

North Transmission 12th & Baseline Main Break

PNWS – AWWA 2015 CONFERENCE

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Legend OCH Water GIS 2/2012

- Intertie
- Fire Service
- PRV
- Domestic Water SVC
- Transmission Valve
- Transmission Lines

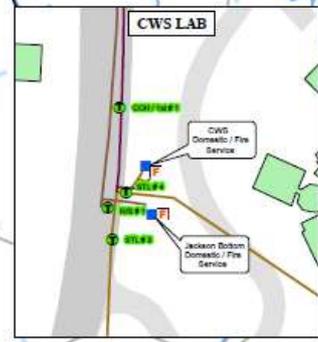
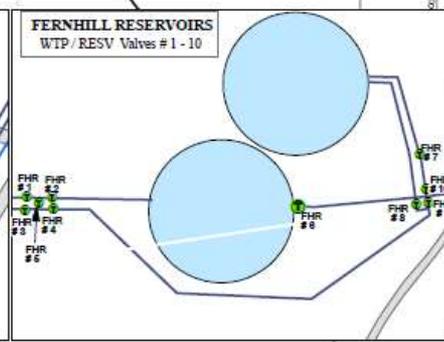
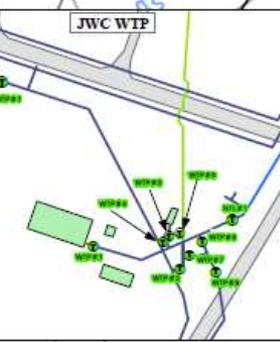
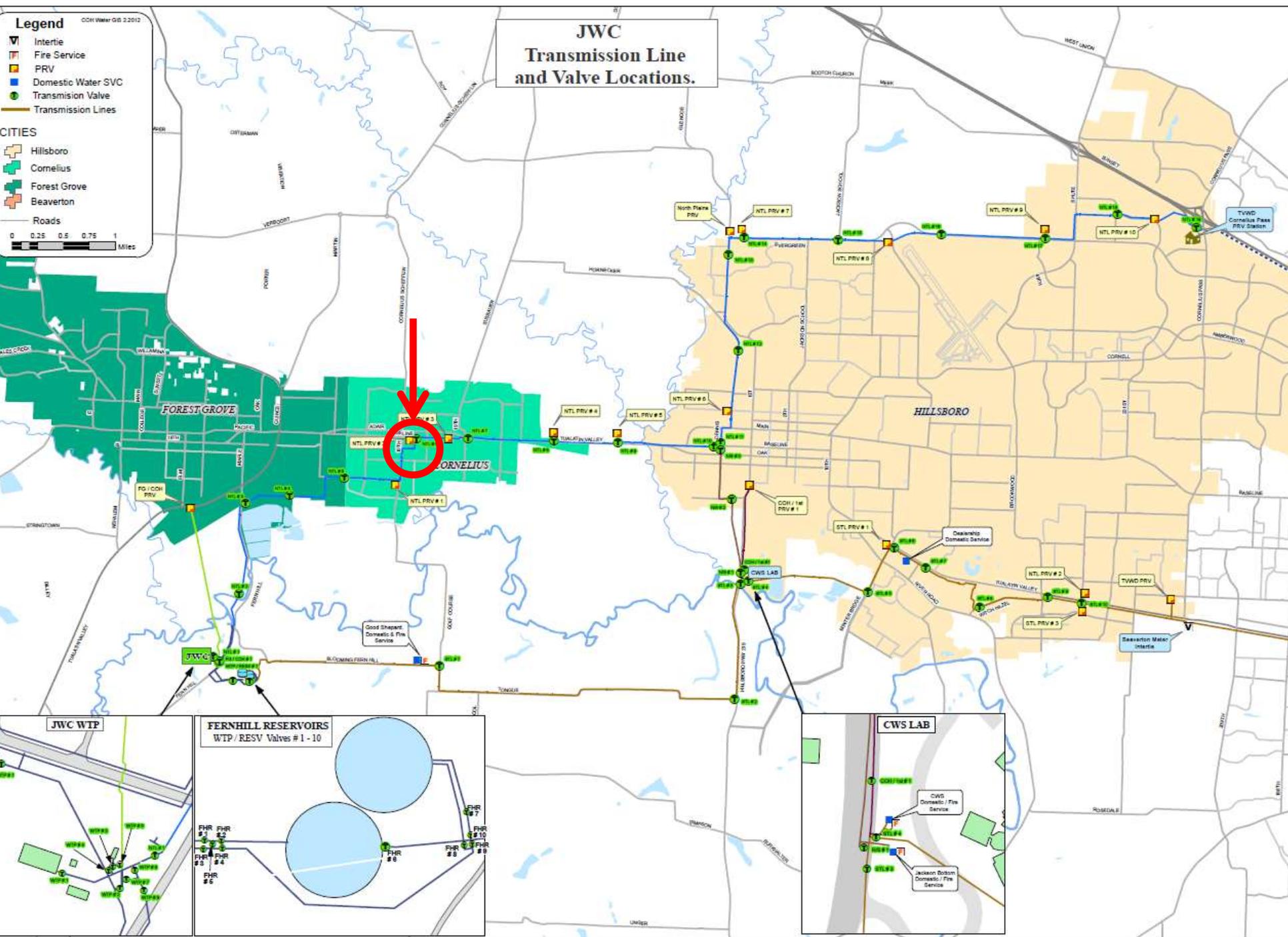
CITIES

- Hillsboro
- Cornelius
- Forest Grove
- Beaverton

Roads

0 0.25 0.5 0.75 1 Miles

JWC Transmission Line and Valve Locations.

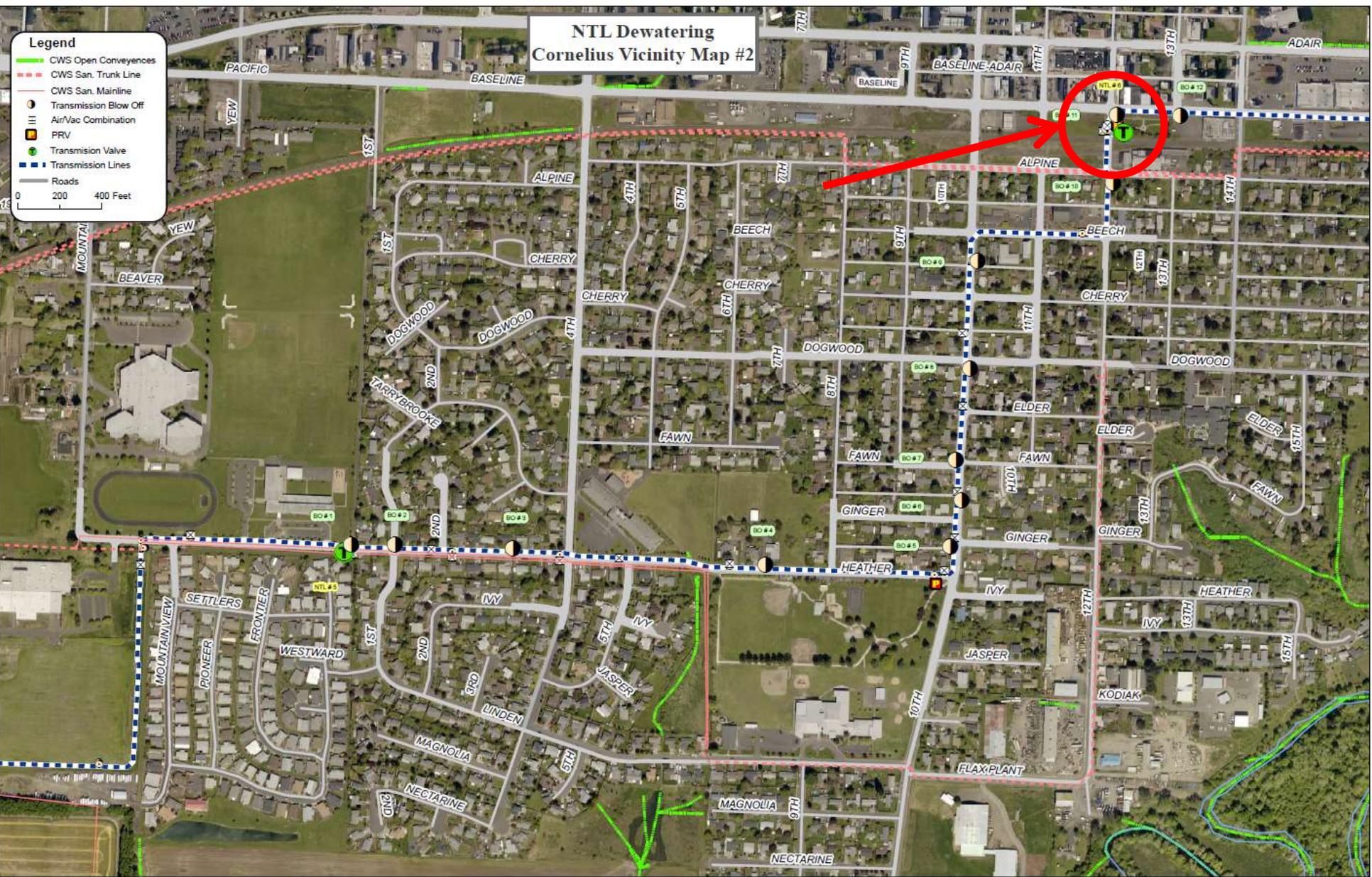


NTL Dewatering Cornelius Vicinity Map #2

Legend

- CWS Open Conveyances
- - - CWS San. Trunk Line
- CWS San. Mainline
- Transmission Blow Off
- ||| Air/Vac Combination
- PRV
- Transmission Valve
- - - Transmission Lines
- Roads

0 200 400 Feet





Tuesday, Feb 11: Hillsboro Operations staff respond to leak at 12th and Baseline in Cornelius



Initial Assessment

(February 11-12)

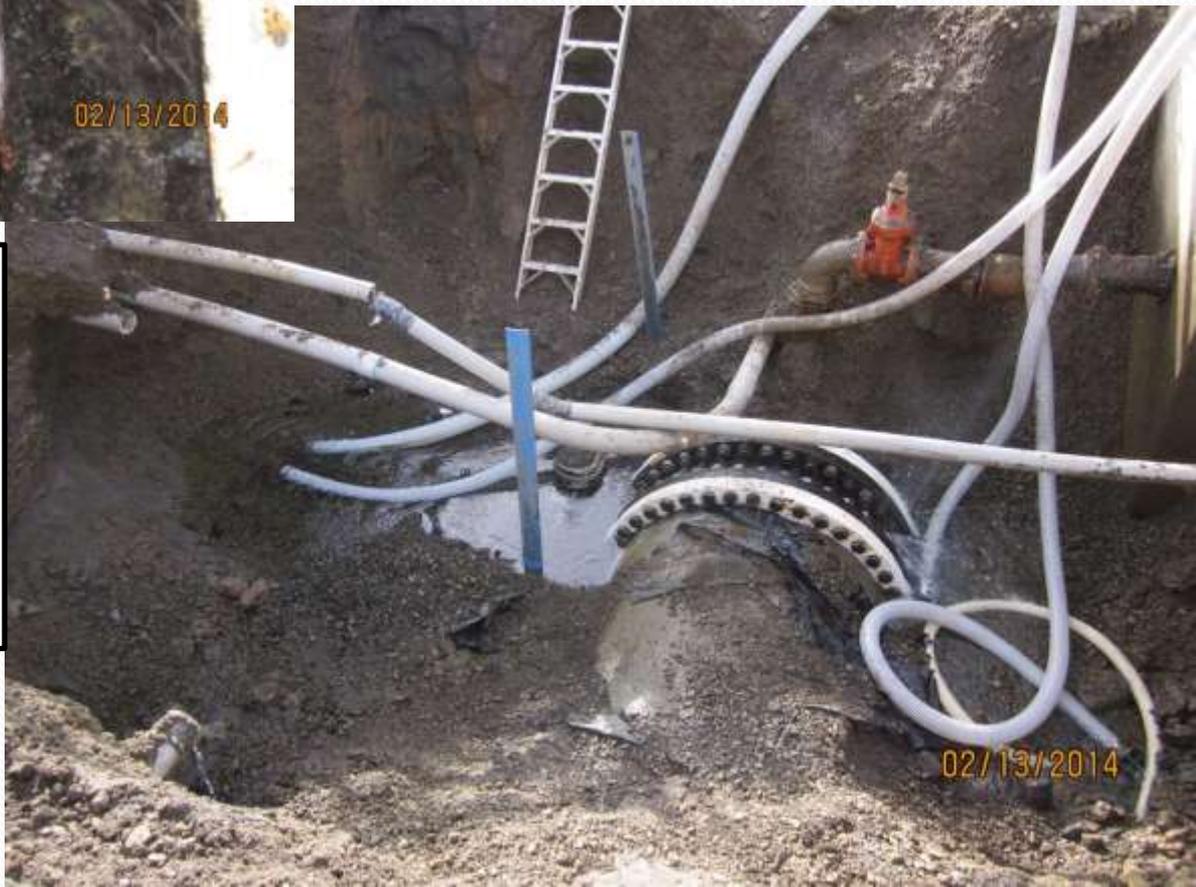
- Repair work beyond the resources of Hillsboro Operations to complete
- Find contractor to assist with repairs – Kerr Construction
- Hire a consultant to assist with assessment and develop a repair plan – HDR
- Keep all parties and stakeholders aware of repair status
- Develop realistic understanding of scope and length of time to repair NTL



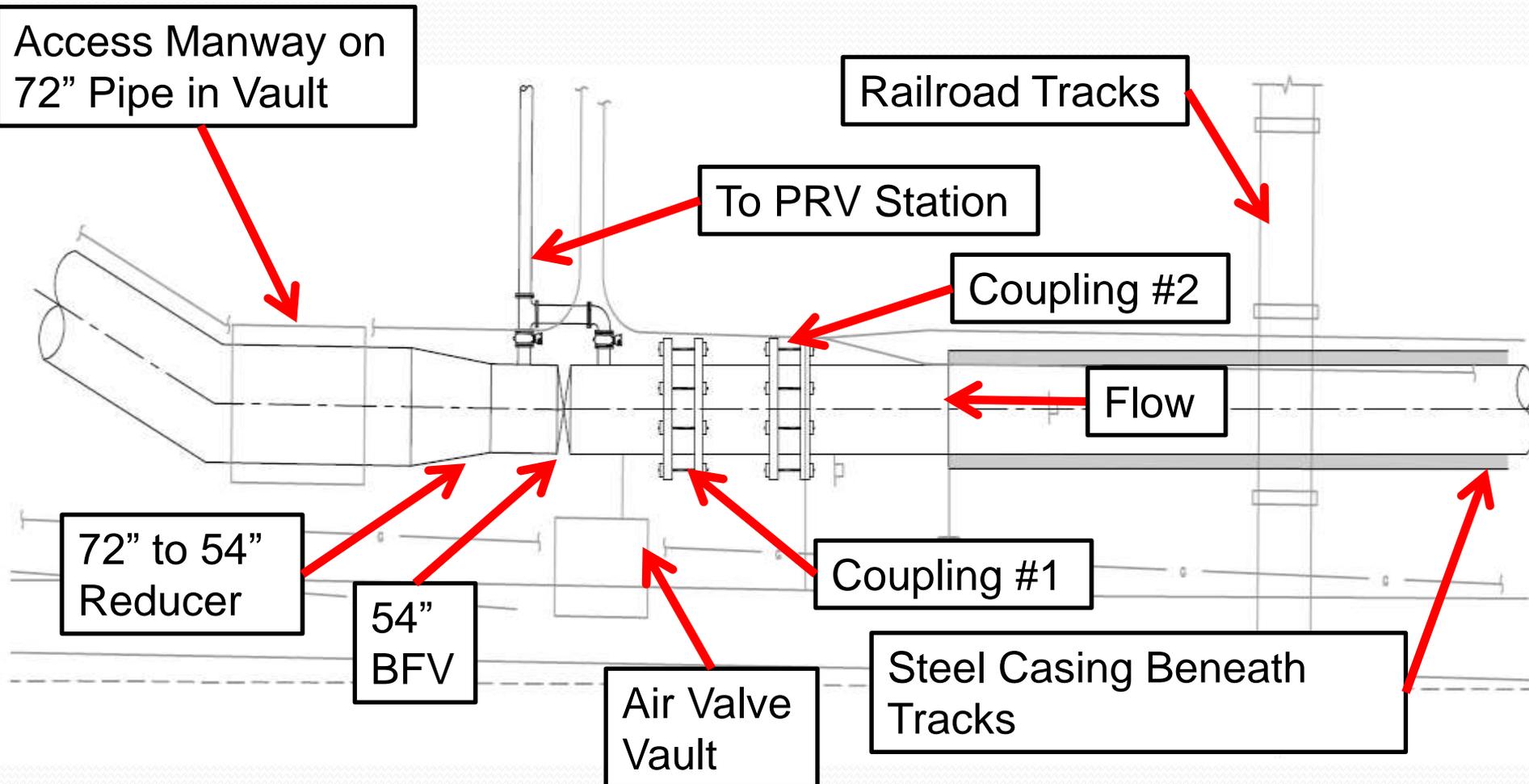
Thursday, Feb 13: Leak inspection by HDR and Hillsboro Engineering staff.

BFV in service 11 years. At the time of failure, no other mainline valves on the NTL had experienced service issues.

- NTL only pressurized on S. side of BFV
- Visible crack in valve body
- Water spraying through bolt holes and flange
- Unable to excavate further



Pipe Layout (Plan View)



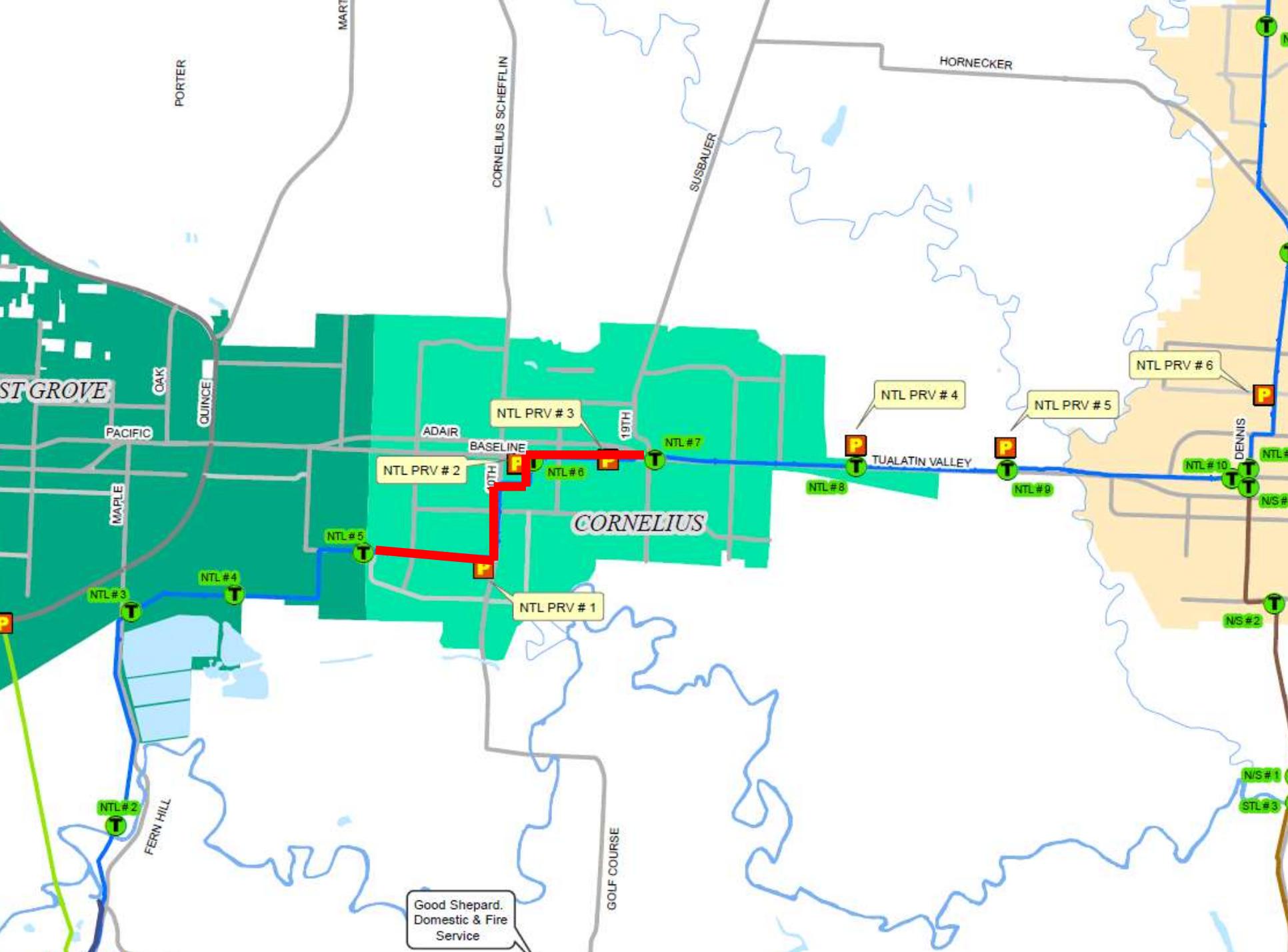
Materials of Construction

- **Pipe:** The NTL is 54-inch I.D. spiral welded steel pipe, fabricated of 0.438-inch thick steel with a 0.50-inch mortar lining and coating.
- **Butterfly Valve:** The valve is a 54-inch Pratt direct buried butterfly valve (AWWA C504 Class 150B) with an EIM worm gear manual operator.
- **Restrained Couplings:** The two existing couplings are Depend-O-Lok FxF Type 2 HP.
- **Corrosion Protection:** The pipe was designed with only corrosion test stations and without active or passive cathodic protection.
- **Pipe Zone and Bedding:** The pipe zone and bedding consisted of clean well graded sand from the pipe invert to 12-inches above top of pipe.

City of Cornelius

Water Service

- City of Cornelius served by 3 PRV (pressure reducing valve) stations
- All 3 PRV stations shut down to isolate leak (Feb 13)
- A 4th PRV station was brought into service (flow meter not functional)
- Flow sufficient to meet domestic but not fire flow needs
- Additional water supply needed to meet life/safety needs of Cornelius



Friday, Feb 14: Staff identified a location for a 2nd PRV feed to Cornelius



02/14/2014

Tuesday, Feb 18: 2nd 6" PRV installed and feeding Cornelius

Development of Repair Scenarios

- Replace 54-inch butterfly valve - yes
- Cracked flange on steel pipe - potentially
- Replace gaskets on Victaulic/Depend-O-Lok couplings - yes
- Remove one or both Victaulic coupling and replace with butt straps - potentially
- Replace all fasteners removed - yes
- Replace flange gaskets – yes
- Denso tape and mastic corrosion protection - yes

54" Valve Search

- 4 manufacturers contacted
- No valves found in inventory
- Valves made to order with 4 to 20 week delivery
- +8 large utilities responded to inquiries
 - Denver Water – new, unused valve in warehouse
 - Las Vegas – used valve available
- HDR sent staff from Denver office to inspect valve

Procurement of Repair Materials

- 54 inch BFV – direct shipped from Denver Water
- Victaulic gaskets – custom manufactured in Georgia
- Pipe and flanges – NW Pipe (Portland)/Thompson Metal Fab (Vancouver)
- Flange bolts – custom “cut” in California
- Denso tape and mastic – shipped from Texas
- All other materials available locally or in reasonable shipping time

Dewatering of NTL

- Estimated 1.8 million gallons of water in isolated section of pipe
- Review and coordinate dewatering with CWS
- Follow DEQ “Management Practices for the Disposal of Chlorinated Water”
- Rental of additional pumps
- Coordinate with start of repair construction





Tuesday, Mar 18: Started excavation and assembly of shoring
Wednesday, Mar 19: Continued excavation

Thursday, Mar 20: Dismantle coupling and valve. Assessed pipe and existing field conditions of pipe, coupling, and other appurtenances.



Unusually narrow gap
at top of coupling



Evidence of binding (in tension)
at bottom of coupling

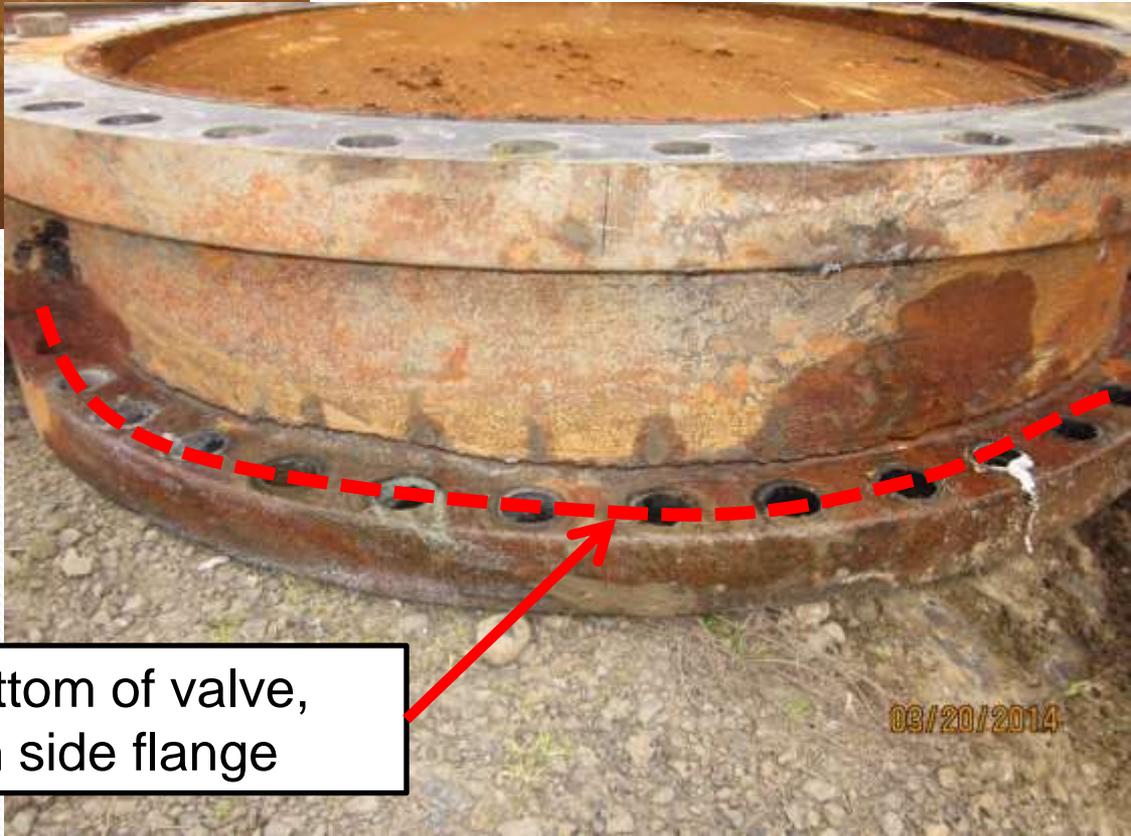


Thursday, Mar 20:
Removal of cracked
valve.





Crack through flange face
(south side of valve)



Crack across bottom of valve,
adjacent to north side flange

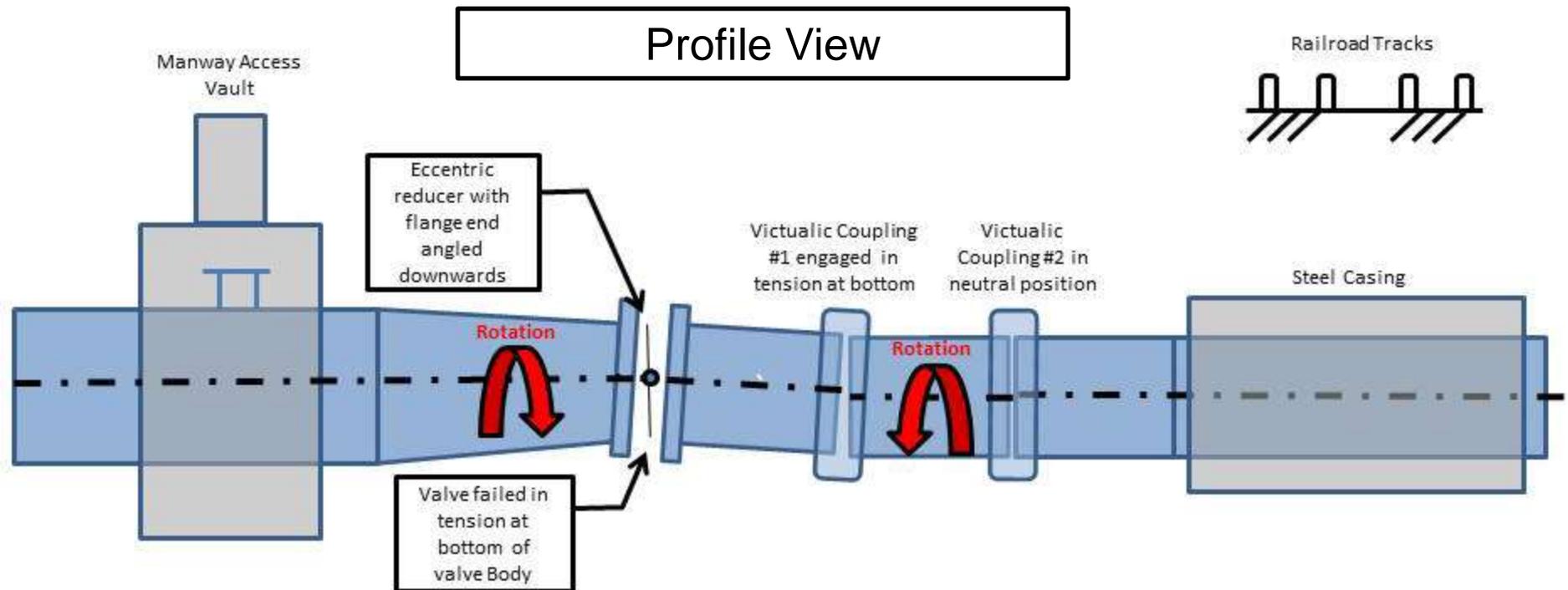


Close up views
cracks in valve body



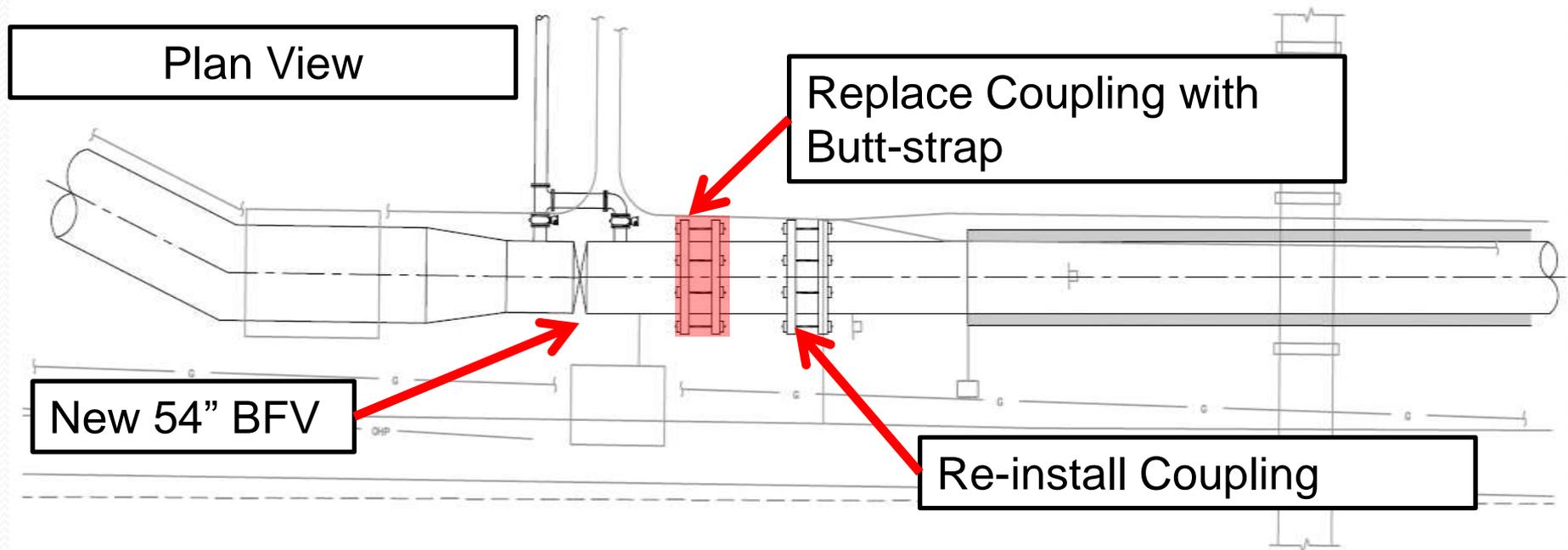
Probable Failure Mechanism

- 54 inch BFV installed with tension from adjacent coupling
- Vertical Mis-alignment during initial construction
- Potential for some settlement in the immediate vicinity of the valve (sand backfill)
- Vibrations from adjacent railroad tracks



Valve Re-installation Plan

- Remove all strain from valve
- Provide full support through valve and excavation area – CLSM (low strength concrete) above spring line
- Replace coupling with butt-strap





Friday March 21:
Magnetic particle
testing of existing
flanges



Interior Inspection

Friday March 21: Interior inspection of existing joints and mortar condition



03/21/20



03/21/2014



03/24/2014

Monday March 24: Interior inspection and repair at 14th and Baseline. This was the NTL repair locations in Nov. 2010.

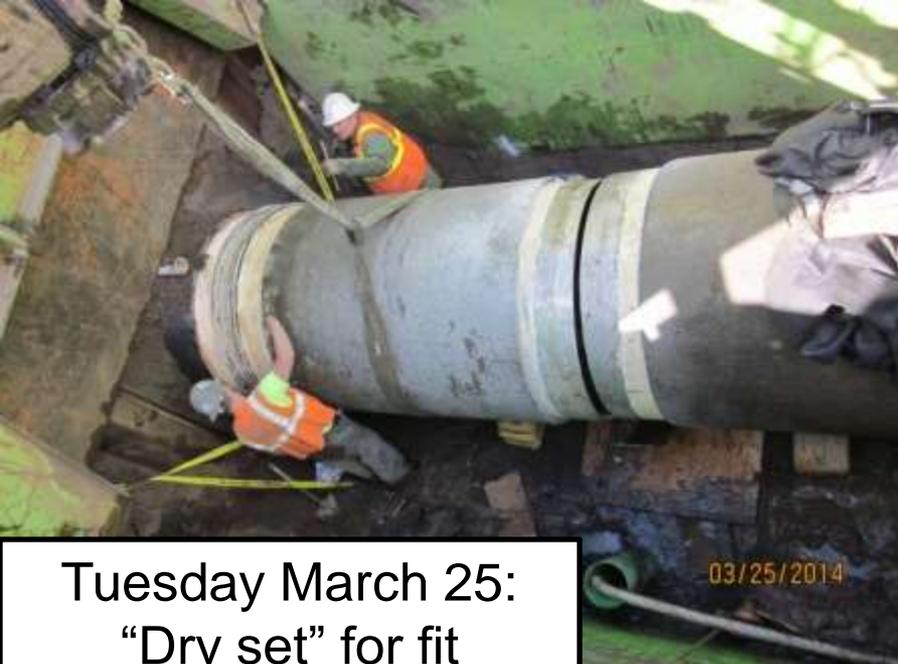


03/24/2014

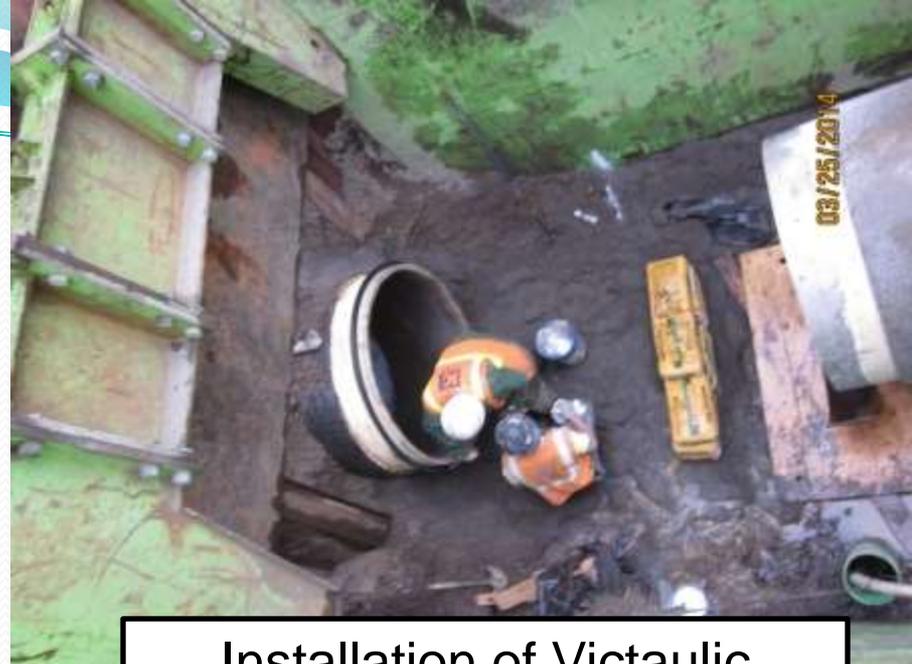


Monday March 24:
Preparation for butt strap and
installation of new BVF





Tuesday March 25:
“Dry set” for fit



Installation of Victaulic
coupling and preparation for
welding of butt strap





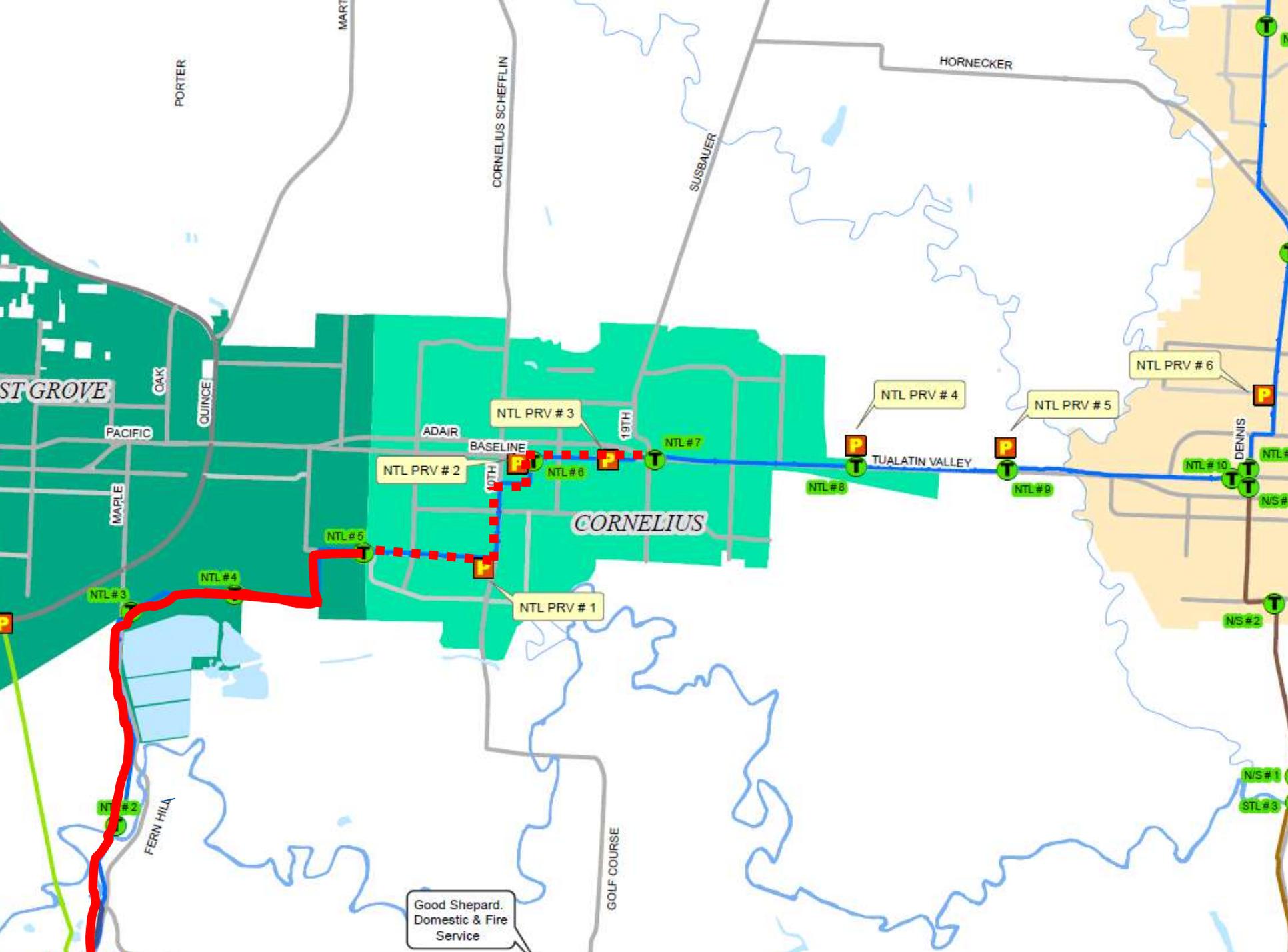
Wednesday March 26: air
test inspection of welded
butt strap joints



Preparation for CLSM
backfill material

Re-pressurizing of NTL: March 28

- Water quality concerns
- Bi-weekly testing of chlorine residual upstream
- Heather Street Cl₂ samples (0.4 to 0.5 mg/L)
- Localized 'swabbing' of transmission main work area
- Close coordination with JWC WTP and Hillsboro Operations Crews
- Bac T sampling



Good Shepard.
Domestic & Fire
Service



Friday March 28: Pressurize NTL, prepare coupling for inspection, close man-way access hatch.





Monday March 31: NTL in service. Final installation of Denso mastic and tape for corrosion protection



Return to Service: March 31

- Bac T sample passed
- Hillsboro Ops staff management of “older” water
 - City of Hillsboro created artificial demand at Evergreen and Crandall Reservoirs
 - Notification to industrial customers with UPW systems
 - Valve opened approximately 9:30 am
 - “Older” water observed at Crandall Reservoir at 2:30 pm
 - Water re-chlorinated at Crandall before being sent to customers

Conclusions

- NTL out of service February 11 to March 31 (49 days)
- Communication is essential – regular updates sent to stake holders
- Look internally for experience and judgment
- Consultants provide additional experience and staff resources
- Assess spare parts program
- Understand long lead times for fabrication or purchasing of parts for emergency repair

Conclusions (cont.)

- Develop relationships with other members of the “Big Pipe Club”
- Be prepared for ‘First Time’ experiences and actions
- Apply lessons towards future transmission main projects
- Close coordination between Contractor and Operations was essential during repair
- Final costs \$248,000 (excluding internal staff costs)

Special Thanks

- Hillsboro Staff
- JWC WTP Staff
- City of Cornelius Staff
- Denver Water
- HDR Engineering
- Kerr Contractors Inc.
- NW Pipe
- Bezates Welding
- CWS staff

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