Meeting Summary
Susitna-Watana Hydroelectric Project Licensing
Water Resources Study Development Workgroup Meeting
April 6, 2012
AEA Project Offices, First Floor Conference Room
411 W 4th Avenue, Anchorage, AK

Attendees:

Organization	Name
AEA	Betsy McGregor
AEA	Wayne Dyok
AEA	Bryan Carey
USFWS	Mike Buntjer
USFWS	Betsy McCracken
USFWS	Bob Henszey (by phone)
NMFS	Susan Walker
NMFS	Eric Rothwell
BLM	Tim Sundlov
BLM	Mike Sundergaard
USGS	Dave Meyer
ADF&G	Joe Klein
ADF&G	Ron Benkert
ADNR	Terry Schwartz
FERC	David Turner
FERC	Paul Makowski
Natural Heritage Institute/Hydropower Reform Coalition	Jan Konigsberg (by phone)
Long View Associates	Steve Padula
Long View Associates	Randall Filbert
Cardno ENTRIX	Craig Addley
Cardno ENTRIX	Jim Gill (by phone)
HDR	Robin Beebee
URS	Paul Dworian
R2 Resource Consultants	Dudley Reiser
R2 Resource Consultants	Kevin Featherston
Tetra Tech	Bill Fullerton
GW Scientific	Michael Lilly
Watershed GeoDynamics	Kathy Dubé
E-Terra	Lars Gleitsmann
Solstice Alaska	Robin Reich
Alaska Ratepayers	Scott Crowther
Chase Resident	Mike Wood (by phone)

MWH

Presentations

- Aquatic Habitat and Geomorphic Mapping of the Middle River Using Aerial Photography – Draft Final (2012 study plan)
- Reconnaissance Level Geomorphic and Aquatic Habitat Assessment of Project Effects On Lower River Channel – Draft Final (2012 study plan)
- Geomorphology Study (2013-2014 study request)
- Fluvial Geomorphology Modeling below Watana Dam Study (2013-2014 study request)
- Documentation of Susitna River Ice Breakup and Formation – Draft Final (2012 study plan)
- Ice Processes in the Susitna River (2013-2014 study request)

Fluvial Geomorphology Modeling below Watana Dam

Wayne Dyok (AEA) stated that Bill Fullerton's (Tetra Tech) extensive experience with fluvial geomorphology would be augmented by the participation of Mike Harvey (Tetra Tech), an internationally recognized expert in the dynamics of glacially fed river systems.

Eric Rothwell (NMFS) questioned that given the one-dimensional (1D) sediment transport model for the Susitna River would be run using input from the flow routing model, would the number of routing model cross sections would be sufficient to adequately simulate sediment transport at the reach and sub-reach level.

Eric (NMFS) stated that flow routing transects, selected for simulating flow attenuation, are typically located in areas where the channel's cross section is simple, and that data from these locations might not be appropriate for modeling sediment transport. Bill (Tetra Tech) replied that more flow routing cross sections could be necessary for 1D sediment transport modeling, but that field reconnaissance would be needed to make decisions about whether- and where-additional cross sections may be needed. He encouraged the workgroup to be careful and patient when making decisions about the placement of additional cross sections to avoid wasting time and funds by establishing additional cross sections in inappropriate locations.

Wayne (AEA) asked how bathymetry would be developed for sections of river where two-dimensional (2D) geomorphic modeling is to be applied. Craig Addley (Cardno ENTRIX) replied that LiDAR would be used to map the terrain above the water-line, multi-beam sonar would be used to develop bathymetry within the wetted channel, and photogrammetry would be applied to characterize those areas not accounted for in the overlap of the previous two methods.

Jan Konigsberg (NHI/HRC) asked how 1D sediment transport modeling would be applied to account for geomorphic dynamics in tributaries. Bill (Tetra Tech) replied that the 1D model would account for flows and sediment input from significant tributaries. Bill (Tetra Tech) emphasized that 1D sediment transport models simulate large-scale dynamics longitudinally within a river basin and as such they respond to large sediment and flow inputs. Addressing smaller-scale geomorphic phenomena, such as sediment dynamics at tributary mouths, would

require 2D modeling or delta evolution analysis. Bill (Tetra Tech) again cautioned that the small-scale methods would be labor intensive and time consuming, so analysis locations would have to be carefully selected to make results as useful as possible for assessing potential Project impacts.

Wayne (AEA) asked if 2D modeling could be applied at the mouth of the Chulitna River, which is a major source of sediment input to the Susitna River. Bill (Tetra Tech) stated that the confluence of the Chulitna and Susitna rivers is a large and complex area and that applying 2D techniques there would be a very involved undertaking. The workgroup should be certain that this level of analysis is necessary before planning such a large-scale effort.

Craig (Cardno-ENTRIX) noted that USGS records would provide good estimates of the volume of flow and suspended sediment entering the Susitna River from the Chulitna River and asked Dave Meyer (USGS) if similar data were available for Indian and Portage creeks. Dave (USGS) replied that no data were available for these streams. Bill (Tetra Tech) stated that it would be necessary to estimate suspended sediment input from many of the tributaries using transport equations and to develop bedload estimates based on sediment deposition at tributary mouths.

Betsy McCracken (USFWS) stated that tributary mouths are often biological "hotspots" and locations where adult fish stage prior to entering tributaries for spawning, so it would be important to model these locations to understand potential Project impacts. Bill (Tetra Tech) asked if members of the workgroup could identify specific tributary confluences of high biological importance. Mike Buntjer (USFWS) and Joe Klein (ADF&G) replied that it would be easier to identify key tributary mouths after the 2012 fisheries studies, especially telemetry studies, are completed.

Terry Schwartz (ADNR) asked if output from the 1D model would be helpful in identifying locations for 2D modeling. Bill (Tetra Tech) replied that the 1D model is a gross tool for assessing large-scale sediment transport and deposition, and as such would not be that useful for identifying potential 2D sites. It would be more effective for 2D sites to be selected by experts, and vetted by the workgroup, based on empirical observations made during 2012.

Bob Henszey (USFWS) noted that during FERC's scoping meetings William Harrison, Professor Emeritus, Geophysical Institute, University of Alaska had stressed the importance of sediment pulses released by glaciers in the upper Susitna basin. Bob (USFWS) noted that these pulses are an important geomorphologic phenomenon, affecting island building and the distribution and persistence of riparian vegetation. He asked if the 1D model would be capable of accounting for these glacially induced sediment pulses. Bill (Tetra Tech) stated that the pulses could be accounted for in the 1D model at a gross level by modeling a range of sediment loading scenarios. However, the 1D model would not be capable of tracking the effect of a sediment pulse at specific downstream locations. Wayne (AEA) stated that Mike Harvey (Fluvial Geomorphology task lead, Tetra Tech) would contact William Harrison to discuss the effects of glaciers on sediment dynamics in the Susitna River basin.

Betsy McCracken (USFWS) asked if the 1D model could be used to assess differences in sediment transport associated with a variety of Project load-following scenarios. Bill (Tetra Tech) explained that the model would not be capable of modeling at such a fine scale and that other techniques would be required to address such questions. Craig (Cardno-ENTRIX) stated that geomorphic changes would result from effects on bedload movement and that bedload is moved by high flows. The magnitude of difference in flows among various load-following scenarios would be small and not sufficient to produce differences in bedload movement, i.e., bedload movement would not vary among load-following scenarios.

Bill (Tetra Tech) reemphasized that the 1D model would be insensitive to small-scale phenomena and would not be capable of identifying locations of erosion, deposition, shoreline sloughing, etc. The purpose of the model will be to understand baseline sediment transport generally and identify large-scale changes to sediment transport associated with Project construction and operation. The Project would dramatically alter sediment supply immediately downstream of the proposed dam site and that this level of effect would be accounted for by the model.

Joe (ADF&G) asked what the time step would likely be for the 1D sediment transport model, and Bill (Tetra Tech) replied that a daily time step would be appropriate given the purpose and capabilities of the model. Joe (ADF&G) asked what the proposed time step would be for 2D modeling. Bill (Tetra Tech) stated that 2D modeling would be conducted at a much finer resolution, not only spatially but temporally. However, the time step for 2D modeling was yet to be determined. Terry (ADNR) asked if the one-day time step proposed for 1D modeling would suffice for evaluating flushing flows. Bill (Tetra Tech) replied that assessing flushing flows with the 1D model would require use of a smaller time step than the overall sediment transport modeling, perhaps at a 1-hour interval rather than the 1-day interval.

Betsy McCracken (USFWS) asked what the first sediment transport model runs would be. Bill (Tetra Tech) replied that initially the model would be calibrated against existing conditions and then used to model the 56-year period of record (or some other agreed-upon period) without the Project in place, to establish baseline conditions. Results of model runs associated with various with-Project scenarios would then be compared to the modeled baseline.

Joe (ADF&G) asked how AEA would address potential indirect effects on salmonid spawning habitat resulting from Project-induced effects on fluvial geomorphology. Bill (Tetra Tech) and Craig Addley replied that 2D geomorphic modeling at representative sites would be needed to assess potential channel changes at this level of resolution, and based on the results of the 2D modeling, indirect effects on fish habitat, riparian vegetation, side channel access, and other resources could be evaluated.

Joe (ADF&G) referred to examples of sediment transport modeling presented by Bill (Tetra Tech) (presentation available at Susitna-watanahydro.org) and asked if sediment data for the Susitna River basin are less comprehensive than what are available for systems in the contiguous United States. Bill (Tetra Tech) replied that data availability varied widely among the river

systems he had modeled. Having access to the studies conducted on the Susitna River in the 1980s provided a significant advantage and that without the 1980s information the sediment transport modeling effort would more time consuming and difficult.

Joe (ADF&G) emphasized that it would be critical to identify and track the consequences of all modeling assumptions, across all tiers of modeling. Betsy McCracken (USFWS) stated that AEA would need to provide stakeholders with an account of the assumptions, uncertainties, and limits associated with the proposed geomorphic modeling approach.

Wayne (AEA) stated that Bill (Tetra Tech) would draft a technical memo (1) summarizing the geomorphic model selection process, (2) describing how geomorphic models will interact with other models, (3) describing the proposed schedule for completion of modeling, and (4) identifying the preferred geomorphic 1D and 2D modeling approaches for use on the Susitna River. The memo would discuss the assumptions, uncertainties, and limits associated with the proposed modeling approach. Wayne (AEA) stated that AEA wanted to avoid use of a proprietary model to provide maximum transparency regarding how model runs are conducted.

Geomorphology Study

Tim Sundlov (BLM) stated that the extent of clear-water habitat in the Susitna River, and its interface with turbid water, varies as a function of mainstem flow and that it would be important to understand how the relative amounts of turbid and clear water would change as the result of the proposed Project and how this might affect fish.

Eric (NMFS) noted that the 2013-14 study request document called for developing the mass balance of sediment above (Gold Creek data) and below (Sunshine data) the three rivers confluence to estimate current sediment contributions from the Chulitna and Talkeetna rivers. Eric (NMFS) asked if the large potential error associated with USGS measurements would potentially affect the accuracy of such an approach. Bill (Tetra Tech) stated that the goal of analysis will be to assess the overall effect on sediment balance brought about by the construction of the reservoir, so what is needed is an estimate of the relative contributions of the tributaries. Bill (Tetra Tech) emphasized that the resolution of the basin-level geomorphic studies will be low; it will not be possible to identify, for example, specific locations of channel aggradation or degradation.

Terry (ADNR) asked what proportion of the suspended sediment originating upstream of the Project would be expected to settle in the reservoir. Bill (Tetra Tech) replied that the extent of settling depends on reservoir retention time, surface area, and depth, as well as the particle sizes of the suspended sediment. He noted that the proposed reservoir would be large and that most of the suspended sediment would be expected to precipitate.

Jan (NHI/HRC) asked if suspended sediment in the reservoir would affect water temperature. Craig (Cardno ENTRIX) stated that reflection/absorption of solar energy by suspended sediment

affects water temperature and that the influence of suspended sediment on water temperatures in the reservoir would be accounted for by the reservoir water quality model.

Betsy McCracken (USFWS) asked what effect the Project was expected to have on geomorphic conditions, and as a result other resources, in the lower river. Bill (Tetra Tech) and Craig (Cardno-ENTRIX) stated that most sediment transport occurs during the high flow periods; the Project would only affect a small portion of the total flow during that time. This, coupled with the fact that a large proportion of the sediment supply to the lower Susitna River originates downstream of the proposed dam site, means the Project will likely have a small effect on channel morphology in the lower river.

Referring to the reservoir geomorphology component of the study, Wayne (AEA) asked if existing high-latitude reservoirs would be examined to gage the nature and extent of impacts that might occur in the Project reservoir. Kathy Dubé (Watershed GeoDynamics) stated that she would investigate other existing reservoirs with characteristics similar to the proposed reservoir to help shape general conclusions.

Tim (BLM) emphasized the importance of accurately characterizing delta formations associated with the upper Susitna River and other tributary inflows to the reservoir to estimate potential Project effects on fish access to riverine habitat upstream of the reservoir.

Mike Sundergaard (BLM) noted that removal of vegetation in the zone of inundation could increase soil erosion during and following the filling of the reservoir. Kathy (Watershed GeoDynamics) agreed, however noting that removal of the above-ground portion of vegetation while allowing the roots to remain in the soil can reduce erosion potential. Depending on plant species and soil conditions, roots can remain in the inundated soil for 5 to 10 years. Mike (BLM) noted that ice formation and thawing in the reservoir fluctuation zone would also have significant effects on shoreline erosion.

Terry (ADNR) asked how the effects on erosion associated with the melting of permafrost would be addressed. Kathy (Watershed GeoDynamics) stated that she had not worked on reservoirs with permafrost and would need to coordinate with others who had, likely in British Columbia or other Canadian provinces, to develop methods to address potential effects. Michael Lilly (GW Scientific) stated that useful information regarding effects of high-latitude reservoirs on permafrost and associated erosion might also be derived from studies of reservoirs in northern Europe.

Referring to the large woody debris (LWD) component of the study, Michael (GWS) stated that Jason Mouw (ADF&G) had conducted his PhD research on the effects of LWD on large braided rivers and recommended that Bill (Tetra Tech) and Kathy (Watershed GeoDynamics) coordinate with Jason (ADF&G) regarding potential methods during the refinement of the 2013-14 study plan. Michael (GWS) also recommended contacting the faculty of the Forestry Department at the University of Alaska, Fairbanks. Wayne (AEA) stated that Dudley Reiser (R2 Resource

Consultants) or Alan Olson (R2) would coordinate with Woody Trihey (Cardno-ENTRIX) to ascertain what, if any, LWD data are available from the 1980s studies of the Susitna River basin.

Craig (Cardno-ENTRIX) asked if AEA had aerial photos of the alternative access road and transmission line alignments. Bryan Carey (AEA) replied that AEA had identified alternative routes on aerial photographs but that the photographs were of low resolution.

Wayne (AEA) stated that the selection of alignments would be an iterative process, with the alignments refined based on information gained during field reconnaissance, with the goal of minimizing resource impacts. Wayne (AEA) stated that AEA's plan was to select preferred access/transmission line routes by the end of 2012 and then refine the alignments in 2013-2014. AEA's consultants would conduct studies, as described in the study request document, of all three corridors until the final routes are established.

Ice Processes

Robin Beebee (HDR) presented a series of aerial photographs taken during the March 2012 open lead mapping exercise (PowerPoint presentation available at Susitna-Watanahydro.org). Mike Wood (Chase resident) stated that ice breakup in the middle Susitna River has dramatic effects on stream geomorphology, including the cutting of new channels and the scouring riparian vegetation from islands. Robin (HDR) stated that beginning with the 2012 reconnaissance, AEA would produce a photographic record of breakup conditions, including channel changes and effects on riparian vegetation. A fish biologist and geomorphologist will accompany HDR's ice processes specialists on over-flights to help document the effects of breakup on a variety of resources. Betsy (AEA) asked if the mouths of Indian and Portage creeks were open during HDR's over-flight, and Robin (HDR) replied that they were.

Robin (HDR) stated that time lapse-cameras were being installed at 10 locations between river mile (RM) 9 and RM 184 to document ice breakup and ice-cover formation. Michael (GWS) stated that for a small incremental cost, additional cameras could be installed at the Tsusena Creek, Gold Creek, and Sunshine USGS gaging stations. If the cameras were mounted on the existing gage houses no permits would be needed from the state for their installation. Betsy (AEA) stated that cameras could also be mounted on the radiotelemetry tower at Portage Creek. Wayne (AEA) stated that a time-lapse camera should be placed at Slough 8a to monitor ice breakup and freeze-up at this location that was shown to be important fish habitat during the 1980s studies. Mike W. (Chase resident) said that another good location for a time-lapse camera would be Whiskers Slough, which could be accessed from his property adjacent to the Susitna River. Mike W. (Chase resident) stated that he would provide AEA with access if desired.

Joe (ADF&G) asked if single cameras were being installed at each location, and Robin (HDR) replied that there would be up to three cameras at a given location to capture a variety of views. Dudley (R2) asked if the cameras were motion-activated, and Robin (HDR) replied that they were not but were set to take photographs at timed intervals.

Photos of ice processes taken at the upstream end of Devils Canyon during the 1980s are available from the Alaska Resources Library & Information Services (ARLIS) but Robin (HDR) indicated they are poor quality. Craig (Cardno ENTRIX) stated that ARLIS had upgraded its scanner and replaced many of the old photos with new ones of better quality so it would be worthwhile to access the newly scanned photos for possible use in the current ice processes study. Lars Gleitsmann (E-Terra) stated that R&M Consultants (in Anchorage) possessed a large collection of historical photos from the Susitna River that could be useful in comparing existing to historic conditions.

Kevin Featherston (R2) stated that it would be useful to coordinate with those conducting the ice processes study to establish protocol to be used to develop photo documentation of ice-vegetation interactions during breakup. During the 2012 riparian vegetation reconnaissance, field crews could re-photograph the locations documented during breakup to characterize the vegetation and assess the effects of ice.

Dudley (R2) asked how frequently ice thickness measurements would be made in 2012. Robin (HDR) replied that one set of thickness measurements was being made in winter/spring 2012, with a possible second set in fall/winter 2012. Bill (Tetra Tech) asked if the transects where ice thickness was being measured were tied to benchmarks. Robin (HDR) replied that the transects were currently linked to temporary benchmarks but that they would eventually be tied to routing model transects.

Wayne (AEA) stated that ice on the Susitna River can be as thick as 10 feet. Robin (HDR) confirmed that the augers used by HDR were capable of drilling through the thickest ice on the river. Wayne (AEA) asked how many ice thickness measurements were being made at each transect. Robin (HDR) replied that ice thickness was being measured at approximately 10 locations at each transect to account for variability across the river and any side channels, but the actual number of locations would vary depending on conditions.

Eric (NMFS) suggested that AEA make flow measurements using the holes drilled to measure ice thickness, which would yield both a spatial and temporal expansion of the winter flow data available from the USGS gages. Wayne (AEA) stated that it would not be feasible to add this to the 2012 study but that it could be added to the protocol for the 2013-2014 ice thickness measurements.

Eric (NMFS) asked if there were existing projects at high latitudes that operated in a manner similar to that proposed for the Susitna-Watana Hydroelectric Project. Robin (HDR) replied that the Peace Canyon Dam on the Peace River in northern British Columbia operated in a similar fashion, with stage fluctuation taking place beneath the ice cover.

Betsy (AEA) asked if the ice processes study would extend upstream to the Oshetna River. Robin (HDR) replied that the study area would extend from RM 0 to RM 250. Betsy (AEA) stated that it would be important to document any open leads in the area immediately upstream of the proposed reservoir.

Craig (Cardno-ENTRIX) asked how various ice features, open leads in particular, will be documented. Robin (HDR) replied that GPS data collected during aerial reconnaissance will be used to produce GIS maps for each reconnaissance trip, showing the locations and basic dimensions of the leads and other key features, such as ice jams, ice bridges, etc. Betsy (AEA) emphasized that aerial photos should be provided to ADNR as soon as possible for digitizing.

Dudley (R2) asked how ice process modeling would be conducted. Robin (HDR) replied that ice-process routines would be developed and calibrated to augment the riverine water quality model, and if that approach proved to be infeasible it would be necessary to employ a separate ice processes model. Craig (Cardno-ENTRIX) reiterated that it would be preferable to use a single model for simulating both water quality and ice processes, but if two models must be used it would be essential that they are applied in a consistent manner. He added that the EFDC model does not have an ice routine, whereas the CRISSP model, for example, can model ice processes. Craig stated that AEA plans to schedule a technical subgroup meeting to discuss ice modeling approaches once technical consultants had more fully developed their study outlines. Wayne (AEA) stated that the model selected would need to have been tested and validated under conditions similar to those occurring in the Susitna River basin. David Turner (FERC) asked if the list of potential ice processes models would be finalized when AEA files its Proposed Study Plan (PSP). Robin (HDR) stated that the list of possible models would be finalized by the time the PSP is filed, although it might require longer to determine which one is most suitable for application.

Jan (NHI/HRC) asked how the ice model would be calibrated. Robin (HDR) replied that the model would be calibrated using a range of field data at multiple locations. If the model accurately simulates existing conditions along the longitudinal profile of the river, it will be considered calibrated and suitable for use in simulating ice processes under a range of with-Project scenarios. Mike W. (Chase resident) stated that he has recorded the timing of freeze up and breakup on the middle Susitna River for a number of years and would be willing to provide his records to AEA.

Mike Buntjer (USFWS) stated that in addition to documenting ice dynamics at sloughs that are known to be important to fish, it would be beneficial to conduct observations at sloughs that are not heavily used by fish to develop a better understanding of what is driving fish habitat selection. Craig (Cardno-ENTRIX) stated that the following side sloughs provide important fish habitat: 8, 9, 10a, 11, 22, and Whiskers. Robin (HDR) stated that HDR had documented conditions at sloughs 1, 9, and 21 in 2012.

Action Items

- AEA stated that Mike Harvey, Fluvial Geomorphology task lead, Tetra Tech, would contact William Harrison, Professor Emeritus, Geophysical Institute, University of Alaska, to discuss the effects of glaciers on sediment dynamics in the Susitna River basin.

- AEA requested that Bill Fullerton (Tetra Tech) draft a technical memo (1) summarizing the geomorphic model selection process, (2) describing how geomorphic models will interact with other models, (3) describing the proposed schedule for completion of modeling, and (4) identifying the preferred geomorphic 1D and 2D modeling approaches for use on the Susitna River. The memo will discuss the assumptions, uncertainties, and limits associated with the proposed modeling approach.
- AEA stated that Dudley Reiser/Alan Olson (R2) would coordinate with Woody Trihey (Cardno-ENTRIX) to ascertain what, if any, large woody debris data are available from the 1980s studies of the Susitna River basin.
- AEA stated that a time-lapse camera would be placed at Slough 8a to monitor ice breakup and freeze-up.
- AEA stated that its technical contractors would add "anticipated level of effort and cost" information to all 2013-2014 study request documents.
- AEA stated that it would issue a revised Project licensing schedule in April 2012.