Non-Potable Water Supply Program Development in Beaverton, Oregon

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In Association with Clean Water Services

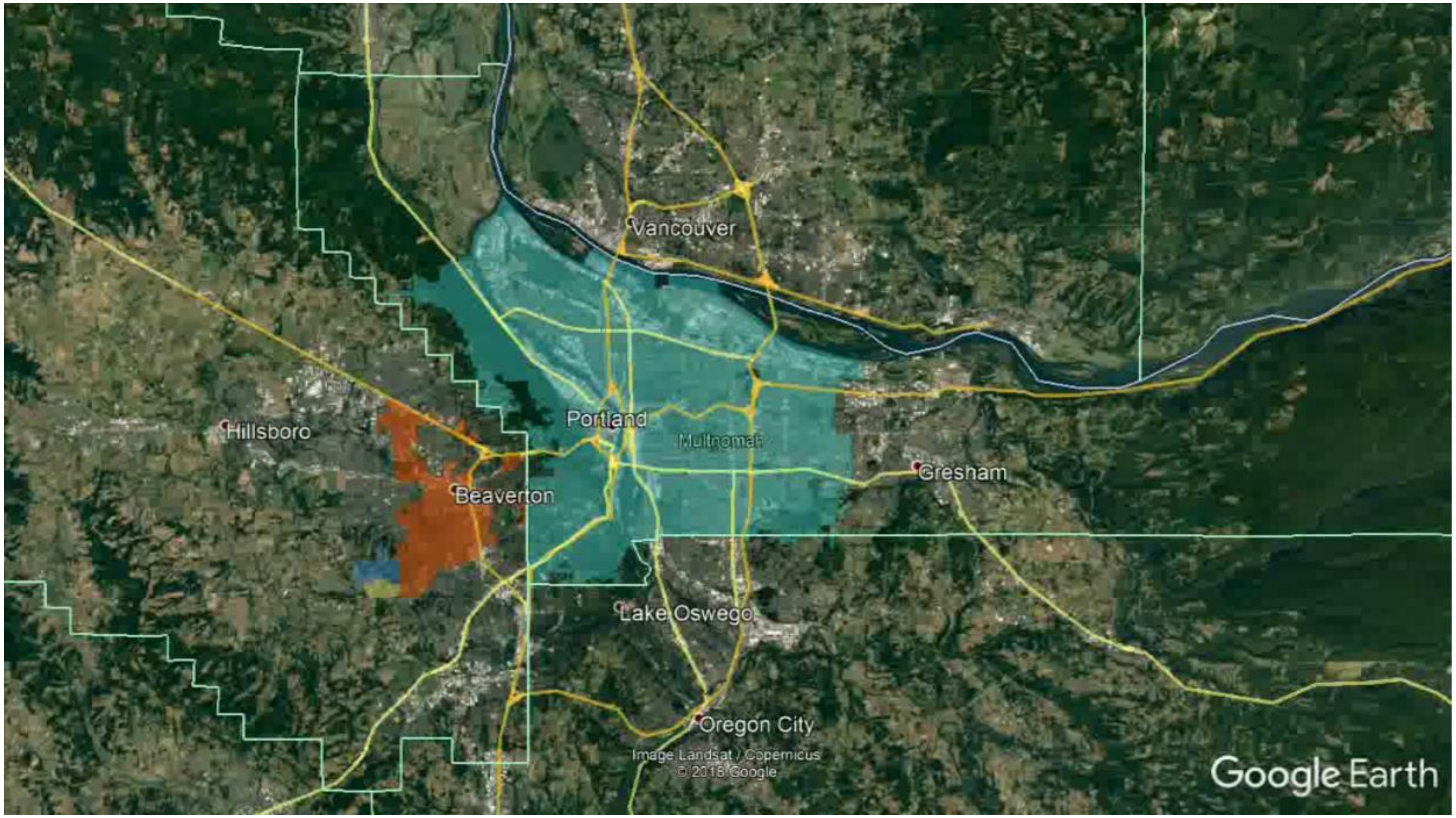
Introduction

- South Cooper Mountain Development Area
  - 540 acres
  - Urban reserve 6B– additional 1,200 acres
  - Planned 7,000 residential units for both areas
- Offset potable water supply
- Leverage infrastructure development opportunity
- Stormwater management
- Streamflow enhancement





Project Location



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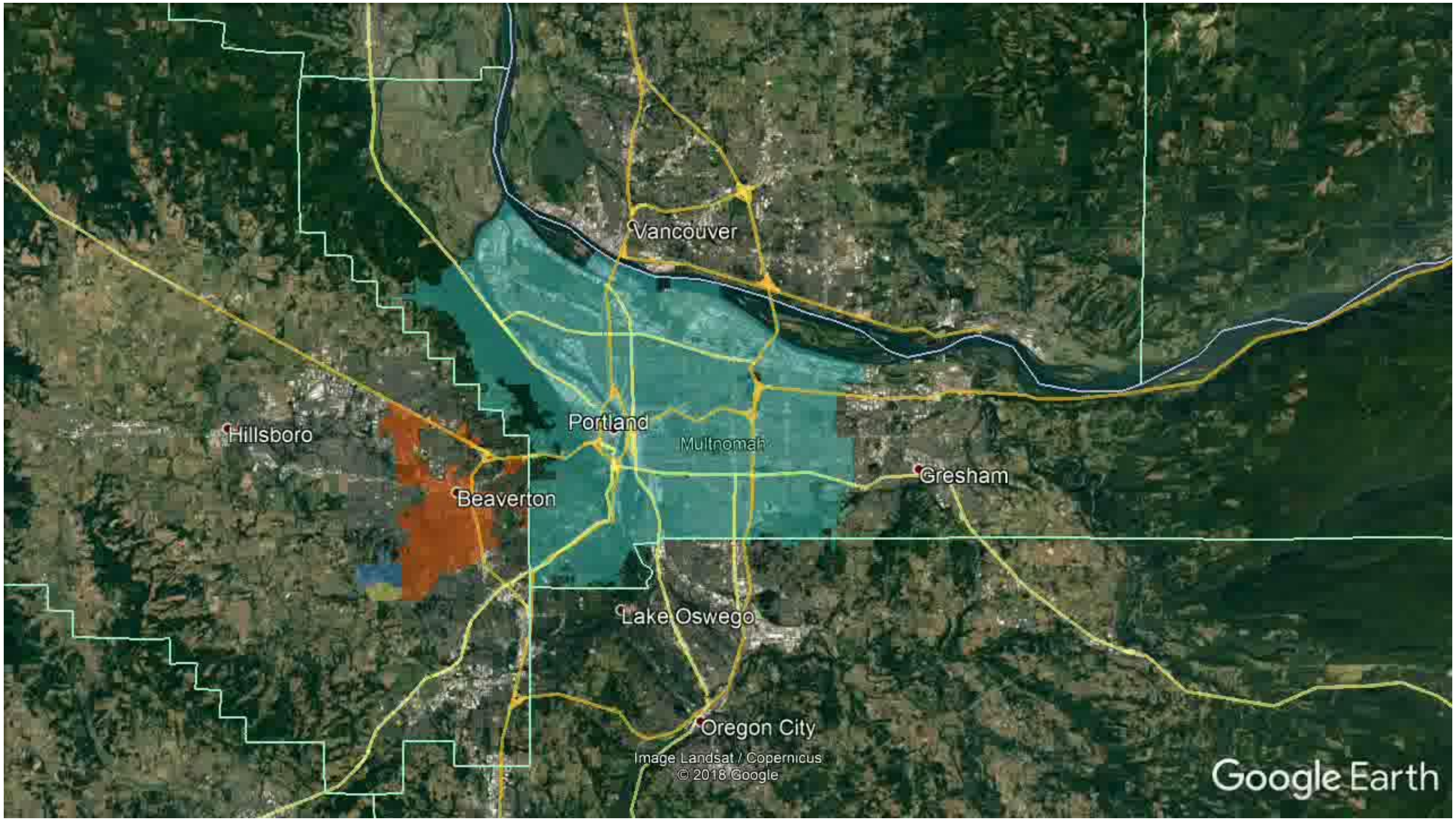
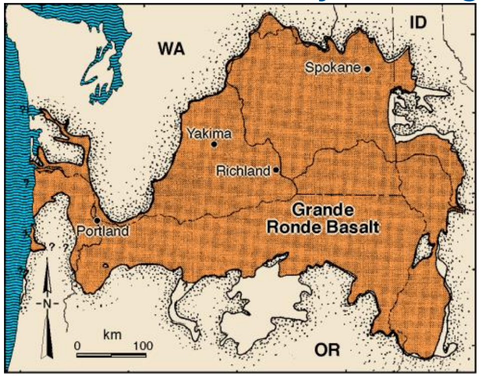
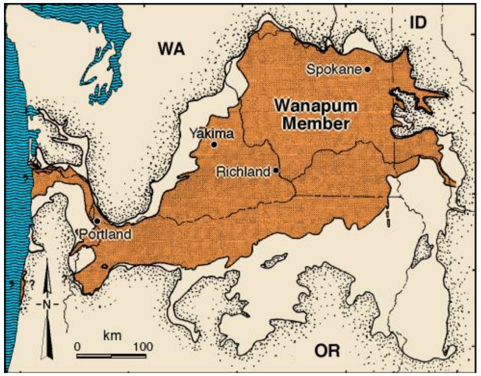


Columbia River Basalt Group

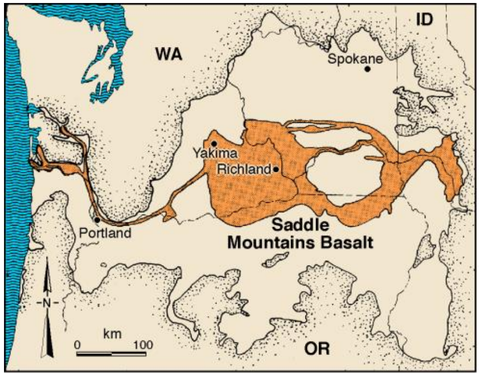
15 to 17 million years ago



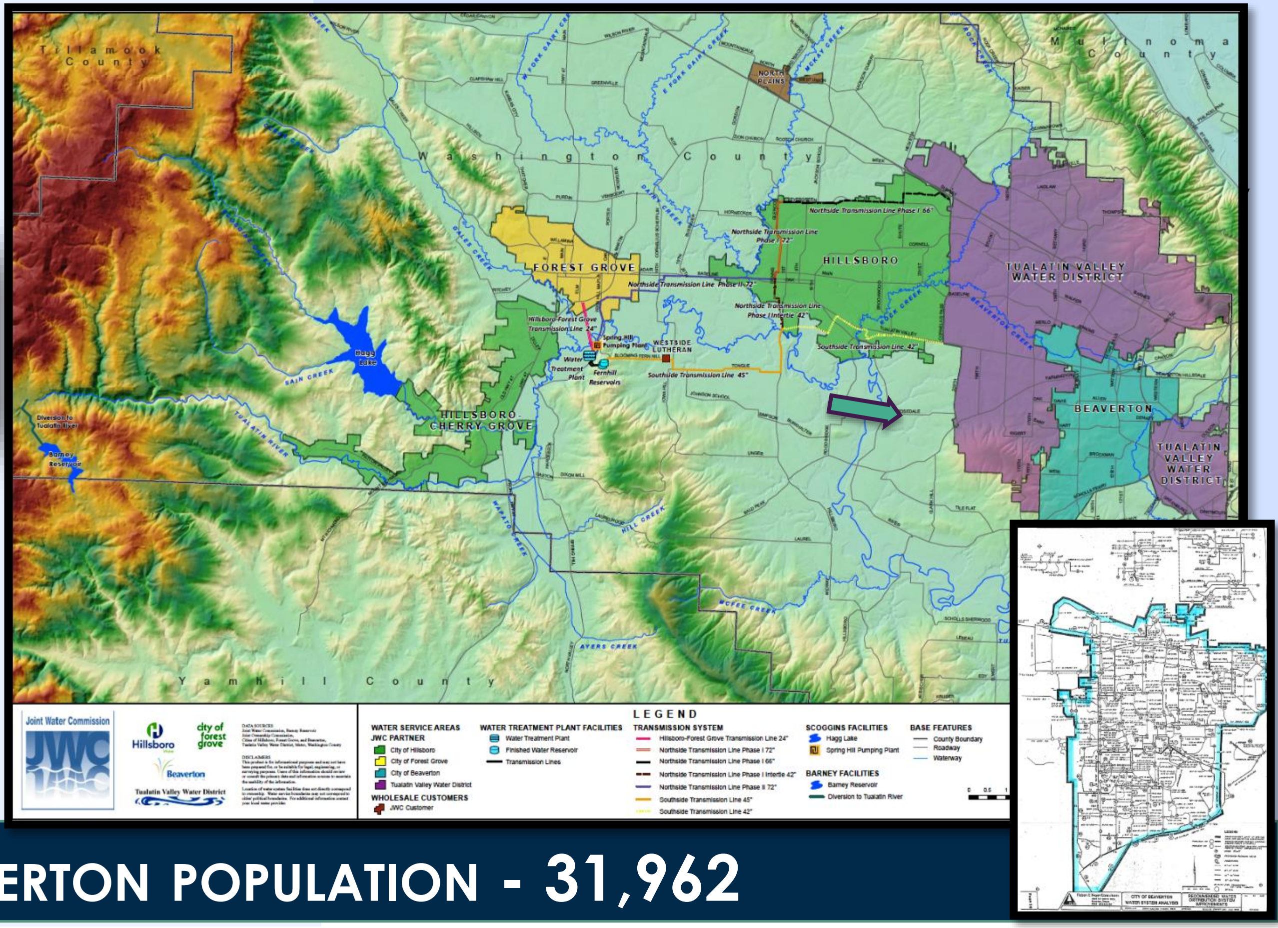
14 to 15 million years ago



6 to 14 million years ago

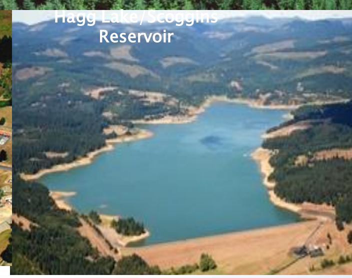


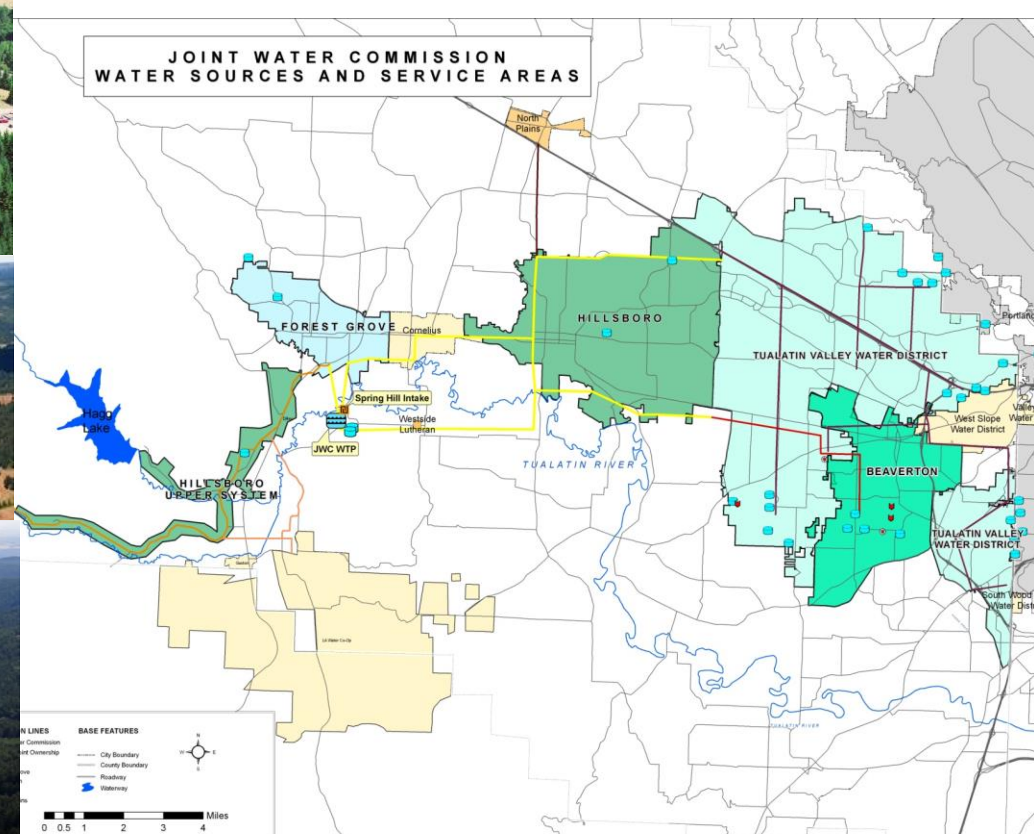
1980 Beaverton joins JWC – 100% surface water supply



1980 Beaverton population - 31,962

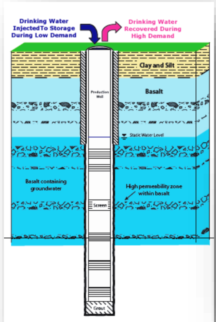
JWC Water Supply System
(75% of City's summer water)
ASR (25% summer water)

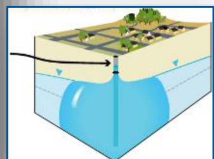




2019 Beaverton Population: 97,000

Beaverton ASR Program





City of Beaverton
Total City Population: 97,000

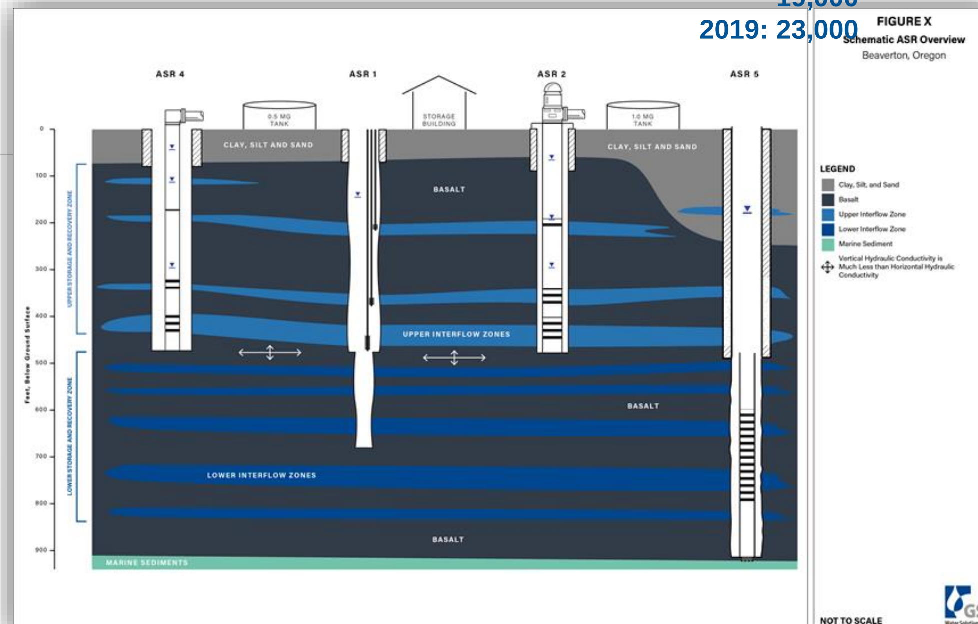
2018 Population Served: 71,000
2019: 87,000

2018 Total Water Meters: 19,000
2019: 23,000

- Second municipality in Oregon to develop ASR, and have been successfully operating ASR wells since 1998.
- Two active ASR wells (ASR2, ASR4), 5 mgd capacity
- Currently in ASR expansion phase on a path for up to three future facilities to serve growth, emergencies and create resiliency.
    - Potable ASR 5 – 2 mgd
    - Potable ASR 7 - 1.4 mgd
    - Non-potable ASR 3A – 1 mgd
    - Recharge Well – ASR 3 – 0.75 mgd

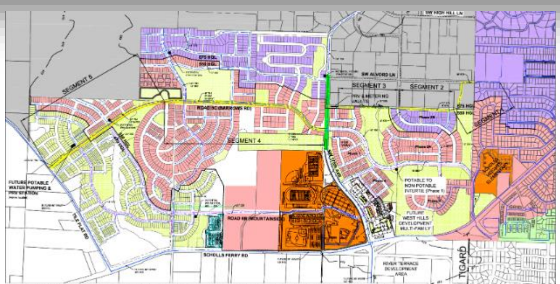
2001 - ASR No. 2
2 mgd

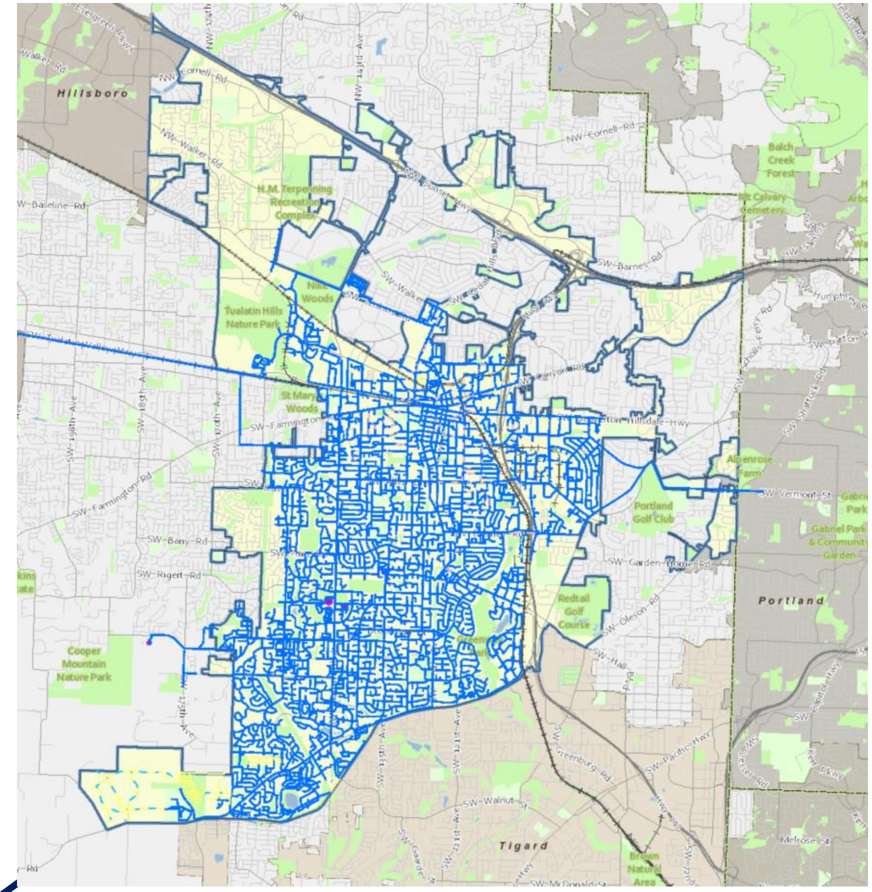
2007 - ASR No. 4
3 mgd



Beaverton OREGON

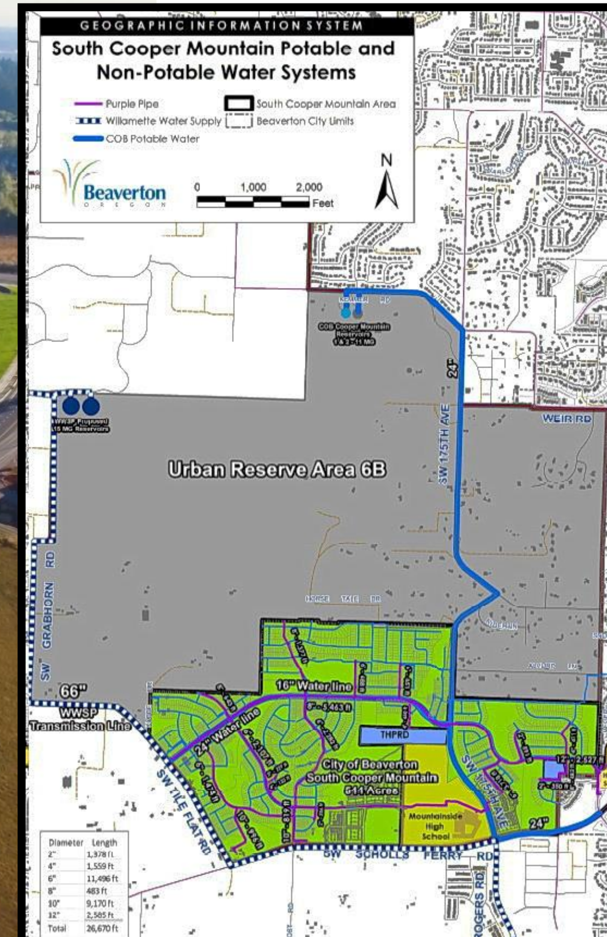
South Cooper Mountain


SOUTH COOPER MOUNTAIN WATER SYSTEM CONCEPT PLAN - 9/11/2017

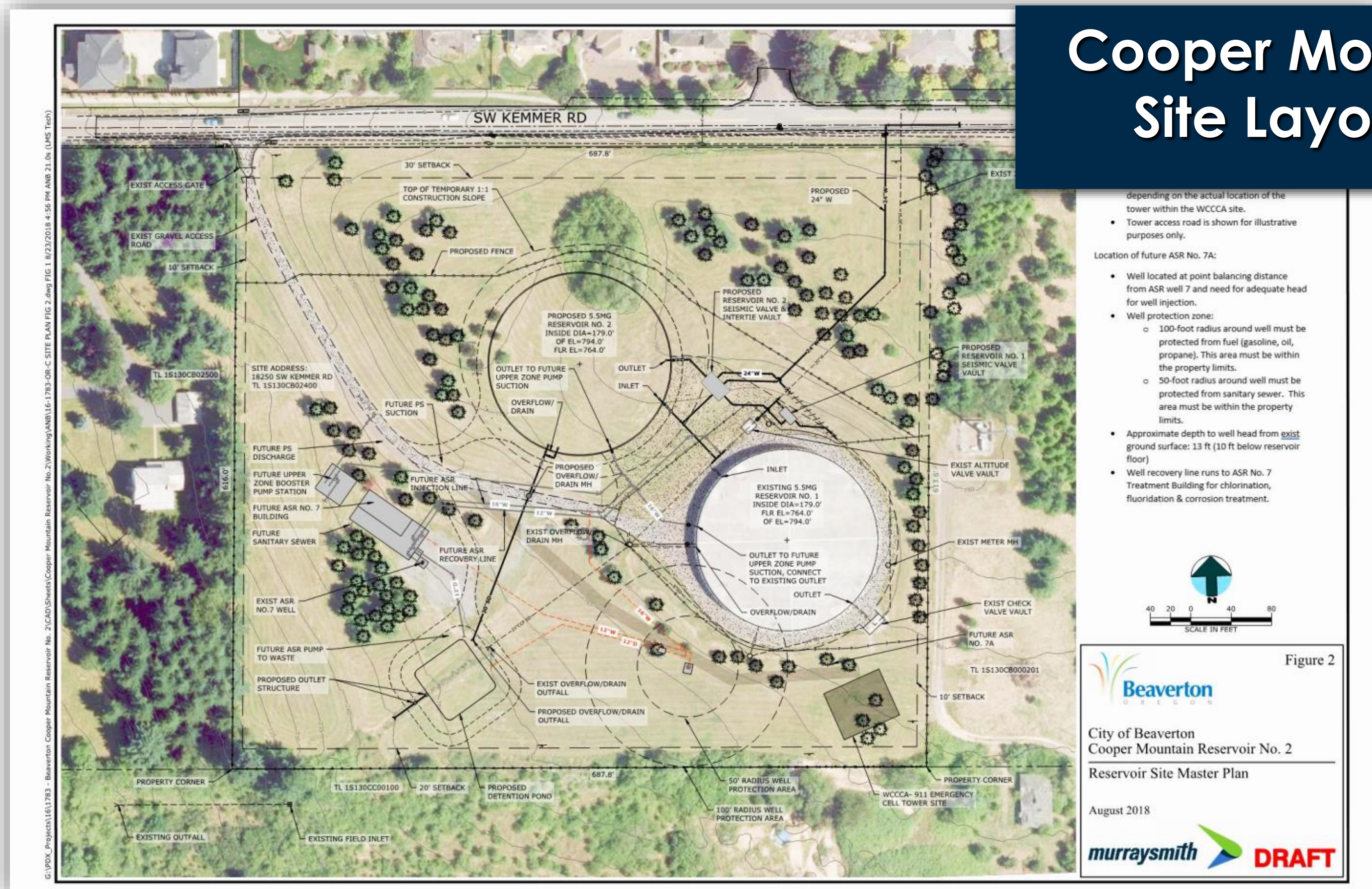


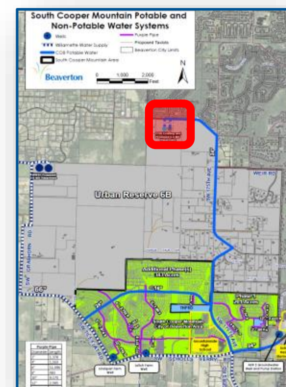
544 Acre Annexation to The City of Beaverton in 2013
3,500 New Homes, a 2,200 Student High School, and a Future Elementary School


South Cooper Mountain Heights Subdivision
Mountainside High School


GEOGRAPHIC INFORMATION SYSTEM
South Cooper Mountain Potable and Non-Potable Water Systems
Purple Pipe
Willamette Water Supply
COB Potable Water
South Cooper Mountain Area
Beaverton City Limits
Beaverton OREGON
0 1,000 2,000 Feet
N
Urban Reserve Area 6B
WEIR RD
SW 175TH AVE
24"
SW GRABHORN RD
66"
WWSP Transmission Line
16" Water line
24" Water line
THPRD
City of Beaverton South Cooper Mountain 544 Acres
Mountainside High School
SW TILE FLAT RD
SW SCHOLLS FERRY RD
ROGERS RD
Diameter Length
2" 1,378 ft
4" 1,559 ft
6" 11,496 ft
8" 483 ft
10" 9,170 ft
12" 2,585 ft
Total 26,670 ft

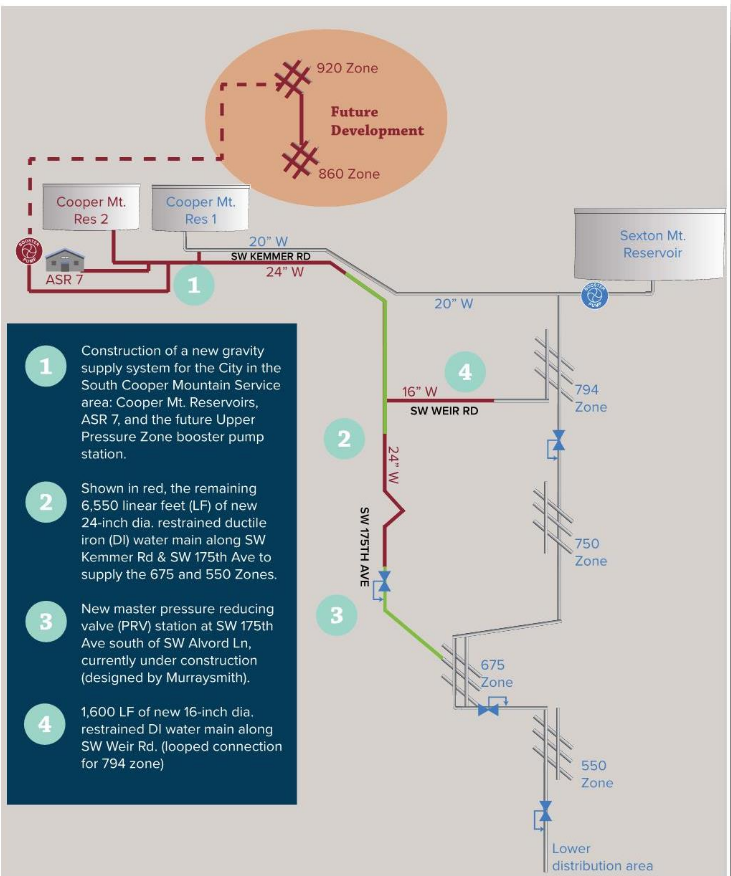
Cooper Mountain Reservoir: Site Layout Master Plan

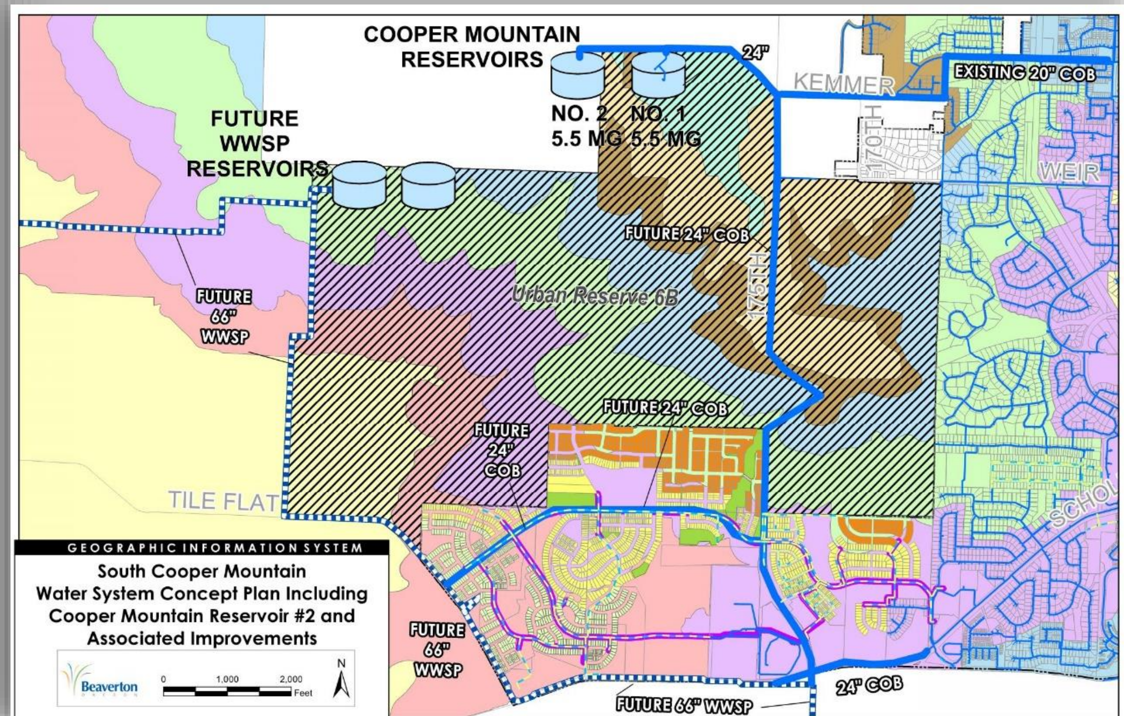




- 5.5 MG Storage Reservoir
- Yard piping
- ASR 7
- Upper Zone Booster Pump Station
- Stormwater attenuation/Noise abatement
- WCCCA Emergency Communications Tower

Cooper Mountain Reservoir No. 2 and Transmission Mains: Concept Plan



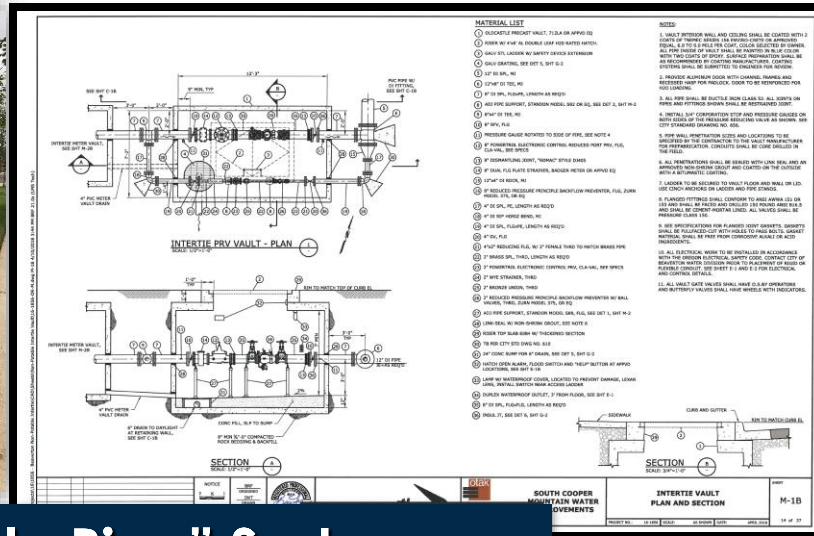


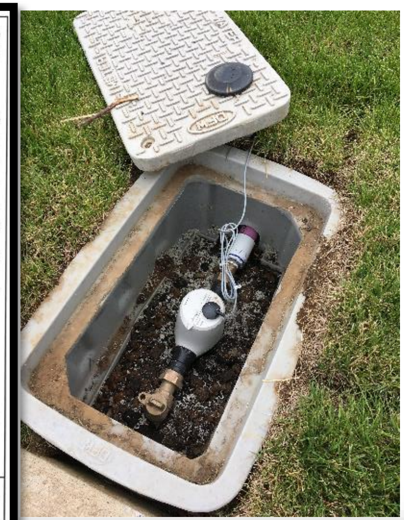
- Water Supply (SCM, URA 6B, City wide)
- Fire Flow
- Resiliency
- Redundancy

Non-potable Water System

Why a Non-Potable Purple Pipe System

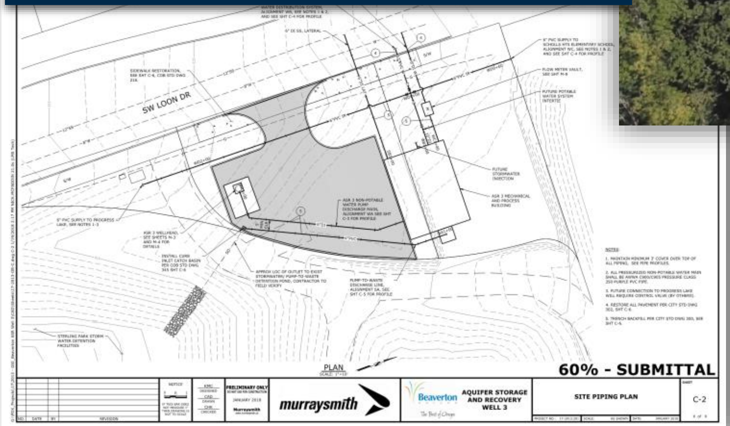
- Summer raw water source up to 40 miles away in Barney Reservoir
- Raw water highly treated then chlorinated and pumped to JWC reservoirs
- Potable water travels 20 miles from the JWC Water Treatment Plant to COB
- Summer potable water demand is 60% higher than winter demand due to irrigation and outdoor use
- High am/pm peaking from irrigation on the potable system are reduced by a non-potable system in the summer
- Reducing am/pm irrigation peaking frees up capacity in reservoirs & pump stations for drinking water, fire protection, emergency pump station outages, and potential JWC supply interruptions.
- A non-potable system directly offsets potable supply, reducing or postponing new supply– Avoided Cost of $14M/mgd
- ***Turf, plants and trees don't need chlorinated/fluoridated drinking water***

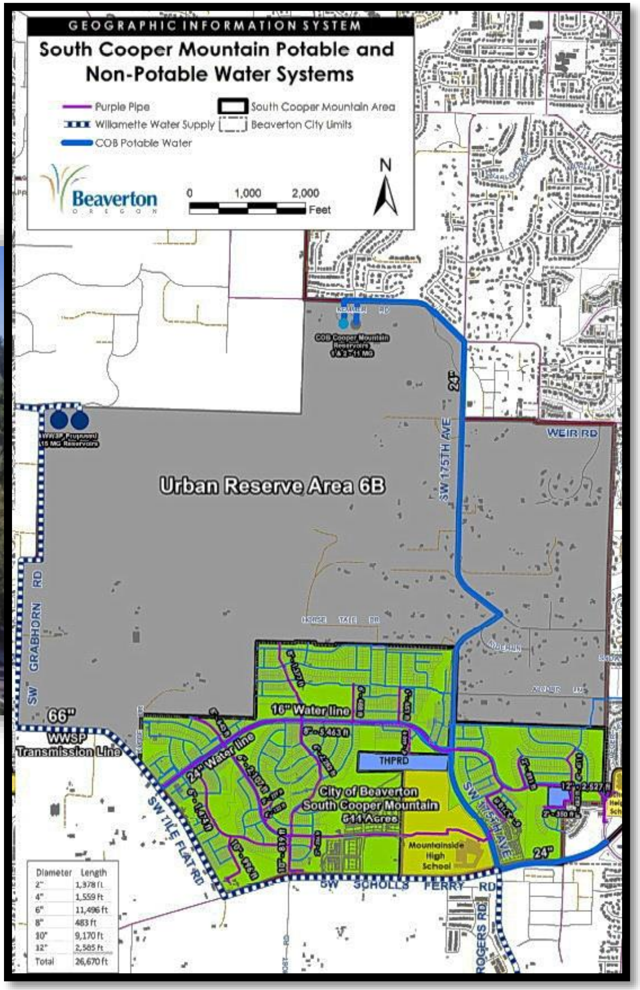




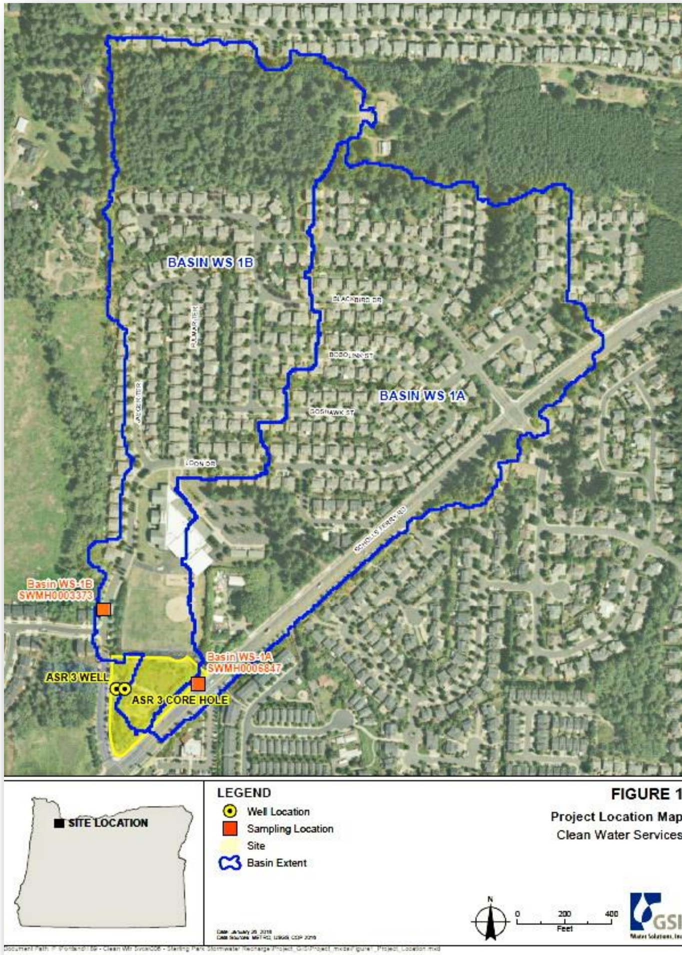
Non-potable "Purple Pipe" System

A New Type of Source Non-Potable



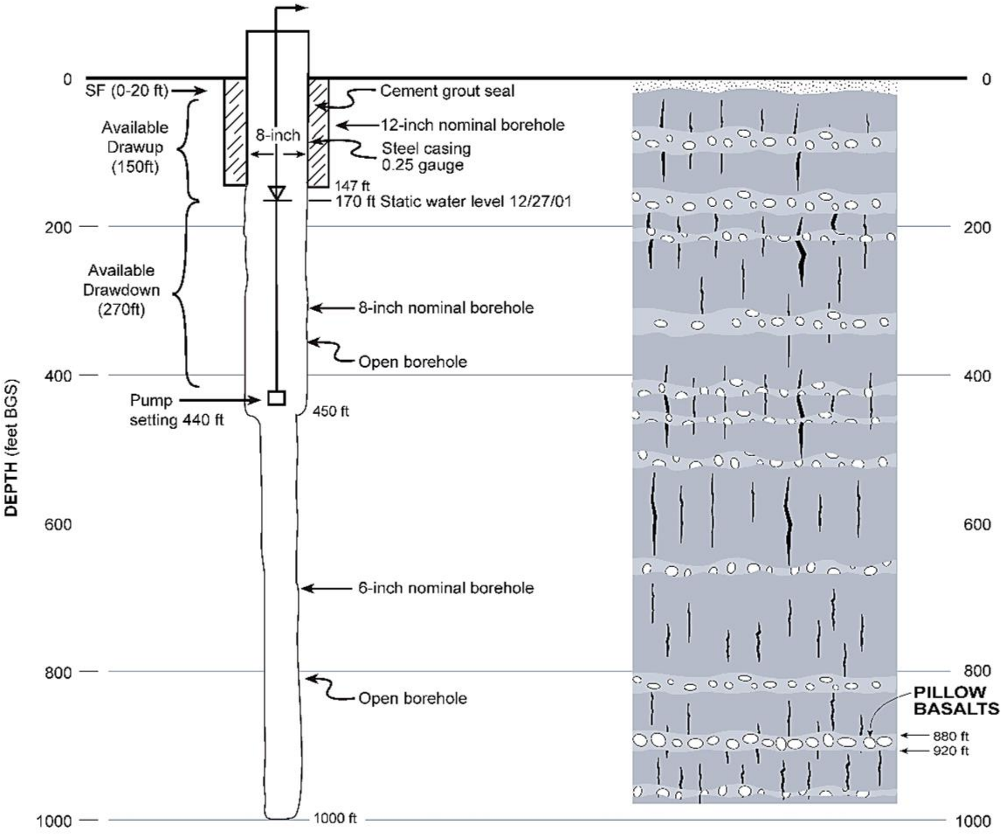


South Cooper Mountain Sterling Park Subdivision



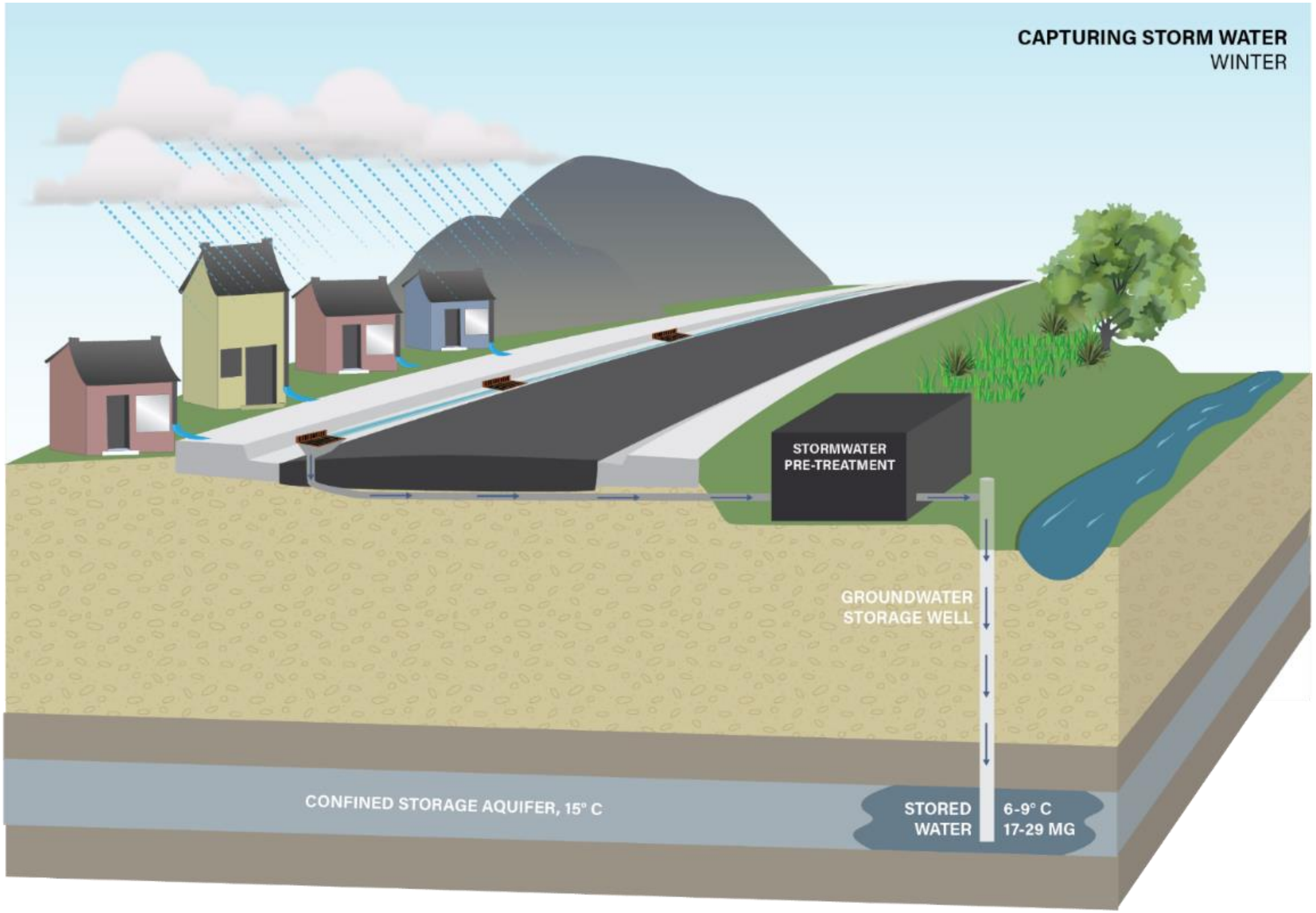
Stormwater Recharge

Project Concept

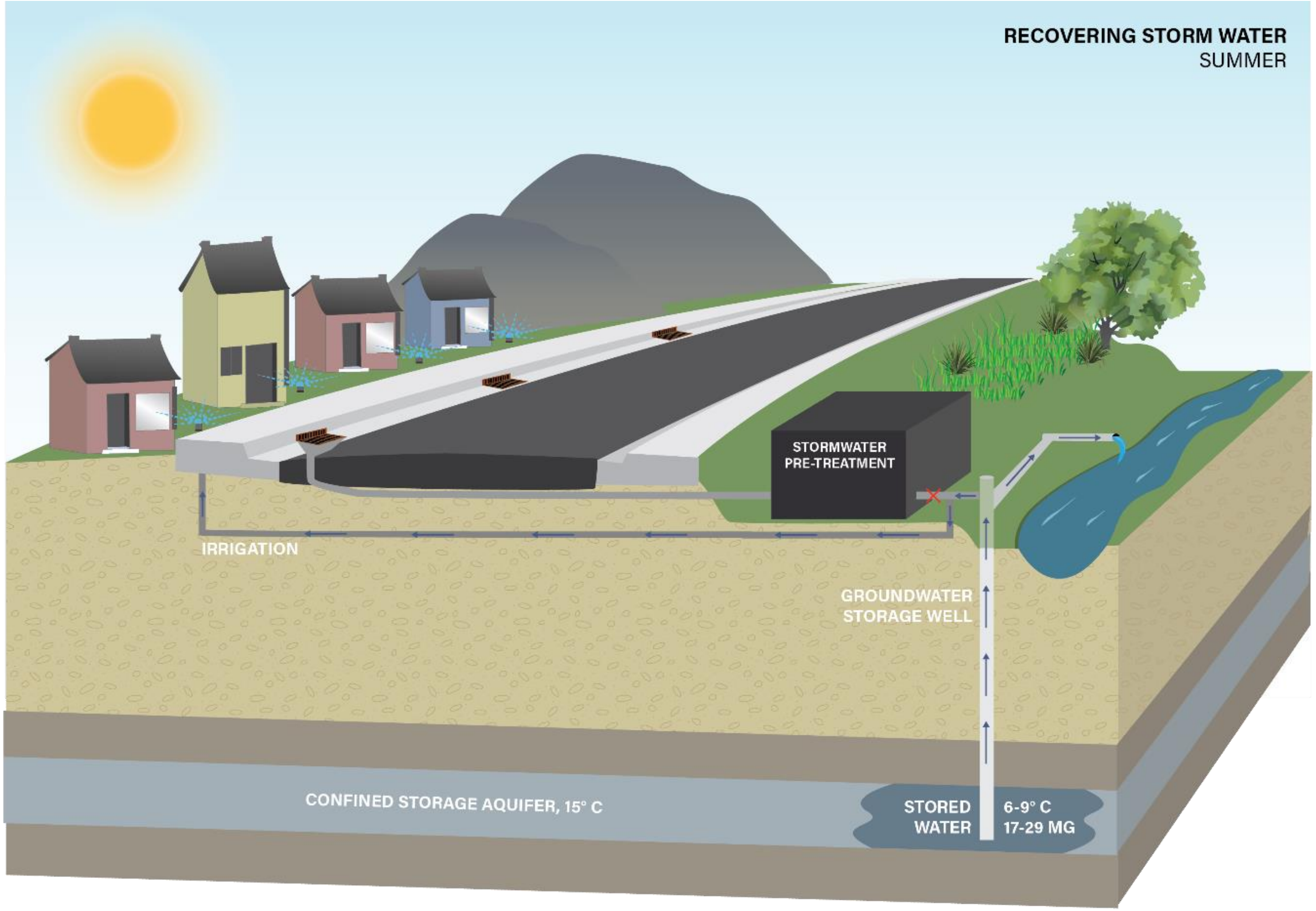


ASR 3 groundwater well

Project Concept: Winter



Project Concept: Summer



Oregon ASR Regulations

- Multi-agency consultation
- Source water quality – twice as stringent as drinking water standards
- Authorization for use of water – water rights
- Limited license
- Water quality testing and aquifer response monitoring
- Annual reporting

Regional Stormwater Quality

Analytes Detected in Oregon Municipal Stormwater Above MCLs

		Total Number of Samples		Percent of Total Samples Exceeding the MCL	
Analyte	EPA MCL (mg/L)	Kennedy/ Jenks Study (2009)	DEQ Municipal Database (2015)	Kennedy/ Jenks (2009)	DEQ Municipal Database (2015)
Antimony	0.006	347	277	0.3	0.0
Arsenic (total)	0.01	846	1,183	0.2	0.08
Benzo(a)pyrene	0.0002	740	1,284	0.3	0.93[b]
Cadmium	0.005	1,609	1,183	0.5	0.0
Chromium	0.1	1,226	1,183	0.8	0.0
DEHP	0.006	641	1,284	4.7	5.5
Lead (total)	0.015 ("Action level")	1,782	1,284	12.7	13.3
Nitrate-Nitrogen	10	633	1,136	0.3	0.0
PCP	0.001	675	1,279	11.7	14.5
Zinc (total)	5[c]	1,661	1,284	0.1	0.0

Feasibility Study

OWRD Grant with CWS: 2016-2018

- Stormwater Flow
  - Radar/ultrasonic automated flow measurement in both basins
- Stormwater Quality Sampling
  - 4 sampling events in each basin (2 time series samples and 2 grab samples). First flush targeted in time series.
  - Samples analyzed for comprehensive list of stormwater contaminants of interest (COIs)
    - Over 300 analytes – pathogens, inorganics, DBP’s, emerging urban contaminants, metals, SOC’s, VOC’s, radionuclides. Every constituent for which there is an MCL, SMCL, or TT.
    - More targeted list of indicator COIs for some samples

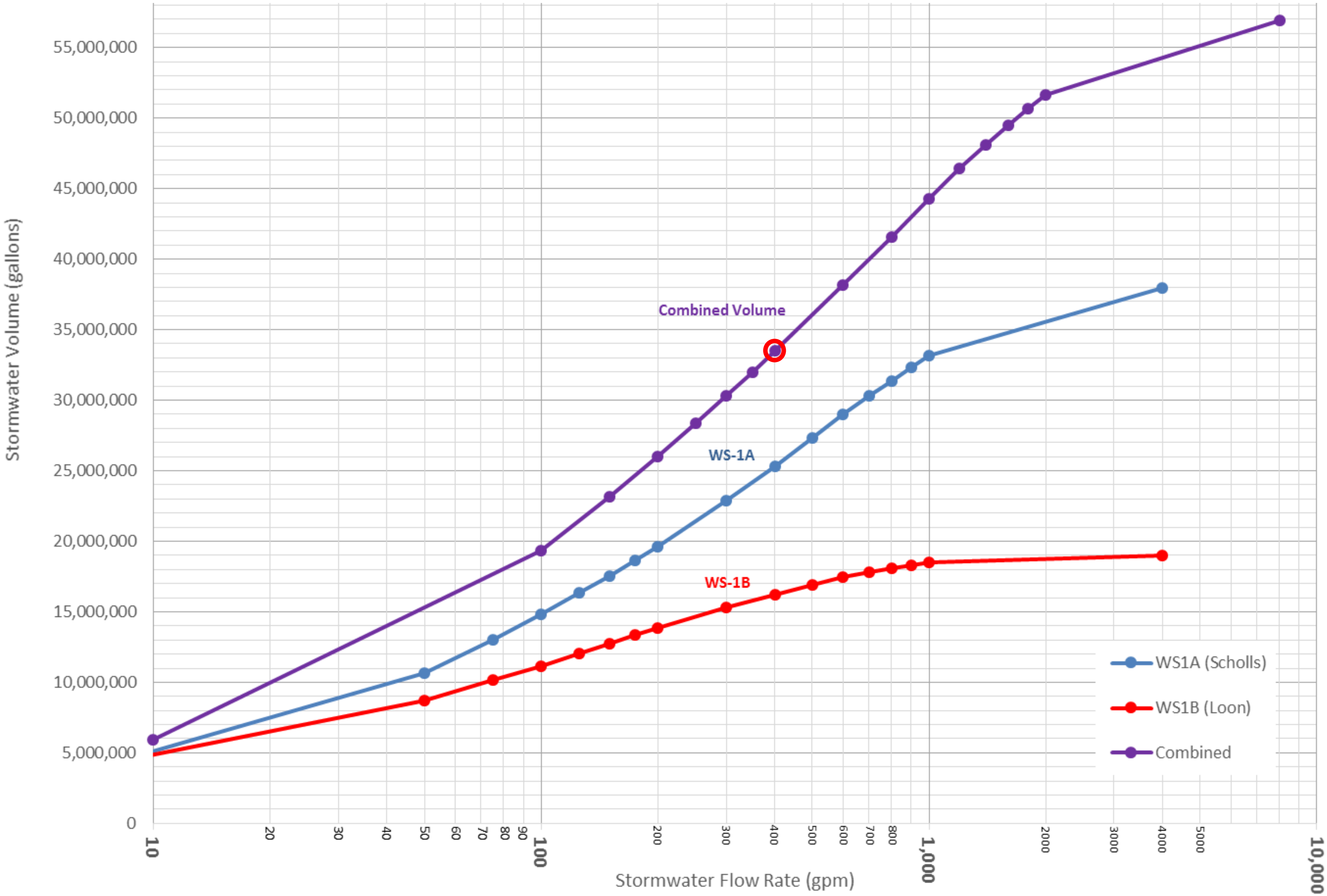






UTILITY
WORK
AHEAD


Stormwater Quantity



Stormwater Quality

Just over 60 COIs detected above reporting limit in one or more sample(s), and only 8 COIs exceeded their respective screening level value (i.e. ½ MCL or SMCL)

Analytes Detected Above Respective Screening Level

Analyte	Units	Regulatory Requirements		Location	Geometric Mean	Percent of Total Samples Exceeding the MCL
		1/2 MCL	SMCL			
Fecal Coliform	MPN/100 mL	--	--	WS-1A	408	100
				WS-1B	255	100
Total Coliform	Presence or Absence	--	--	WS-1A	present	100
				WS-1B	present	100
E. Coli	P or A	--	--	WS-1A	present	100
				WS-1B	present	100
Culturable Cytopathic Enteric Viruses, Primary Value	IU MPN	0	--	WS-1A	1	100
				WS-1B	1	50
Culturable Cytopathic Enteric Viruses, Secondary Value	IU MPN	0	--	WS-1A	1	100
				WS-1B	2	50
Apparent Color	Color Units	--	15	WS-1B	23	100
Turbidity	NTU	0.15 - 0.25	--	WS-1A	9	100
				WS-1B	7	100
Aluminum	ug/L	--	200	WS-1A	320	100
				WS-1B	200	100
Iron	mg/L	--	0.3	WS-1B	0	50

Stormwater Quality and Treatment Options

Data Source			Treatment Options
Sterling Park Site-Specific Stormwater Data (2017)	Oregon Municipal Stormwater Studies (Kennedy/Jenks, 2009; DEQ Municipal Database, 2015)	DEQ Municipal Database (2015)	
Metals			
Zinc (total), Aluminum (total), Iron (total)	Antimony, Arsenic (total), Cadmium (total), Chromium (total), Lead (total), Zinc (total)	Antimony, Arsenic (total), Cadmium (total), Chromium (total), Lead (total)	Total metals are often associated with particulates that can be removed through a filtration step (e.g. sand filter). Concentrations of dissolved metals may be removed through activated carbon/biochar adsorption, ion exchange processes, ultra or membrane filtration, precipitation, electrodialysis, and distillation. Removal may often depend upon pH and influent concentrations.
Solids, Nuisance, Odor			
Turbidity, Apparent Color, Odor	Not Analyzed	Not Analyzed	Turbidity may be removed with flocculants/coagulants, filtration, adsorption or some combination of all of these processes. Water quality issues associated with color and odor may be greatly reduced after water clarification/filtration processes. Color is often a result of dissolved material (Fe, Cu, NOM, Mn) or suspended solids and will resolve with treatment processes that eliminate these underlying constituents.
PAHs, phthalates, and other organics			
No COIs above screening levels	Benzo(a)pyrene, DEHP	Benzo(a)pyrene, DEHP, Benzene	Activated carbon is effective in removing concentrations of dissolved organics such as PAHs, phthalates, and benzene. DEHP is often associated with water pipes and can be readily removed with activated carbon.
Nitrate-Nitrogen			
No COIs above screening levels	Nitrate-Nitrogen	No COIs above screening level	Nitrates are difficult to remove from water sources with passive treatment options and would likely require ion exchange units, reverse osmosis, or distillation. Some nitrate-nitrogen may be removed through filtration and adsorptive treatment steps
Pesticides			
No COIs above screening levels	PCP	PCP	Activated carbon and other adsorptive media such as organoclay are often effective in removing pesticides such as PCP. PCP is also readily degraded in the environment at lower concentrations.
Potential Pathogens			
Fecal Coliform, Total Coliform, E. Coli, Enteric Viruses	Not Analyzed	Not Analyzed	Coliform bacteria, E. Coli, and culturable viruses are often ubiquitous in the environment. Various effective means of disinfection are readily available including chlorine, chloramines, ozonation, ultraviolet irradiation, etc.

Key Findings

- Stormwater volume 57 MG
- Recharge rates 400 gpm
  - 35 MG at rates of 400 gpm or less
- Recovery rates 500 gpm
- Water quality compatibility
- Stored water cooler than native groundwater (9°C vs 15°C)

What's Next

- OWRD implementation grant – CWS and City
  - Awarded $860,000 in November 2018
- Pilot testing phase – 2019-2020
- Full scale implementation – 2020-2021
- Non-Potable Water System Program Management – 2019

Questions?

Acknowledgments

OREGON WATER RESOURCES DEPARTMENT

Clean Water Services

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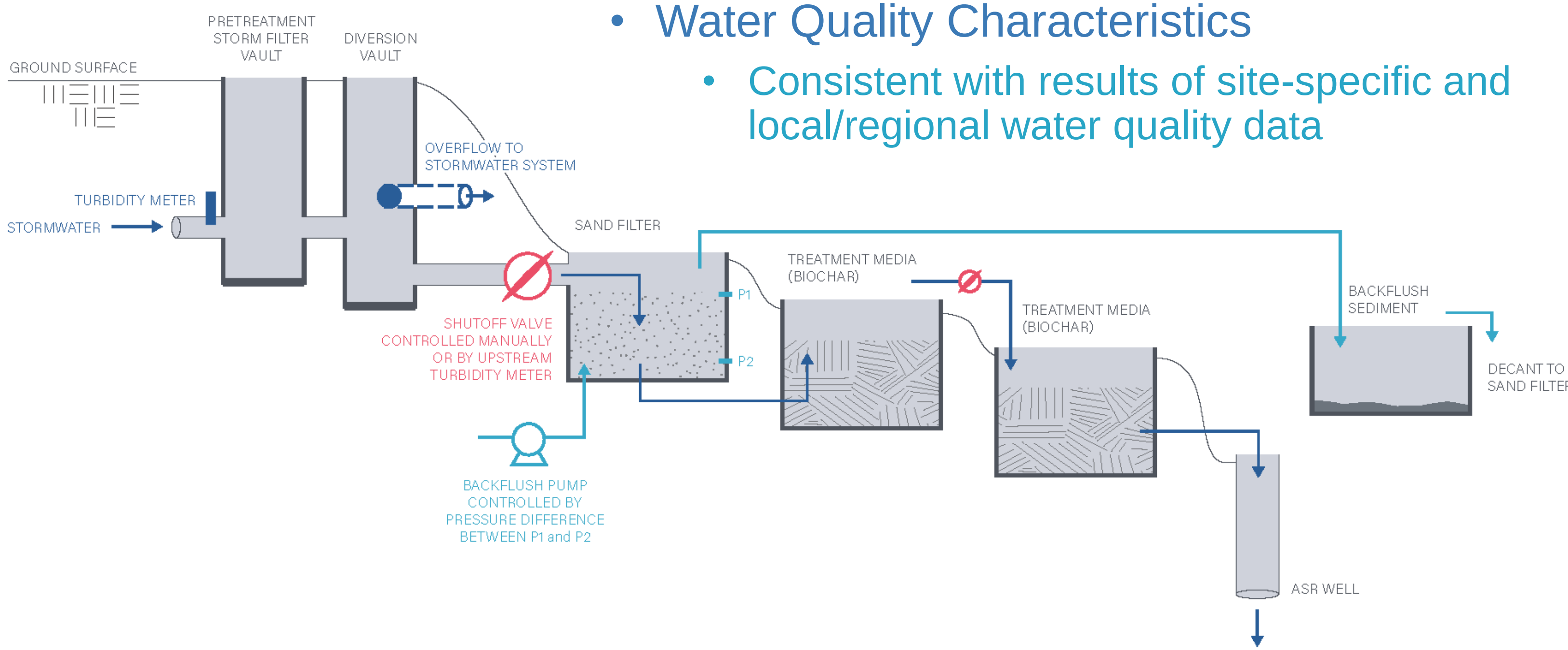
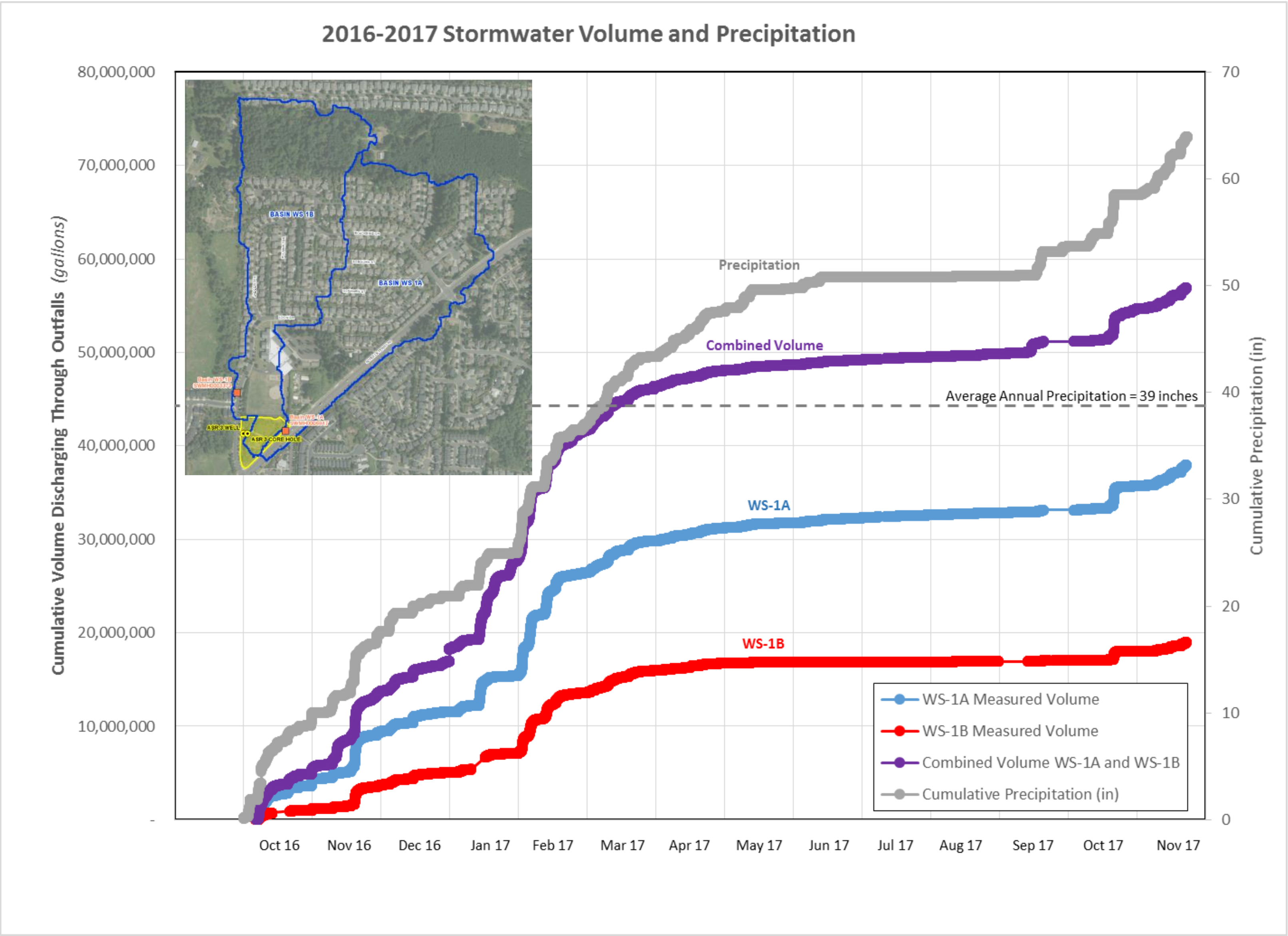
Conceptual Stormwater Treatment



Treatment System Design Parameters:

- Flow Rate = 400 gpm
- Water Quality Characteristics
  - Consistent with results of site-specific and local/regional water quality data

Stormwater Flow



Treatment Performance Summary of Pilot System for some Key COIs at Sterling Park

Parameter	Sample Location	Median, (Range[3]) Number of Samples	Removal Efficiency[4] Median (Range[3])
E.coli *(mg/L)*	Influent	2420, (770 - 2420) n = 7	99 (99 - 99)
	Effluent	0.5, (0.5 - 0.5) n = 7	
Turbidity *(mg/L)*	Influent	60.4, (36.3 - 118) n = 16	72.5 (57 - 95)
	Effluent	11.39, (2.7 - 26) n = 16	
Tot Zn *(mg/L)*	Influent	0.6825, (0.26 - 2.1) n = 98	85.5 (73 - 94)
	Effluent	0.0985, (0.035 - 0.29) n = 98	
Tot Al *(mg/L)*	Influent	2.5, (0.77 - 4.75) n = 29	75 (61 -91)
	Effluent	0.236, (0.06 - 1.02) n = 29	
Tot Fe *(mg/L)*	Influent	4.28, (1.12 -8.1) n = 30	77 (61 - 90)
	Effluent	0.376, (0.172 - 1.93) n = 30	

1 - Sampling from inlet and outlet of Aquip SBE full-scale filtration systems (Purus V for E.coli).

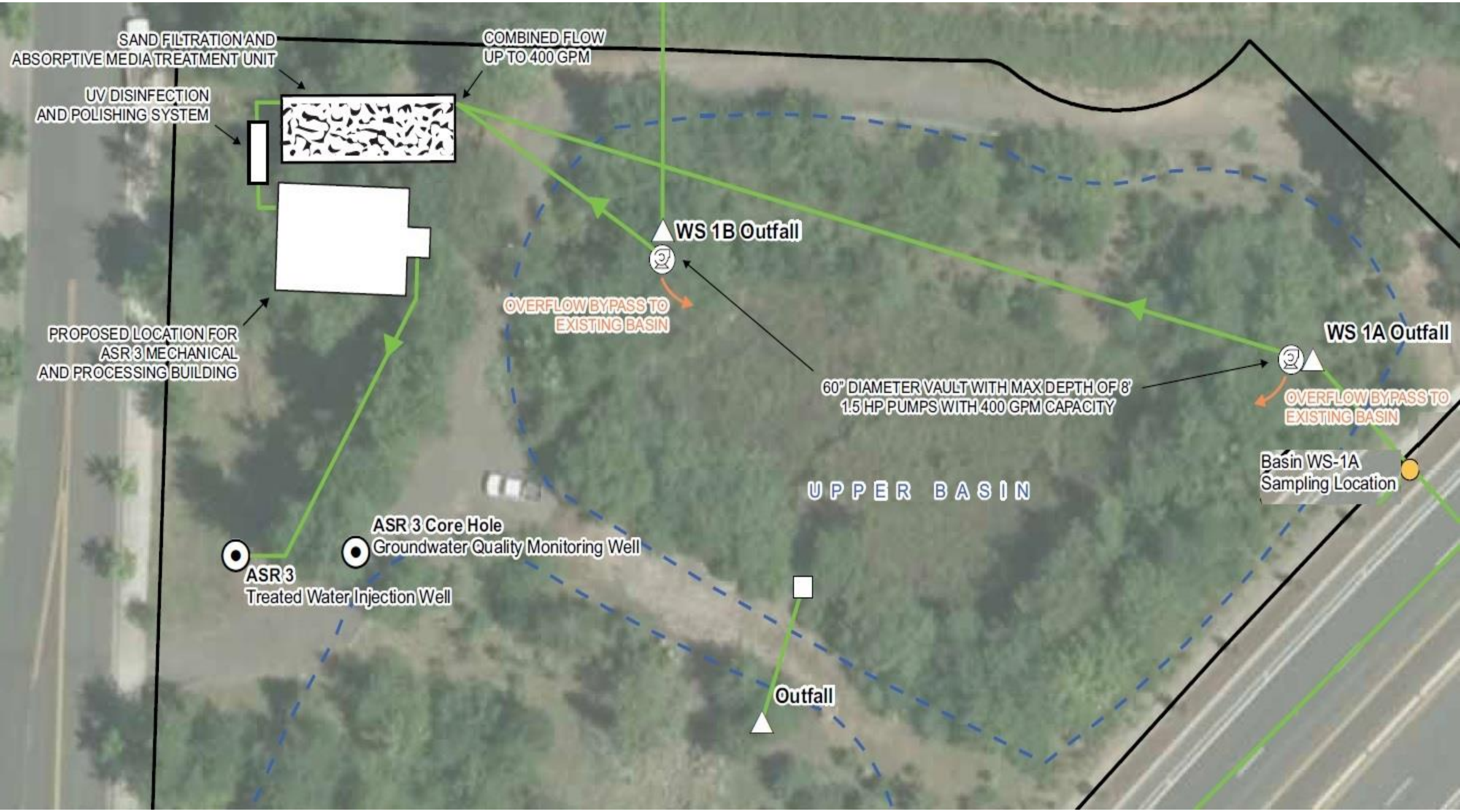
2 - All chemical analysis by third party certified analytical testing laboratory.

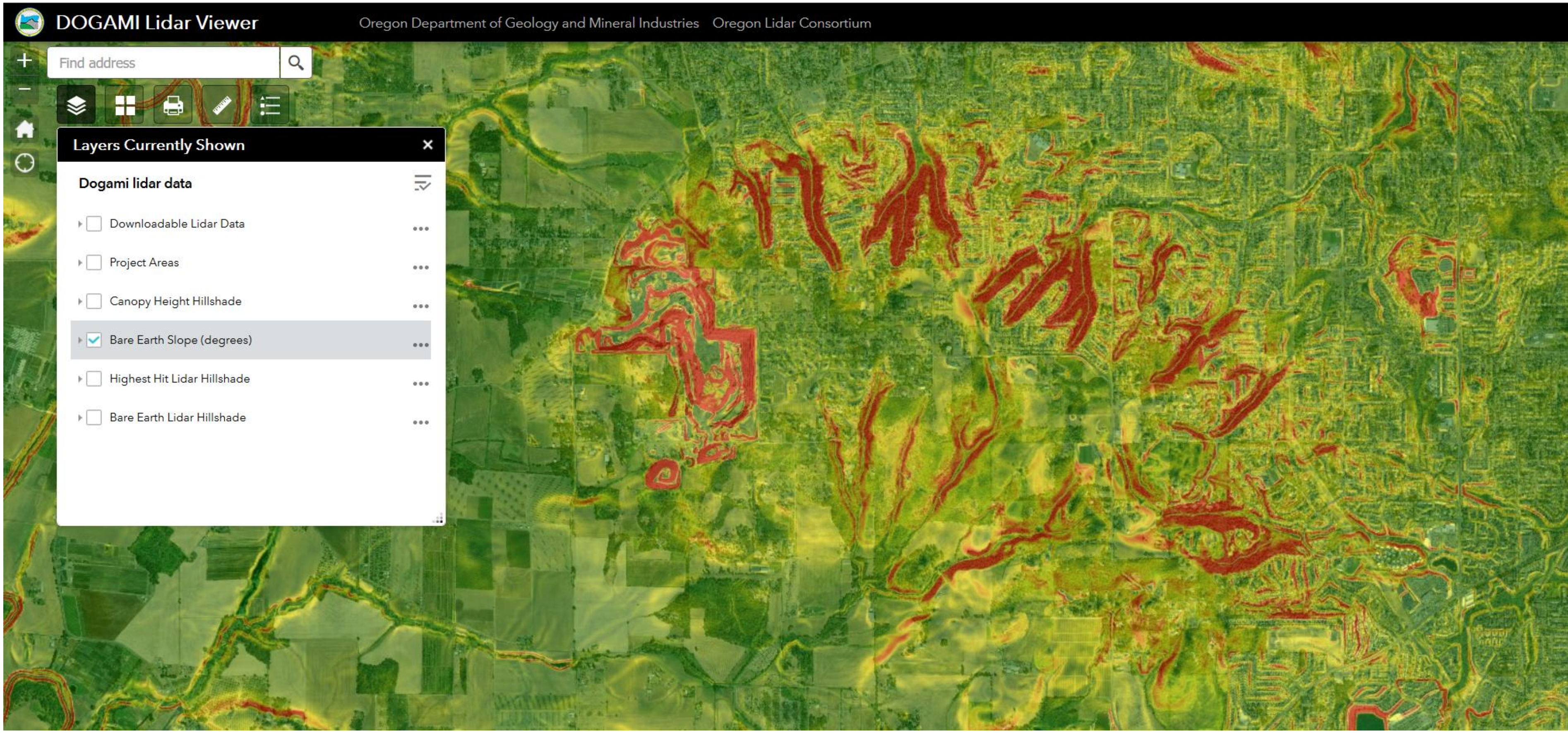
3 - The inlet, outlet, and removal efficiency ranges provided are the 25th to the 75th percentile of all results.

4 - The removal efficiencies based on inlet and outlet pairs.

5 - Median values may include non-detections; for the purposes of these calcs, the non-detected values are presented at half the DL.

Proposed Treatment System Layout




DOGAMI Lidar Viewer
Oregon Department of Geology and Mineral Industries
Oregon Lidar Consortium
Find address
Layers Currently Shown
Dogami lidar data
Downloadable Lidar Data
Project Areas
Canopy Height Hillshade
Bare Earth Slope (degrees)
Highest Hit Lidar Hillshade
Bare Earth Lidar Hillshade