

Case for Expanding West Fork Project Scope

Analysis of West Fork San Jacinto River and Lake Houston Flow Profiles,
Bathymetry, Associated Landforms and Impact on Flooding

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Based on our reading of USACE docs and discussions with a USACE engineer, we feel the key issues are these:

- The Lower West Fork delta of the San Jacinto River is advancing development in size and shape.
- The West Fork mouth bar and surrounding shoal sediments are constraining in-bank flow conveyance capacity.
- **With no action to restore flow conveyance capacity** within the river's banks, the evolving conditions will cause the river to rise out of its banks and extensively flood properties and critical infrastructure in the region.
- **If addressed**, flood risks to developments will be reduced and the river will have the conveyance capacity to pass flood flows and flush sediment that would otherwise reduce conveyance capacity.

Our Objectives

- To understand why mouth bar not being addressed
- Ask whether adding it to project scope is feasible
- Present reasons why it should be



"Let's not define pre-Harvey conditions as the same amount of sand in the same places. Let's define it as "restoring flow."



US Army Corps of Engineers
Galveston District

We Agree!

Value Engineering Study for
EMERGENCY DREDGING
WEST FORK SAN JACINTO RIVER, TEXAS

U.S. Army Engineering District, Galveston
Study Dates: 1 – 4 May 2018

C-12. Conduct a feasibility study for Flood Risk Management (FRM) and/or Ecosystem Restoration (ER) for the entire system (Speculation List # 39): The problem with dredging only during this initial action is that the river is going to eventually revert to its current state. This is a combination of factors related to the velocity of the water in the river channel. First, the river slows down at the West Lake Houston Parkway Bridge as it turns north. As water slows at the bridge, it dumps its suspended sediments on the east side of the bridge. The water then slows as it reaches the upper end of Lake Houston dumping its suspended sediments into a delta. The accretion of this delta creates a dam like feature which then increasingly slows water and accretes the delta, compounding the problem. Additionally, Lake Houston has a spillway dam, which does not allow the majority of sediments to leave the lake and move downstream, out of the system. Essentially, the system is all sediment in and no sediment out. To create a sustainable hydrologic system that would alleviate flood risk along the West Fork San Jacinto River and also maintain water capacity within the lake, the USACE could look at a broader FRM project that incorporates beneficial use features as mitigation, or an ER project that uses ER to improve the health of the river.

Other key messages from USACE reports

Gov't Contract & Bid Document for dredging project (5/2018)

- “The Government has a requirement to dredge and remove shoal material within the West Fork of the San Jacinto River from Interstate 69 to the confluence of Lake Houston.”

Value Engineering Report for dredging project (5/2018)

- Harvey sediment constrains West Fork flow into Lake Houston.
- Smaller recent rains creating greater than expected flooding (3/28/2018).
- “In the event of another heavy rain event there is a near certain likelihood that widespread flooding will occur impacting even more homes than before due to the rivers inability to pass heavy volumes of water.”
- 8 miles dredging requested by TDEM and FEMA (but just 2 being dredged)
- River delta (Stream Mouth Bar) is a sediment dam that slows water entering lake, forces sedimentation and compounds the problem
- Clearing sediment blockage furthest downstream would enable natural scouring from future rain events (but mouth bar not currently in scope)
- Additional work is needed to create a sustainable hydrologic system that would alleviate flood risk along the West Fork San Jacinto River

We agree with USACE key points...

Also feel that...

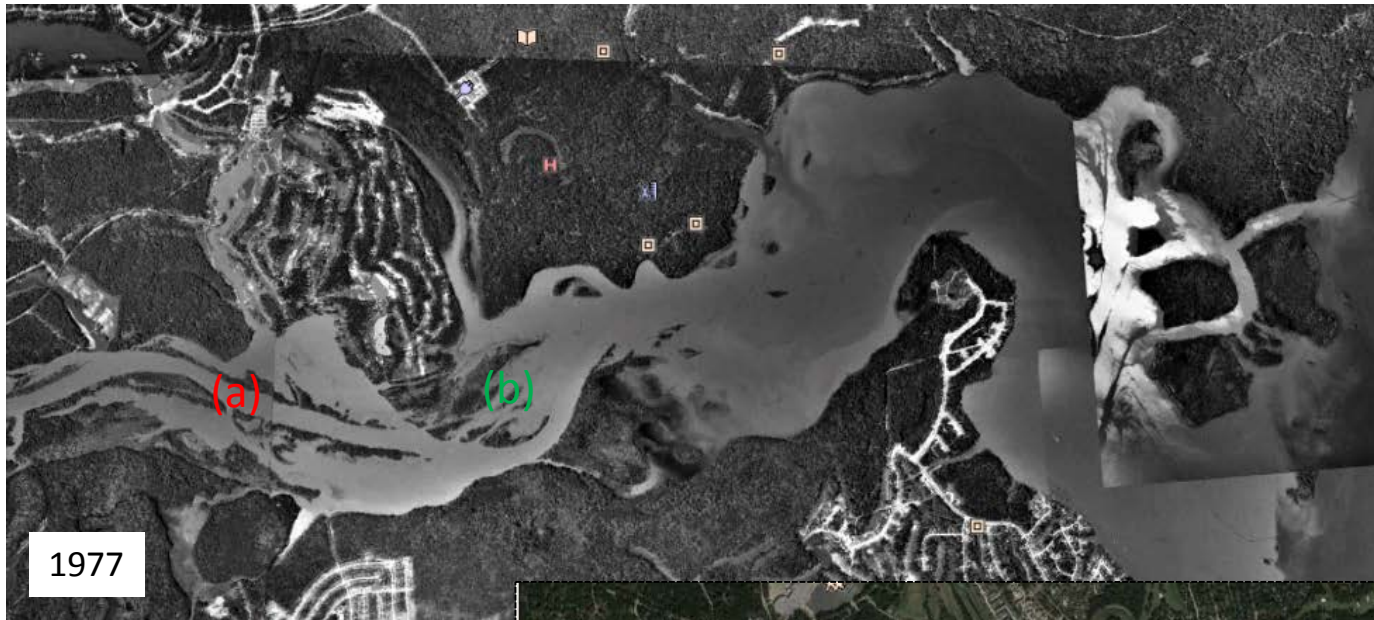
- Most significant blockage is at the river confluence with Lake Houston
- This blockage is past where current dredging plan ends near WLHP bridge
 - West Fork is over 40' deep as it passes under the WLHP bridge.
 - In next 1.5 miles downstream, river bottom rises due to sediment build up to less than 5' at the rivers confluence with the lake where a large emergent Stream Mouth Bar (SMB) sits.
- Significant hydraulic impact/backwater effect caused by this large sediment blockage
- Re-evaluation needed to determine:
 - Negative impact of accelerated sedimentation
 - Contribution to increased flooding upstream
- HALF of all damage in Kingwood happened between eastern boundary of current dredging and SMB.

As geologists we observed...

- **Pre-Lake Houston** - West Fork established equilibrium gradient to the coast.
- **Post-Lake Houston** – A delta with a large Stream Mouth Bar (SMB) has developed in the West Fork and migrated downstream to current position.
- It creates a significant back-water effect (acting as a sediment dam at head of Lake Houston).
- This contributes to elevated flood levels and increased rates of sedimentation upstream.
- Kingwood and N. Atascocita residents no longer live on a lake, but on an advancing delta that keeps floodwaters from equilibrating with the lake.
- Reducing flood impact will require addressing delta issue.
- Reducing crest 4' through Kingwood would have turned major flooding into minor flooding. Impact of bar might be as much as 6'.

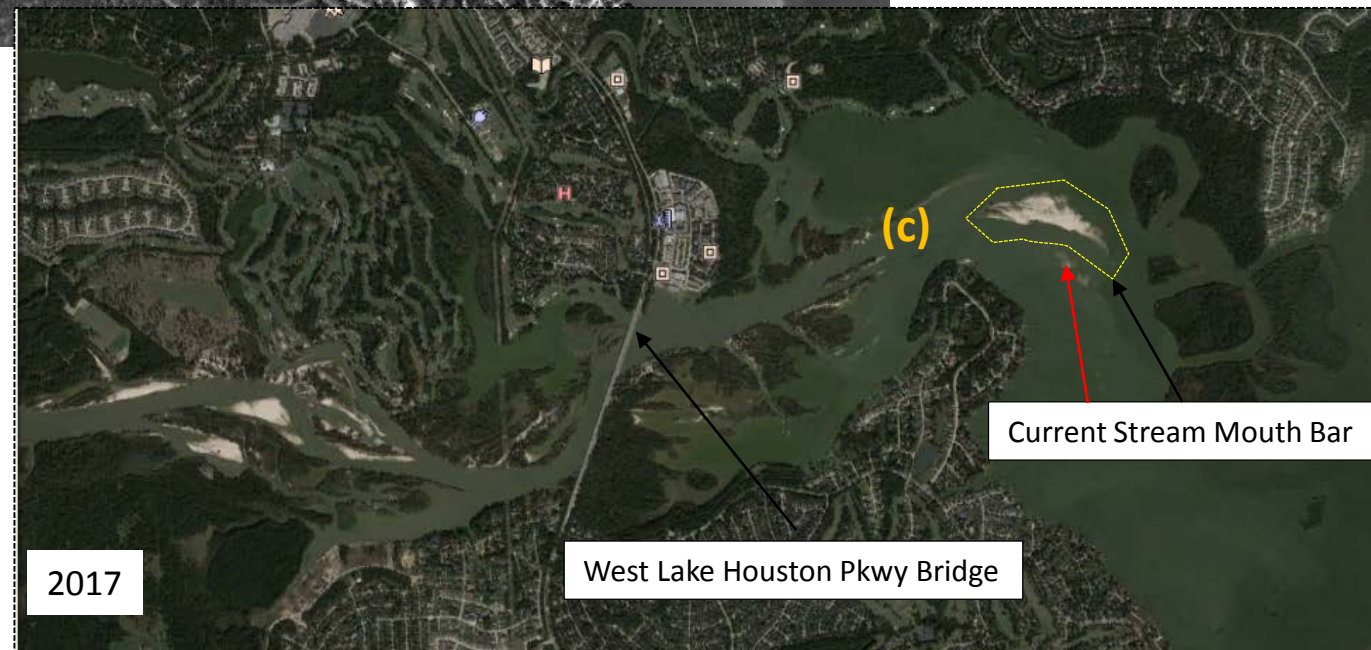
We recommend dredging all the way through SMB.

Delta Front / Stream Mouth Bar Evolution: Dec 1977 - Oct 2017



- A delta has been advancing into Lake Houston since its inception in 1953.
- By 1977, these deltaic sediments included a leveed channel (a) feeding a series of stream mouth bars (b) just upstream of where West Lake Houston Pkwy Bridge is today.

- By October 2017 (Post Harvey) the delta front (c) including a large subaerial stream mouth bar had migrated 1.6 miles downstream.
- These delta front sediments are acting as a dam to flow which is exacerbated by the $>90^\circ$ south bend of the river/lake at this point.



West Lake Houston Pkwy Bridge

Current Stream Mouth Bar

Delta Front / Stream Mouth Bar – Dec 31, 1977



Delta Front / Stream Mouth Bar – Dec 31, 1988

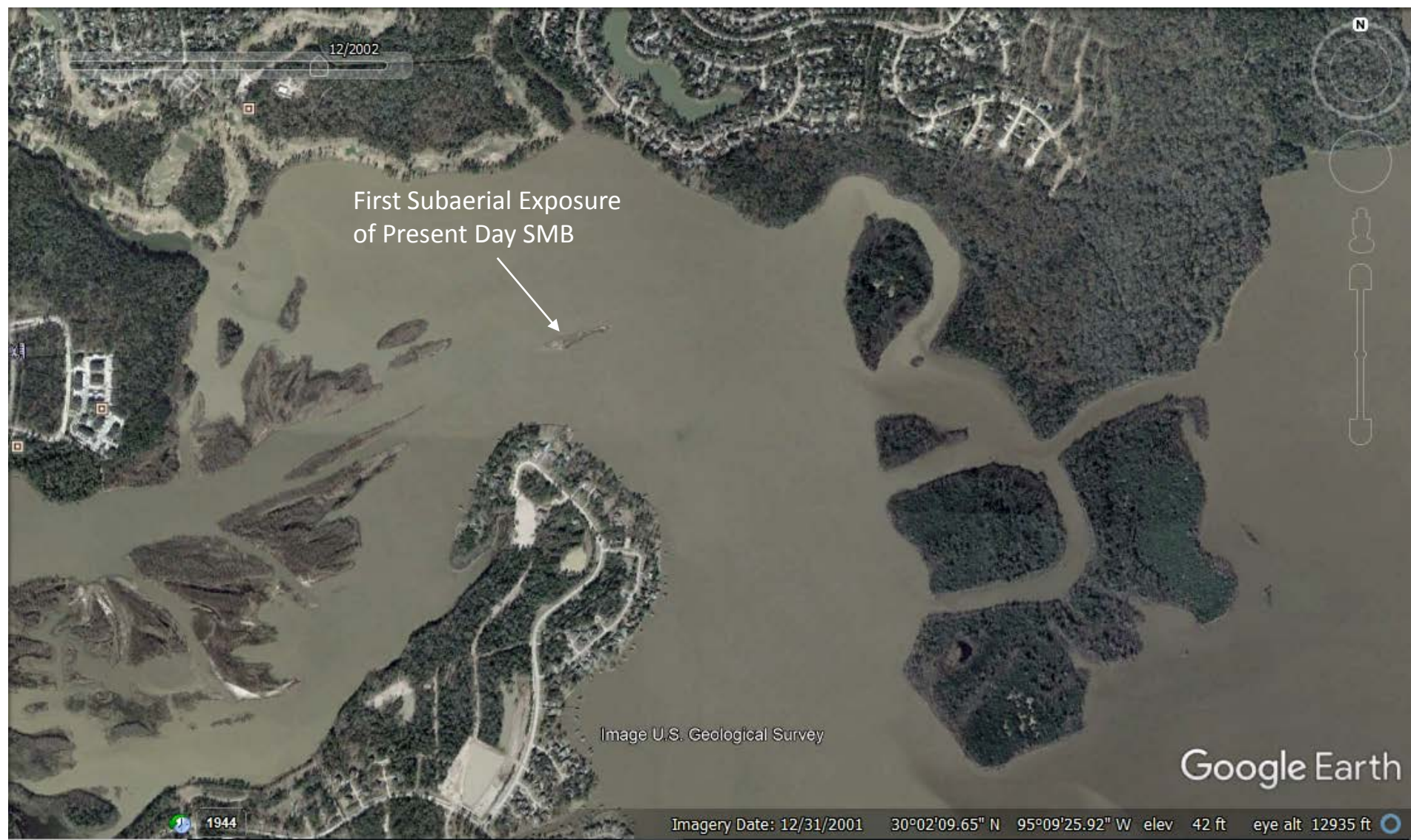


Delta Front / Stream Mouth Bar – Jan 14, 1995

POST-1994 Flood

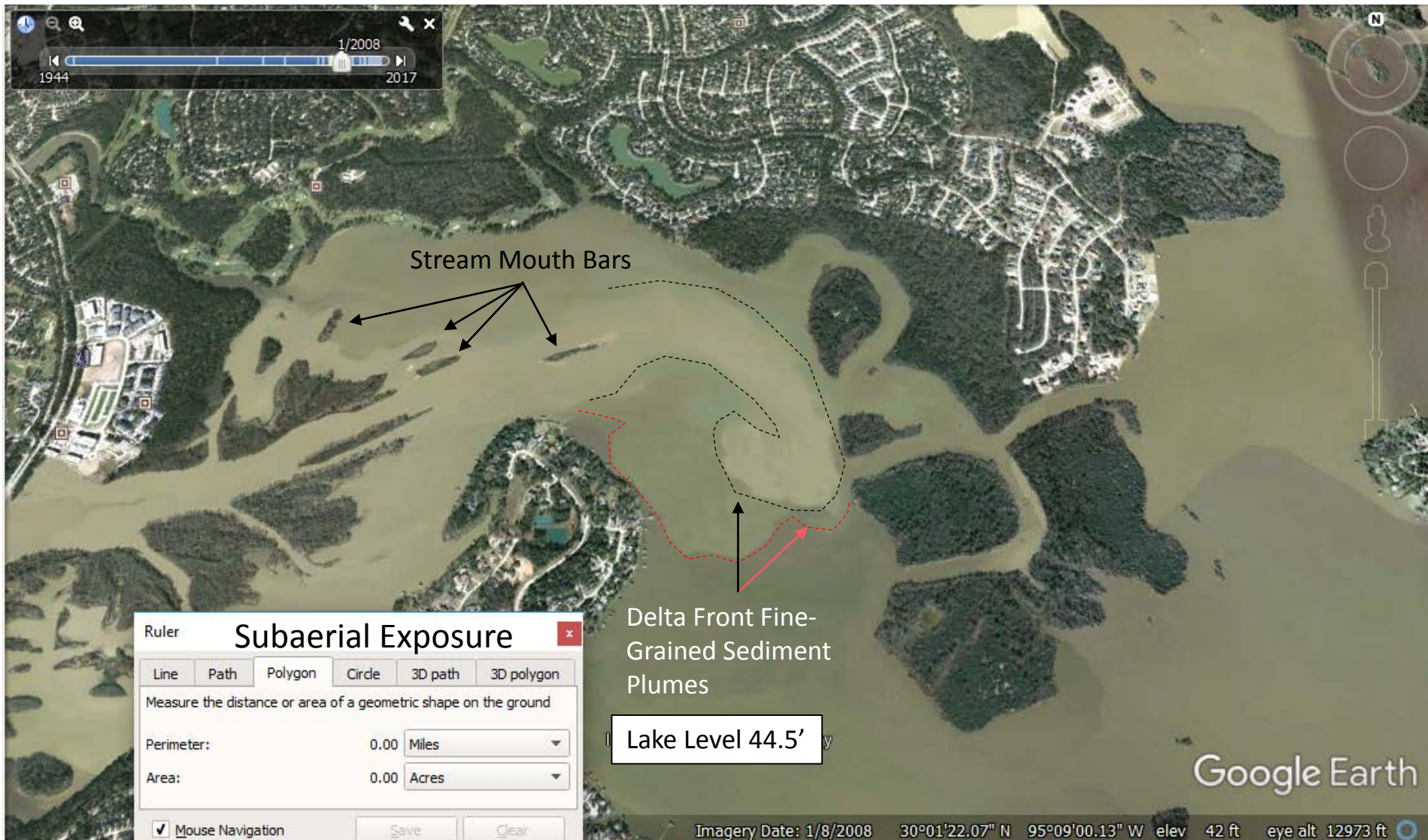


Delta Front/Stream Mouth Bar – Dec 31, 2001

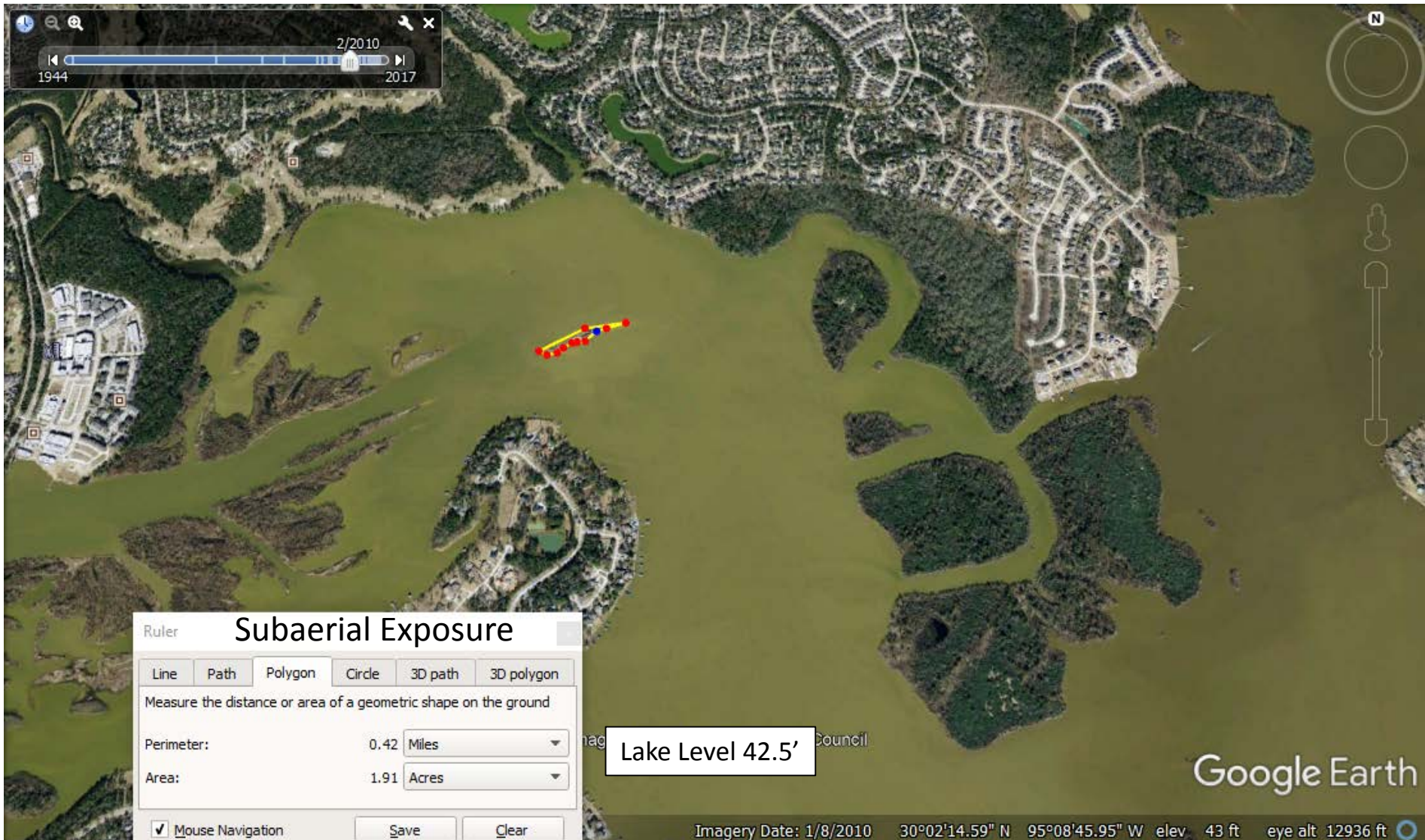


Delta Front / Stream Mouth Bar – Jan 8, 2008

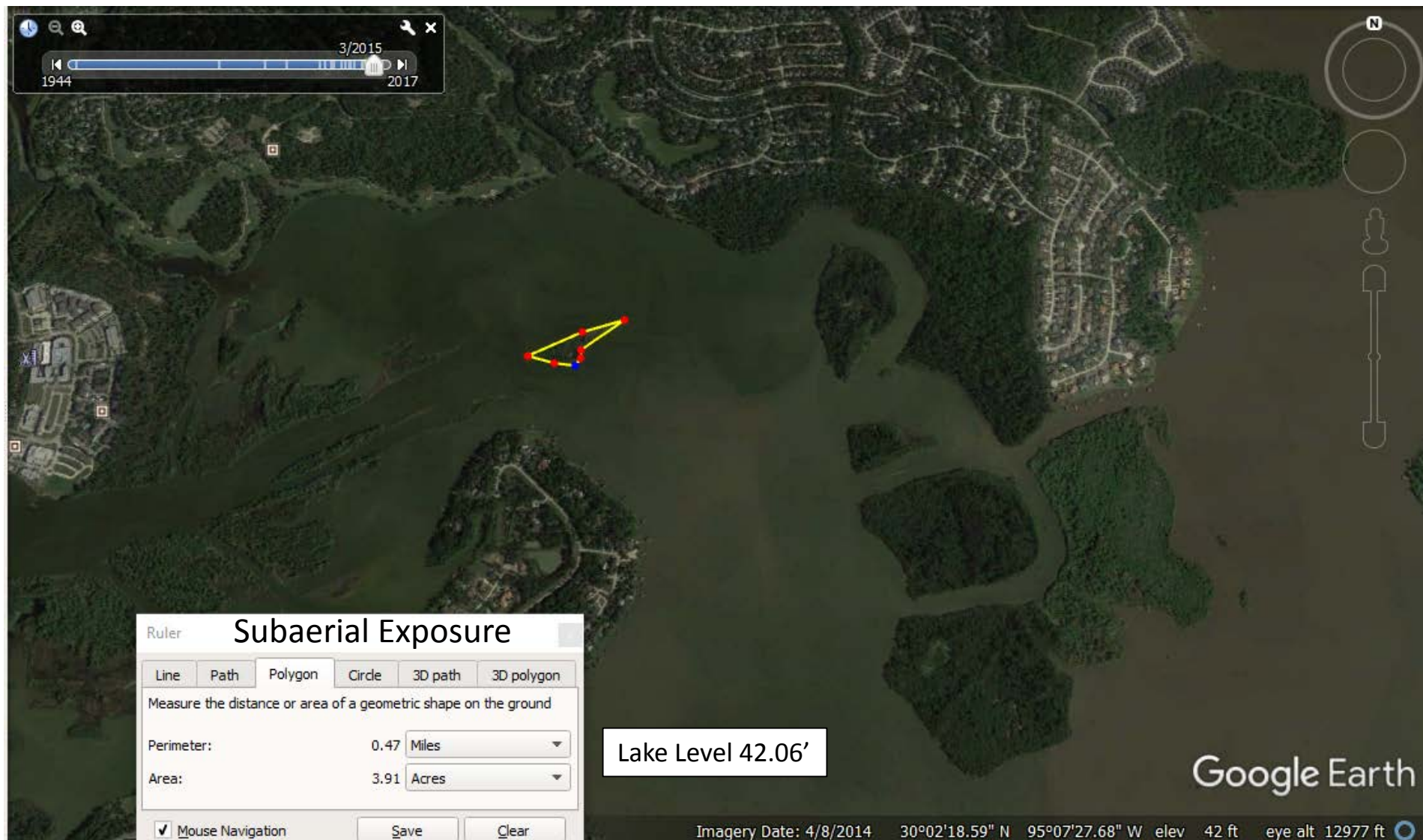
High Water Event



Delta Front / Stream Mouth Bar – Jan 8, 2010



Delta Front / Stream Mouth Bar – Apr 8, 2014



Delta Front / Stream Mouth Bar – Feb 7, 2016

Pre-2016 Floods



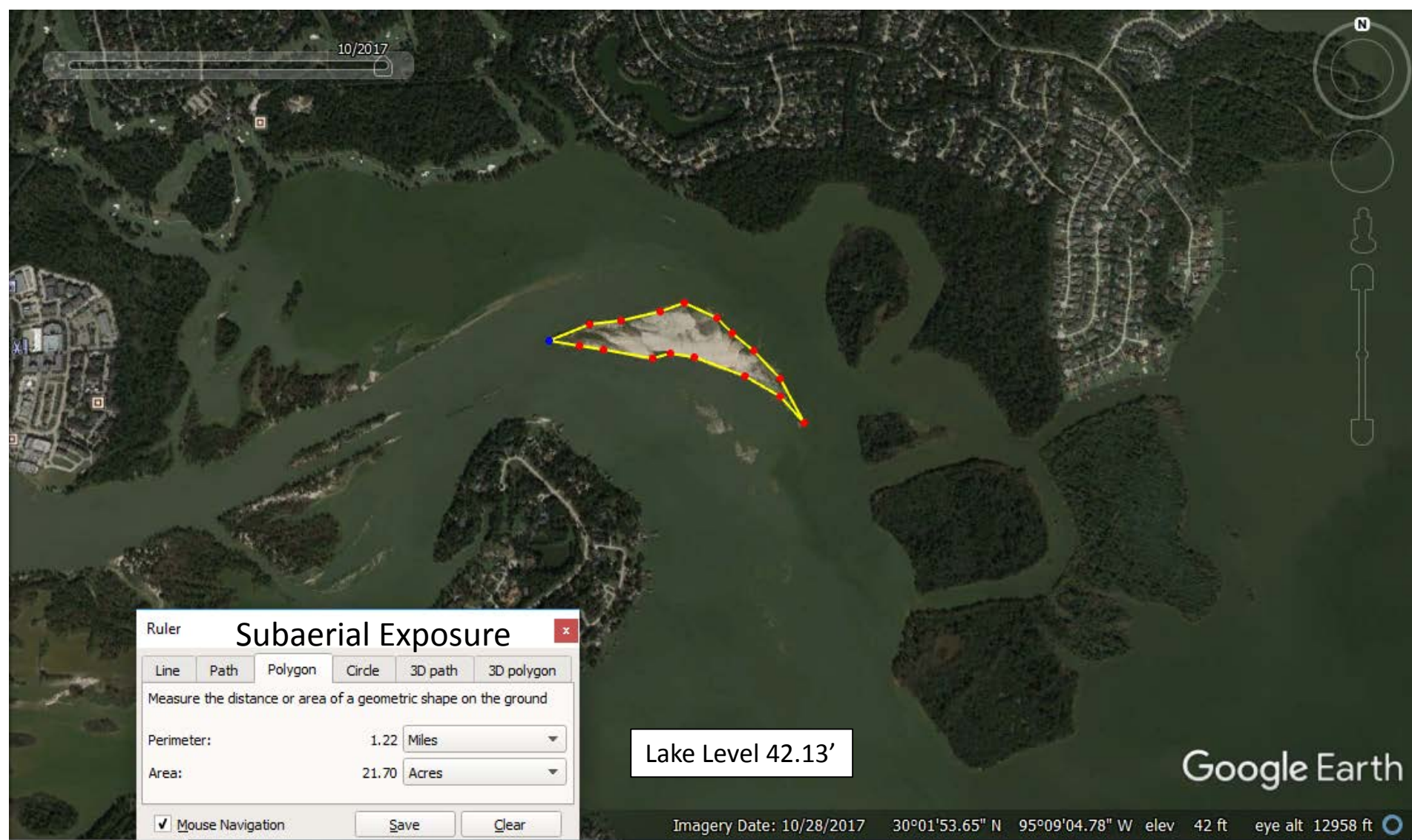
Delta Front / Stream Mouth Bar – Jan 1, 2017

PRE-HARVEY -- Post 2016 Floods

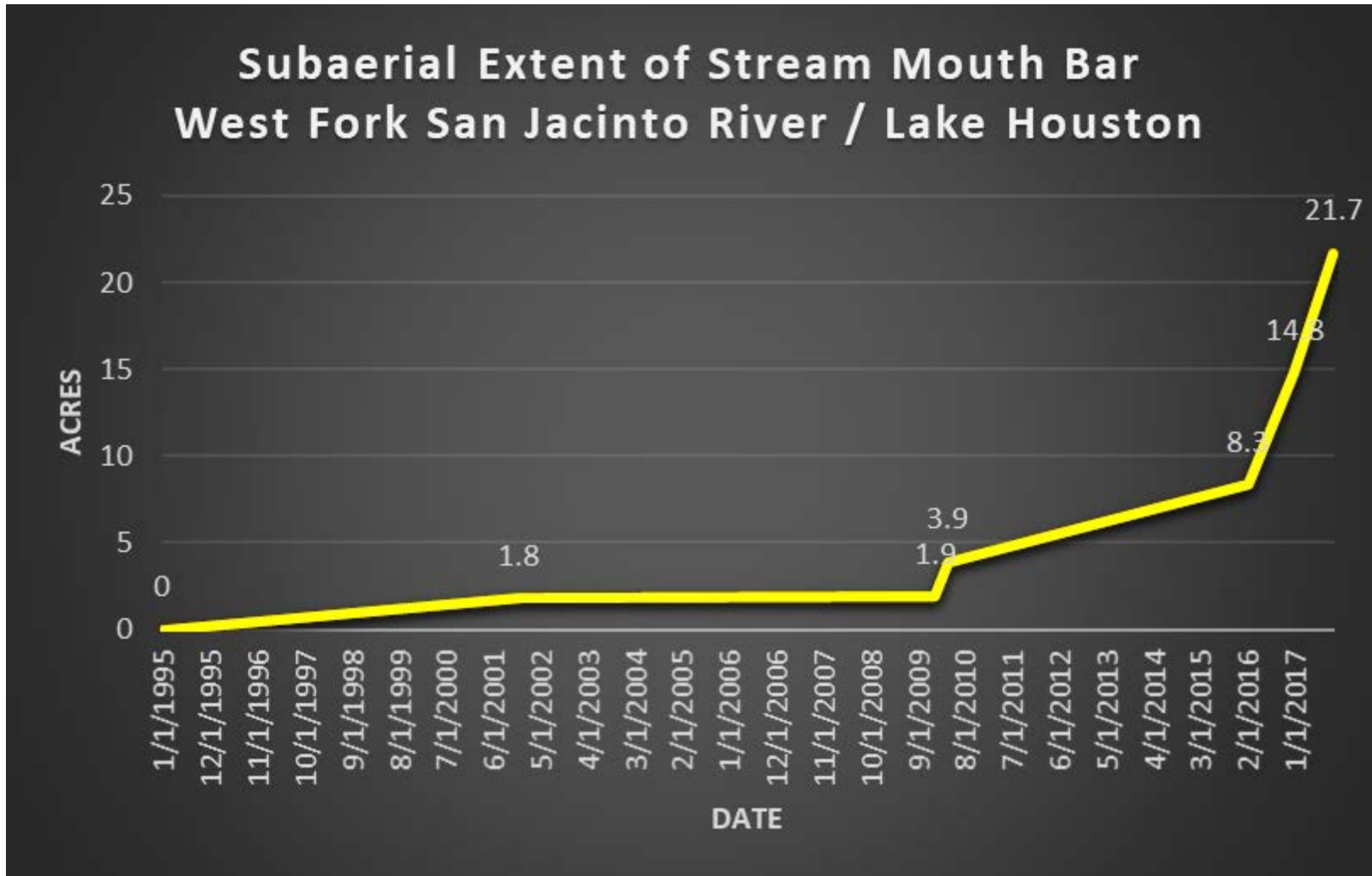


Delta Front / Stream Mouth Bar – October 28,2017

POST-HARVEY

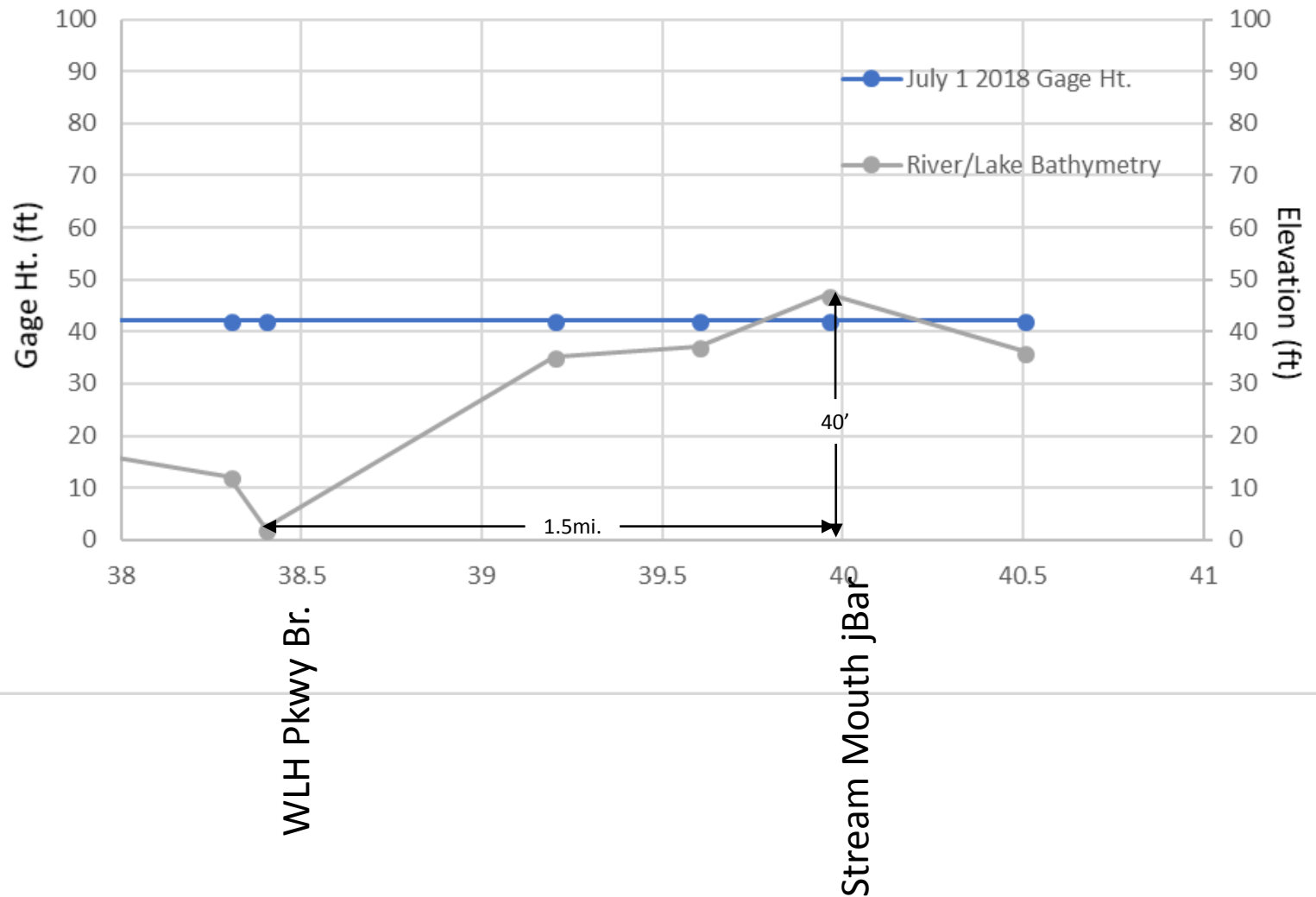


Accelerating Rate of Deposition



Increasing sediment blockage drives flooding, threatens Infrastructure

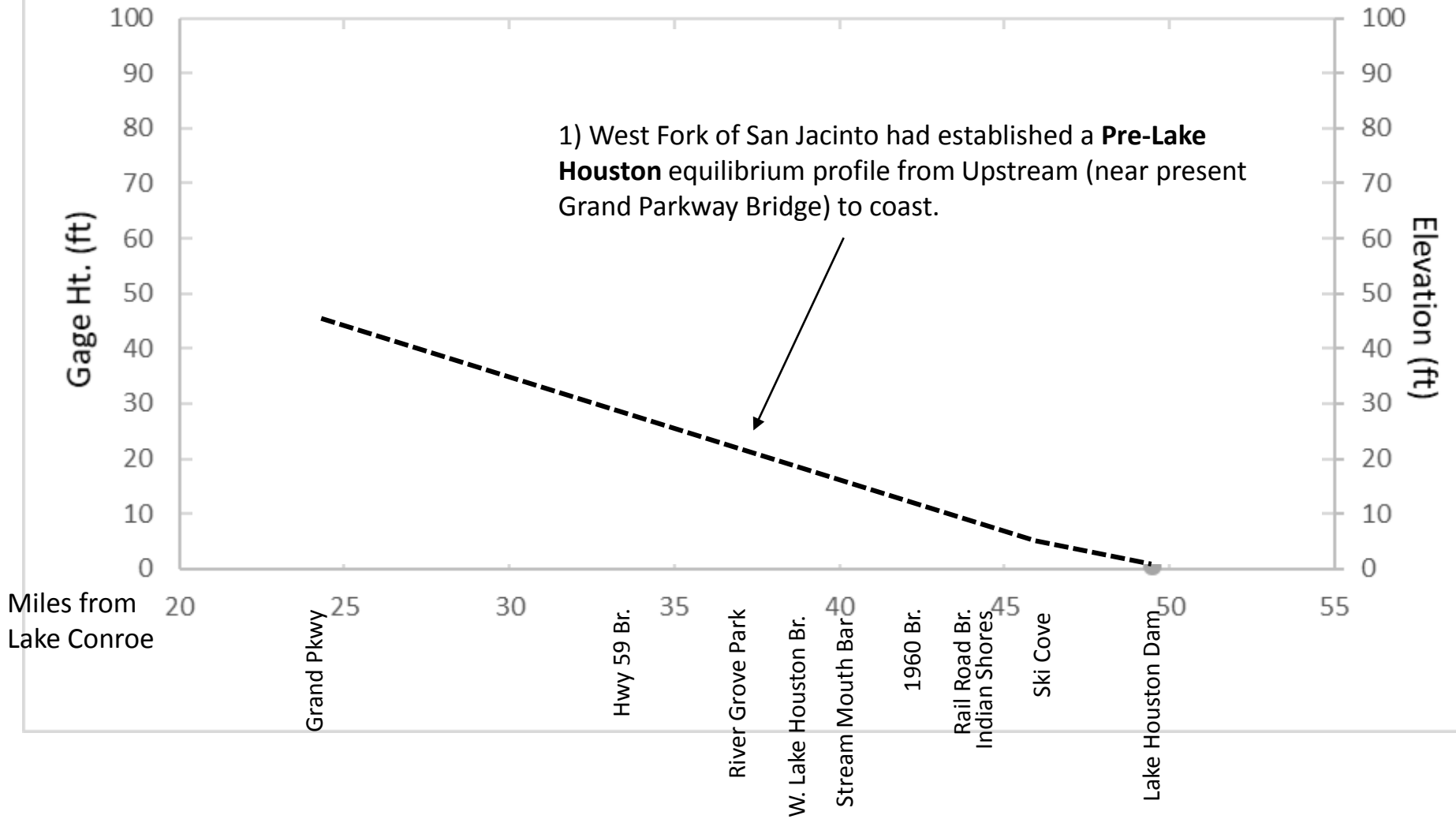
River Profile WLH Pkwy Bridge to Stream Mouth Bar



West Fork San Jacinto River and Lake Houston Elevation Profiles

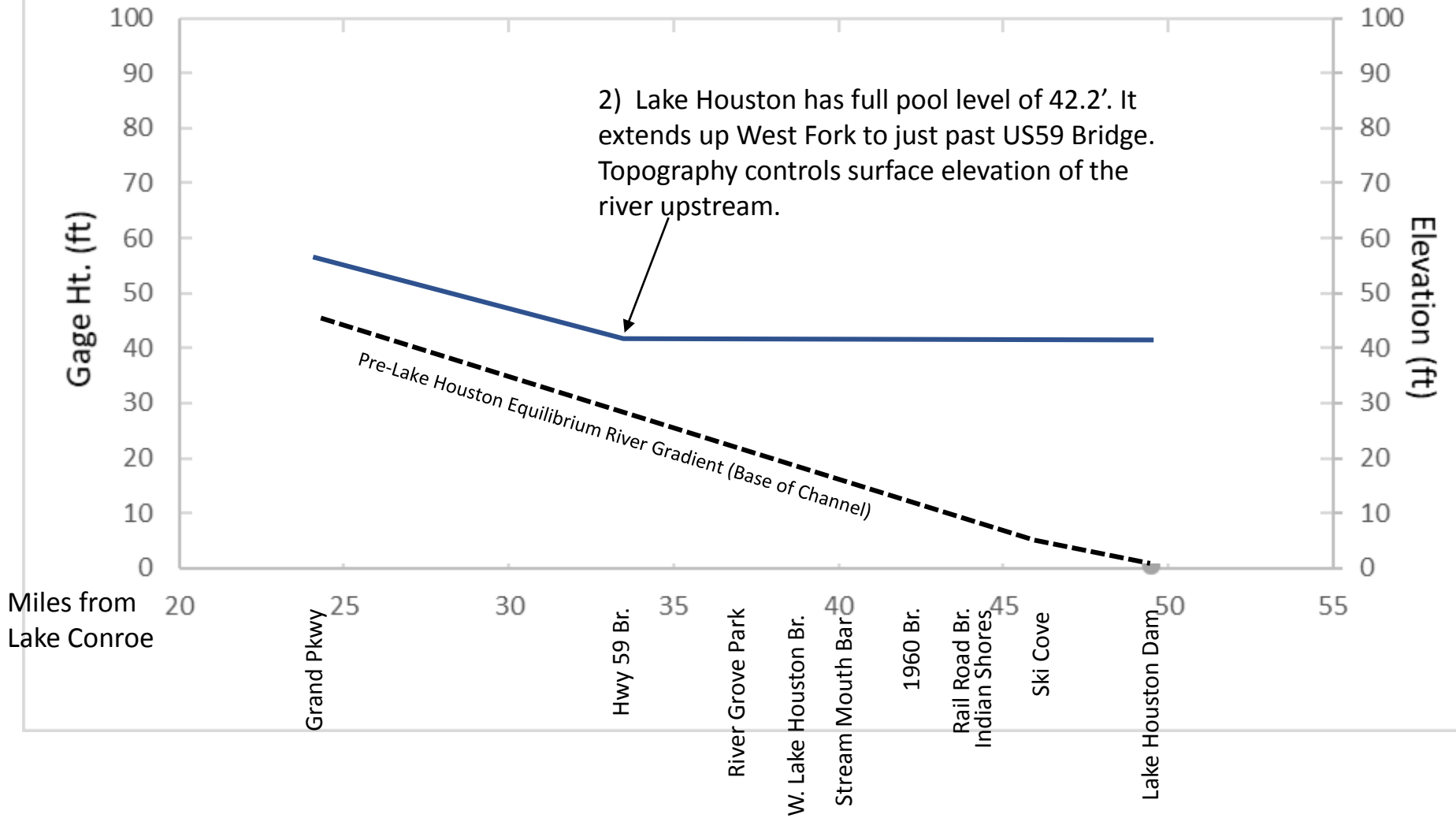
Grand Pkwy to Lake Houston Dam

Implications for Flooding



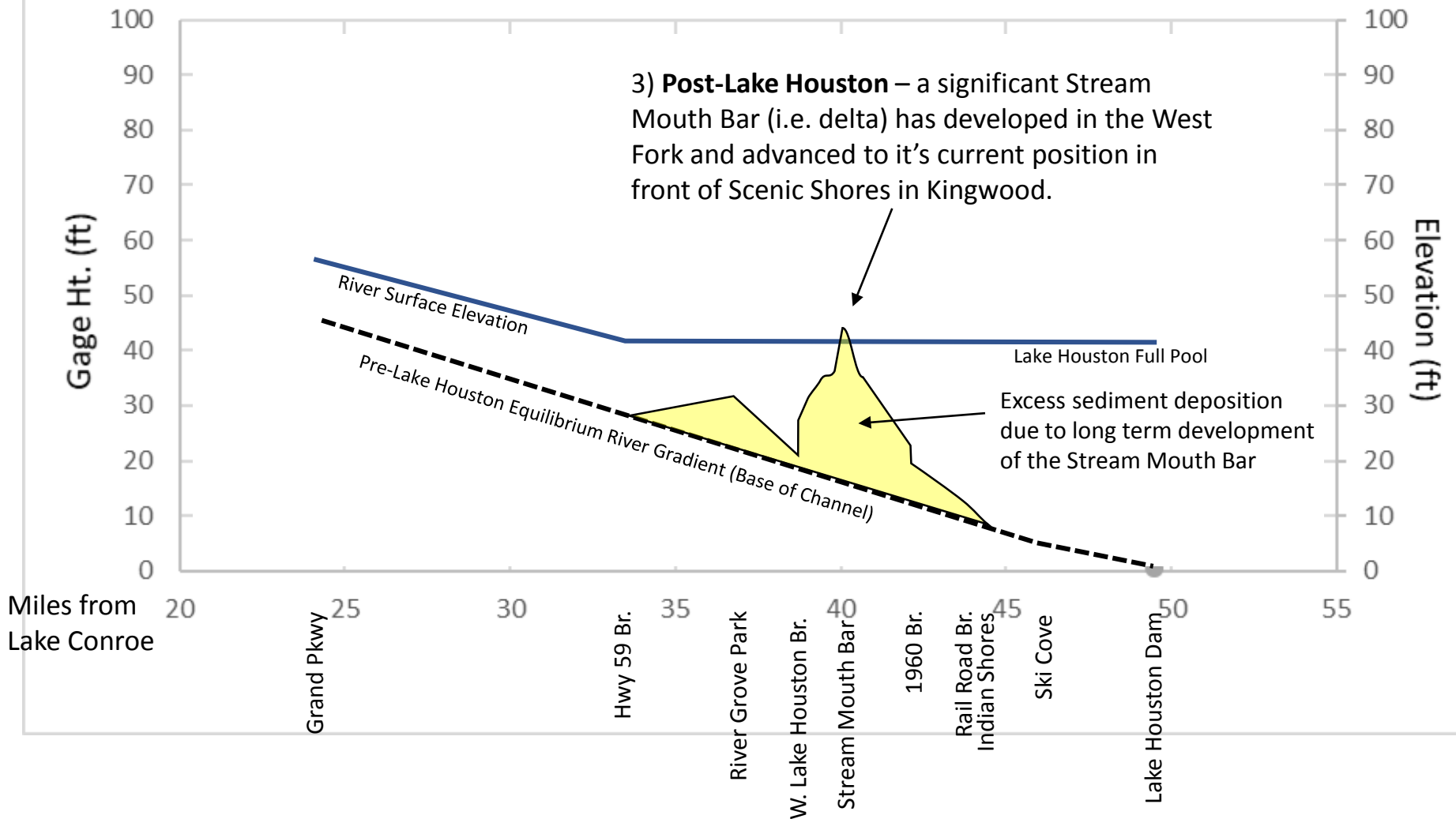
Flood crest and July data points are from river/lake elevation gages and high water mark points. Depth points in the lake are taken from a depth map of Lake Houston (circa 2011) generally along the primary relict river channel.

West Fork San Jacinto River and Lake Houston Elevation Profiles Grand Pkwy to Lake Houston Dam Implications for Flooding



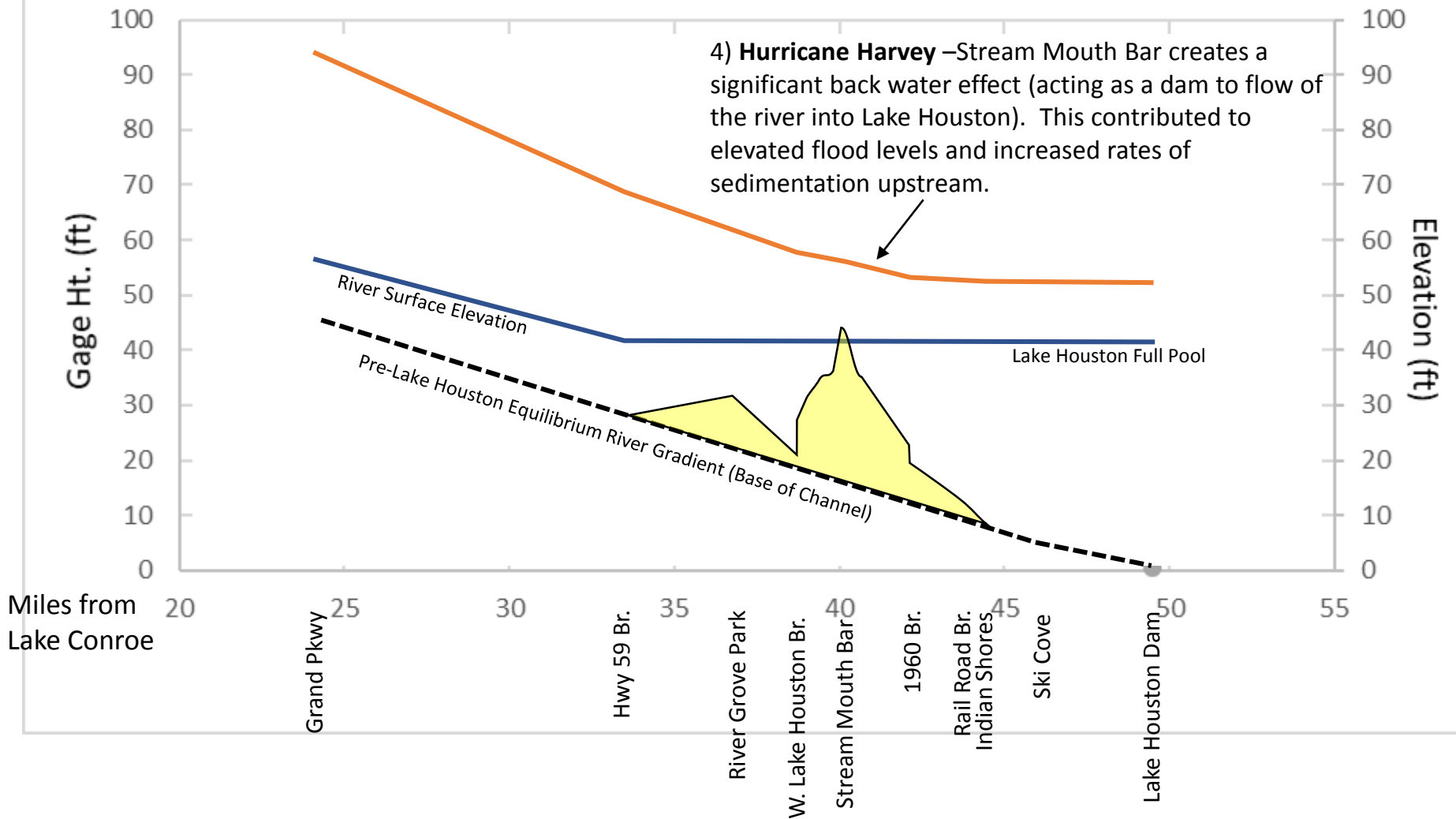
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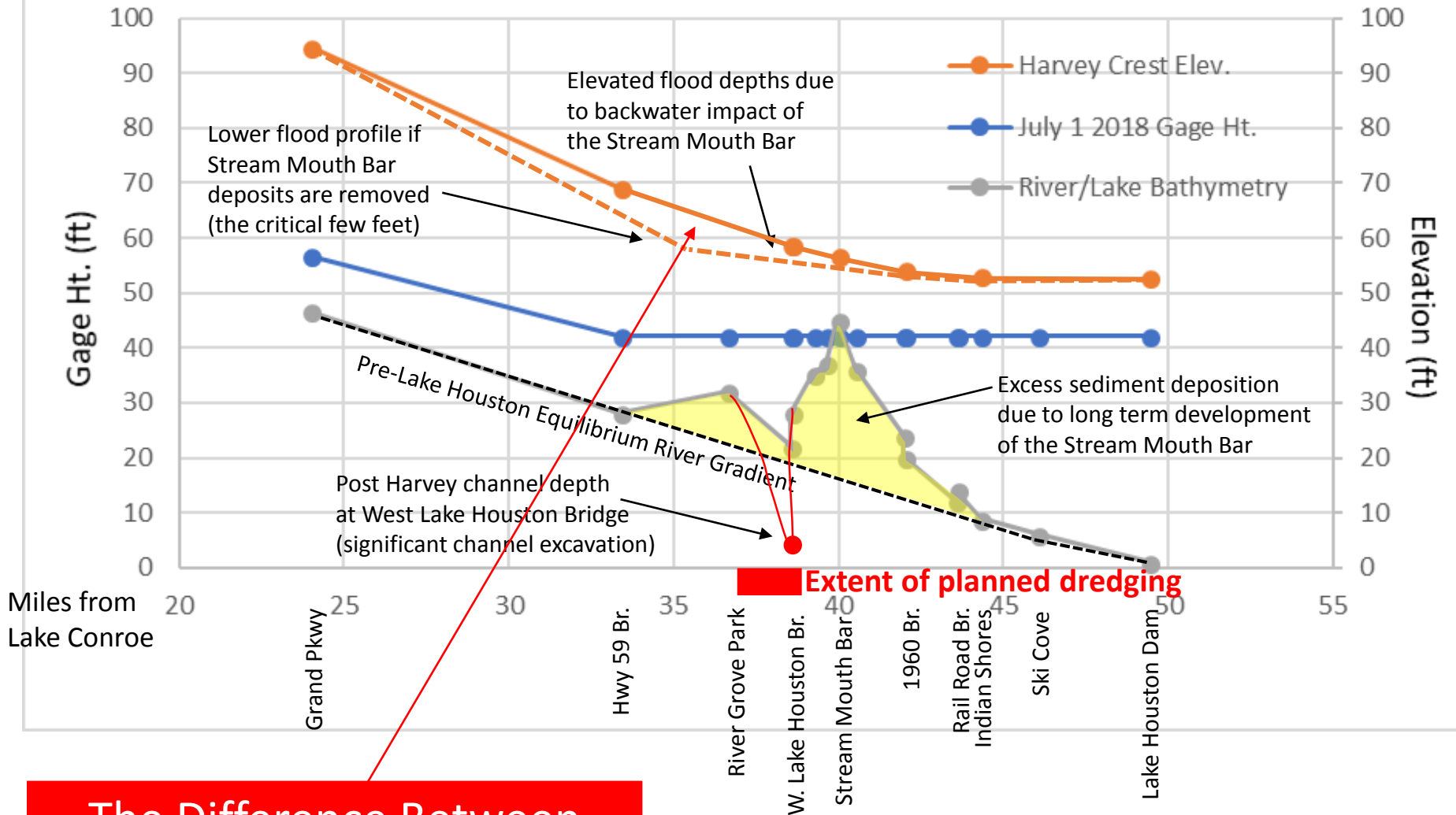
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West Fork San Jacinto River and Lake Houston Elevation Profiles Grand Pkwy to Lake Houston Dam

Implications for Flooding



**The Difference Between
Major and Minor Flooding**

Flood crest and July data points are from river/lake elevation gages and high water mark points. Depth points in the lake are taken from a depth map of Lake Houston (circa 2011) generally along the primary relict river channel.

Observation and Request

- Experience as students of river geomorphology tells us:
 - Lower West Fork delta is advancing
 - Current mouth bar and surrounding shoal sediments are now past critical mass
 - Untouched, they will force river to backup and flood
 - They threaten infrastructure around it and behind it
 - If addressed, flood risk reduced and river able to flush sediment
- **Please revisit scope and extend dredging downstream:**
 - Include all or part of Mouth Bar as change order if possible
 - Leverage equipment, save time/dollars, reduce risk
 - Instead of defining “Pre-Harvey Conditions” as “same amount of sand in the same places,” we need to define it as “restoring flow.”

If not part of emergency, starting over with new stakeholders, surveys, funding, and permitting could delay removal of mouth bar by five years.

Appendices

- Priorities from a geologist's perspective
- 2011 TWDB sediment map

West Fork San Jacinto River/Lake Houston

Restore the Flow/Reduce the Risk



Elevation Relief Map Lake Houston Water Bottom Circa 2011

River / Lake Profile from Preceding Figure
Follows Main West Fork Channel into Lake then
combined East Fork – West Fork channel down
Lake bed to dam.

Map from:
*Volumetric and Sedimentation
Survey of Lake Houston*
December 2011 Survey
Texas Water Development Board,
July 2013

