MT. ST. HELENS SRS CREST RAISE

Jeremy Appt, PE
Portland District

Meeting with American Council of Engineering Companies
10 May 2022

US Army Corps of Engineers

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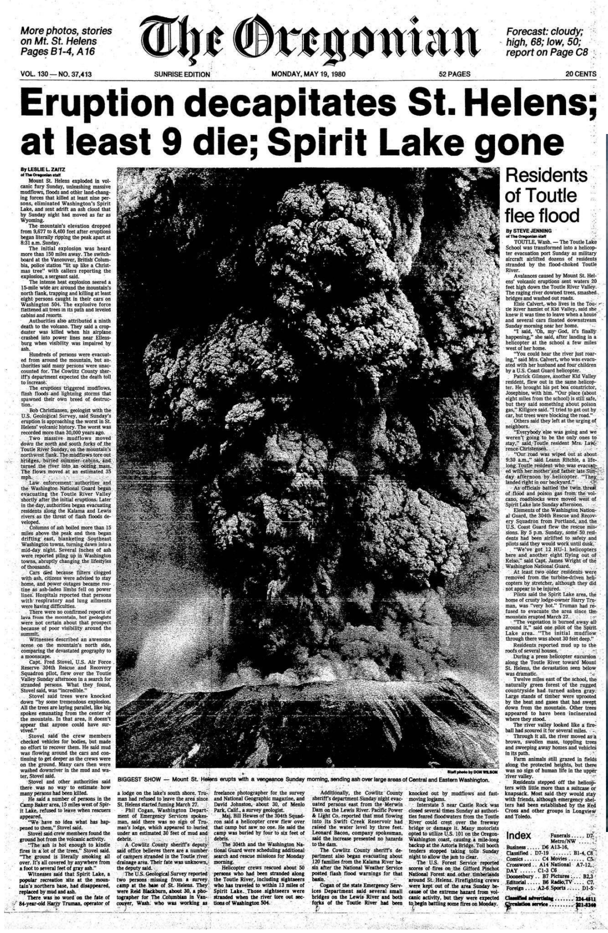
- **PROJECT OVERVIEW**
- **CREST RAISE (2012)**
- **CREST RAISE (2023)**

GENERAL BACKGROUND

US Army Corps of Engineers

- The 18 May 1980 eruption of Mount St. Helens in Washington State resulted in a debris avalanche of approximately 2.3 billion cubic meters (3 billion cubic yards).
- Sediments eroding from the avalanche and depositing downstream in the lower Cowlitz River decrease the capacity of the river and increase flood risk for downstream communities.
- In 1985 USACE, Portland District developed a 50-year plan to manage the sediment and maintain authorized flood risk levels along the Cowlitz River.
- The main feature of the plan was the Sediment Retention Structure (SRS) on the North Fork Toutle River.
- The SRS was constructed from 1987 to 1989 for the single purpose of trapping sediment eroding from the Mount St. Helens debris avalanche



More photos, stories on Mt. St. Helens Pages B1-4, A16

The Oregonian

Forecast: cloudy; high, 68; low, 50; report on Page C8

VOL. 130 — NO. 37,413 SUNRISE EDITION MONDAY, MAY 19, 1980 52 PAGES 20 CENTS

Eruption decapitates St. Helens; at least 9 die; Spirit Lake gone

By LESLIE L. ZAITZ
of The Oregonian staff

Mount St. Helens exploded in volcanic fury Sunday, unleashing massive mudflows, floods and other land-changing forces that killed at least nine persons, eliminated Washington's Spirit Lake, and sent adrift an ash cloud that by Sunday night had moved as far as Wyoming.

The mountain's elevation dropped from 9,677 to 8,400 feet after eruptions began literally ripping the peak apart at 8:31 a.m. Sunday.

The initial explosion was heard more than 150 miles away. The switchboard at the Vancouver, British Columbia, police station "lit up like a Christmas tree" with callers reporting the explosion, a sergeant said.

The intense heat explosion seered a 15-mile wide arc around the mountain's north flank, trapping and killing at least eight persons caught in their cars on Washington 504. The explosive force flattened all trees in its path and leveled cabins and resorts.

Authorities also attributed a ninth death to the volcano. They said a crop-duster was killed when his airplane crashed into power lines near Ellensburg when visibility was impaired by ash.

Hundreds of persons were evacuated from around the mountain, but authorities said many persons were unaccounted for. The Cowlitz County sheriff's department expected the death toll to increase.

The eruptions triggered mudflows, flash floods and lightning storms that spawned their own breed of destruction.

Bob Christiansen, geologist with the U.S. Geological Survey, said Sunday's eruption is approaching the worst in St. Helens' volcanic history. The worst was recorded more than 30,000 years ago.

Two massive mudflows moved down the north and south forks of the ...

Residents of Toutle flee flood

By STEVE JENNING
of The Oregonian staff

TOUTLE, Wash. — The Toutle Lake School was transformed into a helicopter evacuation port Sunday as military ...

Staff photo by DON WILSON

BIGGEST SHOW — Mount St. Helens erupts with a vengeance Sunday morning, sending ash over large areas of Central and Eastern Washington.

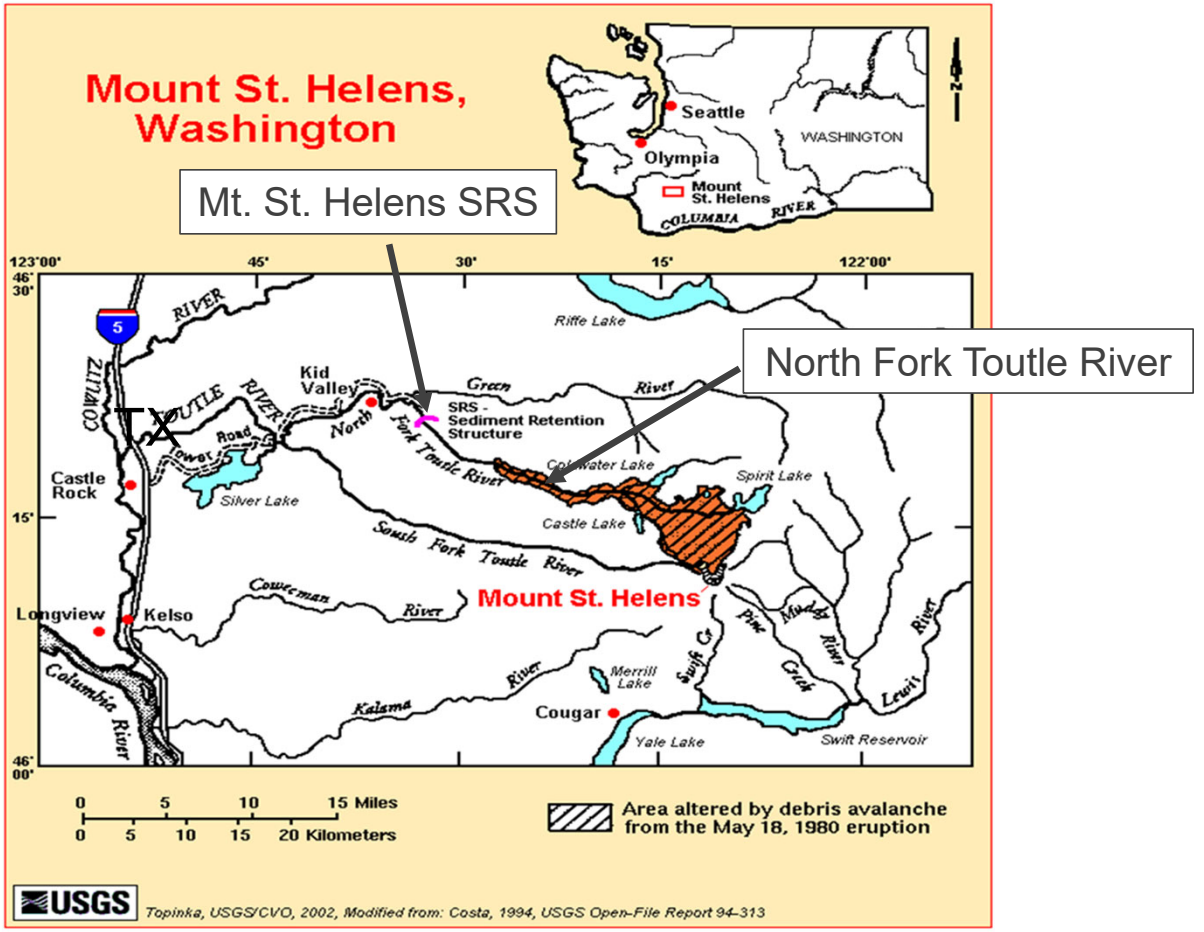
Index

PROJECT LOCATION

– Location: North Fork Toutle River
  - River mile 13.2
  - 30.5 miles above mouth of Toutle River, Washington State
  - 45 miles NNE of Portland, Oregon

– Purpose:
  - The SRS was proposed and designed as a retention structure to impound debris and sediments eroding from the North Fork Toutle River valley debris avalanche deposit.
  - The debris and sediments are a result of the eruption of Mt. St. Helens in May 1980

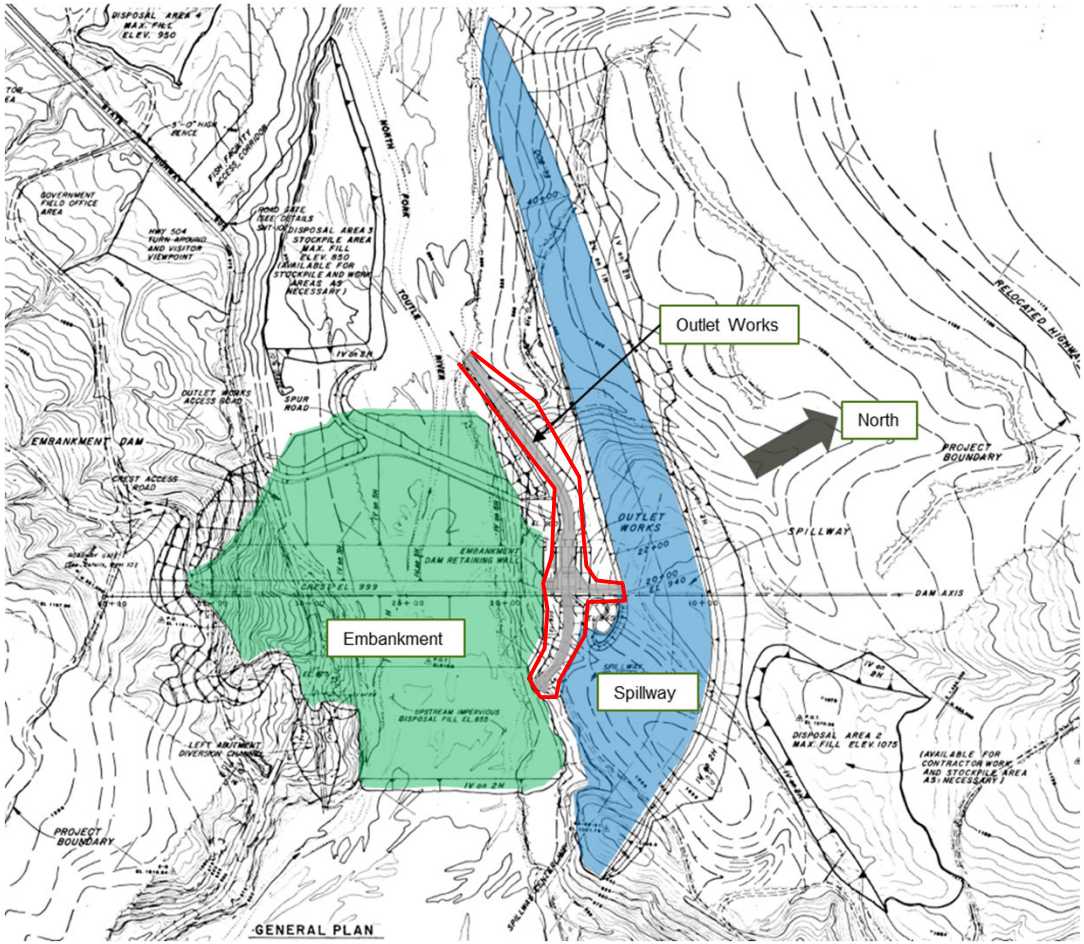
Not a dam because the long term configuration does not meet the criteria for pool head or storage volume



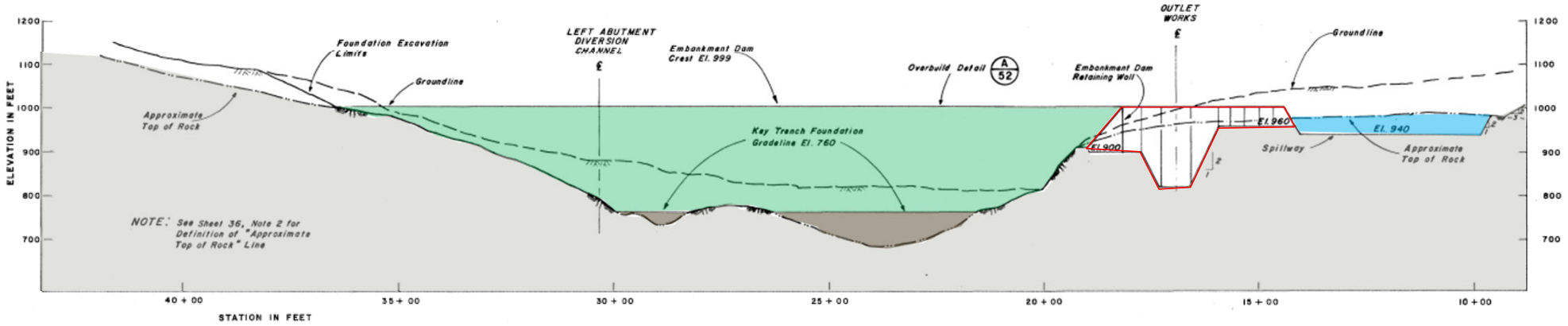
PROJECT FEATURES

US Army Corps of Engineers

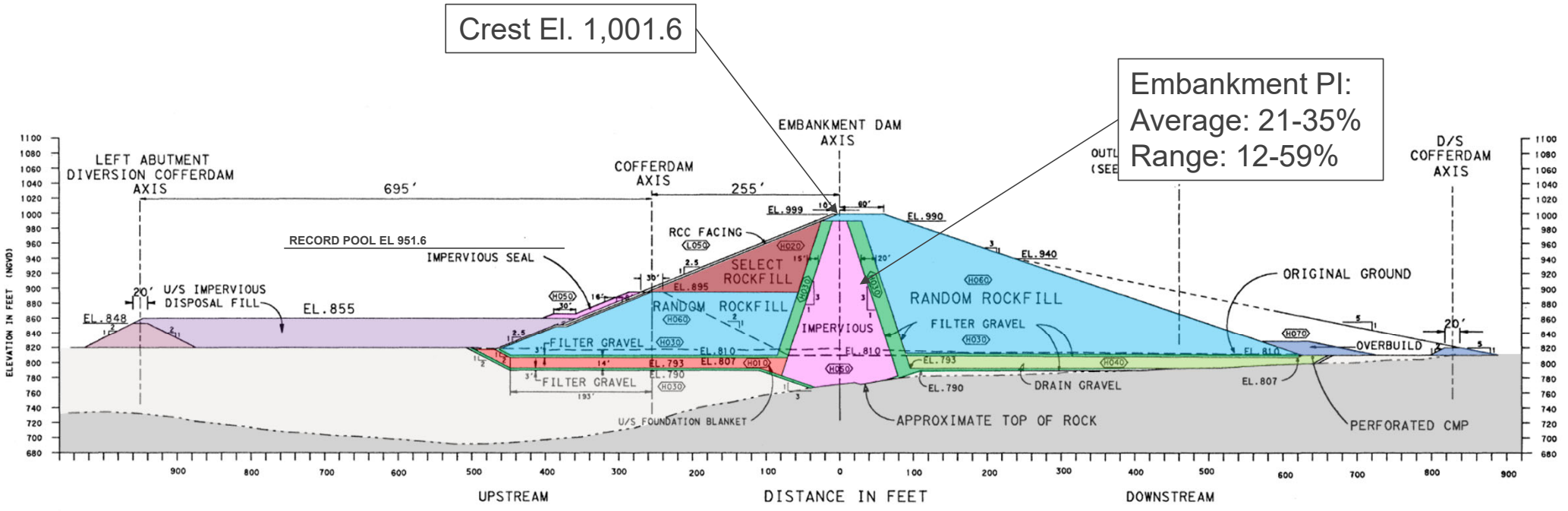
Major Project Features
– Embankment
– Outlet Works
– Spillway



EMBANKMENT DAM AXIS PROFILE



DAM CROSS SECTION AND FOUNDATION PROFILE

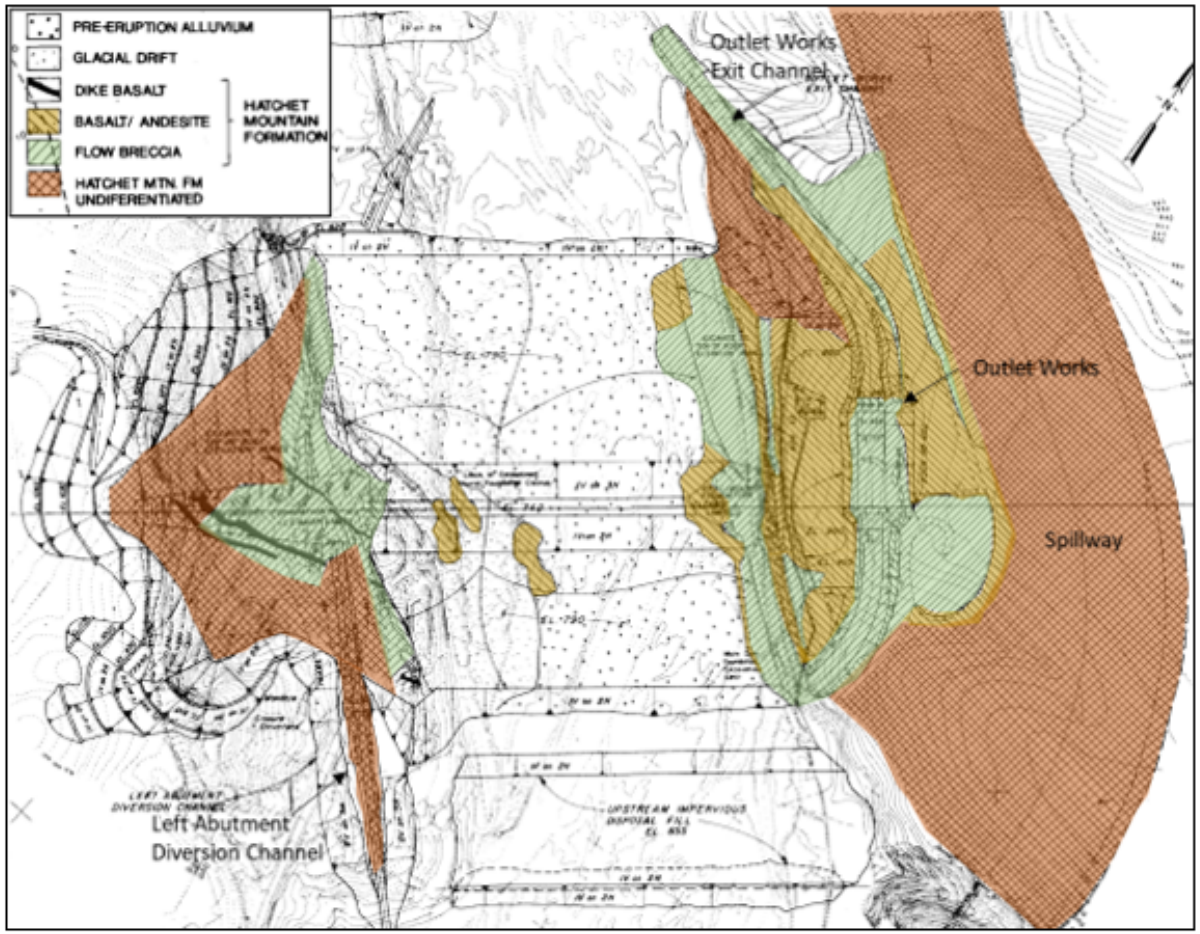


STATION 21+00 (EMBANKMENT DAM AXIS)

TAS: N/A (no active storage)

Pool of Record 954.6 ft-NAVD88 (09 Dec 2015): 80% of dam height

BEDROCK GEOLOGY



PROJECT FEATURES

US Army Corps of Engineers

Major Project Features
– Embankment
– Outlet Works
– Spillway

SPILLWAY: OVERVIEW OF CURRENT FEATURES

RCC SLAB DAMAGE/EROSION

US Army Corps of Engineers

Photo 14. Undermining downstream of RCC patch near Sta. 30+00 (April 1996).

Photo 15. Undermining left shotcrete wall upstream of RCC patch near Sta. 30+00 (April 1996).

Photo 18. Erosion and undermining downstream of RCC patch near Sta. 30+00. (July 1996).

Photo 19. Erosion and undermining downstream of RCC patch near Sta. 30+00. (date unspecified).

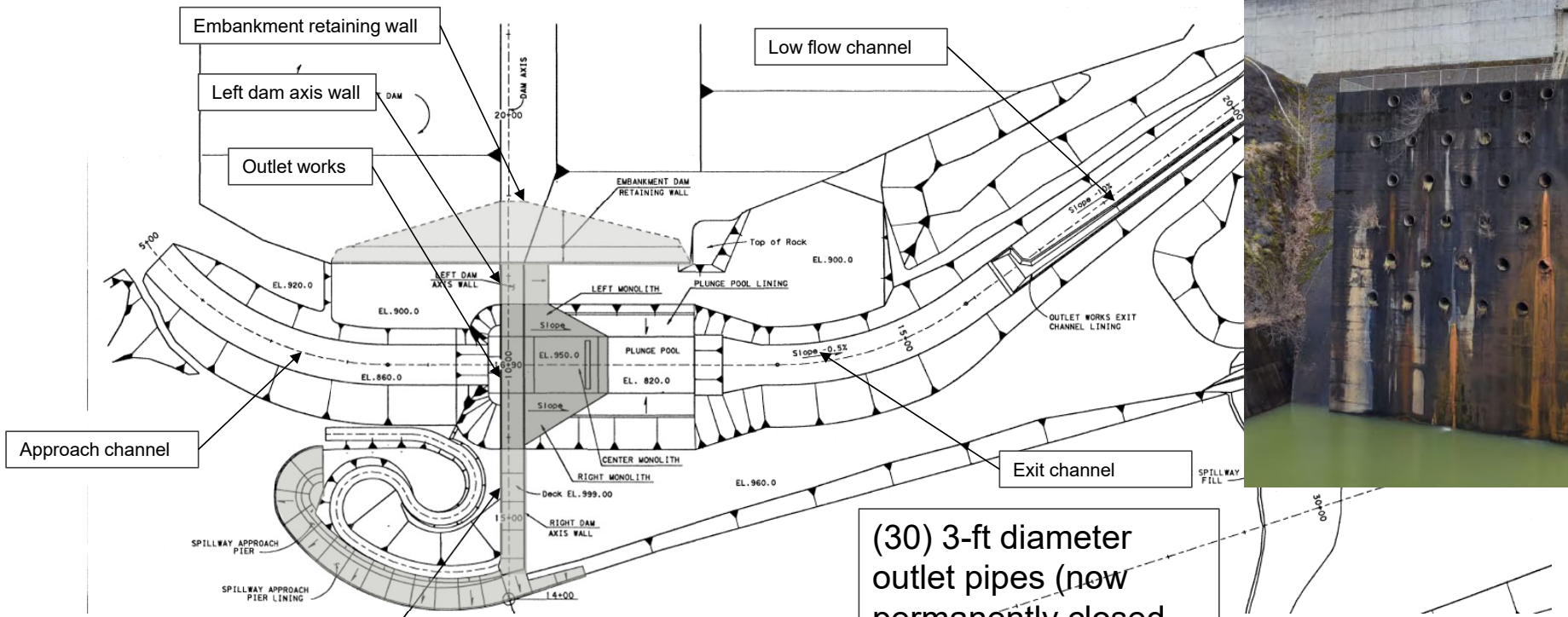
Photo 82. RCC patch at Sta 30+00. Erosion and undercutting at downstream edge.

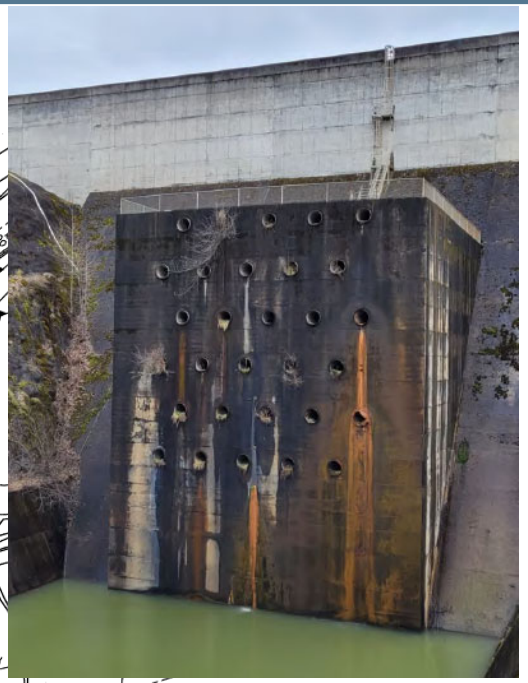
Photo 83. RCC patch at Sta 30+00. Erosion and undercutting up to approximately 3 feet at downstream edge.

SPILLWAY: 1997 SPILLWAY REPAIRS

1. Placement of RCC along the left wall of the spillway up to original spillway grade.
2. Placement of RCC along the crest to elevation 942 feet from the crest centerline to the left wall and placement of RCC from the crest centerline to about 100 feet from the right wall to protect most of the crest from erosion
3. Excavation of a notch in the existing RCC located about half-way down the spillway to facilitate water passage toward the center of the spillway and away from the left wall
4. Placement of RCC from the existing access road around the approach pier to the spillway crest to facilitate access into the spillway.

OUTLET WORKS: PLAN AND PROFILE





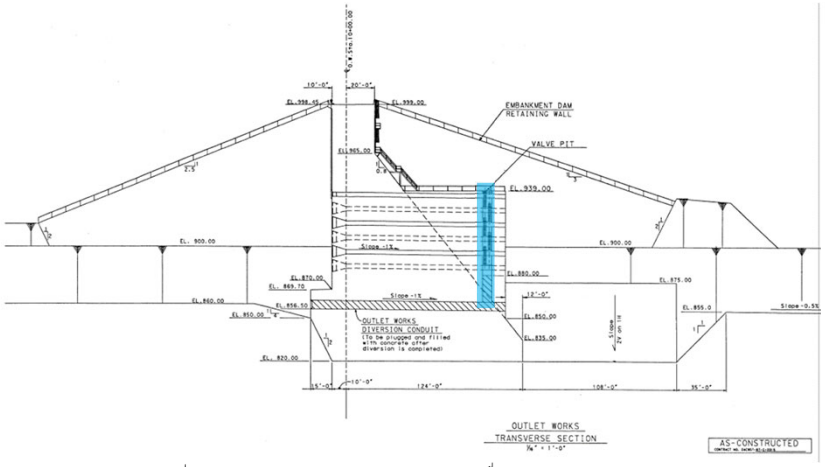
Stilling basin last dewatered: N/A

(30) 3-ft diameter outlet pipes (now permanently closed and no longer in service)

Maximum discharge capacity was: 6,375 cfs

OUTLET WORKS VALVE PIT

US Army Corps of Engineers



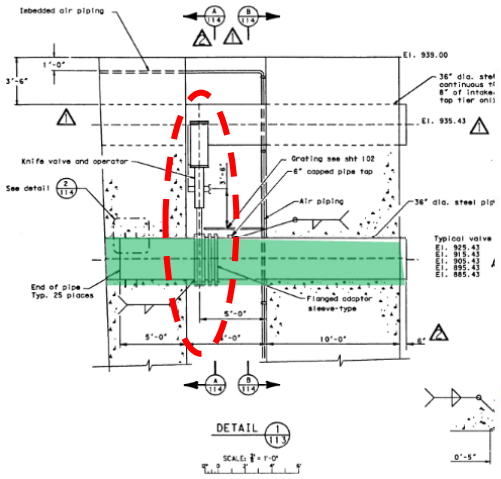
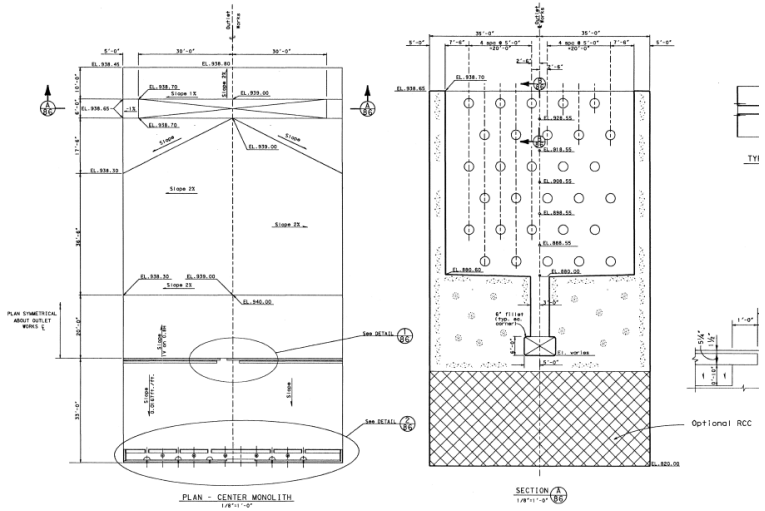


Photo 41. Sediment and water leakage on existing valves in the valve structure (same valve as previous photo after removal of some sediment).

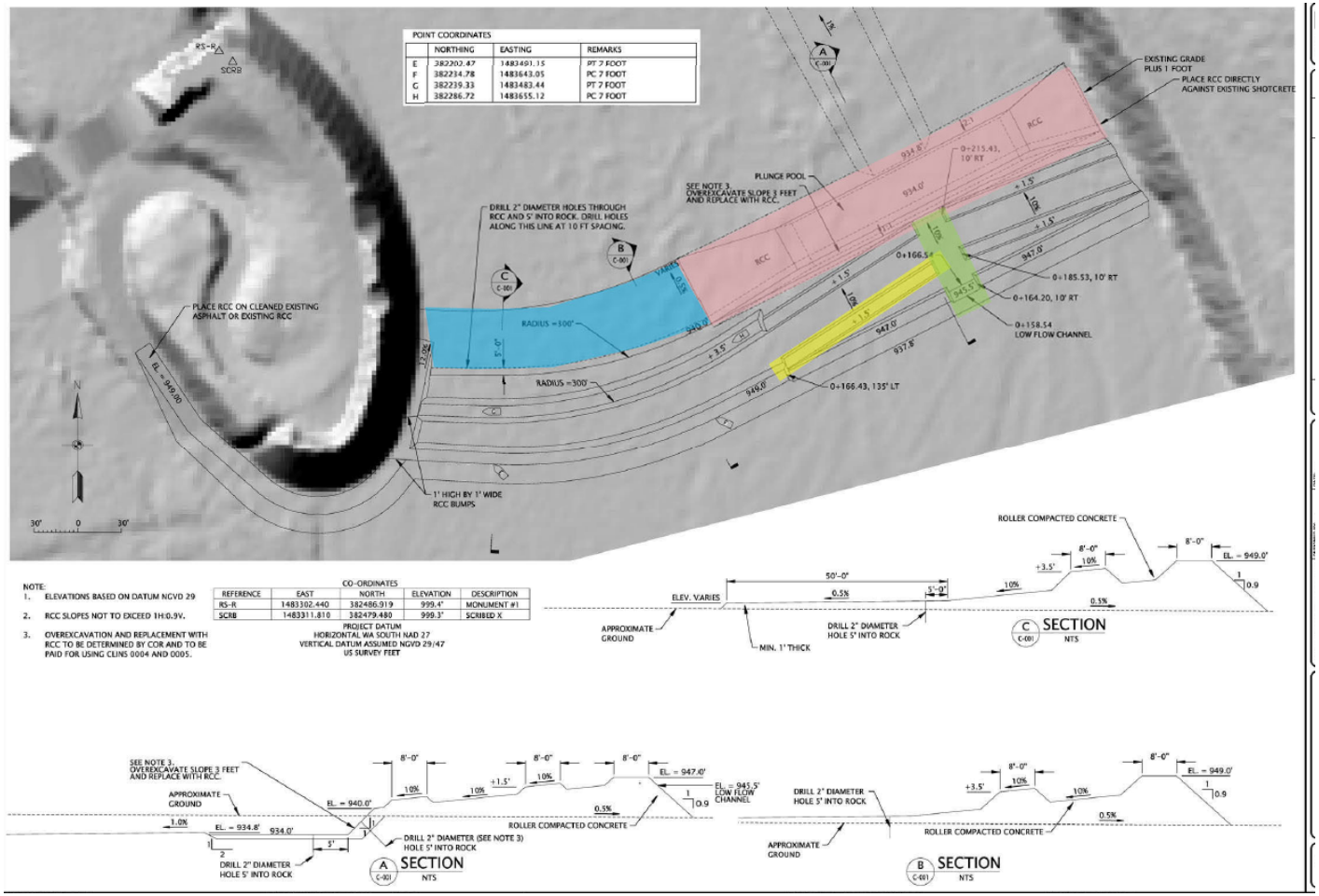


Plan to fill pit with CLSM as part of second crest raise

Photo 42. Sediment buildup on existing pipes in the valve structure.

CREST RAISE (2012)

SPILLWAY: PLAN AND PROFILE (2012 RAISE)



Crest raised 7-feet above existing (8,950 CY)

Low Flow Channel Excavation (8,660 CY)

Low flow Notch at 10% slope

Spillway crest: EL 950 ft-NAVD88 (947 ft-NGVD29)

Maximum discharge capacity: OBM of 228,000 cfs

Maximum discharge to date: 12,200 cfs (2015)

Spillway flows continuously

CREST RAISE – EAST WALL (2012)

US Army Corps of Engineers

CARE AND DIVERSION (2012)

Contractor designed cofferdams and flow conveyance

Split flow in spillway

Built the low flow section first

10 culverts for minimum flow depth of 12-inches

Designed to pass median flow for IWW period of 340 CFS

Fish Rescue Plan

ROCK EXCAVATION (2012)

Rock exposed in the low flow channel

Most excavated with a dozer and ripper hook, some required hydraulic ram on an excavator

FOUNDATION PREPARATION (2012)

Contractor tried various means and methods to prepare the foundation

- pressure wash was effective but interfered with placing RCC on dry surface
- Vacuum truck was effective but was very slow

Ultimately, Gov't approved using a sweeper

BATCH PLANT (2012)

RCC mix designed by Contractor

Issues... Government had to

- Hire a SME to provide QA/QC training
- Ordered Contractor to hire a 3rd party SME to assist with mix design and QC testing

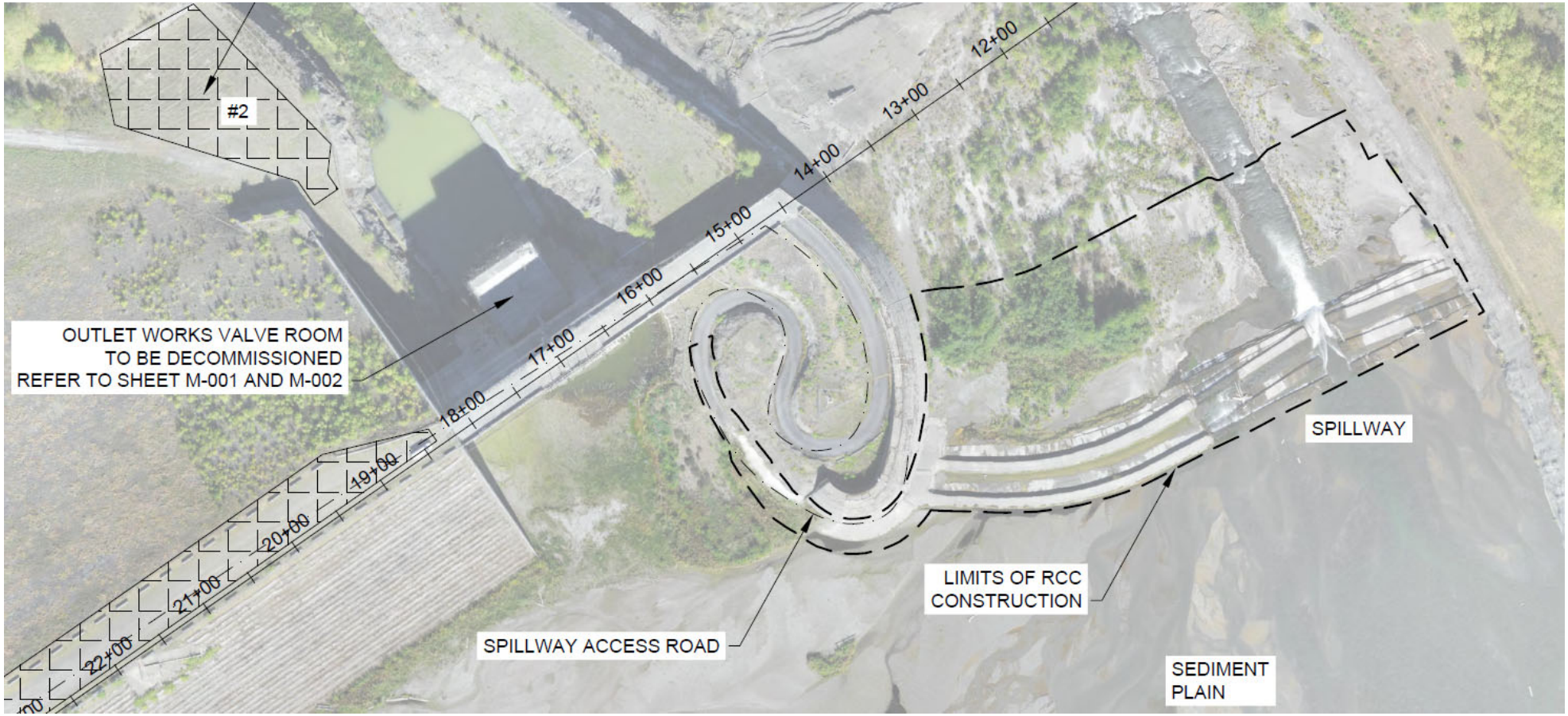
RCC TEST SECTION (2012)

Contract requirement and highly valued by both Contractor and Government

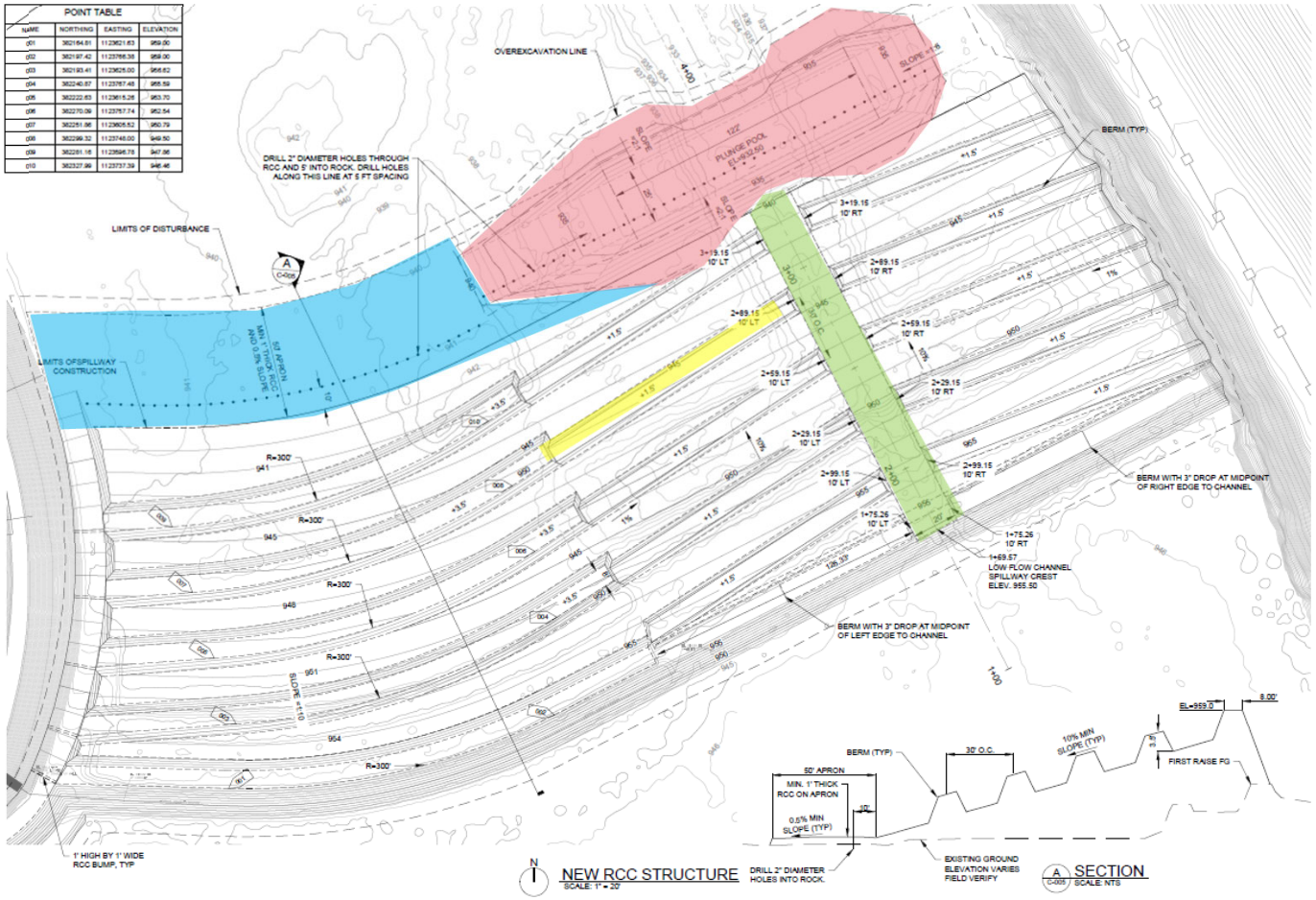
CREST RAISE (2023)

SPILLWAY RAISE PROJECT 2023

US Army Corps of Engineers



SPILLWAY (2023)



Crest raised 10-feet above existing (33,000 CY)

Plunge Pool Excavation (2,000 CY)

Low flow Notch at 10% slope
Spillway flows continuously

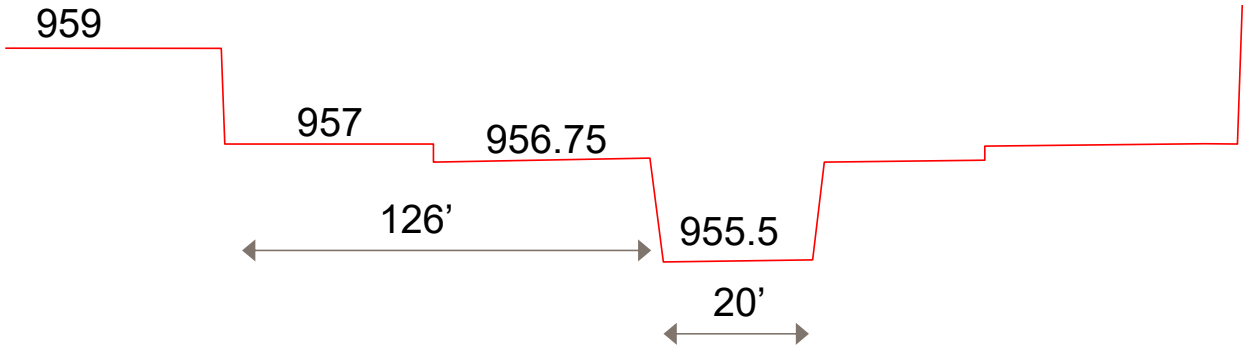
Spillway crest: 959 ft-NGVD29
Low flow notch at 955.5 ft

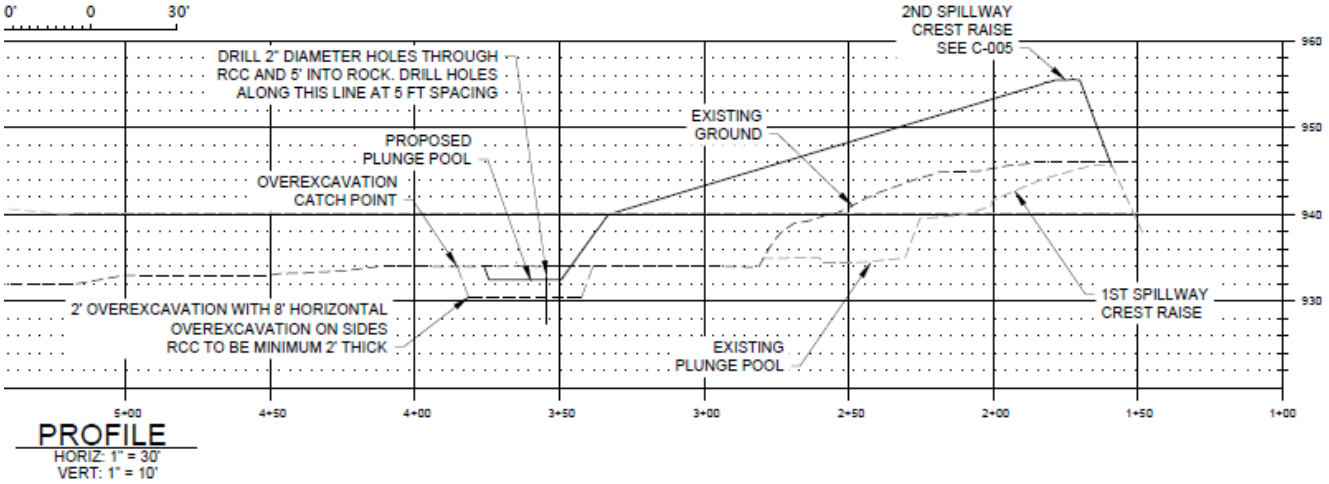
Maximum discharge capacity:
OBM of 228,000 cfs

Berms 3.5 feet high, 8 feet wide

Apron with vertical drain holes

LOW FLOW CHANNEL (2023)





Low flow Notch at 10% slope

Spillway Notch: 955.5 ft-NGVD29

3-inch bump to avoid stranding fish in low flows

Plunge Pool 2-feet deep

ISSUES (2023)

In-water Work Window (IWW) is limited
- July 1 to Oct 4

Batch plant, and test section can be done prior to entering spillway

Outlet Works can be decommissioned any time

RCC placement volume is 3-times that placed for first raise and the contractor barely made it
RCC Placement

River diversion must maintain flow for fish during transition. Siphons may be required to get over first raise

Traffic will be high volume and space is limited

Most labs do not have ERDC validation for the testing of RCC and it takes $ + 90-days

Acquisition

Industry Days planned for mid-May
- SAM.gov for details

- Full and open competition using Best Value Trade Off (BVTO)

END

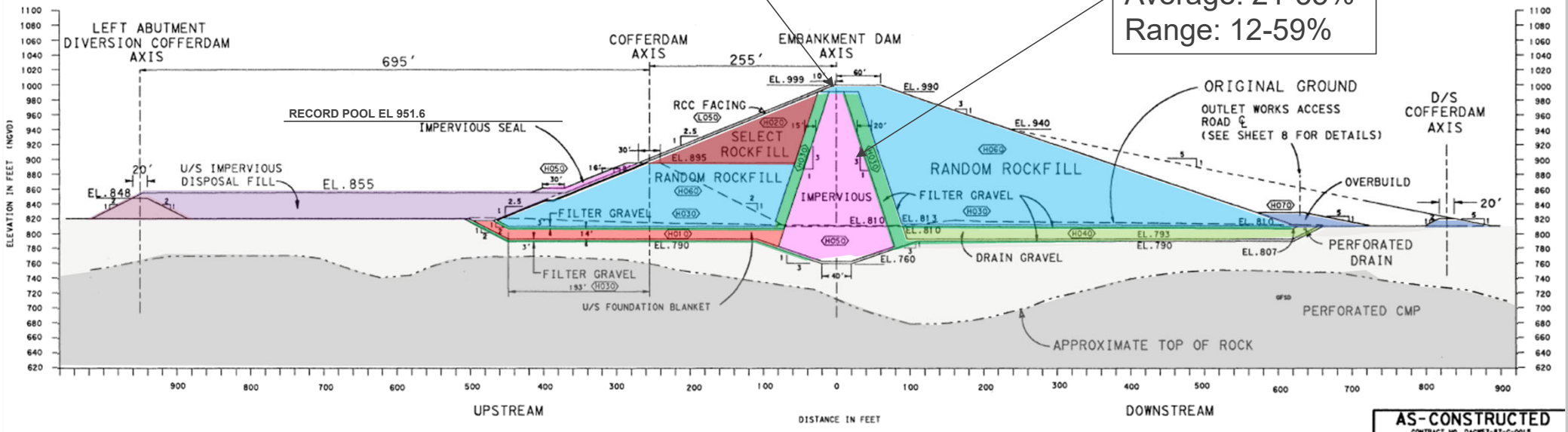
US Army Corps of Engineers

DAM CROSS SECTION AND FOUNDATION PROFILE

US Army Corps of Engineers

Crest El. 1,001.6

Embankment PI:
Average: 21-35%
Range: 12-59%



PAYMENT ITEMS

H01 FOUNDATION BLANKET

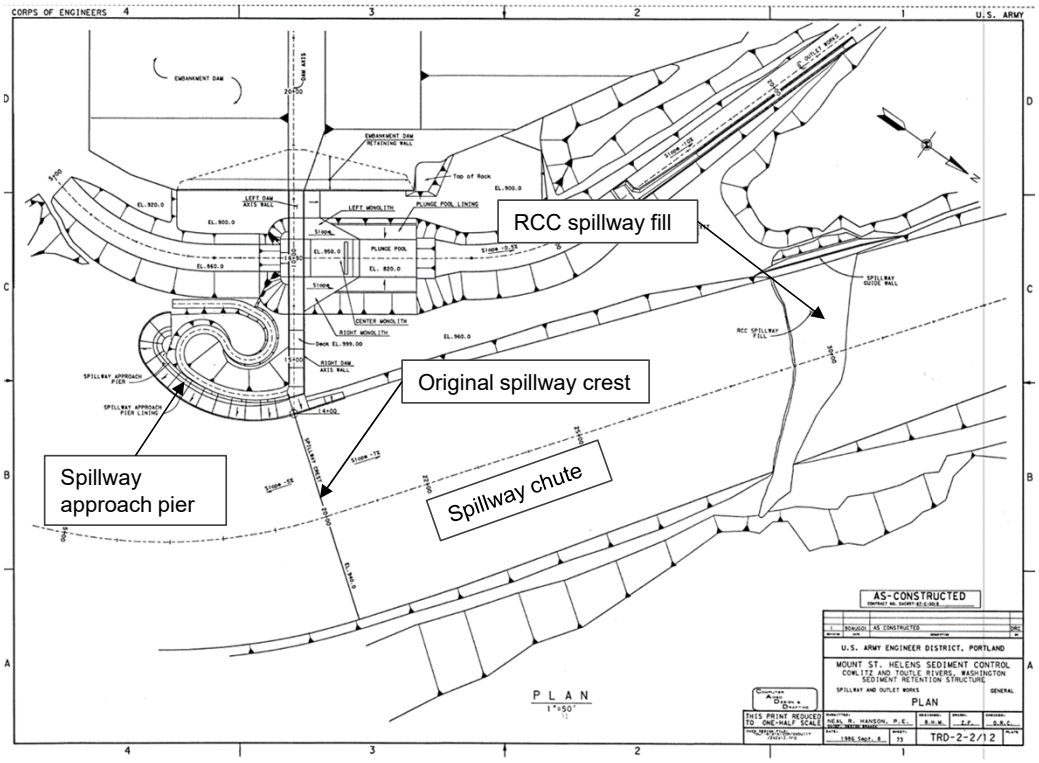
STATION 25+00 (EMBANKMENT DAM AXIS)

AS-CONSTRUCTED
CONTRACT NO. DACW57-87-C-0015

TAS: N/A (no active storage)

Pool of Record 954.6 ft-NAVD88 (09 Dec 2015): 80% of dam height

SPILLWAY: PLAN AND PROFILE (ORIGINAL)



Type and number of gates: N/A

Original spillway crest: EL 943 ft-NAVD88 (940 ft-NGVD29) (1/1 AEP, always flowing)

Maximum discharge capacity: 228,000 cfs

Maximum discharge to date: 12,200 cfs (2015)

Spillway flows continuously

Vulnerabilities: Failing shotcrete walls, vegetation, erosion and damage to RCC spillway fill

Performance: Acceptable performance to date. Repair in 1997 following initial flows

Spillway crest raised 7 feet with RCC in 2012 to EL 950 ft-NAVD88 (947 ft-NGVD29).

OUTLET WORKS: PLAN AND PROFILE