

# Crosswalk of Pressures & Stressors

## Comparison among:

- **South Central LIO for the 2014/15 Action Agenda**
- **WRIA 9 - Green/Duwamish Watershed**
- **WRIA 8 - Lake Washington/Cedar/Sammamish Watershed**
- **WRIA 10/12 – Puyallup/White-Chambers/Clovers Watershed**
- **2014 Puget Sound Pressures Assessment**

*DRAFT April 14, 2015*

The purpose of this memo is to compare the pressures identified by the South Central Local Integrating Organization (LIO) for the 2014/15 Puget Sound Action Agenda with pressures identified by: 1) Local teams from WRIA 8, 9, and 10 as part of the Chinook Monitoring and Adaptive Management Project; and 2) Stressors articulated by the Puget Sound Pressures Assessment. This comparison helps identify similarities and differences, which in turn is intended to help the South Central LIO in its review of current pressures identified for the 2014/15 Action Agenda and development of priorities and actions for the 2016 Action Agenda update.

## I. South Central LIO Identification of Pressures for 2014/15 Action Agenda

In the 2014/15 Puget Sound Action Agenda, the South Central LIO identifies the following four pressures to have the *highest significance* on the local ecosystem:

- Land development
- Shoreline alteration
- Stormwater
- Dams, levees and loss of floodplain function

The LIO also identifies the following additional five pressures as having *significance* as well:

- Habitat conversion
- Climate change
- Dams, levees, and tidegates
- Legacy toxic contaminants
- Current use and release of excess toxics and nutrients

These pressures apply to all three watersheds – WRIs 8, 9 and 10.

## II. Chinook Monitoring & Adaptive Management

Teams from the three watersheds, with assistance from Puget Sound Partnership staff and the coaching team provided by the Partnership, identified pressures from each watershed's 2005 Chinook recovery plan and related documents.

The Green/Duwamish Watershed (WRIA 9) Chinook Monitoring & Adaptive Management team identified 24 pressures during phase I of the project as having a linked effect on Chinook. The team did not rate or rank the pressures.

*Are these pressures consistent with those identified by the LIO for the 2014/15 Action Agenda?*

Yes. Consistent.

The Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Chinook Monitoring & Adaptive Management team identified 31 pressures during phase I of the project as having a linked effect on Chinook. The team did not rate or rank the pressures.

*Are these pressures identified consistent with those identified by the LIO for the 2014/15 Action Agenda?*

Yes. Consistent.

The Puyallup/White-Chambers/Clovers (WRIA 10/12) Watershed Chinook Monitoring & Adaptive Management team identified 31 pressures during phase I of the project as having a linked effect on Chinook. The team did not rate or rank the pressures.

*Are these pressures identified consistent with those identified by the LIO for the 2014/15 Action Agenda?*

Yes. Consistent.

### III. Puget Sound Pressures Assessment

The Puget Sound Pressures Assessment (PSPA) is a modeling tool that expresses the existence of, potential for, and relative intensity of a stressors (e.g., Shoreline hardening) on selected ecosystem endpoints (e.g., Chinook). The PSPA expresses these effects through numerical scoring of Potential Impact (PI) of the stressor and Intrinsic Vulnerability (IV) of the endpoint. The endpoints selected for this memo are the Puget Sound Vital Signs.

#### A. Green-Duwamish Watershed – WRIA 9

##### Results

The PSPA rates several stressors as High for both Intrinsic Vulnerability & Potential Impact for the Vital Signs for this watershed (see Figure 1, upper right hand side). This information could be used to identify priority management actions.

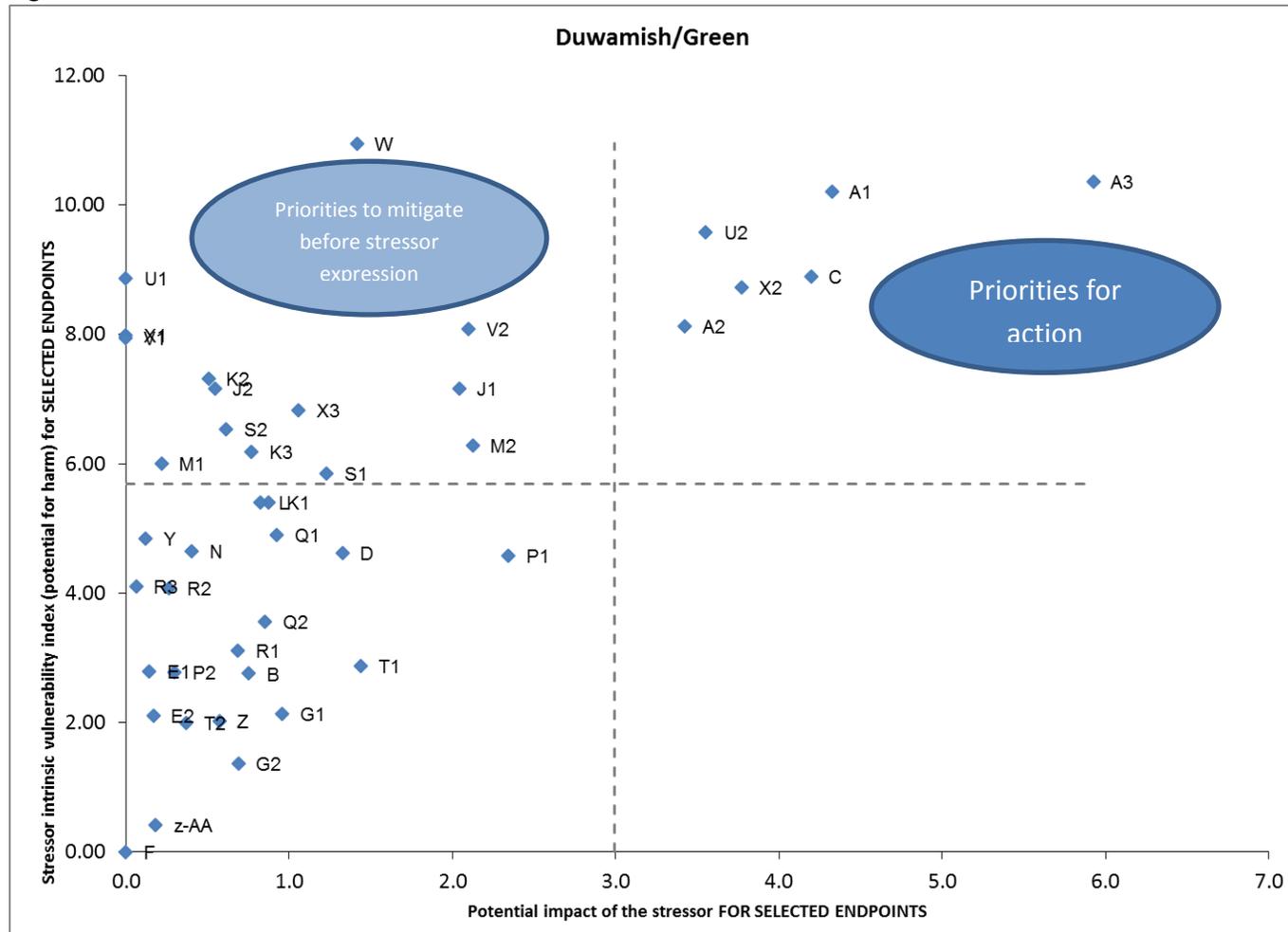
- A3. Conversion of land cover for transportation and utilities.
- A1. Conversion of land cover for residential, commercial and industrial development
- U2. Non-point source, persistent toxic chemicals
- C. Shoreline hardening
- X2. Non-point source conventional water pollutants
- A2. Conversion of land cover for natural resource production

Figure 1 also shows several stressors as High for only Intrinsic Vulnerability. These stressors could be identified for priority action as well, as these stressors may not be expressed significantly yet, but could in the near future, or the potential for significant harm exists. See upper left side of figure.

- W. Large spills
- U1. Point source, persistent toxic chemicals
- V2. Nonpoint source, non-persistent, toxic water pollutants
- X1. Point source conventional water pollutants
- K2. Altered low flows from climate change
- J2. Altered peak flows from climate change
- J1. Altered peak flows from land cover change
- X3. Changes in water temperature from local causes
- S2. Introduction, spread or amplification of human pathogens

- K3. Altered low flows from withdrawals
- M2. Other structural barriers to water, sediment, debris flows
- M1. In channel structural barriers to water, sediment, debris flows
- S1. Spread of disease and parasites to native species

Figure 1



## Discussion

*Does the PSPA articulate similar pressures to those identified by the LIO?*

Yes, for the most part. Land development; Shoreline alteration; Stormwater; Habitat conversion; Climate change; Toxic contaminants; and Current release of toxics and nutrients—all priority pressures for the LIO – all show up clearly in the PSPA. Dams, levees and loss of floodplain function and Dams, levees and tidegates show up (C, K3, M2, M1, X3), but interestingly, the stressor in the PSPA that sounds most closely aligned to dams (E1. Dams as fish passage barriers) shows up relatively low in the PSPA.

*Are there differences?*

Yes, a few. The PSPA ranks relatively highly the following (for Intrinsic Vulnerability alone), whereas the LIO did not rank these as priority pressures. Stressors ranked high for Intrinsic Vulnerability alone are those that have not yet caused harm, but possess the potential to cause harm in the future.

- W. Large spills
- U1. Point source, persistent toxic chemicals

- X1. Point source conventional water pollutants
- S2. Introduction, spread or amplification of human pathogens

Recommendation: The LIO should examine this and other information to determine whether to include these stressors in their list of pressures.

## B. Lake Washington/Cedar/Sammamish Watershed (WRIA 8)

### Results

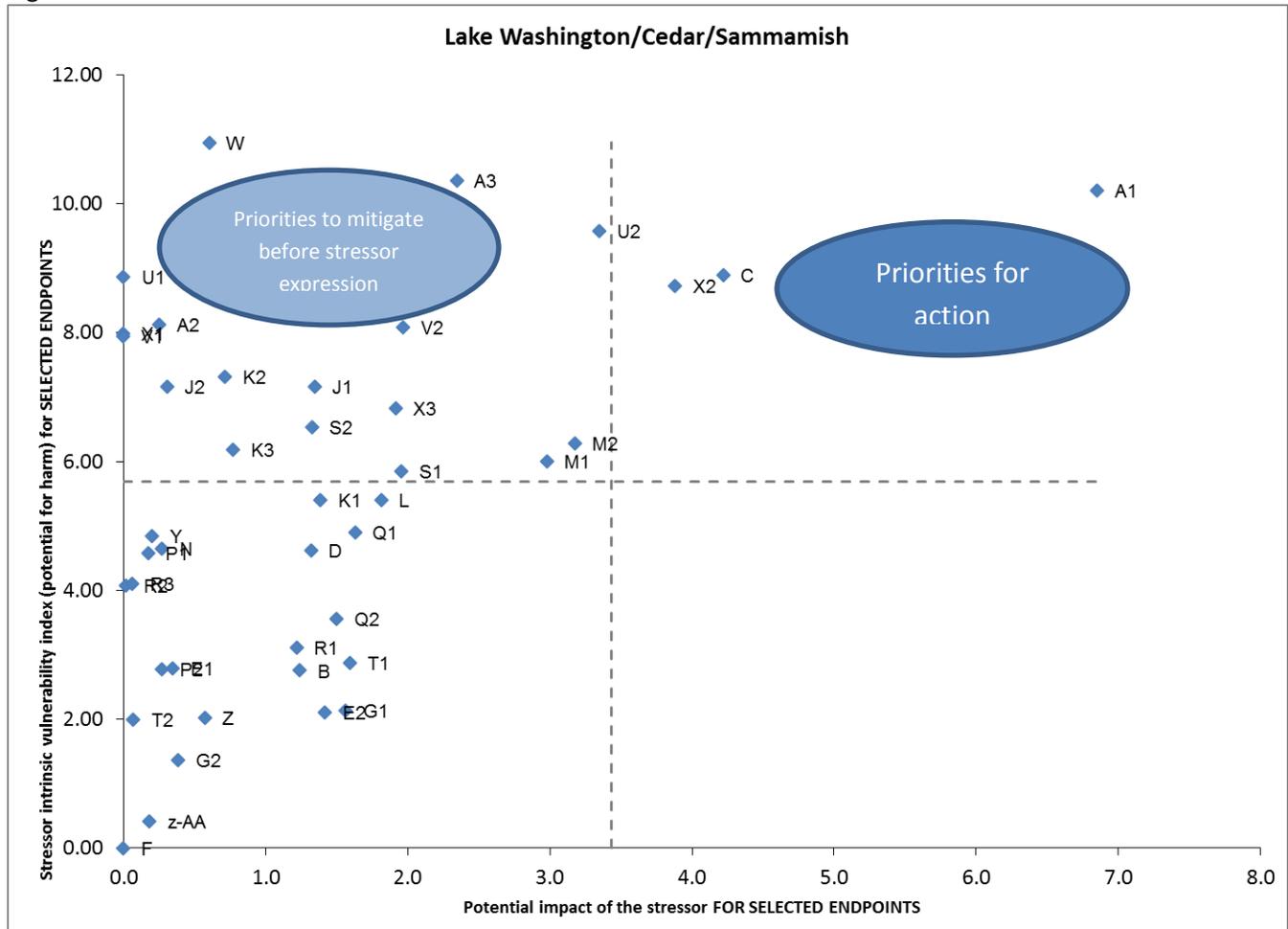
The PSPA rates several stressors as High for both Intrinsic Vulnerability & Potential Impact for the Vital Signs for this watershed (see Figure 2, upper right hand side). This information could be used to identify priority management actions.

- A1. Conversion of land cover for residential, commercial and industrial development
- C. Shoreline hardening
- X2. Non-point source conventional water pollutants

Figure 2 also shows several stressors rated High for only Intrinsic Vulnerability. These stressors could be identified for priority action as well, as these stressors may not be expressed significantly yet, but could in the near future, or the potential for significant harm exists. See upper left side of figure.

- W. Large spills
- A3. Conversion of land cover for transportation and utilities
- U2. Non-point source, persistent toxic chemicals
- U1. Point source, persistent toxic chemicals
- A2. Conversion of land cover for natural resource production
- V2. Non-point source, non-persistent toxic chemicals in aquatic systems
- X1. Point source conventional water pollutants
- K2. Altered low flows from climate change
- J2. Altered peak flows from climate change
- J1. Altered peak flows from land cover change
- X3. Changes in water temperature from local causes
- S2. Introduction, spread, or amplification of human pathogens
- M2. Other structural barriers to water, sediment, debris flows
- K3. Altered low flows from withdrawals
- M1. In channel structural barriers to water, sediment, debris flows
- S1. Spread of disease and parasites to native species

Figure 2



## Discussion

*Does the PSPA articulate similar pressures to those identified by the LIO?*

Yes, for the most part. Land development; Shoreline alteration; Stormwater; Habitat conversion; Climate change; Toxic contaminants; and Current release of toxics and nutrients—all priority pressures for the LIO – all show up clearly in the PSPA. Dams, levees and loss of floodplain function and Dams, levees and tidegates show up (C, K3, M2, M1, X3), but interestingly, the stressor in the PSPA that sounds most closely aligned to dams (E1. Dams as fish passage barriers) shows up relatively low in the PSPA.

*Are there differences?*

Yes, a few. The PSPA ranks relatively highly the following (for Intrinsic Vulnerability alone), whereas the LIO did not rank these as priority pressures. Stressors ranked high for Intrinsic Vulnerability alone are those that have not yet caused harm, but possess the potential to cause harm in the future.

- W. Large spills
- U1. Point source, persistent toxic chemicals
- X1. Point source conventional water pollutants
- S2. Introduction, spread or amplification of human pathogens

Recommendation: The LIO should examine this and other information and consider whether to include these stressors in their list of pressures.

## D. Puyallup/White Chambers-Clover Watersheds (WRIA 10/12)

### Results

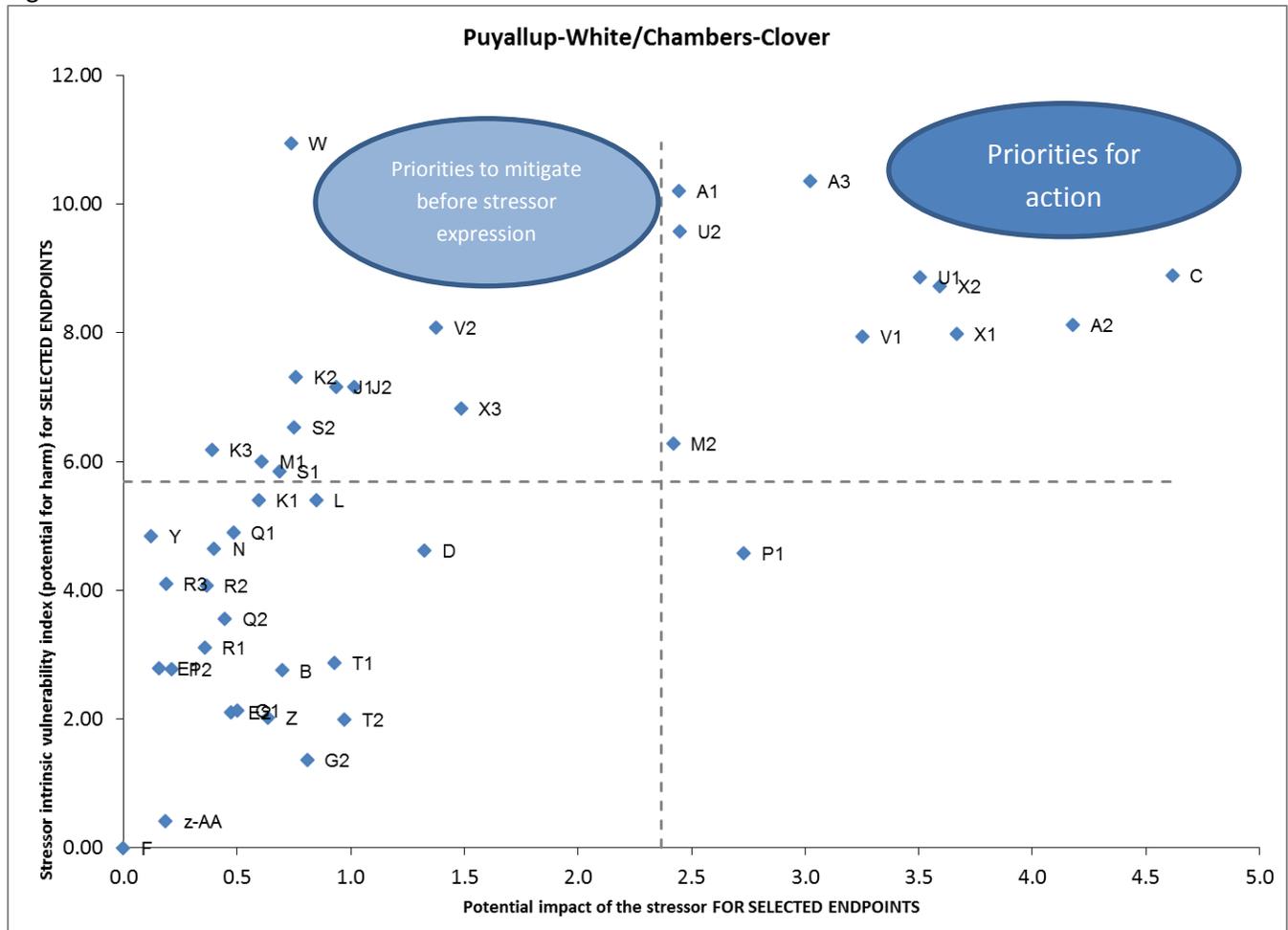
The PSPA rates several stressors as High for both Intrinsic Vulnerability & Potential Impact for the Vital Signs for this watershed (see Figure 3, upper right hand side). This information could be used to identify priority management actions.

- C. Shoreline hardening
- A2. Conversion of land cover for natural resource production
- U1. Point source, persistent toxic chemicals in aquatic systems
- X2. Non-point source conventional water pollutants
- X1. Point source conventional water pollutants
- V1. Point source, non-persistent toxic chemicals in aquatic systems
- A3. Conversion of land cover for transportation & utilities
- A1. Conversion of land cover for residential, commercial, and industrial use
- U2. Non-point source, persistent toxic chemicals in aquatic systems
- M2. Other structural barriers to water, sediment, debris flows

Figure 3 also shows several stressors rated High for only Intrinsic Vulnerability. These stressors could be identified for priority action as well, as these stressors may not be expressed significantly yet, but could in the near future, or the potential for significant harm exists. See upper left side of figure.

- W. Large spills
- V2. Non-point source, non-persistent toxic chemicals in aquatic systems
- K2. Altered low flows from climate change
- J1. Altered peak flows from land cover change
- J2. Altered peak flows from climate change
- X3. Changes in water temperature from local causes
- S2. Introduction, spread, or amplification of human pathogens
- K3. Altered low flows from withdrawals
- M1. In channel structural barriers to water, sediment, debris flows
- S1. Spread of disease and parasites to native species

Figure 3



## Discussion

*Does the PSPA articulate similar pressures to those identified by the LIO?*

Yes, for the most part. Land development; Shoreline alteration; Stormwater; Habitat conversion; Climate change; Legacy toxic contaminants; and Current release of toxics and nutrients—all priority pressures for the LIO – all show up clearly in the PSPA. Dams, levees and loss of floodplain function and Dams, levees and tidegates show up (C, K3, M2, M1, X3), but interestingly, the stressor in the PSPA that sounds most closely aligned to dams (E1. Dams as fish passage barriers) shows up relatively low in the PSPA.

*Are there differences?*

Yes, a few. The PSPA ranks relatively highly the following (for Intrinsic Vulnerability alone), whereas the LIO did not rank these as priority pressures. Stressors ranked high for Intrinsic Vulnerability alone are those that have not yet caused harm, but possess the potential to cause harm in the future.

- W. Large spills
- S2. Introduction, spread or amplification of human pathogens

In addition, the PSPA ranks highly the following for both Intrinsic Vulnerability & Potential Impact:

- U1. Point source, persistent toxic chemicals
- V1. Point source, non-persistent toxic chemicals in aquatic systems

- X1. Point source conventional water pollutants

Recommendation: The LIO should examine this and other information and consider whether to include these stressors in their list of pressures.

#### **D. South Central Marine Basin**

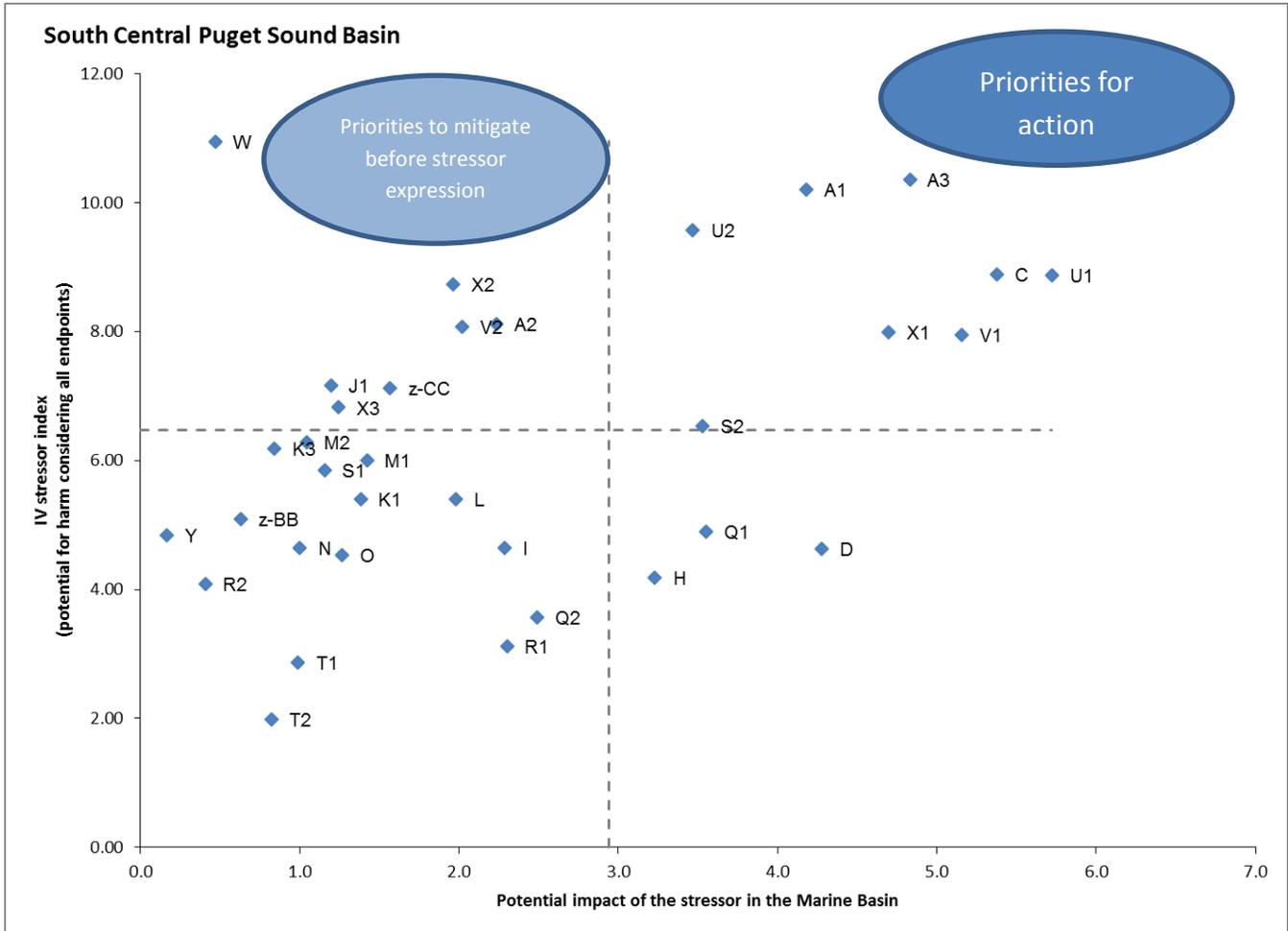
The PSPA rates several stressors as High for both Intrinsic Vulnerability & Potential Impact for the Vital Signs for this marine basin (see Figure 4, upper right hand side). This information could be used to identify priority management actions.

- U1. Point source, persistent toxic chemicals in aquatic systems
- C. Shoreline hardening
- A3. Conversion of land cover for transportation & utilities
- A1. Conversion of land cover for residential, commercial, and industrial use
- U2. Non-point source, persistent toxic chemicals in aquatic systems
- V1. Point source, non-persistent toxic chemicals in aquatic systems
- X1. Point source conventional water pollutants
- S2. Introduction, spread, or amplification of human pathogens

Figure 4 also shows several stressors rated High for only Intrinsic Vulnerability. These stressors could be identified for priority action as well, as these stressors may not be expressed significantly yet, but could in the near future, or the potential for significant harm exists. See upper left side of figure.

- W. Large spills
- X2. Non-point source conventional water pollutants
- V2. Non-point source, non-persistent toxic chemicals in aquatic systems
- A2. Conversion of land cover for natural resource production
- J1. Altered peak flows from land cover change
- z-CC. Changing ocean condition
- X3. Changes in water temperature from local causes

**Table 4**



**Discussion**

*Does the PSPA articulate similar pressures for this marine basin as those identified by the LIO?*

Yes, for the most part. Shoreline alteration, land development, stormwater, nonpoint toxic contaminants, current release of toxic contaminants, and climate change – all prioritized by the LIO - are expressed by the PSPA as High or Very High stressors.

However, the PSPA articulates several stressors as High for both Intrinsic Vulnerability and Potential Impact that the LIO did not prioritize as pressures:

- U1. Point source, persistent toxic chemicals in aquatic systems
- X1. Point source conventional water pollutants
- V1. Point source, non-persistent toxic chemicals in aquatic systems
- X1. Point source conventional water pollutants
- S2. Introduction, spread, or amplification of human pathogens

In addition, the PSPA articulates a stressor as High for Intrinsic Vulnerability alone that the LIO did not prioritize as a pressure. Stressors ranked high for Intrinsic Vulnerability alone are those that have not yet caused harm, but possess the potential to cause harm in the future.

- W. Large spills

Recommendation: The LIO should examine this and other information and consider whether to include these stressors in their list of pressures. Stressors ranked high for Intrinsic Vulnerability alone are those that have not yet caused harm, but possess the potential to cause harm in the future.

#### IV. PSPA Highly Rated Stressors by Watershed & Marine Area

One of the strengths of the PSPA stressor definitions is that they distinguish between sources of stress – for example, between conversion of land cover for industrial uses and conversion of land cover for natural resource production. However, these distinctions also result in a long list of stressors ranked as high in each basin.

To help make the list more manageable, staff created Tables 1 and 2, below. Table 1 summarizes the stressors ranked as high or very high for both Intrinsic Vulnerability and Potential Impact, and for Intrinsic Vulnerability alone, that are analogous to the pressures the LIO chose for the 2014 Action Agenda. Some of the stressors listed under “PSPA Stressors” are summary categories created by staff; the South Central Action Area Caucus Group can and should edit these as it sees fit. Table 3, in Appendix 1, shows the analysis used to create Table 1.

**Table 1: Comparison of Stressors in all Four Basins to LIO Pressures in 2014 Action Agenda**

LIO Pressures in 2014/2015 Action Agenda	PSPA Stressors in all 4 Basins	Other PSPA Stressors (# of basins)
Land development	Conversion of land cover for residential, commercial, and industrial use; Conversion of land cover for utilities and transportation	
Habitat conversion	Conversion of land cover for residential, commercial, and industrial use; Conversion of land cover for utilities and transportation; Conversion of land cover for natural resource production	
Shoreline alteration	Shoreline hardening	In-channel and other structural barriers to water, sediment, and debris flow (3)
Stormwater	Point and non-point sources of persistent and non-persistent toxic chemicals; Point and non-point sources of conventional water pollutants; Changes in water temperatures from local causes; Altered peak flows from land cover change	
Dams, levees and loss of floodplain function		In-channel and other structural barriers to water, sediment, and debris flow (3); <i>does not include dams as fish passage barriers</i>
Dams, levees and tidegates		In-channel and other structural barriers to water, sediment, and debris flow (3); <i>does not include dams as fish passage barriers</i>

LIO Pressures in 2014/2015 Action Agenda	PSPA Stressors in all 4 Basins	Other PSPA Stressors (# of basins)
Climate change		Altered peak flows from climate change (3); Altered low flows from climate change (3); Changing ocean conditions (1)
Legacy toxic contaminants	Non-point source, persistent toxic contaminants in aquatic systems	
Current use and release of excess toxics and nutrients	Point and non-point sources of persistent and non-persistent toxic chemicals; Point and non-point sources of conventional water pollutants (includes nutrients)	

Table 2, below, shows the stressors ranked as high or very high for both Intrinsic Vulnerability and Potential Impact, and for Intrinsic Vulnerability alone, that did not appear in the list of priority pressures the LIO included in the 2014 Action Agenda.

**Table 2: New Stressors Identified in the PSPA**

New PSPA Stressors in all 4 Basins	Other New PSPA Stressors (# of basins)
Introduction, spread, or amplification of human pathogens	Spread of disease and parasites to native species (3)
Large spills	Altered flows from withdrawals (3)

In its NTAs for the 2014 Action Agenda, the South Central Action Area Caucus Group included fixing the fish passage barriers at the Hiram Chittenden Locks, Howard Hanson Dam, and Buckley Fish Trap. These facilities either are, or act as, dams. The PSPA analysis does not rank “Dams as fish passage barriers” (stressor E1) as a high priority stressor; the Caucus Group may wish to include this stressor in its final list of high priority stressors.

## Conclusions

1. The Puget Sound Pressures Assessment largely affirms the pressures identified by the LIO as priorities for the 2014/15 Action Agenda.
2. The PSPA articulates a number of stressors as High for one or more of the watersheds, and the adjacent marine basin (see Tables 1 and 2).
3. There are a few differences in what the PSPA articulates as High for the watersheds and marine basin vs. what the LIO identified as priority pressures for the 2014/15 Action Agenda. These differences should be understood in light of other relevant information, and should serve to initiate conversations around identification of current local priority pressures for the 2016/17 Puget Sound Action Agenda.

## Appendix 1

Table 3, below, shows the stressors ranked as high priority for both Intrinsic Vulnerability and Potential Impact, and for Intrinsic Vulnerability alone, and illustrates how staff arrived at the cross-walk shown in Table 1. The colors are meaningless; they are simply to help guide the eye to show how the individual stressors fit into categories.

**Table 3: Complete List of Stressors Ranked High or Very High for Intrinsic Vulnerability and Potential Impact Combined, and for Intrinsic Potential Alone, by Basin**

South Central Marine Basin	WRIA 10	WRIA 8	WRIA 9
A1 Conversion of land cover for residential, commercial, and industrial use	A1 Conversion of land cover for residential, commercial, and industrial use	A1 Conversion of land cover for residential, commercial and industrial development	A1 Conversion of land cover for residential, commercial and industrial development
A2 Conversion of land cover for natural resource production	A2 Conversion of land cover for natural resource production	A2 Conversion of land cover for natural resource production	A2 Conversion of land cover for natural resource production
A3 Conversion of land cover for transportation & utilities	A3 Conversion of land cover for transportation & utilities	A3 Conversion of land cover for transportation and utilities	A3 Conversion of land cover for transportation and utilities.
C Shoreline hardening	C Shoreline hardening	C Shoreline hardening	C Shoreline hardening
J1 Altered peak flows from land cover change	J1 Altered peak flows from land cover change	J1 Altered peak flows from land cover change	J1 Altered peak flows from land cover change
S2 Introduction, spread, or amplification of human pathogens	J2 Altered peak flows from climate change	J2 Altered peak flows from climate change	J2 Altered peak flows from climate change
U1 Point source, persistent toxic chemicals in aquatic systems	K2 Altered low flows from climate change	K2 Altered low flows from climate change	K2 Altered low flows from climate change
U2 Non-point source, persistent toxic chemicals in aquatic systems	K3 Altered low flows from withdrawals	K3 Altered low flows from withdrawals	K3 Altered low flows from withdrawals
V1 Point source, non-persistent toxic chemicals in aquatic systems	M1 In channel structural barriers to water, sediment, debris flows	M1 In channel structural barriers to water, sediment, debris flows	M1 In channel structural barriers to water, sediment, debris flows
V2 Non-point source, non-persistent toxic chemicals in aquatic systems	M2 Other structural barriers to water, sediment, debris flows	M2 Other structural barriers to water, sediment, debris flows	M2 Other structural barriers to water, sediment, debris flows

South Central Marine Basin

	WRIA 10	WRIA 8	WRIA 9
W	Large spills	S1 Spread of disease and parasites to native species	S1 Spread of disease and parasites to native species
X1	Point source conventional water pollutants	S2 Introduction, spread, or amplification of human pathogens	S2 Introduction, spread, or amplification of human pathogens
X2	Non-point source conventional water pollutants	U1 Point source, persistent toxic chemicals in aquatic systems	U1 Point source, persistent toxic chemicals in aquatic systems
X3	Changes in water temperature from local causes	U2 Non-point source, persistent toxic chemicals in aquatic systems	U2 Non-point source, persistent toxic chemicals in aquatic systems
Z-CC	Changing ocean condition	V1 Point source, non-persistent toxic chemicals in aquatic systems	V2 Non-point source, non-persistent toxic chemicals in aquatic systems
		V2 Non-point source, non-persistent toxic chemicals in aquatic systems	W Large spills
	Large spills	W Large spills	W Large spills
		X1 Point source conventional water pollutants	X1 Point source conventional water pollutants
		X2 Non-point source conventional water pollutants	X2 Non-point source conventional water pollutants
		X3 Changes in water temperature from local causes	X3 Changes in water temperature from local causes