Susitna/Watana Hydroelectric Project Water Quality and Sediment Transport Data Gap Analyses

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Report Organization

- Background
- Methodology
- Water Quality
- Sediment Transport
  - Hydrology
  - Sediment transport and deposition
  - Formation and changes to aquatic habitats
- References
  - Bibliography
  - Water quality data summary

Methodology

- Significant studies prior to 1985, data readily available
- Focused on collecting data from 1985 to present
- Major issues
  - Water quality, esp. impact of fisheries
  - Sediment transport, esp. impact to aquatic habitats and flooding/channel stability
- The Susitna River was divided into segments to provide a framework for organizing and interpreting available data

Segmentation of Susitna River Data Gap Analyses

Bounds of Reach (Susitna River Miles)	Reach Number	General Description
313 – 184	1	Upper Susitna River, including headwaters and tributaries above the proposed Watana dam site
184 – 150	2	Middle Susitna River and tributaries through Devil's Canyon and below the proposed Watana Dam site
150 – 99	3	Middle Susitna River and tributaries from the mouth of Devil's Canyon to the Susitna – Chulitna – Talkeetna confluence
99 – 0	4	Lower Susitna River from Susitna – Chulitna – Talkeetna confluence to mouth at Cook Inlet

Data Sources

- Data evaluated in terms of its potential relevance and completeness, methods reproducible
- Agencies contacted:
  - Alaska Department of Environmental Conservation
  - Alaska Department of Fish and Game
  - Alaska Department of Natural Resources
  - U.S. Environmental Protection Agency, Region 10
  - U.S. Fish and Wildlife Service
  - U.S. Geological Survey
  - National Oceanic and Atmospheric Administration-Fisheries
  - Alaska Energy Authority/Alaska Power Authority
  - American Geophysical Union
  - Cook inlet keeper, graduate studies, and other private groups
- Documents collected and stored electronically
- Water quality data summarized on spreadsheets
- Included lists of possible data sources that could not be found, but that *might* contain useful data.
- Same data sets found in multiple documents

Data Quality

- Data quality evaluated including laboratory and field precision measurements, laboratory analysis accuracy, analytical bias, and matrix spikes
- Low quality data can bias conclusions
- Majority of data found very dated (> 30 years old)
- Most data does not have much data quality backup
- Any results close to cleanup levels were interpreted as exceeding levels
- Comprehensive/synchronous vs. incidental
  - Most of our data since 1980s is incidental – collected while doing other (fisheries) studies.
  - Little comprehensive and synchronous data – most data separated significantly in time, or isolated locations

Water Quality Standards

- Screened data based on time of year and location
- Some of the high concentrations for metals appear to exceed state criteria
  - With the exception of some placer mining operations, the watershed supports no significant industry, agriculture, or urbanization. Source is likely natural.
  - Dissolved and total aluminum (Al), cadmium (Cd), copper (Cu), manganese (Mn), mercury (Hg), and zinc (Zn) found. Dissolved fraction of bismuth (Bi) and the total iron (Fe), lead (Pb), and nickel (Ni)
- Temperature data most abundant type of data. Most is incidental data.
  - Maximum temperature that must not be exceeded in waters where spawning activity occurs is 13°C.
  - Almost all tributaries exceeded the spawning temperature criteria during the summer months in 2008 and 2009
- Mainstem nutrient concentrations were low in almost all cases
  - Data is poor quality and old
  - Temporary increase in nitrate concentrations occurs during the fall season and coincides with presence of the salmon spawning season.

Temperature Exceedences

Table 4-6. 2008 Susitna River Basin Temperatures (Cook Inlet Keepers, via personal communication).

Month	Temperature (°C)	Station Name												
		Alexander Creek	Byers Creek	Cache Creek	Chijuk Creek	Deception Creek	East Fork Chulitna River	Kroto (Deshka) Creek	Little Willow Creek	Montana Creek	Moose Creek (Talkeetna)	Trapper Creek	Troublesome Creek	Willow Creek
June	Max	**16.0**	**17.1**	11.8	**14.3**	**13.9**	10.2	**19.3**	12.3	**13.3**	**17.2**	**17.2**	**13.5**	--
	Min	11.0	5.1	3.2	11.0	5.6	2.6	13.2	5.9	5.2	8.9	10.0	4.5	--
	Mean	13.9	10.6	6.7	12.9	9.4	5.9	16.0	8.9	8.9	12.3	13.3	8.5	--
July	Max	**22.0**	**19.6**	**15.3**	**20.8**	**15.7**	11.6	**20.4**	**15.6**	**16.5**	**19.8**	**19.2**	**17.0**	**14.8**
	Min	11.1	9.8	4.5	10.1	7.9	4.6	10.9	7.7	8.4	10.2	11.9	7.6	7.6
	Mean	14.3	13.6	8.8	13.8	10.7	7.3	14.5	10.4	10.9	13.1	14.2	11.0	10.2
August	Max	**18.3**	**16.5**	**13.7**	**16.1**	**13.9**	10.5	**20.3**	**13.8**	**14.5**	**15.0**	**16.0**	**13.2**	**13.4**
	Min	12.6	10.7	5.4	10.0	8.1	4.5	10.6	8.3	8.0	9.5	11.1	7.9	8.1
	Mean	15.1	13.1	9.7	13.3	10.6	7.2	14.5	10.5	10.7	12.3	13.4	10.7	10.5
September	Max	--	**15.2**	11.6	**13.5**	11.4	9.2	**17.2**	11.2	11.9	12.9	12.5	12.1	11.2
	Min	--	5.2	0.2	2.0	1.9	-0.1	4.9	1.7	2.0	3.8	3.4	1.6	2.3
	Mean	--	10.4	6.6	9.0	7.7	5.2	10.1	7.6	8.1	9.1	9.5	7.8	7.7

Note: Temperatures may not exceed 20°C at any time. Applicable temperature criteria for protection of the salmon life cycle are as follows: migration routes 15°C, spawning areas 13°C, rearing areas 15°C, egg & fry incubation 13°C.

Location of Exceedences

Bounds of Reach (Susitna River Miles)	Reach Number	General Description	Water Quality Criteria Exceedance
313 – 184	1	Upper Susitna River, including headwaters and tributaries above the proposed Watana dam site	Aluminum Iron
184 - 150	2	Middle Susitna River and tributaries through Devil's Canyon and below the proposed Watana Dam site	Total Dissolved Gas Temperature Aluminum
150 – 99	3	Middle Susitna River and tributaries from the mouth of Devil's Canyon to the Susitna – Chulitna – Talkeetna confluence	Temperature Aluminum Iron Total Mercury
99 – 0	4	Lower Susitna River from Susitna – Chulitna – Talkeetna confluence to mouth at Cook Inlet	Temperature Dissolved Oxygen pH Iron Mercury

Water Quality Data Gaps

- Limited for last 30 years
  - Need more current, synchronous data
- Discontinuous over the length of the Susitna River (esp. metals)
  - Need more comprehensive data
- Data gaps will need to be refined, modified, and developed as the licensing study planning process evolves.
- The critical points for water quality monitoring are important mainstem and tributary habitats used by fisheries during different phases of life cycles.

Potential Influence of Project on Water Quality

- Given exceedences of water quality criteria under natural conditions, exceedences do not necessarily define impairment…but
- Potential sensitivity to minor changes in concentrations may occur
- Changes to the hydrology will influence characteristics of exposure:
  - Change in hydrology may increase delivery of metals
  - Slower moving water may promote mobilization of metals
  - Inundate/expose mouths of tributaries may expose aquatic life at sensitive timing
  - Establishment of temperature barriers causing loss of thermal refugia
- Changes to the hydrology could also enhance fisheries habitat
  - Temperature conditions could be improved in tributary confluence habitat
  - Reduction in sediment load from the upper river may reduce metals contribution
  - Dissolved oxygen concentrations and thermal refugia could remain more constant and spatially contiguous so as not to present migrational barriers to fisheries currently known to inhabit the Susitna River drainage.
- Predictions require much more data

Sediment Transport

- Important for physical habitat of fish
- Almost no sediment data collected since 1980s
- Reasonable good hydrology data from USGS
- Primary data gap is current baseline data for comparison with 1980s data

Sediment Data Gaps

- Existing sediment rating curves where the Susitna River enters the proposed Watana Reservoir.
- Proposed perimeter erosion and sediment delivery data from proposed reservoir
- Annual loads and the gradations of the sediment that could be transported to and deposited at the mouth of tributaries that enter the proposed reservoir.
- The volume and gradations of bed material stored in the channel between the Susitna-Watana dam site and the head of Devil's Canyon.
- Tributary data, particularly where the delivery of flow and sediment to the main channel may have the potential to mitigate impacts
- Amount and gradation of sediment delivered by these tributaries to the Susitna River
- Quantify sediment supply and transport capacity (sediment continuity)
- Historical and current aerial photography, and comparison of new topographic surveys at selected locations
- Quantitative bed material data collected between the proposed Project and the confluence.
- Hydraulic conditions necessary for flows to access habitats between the proposed Project and the confluence
- The available sediment data are focused around the confluence of the Susitna – Chulitna – Talkeetna Rivers. The data are insufficient for evaluating temporal and spatial changes in major habitat types, but could be used if calibrated against current and more comprehensive data sets