



Schnabel
ENGINEERING

Rehab or Rebuild: What's the Best Alternative for the Owner

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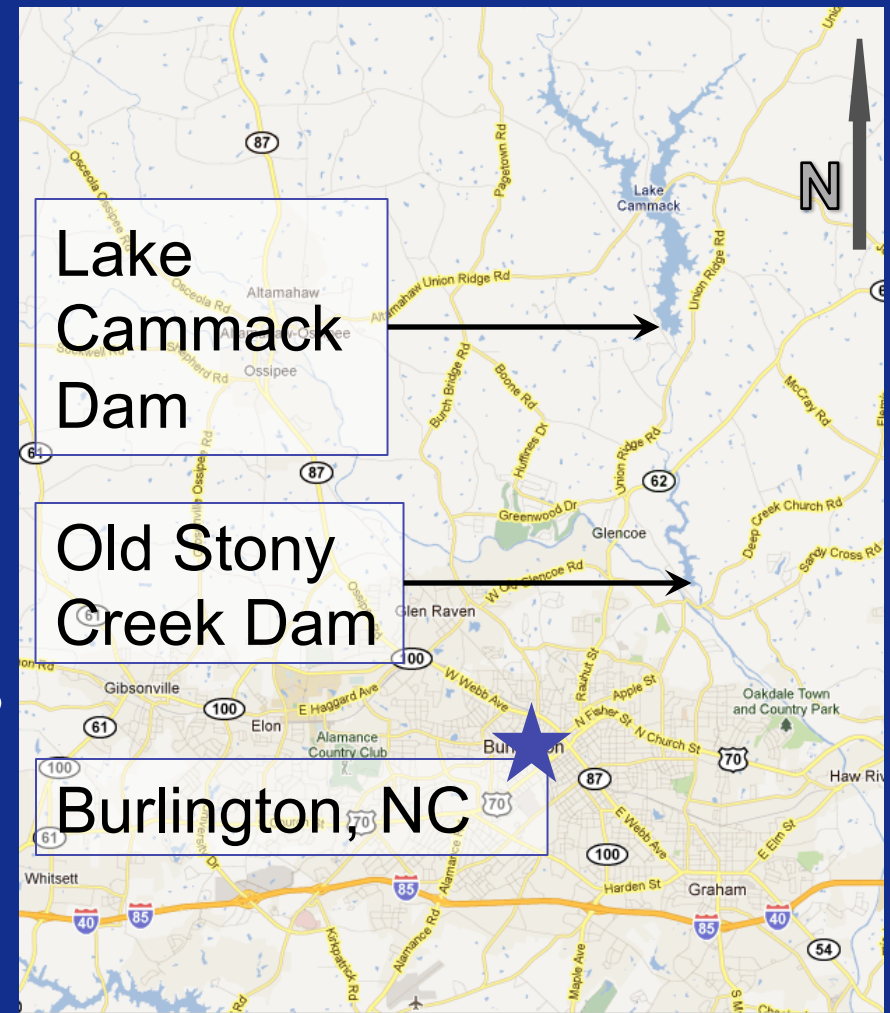
Outline

- Introduction
- Dam Deficiencies
- Alternatives Analysis
- Selection
- Design of Rehab
- Construction



Introduction

- Old Stony Creek Dam
 - Concrete gravity dam
 - Completed in 1928
 - Max. height ~37 feet
 - Ogee spillway (204 ft long)
 - “Non-overflow” parapets (25 ft and 165 ft long)
 - Water supply intake



Old Stony Creek Dam



Old Stony Creek Dam



Old Stony Creek Dam



Dam Deficiencies

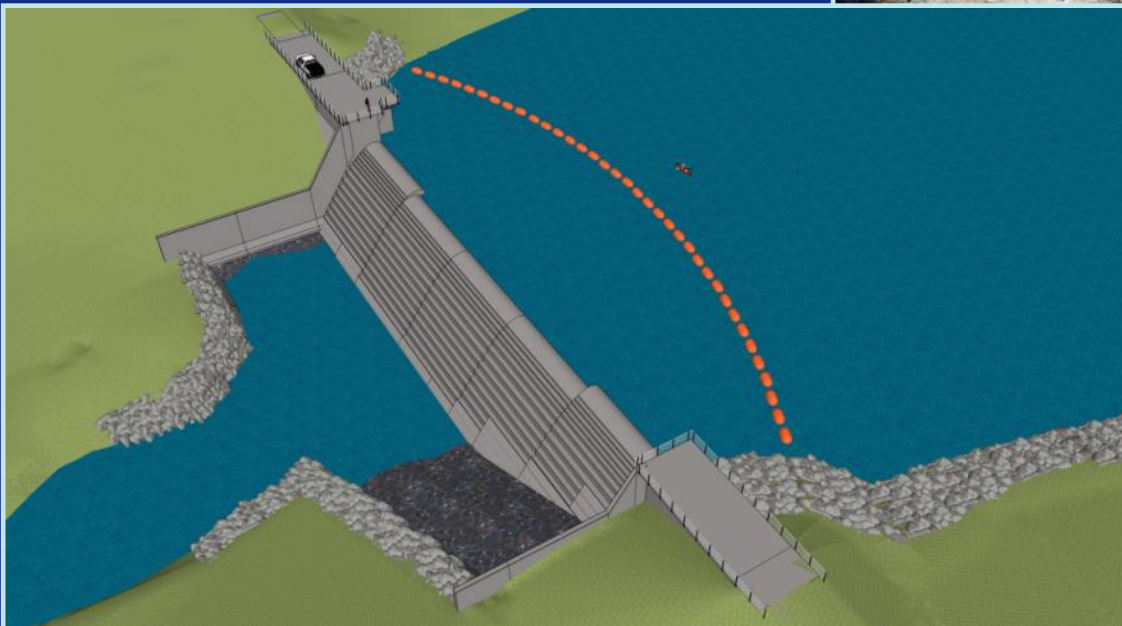
- Hydraulic Capacity
 - Design storm overtops 'non-overflow' parapets by ~12 feet
 - Abutment erosion would drain reservoir
- Stability
 - Overflow spillway
 - Parapets

Alternatives Analysis

- Replacement
- Removal
- Rehab

Alternatives Analysis

- Replacement:
 - Labyrinth
 - RCC
 - Existing Pool
 - Lowered Pool



Alternatives Analysis

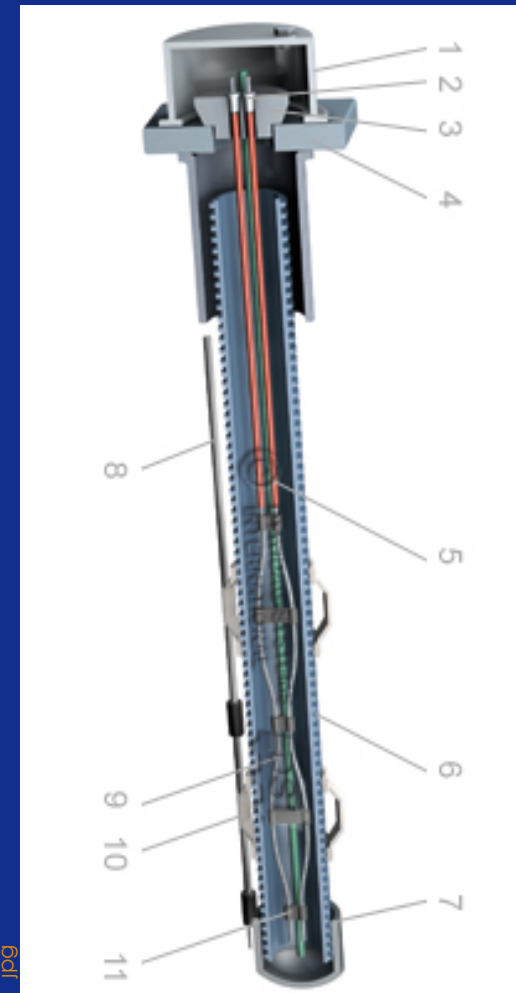
- Removal:
 - Removal is costly
 - Environmental concerns
 - Loss of lake recreation/property value
 - Would require major modifications to intake and pump house

Alternatives Analysis

■ Rehab:

- Armor Abutments/Anchor Dam
- Lower Crest/Anchor Dam
- Raise Abutments/Anchor Dam
- Auxiliary Spillway/Anchor Dam

http://www.dsiamerica.com/uploads/pics/Dywidag_Permanent_Strand_Anchor_02.jpg



Selection



Project : Burlington Dams Alternatives Analysis Project No. 09210020
 Subject : Old Stoney Creek Dam Anchor Rehab Opinion of Construction Cost
 Date : 11/19/2009 By : FAR
 File : G:\2009 Projects\09210020 (Burlington Dams Alternatives Analysis)\Cost Estimates and Budget Tracking\Construction Cost Estimates\{Preliminary Opinion of Const Costs-Old Stoney Rehab - Anchors.xls}\Cost Checked : ML

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST			
Item	Description	Price	Total
1	Bonds, Insurance, Mobilization & Demobilization	389,200	\$ 389,200
2	Sed & Eros Control	35,000	\$ 35,000
3	Clearing & Grubbing	18,000	\$ 18,000
4	Road Access Issues	125,000	\$ 125,000
5	Staging area prep	50,000	\$ 50,000
6	Misc. Control of	100,000	\$ 100,000
7	Remove Pipin	100,000	\$ 100,000
8	Excavation Fou	63,750	\$ 63,750
9	Excavation Fou	5,000	\$ 5,000
10	Foundation Cl	15,750	\$ 15,750
11	Mass concrete	680,000	\$ 680,000
12	Earthfill around	79,800	\$ 79,800
13	Seeding and Mul	10,500	\$ 10,500
14	Misc. Cleanup	20,000	\$ 20,000
15	Anchor installation	2,200,000	\$ 2,200,000
		3,892,000	\$ 3,892,000
		25%	\$ 973,000
		9%	\$ 350,280
	Total(rounded 1000's)		\$ 5,216,000
ENGINEERING			
	Additional Environmental	\$ 20,000	
	Subsurface Investigation	\$ 50,000	
	Design	\$ 600,000	
	CQA	\$ 500,000	
	TOTAL		\$ 6,400,000

30-year fix
 1/2 the cost

Rehabilitate



Project : Burlington Dams Alternatives Analysis Project No. 09210020
 Subject : Old Stoney Creek Dam RCC Replacement Opinion of Construction Cost
 Date : 11/19/2009 By : SKK
 File : G:\2009 Projects\09210020 (Burlington Dams Alternatives Analysis)\Cost Estimates and Budget Tracking\Construction Cost Estimates\{Preliminary Opinion of Const Costs Story - RCC Dam.xls}\Cost Checked : ML

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST			
Item	Description	Unit	Total
1	Bonds, Insurance, Mobilization & Demobilization		\$ 679,294 \$ 679,294
2	Sed & Eros Control		\$ 80,000 \$ 80,000
3	Clearing & Grubbing		\$ 18,000 \$ 18,000
4	Road Access Issues		\$ 125,000 \$ 125,000
5	Access and Demolition		\$ 800,000 \$ 800,000
6	Removal and land		\$ 6,000 \$ 6,000
7	Misc. Control of		\$ 700,000 \$ 700,000
8	Excavation Fou		\$ 62,900 \$ 62,900
9	Excavation Fou		\$ 150,000 \$ 150,000
10	Foundation Cut		\$ 199,500 \$ 199,500
11	Foundation Cut		\$ 66,500 \$ 66,500
12	Foundation Clea		\$ 84,000 \$ 84,000
13	Leveling Concrete		\$ 54,000 \$ 54,000
14	Roller Compacted		\$ 2,400,000 \$ 2,400,000
15	Stilling Basin RCC		\$ 255,000 \$ 255,000
16	Cast-In-Place Concrete		\$ 86,250 \$ 86,250
17	GERCC US & DS Face		\$ 150,000 \$ 150,000
18	GERCC top foot of stilling bas		\$ 75,000 \$ 75,000
19	Earthfill around RCC Section		\$ 49,000 \$ 49,000
20	Water Supply Conduit and Gate		\$ 500,000 \$ 500,000
21	Riprap	2000 CY	\$ 75,000 \$ 150,000
22	Fencing	1 LS	\$ 25,000.00 \$ 25,000
23	Seeding and Mulching	10 AC	\$ 3,500.00 \$ 35,000
24	Misc. Cleanup	1 LS	\$ 30,000.00 \$ 30,000
25	Install Piezometers	250 LF	\$ 50,000 \$ 12,500
Total Bid (Items 1-54)			\$ 6,792,944
CONTINGENCY 25%			\$ 1,698,236
Cost Escalation 9%			\$ 611,365
Subtotal(rounded 1000's)			\$ 9,103,000

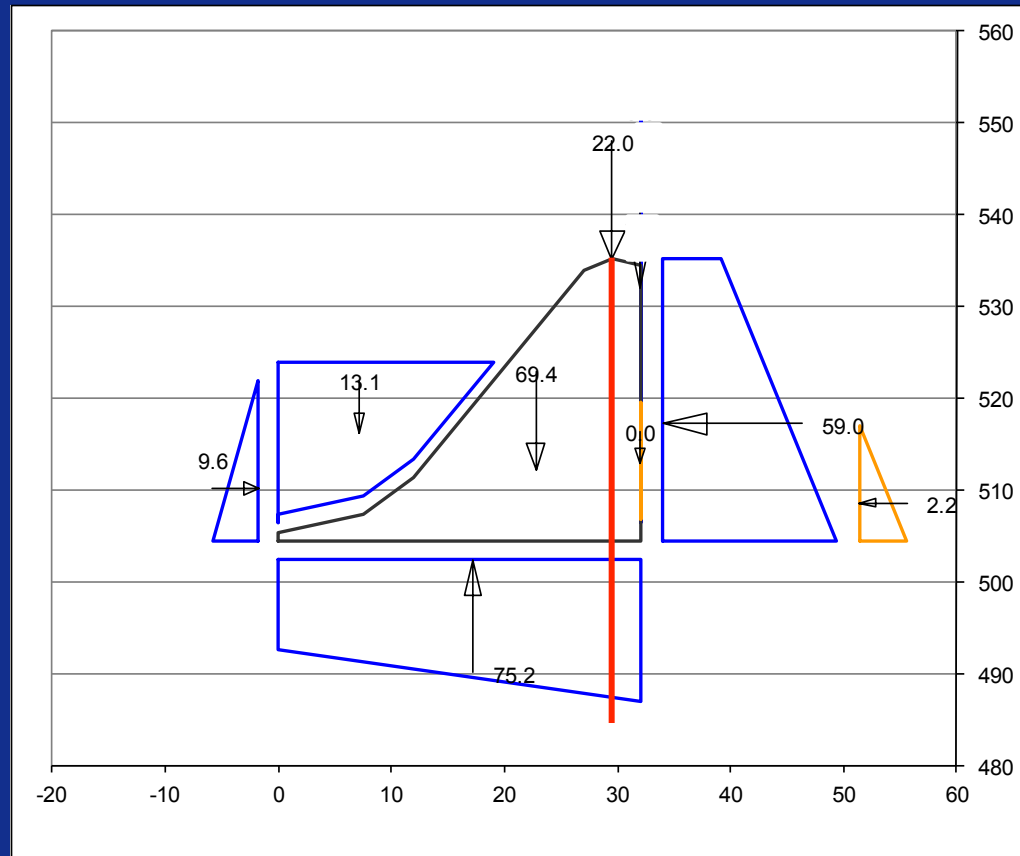
75-year fix
 2x the cost

New Dam \$ 100,000
 \$ 100,000
 \$ 1,100,000
 \$ 1,400,000
\$ 11,900,000

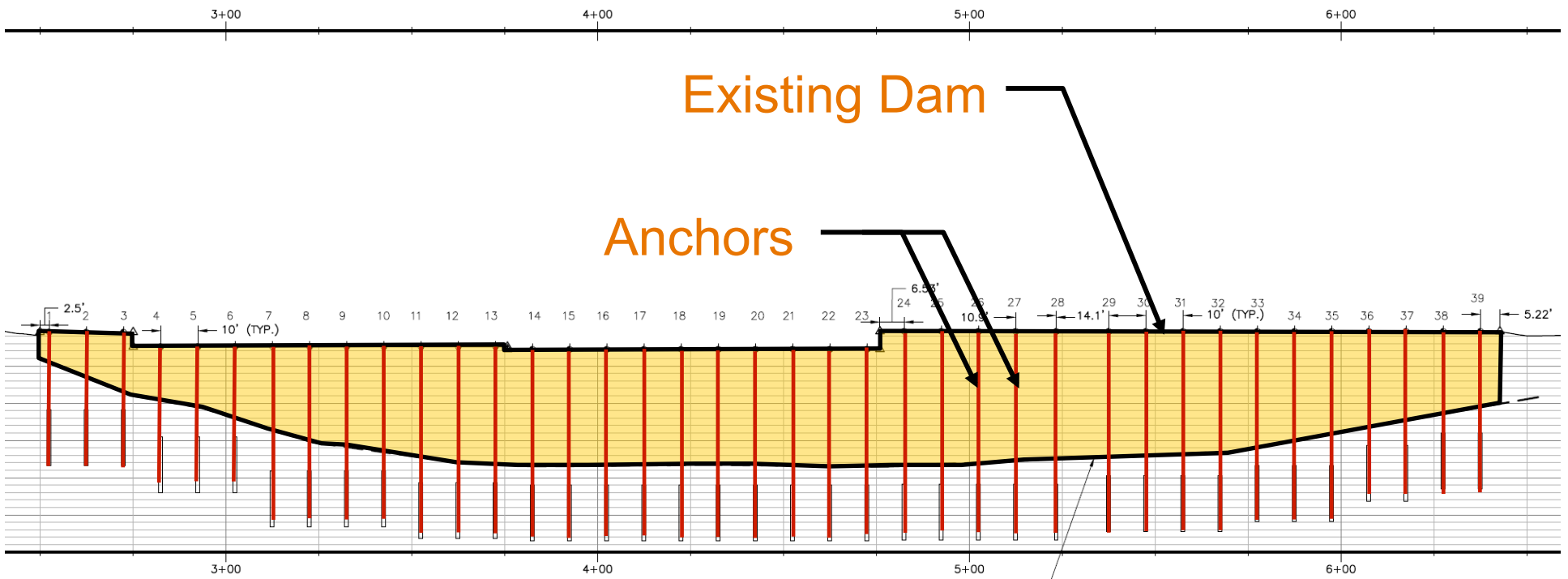


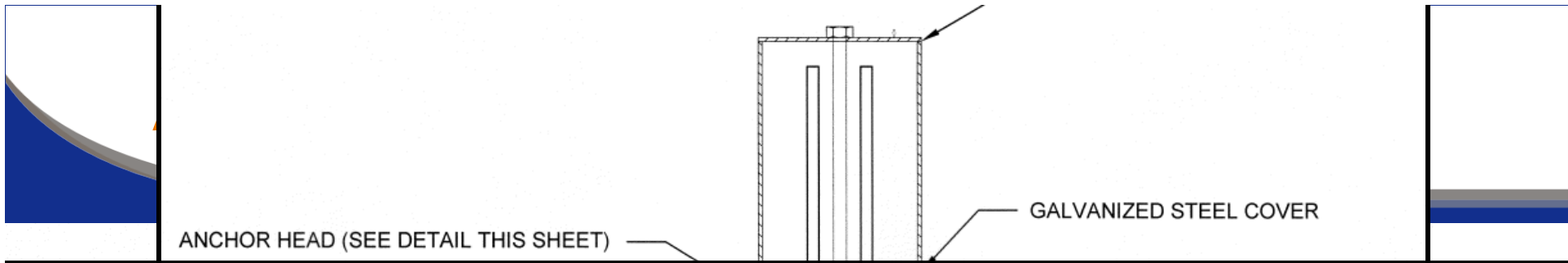
Anchor Design – Post-tensioned Load

- Global stability analysis
 - Anchor load required



Anchor Design – Layout

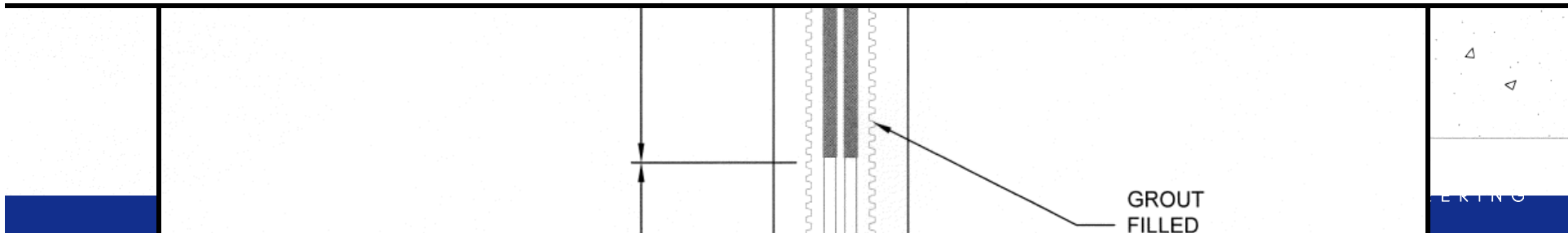
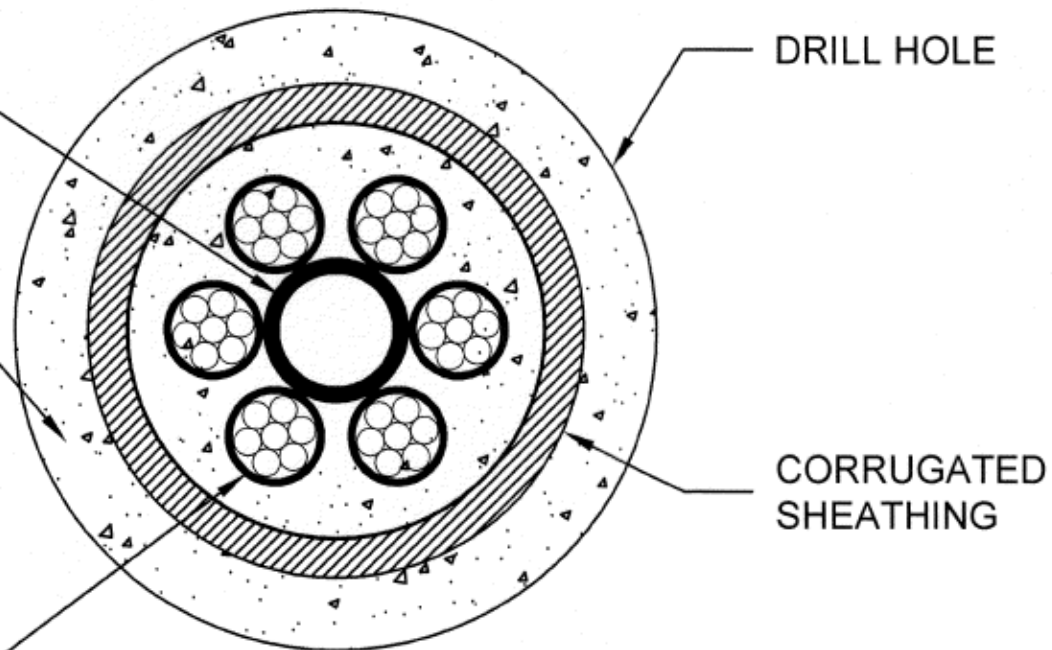




GROUT TUBE, 12" FROM BOTTOM OF ANCHOR

GROUT

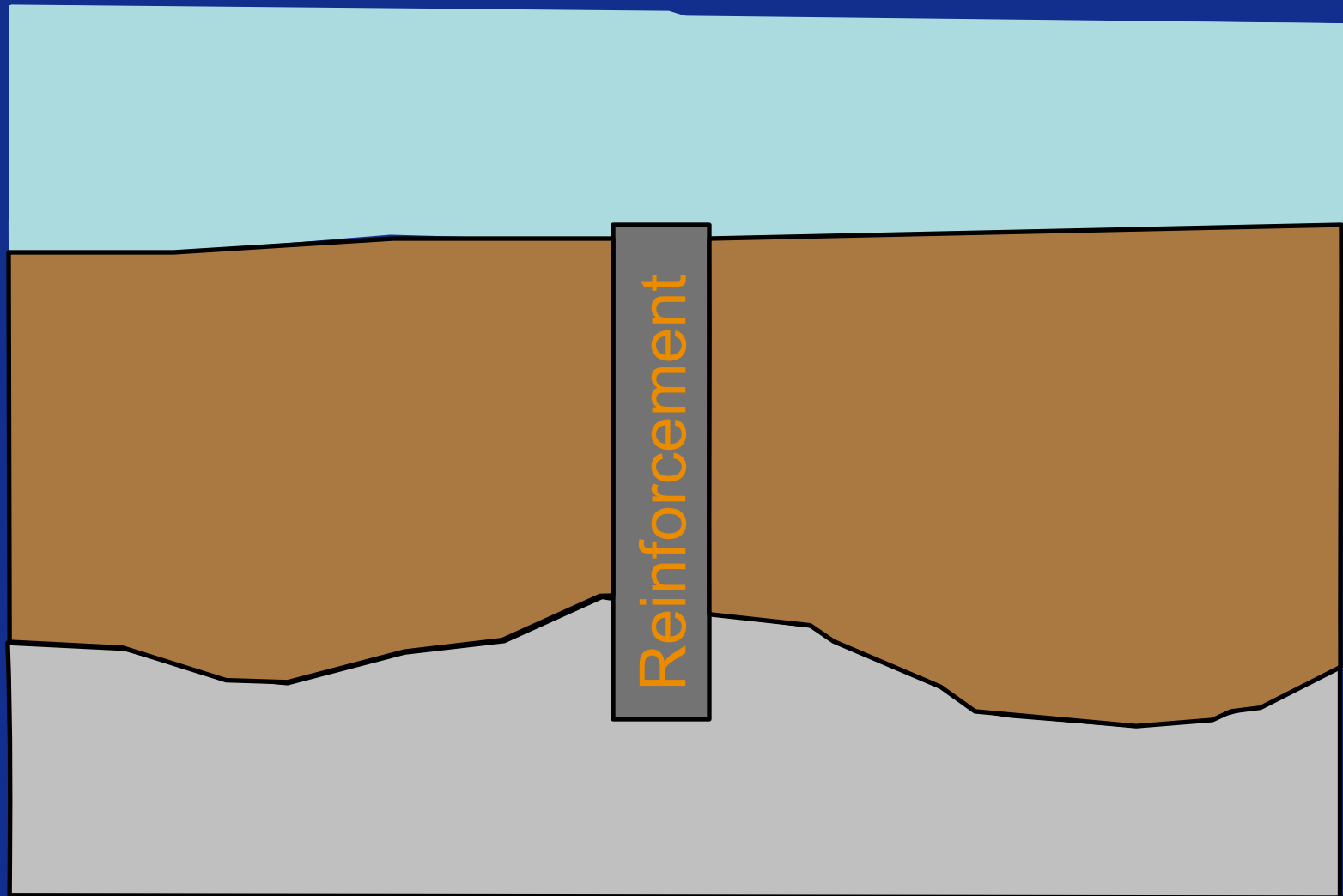
0.6" GREASED & HOT MELT EXTRUSION COATED 60 MIL HDPE STRAND, ASTM A-416



Abutment Reinforcement

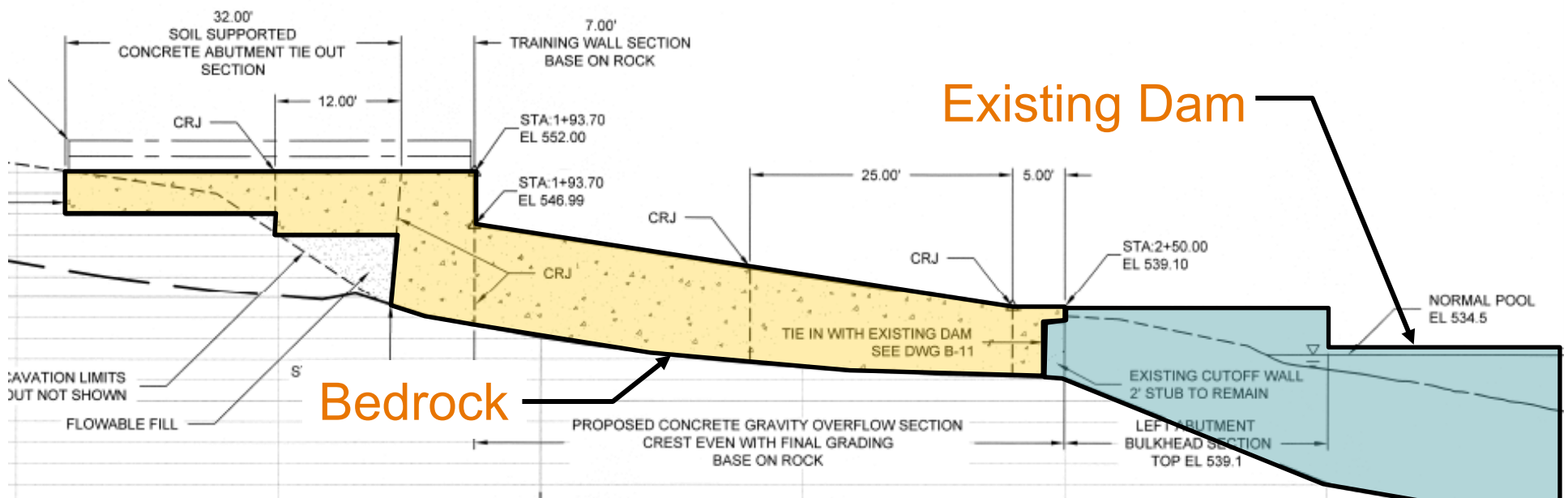
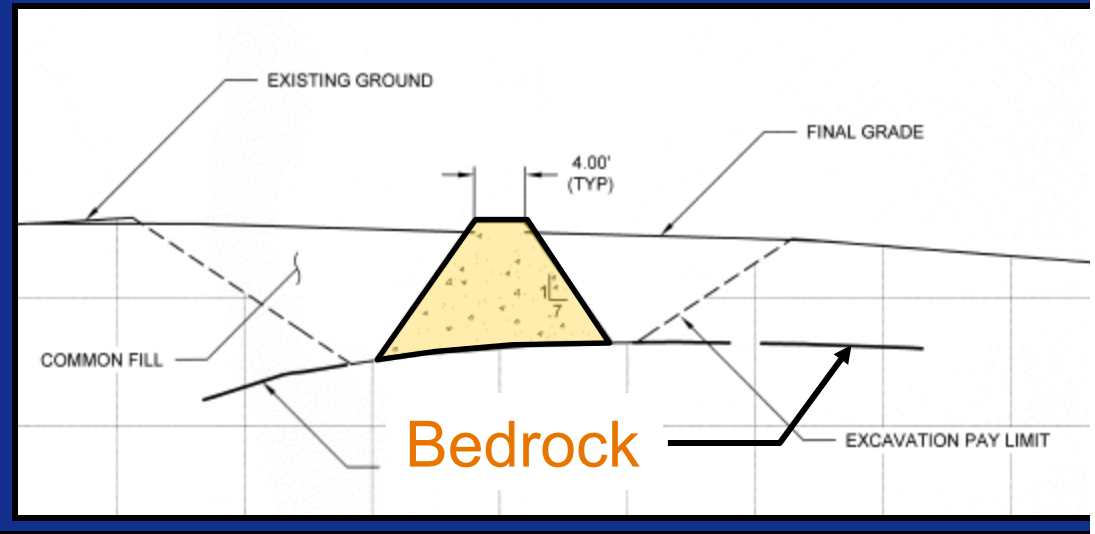
- Goals
 - Prevent breach of dam abutments during abutment overtopping
 - Maintain existing topography
- Design criteria
 - Reinforcement must be stable assuming all downstream soil is eroded

Abutment Reinforcement



Abutment Reinforcement Design

- Left abutment – buried gravity wall



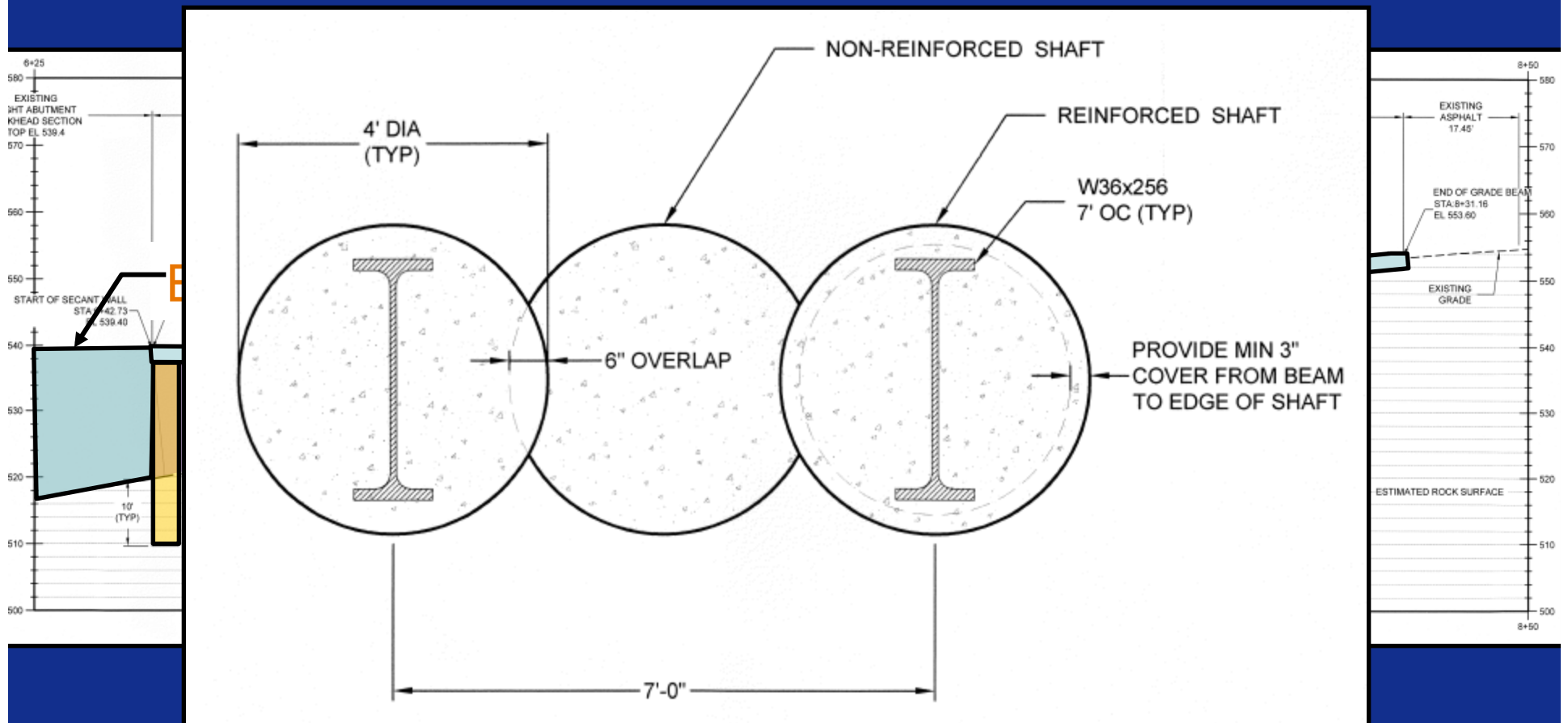
Abutment Reinforcement Design

- Right abutment – secant pile wall



Abutment Reinforcement Design

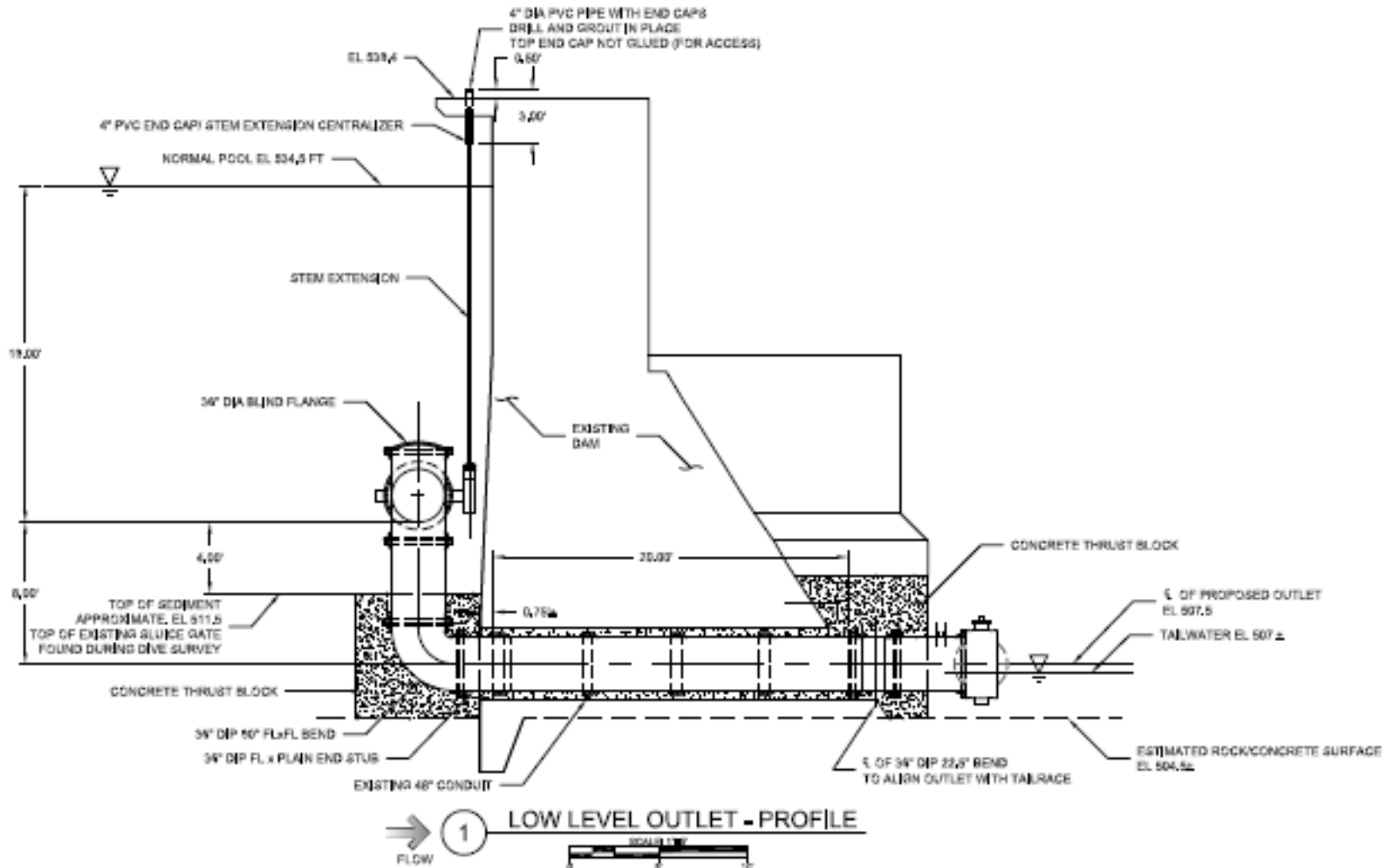
- Right abutment – secant pile wall



Construction

- Started in April 2011
- Prime Contractor: ASI Constructors, Inc.
 - Secant Wall Sub: Braymen Construction
 - Anchor Sub: Nicholson Construction

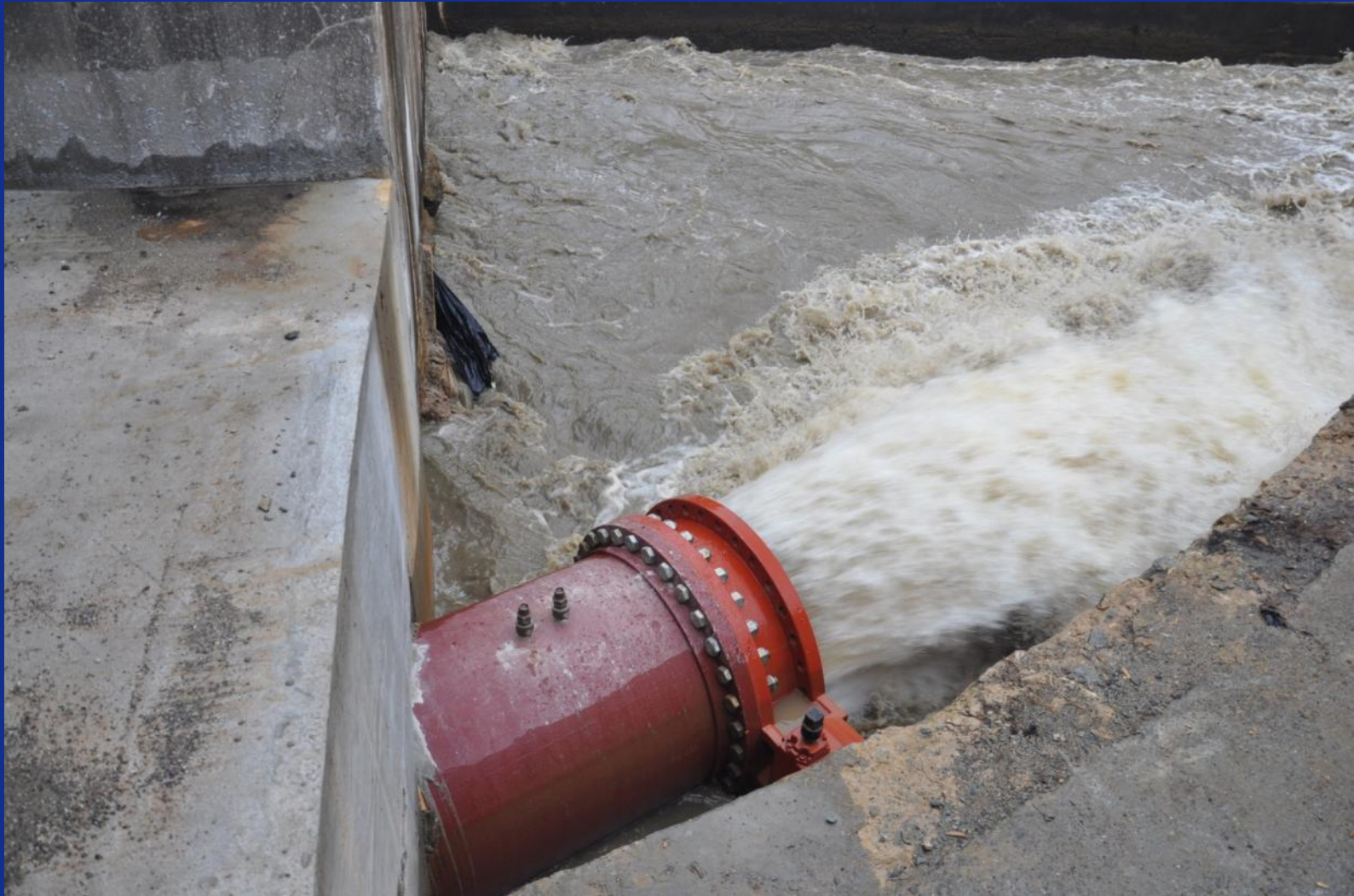
Control of Water



Start of Low Level Outlet Installation



Initial Operation



Construction Sequence

- Installation of left abutment gravity section
- Rock anchor installation
- Installation of right abutment secant wall

Left Abutment – Clearing



Left Abutment – Foundation Preparation



Left Abutment – Formwork



Left Abutment



Left Abutment – Backfill



Left Abutment – Final Grading



Anchor Installation – Access



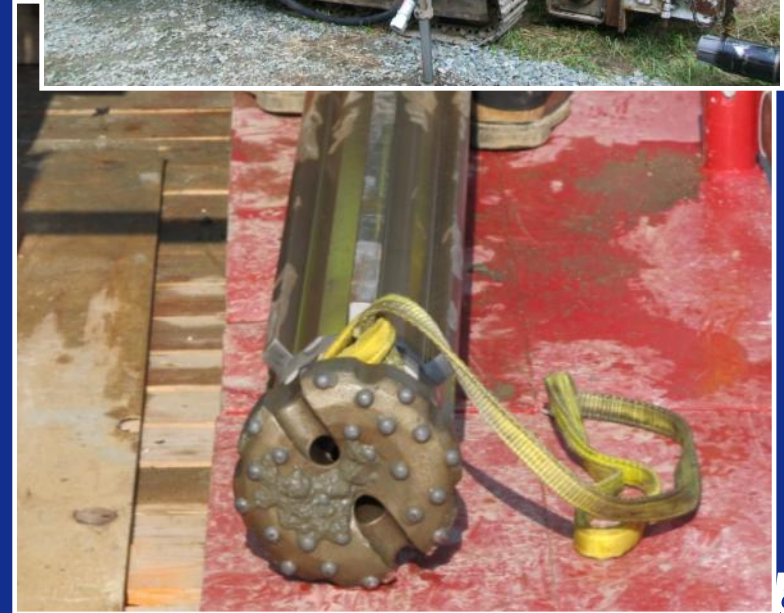
Anchor Installation – Access



Anchor Installation – Drilling



Anchor Installation – Drilling



Drilling – Cuttings Collection System



Anchor Components



Anchor Installation



Anchor Installation



Anchor Installation



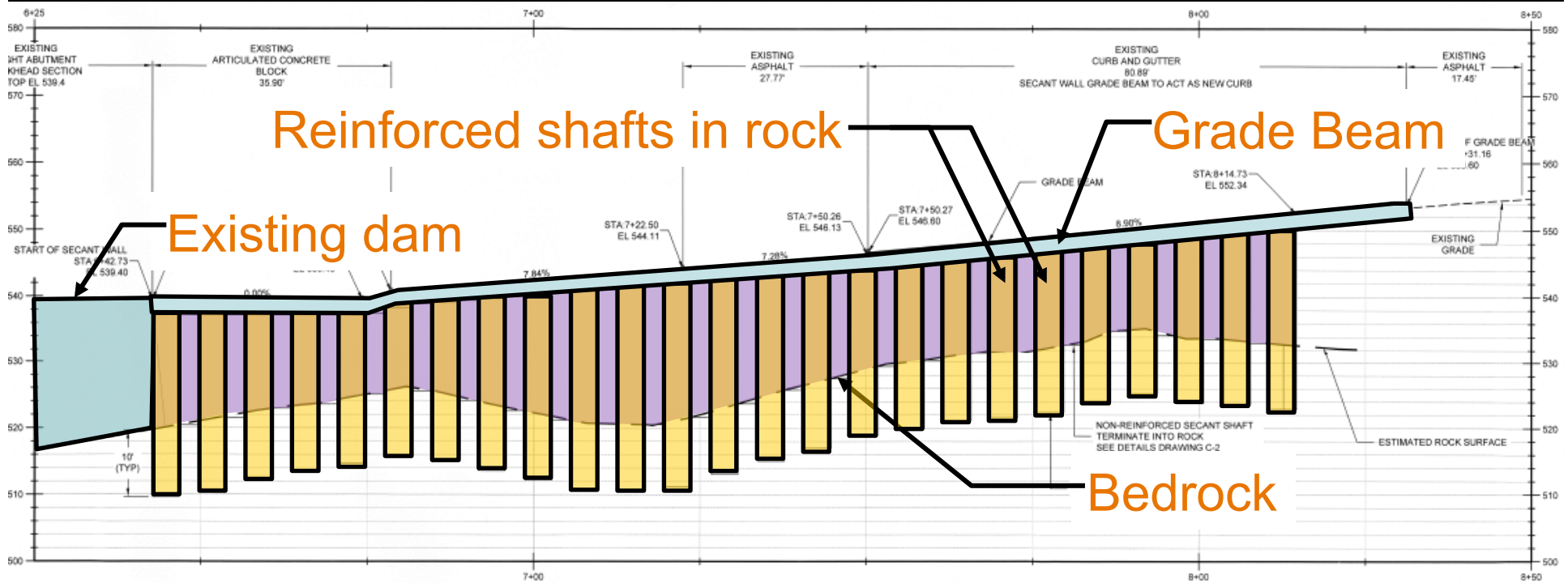
Anchors – Testing & Lockoff



Anchors – Capping and Socket Repair



Right Abutment – Secant Pile Wall



Secant Wall – Drilling Bits



Secant Wall – Soil Augering



Secant Wall – Core Barrel



Secant Wall – Reinforced Pile



Secant Wall – Piles Installed



Secant Wall – Grade Beam Reinforcement



Secant Wall – Grade Beam Placement



Completed Grade Beam and Paving Prep



Finished Product



Finished Product



Finished Product



Finished Product





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Questions & Discussion