



# Gabbert Reservoir Seismic Upgrade Project

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May 9, 2014



SHANNON & WILSON, INC.  
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

# Existing 200,000 gallon Gabbert Reservoir



- Welded steel standpipe, constructed 1969
- Diameter = 24 ft
- Water Depth to Overflow = 60 ft
- Serves 130 customers in City's highest service level
- Supplied by Gabbert Pump Station

# Reservoir Replacement Alternative

- 1999 Seismic Evaluation
- 2006 Master Plan
- 2011 Cleaning & Inspection
- 2011 Geotechnical Investigation
- 2012 Preliminary Design

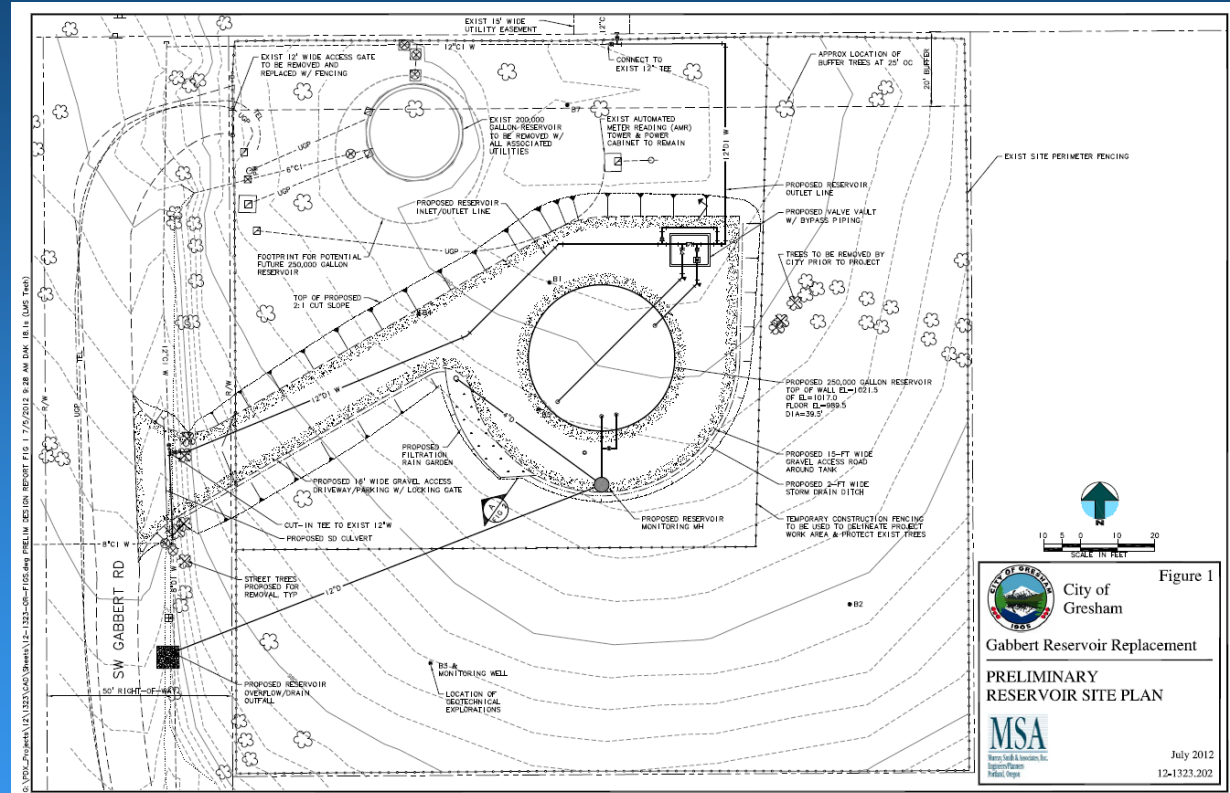


Figure 1  
City of Gresham  
Gabbert Reservoir Replacement  
PRELIMINARY  
RESERVOIR SITE PLAN  
MSA  
Murray, Sells & Associates, Inc.  
Engineers/Architects  
July 2012  
12-1323-202

# Rehabilitation and Seismic Upgrade Alternative



- Seismic upgrade
- Recoating
- Safety Improvements
- Piping Improvements & Access road paving

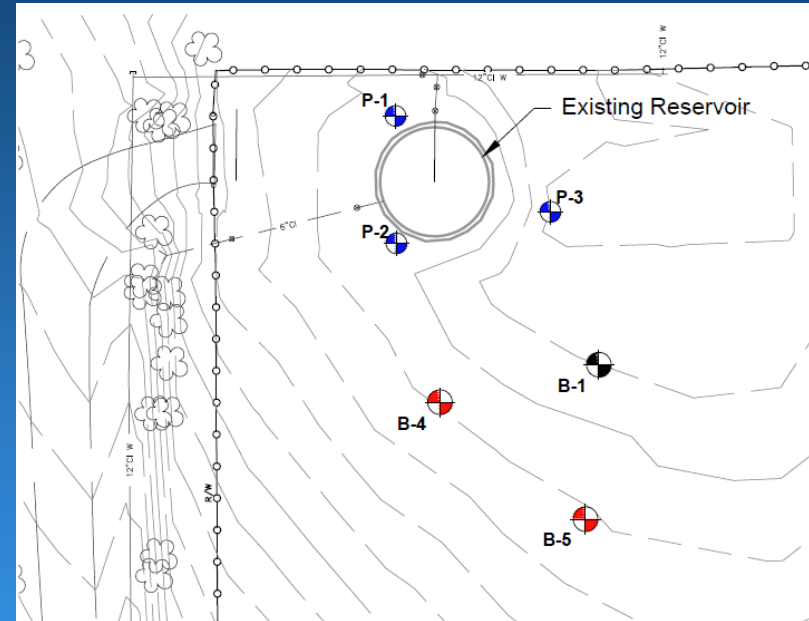
# Geotechnical Findings

## Borings:

- Soft Soils in Upper 25 feet
- High Plasticity Soils
- No Shallow Groundwater

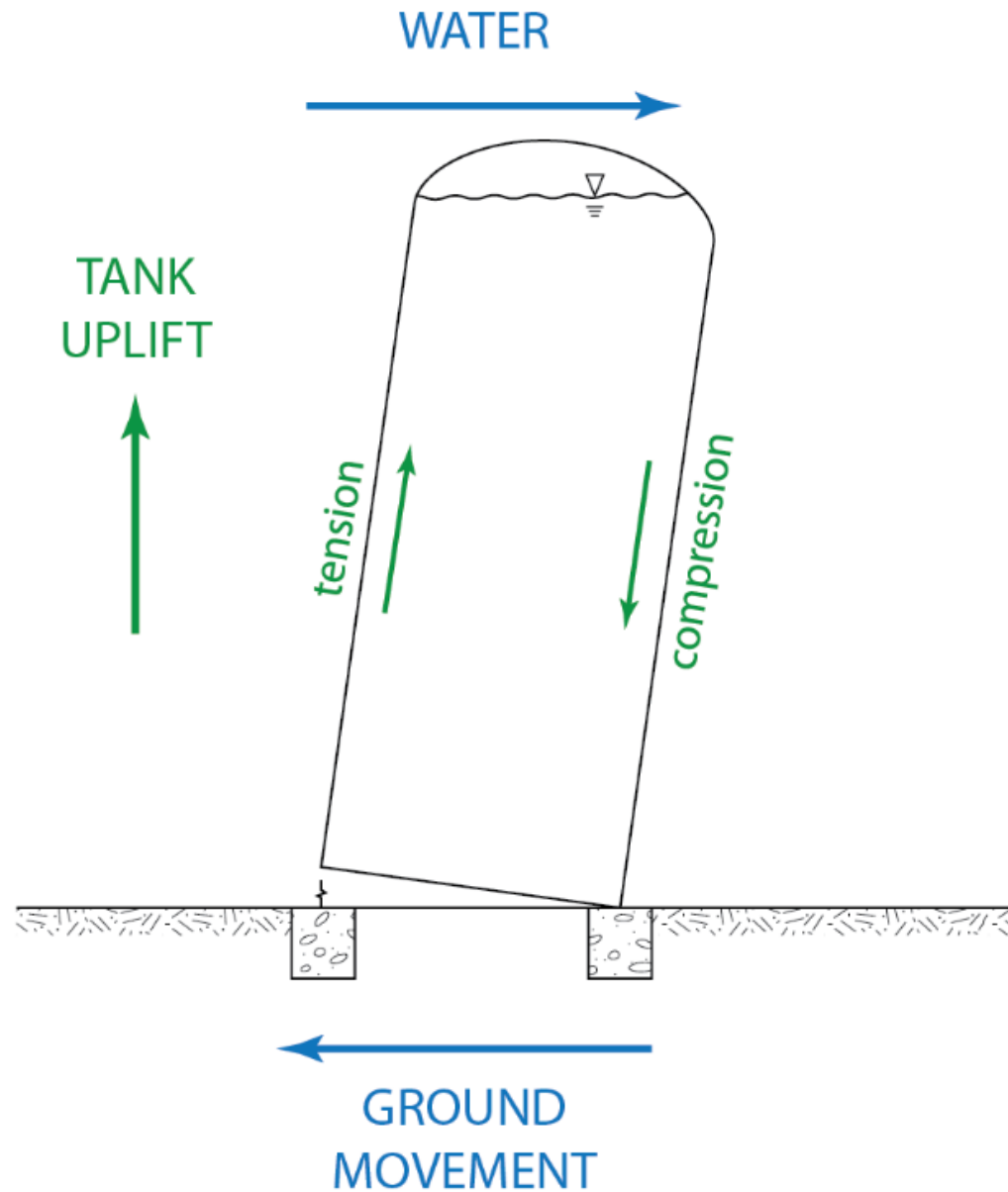
## Probes:

- Basalt at 40 to 65 feet deep

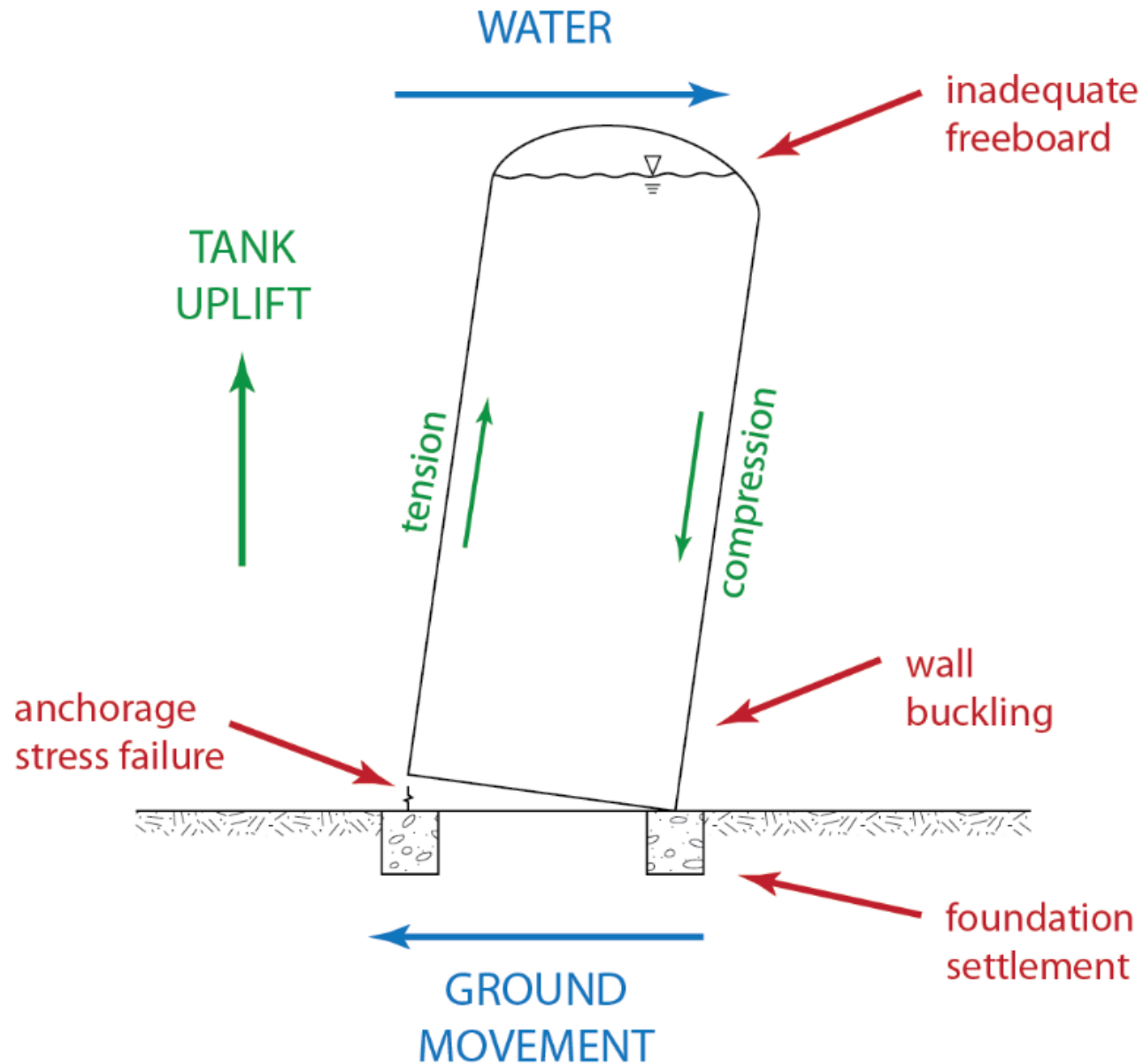


**Primary concern: Seismic induced settlement**

# Seismic Stresses & Key Issues:

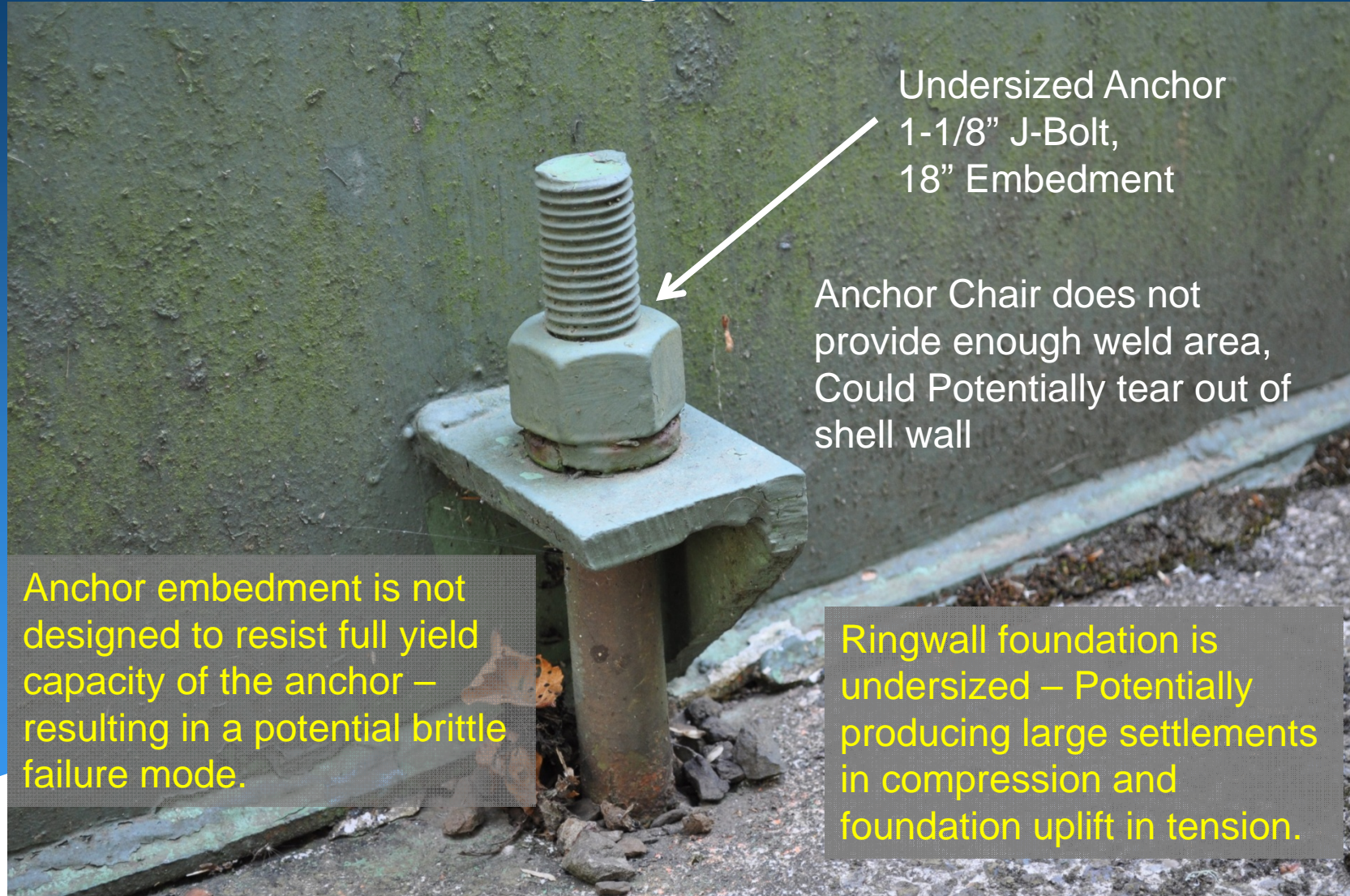


# Seismic Stresses & Key Issues:



## Code Level Seismic & Wind Load Analysis:

- AWWA D100-05 & 2010 Oregon Structural Specialty Code



Undersized Anchor  
1-1/8" J-Bolt,  
18" Embedment

Anchor Chair does not  
provide enough weld area,  
Could Potentially tear out of  
shell wall

Anchor embedment is not  
designed to resist full yield  
capacity of the anchor –  
resulting in a potential brittle  
failure mode.

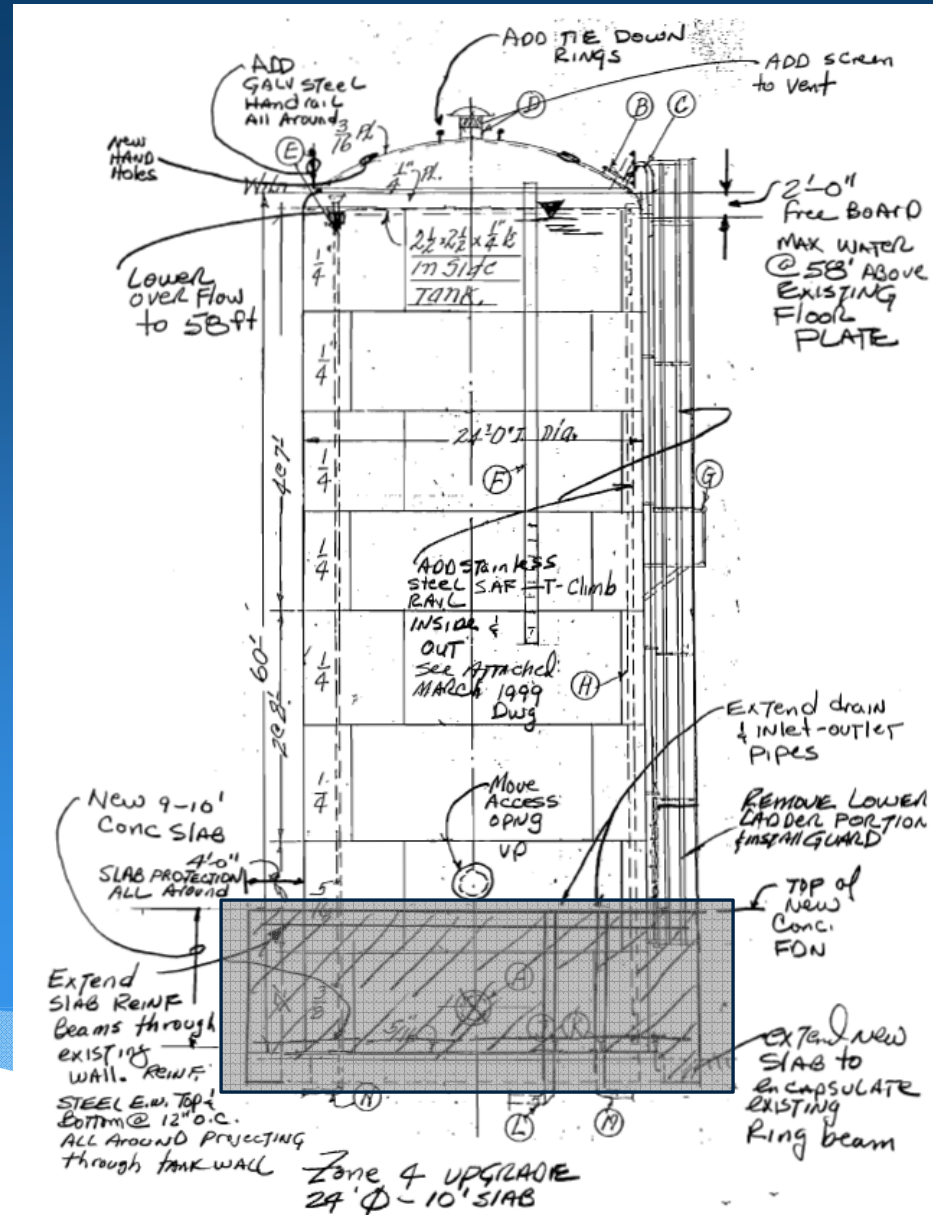
Ringwall foundation is  
undersized – Potentially  
producing large settlements  
in compression and  
foundation uplift in tension.



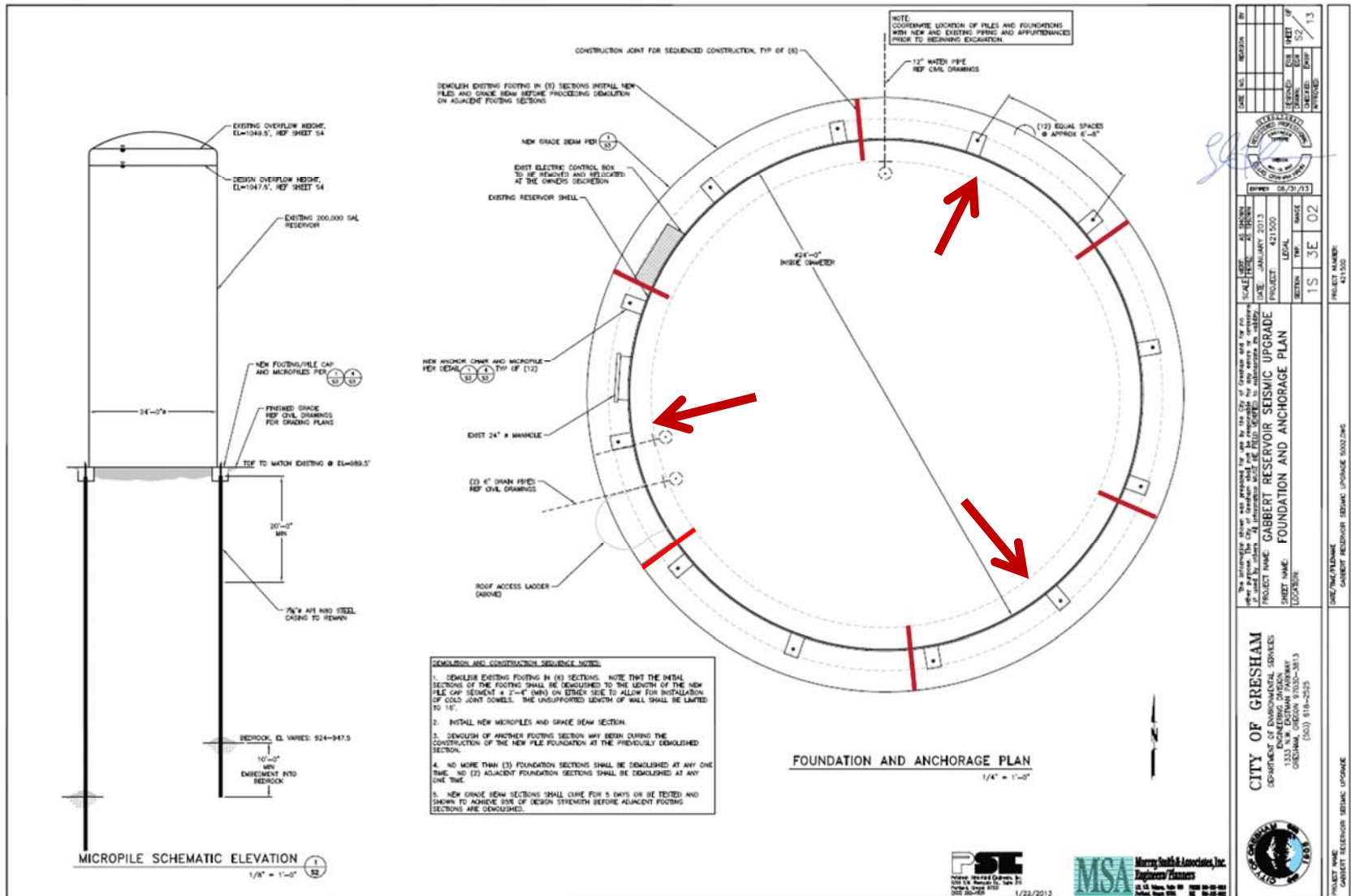
# Resisting Tank Overturn

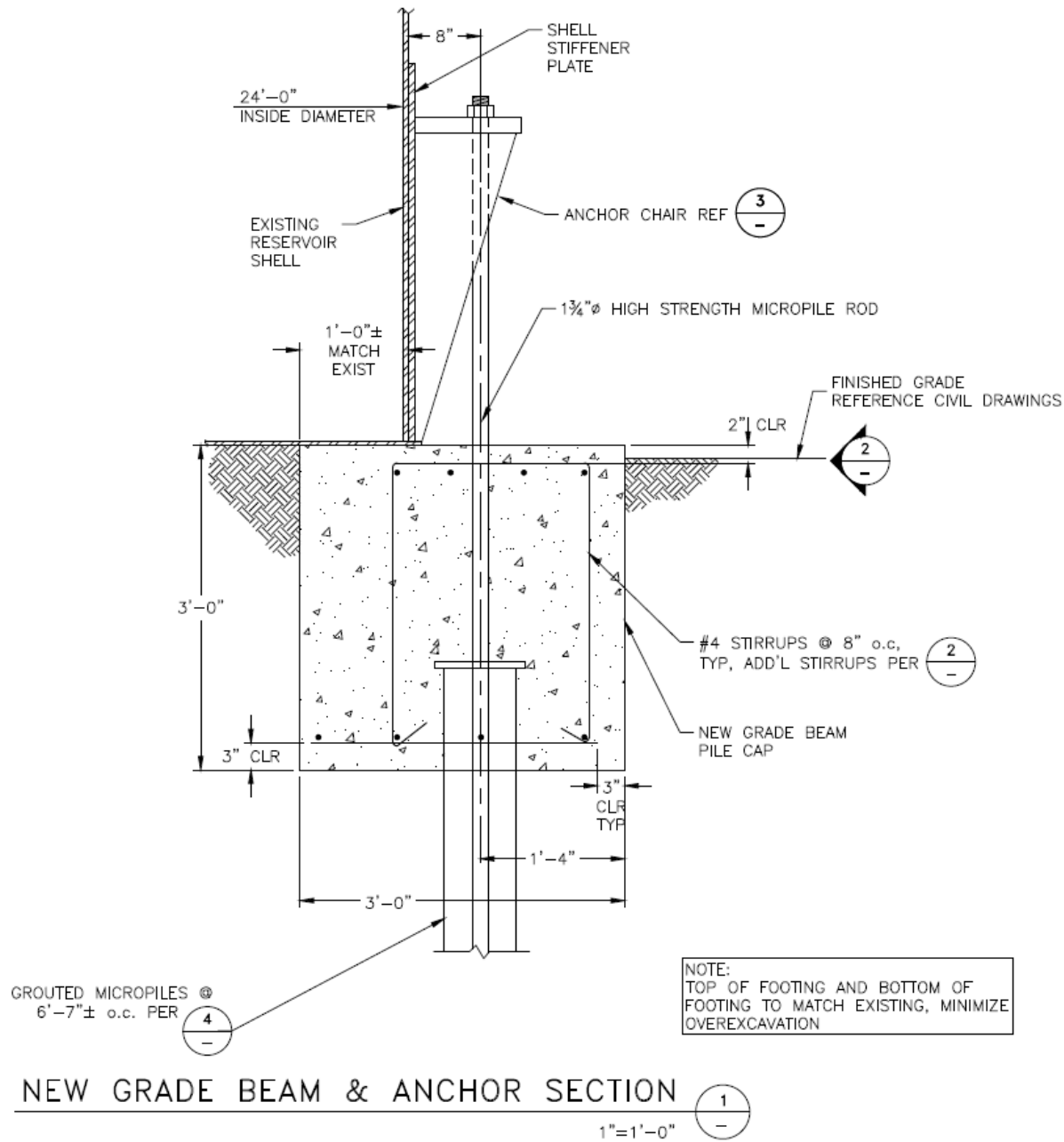
- Improve anchorage
- Improve foundation
- Ballast or Piles?

1999 - Zone 4 upgrade  
 10' thick ballast slab  
 Storage loss & potential  
 settlement



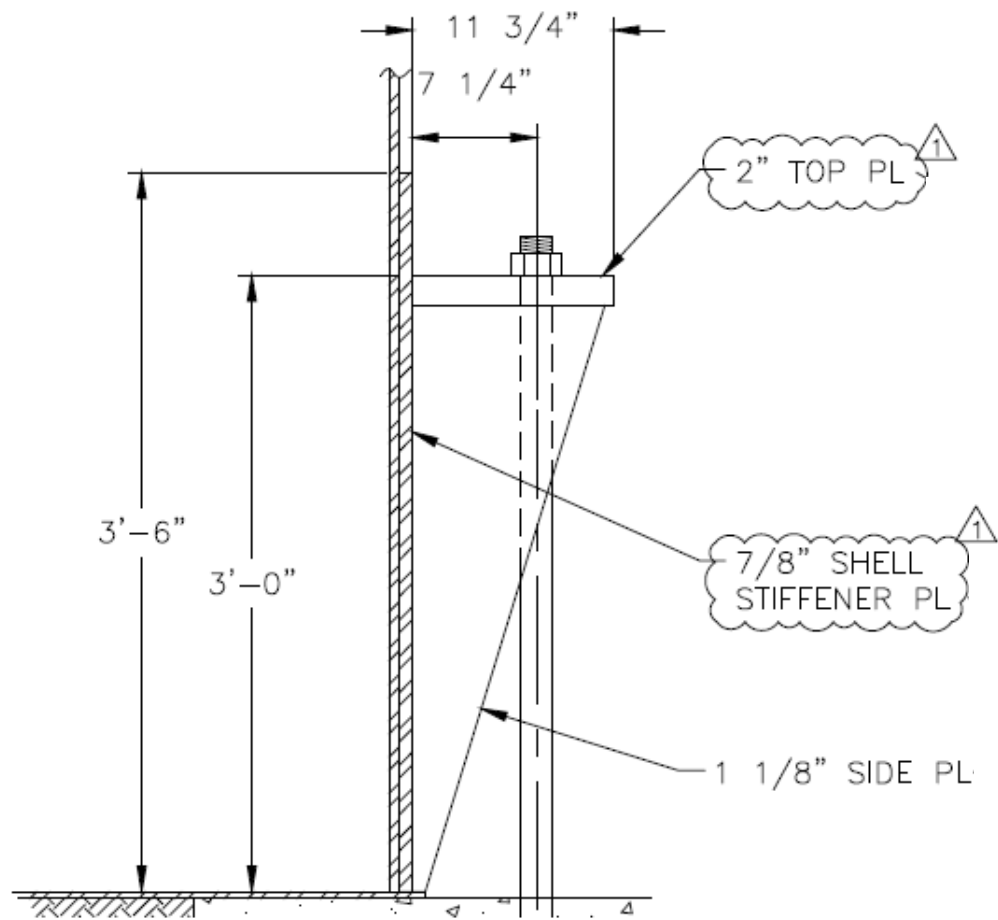
# New Anchorage, Micropiles & Gradebeam Foundation Improvements





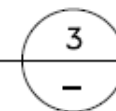
# 12 Micropiles:

- 7-5/8" casing
- 50' – 75' depth
- 10' embedment in basalt
- 1-3/4" threadbar
- Pressure grouted
- Top 20' cased
- 133-kips in tension
- 146-kips in compression



ANCHOR CHAIR DETAIL

1"=1'-0"



- 
- A close-up photograph of a white excavator arm with a hydraulic jackhammer attachment. The jackhammer is actively demolishing a concrete foundation, creating a pile of rubble. A red laser line is visible on the concrete surface. The excavator arm has the number '2082' and a 'HYDRAVIC' logo. The background shows a green corrugated metal wall.
- Excavator Mounted Jackhammer
  - Saw-cutting to prevent cracking of remaining foundation.

# Foundation Demolition



# Micropile drilling



- Micropile batter allowed for clearance
- Unique equipment with special fittings
- Messy / Noisy work



- Drilling shaft and casing in 6-foot sections
- Piles were installed 50 – 75 feet in depth.
- 10 – feet penetration into competent rock





- Full time observation by Geotechnical Engineer
- Detailed reports for each pile



# Threaded Rod Installation

- Drill shaft removed
- Rod installed full depth





- Grout installed as casing removed
- Approx. 16 casing section removed per pile

# Grout batch mixed on-site



# Micropile Testing

- Test load 167% of design
- 244 Kips
- Total movement less than 1-inch



Rebar

Foundation



Forming





Pouring



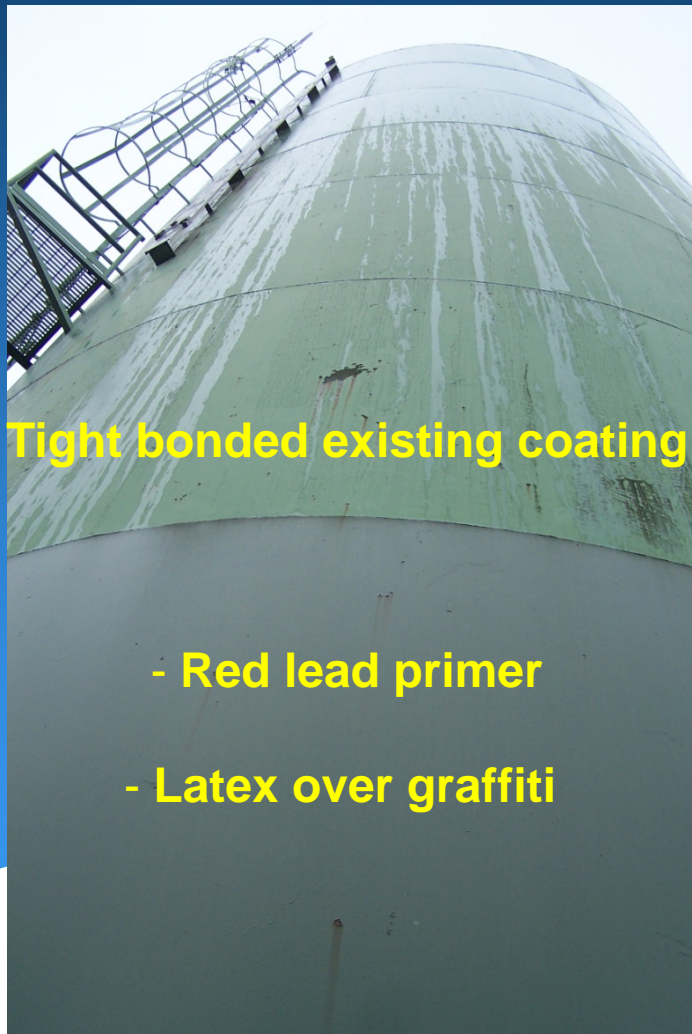
# Anchor Chairs



Expansion during filling



# Exterior Coating



**Tight bonded existing coating**

**- Red lead primer**

**- Latex over graffiti**

**Upper 44 feet & roof – overcoat & encapsulate**

- Hydroblast
- Hand tool cleaning (SSPC-SP2)
- Power tool cleaning (SSPC-SP3)
- Epoxy spot sealer/primer & full prime
- Urethane topcoat

**Lower 16 feet – remove & coat**

- Latex paint over graffiti
- Remove w/Abbrasive Blast (SSP-SP6)
- Existing lead primer – full containment
- Epoxy primer& intermediate coat
- Urethane topcoat



Lead  
Abatement



Surface  
Preparation

# Exterior Coating



Beavers  
Paint  
Scheme



Before



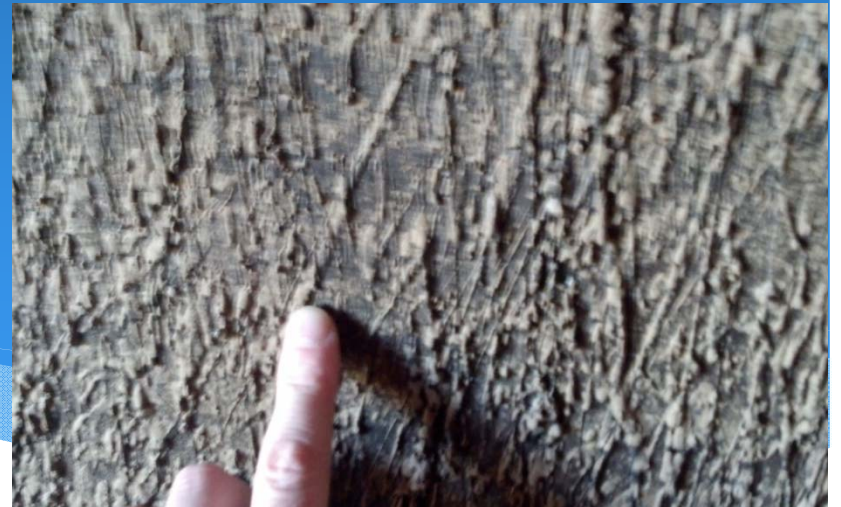
After



# Interior Coating

Existing Coal Tar – remove & coat

- No lead
- Remove w/ abrasive blast  
(SSPC-SP10)
- Epoxy primer, intermediate & topcoats
- Zinc rich epoxy primer – above water level





**Coal Tar Lining Removal**

Removal



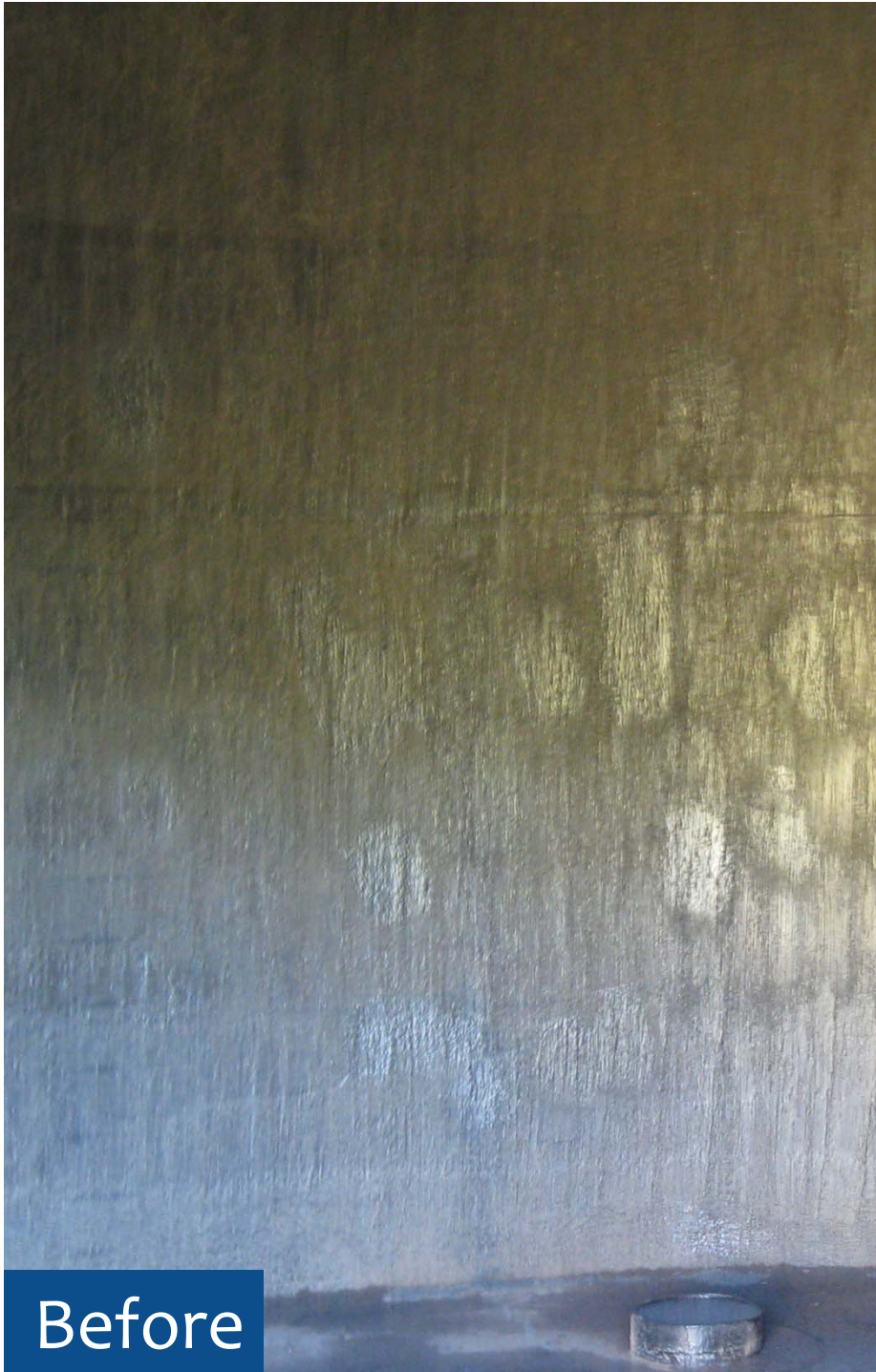


Sand Removal

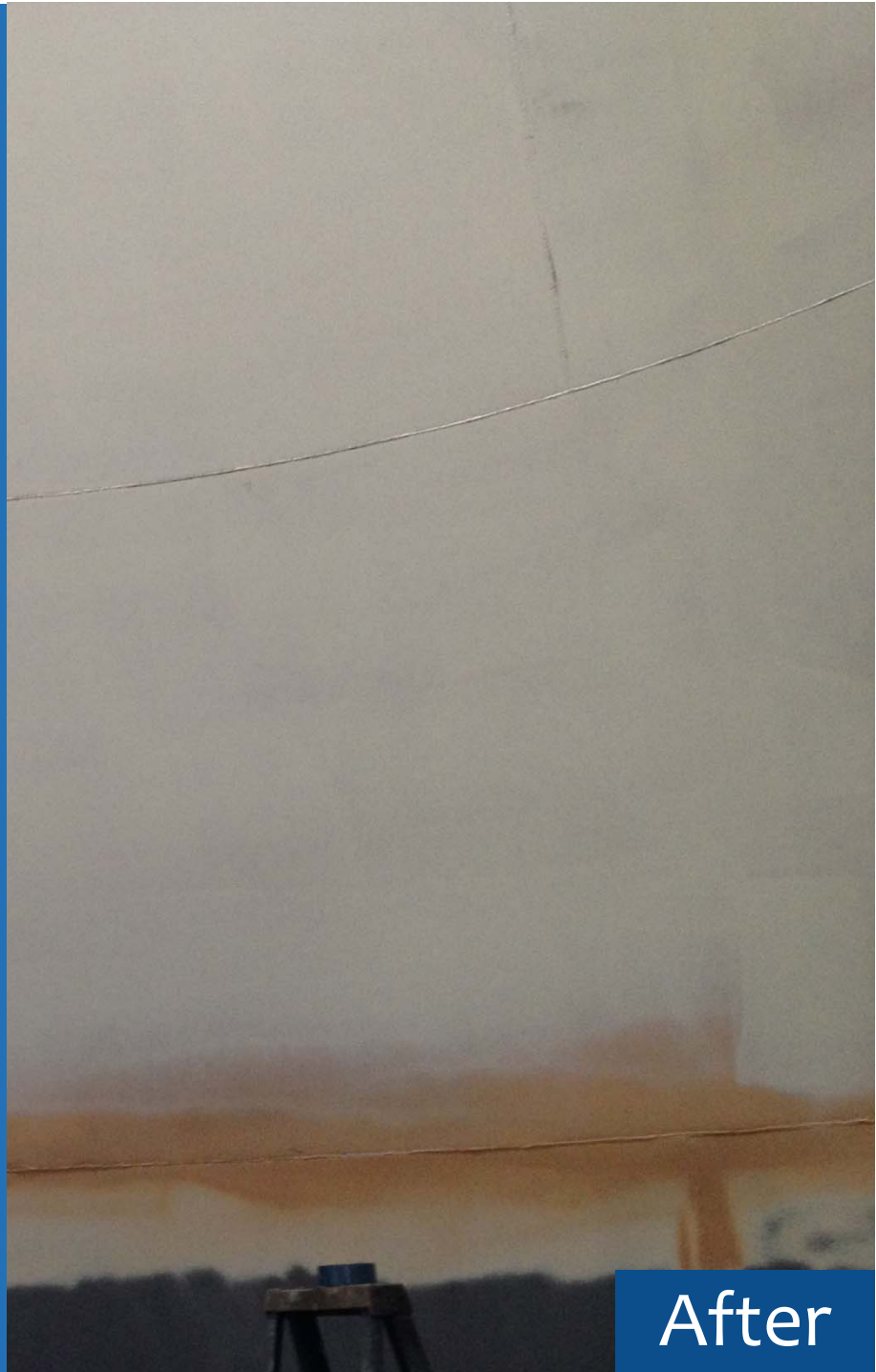
# Interior Coating

Coating Process



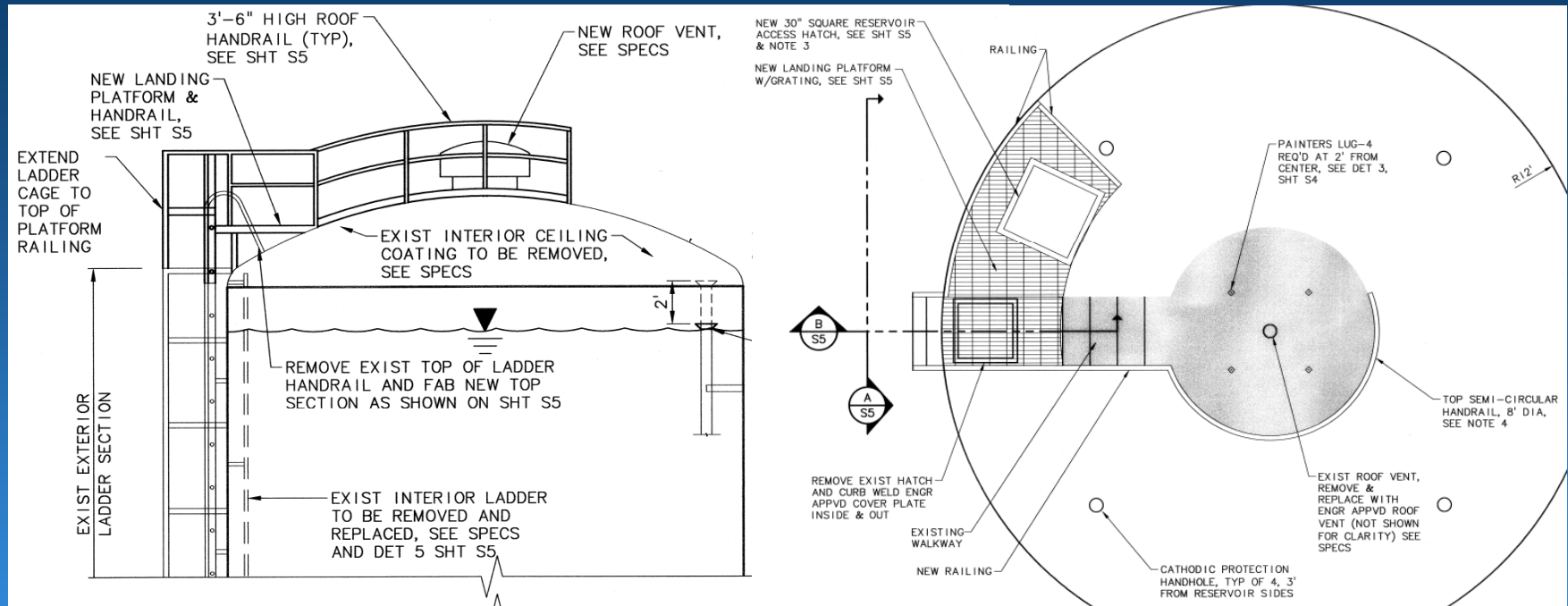


Before



After

# Safety Improvements



- New roof hatch, railing & landing platform
- New interior ladder with Saft-t-Climb
- New roof vent, painters lugs, CP handholes

# Reservoir Safety



Before

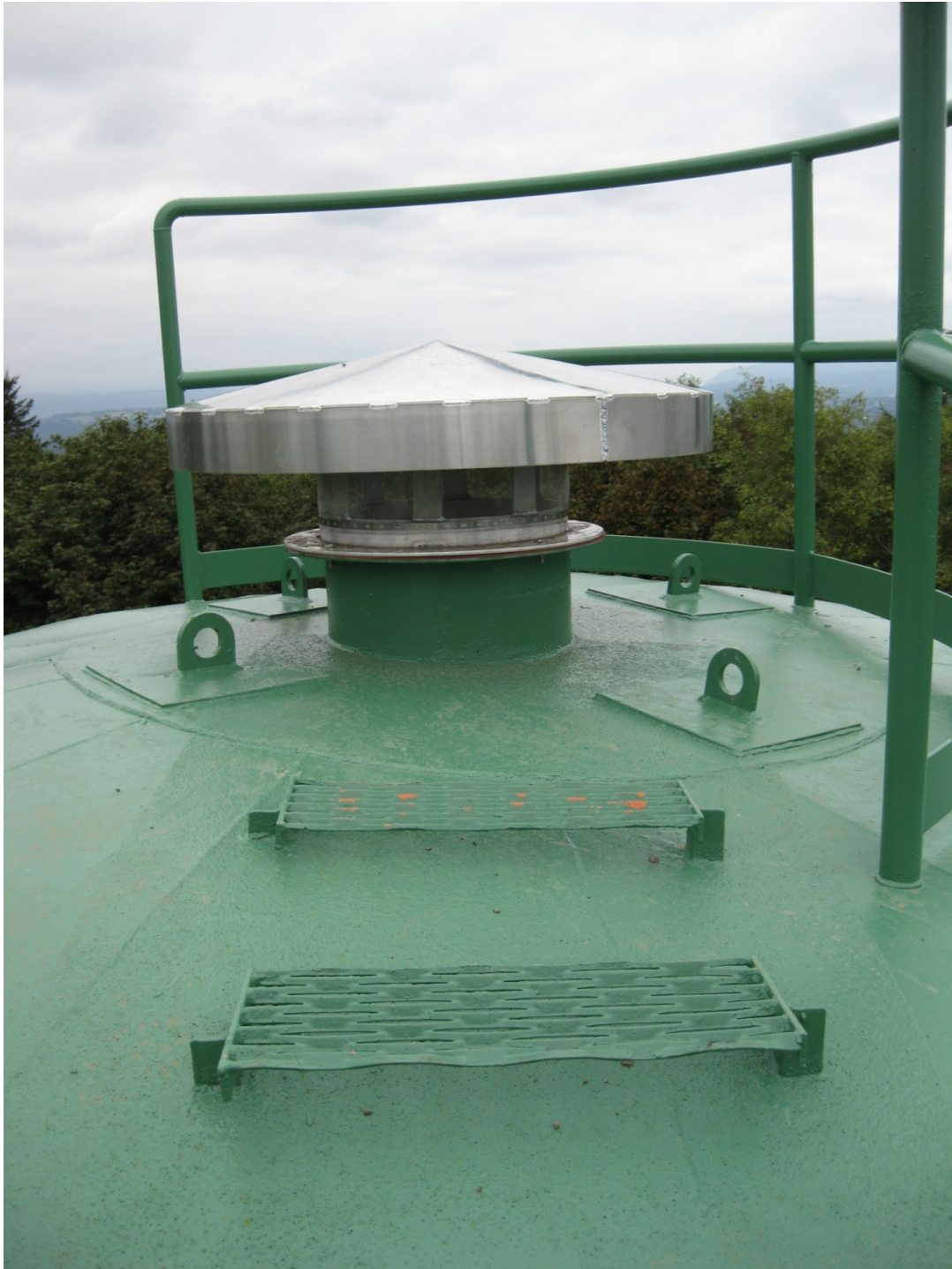




Landing

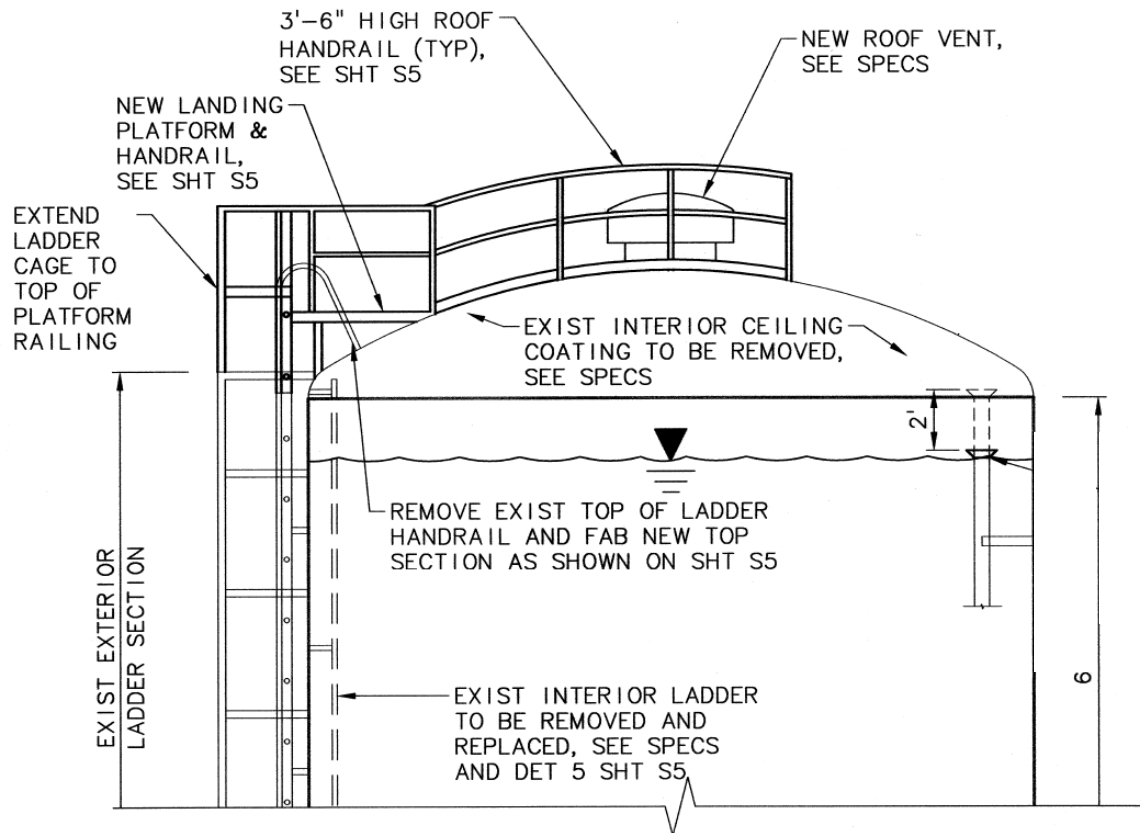


Hatch



Vent

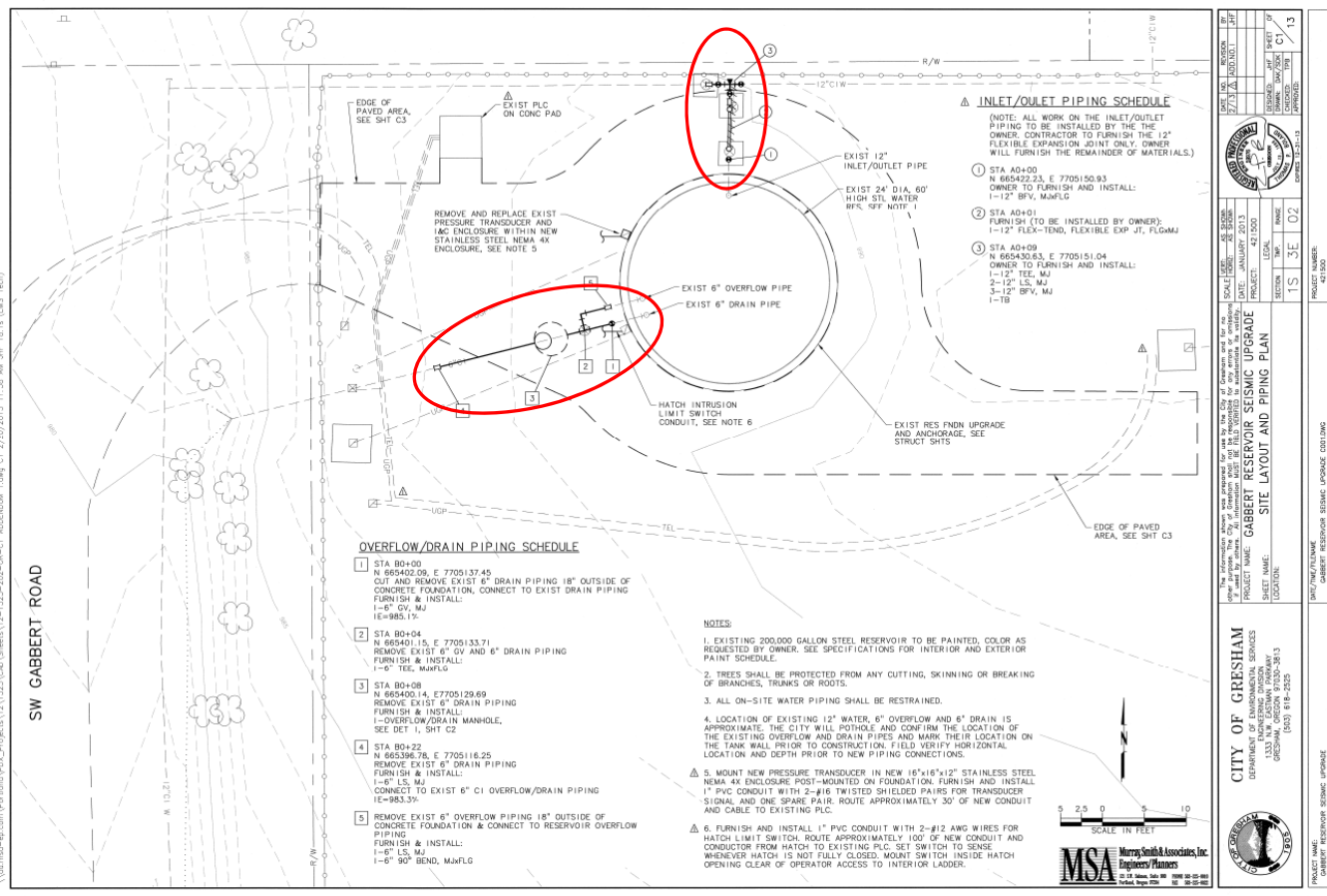
# Increase freeboard



- Drop overflow cone 2' = 58' depth
- City's normal operating level 2' below O.E. = 56' depth

max depth = 57'

# Site Piping & Paving



- New Flex-tend on inlet/outlet pipe
- New overflow/drain piping & manhole
- Paved access road open graded pavement

# Flex Tend Coupling





# Questions?



Before



After



Your Public Works Partner



# Alternative Method

<http://youtu.be/cFbonLCKypg>