Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Initial Study Report Meetings
October 16, 2014
Part A – Transcripts

Millennium Hotel
4800 Spenard Road
Anchorage, Alaska 99517

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SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

SUSITNA-WATANA HYDRO

Agenda and Schedule

Initial Study Report (ISR) Meetings

Glacial and Groundwater (Studies 7.5 and 7.7)

Geomorphology (Studies 6.5 and 6.6)

Water Quality (Studies 5.5 - 5.7)

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ATTENDEES

Emily Anderson, Wild Salmon Center
Julie Anderson, Alaska Energy Authority
Nate Anderson, Alaska Energy Authority
William Ashton, DEC
Greg Auble, U.S. Geological Survey
Jessica Blizard, Tetra Tech
Martin Bozeman, Alaska Energy Authority
Phil Brna, U.S. Fish and Wildlife Service
Bryan Carey, Alaska Energy Authority
John Clark, St. Hubert Research Group
Jason Conder, Environ International
Justin Crowther, Alaska Energy Authority
Matt Cutlip, Federal Energy Regulatory Commission
Connie Downing, Tyonek
Paul Dworian, URS
Wayne Dyok, Alaska Energy Authority
Kevin Fetherston, R2 Resource Consultants
Bill Fullerton, Tetra Tech
Sara Fisher-Goad, Alaska Energy Authority

Hal Geiger, St. Hubert Research Group
Harry Gibbons, Tetra Tech
George Gilmour, Meridian Environmental
Dara Glass, CIRI
Domoni Glass, Environ International
Leanne Hanson, U.S. Geological Survey
John Hamrick, unidentified (phone)
Mike Harvey, Tetra Tech
Stormy Haught, U.S. Fish and Game
Jeremy Hayes, MSI Communication
Sandie Hayes, Alaska Energy Authority
Phil Hilgert, R2 Resource Consultants
Graham Hill, Northwest Hydraulic Consultants
Chris Holmquist Johnson, U.S. Geological Survey
Nick Jayjack, Federal Energy Regulatory Commission
Andy Josephson, Alaska Legislature
MaryLouise Keefe, R2 Resource Consultants
Joe Klein, Alaska Department of Fish and Game
Jan Konigsberg, Alaska Hydro Project (phone)
Felix Kristanovich, Environ International
Ellen Lance, U.S. Fish and Wildlife Service
Michael Lilly, GWS
Becky Long, Susitna River Coalition
Betsy McCracken, U.S. Fish and Wildlife Service
Betsy McGregor, Alaska Energy Authority
David McLean, Northwest Hydraulic Consultants
Jim Munter, J.A. Munter Consulting
Sarah O'Neil, Trout Unlimited
Doug Ott, Alaska Energy Authority
Becky Nichols, Analytica Group
Laura Noland, Environ International
Doug Ott, Alaska Energy Authority
Steve Padula, McMillen
Kathryn Peltier, McMillen
Guy Phillips, Kier Associates
Dudley Reiser, R2 Resource Consultants
Elizabeth Rensch, Analytica Group

Greg Reub, Environ International
Tyler Rychener, Berger/FERC
Hal Shepherd, Fish & Water Advocacy (phone)
Corinne Smith, Nature Conservancy
Marie Steele, Alaska Department of Natural Resources
Miranda Studstill, Accu-Type Depositions
Wayne Swaney, Stillwater Sciences
Cassie Thomas, National Park Service
Rachel Thompson, Alaska Energy Authority
Unidentified Female (phone)
Unidentified Male (phone)
Unidentified Male (phone)
Unidentified Male (phone)
Unidentified Male (phone)
Unidentified Male (phone)
Unidentified Male (phone)
Gary Van Der Vinne, Northwest Hydraulic Consultants
Jose Vasquez, Northwest Hydraulic Consultants
Lori Verbrugge, U.S. Fish and Wildlife Service
Sue Walker, National Marine Fisheries Service
Aaron Wells, ABR
Fred Winchell, Louis Berger
Gabriel Wolken, Alaska Division of Geological Surveys
Mike Wood, Susitna River Coalition
Ed Zapel, Northwest Hydraulic Consultants
Lyle Zevenbergen, Tetra Tech
Jon Zufelt, HDR

INTRODUCTION

MR. PADULA: Hello again, everyone that was here yesterday. And I see some new faces in the crowd. I'm Steve

McMillan. My role today is for me to be the facilitator and hopefully make this an effective meeting for everyone, for us to share information.

A few housekeeping items. In case of an emergency, any of these exits will get you out to the main hallway, and there's a set of stairs that will get you downstairs. Restrooms, straight out and to the right, down at the end of the hall.

We will have folks on the phone, as yesterday, again we hope that we've solved some of our sound issues. But again, if you're going to speak today in the room, you definitely need to use one of the microphones. And even with a microphone, you have to be very directly talking into it. This is your chance to be a rockstar, so embrace it. If you turn your head at all, we cannot pick up the sound in the microphone and we'll try to remind folks of that.

There will be breaks, a lunch break like yesterday. There will be an opportunity to caucus, if folks need that time. We would appreciate mostly doing that around breaks for lunch, but if need be, just let us know and we'll accommodate that.

Miranda is our court reporter again. So again, identify yourself, if you would. If not, I'll probably identify you, but it would be great if you could state your name when you're making your comments.

And try not to talk over one another. Again, that makes it a little challenging for the court reporter.

With that, again, this is day two of three days of meetings this week, on what we call the wet studies related to the Susitna licensing. There's three more meetings next week. Again, welcome back to the folks who were here yesterday. Let's start with a quick set of introductions around the room. Just yell, Bill.

MR. FULLERTON: I'm Bill Fullerton with Tetra Tech and I'm the lead for the geomorphology studies.

MR. HARVEY: Mike Harvey, Tetra Tech, geomorphologist.

MR. ZEVENBERGEN: Lyle Zevenbergen, Tetra Tech, geomorphology modeling

MR. WOLKEN: Gabriel Wolken with the Alaska Division of Geological & Geophysical Surveys. I’m the lead for the Glacier Runoff study.

MR. DYOK: Good morning, Wayne Dyok, Alaska Energy

Authority.

MS. MCGREGOR: Alaska Energy Authority.

MR. LOVE: Matt Love, Van Ness Feldman.

MS. GLASS: Dara Glass, CIRI.

MS. LANCE: Ellen Lance, Fish & Wildlife Service.

MS. McCRACKEN: Betsy McCracken, Fish and Wildlife Service.

MS. WALKER: Sue Walker, National Marine Fisheries Service.

MR. JAYJACK: Nick Jayjack, FERC.

MR. CUTLIP: Matt Cutlip, FERC.

MR. KLEIN: Joe Klein, Department of Fish & Game.

MR. CROWTHER: Justin Crowther, AEA.

MS. PELTIER: Kathryn Peltier, McMillen.

UNIDENTIFIED MALE: (Indiscernible - distance from microphone.)

MR. RYCHENER: Tyler Rychener, Louis Berger, contract team.

MR. WINCHELL: Fred Winchell, Louis Berger, FERC contract team.

MS. THOMPSON: Rachel Thompson, Alaska Energy Authority.

MR. OTT: Doug Ott, Alaska Energy Authority.

MR. KRISTANOVICH: Felix Kristanovich, Environ International.

MR. CONDER: Jason Conder, Environ International.

MS. GLASS: Domoni Glass, Environ.

MR. REUB: Greg Reub, Environ.

MR. HOLMQUIST-JOHNSON: Chris Holmquist-Johnson, USGS.

MS. HANSON: Leanne Hanson, U.S. Geological Survey.

MR. BOZEMAN: Martin Bozeman, AEA.

MR. ANDERSON: Nate Anderson, Alaska Energy group.

MS. ANDERSON: Julie Anderson, Alaska Energy Authority.

MR. CAREY: Bryan Carey, AEA.

MR. MUNTER: Jim Munter, J.A. Munter Consulting, contractor for National Marine Fisheries Service.

MR. REISER: Dudley Reiser, R2 Resource Consultants.

MR. HILGERT: Phil Hilgert, R2 Resource.

MR. BRNA: Phil Brna, Fish and Wildlife Service.

MR. HILL: Graham Hill, Northwest Hydraulic Consultants.

MR. GILMOUR: George Gilmour, Meridian Environmental, on behalf of the agencies.

UNIDENTIFIED MALE: (Indiscernible - distance from microphone.)

MR. PHILLIPS: Guy Phillips, Kier Associates.

MR. FETHERSTON: Kevin Fetherston with RZ.

UNIDENTIFIED MALE: (Indiscernible - distance from microphone.)

UNIDENTIFIED MALE: (Indiscernible - distance from microphone.)

MR. MCLEAN: David McLean, Northwest Hydraulic Consultants.

MS. LONG: Becky Long, Susitna River Coalition.

MS. THOMAS: Cassie Thomas, National Park Service.

MR. WOOD: I'm Mike Wood, Susitna River Coalition.

MR. CLARK: John Clark, St. Hubert Research Group.

UNIDENTIFIED MALE: (Indiscernible - distance from microphone.)

MR. AUBLE: Greg Auble, USGS.

MR. DWORIAN: Paul Dworian, URS.

MS. BLIZARD: Jessica Blizard, Tetra Tech.

MR. GIBBONS: Harry Gibbons, Tetra Tech.

MS. KEEFE: MaryLouise Keefe, R2 Resource Consultants.

MR. LILLY: Michael Lilly with GW Scientific.

UNIDENTIFIED MALE: (Indiscernible - distance from microphone.)

MR. PADULA: And obviously it would have been hard to pass the mic around -- oh, I'm sorry, someone else?

So again, folks in the room, please, if you haven't, please sign in so the transcriber can go get that list and be able to match names to people.

So now, for folks on the phone, please introduce yourselves.

UNIDENTIFIED FEMALE: Jessica (Indiscernible - interference with speaker-phone.) Alaska Operations office.

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone.) Tetra Tech.

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone.) Northwest Hydraulic Consultants, advising Services on (indiscernible).

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone.)

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone.)

MR. KONIGSBERG: Jan Konigsberg, Alaska Hydro Project.

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone.)

MR. SHEPHERD: Hal Shepherd, Fish & Water Advocacy

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone.) with FERC.

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone.) Stillwater Sciences, contractor to FERC.

MR. PADULA: Okay. Thank you. And again, I'd like to remind you folks on the phone, if you have comments or questions, you really need to speak up.

So just a couple of introductory slides, and then Wayne will have a couple of remarks to make.

MR. DYOK: I'm going to pass today, I think there's almost the same group here that was here yesterday.

MR. PADULA: Okay, great. It will gain us back some time.

So just the first slide here, summarizing the purpose of the meetings this week and next week, this is really a check-in progress meeting on the work done and reported on so far in the Initial Study Report, opportunity for discussion about study results.

And also, again, any modifications or variances that might have occurred during the conduct of the study so far, as well as any proposed modifications by AEA for the upcoming work, and then there's obviously the opportunity for others to weigh in on any modifications that they may think are appropriate for the studies.

Those of you who have been in the process for a while will recall that actually last February, there was a draft ISR put out and, then the final official ISR was filed with FERC in June.

Because of the amount of information, FERC extended the review time through October 1st, which leads up to these sets of meetings.

Then there were a series of supplemental technical memorandums that were issued last month. And again, given -- given that additional information, there's been additional time granted for the review of that information, and that will lead to a subsequent set of meetings in January that will be specifically focused on covering the information that's reported in those technical memos.

Basic schedule here, this matches up with the information that was in FERC's last guidance letter. So again, the meetings this week and the meetings in January will be captured in meeting summaries which will be issued by January 22nd.

There's a 30-day period for licensing participants to file comments on the meeting summaries, as well as their recommendations for either modifications to existing studies, or if they think there is a need to initiate a new study.

Then a 30-day period for response to those comments, and then 30 days later FERC will issue its determination as to the specific requirements for modifying the study plans before additional work continues in the next year.

And then the last two are the placeholder dates for issuance of the updated study report and another set of meetings similar to these meetings.

Again, this information has been out there on the Web for a while, so I'm not going to go into this in detail. This just summarizes the topics that are covered three days this week and the three days next week.

Again, the basic structure of the Initial Study Report, you'll remember again, the part A is what was in the draft ISRs, and we committed not to change that. So when the finalize ISRs went out in June, that became part A. Part B was errata, any supplemental information, so folks could find that more easily, and then part C was any new material that had not been included in the draft.

The approach for today, as yesterday, is really to encourage discussion. I thought we did a really good job collectively of that yesterday, so we are again going to keep our presenters as close to ten minutes as we can.

We've got fewer studies to do today, so we may give some of our presenters a little leniency. But still, we're going to try to get through the presentations rather quickly and focus in again on variances, quick summaries of results that've already been available to you folks, and then proposed modifications. And so that will hopefully trigger, again, the same kind of effective conversations we had yesterday.

And the last three slides, which I will not show, are basically FERC's regulatory requirements for requesting modifications to study plans or requesting a new study. Those are on the Web. They are also up on the wall on both sides of the back of the room, if you are interested.

And with that, Wayne, nothing? Anybody else have any comments? Microphone, please.

MS. LANCE: I just wanted to acknowledge the change in format yesterday really -- the participants really appreciated it and it facilitated some good conversation of the 2013 (indiscernible), so thank you.

MR. PADULA: Okay. Do you want to start out, Gabe?

GLACIER AND RUNOFF CHANGES (STUDY 7.7)

MR. WOLKEN: Okay, and I understand that based on the format yesterday, there's more interesting discussion than on the content in the presentations, so I'll summarize this as quick as possible so we can move on to discussion.

The objectives of this study, the ISR portion of this study, was really to review the existing literature and data that's relevant to the glacier retreat in South Central Alaska and the Upper Susitna watershed.

And this really includes an evaluation of all the relevant data regarding glacier melts and runoff in the Upper Susitna Basin, that is, above the dam. And the review summarizes the current understanding.

And so with that, there are multiple components to this study. Looking at the -- effectively the cryosphere, the snow and ice components within the Upper Susitna Basin.

There are no variances to this study.

And I'll just summarize some of the salient points quickly.

It's instructive to go to a broader context to understand what's actually happening in the Upper Susitna Basin, given the lack of data that actually exists for this region.

So this slide is to help illustrate a global perspective on mass budgets in specific geographic regions throughout the globe. And the red circles there that you see are an indication of the mass budgets. The red indicates that it's a negative mass budget of glaciers in these different regions.

I'll just draw your attention to the northern hemisphere, you see that there's a lot of red there, a lot of red dots. And in particular, I probably should mention, in Alaska, which does show one of the largest dots in the northern hemisphere, and that does illustrate that Alaska is one of the places where we do see the greatest mass loss in glaciers in the United States.

The large circle does indicate the area. That's instructive to look at as well, as it gives some sort of analogue to the amount of melt that can occur there, though it does ignore volume.

Now, this is direct linkage to warming climate, global warming of the climate, and it's specifically related to, as this slide shows, the (indiscernible) trend.

Looking at anomalies here from the 1951 to 1980 period, you do see that the red indicates temperature anomalies. Blues indicate negative anomalies. The northern hemisphere clearly has strong lean toward the positive anomaly sides, up to 2.5 degrees over the last decade.

This extends to Alaska, as well. And so while the datum is slightly different here, the trend is the same. And so within the period 1949 to 2011, we do see that we have increases in temperatures, positive temperature, surface air temperature anomalies.

And within the study area, around 2.5-degree increase from 1949 to 2011.

This very busy slide is here just to alert you to the fact that there are a lot of studies in Alaska using a variety of different methods to look at mass loss, none of which focus specifically on the Upper Susitna Basin.

These studies do show that there has been a trend, from -- starting around 1955 up to the present of negative mass loss. And so that highlighted column there, you'll see lots of negatives there.

There's a trend, and that's what we're looking at. We anticipate this trend to continue.

And this is some work by Regine Hoff and Valentina Aradic showing the volume reduction, as modeled with 14 different climate model scenarios. The projection here out to 2100 of glacier volume loss is evident.

In a shorter time span, the glacier mass loss is a positive feedback effect, effectively, showing that as you reduce mass in the glacier, there's a firn reduction in the snow reduction. This causes more bare ice to be exposed, which actually causes a lower albedo, which means we actually have a little bit more mass loss every year.

This also means that there's going to be lower water retention in the specific reservoirs of snow and firn, meaning that we can't hold as much water, so we're going to have a faster through-flow of water and large peak flows.

Long-term perspective, there's -- as climate warms, mass loss increases and as that mass loss increases, then the volume of the glaciers decrease.

Now, the key question here is as that volume decreases, on the runoff curve that you see on the bottom there, what happens and where are we sitting?

And in this case, with the Upper Susitna Basin, we really don't know at this point, based on the literature review, whether or not flows will increase or will decrease at this point.

This is just an illustration of the data that's available within 120 kilometers of the Upper Susitna Basin, the red delineated basin there, and the dots indicate the different climate stations that are available to help provide some indication of what might be happening in this area.

And as you can see within that basin and highlighted here, there are only a few stations -- climate stations that are actually within the Upper Basin that provide some direct information about the climate variables.

And as you can see also by this, there is a -- basically a fragmented record within these records.

Also available through this ISR study is a wealth of knowledge from the previous work that was done in the 1980s. And from that, we were able to recover meteorological stations, records from the stream gauges that were installed, and as well as mass balance records directly from five glaciers. I don't know how many glaciers exist in the Upper Susitna Basin.

We were also able to recover snow depths, which were very informative to help get an idea of what the snow distribution is. These are -- granted, these are point snow-depth measurements, but these also come from the 1980s.

And finally, here's an illustration of the amount of knowledge that we have on effectively the state of the cryosphere within the Upper Susitna Basin. And this shows the distribution of permafrost and glaciers. Again, there's over a hundred glaciers within the Upper Susitna Basin. It's comprised principally of continuous and discontinuous permafrost regions and some sporadic areas, mostly constrained to the rivers.

We do have some data associated with permafrost ground temperatures and permafrost depths, and we also have some modeled variables that we can draw from within the published literature of mean annual ground temperature profiles.

This is the required portion of the study, and it’s considered complete.

And with that, I guess I will open it up to questions.

MR. WANEER: (Indiscernible - over-modulating.)

MR. PADULA: Could you please speak up a little bit?

MR. WANEER: Can you hear me?

MR. PADULA: Yes.

MR. WANEER: Yes? Okay. One of the (Indiscernible - over-modulating.) I did not see that included in the initial report. (Indiscernible).

MS. WALKER: I can understand.

MR. WANEER: (Indiscernible - over-modulating

MR. WOLKEN: I didn't quite catch that, but is the question about sediment production?

MR. WANEER: (Indiscernible - over-modulating)

MS. WALKER: This is --

MR. WANEER: (Indiscernible - over-modulating)

MS. WALKER: Do you know who it is? Do you know who it is?

MR. WANEER: (Indiscernible - over-modulating.)

MS. WALKER: I know what he's asking, because I was going to ask the same thing. Do you want to ask him to clarify?

It was very hard to hear Waneer. This is Sue Walker with NMFS. But I believe your first question is the same question that I had, and that is if the FERC-ordered study plan did require an assessment of the effects of surging glacier on sediment deposition in the reservoir. Particularly there was a unpublished 2012 report. And I had asked about that report and been told it's within the geomorphology, but I have searched and searched and I can't locate it.

And I don't think we could understand the other -- I believe you had two more points to your question, Waneer?

MR. WANEER: Yeah. I had (indiscernible - over-modulating) geomorphology study or not – I didn’t see any mention of that in this report.

MR. DYOK: You might want to come up to the table mic.

MR. PADULA: It would be helpful, yes. So I think the question had to do with the potential for increased sedimentation in the reservoir due to glacial surge.

And were there other components to the question?

MR. WANEER: No, no. that's it. (Indiscernible - over-modulating).

MR. FULLERTON: Okay. And we did some investigation of the issue of the glacial surge.

We contacted Harrison, yes, Dr. Harrison from University of Alaska Fairbanks, had a discussion with him concerning his -- the glacial surge.

And also one of the things that we did just this last field season, was do a reconnaissance of the upper river, starting at the Cantwell Bridge, on downstream, were able to observe a lot of the sediment supply that's been coming off the glaciers and getting into the river and Mike here he did that reconnaissance and has been looking at the issue of the glacial surge, so Mike has.

MR. WANEER: Right. (Indiscernible - over-modulating.)

MR. FULLERTON: Well, if you want to -- first, Mike, characterize our conversation we had with Dr. Harrison.

MR. JAYJACK: I think what he's asking is where is it in the ISR.

MR. FULLERTON: We -- we don't have it -- it isn't in the ISR. We haven't put that information in there at this point.

MR. HARVEY: Maybe I can just expand on that a little bit.

This issue of the glacial surge was brought up in a public meeting by Dr. Harrison at one of the meetings.

We contacted him. There were data, but the last time when the glaciers surged was 1985, towards the end of the last Susitna project.

He and some others had collected some data on sediment, but we and -- neither he nor we have been able to get our hands on that information. It was never formally put into a report and he thinks it's probably in the notebooks and stuff of colleagues scattered in many places, many of whom have retired at this point.

However, the point I would make is that in our discussions with him, he actually just said -- it was sort of more of a throw-away comment, he actually believes that -- at least this is what he told us, that the -- with increased global temperatures, the probability of surging on the Susitna glaciers is likely to be less than it has been historically. Now, I'm not a glaciologist, I just repeat what he said. That's point 1.

Point 2 is that even the data they did collect, there is so much distance between the Cantwell -- where the Cantwell gauge was, where they collected some data, and the glaciers, you've got a vast storage of sediment in that area. The river's transporting at capacity. Now, you can't transport more sediment than at capacity.

And based on our field work this year, that whole upper river is pretty much sand. There's almost no gravel in that upper part of the river. It's sand.

The USGS has a publication -- an individual from the USGS, has a publication back in the '80s, that actually looks at the partitioning of sediment from the glaciers and the distance downstream, and the conclusion in that paper certainly supports what we saw out there. That the gravel does not get out, the gravel stays up, it's the sand that comes through, and that's the [primary sediment supply] from the upper river on the glacier side for at least the river dynamics and a portion of this is the important fraction, this sand, not the gravel.

And believe me, I can guarantee you, there's a hell of a lot of sand there. We more or less had to carry our boats through sections trying to find water just to, you know, get them through. So it's sand and almost an infinite quantity of sand in place in storage up there.

So I don't think surges or anything else are going to, in fact, increase the amount of sand that can be transported out of the upper river.

MR. WANEER: I have a question. In your slides, can you go back to number 7? Slide number 7?

MR. WOLKEN: Now, can you repeat that, please?

MR. WANEER: (Indiscernible - over-modulating.) have you seen any such (indiscernible - over-modulating) run-off or (indiscernible - over modulating)?

MR. WOLKEN: I think you said are there any trends in precipitation and runoff, and if that is the question, then yes, we did --

MR. WANEER: Yes.

MR. WOLKEN: -- we did uncover the available data and we did look at that.

There are so few precipitation measurements and so few reliable precipitation measurements within the study area or within the proximity of the study area, but no real trends could actually be established.

MR. PADULA: Any additional questions?

MS. WALKER: Hi, this is Sue Walker with NMFS.

We've had some conversations with AEA with Wayne Dyok and with Bryan Carey, Gabe, about your report, and they indicate that your report will be available around the first of the year. Is that on schedule?

MR. WOLKEN: We've got an initial draft that will be available in February.

MS. WALKER: February?

MR. WOLKEN: Yes.

MS. WALKER: When in February?

MR. WOLKEN: I think we have the end of February is the target date for that.

MS. WALKER: That's problematic for license participants. We were -- we were informed earlier that it would be around the first of the year. That's information we could use in making our requests for modifications to studies, which we do intend to do.

Based on the FERC director's determination, it was stated that if there was additional information on the effects of climate change, that it might be time now to make a request for a climate study, which is really what this is. It's worded a little vaguely.

Is there any chance that we would be able to get your report in time for us to make our request for changes to studies, which are due to FERC by February 23rd?

MR. WOLKEN: Yes, I think in terms of the timeline, that probably can't be changed too much, just based on what's left to do. I'm happy to share anything that we have with you prior to the actual publishing of that material.

MS. WALKER: Well, in lieu of that, I'm wondering if it might be possible for the climate change technical work group, which only met a couple of times, to get together and at least make use of your study and your data, which is significant, which is the best information we have.

MR. WOLKEN: Yes, I'm happy to do that.

MS. WALKER: Okay. Is that something that AEA would agree to?

MR. DYOK: Yes. This is Wayne Dyok with Alaska Energy Authority.

Yes, Sue as we talked previously, certainly this is an important study for us. We're doing it ourselves and not through the FERC process, and when Gabe gets his work to a point where it makes sense to discuss it, we're certainly happy to discuss that with you. When we had talked earlier, we had talked about sometime in the first part of 2015, and that's still our goal.

But we have to give Gabe, you know, the time to get his work, you know, done, and when he gets to a point where he feels it's appropriate to share results, we're happy to do that.

MS. WALKER: Thanks, Wayne. That doesn't really answer the question, though. I asked if it might be possible for us to have a meeting with your scientists so that we can have this information in time for us to formulate our request for a change to the study plan?

MR. DYOK: Sue, as I said, were -- we would be happy to meet with you and when we spoke on the phone, I asked Bryan Carey to work with Gabe and you to look at a timetable that would make sense to have a productive meeting, and I stand by that.

MS. WALKER: I understand that, but the date that we were given was around the first of the year. Late February is after the timeline for the deadline for our requests for changes to studies. We would have to make our study request without that information , without the best available information.

Is there any possibility that FERC would entertain a later date for that study request that we could have this very site-specific information?

MR. JAYJACK: This is Nick Jayjack from FERC.

The chances of extending the dates are going to be pretty -- pretty low.

I'm not quite understanding the information you're looking for. Is it information that was required as part of our study determination, or is this the information that we didn't require but we said that AEA could, nevertheless, if they wanted to, conduct it on their own?

MS. WALKER: It's both of those. It's both of those things. It's the information that doesn't appear to be in the -- it's a variance from the study. It's the information on glacial surge and sediment input that apparently wasn't completed, but it's also the study that's been done that AEA undertook.

MR. DYOK: So if I could speak to the glacial surge part? We wrote the glacial study that Gabe is doing. There's the literature search that's part of, you know, his area of expertise, so he's doing that. So he did the literature search, which was part of what was required by the Federal Energy Regulatory Commission.

Then there's the part that's not part of the FERC process that AEA felt that it wanted to do on its own.

MS. WALKER: I understand that.

MR. DYOK: We're doing that. The part about the glacial surge with the sediment, that's more of a geomorphology question, and so we turned that piece over to, you know, Tetra Tech to undertake. They're still in the process of doing that.

They collected field data, you know, this summer to address that particular, you know, issue. It wasn't a part of the information contained in the ISR, but certainly is something that will be in the Updated Study Report.

MR. FULLERTON: I don't know if this helps, but I -- we can write this up and somewhere there was some other information yesterday that was needed and I think it said submit it by November 15th.

So, we can write up our information on, there are conclusions about glacial surge and submit it to -- on -- or on or about November 15th, if that helps clear that part up.

MS. WALKER: Thank you.

MS. MCCRACKEN: This is Betsy McCracken with Fish & Wildlife Service.

And I think that it's not clear to me whether this is in the geomorphology study or not, but I think it's relevant to the sediment transport and what I heard Mike say about the sand coming through and mostly coming through, and the transport of that to the lower river, and how that may be altered, and certainly the timing, if nothing else, because that is what creates and supports the lower river.

MR. MCLEAN: This is Dave, Dave McLean. Just a follow-up question on -- relating to sedimentation.

Is there a description or a characterization of glacial changes in major tributaries downstream, not just in the upper reach because the effects of long-term glacial change will affect land characteristics and sediment yield in, of course, of the tributaries that have glaciers, so it's a bit broader question than perhaps in just looking at very specific questions related to the surge in the upper watershed.

MR. WOLKEN: Yes, I can field that to some extent.

Again, the glacial surge and the sedimentation, part of the study is being handled by a different group, but as part of the extended study that we're doing, we are looking at former glaciers extend and area changes within the historical record up to present, so we will be including that in our studies.

MS. LONG: Hi, this is Becky Long. (Indiscernible - over-modulating) I want to give copies to FERC and AEA.

I wish I saw (indiscernible - over-modulating) about Gabe's extended study, because he just said generally that it will be later, outside -- well, actually I think you said it was after the ILP process is done. Yes, I looked at it and so it left it in a very generalized way and I'm glad to hear that it's going to come out. It was not mentioned in the ISR that it will come out in 2015. So that's really good to hear, because I think you will need that.

Licensing participants consider this study data extremely important to determine the feasibility of this proposed hydroelectric project; specifically, will there be enough water in the proposed reservoir from the Upper Susitna Basin runoff to provide 300 to 600 megawatts of hydroelectric power for 50 years, 100 years, and up to a thousand years?

And it's important that we determine this for a thousand years, because we said in the information we will use this summer that the dam could go for a thousand years. So we're going to need this modeling for a thousand years.

Now, this is -- it's tricky to comment on this study because there's, like I talked about, there's a FERC component and an AEA component, so it's kind of hard to talk about it and it's kind of hard to explain.

So I think that the sedimentation people are saying that they're looking at the glacial surge sedimentation. And are you finding that it's insignificant? And -- because in the ISR -- well, let me go over it.

FERC said in their study plan determination to determine the potential for changes in sediment and delivery rates to the reservoir as a result of periodic glacial surges. AEA proposes to review data from previous glacial surges in the Upper Susitna River Basin glaciers, as reported by Harrison & Humphrey, and evaluate the sediment transport capacity of the reaches of the Susitna River upstream at the reservoir.

If it is determined that the increased sediment load could affect project operations, a sediment loading scenario accounting for glacial surges would be added to study 6.5 geomorphology study.

This would include an estimate of reduction in the reservoir life that could result from sediment being associated with periodic glacial surges.

They followed-up, FERC followed up in their SDP analysis with potential changes to sediment delivery from the Upper Susitna watershed into the reservoir from glacial surges as proposed by AEA is necessary and therefore am recommending approval of this portion of the AEA's proposed study item.

This was not included in the ISR. I e-mailed Mr. Jayjack to see. Is -- well, let me back up. In the ISR is a literature review, and it's a really good literature review. I really enjoyed it. I understand a lot and it was very thorough.

But the ISR says the FERC component of the ILP is done, but I respectfully disagree, and I think we need to clarify this.

This -- like I just said, FERC recommended that they do the glacial surge study.

And also I think it's important, the unpublished study refers to Harrison's 2012 Effect of Glacier Surges on the Sediment Regime of the Susitna Basin that was submitted to the Susitna-Watana project.

Now, I understand there really is no study. It's just like notebooks and stuff. But I think this data is important, so I hope there's a follow-through on that.

And the remainder of AEA's 7.7 revised study plan is the actual hydrologic modeling in order to develop water forecast models for the proposed project. FERC does not require this. But FERC does not mind that the applicant carries it out. (Indiscernible - over-modulating) has explained this very well.

AEA states in the ISR that the data from these objectives reported on in later years, and is not part of the integrated licensing process. So now I know that it will be. So thank you for clarifying that.

So what if review did not meet the FERC SPD in terms of (indiscernible -over-modulating) analysis of potential glacial surge reservoir sediment delivery? If 6.5 is going to do that, I think we need to put it in 7.7 because this is where it originated.

There was a few points of the literature review, 7.7 ISR Part A did not answer the question; is the Susitna River considered a highly glacialized catchment basin? Excuse me, I'm nervous.

Also, during periods of low flow, will the glacier's ability to augment stream flow be diminished significantly and eventually lost? This was not answered in Part A under 6.1, Evapotranspiration. That section needs to make clear that increasing temperatures, growing season length, and increased precipitation may not correspond with increased water availability due to evapotranspiration. And this is a direct quote that I took from NMFS's proposed study request in 2012.

There's been references to the 1981 to 1983 data on mass balance and snow depths. The Susitna River Glacial Basin -- pardon me, glacier runoff was analyzed by UAF's Geophysical Institute and R&M Consultants for the Alaska Power Authority to develop water forecast models for the 1980s proposed two-dam Susitna hydro proposal. This historic data we'll be used as part of the calibrations for the hydrologic model for the current 7.7 study.

And I'm just wondering, is this science -- is this data scientifically defensible, because there are limitations to this data. And each -- this -- this was listed in the 1980s -- or the 1984 study. Data from the Talkeetna Mountain glaciers and Eureka Glacier were not included.

At best, this data is considered reconnaissance level with only one measurement point for 50 square kilometers. A short, three-year study duration gives little perspective into year-to-year availability of water supply from the glaciers. The error is too large to say with much confidence that the glaciers were in approximate equilibrium from 1981 to '83. The accuracy is limited for mass balances of the Susitna Glacier in 1983 because the only reliable accumulation data was from the north facing basin of the main tributary.

The study indicates that during this time, roughly 34 percent of the flow from above the Denali Highway is from the glaciers. Is this credible data? Can we make this assumption?

Stakeholders need to know when this material will be presented, and I think you already answered this, that Gabe is working on this.

So I think that's all I have.

MR. PADULA: Thanks, Becky.

So, yes, there's a case that Gabe is working on and Bill, the other information, if I heard you correctly, by November 15th you will have written up on the glacial surge (indiscernible).

UNIDENTIFIED MALE: Correct.

MR. PADULA: .....(indiscernible).

Any others?

MR. JAYJACK: This is Nick Jayjack, Nick Jayjack from FERC.

So my understanding is the part that we required, the literature review of the glacial surge analysis, that will be filed prior to the end of this year. So November -- I think you said November 15th.

MR. PADULA: Correct.

MR. JAYJACK: Okay. And then just -- I haven't followed as closely as some. So the second set of material that we did not require, when are you proposing to send that out to the group? Is that -- is that the February -- end of February data, or February date?

MR. DYOK: That's correct. We just need to keep in mind that that's a draft at that point. Gabe will not have a final, you know, document. But he's willing to meet with folks as soon as he's got his information to discuss it and that is something that AEA was doing external to the ILP process.

MR. JAYJACK: Okay. Thank you.

MS. WALKER: This is Sue Walker with NMFS again.

I'd just like to, for the record, make it known that NMFS does intend, and other licensing participants also intend to make a request to FERC for a modification of this study.

We note that current NEPA standards, at least as set by current practices and by recent case law, do require an assessment of the effects of changing climate on a project of this nature.

Also current ESA consultation, also set by recent practices and case law, require an assessment of changing climate. We're working with the University of Alaska Fairbanks and with our earth research science lab in Boulder, Colorado, to study the effects of climate on this project.

Although FERC did say that if there were unanticipated changes in future climate, that the license could be reopened, we find that changing climate is neither unanticipated nor a future condition. It's certainly happening right now.

The literature search is very well done. We did appreciate having that resource made available for our use. But we will be making a request for a modification to this study, and it may be unfortunate if we don't have the information that's being collected by Gabe and Regine Hock, because I believe that work is being done very well. It's an excellent study. That's what our climate scientists agree, and I think it would be very useful if we could meet with the climate technical work group, which we've only had a couple of meetings. It was very, very useful to us, and we would ask again that we be allowed to have that meeting. It would just be a couple of hours of AEA's time and Gabe's time.

So thank you.

MR. PADULA: Thanks.

Any other comments that we haven't heard yet? I'd like to move us along, but if there's maybe one or two more.

MR. PHILLIPS: Is it on? Is it on? Guy Phillips, Kier Associates.

Yesterday morning, I asked a question and was told I was premature and so I tried to listen through the day to see if the answer would emerge over the course of the day or the end of the day.

And then at the end of the day, I asked the same kind of question around a much narrower and what seemed to me to be a much easier topic which was (indiscernible - distance from microphone) research.

The question was that I asked yesterday is how does all of this fit together? I still have that question. So please (indiscernible - distance from microphone) and I'm still confused in how this all fits together and I'm a little concerned that it's premature to be asking these questions. (Indiscernible - distance from microphone).

I think that it's fair to say that -- well, again, I'm the newcomer on the block, so excuse me I beg your (indiscernible) for that. But I think it's fair to say that we're all making the best effort here to follow the path and build what I will call (indiscernible - distance from microphone) library. And in that library will be sort of a collection of books, on what are the issues involved in designing and building the largest dam in decades in a watershed of (indiscernible - distance from microphone).

And in that -- on that path is everything from collecting raw data, putting that raw data together in some fashion that characterizes the watershed, which I was told yesterday was the stage we are in and why my question was premature. But then as we develop that characterization of the watershed, we're going to need to do some modeling. And there's lots of discussion of modeling. There is going to be some more discussion of modeling today. So there are various stages in the modeling effort already, in which we are using some models to characterize the watershed and in some cases we're already making predictions.

In this trail that we’re following get to the library, it seems to me that we have a (indiscernible - distance from microphone) process that we’re following, more or less. That is, data collection that includes culmination of data collected remotely, observational data, and so forth.

And then along that trail is the characterization work that I just described that involves modeling. But that is very different point in the process with prediction, and a lot of people are confused in this room, I think, from the questions that I've been hearing between characterization and prediction. And to the extent that we remain in a confused state, we will continue to be fighting with the same questions.

So if the answer to my questions yesterday is the same, that this all comes later, and that's according to decisions made by FERC, then I would make a plea to FERC to change that decision, to change that outcome and move the process of trying to agree on what the library looks like to earlier rather than later so that you see how all this fits together.

I'll use one example that I already used with the Beluga whale yesterday afternoon as another for us to try to understand how this fits together. And I asked about the modeling aspects with the belugas (indiscernible) and how it was tied in with the hooligan and the connection wasn’t described but it was somehow going to be in the same model.

Further, on furthering the (indiscernible) content model, we moved in from the characterization process into prediction, and answers to my questions turned to (indiscernible) or want me to use the modeling to predict the impact of reservoir operations on the beluga whale habitat. And yet as far as I can tell, the mapping or data collection around the beluga habitat isn't occurring.

So how do we fit that together later on? Or do we just defer the point at which we argued about that to another time in this process?

So if the answer is the same, I would encourage, plea with FERC that (indiscernible) at which we are going to try to fit all this together sooner rather than later. And we have two more days on this kind of discussion and that will maybe make some kind of discussion around that (indiscernible).

MR. JAYJACK: This is Nick Jayjack from FERC.

So I think I followed what you were saying, but correct me if I'm wrong. The library that we're creating, right now we're at the draft stage. It's the ISR.

The final library, if you will, is the USR. It will include the characterization, as you mentioned, of all of the resources that are out there now. In some instances, it will have predictions, as well, as to what potential effects could be, but really, in this process, the first predictions will be the draft license application that comes after the USR, but of course, prior to the license application being filed.

And I'm anticipating, as in all the ILPs we work with, that that's where you see everything being put together for the first time and a cohesive, you know, complete, more comprehensive look being looked -- taken as to what potential project effects would be.

So it's all regulatory. The regulatory milestones, I don't know what kind of freedom we have to move things around. But that's kind of where we're at. Where we're at right now is we're in the draft library stage, if you will.

MR. PADULA: Thanks, Nick, I appreciate it.

MR. JAYJACK: Yes, I understand the process and the constraints within which you operate.

To the extent that we're trying to characterize this whole dynamic (indiscernible - distance from microphone), it would be helpful if we also characterize how we're going to use it. It would be helpful in that same characterization process to say we now have this as a picture and I think characterizes it and here's how we're going to build upon that to move to that place where we can actually make predictions, rather than wait until the USR to be already making predictions when we haven't really agreed upon the (indiscernible). I think it'll save you time, save everyone frustration.

MR. PADULA: Thanks. We're going to move on.

MS. WALKER: Can I have just one more question?

Gabe, could you turn to your slide that has the graphs of glacial runoff? The -- no. That one.

I think it's really important to know the question that we need answered is on the bottom graph there of runoff over time.

We need to know where the Susitna glaciers -- water glaciers are. And I've talked to other glaciologists and climate scientists who believe that for Interior Alaskan glaciers, we're on the descending loom of that curve.

I think that that's really the big question that we need answered. Is that a question that your study is going to provide some information on where we are located on that curve?

MR. WOLKEN: That's right. I couldn't agree more with you. That's a critical question for this. And what we hope to provide is within these simulations of future runoff out to 2100, we should be able to see what trend is in runoff and discharge throughout that time period.

That at least within that 100-year period to give us an idea of where we are on this curve. If there is a decreasing trend in runoff, then that would be indicative of where we might be. If there is an increase, then that would be indicative of where we might be.

Keep in mind, however, that's a 100-year period that the model (indiscernible) for us, those simulations are restricted, they are restricted to that particular import.

MS. WALKER: Okay. That'll be useful. I think that'll be useful for FERC staff.

And FERC did note that their staff would find this information useful in making their decision on any license application and I believe that your study is ending, it's wrapping up now. So I'm wondering if there will be enough information then for FERC staff to use in their license decision, based on your study being completed now?

MR. WOLKEN: Is this a question about the timing?

MS. WALKER: The timing, and also whether your work will be completed in your eyes.

MR. WOLKEN: We will be completing the study to the degree that we can given the deliverables that we agreed to with AEA.

MS. WALKER: Thanks.

MR. PADULA: Okay, we're going to move on. Here's Bill. This isn't Bill's time but he assures me that he going to help us make up some ground here.

UNIDENTIFIED MALE: Question – are we following a different order than is shown on the website?

MR. PADULA: No, I think we're following the same candidates that are on the website, the meeting website, the AEA website.

MR. DYOK: I think his question is on the website, they list the presentations in a different order than what's actually.....

UNIDENTIFIED MALE: (Indiscernible - interference with

speaker-phone.)

MR. PADULA: Yes. We're going by an agenda here in the room so there has been some reordering.

MR. DYOK: No, no, no, no. He needs to look at the agenda. The agenda is actually correct. The way they just posted the presentations doesn't follow the agenda.

MR. PADULA: Yes, not the order of presentations as they're posted. There's actually an agenda that's posted, and we are following that agenda.

So next up is --

UNIDENTIFIED MALE: Thank you.

MR. PADULA: Oh, did you state your name, please?

MR. HAMRON: John Hamrick.

MR. PADULA: Great. Okay. Moving on.

GEOMORPHOLOGY (STUDY 6.5)

MR. FULLERTON: Okay, Steve, thank you. Bill Fullerton here.

And the rest of the morning we're going to be presenting the geomorphology studies. And I say studies, plural, because there's two of them. There is the geomorphology study, Study 6.5, that I'll be presenting and leading the discussion on, and then there's also the fluvial geomorphology modeling study, Study 6.6, which Lyle Zevenbergen will be presenting and leading the discussion on.

And these two studies have the common overall goal of characterizing the geomorphology at the Susitna River and predicting the effects of the project on that geomorphology. The difference in the separation between the two is in the tools being used and applied in that study. With the modeling study concentrating on the development of the computer simulations and computer models, the 1D and the 2D bed evolution models.

The slide here has part of the objectives. There's actual -- the 11 objectives for the geomorphology study, I'm not going to go through each one of these, but the very last one, you know, is the integration of the fluvial geomorphology modeling study and the geomorphology study. These -- in a way, they're not two separate studies. They're very integrated. The folks working on the modeling part, many of them are working on other aspects of the geomorphology study. Again, the separation is mainly on the tools.

There's 11 study components. Each one is related to or corresponds to the study objective.

Also kind of give a little background. Much of the work in the geomorphology study, 6.5, was conducted or started as part of the 2012 studies. And a lot of this is was used to help inform the development of the RSP.

There are several variances in the -- associated with the geomorphology study. I've highlighted three that we'll discuss a little bit. And there's actually three slides here with variances, of which most of them are -- just deal with timing of material being delivered, being somewhat delayed through the land access, and other issues.

A couple of them are actually variances because we're providing more information than was originally identified in the RSP, so we're pointing that out.

But the three variances I'll discuss, two of them are highlighted on this slide, and they both deal with the data that was being collected by the USGS, the sediment transport data.

The first one deals with the bed-material sampling. It was not conducted in 2012. There's been flex samples at each or near each of the locations where they've collected their discharge and sediment transport information. Due to the high flows, they weren't able to -- there weren't exposed bars. They couldn't do their pebble counts.

This is not an issue because we've done in the geomorphology study extensive bed-material of sampling throughout the Susitna River from the upper river, down through the lower river and tributaries. So we've got a good characterization of the bed material without that information.

The second variance was -- that dealt with the bed-load sampling for the Susitna River at Tsusena Creek, and that was terminated after 2012 due to logistical and safety concerns.

Again, we don't see this as an issue because we have alternate means of determining the bed load at that location and they did continue the other -- the suspended sediment sampling as well as their discharge or the gaging station.

The last variance I was going to discuss is associated with the collection of aerial photography. Originally it was intended that aerial photographs in the middle river would be collected at three different discharges. These would be used to develop habitat area versus discharge relationships in the middle river.

We have only collected aerials at one target discharge, the medium flow, 12,500. Again, the other -- this task of the use of the three aerials is kind of a carryover from the 1980 study where they used that type of a relationship to help determine the effects of the project on the habitat area.

But with the approach we're using now in 2013, '14, '15, to have focus areas where we have complete topography, the bathymetry, we're running 2D models. We can determine at any discharge the areas associated with -- the habitat areas associated with that discharge. So we don't need the aerial photos to do the -- to develop the habitat area versus discharge relationships.

The rest of -- as I said, the rest of the variances are mainly dealing with timing.

Those are the results of the ISR. I'll just to go through this real quickly. We've submitted back in March -- or February and March of 2013, seven different technical memorandums that represented a lot of our work that was done in 2012 and early 2013.

In the ISR itself, we had four very substantial appendices or basically technical memorandums in themselves and we've also updated our geomorphic reach delineation and characterization and filed that in May of 2014.

And just a few slides here highlighting some of – since we can't show information from all 11 study components. This is just some of the sediment transport relationships that were developed from the data the GS collected in the '80s and also 2012, 2013.

This is incredible information. A lot of rivers were studied. Just don't have the opportunity of having data that spans this time frame or as at many locations as we got them.

This slide just highlights one of the findings from the geomorphology study and the field work and integration with the modeling effort, and that's the succession model that Mike Harvey developed to characterize the current condition and the relationship between the river stage and the various geomorphology surfaces.

The takeaway from this was that we found that the ice influenced -- the ice processes influenced the development of the surfaces, it's not just purely fluvial driven.

And the last part here is the decision from the ISR on the six tributaries that were selected for study in the reservoir area as in conjunction with areas of (indiscernible). We're not going to go over the information from the -- since the ISR, the 2014 efforts.

If you do want -- we talked yesterday, Lyle may discuss the modeling behind the decision on extension of the model or not extending the model below Susitna Station.

There's -- and going forward, there's no additional modification other than just continuation of the variances that we've identified for 2013.

The last couple of slides just show the status of the study. If I could tabulate this with 11 components, it's a bit difficult. But we have three columns showing the study component, what was completed to this point in time, and then what's planned for completion. And it goes over each one of the 11 studies, and to kind of highlight things, the regular font is work that we've completed. A substantial effort, but still have a substantial effort to do, such as the component 6. The component 7 is one that we've basically completed and it's noted with the italics.

And then the bold are studies that primarily are being undertaken in the second-year study.

And that's -- I'm ready for questions and discussion.

MR. PADULA: Thank you, Bill. And there's 12 minutes. Great job.

MR. FULLERTON: A record for me.

MR. PADULA: I know you've got a lot of material to cover.

So we're open for questions for Bill for his portion of the work. Again Lyle will be up just after the break, so if there are questions for him, please hold those.

MS. GLASS: This is Dara Glass from CIRI. And, Bill, I'm sorry; I cannot remember why the study is not going beyond Susitna Station.

MR. FULLERTON: So the study is not going beyond Susitna Station -- well, this study actually does go beyond Susitna Station. It's the models that we're not extending beyond. We are doing other geomorphic characterization and that's downstream all the way to the mouth.

MS. GLASS: But what's the reasoning behind it? Is the next study going to deal with that?

MR. FULLERTON: Yes. That's what Lyle will address. I think it'll be more cohesive.

MS. GLASS: Nobody brought me my Pepsi, so I'm a little --

MR. FULLERTON: Again, it's a little confusing that these two are separated to begin with.

MR. MCLEAN: This is Dave McLean from Northwest Hydraulic Consultants.

So because the sediment modeling and the sediment -- geomorphology studies are very integrated and because we have questions on how the two are going to be tied together, how you're going to use different methods to check different predictions, actually, I'd be interested in hearing the modeling presentation now and then we could give questions on both together rather than just talk about geomorphology and end that and then talk about modeling because I think they are very related.

MR. FULLERTON: I have no objection. I think that's a good --

MR. PADULA: We wanted to get through Bill's piece, go right to Lyle's piece, and again, if you have questions then that really relate to the two and how they interact, we'll be right there.

Any other questions just specifically for Bill on his material?

MS. WALKER: Yes, I have one comment that relates to variance in the literature search. Delaying the literature search until after the study tasks and data collection are substantially completed is really unfortunate because it reduces the opportunity to incorporate really important lessons that have been learned from other projects into the study program and the study design.

Normally the literature search would be conducted near the start of a project so that those -- that information could be brought in and those lessons could be applied to this study. It doesn't seem to be cost effective to delay this.

And the reason given is for coordination with the riparian instream flow. I would think that study could benefit from the literature search being done sooner rather than later as well.

MR. FULLERTON: Well, the literature search has been completed and the technical memorandum was submitted.

MS. WALKER: Is that something then we'll be receiving by November 15th?

MR. FULLERTON: It's -- should be posted now because --

MS. WALKER: Because that's really good news.

UNIDENTIFIED VOICE: It's not posted now.

MR. FULLERTON: Oh, I'm sorry. I thought --

MS. WALKER: That was a question. Is that information then that we can expect to receive by November 15th?

MR. FULLERTON: Yes, we'll have that by November 15th.

MR. MCLEAN: So the follow-up question would be, has what you -- the lessons that you learned from that literature review, is that reflected in the ISR and your study planning and the whole program that you've launched on this whole project?

MR. FULLERTON: Yes, because the literature search was being conducted from early in the project. We've been reviewing the literature.

We had submitted, I think with the initial -- the part A of the ISR had a bibliography with all the references in that. So what's gone on in the -- since then was kind of coordination -- more coordination with the riparian and actually grinding it up and synthesizing information.

MR. MCLEAN: But there's no actual sections that describe lessons learned or case studies from previous projects? That is not visible, at least to me.

MR. FULLERTON: In the ISR?

MR. MCLEAN: Yes.

MR. FULLERTON: No. We don't have that information in the ISR. But some of the information such -- a lot of it on the ice processes, influences, like that, helped Mike a lot with the field work that was conducted, and also help Kevin Fetherston, who is conducting the riparian study. So we've been taking advantage of that information and that was in that literature, whether it's reflected as lessons learned in the ISR or not.

MR. MCLEAN: Thank you.

MR. DYOK: This is Wayne Dyok. If I can just make a comment?

Maybe the agencies and others here can help us out because one of the challenges that we've got is in this series of tech memos that we prepared to try to help, you know, folks, to give you current information,. I get criticized because we've got so much information, so we actually held back part of this because of - when we got the feedback, we were told, "Oh, it's overwhelming."

So do you want us to give you a hundred pages of maps? Because I think this is really important for us. Part of the goal here is to give you information, and I don't want this coming back to say, "Hey, you gave us so much information we couldn't deal with it."

Because part of the challenge that we have now to get ready for the next field season, we don't get first determination until April 22nd. We need to be out there potentially on May 1st. And if there are some significant changes, it's going to be a challenge.

So I'm happy to give you, you know, information, but I'd like for us to talk about how that information is going to be used and make sure you get it in a timely fashion. So could we work together on information that we need and when you need it and the kind of level of information, I think that would help all of us as we go forward.

MS. WALKER: This is Sue Walker, with NMFS.

This information, not having it now is a variance. We would have expected it in draft, the literature search. So however long it is, you know, we would have expected it earlier, but now is certainly better than later.

MR. DYOK: And I'm not going to debate a variance or not here with you. We will provide this by November the 15th..

MS. WALKER: List it as a variance.

MR. KRISTANOVICH: This is Felix Kristanovich with Environ (indiscernible) and I would like to raise the point with integration of this study with other studies.

Like for example, the model integration (indiscernible) diagrams showing how one study relates to another study. I know that (indiscernible) [the effects in the lower river]. For example, if you turn to pages 20, 21, it says (indiscernible) results. I would like to know more specifics, you know, how specifically parts of this study are going to be used (indiscernible - over-modulating) for example with respect to changes in the ice process model, or basically the relation of all the other models, how does this all fit together. I don't know whether to (indiscernible).

MR. FULLERTON: Well, I think the presentation that Lyle provides pretty much concentrates on -- within our study but we can talk about that. I think it would be good maybe we can talk about that after Lyle does his presentation and, you know, it's -- Felix's question is along the same lines as Dave's, so we can kind of address those or have a discussion all together. But I think it would help to have Lyle's presentation.

MR. JAYJACK: This is Nick Jayjack from FERC. If you all don't mind, I'd like to go back to Wayne's question just a few minutes ago, because I think it's really pertinent to the process.

I think Wayne was speaking more generically than just about this study. I think the question's a good one. We were sent over 1,500 pages of additional information that, as Wayne stated, I think he felt would be helpful to the process.

And so we -- you know, for some it was difficult to have that kind of information, the volume of that information, prior to this meeting, including us, I will admit. It was a lot of information.

But I see Wayne's point, that having that information could be valuable, but he's kind of walking a thin line as to do I provide it or do I not provide it. So I think it's a worthwhile quick discussion to have what do folks want. Do you want information and -- for all intents and purposes that's in real time, or would you prefer that the information be held back?

I'm not talking about necessarily information that was required by the study plan determination. I think it's more generic than that. The studies are ongoing. They don't stop. They don't stop for timelines. They're -- you know, information is coming all throughout this process.

So I'm just curious to hear what folks have to say about should he hold off on the information until we actually hit a mile -- technically a milestone, or is it better to receive the information a little bit more real time?

MS. LANCE: This is Ellen Lance, Fish & Wildlife Service, and I'll speak for the Fish and Wildlife Service right now.

But I think we had discussions with Wayne about continuing the technical working group meetings to share information and I think that would be really valuable going forward, as we're starting to get into the meat of this information. And I think that would be a really helpful way to share information that's not necessarily in a formal manner.

And also, with regard to the many, many pages of new information, I can understand sort of wanting to pulse it out to us. We just need a heads up so that we can prepare for it, because you know, receiving it a month before and expecting us to comment on it isn't a reasonable expectation.

So I can understand that you need to provide this information, we just need to have a good heads up that it's coming. So knowing that we're getting more November 15th is very helpful. Thank you.

MS. WALKER: This is Sue Walker with NMFS again, and I concur with Ellen.

I'd add, though, that in addition to knowing when we will receive information, we would like to know what we're going to receive in as much detail as possible. That's been a very frequent request of the services. What are we going to get? What's it going to look like? How long is it going to be? And we need that detail. That has not been information that we've received, even this time.

We were told five to ten pages of information in 20 or 21 reports. We ended up with over 1,800 pages and less than two weeks of expected review time. Having had that pulsed out, staggered out, that would have been much easier, I was hoping, and easier to plan if we knew what was coming. So yes, give it to us when you have it. Stagger it. We can't work on it all at once anyway.

MS. STEELE: This is Marie Steele from the Alaska Department of Natural Resources.

I do agree that having a heads-up that the materials coming and what it comprises of is very important, because we have -- the reviewers have a responsibility to get their feedback to you in a timely fashion so that if they can schedule a time, that would be great.

I do want to reiterate that the reviewers have a responsibility to review this material in a timely fashion and get the feedback to you. I do say that there are reviewers on the State side who have reviewed the technical memos and they are frustrated that this information, this timely dynamic information has not been discussed at today's meeting. So I think there is a fine where you have those that are able to assimilate the information in a timely manner and those of course feel over-whelmed.

MS. LANCE: Ellen Lance, Fish & Wildlife Service.

Just wanted to get back to your question about reviews in time for you to prepare for the field season. And we do intend to look at what we have and try to prioritize our comments to you so that you can prepare for the next field season as much as we can.

MR. DYOK: Yes, thank you. That's much appreciated. And maybe if we could take a few minutes tomorrow afternoon, I know people are probably going to be in a hurry to get out of here, but just to go through the information that we're going to be providing by November the 15th, so we all can be on the same page.

I understand where you're coming from, you know, Sue and Ellen. You want to know what you're going to get, when you're going to get it, kind of what it's going to look like. I appreciate that.

MR. PADULA: Any other questions on this topic?

MS. WALKER: One final word. As Ellen touched on the need for technical work groups, I think that would help us greatly to process this information very quickly if we had technical work groups that were really work groups where we could sit down and have discussions and not be just given a presentation, but actual interactive technical work groups.

The licensing process has evolved to the point where more and more of that is happening and that's been extremely helpful. So I would encourage that to happen in this short time frame that we have before us now with the new schedule.

MR. DYOK: We'll ask Lyle to be very, very, very terse as he goes forward with his modeling presentation. I think, you know, we're hearing from everybody here that they want discussion, so let's presume that they've read the materials that are in the ISR and they've looked at your slides and let's go forward from there.

MR. PADULA: Lyle, are you all set?

MR. ZEVENBERGEN: Yes. Thank you.

MR. PADULA: Let's do a 15-minute break. Lyle will get set up, and hopefully we can have a really overall discussion of geomorphology.

(Off record.)

MR. PADULA: It's time to get started. I wanted to make one comment. Just this one comment.

I know this is challenging for everyone, and it's got to be amazingly challenging for folks who haven't been in the process the entire time who knows all of this history of information and where things are.

So with regard to some of the questions about model integration and essentially do we know where we're trying to get to and are reflecting the right information and how do the models work with one another. There is a pretty good write-up, and it's -- for those who want to write this down, in the June 8.5 ISR, that's the instream flow ISR, Appendix N has discussion on model integration. So for those who are looking for kind of that basic roadmap of how this is all intended to come together, there is a good write-up there.

It's basically based on the proof of concept work that's been done. So again, I would -- for those who, again, maybe haven't been with us, and don't realize a lot of that thinking been done, I would refer you there.

And, again, if that generates more questions, that's great, but I think that's a good place for folks to start.

So thank you. And I'm going to turn it over to Justin, who's --

MR. ZEVENBERGEN: I touched the computer and I broke it.

MR. PADULA: Oh, my gosh. It's bad when the modeler does that. I'm worried.

All right. A few seconds while we boot the computer back up.

MR. CROWTHER: That's a different computer.

FLUVIAL GEOMORPHOLOGY MODELING BELOW WATANA DAM (STUDY 6.6)

MR. ZEVENBERGEN: Well, I can say that what I'll do is I'll go very lightly on the ISR material, because that, obviously, you've had time to review, and just touch on some of the changes, modifications, that sort of thing, very briefly.

And then since there's been a lot of questions on the decision point and that sort of stuff, I can bend these back into that information and hopefully answer a lot of questions that have been coming up.

The other side of things is that with the range of studies and all of the integration that does need to take place, that naturally you do have questions regarding a component that affects several studies, but you don't get to hear the presentation until the second day or get to discuss that until the second day.

So I appreciate your patience. And hopefully we can get a lot of your questions answered.

As Bill said, the geomorphology and geomorphology modeling studies are intertwined. They're really one big study, so the interaction is continuous between those studies.

And the -- so we are -- we're always looking at how does the modeling identify issues and then how does the observation inform the modeling, and that sort of thing. So there's a continuous integration between these two studies.

And so to call it formal, you know, it's not like we sit down and have weekly meetings or anything like that. It's always a continuous discussion, and then the modelers versus the field crews, and then the interaction between those.

MR. ZEVENBERGEN : It's slow. I really did break that computer.

So our overall objective, overriding objective, is to characterize the river and to make predictions as the -- as we move forward. So the -- you want to characterize the response of the river, identify what the primary processes are, and use the -- the models to make the predictions in the -- into the potential project effects.

There were no variances in this study. The only variance that -- the only difference really was in the timing, getting access to getting data collected in certain areas, some CIRWG lands, and that sort of thing.

That really wasn't a change, because we didn't anticipate doing all of our data collection in one year to begin with, so we were counting on multiple field seasons, and so that access was not an issue for our data collection.

In terms of our results, in the bed-evolution model development that was reported in the ISR, it focused really on the selection of the models. We wanted to select the best models for the project, and our models became either one-dimensional modeling, reach-scale modeling from Watana Dam down to PRM 29.9.

And the -- that model was selected as the Corps of Engineers' HEC-RAS model and they were very happy with that choice. HEC-RAS version 5.0 is a beta model. The Corps of Engineers was very interested in having us apply this model to the project, and so they've been very supportive of that.

MR. CROWTHER: You can go ahead – we'll get it working.

MR. ZEVENBERGEN: Okay, great. Thanks.

So I'm really up on slide 5 here. There you go.

So the modeling itself was in process during the ISR, development of the ISR.

The two-dimensional modeling that we're doing in the focus areas is related to detailed sediment transport and detailed hydraulic information at the focus areas. And that model is the Bureau of Reclamation as their SHR-2D model was the model that we selected for that.

And again, we have models that were in various stages of ten focus areas, so some of the focus areas have a small amount of work done, and then some of them, like focus area 104, was in process at the time of the ISR.

Study component 1, in terms of the model development, I really would like to identify where all of our data comes from. It comes from numerous studies. You can see Study 8.5, the cross section, bathymetry data. We get substrate mapping from Study 8.5, water surface elevations. So really a lot of data has been collected for both model calibrations and model inputs that you -- for our study and for other studies, as well.

Study 7.5 was stage hydrographs, and then the work that we're jointly doing between geomorphic -- geomorphology and the modeling.

Winter bed sampling, the very last bullet there, is reported in the ISR, but that was a preliminary -- just a study to see if it was possible.

Study component 2, the results include -- we selected the 50 years for our analysis that we're going to run with our reached model, and then we selected representative wet, average, and dry years. Those are for the focus area models. And that is contained in Appendix E, those two items, the 50 years and the representative years.

There was a fluvial geomorphology modeling approach tech memo that was produced in June and then the proof-of-concept meeting, modeling that was done for that, and that's at focus area 128.

This really does show some of the results there for that proof-of-concept meeting and shows the interaction that took place at that meeting demonstrating our ability to provide the hydraulic information that instream flow fisheries needed.

The two technical memorandums that are -- since the ISR are detailed winter bed material sampling and the decision point.

And I think we can just skip to slide 14.

Two modifications that were significant, one of them was including groundwater inputs into the focus area models. That was identified as a very significant item from the habitat standpoint. And then -- so that's in addition. And a deletion is to not include Pacific Decadal Oscillation as part of the distinguishing features for the hydrology.

And then on to Slide 21.

Okay. So this is a future decision point. It's identified in the ISR, and basically it's how much 2D modeling will be done at each focus area. And so this describes, you know, under what circumstances would we curtail some of the 2D modeling at the focus areas if they're not providing additional useful information.

Status and -- is -- we've really collected the vast majority of the data for the modeling. I don't anticipate needing any more data. We have characterized groundwater in flows in some of the lateral habitats, which is very useful.

And the LiDAR's completed. 1D modeling, initial models have been completed. 2D modeling, some models have been completed and some have -- are in development. And there will be a tech memo on that fluvial geomorphology modeling coming up.

Planned activities for 2015 really can be summarized into we will finalize the 1D models; finalize as many 2D models as we can given the available data; and fill in any data gaps that we identify as we put together the models.

So model integration, there have been some questions related to that. We are -- the planned integration -- and we can't really integrate the models until we have reached at least a certain state, so although we've been discussing how we're going to integrate the models, we haven't actually done that model integration yet, because the models are still in process.

But the reservoir trap efficiency from water quality is something that we'll need to look at. Ice break-up surges from the ice processes modeling is an important factor that we were talking to Study 7.6 on.

Groundwater in lateral habitats, that includes both Studies 8.5 and 7.5.

Large woody debris is really part of our study, but it needs to be integrated into our modeling.

The turnover analysis will drive a lot of the information related to production of large woody debris, and also sediments and future change, and floodplain accretion with Riparian Study 8.6.

So those are the primary levels of integration.

So, if I touch this, hopefully I don't break it. Let's see here. Page down.

So questions? I'm sure that took longer than I was supposed to have.

MR. DYOK: You did fine.

MR. ZEVENBERGEN: Good.

MR. PADULA: So you've got Mike, Lyle, and Bill, very integrated (indiscernible). So no, feel free, questions (indiscernible).

MR. MCLEAN: It's Dave McLean.

So my question would be -- if I can start off with an observation that I think most scientists would agree that a lot of these processes that govern channel stability, changes in channel pattern, complex sedimentation interaction between fine and coarse sediments, these are all fairly imprecisely understood and so there's a lot of inherent uncertainty and predictions. I think that's a given.

And yet, I mean, we have to try to come up with predictions and I realize the challenge that your teams are facing. It's quite a complex problem to deal with.

So some people advocate trying to use a variety of techniques using geomorphic methods to provide independent estimates to compare it with modeling estimates and trying to provide checks and balances on these different levels of predictions.

And you talk about integration, so I guess I'm curious to know, could you give some examples of how you are planning to make -- or are you planning to do those kinds of independent verifications or checks with perhaps simpler methods than a 2D model, but that will help validate these results, and will you be trying to give people a picture of what the uncertainty is in these -- in these answers that you're coming up with?

Because that seems to me almost as important as the answer itself. So it's more of a philosophical question, but I thought I'd start with something like that.

MR. FULLERTON: Just one of the first things, which I guess in terms of -- is this portable here?

Okay, so one of the first things we've done is a comparison of some of the model results with what we see in terms of level of response in historical cross sections. So as part of the geomorphology study, 6.5, we have a tech memo which I believe is quite a historical cross-section comparison, where cross sections that were closely located between the 1980s study and the current study were compared.

Also we used those cross sections to develop a profile. And then when Lyle's -- now, we don't have the luxury of having the complete set of data that you could run from the 1980's and compare -- you know, start 1980's and run the present, the response.

So what Lyle did, and maybe you can expound on it, when he's looking at some of the initial runs, and Lyle has compared the level of response and the direction of the response when he ran the 60 years of -- or 50 years of historic record.

Actually, if people were interested -- I mean, there's a tech memo in one of the slides that I had that was 2014, after the ISR showed one of those cross sections, and -- a profile, which it's kind of hard to see anything from the scale on the slide and stuff. But that's one thing.

And then Lyle's got some interesting slides. I think that one of the things I talked about that we were going to be doing is developing the sediment transport relationships in Study 6.5, which in places were used as the supply to the system from the upstream and the tributaries, but also it's at some of the intermediate points Lyle did comparisons of what we were getting from the model in terms of transport with what had been majored over in -- in the 1980's and currently by USGS. And that slide is in your presentation to -- do you want to pop that up, and --

MR. ZEVENBERGEN: I do. But I mean, I think I'm going to also add to this question a little bit more, too, and it does refer back to something that you said in your presentations, that we had different tools.

We have the modeling tools, and then we also have a lot of other process relationships that we are looking at, whether these process relationships are related to grading, channel grading, channel form, channel plan form, you know, whether the modeling is going to tell us something that is incongruous with what the observed features are out there, and so we are doing those kinds of comparisons. So we do have different tools, but we are cross checking the modeling versus the observed information.

MR. HARVEY: Maybe I can just weigh in, too as sort of a baseline.

I've spent my 40-odd-year career being a cynic or a skeptic about models. That's my job on this thing, is to look at the modeling and see if it actually makes sense with what's out there.

We spent a lot of time out on the ground over – nearly three seasons now, pretty much covered every bit of that river and so we have a really good handle as to what's out there. And, you know, as I'm sure you're aware, if you look in the literature.

Most -- well, you can make a generalization that most rivers are singular, that basically responses of a given river to a project are not necessarily transferable, because in essence, each one has its own set of conditions.

In fact, the dam literature will tell you that, that it's very difficult to predict, based on what's happened elsewhere.

And so I think from the perspective of field observation and modeling, I think we have a pretty good understanding of what's out there, and, you know, and probably Lyle’s (indiscernible) with his modeling because we talk about it and say that makes sense or it doesn't make sense for what we're seeing out there.

So to try and answer your question there, yes, we're going backwards and forwards. We're looking at modeling, and we're looking at observation as well.

MR. MCLEAN: Yes, I'm sure you are, and I'm sure any team would do the same.

I guess my question was: Are you actually going to try to make formal analytical calculations and predictions using non-numerical methods to come up with a separate answer so that you can try to -- as an independent check on just the modeling result?

So it's one thing to say while we -- you have a vast amount of field experience, and it makes sense intuitively. but, I mean, there's also a more formal methods that can be done that give you some way of bracketing the predictions.

To me -- I mean, lots -- you can make -- now that we have powerful computers, we can make tons of predictions. How are you going to put the error bars on your predictions?

MR. ZEVENBERGEN: Well, part of that process is doing the turnkey analysis. And we will be looking at -- again, with the models, looking at changing inputs, seeing how the system responds. Is it sensitive to the input or is it insensitive to the input? And we'll be doing that.

We'll also be comparing the results from the different models, and they're extremely different models in 2D versus 1D.

But then in terms of calculations, again, we have the information going back to 2013 tech memos, where we have looked at the sediment transport relationships, looked at the combinations of existing conditions, periods of time, and that sort of thing, to get predictions of how the system is working right now, how the system could respond, put some -- like you say, put some error bounds on that.

And so the -- if you look through, I think, the range of tech memos, at the attributes related to sediment turnover, geomorphic mapping, and that sort of stuff, but that is the basis of comparison for a lot of the modeling that is taking place now. So --

MR. HARVEY: Well, you obviously have something in mind, in terms of your non-numerical testing. I'm just curious as to what you think.

MR. DYOK: Use a mic.

MR. HARVEY: I'm sorry. Obviously, you have something in mind in terms of a non-numerical way of testing the modeling results. And I'm curious as to what you might be suggesting there.

MR. MCLEAN: Well, it's more of a philosophy in a way than speaking about a specific. But I guess I'm thinking of the kinds of work done by people like Kellerhals and Church over periods of decades on -- and essentially, I guess, I'm borrowing their -- some of the work that they have produced and some of the things that they have advocated for studying the effects of large projects on big river systems. So in a sense, I need to acknowledge that I'm reflecting their philosophy on how to study a river.

In terms of specifics, I think the -- what you call a turnover analysis, I would think of more of a sediment budget or a channel zone sediment budget analysis. I mean, that's one way of coming up with sediment loadings or transport rates that's somewhat independent of the bed-load measurements.

So that, to me, would be certainly one of the more critical aspects for looking at the bed loads. So of course the bed load is a very tiny fraction of your overall sediment loads. I mean, it's like 1 to 3 percent or something. I can't remember the number. It's a tiny fraction. And yet, of course, it's so important for habitat, for building the habitat of the -- that's used by fish.

So understanding that bed load seems to me very critical and the data for characterizing it is so -- such a huge range of numbers that you're relying on, like the rating curves that you've put into these -- you know, there's a scatter of the usual two orders of magnitude. I saw one -- for the bed-load rating curve, at a discharge of 15,000 CFS. The bed load could be anywhere from 100 to 10,000 tons per day. I mean, that's 100 -- yes, 10,000 tons per day.

So if you can overcome that -- I mean, that poses a huge limitation on your predictability. And sticking a logarithmic rating curve through a scatter of that magnitude is a very brave effort.

But -- so finding other techniques that can allow you to come up with predictions seems, to me, very important. That's what I'm trying to emphasize.

MR. ZEVENBERGEN: So I think that's a really good segue into the modeling results and --

MR. HAMRICK: We're not seeing the full slides.

MR. ZEVENBERGEN: Would you go to Slide 12, please? Is -- is --

You don't see the transport slide, John?

MR. HAMRICK: The left -- I think the right side of the slide is cut off. I see the slide but only about two-thirds of it. Yes, that's much better. Thank you.

MR. ZEVENBERGEN: Is that better, John?

MR. HAMRICK: Yes, very good.

MR. ZEVENBERGEN: So this slide does show the USGS bed-load data that was, what, in the '80s and more recently, and it does show a very large amount of scatter. And this shows Gold Creek, Sunshine, and Susitna Station.

The large amount of scatter isn't because of data collection errors. It's natural scatter that you would expect in this kind of a system with all of the complexities of the different sediment inputs from the major tributaries and the -- just the natural processes of the transport. So the -- we do put in a -- as you said, a logarithmic rating curve as a boundary condition to the model, at the sediment supply, and yet the model is also providing us with a lot of that scatter at Gold Creek, the majority of the scatter at Sunshine, and the majority of the scatter at Susitna Station.

So the models are very complex models in the processes that they are simulating in terms of the hydrodynamics and in terms of the sediment movement, sediment storage, changes in the substrate through time. And so this is an example of the kind of data that you just don't have in most projects.

And so the -- the data that we're -- none of this data was used as the model input. You know, this data was only used for this kind of comparison, and also to develop the loads -- the long-term loads, the long-term sediment yields from the basin.

So this is really, I think, a very good demonstration that the modeling process is incorporating a large range of the natural variability.

MR. MCLEAN: I can't read the scales, but is this --

MR. ZEVENBERGEN: The scales are --

MR. MCLEAN: -- is this the gravel load or is this the bed material load or the a bed -- gravel bed load? I wasn't sure --

MR. ZEVENBERGEN: This is the -- this is the total bed material load. So, all --

MR. MCLEAN: So it's an suspended sample plus the gravel load and the suspended sand load is, of course, much, much greater than the gravel load by fractures of a hundred or ten or --

MR. ZEVENBERGEN: Yes.

MR. ZEVENBERGEN: Yes. So the gravel loads are dwarfed by the sand loads. So that's why this next slide is, I think, really important. I'm doing page up and page down, and -- okay.

So this -- this next slide is also important. So it's not just the loads that we are -- that we're comparing, but it's the transported gradations. So again, this is all of the USGS data, and it shows, again, a lot of variability. The -- and so the scales here are going from zero to a hundred percent in terms of the -- the sediment gradations.

The X scale is a logarithmic scale that goes from the very fine sand up to very coarse gravel. And so the -- this is showing at Gold Creek, at Sunshine, at Susitna Station that -- at Gold Creek, you have about 99 percent sand and 1 percent gravel on average and the model is also producing pretty darn close to 99 percent sand, 1 percent gravel.

But Sunshine is a bit different where the -- you know, you see a lot more scatter there because we have the influence of the Chulitna as a highly variable sediment supply and very major sediment supply.

And the Talkeetna is also a sediment supply that's, in some respects, greater than the middle river of the Susitna. And so very -- highly variable measured loads occurring from the modeling -- or from the measurements. And again, modeling is a red line for the model and a black line for the -- for the measurements, for the average of the measurements.

So again, a much larger percentage now. We're talking maybe 5 percent gravel and 95 percent sand at this location.

Moving down to Susitna Station, we see a much tighter range there. Definitely dominated by sand, probably on the order of 3 percent gravel, 97 percent sand. So that's -- is showing how the system is responding, and the model, as well.

Now, the models are -- they are our initial models. They do not incorporate 2014 survey, so they were based purely on the 2012 and 2013 survey data. So the models aren't complete by any stretch, but -- but these are the results of our initial model with these comparisons.

So I agree with you that the gravel is an important feature of the transport, but the -- but it is a sand-dominated system and especially in the lower river where there are very few areas where you see traditional (indiscernible) or that sort of thing. It's really much more of a sand-dominated system through the lower river.

MR. MCLEAN: So I guess this sort of brings up a question I also had. In the studies in the '80s, there was a lot of discussion about the supply limitation, about the seasonal history, the variability over the flood hydrograph of sediment loads.

And there was a question really on which fractions of the sediment are supply limited and which fractions are wash load, which are really bed material load. I guess I got a bit confused reading your text because you sort of never really specifically defined how you -- how you came up with what is your criteria for distinguishing wash load and supply limitation and bed-material load.

But I'm not even sure that the sand in some reaches of the river would be characterized as a bed material load. I mean, it may be supply limited. If you look at the bed material samples, the sand fraction in the gravel-bed reaches of the river, you know, it's very small.

So say it's 3 percent of the -- in the bed -- bed material samples and yet it's accounting for ninety- -- as you say, 90 percent of the bed material load. It's odd to think that it's -- all of the sand is actually behaving as bed material load and in fact, maybe some fractions of the sand are really wash load. Some fractions are truly interacting with the bed as bed material load. I mean, the distinction of bed material load just on the sand -- definition of sand seems somewhat arbitrary. I know it's commonly done, but usually there's some logical assessment of how you define that.

MR. ZEVENBERGEN: Well, and I agree and I think that we really have two rivers here. You have the middle river and the lower river.

The middle river, from what I've seen in the field from the data that we've collected in the sediment measurements of the -- that the bar heads, the winter bed sampling, all of our field measurements, and really digging into the available data, really indicates that virtually all of the material being transported in the middle river is throughput load, kind of a wash load condition. The sand certainly -- the -- and the gravel sizes are probably supply limited, as well, in the middle river.

The -- in the lower river, the system changes dramatically, where the interaction with the bed is probably occurring through all of the sand sizes and gravel sizes. So a huge change at the Three Rivers Confluence, and because of that, we -- and because of limitations with HEC-RAS on sediment transport functions, and that sort of thing, we have a middle river model and we have a lower river model in order to make that change because you can only identify it single sediment transport relationship for both of them.

So I have to say I agree with you, that the system really is much more of the supply limited system in the middle river and a transport system in the lower river.

MR. VASQUEZ: Mr. Jose Vasquez, from NHC. It was not clear from reading the ISR exactly how you're going to model the tributaries. I'm talking about the middle -- just the middle reach, okay, because I think that's probably the most critical in terms of degradation, if it happens, it would probably be in that area.

And because in part when I'm reading, looks like you were going to compute sediment rating curves for pre-project and then put that as inputs in the model, and my concern with that approach would be this: The way I picture it, I might be wrong, but after the dam, the water levels in the summer would be lower. It means that at the mouth of the tributaries, it's going to over seep and that might cause the tributaries to look a little (indiscernible) and supply more sediment during that period. Sometimes (indiscernible).

On top of that might be the effect that we saw before of the glaciers, if I understand some of -- I don't know if those basins are glaciated but if there are changes, there could be also changes in the sediment supply.

And so the point that I'm trying to make is the post-project rating curves of the tributary may be different than pre-project. Maybe a better way to model the tributary would actually be to include them as actually branches coming into the main stem. Is that possible or probably -- to do in the model?

MR. ZEVENBERGEN: I won't say it's not possible. The tributaries in the middle river are contributing a pretty small amount of water and sediment. And so they are treated as point sources and with rating curves that we're developing.

And so relative to the supply from the tributaries, we are -- what we're seeing, anyway, is that they're supplying virtually no sand, and the gravels that they're supplying are considerable. But the evidence of fans throughout the middle river, you know, supports the fact that they are supporting, providing large amounts of gravel.

I don't think that incorporating these small tributaries as actual tributary reaches would be superior due to the fact that there's, again, a lot of uncertainty inherent in any kind of an estimate on the tributary sediment loading, and that that approach would only be a very minor effect on the -- relative to that huge uncertainty.

MR. VASQUEZ: Okay. Yes. The reason for my question, of course, we -- we understand in that experience, when one river (indiscernible) be completely transferable to other rivers, we understand that.

But there is -- there is the Peace River in Canada that was -- there is a big dam that was built many years ago. And what's happened there is that there's been a lot of development of (indiscernible) water surface profile because of sediment supply by the tributaries that now, because the flows have been reduced, the river is not able any more to move it, and actually had a big impact in the morphology there.

I'm not trying to say that the same thing is going to happen here because, really, I don't know, but it might. That's what is my -- the concern they're raising is actually because of that, something like that may happen.

And yes, your point is actually good. You say that there is a small amount of sediment coming from that, but if it's mostly gravel, actually that's the most important, because that is the one that is going to affect the morphology.

MR. FULLERTON: Well, we are -- we are doing modeling -- sorry. This is Bill again.

We are looking -- investigating actually the interface or the fans for many of the deltas or the tributaries. They're incorporated in a number of the 2D models and the focus areas, some of the -- some of the larger tributaries, Indian River, Portage, fall within -- in the focus area. So there will be a modeling of the actual fan area within that 2D modeling.

Then most of the tributaries, the ones that we identify that had fans, we're going to look at the potential for accumulation or extension of those fans into the -- into the middle river based on the volume of sediment being transported, reduced ability of the main stem to transport, looking at how potential for constriction of the river to adjust to hydraulics to be able to transport those fans away. So that -- we are looking at exactly that.

Now, I think in terms of the degradation going up the tributaries like -- I mean, when they're -- they actually get away from the fans, they're pretty -- they're pretty controlled. They're pretty coarse. They're pretty armored and I don't envision that that would be a mechanism or concern. So the deposits where -- it's the fan deposits that maybe you could cut through in some cases. And even those are pretty course. I think it may be the opposite issue, not cutting but the accumulation that is probably more likely.

MR. MCLEAN: Since we're talking about tributaries, I wasn't quite clear, in the reservoir itself, you are not modeling any -- any tributaries; is that correct? You're not doing a morphodynamic model of tributaries coming into the reservoir? You're using other methods -- you're using other methods to assess the geomorphic changes on those tributaries in response to the reservoir levels? Could you explain why you don't model that? I'm curious.

MR. ZEVENBERGEN: The modeling in the -- starts at the dam and goes on downstream, and then the focus areas are separate models.

The models of -- we do have models that will look at the sediment development from the tributaries in the reservoir, with the surveys up there. We're not doing morphodynamic models of those. We're treating those mainly as looking at sediment inputs, and then also potential for areas along the reservoir perimeter.

MR. PHILLIPS: Guy Phillips. So, I'd like to check and make sure I'm understanding what you're saying. (Indiscernible - over-modulating) reservoir and aggregate ability, modeling changes in the sediment transport and accumulation of the (indiscernible) reservoir without (indiscernible - distance from microphone). With changes that we can foresee occurring without the (indiscernible - distance from microphone) climate changes or changes in glacier and things of that nature in order to have -- without project (indiscernible - distance from microphone).

MR. FULLERTON: So I guess to the -- and that -- currently, we don't have that in our study plan, to be modeling with a different climate scenario.

But hypothetically, if you provide different hydrologic input, we -- in terms of at least -- one of the drivers of the transport of volume and the water and the discharge amount, we can incorporate that because we're developing rating curves for the tribs that would be related to the flow in the tribs.

So if we change that flow, that would be reflected in the amount of sediment yield from those tributaries.

MR. ZEVENBERGEN: Are there particular tributaries that you're thinking of related to that question?

MR. PHILLIPS: Not specifically. But we heard about the changes in the glaciers, certainly a climate change topic which had been discussed (indiscernible - distance from microphone).

MR. ZEVENBERGEN: So, your question related to glacier-affected tributaries then.

MS. GLASS: So okay back to my question that I asked Bill that Lyle I've been waiting for you to answer because Bill said you would.

And I think I know the answer after listening to you, but can you explain again why you stopped the modeling at Susitna Station and did not go all the way down to the Inlet?

MR. ZEVENBERGEN: Thank you. And actually, the -- the initial models that I've been showing and -- okay, I'm hitting the right buttons now. You know, this part of the presentation was to just describe a little bit about these initial models, some calibration.

So this slide shows some of the hydraulic calibrations, some comparison of observed versus model, hydrographs and stage hydrographs at the various gages. A decent hydraulic calibration, decent sediment results in terms of the observed versus how the model is comparing in terms of sediment loads.

The domination of the sediment loads by sand, but the fact that there are gravels in transport, and that we are in these initial models doing a pretty good job of capturing not only the transported loads, but also the transported gradations throughout the models.

So that was just to say, yes, we are going to make this decision as to whether to extend the modeling, fluvial geomorphology modeling below 29.9. That decision is based on these models.

So this is all from the existing-conditions model. You know, the green dots on this are 9,000 sediment transport results, daily sediment transport results over a 50-year simulation period.

The large dots, you know, are over several years with the USGS measurements, but the green dots are from the simulation results.

So, in terms of the decision to extend fluvial geomorphology modeling below 29.9, in the ISR we indicated how we would make that decision. Basically it would be looking at what is the project effect at 29.9, or in the vicinity of 29.9, projecting that downstream of 29.9 and saying, you know, what can we -- what can we learn or what can we surmise about the potential effects downstream of 29.9 from the model that we've done.

And so we looked at basically three things -- or four things, and they're all to the extent possible, based on how much change would the project have at 29.9 and below compared to natural variability. If you have a very large range of natural variability and then a tiny project effect, then there's no need, no value in extending the modeling below that point.

And so we looked at flow, so the hydrology. We looked at how that could affect channel form both in terms of channel width, you know, is the channel going to widen, is it going to narrow; looking at bed aggradation or degradation; how will the channel change vertically; the sediment transport volumes with and without project, and when I say with "project," I'm talking about the one scenario that we have looked at in more depth and that's the OS1b scenario.

And so sediment-transport volumes, sediment-transport flow depths and velocities in terms to the hydraulics. All of those factors play into, you know, how much change, how much effect could be below 29.9. But our gauge really is the range and variability of the natural system.

And this is very light in terms of if you read the technical memorandum, you'll see a lot more detail, and I really invite you to read that technical memorandum to see, you know, how we made our decisions.

On the left side here, we have the flow duration curves and this is for the open water flow season. So we're looking predominantly at our -- when the sediment transport is occurring, and that's during the open water flow season, and looking at how does the flow change.

So the blue lines on there are annual flow duration curves during -- basically from May through October. We always started at the beginning of the open water flow season, so sometimes that would go into April, and then the end of the open water flow season, and we got that through the ice processes study when -- you know, when the river became ice dominated looking at Talkeetna.

So the blue lines show the range of flow duration curves on an annual basis. The green lines show the flow duration curves for that same 50 years with OS1b operations.

Now, you see that there is a tendency to shift the flow duration curves down, meaning lower flow during the open water flow season, but almost entirely within the range of natural variability. There are -- if you look at the far left of the curve, there's a 10,000 CSF -- let's see, it's not 10,000. It's 50,000 CFS is the first line, 100,000 CFS is the second line.

Right where the second line crosses there, you see a couple of curves that fall a little bit below, the green lines fall a little bit below the blue. So, those are the only points in time during the open water flow season that the operational condition would be outside the natural range of variability for the existing conditions.

The reason for that is that it's dominated by the Chulitna, Talkeetna, and Yentna flow because they're the predominant flow sources. So, by the time you get here, the operational effects are small in relation to the natural variability.

It's not shown here, but in the technical memorandum, it would be (indiscernible) monthly flow duration curves so you can say June is the month that I care about, July is the month that I care about. So you see the flow duration curves for those individual months, and you can see how much that those are affected.

Again, with those, there's a large range of natural variability and a relatively small change.

Width variability, we -- based on the new hydrology that would be occurring during operations, we anticipate that the channel will narrow through the middle river and below. Below 29.9, we anticipate approximately 5 to 6 percent chance of long-term channel narrowing. How rapidly that will occur is debatable.

I personally think it will occur over decades, but the right slide shows how variable width is now with the blue dots, and a 6 percent change is shown in the red line versus a thin trend line that's going through that data. So, large range of natural variability, small change related to the project.

I'm going too long, aren't I?

MR PADULA: You want to make sure Dara gets her question answered.

MR. ZEVENBERGEN: The other part of that decision looked at sediment loads. This is annual sediment loads with and without project.

The dark blue line is with project is existing. The white [hatched] lines are with project so sediment loads are going to decrease.

While we're trapping sediment in the reservoir we're also affecting the hydrology. So this modeling incorporates both of those things and shows that we are definitely reducing sediment loads within a large range of natural variability.

One question would be are we going to change the substrate? And so, again, that's -- substrate that you have below 29.9 is dominated by the Yentna. The Yentna is not going to change. It's going to still put in a whole lot of sand.

It's also dominated by the Chulitna, which puts in more gravel, but a lot of that gravel does not get past 29.9. It doesn't now and it won't with the project. So that gravel is accumulating in the middle river -- in the lower river, sorry. That would be pretty hard for it to (indiscernible) the middle river.

MR. ZEVENBERGEN: So, in terms of -- and this is something that I don't have a graph for and I actually haven't produced a graph yet, but the model will be able to tell us, and I'm sure that it'll say that the gradation of that supply is, you know, very minorly affected and I would be surprised to see much, if any, impact related to that. Maybe because it's dominated by the Yentna River.

The next thing would be the aggradation, degradation. Now, if the river were in an equilibrium state today, it would tend to say that we have little long-term aggradation or degradation. It was purely an equilibrium of the sediment supply.

We don't have that in the lower river. We have a braided system that is -- shows every sign of sediment accumulation through that lower river, the multi-thread channels, the braids – braid plains.

You can definitely see in any kind of aerial photograph where the sediment is being accumulated.

And so this graph shows on the left the reach average in the dark blue lines, aggradation under existing conditions, and then the right side, the blue lines, reach average degradation for with project conditions.

Basically the river stays aggradational, but only slightly less aggradational, so the form of the channel, the character of the channel would remain the same. The more variable line there looks at sediment just volumetrically, sediment accumulation as you move down the river through the lower river, so the -- down to 29.9. So sediment loads, sediment transport capacity, similar character of the river, that leaves us one other thing, and that's the hydraulics.

Looking at the wet, average, and dry years, this shows depth on the left and velocity on the right. And you can see, there are periods where velocities are low. The solid lines are existing and the dashed lines are with project.

So again, we see a tendency for a little bit lower depth, a little bit lower velocity for -- with project conditions. Not too surprising because we're reducing the amounts of flows. So we would expect lower depths and lower velocities, but within the very large range of natural variability as depicted by the red versus the green versus the blue line for wet, average, or dry years, so we're showing the range of conditions.

So in a nutshell, we concluded that there is a very large range of natural variability with everything that we looked at, whether it's velocity, flows, sediment transport, and the -- as the basis, as the existing condition.

By the time you get to 29.9, you know, this will be a very different conclusion in the middle river, but by the time you get to 29.9, all of the tributaries dominate the conditions that we see there. We see minor change in every -- everything that we've looked at compared to a large range of natural variability.

We also see that the channel form should be maintained into the future in that aggradational system.

So, when we do go outside the range of natural variability, as that second lowest bullet states, it's only by small excursions. So, in terms of the processes, whether there's sediment -- and I think that would extend to fine sediments, to turbidity, all of these things. It's a process of dilution. All of the tributary amounts are dominating the change that's occurring with the project operations. So, very small change, very large range of natural variability.

So why are we recommending not doing modeling below 29.9? It's because we don't see impact at 29.9, and the impacts below 29.9 should be less as you move further down, especially when you get into the tidal zone. The tidal zone is going to be dominated by the tides.

And the small operational change going into the system where the tide range is the dominant feature creating the tidal currents, creating depth morphology is, again, very, very minor.

So our decision, our recommendation is to not do any further modeling in terms of computer modeling down below 29.9.

MS. McCRACKEN: This is Betsy McCracken with Fish and Wildlife Service and I just have a few--

MR. PADULA: Sue, do you have any questions?

MS. MCCRACKEN: So I think you said you looked at the open water period from May to October, and I'm wondering if we have information that addresses the increased sediment transport in winter, and whether or not the project would alter the seasonality of sediment transport?

MR. ZEVENBERGEN: We don't have modeling for winter. That -- that extends -- well, in terms of the geomorphology model. We do know that sediment transport in the middle river is pretty much nil during the winter. The sediment supplies from upstream are locked up into the ice and the production from upstream sources is gone during the winter.

The -- as you move further down the system, the flow rates are so low that we're in -- really into a negligible amount of -- negligible amount of sediment loads in the -- you know, in those ranges where the flows are in the thousands and 10,000 CFS, and that is supported by all of the data that USGS collected. So nominal, minimal sediment transport.

MS. MCCRACKEN: So does the project currently have a way to -- or plans to address the winter conditions under the project, the sediment transport?

MR. ZEVENBERGEN: The ice processes study is doing the ice-covered modeling throughout the middle river and it -- as part of our interaction, we will be looking at the results of those models to see if they could initiate sediment movement.

It's our suspicion that they won't, but that is part of what we -- our interaction would be with them, is to look at their model results, do their model results indicate that sediment could even -- any sediment movement could even be initiated.

In the lower river, again, the amount of flow is going to be very low, and so the sediment transport, as you saw -- well, I think you can see it in those graphs, just the amount of sediment transport is towards the low-flow conditions, is negligible in terms of channel form. Channel form is dominated by the higher open water flow season.

MS. MCCRACKEN: So will the ice processes have also a decision point related to this?

MR. ZEVENBERGEN: Not to my knowledge.

MS. MCCRACKEN: Okay.

MR. DYOK: I was going to say, let's have Jon Zufelt come up and maybe respond to that question.

MR. ZUFELT: So -- Jon Zufelt leading the ice processes study.

And the ice processes model is only for the middle river. It's only for the dam site down to approximately mile 100, the three rivers area, and the main reason is because as you go further down the river, as Lyle pointed out, we're in a very highly braided system, highly variable system and that would be impossible to model ice processes in a braided system like that.

MR. DYOK: So maybe, Jon, could you explain I think for Betsy because her question is that you're anticipating that with the ice condition, that you would have sediment movement down in that reach below river mile 29.9. Is that your question, Betsy?

MS. MCCRACKEN: Well, I'm just trying to understand where we're looking at the winter -- the increased sediment load during winter under the project operations and where the decision is coming from or not coming from as to whether we extend it to go below project river mile 29.9.

MR. ZUFELT: So one of the things that we have done is that the winter bed sampling -- and with the winter bed sampling, the -- you know, we were able to see clearly, you know, down to the bed in most cases and we saw very little sediment transports and sediment movement in those conditions, and that's why we -- you know, why we did that through ice video, to look at the bed material during that time.

So -- but the relationship to channel morphology and, you know, channel change is dominated by high flows, peak flows, extreme flows. And so the range of flows during the winter all fall into almost a non-sediment-transport condition, and I think that would be the case both with project and without project, and you know, so that in terms of a channel morphology or any kind of a decision related to that, the project range of flows is almost outside of our ability to -- well, of our need to look at, because it would be such a minor amount of change.

MR. PADULA: Thanks, Jon. I see some hands over here.

MS. GLASS: I have a question is not related to the lower river. You had a slide that was alluded to being an amount of area that you wanted to reduce (indiscernible) and looking at those areas or something like that. My concern with that or at least at home why my people are considering this is that the HEC-RAS1 model isn't nearly as powerful as the other one. And the second model provides a whole lot more information on things like (indiscernible) patterns and they have direct impacts on our ability to evaluate ground water, subsurface flows (indiscernible) in spawning areas and instream flow, habitat conditions post project. So, the more that HEC2 RAS, HEC-RAS modeling is limited and directly limits our ability to address the groundwater issues and fish habitat issues. You know, a smaller area we're modeling with this and smaller area we can do with the rest of it. So I was just hoping that, you know, there's -- within team discussion about, you know, how much you want to limit in doing your modeling.

MR. ZEVENBERGEN: Yeah. And this is -- this is the slide that you're referring to that has the future decision point as to the amount of 2D modeling that would occur in the focus areas and I agree that the focus area models, the 2D models are a really important tool for us to evaluate all the conditions that you were describing.

The reason that we have this decision point in there is that the 2D modeling is a large amount of effort, it's a large amount of money and we wanted to at least have it out there that if and only if, we see that this operational scenario gets us virtually identical results to another operational scenario, that we don't need to continue doing both of those operational scenarios at every focus area or, you know, it really -- you know, when we see a limiting -- limitation on the value of all the extra effort, if it's just going to be the same as the previous model, the same as the two previous models, for finding the same conclusions at every single focus area that we move through, that we would say -- well, we can step back and say we're not getting any additional value for that.

So the 1D model, you know, is -- does provide input to the 2D models. So if two different scenarios produce, you know, nearly the same result as the 1D model, then it's not feeding different information into that focus area.

Or if there -- the change all occurs in 25 years, do we need to run 50-year models for each situation. You know, that's the sort of thing that we're going to look at.

And so it wouldn't be done in a vacuum. It would be done, you know, in -- working with the other study areas with consultation with AEA, and then, you know, as we have future TWG meetings, I understand that we want to have future TWG meetings and so, you know, we're going to be working through the multiple focus area models, and we'll start providing those results and what we're seeing. And so it will be an informed decision.

MR. FULLERTON: Yeah. We put in there to get it out there, that idea out there in front. And part of it was in response -- I mean, when we did the POC, a number of agency folks said well, that is a lot of info, how are we ever going to look at all that information for all those scenarios, for all those focus areas, for all those flows. And you know, if they can decide that there are certain parameters or metrics that we look at more with that -- that -- you know, a more limited set of focus areas addressed that are important for what is happening with that scenario too, then it's a consideration, it's not something that we're saying, you know, forcing, but it's something for us all to consider to maybe make all our lives a little easier so we can focus in on what's important and not be overwhelmed by -- some modeling results that might be fairly similar across scenarios or focus areas.

And so we don't know if that's happening or not, but if just, in fact, if that's how things start developing, maybe we should have that as these discussions.

MS. LANCE: Ellen Lance, Fish & Wildlife Service.

I find myself reflecting back on Guy Phillips' comment earlier about looking at the effects of climate change on the system, and I find myself not being able to be convinced that dropping the lower river is wise at this point without considering the full effects of future conditions.

MR. ZEVENBERGEN: We're not dropping the lower river. We're not extending further. But so is your concern that we're going to drop the lower river?

MS. LANCE: Well, what I guess what I heard you say was that the baseline conditions, the variance in baseline conditions far -- basically swamps the signal that you're getting from the project effects.

But I'm not convinced that you've actually looked at the full suite of possibilities for future conditions if you haven't considered the effects of climate change.

MR. ZEVENBERGEN: I would -- I would think that any kind of climate change would only tend to increase the variability. But remember, we're always looking at a comparison of existing conditions to -- with the project, so that if we said that climate change was going to increase flow, we'd then need to increase flow for existing -- you know, for our existing conditions runs as well as the [US1D].

And again, the project would be a small change once you consider Chulitna, Talkeetna, and Yentna Rivers. So, I think that it would be an equal comparison, would be my suspicion, just in terms of how we are always making the comparisons.

MS. LANCE: It would be good to see that to be convinced. Because I think the other -- the other rivers will change as well. The other rivers that you named; the Yentna, for example, to see how that (indiscernible), you know, the different flows might impact below 29.9.

MS. WALKER: Is it my turn? This is Sue Walker with NMFS again.

And in listening to this presentation, which is very interesting, the questions that arise are how is the glacial change in hydrology study feeding into this study. Is there a link?

MR. ZEVENBERGEN: No.

MS. WALKER: It does seem as if there should be a link when this 7.7 is addressing the input in changes in hydrology into the reservoir and the river.

And also, does this study feed into Study 9.12, --

MR. ZEVENBERGEN: The barriers?

MS. WALKER: -- the assessment on fish-passage barriers, especially tributaries coming into the reservoir? Will sediment deposition affect fish migration into and out of tribs and the main stem above the reservoir?

MR. ZEVENBERGEN: Yes.

MS. WALKER: As far as sediment transport in winter, we're looking at a change in the middle river of roughly a 1,000 CFS flow right now, fairly steady under ice, to between 5 to 7,000 peaking up to 14,000 in load following manner.

How does this increased winter flow affect sediment transport, at least in the middle river? I think what I'm hearing you say, and in looking at your graph, you logarithmic graph, but that is still too low of a flow to induce sediment transport.

MR. ZEVENBERGEN: It is.

MR. FULLERTON: Yes, but also the other thing to remember is that the middle river is predominantly from what we've seen and what we've seen both in the modeling and in the -- or observations as supply limited condition. So the bed -- in terms of bed interaction, even during the open water flow season there's very little bed interaction that we're seeing.

So in the winter it --

MS. WALKER: Even during high flow events?

MR. FULLERTON: Even during high flow events.

MS. WALKER: In summer?

MR. FULLERTON: In summer.

MS. WALKER: Okay. How does the increase in daily variable flow in winter affect ice? And I know ice is kind of a significant impact on channel formation and maintenance. Will the ice model be able to predict how jams are formed and blow out and backwater and how those will affect, those processes will affect sediment transport?

MR. FULLERTON: Jon, is that a yes?

MR. PADULA: I think you're going to have to ask Jon Zufelt. First thing tomorrow Jon is up with his presentation.

MR. PADULA: Go ahead. What was that comment?

MR. KONIGSBERG: This is Jan. Can you hear me?

MR. PADULA: Yes, Jan, I can hear you today.

MR. KONIGSBERG: (Indiscernible - interference with speaker-phone.) I'm hearing myself echo. Assuming there is no need to study the Lower River, from the standpoint of sediment transfer and morphological change of the channel because of the tide…(indiscernible)…I guess my question has to do with, and I'm not trying to jump ahead of the ice modeling, but the ice processes (indiscernible) ice model (indiscernible) in the ISR. But going back to the channel changes, the morphological change (indiscernible) ice cover (indiscernible - over-modulating.) without considering (indiscernible).

MR. ZEVENBERGEN: Yes, from an observational standpoint, and I think Jon, I'm hoping you will agree with this, and if you don't agree, please say so, but we're not seeing strong ice effects in the lower river under existing conditions in terms of channel morphology.

We do see strong ice effects and fluvial effects in the middle river. But in the lower river, it's not -- doesn't appear to be an ice-dominated condition.

MR. KONISBERG: I just want to follow up and say that you're not seeing ice effects in the lower river affecting vegetative cover.

MR. ZEVENBERGEN: Ice effects on vegetative cover in the lower river might be a good question for Kevin, but I think that the -- I think that the vegetation and the forms of the river are not dominated by ice in the lower river, would be my presumption.

MR. PADULA: So, Jan, again tomorrow we cover ice as well as the riparian studies, so combination of that information, and hopefully you will be with us and we will get to that question tomorrow.

MR. FULLERTON: And I want to clarify something and, you know, in terms of decision point, that decision point was not to not model the lower river with our 1D model. The decision point was to not extend the model any further down in the lower river than we already have, which is down to Susitna Station, which is at roughly mile 30, and we're modeling 70 percent of the lower river.

So it's going to the point where we're below where the Yentna contributes its water and sediment supply. That's where we're recommending that we stop the model, the 1D bed evolution model.

MR. PHILLIPS: Guy Phillips, Kier Associates.

Another check-in question that has several parts depending on the answer to the first one. I understood you to say, while I fully appreciate that your focus is downstream on the dam. I understood you to say that you would expect to see sediment accumulating behind the dam. Is that correct?

MR. ZEVENBERGEN: There is going to be sediment trapped by the dam, yes.

MR. PHILLIPS: Yes. And so is there, either by you or anyone else, work on the way that will evaluate the quantity, location, and character of those sediments being accumulated on the dam?

MR. ZEVENBERGEN: Quantity location and caliber, I think yes.

MR. PHILLIPS: Yes, someone is doing that?

MR. ZEVENBERGEN: That's us. It's being done in the water quality model study with two -- the reservoir model.

MR. PHILLIPS: Okay. So if in the power side of the analysis of this project it becomes clear that sediment flushing will be needed to clear the reservoir for power production purposes, will you be able to evaluate the impact of that downstream?

MR. ZEVENBERGEN: As a hypothetical, if flushing were needed, then yeah, we'd be able to track that sediment through the system.

MR. PHILLIPS: Okay.

MR. MCLEAN: This is Dave McLean. The question of the reservoir is so puzzling, I guess. Of course, it's a huge reservoir compared to the volume of sediment coming in, so we're not talking of it filling it in 20 years.

But in terms of changes to physical habitat, questions of where gravel would accumulate, delta formation, those are not really water quality problems, in my view. They would be geomorphic questions.

And so I was a bit concerned to hear that it's simply coming out of a water quality analysis. Surely the -- the -- I mean, this is where models have tended to be used successfully. We have a better track record of running HEC-RAS models in reservoirs than we do of using them to predict downstream impacts.

So I guess I'm really surprised that you're not making an effort to use those kinds of tools, both for individual tributaries, if they're important for fish usage, and just even to figure out the footprint of the reservoir. Because over decades, there will be a fluctuating backwater region that will extend upstream, so your footprint actually increases over time, which has certainly become an issue on some reservoirs we've worked on on the Columbia River.

MR. ZEVENBERGEN: Well, the water quality model, the [EFDH], the vast majority of the sediment loading in the reservoir is the finer sediments and it has much better capabilities to model the fine sediment than RAS does.

MR. MCLEAN: Well, of course. But what we're talking about is the gravel will deposit at the head of the reservoir and cause a fluctuating backwater region that will -- or delta formation, which will be -- consist of coarse sediment. There'll be a – sediment will sort, there will be a sorting process through the reservoir with the fines, the silty clay deposited, and of course -- so I'm not really -- you know, if it's not a trap efficiency problem in terms of reservoir life, that may not be important to some people, or most people.

But the question of the delta formation and the physical changes to the substrate, the effect that there will be a fluctuating backwater region that will move upstream, those are not fine sediment problems. Those are gravel bed load questions, or bed material load questions.

MR. ZEVENBERGEN: And I think John is -- water quality is next? And you can talk about the reservoir model, because I think it has more capabilities than you’re thinking here. It is -- EFCD model is pretty robust especially when it comes to depositing the sediment.

MR. MCLEAN: So will there be boundary conditions on -- of gravel input at each tributary to go into that model?

MR. ZEVENBERGEN: Not now. Currently you're not proposing to model the tributaries in that form. The main stem input would be there, but right now it's not. It's finding a resolution that the tributaries would be modeled with the EFDC.

MR. PADULA: So let's come back on -- just on the questions relative to the water quality and modeling. We do have John Hamrick this afternoon and it will be appropriate then.

MR. MCLEAN: Okay, the second question is during the discussion, a comment was made, I think by Lyle, that said 5 to 6 percent chance of narrowing in the middle reach. I assume you meant the narrowing -- the river is going to narrow by 5 to 6 percent, is your prediction, right?

MR. ZEVENBERGEN: Yeah. I'm sorry. I must have misspoke, yes.

MR. MCLEAN: : And that kind of prediction is not really a modeling -- presumably the numerical models give you no information of any great merit to predict width changes. Very few modelers have claimed they can predict bank erosion rates, encroachment rates. Those are more processes governed by vegetation establishment, perhaps ice formational changes. So this is a non-modeling prediction, I assume?

MR. ZEVENBERGEN: Yes, it's based on hydraulic geometry relationships and the changing flow.

MR. MCLEAN: So you just take Q.5 power and come up with --

MR. ZEVENBERGEN: Yeah.

MS. MCLEAN: That's about -- so that's a back-of-the-envelope sort of --

MR. ZEVENBERGEN: That's what we said we would do in the ISR, and so that's been -- that was -- you know, we said that's how we would do it, and that's what we did.

Now, I'm not going to suggest that I -- that my models can predict bank erosion or -- or accretion, but in the lower river there is plenty of sediment for accretion to take place, especially, you know, with the aid of vegetation that would also encroach into the areas because of the changing hydrology.

So I think it would occur. You know, I'm not saying that 5 percent is some perfect number or anything, but you know, I think it would occur and I think it would occur in matters of, you know, decades to the, you know, 50 years would be a reasonable amount of time for that to occur.

MR. MCLEAN: So that kind of prediction would come out of your succession analysis that you briefly mentioned at the beginning. You talked about how you've characterized channel changes over time as a floodplain formation and vegetation.

So this kind of information, it may be able to improve the predictive ability rather than just relying on regime equations, or is there other ways you can look at this? I mean, the regime approach seems -- like I say, it's -- I mean, we can all do that in about ten minutes.

MR. ZEVENBERGEN: Yeah, I think that's about how long it took me too.

But it is the -- it's a solid way of making a long-term prediction on channel form. There's -- Julien did it on a reservoir in -- I think it was in Vietnam, but the -- you know, in terms of looking at the change in hydrology, the change in -- predicted change in channel width and the actual change in channel width over time.

And I do want to point out that in the lower river where we have sediment, we expect accretion combined with vegetation. In the middle river where we would not have sediment, we would expect it to be primarily from a vegetation encroachment with -- I mean, no available sediment for actual accretions (indiscernible) much more of a vegetation colonization in the middle river.

MR. MCLEAN: So this -- this might be one of these instances where case histories from other rivers of somewhat similar form would be worth reviewing, and so far there's a very large body of literature on the Nechako River, there's also -- on the piece that might help you.

Because essentially, the narrowing on those rivers was essentially a vegetation process, and -- but there's a lot of room for feedback of other processes in your physical setting. You've also got changes in ice. I mean, it would be very worthwhile, I think, to look at that kind of thing.

MR. ZEVENBERGEN: And we agree.

MR. PADULA: Thank you. We have one in the back. Mike?

MR. HARVEY: Just sort of to come full circle on that one the issue of the literature review. You know (indiscernible) to review does incorporate that, does look at the stuff in the (indiscernible), it does (indiscernible) basis for what Lyle sort of finally decided that there is no really deterministic way of predicting this (indiscernible - distance from microphone).

You can't -- past performance on the Susitna does not give you that information because we don't have (indiscernible - distance from microphone), do not have that situation.

We do know that channel --

MR. MCLEAN: But you may have -- but you may have long-term patterns of changes in runoff over decades that you may be somewhat indicative, so you could look at -- you can relate long-term trends in hydrology and run-off patterns to changes in channel geometry or channel pattern in an attempt to look at those kinds of (indiscernible) [changes].

MR. HARVEY: I don't think this system is not sensitive enough to do that. I think you'll find the middle river is extremely insensitive. I think everything we found out about it to date would suggest that. The lower river might be different.

But I think the use of a hydrology geometry relationship is not wrong. There is a theoretical basis behind hydraulic geometry and I think there's a lot of history of people using hydraulic geometry.

MR. MCLEAN: That's true. And first as they learn more, they also recognize that those comparable relationships are reflecting processes like, for example, vegetation encroachment and other processes, bank stability, log-jam formation that stabilizes banks. And so as we get more and more into having to answer complex questions like this, I think you have to look at those actual drivers, not just the empirical relation.

MR. PADULA: Thanks. Mike.

MR. WOOD: All right. This is Mike Wood. I'll restrain myself from going to the ice process – I'll wait for Jon, however I do want to just mention that both freeze-up and break-up is quite a sediment transport event.

I also want to ask if you feel confident given 2013's huge high-water events and whatnot, that you collected enough data. I mean, it was very eventful data for that model that we're seeing now. It was a pretty significant year, 2013.

Yeah, I won't talk about ice too much, and I won't go down river below the three rivers, either. I'll keep it to the middle, what you’re calling the middle river and I -- I want to understand that the sand -- that river carries 90 percent sand and silt throughout the summer months or that's what I'm hearing, and so during operations, once operations begin, that sand and silt will be held back behind the dam site meaning that the river will be flowing very well and clear throughout the summer.

I take issue with someone saying that the water that would be released during operations throughout the winter may have significant -- insignificant effects on transport below the dam site because of the amount of water you're planning to release. I believe it will start picking up what is below the dam site and carrying it -- given the amount that they're talking about releasing.

And again, this has impact on the ice as well. As I said, I'll restrain myself from that, but the sand and silt that is coming down from above the dam is what we see all year long. I'm sorry, all summer long beginning with break-up until about a week to two weeks ago and now it's clear, we're getting it almost clear as you get. Without that, if you increase those flows, I think especially in that middle river area where that's the greatest amount of impacts, looking at fish and whatnot, those loads that you're talking about in the winter and the amount of transport that could be happening beyond then is very significant.

And like I said, I'll restrain myself on the ice process because I believe that the shoulder seasons and the winter have a lot to do with the geomorphology or whatever of this river, probably more significant than the flooding events that we saw during 2013. With that being said, I'll shut up.

MR. PADULA: Any response?

MR. ZEVENBERGEN: Yeah. I would just like to clarify that when it comes to sediment transport, you need the ability to move the sediment, and that's really strongly related to velocity. And you also have to have a supply of sediment. The supply could be from the bed, it could be from an upstream source, from bank erosion, that sort of thing.

So in the summer when there is a supply of the sand and the silt, it is -- you know, it's totally dominated in terms of the quantity of sediment moving. It's dominated by that supply from upstream from the glaciers.

In the winter, the velocities are going to be very low and they're not going to be able to mobilize the bed. Even the summer flows can't mobilize the bed. So without a source of sediment with operations, they'll just be flows that don't have a source of sediment and don't have the capability, in terms of velocity, to pick up sediment from the bed, other than, you know, the small amounts that are, you know, stored here and there, but those are very small volumes of sediment.

So, you know, I know that we increasing flows, but that doesn't mean that there are sources of sediment that correspond to those flows.

MR. WOOD: So when we see these flow rates, they are -- they're carrying sediment with them and that's because it's coming from above the dam site, right?

MR. ZEVENBERGEN: Yes.

MR. WOOD: You take those out, and you still have those high flows. Isn't that water still capable of carrying sediment?

MR. ZEVENBERGEN: It's capable of carrying sediment, but there's no source for -- there's a limited source for that sediment.

MR. WOOD: Would that sediment that exists now in the river as it is now pre-operation, not be picked up by the increased volume below the dam site therefore creating the channelization of -- that we're talking about?

MR. ZEVENBERGEN: And that -- you know, that is a very common response to a dam in an alluvial system that has transportable bed material.

What we're finding is that the middle river is so coarse that it's not mobilized -- the bed is not mobilized for open water conditions, and so it's pretty much a locked-up system to the coarseness of the bed, so that what you're seeing in terms of sediment transport in the middle river is purely supplied from upstream and it's carried through. It's just a conveyor for that. You cut off the supply and now you just have the water without the supply and it just moves through.

And in terms of gravel, the amounts are very small, 99 percent sand, 1 percent gravel. So -- and really, it appears that virtually all of it is sourced from -- from upstream.

MR. VASQUEZ: Jose Vasquez, NHC.

This question relates to the models that have been selected from the 1D model and the 2D model. And as you mentioned, these are better versions, the new releases -- actually, they haven't been released to the public so you are the first that are using this model. Nobody else, or a very limited amount of people, has used them.

And usually, you probably know by experience that it takes several years for a sediment transfer model to actually be well tested and start gaining confidence that it provides good results, because in the beginning, they are very buggy and has a lot of issues.

In the case of HEC-RAS, maybe it has a longer history been around, this is a new release, but you know, but in the case of the 2D model, I would be really surprised that -- for example, you can handle armoring well.

And just my experience using models, it takes a lot of time to correct many of the issues that are --

So the point I'm trying to make is in order to be confident that those models actually provide reliable results, validation is going to be critical, very important.

And I'm wondering how – especially for a process like armoring, I think it's very important, it’s really complex. What are the ways? I don't know if you remember when in the POC meeting, we discussed, for example, like an idea, maybe a start with subsurface (indiscernible) and run the model for existing conditions and see the armor layer (indiscernible) or maybe there are other ways to do it.

So I would like to know what are the strategies, what are you thinking about how to actually validate this model correctly.

MR. ZEVENBERGEN: The validation process, I do want to say that we do use those techniques of running with the substrate or sub -- you know, the (indiscernible), having built the surface layer. We might run the model for 15 years of simulation time to establish that. That becomes our initial condition for the remaining runs that we have.

So, you know, we employ a lot of the processes that you're talking about and they've worked very well for us.

In terms of the armoring process, we actually have been using the 2D model from the sediment transport standpoint for some time.

This isn't the first time we've used the sediment transport model, the two-dimensional sediment transport model.

And so we have a lot of experience with that model, what its limitations are, the problems it has. And it does do a good job at the armoring process from what we've been able to ascertain.

Now, again, with that model, we look at running it for a period of time to establish armor layers and sort of thing and the results are looking very comparable to what we're seeing in the channel.

And then to go back to -- I think that the winter bed sampling was extremely valuable information because it did point -- and, you know, there was a comment that the Susitna River is something that we know -- that very little is known about. And I think that we're gaining a lot of knowledge through each year that we're working on it.

And to see that the islands are -- the bar heads and islands are maybe not representative of the bed as the winter bed material showed, but it's a much coarser bed than what the bar heads are, is further evidence that it is a throughput system. But these are constructional features, but they're not constructional features from bed material. They're constructional features from supply, is what you have to conclude based on what we're seeing in our data and what we're seeing in our modeling.

MR. VASQUEZ: Just to point out, so actually you mention this strong variability across the channel in gradation. And how are you dealing with that the 1-D model just takes a cross-sectional average? How do you deal with all this natural variability in grain sizes?

MR. ZEVENBERGEN: Well, the 1D model is intended and it is really best suited for looking over long reaches. And so there we do start off with -- and right now, all of our models are initial models. We have a lot more data, a lot more cross-sectional data, a lot more work to go into the -- especially the middle river model.

But with it we do start off with the substrate gradation, let it build the armor. We're using that information to see how the model variability and that sort of thing compares.

So the -- you know, we have to really avoid trying to look at, you know, any one point in this model and say this is what's happening at this point, in terms of the 1D model. We really need to be looking at it from a reach basis.

MS. MCCRACKEN: This is Betsy McCracken with Fish & Wildlife Service, and I have a couple of questions.

The Services have been interested in the evaluation of other operational scenarios other than the OSB1 (sic), and so I'm just wondering if you have done any modeling for that scenario? And also if -- if you -- if the modeling efforts have done any channel maintenance modeling for pre- and post-project.

MR. ZEVENBERGEN: So we've only looked at OS1B currently. You know, we will be able to very quickly now run other operational scenarios to see how they would change things.

I suspect, from what I've seen with OS1B, that we're not going to see a huge difference in model results for other operational scenarios.

We also have not at this point and I think that that's -- this is something that's going to happen after we run the initial range of operation scenarios that, again, might look at what the channel maintenance kind of releases or something like that could be, but that -- we're not anywhere close to having to find what they ought to be yet, let alone, you know, whether they're needed, what their magnitudes or durations could be. But so that is obviously on our plate, but not for quite a while.

MS. MCCRACKEN: Okay. Thank you. I just -- I bring that up because as you know better than I know, those flows are important in creating and maintaining fish habitat and complexity of the habitat and so we're definitely interested in that.

MR. ZEVENBERGEN: Yeah. The thing that we're learning is that the middle river and the lower river are very different and so that putting in a big flow into the middle river may not have much of an effect.

The middle river is very much a locked-up system from a fluvial standpoint. And the lower river is definitely an aggrading, alluvial channel. So you know, the things that we can look at, you know, we might see very little impact in the middle river and potentially minimal impact for a totally opposite reason in the lower river. It's a fascinating system.

MR. MCLEAN: Just a little further question on the modeling, the 2D model. So are you going to present applications of the model to other, you know, comparison or have you already done that. I guess I just missed maybe some of that earlier presentation results.

But if you run the model on other river systems and compared it to validate it, or compared it as a quantitative morphodynamic model. I know you've done work as a hydrodynamics model, but the morphodynamics is the part that's the most important for validation.

And I guess I wasn't sure what sediment transport equation is in the 2D model.

MR. ZEVENBERGEN: The 2D model has been run on other rivers in terms of both the hydraulics and the sediment transport, the morphodynamics, so we run it on the -- is it the Platte River, the Rio Grande and then the Snake River as well.

And so -- and the Snake River has got gravel and sand and that sort of stuff. They're looking at island development and that sort of thing. So that -- so our experience with the sediment transport model is pretty extensive.

MR. MCLEAN: The model itself is how many years old? The morphodynamic 2D model, how old is it?

MR. ZEVENBERGEN: Would be five, six, maybe longer.

It's not publicly available, but it has been around for a number of years.

UNIDENTIFIED MALE: Used by the Bureau of Rec.

MR. ZEVENBERGEN: Right, by the Bureau of Rec.

MR. MCLEAN: So what was the equation you're using on the gravel bed?

MR. ZEVENBERGEN: On the gravel, that -- it's -- it actually does both. It has a separate equation for suspended and -- for the sand fraction and the gravel fraction, you know, suspended versus bed load. And I don't recall. I'll have to get back to you on that. But in terms of which equation.

MR. MCLEAN: So in the middle reach, what you described was a very supply limited, coarse-gravel-bed channel, I guess paved, probably in those kinds of rivers, channel structure or bed structures become quite important like imbrication. I mean, those factors for -- govern threshold motion, like a degree of imbrication. I mean, no one has even -- other than knowing that it changes the initiation of motion by a factor of two if you're calculating -- using a Shields parameter, no one has programmed those kinds of issues into bed sorting or bed-material transport rates. I mean, it's a pretty difficult thing to -- and of course, at those low transport rates, the sensitivity of the transport is just incredible. You change the velocity 5 percent, you can change the initiation of motion or you can change the transport by ten times.

MR. ZEVENBERGEN: Yes. Size is really what dominates in this river D50 in a bed of 100 millimeters. The flows really can't move that hundred millimeter deep 50 size with or without imbrication. You can calculate it. And if you had imbrication that would only make it less likely to move.

But the -- one of the really telling things in terms of USGS data, if you look at their report from 1985, they estimated 5,000 tons of -- of gravel moved -- moved back here. 350,000 tons of gravel were moved in that year at the Chulitna River. So gravel surprisingly -- it's a gravel-bed river, cobble-bed river that isn't transporting any gravel. 5,000 tons is a tiny amount of gravel being transported, with Chulitna at 300,000 tons, those are the USGS estimates for that year and they correspond with what we're seeing as well.

MR. MCLEAN: Well, sometimes rivers may not carry a huge gravel bed load, but at least on the -- based on, say, a bed load sampling measurement. I mean, one of the issues is, of course, a Helley-Smith sampler has got an opening of 75 millimeters. You've got 100-millimeter D-50 sediment, so that's an issue.

But also on other rivers, we -- I mean, we find that the overall flux of gravel might be small, but when you actually look at the amount of gravel being exchanged through erosion of bars or islands, can be quite appreciable. So -- and if your real issue is habitat change and spawning gravels, even that small amount of load starts to become really the focus of everyone's attention.

And the fact that 20 million tons of silt is shooting over the top of it, nobody really cares if it all goes straight out to the ocean. But it's dealing with that small but very important fraction that becomes much of the issue that you're dealing with.

MR. ZEVENBERGEN: Well, yeah. Historically you look at the bars, and they're very, very static. You look at the '80s and the '50s aerial photography, there is change, but it's not the kind of change you would see in a lot of other rivers. It's not -- the river system, the location you'll find doesn't change very much.

But then we are doing the two-dimensional modeling in the focus areas, so in a movement of gravels and that sort of thing within the focus areas is something that we can look at and we are looking at, so we are looking at those substrate changes.

MR. PADULA: Thanks, Lyle. I've got a couple of questions, but this gentleman over here first.

MR. VAN DER VINNE: Gary Van Der Vinne, Northwest Hydraulic Consultants.

You talked earlier on the modeling releases from ice jams in the future. You haven't done that yet, I guess?

MR. ZEVENBERGEN: No.

MR. VAN DER VINNE: Are you confident that you are going to get enough information from John to be able to do that?

MR. ZEVENBERGEN: Absolutely. You know, this has probably not been done before, so we're going to have to look very carefully at what information we have, both observational and from the models that they're producing, and then based on that information, we'll develop strategies for making those runs.

But yeah, it is new territory.

MR. VAN DER VINNE: Yes, because the ice models don't really predict formation and release of jams and that's what you're looking for, is it?

MR. ZEVENBERGEN: Yes. And what we are planning on doing is looking at what information we do have observationally and from this model to set up a jam storage, release it, and to develop a pulse that would be a pulse from -- you know, from a hydrodynamic probably 1D model to then provide a discharge boundary to run through the 2D model so that we wouldn't be simulating ice jam formation or that sort of thing, but we would be simulating the effects of a break-up jam releasing.

MR. VAN DER VINNE: Just thinking in advance and trying to see what the effects are in that similar event, okay.

MR. ZEVENBERGEN: Yeah. And we have some data from Gold Creek, if you look through the stage records and that sort of thing. I mean, you do see situations where we get four foot of rise over, you know, 45 minutes, you know, and that's because of a jam that broke upstream and now it's pulsing through Gold Creek. So you can see that kind of -- you know, we know it happens and it's nice to be able to see the effects of that just in a gauge record, for instance.

MR. VAN DER VINNE: But do you have any sense yet of how significant the sediment transport is during break-up relative to the overall loads?

MR. ZEVENBERGEN: You know, I think that the -- from what I've seen, the concentrations are going to be quite high, but they're also very brief. So just from a kind of an effective discharge analysis, they might not contribute, and I don't think they do contribute, to the overall sediment transport, but in a certain location, they can be very effective in terms of depositing sediments in the over bank areas and causing erosion in those areas, as well.

MR. HARVEY: And if I can just sort of add to that. We have actually been trying to measure what is happening depositionally from the ice jam surges in the backwater at various -- of the focus sites, so we're actually getting measurement of deposition primarily of sand size material that was present in the bed of the channel at the end of the last open water season. Sits there over winter, and then becomes available for transport out of the bed through the break-up.

MR. WOOD: This is Mike again. I just wanted to say I finally agree with you on something; that the bed surface is armor-plated and I think, the reason for that is to protect itself under the ice for sure.

But I do want to ask, are you integrating David Brailey's studies of his cross sections and what he's seeing in the movement of that bed into your modeling? Because the statements you're making would lead me to believe that you may not be.

And then I also just want to say on a personal note. I mean, every acre and anything that I have ever put in that river to try to hold something down disappears within days, gone downriver, and it's not stationary whatsoever. So those were my two questions.

MR. ZEVENBERGEN: Well, we're using all of the data that Dave Brailey has collected. So in terms of an anchor or something like that moving, it doesn't surprise me, but the river is armor-plated. There probably isn't really much for an anchor to grab on to, as well. And, you know, it's projecting up in the flow and prone to that kind of movement.

But in terms of bed mobilization, that's really what we're looking at. We're not looking at does an individual particle move, but does the bed mobilize. And if it's armor-plated to protect itself from ice, as you're, you know, suggesting, then it really can't mobilize during open water flows.

MR. PADULA: Does anybody want to eat? I mean, I appreciate the discussion and the questions, I think, are very good and we'll come back to some of those elements in the afternoon discussions. It is 12:30. I think everybody deserve an hour for lunch.

So again, we'll start at 1:30, and then again we'll probably -- I'll anticipate we'll go beyond 4:30 for those who can stay with us.

(Off record.)

MR. PADULA: We're going to get ourselves going again. So, on our agenda, 1:00 has magically become 1:30, but we'll keep the same order. Harry will move us efficiently. We're at Baseline Water Quality. All right, please speak into the microphone, please..

BASELINE WATER QUALITY (STUDY 5.5)

MR. GIBBONS: Okay, how's that? I broke it already.

So Study 5.5, Baseline Water Quality.

We're going to go through the slides fairly quickly so we can get to the discussion.

But the basic objective of the water quality study is to take historical data along with data we're currently generating and pull that together so we have an understanding of what's going on in terms of water quality.

Also to help build a database for temperature and meteorological information, so that that continues with the water quality perimeters into the model so that -- with other models so we have a comprehensive look at what's going on there.

So we're looking at not only a physical chemical and biological characteristics of the system, but also looking at some contaminants, potential contaminants, some metals and sediments and the fish. Sorry about that.

And in the sediments themselves and the characteristics of the sediments. That's for multiple reasons because we need to understand not only the water flowing by but what's in the sediment itself.

So, one of the things we did do also to help augment the temperature information and help with sizing certain samples from many different studies is the thermal imaging. Now, we didn't complete all of that. We'll get into that in more detail, but we got to most of it.

So some of the variances that we had, we need to talk about is one of the things we were ambitious about was setting out continuous measurement flow of the thermistors across the river at several different stations, but because of logistical problems in terms of aces -- not necessarily access, but just physical characteristics in the river and holding those thermistors in place, is the discussion earlier this morning about an anchor not holding it in place. That's what we were trying to do, was anchor them. So we successfully did 28 different sites starting in 2012 /13 and this year, of course.

Okay, we had a couple of sites of a water quality and main water quality sites. We had 17 sites. Three of those sites we had to move from the project river model as in the study plan slightly because of just , again the logistics of getting in.

We also had a variance, a slight variance in terms of some of the sites, two of the sites, and we had trouble with cross-sectional sampling like we had planned to do for both cross sections across the river and at depths, there was only one representative site in that that cross section of the samples.

The plan was to take ten sediment -- detailed sediment samples. We took like four in 213 and completed six this year.

Groundwater, we sampled six piezometers. I have four focus area sites on some of them.

Some of this, this is just a smattering of some of the data that's in the ISR that was -- by the time of the ISR, we had to put it out only part of our data was completely QA/QCed that's what's in the ISR, and this represents some temperature, the weather station on the right, meteorological information there is representative and chlorophyll A.

So it shows a characteristic of some of the data that we have there and we have more coming, so we'll see.

I'm going to go through -- there were some modifications.

The first modification in our thermistor readings, we were taking thermistor readings every 15 minutes. We had proposed to change that to 30 because of battery life, so we could have data storage to make sure we were able to repeat that data. We overcame that problem and we left it at every 15 minutes. So that's really not a modification. It was supposed to be but we didn't. A good thing. We have installed a meteorological snow measurement so we get that sensor in terms of water equivalent (indiscernible) meteorological stations currently.

Other modifications, the main one was, as we went through some of baseline water quality we found that there was some analytical inconsistencies. I'm the old guy on the block so I'm looking at does this data represent reality?

The same thing when I looked at the model. Is it representing the real world. Some of our data didn't look quite right, even though it passed some of the analytical procedures that they followed. Our QAPP was very rigorous and demanded that we really look at it. So there are some samples that we need to verify and take additional information 2014 so that's part of the modifications. So most of the metals except for calcium magnesium, total mercury, total phosphorus, the nutrients and Kjeldhal nitrate (indiscernible) and developing (indiscernible) of course. (Indiscernible) So those were resampled again.

Focus areas, it was originally planned to do ten focus areas. We did seven in 2013, and we repeated the sampling in 2014, in July and September, for those focus areas. For water I mentioned, we took four in 2013 and we've already taken the other six and we have that data. 2013 data was all very good and we expect the same for data for which we're currently providing the QA/QC.

As I mentioned before, thermal infrared, we took 72 percent of the river and I think in 2013, 20 percent of the river in the middle of the section between the project river model, 7890 approximately. We didn't get in 2013 because of weather conditions. We were planning to take it this year, but because of the amount of data we had on temperature from the water quality study and the groundwater information, it was determined that that wasn't going to give us added value so we held off on that this year so we didn't take that last segment. It wasn't going to give us added value and we had the information that was going to help us.

So that's that and we'll open it up for questions.

The next talk is the modeling, 5.6, which is the water quality monitoring, so we can (indiscernible) back and forth with that..

UNIDENTIFIED FEMALE: (Indiscernible - over-modulating.)

MR. PADULA: Is there a question on the phone for Harry?

UNIDENTIFIED FEMALE: (Indiscernible - over-modulating.)

MR. PADULA: Oh, were you not getting -- you weren't hearing this?

UNIDENTIFIED FEMALE: (Indiscernible - over-modulating.)

MR. PADULA: Okay. So any questions for Harry based on what you've seen or seen and heard?

Yes.

MS. VERBRUGGE: This is Lori Verbrugge from US Fish & Wildlife Service.

Is that better?

Okay. This is Lori Verbrugge from the US Fish & Wildlife Service, and I wanted to ask a little bit more about the analytical problems in the water quality data.

UNIDENTIFIED MALE: (Indiscernible - over-modulating.)

MR. PADULA: Can you hear us, John?

UNIDENTIFIED MALE: (Indiscernible - over-modulating.)

MR. GIBBONS: I'll repeat the questions, John.

So the current question is, is about some of the analytical or sampling problems we had and what's happened to that.

MS. VERBRUGGE: And yes, specifically, I have a couple of questions about the specifics of it, specifically about the total metals and the total mercury. And was it only water samples that were affected, or were other matrices also affected by analytical problems?

MR. GIBBONS: The sediment samples that we took in 2013 both (indiscernible) were QA/QC'd and fine and valid and we're moving forward on that QA/QC now, but we think that's going to be fine. It was the water quality samples for the total metals, except for calcium and magnesium, that proved to be problematic in terms of the analytical procedure yielding false positives due to the turbidity and glacial flour and interference creating a false -- a higher level than reality so we wanted to double-check that and come up with ways to resample and see if we can get a better handle on that data.

MS. VERBRUGGE: What percentage of your water samples were affected by this problem?

MR. GIBBONS: The samples that had turbidity, I don't really know, I'll have to get back to you on that.

MS. VERBRUGGE: Approximately.

MR. GIBBONS: The higher-turbidity samples all tended to be high, and that's -- that is not uncharacteristic for a system that's like this that has a lot of glacial flour. The White River for instance, that was a real heartache for them to try go through the analytical procedures to get an actual number that represented reality because of the inferences.

MS. REEVES: This is Mary Reeves, Fish & Wildlife Service.

Were those samples filtered in the field or were they taken in bulk in the field?

MR. GIBBONS: We took -- for totals they were taken in bulk and we did try filtering stuff and so we did different procedures that were -- several things that we weren't sure really good in 2013 relative to the total metals because of the interferences even though they were filtered and some other (indiscernible) preservative and that sort of thing, that we wanted to overcome with the samples and found that it wasn't quite up to where I wanted them to be. So that's why we took them again in 2014.

MS. VERBRUGGE: And are we going to be able to see the actual laboratory reports so that we can get a better understanding?

MR. GIBBONS: Yes, you'll see both the raw data from the QA/QC data from 2013 with the spreadsheets with all the qualifiers and all 2014 also will be given -- presented and with all the qualifiers that we had to finish our QA/QC.

MS. VERBRUGGE: Do you have an expectation of when that will be?

MR. GIBBONS: The 2013 data we're going to try to get it up on the Web site. We're hoping to have that up in the next few to ten days, and that -- the 2014, we're still finishing the QA/QC, so that'll be done as soon as possible and I'm hoping to get it done by the end of this year.

MS. REEVES: Yeah. To that, and there is a lot of data, and right now, one of our thoughts is it's pretty difficult to evaluate because it's not organized as well as it could be. It sounds like you're working on that, which is great.

MR. GIBBONS: Correct.

MS. REEVES: And maybe we can even -- if we can request kind of format that we include a spatial limitation, you know, (indiscernible) lat-long media, maybe an analyzed sample limit of detection, and then lab qualifier with your lab qualifier, were there field concerns for the sample, because it seems like there are also some field sampling.

MR. GIBBONS: That's in our database currently.

MS. REEVES: Okay. And then it can all be in one place?

MR. GIBBONS: Should be, yes, we want it that way. The whole idea is to get the information out.

MS. VERBRUGGE: Did you have other issues with the fish samples?

MR. GIBBONS: Well, fish samples, we didn't take the samples. We got them from other studies and we took them to the lab. The QA/QC for like total mercury count on fish tissue, we had good analysis there. It was really more of how many fish were going to be collected and it was more for mercury testing.

MS. NOLAND: This is Laura Noland with Environ International Corporation, and I have a question about the data quality reports, which I did review, not comprehensively, but I did go through them.

It did seem that in reviewing the COCs, that you were having issues with delivering the samples within temperature limits, and other issues as well that indicated you might be having field sampling issues. [I had a question about the data quality reports which I did review. It seemed that in reviewing the COCs that you did have issues delivering the samples to the lab within the correct temperature range? Could you give an estimate of what percentage of these samples were out of temperature range?]

MR. GIBBONS: Yeah, there were some field sampling issues, but given the amount of percent of issues with those samples, it was a small percentage of the total data base. That was part of the concern. Our concern was the analytical (indiscernible.)

MS. NOLAND: Do you have an estimate of what percentage of those field samples?

MR. GIBBONS: Not off the top of my head. We can look at that.

MS. NOLAND: Well, I just want to --

MR. GIBBONS: It was pretty small.

MS. NOLAND: I don't think I agree with that, that it is reasonable. But we will wait for the final report.

MS. REEVES: And this may be saying the same thing that you just said, but it would be really nice to have a data quality report, so some sort of synthetic document that says, that describes you know, what happened, what bad things happened in the field with your filters or whatever, and how many samples that affected, what happened in the lab, how many samples were affected. If we can have that kind of as a data formally following the report, that would be really helpful to try to understand.

MR. GIBBONS: We did have DVRs for the 2013 data included with the ISR for 2013 data and we're producing DVRs for the 2014, so you'll have that.

MR. CONDER: You took the words right out of my mouth. I'm Jason Conder with Environ.

And I echo their concerns. You know, we think the data reports and lab reports is great, but I think, you know, what we really want to understand is we want to get to the same place where you are when you look at the data and say this data is not a represented reality. We want to, you know, we want to hear the thoughts of the chemist, kind of the situation with glacial flour and the other interferences that we might see and kind of the technical reasons why the data just don't make sense, so I'm looking forward to seeing that.

MR. GIBBONS: Yeah. I'll use an example, for instance, total phosphorus, total phosphorus was in the milligrams per liter and the high micrograms, several hundred micrograms to two -- up to 2-point something milligrams per liter in the system. Now, our chlorophyll never got above 3 milligrams, you know, per liter. So looking at a worldwide average, .3 chlorophyll to total phosphorus, 3 micrograms compared to 3 milligrams is a few orders of magnitude off. So that's a reality check that's we have to figure out what's going on.

MS. REEVES: So that suggested to you that it wasn't dissolved in water, that the phosphorus wasn’t dissolved.

MR. GIBBONS: The dissolved phosphorus met all QA/QC. (Indiscernible) that was given was very, very low.

MR. KRISTANOVICH: Felix Kristanovich from Environ. Two questions.

The QAPP report was issued partway. So in your analysis, the 2013 data, it didn't have a QAPP with it, am I correct in that?

MR. GIBBONS: No, we had a QAPP and we followed the QAPP, that's correct.

MR. KRISTANOVICH: You had a QAPP (indiscernible).

MR. GIBBONS: We have a QAPP, and remember, QAPP (indiscernible) design has addendums filed to it as there are variances and changes and modifications. So, yeah we had it in place.

And part of our rigorous QA/QC, it's spelled out in detail.

MR. KRISTANOVICH: The second question comes back to a presentation from one of the technical meetings that was presented in (indiscernible). Apparently there was a mess up in one of the labs. I never found (indiscernible) an explanation of actually what happened with the labs in the ISR. Can you elaborate on that?

MR. GIBBONS: Well, for instance, the total phosphorus that I used in a previous example, there's a lot of false positives being generated by the glacial flour, particularly the colloids and clay particles, but also arsenic and other things, and that’s very similar to other studies we’ve found with glacial flour where you get false positives in the analytical procedure for the phosphorus. So that's what we're trying to straighten out.

MR. KRISTANOVICH: But that's the reason the results from the two labs are completely different?

MR. GIBBONS: Yes. And there were some other interfering problems too. The results are in the database.

MS. VERBRUGGE: I think I'm thinking of the same technical meeting that you're talking about, and there was some discussion about whether preservative was or was not in the containers and it wasn't --

MR. GIBBONS: We did. We did test on the preservatives in the sample bottles at the filtering and non-filtering levels and also the blank samples from some of the labs, and so there were some issues with the 2013 data at several different points.

MS. VERBRUGGE: And the discussion of that will also be included in your QA report?

MR. GIBBONS: Yes, right.

MR. PADULA: (Indiscernible - distance from microphone.)

MS. LANCE: Ellen Lance, Fish and Wildlife Service. My question goes back to our discussion from earlier today, Wayne. So what I'm hearing is that the 2013 data will be available in about ten days, and the 2014 data won't be available until the end of this year, which won't leave us very much time to consider this data prior to our February 23rd deadline.

So I'd like to request and ask if it's possible for us to get that data sooner, and if so, what date can we expect it?

MR. GIBBONS: It's a lot of data we're going through, so we're trying as hard as we can, as we qualify the data and they pass the QA/QC, we'll be trying to get that to you but I can't give you a date right now.

MR. DYOK: Ellen, I hear your request here. I just -- I know that they've been working very hard on this issue. I just want to make sure that everything goes through the proper QA/QC, you know, process , you know, first, but we'll just try to stay tune with

Harry, but I think he's given you probably a reasonable estimate on when he is going to get that done. I think it would be really tough to expedite that.

MS. LANCE: Ellen Lance, Fish & Wildlife Service.

I understand. My concern is that we won't have all the information to -- prior to potentially making a modified study request.

MR. GIBBONS: I understand.

MS. NOLAND: This is Laura again, Laura Noland with Environ.

Could you just summarize the challenges with the 2013 data and how you corrected the issues that you had in 2013 when you went into the field for 2014?

MR. GIBBONS: There were a multitude of issues. One and the largest was a consistent false positive, for, for instance Kjeldhal, the (indiscernible) detection was too high. So Kjeldhal in 2013 we got very few Kjeldhal nitrogen detections in the reports, and we knew from looking at the data and other things that we have Kjeldahl. So by lowering the detection limit and going to another lab that had a routine to get low-level nutrients , we were able to get the Kjeldhal data for 2014 and it’s coming out to be about 220, 280, and our detection limit (indiscernible) was 310. So that’s one problem.

The false positives of the glacial flour and other issues in the glacial flour, total metals, total phosphorus and others, that was the major analytical problem that we faced, and so we've gone through several techniques with an additional lab who has experience with that to try come back in 2014.

MS. NOLAND: Okay. One last question. Have you amended your QAPP based on the 2013 experience?

MR. GIBBONS: We have amended them. I don't think we have officially filed that yet.

MS. NOLAN: Thank you.

MR. GIBBONS: We will also have, you know, where we can't resolve an issue analytically, we will have the data sets that we will find ways to correct the data to represent (indiscernible.)

MR. MUNTER: This is J.A. Munter with J.A. Munter Consulting.

Can you elaborate a little bit on some of the technical factors that went into the decision to not put back a thermal IR imagery? Was it not working or you already had data in that area? I'm going back to one of the comments you made that was pretty brief.

MR. GIBBONS: Yeah. We -- in 2'13, we couldn't collect all the data because of weather conditions, and the middle reach of the river we didn't collect. We were scheduled to collect it in this year, but we held off because we had a lot of huge database in terms of direct temperature measurements from both the water quality and the groundwater study, and we had already been in the field to do the observations to kind of understand where things were. And Dudley sent an e-mail saying, you know, we're pretty much okay, we don't need this data so let's hold off on that. It wasn't going to give us added value so we saved some money because of the logistics.

MS. REEVES: Mary Reeves, Fish & Wildlife Service.

Can you clarify, you're using the term a lot. You're saying false positive. And to me that has a pretty specific connotation, which is that you are seeing something in your sample which is not in the sample bottle. And I -- but you keep saying it in conjunction of glacial flour.

So can you clarify what you mean by that? I mean, is it possible that there is a lot of arsenic for example, (indiscernible) but in the flour itself and you only see the flour, but you wanted to sample the water, so it was really that field sample that really didn't allow you to distinguish. Because to me, that's not a false positive. That's more of a -- if you could speak to that issue.

MR. GIBBONS: Yeah. It's funny you bring up arsenic because that's one of the parameters we're looking at, the phosphorus.

MS. REEVES: Use that (indiscernible).

MR. GIBBONS: Okay. Yeah. Because it's giving -- it mimics in a colorimetric test for total phosphorus it is a false positive generator and we are getting levels of arsenic that are helping in terms of increasing (indiscernible). So those are the type of things we're trying to sort out. And yes, we're trying to do that.

Also, trying to get out what is the true arsenic total. In both (indiscernible) inside. We are trying to get out what is the true total.

MS. REEVES: That helps to clarify those issues in the data quality report would be very helpful as a summary of what you found regarding those issues.

And then I have one follow-up question. Because sampling for contaminants obviously you're looking at very low levels of things like metals, parts per billion often in water, and so the potential , it's critically important how you handle those samples. I'm sure I'm preaching to the choir, but I'm wondering, I also know this is a very logistically complicated project, and I'm wondering if anywhere it could be provided in the data quality report how many different samplers there were and how many different groups doing all the water quality, were different people doing sediment sampling that water quality sampling and what was the level of training of the field personnel? I'm not questioning but I think it would be really helpful to be able to see that as we move through the data.

MR. GIBBONS: We put that in as (indiscernible). It was basically the same team, different teams at different times, so the water quality team rotated so we had a mix but all trained at the same level and our sediment was taken by the same two individuals both years that were part of the water quality team as well. We tried to avoid as much -- because this is so complicated, so many samples, 40,000 samples.

MS. REEVES: I know. I empathize.

MR. GIBBONS: We wanted to make sure. Those things weren't biting us too bad.

MS. REEVES: I hear you. Been there.

MR. PADULA: Any additional questions for Harry? On the baseline water quality study?

Okay, hearing none, we'll move on.

John, you're going to do the presentation from the phone? John Hamrick, are you on the phone?

MR. HAMRICK: Yeah, this is John. Sorry, I was on mute. Yes, I will be doing the presentation on the phone and Harry will be doing the slide.

MR. PADULA: Great. Can you see your first slide?

MR. HAMRICK: Yeah.

WATER QUALITY MODELING (STUDY 5.6)

MR. HAMRICK: Can you hear me well?

MR. PADULA: Yes. Coming through loud and clear. Thanks.

MR. HAMRICK: Right. Let's go to the second slide, Harry.

Just to highlight the objective of the water quality modeling study, basically modeling both the reservoir and the river temperature and the reservoir river water quality which would include (indiscernible) organic matter, chlorophyll.

And of course, the approach is that the river will be modeled both under pre-project conditions and post-project conditions and the reservoir model will provide the (indiscernible) conditions for the (indiscernible - distance from microphone).

Again, the (indiscernible) will be brought in from the (indiscernible).

Next slide. Just the components (indiscernible), description of the models, modeling approach, special focus area modeling we'll use higher resolution and focus area and (indiscernible) output.

Next slide.

We implemented the (indiscernible) that are described in the study plan with no variances.

Summary results. This is really -- this slide is sort of a -- more of a recap of the state variables that's split between the two models. (Indiscernible) temperature of TSS, (indiscernible) organic matter

(indiscernible)

Next slide.

Summary of results, the reservoir model has been configured, has 20 layers and vertical has about (indiscernible). We have demonstrated the reservoir model to be robust being able to simulate multi-year periods where we have almost (indiscernible) variation river model (indiscernible) in the ISR was configured to downstream project river mile 80 (indiscernible).

Next slide.

For the river model, we again basically simulated multiple (indiscernible) periods. Stay with me a minute. (Indiscernible.)

MS. MCGREGOR: I think he's having technical issues. He said he lost the presentation.

MR. PADULA: John, what's up there?

MR. HAMRICK: I've lost the (indiscernible - interference with speaker-phone) come back. (Indiscernible.)

MR. PADULA: That would be great. Just let us know which slide you're on.

And when you're speaking, you tend to fade out, so if you can try to maintain consistent volume there, that would be great.

MR. HAMRICK: Okay. I think we should be on Slide No. 7.

MR. PADULA: Correct

MR. HAMRICK: And I was there discussing river modeling results, again demonstrating (indiscernible) to simulate multi-year periods looking at pre and post project conditions and their evaluating differences. The pre-project river models will be, or is in the process of being calibrated to data collected between 2012 and 2013, and 2014 data will be sort of brought into play as it becomes available.

Next slide, Slide 8.

These are results since the ISR. Some of this may have been presented as proof of concept B. The reservoir model was used to simulate (indiscernible) 1976 was a dry year period and 1981 was a wet year. The main results of the reservoir simulation here show if we, the maximum load (indiscernible) scenario, (indiscernible) operation of the (indiscernible) somewhat warmer water coming out of the reservoir.

The other thing that we had simulated or looked at so far is we actually had an inflow of fine sand and some clay-size material. We found that the -- with the water (indiscernible) from the surface land to reservoir, we found that the fine sand is almost entirely retained. There is a significant retention of the clay.

Slide 9. The river model was extended down to project river mile 29.9. We did the same two sets of pre-year simulations, again, over the full range of the river from the reservoir to the 29.9.

And again, we looked at the difference in pre- and post-project temperature to 29.9. I can't remember at this point if the technical memo actually shows both three-year periods, but this is just an example of looking at a correlation between pre- and post-project temperature. Generally they differ by less than 1 degree at project river mile 29, again the technical memo shows how temperature differs at various (indiscernible) down the river and (indiscernible). The TSS in the middle river will likely be much lower due to significant trapping of all of the fine sand (indiscernible).

Slide 10, please. Focus area modeling. The focus area modeling that we're conducting goes very much along the same lines as that being done at the geomorphic study. We are planning, of course, to do dynamic simulation rather than (indiscernible) sort of base flow so we'll have to use somewhat coarser resolution for a longer term time for dynamic simulating. One thing we're going to do is maintain consistency of the (indiscernible) between the other -- the two (indiscernible) and the two (indiscernible) are the focus there. We're currently completing the (indiscernible) for focus areas. (indiscernible) demonstrated for the seasonal scale stimulation for those two.

The proposed modification for the study, we have no modification for the study plan.

Slide 12. Decision points (indiscernible), same decision point as the geomorphic modeling. We've reached a similar conclusion that the quality model will not be extended downstream of project river mile 29.9. That decision is based on the analysis and comparison between pre- and post-project temperature at that location where (indiscernible) slide in the technical memorandum show less than 1 degree difference between scenarios, 1 degree (indiscernible), and also that the (indiscernible) river at that point (indiscernible) much of (indiscernible). Of course (indiscernible) sufficient data behind the 29.9 but that was not a major issue in the decision point. And this, again, is documented in the technical memorandum.

Slide 13. Just a current status. I will try to go through all of these quickly, but it says we have completed configuration of the reservoir model. We did not plan to change the model (indiscernible) or the resolution. We've shown that we have done multi-year temperature and fine sediment simulation. A somewhat simple ice model to be sort of implemented and tested which will primarily be a (indiscernible) model that I suspect will cover using something a little beyond our reaches for today.

Again, the water quality model configuration is under way. We'll continue into the next calendar year as the additional water quality data in 2015 become available. Toxic and mercury model, again, will -- hasn't been started because most of the work will be done the early part of next year.

The reservoir doesn't exist. It cannot be calibrated. (indiscernible) sort of documentation of the robustness or the performance of the reservoir (indiscernible) high latitude or high altitude reservoir. The reservoir model is able to, you know, rapidly change scenarios and incorporate scenarios based on the 60 year hydrologic period (indiscernible) looking at outflow levels and (indiscernible).

Slide 14. Again, the river model (indiscernible) configuration in 2013. Final configuration, what we call the four-year model, where this year it was stopped at 29.9. The -- we'll be looking at things for importing ice (indiscernible) from the ice processes model in the middle river. Right now the river (indiscernible) does one for through the year. It's the water temperature does come slightly above (indiscernible) to the reservoir model (indiscernible) to the (indiscernible).

I might note too that the calibration of the river (indiscernible) pre-project (indiscernible) the river model can be calibrated with (indiscernible)

Slide 15, please. Focus area modeling. Sort of developed what we'll call a higher resolution grid for the focus area (indiscernible) independent (indiscernible) river model. We (indiscernible) that will be sort of (indiscernible) focus areas (indiscernible) and focus area (indiscernible). Again, we developed (indiscernible) to provide data to (indiscernible) temperature (indiscernible) and some (indiscernible) divisions indicate the river (indiscernible). Again, (indiscernible) scenario stimulation (indiscernible) the reservoir (indiscernible).

Last slide.

MR. PADULA: Thank you, John. We'll hopefully get some questions for you to answer.

Anyone want to start? Identify yourself, please, folks.

MR. KRISTANOVICH: Yeah, this is Felix Kristanovich Environ International. I have a number of questions, so maybe I can just go one by one if that's all right.

Yeah. My first question is with respect to your model [calibration]. I think originally we were expecting for it to be finalized now. It's being postponed? And I see that now [you're calibrating with] 2012 and 2014. Wasn't originally it was supposed to split [one part for calibration and one part for validation]? That's the first part of the question.

Second part of the question, I think this is really important.

How confident are you right now to (indiscernible)? You are not complete (indiscernible). How are -- how confident are you in your important decision that you have made, based on the results of the model?

Like, for example, not extend model past 29.9. [How confident are you in the decisions to not extend the model downstream of 29.9?]

MR. HAMRICK: I (indiscernible - interference with speaker-phone) or the river, or both?

MR. KRISTANOVICH: For the [riverine model].

MR. HAMRICK: (Indiscernible - interference with speaker-phone) of the river model (indiscernible) or the open water (indiscernible) model, and also (indiscernible) transport model, that there can be a calibration validation process for (indiscernible) discharge and velocity at certain locations. Likewise, the temperature -- the temperature component of the river model is being calibrated to the (indiscernible) open water period.

We likewise (indiscernible) calibration period (indiscernible) in the approach (indiscernible) two years, and so I hope that (indiscernible). My apologies (indiscernible), but (indiscernible).

MR. KRISTANOVICH: Can we at least see some preliminary results of calibration? Because you are providing us with a model. I mean, we probably did some calibration to something that we at least can see.

MR. HAMRICK: Yes, they're not -- at this point they have not been put into -- they are not in the technical memorandum, which primarily focused on the decision point issue regarding the extension to 29.9.

MR. KRISTANOVICH: I'm going to go ahead with some other questions. [I was disappointed not to find any information regarding the development of the mercury model I remember that at the last meeting you were anticipating it being done in the next 6 months. Do you have anything or are you anticipating this in the next year?]

MR. HAMRICK: (Indiscernible - interference with speaker-phone) model, we are (indiscernible) mercury level was (indiscernible) water quality model (indiscernible) predictions. So the (indiscernible) process of developing the -- developing the (indiscernible) organic material that was going to be (indiscernible) primarily from shallow areas where there is vegetation.

MR. KRISTANOVICH: The next --

M: (Indiscernible - interference with speaker-phone) sulfides.

MR. HAMRICK: (Indiscernible - interference with speaker-phone.)

UNIDENTIFIED MALE: (Indiscernible - interference with speaker-phone) sulfides.

MR. HAMRICK: That (indiscernible - interference with speaker-phone) to be determined. I think maybe (indiscernible) better to be (indiscernible) following presentation.

At this level, I don't -- I don't foresee doing that, but that could change if there's different information and sort of the analysis of (indiscernible) -- the analysis of the information that will allow a sort of (indiscernible.)

MR. PADULA: John, could the person who asked that last question identify themselves?

UNIDENTIFIED MALE: I'm (indiscernible).

MR. PADULA: Say that again, please.

UNIDENTIFIED MALE: (Indiscernible - interference with

speaker-phone.)

UNIDENTIFIED MALE: (Indiscernible.)

MR. PADULA: Okay. Thank you.

MR. GIBBONS: Just to clarify what John's saying is we're still finishing the pathway models and putting that together and we'll adjust sulfides relative to the (indiscernible).

MR. KRISTANOVICH: Can we get a timeline (indiscernible.) spend time on this (indiscernible)?

MR. GIBBONS: Yes. We'll be able to discuss and present in January the (indiscernible) model. We're going to put it together by December, have a QA/QC by one of our colleagues and John on that, in terms of fine-tuning the mercury model based on those pathways and then we'll before the January meeting an independent technical review of that pathway.

MR. KRISTANOVICH: Thank you. I'm going to have another question to ask.

[Have you done any sensitivity analysis to other operations that would show us any sensitivity results?]

MR. HAMRICK: (Indiscernible - interference with

speaker-phone.)

MR. KRISTANOVICH: (Indiscernible - distance from microphone).

MR. HAMRICK: That (indiscernible) if you follow the (indiscernible) of the reservoir (indiscernible) would typically be colder than the (indiscernible) are going to (indiscernible) end up with a sort of (indiscernible) there is a certain temperature there is (indiscernible) follow the lead of the (indiscernible).

The other (indiscernible) the issue, I am looking at (indiscernible) of the trapping (indiscernible) we're really confident that fine sand is almost entirely trapped (indiscernible) trapping that much of the silt (indiscernible). I am looking at whether you can simply lump silt and clay into sort of a single (indiscernible) sediment category and assign a (indiscernible).

However, if you do have some information (indiscernible) three or four (indiscernible), then you may get (indiscernible). And certainly, I think that's sort of (indiscernible). We haven't -- we haven't said the (indiscernible) in the river (indiscernible) any effect on (indiscernible) penetration or (indiscernible). So that's (indiscernible).

MR. KRISTANOVICH: Thank you. [I would like to mention that we will review technical memorandums in more detail and you may get more questions because this could have tremendous impact downstream and on other studies.]

MR. HAMRICK: (Indiscernible - interference with speaker-phone) are you referring back to.

MR. KRISTANOVICH: (Indiscernible - microphone feedback.)

MR. HAMRICK: (Indiscernible - interference with speaker-phone.)

MR. PADULA: John Zufelt is indicating that they haven't had a chance to review the latest technical memorandum, so there could be additional questions for you.

MR. HAMRICK: Well, yeah, certainly, if it's (indiscernible) make that comment again. My apologies for not being there (indiscernible), but I certainly encourage everyone to -- I didn't answer your question or I didn't hear on the phone, but (indiscernible._

MR. PADULA: Any additional questions for --

MS. REEVES: This is Mary Reeves with the Fish & Wildlife Service.

I have two questions. I think one is probably broadly related to model calibration. Could you explain how -- and I'm not so much a modeler, so maybe you can kind of dumb this down, but how the historic data fit into the model? You know, the data we collected 20 years ago, how the TIR data, for example, fit into the temperature models. I'm using temperature here, but obviously the modeling was for a whole bunch of different things.

And I would like to know whether those indeed are driving the models, and if they are not driving the models, then how well the models are matching up with those data. That's question one.

MR. HAMRICK: (Indiscernible - interference with speaker-phone) the previous study?

MS. REEVES: Yeah, like the '70s, '80s. I'm new to the project too.

MR. HAMRICK: (Indiscernible - interference with speaker-phone) certainly, in terms of some aspect of (indiscernible) start at the beginning (indiscernible) information towards (indiscernible) from the 50-year hydrology, which (indiscernible) reservoir and (indiscernible). I think that's very wise (indiscernible).

For the next (indiscernible) temperature and say (indiscernible) 50-year period. We now know (indiscernible) correlation of temperature (indiscernible) time of the year (indiscernible). We're basically trying to identify a (indiscernible) temperature (indiscernible) particular data (indiscernible) model back (indiscernible). Basically the (indiscernible) Talkeetna has (indiscernible) long-term National Weather Service station, and that does go back (indiscernible) correlating back with (indiscernible) current data to (indiscernible) and to also (indiscernible) how we're using some of the data.

MS. REEVES: Okay. Thanks. That's good. And I think that will probably get laid out more clearly and kind of as we are able to incorporate these 2014 results and consider them, so I hope that those kind of linkages are very clear as we move forward.

And my second question is, you obviously -- one of the main questions here is how do things change, and the time for example fish eggs that needs to hatch between a certain -- within a certain temperature envelope. In that case, the variation in temperature may be more important to me than predicting an average value. There are some cases where it's very useful to see one line that shows the average, and then there are other cases where it's more useful to see kind of an envelope around that line of uncertainty in your estimates. And I think in the case, for example, biological resources, like fish, that that envelope that shows your uncertainty is very important.

MR. HAMRICK: (Indiscernible - interference with speaker-phone) time scale I (indiscernible) high resolution (indiscernible) so there are (indiscernible) probability that can be (indiscernible) the average (indiscernible) or the variability of that (indiscernible) habitat starting (indiscernible) provide the information for that (indiscernible) process that is (indiscernible - foreground conversation).

MS. REEVES: So what I'm hearing you say is that it is possible in the modeling exercise that we're doing to predict not just the average value, but uncertainty values around the estimates?

MR. HAMRICK: (Indiscernible - interference with speaker-phone) hydrologic and climatological (indiscernible) can be looked at (indiscernible) compare that with (indiscernible) all the information that can be extracted.

MS. REEVES: Right. And so we would -- I guess this is my request, that we are able to see and evaluate that kind of variation as we move forward, and we would like to see the linkage made from the field data that was collected at specific points to what the model is predicting at those points so that we can also see how well those are matched up.

MR. HAMRICK: And (indiscernible - interference with speaker-phone) pre-project, post-project on a day or an hour-by-hour basis at this location, it would really be more appropriate to sort of compare the means or expected values and the variability.

MS. REEVES: Yes.

MR. PADULA: Thanks, John.

MR. MCLEAN: This is Dave McLean from Northwest Development. So my question is related to the reservoir model, and. [Related to the reservoir model and this also relates back to water quality modeling replacing the need for geomorphic studies in the reservoir. How does water quality overlap with sediment modeling?]

MR. HAMRICK: Okay. I think I understand (indiscernible - interference with speaker-phone) the geomorphic model (indiscernible) should be -- should the reservoir be modeled (indiscernible). The modeling (indiscernible) has, let's say, a complete (indiscernible - foreground conversation) the geomorphic study (indiscernible) there are influences (indiscernible) any potential (indiscernible) in those kind of situations and (indiscernible).

MR. MCLEAN: You've answered some of my questions but maybe I can just go through some specific questions.

[For a sedimentation model we would normally run a model for 100 years or longer to look at patterns of deposition. Regulators ask for 1,000 years of data from a model. Not trying to critique your water quality model. How are we going to learn about sedimentation and geomorphology from this model? Is it morphodynamic? How do you handle that aspect of it.]

MR. HAMRICK: (Indiscernible - interference with speaker-phone) depends on the (indiscernible) prediction and the (indiscernible) would lead to this model for representative (indiscernible).

MR. MCLEAN: Yes, I'm not trying to keep your water quality modeling, I'm not qualified to do that, I'm not (indiscernible) presentation. I'm just trying to figure out how we're going to learn about sedimentation processes and geomorphic processes from this very sophisticated model. That's the way I'm approaching it. So (indiscernible) the model (indiscernible) and does that feed back into your (indiscernible)? How do you handle (indiscernible)?

MR. HAMRICK: Actually (indiscernible - interference with speaker-phone) dynamic. It can involve (indiscernible).

MR. MCLEAN: (indiscernible - interference on microphone.)

MR. HAMRICK: Other than the (indiscernible - interference with speaker-phone) at the reservoir site (indiscernible) the model could be updated to (indiscernible).

MR. PADULA: Okay. John, hold on. Another question coming.

MR. MCLEAN: (Indiscernible - interference on microphone) [When you run the model now is it actually doing the updating? With some models you have a choice and you can decide when you do the updating of the bathymetry and it’s much faster to run the model when you don’t. You have run multiple year simulations. If bed loading is not that important certainly in decades it becomes more critical.]

MR. HAMRICK: Right.

MR. MCLEAN: (Indiscernible - interference on microphone) so in that case, do you bother to (indiscernible) for centuries (indiscernible).

MR. HAMRICK: Boy, yeah. (Indiscernible - interference with speaker-phone.)

MR. MCLEAN: Thank you.

MR. HAMRICK: But that sort of crosses the line between the geomorphology and the reservoir study and as I said, it's not (indiscernible.)

MR. PADULA: Thanks, John.

Sue, a question?

MS. WALKER: Yeah, John, this is Sue Walker. I have a question.

As I understand it, the model temperature increase assumes static conditions. It's based on past and current temperatures, yet we know that water is warm and will continue to warm.

So I have two related questions. One is, how does your model project future water temperatures without the project? And then a related question, how does your model project future water temperatures with the project knowing that water temperatures will continue to increase independent of the project, and that project-induced increases in water temperature are on top of, or in addition to, the shifting baseline of continuing environmental warming? [What are you doing to account for that?]

MR. HAMRICK: (Indiscernible - interference with speaker-phone) summarize but I got the point. (Indiscernible) shows the (indiscernible).

MS. WALKER: Slide 8?

MR. HAMRICK: (Indiscernible - interference with speaker-phone.)

MS. WALKER: He didn't understand the question.

MR. HAMRICK: (Indiscernible - interference with speaker-phone) takes a lot to heat up a (indiscernible) mass but once you get into the summer, though (indiscernible) reservoir, we heat it, we do have a therma (indiscernible) actual temperature conditions in the river (indiscernible).

MS. WALKER: Thanks, John. I don't really think that answered the question, though. That -- your model was using past and current temperature data to project future reservoir temperature scenarios. It's -- you mentioned climatologically significant years, cold, dry years, but it doesn't seem to be recognizing climate trends, which are clearly known and identified.

So I think a better question is, is information from Study 7.7 going into this modeling? It's inappropriate to assume static conditions in terms of temperature.

And the same question applies for the modeling of future reservoir conditions and for the outflows. So just very basically, is climate information from Study 7.7 going into your reservoir temperature models in your downstream temperature models?

MR. DYOK: John, this is Wayne Dyok. Maybe I can help you out a little bit on the --

MR. HAMRICK: Yes, I didn't respond to (indiscernible) and I certainly appreciate you jumping in here.

MR. DYOK: First of all, a couple of things, Sue, with respect to the shutter operations, shutter operation, if we ask John tomorrow --

MS. WALKER: I thoroughly understand the shutter operations and that's not related to my question.

MR. DYOK: Okay. So you know that we can pull water at 4 degrees or near the surface?

MS. WALKER: Yeah. I appreciate that. I understand that, but --

MR. DYOK: So your question is specific to climate change. We are looking at combinations of meteorological from you know, different combinations of cold years to warmer years, and you're really referring to from a climate change, maybe a warmer type of thing. We're looking at variability of precipitation with those, as well. We can run sensitivity analysis that would deal with your question.

The plan is to look at the meteorological and hydrological conditions that we have expected to -- that we've seen in the past.

That's part of the study plan. We can easily do a sensitivity analysis, a what if you had 2 degree C, warmer temperature climate, okay? So those are simple things you can do with this model.

But the plan is to look at the historic data first and model based upon current conditions. But the model has enough flexibility to go beyond that, if necessary.

MS. WALKER: Can I just respond that it doesn't need to be a "what if". The climate is warming. That is documented. That is fact. What's being done -- please let me finish. I don't want to hear about shutters. I know that you can do that. I understand that completely.

But the model being used to project future conditions without the project, from which project conditions are being modeled, we know is wrong. We do not have past and current conditions. We have a trend of warming. That trend is not incorporated in this model or in other models.

Mary, do you have --

MS. REEVES: Just as an example of that, there predictions (indiscernible) that might be useful kind of date line where we could monitor (indiscernible)

MS. REEVES: And I did want to say that graph would be a really good example of something that would really be nice to see, kind of a confidence window on so in these reports that we're getting, if you can see not just a red line, but a window around. That red line, when you're having to start making decisions about effects on biology, that window can be really important.

And I had one last question. You talked about stopping modeling below river mile 29.9. That's a very specific number, and so I'm wondering if you can discuss how you -- or describe how you came to arrive at that number and whether there might be uncertainty around that number, and if so, what that might be.

MR. DYOK: I think John needs to respond to that question. It's more of a technical, you know, question.

And as we've said previously, just to deal with your climate change question, we're going to have the information from the glacial study. And so we have that information. We can look at that and compare that meteorologic conditions and see if it's outside.

So we can actually, if necessary, and I'm saying that this is what the Alaska Energy Authority, you know, would do. It's not part of the FERC study, you know, program here. But we can actually use this model to look at and see, are we outside of what these meteorologic conditions are, because we think that the broad range of conditions that we're looking at is a broad range. We're looking at different meterological and hydrological conditions.

We can look at what kind of in-flow temperatures we're seeing. You know, John can look at -- run that in a small -- these are simple things to do, but they take time and they take money.

Before we commit to those things, I would like to see the study that we're doing -- work with you. Let's look at the results and maybe there is value and maybe there isn't value in going to that next level. But I think we have the tools to be able to do that.

MS. WALKER: Mary, may I respond, please?

This is Sue Walker. Wayne, I really appreciate that answer. That does clarify it.

But in reading the studies, it's not clear that the information is going into these modeled studies where temperature is so important and is so biologically important. So knowing that you are going to look at those results and you are going to do a comparison is very helpful.

Also, this is a great example that Mary brings up. You can use the climate information available to put some confidence and (indiscernible) around that to determine whether if there is a difference in temperature from changing climate continued warming, does that difference make a difference? It may not, but without doing the analysis, you won't know. So I'm glad to hear they are doing analysis.

MR. DYOK: And, John, could you answer Mary's question regarding the extent of your modeling downstream to river mile 29.9? Do you recall the question?

MR. HAMRICK: Well, I think that in terms of the choice of 29.9, it is -- it sort of relies back to the geomorphology study also. , and it is just below the (indiscernible), which actually has a (indiscernible) on the temperature.

We have looked (indiscernible) geologic study, the effect of (indiscernible) temperature on the dam has (indiscernible) the dam outflow temperature (indiscernible) I would say (indiscernible) 1 degree, at most, temperature (indiscernible) project. The technical memo actually shows that (indiscernible) current condition shows that the (indiscernible).

UNIDENTIFIED FEMALE: (Indiscernible - interference with speaker-phone.)

MS. WALKER: Is someone calling their dog?

MR. PADULA: There's someone else on the phone with some background noise. If you'd mute yourself, we would appreciate it.

MR. HAMRICK: But yeah (indiscernible - interference with speaker-phone) it's a little more complicated (indiscernible) to see that (indiscernible) and again we see that by the time we reach this point, the difference in temperature is quite small and the (indiscernible) is quite small.

But (indiscernible) becomes quite complex (indiscernible) so there may be some (indiscernible) still might be some effect (indiscernible).

MS. REEVES: (Indiscernible - distance from microphone.)

MR. HAMRICK: (Indiscernible - interference with speaker-phone) is a gauge station and (indiscernible).

MS. REEVES: Can I repeat back to you, just to make sure I got what you just said?

It sounds to me like there are three factors that you're -- that are feeding into this 29.9 decision.

One is data, that you don't have as much data below this point. That was kind of a minor point.

Another was river complexity below this point, that it's hard to model the channel below this point.

And it sounds like the third one is variation between temperatures with the project and without the project. I heard you say that this was the kind of that threshold point (indiscernible). [Are the three factors feeding in to stopping at 29.9- 1) The data, not much, that's a minor point. 2) River complexity –It's harder to model the channel below this point, and 3) the other is variation between temperatures? There is variation pre- and post-project as an estimate at river mile 29.9. I would like to see the variation around that estimate according to your model for example how many miles back and how many miles forward would you like to go, how confident are you in that you stabilized that. I'm interested in seeing a better variation of temperature and interested in seeing what the models are predicting at the spatial and temporal scale. Describe your level of confidence in your estimates does it go from 25-35 or 20-40 how confident are we? It would be helpful to see three maps for example, this is my low and this is my high estimate. Also, it would be helpful to see longitudinal profiles and temperature as flow goes downstream so you can see different kinds of differences and figure out specifics.]

MR. HAMRICK: (Indiscernible - interference with speaker-phone) other things, like we don't have cross sections yet or (indiscernible).

MS. REEVES: Okay. So --

MR. HAMRICK: (Indiscernible - interference with speaker-phone) analysis (indiscernible) study. I (indiscernible) 29.9 (indiscernible).

MS. REEVES: Okay. And so to follow up, so say that this variation pre- and post-project you've got, again, reporting an estimate of river mile 29.9. What I would like to see is the variation around that estimate according to your models, how many miles back and how many miles forward can we -- might we go? Like how confident are you on that 29.9 that you have stabilized the temperature between pre- and post-project?

And this basically underscores I've already put in a request to have a better visual demonstration of temporal variation, so like the charts up there on Slide No. 8, I'd like to see a (indiscernible). We'd also really like to have --

MR. HAMRICK: (Indiscernible - interference with speaker-phone.)

MR. PADULA: John, hold on, let her finish, please.

MS. REEVES: I'd like to have an understanding of partial variation, and your level of confidence. Because one of the things that I think we understand about hydroelectric projects in the (indiscernible) is that there can be a homogenization, ecological homogenization downstream, where we change those characteristics, and we're interested in seeing what the models are predicting about what your spatials -- your spatials (indiscernible) spatial and temporal (indiscernible). Does that make sense? We'd like to you describe your -- your level of confidence in your estimates.

So for example, the estimates 29.9 I would like to confidence (indiscernible) 25 to 35, or does it go from 20 to 40? You know, how confident are you at that point? But I just need kind of spatial (indiscernible - foreground conversation), and it's (indiscernible).

MR. DYOK: Yeah, I think I know where you're coming from. And essentially (indiscernible - foreground conversation) temperatures as (indiscernible) kinds of differences. And we need to sit down and figure out the specifics of what we're going to look at), but I think typically John (indiscernible) is to look at a particular point in time and at a particular location and then see how water temperatures are (indiscernible - foreground conversation) snapshot of the river and we're looking at how (indiscernible) post-project condition and (indiscernible) should be a representation of the (indiscernible) confidence (indiscernible).

And just kind of mention that we might want to look at the technical memo that John's put together on the basis for his curtailed involvement (indiscernible) 29.9 that got submitted (indiscernible).

MS. REEVES: Yeah. And this -- and I know we're talking about changes again, which we don't want to talk about. But I thought that since I had the opportunity, if you could answer the question, it would help me move forward.

MR. PADULA: Okay. One more from Sue.

MS. WALKER: Hi, John. This is Sue again. I have one more question. Well, actually two.

You mentioned that at river mile 29.9, there is a 1 degree C difference in water temperature. I assume that that's an average annual temperature? And – [at RM 29.9 there is a 1 degree difference in water temperature is that an average annual temperature?]

MR. HAMRICK: (Indiscernible - interference with speaker-phone) technical memo (indiscernible) temperature at 29.9 (indiscernible).

MS. WALKER: Okay. I understand now.

MR. HAMRICK: (Indiscernible - interference with speaker-phone.)

MR. PADULA: (Indiscernible - distance from microphone.)

MR. HAMRICK: (Indiscernible - interference with speaker-phone.)

MS. WALKER: (Indiscernible - distance from microphone.)

MR. HAMRICK: (Indiscernible - interference with speaker-phone.)

MR. PADULA: Thank you, John.

MS. WALKER: Thanks, John. I wasn't done with the question.

Anyway, I appreciate that this is in your September tech memo, which we of course will be looking at, and this is our first experience. I understand the significance of this 1 degree in terms of your ability to estimate it and the error margins around it.

However, what I want to request is that we look at the biological significance of that temperature change. We look at the variation seasonally. I don't know how closely you can model it. At least a monthly basis, in some times of the year it would be important to look at that on a weekly basis.

And then the other point I would like to make is that it would be -- it is fantastic to have you here in person in January. Because I know how hard it is to give a presentation over the phone when you're staring at your own computer and you have a telephone and we'd love to see you if we can. Thanks.

MR. PADULA: No need to respond.

MS. WALKER: The point is I would like to see the biological significance of that temperature change used. We need to know why that makes a difference, if it does, and it may.

MR. PADULA: Thanks.

Any other questions?

Okay. Thank you, John. We are going to --

MR. HAMRICK: Well, thank you for bearing with me over the phone here. As I said, I'll be happy to respond to, you know, the rest of the commentary.

MR. PADULA: Perfect. Thank you.

We move on to Mercury and that's Harry's and Rob (indiscernible), and then we will have a break after this one.

MERCURY ASSESSMENT AND POTENTIAL FOR BIOACCUMULATION (STUDY 5.7)

MR. GIBBONS: Okay. Mercury study was put together so we could help understand the fate and nature of mercury within the reservoir and the watershed. And so we wanted to understand how it's available, what its sources were, and how it was with different matrixes within the system. So we want to understand where it was in terms of water -- flow water and sediment, the sediment itself, how that translated to the current biological availability and the current accumulation of the food chains, so we're looking at different elements within that system and trying to map where are there potential soil and vegetation organics that would lead in the inundation area that would lead to increase in metalization of mercury (indiscernible) accumulation potential. So, and that's kind of an overview of what we were looking for.

A had -- let's move on to key one here.

A few variances in what we had to do. We had some study locations that had to be fine-tuned it a little bit because of access issues. We had trouble getting to them in terms of location so that it seems like variation but still sampling the same reach representative -- representative reach, so that was important.

There were also with three of the areas, a slight modification in terms of how we were able to take the sediment and the pooled water because of, again, how do you get valid samples.

We had to change the approach that was in our study plan in terms of how we were going to gather the sediment from a classical (indiscernible) than the type of ground sample to a stainless steel (indiscernible).

Also in some of the terrestrial samples, we had some (indiscernible), so we had slight modification but within the EPA guideline in order to extract, digest the samples essentially before we extracted the mercury (indiscernible), so we had a representative of that.

Some other --

MR. PADULA: Closer.

MR. GIBBONS: A little more, sorry. Closer. How's that?

We also had several species that we wanted to collect samples from and collect a number of samples, seven to ten samples per species. There were three species that we had to -- difficult because of rareness and access to get them. But we didn't sample and we added the one species in lieu of that that was up there so that we could get that sample and (indiscernible) fish tissue samples to get a mercury estimate there.

There were some other little variations in terms of some of the identification of the fish and things, but in terms of mercury, we think we have a handle on what's kind of representative is up there moving forward.

Some of the results, we were able to, as I said, collect soil and vegetation samples. We have -- we are currently together our soil and vegetation inundation area map, so we'll have that information. We have the baseline water quality samples that we've taken a lot of including seven focus area.

We have sediment pore water from ten locations that have been sampled, and only four of those are (indiscernible) because of the 2013 versus 2014

And we have collected, like I said, some fish tissue samples.

Okay. Some of the modifications that we discussed earlier (indiscernible) included total mercury for our water quality samples. We found that our total mercury, we didn't have as much confidence in as we'd like to have, in terms of conducting a QA/QC assessment of that native so we retook samples in 2014 to -- along with other perimeters that are listed here and what -- address that issue.

And again, (indiscernible) water and sediment collection samples in 2013, we weren't able to access on the four to ten sites but we have access to them now. So we got that put together and I already mentioned some of the fish species.

We added the round whitefish and (indiscernible) whitefish and did not -- weren't able to (indiscernible) rainbow and (indiscernible).

For some of our manual species, we had difficulty in sampling because of the rareness of the river otter and (indiscernible) but we were able to obtain some samples and do have those now, and we also (indiscernible). Where we have not been able to meet the original study plan was in our sampling of birds. We have not collected any bird samples for several reasons. One, the rarity of the target birds (indiscernible) that the (indiscernible) are in and are -- we didn't want to just, you know, put them at stress because they are stressed and rare in that area and the difficulty of actually getting ahold of a nest or bird access for those species to get them, and so that is a modification that we still haven't completed yet, and we're looking at that in terms of whether or not we will need to collect the feather samples from our (indiscernible) birds, because we'll have to assess (indiscernible) to see what is bioaccumulation based on what is the increase of methylation because of the reservoir to see whether or not that's going to add to our understanding of the bioaccumulation (indiscernible).

Questions?

MS. VERBRUGGE: The Fish & Wildlife Service thinks it's extremely important to actually get bio monitoring data, to get the actual fur, feather, or even blood if its feathers aren't (indiscernible) We want actual data. We do not think that pathway analysis and literature review or modeling are sufficient.

We need actual numbers in order to understand the baseline and to determine if there's any (indiscernible) capacity for additional mercury exposure or whether they're already, you know, added at a level of risk because with the levels that they have right now, we need that information for our decision-making. And that is in the (indiscernible) study, and we want it to stay there. [It’s extremely important to get bird feathers or eagle blood. We want actual data we need numbers; pathways and literature review is not sufficient to determine if there is assimilative capacity for additional exposure.

We want that as part of our study.]

MR. PADULA: Thank you.

MR. CONDER: Hi. Jason Conder with Environ. I have a few questions. I'll just kind of go through my list here.

[Can you talk more about the pathways analysis? Are these figures or numerical models- what number comes out the other end? Are you comparing to toxicity reference loads? Are those numbers? Continue to refine and be explicit as you can what can come out of the other end of the model? You have a lot of great ingredients but I'm not sure what you're baking at the end of the day? What are the ingredients? We want to be able to evaluate the parameters.]

MR. GIBBONS: Okay. Here's the pathways that we presented before. Of the (indiscernible), we're basically going to have three different pathways (indiscernible) models that we're going to develop.

One is the (indiscernible) model, what's happening (indiscernible) in terms of methylation of going through the system. The others and the (indiscernible) that I have up here, the mature reservoir. In other words, after a while we'll be (indiscernible) degradable that could be the methylation and that's going to diminish over time. Sand sedimentation and stuff, we anticipate there is going to be a different dynamic in terms of methylation when the (indiscernible) first occurs through a period of years. We're trying figure out with all the others and figure out how long it's going to be. But then there's -- once the stabilization period comes, then there's (indiscernible) and that's what this represents. So we're looking at that.

But what I don't have here but is in other tech memos and things that (indiscernible) is what are we really looking at. We're looking at what is waterfall conditions and what is the organic load, and what the (indiscernible) condition. In other words, is it (indiscernible) condition and what is the source of mercury there and those combos to set up what those combination of things could lead to methylation and then how would that fit into this pathway to where we have (indiscernible) based on (indiscernible) chemical and biological condition of the reservoir and the (indiscernible).

MR. CONDER: So are they figures? Are they numerical models? [Are there 30 ppm in fur? Can you quantify that? Is there mercury in sediment?]

MR. GIBBONS: It's a combo of both.

MR. CONDER: Okay. What number comes out the other end? You field all this great data and model assumptions and you have some built-in (indiscernible), but what's the numbers? Is it a hazard quotation or are you comparing to toxicity reference values or just going to be mercury loads or what's going to come out the other end?

MR. GIBBONS: Good question. One of the things that's going to come out is we'll use this to work with the three (indiscernible) models for reservoir to help make sure we have a realistic prediction of what's going to occur in the reservoir for water quality and predicting actual methylation that becomes available and so if you look at our existing condition, look at what -- if there's an increase, how much of an increase , how that's going to move through the system based on different uptake abilities and paths that they can occur and then help quantify that as much as possible though that (indiscernible).

MR. CONDER: So the numbers are going to be predicted concentrations in wildlife or --

MR. GIBBONS: First (indiscernible - distance from microphone).

MR. CONDER: I'm still not exactly sure what's missing.

MR. GIBBONS: (Indiscernible - distance from microphone) from that, where are we at with the existing condition today, and then we can use and go beyond that -- in terms of estimating and quantify at this point.

MR. CONDER: Right, right. Okay. And the problem is, I'm still trying to kind of figure out what's going on, because I'm the ecological risk assessor, so I usually deal in terms of hazard quotients and comparing concentrations of (indiscernible), especially for mercury. I do a lot of mercury risk assessment.

There's always a pathway. So I see a lot of these comments and statements about, you know, since the potential for pathways. And your figure there is great, you know, it captures a lot of what's going on. And obviously there are pathways, for sure, and there will be pathways after a reservoir is built and there are pathways now. The fish are getting eaten by something out there.

So I guess my thought is, is if you can continue to try to refine exactly -- and be as explicit as you can, what is coming out the other end of these models. Because all the data you guys are collecting is great. You have fish livers and fish fillets and sediment and water and all this great stuff. You know, you have a lot of great ingredients, but I'm not still quite sure what you're baking at the end of the day. Is it -- are we baking cookies or a cake, or is it lasagna? Do we need more glacial flour, you know, what are we working with here?

So okay. It's good to hear. So again, try to, if we can, let's try to get a little more explicit with what we're baking here. [I have a note about correction factor for the water samples. Can you talk more about that? I echo earlier comments on 5.5 that we need to see lab data validation reports. We need to see data and bird data. Specifically getting blood from eagles. It sounded as if the agencies were on board with the concept and then it was not implemented but we spoke about it at one of the technical work group meetings. You are requesting a modification to drop this data. We would like to modify the study and get bird blood instead. It is in the RSP.]

MS. VERBRUGGE: And also what the ingredients are, because we want to be able to evaluate the difference parameters and how your parameters are accessing it and, you know, to evaluate that market as well, not just the (indiscernible)

MR. GIBBONS: Right. That's what we're trying to go from.

MS. VERBRUGGE: And I had a question for you about -- I can't remember where I saw it, it was in one of those -- one of the (indiscernible) slides, you didn't show it today. But somewhere I saw something about something about 30 part per million in fur. Can you tell me what that sample was and -- am I remembering that right?

MR. GIBBONS: Slide 8 maybe.

MS. VERBRUGGE: Did you have fur results, and what did they come from and what were they?

MR. GIBBONS: Yes, we had some fur results. Had some otter and a couple of (indiscernible.)

MS. VERBRUGGE: I can't read that. Can you read that?

MR. GIBBONS: Slide 8 maybe at the bottom.

So this is kind of the range, a minimum and maximum we had. I will qualify that some of our maxes all represent a small number of samples. For instance, on some of them, represent small fur samples. So like the mercury in sediment, for instance, that was a relatively small number compared to the whole data. It was more down in the lower number. We didn't have much -- many samples for fur.

MS. VERBRUGGE: How many did you have?

MR. GIBBONS: I'd have to check on it. Maybe I only had one CR -- I mean one (indiscernible.) Four maybe

MR. DWORIAN: I know the answer. We had two river otter samples and two minks.

MR. GIBBONS: Okay.

MR. DWORIAN: One of the river otter samples was from (indiscernible) in the study area and I think the full volume of samples (indiscernible) but we still managed to analyze it and get results.

The mink -- the two mink and the other river otter sample were -- they're an Alaskan story, but we found a trapper who had trapped them nearby and we trapped two mink and river otter and so we purchased those furs and analyzed those. So we had two otters and two minks.

And while we're on this slide, there's a note about the correction factor for all those water samples. Can you talk a little bit more about that?

MR. GIBBONS: The total mercury (indiscernible) in the white columns was QA/QC from (indiscernible) total mercury (indiscernible) --

MR. PADULA: Speak up a little.

MR. GIBBONS: Total mercury in 2013 we weren't satisfied with the QA/QC assessment, and that's why we're retaking total mercury in 2/14 but currently doing the QA/QC analysis for the 2014 data, and we will see if we can find the correction data to broaden our data base to use the 2013 data. If we can't, we're just going to (indiscernible).

MR. CONDER: Okay. And I guess, you know, I'd echo our earlier comments on 5.5, where if we can see a really nice write-up of walking through that data, walking through those correction factors, because again we want to get to an understanding of the data beyond just looking at it in the database.

MR. GIBBONS: Absolutely.

MS. VERBRUGGE: I guess I will say that the result of the (indiscernible), it really points out the need that we actually do need this data. Because that's a pretty (indiscernible) high number, actually, and so we need this data and we need it for (indiscernible).

And I know we discussed in an earlier (indiscernible) that maybe it would make more sense to get blood from nestlings. And I'd like to know where that idea, you know, went. Are we still thinking about that? Because I think it would be, you know, a really important thing to do, if you can do it.

MR. PADULA: Is Brian on the phone? Brian, are you on the phone?

BRIAN: Yes, but I couldn't hear the question.

MR. GIBBONS: So I think the question was related to sampling of the avian population, specifically getting blood from eagles to test for mercury. Can you address that a bit in terms of what that would entail?

MS. VERBRUGGE: Well, we had talked about doing that at a technical working group meeting, and it sounded like the agencies were on board and -- with the concept and -- but then it was not implemented, and I was wondering, you know, whether it will be, is it still on the table, because, you know, at one of the technical working group meetings it seemed like a real possibility.

MR. GIBBONS: The decision I think, and then Brian can get into the details, if you want details, I think the decision is still one we're going to try and actively make that determination. You made a comment that you want to see the data and we're still assessing how much value that is so that's a thing to be discussed. It's not off the table. It's not currently on right now.

MS. VERBRUGGE: I guess you're requesting a modification to drop this this biomonitoring data. I'm making the suggestion to modify the study in another way, that instead of getting feathers that we also get blood as we discussed, so it's just two different modifications that we're discussing (indiscernible). [When will AEA make that decision whether or not they are going to ask for a modification.- This will be discussed in January to see what we all concur.]

MS. MCGREGOR: This is Betsy with AEA. I think I can clarify that for you. We are right now trying to consider whether or not we need that data. If we do need that data, then we are going with the method that we had discussed in the March (indiscernible) record meetings.

MS. VERBRUGGE: It's in the FERC-approved study plan though that you need that data.

MS. MCGREGOR: But the methodology that you were discussing that we change from the blood and feathers that we discussed in the March meeting; that the way that we would proceed. So right now it's a proposed modification where I think it's a decision point whether or not we actually need the data. That's our stance at this point in time. If you're putting in as a proposed month or I guess FERC does a statement determination of whether or not they accept the proposal modification, we put in proposed modifications to stay with the existing SRP and collect that data, we would collect it in the methods that we discussed in March.

MS. LANCE: Ellen Lance, Fish & Wildlife Service. So when will the AEA make that decision whether or not they're going to ask for a modification?

MR. GIBBONS: I think that's going to be after our January meetings; is that correct?

MS. MCCRACKEN: Right now it's (indiscernible) proposed (indiscernible) modification.

MR. GIBBONS: Oh, modification. I'm sorry.

MS. MCCRACKEN: And then it's up to what you come up with the pathway and the analysis and the data.

MR. GIBBONS: So that will be discussed in January to see what we all concur?

MS. MCCRACKEN: Right.

MR. PADULA: Any questions on the study?

MS. LONG: I have a question about -- you mentioned -- well, two more questions. Stabilization of the reservoir when (indiscernible) mercury will not be created or whatever it is, I'm not an expert in this, approximately how many years and then my second part of that question is -- so to get into the stabilization time of the reservoir and it doesn't matter if the level of water in the (indiscernible) zone goes up and down, that doesn't affect it after we get into the stabilization (indiscernible) or whether (indiscernible) mercury is created. Thank you. [Will there be stabilization of the reservoir when methyl mercury will not be created obtained from the literature review? In approximately how many years will this happen? Describe the stabilization time of the reservoir? So, it doesn’t matter if water level goes up and down whether or not methylmercury is created?]

MR. PADULA: That was Becky Long.

MR. GIBBONS: Okay, there's multiple parts that I will try to cover. First, methylation of mercury (indiscernible) is occurring now. That's how part of this getting into the (indiscernible). And when I mentioned a mature reservoir, I'm talking about the methylation based on your (indiscernible) that are integrated based on inundation that occurs now and that degradation of that one. This mature reservoir model will take into effect both the production that comes in from (indiscernible) and the production that's generated within the reservoir in terms of organics. Also it will be looking at in a general way because we don't have absolute data on other sources. We're looking at the geological sources we also have [indiscernible] sources we have to access in their stable environment whether that source is going to increase the source of mercury or not and whether that mercury source itself has the conditions in the reservoir that needs leads to the increased methylation such as load dissolve oxygen and (indiscernible) or can the reservoir be such that those conditions are not going to be present to enhance that methylation. Okay? So that's kind of what we're trying to look at.

MS. NOLAND: This is Laura Noland with Environ. On Slide 14, you made the statement that AEA is not proposing any additional sampling for mercury until 2015. But based on the discussion on theories of discussion, you still have not evaluated the data for 2014. So, I'm wondering how you can make that decision. [You make a statement that AEA is not proposing any additional sampling for mercury in 2014, but based on discussion you still have not evaluated this data so how did you make that decision? You think you have sufficient data? But you don't really know yet?]

MR. GIBBONS: Not all of the data would go into it but a lot of the data. In the mercury study, remember we're looking at the different compounds of (indiscernible) that we're still debating whether to do (indiscernible) of course. The water quality has already been taken and we're evaluating (indiscernible) but we think we'll have valid data there so we can move forward.

MS. NOLAND: Well, I guess that's the point. You think you (indiscernible) but you don't really know yet. I mean, that's what I'm trying to get at.

MR. PADULA: All right. Anything else for Harry? Okay. Let's take a ten-minute break, and we'll wrap up the day with the groundwater study.

(off record.)

GROUNDWATER (STUDY 7.5)

MR. LILLY: We'll get started in 30 seconds or sooner. So, I think I will go ahead and get started. It looks like most people are back in the room and sitting down and so I'm the study lead for the Groundwater Study 7.5.

In the groundwater study, previously had a very long name and it's really groundwater surface water interactions we're looking at. A lot of multi-study components particularly with aquatic and occurring resources, so I'll cover on that today.

And also given the prior studies that everybody has reviewed, these presentations, so I'll go through all the slides, and then we can get back to any of the slides to specific questions.

In the objectives, to not read all of this off, but I think assuming everybody has looked at this, clearly about summarizing what information existed before in the '80s, what has existed in studies in, other Arctic regions. What are the large scale (indiscernible) information processes that we have to know to help us understand really what's going on in a smaller scale, aquatic and riparian resource areas.

And then also how this ground -- you know, how does potential project affects impact shallow groundwater users.

And we look at this not only in summer, but really through all the major four hydrologic seasons of the year, which includes break-up, winter, the ice freeze-up process in the fall and summer. So it's looking at it year round.

The study components really line up with that previous slide, so if you look at the objectives, the components are directly in line with that.

And then in terms of variances, the only thing I wanted to say here, is all these variances were only variances in schedule, and we -- because of the amount of effort taking place, but getting all the -- particularly data infrastructure in place in 2013, mostly variances are all things that were shifted back in time for those elements that could be shifted back.

An example talked about earlier today was like in the bibliography work. It's not that we weren't looking at the literature of the '80s and everything up front because we were, but it's a point of completion that's pushed back so we could both includes more information and deal with the priorities that we had particularly in a very intense field program in 2013.

For the summary of results in the ISR, again, we focused on five major focus area investigations. There were 57 hydrology stations installed, 66 wells were installed following the same kind of method used in the '80s. That was talked about in prior (indiscernible) meetings. A lot of the empirical data collected over these four major hydrologic parts of the (indiscernible) cycle.

Some of the key real observations was the presence of shallow groundwater, which was a real key observation that you'll see in components of the ISR and also in the technical memos that were just released, in terms of your reviews that will be taking place between now and January. I would point that out.

The -- and then the upland and hydrologic recharge from the river valleys really focusing on that to understand the groundwater system and how it interacts, you really have to look at the whole valley system and where our recharge is occurring, and that explains the nature of the consistent shallow groundwater claim that we see. And that we're doing this both winter and summer so there's also an intensive point of the program with this.

In looking at the summary of results, since the ISR, we also and kind of a lot of it was response to the November meetings that the agencies attended where, you know, there was discussions about how do we quantify gaining and losing reaches and doing discharge measurements. This in 2014, there was work done in particularly April, in the winter sampling, and you'll see this data in the TMs that were just released. The end of -- where we did discharge measurements at a whole number of stations, during the summer we installed 42 staff gables to locations, where 25 of these were just completed. Discharge measurements for end of summer conditions, in September, October, and that we maintain the data collection components in the five main focus areas and added some components to others. So now the groundwater studies looking at seven focus areas, but the five main ones that were started in 2013 are the most intensive, so.

And then just some of the summary results and these are in the technical memos that I think ya'll are just starting the review process on, is showing how some of this data is used and you can see both the 2013 and '14 data in this to look at, as an example, in looking at response functions, and how does the lateral habitat change when we have natural changes in our system, and how does this also change important characteristics such as the thermal characteristics in the -- (indiscernible) spawn the areas.

These are looking at just some of the examples that are in these technical memos that were just released, and again, this is just looking at -- these are two examples -- we'll get down low enough on the examples of 2013 and '14 and information.

Looking at some of the -- for the work on the riparian efforts, this is looking at some of the cross-sectional modeling efforts where there were a lot of questions in the past for the groundwater study about why this -- you know, how do we use a cross-sectional approach to understanding but understanding the lateral hydraulic radiance and this is just showing examples of this, which is discussed in the ISR in the following technical memos.

Same in this area where we're looking at how do we use this (indiscernible) information and profile studies.

The -- so for the proposed modifications, this again was something that was just scheduled to line us up with other studies and was a change in schedules, there's no change in the data collection components or their objectives.

The new modifications really are just the same thing, but they're just changes in the schedule. Task being completed in 2014 where ongoing data collection efforts (indiscernible) part of that, and the steps to complete the study as described in the study plans.

MR. PADULA: Nice job.

MR. LILLY: I think that breaks my record for the fastest presentation.

MR. FULLERTON: You shattered my 12.

MR. LILLY: So with that, I'd be happy to answer any questions.

MR. MUNTER: Yes. Is this on? All right. I'm not a technologist here, so.

My name is Jim Munter, J.A. Munter Consulting. I'm also new on the project, so I'm still scratching my head over a few things here.

But, you know, the study plan called for upscaling results to these focus areas. How are you going to do that?

MR. LILLY: That's a good question, Jim. And I think if you get into your review of the technical memos that were released, I'd point out particularly to the task (indiscernible) related to our riparian studies. And this is how we look at these cross-sectional gradients that we've particularly chosen (indiscernible) outside focus areas, to say what are the components we noticed in the landscape that are indications of shallow groundwater that would allow us to take the available information outside of those focus areas such as the DM ?information that is being collected by geomorphology studies and information such as (indiscernible) riparian and vegetation studies where we're looking at the presence of vegetation cover that indicate shallow groundwater and come up with mapping layers for looking out. What are the shallow groundwater occurrences that we see along the valley and in the uplands habitat that will bound the system so we come up with an idea of the consistent -- the nature and consistency of that, and this fits into the detailed studies of the focus areas and then methods of transferring those outside the riparian scale so I --

MR. MUNTER: That's a very good summary. Thank you, but earlier we talked about the thermal IR imagery not being collected for these focus areas, and I'd like you to comment on how useful the thermal IR imagery is to this upscaling and baseline analysis.

MR. LILLY: Well, on the thermal imagery, when it was initially -- there was thermal imagery collected in 2012. Then -- but there was additional thermal imagery collected in the focus areas and tributaries and at a finer resolution and more coordination with our current data collection efforts at the end of 2013, and so there was thermal imagery collected, so I reference you to that information.

MR. MUNTER: Okay. Maybe I just didn't understand then how much imagery is out there.

Well, with regard to variances, I didn't see any reference in the ISR to nested piezometers to define vertical groundwater radiance which was part of the study plan. You know, 66 piezometers or wells put in. It looks like they're all in different places, but they're not nested at the same spot to get different water levels at different depths. Can you comment on that, please?

MR. LILLY: You bet. So for the wells in the main configuration of the wells, we're to look in terms of the internal boundary conditions and at different distances away from sloughs or side channels and habitats, look at pressure responses through that.

In looking at the nature of shallow groundwater system and where we had -- you know, was there a need to have wells at depth and we determined we did not really need to have that if we could look at the groundwater conditions from the upland areas all the way down into -- when I say upland, I mean at the base of major hill slopes down to the river itself along the way.

MR. MUNTER: Okay. I see your point; that the vertical gradients might not be too important, but I think it should be noted as a variance because it was called for in the site plan.

And then that leads into my next question, has to do with the modeling effort. That the presumption going into the study plan of these transit models is that they would be oriented parallel to the direction of groundwater flow. Typically that's how those things work. You get water going in one side, flowing along the flowline, and then coming out or being discharged by well or whatever.

I mean, physically, these things are kind of like ant farms, with glass plates on each side. And as the data has come out and I've looked at it, it strikes me that these flow systems are actually complicated three-dimensional flow systems that vary dramatically at times. They are four dimensional. And I notice in the (indiscernible) study area, you've proposed to do some three-dimensional modeling, which I think will help unravel that.

One of the ways to get a handle on this, and I'm surprised I'm not seeing it in your work so far, is a series of water-table maps. You have in some areas lots of data that will facilitate construction of a water-table map that would document what these groundwater flow systems look like and allow a determination of groundwater flow direction and allow an evaluation of whether or not these transects are located in a technically valid orientation to do that kind of pulse and response modeling that you're referring to.

So I guess there's several questions buried in there. One is, are you planning on doing any water-table maps to illustrate the dynamics of the groundwater flow system?

MR. LILLY: Yes, and we've worked on that.

MR. MUNTER: Okay. And I would assume then that you'll look at the orientation of these transects with regard to those water-table maps.

And I what I would like to toss out here today, is to consider evaluating two-dimensional plan-view groundwater-flow modeling to do the kind of simulations that you're looking to. I think it could potentially work. It's not part of your study plan, but it may be a better mechanism for capturing the dynamics that you're seeing and in the pulses that you're seeing, and it would solve this problem of what direction groundwater is flowing.

And one of the reasons for this is that all your data is really in the horizontal plane. You don't have data at depths with these vertical groundwater gradients, and that's usually what the main thing is, the transect model is trying to simulate and calibrate to, is that deeper groundwater flow data, and since the data is not there, it's not particularly important. I think that the data you've collected would argue towards reevaluating this approach.

MR. LILLY: But, Jim, let me -- so if I was only modeling groundwater to only understanding groundwater, it would be a little bit more component of that. But one of the objectives, and I want to talk about two, we are drilling cross-sectional groundwater models for two separate purposes.

One for riparian, so where we chose the riparian transects needed to line up with where we had certain types of riparian vegetative cover. And we wanted to make sure that we had a good representation of different types of vegetative systems, but also in relationship to hydrologic boundaries and different water-table elevations; so all that went into the selection that you see in those.

And I think that, you know, -- so in terms of moving them around, there's an optimization, not just on the hydrology, but on the land cover itself.

And then on the second side, the other transects were identified by -- in the '80s, where they identified key aquatic habitat, particularly for small (indiscernible) who sat down with IFS (indiscernible) ground and did find where these areas would really need to use models as a way to understand groundwater/surface water interaction processes, which is the primary purpose. But we wanted to place those where the information is most useful to the IFS and fishermen crew.

MR. MUNTER: Well, I can see those objectives. I've done 2D modeling and 3D modeling, cross-section plant view of surface water bodies and we'll incorporate those surface water bodies and I think probably achieve those objectives.

And one of the advantages is, yes, part of your upscaling is to take the results of your focus area analysis and translate it to a bigger area and you're going to have a variety of habitats and riparian? vegetation and if you have a plant view model, you get much greater coverage of different habitats seeing what happens with different water levels up or down. And actually it might be a better approach to achieving the objective of relating the water level fluctuations and the pulses to the large surface area of habitat and vegetation cover out there.

MR. LILLY: Those are good points, and that's why (indiscernible) are still a focus area, to help look at what are the differences we have between looking at the system only and we're not -- we're looking at the hydrology of the system, but the whole focus area scale, but modeling where we have those intense transects, where we're doing that modeling of those transects in that two-dimensional profile that you mentioned.

But it doesn't mean we're not looking at hydrology of the whole area. But slough slide A was chosen as a place for them to look at, but what is the effect of only looking at a few of these transects and how this three-dimensional nature of the (indiscernible) play into it.

So those thoughts that you just said were fundamental then to choosing slough (indiscernible) A as an example that we put (indiscernible.)

MR. MUNTER: Our related concept --

MR. RUSSO: Michael? Hi, Michael, this is Tim Russo (indiscernible) first contacting and I have a few questions, too, related to what was just asked about the work (indiscernible) characterize the groundwork (indiscernible) particularly the structure of the (indiscernible.) Were you going to do the (indiscernible) model. What steps are the (indiscernible) and those words that are constructed? And what types of hydro geologic units are they in? Are they in sand or silt?

Do you have any idea of what degree of (indiscernible) is in those areas? And (indiscernible) have you been able to tie any of this data into more useful data that may be available in study plans? Really why I'm asking, I understand -- I think I understand what your plan is, that you're going to (indiscernible) hydrologic cross data that's been collected and (indiscernible) and you've got a lot of that data now.

But I'm wondering how it's going to be useful without putting into the context (indiscernible). And my major concern is that the models won't be set up properly to give meaningful results, which I know that's your concern as well.

But basically I'm wondering how things are being set up right now to adequately represent that hydro geological framework in terms of the morphology (indiscernible) units, the boundaries (indiscernible) and other things.

I realize that I may be jumping the gun on some of these things, but we're pretty far down the road now and there's still nothing presented as far as I've seen as to subsurface concept models where the hydrological framework, these are usually the first tests that we do at any (indiscernible.) It was my understanding from the study plan, this was to be done 2013. Could you comment on that?

MR. LILLY: Sure. You had a couple of comments there. The -- so the geohydrology, the framework, the information that's coming out of the geomorphology studies, as was discussed earlier today, is being used, and it was going to be beneficial to see them complete the geomorphology mapping, because that was going to be one of the inputs that we were using in the geologic framework so the depths of -- that information was all being collected last year and is being put together. And some of the cross-sectional information on that is in the TMs that were just put out, that, you know, meteorologists is going to be starting the new process zone so I won't talk too much about that unless you want to go into it.

The -- for the wells, in the depth of wells, they were all done in similar methods, done in the '80's, where we used drive point methods. These are hard to access areas, and it's -- so we used a combination of drilling and drive methods, so we're monitoring really the top of the water table, which was, for what we were after, was -- particularly for both riparian and aquatic, what are the boundary conditions and how they are changing? This is the main information we were after, was the top of the water because we're really dealing with the water-table configuration.

We also noticed that in many of these areas, we had -- we didn't even need to drill wells in some areas because we had lots of springs seeps and wetlands where the water table is intersecting the land surface. So our groundwater information is not only coming from the wells, but it's coming from many of the other features we see that give us indications that we have very shallow groundwater systems in the area. And even our aerial flights, we have aerial photographs, we're using that information because all of that is telling us something about the groundwater conditions.

If we had deep groundwater systems, we wouldn't be able to do that. But one of the things that we've seen consistently in the middle river is that we have shallow ground water systems in the uplands and in the areas of the lateral habitat in many of those places.

And I don't think I answered all of your -- you had a number of statements and questions, but I think it was pulling all of this information together so that we can develop the continuing development of the geohydrologic models and then come up with the flow models, which are to really help us with process and understand it.

And, Jim, one of the things you mentioned was, you know, there are times you do cross-sectional models along flow lines. But we purposely are not doing cross flow lines. We are trying to be perpendicular from the sources of stress, which is the river.

So what we're looking at in terms of, just like using a river as a pump test, and you have wells going out in different directions away from your source of the hydrologic stress, is that's why we have the orientation of the transects as they are. And that's been done in other areas. So I think I answered two questions --

MR. RUSSO: Because (indiscernible - interference with speaker-phone) since whenever (indiscernible) models in the direction of out groundwater flow, there are going to be some errors in terms of the flow that's predicted (indiscernible). And I'm wondering how you're going to qualify that.

And I know on the Chena River you did do it 2D horizontal models that quantify those areas, and I don't see anything composed in that here.

MR. LILLY: Well, that's why we proposed the three-dimensional modeling in FA 128 or (indiscernible) so that we could look at the effect of the two-dimensional assumption associated with the transect models. Very similar to what we did on the Chena.

MR. MUNTER: This is Jim Munter again. To weigh into that discussion. My concern here is that the flow systems are changing so rapidly that those adjustments may be very difficult and inaccurate. In other words, when you start out at a flow water situation without a pulse, you might have groundwater flowing left to right or right to left, and then the river jumps out, suddenly the flow direction basically turns 90 degrees in a transient manner.

And the process of that turning of the groundwater flow system and that pulse lining up so that your transect is properly aligned and that is the direction of flow is -- well, I can't imagine how you do an adjustment for that. I mean, it seems very complex, and I haven't seen a lot of literature.

I did see the report of the Chena River that addressed that, and the details of that 2D model and that correction factor wasn't entirely clear to me.

So that's it. But I had another comment, I guess, if I could. I honestly wanted to add something to what I just said that there.

MR. LILLY: Well, Jim, those are good points to bring up, because that helps give us input on the issues that we need to look at and those questions will be used in the data collections, so.

MR. MUNTER: Sure, okay. Thank you. I think one of the big issues that I didn't see written up explicitly, but it's kind of in your concept and I wanted to address it quickly here, is that we've got a big basin, a big groundwater basin with lots of groundwater being recharged throughout the entire basin.

And then most of that groundwater eventually wants to go to the ocean as expeditiously as possible, and the quickest route is to discard to the Susitna River and its near tributaries because its tributaries and sloughs (indiscernible.) So I'm not surprised that, you know, you're seeing a lot of groundwater upwelling because it's hard to get data on those deeper systems. I think it's important to do some kind of analysis that considers that they really are there, maybe a big picture water budget type exercise and say, well, how much groundwater should we be discharging based on studies in other areas. I think that would be a very valid way to look at this.

And where it gets to is understanding better these processes that are going on in the river bottoms and you had a little write-up on down welling and I looked at that in some detail. And I could see the temperature data that you had that indicated that the shallow groundwater was indeed getting colder with the onset of winter.

But typically in those environments, you want to have a measured download hydraulic radiant that confirms that you have down welling. And when I looked at the data that was presented on that slide in the nearby monitoring well and the slough, what I saw was either upward gradients or a flat gradient, no gradient. It seems like an odd thing. You have any explanation for what you think is going on there?

MR. LILLY: There's a lot of variables. From -- if you're talking about where we had the temperature profiles, where we're looking at the thermal profiles through the bed versus the wells that are adjacent to it, we're just seeing variation across that system. And so that's something that's with the data that we're collecting now and putting that information together, we're going to -- we have a lot of variability associated with, well, where are you on the slough system, three dimensionally, as you mentioned. So that's something that all the data collection was intended to help answer those questions, and I think we're headed in the right direction.

MR. MUNTER: Okay. Thank you. That helps.

MR. LILLY: You made another point about how do we understand the groundwater contributions at the larger scale.

If you're referring back to the IFS ISR and if you look at the winter gauging program in that, there is a whole series of measurements that were being conducted in cooperation with USGS. So we're also looking at what are the gains that we've had, particularly in state locations along the middle river, and does that make sense to put in the regional hydrology system.

So we are seeing the evidence. This is some of the information that Dave Brailey is collecting where we are seeing the increase in flow through the winter measurement program where we don't have all the other (indiscernible) in the system, with glacial runoff and precipitation, et cetera.

MR. MUNTER: That's excellent. Thank you. That is a big part of that puzzle, so I'm glad to hear that's working out okay.

But what I get back to with the ground welling is it surprises me that there's much, if any, down well -- down welling in the Susitna River bottomlands during low-flow conditions. You can get it during temporary stage increases. You get a lot of bank storage and water going in and out and a lot of complexity there.

But at low flow, I guess I would encourage you to, if you're seeing evidence of down-welling, it should really be accompanied by some clear hydraulic gradients from the monitoring wells that says, yes, this is, in fact, happening as an important process because then that -- that drives your upscaling and your generalization on how -- what processes are going on and how important are they based basin-wide.

So I think that data and that analysis is really very important to that. So that's -- I didn't have a question. I just wanted to toss that in here.

MR. LILLY: Well, and I think you're in a state, other examples of where we do see down-welling. It is natural. And a lot of what I expect us to unravel, to continue to do all this work, is when we look at the geometric configurations of what is the hydrologic slope, what are the nature of the bottom of the stream channels or slough channels or tributary mouths, we're getting localized effects where you get down lowing. You may have down lowing right at the mouth of let's say tributary channels, where all of a sudden your lower boundary condition in the river dropped a lot, so now your stream bed is locally -- it's flowing through that stream mouth. Here's a hydraulic gradient, it's moving downward.

But if we go up 1,000 feet, it's a discharge area, you're gaining flow. So a lot of it has to do with the relative boundary conditions.

All good questions. Is there anything else I can answer?

MR. MUNTER: It's -- one of the things that's not clear to me, maybe partly because of my recent introduction to the project, but is how your groundwater model results will feed into the riparian aquatic-habitat studies. So what output from the groundwater models specifically will feed into those other analyses, how do they -- can you kind of flesh out how that's going to work a little bit?

MR. LILLY: Sure. For the breakup first with the riparian. So with the -- for the riparian study, we're really looking at what is the dependency of riparian vegetation on shallow groundwater and where are the water budgets and so when we look at the root zone, how much dependency do we have on shallow groundwater versus precipitation coming in? This is why some of the work that Kevin (indiscernible) is going to be doing and maybe covering tomorrow, isotope work and we're looking at what are the different water balances that the vegetation is depending on. It's very (indiscernible) where you've had hydro power investigations that are seen, but there's a dependency on shallow groundwater, if you change that groundwater configuration and change the depth, then there's immediate impact. We have a lot of precip available in this area, so what's the dependency of the vegetation on the precip (indiscernible) water that's coming in through surface drainage, if there's snow melt or summer rainfall coming to the system.

So the groundwater modeling is to look both at what the water -- what the processes are (indiscernible), with the ET processes in water variability in terms of water budgets, as it relates to changes in the depth of water that are related to changes in stage (indiscernible).

So let me stop there in case you have a question as to (indiscernible).

MR. MUNTER: No. Got that. Keep going. Thanks.

MR. LILLY: Okay. So for aquatic, the real intentions of the groundwater modeling is to give us a tool to see what we can't see. What are the groundwater/surface water interactions that are occurring in a (indiscernible) habitat area where we have mass exchange going on, but we have hydraulic connectivity, so we see groundwater levels go up and down, but what's the mass interaction that takes place?

So it's hard with only wells or only temperature profile information, et cetera, to understand those cause-and-effect relationships. So in this case, we're using groundwater models in one of their typical applications to disapprove?? our understanding of processes, so we can then take that process understanding and distribute that next to focus area scale, and then to say what's the available information for segment scale and apply it to that scale.

So really it's to give us a tool to understand the processes involved, particularly with questions relating to the (indiscernible) habitat. A lot of that is (indiscernible).

MR. MUNTER: Okay. Thank you. And if we could move to some winter groundwater questions real quick here.

MR. LILLY: Sure.

MR. MUNTER: You had a big spike in groundwater levels caused by an ice-jam flooding event, and that was not river flow dependent, it was river stage dependent.

MR. LILLY: Exactly, good point.

MR. MUNTER: In your analysis for those other habitats, are you going to do wintertime analysis, or are you going to do this on a seasonal basis where you're going to really just deal with, you know, open water conditions or -- how are you going to handle that ice-jam type event?

MR. LILLY: That's a really excellent question. The -- so really, as I mentioned earlier, the groundwater study is looking at all the hydraulic periods that we have, both ice cover, which are three different -- consider those three different seasons, the fall freeze-up process, our full winter process, spring break-up, because of these transitional periods, are extremely important.

And our data collection efforts were set up to continuously monitor and try to capture that as much as possible. That's why we were really dependent upon continuous daily acquisition systems, so that we can capture all those periods and these time-sequence events that we can never either safely be out in the field for or even schedule logistically to be out to capture events. And you notice that we have mid-winter ice-jam events that have nothing to do with increases in discharge. It's really driven by ice processes.

And that's where with the interaction with -- of what you'll hear Jon Zufelt talk tomorrow (indiscernible) team is, you know, what are the mechanisms that they are going to be modeling in terms of their river flow routing model that deal with ice cover conditions. We'll be taking that output for the winter periods and we'll be taking the ice-free river flow routing model output for this summer ice flow period.? So we're (indiscernible) using dependent.

We're only modeling, you know, efforts that are interested in groundwater modeling, where the analysis will be from those two models, so we're looking at the whole hydraulic year.

MR. MUNTER: Okay, good, thank you. And then there's one item that I didn't see any reference to, and I know you're familiar with this, people commonly use icings to identify groundwater discharge areas. By that, I mean icings caused by groundwater discharge, comes out freezes, and then the groundwater typically backs up behind it.

Is that an important process in this study area, or have you seen it, or are you -- or is it not important? I mean, I really don't know.

MR. LILLY: No. That's an excellent -- because particularly in the winter and the spring, icings and lack of snow cover are two important observations for groundwater output. And we documented, such as the dam -- where the proposed dam site location is and other areas where we had water coming out of the banks, and it's icing. And we got various documentation we've shown in some of the prior TWG presentations that are on the Susitna website. So there's some examples of that. But we're capturing those examples where we have water coming out in the form of springs when it's fairly warm and it's freezing up.

We also have a lot of areas in FA-115, Slough 6A is a great example where we had places where we had groundwater springs that are running ice free all winter long. And we have places where even though everywhere else we have three feet of snow cover, we have no snow cover on the landscape. The reason we don't have that snow cover is because it's shallow groundwater, it's warmer, it's a heat-input into the system.

So by doing aerial surveys at the end of winter, we can identify areas of shallow groundwater just by doing those aerial surveys.

Because we also done on the groundwater to relate those observations to the groundwater conditions.

MR. MUNTER: Okay. I'd like to move downriver now. All your sites, focus areas are on the three-river confluence, and yet we heard -- I think we are all aware that the regime, for lack of a better word, is quite different below the Three Rivers Confluence. It's much more of a (indiscernible).

And you know, it just strikes me that the areas that you're studying are really not representative of that lower river area. And I'm just wondering how you're proposing to do your -- do the upscale groundwater work and do such a different hydro geologic regime.

MR. LILLY: So, Jim, if you go to the ISR for the riparian section, there is going to be a reference to maps that show where walls are at four sections in the lower river. So we do have four sections that we're in coordination with Kevin (indiscernible) riparian study.

That information is probably useful for a variety of studies where there's two wells and a surface water measuring point, and four transects that are downstream of Talkeetna. So we take those pretty far down, so we're covering that range. So I'll point that out.

MR. MUNTER: That's a good point. And I did notice those in the study, but it sort of came in from the side. Because as I read your nine objectives, it didn't seem to me that they sort of fit in any of them and I didn't read much text about why they were there, what they were for, how they were going to be used. I mean, it's a pretty murky process from looking only at your report.

So maybe it's more evident as the riparians have (indiscernible) and figure that out.

But even -- even given that those four wells are there, maybe you can just address what you're going to do to determine the effects of the project with regard to groundwater down that lower river area.

MR. LILLY: So the groundwater questions that we really were given for our riparian was what's the nature of the natural variation that we see now. So we put in -- there's four -- more than four wells. There's four transects. And one of the transects is actually two sets of study sites on the lower river.

So the real question that Kevin Fetherston and I talked about was what's the depth of groundwater in the natural regime, so we can then look at based upon the (indiscernible) models and how they give an indication of how it's going to change, then how well we -- what will we -- will that change be something within the natural variability that we see now.

So it's much -- we had simpler questions and fewer questions down there, and it was strictly for looking at the depth of water versus the -- what the vegetation was using.

Kevin, do you want to comment on that?

MR. FETHERSTON: Yeah. Our (Indiscernible - distance from microphone.)

MR. FETHERSTON: I am Kevin Fetherston. I am the lead riparian (indiscernible) study that Michael is talking about here. And you have four transects in lower river. Our groundwater study on there is essentially characterizing the relationship between (indiscernible) areas and groundwater. And in addition to the intensive studies we're doing in the middle river, the scope of the work (indiscernible) as our current studies in the middle river.

So characterization using groundwater levels (indiscernible), looking at the relationship between the beginning stage and (indiscernible) aquifer water levels, and (indiscernible) the objective of the surface water riparian study is to look at the relationship between (indiscernible) plant communities and groundwater capillary (indiscernible), basically (indiscernible). And that's a picture of our (indiscernible).

MR. MUNTER: I think I only have one more question, slash, comment.

As I look through the data in one of the website that had endless amounts of data, we weren't able to find well depth as one of the parameters reported. And it could be that we just missed it, but it could be that it was not there.

And I guess I would just encourage you to look into that, because that would be the standard item that would be included in a data appendix.

MR. LILLY: I'll make sure that's addressed.

MR. PADULA: Question over here from Domoni.

MS. GLASS: This is Domoni. Just a quick simple question. I just want to know post-project flows and geomorphology change, are you going to be able to predict the change in groundwater (indiscernible).

MR. LILLY: The intent with the groundwater studies is to provide the process understanding, so that when we look at where the post-project conditions, that we can look to see what are the changes in (indiscernible). So yes.

MR. PADULA: Any other questions for Michael? Sue?

MS. WALKER: Yeah. Just a clarifying question relative to Domoni's questions, and that is, I'm not sure that I understood your answer. Will the study be able to project the project effects on groundwater, or will you be assessing the changes to groundwater after the project is under operation?

MR. LILLY: There's different ways of answering that question. So let me -- by developing the understanding of the current processes in the current system and the variability, and then looking at when we -- under the state -- the main channel stage changes, because it's really a stage-to-stage relationship that we're looking at in terms of how it affects lateral habitat and (indiscernible).

But it -- the outcome of the groundwater study is to understand the process understanding, so that if we come up with different stage characteristics in the main channel, we can understand how that impacts the lateral habitat regimes, which includes the groundwater upwelling or recharge/discharge, I guess.

MS. WALKER: Okay. That's just stage change after the project. It's not an explicit study goal that the study will be able to estimate or project the effects of the project on groundwater over time.

MR. LILLY: Groundwater is a basin-wide concept, so I'd have to say you'll want to -- you'll need to clarify that in terms of groundwater in the lateral habitat. I think it is an effect of the study to look to see how groundwater is impacted in terms of relationships to riparian habitat or the work that Kevin, you know, was just talking about, you know, in aquatic products? So I believe the answer is yes, the objective is to understand that. And this fits into some of the --I think you're going to hear tomorrow with IFS and some of the aquatic habitat modeling efforts.

MS. GLASS: I'd just like a follow-up here. As a fish biologist, see fish (indiscernible) in places where we've got (indiscernible) water and often that water is downwell somewhere else, below the subsurface, the changes and characteristics when it comes up. After the dam is put in, you're not only going to change the stage, you're going to have a change in geomorphology. And I'm hoping that geomorphologists are going to be able to tell us where, you know, things are -- deposition is going to change within the basin.

If you know where those places are, are you going to be able to talk about where -- where we're losing or maybe gaining, up-welling, that well supports spawning fish?

MR. LILLY: Yes. And the reason why I'm going to say yes is that what we're -- and I would refer you to the technical memos related to riparian habitation, because it has some very good cross sections in it to look at the cross-section relationships between the upland groundwater system and the river itself. And that's the process understanding that's transferable, that as you change the -- if the geomorphology changes take place and the changing configuration of wild habitat, the relationship of those vertical gradients, that understanding is what's going to allow you to then say how does it change up-welling or down-welling conditions.

MS. MCCRACKEN: This is Betsy McCracken with Fish & Wildlife Service, and I need to ask a clarifying question and I probably asked this before.

But did you do the nested piezometers at the micro-habitat scale in focus areas? And were they co-located with a fish presence and fish absence or any of the other studies like the water quality, temperature, and (indiscernible) productivity?

MR. LILLY: Where the aquatic sections were done in coordination with IFS, so those are all at key aquatic areas where they're taking other measurements for both IFS and fish resources. So our sections are co-located where there's other ongoing investigations for that.

Along with the -- for the riparian side, there's a lot of information with the riparian vegetation groups, they are also collecting along those transects, so they're in coordination with that.

The nested piezometer approach was when we looked at what's the information that we need to understand the water-table configurations? We did not do nested parameters after going in to the study plan ? Because we felt that was not a viable approach to take.

And by nested, what generally people are meaning is that you have several wells at different depths. But we felt that with the questions that we were trying to answer, that that was not necessary. And it -- under the methods that we used to install the wells, with dry-point methods, it also wasn't real practical technique for them.

But the main method was that we felt like we could answer the questions by understanding where the top of the water table was and understanding these transects because that gives us an idea. If we only had one set of wells in one area, we would really need to have nested wells and the fact that we had these wells along these transects. I hope -- I feel gives us a good idea of what the larger groundwater picture is and along that transecting, what some of the vertical components are.

MS. MCCRACKEN: So can we find where you -- which focus areas that you studied and did you do more than, you know, what was the effort that you put in?

MR. LILLY: Okay. So --

MS. MCCRACKEN: Related to the fish (indiscernible).

MR. LILLY: So just for the aquatic side, the main focus areas were FA-104, Whiskers Slough. There are two aquatic transects, and that one was located at the lower end of Whiskers Slough.

One was located in the Whiskers side channel at the upper end. It was one of the identified chum spawning areas. There were wells in surface water measurements and temperature profiles (indiscernible) put in to both of those sections. So those were the main two aquatic sections.

The next one was at FA-113, at Oxbow 1. And that was really because of the simple nature of a hydrologic system, that was a single -- there's two wells, it's not really a transect because we're right at the end of Oxbow 1. That was the second aquatic area to look at where there are a variety of measurements being made, both continuous and manual measurements.

The next key area for the aquatic studies was at FA-128, or Slough 8A, and there's two primary aquatic sections in that. One is in the middle side Channel 8A and that's in the -- for the -- for those who were on the agency meetings, we walked right by that section when we went up during the October -- I think it was the October 2012 field effort. And so you walked right by it. That was near the confluence of what we're calling Slough 8A proper.

And then the second major transect in Slough 8A focus area is up on Slough 8A itself. And in all of these transects are shown -- the newest maps are in the technical memos that I refer you to, because you're going to see what was installed in 2013, plus the additional sites installed in 2014 and the transects are identified. So those maps are all available in those technical memos when you reach that point of review.

Then the next major focus area where we're looking at transect type studies for aquatic was in FA-138, the Gold Creek focus area, and that was looking at Slough 11 and at Upper Side Channel 11.

And the same general approach of having wells on either side of the side channels, obviously for right next to the river. There's not an opposite?? side, but if we had a side channel or slough that we could have wells in both sides, such as upper side Channel 11 in FA 138, there's two wells on one side, two wells on the other side, we have stream bed temperature profile measurements and we have water stage and water temperature that are all being measured in those.

We also measure -- wherever we measure water where we have pressure tranfusions, (indiscernible) water stage, we also measure water temperature.

MS. MCCRACKEN: Okay. Thank you. And these are all co-located with the HSE?

MR. LILLY: Yes.

MR. HILGERT: Yes, although FA-113, it's -- sorry. This is Phil here. They were all co-located with FA-113, Slough 6A didn't have any salmon spawning, so we didn't have any (indiscernible) in those areas.

MR. MUNTER: This is Jim Munter again. One quick modeling thing I'll follow up on. In your methodology for modeling, you didn't talk about what to do if your river stage is going up because it's raining cats and dogs and you need to put recharge into the surface of your model. And are you -- do you have plans to address that process?

MR. LILLY: Yes. In the three main riparian focus areas, and in FA-138, Gold Creek, we have summer precipitation gauges. So we're directly measuring summer precips, along with the -- we also get a good indication when it's raining cats and dogs with a time lapse camera that we have out, so we can account for the do we need to have precip coming in at the top of the box.

MR. MUNTER: All right.

MR. PADULA: Any questions for Michael? Great. Thank you for another good day. We ran over a little bit today, but I appreciate everybody staying with us.

We're starting again at 8:30 in the morning. Those who are interested in ice processes, fisheries, instream flow study, riparian instream flow study, riparian vegetation study (indiscernible) end of the day tomorrow, we will confirm the amendments that have been made and get that information out to you.

MR. DYOK: Right. We're actually compiling a running list, and eventually we'll go over that tomorrow.

MR. PADULA: Okay. Thanks, everybody. See you tomorrow.

4:49:28

(Off record.)

SESSION RECESSED