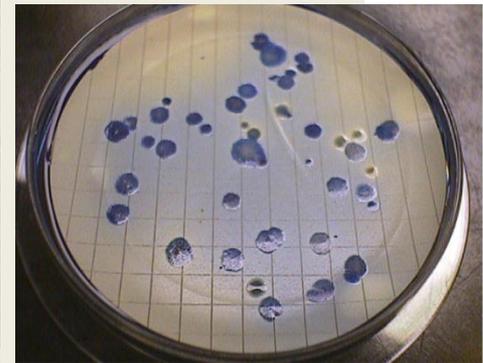


Locating *E. coli* Sources in an Urban Watershed in Seattle, Washington

Repeat In-Stream Sampling, Rapid Bio-assessment, IDDE, CCTV, Bacteroides Analysis and Information on Urban Homeless Encampments



Jonathan Frodge



Working Together for Clean Water

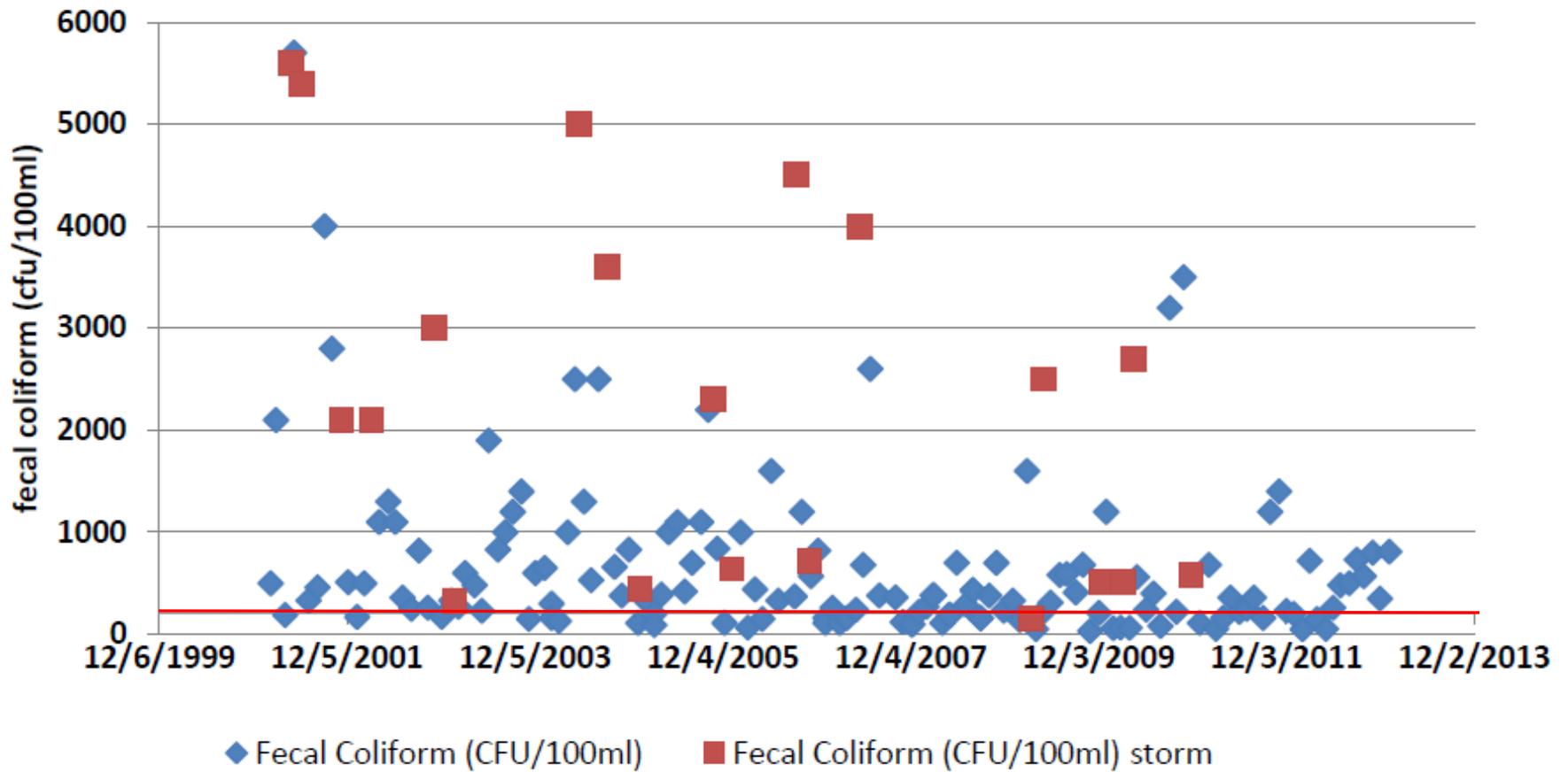
9TH NATIONAL MONITORING CONFERENCE

■ April 28 – May 2, 2014

■ Cincinnati, Ohio

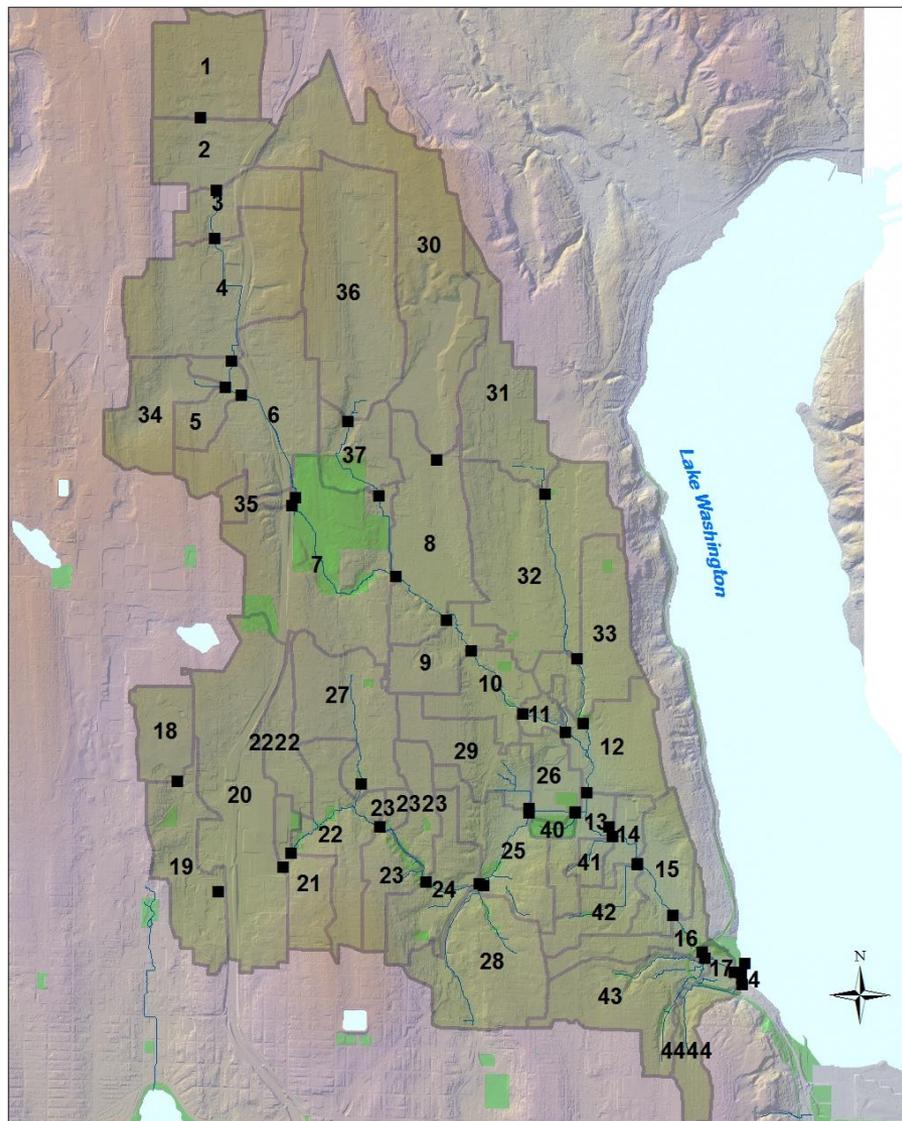






WAC173-201A

fecal coliform criteria for secondary contact geometric mean <200 cfu/100ml and <10% >1000cfu/100ml



0 0.5 1 2 Miles

watershed broken up into sub-basins defined by stream segment between upstream and adjacent downstream sampling sites

Distribution of New Zealand mud snail (*Potamopyrgus antipodarum*) near Thornton Creek outlet, Lake Washington

Julian Olden
Laura Twardochleb

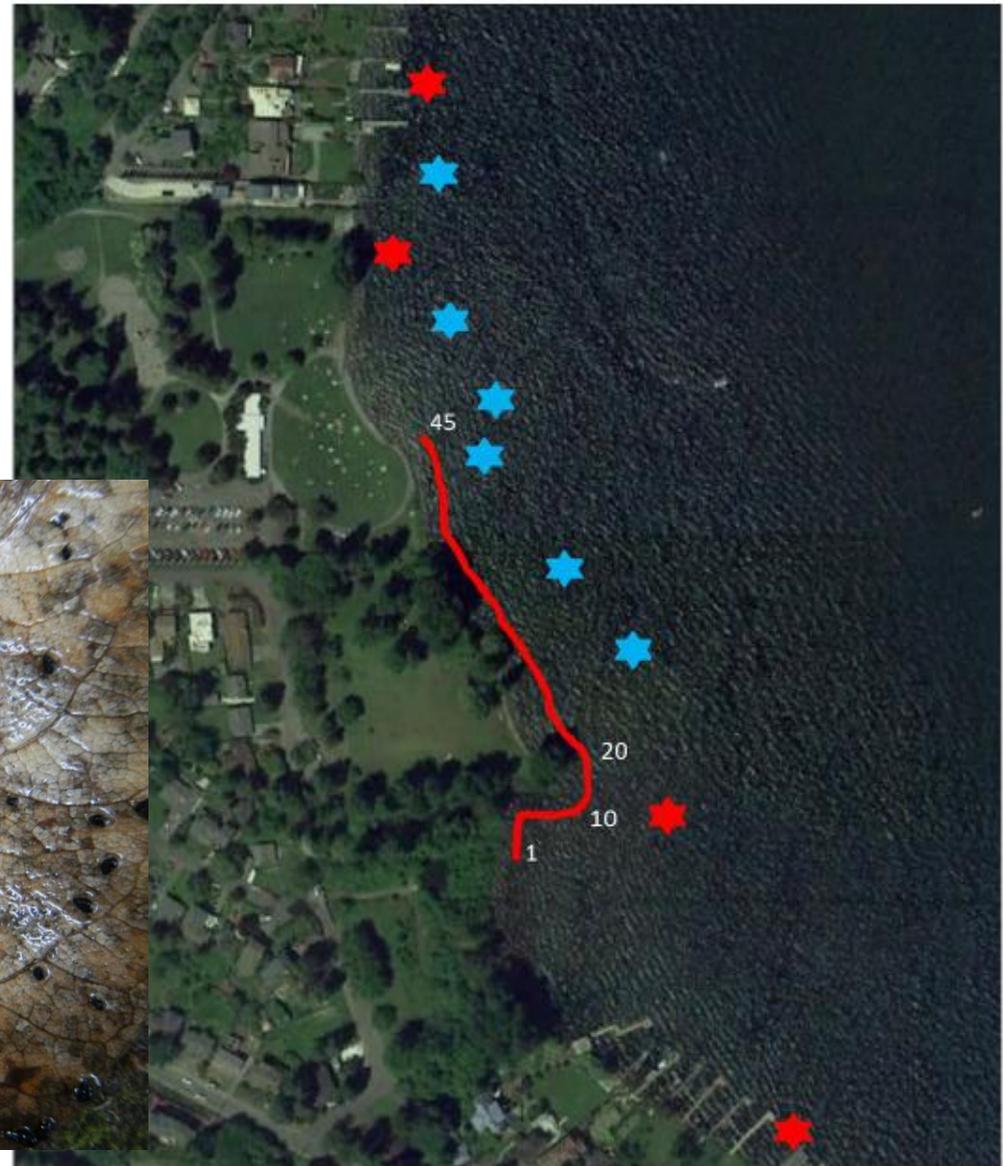
Freshwater Ecology & Conservation Lab
School of Aquatic and Fishery Sciences
University of Washington, Seattle WA 98195
e-mail : olden@uw.edu, phone: 206-616-3112
web: <http://www.fish.washington.edu/research/oldenlab/>

Sampled May 23, 2011

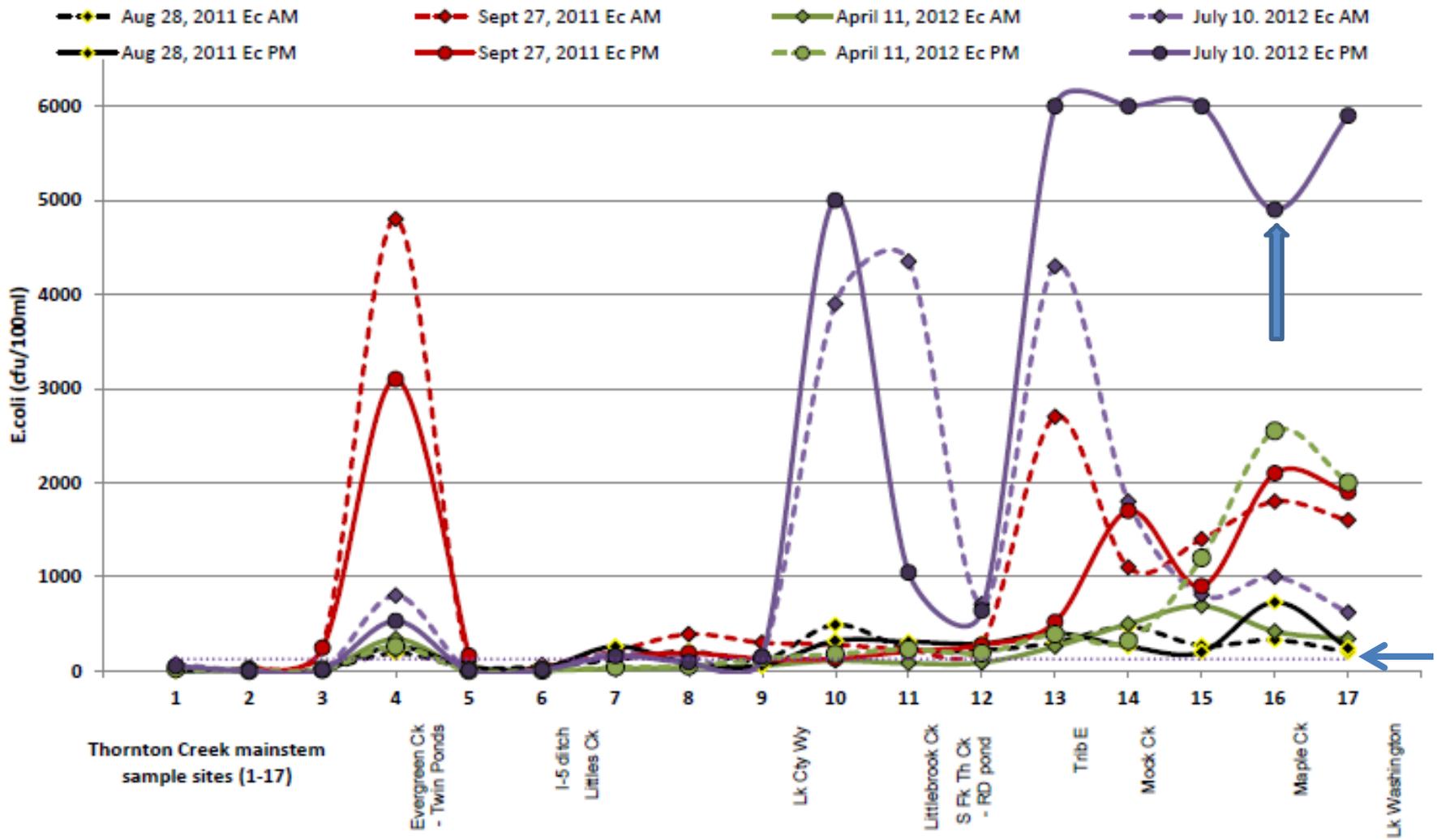


Figure 1

Distribution of New Zealand mud snail near Thornton Creek outlet, Lake Washington – Conducted by Olden Lab, University of Washington



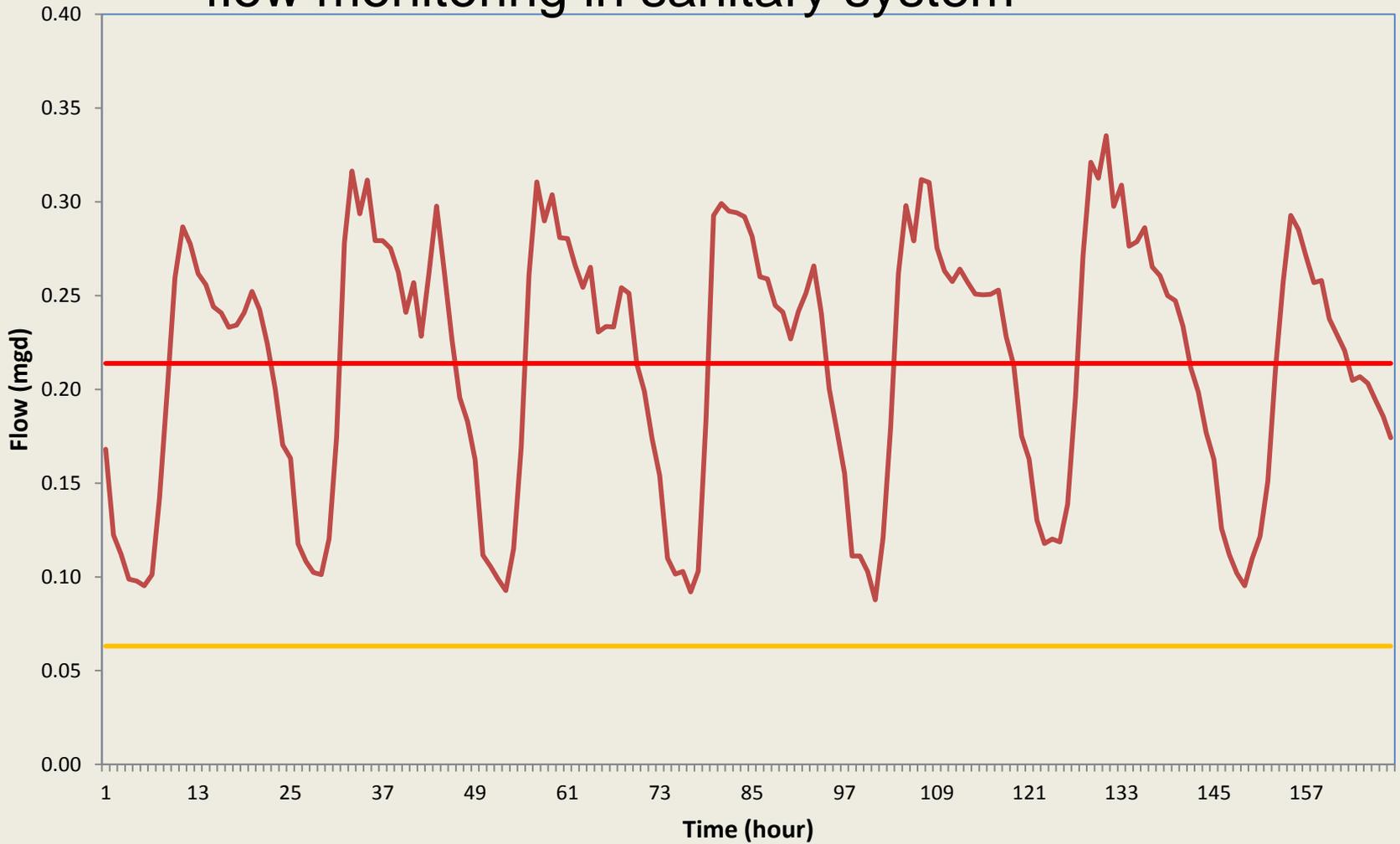
Quadrant Sampling — Ekman Sampling ★ Present ★ Absent



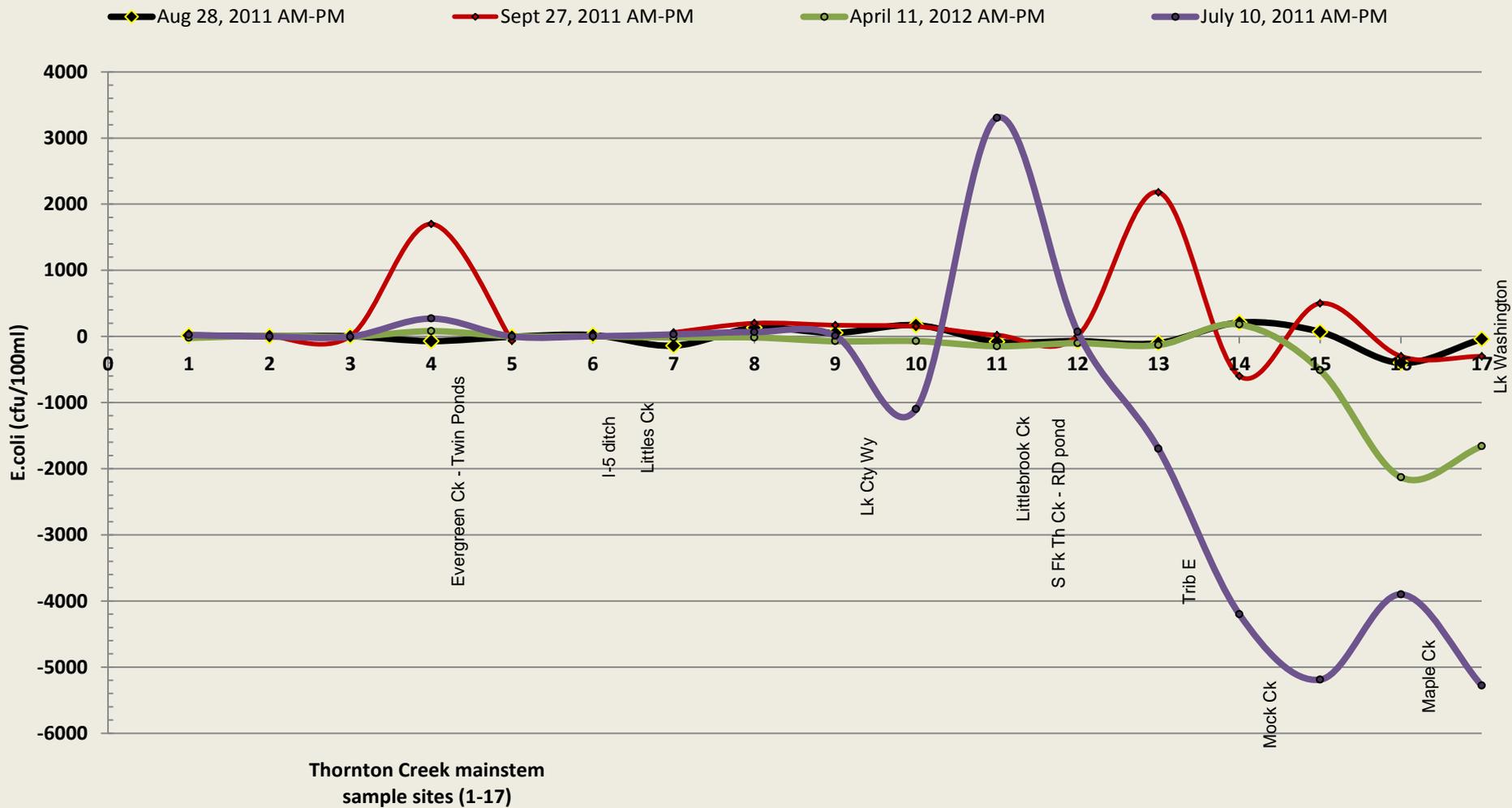
upstream

downstream

flow monitoring in sanitary system



— Meter Flow Pattern — GWI — 7 day Meter Average



afternoon *E.coli* - morning *E.coli*

Table 5. *Bacteroides* samples with synoptically collected *E.coli* and fecal coliform counts (cfu/100ml). Positive *Bacteroides* samples associated with fecal coliform counts that do not exceed WAC173 201A secondary contact or *E.coli* counts that do not exceed the Oregon DEQ *E.coli* criteria of 126 cfu/100ml are highlighted in yellow.

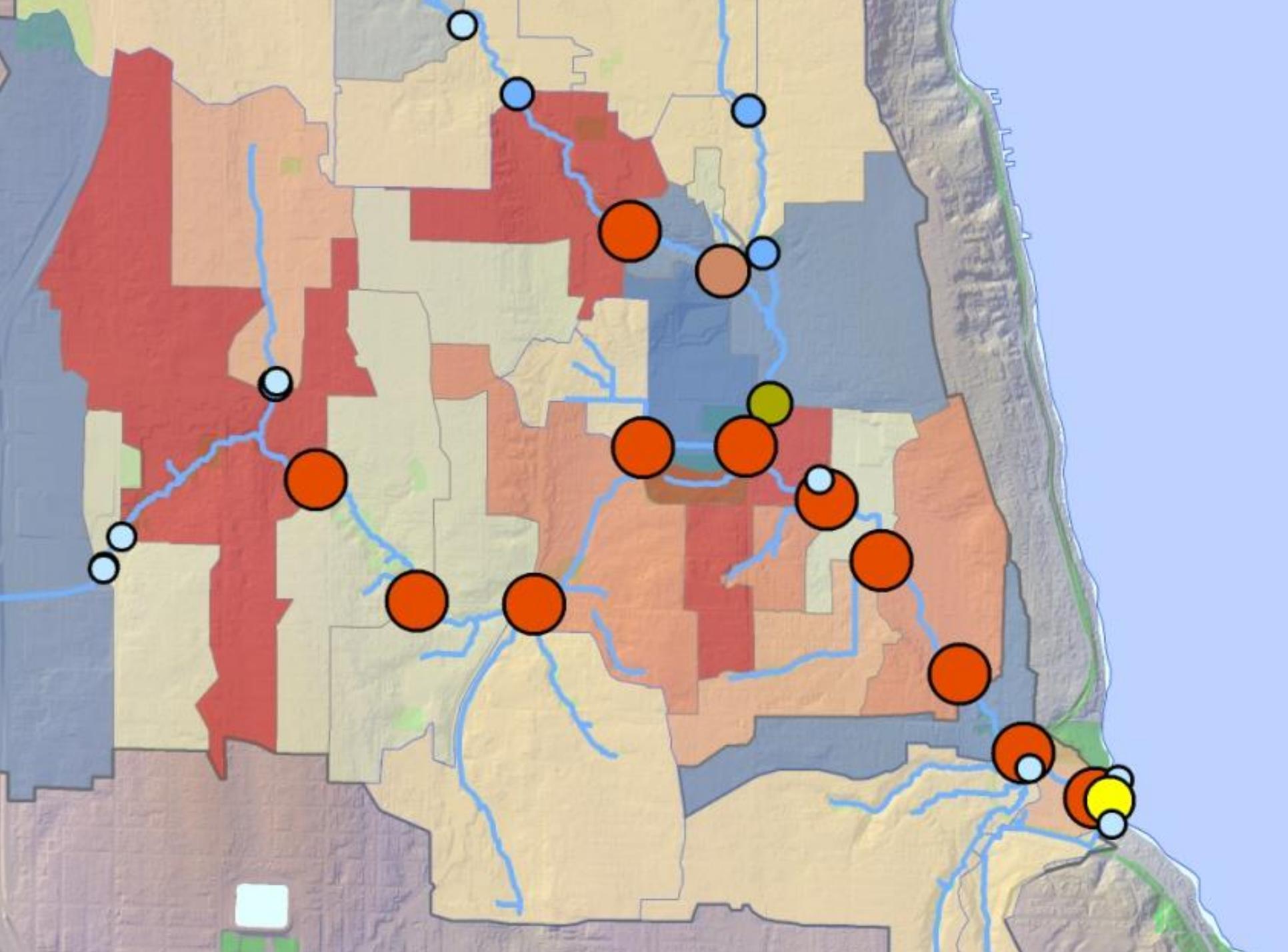
qPCR
quantitative polymerase chain
reaction

technique to isolate and identify
human-specific

Bacteroides thetaiotaomicron

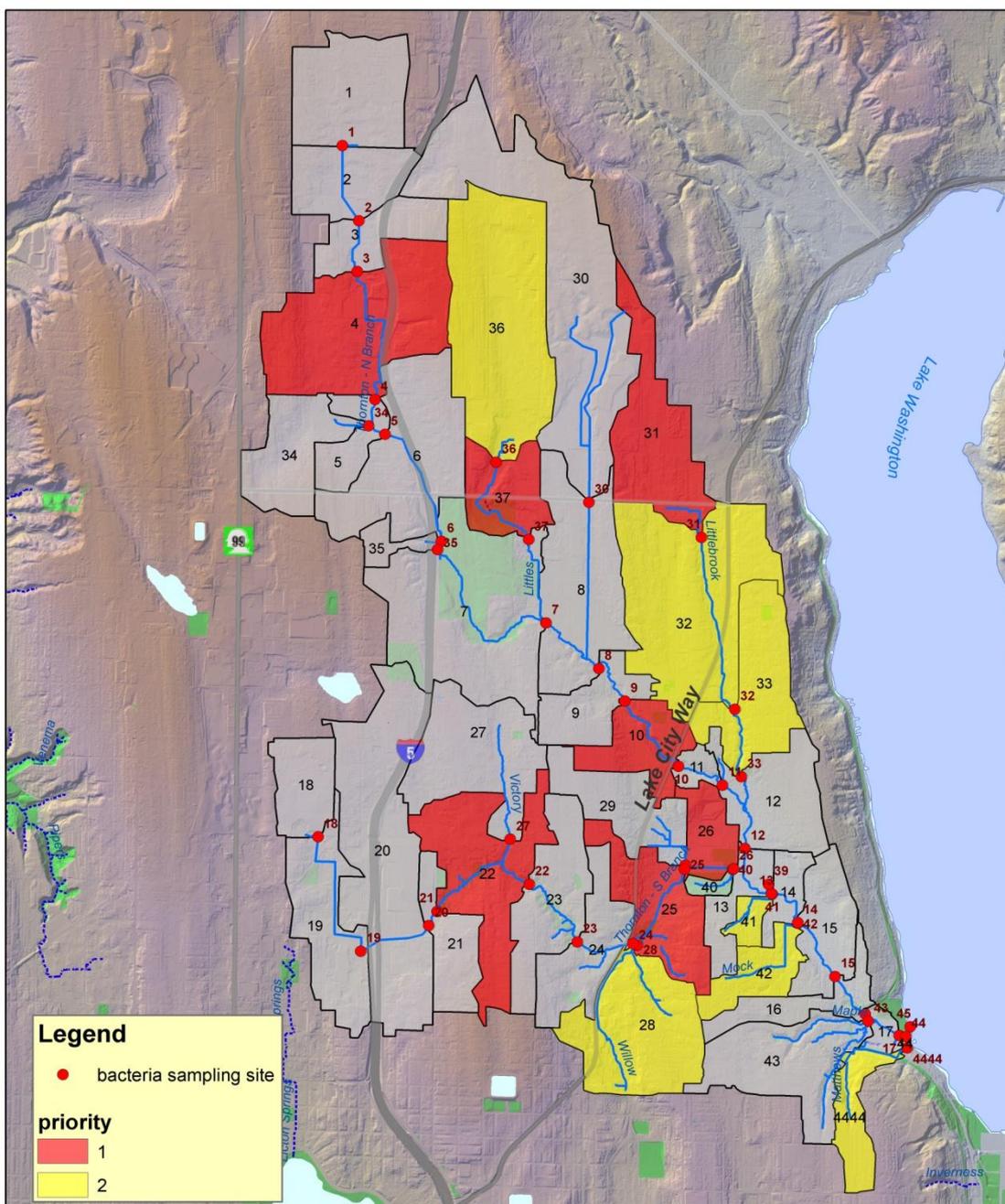
***Not used quantitatively,
only +/-***

August 28, 2011						
site	AM			PM		
	<i>E.coli</i> (cfu/100ml)	fecal coliform (cfu/100ml)	<i>Bacteroides</i> (cells/100ml)	<i>E.coli</i> (cfu/100ml)	fecal coliform (cfu/100ml)	<i>Bacteroides</i> (cells/100ml)
44	9800		14412	4750	2200	12538
37	1550	1500	11675	1300		12800
27	4500		2018	2800	1900	2822
28	575	480	836	430		
25	550		380	380		
22	1200		331	1130	630	553
1	17	1	130	1		
3	14		125	11	8	
19	880	140	28	440		
31	390			570	670	1179
23	160			530		997
8	210	60		80		595
9	110			55		448
16	330			730		332
July 10, 2012						
site	AM			PM		
	<i>E.coli</i> (cfu/100ml)	fecal coliform (cfu/100ml)	<i>Bacteroides</i> (cells/100ml)	<i>E.coli</i> (cfu/100ml)	fecal coliform (cfu/100ml)	<i>Bacteroides</i> (cells/100ml)
42	460	440	107330	160	110	8874
22	6000	6000	85880	6000		23309
23	6000		35720	6000		18240
24	6000		18550	6000	6000	12940
14	1800		13050	6000		2374
36	2300		3694	1500		2402
25	11000	7100	3531	6000		7126
40	8500		3531	6000		5285
44	2500	5200	1974	1000		
13	4300		1442	6000	12000	2153
18	1600		573	2700		294
11	4350	2050	543	1045	515	190
16	1000		432	4900		1448
10	3900		405	5000	2900	187



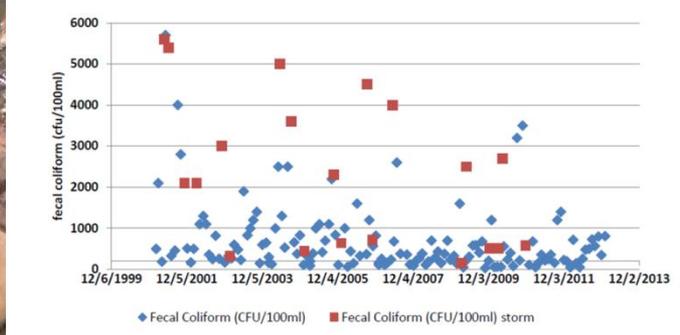
based on 5
sampling events
over a 1 year
period

selected priority
sub-basins to
focus detailed
source ID



Thornton Creek Bacteria Study





high bacteria counts since monitoring began in 1970's

Bacteroides indicates human contribution

Hypothesized sources:

drainage system

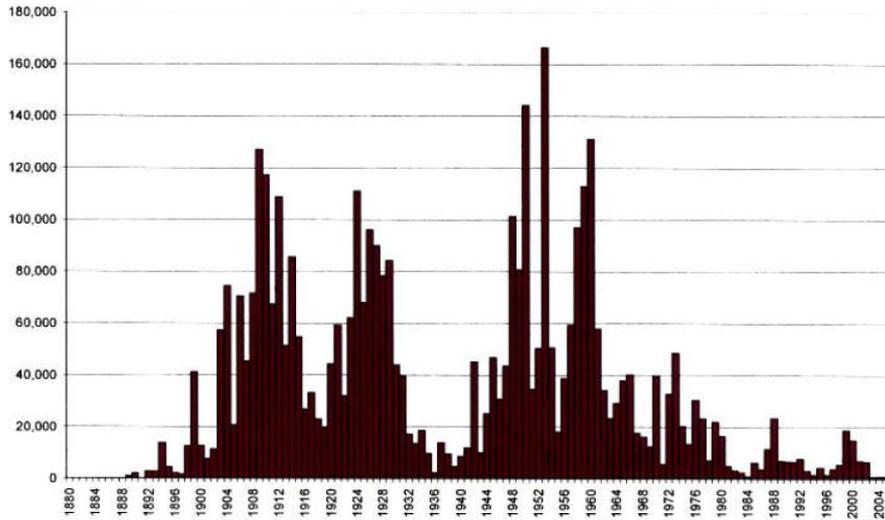


sanitary sewers

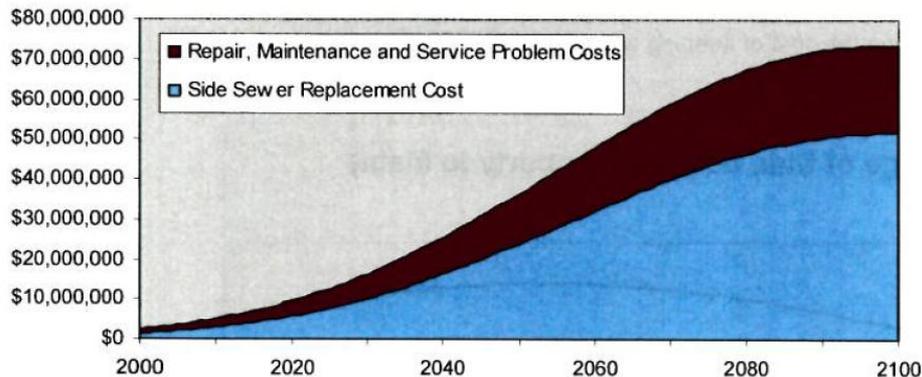
first, check potential sources that are our responsibility to operate and maintain

privately owned and maintained side sewers

Feet of Side Sewer Laterals (Mainline to Property) by Year Installed



Side Sewer Capital and Reactive Cost



Side steps

Battling infiltration and inflow in side sewers

Diane Pottinger, Scott Christensen, and Michael Derrick

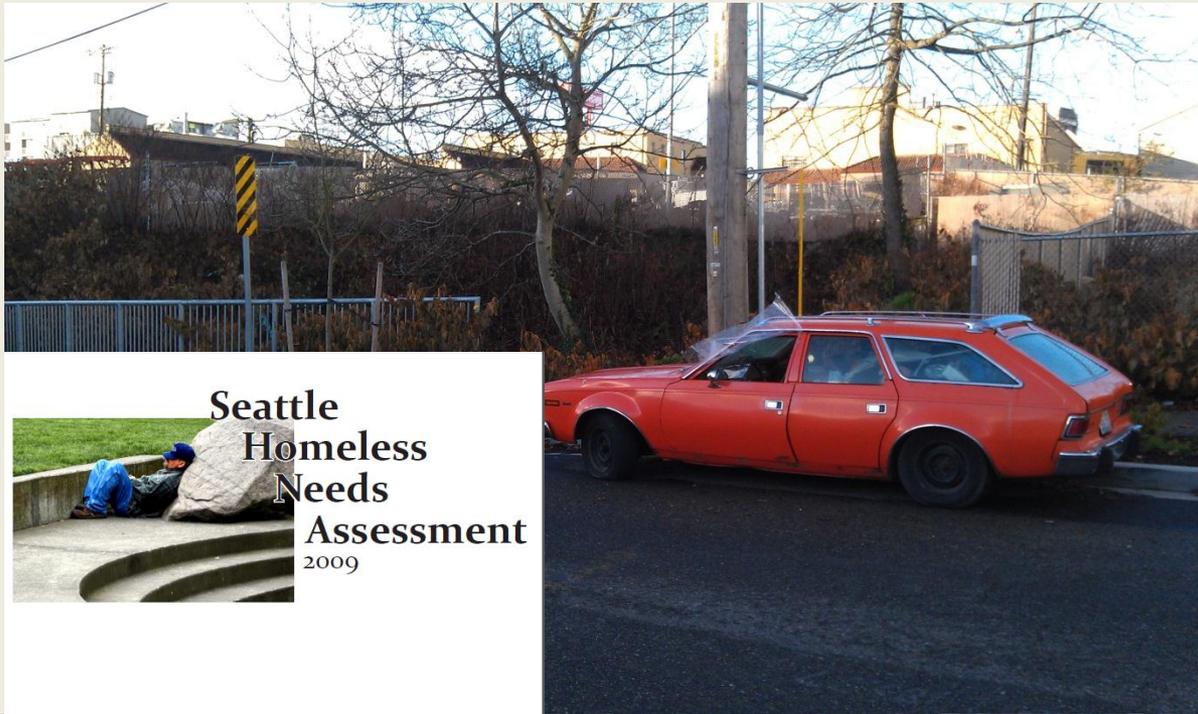


The Ronald Wastewater District (RWD) serves about 53,000 customers in northwestern King County, Wash., with a collection system that was installed primarily during the 1950s and 1960s. The district, which was formed in 1951, collects and transfers wastewater to King County Wastewater Treatment Division (KCWTD) and the City of Edmonds (Wash.) Wastewater Treatment Plant.

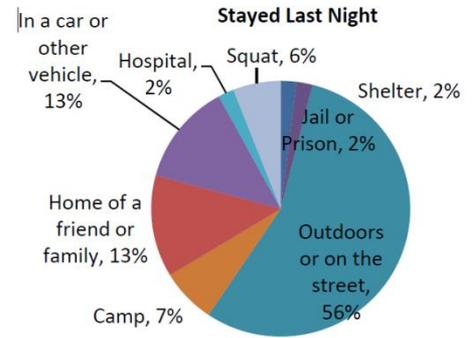
Throughout the region served by KCWTD, infiltration and inflow (I/I) is a concern. Preventing and removing I/I provides

increased capacity for wastewater in the system, reduces annual operating costs, and can prevent or postpone expansion projects.

I/I reduction efforts typically involve repairing or replacing aging and leaking sewer lines, but one area often overlooked or deemed too difficult to address are side sewers – the portion of the lateral that sits on private property. But as RWD found, replacing side sewers can significantly reduce the I/I in the wastewater system, as well as provide a benefit to the property owner.



RV dumping in storm drains



Report on Findings



United Way of King County



City of Seattle



Committee to End Homelessness



homeless encampments

Two Reasons to Stay

1. Bacteria!



Urban creeks contain bacteria. How did it get there? Urban pets, wildlife and human activity from backyards, sidewalks and

How can bacteria levels be reduced? What household practices b

Local News

The Seattle Times

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IN THE NEWS: Weekend traffic alert | Heaven Bog case | Eastside Catholic | Stunning panoramic | High school sports

Originally published June 13, 2013 at 9:35 PM | Page modified June 14, 2013 at 8:58 AM

Public warned to stay away from smelly Thornton Creek

In its tortuous modern history, the 15 miles of Thornton Creek in North Seattle have been paved and concreted over for development. Sections have been daylighted, but now comes a study that says that parts are full of human fecal bacteria.

By Erik Lada
Seattle Times staff

It's the North End over, made to straightened to

There have been daylighting portions of the stream, human fecal bacteria out.

In some instances, times above the Frogde, the Seattle a two-year study the creek, was

The Centers for kinds of E. coli

To Public Health

with you, w



If you see problems with this creek –
24-hour Complaint Hotline

Listen Live > Playlist Schedule Calendar Quirksee Jazz24 Donate Now

KPIU 88.5

News for Seattle and the Northwest
part of the n p i digital network

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Ongoing Coverage: Quirksee Food for Thought Studio Sessions Jazz24 San Francisco Trip

Arts Local Artist Turning Centuries-Old Pieces Of Wood Into Whimsical Creations

Going Places Mexico Still Safe For Vacationers — If You Know Where To Go

Minimum Wage Regional Economist Dick Conway Says \$15 Minimum Wage Is 'Not Outrageous'

Water Pollution 5:00 PM THU JUNE 13, 2013

Human fecal bacteria confirmed in Seattle's Thornton Creek

By BELLAMY PAHLTHORP

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Posted: 5:21 p.m. Thursday, June 13, 2013

Human waste confirmed in Seattle's Thornton Creek

COMMENT (1) Email 11 Share 68 Tweet 18 ShareThis 171

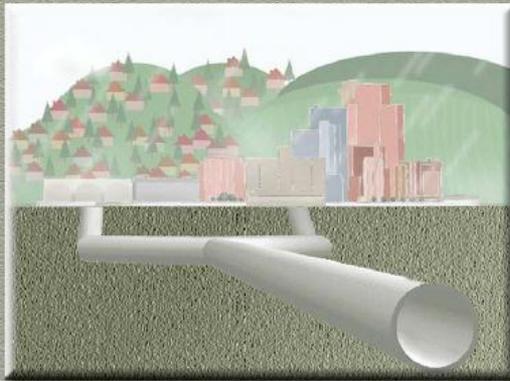
Neighbors react to discovery of human waste in Seattle creek
KIRO - Seattle Jun. 13, 2013

KIRO 7 kirotv.com

View Larger By Chris Legeros
SEATTLE — Signs warning people to

- CSI PROJECT -
**NORTHWEST
 LAKE WASHINGTON BASIN**
 PHASE 3
SUBREGIONAL PLANNING REPORT

October 2003



King County

Department of
 Natural Resources and Parks
Wastewater Treatment Division

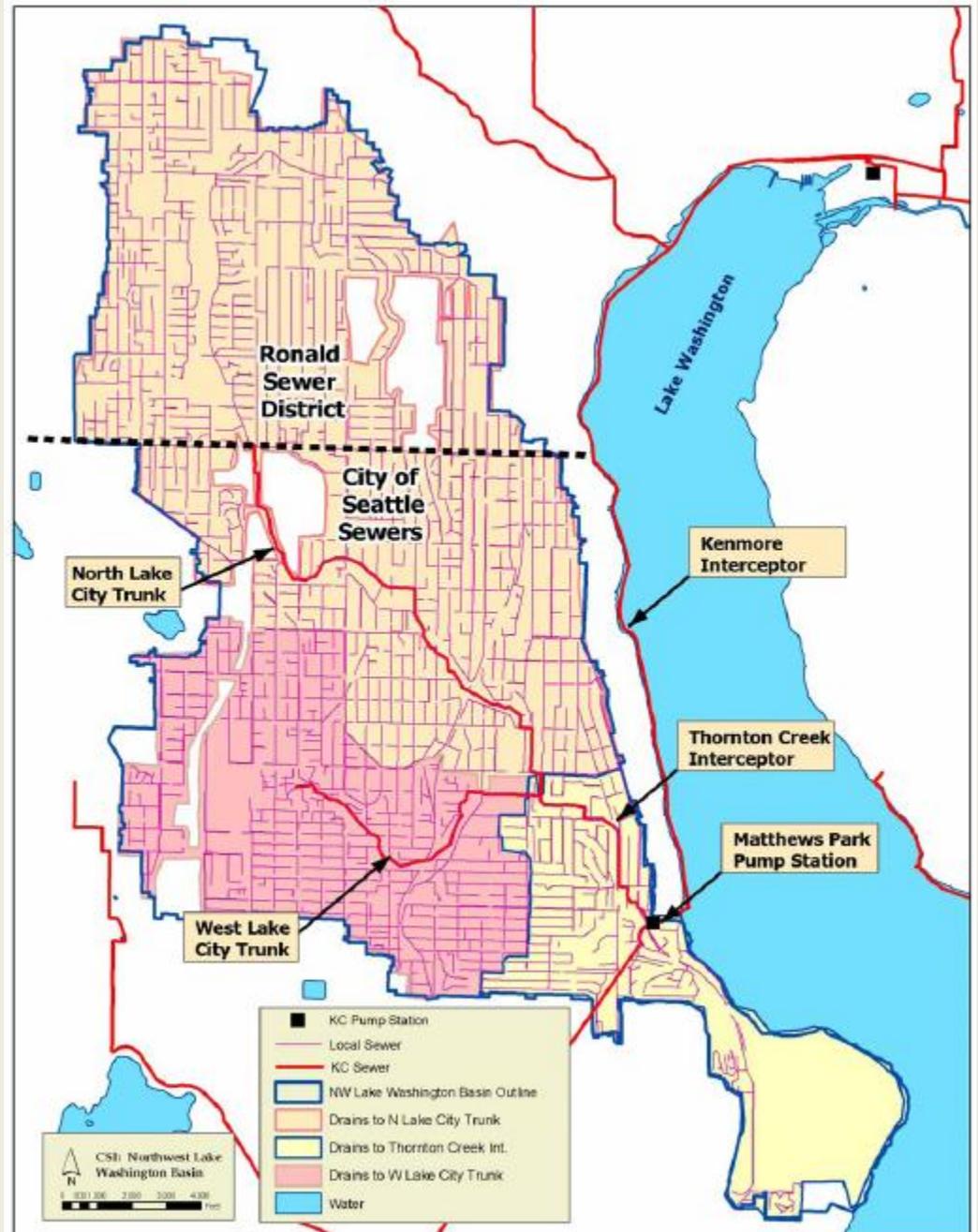
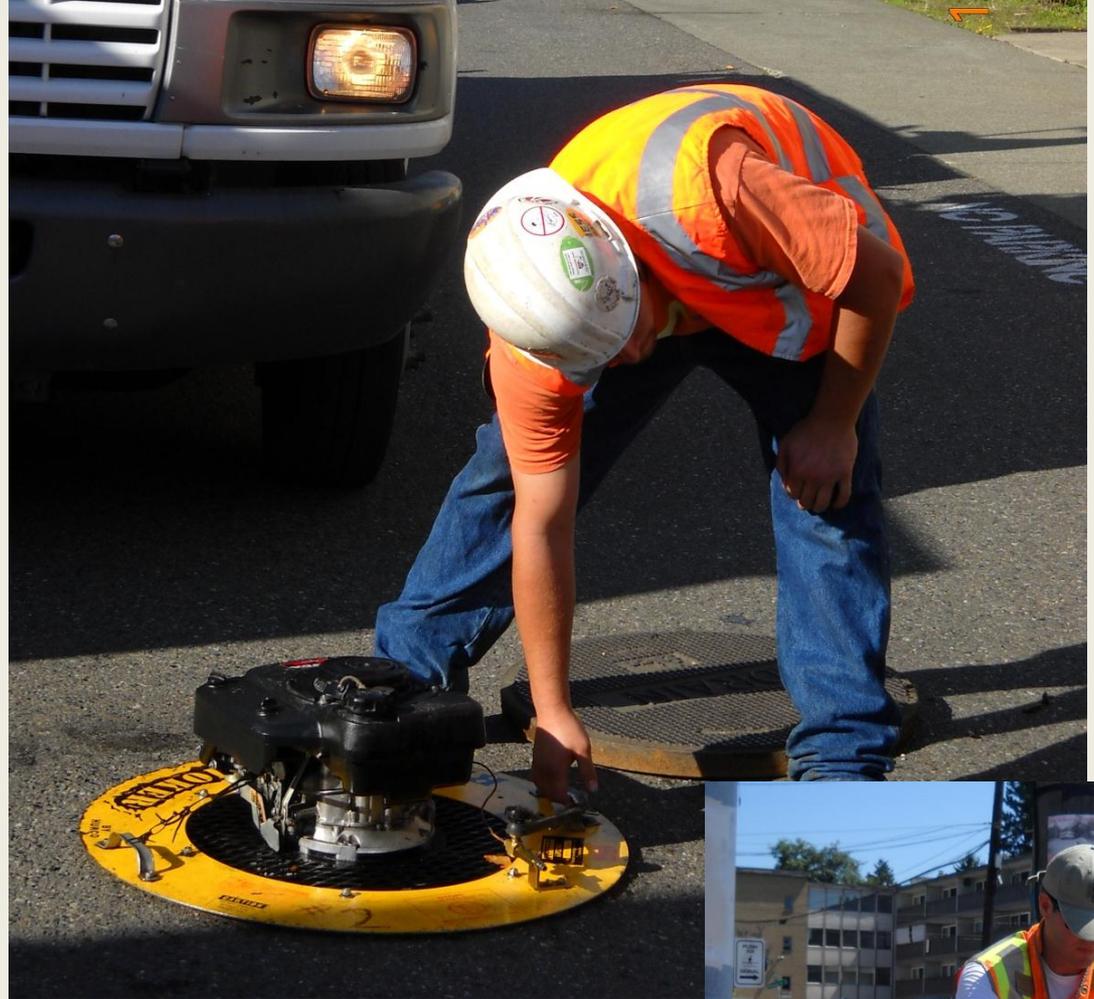


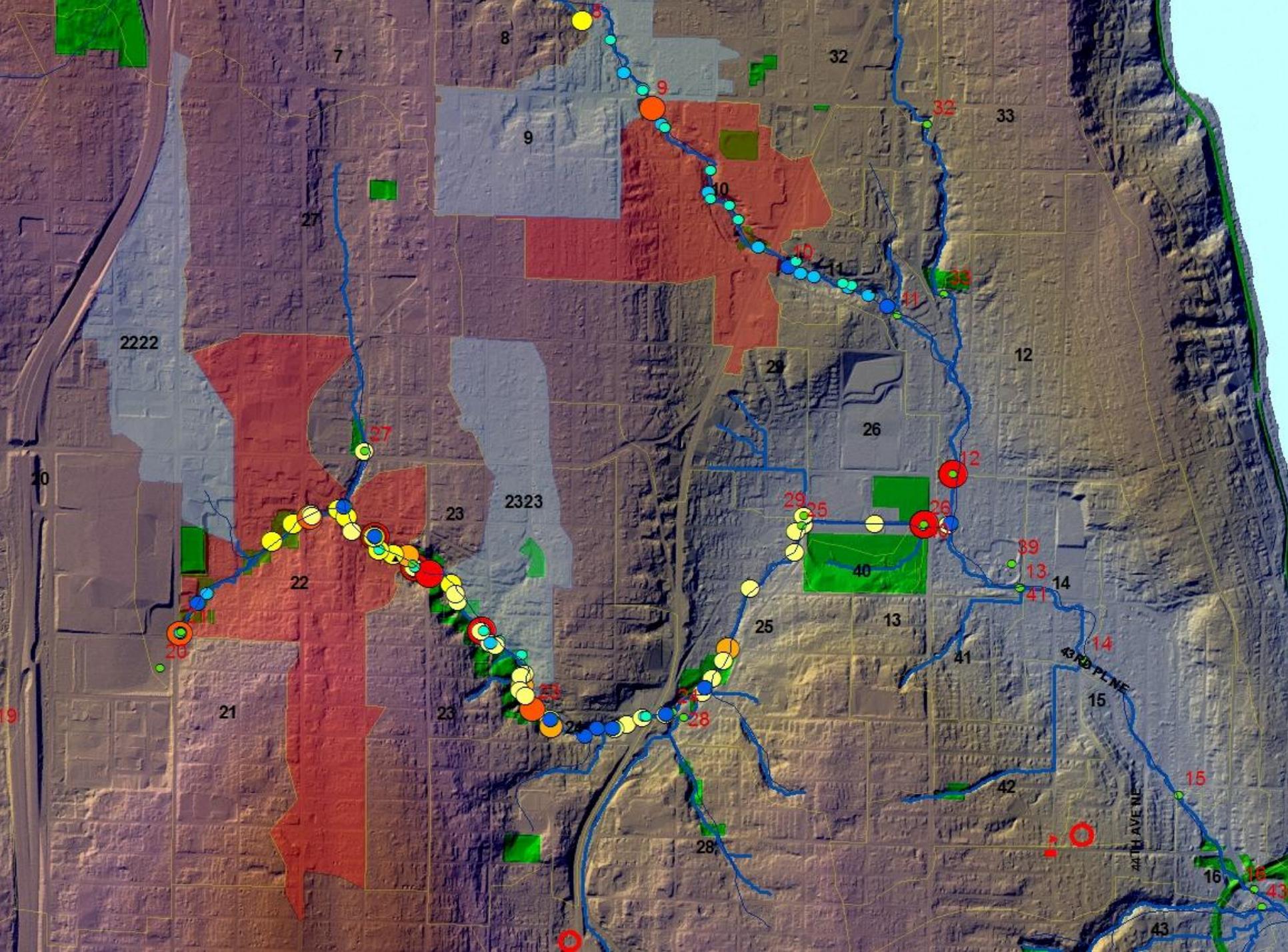
Figure 2. NW Lake Washington Basin Facilities and Drainage Pattern

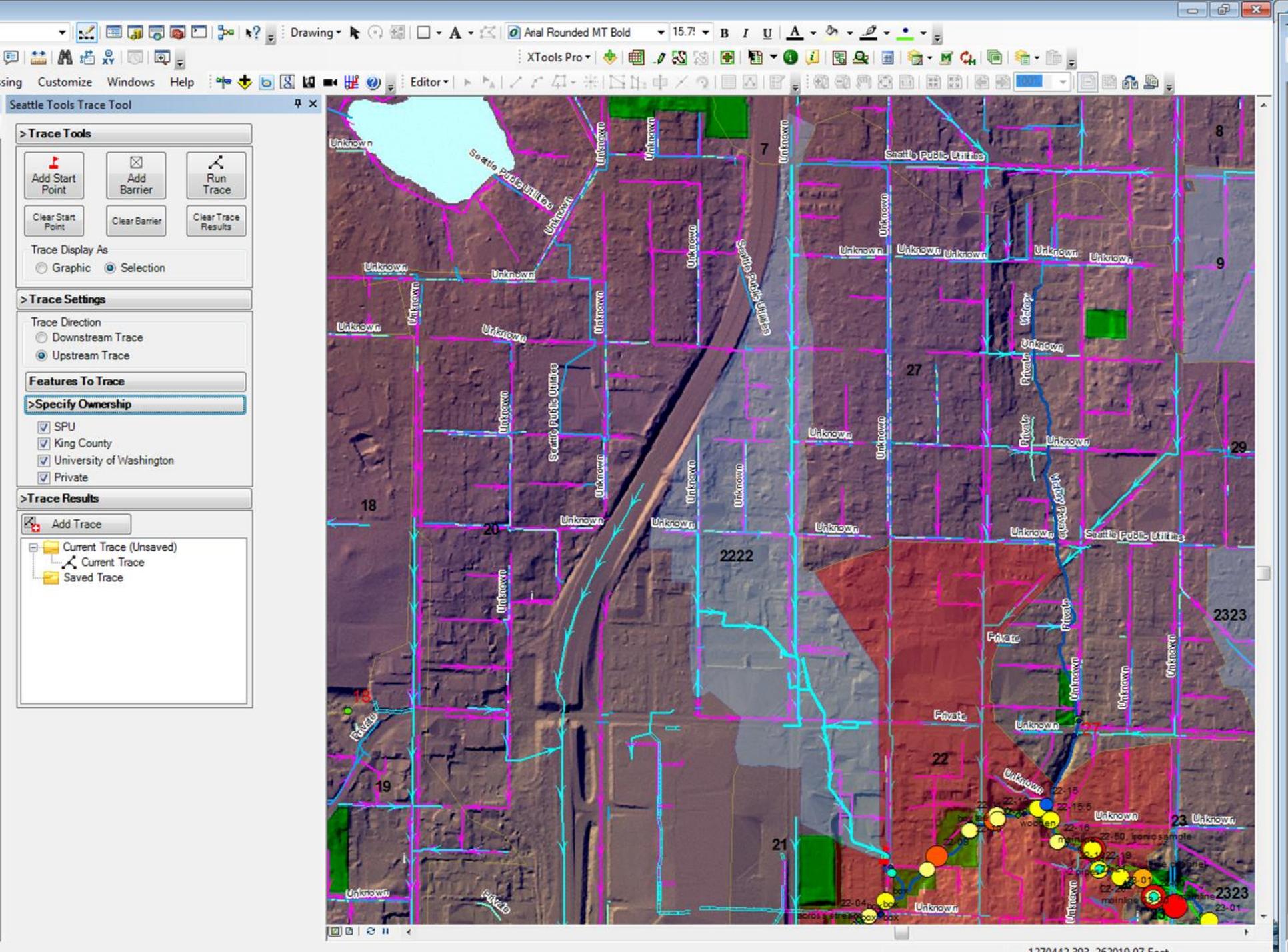


*IDDE on-going
MS4 work*

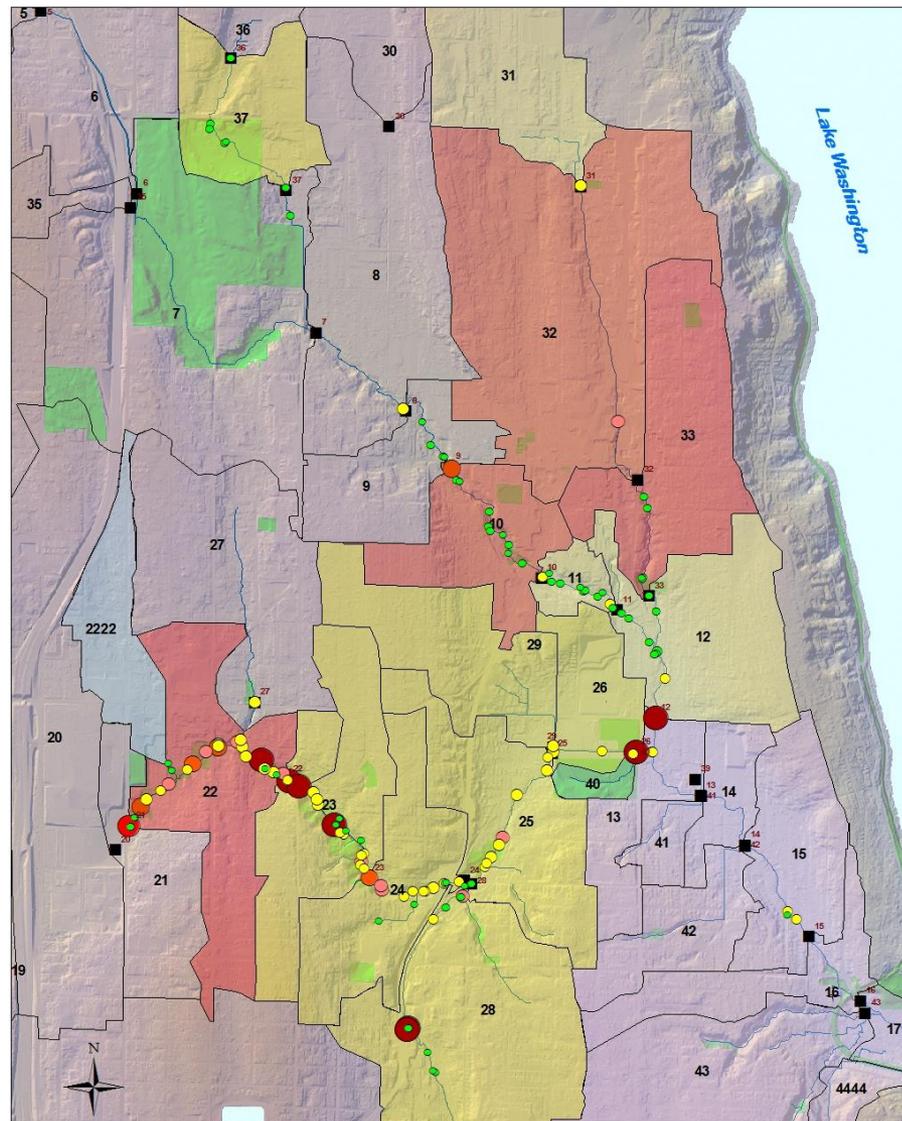
*focused in high
priority sub basins*







re-prioritize
sub-basins
based on
in-stream
sampling



***E. coli (MPN) in Thornton Creek
collected between
August-December, 2013***

0 0.25 0.5 1 Miles

Legend

- sample site
- Streams
- primary basin
- secondary basin
- downstream basins
- park
- E.coli(MPN)
- 24 - 100
- 101 - 126
- 127 - 250
- 251 - 500
- 501 - 750
- 751 - 1000
- 1001 - 1700
- 1701 - 2400
- 2401 - 50000

select assets to
evaluate based on
increased
downstream – upstream
E. coli counts

GraniteXP Observation Report with Still Images

Pipeline segment ref: 016-147 016-148 Project Name: DWRC QUICK LOOK

Upstream manhole No: 016-147 Downstream manhole No: 016-148

Additional info:

Observation

Distance	Length	Code	Reversed	Clock P
0.0		MWL	Yes	/



pipes that cross the creek

adjacent upstream segments of the crossing pipes

pipes at higher elevations than the creek and that are located ~200 ft or in unimproved areas



08.30.2010 13:38



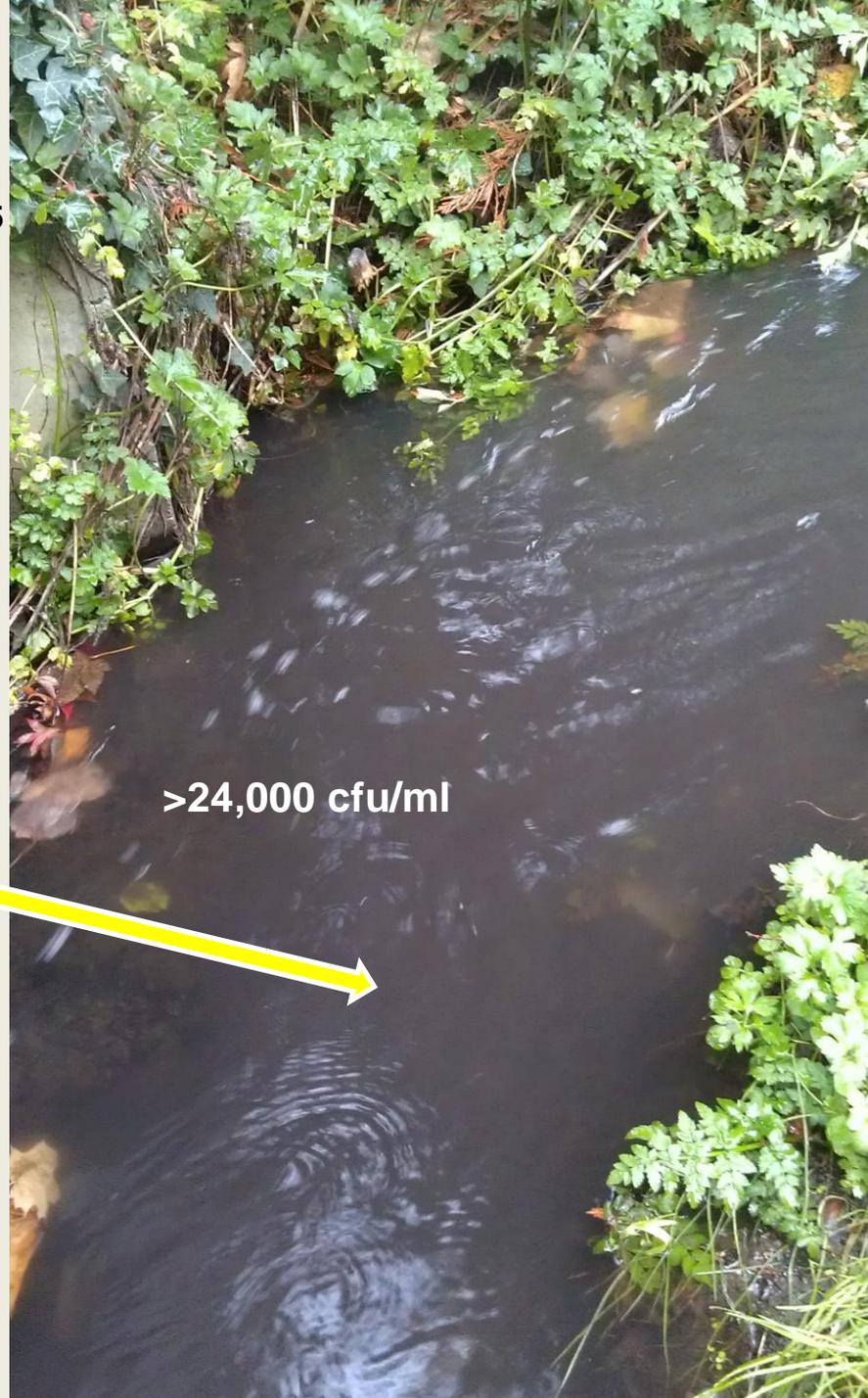
**geographic
concentration
IDDE and
inspections**





20 cfu/100./ml

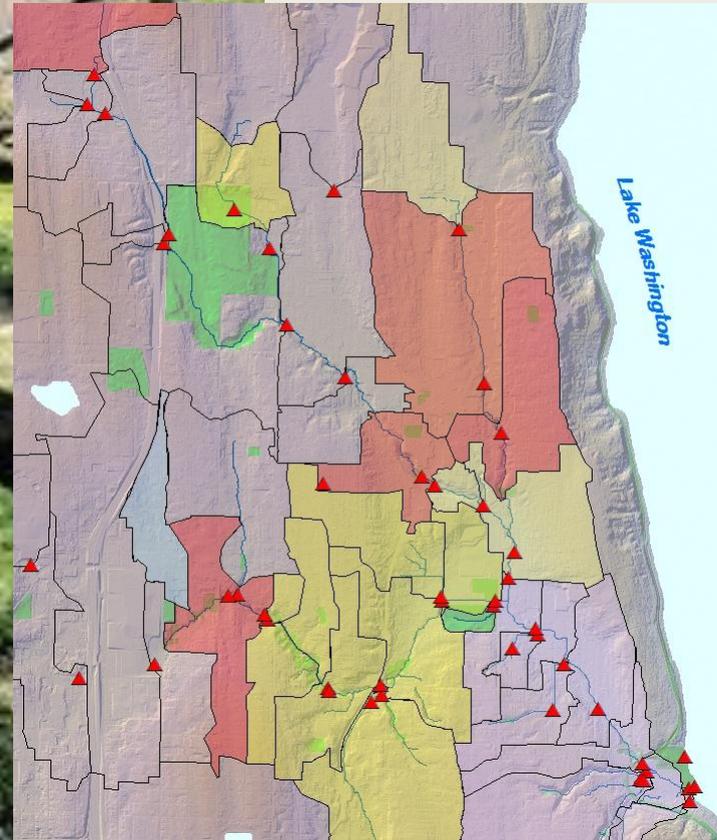
Photos ~15 min. apart, change occurred in creek in about 10 seconds



>24,000 cfu/ml



> 24,000 cfu/100ml



Design:

- collect 'synoptic' samples in tributaries and smaller lower priority sub basins
- random array on football field
 - splits for rapid bioassessment, *E.coli* and *Bacteroides* analysis