MOTT MACDONALD

DRAFT Galveston Island Revised Pump Station Sizes

Coastal Texas Restoration and Protection Feasibility Study

Presentation Summary

- Mott MacDonald tasked to investigate changes in required pump size at Galveston Island due to revised extremal conditions developed by the USACE.
  - Task A.1 of Amendment 6.
  - Old Extremal conditions yielded almost no overtopping of Levee

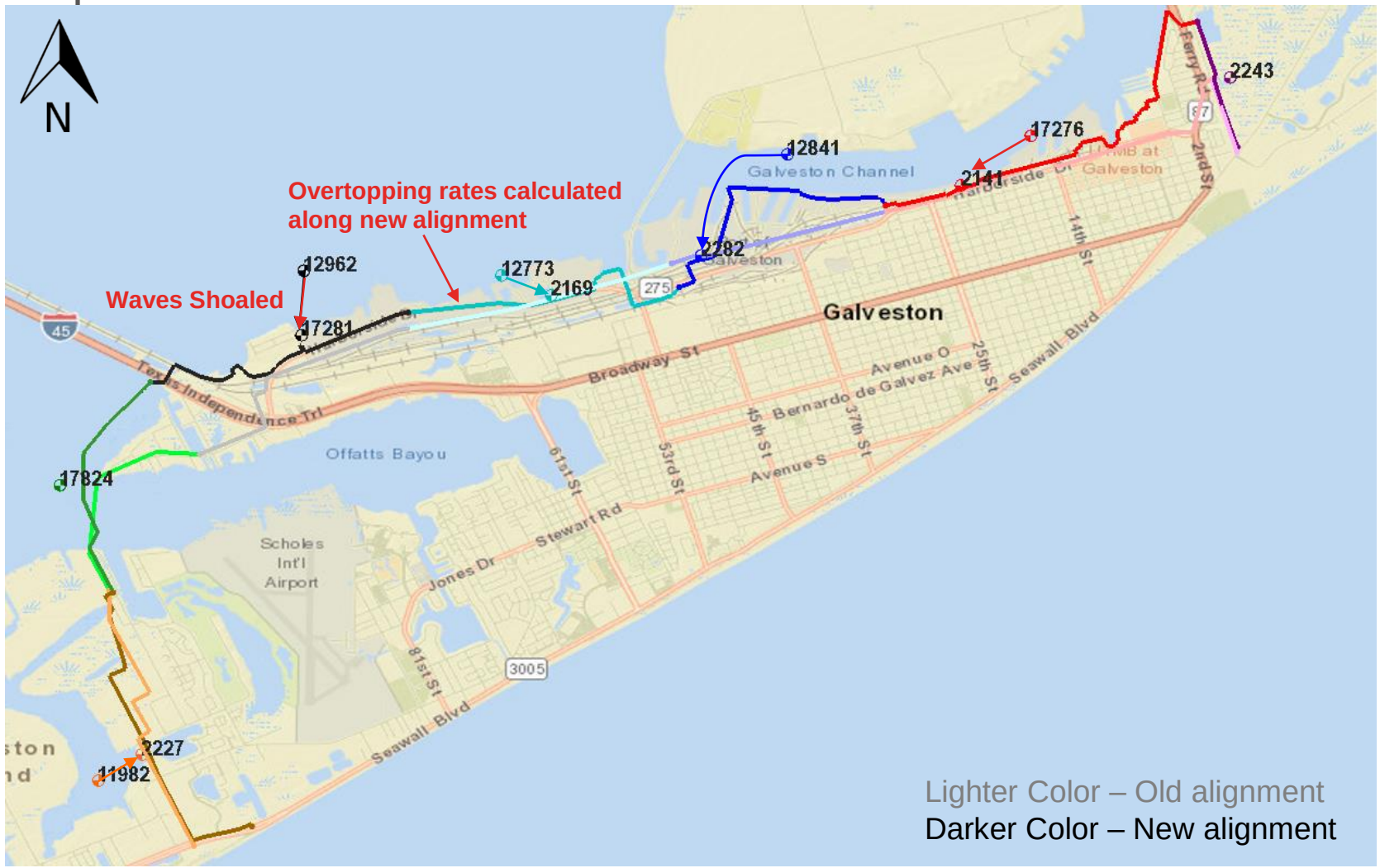
- Revised 100 year, 90% CI WSE with 0.0’ used to calculate overtopping per USACE direction.
  - Resulting overtopping rates were calculated along the revised alignment

- Timesteps for overtopping were modified to align with peak rainfall runoff inflow at each pump site.

- **This presentation investigates required changes to the proposed pump station sizes and conveyance channel cross sections due to including the overtopping along the revised alignment.**

Previous vs. Revised Alignment

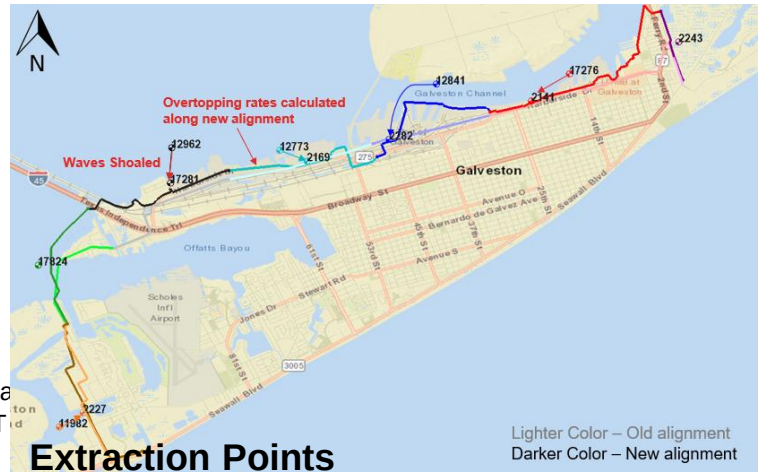
Map



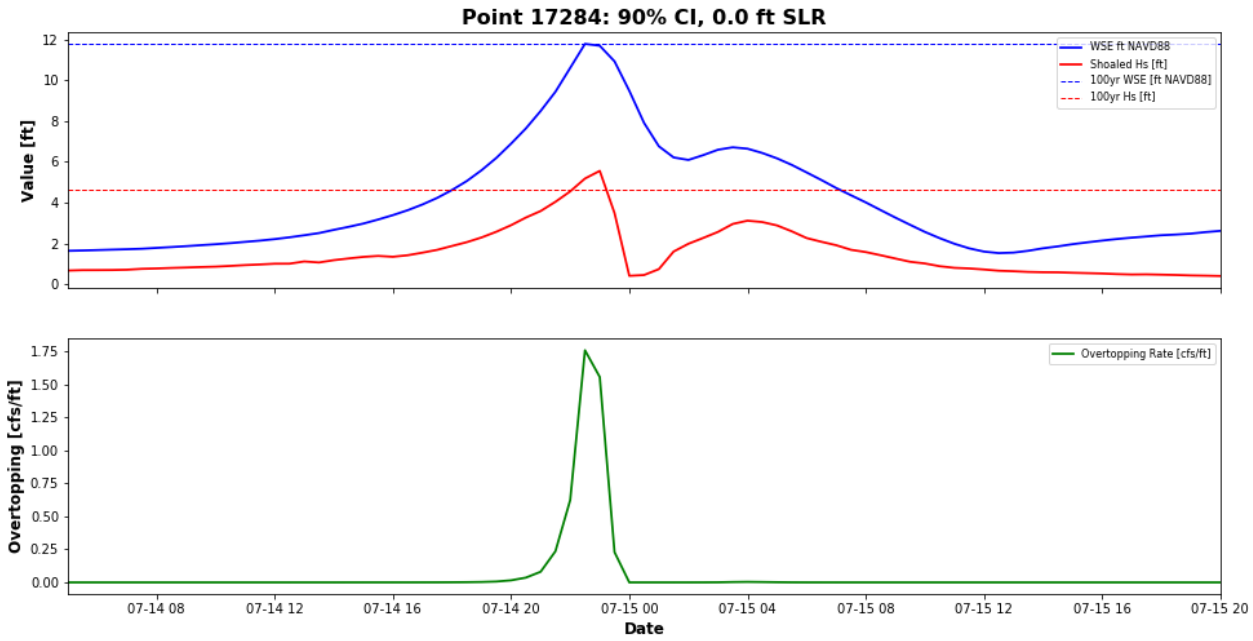
- Overtopping rates (cfs/lf) were calculated along 7 different segments of the new Alignment

Overtopping Analysis Summary

- Timeseries of wave and WSE (scaled) used to calculate overtopping rates at each extraction point.
- Example timeseries shown on right.
- **0.0’ SLR Results used.**
- **No seawall overtopping included.**
- Peak overtopping rate and associated peak volumetric flow rate shown in tables on right.
  - Red numbers above ultimate overtopping limit (1 cfs/ft)
  - Orange numbers above no-damage limits (90%: 0.1 cfs/ft, 50%: 0.01 cfs/ft).



Extraction Points



Rate [cfs/ft]

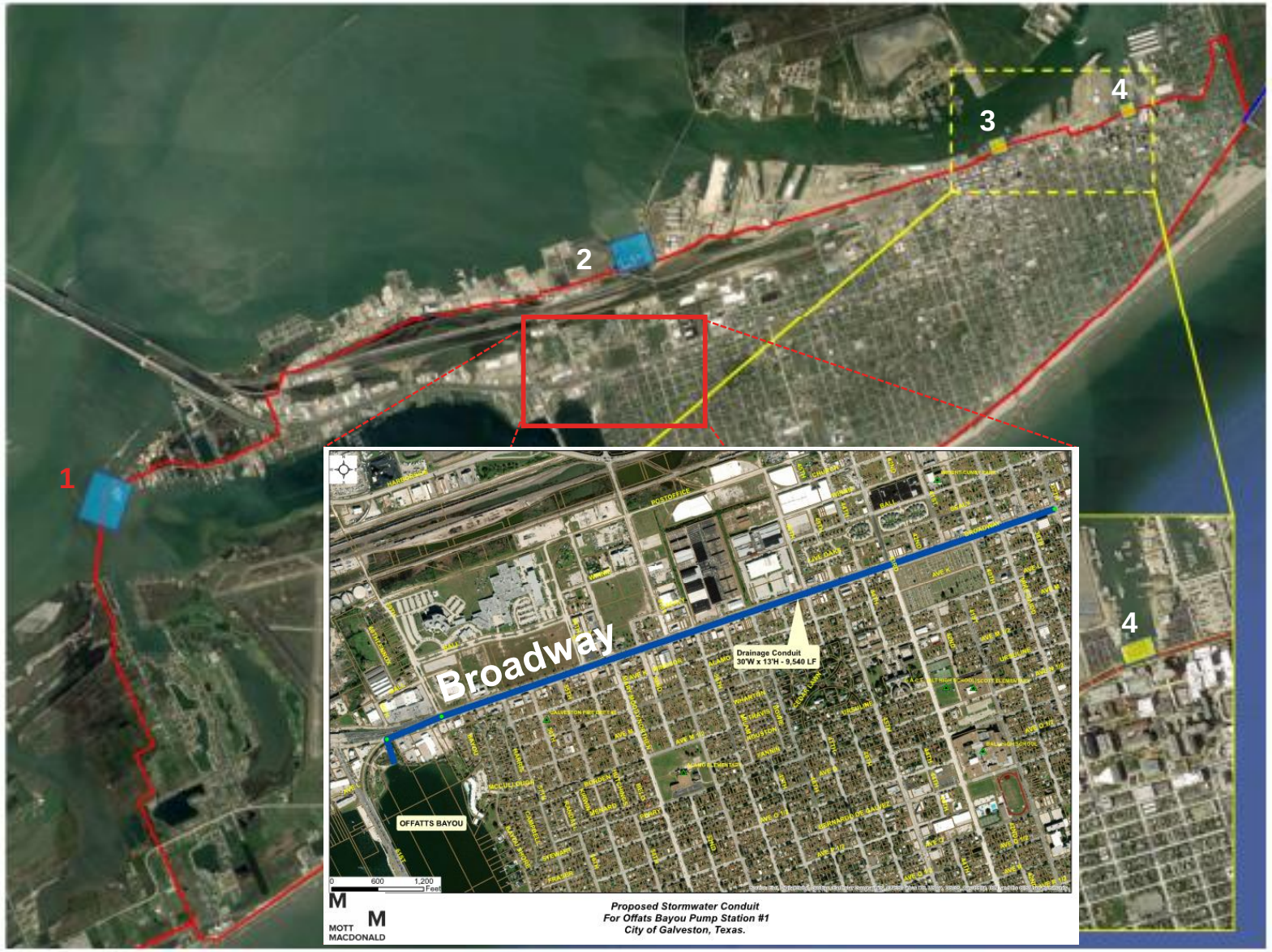
Point	50% CI 0.0' SLR	90% CI 0.0' SLR
11892	0.03	0.61
17284	0.30	1.76
12962	0.07	1.06
12773	0.003	0.19
12841	0.002	0.01
17276	0.05	0.39

Volume [cfs]

Point	50%CI 0.0' SLR	90%CI 0.0' SLR
11892	380	7,553
17284	2,594	15,376
12962	726	11,014
12773	28	2,004
12841	21	89
17276	772	6,212

Note: Results with 0.0 ft SLR.

Galveston: Pump Station 1 Location & Stormwater Conduit



- Preliminary Pump Size[1]: 250 cfs
- Preliminary Drainage Conduit[1]:
  - Length: 9,549 LF
  - Dimensions: 30'W x 13'H

Note[1]: Current pump design does not include overtopping of seawall. Overtopping volume will be incorporated into pump sizes once further analysis is conducted.

Galveston: Pump Station 2 Location & Stormwater Conduit

- Preliminary Pump Size[1]: 1,500 cfs
- Preliminary Drainage Conduit[1]:
  - Length: 5,670 LF
  - Dimensions: 20'W x 10'H

Note[1]: Current pump design does not include overtopping of seawall. Overtopping volume will be incorporated into pump sizes once further analysis is conducted.

Galveston: Pump Station 3 Location & Stormwater Conduit

- Preliminary Pump Size[1]: 4,500 cfs
- Preliminary Drainage Conduits[1]:
  - Length: 9,075 LF
  - Dimensions: 20'W x 10'H

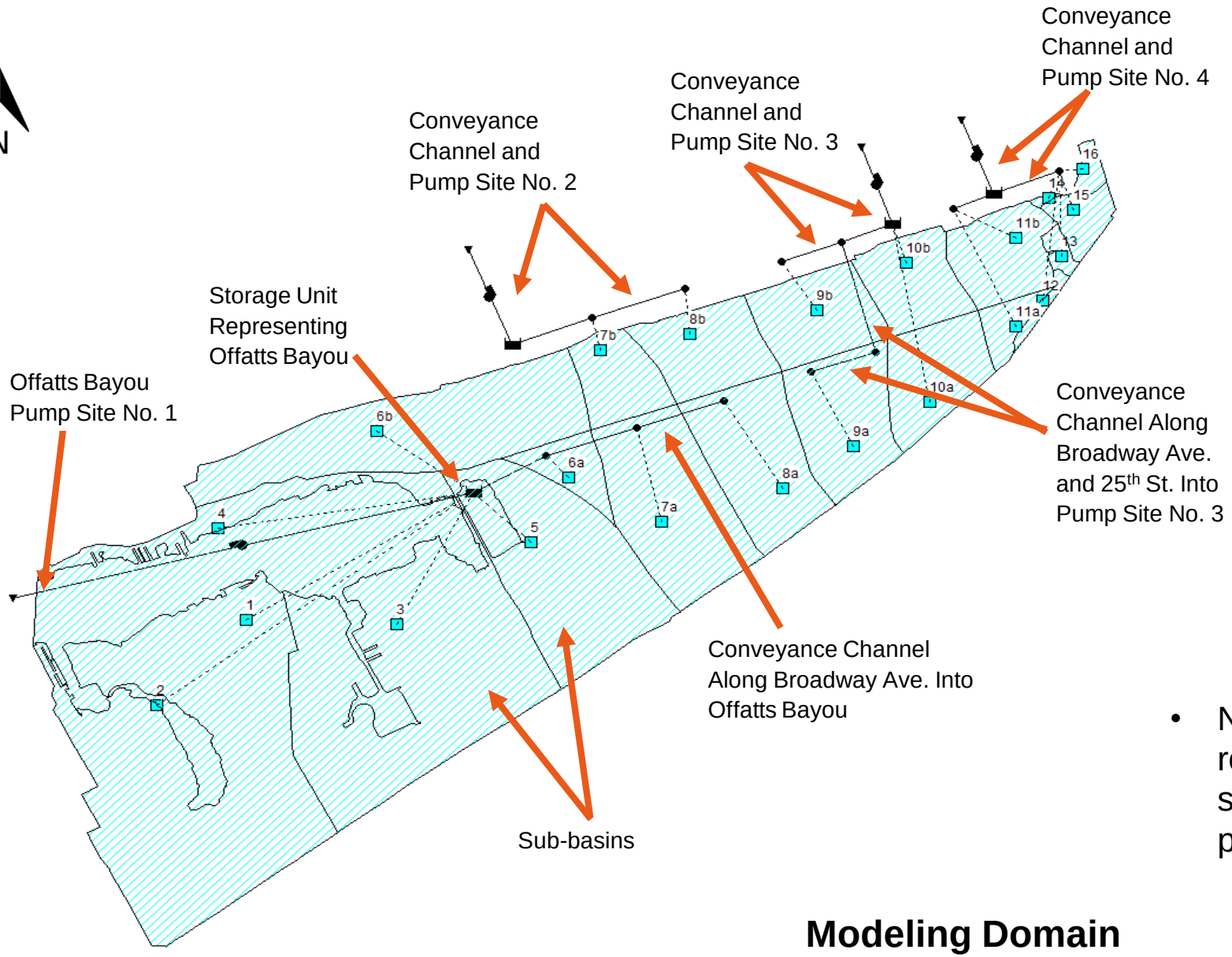
Note[1]: Current pump design does not include overtopping of seawall. Overtopping volume will be incorporated into pump sizes once further analysis is conducted.

Galveston: Pump Station 4 Location & Stormwater Conduit

- Preliminary Pump Size[1]: 1,500 cfs
- Preliminary Drainage Conduits[1]:
  - Length: 12,075 LF
  - Dimensions: 20'W x 10'H

Note[1]: Current pump design does not include overtopping of seawall. Overtopping volume will be incorporated into pump sizes once further analysis is conducted.

Review of Previous SWMM Model Grid



- Note: model layout only serves as visual representation of the system; does not show actual physical locations of proposed pumps and channels

Modeling Domain

Review of Previous Required Pump and Channel Sizes & Design Conditions

- Design conditions:

  Rain & Overtopping:
  - 25-yr + 30% rainfall (24 hr event)
  - No overtopping

  Operational Procedure & Constraints:
  - Offatts Bayou gate closed
  - Offatts Bayou de-watered to elevation of 1 ft below MLW
  - Max allowable surface elevation within Offatts Bayou of +4.0 ft NAVD88
  - No allowable surface flooding

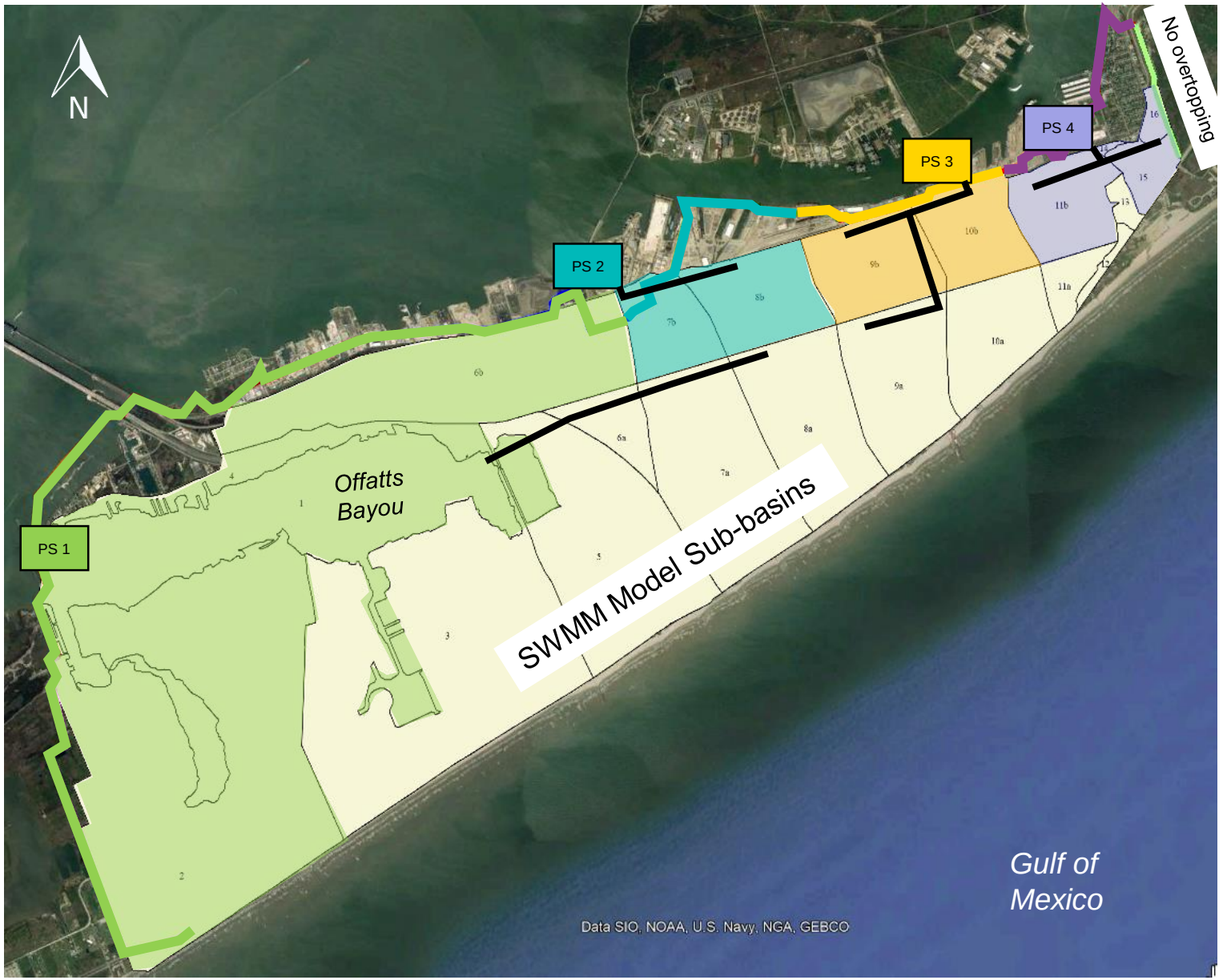
Parameter	Design Conditions for 25-yr+30% Rainfall (no overtopping)	
	Total Peak Inflow into Pump Site (cfs)	**Required Pump and Channel Sizes**
Offatts Pump Size	22,830	**250 cfs**
Broadway Ave. Conveyance channel		30’ wide x 13’ high 390 sf
Pump Site 2 - Pump	1,765	**1,500 cfs**
Pump Site 2 - Conveyance channel		20' wide X 10' high 200 sf
Pump Site 3 - Pump	3,688	**4,500 cfs**
Pump Site 3 - Conveyance Channel		20' wide X 10' high 200 sf
Pump Site 4 - Pump	2,208	**1,500 cfs**
Pump Site 4 - Conveyance Channel		20' wide X 10' high 200 sf

Applying Revised Alignment Overtopping Rates to Existing Model

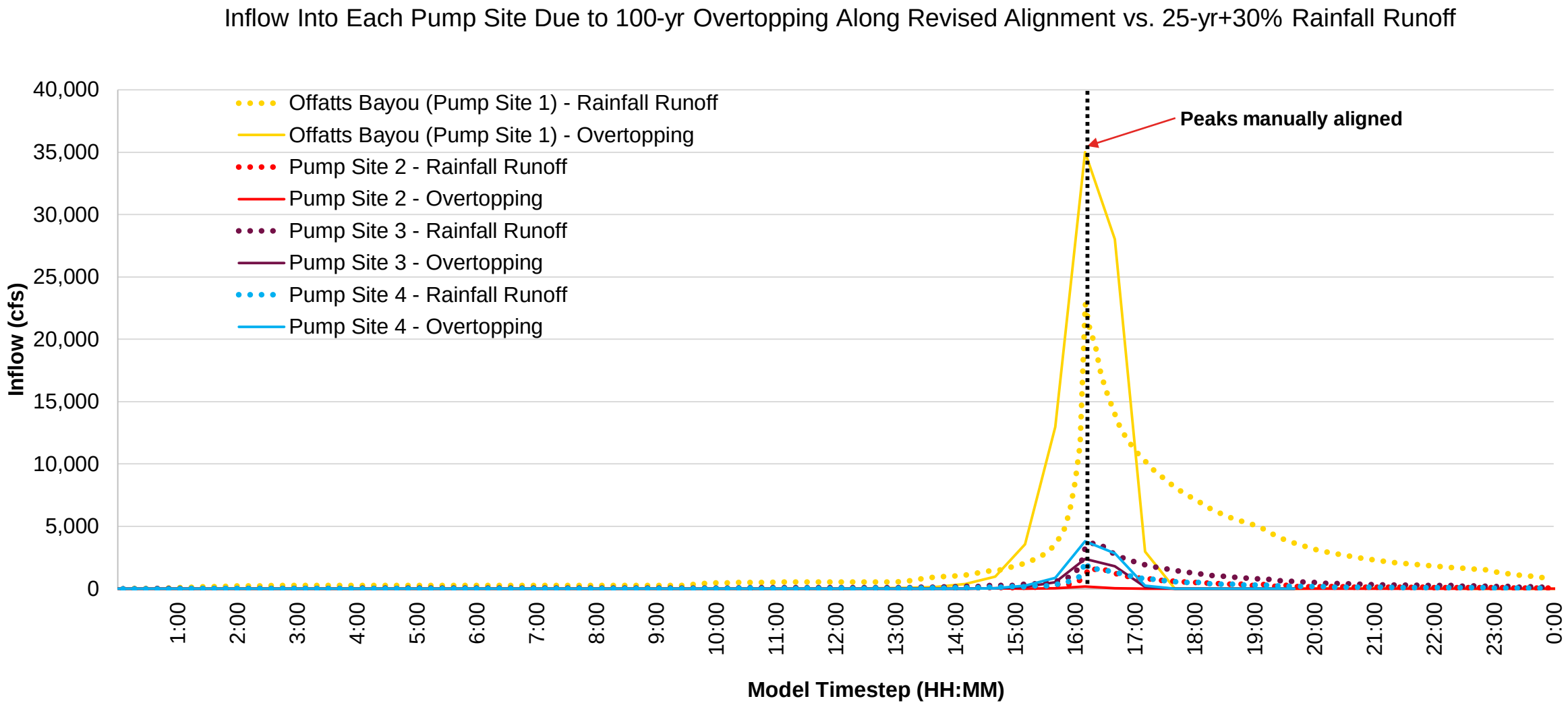
- Sub-basins drain to color-coded pump stations via conveyance channels (not shown)
  - Ex: PS 1, PS 2, etc.

- Overtopping rates were applied to the pump station systems using the rate (cfs/lf) multiplied by the length (lf) of the revised alignment that is adjacent to each existing sub-basin.
  - Results in a volumetric rate (cfs) of overtopping that gets directed into the correlated pump site system

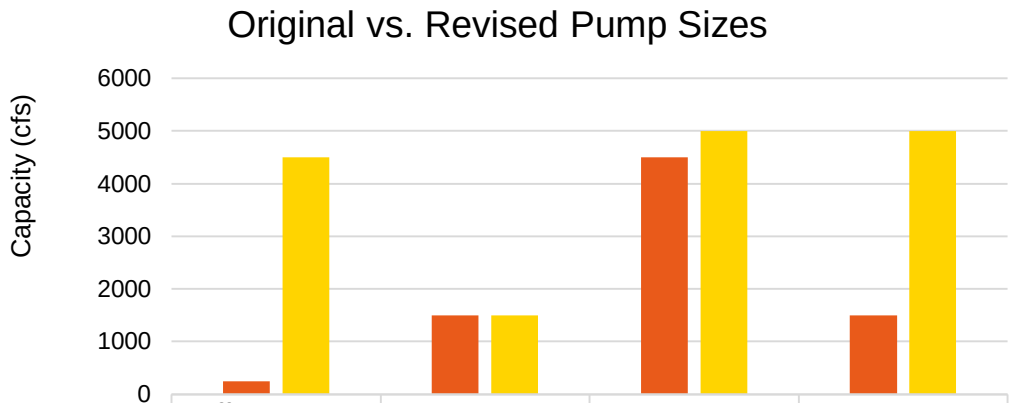
- No overtopping was recorded along the northeastern edge of the alignment



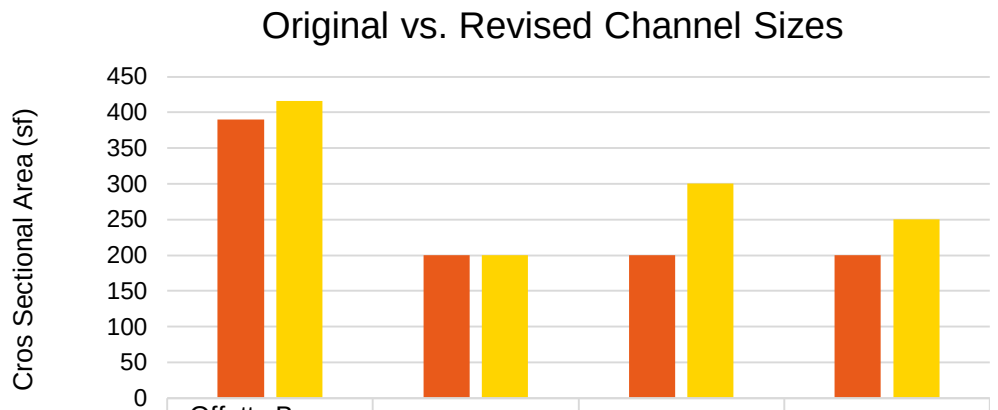
Resulting Inflow per Pump Site



Model Results



	Offatts Bayou (Pump Site 1)	Pump Site 2	Pump Site 3	Pump Site 4
Original Pump Design (cfs)	250	1500	4500	1500
Revised Pump Design (cfs)	4500	1500	5000	5000



	Offatts Bayou (Pump Site 1)	Pump Site 2	Pump Site 3	Pump Site 4
Original Cross Section Area (sf)	390	200	200	200
Revised Cross Section Area (sf)	416	200	300	250

- **<u>Pump Size Change Summary:</u>**
  - **Largest increases at Pump Site 1,4**. This is due to overtopping being relatively high at these sites compared to the other two,
  - Small increases at Pump Site 3.

- **<u>Channel Size Change Summary:</u>**
  - Pump sizes were iterated to maintain depth, but increase width as necessary to efficiently route the water to the pump stations.

Results Summary

- Pump Site 1 (Offatts Bayou)
  - Increase in pump size
  - Increase in channel cross section
  - Increase in Offatts Bayou max water elevation
- Pump Site 2
  - No increase
- Pump Site 3
  - Increase in pump size
  - Increase in channel cross section
- Pump Site 4
  - Increase in pump size
- No changes were made to conveyance channel locations, lengths, depths, slopes, or elevations

Parameter	Updated Conditions for 25-yr+30% Rainfall + 100-yr Overtopping Along Revised Alignment		
	Total Peak Inflow into Pump Site (cfs)	**% Increase of Peak Inflow due to Overtopping**	**Required Pump Sizes**
Offatts Pump Size	57,499	152%	**4,500 cfs**
Broadway Ave. Conveyance channel			32' wide x 13' high 416 sf
Pump Site 2 - Pump	1,984	12%	**1,500 cfs**
Pump Site 2 - Conveyance channel			20' wide X 10' high 200 sf
Pump Site 3 - Pump	5,507	49%	**5,000 cfs**
Pump Site 3 - Conveyance Channel			30' wide x 10' high 300 sf
Pump Site 4 - Pump	5,885	167%	**5,000 cfs**
Pump Site 4 - Conveyance Channel			25' wide x 10' high 250 sf

Conclusions

- At currently proposed +14.0’ floodwall elevation along the backside of Galveston, significant overtopping is expected.

- Additional overtopping results in an increase of required pump sizes, with the largest pump now being 5,000 cfs.

- **Would like USACE concurrence on drainage modeling methodology & pump sizes before moving forward with cost estimating effort.**

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Thank you