

1962 Metro Formed to Clean-up Lake Washington

The history of our mission

From this...



To this...

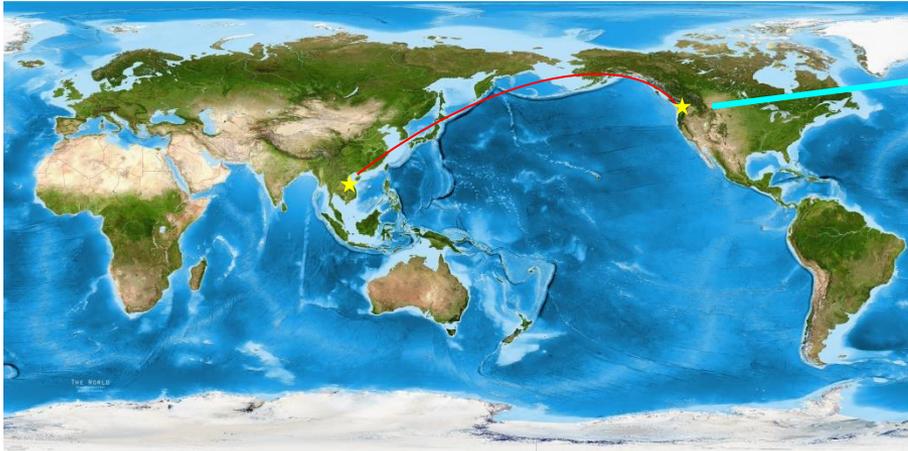


King County

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King County Place in the world



1 of 3007 US Counties
13th Most Populous County –
2.12 Million
2,126 mi² / 5,506 km²
Seattle is Largest City – 21st
Most Populous in the US -

~670,000



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Notable King County Businesses/Commerce

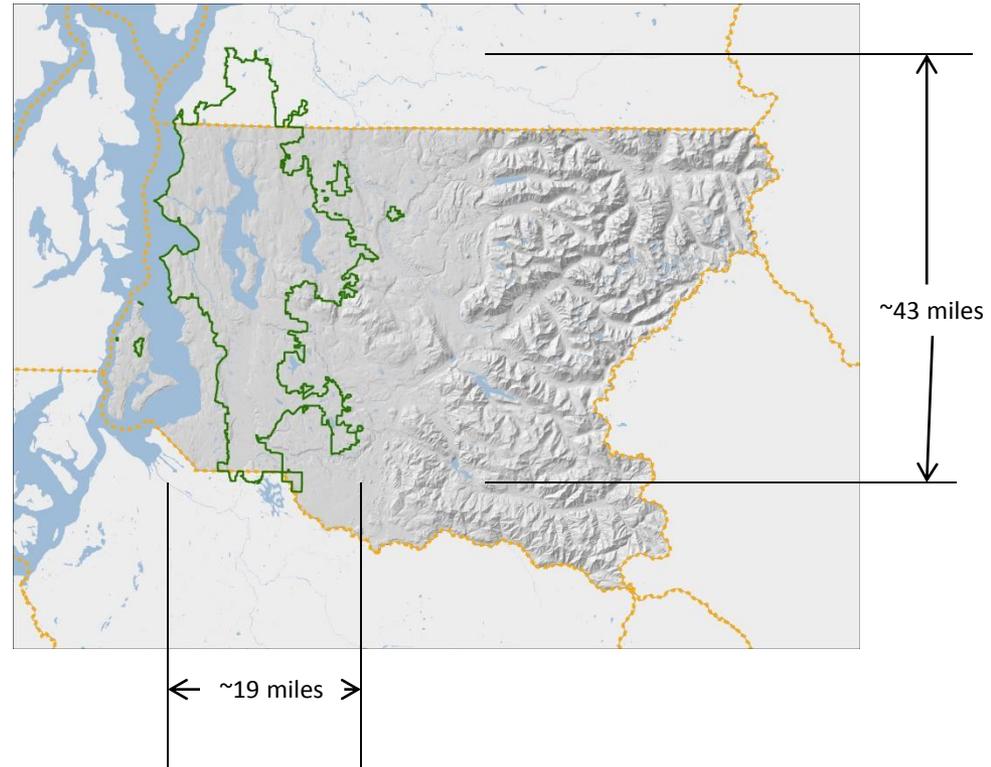


Fishing
Maritime
Shipping



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Mountains and Sound



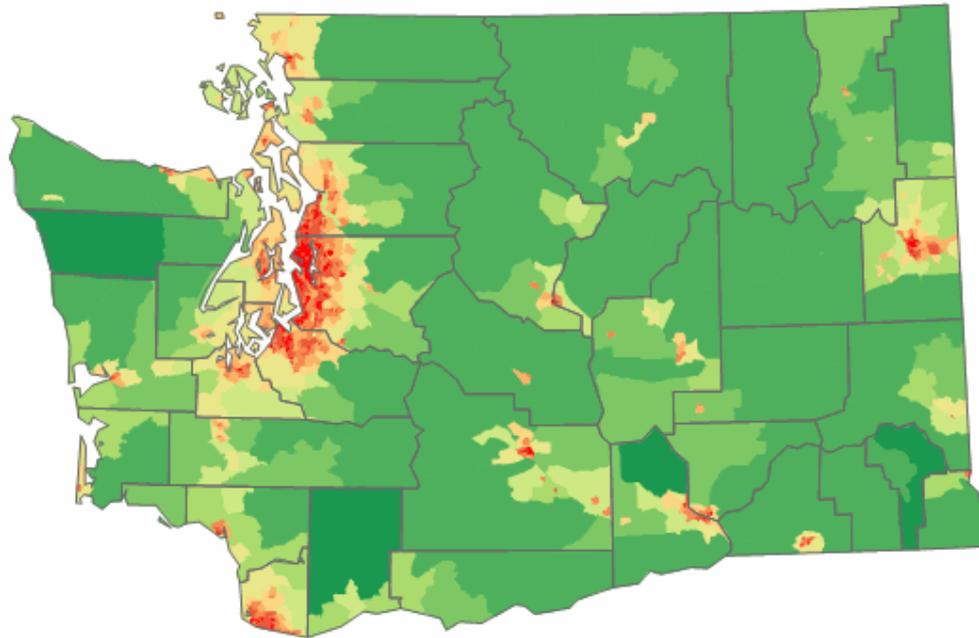
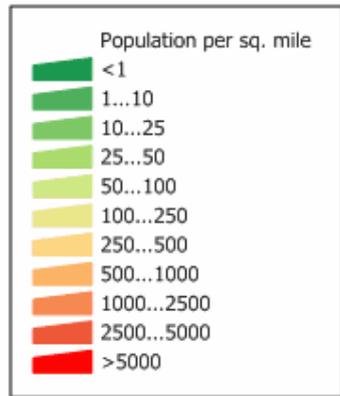
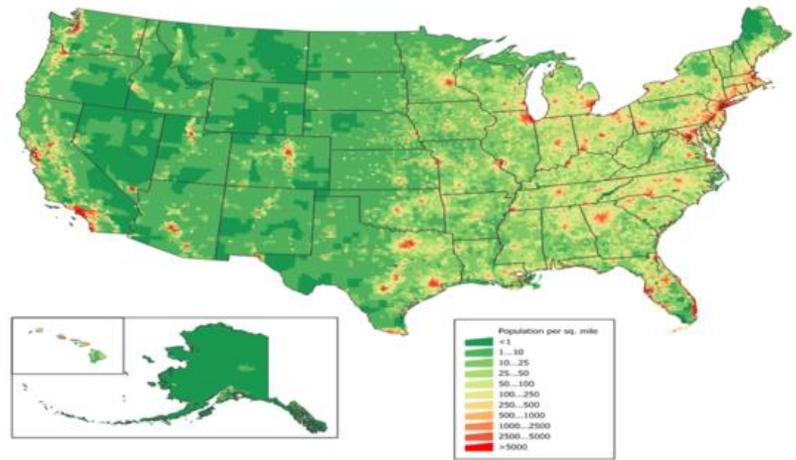
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Population

Where do we live?



Source: U. S. Census Bureau
Census 2000 Summary File 1
population by census tract.



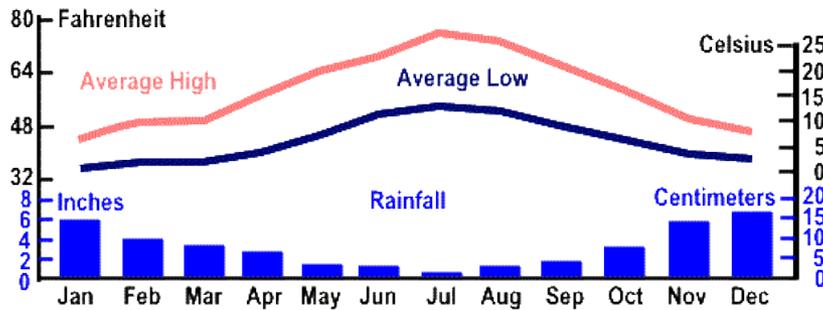
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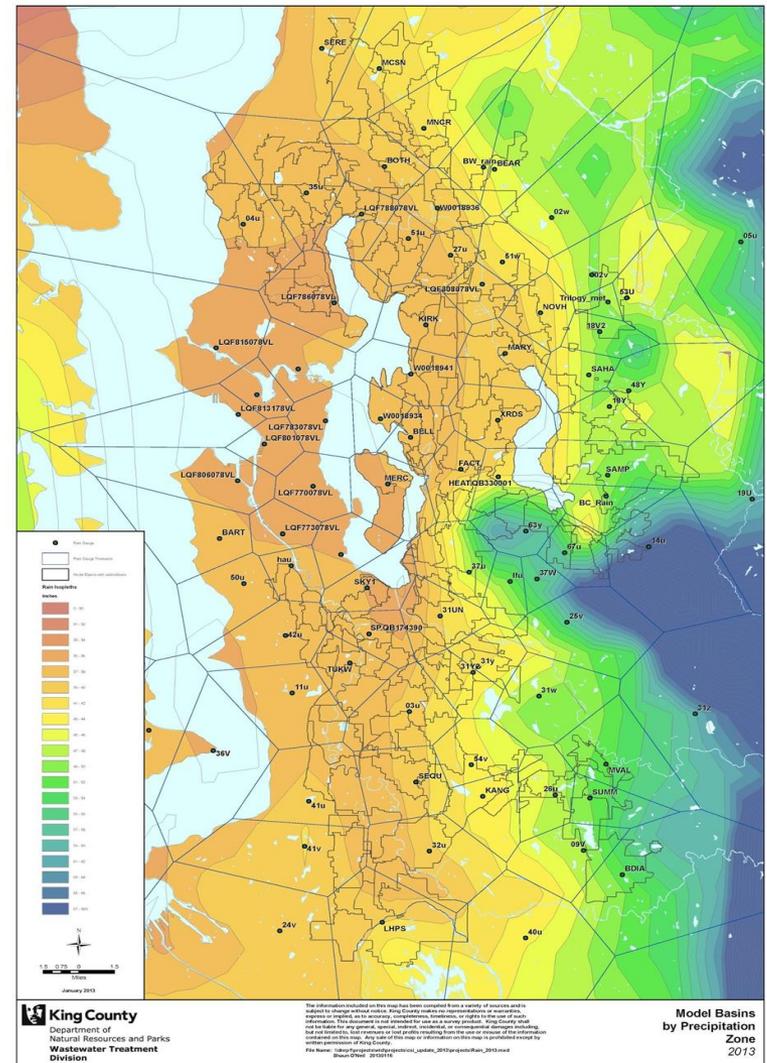
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33- 67 in/per year

Wet Season – October to April



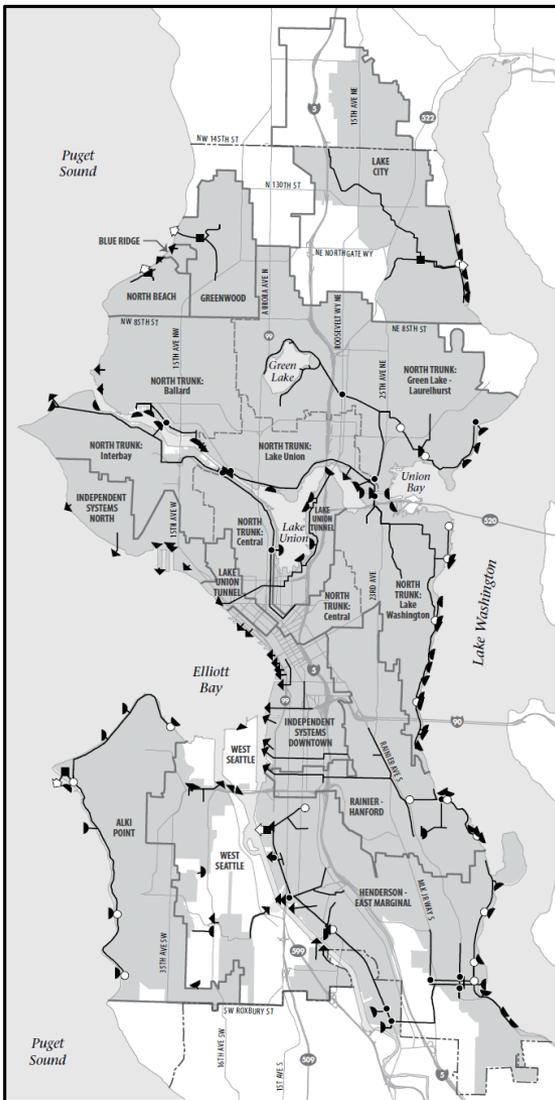
Source: NOAA, Local Climatological Data, Seattle



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Map 1a
Wastewater Service and Sewage/Drainage Systems in Seattle: 1957 Data

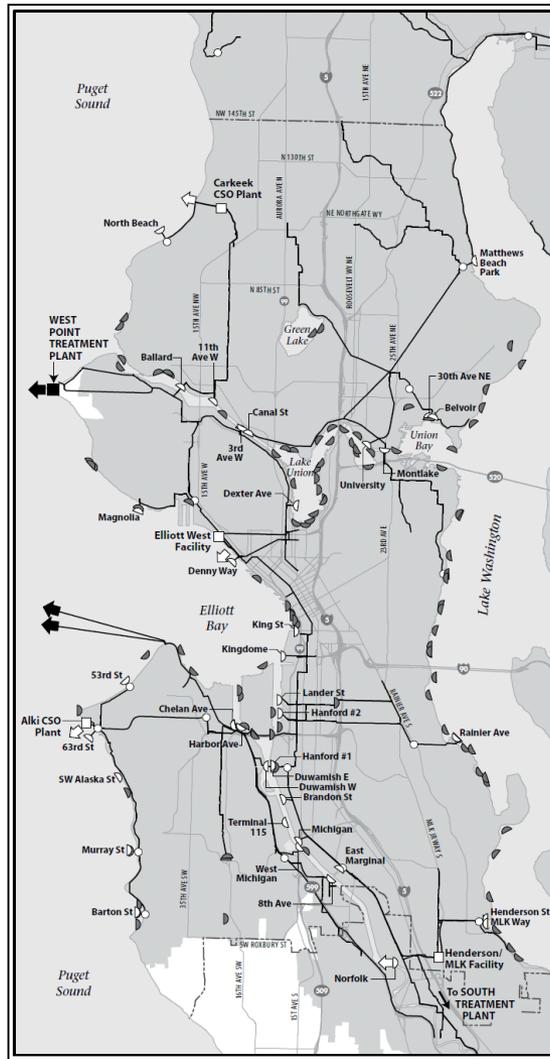
- Wastewater Service System Boundary
- - - North Trunk Sub-District Boundary
- Sewered Area
- Principal Sewer
- ◀ Raw Sewage Outfall
- ◇ Treated Sewage Outfall
- ▶ Overflow
- Sewage Treatment Plant
- Pump Station
- Special Structure
- 2009 Major Road (for reference purposes)
- - - 1957 Seattle City Limit



Map produced by King County DNRP Visual Communications and WTD GIS
 Data source: Department of Sewer Districts and Conveyance for 1956 were generated from the 1956 Metropolitan Seattle Sewerage and Drainage Survey. All other data come from the King County Spatial Data Warehouse.
 File name: 091000057_1alcity.a_ wqab

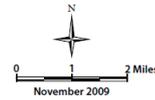
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1957



Map 1b
Wastewater Service in Seattle: Current Conditions

- Wastewater Treatment Service Area
- King County Principal Sewer
- ◇ King County CSO
- City of Seattle CSO
- Wastewater Treatment Plant (Secondary Treatment)
- ◀ Wastewater Treatment Plant Outfall
- CSO Treatment Facility
- ◇ CSO Treatment Facility Outfall
- King County Pump Station
- Major Road
- - - Seattle City Limit



Map produced by King County DNRP Visual Communications and WTD GIS
 Data source: King County Spatial Data Warehouse
 File name: 091000059_1alcity.a_ wqab

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Now

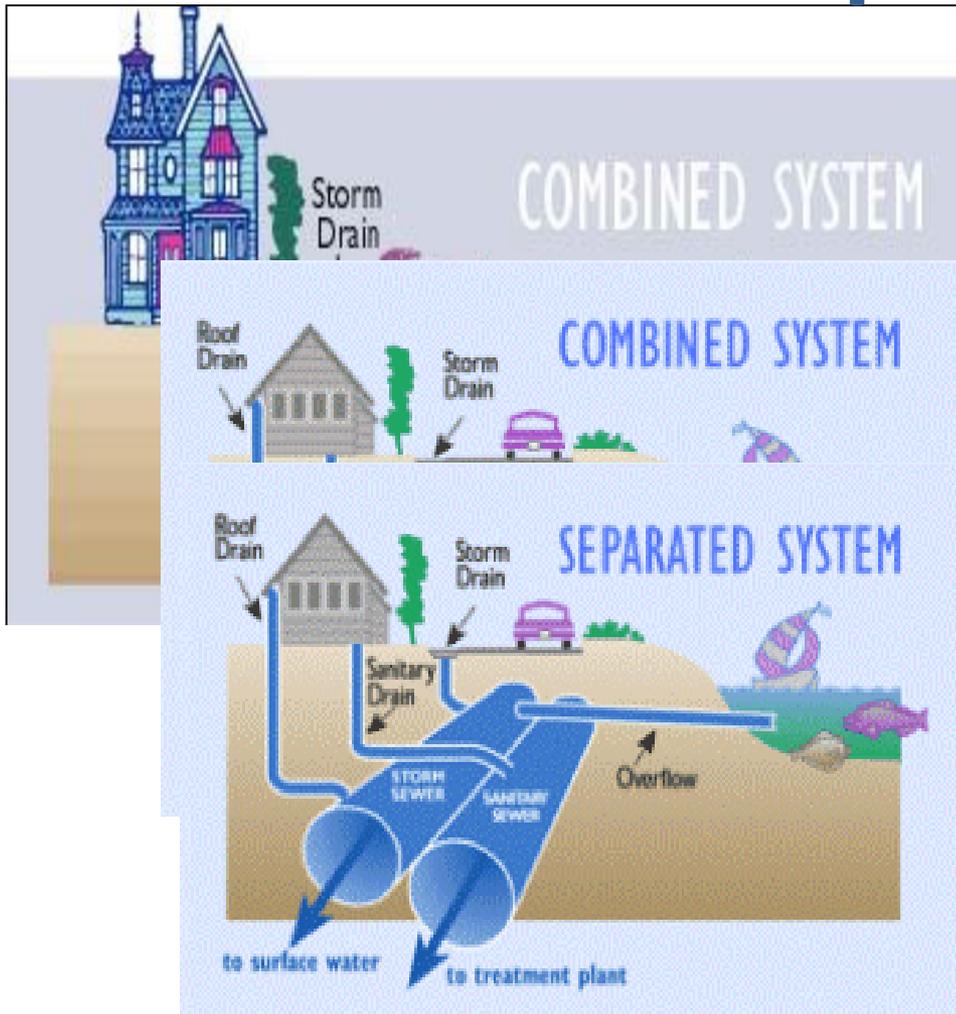


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Combined vs. Separated Systems



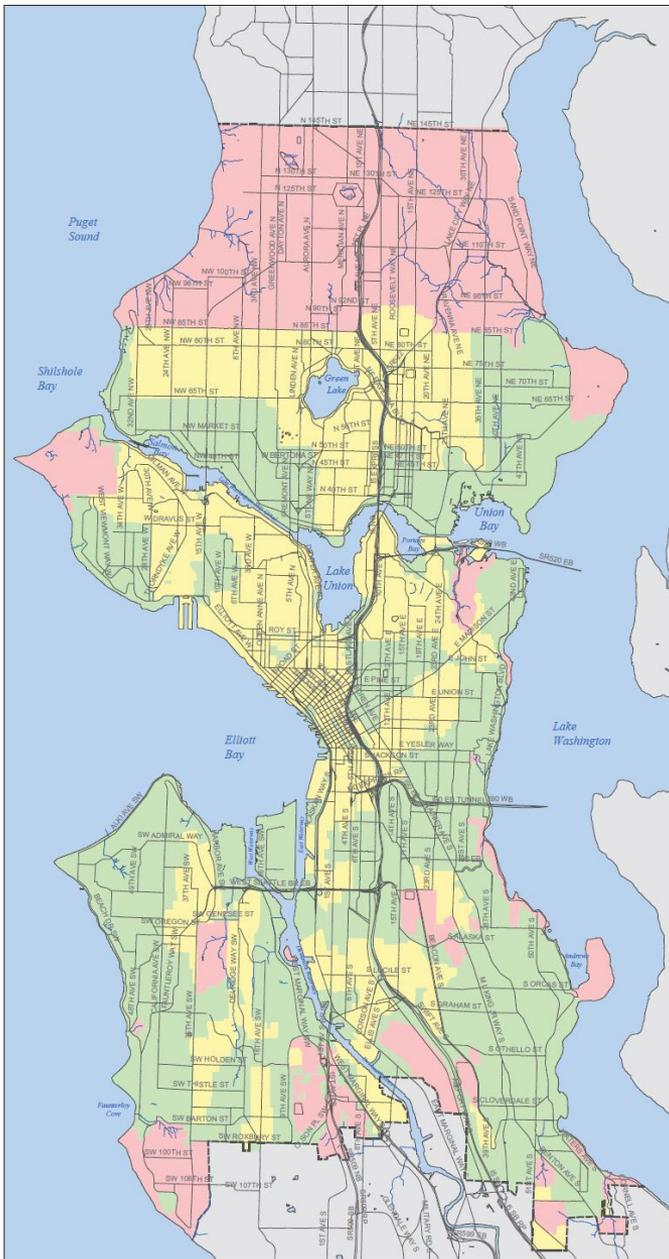
When wastewater treatment became the standard, sewers were connected to interceptors, but relief points – CSOs - were included to discharge excess flow in the largest storm flows

Original Combined Systems built to carry waste from homes, streets & industry to nearest waterbody

After the 1950's when the impacts of CSOs were recognized, the standard became to build separate systems

LEGEND

- City Limit
- Water Body
- Sewer Service Areas:
 - Combined Sewers
 - Partially Separated Sewers
 - Separated Sewers
 - Outside Sewer Service Area



In Seattle This Results in a Mix of Basin Types

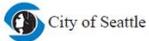
- Yellow is the fully combined areas
- Pink is fully separated
- Green is “partially separated”
 - Street stormwater has been connected to separate storm drains, but roofs and foundations remain connected to the combined system



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City of Seattle

What is a CSO?

Combined sewer overflows or, CSOs, are remnants of the country's early infrastructure. In the past, communities built sewer systems to collect both stormwater runoff and sanitary sewage in the same pipe.

Relief points, called combined sewer overflows (CSOs), are built into sewer systems that carry sewage and stormwater together.



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What is a CSO?

These pipes can fill up and overflow on rainy days. CSOs release untreated sewage and stormwater into rivers, lakes and Puget Sound.

They prevent sewer backups into homes and streets. The water released by CSOs is 10 percent sewage and 90 percent stormwater.

CSOs may be harmful to people and animals living in the water because they release chemicals and disease-causing germs.

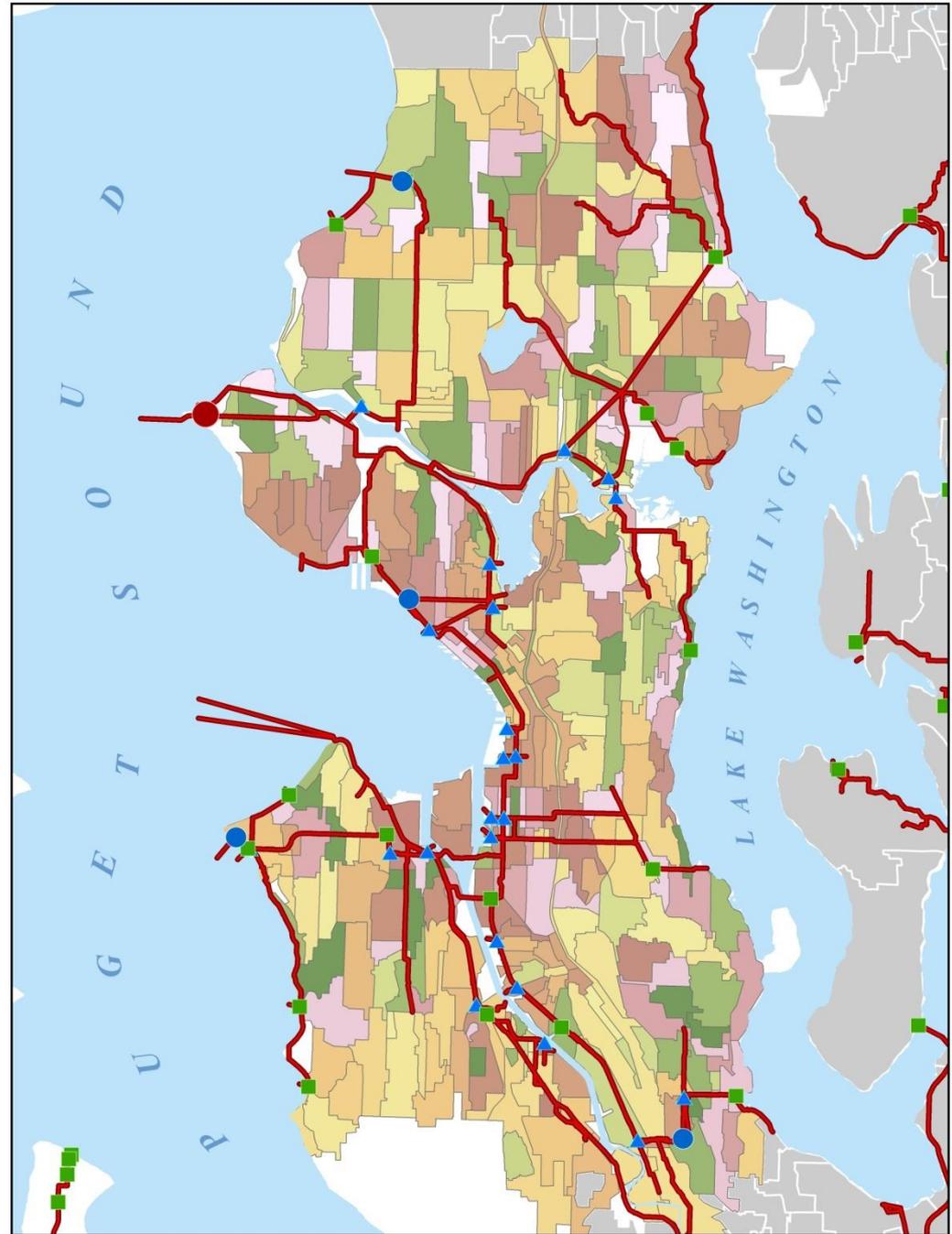


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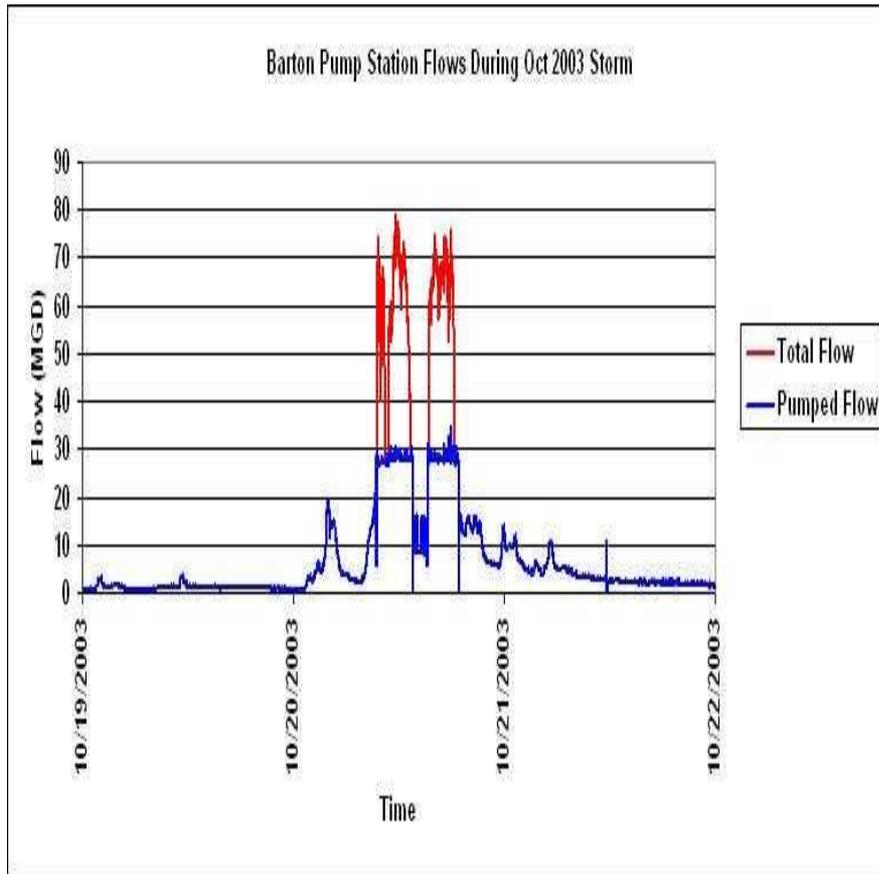
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Combined System ~300 basins



Stormwater causes large fluctuations in volume

The red lines show more flow than the pipeline can carry – it overflows



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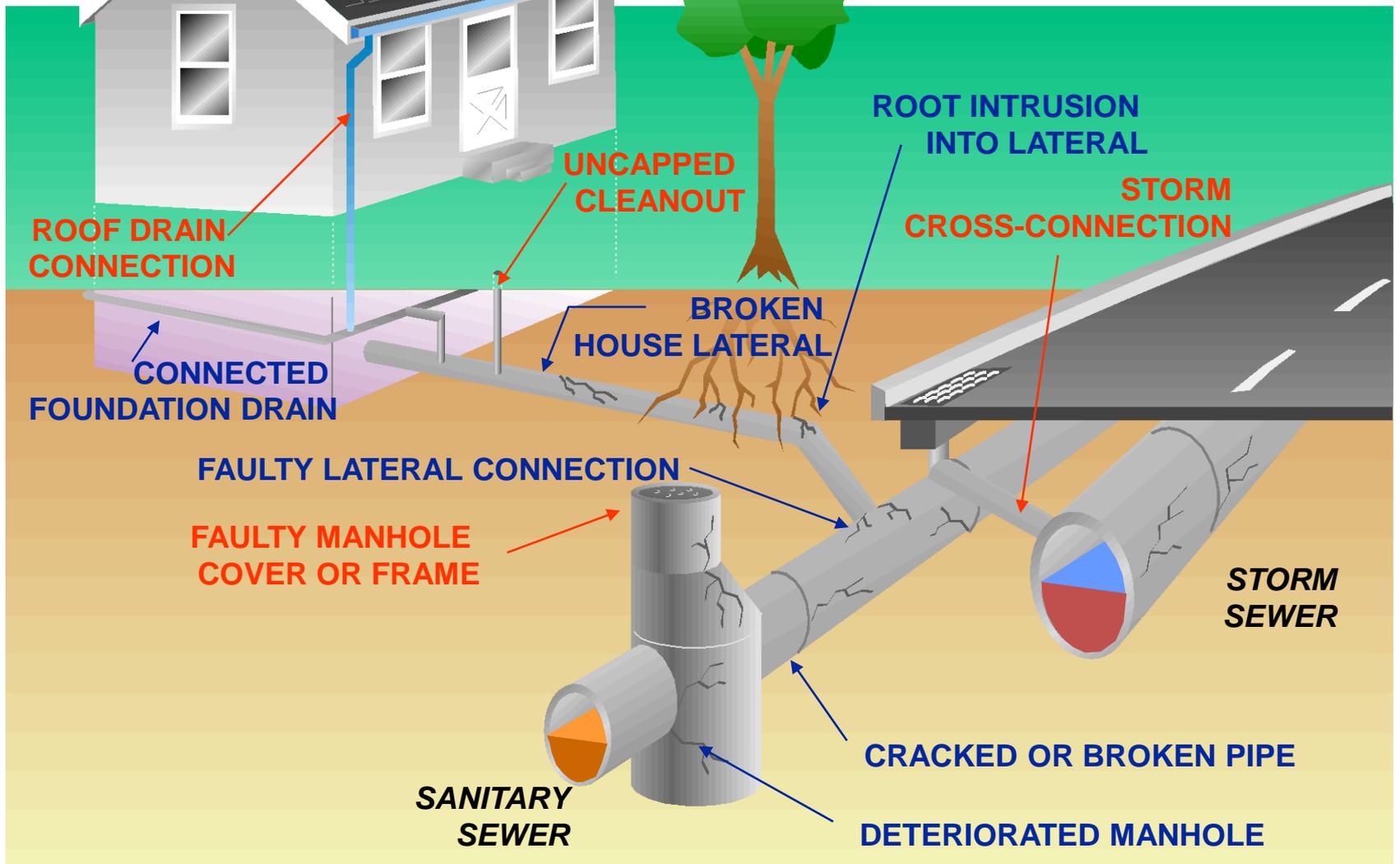
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INFLOW SOURCES

(Generally rapid response)

INFILTRATION SOURCES

(Generally slower response)



Why Use a Computer Model?

To estimate peak flows to meet 1/year and 20-year level of service goal using a limited amount of rainfall and flow data

To estimate storage requirements to meet 1/year goal

To estimate how much of the flow is Inflow and how much is Infiltration

To test various alternative solutions

Instructs us as to variability of rainfall to set expectations of what 1/year means



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Why do we have CSOs?

Most of the time, this polluted water in the combined system goes to a wastewater treatment plant.

But in heavy rains, the pipes can fill up and overflow into rivers, lakes or Puget Sound.

CSOs are built into the system to release the polluted water and prevent sewer backups into homes and streets.



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Why do we have CSOs?

The older parts of King County's wastewater system use a single set of pipes, called “combined sewers” to carry both sewage and rain that runs off streets and buildings.

Since 1979, King County has reduced its overflows by 90 percent and succeeded in keeping more than 2.3 billion gallons of sewage and stormwater out of local waterways



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What is the relationship between King County's and the City of Seattle's management of CSOs?

Each CSO provides a drainage relief point for specific neighborhoods.

King County manages the CSOs that serve areas that are greater than 1000 acres. The City of Seattle manages the CSOs that serve smaller areas.

King County manages 38 CSOs and 4 treated CSOs, Seattle manages about 90.



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- King County CSO
- City of Seattle CSO
- CSO Treatment Plant/Facility
- Wastewater Treatment Plant
- Park



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What's happening in your waterway?

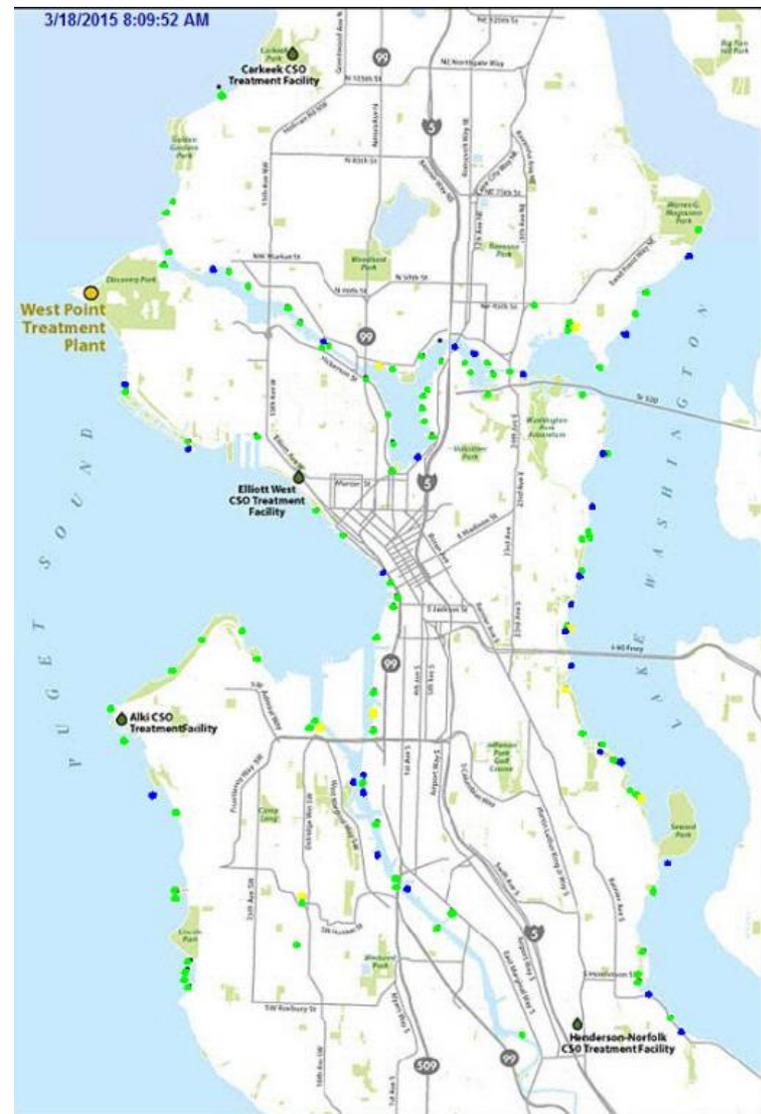
Current information to inform your choices.



NE Seattle CSO Status

CSO ALERT STATUS

- CSO discharging
- CSO discharged in last 48 hours
- CSO not discharging
- Real time data not available
- CSO Treatment Plant/Facility
- Wastewater Treatment Plant
- Park



<http://www.kingcounty.gov/environment/wastewater/CSOstatus/Overview/NESeattle.aspx>



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Where are King County CSOs?

King County CSOs are located in within the Seattle city limits, and primarily conveyed and treated at the West Point Treatment Plant.

King County and the City of Seattle are each responsible for specific CSO relief points.

CSOs can overflow into Puget Sound, the Duwamish Waterway, Elliott Bay, the Lake Washington Ship Canal and Lake Washington.

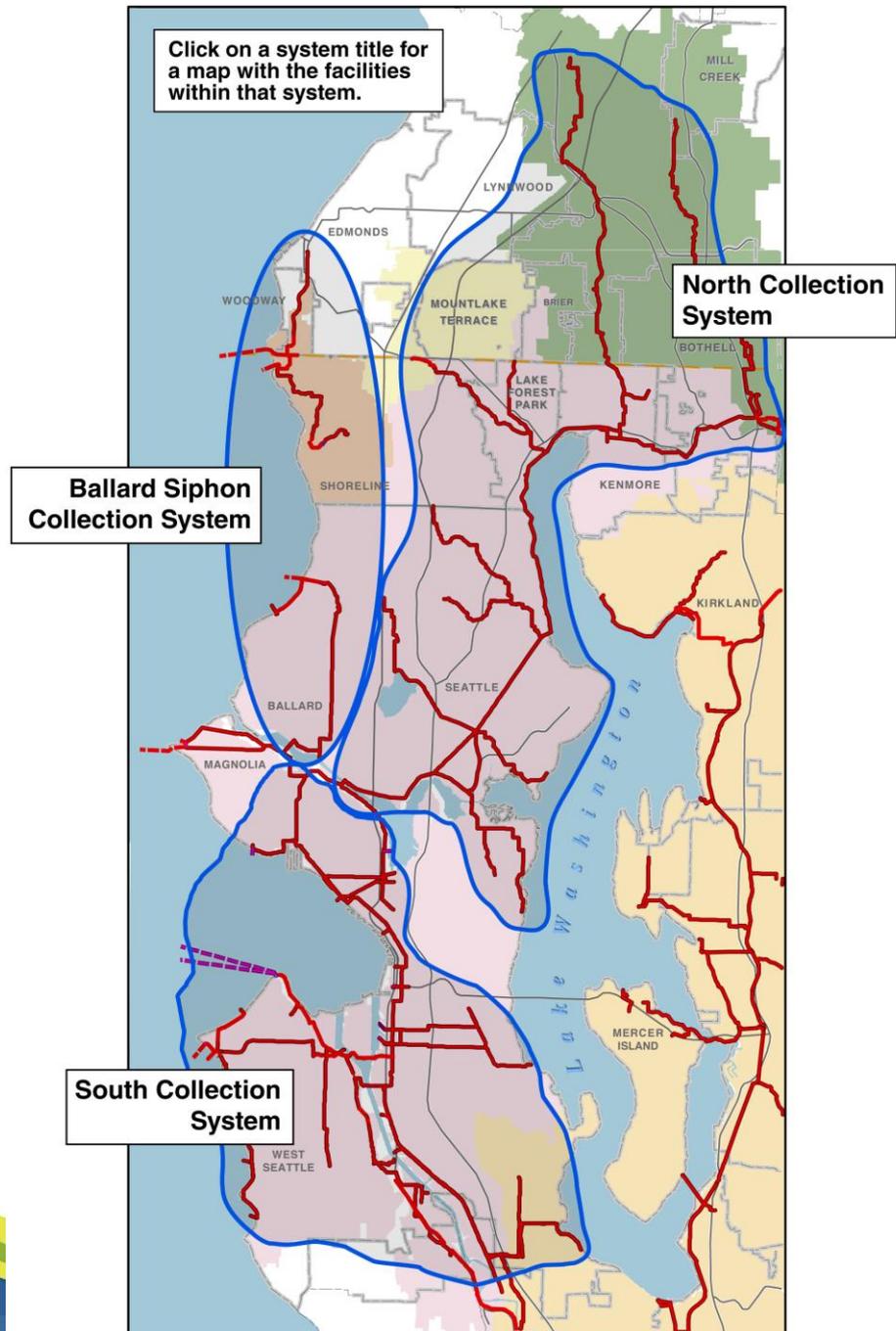


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West Point Service Area



- King County operates sewer trunks and interceptors to convey wastewater from local sewer districts, City of Seattle is the major district in West Point service area
- More than 60% of West Point service area is combined (sanitary/storm)
- Collection system can convey more flow than the treatment plant can manage and treat



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King County has 42 CSO Outfalls

4 – associated with CSO treatment plants

16 – controlled to 1 or less events/year

22 – uncontrolled, that are covered by the County's CSO Control Plan

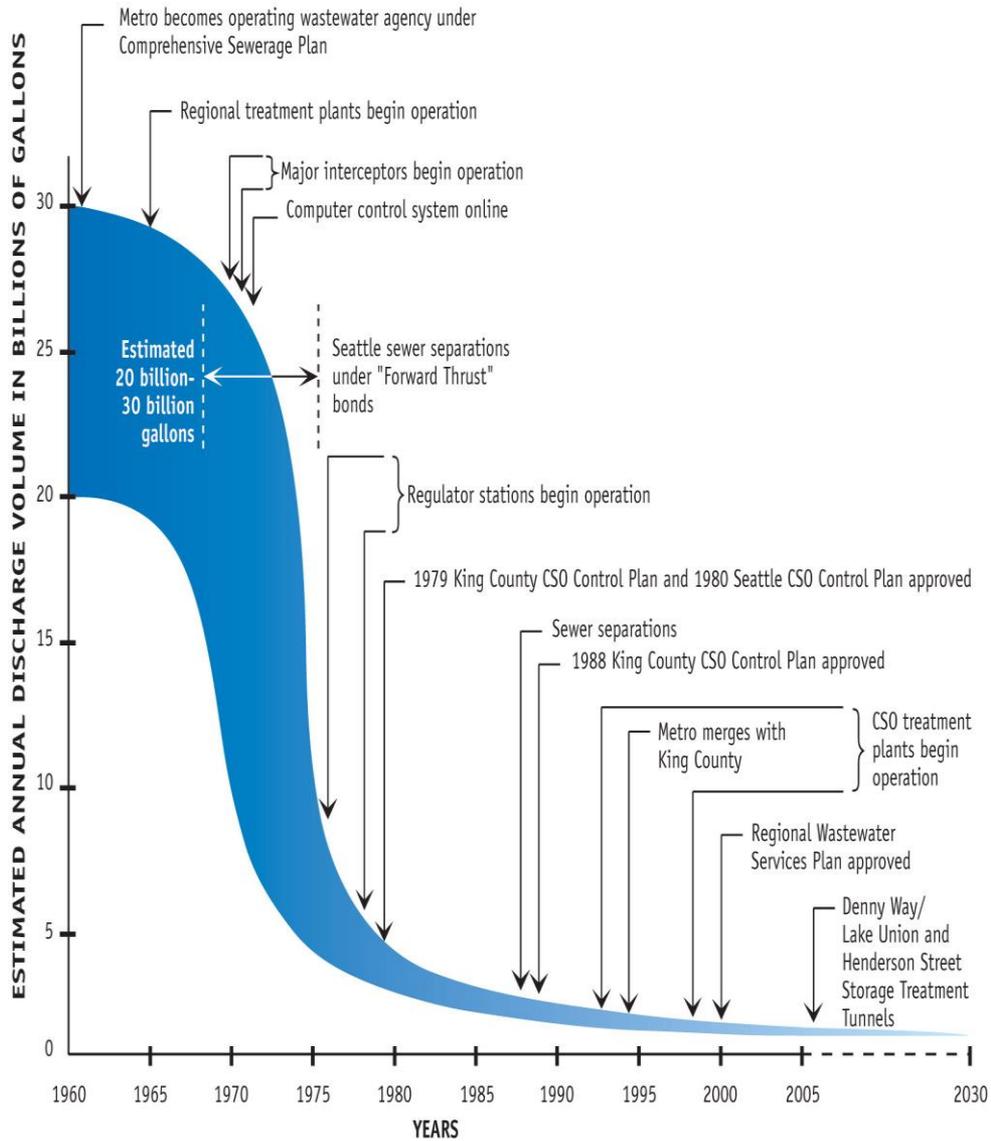
- Eight have projects underway
- Fourteen require planned future capital projects
- Long Term Control Plan is reviewed and updated every 5 years



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Why Didn't We Build Pipes Big Enough to Convey All the Flow?

- **If we build** the pipes big, non-storm flows don't move through the pipes well – we get odors & corrosion
- **If we build** the pipes small, we get sewer backups in homes
- **Pipes were built to** capture large, but not peak wet weather flows



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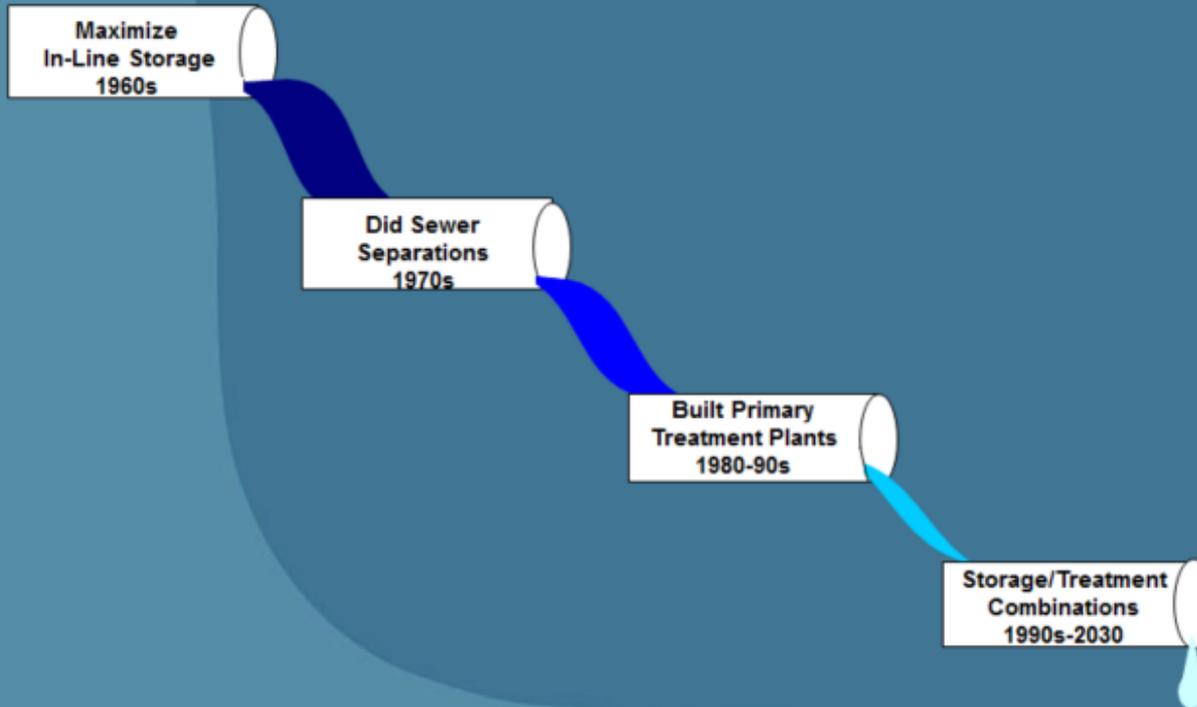
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Preferred control is capture & send to secondary treatment plant



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WTD Has Had a Changing Control Philosophy Over Time



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Treatment & Storage

CSO Treatment plants - West Point, Renton, Brightwater, Alki, Elliot, & Carkeek

Tunnels – Logboom 2- 132’ pipes, Lake City Tunnel 96” pipe, West Seattle Tunnel 10’ Pipe, Mercer ~10’ Pipe, Brightwater Tunnel Crown Storage.

Storage Tanks – North Creek, MLK, 3 in construction Murray, North Beach and South Magnolia



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CSO Treatment

Screening

Disinfection

Primary Clarification

Chemically Enhanced Primary Clarification (BW)

Solids Returned to conveyance

De-chlorination (sodium bisulfate)



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King County CSO Treatment Plants



CSO Storage

Tunnels

- Control strategies automatically optimize storage
- Some tunnels have post storm flush gates

Storage Tanks

- Fill when system reaches capacity
- Some have multiple channels



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Tank Flushing



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Projects Underway



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Georgetown

66 MGD Treatment Facility

Screening – Washer Compactor

Ballasted Sedimentation

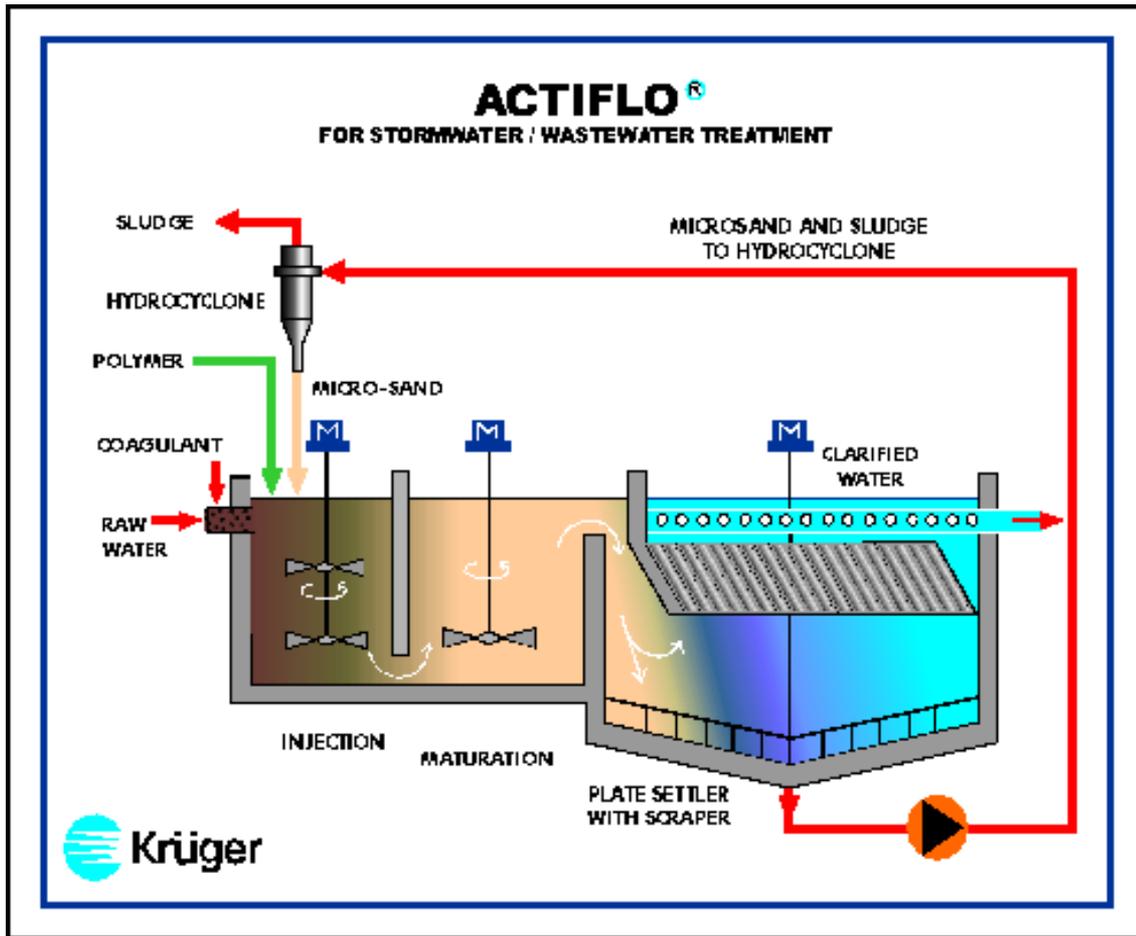
UV Disinfection



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<http://technomaps.veoliawatertechnologies.com/actiflo/en/>



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Ballard Siphon Replacement Project

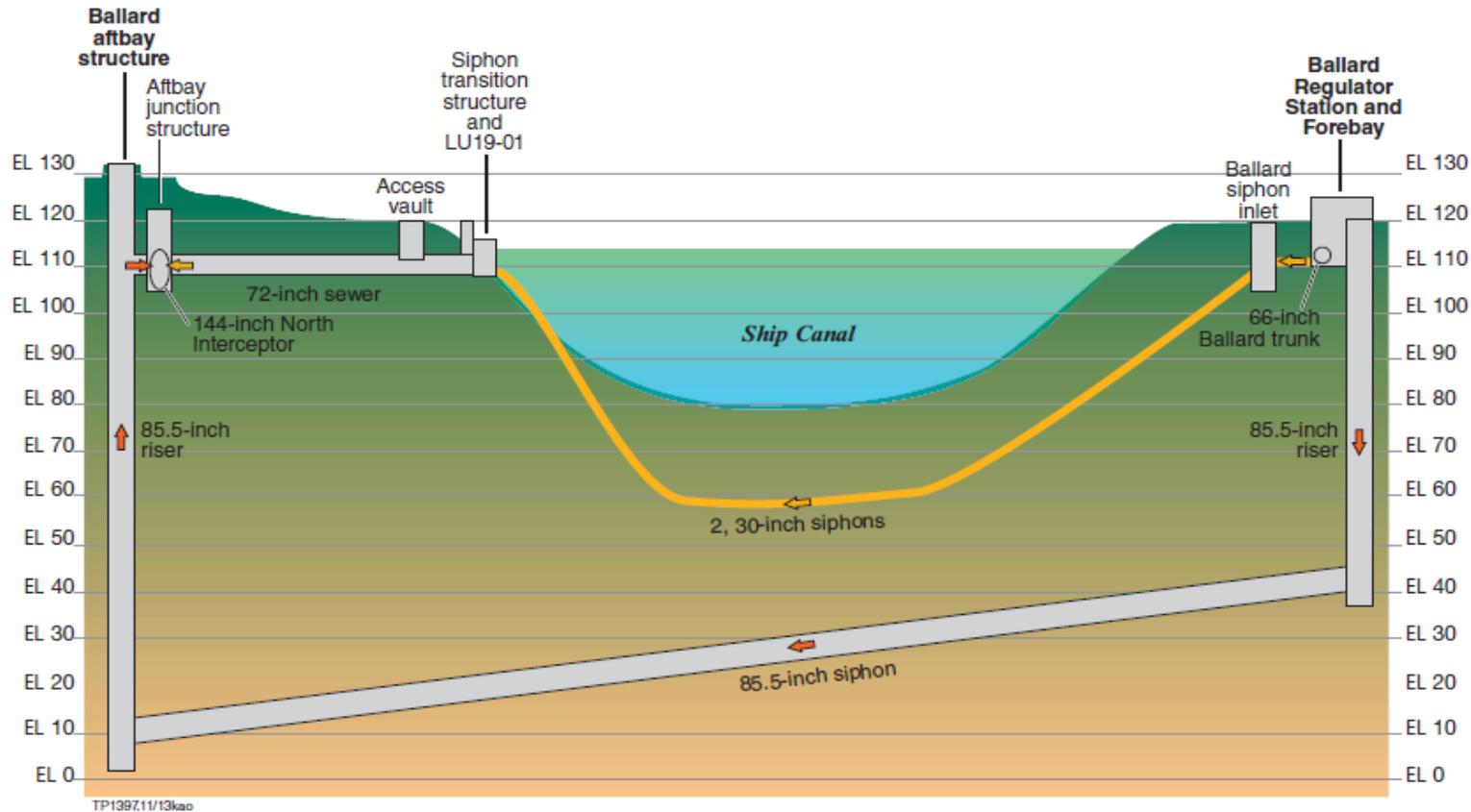


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Hydraulic Profile for Ballard Regulator and Siphons

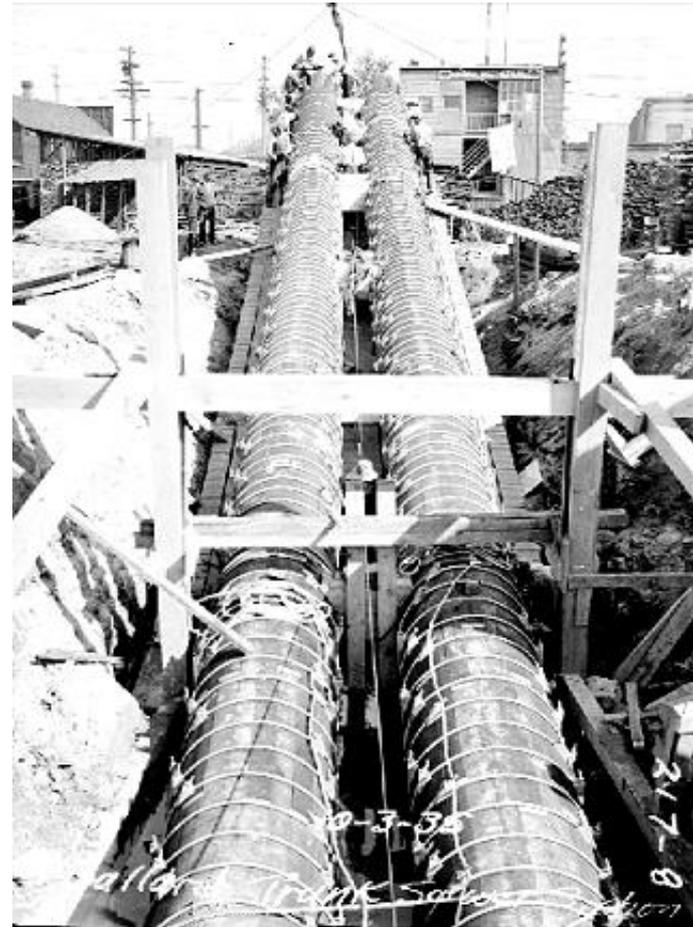


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Ballard Wood Stave Siphon Construction, 1935



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Ballard Siphon Tunnel Construction, 2013



Barton and Murray CSO Basins



Barton basin = 1,111 acres.
Barton PS conveys up to 33 MGD from its basin to the Murray PS.

Murray basin = 1,006 acres.
Murray PS has about the same pumping capacity to handle the flows from the Murray Basin and Barton PS.



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Barton CSO Control Project

Green Stormwater Infrastructure



Barton GSI installed on 15 streets in Sub Basin 416.

Bioretention (vegetated) swales within the public right-of-way planter strips intercept, treat and reduce the amount of stormwater runoff discharging into the combined sewer system.

By reducing the amount of stormwater entering the combined system the number of CSOs at the Barton Pump Station outfall will be reduced.



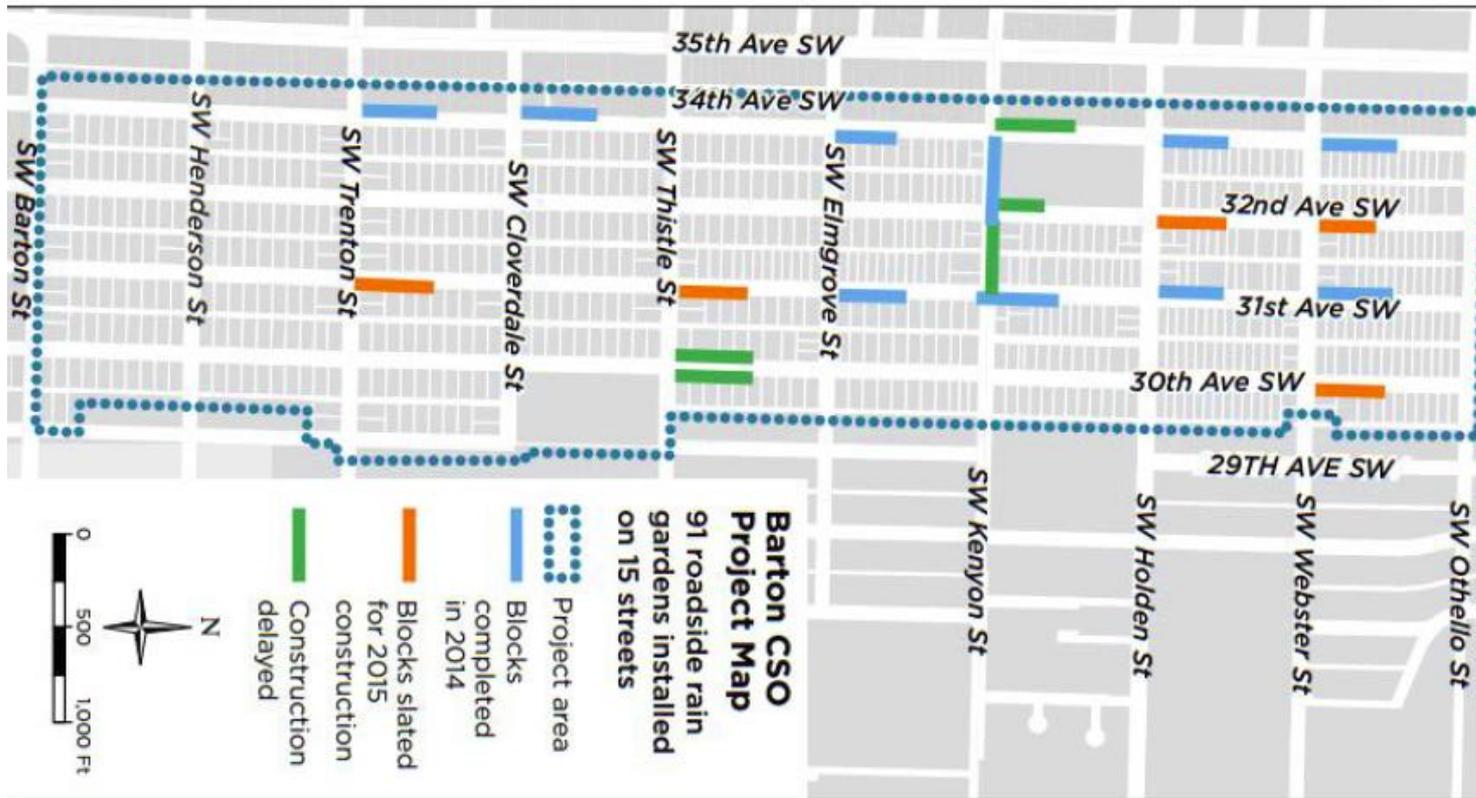
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Barton CSO Control Project

Green Stormwater Infrastructure



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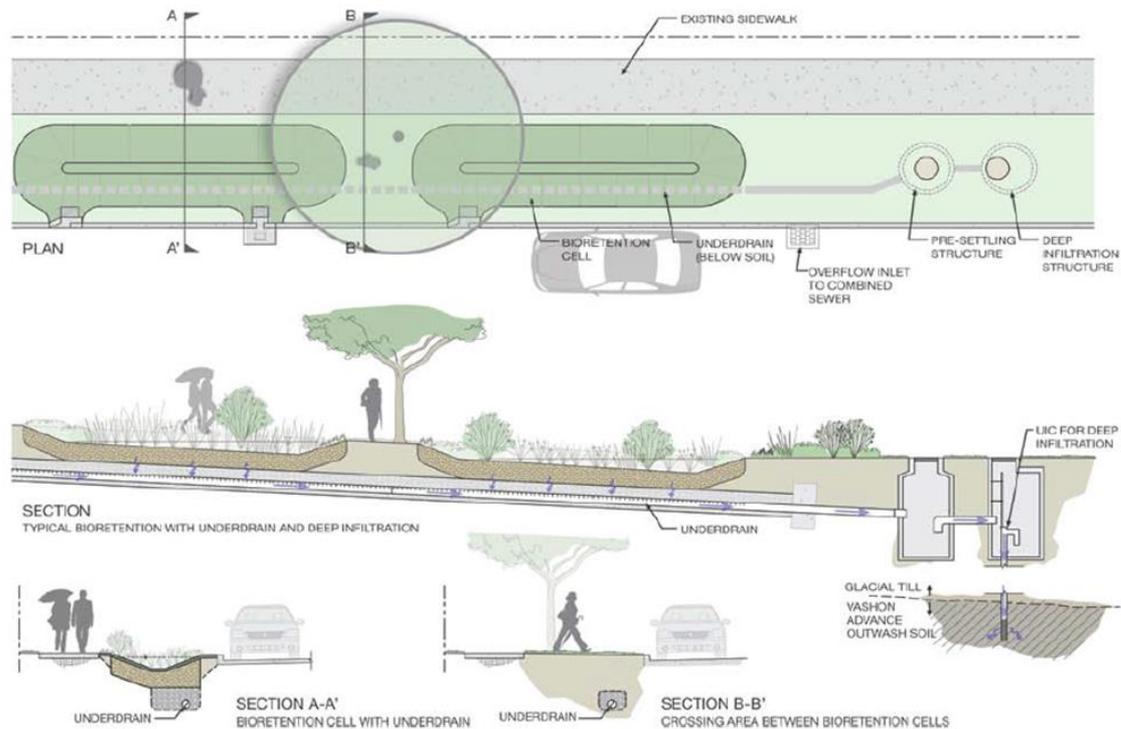
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Barton CSO Control Project

Green Stormwater Infrastructure

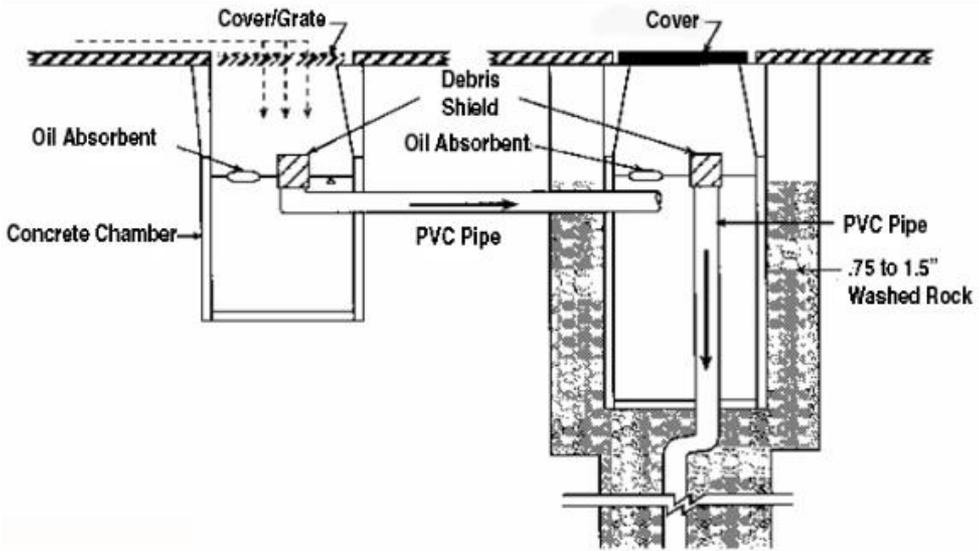
STORMWATER RUNOFF FLOW PATH DIAGRAM



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Murray CSO Control Project

1.0 MG Storage Tank



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Murray CSO Control Project

1.0 MG Storage Tank

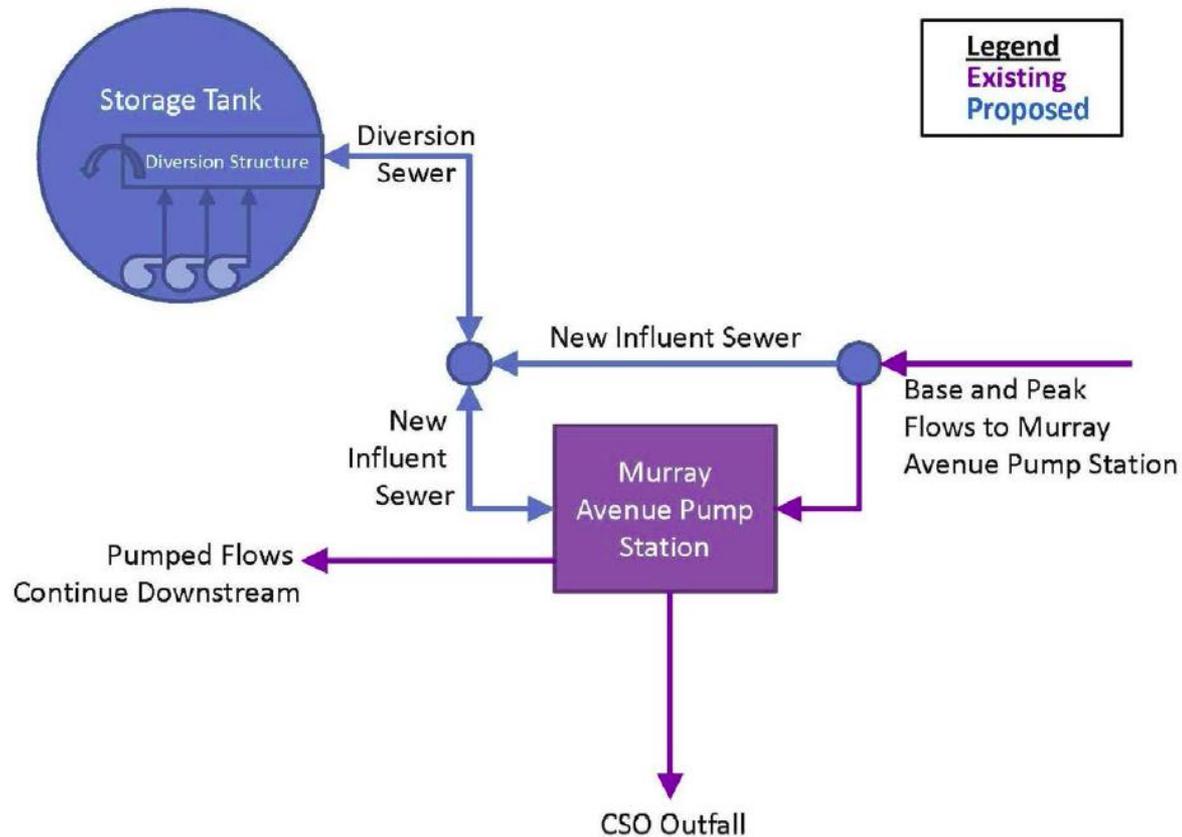


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How the Facility Controls CSOs



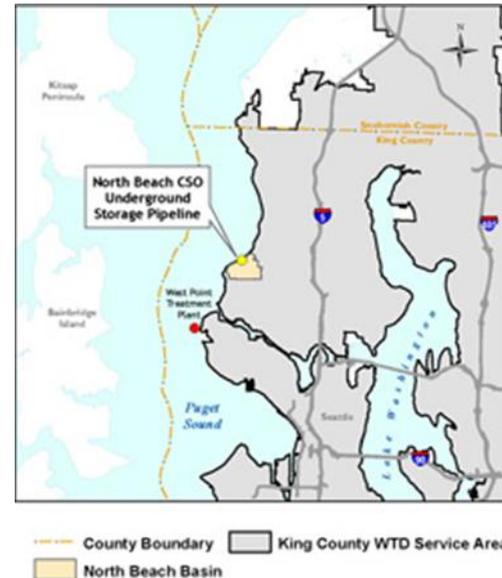
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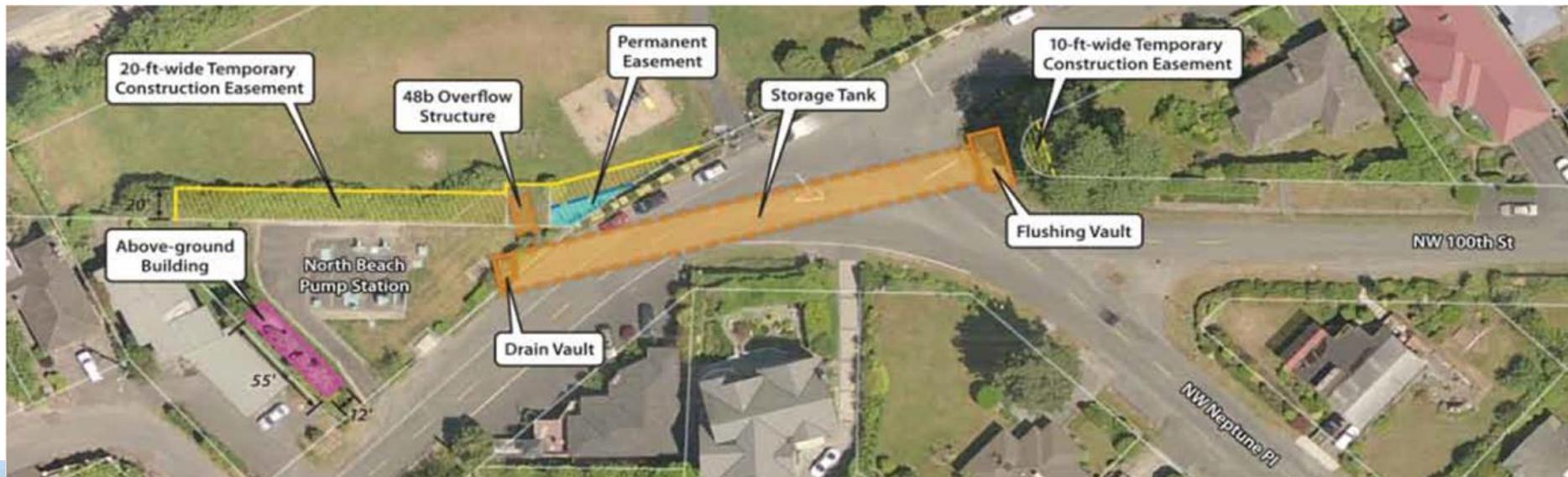
North Beach CSO Control Project

0.3 MG Storage Tank



North Beach CSO Control Project

0.3 MG Storage Tank



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South Magnolia CSO Storage Operational Overview

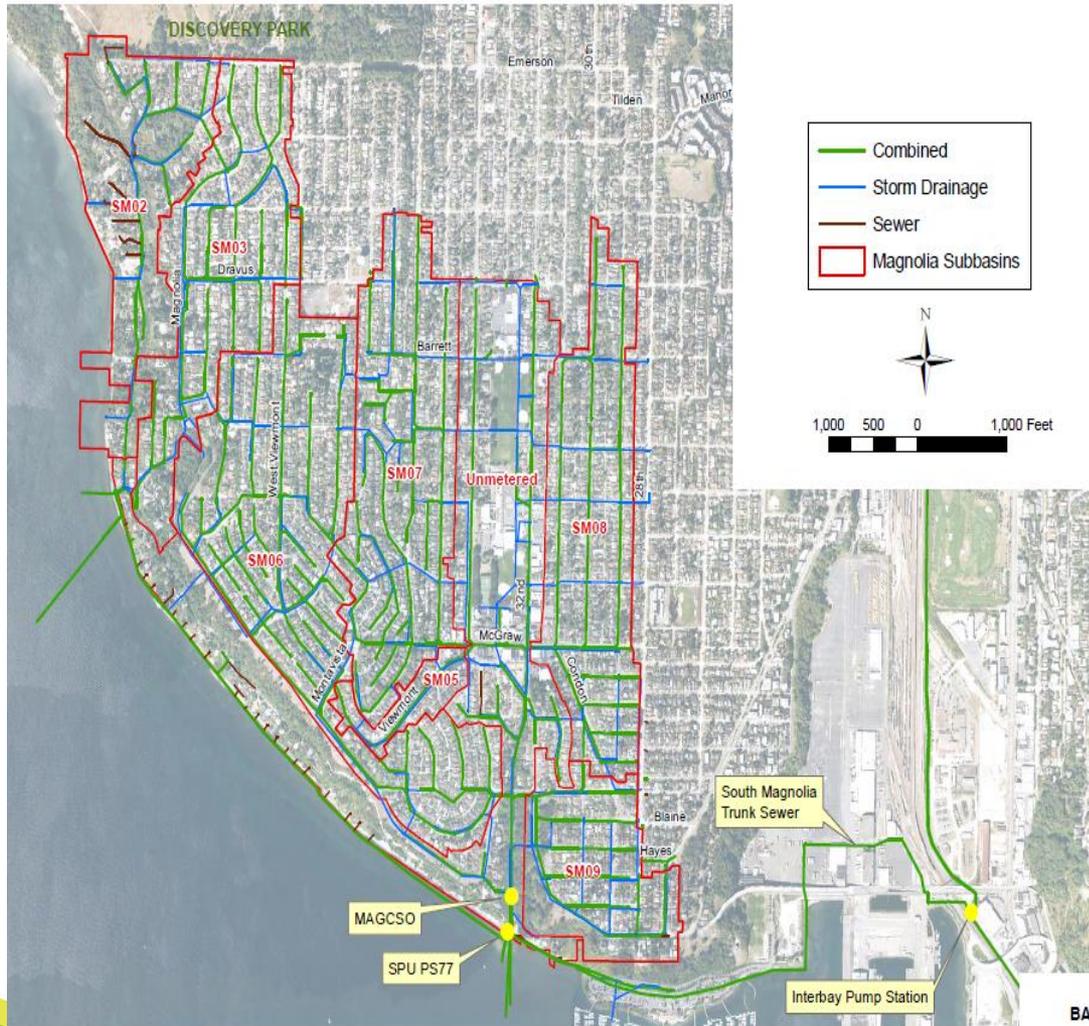


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South Magnolia Drainage Basin



~744 Acres, Partially Separated

20 MGD Peak Flow

4.3 MGD Existing Conveyance System Capacity

“Out of Basin” CSO design requires conveyance & storage



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BAS



Key System Elements –

- Existing Diversion Structure
- Existing CSO Outfall
- Upper Diversion Structure
- Lower Diversion Structure (at storage tank)
- CSO Conveyance Pipeline
- 1.5 MG Storage Tank
- Fully automated (storage, drain, flush modes)



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Upper Diversion Structure (UDS)



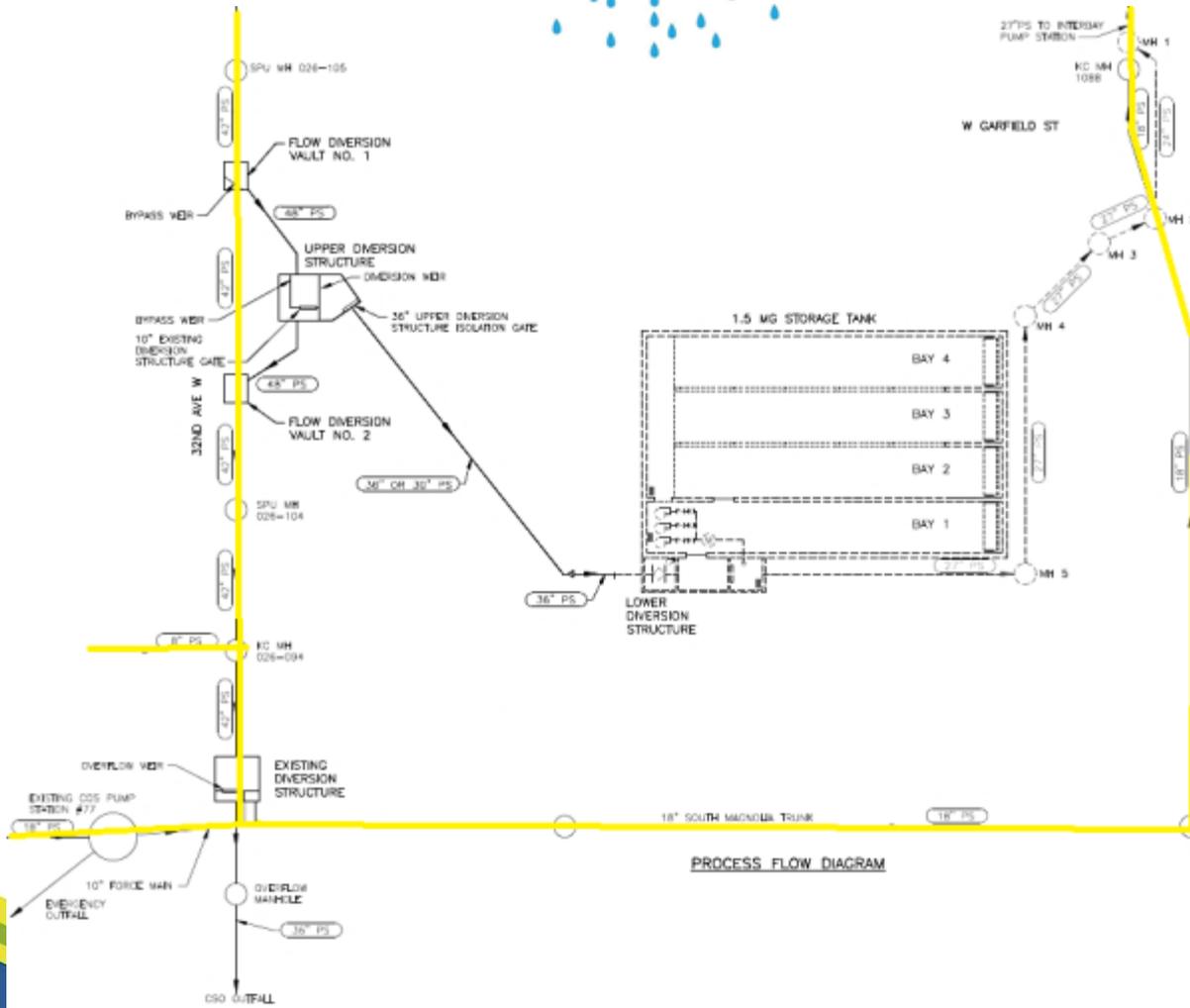
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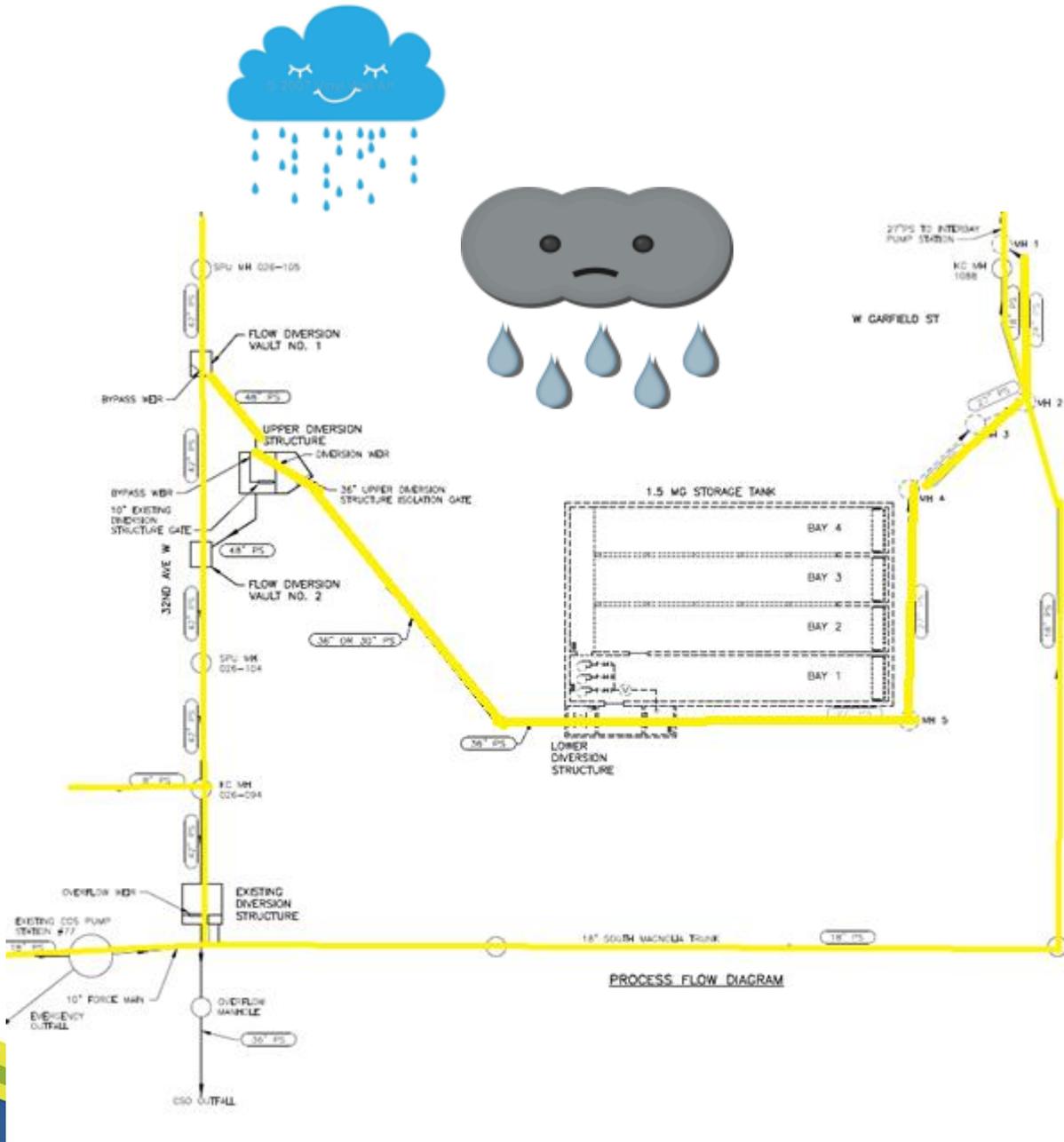
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Dry to Moderate Flow Conditions

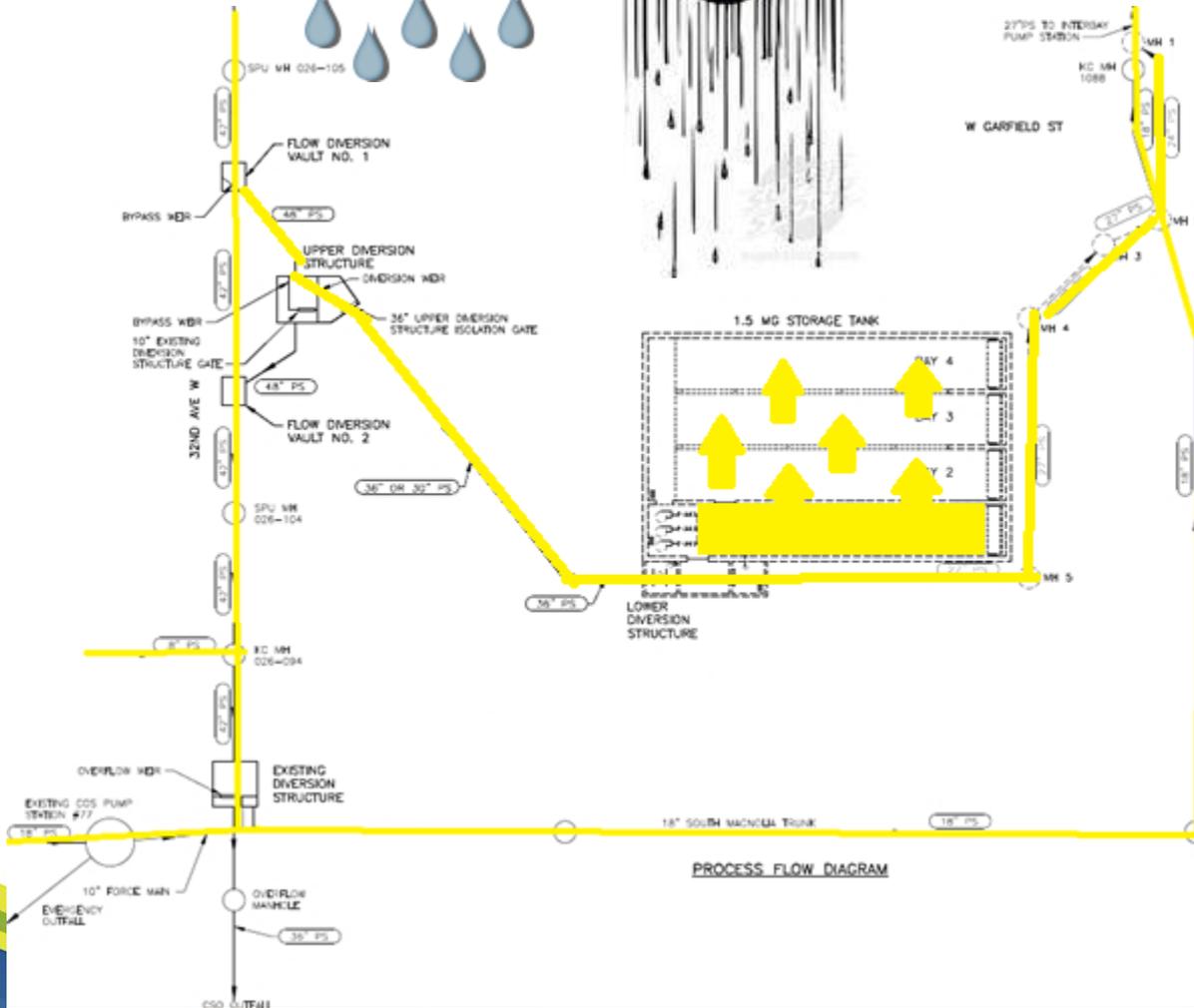


Large Storms

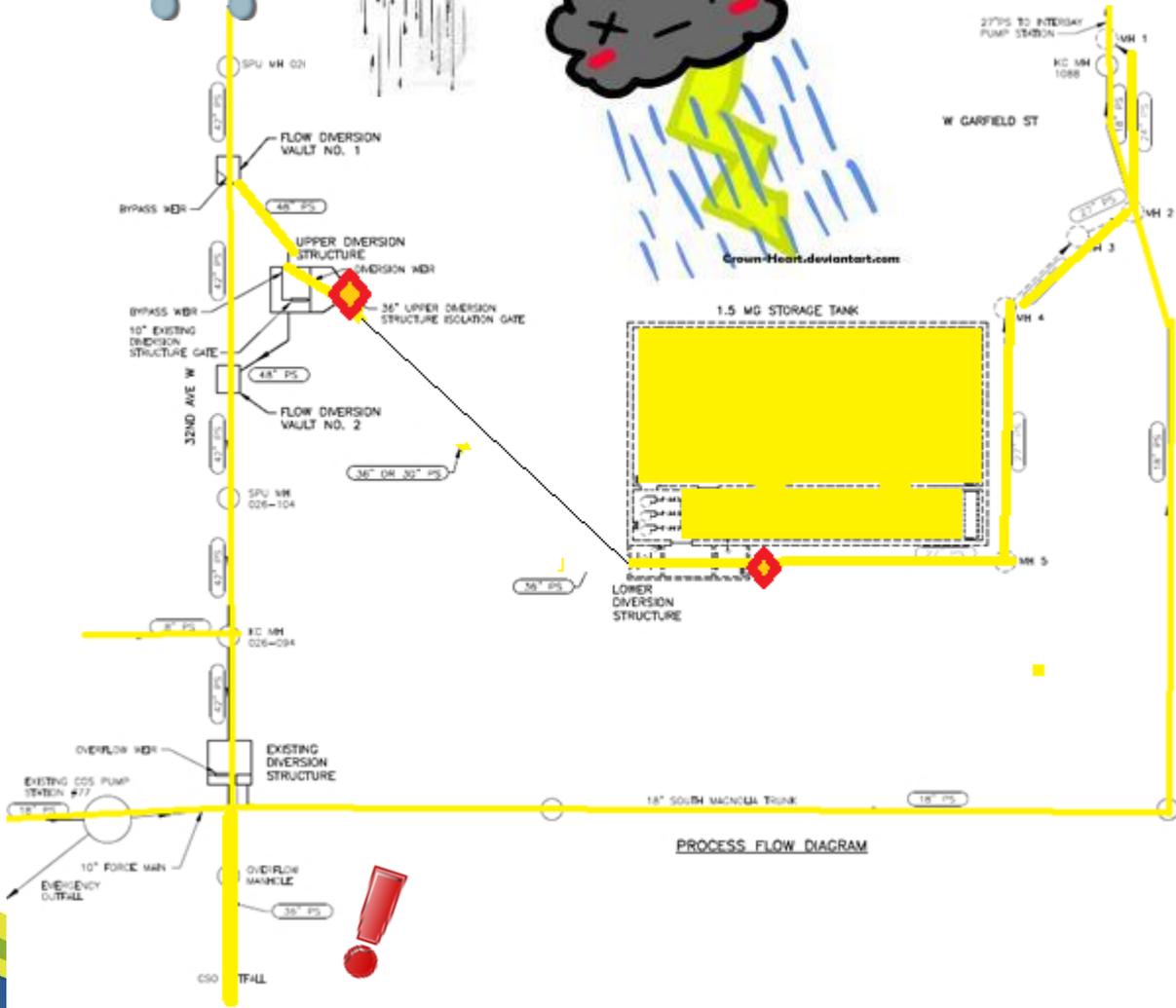




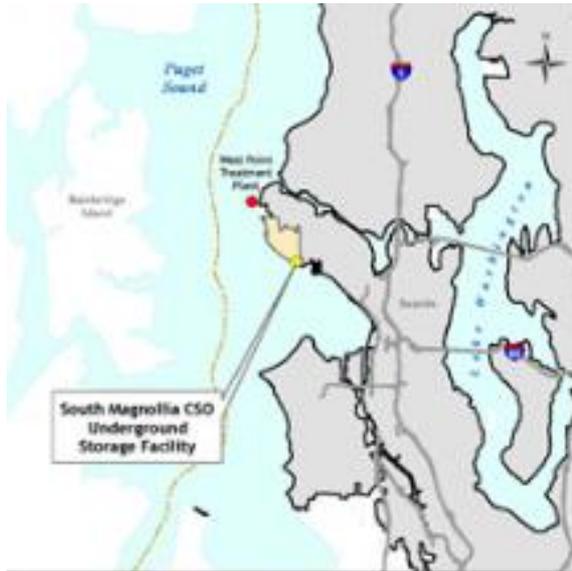
Larger Rain Storm Flow Conditions



Very Large or Sustained Rain Events



South Magnolia CSO



https://www.youtube.com/watch?v=Lok9R_5WbuA



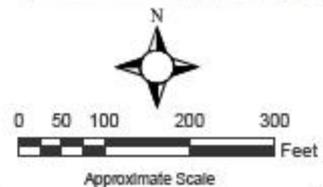
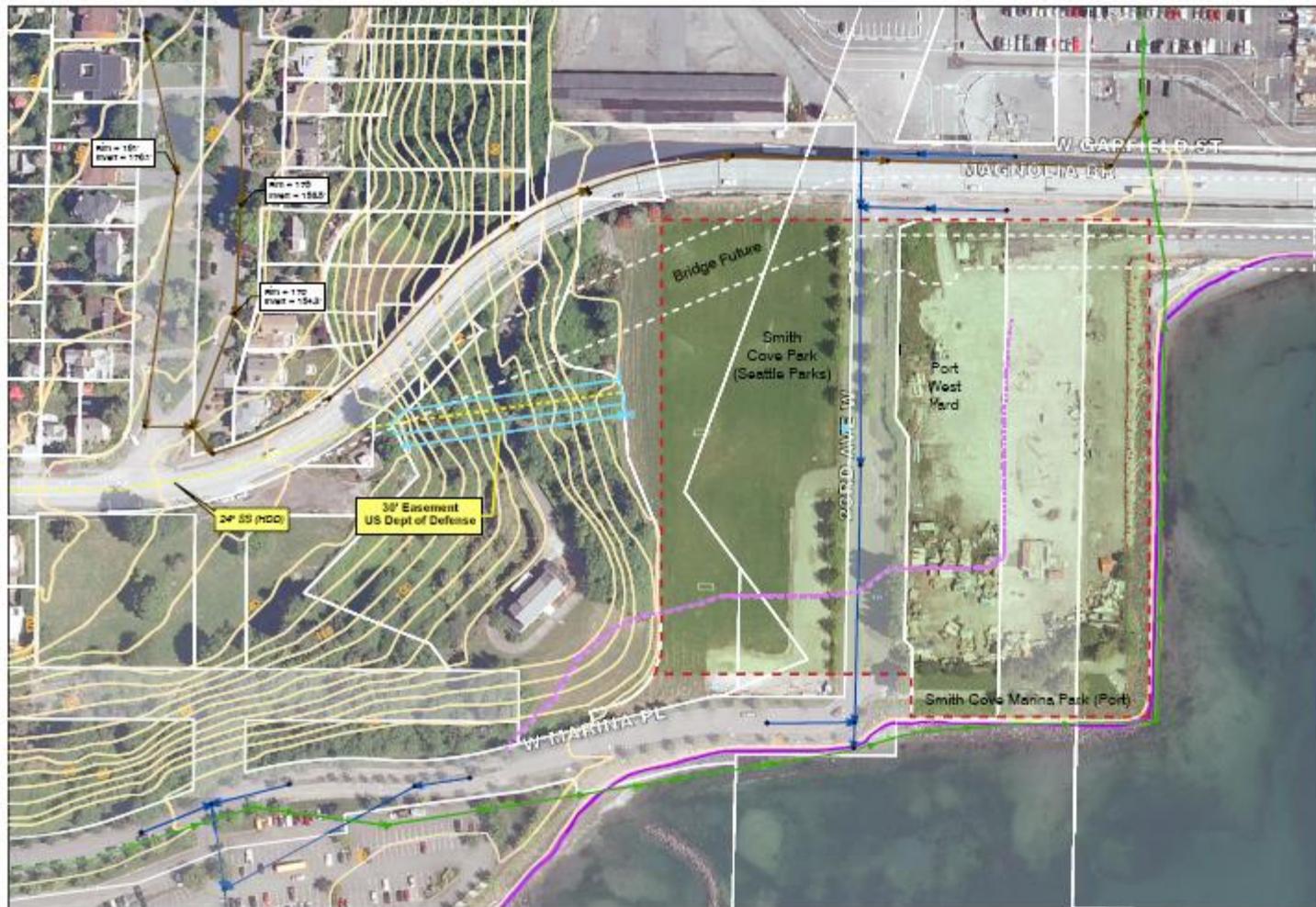
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South Magnolia CSO Project

SITE LAYOUT- EAST



- Legend**
- Combined Sewer System
 - Storm Sewer System
 - Sanitary Sewer System
 - 10' Topographic Contour
 - Shoreline
 - 200' Shoreline Setback
 - Feasible Area for Tank Location
 - Permanent Easement
 - Horizontal Directional Drilled Gravity Sewer

SITE LAYOUT PLAN EAST

LANDSCAPE CONCEPT



GRASSPAVE



CENTRAL UPLANDS



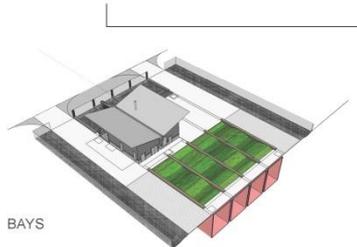
CENTRAL LOWLANDS



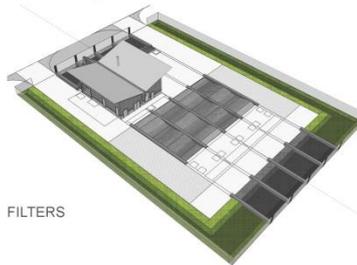
GABION BAY WALLS



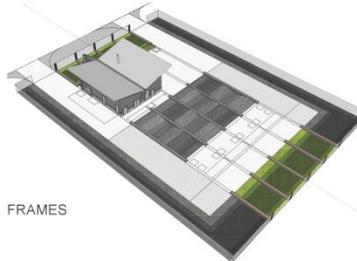
BIORETENTION EDGES



BAYS



FILTERS



FRAMES



BIORETENTION BOTOM AREAS



SUCCESSIONAL GROVE





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