Comprehensive Recommendations Supporting the Use of the Multiple Lines of Defense Strategy to Sustain Coastal Louisiana

Planning Unit 1

Lake Pontchartrain Basin Foundation
Coalition to Restore Coastal Louisiana

Workshop Presentation
November 16, 2007
Requirements for Implementation of the Multiple Lines of Defense Strategy to Rebuild Louisiana’s Coast and Hurricane Protection

Technical Workshops

Sponsored by the Lake Pontchartrain Basin Foundation and the Coalition to Restore Coastal Louisiana

Planning Units 3b and 4 - November 6, 2007
McNeese University (room announced later), Lake Charles, La.

Planning Units 3a and 3b - November 16, 2007
Houma Civic Center, Houma La.

Planning Units 1 and 2 - November 16, 2007
Bayou Segnette State Park

The workshops will start at 8:00 am and end at approximately 3:00 pm
Workshop Objective
Three workshops will be held to discuss and identify the essential recommendations to restore the coast, levee improvement, elevating homes and all other “Lines of Defense” as described by the Multiple Lines of Defense Strategy. Focus will be on not just the individual components of a plan but their relation to each other. Integration means components should mutually support and not conflict with their contribution to the overriding goals of improving flood protection while sustaining the coastal estuary. Notes from the meeting and other related documents will be posted on the MLODS website (www.mlods.org) after the workshop. The overall goal is to facilitate convergence on the best projects to keep our coast healthy while providing adequate flood protection from storm surges.
Multiple Lines of Defense (MLOD) are definable geographic areas in which certain natural or manmade features or activities are promoted or implemented, resulting in the reduction of impacts by tropical weather systems to the Louisiana coast.

The order of LOD’s derived from the physical location of the LOD’s moving from the Gulf of Mexico inland. The order is not intended to indicate a relative significance, just relative physical position.
Source: FEMA Inundation Maps (2006), map adjusted in Orleans and Jefferson Parishes to show approximate inundation.
Hurricane Katrina surge, Note: 5-foot reduction across 14 miles = 1'/2.8 miles

Figure V-36. Maximum computed storm surge using the ADCIRC model, Mississippi to Louisiana region (water levels in feet, NGVD 29)

Interagency Evaluation Performance Task Force, March 2006
100 - Year Surge Frequency Contours

Legend
- Primary Roads
- Planning Unit Boundary
- Leveed Area

Contours (feet)
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 18.5

Notes:
- All levees are assumed to be at authorized grades.
- Contours shown are for outside existing levee systems only.
- Contours reflect still water elevations only.
- Outer perimeter of contour map does not reflect limits of flooding.

March 25, 2007

DRAFT
Louisiana Coastal Protection and Restoration
Planning Units 1 & 2

500 - Year Surge Frequency Contours

Legend
- Primary Roads
- Planning Unit Boundary
- Leveed Area

Contours (feet)
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22

Notes:
- All levees are assumed to be at authorized grades.
- Contours shown are for outside existing levee systems only.
- Contours reflect still water elevations only.
- Outer perimeter of contour map does not reflect limits of flooding.

March 26, 2007

DRAFT
Existing Wetland Habitat Distribution, circa 1988
The wetland habitat goals are the desired future habitat distribution proposed in this plan. This habitat distribution was selected because they compliment other restoration proposals, and they represent potentially sustainable conditions for the coast. The wetland habitat distribution, in general, also corresponds to the historic distribution of habitats around 1900 before significant alteration by humans. One exception is in the area of Atchafalaya & Vermillion Bays where the habitat goals are fresher than historic 1900 conditions. The post-1900 freshening here is due to the increase in discharge through the Atchafalaya River. Since it is desirable to continue the land building of the active deltas which also contribute to the western shore’s mud stream, it is not considered desirable to re-establish the more saline conditions of 1900 in this area of the coast.

<table>
<thead>
<tr>
<th>Wetland Habitat Types</th>
<th>Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline</td>
<td>18 ppt</td>
<td>8-29 ppt</td>
</tr>
<tr>
<td>Brackish</td>
<td>10 ppt</td>
<td>4-18 ppt</td>
</tr>
<tr>
<td>Intermediate</td>
<td>4 ppt</td>
<td>2-8 ppt</td>
</tr>
<tr>
<td>Fresh Marsh/Swamp</td>
<td>0 ppt</td>
<td>0-3 ppt</td>
</tr>
</tbody>
</table>

Draft Wetland Habitat Goals

The wetland habitat goals are the desired future habitat distribution proposed in this plan. This habitat distribution was selected because they compliment other restoration proposals, and they represent potentially sustainable conditions for the coast. The wetland habitat distribution, in general, also correspond to the historic distribution of habitats around 1900 before significant alteration by humans. One exception is in the area of Atchafalaya & Vermillion Bays where the habitat goals are fresher than historic 1900 conditions. The post-1900 freshening here is due to the increase in discharge through the Atchafalaya River. Since it is desirable to continue the land building of the active deltas which also contribute to the western shore’s mud stream, it is not considered desirable to re-establish the more saline conditions of 1900 in this area of the coast.
Conceptual Design of Surge Transfer Spillway

Levee

Spillway

Levee
Conceptual Design of Controlled Crevasse Levee
Un-modeled Alternative for PU 1: Alignments for levees, gates and spillway

Graph showing various alignments and markers for levees, gates, and spillways.
Levee Protected >> Non-Structural Measures for Indirect Storm Surge

Non-levee Protected >> Non-Structural Measures for Direct Storm Surge
See alternative levee alignment (Figure 19)
<table>
<thead>
<tr>
<th>Name</th>
<th>Proposed CFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayou Manchac</td>
<td>200</td>
</tr>
<tr>
<td>Bayou Braud</td>
<td>200</td>
</tr>
<tr>
<td>Blind River</td>
<td>8000</td>
</tr>
<tr>
<td>Maurepas Swamp Diversion</td>
<td>3000</td>
</tr>
<tr>
<td>Frenier via Bonnet Carre'</td>
<td>5000</td>
</tr>
<tr>
<td>Bonnet Carre’ wetlands</td>
<td>1000</td>
</tr>
<tr>
<td>LaBranche via Bonnet Carre’</td>
<td>4000</td>
</tr>
<tr>
<td>Violet Diversion</td>
<td>20000</td>
</tr>
<tr>
<td>Caernarvon Diversion</td>
<td>8000</td>
</tr>
<tr>
<td>White Ditch</td>
<td>1000</td>
</tr>
<tr>
<td>Bohemia to Ft. St. Philip</td>
<td>100,000</td>
</tr>
<tr>
<td>Benney's Bay</td>
<td>50000</td>
</tr>
</tbody>
</table>

**TOTAL** 200,400

*Legend:*
- 200,000 cfs: Pass discharge
- Restore/enhance Overbank discharge to 50,000 to 100,000 cfs
Approximate Location of Mississippi's Major Oyster producing reefs circa 2004, MS Dept. of Marine Resources

1912 oyster reefs of St. Bernard Parish

Proposed Ford Line (Mean 15 ppt), USACE, 1983

Proposed Palmisano Line (Max. 15 ppt) USACE, 1983

CHMP Baseline Habitat Map for the Lake Pontchartrain Estuary
Re-constructed habitats of the Upper, Middle and Lower Sub-basins from historic habitat data circa 1912-1932.

Reconstructed Habitats of the Lower Pontchartrain Basin circa 1912-1932

- Saline: 18 ppt (8-29 ppt)
- Brackish: 10 ppt (4-18 ppt)
- Intermediate: 4 ppt (2-8 ppt)
- Fresh: 0 ppt (0-3 ppt)
- Fresh Swamp: 0 ppt (0-3 ppt)
Utilize the Caernarvon diversion and a larger diversion at Violette to sustain the two estuaries.

Re-establish the hydrologic and ecologic integrity of Bayou la Loutre Ridge by damming the MRGO channel and restoring the forests of the eastern end of the ridge.
Bayou la Loutre Ridge Restoration

Approximate footprint of 600 foot wide restored natural levee on right descending bank of Bayou la Loutre from MRGO (0 mile):
- 0 - 11.1 miles: 11.1 miles length, 800 acres
- Fill volume approximately 3.2 M cy

Approximate footprint of 600 foot wide restored natural levee on right descending bank of Bayou la Loutre:
- 11.1 to 14.2 miles: 3.1 miles length, 250 acres
- Fill volume approximately 0.9 M cy

Base map source LA SONRIS
Bayou la Loutre Ridge Restoration

Re-forest with indigenous ridge species such as live oak (Quercus virginiana), nutal oak (Quercus nigra), Water Oak (Quercus nigra americana), swamp magnolia (Magnolia virginiana L.) and black willow (Salix nigra).
4000 acres - marsh creation
Actual Discharge vs Potential Discharge 2004
Caernarvon Diversion

Estimate potential discharge

Actual discharge (~20% of the annual potential discharge)
March 2, 2006

USGS National Wetlands Research Center Land Area
Changes in Coastal Louisiana After the 2005 Hurricanes
John A. Barras

September 26, 2006
Diagrammatic Profile

Shoreline Restoration and Protection

Jefferson Parish

Levee

Protected side

Existing shoreline position

Flood Side

200-400 feet

Fill & Marsh creation

Reefballs

Submerged Aquatic Vegetation

Offshore breakwater

Approximately 10:1 Vertical Exaggeration

LPBF - Coastal Sustainability Program 2005
To achieving a sustainable coast it will be necessary to abandon the “Birdsfoot Delta” and create a new river channel or channels between Myrtle Grove and Venice. This will redirect the main flow of sediment and freshwater from the river to the nearshore and the upper continental shelf. Tides and waves will transport the sediments towards shore and rework them into a mosaic of wetlands, shallow bays and barrier islands. Breakup of the largely uninhabited Birdsfoot will supply sand and mud to the new coast and to the westward trending currents. Navigation from the Gulf to upstream port facilities can be accommodated either through a slack water channel and lock or by making a new navigable river channel that relies on dredging and beneficial use as well as river flow for maintenance.

Envisioning the Future of the Gulf Coast (Reed et al, 2007)
Navigation Channel with “sail-through lock”

Delta NWR

Closed

Pass a Loutre WMA
Concerns with Complete Abandonment of the Birdsfoot Delta

- Time to resolve engineering and management issues
- Cost of sail through locks
- Cost to protect channel
- Foundation stability of sail through locks
- Barrier islands are less sustainable than a delta
- Barrier island may not develop due to very high RSLR
- Very high maintenance cost of a new open water channel
- Wetland impact of Channel
- Extensive loss of lower delta wetlands and upland habitat including a NWR and State WMA
1985 image courtesy of NASA

### Recommended Diversions

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Bayou Manchac</td>
<td>200</td>
</tr>
<tr>
<td>15</td>
<td>Bayou Braud</td>
<td>200</td>
</tr>
<tr>
<td>16</td>
<td>Blind River</td>
<td>8,000</td>
</tr>
<tr>
<td>17</td>
<td>Hope Canal</td>
<td>3,000</td>
</tr>
<tr>
<td>18</td>
<td>Frenier Wetlands</td>
<td>5,000</td>
</tr>
<tr>
<td>19</td>
<td>Bonne Carre Wetlands</td>
<td>1,000</td>
</tr>
<tr>
<td>20</td>
<td>LaBranche Wetlands</td>
<td>4,000</td>
</tr>
<tr>
<td>21</td>
<td>Violet</td>
<td>20,000</td>
</tr>
<tr>
<td>22</td>
<td>Caernarvon</td>
<td>8,000</td>
</tr>
<tr>
<td>23</td>
<td>White Ditch</td>
<td>1,000</td>
</tr>
<tr>
<td>24</td>
<td>Bohemia</td>
<td>10,000, 5000, 500</td>
</tr>
<tr>
<td>21</td>
<td>Benney’s Bay</td>
<td>50,000</td>
</tr>
</tbody>
</table>

**TOTAL 200,400 cfs**

Authorized or nearly authorized 105,500 cfs
Or approximately 1/6th of the spring discharge of the Mississippi River
Mississippi R. (below ORC)
AvAnQ 450,000
SpAvQ 700,000
Max Q 1,500,000 to 2,400,000

Atchafalaya R
AvAnQ 150,000
SpAvQ 270,000
Max Q 690,000

9,000 cfs
270,000 cfs flood pulse
690,000 cfs
10,000 cfs flood pulse
15,000 cfs
227,000 cfs flood pulse
718,000 cfs
204,000 cfs Flood pulse
600,000 cfs

200,000 to 300,000 cfs through Navigation channel in typical discharge years