ASCE | PIPELINES 2014 CONFERENCE
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From Underground to the Forefront of Innovation and Sustainability

Design of Utility Pipelines Through an Active, Urban Landslide

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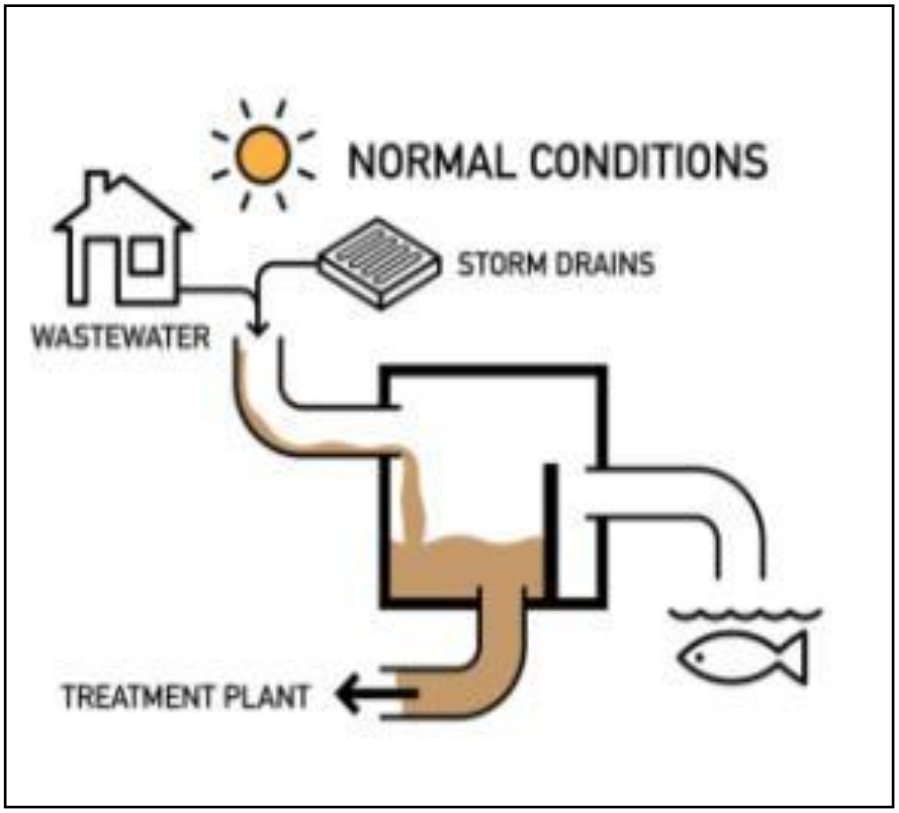
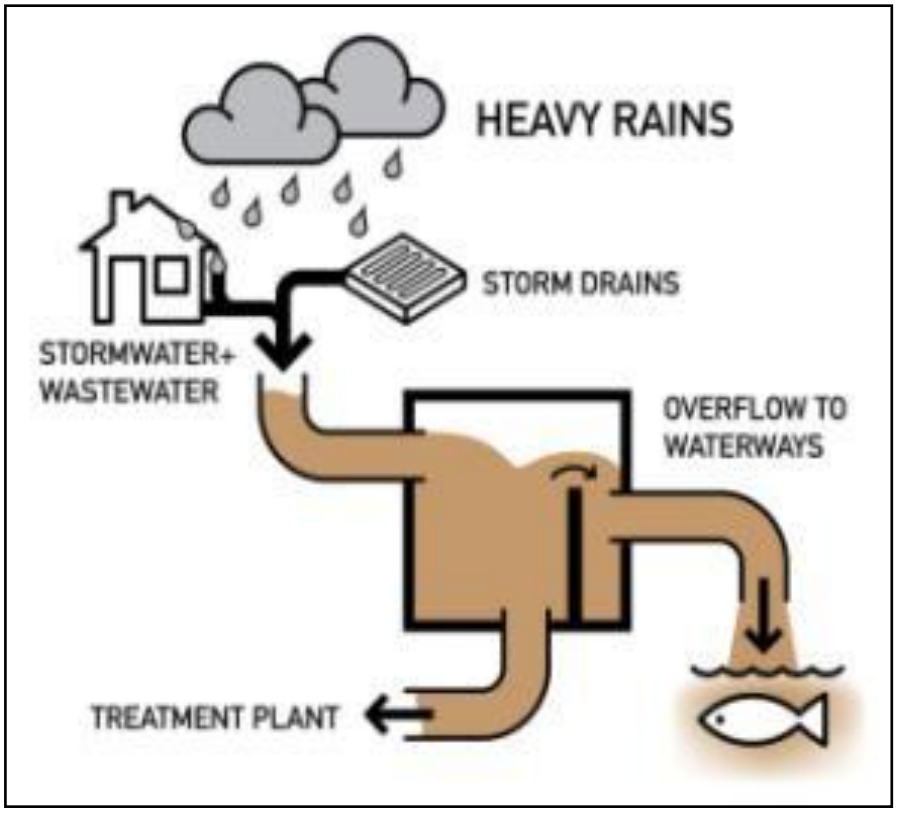
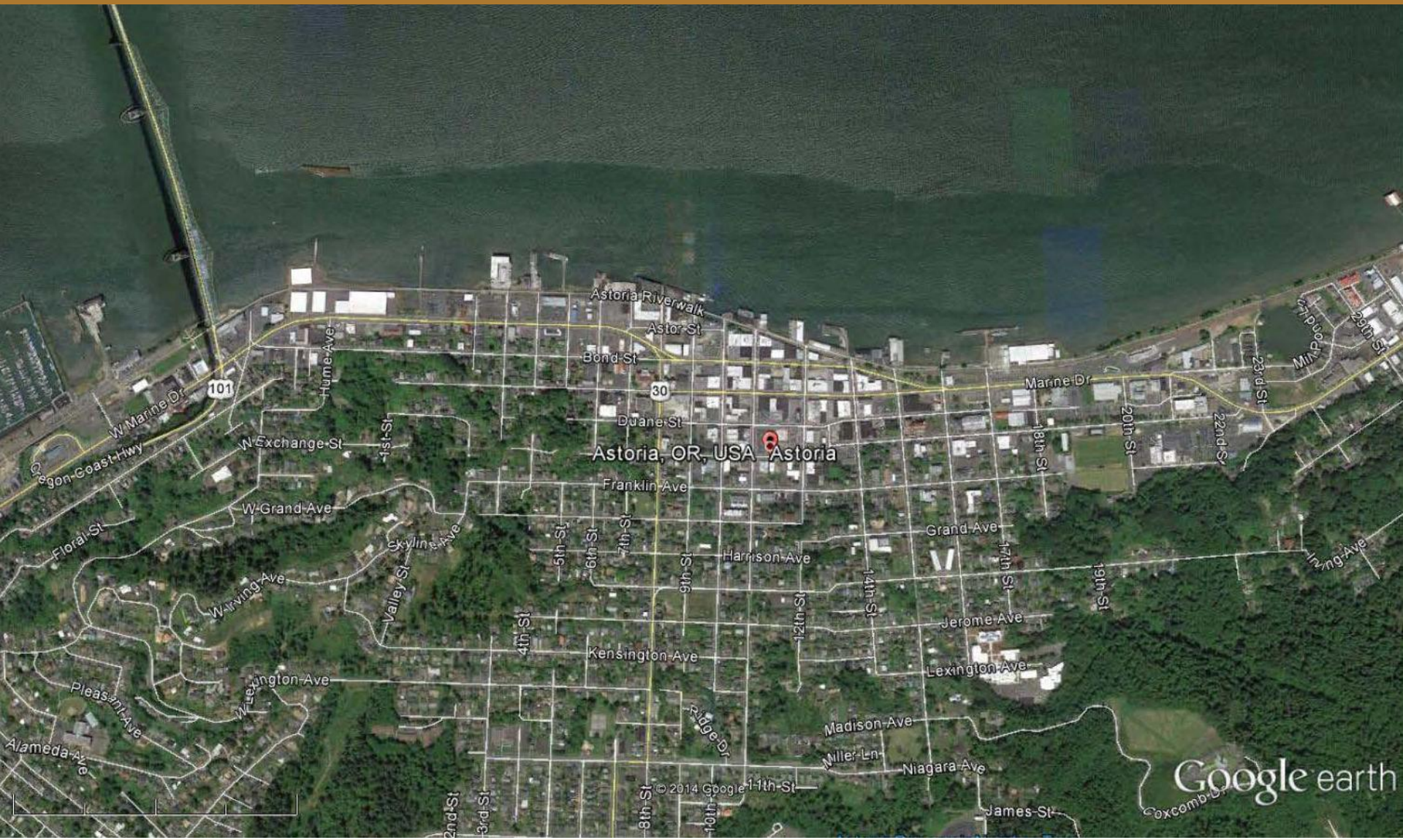
GIBBS & OLSON

Why Project Needed?





Project Area



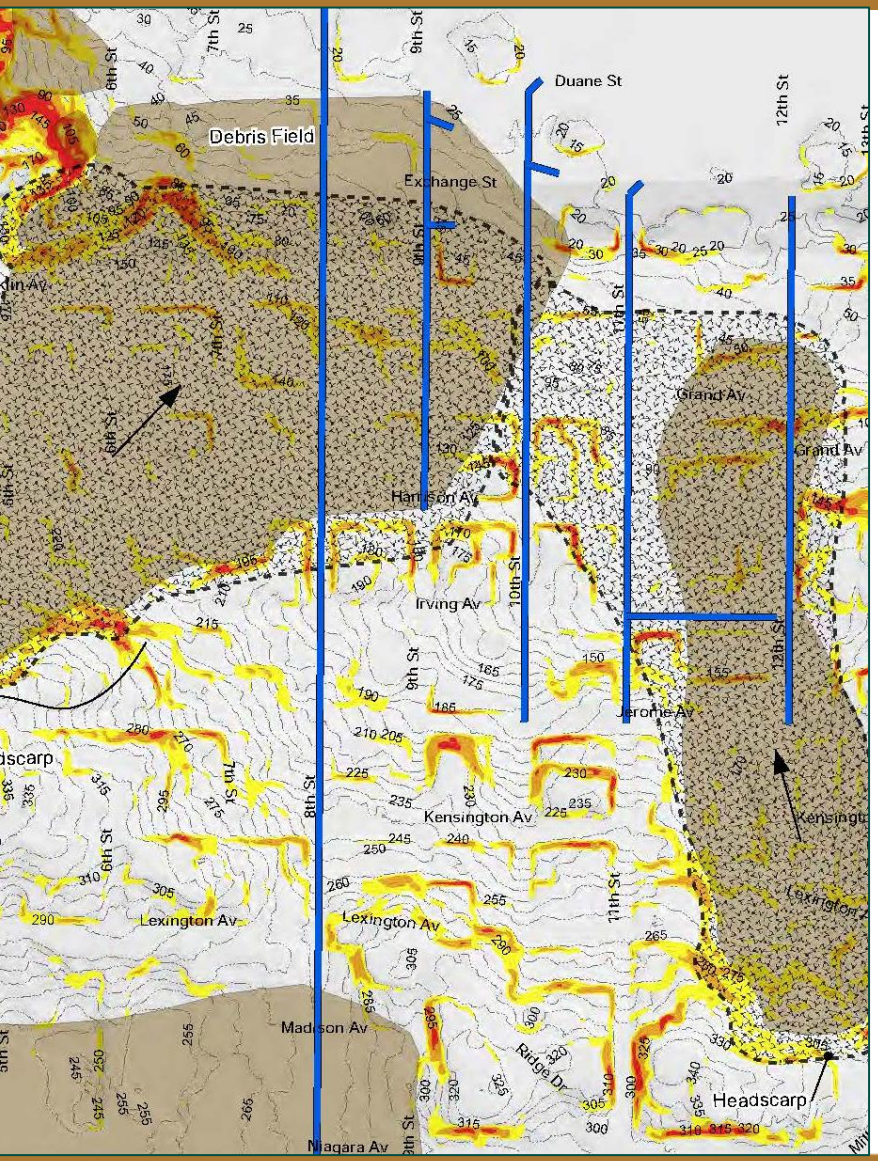
Project Area

- 30 blocks of urban residential area within large active landslide

Existing Conditions - Piping

- terracotta w/ areas of corrugated metal and PVC
- Brittle gray cast iron

Unique Challenges



- Pipelines through two large, active landslides
- Creeping ground movements, variable rates and direction
- Extreme slopes up to 28 percent
- Shallow groundwater and groundwater springs

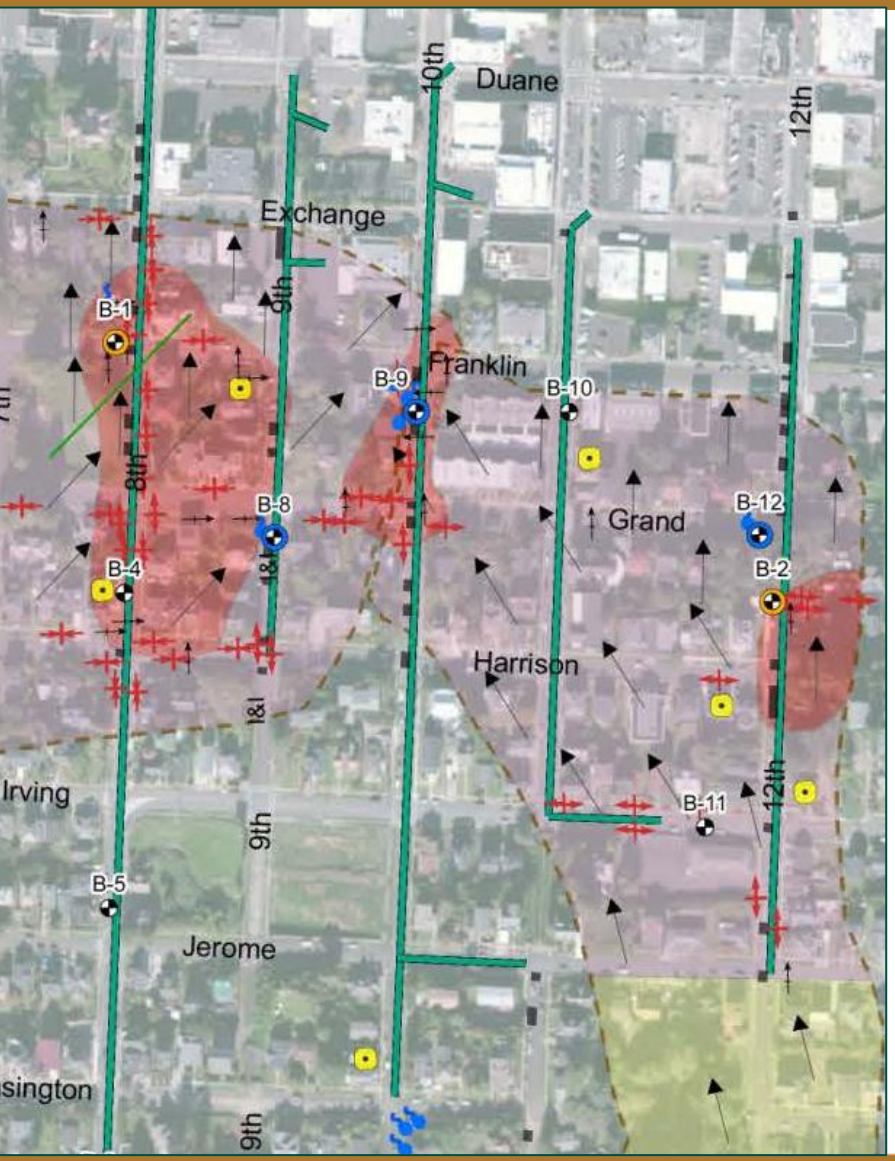
History and Background

- Residential hillside on top of ancient landslide complex
- Activity varies
- Surface and subsurface indicators of differential movement
- Occasional catastrophic failures

1st Phase – Geotechnical Mapping

- Performed preliminary geologic hazard evaluation
- Reviewed existing, documents, sewer video and other data
- Field visits to document existing conditions

1st Phase – Geotechnical Mapping



- Plotted GIS base maps
- Identified areas of tension, compression, and translation
- Determined dominant direction
- Assigned classification and rating system
- Developed boring plan

2nd Phase – Geotechnical Explorations

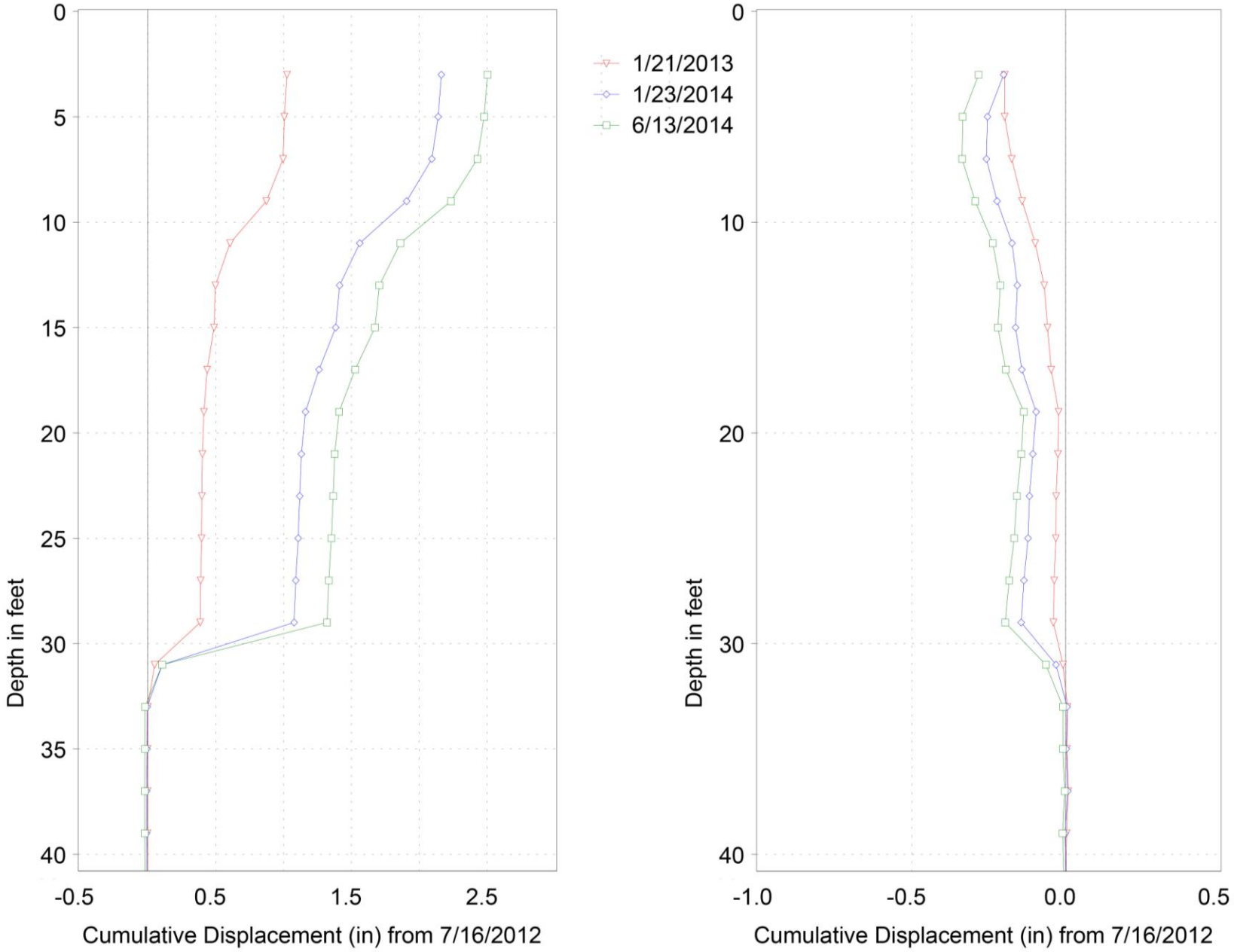
Photo 1: B-1, Box 1, Run 1 at 32.5' to Run 3 part at 43.1'

Photo 2: B-1, Box 1, Run 3 continued at 43.1' to Run 5 part at 52.4'

- 14 bore locations
- 5 observation wells
- 2 vibrating piezometers
- 2 inclinometer casing
- Other field and laboratory testing
- Follow up instrumentation monitoring

Slope Inclinometers

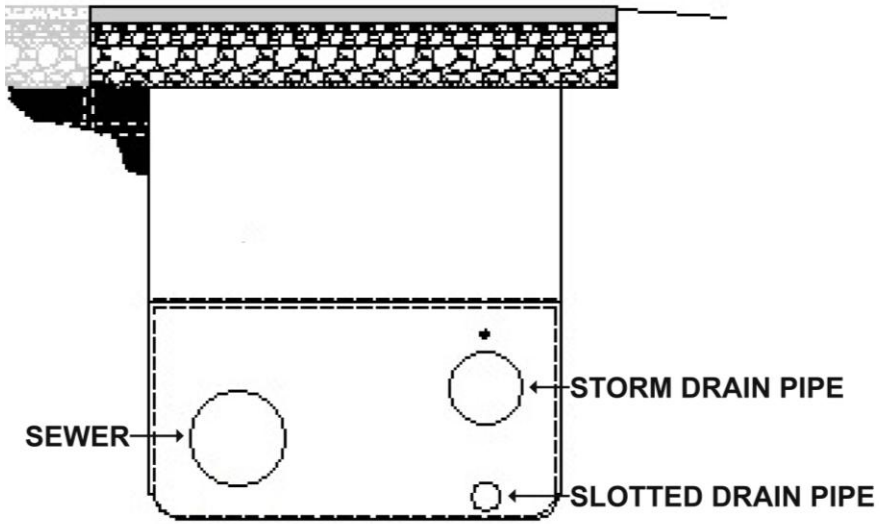
- 2.75 inch slope inclinometer casing installed to depth of 60 feet in two borings
- After initial reading , subsequent readings made to determine direction and magnitude of movement
- Recorded 2.5 inches of cumulative surface movement in a period of 23 months

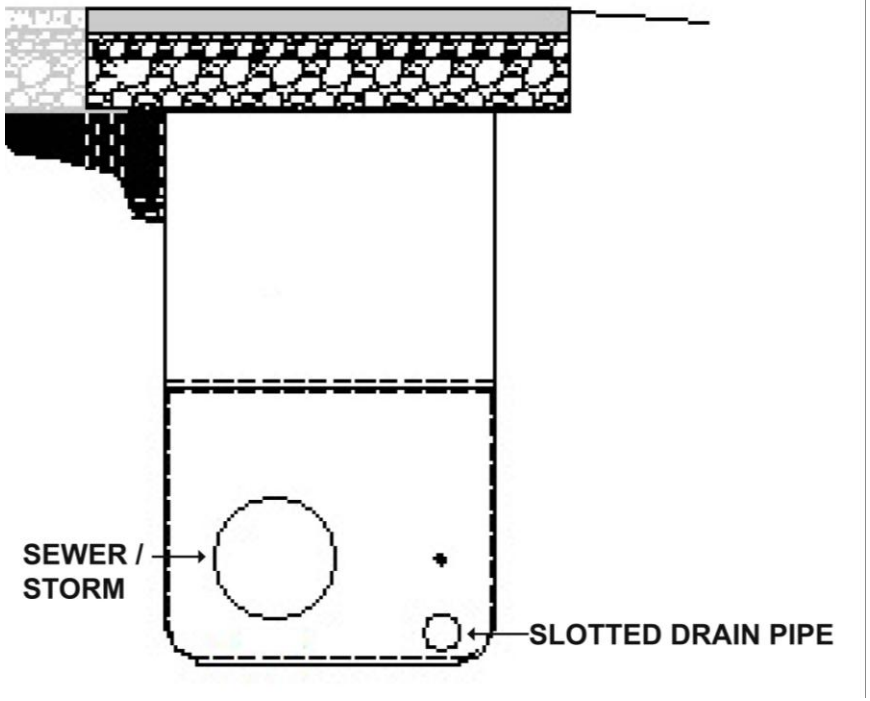

1/21/2013
1/23/2014
6/13/2014
Depth in feet
Cumulative Displacement (in) from 7/16/2012
0
5
10
15
20
25
30
35
40
-0.5
0.5
1.5
2.5
-1.0
0.0

Pipeline Design

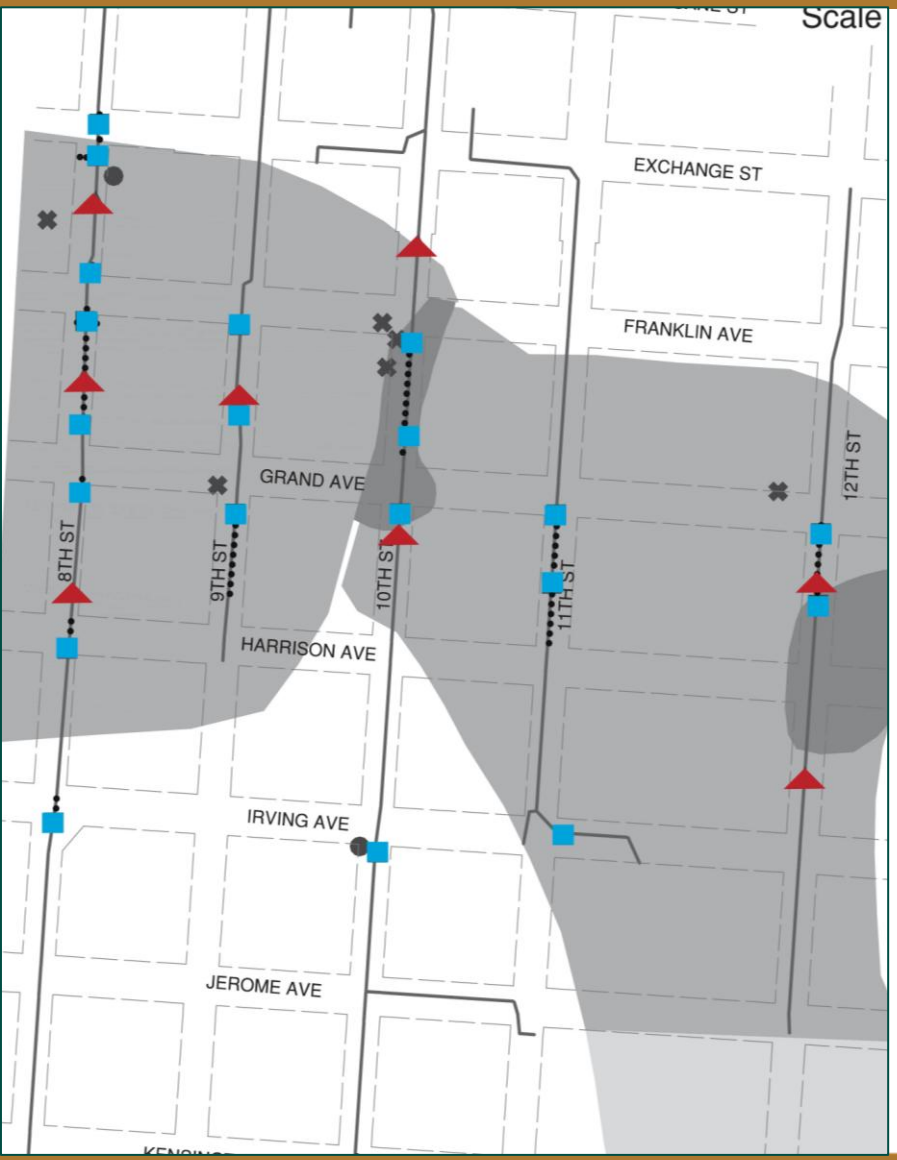
- Accommodate vertical & longitudinal movement
- Groundwater collection
- Vaulted/hallow sidewalk
- Steep slopes
- Joint trench for sewer/ storm
- Major vault on cross street

Pipeline Design



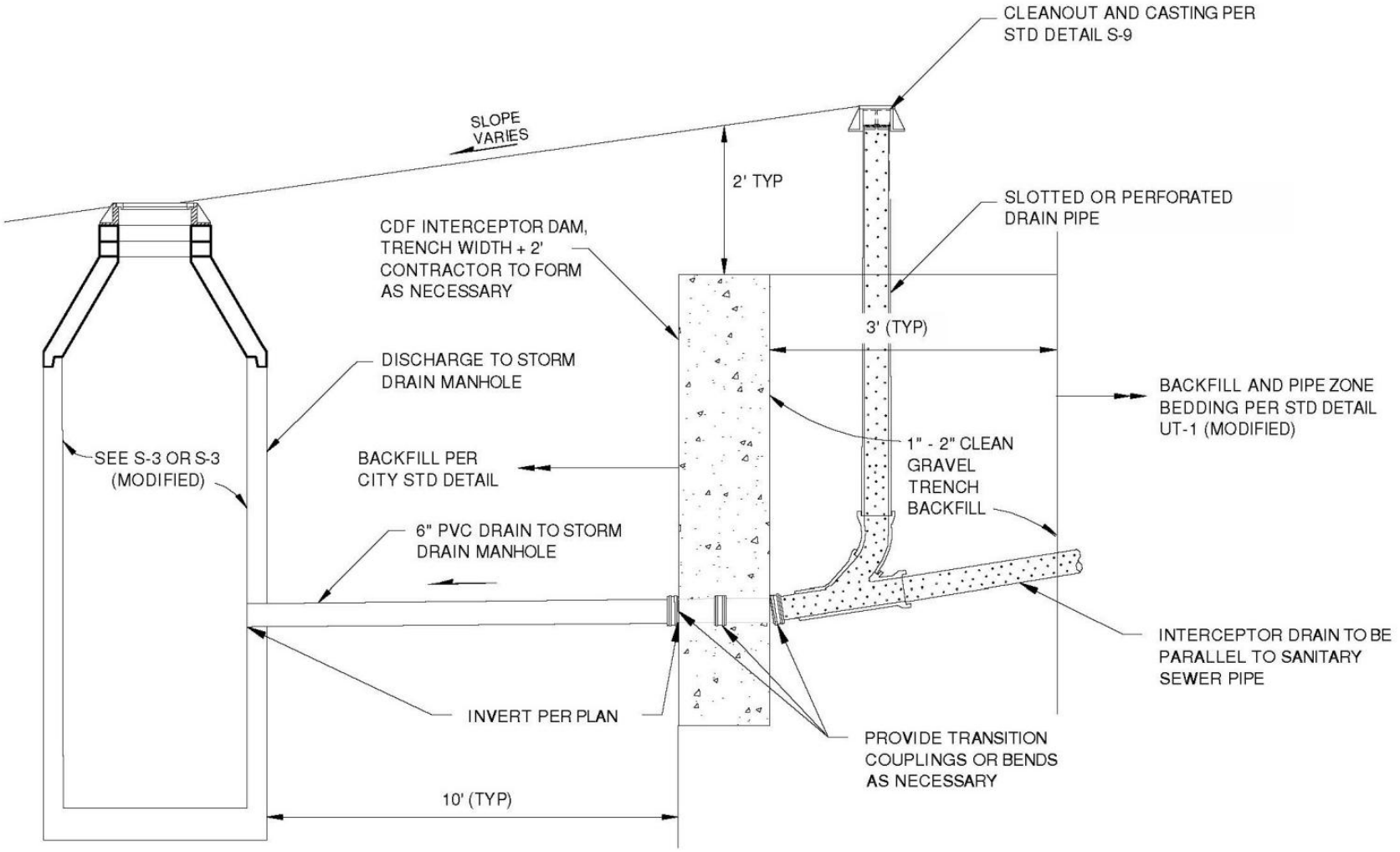


Collection & Redirection of Groundwater



- Two methods
  - Trench cutoff walls with slotted under drains
  - Interceptor drains in key locations using drywell structures

Trench Dam



TRENCH DAM AND INTERCEPTOR DRAIN DETAIL

N.T.S.

Questions?