Pipe Filling and Draining: *Is it really that simple?*

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PLUMMER

UPPER TRINITY REGIONAL WATER DISTRICT

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REGIONAL WATER DISTRICT

- Created in 1989

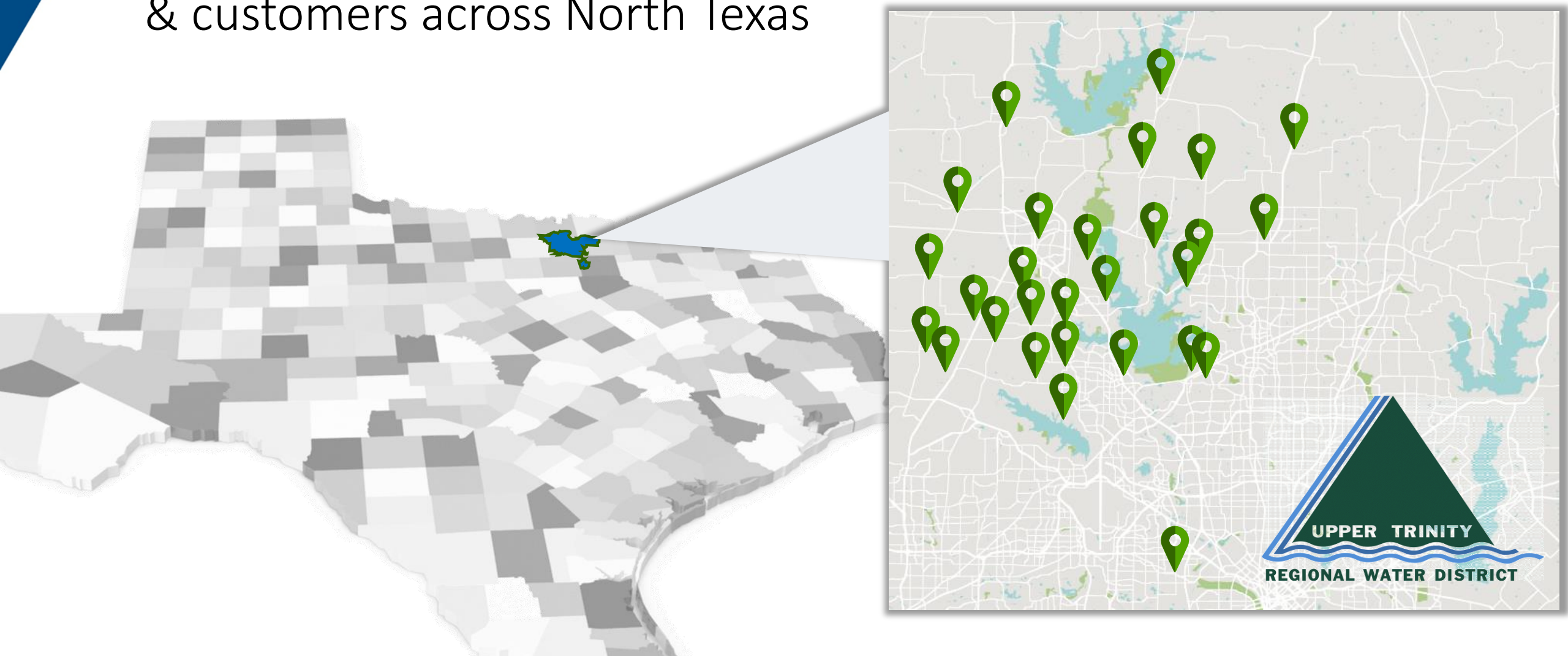
- Located in Denton County Texas

- Approximately 30 member cities and utilities

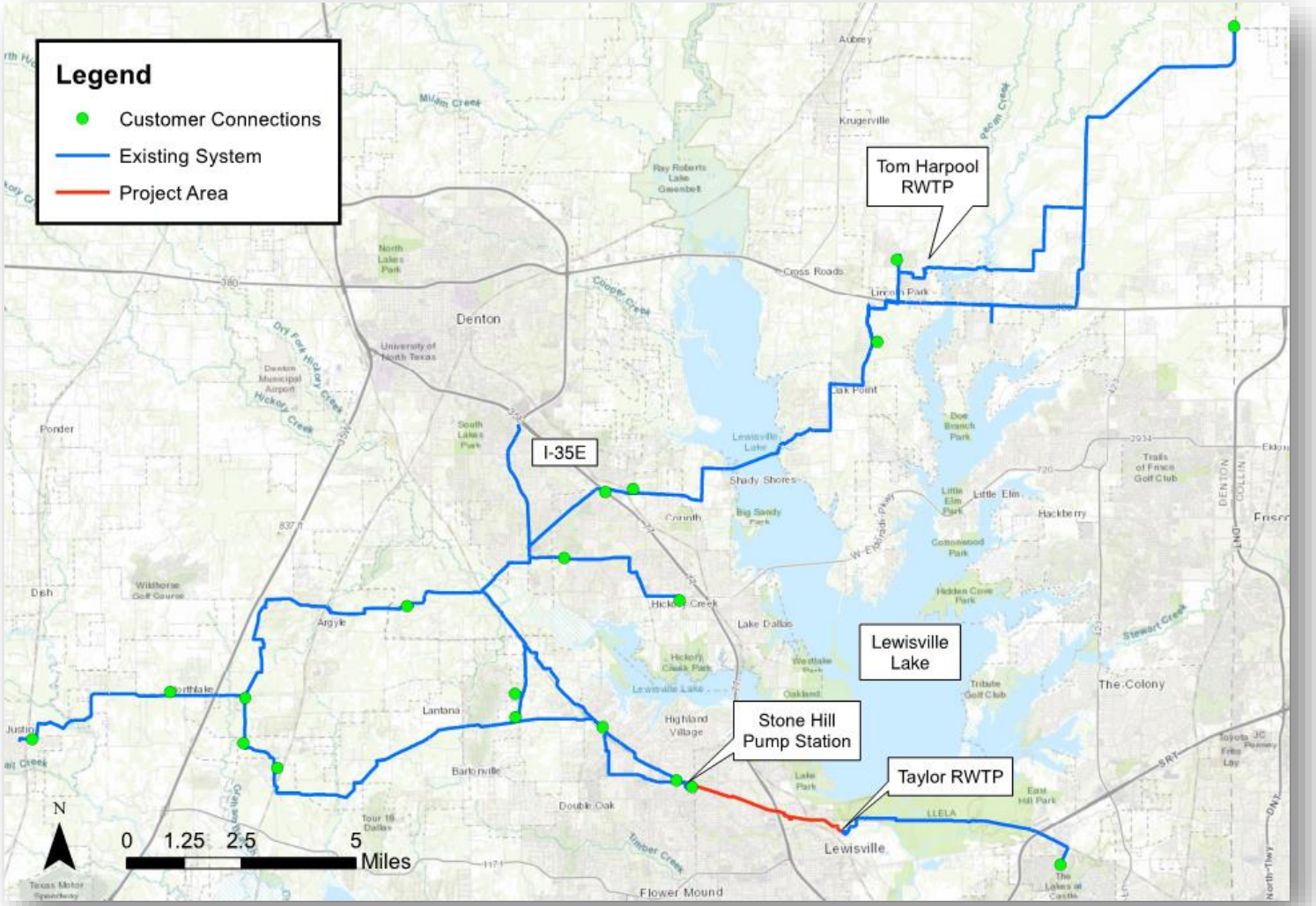
- Wholesale Water and Wastewater service provider

Upper Trinity Regional Water District

Upper Trinity Regional Water District (UTRWD) serves members & customers across North Texas

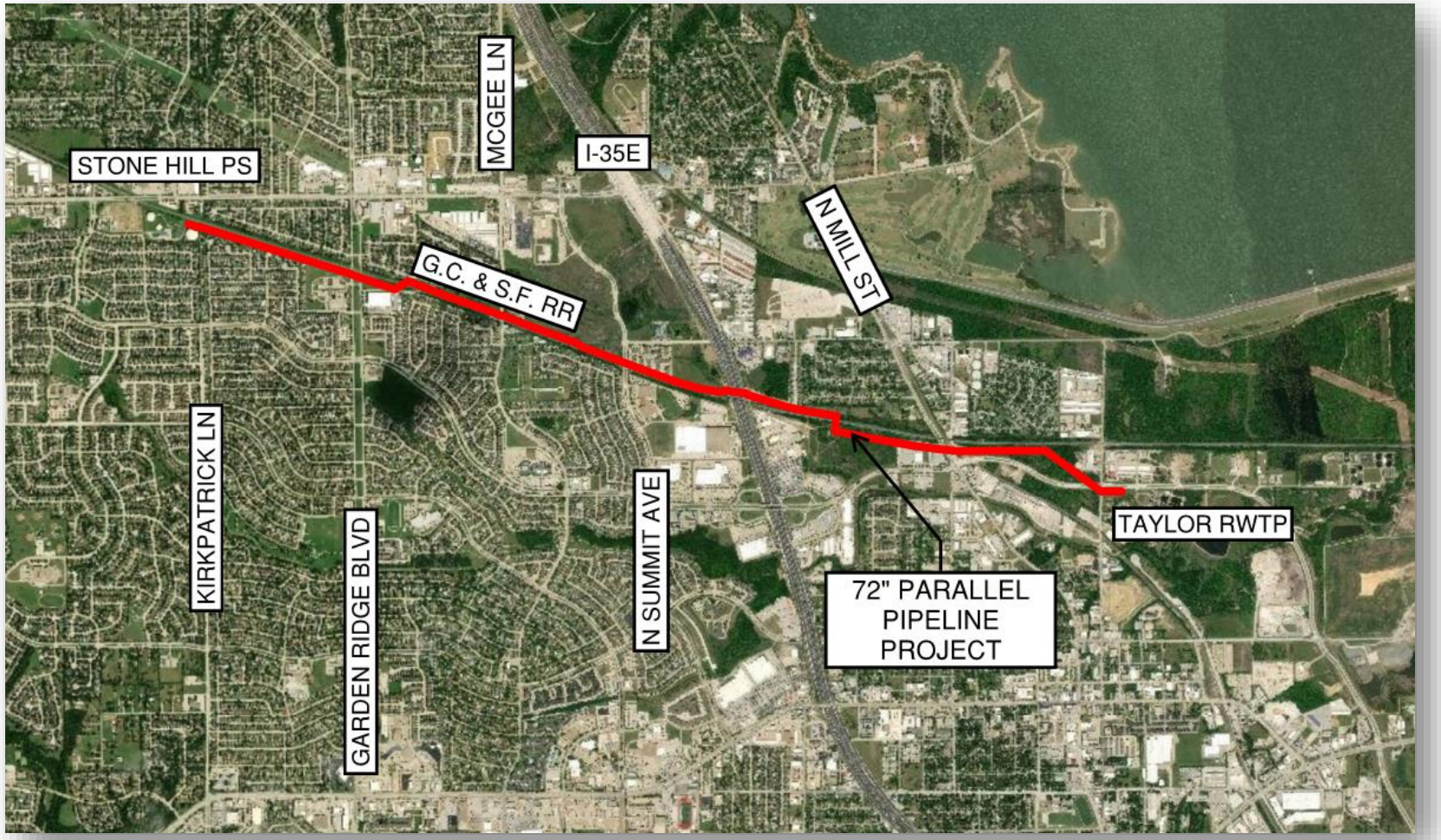


UTRWD System Map



Parallel Pipeline from the Taylor RWTP to Stone Hill PS

- Original 48-inch waterline built in 1996
- New 72-inch waterline begins construction in January 2020 and will be completed by April 2021
- Contract Manager at Risk (CMAR) project
- Three contractors involved



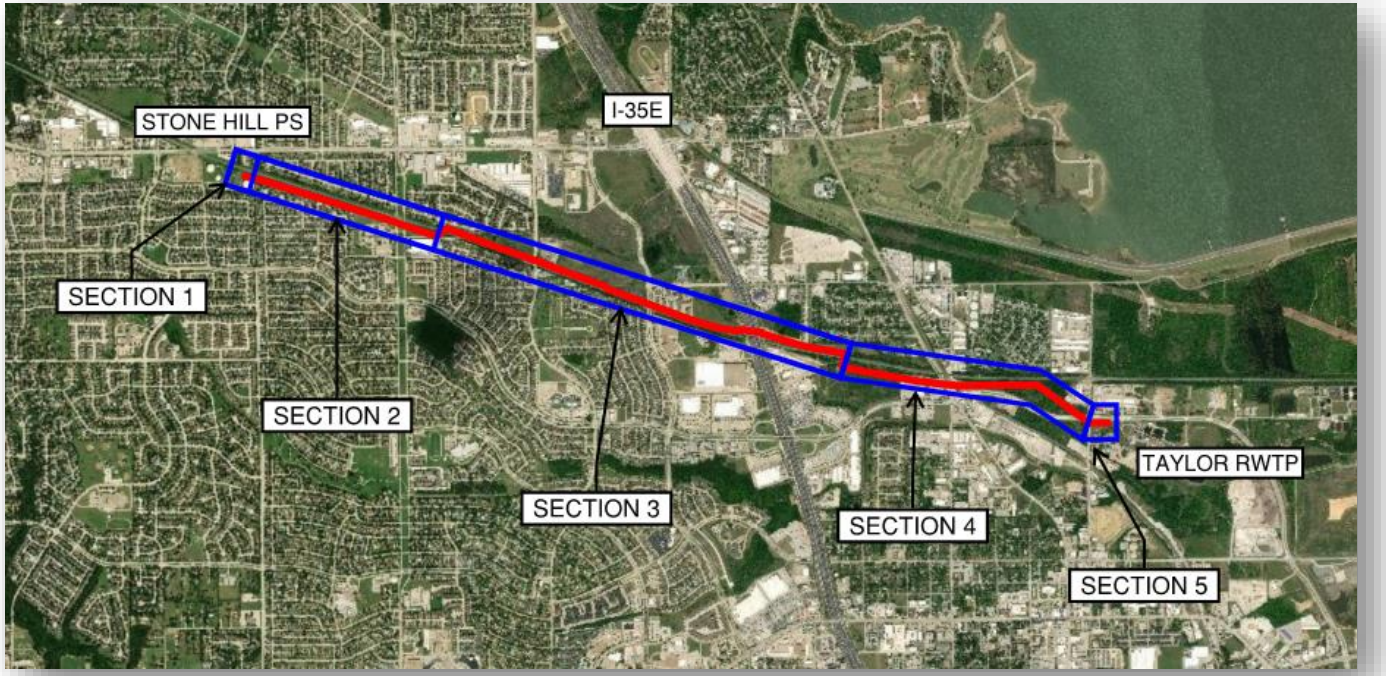
Is it really that simple?

- The design for filling and draining a line can often be taken for granted
- Plummer wanted to develop a strategy to accurately size and place blow-off valves

Image by: https://www.today.com/health/heat-wave-danger-baby-burned-scalding-water-outdoor-garden-hose-t99571

FILLING – One Section at a Time

- Pipeline will be broken into five sections
- Each section will be filled, tested, and drained separately
- Finally the entire pipeline will be refilled, tested, disinfected and flushed
- This process will take an estimated 20 million gallons of water



FILLING – Different Methods

- Evaluated three different options for filling the waterline
  - Existing fire hydrants
  - Main pump station
  - 48-inch parallel pipeline
- The current plan is to use a combination of the 48-inch parallel pipeline and existing fire hydrants at the PS and WTP

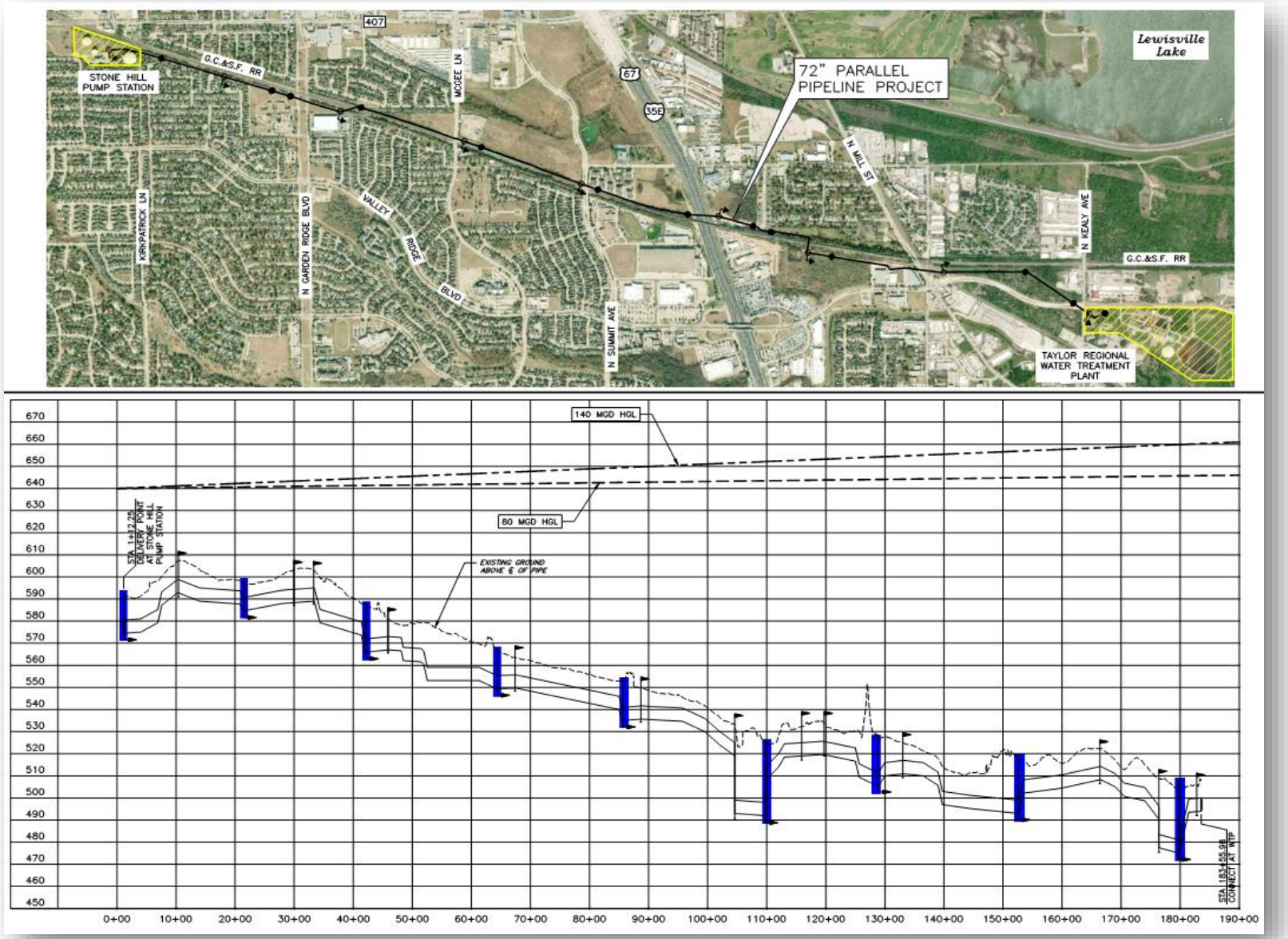
FILLING - How fast is too fast?

- Air release rate will greatly impact the ability to fill a line
- CAV sizing and placement is a large consideration

Image by: https://www.npr.org/2016/04/18/474658536/is-yellowstone-national-park-in-danger-of-being-loved-to-death

DRAINING - BOV Placement

- Used for maintenance
  - Drain line
  - Relieve pressure
- Located at localized low spots



DRAINING – Modeling the System

- The system was modeled as a standpipe to account for the changes in head that affect drainage rate
- Used a derivation of the Bernoulli equation to find velocity of water leaving pipe

$$v = C_v\sqrt{2gh}$$

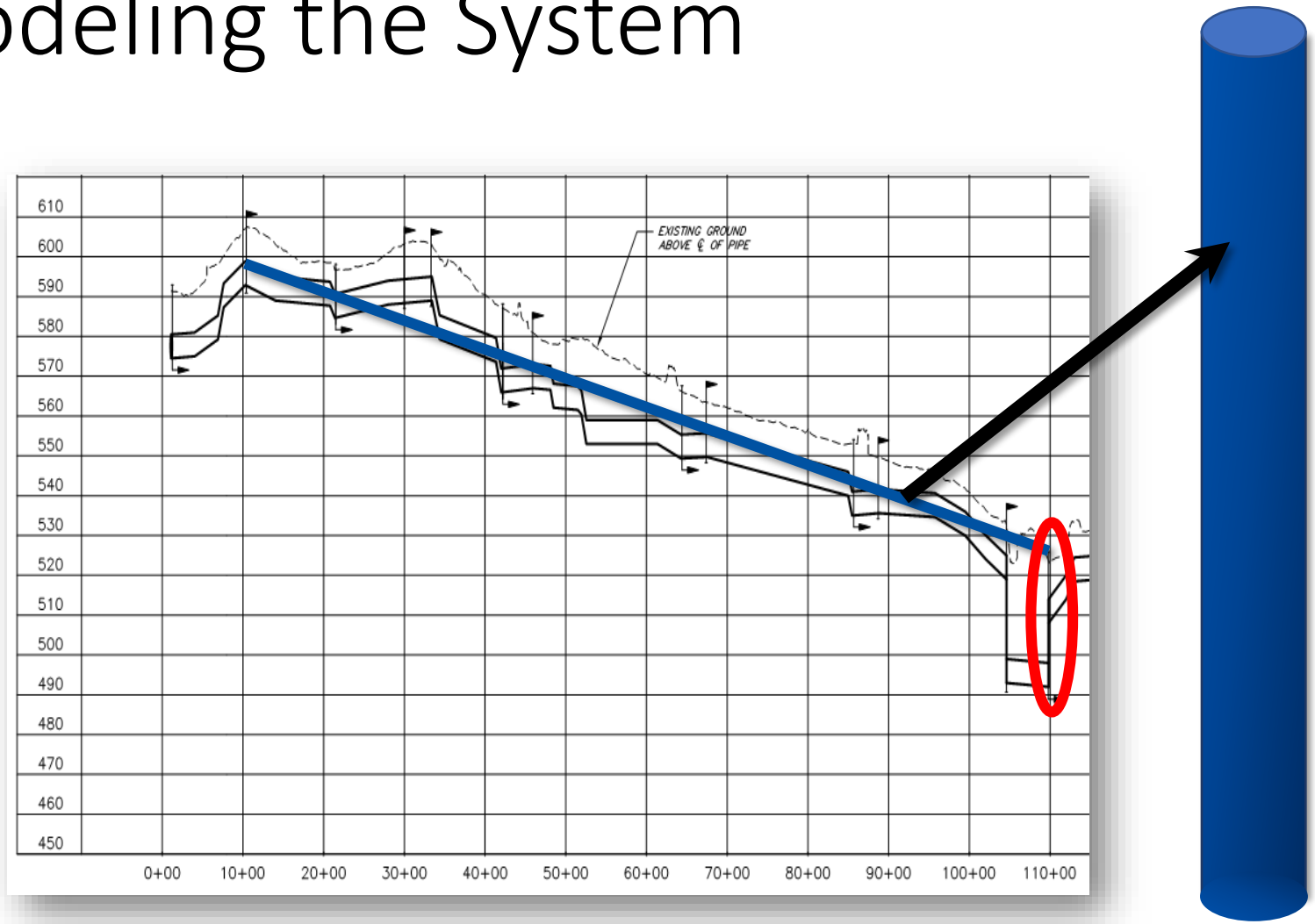
Where,

V = velocity

C_v = coefficient of velocity

g = acceleration due to gravity

h = height of "standpipe"



DRAINING – Sizing Cont.

- Sizing determinations:
  - 24-inch BOV at I-35E
  - All others 12-inch
- Also had to considered the surrounding land surface area drainage capacity

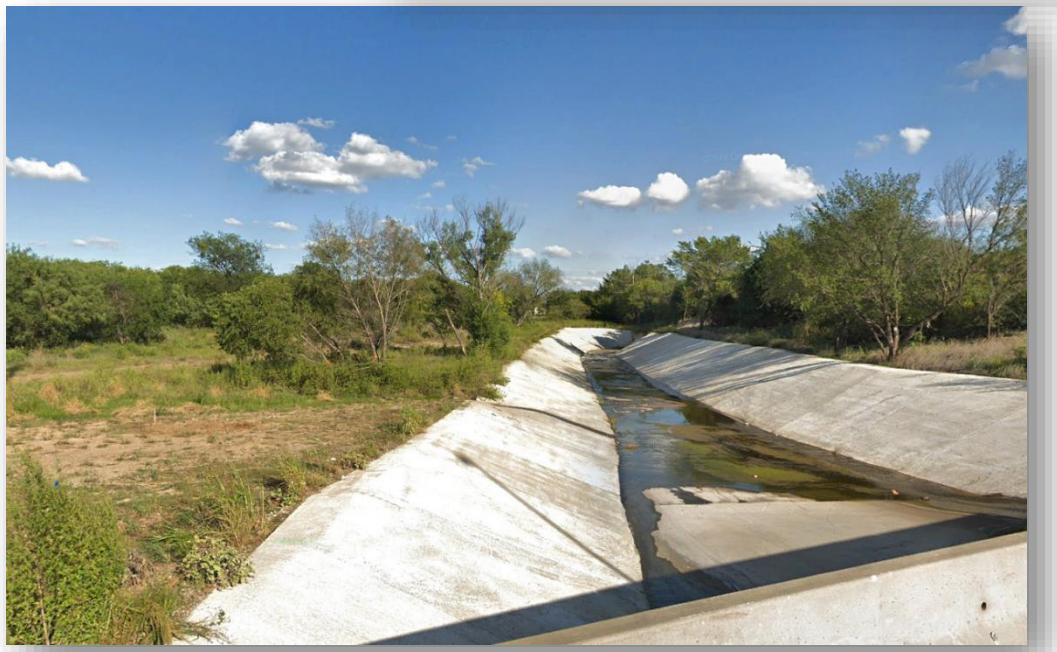
DRAINING – Butterfly Valve vs Gate Valve

- Butterfly valve
  - Less space required
  - Usually cheaper for larger application
  - Prohibits full flow
- Gate valve
  - Allows full port flow
  - Usually cheaper for smaller applications
  - Easier to regulate flow
- Plummer decided to use gate valves for every blow-off valve assembly

Source: https://www.phcppros.com/articles/9245-matco-norca-225-series-gate-valves & http://www.wermac.org/valves/valves_butterfly.html

DRAINING – Discharge Considerations

- Various methods for chlorine elimination from discharge
  - Liquid adding station for sulfur dioxide
  - Bags of de-chlorination pellets on concrete surface at site
- Consider orienting blow-off valve to drain in an acceptable area
  - Utilize existing channels
  - May need to install concrete pads or riprap channels



Operation & Maintenance

- Preliminary setup
  - Estimate possible flow rates
  - How many ARVs and blow-offs CAN be used
  - Helpful tools
  - Time to fill ≈ time to drain
- Possible issues to consider
  - Buoyancy issues
  - Pressure pockets
  - Customer needs
- Operation
  - Multiple personnel
  - Time constraints
  - Location, location, location

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