MINUTES OF THE SPECIAL JOINT MEETING OF THE LAKE LURE TOWN COUNCIL AND UTILITY ADVISORY BOARD HELD TUESDAY, MARCH 17, 2020, 8:00 A.M. AT THE LAKE LURE MUNICIPAL CENTER

PRESENT: Mayor Carol C. Pritchett
Mayor Pro Tem John W. Moore
Commissioner Patrick Bryant
Commissioner David DiOrio
Commissioner John Kilby
Shannon Baldwin, Town Manager
Mitchell Anderson, Community Development Coordinator
Michelle Jolley, Town Clerk, via telecon

UAB MEMBERS PRESENT VIA TELECON:
Wayne Hyatt, Chairman
Richard Glassman
Don Cason
John Chapman
Clement Riddle

OTHER MEMBERS PRESENT VIA TELECON:
Kurt Wright, SDG Engineering
Keith Garbrick, LaBella Associates
Brian Houston, LaBella Associates
Maurice Walsh, LaBella Associates
Seth Robertson, WithersRavenel/WR Martin
Mark Landis, Schnabel Engineering
Jonathan Pittman, Schnabel Engineering
Ken Pohlig, NC DEQ
Anita Robertson, NC DEQ-DWI

ABSENT: N/A

I. CALL TO ORDER

Mayor Carol Pritchett called the meeting to order at 8:00 a.m.

II. APPROVE THE AGENDA

Commissioner John Moore made a motion to approve the Agenda as presented. Commissioner David DiOrio seconded and the motion carried 4-0.

III. PRESENTATION BY SCHNABEL ENGINEERING

(Presentation attached)

Mr. Jonathan Pittman conducted a presentation on the Lake Lure Dam rehabilitation alternatives. During the presentation he briefed on the existing conditions assessment of the Dam mentioning that it is in overall fair condition but does not meet all of NC Dam Safety criteria. NC Dam Safety requires a means to potentially drain the reservoir in the event of an emergency and currently there is no capability to do that. Addressing Dam Safety requirements and extending service life of the Dam by a minimum of 30 years are primary objectives. Other primary objectives include maintaining permanent pool levels, protecting existing hydroelectric facilities without altering their operation or structure, evaluating options to maintain the public access road across the Dam, and minimizing impacts to the Town and community during construction.

Mr. Pittman provided an overview of the two alternatives being considered for rehabilitation; a cross-bracing alternative (Alternative 1) and an infilling alternative (Alternative 2A and 2B). The cross-bracing, or structural bracing, alternative entails adding structural concrete and shear walls between the buttresses and arches to increase the strength of the Dam in the cross canyon section. He also proposes adding an impermeable liner with this alternative to reduce seepage through the lift lines to extend the service life of the existing concrete. The primary structure would still be the existing concrete and significant concrete repairs would be required for this alternative. The infilling of bays alternative (Alternative 2) turns the existing arch buttress sections into a concrete gravity structure. Alternative 2A would have a steeper downstream slope and Alternative 2B would have a flatter downstream slope. He feels that Alternative 2B would be the better alternative. This alternative raises the new replacement bridge to not impact the hydraulics associated with the spillway design.

Mr. Pittman briefed on additional key structure and construction considerations for all rehabilitation alternatives. The intake tower is original to the Dam and does not meet current standards for structural stability. Some degree of structural rehab is likely required but additional investigation and analysis is needed. The lake would need to be drained for construction. The existing spillway gates and trash gate are operable currently but there are some structural challenges associated with those. They have not done a structural inspection of those gates but they fill it is appropriate to assume those gates need to be replaced. He noted that a reservoir drain is required for a potential emergency drawdown and added that there are a host of other beneficial advantages with having this drain as well. He stated that some additional analyses and investigation is needed to determine the stability of the abutment retaining walls. The powerhouse is a very unique structure and will likely need some structural improvements but additional investigation is needed. The NCDOT Bridge has been discussed and some concepts have been presented. Options have been looked at on how to have a bridge independent of the

Dam and a single lane versus a double lane bridge. A downstream access road has potential for impasse due to extreme flooding and alterations to the access road would be required for Alternative 2B.

Mr. Pittman stated that it's difficult to estimate a service life for the Dam. Alternative 1 could vary depending on multiple factors but could extend the service life 30-50 years. Alternative 1 will have a shorter service life than the infilling alternative and requires more maintenance than the other alternatives. He noted that there are technical concerns with Alternative 1 in regards to hydraulic performance and seismic and structural performance. Alternative 2B extends the overall service life to 75+ years. Both alternatives meets the NC Dam Safety criteria. The construction schedule (bridge excluded) for Alternative 1 is 24-30 months and Alternative 2B is 30-36 months. This includes a single mobilization and not phasing the work.

Mr. Pittman noted that structural risks are greater for Alternative 1 and foundation risks are greater for Alternative 2B. Alternative 1 will have fewer environmental impacts than Alternative 2B but permitting requirements are likely similar. Draining the lake is a significant environmental consideration. There are no permanent modifications for either alternative but reservoir levels would need to be lowered 10-15 feet during the significant portion of the construction period for either alternative. The level of maintenance is likely significantly greater for Alternative 1. Restricted lake use for potentially multiple seasons for both alternatives. The public access road across the Dam would not be there for 2-3 years potentially. Alternative 1 construction costs are around $30 million (excludes bridge) and around $50 million (excluding bridge) for Alternative 2B. Engineering services will likely be about 15% of construction costs.

Mr. Pittman stated that a new gravity dam downstream of the existing dam would require additional environmental permitting but would have a service life of 100+ years. The costs of this alternative is in-line with Alternative 2B, around $50 million for construction without hydro. Additionally, hydro costs would be around $15-$20 million and engineering services will likely be about 15% of construction costs. This alternative cannot be phased out. Complete draining of the reservoir would not be required. Demolition of the existing dam could be done underwater and is a primary advantage of this alternative. It would reduce operation and maintenance costs and would not impact the reservoir. He explained that the most advantageous alternative is the dam replacement alternative noting that the rehab alternatives are similar in comparison.

Mr. Pittman provided an overview of the reservoir drain. Constructing the reservoir drain as the initial phase of work allows for critical sewer repairs and funding in-place for sewer repairs, provides benefits for lake dredging, and addresses NC Dam Safety requirements and reduces dam safety risks. If a rehab alternative is chosen, a remote operated vehicle would be needed to further investigate. The town should coordinate with NCDOT and NC Dam Safety to agree on a path moving forward.

IV. QUESTION AND ANSWER SESSION WITH SCHNABEL ENGINEERING

Mr. Pittman conveyed that they are confident with their cost estimate noting that the costs are appropriate based on the work done and the consultants they have brought in to assist. Environmentally they do not feel there would be huge mitigation and permitting costs unless looking at a dam replacement. Rehab alternatives do not have significant costs associated with them. He also stated that doing away with the powerhouse would take away a significant source of revenue for the Town. He mentioned that the gravity sections do not meet sliding stability which is why anchors would need to be added. The entire structure is in compression due to the weight of the water. Mr. Pittman noted that additional discussion would be needed.

V. DISCUSSION BY TOWN COUNCIL, UAB, AND STAFF

During discussion, Commissioner DiOrio stated that Council feels the reservoir drain would achieve a level of dam safety and would expose a portion of the backshore area where access is needed for the sewer system. Going down an additional 10-12 feet allows access to install and maintain the sewer system and benefits as a cost avoidance in the future for rehabilitation of the sewer treatment. It would also expose a majority of the lake where sedimentation collects. He also noted that lowering the lake with the drain exposes portions of the Dam they cannot get to for inspection. Commissioner Kilby added that costs and the economic devastation the lake being drained would have on the Town should be considered.

VI. BREAK

Town Council called for a 15 minute break. The meeting reconvened at 10:00 a.m.

Mr. Riddell asked what management, guidelines, rules, and restraints would be imposed if the Dam was a FERC (Federal Energy Regulatory Commission) regulated dam. Mr. Pittman answered that they would need to talk to FERC about it but there would be some additional dam safety requirements, additional inspection requirements, and other administrative requirements that are somewhat more stringent that other dam safety requirements. However, design criteria is not substantially different. Mr. Wright mentioned that one disadvantage of Alternative 1 is that operation and maintenance costs are going to much higher and service life would be much shorter compared to other alternatives. Dam replacement would have the lowest O&M cost.

Mr. Glassen asked if a calculation has been attempted on the loss of power generation over a 36 month construction period. Mr. Pittman stated that it was not part of the Scope but would be a prudent exercise to go through to decide the most appropriate alternative for the Dam.

VII. PRESENTATION BY LABELLA ASSOCIATES

(Presentation attached)

Mr. Reese Walsh conducted a presentation on the On-call Engineering Services Technical Memorandum, Task 2 authorization, and road map and provided a project background. He explained that the subaqueous sanitary sewer system was completed with the Dam in 1927 and serves public/private connecting systems in Rumbling Bald, Chimney Rock Village, Blue Heron Point, and Lake Lure Village Resort. The system was installed using various methods and installed along the existing grade. The Wastewater Treatment Plant (WWTP) was constructed in 1969 to stop discharge into the Broad River. In 1991 the Dam was renovated and converted to a physical-chemical process. Mr. Walsh briefed on some of the recent projects with the Dam and showed a video of leaking pipe joints recorded in 2007. He conveyed that the WWTP has a legacy of noncompliance due to its inability to meet NPDES effluent limits. There will be social, environmental, and economic impacts to the Town if the lake is drained.

Mr. Walsh provided an overview of the Subaqueous Sanitary Sewer (SASS) alternatives. He highlighted on the benefits and liabilities of five alternatives to the SASS: Backshore Low Pressure Sewer System, Backshore Series Pump Station System, Backshore HDPE Gravity/Lift Station System, Subaqueous Accessible Manholes, and Repair & Rehabilitation Perimeter Manholes (partial solution). He stated that the goal is to get the private laterals out of the lake with all of the alternatives.

Mr. Walsh then provided an overview of WWTP alternatives. The three broad categories for the Plant alternatives are relocation, rehabilitation, or bulk transfer. The WWTP alternative process is not as developed as that for the SASS. Until the major infiltration and inflow issues are resolved, the Plant cannot return to a biological process. Mr. Walsh noted that the SASS will have to be replaced in phases. The bulk conveyance alternative was originally proposed to replace the Plant but this alternative cannot be considered until issues with the SASS have been resolved. This alternative would take the WWTP offline and would eliminate the NPDES permit. Also, an agreement with Spindale would be needed prior to proceeding with design and permitting of this alternative.

Mr. Walsh recommended Council authorizing Task 2 for alternative analysis. He provided an overview of Task 2 – SOC/ER-EID/Alternative Analysis and preliminary task descriptions. There will be four tasks as follows: Task 1 – Technical Memorandum (complete); Task 2 – SOC, ER-EID, and Alternative Analysis; Task 3 – Design, Permitting, Bidding; and Task 4 – Construction Management. Additional tasks included based on funding will be design, permitting, bidding and construction management. He stated that construction must be done in phases and he provided an overview of those phases. As inflow and infiltration is eliminated, the Town may need to rehabilitate the Plant to meet those limitations until it can be converted back to a biological plant. A sewer access valve installed in the existing dam would address NC Dam Safety requirements, provide a mechanism to drain the lake, provide additional access to the

backshore, provide improved working area for SASS replacement and protection for SASS catastrophic failure, and would provide flexibility with dredging. Mr. Walsh pointed out that the initial schedule in the Tech Memo was aggressive for construction and that window is rapidly closing. He discussed a preliminary schedule noting that they would like to begin immediately upon authorization. The schedule will be updated upon completion of Task 2. Task 2 proposal costs are $170,000.

VIII. QUESTION AND ANSWER SESSION WITH LABELLA ASSOCIATES

Ken Pohlig of NC Division of Water Quality asked about the dam bottom drain. Mr. Walsh explained that it was discovered that the lake could not be lowered as low as previously thought. He stated an inverted siphon to draw the water below the spillway was discussed with Schnabel which in turn led to a discussion of a drain at a higher elevation. Discussion ensued regarding elevation levels and a location for the drain. It was noted that the drain would provide access for construction. The better the working condition in the backshore and the more elevation to be utilized, the better the terms of many of the alternatives to reduce construction costs, enabling more construction to maximize all funding available. Putting this in prior to construction of the replacement alternative would immeasurably benefit construction of replacement and provide insurance for catastrophic failure and insurances for the Dam. There are a lot of benefits with not a lot of liabilities.

IX. DISCUSSION BY TOWN COUNCIL, UAB, AND STAFF

Mr. Glassen asked if the scope has been investigated for each phase. Mr. Walsh noted that this is part of Task 2 and has not been done yet. Mr. Pohlig asked if sewer could proceed without the bottom drain and what the costs would be. Mr. Walsh stated the sewer project could proceed without the drain but would limit the elevation they could use to access it during the future. He noted it would also make construction more difficult and would require more pump stations. He stated the costs would be around $2-$2.5 million.

Anita Robertson with NC DEQ-DWI asked about the environmental impact of draining the lake. Mr. Walsh stated social and environmental costs to drain the lake to replace the sewer system would be catastrophic. This is not an option they would pursue unless it must be done for the Dam.

Mr. Pohlig asked about the costs associated with improvements needed for the sludge holding tank. Mr. Walsh stated that it would have to be looked at as part of Task 2 to identify what needs rehabbed or replaced to continue operating the Plant until it can be completely rehabilitated or replaced.

Mr. Wright asked about construction noting that the backshore can be quite muddy. Mr. Walsh mentioned that some of the alternatives could be installed by horizontal directional

drilling. The backshore can be quite muddy and the more water that can be pulled out by the sewer access valve, the easier it is for construction. He stated that they want to improve the construction area as much as possible. Mr. Wright noted that there appears to be a timing issue and questioned what happens if the ultimate grand solution cannot be approved in time. Mr. Walsh conveyed that they would like to finish some of the construction this year and coordinate with Mr. Wright and the Town to move forward. Their goal is to have the rehabilitation as part of their project and work with the Clear Water State Revolving Fund (CWSRF) as part of the process. He stated that they would need to consult with the environmental stakeholders about installing a drain, even if it is not required at this time. There is a certain rate at which the lake can be lowered and the attempt with the drain is to match that rate by opening the valve to maintain the rate down to a certain level for construction. Mr. Pittman added that installation of the dam bottom drain would be about three months. Mr. Walsh pointed out that all environmental concerns must be addressed first.

Mr. Walsh explained that the existing WWTP is in the floodplain and replacement of the Plant must be done outside of the floodplain. Ms. Robertson noted that environmental evaluation is needed prior to any work being done.

ADJOURN THE MEETING

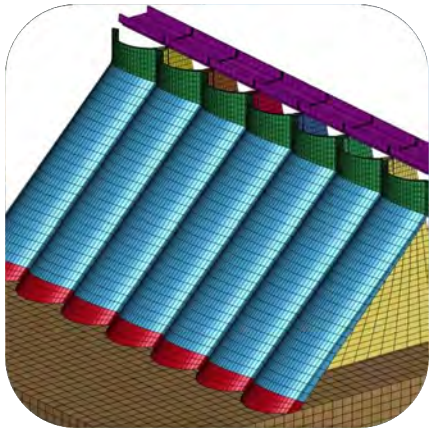
With no further business, Commissioner Patrick Bryant made a motion to adjourn the meeting at 11:00 a.m. Commissioner David DiOrio seconded and the motion carried 4-0.

ATTEST:

Michelle Jolley
Town Clerk

Mayor Carol Pritchett

TOWN OF LAKE LURE
CORPORATE
SEAL
NORTH CAROLINA



Lake Lure Dam
Rehabilitation Alternatives

Jonathan Pittman, PE

Mark Landis, PG, PE

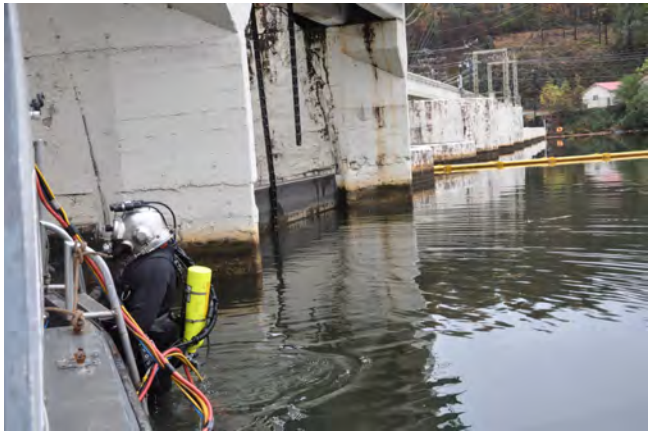
March 17, 2020

Schnabel ENGINEERING

Build Better. Together.

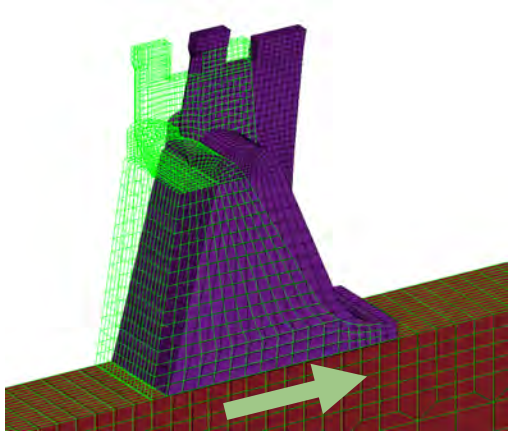
Existing Conditions Assessment Major Findings

- Dam in overall Fair Condition
- Performed well during service life
- Several items that warrant repair, monitoring, and/or additional investigation/assessment
- NC Dam Safety Criteria:
  - Inadequate spillway capacity
  - Arch-buttress sections do not meet structural stability requirements for seismic loading
  - Gravity sections do not meet global stability requirements for each load case analyzed
  - No functional reservoir drain



Dam Rehabilitation Alternatives Scope

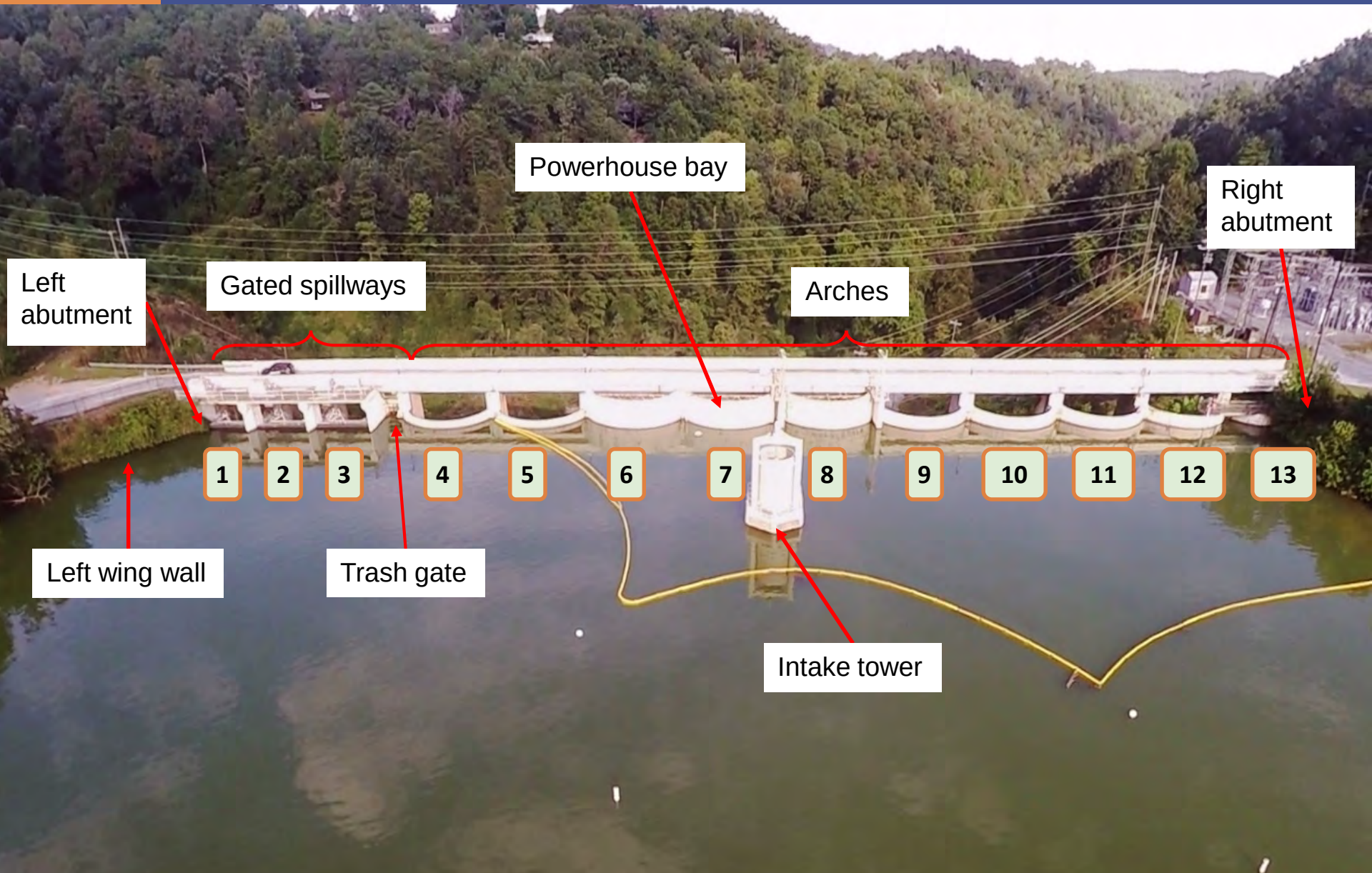
- Development of concepts to meet dam safety requirements
- Various engineering analyses required to support concept development
- Development of cost and schedule opinions
- Comparison of alternatives with respect to:
  - Cost and schedule
  - Service life
  - Reservoir and power generation impacts
  - Community disruption
  - Environmental impacts and permitting
  - Various other technical and non-technical factors
- Support requests for rehabilitation funding



Alternatives Development – Primary Objectives (Section 3.0)

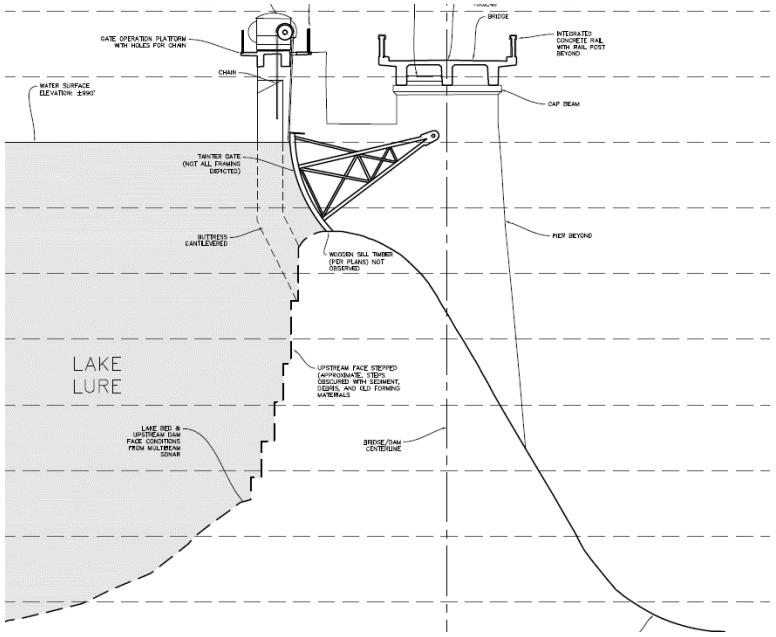
- Address NC Dam Safety Requirements
- Extend Service Life of Dam by 30+ Years
- Maintain Permanent Pool Levels
  - No change in normal pool
  - No increase in flooding upstream/reservoir
  - Match outflows up to the 100-year storm with manual operations and improve ability for gate operators to pass storm flows through the structure
- Protect Existing Hydroelectric Facilities without Altering Their Operation or Structure
- Evaluate Options to Maintain Public Road across Dam
- Minimize Community Impacts during Construction
  - Access
  - Depth and duration of reservoir drawdown

Aerial Upstream View



Hydraulic Capacity – Summary of Existing Conditions

- Very Large, High-Hazard Dam
- Design Storm is the Probable Maximum Precipitation (PMP)
- Current Capacity = 50,700 cfs (64% PMP)
- Required Capacity for PMP = ~105,000 cfs
- Normal Pool at EL 990.5
- PMP at EL 1008.1



Hydraulic Capacity – Alternatives Considered (Section 4.0)

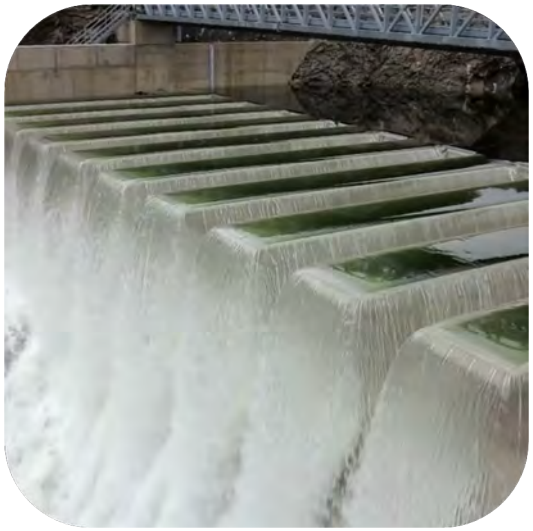
- Lowering arch bays
- Blocking arch bays
- Improving weir efficiency
- Gate replacement
- Raising the abutments
- Armoring the abutments

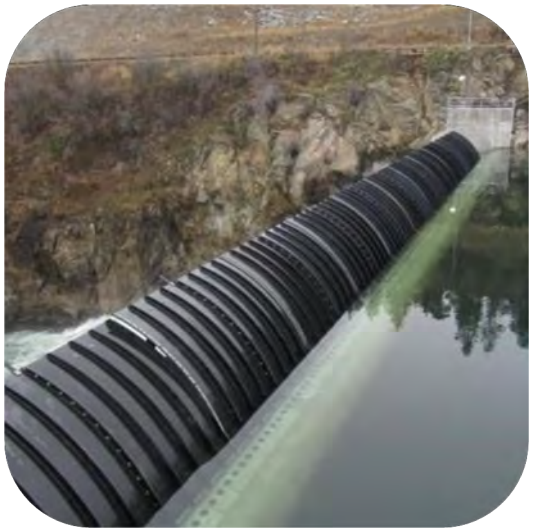
$$\text{Discharge } (Q) = C_d \times L \times H^{3/2}$$

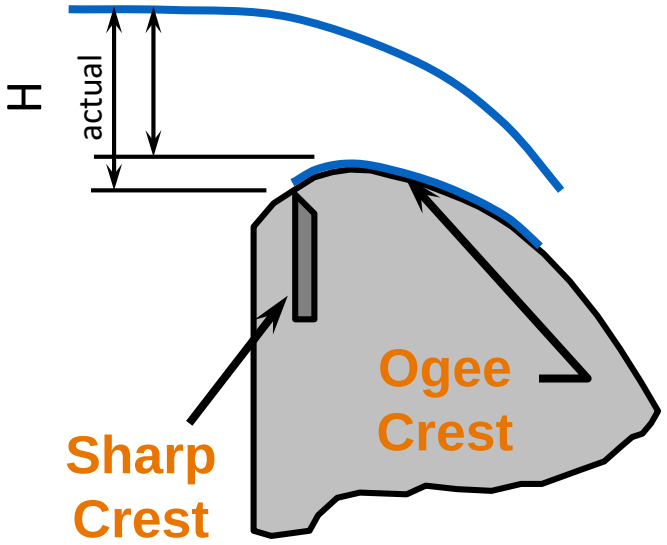
C_d = discharge coefficient [f(weir type, H, H/P)]

L = length of spillway crest

H = head







Hydraulic Capacity – Existing vs. Proposed Elevations for Cross-Bracing Alternative (Alternative 1)

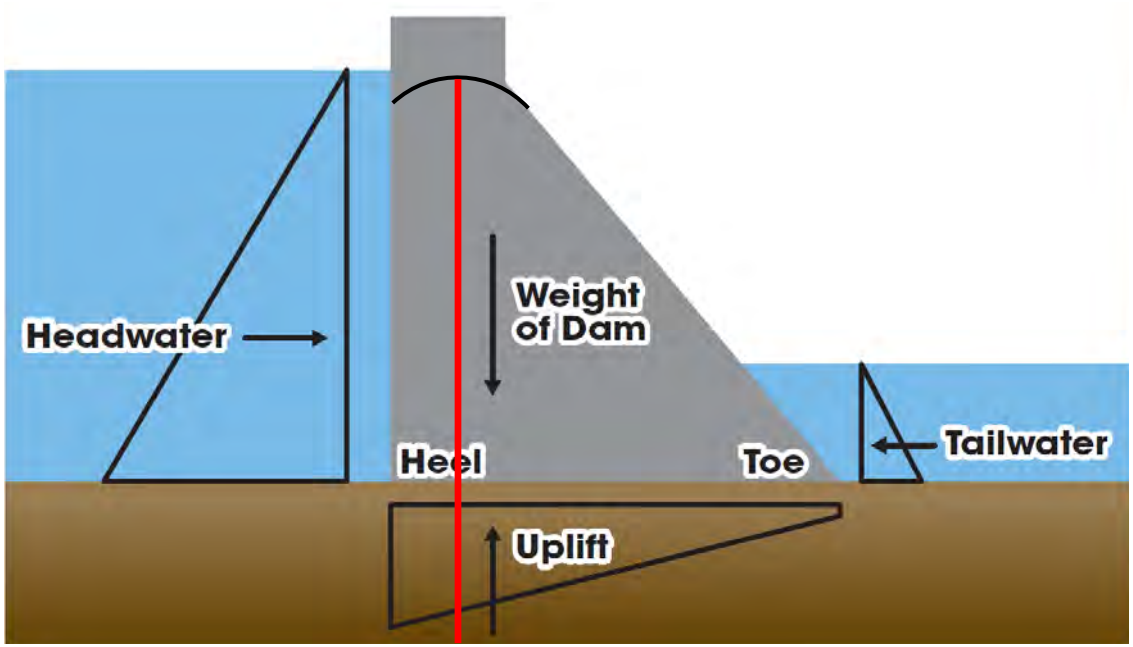
Component	Existing (EL, NAVD88)	Proposed (EL, NAVD88)	Difference (feet)
Bays 1-3 (Gated Spillway)	976.5 (ogee) 991.5 (gate)	976.5 (ogee) 991.5 (gate)	0
Bays 4 & 5	992.5	992.5	0
Bay 6	1000.5	992.5	-8.0
Bay 7 (Powerhouse) and Bay 8	1000.5	1000.5	0
Bays 9-13	994.5	992.5	-2.0
Abutments / Bridge Deck	1002.5 (Min.)	1007.5 (Min.)	+5.0
Bottom of Bridge	998.8	1006.0	+7.2

Hydraulic Capacity – Existing vs. Proposed Elevations for Infilling Alternative (Alternatives 2A and 2B)

Component	Existing (EL, NAVD88)	Proposed (EL, NAVD88)	Difference (feet)
Bays 1-3 (Gated Spillway)	976.5 (ogee) 991.5 (gate)	976.5 (ogee) 991.5 (gate)	0
Bays 4 & 5	992.5	990.5	-2.0
Bay 6	1000.5	990.5	-10.0
Bay 7 (Powerhouse) and Bay 8	1000.5	992.5	-8.0
Bays 9 & 10	994.5	992.5	-2.0
Bays 11-13	994.5	1008.1	+13.6
Abutments / Bridge Deck	1002.5 (Min.)	1008.1 (Min.)	+5.6
Bottom of Bridge	998.8	1006.0	+7.2

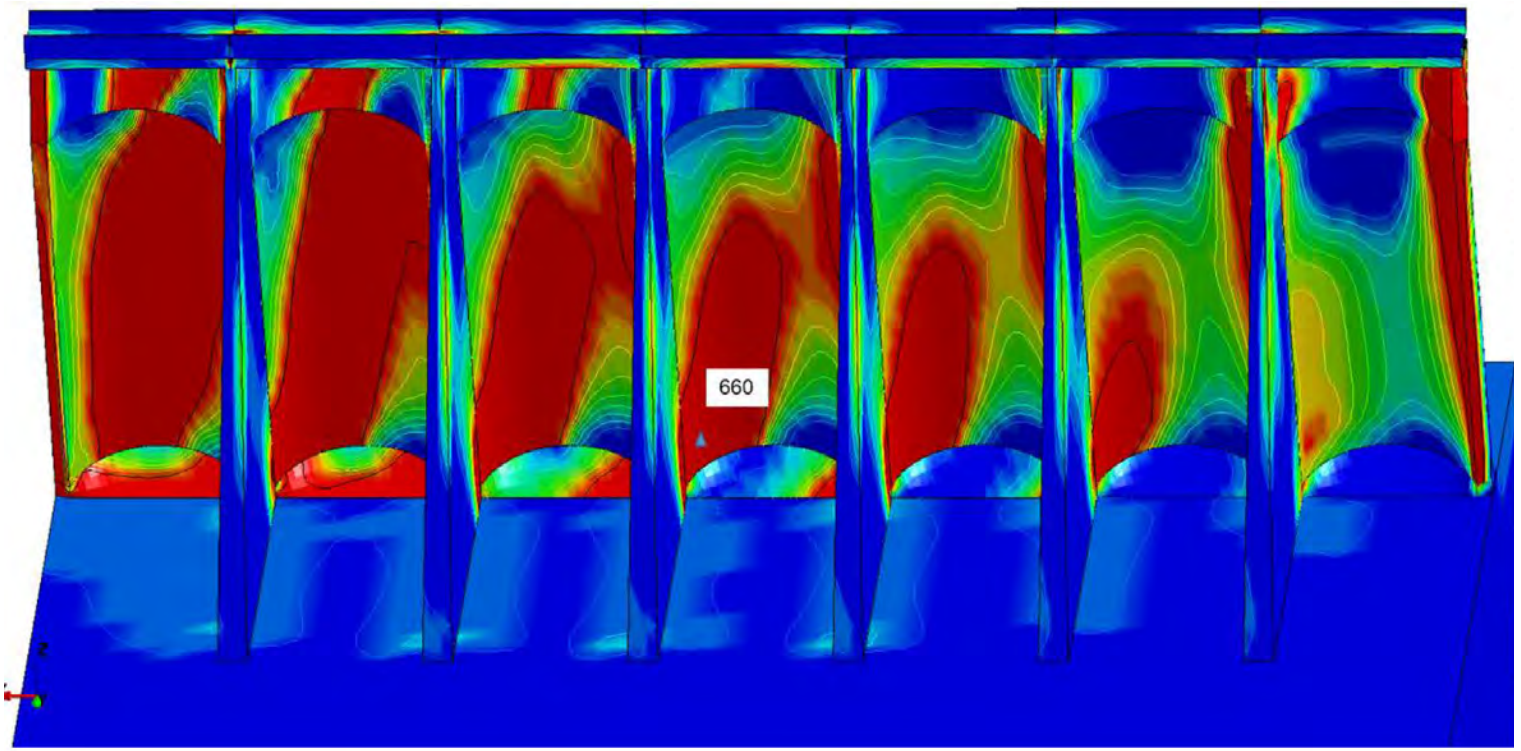
Stability of Gated Spillway Gravity Section (Section 5.0)

- Post-tensioned anchoring vs. geometric modifications
- Utilize post-tensioned rock anchors to increase the factor of safety against sliding



Seismic Stability of Arch-Buttress Sections (Section 6.0)

- Two General Options Evaluated:
  - Structural (cross) bracing of bays (Alternative 1)
  - Infilling of bays (Alternatives 2A and 2B)



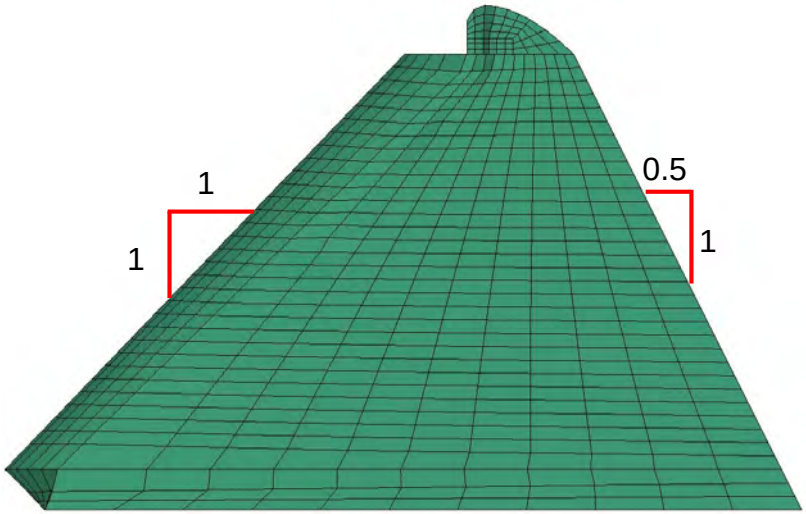
Arch Modifications – Structural Bracing (Alternative 1)

- Structural concrete shear walls required in arch bays to resist potential cross-canyon seismic loads
- Upstream liner required to reduce seepage and extend service life of existing concrete
- Significant concrete repairs likely required

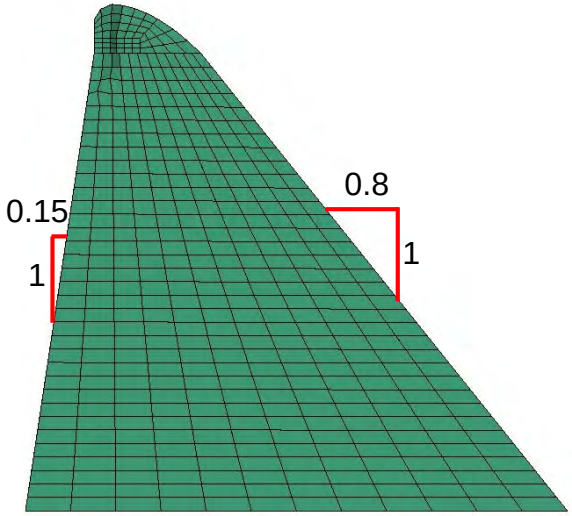
Arch Modifications – Infilling of Bays (Alternative 2)

- Infilling of Bays with Concrete Gravity Section
  - Ogee weir in Bays 4 through 6 (EL 990.5), and 7 through 10 (EL 992.5)
  - Non-overflow sections in Bays 11 through 13
  - Alternative 2A – U/S slope 1:1 (match arch); D/S slope 0.5:1
  - Alternative 2B – U/S slope 0.15:1; D/S slope 0.8:1
  - Infilling void U/S of Alt 2B mass concrete may be stone or flowable fill

Alternative 2A – U/S Infilling

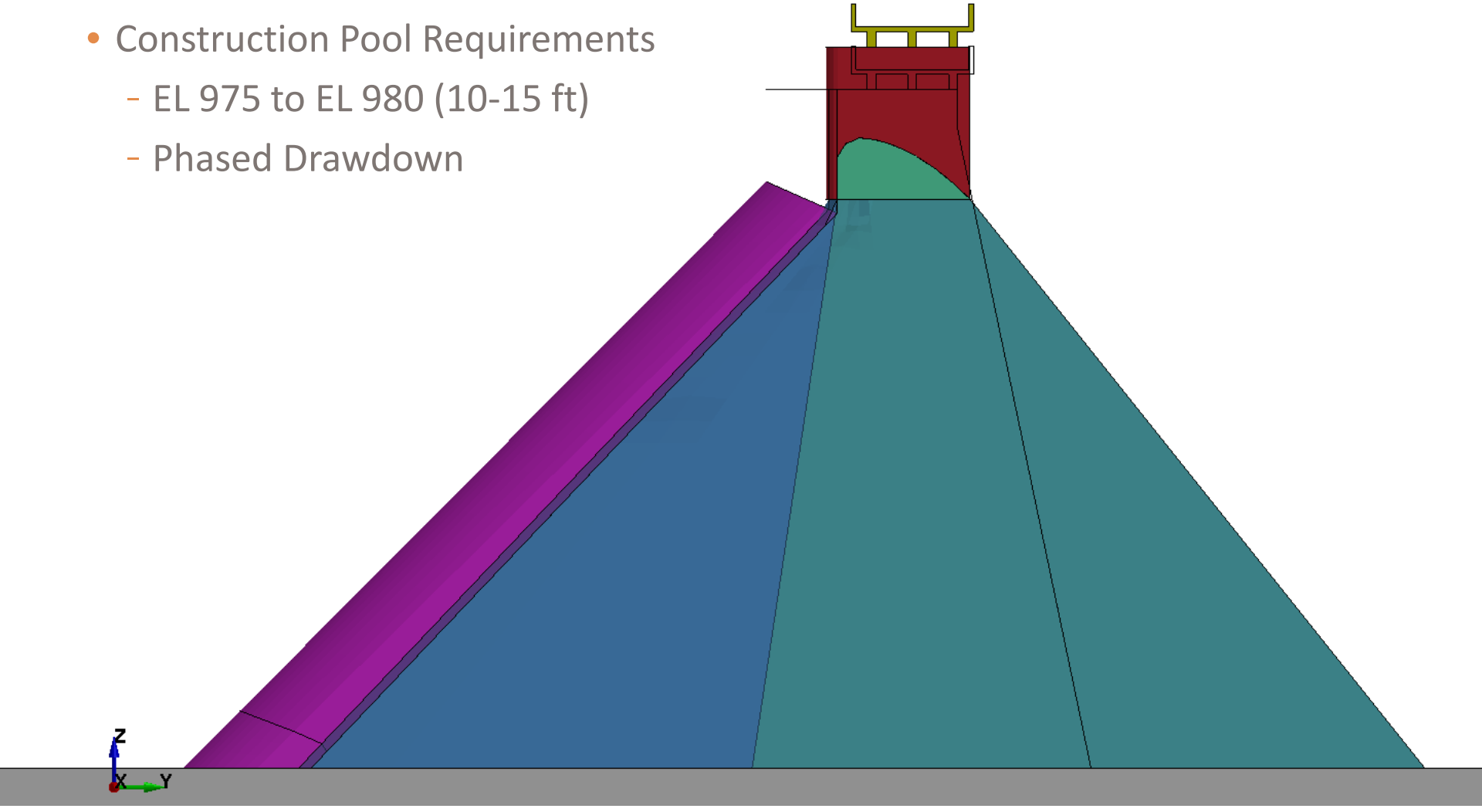


Alternative 2B – D/S Infilling

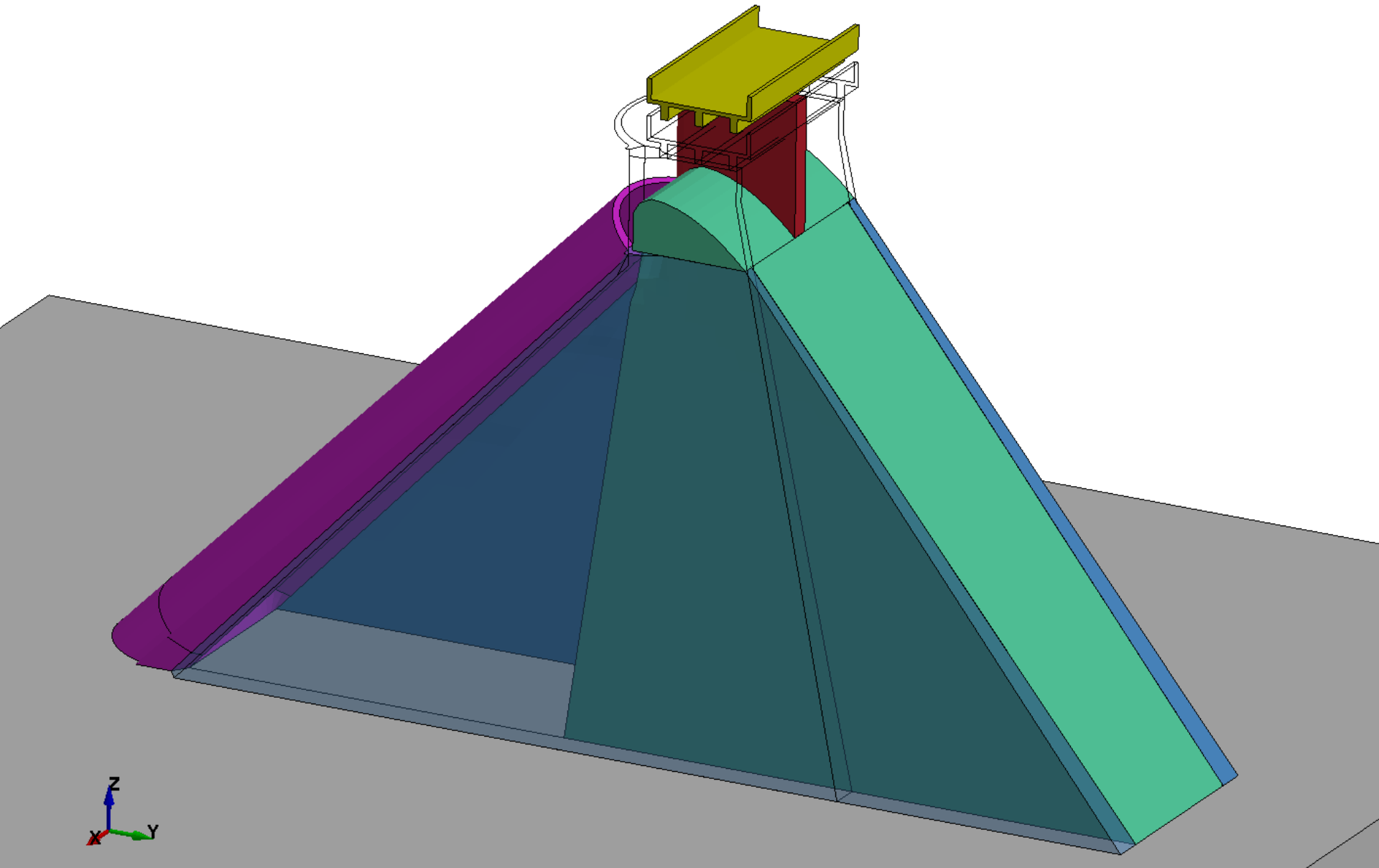


Alternative 2B – 0.15H:1V U/S and 0.8H:1V D/S

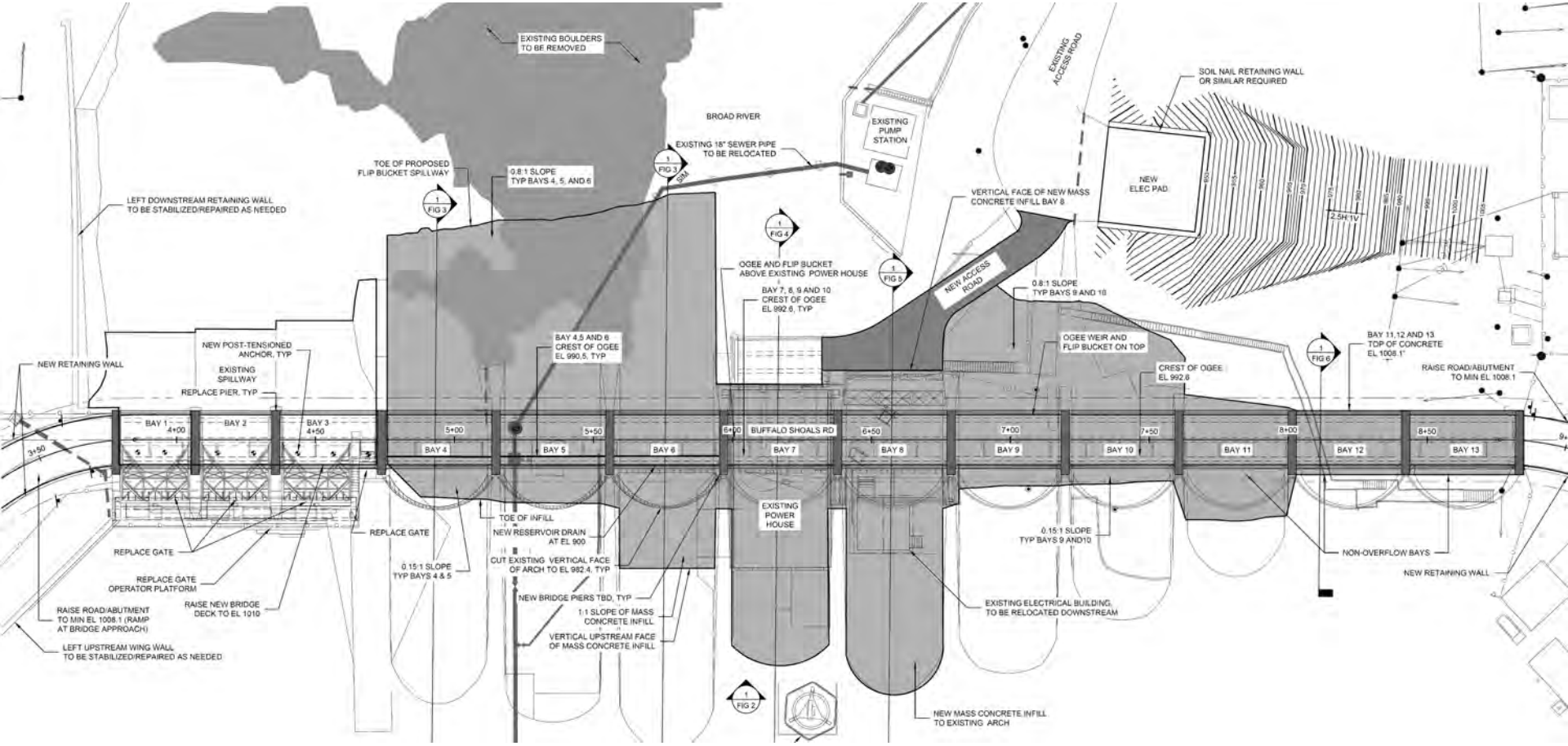
- Demolition of Arches
- Construction Pool Requirements
  - EL 975 to EL 980 (10-15 ft)
  - Phased Drawdown



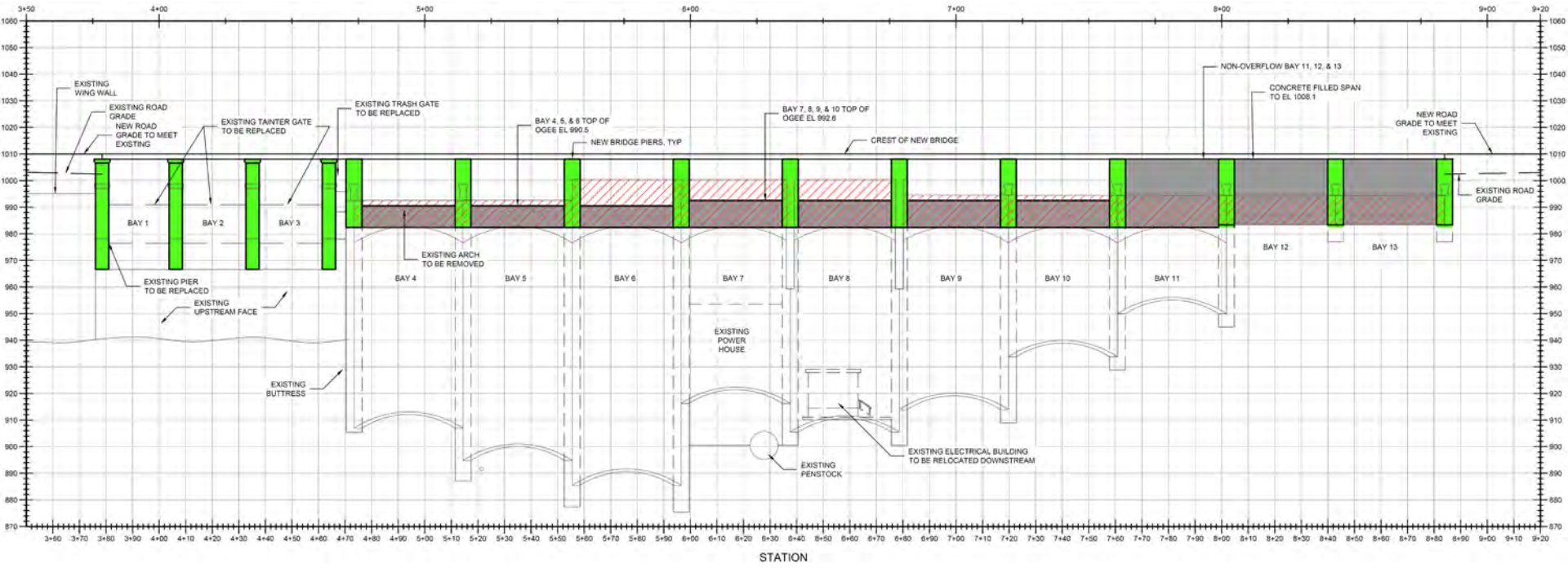
Alternative 2B – 0.15H:1V U/S and 0.8H:1V D/S



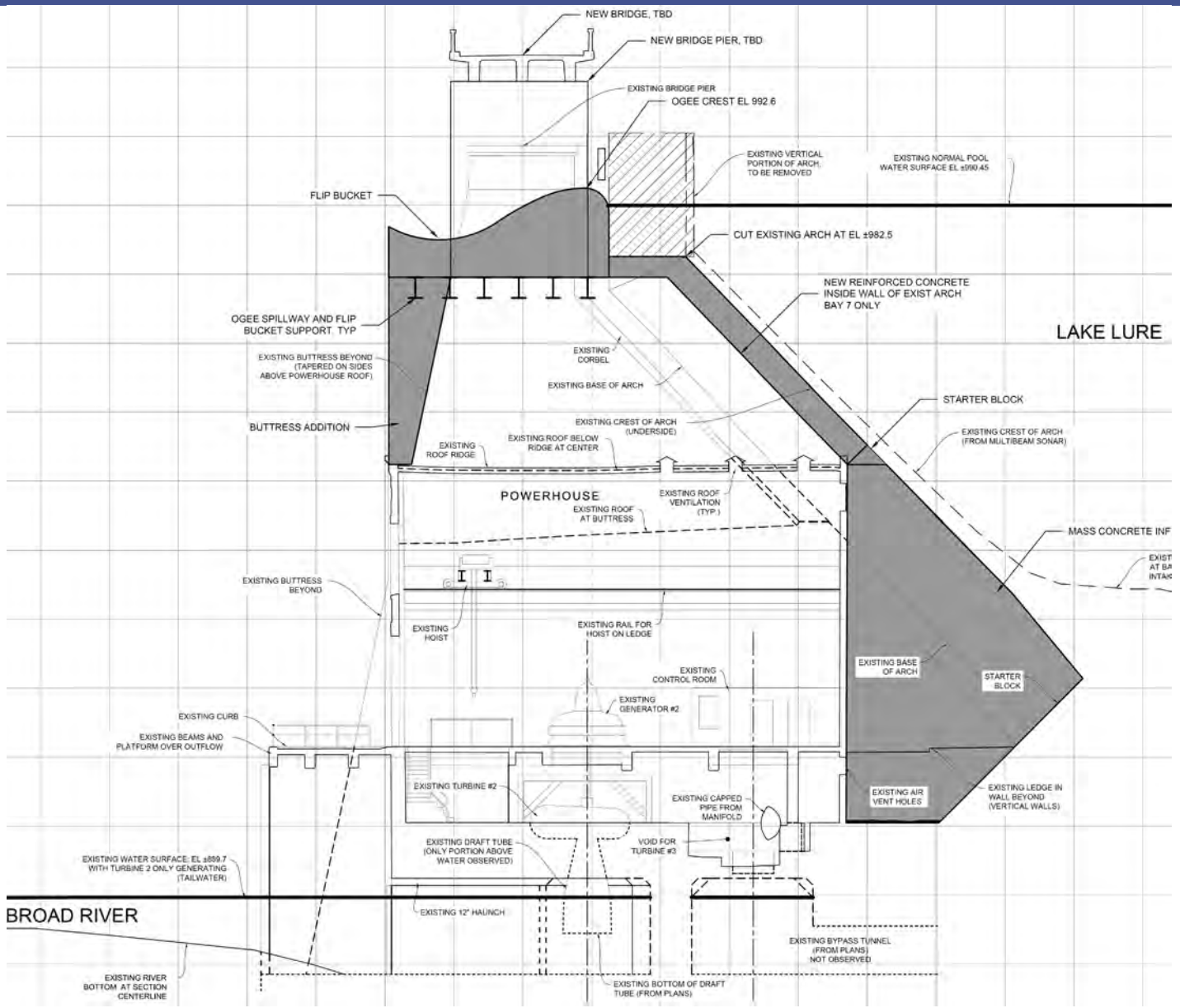
Plan View of Alternative 2B



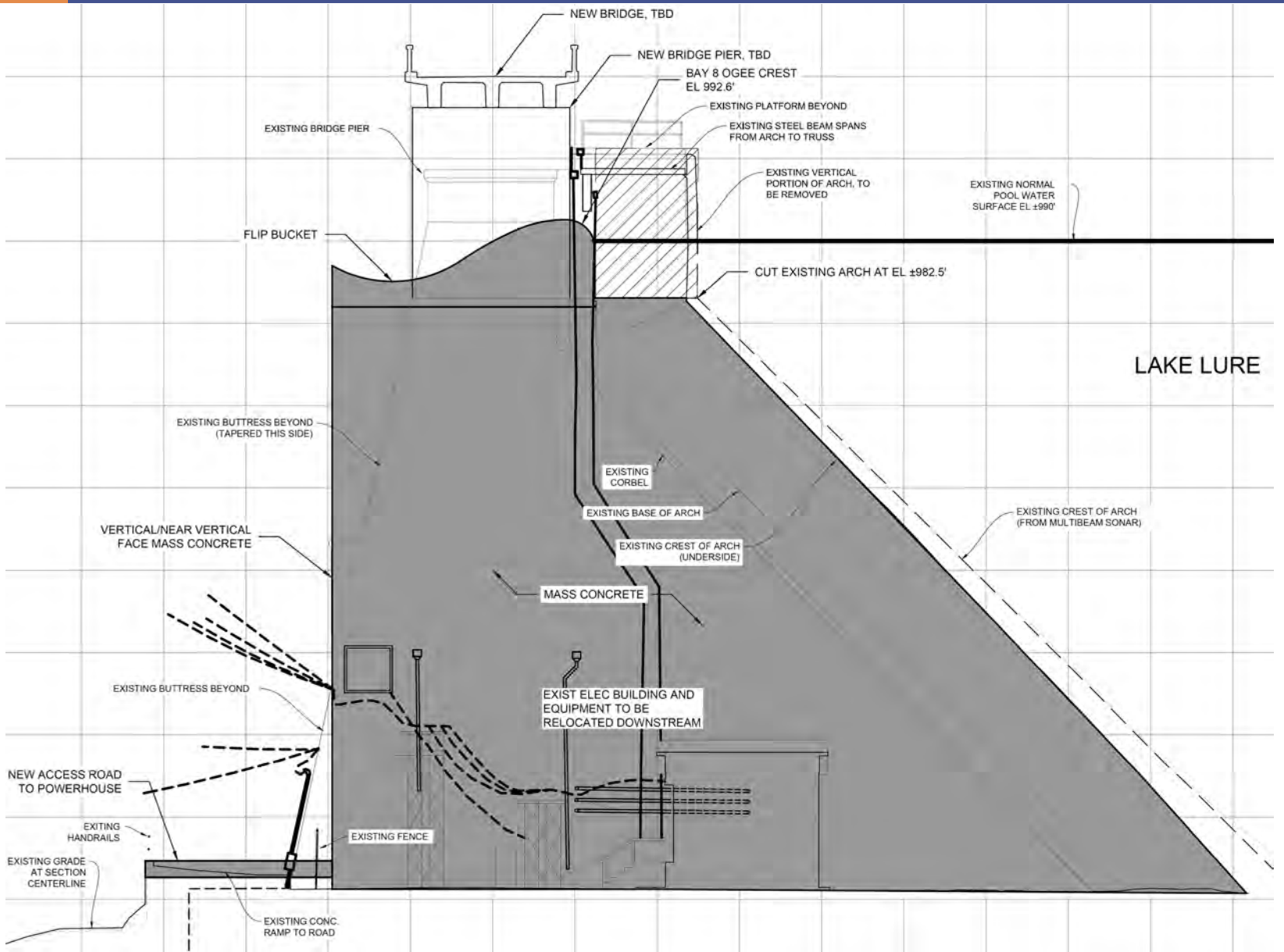
Elevation View of Alternative 2B



Alternative 2B Cross-Section View for Bay 7 Concept

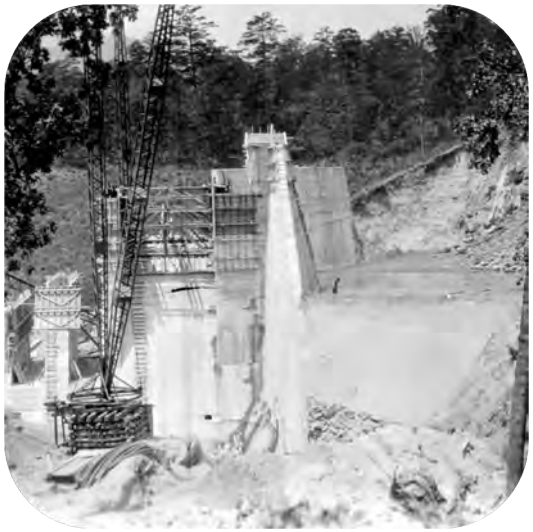


Alternative 2B Cross-Section View for Bay 8 Concept



Additional Key Structure and Construction Considerations for All Rehabilitation Alternatives (Section 7.0)

- Intake Tower
  - Structural rehabilitation likely required
  - Draining of lake likely required for construction
  - Additional investigations and analyses required
- Existing Spillway Gates and Trash Gate
  - Assume replacement of gates and gate piers
  - Bulkhead system recommended
  - Interim gate inspection and repairs may be required
- Reservoir Drain – Additional discussion to follow
  - Required for potential emergency drawdowns
  - Facilitates additional drawdowns for other critical infrastructure maintenance and repairs
  - Target draining 90% of reservoir volume at EL 900?
- Future Sanitary Sewer Penetration
- Abutment Retaining Walls
  - Additional investigations and analyses required
  - Left wall may require stabilization measures
  - Right wall is shorter and could be replaced
  - Both walls to be raised to accommodated raised abutments

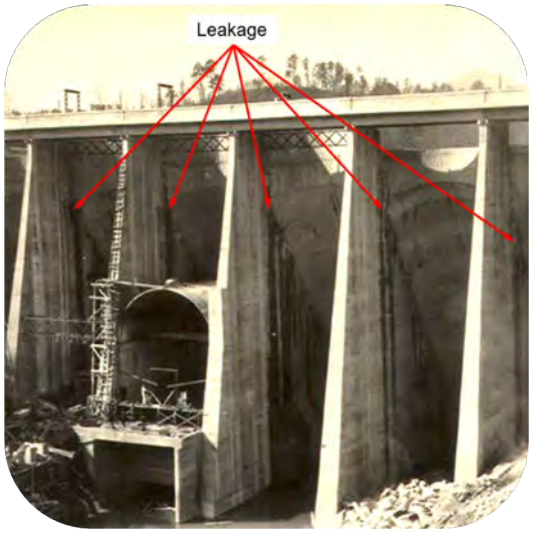


Additional Key Structure and Construction Considerations for All Rehabilitation Alternatives (Section 7.0)

- Right Abutment Armoring
- Powerhouse (Bay 7)
  - Additional evaluation required
  - Structural improvements likely required
  - Additional flood proofing may be warranted
- Relocation of Bay 8 Electrical Infrastructure
- NCDOT Bridge
  - Independent structure requirements
  - Elevated above the PMP (EL 1008.1)
  - Single lane vs. double lane
- Downstream Access Road
  - Potential for impasse due to extreme flooding remains
  - Alterations required for Alternative 2B

Comparison of Rehabilitation Alternatives (Section 8.0)

- Estimated Service Life
  - Alt 1 – 30 to 50 years – could vary depending on multiple factors such as O&M, application of loads, etc.
  - Alt 2B – 75+ Years
- Hydraulic Performance
  - Both alternatives designed to pass SDF
  - Technical concerns with Alt 1
- Seismic and Structural Performance
  - Both alternatives designed to prevent dam failure
  - Technical concerns with Alt 1
  - Current uncertainties associated with intake tower
- Construction Schedule (Bridge Excluded)
  - Alt 1 – 24 to 30 months (single mobilization)
  - Alt 2B – 30 to 36 months (single mobilization)



Comparison of Rehabilitation Alternatives (Section 8.0)

- Construction Stream Diversion and Reservoir Levels
  - Both alternatives may require full reservoir drawdown for intake tower work
  - Alt 1 will require additional drawdown time for upstream liner
- Construction Risks
  - Flooding risks similar for both alternatives
  - Structural risks greater for Alt 1
  - Foundation risks greater for Alt 2B
  - Additional investigations and analyses required
- Environmental Considerations and Permitting
  - Alt 1 will have fewer environmental impacts for Alt 2B but permitting requirements likely similar
  - Draining of lake is a significant environmental consideration
- Hydroelectric Impacts
  - No permanent modifications for either alternative
  - Construction impacts (reservoir drawdown greater than 7 feet) will be similar for both alternatives

Comparison of Rehabilitation Alternatives (Section 8.0)

- Long-term O&M Requirements
  - Additional benefits to reservoir level operations for Alt 2B – Bays 4 thru 6 at about normal pool
  - Level of maintenance likely significantly greater for Alt 1
- Community Disruption and Impacts
  - Restricted lake use for potentially multiple seasons for both alternatives
  - Public road across dam?
- Costs (15% contingency)
  - Alt 1 Construction ~$30M (excludes bridge)
  - Alt 2B Construction ~$50M (excludes bridge)
  - Engineering Services ~15% of construction

Dam Replacement (Section 9.0)

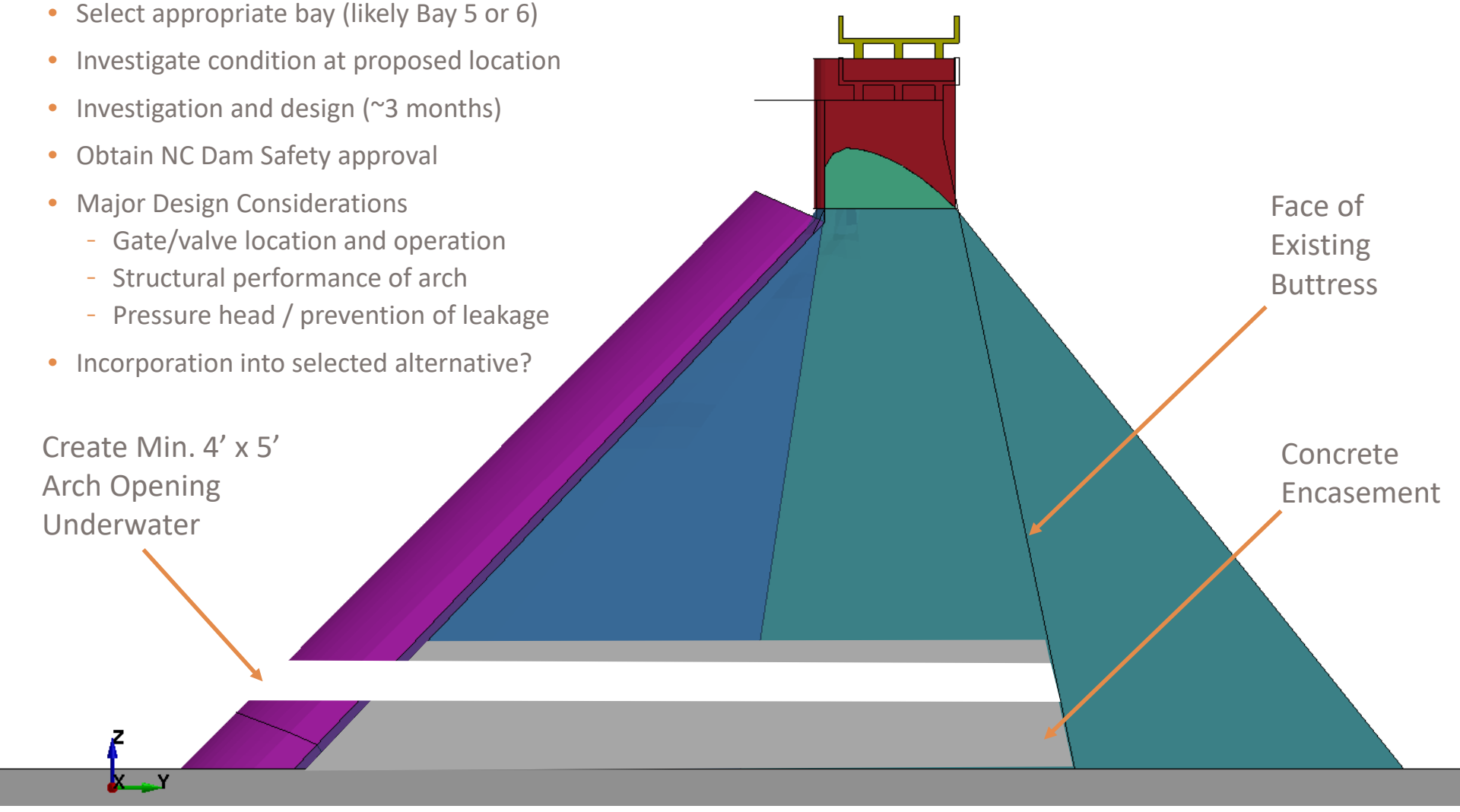
- New RCC gravity dam downstream of existing dam
- Could be designed to support a new bridge
- New hydroelectric facilities could be incorporated but would result in regulation by the FERC
- Additional environmental permitting likely required
- Service life of 100+ years
- Costs
  - Construction without hydro ~$50M
  - Engineering services ~15% of construction
  - Additional hydro costs ~$15M to $20M
- Major Construction Considerations
  - Construction could not be phased
  - Complete draining of the reservoir not required
  - Demolition of existing dam – partial demolition?

Alternatives Comparison Summary (Section 10.0)

Item	Weight of Each Item (Total 100%)	Alternative 1 Cross-Bracing	Alternative 2B Downstream Infilling	Dam Replacement
Initial Capital Costs	25%	1	2	2
Ratio of Initial Capital Costs to Service Life	5%	3	2	1
Expected Hydraulic Performance	10%	3	2	1
Expected Seismic and Structural Performance	10%	3	2	1
Construction Schedule	2%	1	2	3
Construction Stream Diversion and Control of Water	5%	3	3	1
Construction Risks	10%	2	2	1
Environmental Impacts / Permitting Effort	3%	1	2	3
Hydroelectric Impacts	5%	2	3	1
Community Disruption	5%	3	2	1
Long-term O&M Requirements and Costs	10%	3	2	1
Uncertainties	10%	3	2	1
Weighted Ratio:		**2.3**	**2.1**	**1.4**
Cumulative Sum:		**28**	**26**	**17**

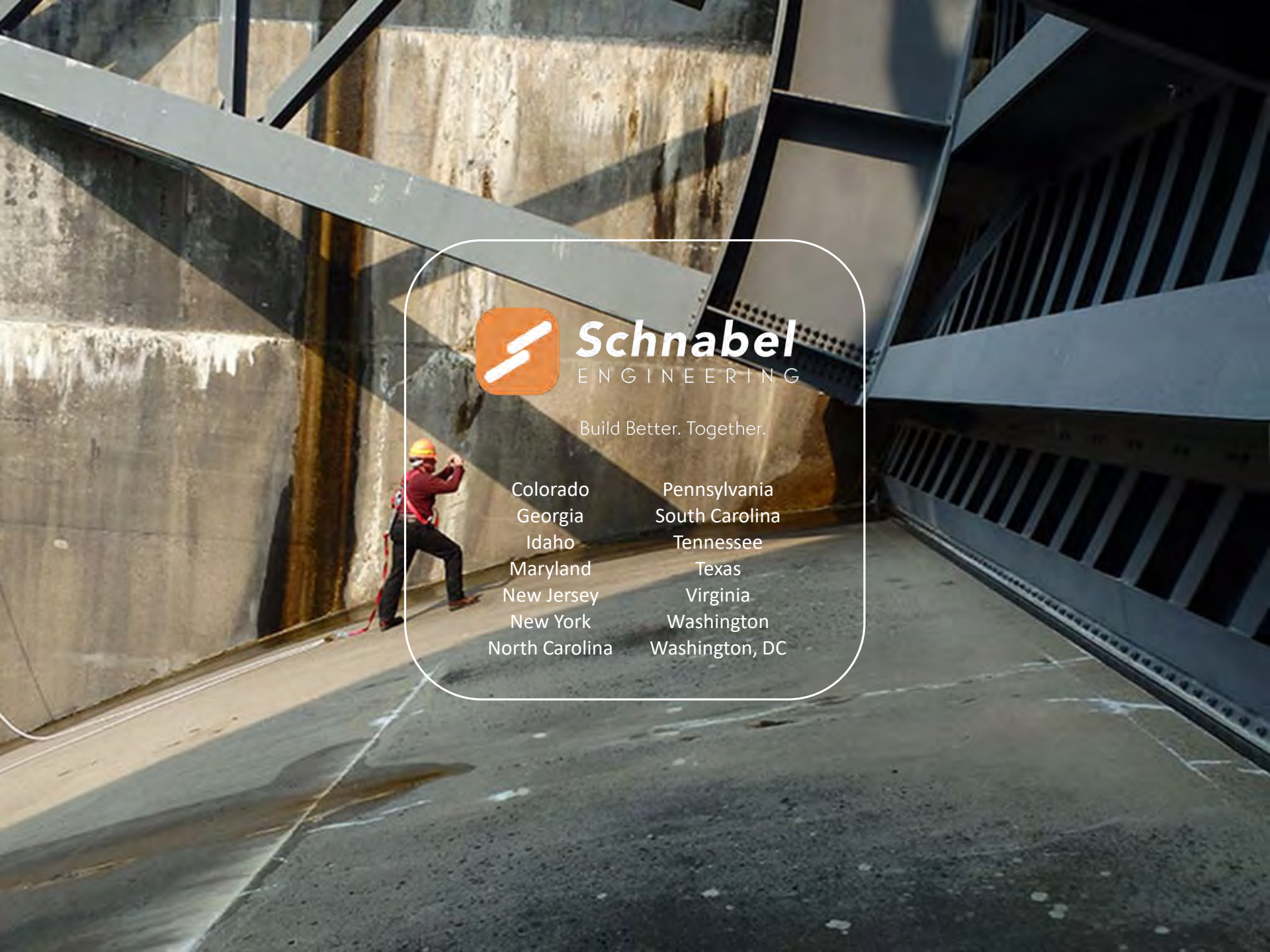
Reservoir Drain

- Finalize required elevation and rate of drawdown
- Select appropriate bay (likely Bay 5 or 6)
- Investigate condition at proposed location
- Investigation and design (~3 months)
- Obtain NC Dam Safety approval
- Major Design Considerations
  - Gate/valve location and operation
  - Structural performance of arch
  - Pressure head / prevention of leakage
- Incorporation into selected alternative?



Proposed Path Forward

- Construct Reservoir Drain as Initial Phase of Work
- Why?
  - Allows for critical sewer repairs and funding in-place for sewer repairs (LaBella)
  - Addresses a NC Dam Safety requirement and reduces dam safety risks
  - Provides benefits to necessary lake dredging
- Next Steps for Dam
  - Select preferred alternative
  - Evaluate phasing approach for rehab alternative (if selected) by performing an SQRA
  - Evaluate funding options and develop schedule for addressing remaining dam safety requirements
  - Meet with NC Dam Safety to agree on path forward
  - Coordination with NCDOT



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Tennessee
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Virginia
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Town of Lake Lure North Carolina

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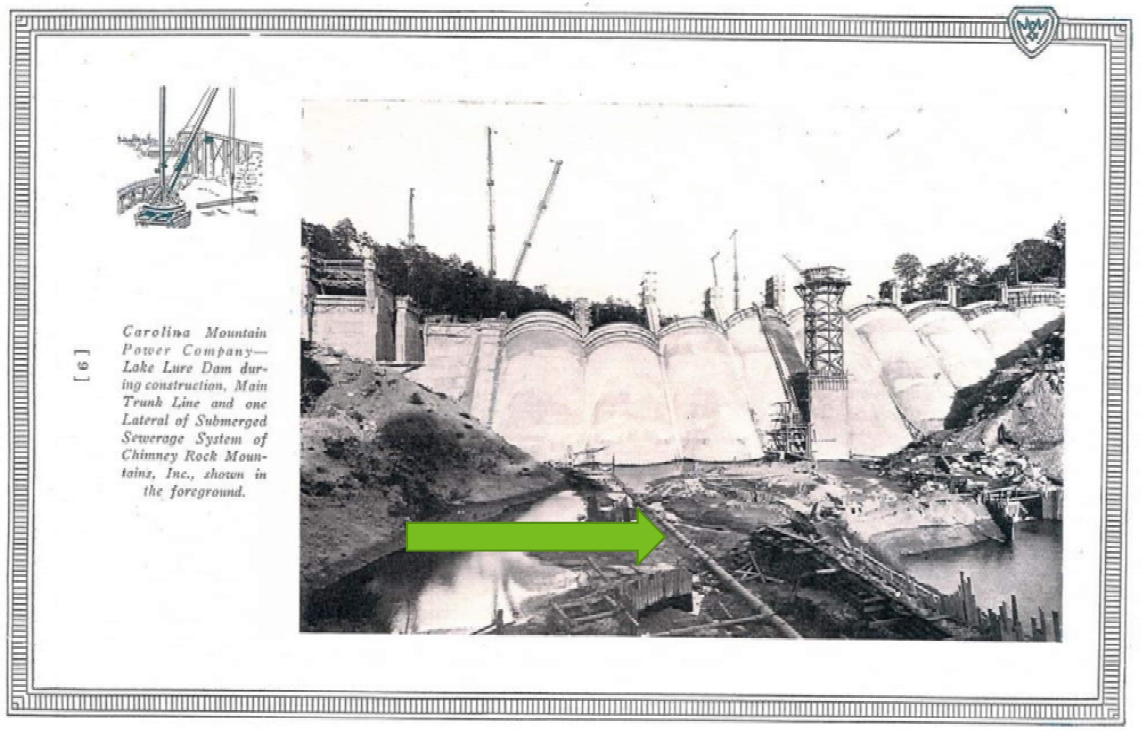
ON-CALL ENGINEERING SERVICES TECHNICAL MEMORANDUM, TASK 2 AUTHORIZATION, & ROAD MAP

PROJECT BACKGROUND

Subaqueous Sanitary Sewer (SASS)

- Completed with Dam in 1927
- 105 feet deep
- Consists of c. 74,000 linear feet CI pipe
- Serves a population of 1,214 year round and up to 5,000 seasonally
- Serves public/private connecting systems
  - Rumbling Bald (private)
  - County system in CRV (public)
  - Blue Heron Point (private)
  - Lake Lure Village Resort (private)
- Max Spillway Elevation = 990.50 above MSL
- Min Spillway Elevation = 978.50 above MSL
- 27 miles of shoreline



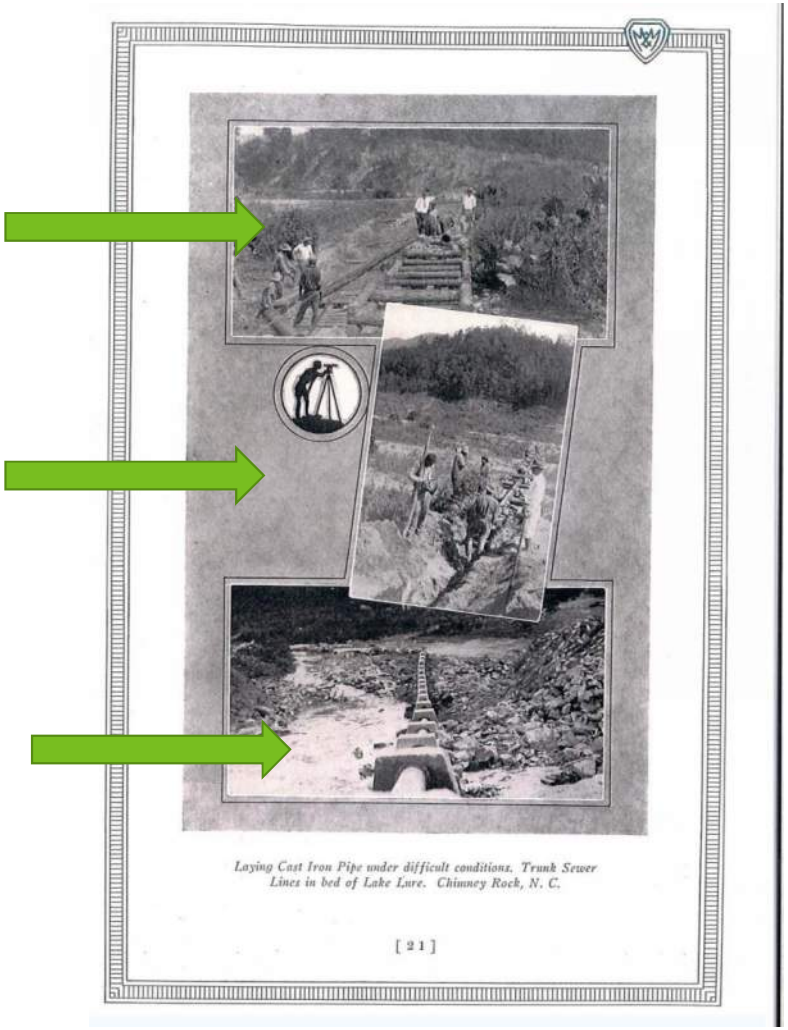
[6]

Carolina Mountain Power Company—Lake Lure Dam during construction. Main Trunk Line and one Lateral of Submerged Sewerage System of Chimney Rock Mountains, Inc., shown in the foreground.

PROJECT BACKGROUND

Subaqueous Sanitary Sewer (SASS)

- Installed using various methods
  - Wood cribbing
  - Buried
  - Concrete collars
- Installed along the existing grade
- Ranges in size from 8" to 18" in diameter
- Contains various bends and submerged junction boxes
- Flow enters through 65 perimeter manholes
- Location of manholes are known
- Location of much of the SASS is approximate



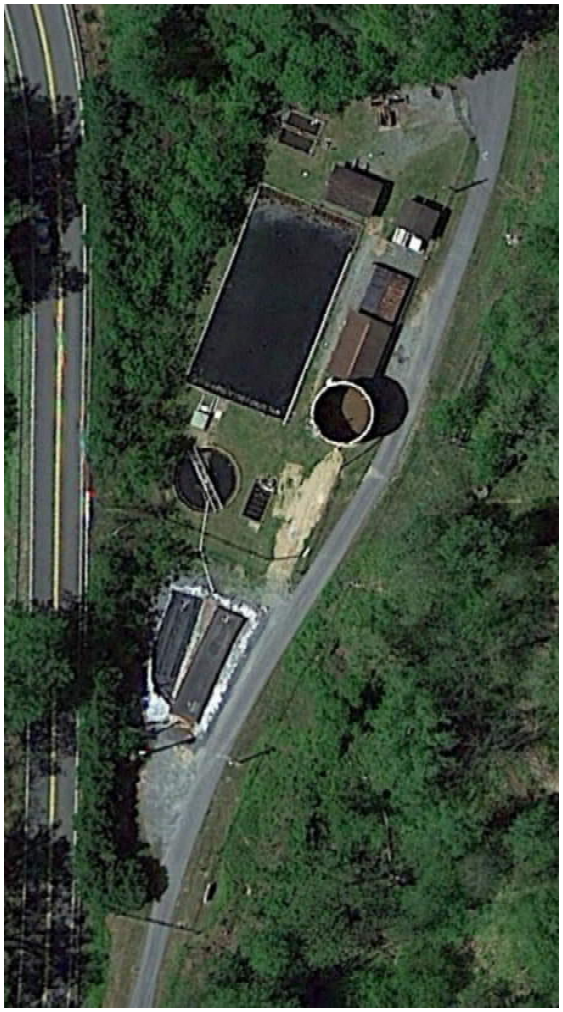
Laying Cast Iron Pipe under difficult conditions. Trunk Sewer Lines in bed of Lake Lure. Chimney Rock, N. C.

[21]

PROJECT BACKGROUND

Wastewater Treatment Plant (Plant)

- Prior to 1969 the SASS discharged to the Broad River
- Constructed in 1969
  - Rated at 0.35 MGD
  - Biological Process
  - One headworks pump station
- 1991 Renovation
  - Converted to a physical-chemical process (P/C)
  - Rated at 0.995 MGD



RECENT PROJECTS

2007 Inspection and Smoke Testing

- Most of the manholes were inspected
- Identified manhole and private lateral leaks
- CCTV of approximately 14% of the SASS
- Divers found leaks in the SASS joints

2009 Pipe Wrap Project

- Some of the accessible pipe joints were wrapped
- Reduced the amount of Lake Infiltration
- 15 year service life (2024)

Emergency Shutoff Valve

- Installed downstream of the Dam
- Shutoff flow in the event of catastrophic SASS failure
- Would require the Town to suspend sewer usage

RECENT PROJECTS

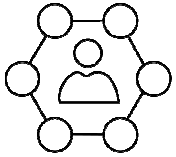
2007 Leaking Pipe Joints

PROJECT METHODOLOGY

THE ABILITY TO INFLUENCE A PROJECT IS GREATEST AT THE BEGINNING AND THEN DECREASES AS THE PROJECT ADVANCES.

THIS REALITY NECESSITATES FRONT END PLANNING (FEP).

FIVE STEP PROCESS



Identify Stakeholders

Define the problem or objectives

Alternative Selection Criteria

Brainstorm

Alternative Validation

IDENTIFY STAKE HOLDERS

- Lake Lure elected officials
- Town of Lake Lure Staff
- Lake Lure Utility Advisory Board
- NC DEQ – DWR
- NC DEQ – DWI
- NC DEQ – Collection System and Compliance
- NC DOT
- LaBella
- Byers Environmental, Inc.
- SDG Engineering, Inc.
- WithersRavenel
- Lake Lure residents
- Outside Users

DEFINE THE PROBLEM AND OBJECTIVES

Subaqueous Sanitary Sewer

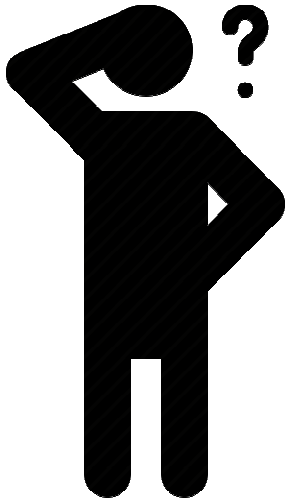
- Considered Noncompliant by NC DEQ
  - Lake infiltration
  - Risk of Catastrophic Failure
  - Inflow and Infiltration (Land-based)
  - Inaccessible

Wastewater Treatment Plant

- Legacy of Noncompliance
  - Inability to meet NPDES Effluent limits
    - Lake Infiltration
    - Inflow and Infiltration (Land-based)

Financial Impact

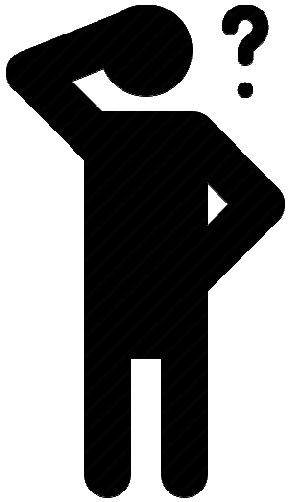
- Limited Revenue base
- High complexity of CIP needs
- High magnitude of CIP cost



DEFINE THE PROBLEM AND OBJECTIVES

Summary of Objectives

- Regulatory Compliance (short term and long term)
- Protect against catastrophic failure
- Provide a sustainable, enduring collection and treatment system
- Financially viable
- Accessible for O&M
- Incorporate future growth
- Reduce inflow and infiltration



ALTERNATIVE SELECTION CRITERIA

These are the "ground rules"

Triple Bottom Line Approach (TBL)

- Economic impact
- Environmental impact
- Social impact

Benefits of the TBL approach

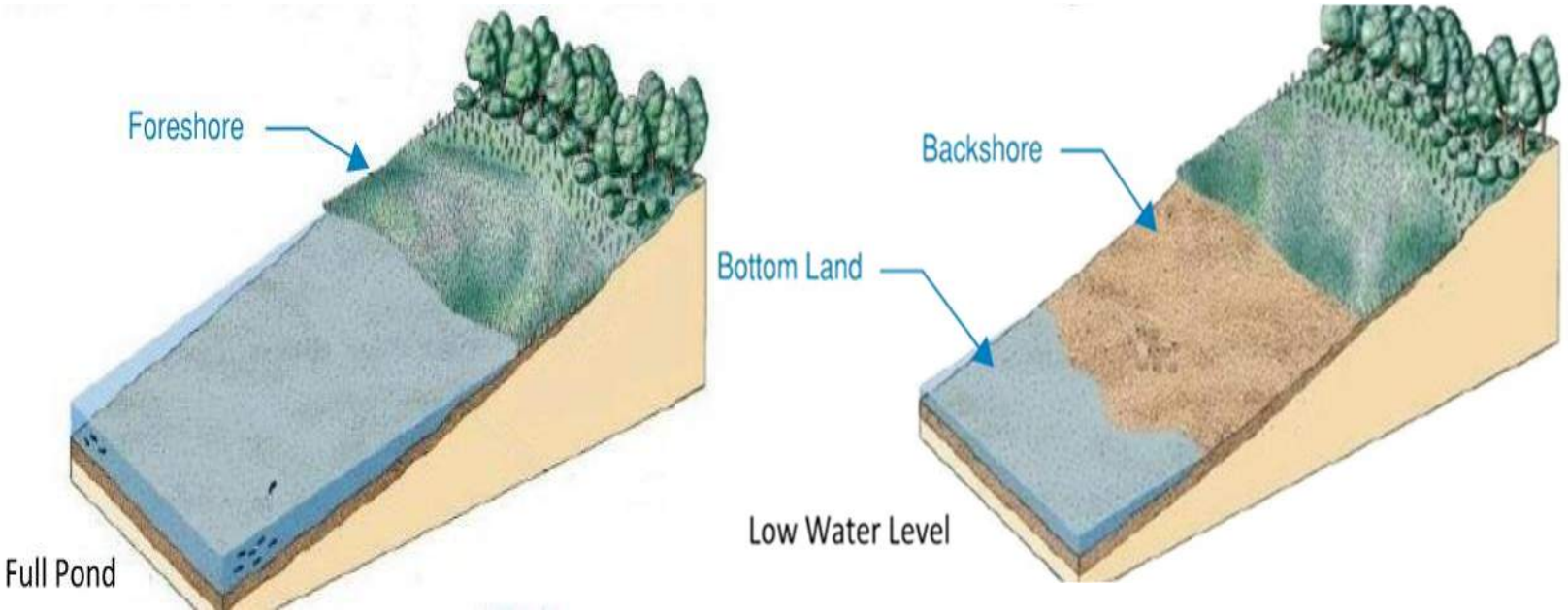
- Allows for the allocation of risk and cost from multiple view points.
- Useful in complex and high risk evaluations
- Considers the cost/benefits
- Addresses multiple or conflicting objectives
- Identifies risk
- Provides a clear defensible result

SASS PRELIMINARY ALTERNATIVES ANALYSIS

TASK 1 TECH MEMO

BRAIN STORMING

PROJECT LOCATION



BRAIN STORMING

Subaqueous Sanitary Sewer Alternatives

Alternative	Cost Order of Magnitude	Phase-able	Consider Further
S1 - Do Nothing	n/a		
S2 - Land-based Low Pressure Sewer System	$50M - $65M	✓	
S3 - Backshore Low Pressure Sewer System	$30M - $40M	✓	✓
S4 - Backshore Series Pump Station System	$30M - $40M	✓	✓
S5 - Backshore HDPE Gravity System	$25M - $35M	✓	
S6 - Backshore HDPE Gravity / Lift Station System	$30M - $40M	✓	✓
S7 - Subaqueous Accessible Manholes	$20M - $30M	✓	✓
S8 - Tethered Buoyant HDPE System	$40M - $50M		
S9 - Submerged HDPE System	Not Established		
S10 - Drain and Replace Approach (if Dam renovation drains lake)	Not Established		
S11 - Repair & Rehabilitate Perimeter Manholes (partial solution)	$1M - $3M	✓	✓

S3 – BACKSHORE LOW PRESSURE SEWER SYSTEM

Benefits

- Uses proven technology and approaches
- Provides for the growth of the customer base
- Constructed using typical means
- Could be phased
- Does not require easement acquisition

Liabilities

- Would require lake levels to be dropped for construction and O&M access.
- The construction schedule would have to be coordinated with lake levels and the dam renovation
- Requires a large number of pump stations
- Requires substantial modifications to each customer's lateral(s)
- Requires a maintenance program or contract with a service provider to be on call to respond to pump failures
- Higher O&M cost due to wear of equipment and power usage
- Loss of unknown number of private wells during construction

Order of Magnitude Range $30M to $40M

BRAINSTORMING

S4 – BACKSHORE SERIES PUMP STATION

BRAINSTORMING

Benefits

- Uses existing proven technology and approaches
- Provides for the growth of the customer base
- Constructed using typical means
- Could be phased
- Does not require easement acquisition
- Greatly reduces the number of pump stations
- Does not require substantial modifications to each customer's lateral(s)

Liabilities

- Would require lake levels to be dropped for construction and O&M access.
- The construction schedule would have to be coordinated with lake levels and the dam renovation
- Requires a maintenance program or contract with a service provider to be on call to respond to pump failures
- High O&M cost due to wear of equipment and power usage
- Requires a backup system of either generators or by-pass pumps
- Requires an electrical grid to supply power
- Requires a SCADA system
- Loss of unknown number of private wells during construction

Order of Magnitude Range $30M to $40M

S6 – BACKSHORE SERIES PUMP STATION

BRAINSTORMING

Benefits

- Uses existing proven technology and approaches
- Provides for the growth of the customer base
- Constructed using typical means
- Could be phased
- Does not require easement acquisition
- Greatly reduces the number of pump stations
- Does not require substantial modifications to each customer's lateral(s)

Liabilities

- Would require lake levels to be dropped for construction and O&M access.
- The construction schedule would have to be coordinated with lake levels and the dam renovation
- Requires a maintenance program or contract with a service provider to be on call to respond to pump failures
- High O&M cost due to wear of equipment and power usage
- Requires a backup system of either generators or by-pass pumps
- Requires an electrical grid to supply power
- Requires a SCADA system
- Loss of unknown number of private wells during construction

Order of Magnitude Range $30M to $40M

S7 - SUBAQUEOUS MANHOLES

BRAINSTORMING

Benefits

- Uses existing technology and approaches (No known installations in North Carolina)
- Could be phased
- Does not require easement acquisition
- Does not require lowering of the lake
- No pump stations
- Does not require substantial modifications to each customer's lateral(s)

Liabilities

- Does restrict parts of the lake for construction
- Does require divers for access
- Would not increase the capacity of the SASS
- Would rely on the existing grade of the SASS
- Would rely on the existing cribbing and concrete collars

Order of Magnitude Range $20M to $30M

S11 – REPAIR AND REHAB PERIMETER MANHOLES

Benefits

- Uses existing proven technology and approaches
- Constructed using typical means
- Could be phased
- Does not require easement acquisition
- Does not require substantial modifications to each customer's lateral(s)
- Would reduce lake infiltration

Liabilities

- Would require lake level to be dropped for construction and access.
- The construction schedule would have to be coordinated with lake levels and the dam renovation
- Would not replace or rehabilitate the SASS
- Would affect an unknown number of private wells during construction

Order of Magnitude Range $1M to $3M

BRAINSTORMING

PLANT PRELIMINARY ALTERNATIVES ANALYSIS

TASK 1 TECH MEMO

WASTEWATER TREATMENT PLANT ALTERNATIVES

In general, there are three broad categories for the Plant alternatives

- Relocation
- Rehabilitation
- Bulk Transfer

- The WWTP alternative process is not as developed as that for the SASS
  - Due to the contingent relationship between the SASS and the WWTP
  - Until the major inflow and infiltration issues of the SASS are resolved, the WWTP will not be returned to a biological process

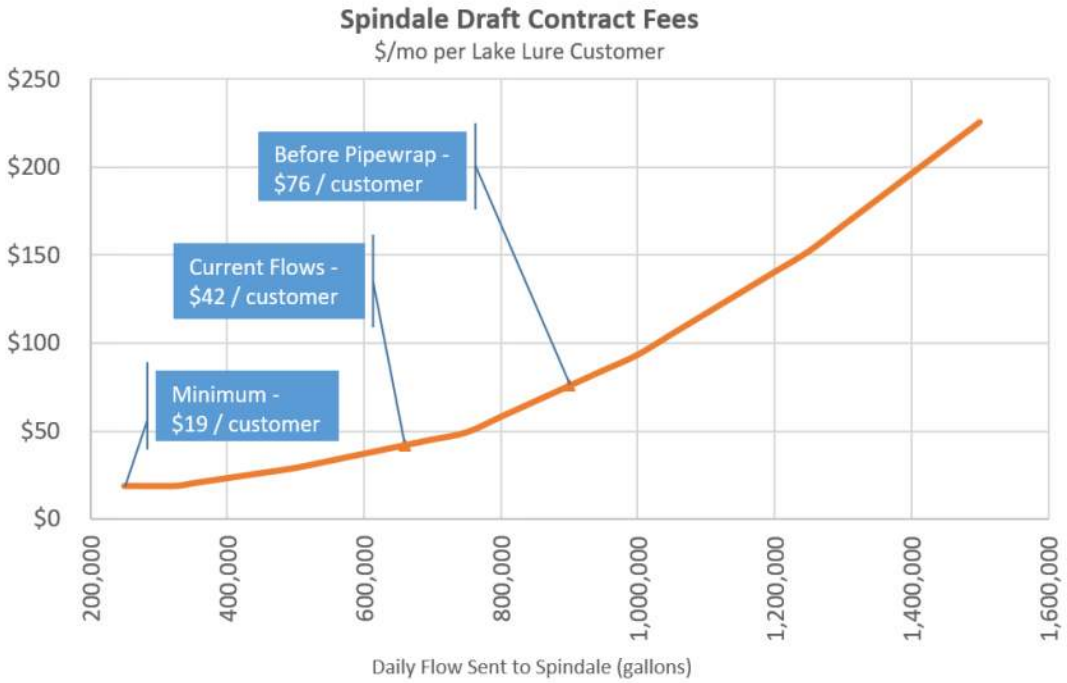
- The SASS will have to be replaced in phases
  - Each phase will reduce the inflow and infiltration and change the wastewater characteristics
  - Rehabilitation, repair, or replacement of the Plant will have to be coordinated with the SASS phasing to ensure short term and long term NPDES compliance.

BRAIN STORMING

P2- BULK CONVEYANCE

This alternative was originally proposed to replace the Plant prior to addressing the inflow and infiltration in the SASS.

LaBella would **NOT** consider this alternative until the issues with the SASS has been resolved.



Based on 1,032 customers

Based on the last tiered rate structure from the suspended negotiations with the Town of Spindale, NC.

If this alternative is selected, these negotiations would need to be reopened and agreed upon prior to proceeding with design and permitting of this alternative.

For comparison, the budget allocation for the contract Plant operator and sludge management totals approximately $23 per customer per month.

BRAINSTORMING

P2- BULK CONVEYANCE

BRAINSTORMING

Benefits

- Would take the WWTP offline
- Would eliminate the NPDES permit
- Eliminates Plant operations costs
- Eliminate future Plant-related NOV's

Liabilities

- O&M cost
- Requires perpetual dependence on the receiving municipality for treatment
- Places potential system capacity limitations under the control of the receiving municipality

Recommendation - LaBella would recommend considering this alternative further as an alternative for the Plant replacement after the rehabilitation or replacement of the SASS.


NEXT STEPS
AUTHORIZE
TASK 2-SOC, ER-EID, AA

ALTERNATIVES VALIDATION

Task 2 – SOC/ER-EID/Alternative Analysis

- LaBella will complete the Special Order by Consent application process
- LaBella will complete the alternatives analysis process and deliver an alternative recommendation, detailed cost estimate, phasing limits, and schedule.
- LaBella will coordinate with contractors, vendors, and subject matter experts as needed to complete the alternatives analysis.
- LaBella will meet with the Town staff, UAB, elected officials and other stakeholders to vet the alternatives and incorporate stakeholders' input in the alternatives analysis process.
- LaBella will coordinate with Town staff to gather the information necessary for the design process.
- LaBella will develop a master schedule in Microsoft Project that includes the dam renovation, WWTP rehabilitation/ replacement, and subaqueous sewer system rehabilitation/ replacement.


NEXT STEPS
ROAD MAP

ROAD MAP

Task Descriptions

- Task 1 – Technical Memorandum (complete)
- Task 2 – SOC,ER-EID, and Alternative Analysis
- Task 3 – Design, Permitting, Bidding
- Task 4 – Construction Management

Additional Tasks based on funding but will include:

- Design, Permitting, Bidding
- Construction Management

ROAD MAP

Short-term compliance

- Special Order by Consent (Task 2)

Mid-term compliance

- Alternatives Analysis (Task 2)
- ER-EID (Task 2)
- Design, Permitting, and Bidding (Task 3)
- Construction of Phase 1 (Task 4)

Long-term Compliance

- Complete replacement of the SASS
- Rehabilitation or replacement of the Plant

ROAD MAP

(1). Special Order by Consent

- Negotiate effluent limits to eliminate NOV's
- Protect against 3rd party litigation
- Set milestones to demonstrate progress
- Allow for renew after initial 2 year period

(2.) ER-EID and Alternatives Analysis

- Solidifies funding
- Provides a plan for the permanent solution
- Provides intermediate steps

ROAD MAP

(3.) Design, Permitting, and Bidding

- Turns the plan into a project
- Provides construction documents
- Acquires regulatory approval
- Submits the project for competitive bidding

(4). Construction of Phase I

- Implements the plan
- Reduces inflow and infiltration
- Puts Lake Lure on the road to compliance

ROAD MAP

(4.) Construction Phase 1

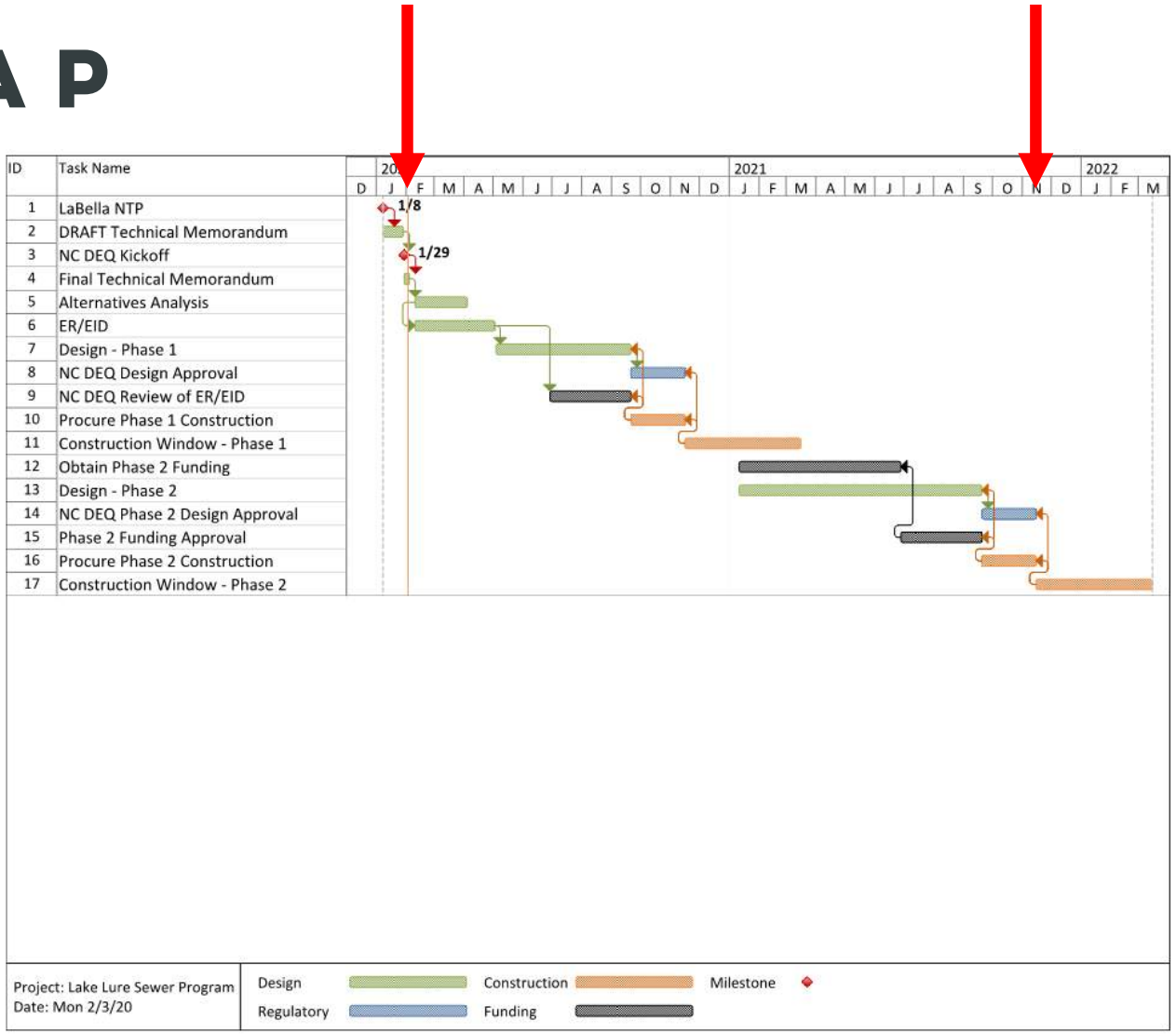
- Replacement of a portion of the SASS
  - The first phase of the total SASS replacement
- Rehabilitation of the perimeter manholes not replaced
  - Reduce lake infiltration
  - Provide a Mid-term solution while additional funding is acquired
- Testing and repairs to public and private laterals
  - Reduce lake infiltration
  - Provide a Mid-term solution while additional funding is acquired
  - Rehabilitate or repair the WWTP as needed
  - The first phase in the rehabilitation or replacement of the WWTP

ROAD MAP

(2.) Construction Phase 1 - (Mid-term Compliance) cont.

- Meter bulk users
  - Provide revenues on a consumptive basis
  - Encourage system owners to reduce I&I
- Include a sewer access valve installed in the existing dam
  - Provide for additional access to the Backshore
  - Provide for improved working area for SASS replacement
  - Provide for protection for SASS catastrophic failure
  - Provide a mechanism to drain the lake
  - Addresses Dam safety requirements
  - Flexibility with dredging

ROAD MAP


ID
Task Name
2021
2022
1 LaBella NTP
2 DRAFT Technical Memorandum
3 NC DEQ Kickoff
4 Final Technical Memorandum
5 Alternatives Analysis
6 ER/EID
7 Design - Phase 1
8 NC DEQ Design Approval
9 NC DEQ Review of ER/EID
10 Procure Phase 1 Construction
11 Construction Window - Phase 1
12 Obtain Phase 2 Funding
13 Design - Phase 2
14 NC DEQ Phase 2 Design Approval
15 Phase 2 Funding Approval
16 Procure Phase 2 Construction
17 Construction Window - Phase 2
1/8
1/29
Project: Lake Lure Sewer Program
Date: Mon 2/3/20
Design
Construction
Milestone
Regulatory
Funding

ROAD MAP

Preliminary Schedule

Special Order by Consent (Task 2)

- Begin immediately upon Task 2 Authorization
- Goal is prior to April 1st (beginning of summer NPDES limits)

ER-EID, Alternative Analysis (Task 2)

- Begin immediately upon Task 2 Authorization
- Goal is submission by Mid June

Design (Task 3)

- Begin prior to ER-EID approval
- Goal is to submit for permitting by late October

Permitting (Task 3)

- Submitted by late October
- Approval by mid December

Schedule to be updated upon completion of Task 2

ROAD MAP

LaBella
Powered by partnership.

February 7, 2020

Shannon Baldwin, Town Manager
Town of Lake Lure
2948 Memorial Highway
Lake Lure, NC 28746

SUBJECT: Lake Lure On-Call Professional Services – Task 2 Deliverable

Dear Shannon:

LaBella Associates appreciates the opportunity to continue to work with the Town of Lake Lure (Town) on this project. We hope to continue the ongoing relationship as we work with you through your various engineering needs. We have previously provided an engineering services agreement, and this work would be performed under that agreement. This proposal letter provides a scope of work and budget to provide the Task 2 deliverable as described below. The deliverable will consist of the special order by consent (SOC) application process, alternatives analysis, and ER-EID which will be submitted to the Town for review and comment prior to being submitted to NC DEQ. The scope of work is summarized below:

- LaBella will complete the SOC application process, including meeting with NC DEQ and subsequent correspondence.
- LaBella will complete the alternatives analysis process and deliver an alternative recommendation, detailed cost estimate, phasing limits, and schedule.
- LaBella will coordinate with the Town staff to review the currently observable perimeter manholes and the wastewater treatment plant and will coordinate with contractors, vendors, and subject matter experts as needed to complete the alternatives analysis.
- LaBella will meet with the Town staff, UAB, elected officials and other stakeholders to vet the alternatives and incorporate stakeholders' input in the alternatives analysis process.
- LaBella will coordinate with Town staff to gather the information necessary for the design process.
- LaBella will develop a master schedule in Microsoft Project that includes the dam renovation, WWTP rehabilitation/ replacement, and subaqueous sewer system rehabilitation/ replacement.

LaBella may provide other related engineering services as requested by the Town, hourly at contracted billing rates in addition to the budget provided for this scope.

Maurice (Reese) Walsh, P.E. will continue to serve as LaBella's Program Manager for this contract, providing direction and oversight for other staff assigned to specific tasks under this contract. Brian Houston and Reese will work on the alternatives analysis. Heather Miller will work on the ER-EID document, and Keith Garbrick will be the qualified technical reviewer as part of our excellence assurance program. Other staff assigned to this contract shall have appropriate experience for the assigned task.

At the request of the Town, we are submitting this on a time and material basis. LaBella will continue to submit monthly invoices that track the charges for each individual task. An allowance is established for reimbursable expenses incurred by the Engineer during performance of this agreement. Subconsultants, if applicable, will be compensated at cost plus 10 percent, out of the time-and-material labor budget. Reimbursable expenses shall be compensated at cost unless otherwise noted and shall be limited to the actual expenditures made by the Engineer during the performance of the work with respect to travel, postage, courier expenses, copies, printing, plots, permitting fees, photographs, maps, or other miscellaneous project expenses.

400 S. Tryon Street, Suite 1300 | Charlotte, NC 28285 | p (704) 376-6423 | f (704) 332-6177
www.labellapc.com

ROAD MAP

A summary of the budget for the scope of work described above is as follows:

Description	Fee
Task 2 Deliverable – SOC, Alternate Analysis & ER-EID	$165,000
Allowable for Reimbursable Expenses	$5,000.00
Total Budget	**$170,000**

If this proposal is acceptable to the Town, please sign this proposal on the signature line below to authorize the scope defined in this proposal and return one copy to us. We appreciate the opportunity to continue our relationship with the Town of Lake Lure. If you have any questions or need additional information, please call me directly at (704) 941-2128.

Sincerely,

Maurice J. Walsh, P.E.
LaBella Associates, P.C.
Program Manager

Town of Lake Lure, North Carolina

Authorized Signature

By: _____

Title _____

Date _____

ROAD MAP

LABELLA ASSOCIATES
Lake Lure ON-CALL ENGINEERING SERVICES

SCHEDULE OF FEES
JANUARY 1, 2020 – DECEMBER 31, 2021

CLASSIFICATION	BILLING RATE
Principal	$180.00/hour
Project Manager	$175.00/hour
Senior Engineer	$165.00/hour
Senior Project Engineer	$140.00/hour
Project Engineer	$120.00/hour
Design Engineer	$105.00/hour
GIS Analyst	$115.00/hour
Senior Engineering/GIS Technician	$105.00/hour
Engineering Technician	$95.00/hour
Construction Inspector	$85.00/hour
Engineering Co-op	$70.00/hour
Clerical	$70.00/hour

Mileage	at current IRS rate
Expenses	at cost
Subconsultants	at cost plus 10 percent


THANK YOU
LaBella thanks you for your time and would like to answer any questions you have at this time.