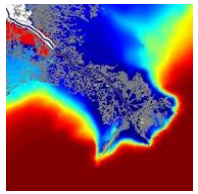
DRAFT
Atchafalaya River Long Distance Sediment Pipeline Feasibility Study (Phase I)

Prepared for the
Terrebonne Parish Consolidated Government
July 2014

Submitted by CBI

Project Goals

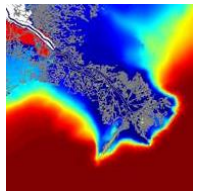


- Engineering, Economics, & Environmental Principles
- Minimization of execution risks
- Construction industry's highest standards
- Cost savings vs. conventional methods
- Consistency with Master Plan objectives
- Parish objectives

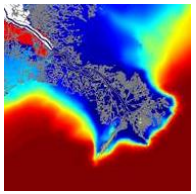
- Coordination with borrow area evaluation team
- Desktop pipeline corridor evaluation and Placement area development
- Pipeline route reconnaissance and field surveys
- Pipeline design criteria development
- Cultural resources and geotechnical tasks
- Stakeholder coordination and public meeting





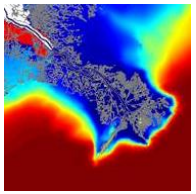



- Pipeline Corridor
  - Intake Structure
  - Pipeline Right-of-Way
  - Design Criteria
- Placement Areas
- Cost Analysis
- Recommendations

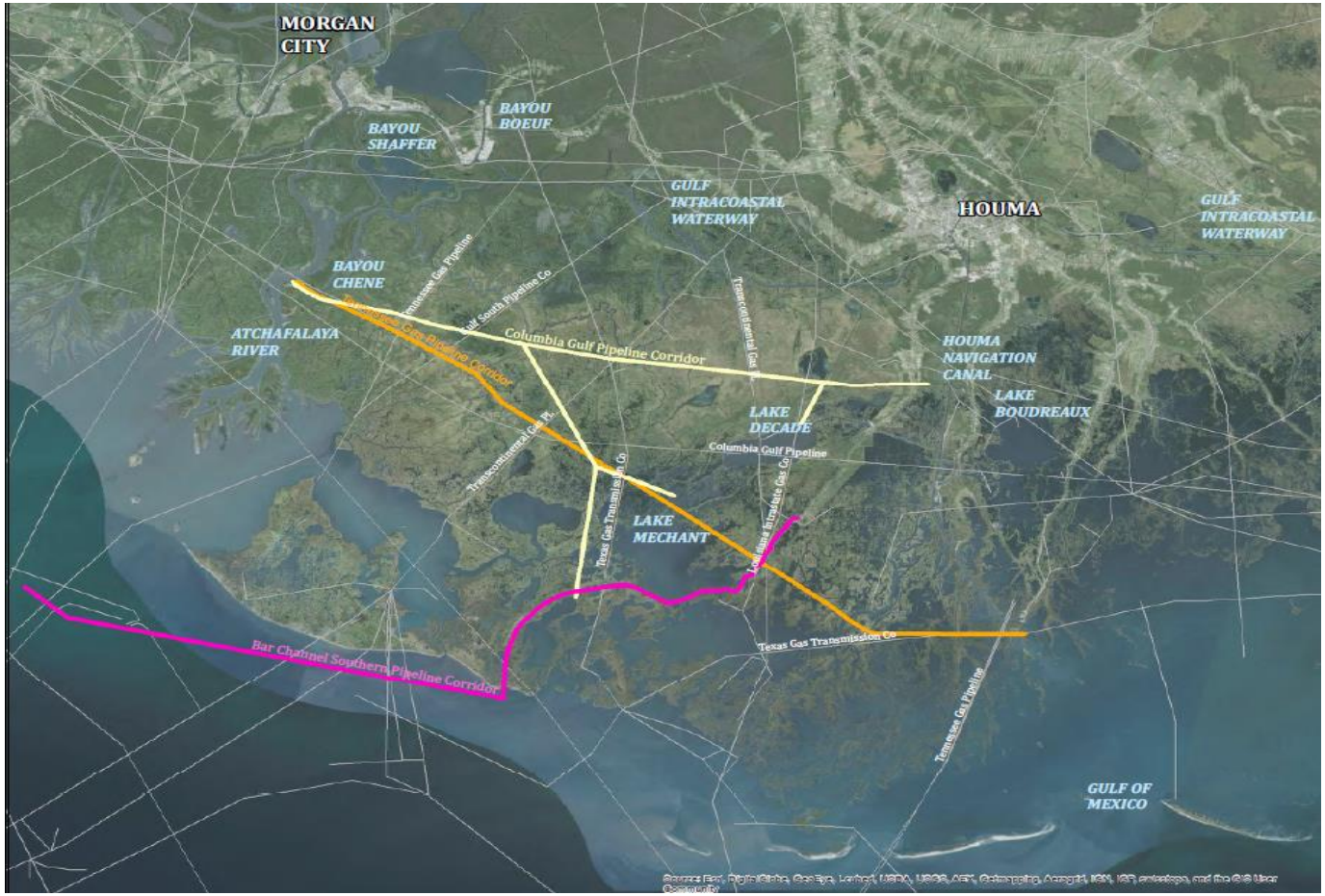


Pipeline Corridor Analysis

- Intake Structure
  - Horseshoe Bend vicinity
  - Intake Structure -Cutter Head and Hopper dredges
  - Cutter Head dredge discharge pipe will directly connects to the intake structure
  - Hopper Dredge (mooring area, re-slurry, and discharge to the intake structure)

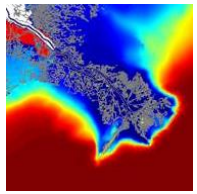


- Tennessee Gas Pipeline (TGP)
- Columbia Gulf Pipeline (CGP)
- Bar Channel- Southern Pipeline (BCS)







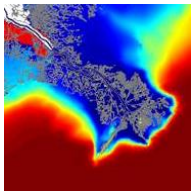
Pipeline Corridor- Selection Criteria

Criteria	TGP	CGP
Sediment Source	X	X
Right-of-Way	X	X
Favorable Topography	X	X
Access	X	
Lack of Physical Obstructions	X	
Permitting Constraints	X	X
Significant Marsh Creation Impacts	X	
Constructability	X	X
Parish Objectives	X	
Louisiana State Master Plan	X	

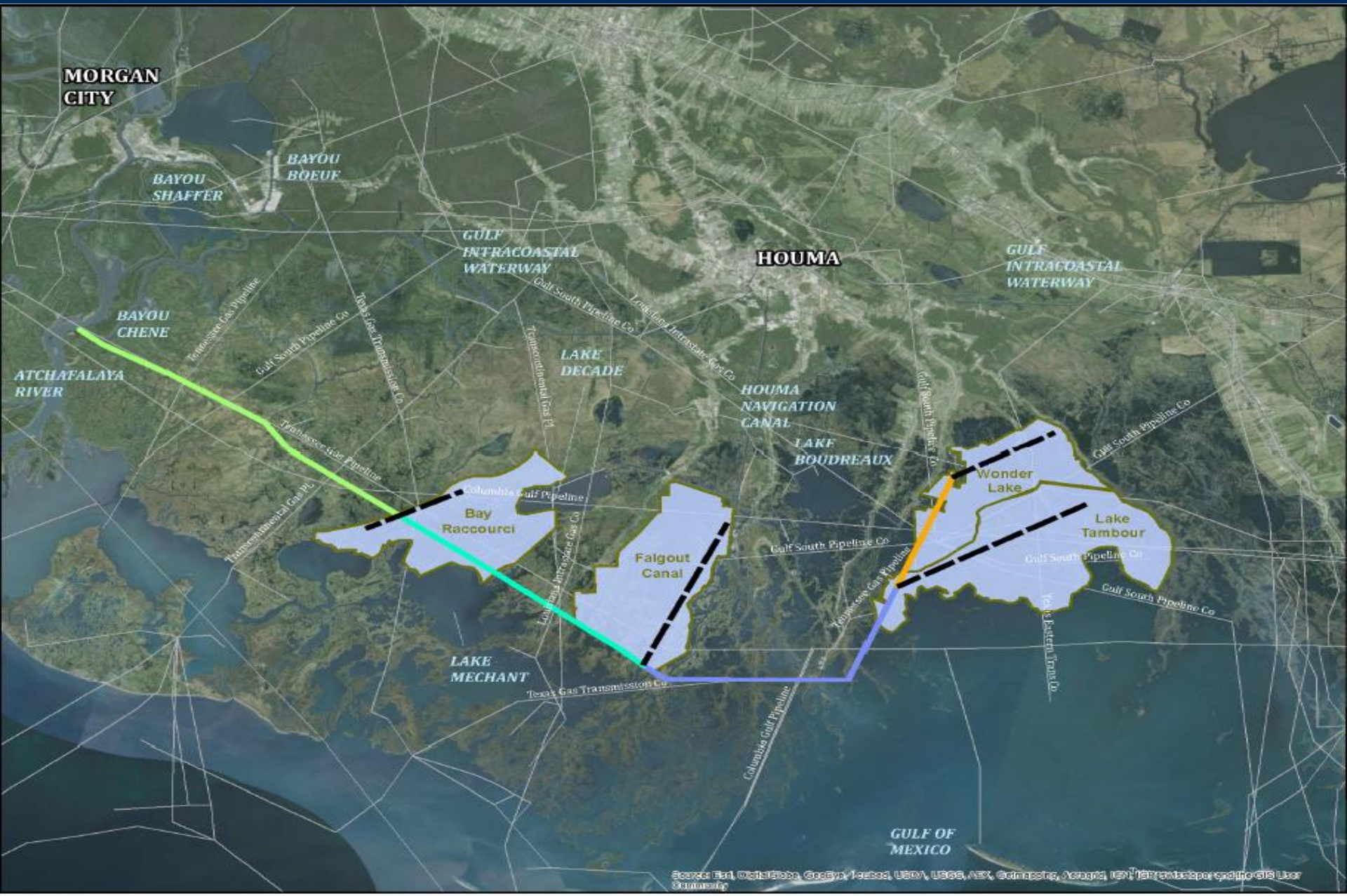
- Existing TGP Corridor (~42 miles)
  - 24 inch gas pipeline (8’ to 12’ deep)
  - 40 feet R-O-W
  - Channel varying in width (60’ to 100’) and depth (2’ to 6’)
- Pipeline Crossings: 29





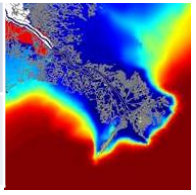



Pipeline Segments



Pipeline Segments- Construction

- **Proposed Pipeline**
  - 42 miles of the existing R-O-W
  - 15 miles of additional R-O-W
- **Four (4) segments**
  - Segment 1 - Bay Raccourci
  - Segment 2 - Falgout Canal
  - Segment 3 - Lake Tambour
  - Segment 4 – Wonder Lake
- Funding, sediment availability, Parish's goals
- Each segment may require combinations of pipeline placement



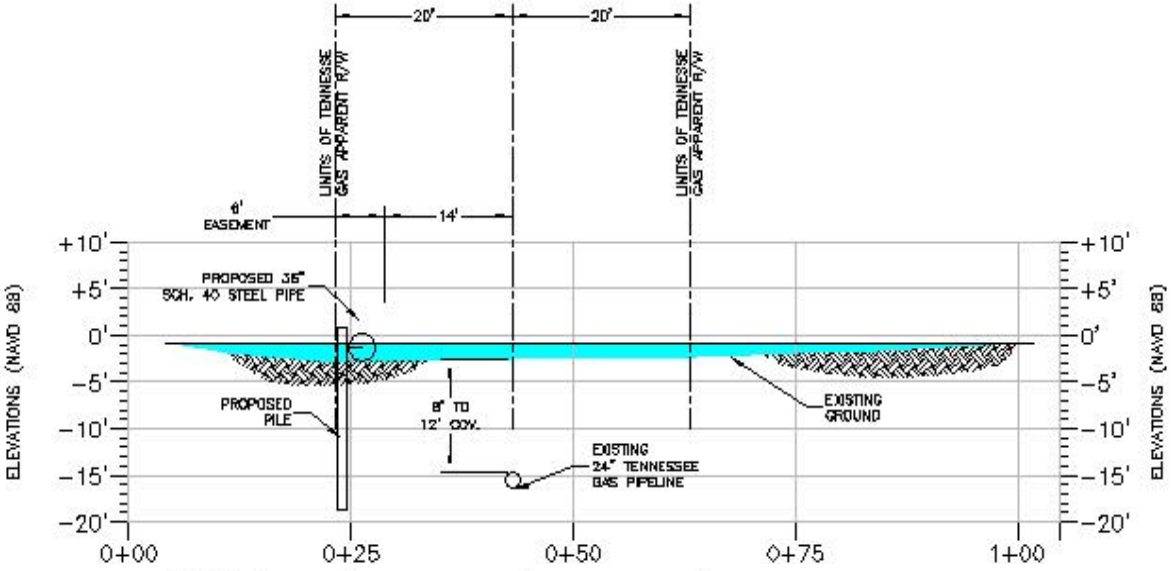
Segment 1 - Bay Raccourci

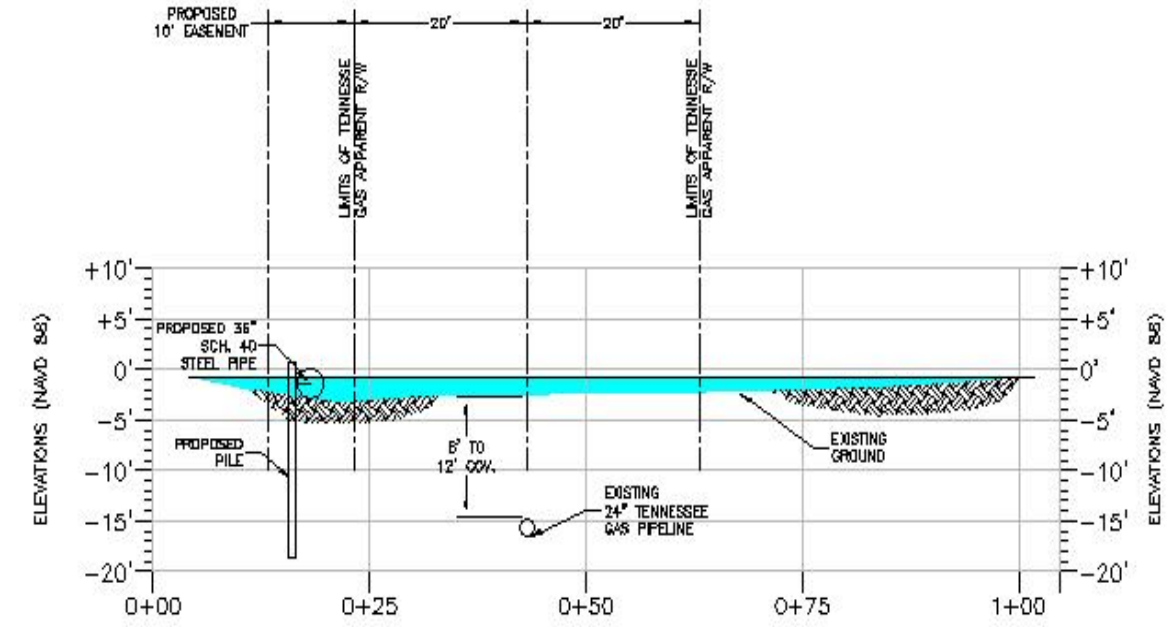
	Miles	No. of Stations
Segment 1		
Trunk Line	19	
Lateral	5	
Booster Stations		3

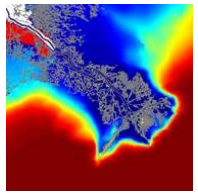
Total Segment lengths and Booster Stations

	Miles	No. of Stations
Totals		
Trunk Line (TPG)	42	
Trunk Line (Non-TPG)	15	
Booster Station		10

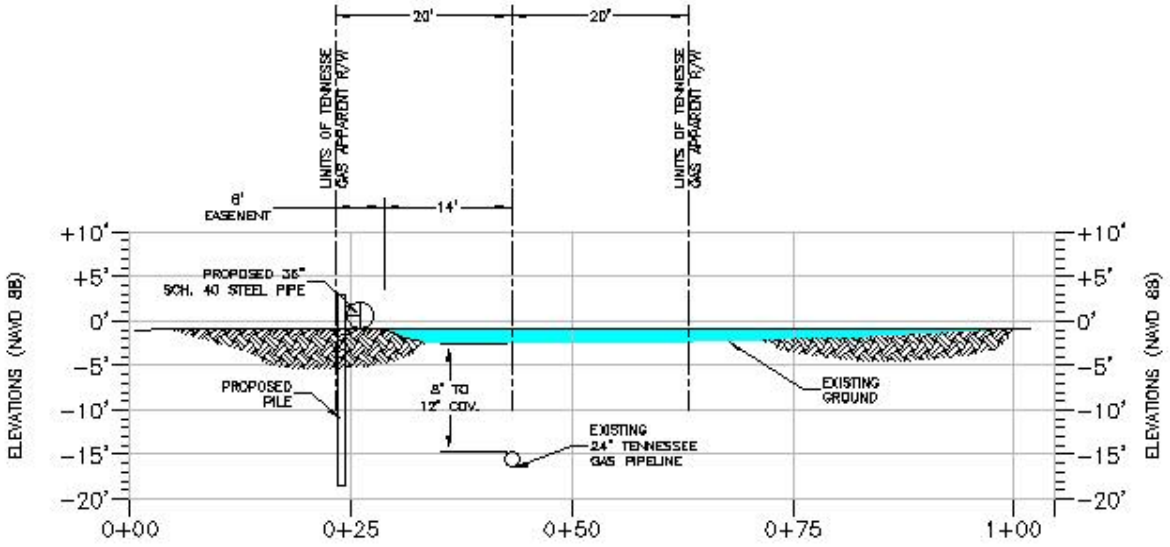
Pipeline Placement-Typical Sections – Submerged (w/out additional ROW)

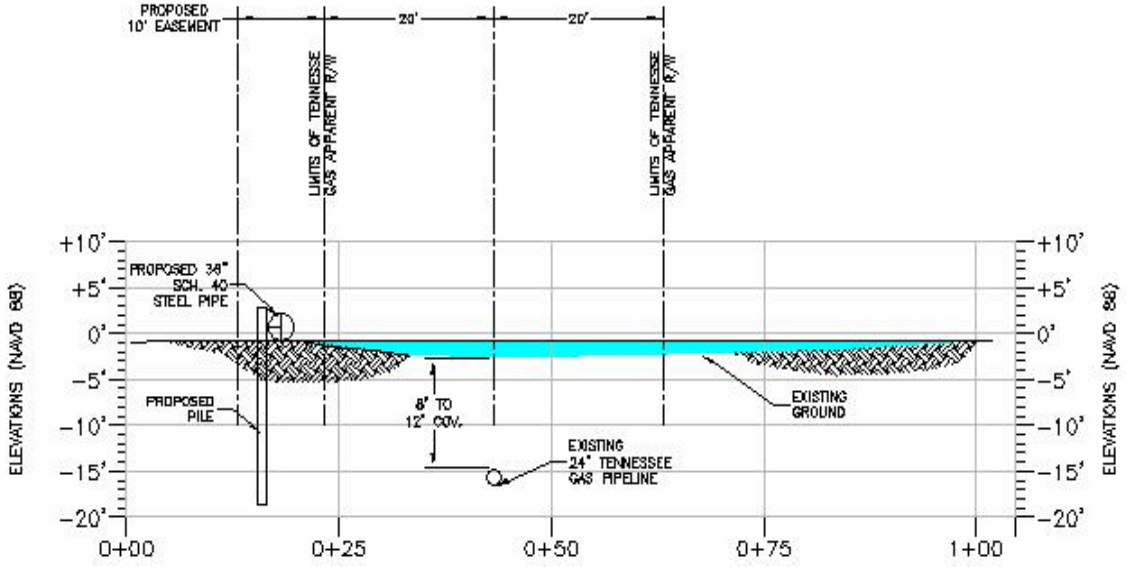


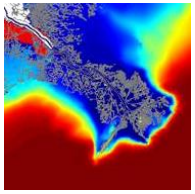




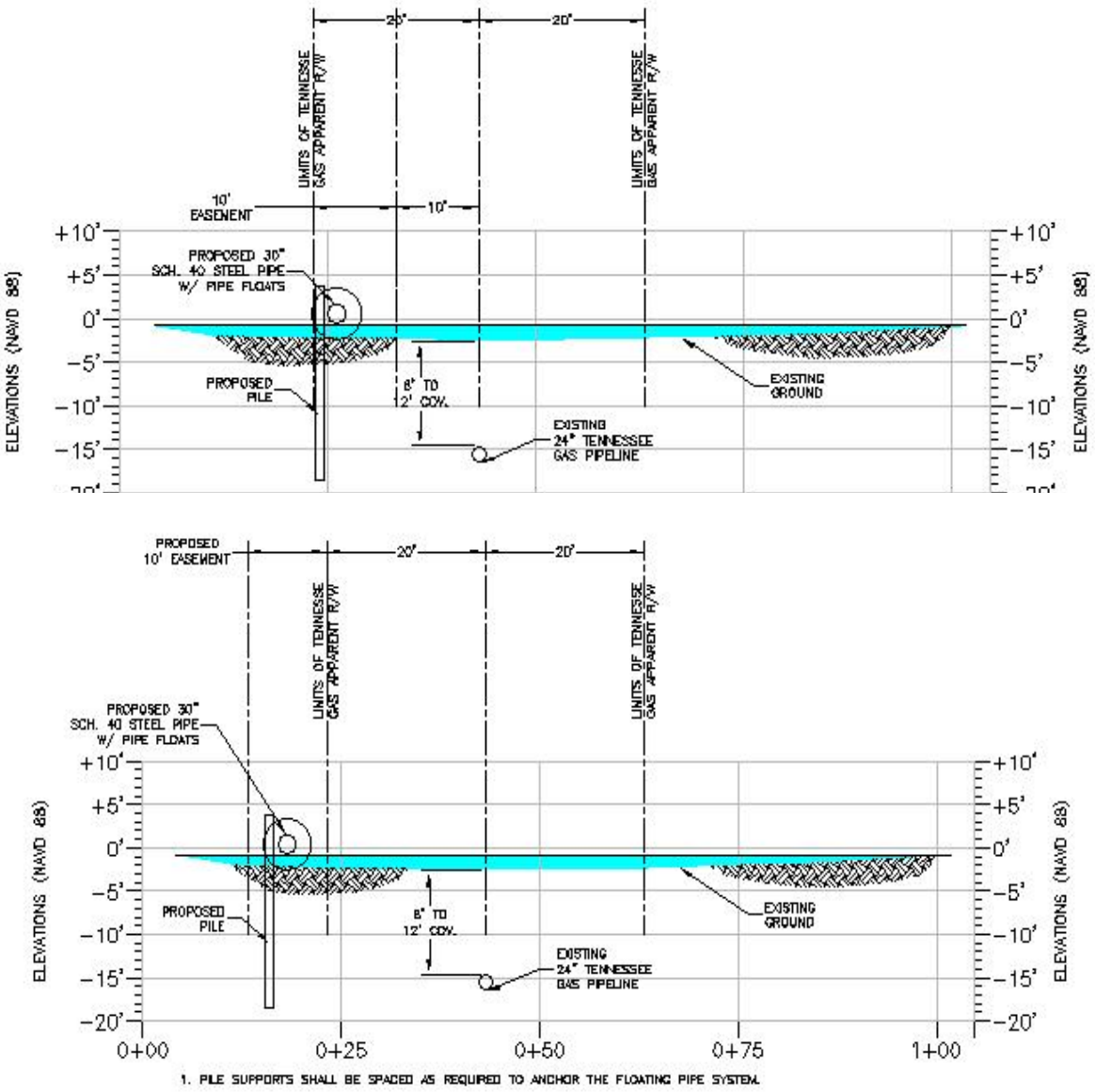
Typical Sections – At-Grade (w/out additional ROW)

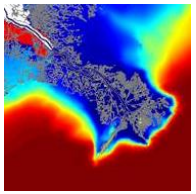




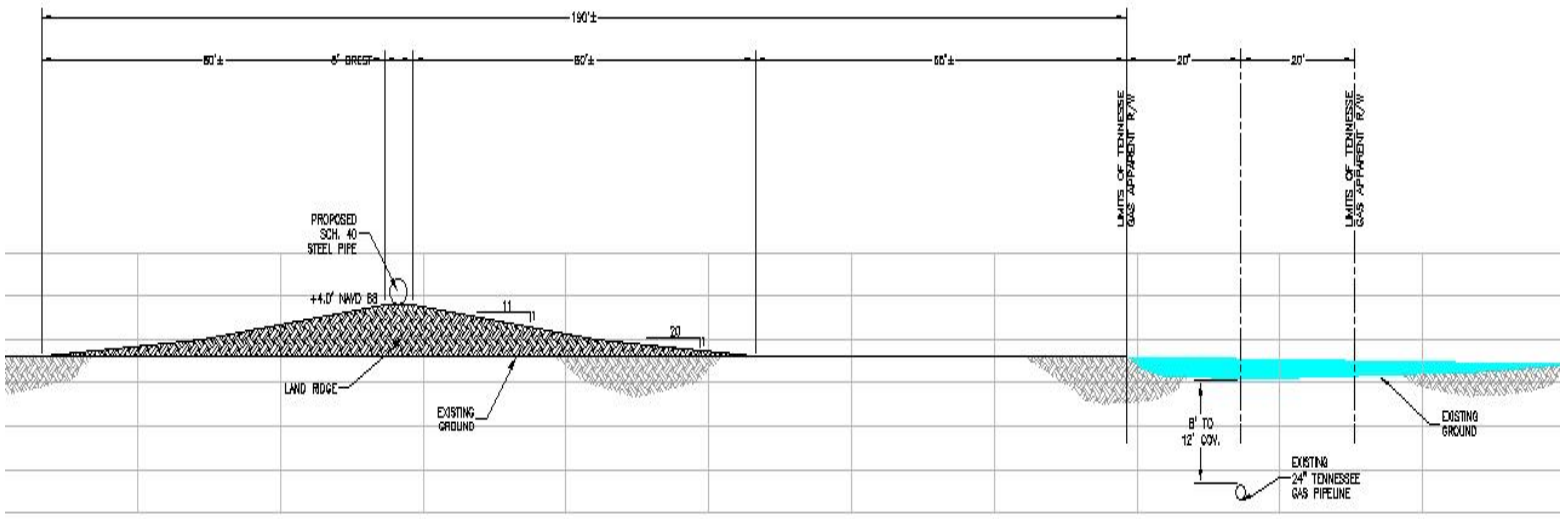


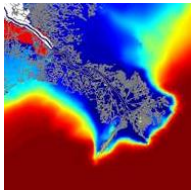
Typical Sections – Floating Pipe (w/out additional ROW)





Typical Sections – Ridge/Fill Placement





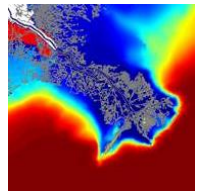
Pipeline & Pump Design Analysis

- **Production Rate:** 40,000 to 50,000 CY/day; Total 50 million cubic yards
- **Pipeline -** 120-foot sections
  - **Pipeline Size: 30” to 36” Diameter**
    - Streamline flow , Velocity (10% above critical velocity) Slurry ratio
  - **Material: ¾” thick steel**
    - Required thickness to avoid frequent rotation and maintenance
    - Two rotations

- **Booster Pumps**
  - 7,000 to 8,400 HP
  - Spacing: 5 Miles
  - Natural gas fuel for the turbine engines

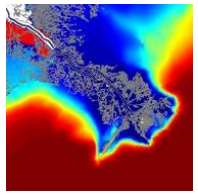




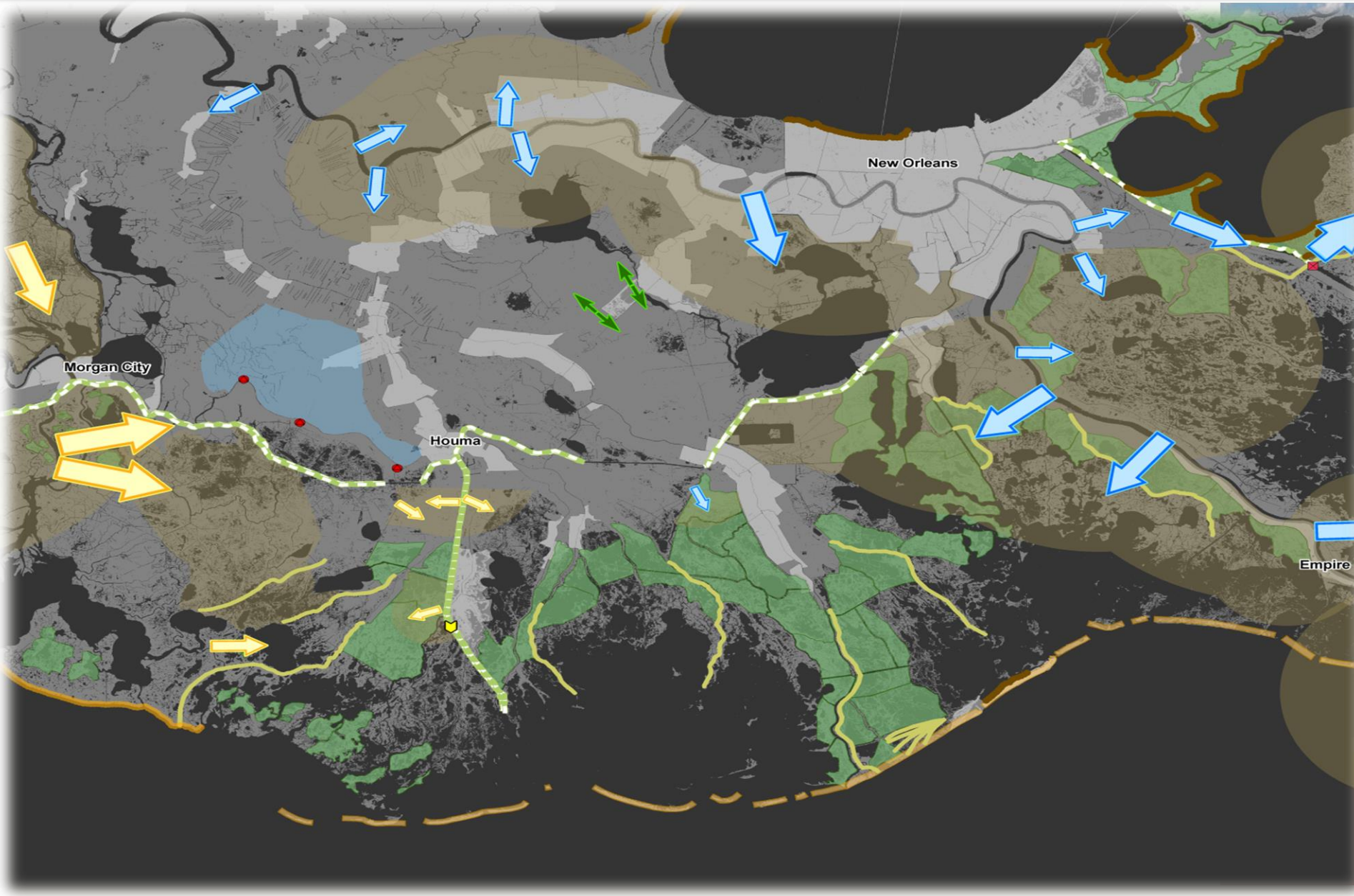



Placement Area Evaluation

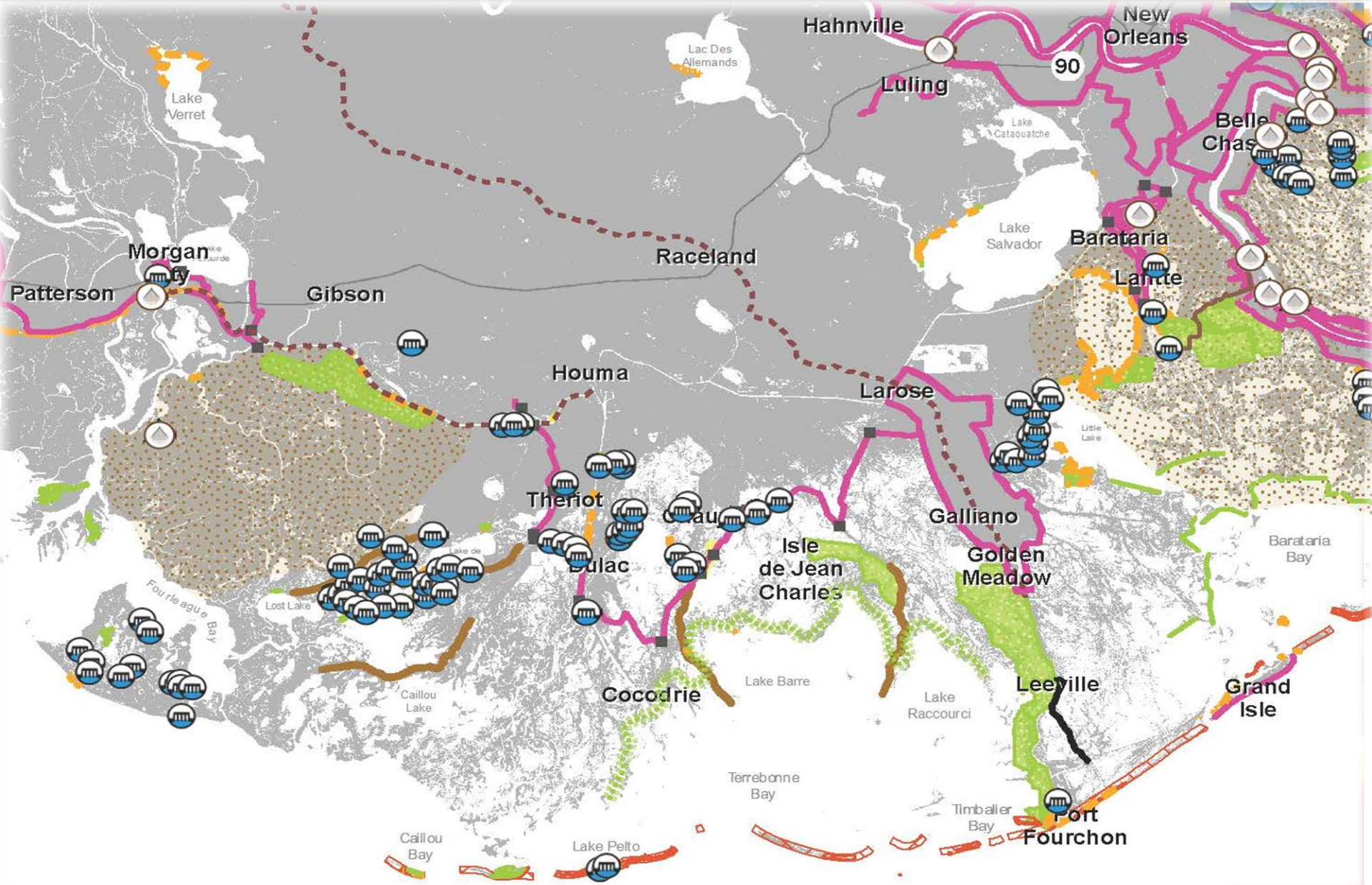
- **Potential Placement Sites**
  - Bay Raccourci (~16,000 acres)
  - South of Falgout Canal (~20,000 acres)
  - Vicinity Of Lake Tambour (~26,000 acres)
  - Vicinity of Wonder Lake (~15,000 acres)
    - Fill volume estimate is based on 30% to 60% coverage of the available area
- The placement areas are inclusive of existing and proposed coastal restoration projects



2007 State Master Plan- Project Map



2012 State Master Plan- Project Map

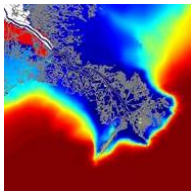


- **Placement based on restoration objectives, site conditions, and sediment type**
  - **Hydraulic Placement**
    - (confined vs. non-confined)
  - **Thin Layer Application**

    (Spraying sediment, contains high volume of water and fine sediment)
  - **Slurry Placement**

    (Sediment with high water content in existing marsh)

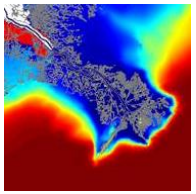
    - **Traditional Hydraulic Placement**
      - Confined and/or semi-confined will be the preferred placement approach



Placement Areas – Target Elevation

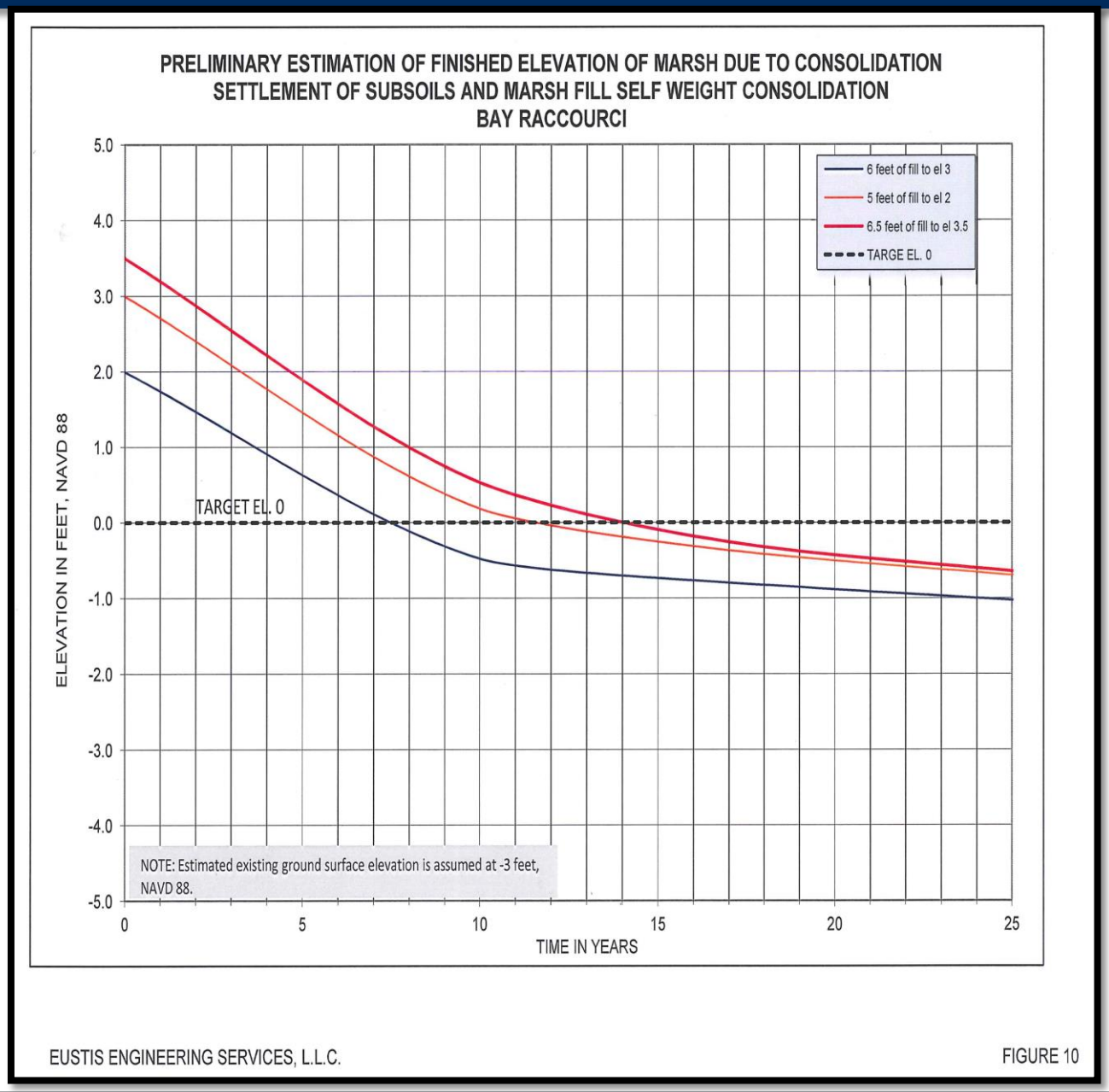


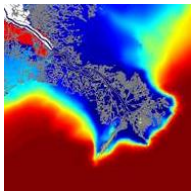


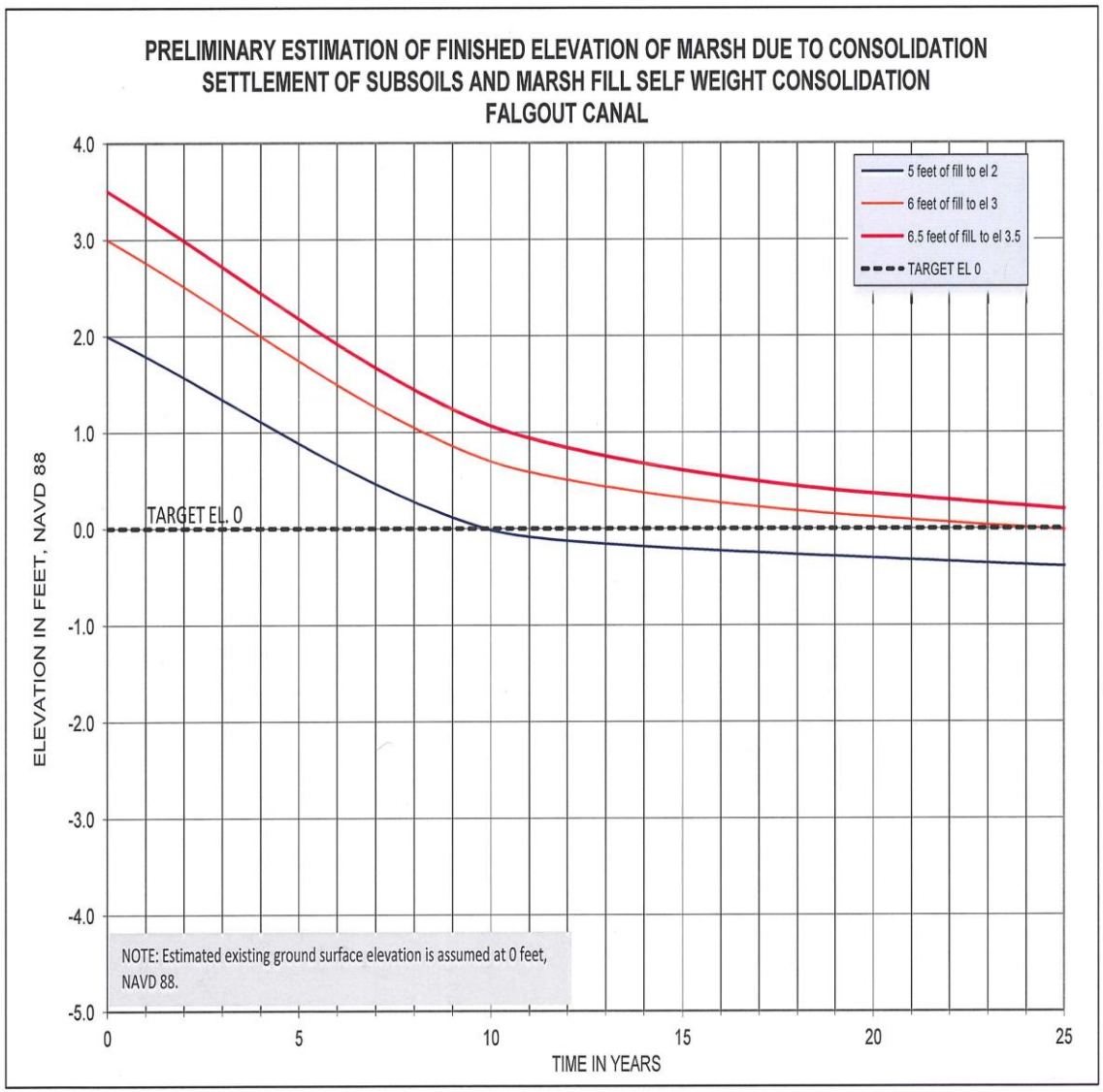
- Healthy and sustainable marsh elevation is between +1.0 ft. and 1.3 ft. NAVD
- The current average mudline elevation is between 0 and -2 ft. NAVD
- Recommended design elevation for placement areas: +3.0 ft. to +3.5 ft. NAVD

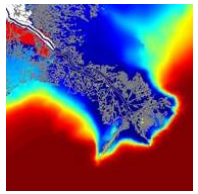
Settlement Curves – Bay Raccourci



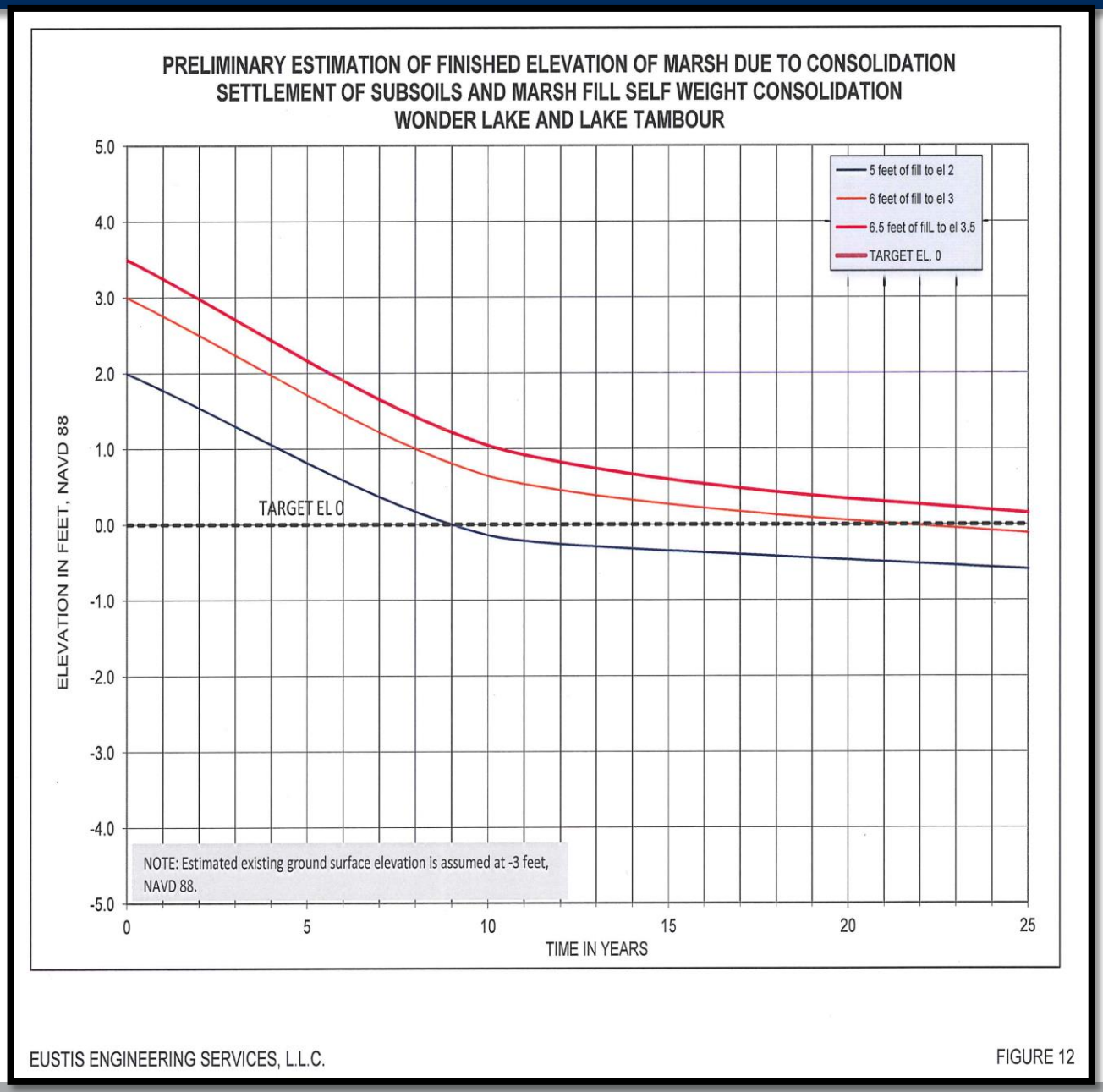


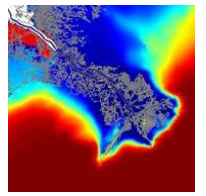
Settlement Curves –Falgout Canal





Settlement Curves –Lake Tambour and Wonder Lake



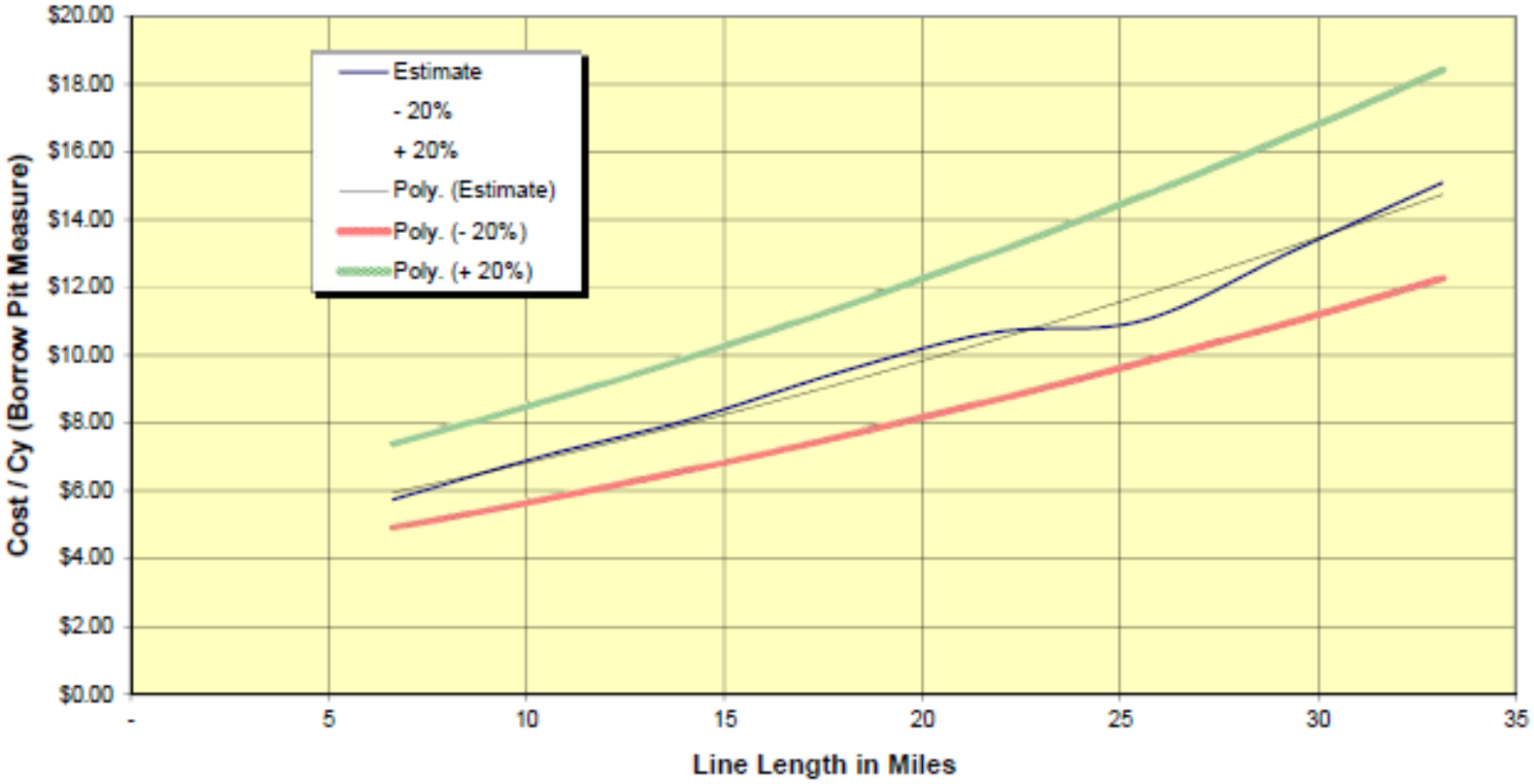


Marsh fill Volumes

	Area	Estimated Placement Area	Initial Fill Elevation	Existing Average Mudline Elev.	Borrow Material Needed
Bay Raccourci		(Acres)	(NAVD Ft.)	(NAVD Ft.)	(CY)
	All	7500 - 16250	+3.5	0	42,500,000 – 92,000,000
Falgout Canal	Area	Estimated Placement Area	Initial Fill Elevation	Existing Average Mudline Elev.	Borrow Material Needed
		(Acres)	(NAVD Ft.)	(NAVD Ft.)	(CY)
	Central	2400 - 5200	+3.0	0	11,750,000 – 25,250,000
	South	6600 - 14300	+3.0	-1	42,750,000 – 92,500,000
Wonder Lake	Area	Estimated Placement Area	Initial Fill Elevation	Existing Average Mudline Elev.	Borrow Material Needed
		(Acres)	(NAVD Ft.)	(NAVD Ft.)	(CY)
	East	2100 - 4550	+3.0	0	10,250,000 – 22,250,000
	Central	2100 - 4550	+3.0	0	10,250,000 – 22,250,000
	West	3300 - 7150	+3.0	0	16,000,000 – 34,750,000
Lake Tambour	Area	Estimated Placement Area	Initial Fill Elevation	Average Mudline Elev.	Borrow Material Needed
		(Acres)	(NAVD Ft.)	(NAVD Ft.)	(CY)
	All	12000 - 26000	+3.0	-2	97,000,000 – 209,750,000
	Total Area	36,000 – 78,000		Total Borrow	230,500,000 – 498,750,000

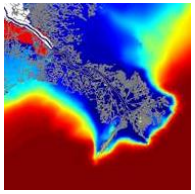
Cost Analysis

- **Segment 1: Bay Raccourci (~20 Miles)**
  - $5 /cubic yard (**dredging** and discharging to intake structure)
  - $5/cubic yard (**operation**- intake structure and boosters)
  - **$10/cubic yard (dredging and operation)**

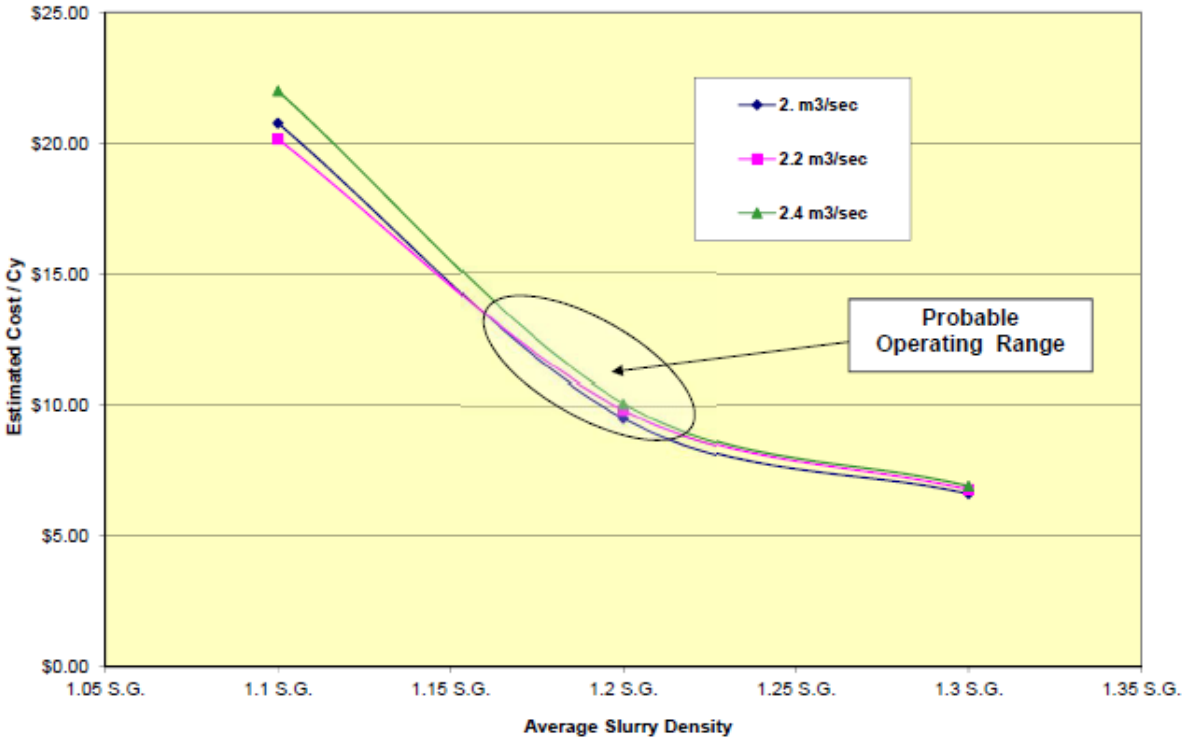






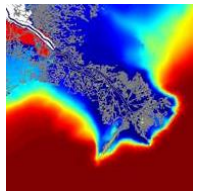



- **Segment 1: Bay Raccourci (~20 Miles)**
  - $5 /cubic yard (dredging)
  - $5/cubic yard (operation)
  - $10/cubic yard (dredging and operation): $500 million
  - $6 million (intake structure)
  - $500 million + $6 million = $506million







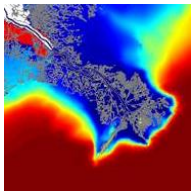



Segment 1 - Bay Raccourci

Pipeline Alternatives	Segment 1
Submerged Pipeline Within TGP ROW	$85,683,000
Submerged Pipeline Outside TGP ROW	$85,976,000
At Grade Pipeline Within TGP ROW	$98,203,000
At Grade Pipeline Outside TGP ROW	$98,496,000
Land Ridge Pipeline	$99,991,000
Floating Pipeline Within TGP ROW	$134,075,000
Floating Pipeline Outside TGP ROW	$134,367,000





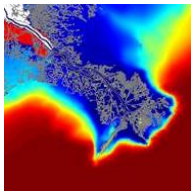
- Cost includes: Trunk line, laterals, booster stations, R-O-W /easement acquisition
- Submerged placement being the least expensive and created land ridge the most expensive
- Floating pipe alternative is cost prohibitive.

Pipeline Cost Summary

	Minimum	Maximum
Segment 1	$85,683,000	$99,991,000
Segment 2	$83,004,000	$93,729,000
Segment 3	$86,532,000	$97,132,000
Segment 4	$43,233,000	$48,232,000
TOTAL PIPELINE CONSTRUCTION COST	$298,452,000	$339,085,000





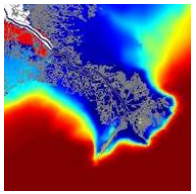



Containment Dikes- Cost Summary

Placement Area	Minimum	Maximum
Bay Raccourci	$2,115,000	$7,045,000
Falgout Canal	$675,000	$2,260,000
Lake Tambour	$1,730,000	$5,760,000
Wonder Lake	$735,000	$2,445,000
TOTAL CONSTRUCTION COST	$5,255,000	$17,510,000





Cost Summary

- Bay Raccourci (Segment 1)
  - Dredging : $500M
  - Intake Structure: $6M
  - Containment Dikes $7M
  - Pipeline: $100M
  - Total Cost- Segment 1 : **$613M**

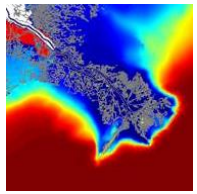
	Dredging & Intake Structure ($ Millions)						Pipeline Corridor And Placement Area Dike Construction ($ Millions)									
	Dredging*, 50 M CY				Intake Structure**	Sub-Total	Segment 1		Segment 2		Segment 3		Segment 4		Sub-Total	Total
	Segment 1 $10/cy	Segment 2 $12/cy	Segment 3 $13/cy	Segment 4 $17/cy			Pipeline	Dike	Pipeline	Dike	Pipeline	Dike	Pipeline	Dike		
Segment 1	$500				$6	$506	$100	$7							$107	$613
Segment 2		$600				$600			$193	$3					$196	$796
Segment 3			$650		$6	$656					$291	$6			$297	$953
Segment4				$850		$850							$339	$3	$342	$1,192
Total	$500	$600	$650	$850	$12	$2,612	$100	$7	$193	$3	$291	$6	$339	$3	$942	$3,554

* Operational Costs Included in the Dredging Cost

** Two replacements





Marsh Creation Cost – Bay Raccourci

- $98,897/acre (4.0 ft. fill)
- $123,622/acre (5.0 ft. fill)

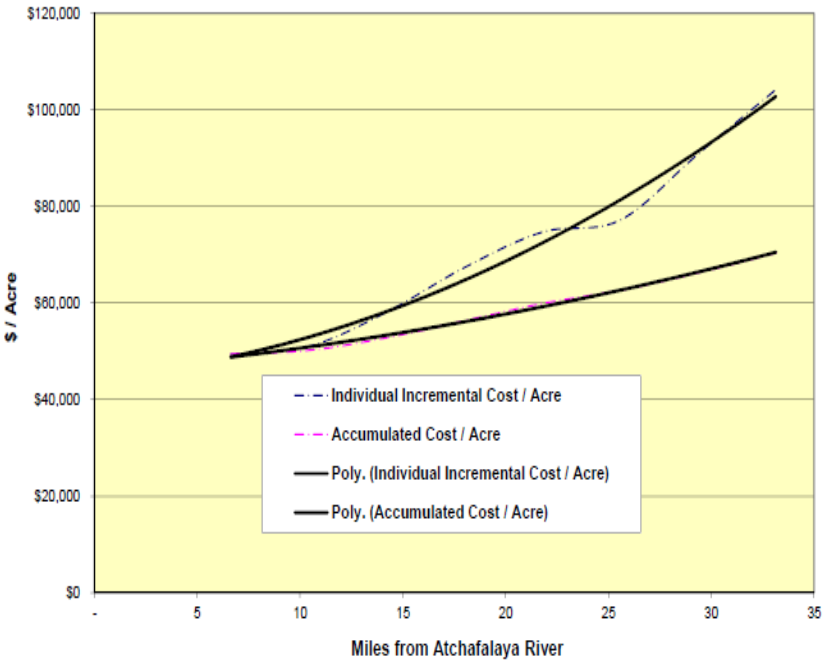
MINIMUM COST PER ACRE		
DESCRIPTION	QUANTITY	UNIT
CUT VOLUME	50,000,000	C.Y.
FILL VOLUME	40,000,000	C.Y.
FILL VOLUME	1,080,000,000	C.F.
AVERAGE FILL HEIGHT	4.0	F.T.
AREA OF FILL	270,000,000	S.F.
AREA OF FILL	6,198	ACRE
TOTAL COST OF SEGMENT 1	$ 613,000,000	$
COST OF SEGMENT 1 PER ACRE	$ 98,897	$

TOTAL CONSTRUCTION COST PER ACRE	$98,897

MAXIMUM COST PER ACRE		
DESCRIPTION	QUANTITY	UNIT
CUT VOLUME	50,000,000	C.Y.
FILL VOLUME	40,000,000	C.Y.
FILL VOLUME	1,080,000,000	C.F.
AVERAGE FILL HEIGHT	5.0	F.T.
AREA OF FILL	216,000,000	S.F.
AREA OF FILL	4,959	ACRE
TOTAL COST OF SEGMENT 1	$ 613,000,000	$
COST OF SEGMENT 1 PER ACRE	$ 123,622	$

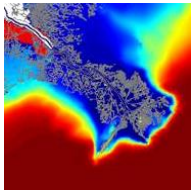
TOTAL CONSTRUCTION COST PER ACRE	$123,622

NOTE: ASSUME CUT:FILL RATIO OF 1.25 FOR REPRESENTATION OF COST







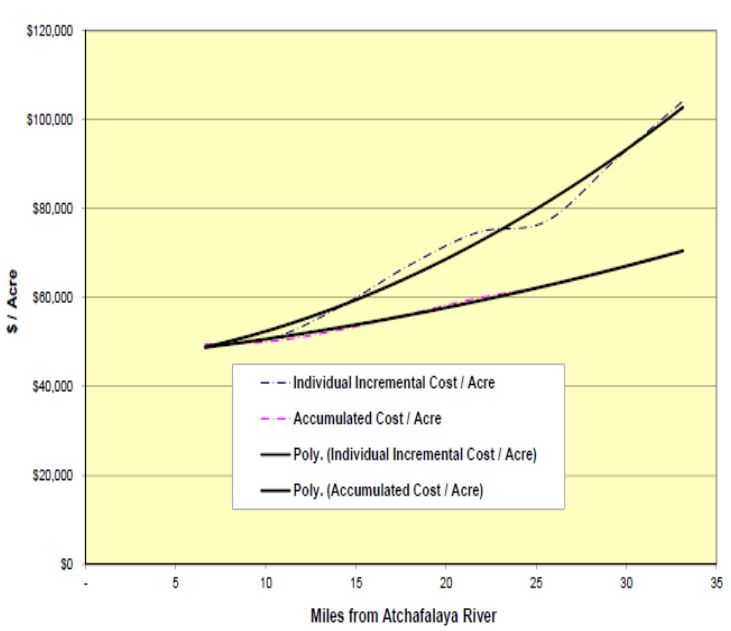
Marsh Creation Cost – Falgout Canal

- $96,316/acre (3.0 ft. fill)
- $128,421/acre (4.0 ft. fill)

MINIMUM COST PER ACRE		
DESCRIPTION	QUANTITY	UNIT
CUT VOLUME	50,000,000	C.Y.
FILL VOLUME	40,000,000	C.Y.
FILL VOLUME	1,080,000,000	C.F.
AVERAGE FILL HEIGHT	3.0	F.T.
AREA OF FILL	360,000,000	S.F.
AREA OF FILL	8,264	ACRE
TOTAL COST OF SEGMENT 2	$ 796,000,000	$
COST OF SEGMENT 2 PER ACRE	$ 96,316	$
TOTAL CONSTRUCTION COST PER ACRE		$96,316

MAXIMUM COST PER ACRE		
DESCRIPTION	QUANTITY	UNIT
CUT VOLUME	50,000,000	C.Y.
FILL VOLUME	40,000,000	C.Y.
FILL VOLUME	1,080,000,000	C.F.
AVERAGE FILL HEIGHT	4.0	F.T.
AREA OF FILL	270,000,000	S.F.
AREA OF FILL	6,198	ACRE
TOTAL COST OF SEGMENT 2	$ 796,000,000	$
COST OF SEGMENT 2 PER ACRE	$ 128,421	$
TOTAL CONSTRUCTION COST PER ACRE		$128,421

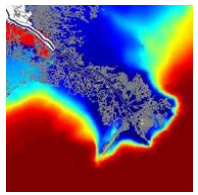
NOTE: ASSUME CUT:FILL RATIO OF 1.25 FOR REPRESENTATION OF COST



Long Distance Sediment Pipeline Cost per CY			
COST PER CUBIC YARD			
DESCRIPTION	COST	CUBIC YARDS	COST/CY
Segment 1	$ 613,000,000	50,000,000	$12.26
Segment 2	$ 796,000,000	50,000,000	$15.92
Segment 3	$ 953,000,000	50,000,000	$19.06
Segment 4	$ 1,192,000,000	50,000,000	$23.84
TOTAL	$3,554,000,000	$200,000,000	$17.77





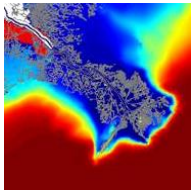



Recommendations (pt. 1)

- ATCH-137E is recommended as borrow area
- Cutter Head dredge operation is preferable
- Intake structure in the Horseshoe Bend vicinity
- Tennessee Gas Pipeline corridor as the LDSP corridor
- 42 miles of trunk line,15 miles of additional R-O-W, 10 booster pumps are required
- Combination of four alternative pipeline placement methods
- Traditional hydraulic placement with a combination of confined and unconfined dike is recommended





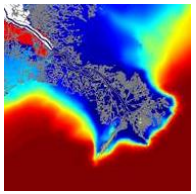



Recommendations (pt. 2)

- The entire project is estimated to cost $3.554 B, whereas a project with Segments 1 and 2 are estimated at $613M and $802, respectively
- Segment 1 could be completed in 6-7 years
- Marsh Creation Cost:
  - Bay Raccourci: $98,897/acre - $123,622/acre; 7,700-6,200 acres; 4-5 ft. fill
  - Falgout Canal: $96,316/acre - $128,421/acre; 10,300-7,700 acres; 3-4 ft. fill
- Cost/cubic yard:
  - Segment 1 (50 m cy): $12.26/cy
  - Segment 2 (50 m cy): $15.93/cy
  - Segment 3 (50 m cy): $19.16/cy
  - Segment 4 (50 m cu): $23.84/cy
  - Total: (200 m cy): $17.77/cy
- Detailed analysis of Segment 1 and 2 construction is required and a Phase 2 of this feasibility study is recommended





Questions?

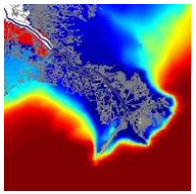
CPRA Bid Summary- 1997 -2009

Year	Number of Projects	Total Number of Bidders	Average Number of Bidders	Average Unit Cost per Cubic Yard	Cubic Yards Dredged	Total Mobilization Demobilization Cost	Total Project Cost
1997	4	14	3.50	1.63	15,568,000	$2,379,401.00	$30,550,275.00
1998	1	3	3.00	2.67	867,600	$196,000.00	$3,144,125.00
1999	1	4	4.00	2.15	2,143,000	$1,050,000.00	$8,347,950.00
2001	1	2	2.00	3.05	2,130,000	$900,000.00	$8,105,150.00
2002	2	9	4.50	4.50	611,300	$2,052,000.00	$15,940,081.15
2004	4	16	4.00	2.46	4,441,654	$1,215,000.00	$13,347,634.05
2005	3	8	2.67	2.87	5,553,914	$3,863,000.00	$32,448,706.75
2006	2	5	2.50	4.70	4,868,650	$4,425,000.00	$23,827,522.50
2007	2	9	4.50	4.52	593,629	$1,119,890.00	$4,300,784.16
2008	6	17	2.83	5.05	21,982,010	$24,715,000.00	$145,581,279.50
2009	2	6	3.00	4.50	6,165,000	$5,200,000.00	$41,677,840.00
Grand Total	28	93	3.32	3.56	64,924,757	$47,115,291.00	$327,271,348.11

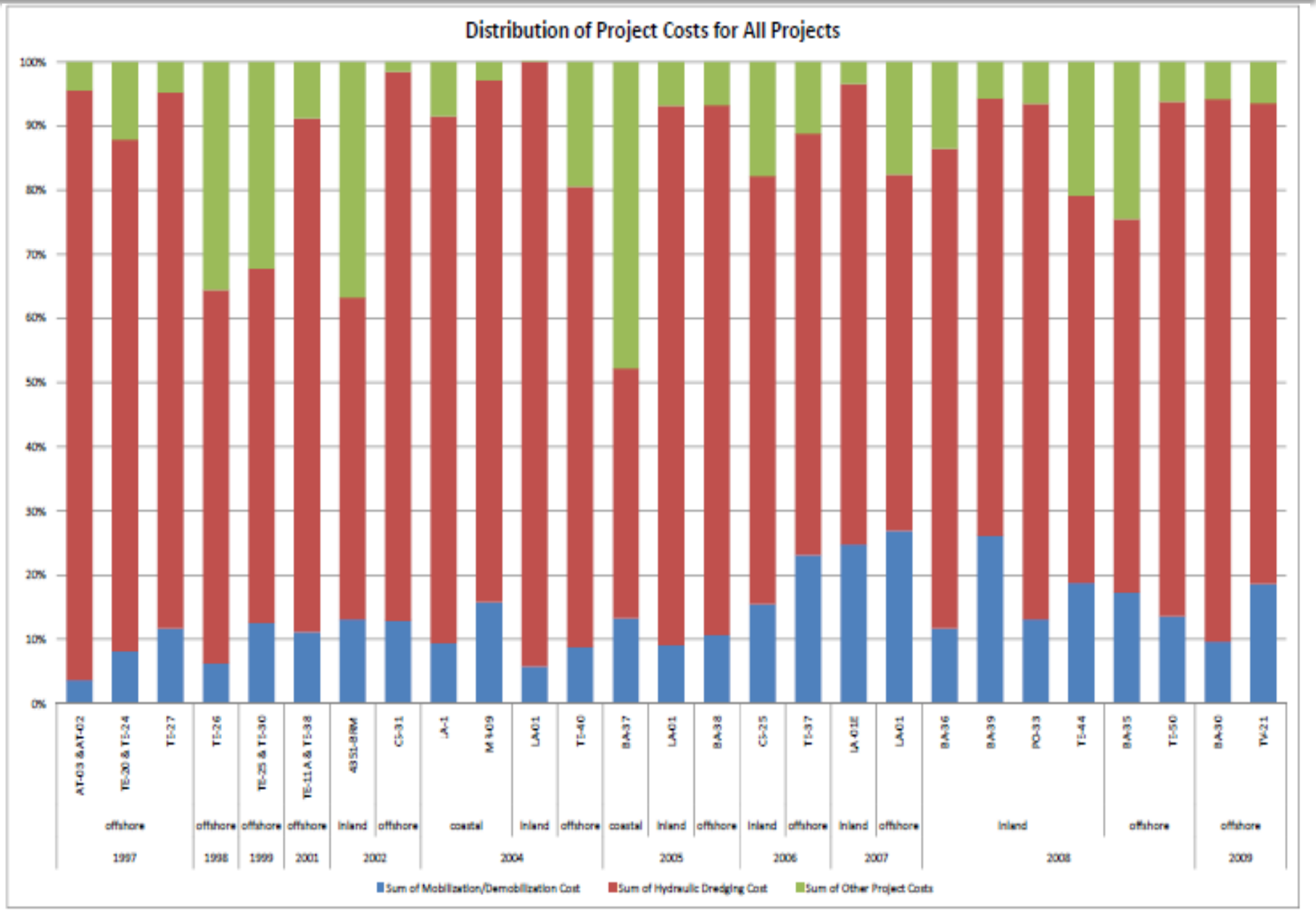
Table 1 OCPR Restoration Project Summary 1997-2009.

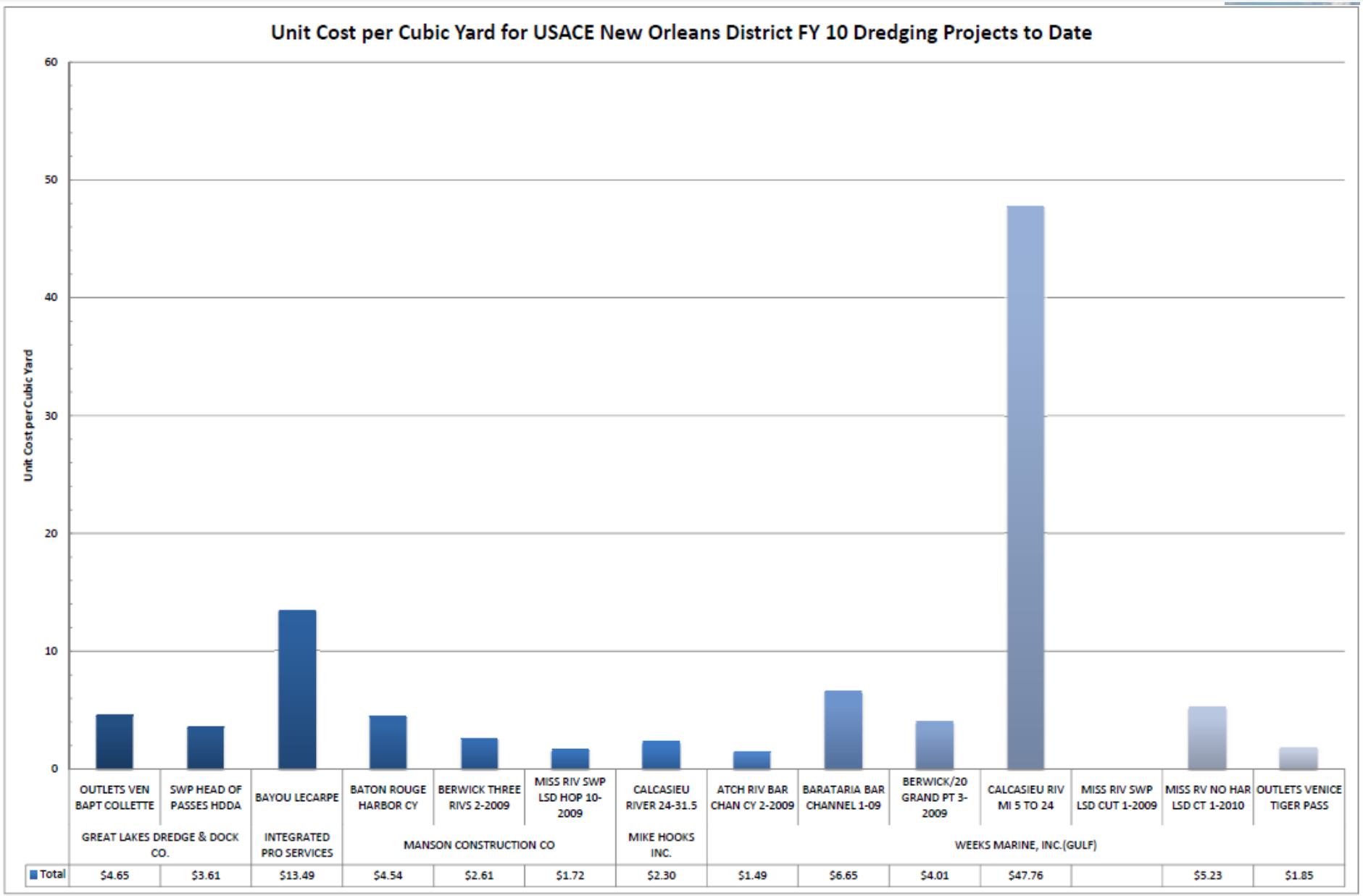




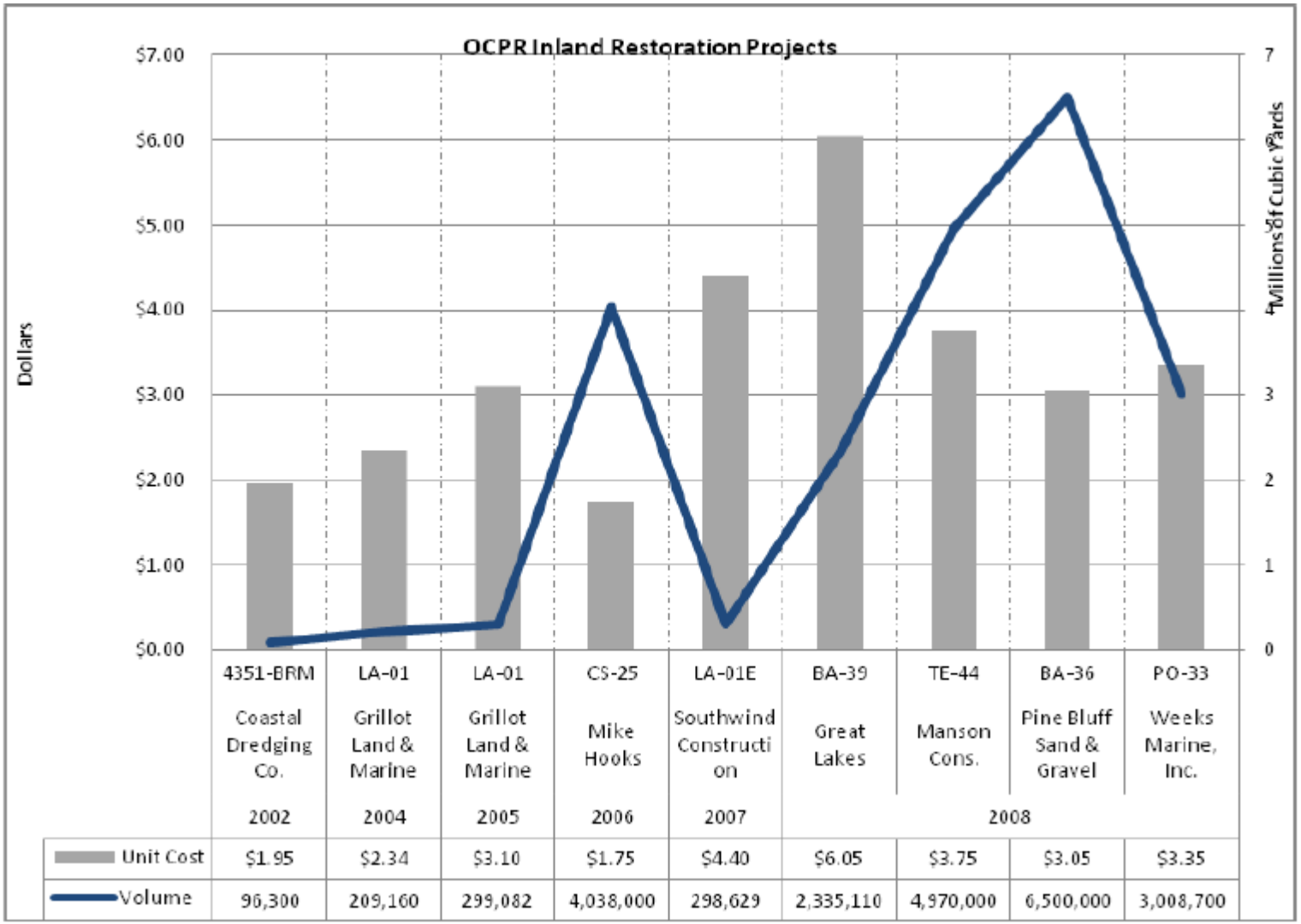



CPRA Project Cost Distribution




Unit Cost per Cubic Yard for USACE New Orleans District FY 10 Dredging Projects to Date
Unit Cost per Cubic Yard
60
50
40
30
20
10
0
OUTLETS VEN BAPT COLLETTE
SWP HEAD OF PASSES HDDA
BAYOU LECARPE
BATON ROUGE HARBOR CY
BERWICK THREE RIVS 2-2009
MISS RIV SWP LSD HOP 10-2009
CALCASIEU RIVER 24-31.5
ATCH RIV BAR CHAN CY 2-2009
BARATARIA BAR CHANNEL 1-09
BERWICK/20 GRAND PT 3-2009
CALCASIEU RIV MI 5 TO 24
MISS RIV SWP LSD CUT 1-2009
MISS RV NO HAR LSD CT 1-2010
OUTLETS VENICE TIGER PASS
GREAT LAKES DREDGE & DOCK CO.
INTEGRATED PRO SERVICES
MANSON CONSTRUCTION CO
MIKE HOOKS INC.
WEEKS MARINE, INC.(GULF)
Total
$4.65
$3.61
$13.49
$4.54
$2.61
$1.72
$2.30
$1.49
$6.65
$4.01
$47.76
$5.23
$1.85

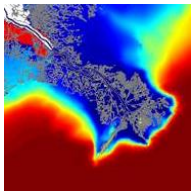
CPRA-Volume Vs. Cost



	4351-BRM	LA-01	LA-01	CS-25	LA-01E	BA-39	TE-44	BA-36	PO-33
	Coastal Dredging Co.	Grillot Land & Marine	Grillot Land & Marine	Mike Hooks	Southwind Construction	Great Lakes	Manson Cons.	Pine Bluff Sand & Gravel	Weeks Marine, Inc.
	2002	2004	2005	2006	2007	2008			
Unit Cost	$1.95	$2.34	$3.10	$1.75	$4.40	$6.05	$3.75	$3.05	$3.35
Volume	96,300	209,160	299,082	4,038,000	298,629	2,335,110	4,970,000	6,500,000	3,008,700





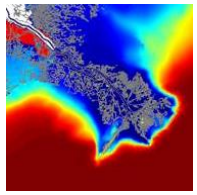



Borrow Area Development

- ATCH-137 E is selected as the potential borrow area
- Initial volume: 19.5 Million Cubic Yards (east borrow area)
- Average Annual Refill Volume: 5.6 Million Cubic Yards
- Assumed annual sediment demand: 5 Million Cubic Yards/Year
- Assumed total sediment demand for this project: 50 Million Cubic Yard
- Considering the refill rates, the project could be completed in 6.5 years (with certain assumptions)






- Beneficial Use of Dredge Material Vs. Dedicated Dredging
  - 3.9 million cubic yards/year availability
  - Not a sustainable source of sediment
  - Uncertainty regarding the availability due to unreliable predictions of sediment availability and unpredictable funding streams
  - Crew Boat Cut- Authorization to realign navigation channel