

DRAFT for Comments and Additions (June 7, 2006)

Science Review Panel Comments On:

TASK ORDER 3

Colorado River Flow Relationships to Aquatic Habitat and State Threatened Species: Blue Sucker

Colorado River - Aquatic Habitat and Water Quality

Committee Chairs: Tom Arsuffi; Larry Hauck

Members: Warren Pulich, Terry Whitledge, Doug Slack

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The primary objective of the Statement of Work for Task Order 3, Colorado River Flow Relationships to Aquatic Habitat and a State Threatened Species is to characterize the flow-habitat and flow-ecological relationships within the lower Colorado River to provide a means of assessing biological impacts/benefits of various flow regimes by development and use of a comprehensive ecologically based tool that will provide prediction capabilities necessary to evaluate the full range of flows on ecological components of the lower Colorado River system throughout the annual hydrologic cycle, with and without LSWP. Another objective is to characterize the essential life history requirements (migration, spawning, and recruitment) of the blue sucker to determine the degree that the flow-habitat and specific biological components for this species can be maintained under the resulting flow regime for the LSWP.

This SOW did a good job of outlining key tasks for 2006, showing integration with other project teams and providing justification and the basis for studies, modeling and analyses to be performed. Table 3, the work breakdown structure was particularly useful in illustrating where this component of the LSWP is heading. Listing assumptions associated with different tasks in this SOW was helpful. The interaction among other teams, especially with regard to key assumptions that are used, is a critical component of this stage of the LSWP. The SRP encourages critical discussion of these assumptions and careful consideration of ramifications if assumptions are violated and effects this would have on analyses and project outcomes. However, some clarification, careful use and consistency are urged with use of the term "assumption" in the SOW. Although there is a key assumption category at the end of each section of the SOW, reading the listed assumptions shows assumptions are associated with other project teams, study, model, data, method and project levels of the study. Violations of assumptions have different effects on LSWP outcomes and decisions dependent on where not meeting assumptions occur and at what scale. SRP is particularly concerned about cases of assumptions not being met that occur at the data and model level and what alternatives will be explored should assumptions not be met. Since much of this, and other SOWs

involve modeling, the underlying assumptions are critical to the validity of the modeling effort. One question SRP would like to see addressed is, to what degree will all the model and data assumptions be worked out and addressed by this and other project teams, before much modeling is undertaken? Since one source of confusion occurs where use of assumption is used inconsistently, in different ways and meanings, perhaps inclusion of a table with a listing of the different kinds and classes of assumptions (project, model, data etc.) would be useful.

Response: The project team will evaluate the assumptions carefully and make necessary revisions prior to the development of the TO4 SOW.

One last general observation for consideration, but not necessarily action. Only 1 of the 7 specific questions listed as important at the start of this SOW deals with the blue sucker, yet nearly half of the SOW and much apparent effort is focused on blue suckers. As a state listed threatened species, SRP recognizes the value of this fish, but important information about blue suckers to date are missing, few or difficult to collect (larval and juveniles). Yet, relative to the larger goals of the LSWP, at this time it appears blue suckers will supply relatively little in the way assessing impacts of a change in flow regime to historical patterns.

Response: Although nearly half of the TO3 SOW focuses on blue suckers, this is simply in response to the request that the detailed components of the blue sucker investigations be documented in the SOW. The budget associated with the blue sucker portion in TO3 is actually <30%. The blue sucker is an obligate large river fish that has been in decline nationwide over the past century because of habitat fragmentation caused by dams, diversions, impoundment, etc.; flow regime alterations; and over fishing. The blue sucker is currently listed as threatened in the state of Texas. The project team feels that the blue sucker serves as an excellent sentinel species for the lower Colorado River, and that considering this sensitive species in the analysis serves as an umbrella for the protection of many fish species in the lower Colorado River. In addition to specific habitat requirements, the fact that this species travels large distances up and down the lower Colorado River makes this species an important candidate for evaluating impacts to a flow regime and/or potential instream structures that may impact/benefit riverine fish. Therefore, the project team disagrees with the statement, “relative to the larger goals of the LSWP, at this time it appears blue suckers will supply relatively little in the way assessing impacts of a change in flow regime to historical patterns”. The project team is not proposing that the blue sucker be the only focus of the instream flow assessment.

SRP asks if the functional fish habitat data will be sufficient to make decisions relative to the instream flows and the LSWP, especially if blue sucker data are lacking for key areas of the river and for key life stages of the species? This leads SRP to ask at this point whether greater return on information and decision-making abilities would occur if larger concentration was placed on fish guild and habitat modeling.

Response: From the outset of the project a larger concentration (time and money) has

been placed on fish guild criteria and habitat modeling. We apologize that this was not made clear in the SOW.

From here, SRP comments italicized.

Study Objectives. Specific Questions.

It would be helpful for clarity and consistency if all questions presented here were also listed in association with specific tasks outlined later in this SOW.

Specific Questions 2 & 5

2. Have the instream flow requirements developed for the LCRA Water Management Plan been tested under the current flow regime and will these requirements still be applicable if operational changes are incurred by the LSWP?

5. What is the impact of changing historical flow regimes on the native aquatic biodiversity and potential special aquatic sites in the lower Colorado River?

Questions 2 & 5 require more specificity to clarify intent. For # 2, the present day seasonal flow regime studied under this SOW is the same as the one upon which the LCRA Water Management Plan was based (i.e. Doyle and Mosier 1992). If so, that would make the present study a comparison to findings of Doyle and Mosier (1992), as opposed to an actual scientific test of validity of that study. Further, it seems clear that taking the findings of Doyle and Mosier (1992) and this study, collectively or separately, and applying resulting instream flow requirements to operational changes incurred by LSWP becomes one huge assumption and at the same time a testable hypothesis.

Response: For clarification, the reference cited in the comment and below should be “Mosier and Ray 1992”. It is true that the present day flow regime is the same as the one upon which the LCRA Water Management Plan was based. However, since the implementation of that plan, releases for rice irrigation have meant that rarely have the river flows been near or at the recommended target criteria. It is true that they have stayed above those criteria, but considerably above during the irrigation season. The goal of the present study is to evaluate habitat selection for the lower Colorado River fish assemblages and conduct detailed hydraulic and habitat modeling in order to evaluate impacts/benefits associated with the LSWP. A comparison to the Mosier and Ray findings is secondary, but important nonetheless. The comparison involves two main components. The first is the biological data collected to create the fish guilds used. The recent fish assemblage information collected in the present study at wider range of flows compared well with the Mosier and Ray biological data. The second comparison would be of the actual recommendations that were based on both the fish guild data and hydraulic and habitat modeling. This is currently being conducted by the project team.

SRP recommends consistency for better description and clarity in use of the term “historical flow regimes.” There are 3 flow regimes/time periods of significance to

the question; pre-Highland Lakes/Rice, post-Highland Lakes/Rice and post-LSWP. For example, historical can be in reference to flows since Doyle and Mozier 1992) or since traditional seasonal flow patterns were altered in the Colorado River in conjunction with Highland Lake operations and flows for rice farming (sorry, we didn't look up the date). In this context, # 5 is possible if the historical flow comparison is between Doyle and Mozier (1992) and the present study. If the purpose of # 5 is to determine impact of recent historical flows and changes in flow that will occur with LSWP, then impacts cannot be determined, only predicted with some degree of uncertainty. As a first step to address # 5 (effects of changes in historical flow regime on native biodiversity) it seems necessary to establish changes to biodiversity that have occurred in the Colorado River since Doyle and Mozier (1992) and prior to implementation of LSWP. However, cause and effect can be problematic. Several studies of rivers show that considerable biological changes occur in biological composition without noticeable perturbations. Also, community compositions can change due to invasive species. In establishing criteria, also consider that changes in historical flow regimes are not only spatial, but also temporal and effects may take years to be fully expressed. Since the Instream Flow Council (IFC, 2002) states, "the objective of an instream flow prescription should be to mimic the natural flow regime as closely as possible" pre-Highland Lake/Rice seasonal flows would be favored by this definition.

Response: "Historical" refers to pre-Highland Lake/Rice seasonal flows.

SRP recommends also that the impacts of the potential placement of instream structures be under consideration for evaluation as components of specific questions # 3, 5 and 6.

Response: That is the intent of the analysis.

1. Biological Data Collection

Subtask 2.20 – Data Analysis and Suitability Criteria refinement

Description of Work: The supplemental fish sampling data collected in 2005 and 2006 will be reduced and analyzed. The data will then be combined with the Mosier and Ray database and evaluation of functional habitat groups using all information will be conducted. The range of suitable habitat conditions associated with each of these functional habitat groups will then be input into the habitat model to predict changes in available habitat for each respective group.

Key Assumptions:

- The 10 functional habitat groups defined in Mosier and Ray (1992) provides a solid biological representation of the lower Colorado River, but can be strengthened by sampling at a wider range of flows.

If this assumption is violated what ramification results to the LSWP? If Doyle and Mozier (1992) is not adequate, how will the project be impacted and what steps will this project team take to remedy?

Response: Since the submittal of this SOW in Fall 2005, the project team has completed sampling and analysis of the biological data. It has been determined that the Mosier and Ray study does provide a solid biological representation with some components adjusted as per the additional sampling conducted by the project team. Subsequent to the data analysis, the project team met with Doyle Mosier (co-author Mosier and Ray 1992, currently employed with Texas Parks and Wildlife Department – River Studies) who supports our findings.

Relative to specific questions # 2 & 5 in this SOW, it is unclear why elsewhere in the SOW it appears data from the LSWP study will be kept separate from Doyle & Mosier (1992) and used for comparisons and to indicate changes in fish composition and habitat or, as stated here, combined to evaluate functional habitat groups. SRP suggests careful evaluation and justification for how the 2 studies will be used. Meaningful data, understanding and interpretation can be obtained from both approaches.

Response: The combination of the biological data has been suggested from project initiation. A more detailed explanation of how that was accomplished is provided below this response as a note. The hydraulic and habitat model used by Mosier and Ray was never proposed to be combined with the present study.

Note: The original intent of the supplemental fish guild sampling was to supplement the Mosier and Ray biological data at a wider range of flows, not replace it. However, because of more modern collection techniques and in the case of the blue sucker, supplementing collection data with telemetry data, the project team was able to collect more individual fish observations during the supplemental efforts (for most species) than in the original study. Additionally, the original data from the Mosier and Ray study was provided to the project team, but unfortunately the data was provided in a statistical format that did not separate individual fish parameters. Several attempts were made to acquire the original raw data in digital form, but were unsuccessful. As such, the biological data collected in the present study was used to create the fish guilds for the habitat model, and these guilds were subsequently compared to the original Mosier and Ray categories as described above.

Task 3 – Blue Sucker Life History Assessment

Subtask 3.10 – Spawning Survey

Key Assumptions:

- The tagging of thirty individual blue suckers and subsequent survival will provide a representative sample of the blue sucker population in the lower Colorado River and will allow interpretation of spawning characteristics when coupled with the specific spawning survey data collection effort. Survival was a success in 2005 with over 75% survival.
- The biological data collected for the blue sucker over a 2 1/2 year time period will be sufficient to describe the habitat suitability requirements of the species/life stage for habitat modeling purposes.

Missing assumption: If juveniles and small size classes of blue suckers are not found does this indicate a declining population under present flow conditions? Recall, blue suckers live 17 years and if juveniles and smaller size classes are rare is it worthwhile to predict effects of LSWP on the blue sucker population. Some further explanation and justification would be helpful here. Specifically, explain how blue sucker analysis will be incorporated with PhabSim and hydrodynamic modeling for criteria determination

Response: The fact that the blue sucker is a large river fish throughout its range seems to imply that it would make worthy candidate in the large, mostly free-flowing stretch of the lower Colorado River. The fact that it is rare in the lower Colorado River leads to many questions, one of which is how have habitat conditions changed for this species historically and under the post Highland Lakes/Rice irrigation flows. For instance, what if the reason that there are so few juvenile blue suckers is that suitable spawning habitat is currently only available 1 out of every 10 years and even at those times it is limited. Through this study, the project team has been able to document the specific adult habitats used, including those for spawning activities. We are currently evaluating the amount and effectiveness of this habitat under various flow conditions. It is understood that the underlying assumption of habitat modeling is if you build it they will come. If it turns out that competition, predation, or some other biological factor other than habitat is controlling the blue sucker population, then the comment above about “worthwhile” is legitimate. However, as these other biological components are outside of the scope of this study, the project team feels that using blue sucker habitat (adult and spawning at this time) is an important component of the analysis.

During blue sucker collection and telemetry activities the project team has been gathering specific depth, velocity, and substrate information for this species. The project team has developed suitability criteria for adult blue sucker habitat, and spawning habitat. These two categories will be included with the fish guild categories (i.e. shallow riffle, riffle generalist, deep pool, rapids, etc.) as input into the River 2D hydraulic models to provide habitat model output in the form of weighted usable area (according to depth, velocity, and substrate parameters).

This brings up an important point that needs careful consideration. It is not entirely clear to SRP how the fish guild, blue sucker and hydrodynamic modeling and habitat models will be reconciled in establishing environmental criteria and subsequently used as a decision making tool for the LSWP. Specifically, it seems that habitat use by all stages of blue suckers is critical in establishing suitability, yet that is not an objective in this SOW and small size classes and juveniles are missing from 2005 data (although we know a couple have been found). This suggests blue suckers may not make reliable indicators for project decisions.

Response: The process for establishing environmental criteria is currently being developed by the project team, and will be discussed on the June 15 SRP aquatic subgroup conference call.

Using all life stages of blue suckers in the habitat modeling was always and remains an objective of this study. However, it is correct that data from larval and juvenile life stages are missing as fish in these stages have not yet been collected on the lower Colorado River. The project team does not understand how not finding larval and juvenile fish “suggests” that blue suckers may not make reliable indicators. What if spawning habitat is the critical parameter? Is the SRP suggesting that if an obligate riverine species is rare or on the decline in a large river that they should not be used in the establishment of an ecologically sustainable flow regime?

Subtask 3.20 – Larval/Juvenile Sampling and Habitat Assessment

Description of Work: Larval and juvenile sampling will be conducted in areas downstream of identified spawning areas as well as up to five additional sites located below spawning areas observed during 2005/2006 activities.

Key Assumptions:

- The biological data collected for the blue sucker over a 2 1/2 year time period will be sufficient to describe the habitat suitability requirements of the species/lifestage for habitat modeling purposes.
- The primary focus of this evaluation is to document the existence of larval/juvenile blue suckers in the lower Colorado River and define the associated habitat requirements. Detailed sampling to establish population estimates is not proposed for this Task Order.
- The ability to capture ecologically meaningful numbers of larval/juvenile blue suckers.

It is not clear to SRP why “Detailed sampling to establish population estimates is not proposed for this Task Order.” This requires explanation and justification given the wide variety of habitats and sites sampled and the diverse array of sampling methods and equipment used to collect fish including “seining, light traps, trawls, and dip netting associated with lights will be used for larval sampling. Backpack electrofishing with block nets, trawls and hoop nets will be employed as an additional collection method for juveniles.” Without some idea of whether blue sucker populations are increasing, decreasing or stationary in the Colorado River, developing habitat suitability curves for blue suckers appears somewhat secondary in importance relative to also having an assessment of whether blue sucker populations are declining. SRP has some concern on effects of a declining population on modeling efforts and subsequent interpretation. This concern is also reflected from preliminary blue sucker genetic analyses conducted by Mike Bessert at the University of Nebraska indicating a population bottleneck in blue suckers, possibly due to a population decline. Also for consideration, species rank abundance curves for a wide variety of assemblages show a few species dominate, many species with intermediate abundance and several rare species comprise a community. If blue suckers historically were a rare species in the Colorado River, then some project level assumptions and ecological approaches need additional review.

Response: Detailed sampling to establish population estimates was not proposed because of funding and time requirements.

The project team is unclear what exactly is meant by “Without some idea of whether blue sucker populations are increasing, decreasing or stationary in the Colorado River, developing habitat suitability curves for blue suckers appears somewhat secondary in importance relative to also having an assessment of whether blue sucker populations are declining” Under the habitat

modeling assumption of if you build it they will come, having developed good adult habitat criteria and spawning criteria for this obligate riverine fish seems very important. Whether the population is increasing, decreasing, or staying stationary is very important from a population standpoint, but doesn't change the type of habitat that this species would select assuming that all habitat types have been available for selection during the course of this study.

We agree completely that understanding the population trends of the blue sucker is extremely important relative to its continued existence in the lower Colorado River. The project team also has concerns about the potential bottleneck identified with the genetics work. Addressing the final comment, even if the blue sucker was historically rare, it is still of particular conservation interest in this watershed due to its limited distribution in the state and the fact that it is one of the few large river species present in the current assemblage. The project team feels that when used in conjunction with the fish guild approach this will provide a good indicator of conditions necessary to maintain the assemblage.

The section on the NFHTC and blue sucker Rio Grande studies are interesting and may be relevant in the future, but for now appear beyond this SOW and determination of LSWP instream flow requirements. Use of blue sucker Rio Grande data raise another whole set of questions and assumptions and NFHTC may not lead to results in a timely manner.

Response: The project team agrees.

The 2nd bulleted key assumption is not an assumption, rather it is an objective.

Response: Okay

For the 3rd bulleted key assumption, SRP asks, What is the difference between “capturing ecologically meaningful numbers of fish to define habitat requirements” (3rd) versus capturing sufficient number of fish to establish population estimates.” Can one be accomplished and not the other? The project team should address this question with sufficient explanation for evaluation.

Response: This assumption was requested by the SRP in the TO2 SOW comments dated April 1, 2005, “The ability to capture ecologically meaningful numbers of larval/juvenile blue suckers should be listed as a key assumption.” The project team's interpretation of this SRP requested assumption is that multiple collections of the life-stage from multiple locations in the river would be ecologically meaningful. A few collections from a few locations would be “sufficient”, and a few fish from one location (albeit really exciting at this point) would be limited.

As for population estimates, the project was not designed with population estimates in mind and therefore the methodology was not conducive to such analysis.

Subtask 3.30 – Migration Assessment

Key Assumptions:

- Thirty individual blue suckers (or that portion that survives) provides a representative sample of the blue sucker population in the lower Colorado River and will **allow interpretation** of migration and adult habitat characteristics. Survival was a success in 2005 with over 75% survival.
- One year into the study we still are locating 29 of 30 tagged fish. However, three tags have been shed (these tags have been recovered) and it appears that three more tags may have been shed (unable to recover) while one tag was never located (thought to be tag malfunction) leaving a total of 23 of 30 tagged fish (76%) confirmed alive and active. Therefore, the important parameter at this point is not the number of fish but the health of the fish. We anticipate losing fish over the next two years to mortality, shedding, fishing, etc.; however, if the remaining tagged fish still appear healthy (alive and congregating with other untagged blue suckers) we will continue this study component. If the fish are not congregating with other blue suckers and rapid mortality/shedding starts to occur, then we will shift to more conventional sampling techniques. Our experience so far is that this will not be the case.
- The biological data collected for the blue sucker over a 2 1/2 year time period will be sufficient to describe the habitat suitability requirements of the species for habitat modeling purposes.

Semantics suggestion (replace interpretation with description): Tracing 30 fish will allow objective “description” of migration and adult habitat characteristics versus subjective “interpretation”.

Response: Okay

In the 2nd bullet assumption, the numbers do not seem add up, unless each of the 6 shed tags were replaced with new tagged fish?

Response: 29 of 30 fish have been found. 3 tags have been recovered. 3 more tags have been shed. 1 unfound + 3 recovered + 3 shed = 7 inactive fish. 30 original fish – 7 inactive fish = 23 fish alive or active as presented in the assumption.

For 3rd bullet, there should exist sufficient data at this point to make a determination to what degree this assumption has and will be met.

Response: You are correct and this assumption will be met for migration and spawning activities for adult blue suckers. However, at the time this SOW was submitted final in December 2005, sufficient data to make that call was not yet available.

Task 4 – Model Development

Subtask 4.10 – Intensive sites – River 2D Model Development

In 2005, River 2D was selected as the two-dimensional hydrodynamic model to be developed for each intensive site. As there was some confusion in the TO2 SOW terminology, we have included some definitions to assist with clarification. The term verification is used to determine whether the modeling code is mathematically sound. River 2D has been used extensively in instream studies and **our canvas of experts has lead us to conclude that it has been verified**. We will continuously evaluate the applicability of the model to the special situations that we may encounter in this study and make appropriate adjustments if necessary.

Calibration will be defined as the process by which we fine tune certain parameters (i.e. roughness and viscosity) to maximize measures (i.e. velocity and depth) of model performance. Validation is the comparison of known data versus the calibrated model results.

Here it would be more scientific to cite literature references where the 2D model has been used, as opposed to an unknown panel of experts, to support model verification. If “canvas of experts” is to be used, they should be listed and expertise noted.

Response: The River 2D model has been used extensively for instream flow habitat studies. The model was developed and tested in a collaborative effort between the Freshwater Institute in Winnipeg (C. Katopodis), the Civil and Environmental Department of the University of Alberta in Edmonton (P. Steffler and several graduate students), the Midcontinent Ecological Science Center of the U.S. Geological Survey in Ft. Collins (T. Waddle), and the Fisheries Division of the Alberta Government in Cochrane (A. Locke). A few of the many of case studies employing this model are listed below.

Bowen, Z.H., K.D. Bovee, and T.J. Waddle. 2003. Effects of channel modification on fish habitat in the Upper Yellowstone River: Final Report to the USACE, Omaha. Fort Collins, CO: U.S. Geological Survey, Fort Collins Science Center. USGS Open-File Report 03-476. 30 + app p.

Gard, M., 2003. Comparison of spawning habitat predictions of PHABSIM and River2D, Presentation given at the International IFIM User’s Workshop, Fort Collins, Colorado.

Ghanem, A., P. Steffler, et al. 1996. Two-Dimensional Hydraulic Simulation of Physical Habitat Conditions in Flowing Streams. Regulated Rivers: Research and Management 12: 185-200.

Katopodis, C. 2003. Case Studies of Instream Flow Modelling for Fish Habitat in Canadian Prairie Rivers, Canadian Water Resources Journal 28 (2): 199-215.

Lacey, R.W. Jay and Robert G. Millar, 2004. Reach Scale Hydraulic Assessment of Instream Salmonid Habitat Restoration. Journal of the American Water Resources Association (JAWRA) 40(6):1631-1644.

Incidentally, we also spoke with Dr. Ben Hodges at UT and with Terry Waddle at USGS (Fort Collins) about the choice to use River 2D.

The SRP still finds the definitions of calibration and validation unclear. “Maximizing measures of model performance” is a confusing statement in the context of velocity and depth alone, independent of some statistical measure of the difference between model predictions and observed values. The definition of validation remains equally unclear to the SRP. Some use the calibration process to tune the input parameters to maximize

various statistical measures of model performance, which seems close to what I read.. Validation often involves operating the model against independent data sets from the calibration process data sets with those tuned input parameters from the calibration process left unaltered, and then seeing how the model performs against the statistical measures. Is this what is to occur or something different?

Response: This is what is occurring. While we were collecting water surface elevation-discharge last year we also collected up to 50 point depth and velocity measurements at each site and flow level. These measurement points were randomly distributed into five depth bins based on the bathymetry we collected. As a result at low flows some of the points were dry and at high flows some were too deep to measure. Half of the points collected at each location and flow will be used to calibrate the model, ie, “tune the input parameters” to minimize the differences between observed and modeled velocities and depths. The other half will be used to validate the model, ie, report the accuracy of the final, calibrated models at the calibration flows.

Subtask 4.50 – Sediment Transport and Riparian Analysis

Description of Work: Based on the geomorphic reconnaissance of the project area in 2005, four distinct river reaches were identified to assist in the assessment of geomorphic features, sediment transport processes, and flow requirements for channel maintenance. The preliminary reaches are: a coarse-bedded/dam-influenced reach immediately below Longhorn Dam; a bedrock-influenced reach between the Bastrop area and the Columbus area where bedrock/ boulder outcrops largely control channel plan form and profile; a transition reach from the Columbus area to the Altair area; and an alluvial/coastal plain reach below Altair characterized by tighter, more regular meanders and fine-grained bed and bank material.

The focus of the 2006 channel maintenance tasks will be to apply the modified 2005 study plan in two “pilot” reaches. The two study reaches that have been chosen are the Austin to Bastrop and Columbus reaches. Within these two reaches, bedload transport rating curves will be developed in order to relate discharge to bedload sediment transport rates. It is anticipated that the bedload relationships will be developed either at existing USGS gage transect(s) or at existing HEC-RAS modeling transect(s) where hydraulic conditions and stage-discharge relationships have already been established. Data collection efforts will focus on gathering information for model (transport equation) inputs and calibration purposes. Suspended sediment rating curves will also be developed but will primarily be based on data provided by the Water Quality team and/or existing agency data.

More justification and rationale should be provided for selection of particular pilot sites and for why downstream pilot sites were not evaluated. From a time and cost saving perspective, since some proposed OCSF are located in the downstream sections, it would seem prudent that sediment transport modeling already be developed for these regions of the Colorado River.

Response: As of May 2006, progress has been made in the refinement of locations for the Off Channel Storage Facilities (OCSF). The remaining six potential OCSF sites are split equally downstream in Matagorda County and upstream in Colorado County. The

more diverse habitat conditions occur prior to entering the coastal plain, Colorado County and up. Therefore, to maximize resources, the project team has selected two reaches, one near the LaGrange intensive site, and one near Columbus. These reaches are just upstream of half the potential OCSF's as well as the only potentially new instream structure. The OCSF's in Matagorda County will all use existing instream structure for diversions.

Task 5 – Alternatives Analysis

Subtask 5.10 – Interim Environmental Criteria Development

For clarity and comprehension, it would be useful to list components, categories and methods associated with environmental criteria development.

Response: This will be one topic discussed on the June 15 SRP aquatic subgroup conference call.

Subtask 5.40 – Socioeconomic Team Interaction

Description of Work: This task will include the coordination between the Aquatic Habitat team and the Socioeconomic team.

One key assumption is that,

- Recreational suitability criteria established in the literature is sufficient to address recreational activities for the lower Colorado River.

For consistency between SOWs it would be helpful to explain the nature of the literature that will be used to make decisions for the task since this is a key assumption. Is the literature peer reviewed, technical reports, published books etc.? There are several very good published books and reviewed studies on ecology and impacts of recreation on aquatic ecosystems and it is SRP's hopes that suitability criteria referred in this task is largely based on this material. It would be useful for comprehension and evaluation if referenced literature were included here and suitability criteria to be used provided.

Response: All sources identified above are being evaluated for this analysis. We agree that several good sources of recreational use criteria are available. If the SRP has any particular references in mind, the project team would welcome those suggestions.