Franklin County Water District

Preliminary Engineering Report (PER)

Flood Relief Project Alternatives

3/6/2017

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Phil Bullock, P.E.

Engineers...Working Wonders With Water®

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Carollo delivers national expertise specializing ONLY in water and wastewater



WATER

OUR FOCUS

OUR BUSINESS

OUR PASSION

Lake Cypress Springs

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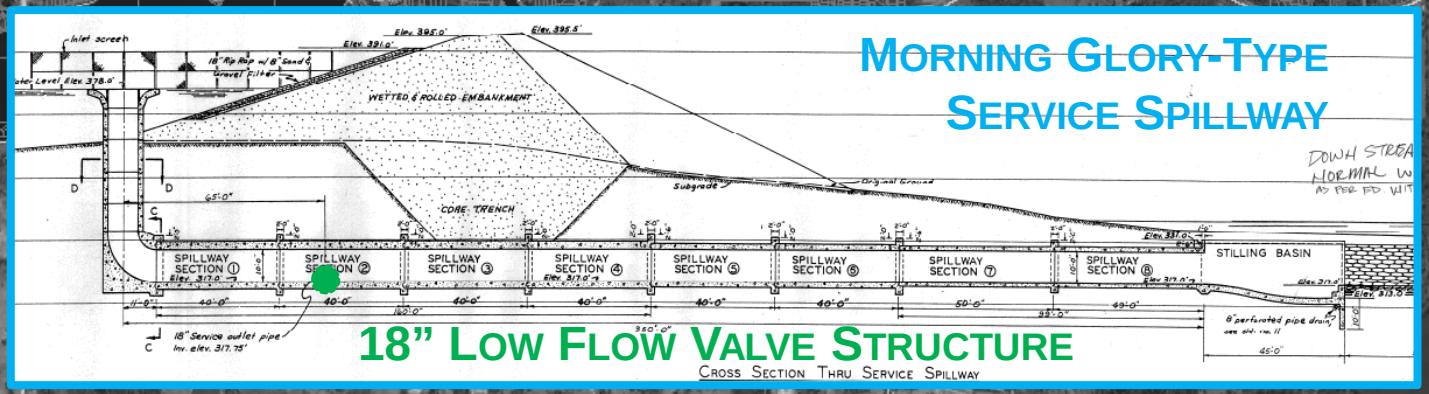
EMERGENCY SPILLWAY

Co Rd SE 3122

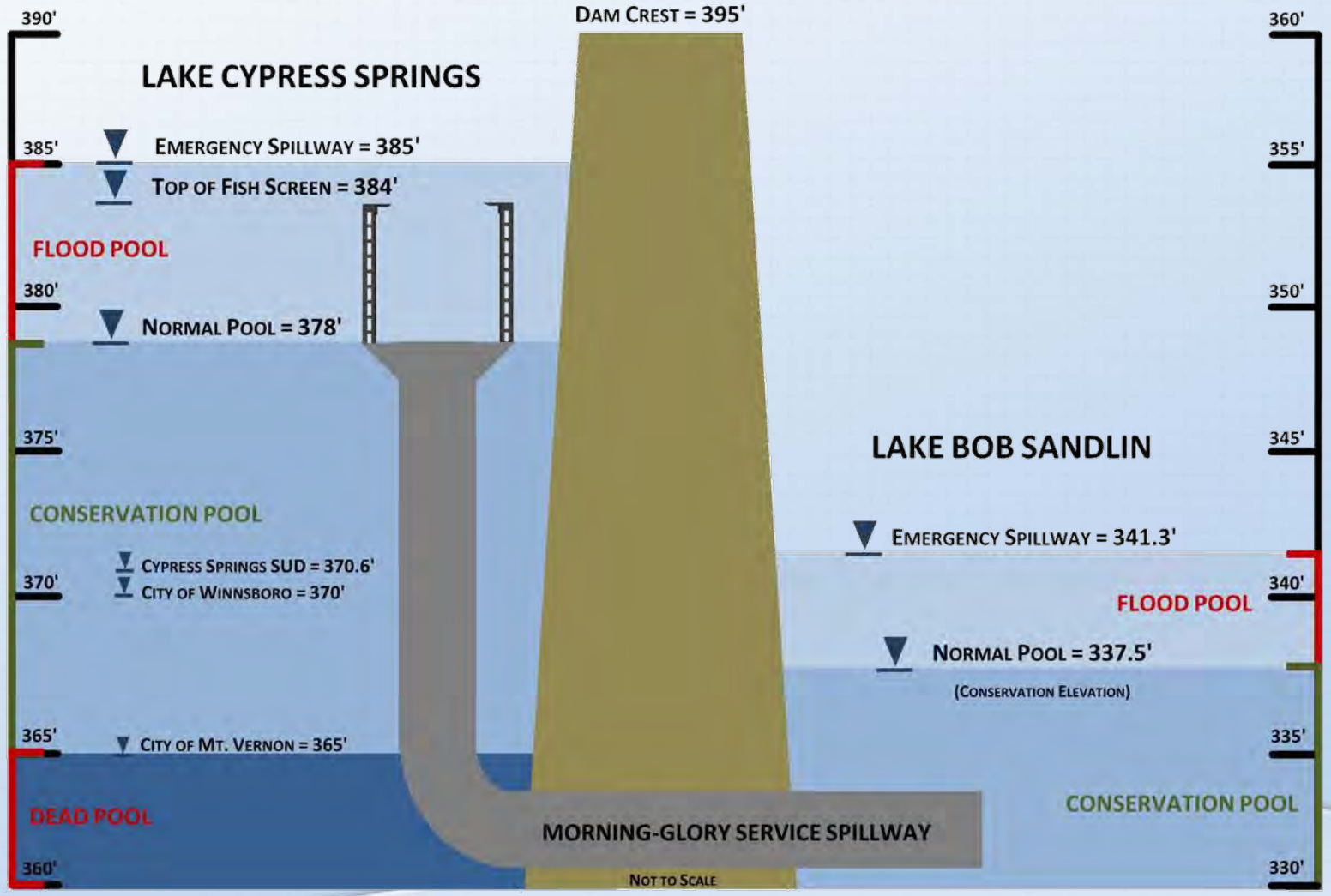
Lake Cypress Springs

LCS DAM

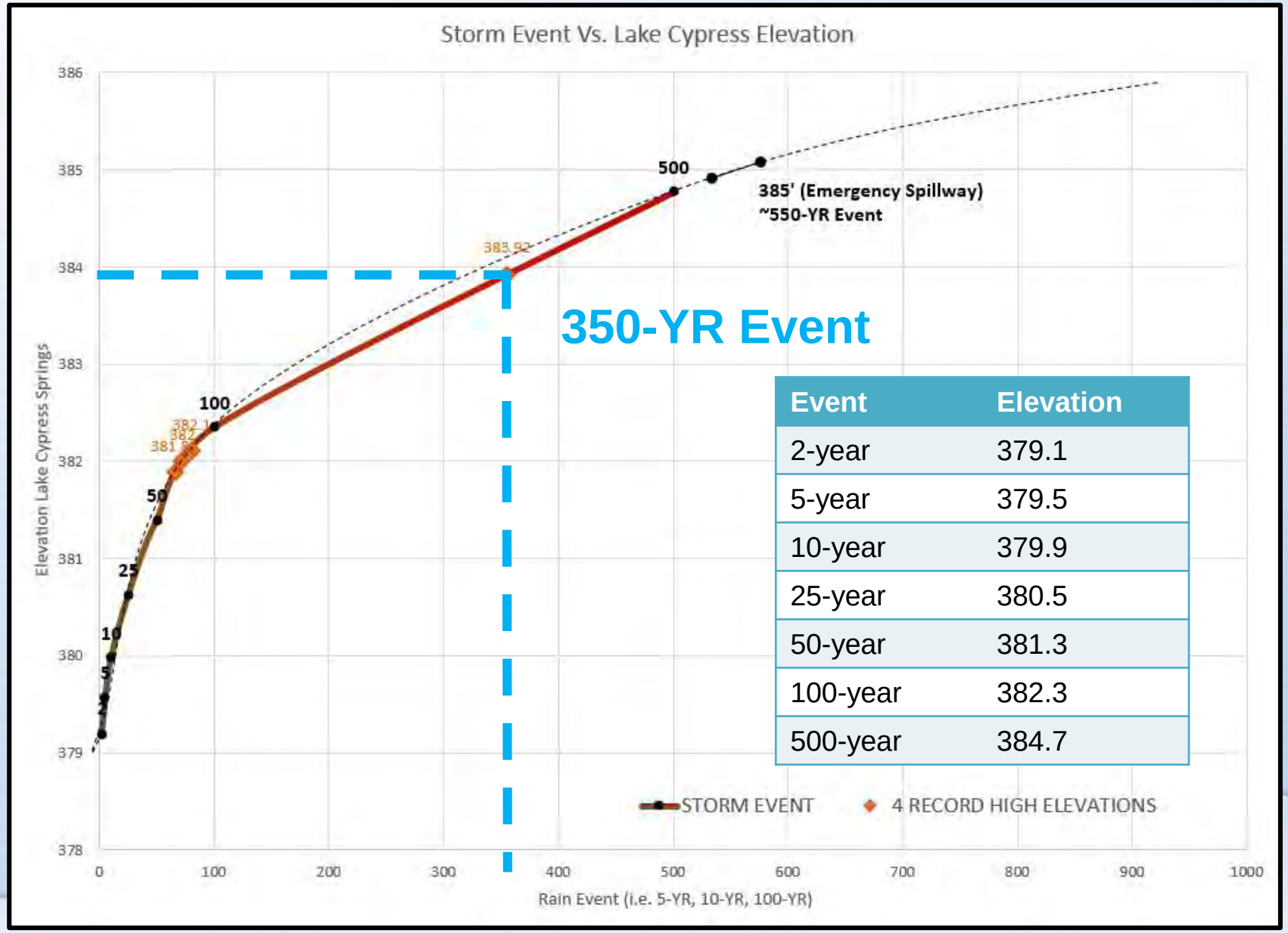
LAKE BOB SANDLIN



Lake Cypress Springs Spillway



December 2015 Event (383.92')



Event	Elevation
2-year	379.1
5-year	379.5
10-year	379.9
25-year	380.5
50-year	381.3
100-year	382.3
500-year	384.7

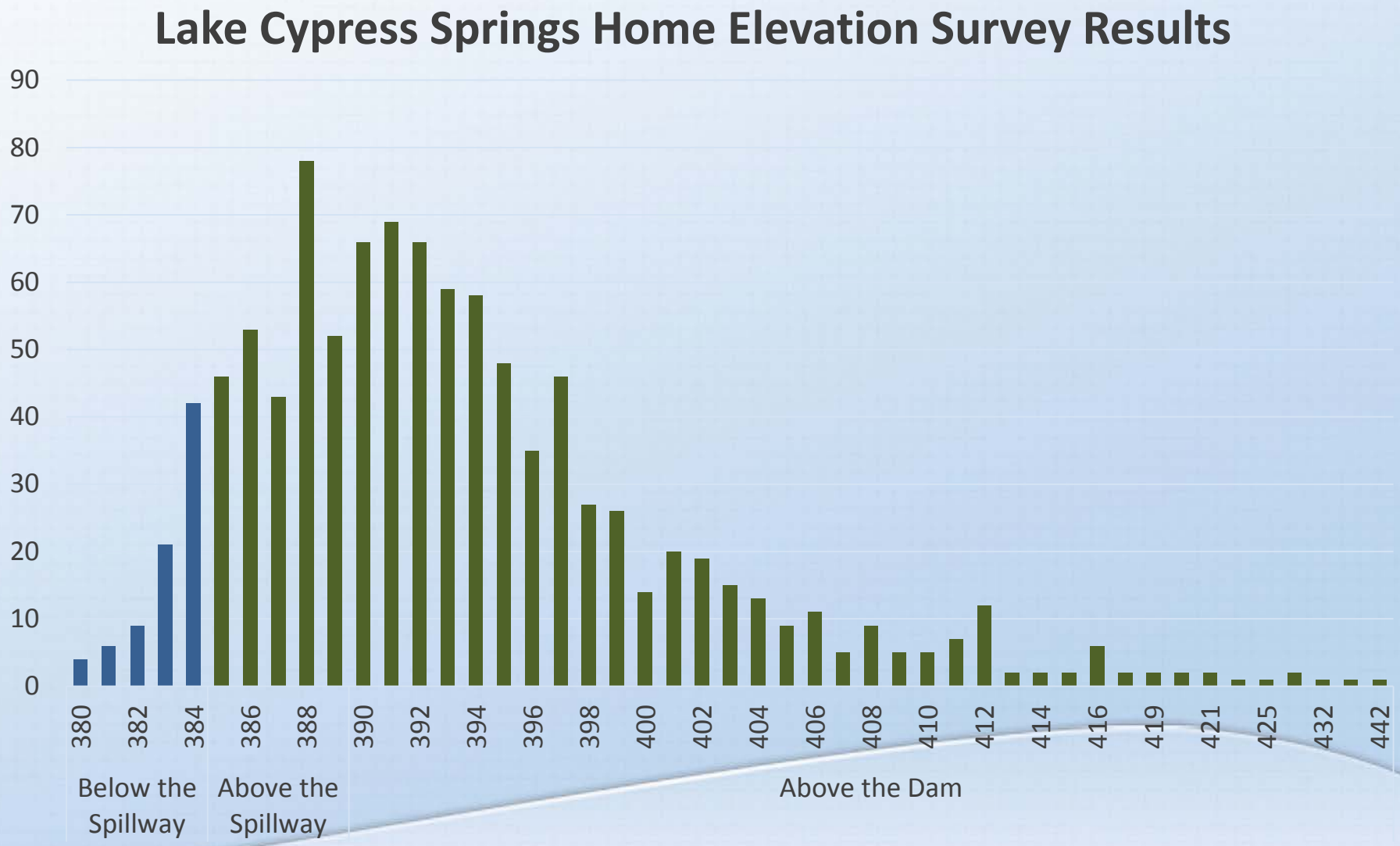
Data Gathering for Analysis – Elevations



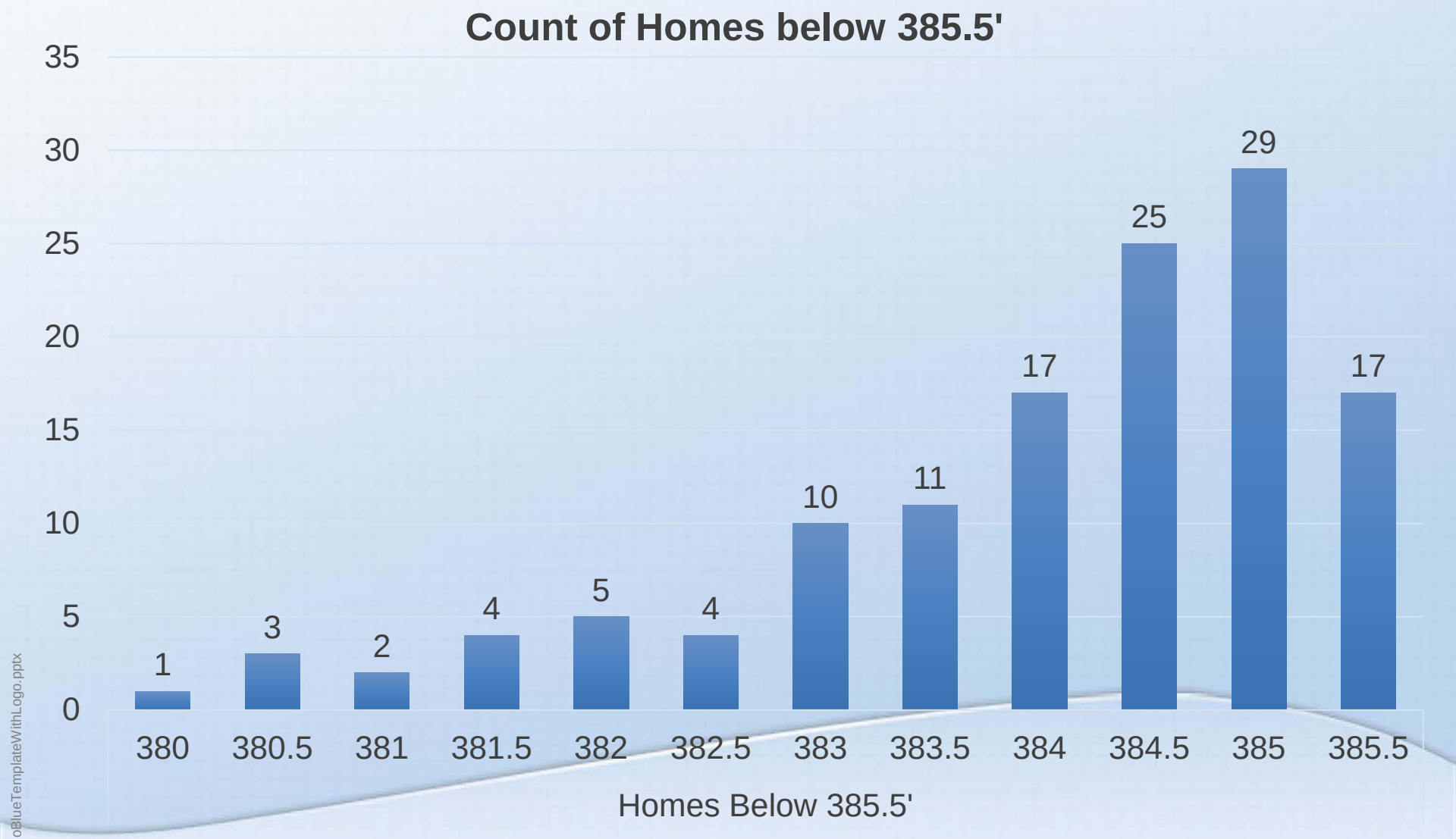
Data Gathering for Analysis – Elevations



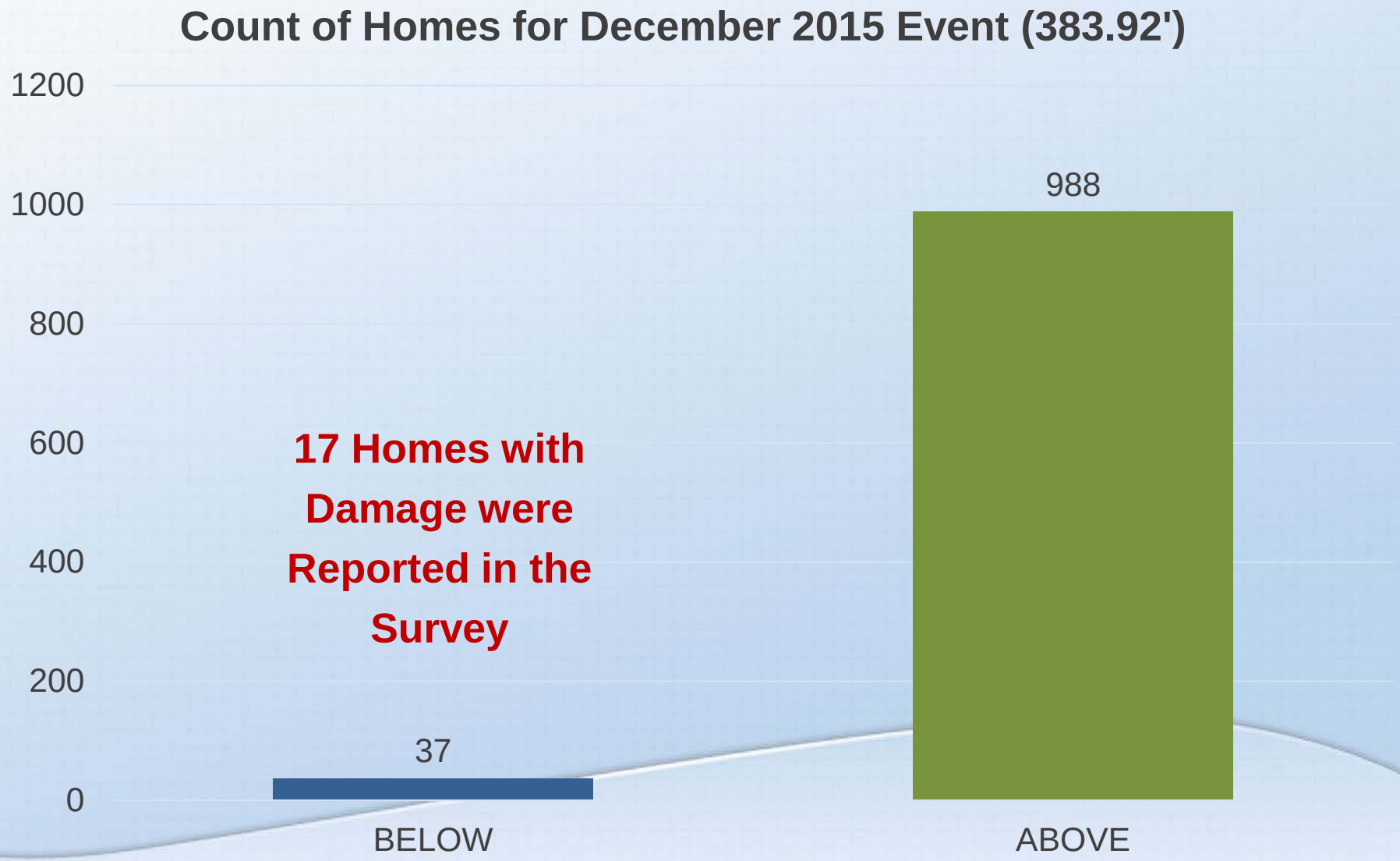
Data Gathering for Analysis – Elevations



Data Gathering for Analysis – Elevations



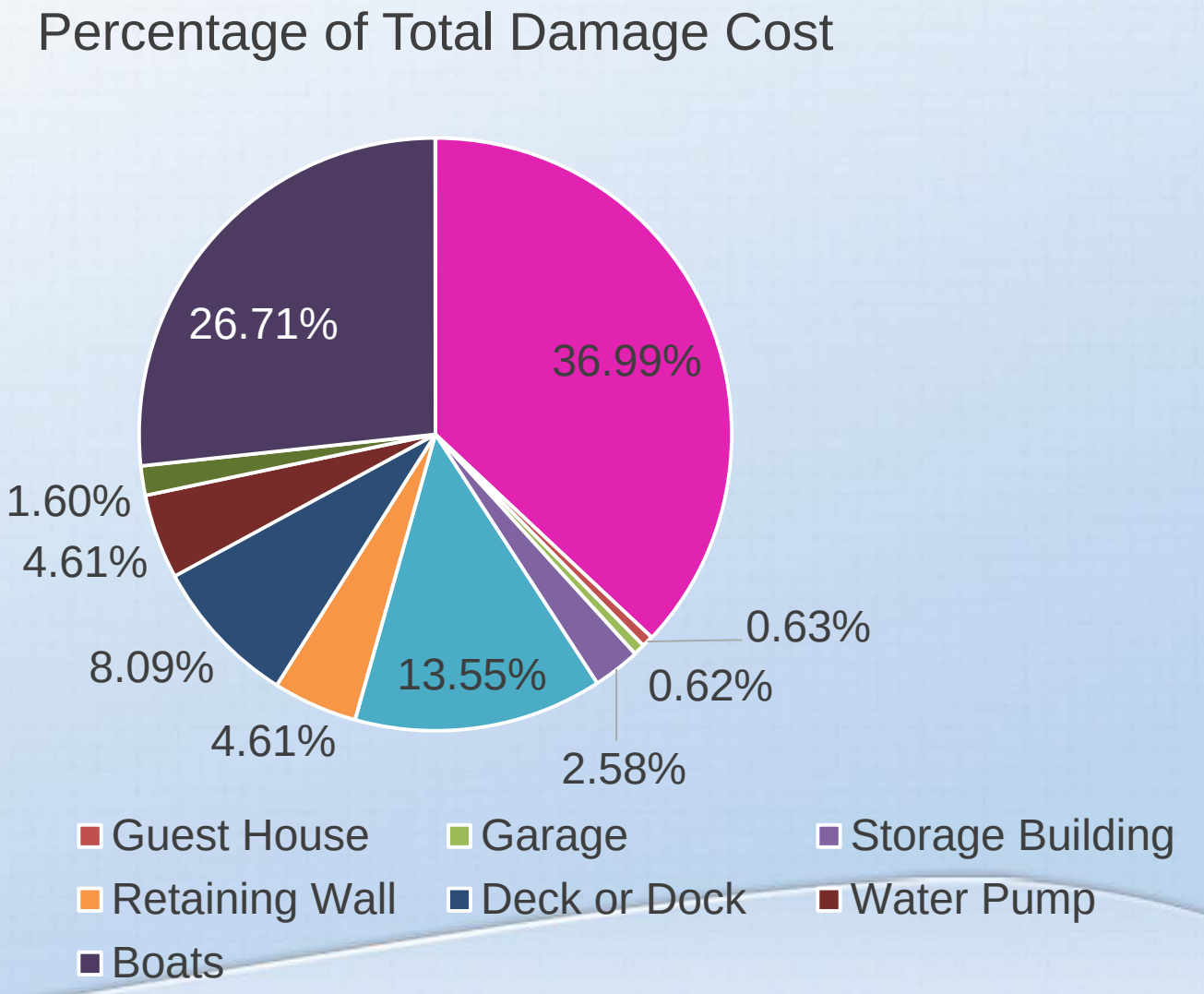
Data Gathering for Analysis – Elevations



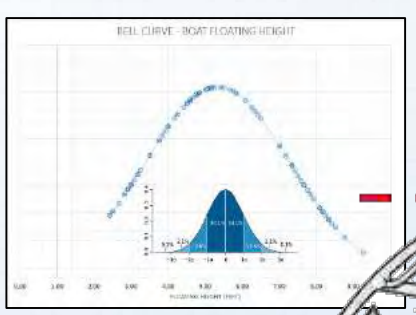
Data Gathering for Analysis – Online Survey

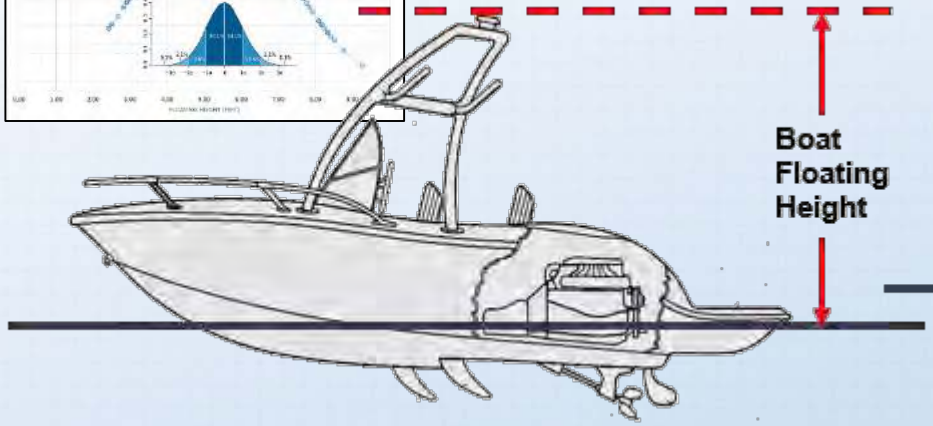
Costs	
Total Structural Damage Cost	$571,642.00
Average Total Structural Cost	$38,169.14
Total Boathouse Damage Cost	$303,144.50
Average Boathouse Damage Cost	$7,496.16
Total Retaining Wall Damage Cost	$64,561.00
Average Retaining Wall Damage Cost	$3,397.95
Total Other Damage Cost	$460,977.65
Average Other Damage Cost	$14,634.57
TOTAL DAMAGE COST	**~$1,500,000**

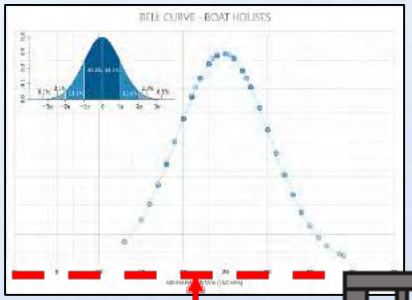
Data Gathering for Analysis – Online Survey

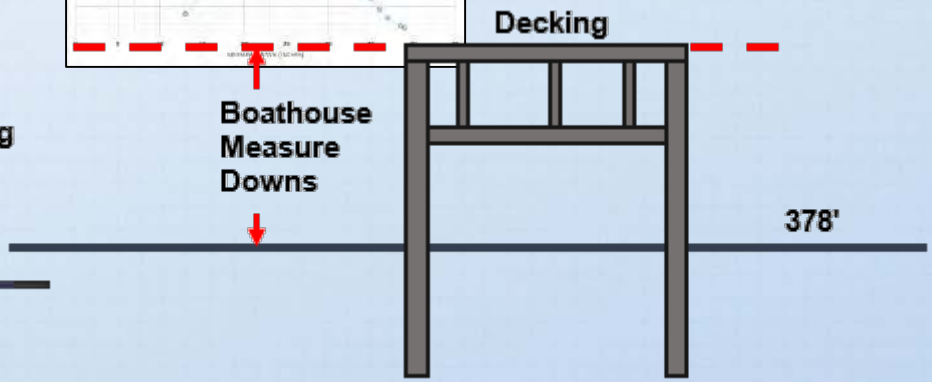


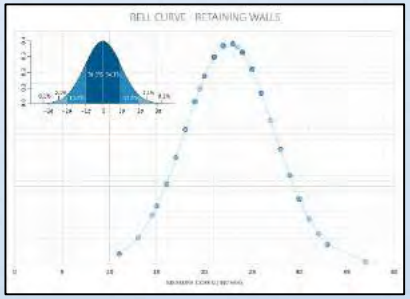
Data Gathering for Analysis - Samples

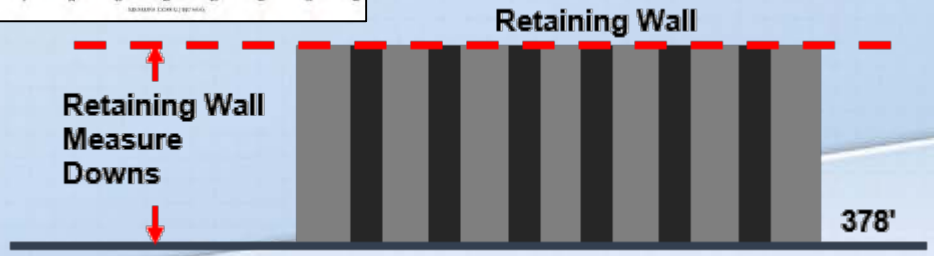


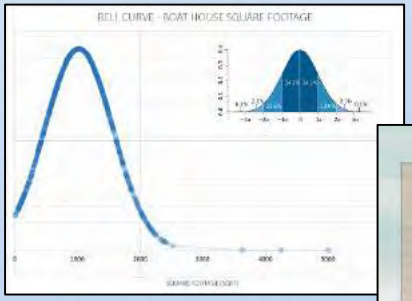














Evaluated Alternatives

1. Addition of canal on emergency spillway
2. Addition of box culverts on north end of Lake Cypress Springs Dam (LCS)
3. Add tainter gates to LCS dam (comparable to Lake Bob Sandlin (LBS))
4. ~~Add pump station at north end of LCS Dam~~
5. ~~Additional morning glory spillway~~
6. Operational Alternative











Additional Canal



Canal Section


NATURAL CANALS


CONCRETE LINED CANALS


OVERBANK CANALS



Crossing Section

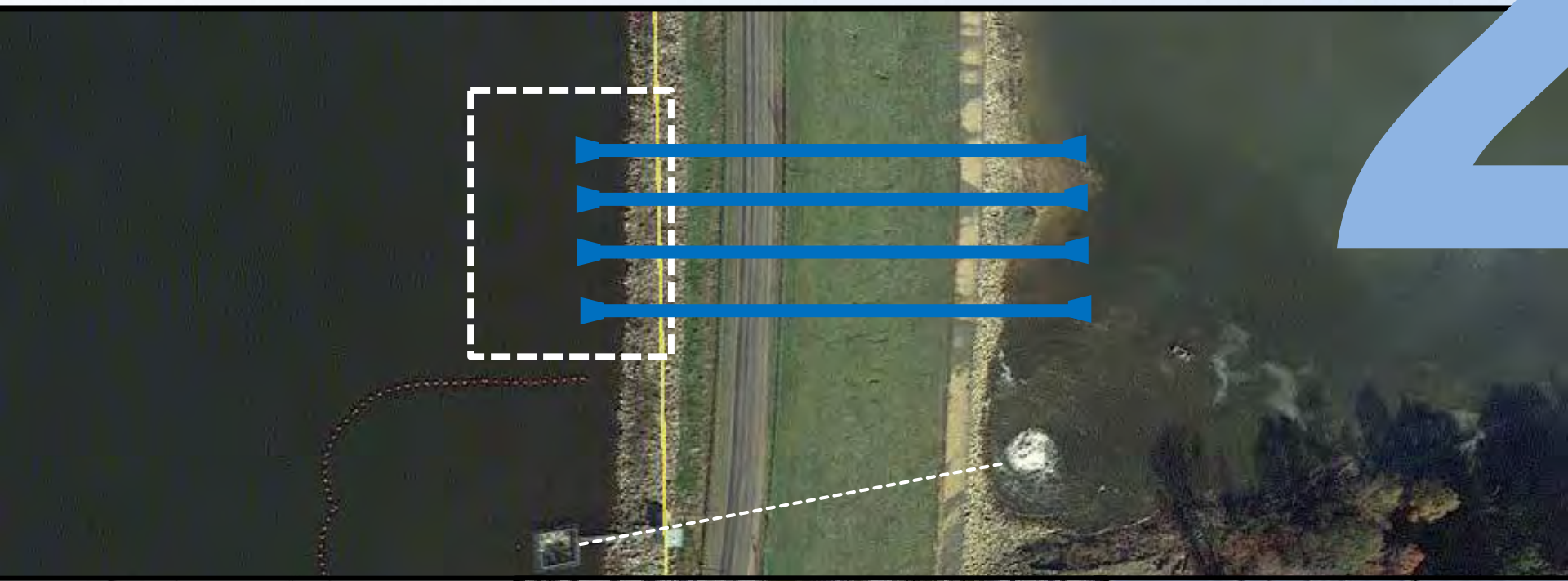








Box Culverts

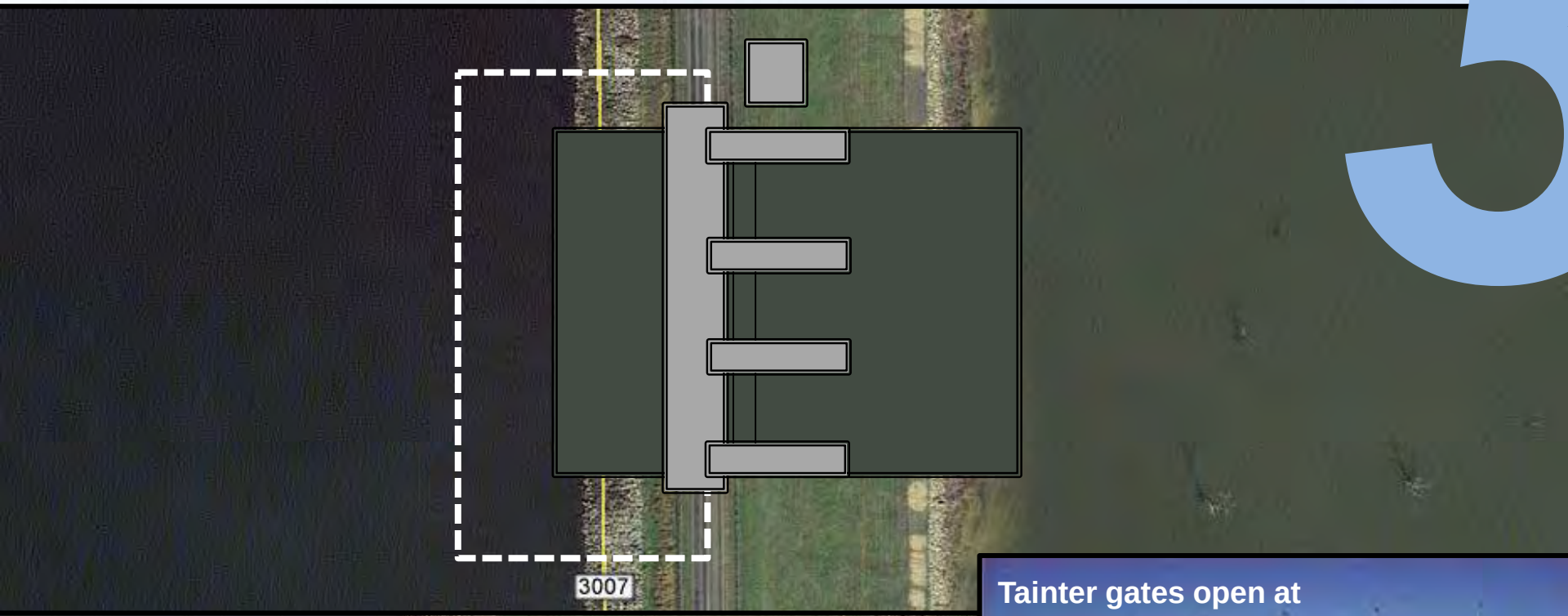








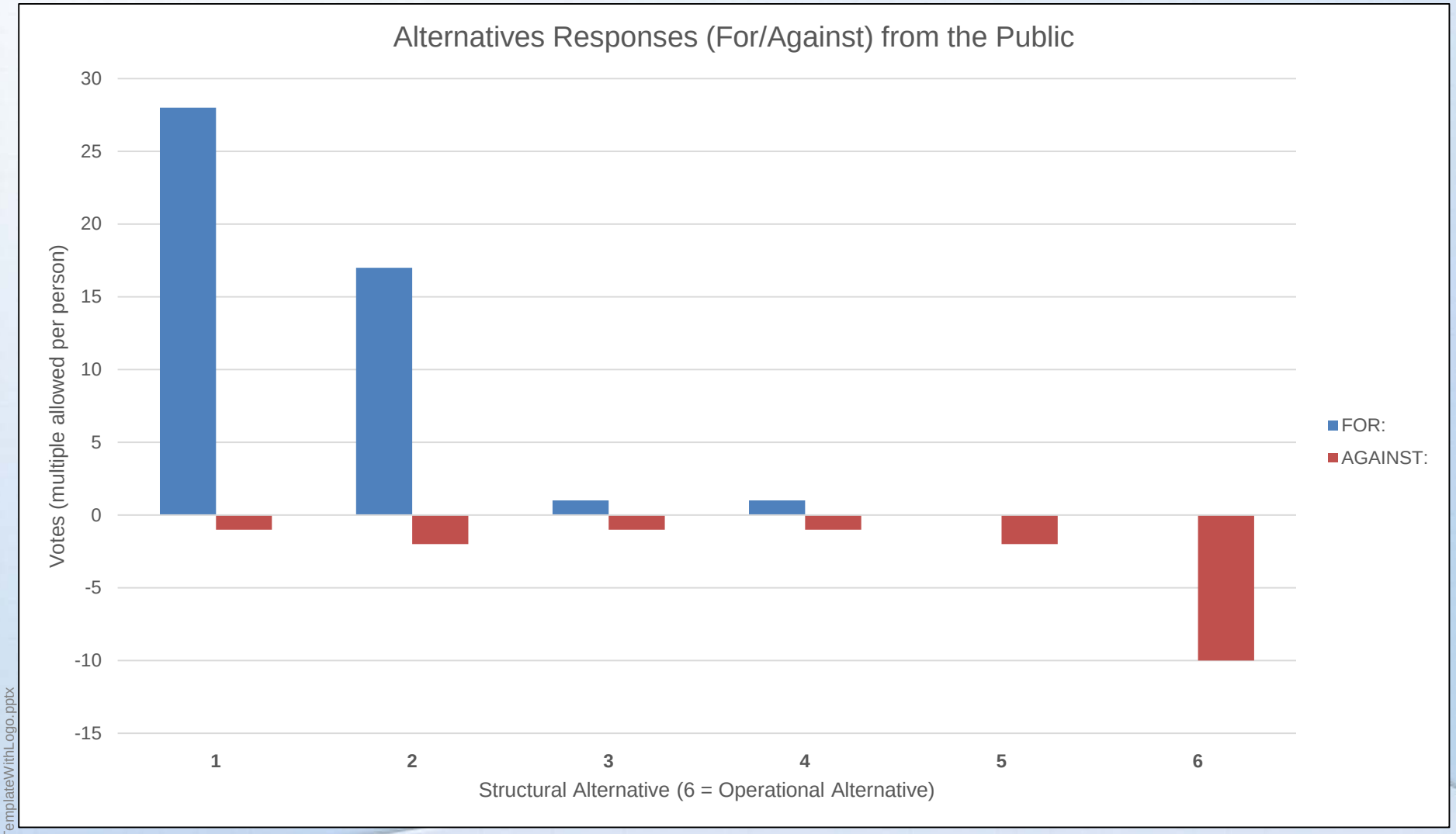
Building a Tainter Gate System




Tainter gates at
Lake Bob Sandlin


Tainter gates open at
Lake Bob Sandlin

Response from the Public



5 Task Hurdles / 3 Sub-Alternatives

Task Hurdle				
Hydraulic Feasibility	**Federal / State Agency Approval is Feasible**	**Local Agency Approval (Downstream Stakeholders) is Feasible**	**Cost Feasibility**	**Minimal Impact to Water Supply**



Sub-Alternative Identification

Sub-Alternatives		
Sub-Alternative A	**Sub-Alternative B**	**Sub-Alternative C**
100-Yr Flood Event	350-Yr Flood Event (December 2015 Event)	500-Yr Flood Event
Max Water Surface Elevation **381.00 msl**	Max Water Surface Elevation **381.00 msl**	Max Water Surface Elevation **381.00 msl**

Alternatives Matrix

Alternative	Task Hurdle				
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
1A					
1B					
1C					
2A					
2B					
2C					
3A					
3B					
3C					
6A					
6B					
6C					
6D					
6E					

Legend	
✓	Carollo predicts FCWD's ability to hurdle the task is feasible for specific alternative.
✓*	Carollo predicts FCWD's ability to hurdle the task is feasible, however, cost feasibility and funding options will be determined by the FCWD available funds and policy decisions.
✗	Carollo predicts FCWD would not be able to hurdle the requirements for a specific alternative. Feasibility of accomplishment is deemed low.

Local Agency Approval (All Alternatives)

Task Hurdle				
Hydraulic Feasibility	**Federal / State Agency Approval is Feasible**	**Local Agency Approval (Downstream Stakeholders) is Feasible**	**Cost Feasibility**	**Minimal Impact to Water Supply**

Local Agency Approval (Downstream Stakeholders) is Feasible			
Agency	**Owner**	**Request**	**Approximate Cost**
Titus County Fresh Water Supply District **TCFWSD**	Lake Bob Sandlin	H&H Analysis for Downstream Impacts	~250K
North East Texas Municipal Water District **NETMWD**	Lake of the Pines	Water Quality Assessment	~85K

Alternatives Matrix

Alternative	Task Hurdle				
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
1A			✓		
1B			✓		
1C			✓		
2A			✓		
2B			✓		
2C			✓		
3A			✓		
3B			✓		
3C			✓		
6A			✓		
6B			✓		
6C			✓		
6D			✓		
6E			✓		

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Alternatives Matrix

Alternative	Task Hurdle				
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
1A			✓		✓
1B			✓		✓
1C			✓		✓
2A			✓		✓
2B			✓		✓
2C			✓		✓
3A			✓		✓
3B			✓		✓
3C			✓		✓
6A			✓		
6B			✓		
6C			✓		
6D			✓		
6E			✓		

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Additional Canal



Hydraulic Feasibility

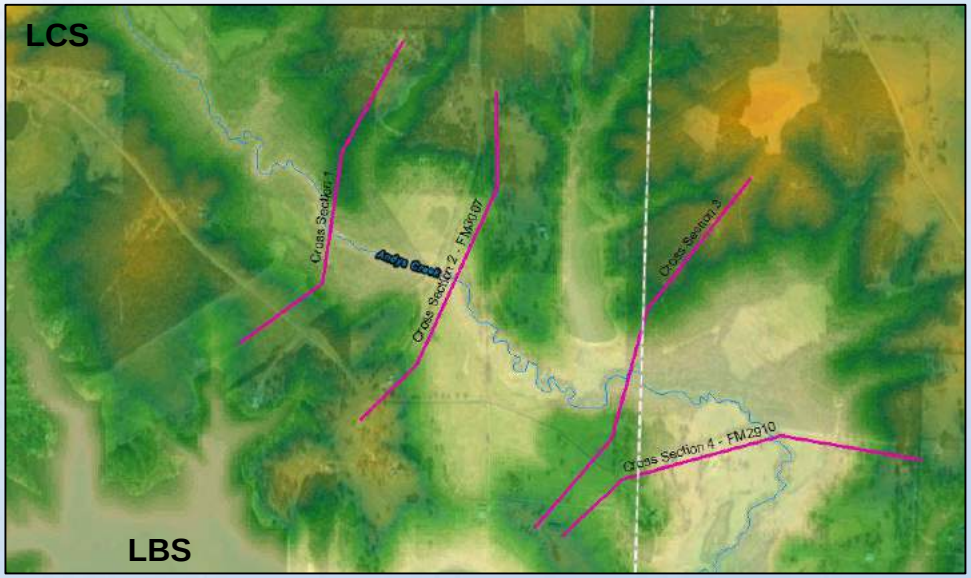
Task Hurdle				
Hydraulic Feasibility	**Federal / State Agency Approval is Feasible**	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply

			1 - STRUCTURAL ALTERNATIVES		
			Alternative 1A	Alternative 1B	Alternative 1C
Rain Event	**Probability**	**Revised Conditions**	100-YR **71 culverts***	350-YR **203 culverts***	500-YR **243 culverts***
2-year	0.50000	379.1	378.9	378.8	378.7
5-year	0.20000	379.5	379.2	379.0	379.0
10-year	0.10000	379.9	379.6	379.3	379.2
25-year	0.04000	380.5	379.9	379.6	379.5
50-year	0.02000	381.3	380.5	379.9	379.8
100-year	0.01000	382.3	**381.0**	380.3	380.1
350-Year	0.00285	384.7	382.1	**381.0**	380.9
500-Year	0.00200	384.9	382.4	381.3	**381.0**

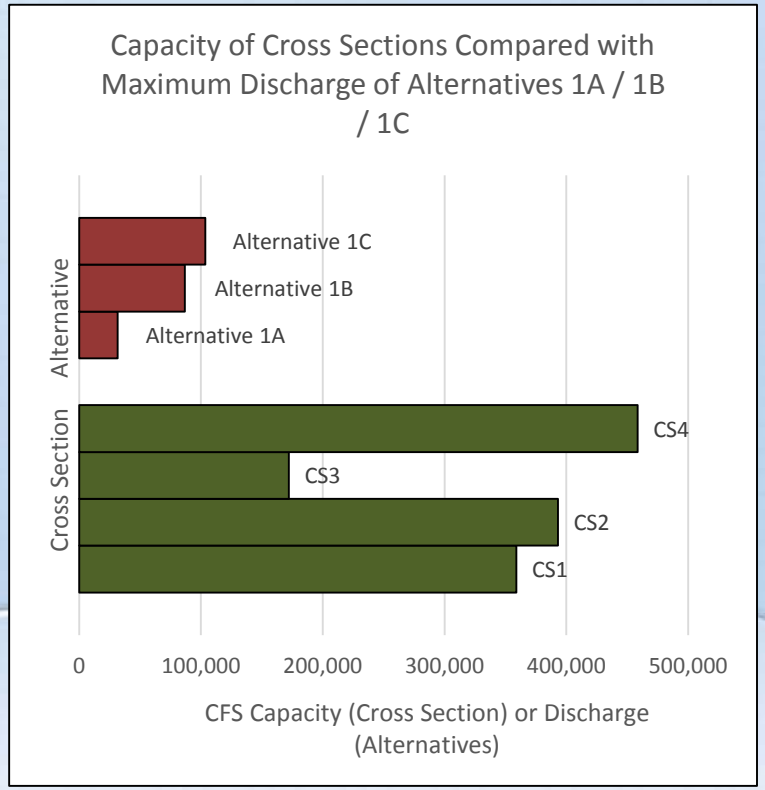
*** 1 Culvert = 10’ Wide X 4’ Tall Box Pipe**

Federal Agency Approval

Task Hurdle				
Hydraulic Feasibility	**Federal / State Agency Approval is Feasible**	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply



Maximum Area (SF) Available for Discharge



USACE Permit Process
State and Federal Regulation

Communication Started in PER



- **EPA** – U.S. Environmental Protection Agency
- **USFWS** – U.S. Fish and Wildlife Service
- **TPWD** – Texas Parks and Wildlife Department
- **NMFS** – National Marine Fisheries Services
- **TxDOT** – Texas Department of Transportation
- **HUD** – U.S. Department of Housing and Urban Development
- **BOR** – Bureau of Reclamation
- **SHPO** – State Historic Preservation Office
- **TCEQ** – Texas Commission on Environmental Quality
- **TCH** – Texas Historical Commission

Cost Feasibility

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply

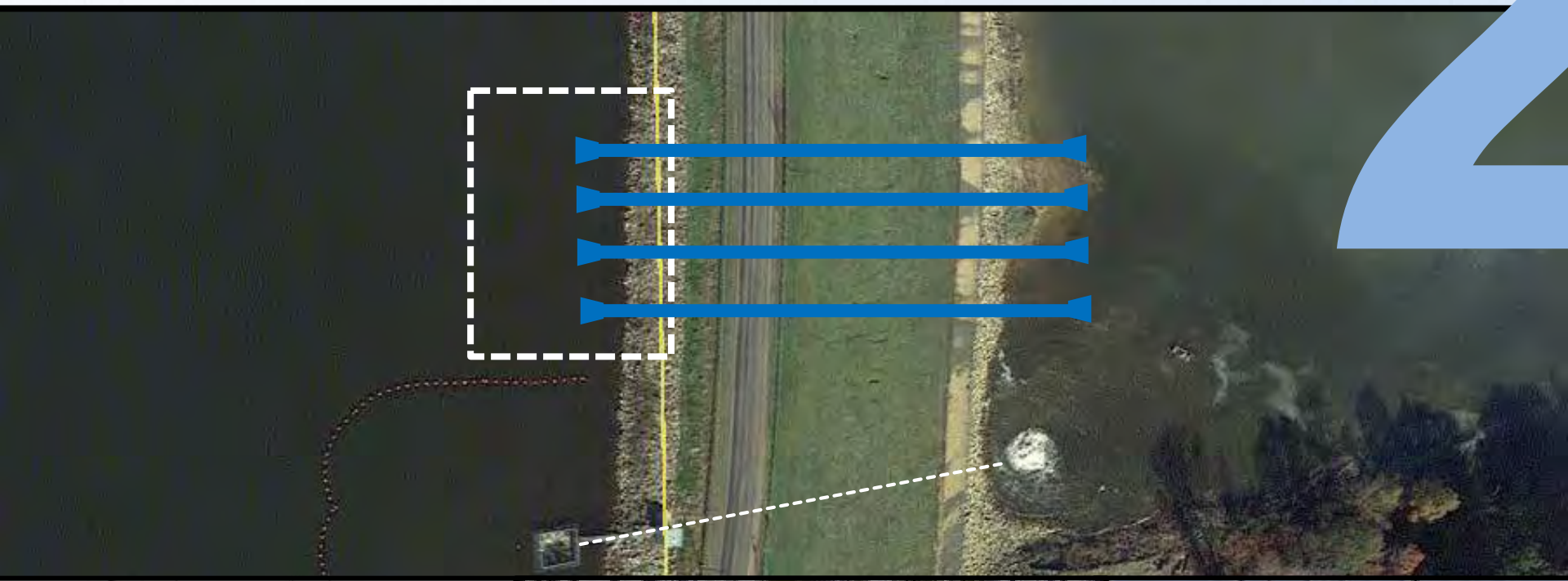
	ALTERNATIVE 1					
ITEM CATEGORIES	**1A**		**1B**		**1C**	
Startup and SW3P Items	$642,526		$1,788,644		$2,136,139	
Canal Items	$7,174,574		$20,501,685		$24,540,203	
Road Crossing Items	$11,295,307		$31,346,107		$37,422,107	
Closeout and Other Items	$2,570,000		$7,190,000		$8,590,000	
Design Fees	$3,734,861		$9,225,048		$11,021,624	
Contingency	**20%**	$5,083,454	**20%**	$14,010,297	**20%**	$16,742,015
OPCC TOTAL COST	**$30,501,000**		**$84,062,000**		**$100,452,000**	

Alternatives Matrix

Alternative	Task Hurdle				
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
1A	✗	✗	✓	✗	✓
1B	✗	✗	✓	✗	✓
1C	✗	✗	✓	✗	✓
2A			✓		✓
2B			✓		✓
2C			✓		✓
3A			✓		✓
3B			✓		✓
3C			✓		✓
6A			✓		
6B			✓		
6C			✓		
6D			✓		
6E			✓		

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Box Culverts









Hydraulic Feasibility

Task Hurdle				
Hydraulic Feasibility	**Federal / State Agency Approval is Feasible**	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply

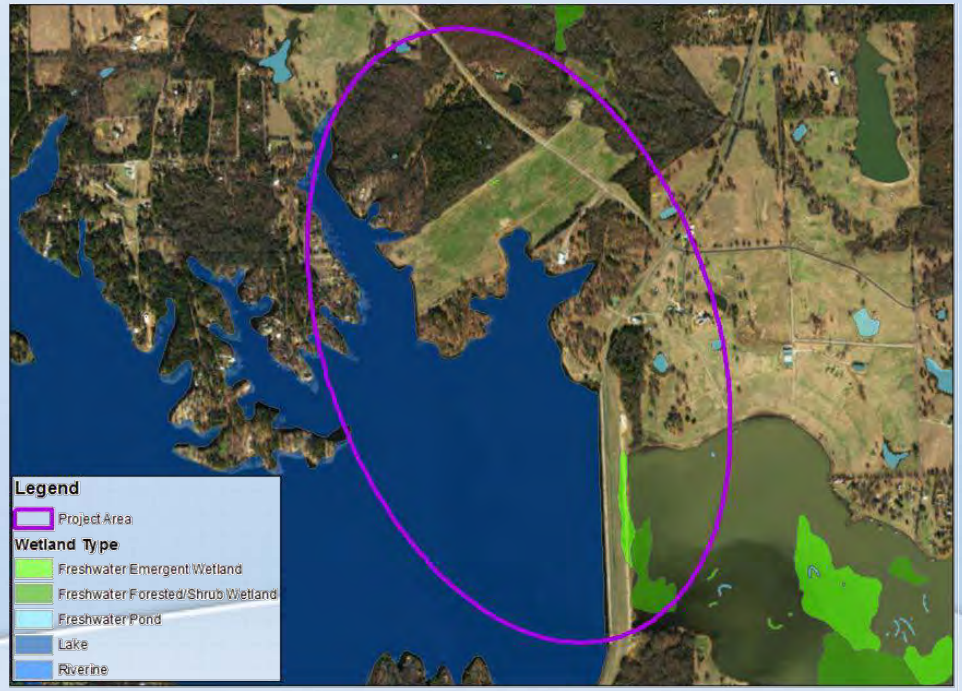
			2 - STRUCTURAL ALTERNATIVES		
			Alternative 2A	Alternative 2B	Alternative 2C
Rain Event	**Probability**	**Revised Conditions**	100-YR **72 culverts***	350-YR **204 culverts***	500-YR **244 culverts***
2-year	0.50000	379.1	378.9	378.8	378.7
5-year	0.20000	379.5	379.2	379.0	379.0
10-year	0.10000	379.9	379.6	379.3	379.2
25-year	0.04000	380.5	379.9	379.6	379.5
50-year	0.02000	381.3	380.5	379.9	379.8
100-year	0.01000	382.3	**381.0**	380.3	380.1
350-Year	0.00285	384.7	382.1	**381.0**	380.9
500-Year	0.00200	384.9	382.4	381.3	**381.0**

*** 1 Culvert = 10' Wide X 10' Tall Box Pipe**

Federal/State Agency Approval

Task Hurdle				
Hydraulic Feasibility	**Federal / State Agency Approval is Feasible**	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply

- Threatened and Endangered Species
- Jurisdictional Waters and Adjacent Wetlands
- Roadway Concerns (FM3007)



Cost Feasibility

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply

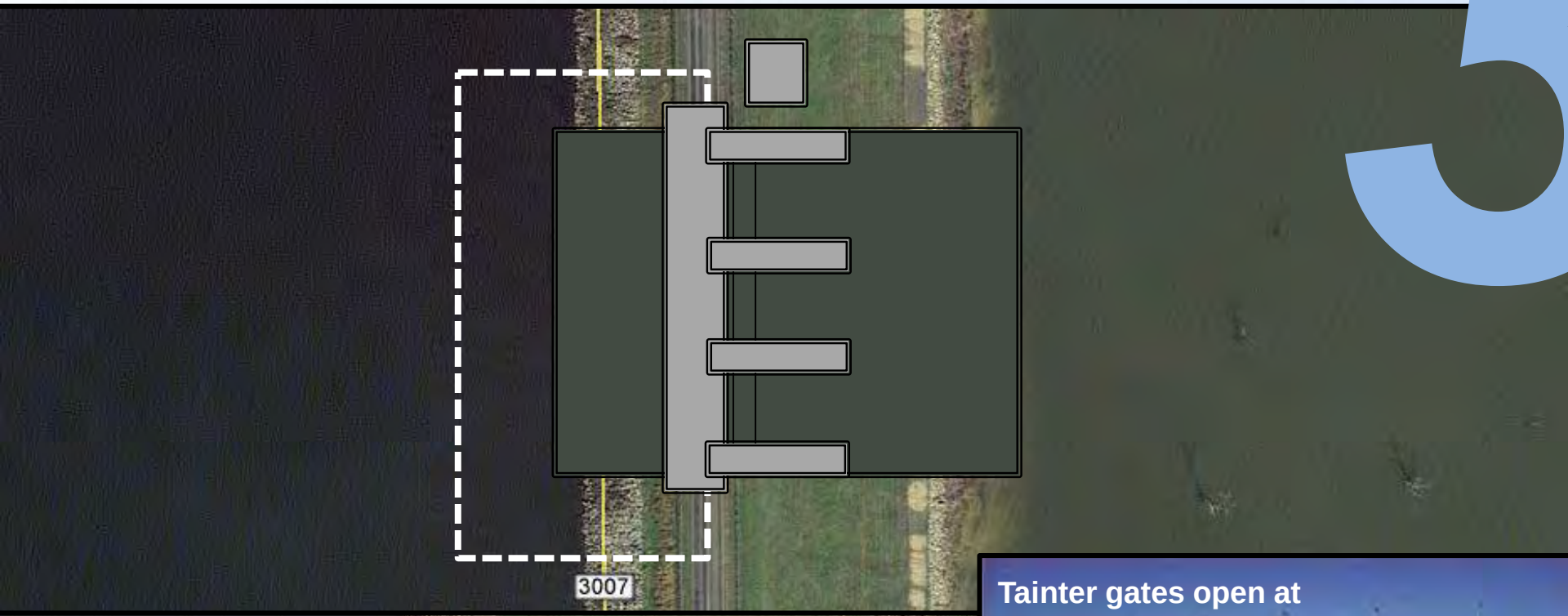
	ALTERNATIVE 2					
ITEM CATEGORIES	**2A**		**2B**		**2C**	
Startup and SW3P Items	$485,259		$1,173,943		$1,381,980	
Emergency Spillway Items	$349,885		$349,885		$349,885	
Dam Crossing Items	$12,142,763		$33,366,896		$39,798,452	
Closeout and Other Items	$3,305,000		$4,625,000		$5,025,000	
Design Fees	$2,924,936		$5,928,285		$6,984,224	
Contingency	**20%**	$3,841,569	**20%**	$9,088,802	**20%**	$10,707,908
OPCC TOTAL COST	**$23,049,000**		**$54,533,000**		**$64,247,000**	

Alternatives Matrix

Alternative	Task Hurdle				
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
1A	✗	✗	✓	✗	✓
1B	✗	✗	✓	✗	✓
1C	✗	✗	✓	✗	✓
2A	✗	✓	✓	✗	✓
2B	✗	✓	✓	✗	✓
2C	✗	✓	✓	✗	✓
3A			✓		✓
3B			✓		✓
3C			✓		✓
6A			✓		
6B			✓		
6C			✓		
6D			✓		
6E			✓		

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Building a Tainter Gate System




Tainter gates at
Lake Bob Sandlin


Tainter gates open at
Lake Bob Sandlin

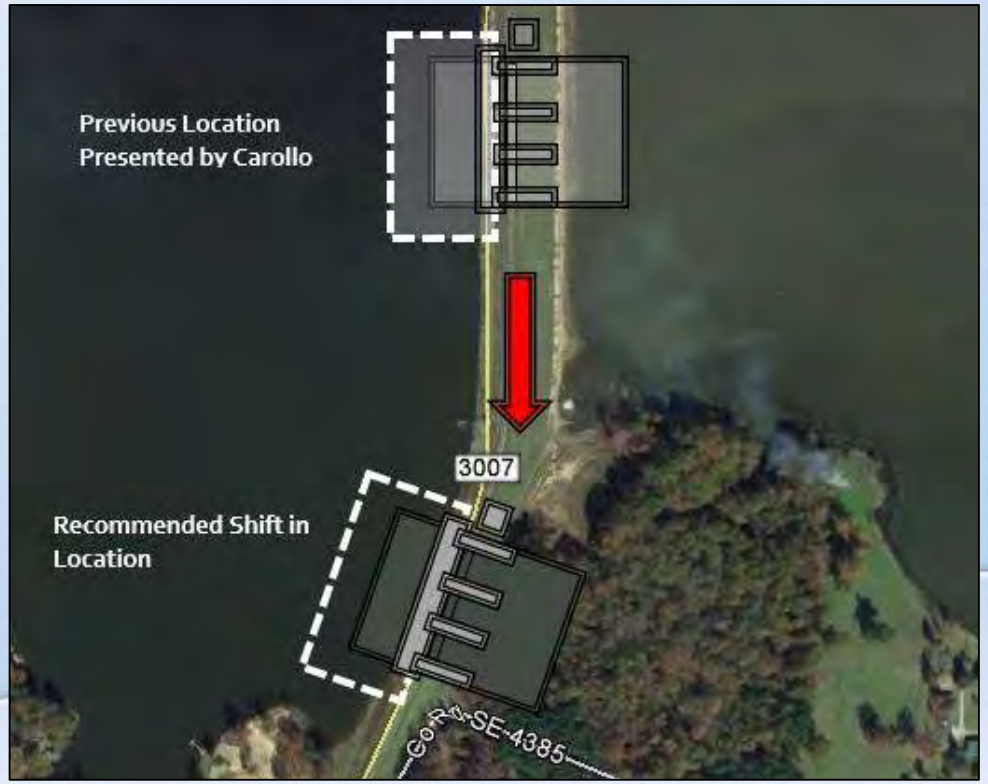
Hydraulic Feasibility

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply

			3 - STRUCTURAL ALTERNATIVES		
			Alternative 3A	Alternative 3B	Alternative 3C
Rain Event	**Probability**	**Revised Conditions**	100-YR **1 gates**	350-YR **2 gates**	500-YR **3 gates**
2-year	0.50000	379.1	378.0	378.0	378.0
5-year	0.20000	379.5	378.0	378.0	378.0
10-year	0.10000	379.9	378.3	378.0	378.0
25-year	0.04000	380.5	378.6	378.0	378.0
50-year	0.02000	381.3	379.1	378.0	378.0
100-year	0.01000	382.3	**379.7**	378.4	378.0
350-Year	0.00285	384.7	381.1	**379.4**	378.4
500-Year	0.00200	384.9	381.5	379.6	**378.6**

Hydraulic Feasibility

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply



Cost Feasibility

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	**Cost Feasibility**	Minimal Impact to Water Supply

	ALTERNATIVE 3					
ITEM CATEGORIES	**3A**		**3B**		**3C**	
Mobilization	$120,400		$154,800		$197,800	
Structure Costs	$14,439,975		$18,973,300		$23,906,625	
Closeout and Other Items	$2,236,474		$2,938,076		$3,702,440	
Design Fees	$3,027,027		$3,817,426		$3,702,440	
Contingency	**20%**	$3,964,775	**20%**	$5,176,721	**20%**	$6,497,079
OPCC TOTAL COST	**$23,789,000**		**$31,060,000**		**$38,982,000**	

Alternatives Matrix

Alternative	Task Hurdle				
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
1A	✗	✗	✓	✗	✓
1B	✗	✗	✓	✗	✓
1C	✗	✗	✓	✗	✓
2A	✗	✗	✓	✗	✓
2B	✗	✗	✓	✗	✓
2C	✗	✗	✓	✗	✓
3A	✓	✓	✓	✓*	✓
3B	✓	✓	✓	✓*	✓
3C	✓	✓	✓	✓*	✓
6A			✓		
6B			✓		
6C			✓		
6D			✓		
6E			✓		

Legend

✓*	Carollo predicts FCWD's ability to hurdle the task is feasible, however, cost feasibility and funding options will be determined by the FCWD available funds and policy decisions.

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Operational Alternative

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
✓	✓		✓	

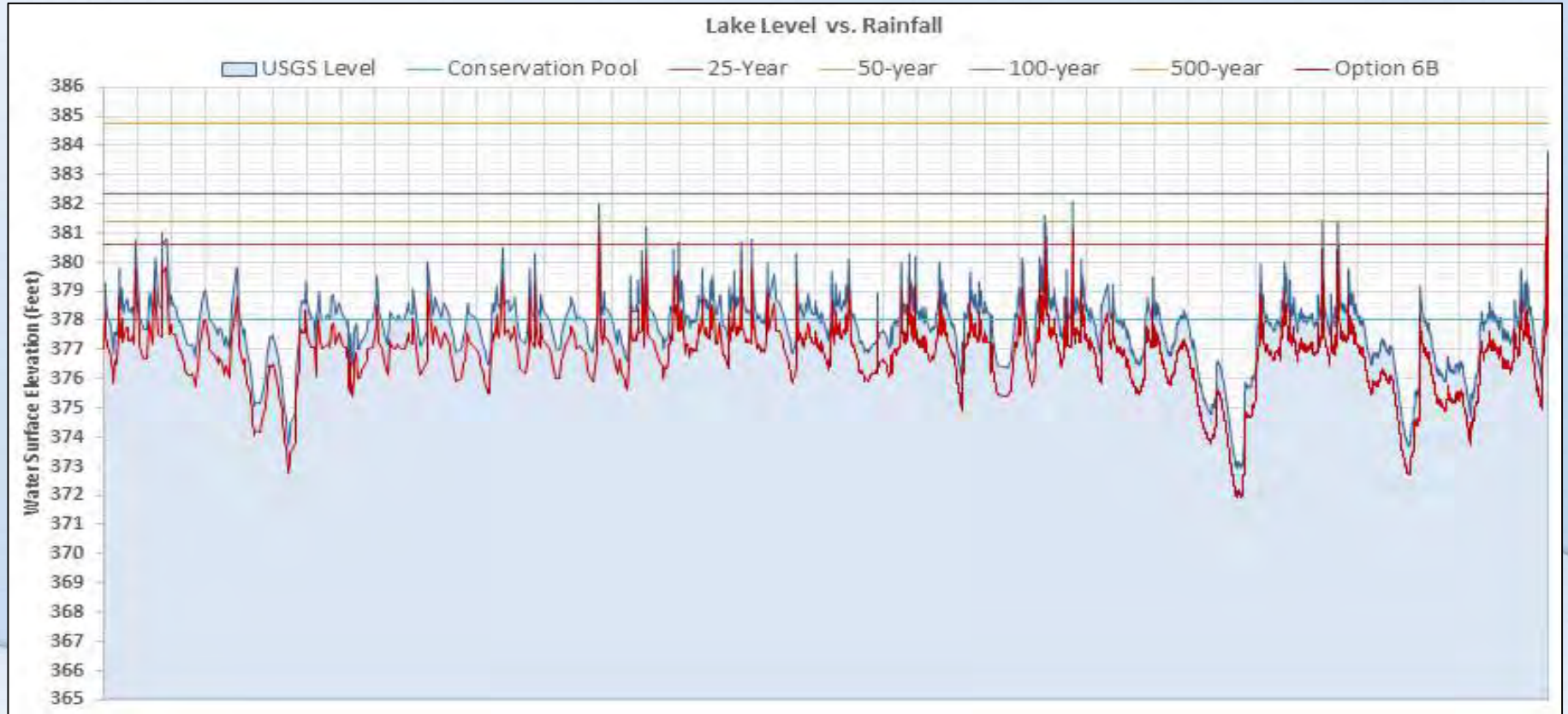
Impact to Drinking Water Supply

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	**Minimal Impact to Water Supply**

Alternative	Conservation Pool	Difference in WSE	Firm Yield (ac-ft)	Difference (ac-ft)
Existing	**378.0 ft msl**	**---**	**13,943**	**---**
Alternative 6A	377.5 ft msl	-0.5 ft	13,597	346
Alternative 6B	377.0 ft msl	-1.0 ft	13,251	692
Alternative 6C	376.0 ft msl	-2.0 ft	12,560	1,383
Alternative 6D	375.0 ft msl	-3.0 ft	11,873	2,070
Alternative 6E	374.0 ft msl	-4.0 ft	11,188	2,755

Impact to Drinking Water Supply

Task Hurdle				
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	**Minimal Impact to Water Supply**



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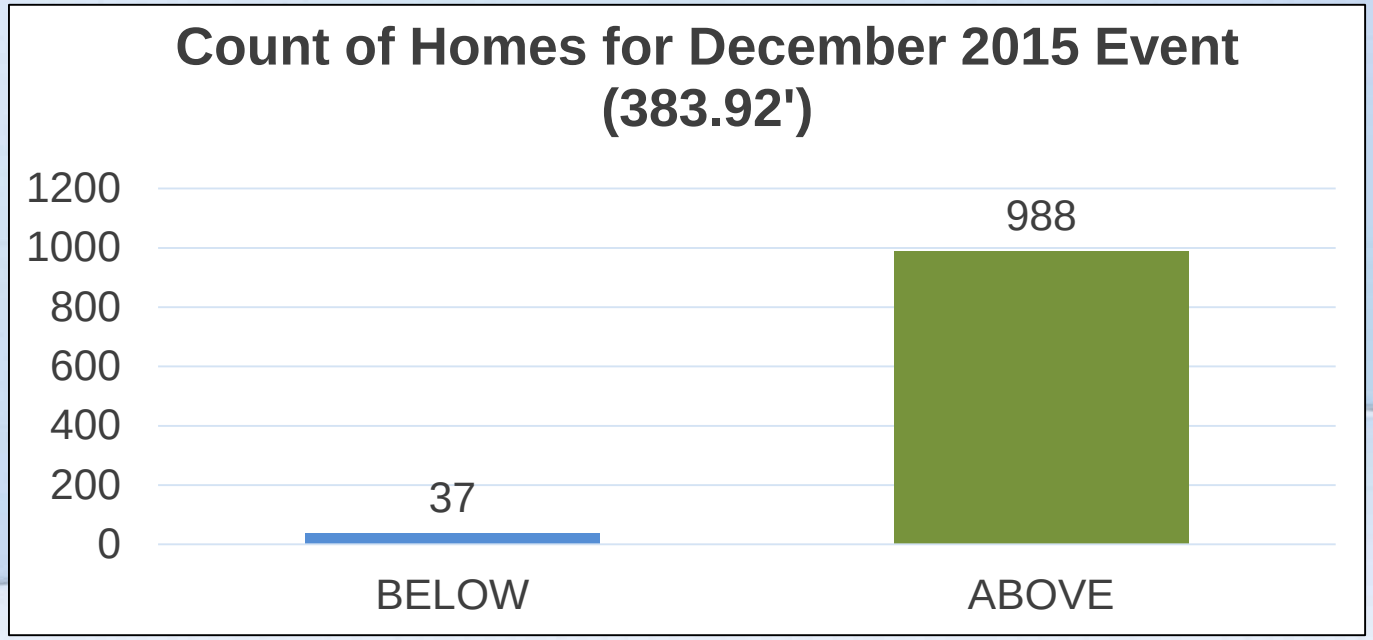
FINALIZED Alternatives Matrix

Alternative	Task Hurdle				
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply
1A	✗	✗	✓	✗	✓
1B	✗	✗	✓	✗	✓
1C	✗	✗	✓	✗	✓
2A	✗	✓	✓	✗	✓
2B	✗	✓	✓	✗	✓
2C	✗	✓	✓	✗	✓
3A	✓	✓	✓	✓*	✓
3B	✓	✓	✓	✓*	✓
3C	✓	✓	✓	✓*	✓
6A	---	✓	✓	✓	✗
6B	---	✓	✓	✓	✗
6C	---	✓	✓	✓	✗
6D	---	✓	✓	✓	✗
6E	---	✓	✓	✓	✗

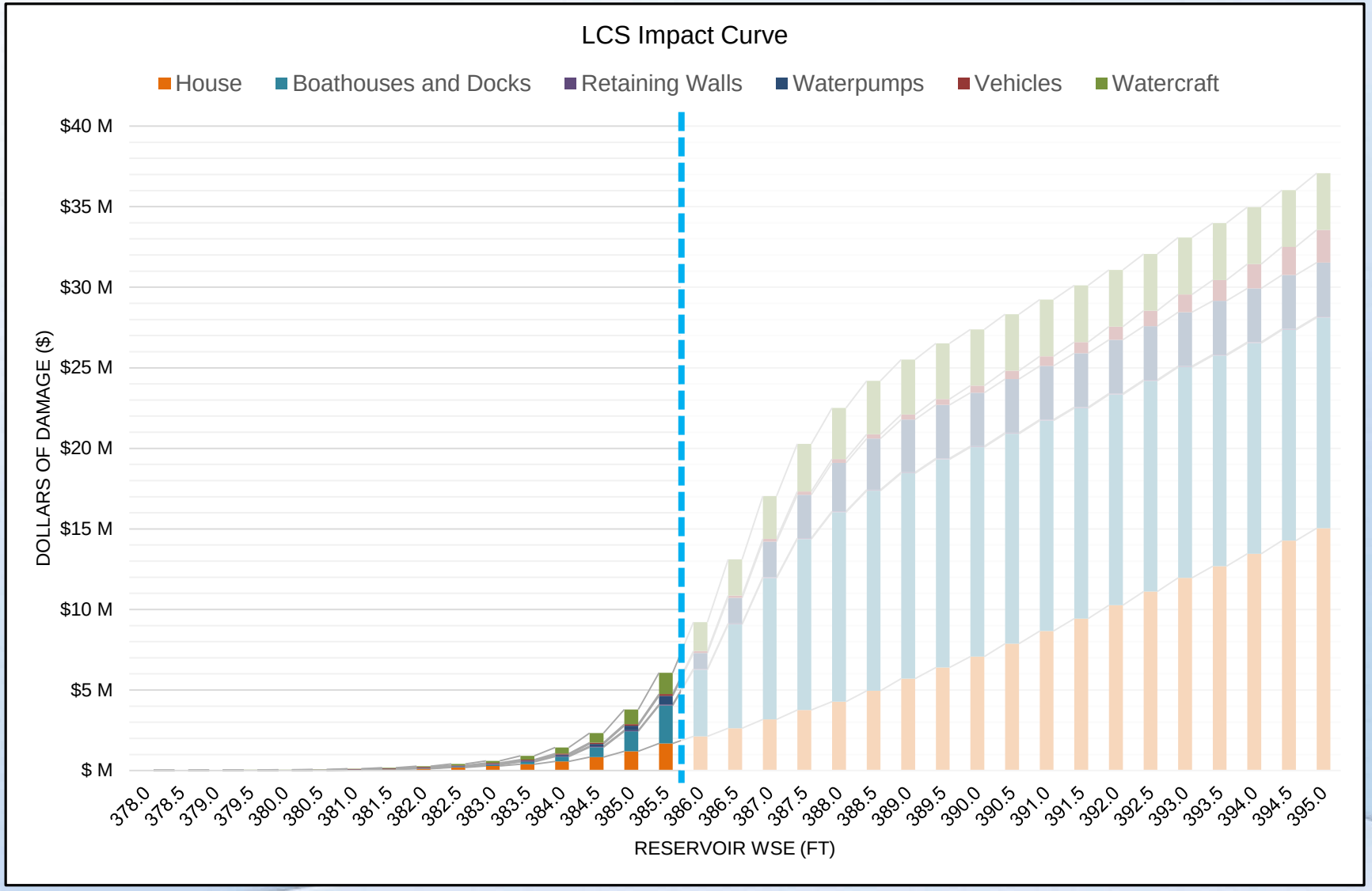
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Total Lake Cypress Springs Damage Curve

Key Board-Decision Elements		
Project Cost	Storm Frequency (Risk)	Property Damages



Total Lake Cypress Springs Impact Curve



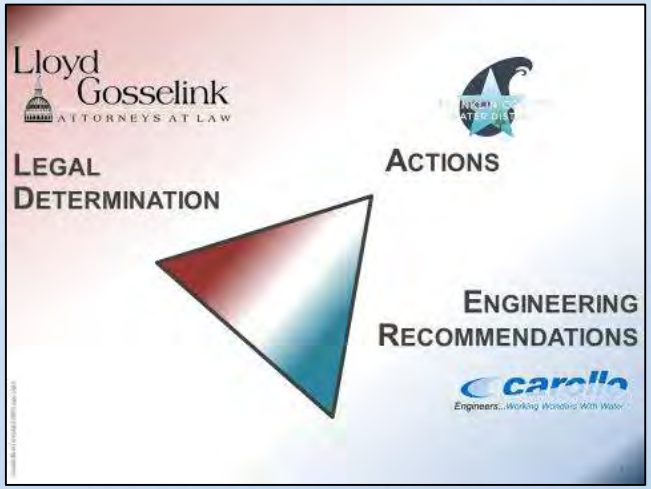
Alternative 3 – Benefit Cost (BC) Ratio

Rain Event	Probability	Revised Model Conditions Impacts ($)	ALTERNATIVE 3		
			3A	3B	3C
			1 gates Impacts ($)	2 gates Impacts ($)	3 gates Impacts ($)
CAPITAL COSTS →		---	**$23.8 M**	**$31.1 M**	**$39.0 M**
100-year	0.01000	$347,890	$38,402	$19,706	$16,104
350-Year	0.00285	$2,910,117	$120,175	$32,749	$19,706
500-Year	0.00200	$3,495,949	$174,235	$36,353	$21,790
	100-YR BC RATIO		1.30%	1.06%	0.85%
	350-YR BC-RATIO		**11.73%***	9.26%	7.41%
	500-YR BC-RATIO		**13.96%***	11.14%	8.91%

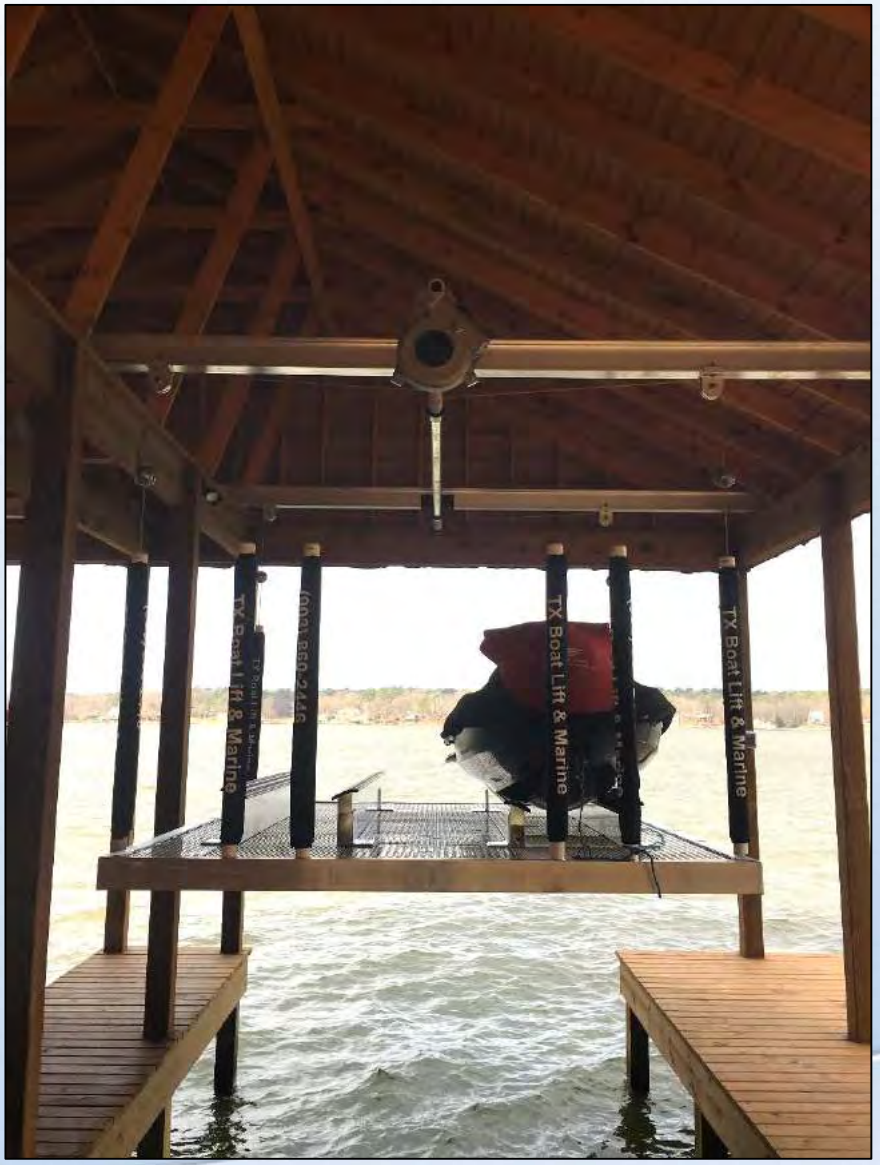
*** It takes over 7+ 500-yr events (or 8.5+ December 2015 Events) to break even on the capital investment of the 1-gate project**

Completed Technical Memorandums (TMs)

- **TM#1 –Retaining Walls, Dredge, and Fill**
- **TM#2 –Boat Houses**
- **TM#3 –Lake Closure**
- **TM#4 –FEMA Coordination**
- **TM#5 –Residential Structures**



Boat Lift Changes to Rules and Regulations





TM#4 – FEMA Coordination

- County is participating in the National Flood Insurance Program (NFIP).

- The County has never been mapped, but did enter the NFIP on 07/28/2000. FEMA mapping is scheduled to be completed at some unknown date in the future.

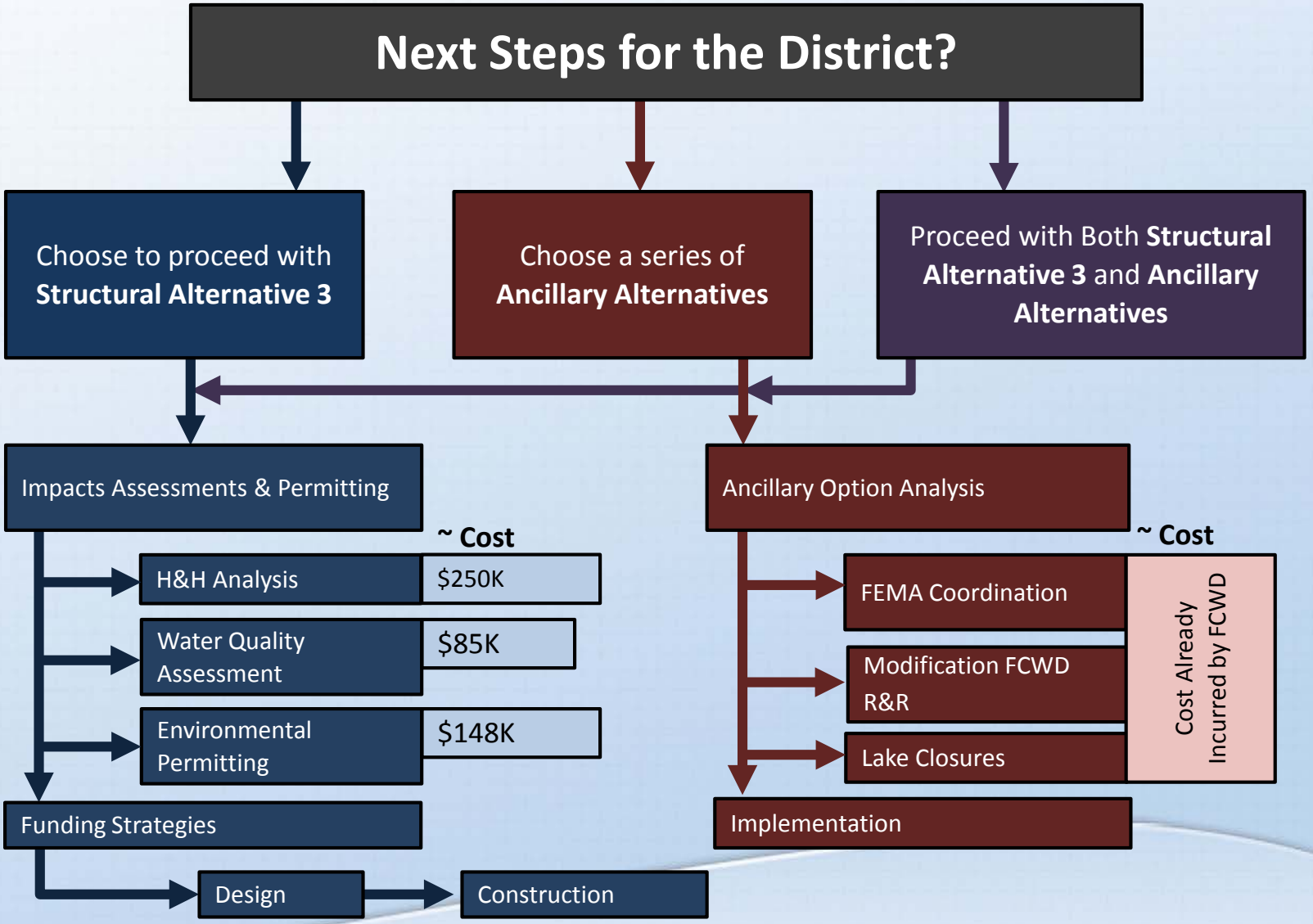
- With mapping will come **additional regulations** and mandates for construction in the floodplain/floodway. It also mandates **flood insurance requirements**.

Example Flood Insurance Requirement

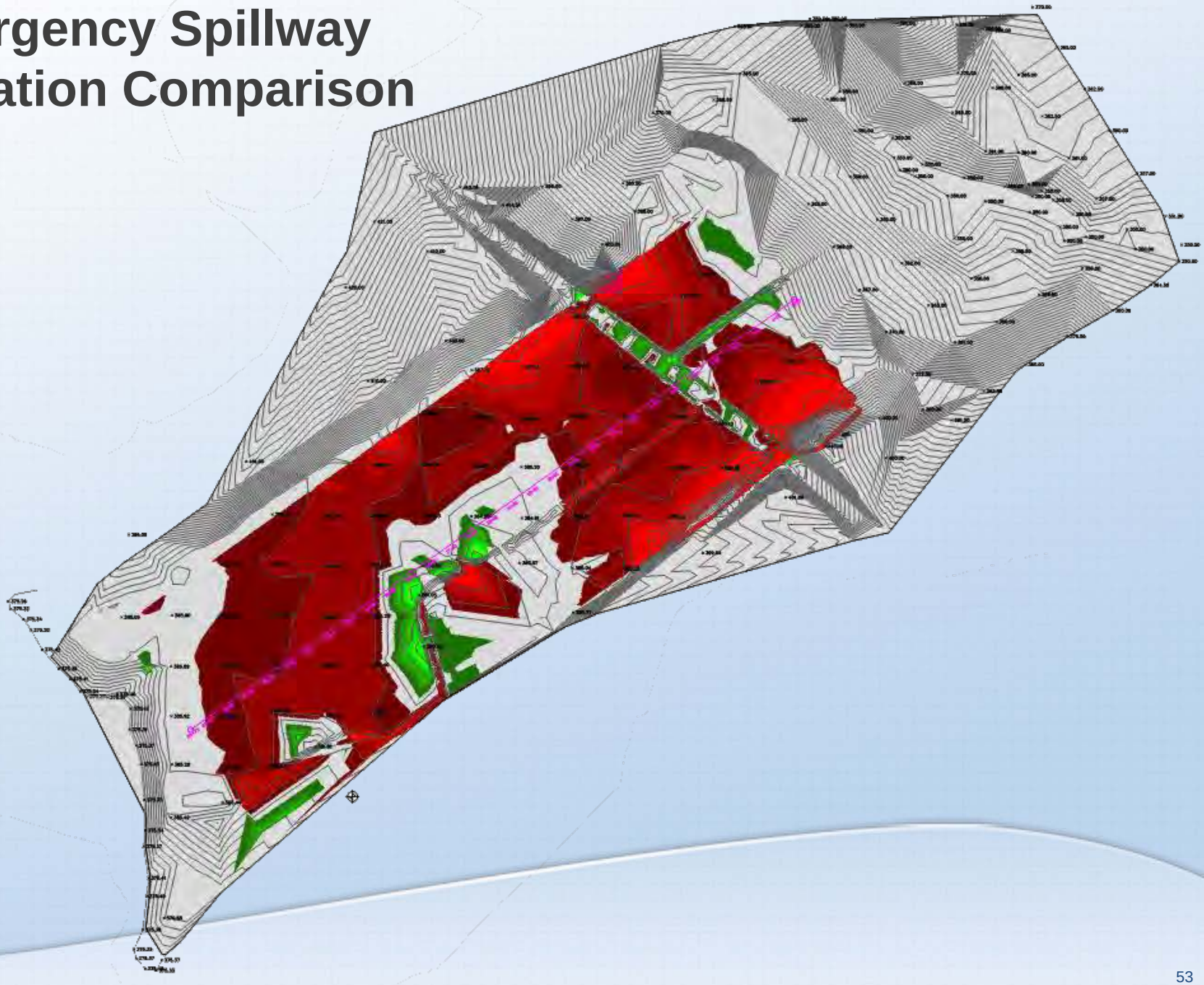


- Currently the County Judge is designated as the floodplain administrator (FPA) by court order, meaning that it is the County's responsibility to enforce FEMA policy in the county.

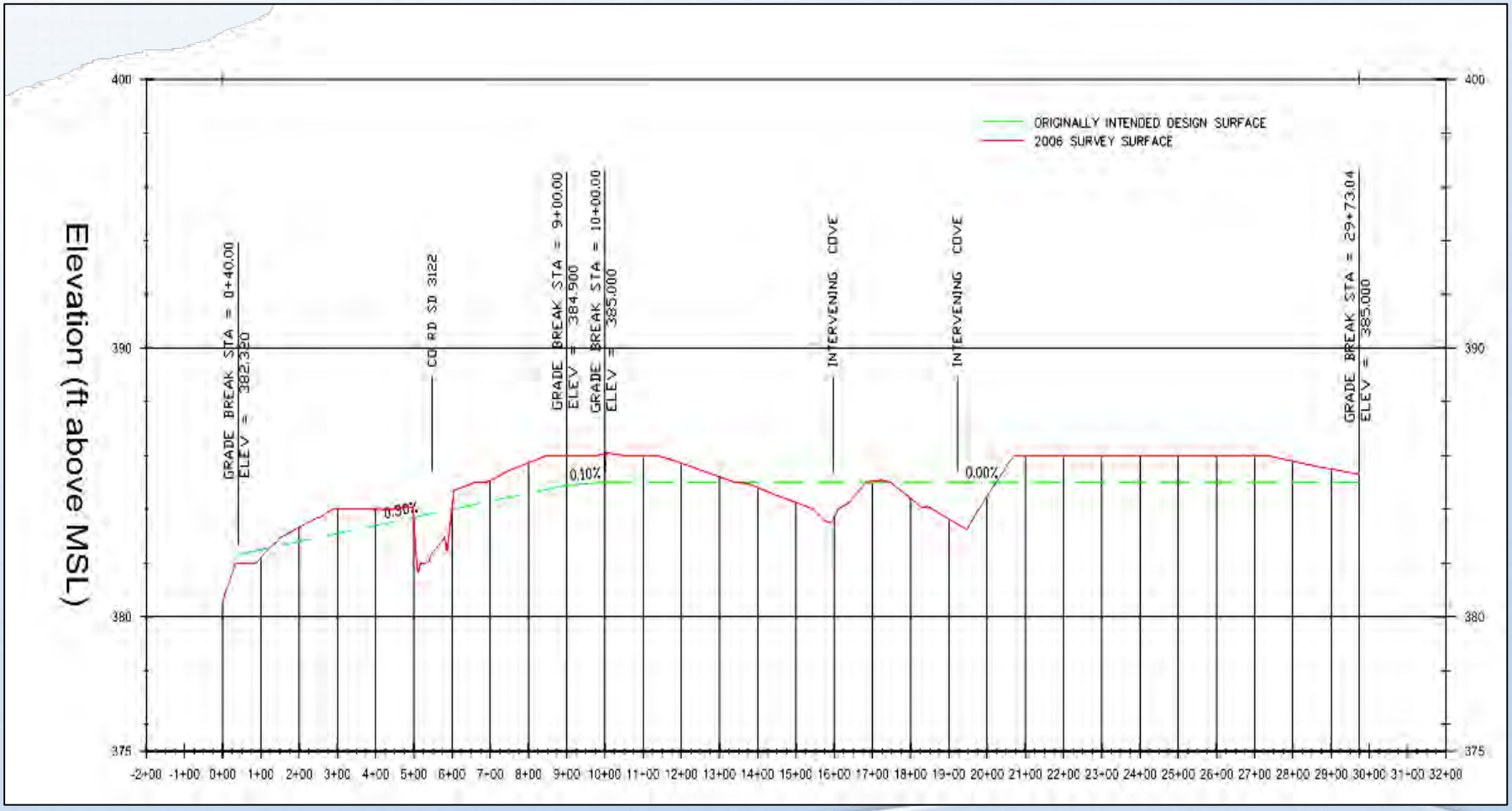
Next Steps


Next Steps for the District?
Choose to proceed with Structural Alternative 3
Choose a series of Ancillary Alternatives
Proceed with Both Structural Alternative 3 and Ancillary Alternatives
Impacts Assessments & Permitting
~ Cost
H&H Analysis
$250K
Water Quality Assessment
$85K
Environmental Permitting
$148K
Funding Strategies
Design
Construction
Ancillary Option Analysis
~ Cost
FEMA Coordination
Modification FCWD R&R
Lake Closures
Cost Already Incurred by FCWD
Implementation

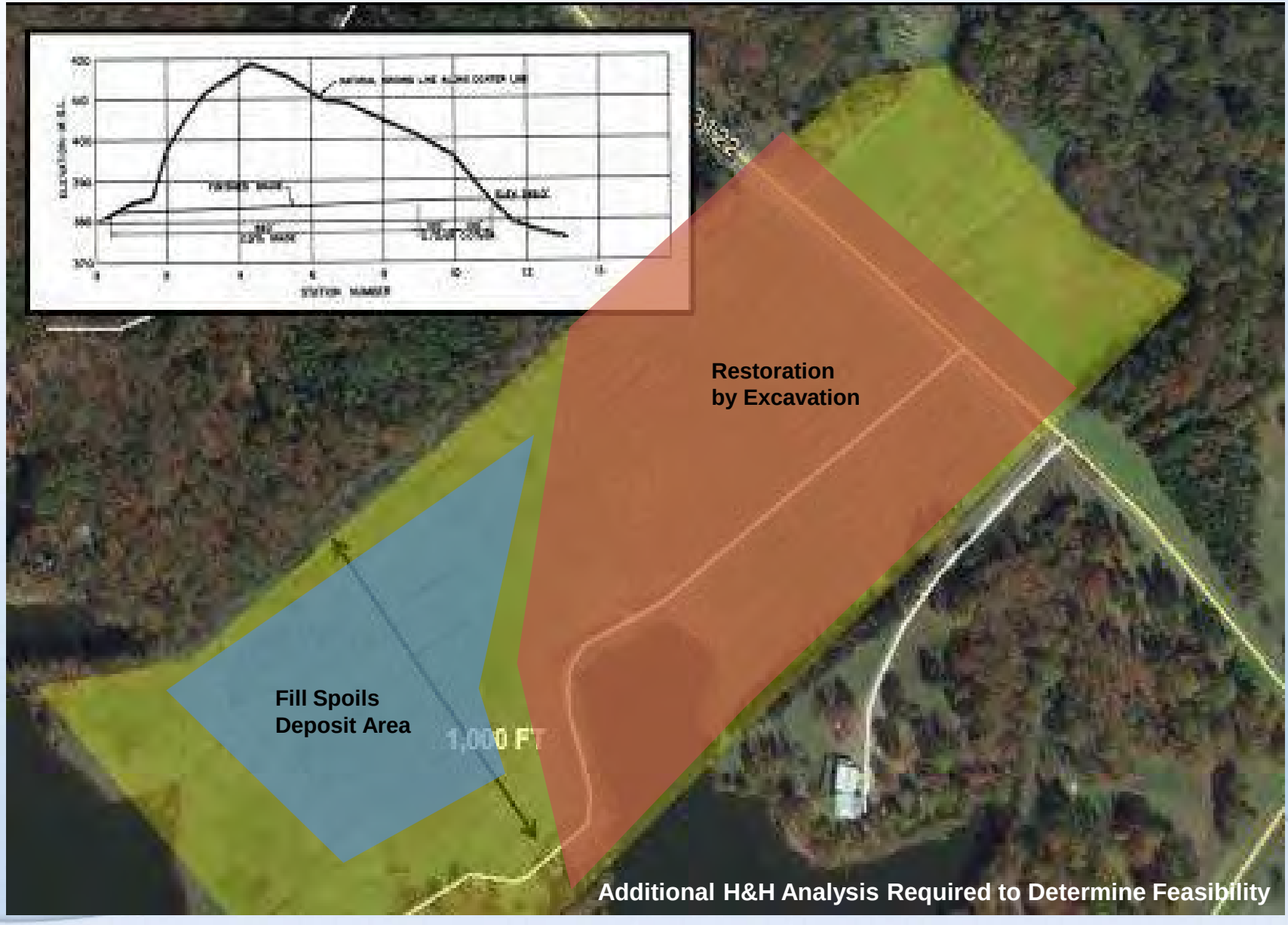
Emergency Spillway Elevation Comparison



LCS Emergency Spillway Cross Section



Emergency Spillway Restoration Possibility



Emergency Spillway Evaluation

Alternative	Task Hurdle		
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Cost Feasibility
Do-Nothing	✗ - ✓ - ✓*	✗ - ✓ - ✓*	✗ - ✓ - ✓*
Return Emergency Spillway to Design	✗ - ✓ - ✓*	✗ - ✓ - ✓*	✗ - ✓ - ✓*
Evaluation of Alternative Restoration	✗ - ✓ - ✓*	✗ - ✓ - ✓*	✗ - ✓ - ✓*

Questions

