

**Susitna-Watana Hydroelectric Project  
Fish Passage Feasibility Study  
Information Needs**

**Rev 4: May 16, 2013 (with input from April 9-10, 2013 Workshop #1 Added)**

**Table 1. Biological Data Needs**

| <b>No.</b> | <b>Item</b>   | <b>Data</b>               | <b>Comments</b>  |
|------------|---|---------------------------|--|
| B1         | Target fish species for upstream and downstream passage.                                | See attached appendix B1. | Add to Table B1: coho, sockeye, chum, rainbow trout, steelhead, arctic lamprey, Bering cisco. Passage facilities will require species sorting. Consider species that we do not want to pass (nuisance species). Update appendices to reflect additional species, including periodicity and numbers. Due June 24 <sup>th</sup> (2 weeks prior to originally planned site tour). Note those species that occur in Upper River. |
| B2         | List of other species in the system that may be accessible to any passage facilities.   | See attached appendix B2. | Change lake trout to be considered as native species.  |
| B3         | Life stage specific periodicity   | See attached appendix B3. | Update table headings, and update periods. Create a combined fish passage design table for B3, 4, 5, 6. Prepare example for next meeting, and identify holes ASAP.   |
| B4         | Migratory characteristics - routes, seasonal timing & duration by species & life stages | See attached appendix B4. | Create a combined fish passage design table for B3, 4, 5, 6. Prepare example for next meeting, and identify holes ASAP. Reference routes in B8 also.   |
| B5         | Estimated numbers & sizes of fish for upstream and downstream migrants                  | See attached appendix B5. | Create a combined fish passage design table for B3, 4, 5, 6. Prepare example for next meeting, and identify holes ASAP. Reference upper reservoir future fish community study (note this is a management decision).  |

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| No. | Item   | Data                       | Comments   |
|-----|--|----------------------------|--|
|     |  |                            | <p>Consider how large numbers of potential anadromous fish could impact passage of resident fish. Intent for passage facility design is to create bookends for feasibility analysis. Later work needs to revisit this issue, and plans could consider flexibility, phased approach, etc.</p> <p>Provide 2 columns in the population number estimate table: best estimate of numbers (design for what is there now), and potential future fish numbers. Note potential rate of increase, as feasible.</p> |
| B6  | Life stage specific parameters – size, migratory behavior, swimming behavior & speed, other physical passage constraints | See attached appendix B6.  | Create a combined fish passage design table for B3, 4, 5, 6. Prepare example for next meeting, and identify holes ASAP. Lump whitefish.  |
| B7  | Fish relative abundance upstream and downstream of project including tributaries   | See attached appendix B7.  | Merge with B5. To be completed with next major iteration.  |
| B8  | Locations of spawning and rearing habitats   | See attached appendix B8.  | Update B8 with new data on Chinook spawning maps, which will be ready soon after AEA review prior to distribution. Reference migration routes with B4. To be updated in June.  |
| B9  | Predators – species, abundance, location   | See attached appendix B9.  | Will be used to help compare alternatives, may be a data need. Likely a management issue. This item has been added to the management table, and will be retained here also.  |
| B10 | Existing ecological conditions – invasive species, light, temperature,   | See attached appendix B10. | See Water Quality item (P1, P11).  |

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| No. | Item   | Data   | Comments  |
|-----|--|--|---|
|     | flows  |  |   |
| B11 | Bio performance tool   | Initial overview presented at 4/10 mtg.  | To be developed further for review at brainstorm meeting, and final mock-up by Oct 8, 2013. Not on current short-term critical path.              |
| B12 | Influence of the reservoir on juvenile and smolt migration timing, and migration routes from tributaries to the reservoir to the intake or capture location.                       | See Appendix B6.   | See temperature model being developed this summer by Rob P. which may also provide velocity information (RSP 5.6 – Water Quality Modeling Study). |
| B13 | Influence of post-project reservoir on ice formation on juvenile and smolt migration from tributaries.   | To be determined. Is there risk of increased ice conditions that could affect downstream migration and the ability to collect fish out of tributaries? | See temperature model output noted in B12.  |
| B14 | Influence of the reservoir on fish community and target species including the introduction and proliferation of predators (i.e. Lake Trout) in the modified reservoir environment. | See Appendix B9  |   |
| B15 | Risk of entrainment of non-target species into the intake or capture device under different passage alternatives   | See Appendix B2  |   |
| B16 | Influence of seasonal and longitudinal changes in turbidity, and thermocline presence and depth on predation and migration routes (depth).   | See Appendix B10   | See water quality model output (RSP 5.6 – Water Quality Modeling Study), which will indicate thermal barriers, etc. (P2, P9)                      |

**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item   | Data  | Comments  |
|-----|--|---|---|
| P1  | Water quality & water temperature under existing conditions, main stem & tributaries | See presentation on water quality data on 4/9 and 4/10. | 1980 data exists. New data is being collected. Results from modeling on 2012 report summary, see web. Add links to web site (see 2 appendices). 2012-2013. Review data from Gold Creek. Note significant milestones from 2013 field season data. See current study plan (RSP 5.5 – Baseline Water Quality Study).<br>Confirm we get velocity data in reservoir with Rob P., understand what info will be provided. Currents through reservoir, confirm data and presentation. |
| P2  | Water quality & water temperature above & below proposed dam                         | Presentation on water quality data on 4/9 and 4/10.     | Same as above. Look for surrogate sites, similar lakes, smaller tributaries, etc. Dana S. will investigate and report on status (exists, or no data). Goal by June 7.   |
| P3  | Tailwater Rating curves at dam and expected trap location                            | Included in the P3-P5 PowerPoint presentation.          | Forebay rating information is in Item P5 below. 1980's data. Use to start. Updates with new survey data will likely available by December, 2013. Tailwater rating curve was submitted on April 22.  |

**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item  | Data   | Comments   |
|-----|---|--|--|
| P4  | Flow duration by month, through turbines, spillways, other outlets          | Included in the P3-P5 PowerPoint presentation.       | From operations modeling. John H. to provide summary of all duration flows with spreadsheet by May 7. Data provided for OS-1. AEA to provide feedback on other run scenarios (i.e., run of river). When can we get other runs to fill in sideboards? (note action item for AEA). |
| P5  | Reservoir elevation duration curves by month                                | Included in the P3-P5 PowerPoint presentation.       | From operations modeling. Have data for OS-1. Could have other data for other Operational Runs, see P4 also. Submitted on Apr 22. To be posted to web.   |
| P6  | Other project operations data (rule curve, expected operating restrictions) | To be determined                                     | See P4, P5 – relates to what operational scenarios are going to be run. Need input from AEA.   |
| P7  | Ice cover on river and tributaries in project area before project           | Presentation on ice conditions data on 4/9 and 4/10. | Ice conditions annually Oct-May. See RSP 7.6 - Ice Processes in the Susitna River Study. Request more of an annual summary of typical seasonal ice issues, access, etc. at the tributaries of interest. Biological component to correlate with life cycle by species.            |
| P8  | Ice cover on reservoir and in river below dam                               | Presentation on ice conditions data on 4/9 and 4/10. | Dana S. search for analogous reservoirs for Kokanee, etc. Will have ice model from WQ study, Rob P. will give update on model study, see action items. Due May 7.  |

**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item  | Data  | Comments   |
|-----|---|---|--|
| P9  | Water temperatures during upstream migration period   | Presentation on water temperature data on 4/9 and 4/10. | See WQ Study (P1), more data will be coming. Coordinate with climate change studies. Goal is to define range potentials in the future to assure fish passage design is flexible, can be expanded, can function over range, etc. So design won't be obsolete, etc. Add this item to several items, revisit off line.  |
| P10 | Water temperatures during downstream migration period   | Presentation on water temperature data on 4/9 and 4/10. | See WQ Study (P1), more data will be coming.   |
| P11 | Air temperature, wind, light, MET station info information by month (max, min, average)       |   | Estimate fetch, etc. from available data. Some data likely available in the fall of 2013.  |
| P12 | Sediment information (transport rates, sediment gradation, sediment sources & their location) | Geomorphology presentation on 4/9 and 4/10.             | 2012 Report on Project website – Documents – 2012 Environmental Studies ( <a href="http://www.susitna-watanahydro.org/wp-content/uploads/2013/03/SuWa-2012-Sediment-Report.pdf">http://www.susitna-watanahydro.org/wp-content/uploads/2013/03/SuWa-2012-Sediment-Report.pdf</a> ). Tributaries: modeling potential for perching and barrier potential at mouths. Model scheduled to be completed 2014. Sediment data being collected this summer. Be aware of ISR/USR, quarterly data updates. Ask Bill Fullerton to send provisional data to this group. Prioritize tributary data. |
| P13 | River morphology trends after project operation   | Geomorphology presentation on 4/9 and 4/10.             | Model results in 2014. Fluvial Geomorphology Modeling below Watana Dam Study (6.6) RSP ( <a href="http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/02-RSP-Dec2012_2of8-Sec-6-Geomorphology-v2.pdf">http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/02-RSP-Dec2012_2of8-Sec-6-Geomorphology-v2.pdf</a> ).  |

**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item   | Data  | Comments  |
|-----|--|---|---|
| P14 | Topographic mapping of the project site and along river downstream. Tsusena Creek.                                 | Attached  | Fish passage will be sketched on these sheets. Dennis D., Dana P., Dan T. – refine data needs.<br>Request centerline profiles for any available tributaries upstream and downstream of dam. Use best available data. Check with Joetta Z, GIS.<br>Get available cross section data – Dennis D.                            |
| P15 | Current dam layout drawings, plans, elevations, and cross sections (include details of outlet works and spillways) | Drawings provided to Board of Consultants. Please note this information may be subject to “Critical Energy Infrastructure” restrictions so care should be taken in divulging details to third parties.<br><br>Providing PDFs 04-01C002, 04-01C003, 04-03S002, 05-06S001, and AutoCAD .dwg files as a base.<br>Dam_site_sm_contours_5ft_z.dwg<br>camp_site_lg2_contours_20ft_z.dwg | Fish passage will be sketched on these sheets. Prefer simplified, scale drawings with a plan, section, and elevation suitable for brainstorm sketching in 11x17 format. Any 3D drawings showing general arrangement would also be helpful.<br><br>Data presented at this point in time, note overall dam design schedule. |

**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item   | Data   | Comments   |
|-----|--|--|--|
| P16 | Makeup of project components – turbines (number & type), outlet valves & gates | <p>3 x 200 MW Francis Turbines fed by individual penstocks</p> <p>Intake structure – Multi-level, gated</p> <p>Number of Levels- 6</p> <p>Number of shutters per level 8</p> <p>Dimensions of Shutters 25 ft. H x 22 ft. W</p> <p>Control Gates - 2 per intake</p> <p>Dimensions 18.5 ft. H x 8 ft. W</p> <p>Invert Elevation of Intake 1,800 ft.</p> <p><u>Also Outlet facilities</u> sized to pass 50 year flood if turbines are operating:</p> <p>Control Structures 6 Fixed Cone Valves</p> <p>Diameter 78 inches</p> <p>Water Passage Diameter 20 feet x 2</p> <p>Capacity 24,000 cubic feet per second</p> <p>Intakes for outlet facilities - 2 without shutters, but with trash racks and 2 gates</p> | See Aled’s presentation. Note CEII information. Attendees were asked to sign CEII forms for access to copies of this data. |



**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item   | Data  | Comments   |
|-----|--|---|--|
| P17 | Projected operation of project turbines, gates, & valves | <p>Turbines will be operated in accordance with rules to be agreed with environmental stakeholders, but some load following is to be expected.</p> <p>Turbine flow at full pool and 200 MW generation will be 4544 cfs per unit.</p> <p>Turbine flow at minimum pool (1,850) and 200 MW generation will be 6,917 cfs per unit</p> <p>Shutters at power intake will be moved to accommodate drawoff at chosen depths. Heated ice booms will be activated as appropriate to prevent ice build up on trash racks etc.</p> <p>Outlet facilities will be operated as agreed with environmental stakeholders, but will be capable of passing (in conjunction with power flows, floods up to 50 year return period).</p> <p>Spillway will operate at full pool level if flood flows are above 50 year return period.</p> <p>Normal spillway operation will be by incremental gate opening selected by the operator until the water level cannot be maintained at which time the gates will be raised sequentially.</p> | <p>Turbines operate to meet Railbelt loads and minimum flow requirements. Fixed-cone valves operate to control floods up to about the 1 in 50 year event. The gated spillway operates for floods greater than about the 1 in 50 year event. Refinements to this operation are to be determined.</p> <p>Operations data presented based on 3 turbine arrangement.</p> |

**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item  | Data   | Comments  |
|-----|---|--|---|
| P18 | Site access or restrictions to access for operation and maintenance. Include entire project area at dam, along reservoir, and into tributaries (i.e., existing or planned access roads) | <p>Access corridors have been established westwards on the north bank of the Susitna, westwards on the south bank of the Susitna (both to the ARRC but without connection to the State highways) and also northwards to the Denali highway. Road width will be 37 ft, but bridges will be single lane. The road will be designed for movement of the transformers – approximately 200 tons.</p> <p>There will be site access to the upstream side of the dam, around the dam works, and to the quarry, most of which will be reinstated if appropriate. No roads to the reservoir area or tributaries are currently planned.</p> | 3 potential corridors are still under study for access to the dam.  |
| P19 | Electrical power availability   | Yes  | FP Team can provide more info later on load requirements. Substation will be on hill, right abutment.   |
| P20 | Amounts and types of debris expected in the reservoir   | There may be occasional logs or similar organic debris. Possibly dead fauna occasionally (bears, caribou, moose etc.). During winter there will be ice.  | The Large Woody Debris component of the Geomorphology Study (RSP Section 6.5.4.9) will be assessing large woody debris loading in the Susitna River, including estimated input to the reservoir during project operation. Additional information can be provided as needed from Kathy Dubé. |

**Table 2. Physical, Hydrologic and Engineering Information**

| No. | Item  | Data   | Comments  |
|-----|---|--|---|
| P21 | Amounts and types of debris expected below the dam  | Same as P20.   | Same as P20. Potential for passing from reservoir above. LWD, etc. Potential to move LWD below dam, burn management, etc.   |
| P22 | Location downstream of any barrier and trap & haul locations, stress release ponds, adult release locations, etc. | See available mapping.   | Review mapping and identify any additional needs. Ask MWH dam designers for their opinions.   |
| P23 | Other data which you feel are important to fish passage   |  | Possibility of establishing a natural fishway at Tsusena creek.   |
| P24 | Tributary flow data   |  | Tributary stage data will be collected in 2013 field season. Rating curves to convert stage to flow will be developed in 2014 as part of RSP 8.5 Instream Flow.   |
| P25 | Tributary trap access data. Consider also for Adult release sites.  | Any studies on roads, ice roads, boat access, helicopter, etc. | No roads or plans for roads exist. Understand planned roads at this point in time. This group can advise more on needs concurrent with brainstorm session.  |
| P26 | Seepage study, right abutment   |  | Groundwater-related Aquatic Habitat Study (7.5) RSP - <a href="http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/03-RSP-Dec2012_3of8-Sec-7-8-HydrologythroughInstreamFlowStudies-v2.pdf">http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/03-RSP-Dec2012_3of8-Sec-7-8-HydrologythroughInstreamFlowStudies-v2.pdf</a> |
| P27 | Glacier outburst floods   |  | Glacial and Runoff Changes Study (7.7) RSP - <a href="http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/03-RSP-Dec2012_3of8-Sec-7-8-HydrologythroughInstreamFlowStudies-v2.pdf">http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/03-RSP-Dec2012_3of8-Sec-7-8-HydrologythroughInstreamFlowStudies-v2.pdf</a>          |

**Table 2. Physical, Hydrologic and Engineering Information**

| <b>No.</b> | <b>Item</b>   | <b>Data</b> | <b>Comments</b>                      |
|------------|---|-------------|--------------------------------------|
| P28        | Foundation condition, bank stability near ladders, etc. |             | Coordinate with geotechnical studies |

**Table 3. Management Items (Parking Lot)**

| <b>No.</b> | <b>Item</b>  | <b>Data</b>  | <b>Comments</b>   |
|------------|--|--|---|
| M1         | Resident fish passage and sorting facilities.  | Intent is for a subgroup to address this issue. For example: what should the passage group do with nuisance species (return to river, other?). | Added from B17. Consider how sorting/passage facilities should perform for resident fish. |
| M2         | Consideration of new salmon stocks (e.g., Sockeye, chum, coho) in the Upper River if they are not currently there. | Intent is for a subgroup to address this issue.  | Noted from discussion at Workshop #1.   |