

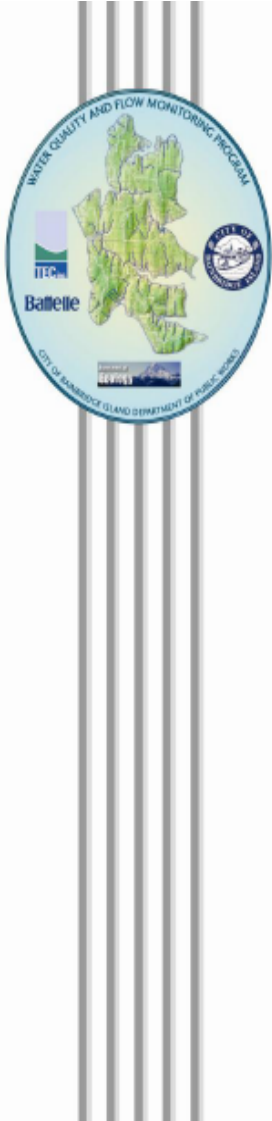


# **FLETCHER BAY WATERSHED SURFACE WATER STATUS AND TRENDS MONITORING**

**1**

**FEBRUARY 21, 2018**

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Water Quality and Flow Monitoring Program**



# Water Quality and Flow Monitoring Program

## FINAL MONITORING PLAN Bainbridge Island, Washington

April 2008

### WATER QUALITY AND FLOW MONITORING PROGRAM

Continuous flow and weather

Monthly grab & in-situ physiochem

Annual stream benthos (bugs)

Targeted storm event (every 5 years)

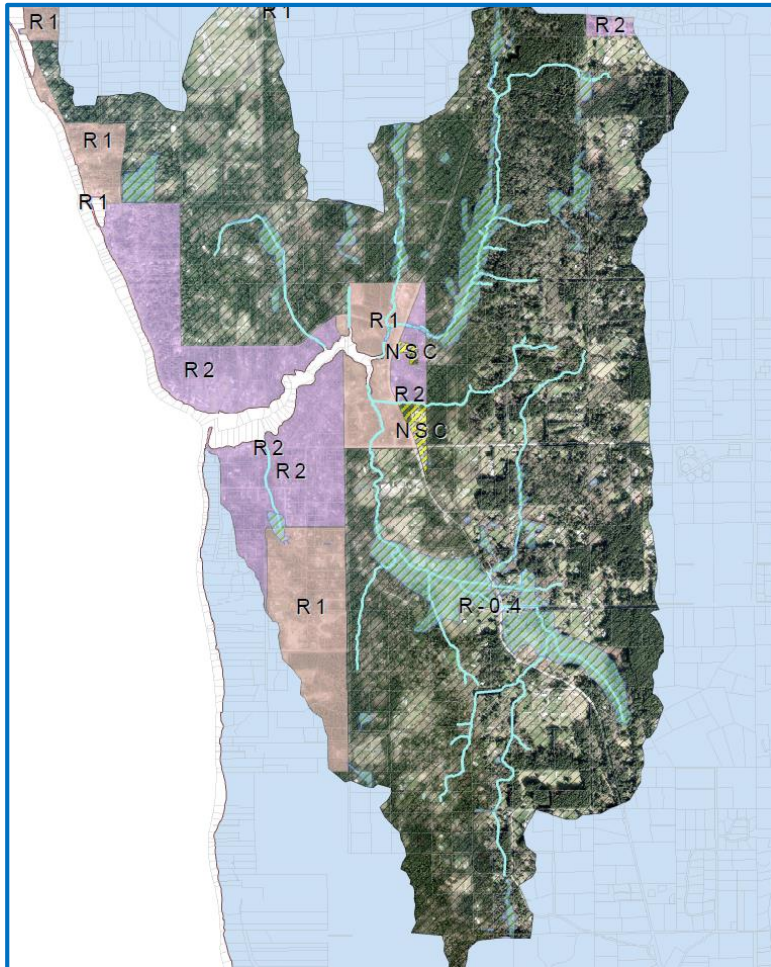
Sediment (every 5 years)

2/21/18

## Other Sources of Data

- Department of Health Shellfish Program
  - Fecal Coliform Bacteria
- Stormwater Action Monitoring – Washington Department of Fish and Wildlife Mussel Monitoring
  - Organic Contaminants (PAHs, PCBs, PBDEs, and DDTs)
  - Metals (Lead, Copper, Zinc, Arsenic, Cadmium, and Mercury)

# FLETCHER BAY WATERSHED



- 2102 total acres
- 147.1 acres of wetland
- 10.6 miles of stream
  - 7.2 miles fish-bearing
- 4.5 miles shoreline
- ~7% impervious
- 2 of 8 combined streams
  - Issei Creek
  - Springbrook Creek

## State Listings

- Fletcher Bay
  - Water of Concern – Fecal Coliform Bacteria
- Springbrook Creek
  - Impaired – Fecal Coliform Bacteria
- Springbrook Creek/Fletcher Bay
  - Sinclair and Dyes Inlets Fecal Coliform Bacteria TMDL

# Springbrook Creek Water Quality

- Physiochemistry
  - Dissolved oxygen (summer lows)
  - pH (good)
  - Temperature (summer highs)
  - Turbidity (rain event slight elevations)
- Fecal Coliform Bacteria
  - Does not meet standard
- Metals
  - Routine sampling – no exceedances
  - Targeted storm sampling
    - Aluminum – Exceeds acute criteria
    - Copper – Exceeds chronic criteria
    - Lead – Exceeds chronic criteria

# Springbrook Creek Water Quality

- Nitrogen and Phosphorous
  - Low to moderate concern
- Ammonia
  - Exceeds chronic criteria in wet season and storms
- Stream Bug Health
  - B-IBI (fair)
  - Fine Sediment Sensitivity Index (low)
  - No statistically significant trends

# Springbrook Creek Sediment Chemistry

- Sediment Chemistry – No exceedances
  - Metals (Aluminum, Copper, Lead, Zinc)
  - Hydrocarbons
    - Diesel range organics (2013)
  - Semi-volatile organic compounds
    - Butyl Benzylphthalate (2013)



## Springbrook Creek Sediment Grain Size

Size	2008 (%)	2013 (%)
Gravel	30	41
Sand	66	57
Silt	2	1
Clay	2	1

WQFMP Sediment  
Quality

# Issei Creek Water Quality

- Physiochemistry
  - Dissolved oxygen (summer lows)
  - pH (good)
  - Temperature (good)
  - Turbidity (rain event slight elevations)
- Fecal Coliform Bacteria
  - Does not meet standard
- Metals
  - Routine sampling – no exceedances
  - Targeted storm sampling
    - Aluminum – Exceeds acute criteria
    - Copper – Exceeds chronic criteria

# Issei Creek Water Quality

- Nitrogen and Phosphorous
  - Low to moderate concern
  - High concern (summer)
- Ammonia
  - Exceeds chronic criteria in wet season and storms
- Stream Bug Health
  - B-IBI (poor)
  - Fine Sediment Sensitivity Index (low)
  - Statistically significant trends
    - Percent tolerant species (declining)
    - Metals Tolerance Index (declining)

# Issei Creek Sediment Chemistry

- Sediment Chemistry – No Exceedances
  - Metals (Aluminum, Copper, Lead, Zinc)
  - Hydrocarbons
    - Diesel range organics (2013)
    - Heavy Oil (2013)
  - Semi-volatile organic compounds
    - Butyl Benzylphthalate (2013)

## Issei Creek Sediment Grain Size

Size	2008 (%)	2013 (%)
Gravel	No Sample	42
Sand		56
Silt		1
Clay		1

# Fletcher Bay Water Quality

- Physiochemistry
  - Dissolved oxygen (good)
  - pH (good)
  - Temperature (good)
  - Turbidity (slight elevations)
- Fecal Coliform Bacteria
  - Does not meet standard
- Metals
  - Meets criteria

# Fletcher Bay Water Quality

- Nitrogen and Phosphorous
  - Ratio of Total Inorganic Nitrogen to Total Phosphorus
    - Good – control algal blooms
    - But, near high end of acceptable ranges – could be limiting aquatic diversity
  
- Ammonia
  - Exceeded chronic criteria one out of two storms

# Fletcher Bay Sediment Chemistry

- Sediment Chemistry – No Exceedances
  - Metals (Aluminum, Copper, Lead, Zinc)
  - Hydrocarbons
    - Diesel range organics (2013)
    - Heavy Oil (2013)
  - Semi-volatile organic compounds
    - Butyl Benzylphthalate (2013)
    - Bis(2-Ethylhexyl)phthalate (2013)



## Fletcher Bay Sediment Grain Size

Size	2008 (%)	2013 (%)
Gravel	59	28
Sand	34	70
Silt	5	1
Clay	3	1

# Port Orchard Passage Shellfish Growing Area

## FLETCHER BAY SUMMARY

Shellfish Growing  
Area Monitoring  
(DOH Shellfish  
Program 2016)



NATIONAL  
GEOGRAPHIC

0.0 0.5 1.0 miles  
0.0 0.5 1.0 1.5 km

TN 07N  
174  
07/03/17

2/21/18

# Port Orchard Passage Shellfish Growing Area

**TABLE 1**  
**Summary of Marine Water Data (SRS)**  
Growing Area: Port Orchard Passage

Sampling Event Type: Regulatory  
Maximum Number of Samples: 30

Tides Included: ALL

Station Number	Classification	Date Range	Range (FC/100 mL)	GeoMean (FC/100 mL)	E90th (FC/100 mL)	Meets Standard
436	Approved	12/28/2011 - 12/19/2016	1.7 - 11.0	1.9	2.9	Y
438	Approved	1/30/2012 - 12/19/2016	1.7 - 7.8	1.9	2.8	Y
439	Approved	1/30/2012 - 12/19/2016	1.7 - 13.0	1.9	3.0	Y
440	Approved	1/30/2012 - 12/19/2016	1.7 - 4.5	1.8	2.2	Y
441	Approved	1/30/2012 - 12/19/2016	1.7 - 14.0	1.9	3.1	Y
443	Approved	1/30/2012 - 12/19/2016	1.7 - 7.8	1.9	2.9	Y
444	Approved	1/30/2012 - 12/19/2016	1.7 - 7.8	2.0	3.4	Y
445	Approved	1/30/2012 - 12/19/2016	1.7 - 33.0	2.3	6.3	Y
446	Approved	1/30/2012 - 12/19/2016	1.7 - 4.5	1.8	2.3	Y
448	Approved	1/30/2012 - 12/19/2016	1.7 - 11.0	2.2	4.0	Y
449	Approved	1/30/2012 - 12/19/2016	1.7 - 17.0	2.4	6.1	Y
450	Approved	1/30/2012 - 12/19/2016	1.7 - 79.0	2.6	8.5	Y
452	Approved	1/30/2012 - 12/19/2016	1.7 - 17.0	2.2	4.6	Y
453	Approved	1/30/2012 - 12/19/2016	1.7 - 49.0	2.2	5.2	Y
454	Approved	1/30/2012 - 12/19/2016	1.7 - 23.0	2.4	6.1	Y
455	Approved	12/28/2011 - 12/19/2016	1.7 - 46.0	2.0	4.4	Y
456	Approved	1/30/2012 - 12/19/2016	1.7 - 33.0	1.9	3.9	Y
457	Approved	1/30/2012 - 12/19/2016	1.7 - 49.0	3.7	13.7	Y
504	Approved	1/30/2012 - 12/19/2016	1.7 - 14.0	2.4	5.4	Y

# Organic Contaminants in Mussels

## Appendix 2: Concentration of Organic Contaminants in Mussels by Site

### Dry Weight Concentrations of Organic Contaminants

\* Mean of six replicate samples from Penn Cove, Whidbey Island aquaculture source of mussels (i.e., starting condition)

< Indicates the concentration was not measured above the limit of quantitation (LOQ), which is the value reported in this case

Site ID	Site Name	Concentrations in ng/g, dry weight (ppb)						
		$\Sigma_{38}$ PAHs	TCBs	$\Sigma_{11}$ PBDEs	$\Sigma_6$ DDTs	$\Sigma_8$ Chlordanes	$\Sigma_3$ HCHs	Dieldrin
WB_PC	Baseline Site (n = 6)*	35.5	5.4	<1.27	<1.27	<1.27	<1.27	<1.25
Site #2	Arroyo Beach	290.2	41.7	12.4	3.4	<2.03	<0.801	<0.801
Site #3	Brackenwood Ln	435.2	31.8	7.1	2.3	<1.09	<1.02	<1.02
Site #4	Cherry Point North	123.9	6.2	<2.08	<1.70	<1.01	<1.01	<1.01
Site #5	Salmon Beach	223.1	30.9	6.9	2.1	<0.857	<0.857	<0.857
Site #6	Eagle Harbor Dr.	1821.8	116.7	3.0	3.2	<0.828	<0.828	<0.828
Site #8	Chimacum Creek delta	94.9	12.5	<2.09	<1.20	<1.20	<1.20	<1.20
Site #10	Fletcher Bay, Fox Cove	↓ 256.0	— 55.2	↓ 5.9	↓ 3.3	<0.920	<0.920	<0.858
Site #11	South Bay Trail	382.1	22.4	8.0	3.1	<1.12	<1.12	<1.12

# Metals in Mussels

Stormwater Action  
Monitoring -  
WDFW Mussel  
Monitoring  
(Lanksbury, J. et  
al. 2017)

## Appendix 3: Concentrations of Metals in Mussels by Site

### Dry Weight Concentrations of Metals

\* Mean of six replicate samples from Penn Cove, Whidbey Island aquaculture source of mussels (i.e., starting condition)

< Indicates the concentration was not measured above the reporting detection limit (RDL), which is the value reported in this case

Site ID	Site Name	Concentrations in mg/kg, dry weight (ppm)					
		Mercury	Arsenic	Cadmium	Copper	Lead	Zinc
WB_PC	Baseline Site (n = 6)*	0.0440	6.14	1.71	7.60	0.34	84.3
Site #2	Arroyo Beach	0.0533	7.89	1.95	7.95	0.30	97.0
Site #3	Brackenwood Ln	0.0559	7.35	1.96	6.71	0.29	85.7
Site #4	Salmon Beach	0.0404	6.87	1.56	6.56	0.32	85.3
Site #5	Eagle Harbor Dr.	0.0578	6.78	1.66	8.77	0.98	97.1
Site #6	Fletcher Bay, Fox Cove	< 0.0424	< 6.63	< 1.70	↑ 8.31	↑ 0.51	↑ 91.0
Site #8	South Bay Trail	0.0501	6.88	2.14	8.79	0.92	97.1

# Land Use Impact

Table 3. Impact of a land-use and point source factors on the concentration of contaminants in nearshore mussels.

Type	Test	Significant Results ( $\alpha < 0.05$ )	
		Organic Contaminants	Metals
Municipal land-use planning designations	UGA vs. Baseline Site	PAHs, PCBs, PBDEs, DDTs	NS
	UGA class (city vs. unincorporated-UGA)	PAHs, PCBs, PBDEs, DDTs	Zinc
Watershed land use* measured in adjacent watersheds with an average area 8.8 km <sup>2</sup> (3.4 miles <sup>2</sup> )	mean % Impervious Surface	PAHs, PCBs, PBDEs, DDTs	NS
	% Urban area	PBDEs, DDTs	NS
	% Forested area	NS	NS
	% Agricultural area	PCBs, PBDEs, DDTs	Lead
	% Wetland area	NT	NT
Shoreline land use† measured up to 200 meters (656 ft.) inland from shoreline	% Urban area	NS	NS
	% Forested area	NS	NS
	% Agricultural area	NS	NS
In-water point sources	Marina/ferry terminal presence	PAHs, PCBs, DDTs	Lead
	Creosote observed	NS	NS
Natural geographical/geological features	Shoreline form (bay vs. open)	NS	Lead
	Substrate (depositional vs. coarse)	NS	Lead

UGA = urban growth area, NS = not significant, NT = not tested due to lack of replicates

\* Data from National Land Cover Dataset 2011

† Data from NOAA's C-CAP Land Cover Atlas shoreline characterization

# SPRINGBROOK CREEK EVALUATION AND FEASIBILITY STUDY — JUNE 2018



- BI Land Trust
  - City
  - Wild Fish Conservancy
  - West Sound Watersheds Council
  - BI Watershed Council
- Activities/Outcomes
  - Baseline Monitoring
  - Habitat Assessment
  - Watershed Characterization
  - Project ID and Prioritization
  - Conceptual Design of 5 Projects



THANK YOU

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