



Coastal Protection and Restoration Authority
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2017 Coastal Master Plan

Attachment G5: Science and Engineering Board



Report: Final

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Overview

CPRA convened a multidisciplinary Science and Engineering Board (SEB) to support CPRA in fulfilling its mission to complete the 2017 Coastal Master Plan. The SEB played a key role in refining the 2017 Coastal Master Plan process and in developing recommendations for improving elements of the Plan to be submitted through the CPRA Point of Contact (Ashley Cobb) to the Executive Director of CPRA (Michael Ellis), in collaboration with the Master Plan Delivery Team (MPDT).

The following provides an overview of the SEB and its role in the development of the 2017 Coastal Master Plan, as well as comprehensive reports and key outcomes from each SEB meeting.



2017 Coastal Master Plan

Science & Engineering Board Terms of Reference *July 6, 2015*

Purpose

The Coastal Protection and Restoration Authority of Louisiana (CPRA) is convening a multidisciplinary Science and Engineering Board (SEB) to support CPRA in fulfilling its mission to complete the 2017 Coastal Master Plan, which will serve as the State's comprehensive framework for future coastal protection and restoration.

The SEB will play a key role in refining the 2017 Coastal Master Plan process and in developing recommendations for improving elements of the Plan to be submitted through the CPRA Point of Contact (Ashley Claro) to the Executive Director of CPRA (Kyle Graham), in collaboration with the Master Plan Delivery Team (MPDT).

Background

The Louisiana Legislature's passage of Act 8 of the Second Extraordinary Legislature of 2005 (Act 8) created the CPRA and tasked it with identifying priorities that support comprehensive, long-term coastal protection and restoration. Act 8 required that hurricane protection projects and coastal restoration projects must be integrated. Act 8 also outlined a series of actions to develop and implement its new, mandated strategy of integrating protection and restoration including the development of a master plan for coastal Louisiana.

The initial master plan, titled *Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast* (Master Plan) was completed in 2007. The Master Plan's primacy was reaffirmed by Governor Bobby Jindal in Executive Order BJ2008-7, which directed all State agencies to administer their activities, to the maximum extent possible, in accordance with the Master Plan's recommendations.

The 2007 Master Plan was a conceptual document and was not intended to address all of the complex issues that Louisiana faces with respect to protection and restoration of its coastal resources. To accommodate the dynamic nature of coastal processes, the Master Plan is a living document that will be updated every five years. These updates will incorporate new data and planning tools as they become available. The first update of the Master Plan was completed in 2012.

The 2012 Coastal Master Plan holds true to the overall objectives and approach of the 2007 plan. However, whereas the 2007 plan had a more general focus on strategies and possible project options, the 2012 plan identified a specific group of project concepts in which the state should invest.

The 2012 Coastal Master Plan is based on a two year analysis by some of the state's most respected scientists as well as national and international specialists. The state used this analysis to select 109 high performing projects that could deliver measurable benefits to our communities and coastal

ecosystem over the coming decades. The plan shows that if these projects are fully funded, at a cost of \$50 billion, we could substantially increase flood protection for communities and create a sustainable coast.

Each update to the Coastal Master Plan builds on the past and establishes a clear vision for the future, but it is not the last word. We continually work to improve our methods to ensure projects are completed as efficiently and effectively as possible. Louisiana citizens will see this progress reflected in upcoming annual plans and in the 2017 Coastal Master Plan.

This document is intended to provide additional detail about the role of the SEB, the intended qualifications of the representatives who serve on the team, as well as the work products for which the SEB will have a major role.

Guiding Principles for the Science and Engineering Board

The SEB's work will be guided by several key principles:

Be bold in conducting outcome-focused deliberations. It is CPRA's intention to use the SEB to produce concrete recommendations to improve the elements of both the planning process and content of the 2017 Coastal Master Plan. It is also the intention that the SEB "be bold" in offering its advice. As appropriate, the MPDT will work with the SEB and support its efforts by developing concise memoranda that summarize its recommendations.

Recognize the challenges for the State of Louisiana. To be successful, the 2017 Coastal Master Plan must integrate the perspective of multiple disciplines, and the views of a wide variety of coast wide interests, while being mindful of the institutional responsibilities to the planning process (e.g., legislative mandate to complete the 2017 Coastal Master Plan and present to the Legislature for approval in April 2017).

Uphold and foster legitimacy and accountability. To ensure that the process is credible and results in advice useful to the MPDT, it is essential that the SEB's work be structured to foster consideration of the best available science and engineering, accountability to CPRA, and thoughtful deliberation.

Charge to the Science and Engineering Board

The SEB's deliberations should be solution-oriented and will be used to develop specific recommendations on the content of the planning process and the elements that make up the 2017 Coastal Master Plan. The SEB is charged with:

- Providing disciplinary expertise on scientific and engineering issues relevant to coastal protection and restoration, which may include experience in Louisiana and other national and international efforts.
- Providing evaluation and recommendations on the structure of the planning process, including the integration of science and policy in producing the 2017 Coastal Master Plan, as well as procedures for outreach and engagement to stakeholder groups. The SEB is not being asked to endorse any of the specific recommendations of the 2017 Coastal Master Plan.

- Providing timely response on questions pertaining to the interpretation of key scientific methodologies as they pertain to 2017 Coastal Master Plan elements.
- Providing evaluation and recommendations on improving the elements of the 2017 Coastal Master Plan, which could include the following:
 - Decision drivers and metrics to evaluate and prioritize projects;
 - Constraints;
 - Uncertainties and scenarios;
 - The procedure of project selection to be included in the 2017 Coastal Master Plan;
 - Tools used to support the analysis (i.e., Planning Tool and Predictive Models); and
 - The overall suite of projects to be included in the 2017 Coastal Master Plan;
 - Appropriate incorporation of adaptive management and socio-economics in the process.
- Identifying analysis and information to improve the above 2017 Coastal Master Plan elements, consistent with the principle of the time-bounded nature of the work.
- Striving for a robust level of cross-disciplinary involvement and documenting both individual feedback and broad concurrence where applicable.

To address these and other tasks in an effective and collaborative manner, the SEB will work primarily with the MPDT and other consultative groups as requested by CPRA. The SEB will meet two or three times a year for a total of up to five meetings over the next two years. The SEB may also meet in additional work sessions or webinars as appropriate.

Use of Work Teams and Individual Assignments. It is the intent of CPRA and the MPDT to develop a strategy to enable SEB members to focus on specific 2017 Coastal Master Plan elements, while remaining aware of how all the pieces fit together. The MPDT will work with SEB members to structure and support this work.

Science and Engineering Board Membership

Close Attention to Broad Disciplinary Representation. The SEB is intended to represent a broad range of disciplines and to engage experts with national and international experience. The disciplines to be represented include the following:

- Ecosystem Science/Coastal Ecology;
- Engineering;
- Geosciences;
- Land Use Planning and Risk Management;
- Climate Change; and
- Economics.

Criteria for Recruitment and Selection. Each member of the SEB is expected to have the following attributes:

1. Technical capability in his/her respective discipline(s) as well as an ability to work across disciplines.
2. Experience with development or evaluation of coastal protection and restoration plans.
3. Objectivity, as reflected by a willingness and ability to integrate diverse viewpoints.

4. Ability to maintain effective, timely two-way communication with the MPDT.
5. Ability to work collaboratively with other SEB members; seeking to integrate the interests of the full range of disciplines and areas of expertise.
6. Track record of advising for time-bounded environmental decision-making, and a proven track record of meeting deadlines.
7. Experience with practical applications of advice.
8. Commitment to completing all aspects of the charge to the SEB.

Taken together, selections will be made to achieve a diversity of disciplines and perspectives, and a national and international body of experience.

Size of the Science and Engineering Board. In order to foster productive deliberation and multiparty dialogue, the intent is that the SEB will have no more than 10 members.

Appointing Authority. CPRA, as represented by the Executive Director – Kyle Graham, is the appointing authority.

Science and Engineering Board Deliberative Process

The SEB works with the expectation that members represent an important voice in bringing their disciplinary perspective to bear on both the planning process and content of the 2017 Coastal Master Plan. The SEB will convene its first meeting October 21-23, 2015. The intent is to carry out a process that includes the following activities:

1. The MPDT will identify key documents that represent either steps in the 2017 Coastal Master Plan process or key plan elements for review and deliberation by the SEB.
2. SEB members will receive and review agenda packets and supporting materials in advance of the meetings.
3. SEB members will meet face-to-face as a team up to five times as needed, to conduct their deliberations. SEB members will be expected to work together to document findings and key recommendations for modifications or changes, in the form of post-meeting reports. These reports will be submitted to the CPRA Executive Director through coordination with the CPRA Point of Contact. Response comments will be provided to the SEB.
4. Members will also meet in webinar or teleconference settings as needed to supplement face-to-face meetings.
5. The SEB may work in small ad-hoc work teams, as necessary, to further concepts and issues, as requested by the MPDT.
6. As needed, the SEB will review additional documents and request additional focused analysis.
7. The SEB will present its findings and recommendations to the CPRA Executive Director through the CPRA Point of Contact.

Review and Improve Work Products. The SEB's evaluation and recommendations on various draft plan elements will be taken into account and, to the extent possible, revised plan elements will reflect improvements suggested by the SEB. Any improvements that are not possible to incorporate into the 2017 Coastal Master Plan due to time constraints will be archived for future inclusion into future five-year Master Plan updates.

Deliverables. The SEB, unlike groups such as NRC panels, will not be expected to issue a single comprehensive report at the end of its deliberation. Rather, a more engaged, yet independent, approach will be applied, allowing the SEB to provide directed responses incrementally as key plan

elements are developed. Short post-meeting reports will be produced, as requested, in a timely manner and will summarize SEB recommendations on the planning process, interpretation of key scientific and engineering analyses, and suggested refinements to elements of the 2017 Coastal Master Plan.

Broad, cross-disciplinary concurrence on recommendations is desirable; however, in cases where it is not attainable, SEB members may generate multiple divergent recommendations.

Role of the Science and Engineering Board Relative to the Framework Development Team and the Technical Advisory Committees. The SEB has important responsibilities distinct from, and complementary to, two other primary consultative groups: the Framework Development Team (FDT) and two Technical Advisory Committees (TAC):

- The FDT has been established by CPRA to represent key coastal constituencies and to maintain strong two-way communication between the MPDT and those constituencies. Additionally, FDT members are asked to weigh in on tradeoffs among key choices and to consider the implications of proposed projects on specific coastal constituencies.
- Small advisory groups, or TACs, have been convened to provide advice and assistance on two topics: the Predictive Models and the Flood Risk and Resilience Program:
 - The Predictive Models TAC is advising on the development of a suite of interconnected hydrodynamic and ecological models that will be used to assess project effects; and
 - The Resiliency TAC is advising on improvements to the socio-economic and resiliency data and metrics that will be used to assess project effects.
 - The TACs are expected to provide ongoing technical advice and guidance on critical technical components, review draft materials, and discuss progress, issues, and questions with members of the MPDT.

The SEB is intended to bring an objective, rigorous analysis to the 2017 Coastal Master Plan process. In general, the SEB will have an opportunity to evaluate and recommend improvements as appropriate to the general planning approach and elements of the 2017 Coastal Master Plan.



2017 Coastal Master Plan

Science & Engineering Board *Draft* Ground Rules (For review, revision, and adoption at the July 16, 2015 Science and Engineering Board meeting) July 6, 2015

Purpose

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Roles and Responsibilities of the SEB Chair, in coordination with the CPRA Point of Contact:

- Serving as a liaison with staff assigned from the MPDT;
- Maintaining communication with the SEB members;
- Framing questions for deliberation and articulating the scientific dimensions of key issues;
- Upholding ground rules;
- Moderating and chairing deliberations of the SEB and tracking the queue;
- Assigning tasks to ad hoc work teams within the SEB;
- Summing up the results of deliberations to produce recommendations and articulating the "sense of the group" relative to reaching broad based concurrence; and
- Responding to/planning for potential presentations at select venues.

The following Ground Rules are intended to foster and reinforce constructive interaction and deliberation among SEB members. They emphasize active engagement, clear communication, respect for divergent views, creative thinking, and collaborative problem solving. They also emphasize striving toward multidisciplinary concurrence on key findings and recommendations, but recognize this may not occur in all cases. CPRA as lead convening agency, the MPDT and the SEB may choose to reconsider and revise these Ground Rules if they do not adequately serve the 2017 Coastal Master Plan process.

1. **Collaboration.** Below are a series of Ground Rules intended to foster collaborative, effective and respectful SEB deliberations.

- **Active, Focused Participation.** Every SEB member is responsible for communicating his/her perspectives. Everyone is encouraged to participate; no one dominates. Only one

person will speak at a time and only after being recognized by the SEB Chair. Everyone will help stay on track.

- **Respectful Interaction.** Participants will respect each other's personal integrity, values and legitimacy of interests. Participants will assist each other in creating an effective atmosphere by turning off cell phones, refraining from sidebar conversations, and using computers for SEB-related work only.
 - **Integration and Creative Thinking.** Participants will strive to be open-minded and integrate members' ideas and interests. Participants will attempt to reframe contentious issues and offer creative solutions in a timely fashion to enable constructive dialogue.
 - **Adherence to Ground Rules.** As a set of mutual obligations, SEB members will commit to adhere to these Ground Rules once they are adopted. SEB members are encouraged to help uphold and enforce these Ground Rules.
 - **Deliberating in good faith.** In their formal capacity as SEB members, appointees are asked to deliberate in good faith at and between SEB meetings. Nothing in these Ground Rules limits SEB members' abilities to take action in other forums. However, SEB members are asked to be mindful of how their actions elsewhere could impact the collaborative process and the SEB's collective efforts to reach concurrence on improving the planning process and the elements of the 2017 Coastal Master Plan.
2. **Meeting Materials.** CPRA staff and the MPDT commit to provide, to the extent practicable, all primary meeting materials at least two weeks prior to meetings in order to give SEB members ample time to review the relevant information. All SEB members will have equal access to meeting materials. Members are expected to review meeting materials beforehand to foster informed deliberations. Members also are asked to bring their supporting materials to each SEB meeting.
 3. **Information Sharing.** SEB members will be presented with preliminary 2017 Coastal Master Plan elements. Preliminary information will be treated as such.
 4. **Meeting Participation.** SEB meetings will consist of both formal presentations to be given by members of the MPDT and other team members as requested by the MPDT, as well as closed-door working sessions.
 5. **Developing Recommendations.** In the event that the SEB is able to develop recommendations that reflect broad, cross-disciplinary concurrence, this will be documented. In this context, "concurrence" means all SEB members present at the meeting support the recommendation in question. This does not necessarily mean that each SEB member likes everything about the recommendation, but that each member is willing to accept and support the overall recommendation. Where broad, cross-disciplinary concurrence is not reached, the range of possibilities considered by the SEB will be presented, including the views of both the majority and minority. MPDT will reply to recommendations made, indicating actions taken to incorporate suggested changes into the Coastal Master Plan process.
 6. **Documentation.** The MPDT will assign staff to document and summarize issues discussed, key decisions made, suggested next steps, and individual tasks. Meeting documentation will not serve as a meeting transcript nor will it typically attribute comments or suggestions to specific individuals. Following the meetings, SEB members will be expected to work together to document findings and key recommendations for modifications or changes, as requested by CPRA. These reports will be submitted to the Executive Director of CPRA, through the CPRA Point of Contact, and response

comments will be provided to the SEB. Overall documentation will be done in coordination with the MPDT and SEB to archive recommendations and responses throughout the 2017 Coastal Master Plan process.

7. **Communications.** Inter-meeting communication among SEB members is encouraged. Requests for additional information from specific MPDT members will be routed through the MPDT Point of Contact to facilitate tracking of significant developments or suggested changes.
8. **Media Contact.** The SEB recognizes that members may be contacted by press during the course of SEB deliberations. To the extent SEB members are contacted, they agree to the following:
 - SEB members agree not to attribute particular comments to particular individuals, nor to characterize others' views;
 - SEB members agree not to portray ideas as achieving concurrence before the SEB has explicitly reached this conclusion;
 - SEB members inform the MPDT Point of Contact when the 2017 Coastal Master Plan appears to be the primary focus of the media contact.
9. **Coastal Master Plan Website.** The MPDT will prepare a password-protected website to support SEB deliberations. This website is intended to facilitate the sharing of draft or interim work products by the SEB. Similar to the discussion under the Communication Protocols Ground Rule, to the extent SEB members wish to provide others affiliated with their organization access to the password-protected website in order to foster broader input, SEB members are asked to make clear that the materials on the website are being provided to support SEB deliberations and not targeted for general distribution.



2017 Coastal Master Plan

Science and Engineering Board (SEB) Report #1

*Baton Rouge
October 21-23, 2015*

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Meeting Agenda

Science and Engineering Board

In-Person Meeting #1

Galvez Building, Pensacola Room
602 North 5th Street
Baton Rouge, LA
October 21-23, 2015

October 21, 2015

11:30pm – 4:00pm Flyover Fieldtrip, departing CPRA's office (450 Laurel Street)

October 22, 2015

8:30am Breakfast

8:45am Welcome and Introductions Kyle Graham/Karim Belhadjali

9:00am General Update Karim Belhadjali

- Recap of July 16th Webinar
- What the Coastal Master Plan is/is not
- Master Plan objectives

9:45am Candidate Projects Karim Belhadjali

10:15am Predictive Modeling Denise Reed

15 minute Break

11:30am Planning Tool and Alternative Formulation Process David Groves

12:15pm Break for Lunch

1:15 pm Flood Risk and Resilience Program Melanie Saucier

2:00pm Outreach and Engagement Nick Speyrer

15 minute Break

3:00pm Updates on Diversion Projects and Other CPRA Efforts Bren Haase

4:00pm Open Discussion / Next Steps

Send Aheads:

- Recorded Modeling Webinar
- 2012 SEB Compiled Reports
- New Project Development Program document

Handouts:

- O&E Roadmap
- SEB Discussion Questions

October 23, 2015

8:00am Breakfast

8:30am Group Discussion (*SEB + MPDT*)

- Initial Thoughts
- Clarifying Questions
- Requests for Additional Information

9:30am SEB Closed Door (*working session*)

11:30am SEB Report-out to MPDT (*working lunch*)

1:00pm Wrap-up and Next Steps

Introduction

Meeting Format and Process

- The Science and Engineering Board (SEB) met in Baton Rouge from October 21- 23.
- Members of the SEB in attendance were:

Dan Childers, Ph.D. Arizona State University
Margaret Davidson, J.D.
Carl Friedrichs, Ph.D. VIMS, William & Mary
William Fulton, Rice University
Ed Houde, Ph.D. University of Maryland
Jen Irish, Ph.D. Virginia Tech
Sandra Knight, Ph.D. WaterWonks, LLC
Michael Orbach, Ph.D. Duke University
Len Shabman, Ph.D. Resources for the Future
Marius J. Sokolewicz, Royal Haskoning DHV

- On October 21, the SEB had the opportunity to fly over the coast and have an orientation discussion presented by David Muth representing the Restore the Mississippi River Delta Campaign; thanks are expressed to the Restore the Mississippi River Delta Campaign for providing support for the flyover.
- On October 22 and for the first hour of October 23, the SEB meeting was organized around presentations that grounded the SEB in the master plan objectives and development process and allowed for much give and take between the Master Plan Delivery Team (MPDT), other staff from the Coastal Protection and Restoration Authority (CPRA) and the SEB. The SEB met in a closed session and reported out on October 23.
- The SEB was provided with read ahead materials and was expected to participate in, or review the content of, a modeling webinar conducted on September 22, 2015.
- The SEB agrees that the background presentations were well organized and informative and appreciates the effort that went into preparing for the meeting. Suggestions for future meetings topics, process and logistics were provided to CPRA.

The SEB Report

The presentations were structured to present information that the SEB would use to prepare its report. Key points for SEB orientation about the master plan development process were:

- The master plan predictive models and the planning tool are at a spatial and technical resolution necessary to screen projects in order to set relative priorities among projects.
- Additional analysis (engineering and design (E&D), environmental impact statements (EIS), etc.) will be required once a project is selected for implementation. During that time, refinement to the projects will be possible.
- The choice of projects that move to additional analysis is a choice made by the CPRA Board. The example provided was the 10/21 CPRA Board decision to move forward with E&D for two diversions, as funds become available through the National Fish and Wildlife Foundation (NFWF) and other sources.

- The master plan objectives are expected to inform and direct all agency decisions in the coastal zone. An Executive Order requires that all state agencies' actions align with the master plan objectives.

The expectation was that the SEB report would answer questions that were provided along with the agenda. The questions listed below are used to structure this report.

1. **Predictive Models.** Is the overall approach of the predictive models that will be used to evaluate candidate projects sound and appropriate given the scale of analysis? Are the ranges of values for environmental scenarios considered reasonable and justified in current literature? Based on the process described for developing environmental scenarios (i.e., literature review, model runs, etc.), are the ways in which scenario values for each parameter were determined defensible? For the risk scenarios, are the approaches to population and asset growth and fragility of structural protection projects appropriate for this level of project evaluation?
2. **Decision-making Process.** Is the State's decision-making process clear and understandable? Do the metrics adequately address master plan objectives and interests across the coast? Are they being applied appropriately? Are the decisions we will be making commensurate with the level of analysis? Any insights from the SEB regarding useful approaches and key concepts to more clearly communicate our decision-making process to our stakeholders (i.e., FDT, legislators, and citizens)? What key components is the current process missing?
3. **Flood Risk and Resilience.** Does the SEB see any fatal flaws or missing components in the Flood Risk and Resilience Program Framework? Is the process by which nonstructural projects were developed appropriate given the need for evaluation of projects at a coast wide scale? Are the criteria by which we have proposed to evaluate nonstructural projects understandable/justifiable given the inherent difficulties in evaluating restoration and structural and nonstructural protection on a level playing field?
4. **Outreach and Engagement.** Does the outreach and engagement plan include appropriate methods to effectively reach all of the audiences that CPRA needs to engage on the full list of master plan topics (e.g., from an informed technical audience to community members)? What other methods could be used to gain buy-in from local, state and federal leaders as this multi-stakeholder decision process handles difficult tradeoffs? Any examples of visual depictions or other effective communication tools that the team could employ?
5. **Leveraging previous work.** Can members of the SEB provide:
 - a. Examples of effective integration of ecosystem and socio-economic objectives and/or metrics in decision making processes for other coastal systems?
 - b. Examples of how to appropriately consider human impacts of large projects (e.g., large diversions, displacement of communities or economies, and environmental justice issues)?

- c. Pitfalls, lessons learned from other similar, large programs (Everglades, Chesapeake, Dutch, or other) that should be considered?

6. **SEB Engagement.** How can/should the Master Plan Delivery Team (MPDT) utilize the outcome of SEB engagement (endorse, acknowledge, other)? Which key components of the master plan process would the SEB prefer to engage on at the upcoming webinars and meetings?

In reading the report the following should be kept in mind:

- Individual members comments were written after the meeting and the responses are organized in the report according to the discussion questions provided to the SEB. There are some places where there were points of disagreement. The few places where this was the case are noted.
- The 2017 Coastal Master Plan is far along in its process and there is little the SEB can do to alter the course of modeling and, probably, decision making. In some places this SEB report does suggest actions that would apply to the 2017 Coastal Master Plan development process. However, most comments are about the science and uncertainties in it with respect to the 2017 plan, in addition to recommendations on its implementation and communication to the public. The SEB also provides suggestions for most beneficial use of the SEB in support of the 2022 Coastal Master Plan.
- As preamble to the presentation of comments on the discussion questions, the SEB unanimously agrees to the following:
 - CPRA staff has, since the 2012 plan, made significant progress in addressing the complexity involved in the Coastal Master Plan, in particular the further development and refinement of the various modeling components and the nonstructural and outreach components.
 - The effort to keep stakeholders and the public engaged early and build in community perspective into decisions is an ongoing challenge, but the commitment to meeting that challenge is essential to the success of the plan. Therefore, the SEB applauds the approach wherein total reliance is not placed on the model outputs, but rather uses those outputs as advice and input into the selection of the final projects in consultation with the various constituencies of the state.
 - The five-year cycle of revised master plans is a good strategy for updating overall modeling techniques at appropriate time intervals. The modeling teams should (and certainly will) be in a continuous process of revision and updating/balancing the degrees of model complexity versus model parsimony as scientific understanding and agreement grows. The CPRA Technical Analysis website on predictive models and modeling are very useful, presented in detail, and quite transparent to the issues of concern.

SEB Responses to Questions

Question 1: Predictive Models

Land Building Modeling

The output of the land building components of the Integrated Compartment Models (ICM) associated with diversions is central to the prioritization of projects and to the decision making process in general. Thus, it would be very useful to compare the output of structurally distinct modeling approaches for diversion-induced land building in both a hind-cast and a forecast scenario. In the short run, such an intercomparison would better constrain uncertainties associated with the land building formulations within ICM, and in the long run, it would help guide future iterative improvements in ICM.

A logical forecast scenario would utilize the forcing already used by the non-ICM models ADH and Delft3D in modeling the Mid-Barataria diversion. For a hind-cast scenario, the Wax Lake Delta is an appealing choice. In each case, the SEB recommends that additional modelers be invited to participate in the multi-model comparison for these two scenarios. Ideally, a range of modeling approaches from very simple (i.e., mainly sediment mass conservation) to relatively complex (e.g., ROMS and/or FVCOM) might be added to the pool. To minimize costs, additional “complex” models should be limited to existing open-source community models. Similarly, CPRA could use the several models already being applied to the Barataria diversion and Wax Lake Delta to assess uncertainty by comparing the different models land building predictions for that environment. The SEB suggests CPRA invite other groups with existing models to use the same forcing and to compare results for those areas.

The effectiveness of sediment diversions is difficult to estimate; however, they provide a major portion of land growth in the current master plan. Models give only a rough approximation of what could actually happen. Fine sediments are the main building material for marshes; they are difficult to control, can travel tens of miles before settling, are very easy to stir up due to their low settling velocity, and can even be washed out to deeper water. Strong deposition occurs in the brackish zone due to flocculation. Creating zones of still standing water/building small dams/leading the water flow through zones of vegetation (e.g., mangroves) strongly enhances trapping efficiency of a sediment diversion. Besides models, the SEB suggests CPRA use knowledge of similar sedimentary systems/diversions/outlets around the world (e.g., Rio Magdalena/Canal del Dique in Colombia, estuary of Ganges and Brahmaputra in Bangladesh).

In addition, a SEB member suggests setting legal requirements for zoning on newly created land that prohibits future use for anything other than conservation.

ADCIRC/SWAN

The SWAN wave modeling does not include damping of waves propagating through dense vegetation/forest, apparently due to a problem in linking ADCIRC to SWAN. The ADCIRC-SWAN model implemented by CPRA handles wave damping by friction, so damping effects are not ignored entirely. This means that in some occasions the wave height near levees and the associated

overtopping volumes might be considerably overestimated, making the risk calculation for these very conservative. However, the overall impact will not be that large. There has been a lot of research on this aspect, (e.g., physical model testing by Deltares); the SEB suggests CPRA implement this in the 2022 plan.

CLARA

The flood hazard assessment modeling and methods are solid and consistent with state-of-the-art efforts. The SEB encourages revisiting the flood hazard assessment modeling and methods and integrating advancements as appropriate and practical for future planning efforts in the 2022 plan.

The SEB noted that some of the flooding tools were pretty good and suggested that CPRA refer to the recently released World Resources flooding tool. There are no tools or funding for the effort to help communities themselves build an awareness and strategy to relocate.

Effects of Land Building on Ecosystem Services

There have been clear advances and improvements in the Habitat Suitability Indices since the development of the 2012 Coastal Master Plan. These indices lack a dynamic component and depend on believing that, if the habitat is good the selected organisms will prosper. This was a criticism in the 2012 plan. The MPDT has added ecosystem modeling to the suite of models. These predominantly food web models will be useful to predict changes in biomass of key species, including effects of fishing. However, they often lead to non-intuitive results, making it difficult to implement management actions based on the modeled outcomes. It seems uncertain that the EWE-Ecospace modeling will be far enough along to have much utility in the 2017 plan, but it should be encouraged for the future and for the 2022 plan.

Project Synergies

The question of potential interactive effects of implementation of projects, i.e., synergy or potential negative effects needs further attention. This question was also raised in the 2012 plan development. It was thought the issue was being addressed in the 2017 plan, but the SEB did not get that impression at this meeting. The SEB noted that effects of projects are often not additive; their combined impact may be much different from the sum of impacts of independent projects. It was also noted that one weakness is the omission of explicit modeling of synergy (competition) among various project components before the decision making stage; there is the potential for significant benefits (or adverse impacts) to be missed. The SEB suggests CPRA use expert judgment to help address this concern in the 2017 plan. In future planning efforts such as the 2022 plan, combinations of projects should be explicitly evaluated before decision making, then these inputs should be carried into the decision making processes.

Scenario(s)

One challenge is that the predictive models need to consider a catastrophic situation, either based on cumulative impacts, a single event, or series of back-to-back events that can capture key system/subsystem tipping points (e.g., sudden marsh demise, rapid retreat) for ecosystems, economies and communities. These “events” could be outside of the current modeling suite, such as another major oil spill. To the extent feasible, future planning efforts (such as the 2022 plan)

should integrate modeling advancements that help to identify and quantify the impact of these tipping points.

Another issue is the hydro problem with connecting the upper Mississippi snowmelt to the lower Mississippi dynamics. The upper Mississippi snowmelt is a weather service problem but bears a lot of relationship with what happens downstream. CPRA should build a little more pressure into working on that. In addition, a new “normal” of Mississippi River flood and drought cycles should be included. These should be considered with models and scenarios and not just historical data. While this suggestion is, in part, about model inputs, it is also about governance and outreach and engagement. The whole upper Mississippi River snowmelt outlook and the coupling downstream, especially in drought years, should not only be explored scientifically but there is the basis for Mississippi River Governor engagement. (Unlike the current Task Force which is water quality centric to the near exclusion of all else, it should be more like the multi-state compact for the Chesapeake Bay Program.)

The SEB noted that the way the variables are combined is not very clear, but seem to lead to scenarios like: *worst case, average and slightly optimistic/less pessimistic* and suggests CPRA clarifying this. In addition, the future scenarios should refer to something understandable for the public and not be called S01, S02 and S03.

Population and Asset Growth Projection

Attachment C3-25, Chapter 9, explains the process for developing population and asset growth scenarios, <http://coastal.la.gov/a-common-vision/2017-master-plan-update/technical-analysis/>. The approach used was explained in general terms at the SEB meeting. The 2012 Coastal Master Plan analysis assumed that asset growth would track with population change and assets at risk were assumed to follow projections in population. This fundamental assumption remains in the 2017 plan; however, there were several refinements made to the 2012 plan approach that were made to recognize how changes in coastal conditions might influence the population numbers and location. The highlighted text below is central to the approach used and makes the point that there was a conscious choice to avoid use of an economic model to make projections of assets at risk in the future.

The model assumes that commercial and industrial assets grow in proportion with population growth at the census tract level, where the correlations are moderately strong ($r = 0.53$ for commercial properties, $r = 0.42$ for industrial structures). As a result, projecting plausible future population patterns provides a relatively simple, convenient, and understandable means to project scenarios of future asset distribution, and avoids the substantial complications and high level of effort involved in trying to develop 50-year economic projections with a general equilibrium model.

The admonition from CPRA to make projections using a “relatively simple approach” (Attachment C3-25, Chapter 9, page 181) led to the continuation of the logic that assets follow population as opposed to population follows assets; more correctly economic conditions and activity determine asset types and location and then population numbers and location follow. The 2022 Coastal Master Plan should begin to build asset-at-risk scenarios based on possible futures using national projections for the external economy and projected changes to the local coastal landscape without

the master plan projects in place, recognizing that populations in a working coast will follow levels of economic activity on the coast and not the other way around.

While one SEB member feels that the approaches to asset growth should be a priority for improvement within the present master plan, others feel that given the work to date, no changes should be made in the computations supporting the asset change scenarios for the 2017 Coastal Master Plan. However, the MPDT should be prepared to explain to stakeholders and prepare a clear accompanying text explaining the exogenous (to the master plan) changes to the environment and economy that would be consistent with each asset change scenario actually occurring. CPRA needs to simply be clear about what premises have to be believed about key drivers in the environmental and the economy to believe a particular projection. It is also suggested that CPRA validate its numbers with the NOAA population growth study for Gulf coast states.

The SEB advises that the Population Growth/Asset Risk Prediction model should be used with extreme caution due to the omission of external drivers of assets and population growth/migration, due for example, to changes in industrial base, national and international economies. The SEB suggests using expert judgment to address this concern in the 2017 plan. The SEB also has concerns regarding the sufficiency of the population growth/asset risk prediction model as the population predictions are based on historic census data; the SEB finds the direct correlation of population with assets questionable/troubling as the correlations between population growth/migration and flood risk may not be well documented or validated and may result in misleading future scenarios. Recent anecdotal information suggests that there are new shifts/patterns in population movement in south Louisiana. The number of houses may increase if the population increases, but the number of oil and gas facilities is not likely to. It is suggested to remove oil and gas assets from this equation and simply assume that, given the uncertain circumstances, they are not likely to increase or decrease but, rather, stay fixed at the current level. Also, assuming that the same type/category of assets exists in 50 years could skew the risk assessment. The SEB recommends CPRA have a more comprehensive methodology implemented for future planning efforts, i.e., the 2022 Coastal Master Plan.

In addition, “Scenario Planning” may be the wrong terminology when considering how alternatives perform under future conditions. This especially seems constrained under the population assessment model. Scenario planning implies testing decisions and alternatives by considering diverse big picture futures – like high-tech green economy (no oil and gas), oil and gas production triples, fisheries economies shift to aquaculture, coastal populations being devastated by a major hurricane and only left with a port economy, etc. Looking through a broader scenario lens helps to define a “no regrets” selection of projects. A suggested reference might be the UK Foresight Study or recent Scenario planning used by USACE.

Elevation Data

Another major challenge is the obvious dependence of the modeling work on accurate land elevation (LIDAR) data and the problems and irregularities in the currently existing elevation data sets. Output from these landscape/ecosystem models is being used to make decisions about billions of dollars in restoration project investments, and the decision support approach relies heavily on

land building model output for these decisions. It is critical that CPRA do everything within its power to obtain the most accurate LIDAR land elevation data possible for the entire Louisiana coastal zone, as soon as possible and as often as possible.

Other

The SEB cautions that diversions generally have negative impacts on the sailing depth in rivers, as a bar forms downstream of the diversion point. This may reduce sailing depth in the navigation channel below an acceptable level. The SEB also suggests that models should be able to model population dynamics, socio-economic forecast, and ecosystem benefits for the 2022 plan.

Question 2: Decision Making Process

Land Building as Objective

The two objectives of land building and risk reduction are chosen to facilitate the computation and presentation of results from the decision tool. The computational necessity and decision making transparency from having a “simple” two part objective function for guiding decision making was a lesson learned in the 2012 plan development process. This means that predictive models are needed for land building (see above). However, the land building models are not predicting the creation of fast-lands suitable for human occupancy, but rather wetlands of five general types – salt, intermediate, brackish, fresh and floating. In turn, other predictive models are used to identify how the location and other features of these land building projects affect ecosystem services of different types. The realization of the different combinations of services (“objectives”) from different landscapes is what in the end drives the choice of projects and not land per se. This is accomplished in the decision tool by treating ecosystem service changes in an incremental cost/tradeoff framework. This makes sense for the 2017 plan and probably for the 2022 plan. However, one possible improvement for 2022 is to investigate if the number of metrics can be reduced if there is a strong relationship among some of the ecosystem service metrics (e.g., they move in the same direction and magnitude with different wetland building locations and types). This would mean that tradeoffs can be among land locations and types without pretending the tradeoff among ecosystem services can be predicted with certainty.

Some SEB members are not convinced that the mere creation of land is the best proxy for all the other objectives. It is certainly simple and understandable, but 1) it may or may not truly be the best proxy for the other objectives, and 2) it may be driven as a metric too much by what people living in the area want, which may mean that it is biased in favor of structural solutions to rescue the status-quo. For the 2022 plan it is suggested that CPRA do a rigorous analysis of what the best single metric is, rather than simply assuming it is land.

Another SEB member noted that while CPRA’s focus on the two decision drivers, land and risk reduction, is understandable, they are rather different “end-points”. It seems that the real decision drivers are risk reduction and ecosystem restoration and that these are measured with initial proxies of expected annual damages and acres, respectively. However, with more information, CPRA could consider adding more metrics of social resilience, marsh productivity, safety, etc. for

the 2022 plan; it is not necessary to have only one metric per driver. Another SEB member suggested that an allowance needs to be made for multiple benefits: risk protection and habitat benefits should move projects up the priority list.

The master plan exercise is similar to the effort undertaken by the Davis Administration in California to catalogue all the state's legal and policy mandates regarding open space and natural resource protection. By the time it was done, the state had a policy of basically preserving everything for every reason (working landscapes, habitat, wetlands, steep slopes, coast, mountains, etc.), many of which conflicted with each other and most of which were embedded in state statute. The list of possible metrics (alligators, etc.) is reminiscent of that effort. Not to suggest that because land is an imperfect metric, it should not be used, or there should be no effort at boiling it down to two-three metrics, but CPRA needs to do a better and more rigorous job of deciding which metrics are the best proxies and "do the most with the least".

In addition, the SEB suggests it would be useful in communicating decisions that use land building/loss output from models that the amount of net land predicted to be built/lost from one scenario to another is a relative estimate. The absolute numbers are not nearly as reliable as the relative numbers. A better way to communicate the benefit from a given choice of projects might be to indicate the percent reduction in total land lost relative to no action rather than stating the absolute square miles of land built/lost.

Decisions under Uncertainty

Information is fundamental to any nimble adaptive management of a large restoration program such as this one. The primary source of this information should be a monitoring program that is landscape-scale, holistically-conceived, multi-parameter, flexible and nimble, long-term, and untouchably-funded. If this exists, the SEB would like to hear more about it. Beyond such a monitoring program there should be a plan for how these data will be regularly assessed and how information from this regular assessment will be used to adaptively manage and modify, if necessary, the decision making process and the overall CPRA restoration program. Again, if this assessment process already exists and is functioning well, great! The SEB would like to hear about it and have an opportunity to provide input on improving it.

In general, uncertainty in all modeling components, and its propagation through the decision making process, is a significant consideration. The proposed quantification of uncertainties is an excellent step. The SEB suggests that for the 2022 plan, CPRA continue regular monitoring and data collection, especially of essential items such as LIDAR topography, are critically important for establishing baseline conditions, validating models, and evaluating new project performance.

As the future is highly unpredictable and the scenarios used have large uncertainty, the SEB suggests that the decision making process would benefit from preferential treatment of no-regret projects (e.g., those with high potential for success and/or ability to be adapted). CPRA should plan for extreme scenarios, but postpone construction of projects that will be needed in the future, or construct them in an expandable manner, so the plans can be adapted to the actual developments. Only the no-regret measures should be implemented now. However, this recommendation does not apply to land building projects as these need decennia to become effective. The SEB suggests that

expert opinion on alternatives and screening should be used to help address the abovementioned concerns regarding modeling uncertainties, unknowns (e.g., tipping points), and omitted processes (e.g., external drivers of assets/population migration) in the 2017 predictive modeling.

Decision Support/ Planning Tool and Decisions Made

Parishes, levee boards, communities, etc. should continue to have regular input into “metrics”, both in the design and tracking. While the Planning Tool, and how it should be used, has evolved and is improved since 2012, there are still many questions about how to reach decisions. The MPDT is aware of this; its numerous Technical Committees, the FDT, the SEB, and stakeholder engagement groups should help to deal with the uncertainties. There will be many tradeoffs – science will help to inform the MPDT and the many advisory groups can provide support, but the process of selecting alternatives is not always clear.

The SEB noted that multiple benefits resulting from restoration projects that also provide risk protection are not recognized in the Planning Tool. This leaves out potential synergy effects. Some projects that could get a higher score when being considered simultaneously for both criteria might drop out in the selection procedure. The decision tool needs to have some way of relating interdependencies of projects, evaluating sub-regions and phasing/sequencing of projects. However, the model seems to have this capability and some efforts on phasing have been included. It was suggested that CPRA consider capturing both the ecosystem and risk reduction benefits that land provides in the 2022 plan.

A SEB member suggests CPRA consider decision support tools or collaborative modeling to tie Planning Tool to stakeholder engagement and to better relate and visualize other measures (e.g., navigation, funding, fisheries, etc.) to decision drivers. This could be done via building a “dashboard” in the decision tool so that stakeholders can correlate how different alternatives related to land growth impact the other measures (e.g., navigation, fisheries, etc.). Lastly, the SEB noted the process of CPRA itself is clear with respect to structural measures (e.g., dikes, diversions), but the relationship among the different entities and CPRA (e.g., CZMA, FEMA) is not clear.

Funding in Relation to Choice

The SEB noted that current funding for executing the master plan projects comes largely from post-disaster funding sources (natural and manmade). There is a need to have a fully developed funding strategy as storms and oil spills are not “enough”. Moving forward, there is an opportunity to leverage communication and collaborations with other groups, both government and private (e.g., through the outreach steering committee). For example, if the projects remove the need to move transportation networks, perhaps transportation funding can be leveraged for plan implementation. In addition, see discussion on budget constraints and new revenue sources under Question 5, Netherlands.

Question 3: Flood Risk and Resilience

Nonstructural or Structural Risk Reducing Measures

The SEB requests that the significant portion of the planning effort that addresses nonstructural efforts be expanded upon and be further elaborated, in particular in the area of coordination among the various local, state and federal entities and with the focus on rural areas of the state, for a future meeting. The SEB suggests CPRA develop user-friendly, community-level decision tools and processes to enable communities to consider alternative futures and be adequately informed on the wide range of biophysical, socio-economic and governance factors that will be involved in creating those futures. In addition, investing in nonstructural alternatives could provide large reductions in costs of other constructed projects; this is a critically important aspect in the master plan. The SEB suggests CPRA review the North Atlantic Coast Comprehensive Study (NACCS) in evaluating social vulnerability and risk.

While it is good that CPRA is including hazard mitigation in its policy recommendations, a SEB member suggests that there needs to be a much more aggressive strategic plan around this. CPRA needs to work better with USACE, FEMA, and NGOs (e.g., NFWF) since they have access to congressional funds. In addition, CPRA should have a strategy for greater engagement with the HUD Resilience efforts (maybe even the Rockefeller Foundation which funded a portion of the Rebuild by Design competition). CPRA should possibly try limiting development in floodplains similar to how the Endangered Species Act listings are being leveraged in the Pacific Northwest to limit development.

Retreat

The SEB noted that there has been a lot of socio-economic data collected by the university community that CPRA could still bring into the effort for the 2017 plan. CPRA needs to have a program that supports relocation. After Hurricane Katrina, Louisiana had the *Road Home* program; CPRA needs to have a *Road Away* program to provide tools and resources for relocation.

A SEB member noted that there appears to be a reluctance to look at and accept the possibility that a permanent loss of land, and relocation/reorganization of human settlements, might be a preferable and possibly even cheaper outcome in some cases. Understanding that this is an extremely difficult political position, some groundwork has already been laid in the form of the master plan as the state has now made clear that they cannot and will not do everything to save every location. In addition, a SEB member suggests that there may not be enough emphasis on nonstructural efforts; these are simply leftover efforts once all of the obvious structural “projects” are considered. The question of putting nonstructural efforts on equal footing – “managed retreat” and new development areas – should be worked into the 2022 plan.

The SEB suggests that outside of the physical actions like buyouts, zoning will be the most critical aspect; as new land is created it needs to have legal actions attached to it so that it is not derestricted. In addition, CPRA needs to help communities think about and discuss pre-disaster planning, managed areas for retreat, and/or zones that encourage development in the right areas. The nonstructural program/activities need to be based on the Federal Flood Risk Management

Standard, be from the community/neighborhood perspective, not just house-by-house, and should not be solely dependent upon FEMA or HUD programs. Opportunities should integrate funding sources from multiple programs to achieve resilience.

A SEB member noted that currently, retreat appears to be dictated by the lack of project specification in an area, based on the decision making outcomes, with no consideration for planning of retreat. If possible within CPRA's schedule, planned retreat should be more explicitly considered but most certainly should be considered in 2022 plan. Another SEB member noted that some locations along the coast may not receive any structural or nonstructural projects and may not realize storm damage reduction from land building, forcing people as individuals and communities to leave these places under the future scenarios. It is not clear how the master plan will treat these people. Are these people as individuals "on their own"? From a whole community perspective will the master plan direct when (for example) DOTD decides to no longer maintain a road or when a sewer/water facility is shut down? Is this kind of consideration now, or will it become, a component of the master plan?

It was reported that expected damages avoided would be a selection criteria for nonstructural projects (as it is with structural projects). A SEB member noted that this project selection creation which defines eligibility for assistance with nonstructural projects will be biased toward the more financially well off households (assuming a positive correlation of income and property value). CPRA might consider a decision process and criteria that a) screens first for areas where investment will only be for managed retreat so that there will be no nonstructural investments made there, and b) uses property owners ability to pay for prioritizing investment in nonstructural actions. The member also noted that a retreat strategy as well as nonstructural implementation will be budget constrained, which means that new design standards to address risk will increase individual project costs (e.g., Morganza to the Gulf, new Federal Flood Risk Management Standards) with the result that fewer projects can be funded and fewer will benefit from a fixed budget.

Question 4: Outreach and Engagement

Methods

The Flood Risk and Resilience Data Viewer is a very positive way of communicating, it puts the power of knowledge in the hands of the property owner and is a transparent, decision support tool CPRA can exercise with stakeholders. CPRA can use the viewer to build 'local' champions as an effective way to further the program. However, one SEB member notes that CPRA needs a real campaign; even the Americas Wetland Campaign struggles to be really effective.

Another SEB member suggests CPRA use the research that has been done on ecosystem services and valuation of habitat when communicating alternative selections to the public. In addition, another member suggests that CPRA use the growing literature and increased experience with collaborative modeling as a way to resolve the most contentious/uncertain/analytical disputes. For

the 2022 plan, there should be efforts to identify the most decision relevant analytical disputes and initiate collaborative modeling efforts to resolve such disputes to the extent possible.

Resources

The CPRA Outreach & Engagement program emerged from advice and encouragement provided by the previous SEB. It seems to be broad-reaching, ambitious, excellently constructed, well founded, and there is an enthusiasm for it in the MPDT. One SEB member noted that it is not certain that the effort is underfunded or understaffed at this time while other SEB members questioned whether the effort is properly supported and resourced. It is not clear that the program has, or will devote, the necessary staff and other resources to carry out the plan, especially going forward with the need to continuously engage and communicate with stakeholders. It is suggested that the endeavor needs more investment in human resources (i.e., more people working on it). However, one SEB member suggests that the MPDT needs to seriously assess the effectiveness of the present effort before major expansion. Some outreach and engagement activities may not be conducted in the timeframe that recommendations or decisions can be accepted or implemented for the 2017 plan development.

A SEB member suggests that communication of scientific outputs can always be improved. Engaging social scientists to help in developing communication visuals, and other products, to minimize misinterpretation of information would have immediate benefit. In addition, CPRA needs to continue to connect to other efforts such as the Barataria-Terrebonne National Estuary Program, Coastal Zoning, Lake Pontchartrain Basin Foundation, NFWF, etc.

Question 5: Leveraging Previous Work and Planning Experiences

Everglades

CPRA leadership is encouraged to look into the Everglades Restoration Program's Monitoring and Assessment Plan (MAP) for help with design or refinement of the monitoring program the SEB recommended earlier. A SEB member suggests that there also may be lessons to be learned by careful analysis of the development of the Comprehensive Everglades Restoration Plan (CERP) during the Clinton Administration. CERP was followed by the programmatic regulation for further prioritizing projects and then the Project Delivery Team process (akin to E&D) in the comprehensive/master plan process. The basic CERP strategy was to begin with a conceptual landscape plan to "get the water right" (i.e., restoration) and then prioritize restoration projects for funding and implementation based on further analysis. In that process there was a concern for minimizing harm to others (e.g., flooding urban areas and meeting water supply demands) as restoration projects take place. The parallels are striking; there is a water quality dimension to the CERP that has a regulatory and cost allocation implication that affects the setting of priorities and project design and there is a constant give and take over who (i.e., state or federal government) pays for what projects. However, the driver was restoration of the Everglades National Park and to some extent meeting Lake Okeechobee water quality. This is a different motivation than the working coastal landscape that governs the CPRA master plan.

With this as context there may be lessons to be learned by careful analysis of the CERP experience. First, actual implementation of the CERP has been much slower than was initially aspired to. Why? How much are attributable to budget shortfalls and why were budgets limited? How much to stakeholder disagreement over project priorities and the ability of stakeholders to slow the pace of decision making? How much to other factors? Second, how have efforts at adaptive management affected or not affected project design and implementation? Third, why was the concept of Incremental Adaptive Restoration (IAR) developed and how has IAR affected implementation? Fourth, other possible lessons might be imagined.

Netherlands

Large programs in the Netherlands have been planned utilizing assumptions of rather extreme climate change impacts; however, the actual projects which have been built are generally based on less extreme scenarios and can be adapted in the future according to the actual development. This is incorporated in the spatial planning (e.g., by reserving extra space for extending levees in the future). Only the structures which cannot be easily adapted are built directly to the level corresponding to the more extreme scenarios. In addition, several national flood protection programs in the Netherlands use the “Building with Nature” philosophy – use of natural processes to achieve desired effects, giving preference to soft solutions.

The Dutch adopted a “multi-layer flood safety” philosophy, with three layers: 1) prevention, 2) spatial planning taking into account water, and 3) disaster management during floods. New urban developments do not rely solely on the flood protection by levees. Furthermore, the legislation in the Netherlands does not allow construction of any kind in the floodplain if it has any negative impact on flood levels in the surrounding areas.

One SEB member notes that the Netherlands planning is instructive, in particular their latest 10-year plan entitled, “Living with Water”, which envisions more provision for ‘natural’ flooding of the polder area behind their dike system in light of climate change effects, to wit:

Our old “higher dikes” approach is no longer sustainable, or affordable. We are learning to adapt, to live with water, and not always fight it. Our collective DNA is mutating, away from flood resistance at any cost to flood accommodation wherever possible.

That is why a new paradigm – Living with Water – infuses our policy and our public investments today. Of course: we must always be on guard against floods. That cannot and will not change. The new paradigm means, however, that we can’t always fight the water. Instead, we need to accommodate water, and give it room. And in the world’s 3rd most-densely populated country, giving room to water means taking space from something else. It is a zero sum game. Or is it? Climate change, oddly enough, is reminding us of both the beauty and resiliency of nature, and the benefits of sustainable design. The sober optimist is again making lemonade...

- Ambassador Renée Jones-Bos, closing speech, American Planning Association National Planning Conference 2012

However, other SEB members note that reliance on the Dutch methods while useful is also limited as the Dutch have a rich and long tradition of public works and a relatively homogeneous

electorate. In addition, the existence of the Netherlands as a nation is at the mercy of the sea and flooding. This provides a rationale for massive public spending on flood protection and creates a context for highly centralized land use controls (retreat is not an option). On the other hand, as a matter of national “survival” for the U.S., land loss in coastal Louisiana is not a problem equivalent to the problem faced by the Dutch. For this reason planning for coastal Louisiana will need to recognize that general revenues for implementing the master plan will be limited if reliance is on the federal treasury. A realistic approach to development of the master plan over time will require a) careful analyses and honest appraisal of the life cycle costs of different implementation strategies, b) outreach and communication that explains the consequences for the objectives of the plan of different budget limits, and c) identification of revenue sources need to be developed that are paid by the direct beneficiaries of the plan to maintain a working coast.

Chesapeake Bay

The Chesapeake Bay Program (CBP) is facing similarly challenging integration objectives. The CBP has not yet effectively accomplished this. To help address these types of issues, the CBP funds workshops that are steered by and attended by independent experts who then provide workshop reports /white papers to advise the CBP on how it might best proceed. There are no easy answers, but this strategy facilitates an independent, open and science-driven process that hopefully helps guide the restoration program in the right direction. However, a pitfall common to both CPRA and the CBP is bringing in independent, science-driven reviews too late in the cyclical update process to facilitate the optimally useful, proactive adjustments they might otherwise help guide.

The CBP is motivated by a water quality objective that is then presumed to support an array of ecosystem services. In that sense, there is a physical system objective (physical water quality targets are akin to land building) that is then presumed to support ecosystem services. However, a significant difference between the master plan and CBP plan is that the CBP plan is directed by the provisions of the Clean Water Act; by its implementation, the CBP can “extract” funding from persons in the region as needed to implement the plan. Actual implementation has been much slower than was initially aspired to, often because of the perception of the costs of implementation and who bears the cost. CPRA should consider what cost distribution lessons can be learned that might affect the likelihood of the master plan being implemented.

The SEB cautions that it is important to get the modeling right in the program. The consequences of not doing that were seen in the CBP. The models in the Chesapeake took people down a path that provided the wrong information or were so controversial that the whole program was restructured in 2009. In coastal Louisiana there are so many elements, the MPDT needs to get it right. Monitoring programs in support of modeling and of decision making are vital to any major restoration and coastal protection plan. The Chesapeake has several key monitoring programs instituted, but others (e.g., plankton monitoring) have been eliminated over the years, in some cases unwisely.

The SEB noted that the CBP is multi-jurisdictional, with several states involved and the usual mix of federal agencies. This complicates decision making, but it also can help to garner broad public

support across the mid-Atlantic region. In addition, CBP is still struggling with metrics and assessing effectiveness, even after nearly 40 years.

General

CPRA needs to identify appropriate places/programs to use as examples – such as the Road Home Program. Smaller restoration efforts would be more identifiable or comparable in terms of political capabilities. CBP and the Netherlands are not good examples. If it was not for the natural disasters, this whole effort would not have happened.

CPRA might use the results of the National Estuary Programs in the U.S., such as the Puget Sound program in Washington State and the Albemarle-Pamlico program in North Carolina, the latter of which in particular integrated fisheries, water quality, land use planning, etc. Another source for lessons learned could be the California Delta programs and decision making processes where many problems are similar to those in Louisiana – although the California situation is even more complex with many invasive species, endangered species, too little water, and even earthquakes. In addition, the master plan development and implementation is centered in and overseen by CPRA, which should offer advantages relative to the multi-agency shared authority in some other coastal programs.

Question 6: SEB Engagement

Possible Topics for next SEB meeting

During this first meeting, the SEB heard presentations about pre-construction planning and project prioritization. The term “adaptive management” was used occasionally in the context of decision making under uncertainty. The SEB would like to hear how plans are formulated to identify key uncertainties, assure that knowledge to reduce uncertainty is secured during project implementation, and how is new knowledge looped back into the project operations decision process, as well as the master plan development process.

Information is fundamental to any nimble adaptive management of a large restoration program such as this one. The primary source of this information should be a monitoring program that is landscape-scale, holistically-conceived, multi-parameter, flexible and nimble, long-term, and untouchably-funded. Beyond such a monitoring program there should be a plan for how these data will be regularly assessed and how information from this regular assessment will be used to adaptively manage and modify, if necessary, the decision making process and the overall CPRA restoration program. Assuming such a monitoring and assessment program exists, the SEB needs to hear more about it and have an opportunity to provide input on improving it.

In addition, the draft for the LSU/RAND socio-economic study is expected to be ready in December. The SEB would like a full presentation on this and other socio-economic analyses at the January meeting. Once CPRA has the socio-economic analysis in hand, the SEB is interested in learning how the analyses will be used in the predictive models, Planning Tool, and in decision making. Similarly, USACE currently has a feasibility study underway for the section of the river

where diversions look most promising. At the next meeting, the SEB is interested in being briefed on how USACE project planning is informed by the master plan models, if there are differences how are these reconciled and how USACE projects, if authorized, might influence the master plan's project priorities. The SEB heard that some places will not have projects included in the master plan and that some properties might get financial assistance to implement "nonstructural" measures. The SEB understands that some areas and some properties will not be included for protection or for financial assistance in the master plan but would like more information on the decision criteria for elevation, flood proofing and buyouts for individual properties and priority areas/communities for these nonstructural actions. The SEB would like to hear more about the master plan's approach for identifying and then supporting whole community approaches to coastal retreat (pre-planned and facilitated or reactive). The SEB heard that before the next meeting, the Planning Tool report will be available for SEB review and that CPRA will share results/outputs of project analysis and early thoughts on alternative plan formulation.



2017 Coastal Master Plan

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Introduction

The Science and Engineering Board (SEB) met in Baton Rouge from January 27-29, 2016. Members of the SEB in attendance were:

Dan Childers, Ph.D. Arizona State University
Margaret Davidson, J.D.
Carl Friedrichs, Ph.D. VIMS, William & Mary
William Fulton, Rice University
Ed Houde, Ph.D. University of Maryland
Jen Irish, Ph.D. Virginia Tech
Sandra Knight, Ph.D. WaterWonks, LLC
Michael Orbach, Ph.D. Duke University
Len Shabman, Ph.D. Resources for the Future
Marius J. Sokolewicz, Royal Haskoning DHV

The SEB remains impressed by the level of effort and the analytical detail already completed (or ongoing) for project ranking as the necessary result of the master plan development. The intent to revise the projects included and ranked in the master plan in consideration of new information every five years demonstrates a clear commitment to the concepts of adaptive management.

In preparing for the meeting the MPDT provided read ahead material to the SEB, offered one webinar and distributed PowerPoint slides one day in advance of each day of the meeting. The SEB was also offered the opportunity to comment on and help shape the meeting agenda. The agenda for the SEB meeting is provided at the end of this report.

The MPDT provided questions in advance of the meeting. The areas covered by each question were: Technical Communications, Community Metrics, Scenarios and Project Results, Planning Tool and Alternative Formulation, Adaptive Management, and System Wide Assessment and Monitoring Program (SWAMP). The questions for each category were used to focus the discussion at the meeting. The questions were re-ordered to structure the content of this report.

The report is organized as follows: each question is listed and then one or more high level SEB comments are made. Following each comment is a discussion. The discussion sections are presented as elaboration on the comment are not expected to require a MPDT response.

Question 1: Technical Communications

Do the reports and send-ahead materials shared thus far have sufficient detail for SEB members to obtain a general understanding of the technical aspects described?

If time permits and the Master Plan Development Team (MPDT) interest dictates, MPDT may wish to contact individual members of the SEB between meetings to discuss the content of this report in greater detail.

The comments and discussion in this SEB report are, by intent, meant to offer strategic direction to the MPDT. However, some individual SEB members may be willing and able to engage in

further discussion with MPDT members between SEB meetings or suggest technical references. The areas where more detailed discussion might be possible include:

- Specific metrics (e.g., navigation, fisheries, social vulnerability index (SVI), and others)
- Economic valuation, social and financial impacts assessment in alternative formulation, evaluation and ranking
- Collaborative modeling
- Cost estimation for, but not limited to, “nonstructural” and community relocation
- Risk communication to stakeholders
- Sources of socio-economic data
- Different terms for what are now called structural and nonstructural

MPDT should continue content webinars and post recorded presentations, such as the recent modeling and Planning Tool webinars. As resources and schedules permit, MPDT might consider offering a brief webinar on the most complicated technical topics a week or two in advance of the SEB meeting so that SEB can reflect on the topics ahead of time, allowing for a more discussion-oriented face-to-face meeting.

The recorded webinars allow SEB members to access these presentations as their time permits and review key points. While having more webinars leading up to SEB meetings would be valuable to the process, the SEB recognizes that making the webinar preparations places a burden on the MPDT and that the material for SEB meetings is often being developed right up to the time of the meetings.

As time and staff resources permit, provide executive summaries/FAQs of the most extensive documents to highlight key points or specific topics that should be the focus of the SEB technical review.

Question 2: Community Metrics

Understanding current limitations on our ability to perform detailed economic analysis, are the proposed community metrics (e.g., Support for Traditional Fishing) appropriate for evaluating project effectiveness and developing alternatives for the master plan? Is the underlying purpose of the metrics clear and are there any critical assumptions or messaging that needs to be communicated in the write-ups to avoid misinterpretation?

Socio-Economics Analysis

MPDT should continue to use the deliberative process of project selection and ranking as informed by the Planning Tool. The example economic analyses presented to the SEB, or similar future studies of this nature, should not determine project selection and ranking.

As requested by the SEB at its first meeting, presentations about the Basin-wide Diversion Socio-Economic Study and the LSU/Rand Economic Valuation of Coastal Land Loss in Louisiana study were presented.

The question is, “might these results be used in selecting the projects for the 2017 Coastal Master Plan?” (What follows assumes the validity of the value estimates). The Planning Tool with its two objectives and multiple metrics informs a MPDT-led deliberative process that makes decisions

about what mix and priority of project alternatives maximizes “value” to the state. MPDT might consider using results from economic valuation analysis to compute net benefits for each alternative and use such estimates for ranking alternatives as inputs to, but not a replacement for, the Planning Tool project prioritization process.

MPDT might use methods of socio-economic analysis to identify which stakeholders bear financial costs and/or social dislocations as a result of each possible master plan strategy. MPDT might use such analyses to formulate master plan strategies that avoid or minimize socio-economic impacts. These same analyses might be used to consider amounts and forms of compensation for unavoidable socio-economic effects to the most vulnerable populations.

MPDT staff could include resident expertise in socio-economics analysis to guide and expand the production and use of socio-economic analyses. Such analyses might isolate the financial consequences to different groups from different coastal conditions.

Metrics

The SEB offers the bulleted discussion points on metrics in the discussion section below. These are for consideration by the MPDT as it begins using the Planning Tool to identify projects and priorities for the 2017 Coastal Master Plan. MPDT should again ask this same question of the SEB about community metrics after demonstrating to the SEB how the metrics are used in the Planning Tool process.

- The appropriateness of a metric is not a technical determination. The metrics¹ are to reflect the effect of alternatives on the interests of affected stakeholders. MPDT should pose the question (if they have not already done so) “are the proposed community metrics appropriate for evaluating project effectiveness” with those stakeholders to see if the metrics are acceptable or if other metrics might better reflect their interests.
- If at all possible, consolidate to fewer metrics by a) formulating the alternatives to offset any financial impacts on some stakeholders and b) looking for highly correlated metrics. Fewer metrics will make the Planning Tool driven tradeoff analysis more tractable and, most importantly, understandable for communication purposes.
 - The metrics assume that the plans are not going to include financial mitigation for adversely affected stakeholders. Unless such mitigation is not technically possible or cannot be justified in some other way, some metrics can be replaced in the Planning Tool by adding compensation costs to the project costs. For example, shoaling can be offset by dredging so dredging costs for keeping a navigation channel open can be added to project costs resulting in no effect on navigation, at least for this possibility. As another example, commercial fisheries may need to have a more complicated financial cost analysis and compensation mechanism, but still can imagine a compensation system being developed and the costs of that compensation being a cost of the master plan. In short, costing out and including compensatory mitigation as much as possible, reduces the need to have metrics for adverse effects on the Planning Tool.

¹ Some SEB members ask whether the term “metric” is the best way to characterize what appear to be sub-objectives or auxiliary objectives.

- A correlation analysis (maybe even a Principal Components Analysis (PCA)) might be conducted to identify metrics that move in similar ways and then one or fewer metrics might be chosen to represent (act as a proxy) for several others in the Planning Tool. However, for reporting purposes once a possible plan is identified results for the full array of metrics or any requested metric may be displayed if someone asks.
- Output from some models might replace or confirm reliability of suites of metrics. For example, whole-biological community modeling in the master plan using the newly implemented Ecopath with Ecosim (EwE) modeling might serve this role, at least for fish and some other aquatic animals. As applied by the MPDT, EwE includes the Ecospace option and thus can portray spatial distribution of biomass for designated taxa, providing estimates and visualizations of biomass distributions of key organisms based on trophodynamics principles, over time.
- SVI is a metric to represent “vulnerability”/“resiliency” of current occupants (community and individual) of coastal areas. Presumably vulnerability/resiliency has to do with exposure to a hazard that can cause harm and the ability to recover if that harm occurs. The hazard and harm may be continuous and increasing (e.g., land loss due to sea level rise (SLR)) or episodic (e.g., storm events). Recovery may occur in place or may require relocation. The PCA is an effort to aggregate into an index the hypothesized determinants of vulnerability/resiliency (V/R); that is, $V/R = f(SVI)$. SVI is an effort to identify vulnerable places using multiple indicators rather than a single focus on poverty, race, or age. For example, SVI has special needs, employment sector, gender-based participation in the labor force, unemployment, foreign born, educational levels, and rural/urban population data. However, the index needs to be understood as, at best, an untested proxy for vulnerability/resiliency.
 - As a proxy, what is the implication and use for the master plan if there are places of high vulnerability/low resiliency, as measured by the PCA? Does this prioritize “projects to protect” (including property level mitigation) and relocation because the communities and individuals are not positioned to do that by themselves? Is there a vulnerable community that is being left out of the plan and if the answer is “yes,” then should the plan be adjusted in some way?
 - If communication to stakeholders is a consideration, consider selecting the socio-economic variable(s) that a PCA signifies are the most important for measuring vulnerability/resiliency instead of using an index like SVI.
 - The American Community Survey (ACS) data used to construct the SVI, or some other existing socio-economic variable, may not be the best predictors of vulnerability/resiliency. Consider how to fill this gap over time if vulnerability/resiliency is going to be a consideration in developing the master plan. Is there a plan to collect and interpret data at a more detailed and specific level than census data, specifically on the character and cultural networks of the human communities?
 - HAZUS is a hypothetical loss estimation tool for three hazards (earthquakes, floods, and hurricanes). Potential losses are modeled based on current building stock, not actual loss data on an event. HAZUS does not have SVI or SHELDTUS contained within it. HAZUS uses income, race/ethnicity, owners/renters, and age (but the last two are given a weight of zero and thus do not count in determining sheltering

requirements) – no other social or economic variables are included. HAZUS does not include crop losses. There is no overlap between SHELDUS or SVI and HAZUS. SHELDUS is a geo-referenced (county) data base of actual recorded losses by 18 different types for both property and crop losses. Loss profiles for communities can be created from SHELDUS for all or selected hazards and trends can be identified over time (1960-present) and across space (by county for the entire US). SHELDUS is not a loss model; SHELDUS records can be used to validate the predictive accuracy of HAZUS outputs for recent disasters (e.g. Sandy). SHELDUS contains an inflation adjusted capability and also includes population estimates to derive per capita estimates of losses, which gives planners the ability to compare losses over time and between places. SHELDUS data meet Federal Geographic Data

- Marsh creation projects that enhance flood protection of densely populated areas (e.g., New Orleans) have an added value for risk mitigation. Is there a metric to take this into account in the Planning Tool?
- As the master plan is designed to benefit the whole coast of Louisiana, will there need to be a geographic distribution metric that weights the spatial distribution of restoration areas?
- One SEB member noted that while land creation and risk reduction are currently primary objectives, it would be interesting to use the Planning Tool to ask about a sustainable economy (defined by advancing certain objectives (i.e., metrics) to identify preferred places for land creation and risk reduction. At some point perhaps swapping the current primary objective functions with specific auxiliary functions as defined by the metrics might provide some sensitivity to which projects actually benefit those metrics most.

Question 3: Scenarios and Project Results

Given the number of projects, scenarios and varied outputs available for each project run, does the SEB have any recommendations on how to present the findings of the master plan analyses to wider audiences (both technical and non-technical)? How should we communicate and name the three environmental scenarios? Ideas on ways to summarize or visualize data that have been useful elsewhere would be especially helpful.

Re-naming and Communicating the Environmental Scenario

The SEB was in general agreement that the adjectives used to describe the future “environmental” scenarios might be reconsidered. However, the SEB did not reach a strong consensus on this point, although there was some agreement that the term “hazard” as opposed to “environmental,” might better describe these future conditions.

There are plausible ranges of parametric inputs to what MPDT models as future “environmental” conditions (e.g., precip, ET, SLR, etc.). The adjective “optimistic”, “moderate” and “pessimistic” might describe these environmental conditions. One SEB member was inclined to keep the names of the three environmental scenarios for the 2017 Coastal Master Plan relatively consistent with the names from 2012 presuming that these terms were understood and accepted when included in the 2012 plan. A possible modification offered was “more optimistic”, “moderate” and “less optimistic.”

However, the fact that the SEB was asked to propose naming alternatives suggests that there is some dissatisfaction in the MPDT with these adjectives. The SEB first discussed that the scenario was describing a very specific change in the future environment – a change in the hazard to coastal property and to the coastal landscape. The parametric model inputs such as SLR are combined in different ways to create limited number of hazard possibilities, *relative to the current (historical) conditions*.

The SEB discussed that the name for hazard scenarios would be relative to current conditions and discussed the terms: High/significant (change in) hazard, Moderate (change in) hazard and Low (change in) hazard. No final agreement was reached.

Regardless of the naming convention, the SEB suggests that the MPDT communication include the following:

- Make it clear that these are “examples” of many, many possible future scenarios.
- SLR is different from storm effects, in that unlike storms which come and go, SLR is a permanent change of state. In addition, future storm surges will be 'on top of' SLR – that is, the magnitude of future storm surges will be increased by SLR.
- If the team has not incorporated the new experimental storm surge analysis and maps that the National Weather Service released this year for south Louisiana, consider what this might mean for communication.
- Mention that the SLR assumptions used to build the scenario may not be based on the most recent analyses and projections.
- It is highly effective to show the more extreme cases (“A” and “C”) together as often as possible. This helps appropriately highlight the uncertainty in what is being considered in the master plan and continues to prepare the community for a wide range of possible outcomes.
- The National Oceanic and Atmospheric Administration (NOAA) National Hurricane Center recently completed an extensive study on how best to convey forecasted coastal inundation information to the public. Best practices and lessons learned from this effort could be leveraged when developing public outreach graphics, etc.
- It looks like future without action (FWOA) for case C after 50 years means the loss of all wetlands up to the land edge. This implies that no matter what is done, in the face of expected long-term sea level rise, it is a matter of time until virtually all Louisiana coastal wetlands are gone. Thus another useful metric would be number of years to loss of the large majority (e.g., 90% perhaps) of all coastal wetlands under various scenarios.
- The sequence of storms in the modeling determines to a large degree the land growth at the end of planning period (year 50). In the present modeling set up, the historical time series of storms is applied. However, from a statistical point of view this is only one possible realization out of many possible sets of storms. Running a statistical analysis may not be possible due to the complexity of models; however, a check on sensitivity of the result to the sequence of storms would provide greater confidence into how realistic this outcome is. One possibility is to run a small number of sensitivity runs for the preferred plan, shifting the start of the time series.

The metrics for sustainability are built of two parts, 1) land building potential in 50 years, and 2) potential land loss after year 40. If there is a loss of land between year 40 and 50, this loss is likely

to continue. Can such a project be considered sustainable if it starts to decline already during the first 50 years? If not, the function should return the value of 0 in such cases and the project should be taken out from evaluation as it does not meet the primary objective of land building.

Modify Number and Type of Scenarios

MPDT should evaluate the advantages and disadvantages of removing the fragility scenario from its analysis.

The analytical challenge is simulating and then reporting on the effects of the projects on outcomes of interest. The number of projects initially considered for inclusion in the master plan has been set. In answering the preceding question one suggestion (above) was to reduce the number of metrics for describing outcomes, at least for use in the Planning Tool. Another suggestion from some SEB members is to reduce the number of scenarios from three environmental, three population changes and three fragility scenarios, by using only one fragility curve (not including differences in fragility as a scenario). In this way the MPDT can reduce the number of scenarios from 27 (3x3x3) to 9 (3x3). Based on the results shown to the SEB, the differences in expected damages under the different fragility assumptions was not "large". Also, if there is no anticipated alternative that has a cost and that would reduce fragility then the differences in the scenarios are not decision relevant.

The SEB expressed concern in the SEB Report #1 about the future population and asset growth and location scenarios. The SEB recognizes that modifying the methods by which the scenarios were developed is not a possibility given the limited timeframe for the 2017 Coastal Master Plan. In the first SEB report the suggestion was that a text be prepared to set out the implicit assumptions that are behind the scenarios and what the necessary economic conditions would be for that scenario to be realized. The SEB is prepared to review and comment on such a text if it is prepared.

The expected annual damages calculations for future conditions are a direct function of the value and location of exposed assets. Property and asset values will fall near the coast and assets will shift in type and location as a result of changes in the hazard as well as possible exogenous changes in the economy. However, these possibilities do not appear to be reflected in the different population and asset scenarios. Instead there appears to be an implicit assumption that the population and asset values will grow as in the past, the mix of assets will be unchanged and there will be some relocation but only as a result of land loss. For example, the projections assume that oil and gas extraction and processing will continue as in the past (but there may be shifts in energy sources in the future); that the ports in Louisiana will continue to prosper (but there may be increased competition from expanding southeast coastal ports and some commodities (e.g., coal) may decline); that oyster production technology will be the same in 50 years (but new forms of aquaculture may emerge).

Ideally, the scenarios would be different plausible projections of population and asset location, values, and mix as a result of different possible shifts in the larger economy, fully recognizing how land loss may also result in such changes. The text of the report and the presentations of the results of the analyses should acknowledge that such changes have not been considered in developing the future population and asset scenarios. The same text could note that aspirational scenarios for a viable working coast might mean that other businesses and industries should be encouraged by the master plan. An example might be something like the Tabasco Company, ecotourism, etc. This could be an example of the scenarios driving the Planning Tool.

MPDT might consider time slices beyond 50 years.

The report indicates that there have been runs for land building that extend beyond 50 years, but not for flood risk. At least internally, MPDT could be exploring these out-year runs. Environmental scenario results are run on a 50-year time horizon. It appeared as if there was little change predicted in runs for some major projects. Consider investigating what the outcomes would be by doing runs for 75 or 100 years. Will SLR after 50 years overcome any gains in land building and increase susceptibility to storms? How does MPDT deal with projects that are good 30 years from now and projects have no benefits in 30 years?

Question 4: Formulation of Alternatives and the Planning Tool

The 2012 Planning Tool was used internally within CPRA and to support FDT meetings. For 2017, CPRA is considering expanding the use of the Planning Tool to showcase highlights of the analysis to the public. Does the SEB have any recommendations or suggestions of how to do this most effectively? Are there potential pitfalls CPRA should be aware of?

Public Use of PT as Communication

In communicating the likely implementation of the 2017 Coastal Master Plan, stakeholders might be interested in projections of the levels of funding that are more certain and those that are more speculative, descriptions of how the source of the funding may affect the kinds of projects that will be implemented, and what funding gaps are anticipated.

The SEB recognizes that the Planning Tool considers different funding levels as part of the scenario development process. The SEB also understands that current funding for implementing projects in the master plan comes largely from post-disaster funding sources (natural and manmade) and the future funds will be from varied sources, many of which may not be available for implementing the kinds of projects now being included in the master plan (http://coastal.la.gov/wp-content/uploads/2015/12/Sect-1_web.pdf). However, the Planning Tool does not recognize that some funding sources may not be able to be used for some projects.

As the Planning Tool is used for public communication, the MPDT might total costs for the projects in the master plan for the next (for example) 10 years and prepare an analysis of the sources of funds that might be used to pay those costs (e.g., planning, investment, and operations), identifying any gaps. Such a “gap analysis” could be a useful contribution to the public discussion and understanding of the master plan priorities and outcomes in, for this example, the next 10 years.

Of course any presentation of costs will be accompanied by a presentation of the positive results (e.g., level of goal attainment) of a set of projects in place. In such communication the MPDT might pose some minimum level of goal attainment that will make implementation worthwhile and ask what level of investment might be required to meet that minimum.

The literature on collaborative modeling processes might suggest principles and methods that will be helpful when communicating the Planning Tool to the FDT and other stakeholder groups.

The Planning Tool and the many models that are used to support the Planning Tool are to inform a decision-making process by CPRA. However, the perspective of stakeholders may be that the Planning Tool is used to actually make the decision as opposed to informing the decision-making process. If that is the perspective, the danger is that stakeholders will feel “black-boxed” by the model. MPDT will have to experiment with and then adopt understandable ways to explain how

the model works; and also acknowledge that it is only a model and is an aid to decision-making and is not the “decision maker;” CPRA is the decision maker.

There is available literature that can suggest ways to open the models and Planning Tool to stakeholder access and to build confidence in the models and Planning Tool.

Opportunities and Pitfalls in Outreach Using the PT

The SEB offers the bulleted discussion points in the section below for MPDT as it begins using the Planning Tool in its outreach program for the 2017 Coastal Master Plan.

- During the meeting the SEB pointed out many issues related to presentation that can be improved. Most of these are simple fixes to graphics (e.g., colors, scaling, etc.). One specific point was that care should be taken with the characteristics of the displays, for example whether the use of “gray” areas in the visuals represents simply the boundary of the study area or an actual outcome of the impact analysis.
- Besides maps and reports, make use of computer animations to illustrate the dynamics and scale of changes.
- Pre-brief local/regional/ stakeholder “trusted sources” and ask those sources to convene (not endorse) meetings for the Planning Tool results roll out.
- Explain project effects and the decisions made in terms of the stakeholder’s interests rather than the goals defined by the state. Specifically, some stakeholder’s interests fare better, or at least no worse, under the no action scenario. This needs to be acknowledged, especially when they are worse off relative to the project in the master plan. In effect if the master plan creates “losers” this should be acknowledged and (maybe) compensatory financial mitigation discussed.
- Consider presenting results in the context of what specific community sectors already know. For example, showing how shrimp biomass shifts in relation to current “catch” locations and existing harbors/docks.
- Consider presenting information on lessons learned during the planning phase: 1) what classes of alternatives were most effective and why/where, and 2) what classes of alternatives were least effective (or had negative impacts) and why. This will convey the idea that many long cherished projects simply will not achieve what their advocates want to believe they will achieve. This is the power of the model – to show what will work and what will not. In other words, the message needs to be: “The reason we are not doing the project you want is not because protecting you is not a priority to us, or because we do not care about you – it is because that project will not do what you think it will do.”
- MPDT should self-assess its model prediction results and identify analytical uncertainties, openly acknowledge them, and be prepared to address how the consequences of model uncertainty were recognized in project prioritization (e.g., robustness of results, adaptive management plan/SWAMP/ piloting projects, etc.).
- Be sensitive to determinants of stakeholder risk perceptions (there is an extensive literature on this topic). For example, stakeholders often:
 - Think in terms of extremes and consequences and not likelihoods and expected damages

- o Have a truncated time horizon
- o Have unreasonable expectations of federal and state programs post-flood recovery

Flood Risk and Resilience Plan Formulation

The SEB spent significant time with MPDT discussing the adjective “nonstructural”, the noun “project,” and the broad concept of community relocation. The SEB offers the bulleted discussion points in the section below for consideration by MPDT for the 2017 Coastal Master Plan development and outreach activities and for the 2022 Coastal Master Plan process.

- The standard and long established terms "structural and nonstructural" may not convey the nature of the different projects and may be confusing to non-experts. MPDT might consider adapting terms such as those used in a recent Coastal Risk Study report from the National Academies: “hazard reduction” strategies/alternatives (flood protection) and “impact reduction” alternatives. The Corps of Engineers draft levee safety guidance replaces the terms with hazard reduction, exposure reduction, and vulnerability reduction.
- Flood protection is protection from the hazard and if the hazard is not changed then there are actions to reduce the impact of the hazard (e.g., reducing exposure or vulnerability or increasing post-flood recovery). Measures for protection from the hazard impact include elevation, floodproofing, acquisition on an individual structure basis, building codes, and post-flood recovery through increasing the number of properties with flood insurance.
- A project can be a “strategy” and does not have to be something designed, engineered, and built at the property level or for a larger area. Therefore, for the 2022 Coastal Master Plan the MPDT should expand the concept of “project”, to include projects to support community-scale relocation. The SEB notes that for the 2017 Coastal Master Plan, relocation and retreat is being treated passively.
- Relocation is not a nonstructural mitigation measure being proposed in the 2017 Coastal Master Plan, but voluntary acquisition is. Buyouts are a tool. Relocation planning (i.e., institutions as “projects” is totally different, transfer of development rights and tax incentives) needs to be considered. The SEB discussed some of the following aspects of a relocation alternative:
 - o A point in time will come where public services are not provided.
 - o The new HUD grant for Isle de Jean Charles is a real-time case study; MPDT needs to analyze and learn from that process.
 - o Are there other areas that need to be looked at?
 - o The key is to make transition easier and come into area and help them see what future looks like and start to see what options they have – not telling them they have to relocate.
- The cost of relocation is the cost of acquiring and settling a household or business in an alternative location net of salvage value of the current site; and, if a whole community is to move then the salvage value is zero and the cost of relocation is the cost of the new site plus resettlement costs and any incremental infrastructure support costs (e.g., public services) for the new location, if it is a managed movement.

- Prior to the point where it is *necessary* to assist communities and industries in their consideration of relocation possibilities, it would be desirable to explore opportunities to work out the details of such possibilities in specific “test” cases; for example, displaying the “cost” of staying compared to the “cost” of relocating, both to the local communities and to the state and nation. This process will almost certainly have to be adapted to specific communities and industries.
- Relocation and other such alternatives have to be put on the table as part of the master plan, and the cost of these alternatives have to be weighed against the cost of staying in place with hazard reduction or impact reduction projects.
- In the end what CPRA probably has to say is: Here are the areas that we can no longer protect. Once we cannot protect them anymore, we will have no choice but to withdraw services and cease maintaining infrastructure. Once we do that, you are on your own – we cannot make you move – but here are some options for how you might proceed. The 2017 Coastal Master Plan should at least hint at the need to undertake this sort of discussion.
- There is probably a financial analysis possible here too. First, there may be infrastructure or other public capital projects designed to serve areas that cannot be protected. Those should be identified and, assuming the governor supports this approach, those agencies could be encouraged or required to withdraw those projects. In theory, this might free up money to assist with relocation. Of course the financial cost is far from the only consideration in relocation (e.g., family, community, and cultural ties are highly prized), but at the least CPRA could begin to say: This is what it costs us to keep a small number of people here, versus this is what it costs to assist them in finding a new home.
- The current CLARA does not consider “systemic” risks (i.e., individual house as opposed to getting to the house), which in the end may be among the most important risk categories.

Question 5: Adaptive Management

What additional components should CPRA consider as it develops the Adaptive Management Plan for 2017?

The question posed to the SEB is a request for advice as MPDT's Adaptive Management plan is being developed. The SEB offers the bulleted suggestions below for MPDT consideration and the SEB looks forward to a progress report on the Adaptive Management plan development at a future SEB meeting.

- Adaptive decision-making requires an institutional commitment to revisit a plan periodically in consideration of what has been implemented, the effects of that implementation and changing physical, biological, and socio-economic conditions in the area of interest. The authority and budget for such a review is often not available, however the master plan authority and budget for such reconsideration is already included in the master plan process. This means that the MPDT is necessarily pursuing adaptive management in the sense that information, alternatives, and impacts are continually being developed and assessed in the 5-year update process.

- There are three possible objectives of adaptive decision-making: 1) reduce model prediction error; 2) check whether project performance (e.g., outcomes) aligns with model-predicted outcomes, predictions that are accompanied by uncertainty; and 3) adjust goals and objectives to accommodate an unpredictable, but changing environmental *and* socio-economic landscape.
 - Adaptive decision-making means that management includes learning as a goal and that management choices are made over time in response to learning about the system being managed. Making decision-making adaptive (e.g., learning while doing through feedback) adds a dynamic component requiring the decision-making process to be nimble and flexible.
 - Objectives 1 and 2 are what is commonly referred to as adaptive management. Objective three might be called “evolutionary problem solving”.
 - A well-recognized distinction is between passive adaptive management and active adaptive management. Passive adaptive management is less experimental than active and less costly. Passive adaptive management might involve monitoring the predicted outcomes of actions taken to see if the outcomes were achieved, but would add little to understanding why an outcome was or was not met. In the end the models used to inform future decision-making may not be significantly improved through passive adaptive management, but progress toward meeting the goals for which the action was taken can be tracked.
 - In active adaptive management the objectives 1) and 2) above can be served by a) continued monitoring of the landscape, economy, and population, and b) experiments to reduce particular model parameter uncertainties or increase data for model calibration and validation through the application of models developed for the master plan and for similar well-monitored cases elsewhere and/or building smaller scale test projects. The expectation in active adaptive management is that the learning will be used to improve the predictive models as a way to better inform future decision-making. As one example, working of diversions is a rather uncertain part of the master plan. Active adaptive management might mean “starting small”; that is, identifying key model uncertainties and data needed to test hypotheses about those uncertainties, building a portion of the full structure (say the first gate), treating its operations as a test project, monitoring outcomes to test the hypotheses, using the collected data to calibrate/validate models, then optimizing the design or operation rules. The distinction between either form of adaptive management and evolutionary problem solving turns on the responsiveness of objectives to what is learned. Adaptive management is goal-seeking, and evolutionary decision-making is goal-discovering. Evolutionary problem solving requires monitoring not only projects and the landscape, but also changing social and economic conditions, changing public preferences, and changes in available funding.
- Who will be tasked with tracking ongoing and completed projects and making key decisions about their management? This cannot be a haphazard, periodic, or spontaneous activity, it needs to be part of the routine for MPDT, suggesting that an adaptive management plan should include charging particular staff to the analysis-

decision process and making sure the staff has direct access to decision-makers in the agency that can modify design, construction, or management of the restoration projects.

Data needed for outcome monitoring versus model improvement may be different in terms of frequency and spatial resolution. Data collection for model enhancement may be more frequent for a shorter period of time. For diversions, regular and well-distributed measurements of sediment concentrations and deposition are important to validate that the sediment is actually deposited where predicted. For outcome measurement, data will be continuously collected, but perhaps less frequently.

Tipping points (such as ecological or socio-economic health, marsh collapse, or major economic shifts), key thresholds for environmental parameters (such as temperature, water quality, species diversity, etc.), and perhaps most critical, actual funding availability, could trigger key decision points and re-evaluation of certain projects.

Question 6: System Wide Assessment and Monitoring Program

As the System Wide Assessment and Monitoring Program (SWAMP) is implemented across the coast, how might the success of the program be ensured over the long term and what are some potential pitfalls in the implementation of the program?

The SEB suggests developing SWAMP in parallel with the adaptive management plan, recognizing that SWAMP needs to serve the adaptive management program. The SEB offers the bulleted discussion points below for consideration by MPDT as it begins developing SWAMP to support adaptive management and the 2022 Coastal Master Plan revision.

Physical and biological data

- The temporal sampling designs need to be considered carefully as well as the distribution of spatial sampling. To date SWAMP planning appears to propose statistically rigorous spatially sampling with perhaps insufficient consideration of sampling frequency. The need for a solid temporal sampling design will be particularly important if one objective of SWAMP is to detect system state changes or tipping points, such as marsh collapse and conversion to open water. In this example, the SEB know that there are several early warning signs of marsh stress that can probably be detected through parameters that SWAMP will sample (e.g., live plant biomass, plant species composition). But if these data are only collected or considered every five years, the likelihood of early detection of change is low and when it happens it will be serendipitous at best.
- Consider both temporal frequency as well as the spatial extent of the monitoring. For example, long-term data on hydrodynamics are likely not needed at all geographic locations for hydrodynamic model validation; a short-term, spatially resolved field campaign may well suffice. On the other hand, temporal changes in hydrodynamics (as they relate to SLR and other factors) may be captured by long-term monitoring at a small subset of geographic locations, if those locations are strategically chosen.

- Collection of current velocities and wave parameters for model validation could be limited to one season; longer series of measurements of this kind have very limited added value.
- Temperature is a key controller of biological activity and distribution/occurrence of organisms. A two-degree rise in temperature (annual means or even more importantly, seasonal maxima and minima) in coastal Louisiana will have a big effect on organism occurrences and distributions, and on biological communities. The SWAMP presentation by MPDT did not indicate that temperature is incorporated into the scenarios and results that were presented, but it might have been incorporated into some of the taxa-specific habitat suitability index (HSI) values and not obviously included.
- For fish and shrimp, how are data from different samples (e.g., gillnets, trawls, seines) being combined or aggregated? This is difficult to do. MPDT is aware of this “gear selectivity” problem but it was not clear that it is being addressed.
- There is a perfunctory treatment of oyster monitoring and surveying. Oysters are a key indicator species in estuarine and coastal ecosystems and are easily sampled with rigorous designs. Because oysters do not move they are much like vegetation and thus amenable to rigorous sampling-survey design.

Socio-Economic Data

- Socio-economic data are needed to track shifts in the underlying economy and assets in order to characterize future risk and links of the economy to the changes in the coast.
- ACS is too coarse. Sample surveys can fill in data at the micro (e.g., household) level. There are other sources for such data; however, acquiring such data can be time consuming and perhaps costly. This is particularly important in areas such as constituent perception, values and attitudes, which are not normally captured in large data sets.
- CPRA should resist the inertia in data base development for adaptive management programs to focus primarily on physical and biological measurements, while ignoring the need to build a socio-economic data base to support the master plan revision process. In the end, adaptation is about human behavioral change.

General

- SWAMP data are being collected by an array of state and federal monitoring programs and university research contracts. This is a clever “value-added” way to avoid having to set up and pay for a separate monitoring program for coastal restoration efforts, and doing that would make little sense. One question that comes from this partnership-type arrangement is: What are the time lags between when data are collected by other entities and when they are available in the CIMS database? If this time lag is weeks to a month or two, there should be no problem. If this time lag is a year or more, the data will have little to no short-term utility and may not be useful for adaptive management. The SEB also expresses concern about the vulnerability of SWAMP data collection in the long-term, given the vagaries of state and federal budgets and commitment of these agencies. The only solution to such a worry is that MPDT monitoring staff be ever-vigilant

of the sustainability of their data-generating partnerships. There is every indication that CPRA is aware of this potential vulnerability, though, and are vigilant to problems that may arise.

- Dependency by CPRA on sampling by other agencies and their budgets and priorities could be problematic for successful monitoring, especially where MPDT's power analyses indicated additional or more frequent sampling is may be required to detect changes. Frequency of monitoring and evaluation of survey results may be a concern.

Meeting Agenda

Science and Engineering Board

In-Person Meeting #2

BRAF Boardroom, IBM Building

100 North Street (corner of North and Lafayette Streets)

Baton Rouge, LA

January 27-29, 2016

January 27, 2016 – 1:00pm – 5:00pm

- 1:00pm Welcome and General Update Karim Belhadjali
- Recap of October Meeting
 - CPRA Responses to SEB Feedback
- 1:45pm Outreach and Engagement Update Nick Speyrer
- 2:15pm Socio-economics Update Steven Barnes/Bren Haase/Karim Belhadjali
- Programmatic Level: Economic Impact of Coastal Land Loss Study
 - Project Level: Basin wide Diversion Socio-economic Study
 - Master Plan Level: How socio-economics will be incorporated into master plan decision-making
- 3:30pm Adaptive Management and SWAMP Ann Hijuelos
- Monitoring variables and objectives
 - Development of coast wide and basin wide monitoring plans
 - Progress towards developing a programmatic Adaptive Management plan
- 4:30pm Wrap-up and Next Steps

January 28, 2016 – 8:30am – 4:30pm

- 8:30am Scenarios Update (Environmental + Risk) Denise Reed/Jordan Fischbach
- Scenario talking points review/how to communicate to the public
- 9:25am Risk Initial Condition and ICM FWOA Results Denise Reed/Jordan Fischbach
- 10:45am *15 minute Break*
- 11:00am Restoration Project Results Denise Reed
- ICM Outcomes for Hydrology, Vegetation, Morphology, HSI
 - EwE example project results (diversions, marsh creation, etc.)
- 12:00pm Lunch
- 1:30pm Remaining Restoration Project Results Discussion/Questions Denise Reed
- 2:00pm Flood Risk and Resilience Program Update Melanie Saucier

- 2:30pm Planning Tool and Alternative Formulation David Groves
- Planning Tool Report details and feedback from webinar
 - Alternative Formulation and Next Steps
- 3:15pm 15 minute Break
- 3:30pm Group Discussion / Next Steps (*SEB + MPDT*)
- Initial Thoughts
 - Clarifying Questions
 - Requests for Additional Information
 - Wrap-up and Next Steps
- 4:15pm SEB Closed Door

Send Aheads:

1. Planning Tool Report
2. Metrics Report
3. LSU/RAND Economic Evaluation of Coastal Land Loss in Louisiana Report
4. Chapter 2 - Future Scenarios
5. Coastwide and Barataria Basin Monitoring Plans for Louisiana's System-Wide Assessment and Monitoring Program (SWAMP) Report

Handouts:

- SEB Discussion Questions
- Updated Outreach and Engagement Roadmap
- CPRA Agency Relationship Diagram

January 29, 2016 – 8:30am – 1:30pm

- 8:30am SEB Closed Door (*working session*)
- 12:30pm SEB Report-out to MPDT (*working lunch*)
- 1:00pm Wrap-up and Next Steps Discussion
- 1:30pm Adjourn



2017 Coastal Master Plan

Science and Engineering Board (SEB) Report #3
Baton Rouge
July 11-13, 2016

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Introduction

The third meeting of the SEB was held on July 11-13, 2016. The agenda is attached. Prior to the meeting the SEB was provided with three questions for its consideration after hearing the presentations.

1. **Adaptive Management.** Based on the Adaptive Management Report send ahead and the content of the presentation, are there any key gaps in the process that CPRA needs to address? Is the relationship between programmatic and project level adaptive management clear? If not, what additional information is needed? Do you foresee any potential conflicts between the programmatic and project level adaptive management processes that could be remedied by making changes now? Are the roles and responsibilities of each of the entities in the programmatic adaptive management process clearly articulated and assigned to the appropriate entity? Are there additional role/responsibilities that have not been identified that would increase the effectiveness of the programmatic process?
2. **Scenarios and Alternative Results.** Given the individual restoration and protection project results and the alternative formulation results shown in the Planning Tool, including information shown in the land effects matrices, provide recommendations for which of the three environmental scenarios the draft plan should be formulated on and provide the pros/cons of formulating on a given environmental scenario that should be considered in messaging/communication for the draft plan to various audiences.
3. **Communication of Results.** Does the SEB have any recommendations on how to present the findings of the master plan alternatives to wider audiences (both technical and non-technical), given that the outcomes and project benefits for land creation are not as successful as the 2012 Master Plan?

The SEB met in closed session late in the afternoon of July 12 and in the morning of July 13. During the closed session ideas were shared and there was an effort to identify points of broad consensus. The points of consensus are reported in the next section of this report, organized according to the three questions. A fourth category of “other” consensus responses is also included.

Question 1: Adaptive Management

During the closed session discussion the SEB members expressed similar views with respect to the Adaptive Management Report and presentation. The consensus is that the adaptive management draft report is extremely well written and is a rigorous treatment of the concept. Rather than repeat selected comments from individual SEB members in this summary report, the SEB recommends that those charged with revising the Adaptive Management Report should carefully review and consider the individual SEB comments listed below.

The SEB recommends that the necessity of adaptive management and the comprehensive adaptive management framework (as developed in the Adaptive Management Report) be

used to set the stage for the presentation of the 2017 Coastal Master Plan results. Specifically, in communicating results (also applies to communication of results, below) the MPDT should use adaptive management to convey the reality of why the master plan changes over time in sometimes dramatic ways. Two drivers of change are 1) new understanding of the hazards, socio economic conditions, available budgets, etc. and 2) what is learned in process of project implementation.

The following suggestions and feedback are specific to individual SEB members and do not reflect general SEB discussion consensus:

The requirement for five-year updates to the master plan insures that the evaluation and assessment components of adaptive management planning will be incorporated into the program. At the programmatic level, the timeframe is conducive to adaptive management and the Adaptive Management Report provides convincing text that supports the adaptive management planning process.

It is apparent that the Everglades recovery program (RECOVER) and its adaptive management planning processes have significantly influenced coastal management planning in Louisiana. The Everglades model is a good one to follow and the MPDT is commended for recognizing it.

To build for resilience, priority should be given to project designs that consider features or concepts that can be modified, such as ability to raise the levee or add another gate or pump bay, to accommodate future uncertainties.

In terms of roles and responsibilities of entities within the programmatic adaptive management process, the mechanism by which the results of monitoring would be assimilated and who would lead that effort was not sufficiently clear relative to other components of adaptive management. Also, the composition and responsibilities of the crucially important Plan Assessment Team needs to be further developed. The appointment of an Adaptive Management Coordinator for the Program should be a high priority for the 2017 Coastal Master Plan.

A SEB member questioned if resources will be available to fund the adaptive management process and if adaptive management can realistically be implemented on either annual or even five-year timeframes? Perhaps not in many individual project cases, but this does not imply that the overall adaptive management process will fail. Managers can adopt many ad hoc measures that, while not fully adhering to the adaptive management plan as described in the Adaptive Management Report, may be sufficient to insure that the overall AM process and its key principles are supported.

During our meeting we heard details about how adaptive management will be used with SWAMP to adaptively manage on-the-ground projects, as well as the environmental monitoring process itself. We saw a flow chart figure demonstrating how this more pragmatic adaptive management cycle will work, and the annual iterations of how monitoring data will inform project construction and operations. This information should be part of the formal Adaptive Management Plan.

Recognizing uncertainty will not necessarily insure that the Program can adequately account for or deal with it in the AM process if funding and time are serious limiting factors (which they likely will be). The Uncertainty Matrix (see Table 4) in the Adaptive Management Report helps to categorize uncertainties, but does not necessarily provide a solution.

In traditional application the goal of AM is to reduce uncertainty in model predictions used to inform future decision making. In this case reduce the uncertainty in predictions from the ICMs and other models that would be used in the 2022 MP and beyond to improve knowledge about natural processes. The way uncertainty would be reduced is to specify hypotheses about model parameters or response functions to be “tested” through the collection and analysis of monitoring data. The hypotheses to be tested can then serve to target (best allocate) limited monitoring resources.

- It was not clear from the presentation on Mid Barataria what uncertainties were most critical and what hypotheses were going to be tested, and therefore it is not clear how the data collected will support model improvement.
- At the individual project level, the ability to conduct AM in a formal sense was not clear. There are literally dozens of projects that potentially will be selected and which must be planned, implemented, monitored, assessed, and evaluated. For example, an AM plan and associated monitoring for Mid Breton would be different than for Mid Barataria
- The presentation of the mid-Barataria AM plan appeared to be about a step-wise (incremental) implementation to be certain that the project grew land as predicted by the Delft 3d runs, and if there might be unintended consequences on stakeholders and aquatic resources. If land building was limited or there were unintended consequences operations would be adjusted based on what was learned based on measured land building; it was not clear if there were any hypotheses being tested and if so what feedback they would have to either the Delft or ICMs.

Question 2: Scenarios and Alternative Results

Based on the presentations the SEB understood that under all scenarios (given uncertainties in models and future conditions), and under all budget constraints, that most of the justified projects get selected at some point. If this is the case, then choosing one scenario for sequencing projects is not the preferred approach. Instead, the SEB recommends that 2017 Coastal Master Plan near-term projects should be based on a criterion of “robustness” and “limited regret”. This means that the near-term projects should be those that perform best under all scenarios.

The SEB recommends that the high environmental scenario should be prominent in presentations to the public (also applies to communication of results, below). This will set the stage for the 2022 Coastal Master Plan by suggesting that there may be radical (perhaps) adaptation in the master plan objectives and project types, because the new evidence is that the sea level rise component of the environmental scenario makes the current high estimate increasingly likely. *The following suggestions and feedback are specific to individual SEB members and do not reflect general SEB discussion consensus:*

A few SEB members suggested that given the uncertainty in future conditions (sea level, precipitation, etc.) and in model predictions, it is not clear selecting one, specific scenario for formulation is the appropriate approach. From the Planning Tool it can be seen there are a number of projects that appear in all three scenarios, suggesting that the actual scenario selected is probably less important for the choice of projects for the short-term implementation in the 2017 Coastal Master Plan. One SEB member noted that the projects that appear in all three scenarios indicate that there is a subset of projects with positive benefits regardless of scenario considered. This is especially true for projects recommended in the 10- to 20-year timeframe. In the 30- to 50-year timeframe, conditions deteriorate under all environmental scenarios and alternative modeling approaches. Projects that allow flexibility in implementation and are judged to be amenable to adaptive management or shifts in approaches may be preferred. One recommendation is to select the suite of projects for near-term construction priority based on those projects that perform best under all three scenarios. The projects which are selected for all scenarios can be considered as non-regret measures and should be selected for construction, as well as projects that take a long time to build land. At the same time, it is recommended the results be reviewed in the context of which projects are most likely to have positive benefits if the actual future state is less optimistic than the least optimistic scenario considered in the 2017 plan.

Given the effects of climate change, primarily rising sea level, the high environmental scenario seems most likely to be best for evaluating, modeling, and predicting coastal responses that support selection of projects.

Given the knowledge gained from the scenarios and alternative results, it is recommended the results be evaluated in the context of selecting the best projects for, for example, a) providing time for planned relocation and b) providing time for planning economic sustainability (e.g., if the fishing industry or oil and gas industry decline, what replaces it as the jobs creator for the region?) In this context, where land is preserved or created (or land loss slowed) is important.

As mentioned in the previous SEB Report #2, two SEB members suggest that the 2017 Coastal Master Plan communications might employ the term “hazard” scenarios (versus “environmental”) and clarify that the change in hazard is not limited to sea level rise. The communication should make clear that hazard is based on a combination of factors that define the three hazard possibilities, relative to the current (historical) conditions. These are high (change in) hazard, moderate (change in) hazard and low (change in) hazard.

It was noted that determining the relative costs of “preserving” versus “creating” land under the three environmental scenarios would seem to have value. It was noted that “Land Creation” is not one of the five specific objectives of the master plan, but it plays prominently in the Planning Tool modeling.

Selection criteria of projects should consider 1) different types of projects to include policy strategies, such as incentivizing smart development, relocation, conservation, 2) focus on high impact, but potentially sustainable geographic areas with high ecological, economic or social value, 3) multi-purpose benefits (risk reduction AND restoration), and 4) a blend of near- and long-term projects to help transition to the 50-year endpoint.

The analysis should consider ecological, geomorphic and economic “tipping points” and the plausibility of drivers over the 50-year horizon that could cause them (e.g., a major oil spill, sustained hypoxia, or hurricane).

The message the high scenario sends to the public will better communicate the severity of the situation faced by the Louisiana coast. It will help the public recognize that the master plan is not a solution to the loss of coastal land, flooding risk, and long-term submergence. Rather the recommendations of the master plan are part of a transition process to adapting over the next few decades to a very different future coast.

It might be good to make a note in the master plan document that the sea level rise scenarios are rather uncertain and undergo continuous changes in line with scientific developments.

Documented uncertainty in the land building projections could be directly considered when identifying low regret projects.

Individual projects that can easily be adapted (or have adaptive designs) be specifically identified and given priority in project selection for the 2017 Master Plan, as appropriate.

In some cases a specific project appears in the “low” and “high” scenario, but not in the mid-range scenario (usually indicated because of no net benefits). It is recommended this discontinuity in the results be investigated and explained. Is it, for example, an inadvertent artifact of how uncertainty in the modeling is treated within the planning tool?

In a 50-year timeframe, the three environmental scenarios proposed by the MPDT often appear to project only small differences in outcomes. This is a consequence of the Louisiana coast being on a “one-way trip” of unidirectional change. Still, the magnitudes, spatial extents, timing, etc., are important in evaluating projects. For those projects where land building is projected to have substantial positive effects, even if limited to 2-3 decades, they should be considered for high priority.

If only one of the three scenarios (low, medium, high) must be chosen for formulating recommended projects, then the high scenario should be chosen. The analysis to date indicates that the regrets from choosing the high option, even if the actual conditions end up being medium or low, are much less than the regrets from choosing low or medium case if the high conditions end up being true. Also, if true conditions end up being low or medium, everyone can be thankful for that result in itself!

Question 3: Communication of Results

The SEB recommends that the 2017 Coastal Master Plan results be presented to emphasize changes from the 2012 plan. Changes that need to be highlighted are 1) land area and risk in the future without action conditions, 2) projects chosen for the plan and the sequence of projects. The description of key changes should be clear on the major factors explaining *why* the results changed. In the spirit of the adaptive management framework, reasons why there are changes can be explained by i) new analysis and assumptions made affecting the environmental scenarios, ii) changes in project design and iii) significant advancements in

model development and data availability for predicting project effects. When there are changes in 1) - 3) (above) from 2012 to 2017, the reasons for the change should be explained as a result of i), ii) or both.

Additional specific suggestions for communication strategies from individual SEB members were provided to the MPDT, and those charged with communication of the 2017 plan should carefully review and consider all of the individual SEB comments.

The following suggestions and feedback are specific to individual SEB members and do not reflect general SEB discussion consensus:

The 2017 Coastal Master Plan, relative to the 2012 plan, predicts a greater net land loss over the next 50 years even with land building projects in place. This predicted difference will draw public attention. Explaining this difference should be one focus of the communication strategy. Key themes of the communication should include:

- Emphasize the uncertainty both in modeling and in climate change and subsidence predictions, pointing out that although the magnitude of changes is predicted differently, the predicted trends have generally not changed.
- Reminder that 2022 Coastal Master Plan may have different projected net land loss in 2022.
- Calculate, in order to communicate, the relative contribution to the differences in predicted net land loss of the following changes between the 2012 Coastal Master Plan to the 2017 plan: changes in assumptions about future environmental (hazard) conditions, changes in the Integrated Compartment Model, changes in data used, and changes in projects (e.g., number, location and design).

Maps and graphics for display of results that have been presented to the SEB often show what is lost relative to current conditions in future years. An effective alternative display would be what is left in future years. Specifically,

- What land will be left in future years with project implemented, with the rest as open water?
- What expected annual flood damages (to all assets) will remain in future years with projects implemented and where will those damages will be located (i.e., who is outside of the protection with no structural projects)?

Provide some means to show the uncertainty in the predictions and outputs of the projects. The MPDT's community flooding work is a major step forward and to the extent the MPDT is comfortable with the results to date, it should be made part of all communication and outreach efforts.

Communications with stakeholders that emphasize how the master plan can increase quality of life over the next few decades, even under the certainty of major changes to the coast may be effective. These communications should explain how the master plan will allow communities and their industries to adapt to new and different conditions. Even with substantial land loss, many communities will evolve to be more secure, stable, and prosperous under implementation of the master plan. There will, of course, be some losers and this needs to be acknowledged in communications with the public.

One SEB member very strongly supports the expanded outreach capabilities associated with the physical model and associated visitor's center at the Center for River Studies.

For the long term (i.e., in preparing for 2022 and beyond), develop graphical presentations for the public that highlight what the coast is likely to look like in 50 (or some other significant number of) years under the high scenario. Emphasize that the master plan is reducing hazards, aiding the coastal economy and way of life, and slowing the degradation of environment conditions as much as possible as we continue to move along the unstoppable transition toward increased coastal flooding and land loss.

It is recommended to be clear with regard to how civil infrastructure is included (not included) in the planning process, and what are the possible implications of how infrastructure is (is not) considered.

Give serious consideration to retaining a communications professional/facilitator or two to help formulate and communicate the findings. Technical people should be available as backup, but do not always have the natural skills in this area (they get too much 'into the weeds' for most of the public).

The most important rule for this is to keep the message as simple as possible (i.e. KISS). For example, if the decision has been made to use the high scenario for decision-making, there is no reason to complicate the message by talking about low and medium scenario outcomes. Another example is that the 50-year end point has often been the focus of data/model output presentation and interpretation. In reality it is the sequence of change over those 50 years of simulations that is important so where possible, communicate about the future using animations of temporal and spatial change, such as the examples we saw in presentations that showed 5-year iterations of model output. In those animations, there is real value to showing land loss as water overtaking land using simple green and blue colors. Most people know where they live on a map. Seeing the land where they live turn from green to blue is much more powerful than seeing it turn from green to black (which is the way land loss is currently being shown most often in graphics). When linear-type graphics are shown to compare a given scenario or project impact relative to FWOA predictions, it is better to show these as the difference between the two rather than showing two curves. Land loss predictions that show FWOA vs. a given scenario always decline over the 50-year simulation. Showing the same results as a "delta" will actually show the positive impacts of a given scenario or project as gains, rather than as slightly less loss.

Neither the EAD nor "land created" metrics are likely to be received with much enthusiasm by Louisiana residents., reductions in EAD don't translate easily to improvements in living conditions, or to improvements in the productivity or value of Louisiana's coastal ecosystem.

Other Comments

The 2017 Coastal Master Plan scenario analysis identifies "hotspots" of storm risk to communities and for land loss. The 2017 Coastal Master Plan projects analysis, under the high scenario, reports that many projects proposed by the public and in previous plans will be less effective in reducing risk or sustaining land beyond the time horizon of the analysis. The SEB recommends that, in considering land building projects for the 2022 Coastal Master Plan, the scenario analysis be used to identify land creation locations that can be sustained over the longer term.

Some members of the SEB believe that the “vision” of coastal master planning should be updated with each plan to recognize the realities of successes and failures of the master plan implementation. Additional emphasis could be placed on strategic planning and designation of locations and major areas prioritized for restoration and risk reduction. This approach could be viewed as a part of the overall adaptive management framework of the evolving master plans. Vision and strategic planning are not absent from the present overall approach, but could be emphasized more.

The SEB recommends when formulating for risk management in the 2022 Coastal Master Plan that one strategy be developed in two steps. First, describe a “coastal line” for the year 2030 (or some other future year) under most likely hazard scenario. The line would follow high ground (for example +2 BFE for the 100-year flood in that future year) and consider the storm surge defenses that are expected to be in place in that year. The premise is populations and assets that are not dependent on direct water access would concentrate behind that line. Second, given that premise formulate alternatives that include an array of projects and programs to facilitate relocation of communities and assets to that coastal line.

At its initial meeting the SEB was asked by the MPDT to offer comments that could be addressed in the 2017 Coastal Master Plan and offer other comments for consideration for the 2022 plan. Comments in previous SEB reports have addressed these two categories. The SEB recommends that its last meeting include a significant block of time to discuss a) changes to be considered for the 2022 Coastal Master Plan (consistent with the program level adaptive management concept and the MPDT request at the first SEB meeting); and, b) reflection on the role of the SEB (what worked and what did not for the 2017 plan) when a SEB is re-constituted for the 2022 Coastal Master Plan. The SEB recommends that those charged with developing the 2022 Coastal Master Plan work with the SEB in advance of the last meeting to structure an agenda around discussion questions that could include, but not be limited to, the following: What are the objectives for the 2022 Coastal Master Plan?; What are the kinds of “projects” that will be considered for the 2022 Coastal Master Plan?; What are the criteria that might be used to evaluate projects for the 2022 Coastal Master Plan?; What is the best timing for SEB input?; What is the best form of feedback from CPRA to SEB comments? “How can CPRA best take advantage of the SEB’s expertise, relative to technical advisory committees, as models are being refined, data are being analyzed, and projects are being chosen for the 2022 Coastal Master Plan?

The following suggestions and feedback are specific to individual SEB members regarding the 2022 Master Plan and do not reflect general SEB discussion consensus:

The collective benefits of the set of projects should be evaluated (i.e., is the impact greater than [less than] the sum of the parts?). It is recommended the interaction between projects be explicitly considered in developing the 2022 Master Plan.

While the effect of sea level rise is well appreciated and possibly appropriately accounted for in the environmental scenarios, effects of temperature may not have been fully appreciated, at least for the Plan’s vegetation modeling and components. For the HSI and EwE modeling, temperature certainly is considered and included in formulations and modeling but not

necessarily in the context of unidirectional climate change and a projected continuous increase in temperature in the coastal ecosystem.

Project formulation for the 2022 Coastal Master Plan should be independent of policy and political constraints to encourage out of the box solutions that allow more flexible, innovative and robust project(s) formulation. For example, project designs and locations plans should consider the possibility of re-nourishing some of these projects to extend their durability over the 50 years period, and projects that have that potential should be raised higher in priority. The result is that the master plan land building objective would change from building and sustaining as much land as possible in coming years to building land in more concentrated areas that could sustain changes and be there for the next generations.

The SEB has recommended that the 2022 plan include a new conception of “project”, including but not limited to whole community adaptation and relocation strategies. However, would this be a project, in the sense that the hypothetical budgets in the MP could be used to pay for such activities? In fact it seems that for a project to be included in the MP it must meet some criteria that would make it eligible for funding from the hypothetical MP budget. Exploring questions such as the ones below would help clarify the criteria for defining “project” for MP 2022.

- Would increasing road culvert sizes and raising roads across coastal communities, be a project eligible for MP budget? If not, why not?
- Would allocating MP budget funds to capitalize a subsidized loan program for allowing a household to purchase a home in an inland location be a project? If not, why not?
- Would strategies building upon the concept of the Isle de Jean Charles community relocation program, if administered through the Louisiana Department of Community Development, be an acceptable use of the MP budget? If not, why not?

Science and Engineering Board

In-Person Meeting #3

BRAF Boardroom, IBM Building

100 North Street (corner of North and Lafayette Streets)

Baton Rouge, LA

July 11-13, 2016

July 11, 2016 – 1:00pm – 4:30pm

1:00pm	Welcome and General Update	Karim Belhadjali
1:10pm	2017 Master Plan General Update <ul style="list-style-type: none">Recap of January Meeting/April WebinarCPRA Responses to SEB Feedback	Karim Belhadjali
1:50pm	Outreach and Engagement Update	Nick Speyrer
2:15pm	Adaptive Management Update	Karim Belhadjali/Rick Raynie
3:15pm	Updates on Related CPRA Work <ul style="list-style-type: none">CPRA Implementation Projects - DiversionsCenter for River Studies & Small Scale Physical ModelCenter of Excellence	Rudy Simoneaux Rudy Simoneaux Denise Reed
4:30pm	Wrap-up and Next Steps	

July 12, 2016 – 8:30am – 5:00pm

8:30am	Recap from Day 1	Karim Belhadjali
8:45am	Modeling Update <ul style="list-style-type: none">Future Without ActionRestoration & Protection Projects<ul style="list-style-type: none">Project UpdatesProject Interactions	Denise Reed
9:45am	<i>15 minute Break</i>	
10:00am	Planning Tool Analysis <ul style="list-style-type: none">Funding ScenariosRestoration<ul style="list-style-type: none">Project ResultsAlternative FormulationProtection<ul style="list-style-type: none">Structural & Nonstructural Project ResultsAlternative Formulation	Karim Belhadjali/David Groves
12:00pm	Lunch	
1:30pm	Planning Tool Review	All

- Alternative Formulation (Planning Tool max land/max risk, CPRA max land/max risk, scenario formulation)

3:00pm 15 minute Break

3:15pm Continue Planning Tool Discussions

4:15pm Group Discussion/Next Steps

- Initial Thoughts
- Clarifying Questions
- Requests for Additional Information
- Wrap-up and Next Steps

4:45pm Wrap-up and Next Steps/Schedule Discussion

July 13, 2016 – 8:30am – 12:00pm

8:30am SEB Closed Door (*working session*)

11:00am SEB Report-out to MPDT (*MPDT join meeting*)

12:00pm Adjourn

Send Aheads:

1. Appendix A – Project Definitions
2. Appendix D – Planning Tool Methodology
3. Appendix F – Adaptive Management

Handouts:

- Agenda
- SEB Discussion Questions



2017 Coastal Master Plan

Science and Engineering Board (SEB) Report #4

Baton Rouge

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1.0 Introduction

The fourth meeting of the SEB took place on December 5-6, 2016 in Baton Rouge. An agenda is attached to this report. Day 1 included presentations and discussion of analyses used to prepare the 2017 Master Plan and the significant outcomes resulting from that work. On day 2 each SEB member presented their reflections on past meetings and reports of the SEB, but with the focus on preparing the 2022 Master Plan. These presentations were followed by an expansive and productive discussion among the MPDT and SEB members about ways to move forward for 2022.

Because of this meeting structure, by mutual agreement between the SEB and the MPDT staff, no specific questions were provided as a guide to the content of this fourth SEB report. Instead, there were several common topics that were evident in the independently written comments prepared in advance of the meeting and that were reinforced in the discussion among the members on the afternoon of the second day of the meeting. These topics can be grouped into broad themes described below. Reflections of the SEB members are categorized according to those themes. The submission by each member can be found below.

Following the format of previous reports:

- This report includes each individual SEB member's written submissions, but without attribution to any individual member. If there is interest in further discussion of any particular point being made, the SEB members are willing to discuss and elaborate and the chair can identify who made the comment of interest.
- Members' text was not edited or synthesized (other than to adjust punctuation, spelling, or acronym usage).
- The reflections do represent different points of view, even when there is an agreement on a theme. As one example, the theme of modeling for 2022 includes reflections on objectives, but there were differences of view about how the risk management objective might be represented and whether land building was a useful objective.

Finally, in addition to reading this report, the MPDT staff is strongly encouraged to review SEB reports 1, 2 and 3, as many of the comments in those reports remain relevant for 2022 but were not repeated in this report.

Theme I - Modeling for 2022

The modeling work that supports the 2017 Coastal Master Plan is impressive and highly advanced, relative to any other such effort in the nation, and indeed beyond the U.S. The SEB finds that the modeling work has been instrumental in helping to shape the content of the 2017 Coastal Master Plan, giving the plan analytical and technical credibility in the scientific community and among stakeholders and decision makers. Nonetheless, important advancements in modeling are possible for supporting the 2022 Coastal Master Plan, and the individual member reflections offer suggestions for such modeling advancements.

Theme II - Strategic Thinking

The SEB understands how the projects considered for the 2017 Coastal Master Plan were identified, formulated and then evaluated. However, this project identification process is divorced from an understanding of the analyses that describe the without action future environmental conditions. Some of the projects and programs in the 2022 should be identified and formulated as a response to those future conditions. Most SEB member' reflections cite the need in the 2022 Coastal Master Plan for formulation of a program of planned retreat from predicted rising sea levels and associated increased effects of periodic flooding for areas that

will not benefit from the master plan selected projects, and perhaps even for some of those areas.

Theme III - Adaptive Management

The SEB supports the 5-year update process as a form of programmatic scale (as opposed to project scale) adaptive management (AM). There are implications for the data that might be prioritized for collection through SWAMP if a programmatic AM, as opposed to project specific AM, is the focus.

Theme IV - Communication and Outreach

The SEB is impressed with the efforts at stakeholder outreach. The reflections include suggestions for enhancement of that work.

2.0 Member's Reflections

2.1 Theme I – Modeling

2.1.1 Future population and asset location scenarios

Expected future without action storm damages, as well as expected reduction in damages for master plan projects, depend on the assumed location of populations and assets in future years. This assumption is critical to the results from every storm risk assessment.

There was reference to a concentrated growth scenario in the 2017 Coastal Master Plan documentation, where the future location of population and assets was influenced by the land loss projections. However, this was not the scenario that was used to estimate the without action future storm damages and the effect of the master plan selected alternatives on damages reduced.

In fact, population and asset location will be influenced by social and economic changes in the area and in the larger national and international economy, as well as by land loss. This reality was noted in a previous SEB report, but planning had progressed too far to make changes to the projections for the 2017 Coastal Master Plan. Looking to the 2022 Coastal Master Plan there needs to be rigorous development of credible social and economic scenarios that can be used to describe alternative population and asset locations, much as the current master plan has alternative environmental scenarios.

I recognize that if any prediction of future population and asset locations may be more uncertain than predictions of physical system changes. Nonetheless there is a literature of scenario building and choosing credible scenarios, based on sensitivity analysis and securing consensus of experts.

2.1.2 Decision relevant metrics

1. Storm Risk: Expected storm damages reduced has been used to measure project benefits that are compared with project costs, in effect to justify the investment made in that project. However, residual damages (remaining damages with all projects in place) and not damages prevented may be a preferred way to report the future conditions with the master plan projects in place. Damages prevented may be significant, but if residual damages are trending upward even with master plan projects in place this needs to be emphasized. Residual damages, and not damages avoided, will influence household, business and community relocation decisions, and should be considered in constructing population and asset location scenarios (see above).

2. Routine flooding: The 2022 Coastal Master Plan needs a metric that is about “sunny day” flooding, or flooding that is not storm driven. The MPDT has begun analyses to represent changes in routine flooding and are encouraged to keep up the progress. One suggestion is to define a threshold elevation which will create nuisance flooding and then report on changes in the frequency of nuisance flooding as a risk metric. Changes in frequency of nuisance flooding will influence household, business and community relocation decisions, and should be considered in constructing population and asset location scenarios (see above).

3. Land building: The metric of “acres built” is widely understood in the region and the benefits of land building as an end itself do not need to be defended by further analysis of land building benefits. However, there are potential adverse effects of land building on some interests. There were several metrics used in development of the 2017 Coastal Master Plan that were deployed to identify adverse effects. Adverse effects can be better recognized and addressed, ideally using a reduced number of metrics from the 2017 Coastal Master Plan, 2022. Examples follow:

- Allocate funds to improved assessment (and data to support such assessment) of adverse impacts on legally and politically important species.
- Identify any strong correlations between metrics and where these exist use a single metric to represent effects.
- Where mitigation to avoid adverse effects is possible formulate mitigation plans, estimate the cost of that mitigation and add mitigation costs to the cost of the projects. Examples of adverse effects include disruptions to navigation which can be mitigated by dredging, induced flooding which can be mitigated by protection works, elevation or buyouts, and changes in the location and mix of commercial species that can be mitigated with an assistance program for the temporary reduction in net income of commercial harvesters.

2.1.3 Socio economic Analysis

Socio economic analysis should focus on predicting behavioral responses to incentives (market and policy) and to changes in storm and routine flooding (see above). In addition, socio economic analysis may be needed to estimate mitigation costs (see above).

2.2 Theme II – Strategic Thinking

2.2.1 Projects eligible for the master plan budget

Projects were nominated for the 2017 Coastal Master Plan by project advocates or were selected from existing lists of projects that had been considered for the coast in previous reports. Some of the specific design or operational features for some projects were modified in the process of formulating the projects for the master plan. All required construction action of some sort (here I include elevation and buyout).

The projects were evaluated in order to determine whether the cost for construction was justified either by storm damage reduction benefits or by acres of land built. The result was to pick areas that would be protected from episodic storm events and land that would be created or retained in the future. The costs of the justified projects were paid from the master plan budget (a hypothetical amount of \$50B).

The 2017 Coastal Master Plan did not spend master plan budget funds for facilitating human adjustments to the predicted changes in environmental conditions for places that received no protection or land building. The 2022 Coastal Master Plan should consider formulating and evaluating adaptation and retreat alternatives and allocate funds for the master plan budget to those alternatives, in addition to construction projects. Illustrative human adjustment alternatives (projects) might be cost sharing for new home purchase is another area, a subsidy to purchase flood insurance, and providing leadership to secure interagency coordination for

retreat plan development. If funds are not to be allocated from the master plan budget then the plan should indicate what other agencies and funding sources could support these human adjustment programs.

2.2.2 Coast by Design

A coastal design approach to the 2022 Coastal Master Plan might be developed in two steps. First, describe a “coastal line” for the year 2030 (or some other future year) under a most likely hazard and population and asset location scenario. The line would likely follow high ground (for example +2 BFE for the 100 year flood in that future year) and consider the storm surge defenses that are expected to be in place in that year. The line might reimagine the navigation channel and port system locations. The premise is populations and assets that are not dependent on direct water access would concentrate behind that line. Second, given that premise formulate alternatives that include an array of projects and programs to facilitate relocation of communities and assets to that coastal line. Regarding land building projects for the 2022 Coastal Master Plan, the scenario analysis would be used to identify land creation locations that can be sustained over the longer term.

2.3 Theme III - Adaptive Management

2.3.1 Adaptive Management and the 5 year master plan revisions

Adaptive operations (AO) occur when specific projects are operated to seek out ways to maximize benefits (for example land building) and minimize adverse effects (for example estuary impacts). Adaptive operations will occur within boundary conditions defined in a project permit and operations will be based on “triggers”, such as measured salinity in the receiving basins, or dates during which estuary species are particularly sensitive to freshwater pulses.

In contrast, the purpose of adaptive management (AM) at the program level is to allow for modification of projects' triggers in future if what is learned suggests that new operational practices outside the triggers will, for example, enhance land building and/or reduce adverse effects. Most important, AM allows for modifications to the overall master plan strategy based on what is learned about not only the projects, but also what is learned about changes in external environmental and socio- economic conditions. The 5 year master plan revision process is about AM and not AO, yet the presentations to the SEB were actually about AO for diversions.

The time between 2017 and the 2022 master plans, and future master plans, will allow for tracking how projects are performing but also what changes are occurring in the coastal physical, biological and socio economic setting. The SWAMP program can identify and then monitor the physical, biological and socio economic conditions most relevant to the development of each master plan revision. In particular, monitoring socio economic conditions (populations and assets) as much as the physical and biological system - perhaps more so – is a priority because future socio economic conditions are less predictable, subject to sudden and significant departures from trends, and are likely to have major effects on the master plan revisions.

3.0 Member's Reflections

3.1 Theme I - Modeling for 2022

3.1.1 Land metric

Currently, one of the two metrics used in modeling future outcomes is the amount of land either created or preserved. While this metric has the advantage of being easy to understand and easy to model and measure, the disadvantage is that there is a lack of *clarity* about why, exactly, this metric is being used.

CPRA should consider more sophisticated metrics regarding the creation and preservation of land – for example, the value of ecosystem services that wetlands provide. Such metrics will be more complicated to craft, but they will have the advantage of bringing clarity to the question of land creation/preservation. It would also open up the possibility of a more sophisticated understanding of the costs and benefits of specific efforts to create or preserve land.

3.1.2 Cost-benefit assessment of resettlement

With each coastal plan update, CPRA will have to acknowledge more openly and more specifically that all areas cannot be protected and some resettlements will occur. However, such resettlements are not currently included in the model. In the future, CPRA should consider the cost of resettlement as if such resettlement were another “project”. (And saved costs from other agencies, see above, should be included.) This will be controversial, and will have to be balanced against non-monetary considerations regarding the lives of the individuals involved. But it will bring to light a broader set of considerations that need to be discussed overtly.

3.2 Theme II - Strategic Thinking

3.2.1 Future vision

I agree with other SEB members that CPRA should try to reshape the discussion around an affirmative vision of the future, rather than an exercise in determining what to save and what not to save. This does not necessarily mean creating a “plan” for the future of the Louisiana coast and slavishly adhering to it – that is not the nature of adaptive management. But it does mean communicating to all parties that the plan is an acknowledgment that the future of the coast will be different than the present situation, thus allowing the discussion to be re-framed away from the question of who wins and who loses in a gradual retreat effort.

3.2.2 Coordinate with other departments

CPRA has been understandably focused on its own efforts, but the future of the Louisiana coast will be shaped not only by those efforts but by the efforts of all state (and federal) agencies. It would do little good, for example, for CPRA to make a difficult decision not to protect one area, only to have LaDOTD expend funds to repair or improve a bridge providing access to that area. Obviously, this is not an undertaking that CPRA can do on its own; this probably requires gubernatorial leadership.

4.0 Member’s Reflections

4.1 Theme I - Modeling for 2022

4.1.1 Science: Evolution and Evaluation

The science to support development of Master Plans has evolved and is both comprehensive and effective in supporting project selection based on the MPDT’s two decision criteria. The substantial improvements in the ecological modeling, including strengthening of the Habitat Suitability Indices and addition of ecosystem modeling (Ecopath with Ecosim, including Ecospace) are honest, transparent, and well explained efforts that are linked to the ICM and incorporated into the Planning Tool for project consideration. Both the HSI and EwE can be improved and strengthened as CPRA moves forward with 2022 Coastal Master Plan. New ecosystem models (e.g. ATLANTIS) and management strategy evaluations are worth considering. The EwE modeling is very good but estimates of biomasses and yields, and the calibrations and validations supporting them, may not be as reliable as the Appendix C-3-20 write-up suggests. As planning for 2022 Coastal Master Plan gets underway, the MPDT should continually update and correct information, assumptions and parameters in the HSI and EwE. The EwE modeling lends itself to simulations that explore sensitivity of key organisms and communities to changing conditions that affect predator-prey relationships. Typically, effects of variable fishing mortality on target species are simulated in EwE to explore shifts in biomass

distributions of key components of ecosystems. Other simulations that explore effects of stress on the coastal ecosystem are possible.

It is worth noting that the SEB has recommended that “tipping points” for the coastal ecosystem be identified and incorporated by the MPDT into decisions on planning and project selection. Considering biological components of the ecosystem and key organisms, the EwE modeling and the HSI potentially can provide estimates of thresholds and limits that could define tipping points and shifts or declines in ecosystem services.

4.1.2 Changing Ecosystem: Temperature

Effects of future sea level rise on the coastal ecosystem are considered and accounted in the master plan. Effects of temperature on individual organisms and life stages also are accounted for in the HSIs and in EwE modeling. However, the long-term, unidirectional increase in temperature that is expected and probable effects on organisms, estuarine communities and productivity have been less considered. Long-term temperature changes and tolerance limits of organisms should be modeled. Tolerances to low temperatures are variable for many coastal Louisiana organisms (e.g., many taxa fall into the ~0-12 C range) and are not a concern in future decades, but high temperature limits for extended habitation and successful reproduction are mostly near 32 C (with a few exceptions), a temperature that may prevail for prolonged periods in the future. What will be the ecosystem effects of long-term, elevated mean temperatures?

4.1.3 Decision Drivers

The two decision drivers, Land Building and Risk Reduction, are easy to understand. The land building objective is commendable but achievable only in patches and probably with a high degree of uncertainty. Planners need to keep in mind that the Louisiana coastline is on a “one-way trip” when selecting projects that promise to build land. The risk reduction driver is necessary and, to a degree, achievable. The EAD metric is understandable, but results projected by the planning tool and presented to the SEB at its 6 December meeting were not particularly reassuring in terms of predicted outcomes of project implementation on risk and EAD. The land building metric, unless demonstrated to be successful on a reasonably large scale, could bring false hope to stakeholders. Conversely, it is probable that small gains from implemented projects in some places may persist for decades and could support valuable industries and communities.

4.2 Theme III - Adaptive Management

The MPDT has done a commendable job in developing its adaptive management plan. The proposed AM at the program level is especially important to assure smooth transitions in the five-year planning and projects implementation processes. The AM planning is a worthy goal for individual projects as well but will be logistically challenging, given the large number of projects. Monitoring and evaluation steps are costly and time-consuming, but important for effective AM. The SWAMP monitoring and evaluation protocols appear to be well considered and are critical for successful AM. Success of the SWAMP in supporting AM apparently is dependent on multi-agency good-will, collaboration, and commitments to funding, which could be challenging and a potential impediment to AM, especially at the individual project level.

The MPDT has recommended appointment of an Adaptive Management Coordinator. Hopefully, this good idea will be implemented. Coordination and implementation of proposed AM will require effective leadership.

4.3 Theme IV - Communications and Outreach

The planning process and implementation of the master plans presents opportunities for stakeholders to develop new industries and occupations in the coastal zone, despite its probable diminished extent. Although possibly beyond expectations of MPDT commitments,

educating, advocating, and informing communities of opportunities (i.e., extension activities) in a changing coast and ecosystem could be valuable contributions to assure sustainable coastal communities. One example, hardly considered in the master plan, is the potential for development of extensive aquaculture in a changing coastal zone. In the US and globally, aquaculture has become a major producer of fishery products, with strong future potential. This may be the case in Louisiana, especially for oysters but also other species.

5.0 Member's Reflections

5.1 Theme I – Modeling for 2022

5.1.1 Socio Economics

The socio-economic research and data analysis, including economic and demographic modeling, needs to be expanded substantially. Over the next few decades, the issue will not be so much how to protect the people who will remain in place, but how to deal with the people who will have to move. This data and analysis should focus on people and communities, not just dollars and cents, and include such data and analysis as historical cultural adaptations of coastal Louisiana populations (to get an idea of how they may adapt in the future) and levels of education, training and other characteristics necessary for successful adaptation. For example, which people, communities and infrastructure will likely have to relocate, and how, when, and where will this relocation take place? How will the different community characteristics either help or hinder them in this effort? What resources will be required, both public and private, monetary and otherwise, to accomplish this?

5.2 Theme II – Strategic Thinking

5.2.1 Relocation and retreat

Beginning with the 2017 Coastal Master Plan, reference should be made to the term “planned retreat/relocation” (or whatever phrasing seems most appropriate), which will be necessary for many people and much infrastructure in South Louisiana in the next few decades. Much of the current material makes the implicit assumption that people, business and industry and communities will be able to remain in place which, following on from the master plan analysis itself, will clearly not be the case. It is important to begin to discuss this idea in a serious, transparent and complete way.

5.2.2 Legal Analysis

Work should begin, and become increasingly included in the master plans, regarding the legal and public trust policy aspects of Louisiana's coastal future. Issues such as eminent domain, fiduciary responsibility for permanently inundated infrastructure, and authority and responsibility for relocation decisions and costs should be fully explored and their role in future planning discussed.

5.3 Theme IV – Communication and Outreach

5.3.1 Terms used

Subsequent master plans should begin to shift away from language and concepts such as “land loss”, “risk” and “hazards” to concepts such as “permanent inundation”, “loss of use and access” and “the new (different and changing) Louisiana coast”. This will be necessary to convey the difference between periodic storm events, which come and go and whose effects can be dealt with ‘in place’ (and will still be occurring ‘on top of’ sea level rise), and phenomena such as sea level rise, which are essentially permanent changes of state requiring permanent shifts in coastal biophysical, socio-economic and infrastructural configurations. For example, the current Section 3.6.7 in the draft 2017 Coastal Master Plan outline is titled,

“Protection/Restoration Balance”, and might be retitled, “Protection/Restoration/Relocation Balance”.

5.3.2 Resource Adequacy

Although the public outreach component of the 2017 Coastal Master Plan is well designed and well executed given the current staff and funding allocation, not enough resources have been devoted to its implementation. Much more use should be made, for example, of state of the art visualization techniques (think Google Earth street level visualizations) to help coastal populations and decision-makers become fully cognizant of the changes that are likely to occur in their communities and on the Louisiana coast. This will require both specific technical expertise and dedicated funding.

6.0 Member’s Reflections

6.1 Theme II - Strategic Thinking

6.1.1 Identify a “Sustainable Front Line”

Given the inevitability of a continuing net loss of land, CPRA should use the expertise it has engaged in all of its activities, along with stakeholder input and the extensive modeling capabilities it has developed to identify sustainable areas. By this I mean to identify:

- 1) Areas we know absolutely will be lost due to subsidence, erosion, SLR and storm susceptibility. For those areas begin a strong communication and stakeholder outreach strategy to identify an adaptive transition plan that can minimize economic, social and environmental losses.
- 2) A reasonable retreat line such as the conceptual ideas in all 3 Changing Course reports. With the scientific data developed to date, a far more reasonable and scientifically defensible region could be developed. It doesn't have to be a single line. It could consist of, as at least one of the CC course teams identified, an economic corridor, a community's network and an ecosystems framework. A focus of resources on strengthening these safe areas will help with retreat strategies and socio-economic sustainability.
- 3) Areas and assets that we value most, given the inevitable retreat of land. This may mean a fundamental shift in project formulation that identifies projects specifically to support geographic areas with high ecological, economic or social value. The selection of the areas can be based on what you now know about the changing landscape, community inundation and fine-tuned to potential projects that have higher probability of sustainability. Given the messaging and communication already accompanying the 2017 Plan, this is an excellent time to really get communities engaged in helping CPRA identify what is most important to them and what projects should be moved forward. A bottom up perspective could bring value to a top-down project formulation strategy. It could also generate support and buy-in by those most impacted.

6.1.2 Conduct a transportation and navigability study

Since navigation and the ports in LA provide a critical economic driver for local, state, regional and national level interests, a detailed study of port, channel and intermodal options should be considered. This includes realigning the channel to a “sustainable front Line”, consideration of intermodal transportation corridors or off-shore port platforms. To do this, there will need to be considerable navigability, economic and engineering studies done to determine which alignments, locations, and intermodal options minimize dredging and operations, impact or enhance environmental assets, optimize economic throughput and provide safe navigable routes for shippers. Consideration must be given to current and future commodities/economies, the industries involved, and the employees who must work there. The sooner this is done, the

sooner benefits can be realized. If continuing with METRIC evaluation rules, it is suggested you should align your metrics to consider safety, through-put, and O&M. It is better to include navigation, industry and fisheries in the formulation of projects that provide benefits to those interests up front. This may help leverage resources.

6.1.3 Broaden the resilience alternatives

CPRA is doing a good job considering “non-structural” mitigation strategies and coordinating resilience with other agencies. However, these strategies should go well beyond elevating, buying or flood-proofing homes. For example, where transportation, critical infrastructure, schools and hospitals and utilities are located drive development and incentivize businesses and individuals to stay or locate in high risk areas. Therefore, not only should critical infrastructure be modeled in the 2022 plan, but policies should be considered that require any investments in this type infrastructure be guided by resilient design principles, strict adherence to building codes and good land-use policies. While a community’s social cohesion can make them more resilient, it can also make decisions to leave an area very hard. It is critical that the relocation alternatives go beyond “buyouts” to explore more holistic planning, policy and incentive measures that preserve communities, consider social justice and affordability and dis-incentivize quick fixes or short sighted options to allow development in high risk areas. (see below recommendation for a relocation alternatives study).

6.1.4 Conduct extensive research on a real retreat/relocation strategy

In addition to Isle de Jean Charles, there are numerous examples of retreat (see below examples). Not all relocation/retreat stories are related to flood or climate change. And what we know is buy-outs alone are NOT a retreat or relocation strategy. There have been numerous historical examples of retreat and migration due to various hazards whether it is drought, nuclear exposure, volcanic eruptions or other. While CPRA may not have authorities to implement broader relocation strategies, it could use its resource to conduct a study that reviewed these historical examples and identified the political and institutional barriers that inhibit success. This type of study would be invaluable not only to Louisiana, but to other areas of the US subject to climate change impacts.

- NYT - Resettling Isle de Jean Charles
- <http://www.nytimes.com/2016/05/03/us/resettling-the-first-american-climate-refugees.html>
- Bloomberg - Sandy Blue Acres Program
- <https://www.bloomberg.com/view/articles/2016-08-22/nj-s-blue-acres-program-a-new-strategy-for-climate-change>
- NYT - Alaska City Retreats due to SLR
- <http://www.nytimes.com/interactive/2016/11/29/science/100000004788791.app.html?nytapp=ipad&r=1>
- Devil’s Lake, ND - closed basin lake that was subject to slowly rising water tables (could be a proxy for a SLR scenario in a coastal town).
- <http://www.theatlantic.com/national/archive/2011/05/where-the-roads-end-in-water-the-lake-that-wont-stop-rising/238848/>

7.0 Member’s Reflections

7.1 Theme I – Modeling for 2022

7.1.1 Prediction Uncertainty

Predictions of climate change are scary, but also very uncertain. We can experience an eustatic Sea Level Rise of 1 or 2 meters in 100 years, but it can be also 0.3 or 0.5 meter only. Also modeling has large uncertainties, which are difficult to estimate. We know the direction in which changes will go, but not their magnitude. This is where adaptive management steps in. The plans

should not be rigid; they need a lot of flexibility to be changed if the circumstances change. The no-regret measures should be carefully selected and implemented soon, measures with short implementation time could be postponed until we better understand what is happening.

The way the 2017 Coastal Master Plan modeling is set up introduces system tipping points related to the use of historical time series (storms, Mississippi flows) as boundary conditions. These tipping points have a large impact on the results of simulations. Consider using a Monte-Carlo or other probabilistic approach to reduce this impact, and to assess sensitivity of the method to sudden impacts (hurricanes, droughts).

7.2 Theme II - Strategic Thinking

7.2.1 Target projects for longevity

The outcome of modeling leads to the conclusion that most of land building projects will probably be lost in 50 years. A major part of the \$50 billion investment will be lost to the sea. A paradigm shift is required. Consider changing the objective of the next master plan from building and sustaining as much land as possible in coming 30-40 years to building land in more concentrated areas that could sustain changes. The objective of the Master Plan would be to preserve a certain part of the coast which should be preserved for the next generations. Selection of the areas to be protected is done top-down, while the projects to realize this objective are selected bottom-up.

7.2.2 Port access

Consider introducing long-term concepts like creating a new access to the Port of New Orleans. Relocation of the navigation channel would allow using 100% of sediment load of Mississippi for land building. If the bird-foot delta is going to disappear anyhow in the long term, it is unlikely that the existing navigation channel will be kept as it is now at all cost.

7.2.3 Sediment resources

The availability of sediment in the Mississippi River has strongly decreased in the last century due to construction of dams in the upper basin. This forms a serious constraint for the restoration of the lower basin. Therefore, a part of the solution should be sought outside of the borders of Louisiana. Considering the national importance of the Mississippi River, this should be dealt with at the national level.

7.3 Theme III- Adaptive Management

Intensive monitoring should be used to expand the knowledge base, to improve our understanding of environmental processes and to improve the models. Lessons learnt from monitoring can also lead to new ideas for more effective projects or improvement of already constructed projects.

8.0 Member's Reflections

8.1 Theme I – Modeling for 2022

8.1.1 Progress is Impressive

I am extremely impressed with the continued, on-time, steady progress being made on Master Plan development. Highlights include the successful simulation of multiple recommended projects together, their consistency (plus positive interactions) relative to the non-interactive sums of individual projects, and the simulation (plus positive interactions) of sustained wetlands on risk outcomes. The clarity of the bar graphs summarizing sustained land areas and risk reductions (e.g., slides 19 to 28) are significantly improved relative to previous iterations, and these improvements are consistent with feedback received early from the SEB. Also the focus on

medium and high scenarios (rather than the low scenario) is consistent with feedback received early from the SEB.

8.1.2 Show Annual Damages Relative to the Local Economy

To further clarify the significance of expected annual damages, perhaps also display them as a percent of some relevant annual measure of local economic output. It's hard to understand if \$10 billion in expected annual damages is very large or not without comparing it to a reference economic value.

8.1.3 Integrate (Land) x (Years)

I suggest integrating sustained land area times years as an additional metric for success under various scenarios. The value of sustained land relative to FWOA includes both its area and the time over which it exists. For example, a scenario that sustains a large amount of land through year 45, but loses a lot of land by year 50, could still be worthwhile compared to one which has much less land in years 20, 30 and 40, even though it has slightly more land in year 50. The integrated metric could be something like (Years) X (Square Miles Sustained).

8.1.4 Emphasize the Restoration Economy

More emphasis could be made regarding the direct benefits of the coastal protection and restoration economy. How much additional economic growth might there be in the region due to both the jobs created by the protection/restoration effort (and the jobs saved by risk reduction)?

8.1.5 Continue to Clarify the Degree of Recurrent Flooding of Communities

A relatively simple metric might be the future number of days per year that flood water up to a given depth is predicted to be present over a given community and on specific areas of individual communities. A useful related metric could be the days per year that roads to a given community will be flooded up to a given depth.

8.1.6 Explicitly Include Mitigation in Future Master Plans

The present simulations of project impacts relative to FWOA do not include potential mitigation of some possible negative effects of protection/restoration. For example, turning off diversions during periods of very low river flow has been predicted to cause salinity shocks leading to sudden loss of wetlands. In future Master Plan scenarios, mitigation of locally severe negative effects such as this should be considered as an explicit part of sustained land predictions.

8.1.7 Multiple River Discharge and Storm History Scenarios in "Final" Predictions

Diverse discharge and storm histories (with the same total discharge and number of storms) should be used in the future for "final" Master Plan scenarios, with the average amount of land sustained by these diverse histories considered to be the most probable prediction for the future. An average of as few as three different histories could still help reduce the potentially misleading major effect of a stochastically unlikely single event dominating the response of the predicted future distribution of wetlands.

8.1.8 Metrics Presentation (Beyond Land and Expected Damages) is Confusing

In future Master Planning cycles, presentation of secondary metrics should be significantly clearer. Regarding the bar graphs in the metrics presentation section, for example, the lack of units or other clear explanation for the values on several of the y-axes was frustrating. Also the many abbreviations and their inconsistent ordering along on the x-axes added to the confusion. In the future, I suggest that y-axes on metric graphics be normalized to +/- 1 on a scale of significance, with +1 indicating significantly favorable, and -1 significantly unfavorable, and with the importance of +1 and -1 as consistent as possible across all the metrics. The specific

definition of the +1/-1 normalization criteria for each case can be referred to explanations contained in documentation elsewhere. But clearly utilizing a relative significance rating between +1 and -1, and more consistently implementing them across the metrics, would be very useful. The positive and negative impacts on habitats should likewise be normalized.

8.2 Theme III - Adaptive Management

8.2.1 Continue to Formalize the Five-Year Adaptive Management Cycle

Louisiana is far ahead of most other coastal states in adaptively managing the future evolution of their coast. CPRA is to be strongly commended in this regard and should be held up as an example for other long-term regional efforts focused on coastal protection and restoration. Nonetheless, further expansion of open and outward emphasis on the formal AM process in terms of publicly documenting the AM steps in each (past and future) 5-year cycle will significantly aid in maintaining transparency and help prevent some possibly ill-advised policies from continuing under their own inertia. In fact, a more formalized AM structure can and should be the core for organizing, rationalizing and communicating the entire cyclical master planning process. In terms of roles and responsibilities of entities within the programmatic AM process, the mechanism by which the results of monitoring would be assimilated and who would lead that effort was not sufficiently clear relative to other components of AM. Also, the composition and responsibilities of the crucially important Plan Assessment Team needs to be further developed.

9.0 Member's Reflections

9.1 Theme I - Modeling for 2022

9.1.1 Tipping points (uncertainty/sensitivity analyses)

It is recommended the 2022 Master Plan analyses identify tipping points in the system (physical, biological, socioeconomic, etc. and combinations thereof) and directly consider this information in the alternatives selection/adaptive management process. The models implemented may not adequately capture system/subsystem tipping points (e.g., sudden marsh demise, unplanned community retreat). The relative sequencing of episodic events (flooding, draught), planned interventions, and other reactionary anthropogenic and industry responses should be considered directly (e.g., rigorous Monte Carlo approach, or if not feasible limited scenarios as a sensitivity analysis).

9.1.2 Presentation of flooded areas

(1) show direct inundated area along with change with Plan; (2) include AEP in addition to return period to help overcome misconception with return period

9.1.3 Damages moving forward to 2022

Plan should consider differences between building back as before versus adaptive "building back better."

9.2 Theme II - Strategic Thinking

9.2.1 Relocation

It is recommended the plan's goals be revisited and revised in light of the 2017 analyses and the reality that many communities will need to relocate. At present, the Master Plan treats relocation passively rather than proactively, namely it appears to be dictated by the lack of project specification in an area. Planned relocation needs to be considered explicitly as a project(s) for the 2022 Master Plan. Given knowledge gained in developing the 2017 Plan, develop a desired target for coastal Louisiana in 50 years then identify projects that promote achieving this target. It is recommended the results be evaluated in the context of selecting the best projects for, for example, (a) providing time for planned relocation and (b) providing time for planning economic sustainability (e.g., if fishing industry or oil/gas industry decline, what replaces it as the

jobs creator for the region?). Civil infrastructure/critical facilities and its protection is highly relevant to planned relocation, economic sustainability, etc., and, therefore, needs to be specifically integrated into the analysis. In this context, it is important where land is preserved or created (or land loss slowed). Consider comparing cost to reduce land loss versus cost for planned relocation, at different time scales.

9.2.2 Leveraging resources

Current funding for executing the master plan comes largely from post-disaster funding sources (natural and manmade). Moving forward, there is an opportunity to leverage communication and collaborations with other groups, both government and private (e.g., through the outreach steering committee). For example, (a) if the projects remove the need to move transportation networks, perhaps transportation funding can be leveraged for plan implementation; (b) if the projects reduce dredging requirements perhaps navigation funding can be leveraged; (c) if the projects enable oil and gas industry employees to make it to work, perhaps oil and gas funds can be leveraged, etc. Having conversations now to establish agreements/policies with these potential funding stakeholders will facilitate broadening the overall focus and goals of Master Plan, which is currently constrained because of the types of projects existing funding can be used to support.

10.0 Meeting Agenda

Science and Engineering Board (SEB)

In-Person Meeting #4

BRAF Offices – 9th floor, IBM Building
100 North Street (corner of North and Lafayette Streets)
Baton Rouge, LA
December 5-6, 2016

December 5, 2016 – 1:00pm – 5:00pm

BRAF Kantrow Conference Room

1:00pm	Welcome and Introductions	Bren Haase
1:10pm	General Update <ul style="list-style-type: none">• Agenda for Meeting #4• Recap of October Webinar	Bren Haase
1:30pm	2017 Master Plan Update <ul style="list-style-type: none">• Draft plan projects• Draft plan outcomes (results of risk and restoration, project fact sheets, parish fact sheets)<ul style="list-style-type: none">○ Comparison of Planning Tool Results vs. Model Results○ Species Results○ Metrics Results○ Community Inundation	Bren Haase/David Groves Denise Reed/Eric White Brett McMann
4:00pm	Outreach and Engagement Update <ul style="list-style-type: none">• Key Messages/Feedback to Date• Legislative/Parish Outreach• January Public Meetings	Nick Speyrer
4:15pm	Key Insights from 2017 and Opportunities for 2022 Identified by MPDT	Bren Haase
4:45pm	Wrap-up and Next Steps	

December 6, 2016 – 8:00am – 5:00pm

BRAF Boardroom

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| 8:00am | Recap from Day 1 | Bren Haase |
| 8:20am | Individual SEB Members Hot Topics, followed by clarifying questions <u>only</u> , not to exceed 5-10 minutes per person | |
| 10:30am | <i>15 minute Break</i> | |
| 10:45am | Open Discussion | All |
| 12:00pm | Lunch*
* Unfortunately, CPRA can no longer provide meals. Everyone will be responsible for their own for lunch. | |
| 1:00pm | SEB Members Design Final Report and Identify Consensus Points | |
| 4:00pm | SEB Report-out to MPDT | |
| 5:00pm | Adjourn | |