City of Everett
Pipeline 5 Replacement
Pilchuck River Crossing
Open Trench Construction

Richard Hefti, PE

Carla Talich, PE

May 5, 2016

PUBLIC WORKS EVERETT

MAY THE PNWS-AWWA SOURCE BOISE 2016 BE WITH YOU

AECOM

Agenda:

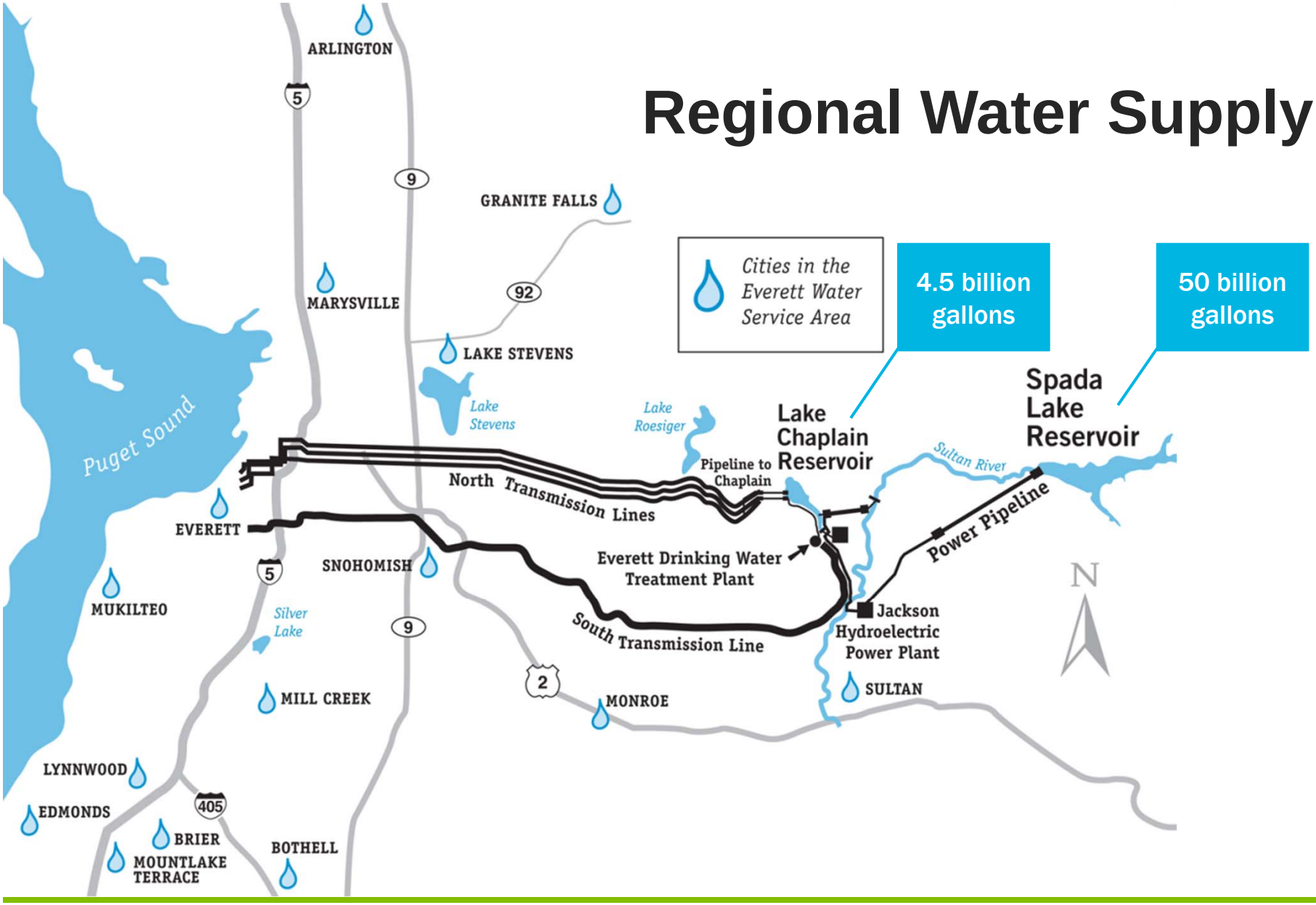
1. **Introduction**
2. **Pre-design**
3. **Design and Permitting**
4. **Construction**

PUBLIC WORKS
EVERETT

AECOM

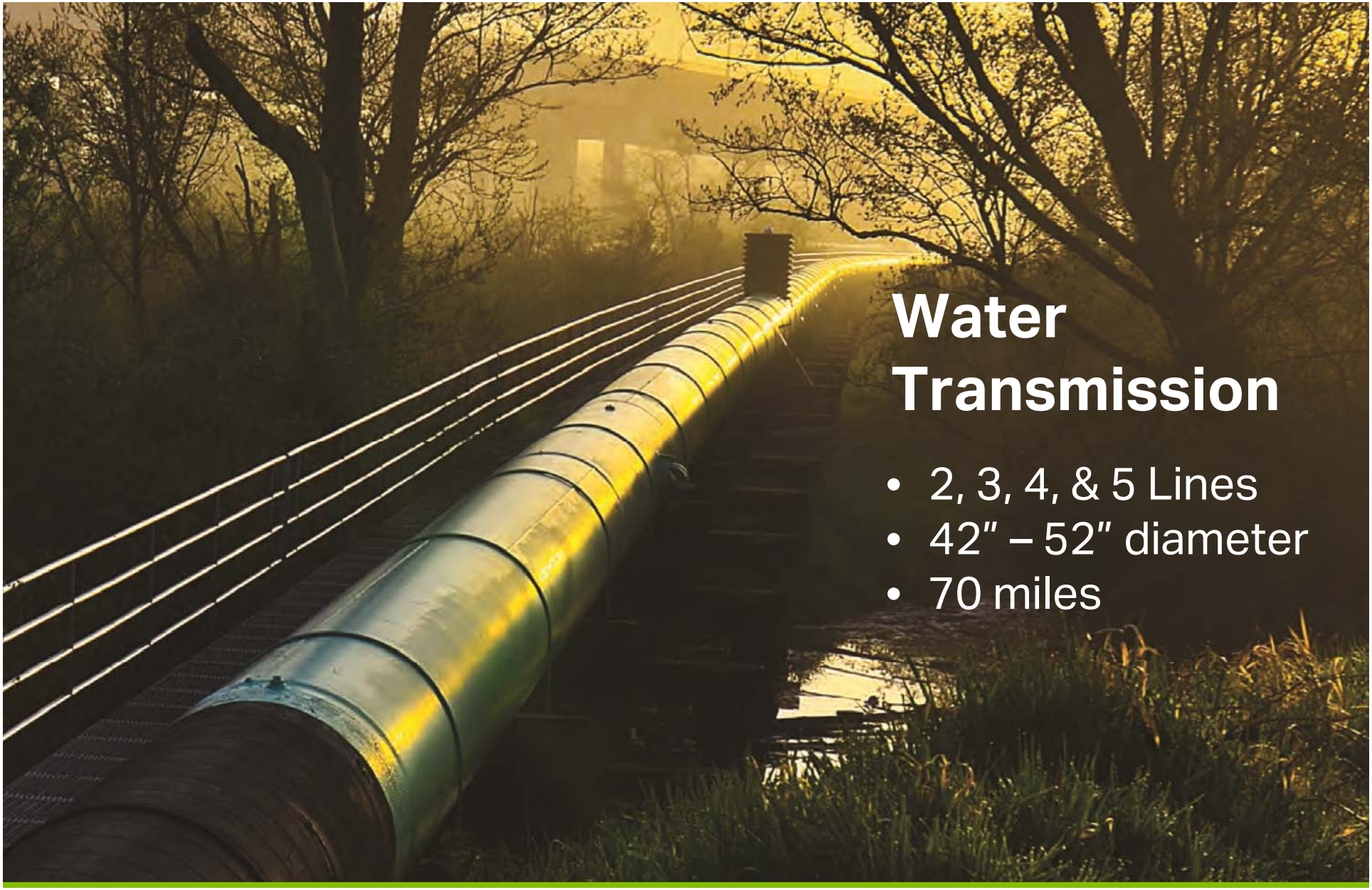
1: Introduction

Regional Water Supply



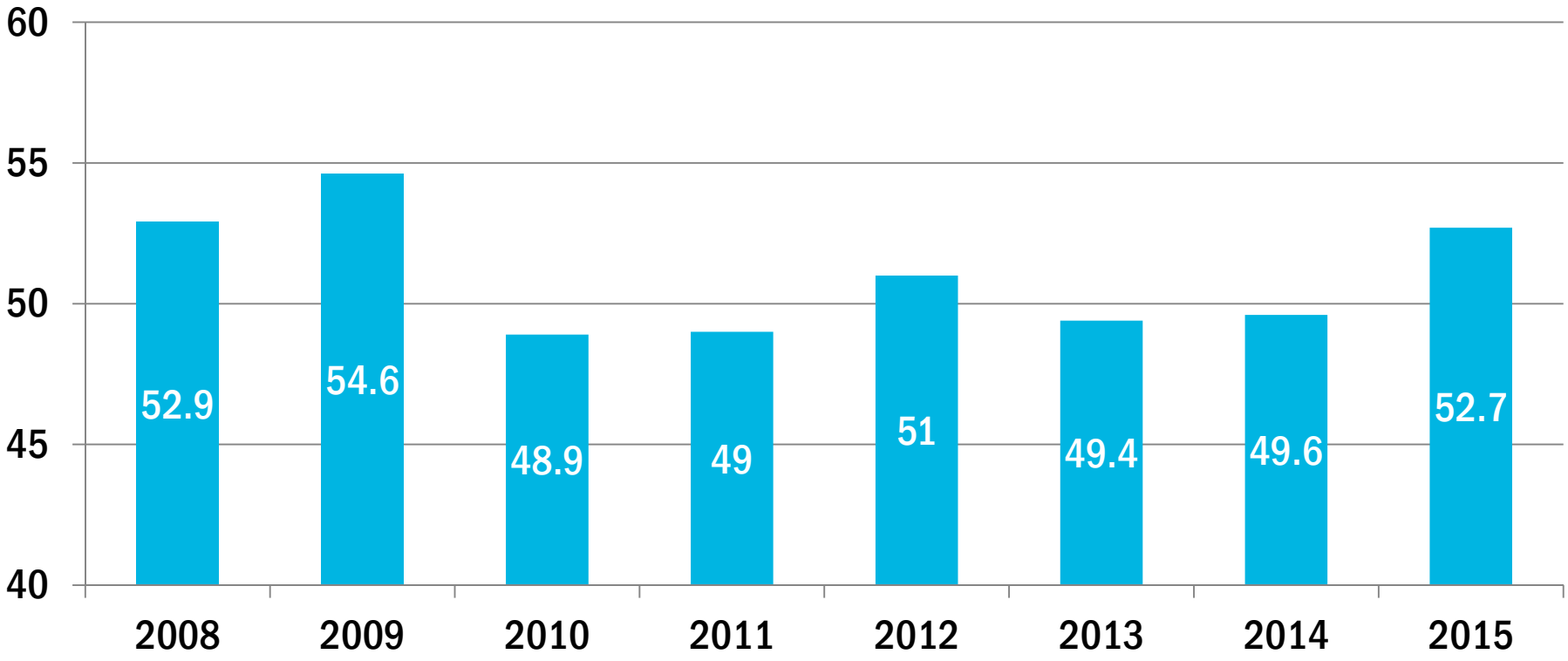
Drinking Water System

- 96 direct wholesale customers (33 Group A & 63 Group B)
- Tulalip Tribes
- Over 27,000 connections
- Service area population ~ 600,000


Water Transmission
• 2, 3, 4, & 5 Lines
• 42" – 52" diameter
• 70 miles

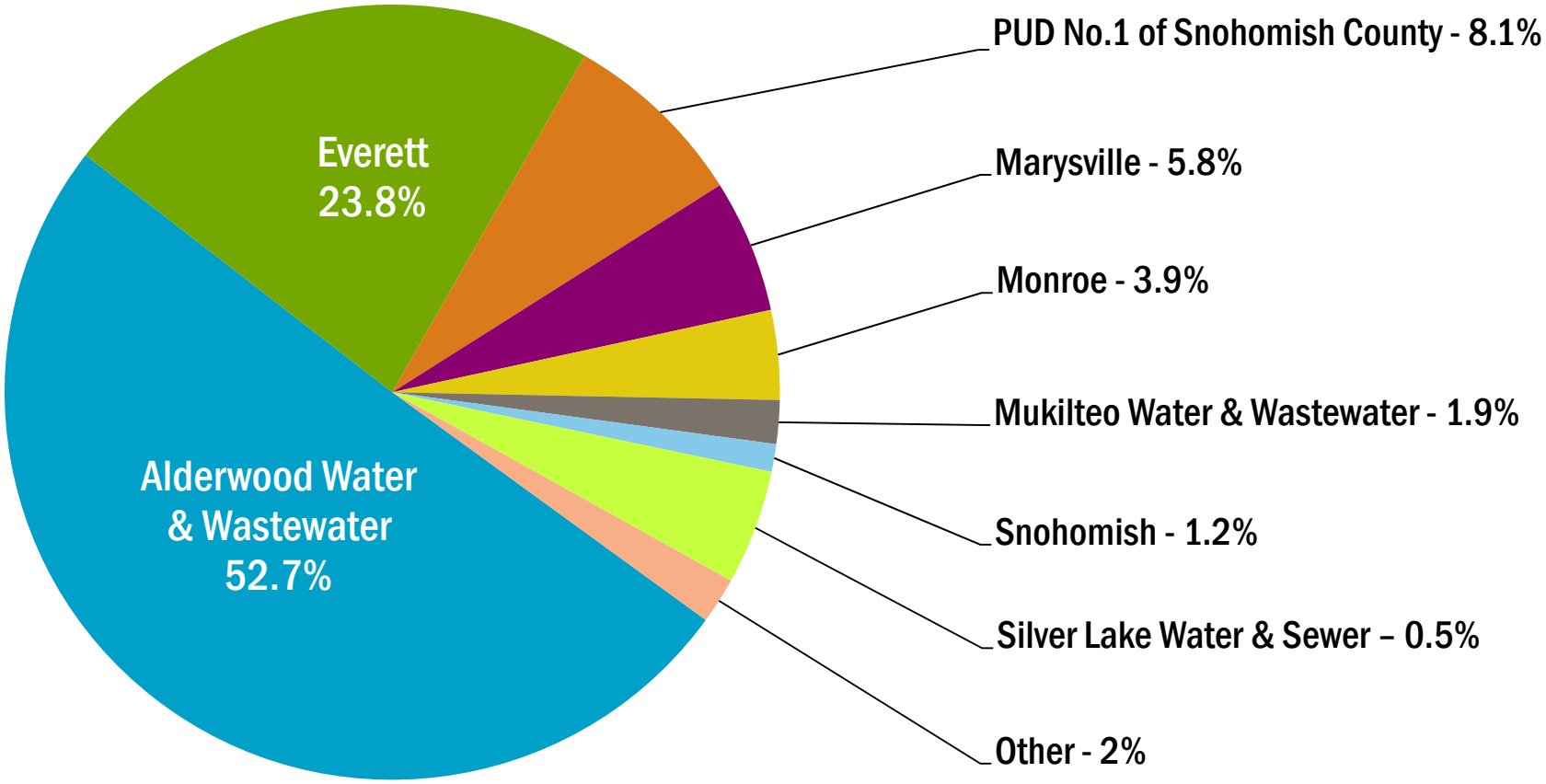
Average Daily Production of Drinking Water

(MILLION GALLONS PER DAY)

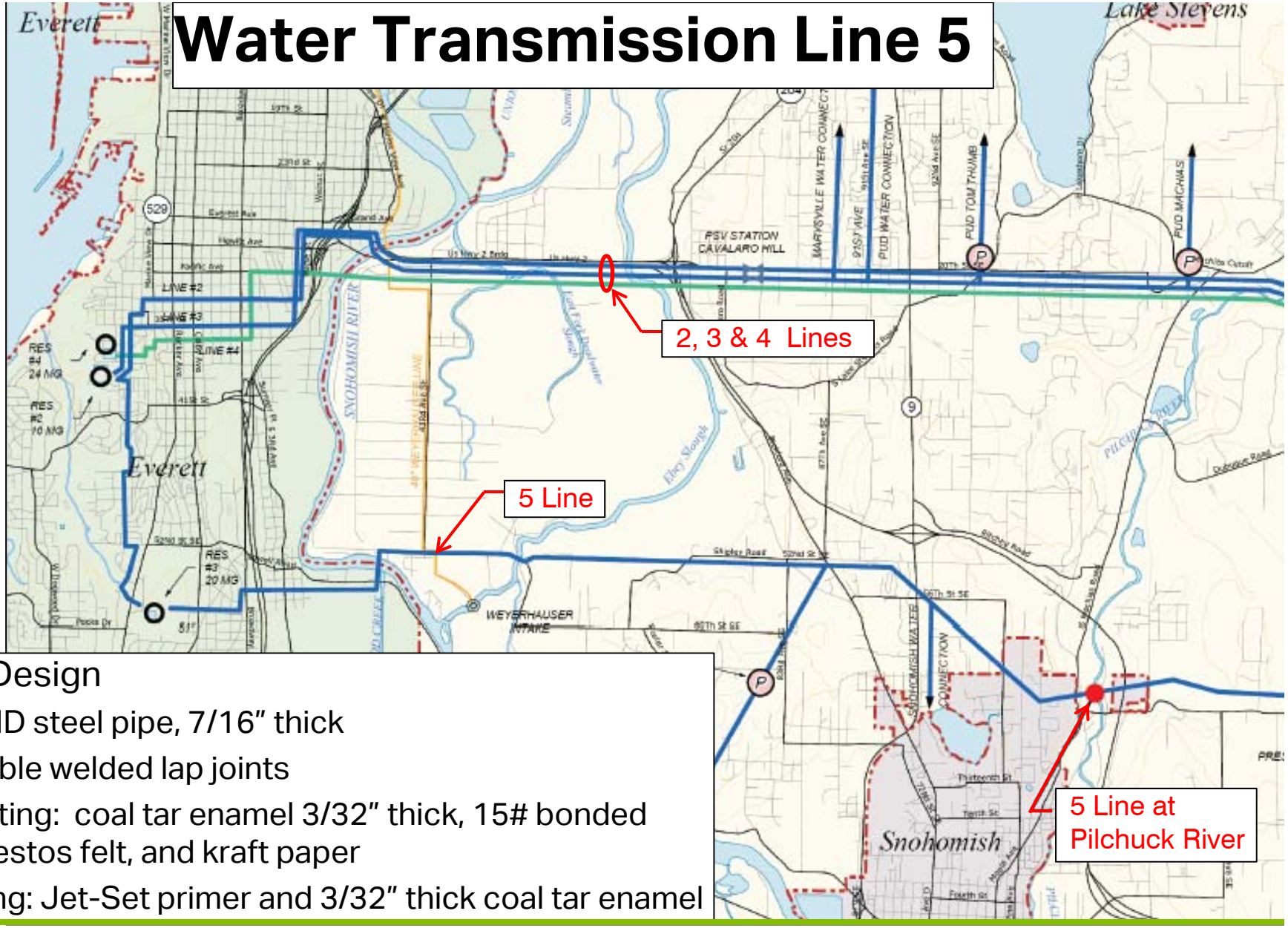


The Everett Drinking Water Treatment Plant produced an average of 52.7 MGD of water in 2015, a 5.9 percent increase from the 49.6 MGD produced in 2014 and 5.6 percent increase from the previous four-year average of 49.8 MGD.

Drinking Water Distribution
(PERCENT OF DEMAND)



Water Transmission Line 5



- 1965 Design
  - 51" ID steel pipe, 7/16" thick
  - Double welded lap joints
  - Coating: coal tar enamel 3/32" thick, 15# bonded asbestos felt, and kraft paper
  - Lining: Jet-Set primer and 3/32" thick coal tar enamel

Pilchuck River Crossing

Many users = Many considerations

2: Pre-design

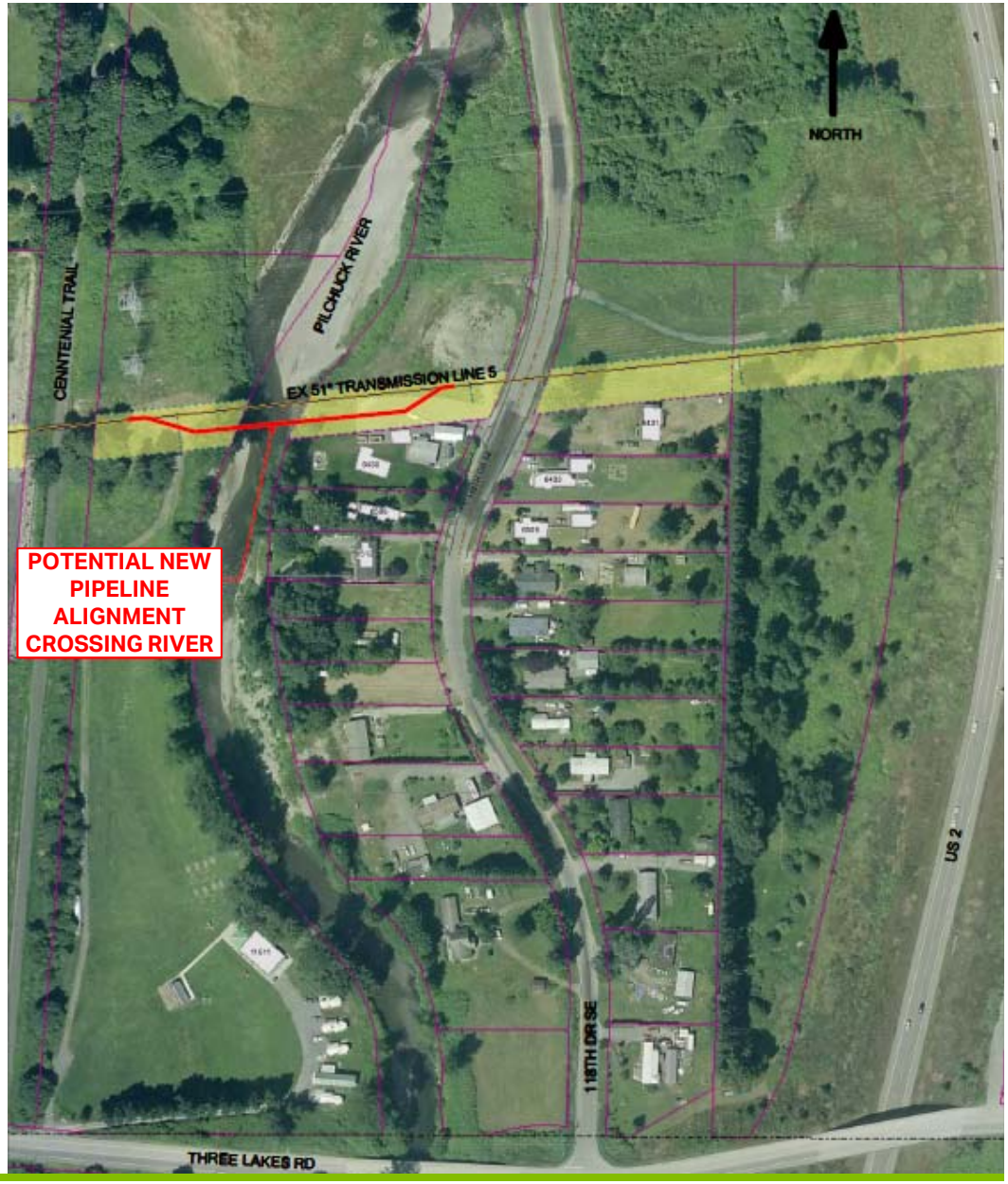
Pre-Design Condition Assessment

- Pipeline exposed and subject to scour and impact from debris
- Multiple repairs to provide cover and protection
- Non-destructive testing and pipe condition assessment concluded reduced life expectancy / risk of failure

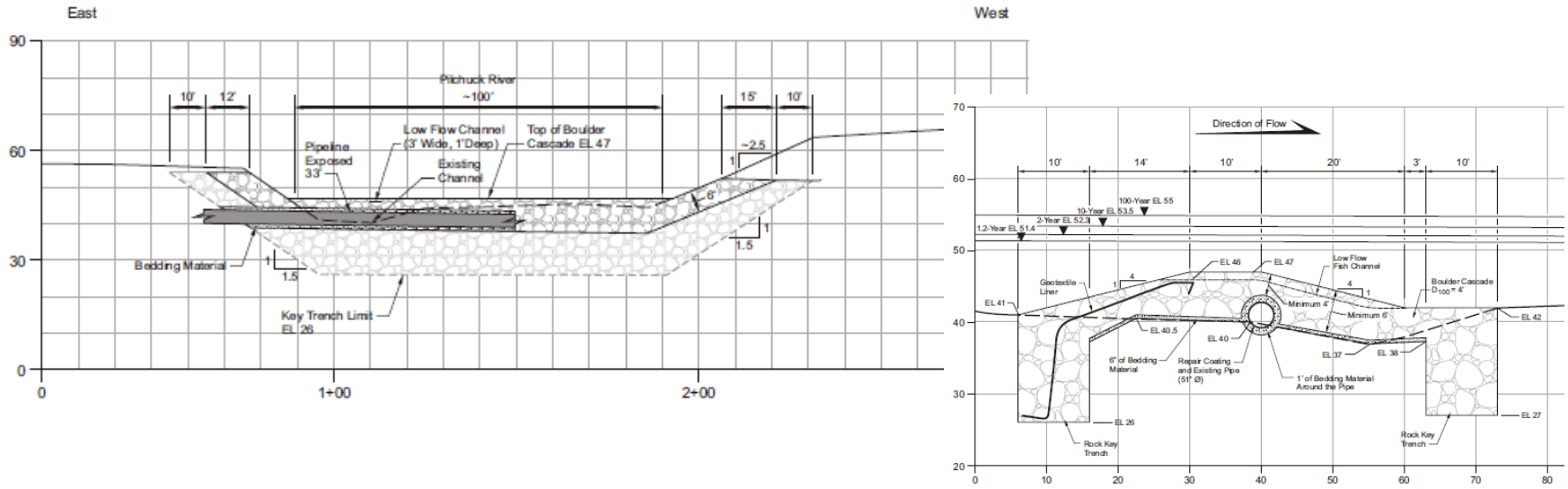
➢ **Conclusion: Repair / Replace**

Pre-Design Alternatives

- Repair
- Horizontal Directional Drilling
- Microtunneling
- Overhead Bridge
- Open Trench



Pre-Design Alternative – Repair: Grade Control Structure

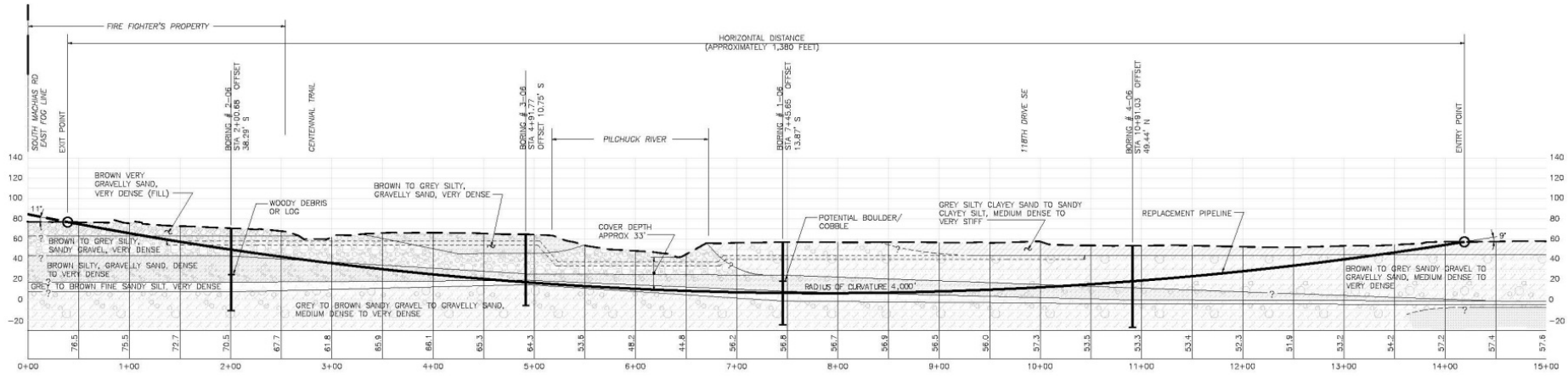


– Pros
  - Fastest way to provide protection
  - Lowest cost

– Cons
  - History (recent repairs did not last)
  - Pipe condition assessment showed limited longevity

➢**Conclusion: Replace the pipeline at the crossing**

Pre-Design Alternative – Horizontal Directional Drilling



– Pros

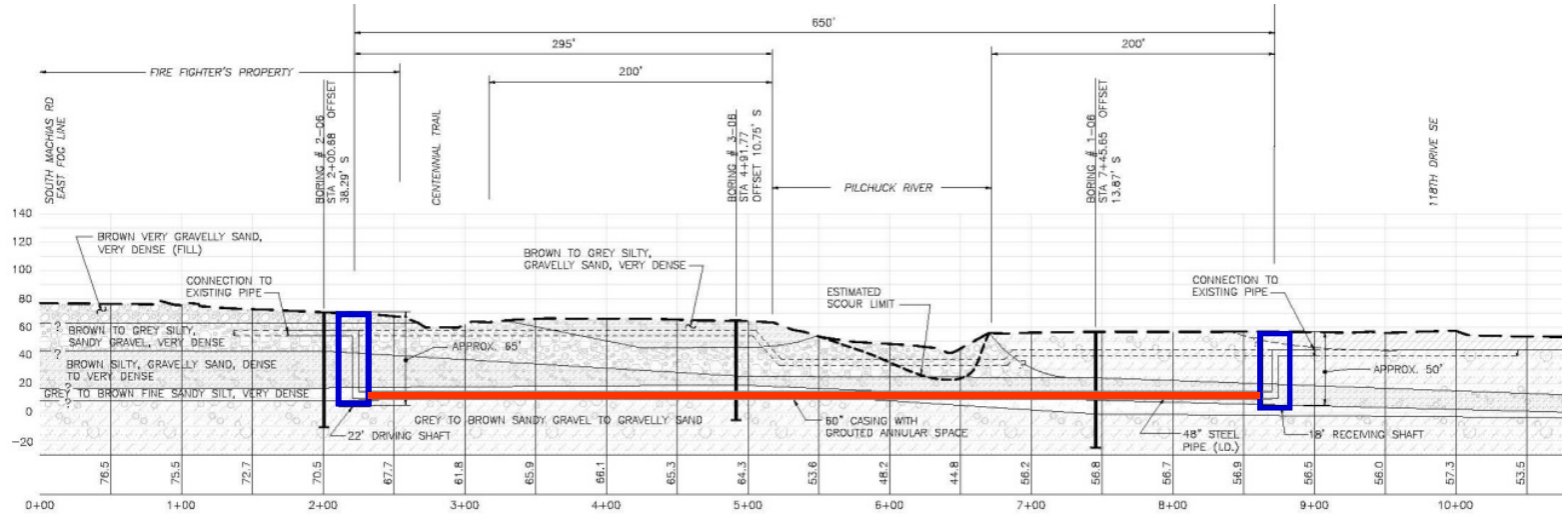
- Underground pipeline preferred (more secure)

– Cons

- Marginal feasibility / high risk (sand, gravel, cobbles, boulders, debris)

➢**Conclusion: Ruled out due to feasibility/risk**

Pre-design Alternative – Microtunneling



– Pros

- Underground pipeline preferred (more secure)
- Lower risk than HDD

– Cons

- Risk (boulders, stumps, mixed face conditions)
- Highest cost

➢**Conclusion: Ruled out due to risk**

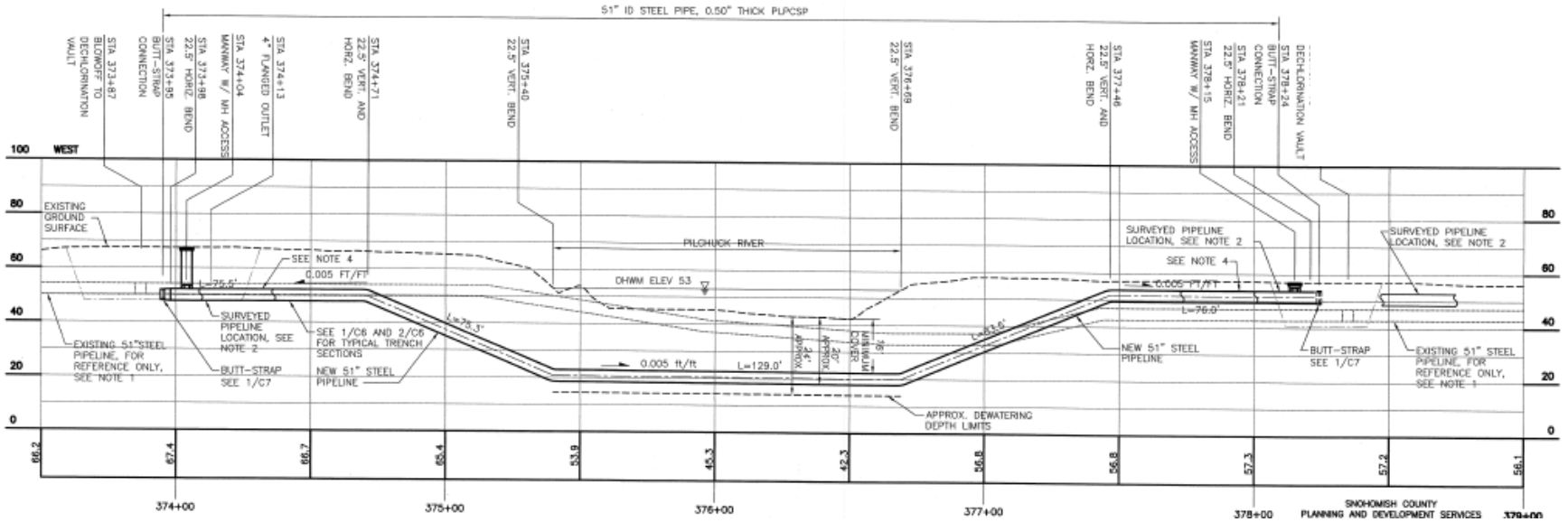
Pre-Design Alternative – Overhead Crossing

– Pros
  - Feasible / low risk construction

– Cons
  - Above ground (less secure, conflicts with City policy)

➢**Conclusion: Ruled out due to security**

Pre-Design Alternative – Open Trench



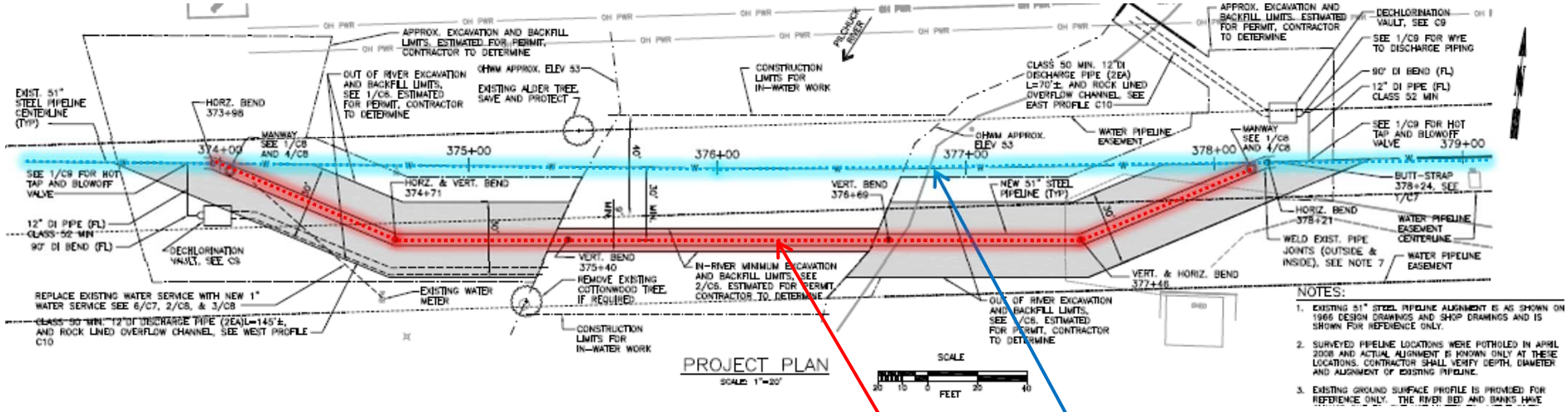
– Pros
  - Underground pipeline
  - Technically feasible

– Cons
  - Permits (longest timeline)
  - Challenging soil conditions
  - Surface and groundwater control

➢**Conclusion: Preferred Alternative for Design Phase**

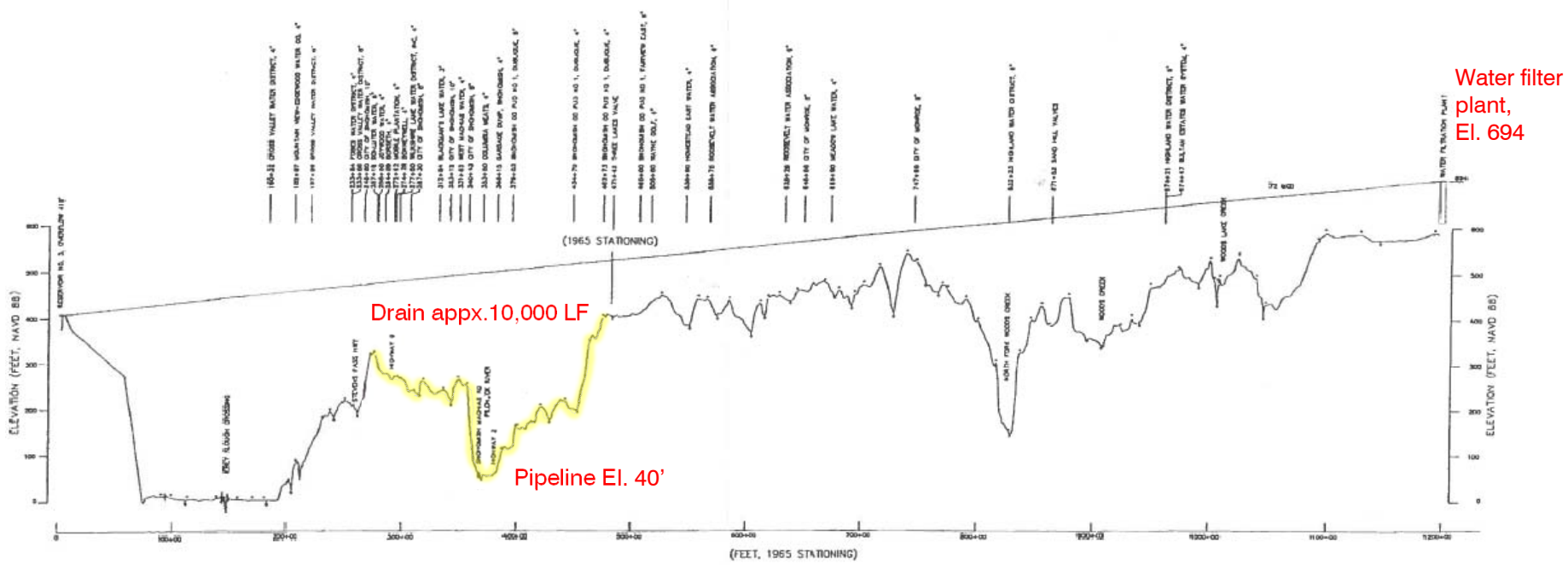
3: Design and Permitting – Open Cut Replacement

Design Bid Build for 2012 Construction



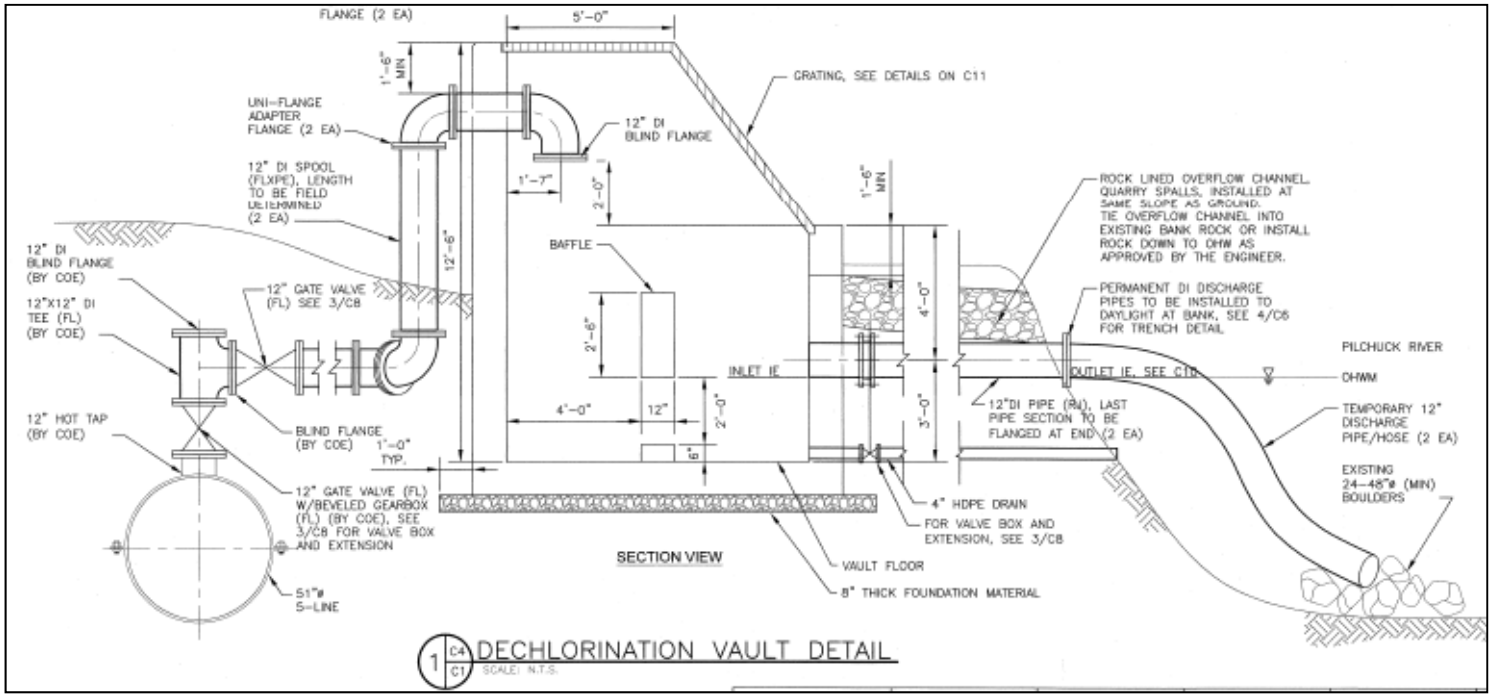
- Pipeline Design Elements
  - 430 LF
  - Welded Steel, 0.5" thick
  - Coating: 40 mil polyurethane
  - Lining: 20 mil polyurethane
  - Connections
  - Access manways
  - Draining and dechlorination

Pipeline Design



- Operating pressure: 160 psi
- Connections
  - Volume of water to drain, treat, discharge to river = 1MG
  - Total Down-time allowed for 5-Line: 12 hour target

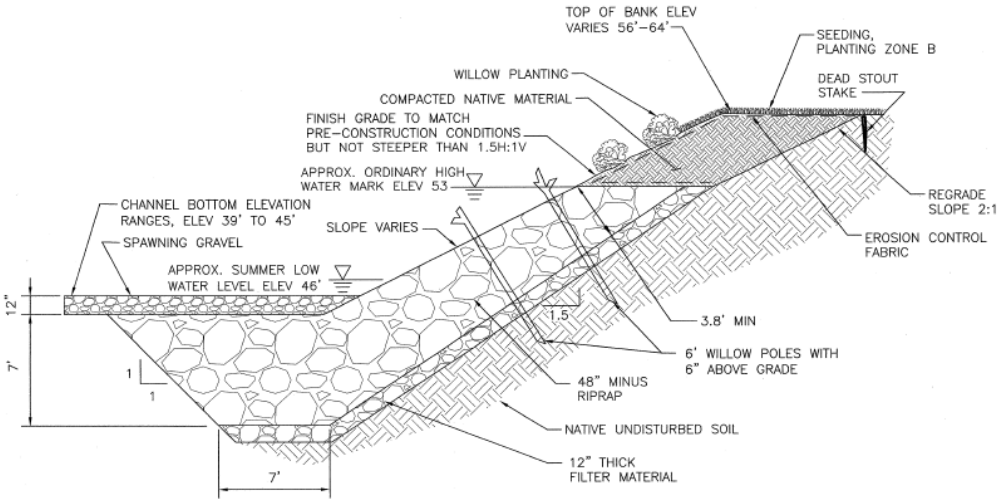
Dechlorination Vaults



- Permanent structure located above OHWM with temporary pipe connections
- Internal baffle to dissipate energy

- Used for:
  - o treating and discharging water from 5-Line
  - o During testing of new pipeline
  - o Prior to final connections

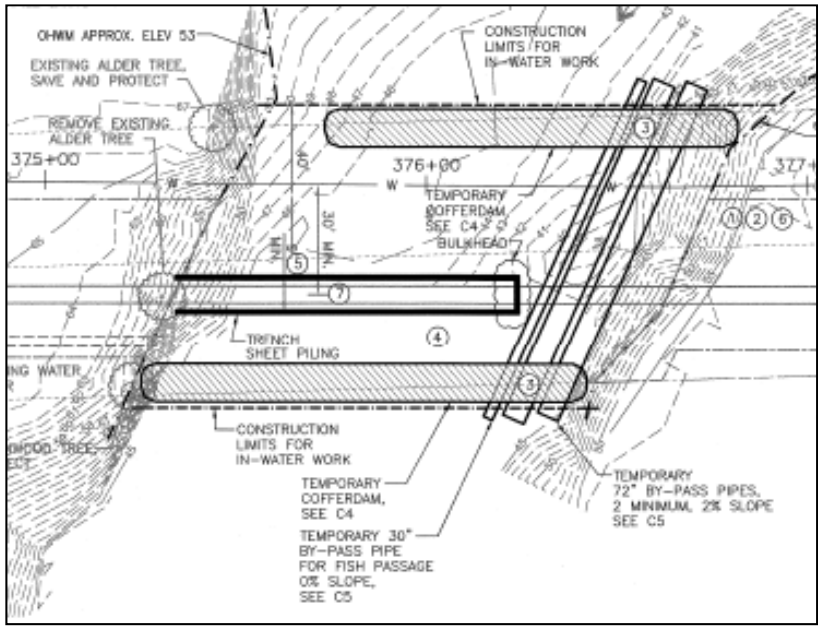
Design

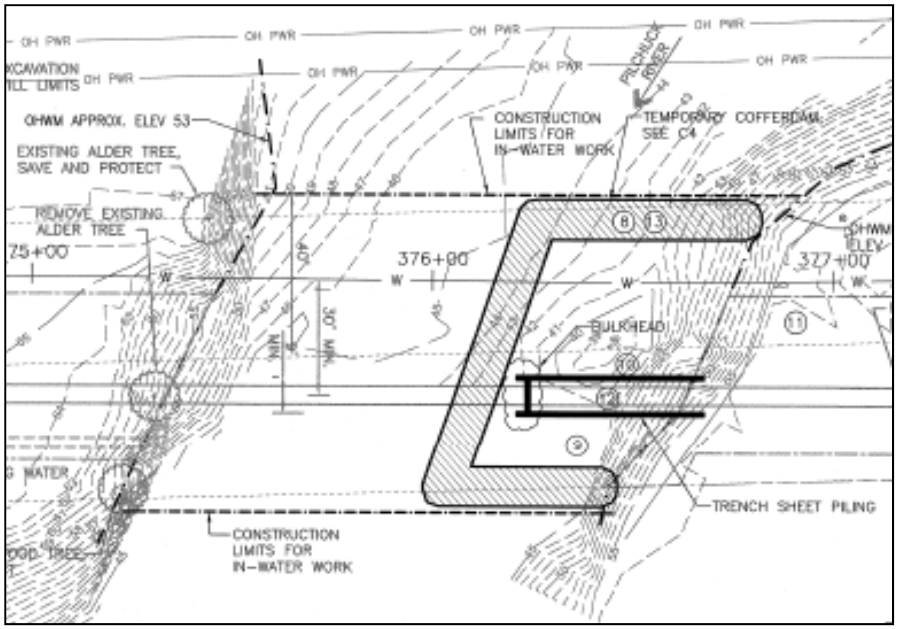


– Geotechnical
  - Investigation and data report
  - Performance based dewatering and shoring specifications

– River Hydraulics
  - Scour depth / cover over pipeline
  - Geomorphic review
  - Channel and streambank restoration
  - Zero rise analysis

River Diversion / Isolated Work Area





– Purpose
  - Obtain permits for in-water work
  - Isolate work area
  - Protect aquatic life

– Goals
  - Work within easement

– Concept
  - Two phased approach, if needed
  - Contractor to final design

Permits and Approvals

- Permit Agencies
  - US Army Corps of Engineers (Corps 404)
  - US Fish and Wildlife Service (ESA consultation)
  - National Marine Fisheries Service (ESA consultation)
  - Washington State Department of Fish and Wildlife (HPA)
  - Washington State Department of Ecology (401Certification)
  - Washington State Department of Natural Resources (Aquatic Easement)
  - Snohomish County (Shoreline, Flood Hazard, Building Permit, LDA)
- Permits finalized in May 2012
- Contractor Award June 2012
- In-water Work period
  August 1 to August 31, 2012

4: Construction

Construction – Design Bid Build 2012

Viewing South, downstream. Sheets are set up against sandbag diversion.

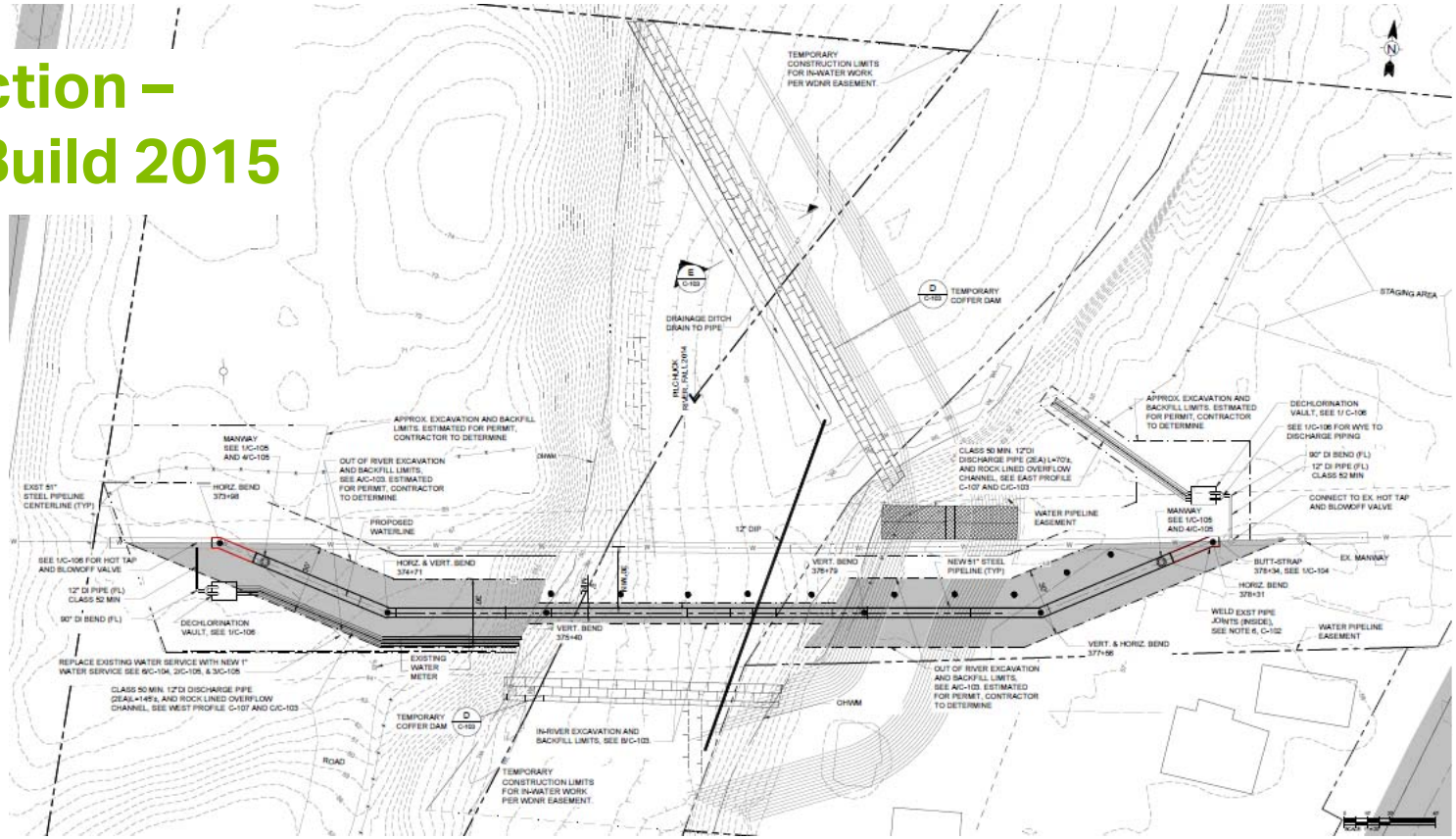
View southwest, downstream at remaining Pilchuck River flow.

- Permitted in-water work period:
  - 30 Days (August 1 to August 31)
- River Diversion (phase 1):
  - ~ 2/3 of the river around work area
- No dewatering wells installed
- Contractor needed more time to plan and construct

Construction – Design Bid Build 2012

- Sheet pile and shoring installed August 19-20
- Attempted to remove water from trench without success
- Contractor withdrew
  - Isolated work area dismantled
  - Banks restored
  - Site secured for future construction

Construction – Design-Build 2015



- Contractor team planned from RFQ, RFP, and through construction
- Permit revisions:
  - Longer in-water work period (July 1 to August 31)
  - River diversion around the work area
- Planning and ownership of soil and groundwater conditions

Early planning / preparation for in-water work window

– Groundwater wells:
  - Test wells (winter 2014/2015)
  - Well installation east trench April 2015
  - Low water year, so in June 2015, worked with agencies to install wells below OHW (close to the edge of the river)

East Pipe Trench

- Installed prior to in-water work (May/June 2015)
- Test section of pipe to learn about soil and groundwater
- River diversion channel to be constructed over top this new section of pipe

➢ Lessons Learned

- Significant amount of water in pipe trench, “like a waterfall”
- Bulkhead installed to help cutoff flow of water into the trench

Diversion Channel Construction / River By-pass

- Open channel, lined with geomembrane and rock
- Constructed out of the OHW prior to in-water work period

Diverting the River into Diversion Channel

– Upstream end

– Downstream end

Fish Removal / Start work to “dry” river bed

- River is diverted
- Now time for fish removal

- Route surface water out of channel
- Groundwater well installation and trench shoring

Pipe Trench Across River

– 20 feet below river bottom

Connection Points (old / new pipe)

– East
  - Looser material than west side
  - Many large boulders encountered
  - Difficult groundwater conditions

– West
  - Highly cemented soils
  - Less groundwater

River Crossing Complete

Construction Everett-HD.mp4

Bank Restoration

- Rock riprap below OHWM
- Soil/coir fabric wraps
- Live stakes / native vegetation

- Restore diversion channel cut through private property
- Cottonwood to be used for restoration

Dewatering Existing 5-Line / Preparing for Connections

– October 22-23, 2015
  - Pipeline shutdown at 10 PM, 10/22
  - Gravity drained by 2:15 AM

- Multiple crews both sides of river (pumping out water, welding, coatings)
- Connections complete and water restored 8 PM, 10/23.

Summary and Lessons Learned

- Design Build
  - Provided excellent planning opportunity for dewatering and river diversion
  - Good and direct communication with permitting agencies allowed for meeting deadlines
    - Increased time for in-water work
    - Can talk with permit agencies directly about means and methods
    - Coordinated permission to encroach on OHWM areas
    - Removal of existing pipeline
      - » Condition of Aquatic Lease Agreement (by 2022)
      - » Easily added to permit through direct coordination with Agencies based on actual Contractor methods
      - » Successful removal in November 2015
  - Contractor's team had to think about it from RFQ to RFP selection.
  - Paid off as work went seamlessly.
- Sentiment after 1st try was to go trenchless
  - Low feasibility / High Risk due to geologic and groundwater conditions
    - Verified via construction

Thank You

Richard Hefti, PE
Senior Engineer, City of Everett Public Works
D: 425-257-7215, RHefti@everettwa.gov

Carla Talich, PE
Senior Civil Engineer/Project Manager, AECOM
D: 206-438-2125 carla.talich@aecom.com