King County

Barton, Murray, Magnolia, and North Beach

CSO Facilities

Broadview Community Update
July 29, 2010

carollo
Engineers...Working Wonders With Water™

TETRA TECH

And Associated Firms

Meeting Purpose

- Describe three alternative means for CSO control in the North Beach basin
- Provide project timeline and decision process

CSO Control Program Overview

What is the CSO Control Requirement?

- Set by State Regulations (WAC 173-245)
- One untreated event per year on average
- Protect public health, environment, and aquatic life by 2030
- Ecology set West Point permit deadlines
  - CSOs must be controlled to the state regulation
  - Ecology & EPA can use fines and court orders to enforce requirements
  - EPA is tracking King County's compliance schedule

CSO Project Objectives

- King County has 38 CSOs
- Over half are controlled
- CSO Beach projects are a priority due to location near popular beaches
- CSO Beach projects under construction 2013

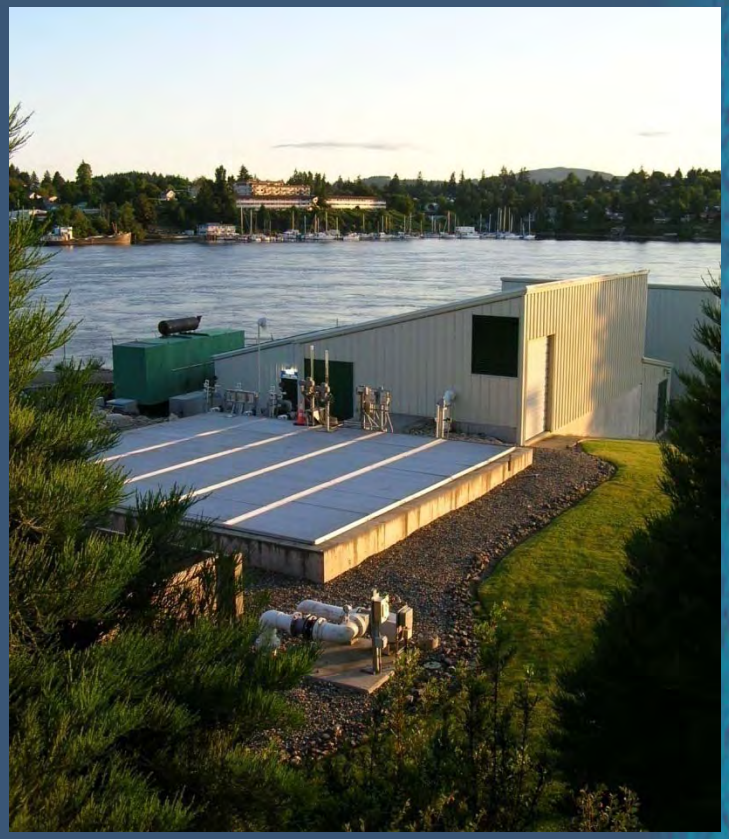
CSO Control Approaches

Storage Approach

- Peak flows diverted into storage during wet weather
- Stored flow drained back to collection system following wet weather
- May be “centralized” at bottom of basin, centralized higher in basin, or distributed within basin
- Majority of facility is typically underground
  - Associated facilities located aboveground

On-site Treatment Approach

- Treatment facilities located near the CSO point
- Peak flows are treated and discharged
- Facilities operate only during wet weather events
- May be “centralized” at bottom of basin or centralized higher in basin

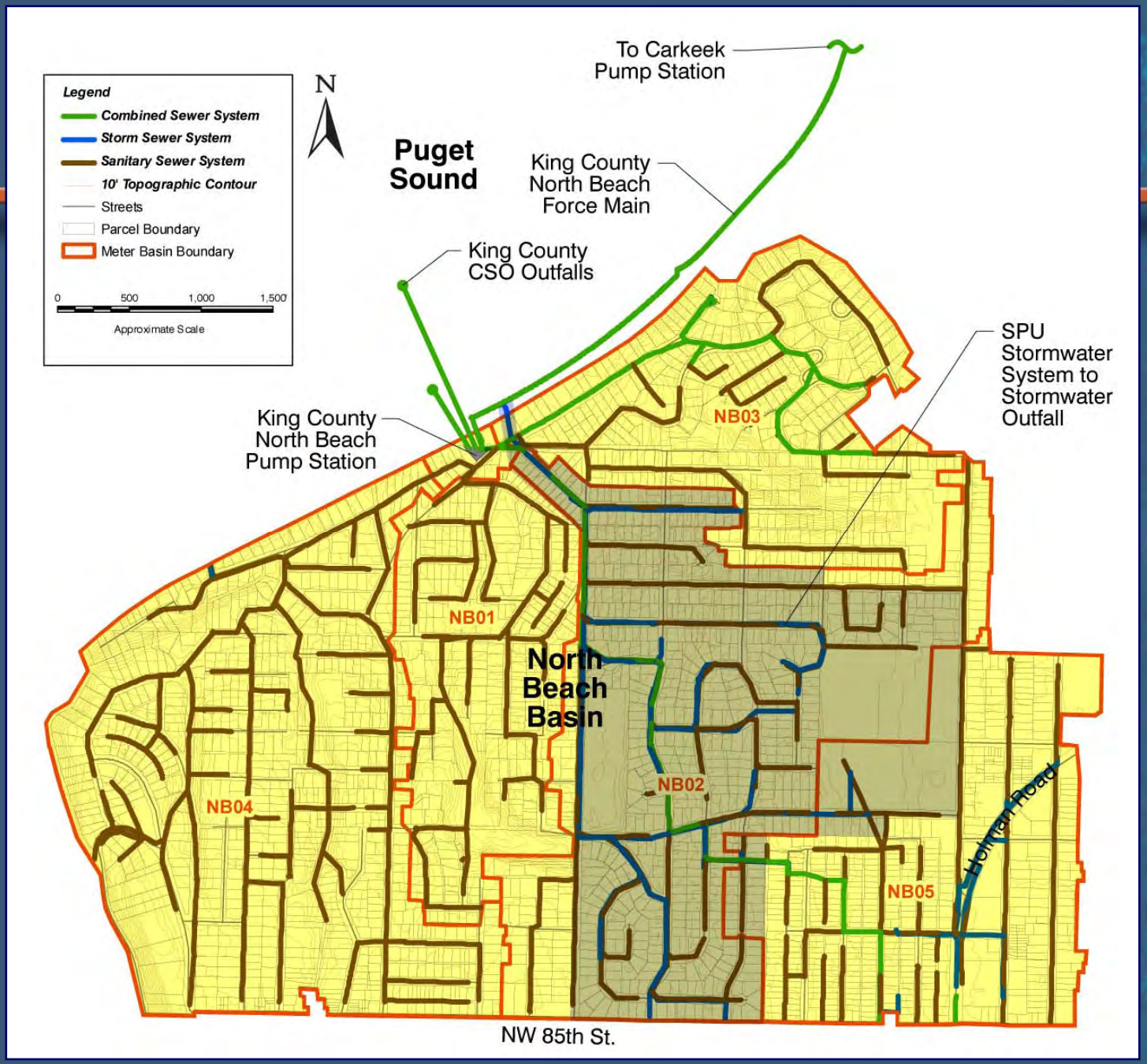


Conveyance & Treatment Approach

- Flow conveyed to downstream County facilities where flows are treated and discharged
- Requires increased:
  - Pumping capacity
  - Pipeline capacity
  - Treatment capacity

Peak Flow Reduction Approach

- Separate stormwater from sewer system
  - Disconnect down spouts
  - Re-route stormwater to storm drainage system
- Green stormwater infrastructure (GSI)
  - Roadside rain gardens, bio-swales
  - Green roofs
  - Street trees
  - Pervious pavement
- Inflow and Infiltration (I/I) reduction


Legend
Combined Sewer System
Storm Sewer System
Sanitary Sewer System
10' Topographic Contour
Streets
Parcel Boundary
Meter Basin Boundary
0
500
1,000
1,500'
Approximate Scale
N
Puget Sound
To Carkeek Pump Station
King County North Beach Force Main
King County CSO Outfalls
King County North Beach Pump Station
SPU Stormwater System to Stormwater Outfall
NB03
NB01
North Beach Basin
NB02
NB04
NB05
Holman Road
NW 85th St.

North Beach Conveyance System

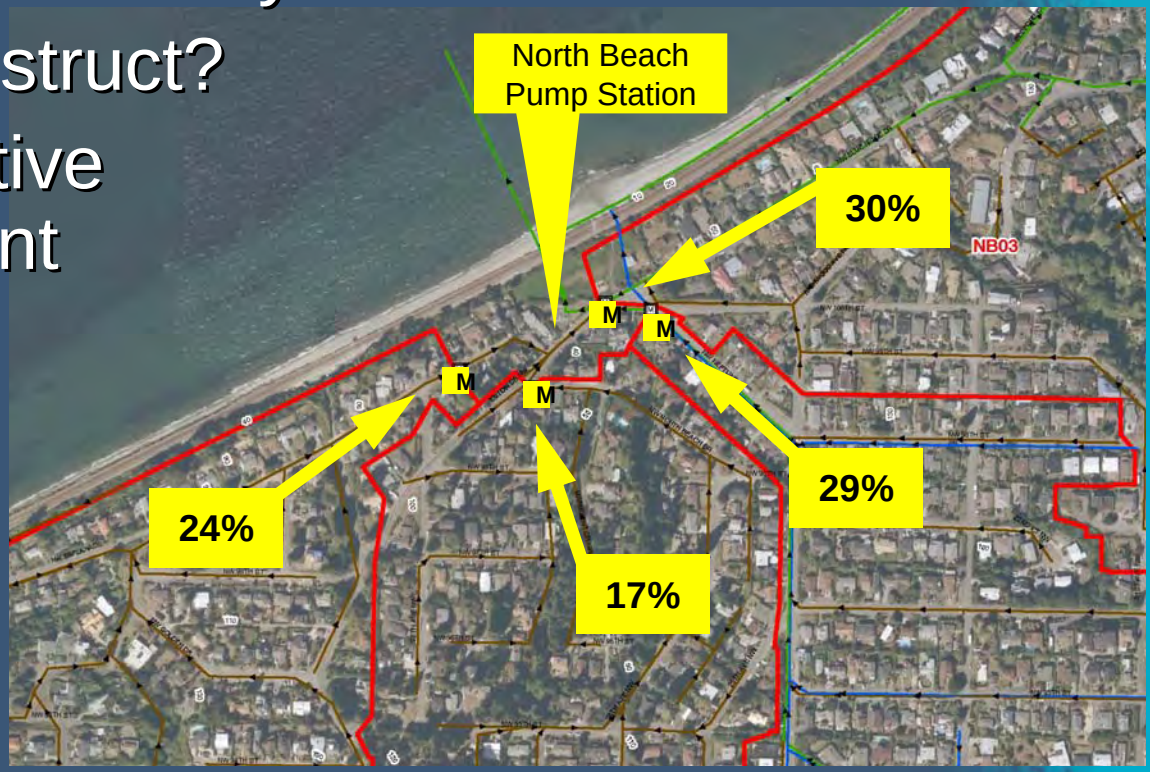
- North Beach pumps to Carkeek Wet Weather Treatment Facility and Pump Station
  - Maximum North Beach PS capacity is ~3 mgd
- Under "low flow" conditions (below ~9 mgd) Carkeek flows are pumped to 8th Ave. Interceptor, and ultimately to West Point Treatment Plant
- Under "high flow" conditions Carkeek discharges treated effluent <u>and</u> pumps to West Point Treatment Plant

Results of Control Requirements Analysis

- North Beach CSOs
  - Average of 10 events per year
  - Average of 2.2 Mgal per year
- 230,000 gal of storage for CSO control
  - Tank roughly 75’ x 30’ x 15’ deep (inside dimensions)
  - Alternately need 300’ of 12’ dia. Pipe (inside dimensions)
- 8.5 mgd of conveyance/treatment capacity is required to eliminate storage

Alternatives Developed to Meet Basin Requirements

- What's required for a workable alternative:
  - Sufficient room to site and construct the facility?
  - Feasible to construct?
  - Will the alternative capture sufficient peak flow?



What Alternatives Were Considered?

- 1A: Bottom of Basin Storage (Rectangular Tank)
- 1B: Bottom of Basin Storage (Pipe in ROW)
- 1C: Storage/Pumping (Store at Top of Basin)
- 1D: Storage/Pumping (Store at Bottom of Basin)
- 2A: Convey and Treat (Beach FM alignment)
- 2B: Convey and Treat (Neighborhood FM alignment)
- 3A: On-site Treatment (Bottom of Basin)
- 3B: On-site Treatment (Up in Basin)
- 5A: Peak Flow Reduction (I/I Removal)

How were the Alternatives Evaluated?

- Individual alternatives were evaluated using a range of factors:
  - Land Use/Permitting
  - Environmental
  - Community
  - Costs
  - Operations & Maintenance
  - Design and engineering
- Public input used to shape and inform our work

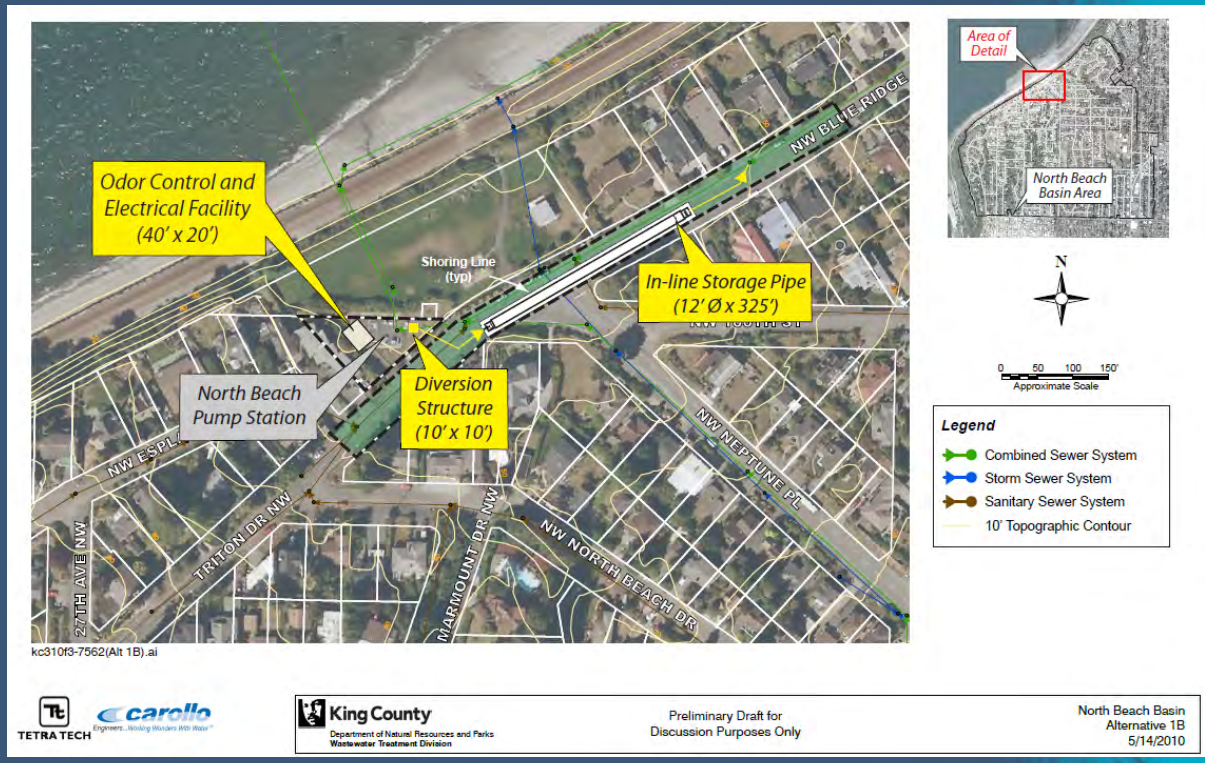
Carkeek Park
NW Blue Ridge Drive
(Underground Storage)
Puget
Sound
North Beach
Pump Station
Blue Ridge Park Area,
Right-of-Way, and Holman Road
(Conveyance and Underground Storage)
Blue Ridge Park Area
(Underground Storage)
Soundview
Playfield
Golden
Gardens
Park
KC-WTD Pump Station
KC-WTD Conveyance
KC-WTD CSO Outfall
Alternatives
North Beach Basin
Park
1,000 500 0 1,000
Feet
March 2010

1A: Bottom of Basin Storage (Rectangular Tank)

- Characteristics:
  - 230K gallons storage
  - Property acquisition required
  - Shoreline zone is Conservancy Recreation

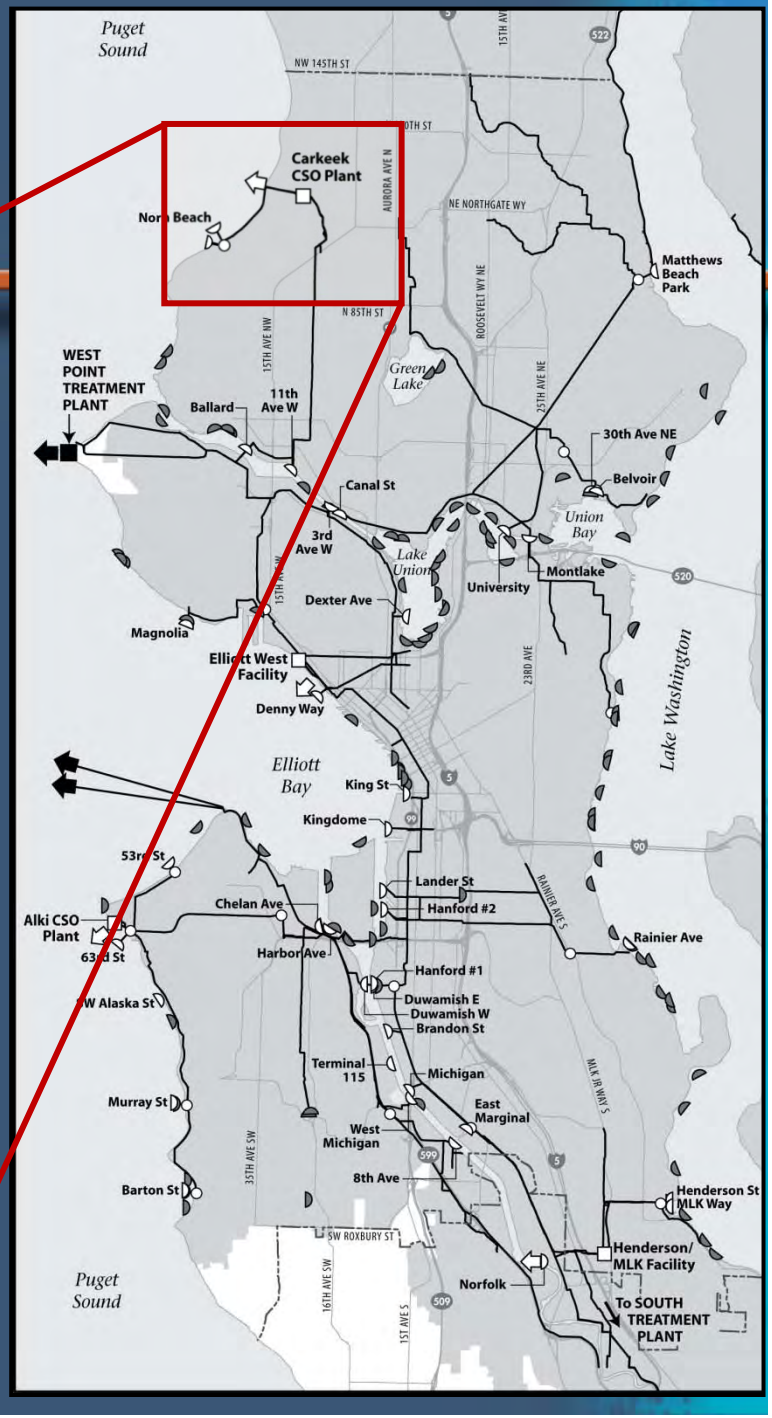
1B: Bottom of Basin Storage (Pipeline in Right-of-Way)

- Characteristics:
  - 230K gallons storage
  - Property acquisition not required
  - Street closures for construction and O&M activities



Storage/Pumping

- Addresses CSO control requirement & replaces existing North Beach Pump Station and force main



1D: Storage/Pumping (Store at Bottom of Basin)

- Characteristics:
  - 3.5 mgd two-stage pump station/ 150K gallons storage @ bottom of basin/ 8,000LF pipeline
  - Replaces existing North Beach PS and FM
  - Property acquisition required
  - Shoreline zone is Conservancy Recreation

TETRA TECH carollo

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Preliminary Draft for Discussion Purposes Only

North Beach Basin
Alternative 1D
5/14/2010

Next Steps

- Refine alternatives for each basin
- Decide on a proposal for each basin
- Environmental review
  - SEPA
  - SERP (EO-0505)
- Regulatory review and approval
- Proceed to facility design
- Construction

Project Timeline

- Spring 2010 –
  - Public meetings for 3 alternatives
  - Refinement of alternatives
- Summer to Fall 2010 –
  - **Recommend proposal for further environmental review**
  - Report back to public
  - Draft Facility Plan preparation
- December 31, 2010 – Draft Facility Plan to Ecology
- Early 2011 – Public comment on SEPA
- December 2013- Start of construction

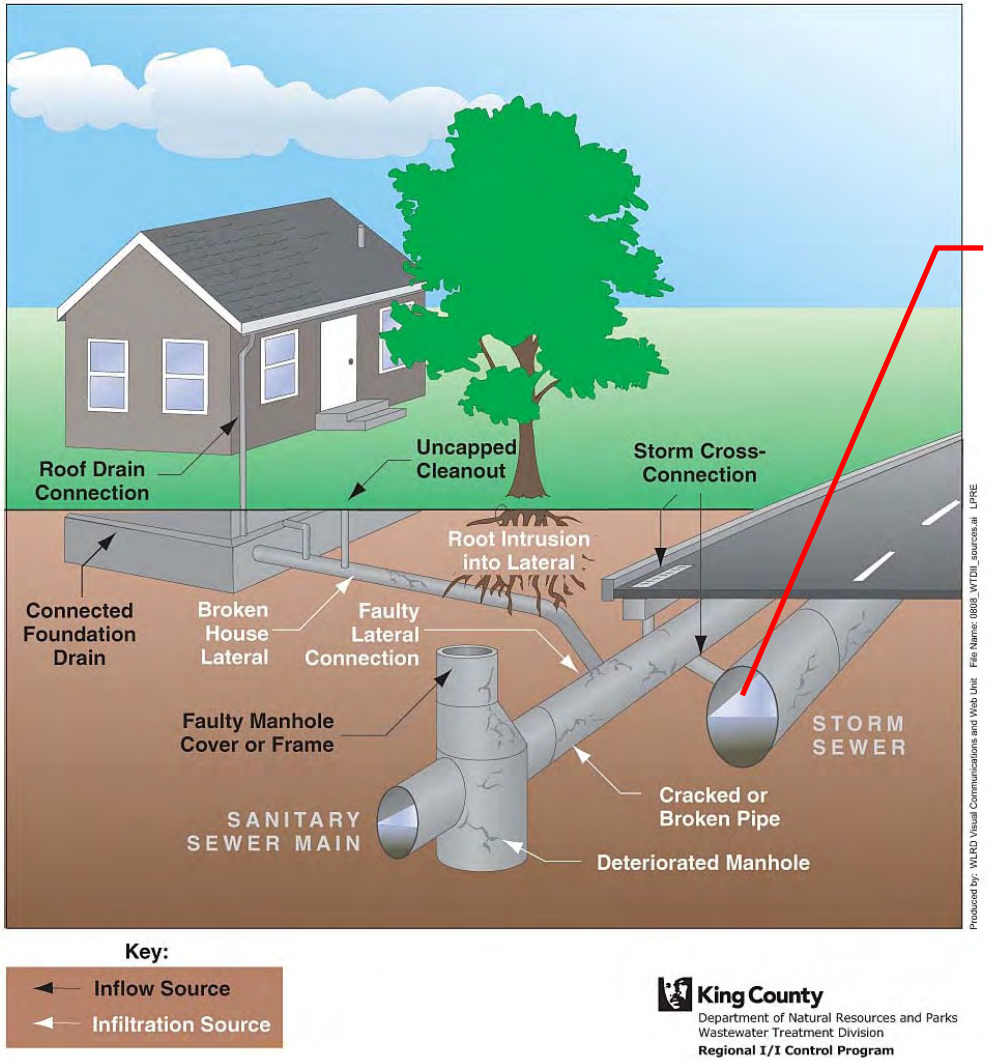
Information and Input

- Project information, updates, and meeting calendars are located at: www.kingcounty.gov/csobeachprojects
- Contact Monica Van der Vieren at (206) 263-7301 or monica.vandervieren@kingcounty.gov
- Email CSOBeachProjects@kingcounty.gov

Alternative 5A: Peak Flow Reduction (I/I Removal)

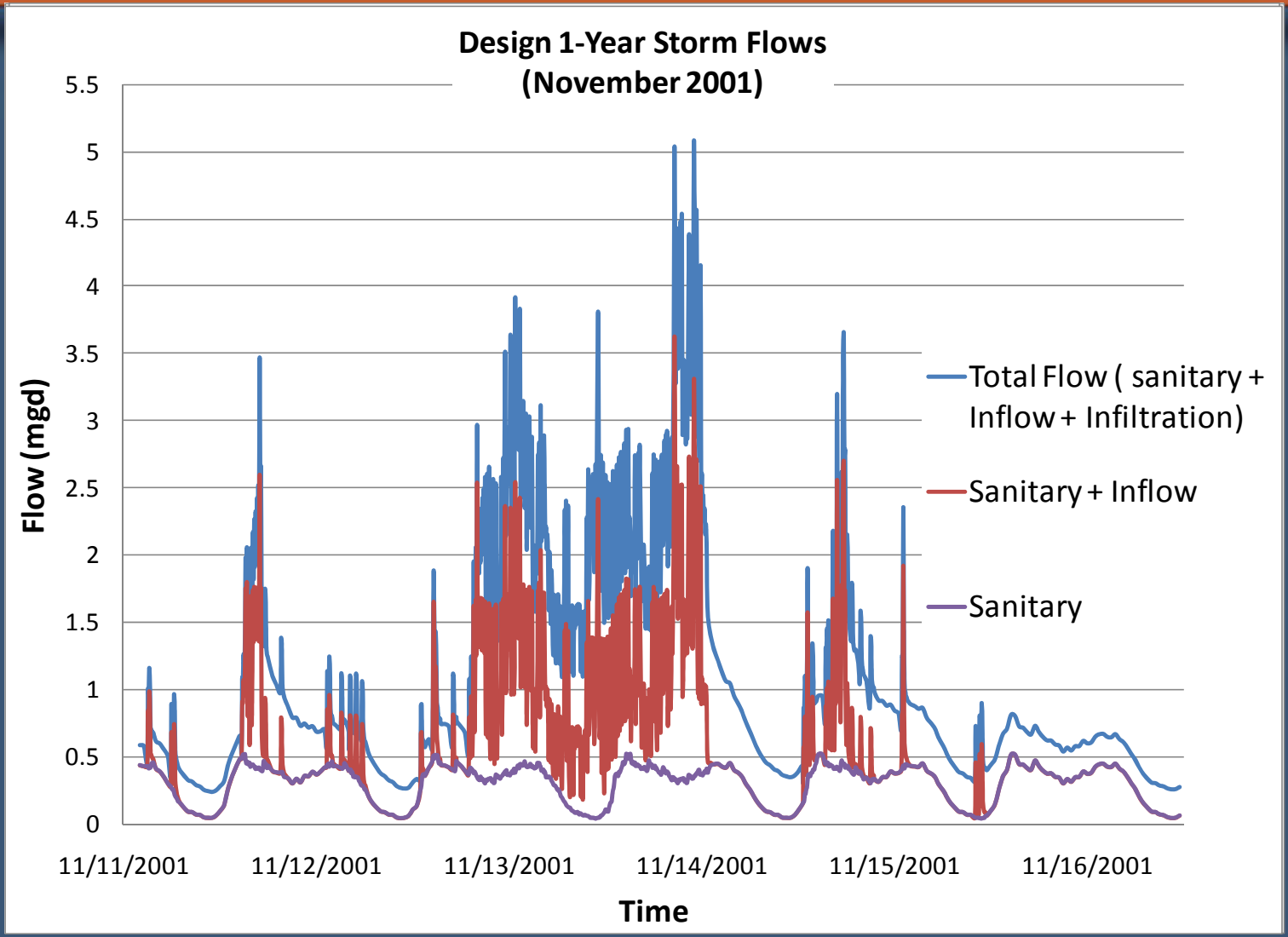
- Evaluate flow data during peak events to estimate:
  - Where in the basin flows are coming from
  - What type of connection (inflow or infiltration) is contributing to peak
- Based on prior experience, estimate:
  - Amount of flow/volume that can be reduced
  - Potential cost of inflow and infiltration removal

North Beach Basin Flow Impacted by Both Inflow and Infiltration



NOTE: Separate storm sewers do not exist in North Beach basin

Flow Data Used to Estimate I/I Magnitude



Inflow Sources Estimated Using Flow/GIS Data

- Total No. of Houses: 2,388
- Total Connected Rooftop Area: 13 Ac.
- Avg. Rooftop Area: 1,780 ft^2
- Equivalent to ~310 Houses Connected
- Connected Houses Spread Throughout Basin

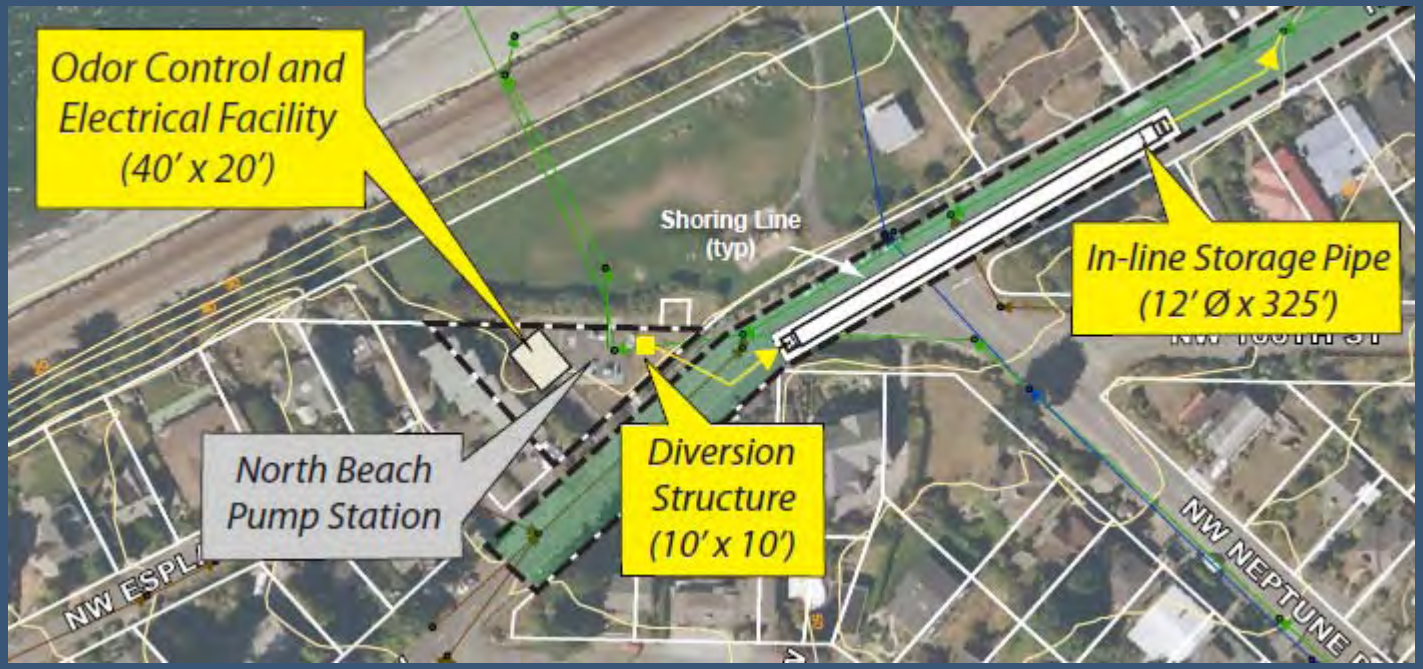
Inflow Reduction = Disconnecting Roof Drains on Private Property

- **Key Assumptions/Requirements**
  - Approximately 75% of connected houses could feasibly be separated
  - For these houses, 100% of the rooftop stormwater would be removed from the sewer system
  - Average construction cost of disconnecting is $3,300 per house (base cost only)
  - Additional stormwater must be controlled
    - Neighborhood concerns with flooding, slope stability

Roof Drain Disconnection Initial Conclusions

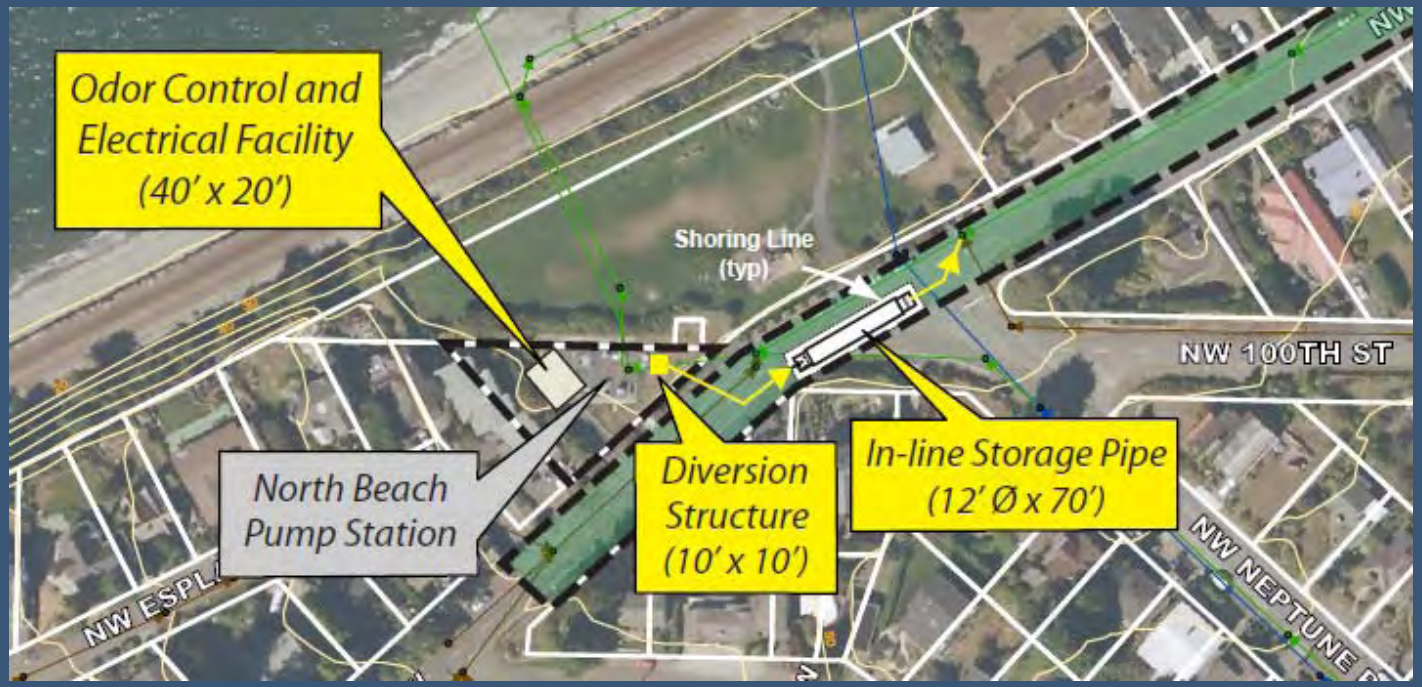
- Storage cannot be eliminated by disconnecting roof drains alone
  - Storage may be reduced to ~40,000 gallons with the most aggressive roof drain disconnection program
- Removing infiltration from private side sewers is also required to eliminate storage
- Additional infrastructure for stormwater
  - Storm sewers do not exist in majority of basin
  - Stormwater treatment likely required

Disconnection Would Decrease Volume and Size of Storage



230,000 gallons Storage

Disconnection Would Decrease Volume and Size of Storage



40,000 gallons Storage

Preliminary Construction Cost Comparison

	230k Gal Storage	Disconnection w/ 40k Gal Storage	I/I Reduction, No Storage
Disconnection (Inflow)	--	$2 M	$2 M
R&R of Side Sewers (Infiltration)	--	--	~$30 M
Storage	$7 M	$4 M	--
Stormwater Control	--	~$40 M	~$40 M
Total	$7 M	~$46 M	~$72 M
Est. Cost/Gal	$30	~$200	~$310

NOTES:

1)Comparative construction costs shown do not include other project costs (e.g. Engineering, Legal, Administration, property acquisition, permitting, etc.).

2)Additional cost for stormwater treatment is not included in “Stormwater Control” costs.

Overall Summary and Conclusions (I/I Control)

- I/I not proven for CSO control at this time
- King County's I/I Program is under development
- I/I projects are being pursued based on:
  - Close coordination with member agencies
  - Lessons learned from I/I pilot basins
  - Cost effectiveness compared to other alternatives

Why use GSI?

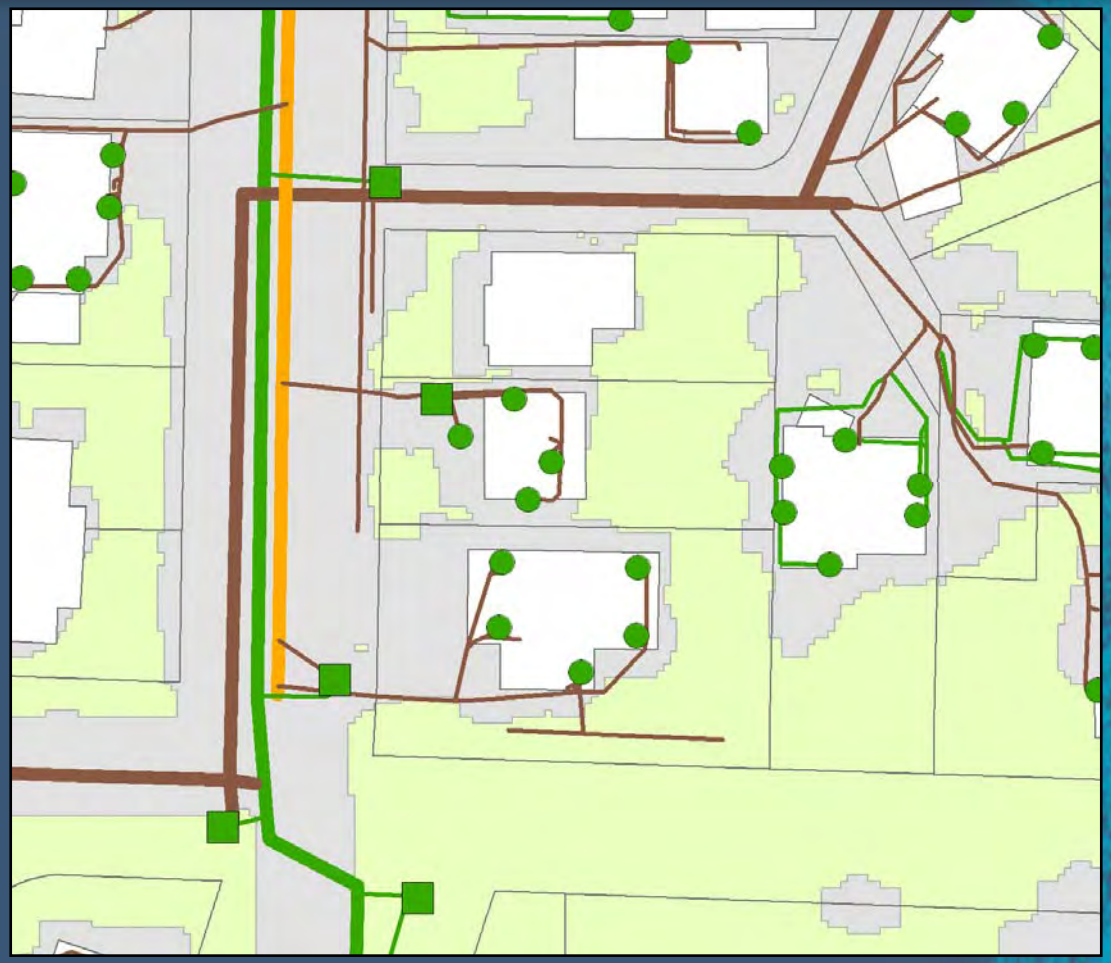
- Green Stormwater Infrastructure (GSI)
- Considerable challenges with using GSI, especially in the North Beach area
- King County and SPU worked together to integrate GSI into CSO planning
  - Reduce size of grey infrastructure project
  - Reduce costs of CSO program implementation
  - Reduce stormwater volume over time
  - Adapt to unknown future conditions

GSI Evaluation

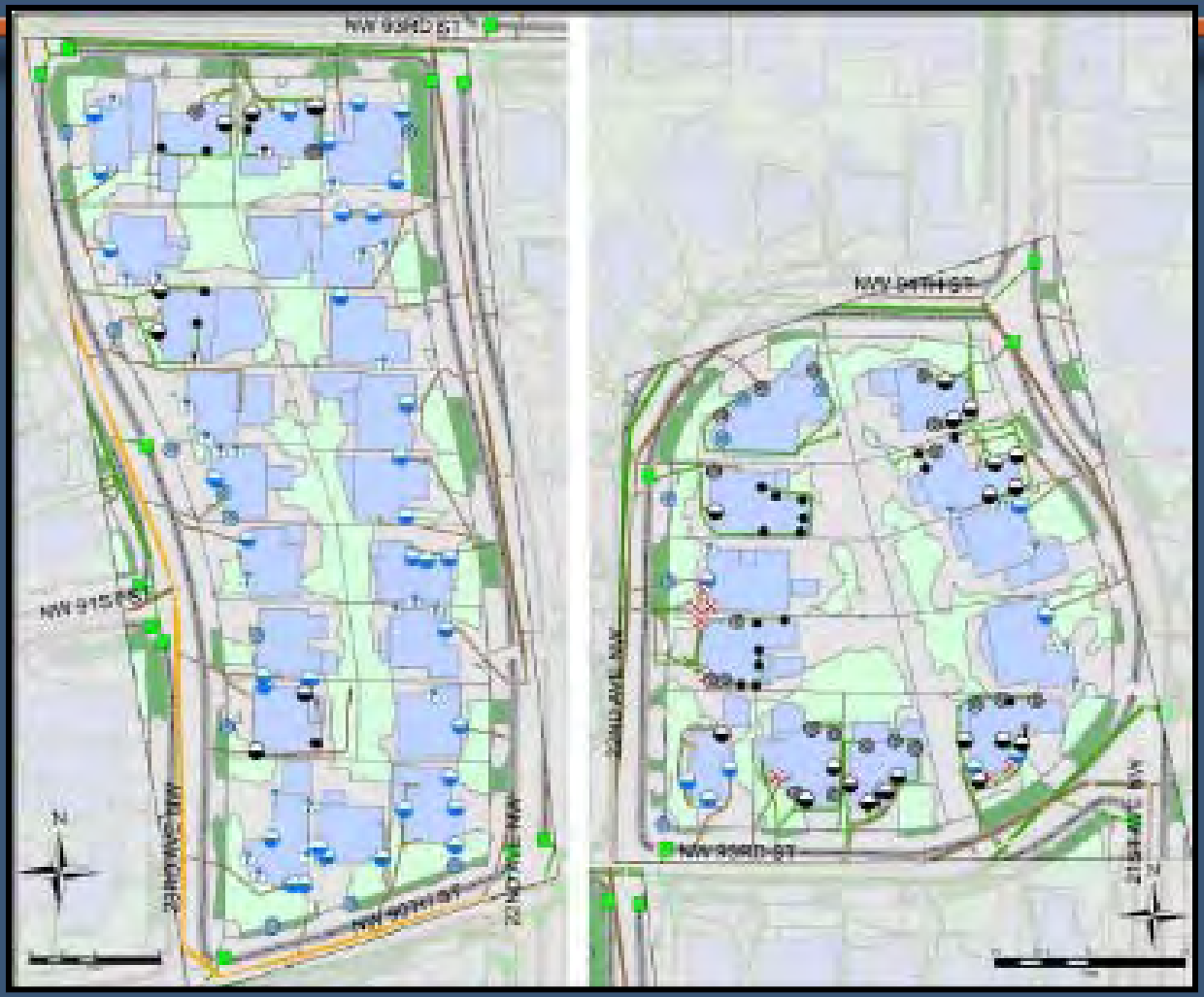
Where does the flow come from and where is it going?

Three Sources

- Roofs
- Impervious Areas
- Pervious Areas



Field Verification



GSI Spatial Analysis

- Identify five GSI techniques
  - Ecoroofs/Green Roofs
  - Roof Disconnection
  - Street Trees
  - Bioretention
  - Permeable Pavement
- Use a set of criteria to identify suitable locations

GSI Project in Barton

- Identified Barton basin having highest feasibility for most green techniques
- Identified large area of connected streets
- Proceed with a project similar to SPU's Ballard Roadside Rain Gardens project
- Allow SPU and King County to evaluate design, construction and performance of GSI in combined basins

Evaluation for Green Stormwater Infrastructure in North Beach

- Connected areas established through geographic information system evaluation

Impervious Areas Connected to Combined Sewer System

Source	Acres
Residential Roof Area	5
Residential Impervious	6
Non-Residential Roof	6
Non-Residential Impervious	9
CSS ROW (Streets)	0
TOTAL	26

Challenges for GSI

- Steep slopes
- Lack of connection in public right of way
- Unproven criteria and assumptions
- Implementation requires voluntary participation
- Storage still needed to contain peak CSO
- Buy-in from regulators