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Options for Setting 2020 Recovery Targets for the Puget Sound Ecosystem

May 19, 2011

Summary prepared by Scott Redman, Puget Sound Partnership staff

At its June 16-17, 2011 meeting, the Puget Sound Partnership's Leadership Council will adopt ecosystem recovery targets as a key feature of the 2011 revision of the Action Agenda. For the Puget Sound Partnership, ecosystem recovery targets are policy statements that reflect the region's commitments to and expectations for recovery, or a measurable path to recovery, by 2020 based on scientific understandings of the ecosystem.[1]

Tables 1 through 21 present options for recovery targets for a number of key ecosystem conditions, including most items on the Partnership's Dashboard of Ecosystem Indicators:

1. Land development
2. Land use and land cover
3. Benthic invertebrate communities in small streams[2]
4. On-site sewage systems[3]
5. Dissolved oxygen in marine waters[2]
6. Toxic contaminants in fish
7. Marine sediment quality[4]
8. Freshwater water quality
9. Marine water quality
10. Swimming beaches
11. River mouth estuaries[5]
12. Floodplains[6]
13. Shoreline armoring
14. Low summer stream flow (water availability)
15. Recreational fishing permits
16. Southern resident killer whales (orcas)
17. Chinook salmon abundance
18. Pacific herring
19. Upland birds
20. Funding for Puget Sound
21. Action Agenda implementation

The options presented in this package for consideration by the Ecosystem Coordination Board and Salmon Recovery Council are based on:

- March 2011 (draft) target setting brief sheets authored by "indicator champions" and technical reports authored by Puget Sound Partnership staff and interdisciplinary teams of advisors or co-authors

[1] Applying a U.S. Fish and Wildlife definition of the "SMART" mnemonic for developing performance objectives, targets will be (S) specific, (M) measurable, (A) achievable, (R) results-oriented, and (T) time-fixed. For the Puget Sound Partnership, "results-oriented" would mean that the target would relate to ambitions for a recovered Puget Sound ecosystem.

[2] Originally developed as an element of target setting for "runoff from the built environment"

[3] Originally developed as an element of target setting for "wastewater"

[4] Renamed from "toxics in sediment" to better represent the topic addressed

[5] Originally developed as an element of target setting for "estuaries, nearshore restoration, and shoreline alteration"

[6] Developed in April and May 2011 as it became clear that this topic was not covered elsewhere.

- Discussion at three April 2011 workshops on target setting
- Discussions in early May with various caucus groups, especially the business community, local governments, tribal staff, and salmon recovery watershed leads
- Addenda or revisions to the brief sheets or technical reports created in early May 2011 for some of the target setting topics
- Discussion at two May 2011 workshops on target setting
- Written comments received by the Partnership through May 16, 2011.

Partnership staff have endeavored to develop materials that are responsive to comments made at workshops and in writing. The options in this document are intended to reflect (1) the best available scientific understanding of Puget Sound future conditions related to target-setting topics and (2) a range of achievable and recovery-oriented ecosystem outcomes for 2020 and other time frames.

These materials are provided to support the discussion of target options at a May 24 and 25 meeting of the Partnership's Ecosystem Coordination Board and a May 26 meeting of the Puget Sound Salmon Recovery Council. The Partnership also expects that these materials will help stakeholders, entities engaged in implementing ecosystem recovery actions, and residents of Puget Sound region to understand and develop their comments on the options for setting ecosystem recovery targets.

Science Panel members' review of the brief sheets and technical reports was concluding as the target options presented here were being developed. Similarly, review of target setting material by the Recovery Implementation Technical Team (RITT), which provides science support for the region's salmon recovery efforts, was underway as the target options presented here were being developed. The options and discussions presented in the following tables may not address issues identified by the Science Panel members' and RITT review, which are presented in separate documents.

University of Washington's Climate Impacts Group (CIG) has recently undertaken a review of climate change and adaptation issues related to target setting on the topics addressed in the following tables. The findings and conclusions from CIG (to be presented in a separate document) were not available as this document was prepared.

A list of brief sheets and reports, workshop summaries, and comment summaries is provided at the end of this document. These materials will be posted online by May 20, 2011 at:

http://www.mypugetsound.net/index.php?option=com_docman&task=cat_view&gid=135&Itemid=172

Table 1. Land Development

A functioning, resilient ecosystem requires:	• Puget Sound landscapes that provide important habitat and hydrology functions • A land base to support the built environment for a growing human population
Biophysical constraints that affect what might be achieved by 2020:	• Spatial arrangements of waterways, shorelines, geologic features, and existing infrastructure
Socio-economic conditions that affect what might be achieved by 2020:	• Local government and private sector decisions and perspectives about growth inside and outside of urban growth areas (UGAs) • Patterns of existing development and infrastructure (including job centers and transportation corridors) • Preferences and values about where to live, importance of resource lands, etc. • Economic conditions between 2011 and 2020
Decisions on target setting might also consider:	• Setting this target in conjunction with the target for land use/land cover Dashboard indicator • Recent rates of development in various types of watershed analysis units (not yet available) • Geographic overlays of watershed analysis units with UGAs, transportation corridors, job centers, etc. (not yet available)
Options for 2020 targets	Establish objective (but no numeric target) 1. Accommodate a growing human population in the Puget Sound basin while minimizing the percentage of land area within "Protection" and "Restoration" watershed analysis units that is converted to a developed land cover. (no options identified)
Other items that might be included in a Leadership Council resolution	a. Convene expanded interdisciplinary team to continue analysis and stakeholder engagement to develop options for numeric targets for extent of land development in "Protection" and "Restoration" analysis units. Numeric target options would be available for Leadership Council consideration by October 2011 or soon thereafter as agreed by the interdisciplinary team. b. In 2011, develop a robust system of indicators to characterize local and regional trends in land development by county and/or action area as well as changes of specific lands: forest lands, farmlands, riparian areas. c. During the 2011 revisions of the Action Agenda, develop an approach to identify, coordinate, and produce consistent data on changes in land use, land cover, and geographic patterns of development d. In 2011, establish a workgroup of the coordinated monitoring program to identify both the existing and needed data and resources to create and implement a system of land development and land use/land cover indicators.

Table 2. Land Use/Land Cover

A functioning, resilient ecosystem requires:	• Extent of forest cover, across all forest types, to support the suite of ecosystem services that forests are expected to provide – current levels or more • Agricultural lands, open space, natural lands, and development to support the delivery of expected ecosystem services
Biophysical constraints that affect what might be achieved by 2020:	• Time needed for forests to grow and mature • Climate shifts and variability might affect (1) the distribution and seasonal timing of life cycle events of tree species; (2) forest disturbances; and (3) suitability of forest for cultivation
Socio-economic conditions that affect what might be achieved by 2020:	• Local and state government and private sector decisions and perspectives about the conversion of forest lands • Patterns of existing development and infrastructure (including job centers and transportation corridors) • Preferences and values about where to live, importance of resource lands, etc. • Economic conditions between 2011 and 2020, especially related to forestry and home building industries
Decisions on target setting might also consider:	• Setting this target in conjunction with the target for land development • Recent rates of forest conversion to developed lands (need to confirm/understand signals from various data sources) • Interests in land cover other than forest
Options for 2020 targets	1. Extent of non-federal forest cover is stable or increases from 2006 to 2021, as measured by the Coastal Change Analysis Product (CCAP) land cover data product conversions from forested land in non-federal ownership to developed land classes. 2. Non-federal forest cover is converted to developed land cover at a rate of 0 to 0.08 percent per year from 2006 to 2021 (as measured by the CCAP land cover data product) 3. Non-federal forest cover is converted to developed land cover at a rate of 0.08 to 0.13 percent per year from 2006 to 2021 (as measured by the CCAP land cover data product) 4. Non-federal forest cover is converted to developed land cover at a rate of greater than 0.13 percent per year from 2006 to 2021 (as measured by the CCAP land cover data product) 5. Set no target in June 2011 – set this target in late 2011 (or later) concurrent with target setting for land development
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on analyses and decisions related to target setting for land development b. Develop a robust system of indicators to characterize local and regional trends in land cover and land use, especially related to forest lands, farmlands, and riparian areas. c. Identify, coordinate, and produce consistent data on changes in land use and land cover

Table 3. Benthic Invertebrate Communities in Small Streams

A functioning, resilient ecosystem requires:	• Lowland streams that support the salmonids and invertebrates native to this region, as indicated by benthic index of biotic integrity (B-IBI) scores.
Biophysical constraints that affect what might be achieved by 2020:	• Improvement in B-IBI scores lags behind improvements to flow and water quality
Socio-economic conditions that affect what might be achieved by 2020:	• Resources committed to redevelopment and/or stormwater retrofit projects to improve stormwater management and stream health • Development practices may degrade stream health in urbanizing areas • Economic conditions between 2011 and 2020
Decisions on target setting might also consider:	• Several Dashboard indicators address other concerns about the impacts of runoff from the built environment: freshwater water quality, marine sediment quality, toxics in marine fish, shellfish beds restored, swimming beaches • The biological health of small, lowland streams is not currently addressed by the Dashboard of ecosystem indicators
Options for 2020 targets	1. By 2020, 90% of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better retain these "excellent" scores and mean B-IBI scores of 10 Puget Sound lowland drainage areas improve from rating of "fair" (28 – 36) to "good" (35 - 38 or better). 2. By 2020, 90% of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better retain these "excellent" scores and mean B-IBI scores of 20 Puget Sound lowland drainage areas improve from "fair" to "good." 3. By 2020, 90% of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better retain these "excellent" scores and mean B-IBI scores of 30 Puget Sound lowland drainage areas improve from "fair" to "good." 4. By 2020, 100% of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better retain these "excellent" scores and mean B-IBI scores of 10 Puget Sound lowland drainage areas improve from "fair" to "good." 5. By 2020, 100% of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better retain these "excellent" scores and mean B-IBI scores of 20 Puget Sound lowland drainage areas improve from "fair" to "good." 6. By 2020, 100% of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better retain these "excellent" scores and mean B-IBI scores of 30 Puget Sound lowland drainage areas improve from "fair" to "good."
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on analyses and decisions related to: the effects of development on B-IBI scores; the effectiveness of stormwater management practices, and stream health needed to support salmon recovery or other aspects of a functioning, resilient ecosystem b. Develop a robust system of monitoring and indicators to characterize status and trends in aquatic systems that receive runoff from the built environment. Describe the costs and implementation approach for such a system.

Table 4. Management of On-Site Sewage Systems

A functioning, resilient ecosystem requires:	• Proper operation and maintenance of on-site sewage systems (OSS) in sensitive areas of the Puget Sound basin
Biophysical constraints that affect what might be achieved by 2020:	(none identified)
Socio-economic conditions that affect what might be achieved by 2020:	• Funding and design of OSS operation and maintenance programs at 12 local health jurisdictions, including their approaches to inventorying systems, notifying homeowners, inspecting systems, and reporting results • Local health jurisdictions' designation of marine recovery areas • Resources available to property owners for OSS repair
Decisions on target setting might also consider:	• Several Dashboard indicators address other concerns about the impacts of OSS on the Puget Sound ecosystem: freshwater water quality, shellfish beds restored, swimming beaches • The pressure of OSS on sensitive marine environments is not fully addressed by other Dashboard indicators
Options for 2020 targets	1. By 2020, all on-site sewage systems in marine recovery areas are inventoried, 75% are current with inspections, and all failed systems are fixed. 2. By 2020, all on-site sewage systems in marine recovery areas are inventoried, 90% are current with inspections, and all failed systems are fixed. 3. By 2020, all on-site sewage systems in marine recovery areas are inventoried and are current with inspections, and all failed systems are fixed. 4. By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried, 75% are current with inspections, and all failed systems are fixed. 5. By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried, 90% are current with inspections, and all failed systems are fixed. 6. By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried and are current with inspections, and all failed systems are fixed.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on analyses and decisions related to the effectiveness of OSS operation and maintenance programs and the need protect resources beyond designated marine recovery areas. b. Develop a robust system of indicators and strategies to effectively address and reduce harms from OSS

Table 5. Dissolved Oxygen in Marine Waters

A functioning, resilient ecosystem requires:	• Dissolved oxygen concentrations in marine waters that are not measurably reduced by human-related contributions of nitrogen (Washington State water quality standards)
Biophysical constraints that affect what might be achieved by 2020:	• Time lag (of 1 to 2 years) in environmental response to reduced loadings
Socio-economic conditions that affect what might be achieved by 2020:	• Permitting schedules and wastewater facilities planning schedules • Resources (from utility fees, grants, or loans) for improved wastewater treatment infrastructure • Limited availability of affordable, reliable, sufficiently-demonstrated nitrogen removing technologies for OSS at single-home applications. • Financial and technical assistance to control non-point source pollution
Decisions on target setting might also consider:	• Level of effort needed to achieve this target is not yet known: baseline analysis of current locations with dissolved oxygen reduced by human-related contributions of nitrogen expected to be complete in early 2012 • Several Dashboard indicators address other concerns about the impacts of wastewater on the Puget Sound ecosystem: freshwater water quality, marine water quality, toxics in sediment, toxics in fish, shellfish beds restored, swimming beaches • The pressure of wastewater on dissolved oxygen in marine waters is indirectly addressed by the marine water quality Dashboard indicator
Options for 2020 targets	1. By 2020, human-related contributions of nitrogen do not result in more than 0.2 mg/L reductions in dissolved oxygen levels in sensitive areas of Puget Sound. 2. By 2020, human-related contributions of nitrogen do not result in more than 0.2 mg/L reductions in dissolved oxygen levels anywhere in Puget Sound.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on analyses and decisions related to the effectiveness of wastewater treatment and OSS operation and maintenance programs. b. Develop a robust system of indicators and strategies to effectively address and reduce harms from wastewater treatment plant and OSS

Table 6. Toxics in Fish

A functioning, resilient ecosystem requires:	• Exposure of marine fish to toxic chemicals at levels low enough to minimize 1) harm to the health of fish populations throughout the food web and 2) the risk of harm to human consumers of fish. Adverse-effects thresholds from the scientific literature provide information related to the levels of PCBs, PBDEs, PAHs, and endocrine disrupting compounds in Puget Sound fish.
Biophysical constraints that affect what might be achieved by 2020:	• Reservoirs of some toxic contaminants persist in the Puget Sound ecosystem long after sources are controlled; measurable reductions in persistent, biaccumulative compounds may not occur in the 2020 timeframe • Natural recovery of contaminated sediments depends on incoming load of clean(er) sediment
Socio-economic conditions that affect what might be achieved by 2020:	• Time needed to find safe substitutes of chemicals currently in use and to change behaviors • Resources available for stormwater retrofit, improved wastewater treatment, and site clean up • Individuals' preferences and behaviors with regard to (1) use and disposal of pharmaceutical, personal care products, and other consumer products and (2) generation of toxic chemicals from residential heating, transportation, etc.
Decisions on target setting might also consider:	• Targets established for marine sediment quality • Partnership's interests in supporting human health
Options for 2020 targets	1. By 2020, achieve declining trends in a. PCBs and PBDEs in central and southern Puget Sound herring, with stable or increasing trend in north Puget Sound herring; and b. PCB and PBDE concentrations, risk of liver disease, and occurrence of toxicant-related reproductive impairments in urban English sole, with no increasing trends in non-urban English sole. 2. By 2020, 95% of measurements meet the following adverse-effects thresholds to protect fish health: a. Central and southern Puget Sound herring and urban English sole sampled by biannual PSAMP monitoring are below 2,400 ng PCB/g lipid), b. Puget Sound Pacific herring and English sole are below 1,400 ng PBDEs/g lipid 3. By 2020, 95% of Central and Southern Puget Sound herring and urban English sole are below human-health screening levels (e.g., Department of Health recreational or subsistence levels, currently 33 ng/g and 10 ng/g in fish tissues, respectively). 4. By 2020, English sole populations in Puget Sound urban bays will have background risks of liver disease, no feminization of males, and normal reproductive timing in females.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on new understandings of thresholds protective of fish, predator, and human health. b. Develop a robust system of indicators and strategies to effectively address levels of toxic contaminants in Puget Sound ecological systems.

Table 7. Marine sediment quality

A functioning, resilient ecosystem requires:	• Sediment quality in various regions and bays of Puget Sound that supports functioning, healthy communities of sediment-dwelling invertebrates.
Biophysical constraints that affect what might be achieved by 2020:	• Reservoirs of some toxic contaminants persist in the Puget Sound ecosystem long after sources are controlled; measurable reductions in persistent compounds may not occur in the 2020 timeframe • Natural recovery of contaminated sediments depends on incoming load of clean(er) sediment
Socio-economic conditions that affect what might be achieved by 2020:	• Time needed to find safe substitutes of chemicals currently in use and to change behaviors • Resources available for stormwater retrofit, improved wastewater treatment, and site clean up • Individuals' preferences and behaviors with regard to (1) use and disposal of pharmaceutical, personal care products, and other consumer products and (2) generation of toxic chemicals from residential heating, transportation, etc.
Decisions on target setting might also consider:	• Targets established for toxics in fish • Option 3 is currently met • Option 4 cannot be implemented immediately; definition of "minimally affected" benthic community is currently being developed
Options for 2020 targets	1. Chemistry measures reflect "minimum exposure" (mSQS is <0.1 and the SCI is >93.3), Sediment Quality Triad Index (SQTI) scores reflect "unimpacted" conditions (SQTI values >83), and no measurements exceed Sediment Quality Standards set in the Washington State sediment management standards. 2. Chemistry measures reflect "minimum exposure" (mSQS is <0.1 and the SCI is >93.3) and Sediment Quality Triad Index (SQTI) scores reflect "unimpacted" conditions (SQTI values >83) 3. Chemistry measures reflect low levels of exposure (mSQSq is 0.1 - <0.3 and SCI = >80 - 93.3) and SQTI measures reflect "likely unimpacted" conditions (SQTI values from >57 – 83) 4. Chemistry measures reflect "minimum exposure" (mSQS is <0.1 and the SCI is >93.3), benthic community scores reflect "minimally affected" conditions, and no measurements exceed Sediment Quality Standards set in the Washington State sediment management standards.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on development of benthic index and new understandings of thresholds protective of marine ecosystem and human health. b. Develop a robust system of indicators and strategies to effectively address levels of toxic contaminants in Puget Sound ecological systems.

Table 8. Freshwater water quality

A functioning, resilient ecosystem requires:	• Freshwater water quality that protects aquatic life and other uses of the state's waters. A freshwater quality index score of 80 of higher indicates that (a) water quality criteria for conventional pollutants are met and (b) sediment and nutrient concentrations reflect better conditions observed during a benchmark period.
Biophysical constraints that affect what might be achieved by 2020:	• Expected climate changes are likely to worsen index scores for temperature, oxygen, pH, and winter scores for nutrients and sediment. Climate changes are likely to improve summer index scores for nutrients and sediment.
Socio-economic conditions that affect what might be achieved by 2020:	• Adoption of management practices to control non-point sources of sediment, nutrients, and fecal coliform bacteria. • Extent and pattern of land development can affect stream hydrology and pollutant loads
Decisions on target setting might also consider:	• Targets set for benthic invertebrate communities in small streams • Central Puget Sound region index scores have remained stable or improved slightly over the past ten years: improved watershed management activities may be balancing the negative driver of a growing human population • Projecting current trends into the future suggests that average index scores will reach 80 by 2025 (if no flow adjustment is included) or by 2060 (using flow adjusted scores)
Options for 2020 targets	1. By 2020, average of scores from long-term stations on 14 major rivers in 12 basins is 80 or higher. 2. By 2020, average of scores from long-term stations on 14 major rivers in 12 basins is 80 or higher and average of scores from long-term stations on urban streams is 80 or higher. 3. By 2020, all long-term stations demonstrate stable or increasing/improving trends in Freshwater Water Quality Index scores. 4. By 2020, at least 50 percent of long-term stations with suitable data have Freshwater Water Quality Index scores of 80 or higher. 5. By 2020, at least 50 percent of all monitoring stations with suitable data have Freshwater Water Quality Index scores of 80 or higher.
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address the health of Puget Sound's flowing freshwater systems

Table 9. Marine eutrophication index

A functioning, resilient ecosystem requires:	• Marine water quality that protects aquatic life and other uses of the state's waters. The marine water quality composite index (WQCI) reports on changes in marine water conditions and evaluates if those changes are positive or negative with respect to beneficial uses.
Biophysical constraints that affect what might be achieved by 2020:	• Variations and shifts in ocean conditions (related to El Nino/Southern Oscillation, Pacific Decadal Oscillation, and climate change) might shift fundamental oceanic and atmospheric conditions away from those observed during the 1999-2008 base period.
Socio-economic conditions that affect what might be achieved by 2020:	• Management of freshwater flows and water quality control programs to control point and non-point sources of nutrients. • Extent and pattern of land development can affect stream hydrology and pollutant loads
Decisions on target setting might also consider:	• Target set for dissolved oxygen in marine waters • Scores for ambient nutrient concentrations and nutrient enrichment are expected to decrease in response to continued population growth.
Options for 2020 targets	a. Sustained index scores of "0" to 2020; this represents steady state of conditions encountered from 1999-2008. b. By 2020, achieve index scores greater than "0"; this represents qualitatively improved conditions relative to 1999-2008. c. By 2020, achieve improved scores in the enrichment and impact modules of the index; this represents qualitatively improved nutrient-related conditions and processes. d. Do not set a target for marine eutrophication in June 2011
Other items that might be included in a Leadership Council resolution	a. Develop a model-based understanding of conditions with minimal human discharges to support more specific targets (numeric and by region) for the eutrophication index b. Develop a robust system of indicators and strategies to effectively address the health of Puget Sound's marine waters (including nearshore environments, fecal pollution, and toxic contaminants)

Table 10. Swimming beaches

A functioning, resilient ecosystem requires:	• Swimming beaches that are clean enough for contact recreation: water quality at swimming beaches that meets water quality standards from May through September.
Biophysical constraints that affect what might be achieved by 2020:	• Drier summers with reduced rainfall during the swimming season might improve water quality at swimming beaches that are most affected by wet-weather runoff.
Socio-economic conditions that affect what might be achieved by 2020:	• Location of stormwater and wastewater infrastructure in proximity to swimming beaches • Growing human population and extent and pattern of land development can affect pollutant loads
Decisions on target setting might also consider:	• Targets set for shellfish beds restored and recreational fishing permits • Seven to 15 monitored beaches (and 5 to 13 core beaches) have failed to meet the marine water quality standard for enterococcus two or more times per year from 2004 to 2010. • The BEACH program monitors only marine swimming beaches; some local jurisdictions monitor conditions at freshwater swimming beaches
Options for 2020 targets	1. By 2020, all monitored Puget Sound beaches meet enterococcus standard 2. By 2020, 95% of all monitored Puget Sound beaches meet enterococcus standard 3. By 2020, all core Puget Sound beaches meet enterococcus standard 4. By 2020, 95% of core Puget Sound beaches meet enterococcus standard
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address water quality at swimming beaches -- marine and fresh water; to protect recreational uses at other locations and seasons (SCUBA diving, wind surfing, kayaking); and to track the issuance of swimming advisories.

Table 11. River mouth estuaries

A functioning, resilient ecosystem requires:	• Wetland extent, configuration, and condition at the estuaries of Puget Sound's major rivers to provide ecosystem functions, goods, and services, especially those needed to support recovery of Puget Sound Chinook salmon
Biophysical constraints that affect what might be achieved by 2020:	• Rising sea-level may reduce extent of wetlands at Puget Sound's river mouth estuaries
Socio-economic conditions that affect what might be achieved by 2020:	• Extant wetlands in tidal areas of Puget Sound currently cover 17 to 19 percent of the historic extent. Areas of historic wetlands have been converted to other uses and these transformed landscapes provide other valued services (e.g., ports, agricultural lands, utility and transportation infrastructure) • Restoration projects depend on financial resources (total cost not yet known) and social buy-in (which has proven difficult). • Rate of restoration envisioned in 2005 has not been accomplished in the last six years
Decisions on target setting might also consider:	• Targets set for eelgrass and Chinook abundance • Historic extent of estuarine wetland acreage is currently used as a surrogate for resilient status in the absence of socio-political consensus about how much of which ecosystem goods and services society wants and is willing to pay for. • Restoration need based on achieving 80% of historic extent was developed in spring 2011 for consideration as a system-wide numeric benchmark. Other articulations of restoration need have been developed for specific river systems. • Present-day extent of estuarine wetland acreage is not currently monitored. Changes from restoration activities in the river mouth deltas are tracked, but the effects of other activities (e.g., river restoration and flow management) are not assessed.
Options for 2020 targets	*Partnership staff and partners are continuing conversations about target options for this topic. A new version of target options may be developed in advance of the ECB meeting.* *1. By 2020, 80% of restoration need in major river deltas is achieved basin-wide* *2. By 2020, 30% of restoration need is achieved basin-wide and at least 15% of restoration need is achieved at each river mouth estuary* *3. By 2020, 15% of restoration need is achieved basin-wide and all Chinook natal river deltas meet 10-year salmon recovery goals (or 10% of restoration need as proxy for river deltas lacking quantitative acreage goals in salmon recovery plans)* *4. By 2020, all Chinook natal river deltas meet identified 10-year salmon recovery restoration goals (or 10% of restoration need as proxy for other goals)* *5. By 2020, some portion of restoration need is achieved but 10-year salmon recovery goals are not met in all Chinook natal river deltas* 6. *Do not set a target for river mouth estuaries in June 2011*
Other items that might be included in a Leadership Council resolution	a. Continue assessments (via Puget Sound Nearshore Ecosystem Restoration Program and/or salmon recovery efforts) to refine projections of the extent, configuration, and condition of wetlands at major river mouth estuaries needed for a functioning, resilient ecosystem. b. Develop a robust system of indicators and strategies to effectively address interests in river mouth estuaries, including additional ecosystem functions and services.

Table 12. Floodplains

A functioning, resilient ecosystem requires:	• Tidal and non-tidal freshwater floodplains associated with large rivers and their major tributaries that support natural processes (e.g., channel migration, sediment delivery and routing, large woody debris recruitment and other riparian functions) and deliver ecological services, including flood storage, spawning and rearing contributions to fisheries production, water filtration, and ground water recharge.
Biophysical constraints that affect what might be achieved by 2020:	• Hydrologic shifts and variability related to a changing climate is likely to alter the interactions between rivers and their floodplains.
Socio-economic conditions that affect what might be achieved by 2020:	• Floodplain recovery objectives and actions need to recognize the significant social and economic values of floodplains. Objectives and actions that advance human safety and protect economic activities are more likely to succeed than those advance solely on ecological merits.
Decisions on target setting might also consider:	• Targets set for Chinook abundance and river mouth estuaries • "Functional floodplain area" can be defined according to existing 100-year floodplain or the existing mapped channel migration zone, where "functional" refers to hydrologic connection.
Options for 2020 targets	Do not yet set 2020 targets, but conduct the work plan mentioned below and establish one of the following near-term targets: 1. In the near term, the total amount of functional floodplain area increases on a Sound-wide basis in rural areas and there is no loss of riparian or floodplain functions in any urban areas. 2. In the near term, the total amount of functional floodplain area increases on a Sound-wide basis and there is no net less of functional floodplain area in any individual watershed 3. In the near term, the functional floodplain area in 50% of Puget Sound's 16 major river basins increases. 4. In the near term, there is no net loss of functional floodplain area or flood storage capacity due to development or shoreline armoring (i.e. structural hydromodifications) in any watershed.
Other items that might be included in a Leadership Council resolution	a. Over the next two years, the Partnership and partners should work to develop an indicator and an associated 2020 target addressing floodplain extent and level of condition (connectivity, condition and flood storage capacity). This work will include identification of the most important area of the floodplain on which to focus recovery and protection efforts (i.e. the entire 100-year floodplain or a narrower, more dynamic and ecologically critical portion of the floodplain). The two-year work plan would include completion of Ecology's current Sound-wide mapping of CMZs and hydromodifications due to shoreline alteration (to be completed 2013) as well as development of a land cover-based measure of riparian and floodplain condition.

Table 13. Shoreline armoring

A functioning, resilient ecosystem requires:	• Extent, configuration, and condition of shoreline armoring that does not negatively affect coastal processes such as shoreline erosion and ecological exchange between terrestrial and aquatic systems.
Biophysical constraints that affect what might be achieved by 2020:	• Rising sea-level and shifts in precipitation and runoff patterns may alter coastal erosion processes.
Socio-economic conditions that affect what might be achieved by 2020:	• Shoreline armoring is used to protect interests in shoreline properties. • The extent of shoreline armoring has increased over the past six years with recent placements concentrated in a few counties. • Population growth and development of shoreline properties is likely to result in continued armoring
Decisions on target setting might also consider:	• Target set for eelgrass • The degradation and impairment of function of drift cells – the fundamental unit of analysis of coastal erosion-transport-accretion processes – has been assessed in the change analysis of the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). • Armoring of shorelines is currently monitored and tracked by WDFW's database of hydraulic project approvals.
Options for 2020 targets	1. From 2011 to 2020, the annual amount of new armoring in Puget Sound is declining, but the total amount of new armoring is greater than the total amount of armoring removed (total miles added > total miles removed) 2. From 2011 to 2020, the total amount of new armoring in Puget Sound is at least equal to the amount removed during this period (total miles added = total miles removed) 3. From 2011 to 2020, the total amount of new armoring in Puget Sound is less than the amount removed (total miles added < total miles removed) 4. From 2011 to 2020, the total amount of new armoring in Puget Sound is less than the amount removed (total miles added < total miles removed); feeder bluffs receive strategic attention for removal of existing armoring and avoidance of new armoring; and soft shore techniques are used for all new and replacement armoring
Other items that might be included in a Leadership Council resolution	a. Conduct assessments to project the extent of drift cell improvements needed for a functioning, resilient ecosystem and to support increases in Sound-wide extent of eelgrass b. Develop a robust system of indicators and strategies to effectively address interests in beach systems.

Table 14. Low summer stream flow (water availability)

A functioning, resilient ecosystem requires:	• Summer stream flows that support salmon habitat needs, other ecosystem needs, and water for people. The summer (June through October) lowest 30-day average flow is a statistical measure of flow that has been linked to salmon habitat needs.
Biophysical constraints that affect what might be achieved by 2020:	• Expected climate changes will result in decreased summer low flows (related to decreased snow pack and loss of glaciers combined with higher air temperatures). Increased glacial melt may temporarily increase summer low flows in glacially-fed rivers.
Socio-economic conditions that affect what might be achieved by 2020:	• Surface water withdrawals for consumptive uses, flow management by dams, ground water withdrawals, and increase in impervious land cover can all affect summer stream flows. • Flow restoration goals may not be achievable by 2020 given: the nature of recent trend, the level of implementation effort needed to increase flows to change recent trends, and the funding and legal tools available to accomplish implementation.
Decisions on target setting might also consider:	• Targets set for benthic invertebrate communities in small streams, freshwater water quality index, and Chinook salmon abundance.
Options for 2020 targets	1. By 2020, 100% of streams have stable or increasing flows (GMAP target). 2. By 2020, meet the following river-specific targets: a. Maintain stable or increasing flows in highly regulated rivers: Nisqually, Cedar, Skokomish, Skagit, Green b. Monitor low flow in Elwha River after dam removal c. Maintain stable flows in unregulated rivers that are currently stable: Puyallup, Dungeness, Nooksack d. Restore low flows to bring the Snohomish River from a weakly decreasing trend to no trend e. Restore low flows to bring the Deschutes River, North Fork Stillaguamish River, and Issaquah Creek from a strongly decreasing trend to a weakly decreasing trend
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address all aspects of stream flow and water availability. Consider using a 7-day average flows instead of 30-day, including more gages; addressing concerns over the WY 1975-current time period, using a 2-way indicator that includes the adequacy of flow levels (both status and trend; and developing an hydrologic index that captures "environmental flows"

Table 15. Recreational fishing license sales

A functioning, resilient ecosystem requires:	• Adequate supply of ecosystem-derived recreational and cultural services and non-commercial provisioning services
Biophysical constraints that affect what might be achieved by 2020:	• Poor condition of some fish stocks
Socio-economic conditions that affect what might be achieved by 2020:	• Price of recreational fishing licenses • Overall economic conditions (which affect time available for fishing, interest in fishing for food provisioning, etc.) • Allocation of fisheries among commercial non-tribal, tribal, and recreational harvest
Decisions on target setting might also consider:	• Relationship to other indicators and targets via anglers' perceptions of water quality, condition of fish stocks. • Relationship to commercial fisheries harvest and to targets for Chinook salmon abundance and Pacific herring • Lack of information about the degree to which license sales are affected by gasoline prices, perceptions about quality of fishing experience, license prices, and weather conditions. • Increased harvest implied by increased license sales would be interpreted as increased pressure on fish populations.
Options for 2020 targets	1. Set no recovery targets in June 2011
Other items that might be included in a Leadership Council resolution	a. Investigate targets for this indicator based on per capita license sales when fishing was perceived as "good." b. Expand this indicator so that it represents a broader view of the recreational services supported by the Puget Sound ecosystem

Table 16. Southern resident killer whales

A functioning, resilient ecosystem requires:	• A viable population of southern resident killer whales. Protections of this population segment under the federal Endangered Species Plan will no longer be needed if the population grows at an annual rate of 2.3% over a 28-year period, if population characteristics are indicative of a stable or increasing population, and if threats to the population segment have been addressed
Biophysical constraints that affect what might be achieved by 2020:	• Recent growth of the southern resident killer whales has been 0.66% per year. • Although this population segment currently includes 25 females of reproductive age, only 17 or 18 are reproductively active. At a 5-year calving interval, a population with 17 or 18 reproductively active females will produce 3-4 calves per year. Accounting for calf mortality and other mortality in the population, a 2.3% annual growth rate does not appear to be achievable in the near-term.
Socio-economic conditions that affect what might be achieved by 2020:	• Levels of ocean harvest and hatchery production of Chinook salmon from Puget Sound and Georgia Basin rivers affect the availability of prey for southern resident killer whales • Level of effort to address the threats to southern resident killer whale recovery might affect the rate of population recovery
Decisions on target setting might also consider:	• Targets set for Chinook salmon and toxics in fish
Options for 2020 targets	1. Demonstrate progress toward biological criteria for downlisting southern resident killer whales by achieving 2.3% annual average growth rate for some period of years ending in 2020. At most, this might mean a 2020 end of census of 108 individuals based on 2.3% growth rate from 2010 to 2020. 2. By 2020, achieve an end of year census of southern resident killer whales of 95 individuals, which would represent a 1.0% annual average growth rate from 2010 to 2020. 3. By 2020, achieve an end of year census of southern resident killer whales of 92 individuals, which would represent a 0.66% annual average growth rate from 2010 to 2020.
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address southern resident killer whale recovery and reduction in threats to recovery.

Table 17. Chinook salmon abundance

A functioning, resilient ecosystem requires:	• 95 to 99% probability that Puget Sound Chinook salmon can persist on their own for 100 years. This equates to an abundance of 60,580 to 271,640 wild Puget Sound Chinook salmon, depending on the productivity of the Chinook populations.
Biophysical constraints that affect what might be achieved by 2020:	• Chinook salmon may respond to actions that directly affect their survival (e.g., improving passage, restricting harvest) over decades or less. Responses to other actions (e.g., improving hatchery practices, improving habitat quality) may take much longer. • Spatial distribution of populations is a key ecological attribute of Chinook salmon viability and the recovery plan suggests that at least 2 populations in each of five biogeographic regions should reach their recovery goals for Puget Sound Chinook to achieve a low risk of extinction.
Socio-economic conditions that affect what might be achieved by 2020:	• Level of effort in implementing habitat, harvest, and hatchery contributions to salmon recovery. • Effectiveness of regulatory and non-regulatory efforts to protect Chinook salmon habitat.
Decisions on target setting might also consider:	• Targets set for land use/land cover, benthic invertebrate communities in small streams, freshwater water quality, marine water quality, estuaries, floodplains, low summer flows, and Pacific herring
Options for 2020 targets	1. Through 2020, maintain current levels of abundance. 2. By 2020, demonstrate a statistically significant increase in wild Chinook salmon returning to Puget Sound. Preliminary statistical modeling indicates that a 40-45% increase over current levels (at least 22,000 more returning fish) would be needed for an improvement to be detectable in 2020. 3. By 2020, demonstrate increases of 45,000 to 50,000 wild Chinook salmon returning to Puget Sound, consistent with a linear trajectory toward achieving recovery planning ranges in 2050.
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address all aspects of Puget Sound Chinook population viability, including population productivity, spatial distribution, and diversity.

Table 18. Pacific herring

A functioning, resilient ecosystem requires:	• Biomass of herring to satisfy predators' consumption requirements, meet bait and other fishery needs, and assure sufficient herring for successful spawning and recruitment.
Biophysical constraints that affect what might be achieved by 2020:	• Food web modeling suggests that predators in central Puget Sound need 8,170 mt of juvenile and 2,540 mt of adult herring annually. • Age composition of Cherry Point and other herring stocks has been skewed to younger ages over time; this shift may reduce reproductive capacity and impair the capacity of the population to recover.
Socio-economic conditions that affect what might be achieved by 2020:	• Human population growth and associated land development may reduce the amount or quality of spawning habitat for herring. • Management of herring commercial harvest
Decisions on target setting might also consider:	• Targets set for shoreline armoring and eelgrass
Options for 2020 targets	1. By 2020, maintain 90% of the mean of annual cumulative estimated herring spawning biomass from 1986-2010 indicated by a. 2,520 tons for Cherry Point stock b. 710 tons for Squaxin Pass stock c. 10,876 tons for all other stocks combined 2. By 2020, maintain 100% of the mean of annual cumulative estimated herring spawning biomass from 1986-2010 indicated by a. 2,800 tons for Cherry Point stock b. 789 tons for Squaxin Pass stock c. 12,084 tons for all other stocks combined 3. By 2020, achieve biomass targets based on 25% of the unfished biomass for each genetic stock unit. (Specific targets not yet available) 4. By 2020, achieve biomass targets based on alternative thresholds for fishery or ecosystem needs. (Specific targets not yet available)
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators, monitoring, and strategies to effectively address all aspects of Pacific herring population viability, food web support, and provisioning for fisheries. b. Develop herring biomass thresholds based on biomass required for herring viability, fishery needs, and/or ecosystem needs

Table 19. Upland birds

A functioning, resilient ecosystem requires:	• Viable populations and communities of breeding birds associated with the diversity of Puget Sound terrestrial ecological systems, including urbanizing landscapes, forest interiors (sensitive to forest fragmentation), riparian habitats. • Population size of marbled murrelets at or near levels observed in 1997. The Recovery Plan for Marbled Murrelets under the Endangered Species Act (U.S. Fish and Wildlife Service 1997) calls for 'stabilizing the population size at or near current levels' suggesting that this population size is "acceptable."
Biophysical constraints that affect what might be achieved by 2020:	• At-sea densities of marbled murrelets in this region have declined from 2001-2010 at an annual rate of 7.34% • Spend most of their lives in the marine environment where they forage in near-shore areas and consume a diversity of prey species, including small fish and invertebrates. • Murrelet nesting habitat use is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge habitat, reduced habitat fragmentation, and proximity to the marine environment. The presence of platforms (large branches or deformities) used for nesting is the most important characteristic of their nesting habitat • A climate-induced increase in fire frequency in forests used by nesting murrelets would reduce the amount of late-succession and old-growth forests used as nesting habitat by murrelets and increase forest fragmentation, which could also result in increased nest predation rates
Socio-economic conditions that affect what might be achieved by 2020:	• Land development fragments habitat, increases predation, and reduces forest habitat extent. • Human activities in forests with marbled murrelet nesting habitat increases avian predation
Decisions on target setting might also consider:	• Ongoing development of a breeding bird indicator to supplement or replace the marbled murrelet indicator on the Partnership's Dashboard of Ecosystem Indicators • Targets set for land cover/land use and land development • A numeric target for Option 2 is not yet available, it might be available in 1-2 months or might require original analysis • Additional analysis is needed to evaluate whether Options 3 and 4 are achievable given known murrelet survival and fecundity rates.
Options for 2020 targets	1. Achieve a stable or increasing marbled murrelet population size for the 10-year period from 2011-2020. 2. By 2020, marbled murrelet populations demonstrate rates of increase consistent with predicted habitat improvements. 3. By 2020, recover marbled murrelet population size to 2001 levels: 8,936 individuals with 95% CL of 5,536 to 12,583 individuals. 4. By 2020, recover marbled murrelets to population size that is 15 percent above 2001 levels: 10,276 individuals (assumes ~15% above 2001 levels is a fair estimate of 1997 levels based on 4%/year decline)
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators, monitoring, and strategies to effectively address all aspects of terrestrial birds and their habitat needs.

Table 20. Funding for Puget Sound

A functioning, resilient ecosystem requires:	• Funding from federal, tribal, state, and local governments • Funding from the private sector
Biophysical constraints that affect what might be achieved by 2020:	(none identified)
Socio-economic conditions that affect what might be achieved by 2020:	• Economic conditions between 2011 and 2020
Decisions on target setting might also consider:	• Stategies and actions in the 2011 revision of the Action Agenda will be developed later in 20111. Cost estimates for near-term actions will be developed in late 2011 and early 2012.
Options for 2020 targets	1. Current level of funding should be maintained or increasing. 2. Set target based upon the percentage of the Biennial Action Agenda Cost estimate that is funded. 3. Establish target for funding for the entire Action Agenda by a date certain (September 2011, December 2011, February 2012) based upon ecosystem targets adopted by the Leadership Council. **4.** Establish funding target for high priority NTAs or strategies by a date certain (September 2011, December 2011, February 2012) based upon ecosystem targets adopted by the Leadership Council.
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address all aspects of public and private funding for Puget Sound ecosystem recovery

Table 21. Action Agenda implementation

A functioning, resilient ecosystem requires:	• Implementation of the Action Agenda and the foundation of programs and activities by governments, business, social organizations, and individuals that contribute to recovery of the Puget Sound ecosystem
Biophysical constraints that affect what might be achieved by 2020:	(none identified)
Socio-economic conditions that affect what might be achieved by 2020:	• Economic conditions from 2011 to 2020 • Funding to implement the Action Agenda • Complexity of actions needed and institutional situations
Decisions on target setting might also consider:	• Targets set for other topics • The extent to which near-term actions (NTAs) are discretely scoped and time-bound
Options for 2020 targets	1. 90% of all NTAs are on-plan or completed. 2. 80% of all NTAs are on-plan or completed. **3.** 100% of all funded NTAs are on-plan or completed. **4.** 100% of the funded high-priority Near Term Actions are completed and 80-90% of other funded actions are completed.
Other items that might be included in a Leadership Council resolution	

Source Materials

- Land Development – Setting Targets for Pressure Reductions Technical Memorandum; J Leckrone Lee, D Peters, K Pierce, S Stanley, and K Stiles; March 25, 2011 DRAFT
- Land Development -- Addendum to Technical Memorandum (May 12, 2011)
- Conversion of forested to developed cover in non-federal ownerships (Land-use/Land-cover) -- Setting Targets for Dashboard Indicators Briefsheet; KB Pierce, Jr.; March 25, 2011 DRAFT
- Land use/land cover -- Addendum to Brief Sheet (May 12, 2011)
- Runoff from the Built Environment – Setting Targets for Pressure Reductions Technical Memorandum; B Wulkan; March 23, 2011 DRAFT
- Runoff from the built environment – Addendum to Technical Memorandum (May 5, 2011)
- Wastewater and On-Site Sewage Systems – Setting Targets for Pressure Reductions Technical Memorandum; D Fagergren; April 2011
- Wastewater and onsite sewage systems – Revised pressure reduction objectives (May 11, 2011)
- Toxics in fish – Setting Targets for Dashboard Indicators Briefsheet; JE West; March 23, 2011 DRAFT
- Toxics in fish: Addendum to target options (May 9, 2011)
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- Toxics in sediments – Addendum to target setting options; M Dutch (May 2011)
- Freshwater water quality index – Setting Targets for Dashboard Indicators Briefsheet; D Hallock; March 23, 2011 DRAFT
- Marine water quality composite index – Setting Targets for Dashboard Indicators Briefsheet; C Krembs; May 2011 REVISION
- Swimming beaches – Setting Targets for Dashboard Indicators Briefsheet; J Bennett; March 23, 2011 DRAFT
- Swimming beaches addendum (May 2011)
- Setting Targets for Estuaries, Nearshore Restoration, and Shoreline Alteration; Technical Memorandum; J Mulvihill-Kuntz, M Schneidler, K Currens, and K Stiles; May 16, 2011 REVISED DRAFT
- Floodplains technical memo (April 2011)
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- Water availability Setting Targets for Dashboard Indicators Briefsheet; P Pickett.; March 25, 2011 DRAFT
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- Southern resident orcas – Setting Targets for Dashboard Indicators Briefsheet, S Redman, March 24, 2011 DRAFT
- Wild Chinook salmon abundance – Setting Targets for Dashboard Indicators Briefsheet; K Currens; May 5, 2011 REVISION
- Pacific herring spawning biomass – Setting Targets for Dashboard Indicators Briefsheet; K Stick and W Palsson; May 2011 REVISION

- Terrestrial birds – Setting Targets for Dashboard Indicators Briefsheet; S Pearson; May 2011 REVISION
- Funding for Puget Sound – Setting Targets for Dashboard Indicators Briefsheet; J Cahill; March 22, 2011 DRAFT
- Action Agenda engagement -- Setting Targets for Dashboard Indicators Briefsheet; K Boyd, M Daily, A Mitchell, and M Neuman; March 22, 2011 DRAFT
- Summary of April 14 Target Setting Workshop
- Summary of April 18 Target Setting Workshop
- Summary of April 19 Target Setting Workshop
- Summary of May 12 Target Setting Workshop
- Summary of May 13 Target Setting Workshop
- Summary of written comments on Partnership target setting: April through May 16, 2011