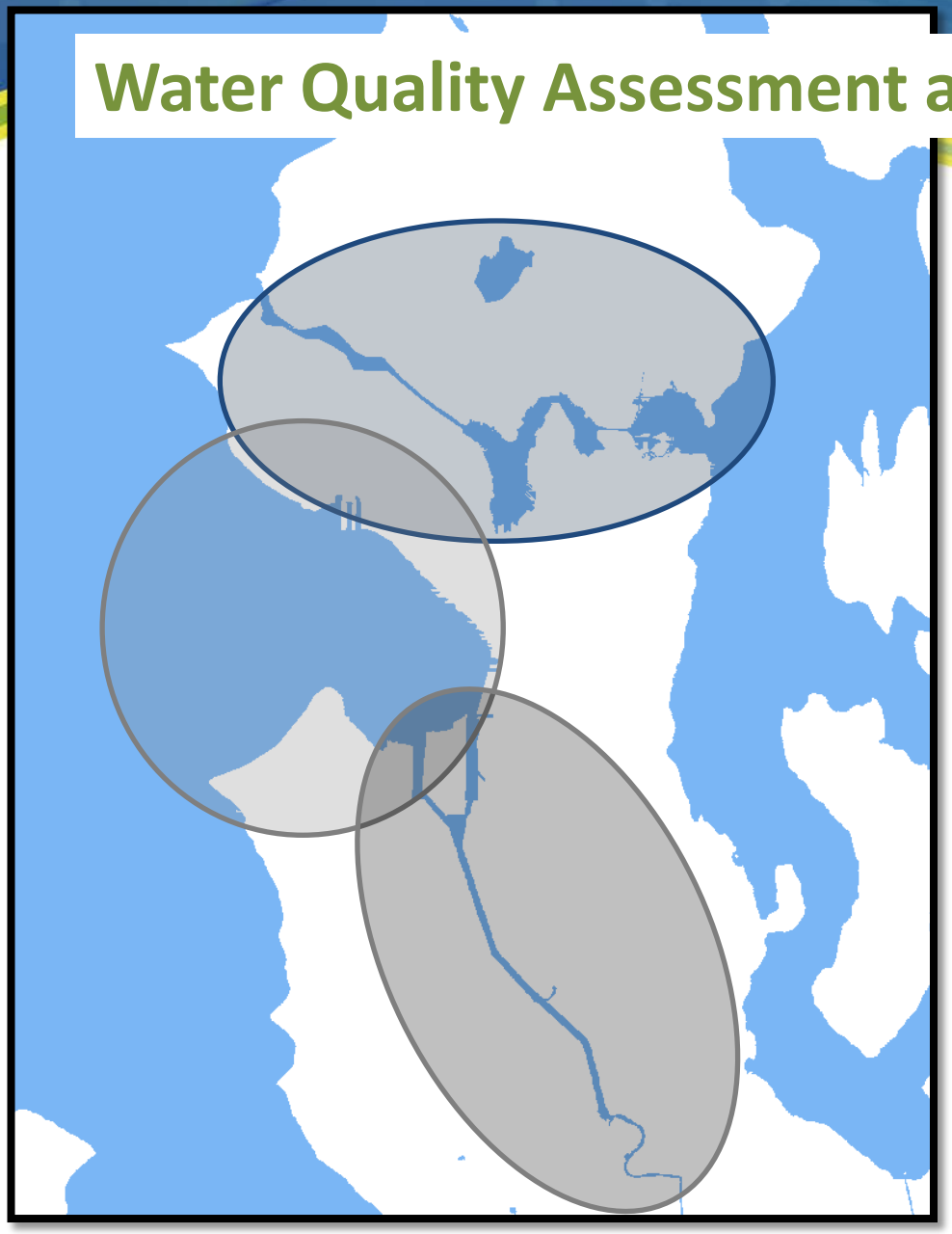
King County
Protecting Our Waters
Doing our part on rainy days

Water Quality Assessment and Monitoring Study

Briefing

April 7, 2016

Water Quality Assessment and Monitoring Study

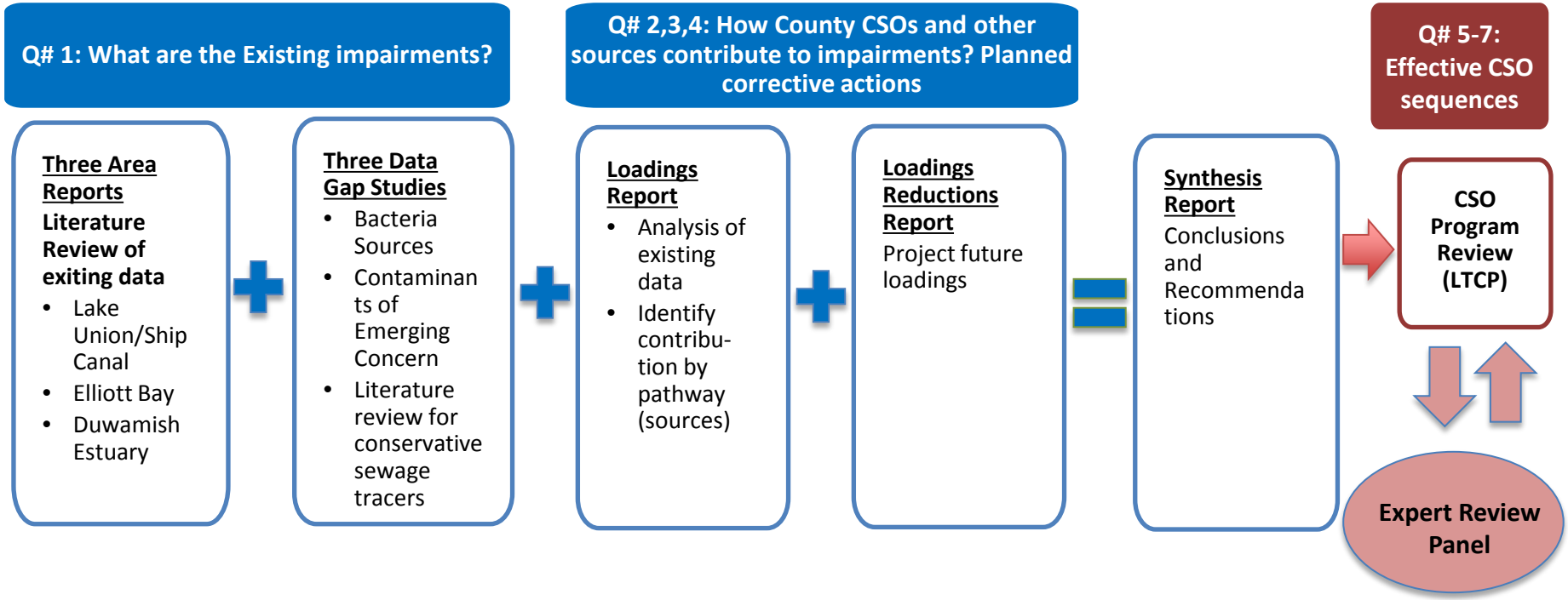


Purpose:
To ensure that future CSO projects are well-planned and timed to improve water quality.

Study Areas:

- Lake Union / Ship Canal / Montlake Cut
- Elliott Bay
- Duwamish Estuary

WQA/MS Process:



Data gap studies

- **Bacteria Study**
- **Contaminants of Emerging Concern**
- **Sewage Tracer Literature Review**

Bacteria Data Gap Study

- All three waterbodies are on Ecology's 303(d) list of polluted waters that require a TMDL for fecal coliforms.
- Fecal (enteric) bacteria indicate possible presence of pathogens.
- Fecal coliform concentrations have decreased since the 1970/80s but exceedances of standards still occur.

Sources and Pathways of Bacteria

Sources:

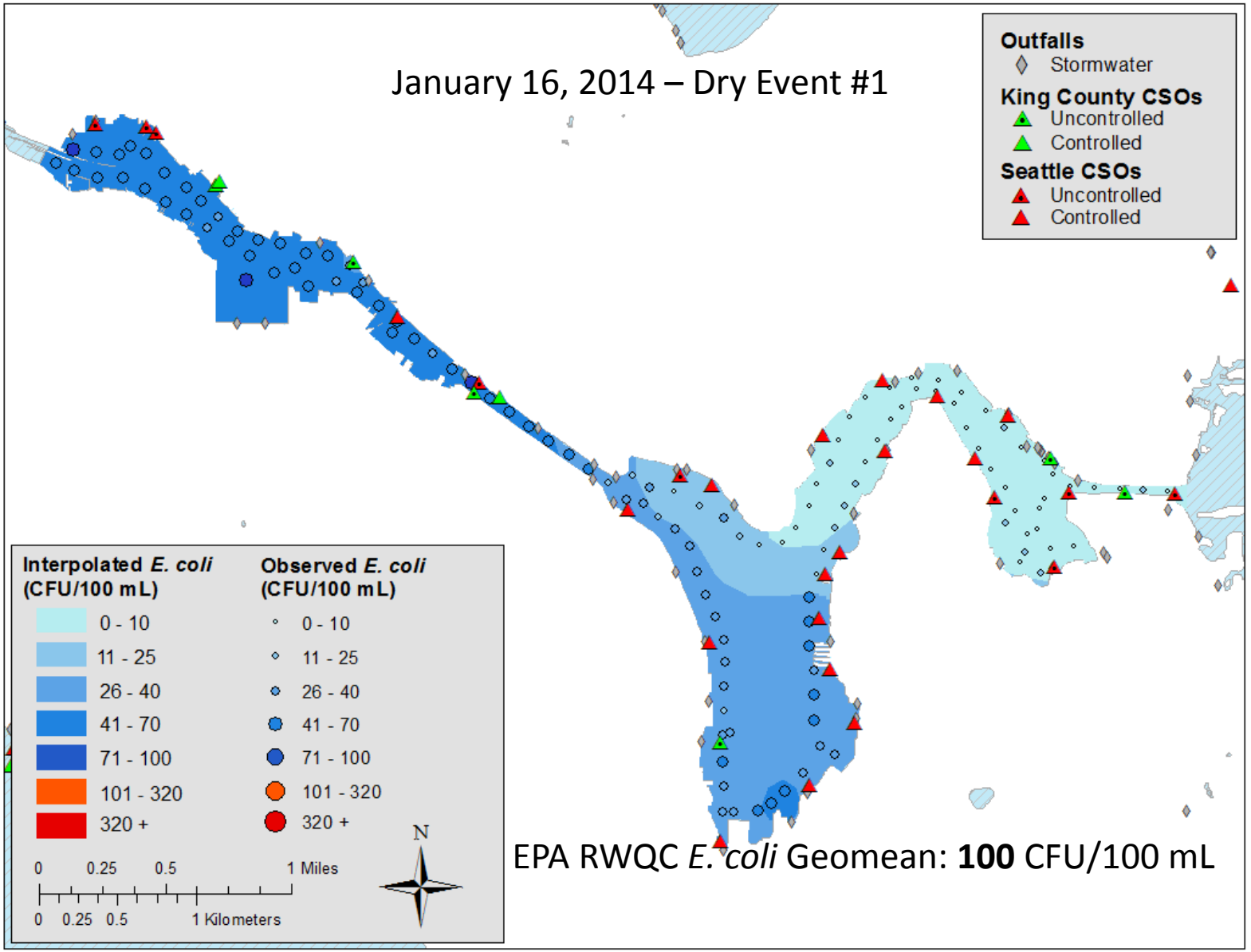
- Warm-blooded animals and people

Pathways:

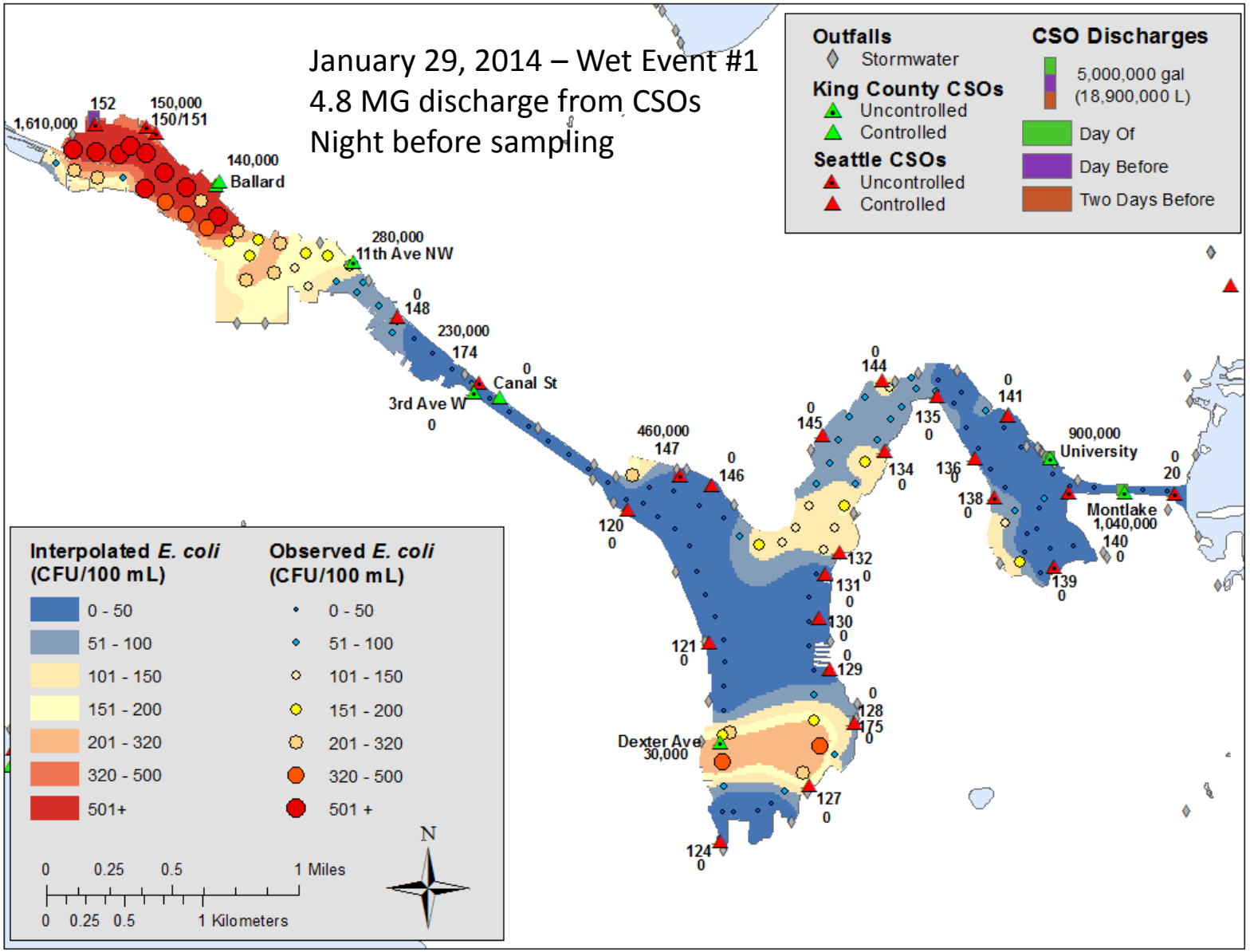
- Stormwater
- CSO
- Illicit boat discharges
- Sediment resuspension
- Septic Sewer Overflows
- Upstream/tributaries
- Baseflow in streams and stormwater conveyance

Methods - Sampling

- **Samples taken during 3 storm and 3 non-storm events**
- **Samples collected every 500 feet along shore in three study areas**
- **Human microbial source tracing (Hu-2-Bacteroides) subsampling at select locations**
  - Two dry-weather events in Lake Union/Ship Canal
  - Two dry- and one wet-weather event in Duwamish and Elliott Bay

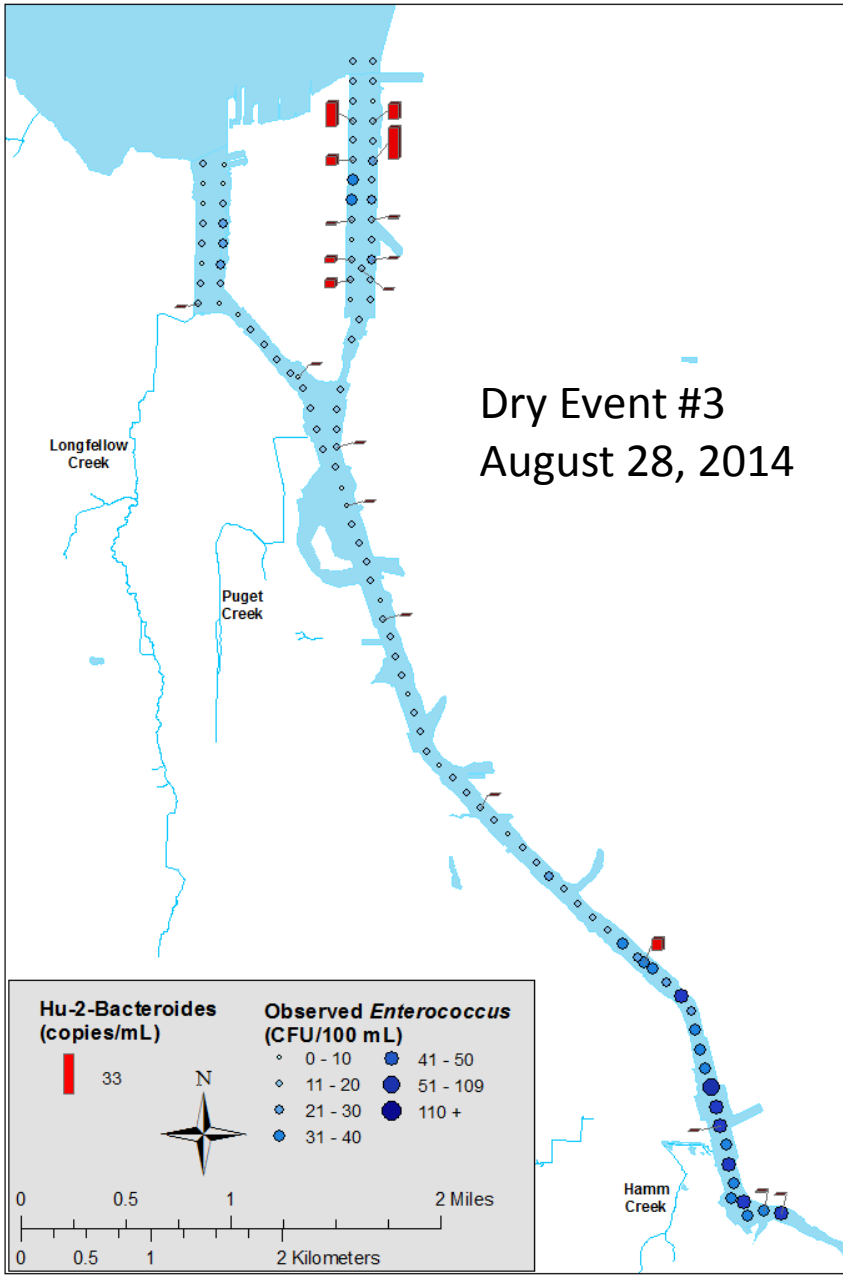


Results – Lake Union/Ship Canal

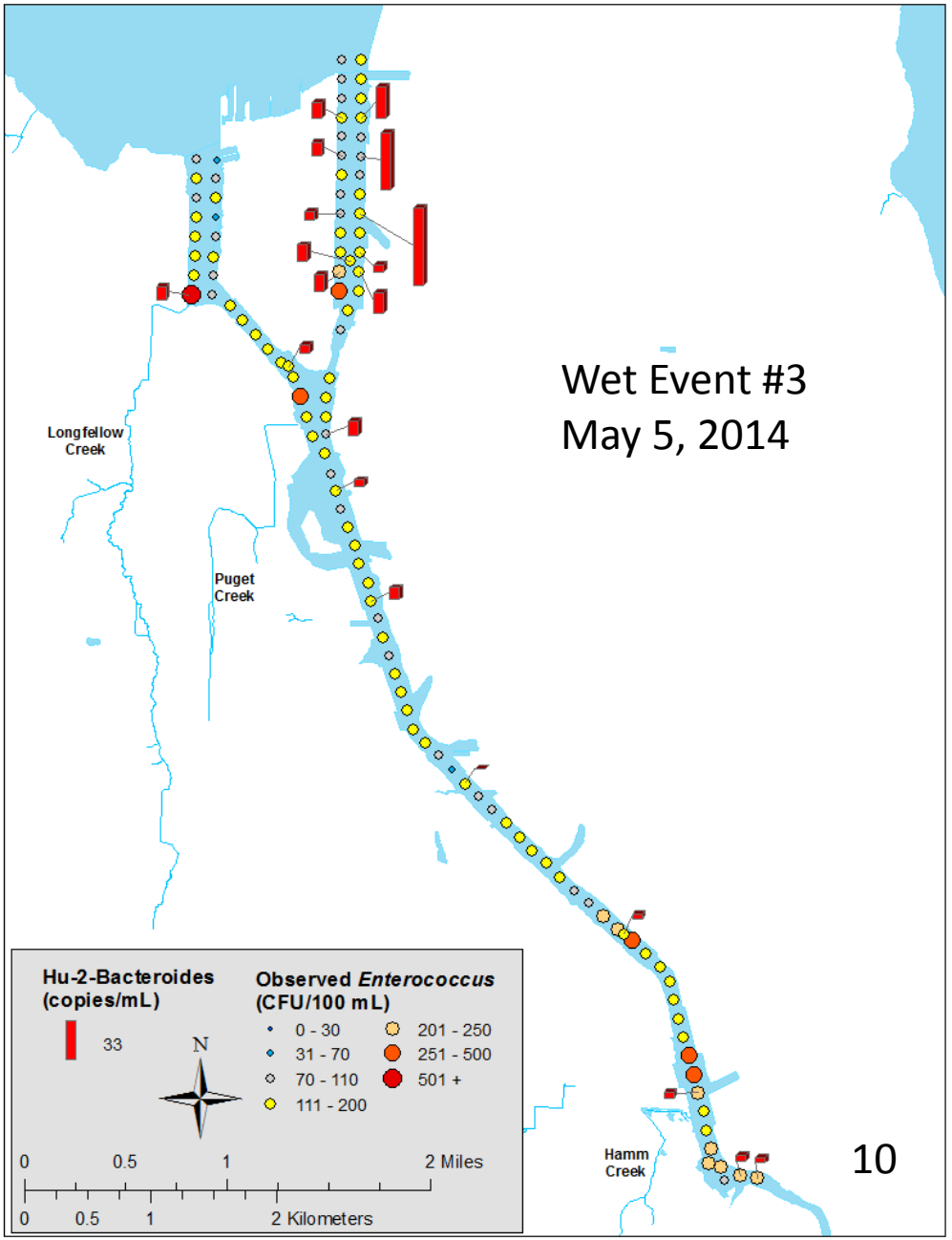


Results – Lake Union/Ship Canal

Human Genetic Marker Sampling At Select Locations Duwamish



Dry Event #3
August 28, 2014



Wet Event #3
May 5, 2014

Summary

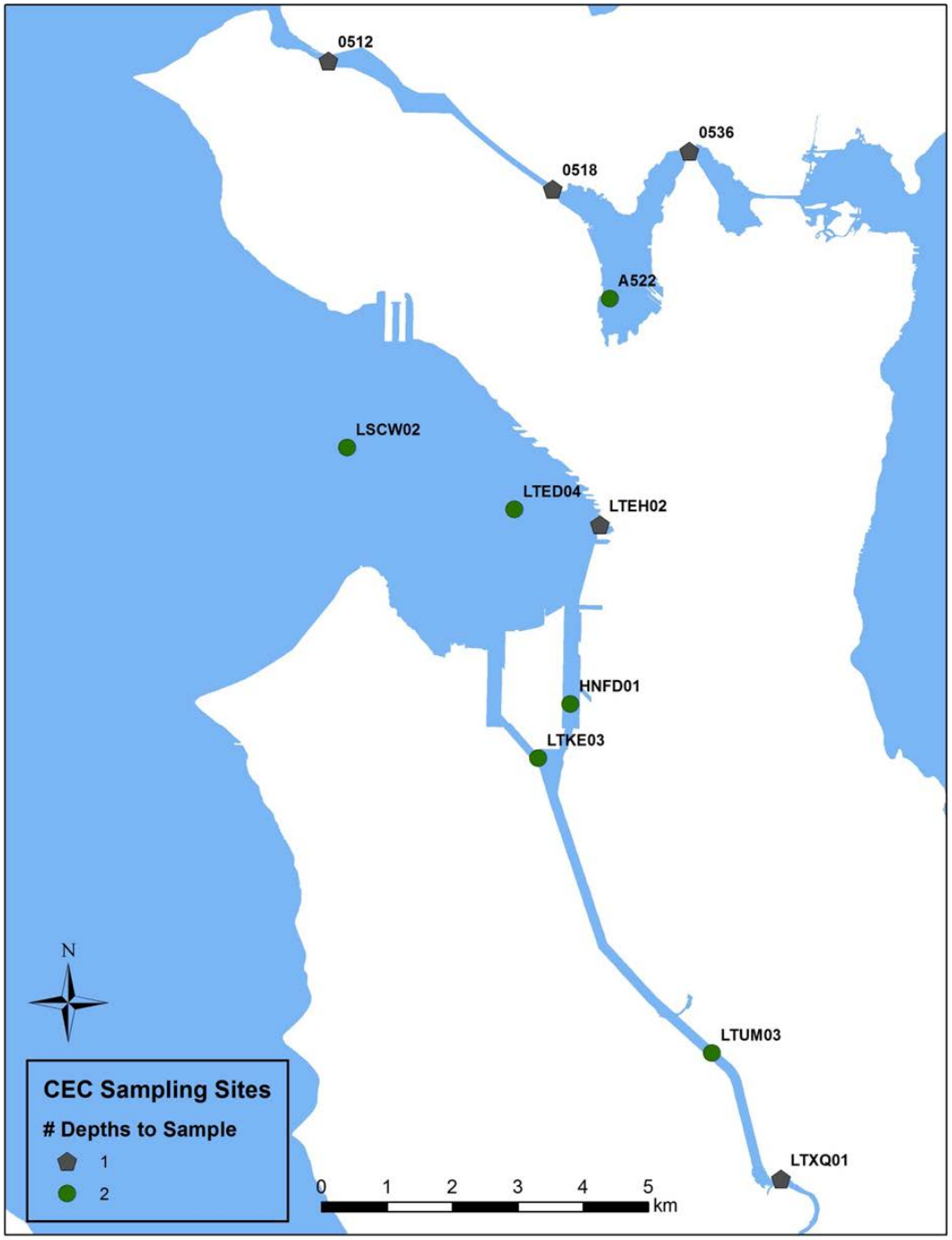
- **Bacteria highest during CSO events**
- **No strong signal that indicates houseboats are sources during dry-weather.**
- **Positive hits of human-source fecal during dry weather**
- **Bacteria decays faster in marine waters**
- **Local creeks appear to be a source of bacteria**
- **High bacteria doesn't always correlate with human genetic marker**

Contaminants of Emerging Concern (CECs)

- **Pharmaceuticals and Personal Care products**
- **Concerns vary depending on the compound:**
  - Antibiotics and antibiotic resistance
  - Impacts to aquatic life
- **Stormwater, wastewater, agriculture, CSO and septic sources**
- **No regulatory standards/effects not well known**
- **Baseline study recommended by peer review team**

Sampling Locations

- 4 Lake Union Ship Canal
- 4 Duwamish
- 3 Elliott Bay
  - Some with multiple depths
  - 1m and near bottom



Chemicals Analyzed

- 100 pharmaceuticals
- 12 pharmaceutical metabolites
- 20 pyrethroid insecticides
- DEET
- Cocaine and nicotine (and metabolites)
- 139 different CECs total

Summary

- Metformin (diabetes drug) in Lake Union/Ship Canal, Elliott Bay and Duwamish
- DEET in most samples
- Blank contamination is a challenge.
- Cocaine and main metabolite in all waters
- Many sulpha antibiotics including some which are exclusively for veterinary use

Conservative Chemical Sewage Tracer Literature Review

- Peer review team recommended literature review.
- Determine from the literature which chemicals may be the most promising for use as tracers of human sewage.
- What characteristics make a good conservative tracer.
- Establish a list of 3 to 10 compounds that can be used as markers for sewage entering surface waters.

Characteristics from the Literature

- Abundant in sewage.
- Detectable above method detection limits.
- Not present in waters with no human waste discharge.
- Does not undergo bio or photo degradation, should have known degradation rates.
- High water solubility and low volatility.
- High frequency of detection (>80%)
- Removed/not removed during the wastewater treatment process.

Potential Tracers

- Sucralose
- Acesulfame
- Carbamazepine
- Metformin
- Caffeine (Raw sewage only)

Conclusions

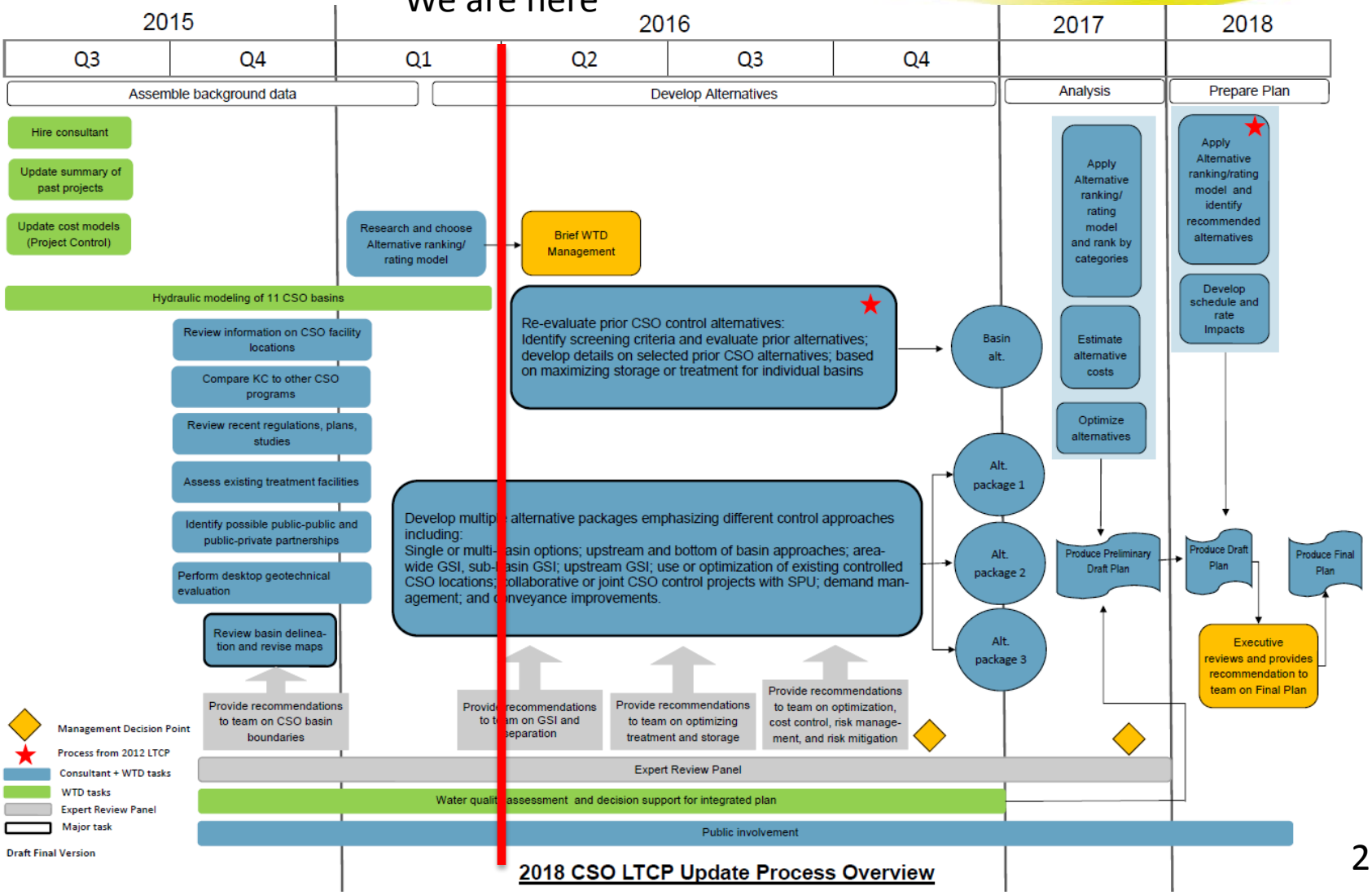
- No one unique single chemical can work in all situations.
- Several chemicals would allow separate lines of evidence to a single source.
- King County will continue to monitor sewage tracer developments
- Will continue to use microbiological tracers

King County CSO Long Term Control Plan Update

As of Today

- 8 projects to control remaining 14 uncontrolled CSOs by 2030
- Incorporate GSI where cost-effective
- Current schedule is Duwamish Projects first (3 out of 4 underway)
- Ship Canal Water Quality Project underway and led by SPU

We are here



2018 CSO LTCP Update Process Overview

Overview of 2018 CSO LTCP Update

For 11 remaining uncontrolled CSO locations:

- **Assemble background information**
- **Develop and analyze alternatives**
- **Coordinate with SPU**
- **Public Involvement throughout**
- **Consider Integrated Plan option**

Factors affecting the 2018 CSO LTCP Update

- Consent Decree
- Expert Review Panel
- Past and future SPU capital projects
- Impacts of climate change
- Use of Green Stormwater Infrastructure
- 2013 and 2014 County audit recommendations
- Water Quality Assessment and Monitoring Study

Questions?

Water Quality Assessment and Monitoring Study

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