

Grant Lake Hydroelectric Project (FERC No. 13212)
Natural Resource Studies Meeting
December 12, 2012 – Anchorage, AK


Water Resources Studies
Water Quality
Hydrology
Geomorphology



In Association with



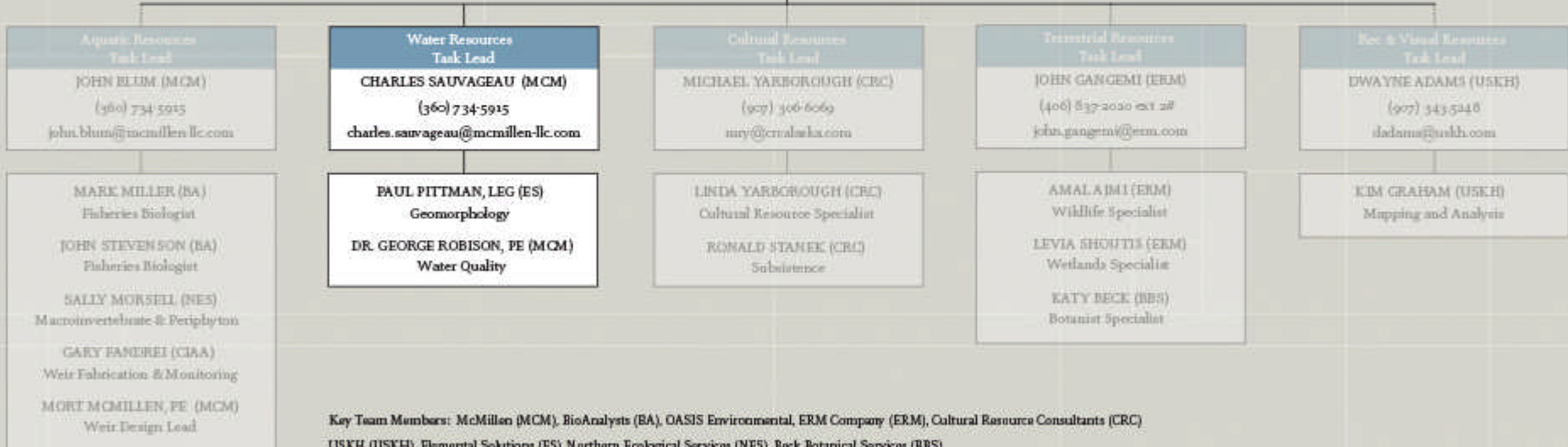
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Resource Area Studies

- Water Quality and Temperature Studies
 - Grant Lake and Grant Creek Water Chemistry Sampling
 - Grant Lake and Grant Creek Water Temperature Data Collection
 - Trail Lakes Narrows Water Chemistry Sampling

Grant Lake and Grant Creek sampled once in late summer 2013

Trail Lakes Narrows sampled 3X, spring, summer, fall.

Resource Area Studies

- Hydrology Studies

- Re-establish historical USGS gaging station to continuously monitor stage during ice-free periods.
- Take multiple discharge measurements throughout the season to develop a stage-discharge rating curve
- Conduct a low flow accretion study in Reach 5 (i.e., Canyon Reach) of Grant Creek

Resource Area Studies

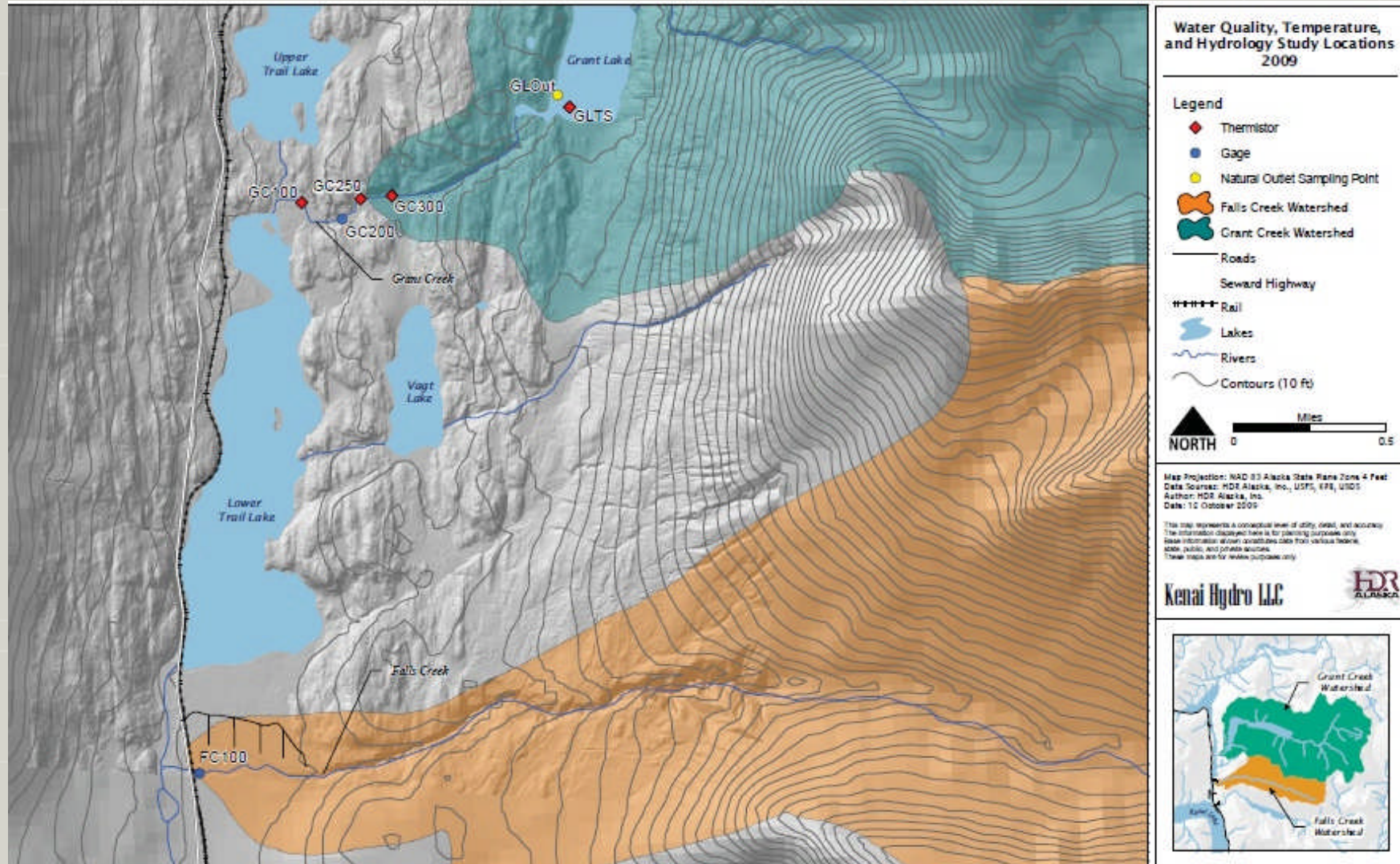
- **Geomorphology Studies**

- Assess material transport within Grant Creek.
- Characterize shoreline erosion potential of Grant Lake and its tributaries

Sediment transport studies will emphasize gravel movement in relation to maintenance of habitat for spawning salmon.

Shoreline erosion studies to emphasize potential lake impoundment and drawdown scenarios.

Water Quality and Hydrology Site Locations



Source: Grant Lake Hydroelectric Project Environmental Studies Baseline Report, 2009

Water Quality and Temperature – Grant Lake

Work Completed

- Water chemistry sampling in Grant Lake intermittently by the USGS in the 1950's; AEIDC in 1981-1982; and KHL in June and August 2009; June 2010
 - 2009/2010 water samples collected at proposed Project intake and Grant Lake outlet
- Temperature and dissolved oxygen profiles by USFWS in 1961; ADFG in 1981; and AEIDC from 1981-1982. KHL conducted reservoir profiles in 2009 as well as installing a thermistor string in June of 2009 and July 2010 at proposed Project intake.
 - Thermistor string (20m depth) collects temperature data at 10 discrete depth nodes
- Water Chemistry data analysis consists of tabular and graphical summaries (reservoir profiles and histograms) for each water quality analyte to determine baseline conditions and temporal trends.
- Water temperature data analysis consists of graphical summaries (reservoir profiles and line graphs) to depict continuous mean daily or instantaneous temperature trends.
- 2009 Study Reports submitted to FERC and stakeholders.
- Stakeholders reviewed 2009 report and submitted formal comments in summer of 2010 to shape 2012 study plans.

Water Quality and Temperature – Grant Lake (continued)

- 2013 Study Efforts
 - Water chemistry sampling in Grant Lake: September 2013
 - Water samples collected at proposed Project intake (GLTS) and Grant Lake outlet (GLOut)
 - Re-establish relict GLTS thermistor string to commence data collection after ice breakup in 2013.
 - Water Chemistry data analysis consists of graphical summaries (reservoir profiles and histograms) for each water quality analyte to determine baseline conditions and temporal trends.
 - Water temperature data analysis consists of graphical summaries (reservoir profiles and line graphs) to depict continuous mean daily water temperature trends.
- 2013 Study Reports will be submitted to stakeholders in January of 2014

Water Quality and Temperature – Grant Creek

Work Completed

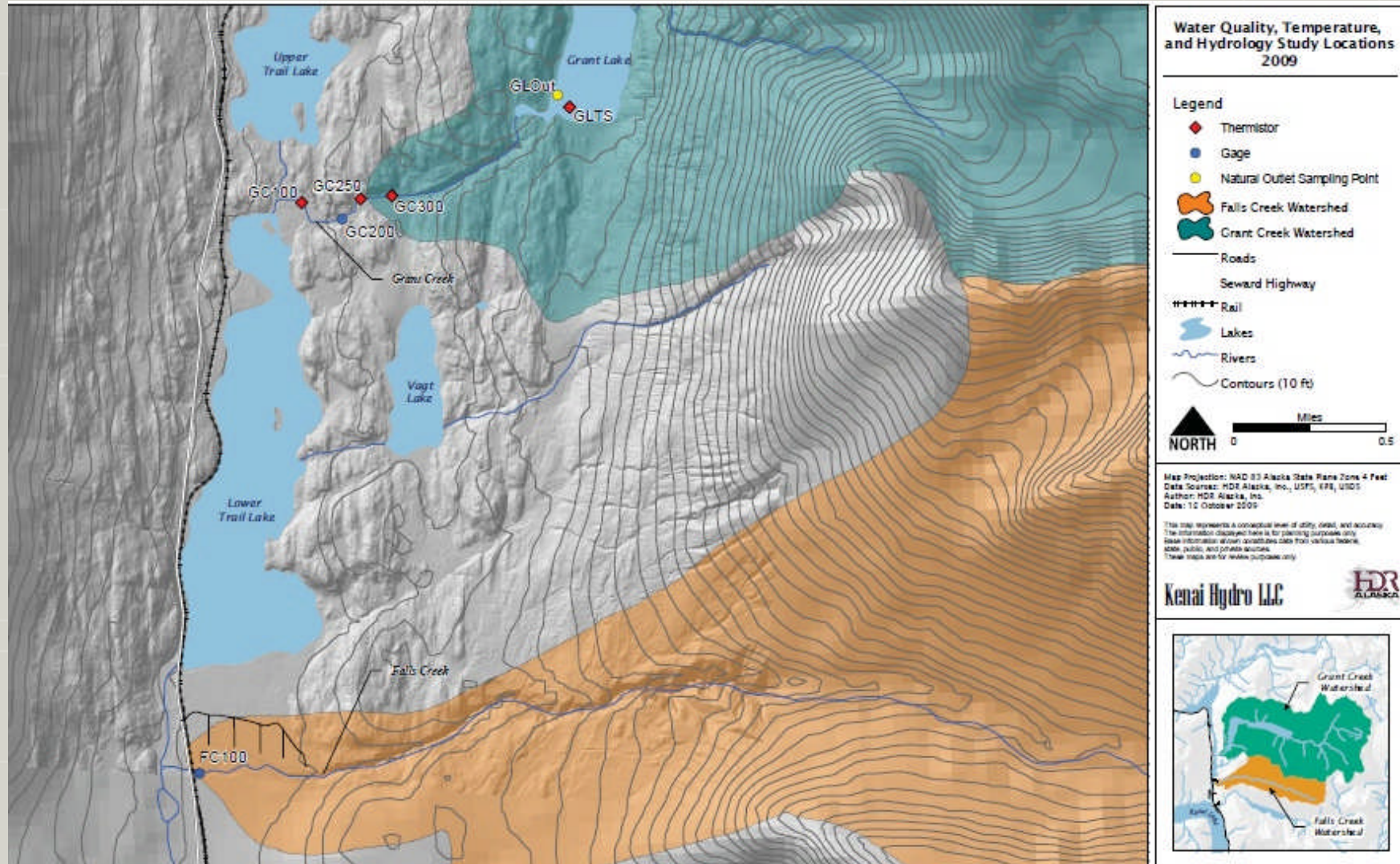
- Water chemistry sampling in the lower reaches of Grant Creek by the USGS from 1950-1958; AEIDC in 1982; KHL in June and August 2009; June 2010
 - 2009/2010 water samples collected at GC 100, GC 200, and GC 300.
- Thermistors deployed in August 1982 at GC 200; June of 2009 and July 2010 at GC 100, GC 200, GC 250, and GC 300.
- Water Chemistry data analysis consists of tabular and graphical summaries (histograms and line graphs) for each water quality analyte to determine baseline conditions and temporal trends.
- Water temperature data analysis consists of tabular and graphical summaries (line graphs) to depict mean daily water temperature trends.
- 2009 Study Reports submitted to FERC and stakeholders.
- Stakeholders reviewed 2009 report and submitted formal comments in summer of 2010 to shape 2012 study plans

Water Quality and Temperature – Grant Creek (continued)

– 2013 Study Efforts

- Water chemistry sampling in Grant Creek: September 2013
 - Water samples collected at GC 100, GC 200, and GC 300
- Install thermistors at GC 100, GC 200, GC 250, and GC 300 to commence data collection after ice breakup in 2013.
- Water Chemistry data analysis will add to graphical summaries (histograms) for each water quality analyte to round out seasonal baseline conditions and temporal trends.
- Water temperature data analysis consists of graphical summaries (line graphs) to depict seasonal mean daily water temperature trends in relation to streamflow.
- 2013 Study Reports will be submitted to stakeholders in January of 2014

Water Quality and Hydrology Site Locations



Source: Grant Lake Hydroelectric Project Environmental Studies Baseline Report, 2009

Water Quality – Trail Lake Narrows

- Historical Water Quality Data Not Available
- 2013 Study Efforts
 - Three water chemistry sampling events in Trail Lake Narrows: spring, summer, and fall 2013
 - Water samples to be collected downstream of proposed access road crossing.
 - All water quality analytes to match Grant Lake and Grant Creek samples, with the addition of hydrocarbons.
 - Water Chemistry data analysis will provide tabular and graphical summaries (histograms) for each water quality analyte to assess seasonal baseline conditions and temporal trends.
 - 2013 Study Reports will be submitted to stakeholders in January of 2014

Grant Lake and Grant Creek Water Quality Analytes

Parameter	Units
Alkalinity (CaCO ₃)	mg/L
Total dissolved solids (TDS)	mg/L
Total suspended sediment (TSS)	mg/L
Kjeldahl Nitrogen	mg/L
Nitrate/Nitrite	mg/L
Orthophosphate	mg/L
Total phosphorous	mg/L
Lead	µg/L
Hardness	mg/L
Calcium	mg/L
Magnesium	mg/L
Sodium	mg/L
Potassium	mg/L
Low level mercury	ng/L
Fluoride	mg/L
Chloride	mg/L
Sulfate	mg/L
pH	STD
Temperature	°C
Dissolved oxygen (DO)	mg/L, %
Specific and Relative Conductivity	mS/cm, µS/cm
Oxygen Reduction Potential (ORP)	mV
Turbidity	NTU

Hydrology – Grant Creek

– Work Completed

- Historical USGS gaging site 15246000 (GC 200), operational for 11 years (1947 - 1958)
- Simulated discharge record from 1959-1980 with the HEC-4 monthly streamflow simulation model (Ebasco,1984)
- Continuous stage recording device installed in Grant Creek (GC 200) at historical USGS gaging location. Operational Periods: May 1982 - December 1983; June - October 2009; April 2010-June 2010.
- Hydrology data analysis consists line graph tracking mean daily stage values over time. Also instantaneous staff gage datum are overlaid with continuous data to track measurement error.

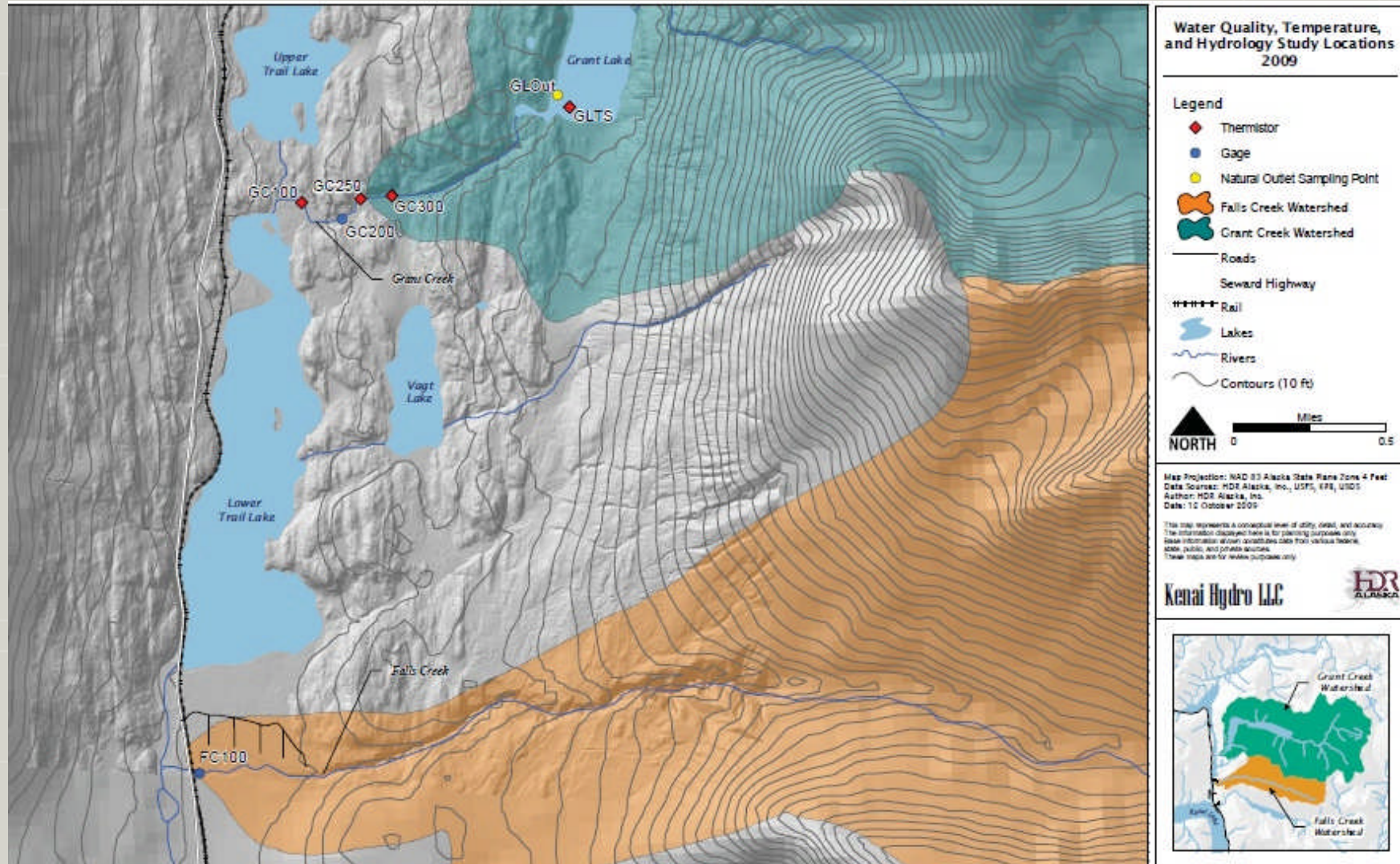
- 2009 Study Reports submitted to FERC and stakeholders.
- Stakeholders reviewed 2009 report and submitted formal comments in summer of 2010 to shape 2012 study plans

Hydrology– Grant Creek (continued)

– 2013 Study Efforts

- Install continuous stage recording device, take discharge measurement: Spring 2013
 - Stage recording device upgraded to USGS standards
- Service and calibrate stream gage on a 6-8 week schedule.
 - Gage to be disabled in late fall due to icing conditions
- Low flow accretion study in Reach 5 of Grant Creek (Fall 2013)
- Hydrology data analysis will consist of mean daily flow tables with streamflow and stage hydrographs depicting temporal trends in stage and flow conditions. Accretion data to indicate water gains/losses within Reach 5 of Grant Creek.
- 2013 Study Reports will be submitted to stakeholders in January of 2014

Water Quality and Hydrology Site Locations



Source: Grant Lake Hydroelectric Project Environmental Studies Baseline Report, 2009

Geomorphology – Grant Lake Shoreline Erosion

- Work Completed
 - Bathymetry (Ebasco, 1984)
 - Geologic mapping
 - LiDAR
 - Air photos
- 2013 Study Efforts
 - Desk-top GIS analysis
 - Existing shoreline condition inventory (boat-based field assessment, geo-referenced photos, field interpretation and GIS-based mapping product)
 - Prediction of potential geomorphic response to lake impoundment and drawdown scenarios

Geomorphology – Grant Creek Sediment Transport

– Work Completed

- Historic hydrology (Historical USGS gaging site (1947 - 1958), Simulated discharge record from 1959-1980 with the HEC-4 (Ebasco, 1984), Continuous stage recording device installed in Grant Creek at historical USGS gaging location (May 1982 - December 1983; June - October 2009; April 2010-June 2010).
- Historic geologic mapping, LiDAR and air photos

– 2013 Study Efforts

- Desktop analysis (geomorphic mapping and characterization)
- Field sediment characterization (bulk samples, Wolman counts, ebeddedness, cross-section)
- Field geomorphic characterization (sediment inputs, channel form, transport/deposition)
- Prediction of potential geomorphic response to stream flow under management scenarios (integrate existing hydrology and field measurements to estimate incipient motion thresholds for a range of flows)

Permitting– Water Resources

- Water Quality and Temperature

Multi-agency permit application to be submitted to Kenai River Center. Grant Lake thermistor string is the only monitoring device potentially in need of a permit.

- Hydrology

Installation of stream gage will require a Fish Habitat Permit

- Geomorphology

Multi-agency permit application to be submitted to Kenai River Center for the proposed bulk sampling in Grant Creek.

Water Resources – Questions and Comments?