

STRATEGIES FOR PROTECTING AND RESTORING B-IBI BASINS

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King County

Department of
Natural Resources and Parks
Water and Land Resources Division

PNW Society for Freshwater Science Nov 5, 2015

B-IBI: Puget Sound Partnership Vital Sign Indicator



Puget Sound Partnership's Ecosystem Recovery Targets

Freshwater Quality B-IBI Targets by 2020:

- 🐛 PROTECTION - All stream drainage areas retain “excellent”
- 🐛 RESTORATION - 30 basins improve from “fair” to “good”



King County's tasks



Initial steps of planning

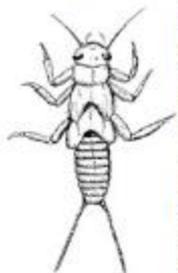
-  Create framework to identify sites
 -  Develop strategies for protection & restoration
 -  Present relative costs of strategies
 -  Identify next steps
-
-  No funds for site visits or new data
 -  “30,000-foot level”

Puget Sound Stream Benthos

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Analyzing Stream Health

This site analyzes benthic macro-invertebrate community structure to determine the ecological health of streams. [Participating agencies](#) use this site to manage, analyze and share data from their ongoing stream monitoring programs.

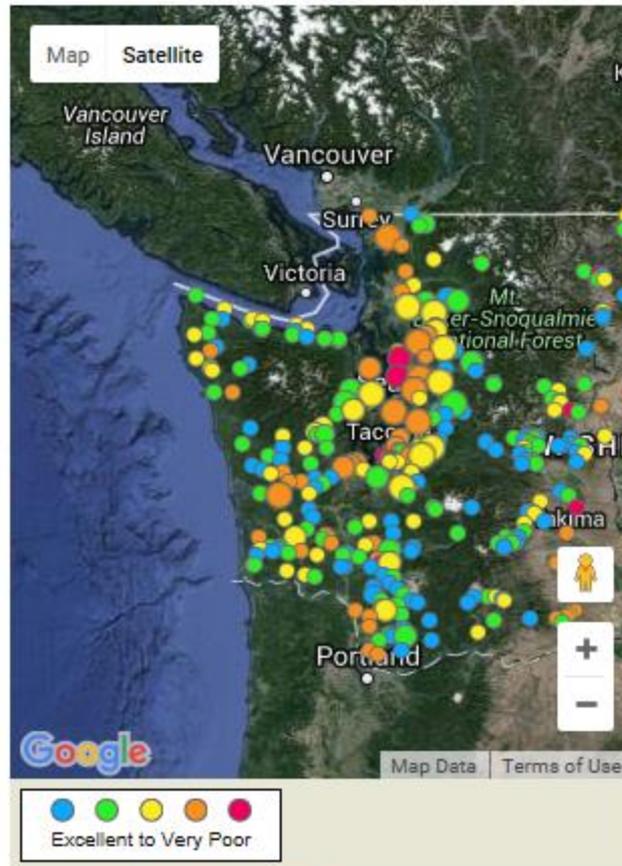


Benthic macro-invertebrates, also known as stream bugs, are animals that can be seen with the naked eye, do not have backbones and live in the **stream benthos**—in or near the streambed. They include insects, crustaceans, worms, snails, clams,

etc.

Benthic macroinvertebrates are monitored because they are good indicators of the biological health of stream systems and play a crucial role in the stream ecosystem.

Plotting Biotic Integrity



[Click here to customize chart.](#)

The B-IBI Scoring System

We use the [Benthic Index of Biotic Integrity \(B-IBI\)](#) scoring system to determine stream health. Since the B-IBI is a standardized scoring system, it can be used to compare and rank the health of different streams.

B-IBI has several variants, and we will support many of them over time. Currently, we are using Puget Sound Lowlands B-IBI. This site allows you to filter the scores by a variety of parameters and then

- [Plot the scores on maps](#)
- [Show the scores in tables](#)

B-IBI Recalibration

From 2010-2014 King County worked with regional partners to enhance benthic macroinvertebrate monitoring tools for the Puget Sound region as part of an EPA-funded project. For more information and to view documents and other products related to this effort please go to the [B-IBI Recalibration page](#).

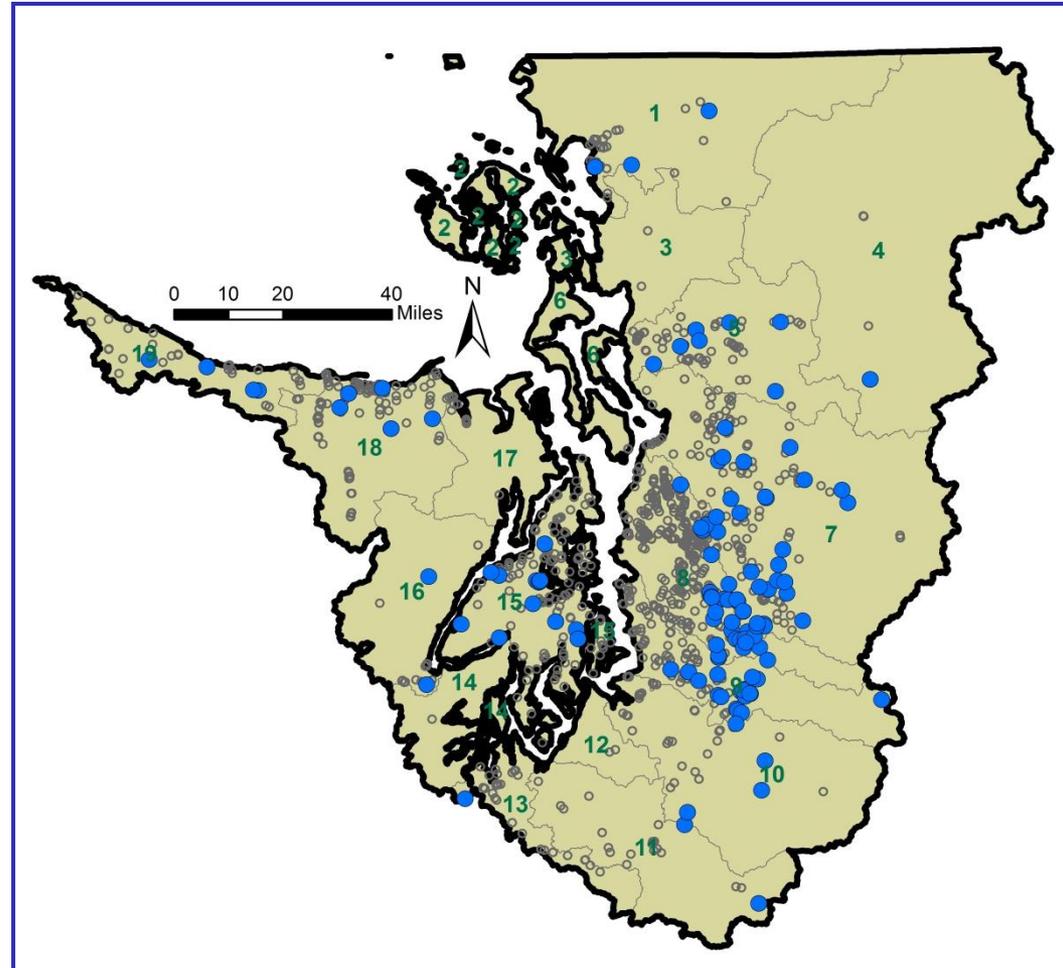
Target 1: Protect “Excellent” Sites (B-IBI ≥ 42)

Of 1294 sites,

 160 scored “excellent”
at least once

 Some excluded that
typically scored lower

 Several basins overlap,
after consolidation:
101 unique basins

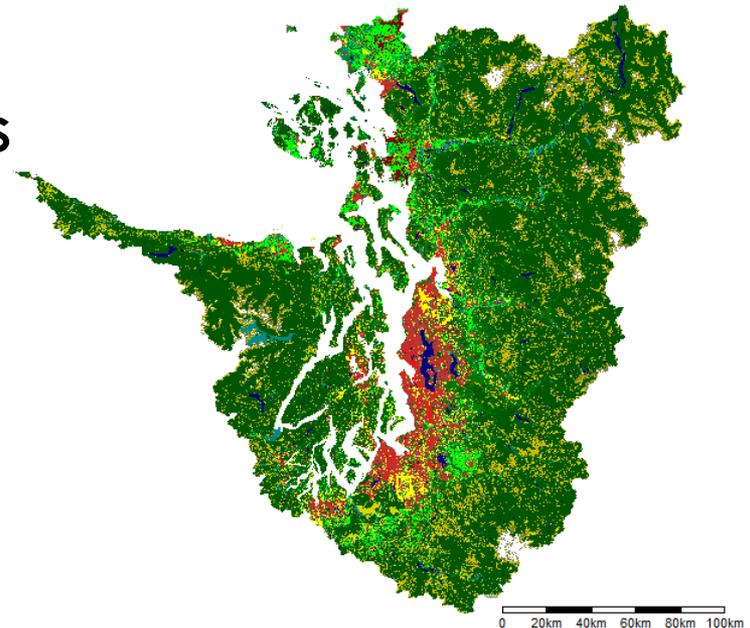


Considerations: Land Use (C-CAP)

2011 Land Use	Median % (min-max)	Notes
% Natural	97 (33-100)	
% Natural (buffer)	97 (42-100)	
% Urban	1 (0-43)	10 basins with >20%; 10 with 10-20%
% Ag - Pasture	0 (1-26)	5 basins with >10%

🦋 “Excellent” sites primarily in undeveloped, forested basins

🦋 A few exceptions with moderate urban and agricultural development



Considerations: Zoning

Puget Sound Mapping Project

Zoning Category	Median % (min-max)	Notes
Intensive Urban	0 (0-62)	6 basins with >5%
Urban Character	0 (0-72)	6 basins with >20%; 10 with 5-20%
Rural Character	11 (0-100)	20 basins with >90%; 18 with 30-90%
Resource Forest	84 (0-100)	49 basins with >90%; 17 with 50-90%

 Few zoned for preservation or conservation

 Most at risk of future threats:

 Forest harvest

 Rural development (1 unit/5 to 20 acres)

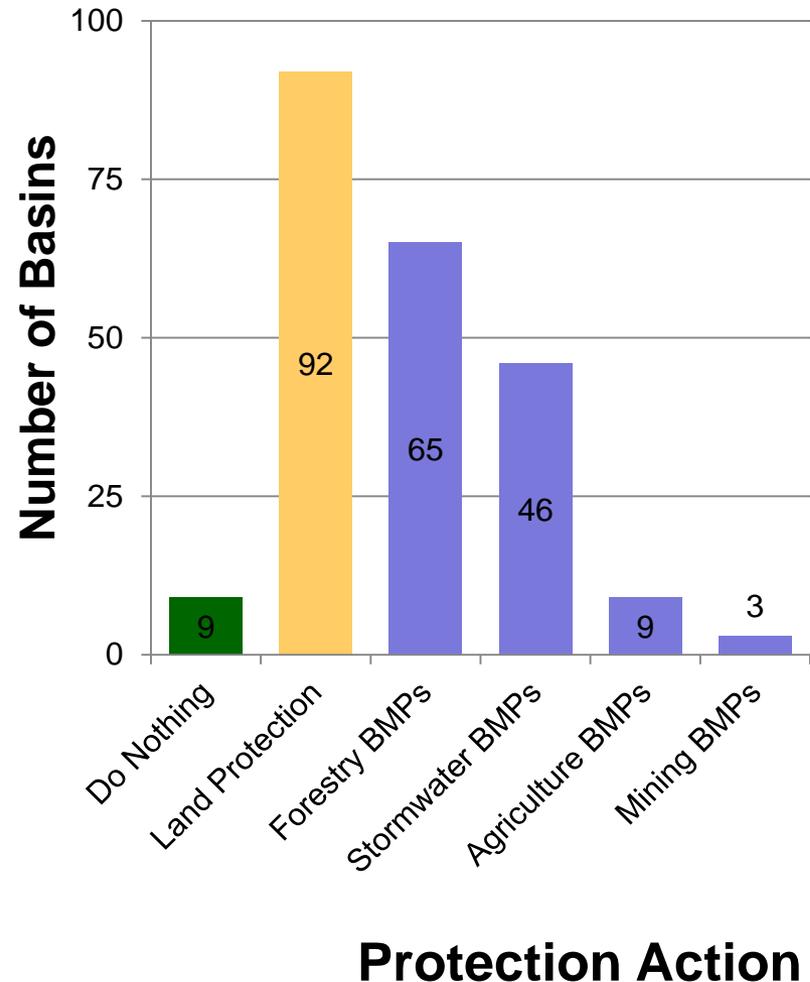
 Urban development (>1 unit/acre)

 Basin specific challenges:

 Mining, Military activities

Strategies to Protect “Excellent” Sites

-  **Land protection**
 -  Land purchase
 -  Conservation easements
 -  Development rights
-  **Encourage/enforce BMPs**
 -  Forestry BMPs
 -  Stormwater BMPs
 -  Agricultural BMPs
 -  Mining BMPs



Conclusions: Protection Target

- Most basins at risk of future development or harvest
- Land protection needed in most basins to maintain “excellent” scores
- BMPs and restoration may also be needed
- Prevention of degradation is generally easier and cheaper than restoration



Target 2: Restore “Fair” Sites to “Good”

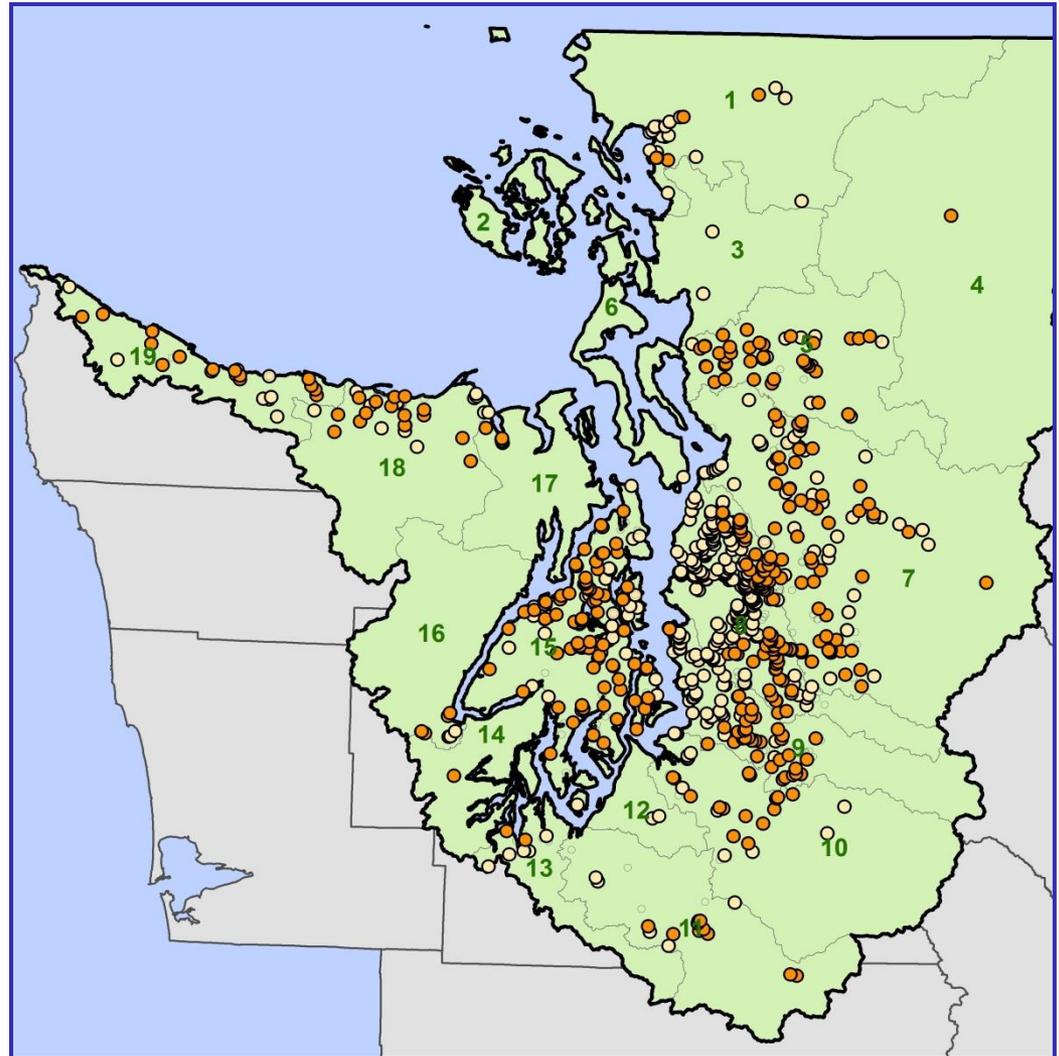
● “Fair” average

○ “Fair” at least once

B-IBI = 28-36

 648 sites scored “fair”
at least once

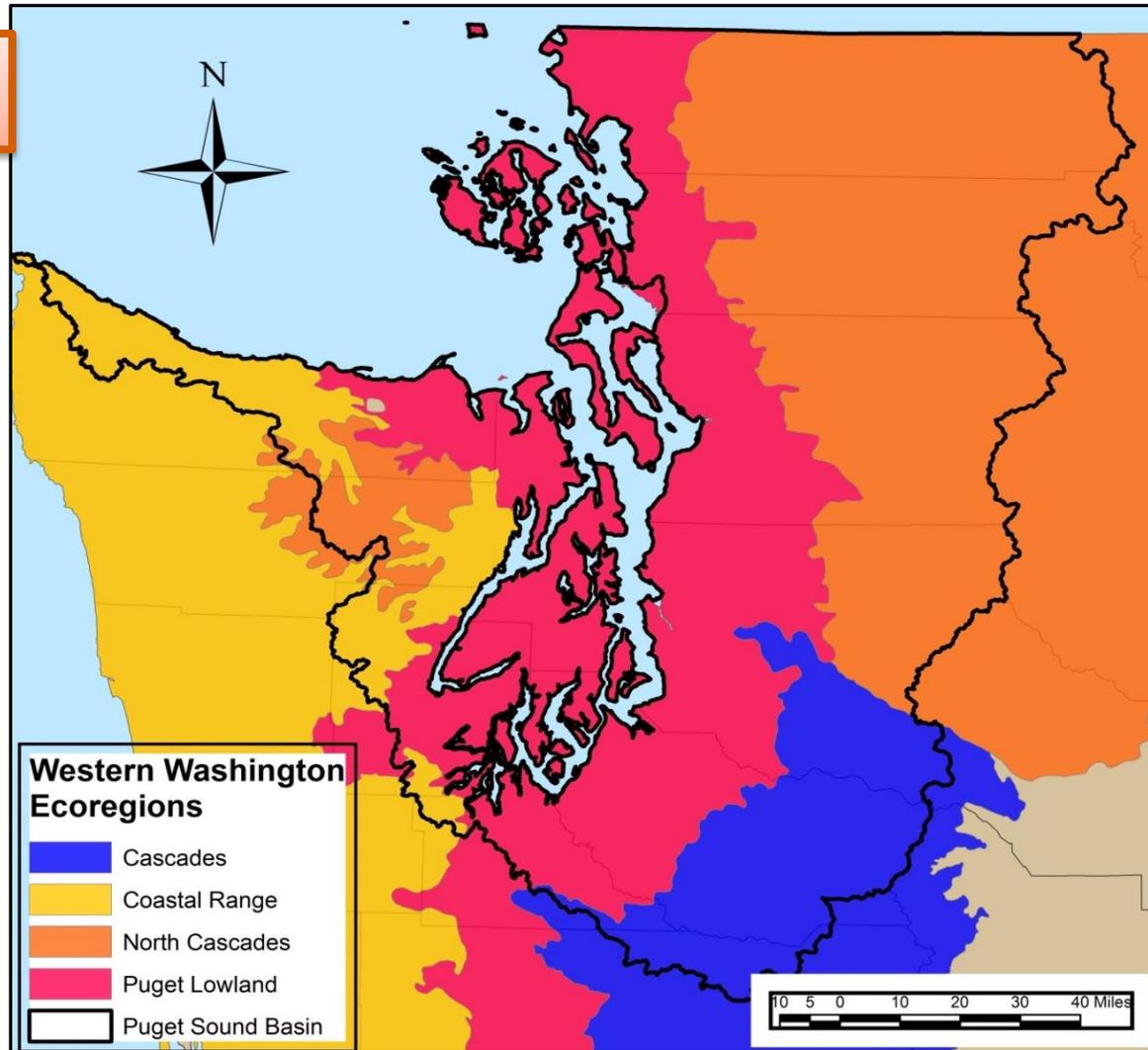
 **439 sites with
median “fair”
scores**





Filtering: Ecoregion

439 →



→ 362

Filtering: Sampling History

362 →

Site sampled 3 years or more?

Site sampled since 2007?

If not, are there 5 or more
years of data?

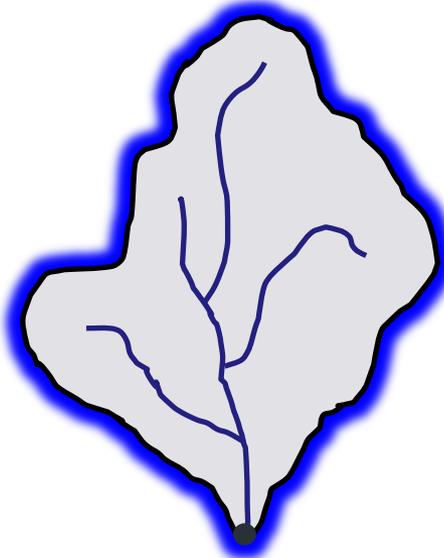
→ 174

Filtering: Watershed Area

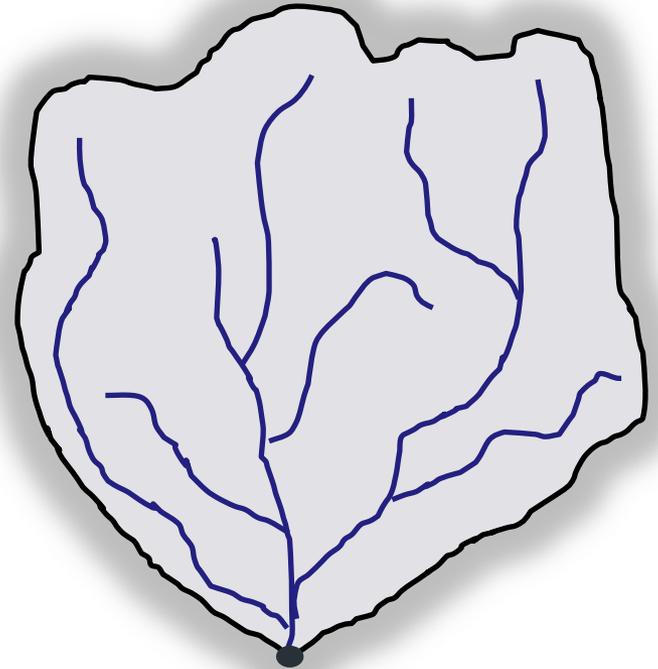
174 →



<200 Acres:
Too Small



200-3000 Acres:
Just Right



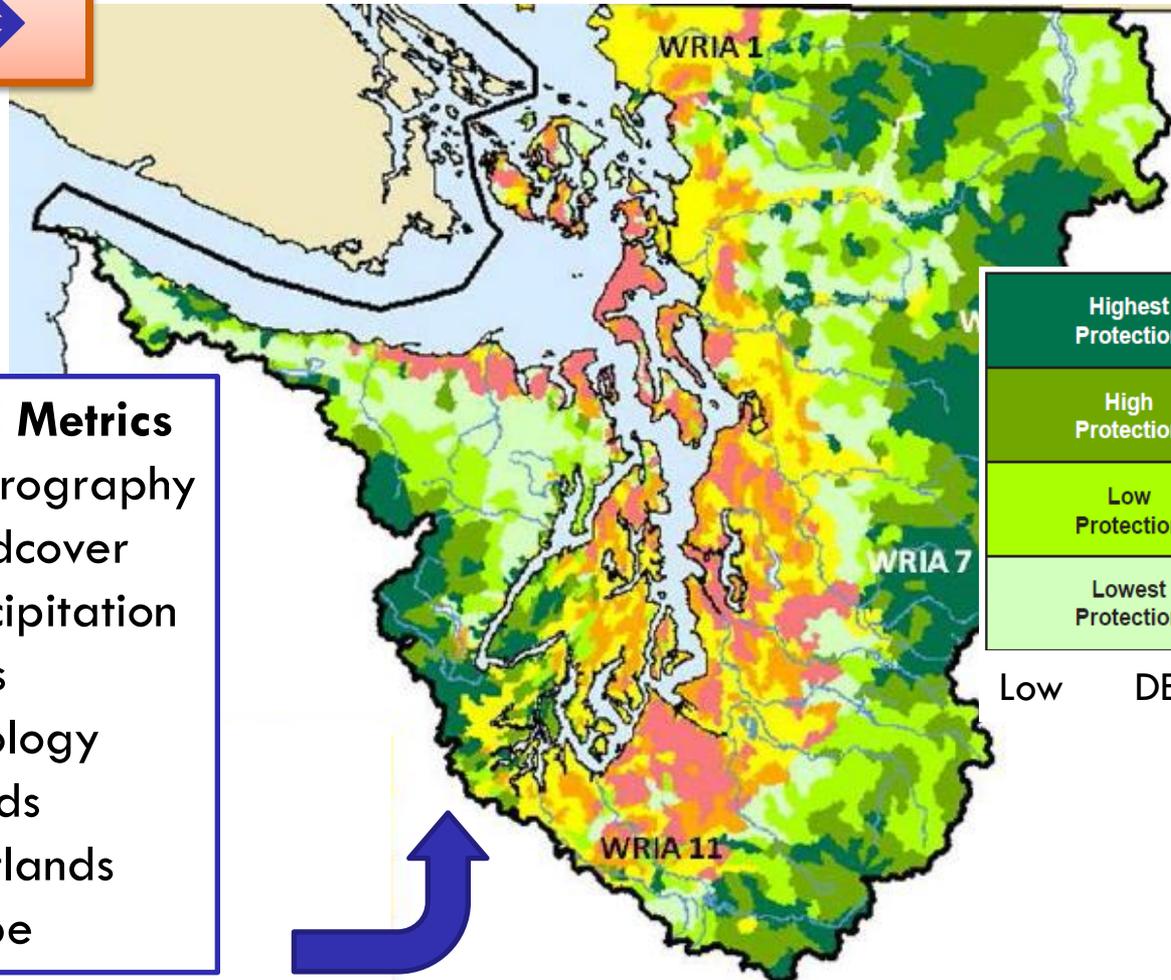
>3000 Acres:
Too Big

→ 81

Filtering: PS Watershed Characterization

81 →

- PSWC Metrics**
- Hydrography
 - Landcover
 - Precipitation
 - Soils
 - Geology
 - Roads
 - Wetlands
 - Slope



Highest Protection	Highest Restoration
High Protection	High Restoration
Low Protection	Low Restoration
Lowest Protection	Lowest Restoration
Low	High

DEGRADATION

Low IMPORTANCE High

→ 54

Potential Ranking Criteria

Fish Use (Chinook, coho, steelhead)

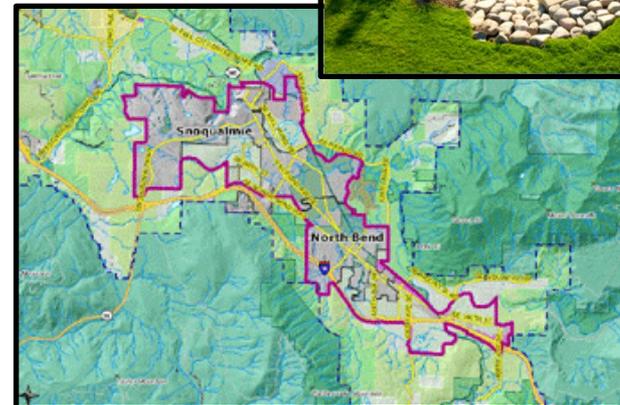
-  Basin Average Intrinsic Potential

Stormwater

-  Align with stormwater retrofit priorities

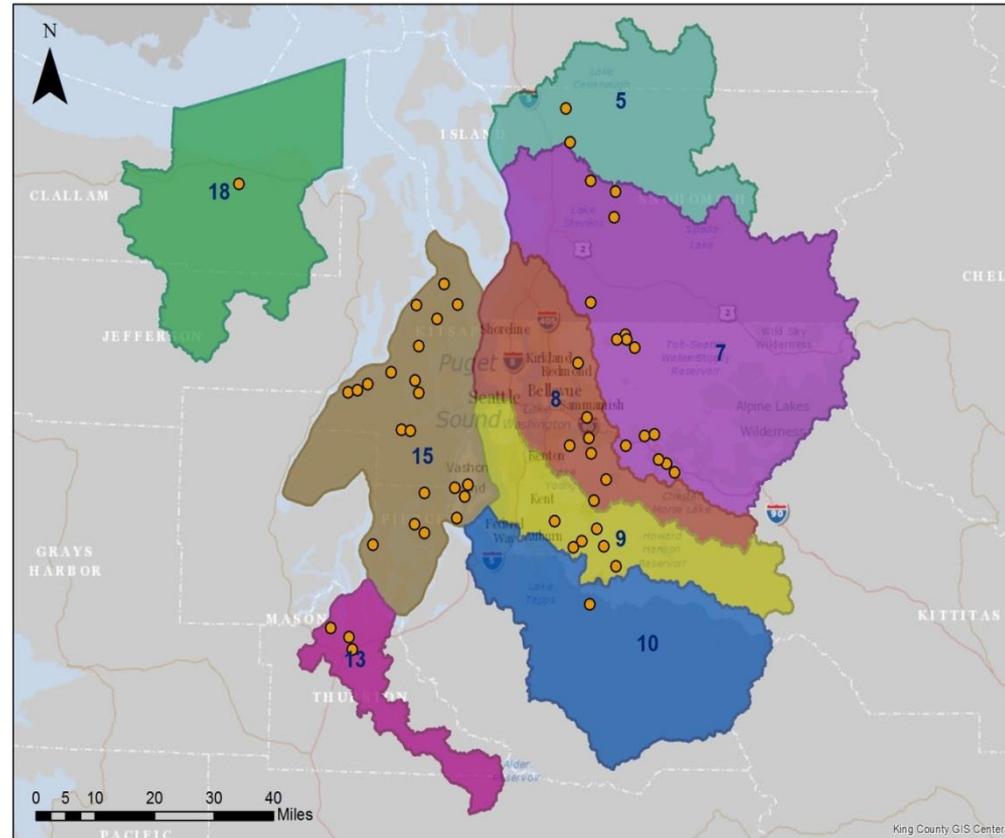
Price and Feasibility

-  Funding limits
-  Property acquisition
-  Community support



54 “Fair” sites

Watershed #	Watershed Name	Number of Sites
5	Stillaguamish	2
7	Snohomish	14
8	Cedar-Sammamish	6
9	Duwamish-Green	10
10	Puyallup-White	1
13	Deschutes	3
15	Kitsap	17
18	Elwha-Dungeness	1



Recommending restoration actions

-  Desktop reconnaissance
-  Outreach
-  Best professional judgment



Desktop reconnaissance & outreach

- 🪳 Historic and current stressors?
- 🪳 Risk of future impacts?
- 🪳 What actions could alleviate or remove stressors?



Desktop reconnaissance & outreach

Historic and current stressors?

-  Land use – CCAP data
-  2006 and 2011 orthophotos
-  Age of homes, density of developments
-  People familiar with site and basin
-  Natural limitations



Desktop reconnaissance & outreach

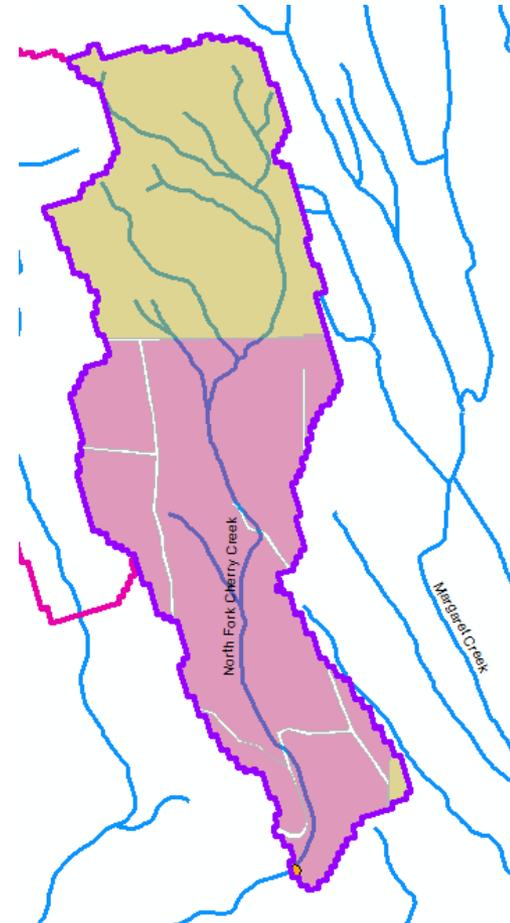
 Risk of future impacts?

 Zoning

 2011 orthophotos/Google

 Zillow

 People familiar with site & basin



Recommendations

- 
-  **What actions could alleviate/remove stressors?**
 -  In-stream restoration
 -  Riparian restoration
 -  Agricultural best management practices (BMPs)
 -  Forest BMPs
 -  Mining BMPs
 -  Stormwater BMPs
 -  Other approaches and actions

Recommendations: In-stream restoration

-  **Add wood**
-  **Add substrate**
-  **Enhance sinuosity**
-  **Replace culverts**
-  **Stabilize stream banks**



Recommendations: Riparian

 **Stabilize slopes**

 **Plant vegetation, extend buffer**



Recommendations: Agricultural BMPs

 **Exclude livestock**

 **Manage waste**

 **Manage soil loss**



Recommendations: Forest BMPs

-  **Road maintenance**
-  **Minimize clearcutting**
-  **Replant**



Recommendations: Mining BMPs

Mining BMPs



Recommendations: Stormwater BMPs

-  **Flow controls**
-  **Treatment**
-  **Maintain storage and treatment facilities**
-  **Street sweeping**



Recommendations: Other Approaches

-  **Limit pesticide use**
-  **Outreach and education campaign**
-  **Create incentives to follow BMPs**
-  **Purchase and protect property**
-  **Seed invertebrates**

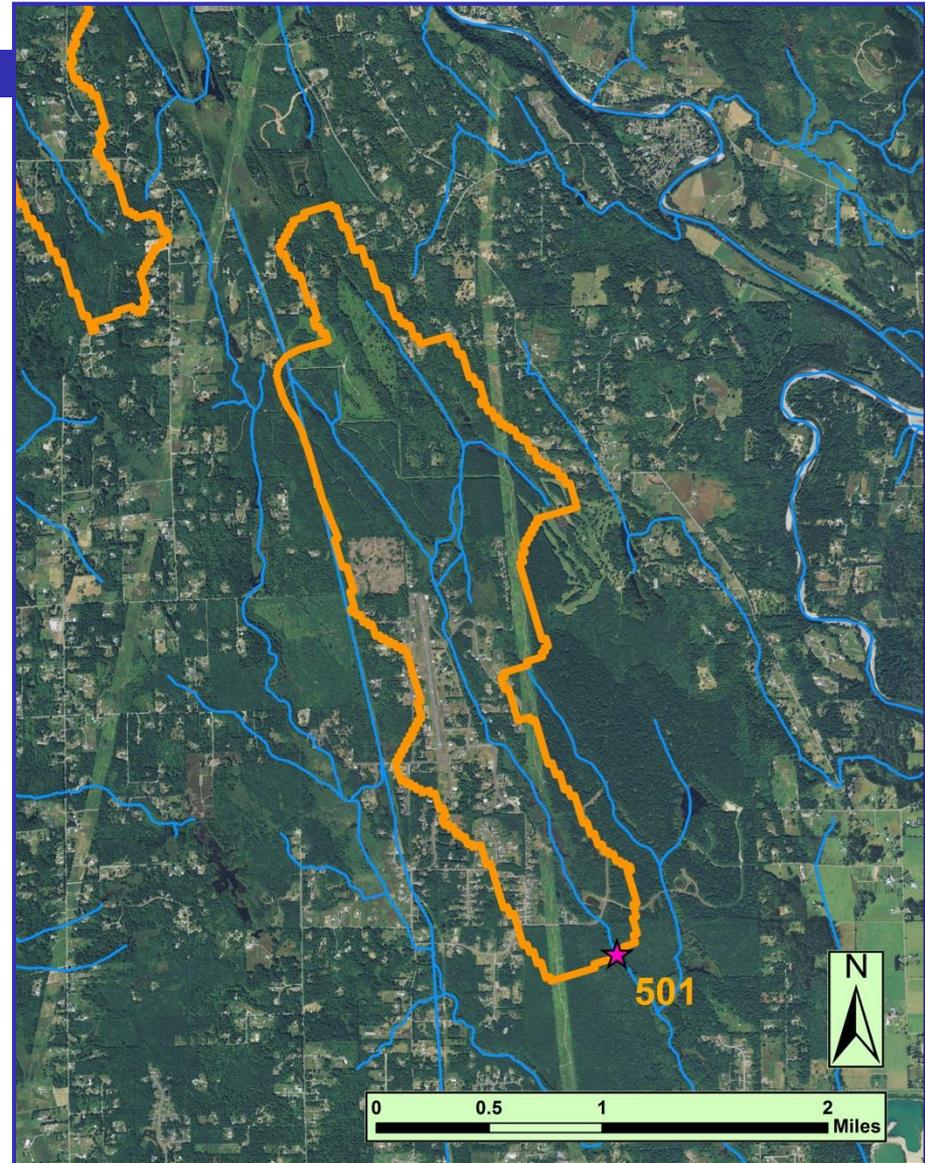
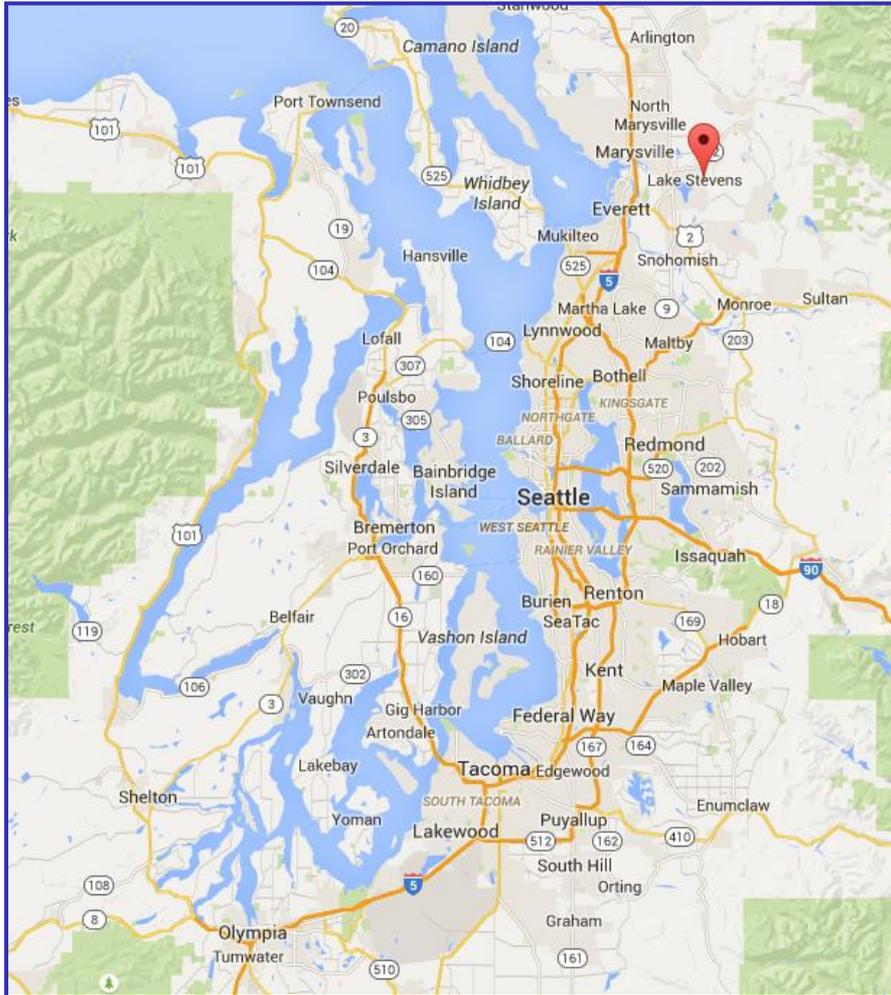


Restoration Recommendations

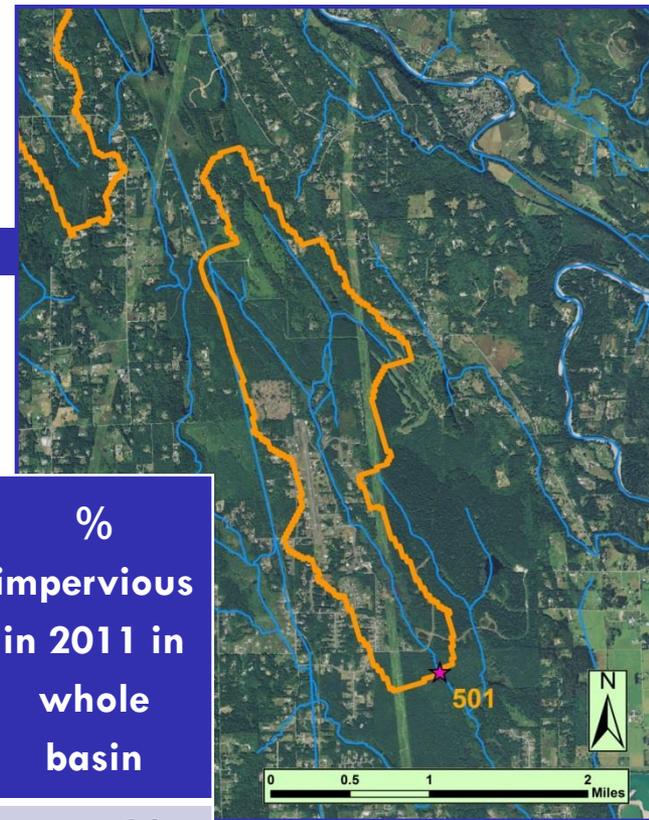
Likelihood action would help restore the basin:

not applicable	unlikely	possibly	likely	highly likely
0	1	2	3	4

Example 1: Little Pilchuck Creek (Snohomish)



Example 1: Little Pilchuck Creek

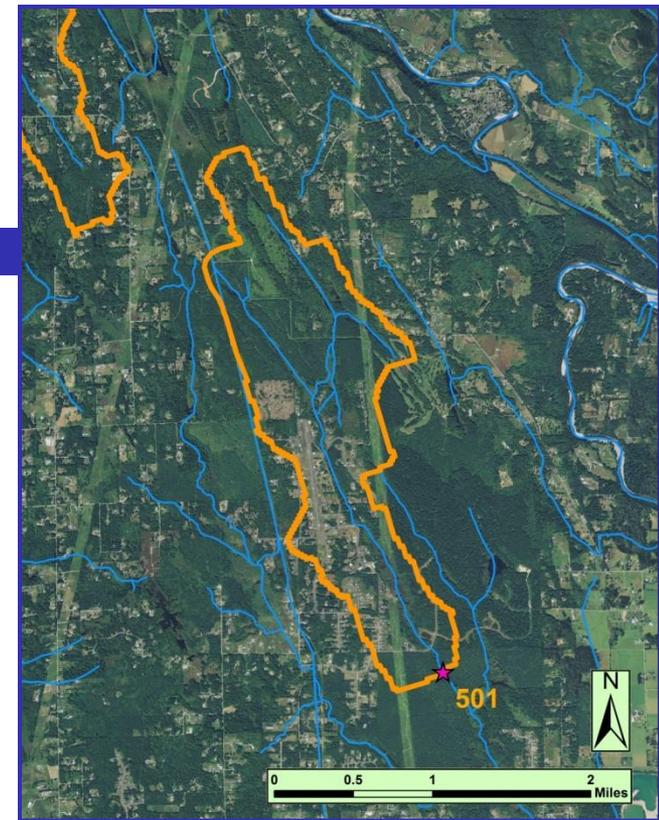


Basin area (acres)	% urban within basin 1-km of site	% urban in whole basin	% pasture in whole basin	% natural in 90-m buffer in whole basin	% impervious in 2011 in whole basin
1406.5	11.41%	11.89%	0.52%	93.43%	3.92%

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	1999-2012 Median
B-IBI										32	30	28					30

Example 1: Little Pilchuck Creek

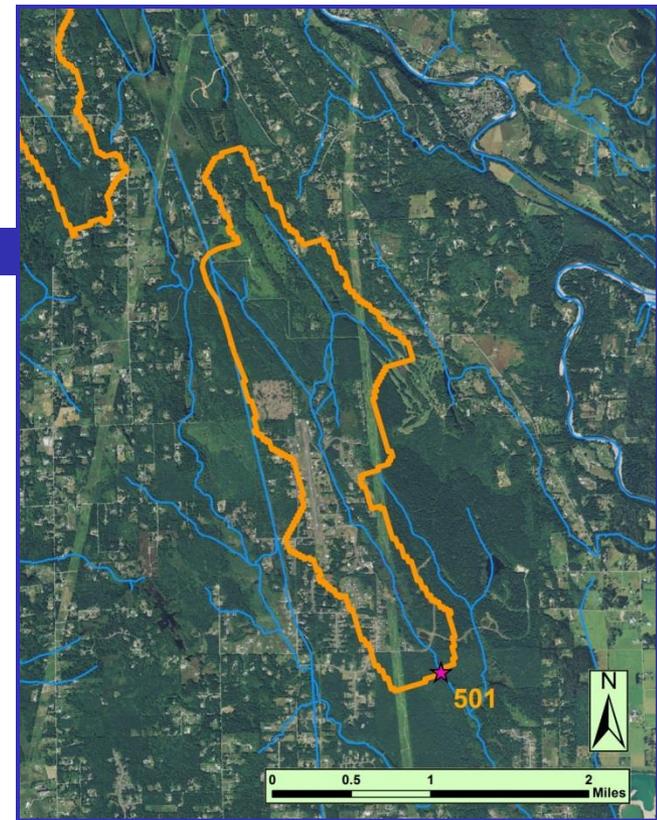
Restoration and Management Actions		Likelihood action would help restore the basin
In-stream	add wood	2
	add substrate	2
	enhance sinuosity	2
	replace culverts	2
	stabilize stream banks	2
Riparian	stabilize slopes	2
	plant vegetation, extend buffer	3
Agricultural BMPs	exclude livestock	0
	manage waste	0
	manage soil loss	0
Forest BMPs	road maintenance	0
	minimize clearcutting	0
	replant	0
Mining BMPs	mining BMPs	0
Stormwater BMPs	flow controls	4
	treatment	4
	maintain storage and treatment facilities	4
	street sweeping	1
Programmatic BMPs	limit pesticide use	2
	outreach and education campaign	3
	create incentives to follow BMPs	3
	purchase and protect property	3
	seed invertebrates	3
Is the basin at risk of further degradation?		4



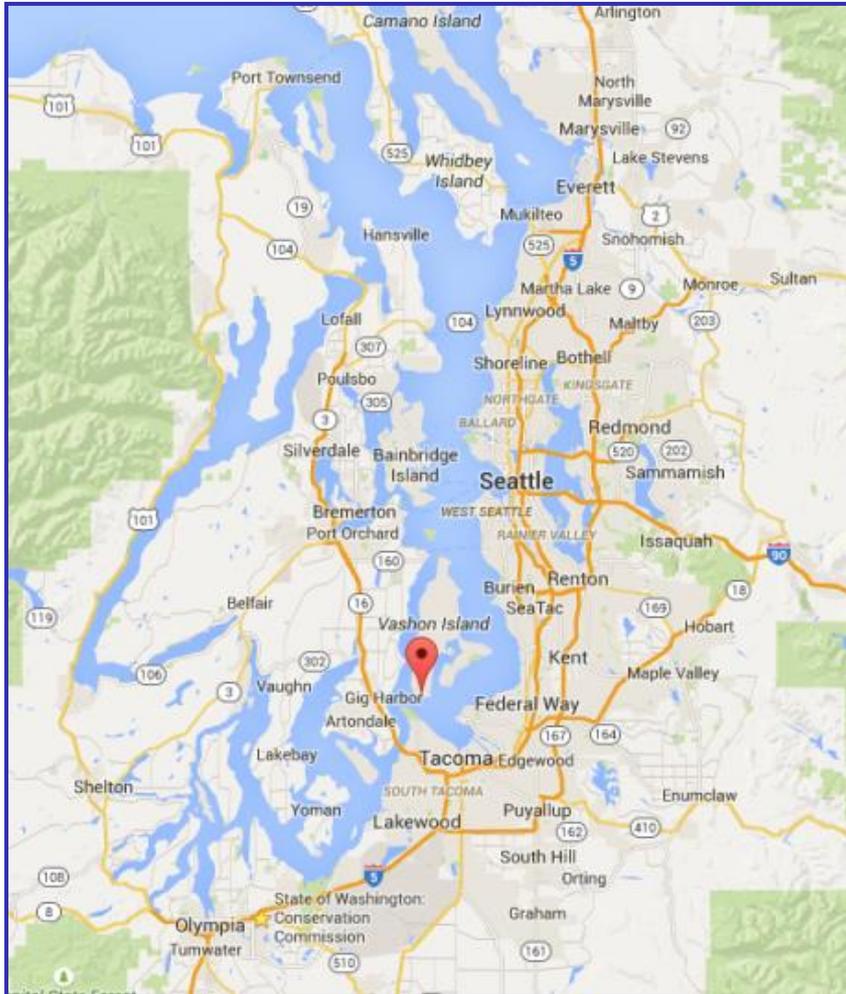
Example 1: Little Pilchuck Creek

Key restoration or management action(s) recommended:

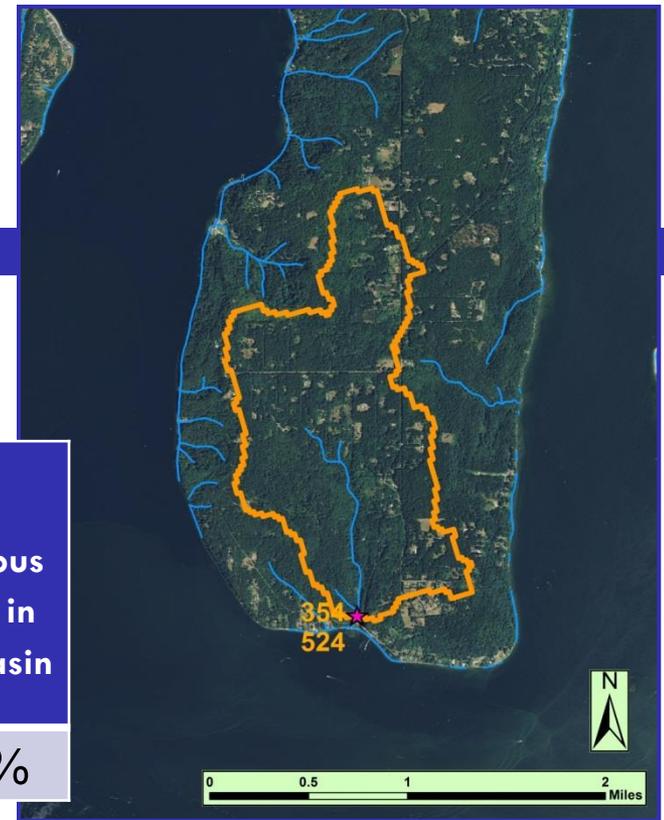
- stormwater BMPs, homes and airport
 - widen buffer where possible
 - outreach
- ✓ More development likely



Example 2: Tahlequah Creek



Example 2: Tahlequah Creek

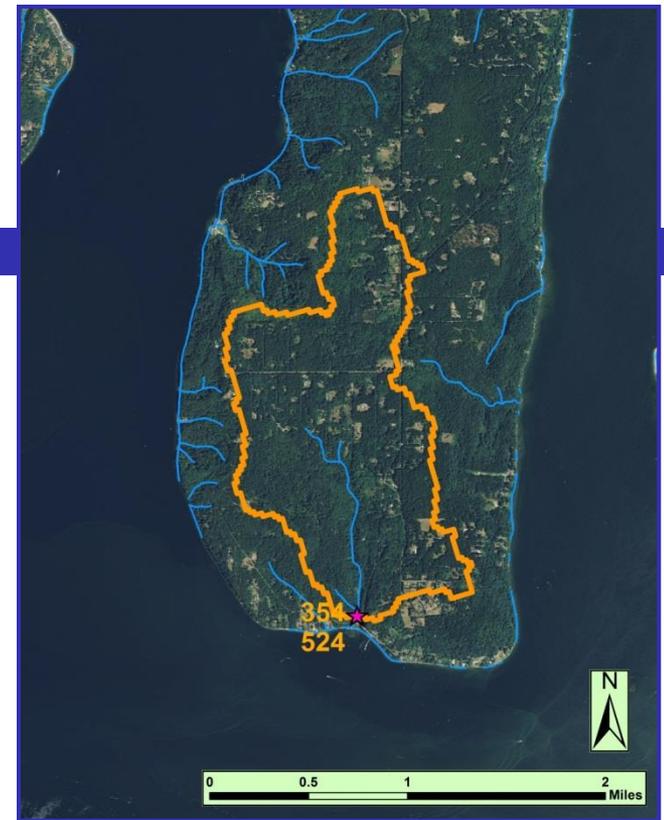


Basin area (acres)	% urban within basin 1-km of site	% urban in whole basin	% pasture in whole basin	% natural in 90-m buffer in whole basin	% impervious in 2011 in whole basin
984.1	3.4%	4.9%	0.05%	99.3%	2.37%

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	1999-2012 Median
B-IBI						22	24	32	34	32	28	24					28

Example 2: Tahlequah Creek

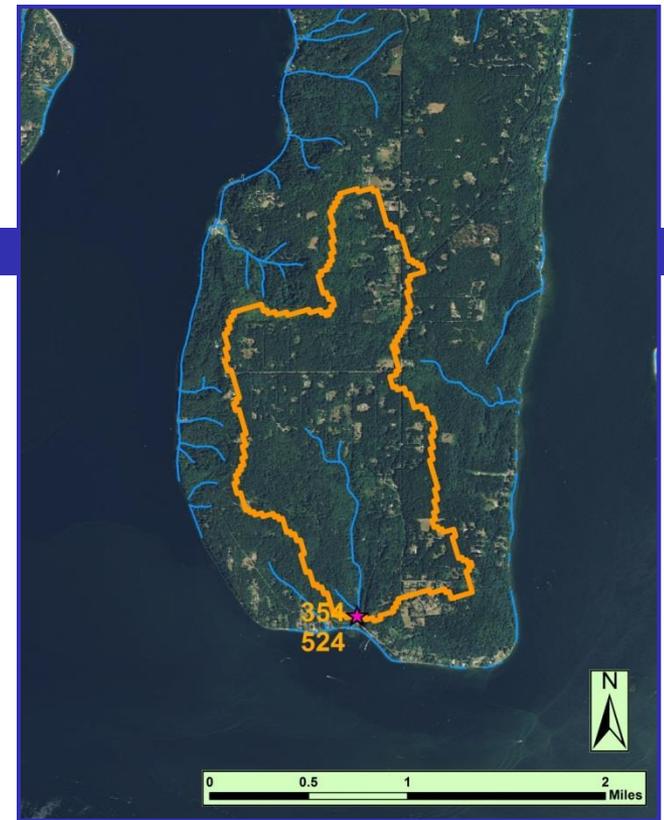
Restoration and Management Actions		Likelihood action would help restore the basin
In-stream	add wood	3
	add substrate	3
	enhance sinuosity	3
	replace culverts	2
	stabilize stream banks	2
Riparian	stabilize slopes	2
	plant vegetation, extend buffer	1
Agricultural BMPs	exclude livestock	2
	manage waste	0
	manage soil loss	0
Forest BMPs	road maintenance	0
	minimize clearcutting	0
	replant	0
Mining BMPs	mining BMPs	0
Stormwater BMPs	flow controls	3
	treatment	3
	maintain storage and treatment facilities	2
	street sweeping	2
Programmatic BMPs	limit pesticide use	2
	outreach and education campaign	2
	create incentives to follow BMPs	2
	purchase and protect property	2
	seed invertebrates	4
Is the basin at risk of further degradation?		4



Example 2: Tahlequah Creek

Key restoration or management action(s) recommended:

- Invertebrate seeding
 - Possibly stormwater BMPs
 - Possibly in-stream restoration
- ✓ Local support for restoration



Restoration and management actions recommended most:

protect what is there (zoning indicates basin at further risk)	200
flow controls (stormwater BMPs)	173
treatment (stormwater BMPs)	172
outreach and education campaign	157
maintain storage and treatment facilities	155
plant vegetation, extend buffer	150
create incentives to follow BMPs	148
limit pesticide use	137
seed invertebrates	137
add wood	130
add substrate	121
enhance sinuosity	120

Values are the sum of the 0-4 scores across the fair basins

Conclusions: Restoration

-  Protecting intact forest, buffers, in-channel habitat from further impacts is critical in “fair” basins
-  Basins with pre-1990 development would likely benefit from stormwater BMPs
-  Many “fair” basins zoned primarily for rural residential, but have a range of potential stressors
-  Basins with fewer stressors likely easier to fix
-  Stormwater retrofits most expensive actions

Next steps:

-  Prioritize basins for restoration and protection
-  Secure funding and develop partnerships for detailed planning and implementation
-  Increase scientific knowledge base, especially linking restoration actions and B-IBI responses

(and more in report...)

Project Web Page:

<http://pugetsoundstreambenthos.org/Projects/Restoration-Priorities-2014.aspx>

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Restoration Priorities

Strategies for Preserving and Restoring Small Puget Sound Drainages

Background

In fall 2013 the King County Water and Land Resources Division finalized a two year interagency agreement with the Washington State Department of Ecology funded by Environmental Protection Agency pass through funds as part of the Puget Sound Action Agenda Ecosystem and Protection Project. The purpose of this project is to develop strategies and cost estimates for preserving all Puget Sound drainages with "excellent" benthic index of biotic integrity (B-IBI) scores, and for restoring 30 drainages from "fair" to "good" B-IBI scores, two Action Agenda ecosystem recovery targets. This project is intended to accomplish near-term actions from the 2012/2013 Action Agenda including C2.1 NTA2: managing urban runoff.

This project relies on data from the Puget Sound Benthic Index of Biotic Integrity (B-IBI) to be identified. A geographic information system (GIS) including land cover data is being developed.

King County staff will work with "fair" scores and stakeholders. Once identified, activities on a geographic information system (GIS) individual restoration projects.

King County will also purchase, conserve

Documents and Presentations

[B-IBI Restoration Decision Framework and Site Identification](#), Jo Wilhelm, Debra Bouchard, Chris Gregersen, Chris Knutson, Kate Macneale
Explain the criteria used for selecting and prioritizing "Fair" B-IBI sites for restoration actions and list the selected sites. This is step one of addressing the Puget Sound Partnership's B-IBI ecosystem recovery target to restore 30 B-IBI sites from "Fair" to "Good" B-IBI. The next step is to recommend restoration and conservation actions and estimate associated costs.

[Deliverable for Task 2: Geospatial Analysis](#), Chris Gregersen, Jo Wilhelm, Chris Knutson

[Quality Assurance Project Plan \(QAPP\)](#), Jo Wilhelm, Chris Gregersen

[Signed Interagency Agreement \(C1300210\)](#), WA Dept of Ecology, King County WLRD

[PNW Chapter of the Society for Freshwater Science](#) [\[show\]](#)

October 2014, Bellingham, WA

[King County Science Seminar](#) [\[show\]](#)

October 2014, Seattle, WA

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Snoqualmie Tribe: Tim Miller

 Stakeholder Workgroup