EXPERT PANEL ON DIVERSION PLANNING AND IMPLEMENTATION

Report #4

March 2015

Submitted to:
Coastal Protection and Restoration Authority

EXECUTIVE SUMMARY

The fourth meeting of the *Expert Panel on Diversion Planning and Implementation* focused on presentations and discussions regarding: (1) specific responses to the Panel's recommendations in Report #3; (2) outcome of the *Winter 2014 Decision Point*; (3) status of the Delta Management Study; (4) effects of sediment diversions on vegetation, soils and water quality; and (5) status of on-going studies that are tied to socio-economic analyses. This report summarizes our findings and offers four recommendations for more effectively advancing the diversion planning process as it moves towards the *Fall 2015 Decision Point*. Panel recommendations were developed from, and built upon, recommendations in the first three Panel reports following review of all 35 of the previous recommendations. We again note that CPRA has already implemented a number of our recommendations, and we compliment the staff for their willingness to provide key information when requested by the Panel and to answer questions that arise during and between meetings. We also reiterate that there continues to be a need for in-depth peer review of each technical element, whether in the modeling work, the monitoring program, or in the socio-economic studies, in order to ensure that conclusions drawn from the technical analyses are in fact well supported.

1.0 INTRODUCTION AND BACKGROUND

The *Expert Panel on Diversion Planning and Implementation* (the Panel) held its fourth meeting in Baton Rouge on February 11-13, 2015. The Panel was established to provide expert advice and guidance on key issues that pertain to river diversions in recognition that diversions are an essential restoration tool in coastal Louisiana. Indeed, Louisiana's 2012 Comprehensive Master Plan states (p. 106) that "…sustainable restoration of our coast without sediment diversions is not possible". The Panel's official charge was thus to *provide technical input, review and guidance as plans are refined on diverting freshwater and sediment from the Mississippi and Atchafalaya rivers into adjacent estuarine basins to build, maintain and sustain coastal wetlands.*

The Panel, convened by The Water Institute of the Gulf (the Institute), is comprised of 12 members with backgrounds in a broad range of physical and biological sciences, social science, economics, and engineering. The extensive experience of Panel members in other restoration programs, together with the particular blend of Panel expertise, was considered important for advancing our understanding of river diversions. The Panel recognizes that there is an expectation that they remain independent and objective, and that their role is advisory in nature. As such, the Panel is not in a position to make policy or implementation decisions. More information on the Panel, including the list of members and their professional expertise, is given in Appendix 1.

The primary issues that the Panel will address over the next two years include: (1) evaluation of critical scientific and technical uncertainties; (2) identification of research that will be needed to reduce uncertainties; and, (3) review and comment on technical reports, model outputs, and other aspects of project development identified by the Panel or by the Coastal Restoration and Protection Authority (CPRA). The Panel anticipates that topics for consideration will continue to vary from meeting to meeting and that Panel members will be engaged periodically through webinars between the formal meetings. The agenda for the open part of the meeting is given in Appendix 2. The Panel also met in closed session to discuss findings and recommendations, which are summarized below in Section 3.0.

2.0 FOCUS OF MEETING #4

Meeting #4 occurred close to the one-year anniversary of the first Panel meeting, which was held in January 2014. Over the past year, the Panel has made 35 recommendations, spread over the first three Panel reports, to improve the technical foundation and the process for planning and evaluating sediment diversions. Findings and recommendations have covered a wide range of topics that are relevant to river diversions: uncertainty that stems from natural variability and knowledge limitations; conceptual models that are used to frame the approach in the planning process; data collection and hydrodynamic modeling that define the physical system; socio-economic analyses that need to link to stakeholder concerns; and, ecosystem monitoring and modeling that are essential for understanding the living resources.

The primary focus of the presentations to the Panel during the fourth meeting was to (1) provide the Panel with a response to recommendations from its third report, (2) inform the Panel of the outcome of the *Winter 2014 Decision Point* for advancing four of the sediment diversion to the next phase of analysis and design, (3) present preliminary engineering on Lower Barataria and Lower Breton sediment diversion projects, (4) update the Panel on progress with the Delta Management Study, (5) engage the Panel in discussion with local experts following presentations on ecosystem effects of sediment diversions on vegetation, soils and water quality, and (6) discuss ongoing and completed socio-economic analyses that CPRA expects to use to inform its *Fall 2015 Decision Point*.

The Panel also discussed specific charge questions that were framed in advance of the meeting (Appendix 3), and reviewed the 35 previous recommendations for the purpose of prioritizing those that will be most relevant to the *Fall 2015 Decision Point*. The findings and recommendations in this report have their origin in the discussions of uncertainty, monitoring and modeling from earlier Panel meetings. Given the complexity of the science and engineering associated with the design and operation of major freshwater and sediment diversions, it became clear that uncertainty and prediction from modeling were highly relevant and pressing topics for early consideration. Although some of the earlier recommendations lacked specificity and have since been refined, they are still relevant.

3.0 RESPONSE TO THE CHARGE

The Charge provided to the Panel in advance of the meeting covered three main topics (Appendix 3). Additional reading materials were supplied to the Panel for several of the topics. The Panel's response to the Charge is given below in the form of answers to the questions that were posed in the Charge.

3.1 CHARGE QUESTIONS: WINTER 2014 DECISION POINT.

1. *Is there sufficient support to advance all sediment diversions to more detailed analysis and design?*
   The short answer is yes. We conclude that the four sediment diversions below New Orleans (Mid-Barataria, Lower Barataria, Mid-Breton, Lower Breton) are viable projects that meet basic criteria for advancement to the next phase. While there are detailed design and other issues that remain unresolved, the *Winter 2014 Decision Point* is only one step in a multi-step process. Understanding of the ecosystem continues to advance quickly, and there is enough overall knowledge to know that the diversions will almost certainly take us in the direction of achieving the goal of building new deltaic land.

2. *Were the tools and approaches in the December 2014 decision appropriate and sufficient?*
   The panel found that the array of tools and approaches used in the Winter 2014 decision were appropriate, recognizing that there will be subsequent refinements. We note that river models based on 3D hydrodynamic and sediment transport processes were used, and that basin-wide models including 2012 Master Plan ecohydrology, vegetation, and wetland morphology models provided additional support. Application of the Delft 3D model that uses West Bay as an analog has considerable promise for future decision milestones. Together the information derived from these models ranges from flows of water, sediment, and nutrients to projections of wetland vegetation.

3. *Are differences from results in the 2012 Master Plan adequately described?*
   Not necessarily. The panel appreciated the fast-paced presentations given by CPRA and consultants on costs and various elements of initial design. However, we remain uncertain about the specific nature of changing cost estimates for the projects and are unable to reconcile cost against other variables. Given the overriding focus on project cost and the likelihood of future changes and a continuing degree of uncertainty, additional thought is needed for explaining specific cost implications of design alterations and constraints. This information is of general interest to the Panel but of vital interest to decision-makers and the public.

4. *Are there specific aspects of engineering design that present particular challenges?*
   Selection of the 40-ft depth parameter for diversion channels is particularly significant because of its hydraulic, sediment transport, management, and cost implications. Given its importance, the Panel would have benefited from a more detailed explanation of the choice of invert depth in the analyses presented. The Panel also found that, while it is true that sea-level rise and subsidence will be similar for all of the projects and thus is not a particularly important decision point in sequencing the selected projects, more information is needed on the implications of the inevitable rise of the sea surface and sinking of land surfaces. Final design should reflect subsidence and sea-level rise over the design life (50 years) of diversions projects. This information not only informs our thinking about the engineering design, but it directly affects the way we think about land building and the ecology of these new surfaces.

3.2 Charge Questions: Water Quality, Vegetation and Soils.

1. *What is a reasonable expectation for analysis of these variables for predicting the future with and without projects over the next 50 years?*
   The Panel notes that the primary objective of the diversion projects is to build and sustain land, specifically wetland ecosystems, through restoration of deltaic processes. In a future without action, dramatic losses of coastal wetlands will continue, the rate of which will increase with high relative sea level rise. In a future with diversions, the broad expectation is that land building and coverage of coastal wetlands will increase. While development of testable hypotheses and predictions is a key and necessary step toward understanding diversion effects, the Panel does not consider the prediction of *specific* outcomes (e.g., exact combinations of plant species present) to be achievable. Operation regimes (e.g. duration and timing) will largely drive the genesis, composition and trajectories of vegetation and soil. Targets should remain general until construction is completed. Then, through adaptive management, more detailed targets and operational scenarios can be developed.

2. *What are the highest priority issues to address and which can be predicted with more confidence?*
   Even with the establishment of operational regimes, much uncertainty in vegetation and soils will remain. Therefore, a strong focus on pre- and post-diversion monitoring will be necessary to refine understanding of the relationships between biophysical impacts and trends and operational strategies. Monitoring efforts will help to inform adaptive management, particularly as it applies to adjustments in operations. The Panel considers embracing the diversity of conditions to be more fruitful than aiming for highly specific targets. For water quality, a key priority is a clear understanding of residence time in the receiving basins, which can be readily addressed with the Delft 3D model that is being developed.

3. *Are there water quality or vegetation-related outcomes that are particularly challenging to predict?*
   The impact of climate change will have multiple effects on vegetation and soil dynamics. Consider: (1) rate of sea level rise will influence, together with subsidence, longevity of emerging delta communities; (2) shifts in tropical storms will influence frequency and duration of storm surge inundation; (3) invasive species (including those that float) are likely to affect dynamics of plants and soils; and, (4) shifts in upstream precipitation regimes are likely to have major influence on operations. Moreover, effects of diversions on soil strength and organic accretion rates in receiving basins are not well understood and present a significant challenge in predicting longevity of emerging land and wetlands in the diversions' footprints. Finally, one of our earlier recommendations was to conduct an experiment on nutrient effects on existing wetlands, and we understand the constraints that may make such an experiment difficult to conduct in a timely manner. We regard this information as still being important to the success of the diversion process. Without such an experiment, adequate monitoring to assess project effects and outcomes becomes especially important.

3.3 CHARGE QUESTIONS: SOCIO-ECONOMIC ANALYSES.

1. *Is the approach to socio-economic analysis presented likely to result in a reasonable base of information to support decisions on whether sediment diversions should move forward to advanced planning and engineering and design?*
   The Panel has yet to be provided with documentation of socio-economic methods, data, or scopes of work. Accordingly, our findings and recommendations are based only on the presentations made during the open part of the meeting that covered the Coastal Valuation Study, Commercial Fisheries Study, Coastal Atlas, and Basin-Wide SE Study.

   A socio-economic analysis should reveal differences across different decision options. To achieve this objective, socio-economic outcomes need to be causally linked to (1) different policies or actions, and (2) the differential biophysical changes implied by those policies or actions.

   The Coastal Valuation Study, Commercial Fisheries Study, and Coastal Atlas are "static," "baseline descriptive" exercises meant to document a variety of social and economic conditions across Louisiana. Alone, these activities do not allow for comparison of outcomes across diversion projects or between diversions and the no-action option. It is therefore unclear how this work can be used to support policy choices associated with diversions.

The Basin-Wide SE Study is the only study designed to compare decisions. Our understanding is that the comparison will be between "build diversions" and "no diversions" decisions. We also understand that diversion *operational* decisions are likely to have significant effects on biophysical outcomes and, in turn, socio-economic outcomes (see recommendations section).

2. *Are the biophysical outputs that will be used to inform the socio-economic analysis sufficient for evaluating with and without projects?*
   It is difficult for the panel to answer this question since the ways in which socio-economic analyses will integrate with hydrological and ecological models have not yet been articulated. However, we can provide a couple of examples of how we see this being done. Our understanding of the basin-wide biophysical models is that they will allow a comparison of diversion projects (of differing size, location, and operations) in terms of their effects on (1) diversion-triggered flood risks, and (2) the biomass and location of fishery species. These location-specific biophysical outcomes can be used to generate different social and economic outcomes. The intent of the Basin-Wide SE study should be to make that translation through close linkages to the biophysical modeling.

   In terms of flooding, and assuming hydrological modeling will allow diversion-specific flooding to be mapped, the location of populations, property, and infrastructure could be coupled with the hydrological model so that the diversions could then be compared with regard to human, social, and property damage risks that may result.

   In terms of fisheries impacts, and assuming that water quality and species modeling will allow diversion-specific fishery impacts to be mapped, the effect of those changes on fishing costs and fishing community impacts could be described. Does a particular diversion lead to significant losses to a fishery? If so, what is the economic cost of those losses (e.g., in terms of landing revenues)? Does a particular diversion lead to significant changes in the location of a fishery? If so, how much will this increase in costs be borne by the fishing community in terms of gear, fuel, and travel times? Here we note that the data being created by commercial fishing study could be extremely useful.

4.0 SYNTHESIS OF RECOMMENDATIONS FOR 2015 DECISION POINT.

The Panel is keenly aware of the significant challenge of addressing all of the recommendations in our previous reports given budget constraints and limitations in human capacity. We thus begin by recognizing the progress that CPRA and its partners have made: many of our recommendations have in fact been followed and there has been considerable progress in moving forward with technical studies to support sediment diversion planning. In particular, we think that the general conceptual model of the diversion planning process has been a useful tool to communicate with public and CPRA partners. Many of the recommendations in our earlier three reports were about monitoring and modeling of ecosystem impacts, and we appreciate the progress being made in addressing these concerns through the development of SWAMP, EwE, and CASM.

We encourage further efforts to develop a detailed monitoring plan that will be useful in (1) validation of hydrodynamic and ecosystem models, (2) adaptive management of diversions, and (3) provision of hard data to use in the assessment of progress toward the ultimate goals of the diversion projects. We look forward to seeing details of the monitoring plan for tracking changes in the receiving basins particularly for bathymetry, geomorphology, suspended sediments, turbidity, and the abundance and

biomass of trophic groups included in ecosystem models, as well as the economic and social impacts on human communities.

An example of such a plan, with particular reference to adaptive management, is given in Figure 1 for restoration of the Florida Everglades. The Comprehensive Everglades Restoration Plan developed a Monitoring and Assessment Plan (MAP) for large-scale restoration similar to the diversion plan for the Mississippi River. Although the MAP underwent subsequent changes, its initial phases may be an instructive starting point for CPRA. The Panel encourages CPRA to learn lessons from other large scale ecosystem restoration efforts that have faced the same challenges of tracking change in complex systems.

As CPRA moves toward the 2015 decision to implement sediment diversion projects, we have reviewed our 35 previous recommendations, and synthesized a subset of the recommendations into three principal themes to better enable CPRA to address critical elements that need to be developed or better articulated to the Panel and to the public.

Recommendation #1:
Expand the current conceptual model of the sediment diversion planning process to provide greater detail on the modeling and socioeconomic studies and their respective linkages, leading into the 2015 decision to implement.

Recommendation #2:
Use this refined conceptual model (science and planning) and detailed description of the socio-economic valuation approach to communicate with stakeholders over the next 6 months and solicit their feedback. This is an important step in this public process that gives CPRA the opportunity to strengthen relationships with key stakeholder groups.

Recommendation #3:
Provide for the review of monitoring and modeling efforts by independent subject matter experts and make results of the reviews available. Transparent technical review ensures that conclusions drawn from the technical analyses are in fact well supported and will add credibility to difficult or controversial aspects of diversion implementation.

Recommendation #4:
Design the Basin-Wide SE study so that operational decisions can be compared in terms of socio-economic outcomes, and apportion available resources to support this work over other more descriptive studies that do not have clear relevance to diversion decisions.

The expanded conceptual model in Recommendation #1 should explicitly include the modeling outcomes from MR hydrodynamic and delta management models (ADH), the basin-wide hydrodynamic, habitat and WQ models (Delft 3D) and the ecological models (EwE and CASM). A detailed conceptual approach to socioeconomic analyses should be provided, including a description of the outcomes of these analyses. It will be important to (1) describe how the modeling outcomes are linked to socio-economic analysis and to provide understanding of how this linkage will integrate temporal and spatial scales of the modeling and socio-economic analyses, (2) describe how or at what stage during the decision-making process the diversion operational scenarios will be explored and provide examples of

operational scenarios (e.g., will operational scenarios be evaluated as a part of the 2015 decision, or will operational scenarios be evaluated post-2015 in order to develop information about how to minimize impacts?), and (3) describe to what extent socio-economic analyses will be linked to analyses of diversion operational scenarios (e.g., will you be able to predict effects of different diversion operational scenarios on jobs, economy, and flood risk?).

This expanded conceptual model to support the 2015 decision will be invaluable in expanding outreach to stakeholders and improving coordination among project partners. While the conceptual models may be described through a simple set of presentation graphics, ultimately there is great value in engaging the LSU Coastal Sustainability Studio to make graphics that can visually translate these conceptual model concepts to the public. Effort should be made to engage key stakeholder groups through planned stakeholder outreach efforts as well as through CPRA Board meetings.

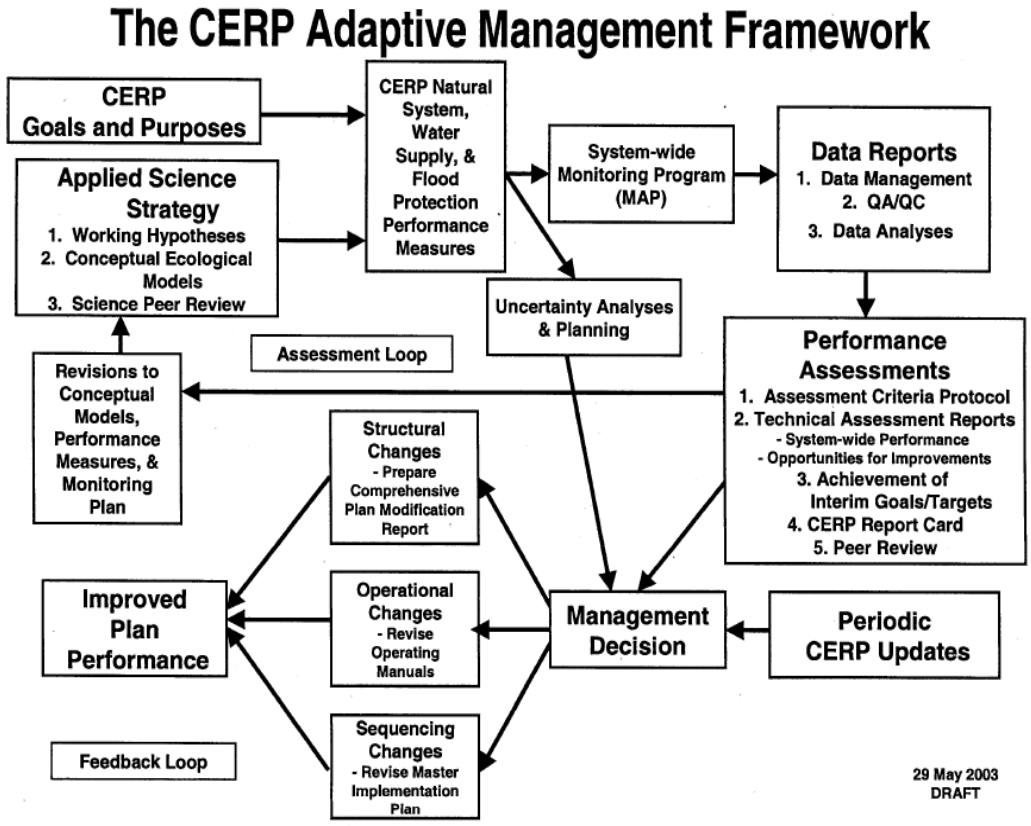

Figure 1. Adaptive Management Framework for monitoring and assessment in the Comprehensive Everglades Restoration Plan.

Appendix 1:

ABOUT THE EXPERT PANEL ON DIVERSION PLANNING AND IMPLEMENTATION

The Expert Panel on Diversion Planning and Implementation was established to provide independent advice as plans for implementing sediment diversion projects along the Mississippi and Atchafalaya rivers that support coastal restoration are refined.

This independent panel is expected to meet approximately three times per year. It will identify critical scientific and technical uncertainties, suggest specific research to reduce uncertainty, and review and comment on technical reports, model outputs, and other aspects of project development. Given the issues surrounding the complexity of the design and operation of a major sediment diversion, the panel's recommendations will be in an adaptive management context. Meetings of the panel will be structured to ensure key input is received from a variety of local experts, stakeholders, and citizens. Panel reports will be presented at meetings of the CPRA Board.

The Expert Panel was formed at the request of CPRA, which is also funding the effort. The Water Institute of the Gulf provides staff and logistical support to the panel.

MEMBERS

Member	Affiliation	Expertise
Dr. John T. Wells	Virginia Institute of Marine Science (Panel Chair)	Deltaic Processes
Dr. Loretta Battaglia	Southern Illinois University	Restoration Ecology and Climate Change
Dr. Philip Berke	Texas A&M University	Urban Land Use and Environmental Planning
Dr. James Boyd	Resources for the Future	Economics and Environmental Policy
Dr. Linda Deegan	Marine Biological Laboratory	Fish Ecology, Biogeochemical Cycling and Nutrient Delivery
Dr. William Espey Jr	Espey Consultants Inc	Civil/Coastal Engineering and Water Resources
Dr. Liviu Giosan	Woods Hole Oceanographic Institution	Morphodynamics and Sedimentation
Dr. William Graf	University of South Carolina (Emeritus)	Rivers and Water Resources Management
Dr. Matt Kirwan	Virginia Institute of Marine Science	Coastal Landscapes and Sea Level Change
Dr. Tom Minello	NOAA Southeast Fisheries Science Center	Fisheries Ecology
Dr. Martha Sutula	Southern California Coastal Water Research Project Authority	Water Quality Management, Systems Ecology
Dr. John Teal	Woods Hole Oceanographic Institution (Emeritus)	Coastal Wetlands Ecology

Appendix 2:
MEETING #4 AGENDA

February 12, 2015
State Capitol Welcome Center
Baton Rouge, LA

9:00	**Welcome and Introductions; Agenda Review**	**Dr. John Wells (Panel Chair),** Virginia Institute of Marine Sciences
9:15	**Diversions Update**	**Mr. Bren Haase,** CPRA
10:15	**Break**	*Coffee*
10:30	**Winter 2014 Decision Points**	**Mr. Wes LeBlanc,** CPRA • Introduction **Mr. Kent Bollfras,** CPRA • Overview of Planning Process **Mr. David Escude**, ARCADIS • Lower Barataria Engineering/Design **Mr. Richard Speer**, URS • Lower Breton Engineering/Design
12:00	**Lunch**	
1:15	**Delta Management Study**	**Ms. Elizabeth Jarrell,** CPRA **Ms. Cherie Price**, USACE
1:45	**Ecosystem Effects of Sediment Diversions: Vegetation, Soils and Water Quality**	**Dr. Dubravko Justic,** Louisiana State University **Dr. Jenneke Visser,** University of Louisiana at Lafayette **Dr. Robert Twilley,** Louisiana State University *Discussion with Pane*l
2:45	**Break**	*Coffee*
3:00	**Socio-Economic Analyses**	**Mr. Karim Belhadjali,** CPRA • Introduction **Dr. Stephen Barnes,** Louisiana State University • Economic Evaluation of Coastal Land Loss in Louisiana • Commercial Fisheries Study **Dr. Scott Hemmerling**, The Water Institute of the Gulf • Coastal Atlas **Ms. Melanie Saucier, Mr. Bren Haase, Mr. Karim Belhadjali,** CPRA • Using the Results *Discussion with panel*
4:15	**Public Comment Period**	

Appendix 3:
CHARGE FOR MEETING #4

(1) Considering the information available from the planning level evaluation, e.g., the engineering/design analysis, is there sufficient support to advance all of the sediment diversions to undergo more advanced analysis, e.g., sequencing, detailed exploration of operational effects on fish/shellfish communities? Were the tools and approaches used in the December 2014 decision appropriate and sufficient to support the decision? Are the differences from the results presented in the 2012 Coastal Master Plan adequately described? Are there specific aspects of the engineering design, which present particular challenges for implementation?

(2) What is a reasonable expectation for water quality and vegetation/soils analysis that seeks to predict changes resulting from both future without action and future with sediment diversions 50 years into the future? What are the highest priority issues to address? Which of these ecosystem outcomes can be predicted with more confidence? Are there any water quality or vegetation-related ecosystem outcomes for which such long term predictions are particularly challenging?

(3) Is the approach to socio-economic analysis presented likely to result in a reasonable base of information to support decisions on whether sediment diversions should move forward to advanced planning and engineering and design, at which point they will go through additional socio-economic examination? At the basinwide planning level, are the biophysical outputs that will be used to inform the socio-economic analysis and the tools used to generate those outputs sufficient to evaluate a future with or without sediment diversions