Table 5.4-1. Summary of consultation on Water Quality study plans.

Comment Format	Comment Date	Licensing Participant Name	Licensing Participant Affiliation	Comment	Response
General					
Email	08/23/2012	Joseph Klein	ADF&G	Information on availability of the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) is needed.	AEA will include in the SAP and QAPP in the RSP as an appendix.
Baseline Water Quality Study (Section 5.5)					
Email	08/23/2012	Joseph Klein	ADF&G	5.5.4.3.2 **In-Situ Water Quality Sampling** The sampling protocol currently calls for monthly in-situ water quality monitoring for the 4 summer months. It should be revised to include continuous (hourly or so) water quality measurements for basic parameters (pH, DO, conductivity, turbidity), year-round if possible using in-situ semi-permanent sensors (e.g. sondes). The technology is readily available and would provide very useful baseline information to assess any post project impacts.	Grab sampling of surface water has been proposed at approximately every 5 river miles (39 sites). Grab sampling of water for physical parameters allows for better quality control, especially regarding calibration of parameters such as DO and pH. The use of multi-parameter probes would be appropriate for the focus study areas where monitoring of conditions is required to detect changes in water quality that may affect aquatic life stages. This will be performed in the Focus Areas selected for intensive in-stream flow studies. (Section 5.5.4.5)
Email	08/23/2012	Joseph Klein	ADF&G	Any monitors should be calibrated pre- and post-monitoring along with multiple field measurements for post monitoring calibration.	Agreed. The RSP's QAPP will include this detail.

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Email	08/23/2012	Joseph Klein	ADF&G	GW Quality in Selected Habitats (Section 5.5.4.7) - need more information on study. For example, sampling intensity/number of site measurements per slough or criteria for how they will be determined. Will ground water level monitors be installed if so, what is the sampling intensity (numbers per habitat type) and duration of monitoring (e.g. continuous year-round/ point samples during field visits, etc.). If not, it is strongly recommended groundwater monitoring be performed concurrently with water quality monitoring in this study.	This comment will be addressed more thoroughly when the Focus Area intensive study site selection is complete. The RSP will include a process, criteria, and schedule for selection of Focus Area. See RSP Section 5.5.4.5t. For each Focus Area, the sampling methodology will be described, including sampling intensity/number of site measurements per slough; whether ground water level monitors will be installed, and sampling intensity and duration of monitoring.
Water Quality Modeling Study (Section 5.6)					
				No Comments.	

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Mercury Assessment/Potential For Bioaccumulation Study (Section 5.7)					
Letter	08/17/2012	Lori Verbrugge	USFWS	1) Mercury modeling aspect is absent in all studies. We need them to model mercury inputs into the reservoir, amounts of mercury methylation, uptake and biomagnification of methylmercury in reservoir organisms including concentrations at each trophic level, and transport of mercury downstream from the reservoir, from date of initial flooding until 20 years post-impoundment. 2) Avian piscivores - need to analyze feathers for mercury content to determine baseline. This objective is absent from the bird studies. 3) Actual risk assessment step is missing. We need them to perform an ecological risk assessment for each piscivorous species. Estimate the amount of mercury ingested by individuals of each piscivorous species, based upon dietary information and modeled mercury levels in food items post-impoundment. Compare ingested mercury amounts to toxic levels, based on species-specific data from the scientific literature. Note: this step is missing in the study plans for avian species and aquatic furbearers.	Mercury modeling is being addressed in both the water quality modeling (Section 5.6.4.8) and the Mercury Assessment and Bioaccumulation study plan (Section 5.7). Studies have shown that the occurrence of mercury in newly formed reservoirs is a relatively predictable phenomenon, and that such predictions do not require the degree of modeling requested. The proposed mercury study plan will predict mercury concentrations in water and sediment within the reservoir, as well as predict mercury concentrations in piscivorous and non piscivorous fish. We believe that the proposed study is actually more protective of the environment than the agency request, as it proposes to mitigate methylmercury if the potential for environmental impact exists, as opposed to a more uncertain modeling of the scale of such impacts on individual species.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-164, first paragraph: discussion does not make sense. The State of Alaska (SOA) measured total mercury in salmon and other freshwater fish species from the Susitna River drainage. Contrary to the discussion, the SOA does not compare fish mercury concentrations to water quality standards. Unlike some other states such as Oregon, SOA does not base mercury water quality standards on fish concentrations. Table 5.12-1 reveals mean concentrations of mercury in several species of fish (arctic char, northern pike, pink salmon and lake trout) that are above levels deemed safe for unlimited consumption by women of childbearing age, as determined by the Alaska Division of Public Health.	The text has been changed and clarified. See section 5.5.4.7. The text has been changed to reference SQuiRT tables.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-163, paragraph 5: The report states "At Costello Creek only 0.02 percent of the mercury detected (in what- sediments?) was found to be methylated. This study suggests, based on limited data, that mercury concentration varies significantly between separate drainages, and that methylation is also tributary specific". a. This may be true for sediments, but is very unlikely to be true for fish. As a general rule, mercury in fish tissue is nearly 100% methyl mercury.	This text has been clarified (Section 5.5.2); however, several studies have shown that both metallic and methylated mercury concentrations and ratios in water, sediment, and fish can vary considerably between drainages and tributaries of the same drainage. In the case of the Frenzel study, significant differences were noted in mercury speciation in sediment between Costello Creek and the Deshka River, and the report attempted to explain those differences based on tributary specific physical conditions. It can be assumed that tributaries with higher methylmercury concentrations in sediment and water will also display higher methylmercury concentrations in fish, particularly those (ex. Slimy sculpin) that spend a majority of their time confined to specific tributaries. The Frenzel study also reported inorganic mercury in both Slimy sculpin and Dolly Varden. This data has been added to the text.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-168, Section 5.12.4.3.2 "Fish Tissue": The report states, "Body size targeted for collection will represent the non-anadromous phase of each species life cycle (e.g., Dolly Varden; 90 mm- 125 mm total length to represent the resident portion of the life cycle.) a. This makes some sense, in order to understand the amount of mercury in the fish that is clearly attributed to the local environment. However, for risk assessment purposes it is also important to sample fish that are representative of those taken for consumption by humans and wildlife receptors. Specifically, large adult fish that are targeted by anglers (and bears) should also be sampled, to determine how much additional mercury can "safely" be added from the project before consumption advisories are warranted.	The goal is not to determine the current mercury concentration in all species and model their connections, rather it is to determine whether the conditions for mercury methylation will be enhanced or diminished by the dam (described in Section 5.7.1). Target fish species in the vicinity of the Susitna-Watana Reservoir will include adult Dolly Varden, arctic grayling, whitefish species, burbot, and resident rainbow trout. If possible, filets will be sampled from seven adult individuals from each species.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-170, Section 5.12.4.5, "Pathway assessment of mercury into the reservoir..." a. The water quality modeling this section refers to (from Section 5.6) does not have the capacity to predict mercury inputs from inundated bedrock, soils and vegetation, mercury fate and transport, mercury methylation, or mercury uptake by biota. Studies 5.6 and 5.12 point to each other, but neither actually does this critical mercury modeling work. A concerted, specific mercury modeling component is essential and must be added.	The differences seem to be between the use of the words “model” and “assessment”, and not in the functional result. Since we understand that a source of inorganic mercury already exists (the atmosphere and inundated organic soils), and that inorganic mercury is not a significant issue, and we know the receptors are and will be present in the inundation area (macro invertebrates, fish, birds, etc.), the only questions remaining are whether conditions within the reservoir will cause mercury methylation, and whether this mercury is bioavailable. The Water Quality Modeling Study (Section 5.6) will generate a three-dimensional model of the proposed reservoir. This model will allow us to evaluate the potential for conditions conducive to mercury methylation in the reservoir. If conditions for mercury methylation are created, mitigation may be necessary.
Letter	08/17/2012	Lori Verbrugge	USFWS	Section 5.12.6 Schedule: Two additional monitoring activities needs to be added to this table and scheduled. a. Quantitative modeling of mercury inputs, rates of methylation, and uptake by biota; and b. Ecological risk assessment for mercury exposure to avian and mammalian piscivores in the study area. I don't have the expertise to opine on the discussion regarding the choice of model to use.	The planned modeling will generate predictions regarding methylmercury concentrations in water, sediment, and fish within the reservoir. The source of inorganic mercury and receptors of methylmercury are assumed to be present and don’t have to be quantified.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-17, paragraph 2 in total: the report states, "Body size targeted for collection will represent the non-anadromous phase of each species life cycle (e.g., Dolly Varden; 90 mm-125 mm total length to represent the resident portion of the life cycle.) a. This makes some sense, in order to understand the amount of mercury in the fish that is clearly attributed to the local environment. However, for risk assessment purposes it is also important to sample fish that are representative of those taken for consumption by humans and wildlife receptors. Specifically, large adult fish that are targeted by anglers (and bears) should also be sampled, to determine how much additional mercury can "safely" be added from the project before consumption advisories are warranted. Similarly, for ecological risk assessment purposes it is important to sample fish representative of those in the diet of avian and mammalian piscivores in the project area. Our study request (Page 19 paragraph 3) contains a more robust description of the types and sizes of fish that should be sampled.	The RSP has been modified (See Section 5.7.4.2.5). Target fish species in the vicinity of the Susitna-Watana Reservoir will be Dolly Varden, arctic grayling, stickleback, whitefish species, burbot, and resident rainbow trout. If possible, filets will be sampled from seven adult individuals from each species. The larger number of samples from existing fish species will allow for some statistical control over the results. All fish species present in the inundation zone will be sampled.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-17, paragraph 4: the report states "Results will be reported with respect to applicable Alaska State and federal standards". The comparison values must be specified and agreed to up front. For human risk assessment purposes, US EPA guidance for fish consumption advisories is most appropriate. For ecological risk assessment purposes, risks should be interpreted using published scientific literature, based on both field observational studies and controlled laboratory experiments, using the same or comparable piscivorous avian and mammalian species.	The study plan does not intend to perform a risk assessment for various species. Even if this were done, published literature is unlikely to have usable data for appropriate mercury concentrations for all piscivorous species in the study area.
Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-17, paragraph 5: the report states "Results from fish tissue analysis will also be used as a baseline for determining how the proposed Project may increase the potential of current metals concentrations to become bioavailable". This doesn't make sense. Results from fish tissue analysis will be used as a baseline for fish metal concentrations prior to development. In order to understand how the Project may increase the potential for current metal concentrations to become bioavailable, you need to predict how mercury methylation rates may change in response to the Project. This would entail prediction of organic carbon stores, amount of wetland or peat surface this context, because water levels do not relate directly to fish levels.	This will be taken care of by mercury modeling under EFDC. The model will predict if the conditions in the reservoir will be conducive to mercury methylation. Fish tissue mercury concentrations will be modeled using Harris and Hutchison and Hydro Quebec methods, which predict mercury concentration against background.

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TWG meeting	08/17/2012	Lori Verbrugge	USFWS	Explain the absence of macroinvertebrate sampling in the PSP.	The RSP has included the possible addition of macroinvertebrate sampling. See Section 5.5.4.7.
Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-17, paragraph 5: the report states, "Detection of mercury in fish tissue and sediment will prompt further study of naturally occurring concentrations in soils and plants and how parent geology contributes to concentrations of this toxic (sic) in both compartments of the landscape". The study of "naturally occurring concentrations of mercury in soil and plants and how parent geology contributes to concentrations of this toxicant" must be undertaken, regardless of whether it is currently present in fish and sediment. Vast surface areas and vegetation will be inundated, that are not currently part of the system. There is not the need to prove current presence before proceeding to predict the addition from the project. In any case, if adequate detection limits are used it is a given that fish and sediments will contain mercury; unfortunately they do everywhere. There is no reason to delay this "further study", particularly as the ILP process is so compressed. This study needs to be planned and implemented now. Likewise, macroinvertebrates need to be added to the current study plan.	Many studies have shown the principal source of mercury is atmospheric, not from the soil, rocks, or plants. We agree that there is no need for additional studies if mercury is found, and that current studies are for documentation purposes only. This statement will be removed. The RSP has included the possible addition of macroinvertebrate sampling. See Section 5.5.4.7.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-19, section 5.5.6 Schedule: Several needed elements are missing, including the collection of geomorphology, geology, vegetative type and quantity, etc. needed to estimate mercury inputs to the reservoir. Then modeling is needed to incorporate baseline conditions, estimate new mercury inputs and rates of methylation, and predict mercury levels in biota post-impoundment. Several study plans point to each other regarding this topic, but none actually undertake these tasks.	Soil and vegetation sampling have been added, and a geologic survey will be done for mineral deposits. However, this information is not necessary for estimating methylmercury impacts to fish. The proposed study will provide mercury modeling for methylmercury in water, sediment and fish. The schedule can be found in Section 5.7.6
Letter	08/17/2012	Lori Verbrugge	USFWS	Objectives Analysis: Two objectives contained in our study request are not included in the AEA study plan. These are: 1) Model mercury inputs into the reservoir, amounts of mercury methylation, uptake and biomagnification of methylmercury in reservoir organisms including concentrations at each trophic level, and transport of mercury downstream from the reservoir, from date of initial flooding until 20 years post-impoundment.	The study will be limited to predicting mercury impacts to water, sediment, and fish.

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Letter	08/17/2012	Lori Verbrugge	USFWS	Page 5-37, paragraph 4: the report reads, "Organic carbon content from inflow sources will be correlated with mercury concentrations determined from the Baseline Water Quality Study discussed in Section 5.5. Predicted water quality conditions established by Project operations and that promote methylation of mercury will be identified by location and intensity in both riverine and reservoir habitats." a. Nowhere in Section 5.5 or elsewhere does it indicate how mercury inputs will be estimated based on the specific vegetation, bedrock and soils in the area to be inundated. Likewise, a specific model has not been proposed to predict mercury inputs, concentrations, or rates of methylation in the reservoir. Neither the underlying data collection nor the modeling activity necessary to quantify future mercury levels in biota are contained within any of the current study plans. This includes the area inundated, and the pH, calcium concentration and water hardness of the reservoir ... among other factors	Hydro Québec (2003) has studied these phenomena extensively, and found the increase in fish mercury levels after reservoir impoundment does not depend on the mercury content of soil, rock, or vegetation, but rather on the conditions within the reservoir after filling. Numerous studies have shown that mercury inputs to reservoirs are fairly consistent across North America, and are for the most part not drainage specific. The variability in methylmercury concentrations within reservoirs and drainages is based on the methylation rate, not on the mercury source, which is largely atmospheric. Samples of vegetation and soil will be analyzed for mercury as part of this study; however, this information does not directly input calculations for methylmercury concentrations in fish and wildlife. It will be used as part of potential mitigation strategies.