the falls and the proposed diversion structure. Selected areas within accessible stream segments will be sampled for fish presence using both baited minnow traps and backpack electroshocker. At least five pool/riffle sequences will be sampled in the study reach. If no fish are found, then the study will end.

If Dolly Varden or other salmonid species are present, then fish abundance will be estimated within a subset of habitat units (pools, riffles, and runs) using shocker or minnow trap removal techniques. Density of fish per unit surface area will be estimated for each habitat type. Surface area of each habitat type within the study segment will be estimated from aerial photographs and ground observations. Overall abundance of fish will be calculated by extrapolating the density over the entire length of stream that may be vulnerable to disturbance.

All fish captured will be identified to species, measured, and released at or near the point of capture.

HDR will attempt to collect three macroinvertebrate samples in Stetson Creek (above the falls) in June. Sample locations will be based on accessibility and stream morphology. All macroinvertebrates from each sample will be sorted and identified to genus when possible (excluding chironomidae). In the event that it is evident there are more than 600 macroinvertebrates in the sample, the sample will be split to achieve an approximate 300 count sample.

Schedule and Reporting

The fish survey will be conducted in late June or early July, 2005. Results will be reported in a brief technical memorandum to be completed by the end of July, 2005.

Macroinvertebrate sampling results also will be presented in a brief technical memo, which will include a taxa list and some limited qualitative comparisons between populations found in Southwest Creek and Lower Cooper Creek. No statistical data analyses will be performed for this task. The memo will be completed by end of July, 2005.

Accretion Flows Evaluation
HDR

Study Purpose and Objectives

This analysis is to determine the flows entering Stetson Creek downstream of the proposed diversion structure. The objective of the analysis is an estimation of how much water will remain in the stream during low flow conditions.

Methods

Existing data will be collected. This data is expected to include:

- USGS stream flow measurements.
- HDR collected stream flow measurements.
- Weather information as a correlation to stream flows.
- Topographic information.

One site visit will be made to attempt to collect near simultaneous stream flow measurements at four points along the creek. These points will include the proposed diversion site as well as the three other sites described below. This data will be used for comparison with the calculated values.

Expected low flows will be calculated for three points in Stetson Creek below the diversion site. Suggested flow calculation points are 1,000 feet downstream of the diversion, 3,500 feet downstream of the diversion and at the confluence with Cooper Creek. Specifically targeted will be the expected 7-day 10-year low flows for these points. Several methods for calculating these flows will be evaluated including those outlined in USGS Water-Resources Investigations Report 03-4114. Average elevation differences of the sub basins will be considered and discussed as will data collected at points along the stream.

Schedule and Reporting

Data collection is expected to take place in late June – early July. A brief technical memo will be completed by late July, 2005 to summarize findings.

Terrestrial Wildlife Study Plan
HDR Alaska

Study Purpose and Objectives

The purpose of the study is to gain knowledge of the wildlife resources in the Stetson Creek drainage and along the corridor of the proposed pipeline/access road. The potential effects to terrestrial wildlife from development of a Stetson Creek diversion and increased flows in upper Cooper Creek (above the confluence with Stetson Creek) will be assessed by conducting field observations of existing habitat and wildlife in the study area for this study (the vicinity of the proposed pipeline/access road). In addition, the field observations will be supplemented by information gained through interviews with knowledgeable members of the public and resource agency personnel.

The Kenai population of brown bears has been formally declared by the State of Alaska as a species of special concern that is very vulnerable to human caused disturbance (ADF&G 2000). Therefore, impacts to brown bears or their habitat from the construction, operation and maintenance of the proposed Stetson Creek diversion will be evaluated. Other species of concern or noted interest are bald eagles, Dall sheep, and mountain goats.

Methods

The general survey protocol consists of two biologists experienced with Alaskan wildlife species walking the 2.13 mile long proposed pipeline and access road corridor and recording birds, mammals, tracks, and scat or other indicators of mammal activity (e.g., hair, digging activity, etc.). The survey effort is expected to take approximately 3 days and will be conducted either the last week of May or the first week of June. Data will be collected using separate standardized data sheets for terrestrial mammals, birds, and any nest observations. The intensive site survey will involve surveyors walking slowly and quietly along the centerline of the access road corridor and stopping every 100 to listen for presence of birds or mammals. All terrestrial wildlife species seen or heard from the corridor as well as their approximate location and distance from the corridor will be recorded. Habitat type in which the wildlife was observed and behavior of the animal(s) observed will be noted on the data sheets for each observation. Vegetation characteristics such as canopy height, community composition, and density will be identified from aerial photography and ground truthed in order to delineate vegetation communities as part of the Vegetation and Wetland Study (see following study plan).

In addition to field observation, interviews will be conducted with knowledgeable local residents and the appropriate agency personnel to establish further information about wildlife presence along the Stetson Creek drainage and Cooper Mountain.

Brown Bears

Existing brown bear habitat resources in the immediate vicinity of the proposed Stetson Creek diversion structure and pipeline and access road corridor will be identified. This task will involve documenting habitat variables such as distance to salmon bearing streams, berry resources, cover type and density, and existing human disturbance (trails, developments, recreation). These resources will be documented during the course of the vegetation mapping task (see Vegetation and Wetlands Study Plan). The ground surface to be disturbed by the proposed construction of the Stetson Creek diversion and pipeline will be quantified by total area and habitat type. In addition, agency biologists will be consulted to determine if sensitive areas or travel corridors are present along Stetson Creek that may be affected by development of the proposed diversion, pipeline, and access road in the Stetson Creek drainage. The ADF&G and USFS are currently developing a model to determine brown bear travel corridors on the Kenai Peninsula (Goldstein 2004). The model is scheduled to be completed by spring 2005. Results from the model, which will cover general brown bear habitat on the Kenai Peninsula, will be evaluated in relationship to the area potentially affected by the project

Disturbance to denning bears could result in human/bear conflicts and abandonment of dens and/or cubs. Brown bears are known to den at all elevations, from alpine snow chutes in the Kenai Mountains down to small upland areas scattered around the Kenai Lowlands. Brown bears may potentially den on Cooper Mountain and could be disturbed by the development of an access road and pipeline alignment. The analysis for this study will include a discussion of the potential direct and indirect effects on brown bears resulting from construction of the pipeline and access route, as well as the anticipated effects of increased human-wildlife interaction due to use of the new access road. Spring denning surveys along Cooper Mountain and the Stetson Creek drainage, following the pipeline and access road alignment, will be conducted in late April 2005. Recommendations regarding the timing of surveys and information regarding existing dens in the area have been obtained through coordination with the USFS, USFWS and ADF&G in March and April 2005.

If available, tracking data from the Interagency Brown Bear Study Team work will be used and all brown bear sightings in the study area will be reported to ADF&G. In addition to the tracking data we will access current defense of life and property (DLP) records for the Kenai Peninsula.

Brown bears are sensitive to human disturbance, especially when raising young. Potential impacts to bears may therefore occur from increased public access into the Stetson Creek drainage area by way of the proposed access road and pipeline corridor corridors. In addition, if the expansion of suitable spawning, incubation, and rearing habitat in Cooper Creek through the proposed mitigation results in substantial numbers of salmon in the creek, this may attract brown bears into the Cooper Creek area, where they are currently not abundant due to lack of salmon resources, thus also potentially increasing the numbers of encounters with humans. The potential increases in bear-human interactions in the Cooper Creek and Stetson drainages as a result of the proposed mitigation will be evaluated based on results of the brown bear travel corridor model and discussions with agency brown bear experts.

Bald Eagles

An aerial survey for bald eagle nests will be conducted in late April 2005 before the trees leaf out. This survey will be conducted in conjunction with the aerial spring denning surveys for brown bears along the Stetson Creek drainage project footprint. Prior to the survey, primary resource managers with jurisdiction over properties within the study area will be contacted to obtain existing nest information for verification in the field. Joe Connor (USFWS Biologist) will accompany the pilot and HDR biologist on the survey.

A 660-foot buffer around bald eagle nests is recommended to minimize the chances that eagles might abandon an active nest (USFWS Bald Eagle Basics brochure). Therefore, the aerial survey will entail looking for bald eagle nests within 660 feet from the proposed pipeline and access road.

For each identified nest, the team will circumnavigate the nest to record the coordinates and the tree species where the nest is found, the activity of the nest (active or inactive), and any general comments about the location of the nest. The nest location will be recorded on the quadrangle map and will be mapped using GIS technology.

Dall Sheep and Mountain Goats

During the field investigations for this study, locations of Dall sheep and mountain goats in relation to the proposed access road and pipeline will be recorded. In addition, field teams working on other studies that are part of the Stetson Creek studies program will also record observations of sheep and goats. Potential impacts to sheep and goats from increased human access along the road and pipeline corridor will be evaluated based on the results of the field observations.

Schedule and Reporting

Field surveys will be conducted in late April through early June 2005. The results of the study will be presented in brief technical memoranda with supporting data, in a form suitable for supporting FERC’s NEPA analysis of Chugach’s licensing proposal for the Cooper Lake Project and any related USFS or other permitting processes. Wildlife observations will also be summarized in a table, along with any relevant information associated with the observations. The discussion section in the report will focus on potential brown bear impacts from the proposed pipeline and access road corridor and potential impacts to Dall sheep and mountain goats from increased human access due to pipeline and access road construction.

References

ADFG Division of Wildlife Conservation. 2000. *Kenai Peninsula Brown Bear Conservation Strategy*. Alaska Department of Fish and Game, Anchorage, Alaska.

Goldstein, Mike. 2004. United States Department of Agriculture Forest Service, Wildlife Ecologist. Telephone conversation with Sirena Brownlee on 11/4/04.

USFWS. *Bald Eagle Basics Brochure.* Alaska Region U.S. Fish and Wildlife Service.

Vegetation and Wetland Assessment Study Plan
HDR Alaska

Study Purpose and Objectives

The objectives of this study are to identify vegetation cover types and wetlands in the study area (see below) and quantify potential future impacts to these resources due to the proposed Stetson Creek diversion. Because wildlife use is related to vegetation type, understanding present and future vegetation will also assist in developing descriptions of existing and future wildlife use as well (see Terrestrial Wildlife Study Plan).

The wetland assessment component of the study will describe locations that are subject to the jurisdiction of the U.S. Army Corps of Engineers (USACOE) under authority of Section 404 of the Clean Water Act or under authority of Section 10 of the Rivers and Harbors Act of 1899. The USACOE has authority over certain work in "waters of the U.S.," including wetlands, and in "navigable" waters. By federal law (Clean Water Act) and associated policy, it is necessary to avoid project impacts to wetlands wherever practicable, minimize impact where impact is not avoidable, and in some cases compensate for the impact. The focus of this study is on delineation of wetlands. Wetlands are defined by the U.S. Environmental Protection Agency and the USACOE as: "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR part 328.3(b)). If construction of the proposed Stetson Creek diversion structure or pipeline to Cooper Lake will require soil disturbance in wetlands, the wetland permitting process (Section 404) may also be necessary. To accommodate this need, we propose to identify wetland locations in the study area to allow an impact analysis to be done, if needed.

Study Area

The study area for this study is intended to cover vegetation and terrestrial wildlife habitat that may be affected by the proposed Project. The study area is defined as follows:

1. ***Diversion Dam.*** Plant communities and wetlands will be mapped along an area extending 200 feet upstream and downstream of the proposed location of the diversion structure within Stetson Creek and extend 100 feet either side of the creeks floodplain. This area is approximately 2.5 acres in size.
2. ***Pipeline and Access Road Alignment.*** Plant communities and wetlands will be mapped along a 200 foot swath surrounding the proposed pipeline alignment, defined as 100 feet on either side of alignment centerline. This area is approximately 52 acres in size.

Terrestrial Vegetation Study Methodology

We propose using the same vegetation mapping and classification methods used for the 2003 Terrestrial Vegetation Study conducted for the Project relicensing. These methods are largely based on USFS techniques outlined in existing research publications and study concepts provided by the USFS in response to the Project's initial consultation package (USFS 2002b). Project scientists have gathered existing vegetation information for the Project area. Three datasets exist for the Project study area, but do not describe the communities with enough detail to understand community structure and habitat characteristics. Datasets reviewed and their potential usefulness to this phase of the study include:

Table 1. Existing Vegetation Mapping for the Project Area

Study	Year	Description	Usefulness to Study
Cover Type Mapping	1978	Using source data from 1950-1970, the USFS categorized vegetation cover in Chugach National Forest. A sub-set of data from the USFS timber type mapping.	Low- minimum size of mapped plant communities is 10 acres. Too large for the purpose of this study.
Land Cover Classification	1997	Using source data from 1977-1991, the USGS categorized vegetation communities throughout Southcentral Alaska using satellite imagery.	High- minimum size of mapped plant communities is 30^2 meters. Limited ground truthing. Good descriptions of Level II/III communities.
Timber Type Mapping	1978	Using source data from 1950-1970, the USFS categorized timber production areas in Chugach National Forest.	Low- mapping is oriented to timber activities and does not accurately describe plant communities.

For the terrestrial vegetation study, color aerial photograph contact prints (taken May 7, 2003 at 1"=700' scale) will be inspected under a stereoscope to delineate different vegetation cover types. Vegetation cover type boundaries will be digitized into the Project's GIS database. Vegetation characteristics such as cover type, canopy height, cover class, and community type will be identified from aerial photography and will be the basis for delineating vegetation boundaries. Communities will be mapped to a minimum scale of 0.5 acres and classified using the system shown in Attachment A.

Biologists will ground truth representative cover types defined from aerial photograph interpretation. Baseline plant community data will be used to assess habitat quality and allow us to attribute digitized polygons with habitat characteristics identified in the field. Quantitative data will be collected from sampling plots that represent a homogeneous $50m^2$ vegetated area that is encompassed by a larger (2-acre minimum size) plant community polygon mapped by aerial photographic interpretation. The shape of the plot will be circular except in locations where a narrow, linear stand may require the plot to be rectangular. The location of each plot will be identified using a hand-held global positioning system (GPS) unit. Sampling locations will be distributed over a full range of environmental and physical conditions (i.e., elevation, slope). Observational and incidental data describing habitat potential will be collected as well. Specific parameters to be measured at each plot will include:

a. Dominant vascular plant species in the canopy and sub canopy. Dominance will be determined by a visual estimate of a plant's percent cover in the plot. Species with less than 5% cover will not be identified; those greater than 5% will be identified and recorded to species.

b. Average height and basal trunk diameter of dominant tree species.
c. Observations on fruit production.
d. Wildlife usage signs - droppings, browsing, bird singing, carcasses, tracks and burrows.
e. Individual plant communities will be attributed for vegetation structure and composition based on the coding system outlined in Attachment A.

We will modify preliminary mapping to address new information gained during the field verification. This will include extrapolating findings from the representative sites we visited to others we did not visit. Field data collection sites will be added to the digital coverages. GIS technology will be used to analyze plant community abundance, quantify changes associated with future project developments, and summarize results of the mapping.

Wetland Assessment Study Methodology

Initially, we propose reviewing the existing USFWS National Wetland Inventory (NWI) mapping available to determine the extent to which wetlands may occur in the study area. Following that, wetland scientists will stereoscopically analyze color aerial photography and digitize preliminary wetland boundaries into the Project GIS database. This digitization process will use existing photogrammetric derived topographic mapping (at 2-foot intervals) and aerial photography collected by Kodiak Mapping, Inc. (taken at a 1"=700' scale, May 7, 2003). Delineating wetlands from aerial photography is based on the following types of evidence:

a. *Vegetation clues:* On aerial photography, scientists will look for saturation-adapted vegetation communities, open canopy structure, low plant height, and presence of hydrophytic plant species. A common example includes dwarf spruce trees, which are indicative of a limitation to growth such as excessively wet soils.
b. *Evidence of soil saturation:* Surface water and darker areas of photos indicating surface saturation is an indicator of wetland hydrology. An area's proximity to streams, open water habitat, and marshes can be indicative of shallow subsurface water as well.
c. *Topography:* Evidence of topographic high points and sloped surfaces that would allow soils to drain is used to support classifying areas as upland. Topographic depressions, toes of slopes, and flat topography serve as indicators of potentially poor soil drainage.

Following aerial photograph interpretation, scientists will complete a field investigation where characteristic wetland and upland areas will be studied using the USACOE 1987 wetland delineation manual's three-parameter method of determining an area's wetland status. Wetland Determination Field Data Forms will consist of standard USACOE data sheets, and will be completed at the representative wetland and upland areas. Soil profiles will be examined at selected representative sites, and will be logged into a handheld GPS unit and later entered into the Project GIS database. Representative photographs of the soil profile and surrounding plant community and observational data will be collected in conjunction with wetland determination data form plots.

Refinements to NWI mapping will be made following aerial photographic interpretation and ground truthing. NWI boundaries will be overlaid on orthorectified aerial photography and boundaries adjusted according to the new information developed through fieldwork and aerial photograph interpretation. Unmapped wetland areas or incorrect mapping codes that are discovered in the study area will be recorded and coded using the Cowardin et al. (1979) wetland classification system and NWI mapping codes. A wetland layer for the study area will be added to the Project's GIS database.

Schedule and Reporting

All study components are proposed to be complete in summer 2005. The ground truthing portion of the study will be done during summer 2005, when vegetation is leafed out. The results will be presented in a technical memorandum, which will be completed by the end of July 2005. The technical memorandum will summarize plant community characteristics, wetland types, and diversity of communities in the study area. The discussion section of the memorandum will be focused on the information needed to assess Project-related impacts on the different communities and on wildlife habitat. It will include a summary of proposed Project operations, detailed vegetation maps showing impacted areas in conjunction with mapped vegetation boundaries and wetlands, tabulations of the various community and wetland types found in the Project area, and representative ground photos.

References

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, U.S. Fish and Wildlife Service. Washington, DC.

U.S. Army Corps of Engineers Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Vicksburg, MS.

U.S. Federal Register. November 13, 1986 Part II. Rules and Regulations, Vol. 51, No. 219. U.S. Department of Defense. Corps of Engineers, Department of the Army. 33 CFR Parts 320-330, Regulatory Programs of the Corps of Engineers; Final Rule.

USDA Forest Service, Chugach National Forest. 2002b. Cooper Lake Hydroelectric Project (FERC #2170). Forest Service Response to Chugach Electric Associations, Inc.'s First Stage Consultation Package and Preliminary Study Concepts and Forest Service Recommended Studies. September 5, 2002.

Viereck L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification. U. S. Department of Agriculture.

Attachment A. Plant Community Mapping Codes

Vegetation cover type

a. spruce	k. alder tall scrub
b. hemlock	l. willow tall scrub
c. hemlock-spruce	m. low scrub
d. birch	n. dwarf scrub
e. cottonwood	o. graminoid herbaceous
f. aspen	p. forb herbaceous
g. spruce-birch	q. free water
h. spruce-cottonwood	r. frozen water
i. spruce-aspen	s. barren/sparsely vegetated
j. hemlock-birch	

Forest canopy cover class

a. Closed - ≥60 percent
b. Open - 25-59 percent
c. Woodland - 10-24 percent

Vegetation community type group

Forest Types	Scrub Types	Herbaceous Types
a. alder	j. alder	r. bluejoint
b. bluejoint	k. cassiope	s. fern
c. devil's club	l. crowberry	t. fireweed
d. dwarf scrub	m. dwarf birch	u. horsetail
e. fern	n. salmonberry	v. rough fescue
f. menziesia	o. sweet gale	w. sedge
g. moss	p. willow	x. not differentiated
h. tall blueberry	q. not differentiated	
i. not differentiated		

Vegetation community type group: The appropriate indicator of the undergrowth community type group is appended to the vegetation cover type name. Determinations of the indicator species will be made using *Plant Community Types of the Chugach National Forest: Southcentral Alaska* (Technical Publication R1O-TP-76).

Height Class

Upper Canopy	Subcanopy
a. 0-5 feet	a. 0-1 feet
b. 5-10 feet	b. 1-5 feet
c. 10-20 feet	c. 5-10 feet
d. 20-30 feet	d. >10 feet
e. 30-40 feet	
f. 40-50 feet	
g. 50-60 feet	
h. 60-70 feet	

Height Class	
i. 70-80 feet	
j. 80-90 feet	
k. 90-100 feet	
l. 100-110 feet	
m. >110 feet	

Sensitive Plants Survey
HDR Alaska

Study Purpose and Objectives

The purpose of this study is to develop the information necessary for the USDA Forest Service (USFS) to meet its goals and objectives related to sensitive plant species. Specifically, this study is designed to determine the locations and abundance of sensitive plants in the area of the proposed Stetson Creek diversion in preparation for completing a Biological Evaluation for Plants for the Cooper Lake Project as a whole. The objectives of the Biological Evaluation for Plants will be: (1) to ensure that actions do not contribute to loss of viability of any native or desired non-native plant or animal species; (2) to incorporate concerns for sensitive species throughout the planning process; and (3) to ensure that ongoing and potential future Project-related activities will not cause a species to move toward federal listing as a threatened or endangered species. The primary objectives of this study are twofold: (1) to survey the study area to determine whether it supports any plants currently identified by Region 10 of the USFS as "sensitive plants"; and (2) if any sensitive plants were found, to collect the information needed to evaluate the potential effects on those plants and to develop any necessary mitigation measures.

Study Area

The study area for the sensitive plant survey is intended to cover habitats that may be affected by the proposed Project. The study area is defined as follows:

1. ***Diversion Dam.*** An area extending 200 feet upstream and downstream of the proposed location of the diversion structure within Stetson Creek and extend 100 feet either side of the creeks floodplain will be surveyed for sensitive plants. This area is approximately 2.5 acres in size.
2. ***Stetson Creek below Diversion.*** Sensitive plants may live in suitable habitats along Stetson Creek and riparian habitats will be identified and surveyed.
3. ***Pipeline and Access Road Alignment.*** An area defined as 100 feet on either side of alignment centerline will be surveyed. This area is approximately 52 acres in size.
4. ***Cooper Lake Dam Area.*** Area downstream of dam that might be disturbed during construction, including the permanent disturbance area.

Methods

Areas of focus for the sensitive plant survey will be habitats known or suspected to support sensitive plants in Chugach National Forest, as directed in the "Procedures for Sensitive Plant Biological Evaluations" section of the USFS sensitive plant manual (Stensvold 2002; appended to the April 2003 Study Plan, HDR 2003). These may include heath, alpine and subalpine areas, wet meadows, shallow fresh water, forest edges, rock outcrops, well drained open areas, open forests, waterfalls, and stream banks. The exact areas of focus will be based on a review of pertinent information (habitat descriptions and USFS data), the surveyors' understanding of habitat preferences of each of the suspected species, and on surveyors' judgment about where those habitats might exist within the study area. Thus, professional judgment will be exercised in the field to select areas for close examination.

The study methods will be based on the "Procedures for Sensitive Plant Biological Evaluations" (Stensvold 2002). The methods are summarized below.

Scientists previously reviewed and compiled existing information on known locations, habitat preferences, and general geographic distributions of sensitive vascular plant species for the Cooper Lake Project Sensitive Plant Survey (HDR, 2003). This information will be reevaluated with regard to the Stetson Creek diversion study area.

The following existing information will be used:

- List of Alaska Region Sensitive Vascular Plants (June 2002) (see Appendix 2).
- Forest Service protocols for sensitive plant surveys and Biological Evaluations (Stensvold 2002).
- Known geographic locations of sensitive species on the Kenai Peninsula (USFS digital records, conversation with forest ecologist). [None are known to exist in the project area]
- Known habitat preferences and general geographic distributions of listed sensitive plants (Forest Service sensitive plant manual [Stensvold 2002]).
- Vegetation maps to be produced as part of other studies to be conducted in conjunction with the Project.
- 2003 aerial photography of Cooper Creek and Cooper Lake.

Table 1 shows the results of the 2003 review. Through stereoscopic interpretation of aerial photographs of the Project area, scientists will identify potential habitat based on the reevaluation of the information summarized in Table 2.

Table 2. Sensitive Plants Suspected in the Project Area

Latin Name	Common Name	Potential Habitats
Aphragmus eschscholtzianus	Eschscholtz's little nightmare	Wet areas of tundra and heath, areas of slow water flowage, moist mossy areas, solifluction slopes, seeps and scree slopes
Arnica lessingii ssp. *norbergii*	Norberg arnica	Meadows, open forest, tall shrubland, willow-alder openings, tundra, heath
Carex lenticularis var. *dolia*	Goose-grass sedge	Wet meadows, edges of snow beds, near glaciers, pond and lake margins
Draba kananaskis	Tundra whitlow-grass	Rocky alpine, scree slopes, rock ledges
Isoetes truncata	Truncate quillwort	Shallows of lakes, ponds, and streams, immersed in fresh water
Ligusticum calderi	Calder's lovage	Meadows in alpine and subalpine, margins of subalpine mixed conifer forest. Wet to moist areas. Limestone, often rocky habitats, rocky cliffs, open boggy or rocky slopes

Latin Name	Common Name	Potential Habitats
Papaver alboroseum	Pale poppy	Well drained sandy and gravelly soil, rocky, open habitats, recently deglaciated areas, rock outcrops, riparian areas, disturbed gravels
Puccinellia glabra	Smooth alkali grass	Coastal flats frequently flooded by tides; stabilized sandy, shingle, or muddy beaches in upper tide zone
Puccinellia kamtschatica	Kamchatka alkali grass	Wet places on coast
Romanzoffia unalaschensis	Unalaska mist-maid	Moist places, wet rock outcrops, shorelines, riverbanks, beach terraces
Stellaria ruscifolia ssp. *aleutica*	Circumpolar starwort	Moist gravelly habitats, along streams in lowlands and in the mountains

Sources: Stensvold 2002, Lipkin and Murray 1997.

Because previously undisturbed ground will be affected, field surveys will be conducted at intensity level 5 ("Intuitive Controlled") between late June and early July, 2005 or earlier if conditions permit. Survey intensity levels were recommended by the USFS, and are defined in Attachment B (following this section). Level 5 entails a complete examination of specific high-probability or unique areas after examining the study area intensively enough to locate any such habitats.

Records of field surveys will be kept according to current USFS protocols for sensitive species surveys, including use of the R-10 Daily Sensitive Plant Survey Forms and the R-6 Threatened, Endangered, and Sensitive Plant Sighting Form. Locations of surveys will be recorded in the field on georeferenced aerial photography and recorded using a GPS receiver.

Habitats likely to support sensitive plants will be thoroughly searched. The searches will be conducted following the concepts of the timed meander method (Goff et al. 1982). Searches in each unit will be timed, and all species encountered will be recorded. Surveyors will remain in each survey unit until they feel that no new species will be encountered with further searching, or until they deem the habitat unsuitable for the sensitive species. A list of species encountered in each survey area will be developed.

Schedule and Reporting

The sensitive plant survey is scheduled for late June and early July, 2005. The results of the survey will reported in a technical memorandum completed by the end of July, 2005.

References

Goff, F.G., G.A. Dawson, and J.J. Rochow. 1982. Site Examination for Threatened and Endangered Plant Species. Environmental Management, Vol. 6, No. 4. pp. 307-316.

HDR Alaska, Inc. (HDR). 2003. Sensitive and Exotic Plants Survey, Final 2003 Study Plan, Cooper Lake Project (FERC No. 2170). Prepared for Chugach Electric Association. April 2003.

HDR Alaska, Inc. (HDR). 2004. Sensitive Plant Survey, 2004 Study Plan, Cooper Lake Project (FERC No. 2170). Prepared for Chugach Electric Association. February 2004.

Lipkin, R., and D.F. Murray. 1997. Alaska Rare Plant Field Guide. Alaska Natural Heritage Program, University of Alaska Anchorage, and University of Alaska Museum, University of Alaska Fairbanks, Alaska.

Stensvold, M. 2002. Sensitive Plants, Chugach National Forest, July 2002 (in-house training publication).

Attachment B

SURVEY INTENSITY LEVELS FOR PLANTS

LEVEL 1 = "FIELD CHECK"
The surveyor gives the area a quick "once-over" but does not walk completely through the project area. The entire project area has not been examined.

LEVEL 2 = "CURSORY"
The surveyor gives the area a "once-over" by walking through the project area. The entire project area has not been examined.

LEVEL 3 = "LIMITED FOCUS"
The surveyor closely examines one or more habitat-specific locations within the project area, but does not look at the rest of the area.

LEVEL 4 = "GENERAL"
The surveyor gives the area a closer look by walking through the project area and walking around the perimeter of the area or by walking more than once through the area. Most of the project area is examined.

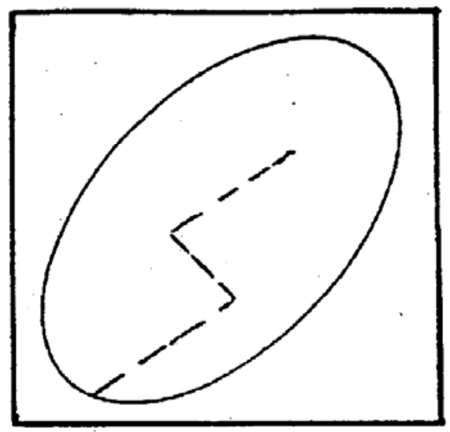
LEVEL 5 = "INTUITIVE CONTROLLED"
The surveyor has closer look by conducting a complete examination of specific areas of the project after walking through the project area and perimeter or by walking more than once through the area.

LEVEL 6 = "COMPLETE"
The surveyor has walked throughout the area being examined until nearly all nearly all of the area has been examined.

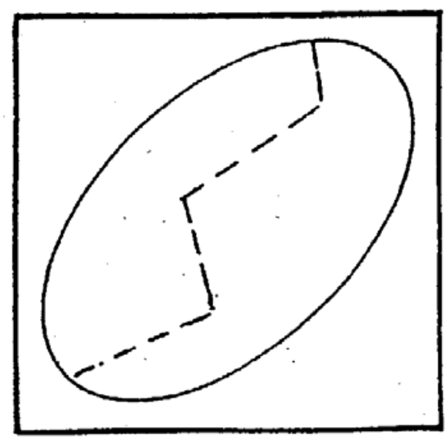
Survey Intensity Levels Used In Sensitive Plant Surveys

The following types of surveys are linked with the completion of the Biological Evaluation:

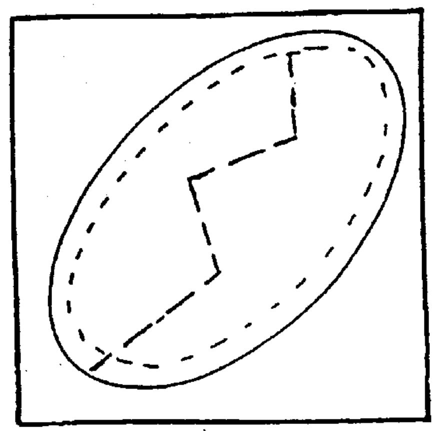
<u>Field Check</u>
The surveyor gives the area a quick "once-over" but does not walk completely through the project area. The entire project area has not been examined.



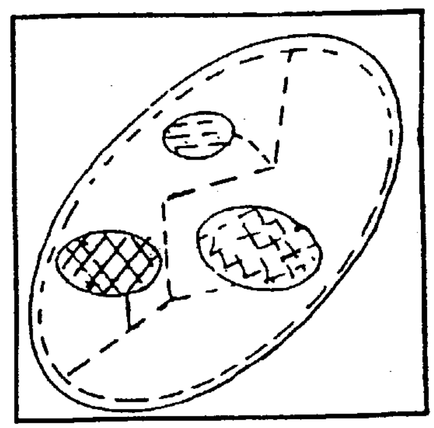
<u>Cursory/Limited Focus</u>
The surveyor gives the area a "once-over" by walking through the project area. The entire project area has not been examined.



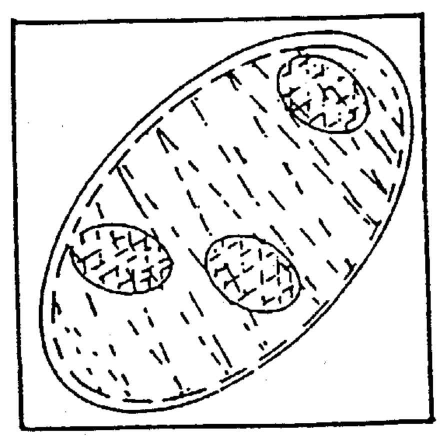
<u>General</u>
The surveyor gives the area a closer look by walking through the project area and perimeter or by walking more than once through the area. Most of the project area is examined.



<u>Intuitive Controlled</u>
The surveyor has given the area a closer look by conducting a complete reconnaissance through a specific area of the project after walking through the project area and perimeter or by walking more than once through the area.



<u>Complete</u>
The surveyor has walked throughout the area being examined until nearly all of the area has been examined.



Cultural Resources Study
Cultural Resource Consultants

Study Purpose and Objectives

FERC requires applicants to address historic properties along with other environmental resources in the license application (18 CFR 4.51.f.4). Section 106 of the National Historic Preservation Act (NHPA) requires that FERC take into account the effects of its relicensing decision on historic properties and provide the Advisory Council on Historic Preservation a reasonable opportunity to comment. This study plan outlines the purpose and protocol for evaluating the potential future effects of the proposed Stetson Creek diversion on cultural resources.

All aspects of the cultural resources study for the Cooper Lake Project relicensing, as described below, will be done in accordance with the implementing regulations of Section 106 of the NHPA (36 CFR Part 800), FERC's hydropower licensing regulations (18 CFR Chapter 1, Part 4), the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716), the Secretary of the Interior's Professional Qualifications Standards (48 FR 22716), the Advisory Council on Historic Preservation's general guidelines for identification and testing procedures as set forth in *Treatment of Archaeological Properties, A Handbook*, and the standards stated in the Programmatic Agreement Among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation and the Alaska State Historic Preservation Officer Regarding Heritage Resource Management on National Forests in Alaska. Unless otherwise specified, field notes, samples, artifacts and other collected data will be curated with the University of Alaska Museum in Fairbanks in accordance with the requirements set forth in 36 CFR Part 79. All site information, other than its Alaska Heritage Resources Survey (AHRS) number and National Register of Historic Places (National Register) eligibility, will be confidential as stipulated in Section 304 of the NHPA, as amended (16 USC 470w-3).

Inventory and Assessment of Archeological and Historical Resources

The goal of this inventory will be the continued identification of historical and archeological resources in the Project's area of potential effect (APE—see below) — specifically for this study, the portion of the APE associated with the proposed Stetson Creek diversion structure and pipeline to Cooper Lake. "Identification" includes identifying properties and determining whether or not they are listed on, or eligible for inclusion in, the National Register. The standard for identification is a reasonable and good faith effort, including (as necessary) background research, consultation, oral history interviews, reconnaissance investigations, and intensive field surveys. Field methods will include systematic pedestrian surveys of lands in the primary APE, archaeological test excavations to sample cultural deposits, and laboratory analyses of cultural materials. The ultimate product of the work will be information that will be incorporated into the Project's Historic Properties Management Plan (HPMP).

Area of Potential Effect (APE)

The APE includes lands that could be affected (directly or indirectly) by operation of the Project or ground-disturbing activities required by or permitted under the new FERC license. The APE consists of lands within the FERC-licensed Project boundary, as well as areas where potential Project-related activities might affect cultural resources.

As noted above, the 2005 fieldwork will focus on areas that could be affected by diversion of water from Stetson Creek to Cooper Lake. Survey areas will include the locations of a diversion dam and impoundment on Stetson Creek—an area that was intensively mined during the early 1900s—and archeologically sensitive portions of a pipeline and access road. This study area is referred to in the remainder of this study plan as the Stetson Creek Diversion APE.

Consultation

This study will include continued consultation and coordination between FERC, USFS, (SHPO, the Kenaitze Indian Tribe, and the Native Village of Eklutna.

Background Research

Much of the available archeological and historical information about the study area was reviewed prior to the 2003 field season (Cultural Resource Consultants 2003). However, additional research will likely be needed to identify and determine the significance of historic resources in the upper Stetson Creek drainage. Information will continue to be sought from groups and individuals likely to have knowledge of, or concerns with, historic properties in the area. AHRS records for previously identified sites will be updated to include any newly discovered information.

Field Surveys

Field surveys will locate known and previously unrecorded historical and archaeological sites in the Stetson Creek Diversion APE. If necessary, previously recorded sites will be evaluated to determine their National Register eligibility. High sensitivity locations within the APE will be intensively surveyed. These surveys will include systematic pedestrian examinations of the ground surface and subsurface testing. Systematic subsurface testing will be the principal method for field sampling.

Sites will be examined for evidence of surface features—such as cache pits, roads, ditches, and tailings piles—which will be photographed, measured, and mapped. Surface collecting and subsurface testing will also be used to establish site boundaries. Boundaries will be recorded with a GPS unit and shown on aerial photographs and/or USGS topographic maps. Newly discovered sites will be recorded on AHRS inventory forms. Surface artifacts will be collected to establish site age and function, although collection methods will vary between prehistoric and historic sites. For prehistoric sites, an effort will be made to recover all exposed diagnostic artifacts, as well as a representative sample of lithic debitage. The presence and relative density of fire-cracked rock will be noted, but fire-cracked rock will not be collected. At historic sites, which are often characterized by high densities of diagnostic materials, a representative sample of artifacts will be collected.

The techniques used in analyzing the data collected from the surveys will depend on the type of information recovered. Techniques that could be appropriate for the objectives of this study include, but are not limited to, studies of artifacts and their distribution, C-14 dating, analysis of faunal remains, and studies of soils and stratigraphy. All materials requiring curation, including artifacts, samples, field notes, photographs, and drawings, will be accessioned to the University of Alaska Fairbanks Museum (UAM). Archeologists in the field and in the lab will employ any needed preventive conservation measures. The collection will be in stable condition and any necessary conservation will be completed before the collection is deposited at UAM.

Documentation

Results of the work will be assembled in a technical memorandum with graphics as supporting documentation. The memorandum will be submitted in two parts. One volume will be suitable for release to the public as an appendix to the environmental document and the other will contain sensitive information such as site-specific maps, figures, and text, and will receive only limited distribution.

Human Remains

In the event that human remains are discovered during the course of fieldwork, FERC will be notified immediately. FERC will notify other parties, including SHPO, USFS, and appropriate Native groups. Any Native American graves and/or associated cultural items discovered on federal lands during the archaeological survey will be dealt with in accordance with the 1990 Native American Graves Protection and Repatriation Act (NAGPRA - Public Law 101-601) guidelines.

Determinations of Eligibility and Effect

Cultural Resource Consultants (CRC) will make recommendations regarding the National Register eligibility of cultural resources in the Stetson Creek Diversion APE. As FERC's delegated representative for routine and technical aspects of Section 106 consultation during the pre-filing phase of the relicensing, Chugach will then correspond with the SHPO to make formal determinations regarding these properties. Each determination of eligibility will include a description and evaluation of the property; a statement of significance; a selected list of sources; and maps, photographs, and other illustrations. Consideration will be given to both the criteria of significance and integrity of the site. Each determination will consider the historic context of the property, including its relation to other known historic properties.

CRC will then consider potential Project-related impacts and other land use impacts on National Register eligible cultural resources in the APE. If necessary, recommendations will also be made as appropriate mitigation and management measures. If data recovery is required as a mitigation measure, a data recovery plan will be developed in consultation with the FERC, USFS, and SHPO.

Schedule and Reporting

The field work described above will begin in June 2005 when the study area is clear of snow. The technical memorandum of results will be completed by the end of July 2005.

References

Cultural Resource Consultants. 2003 *Cultural Resources Study: Final 2003 Study Plan*. Cooper Lake Project (FERC No. 2170). Prepared for Chugach Electric Association, Inc. Cultural Resource Consultants, Anchorage.

Cultural Resource Consultants. 2004 Cultural Resources Study: Draft 2003 Inventory and Assessment of Archeological and Historical Resources. Prepared for Chugach Electric Association, Inc. Cultural Resource Consultants, Anchorage.

Recreation and Visual Resources Study Plan
Land Design North

Study Purpose and Objectives

The purpose of this study is to estimate the recreational and visual resource opportunities and constraints that could be created by a new diversion facility and pipeline/access road that would extend from Stetson Creek to Cooper Lake. The corridor may present new opportunities that extend the potential recreational uses within the Cooper Creek drainage, but may compromise visual resources, or may displace existing recreational activities. This study will assess and describe what these changes may be and the degree to which these are negative or positive changes to the existing conditions.

The objectives are specifically:

For Recreation Resources:

A.. Determine the potential opportunities that a new cleared corridor may provide for recreation.
B. Determine whether decreased water flow in Stetson Creek may have an impact on recreational mining activity.

For Visual Resources:

A. Determine whether the diversion clearing will be visible from locations within the forest from where they would be viewed by the visiting public, including the Cooper Lake Dam access road.
C. Determine whether the cleared right-of-way for the diversion channel/pipe provide an appropriate visual setting if used as a hiking trail.

Study Area and General Approach

The study area for the recreation/visual resources assessment will include the Stetson Creek drainage and the Cooper Creek drainage.

The recreational resource assessment will require determination of the potential for the diversion to provide for trail use. Assessment will include evaluation of terrain, soils, and hazards that may restrict use, and evaluation of likely types of potential users. Consideration will also be provided to connections between the Cooper Lake Dam access road (which will be extended to continue along the proposed pipeline) and the Stetson Creek trail and whether creek crossings along the connection route could be made without posing safety challenges.

An evaluation will be made of other existing uses that could be displaced by the new diversion. Specifically, the study will seek to determine the numbers of mining permits that exist for the two creeks and whether a change in the water regime will affect the use of the drainages for mining.

The visual resources assessment will include an evaluation of the viewsheds that are affected by the new corridor and the degree to which these areas are affected. Consideration will be given to area of clearing, soils, aspect, and vegetative cover. The evaluation will also consider the aesthetics of the cleared area as evaluated from the viewpoint of those that might use the corridor as a hiking/recreational trail.

Methodology

Task I: Investigation

A. Trail Opportunities
The new corridor will be assessed for potential use as a trail including evaluation of whether the trail could provide a loop when combined with the Cooper Lake Dam access road and Stetson Creek trail. Specific investigation will focus on physical characteristics including topography, soils, and hazards such as avalanche. Topographic mapping will be used for a "macro" evaluation of attributes. After mapping is complete, an on-site hike will be used to gain more targeted information.

B. Mining
The Bureau of Land Management and the USFS Mineral Claims offices will be contacted to determine the number of mining claims on Stetson Creek and whether any recoverable gold has been reported. We will interview potentially affected parties, if identified in our contacts, regarding flow conditions necessary to mine Stetson Creek, and evaluate this information with respect to predicted flow conditions with the proposed diversion in place.

C. Clearing Effects to Views
The clearing for the new corridor will be modeled in ARCVIEW to determine the areas that have views to the corridor.

D. Cooper Lake Dam Access Road
Views to the new cleared corridor will be photographed from the Cooper Lake Dam Access Road.

E. Trail as a Visual Resource
The corridor will be hiked in order to determine whether the proposed pipeline/access route provides opportunities for views or aesthetic settings that are desirable for a trail and whether any visual factors warrant consideration in the design process.

Task II: Analysis

A. Trail Opportunities
The corridor will be mapped and opportunities and constraints will be illustrated and described. The physical ability to construct and maintain a trail will be described in terms of the USFS's Recreation Opportunity Spectrum. Specific descriptions and evaluations of waterway crossing and bridging needs will be provided.

B. Mining
Discussions with identified parties will be documented and specific concerns that were raised will be described. If warranted, we will contact third parties with knowledge of mining methods to validate and assess any concerns raised.

C. Mapping of Scenery
Areas with views to the corridor will be mapped and described in terms of USFS Handbook Number 701, "Landscape Aesthetics-A Handbook for Scenery Management." Landscape character, scenic integrity, and landscape visibility will be documented.

D. Key View Simulations
Potential changes to key views will be simulated using computer images. Changes will be assessed in terms of the resulting modification to visual resources. Simulations will be provided for the proposed pipeline/access corridor in order to provide an image of the resulting trail aesthetics should the corridor be used as a trail.

Task III: Conclusions

Conclusions will describe the ability of the proposed pipeline/access corridor to serve as a recreational use trail. They will be based on both opportunities and constraints with a description of the trail in terms of the ROS criteria. The conclusions will also address the potential of Stetson Creek to continue as a mining resource based on an objective analysis of the changes to the water regime.

Visual impacts will be described in terms of potential changes to existing visual conditions. The potential change will also be described in terms of compliance with USFS management prescriptions for the area.

Schedule and Reporting

The work described above will take place in May – early July 2005 and will be reported in a technical memorandum to be completed by late July 2005.

Pipeline/Access Route Erosion Potential Evaluation
HDR

Study Purpose and Objectives

This analysis will be a reconnaissance-level review of what is likely a complex geotechnical question. It is expected to formulate questions for future study during project design.

Methods

HDR will gather and review existing information on the topography, geology, and soils of the area.

There will be one site visit to walk the alignment (the proposed centerline will be surveyed and flagged by mid-June), verify assumptions, look for alternatives and look for physical clues to erosion potential. We will attempt to determine whether road construction will require side casting of material.

Schedule and Reporting

Data collection is expected to take place in late June – early July. A brief technical memo will be completed by late July, 2005 to summarize findings.