CHANGING RESTORATION COSTS

Prepared for Coast Builders Coalition
Fall 2016

THE WATER INSTITUTE
OF THE GULF®
OUTLINE

Summary Methods  Main Findings  Supporting Graphics
METHODS

• Five different combinations of subsidence/sea-level rise
• Selected 2,000 acre areas across the coast with similar initial conditions
• Estimated fill needed to implement marsh creation in each area under initial conditions and at future 10 year intervals
• Assumed open water up to 2.5ft and 5ft would be filled
• Used project cost analysis based on 2012 MP and MP designated borrow areas to estimate unit costs per mile
• For each area/fill depth converted 2010 costs to 2015 costs
• Estimated future costs of marsh creation in areas using 1% & 2% annual inflation for each future decade
• Estimated savings based on selling 10, 20, 30 year bonds to construct now instead of in the future
• Estimated potential increase in cost if construction is delayed 10 years but funds are in hand
MAIN FINDINGS – FILL REQUIREMENTS/LAND BUILT

- Filling only shallow areas to create marsh reduces volume (and costs) but as water gets deeper less area meets the criteria
- Filling deeper depths to create marsh increases volumes (and costs) but enables more land to be built in future years
- Assumptions about sea-level rise dramatically influence future fill volumes (and costs)
  - Greater increases in SW Louisiana (lower subsidence areas)
  - Lower increases in SE Louisiana but less land is built
MAIN FINDINGS – COST OF DELAY

• Cost per acre created for even the lowest scenario more than doubles in 20 years
• For the medium scenario cost per acre created increases almost 200% in 20 years and more than 600% in 40 years at 2% inflation
• Finding ways to build projects sooner (e.g., selling bonds) decreases total costs
• For the medium scenario savings can be as much as 30% vs waiting 10 years to build – and benefits are realized sooner
• Delays in construction make projects more expensive as water gets deeper, land degrades – cost increase is not compensated for by interest earnings even in low subsidence areas
DISTANCE-COST ASSUMPTIONS BASED ON 2012 MASTER PLAN PROJECT COSTS

\[ y = 1.6662x + 1.7258 \]
\[ R^2 = 0.87785 \]
SUBSIDENCE AND SEA LEVEL RISE ASSUMPTIONS

<table>
<thead>
<tr>
<th>Scenario</th>
<th>2017 MP Scenarios</th>
<th>ESLR (ft/50yr)</th>
<th>Subsidence</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>Low</td>
<td>1.40</td>
<td>Low</td>
</tr>
<tr>
<td>B</td>
<td>Med</td>
<td>2.07</td>
<td>Low</td>
</tr>
<tr>
<td>C</td>
<td>N/A</td>
<td>2.07</td>
<td>Medium</td>
</tr>
<tr>
<td>D</td>
<td>N/A</td>
<td>2.07</td>
<td>High</td>
</tr>
<tr>
<td>E</td>
<td>High</td>
<td>2.72</td>
<td>High</td>
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</table>
Analysis conducted for all areas. Discussion focuses on WLL (higher subsidence) and SAB (lower subsidence).
For higher relative sea-level rise rates, in later years water is too deep for the shallow fill criteria. By year 50 in Scenario E hardly any land can be built using the 2.5ft depth criteria.
CHANGE IN FILL VOLUME OVER TIME – EFFECT OF FILL DEPTH

W. LITTLE LAKE

For deeper fill criteria, volumes continue to increase over time.
CHANGE IN FILL VOLUME OVER TIME – EFFECT OF FILL DEPTH

SABINE

![Graphs showing change in fill volume over time with effect of fill depth.]

- **2.5 ft fill depth**
- **5 ft fill depth**

In lower subsidence areas the decrease in volume in later years is less pronounced.
Volumes needed increase over time in all locations until water depths become too deep for the shallow fill criteria to be met. When this occurs varies by location/subsidence and scenario.
CHANGE IN AREA CREATED AND EFFECT OF FILL DEPTH
WEST LITTLE LAKE

In later years for higher scenarios, less land is built within the 2000 acre area as water depths begin to exceed the fill criteria depth. Less of an effect with the 5ft fill depth.
In lower subsidence areas, marsh creation remains viable for decades even for shallow fill criteria.
Increasing water depths over time, especially in higher scenarios, limit the ability to build land within the areas. For the 2.5ft fill criteria there is less of an effect in the Chenier Plain due to lower subsidence rates.
FUTURE CHANGES IN CONSTRUCTION COST

Construction Cost at Fill Year
West Little Lake 2% Inflation 2.5 ft fill depth

Construction Cost at Fill Year
Sabine 2% Inflation 2.5 ft fill depth

- Inflation influences future project costs.
- Increases still occur even for 1% inflation.
FUTURE CHANGES IN COST PER ACRE

- Cost per acre increases even when area built begins to decline.
- Increase greater in higher subsidence area.
- Increase still occurs even for 1% inflation.
EFFECT OF SUBSIDENCE RATE AND TIME ON CONSTRUCTION COSTS

2.5 ft fill depth - Scenario B (Medium) - 2% Inflation

<table>
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<th>Year</th>
<th>West Little Lake</th>
<th>Sabine</th>
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<tr>
<td></td>
<td>Cost ($k)</td>
<td>Area Created (acres)</td>
</tr>
<tr>
<td>2017</td>
<td>$89,981</td>
<td>2007</td>
</tr>
<tr>
<td>2037</td>
<td>$256,140</td>
<td>1921</td>
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<tr>
<td>2057</td>
<td>$560,076</td>
<td>1667</td>
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SELLING BONDS TO IMPLEMENT SOONER

Scenario B (Medium) 2% Inflation  Bond Rates as of 8/8/16

West Little Lake

<table>
<thead>
<tr>
<th>Bond Until</th>
<th>Bond Cost ($k)</th>
<th>Savings by borrowing to build now ($k)</th>
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<tbody>
<tr>
<td>2027</td>
<td>$105,584</td>
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<td>2037</td>
<td>$131,553</td>
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<td>2047</td>
<td>$179,279</td>
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Sabine

<table>
<thead>
<tr>
<th>Bond Until</th>
<th>Bond Cost ($k)</th>
<th>Savings by borrowing to build now ($k)</th>
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<tr>
<td>2027</td>
<td>$29,373</td>
<td>$11,257</td>
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<td>2037</td>
<td>$36,597</td>
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<td>2047</td>
<td>$49,875</td>
<td>$69,524</td>
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10 YEAR DELAY IN IMPLEMENTATION

Scenario B (Medium)  2% inflation  Interest Rates as of 8/8/16

<table>
<thead>
<tr>
<th></th>
<th>West Little Lake</th>
<th>Sabine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$ Thousands</td>
<td>$ Thousands</td>
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<tr>
<td>Construction Cost in 2017</td>
<td>$89,981</td>
<td>$25,032</td>
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<tr>
<td>Interest earnings by year 10</td>
<td>$15,602</td>
<td>$4,340</td>
</tr>
<tr>
<td>Deficit due to 10 year delay in construction</td>
<td>($57,470)</td>
<td>($11,257)</td>
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