

SHORELINE MASTER PROGRAM INVENTORY & CHARACTERIZATION

Department of Ecology

May, 2010

Inventory & characterization

- ◆ Foundation for SMP!
 - ◆ Tells you what's on the shoreline
 - ◆ Identifies ecosystem processes & functions
 - ◆ Identifies potential sites for restoration, protection and public access
 - ◆ Guides development of strategy leading to policies, regulations & environment designations
 - ◆ Sets baseline for cumulative impacts analysis

Developing the inventory

- 1) Scope out the issues
- 2) Identify appropriate data sources
- 3) Gather data & information
- 4) Prepare maps



Kayak Point, Snohomish County

Inventory-- scoping

- ◆ Intent of scoping – focus on relevant issues & data
- ◆ Identify shoreline issues & opportunities
 - ◆ What do you already know?
 - ◆ Look at local and WRIA plans, Coastal Atlas, etc.
 - ◆ What are your shoreline management issues?

Table 7-1 Potential shoreline ecological issues

Water flow/quantity	Water quality	Habitat
Flooding	Storm water runoff	Loss of riparian vegetation
Channel movement/migration	Sediment in water column	Loss of upland habitat
Floodplain disconnected from streams	Erosion and sediments in streams	Habitat fragmentation
Potential flooding due to climate change and sea level rise	High temperature	Loss of eel grass, forage fish, shellfish, etc.
Upstream or local dams and levees	Nutrients and pathogens	Beach erosion

Inventory – data sources

- ◆ Identify data & information sources
 - ◆ To understand the issues, develop questions
 - ◆ Link questions to data & information sources
 - ◆ Information should be relevant to issues
 - ◆ For example, lake shorelines – no need to list Puget Sound forage fish species
 - ◆ No hyporheic info for lakes – don't worry about it!



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Shoreline Management

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Integrated reports, catalogs, multi-feature data sets, and internet mapping sites

Data type	Link to source
Reports, projects and research organizations	<ul style="list-style-type: none"> • Limiting Factors Analysis: order CDs from State Conservation Commission • Columbia Basin subbasin plans • USGS Studies and Research Projects • Conservation priorities: An assessment of freshwater habitat for Puget Sound Salmon: prepared by the Trust for Public Lands • Puget Sound Nearshore Ecosystem Restoration Project • Northwest Salmon Recovery Planning • NOAA Northwest Fisheries Science Center
Catalogs and multi-feature datasets	<ul style="list-style-type: none"> • Ecology publications - by watershed • DNR Nearshore Habitat Program • DOT geodata catalog • DNR GIS catalog • IAC Natural Resources Information Portal • University of Washington Libraries - Map Collection • USGS geo-spatial data

Data Available – Coastal Atlas

• Biological/Habitat Features

- Wetlands
- Historic Estuary Maps
- Pocket Estuaries
- Dunegrass, Surfgrass
- Kelp, Eelgrass
- Salt Marsh
- Low Marsh

• Physical Features

- Drift Cells
- Slope Stability
- Water Bodies (100k)
- Water Courses (100k)

• Regulated Features

- Commercial Shellfish
- Flood Zone
- Drinking Water Wells
- Category Water (5, 4C, 4B, 4A, 2, 1)

• Modifications

- Piers and Docks
- Shore Modification

• Jurisdictional Delineations

- Watershed (WRIA) Boundaries
- Sub Basins
- Counties
- Cities
- Township/Range/Section

• Transportation Features

- Major Roads
- Streets
- Railroads

• Background Imagery

- USGS Topo Maps
- Aerial Imagery
- Hillshade
- Nautical Charts

• Satellite Imagery

- Land Use/Land Cover 1991, 1996, 2001

• Other Imagery

- Oblique shoreline photos 1976-77, 1992-'97, 2000-02, 2006

Inventory – Mapping

Built Environment

- ◆ Areas of **special interest** (e.g., toxic/hazardous waste sites, priority habitats, eroding shorelines, redevelopment areas).
- ◆ Land and shoreline **ownership**, public tidelands and Public Trust Doctrine areas.
- ◆ Pertinent **plans** and regulations: zoning, comprehensive planning, revitalization plans, historic districts, etc.
- ◆ **Public areas**: parks, open spaces, trails (existing and proposed), existing and potential public access sites.
- ◆ Shoreline **modifications** (bulkheads, docks, dikes, etc.).
- ◆ **Shoreline uses**: residential, commercial, industrial, ports, water-oriented, non-water-oriented uses.
- ◆ **Transportation** and utility systems.

Inventory – Mapping

Environmental

- ◆ Shorelines of statewide significance
- ◆ Significant natural resources: vegetation, topography, etc.
- ◆ Degraded areas.
- ◆ Drainage or hydrological systems, flood protection, irrigation, etc.
- ◆ Critical areas.
- ◆ Channel migration zones and floodplains.

Other

- ◆ Archeological and historical sites and cultural resources.

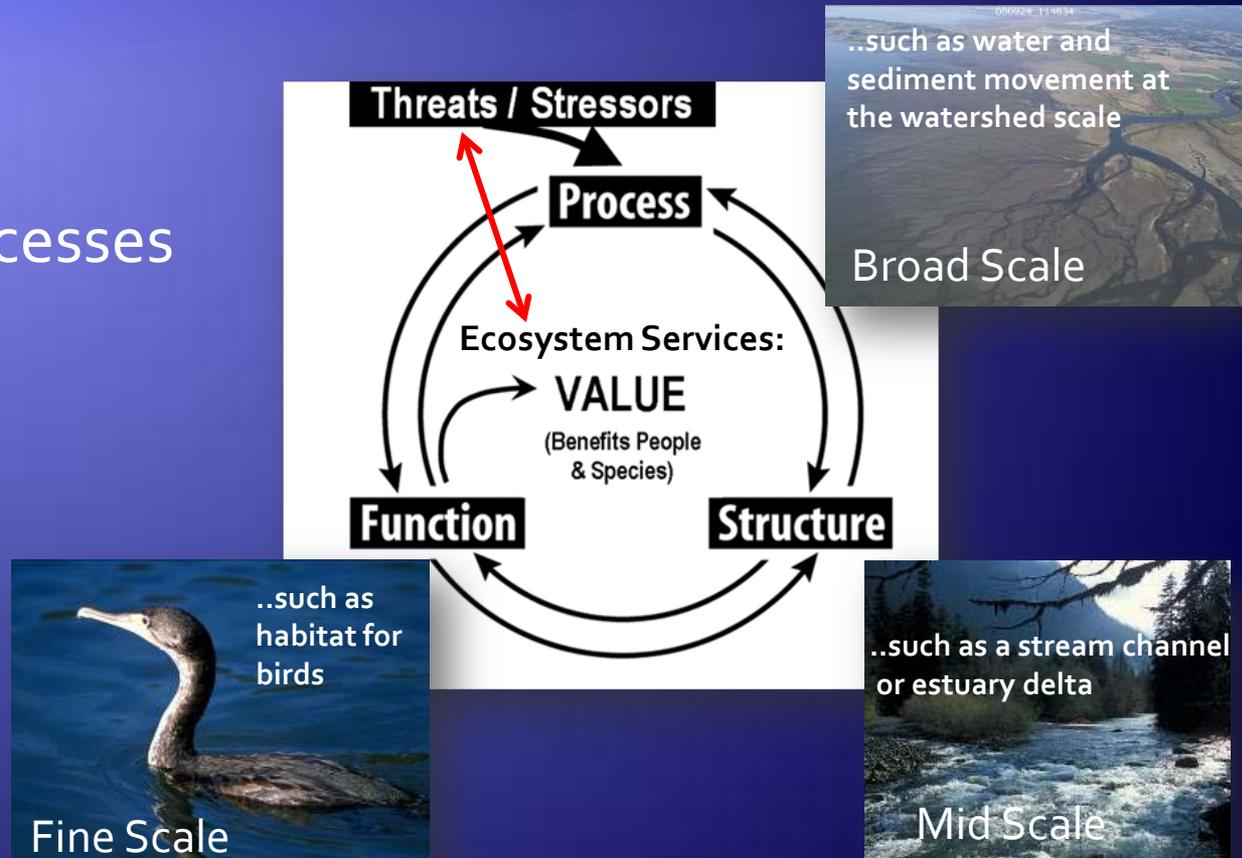
Inventory – Example of Issues and Questions

Table 7-2 Shoreline issues and data-related questions

Issue	Questions
Beach erosion	Has the source of the sediment supply to the beach been changed? Have bulkheads reduced the movement of sediment to the beach?
Flooding	What are the storm runoff processes? What are potential land management impacts to storm runoff processes in the watershed? Are floods increasing in magnitude and frequency? Have depressional wetlands been filled or altered?
Channel movement	Are there potential hazards such as avulsion, erosion or flooding due to channel migration?

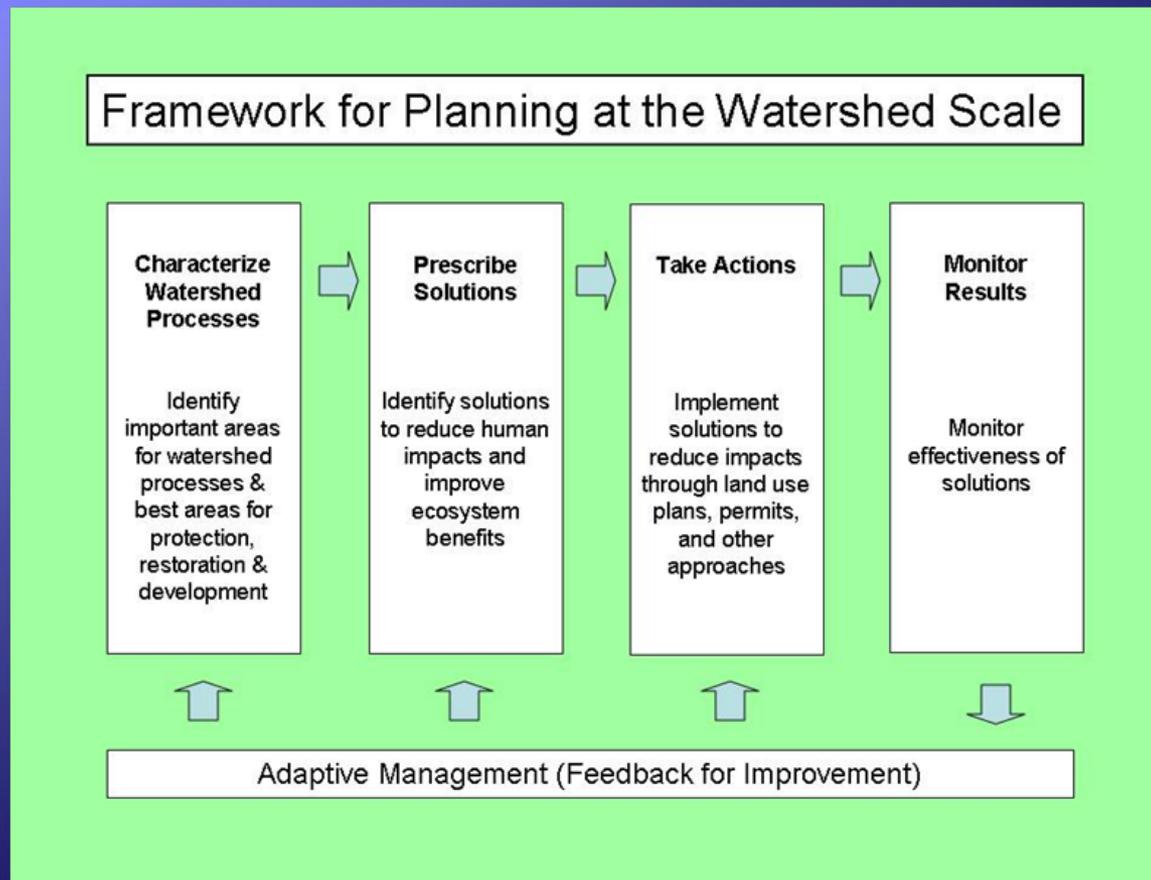
Characterizing Ecosystem Processes - Purpose

- ◆ Ecosystem Processes Drive Reach & Site Scale:
 - ◆ Structure
 - ◆ Function
 - ◆ Shoreline Processes



Characterization + Inventory

- ◆ Information on ecosystem processes and finer scale information helps inform SMP plan development



Characterization - analysis

- ◆ Use inventory information to help answer questions related to specific issues
 - ◆ Establish the relationship between processes and functions
 - ◆ Identify impairments to processes and functions
 - ◆ Briefly discuss historical impacts, if relevant
 - ◆ If needed, relate geology to shoreline issues

Characterization - solutions

- ◆ Develop preliminary recommendations for shoreline management
 - ◆ What are appropriate types and intensity of development?
 - ◆ What are the best areas for restoration and protection?
 - ◆ What types of mitigation are needed in certain shoreline areas?

Developing the inventory

- ◆ Link issues and questions to data source

Issue	Question	Data Source
Flooding in City of Issaquah	What is the primary cause of flooding?	Basin Plan and HSPF modeling

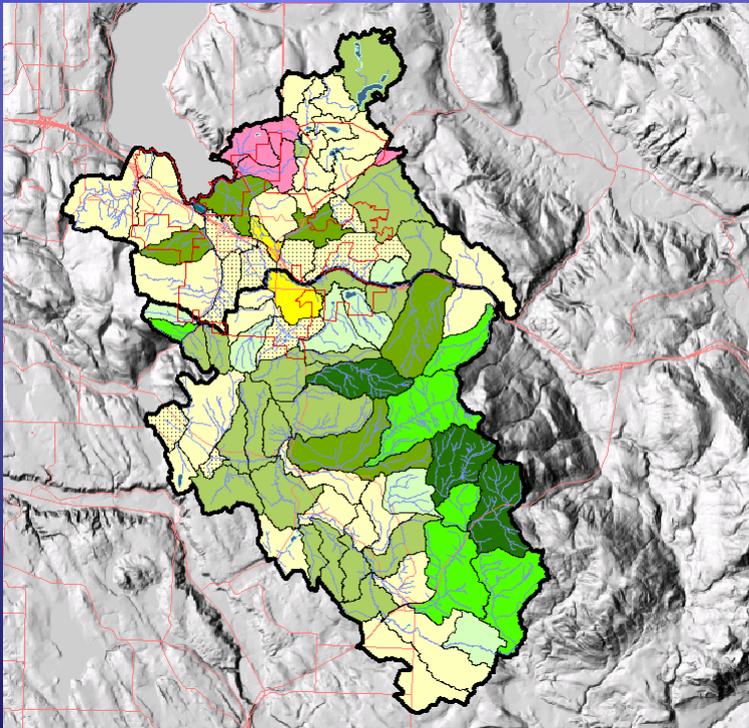
Conducting the characterization

- ◆ For Puget Sound communities, Ecology will provide:
 - ◆ Coarse scale characterization of ecosystem processes
 - ◆ Web-based maps showing areas important for protection & restoration
- ◆ Lots of work left for you

Conducting the characterization

- ◆ Determine shoreline reaches and contributing watersheds
- ◆ Conduct analysis to characterize processes and functions
- ◆ Prepare inventory and characterization report
 - ◆ Be brief! Most of the inventory and analysis can be placed in tables.

Characterization - watersheds



- ◆ Determine what watersheds directly influence the shoreline
 - ◆ Check local watershed or WRIA plans
 - ◆ Review Ecology “hydrologic units”

Characterization - reaches

- ◆ Determine shoreline reaches
 - ◆ Use maps and aerial photos
 - ◆ Consider physical & biological changes – gradient, confinement, vegetation, drift cells, tidal influence, land use
 - ◆ Review marine inventories, DNR ShoreZone Inventory
 - ◆ Classify shoreline types – dunes, sand-gravel beaches, estuaries, glacial scour lakes, etc.
- http://www.ecy.wa.gov/programs/sea/sma/st_guide/SMP/inven_analysis/analysis/eco_functions/shore_types.html

Characterization - reaches



Reach D, Mainstem Issaquah Creek

Reach X, East Fork Issaquah Creek

City of Anacortes SMP Update

- ◆ Using existing information the City's shoreline was characterized
- ◆ A template using the four step watershed planning framework was applied
- ◆ This involved identifying the processes, the type of alteration, then solutions and actions

City of Anacortes SMP Update

- ◆ Using air photos, inventory data and an analysis table format, 8 shoreline designations were changed
- ◆ An in-lieu fee program to help implement shoreline restoration was set up
- ◆ Application of the analysis table required only two meetings with the City and approximately one week of work
- ◆ The analysis table was designed to be web-based and accessible to citizens and applicants

Reach: Shannon Pt. & Fidalgo Head
Designation: Natural/Conservancy

Reach: Lovric's Marina
Designation: Urban

Reach: East of Lovric's Marina
Designation: Shoreline Residential 1

Reach: Cap Sante North
Designation: Urban Maritime Expanded

Reach: Cap Sante
Designation: Residential 1 & Conservancy

Reach: Cap Sante Marina and Industrial Area South
Designation: Urban & Urban Maritime

Reach: North Weaverling Spit
Designation: Residential 1

Reach: Weaverling Spit
Designation: Urban

Reach: South Fidalgo Bay

Reach: Padilla Bay SW
Designation: Conservancy

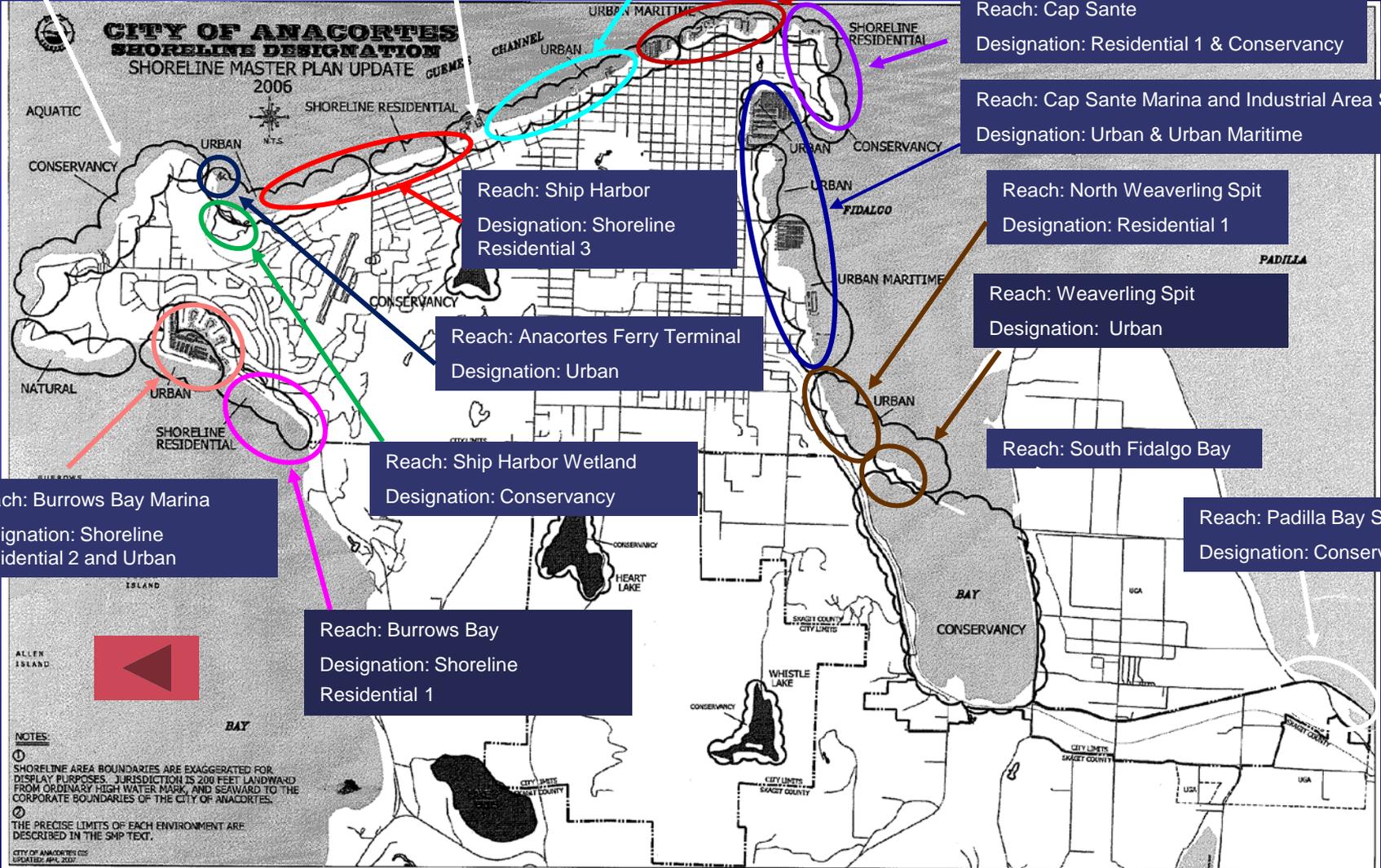
Reach: Ship Harbor
Designation: Shoreline Residential 3

Reach: Anacortes Ferry Terminal
Designation: Urban

Reach: Ship Harbor Wetland
Designation: Conservancy

Reach: Burrows Bay
Designation: Shoreline Residential 1

Reach: Burrows Bay Marina
Designation: Shoreline Residential 2 and Urban



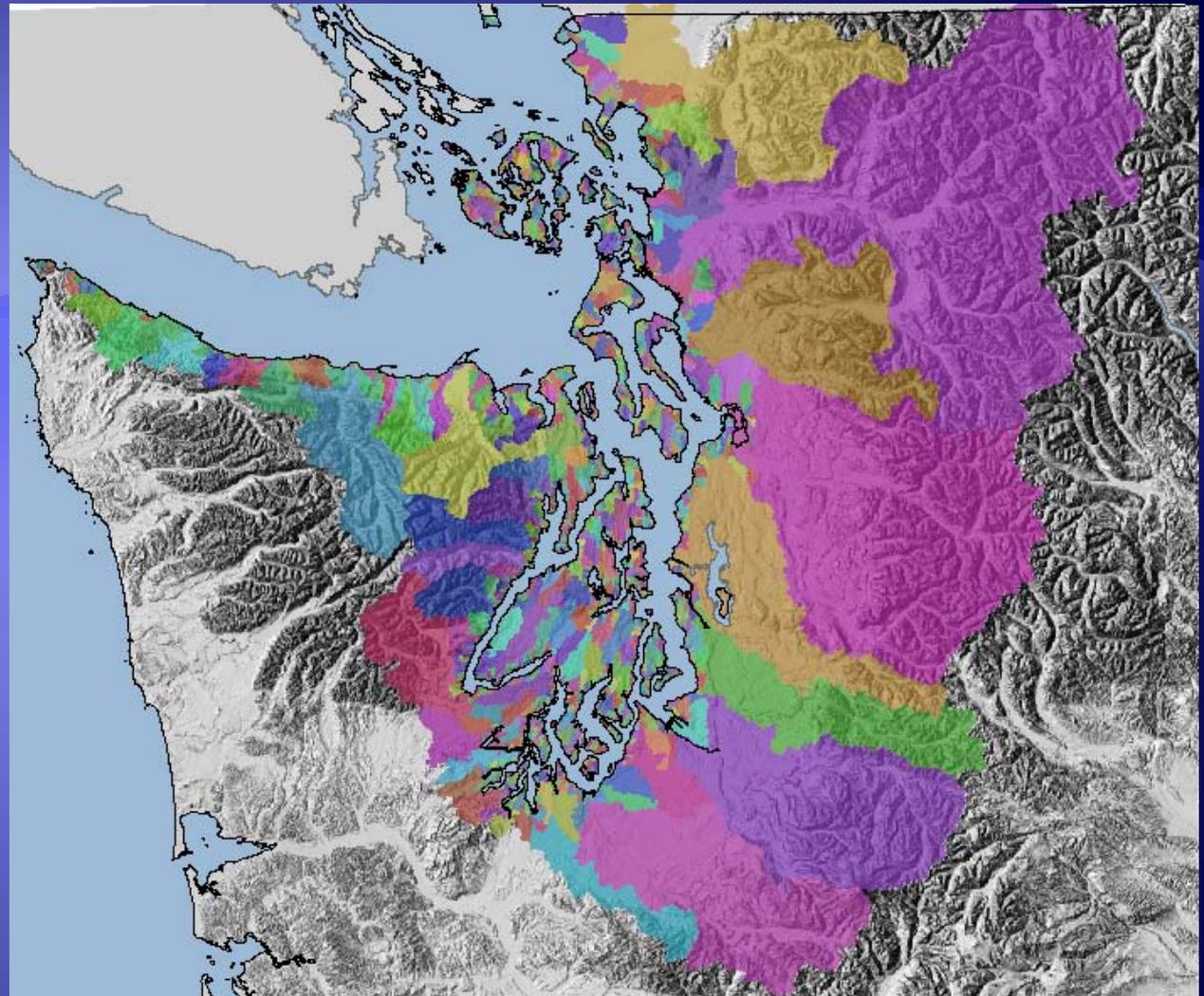
Burrows Bay - Summary of Inventory & Characterization Analysis Protection & Restoration Measures

Reach Name and Existing Shoreline Designation	Assessment of processes & functions	Level of impairment to processes & functions	Recommended protection & restoration measures
<p>Burrows Bay – Shoreline Residential</p> <p>Shoreline Oblique Photo</p>	<p>Ecosystem processes :</p> <p><u>Partially exposed shoreline</u> with low bluffs and berms of unconsolidated material with <u>low present</u> Moderate provide spawning Intertid patchy</p> <p>Shoreline</p> <p>The eas shoreline spawning Intertid patchy</p>	<p>Ecosystem processes:</p> <p><u>Shoreline armoring</u> occurs along the majority of this shoreline,</p> <p><u>Shoreline Residential 1</u>, provides minimum 75 foot buffer (revegetated) and setback/buffer from OHWM. If not possible due to site constraints variance will be allowed. Cost of buffer area lost under variance will be calculated (based on replacement cost elsewhere in city) and in-lieu fee assessed. Fee will be specifically linked to projects described in restoration plan.</p>	<p>Ecosystem processes:</p> <p>Provide adequate setback/buffer for new structures so that shoreline required for duration of life of Burrows Bay will be removed and shoreline armoring</p> <p>Notes:</p> <p><u>tidal lance habitat</u> at Burrows Bay will be removed by shoreline armoring of</p> <p>Environment</p> <p>assessment of processes and functions and degree of impairment.</p>

Characterization
Results Available
for 19 WRIAs

For Water Flow
Process Only

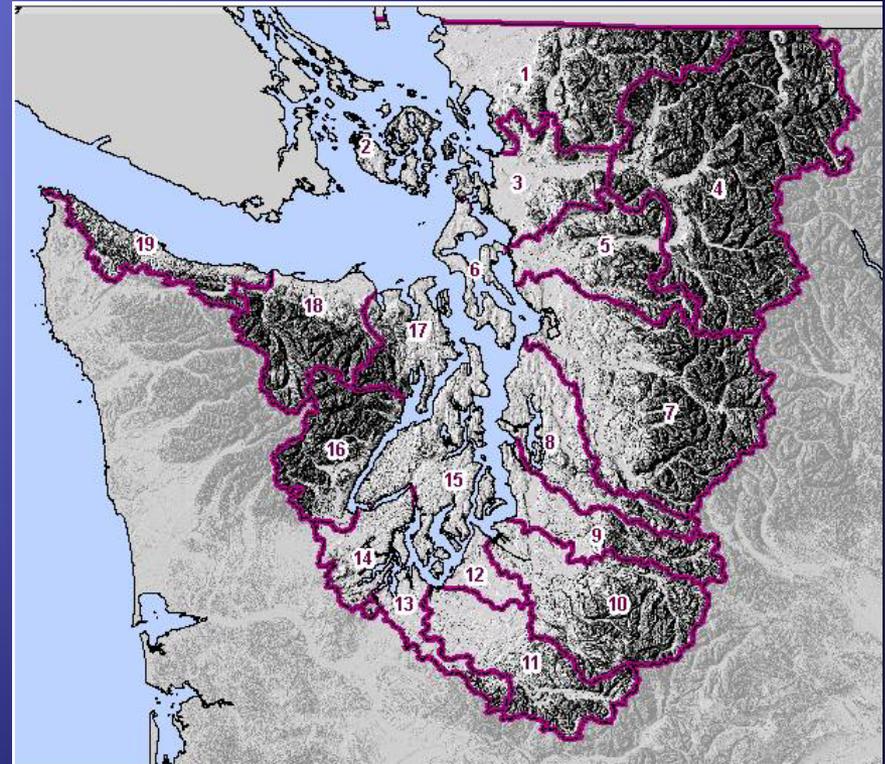
Sufficient for
meeting
characterization
of ecosystem
processes
requirement



PUGET SOUND CHARACTERIZATION PROJECT -

Phase I Product Results – 4/2010

- ◆ Assessment of Water Flow Processes for 19 WRIA's , identifies areas most suitable for:
 - ◆ Protection
 - ◆ Restoration
 - ◆ Higher intensity land uses

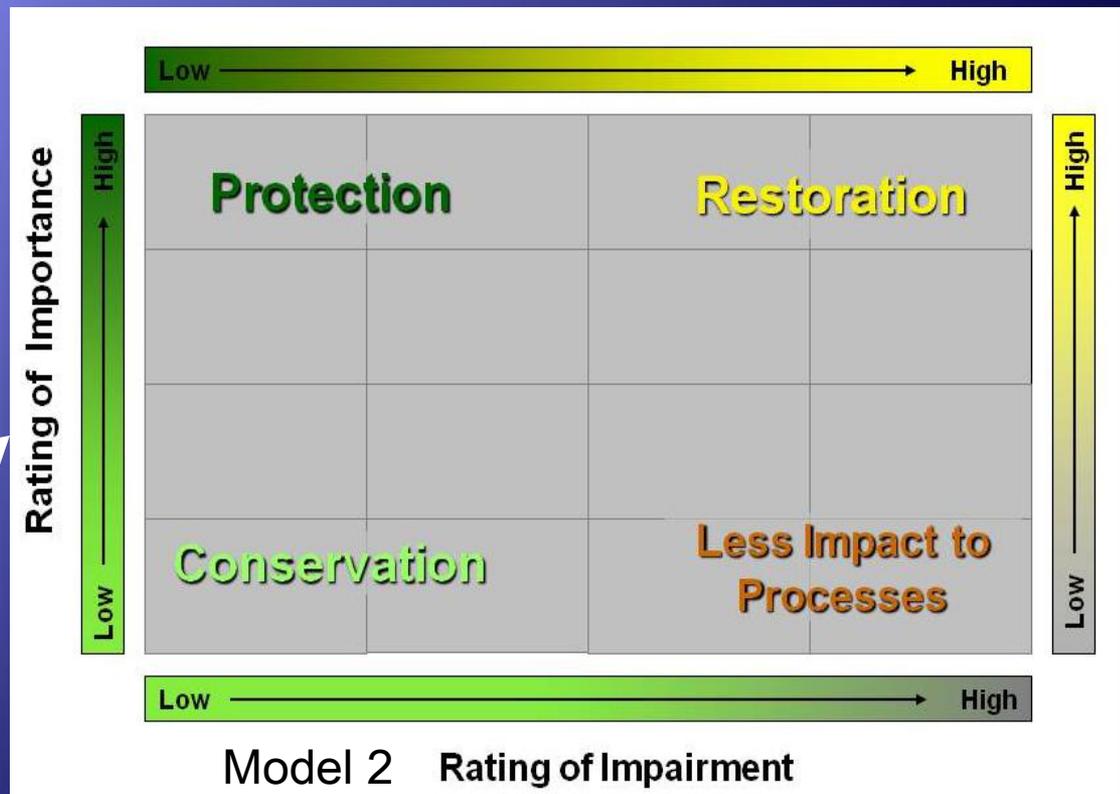


Phase I Product Results

- ◆ Water Flow Model Results

- ◆ Protection
- ◆ Restoration
- ◆ Less Impact to Processes

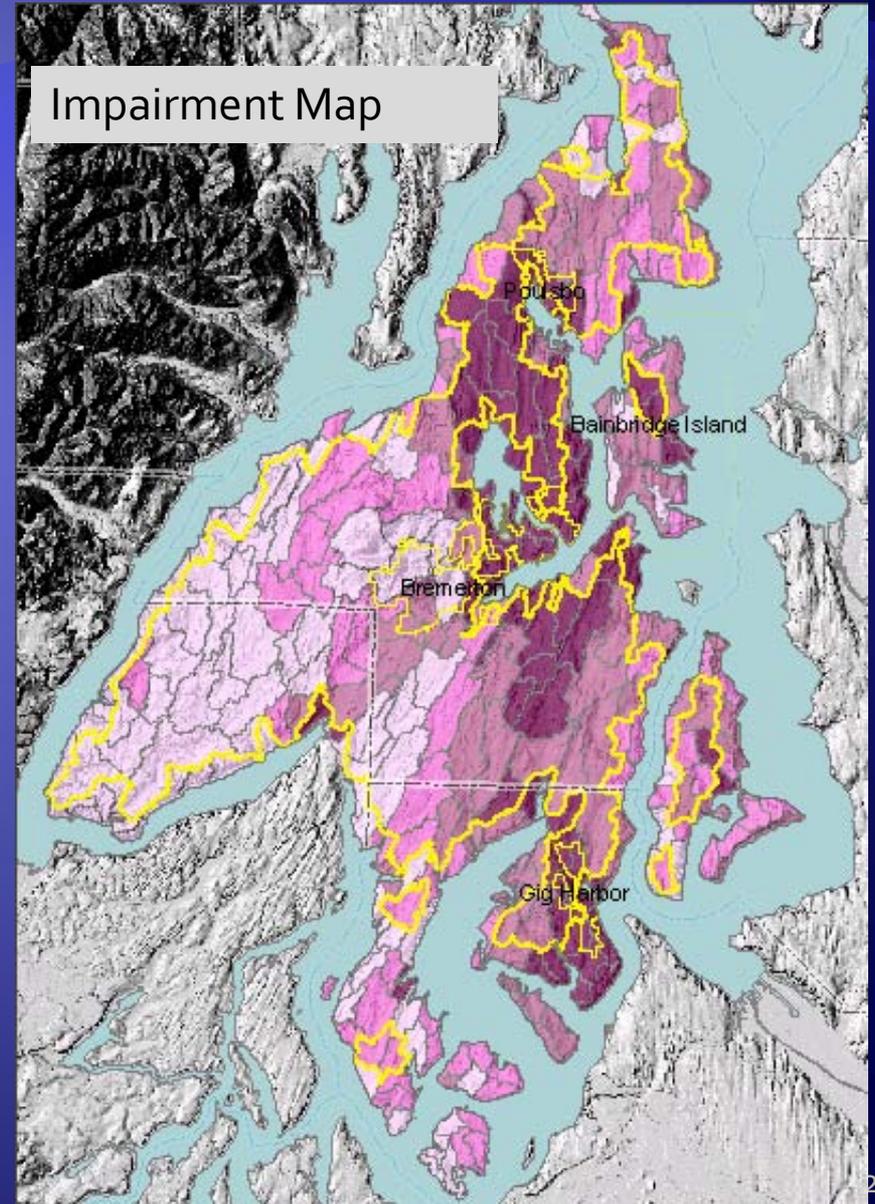
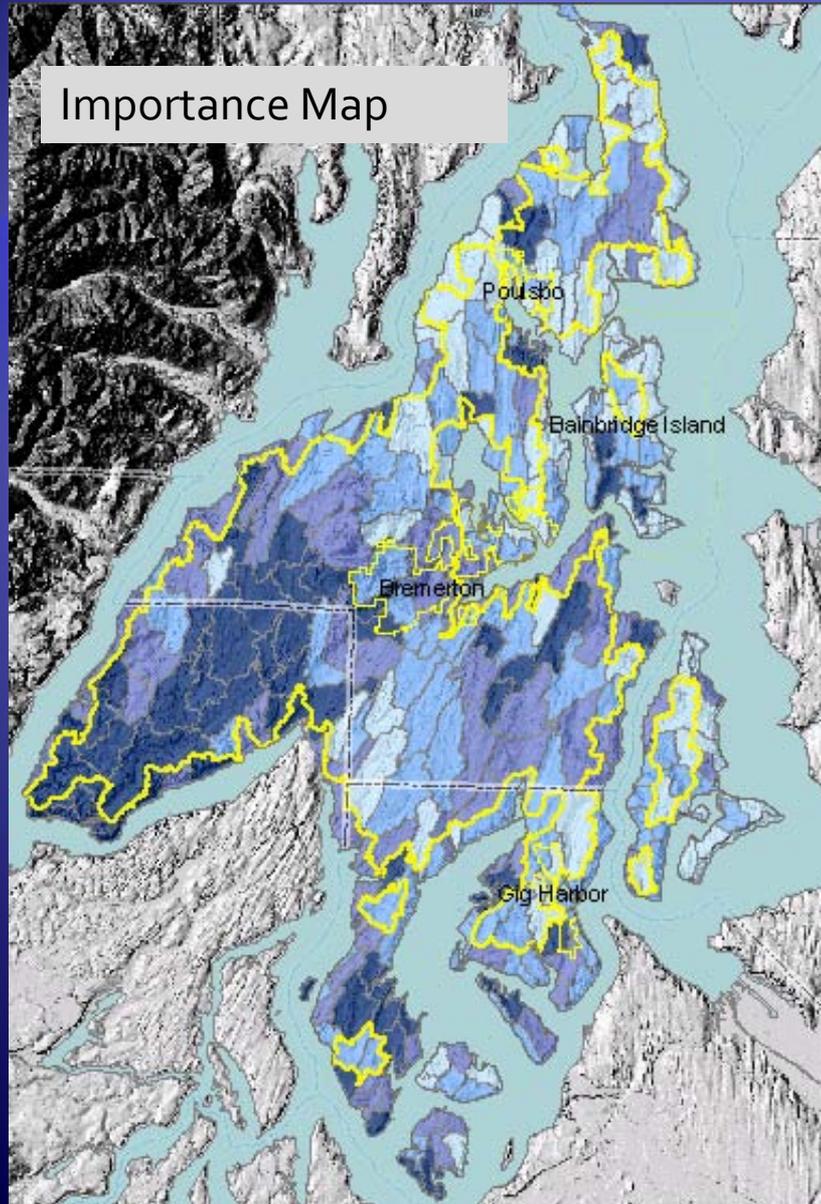
Model 1



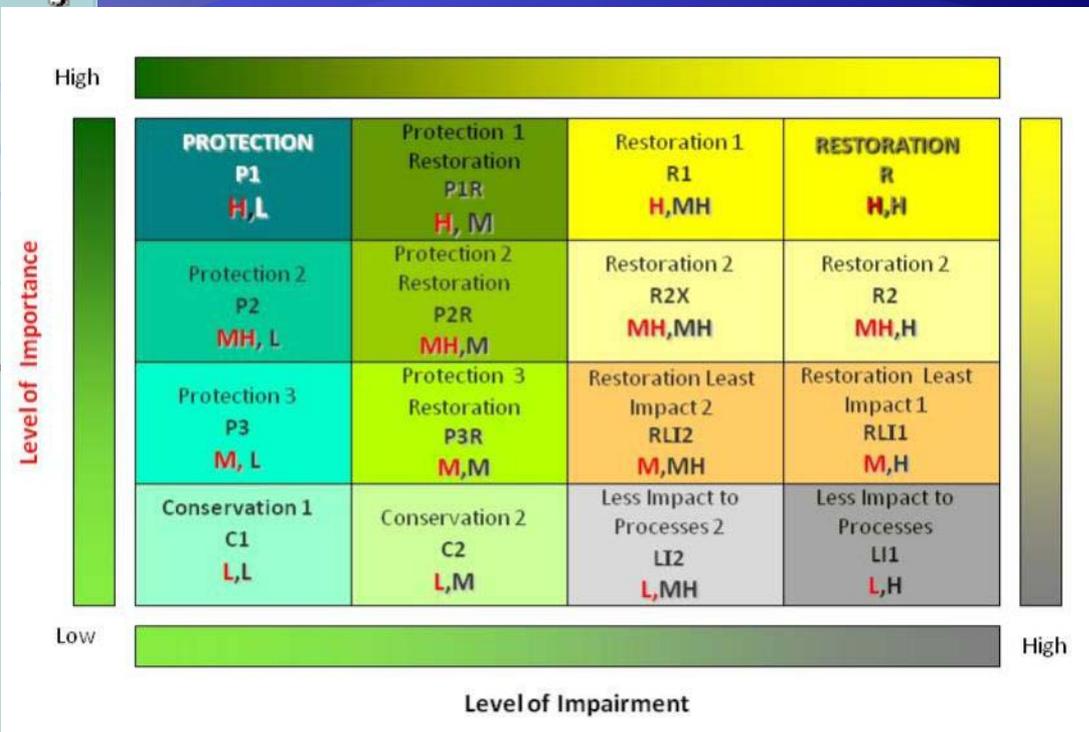
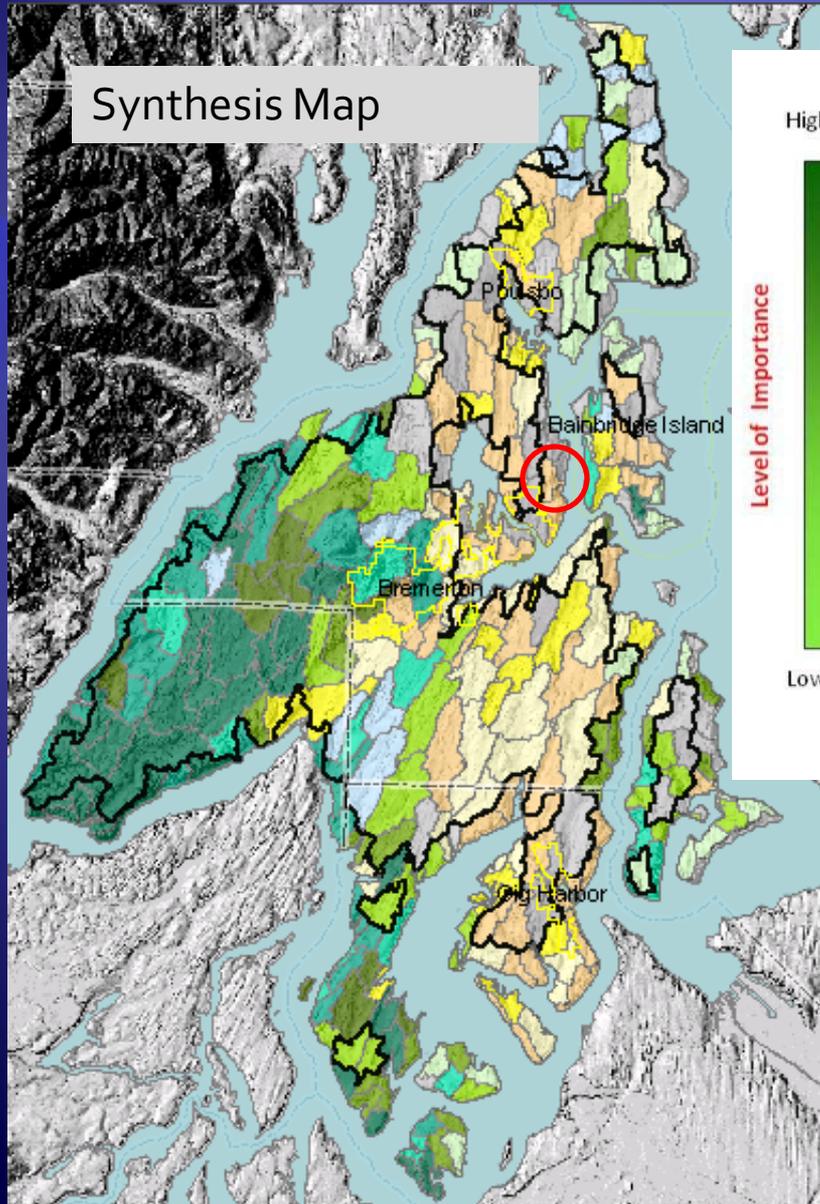
Interpreting & Applying Characterization Results to SMP's

- ◆ View model results for each component of the process:
 - ◆ Delivery
 - ◆ Surface storage
 - ◆ Groundwater - Recharge and Discharge

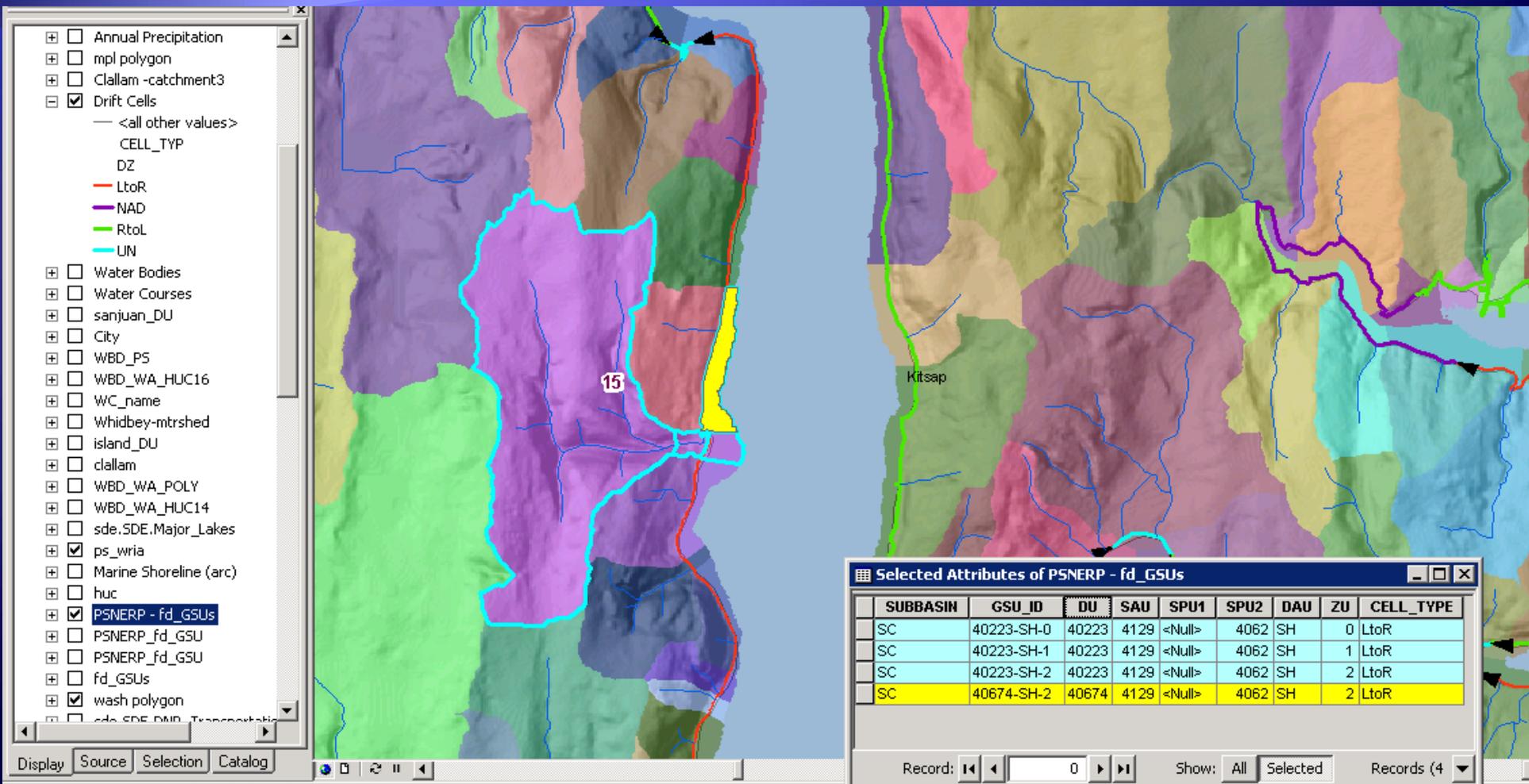
Overall Results for Water Flow Process



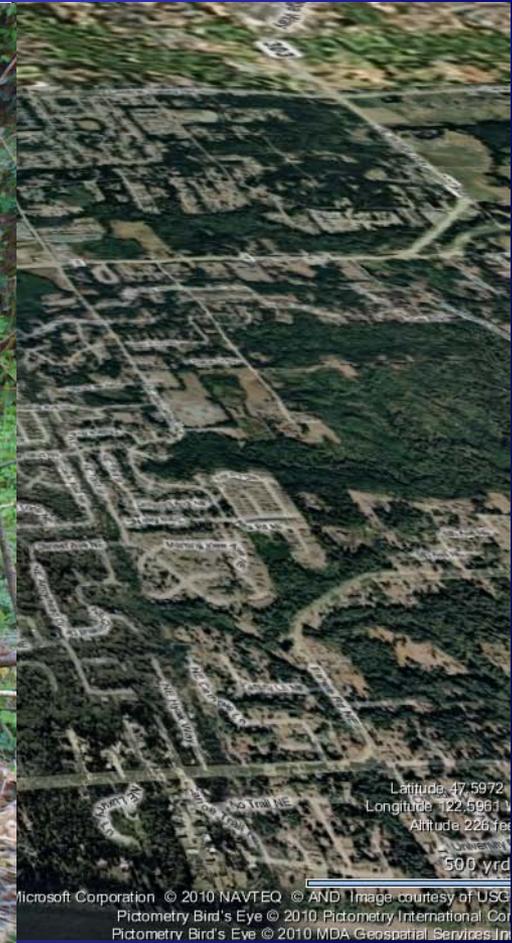
Overall Results for Water Flow Process



Analysis Units – Illahee Creek



Shoreline Issue – Increased Sediment Delivery



Downstream Erosion and Bedload Transport and Deposition is Occurring

Conducting the Inventory & characterization – Illahee Creek

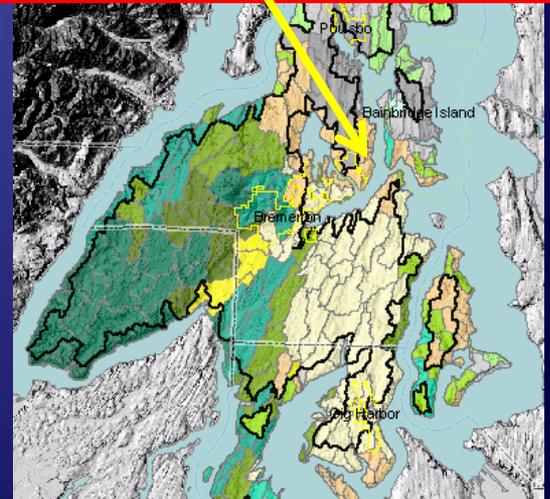
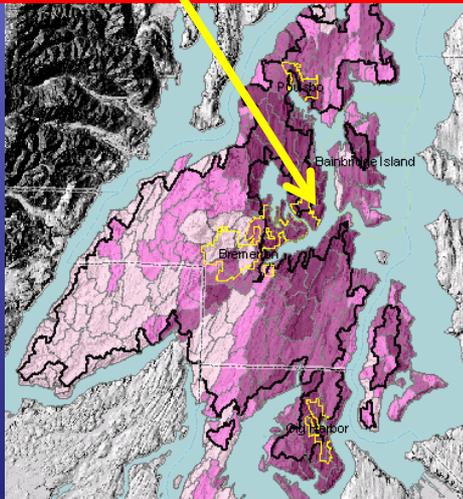
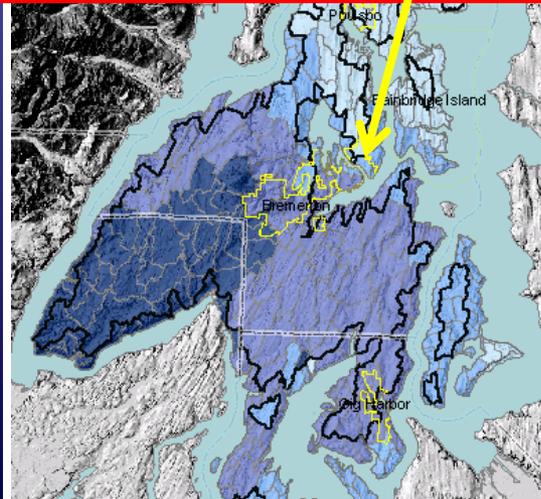
- ◆ Use analysis template to address issues (Issaquah example)

Shoreline Issue	How have ecosystem processes been changed relative to issue?	Solution	Solutions and Actions: Recommended protection & restoration measures and environment designations
High sediment delivery to shoreline. Building of delta – affecting public access to dock and habitat functions.	Sediment Processes have been impaired within the shoreline	Requires additional analysis. Use characterization results and other reports to determine source of sediment and transport mechanism	Not determined

Interpreting Results - Delivery

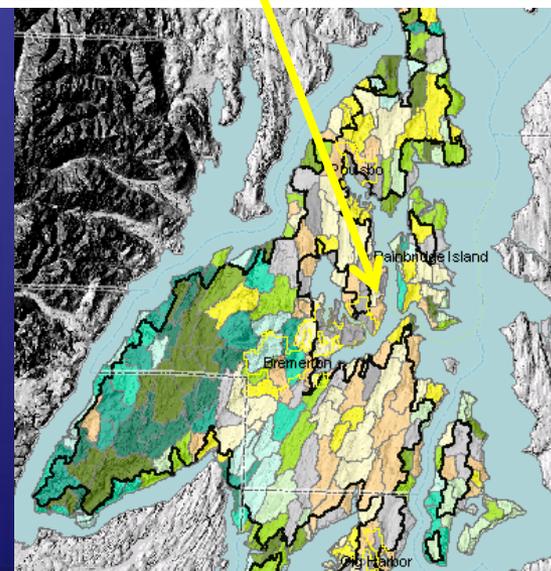
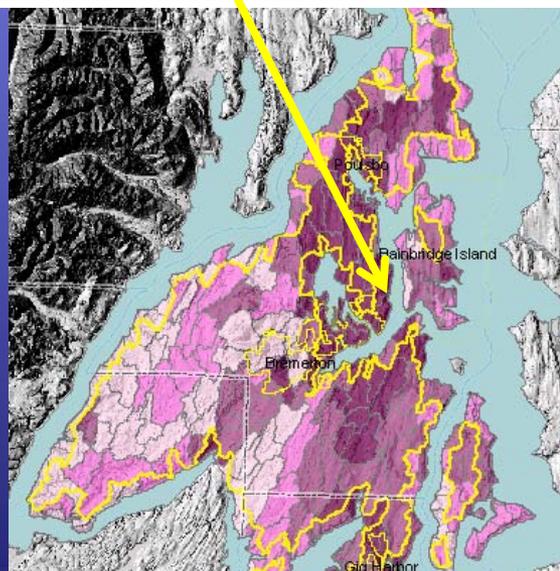
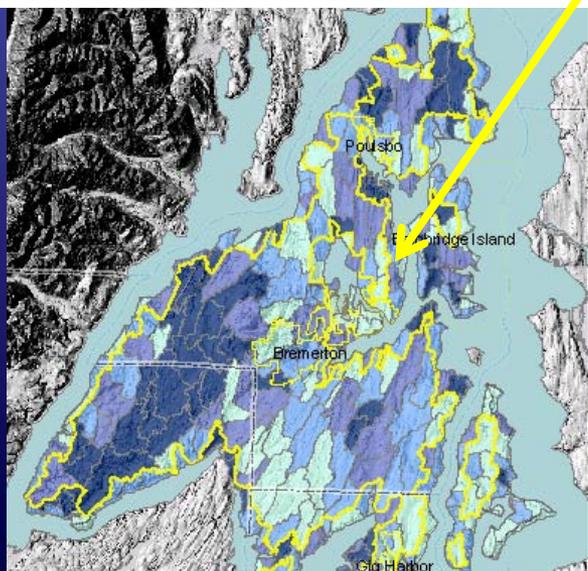
TABLE 2 - Interpreting Map Results- Understanding What Important Areas Do and Possible Actions to Offset Impairments Identified

Process Component	Description of Component	Important Areas - Look for :  and locate the following features within Hydro Unit	Areas of Higher Impairment Look for:  and locate the following land cover types with Hydro Unit	How Impairment Affects Process Component	General Actions if Synthesis Maps Show: 	General Actions if Synthesis Maps Show: 
Delivery Maps – Mountainous Group 	The type of precipitation and timing for its movement across the landscape in a hydro unit.	 Rain-on-snow & Snow Dominated areas	 Loss of Forest Cover in Rain-on-snow and Snow Dominated areas.	Increases the rate of snow melt which in turn increases downstream flooding.	 Reforest	Minimize logging in rain-on-snow and snow dominated areas.
Delivery Maps – Lowland & Coastal Groups 	The type of precipitation and timing for its movement across the landscape in a hydro unit.	Rainfall dominated areas (which would occur throughout the unit)	 Impervious surfaces	Prevents infiltration and reduces residence time on the surface, thus allowing precipitation to flow overland and reach streams and wetlands more rapidly.	 Re-establish natural cover or use other green infrastructure measures	For new development minimize forest clearing through clustering (approximately 65% or more forest retained)

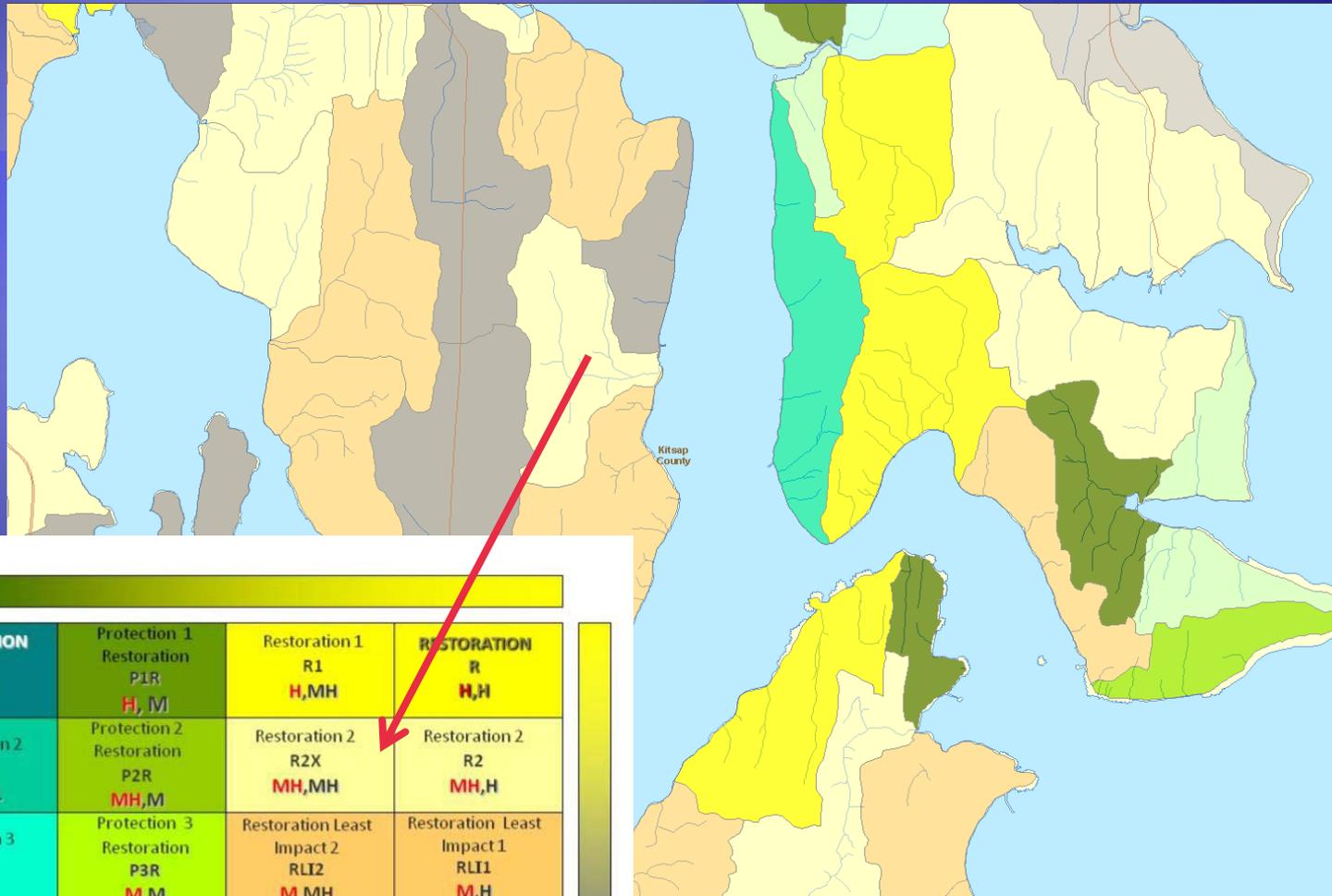


Interpreting Results - Storage

TABLE 2 - Interpreting Map Results- Understanding What Important Areas Do and Possible Actions to Offset Impairments Identified						
Process Component	Description of Component	Important Areas - Look for :  and locate the following features within Hvdro Unit	Areas of Higher Impairment Look for:  and locate the following land cover types with Hydro Unit	How Impairment Affects Process Component	General Actions if Synthesis Maps Show: 	General Actions if Synthesis Maps Show: 
Storage Maps – Mountainous, Lowland and Coastal Group 	The relative amount of surface storage in a hydrologic unit 	Depressional wetlands and floodplains. For Mountainous groups this will primarily be in alluvial valleys. In lowland groups depressional wetlands are located in terraces and floodplains.	Urban and rural development that intersects areas where depressional wetlands and floodplains are located.	Ditching and draining will reduce storage capacity of wetlands. Diking and channelization also reduces storage of floodplains. In urban areas these impacts are usually greater with the filling, diking and draining of wetlands and floodplains. The net result of these impairments is increased channel velocity and greater erosion and flooding downstream.	For wetlands, re-establish natural hydrology by plugging ditches that drain wetland, and restore natural outlet and native vegetation (to slow water). For floodplains, re-establish overbank flooding by removing dikes/levees or raising incised channel. Also remove any floodplain fill. 	Protect and maintain existing condition by preventing development in floodplains or depressional wetlands and limit sediment transport into depressional wetlands by maintaining adequate buffers.



Storage is Impaired – Illahee Creek

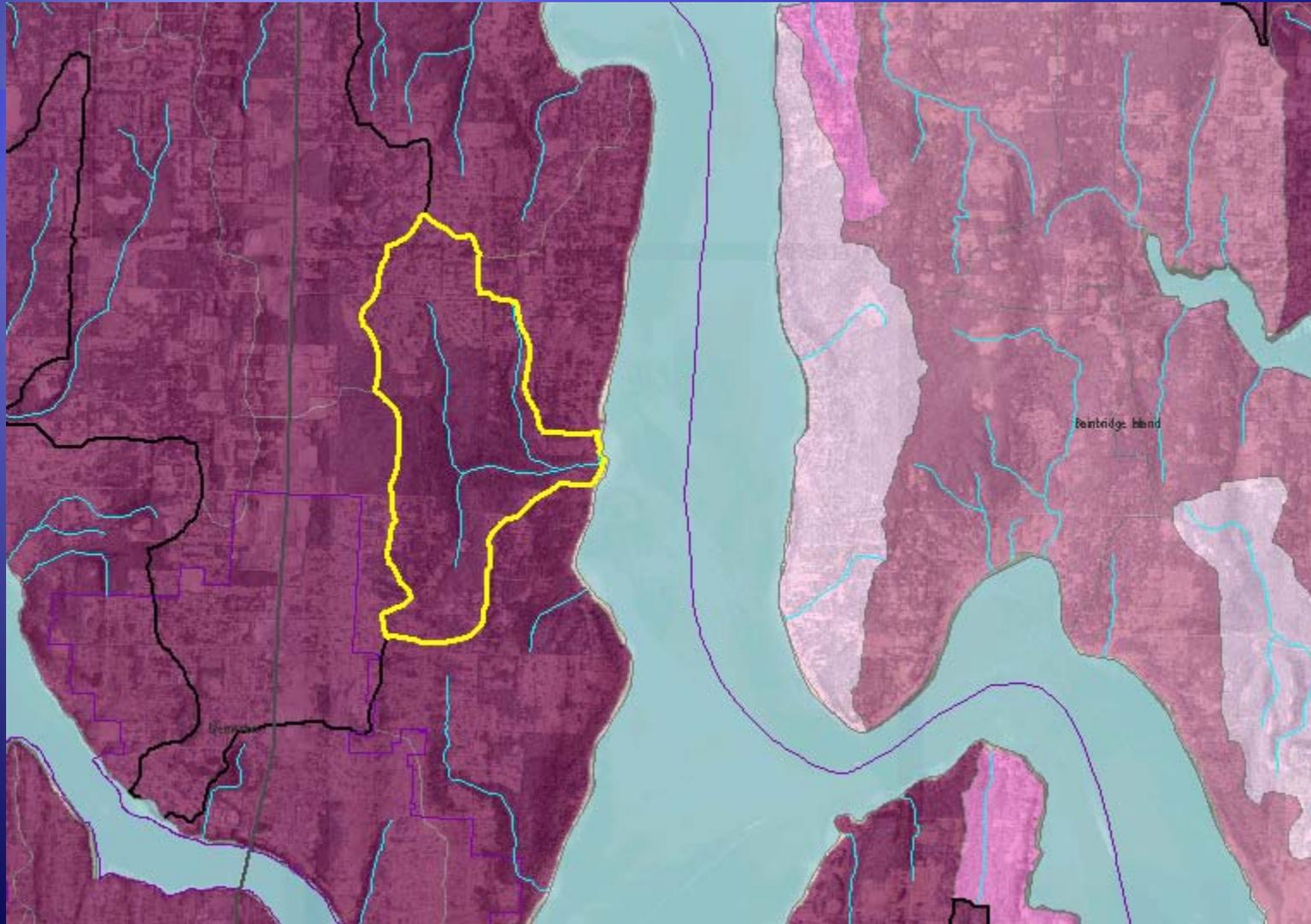


High

	High			
	PROTECTION P1 P1 H,L	Protection 1 Restoration P1R H, M	Restoration 1 R1 H,MH	RESTORATION R R H,H
	Protection 2 P2 MH, L	Protection 2 Restoration P2R MH,M	Restoration 2 R2X MH,MH	Restoration 2 R2 MH,H
	Protection 3 P3 M, L	Protection 3 Restoration P3R M,M	Restoration Least Impact 2 RLI2 M,MH	Restoration Least Impact 1 RLI1 M,H
	Conservation 1 C1 L,L	Conservation 2 C2 L,M	Less Impact to Processes 2 LI2 L,MH	Less Impact to Processes LI1 L,H
Low	High			

Level of Impairment

Delivery is Impaired – Illahee Creek

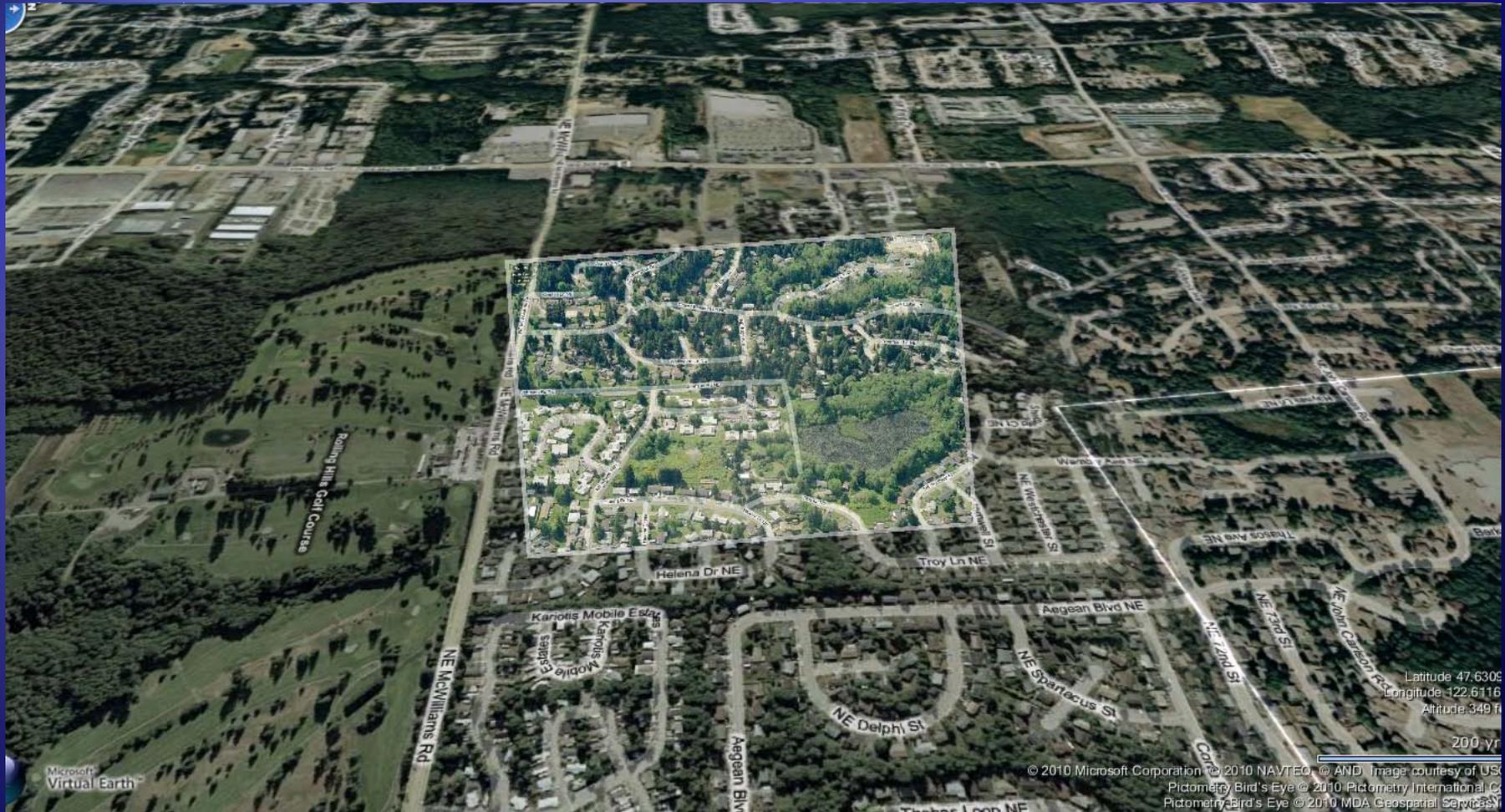


DOE “No Net Loss” Indicators can help with your analysis at the reach scale

POTENTIAL NO NET LOSS INDICATORS for SHORELINE MASTER PROGRAMS

Indicator (all in shoreline jurisdiction)	Functions affected – key categories – water quality, water quantity and habitat	Type of Impairment**	Limitations of indicator	Where	Is data available or reasonable to obtain
Forest cover: <u>Acres</u> converted from forest land to other land uses.	Water quality–sediment, nutrients & toxic filtration, conversion, and/or retention; temperature regulation. Water quantity–flow regulation. Habitat–structure for habitat life needs; input of organics & LWM*.	Reduces forest buffers and decreases filtering, conversion, and/or retention of pollutants from surface & subsurface flow; increases quantity of pollutants to aquatic habitats. Alters the delivery and timing of water to aquatic areas, increasing quantity of water delivered to aquatic habitats during high and low flows, which affects habitat structures. Increases water temperature. Loss of nesting sites, rearing, refuge & foraging areas.	Doesn't identify future land use. May be difficult to determine acres in shoreline jurisdiction without finer scale analysis	Rural.***	Details of application available from DNR and local government. Class IV forest practice applications. CCAP data.
Shoreline stabilization: <u>Linear length</u> or area of bulkheads, revetments, bioengineering, seawalls, groins, retaining walls, gabions. (Includes decrease in length, change to soft structure.)	Habitat–Riparian and aquatic habitat, sediment supply. Input of organics, prey base, & LWM. Structure for habitat life needs.	Interrupts habitat-forming processes, such as beaches & channel migration, by impacting sediment supply and transport. Loss of nesting sites, rearing, refuge & foraging areas. Loss of prey base with associated loss of riparian vegetation.	Combines different types of stabilization measures into one general category; impacts may vary.	Rural, urban.	Is data available from local government, including permits & SDP exempt projects? Can locals track over time? HPA information can supplement other data, but is not sufficient on its own. Detailed aerial photos may also show stabilization changes.
Marine & freshwater riparian vegetation: <u>Linear measurement</u> of mature native riparian vegetation of a given width (buffer width) or <u>percent cover</u> of different vegetation classes.	Water quality–sediment, phosphorus & toxic filtration, conversion, and/or retention; temperature regulation. Water quantity–flow regulation. Habitat–input of organics, prey base, & LWM. Structure for habitat life needs.	Removes capacity of riparian vegetation to filter surface flows, sediment, phosphorous and toxics; subsurface removal/conversion of nitrogen, pathogens. Increases overland and subsurface flows. Increases water temperature. Reduces prey base. Loss of LWM that provides instream	No permit, so no record of change. Focused project needed to track. Useful only if a baseline exists. Methodology needs to be able to measure change. May be difficult to measure over short time frame.	Rural, urban.	Can locals measure and track? Use sample areas, aerial photos. Puget Sound LIDAR consortium has some data.

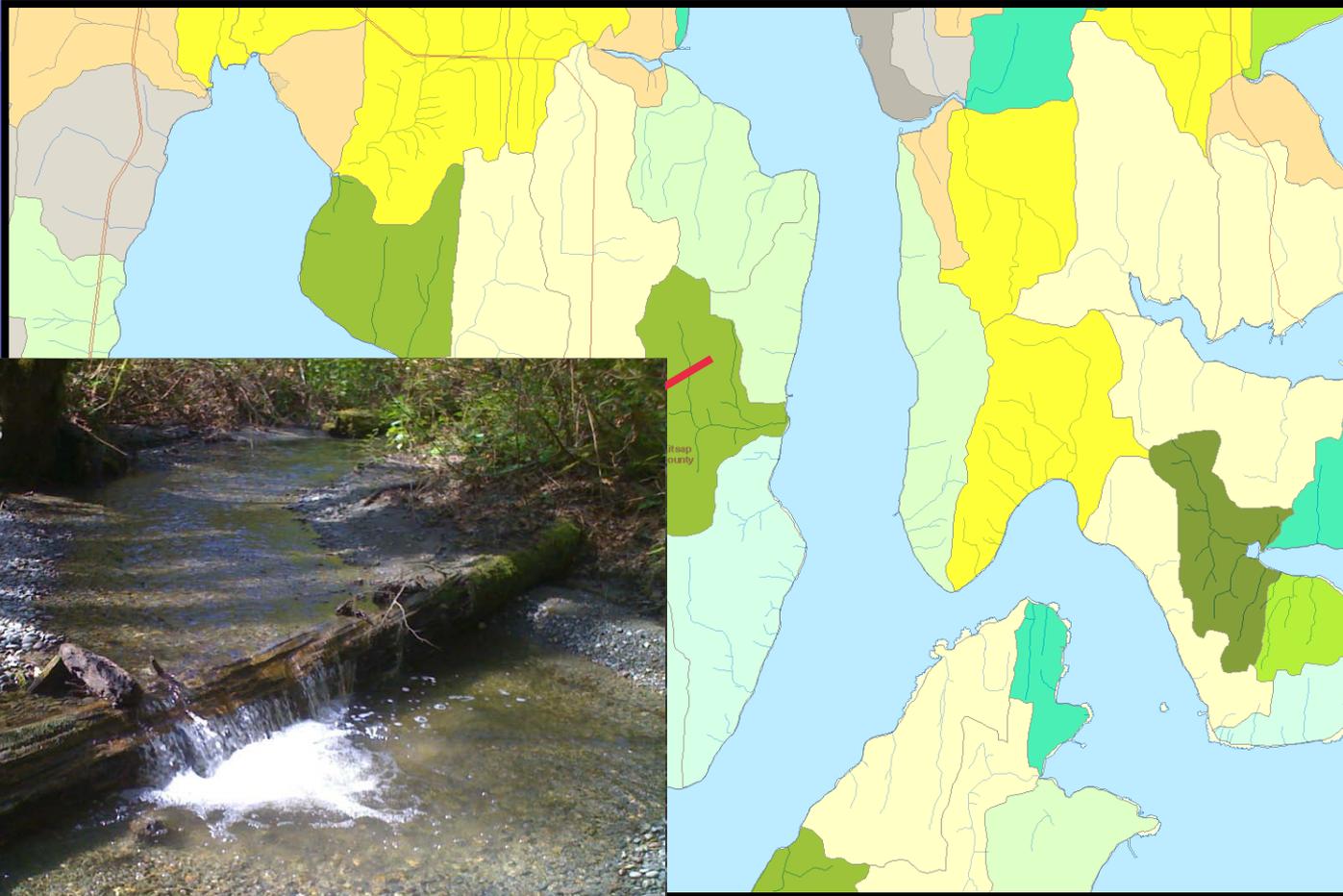
Storage & Delivery are Impaired – Illahee Creek



Downstream Erosion and Bedload Transport and Deposition is Occurring

Discharge Map – Illahee Creek

Helps establish relative importance of stream system and restoration priority

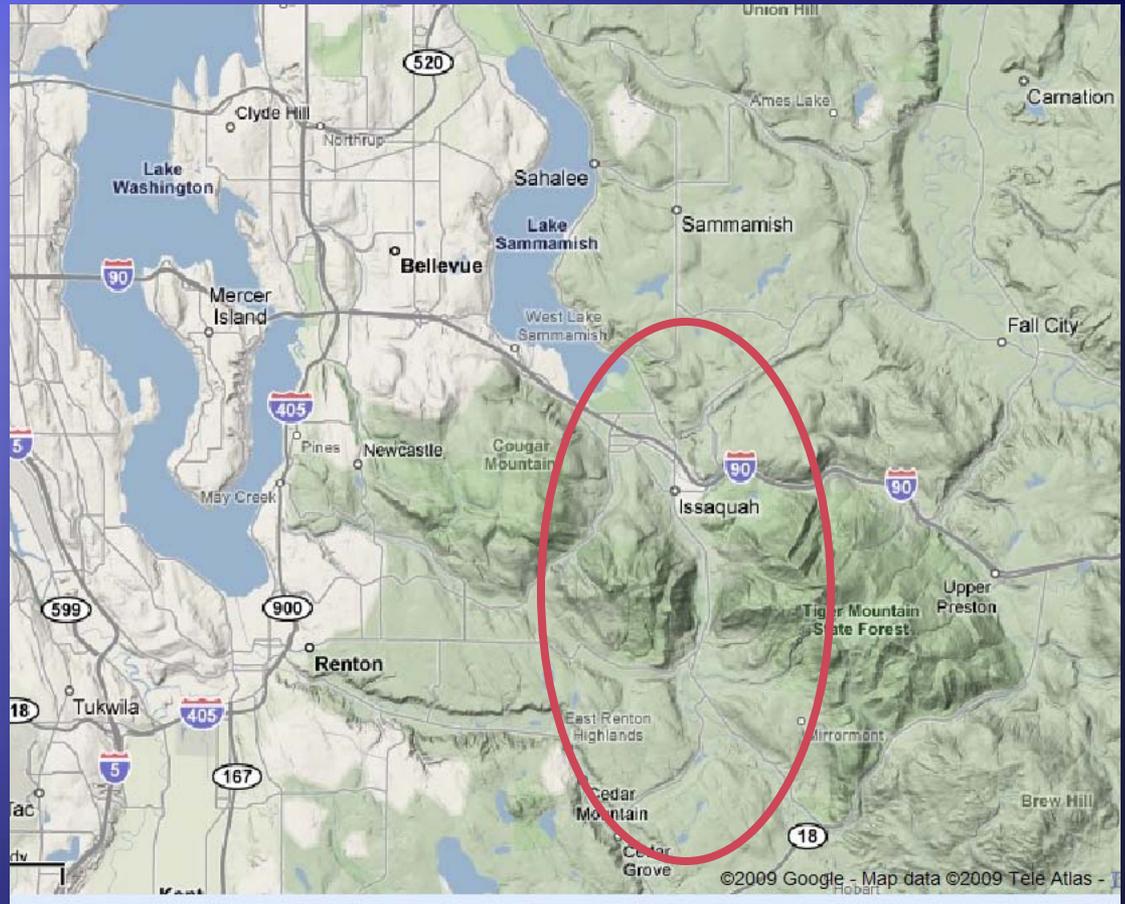


Conducting the Inventory & Characterization – Illahee Creek

Shoreline Issue	How have ecosystem processes been changed relative to issue?	Solution	Solutions and Actions: Recommended protection & restoration measures and environment designations
<p>High sediment delivery to shoreline. Building of delta – affecting public access to dock and habitat functions. Loss of salmon spawning habitat.</p>	<p>Erosion and Bedload Transport. Sources of sediment in upper watershed</p>	<p>Stormwater Retrofit – Route runoff from impervious surfaces to rain gardens, infiltration galleries and detention ponds. Detention ponds necessary on golf course. Limit development on outwash deposits adjacent to steep slopes.</p>	<p>Provisions in SMP for stormwater mitigation fee. Develop new standards for stormwater retrofit. New BMPs and larger buffers elsewhere.</p> <p>High Priority for restoration – historic salmonid run. Year round flows.</p>

Example of Applying Inventory and Characterization to SMP

Issaquah Creek
Basin in the
Lake Washington
Watershed



City of Issaquah SMP

- ◆ Example of Using Watershed Approach for planning starting in early 1990's
- ◆ Identified problems and solutions.
- ◆ Implemented solutions through changes to land use policy and watershed based restoration plan/actions

Conducting the characterization

- ◆ Use analysis template to address issues
- ◆ This can be done for each reach

Shoreline Issue For: Reach #	How have ecosystem processes been changed relative to issue? What functions are affected at reach scale?	Solution	Solutions and Actions: Recommended protection & restoration measures and environment designations
Flooding in lower reaches	Overbank flooding has been reduced. Floodplain functions impaired including sediment and toxicant removal, denitrification, and food chain and habitat functions.	Review and analyze characterization and inventory information	To be determined

DOE “No Net Loss” Indicators can help with in your analysis at the reach scale

POTENTIAL NO NET LOSS INDICATORS for SHORELINE MASTER PROGRAMS

Indicator (all in shoreline jurisdiction)	Functions affected - key categories - water quality, water quantity and habitat	Type of Impairment**	Limitations of indicator	Where	Is data available or reasonable to obtain
<p>as temperature, dissolved oxygen, fecal coliform, heavy metals, toxics, organics and biological indices (e.g., Biological Index of Biotic Integrity).</p> <p>Shellfish listings closures.</p>			<p>improvement project in place. No criteria to remove from list. Sampling methodology changes, not always comparable. Marine & fresh water lists updated in alternating 2-year cycles.</p> <p>Some impacts from outside shoreline jurisdiction and municipality. Emergency closures updated regularly. Uneven data. Changes may be too frequent for NNL purposes. Limited to fecal coliform. Reflects impacts on human health, not shellfish health.</p>		<p>303(d) - comprehensive,</p> <p>Dept of Health Shellfish Program.</p>
<p>Levees/dikes: <u>Linear feet</u>, floodplain area gained from levee setbacks.</p>	<p>Water quality - sediment removal, temperature regulation. Water quantity - water storage, flooding. Habitat - structure for habitat life needs (e.g., low LWM, stream bed aggradation, river mouth progradation).</p>	<p>Impairs natural flooding regime. Reduces floodplain sediment retention, denitrification and hyporheic functions. Decreases groundwater storage and base flows. Interferes with formation of habitat structure such as distributary channels in tidal and riparian and in-channel and off-channel habitat in freshwater settings. Removes habitat structure for nesting, rearing, refuge and foraging.</p>	<p>Can change in habitat quality as a result of levee/dikes be easily measured? Various types and locations of levees & dikes are lumped together; Types of openings in levees and dikes vary; impacts may vary.</p>	Rural, urban.	<p>Measure increase/decrease in lineal feet, quality of levee related to riparian vegetation & slope. Data from locals or FEMA?</p>
<p>Floodplain area: <u>Acres</u> allowed to flood - tidal and river (lack of flood control and lack of other structures such as houses.)</p>	<p>Water quality - removal of toxics, sediment, phosphorous and pathogens through adsorption, filtration and retention. Removal of nitrogen through denitrification. Temperature regulation. Water quantity - water storage and flow regulation and reduction in downstream</p>	<p>Impairment similar to that for levees & dikes with loss of floodplain from diking & filling.</p>	<p>Availability of data, maintenance of data.</p>	Rural, urban.	<p>Do local governments measure this for shoreline inventory? FEMA floodplain info available.</p>

Characterizing the Watershed – Step 1

King County Developed Basin Plans in 1990

- Goal was to address surface water problems at multiple scales (broad, mid and fine)
- Centered on **pragmatic** solutions to address underlying **causes** at the watershed scale
 - Altered hydrology, hydraulics and sediment supply

Recent SMP Characterization (Stanley et al 2005)

- Rating of important areas for water flow process
- Rating of degree of impairment across the watershed

Characterizing the Watershed – Step 1

Basin Plans:

- ◆ Current and Future Conditions Report
 - ◆ Assessed hydrology, geology, water quality and aquatic habitat
 - ◆ Identified Current Problems (impairment)
 - ◆ Used hydro modeling to ID where problems could worsen

Characterize Watershed Processes

Identify important areas for watershed processes, level of impairment & best areas for protection, restoration & development

Characterizing the Watershed – Step 1

- ◆ Current and Future Conditions Report – Conclusions:

If upper basin developed

- ◆ Flooding in Issaquah would be severe
- ◆ Water quality would deteriorate
- ◆ Significant habitat impacts

**Characterize
Watershed
Processes**

Identify
important areas
for watershed
processes, level
of impairment &
best areas for
protection,
restoration &
development

Prescribe Solutions – Step 2

- ◆ Current and Future Conditions Report:

Protect Processes in Upper Watershed

- ◆ Limit Forest Clearing
- ◆ Limit Impervious Cover

Prescribe Solutions

Identify solutions to reduce human impacts and improve ecosystem benefits

Prescribe Solutions – Step 2

- ◆ Current and Future Conditions Report:

Restore floodplain in Issaquah

- ◆ Purchase homes
- ◆ Remove channelization
- ◆ Regulate location of new development

Prescribe Solutions

Identify solutions to reduce human impacts and improve ecosystem benefits

Actions – Step 3

- ◆ Upper Watershed, County Jurisdiction:

County Adopted an Ordinance to:

- ◆ Limit Forest Clearing to 35%
- ◆ Limit Impervious Cover to 10%

Take Actions

Implement solutions to reduce impacts through land use plans, permits, and other approaches

Actions – Step 3

- ◆ Lower Watershed, City of Issaquah:

City Initiated Issaquah Creek Waterways Project:

- ◆ Began Purchasing Creek Properties and Removing Houses
- ◆ 117 Acres Have Been Acquired

Take Actions

Implement solutions to reduce impacts through land use plans, permits, and other approaches

Actions – Step 3

Protection of Watershed, City of Issaquah and County:

Formed Squak, Cougar, and Tiger Interagency Committee

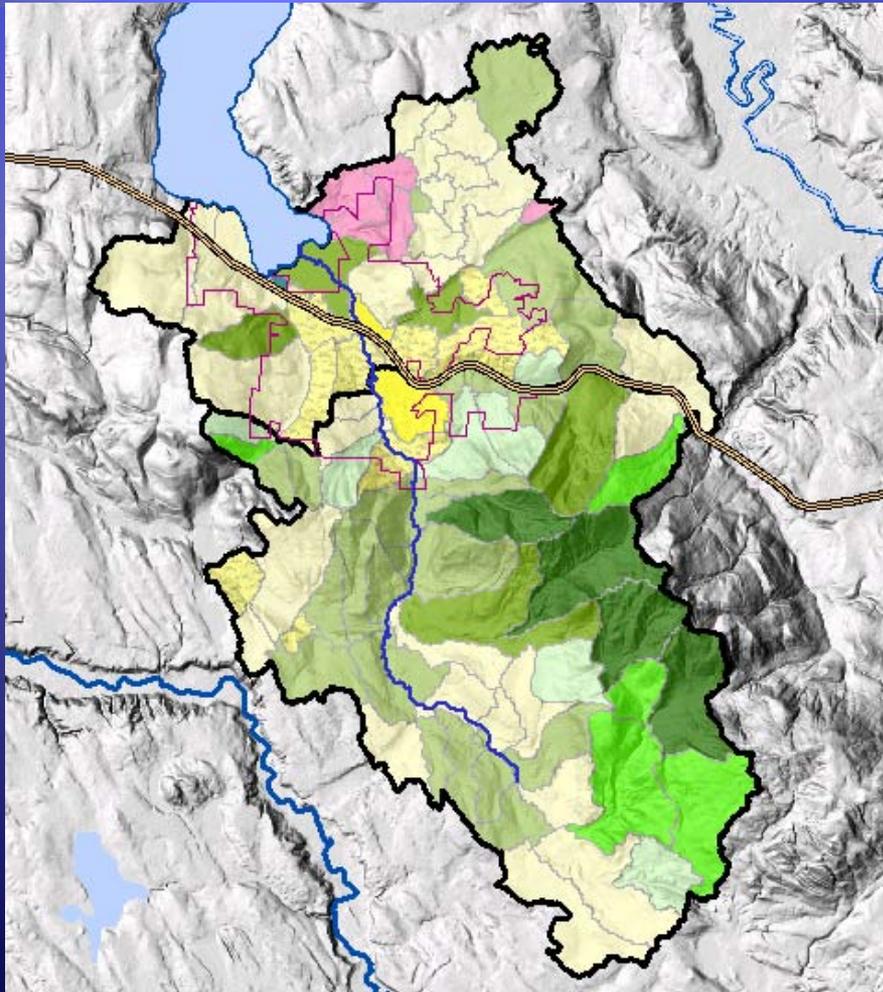
- ◆ Partnered with other non-profit groups (Mountains to Sound Greenway)
- ◆ Began Purchasing Properties
- ◆ Over 10,000 acres have been acquired

Take Actions

Implement solutions to reduce impacts through land use plans, permits, and other approaches

Actions – Step 3

Potential Areas for Protection and Restoration

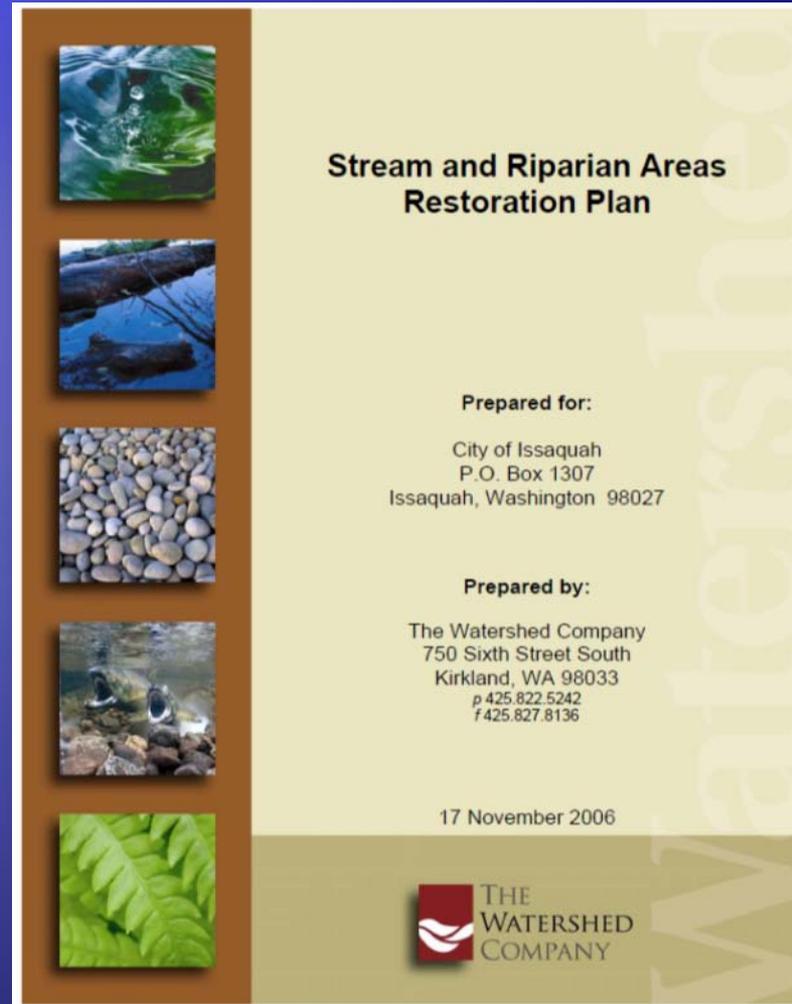


Take Actions

Implement solutions to reduce impacts through land use plans, permits, and other approaches

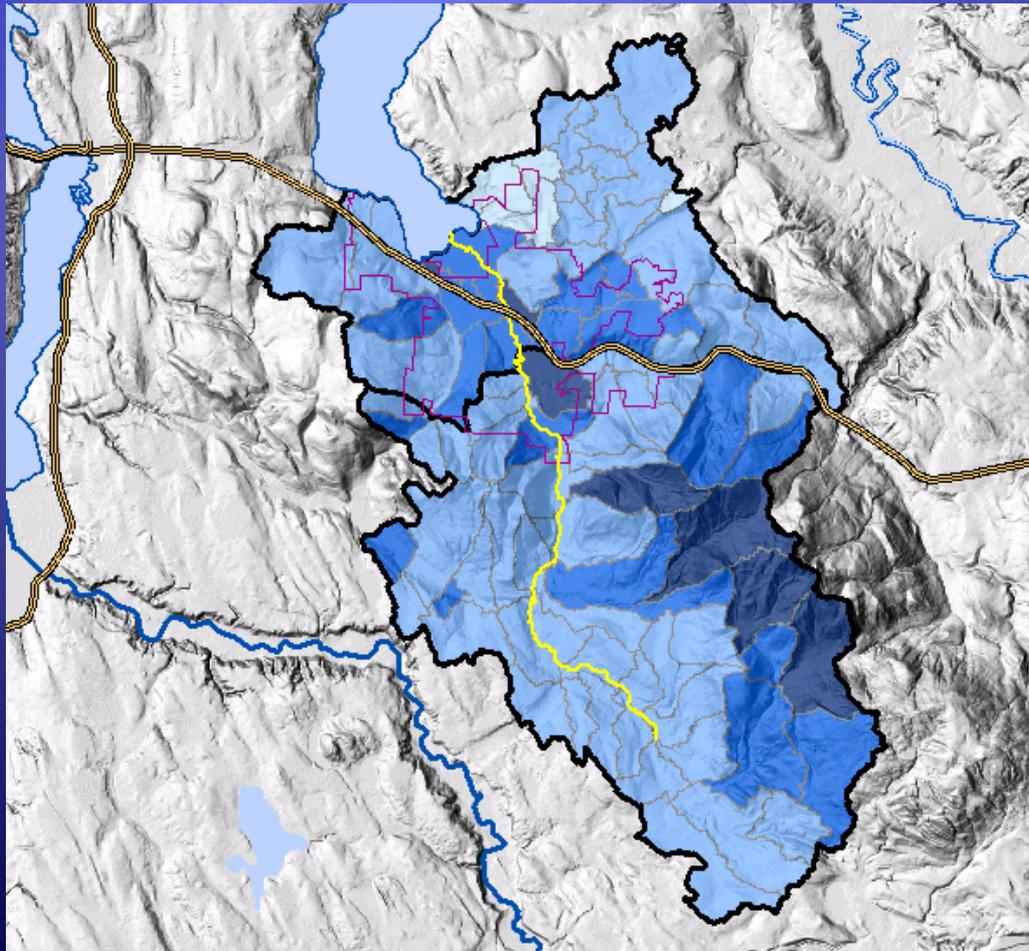
Actions – Step 3

- ◆ Restoration of Watershed – City Developed a Restoration Plan as part of SMP



SMP Characterization

Important Areas for Hydrologic Processes

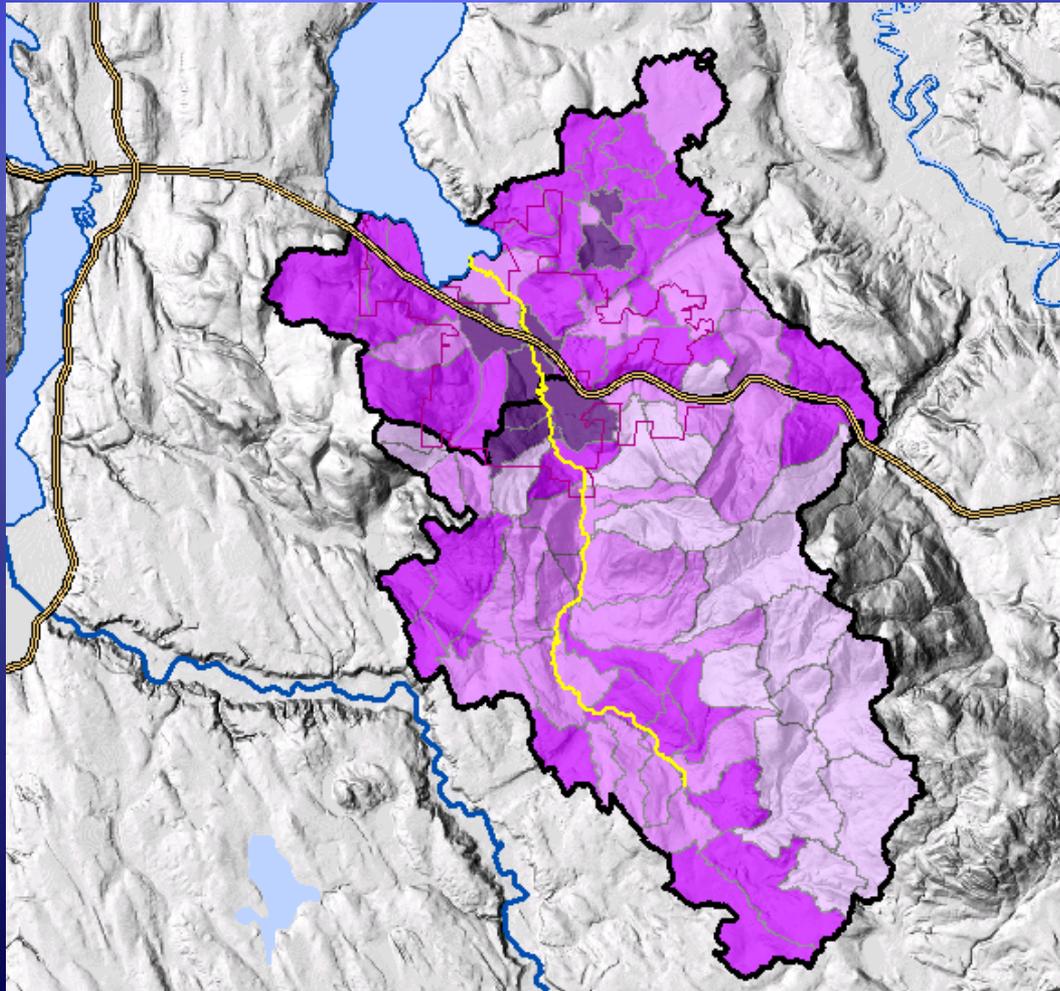


**Characterize
Watershed
Processes**

Identify
important areas
for watershed
processes, level
of impairment &
best areas for
protection,
restoration &
development

SMP Characterization

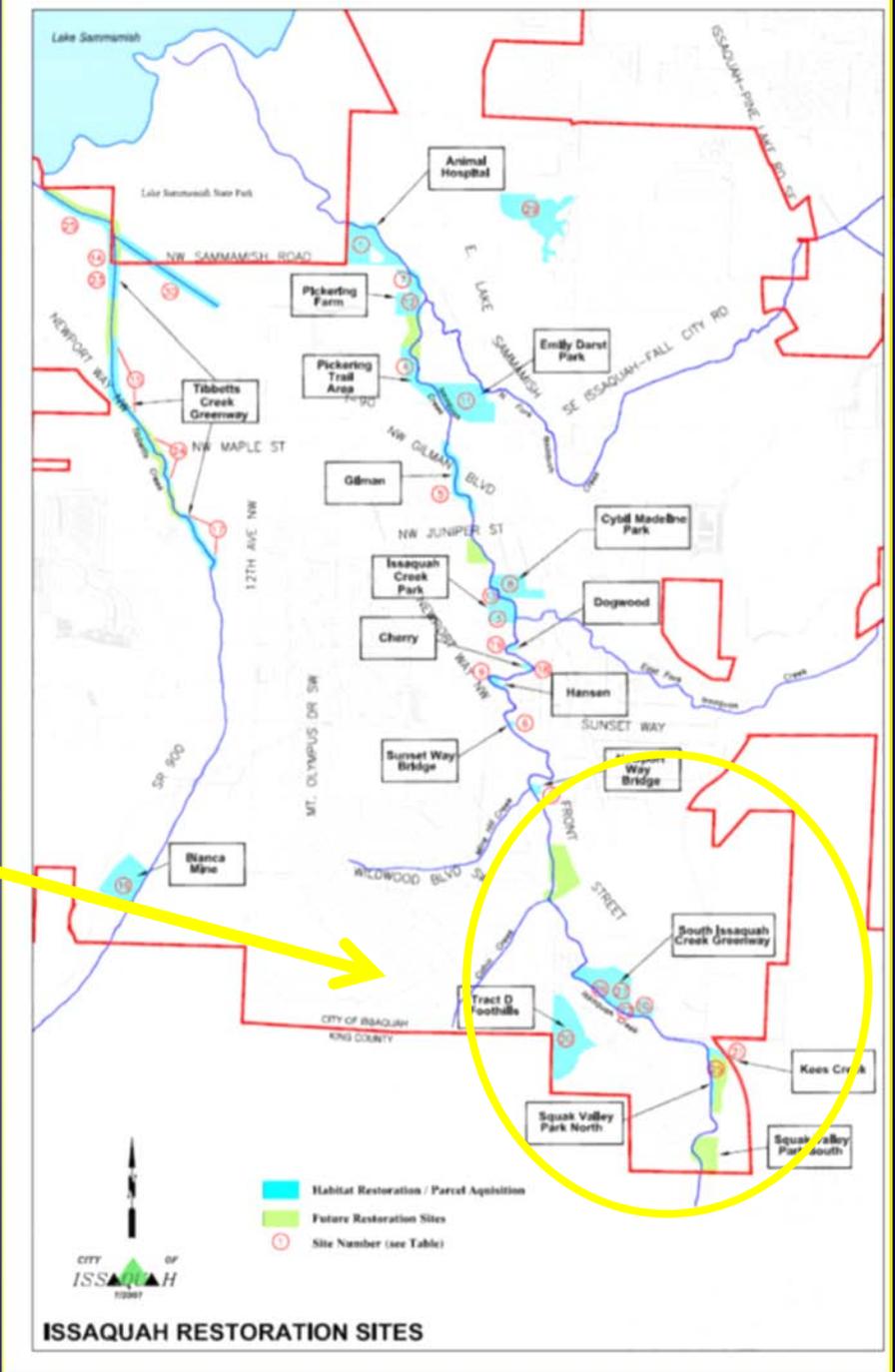
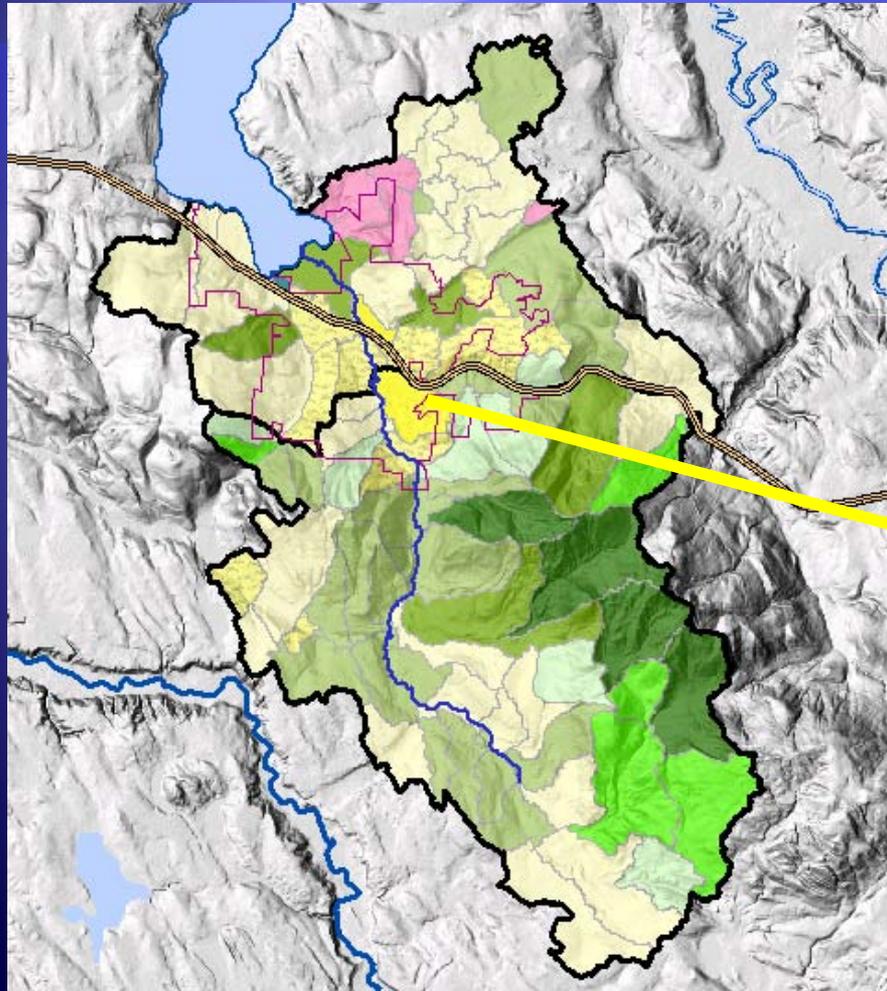
Level of Impairment



Characterize Watershed Processes

Identify important areas for watershed processes, level of impairment & best areas for protection, restoration & development

Prioritize Using Characterization



Step 2 & 3 – Solutions and Actions

- ◆ Use analysis template to address issues (Issaquah examples)

Shoreline Issue	How have ecosystem processes been changed relative to issue?	Solution	Actions: Recommended protection & restoration measures and environment designations
Flooding in lower reaches	Overbank flooding has been impaired due to channelization in lower reaches Upper watershed is intact.	Reconnect stream to floodplain. Increase storage and reduce severity of larger flooding events. Continue to protect upper watershed via clearing ordinance.	Action: Purchase houses in floodplain and remove. Restore floodplain. Designation: Community facilities – open space.

Preparing the report

- ◆ Inventory and characterization report includes:
 - ◆ Inventory information
 - ◆ Ecosystem characterization
 - ◆ Shoreline functions
 - ◆ Shoreline use analysis
 - ◆ Public access opportunities
- ◆ Should be useful for making decisions

Link to Technical Document for Characterization:

<http://www.ecy.wa.gov/mitigation/landscapeplan/peerreview.html>

Link to Data:

<ftp://www.ecy.wa.gov>

On the upper right corner of the window, click on 'Page' and scroll down to 'Open FTP Site in Windows Explorer'.....then locate the folder '2010_PS_Char', where there is a separate folder for each WRIA

Burrows Bay - Anacortes



Burrows Bay – West End



Unconsolidated deposits
along entire shoreline –
source of beach sediment

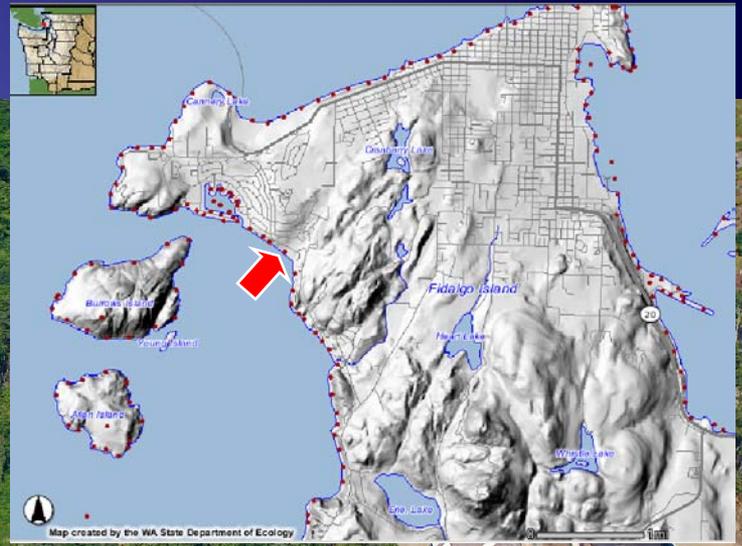
Sand Lance Spawning Habitat



6/29/2006 4:10 PM

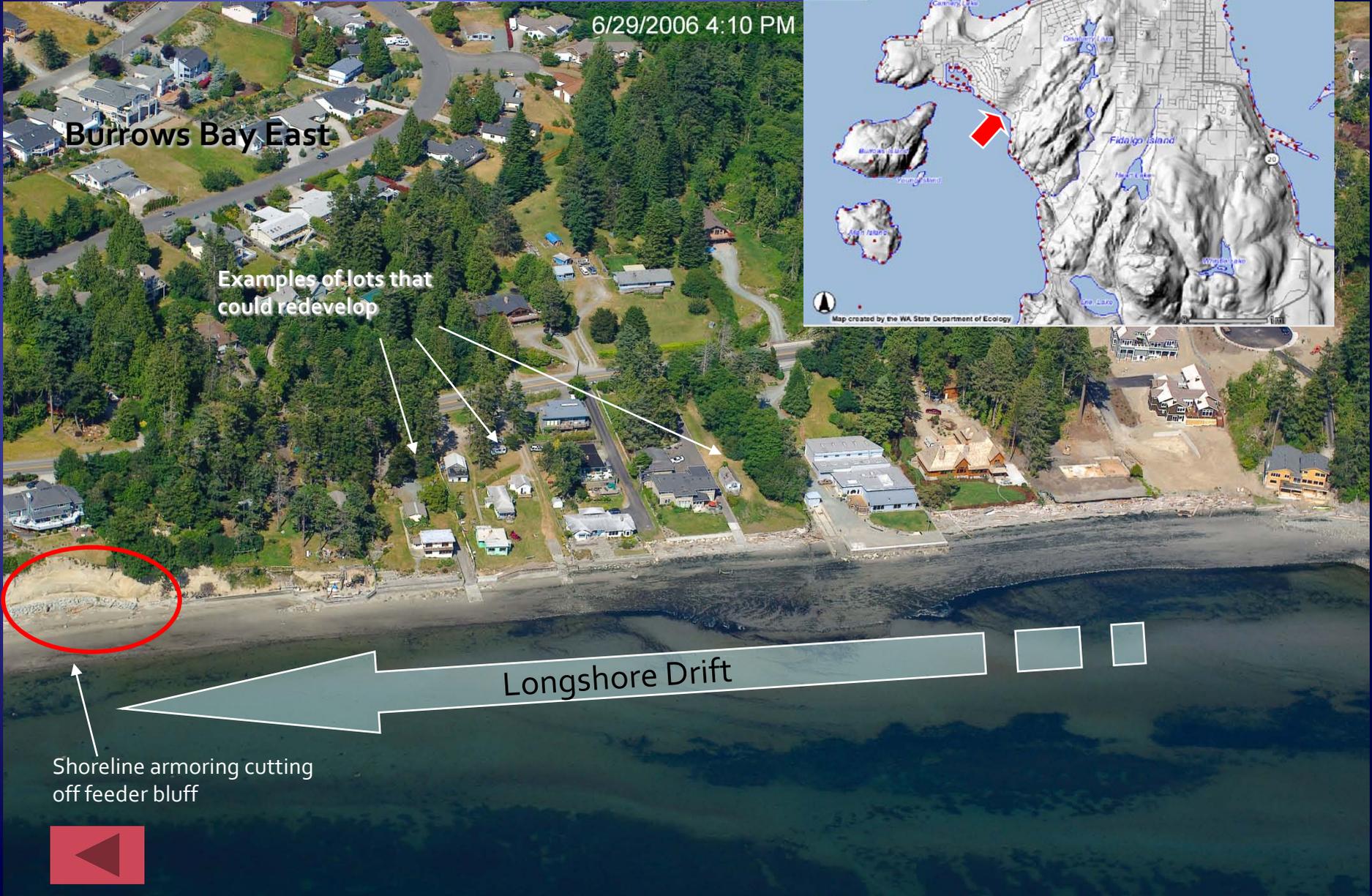
Burrows Bay East

Examples of lots that could be redeveloped



Shoreline armoring cutting off feeder bluff

Longshore Drift



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Shoreline
Residential II

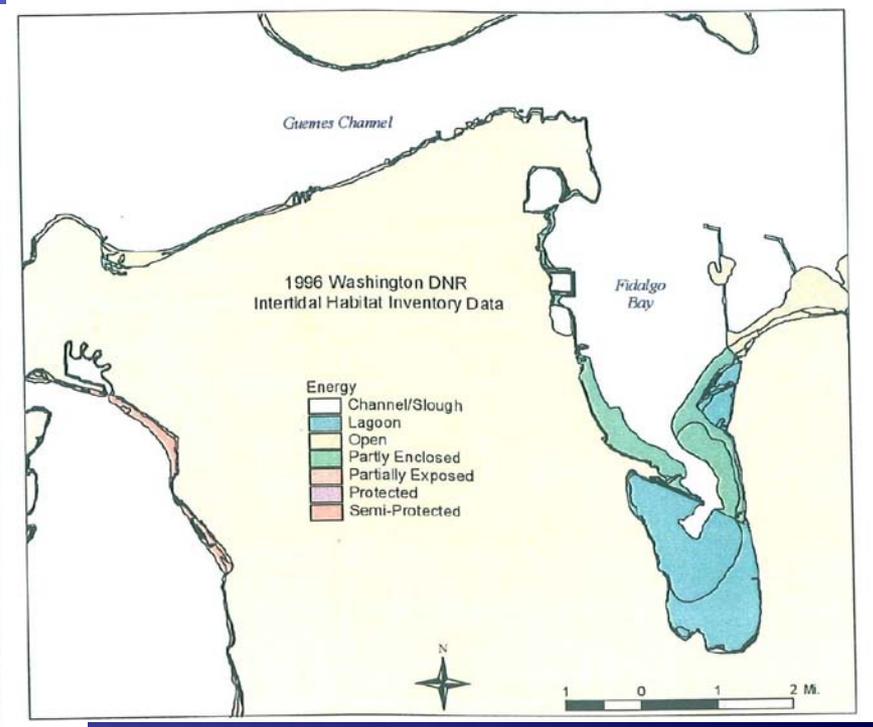
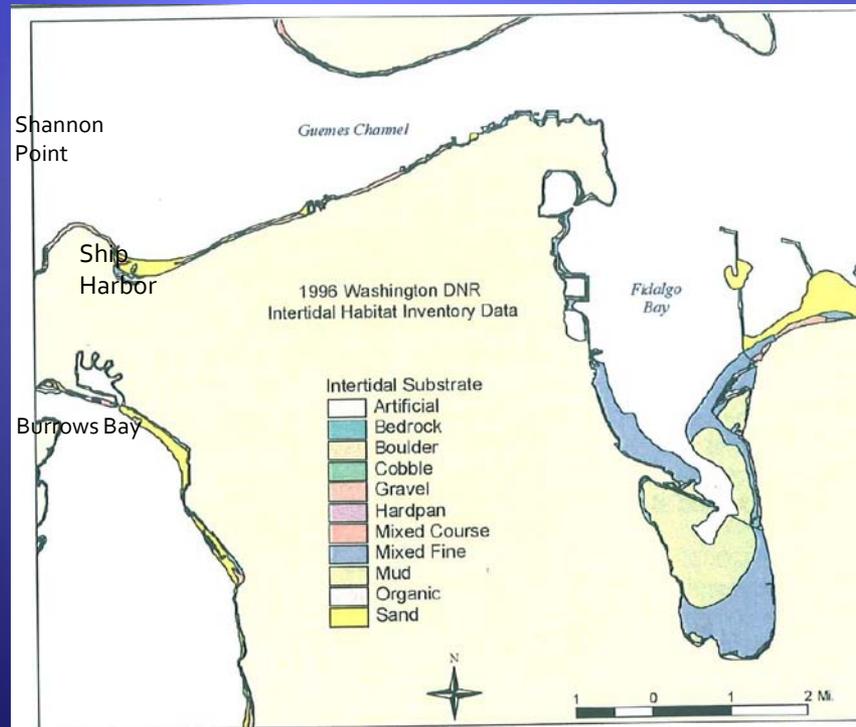


Map created by the WA State Department of Ecology

Urban



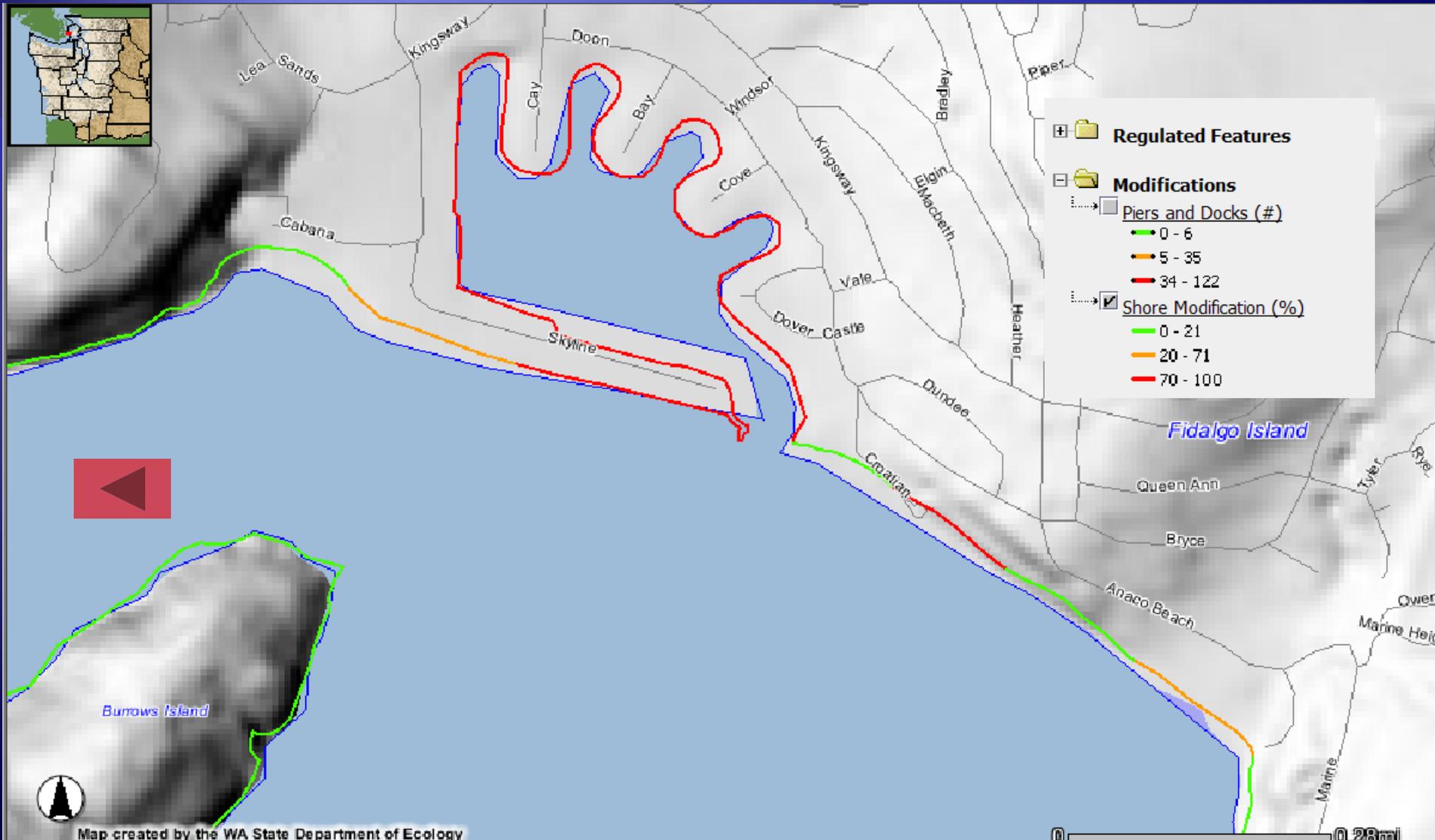
Shoreline Processes



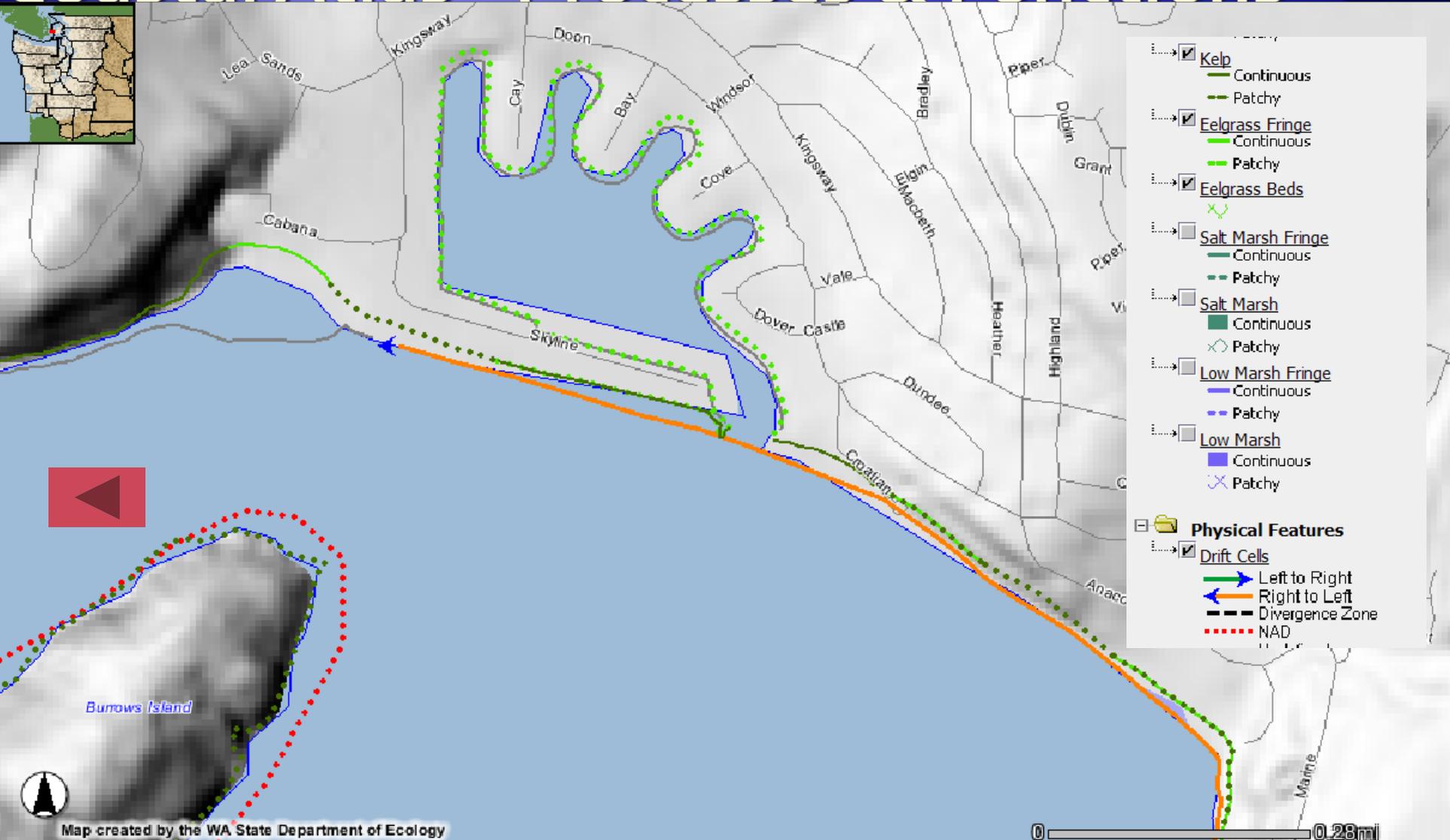
Source: DNR and Integrated Fidalgo Bay Plan and EIS



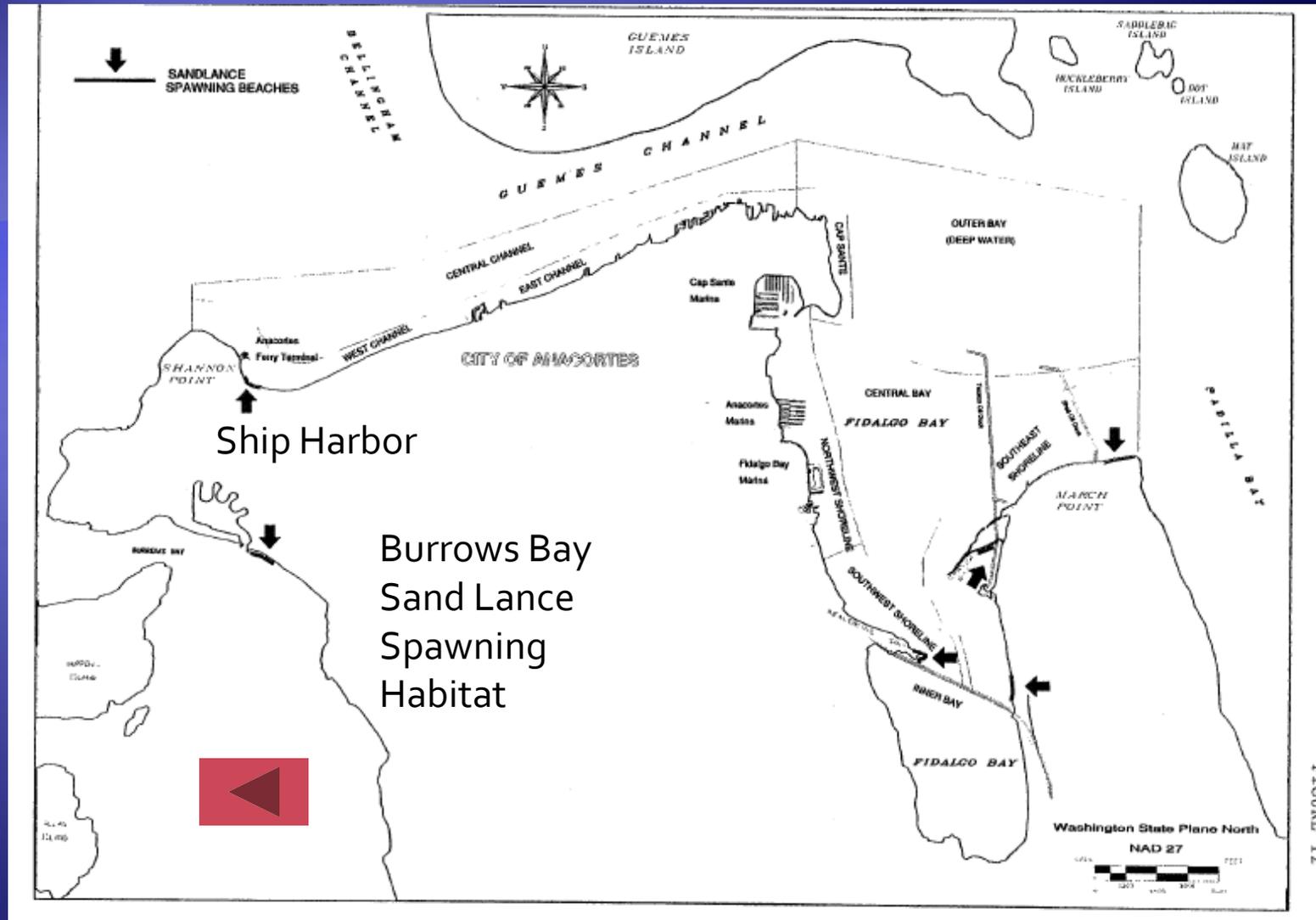
Coastal Atlas - Processes & Functions



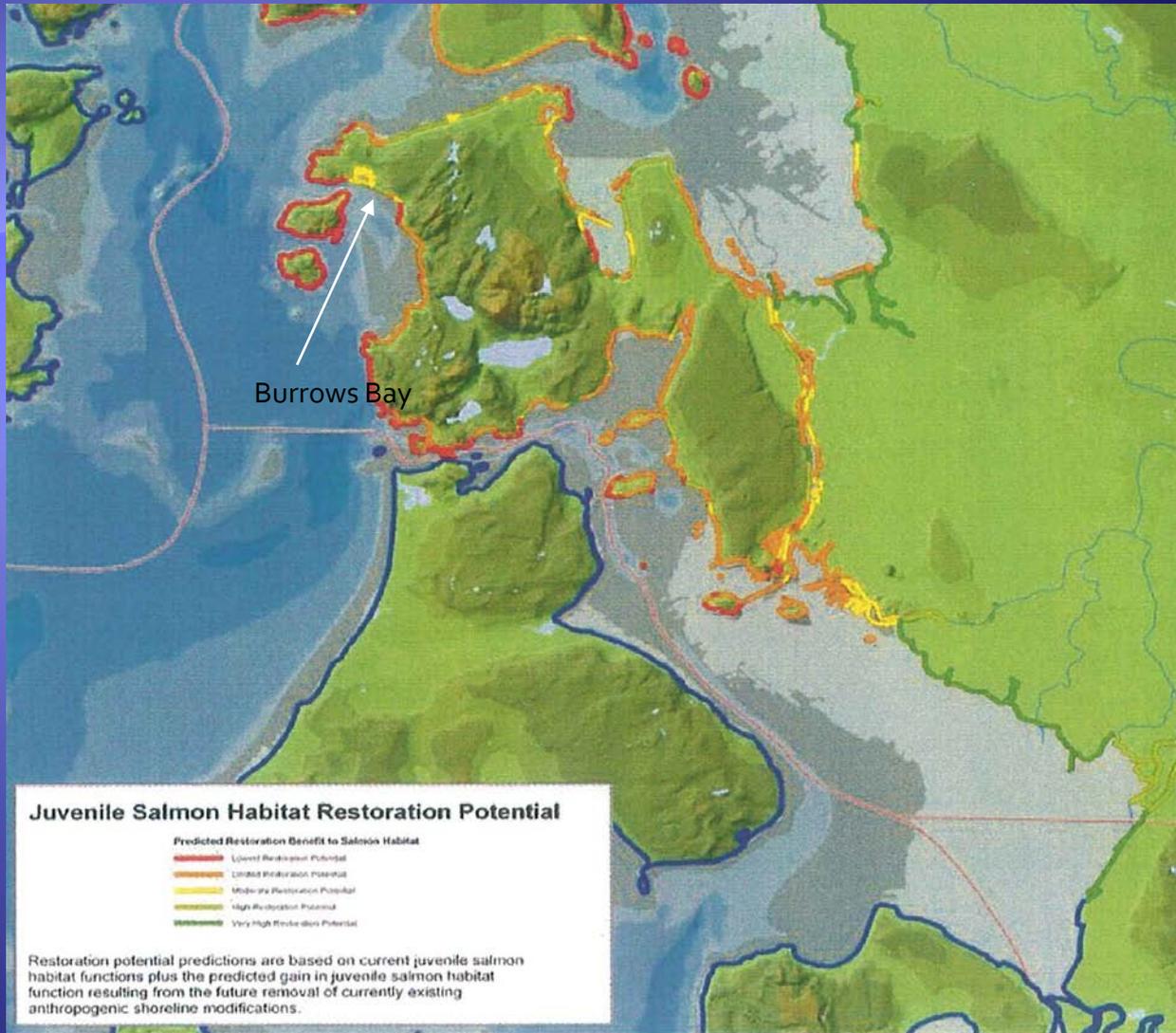
Coastal Atlas - Processes & Functions



Zoom In Tool



Source: Figure 12, Revised Final Integrated Fidalgo Bay-Wide Plan and EIS



**Map 8. NWS Nearshore
Habitat Inventory**

Source: Anchor
Environmental

Reach: Shannon Pt. & Fidalgo Head
Designation: Natural/Conservancy

Reach: Lovric's Marina
Designation: Urban

Reach: East of Lovric's Marina
Designation: Shoreline Residential 1

Reach: Cap Sante North
Designation: Urban Maritime Expanded

Reach: Cap Sante
Designation: Residential 1 & Conservancy

Reach: Cap Sante Marina and Industrial Area South
Designation: Urban & Urban Maritime

Reach: North Weaverling Spit
Designation: Residential 1

Reach: Weaverling Spit
Designation: Urban

Reach: South Fidalgo Bay

Reach: Padilla Bay SW
Designation: Conservancy

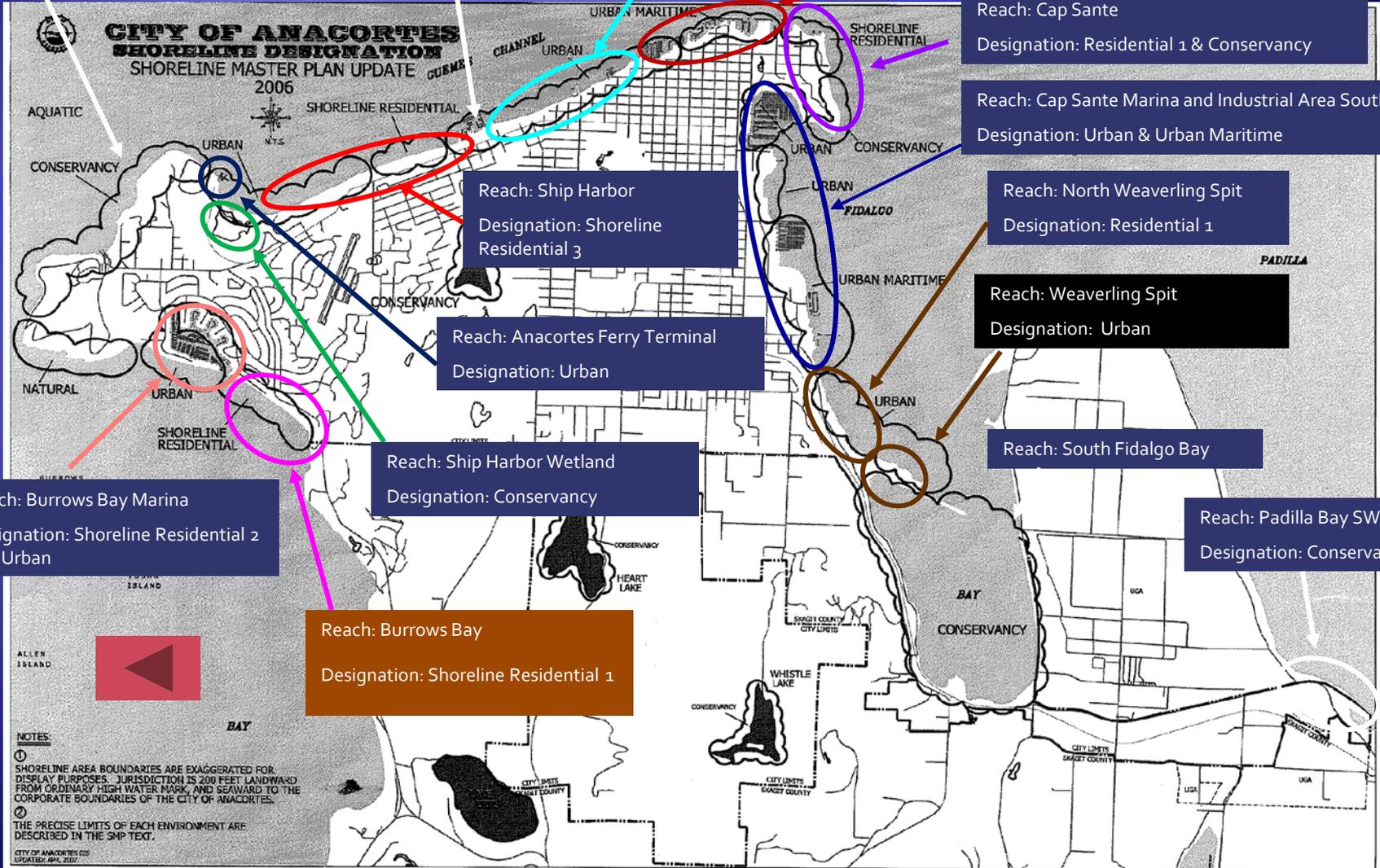
Reach: Ship Harbor
Designation: Shoreline Residential 3

Reach: Anacortes Ferry Terminal
Designation: Urban

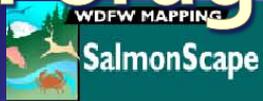
Reach: Ship Harbor Wetland
Designation: Conservancy

Reach: Burrows Bay
Designation: Shoreline Residential 1

Reach: Burrows Bay Marina
Designation: Shoreline Residential 2 and Urban



Forage Fish Spawning Habitat



Select Area SASI Queries Tools Links Help

Mapping Tools

Redraw Map Legend



Map Layers

- ESA Listing Units
- Gauging Stations
- Stream Attributes
- Stock Status (SaSI)
- Fish Distribution
- EDT Restoration
- EDT Preservation
- Intertidal Forage Fish

Potential Spawning Habitat

- Facilities
- Fishways
- Fish Passage Barriers
- Repaired Barriers
- Juvenile Fish Traps
- Place Names
- County
- WRIA's
- Major Public Land
- PLSS Townships
- PLSS Sections
- River Names
- Hydro (24k)
- Roads

DOT Roads 24k

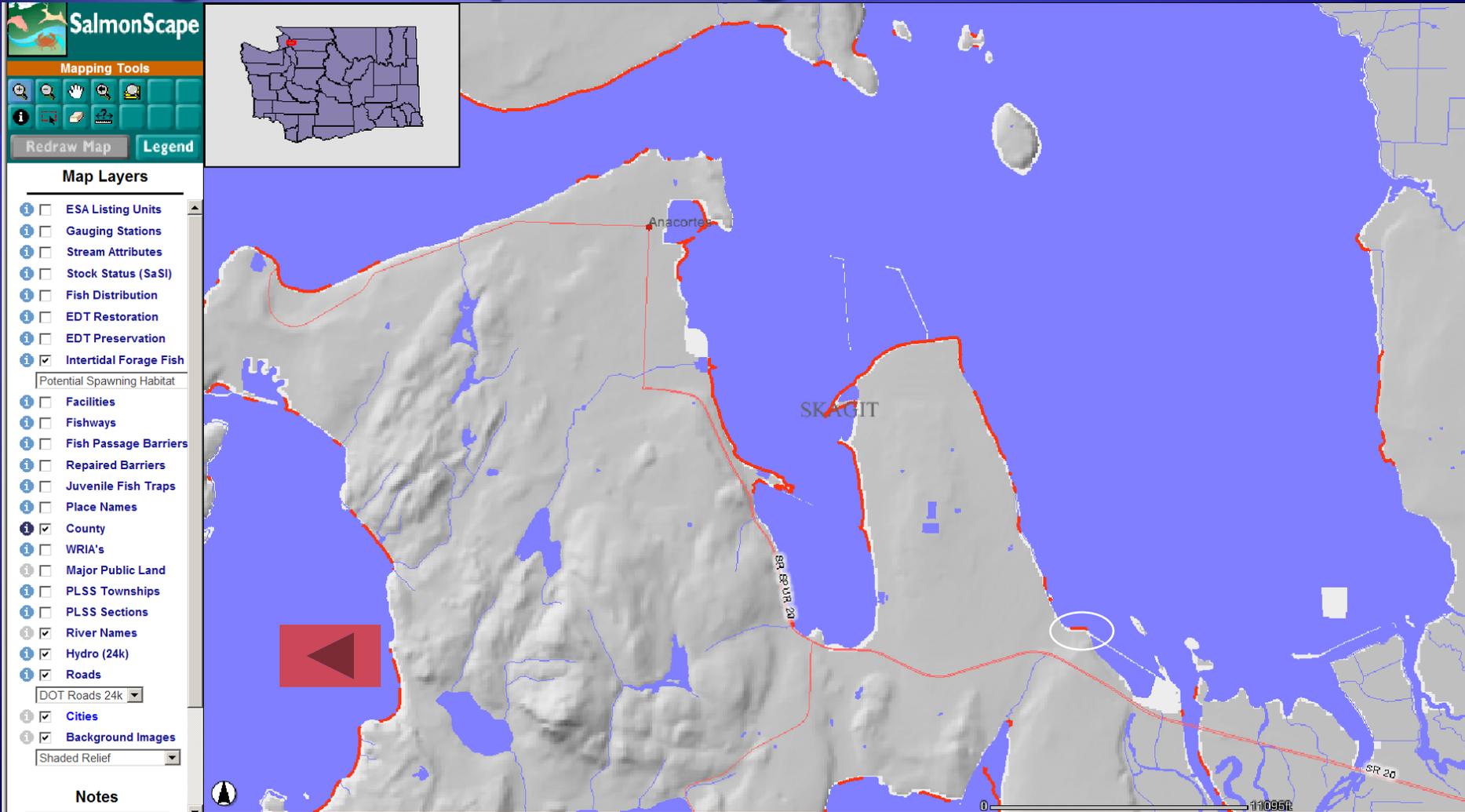
- Cities
- Background Images

BW Orthos

Notes



Forage Fish Spawning Habitat



Burrows Bay: City of Anacortes SMP –Summary of Inventory/Characterization Analysis and SMP Designations and Regulations

Reach Name and Existing Shoreline Designation	Potential Ecosystem process and associated shoreline function	Assessment of processes & functions	Level of impairment to processes & functions	Recommended protection & restoration measures
<p>Burrows Bay – Shoreline Residential</p> <p>Shoreline Designation with Proposed Changes</p> <p>Shoreline Oblique Photo West</p> <p>Shoreline Oblique Photo East</p>	<p>Ecosystem process: water movement (tidal and wave energy); sediment movement (inputs, longshore transport, deposition and loss); shoreline erosion; and movement of woody debris; organic inputs from shoreline;</p> <p>Shoreline functions: Water quantity – discharge from streams/ivers and groundwater at shoreline Water quality - temperature regulation (i.e. marine riparian vegetation, groundwater discharge at shoreline, freshwater inputs from streams/ivers); nutrient removal (denitrification), sediment retention (e.g. deposition in estuaries and intertidal mudflats), toxicant removal & temperature regulation Habitat: shoreline, intertidal, estuarine, subtidal habitats. Habitat structure and complexity for marine plants, macroalgae, diatoms, marine invertebrates, fishes, birds, mammals and anadromous fish species and terrestrial plants and animals.</p>	<p>Ecosystem processes :</p> <p>Rating: Importance is Moderate to High for this jurisdiction</p> <p>Partially exposed shoreline with low bluffs and berms of unconsolidated material with longshore drift present. Moderate wave energy provides for suitable beach spawning substrate.</p> <p>Shoreline functions</p> <p>Rating: Importance of habitat functions are Hgh for this jurisdiction</p> <p>The eastern portion of this shoreline is sand lance spawning habitat (Figure 12, Fidalgo Bay Plan 2000 and Salmonscape). Intertidal area supports patchy eelgrass beds. Majority of shoreline provides juvenile salmon habitat.</p> <p>Rating: Importance of water quality and quantity functions is Moderate. No significant inputs from stream systems for water quantity function; and no estuarine wetland systems present for water quality functions of sediment, toxicant, nutrient removal.</p>	<p>Ecosystem processes:</p> <p>Rating: Moderate to High Shoreline armoring occurs along the majority of this shoreline, which reduces movement of sediment from low feeder bluffs and berms into intertidal zone.</p> <p>functions at shoreline:</p> <p>Rating: Moderate</p> <p>Sand lance habitat is threatened from armoring of shoreline.</p> <p>Shoreline armoring has removed shoreline vegetation which may affect adjacent juvenile salmonid habitat.</p> <p>Majority of shoreline has moderate to high restoration potential for salmon habitat.</p>	<p>Ecosystem processes:</p> <p>Provide adequate setback/buffer for new structures so that shoreline armoring is not required for protection of structure over life of structure. Several lots along Barrows Bay will probably redevelop, so removal and restoration of shoreline armoring could occur.</p> <p>Shoreline functions:</p> <p>Protect existing sand lance habitat at northwest end of the bay by preventing additional armoring of shoreline. Restore old armored areas when redevelopment of lots occurs.</p> <p>Shoreline Residential 1, provides minimum 75 foot buffer (revegetated) and setback/buffer from OHWM. If not possible due to site constraints variance will be allowed. Cost of buffer area lost under variance will be calculated (based on replacement cost elsewhere in city) and in-lieu fee assessed. Fee will be specifically linked to projects described in restoration plan.</p> <p>Cap and plant existing rip rap to provide marine riparian vegetation in order to protect and restore juvenile salmonid habitat.</p> <p>Consistency of Environment Designation with assessment of processes and functions and degree of impairment.</p> <p>Residential zone and development standards/regulations will protect existing processes and functions and help to partially restore altered processes and functions.</p>