

# Fisheries and Aquatics Study Plan

**Grant Lake Hydroelectric Project (FERC No. 13212)  
Natural Resource Studies Meeting**

**December 12, 2012 – Anchorage, AK**



In Association with



Owner



**MIKE SALZETTI**  
(907) 283-2375  
msalzetti@homerelectric.com

Project Manager

**CORY WARNOCK (MCM)**  
(360) 384-2662  
cwarnock@longviewassociates.com

**Aquatic Resources  
Task Lead**

**JOHN BLUM (MCM)**  
(360) 734-5915  
john.blum@mcmillen-llc.com

**MARK MILLER (BA)**  
Fisheries Biologist

**JOHN STEVENSON (BA)**  
Fisheries Biologist

**SALLY MORSELL (NES)**  
Macroinvertebrate & Periphyton

**GARY FANDREI (CIAA)**  
Weir Fabrication & Monitoring

**MORT MCMILLEN, PE (MCM)**  
Weir Design Lead

**Water Resources  
Task Lead**

**CHARLES SAUVAGEAU (MCM)**  
(360) 734-5915  
charles.sauvageau@mcmillen-llc.com

**PAUL PITTMAN, LEG (ES)**  
Geomorphology

**DR. GEORGE ROBISON, PE (MCM)**  
Water Quality

**Cultural Resources  
Task Lead**

**MICHAEL YARBOROUGH (CRC)**  
(907) 306-6069  
muy@crvalaska.com

**LINDA YARBOROUGH (CRC)**  
Cultural Resource Specialist

**RONALD STANKEE (CRC)**  
Subsistence

**Terrestrial Resources  
Task Lead**

**JOHN GANGEMI (ERM)**  
(408) 837-2020 ext 28  
john.gangemi@erm.com

**AMALAJI (ERM)**  
Wildlife Specialist

**LEVIA SHOUTTS (ERM)**  
Wetlands Specialist

**KATY BECK (BBS)**  
Botanist Specialist

**Rec. & Visual Resources  
Task Lead**

**DWAYNE ADAMS (USKH)**  
(907) 343-5448  
dadams@uskh.com

**KIM GRAHAM (USKH)**  
Mapping and Analysis

**Key Team Members:** McMillen (MCM), BioAnalysts (BA), OASIS Environmental, ERM Company (ERM), Cultural Resource Consultants (CRC), USKH (USKH), Elemental Solutions (ES), Northern Ecological Services (NES), Beck Botanical Services (BBS)

# **Fisheries and Aquatics Studies**

## **Grant Creek Studies**

- Fish Weir Installation and Monitoring
- Resident and Rearing Fish Abundance and Distribution
- Salmon Spawning Distribution and Abundance
- Trail Lake Narrows Fish Study
- Aquatic Habitat Mapping
- Instream Flow Study
- Macroinvertebrate Studies
- Periphyton Studies

# **Grant Creek Weir Installation and Monitoring**

## **Objectives**

- Enumerate Pacific Salmon Immigration to Grant Creek
- Describe Pacific Salmon Returning to Grant Creek
  - Age
  - Sex
  - Length
- Identify Pacific Salmon Run Timing
- Support Genetic Sampling and Fish Tagging

# **Grant Creek Weir Installation and Monitoring – Remaining Tasks**

- **Crew Orientation**
  - Methods
  - Safety (Including Bear Safety)
- **Setup Field Camp**
  - 2 person field camp to provide continuous surveillance (24x7) of the weir
  - Temporary housing for other researchers
- **Install Weir**
  - Weir design: standard steel and aluminum picket weir
    - 1.9 cm steel pickets spaced 2.54 cm apart

# Grant Creek Weir Installation and Monitoring – Remaining Tasks

- Monitoring
  - Identify and enumerate all salmon species migrating through the weir – upstream and downstream
  - Temporarily collect a representative sample of returning salmon by species:
    - Identify sex
    - Remove scale for age determination
    - Measure length – mideye to fork of tail

# Grant Creek Weir Installation and Monitoring – Schedule

### Proposed Schedule for Grant Creek Weir Installation and Monitoring

[illegible]



# Grant Creek Weir Installation and Monitoring – Aluminum and Steel Picket Weir





# Grant Creek Weir Installation and Monitoring – Typical Field Camps



# **Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed**

- Recent Work Completed
  - HDR Alaska, Inc. 2010. Report
  - HDR Alaska, Inc. 2010. Additional Field Studies
- Background Information
  - Arctic Environmental Information and Data Center 1983.
  - United States Fish and Wildlife Service 1961.

# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

- Background Info:
- USFWS (1961)
  - The only fish species present in Grant Lake are coastrange sculpin and threespine stickleback.
  - The falls in Grant Creek preclude immigration of other fish species.
  - Monthly sampling by minnow traps in Grant Creek established the presence of juvenile Chinook, Coho, and Dolly Varden and sculpins.

Fish species collected by minnow traps by USFWS in Grant Creek, July 1959 to January 1961

Month	King Salmon	Coho Salmon	Dolly Varden	Sculpins
Jan	X			
Feb	X			
Mar				X
Apr	X		X	X
May	No Sampling			
Jun	X		X	X
Jul	X		X	X
Aug	X	X	X	X
Sep	X	X		
Oct	X	X		X
Nov	X	X		
Dec	No Sampling			

Source: USFWS (1961) as reported by AIEDC (1983).

# **Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed**

- Background Information
- AEIDC (1983)
  - To address objectives they conducted week long field investigations. Samples in October 1981, March, May, June, and August 1982
  - Objectives:
    - Document seasonal presence of resident and anadromous fish species in Grant Creek
    - Estimate their relative abundance
    - Document habitat use characteristics

# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

- AEIDC (1983) Minnow Trapping and Electrofishing

Grant Creek fish taken by minnow trapping and electrofishing, October 1981- August 1982

Location	October 1981				March 1982				May 1982				June 1982				August 1982			
	CH	CO	RB	DV	CH	CO	RB	DV	CH	CO	RB	DV	CH	CO	RB	DV	CH	CO	RB	DV
Minnow Trap Sample Area 1	3	0	12	10	5	4	3	0	1	0	0	3	0	2	2	15	21	5	4	21
Minnow Trap Sample Area 2	17	0	2	1	1	0	0	0	1	0	7	6	0	0	1	5	3	6	1	34
Minnow Trap Sample Area 3	37	2	6	9	0	0	0	0	0	0	3	0	0	0	1	1	8	0	2	26
Minnow Trap Sample Area 4	14	0	3	2	0	0	0	1	0	0	0	0	4	0	0	3	2	0	0	32
Total Fish	71 <sup>1</sup>	2	23 <sup>2</sup>	22	6	4	3	1	2	0	10	9	4	2	4	24	34	11	7 <sup>3</sup>	113 <sup>4</sup>
Total Trap Hours	80				306				162				108				126			
Catch per Hour	0.89	0.03	0.29	0.28	0.02	0.01	0.01	0.01	0.01	0.00	0.06	0.06	0.04	0.02	0.03	0.22	0.27	0.09	0.06	0.90
Electrofishing	21	8	15	3	6	0	1	1	79	11*	7*	22*	**	**	**	**	**	**	**	**

CH=Chinook; CO=Coho; RB=Rainbow Trout; DV=Dolly Varden

- Two additional juvenile Chinook (70 and 81 mm) were taken by angling
- A 27 cm rainbow was taken by angling at the mouth of Grant Creek
- Three additional rainbows (20 to 30 cm) were taken by angling in Grant Creek.
- Twenty additional Dolly Varden (20 to 30 cm) were taken by angling in Grant Creek.

\* All fish were fry or alevins taken while performing the block and removal methodology (Zippen 1958)

\*\* No electroshocker sampling conducted

# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

- HDR (2010) – 2009 Field Study

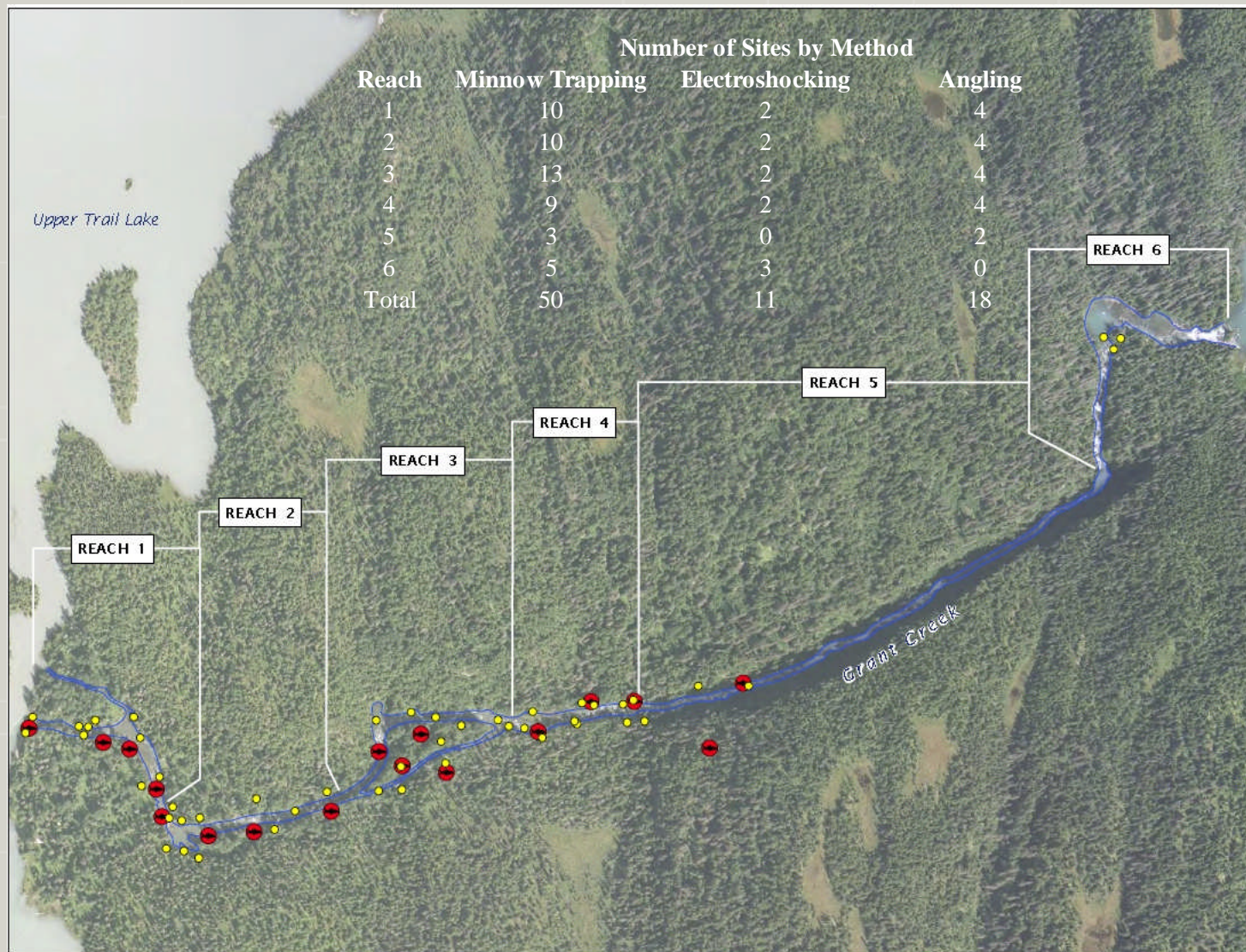
- Study Objectives

- ❖ Determine Relative Abundance and Distribution of Juvenile Fish in Grant Creek
    - ❖ Determine Relative Abundance and Distribution of adult Dolly Varden and Rainbow Trout in Grant Creek
    - ❖ Characterize Fish Use of Microhabitats

- Methods

- ❖ Adult Resident Fish
      - Foot Surveys – Conducted every 10 days from June through September
      - Angling – Approximately every 10 days with 30 minute sessions
    - ❖ Juvenile Salmon and Resident Fish
      - Minnow Trapping – Monthly with 24 hour sets from June through September
      - Electroshocking – After each minnow trapping session – for approximately 1 minute
      - Snorkel Surveys – Used to document fish use of micro-habitat
    - ❖ Used Same Reach Delineation as AEIDC (1983)





## Fisheries Field Studies

### 2009 Grant Creek Sampling Sites and Reaches

#### Legend

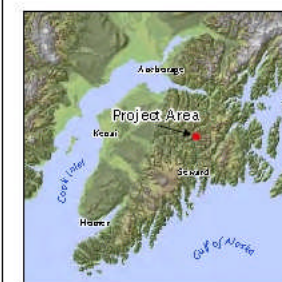
- Minnow Trap / Efish Site
- Angling Site
- Grant Creek Wetted Edge



Map Projection: NAD 83 Alaska State Plane Zone 4 Feet  
 Data Sources: HDR Alaska, Inc., USFS, KPE,  
 USGS, Aeronautic  
 Author: HDR Alaska, Inc.  
 Date: 05 October 2009

This map represents a conceptual level of utility, detail, and accuracy.  
 The information displayed here is for planning purposes only.  
 Base information shown consists of data from various federal,  
 state, public, and private sources.  
 These maps are for review purposes only.

**Kenai Hydro LLC**



# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

## ➤ Analytical Methods/Metrics

### ❖ Adult Resident Fish

- Angling used to determine relative abundance and distribution of resident fish
- Upon capture, each fish was inspected for caudal fin clip – recapture noted
- Species, location of capture, fork length, sex, and spawning condition recorded
- Caudal fin was clipped to indicate capture, and fish was released near site of capture
- CPUE calculated by reach

# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

## ➤ Analytical Methods/Metrics - Continued

### ❖ Juvenile Fish

- Minnow traps and electrofishing used to collect juvenile fish
- All captured fish were enumerated by species, and subsample (n=20 for salmonids) was measured
- Electrofishing used to supplement collection of minnow traps – collect fish not susceptible to minnow traps (i.e., sockeye fry)
- CPUE calculated by reach
- Snorkel surveys were used to document fish presence in micro-habitat areas – Species I.D. and length estimated within 20 mm bins – Confirmed with electroshocking – Recorded dominant and subdominant substrate and cover

# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

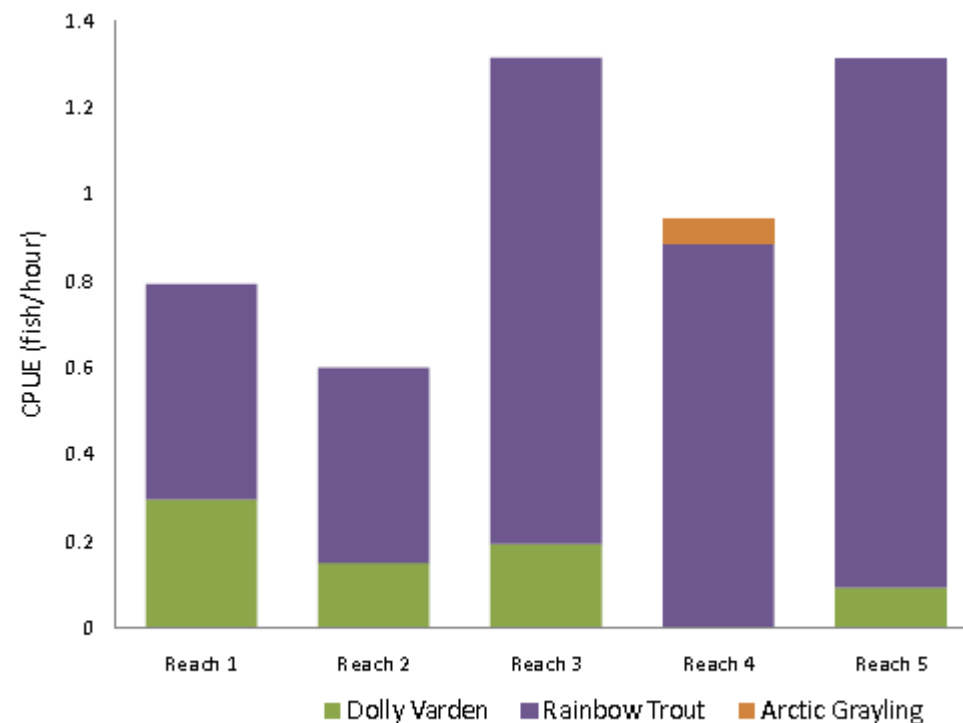
## ➤ Study Results

### ❖ Adult Resident Fish

- Angling surveys used to describe relative abundance and distribution based on CPUE
- Resident fish present in Grant Creek include rainbow trout and Dolly Varden (single Arctic grayling was caught in Grant Creek)
- No direct evidence of resident fish spawning in Grant Creek
- However, angling surveys weren't initiated until June 2
- Presence of YOY rainbow indicates spawning may have occurred
- Studies to date have not investigated Dolly Varden spawning in Grant Creek

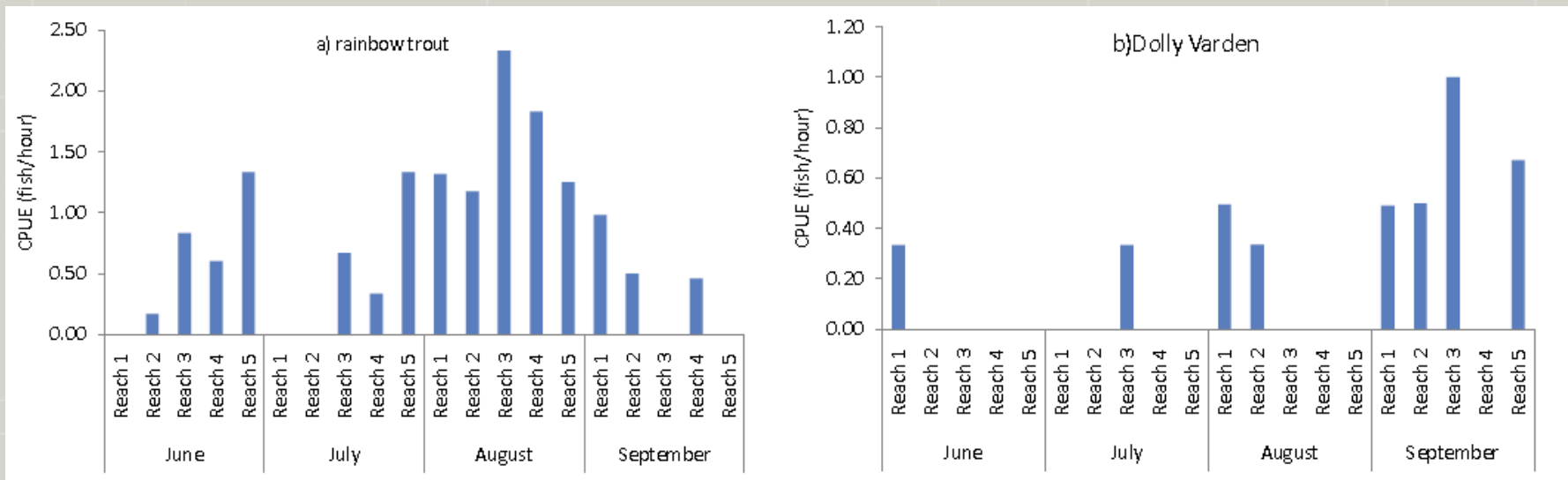


# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed



**Figure 3.5.2-14 CPUE by reach and species from angling surveys in Grant Creek, June – August, 2009**

# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed



**Figure 3.5.2-15 CPUE by month and reach for a) rainbow trout and b) Dolly Varden from angling surveys in Grant Creek, June – September, 2009**



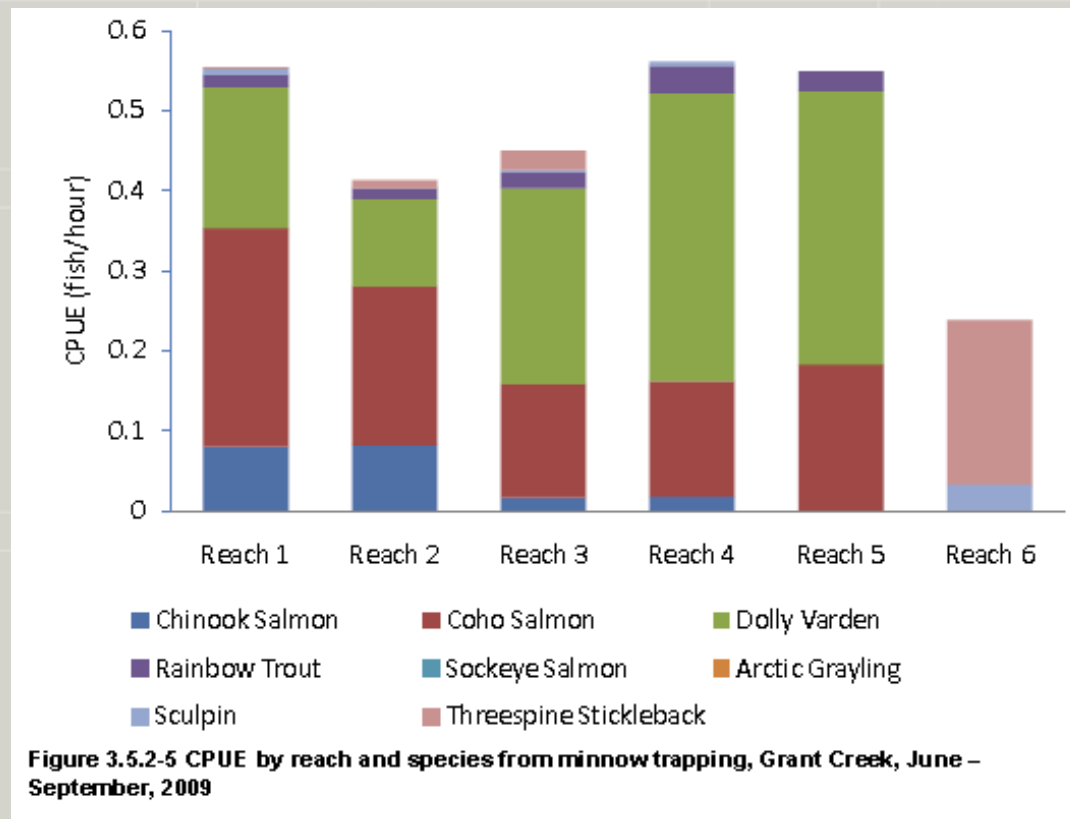
# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

## ➤ Study Results

### ❖ Juvenile Fish

- Species present in Grant Creek include juvenile Chinook, coho, and sockeye salmon, rainbow trout, Dolly Varden, sculpin, and threespine stickleback
- Minnow trapping was the primary means of sampling in Reaches 1-6, with Dolly Varden being most abundant, followed by coho and then Chinook. Other species were captured to a lesser degree (i.e., threespine stickleback, RBT, sculpin, and juvenile sockeye)
- Reach 4 had the highest combined CPUE for all reaches across all months
- Juvenile Chinook abundance steadily decreased moving upstream into Reach 5, where no Chinook were captured
- Juvenile coho abundance also decreased moving upstream, however coho abundance in Reach 5 was relatively high
- No salmonids were captured in Reach 6 (above the falls)

# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed



# Grant Creek Resident and Rearing Fish Abundance and Distribution Work Completed

- HDR (2011)
  - 2010 Field Season was Terminated Early – As such, results were Incomplete
    - ❖ Resident and Rearing Fish Distribution and Abundance
      - Surveys conducted for Reach 5; and Reaches 1-4
      - Three surveys planned – Two were conducted (May 24-28; and July 21-26)
      - In Reach 5 – Surveyed 2009 sites (lower R-5) and established new upper sites in R-5
      - Set minnow traps, snorkeled, and used angling
        - ❑ Captured adult rainbow trout in upper Reach 5 in July
        - ❑ No juvenile salmon were observed in the upper Reach 5 sites (only D.V. and RBT)
        - ❑ Within lower Reach 5, mostly DV and RBT were observed, but so were juvenile Chinook, coho, and sockeye
      - In Reaches 1-4, surveyed 2009 sites, plus some new sites
        - ❑ Used minnow traps, snorkeling, seine and hand nets
        - ❑ Captured and/or observed juvenile Chinook, sockeye, coho, DV, and RBT
    - ❖ Significant Findings for 2010
      - The distribution and composition of fish in Reach 1-4 was similar to past years
      - Juvenile DV and RBT were present in upper reaches R-5 – Flows too high to migrate into the area – suggesting DV and RBT spawning in Reach 5
      - Some adult RBT captured in upper Reach 5 – also suggesting adult use of the area

# **Grant Creek Resident and Rearing Fish Abundance and Distribution – Remaining Tasks**

- Field Work (2013)
  - Juvenile incline plane traps will monitor Reach 1-4 and Reach 5
  - Reach 5 fish assessment using previous methods
  - Winter habitat and fish monitoring
  - Rainbow trout habitat use and spawning using radiotelemetry
- Data Analysis
  - Juvenile incline plane traps will provide abundance estimates for Reach 5 and reaches 1-5, as well as length, species diversity, and outmigration timing.

# **Grant Creek Resident and Rearing Fish Abundance and Distribution – Remaining Tasks**

- Data Analysis (con't)
  - Evaluate resident and juvenile fish use of Reach 5 (Sep)
    - Baited minnow traps, electrofishing, snorkel surveys, juvenile migrant trap for Reach 5 (Sep)
    - Metrics: presence/absence, abundance, CPUE, distribution, fish size, habitat-fish abundance relationships, outmigration timing; for adult RBT - passage at fixed station telemetry site and mobile telemetry surveys.
    - Coordination of habitat use with IFIM team

# **Grant Creek Resident and Rearing Fish Abundance and Distribution – Remaining Tasks**

- Data Analysis (con't)
  - Evaluate winter habitat use of Reach 5 in Grant Creek (Feb-Mar)
    - Baited minnow traps, electrofishing, underwater video, and snorkel surveys
    - Metrics: presence/absence, CPUE, distribution, fish size, habitat-fish abundance relationships
    - Coordination of habitat use with IFIM team



# **Grant Creek Resident and Rearing Fish Abundance and Distribution – Remaining Tasks**

- Data Analysis (con't)
  - Evaluate resident and rearing fish use of open water habitat in lower Grant Creek: (spring, summer and fall sample events)
    - Rainbow trout radiotelemetry study component, baited minnow traps, electrofishing, seine, and snorkel surveys.
    - Metrics: abundance, presence/absence, CPUE, fish size, distribution, and habitat-fish abundance relationships.
    - Coordination of habitat use with IFIM Team

# **Grant Creek Resident and Rearing Fish Abundance and Distribution – Remaining Tasks**

- Reporting
  - Submit report January, 2014

# Grant Creek Resident and Rearing Fish Abundance and Distribution -Work Schedule

[illegible]

# Grant Creek Salmon Spawning and Abundance Work Completed

- Background Info:
  - ADFG (1951/1981)
  - AEIDC (1983).

Peak salmon escapement counts for Grant Creek, 1952-1982

Year	King Salmon	Sockeye Salmon
	Number of Spawners	Number of Spawners
1952	0	250
1953	12	13
1954	6	45
1957	8	0
1959	28	0
1961	86 Total Salmon*	
1962	2	324
1963	33	41
1976	29	0
1977	0	4
1978	5	0
1979	42	29
1980	5	0
1981	45	19
1982	46**	135**
Average	19	61

\* Not included in averages

\*\* Source AEIDC 1982

Source: Alaska Department of Fish and Game 1952-1981

# **Grant Creek Salmon Spawning and Abundance Work Completed**

- **Field Work (2009 & 2010)**
  - Adult sockeye and Chinook escapement was estimated in 2009.
  - Recorded locations of adult fish (spawning aggregates)
- **Data Analysis**
  - Area under the curve (AUC) used with visual counts to estimate escapement
  - Plotted distribution of visual observations
- **Reporting**
  - Baseline study reported in 2010 (HDR 2010)

# **Grant Creek Salmon Spawning and Abundance Work Completed**

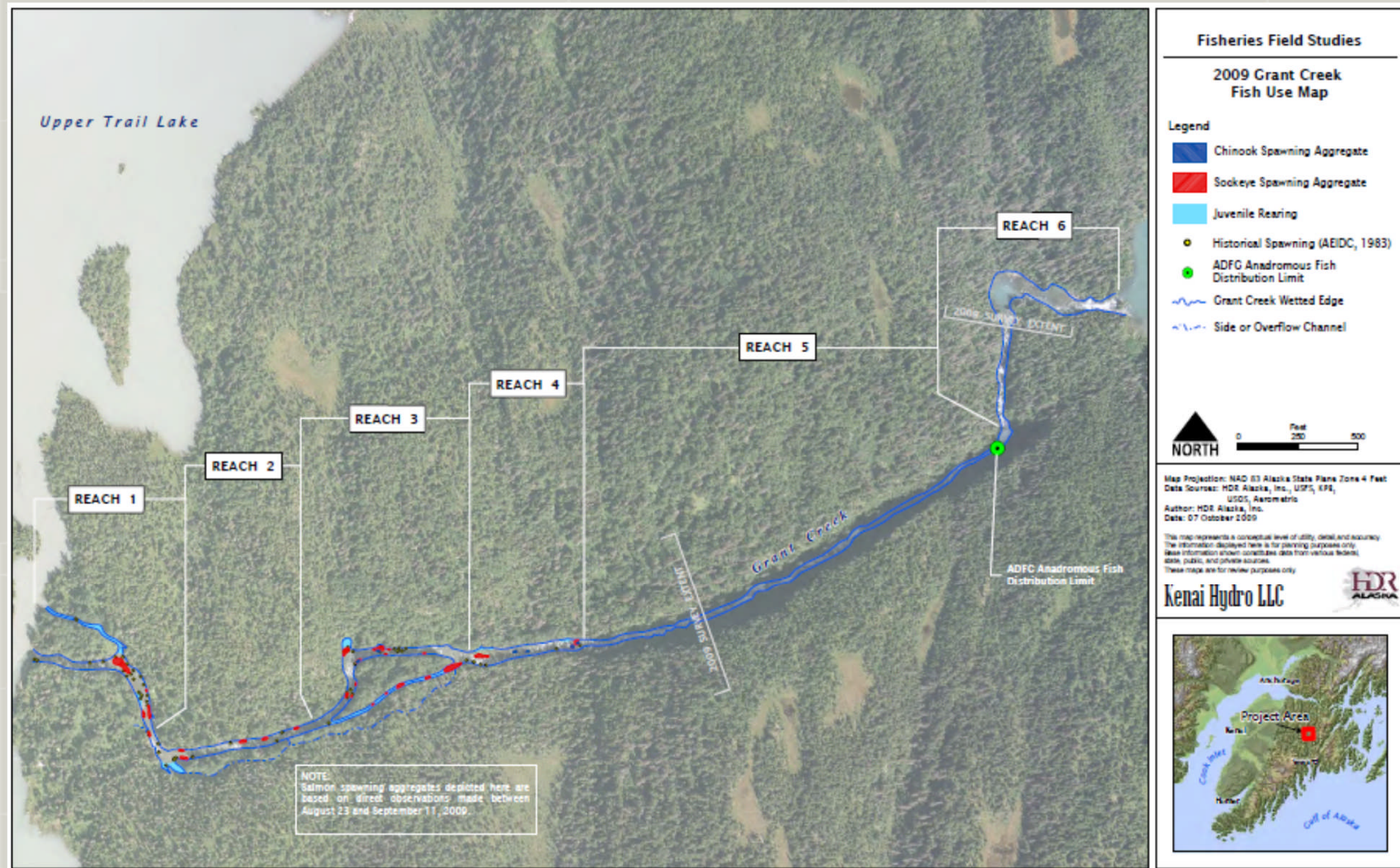
- Consultation
  - September 22, 2009: aquatic resources technical work group meeting with agencies and interested stakeholders. Site visit to Grant Creek.
  - October 22, 2009: Recommendation from the Moose Pass Advisory Planning Commission to hold a public meeting regarding the Grant Lake Project in Moose Pass.
  - March 4, 2010: The Aquatics Technical Work Group was notified that the 2009 environmental baseline study report was posted on the Kenai Hydro website.



# **Grant Creek Salmon Spawning and Abundance Work Completed**

- Consultation (cont'd)
  - May 4, 2010: All licensing contacts were notified that draft study plans for the Aquatic and Water Resources were posted on the Kenai Hydro website and that a review Project description was filed with FERC on May 3, 2010.

# Chinook and Sockeye Salmon Spawning Aggregates



# Adult Salmon Visual Counts

- Area under the curve estimated
  - Chinook escapement estimate 231- w/ survey life at 14 days & observer efficiency at 0.30
  - Sockeye escapement estimate 6,293- w/ survey life at 9 days & observer efficiency at 0.50.
  - No escapement estimate for Coho salmon.

Survey Date	Species		
	Chinook	Sockeye	Coho
8/1/2009	0	0	0
8/10/2009	4	2	0
8/13/2009	19	1	0
8/23/2009	62	6	0
8/30/2009	31	545	0
9/11/2009	0	1351	0
9/16/2009	0	1188	0
9/29/2009	0	78	6

# **Grant Creek Salmon Spawning and Abundance – Remaining Tasks**

- **Field Work (2013)**
  - Sockeye, Chinook, & Coho escapement est. 2013.
  - Document locations of adult fish (spawning aggregates)
  - Radio tag and monitor adult salmon and rainbow trout
  - Collect scale, genetic samples, carcass surveys
- **Data Analysis**
  - Develop area under the curve (AUC) escapement estimates from visual counts of salmon.
  - Develop survey life estimate for AUC estimate from radio tagged and Floy tagged adults salmon tagged at the weir.



# **Grant Creek Salmon Spawning and Abundance – Remaining Tasks**

- Data Analysis (cont'd)
  - Develop observer efficiency estimate for AUC based on ratio of visual counts to weir counts.
  - Plotted distribution of visual observations, redds and document habitat use.
  - Develop migration and spawning periodicity for salmon based on weir counts, radiotelemetry, and visual counts
  - Document age-at-return (scale analysis), egg voidance, gender, and length-at-age.
- Reporting
  - 2013 field studies reported in January of 2014.

# Grant Creek Salmon Spawning and Abundance Work Schedule

[illegible]



# Comments to Existing Fisheries Study Plans

- A majority of formal comments were incorporated into study plans
  - Use radiotelemetry to document rainbow trout and salmon movement, spawning, and habitat use.
  - Use radiotelemetry on adult salmon to:
    - Develop estimates of survey life for Chinook, sockeye, and coho
    - Track movements in Grant Creek and use of Reach 5
  - Install fixed station telemetry sites at confluence and Reach 4/5 boundary.

# Comments to Existing Fisheries Study Plans

- Use weir to obtain:
  - Abundance estimate for salmon and trout
  - Develop observer efficiency for AUC estimates
  - Sample, tag, and document information on salmon and trout migration periods.
- Conduct winter habitat use study
- Finish fall Reach 5 sampling to complement spring and summer information collected previously
- Conduct resident and rearing study to assess Reaches 1-4 fish habitat use with special attention to focal habitats.

# **Comments to Existing Fisheries Study Plans**

- Install juvenile migrant traps to assess Reach 5 and Grant Creek juvenile migrant abundance and timing

# **Trail Lake Narrows Fish and Aquatic Habitats Study-Work Completed**

- No previous fisheries work has been completed in Trail Lake Narrows in association with the potential bridge site location.

# **Trail Lake Narrows Fish and Aquatic Habitats Study-Remaining Tasks**

- **Field Work (2013)**
  - Assessment of fish use within the Trail Lake Narrows, particularly in the vicinity of the proposed Trail Lake Narrows Bridge.
  - Sampling techniques may include minnow traps, snorkeling, and seining with stream bank habitat the area of focus for Chinook and coho juveniles.
- **Data Analysis**
  - Document CPUE, number of fish sampled, size, species diversity and habitat type and location.

# **Trail Lake Narrows Fish and Aquatic Habitats Study – Remaining Tasks**

- Reporting
  - submit report in January of 2014



# Trail Lake Narrows Fish and Aquatic Habitats Study

[illegible]

# **Grant Creek Aquatic Habitat Mapping – Work Completed**

- Field Work
  - Lower Grant Creek (Reaches 1 – 4) mapped key habitats using the following mesohabitat categories
    - Backwater/slow pockets
    - Margin with Undercut Bank (UCB)
    - Margin with No UCB
    - Pool/fastwater
    - Riffle/fast water
    - Margin Shelf with instream cover
    - Large Wood Debris (LWD) dam
    - Side channel Variable (tributary, secondary, and tertiary)

# **Grant Creek Aquatic Habitat Mapping Work Completed**

- **Data Analysis**
  - Completed by 2010. Habitat data from 2009 synthesized and incorporated into GIS platform
  - Incorporated spatial fish data from 2009 and 2010
- **Reporting**
  - Baseline studies report issued in 2009
- **Consultation**
  - HEA consulted with Work Groups 11 times in 2009 on fisheries, habitat, and instream flow issues

# **Grant Creek Instream Flow Study Work Completed**

- Consultation:
  - 24 March 2009: TWG presentation in Moose Pass
  - 21 April 2009: TWG meeting in Kenai
  - 18 May, 2009: Study plans uploaded to Kenai Hydro web site
  - 19 May 2009: TWG conference call
  - 10 June 2009: TWG sent compilation of documents from ADF&G
  - 01 July 2009: Technical memo to TWG re: habitat use work in 2009

# **Grant Creek Aquatic Habitat Mapping Remaining Tasks**

- Field work:
  - Ground truth habitat mapping and modify if revisions required
- Data Analysis
  - Synthesize fish utilization data collected in 2013
  - Analyze and identify factors that influence fish use in key habitats

# **Grant Creek Aquatic Habitat Mapping Remaining Tasks**

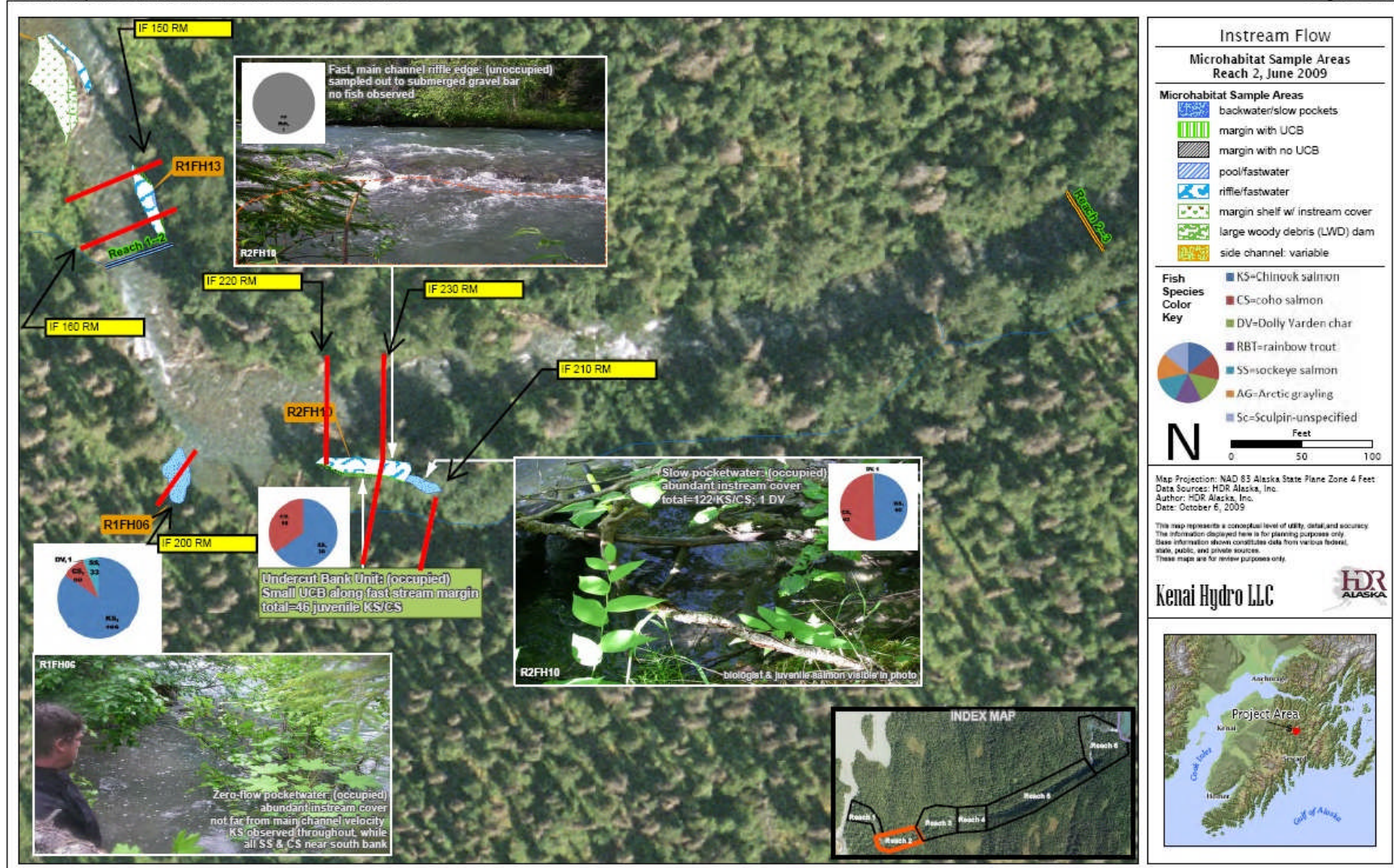
- Reporting
  - Revisions to existing maps will be incorporated at the end of the field season



# Reach 2 – Transect Locations on Key Habitats (from HDR)

Kenai Hydro Environmental Baseline Studies

Figure 3.7



# Aquatic Habitat Mapping Schedule

[illegible]

# **Comments to Habitat Mapping Study Plan**

- Project will collect depth, velocity, temperature, substrate and cover data for all fish utilization measurements
- Mesohabitat categories expanded

# Grant Creek Instream Flow Study Work Completed

- Field Work
  - 18 Transects approved by Instream Flow Work Group set up to model the most sensitive Lower Grant Creek areas with following measurements:
    - Middle Flow calibration measurement (175 – 184 cfs) with depth, velocity, water surface elevations (WSE)
    - Low flow WSE (92 – 169 cfs)
    - No High flow WSE
    - Substrate across all transects
    - Cover across all transects



# **Grant Creek Instream Flow Study Work Completed**

- **Data Analysis:**
  - None completed since all field measurements were not taken
- **Reporting**
  - Baseline studies report in 2009; no complete report, since all field measurements were not taken
- **Consultation**
  - HEA consulted with Work Groups 11 times in 2009 on instream flow, habitat and fisheries issues

# **Grant Creek Instream Flow Study**

## **Remaining Tasks**

- **Field Work**
  - Verify stability of the 18 existing transects (bed profile, stage of zero flow, substrate and cover)
    - If stable, use existing middle flow measurements taken in 2010 and use as high flow measurement
    - If not stable, redo those transects that have shifted (bed profiles, depth/velocities, WSE, substrate and/or cover)
  - Take low/middle flow WSEs and discharges
  - Collect higher WSE and discharge if necessary/safe
  - Collect data for site-specific Habitat Suitability Index (HSI) curves

# **Grant Creek Instream Flow Study**

## **Remaining Tasks**

- **Field Work**
  - Survey bed profiles and water surface elevations, residual depth of representative pools in Reach 5 at a range of flows, and assess connectivity
- **Data Analysis**
  - Use 3 WSEs and one velocity set (one flow model) to simulate the range of flows for Grant Creek:
    - WSE and discharges at low, middle, high and potentially higher calibration flow
    - Depths and Velocities from high flow (approximately 200 cfs)
    - Use One flow model for flows at and below the high flow measurement (~200 cfs)



# **Grant Creek Instream Flow Study**

## **Remaining Tasks**

- Use a combination of One Flow model and Depth Calibration model to simulated flows above the high flow measurement (~200 cfs)
- **HSI Curves: use site-specific data to develop curves for Grant Creek**
  - Supplement with literature curves that reflect conditions in Grant Creek
- **Weighted Usable Area**
  - Developed for target species and life stages
- **Reach 5 Analysis**
  - Use Thompson (1972) to assess connectivity for upstream passage into representative pools

# **Grant Creek Instream Flow Study**

## **Remaining Tasks**

- Reporting
  - Calibration, HSI data reports
  - Grant Creek IFIM Report
  - Reach 5 Calibration Report



## Downstream of Canyon, Upper Reach 4 (from HDR)





# ISF 120, Middle Flow (HDR)



# Grant Creek Instream Flow Schedule

	2012	2013											
Task	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Site Visit													
Agency Communication													
Habitat Utilization Studies													
Conduct Instream Flow Studies													
Data reduction/QA/QC													
Data Analysis/Report													

## Comments to Existing Study Plans

- A majority of the comments were incorporated into study plans
  - Development of site-specific HSI curves for synthesis with existing, pertinent curves
  - Continue to use the 18 transects agreed-upon by TWG
  - Due to the limited utilization of side channels on Reach 3, 2D modeling is not warranted.

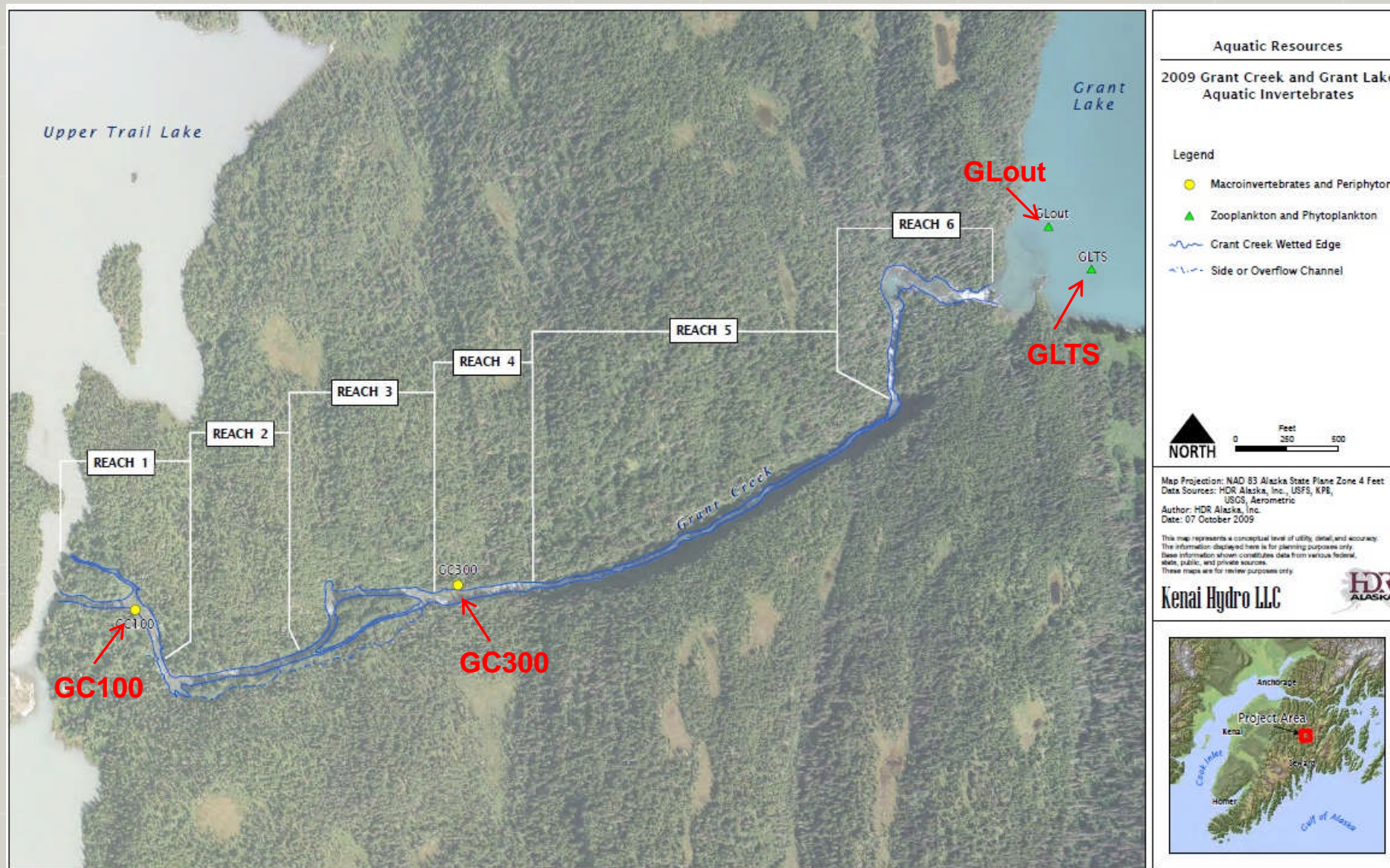


# Grant Creek Macroinvertebrate Study – Work Completed

- Field Work: one sampling event in 2009
  - Samples collected on August 31, 2009, at sites GC100 and GC300
  - Used both Alaska Stream Condition Index (ASCI) methods and Surber samplers
  - ASCI methods sample all habitats proportionately within a study reach and provide an overview of population characteristics
  - Five Surber samples collected within a single habitat type (riffles) are pseudo-replicates that provide more quantitative data for monitoring purposes
  - Also, zooplankton and phytoplankton samples collected in Grant Lake at GLout and GLTS



# Grant Creek Macroinvertebrate Study



# Grant Creek Macroinvertebrate Study – Work Completed

- Sample Identification: all samples identified to genus or next practicable taxon
- Data Analysis:
  - Metrics calculated for populations collected using both methods:
    - Population Density
    - Percent Ephemeroptera, Plecoptera, and Trichoptera (EPT)
    - Taxa Diversity
    - Percent Dominant Taxa
    - HBI – Biotic Index Score
- Report of 2009 results

# Grant Creek Macroinvertebrate Study – Work Completed

- 2009 results
  - Trend in metrics different between GC100 and GC300
  - Percent EPT and percent dominant taxa indicate better habitat at GC300
  - Taxa diversity and population density were greater at GC100
  - Three taxa of zooplankton identified in Grant Lake at both sites, greatest density at Glout; highest chlorophyll *a* concentrations at GLTS

# **Grant Creek Macroinvertebrate Study – Remaining Tasks**

- **Field Work:**
  - One more sampling event in August 2013 at GC100 and GC300
  - Employing Surber samplers for quantitative results for use in future monitoring
- **Sample processing and identification:**
  - Identification to genus or next practicable taxon
- **Data analysis and reporting:**
  - Combine with earlier analysis to further establish baseline condition



# Grant Creek Periphyton Study Work Completed

- Field Work: one sampling event in 2009
  - Samples collected on August 31, 2009 at sites GC100 and GC300
  - Used a modified rapid bioassessment protocol
  - Ten samples collected within a single habitat type (riffles) are pseudo-replicates that provide more quantitative data for monitoring purposes
- Data Analysis: samples analyzed for concentration of chlorophyll *a*
- Report of 2009 results

# Grant Creek Periphyton Study Work Completed

- 2009 Results
  - Trend in chlorophyll *a* concentrations indicate difference between sites
  - Average concentrations higher at GC100 than GC300

# **Grant Creek Periphyton Study**

## **Remaining Tasks**

- **Field Work:**
  - One more sampling event in August 2013 at GC100 and GC300
  - Using same modified RBP methods
- **Analyze samples for chlorophyll *a* concentration**
- **Data analysis and reporting:**
  - Combine with earlier analysis to further establish baseline condition



# **Grant Creek Macroinvertebrate and Periphyton Studies– Schedule**

- Field Work:  
Mid-August 2013
- Sample processing and identification:  
September – October 2013
- Data Analysis and Reporting:  
November – December 2013

# **Grant Creek Macroinvertebrate and Periphyton Studies Comments /Response**

- Study has better defined its objectives to collect quantifiable data and is using repeatable methods – pseudo-replicates collected using a Surber sampler

# **Grant Creek Salmon Spawning and Abundance Consultation**

- September 22, 2009: aquatic resources technical work group meeting with agencies and interested stakeholders. Site visit to Grant Creek.
- October 22, 2009: Recommendation from the Moose Pass Advisory Planning Commission to hold a public meeting regarding the Grant Lake Project in Moose Pass.
- March 4, 2010: The Aquatics Technical Work Group was notified that the 2009 environmental baseline study report was posted on the Kenai Hydro website.

## **Grant Creek Salmon Spawning and Abundance Consultation, (cont'd)**

- May 4, 2010: All licensing contacts were notified that draft study plans for the Aquatic and Water Resources were posted on the Kenai Hydro website and that a Project description was filed with FERC on May 3, 2010.

# **Grant Creek Instream Flow and Habitat Mapping Consultation**

- 24 March 2009: TWG presentation in Moose Pass
- 21 April 2009: TWG meeting in Kenai
- 18 May, 2009: Study plans uploaded to Kenai Hydro web site
- 19 May 2009: TWG conference call
- 10 June 2009: TWG sent compilation of documents from ADF&G
- 01 July 2009: Technical memo to TWG re: habitat use work in 2009

## **Grant Creek Instream Flow and Habitat Mapping Consultation (cont'd)**

- 16 July 2009: TWG conference call
- 27 August 2009: Instream flow study report uploaded to Kenai Hydro web site
- 08 September 2009: TWG sent summary of 1984 instream flow study
- 22–24 September 2009: TWG meeting in Moose Pass
- 07 October 2009: TWG sent tech memo re: instream flow study plan

# **Anticipated Grant Creek Weir Installation and Monitoring/Fisheries Investigation Permits**

- ADF&G Fisheries Resource Permit
- ADF&G Fish Habitat Permit
- USFS Special Use Permit
- KPB Floodplain Permit



# **Anticipated Permits for other Aquatic Studies**

- **Habitat Mapping:**
  - No permits are anticipated to be required for collecting habitat mapping data
- **Instream Flow Study:**
  - No permits are anticipated to be required for collecting instream flow and HSI curve data
- **Macroinvertebrate and Periphyton Studies:**
  - No permits are anticipated to be required for collecting macroinvertebrate and periphyton data