University of Washington
Program on the Environment Keystone Team

Snohomish County Oil Spill Preparedness and Response

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The views and information presented in this report are solely those of the project team and do not necessarily reflect those of the people listed here.

Index of Acronyms

ACP	Area Contingency Plan
BNSF	Burlington Northern and Santa Fe Railroad
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CFR	Code of Federal Regulations
CWA	Clean Water Act
CWD	Stillaguamish River Clean Water District
DOE	Washington Department of Ecology
DEM	Department of Emergency Management
DNR	Washington Department of Natural Resources
ESCA	Emergency Services Coordination Agency
EPA	Environmental Protection Agency
ESI	Environmental Sensitivity Index
FEMA	Federal Emergency Management Agency
FOSC	Federal On-Scene Coordinator
GRP	Geographic Response Plan
ICS	Incident Command System (Unified Command)
JIC	Joint Information Center
LEPC	Local Emergency Planning Committee
LGR	Local Government Representative
LO	Liaison Officer
LOSC	Local On-Scene Coordinator
MRC	Snohomish County Marine Resources Committee
MSRC	Marine Spill Response Corporation
NOAA	National Oceanic and Atmospheric Administration
NRC	National Response Corporation
NWAC	Northwest Area Committee
NWACP	Northwest Area Contingency Plan
OPA	Oil Pollution Act
ORR	Office of Response and Restoration
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
RCW	Revised Code of Washington
RP	Responsible Party
RRT10	Regional Response Team 10
RTA	Response Time Analysis
SARA	Superfund Amendments and Reauthorization Act

SERC	State Emergency Response Commission
SIA	Shoreline Impact Analysis
SOSC	State On-Scene Coordinator
SWM	Snohomish County Surface Water Management
TAP	Trajectory Analysis Planner
TOSC	Tribal On-Scene Coordinator
UC	Unified Command
USCG	United States Coast Guard
VTS	Vessel Traffic Service
WAC	Washington Administrative Code
WCD	Worst Case Discharge
WDFW	Washington Department of Fish and Wildlife
WSU	Washington State University

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Part 1: Background

1.1 Overview

Oil. It is everywhere around us, in both solid and liquid forms – gasoline, plastics, fertilizer…the list is nearly endless. And yet, despite the ways in which humans have harnessed it for our benefit, it can be a source of great harm, as demonstrated dramatically by the Deepwater Horizon spill in the Gulf of Mexico less than one year ago.

Although Puget Sound boasts no oil reserves, its proximity to the oilfields of Alaska and Alberta has made it one of the largest refining regions in the country.[1] Billions of gallons of crude oil and its refined byproducts are used as fuel or transported by tank ships, pipelines, barges and other forms of transport annually – a number that is projected to increase as the regional population grows.[2] Inevitably, some of that oil finds its way into our marine waters, posing a threat to the health of marine organisms and humans alike. Spills also have economic and societal impacts – commercial and recreational fisheries can be shut down, beaches and other tourist destinations can become unusable, and communities can be disrupted.

Given the economic and ecological impacts that marine oil spills can produce, government agencies and industry have worked diligently to create and maintain a system to prevent, prepare for, and respond to spills. The Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA) are the principle laws underpinning the federal government's responsibility and role in spill prevention and preparedness. The regulations established by these laws are primarily implemented by the U.S. Environmental Protection Agency (EPA) in inland waters, and the U.S. Coast Guard (USCG) in coastal waters. At the State level, Chapter 90.56.005 of the Revised Code of Washington (RCW) has the same effect and is largely implemented through the Departments of Ecology (DOE) and Fish and Wildlife (WDFW). Funding for Washington's state oil spill programs is generated by the Oil Spill Administrative Tax and the Oil Spill Response Tax, both of which are levied on the first transfer of oil from a tank vessel or barge into a refinery's storage tanks and are known collectively as the 'barrel tax', because the fee is calculated per barrel of oil transferred. There are also a variety of industry organizations such as the Marine Spill Response Corporation (MSRC) and National Response Corporation that provide spill planning and response services to private companies and government. Thanks to all these programs and organizations, oil spill preparedness may be considered a mature field – one that is staffed by capable professionals and that has addressed most of the critical issues. But although Washington State's preparedness is effective and well-thought-out, even the best

[1]US Energy Information Administration. Number and Capacity of Petroleum Refineries. 25 Jun 2010. Retrieved February 27, 2011 from http://www.eia.gov/dnav/pet/pet_pnp_cap1_dcu_nus_a.htm.
[2]Washington State Legislature, Chapter 90. 56.005 RCW Findings-Purpose. Retrieved February 27, 2010 from http://apps.leg.wa.gov/rcw/default.aspx?cite=90.56.005

system can be improved. The Deepwater Horizon spill showed that greater pre-spill involvement by county-level organizations can improve the outcomes of major spills.

Counties and other local governments in Washington, and generally in the nation as a whole, have not played a significant role in spill preparedness and response with respect to large spills. In many counties, oil spill response has been treated primarily as a component of emergency management programs rather than as an environmental or economic hazard, resulting in a different perspective from that of state and federal programs. Individual county agencies, while responsible for a wide variety of contingencies, also tend to be limited in the amount of staff and funding dedicated exclusively to marine spill preparedness.

Now, however, budgetary constraints at the state and federal level are reducing those entities' funding and staff capacity to manage existing programs and to create new ones to respond to the lessons learned from the Deepwater Horizon event. Recognizing this challenge, county governments are increasingly examining their responsibilities with regard to spills to consider what they can do to ensure the highest levels of protection for their citizens and resources. Some actions that counties might consider desirable, such as more stringent vessel safety requirements, are pre-empted by the interstate commerce rules of the U.S. Constitution. Recent spills such as the M/V *Cosco Busan* in California and the Deepwater Horizon/Gulf of Mexico spill have demonstrated the need for better integration of Federal and state response efforts with local communities.[3,4] In general, the counties' official role is not fully defined in law, regulation or practice, which leaves gaps in understanding as to the most effective use of county resources for spill preparedness and response. Some counties have already embarked on a more active approach. The collaboration between San Juan County and the Island Oil Spill Association and between Clallam and Jefferson counties and the Strait Ecosystem Recovery Network are two examples.

Snohomish County (herein referred to as "the County") recognizes that a large spill could have a significant impact to the portion of its economy that depends on Puget Sound, and that ensuring a clean, healthy environment for its citizens requires a more active focus on marine oil spill preparedness. The Snohomish County Marine Resources Advisory Committee (MRC), therefore, engaged the Oil Spill Keystone Project Team (herein referred to as "the Team") from the University of Washington's Environmental Management Certificate program to provide the County with recommendations for improving spill preparedness and response. The Team is comprised of four graduate students and a faculty advisor.

1.2 Scope

In the project charter (attached as Appendix 1), the MRC requested that the Team assess the County's current marine oil spill prevention and preparedness abilities and

[3] *Incident Specific Preparedness Review (ISPR): M/V Cosco Busan Oil Spill in San Francisco Bay*, (2008).
[4] National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. (2011) *Deep water: the Gulf oil disaster and the future of offshore drilling: report to the President*. Washington, D.C.:

present recommendations for reducing the consequences of oil spills affecting the County's marine waters. (For the purposes of the project, marine waters are defined to be those that fall under the jurisdiction of the U.S. Coast Guard in the event of an oil spill.) The project charter specifically directed the Team not to consider the ramifications of non-point source spills, such as urban run-off. Given a broad mandate, but faced with time and resource constraints, the Team has worked carefully with the MRC to define a scope that allows the project to deliver careful analysis and useful recommendations to the County.

1.3 Objectives

For the purpose of establishing a blueprint to guide the work and to serve as milestones by which to measure progress, the Team established the following objectives:

1. Investigate single-source oil spill prevention and preparedness laws, regulations, and programs at federal, state, and county levels.
2. Examine environmental impacts of single-source marine oil spills and related treatment methods based on spill characteristics.
3. Assess spill threats to Snohomish County interests and resources with regard to differing types, sizes, and sources of spills and identify oil spill scenarios for detailed study.
4. Identify threats to environmental, and economic interests within Snohomish County should a spill occur. Identify existing gaps in oil spill preparedness plans affecting Snohomish County.
5. Develop and compare a suite of options that the County can implement to enhance spill preparedness.
6. Deliver findings and options to the MRC, via final report and group presentation.

1.4 Methodology

Oil spill preparedness is a broad and complex field that encompasses policy tradeoffs, a wealth of technical data, many potential spill sources, and overlapping fields of authority and responsibility among response agencies. It is also a field where a tremendous amount of analytical work has already been accomplished – too much for the Team to be able to completely review while reserving time to accomplish our other objectives. To overcome these issues, the project focuses on the risks associated with large spills (i.e. those greater than 50 gallons), due to their potential for severe, prolonged, and widespread consequences. We have also elected to concentrate on the preparedness and response aspects of the oil spill continuum (defined as prevention, preparedness, response, restoration) as, in our opinion, they provide the greatest opportunities for the County to have a positive impact. In implementing this approach, the Team examined a range of oil transport methods (e.g. vessels, pipelines) with large spill potential and from them developed and evaluated realistic spill scenarios and their related economic and environmental consequences. The scenarios were compared to current state and county practices to identify gaps that are addressable at the county level to further reduce the County's risks. Based on an analysis of those gaps, the Team

developed options through which they could be addressed and rated based on their effectiveness and the County's capacity to implement them. Specific tasks completed include:

- Literature review–Working with our project advisor, sponsor, and subject matter experts, the Team compiled a list of documents for review. While necessarily not exhaustive, the list is representative of relevant materials. Individual team members were assigned portions of the reading and submitted notes to the full group as appropriate.
- Use of expert opinion – Our biggest resource has been the opinion of technical experts. Through over 20 group and individual consultations with scientists, policymakers, emergency responders, volunteer coordinators, and other spill professionals, the Team has built an understanding of the broad issues around oil spill preparedness and gained multiple perspectives on potential roles for the County. These individuals have provided us with advice, access to others within the community, technical support, and suggestions. A list of our expert sources is provided in the Acknowledgments section.
- Reliance on existing data – Time and resource constraints precluded collection of new research data specific to Snohomish County waters, thus the Team has relied on existing data and reports generated by and for government agencies rather than performing original research. Where necessary, we have used our best judgment to extrapolate from our sources the conditions present in the County.
- Application of simulation models – NOAA provided the Team with access to its Trajectory Analysis Planner (TAP) model and Environmental Species Index (ESI) maps, which we have used to study trajectories for our spill scenarios and the landforms and species that would be affected. Our scenarios have been designed to provide the County with a range of spills of varied fuel types, locations, and sizes with the intent to not only provide specific information, but also to spark dialogue about larger questions which may arise during large spill events.
- Analysis – The Team analyzed the accumulated information to understand the broad economic and environmental impacts of an oil spill. We then evaluated the impacts to identify gaps that the County can exploit to increase preparedness and to develop potential options for closing the gaps. To ensure the relevance of these options to the County, we have also measured them against a set of criteria developed in conjunction with our sponsor. Lastly, our report has been reviewed by volunteers from among our technical experts, and their comments incorporated in the final document.

1.5 Structure of this Report

Our report has been organized into six major sections:

1. Overview
    - Background information and summary of the Team's mission, objectives and methodologies.

2. Threat Identification and Findings
    - Existing laws and policies which frame and support the oil spill preparedness structure, and the stakeholders who are involved in the process.
    - Discussion of the marine oil spill threats which the County faces, their potential impacts to economic and environmental resources, and the response strategies which are employed against them.
3. Scenarios
    - Selected representative oil spills with the potential to affect Snohomish County interests, as shown through statistical modeling overlaid with data from Environmental Sensitivity Index maps.
4. Gap Analysis
    - Description and discussion of the general areas and specific gaps where potential exists for the County to engage and improve oil spill preparedness, as identified by our information-gathering and analysis processes.
5. Options and Criteria
    - Discussion of possible options for closing the gaps revealed in the previous section.
    - Development of criteria relevant to the County and comparison of the options to the criteria, using a matrix format.
6. Next Steps
    - The Team's recommended path forward.

Part 2: Findings

2.1 Laws and Policies

2.1.1 Selected Federal Statutes relating to Oil Spill Response

Each of the following statutes is complex and has numerous components. The descriptions provided are not meant to provide a complete summary, but rather to highlight their most relevant components.

Oil Pollution Act of 1990 –The OPA amended the Clean Water Act and created the Oil Spill Liability Trust Fund (OSLTF), which is financed by a tax on the petroleum industry. In marine spills, the OSLTF can be accessed by the FOSC or their representative in order to "cover expenses associated with mitigating the threat of an oil spill, as well as the costs of oil spill containment, countermeasures, cleanup, and disposal activities".[5] The OSLTF is important because it provides funding for timely oil spill response operations when there is no RP or when the RP is unwilling or unable to conduct the clean-up. The National Pollution Fund Center can later take steps to recover the OSLTF money spent on the response from the RP. In addition to creating the OSLTF, the OPA also mandated contingency planning and increased federal response capability and enforcement authority.[6] (See Section 2.1.3 for details on the Northwest Area Contingency Plan (NWACP).)

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The NCP is an operational supplement to the Federal National Response Framework, incorporated as Emergency Support Function #10.[7] This plan created National and Regional Response Teams (RRTs), defined the objectives and authority of National, Regional, and Area Contingency Plans, established general responsibilities for the FOSC, and established the Unified Command structure [ICS] for oil spill response.[8] Additionally, it required the National Response Center (NRC) be notified of all oil spills and established national priorities for oil spill response. Specific components of the NCP can be found in 40 CFR Part 300.

[5]U.S. Coast Guard. The Oil Spill Liability Trust Fund (OSLTF). (2010, November 9). U. S. Coast Guard. Retrieved from http://www.uscg.mil/npfc/About_NPFC.
[6]US Coast Guard, 2010, Oil Spill Liability Trust Fund.
[7] Federal Emergency Management Agency, from http://www.fema.gov/pdf/emergency/nrf/nrf-esf-10.pdf
[8]United States Environmental Protection Agency, Emergency Management, National Oil and Hazardous Substances Pollution Contingency Plan Overview, from http://www.epa.gov/oem/content/lawsregs/ncpover.htm#key

2.1.2 Selected State Statutes relating to Oil Spill Response

State law generally echoes and supports the existing federal legislation.

(RCW) 90.48: Water pollution control – This chapter designates the DOE as the State Water Pollution Control Agency and prohibits the discharge, by any means, of polluting matter into the waters of Washington State.[9]

RCW 90.56: Oil and Hazardous Substance Spill Prevention and Response - This code established a state oil spill prevention account, which funds a variety of activities including "facility and vessel plan review and approval, drills, inspections, investigations, enforcement, and litigation."[10] It also established a state oil spill response account, which funds "response[s] to spills of crude oil or petroleum products" and "use of the emergency response towing vessel."[11] Additionally, this chapter requires that the owner/operators of each onshore/offshore facility prepare and submit a complying oil spill prevention plan, contingency plan, and operations manual to the DOE.

2.1.3 Northwest Area Contingency Plan

The NWACP is the regional planning document for oil and hazardous substance response for the Regional Response Region 10, which includes Washington, Oregon, and Idaho. In the Pacific Northwest, the Regional Contingency Plan (written by the Regional Response Team) and the Area Contingency Plan (written by the Area Committee) have been merged together to form the NWACP. The NWACP is intended to "address responses to worst-case discharges of oil or hazardous substances"[12] as well as "provide detailed information on response procedures, priorities, and appropriate countermeasures."[13] In Washington State, the NWACP has been accepted as the statewide Oil and Hazardous Substance Contingency Plan required by state statute RCW 90.56.060.[14] The wide availability and acceptance of this plan helps ensure a coordinated, efficient, and effective response from the regional, federal, state, and local levels.

The NWACP is a particularly relevant document for the County to be familiar with because it addresses topics such as the role of the counties in the oil spill response structure (Chapter 2000), use of controversial response technologies such as use of chemical dispersants and in-situ burning (Chapter 4000), communication procedures for

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[9]Washington State Legislature, Chapter 90.48 RCW Water pollution control from http://apps.leg.wa.gov/rcw/default.aspx?cite=90.48

[10]Washington State RCW 90.56

[11]Washington State RCW 90.56

[12]Region 10 Regional Response Team and Northwest Area Committee.*(2010) Northwest Area Contingency Plan.* Section 1100.

[13]Oil Spill Contingency and Response Planning Fact Sheet. (2002) Retrieved from http://www.rrt10nwac.com/Files/FactSheets/20020521_02.pdf

[14]Washington State Legislature Chapter 173-182 WAC: Oil spill contingency plan. Retrieved from http://apps.leg.wa.gov/WAC/default.aspx?cite=173-182&full=true

responders (Chapter 9650), and procedures for communicating with the public during environmental emergencies (Chapter 9610). The NWACP can be accessed online at: http://www.rrt10nwac.com/NWACP/Default.aspx

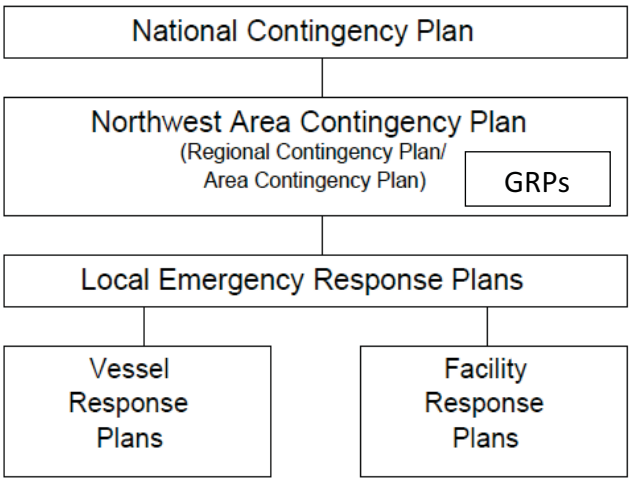

Figure 1: Hierarchy of Contingency Planning. Adapted from RRT/NWAC Oil Spill Contingency and Response Planning Fact Sheet.

2.1.4 Geographic Response Plans (GRPs)

GRPs are a tactical component of the NWACP which identify public and private natural, cultural, and economic resources within specific geographic regions and describe and prioritize response strategies for protecting them.[15] They provide first responders with detailed site-specific information such as site descriptions and maps, recommended strategies and logistical information. GRPs are valuable because they allow protection measures to begin before the UC begins to function. In an extended response, the strategies in the GRP will be adapted by the Incident Command to meet real-time conditions.[16]

GRPs are developed through workshops in which representatives from all levels of government, ports, industry, response contactors and environmental groups work together to identify resources at risk and potential protection strategies.[17] Although they are extremely valuable tools, GRP do have limitations. They were specifically designed to protect resources from heavy persistent oils and their effective implementation is highly dependent on environmental conditions such as wind and waves.[18]

[15] Region 10 Regional Response Team and Northwest Area Committee.(2002) GRP fact sheet. Retrieved fromhttp://www.rrt10nwac.com/Files/FactSheets/20021009.pdf
[16] RRT10/NWAC, GRP fact sheet, 2002
[17] RRT10/NWAC, GRP fact sheet, 2002
[18] RRT10/NWAC, GRP fact sheet, 2002

GRPs are maintained and updated by WA DOE and can be found at http://www.ecy.wa.gov/programs/spills/preparedness/GRP/wa_marine_grps.htm

Snohomish County GRPs

Snohomish County resources are addressed in three GRPs: the North Central, the Admiralty Inlet/Hood Canal, and the Central Puget Sound. These GRPs can be implemented through a variety of avenues including use of approved Primary Response contractors and Oil Spill Response Organizations (OSRO).

Approved Primary Response contractors and Oil Spill Response Organizations (OSRO) within Snohomish County are listed below as well as in relevant GRPs as per Chapter 173-182 of the Washington Administrative Code (WAC).

OSRO/Contractor	Phone Number
All Out Industrial & Environmental Services	(360) 414-8655
Certified Cleaning Services, Inc.	(253) 536-5500
Cowlitz Clean Sweep, Inc.	(360) 423-6316
Global Diving and Salvage	(206) 623-0621
Guardian Industrial Services, Inc.	(253) 536-0455
Island Oil Spill Association	(360) 378-5322
Matrix Service, Inc.	(360) 676-4905
MSRC	(425) 252-1300
National Response Corporation	(206) 340-2772

Figure 2: Oil Spill Contractors Available in Snohomish County. From North Central Puget Sound GRP, DOE and DOE website.

The table below shows the specific map sections that cover the Snohomish County within these three GRPs**.** A sample GRP map (Everett Map #NC-5) is included in Appendix 2.

GRP	Maps Covering Snohomish County
North Central (NS) GRP:	• Skagit Bay Map # NC-2 • Saratoga Passage Map # NC- 4 • Everett Map # NC-5
Admiralty Inlet/Hood Canal GRP:	• Useless Bay Map #3
Central Puget Sound (CPS) GRP:	• Edmonds Map #CPS-1 • Port Madison Map # CPS-2

Figure 3: GRP Maps covering Snohomish County

2.1.5 The Incident Command System (ICS)

During oil spill events, several organizations may share responsibility for the response. ICS allows for the integration of different agencies and levels of government into a Unified Command (UC) that sets objectives and priorities, and has overall responsibility for the incident response. A well-informed UC is a critical component of a large spill response because it maximizes coordination and avoids duplication of effort.[19] In coastal spills, the UC is typically comprised of the Federal On-Scene Coordinator (FOSC), the State On-Scene Coordinator(s) (SOSC), and a Responsible Party representative (RP). A Local On-Scene Coordinator (LOSC) and a Tribal On-Scene Coordinator (TOSC) are also permitted by the NWACP.[20] See Figure 4 below. The most direct way for Snohomish County to ensure that their priorities and concerns are incorporated into response decisions would be to have a County representative as the LOSC in the UC. The list of criteria for inclusion into the UC can be found in the NWACP Chapter 2000, page 2000-5.

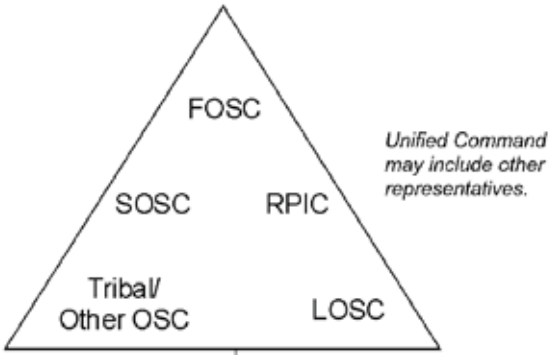

Figure 4: Positions included in Unified Command. From NWACP, 2000-1. (2010)

The Unified Command is directly supported by the Command staff, which includes the Safety Officer, the Liaison Officer (LO), and the Public Information Officer as shown in Figure 5. If the County is not able to designate a LOSC in the Unified Command, they could instead work closely with the LO to ensure that their concerns are communicated to the UC. The County might also want to designate representatives to work closely with the Public Information Officer to ensure that the local press releases align with the press releases from the Unified Command (under the Incident Command System, this public information coordination would likely occur at a Joint Information Center or JIC).

In addition to the Command Staff, the Unified Command is also supported by the General Staff, which includes the Operations, Planning, Logistics, and Finance sections. Potential roles for the County within the General Staff could be within the Emergency Response Branch of the Operations Section or within the Environmental Unit of the Planning Section. The **bold** ICS positions in Figure 5 represent roles that County representatives might want to participate in during a spill response. Before County

[19]FEMA.(2010). ICS Resource Center – ICS Review Document. Retrieved November 23, 2010 from http://www.training.fema.gov/EMIWeb/IS/ICSResource/assets/reviewMaterials.pdf
[20]RRT/NWAC, 2010, Northwest Area Contingency Plan, p.2000-1

representative can effectively participate in these ICS positions they would need to complete appropriate ICS training.

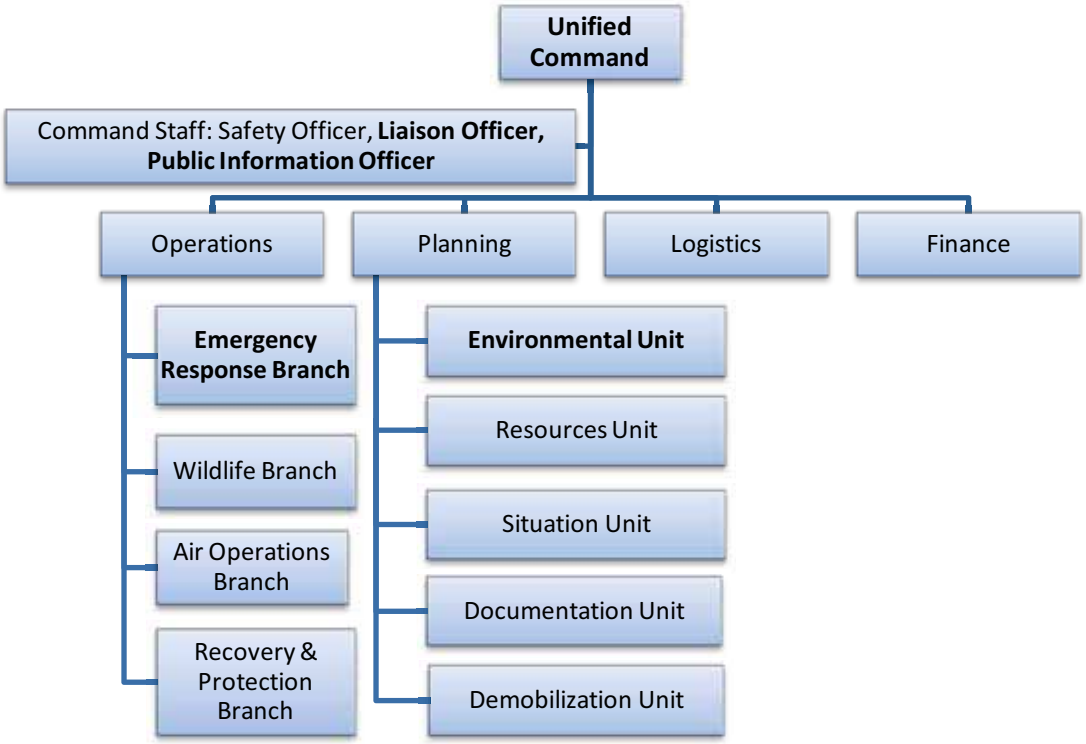

Figure 5: Typical ICS organization structure with positions of interest to the County in bold. Adapted from NWACP.

ICS is designed to be flexible, with the size of the ICS structure depending on the size and complexity of the particular response. In a small spill only key positions would be staffed, while in a large spill the size of the ICS organization would be expanded and every position might be filled.[21] More details about the responsibilities of the ICS Sections can be found within the NWACP. Specific guidance and job aids for each ICS position can be found in the Coast Guard Incident Management Handbook, U.S. Coast Guard COMDTPUB P3120.17A.

Available online at http://www.uscg.mil/hq/nsfweb/docs/FinalIMH18AUG2006.pdf

[21]FEMA.(2010). ICS Review Document. Retrieved November 23, 2010 from http://www.training.fema.gov/EMIWeb/IS/ICSResource/assets/reviewMaterials.pdf

2.2 Resources at Risk

2.2.1 Environmental Resources at Risk

Oil spills and the response efforts mounted against them are subject to a broad range of dynamic variables which in turn determine the magnitude of their environmental impact. For example, winds, tides, and currents can move the oil hundreds of miles from the original site.[22] Strong waves can reduce the effectiveness of skimming vessels and oil booms, while also helping to disperse the oil. Light oils such as gasoline and kerosene evaporate rapidly, but are more acutely toxic, while heavier variants like crude oil and bunker fuel are more persistent and pose a higher risk of contacting marine life. Oil can mix with sediments in the intertidal region and experience greater persistence than would otherwise be expected. Additionally, the season could affect the type and density of marine life present. Ecological values also come into play – response resources are always insufficient to protect all sites at all times and, therefore, locations deemed to be of greater sensitivity receive a higher priority for protection. In some cases, there will be a direct trade-off between the environmental impact of contact with oil, and the environmental impact of response and clean-up activities. The following diagram illustrates some of the dynamic processes affecting the fate and transport of spilled oil.

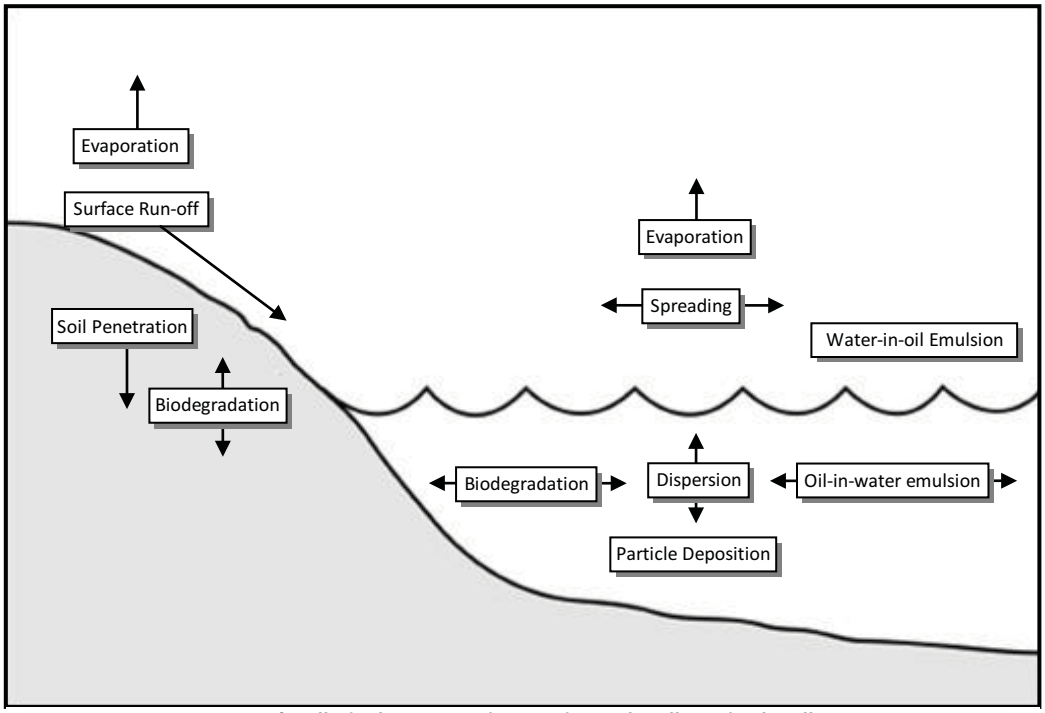

Figure 6: Fate of spilled oil. From Understanding Oil Spills and Oil Spill Response.

This section will review environmental resources present in Snohomish County, including aquatic and shoreline habitat, birds, fish, invertebrates and marine mammals,

[22] Rice, Stanley D. 2009.*Persistence, toxicity, and long-term environmental impact of the Exxon Valdez oil spill. University of St. Thomas Law Journal*: 7: pp. 55-67.

and describe some of the environmental impacts they could face in the event of an oil spill. The overall risk posed to each of these resources is a function of the nature of the *threat* (type of oil, impacts associated with response actions), the particular resources *sensitivity* to that threat, and the particular resource's *vulnerability* at the time of contact. Sensitivity refers to the relationship between a specific dose of the threat and the associated harm it causes. More sensitive resources will experience greater harm for a given *dose* of the threat. Vulnerability factors in a habitat or species' particular behaviors or characteristics which could increase its exposure to the threat. This could include diving and feeding behavior of some waterfowl, or intertidal spawning habits of some fish species in the Sound. All of these factors will vary with each spill, meaning responding agencies will require an understanding of the dynamic relationships among the threats and the resources at risk to be able to make sound decisions in the event of a spill.

One tool to promote this understanding is the Environmental Sensitivity Index (ESI),[23] created and managed by NOAA's Office of Response and Restoration (ORR). It is a summary of coastal resources at risk in the event of an oil spill in the form of maps depicting in high detail the resources that exist in Snohomish County; including shoreline biological resources, as well as human use resources (aquaculture, boat ramps, commercial fishing, marinas, parks, and recreational fishing areas). An example ESI map for Port Susan is included in Appendix 3. The following information is drawn from the ESIs and other sources to present a basic review of the resources in Snohomish County and how they could be affected by contact with an oil spill.

Marine Habitat

In open water, fish and marine mammals have the ability to swim away from a spill, reducing the likelihood of harm from major spills, as compared to the attached residents of shallow water and intertidal zones.[24] However, the type of oil has bearing on the relative risk posed to the water column. Very light oils tend to have more acute toxic impacts and readily mix into the water column, posing a threat of toxic impacts on fish, invertebrates and plants which live in the upper water column. Medium oils will not mix as readily in to the water column, but persist longer on the surface, posing a threat of oiling to species and habitats at the water surface. Very heavy oils can float, mix, sink or suspend in the water, posing a yet another set of threats to species and habitats.[25]

Shoreline Habitat

Approximately 36 percent of Snohomish County shoreline is classified as salt and brackish-water marshes, which is the most sensitive shoreline type according to NOAA.[26] This includes areas around Marysville, Port Susan, and Tulip Bay.

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[23]National Oceanic and Atmospheric Administration. (2006). *Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.* Seattle: NOAA.
[24]EPA, 2011, *Understanding Oil Spills and Oil Spill Response,* p.7.
[25] US Fish & Wildlife Service, 2004, *Effects of Oil Spills.*p.1.
[26]NOAA, 2006, *Environmental Sensitivity Index.*

Approximately 15% of Snohomish County shoreline is classified as sheltered tidal flats, the second most sensitive shoreline type according to NOAA. These are found contiguous to the marshland in Snohomish County, but also in large amounts on the south side of Camano Island and in the southern section of the County between Edmonds and Mukilteo. Another 16% of shoreline is made up of mixed-sand and gravel beaches. While not as sensitive as other types of shoreline, these areas are easy for oil to permeate and could lead to a more persistent, more difficult to clean up spill area. The region north of Tulalip up to Kayak Point makes up the largest portion of mixed sand and gravel beach in Snohomish County. The table below summarizes shoreline habitat types in Snohomish County.

Shoreline Type	ESI Rank (10 = most sensitive)	Length (m)	Percent of Total Shoreline
Salt-and brackish-water marshes	10A	117,011	36.0%
Sheltered tidal flats	9A	47,997	14.8%
Vegetated low banks	9B	23,724	7.3%
Sheltered scarps in bedrock, mud or clay	8A	2,985	0.9%
Sheltered, solid man-made structures	8B	12,690	3.9%
Sheltered riprap	8C	22,596	6.9%
Exposed tidal flats	7	8,722	2.7%
Gravel beaches	6A	3,501	1.1%
Riprap	6B	26,937	8.3%
Mixed sand and gravel beaches	5	52,376	16.1%
Coarse-grained sand beaches	4	10,258	3.2%
Exposed, wave-cut platforms in bedrock, mud or clay	2A	310	0.1%
Exposed rocky shores	1A	627	0.2%
Exposed, solid man-made structures	1B	14,665	4.5%
Unmapped (mostly rivers)	-	77,300	23.8%
Total Snohomish Shoreline		**325,269**	**100.0%**

Figure 7: Summary of Snohomish County shoreline types. From *Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.*

Once the oil reaches the shoreline, its effect varies by location, and more specifically by shoreline type. The sensitivity of a length of shoreline is a function of the substrate size and type, exposure to wave and tidal energy, shoreline slope, and biological productivity.

Coarse, uniform substrates (such as those found at gravel beaches making up 16% of the Snohomish shoreline) make it easier for the oil to penetrate and are therefore associated with increased persistence. Further, these types of shorelines are the least amenable to response activities because the coarse gravel decreases mobility (increased hazard of slips, trips, and falls) and the fact that traffic could force the oil further into

the substrate. Muddy, clay-like beaches are less permeable due to the fine grain of the substrate. They tend also to be compact and easy for response workers to operate on.[27] In general, exposure to higher energy tidal and wave action, and steep shorelines mean quicker natural removal of oil. These factors can have bearing on the response technology appropriate for a section of shoreline as well as its relative ranking among other priority sites for response (see section 2.5.2 Oil Spill Response Strategies for more details).

The majority of Snohomish County shoreline is classified as "Stable," or as less than 15 degree grade, according to the DOE Slope Stability Maps in the Coastal Zone Atlas.[28] This means they will tend to naturally retain oil on the shore, especially in sheltered areas. Flat intertidal areas also often happen to be an area of greater plant and animal diversity, which is the case in Snohomish County. Plants in this type of habitat are most sensitive to persistent oil on plant surfaces, as well as potential impacts from response and cleanup activities. Snohomish County is home to large eelgrass beds which are especially important as habitat, nursery beds and a food source for many species, including herring and shellfish. While eelgrass itself is not likely to be directly impacted by oil, it is very vulnerable to the human-impacts of response activities (such as trampling of delicate root systems).[29]

Biological Resources

Snohomish County is home to several species of national and local concern, such as the bald eagle, western grebe, herring, char, and Chinook salmon. Additionally, several species hold commercial value for the Snohomish County economy. Harm to these populations could initiate a chain of long-term damage to local ecosystems, or adversely impact employment and economic growth in the region. As a highly visible and tangible aspect of oil spills, damage to wildlife and habitats will also have significant bearing on the public perception of the response.

The impact of oil on biological resources can be separated into acute effects or chronic effects. Acute effects, an immediate impact resulting in death, associated with oil could include direct physical contact (smothering) or toxic exposure. Chronic effects are more difficult to detect and can include impacts on an organism's physiology, behavior or reproductive capacity over the long-term. Additionally, destruction of food resources and habitats could have an indirect impact on certain species over the long term.[30]

Besides sensitivity to acute and chronic effects of oil, the vulnerability of species will vary according to season and associated life stages such as nesting, birthing, hatching and fledging in the case of bird species. Species which tend to cluster in large amounts

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[27]NOAA. (2002). Environmental Sensitivity Index Guidelines Version 3.0. Seattle: NOAA p. 12.

[28]Department of Ecology. (n.d.). *Slope Stability Maps - Coastal Zone Atlas.* Retrieved February 1, 2011, from http://www.ecy.wa.gov/programs/sea/landslides/maps/maps.html

[29]NOAA.(2002). *Environmental Sensitivity Index Guidelines Version 3.0.*Seattle: NOAA p. 12.

[30]EPA, 2011, *Understanding Oil Spills and Oil Spill Response. p.8.*

in smaller area are more vulnerable to having large portions of their population exposed to an oil slick. Endangered and threatened species or cases where large segments of their total population are found in Snohomish County should also be priorities for protection.

Birds – Perhaps the most publicly visible biological resources affected by a spill, birds experience fouling of plumage, oil ingestion, reproductive effects, and physical disturbance.[31] Plumage soiled by oil allows water to penetrate to the bird's body, causing chilling and sometimes hypothermia and drowning from loss of flight and buoyancy. Birds also ingest and inhale oil in efforts to clean themselves, sometimes leading to immediate mortality, but more often, lung, liver and kidney damage leading to death.[32] In the longer term, reproductive effects such as decreased or less successful egg-laying by oiled adult birds has been documented. Oil could also decrease the viability of soiled eggs themselves, creating ecosystem impacts in terms of population health. On the other hand, physical disturbance and habitat disruption could also impact birds as a result of response work. Adult birds could abandon nesting areas or roosting areas in response to human intrusion. The following bird species are in Snohomish County; and could be of particular concern.[33]

[31]NOAA.(n.d.).*An Introduction to Coastal Habitats and Biological Resources for Oil Spill Response.* Seattle: NOAA. p. 156-7.
[32] US Fish & Wildlife Service, 2004, *Effects of Oil Spills.*
[33]NOAA, 2006, *Environmental Sensitivity Index.*

Species	State Status	Federal Status	Sensitive Life Stages (Nesting, Laying, Hatching, Fledging)											
			J	F	M	A	M	J	J	A	S	O	N	D
Bald eagle	Threatened	Threatened	■	■	■	■	■	■						
Western grebe	Concern		■	■	■	■						■	■	■
Caspian tern						■	■	■	■	■				
Gulls							■	■	■	■	■			
Cormorant						■	■	■	■	■	■	■		
Scaup			■	■	■	■							■	■
Scoters			■	■	■	■	■			■	■	■	■	■
Red-throated loon													■	■
Pacific loon			■	■	■	■	■					■	■	■
Waterfowl											■	■	■	■
Goldeneye													■	■
Bufflehead													■	■
Pigeon guillemot							■	■	■	■				
Seabirds						■	■	■	■	■	■	■	■	
Great blue heron				■	■	■	■	■	■					
Rhinoceros auklet						■	■	■	■	■	■			
Shorebirds											■	■	■	■

Figure 8: Summary of Coastal Birds in Snohomish County. From *Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.*

Fish – While fish are less likely than other species to come into contact with floating oil slicks,[34] adult fish could be exposed to oil that has entered the water column via the gills, and by ingesting oil either directly or through eating contaminated food. This can result in stunted growth, enlarged livers, fin erosion, and reproductive impairment. Further, if the oil makes contact with a spawning habitat, it will likely adversely impact spawning success.[35] Fish which spawn in the intertidal area (as opposed to freshwater spawning fish) are of particular concern.[36] This type of habitat (common in Snohomish County) retains oil easily and tends to be biologically rich, making it more likely that changes in the spawning rate have impacts throughout that ecosystem. Depending on the type of oil, fish could bio-accumulate hydrocarbons in the liver, gall bladder and neural tissue.[37] Fish are relatively efficient at removing the hydrocarbons which pose a human health risk from their tissue. However, the real threat to Snohomish County could be economic rather than health-related should there be loss in commercial fishing due to precautionary closure of fisheries. The following fish are found in Snohomish County waters.

[34]NOAA Office of Response and Restoration. (2010). *Bioaccumulation of Oil Chemicals in Seafood.* Seattle: NOAA.

[35] US Fish & Wildlife Service, 2004, *Effects of Oil Spills.*

[36]NOAA.(n.d.).*An Introduction to Coastal Habitats and Biological Resources for Oil Spill Response.* Seattle: NOAA. p. 198.

[37] Bioaccumulation is the buildup of a chemical substance in an organism to levels that are higher than the environment in which the organism lives.

Species	State Status	Federal Status	Sensitive Life Stages (Spawning, Egg, Juvenile, Adult)											
			J	F	M	A	M	J	J	A	S	O	N	D
Chum salmon														
Coho salmon		Concern												
Surf smelt														
Pacific sand lance														
Pacific herring	Concern	Concern												
Native char	Concern	Threatened												
Chinook salmon	Concern	Threatened												
Pink salmon														
Steelhead														

Figure 9: Summary of Fish Species in Snohomish County. From *Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.*

Invertebrates – Oil effects on invertebrates tend to be chronic rather than acute because they tend to bio-accumulate hydrocarbons. Oil which penetrates the sediment occupies interstitial spaces and decreases the amount of oxygen available. Oil could also affect invertebrate behavior. For example, Dungeness crab were found to have a decreased ability to detect prey, and bivalves could be unable to close their shells, increasing exposure to contaminants.[38] Mollusks are physically unable to avoid oil spills, causing them to be more exposed to oil than other invertebrates. Additionally, they are less able than fish to purge larger hydrocarbons, which have been linked to cancer in humans.[39] This will have ecological impacts as well as raising concerns about seafood safety, affecting Snohomish County's seafood and aquaculture business. The following invertebrates are found in Snohomish County coastal areas.

Species	State Status	Federal Status	Sensitive Life Stages (Spawning, Eggs, Larvae, Juvenile, Adult)											
			J	F	M	A	M	J	J	A	S	O	N	D
Pandalid shrimp														
Dungeness crab														
Scallops														
Hard-shell clams														
Geoduck														
Giant octopus														

Figure 10: Summary of Marine Invertebrates in Snohomish County. From *Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.*

Mammals – Marine mammals, like birds, are highly visible and charismatic residents of Puget Sound. Their protection is a public affairs concern as much as an environmental

[38]NOAA.(n.d.).*An Introduction to Coastal Habitats and Biological Resources for Oil Spill Response*. p. 153.
[39]NOAA, 2010, *Bio-accumulation of Oil Chemicals.*

one. Marine mammal oil exposure routes include direct contact or oiling of the fur or skin, direct and indirect oil ingestion and inhalation of evaporating petroleum compounds. Like the birds, some marine mammals could experience chilling due to the lessened insulating effect when fur is oiled. Consumption and inhalation could lead to a number of physiological effects such as neurological disorders, liver lesions and kidney failure.[40] While sea lions and harbor seals have the ability to detect and avoid oil, in past spills, they have been documented as swimming into slicks unawares.[41] The following mammal species are in Snohomish County waters; and could be of particular concern.

Species	State Status	Federal Status	Sensitive Life Stages (Mating, Calving, Pupping, Molting)											
			J	F	M	A	M	J	J	A	S	O	N	D
Gray whale														
California sea lion														
Harbor seal														

Figure 11: Summary of Marine Mammals in Snohomish County. From various sources.

Human-Use Resources

Humans are an integral part of the environment, using its resources for recreation, food, livelihood, and spiritual or cultural purposes. Human-use resources to be considered include recreation and shoreline access areas, management areas, resource extraction locations and archeological and historical cultural resources areas. Recreation areas are typically for sport-fishing, and diving, and thus include boat ramps and marinas. Management areas include Tribal reservations, parks (national, state, and county), marine sanctuaries, wildlife refuges, Nature Conservancy lands, preserves and reserves. Resource extraction areas are of economic and environmental significance to Snohomish County. These include commercial and subsistence fisheries, water intakes, and aquaculture among other things. Areas of archaeological, historical, religious, and/or cultural significance are not listed in the ESI, and the County might want to collect information on them.

2.2.1 Economic Resources at Risk

The health of Snohomish County's marine areas is also critical for the economic activity it supports. Snohomish County participates in the following marine-dependent industries.

Commercial and Recreational Fishing

The 2008 Washington Regional Economic Analysis reports that Forestry, Fishing, and related activities employ 1,310 people in the County (or 0.4% of the total working population). This number is likely to be underreported because only firms employing 10

[40]NOAA.(n.d.).*An Introduction to Coastal Habitats and Biological Resources for Oil Spill Response.* Seattle: NOAA. p. 169.

[41]NOAA.(n.d.).*An Introduction to Coastal Habitats and Biological Resources for Oil Spill Response.* Seattle: NOAA. p. 179.

or more people are required to report employment, and large numbers of smaller independent fishermen would not be counted.[42]

The Port of Everett is the only port in Snohomish County and is made up mostly of recreational boaters. Though commercial fishing boats make up a small percent of Port use, Snohomish County fisheries and access to them remain an important economic resource.[43] The Port of Everett had 1.8 million pounds of commercial fish landings in 2007.[44] The following table describes 2006 data on total commercial landings to the Port of Everett in more detail:

Species	Snohomish County	State Total
Groundfish	$77,900	$14,307,900
Salmon	$158,500	$9,495,600
Other Anadramous and Eggs	-	$193,100
Shellfish	$1,309,000	$41,102,500
Total	$1,376,200	$65,099,100

Figure 12: Value of non-treaty commercial fish landings, 2006. From WDFW Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State.

Commercial and subsistence fishing is an important, though declining, economic resource for the Tulalip tribes in northern Snohomish County. The 1974 Boldt Decision entitles local tribes to half of salmon stocks and the right to co-manage fishing resources in Washington State.[45] The Tulalip Tribes also manages the Bernie Kai-Kai Gobin Hatchery on the reservation near Marysville, which raises and releases Summer Chinook, Coho and Chum salmon, bolstering both tribal stocks and those of other fisheries in Washington and British Columbia.[46]

Oil spills could economically impact County commercial and recreational fisheries in several ways. As an example, oil might cause acute impacts on current fish stocks and cause chronic and reproductive impacts on future fish populations, decreasing the amount available to local fishermen for years to come. Additionally, some fisheries might experience temporary closure as a precaution against human health effects from eating contaminated fish or shellfish.

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[42] Pacific Northwest Regional Economic Analysis Project (PNREAP). (2010).Washington Regional Economic Analysis Project – Snohomish Industry Structure and Performance. Retrieved December 6, 2010 from http://washington.reaproject.org/analysis/industry-analysis/

[43]NOAA Fisheries.(2010). Everett Community Profile. Retrieved December 6, 2010, from http://www.nwfsc.noaa.gov/research/divisions/sd/communityprofiles/Washington/Everett_WA.pdf

[44]NOAA Fisheries (2007).Total Commercial Fishery Landings At An Individual U. S. Port For All Years After 1980. Retrieved December 6, 2010 from http://www.st.nmfs.noaa.gov/st1/commercial/landings/lport_hist.html

[45]Northwest Indian Fisheries Commission. (n.d.) Historical Background. Retrieved February 24, 2011 from http://nwifc.org/about-us/

[46]Tulalip Tribes Natural Resources Program. (October 14, 2005). Bernie Kai-Kai Gobin Hatchery. Retrieved February 24, 2011 from http://www.tulalip.nsn.us/htmldocs/salmonhatchery.htm

Seafood Processing

Quality Seafood Services LLC is a major processor and cold storage plant for seafood products primarily from Puget Sound and Alaskan fisheries. The company is located at the Port of Everett and provides off-loading for local vessels.[47] Their business and the associated retail business could be adversely affected either directly from oil spills, or indirectly from disruptions in the Sound related to oil spills.

Aquaculture

Data from the USDA's agricultural census indicates that Snohomish County generated $4,832,000 from aquaculture in 2007, including finfish, other fish, and shellfish farming.[48] NOAA's Environmental Sensitivity Index has mapped Kingston and Possession Sound as two major aquaculture regions in Snohomish County. Individual aquatic farms have not been captured in this analysis, [49] but a full list of Washington Licensed Shellfish companies and their growing area is available from the Department of Health. [50]

Recreational shellfish beaches are managed jointly with the Department of Health and the Department of Fisheries and Wildlife. These shellfish growing areas provide revenue through department licensing and indirect tourism revenue as a recreational attraction. Snohomish County has seven recreational shellfish growing beaches: West Pass Access, Kayak Point County Park, Howarth Park, Mukilteo State Park, South Mukilteo Park, Picnic Point County Park, and Meadowdale County Park.[51] Contact with oil spills could adversely impact shellfish growing areas through acute damage to their livestock, or precautionary health-related closure. Closure of recreational areas for the same reasons might impact the County's tourism industry.

Tourism

According to the Snohomish County Office of Economic Development, tourism is linked to 9,610 jobs, $203.2 million in payroll, $14.7 million in local taxes and $51.6 million in state taxes.[52] While most tourism does not directly involve the shoreline, a major spill might disrupt other tourism activities and may be a deterrent for future visitors.

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[47]NOAA Fisheries. (2006). Everett Community Profile

[48]USDA.(2007). Census of Agriculture – State and County Reports. Retrieved December 6, 2010, from http://www.agcensus.usda.gov/Publications/2007/Full_Report/index.asp

[49]NOAA. (2006). Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas. Seattle: NOAA.

[50]Washington State Department of Health Office of Shellfish and Water Protection. Washington Licensed Shellfish Companies, Alphabetical Listing. February 2, 2011. Retrieved February 26, 2011 from http://www.doh.wa.gov/ehp/sf/Pubs/sf-co-alpha.pdf

[51]Washington State Department of Health Office of Shellfish and Water Protection. Commercial and Recreational Shellfish Growing Areas: January 1, 2010. Retrieved February 26, 2011 from http://www.doh.wa.gov/ehp/sf/Pubs/ai-map.pdf

[52]Snohomish County Business Journal. (1 April 2010). *Strategic Tourism Plan update underway at Office of Economic Development.* Retrieved December 6, 2010 from, http://www.snohomishcountybusinessjournal.com/article/20100401/SCBJ04/100339998/-1/SCBJ

2.2.3 Oil Spill Response Strategies

Much as oil spills can occur and affect the environment in a multitude of ways, responses to oil spills also take many forms. In that the response options themselves could have significant environmental impact, these options all require key trade-offs the County could be asked to consider in the event of a spill. The decision to use each option depends on capacity criteria including, but not limited to, the nature and amount of oil, the proximity of the spill to access points and resources at risk, timing considerations, environmental considerations, and proper authorizations. This section introduces the most common response options available and some of the key trade-offs associated with their use.

An oil spill typically goes through three distinct chronological phases, all of which require different combinations of response strategies. Early in the spill, responders will focus on stabilizing and containing the source of the spill. Depending on location and weather, the window for this activity could only be a few hours. The focus of the response then shifts to minimizing the spread of oil and protecting at-risk resources. These activities could go on for several days to several weeks. The last response phase focuses on areas where shorelines have been contaminated by oil and involves shoreline cleanup with the goal of speeding natural recovery and minimizing environmental impacts. These activities can take several months. The following diagram summarizes some response strategies by chronological phase.

Incident Start (window of opportunity)	⇨ …hours… (very early)	⇨ …hours/days/weeks… (early)	⇨ …months… (later)
PHASE / **STRATEGY**	**Stabilize/Secure Source**	**On-Water Contain/Recover Protect**	**Shoreline Treatment/Cleanup**
Mechanical	Close valves Patch Pump/offload	Manual Oil Removal Boom, skimmers Sorbents Mechanical Oil Removal Vacuum Barriers	Sorbent Manual Oil Removal Mechanical Oil Removal
Chemical		Dispersants Emulsion treating agents Solidifiers Herding agents Elasticity modifiers	Shoreline cleaning agents Solidifiers
Other		In-Situ burning	Bioremediation
Waste Management		On-site Storage Recycle Incineration	Stabilization Recycle Landfill Incineration Bioremediation

Figure 13: Summary of Response Strategies. Adapted from NOAA Characteristics of Response Strategies. (2010)

These phases imply a natural categorization of response strategies to on-water (typically earlier in the response timeline) and shoreline (typically later).

On-Water Strategies

Booming. Boom refers to a floating physical barrier which can be put to several different uses in a response. Very early on, it could be deployed around an oil slick to *contain* and concentrate it until it can be removed by a complementary strategy. Boom could also be deployed to *deflect* incoming oil away from a particular site, or *divert* it to a less sensitive or easier to access site. *Exclusion* boom is deployed around a sensitive resource to ensure that oil is unable to make contact. Resources required for booming are the boom itself and skilled labor to deploy it correctly, according to constantly shifting water flow, water levels and wave conditions. Placing and maintaining boom involves increased vessel traffic which could raise concerns about wildlife disturbance.
Skimming. Skimming involves using specially-designed equipment to mechanically remove oil from the surface of the water. This strategy is most effective in areas of concentrated oil (since they could intake large amounts of water as well as oil), making it a natural complement to a containment booming strategy. Resources required for skimming are the skimming devices and skilled labor to deploy it correctly, in areas of large oil volume. The use of skimmers involves increased vessel traffic, raising potential

for wildlife and habitat disturbance. Proper storage, transport and disposal of oil recovered through skimming is also a concern associated with their use.

Sorbents. Sorbents are materials which attract and absorb oil, and they can be used both on-water and at the waterline. There is a large variety of sorbent material available, including organic, inorganic and synthetic materials. However, a common concern with using sorbents is ensuring that they are collected and properly disposed of after use. Wildlife and habitat disturbance due to increased traffic during the deployment and later removal of sorbent is another concern with this option.

In-Situ Burning. This option involves burning the oil while contained in slicks at least 1-2 mm thick. Containing the oil to appropriate thickness could require complementary strategies such as deploying fire-resistant boom. This temporarily produces large volumes of smoke which could disturb birds and other area wildlife. The resulting burn residue could have long term environmental effects if it is not collected. Responders will require RRT approval before using this option.

Dispersants. Chemical dispersants work by reducing the oil/water interfacial tension, allowing waves and break to oil up into smaller particles. These products work best in water deep enough to support mixing and dilution, however, the dispersed oil and the dispersant itself could affect marine life in the upper water column. The application of the dispersant requires increased vessel traffic, and spraying, which if not done accurately, could adversely affect local wildlife. The response team will require RRT approval before using this option.

Shoreline Strategies

Natural Recovery (do nothing). This option leaves oil in place to degrade naturally. Oil degrades through natural processes such as evaporation or strong wave-action. It uses the least amount of resources, though shoreline health should be monitored through the natural recovery process. This option could be chosen if other clean-up activities will have more environmental impact, or if the rate of natural degradation is very high. This option is not favorable if the area is used by high numbers of people or wildlife.

Manual Oil Removal/Cleaning. Manual removal involves a number of workers using hands, rakes, buckets, shovels, scrapers, sorbents, and pitchforks to remove oil from surfaces and place it in containers for disposal. This requires the aforementioned hand tools and protective gear as well as workers. These efforts could cause environmental harm through increased foot traffic through sensitive areas and potential wildlife disturbance.

Mechanical Oil Removal. This option uses heavy machinery such as backhoes, bulldozers, and graders to remove oil from shoreline and bottom sediments. The aim is to remove as much contaminated sediment as possible, while leaving clean sediment intact. The precision of the equipment, however, does not always allow this to be achieved. This option requires heavy equipment and skilled personnel to support it. The removal of the sediment and the organisms within and dependent on it will have significant environmental impacts, not to mention the impacts of machinery and worker traffic.

Sediment Re-working/tilling. This option breaks up oily sediments and surface oil deposits using roto-tilling equipment to increase aeration of the substrate, hastening natural degradation of the oil. Another way to hasten natural degradation is to push contaminated sediment to the water's edge, exposing it to wave action. This option carries a trade-off between sensitive resources on the shore and in the water, since oil removed from the shoreline would then re-enter the water column. Additionally, care needs to be taken not to mix the oily sediment even deeper into the substrate, exposing other organisms. Like many of the other options, this will involve increased traffic on the shoreline, and the impacts associated with numbers of workers and machinery operating in a locale.

Vegetation Cutting. Vegetation cutting is done with the aim of removing oiled vegetation to prevent it from soiling wildlife, or being ingested by them. Heavily oiled vegetation is also a risk for secondary release and should be removed. This is often applied in vegetated habitats such as salt marshes and beds of aquatic vegetation, both of which are present in Snohomish County. There is a direct trade-off between the habitat value of keeping the vegetation and the risk of contamination to wildlife which use those plants.

Water-Flushing. In this option, water is sprayed to loosen oil from shoreline substrate and float it to an area where it can be more easily recovered by complementary means such as skimming or sorbent materials. Depending on the viscosity of the oil and the material it has adhered to, responders could choose to use ambient temperature water or hot-water, at low to high pressures. Hot water, while more effective at removing persistent oil, can kill plants and animals on contact. Care must be taken to control the direction of the resulting flow of oily water so it doesn't cross sensitive habitat on the way to the water.[53] These options are not representative of the entire spectrum of response options available. They do, however, capture the trade-offs inherent in making key response decisions. Because the options themselves present significant resource use and environmental impact, a well-prepared county will have weighed these trade-offs beforehand and be able to guide these critical decisions.

2.3 Stakeholder Analysis

Stakeholder analysis is a tool for visualizing the different actors who would be involved in an issue and understanding their different levels of interest and empowerment. Each actor will have different levels of *interest* in the outcome of the oil spill response – some are interested because it is their mission or mandate to be involved; others because their livelihoods are tied to the outcome; some are civic-minded citizens interested in the common good. Figure 14 depicts the major stakeholders, with a summary of their interests and their ability to respond to a spill.

[53] NOAA. (2010). *Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments.* Seattle: US Dept of Commerce; US Coast Guard; US EPA; American Petroleum Institute.

Stakeholder	Interest	Empowerment and Resources
US Coast Guard	Designated marine environmental protection is a legacy mission; lead Federal response agency for spills in coastal waters and deepwater ports	National perspective; response experience and training; Federal funding; legitimacy; official mandate
US Environmental Protection Agency	Designated lead Federal response agency for oil spills occurring in inland waters	National perspective; response experience and training; Federal funding; legitimacy; official mandate
Federal Emergency Management Agency	Mission to support lead agency, citizens and first responders in event of a spill	National perspective; response experience and training; Federal Funding; legitimacy; official mandate
Northwest Area Committee	Required by Oil Pollution Act to develop area contingency plan	Regional perspective; response experience and training
State of Washington Department of Ecology	Lead State agency on oil spill issues; State Incident Commander when oil or hazardous substance spills occur on waters of the state	Some local area knowledge; continuation; drill experience and training; Oil Spill Trust Fund money; official mandate
Washington State Patrol	Managing beach access; traffic; creating of staging areas; crowd management; State Incident Commander when oil and hazardous substance spills occur on state highways	Local area knowledge; local networks
Responsible Party	Financially and legally liable for spills response and damages	Private financial resources
Snohomish County Council	Future use of threatened environmental and economic resources; community disruption; public and media perceptions	Local area knowledge; local networks; access to local media; legitimacy in area
Snohomish County DEM	Community disruption	Local area knowledge; local networks
Snohomish Health District	Public health risk associated with oil exposure; Illness and injury of response workers	Local area knowledge; local networks
County volunteer coordinators	Volunteer opportunity coordination	Local area knowledge; local networks
Tribal Government	Future use of threatened environmental and economic resources; community disruption	Local area knowledge; local networks; vessels; treaty rights
Local Fire Department	Public safety	Local area knowledge; response experience and training; local networks
Community Groups	Future use of threatened environmental and economic resources; community disruption	Local area knowledge; local networks; private vessels
Local Residents	Future use of threatened environmental and economic resources; community disruption	Local area knowledge; local networks
Local Commercial Fishermen	Future use of threatened environmental and economic resources; marine traffic issues; port access; community disruption	Local area knowledge; local networks; vessels
Navy	Disruption of Navy activity; local community relations	Response equipment (nine skimmers); response experience and training
Everett Port Authority	Disruption of port activity	Local area knowledge
Port Users	Marine traffic issues; port access	Local area knowledge; local networks

Figure 14: Summary of Oil Spill Stakeholders

In addition to stakeholder interests, stakeholder analysis can show what the needs of various impacted groups are, and where they could look to fulfill these needs. When viewed in this manner the County government occupies a unique position, where it potentially is a nexus of both local and regional assets that will be sought in the event of a spill. Figure 15 below illustrates the County's central role among selected stakeholders in information, access and resource transactions in the event of an oil spill.

Figure 15: Stakeholder Demands and Resources

Similarly, the County can expect to rely on these stakeholder groups to obtain resources as well. While state and federal agencies could look to Snohomish County for local knowledge and access, Snohomish County can potentially expect these agencies to provide the County with funding and relief expertise. The County can also look to local groups for various response resources, including manpower resources that can be found among Snohomish County residents and coordinated through County volunteer coordinators.

2.4 Jurisdiction Analysis

Much like the stakeholder analysis above, the purpose of this jurisdictional analysis is to clarify and summarize the specific action or set of actions which a governmental entity is responsible for completing in the event of an oil spill. Figure 16 presents an Oil Spill Authority and Jurisdiction analysis.

Party	Description	Spill-Related Authorization	Participation
US Coast Guard	Responsible for coordinating ICS, marine-based spill response at local and federal level	• Executive Order • Federal Statutes (CFR) • OPA • FWPCA	Planning, Prevention, Response
EPA	Responsible for land-based spill response at local and federal level	• Executive Order • Federal Statutes (CFR) • CERCLA • OPA	Planning, Prevention, Response
NOAA	Responsible for providing scientific information and natural resource damage assessment	• Federal Statutes • OPA • FWPCA	Planning, Response, Restoration
Department of Ecology	Involved in spill response at state level	• RCW and WAC sections	Planning, Prevention, Response, Restoration
Snohomish County Local Emergency Planning Committee (LEPC)	Responsible for creating hazardous materials and oil spill planning documents at the county level	• SARA Title III • OSHA • NFPA • RCW and WAC sections	Planning
Responsible Party	Responsible for directing response and any associated costs	• Federal Statutes • State Legislation • NWACP	Response
WA State Patrol	Responsible emergency response	• Washington SERC • LEPC • RCW sections	Response
Tribal governments	Authorized to participate at any level desired by the tribe if tribal resources are threatened by a spill	• NWACP • National Response Plan (FEMA) • Federal Statutes	Planning, Prevention, Response
County volunteer coordinator	Involved in organizing and assuring volunteers are safe and properly trained	• NWACP • Snohomish County	Planning, Response
Fire Department	Responsible for providing requested emergency aid, knowledge of ICS	• Washington SERC • LEPC	Response

Figure 16: Oil Spill Authority and Jurisdiction

Participation in these four phases (prevention, preparedness, response, restoration) of managing oil spills has a number of trends. First, that if an agency or organization participates in decision-making during an early stage, they are likely to be involved in subsequent stages. For example, almost all organizations that participate in decision-making during the planning stage also participate during the response stage. Restoration is an exception to this rule. The other is that jurisdiction can be considered in two

distinct ways: requirement and right. Of the above-mentioned agencies, some have jurisdiction because they are explicitly directed to be present and participate in an oil spill. The two primary agencies in this role are the U.S. Coast Guard and the DOE. The second type of jurisdiction refers to a legal entitlement to participate in decision-making during a spill if they so choose. These organizations could submit input, but are not obligated to by applicable legislation. This is particularly true of local and tribal governments. Jurisdiction applies mostly at the level of government: local governments have jurisdiction for local issues, state agencies for state issues, and the EPA and the Coast guard have jurisdiction for federal issues related to the spill. During a spill requiring a major response, the lead agencies would be the Coast Guard or the EPA, but once the ICS system is in place, all response decision-making would go through the Unified Command (UC), which can encompass many parties in a joint decision-making body.

2.5 Threat Identification

2.5.1 How Threats Were Identified

Mitigating the impact of oil spills begins with developing an understanding of the range of threats and the risks that they carry. Snohomish County's extensive, heavily-used marine waters expose it to numerous potential point-source spill threats, from ferries to pipelines to commercial airplanes. (Point-source spills are those originating from a single definable source in concentrated form, such as spillage from a vessel. Non-point source spills are outside our charter and not addressed.)

Figure 17 depicts potential spill sources within the County that could impact marine waters. The sources were derived by comparing Snohomish County facilities and resources with threat lists compiled separately in reports by the Washington State Legislature's Joint Legislative Audit and Review Committee (JLARC)[54] and the DOE,[55] in 2009, as well as the opinions of subject matter experts.

Potential Sources of Oil Spills in Snohomish County	
Olympic Pipeline	Naval vessels
Derelict vessels	Fishing vessels
Passenger vessels	Tug and barge combinations
Marinas and ports	BNSF railroad
Oil tankers	Cargo vessels

Figure 17: Potential sources of marine oil spills in Snohomish County.

[54]Joint Legislative Audit and Review Committee (JLARC).*Review of Oil Spill Risk and Comparison to Funding Mechanism*, Report 09-2, 7 January 2009, p. 16.

[55]Etkin, D. *Oil Spill Risk in Industry Sectors Regulated by Washington State Department of Ecology Spills Program for Oil Spill Prevention and Preparedness*, February 28, 2009, p. 4.

2.5.2 Description of Threats

Derelict Vessels

The Washington Department of Natural Resources (DNR) has reported 19 derelict vessels of varying size and condition within Snohomish County boundaries. Each vessel has been assigned a priority code and added to a list of vessels to eventually be addressed by DNR's derelict vessel removal program. Funding and timeline for removal is uncertain.

Rail

Burlington Northern Santa Fe Corporation (BNSF) is the primary rail operator in Snohomish County; Amtrak also uses the same track under a lease arrangement. Petroleum products are shipped in 10,000 gallon tank cars, and locomotives powered by diesel fuel (with capacity of up to 5,000 gallons each) transit regularly along more than 23 miles of Snohomish County coastline and over multiple river crossings (Figure 18).[56] In October 2001, approximately 3,500 gallons of diesel fuel spilled on tracks near Edmonds when a BNSF locomotive's fuel tanks were punctured by debris.

Figure 18: BNSF rail routes in Snohomish County. From www.bnsf.com.

Marinas and Ports

Marinas pose a risk for oil spill due to their fuel docks and storage tanks and the number of vessels in their slips. Figure 19 shows the marinas located in Snohomish County, their associated fuel capacities, and the number of slips they contain. In addition, cargo vessels at the Port of Everett, and ferries at Edmonds and Mukilteo are refueled by tanker truck; ships at Naval Station Everett are refueled via barge. Spills during transfers of petroleum products internally, between vessels, or between vessels and shore facilities are a constant threat. From 2006-2008, the DOE received 219 notifications of transfer totaling over 100 million gallons of petroleum products in Snohomish County,[57] which includes only those transfers of more than 100 gallons into non-recreational vessels.[58] Transfer-related spills due to human error and equipment failure are among the most common spill types.[59]

[56]BNSF Railway. (2010). Retrieved December 6, 2010, fromhttp://www.bnsf.com/
[57]Washington Department of Ecology. *Spills By County Report 2009*.
[58]Washington Department of Ecology. (n.d.) Retrieved February 25, 2011 from www.ecy.wa.gov/programs/spills/prevention/antsystem.html
[59]U.S. Coast Guard, Spill Statistics Database

Marina	Fuel Storage Capacity (gallons)	Number of Slips
Port of Everett	60,000	2,300
Gedney Island	None	85
Port of Edmonds	24,000	665
Geddes Marina	None	~100
Tulalip Marina	None	~30
Dagmar's Marina	None	Dry storage

Figure 19: Snohomish County marina data. From various sources.

Large Vessels

Everett is home to a large and growing shipping terminal, visited by up to two cargo ships weekly,[60] and Naval Station Everett, which transferred approximately 1.7 million gallons of fuel in 2010.[61] Two state ferry terminals are located further south in Mukilteo and Edmonds. The waters to-and-from Admiralty Inlet are traversed by naval and cargo vessels, tug-and-barge combinations, and a variety of smaller commercial craft, such as fishing vessels and whale watching tours.

- In February 2002, a U.S. Navy vessel spilled 2,000 gallons of oily water
- In July 2007, a tugboat spilled 374 gallons of diesel in Steamboat Slough

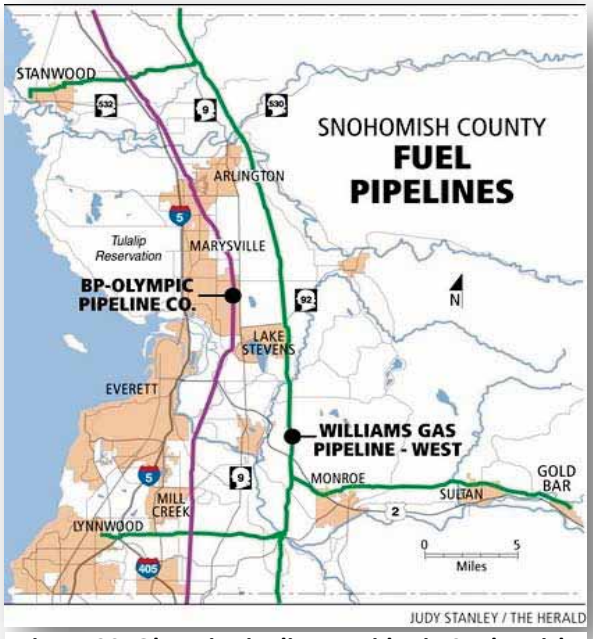

Figure 20: Olympic Pipeline corridor in Snohomish County. From www.heraldnet.com.

Pipelines

The Olympic Pipeline runs from refineries in Whatcom and Skagit counties south through Snohomish County and as far south as Portland. Figure 20 shows the pipeline corridor through Snohomish County. The line has two pipes (laid in 1965 and 1972, with diameters of 16 and 20 inches, respectively) that distribute approximately 18.7 million gallons of fuel products daily from refineries at Cherry Point, WA and March Point, WA.[62,63] The pipeline poses a marine spill threat at its waterway

[60] Madura, E. Port of Everett Security Supervisor, January 7, 2011. Personal conversation.
[61] Miller, J. NS Everett Environmental Program Manager, January 10, 2011. Personal conversation.
[62] HeraldNet. (9 Sept 2010). Is there a major pipeline near you? Retrieved November 14, 2010 from www.heraldnet.com/article/20100919/NEWS01/709199869
[63] City of Kent. Hazardous Liquid Pipeline Risk Assessment. Retrieved November 14, 2010 from www.ci.kent.wa.us%2FWorkArea%2Flinkit.aspx%3FLinkIdentifier%3Did%26ItemID%3D8096&rct=j&q=risk%20gallons%20olympic%20pipeline&ei=WqcLTdGQJIS0sAOaqomXCg&usg=AFQjCNGUguMhJArMpSLn6m9gh81IUc3KVQ&cad=rja

crossings over the Stillaguamish and Snohomish Rivers. In 1999, the pipeline ruptured in Bellingham, killing three and spilling about 237,000 gallons of gasoline into Whatcom Creek, a 3.5 mile long tributary to Bellingham Bay.[64] Although shutoff valves are incorporated at intervals along the line to limit damage from a spill, the volume between valves is in the hundreds of thousands of gallons. A DOE-commissioned study estimated the Worst Case Discharge (WCD) potential of the Bellingham spill at 3.4 million gallons.[65]

2.5.3 Defining Spill Risk

There is no absolute way to determine the probability of a major spill occurring in Snohomish County. The largest oil spill in Puget Sound in the last decade occurred when the *Polar Texas* released 7,200 gallons of North Slope crude oil into Dalco Passage[66] in 2004, and the potential for an event of equal or greater size remains very real. For example, in July 2010, an articulated tug-barge combination lost all power while transiting the Strait of Juan de Fuca with a cargo of more than 8 million gallons of diesel and jet fuel.[67] There have been similar near-misses along Washington's outer coast and in the Columbia River. Oil tankers with WCD potentials of up to 80 million gallons each regularly enter Puget Sound.[68] Figure 21 shows the number of oil spills in excess of 25 gallons and near-misses which occurred in Washington State's waters from 1995-2008.

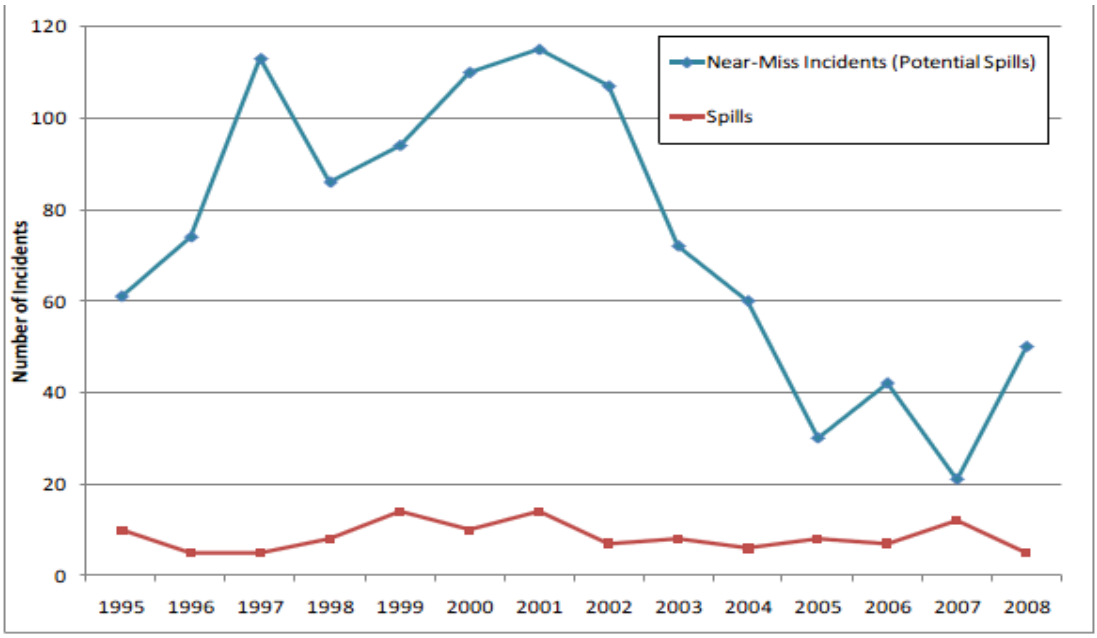

Figure 21: Oil Spills and near-misses in Washington State waters, 1995-2008. From Etkin. (2009).

[64]City of Bellingham.(2010). Olympic Pipeline Incident. Retrieved December 5, 2010, from www.cob.org/services/environment/restoration/olympic-pipeline-incident.aspx
[65]Etkin, 2009, p. 5.
[66]Washington State Department of Ecology. *(n.d.)Polar Texas -ConocoPhillips Spill*. http://www.ecy.wa.gov/programs
[67]Washington State Department of Ecology. ATB Commitment Loss of Propulsion Incident. (2010, July 8). Retrieved from http://www.ecy.wa.gov/programs
[68]Etkin, 2009, p. 5.

The 2009 JLARC report examined the risks for the State of Washington as a whole (as opposed to marine spills or Puget Sound) and determined that risk is a function of the probability of a spill occurring combined with its consequences.[69] The report described four different approaches to risk estimation and concluded that while each method produced different results, "oil spills are likely to occur across the state from many sources in both large and small amounts."[70] This is supported by U.S. Coast Guard data, which documents 151 spills in the County's waters from 2006-2009.[71] While most of these spills were very small (a gallon or less), and the largest was estimated at 374 gallons, the potential for larger spills exists. As described above, Snohomish County is exposed to a wide variety of non-trivial spill threats, any of which could produce a catastrophic spill. Figure 22 lists the five largest spills in Snohomish County in the past decade.

2.5.4 Historical Spills of Interest

To bring the risk and threat identification concepts to life, we also studied past spill incidents and the lessons learned from their associated responses. While retrospective analysis cannot predict the future, it can provide insights that help responders avoid past mistakes and illustrate gaps in the existing response structure that Snohomish County can address. The Dalco Passage and M/V *Cosco Busan* spills were chosen as examples because they occurred relatively recently, illustrate threats that are relevant to the County, and used response techniques representative of current spill best practices.

Date	Incident	Volume (gallons)	Type of Product	Location	Medium
Apr-07	**Tug:** Island Champion	374	Diesel	Everett	Marine water
Dec-03	**Tug:** Foss Maritime	4,700	Heavy fuel oil	Point Wells	Marine water
Feb-02	**Navy** :USS Abraham Lincoln	2,000	Oily ballast water	Everett	Marine water
Oct-01	**Railroad:** Burlington Northern Santa Fe	982	Diesel	Edmonds	Marine water
Jun-00	**F/V**: Lucky Buck	540	Diesel	Edmonds	Marine water

Figure 22: Summary of large spills in Snohomish County, 2000-2010. From various sources.

Dalco Passage Spill, Tacoma WA

Early on the morning of October 14, 2004, a tugboat operating in Dalco Passage reported a 1000'x200' oil slick to the USCG Vessel Traffic Service (VTS).[72] The oil type, volume, and source/responsible party were initially unknown but later established to be 7200 gallons of crude oil from the oil tanker *Polar Texas*. Despite the relatively small amount released, the oil eventually spread north through Colvos Passage (west of

[69] JLARC, 2009. Review of Oil *Spill Risk, p.10.*
[70] JLARC, 2009.*Review of Oil Spill Risk*, p13.
[71] U.S., Sector Puget Sound, Incident Management Division, Spill Statistics Database
[72] Oil Spill Early Action Task Force. *Final Report and Recommendations*. January 2005. Appendix 3, p. 1.

Vashon Island), south to Tacoma Narrows, and east to Maury Island. Clean-up operations lasted 15 days, involved hundreds of personnel, and cost $2.2 million dollars.[73,74]

Spills of this magnitude are not uncommon, and the fact that this spill occurred in an environment highly similar to Snohomish County's waters and called on many of the same resources as would be used in a spill within the County makes the lessons learned from the spill particularly instructive. These facts have been reflected in choices made in designing the scenarios modeled in Section 3.

M/V *Cosco Busan* Spill, San Francisco Bay

On November 7, 2007 the M/V *Cosco Busan* collided with the San Francisco-Oakland Bay Bridge, sustaining damage that released 53,000 gallons of heavy fuel oil into San Francisco Bay. The oil contaminated "about 26 miles of shoreline, killed more than 2,500 birds of about 50 species, temporarily closed a fishery on the bay, and delayed the start of the crab-fishing season. Total monetary damages were estimated to be…more than $70 million for environmental cleanup."[75]

Although San Francisco Bay and Puget Sound are not perfect analogs, they do demonstrate similarities in this context: multiple political entities sharing a common water body; valuable economic resources placed at risk by a major spill; and estuaries inhabited by threatened or endangered species. The spill volume is also well within the hypothetical spill range for threat sources in Snohomish County. For these reasons, we feel that the M/V *Cosco Busan* spill response offers valuable comparisons. As with the Dalco Passage spill, we have attempted to incorporate these concepts into our modeled scenarios.

2.5.5 Lessons from Historical Spills

Retrospective reports for both spills identified the following issues:

1. Delays in establishing UC structure
2. Under-utilization of manpower and knowledge
3. Communication breakdowns with local governments and stakeholders
4. Inconsistent application of ACPs

Delays in establishing Structure

In both the Dalco Passage and M/V *Cosco Busan* spills, the UC and essential staffing positions were slow to materialize, causing delays in the response process. In the case of the Dalco Passage spill, this can be partially attributed to the initial lack of an identifiable

[73]Washington Department of Ecology. *News Release – March 15, 1020.* Retrieved February 26, 2011 from http://www.ecy.wa.gov/news/2010news/2010-046.html.

[74]Washington Department of Ecology. Dalco Passage Spill Update #12. October 29, 2004. Retrieved February 26, 2011 from http://www.ecy.wa.gov/programs/spills/incidents/dalco/jic/cg12.htm.

[75]National Transportation Safety Board. 2009. *Allision of Hong Kong-Registered Containership M/V* Cosco Busan *with the Delta Tower of the San Francisco–Oakland Bay Bridge, San Francisco, California, November 7, 2007.* Marine Accident Report NTSB/MAR-09/01. Washington, DC., Executive Summary, p. xi.

RP.[76] While the ACP outlines procedures in such cases, the need for these procedures is relatively rare and led to an atypical response where the DOE was responsible for initial coordination rather than the RP. Because of this, and because no Initial Incident Commander was designated, initial set up of the UC command post was slow, and essential staffing positions within the UC were left unfilled, leading to further delays.[77]

In the M/V *Cosco Busan* spill, while the RP was quickly identified, the command post took "an unusually long time to get organized", again leading to delays in response and positional staffing decisions.[78] The M/V *Cosco Busan* spill UC also encountered difficulty in managing outside requests for information and coordination, and was unable to incorporate available personnel from outside the spill response community, leading to delayed decision-making and tension with local government representatives (LGR).[79]

Under-utilization of Manpower and Knowledge

The M/V *Cosco Busan* Incident Specific Preparedness Review (ISPR) stated that "[t]he public response to the M/V *Cosco Busan* oil spill highlighted the tremendous importance of building and maintaining effective, ongoing partnerships among federal, state and local governments and other key stakeholders in preparing for oil spills."[80] As examples, the ISPR cites local land managers in spill-affected areas who were initially left out of the decision-making structure, were unaware of the ICS structure or the existing clean-up initiatives and consequently led their own efforts to patrol beaches and capture oiled wildlife. While 100 volunteers[81] were utilized through the Oiled Wildlife Care Network, the ISPR indicated that more people were interested in helping, but were uninformed of the processes for doing so and therefore pursued strategies outside of the official response. This led to a lack of formal reporting of the conditions, redundancy of efforts, and some inadvertent setbacks (inadvertent hazing of wildlife, health risks to volunteers).[82] In the Dalco Passage Spill some volunteers were used as spill assessment coast watchers, however other residents of the area were frustrated in their attempts to participate due to a lack of training, equipment and organized structure.[83]

Both spills also apparently experienced a lack of local input to protection prioritization. The ISPR recommended re-examination of Bay-area GRPs to more effectively distinguish between 'sensitive areas' and 'priority protection areas', and noted that sites submitted for priority protection in the first 72 hours outstripped local response limitations, indicating a failure to understand and effectively prioritize valuable sites.[84] A lessons-

[76] Murphy, J., GenWest Systems. *Dalco Passage Mystery Spill 14 October 2004: Lessons Learned Report.* Prepared for Washington Department of Ecology, 2004, p. 15.
[77] Murphy, *Dalco Passage Mystery Spill,* 2004, p. 7.
[78] Incident Specific Preparedness Review (ISPR) M/V *Cosco Busan* Oil Spill in San Francisco Bay.2008, p. 13.
[79] ISPR, 2008, p 13.
[80] ISPR, 2008, p. 4.
[81] http://www.calepa.ca.gov/disaster/
[82] ISPR, 2008, pp. 8-10.
[83] Murphy, *Dalco Passage,* 2004, p. 3.
[84] ISPR, 2008, p. 44.

learned report prepared for DOE following the Dalco Passage spill also recommended re-evaluating GRP strategies to ensure effective utilization of available resources.[85]

Communication Breakdowns with Local Governments and Stakeholders

Another common theme highlighted the importance of communication with local stakeholders. In the Dalco Passage incident, local entities experienced delays in initial notification and information updates due to unstaffed positions, notably a Liaison Officer (LO). Lack of designated LO also allowed news releases to be disseminated without UC approval.[86] With the M/V *Cosco Busan* spill, local government representatives were not quickly identified nor was a multi-agency group created to coordinate spill response progress, which left not only local jurisdictions without spill information; it also left the response effort without local assistance that could have benefitted the effort. Finally, in both spills the UC appears to have had trouble identifying interested entities and their respective points of contact.[87]

Inconsistent Application of Area Contingency Plans

The notification delay in the Dalco Passage spill and the lack of UC cooperation with local agencies in the M/V *Cosco Busan* spill were attributable not to failures in the respective planning documents, but to a lack of adherence to those documents at key points. In the case of the Dalco spill, USCG and DOE duty officers received the first report of the spill at 1:30am, but delayed assessment until morning.[88] Consequently, relevant responding agencies and impacted stakeholders were unaware that a spill had occurred and deployment of response resources was delayed. The post-spill lessons-learned report notes that "[n]either of these decisions would be acceptable for a plan holder under the NWACP guidance."[89]

In the M/V *Cosco Busan* spill, the failure to identify a LGR and to form a multi-agency group was similarly inconsistent with pre-spill planning, both under California's ACP and the Memorandum of Understanding regarding spills between the California Office of Spill Prevention and Response and the City of San Francisco.[90] Not only did this inhibit local participation at the UC level, it forced all communication with local agencies to go through the LO, slowing information flows.

These examples illustrate that, no matter how thorough the planning process, errors can occur. Successful spill response depends not only on meticulous planning, but on familiarity with planning documents and frequent in-depth training of primary and back-up response personnel.

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[85] Murphy, *Dalco Passage,* 2004, p. 23-24.
[86] Murphy, *Dalco Passage*, p. 7, 12, 19
[87] Murphy, *Dalco Passage,* 2004, p. 12.
[88] Murphy, *Dalco Passage,* 2004, p. 7.
[89] Murphy, *Dalco Passage,* 2004, p. 7.
[90] *Cosco Busan Spill,* 2008, p. 14.

Part 3: Scenarios

3.1 Introduction/Rationale for use of scenarios

To aid in visualizing the spill possibilities in Snohomish County, the Team has developed four scenarios representing a range of credible threats. Three scenarios have been analyzed using the Trajectory Analysis Planner (TAP) designed by NOAA, in conjunction with Environmental Sensitivity Index (ESI) data. The fourth (a pipeline spill) incorporates elements that are outside the TAP model's domain but has been included due to its high relevance to County interests. Due to the challenges of accurately quantifying and assigning risk, as discussed in Section 2.5.3, the Team has not attempted to develop scenarios around that measure. The scenarios are not intended to exclude other possibilities, or even to suggest that these are the most likely sources of spills. Rather, they are meant to present a realistic, tangible set of spill events which could have significant impacts to Snohomish County and its resources, and to serve as a catalyst for dialogue within the County and between the County and outside agencies on issues related to spill preparedness and response. The Team believes this dialogue will enhance understanding of spill response strategies and capabilities, promote information sharing, and result in a more synchronized response in the event of a large spill in Snohomish County's waters.

3.2 How identified threats led to these scenarios

The potential spill sources identified in Section 2.5 and the historical spill information for Snohomish County obtained from the USCG were compared to statewide data in a DOE-sponsored study, *Oil Spill Risk in Industry Sectors Regulated by Washington State Department of Ecology Spills Program For Oil Spill Prevention and Preparedness.* The study reported that (in terms of volume) pipelines, cargo vessels, and oil tankers were responsible 93 percent of oil spilled in Washington waters from 1995-2008.[91] Note that this percentage is skewed by the dominating influence of the Bellingham pipeline spill in 1999, a one-time event that spilled 237,000 gallons of gasoline.

The study also found that the oil tanker industry sector had the greatest (76 percent) worst-case discharge (WCD) potential in Washington State from 1995-2008, followed by cargo vessels, and oil tug-and-barge combinations.[92] WCD is defined as the largest possible release of oil from a source (e.g. all the oil in tanker).

After compiling this information, the Team determined that spills based on a barge, a cargo ship, a fishing vessel (a reflection of the fact that 90 percent of spills in the state are less than 1,000 gallons[93] and the large number of fishing vessels operating in Snohomish waters), and a pipeline breach effectively reflected the threats as defined by WCD and historical spillage. In total, these scenarios are intended to represent a cross-section of possible spills within Snohomish County in terms of source, location, volume

[91] Etkin, D., 2009. *Oil Spill Risk in Industry Sectors*, p. 7
[92] Etkin, 2009, *Oil Spill Risk in Industry Sectors* p. 7
[93] JLARC, 2009, p. 1

and type of oil spilled; they should not be interpreted as representative of all possible risks, or even the most probable spills.

3.3 The Trajectory Analysis Planner

3.3.1 Basic Information

TAP is a statistical model designed by NOAA's Office of Response and Restoration, located at Sand Point, WA; the Puget Sound region is one of only four locations in the country for which data has been compiled and modeled.[94] TAP uses a multi-year database of regional environmental conditions (such as weather, tides, and currents) to forecast a range of probabilistic spill outcomes. Unlike the GNOME model, which computes the specific trajectory of an individual spill, TAP is not intended to be used in a spill response, but instead to provide planners with pre-spill awareness of possible trajectories. The model allows the user to specify which of five modes to use, and to select season, spill volume, level of concern (see Section 3.3.2 for additional information), and the time window of interest (from 3 to 'greater than 48 hours' post-spill). Informed by the user's choices, each simulation is run 500 times, using a randomized selection of environmental conditions, in order to create a statistical representation of outcomes.[95] More complete information may be obtained by consulting *The NOAA Trajectory Analysis Planner: TAP II* and the *TAP II 1.1 User Manual*; both are available from NOAA.

For the purposes of this paper, the Team has confined itself to two of the available modes: Shoreline Impact Analysis (SIA) and Response Time Analysis (RTA). SIA depicts all segments of shoreline modeled to potentially be at risk of oiling by a user-defined amount of oil (the level of concern), and the probability of that oiling, given the initial inputs. RTA calculates the amount of time until a site expected to be oiled can expect to have oil come ashore. Resources impacted by the oil have been determined by overlaying the TAP outputs with data from the relevant ESIs (the technical work of combining the outputs was performed by Jill Petersen, NOAA ORR).

It is worth mentioning that, as a statistical model, TAP's predictive power is limited by the data available to it; the occurrence of events and conditions which do not appear in its data set will create outcomes which TAP cannot foresee. Although the model has 10 or more years of data at its disposal, its range is finite and planners should be aware that outcomes different from those represented by the limited set of spill scenarios included in this report are possible.

3.3.2 Trajectory Discussion and Assumptions

In order to develop modeled information that is both useful and manageable in the context of this report, we have limited our included examples and analysis to the April-

[94] Incident Specific Preparedness Review (ISPR), Part 1, M/V *Cosco Busan* Oil Spill in San Francisco Bay. 2008, p. 32

[95] Barker, C., (1999) *The NOAA Trajectory Analysis Planner: TAP II*, p. 2, 3.

June period (determined to be the season of highest environmental impact in Snohomish County waters).[96] The time window has been set to 48 hours after the spill and the level of protection to 90 percent. (This means that 90 percent of spills will reach a particular location in 48 hours or more. Increasing the level of protection has the effect of decreasing the amount of time needed for oil to reach a particular location.) The 48-hour time window was chosen in order to allow the model to capture the maximum possible extent of the scenario spills. We recognize that seasonal variations in the spill extent and species affected will not be captured by this approach, and that light oils such as diesel or gasoline will have already begun to dissipate within 48 hours, possibly masking the full extent of spills in those cases. Finally, because determining the volume of oil required to produce a negative effect on a range of species is complicated and the results highly variable, we have attempted to simply maintain a consistent Level of Concern (LOC) across the scenarios. (The LOC is the volume of oil deposited on an individual shoreline segment, each approximately 1-2 kilometers in length. The maximum resolution achievable by the model is 1/1000 of the amount of oil spilled.) The maximum resolution for Scenario 1 results in a LOC of 25 gallons; this level has been repeated for Scenario 2 (which has a much smaller volume) to facilitate comparison. Scenario 3's volume is much larger, requiring a return to the model's maximum resolution and producing a LOC of 250 gallons. Maintaining this level throughout was considered but rejected as unrealistic for the smaller spills. The Team expects that the County will wish to collaborate with ORR to further define and understand the possible impacts of a spill under a variety of conditions.

Additionally, the ESI data used are not limited to Snohomish County waters but include the waters (and thus the resources) of neighboring counties where spill trajectories overlap County boundaries – at least one other county is affected in all cases, and in some cases up to three. While we realize that this is not ideal for determining County-specific resource impacts, there are benefits in terms of highlighting the need for cross-boundary cooperation. Data on affected ecological and economic resources was drawn from ESI maps prepared by NOAA.

3.4 Description of scenarios

When visualizing each scenario, it could be tempting to dismiss it as unlikely. Recall, then, the work of sociologist Charles Perrow and psychologist James Reason. Reason created a well-known framework for considering accidents, referred to as the 'Swiss Cheese' model, wherein multiple layers of defense serve as a barrier between dangerous hazards (in this case, oil spills) and surrounding people and assets. Like a piece of Swiss

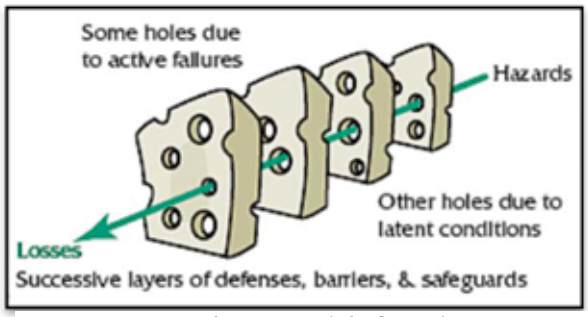

Figure 23: Swiss Cheese model of accident causation. Adapted from Reason. (1997)

[96] Etkin, 2009, p. 16-17

cheese, each layer has 'holes' caused by latent weaknesses and the lapses of persons charged with maintaining the layer. Accidents occur when holes in all the defense layers align.[97] The marine transportation system could in fact be particularly prone to these types of accidents; according to Perrow, marine accidents such those in the scenarios below should not be surprising, but should rather be expected because of the inherently error-inducing nature of the marine transportation system.[98]

The scenarios described herein use realistic parameters and were chosen to demonstrate the impact that oil spills might have on important Snohomish County resources. Each was sited where the spill source could reasonably be present (e.g. the cargo ship collision occurs near the Clinton-Mukilteo ferry route), and reflects a type and amount of oil corresponding to the spill source. Below are non-specific examples of the types of questions the Team hopes will be raised by the scenarios (note that not all questions involve direct action on the County's part but can still affect the County's interests and therefore deserve consideration):

- What resources are at risk, and do current GRPs provide adequate coverage for spills in this location? What sites will be prioritized after the first 24 hours?
- Will the spill significantly affect local or regional transportation?
- How can Snohomish County ensure that local priorities are understood and respected?
- How will response efforts with neighboring counties be coordinated, given the shared waterways? Are points of contact for their corresponding agencies known?
- What access points can responders use to launch containment and recovery activities? Have staging areas been pre-identified?
- Is there a public communication strategy in place? Is it appropriate for an oil spill event?
- Will the spill significantly affect local and tribal fisheries?
- What stakeholders will be most affected and how will they react to a spill?
- How will oily waste storage, transportation, and disposal affect the County?

The individual scenarios each contain further questions related to their particular details.

Scenario 1: Cargo vessel/ferry collision

- Location: Possession Sound, between Mukilteo and Clinton
- Counties Affected: Snohomish, Island
- Product Spilled: 25,000 gallons of intermediate fuel oil

[97]Reason, James. 1997. "Hazards, Defenses and Losses" *Managing the Risks of Organizational Accidents.* Ashgate. pp. 1-20.

[98]Perrow, Charles. 1999. "Marine Accidents," *Normal Accidents: Living with High Risk Technologies*. Princeton, NJ: Princeton University Press.

- Initiating Event: Collision between a Washington State Ferry (WSF) and an inbound cargo vessel
- Rationale for this scenario:
    - 94 freighters called at the Port of Everett in 2010,[99] a number expected to grow as the Port continues its efforts to increase business.[100] Ships entering and leaving the Port cross the Clinton/Mukilteo ferry lanes at right angles to ferries that transit up to four times an hour, 21 hours per day.[101] Despite existing traffic procedures intended to provide separation between shipping, a collision risk exists in the event of a mechanical or procedural failure. An example of such an event is the M/V *Cosco Busan*, which spilled over 50,000 gallons of IFO after colliding with the San Francisco Bay Bridge in heavy fog in 2007.[102]
- Suggested discussion points for this scenario:
    - This event could involve search and rescue or national security (in the event of terrorist involvement) in addition to oil spill response. How would this affect the County?
    - How should the County be involved if closures of public beaches at Mukilteo and Picnic Point are necessary?
    - What would be the economic impact of an extended closure of traffic to the Port of Everett?
    - What are the consequences if the spill enters the northern reaches of Port Susan, impacting public and private shell-fishing.
- Shoreline Impact Analysis and Response Time Analysis output maps are attached as Figures 24 and 25, respectively.

Scenario 2: Fishing vessel sinking

- Location: Slightly southeast of Gedney Island
- Counties Affected: Snohomish, Island
- Product Spilled: 500 gallons of diesel
- Initiating Event: Vessel collides with rocks, rupturing fuel tanks and causing the vessel to sink
- Rationale for this scenario:
    - The Port of Everett and Tulalip Bay are home to a substantial commercial fishing fleet. Fishing vessels pose a potential threat because they typically carry hundreds or thousands of gallons of fuel. Past accidents involving

[99] Port of Everett - Cargo Statistics.(n.d.).*Port of Everett - Home*. Retrieved from http://www.portofeverett.com/home/index.asp?page=167
[100] Madura, E. (2001, Jan 7). Facility Security Officer. Personal Communication
[101] Winter 2011 Sailing Schedule for Mukilteo / Clinton. (n.d.).*Washington State Department of Transportation*. Retrieved from http://www.wsdot.com/Ferries/Schedule/ScheduleDetailByRoute.aspx?route=muk-cl
[102] ISPR: *Cosco Busan, 2008.*

such vessels have included the F/V *Angel Rae*, which spilled 665 gallons of diesel when it sank near Seattle in 2009.[103]

- Suggested discussion points for this scenario:
  - How should fuel remaining in the vessel's tanks be addressed?
  - How can the Snohomish estuary be protected?
- Shoreline Impact Analysis and Response Time Analysis output maps are attached as Figures 26 and 27, respectively.

Scenario 3: Barge aground

- Location: West of the mouth of Possession Sound
- Counties Affected: Snohomish, Island, Kitsap, King
- Product Spilled: 250,000 gallons of crude oil
- Initiating Event: A laden oil barge inbound for a refinery in southern Puget Sound parts its tow line and goes aground west of the mouth of Possession Sound
- Rationale for this scenario:
  - Tank barges carrying crude oil transit south through Admiralty Inlet en route to refineries in Tacoma. These barges are towed by a tug and typically carry up 420,000 gallons of crude oil. The high volume of oil carried and their varied routes make tank barges a potential threat to Snohomish County.
- Suggested discussion points for this scenario:
  - How should the County be involved if closures of public beaches at Mukilteo and Picnic Point are necessary?
  - What would be the economic impact of an extended closure of the Port?
  - How might County interests at Edmonds Underwater Park, Brackett's Landing Marine Protected Area, and Edmonds marsh be affected?
  - What coordination will be required between ESCA and Snohomish DEM? Between Snohomish and King County?
- Shoreline Impact Analysis and Response Time Analysis output maps are attached as Figures 28 and 29, respectively.

[103]Ecology fines boat owner $5,500 for spill in Duwamish sinking. (2010, April 21). *Washington State Department of Ecology News Release*. Retrieved from http://www.ecy.wa.gov/news/2010news/2010-074.html

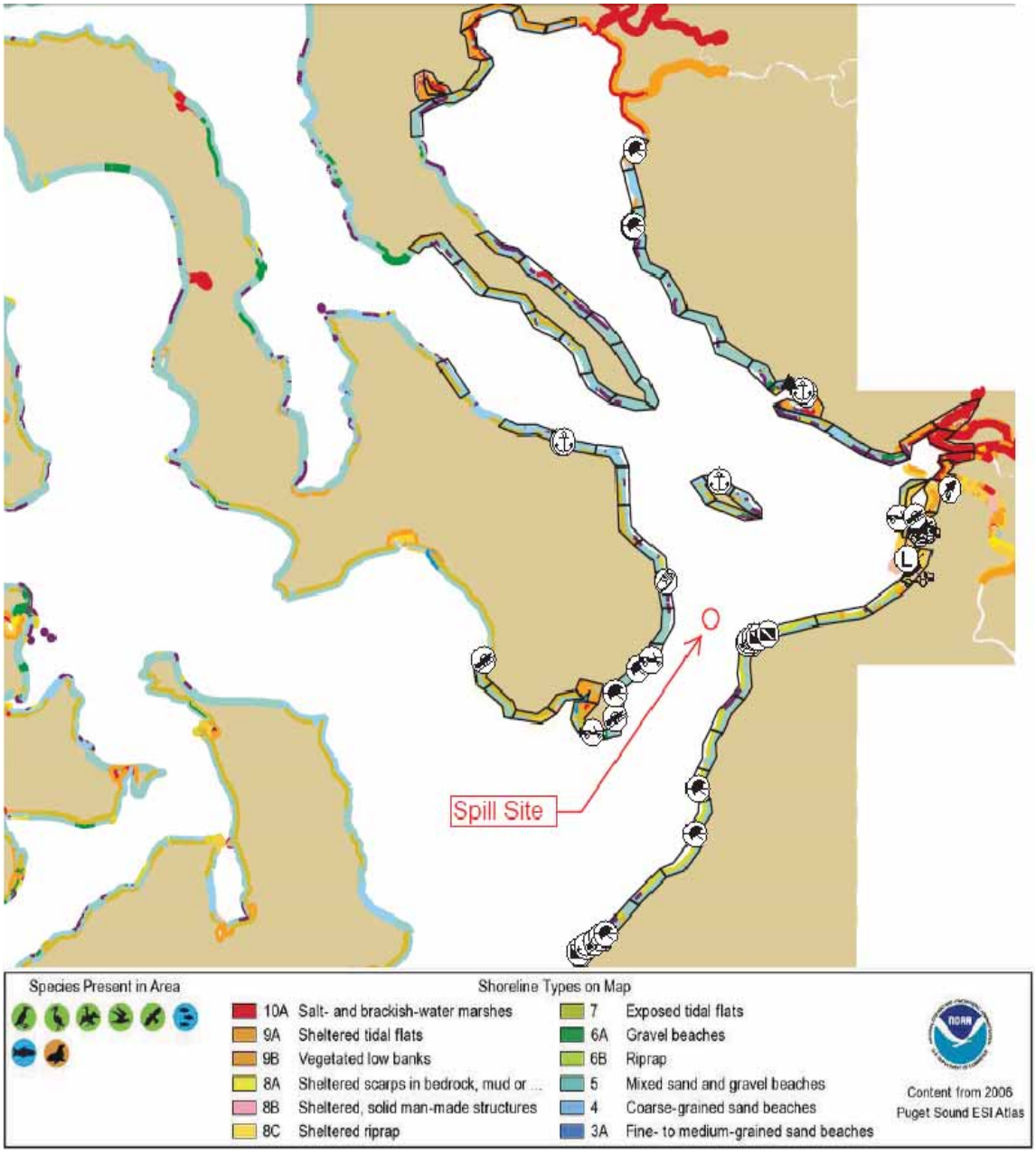

Figure 24: TAP output with ESI overlay, Shoreline Impact Analysis mode, Scenario 1 – Cargo vessel

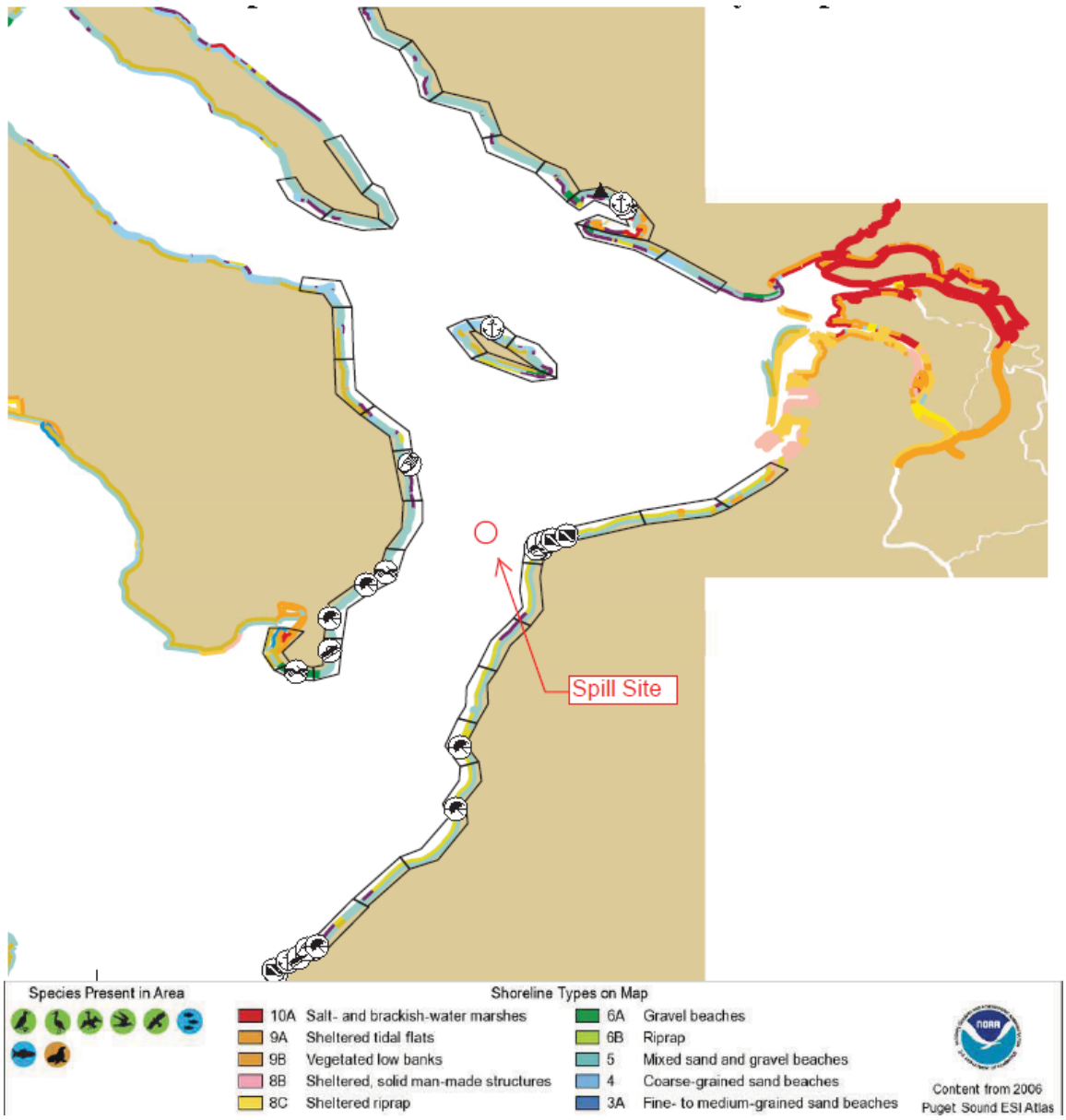

Figure 25: TAP output with ESI overlay, Response Time Analysis mode, Scenario 1 – Cargo vessel

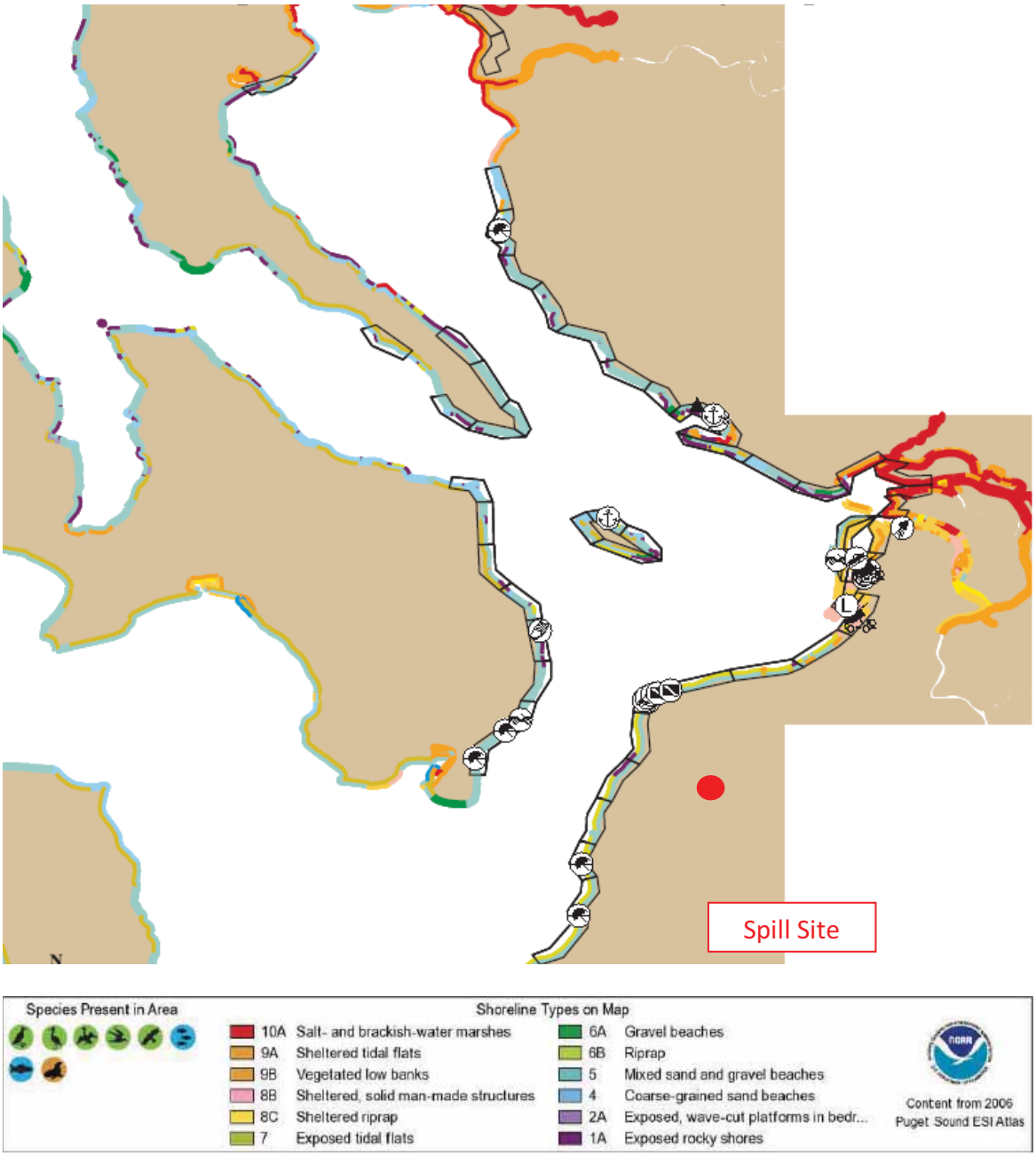

Figure 26: TAP output with ESI overlay, Shoreline Impact Analysis mode, Scenario 2 – Fishing vessel

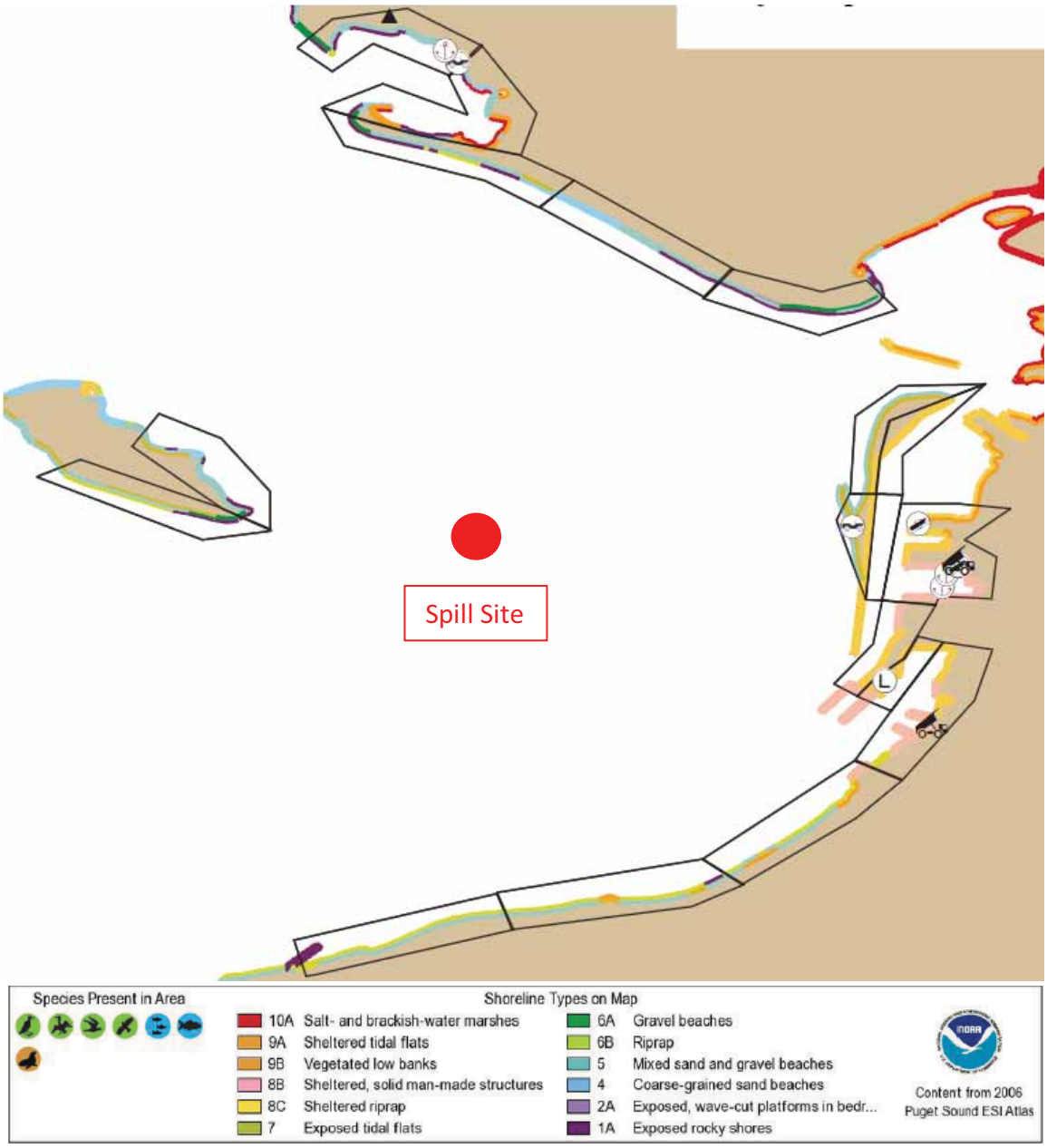

Figure 27: TAP output with ESI overlay, Response Time Analysis mode, Scenario 2 - Fishing vessel

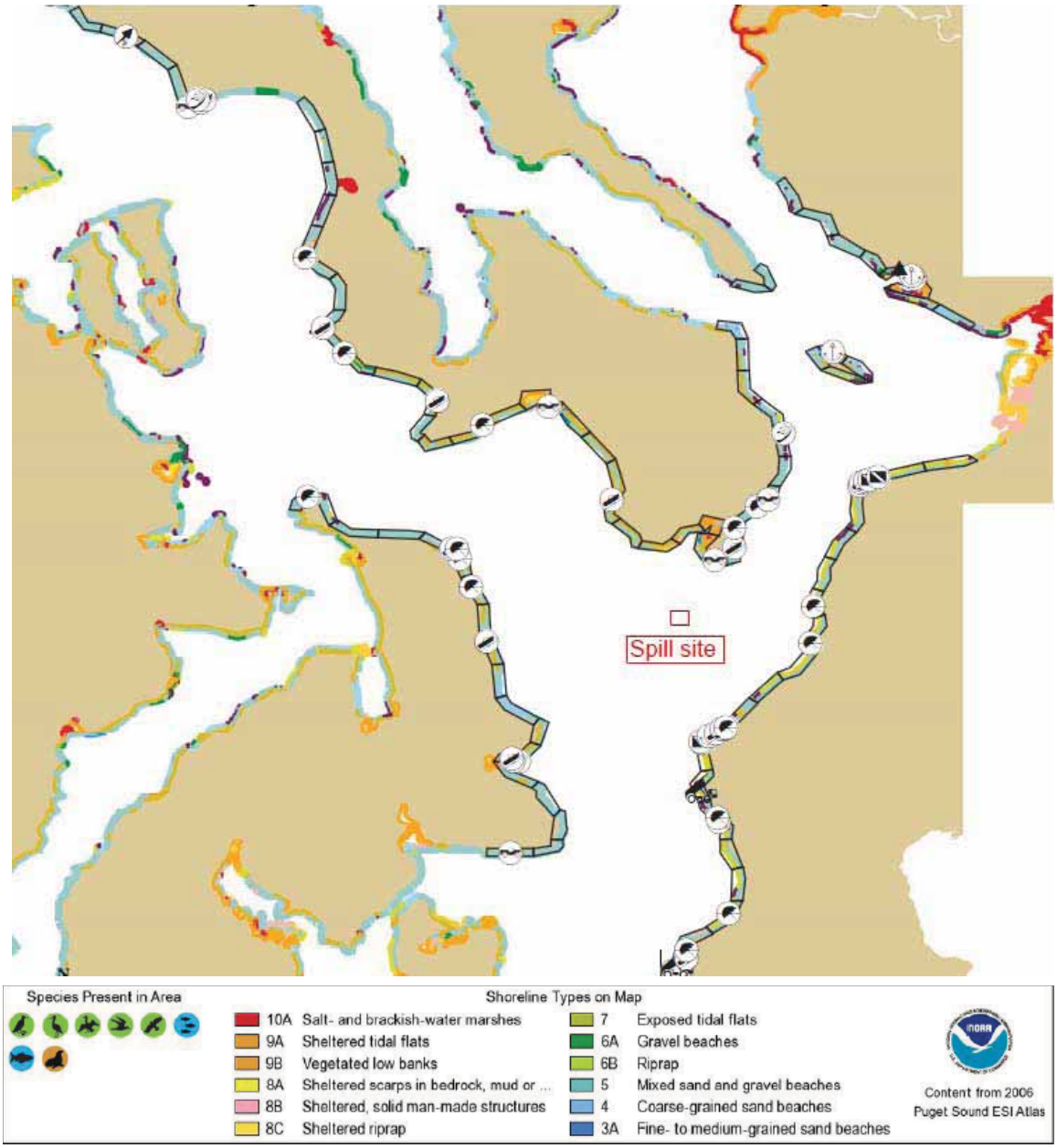

Figure 28: TAP output with ESI overlay, Shoreline Impact Analysis mode, Scenario 3 - Barge

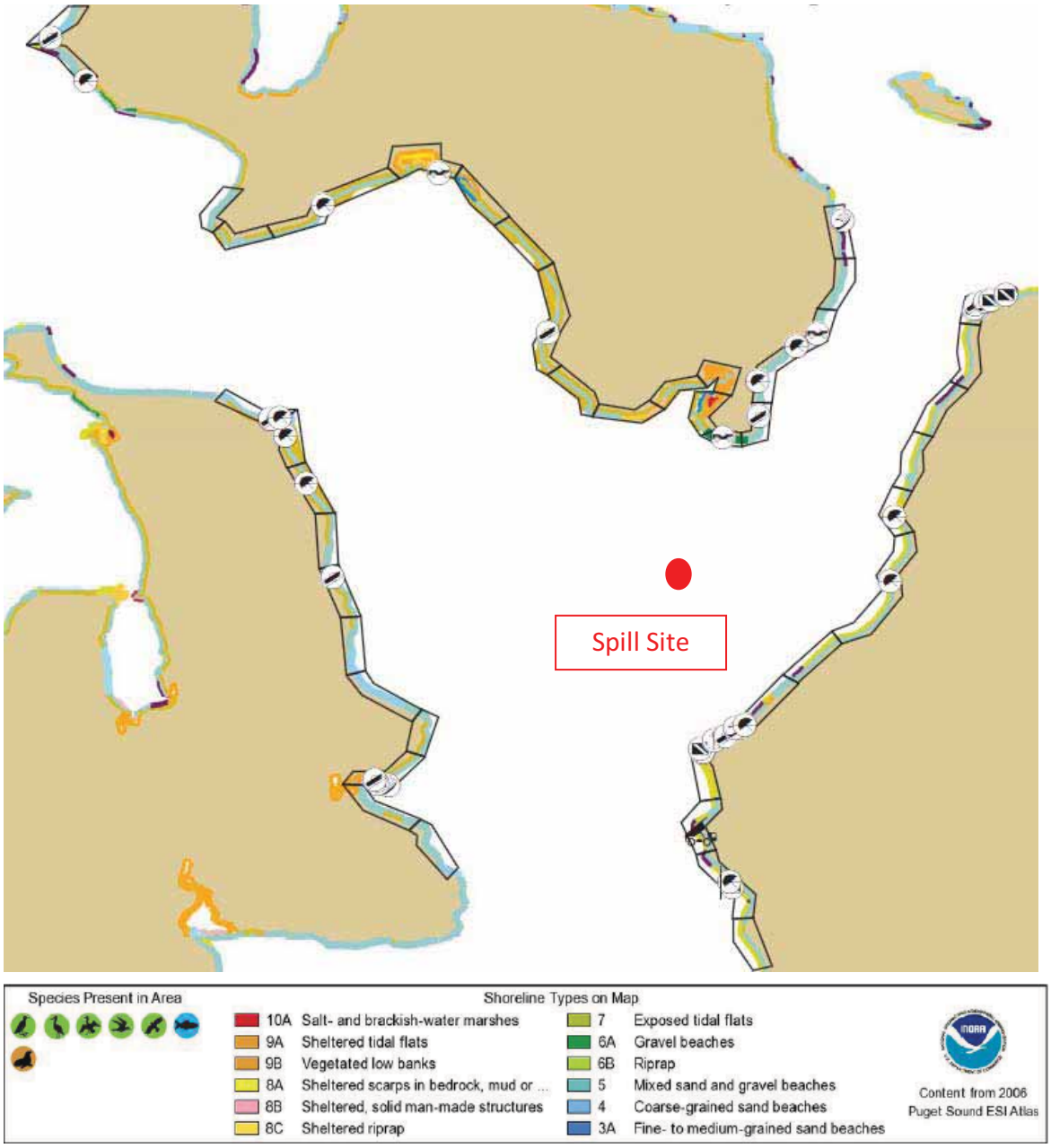

Figure 29: TAP output with ESI overlay, Response Time Analysis mode, Scenario 3 - Barge

Scenario 4: Pipeline breach

- Location: I-5 crossing over the Stillaguamish River, approximately 10 river miles upstream from the river mouth
- Counties Affected (estimated): Snohomish, Island
- Product Spilled: 168,000 gallons of diesel
- Initiating Event: An earthquake ruptures a section of pipe over the river. Valves at either end of the segment close as expected, but all fuel in the segment is spilled.
- Rationale for this scenario:
    - The Olympic Pipeline carries millions of gallons of gasoline, diesel, and jet fuel across Snohomish County through its 16- and 20-inch pipes daily, and poses a threat to the County's marine resources because it crosses the Stillaguamish River approximately 10 miles upstream from ecologically sensitive Port Susan, as well as the Snohomish River at multiple points.[104] A 1999 Olympic pipeline rupture in Bellingham released 237,000 gallons of gasoline into Whatcom Creeks, killing three people.[105]
    - This scenario has not been modeled with TAP because the river is outside the model domain.
- Suggested discussion points for this scenario:
    - How might cross-boundary coordination between inland and maritime response agencies be managed?
    - How will major stakeholders such as The Nature Conservancy be involved?
    - How will the County manage a river spill with limited access points, and then transition to a marine spill as the fuel reaches Port Susan?
    - What will be the impact to aquaculture and recreational clamming at the head of Port Susan Bay if there is a shellfish harvest ban?
    - How would the County engage in consideration of the threat to a federally-listed salmon species?
    - If Port Susan achieves MPA-status, how will that affect response strategies for the area?

[104]Olympic Pipe Line - about us.(n.d.)*Olympic Pipe Line - home*. http://www.olympicpipeline.com/aboutus
[105]City of Bellingham.(2010) Olympic Pipeline Incident. Retrieved December 5, 2010, from www.cob.org/services/environment/restoration/olympic-pipeline-incident.aspx

3.5 Scenario Analysis

3.5.1 Biological Resources Affected

Figures 32-34 below represent the aggregated data from the TAP model for scenarios 1-3, combined with ESI information about biological and socio-economic resources affected, as well as the amount and type of shoreline at risk. Scenario 4, the pipeline spill, will be addressed separately. The column labeled 'Max' indicates the maximum extent of the spill as derived from the Shoreline Impact Analysis output. Note that, as mentioned in Section 3.3.2, lighter oils will have already begun to evaporate within the 48-hour window which may cause the maximum extent to render more conservatively than if a shorter time period was chosen. The County should examine this possibility in greater detail.

Biological Resources		Scenario					
		Cargo ship		Fishing vessel		Barge	
		<48 hrs	Max	<48 hrs	Max	<48 hrs	Max
Birds	Alcids	X	X	X	X	X	X
	Diving	X	X	X	X	X	X
	Gull/tern	X	X	X	X	X	X
	Pelagic	X	X	X	X	X	X
	Raptor	X	X	X	X	X	X
	Wading	X	X		X	X	X
Fish	Diadromous	X	X	X	X	X	X
	Pacific Herring	X	X	X	X		X
	Sand lance	X	X	X	X	X	X
	Surf smelt	X	X	X	X	X	X
Mammals	Pinnipeds	X	X	X	X	X	X
Invertebrates		X	X	X	X	X	X
Vegetation		X	X	X	X	X	X

Figure 30: Species of State or Federal Concern present in areas potentially affected by oil. Adapted from *Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.* The white-filled boxes in the table indicate scenarios that do not impact the indicated group or species.

The Biological Resources included in Figure 30 are wildlife types known to be present in the region during the April-to-June time frame, are susceptible to oil injury, have a particular life stage during that time period which places them or their offspring at heightened risk, or are identified by the State or Federal government as Species of Concern, Threatened or Endangered. The effects of different types of oil on the categories of resources shown above were discussed in Section 2.2.1. The fact that nearly all are at risk, however, in both the less-than-48-hour and the Maximum Spill Extent windows for all four scenarios is indicative of two points:

1) the species are widespread in Snohomish waters and therefore are exposed to risk by almost any oil spill; and,
2) large oil spills in County waters, regardless of oil type or location have the ability to spread to much of the County's shoreline.

3.5.2 Shoreline Affected

Figure 31 depicts the amount of shoreline which TAP calculates to have a 1 percent or higher chance of being oiled in amounts at least equal to the Level of Concern for each scenario. To preclude the possibility of double-counting shoreline which consists of more than one type (NOAA data identify multiple shore types where appropriate for greater accuracy), we have used ESI shoreline length, which counts only the most sensitive shore type for any given length of shoreline, resulting in an accurate measure of the actual shore length. For reference, the total actual shore length in Snohomish County is approximately 248,000 meters, a substantial portion of which lies in the deltas of the Skagit, Stillaguamish, and Snohomish Rivers and is not impacted by the first three spill scenarios.[106] As a reminder, the totals below include the shoreline of other counties, where they are impacted by the spill.

Shoreline Potentially Affected

Shoreline Type	Length Affected (in meters)					
	Cargo ship		Fishing vessel		Barge	
	<48 hrs	Max	<48 hrs	Max	<48 hrs	Max
Rocky or steep	665	1,417	938	938	1,266	5,071
Flats (mud or sand)	13,470	64,719	9,230	23,390	44,454	59,684
Beaches (sand/ gravel)	72,503	133,040	21,945	80,094	83,359	174,558
Vegetated	4,175	28,110	2,356	12,386	5,273	8,646
Armored	39,407	79,849	27,892	54,539	35,320	65,648
Total	130,220	307,135	62,451	181,347	169,636	313,607

As seen by the category totals in Figure 31, all modeled spills have the potential to affect

Figure 31: Shoreline length potentially at risk. Adapted from Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.

tens of thousands of meters of shoreline. Figure 32 depicts the area of the three most sensitive types of natural shoreline which are at risk from the three scenarios[107] (1,000,000 square meters equals 1 square kilometer). Such widespread presence of oil

[106] NOAA, 2006, *Environmental Sensitivity Index.*
[107] NOAA, 2006, *Environmental Sensitivity Index.*

suggests that impacts to all forms of wildlife will not be localized to the immediate vicinity of the spill, but will instead affect much broader population segments.

Maximum Extent of Shoreline Potentially Affected (m^2)				
	Marsh	Sheltered tidal flats	Exposed tidal flats	Total
Cargo ship	2,925,678	2,894,738	3,076,946	8,897,362
Fishing Vessel	1,553,821	596,676	656,969	2,807,466
Barge	351,251	913,650	4,856,252	6,121,153

Figure 32: Square meters of shoreline potentially at risk. Adapted from Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.

While not all affected shorelines are within the County, a comparison of Figures 24, 26, 28, and 30 demonstrates that Snohomish County is broadly represented in the totals. These Figures also show that all three scenarios affect approximately the same geographic regions, implying that spills of these magnitudes are likely to affect a significant amount of the County's shore, again regardless of the spill location or oil type. That the less-than-48-hour affected regions are one-third to one-half the maximum possible spill extent indicates the value of a rapid, well-planned, and well-executed response. Figure 32 indicates that Scenario 1 (Cargo ship collision) endangers the largest geographic area. The County should consider exploring additional scenarios using modeling tools to more fully evaluate threats and responses to spills affecting its shorelines.

3.5.3 Socio-economic Resources Affected

Natural resources are not the only resources at risk from an oil spill; historical, cultural, and economic resources are affected, as well. On the next page, Figure 33 identifies broad categories of socially valuable sites in the region and totals the number of each at risk from Scenarios 1-3.

Socio-economic Resources Potentially Affected						
Type of Resource	Number of Sites Affected					
	Cargo ship		Fishing vessel		Barge	
	<48 hrs	Max	<48 hrs	Max	<48 hrs	Max
Access points	2	3	1	2	2	5
Aquaculture sites	2	2	1	1	3	5
Archaeological sites	0	1	0	1	0	1
Beaches	6	9	0	5	12	16
Boat ramps	3	7	2	4	8	11
Commercial fisheries	3	3	3	3	3	3
Recreational diving sites	7	9	0	5	8	9
Equipment staging areas	0	2	2	2	1	1
Ferry landings	3	3	0	2	4	5
Indian reservations	2	2	2	2	1	2
Lock and dam	1	1	1	1	1	1
Log storage	0	1	1	1	0	0
Management areas	2	2	0	0	2	5
Marinas	3	6	3	4	2	5
Public parks	2	2	0	1	2	7
Recreational fisheries	3	3	3	3	3	3
Total	39	56	19	37	52	79

Several observations are possible, based on this table. First, many locations of public use and interest are at risk, requiring that the County be prepared to manage those resources during and after the response to protect public health and safety. Second, many of the sites constitute valuable economic resources on which the County and the

Figure 33: Socio-economic sites potentially affected. Adapted from Environmental Sensitivity Index - Washington: Puget Sound & Strait of Juan de Fuca Atlas.

public depend – for example, marinas, aquaculture sites, and ferry landings. Third, there is a marked difference between the number of sites affected after 48 hours and those affected by the spills' maximum extent. This fact alerts the County to the both the need to act quickly in the event of a spill, and also to prioritize sites of interest considering the full potential extent of impacts. If a location is unlikely to be affected in the short-term, it may be possible to focus on protecting areas which are more immediately at risk.

To the extent that any or all of these resources may be unavailable for use during or after a response, the County's economic base may be damaged. It is in the County's interest to determine the extent to which this is true, and to use that knowledge to guide its planning efforts. It is also worth noting that the Figure 33 resource list is incomplete. Aside from its marina, the Port of Everett is not listed among the resources

at risk, although a prolonged closure of Possession Sound could clearly impact its operations – as was recognized in a 2005 DOE-sponsored paper on the economic impacts of oil spills in Washington.[108] The County should evaluate how to best fully incorporate social and economic resources of concern into area spill response plans.

3.5.4 Scenario 5 – Pipeline Spill on the Stillaguamish

Hypothesized distribution and impacts of the spill

Port Susan and the Stillaguamish River are outside the domain of the TAP model, therefore, it is not possible to model spill movement in this area. However, NOAA's ADIOS 2 planner (a model for predicting oil fate but not its transport or movement) suggests that 50 percent of the oil will have evaporated or dispersed (depending on wind speed and wave action) within 2-3 days after the spill.[109]

The oil from this scenario would affect both the river and the Port Susan area:

1. Oil within the river. The pipeline crossing is approximately 10 river miles upstream from the river mouth. The Stillaguamish will likely be flowing quickly in spring; a spill of this magnitude will probably oil the shoreline from the spill source to the river mouth. The main body of oil would reach the mouth of the river within 6-12 hours of being spilled under high flow conditions. Birds, shoreline wildlife, and shoreline habitats will be at risk from both mechanical oiling (i.e. physically contaminated with oil) and toxicity.
2. Oil in northern Port Susan. The spill produces a concentrated pulse of diesel which will flow downriver to the mouth. The quantity of oil spilled from the pipeline is probably sufficient to have toxic effects on birds and marine life in a highly sensitive and ecologically valuable area. Given the quantity, the potential for mechanical oiling exists as well.

A pipeline spill could result in a significant risk to highly sensitive resources in Port Susan, an area of particular concern to the County. A spill that involves both an extensive reach of river habitat in addition to marine resources will also present unique response and management challenges. The County should consider a more detailed evaluation of pipeline spill scenarios to conduct a more complete analysis than was possible during this report.

3.5.5 Conclusions from Scenarios

The TAP model outputs combined with the Environmental Sensitivity Index data make clear that oil spills have the potential to significantly affect Snohomish County natural

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[108] Etkin, D. (15 November 2005). *Socioeconomic Cost Modeling For Washington State Oil Spill Scenarios: Part II.* Washington Department of Ecology. p. 12.

[109] Dispersal is the process by which oil loses its form as a coherent, identifiable substance on the water's surface and becomes entrained in the water column as minute particles. Dispersal does not imply that the oil ceases to have an environmental impact, but rather that it is beyond the capabilities of mechanical recovery.

and economic resources, and provide insight into the outcomes of a pipeline spill on the Stillaguamish River. The trajectories indicate that regardless of the delivery method, spill volume, oil type, or spill location, the potential exists for widespread impacts. Numerous sites of economic and cultural value may be damaged.

By employing pro-active planning and prioritization to facilitate a rapid, well-organized response, the County can help to avoid the worst outcomes.

4.1 Reports on Gaps Observed

The following section describes four major gaps identified through conversations with spill response professionals, review of existing planning documents (such as the NWACP), and consideration of lessons learned from comparable spills (Dalco Pass and M/V *Cosco Busan*). These gaps represent areas where Snohomish County could take action in order to improve oil spill planning and response. The gaps include: Participation in the Planning Process, Communication Between Agencies and the Public, Developing and Communicating Local Knowledge, and Volunteer Utilization.

4.2 Potential Gap: Participation in the Planning Process

In the event of an oil spill in Snohomish County, the NWACP will come into effect as will the relevant GRPs. The NWACP is the primary guidance document for oil spill response in the Northwest, and the GRPs contain site specific response tactics (see sections 2.4.3 and 2.4.4 for more details). Snohomish County waters are covered by three different GRPs, namely, North Central Puget Sound, Central Puget Sound, and Admiralty Inlet/Hood Canal. These plans are considered living documents and undergo development during pre-spill times with the aim of providing the most up-to-date information and incorporating the perspective of local governments as an important stakeholder and partner.[110,111] As Figure 34 shows, this feedback loop provides opportunities for the County to become more active in the planning process.

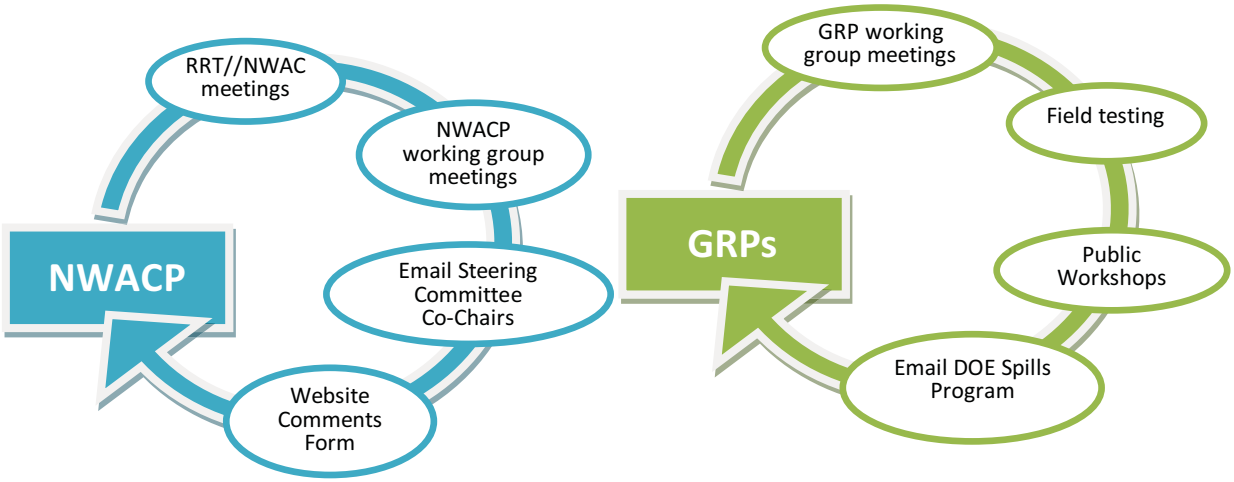

Figure 34: Ways for the County to provide feedback to the oil spill planning processes

[110] Region 10 Regional Response Team/ Northwest Area Committee. (2008). *2005 Strategic Plan (March 2008 Revision).* RRT10.

[111] Department of Ecology Spills Program. (2009). *Spill Prevention, Preparedness and Response Program: Program Plan 2009-2011.* Department of Ecology.

Benefits of Participation in the Planning Processes

Representatives from a wide range of groups including tribes, the public, industry, and response contractors attend Northwest Area Committee (NWAC) meetings and the NWAC working group meetings on specific issues, including GRPs. These meetings are an opportunity for County representatives to network, exchange information and develop new ideas for spill preparedness in Snohomish County. The ideas brought back to the County will help to build local capacity for oil spill response through familiarity with the most current technologies and strategies that RRT/NWAC are considering. As an example, some response strategies like in-situ burning and dispersant use require RRT approval. By attending planning meetings with the RRT, a County representative would have more information about the RRT stance on the use of these strategies, and could inform critical decision-making. Further, the NWAC meetings are an opportunity to build personal relationships with people and organizations that will be involved with the response, should a spill that exceeds local capacity occur. Levels of trust and understanding can play a major role in whether or not agencies will work together effectively to contain and clean-up a spill.[112]

Another benefit to being involved in the planning process is the opportunity to become more familiar with plan-holding entities in Snohomish County and their state of preparedness. There are numerous ways to be involved in this regard, such as participating in industry self-assessing drills, DOE-sponsored WCD drills or plan-holder tabletop exercises.

Getting County input into the planning process is already a stated priority for both the NWAC and the DOE. In the most recent available RRT/NWAC strategic plan, Objective 4 specifically calls out increased stakeholder participation and working relationships as a goal for the committee. Strategies for achieving these include encouraging stakeholders to become involved in the workgroups and task forces, and assisting local Emergency Response Commissions in developing contingency plans.[113] The DOE spills program has a similar mission outlined in their strategic plan. They plan explicitly to "continue to seek data from local communities on the resources that are prioritized for inclusion in GRPs" and to "enhance the capability of local and tribal response personnel to support Unified Command operations."[114]

Participation in the planning process is a way to ensure the representation of County priorities and concerns in the event of a spill. Participation in this process also ensures that Counties systematically review the content of these plans. If the plan does not accurately represent the situation locally, the County is then aware of the error and best suited to correct the plan. Non-participating counties are less likely to review existing plans, and thereby more likely to be affected by flaws therein. Outside of correcting

[112]Knight, J. (2011, February 14). Personal Communication.
[113]Region 10 Regional Response Team/ Northwest Area Committee. (2008).
[114] DOE Spills Program, 2009, *Spill Prevention Program Plan*

errors, Counties are also able to actively promote certain resources as priorities for protection during a response by participating in the planning process. In the event of a major spill, responders will use the information contained in the NWACP and the GRPs directly. The effectiveness of the response will only be as good as the planning that went into it in pre-spill times.

Challenges to Participation in the Planning Process

While the case for participating in the planning process is strong, it is not without its challenges. One major challenge is balancing and accurately representing constituents' priorities. The County's input will be more effective if it is presented as a consensus of opinion, but the reality is that even among County groups, the list of priorities and concerns will vary. Coordinating a strategy for NWACP and GRP plan input will require some dedicated manpower and political effort.

DOE budget cuts will affect programming across the state. Due to an Oil Spill Account shortfall, DOE's budget for oil spill preparedness activities has been reduced by approximately $2 million dollars.[115] One of the areas hit by the staff cuts is the Drills Program. Specifically, DOE will no longer design, participate or evaluate worst-case drills and annual tabletop drills. For the time being, industry will self-certify these drills. The Spills program will continue deployment drills and unannounced vessel notification drills with lesser frequency.[116] These changes will reduce the opportunities for the County to participate in drills or have an exercise in Snohomish County itself. Additionally the County is not guaranteed access to plan-holder exercises, and participation on this level may require relationship building to acquire the necessary level of trust.

Despite the RRT/NWAC and the DOE's stated commitment to increasing stakeholder participation and outreach, their meeting schedule is not immediately clear or available. Because sending a representative to the meetings will require some advance notice and coordination, this could hinder County participation. The schedule for field testing and revising GRPs is also not immediately clear or available. The DOE will facilitate field tests for specific strategies on request, but as mentioned earlier, is operating on a constrained budget.[117]

Each GRP during revision has a 30-day timeframe for public comment. Once the 30-day timeframe ends, the GRP is published and comments are closed until the next revision of that particular GRP. The Central Puget Sound GRP's last public review was from 5/31/2007 to 6/30/2007 and received comments from 8 sources. The North Central Puget Sound GRPs last public review ended in March of 2009 and also received

[115]Office of Financial Management. (2011). Key Ecology Budget Reductions. OFM. Retrieved February 18, 2011 from http://www.ecy.wa.gov/services/fs/20101220_reductions.pdf

[116]Department of Ecology. (n.d.). Drills. Retrieved February 18, 2011, from http://www.ecy.wa.gov/programs/spills/preparedness/Drills/Drills.html

[117]Department of Ecology. (2010, August 8). Northwest Area Committee Drill Calendar 2010-2011. Retrieved February 16, 2011, from http://www.ecy.wa.gov/programs/spills/preparedness/Drills/drill_calendar1011.html

comments from 8 sources.[118] The relatively low number of commenters could indicate that the public is not well-enough aware of these comment periods.

4.3 Potential Gap: Communication

Benefits of Improved Communication

Minimizing the damage from an oil spill requires rapid, effective communication in many directions. The RP, or other reporting entity, must contact response agencies. Agencies must contact their personnel and provide direction. Governments need to provide input to the UC, while also keeping citizens informed and hearing their concerns. Logistics must be coordinated. Workers must be able to communicate the situation on the ground to the UC. Communication channels must be kept open and unimpeded by noise. And it all must function for the duration of the spill. After-action spill reports and subject-matter experts indicate that, not surprisingly with so many requirements, communication breakdowns occur, sometimes with damaging results.[119] As the *M/V Cosco Busan* report stated,

> "The initial task of notifying impacted local and tribal jurisdictions and other stakeholders is monumental. Early and ongoing communications are critical to keep other personnel and the public safe and informed."[120]

Increased and improved communications have the potential to improve both the perception of response and the coordination of federal and local resources. If the public receives timely information from sources that they can trust and believes that whatever knowledge they possess is being used to improve spill response, then they are more likely to understand the choices made by decision-makers and to have a positive opinion of the overall response process. Additionally, if agencies are disseminating information to all parties whose equipment, knowledge, or experience could be an asset to the response, the response is likely to be faster and more successful than if only carried out by large federal agencies.

Challenges to Improving Communication

Two areas in particular have been identified as experiencing communication problems:

- Interagency communication, both between local and external agencies, as well as among local agencies
- Communication with concerned stakeholders

[118] Department of Ecology. (n.d.). Public Comments for Geographic Response Plans. Retrieved February 15, 2011, from http://www.ecy.wa.gov/programs/spills/preparedness/GRP/grppubliccomment.html

[119] ISPR: *Cosco Busan, 2008.*
Murphy, 2004, *Dalco Passage Mystery Spill.*

[120] Murphy, 2004, *Dalco Passage Mystery Spill.* p. 2.

Communication Challenges between Unified Command and the County

Despite the importance of collaboration with local agencies in planning, post-spill reports of the Dalco Passage and the *M/V Cosco Busan* spills both point to key areas where communication breakdowns between federal responders and local jurisdictions inhibited response. *M/V Cosco Busan* provides one illustrative case of how, despite the stated plans, local communication is not always prioritized. In that case, the local ACP called for a LGR to be chosen by the LO as part of a multi-agency coordination effort; however when it came time for the plan to put into practice, a local representative was never selected.[121]

This example demonstrates that it is critical that local governments are proactive with respect to the roles they are authorized to fill as per the ACP. If local governments do not work in advance to clarify and communicate their roles in the ICS, they run the risk of being cut off from decision-making process and starved of up-to-date response information. The failures of the *M/V Cosco Busan* response prompted authors of the Incident Specific Preparedness Review to recommend "Oil spill response management should be adjusted to embrace local and regional emergency management structures to improve UC-local government interaction in a manner that is consistent with both [the Standardized Emergency Management System] and ICS."[122] Currently the Emergency Management agencies in Snohomish County do not participate in the NWACP planning process, which could leave Snohomish County vulnerable in this area.

Another dimension of communication between the UC and the County is the ability to integrate into the Incident Command System. If more stakeholders (such as NGOs) or officials are trained in ICS, they will be more able to interact with the UC. Currently the Emergency Management groups, fire departments, and law enforcement are trained to respond within the ICS structure. However, with limited numbers of people eligible to interact with the UC, problems can arise both in terms of having relevant agencies' needs communicated, and in terms of staffing liaisons or representatives in a 24/7 capacity for an extended spill response. ICS training and Community-UC interface need not be limited to these groups; local and tribal officials interested in participating in UC should also seek ICS training. Staff with technical expertise, communication skills, and decision-makers can perform within the ICS structure in the capacity best suited to their talents. These positions can include acting as the LGR or the Local/Tribal On-Scene Coordinator, as well as positions with Liaison or the JIC.

Challenges in Interagency Communication within the County

Three emergency management groups (the DEM, Everett Emergency Management and ESCA) exist in Snohomish County, posing a potential communication and coordination challenge. In the event of a significant marine oil spill, the individual agencies might not have the capacity to fully engage in the response unless their efforts are closely

[121] ISPR: *Cosco Busan, 2008.* p. 14
[122] ISPR: *Cosco Busan, 2008.*p. 15

coordinated. The interagency emergency notification system identifies numerous communication methods. This strategy allows for flexibility during the response, but the lack of a consistent known notification mechanism for alerting interested agencies could result in confusion and potentially slow the flow of information.

Challenges of Communication with the Public

> *"When response groups could not supply the public with real-time information, many people saw the delay in communication as a signal that the response was not being conducted properly or fast enough, which created a very difficult dynamic for responders."*[123]

When a spill occurs, community members will likely turn to local, familiar sources for information. The County will need to facilitate the flow of official information from the Joint Information Center (JIC) to the public as quickly as possible. Although the Snohomish County Hazardous Materials Response Plan incorporates a warning system for disseminating information over a range of potential media, the protocol for delivering these messages is ambiguous. Additionally, this messaging system is primarily to warn citizens in danger areas of a hazardous materials release; the dangers of oil spills have less to do with immediate threats to human health, making it unclear if this network would be used for disseminating recurring response updates after initial notification.[124] The type of communication system required may be different, as oil spill communication requires updates and information over potentially days and weeks, rather than the emergency notifications that occur within hours of an event.

Another challenge is communicating realistic expectations about response capabilities to the community. Local stakeholders unfamiliar with oil spills could expect the pace of response or of cleanup to be faster than is possible. This disconnect between expectations and results could lead to disappointment, resentment, or even distrust of the government.

<u>Existing Communication Policies</u>

According to the NWACP, local communities are an important element of the response. Local jurisdictions **"**are usually the first responders to oil and hazardous substance spills and releases."[125] The importance of local involvement is reinforced at the county level with the Snohomish County Hazardous Materials Response Plan. According to the plan, any hazardous materials release (which includes oil spills) should be reported to 9-1-1, which will contact the appropriate emergency responder agency—either the Fire Department or the Washington State Patrol, who in turn reports to local Emergency Management. Emergency Management then contacts relevant state, federal, and local agencies. As a parallel structure, the RP will also be making these contacts, via the

[123] ISPR: *Cosco Busan, 2008,* p 41.
[124]Snohomish County Local Emergency Planning Committee. (Dec 2005). *Hazardous Materials Response Plan (ESF-10).* Snohomish County Department of Emergency Management.p. 16.
[125]RRT/NWAC, 2010, *Northwest Area Contingency Plan, p.* 1000-19.

National Response Center, the Washington State Emergency Response Commission (SERC), and the Local Emergency Planning Commission. Both the Snohomish County DEM and Everett Emergency Management confirmed that they have policies for such notification.[126]

Interagency Communication Policies

Once a spill is reported and the Incident Command Post has been established, the following communication policies are in effect:

- NWACP, Section 9610:

"In response to most 'routine' or 'minor' environmental incidents, public information activities are carried out by the lead response agency, in coordination with other organizations. In these cases, the lead Information Officer usually conducts activities from the office or another remote location, as directed by the Incident Commander, via phone and e-mail with agency counterparts. Early notification and coordination includes timely review of draft news releases and other materials, and collaboration to determine other information needs."

- NWACP, Section 1540:

"During responses to oil and hazardous substance spills, local agencies could be involved as part of the UC, and could provide agency representatives who interface with the command structure through the Liaison Officer or the SOSC. When a UC is used, an Incident Command Post (ICP) and JIC shall be established. The ICP shall be as near as practicable to the spill site. All responders (federal, state, tribal, local, and private) should be incorporated into the response organization at the appropriate level."

- NWACP, Section 9610:

"A Liaison Officer is appointed by and reports to the Unified Command. The Liaison Office is the point of contact for federal, state, and local agency representatives and elected officials with a vested interest in the response. Calls received by the hot line could be directed to the Liaison Officer. The Liaison Officer coordinates all calls from public and private entities offering assistance or re-questing information."

Communication Policies between Unified Command and the County

The ICS is intended to facilitate communication and information flow between participating agencies. At the head of the system is the UC which explicitly includes local and tribal governments in of roles of Local and Tribal On-Scene Coordinators (LOSC/TOSC).[127] Another communication role for a County representative could be as a Liaison Officer (LO). According to the NWACP, the duty of the LO is to facilitate communication with local agencies and other interested parties. This is meant to address issues of interagency

[126]Dehaan, D. (2011, Feb 1).Director of the Office of Emergency Management. Personal communication. Murphy, M.(2010, Nov 12). Emergency Program Manager. Personal Communication

[127]RRT/NWAC, 2010, *Northwest Area Contingency Plan*, p. 1000-1.

communication. Lastly, for the public and stakeholders not involved in response efforts, communication facilitation occurs at a central location designated the Joint Information Center (JIC). Although the NWACP provides structured guidance on communication, it continues to be an area where problems arise in oil spill response due to insufficient adherence to the ICS system and the Area Contingency Plan.

Local Interagency Communication Policies

While the NWACP dictates the structures for dealing with federal-to-local communication, local-to-local communication is left to county emergency management plans. According to the Snohomish County Hazardous Materials Response Plan, the coordinating agency, or the default local government representative (LGR), is the Snohomish County DEM. DEM's official responsibilities are as follows:

> "The Snohomish County DEM Duty Officer, working from either or both the County Emergency Operations Center and on-site in support of the Incident Commander, will provide required 24-hour notifications, resource and logistical assistance, and other functions as requested by the IC. At the IC's request the SCDEM representative could coordinate any public information requirements of the incident, including the organization of a Joint Information Center."[128]

Within the ICS structure, the JIC is primarily responsible for public affairs and drafting statements to the public. Per the ACP:

> "A Joint Information Center (JIC) is created under Unified Command to effectively manage communication resources and public messages when multiple organizations are involved in incident response. The need to form a JIC is determined by the Incident Commander or Unified Command as advised by the incident Information Officer. Ideally, a JIC should be located in or near the incident command post and staffed by personnel from the participating organizations."[129]

There is a potential role for local agencies in creating and staffing the JIC. For example, contacting other local agency communicators for assistance/information about their community or distributing initial news release to media, affected agencies, and other audiences.[130]

[128]Snohomish County LEPC, *Hazardous Materials Plan*, 2005, p 13.
[129]RRT/NWAC, 2010, *Northwest Area Contingency Plan*, p. 9610-5.
[130]RRT/NWAC, 2010, *Northwest Area Contingency Plan* p. 9610-4

4.4 Potential Gap: Developing and Communicating Local Knowledge

"A general government entity at the local level will provide a wider perspective than highly specialized agencies answering to governmental levels further removed."[131]

Local knowledge refers to information possessed by residents of a region which outsiders could be unaware of or otherwise unable to access or understand. In the context of oil spills, this could include knowledge of local environmental and economic resources, shoreline access and vantage points, local agency relationships, local community communication routes, and community priorities. An implicit, but critical, aspect of local knowledge is the ability to make that knowledge available and relevant to other entities, perhaps through communication strategies or by integrating it into area plans and GRPs.

Examples of Local Knowledge[132]

- **Natural Resources** – Fish, wildlife, habitats and Endangered Species Act issues
- **Cultural Resources** - Sites of historic significance, tribal resources, sites of community significance
- **Critical Infrastructure** – Drinking water intakes, irrigation channels, information on traffic flows
- **Water Dependent Commercial Areas –** Aquaculture, marinas, hatcheries, commercial fishing and shellfish harvest areas
- **Water Dependent Recreational Areas –** Public recreation areas, sport fishing grounds, boat launches, beaches
- **Local Relationships –** Who in the area can provide park access, grant authority to close roads, handle public inquiry, or bring supplies to responders

Benefits of Developing and Communicating Local Knowledge

Oil spills requiring a federal response create a situation whereby the parties with responsibility for managing response efforts (USCG, EPA, RP) might lack knowledge of the affected region. While they possess the resources and technical expertise necessary to respond to an oil spill, they could lack detailed area-specific information which could maximize response effectiveness. An optimal oil spill response would integrate the strengths of all parties involved; aggressive engagement of local governments in the planning and response process by state- and federal-level agencies will ensure that pertinent local knowledge is available and utilized.

Arriving on-scene, the agencies in charge will set up ICS and begin operational planning. The Logistics Chapter of the NWACP pre-identifies Everett as a major metropolitan area

[131] Fischer, D. W., & Martinet, L. (1993). "Local government response to the American Trader oil spill of 1990: Implications for policy". *Ocean & Coastal Management, Volume 19* (Issue 1), 59-73.
[132] RRT/NWAC, 2010, *Northwest Area Contingency Plan*, Section 3000.

that could be used as an incident command post location.[133] In addition to a command post, the response will also require safe access points, appropriate staging areas for equipment and convenient vantage points from which to monitor the spill. A local representative with knowledge of the area could be valuable in this initial set-up phase by identifying areas suitable for these purposes. One potential model is the IOSA Access Launch and Viewpoint Database.[134] Having this information readily available would save time otherwise spent consulting maps and surveying the area, allowing for more rapid deployment.

Local knowledge also plays a role in understanding local area relationships. There can be significant variation in terms of responsibilities among agencies and departments, depending on where the spill occurs. As an example, Snohomish County has two different emergency management bodies, each with different functions: DEM and ESCA. In addition, the City of Everett maintains its own emergency management division, as do the Tulalip Tribes. A federal-level responder might not know that more than one exists, which one should be involved in a particular response, or how to contact them. Experience from previous spill responses has indicated that valuable time is often expended in a spill's early stages in making such determinations.[135] A potential role for county government is to quickly identify the most appropriate agencies or individuals for coordination with responders.

Further, the federal agencies involved tend to be very technically oriented, possibly leading the response team to neglect human concerns.[136] County and city governments are more closely attuned to the people and resources affected and thus able to represent their interests to the UC. For example, certain sites of cultural or historical value might not be protected unless specifically identified as a priority by local government.

Challenges to Developing and Communicating Local Knowledge

Technical data and response procedures are relatively easy to codify and disseminate broadly, as variation tends to be low across geographic regions. Local knowledge, on the other hand, is often highly variable and possessed by just a few individuals who could change jobs or be unavailable at a critical time, presenting a continuity challenge. It might not even be held by an agent of the government, but instead lie with a member of the community or the local Tribes. It can be a challenge, therefore, for local government to identify and codify local knowledge. Further, just possessing the information is not enough; to realize its full value, it must be communicated in a timely manner to the appropriate entities.

Local governments' ability to communicate important details could be constrained by questions of legitimacy, as well. Outside experts could be inclined to focus on the

[133] RRT/NWAC, 2010, *Northwest Area Contingency Plan,* Section 5000.
[134] Knight, J., 2011, Feb 14.
[135] Fischer & Martinet, 1993, Local Response to American Trader Oil Spill of 1990.p.10.
[136] Fischer & Martinet, 1993, Local Response to American Trader Oil Spill of 1990.p.5.

scientific or technical details of the response and to overlook what could appear to them as anecdotal information. According to the Command Chapter of the NWACP, "The unified command could incorporate additional tribal or local government on-scene coordinators into the command structure as appropriate."[137] The use of the words 'could' and 'as appropriate' leave the degree of participation which is granted to local governments in a response to the discretion of the UC. As a result, localities across the US vary in the degree to which they are involved in oil spill planning and response. The role played by interpersonal relationships in the communication and information exchange process can be highly important and should be a consideration in identifying people to represent the County in the UC. Early development of these working relationships is essential; the FOSC is far more likely to accept and rely on local information when it is provided by individuals who have proven themselves over time through planning exercises and drills than when it comes from unknowns.

The close relationship between local governments and their citizens which creates useful local knowledge can also create certain risks. As government takes actions which serve the greatest good, citizens might not understand why their particular concern is not receiving the highest priority and political pressures to adopt ineffective strategies can arise. When communicating local priorities to the UC during a response, the County should be aware of the dangers of deploying equipment where it is not strategically worthwhile in order to satisfy constituents.[138] Such so-called 'political booming' was a particular challenge in the Deepwater Horizon response. According to the National Incident Commander in that spill, U.S. Coast Guard Admiral Thad Allen, "self-worth was being measured by how much boom was in each state."[139] Politics ultimately outweighed response criteria and miles of boom were used ineffectively because of the high visibility of booming as a response strategy. As the local authority, one of the County's roles will be to act as a mediator between the high expectations and misconceptions of their constituents and the technical limitations and realities of oil spill response.

Capacity is an ongoing challenge for all governments; scarce resources must be allocated across a variety of needs, including oil spill preparedness. Local knowledge encompasses a great breadth of possible activities; it will be up to the County to determine those which are most appropriate to study in greater detail.

Finally, there is the question of issue salience. Major spills are quite rare and during the quiet times between them, when public perception of spill risk is low, it could be difficult to allocate the resources necessary to develop and carry out a plan for gathering and compiling local knowledge. Failure to do so, however, could lead to localities finding themselves caught off guard and unable to participate in the event of a

[137]RRT/NWAC, 2010, *Northwest Area Contingency Plan,* Section 2000.
[138]McCreery, S. 2010, Nov 19.
[139]Tilove, J. (2011, January 19). Battle for boom became political after Gulf oil spill, officials say. *The Times-Picayune*.

spill.[140] Governments could find it useful to think about the problem strategically, creating ways where spill preparedness activities can be integrated on issues that have ongoing public interest.

4.5 Potential Gap: Volunteer Utilization

Benefits of Effective Volunteer Utilization

Generate Positive Public Opinion of Response

An important benefit of effective volunteer utilization is that it presents a positive image of spill response to the local community.[141,142] It is critical to cultivate this confidence in the adequacy and appropriateness of the spill response. If the local community does not believe that a spill is being handled properly they could exert political pressure, which could distract responders and detract from response effectiveness. The consequences of lack of community confidence in response efforts were seen in the Gulf during the Deepwater Horizon spill. Local officials and residents of the Gulf complained that the federal responders were not sensitive to their local needs.[143] According to the National Commission report on the Deepwater Horizon oil spill, "The National Incident Command was not deaf to these complaints and gave an unofficial order to 'keep the parishes happy.' Coast Guard responders distributed many miles of boom according to political, rather than operational, imperatives."[144] This kind of antagonistic relationship between responders and the public can be mitigated by generating public support for the spill response through effective volunteer utilization.

Public opinion would be expected to react favorably to the well-orchestrated use of volunteer citizens performing valuable roles that assist their neighbors, communities, and the environment. Discussions with the USCG and other volunteer professionals and review of the NWACP and Pacific States/British Columbia Oil Spill Task Force Planning Guidelines for Convergent Volunteer Management, provided a general consensus that these volunteers should be used only for tasks that would not normally be funded, thus avoiding the issue of volunteers taking employment away from professional contractors, as well as the ethical question of whether the party which caused the spill should be the recipient of free labor rather than bearing the full financial burden.

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[140] Baribeau, A. L. (1998). *Oil Pollution Act of 1990: False Expectations for Local Agency Participation in Planning and Response to Oil Spills?* Seattle: University of Washington School of Marine Affairs. Chapter 4: Findings.

[141] The Pacific States - British Columbia Oil Spill Task Force Planning Guidelines For Convergent Volunteer Management June, 2008

[142] RRT/NWAC, 2010, *Northwest Area Contingency Plan,* Section 4338.2.

[143] The National Commission on the BP Deepwater Horizon Oil Spill And Offshore Drilling, Final Report, 2010.

[144] The National Commission on the BP Deepwater Horizon Oil Spill And Offshore Drilling, Final Report, 2010, Ch5 p. 153.

Source of Valuable Local Knowledge and Resources

An additional benefit of effectively utilizing community volunteers is that they provide a wealth of local knowledge about such factors as microclimates, local weather patterns, shoreline access points/monitoring locations, and local communication networks. Access to such relevant local information can be a critical resource that helps professional responders to reach and secure a spill as quickly as possible, mitigating its effects and minimizing environmental damage. Volunteers also provide a valuable capability that can be used to perform important work outside the spill zone, freeing trained workers to combat the spill directly. Where volunteers possess the necessary skills and training (through WDFW accordance with NWAC 4338.5) they can participate in the spill zone, assisting with wildlife recovery or other tasks.[145]

Challenges of Volunteer Utilization

> *"Early in the response the UC [Unified Command] was confronted with several challenges that consumed time and distracted them from conducting the clean-up efforts. Many of those challenges came from local government requests for information, action and volunteer deployment."*[146]

Volunteers can be grouped into two main categories: those affiliated with an existing volunteer group prior to a spill event (affiliated volunteers) and those who spontaneously converge at the spill site following an oil spill event because they have a desire to participate in the spill response (convergent volunteers).Examples of affiliated volunteer groups are the Red Cross and Washington State University (WSU) Snohomish and Skagit County Extension Beach Watchers.

Affiliated Volunteers - Volunteers are not a free resource; both affiliated and convergent volunteers present challenges for the managing agency. Existing affiliated volunteer groups are often constrained by limited resources.[147] Annual Hazardous Materials Operations and Response (HAZWOPER) training is required for anyone operating within the spill zone, but the opportunity costs of the holding and maintain the training is high and many volunteer organizations are unable to take on the task without financial assistance from the state or county. Maintaining morale and interest among affiliated volunteers presents an additional challenge. When individuals commit significant amounts of their personal time to volunteer activities but perceive little return, they could become discouraged, lose interest, and ultimately disengage, taking with them a sizeable investment in training and time. Since major oil spills are relatively rare, volunteer organizations are faced with the challenge of maintaining volunteer commitment and response competencies in the quiet times between oil spill events.[148]

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[145]RRT/NWAC, 2010, *Northwest Area Contingency Plan,* Section 4338.5.
[146] ISPR: *Cosco Busan, 2008*
[147]Litle, K., 2011, Jan 20.
[148] Litle, K., 2011, Jan 20.

Convergent volunteers - While enthusiastic and eager to assist when a spill occurs, convergent volunteers typically lack the specific training to participate in the spill zone and could require substantial management and oversight in order to be effective. Excluded from what they might regard as meaningful work, they could attempt to enter the spill zone on their own, endangering themselves, others, or the environment. This occurred during the response efforts to the *M/V Cosco Busan* spill in San Francisco. According to the *Cosco Busan* ISPR, "The presence of members of the public in the field near oiled wildlife threatened the success of wildlife recovery efforts and the security of field personnel" and "[volunteers] exposed themselves to hazards associated with oiled bird contact."[149] Valuable personnel could be needed to keep them out of harm's way, diverting these resources away from other roles where they could be more effective.

The question of who will bear responsibility for convergent volunteers' liability coverage during the response is an additional concern for the employing agency, one which has not been definitively answered at either the state or local level. Faced with the reality of oil spill clean-up operations, convergent volunteers could lack the will or ability to return daily over the long term. In general, a substantial investment in time and effort will be required by the employing agency to create the intake and demobilization functions necessary for managing convergent volunteers.

Volunteer Coordination Policies Currently in Place

Federal Policies:

Federal regulations related to the use of volunteers can be found in 29 CFR 1910.120 (Occupational Safety and Health Standards / Hazardous Waste Operations and Emergency Response), 40 CFR 311 (Worker Protection), and 40 CFR 300 (National Contingency Plan) (NWAC 4338.4).The following is an excerpt from 40 CFR § 300.185:

> "(c) Area Committee Plans (ACP) shall establish procedures to allow for well organized, worthwhile, and safe use of volunteers, including compliance with §300.150 regarding worker health and safety. ACPs should provide for the direction of volunteers by the On-Scene Coordinator/Remedial Project Managers or by other federal, state, or local officials knowledgeable in contingency operations and capable of providing leadership. ACPs also should identify specific areas in which volunteers can be used, such as beach surveillance, logistical support, and bird and wildlife treatment. Unless specifically requested by the OSC/RPM, volunteers generally should not be used for physical removal or remedial activities. If, in the judgment of the OSC/RPM, dangerous conditions exist, volunteers shall be restricted from on-scene operations."

Other than the minimal guidance in the references listed above, there does not appear to be any standardized procedures for managing convergent volunteers at the federal

[149] ISPR: *Cosco Busan,* 2008, p. 8.

level, which suggests that the federal government could prefer to see the issue addressed at the state or local level.

Regional/State Policies:

Regionally, the Northwest Area Committee has developed a volunteer policy, which can be found in the NWACP, which states:

"The general policy accepted by the RRT/NWACP is that volunteers will normally be used in low risk activities and only after receiving safety training appropriate for their designated activities. If volunteers are used for higher risk activities such as wildlife rehabilitation or pre-cleaning beaches and in some cases licensing could be required.

- Volunteers associated with an Affiliated Volunteer Organization and with documented specialized training will be given a higher priority.
- Convergent volunteers must participate through either local government or an Affiliated Volunteer Organization.
- Use of unpaid, convergent volunteers will supplement, not replace, the work of professional responders hired by the RP."[150]

According to the NWACP, the "[DOE] is responsible for the development and maintenance of the Washington State Volunteer Management Plan" and the WDFW is recognized as the "'sponsoring agency' for the purpose of recruiting, training and managing volunteers for oiled wildlife rescue."[151] Washington State also has provisions for a volunteer emergency work program, which is implemented by local governments (DEM and ESCA in the case of Snohomish County). According to the NWACP, this program is primarily used for search and rescue missions, however it could also be used in the event of an oil spill as long it was integrated into the larger ICS.[152] More information on this program is available in Chapter 118-04 of the WAC.

Volunteer coordination at the state level has the potential to evolve significantly if HOUSE BILL 1186 State of Washington 62nd Legislature 2011 Regular Session (H-0160.4) passes. The original version of this Bill is available online at: http://apps.leg.wa.gov/documents/billdocs/2011-12/Pdf/Bills/House%20Bills/1186.pdf

Local Level

The two primary entities for coordinating disaster response (disaster response volunteers) in Snohomish County are DEM and ESCA.

Snohomish County is in the process of reviewing its draft *Spontaneous Volunteer Registration and Management Annex* for future inclusion in the Snohomish County

[150]RRT/NWAC, 2010, *Northwest Area Contingency Plan,* p. 4000-16.
[151]RRT/NWAC, 2010, *Northwest Area Contingency Plan,* pp. 2000-20, 4338.5.2
[152]RRT/NWAC, 2010, *Northwest Area Contingency Plan,* Section 4338.5.3.

Operations Plan. This draft annex "defines the actions and roles necessary to provide a coordinated response by Snohomish County DEM and its partner cities and the unincorporated areas of the County"[153] and sets up detailed procedures on how convergent volunteers will be managed at the County level. Although this plan was not created with oil spill volunteers in mind, the procedures it outlines would be applicable to management of convergent volunteers for oil spills as well as for other disasters. It rightly acknowledges the fact that "an overwhelming number of spontaneous volunteers will arrive in the impacted area in order to assist with the response and recovery efforts."[154] It also acknowledges that "One of the keys to keeping volunteers from impeding the response and recovery processes of a catastrophic incident, and essentially becoming a second disaster; is timely, informative, and accurate information distributed to the public."[155] This plan could be activated at the county level, the city level by a partner city, or by ESCA.

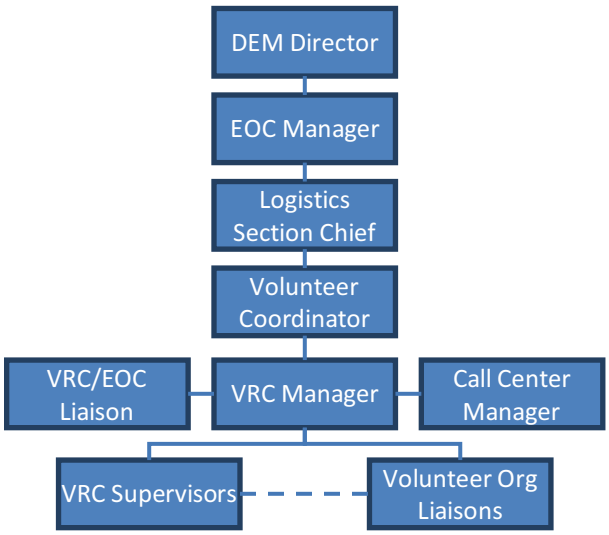

Figure 35: Emergency Volunteer Coordination Hierarchy. From DEM Emergency Operations Plan Annex. (2010).

The ICS structure presented in this annex (picture at left) is slightly different from the ICS structure presented in the NWACP. According to this annex, the Volunteer Coordinator would report to the Logistics Section, while according to the federal ICS structure presented in the NWACP, the volunteer coordinator would report to the Resource Unit, within the Planning Section.[156] Addressing this slight discrepancy could be an opportunity create dialogue and better synchronize state/federal and county response coordination.

At present, both DEM and ESCA have volunteer coordinators, but they are focused on managing all-purpose volunteers - those who will perform tasks that would apply to any disaster and are not oil spill-specific. While some convergent volunteers will be happy to assist in these tasks, others would prefer more spill-specific jobs. To optimally use the resources that will present themselves in a major oil spill response, volunteer coordinators and their respective agencies will need to pro-actively identify meaningful

[153] Snohomish County Draft Spontaneous Volunteer Registration and Management , DEM-Emergency Operations Plan Annex, April, 2010
[154] Snohomish County Volunteer Registration and Management, 2010.
[155] Snohomish County Volunteer Registration and Management, 2010.
[156] RRT/NWAC, 2010 *Northwest Area Contingency Plan*, 2000-2.

and spill-specific tasks for volunteers and integrate these tasks into the pre-existing volunteer utilization mechanisms.

Chartered organizations are an additional local level resource that could assist with volunteer outreach and coordination. Two examples are the Snohomish County MRC, which can bring experience with grass roots consensus-building, and the Stillaguamish River Clean Water District (CWD) Advisory Board, which can bring experience with coordinating citizen input.

If past oil spills are indicative of future incidents, local citizens can be expected to volunteer in the event of a large spill. As previously described, there are benefits and challenges associated with the large-scale use of volunteers which must be understood and assessed by managing agencies and their volunteer coordinators. The major challenges include: keeping affiliated volunteers engaged and motivated between spills; providing convergent volunteers with safe, meaningful and spill-specific jobs; providing oil-spill related training to both convergent and affiliated volunteers; and integrating local, state, and federal volunteer management plans. The following section will describe several options that County can take to help address these challenges.

Part 5: Presentation of Options

5.1 Summary of Potential Options

This section details some options or activities the County could undertake in order to address the gaps described in Part 4. Each option or activity (except for status quo) will be partially effective in filling one or more of the existing gaps, therefore the preparedness strategy the County ultimately adopts might include a combination of the following options. Figure 36 on the following page identifies the relationship between each option and the gaps it could help to bridge. This table is not intended to discount options that fill only one or two gaps but rather to illustrate that it is possible for one option to fill multiple gaps. Options should be chosen based on County priorities and an assessment of their effectiveness and the Counties capacity to implement them.

	Volunteer Utilization	Local Knowledge	Communication	Participation in Planning Process
Options				
Status quo				
Pre-identify County Resources	X	X		
Pre-identify Volunteer Roles	X			
Prioritize Resources at Risk		X	X	X
Maintain list of contacts			X	
Tabletop exercises	X	X	X	X
Participate in drills with local plan-holders		X	X	
Sign up for the GRP & RRT/NWACP list serve				X
Request and Participate in GRP field tests		X	X	X
Coordinate community input to GRP and NWACP		X		X
Ensure alignment between County response plans & NWACP			X	X
Develop community education			X	
Revitalize Beach Watchers OSA Program	X	X		
County Vessel of Opportunity Program		X		

Figure 36 Gaps and the Options that fill them

- *Status quo* – The County could rely on existing Federal, State, and Local planning and take no further action. This option leaves gaps as they are without addressing them.

- *Pre-identification* - Pre-identification options are activities that the County could undertake during quiet times in order to be more prepared in the event of a major oil spill. Several types of information lend themselves to pre-identification. Some relate to resources the County could provide to the oil spill response such as access, launch and viewpoints, public information networks, and roles for convergent volunteers. Other types of information pertain to developing an inventory of the County's environmental and economic resources and identifying which ones are priorities for protection.

    - *Pre-identification of County Resources:*
        - *Access, Launch and Viewpoint database and map*
          The County could improve oil spill preparedness by pre-identifying sites that could serve as access points, launching areas or viewpoints to monitor the spill. These will include public areas such as parks or the Port of Everett, but the process could be expanded to include private landowners. As an example, IOSA, a primary spill responder in San Juan County, maintains an access, launch and viewpoint database and map of private property where pre-arrangements with the owners will allow responders access in an emergency situation.[157] By identifying and coordinating with landowners before the fact, the County could set the stage for not only a faster response but also for better relations between the County and its citizens under what are likely to be difficult circumstances. According to Washington State University (WSU) Snohomish and Skagit County Extension Beach Watchers, the last assessment of Snohomish County access points was in 1989. A potential model for this activity is *Getting to Water's Edge*, a field guide co-produced by the Island County MRC and WSU Snohomish and Skagit County Extension Beach Watchers with up-to-date information on shoreline public access and intertidal life[158] in Island County. This guide was originally produced during quiet time with recreational users in mind and is an example of how already existing initiatives could be re-purposed to aid in oil spill response. An alternative to creating an independent database would be to provide input to DOE's statewide public access database, Washington Marine Shoreline Public Access Project. [159] This option addresses both Local Knowledge and Communications concerns.

[157]Knight, J., 2011, February 14.
[158]Bertolotto, C. (2011, January 17). WSU Snohomish and Skagit County Extension Beach Watchers. Personal Communication.
[159]See: http://www.ecy.wa.gov/programs/eap/beach/shoreline_public_access_project.html

- *Identify Public Information Networks*
  In addition to passing knowledge upwards to response agencies, local government also has a need to keep its citizens informed of developments in the response. To facilitate the flow of information between the official response and the public, the County could turn their knowledge of local public information networks into a resource for the incoming responders. This type of knowledge could include knowing prominent individuals with strong community networks who could serve as semi-official information hubs or which community organizations have extensive member lists and existing communications plans. The County might also want to pre-arrange consent with these parties to confirm their willingness to act as public information hubs when called upon. This option would primarily address Communications concerns but also help build Local Knowledge.

- *Pre-identify Volunteer Roles*
  This option includes interviewing NOAA and other federal/state agencies to determine what information they would like to have about a spill that they do not usually have access to, and whether this information could be collected by volunteers. Snohomish County could then convene a focus group of interested citizens to determine which of these roles they would like to play in the event of a large spill. This option views volunteers as conducting a form of 'citizen science' which Washington Sea Grant, WSU Extension and the Citizen Science Advisory Panel define as "Projects that engage the public in making observations and collecting and recording data".[160] In this option, the information collected would be information requested by response agencies regarding the oil spill. When considering volunteer/citizen science roles, a focus should be put those that would not put volunteers in contact with hazardous material, but would still give them meaningful tasks directly related to the spill.[161] The information gathered from this option could be presented to the NWAC for possible inclusion in the NWACP. This option will primarily address the Volunteer gap.

- *Prioritize Resources at Risk*
  This option entails two phases. First, the County should inventory available information on resources at risk in Snohomish County. The NOAA-generated Environmental Sensitivity Index provides a good starting point for this inventory, but could be supplemented by data from Tribes or local environmental organizations, for example. Second, the County should prioritize the resources at risk and be prepared to communicate these to responders in the event of a spill. Additionally County priorities should be compared to those protected by the GRPs. For example, in 2004, the Nature

[160]Washington Sea Grant.(2007). Citizen Science. Retrieved February 14, 2011, from http://www.wsg.washington.edu/citizenscience/index.html
[161]Litle, K. 2011, Jan 20.

Conservancy described Port Susan as a "priority conservation area of high biodiversity importance within the greater Pacific Northwest"[162], but information derived solely from the ESI or the GRP would not identify Port Susan as a particular priority. Reliable information on environmental and economic resources at risk would allow the UC to make the most informed response decisions possible. The ICS 232 Form (attached as Appendix 4) is used in actual oil spill response and provides a good format for understanding the types of information responders need in an emergent situation.[163] This type of knowledge would allow the County to provide the UC with insights into which areas would be suitable for response and which areas are so sensitive that boat traffic or other human impacts from responders could actually cause more damage than contact with oil. This option will build Local Knowledge, improve Communication and enhance Participation in the Planning Process.

- *Maintain a current list of relevant contacts*
  During a spill response, the LO requires a clear idea of who will be involved at the local level and other stakeholders with significant interests in the response process. The County could designate representatives for two roles:
  1. to act as LOSC in the Unified Command and
  2. to coordinate with the Public Information Officer.

  Several of the experts consulted for this report, including a representative of the Northwest Straits Commission and representatives of the USCG recommended keeping an updated list of contact information of people (including any County designated representatives) who should be informed in the event of a spill. This recommendation is supported in the lessons learned report of the Dalco Passage Spill in 2004.[164] Maintaining this list would help to ensure that information transfer is not impeded by job turnover.[165,166] This option would address the Communication gap, specifically that which exists between UC and local entities.

- *Tabletop exercises*
  Tabletop exercises are simulations used by the emergency response community to test organizational response capabilities. In doing so, they also foster relationships and personal dynamics by gathering key personnel from several agencies at one table. The USCG and DOE facilitate tabletop exercises for plan-holding facilities across the state (though DOE has suspended their participation in these due to recent budget cuts). DOE evaluates these exercises based on their adherence to the NWACP and uses lessons learned from these exercises to improve the plan. Per the Area Plan, the County has the right to participate in these exercises. The County might also want to hold its own

[162]Floberg, J. M. (2004). *Willamette Valley-Puget Trough-Georgia Basin Ecoregional Assessment, Volume One: Report.* The Nature Conservancy.
[163]Knudson, S. & Parker, H., 2011, Jan 18.
[164]Murphy, 2004, *Dalco Passage Mystery Spill,* p. Apndx
[165]Knudson, S. & Parker, H. (2011, Jan 18). US Coast Guard. Personal Communication.
[166]Litle, K. (2011, Jan 20). Washington Sea Grant Citizen Science Specialist. Personal Communication.

tabletop drills. We have identified two topics which warrant the use of tabletop exercises.

- *Tabletop – Volunteer Utilization*
  A tabletop discussion about use of convergent volunteers during an oil spill response would serve to increase County preparedness by increasing awareness of the issue. Additionally, if state and federal response agencies were involved in the tabletop, it could help to identify and resolve any discrepancies in response plans between the local and state/federal level.
- *Tabletop –Roles among agencies and communications pathways*
  Large-scale oil spill response is a complex undertaking and a relatively infrequent event. Because of this, and the fact that lead agencies for spills are at the federal and state level, the local plans for oil spill response are somewhat limited in detail, and agencies that would be involved in a response may have little or no experience with an actual oil spill. Internal table-top exercises could be a forum for exploring County capabilities and expanding relationships, perhaps soliciting the participation of members of all the response agencies within the County – DEM, ESCA, the Port, the City of Everett, the Tribes, and fire or law enforcement personnel. This option would bring all parties together at one table to discover how a particular response might play out. Following this exercise and based on its findings, involved parties could create a plan for notifying relevant agencies and delivering updates to affected parties. These consistent, uniform information pathways have proved to be a crucial component of spills within the ICS structure.[167] This option primarily addresses the Communications gap, but also serves to close the Local Knowledge and Planning Participation gaps.

- *Participate in drills with local plan-holders*
  The NWAC/DOE drill program for plan-holding facilities is organized in a three year cycle. In each of the three years, plan-holders are required to have one tabletop exercise and two deployment exercises each year. In one of the three years each facility and vessel is required to hold a worst case drill. The County could request to attend these drills to assess the level of preparedness of facilities within County borders. This option would build Local Knowledge as well as personal relationships which would smooth the flow of Communication during a response.

- *Sign up for the GRP & RRT/NWACP listserv*
  The DOE Spills Program maintains a listserv to notify interested parties about upcoming meetings and which GRPs are scheduled to be revised.[168] The RRT/NWAC drill calendar is also publicly available.[169] Monitoring these activities will allow the County to see

[167] ISPR: *Cosco Busan, 2008,* p. 14
[168] http://www.ecy.wa.gov/programs/spills/preparedness/GRP/grppubliccomment.html
[169] Northwest Area Committee Exercise Schedule (NACES). (n.d.). Retrieved February 18, 2011, from https://fortress.wa.gov/ecy/naces/

which upcoming exercises they might want to participate in and make the necessary arrangements. This option is a step towards closing the Participation in Planning Processes gap.

- *Request and Participate in GRP field tests*
  As part of their outreach to local governments, the USCG, NWAC and DOE spills program may be able to facilitate an exercise at the County's request. The County might wish to organize a Snohomish County exercise designed to field test GRP strategies to protect a specific area or resource; or a table-top type exercise to test working relationships. These exercises are a way to improve Participation in Planning Processes, build Local Knowledge about the resources at risk, and improve Communication by interacting with oil spill response agencies in the field.

- *Coordinate community input to GRP and NWACP*
  The County should seek to represent its constituents' priorities in the area planning documents such as the NWACP and GRPs. The County could hold local-level workshops and forums to gather public comments on the existing plans prior to NWAC meetings or official GRP comment periods. These workshops would not only increase awareness of oil spill planning within the local community, but allow the County to submit one comprehensive set of comments backed by a legitimate stakeholder process. An alternative to County-led meeting to coordinate GRP input would be to participate in DOE-sponsored community workshops which are held as part of the GRP review process. When relevant GRPs are under review (approximately every 5 years) the County should send representatives and encourage community members to participate in these workshops. County participation will provide DOE with invaluable information on local natural, cultural and economic resources that need protection.

  NWAC meetings are a formal venue for County representatives to provide input into regional planning and represent changing priorities. The RRT/NWAC meets three times a year in locations throughout the Pacific Northwest. NWAC members are described as "any entity with response interest in [the] region. This includes all RRT members as well as county and city agencies and the private sector."[170] NWAC has also commissioned working groups to address specific topics related to the NWACP. These workgroup meetings are more intimate and are viewed by RRT/NWAC as the most direct way for the public, non-profits, industry, contractors and government agencies to provide input to the NWACP. Formal participation in RRT/NWAC meetings can be resource-intensive and may not constitute the best use of County time. Emailing the RRT/NWAC Steering Committee Co-Chairs and using the comments form on the RRT/NWAC website are a less resource-intensive option for providing feedback.[171] A reasonable middle ground

[170]Clark, J. (2010). Regional Response Team and Northwest Area Committee. RRT/NWAC Public Meeting: Boise.
[171]ACP Comments Page URL: http://www.rrt10nwac.com/Comment/Default.aspx
Heather Parker, USCG District 13; Jackson Federal Building; 915 Second Avenue; Seattle, WA 98174; 206-220-

might be to develop a strategy in partnership with the USCG and DOE on the best way to contribute to regional plans. Coordinating local input into the GRPs and the NWACP closes both the Local Knowledge and Participation in Planning Process gap.

- *Ensure alignment between County response plans and NWACP*
  This option entails a thorough analysis of local County response plans and the regional NWACP. The NWACP is a particularly relevant document for the County to be familiar with because it addresses topics such as the role of the counties in the oil spill response structure, use of controversial response technologies, and procedures for communicating with responders and the public during environmental emergencies. The local plans and the NWACP may differ in details about the ICS structure, and recommended communications plans. A well-executed oil spill response depends on these plans being in alignment, with a clear understanding among agencies about which plan should be deferred to in instances of uncertainty. This activity will help address Participation in the Planning Process and Communication issues.

- *Develop community education*
  Community education efforts on oil spill response come in two main types. The first type will occur during quiet times. These efforts recognize that communities familiar with spill response better understand the realities and tradeoffs involved in response decisions (for example, between allowing natural weathering to clean a lightly oiled shoreline or applying treatment methods which may cause greater harm) as well as the physical limitations of response equipment. This education will serve to promote realistic expectations in the local community. It might also involve education on proper spill reporting.[172] If local recreational and commercial users know what characteristics are important to report, they can give the responding agency a better idea of the nature of the spill. The second type of education will occur during a spill response and is mostly concerned with providing timely information to the public.[173,174] These efforts will primarily address Communication gaps.

- *Revitalize Beach Watchers Oil Spill Assessor Program*
  This program provided interested WSU Extension Beach Watchers with training on how to assess oil spills by location, percent coverage, and oil type as well as the ability to coordinate and sustain volunteers. The program was designed with a 24-hour hotline that response agencies such as DOE could call in the event of a spill. The Oil Spill Assessors typically made their spill observations from bluffs or other vantage points removed from the spill hazard and their liability was covered by WSU. The program was

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[172]Olssen, E. (2011, Jan 21).Washington Sea Grant. Personal Communication.

[173]Leschine, T. (2010, Nov 19). School of Marine Affairs. Personal Communication.

[174]McCreery, S. (2010, Nov 19). BP. Personal Communication.

disbanded in 2007 due to lack of agency interest/ support, but the training and procedures for the program remain intact and the program could be revived with sufficient county and agency interest.[175] In order to prevent the revitalized oil spill assessor program from encountering the same difficulties as the previous program, emphasis should be put on developing trust and strong relationships with response agencies and communicating the value of this program. Additionally, both State and Federal response agencies should be actively involved in the program development to ensure its utility. Volunteer satisfaction, and thus program sustainability, would be enhanced by integrating these efforts with those of other citizen science groups and involving volunteers in quarterly or semi-annual oil spill phone notification drills.

A possible expansion of the role of oil spill assessors is to pair them with convergent volunteers in the event of a large spill. While Beach Watchers would likely be unable to integrate all of the convergent volunteers, taking this option would nevertheless reduce the number of unused volunteers looking for ways to assist and would buy the County and the response agencies time to establish training facilities and management protocols for the remaining convergent volunteers. An active Oil Spill Assessors program would help close the Local Knowledge and Volunteers gaps.

- *County Vessel of Opportunity Program*

  This option involves the County developing and maintaining a vessel of opportunity (non-dedicated response vessel) program. Reliance on fishing vessels as trained non-dedicated response vessels is difficult because fishing vessel crew are extremely mobile, many fishing vessel travel seasonally between Seattle and Alaska to participate in various fisheries, and it is likely that the most suitable and well-equipped vessels will be actively involved in fishing and thus would have their decks full of fishing gear (which would need to be removed before spill response operations could commence).[176] Many of the local oil spill response contractors already have their own guidelines for how they would proceed to contact and contract with non-dedicated response vessels in the event of a large spill.[177] One example of a spill where non-dedicated vessels (fishing vessels in this case) were used to assist with oil recovery is the *M/V Cosco Busan* spill in San Francisco. According to the *Cosco Busan* ISPR, "the Port of San Francisco made an offer to use fishing vessels to assist in the cleanup. Crews did not have HAZWOPER training, so the UC put trained HAZWOPER personnel on each of the commercial fishing boats, which were then used to collect oil. The Port paid the fishing vessel operators and supplied their fuel."[178]

[175] Bertolotto, C., 2011, January 17.

[176] Oil Spill Response Vessel Capabilities in the State of Washington: Use of Commercial Fishing and Other Vessels to Augment Oil Spill Response Capabilities, Prepared for State of Washington Department of Ecology Contract No. C0500277, File No. 05051, June 2005 http://www.ecy.wa.gov/programs/spills/studies_reports/Fishing%20Vessel%20Study%20Report.pdf

[177] Knight, J., 2011, February 14.

[178] ISPR: *Cosco Busan, 2008*

These fishing vessels should not be considered volunteers because they were paid for their service. The report concluded that "The ISPR Team cannot determine whether the fishermen's efforts were cost-effective but they clearly increased oil recovery capacity. In addition, their participation was important to promoting community goodwill."[179] An alternative to this option would be for the County to closely monitor proposed HOUSE BILL 1186 which, if passed, could require "tank vessels transiting to or from a Washington port [to] establish and fund a Vessels of Opportunity system to supplement the timely and effective response to spills."[180]

5.2 Criteria by which options are rated

To select the most appropriate course of action for the MRC or the County to undertake, each option has been evaluated on a number of criteria relevant to the County's decision-making process. Criteria can be broken down into two main categories: criteria related to capacity to implement and criteria related to operational effectiveness. The capacity criteria ascertain the level of ease with which the County could implement an option. These are rated on a green-yellow-red scheme. A green score indicates ease of implementation, yellow indicates an intermediate score, and red indicates that the option might be difficult to implement.

The effectiveness criteria demonstrate the extent to which these options yield benefits. The effectiveness criteria are evaluated in the table below with a green-yellow-gray grading scheme. A green score indicates that option fulfills that criteria, yellow indicates it partially fulfills the criteria, and gray indicates it does not fulfill the criteria.

<u>Capacity Criteria:</u>

Authority

This criterion examines whether or not the authority to undertake this option is known, and whether the County has that authority.

Resources Required

This criterion gauges the resources required to complete the action, in terms of additional funding, equipment or human resources. The main questions asked by the Team were:

- Can this option be added to or blended with existing County staff responsibilities?
- Can the County complete this option without purchasing equipment?
- Can the County complete option without additional training?

The scoring for this criterion is based on a cumulative look at these three questions, and a subjective appraisal of to what extent each resource might be needed to complete the option.

Existing Frameworks

This criterion examines whether or not there is an existing foundation or precedent that an option can be built on, either within or outside of the County. It also looks at the ease of integrating an option within existing County frameworks.

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[179] ISPR: *Cosco Busan, 2008*

[180] HOUSE BILL 1186: State of Washington 62nd Legislature 2011 Regular Session (H-0160.4) http://apps.leg.wa.gov/documents/billdocs/2011-12/Pdf/Bills/House%20Bills/1186.pdf

Independence

This criterion assesses the County's ability to complete a given option without additional assistance from other outside stakeholders. It is closely tied to both the criterion regarding authority as well as for resources required. Questions asked to evaluate an option on this criterion include:

- Can the County complete option without state- or federal-level assistance?
- Can the County complete option without relying on partners outside the County?

Avoids Duplication of Effort

This criterion assesses whether or not other entities exist that are better positioned to provide the same benefits as a proposed option. In this case, it is more an issue of whether or not the County would be expending resources for an option that is either already being addressed or better addressed elsewhere.

<u>Organizational Effectiveness Criteria:</u>

Community Engagement

This criterion evaluates the extent to which a given option engages County constituents. Community engagement lends legitimacy to the project and generates public support.

Communication Flows

This criterion assesses whether or not an option improves communication regarding spills. The Team primarily focused on how a given option affected interagency communication flows at the County level, or between the County and other spill-related agencies at the state, regional, or federal levels.

Increase Trust between the County and Other Agencies

This criterion looks at how the County's implementation of an option would affect its level of trust with other agencies involved in spill preparedness and response. Three factors considered within this one idea are whether:

- acting on the option will increase County credibility;
- it will positively affect the County's relationship with spill responders; and
- it improves the flow of information between the County and response agencies.

Increase County Influence

Similar to increasing trust, this criterion assesses whether or not an option increases the County's influence in spill response within the spill response community. Influence refers to the ability to impact relevant preparedness or response decision-making.

Building Community Knowledge & Understanding of Spill Response

This criterion examines whether an option increases knowledge at the local level regarding spill response, both for County officials and for the public.

5.3 Option Matrix & Recommendations

In order to evaluate options, the Team rated each option in terms of the criteria described above. Figure 37 evaluates the County's capacity for implementing the options. Figure 38 evaluates the operational effectiveness of the option. At the most basic level, Figure 37 is intended to assist the County with determining whether they will be able to implement the option and the Figure 38 is intended to assist the County with evaluating whether they should implement the option.

- The option is fully within the County's capacity
- County has partial capacity to implement
- The option is beyond the County's capacity

	CAPACITY				
	Authority	Resources Required	Frameworks	Independence	Avoids Duplication of Effort
Status Quo					
Pre-identify County Resources					
Pre-identify Volunteer Roles					
Prioritize Resources at Risk					
Maintain list of contacts					
Tabletop exercises					
Participate in drills w/ local plan-holders					
Sign up for the GRP & RRT/NWACP listserv					
Request and Participate in GRP field tests					
Coordinate community input to GRP/NWACP					
Ensure alignment between County response plans &NWACP					
Develop community education					
Revitalize Beach Watchers OSA Program					
County Vessel of Opportunity Program					

Figure 37: Table rating options against Capacity Criteria

The option improves effectiveness

The option moderately improves effectiveness

The option has no impact in this category

	EFFECTIVENESS				
	Community Engagement	Communication Flows	Increase Trust (w agencies)	Increase Influence	Community Knowledge
Status Quo					
Pre-identify County Resources					
Pre-identify Volunteer Roles					
Prioritize Resources at Risk					
Maintain list of contacts					
Tabletop exercises					
Participate in drills w/ local plan-holders					
Sign up for the GRP & RRT/NWACP listserv					
Request and Participate in GRP field tests					
Coordinate community input to GRP/NWACP					
Ensure alignment between County response plans &NWACP					
Develop community education					
Revitalize Beach Watchers OSA Program					
County Vessel of Opportunity Program					

Figure 38 Table rating options against Effectiveness Criteria

It should be noted that this table does not weight any of the criteria as more important than any other. When considering which options to implement, the County should refer to the color ratings proposed in this table, but should also consider whether the color rating should be revised based the relative importance of that particular criteria.

In order to further clarify these option's capacity and effectiveness, the Team established 4 categories for the ratings seen in Figure 37 and 38:

- High Effectiveness and High Capacity;
- High Effectiveness and Low Capacity;
- Low Effectiveness High Capacity; and,
- Low Effectiveness and Low Capacity.

The options fitting in each of these categories are listed below and shown in Figure 39 (next page).

High Effectiveness &High Capacity

- Pre-Identify County Resources
- Pre-Identify Volunteer Roles
- Prioritize Resources at Risk
- Coordinate community input to GRP/NWACP
- Maintain list of contacts

High Effectiveness &Low Capacity

- Tabletop exercises
- Participate in drills w/ local plan-holders
- Request and Participate in GRP field tests
- Revitalize Beach Watchers OSA Program

Low Effectiveness &High Capacity

- Status Quo
- Sign up for the GRP and RRT/NWAC listserv
- Ensure alignment between County response plans & NWACP
- Develop community education

Low Effectiveness &Low Capacity

- County Vessel of Opportunity Program

These options are not intended to be viewed as mutually exclusive bundles. The County might find it more beneficial to implement options from two or more bundles concurrently, based on perceived synergies between options.

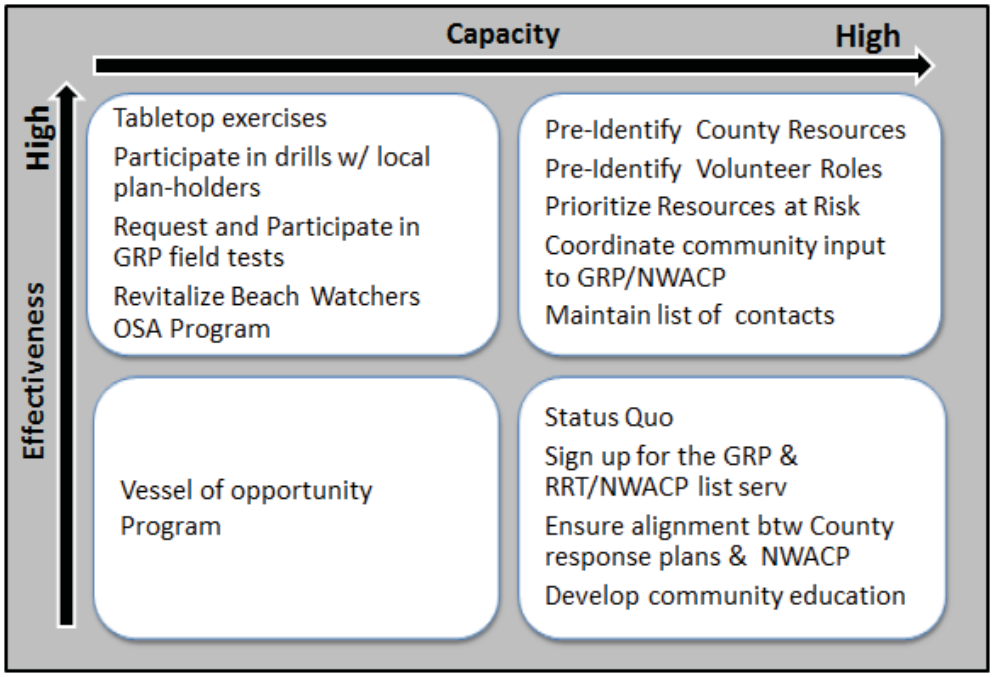

Figure 39: Summary of Options' overall Capacity and Effectiveness ratings

Next Steps

The work conducted by this Team provides a foundation for understanding and improving oil spill preparedness and response in Snohomish County. This report evaluates existing response structures and plans, identifies potential gaps, and presents options for addressing those gaps. This report lays the groundwork for future work relating to oil spill preparedness and response within Snohomish County. The County is rich is in human and institutional resources who can assist them with completing these tasks.

The Team offers some suggested next steps:

- Review the options presented, update capacity and effectiveness ratings based on current County resources and priorities, and consider which options could be easily integrated into existing County efforts.
- Reach out to partners for developing a strategy. One possibility is to engage the many spill response professionals who reside within Snohomish County in this process. The Coast Guard and DOE are also potential partners for strategy development.
- Identify areas for future research. One potential project would be to conduct working groups with Federal and State agencies to identify and collect the most salient types of local knowledge for use in the planning process.
- Work with NOAA to further refine the modeling analysis presented within this report so that shoreline and resources impacted would be specific to Snohomish County.
- Build overall County capacity by investing in ICS training. Specific guidance and job aids for each ICS position can be found in the Coast Guard Incident Management Handbook, U.S. Coast Guard COMDTPUB P3120.17A. Available online at http://www.uscg.mil/hq/nsfweb/docs/FinalIMH18AUG2006.pdf. FEMA offers free online training in ICS at http://www.training.fema.gov/IS/NIMS.asp

It is the sincere desire of this Team that the information presented in this study will greatly aid the County in realizing their goal of enhanced oil spill preparedness. Thank you for this opportunity to work with you toward this important and exciting goal.

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Appendix 1: UW Keystone Team Charter

SNOHOMISH MRC OIL SPILL PREVENTION/PREPAREDNESS PROJECT
UW Environmental Management Certificate Program

Team Name: EM Keystone Oil Spill Team

Team Sponsor: Snohomish County Marine Resources Committee
Contact: Kathleen Herrmann

Team Members: Sara Booth Andrea Kunz
Tom Carter Vivien Savath
Advisor: Dr. Robert Pavia

Purpose of this Memo

This memo provides an initial description of the mission and goals of the EM Keystone Oil Spill Team (the Team) in partnership with the Snohomish County Marine Resources Committee (MRC).It is intended as an iterative document which will help both parties develop a more complete understanding of the work to be accomplished. Following discussion with the MRC and the Team Sponsor, this memo will provide the basis for defining the project management plan scope.

Project Goal/Mission Statement

To inform Snohomish County government about the threats and potential impacts of marine oil spills on social, environmental, and economic interests in the County, and to identify and develop prevention and preparedness options for reducing the risks and consequences of marine oil spills.

Project Objectives

7. **Investigate single-source oil spill prevention and preparedness laws, regulations, and programs at federal, state, and county levels** through research and interviews with relevant stakeholders.*(Phase 1)*

8. **Examine environmental impacts of single-source marine oil spills and related treatment methods** based on spill characteristics, through research and interviews with relevant scientific bodies. *(Phase 1)*

9. **Assess spill threats to Snohomish County interests and resources** with regard to differing types, sizes, and sources of spills and identify 3-5 likely oil spill scenarios for more detailed study. *(Phase 1)*

10. **Identify threats to social, environmental, and economic interests** within Snohomish County should a spill occur. Identify existing gaps in oil spill prevention and preparedness plans affecting Snohomish County. *(Phase 2)*

11. **Develop and compare a suite of options (using a matrix or similar rating system) that the County can implement** to reduce the likelihood or consequences of a spill occurring in Snohomish County. *(Phase 2)*

12. **Deliver findings and options** to Snohomish MRC, via final report and group presentation. *(Phase 2)*

Constraints

Economic

- The Team has a limited budget to pursue these objectives.
- Economic constraints within Snohomish County could limit the range of options that can be implemented.

Time

- The Team has only two academic quarters (20 weeks) in which to research the problem and submit our findings and recommendations.
- Creating options which address an uncertain future event can be politically difficult; the window of time where oil spills command sufficient public attention to support action is narrow.

Influence

- The advisory nature of both the MRC and the Team could constrain the project's ability to drive change.
- Many areas related to oil spill prevention and preparedness are managed at Federal and State levels, which could limit the County's authority to address perceived needs.

Scientific

- Scientific information regarding the specific impacts of oil spills to Snohomish County's marine areas and resources could be unavailable or contradictory, creating uncertainty as to the most effective solutions.

Deliverables

The Team envisions the project in two phases, with discrete deliverables in each.

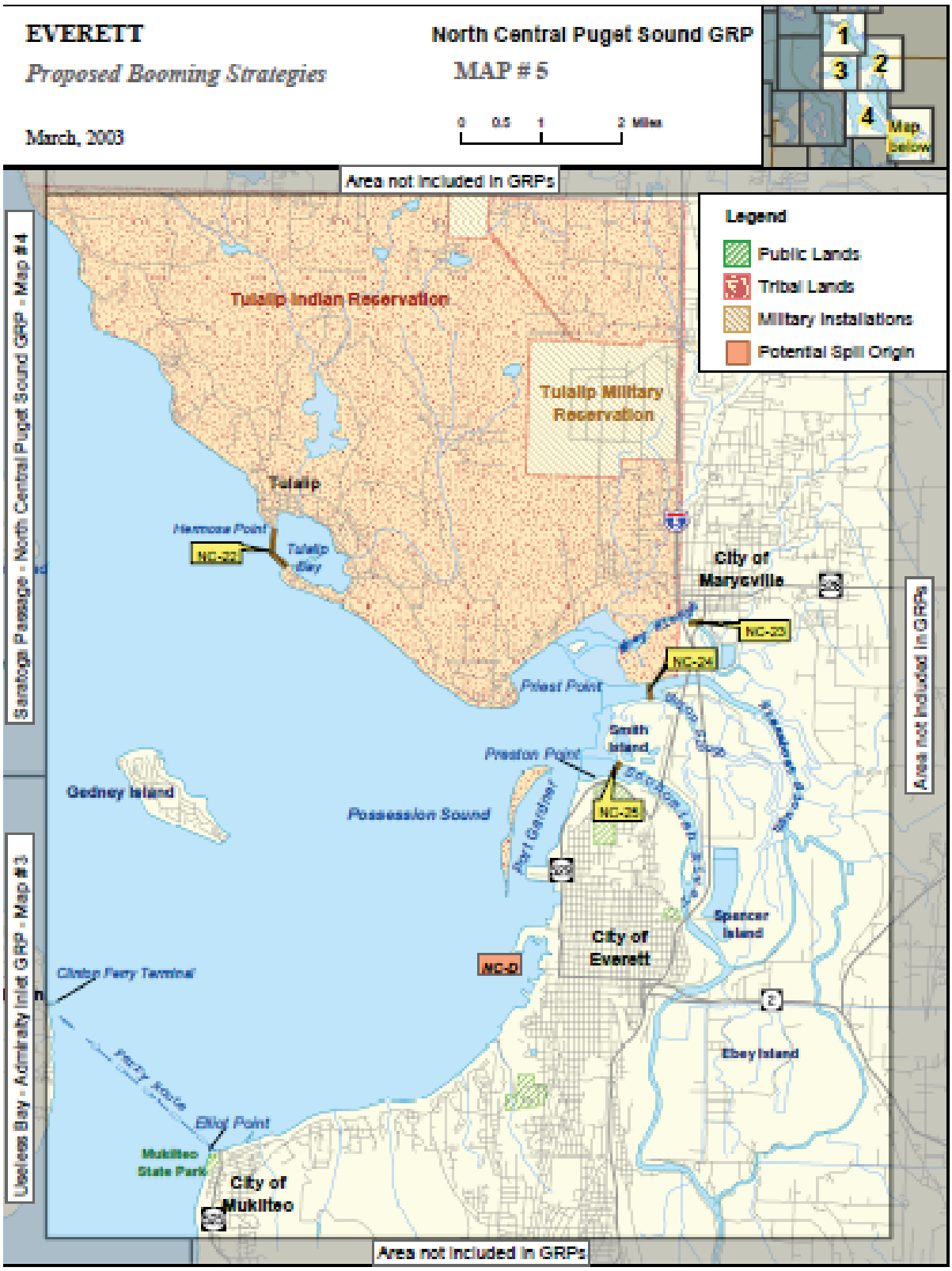
Phase 1: Investigate and document existing situation (15 Dec 2010)

- Report of Existing Conditions
  - Threat map
  - Stakeholder map
  - Comparison of stakeholder jurisdictions
  - Identification and description of 3-5 likely spill scenarios

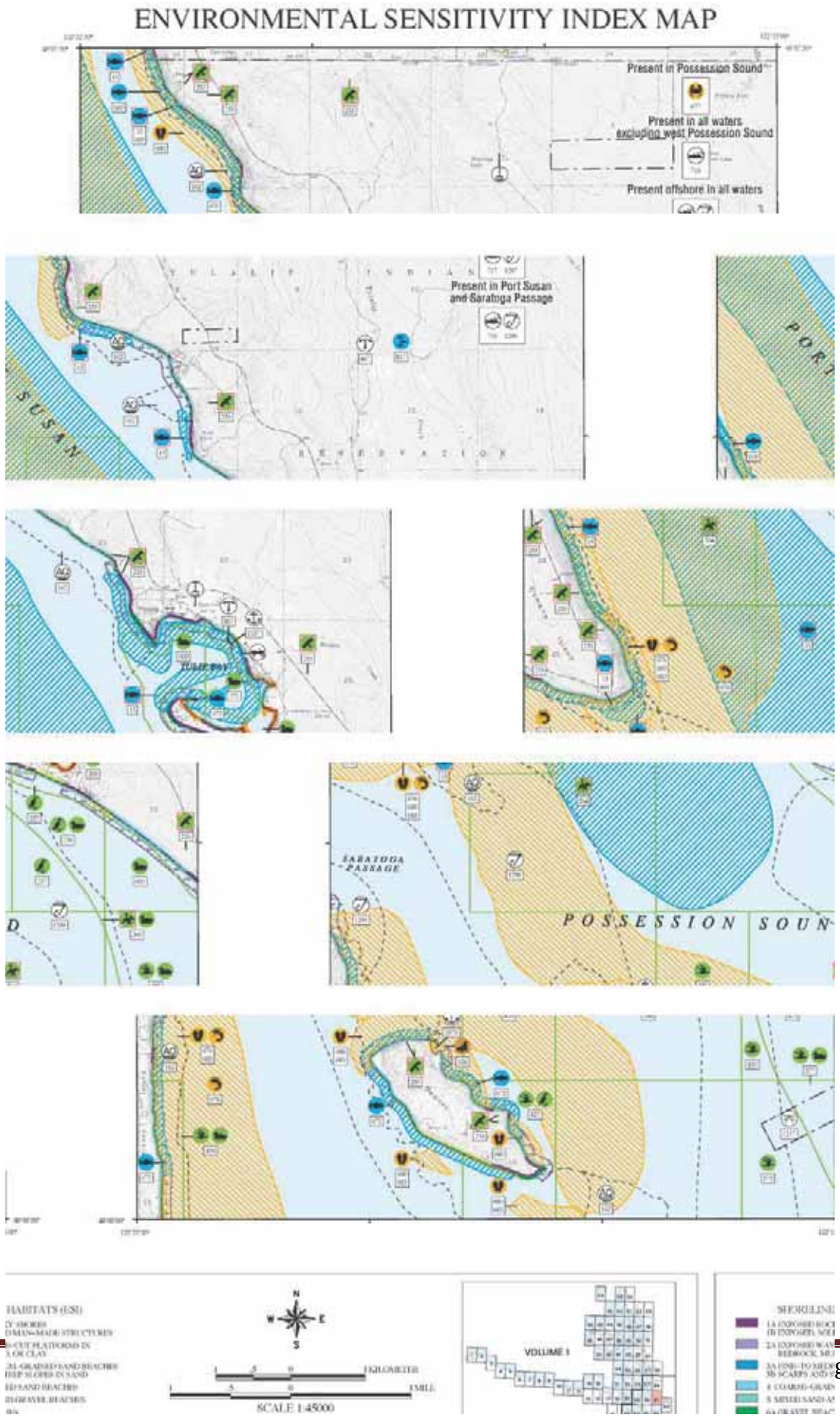
Phase 2: Analysis and Recommendations (16 Mar 2011)

- Spill scenario analysis and comparison
- Alternatives matrix
- Final paper and presentation

Appendix 2: Sample GRP Map: NC-5 Everett



Appendix 3: Port Susan ESI – created by NOAA



Appendix 3 Port Susan ESI (continued) – created by NOAA

Puget Sound and the Strait of Juan de Fuca: ESIMAP 61

BIOLOGICAL RESOURCES:

BIRD:

RAR#	Species	$	F	Conc.	J	F	M	A	M	J	J	A	S	O	N	D	Nesting	Laying	Hatching	Fledging
253	Bald eagle	T	T		X	X	X	X	X	X							JAN-JUL	FEB-MAR	MAR-APR	JAN-JUL
257	Pigeon guillemot						X	X	X	X	X	X					MAY-AUG	MAY-JUL	JUN-AUG	JUL-AUG
259	Pigeon guillemot						X	X	X	X	X	X					MAY-AUG	MAY-JUL	JUN-AUG	JUL-AUG
	Waterfowl				X	X	X	X	X	X			X	X	X	X	-	-	-	-
264	Western grebe		C		X	X	X	X						X	X	X	-	-	-	-
266	Waterfowl				X	X	X	X	X	X			X	X	X	X	-	-	-	-
	Western grebe		C		X	X	X	X						X	X	X	-	-	-	-
268	Scoters				X	X	X	X	X			X	X	X	X	X	-	-	-	-
271	Scoters				X	X	X	X	X			X	X	X	X	X	-	-	-	-
	Waterfowl				X	X	X	X	X	X			X	X	X	X	-	-	-	-
420	Gulls				X	X	X	X	X	X	X	X	X	X	X	X	MAY-SEP	MAY-JUL	JUN-AUG	JUN-SEP
425	Gulls				X	X	X	X	X	X	X	X	X	X	X	X	MAY-SEP	MAY-JUL	JUN-AUG	JUN-SEP
	Waterfowl				X	X	X	X	X	X			X	X	X	X	-	-	-	-
427	Gulls				X	X	X	X	X	X	X	X	X	X	X	X	MAY-SEP	MAY-JUL	JUN-AUG	JUN-SEP
	Pigeon guillemot						X	X	X	X	X	X					MAY-AUG	MAY-JUL	JUN-AUG	JUL-AUG
439	Gulls				X	X	X	X	X	X	X	X	X	X	X	X	MAY-SEP	MAY-JUL	JUN-AUG	JUN-SEP
	Scoters				X	X	X	X	X			X	X	X	X	X	-	-	-	-
575	Caspian tern							X	X	X	X	X					APR-AUG	APR-AUG	MAY-JUL	JUN-AUG
	Gulls				X	X	X	X	X	X	X	X	X	X	X	X	MAY-SEP	MAY-JUL	JUN-AUG	JUN-SEP
577	Caspian tern							X	X	X	X	X					APR-AUG	APR-AUG	MAY-JUL	JUN-AUG
	Gulls				X	X	X	X	X	X	X	X	X	X	X	X	MAY-SEP	MAY-JUL	JUN-AUG	JUN-SEP
	Waterfowl				X	X	X	X	X	X			X	X	X	X	-	-	-	-
600	Waterfowl				X	X	X	X	X	X			X	X	X	X	-	-	-	-

FISH:

RAR#	Species	$	F	Conc.	J	F	M	A	M	J	J	A	S	O	N	D	Spawning	Eggs	Larvae	Juveniles	Adults
15	Pacific herring	C	C		X	X	X	X	X	X							JAN-JUN	-	-	-	-
16	Pacific herring	C	C		X	X	X	X	X	X							-	-	-	-	JAN-JUN
669	Surf smelt				X	X	X	X	X	X	X	X	X	X	X	X	JAN-DEC	-	-	-	-
670	Pacific sand lance				X	X									X	X	NOV-FEB	-	-	-	-
	Surf smelt				X	X	X	X	X	X	X	X	X	X	X	X	JAN-DEC	-	-	-	-
672	Pacific sand lance				X	X									X	X	NOV-FEB	-	-	-	-

INVERTEBRATE:

RAR#	Species	$	F	Conc.	J	F	M	A	M	J	J	A	S	O	N	D	Spawning	Eggs	Larvae	Juveniles	Adults
676	Pandalid shrimp				x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
677	Dungeness crab				x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
680	Hardshell clams				x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
683	Geoduck				x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-

MARINE MAMMAL:

RAR#	Species	$	F	Conc.	J	F	M	A	M	J	J	A	S	O	N	D	Mating	Calving	Pupping	Molting
656	Harbor seal				X	X	X	X	X	X	X	X	X	X	X	X	-	-	JUN-AUG	AUG-OCT

HUMAN USE RESOURCES:

AQUACULTURE:

HUN#	Name	Contact	Phone
162	POSSESSION SOUND		

COMMERCIAL FISHING:

HUN#	Name	Contact	Phone
716	DEMERSAL GROUNDFISH FISHING		
717	PELAGIC GROUNDFISH FISHING		
719	SALMON FISHING		

HATCHERY:

HUN#	Name	Contact	Phone
817	TULALIP HATCHERY (BERNIE GOBIN HATCHERY)		

INDIAN RESERVATION:

HUN#	Name	Contact	Phone
867	TULALIP INDIAN RESEVATION	TULALIP RESERVATION	360/651-4000

MARINA:

HUN#	Name	Contact	Phone
1075	HAT ISLAND COMMUNITY	HAT ISLAND COMMUNITY	360/444-6611
1157	TULALIP BAY MARINA		

PARK:

HUN#	Name	Contact	Phone
1217	EVERETT JETTY	DEB PETERSEN, WASHINGTON STATE PARKS	360/902-8634

RECREATIONAL FISHING:

HUN#	Name	Contact	Phone
1296	DEMERSAL GROUNDFISH FISHING		
1297	PELAGIC GROUNDFISH FISHING		
1299	SALMON FISHING		

Appendix 4: ICS 232 Form

1. Incident Name	2. Operational Period (Date / Time) From: To:	RESOURCES AT RISK SUMMARY ICS 232-OS

3. Environmentally-Sensitive Areas and Wildlife Issues

Site #	Priority	Site Name and/or Physical Location	Site Issues

Narrative

4. Archaeo-cultural and Socio-economic Issues

Site #	Priority	Site Name and/or Physical Location	Site Issues

Narrative

5. Prepared by: (Environmental Unit Leader) **Date / Time**

RESOURCES AT RISK SUMMARY June 2000 ICS 232-OS

Electronic version: NOAA 1.0 June 1, 2000