Overall Water Flow Results for Puget Sound B-IBI basins

3/19/14

Watershed Characterization Technical Assistance Team

Stephen Stanley, Colin Hume, Susan Grigsby, Kelly Slattery

Washington Department of Ecology

The Puget Sound Watershed Characterization Project

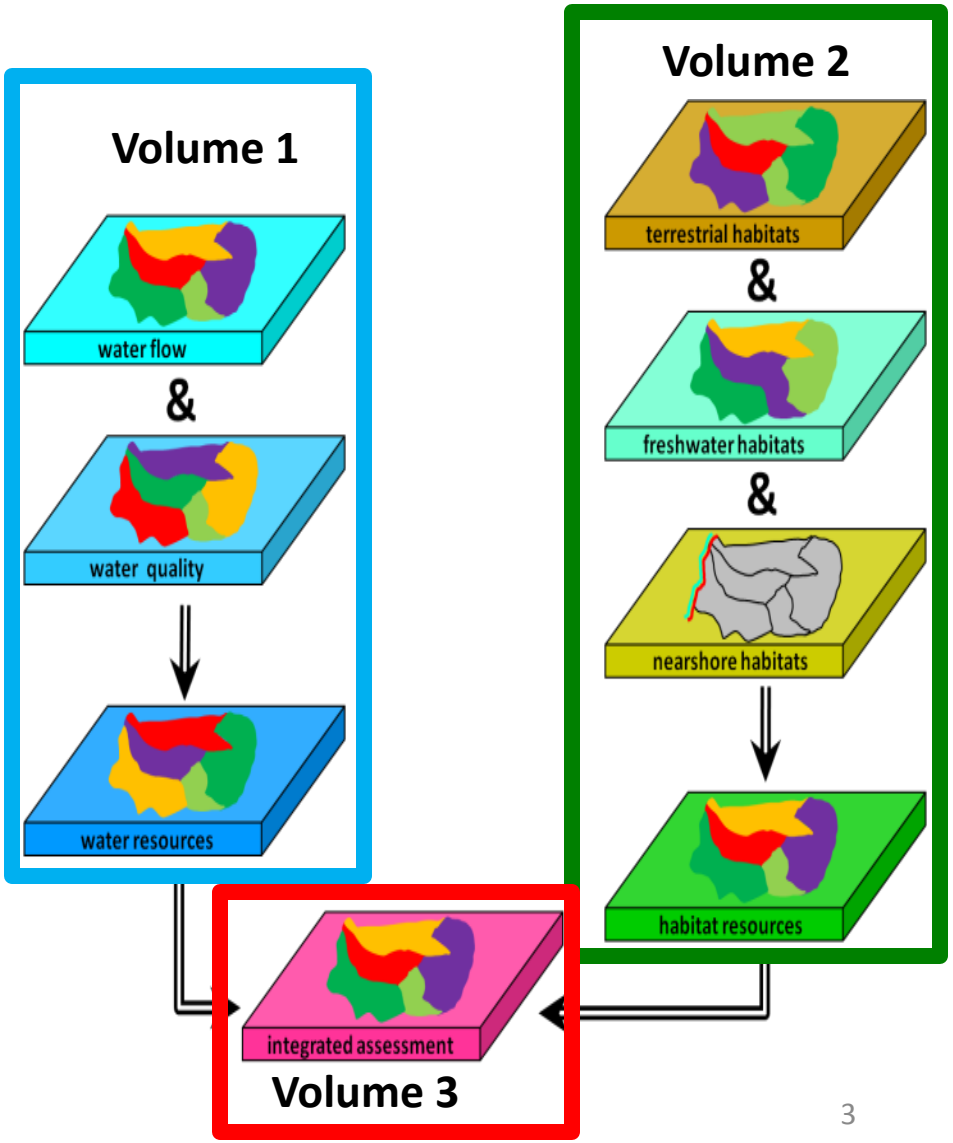
- A multi-agency effort to provide land use planners and resource managers with a **watershed context** for decision making.

- A **resource** for conservation planners and restoration practitioners across Puget Sound.

Data Integration at the Broad Scale

Assessment of:

- Water Flow & Water Quality Processes – **Vol.1**
- Terrestrial, Freshwater, & Marine shoreline habitats – **Vol. 2**
- Users Guide – **Vol. 3**



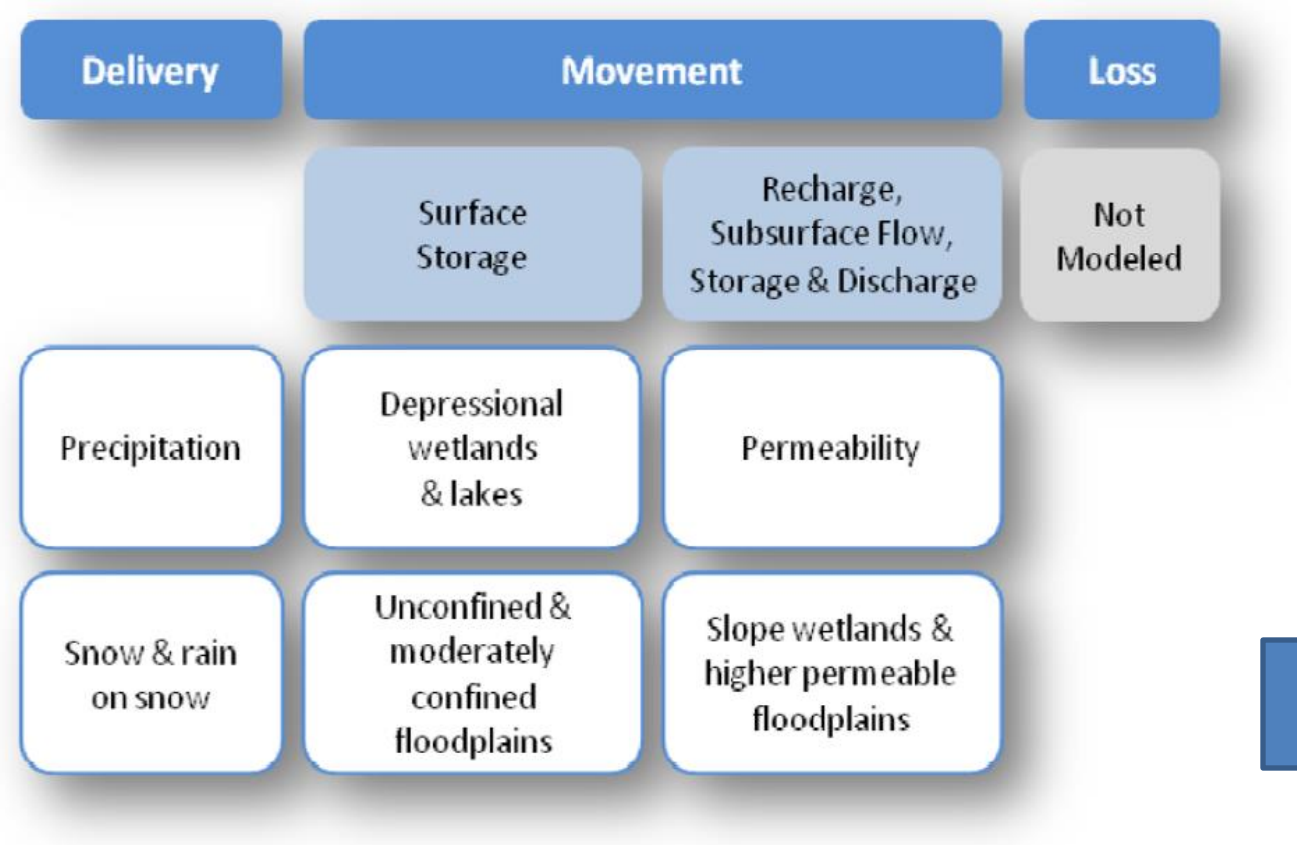
New Website

https://fortress.wa.gov/ecy/coastalatlas/wc/landingpage.html

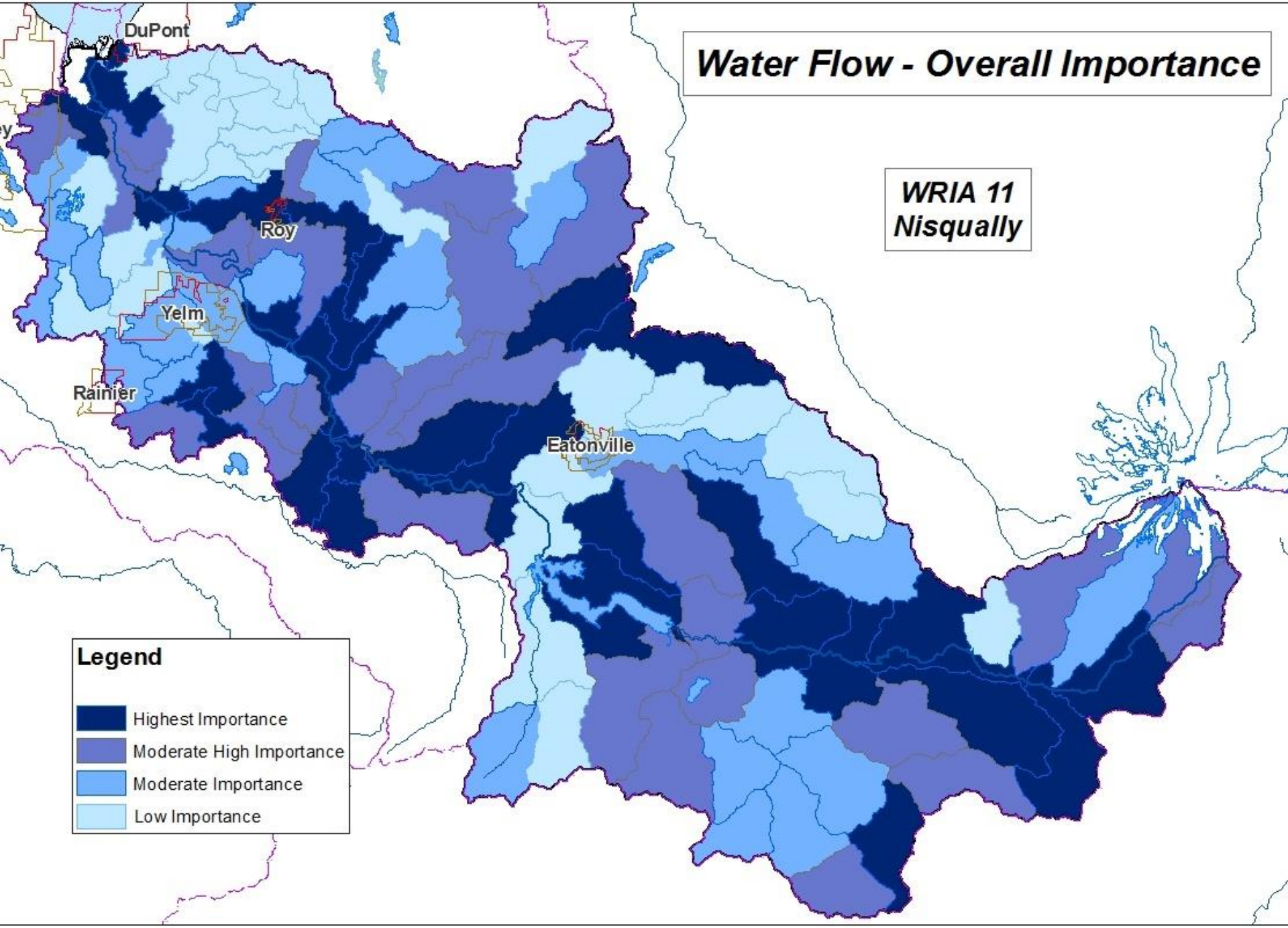
Sample GIS Data for Water Models

- **Hydrography** – NHD streams, water bodies;
  – SSHIAP gradient & confinement (WDFW)
- **Land Cover** – 2006 C-CAP (Coastal Change Analysis Program) (NOAA)
- **Precipitation** – Annual Precip Isohyets (NOAA)
  – Rain-on-Snow Zones (DNR)
- **Soils** – SSURGO (NRCS)
- **Geology** – Geologic units (DNR)
  – Slope Stability (DNR)
- **Roads** – DNR & DOT
- **Wetlands** – Hydric soils, NWI (USF&W), Landcover wetlands, "marsh" water bodies
- **Slope** – 10 meter DEM (USGS)

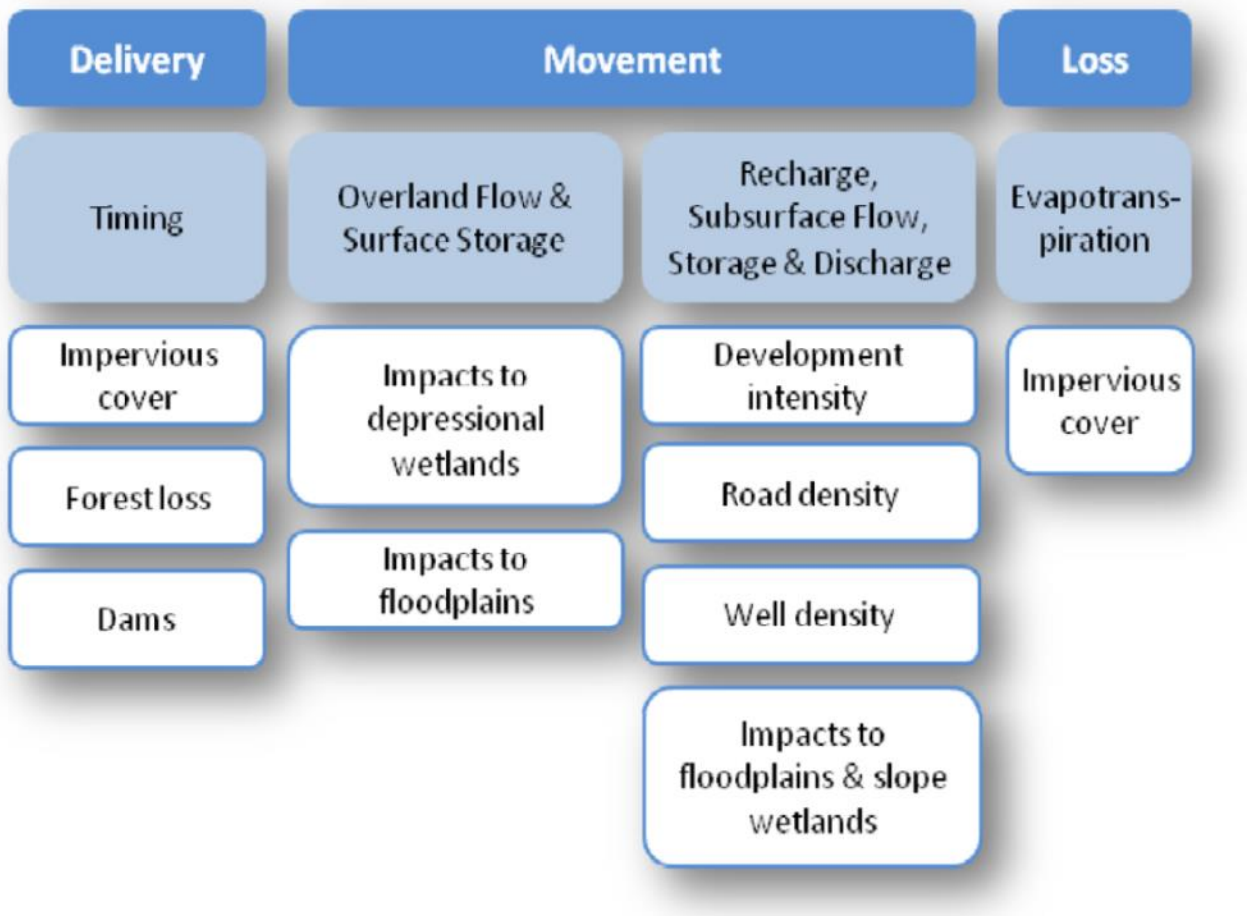
Model Water Flow Processes - Importance



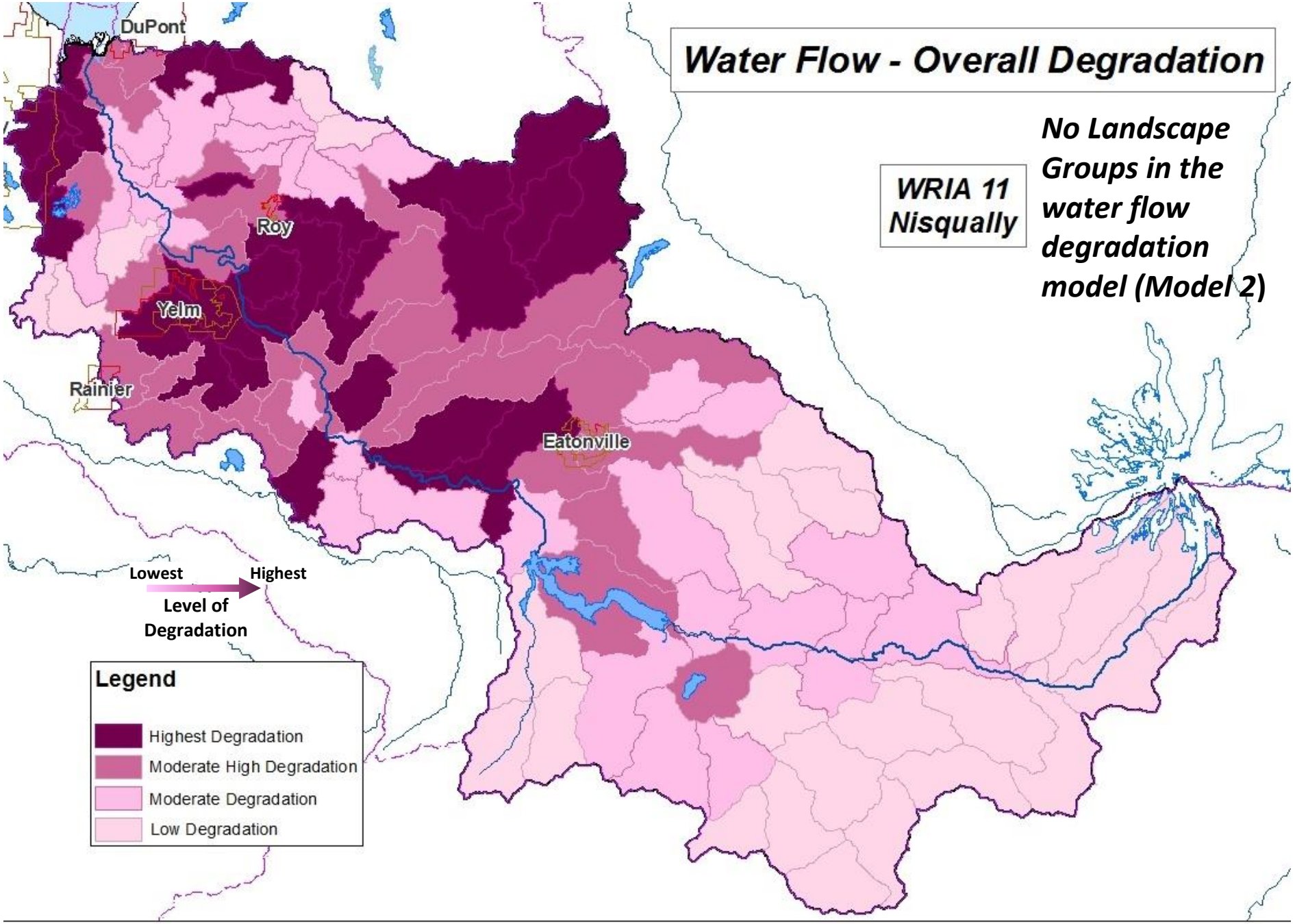
Model 1 – Importance of Water Flow Processes


Water Flow - Overall Importance
WRIA 11
Nisqually
DuPont
Roy
Yelm
Rainier
Eatonville
Legend
Highest Importance
Moderate High Importance
Moderate Importance
Low Importance

Model Water Flow Processes - Degradation



Model 2 – Degradation to Water Flow Processes

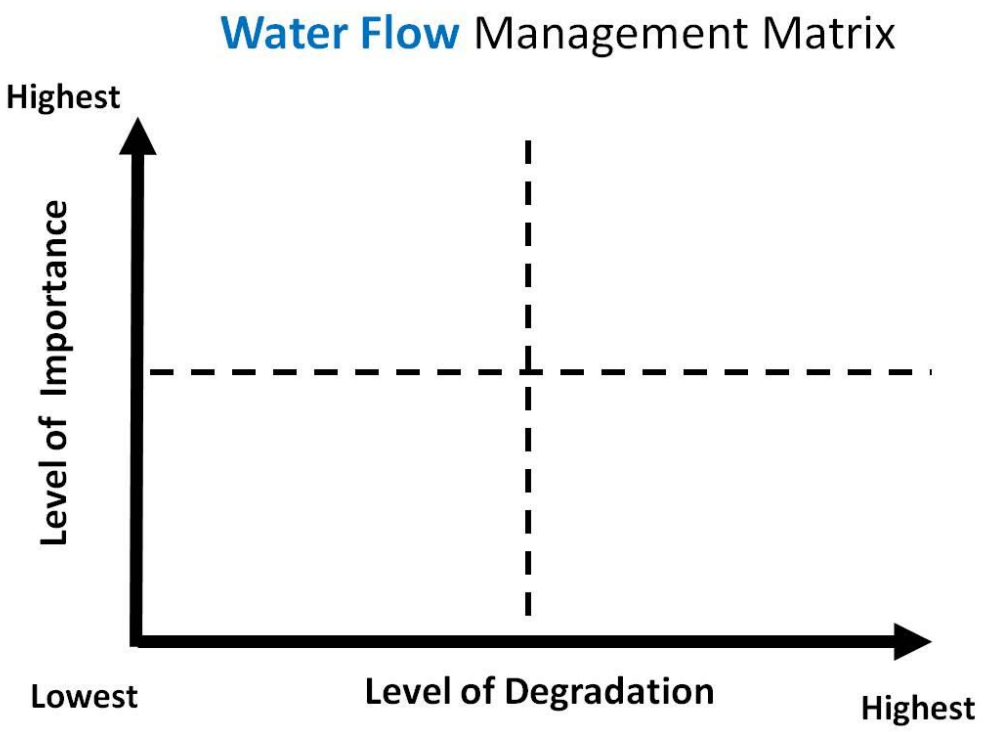

Water Flow - Overall Degradation
WRIA 11
Nisqually
No Landscape Groups in the water flow degradation model (Model 2)
DuPont
Roy
Yelm
Rainier
Eatonville
Lowest
Highest
Level of Degradation
Legend
Highest Degradation
Moderate High Degradation
Moderate Degradation
Low Degradation

Water Processes Assessments

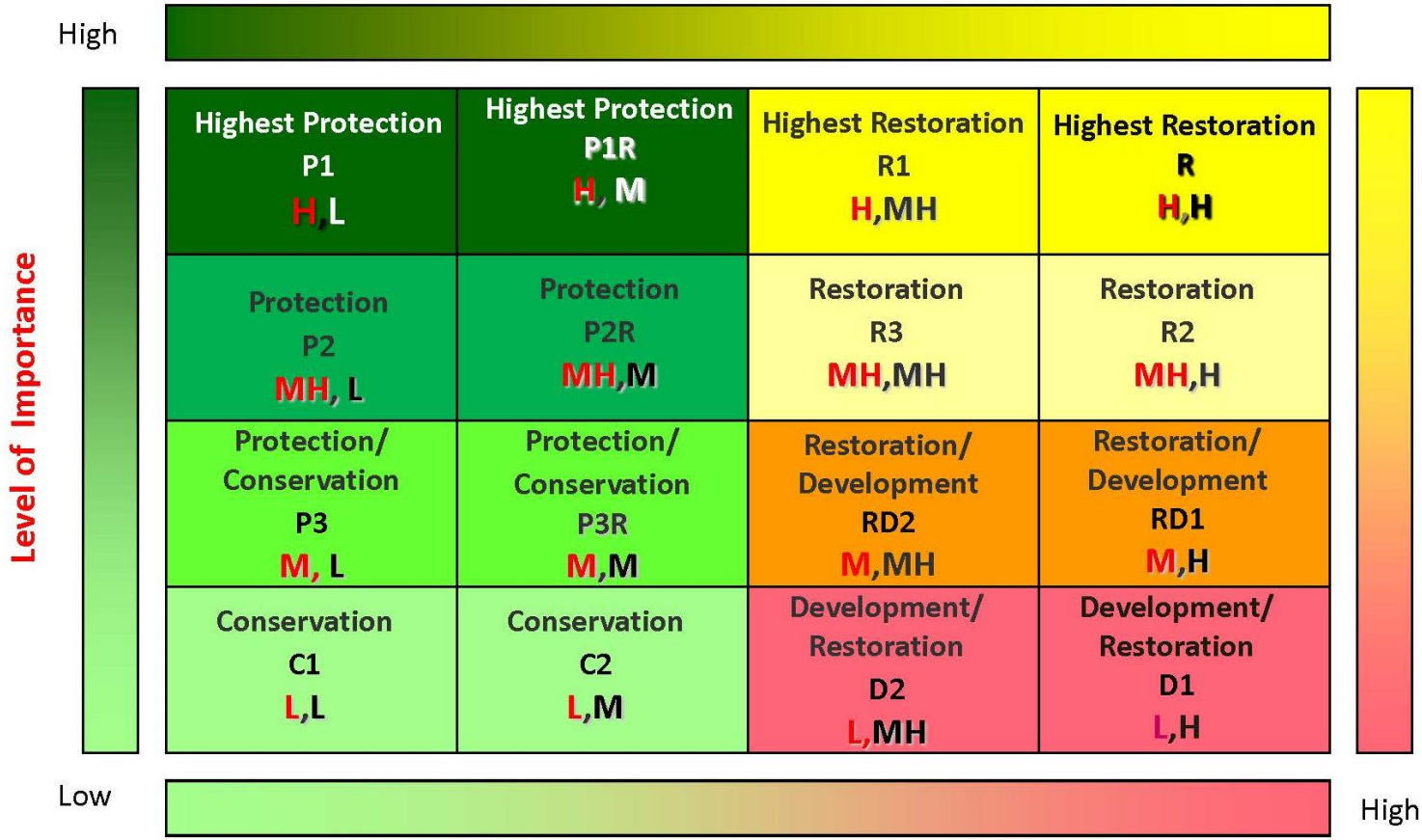
- ***Water Flow***

  Importance and **Degradation** models for

  Delivery + Movement + Loss (0-1 normalized score)



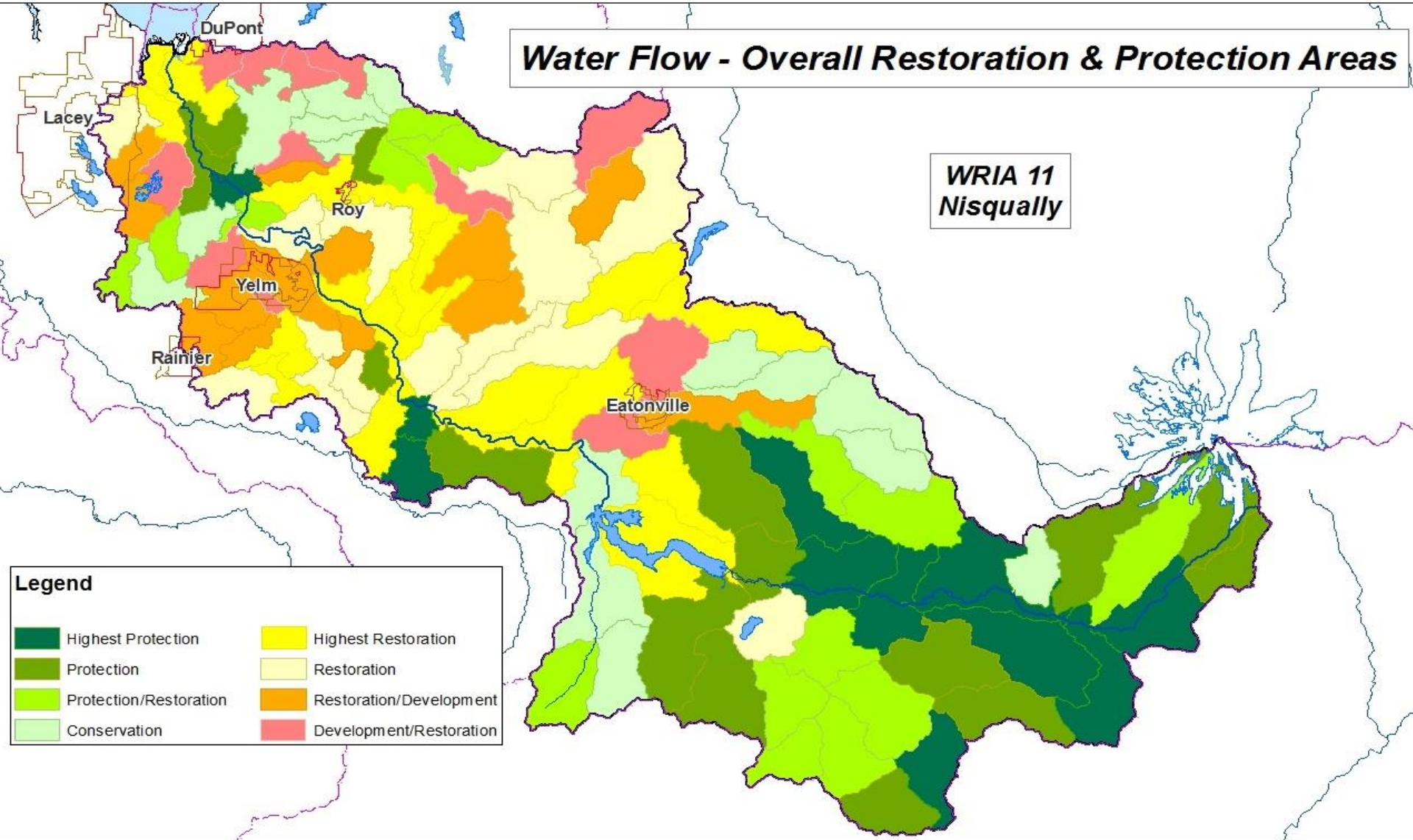
Combine **Importance** and **Degradation** models for certain planning scenarios



Red Letter = H, MH, M, or L for Importance Score

Black Letter = H, MH, M, or L for Degradation Score

Watershed Management Recommendations (WF_RP)



Water Flow – B-IBI

Applying models to B-IBI basins

-Filter and Ranking criteria

Assessment Methods

The model was run on polygon features associated to the B-IBI points (derived from PSB database)

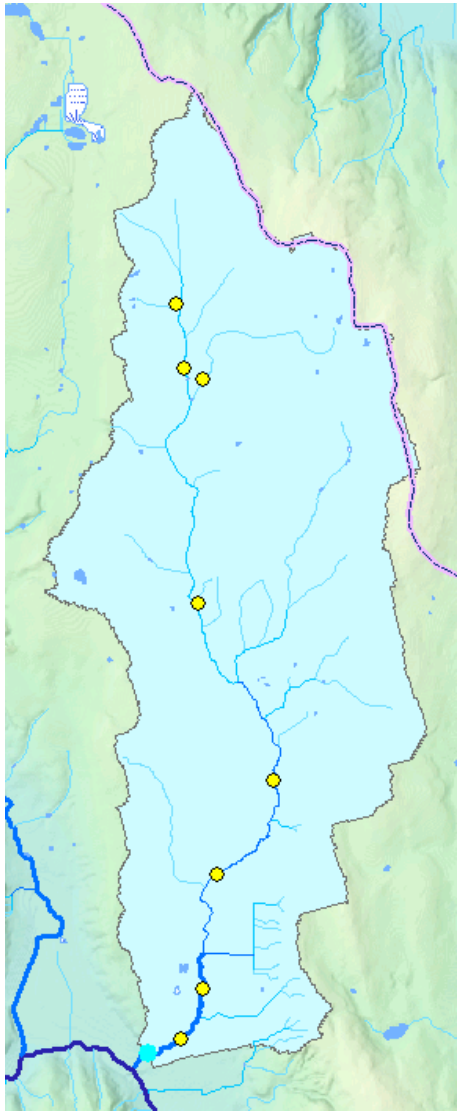
Each point is at the bottom of its watershed (polygon), and the polygon includes all the land that drains to that point.

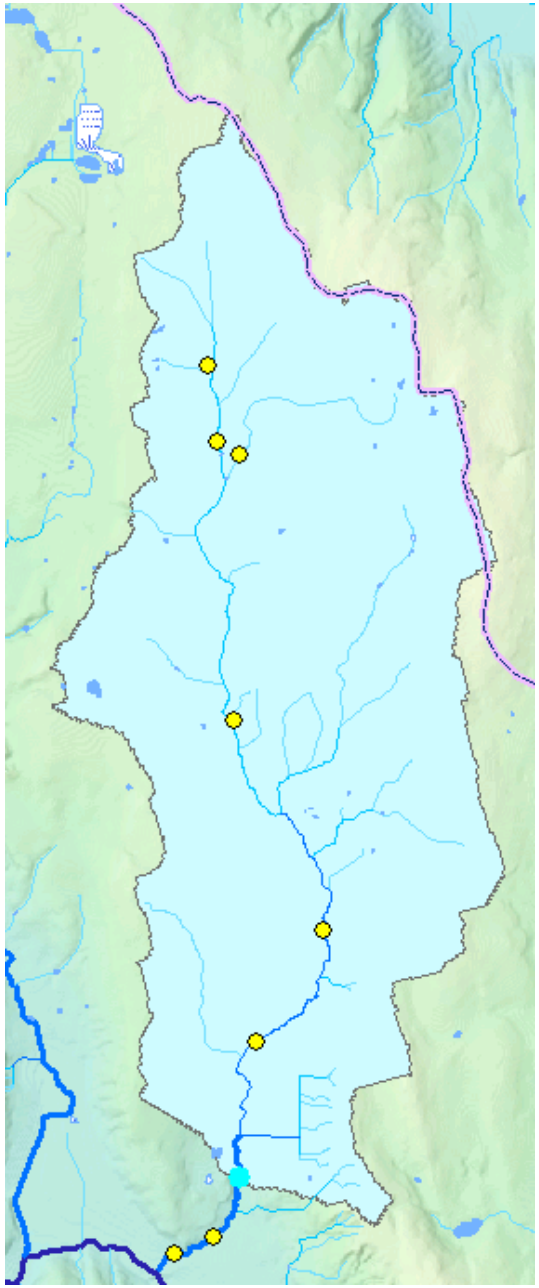
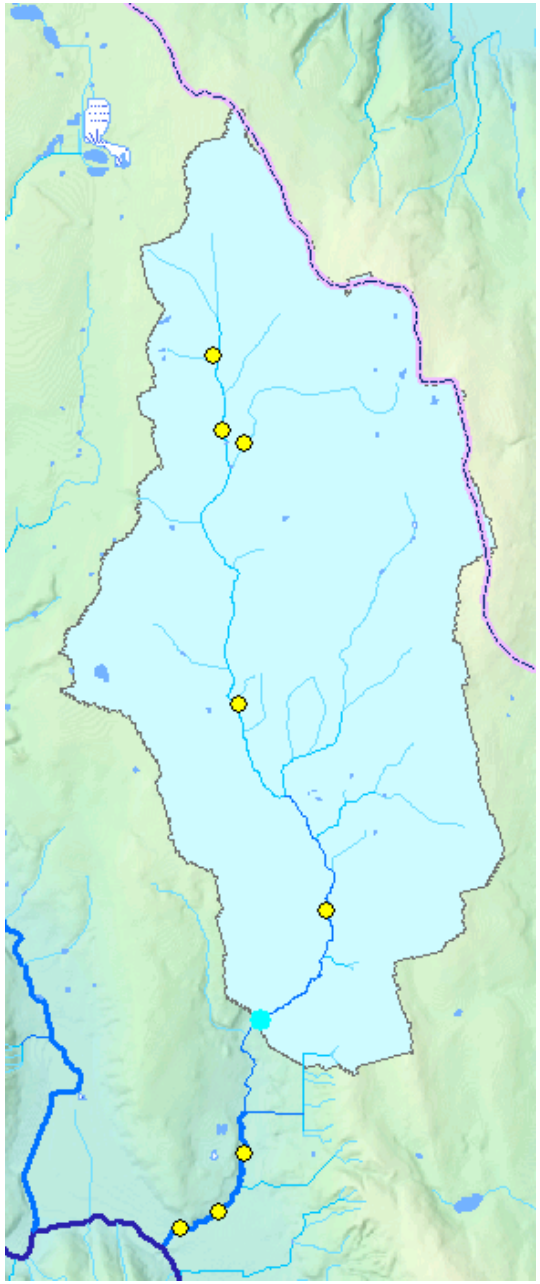
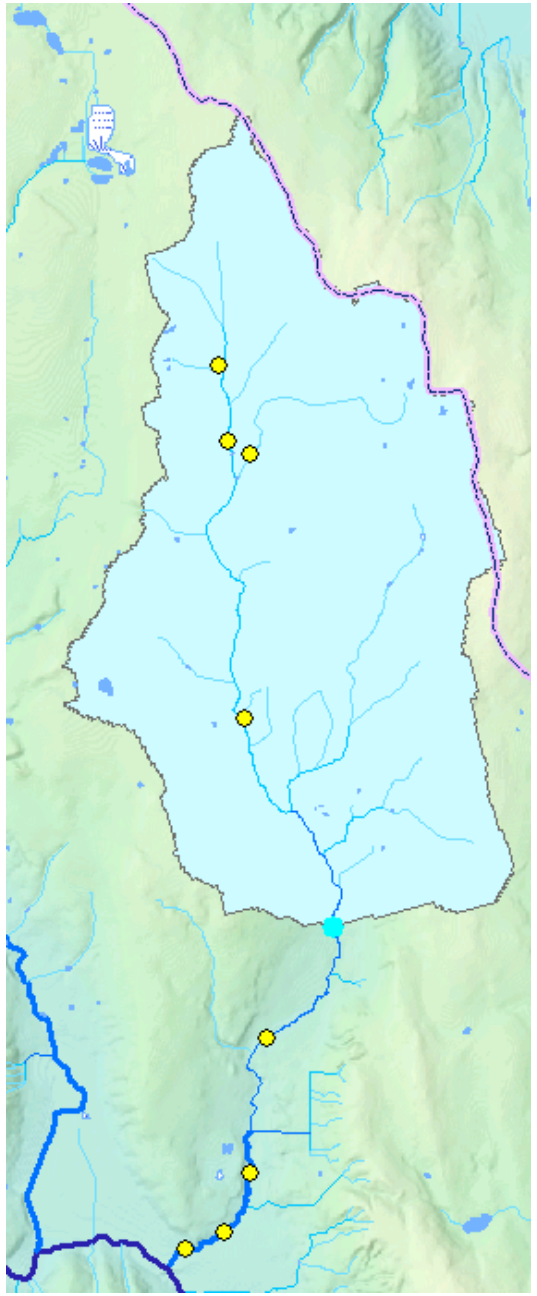
Assumption: natural features in a B-IBI watershed have potential to impact the B-IBI score

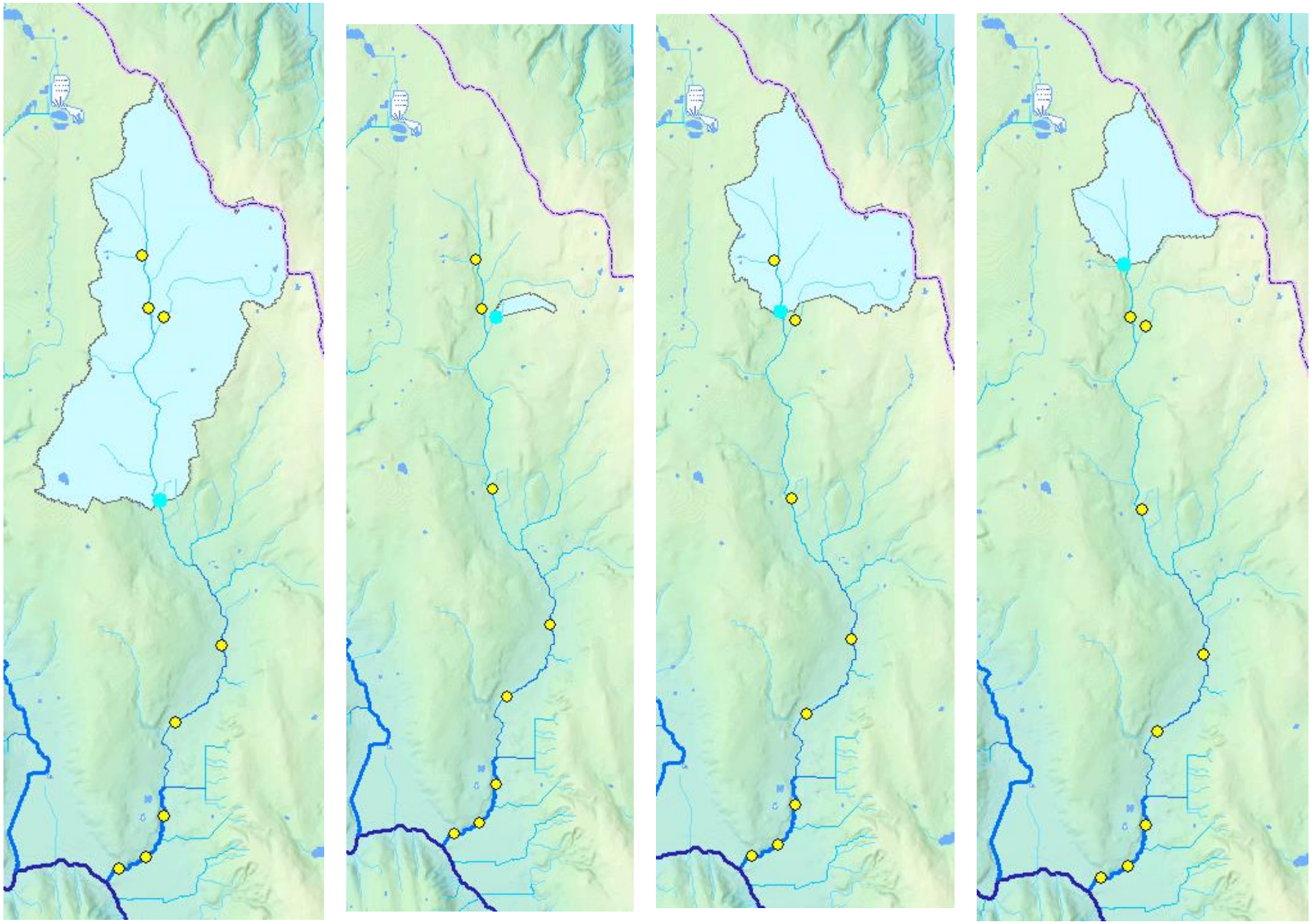
- Presence of areas important to water flow processes (e.g. wetlands and highly permeable floodplains)
- Presence of degraded areas important to water flow processes (e.g. impacts to wetlands)

Assessment Methods

Here, the point furthest South (highlighted in blue) is the point that represents the blue polygon. All the land that drains to this point was used to calculated the scores in the Water Flow Model.



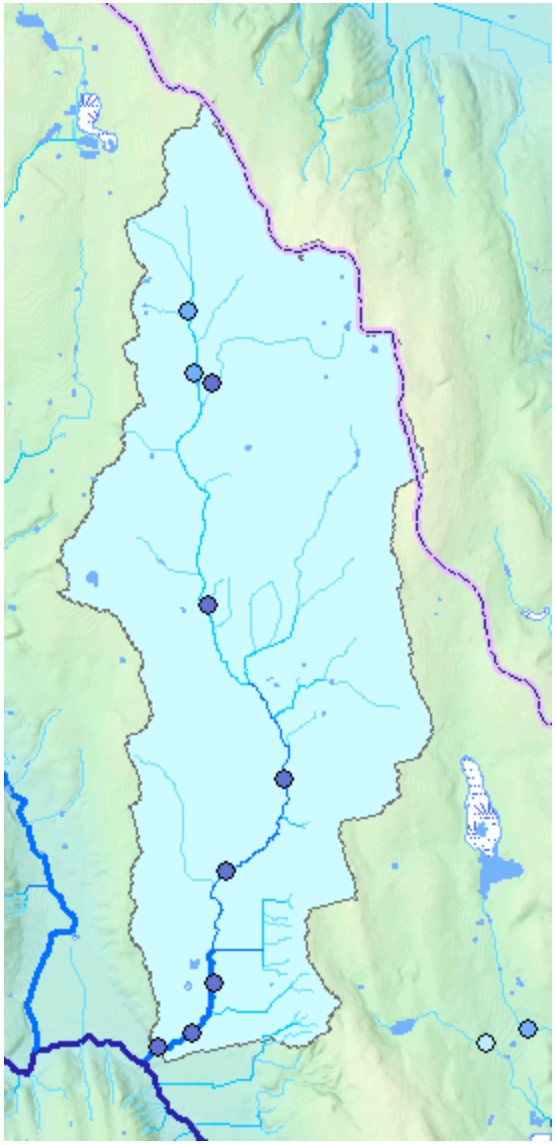






Overall Importance of Water Flow

Overall Importance of Water Flow

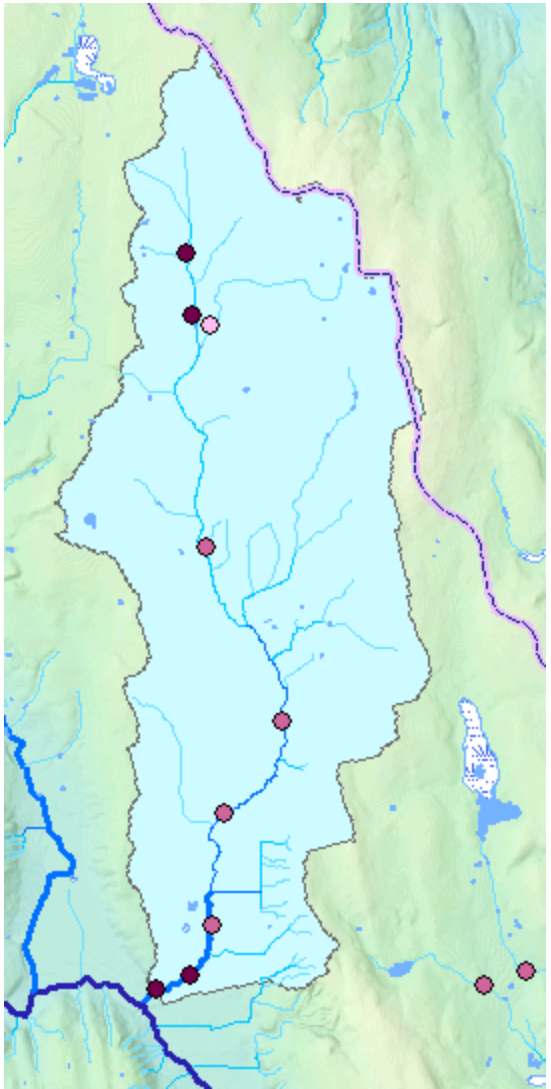
- High
- Medium High
- Medium
- Low



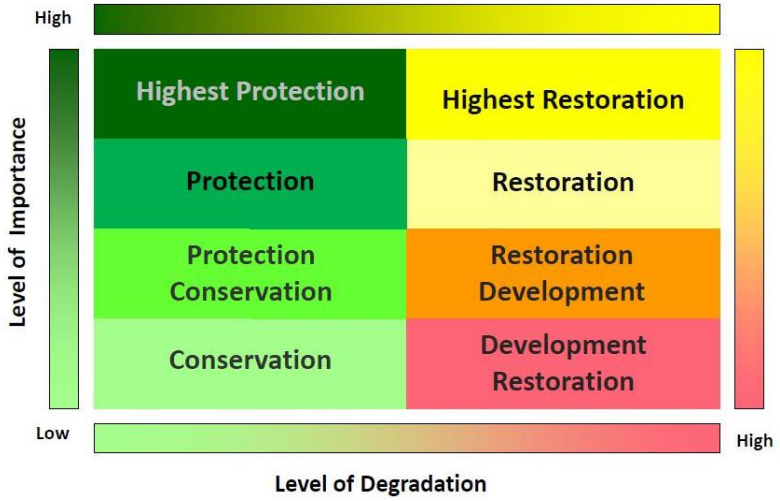
Overall Degradation to Water Flow

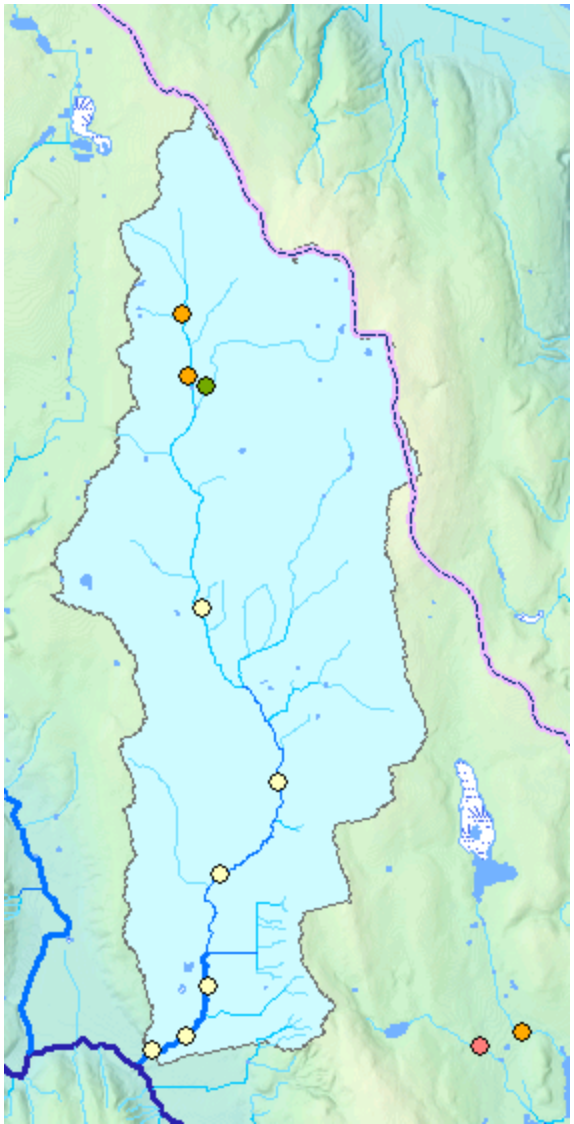
Overall Degradation to Water Flow

- High
- Medium High
- Medium
- Low



Overall Restoration/Protection for Water Flow

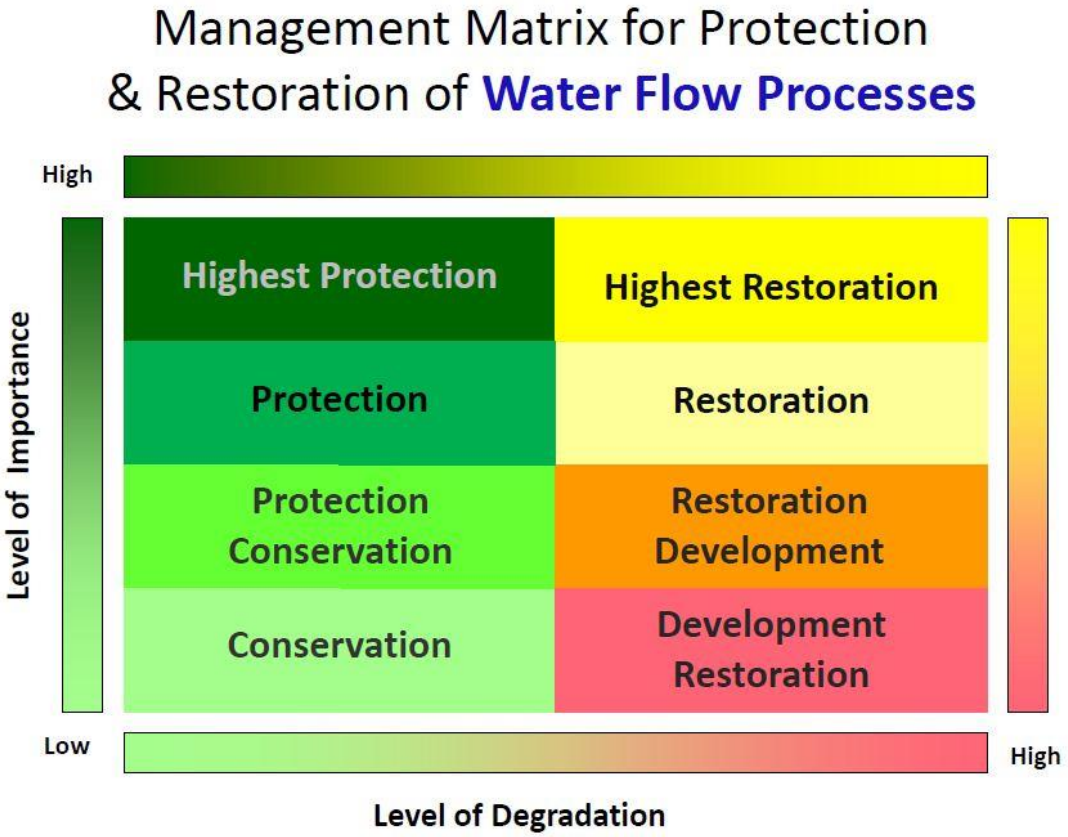


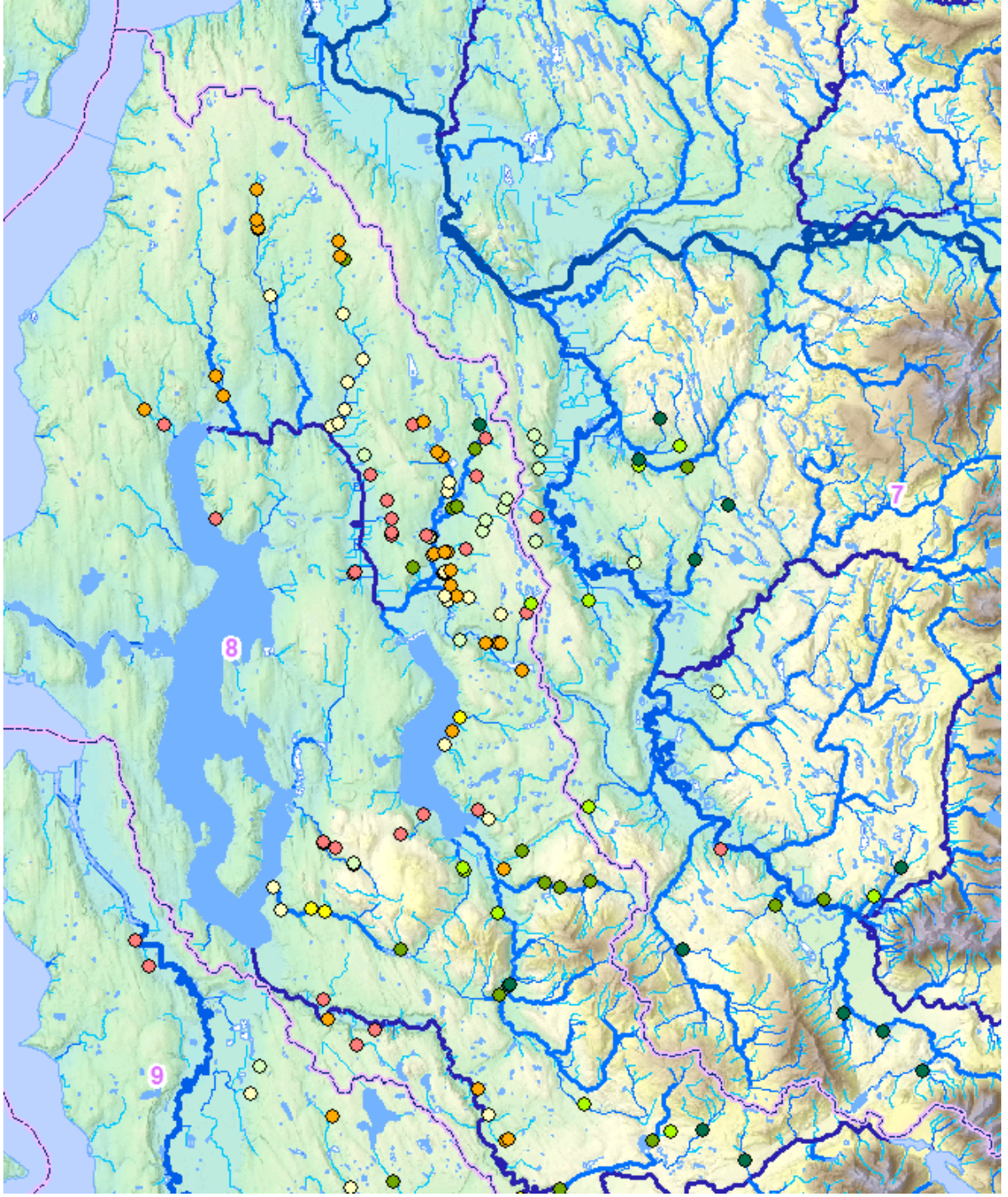


Results of applying Water Flow models to the filtered (n=284) basins

1. Scored “Fair” at least once (28-36)
2. N>2
3. Within the Puget Lowland Ecoregion
4. Stream Order 1-4

Overall Restoration/ Protection for Water Flow





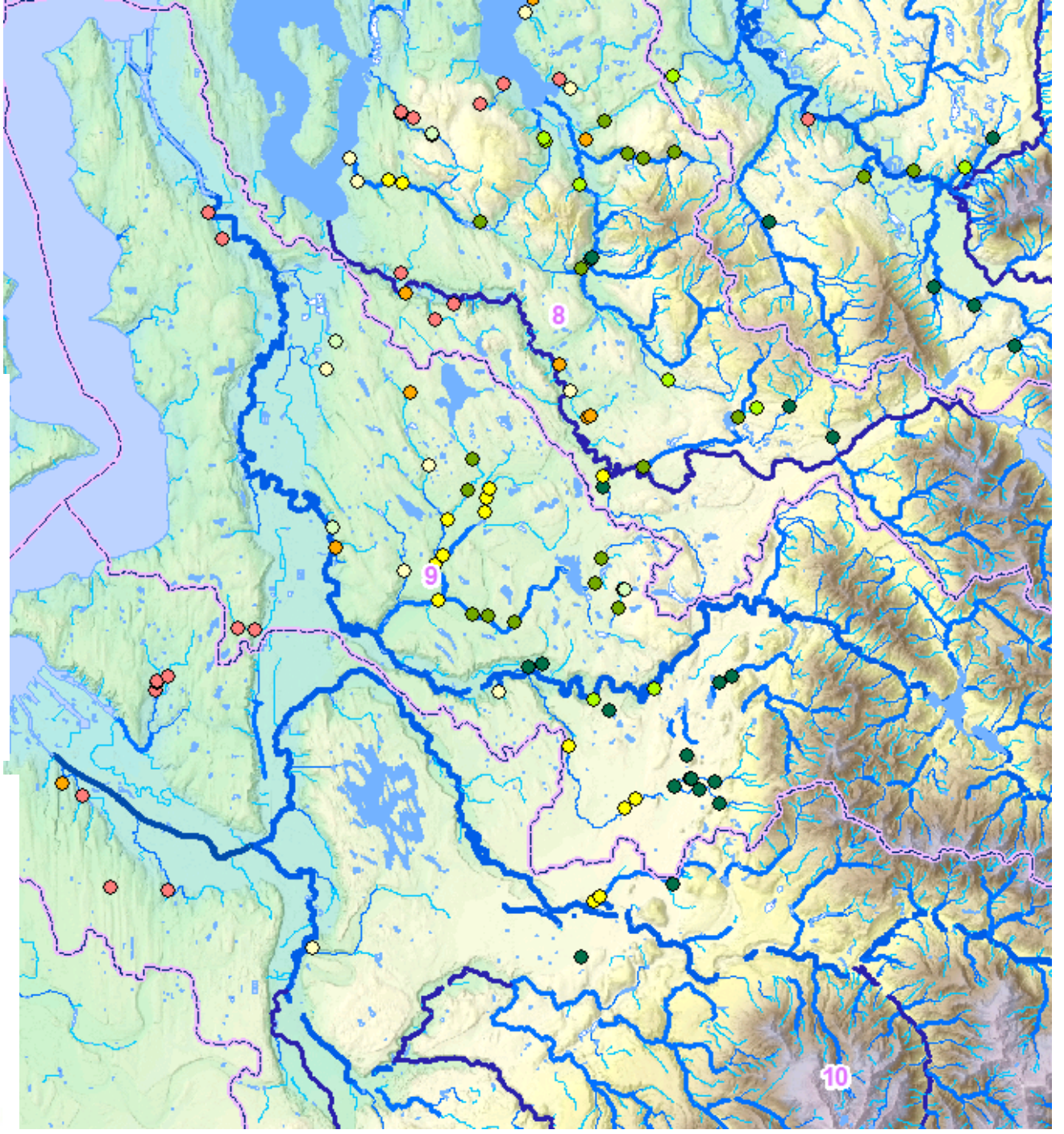
Overall Restoration/Protection for Water Flow

- Conservation
- Development/Restoration
- Highest Protection
- Protection
- Protection/Restoration
- Highest Restoration
- Restoration
- Restoration/Development

Management Matrix for Protection & Restoration of **Water Flow Processes**

Level of Importance	Level of Degradation	
High	Highest Protection	Highest Restoration
	Protection	Restoration
	Protection Conservation	Restoration Development
Low	Conservation	Development Restoration

Level of Degradation: Low → High



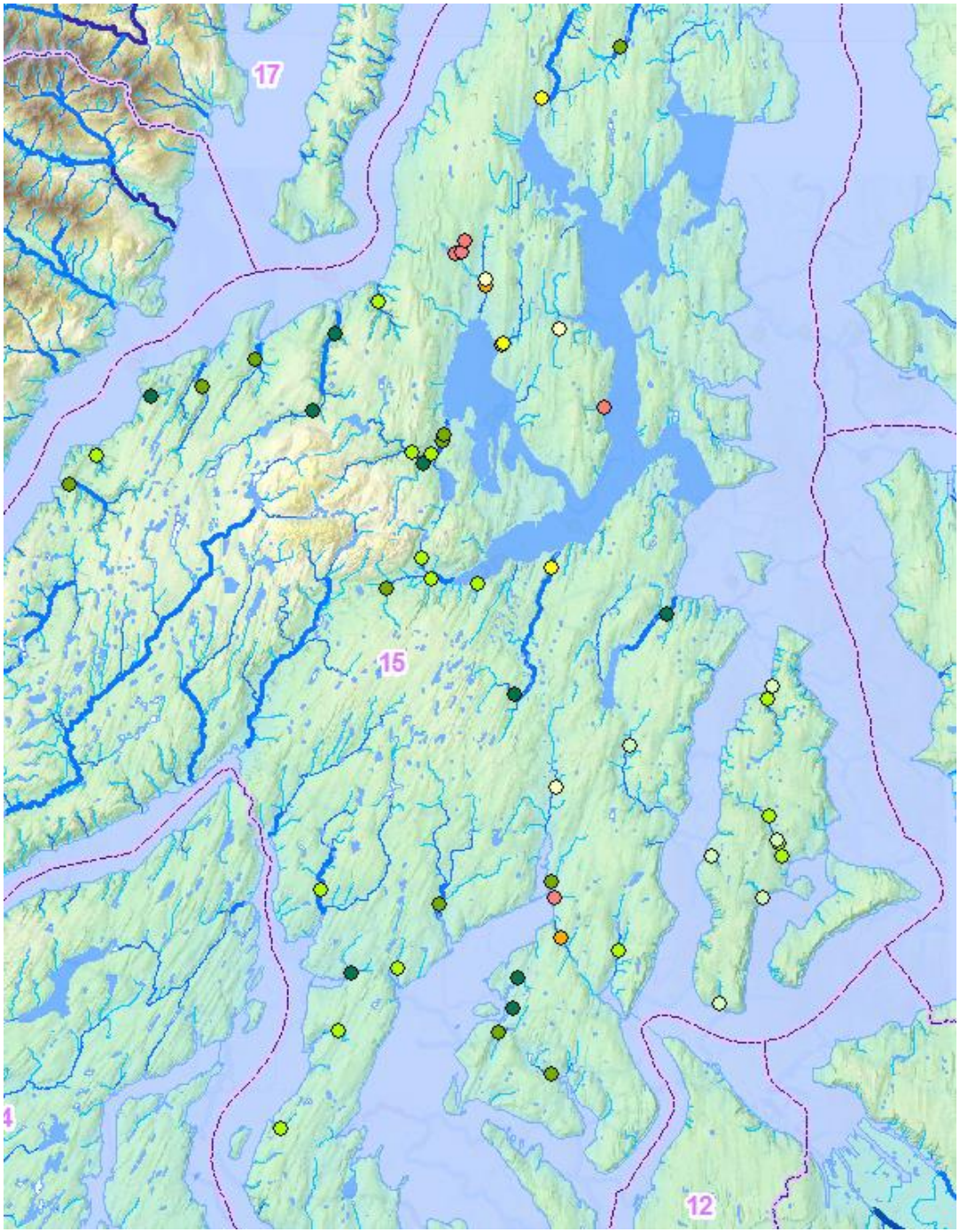
Overall Restoration/Protection for Water Flow

- Conservation
- Development/Restoration
- Highest Protection
- Protection
- Protection/Restoration
- Highest Restoration
- Restoration
- Restoration/Development

Management Matrix for Protection & Restoration of **Water Flow Processes**

Level of Importance	Level of Degradation	
High	Highest Protection	Highest Restoration
	Protection	Restoration
	Protection Conservation	Restoration Development
Low	Conservation	Development Restoration

High



Overall Restoration/Protection for Water Flow

- Conservation
- Development/Restoration
- Highest Protection
- Protection
- Protection/Restoration
- Highest Restoration
- Restoration
- Restoration/Development

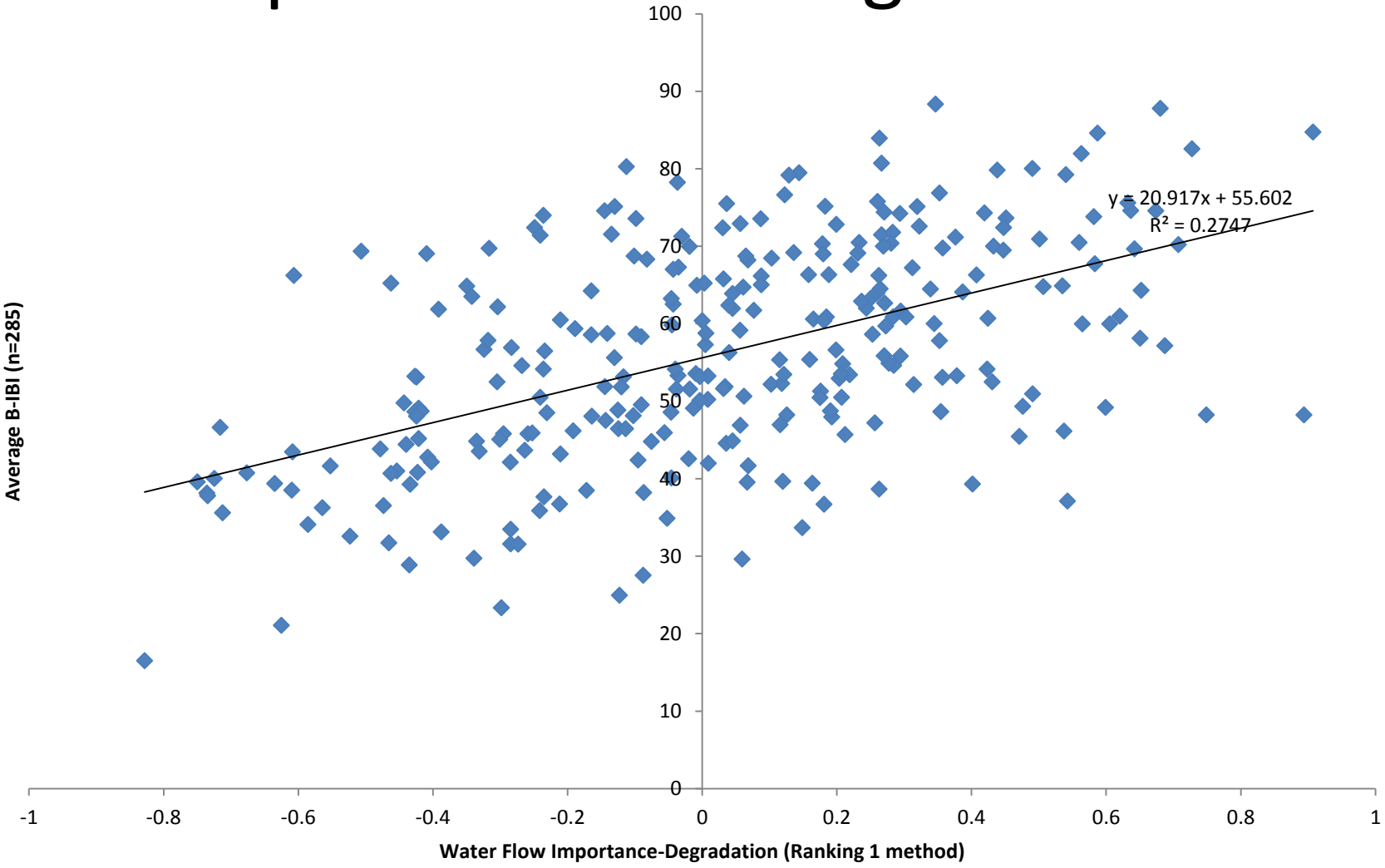
Management Matrix for Protection & Restoration of **Water Flow Processes**

Combining Importance and Degradation – a score for ranking sites

In reviewing the latest assessment run on 285 small watersheds in Puget Sound,

- the Rank 1 Scoring method for water flow (importance minus degradation) had the best correlation with BIBI scores.
- The other rankings water flow Importance and water flow Degradation had increasingly lower correlations with BIBI scores.
- Rank 1 scoring method identifies watersheds that have the highest potential for increasing B-IBI score from fair to good based on water flow process condition (generally Most Important, least degraded)

Ranking method combining Importance and Degradation



Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Tate Creek	N Fork Snoqualmie Subbasin	0.907	1	H	L	P1	84.7	903
Little Boston	Bangor-Port Gamble Subbasin	0.894	2	H	L	P1	48.2	880
Big Beef Creek	W Kitsap Subbasin	0.749	3	H	M	P1R	48.2	888
Rock Creek (Upper Cedar)	Upper Cedar River Subbasin	0.728	4	H	L	P1	82.6	128
Harris Creek	Harris Creek Subbasin	0.707	5	H	M	P1R	70.2	302
Stonequarry Creek	Newaukum Creek Subbasin	0.687	6	H	M	P1R	57.2	258
Cherry Creek - N Fork tributary	Cherry Creek Subbasin	0.680	7	H	L	P1	87.8	281
Deep Creek (Green River)	Deep Creek Subbasin	0.674	8	H	L	P1	74.5	290
Boxley Creek tributary	S Fork Snoqualmie Subbasin	0.652	9	H	L	P1	64.3	347
Harris Creek	Harris Creek Subbasin	0.650	10	H	L	P1	58.1	303
Boyce Creek	W Kitsap Subbasin	0.642	11	H	L	P1	69.7	873
Newaukum Creek - N Fork	Newaukum Creek Subbasin	0.637	12	H	M	P1R	74.6	328
Newaukum Creek - N Fork	Newaukum Creek Subbasin	0.633	13	H	M	P1R	75.6	257
Newaukum Creek	Newaukum Creek Subbasin	0.621	14	H	L	P1	61.0	329
Big Beef Creek	W Kitsap Subbasin	0.606	15	H	L	P1	60.0	1069
Vaughn Creek	Key Peninsula Subbasin	0.599	16	H	M	P1R	49.2	1102
Williams Creek	Upper Cedar River Subbasin	0.587	17	H	L	P1	84.6	1086
Clough Creek	S Fork Snoqualmie Subbasin	0.583	18	H	L	P1	67.7	348
Deep Creek (Green River)	Deep Creek Subbasin	0.582	19	H	L	P1	73.8	224
Spiketon Creek	S Prairie Creek Subbasin	0.565	20	H	M	P1R	60.0	1099
Newaukum Creek	Newaukum Creek Subbasin	0.563	21	H	L	P1	81.9	261
Newaukum Creek - N Fork	Newaukum Creek Subbasin	0.560	22	H	L	P1	70.5	260
Rosedale Creek	Carr Inlet Subbasin	0.543	23	H	M	P1R	37.1	89
Newaukum Creek	Newaukum Creek Subbasin	0.540	24	H	L	P1	79.2	259
Crisp Creek	Middle Green River Subbasin	0.538	25	H	M	P1R	46.1	244
Cristy Creek	Middle Green River Subbasin	0.535	26	H	L	P1	64.9	247
Boise Creek	Mud Mt Lake Subbasin	0.507	27	H	L	P1	64.8	357
Blackjack Creek	S Sinclair Inlet Subbasin	0.501	28	H	M	P1R	70.9	1438
Snoqualmie River - S Fork tributary	S Fork Snoqualmie Subbasin	0.491	29	H	M	P1R	50.9	346

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Dickerson Creek	Dyes Inlet / Central Kitsap Subbasin	0.490	30	H	L	P1	80.0	890
Cherry Creek	Cherry Creek Subbasin	0.476	31	H	L	P1	49.3	284
Martha John Creek	Bangor-Port Gamble Subbasin	0.471	32	H	L	P1	45.4	881
Raging River tributary	Raging River Subbasin	0.451	33	H	M	P1R	73.6	332
Fifteenmile Creek	Issaquah Creek Subbasin	0.448	34	H	L	P1	72.4	153
Fifteenmile Creek	Issaquah Creek Subbasin	0.447	35	H	L	P1	69.5	306
Hotel Creek (0342)	Lower Cedar River Subbasin	0.438	36	MH	L	P2	79.8	127
Harvey Creek	Stillaguamish Flats Subbasin	0.433	37	H	L	P1	70.0	500
Stavis Creek	W Kitsap Subbasin	0.431	38	MH	L	P2	52.5	884
Little Pilchuck Creek (Snohomish)	Lower Pilchuck River (Snohomish) Subbasin	0.425	39	H	M	P1R	60.7	501
Seabeck Creek	W Kitsap Subbasin	0.424	40	MH	L	P2	54.1	883
Ellis Creek (Deschutes)	Lower Deschutes River Subbasin	0.419	41	H	MH	R1	74.3	812
Big Anderson Creek	W Kitsap Subbasin	0.407	42	MH	L	P2	66.3	887
Crisp Creek	Middle Green River Subbasin	0.402	43	H	M	P1R	39.3	243
Brockway Creek	Kimball Creek Subbasin	0.387	44	MH	L	P2	64.1	342
Bear Creek (Sammamish River)	Bear Creek Subbasin	0.378	45	H	M	P1R	53.3	117
May Creek (Lake Washington)	May Creek Subbasin	0.376	46	MH	L	P2	71.1	320
Boise Creek	Mud Mt Lake Subbasin	0.357	47	H	MH	R1	69.8	1239
Newaukum Creek	Newaukum Creek Subbasin	0.357	48	H	MH	R1	53.1	256
Boise Creek	Mud Mt Lake Subbasin	0.355	49	H	MH	R1	48.6	356
Green Cove Creek	McLane Creek Subbasin	0.353	50	H	MH	R1	57.8	814
Hotel Creek (0342)	Lower Cedar River Subbasin	0.352	51	M	L	P3	76.9	1089
Rock Creek (Lower Cedar)	Lower Cedar River Subbasin	0.347	52	H	M	P1R	88.3	125
Newaukum Creek	Newaukum Creek Subbasin	0.345	53	H	MH	R1	60.0	255
Tanwax Creek	Tanwax Creek Subbasin	0.339	54	H	M	P1R	64.5	101
Carey Creek	Issaquah Creek Subbasin	0.322	55	M	L	P3	72.6	156
Coal Creek (Snoqualmie River)	Kimball Creek Subbasin	0.319	56	MH	L	P2	75.1	286
Horn Creek	Yelm Creek Subbasin	0.314	57	MH	M	P2R	52.1	102
Cherry Creek - N Fork	Cherry Creek Subbasin	0.312	58	M	L	P3	67.2	282

How the PSWC models can be used in this project

- Water Flow Restoration & Protection categories (management matrix)
  - Can be used as a FILTER criteria (e.g. filter based on WF_RP categories)
  - May help with future work determining “what” to do to restore a site (submodel results can help as well)
- Combined Importance minus Degradation score
  - Can be used as a RANKING criteria which accounts for both models
  - Can also be used as a FILTER (e.g. take top XX% of sites)

Advantages and Limitations

- GIS layers used in the models are consistent in extent and resolution (across Puget Sound)
  - But may be missing higher resolution data layers, or other types of water flow process layers which are not consistent across PS
- Our approach does not identify or weight different factors based upon relative potential to impact B-IBI specifically
  - Relationships between B-IBI and landscape conditions still not well understood or quantified (except for %Urbanization)
  - Beginning to explore this relationship
- Reach/site level factors incredibly important – how do we weigh coarse landscape scale assessments with local scale?

Questions/Comments?

Contact:
Colin Hume
Coordinator, WCTAT
425-649-7139
Colin.hume@ecy.wa.gov

OR

https://fortress.wa.gov/ecy/coastalatlas/wc/landingpage.html

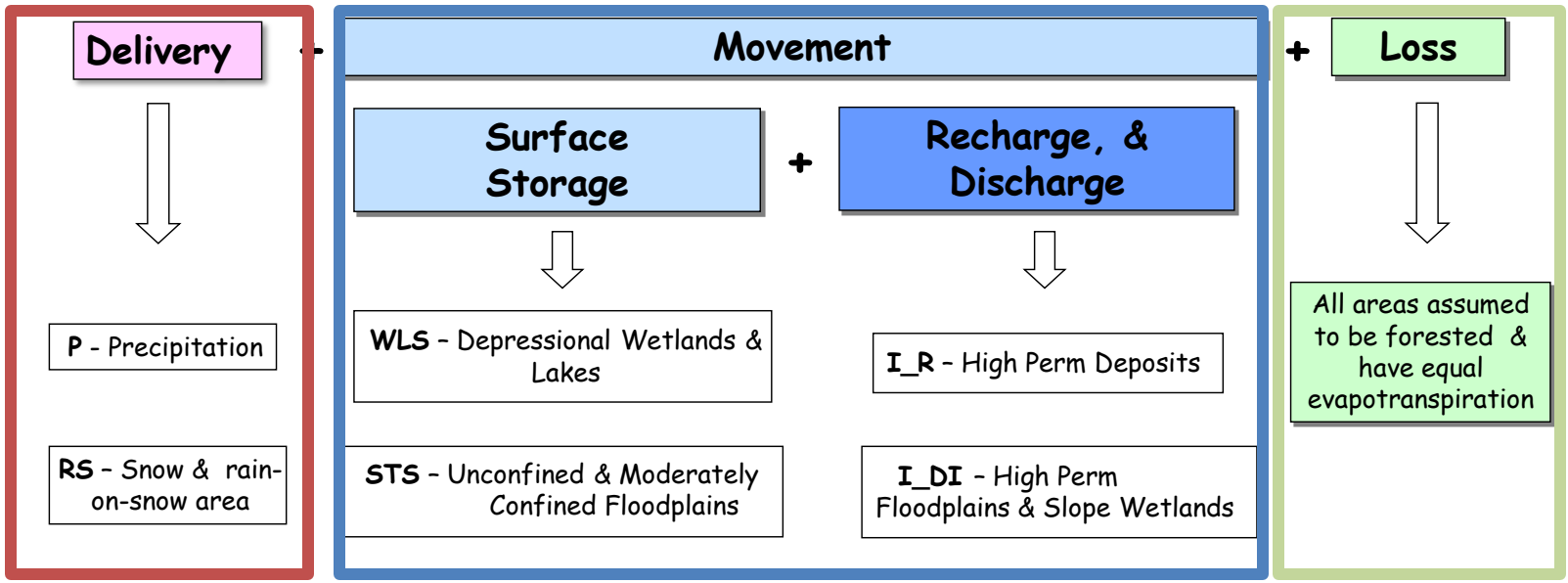
Stephen Stanley
Project Manager, PSWC Project
425-649-4210
ssta461@ecy.wa.gov

Extra Detail Slides

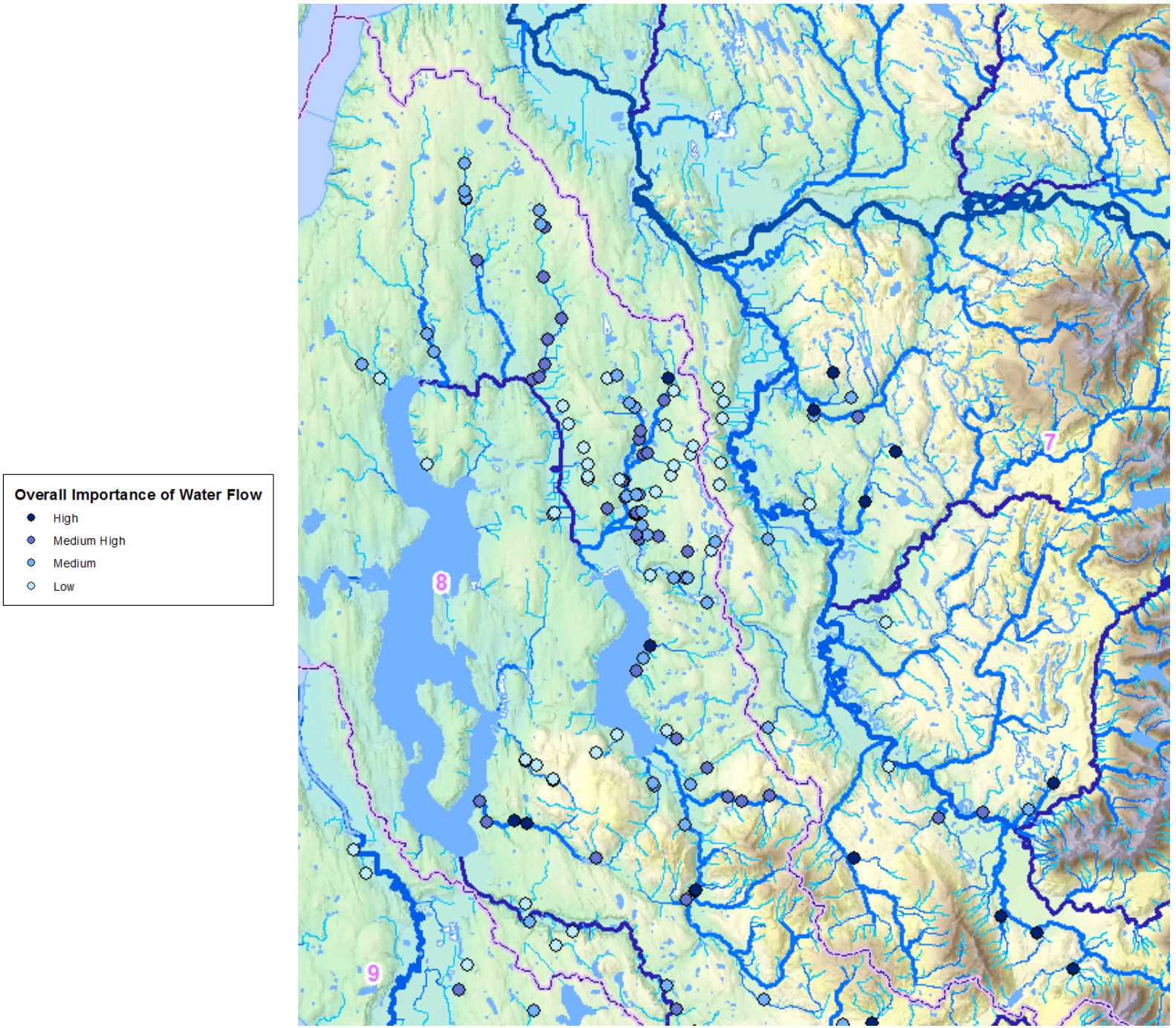
Overall Importance to Water Flow

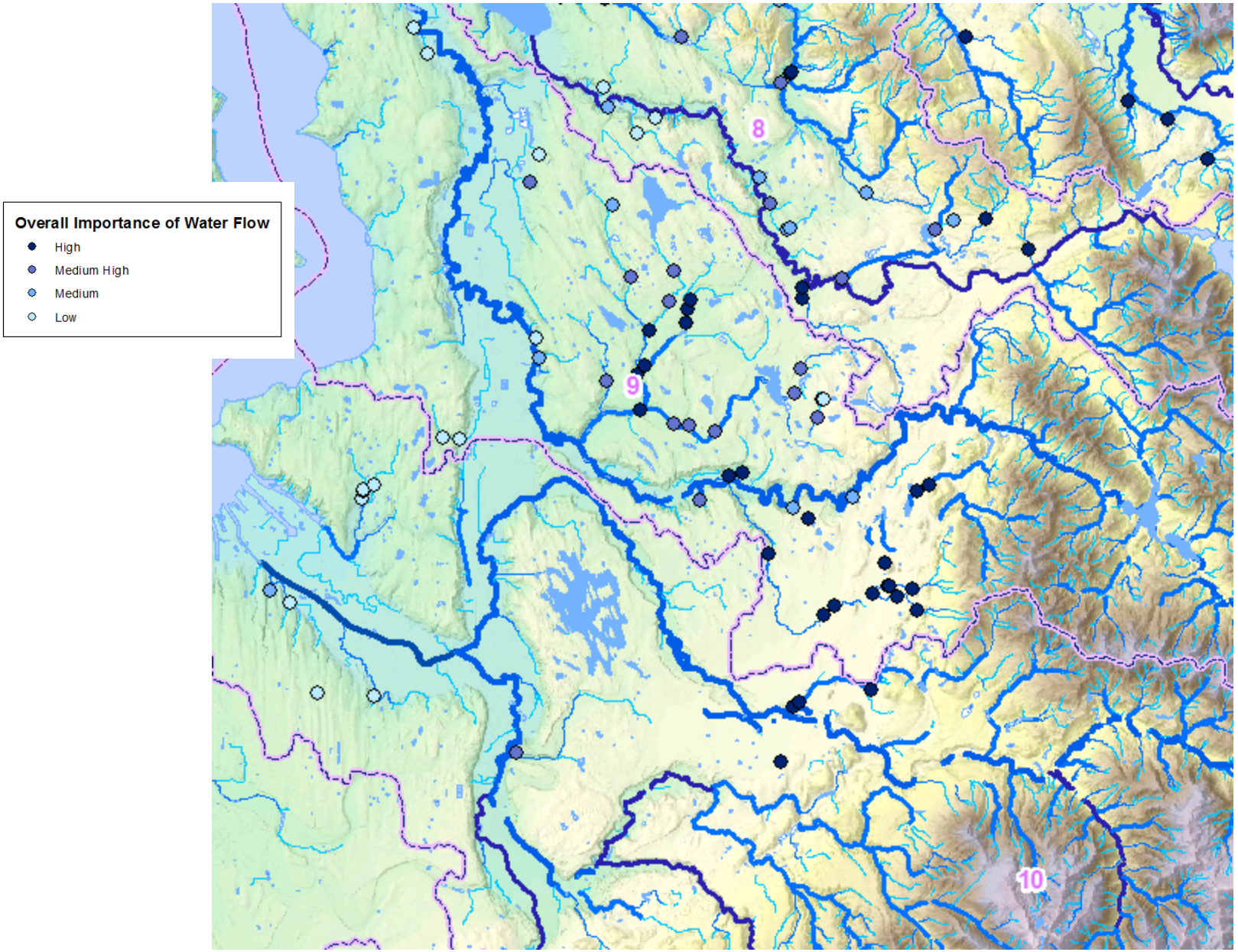
Water Flow Assessment

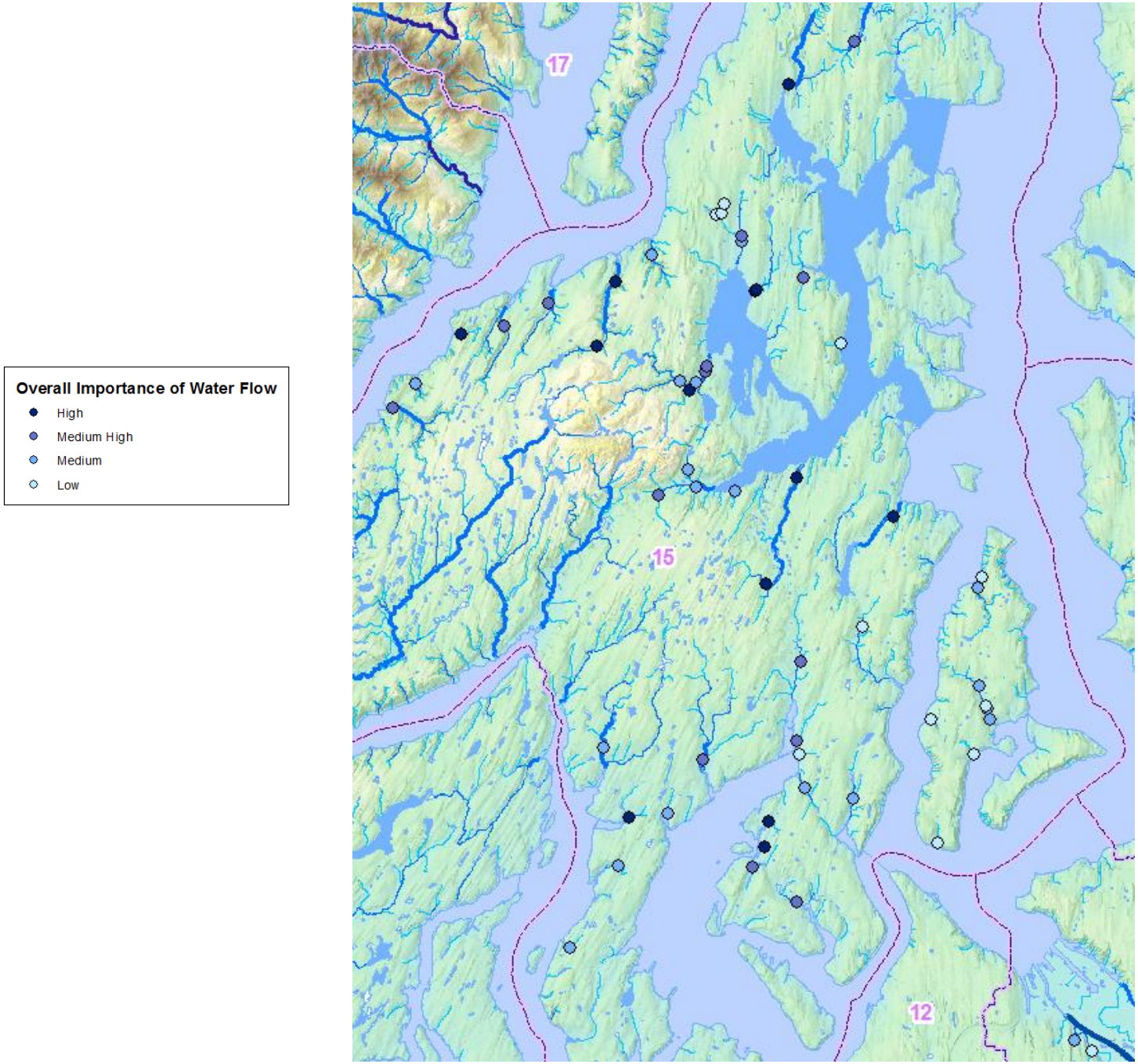
Important Area for Water Process =



Model 1

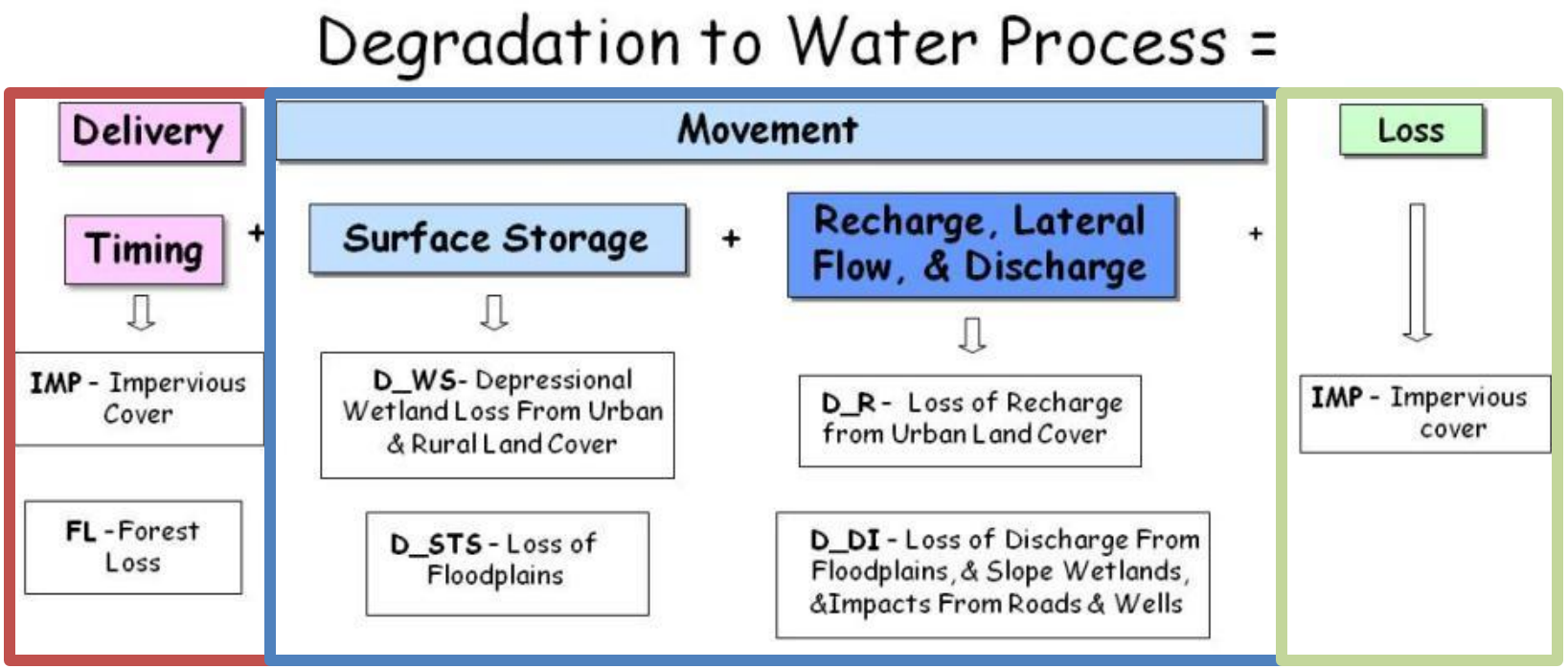

Overall Importance of Water Flow
High
Medium High
Medium
Low
8
7
9


Overall Importance of Water Flow
High
Medium High
Medium
Low
8
9
10

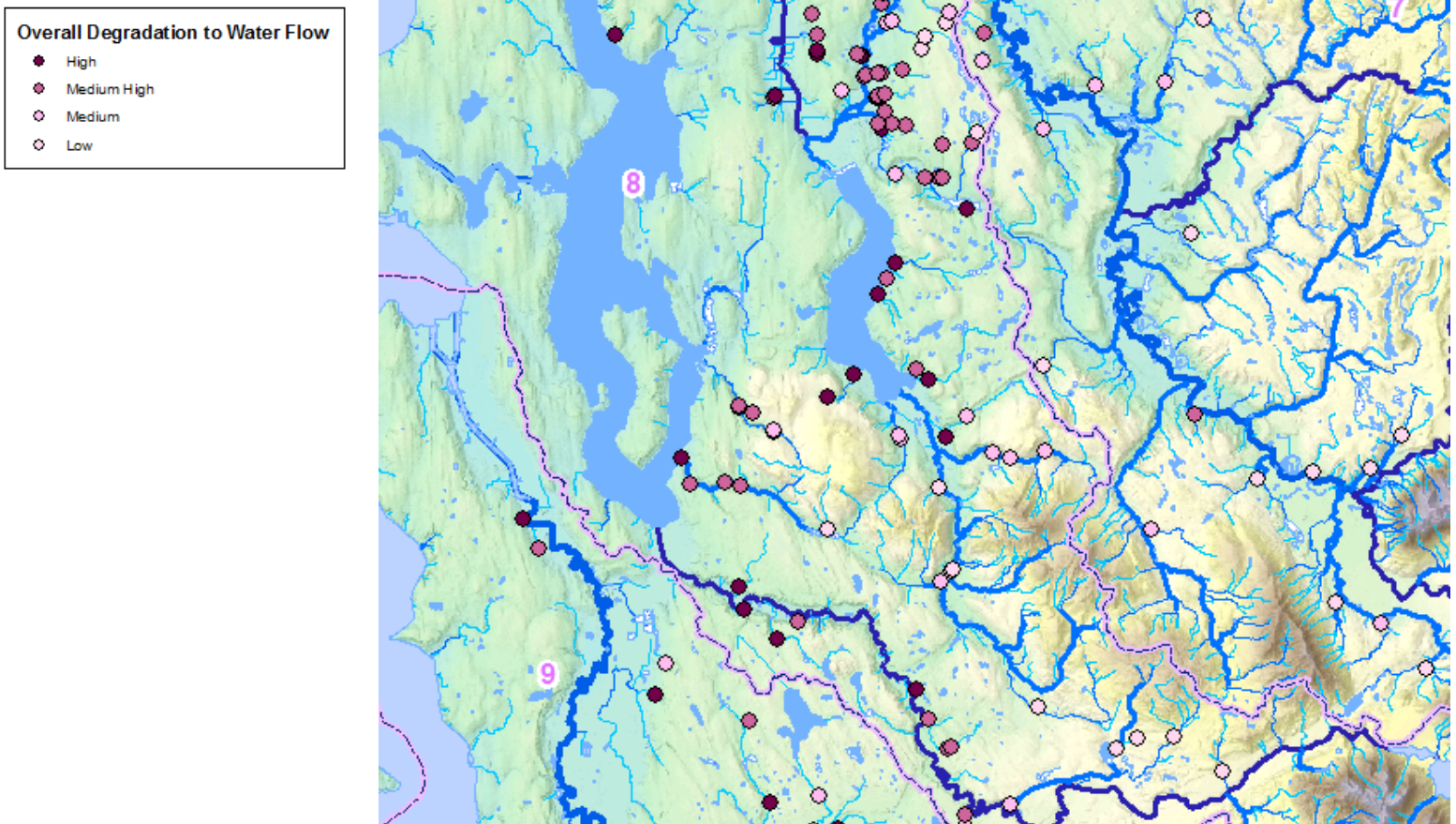

Overall Importance of Water Flow
High
Medium High
Medium
Low
17
15
12

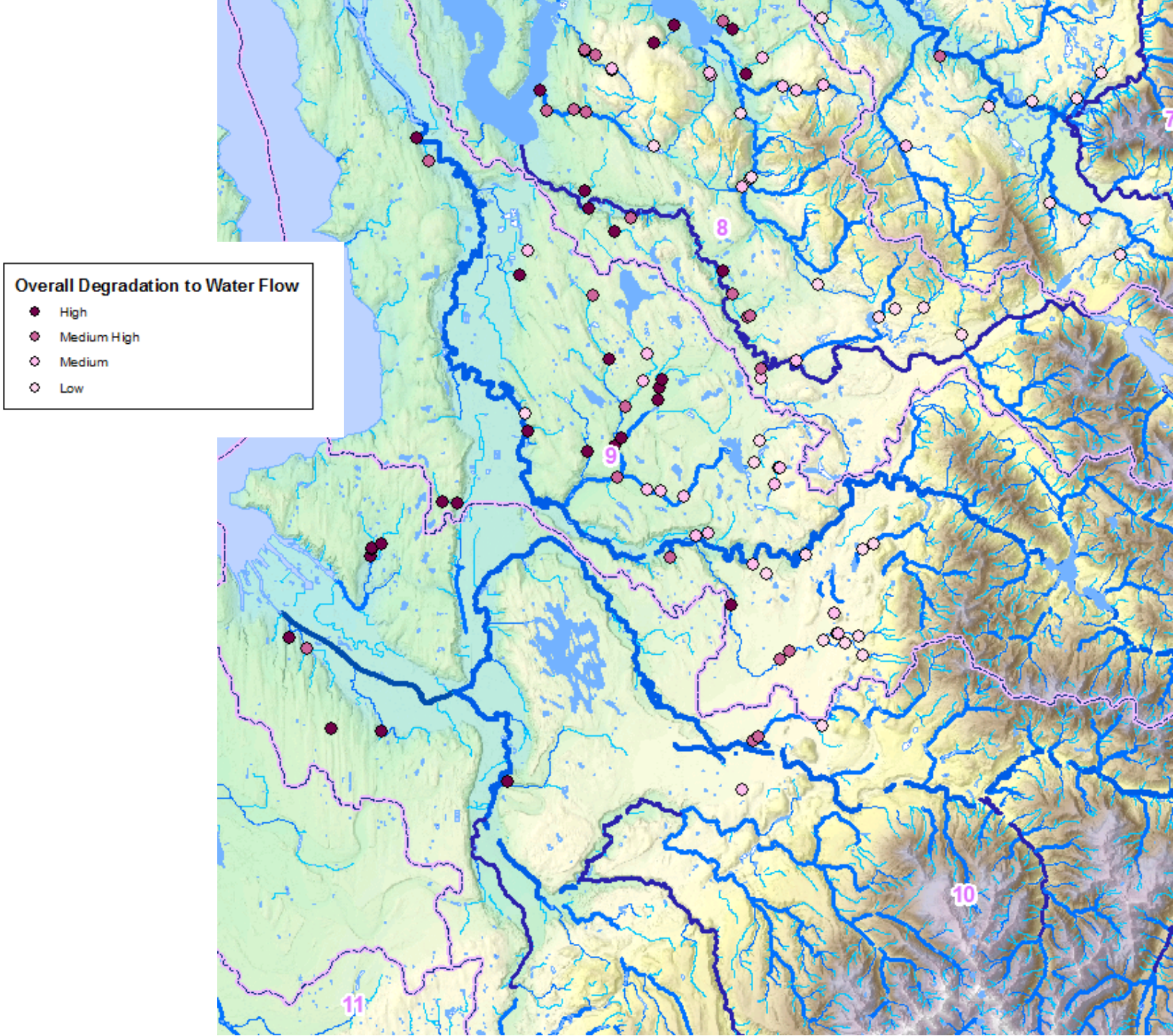
Overall Degradation to Water Flow

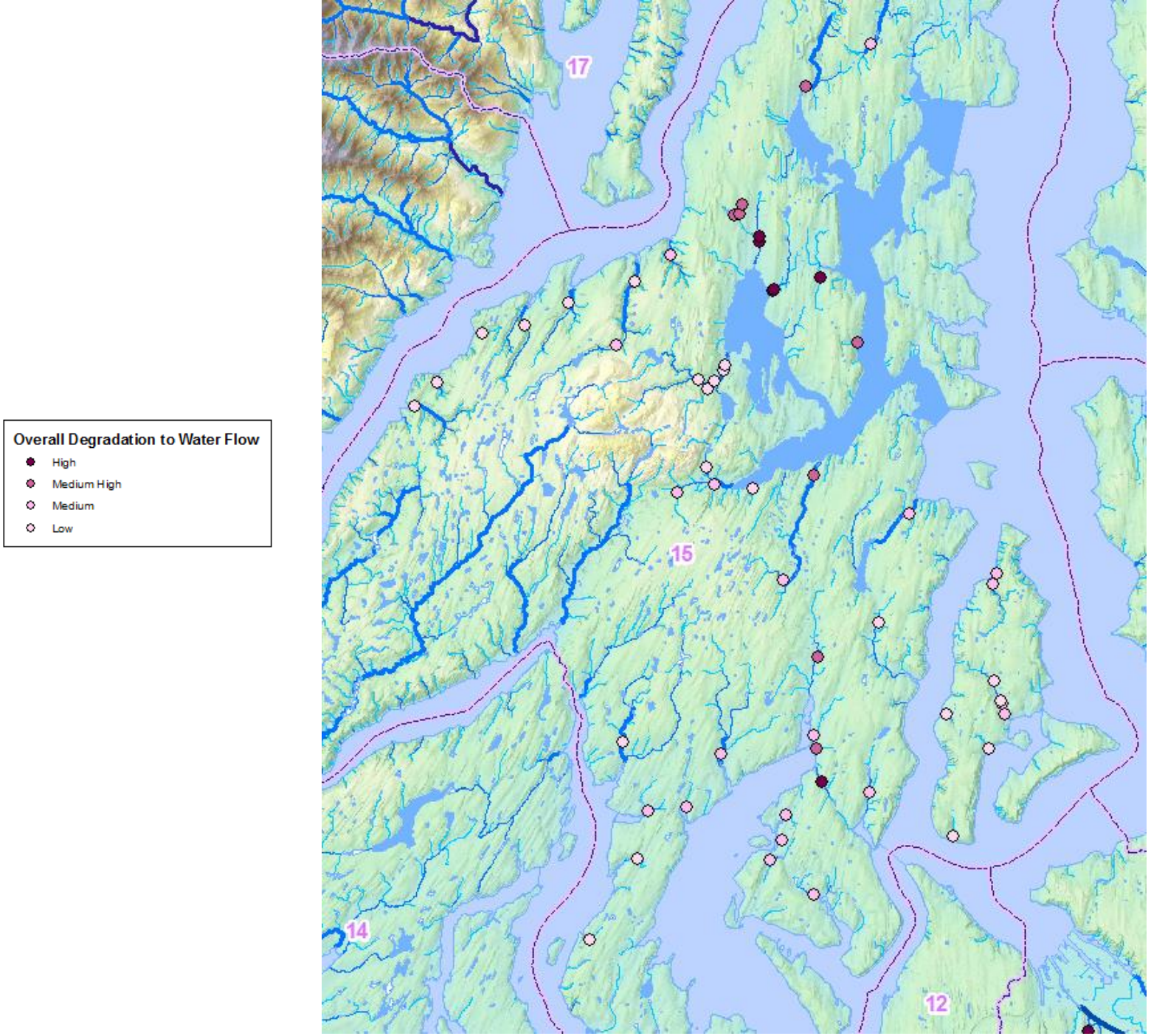
Water Flow Assessment

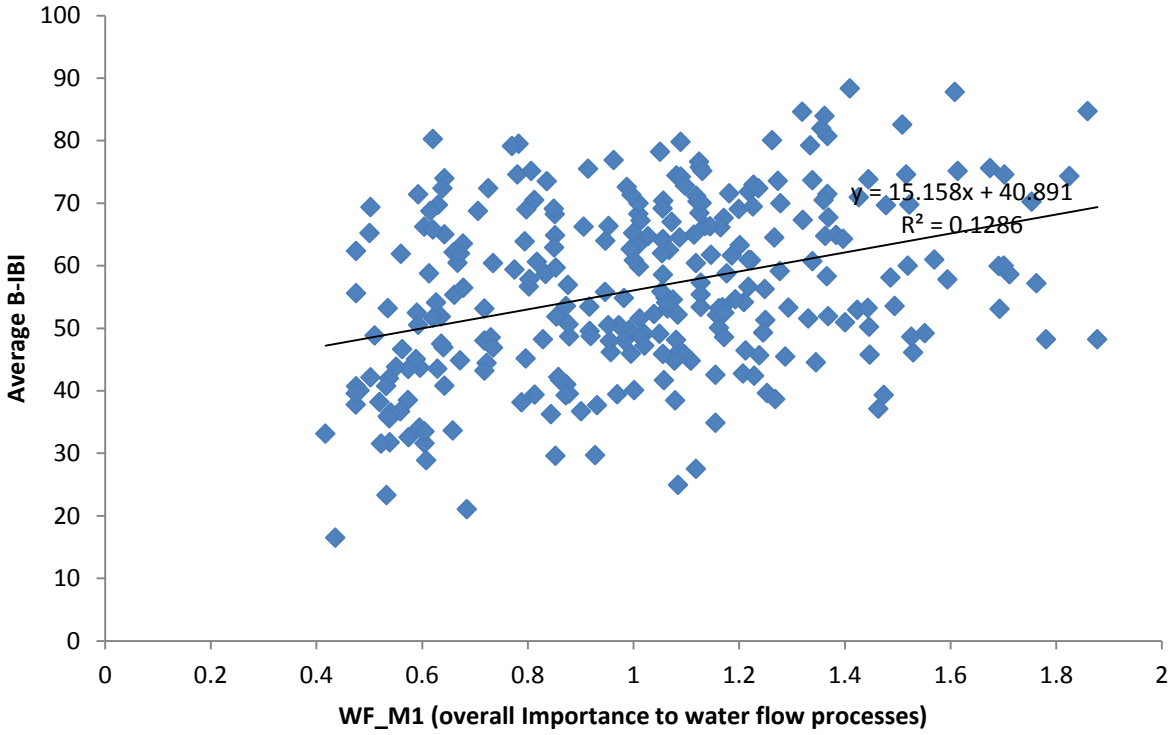


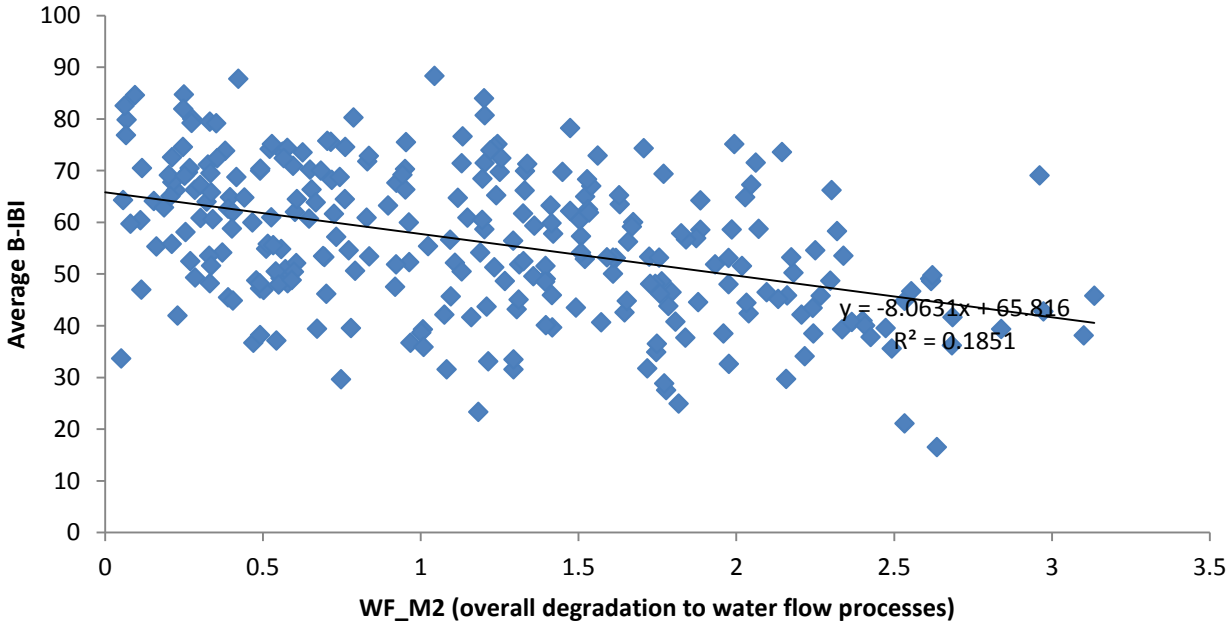
Model 2

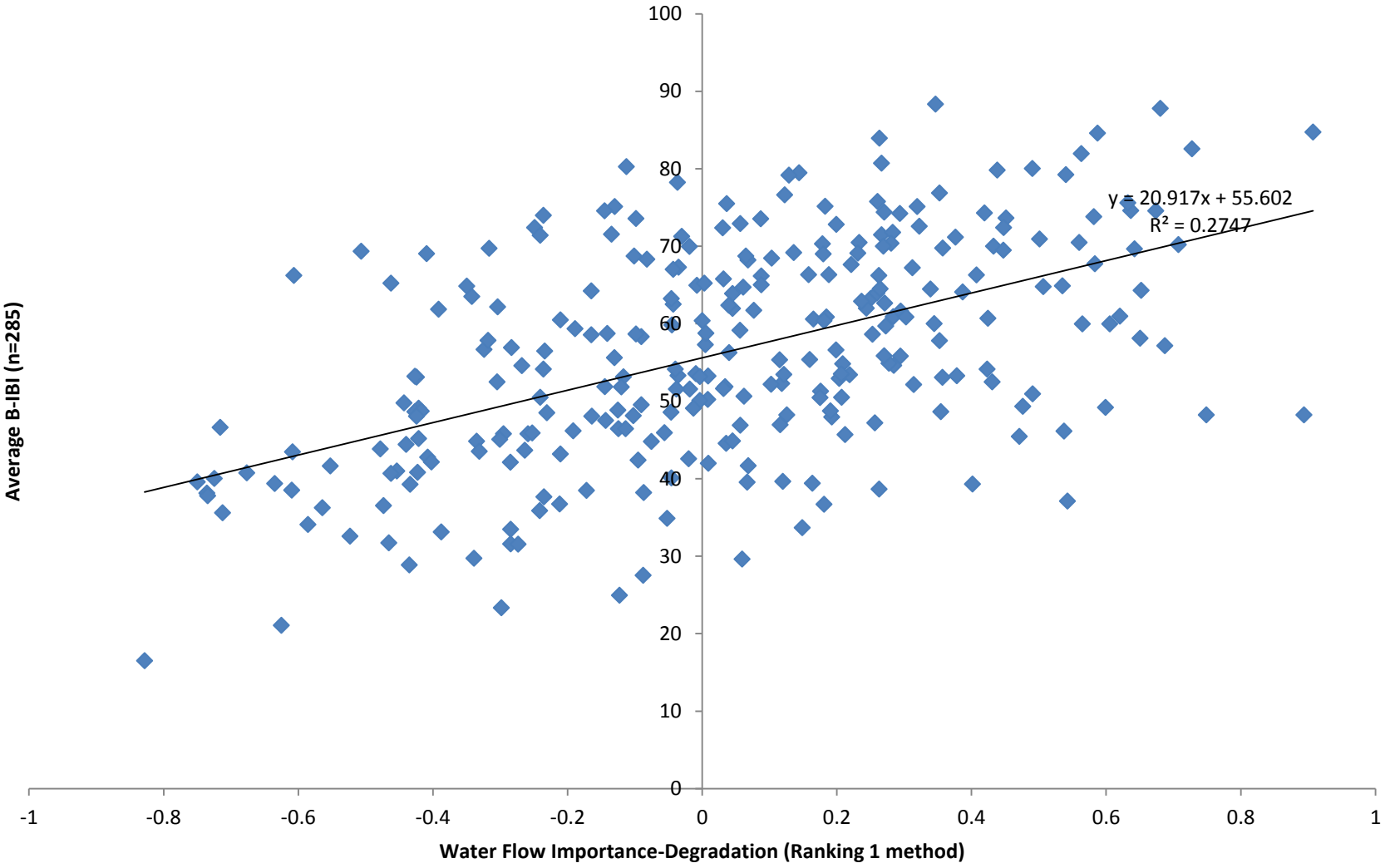

Overall Degradation to Water Flow
High
Medium High
Medium
Low
8
7
9


Overall Degradation to Water Flow
High
Medium High
Medium
Low
7
8
9
10
11


Overall Degradation to Water Flow
High
Medium High
Medium
Low
17
15
14
12


Average B-IBI
WF_M1 (overall Importance to water flow processes)
y = 15.158x + 40.891
R² = 0.1286


Average B-IBI
WF_M2 (overall degradation to water flow processes)
y = -8.0631x + 65.816
R² = 0.1851


y = 20.917x + 55.602
R² = 0.2747
Average B-IBI (n=285)
Water Flow Importance-Degradation (Ranking 1 method)
100
90
80
70
60
50
40
30
20
10
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Tate Creek	N Fork Snoqualmie Subbasin	0.907	1	H	L	P1	84.7	903
Little Boston	Bangor-Port Gamble Subbasin	0.894	2	H	L	P1	48.2	880
Big Beef Creek	W Kitsap Subbasin	0.749	3	H	M	P1R	48.2	888
Rock Creek (Upper Cedar)	Upper Cedar River Subbasin	0.728	4	H	L	P1	82.6	128
Harris Creek	Harris Creek Subbasin	0.707	5	H	M	P1R	70.2	302
Stonequarry Creek	Newaukum Creek Subbasin	0.687	6	H	M	P1R	57.2	258
Cherry Creek - N Fork tributary	Cherry Creek Subbasin	0.680	7	H	L	P1	87.8	281
Deep Creek (Green River)	Deep Creek Subbasin	0.674	8	H	L	P1	74.5	290
Boxley Creek tributary	S Fork Snoqualmie Subbasin	0.652	9	H	L	P1	64.3	347
Harris Creek	Harris Creek Subbasin	0.650	10	H	L	P1	58.1	303
Boyce Creek	W Kitsap Subbasin	0.642	11	H	L	P1	69.7	873
Newaukum Creek - N Fork	Newaukum Creek Subbasin	0.637	12	H	M	P1R	74.6	328
Newaukum Creek - N Fork	Newaukum Creek Subbasin	0.633	13	H	M	P1R	75.6	257
Newaukum Creek	Newaukum Creek Subbasin	0.621	14	H	L	P1	61.0	329
Big Beef Creek	W Kitsap Subbasin	0.606	15	H	L	P1	60.0	1069
Vaughn Creek	Key Peninsula Subbasin	0.599	16	H	M	P1R	49.2	1102
Williams Creek	Upper Cedar River Subbasin	0.587	17	H	L	P1	84.6	1086
Clough Creek	S Fork Snoqualmie Subbasin	0.583	18	H	L	P1	67.7	348
Deep Creek (Green River)	Deep Creek Subbasin	0.582	19	H	L	P1	73.8	224
Spiketon Creek	S Prairie Creek Subbasin	0.565	20	H	M	P1R	60.0	1099
Newaukum Creek	Newaukum Creek Subbasin	0.563	21	H	L	P1	81.9	261
Newaukum Creek - N Fork	Newaukum Creek Subbasin	0.560	22	H	L	P1	70.5	260
Rosedale Creek	Carr Inlet Subbasin	0.543	23	H	M	P1R	37.1	89
Newaukum Creek	Newaukum Creek Subbasin	0.540	24	H	L	P1	79.2	259
Crisp Creek	Middle Green River Subbasin	0.538	25	H	M	P1R	46.1	244
Cristy Creek	Middle Green River Subbasin	0.535	26	H	L	P1	64.9	247
Boise Creek	Mud Mt Lake Subbasin	0.507	27	H	L	P1	64.8	357
Blackjack Creek	S Sinclair Inlet Subbasin	0.501	28	H	M	P1R	70.9	1438
Snoqualmie River - S Fork tributary	S Fork Snoqualmie Subbasin	0.491	29	H	M	P1R	50.9	346

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Dickerson Creek	Dyes Inlet / Central Kitsap Subbasin	0.490	30	H	L	P1	80.0	890
Cherry Creek	Cherry Creek Subbasin	0.476	31	H	L	P1	49.3	284
Martha John Creek	Bangor-Port Gamble Subbasin	0.471	32	H	L	P1	45.4	881
Raging River tributary	Raging River Subbasin	0.451	33	H	M	P1R	73.6	332
Fifteenmile Creek	Issaquah Creek Subbasin	0.448	34	H	L	P1	72.4	153
Fifteenmile Creek	Issaquah Creek Subbasin	0.447	35	H	L	P1	69.5	306
Hotel Creek (0342)	Lower Cedar River Subbasin	0.438	36	MH	L	P2	79.8	127
Harvey Creek	Stillaguamish Flats Subbasin	0.433	37	H	L	P1	70.0	500
Stavis Creek	W Kitsap Subbasin	0.431	38	MH	L	P2	52.5	884
Little Pilchuck Creek (Snohomish)	Lower Pilchuck River (Snohomish) Subbasin	0.425	39	H	M	P1R	60.7	501
Seabeck Creek	W Kitsap Subbasin	0.424	40	MH	L	P2	54.1	883
Ellis Creek (Deschutes)	Lower Deschutes River Subbasin	0.419	41	H	MH	R1	74.3	812
Big Anderson Creek	W Kitsap Subbasin	0.407	42	MH	L	P2	66.3	887
Crisp Creek	Middle Green River Subbasin	0.402	43	H	M	P1R	39.3	243
Brockway Creek	Kimball Creek Subbasin	0.387	44	MH	L	P2	64.1	342
Bear Creek (Sammamish River)	Bear Creek Subbasin	0.378	45	H	M	P1R	53.3	117
May Creek (Lake Washington)	May Creek Subbasin	0.376	46	MH	L	P2	71.1	320
Boise Creek	Mud Mt Lake Subbasin	0.357	47	H	MH	R1	69.8	1239
Newaukum Creek	Newaukum Creek Subbasin	0.357	48	H	MH	R1	53.1	256
Boise Creek	Mud Mt Lake Subbasin	0.355	49	H	MH	R1	48.6	356
Green Cove Creek	McLane Creek Subbasin	0.353	50	H	MH	R1	57.8	814
Hotel Creek (0342)	Lower Cedar River Subbasin	0.352	51	M	L	P3	76.9	1089
Rock Creek (Lower Cedar)	Lower Cedar River Subbasin	0.347	52	H	M	P1R	88.3	125
Newaukum Creek	Newaukum Creek Subbasin	0.345	53	H	MH	R1	60.0	255
Tanwax Creek	Tanwax Creek Subbasin	0.339	54	H	M	P1R	64.5	101
Carey Creek	Issaquah Creek Subbasin	0.322	55	M	L	P3	72.6	156
Coal Creek (Snoqualmie River)	Kimball Creek Subbasin	0.319	56	MH	L	P2	75.1	286
Horn Creek	Yelm Creek Subbasin	0.314	57	MH	M	P2R	52.1	102
Cherry Creek - N Fork	Cherry Creek Subbasin	0.312	58	M	L	P3	67.2	282

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Herron Creek	Key Peninsula Subbasin	0.303	59	M	L	P3	60.8	1100
Covington Creek	Covington Creek Subbasin	0.295	60	MH	M	P2R	61.6	218
Ennis Creek	Port Angeles Bay Subbasin	0.295	61	M	L	P3	55.8	678
Covington Creek	Covington Creek Subbasin	0.294	62	MH	L	P2	74.2	220
Ginder Creek	Covington Creek Subbasin	0.285	63	MH	M	P2R	54.6	288
Minter Creek (Key Peninsula)	Key Peninsula Subbasin	0.284	64	MH	M	P2R	60.9	107
Bear Creek (Sammamish River)	Bear Creek Subbasin	0.283	65	MH	M	P2R	71.8	918
Chico Creek	Dyes Inlet / Central Kitsap Subbasin	0.281	66	MH	L	P2	70.4	1268
Chico Creek	Dyes Inlet / Central Kitsap Subbasin	0.278	67	MH	L	P2	54.9	891
Tate Creek tributary	N Fork Snoqualmie Subbasin	0.273	68	M	L	P3	59.7	349
Anderson Creek (Kitsap)	S Sinclair Inlet Subbasin	0.271	69	M	L	P3	62.6	1291
Covington Creek	Covington Creek Subbasin	0.271	70	MH	L	P2	55.8	221
Cherry Creek tributary	Cherry Creek Subbasin	0.271	71	MH	M	P2R	74.4	283
Issaquah Creek - E Fork	Issaquah Creek Subbasin	0.269	72	MH	M	P2R	70.0	920
Rock Creek (Lower Cedar)	Lower Cedar River Subbasin	0.266	73	H	MH	R1	71.5	314
Rock Creek (Lower Cedar)	Lower Cedar River Subbasin	0.266	74	H	MH	R1	80.7	315
Issaquah Creek - E Fork	Issaquah Creek Subbasin	0.265	75	MH	M	P2R	64.5	768
Rock Creek (Lower Cedar)	Lower Cedar River Subbasin	0.263	76	H	MH	R1	83.9	316
Nelyaly Creek	Carr Inlet Subbasin	0.263	77	H	M	P1R	38.7	1104
Icy Creek	Middle Green River Subbasin	0.263	78	M	L	P3	66.2	248
Walsh Lake Diversion	Lower Cedar River Subbasin	0.260	79	MH	M	P2R	75.7	126
Rocky Creek	Key Peninsula Subbasin	0.260	80	M	L	P3	64.0	1101
Judd Creek	Vashon-Maury Island Subbasin	0.257	81	M	L	P3	47.2	310
Newaukum Creek	Newaukum Creek Subbasin	0.253	82	H	H	R	58.6	254
Covington Creek	Covington Creek Subbasin	0.251	83	MH	M	P2R	63.2	289
Purdy Creek (Burley Lagoon)	Carr Inlet Subbasin	0.244	84	MH	M	P2R	62.0	908
Gorst Creek	S Sinclair Inlet Subbasin	0.237	85	M	L	P3	62.9	1457
Canyon Creek (Snoqualmie River)	Patterson Creek Subbasin	0.233	86	M	L	P3	70.5	331
Jimmycomelately Creek	Sequim Bay Subbasin	0.231	87	M	L	P3	69.1	699

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Little Soos Creek	Soos Creek Subbasin	0.222	88	MH	M	P2R	67.6	345
Artondale Creek	Carr Inlet Subbasin	0.219	89	MH	M	P2R	53.4	86
Curley Creek	Carr Inlet Subbasin	0.213	90	H	M	P1R	45.7	869
Judd Creek	Vashon-Maury Island Subbasin	0.209	91	M	M	P3R	54.8	273
Carpenter Creek (Kitsap)	Liberty-Miller-Appletree Subbasin	0.207	92	M	M	P3R	50.5	867
Harding Creek	W Kitsap Subbasin	0.207	93	M	L	P3	53.5	878
Dogfish Creek	Liberty-Miller-Appletree Subbasin	0.204	94	H	MH	R1	52.9	1282
Issaquah Creek - E Fork	Issaquah Creek Subbasin	0.199	95	MH	M	P2R	72.8	921
Gamble Creek	Bangor-Port Gamble Subbasin	0.199	96	MH	M	P2R	56.6	876
Judd Creek	Vashon-Maury Island Subbasin	0.193	97	M	M	P3R	47.9	525
Dutchers Creek	Key Peninsula Subbasin	0.191	98	M	L	P3	48.7	90
Bear Creek (Sammamish River)	Bear Creek Subbasin	0.188	99	MH	M	P2R	66.3	115
Little Soos Creek	Soos Creek Subbasin	0.185	100	MH	M	P2R	60.9	271
Palm Creek	Woodland Creek Subbasin	0.183	101	H	H	R	75.1	820
Carpenter Creek (Woods Creek) tributary	Woods Creek Subbasin	0.181	102	L	L	C1	60.4	496
Evans Creek	Evans Creek Subbasin	0.181	103	M	L	P3	36.7	72
Cabin Creek	Issaquah Creek Subbasin	0.180	104	M	L	P3	69.0	151
Seidel Creek	Bear Creek Subbasin	0.179	105	MH	M	P2R	70.3	116
Blackjack Creek	S Sinclair Inlet Subbasin	0.176	106	H	MH	R1	51.3	866
Tibbetts Creek	Tibbetts Creek Subbasin	0.175	107	M	M	P3R	50.4	1073
Chico Creek	Dyes Inlet / Central Kitsap Subbasin	0.165	108	M	L	P3	60.6	1441
Tibbetts Creek - Lower	Tibbetts Creek Subbasin	0.164	109	M	M	P3R	39.4	167
Rock Creek tributary (Covington)	Covington Creek Subbasin	0.160	110	MH	M	P2R	55.4	222
Portage Creek	Stillaguamish Flats Subbasin	0.158	111	M	M	P3R	66.3	502
Seidel Creek	Bear Creek Subbasin	0.149	112	L	L	C1	33.7	522
Chico Creek	Dyes Inlet / Central Kitsap Subbasin	0.144	113	M	L	P3	79.5	889
Gorst Creek	S Sinclair Inlet Subbasin	0.136	114	MH	M	P2R	69.2	1456
Cherry Creek	Cherry Creek Subbasin	0.129	115	M	L	P3	79.1	520
Ennis Creek	Port Angeles Bay Subbasin	0.126	116	M	L	P3	48.2	677

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
McDonald Creek (Issaquah)	Issaquah Creek Subbasin	0.123	117	MH	M	P2R	76.6	305
Ames Creek	Harris Creek Subbasin	0.121	118	M	M	P3R	53.4	275
Little Soos Creek	Soos Creek Subbasin	0.120	119	H	MH	R1	39.6	270
Perrigo Creek	Bear Creek Subbasin	0.118	120	MH	M	P2R	52.3	644
Judd Creek	Vashon-Maury Island Subbasin	0.116	121	L	L	C1	47.0	311
Colin Creek S	Bear Creek Subbasin	0.115	122	L	L	C1	55.3	71
Burley Creek	Carr Inlet Subbasin	0.103	123	MH	MH	R3	68.4	874
Ray Nash Creek	Carr Inlet Subbasin	0.102	124	MH	M	P2R	52.2	896
Langlois Creek tributary	Griffin Creek Subbasin	0.088	125	L	L	C1	65.0	351
O'Grady Creek	Middle Green River Subbasin	0.088	126	MH	MH	R3	66.1	242
Crescent Creek	Carr Inlet Subbasin	0.087	127	M	M	P3R	73.5	87
Mackey Creek	Bear Creek Subbasin	0.077	128	MH	MH	R3	61.7	632
Issaquah Creek - N Fork	Issaquah Creek Subbasin	0.068	129	MH	M	P2R	41.7	330
Parish Creek	S Sinclair Inlet Subbasin	0.068	130	M	M	P3R	68.2	1290
Little McAllister Creek	McAllister Creek Subbasin	0.067	131	M	M	P3R	39.5	816
Olalla Creek	Carr Inlet Subbasin	0.065	132	L	L	C1	68.7	882
Lacky Creek	Key Peninsula Subbasin	0.062	133	M	M	P3R	50.6	91
Little Bear Creek	Little Bear Creek Subbasin	0.061	134	MH	M	P2R	64.7	916
Shinglemill Creek	Vashon-Maury Island Subbasin	0.059	135	M	M	P3R	29.6	274
Valley Creek (Port Angeles)	Port Angeles Bay Subbasin	0.057	136	M	L	P3	46.9	728
Covington Creek	Covington Creek Subbasin	0.057	137	H	MH	R1	72.9	217
May Creek (Lake Washington)	May Creek Subbasin	0.056	138	H	MH	R1	59.1	139
Fisher Creek (Vashon)	Vashon-Maury Island Subbasin	0.045	139	L	L	C1	61.9	523
Fisher Creek (Vashon)	Vashon-Maury Island Subbasin	0.045	140	L	L	C1	44.8	355
Little Anderson Creek	W Kitsap Subbasin	0.045	141	M	M	P3R	63.9	879
May Creek (Lake Washington)	May Creek Subbasin	0.040	142	H	MH	R1	56.2	1092
Seidel Creek	Bear Creek Subbasin	0.040	143	L	L	C1	62.4	521
Cristy Creek	Middle Green River Subbasin	0.036	144	M	M	P3R	75.5	246
Jenkins Creek	Jenkins Creek Subbasin	0.036	145	H	H	R	44.5	236

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Jenkins Creek	Jenkins Creek Subbasin	0.034	146	H	H	R	51.9	235
Tahlequah Creek	Vashon-Maury Island Subbasin	0.032	147	L	L	C1	65.8	524
Tahlequah Creek	Vashon-Maury Island Subbasin	0.032	148	L	L	C1	51.6	354
Weiss Creek	Harris Creek Subbasin	0.030	149	L	M	C2	72.4	519
Snoqualmie River tributary (Cherry Creek subbasin)	Cherry Creek Subbasin	0.009	150	L	L	C1	42.0	343
Barker Creek	Dyes Inlet / Central Kitsap Subbasin	0.009	151	H	H	R	53.2	1270
Barker Creek	Dyes Inlet / Central Kitsap Subbasin	0.008	152	H	H	R	50.2	865
Christenson Creek	Vashon-Maury Island Subbasin	0.006	153	L	L	C1	58.8	272
Evans Creek tributary (0108A)	Evans Creek Subbasin	0.005	154	MH	MH	R3	57.3	145
Mackey Creek	Bear Creek Subbasin	0.003	155	M	MH	RD2	65.2	113
Bear Creek (Sammamish River)	Bear Creek Subbasin	0.000	156	MH	MH	R3	60.4	936
Stensland Creek	Bear Creek Subbasin	-0.004	157	MH	MH	R3	50.1	279
Stensland Creek	Bear Creek Subbasin	-0.004	158	MH	MH	R3	53.2	635
Stensland Creek	Bear Creek Subbasin	-0.008	159	MH	MH	R3	64.9	947
Percival Creek	McLane Creek Subbasin	-0.009	160	H	H	R	53.5	821
Rutherford Creek	Evans Creek Subbasin	-0.013	161	MH	MH	R3	49.1	74
Jenkins Creek	Jenkins Creek Subbasin	-0.018	162	H	H	R	51.6	234
Taylor Creek/Jem Creek (Lower Cedar)	Lower Cedar River Subbasin	-0.019	163	M	MH	RD2	69.9	317
Evans Creek	Evans Creek Subbasin	-0.020	164	MH	MH	R3	42.5	141
Taylor Creek/Jem Creek (Lower Cedar)	Lower Cedar River Subbasin	-0.030	165	M	MH	RD2	71.3	937
Jenkins Creek	Jenkins Creek Subbasin	-0.035	166	H	H	R	67.3	308
May Creek (Lake Washington)	May Creek Subbasin	-0.036	167	MH	MH	R3	53.3	133
Cottage Lake Creek	Bear Creek Subbasin	-0.037	168	MH	MH	R3	78.2	929
Cottage Lake Creek	Bear Creek Subbasin	-0.038	169	M	MH	RD2	51.6	278
Taylor Creek/Jem Creek (Lower Cedar)	Lower Cedar River Subbasin	-0.040	170	MH	MH	R3	54.1	318
Little Bear Creek	Little Bear Creek Subbasin	-0.043	171	MH	MH	R3	67.0	176
Little Bear Creek	Little Bear Creek Subbasin	-0.043	172	MH	MH	R3	62.5	177
Evans Creek	Evans Creek Subbasin	-0.045	173	M	MH	RD2	59.8	146
Cottage Lake Creek	Bear Creek Subbasin	-0.046	174	M	MH	RD2	40.1	114

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Rutherford Creek	Evans Creek Subbasin	-0.046	175	M	MH	RD2	63.2	147
May Creek (Lake Washington)	May Creek Subbasin	-0.046	176	MH	H	R2	48.6	132
Evans Creek tributary (0108)	Evans Creek Subbasin	-0.052	177	MH	H	R2	34.9	300
Rutherford Creek	Evans Creek Subbasin	-0.056	178	M	MH	RD2	45.9	301
Little Bear Creek	Little Bear Creek Subbasin	-0.075	179	MH	MH	R3	44.8	175
Stensland Creek	Bear Creek Subbasin	-0.082	180	M	MH	RD2	68.3	946
Green River - Lower tributary (S 277th St.)	Lower Green River - E Subbasin	-0.087	181	L	L	C1	38.2	240
Pine Lake Creek	E Lake Sammamish Subbasin	-0.087	182	MH	H	R2	27.5	163
Daniels Creek	Bear Creek Subbasin	-0.090	183	M	MH	RD2	49.5	112
Mission Creek	Lower Deschutes River Subbasin	-0.090	184	H	H	R	58.3	818
Eden/George Davis Creek	E Lake Sammamish Subbasin	-0.095	185	H	H	R	42.4	166
Soos Creek	Soos Creek Subbasin	-0.098	186	H	H	R	73.5	268
Evans Creek tributary (0107)	Evans Creek Subbasin	-0.098	187	M	MH	RD2	58.7	144
Tuck Creek	Cherry Creek Subbasin	-0.101	188	L	M	C2	68.7	352
Little Bear Creek	Little Bear Creek Subbasin	-0.102	189	MH	MH	R3	48.1	174
Tuck Creek	Cherry Creek Subbasin	-0.112	190	L	M	C2	80.2	353
Little Bear Creek	Little Bear Creek Subbasin	-0.114	191	MH	H	R2	46.4	171
Clear Creek (Kitsap)	Dyes Inlet / Central Kitsap Subbasin	-0.117	192	MH	H	R2	53.1	1446
Evans Creek tributary (0108)	Evans Creek Subbasin	-0.120	193	M	MH	RD2	51.8	143
Little Bear Creek	Little Bear Creek Subbasin	-0.123	194	MH	H	R2	24.9	170
Big Soos Creek	Soos Creek Subbasin	-0.124	195	MH	H	R2	46.4	269
McCormick Creek (Vashon)	Vashon-Maury Island Subbasin	-0.125	196	L	M	C2	48.8	297
Mackey Creek	Bear Creek Subbasin	-0.130	197	M	MH	RD2	75.1	633
Snoqualmie River tributary (Harris Creek subbasin)	Harris Creek Subbasin	-0.130	198	L	M	C2	55.6	75
Fennel Creek	Lower Puyallup River Subbasin	-0.135	199	MH	H	R2	71.5	96
Cottage Lake Creek tributary	Bear Creek Subbasin	-0.141	200	MH	H	R2	58.7	277
Coal Creek (Lake Wash.)	Coal Creek (Cedar) Subbasin	-0.143	201	L	M	C2	47.5	571
Coal Creek (Lake Wash.)	Coal Creek (Cedar) Subbasin	-0.144	202	L	M	C2	51.9	1070
Mackey Creek	Bear Creek Subbasin	-0.145	203	M	MH	RD2	74.6	634

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Ebright Creek	E Lake Sammamish Subbasin	-0.164	204	M	MH	RD2	48.1	165
Monticello Creek	Bear Creek Subbasin	-0.165	205	MH	H	R2	58.5	110
Monticello Creek	Bear Creek Subbasin	-0.165	206	MH	H	R2	64.2	628
Woodland Creek	Woodland Creek Subbasin	-0.172	207	MH	H	R2	38.5	824
United Nations Creek	Soos Creek Subbasin	-0.189	208	M	MH	RD2	59.4	344
Clear Creek (Kitsap)	Dyes Inlet / Central Kitsap Subbasin	-0.192	209	M	H	RD1	46.2	1442
Goodnough Creek	Carr Inlet Subbasin	-0.210	210	L	MH	D2	43.2	88
Mackey Creek	Bear Creek Subbasin	-0.210	211	L	MH	D2	60.5	938
Panther Creek (Black River)	Black River Subbasin	-0.212	212	L	M	C2	36.7	213
Snoqualmie River tributary (Raging River subbasin)	Raging River Subbasin	-0.230	213	L	MH	D2	48.5	341
Many Springs Creek	E Lake Sammamish Subbasin	-0.234	214	L	MH	D2	56.5	169
McCormick Creek (Gig Harbor)	Carr Inlet Subbasin	-0.235	215	M	H	RD1	37.7	92
Struve Creek	Bear Creek Subbasin	-0.236	216	L	MH	D2	74.0	118
Struve Creek	Bear Creek Subbasin	-0.236	217	L	MH	D2	54.1	276
Covington Creek	Covington Creek Subbasin	-0.240	218	L	M	C2	71.4	287
Rock Creek tributary (Covington)	Covington Creek Subbasin	-0.240	219	L	M	C2	50.5	223
Colin Creek N	Bear Creek Subbasin	-0.241	220	L	M	C2	35.9	70
Adair Creek	Harris Creek Subbasin	-0.249	221	L	MH	D2	72.4	69
Woodland Creek	Woodland Creek Subbasin	-0.252	222	MH	H	R2	45.9	825
Steele Creek	Dyes Inlet / Central Kitsap Subbasin	-0.259	223	MH	H	R2	45.8	885
Illahee Creek	Dyes Inlet / Central Kitsap Subbasin	-0.263	224	L	MH	D2	43.7	870
Laughing Jacobs Creek	E Lake Sammamish Subbasin	-0.268	225	MH	H	R2	54.6	168
Evans Creek tributary (0111E)	Evans Creek Subbasin	-0.273	226	L	M	C2	31.5	142
Little Bear Creek	Little Bear Creek Subbasin	-0.283	227	M	H	RD1	56.9	172
Coal Creek (Lake Wash.)	Coal Creek (Cedar) Subbasin	-0.284	228	L	MH	D2	31.6	136
Coal Creek (Lake Wash.)	Coal Creek (Cedar) Subbasin	-0.284	229	L	MH	D2	33.5	573
Gold Creek	Sammamish River Subbasin	-0.285	230	L	M	C2	42.1	193
Indian Creek (Lower Deschutes)	Lower Deschutes River Subbasin	-0.295	231	H	H	R	45.8	815
Coal Creek (Lake Wash.) tributary (0273)	Coal Creek (Cedar) Subbasin	-0.298	232	L	MH	D2	23.3	137

Stream	Subbasin	Score -water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_New (B-IBI score)	B-IBI Site_ID
Cedar River - Lower tributary (0311)	Lower Cedar River Subbasin	-0.301	233	L	MH	D2	45.1	123
Clear Creek (Kitsap)	Dyes Inlet / Central Kitsap Subbasin	-0.304	234	L	MH	D2	62.2	868
Evans Creek	Evans Creek Subbasin	-0.304	235	L	MH	D2	52.5	73
Clear Creek (Kitsap)	Dyes Inlet / Central Kitsap Subbasin	-0.316	236	L	MH	D2	69.7	1445
Issaquah Creek - E Fork	Issaquah Creek Subbasin	-0.318	237	M	H	RD1	57.8	767
Olson Creek	Lower Green River - E Subbasin	-0.324	238	M	H	RD1	56.7	239
Clear Creek (Kitsap)	Dyes Inlet / Central Kitsap Subbasin	-0.331	239	L	MH	D2	43.5	1444
North Creek	North Creek Subbasin	-0.335	240	MH	H	R2	44.8	407
Moxlie Creek	Lower Deschutes River Subbasin	-0.339	241	M	H	RD1	29.7	819
Monticello Creek	Bear Creek Subbasin	-0.342	242	L	MH	D2	63.5	629
Cedar River - Lower tributary	Lower Cedar River Subbasin	-0.350	243	M	H	RD1	64.8	319
Riverton Creek (003D)	Duwamish River Subbasin	-0.387	244	L	MH	D2	33.1	233
Cold Creek	Bear Creek Subbasin	-0.392	245	L	MH	D2	61.9	111
Molasses Creek	Lower Cedar River Subbasin	-0.402	246	M	H	RD1	42.2	121
Springbrook Creek (Black River)	Black River Subbasin	-0.408	247	MH	H	R2	42.8	212
Soosette Creek	Soos Creek Subbasin	-0.409	248	MH	H	R2	69.0	264
Little Bear Creek	Little Bear Creek Subbasin	-0.417	249	M	H	RD1	48.7	173
Evans Creek tributary (0111A)	Evans Creek Subbasin	-0.421	250	M	H	RD1	45.2	149
North Creek	North Creek Subbasin	-0.421	251	M	H	RD1	49.1	183
Mill Creek (Auburn)	Mill Creek Subbasin	-0.422	252	L	H	D1	40.8	251
Mill Creek (Auburn)	Mill Creek Subbasin	-0.424	253	L	H	D1	48.0	324
Mill Creek (Auburn)	Mill Creek Subbasin	-0.424	254	L	H	D1	53.1	252
North Creek	North Creek Subbasin	-0.427	255	M	H	RD1	48.6	927
Sammamish River tributary (0095D)	Sammamish River Subbasin	-0.427	256	L	MH	D2	53.2	197
Schneider Creek	McLane Creek Subbasin	-0.434	257	M	H	RD1	39.3	822
Denny Creek	E Lake Washington - Kenmore S Subbasin	-0.435	258	L	H	D1	28.9	131
Mill Creek (Auburn)	Mill Creek Subbasin	-0.440	259	L	H	D1	44.4	325
North Creek	North Creek Subbasin	-0.443	260	M	H	RD1	49.8	940
Swan Creek	Lower Puyallup River Subbasin	-0.453	261	M	H	RD1	41.0	93

Stream	Subbasin	Score - water flow Importance - Degradation	Rank (out of 285)	Water Flow Importance (low-High)	Water Flow Degradation (low-high)	Water Flow Restoration & Protection	Avg_ New (B-IBI score)	B-IBI Site_ID
Sammamish River tributary (0095F)	Sammamish River Subbasin	-0.462	262	L	MH	D2	40.7	196
Squally Creek	Lower Puyallup River Subbasin	-0.462	263	L	MH	D2	65.2	94
Willows Creek	Sammamish River Subbasin	-0.465	264	L	MH	D2	31.7	623
Willows Creek	Sammamish River Subbasin	-0.473	265	L	H	D1	36.5	622
McAleer Creek	McAleer Creek Subbasin	-0.478	266	L	H	D1	43.8	763
Sammamish River tributary (0090)	Sammamish River Subbasin	-0.506	267	L	H	D1	69.3	192
Lewis Creek (Lake Sammamish)	W Lake Sammamish Subbasin	-0.523	268	L	H	D1	32.6	576
Swamp Creek	Swamp Creek Subbasin	-0.552	269	M	H	RD1	41.6	182
Swamp Creek	Swamp Creek Subbasin	-0.564	270	M	H	RD1	36.2	181
W Hylebos Creek	Lower Puyallup River Subbasin	-0.585	271	L	H	D1	34.1	549
Clarks Creek	Lower Puyallup River Subbasin	-0.606	272	L	H	D1	66.2	1103
W Hylebos Creek	Lower Puyallup River Subbasin	-0.608	273	L	H	D1	43.4	541
W Hylebos Creek	Lower Puyallup River Subbasin	-0.609	274	L	H	D1	38.5	542
Madsen Creek	Lower Cedar River Subbasin	-0.625	275	L	H	D1	21.1	122
North Creek tributary	North Creek Subbasin	-0.635	276	M	H	RD1	39.4	925
Maplewood Creek	Lower Cedar River Subbasin	-0.676	277	L	H	D1	40.7	120
W Hylebos Creek	Lower Puyallup River Subbasin	-0.712	278	L	H	D1	35.6	543
Lewis Creek (Lake Sammamish)	W Lake Sammamish Subbasin	-0.716	279	L	H	D1	46.6	574
Canyon Creek (Puyallup)	Lower Puyallup River Subbasin	-0.724	280	L	H	D1	40.0	895
High School Creek	Sammamish River Subbasin	-0.734	281	L	H	D1	37.8	626
McAleer Creek	McAleer Creek Subbasin	-0.736	282	M	H	RD1	38.1	762
High School Creek	Sammamish River Subbasin	-0.750	283	L	H	D1	39.6	627
Duwamish River tributary (0003)	Duwamish River Subbasin	-0.828	284	L	H	D1	16.5	291