

Developing Human Wellbeing Indicators for the Hood Canal Watershed

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Executive Summary:

The Puget Sound Institute (PSI) and Stanford University collaborated with Hood Canal Coordinating Council (HCCC) to develop a process for selecting human wellbeing indicators relevant to natural resource management in the Hood Canal watershed. The purpose of these indicators will be to monitor the state of Hood Canal communities and to inform and evaluate integrated watershed strategies for key social impacts.

The process involved several steps of compiling, creating, rating and refining potential human wellbeing indicators that related the values of Hood Canal residents to the health of Hood Canal ecosystems (Figure 1). These steps included 1) a review of all social indicators being collected or intended to be collected in the Puget Sound region, 2) an analysis of values of Hood Canal residents related to the environment from interviews and literature review, 3) a merging of existing Puget Sound indicators with Hood Canal values, and 4) three ranking processes with the project team, Hood Canal stakeholders, and regional social scientists.

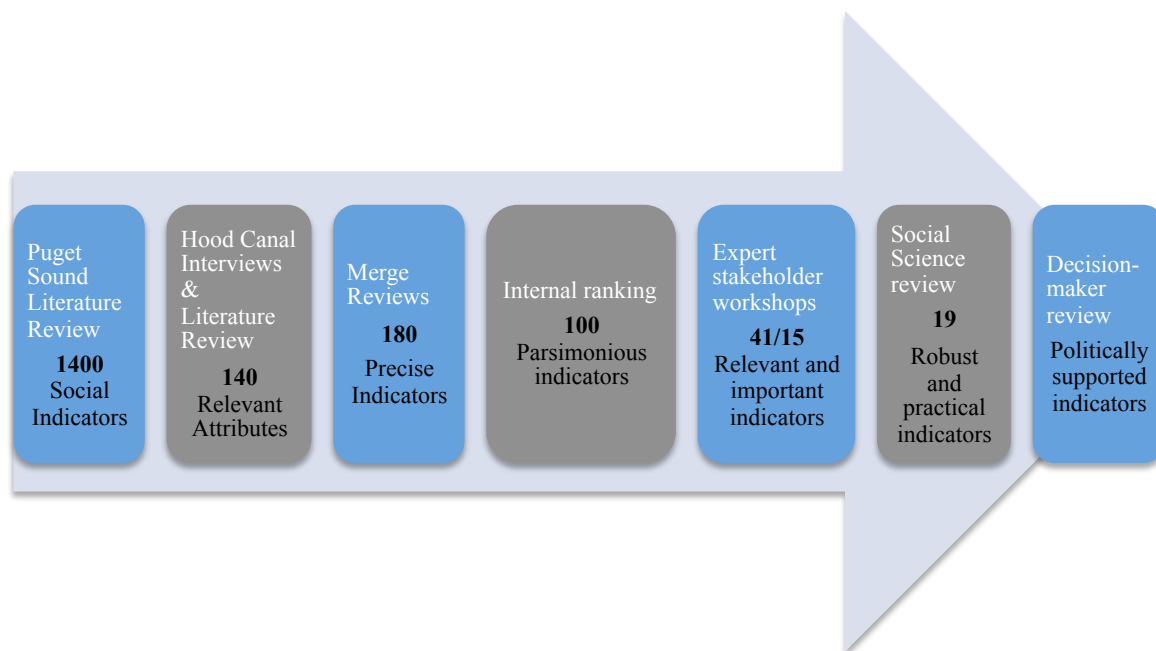


Figure 1. Primary phases of the Hood Canal human wellbeing indicator development process. Each phase builds off the outcomes of the prior.

Indicators were developed to represent six domains of Human Wellbeing: Psychological, Physical, Cultural, Social, Economic and Governance. In the stakeholder workshop phase, 100 indicators were presented to 32 workshop participants in three workshops (Belfair, Port Gamble and Quilcene). From this initial list of 100, 41 were highly rated for relevance and importance in at least two workshops. This list was then sent to social scientists outside of Hood Canal to determine practicality and robustness. A summary table of 26 potential indicators is provided that includes the 15 indicators that were highly rated in all three workshops and the 19 indicators that were highly rated by social scientists (Table 1) – 10 were highly ranked by both. Two additional indicators are included that were recommended by social scientists because they respond to commonly expressed gaps throughout the indicator development process.

Data for some of these indicators are available from regional and national sources. Many, however, will require a regular household survey of Hood Canal residents or independent analyses of existing data. The HCCC, in consultation with partners and member governments, will need to make decisions about how often these indicators are measured and how the information will be collected.

It is important to remember that:

- All indicators must be disaggregated by demographic variables to understand equity issues, one of the most important aspects of human wellbeing
 - Socioeconomic status
 - Age
 - Gender
 - Time living in Hood Canal
 - Ethnicity or Tribal/Non-tribal
- Indicators are not targets. They are a measure of the status of a specific aspect relevant to human wellbeing associated with the environment
- Consequently, it is not necessarily desirable that the unit of measure of an indicator increases. The measure *only* demonstrates the status of the indicator. It is still up to people to analyze the implications of that measure. For example, if residents are increasingly eating larger quantities of shellfish, we would need to know the relationship of this indicator to shellfish population to then determine appropriate policy responses.

Table 1. Human Wellbeing indicators highly ranked by all three workshops and by social scientists.

Domain	Attribute	Indicator	Highly rated in all 3 workshops	Highly rated by social scientists (an overall score of at least 4/5)
Physical	Exercise	Approximate number of hours residents engage in outdoor activities (divided into work that involves outdoor physical activity, swimming, hiking, walking, running, mountain biking, human-powered watercraft, skiing, scuba, home care (garden, yard), & other motorcraft) per week ¹	X	X
	Exercise	Percent of swimming beaches that meet safe swimming standards at all times during the summer		x
	Access to Local Food	Availability of commonly harvested species (e.g. hardshell clams, crabs, shrimp, salmon, deer, elk, mushrooms, rose hips, willow, cedar, other plants or animals)	X	X
	Safe Drinking Water	Drinking water testing results from Community Groups and wells		X
	Safe Food	Toxin levels in shellfish harvest areas, commercial and recreational: PSP, crypto, giardiasis, vibriosis, notovirus ²	X	X
	Air Quality	Number of days during the calendar year that air quality was good, moderate, unhealthy, very unhealthy, or hazardous (must include pollutants from smoke) ³	X	X
Psychological	Positive emotions	Percent of residents who describe experiencing positive feelings/emotions from being in nature in Hood Canal, such as awe, inspiration, fulfillment, appreciation, solitude, relaxation, sense of peace and reflection	X	X
	General subjective wellbeing	Percent of residents who express high life satisfaction or happiness and percent who express living in Hood Canal as a contributor to this		X
	Place Identity	Percent of residents who express a positive connection to the region		added
Governance	Access	Percent of shoreline that is publicly accessible or owned ⁴	X	x
	Access	Percent of residents who are satisfied with their access to public shorelines		added
	Communication	Percent of Hood Canal residents who have learned about resource management or recreation issues through different media this year: newspaper, radio, website, printed media, mobile app, educational resources for school aged children, word of mouth; include source	x	X
	Trust in government	Number of Hood Canal residents who report trust in experts and local and state government and collaborative government efforts		X
	Effectiveness of Public Policies	Percent of identified PIC failures with corrective action initiated within "x" weeks ⁵		X
	Stewardship	Percent of participants engaging in a natural resource stewardship activity/year	X	

¹ May want to analyze by ability to engage in outdoor activity (elderly and handicapped)

² May want to consider toxics more generally instead, using data from WDFW

³ May want to combine this with regional asthma rates

⁴ This may not be informative as there will likely be little change, but it was widely seen as important

Cultural	Cultural Events	Percent of residents who participate in natural-resource inspired cultural activities ⁶	X	
	Traditional resource practices	Proportion of residents who say that they would like to regularly access traditionally/commonly harvested natural resources and are able to do so as much as needed	X	X
	Rural Character ⁷	Distribution and quantity of urban, rural, agriculture, forest, mineral resource, conservation and stewardship lands.		X
Social	Trust	Percentage of residents who trust people in their surrounding community ⁸	X	
	Strong Families and Friendships	Average number of days/year participate in outdoor activities with family members and/or friends ⁹	X	
	Strong Communities	Percent of residents who have worked with other residents to manage resources, prepare cultural events, solve community challenges, or share harvested goods in the past year ¹⁰		x
Economic	Jobs	Number of jobs and living wages per worker by resource-based employment/industry categories and economic clusters by county, and unemployment rates at subarea level matching state database		x
	Jobs	Number of new jobs created by natural resource employment sector/year	X	
	Industry	Percent of economic activity that is from natural resource-based small business ¹¹		x
	Industry	Percent of revenue to local economy from agriculture, commercial shellfish, commercial fishing, timber, non-timber products and tourism	X	x
	Industry	Number of local supporting businesses to industry, by natural resource sector	x	x

⁶ May need to provide specific examples to orient survey participants

⁷ There was significant discussion about the title for this attribute as Rural Character may not be a value for all

⁸ May be too vague, see Footnote #6

⁹ Can be a component of the exercise indicator; could add process, share, eat or use harvested food, medicine or materials

¹⁰ Potentially more important than the general trust indicator as it is more specific and can act as a proxy to trust

¹¹ No consensus that small businesses are more important than large businesses

Introduction

Human wellbeing (HWB) is multi-faceted and can be enhanced, or negatively affected, by our daily experiences, such as the quality of our work life and personal relationships, our engagement in physical activity and adherence to a healthy diet, and opportunities to participate in cultural activities. Many facets of wellbeing are directly related to the health of the natural environment such as the ability to release stress in a peaceful forest or a thriving local economy derived from sustainable shellfish harvesting. The status of our wellbeing can influence the way we make decisions that affect the environment and the status of those resources, in turn, can affect our wellbeing. In many cases, this perspective is left out of ecosystem recovery.

Because of a growing understanding of the relationship between HWB and the status of natural resources, planning for and monitoring human wellbeing as a component of ecosystem recovery is a growing trend. Within the Puget Sound specifically, the Puget Sound Partnership has a placeholder for quality of life indicators and the Hood Canal Coordinating Council (HCCC), a watershed-based council of governments, has identified nine human components of interest for their Integrated Watershed Plan, a coordinated strategy to guide natural resource-based actions. The actual incorporation of human wellbeing into these types of policies has been limited, however, because of a lack of guidance for developing indicators to begin addressing HWB in practice.

The Hood Canal is a 60-mile long fjord in the western Puget Sound (Figure below). The HCCC has been leading a community-based process to develop an Integrated Watershed Plan based on visioning, establishing goals and selecting priority strategies for the health and wellbeing of Hood Canal ecosystems and residents. The Puget Sound Institute collaborated with the HCCC to develop a process for selecting HWB indicators related to the health of Hood Canal natural resources. This report summarizes the methods and results of a pilot process for HWB indicator



development in the Hood Canal. The data from the process is intended for the HCCC to incorporate into their Integrated Watershed Plan so that future management strategies can take into consideration the effects on HWB and the aspects of HWB that are driving the actual status of environmental health.

Methods

We adapted methods from several international efforts to incorporate social, economic and cultural indicators into coastal and watershed planning processes (e.g., Tipa 2009; Day and Prins 2013). The process involved iterative phases of gathering and refining potential attributes and indicators with soliciting feedback from local and scientific experts in participatory, on-line, and one-on-one formats.

PREPARING POTENTIAL INDICATORS

To begin the process, we conducted a review of social indicators that were being measured or intended to be measured by government and non-government organizations in the Puget Sound region (Hanein & Biedenweg 2012) (Figure below). This resulted in 1400 indicators that were coded into one of seven common HWB domains (Social, Cultural, Spiritual, Psychological, Physical, Economic and Governance), as well as relevant attributes within those domains.

We then compiled existing data about Hood Canal resident values. These data came in various formats from diverse projects, including the human ecology mapping project (McLain et al. 2013), conceptual modeling workshops held by the HCCC with diverse stakeholders, social marketing assessments from Washington State University Extension, and reports describing the proceedings of visioning workshops for the Hood Canal Coordinating Council (Appendix I). We also reviewed two edited compilations of news stories (Brody 1991 and Sande 2010) and one 15-minute video summary of a prior process that assessed the relationship of people to the Hood Canal ecosystems (Hood Canal Community Circle 1996).

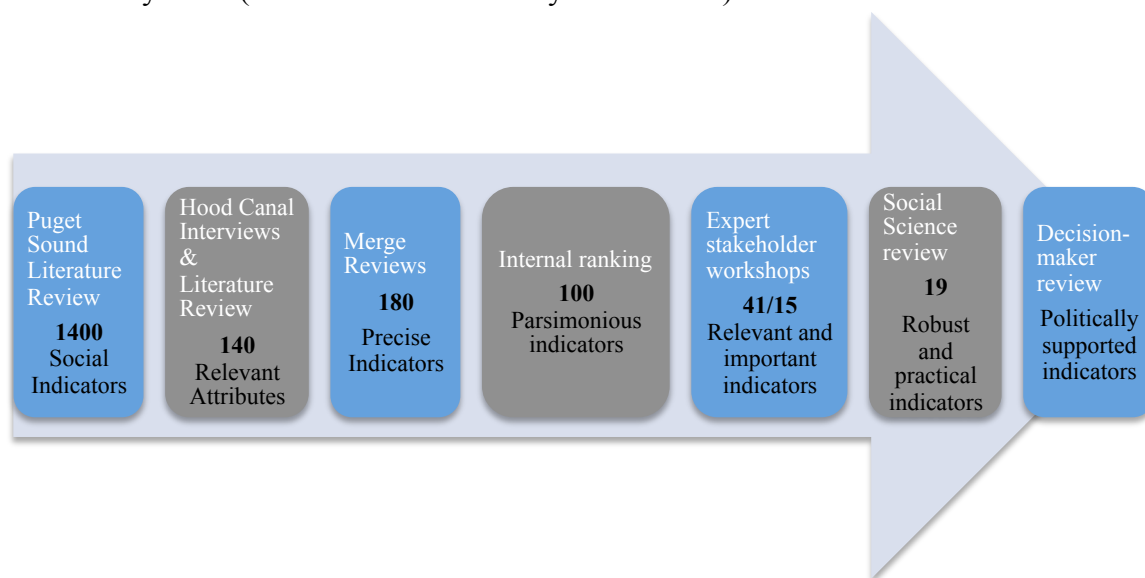


Figure 1. Primary phases of the Hood Canal human wellbeing indicator development process. Each phase builds off the outcomes of the prior.

To complement existing Hood Canal data, we conducted nineteen open-ended interviews lasting from 15-90 minutes focused on the question “How does living in the Hood Canal contribute to your wellbeing.” Participants were recruited using a snowball sampling procedure. We started with a short list of tribal and non-tribal residents who had engaged in previous discussions about the management of Hood Canal. We then asked these participants to recommend other community members who thought differently than they did about the determinants of wellbeing in the Hood Canal. We stopped at nineteen interviews after we saw strong trends in wellbeing attributes across the majority of participants.

We coded the Hood Canal interviews and existing data into one of the seven human wellbeing domains. As we did so, we created attributes (a more specific category to the domain, but not yet a measurable indicator) that best represented the concept and potential indicators that would measure the specific aspects of the attributes. Example attributes include “exercise” and “safe food” for the physical domain, which could be measured by the indicators “number of hours spent in outdoor activity per week” or “level of toxins in commonly harvested species,” respectively. Two of the authors worked on this process, resulting in 132 potential attributes spread across the seven domains.

To come up with specific indicator wording for the 132 attributes, and ideally indicators for which data was already regularly collected, we filtered the initial Puget Sound social indicator database (Hanein & Biedenweg 2012). First, we removed all indicators and attributes that were not related to natural resources or were duplicated in the data set. Second, we removed indicators that were not applicable to the Hood Canal region because they were specific to urban areas or other regions. This resulted in a set of 386 specific indicators. In order to merge these indicators with the list of 132 derived Hood Canal attributes, we searched the set of 386 indicators for each of the 132 attributes. Based on this merge, a total of 241 potential indicators were selected.

REFINING AND RANKING INDICATORS

To reduce this list to a more manageable set of indicators, we used a three-phased process to refine and rank the potential indicator list based on:

Relevance	Importance	Robustness	Practicality
<ul style="list-style-type: none"> •How well the indicator represents the issues of Hood Canal 	<ul style="list-style-type: none"> •How important the indicator is in relation to the other indicators to provide a complete representation of the domain 	<ul style="list-style-type: none"> •How well the indicator measures the intended attribute and domain 	<ul style="list-style-type: none"> •How feasible it would be to get data for the indicator, assuming a household survey is feasible

Criteria used in the indicator selection process.

These four criteria were selected to enhance the robustness of the selection process and are a subset of criteria used in other indicator ranking processes (i.e., Kurtz et al. 2001; Kershner et. al 2011; and Day and Prins 2013). The first ranking phase was an internal review of the potential indicators. Our research team ranked each indicator on a scale of 1-5, resulting in a list of 100 potential indicators. The primary outcome of this first step was to remove redundant and irrelevant indicators.

The second phase included three stakeholder workshops with participants who had regional expertise in measurement or first-hand-knowledge of one of the seven domains. A list of potential participants was put together based on recommendations from county commissioners, HCCC representatives, county representatives, and active community members. A total of 32 participants from the 161 invited attended the workshops representing each of the three counties and two tribes (Appendix II). Fourteen participants attended the Belfair workshop, 11 participants attended the Port Gamble S’Klallam workshop and 7 participants attended the workshop in Quilcene. While we acknowledge the small group size, this is a common size for specialized working groups comprised of people with the most regional understanding of a topic. These 32 participants represented diverse perspectives as tribal members, public health scientists, economic development representatives, and active citizens in economic and cultural activities.



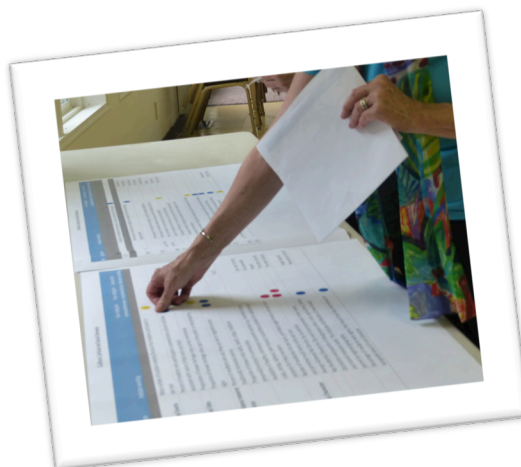
Workshop at the Port Gamble S’Klallam Longhouse

Each participant was assigned to one of four small groups focused on 1 to 3 of the domains. They were informed of their group placement and provided the indicator list prior to their attendance at the workshop (Appendix III). Examples of Economic group participants included representatives from economic development, private businesses and marketing; the Social/Cultural/Spiritual group had representatives from tribal nations, religious organizations, social researchers, and long-term residents; the Governance group included representatives from tribal nations, long-term community activists, non-profits, and researchers; and the Psychological/Physical group had representatives from county health departments and recreation groups. Each group was provided 22-27 indicators from which they were asked to refine and prioritize to less than ten to facilitate the narrowing of indicators to the most relevant.

We asked workshop participants to complete two steps to refine and rank potential indicators.

Step 1

The first step was to independently rate each indicator for relevance to the region, placing green (good indicator), yellow (potentially good but needs modification), and red (not relevant) sticker dots on poster-sized printouts of the indicators for their domain. This first step allowed participants to see where they had some agreement and allowed the second step to proceed more efficiently.



Step 2

In the second step, each group worked with a facilitator to refine their list of indicators to less than ten based on relevance and importance. In this step they were also welcomed to add any indicator or attribute that they perceived as critical. Although we recommended methods for doing this, each group chose a different path to accomplish this task. Some approached this step by discussing the potential indicators (yellow stickers), trying to refine these so they better filled a gap or choosing to eliminate them altogether. Other groups looked primarily at the good indicators (green stickers) and asked participants to rank those. Each group was facilitated by a member



of the research team who kept detailed notes of the conversations either in an Excel spreadsheet or directly on the printouts of indicators. Results from all three workshops were compiled; indicators that were prioritized in at least two workshops were retained and new indicators were created based on stakeholder comments if the concepts were discussed in at least two workshops. This resulted in 41 indicators that reflected stakeholder input on the most relevant and important measures for each domain.

Finally, in the third phase of refinement we received input from seven social scientists on this list of 41 indicators. The scientists were sent an Excel datasheet with a 2-page background document and were requested to rank each indicator on a scale of 1-5 for robustness, practicality and importance. We selected scientists with social science experience in the Puget Sound region, although not necessarily Hood Canal, who were familiar with existing datasets and data collection methods and therefore would contribute their topical expertise while ensuring the final list of indicators were both scientifically rigorous and consistent with existing monitoring when possible.

Recommended Indicators

We present a list of 26 HWB indicators that stakeholders and social scientists believed to be relevant, practical, robust and important. Fifteen of these indicators were highly ranked in all three stakeholder workshops. Nineteen of these indicators were highly ranked by social scientists. Two were added based on social science recommendation because they responded to concerns about gaps throughout the indicator process. Of the 26 indicators, 10 were the top rated among all stakeholders and scientists.

The indicators represent six domains of HWB and are specific to the way residents interact with natural resources in the Hood Canal watershed. This includes upland, freshwater and estuarine ecosystems. Footnotes are provided for many of the indicators based on comments from regional social scientists. These footnotes highlight potential considerations when choosing to monitor a specific indicator. Any or all of these indicators may be officially selected by the HCCC to become part of the Integrated Watershed Plan, but consideration should be given to the fact that participants have already selected based on the importance of each indicator to measure the domain.

It is important to remember that:

- All indicators must be disaggregated by demographic variables to understanding equity issues, one of the most important aspects of HWB
 - Socioeconomic status
 - Age
 - Gender
 - Time living in Hood Canal
 - Ethnicity or Tribal/Non-tribal
- Indicators are not targets. They are a measure of the status of a specific aspect relevant to HWB associated with natural resources
- Consequently, it is not necessarily desirable that the unit of measure of an indicator increases. The measure *only* demonstrates the status of the indicator. It is still up to people to analyze the implications of that measure. For example, if residents are increasingly eating larger quantities of shellfish, we would need to know the relationship of this indicator to shellfish health and population status to then determine appropriate policy responses.

Highly Ranked Indicators of Human Wellbeing related to Natural Resource Health by Hood Canal Stakeholders and Social Scientists

Domain	Attribute	Indicator	Highly rated in all 3 workshops	Highly rated by social scientists (an overall score of at least 4/5)
Physical	Exercise	Approximate number of hours residents engage in outdoor activities (divided into work that involves outdoor physical activity, swimming, hiking, walking, running, mountain biking, human-powered watercraft, skiing, scuba, home care (garden, yard), & other motorcraft) per week ¹	X	X
	Exercise	Percent of swimming beaches that meet safe swimming standards at all times during the summer		x
	Access to Local Food	Availability of commonly harvested species (e.g. hardshell clams, crabs, shrimp, salmon, deer, elk, mushrooms, rose hips, willow, cedar, other plants or animals)	X	X
	Safe Drinking Water	Drinking water testing results from Community Groups and wells		X
	Safe Food	Toxin levels in shellfish harvest areas, commercial and recreational: PSP, crypto, giardiasis, vibriosis, norovirus ²	X	X
	Air Quality	Number of days during the calendar year that air quality was good, moderate, unhealthy, very unhealthy, or hazardous (must include pollutants from smoke) ³	X	X
Psychological	Positive emotions	Percent of residents who describe experiencing positive feelings/emotions from being in nature in Hood Canal, such as awe, inspiration, fulfillment, appreciation, solitude, relaxation, sense of peace and reflection	X	X
	General subjective wellbeing	Percent of residents who express high life satisfaction or happiness and percent who express living in Hood Canal as a contributor to this		X
	Place Identity	Percent of residents who express a positive connection to the region		added
Governance	Access	Percent of shoreline that is publicly accessible or owned ⁴	X	x
	Access	Percent of residents who are satisfied with their access to public shorelines		added
	Communication	Percent of Hood Canal residents who have learned about resource management or recreation issues through different media this year: newspaper, radio, website, printed media, mobile app, educational resources for school aged children, word of mouth; include source	x	X
	Trust in government	Number of Hood Canal residents who report trust in experts and local and state government and collaborative government efforts		X
	Effectiveness of Public	Percent of identified PIC failures with corrective action initiated within "x" weeks ⁵		X

¹ May want to analyze by ability to engage in outdoor activity (elderly and handicapped)

² May want to consider toxics more generally instead, using Jim West data

³ May want to combine this with regional asthma rates

⁴ This may not be informative as there will likely be little change, but it was widely seen as important

⁵ An appropriate time period should be determined with agency representatives; might be too specific to be informative, but it was an attempt to measure government response

	Policies			
	Stewardship	Percent of participants engaging in a natural resource stewardship activity/year	X	
Cultural	Cultural Events	Percent of residents who participate in natural-resource inspired cultural activities ⁶	X	
	Traditional resource practices	Proportion of residents who say that they would like to regularly access traditionally/commonly harvested natural resources and are able to do so as much as needed	X	X
	Rural Character ⁷	Distribution and quantity of urban, rural, agriculture, forest, mineral resource, conservation and stewardship lands		X
Social	Trust	Percentage of residents who trust people in their surrounding community ⁸	X	
	Strong Families and Friendships	Average number of days/year participate in outdoor activities with family members and/or friends ⁹	X	
	Strong Communities	Percent of residents who have worked with other residents to manage resources, prepare cultural events, solve community challenges, or share harvested goods in the past year ¹⁰		x
Economic	Jobs	Number of jobs and living wages per worker by resource-based employment/industry categories and economic clusters by county, and unemployment rates at subarea level matching state database		x
	Jobs	Number of new jobs created by natural resource employment sector/year	X	
	Industry	Percent of economic activity that is from natural resource-based small business ¹¹		x
	Industry	Percent of revenue to local economy from agriculture, commercial shellfish, commercial fishing, timber, non-timber products and tourism	X	x
	Industry	Number of local supporting businesses to industry, by natural resource sector	x	x

⁶ May need to provide specific examples to orient survey participants

⁷ There was significant discussion about the title for this attribute as Rural Character may not be a value for all

⁸ May be too vague, see Footnote #6

⁹ Can be a component of the exercise indicator; could add process, share, eat or use harvested food, medicine or materials

¹⁰ Potentially more important than the general trust indicator as it is more specific and can act as a proxy to trust

¹¹ No consensus that small businesses are more important than large businesses

Collecting Data on Indicators

Many of the indicators selected during the process require direct data collection from Hood Canal residents. The easiest way to collect such data is with a randomized phone, mail, or Internet survey. We can ensure that the data represent the overall population by comparing respondent demographics with overall demographics of the region. Any demographics with low representation can be weighted, if desired, to better represent the Hood Canal stakeholders.

Other indicators, however, already have data being collected for them by other agencies. In the table below, we have noted whether a new survey would be required (“Survey”) or the name of a specific data source that could provide such data if Hood Canal responses are disaggregated or aggregated.

Domain	Attribute	Indicator	Data Source
Physical	Exercise	Approximate number of hours residents engage in outdoor activities (divided into work that involves outdoor physical activity, swimming, hiking, walking, running, mountain biking, human-powered watercraft, skiing, scuba, home care (garden, yard), & other motorcraft) per week	Partially in PSP General Opinion Survey
	Exercise	Percent of swimming beaches that meet safe swimming standards at all times during the summer	Survey
	Access to Local Food	Availability of commonly harvested species (e.g. hardshell clams, crabs, shrimp, salmon, deer, elk, mushrooms, rose hips, willow, cedar, other plants or animals)	Survey
	Safe Drinking Water	Drinking water testing results from Community Groups and wells	WA State Water Quality Drinking Program
	Safe Food	Toxin levels in shellfish harvest areas, commercial and recreational: PSP, crypto, giardiasis, vibriosis, notovirus	WA State Department of Health
	Air Quality	Number of days during the calendar year that air quality was good, moderate, unhealthy, very unhealthy, or hazardous (must include pollutants from smoke)	Puget Sound Air Control Agency
Psychological	Positive emotions	Percent of residents who describe experiencing positive feelings/emotions from being in nature in Hood Canal, such as awe, inspiration, fulfillment, appreciation, solitude, relaxation, sense of peace and reflection	Survey
	General subjective wellbeing	Percent of residents who express high life satisfaction or happiness and percent who express living in Hood Canal as a contributor to this	PSP Social Capital Survey
	Place Identity	Percent of residents who express a positive connection to the region	PSP General Opinion Survey
Governance	Access	Percent of shoreline that is publicly accessible or owned	Separate analysis
	Access	Percent of residents who are satisfied with their access to public shorelines	Survey
	Communication	Percent of Hood Canal residents who have learned about resource management or recreation issues through different media this year: newspaper, radio, website, printed media, app, educational resources for school aged children, word of mouth; include source	Survey
	Trust in government	Number of Hood Canal residents who report trust in	PSP Social Capital

		experts and local and state government and collaborative government efforts	Survey
	Effectiveness of Public Policies	Percent of identified PIC failures with corrective action initiated within 2 weeks	Survey
	Stewardship	Percent of participants engaging in a natural resource stewardship activity/year	Survey
Cultural	Cultural Events	Percent of residents who participate in natural-resource inspired cultural activities	Survey
	Traditional resource practices	Proportion of residents who say that they would like to regularly access traditionally/commonly harvested natural resources and are able to do so as much as needed	Survey
	Rural Character	Distribution and quantity of urban, rural, agriculture, forest, mineral resource, conservation and stewardship lands.	Puget Sound Regional Council
Social	Trust	Percentage of residents who trust people in their surrounding community	PSP Social Capital Survey
	Strong Families and Friendships	Average number of days/year participate in outdoor activities with family members and/or friends	Survey
	Strong Communities	Percent of residents who have worked with other residents to manage resources, prepare cultural events, solve community challenges, or share harvested goods in the past year	Survey
Economic ²³	Jobs	Number of jobs and living wages per worker by resource-based employment/industry categories and economic clusters by county, and unemployment rates at subarea level matching state database	Washington State Employment Security Department
	Jobs	Number of new jobs created by natural resource employment sector/year	Puget Sound Regional Council
	Industry	Percent of economic activity that is from natural resource-based small business	Survey, maybe Bureau of Economic Statistics
	Industry	Percent of revenue to local economy from agriculture, commercial shellfish, commercial fishing, timber, non-timber products and tourism	Survey, maybe Bureau of Economic Statistics
	Industry	Number of local supporting businesses to industry, by natural resource sector	Survey, maybe Bureau of Economic Statistics

²³ For the economic indicators, there may be national sources (e.g., IMPLAN Group LLC, Bureau of Economic Statistics or Bureau of Labor Statistics) but there may be issues with aggregation of different sectors. Otherwise, data can be collected with a survey.

Next Steps and Potential Uses of Indicators

These 26 recommended indicators are presented to the HCCC for their consideration. A consultant has been contracted to facilitate the process of adopting all or some of the indicators, with the goal of facilitating pathways to select and incorporate the indicators into the Integrated Watershed Plan and future strategic planning.

Once indicators have been selected and data have been collected, this information can be used in a variety of ways. Some examples include:

- 1) **Assessing the state of HWB related to the environment in Hood Canal residents.** This can be done at a single instance or compared over time. Numerical measures for each indicator can be presented at time “x” and change over time can also be explored to demonstrate increasing or decreasing trends in HWB.
- 2) **Monitoring the impacts of recovery strategies.** Once we calculate if any indicators are changing over time, we can run statistical models and collect qualitative data to test whether any changes in indicator status (increases or decreases) are likely results of recovery strategies in the recent past. For example, we may find that the local income from timber harvests has increased over six years. We can test if this could be due to a strategy that reduced regulations on timber harvest, or if it is more likely due to other factors.
- 3) **Prioritizing scientific research.** When we see that HWB indicators are changing over time, we might question why that is so. And how is it related to the health of the environment? We can use data collected for HWB in the Hood Canal and data collected about ecological indicators to test relationships that we hypothesize, but haven’t been able to test for before because of lack of data. For example, to what extent do positive emotions vary with the health of forests, shellfish beds, or the presence of seals? We can answer this question fairly easily if we have data about both positive emotions and the ecological status of these systems or species.
- 4) **Assisting the selection of recovery strategies that are most appropriate to enhance or at least not harm the current status of HWB.** When we are considering potential ecosystem recovery strategies, we want consider the potential impacts on HWB. This is because we want to enhance HWB while we enhance ecosystem health. It is also because we want to implement strategies that will address, and not exacerbate, human pressures on ecosystems. To do so, we will need to model these potential relationships between HWB and the environment. For example, we may learn through our research that people are more likely to engage in outdoor family activities in public parks closer to towns than further away, all other factors being equal. If we are faced with budget cuts and must close a certain number of public parks, then, we may choose to close those further from town centers. There are at least three details to consider when trying to prioritize strategies that enhance both ecological and human wellbeing:

- a. **Prioritizing regions or demographics of Hood Canal in order to address specific HWB needs.** Selecting recovery strategies that also benefit HWB might include prioritizing regions based on their specific HWB status. Disaggregated data by region and demographics can be used to aid decision-making about where to prioritize strategies that might benefit specific regions or demographics. For example, if governance of natural resources is considered strong in one county but weaker in another, we may choose to prioritize strengthening governance in the weaker county.
- b. **Prioritizing strategies that most likely influence multiple domains of HWB.** Another aspect of selecting recovery strategies that benefit both ecology and human wellbeing is to use research data about the relationship of HWB indicators to specific ecological components to choose strategies that are most likely to enhance a variety of HWB domains. For example, enhancing the population of salmon is likely to enhance all aspects of human wellbeing, from cultural practices to natural resource-based income.
- c. **Understanding HWB tradeoffs.** A critical piece to selecting strategies that benefit ecosystems and HWB is to understand any potential tradeoffs among HWB domains. For example, while natural resource based jobs and income might go up, family outdoor time might decrease. We would need to use scientific data or expert-driven decision-making processes to consider how to handle this tradeoff when selecting a recovery strategy.

Conclusions & Lessons Learned

This multi-step process for developing HWB indicators for the Hood Canal provides an example of how to combine scientific evidence with local knowledge to develop indicators. We have recommended indicators that are more specific than components developed in prior HCCC stakeholder meetings and more relevant than indicators developed for other regions. For this reason, we are satisfied with the results of the process fulfilling both scientific and public engagement goals.

We believe that the success of the project is due to the iterative steps that included compiling existing indicators, matching them to local values, and refining them based on both stakeholder and scientific input. This was greatly enabled by the partnership of scientists, planners, and staff from the HCCC to develop a process that was both scientifically robust and locally supported. This process took about nine months; having one 50% FTE dedicated to indicator preparation and workshop organization was important for maintaining continuity and flow.

Most of our lessons, as usual, were learned during the stakeholder workshop process. Key aspects that enabled success at the workshops included significant preparation of materials in advance, having diverse people at the table, providing a small number of indicators, starting with an individual ranking exercise, and facilitating small-group decision-making. After the first workshop, we realized we had not provided enough background information prior to participant

arrival, although we had provided the potential indicator sets. For the next two workshops, we provided greater detail in the logistics email. At both these workshops, participants engaged more quickly in the tasks and their exit surveys showed a higher opinion that the activities were effective and easy to complete (Appendix IV).

During the workshops, we first asked participants to individually rank the indicators on poster-sized sheets. This was a critical piece to getting people on the same page; the indicators were fresh on everyone's mind, they had personal time to process the meaning, and group members could visually assess their initial agreement or disagreement with the indicators. This step greatly facilitated the following discussion. We also found that the number of indicators we provided each group (22-27) for ranking and discussion was sufficient enough to represent the diversity of the domains but not so large as to result in fatigue.

Refining and ranking indicators is not an easy task no matter how it is presented, but it appears that this deliberate process was helpful in making the process reasonable. In fact, from a list of 15 potential positive and negative adjectives to describe the workshops, participants most often selected interesting (78% of respondents) and stimulating (70%) (Appendix IV). They also selected challenging (70%) and rated the ease of completing the ranking tasks a 6.7 out of 10 (N=24). Thus, although the ranking and rating tasks were cognitively difficult, when organized and facilitated, they can become a positive experience. Some participants, however, still had a difficult time representing ideas outside of their immediate work sphere.

For those considering conducting a similar process at a similar scale, we recommend the following:

- Carefully select a small team (3-5 people) of scientists, policymakers and/or active citizens that is willing to champion the project and work together throughout the process.
- Work with the agency/organization that will adopt the indicators to learn what type of product is most useful or adaptable to them.
- Look carefully for existing data about why residents value your watershed and use this data to inform the initial set of potential indicators.
- Start early in identifying potential workshop participants – look for these in county, state and federal agencies as well as academic institutions and research-based non-profit and for-profit organizations.
- When inviting workshop participants, look for a balance in representation across the six domains.
- You will need to repeatedly email and call potential participants. Plan for this amount of time.
- Carefully prepare information for workshop participants and scientific reviewers. A 1-2 page handout is helpful, and clear, detailed emails are important.

For developing HWB indicators at a larger scale, such as the Puget Sound basin, we are still determining next steps. We hope to conduct a similar process in at least one other watershed to get a better sense of common indicators that are appropriate across the region. After that, we will decide if we want to conduct one large process where workshops are attended by stakeholders from throughout the Puget Sound, or whether we will continue with several

watershed-scale processes and summarize the set of indicators that are the same across the watersheds.

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Appendix I: Sources for Hood Canal Values Review

Source	# of respondents	% Female	Age distribution (N)	Years in Hood Canal Area (N)
USFS Values Mapping Project	62	45%	18-40 = 5 40-65 =33 Over 65 = 20	0-5 =9 6-10 =7 11-20 =15 Over 20 =27
WSU Extension Survey of Households in Hood Canal Area	167	Unknown	18-35 = 32 35-65 =113 Over 65 = 35	0-5 =12 6-10 =24 11-20 =55 Over 20 =75
WSU Shoreline Property Owner Interviews/Focus group	15	60%	Unknown	0-5 =1 6-10 =2 11-20 =7 Over 20 =5
WSU Social Marketing Survey for Environmental Practices	354	45%	60% over 60	56% more than 15 years
Building a Community within a Watershed VHS	23	26%	Unknown	Unknown (all long term)
Human Wellbeing Interviews	19	58%	18-40 = 2 40-65 =9 Over 65 = 8	0-5 =2 6-10 =1 11-20 =4 Over 20 =10

Appendix II: Stakeholder Workshop Participants

Mason County Workshop: August 15, 2013 at Theler Community Center, Belfair, WA

Participant Name	Organization	Stakeholder Type
Terry Oliver	New Community Church Union	Cultural and Spiritual and Social
Pam Volz	Harmony Hill Retreat Center	Cultural and Spiritual and Social
Dave Ward	PSP	Cultural and Spiritual and Social
Pat McCullough	Selah Inn	Economic
Terri Jeffreys	Commissioners	Economic
Erik Hagan	WSU Extension - Mason County	Economic
Kim Klint	Mason Matters	Economic
Dave Herrera	Skokomish Tribal Nation	Governance
Herb Gerhardt	Retired	Governance
Tamra Ingwaldson	United Way of Mason County	Governance
Cammy Mills	WSU Extension - Mason County	Physical and Psychological
Heidi Iyall	Mason County Public Health	Physical and Psychological
Stan Graham	Mason County Historic Preservation	Physical and Psychological
Norm Reinhardt	Kitsap Poggie Club (Dave).	Physical and Psychological
Total = 14		

Kitsap County Workshop: August 27, 2013 at Port Gamble S'Klallam Longhouse, WA

Participant Name	Organization	Stakeholder Type
Patty Charnas	Kitsap County Department of Community Development: Planning and Environmental Programs Division	Economic
Lynn Wall	Naval Base Kitsap, Bremerton	Economic
Patricia Graf-Hoke	Graf-Hoke Inc.	Economic
Leslie Banigan	Kitsap Public Health	Governance
Phil Best	Hood Canal Environmental Council	Governance
Melissa Poe	NOAA NW Fisheries	Governance
Siri Kushner	Kitsap County Health District	Physical and Psychological
Rory O'Rourke	Port Gamble S'Klallam Tribe Natural Resources Department	Physical and Psychological
Don White	Puget Sound Anglers	Physical and Psychological

Beth Lipton	Kitsap County Health District	Social/Cultural/Spiritual
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Jamie Donatuto	Swinomish Indian Tribal Community	Social/Cultural/Spiritual
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Total = 11

Jefferson County Workshop: August 28, 2013 at Masonic Lodge, Quilcene, WA

Participant Name	Organization	Stakeholder Type
Stacie Hoskins	Jefferson County - Dept of Community Development - Development Review Division	Economic
Bill Dewey	Taylor Shellfish Company	Economic
George Yount	former Port Commissioner; environmental mediation; retired; party chair of Democratic party	Governance
Dana Fickeisen	Jefferson County Public Health	Physical and Psychological
John Austin	Jefferson County Commissioner	Physical and Psychological
Kathleen Kler		Social/Cultural/Spiritual
Tami Pokorny	Jefferson County Public Health	Social/Cultural/Spiritual
Total = 7		

Facilitator Information:

Facilitator Name	Organization	Belfair	Port Gamble S'Klallam	Quilcene
Adi Hanein	UW School of Marine and Environmental Affairs	X	X	X
Kara Nelson		X	X	
Kari Stiles	Puget Sound Partnership	X	X	X
Katharine Wellman	Northern Economics, Inc.		X	X
Kelly Biedenweg	Puget Sound Institute & Stanford	X	X	X
Julie Horowitz	HCCC			X
Stacy Vynne	Puget Sound Partnership	X	X	

Appendix III: Initial Indicator Sets Provided at Stakeholder Workshops

Group 1: Physical and Psychological Domains

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
	Physical			
1		Exercise	Percent of residents who engage in outdoor activities (divided into swimming, hiking, walking, running, human-powered watercraft) per week/month	Schneider et al
2		Healthy Diet	Availability of commonly harvested species (e.g. hardshell clams, crabs, shrimp, salmon), year-round, in quantities suitable for subsistence purposes for tribal members	San Juan County
3			Reported cases of E. coli 0157:H7, campylobacteriosis, giardiasis, salmonellosis, shigellosis, listeriosis, vibriosis, yersiniosis	Snohomish County
4			PSP toxin levels in shellfish from commercial areas	PSP
5			Amount of local collected food consumed	
6		Drinking Water	Community Group drinking water systems testing results	Mason County
7		Air	Annual number of days per year particulate matter or ground-level ozone determined the level of air quality	King County Communities Count
8			Annual number of days that air quality was unhealthy for sensitive populations due to fine particulate matter	King County Communities Count
9			Annual number of days that air quality was unhealthy for sensitive populations due to ozone concentrations.	County Health Rankings

10			Annual number of exceedences of the National Ambient Air Quality Standards (NAAQS) for carbon monoxide and coarse particulate matter	County Health Rankings
11			Number of days during the calendar year that air quality was good, moderate, unhealthful, very unhealthful, or hazardous	Sustainable Seattle
12			Number of days fine particulates exceed the federal standard	Pierce County
13		General Health	Percent of adults age 18 or older who report 14 or more days of poor mental health in the past month	San Juan and Snohomish Counties
14			Percent of residents who report a high level of overall health	Puget Sound Partnership
	Psychological			
15		Positive Emotions	Percent of residents who claim high inspiration due to living in Hood Canal	
16			Percent of residents who regularly experience awe from the Hood Canal	
17			Percent of residents who describe their experience of living in Hood Canal as unique to any other place	
18		Restoration/ Therapeutic	Viewshed analysis of scenic resources	Neuman, M. et al.
19			Percent of shoreline with intact shoreline vegetation	San Juan County
20			Noise along high volume roadways and arterials, by race/ethnicity and geography	King County
21			Percent of residents who describe opportunities for solitude	

22		Self-Actualization	Percent of residents who feel they are able to take care of themselves with the resources provided by the Hood Canal ecosystem	
23			Percent of residents who say they have learned new things about themselves or nature by observing/interacting with local natural resources	
			Percent of residents who say they have felt a sense of accomplishment or achievement by engaging in the environment through work or recreation	
24		General Subjective Wellbeing	Percent of residents who express high life satisfaction or happiness	Puget Sound Partnership
25		Sense of Place	Percent of residents who say that Hood Canal means a lot to them	Puget Sound Partnership
26			Percent of residents who feel that living in the Hood Canal says a lot about who they are	Puget Sound Partnership
27			Percent of residents who feel that the Hood Canal is a part of them	Puget Sound Partnership

Group 2: Governance

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
1	Governance	Access to Natural Resource Extraction	Number of permits for west coast fisheries registered to individuals residing in the community	Schneider et al.
2			number of permits held for west coast fisheries by community and fishery	Schneider et al.
3			Number of federal state permits in the community/total number of permits	Schneider et al.
4			Number of forest passes sold	Neuman et al.
5			Number of fishing and hunting licenses used in Hood Canal	HCCC
6			Utilization trends of recreation facilities and programs	King County
7		Access to Recreational Opportunities	Percent of swimming beaches that meet safe swimming standards at all times during the summer	Schneider et al.
8			Percent of shoreline that is publicly accessible or owned	Cassin et al.
9			Percent of residents that live within in 1/4 mile of a park, open space, or trail by race/ethnicity, income and geography	King County
10			Distance to the nearest park or open space	Puget Sound Resources Council
11		Communication	Percent of Hood Canal residents who report availability of natural resource professionals to respond to questions	
12			Hits to natural resource management websites (SeaGrant, HCCC, county sites, WADFW, WADNR)	

13			Percent of Hood Canal residents who report having learned about resource management issues through different media this year: newspaper, radio, website, printed media, app	
14			Percent of residents who agree that they have opportunities to influence decisions	King County
15		Trust in government	Percent of Hood Canal residents who report trust in local and state government and collaborative government efforts	Puget Sound Partnership
16			Percent of Hood Canal residents who report trust in how moneys are spent by local, state and collaborative government efforts	
			Percent of residents who highly trust their community police	Puget Sound Partnership
17		Effectiveness of Public Policies	The number of on site sewage systems that are fixed and inventoried	Puget Sound Partnership
18			Percent of identified PIC failures with corrective action initiated within 2 weeks	San Juan County
19			Percent of armored marine shoreline by county	B-Sustainable Project
20		Stewardship	Percent of participants engaging in a natural resource stewardship activity/year	King County
21			Distribution/extent and content focus of stewardship efforts within a given ecosystem type	
22		Enforcement	Poaching enforcement (wording needed)	WDFW and Tribes?

Group 3: Cultural, Spiritual and Social

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
	Cultural			
1		Cultural Events	Mean number of outdoor events/festivals that residents participate in per year	
2			Percent of residents who participate in representative cultural activities associated with nature (tribal and non/tribal)	San Juan County
3		Cultural Sites	Proportion of known heritage sites actively maintained	HCCC
4			Proportion of known heritage sites open to the public or interpreted by signs	HCCC
5		Traditional resource practices	Percent of residents who say they are able to regularly access traditionally harvested species	San Juan County
6			Proportion of known tribal skills, beliefs, songs, traditions preserved/practiced in communities	HCCC
7			Availability of healthy, commonly harvested species (e.g. hardshell clams, crabs, shrimp, salmon), year-round, in quantities suitable for subsistence purposes for tribal members	San Juan County
8		Rural Character	Number of residential lots per acre, permitted single family units per acre and permitted multi-family units per acre	B-Sustainable Project
9			Average Achieved Net Density, by Jurisdiction	Thurston County

10			Net Residential Density by City and Unincorporated Urban Areas	Thurston County
11			Distribution and quantity of designated urban, rural, agriculture, forest, and mineral resource lands. This includes distribution of new issued permits by regional geography.	Puget Sound Resources Council
12			Percentage of residents who agree that Hood Canal has maintained an acceptable level of rural character	
Spiritual				
13			Number of residents who express a spiritual connection to the region	
	Social			
14		Trust	Percentage of residents who highly trust people in their surrounding neighborhood	Puget Sound Partnership
15			Percentage of residents who highly trust their immediate neighbors	Puget Sound Partnership
16		Future and Past Generations	Percentage of privately owned rural acres with a stewardship plan or that is enrolled in an open space incentive program.	B-Sustainable Project
17			Acres in protected critical areas or conservation status	Edmonds
18			Acreage and Percent of rural land preserved from development	King County
19			Average number of days/year residents enjoy the outdoors with younger generations	

20			Average number of days/year residents enjoy the outdoors with older generations	
21		Strong Families	Frequency of participation in outdoor activities with family members	
22		Strong Friendships	Frequency of participation in outdoor activities with friends	
23		Strong Communities	Percent of residents who have cooperated or worked with other residents to manage resources or prepare cultural events	Swinomish
24			Average level of neighborhood social cohesion	King County

Group 4: Economic

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
1	Economic	Community Supportive Job Sector	The percentage of all regional jobs that provide living wages within 15 minutes of travel time by automobile and 30 minutes via public transit	B-Sustainable Project
2			Living wage income compared to WA minimum wage and federal poverty level	B-Sustainable Project
3			Average Real Wage per Job	B-Sustainable Project
4			Number of living wage jobs by sector	Washington State
5			Percent of economic activity that is from small business	Washington State
6			Number of jobs and real wages per worker by employment/industry categories and economic clusters by county, and unemployment rates at subarea level matching state database.	ECONorthwest
7		Development	Number of new jobs created by employment sector/year	ECONorthwest
8			Net number of new businesses (opened-closed)/year	Washington State
9			Number of businesses closed/year	Schneider et al.
10			Number of businesses opened/year	
11		Agriculture	Acres of farmland in production by product in County Agricultural Production Districts	Schneider et al.

12			Average Farm Size	Schneider et al.
13			Number of farms	Neuman et al.
14			Actual acreage in production with WSDA Crop Mapping	
15			Percent of total farm acreage and sales by type of organization	HCCC
16			Average net income/acre in farms	Neuman et al.
17			Ratio of average farm worker income to average non-farm worker income	PSRC
18			Net cash return from agricultural sales divided by total number of harvested acres in the county	Communities Count
19			Percent of revenue to local economy	Thurston County
20	For each industry: Commercial Shellfishing Commercial Fishing Commercial Timber Non-timber forest products Tourism		Number of businesses/establishments	Schneider et al.
21			Annual payroll of establishments	Schneider et al.
22			Total number of employees	Schneider et al.
23			Value of landed resource in the community	King County
24			Revenue of resource in the community/total revenue of the resource	Puget Sound Resources Council
25			Number of local supporting businesses to the industry	

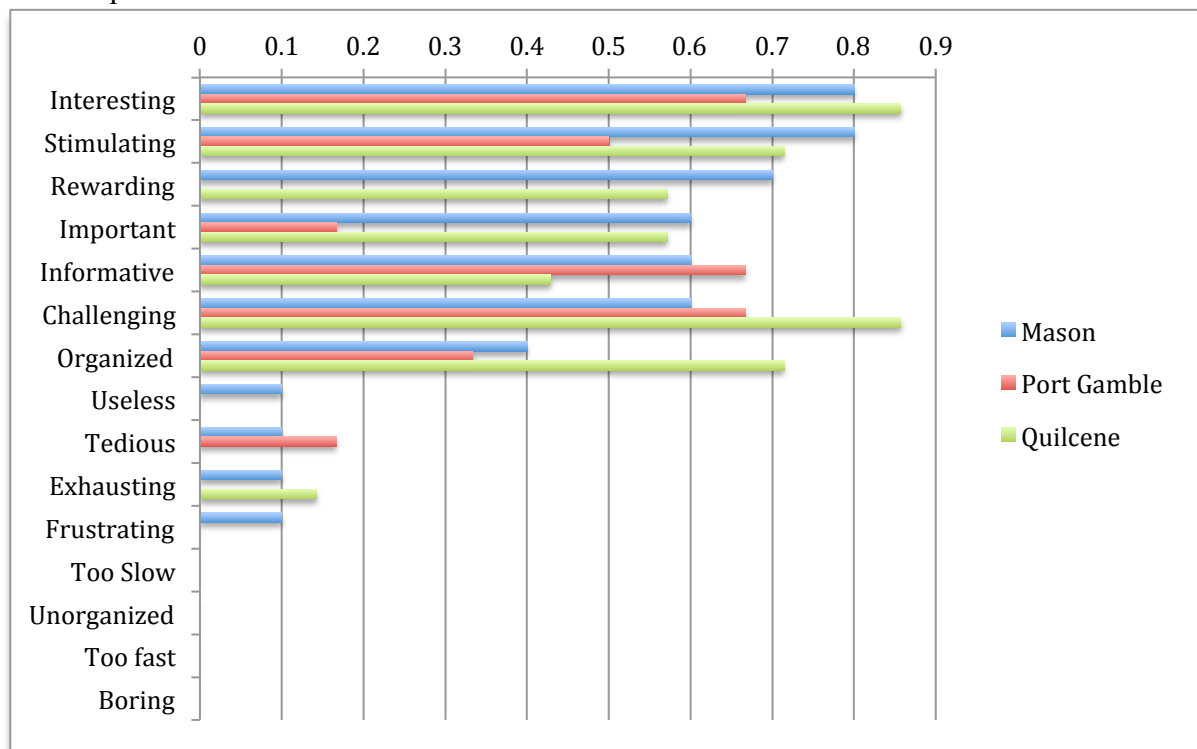
Appendix IV: Workshop Evaluations

We requested workshop participants to provide feedback about the indicator rating process. Below are the tallied results.

1) On a scale of 1-10 (10 is high), please rate... (mean responses), N=32

	Belfair	Port Gamble	Quilcene	Average
Importance of workshop	8.68	8.00	8.50	8.39
Ease of completing activities	6.09	6.58	7.43	6.7
Ability of workshop to help refine indicators	7.40	7.58	8.57	7.85
Quality of background Information	5.36	6.67	7.17	6.4
How well the workshop met expectations	8.00	7.80	8.67	8.16

2) From a list of 15 descriptors, please circle the ones that most describe your experience in this workshop:



Percent of respondents who circled descriptor by workshop