



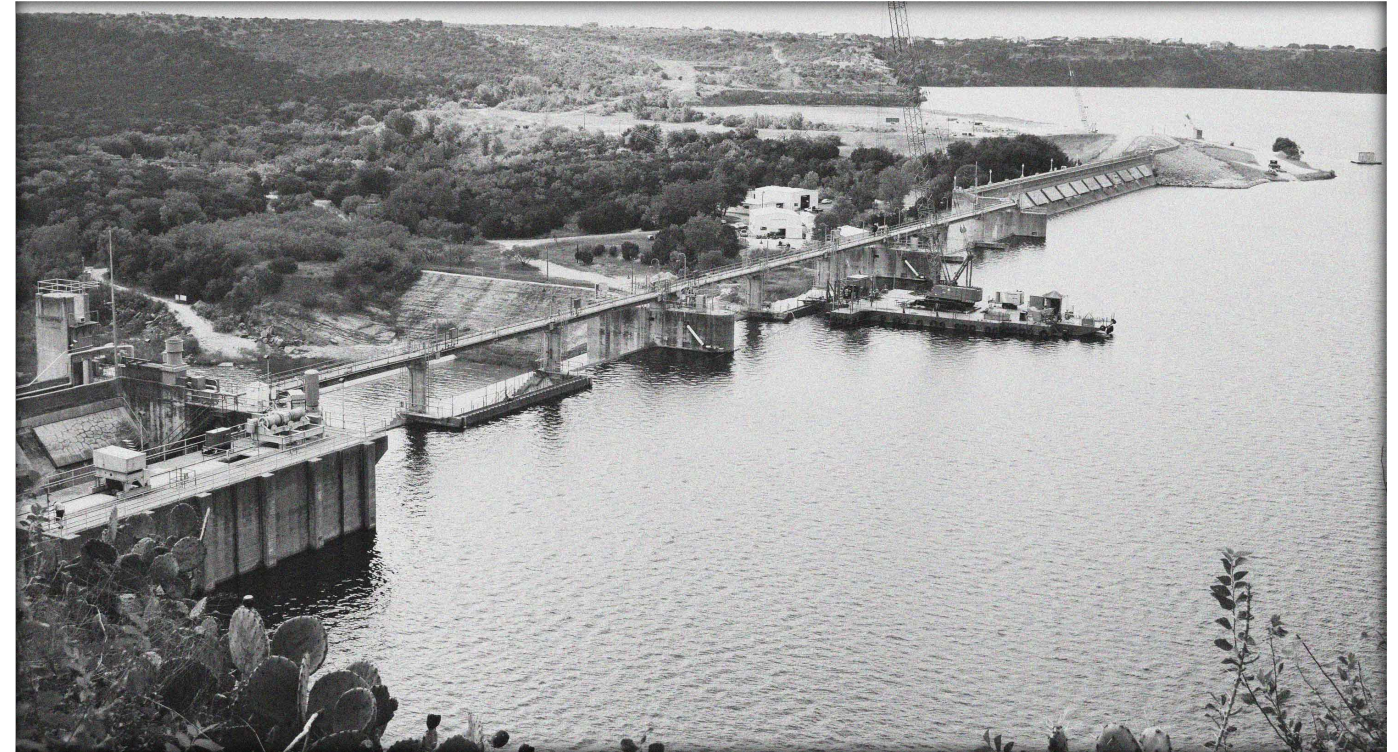
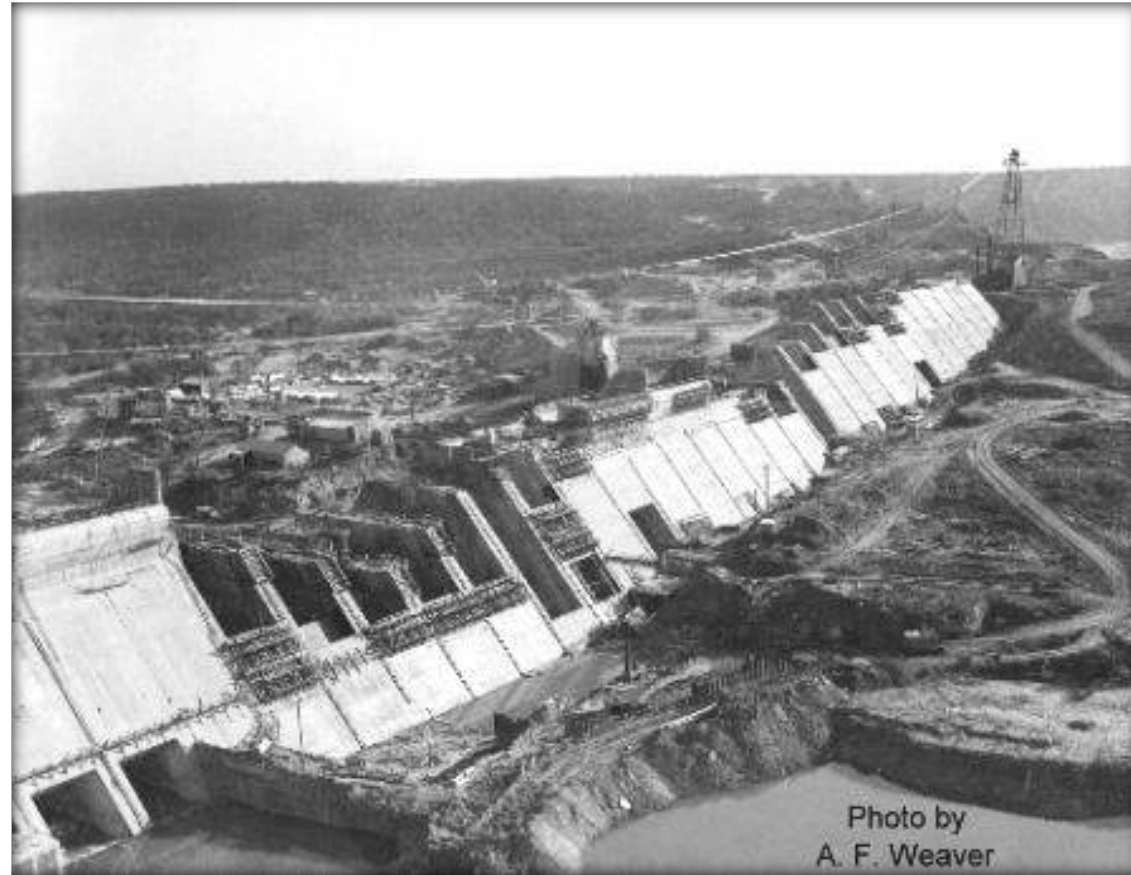
# ***CAASLE Project, Phase II***

***Presented by  
Michael McClendon - Upper Basin Regional Manager  
&  
Stewart Vaghti P.E. - Gannett Fleming Inc.***





# Morris Sheppard Dam



Goal - Extend the  
Service Life





# ***Phased Approach***

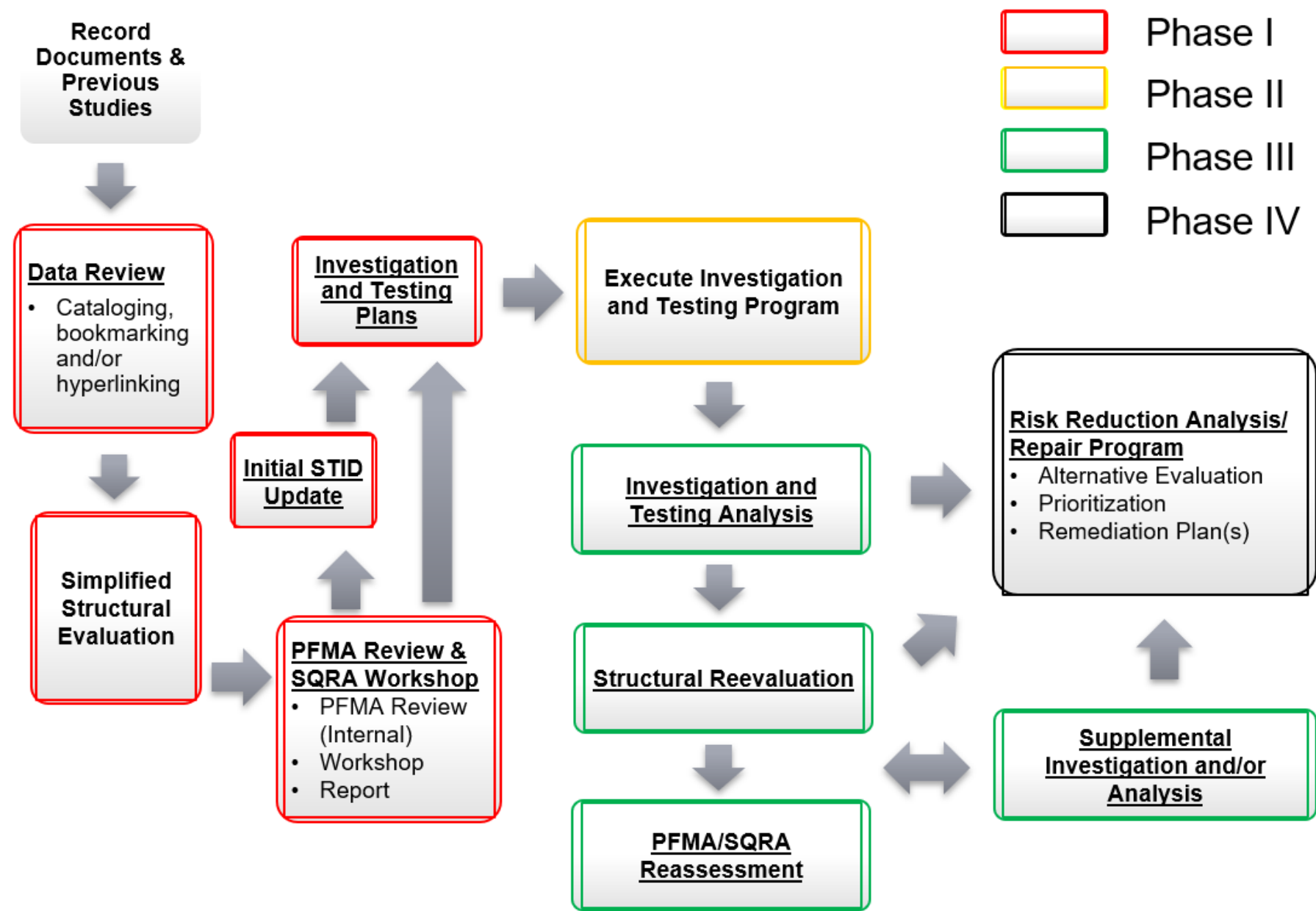
Phase I: Targeted & Credible Investigation Program

Phase II: Execute Targeted & Credible Investigation Program

Phase III: Investigation & Testing Analysis

Phase IV: Risk Reduction Analysis; Remediation Plans and  
Recommendations

# Scope Outline Flowchart





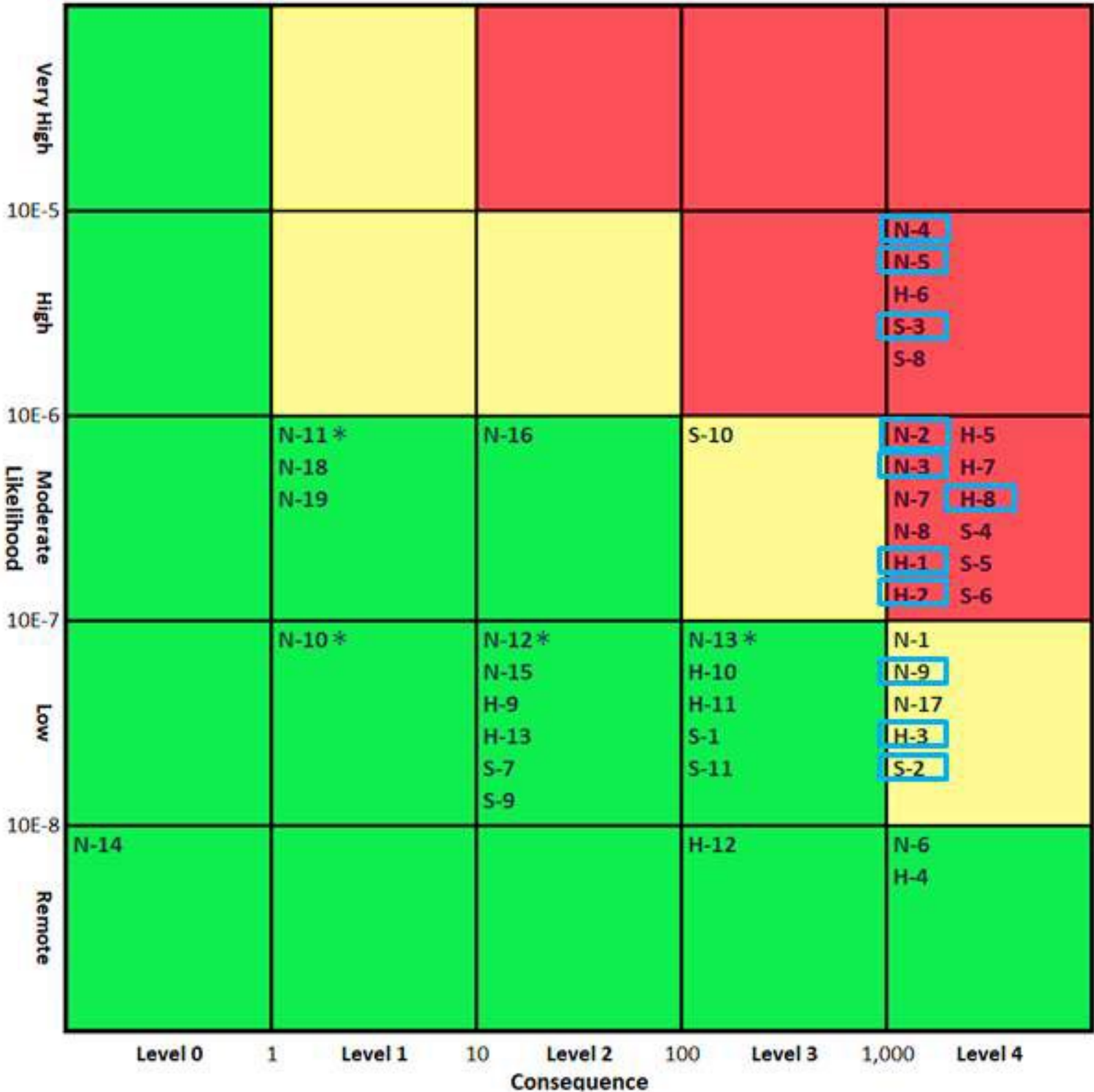
# ***Scope of Services***

## **Phase I: Targeted and Credible Investigation Program**

- Task 1: Site Visit, Data Collection; Document Review – **Completed**
- Task 2: Simplified Structural Evaluation – **Completed**
- Task 3: Potential Failure Mode Analysis – **Completed**
- Task 4: Supporting Technical Information Update – **Completed**
- Task 5: Preparation of Investigation and Testing Plan(s) – **Completed**
- Task 6: Phase II Scoping Development - **Completed**

# SQRA f-N Chart

- What is it?
- What were findings?
- How will it be used?



# Scope of Services

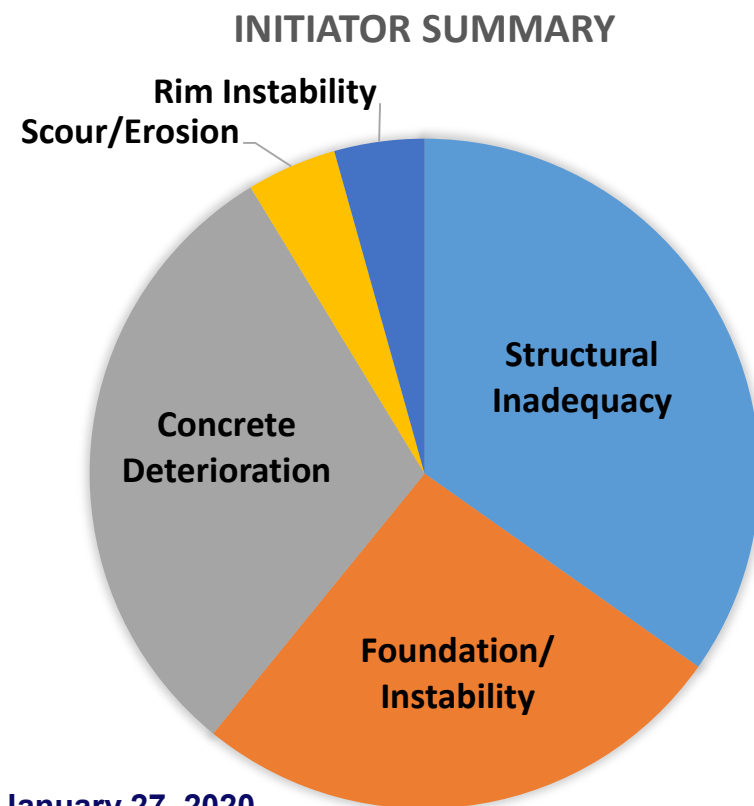
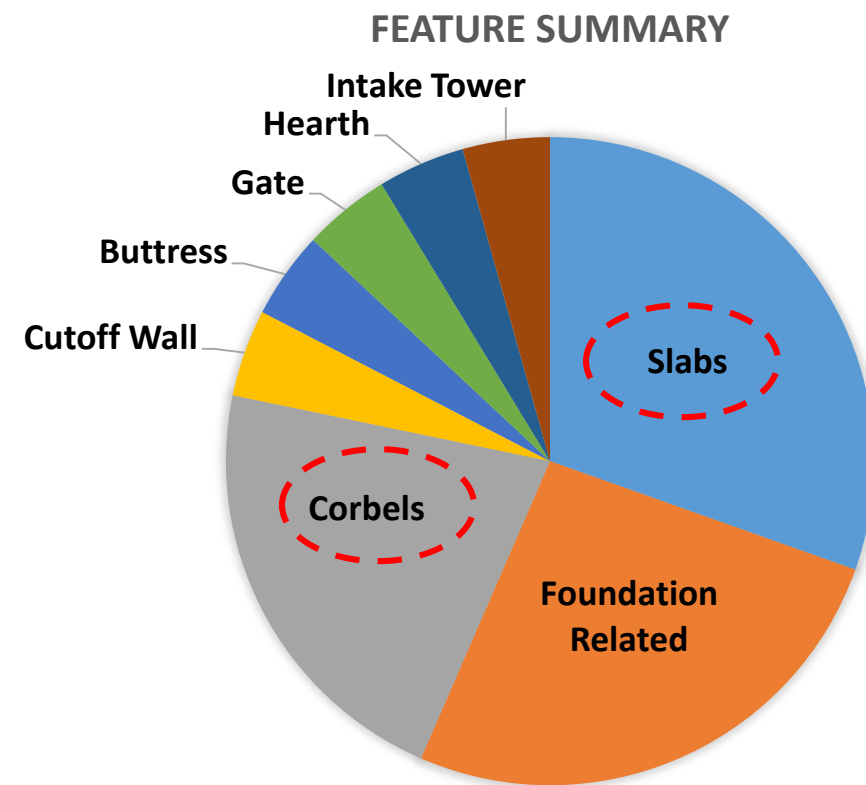
## Phase II: Execute Investigation & Testing Program

**Goal** – Investigate the concrete and reinforcing conditions related to higher-risk potential failure modes identified in Phase I – *Guide decision making to achieve a longer service life*

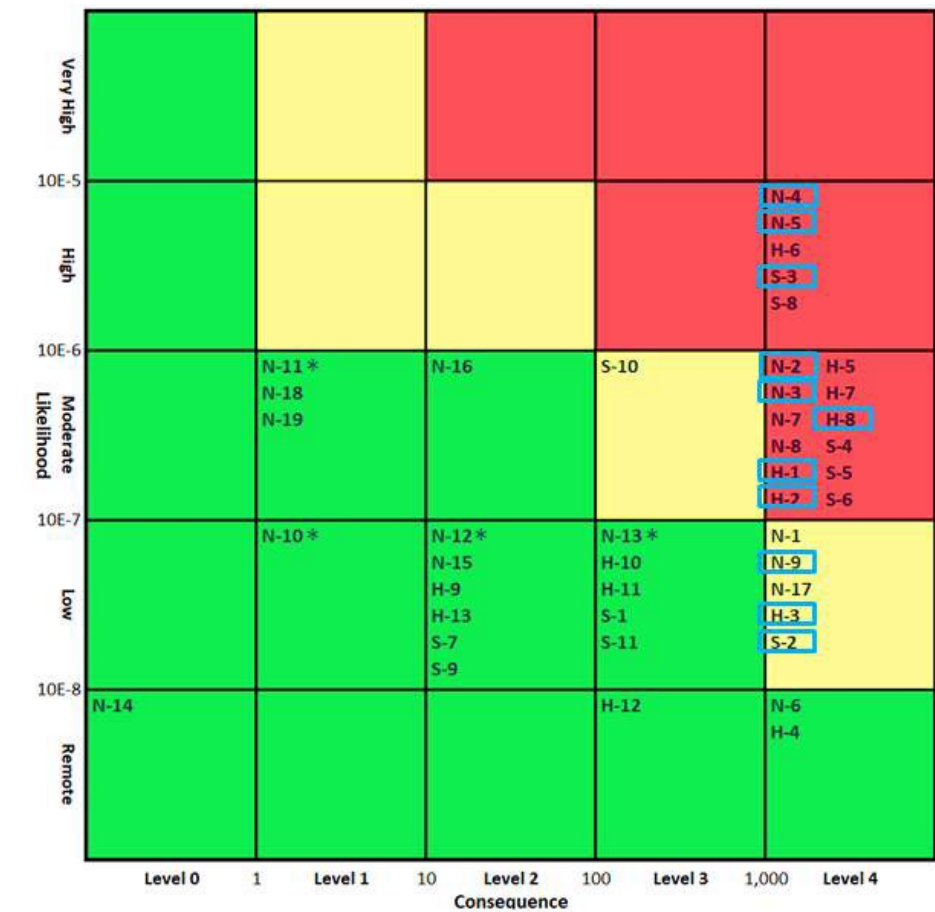
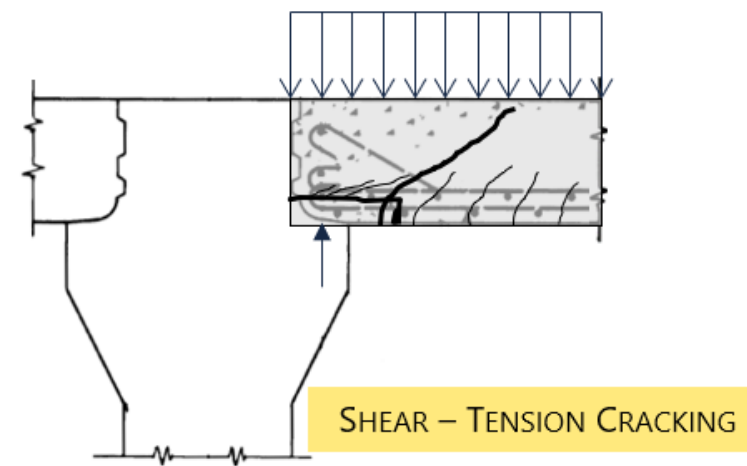
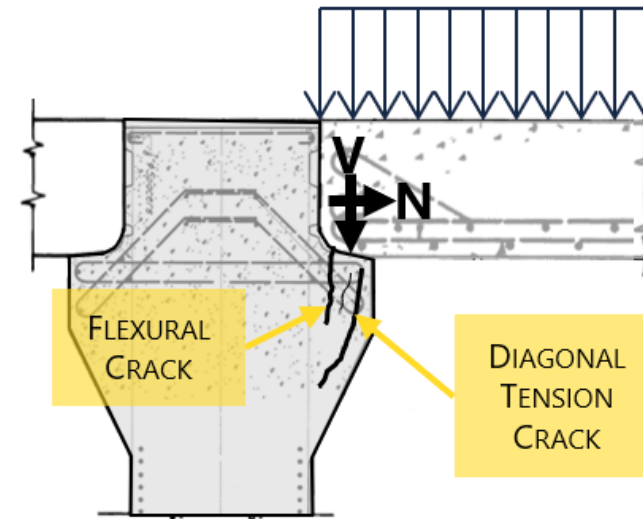
**Result** – Assist BRA in prioritizing preventative maintenance, repairs, and/or modifications to extend Morris Sheppard Dam's service life

**Phase II Schedule** – Approximately 18 weeks

**Overview of Tasks/Testing** – Stewart Vaghti P.E. – Gannett Fleming Inc.

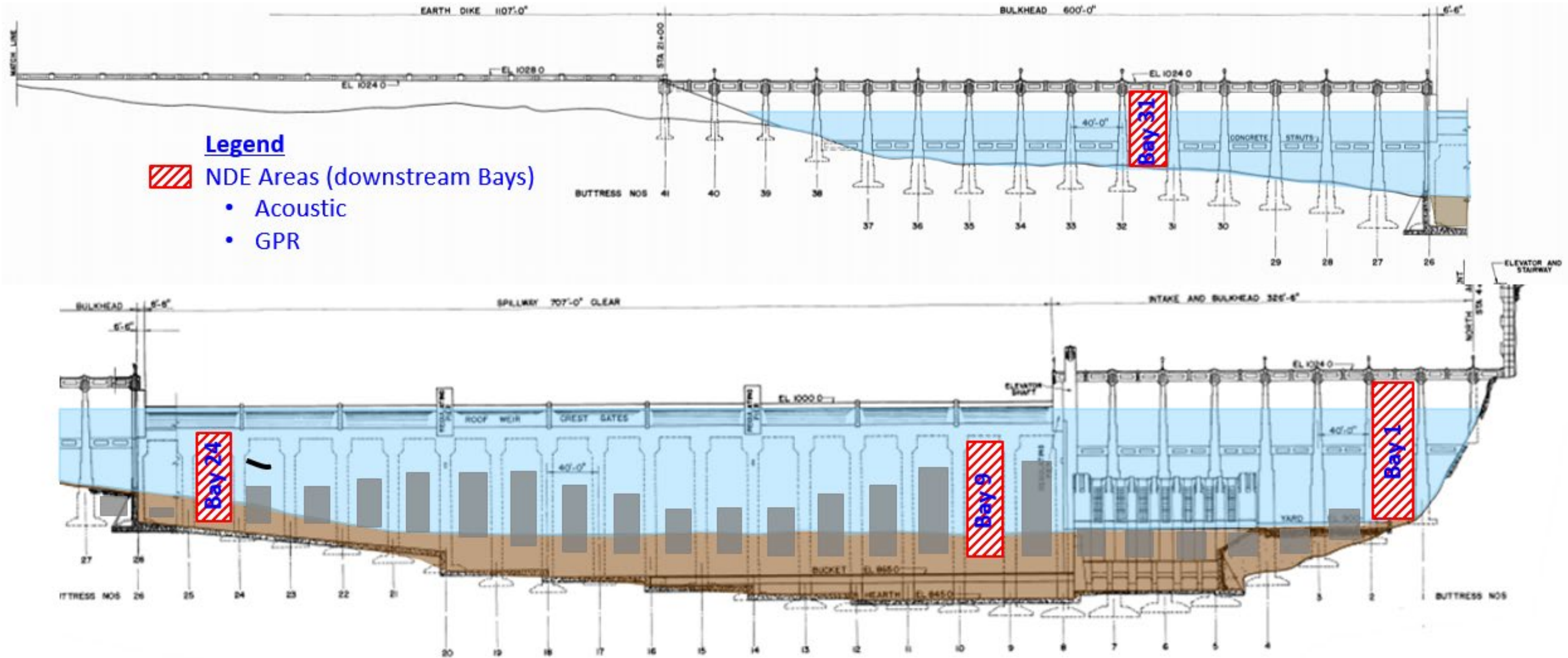


## Priority Features

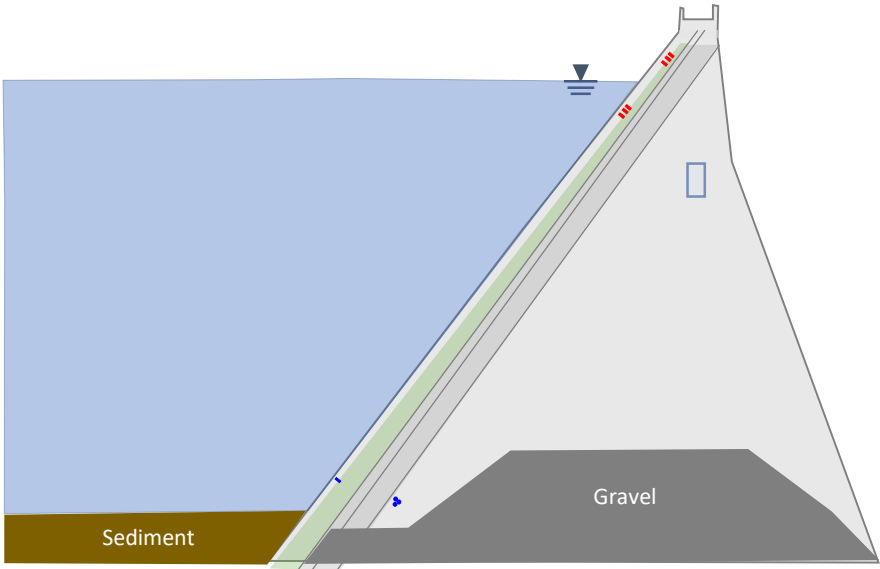
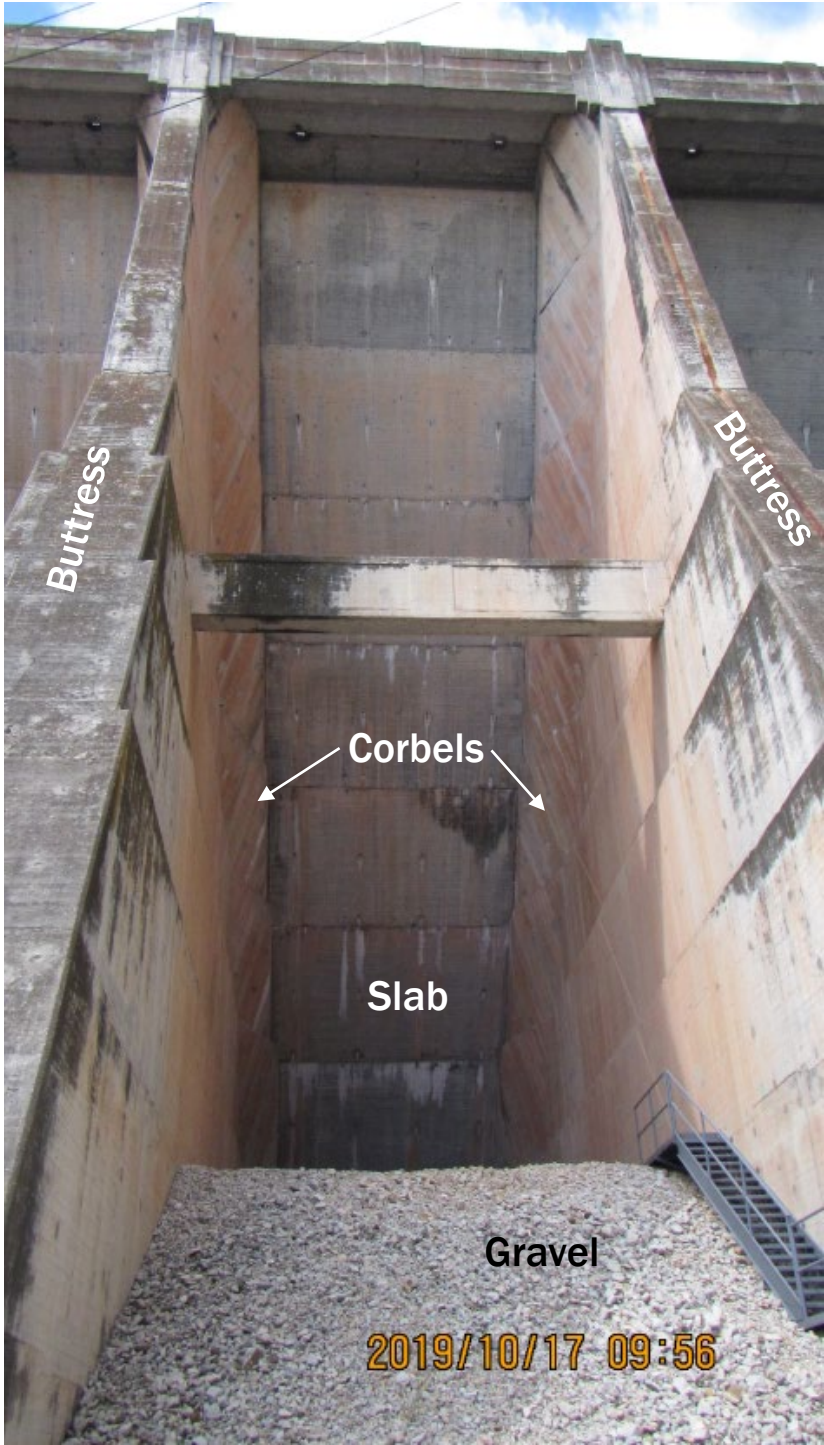




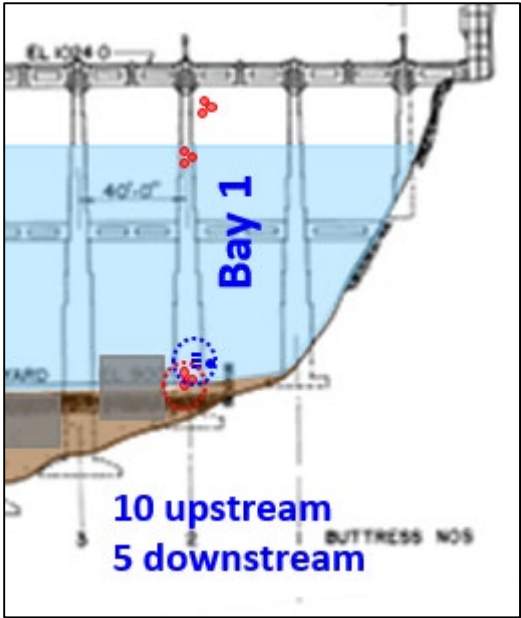
# Investigation Areas







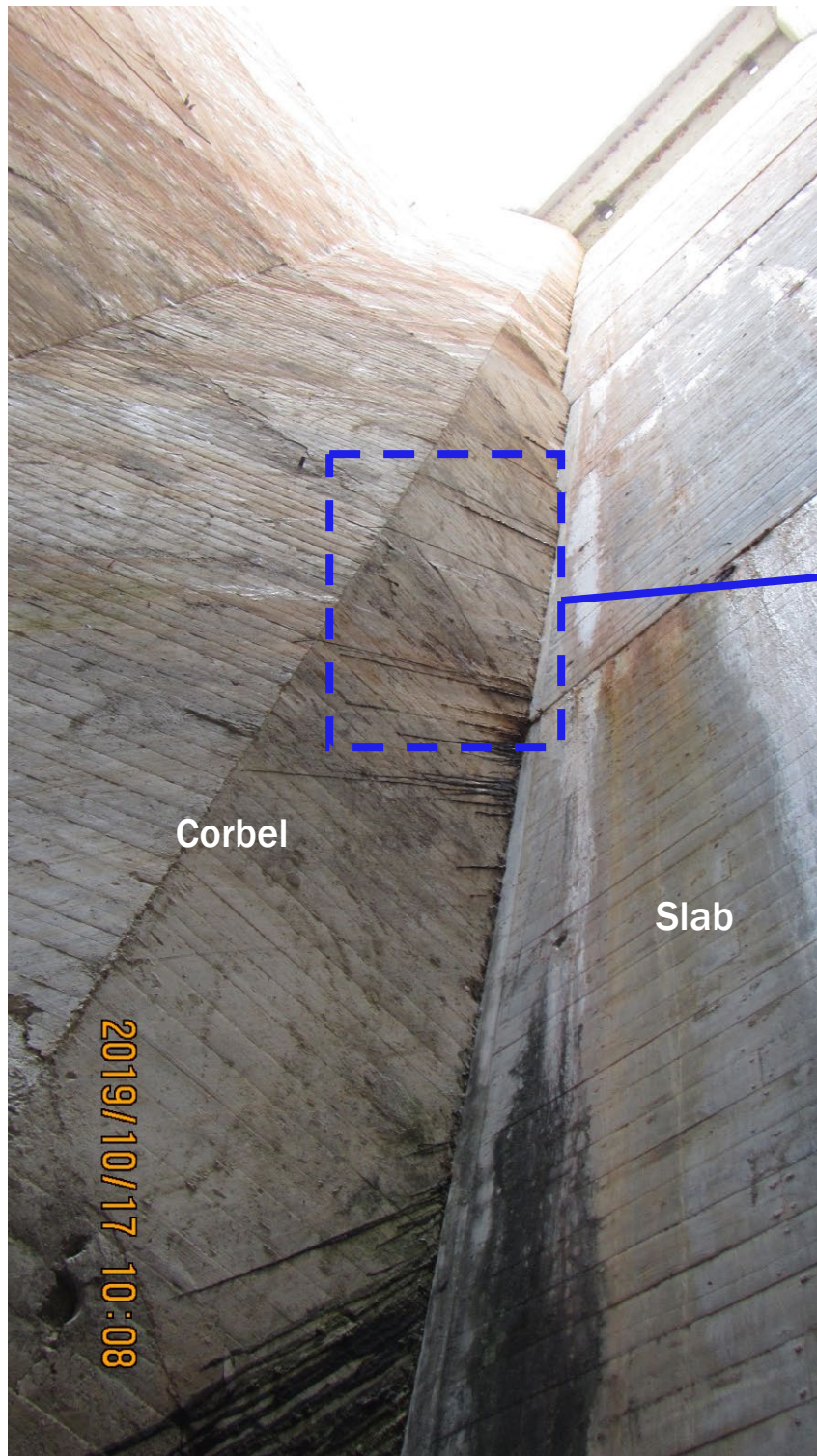
Section



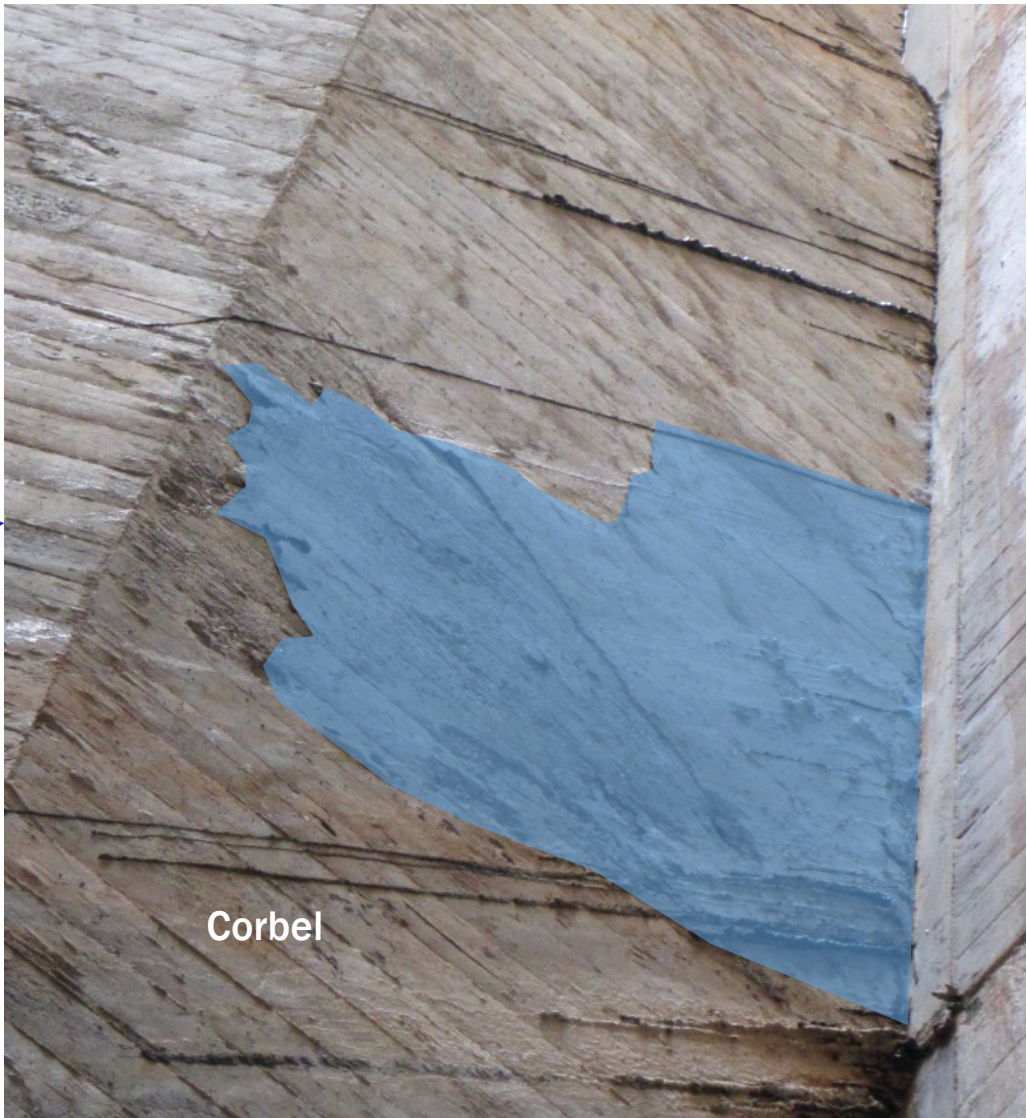
Elevation



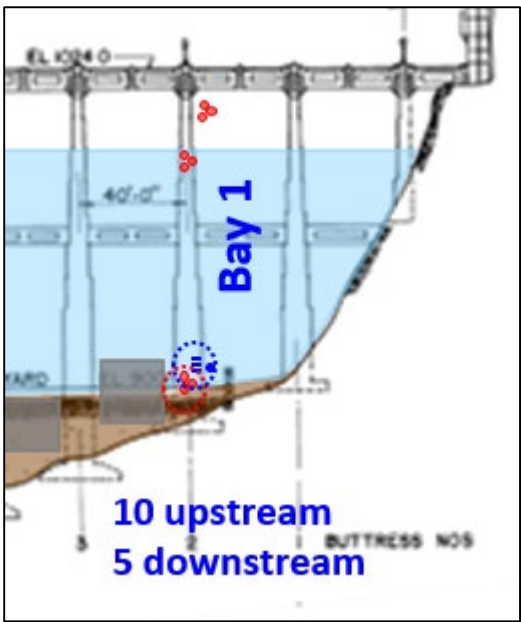




Bay 1 Corbel



Active Delamination



Elevation

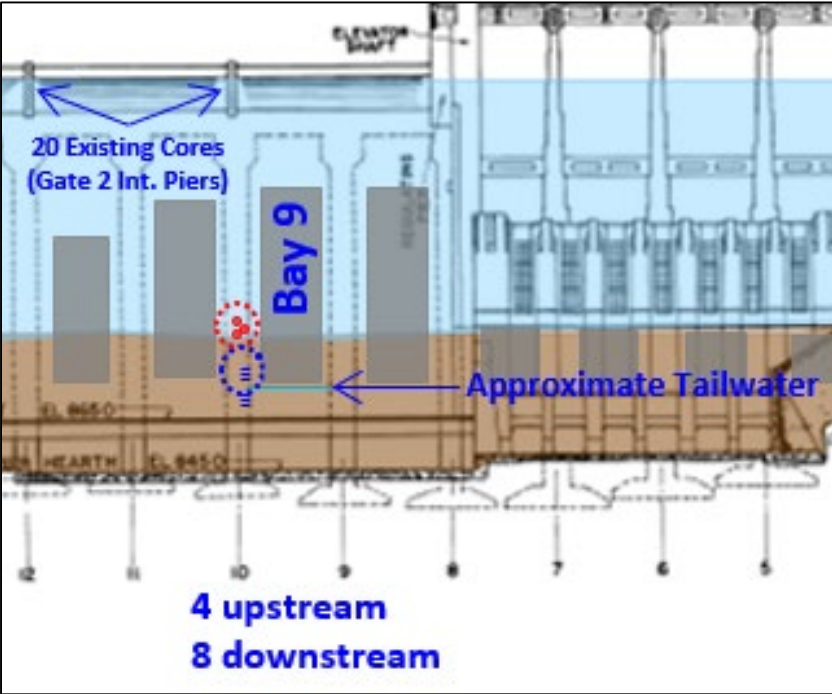


Previous Corbel Repair Page 11

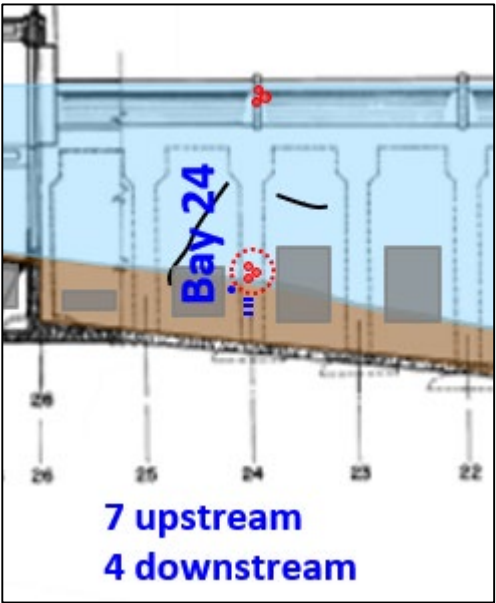




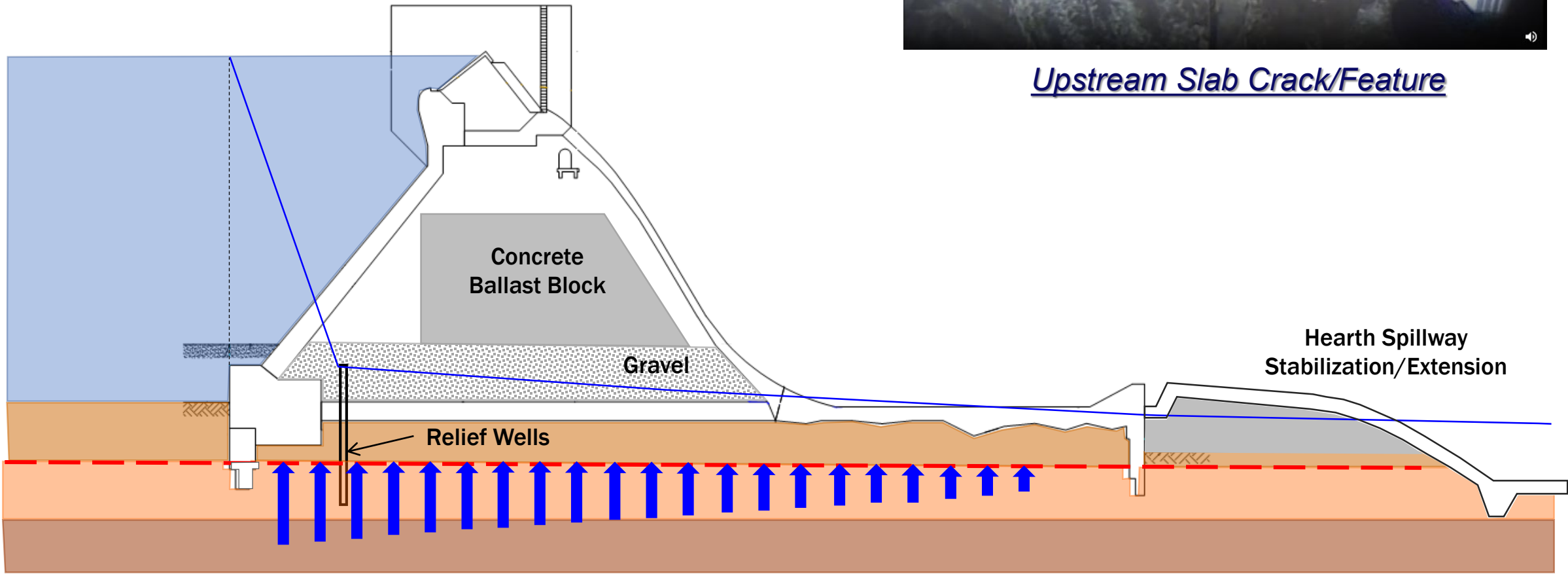
Collapsed Concrete Pipe



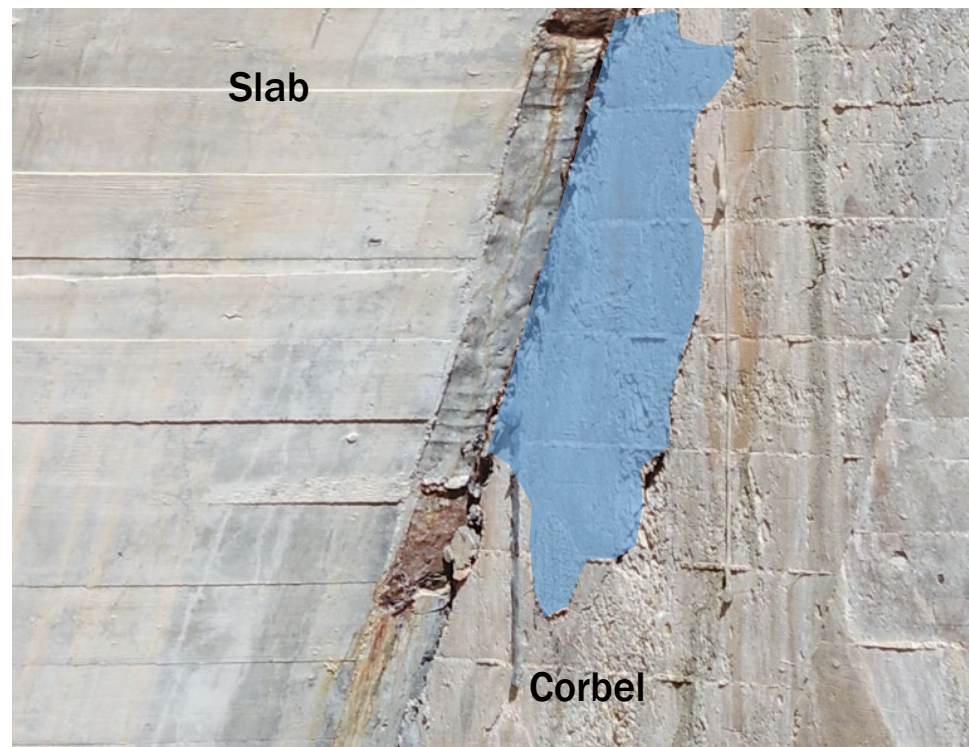
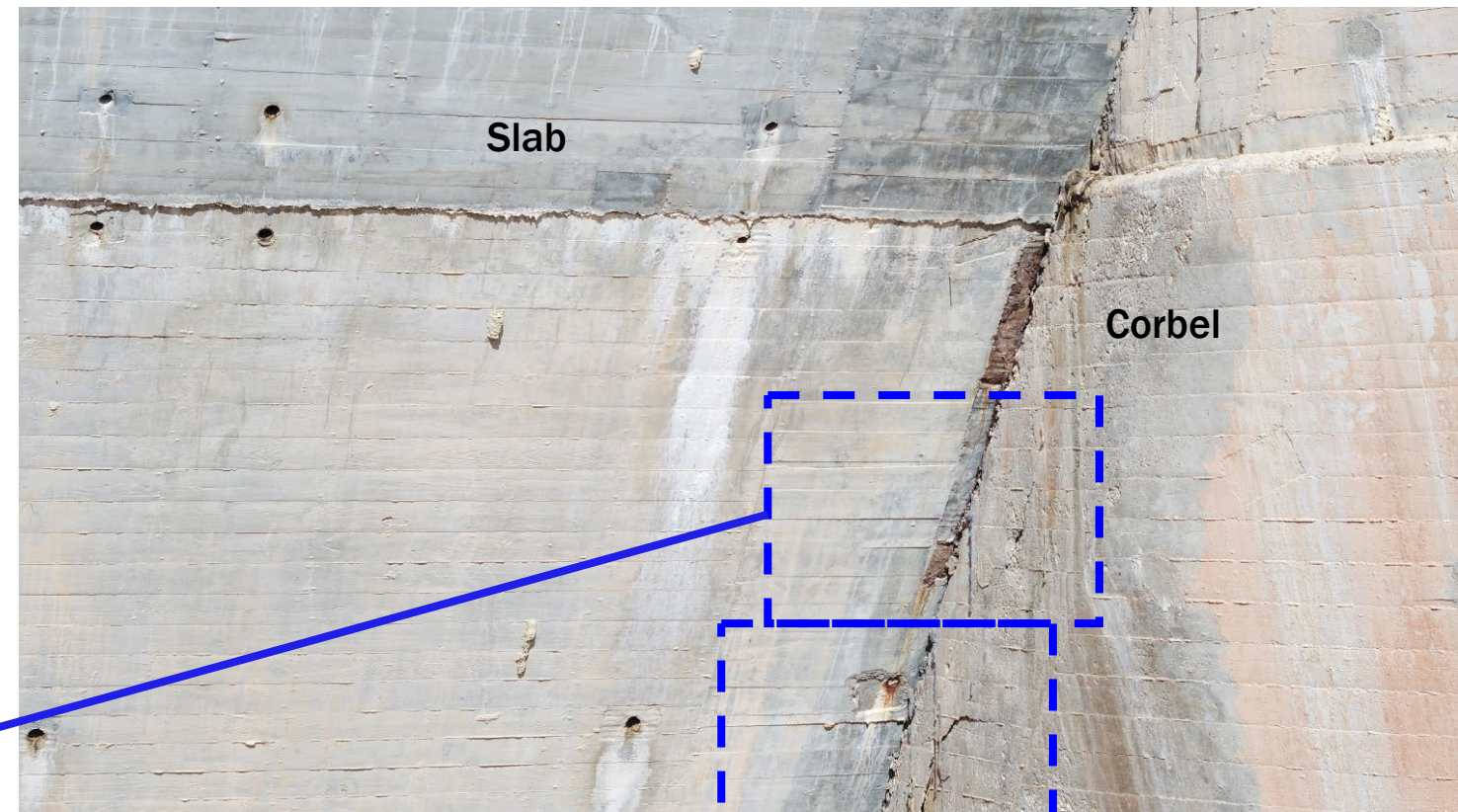
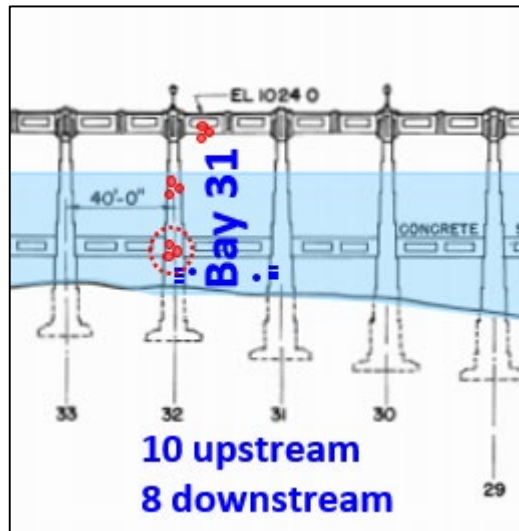
Deteriorated Concrete



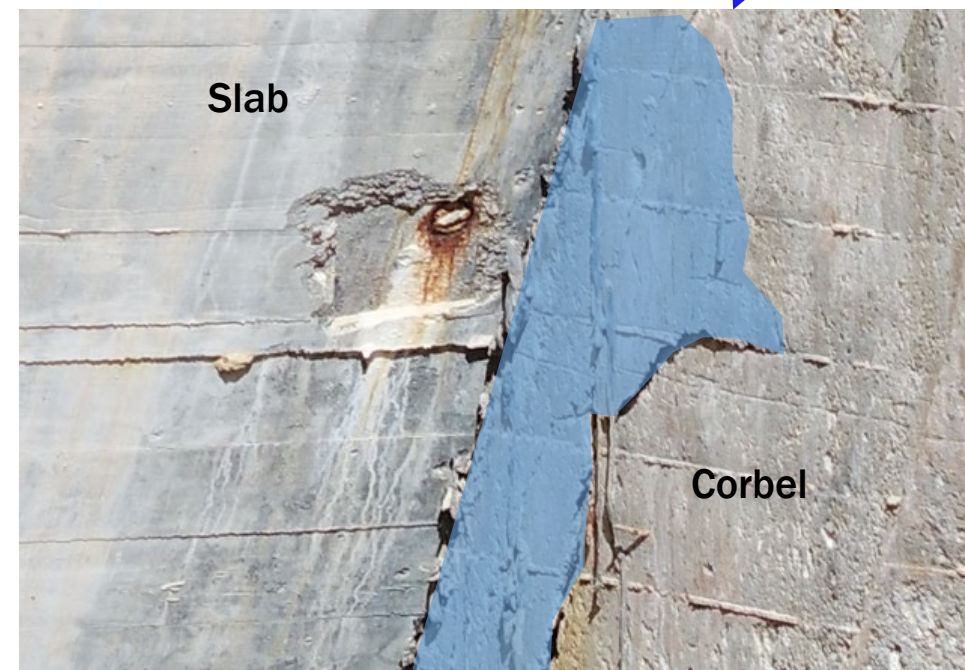
Upstream Slab Crack/Feature







Active Delamination

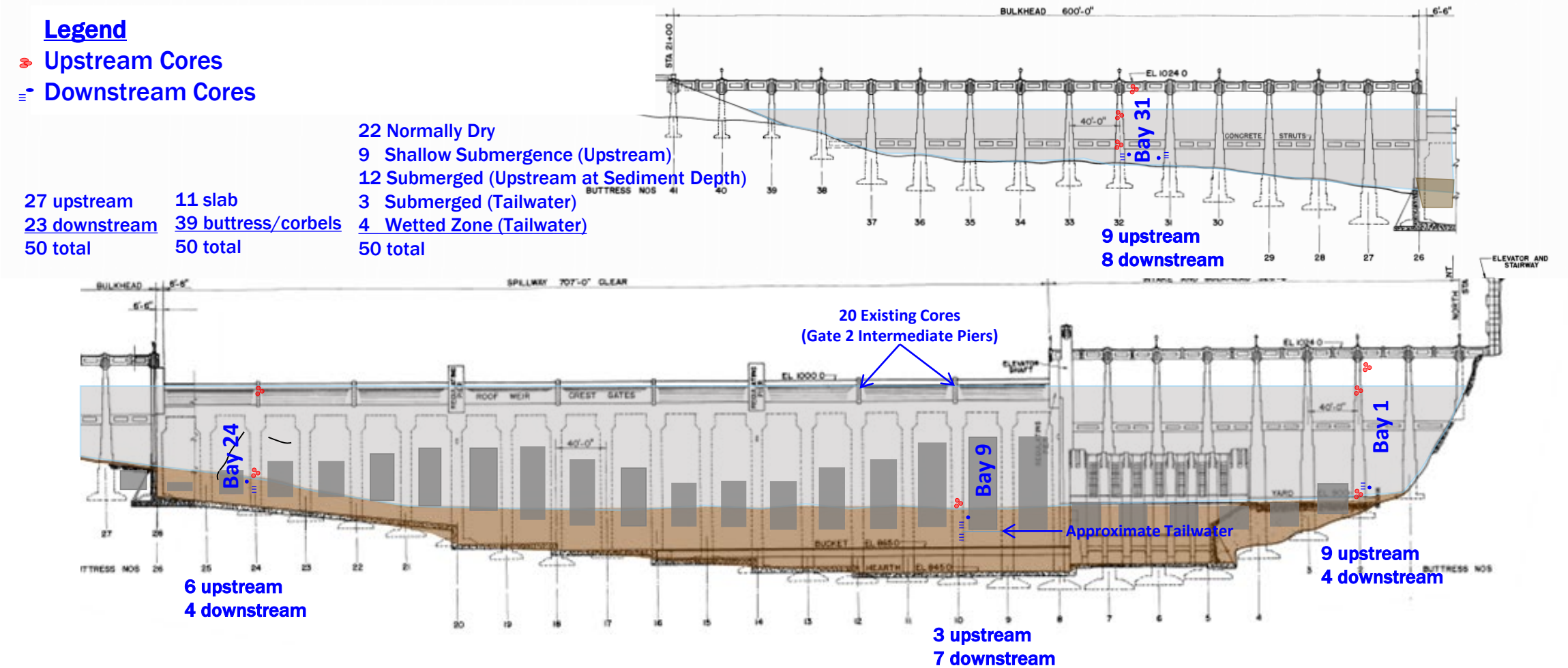


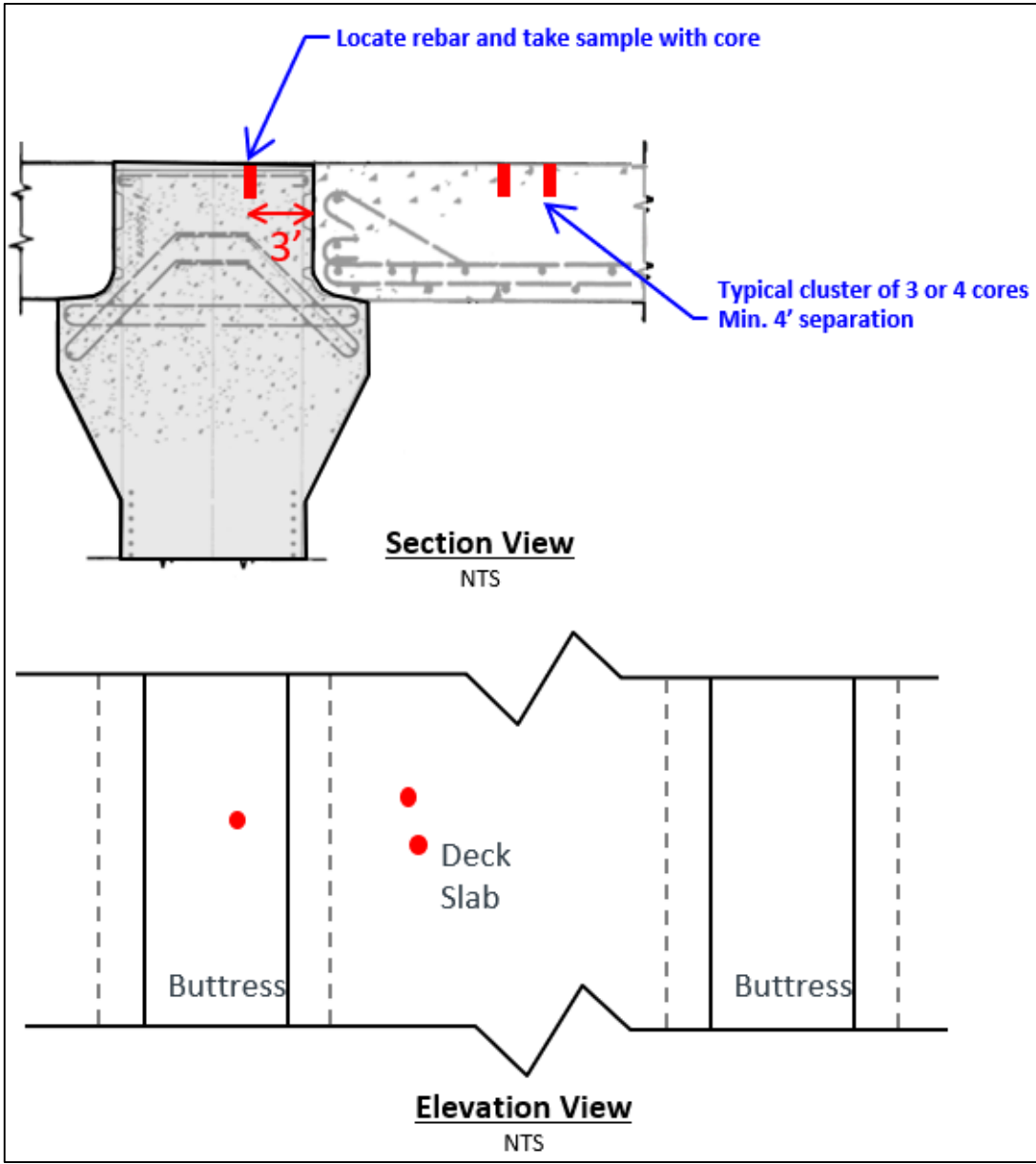
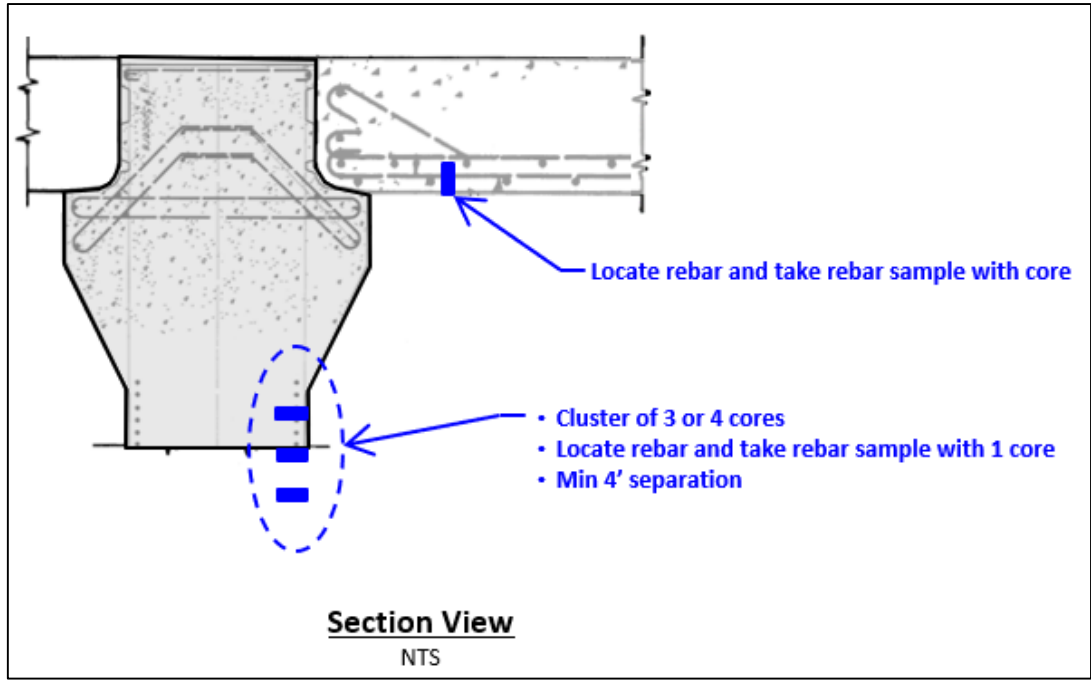
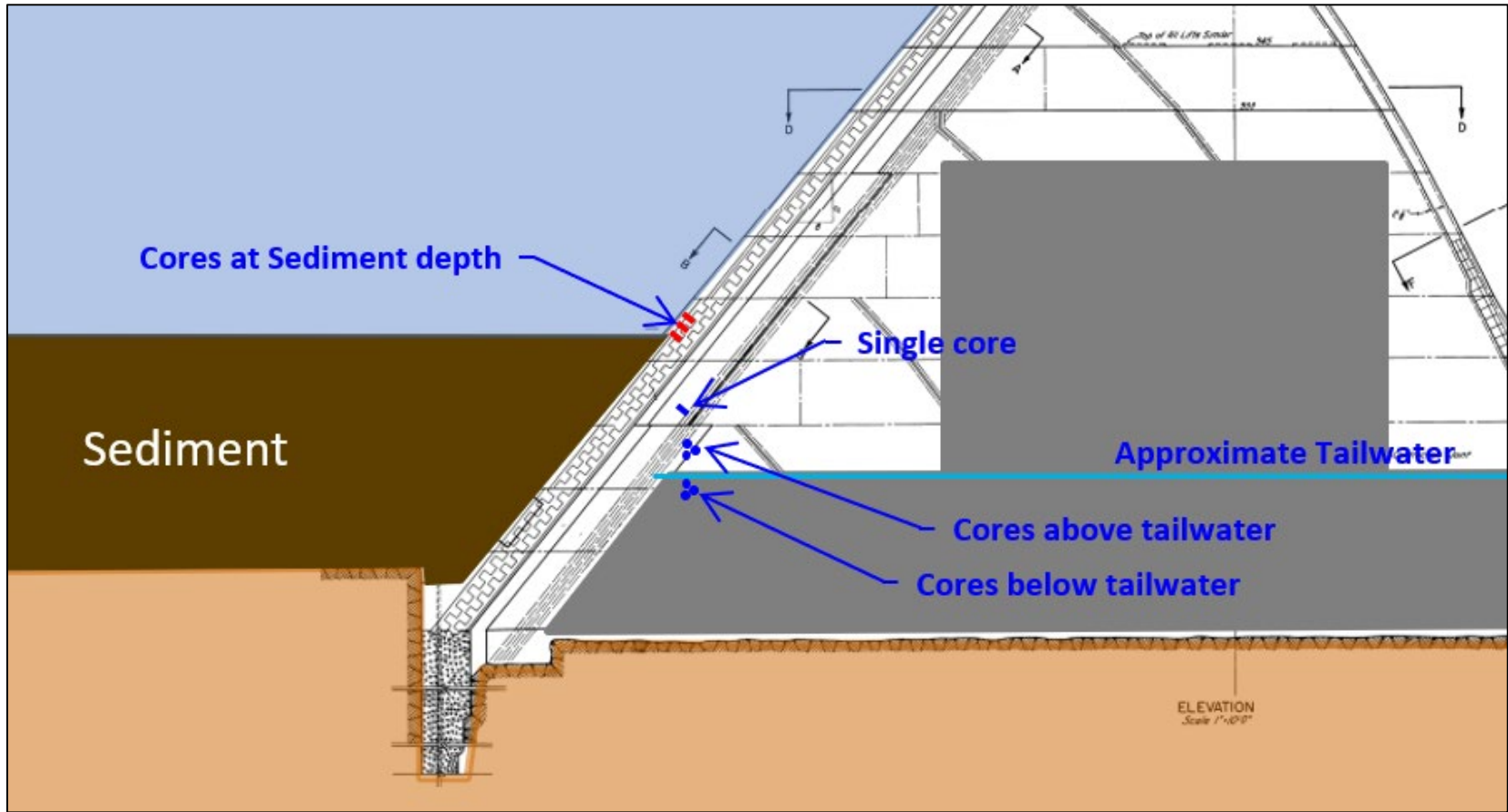
Active Delamination

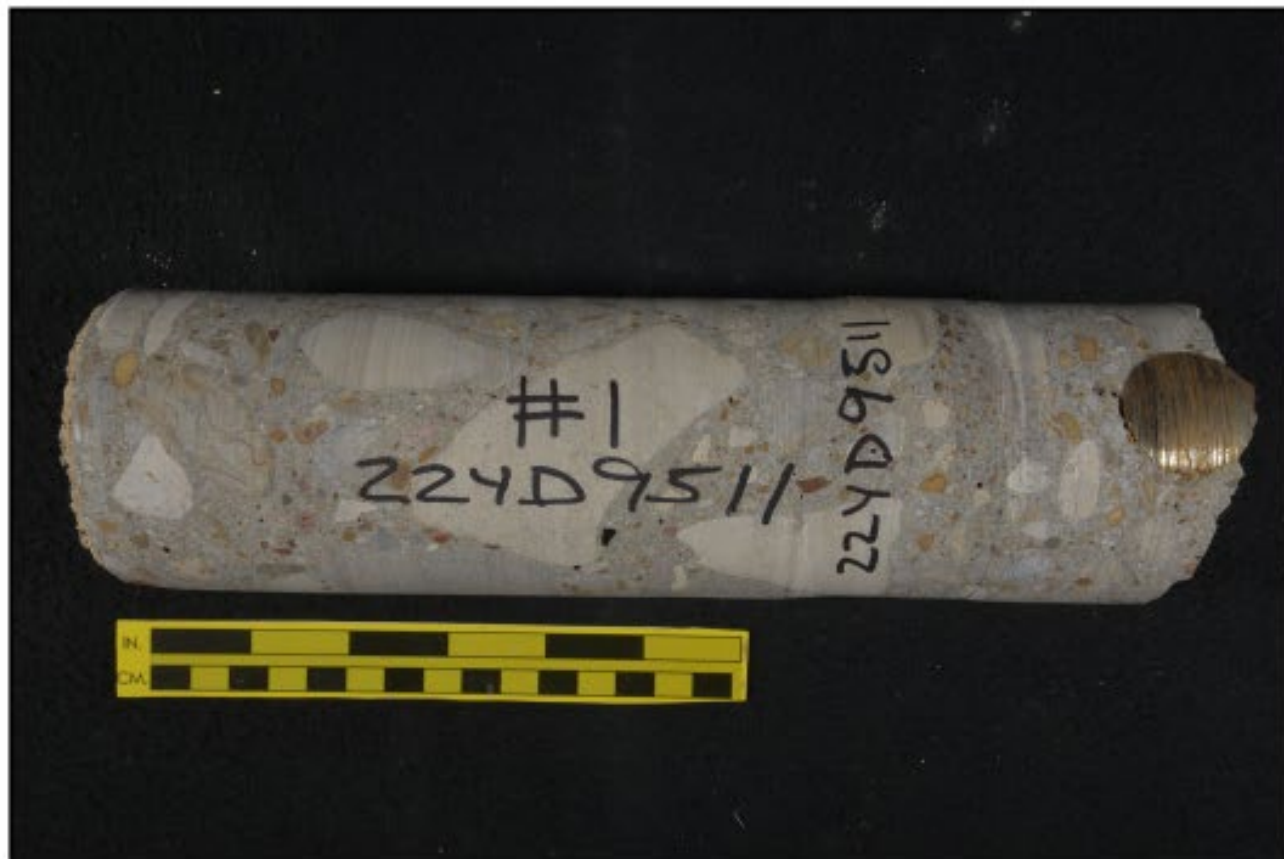


# Concrete Coring

<b>Bay 1</b>	<b>Bay 9</b>	<b>Bay 24</b>	<b>Bay 31</b>
4 Compressive	3 Compressive	3 Compressive	5 Compressive
4 Tensile	3 Tensile	3 Tensile	5 Tensile
4 Unit weight	3 Unit weight	3 Unit weight	5 Unit weight
5 Petro	4 Petro	4 Petro	7 Petro
15 Chloride	12 Chloride	12 Chloride	18 Chloride
15 Sulfur	12 Sulfur	12 Sulfur	18 Sulfur







Test(s)	Qty	Sample Notes
Petrographic Exam. (ASTM C856) w/ SEM (ASTM C1723)	21 <sup>1</sup>	6" dia, 12" long (min)
Chem. analysis for chloride (ASTM C1152)	58 <sup>1</sup>	petro core (outer, mid & inner core)
Chem. analysis for total sulfur content (LECO) (ASTM C114)	58 <sup>1</sup>	petro core (outer, mid & inner core)
Compressive Strength (ASTM C39)	16 <sup>2</sup>	6" dia, 12" long (min)
Splitting Tensile Strength (ASTM C496)	16 <sup>3</sup>	6" dia, 12" long (min)
Formation Factor of Concrete test	6 <sup>4</sup>	6" dia, 12" long (min)

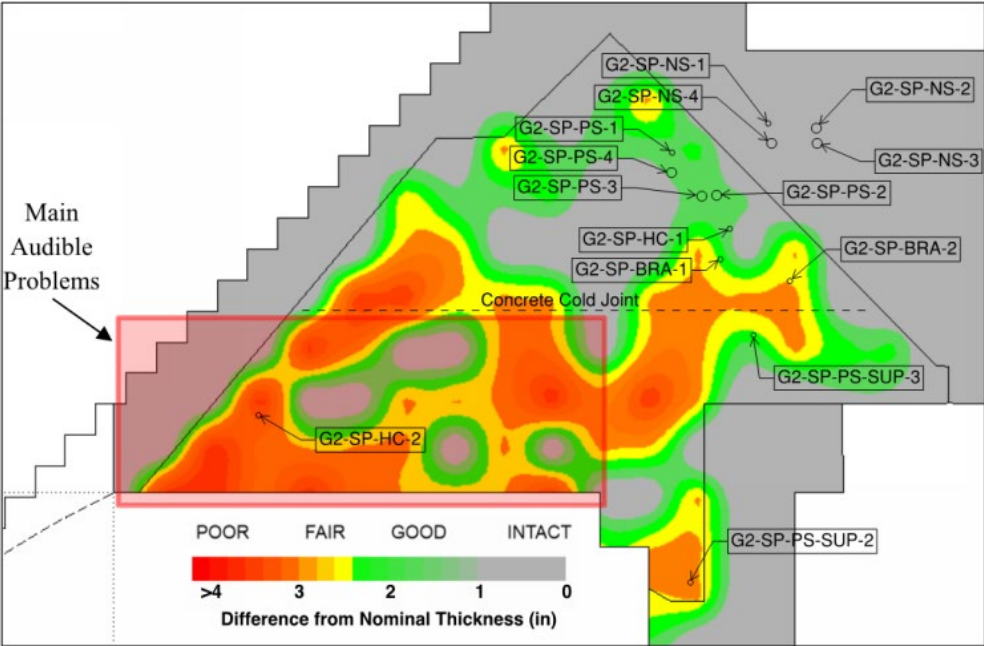
<sup>1</sup>One core will be used for each petrographic analysis (ASTM C856 w/ SEM ASTM C1723) and chloride (ASTM C1152) and sulfur content analysis (ASTM C114); rebar samples to be extracted from this core.

<sup>2</sup>One core will be used for each Compressive Strength test (ASTM C39)

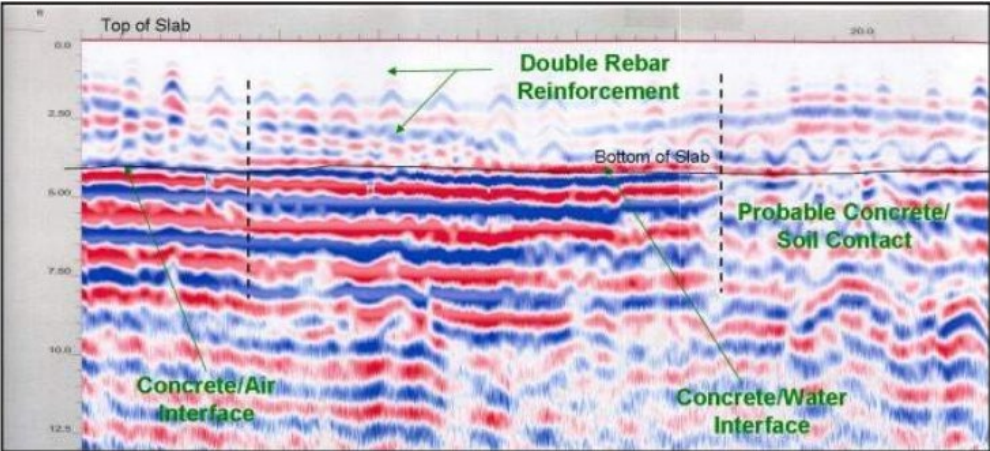
<sup>3</sup>One core will be used for each Tensile Strength Test (ASTM C496)

<sup>4</sup>One core will be used for each Formation Factor test.





Impact Echo



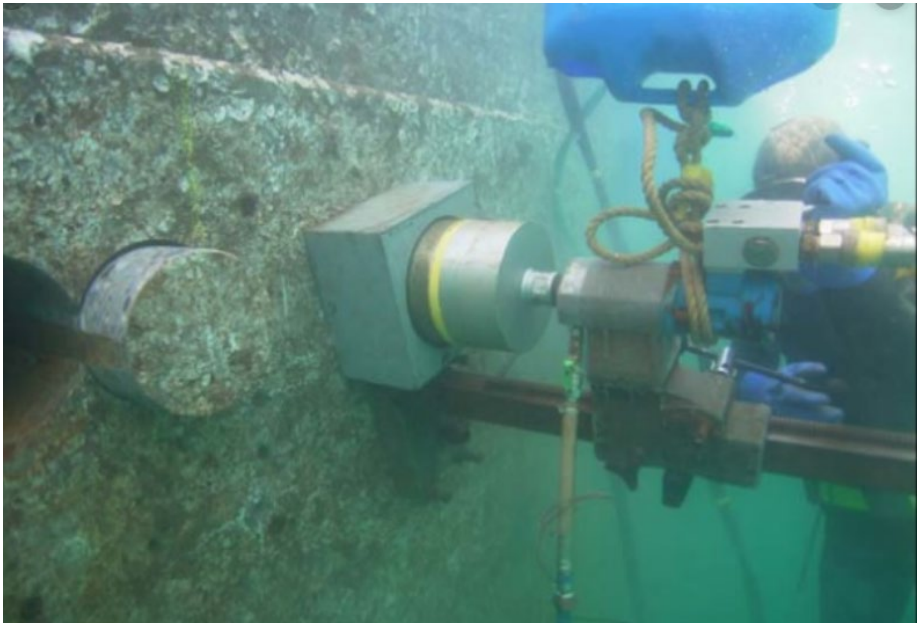
GPR

# NDT

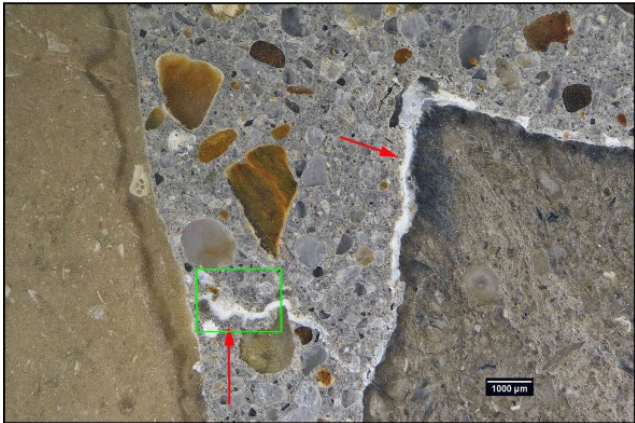
Upstream Deck Slabs (Bulkhead and Spillway)								Associated Red Risk PFM: PFM Nos. N-2, N-3 & H-1; Yellow Risk PFM No.S-2		
Log ID	Testing Method	Testing Physical Parameters					Cost	Usage Recommendation	Notes	
		Thickness	Reinforcement Schedule	Corrosion	Concrete Deterioration	Concrete Cracking				Strength of Concrete
Non-Destructive Evaluation (NDE) Methods										
1	Visual Inspection				✓	✓		\$	Yes	<ul style="list-style-type: none"><li>Limited to observable concrete deterioration and cracking, and exposed reinforcing condition (e.g. at spalled areas).</li><li>Access limitation (below grade, high areas, etc.). Supplemental photogrammetry and thermography can be used.</li><li>Only surface degree of concrete deterioration and cracking can be ascertained.</li><li>Additional NDE methods are needed to access interior condition (i.e., reinforcement, thickness, and corrosion).</li></ul>
2	Ground Penetrating Radar (GPR)	✓								<p>Inspection is already part of the O&amp;M protocol, so with other NDEs.</p> <p>method in the microwave range</p> <p>grity and potential future problem areas</p> <p>areas before delamination evident by other NDE ultrasonic methods</p> <p>for corrosion issues</p> <p>rent tool</p> <p>ness of structure, but may need to be validated using other NDE and</p> <p>ation, but may need to be validated using other NDE and destructive methods</p> <p>can be assessed using GPR</p> <p>lar will require other NDE and/or destructive methods.</p> <p>ver meter testing</p> <p>g samples in dry areas</p> <p>h other ultrasonichacoustic methods like MIRA, Impact-Echo, and UPV/</p>
3	Impact-Echo (IE) Method	✓			✓	✓		\$\$	Yes	<ul style="list-style-type: none"><li>Acoustic Method</li><li>Can be used to approximate the thickness using stress waves (sound) by striking the concrete with an impactor.</li><li>Can locate defects like delamination</li><li>Alternate to MIRA<ul style="list-style-type: none"><li>MIRA will provide a better estimate of the extent of the deterioration for thinner structures less than 3-4 feet</li></ul></li><li>Recommended Uses:<ul style="list-style-type: none"><li>More ideal for thicker sections of the dam, but can be used as alternate for MIRA</li><li>Use in conjunction with GPR</li></ul></li></ul>
4	LIDAR Survey				✓	✓		\$\$\$	No	<ul style="list-style-type: none"><li>LIDAR survey cannot be used with a singular study and needs to be studied in conjunction with previous results to ascertain the changes in the structure.</li><li>Only observable surface concrete deterioration can be assessed with LIDAR studies</li><li>Recommend validation from other NDE and destructive methods</li></ul>
5	Half-cell Electrical Potential (HCP) Method			✓				\$	No	<ul style="list-style-type: none"><li>Ascertains the presence of corrosion, but does not provide degree of corrosion</li><li>The sites of substantial corrosion often correlate with the sites of the concrete deterioration.</li><li>Half-Cell has been performed on Gate 2 piers, corrosion has been observed and is known to exist throughout the structure. Usage of this method does not provide much value to the structure's condition.</li></ul>

- Testing Methods

  - 15 Non-Destructive Tests Evaluated
  - 7 Destructive Tests Evaluated



Concrete Coring



Lab Testing

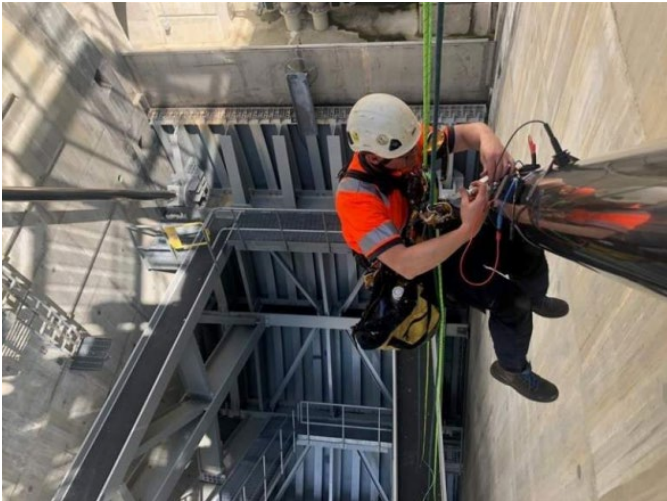


# Feasibility/Execution

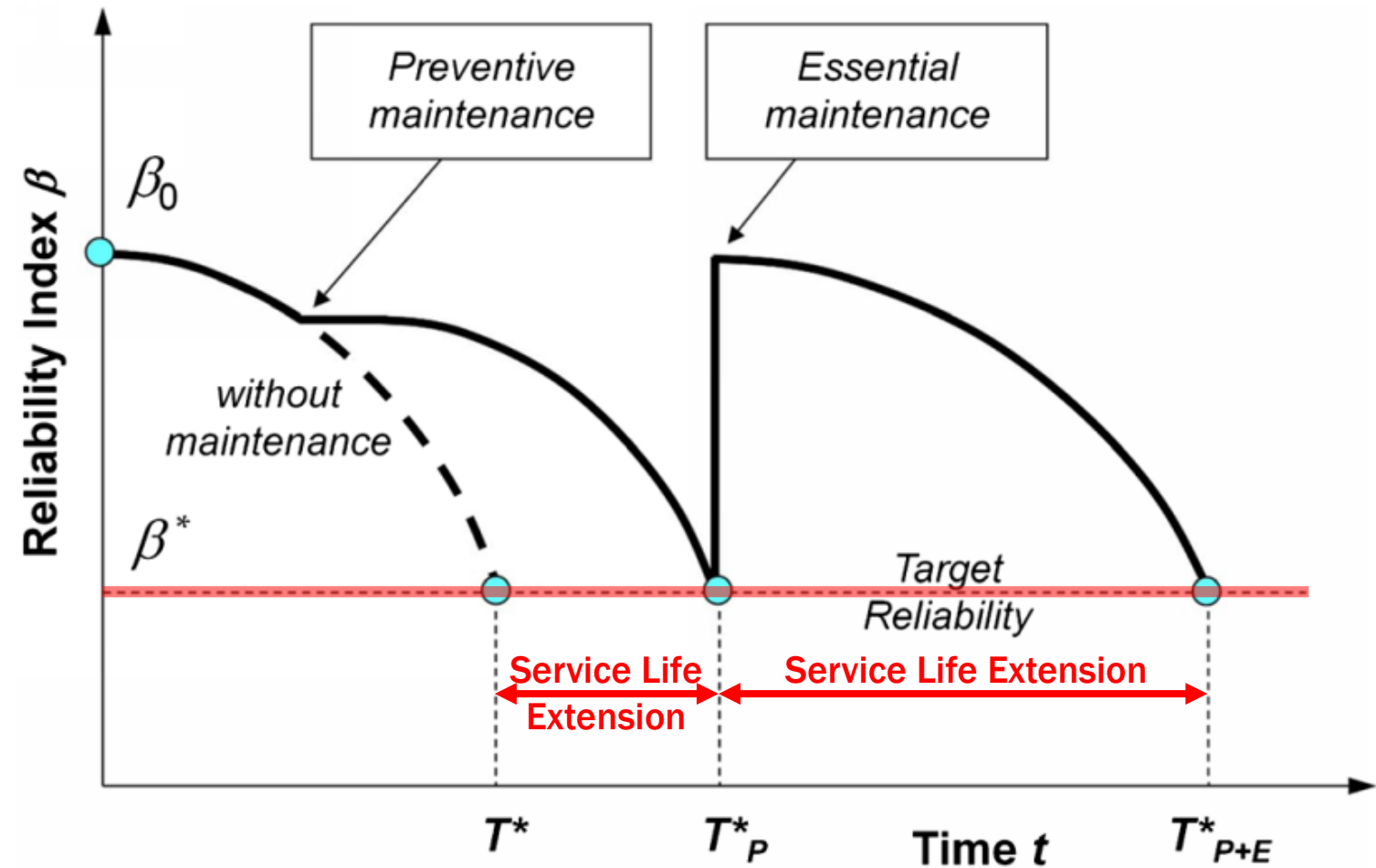


Method No.	Proposed Testing Method	Access Provisions						
		SPRAT	Boomlift	Scaffolding	Robotics	Terrestrial Camera	UAV/Drone	Divers
Non-Destructive Evaluation Methods								
1	High Resolution Imagery (HRI)					P	A	
2	Ultrasonic Tomography (MIRA)	P	A	A	A			
3	Impact-Echo (IE)	P	A	A	A			
4	Ultrasonic Pulse Velocity (UPV)	P	A	A	A			P
5	Ground Penetrating Radar (GPR)	P	A	A	A			
Destructive Testing Methods								
6	Concrete Core Extraction	P	A	A				P
<b>Notes:</b>  P = Preferred Method A = Alternate Method Blank = Not Applicable								

## Feasibility Assessment Summary



Goal





The following resolution is presented for consideration to the Board of Directors of the Brazos River Authority for adoption at its January 27, 2020 meeting:

**“BE IT RESOLVED** that the Board of Directors of the Brazos River Authority hereby authorizes the General Manager/CEO to amend the contract with Gannett Fleming Inc. to perform Phase II engineering services at Morris Sheppard Dam in an amount not exceed \$964,000.”



# Brazos

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RIVER AUTHORITY