ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 96-1, OLYMPIC PIPE LINE COMPANY CROSS CASCADE PIPELINE PROJECT.	**NO.** **PREFILED TESTIMONY OF : STEVEN E. HUGHES** **ISSUE: COMPARATIVE RISKS TO RESOURCES** **SPONSOR: COUNSEL FOR THE ENVIRONMENT**

Q. Please state your name, employment position and work address.

A. My name is Steve Hughes. I am president of Natural Resources Consultants, Inc. (NRC). My business address is 4055 21st Avenue West, Suite 100, Seattle, WA 98199.

Q. What is NRC and how long has this company been in business?

A. NRC is a private fisheries research and consulting firm, founded in 1980.

Q. What is your educational and employment background?

A. B.S. (Biology), Western Washington University, 1967
M.S. (Biology), Western Washington University, 1969

1960-1964	Commercial fisherman, summer seasons
1968-1970	Fishery biologist, U.S. Bureau of Commercial Fisheries, Seattle
1970-1972	Fishery biologist, project leader, National Marine Fisheries Service, Seattle
1973-1976	Sub-task leader, Alaskan Groundfish Assessment, National Marine Fisheries Service, Seattle
1977-1981	Task leader, Latent Resource Assessment, National Marine Fisheries Service, Seattle
1981-1991	Owner, Natural Resources Consultants, Inc., Seattle
1992-1993	Owner/Executive Vice President, Natural Resources Consultants, Inc., Seattle
1994	Owner/Vice President, Natural Resources Consultants, Inc., Seattle
1995-Present	Owner/President, Natural Resources Consultants, Inc., Seattle

Q. What topics is your testimony intended to cover?

A. First, I will explain the types of services NRC provides.

Second, I will explain the types of projects I have worked on at NRC.

Third, I will describe the NRC team that prepared the analysis presented here and explain the expertise of the team members.

Fourth, I will describe the process used to develop our analysis.

Finally, I will discuss the comparative risks to resources posed by each of the three Scenarios developed for Counsel for the Environment by Dr. Wes Miller.

Q. What types of services does NRC provide and who are NRC clients?

A. Natural Resources Consultants, Inc., was established to meet the need for a comprehensive consulting service dealing with all aspects of marine and inland fisheries and their related resource base. Since its formation, NRC has undertaken more than 1,300 projects concerned with assessment, conservation, utilization, valuation, and commercial development of marine and inland aquatic resources.

Best known for its work in commercial fisheries of the Northeast Pacific and Bering Sea, NRC and its officers have also done extensive work in fisheries research throughout the world, including the North Atlantic, Indian Ocean, and South Pacific. More recently, NRC has carried out extensive research in the growing areas of natural resource damage assessment, port development, aquaculture, and recreational fisheries.

This work includes:

- Resource appraisals and forecasts

- Environmental assessment and impact assessment
- Port and fishery infrastructure development
- Expert witness and legal research work in loss and liability claims
- Investment appraisals and planning
- Economic analysis and forecasting
- Market analysis, market development, and market forecasting
- Fishery policy, plans, and legislation
- Industry strategy, development, and investment
- Special publications, symposia, and workshops
- Vessel operation and gear design
- Geographic Information Systems (GIS) development
- Satellite and aerial photographic image interpretation
- Remote sensing data acquisition, handling and analysis

In addition, NRC provides general advisory services for a variety of industry and government agencies on a continuing retainer basis.

NRC's private clients include a long list of vessel owners, fish processing companies, fisheries trade associations, shipyards, freight companies, banks and other lending firms, law firms, marine insurance companies and marine cable installation companies. In the public sector we advise and do research for the National Marine Fisheries Service, North Pacific and Pacific Fishery Management Councils, the Pacific States Marine Fisheries Commission, several state fisheries agencies, the Port of Seattle and numerous municipalities

Q. What types of projects have you worked on at NRC?

A. My work has been primarily in the areas of commercial fisheries research, fisheries development, fisheries strategy and the promotion of sustainable yield fisheries management. In recent years I have also worked extensively as a fisheries expert in litigation involving business interruptions and personal injury cases.

During the 1980's, with 13 years of experience and over 1,000 days of work at sea in fisheries resource assessment as a chief scientist in the North Pacific, Gulf of Alaska and Bering Sea, my work involved primarily research directed at rational development of American fisheries in Alaska and their management. During this decade, large-scale foreign fisheries in this region were replaced by domestic fisheries. The 1980's involved work at sea in commercial operations, training, commercial gear development, bycatch reduction programs, development of a domestic fisheries observer and catch reporting program and work with the North Pacific Fishery Management Council as technical director of a fisheries trade association called the Midwater Trawlers' Cooperative. Also during the 1980's I was in charge of a two-year fisheries research and development program for the World Bank in North Africa. During the 1990's much of the work from the 1980's has continued but with much less time at sea in fisheries development and more time overseeing the business of NRC, serving as fisheries technical director for a large trade association of catcher boat owners, advising a diverse clientele of fishing companies and an expanding expert witness practice. In my career to date, I have authored or co-authored over 30 scientific and technical articles and over 600 NRC private client reports. I have been retained in about 600 NRC legal cases and I have provided expert witness testimony in numerous federal courts in Seattle, as well as federal courts in Portland, Eugene, Hawaii, Anchorage and Tacoma, plus state courts in Alaska, Washington and Oregon.

Q. What analysis were you requested to make in preparation for testifying in this case?

A. Counsel for the Environment retained NRC to assess the comparative risks to resources of Washington State from the transport of refined petroleum product by the proposed Cross

Cascade Pipeline, by the status quo routes of transportation, and alternative north/south pipeline from Renton to Portland.

Q. What was the primary conclusion you reached based upon NRC's assessment?

A. Over a projected 50-year period, the relative risk to Washington State natural resources from the proposed Cross Cascade Pipeline is more than double the risk to natural resources posed by the existing transport by truck and barge.

Q. Who was on the NRC team for the analysis presented here?

A. Besides myself, the team consisted of Dr. Greg Ruggerone, Dr. Sarah Cooke, Dr. Gary Pascoe, Don Norman and Steve Speich. Dr. Ruggerone's expertise is in the area of fisheries habitat and management. Dr. Cooke is a wetlands scientist with expertise in botany, soils and mass wasting. Dr. Pascoe is an environmental toxicologist. Mr. Norman has expertise in toxicology and wildlife, and Mr. Speich has expertise in wildlife and pipeline/pollution impacts to natural resources. With this team of people, we covered the range of resources at risk of impact from a spill of petroleum product in freshwater, the marine environment or on land. For more detailed information on the qualifications of the NRC Team, I have included the curriculum vitae of all team members. Exh. SEH-17.

Q. Explain how team members familiarized themselves with the proposed CCP.

A. The Team members reviewed Olympic's application, revised application and the Draft Environmental Impact Statement, with special attention to their areas of expertise. In October

1997, Greg Ruggerone, Sarah Cooke, Don Norman and I conducted a two-day site visit of the proposed pipeline route. We investigated 27 different sites along the route. The Team also met with Dr. Wes Miller and discussed his analysis of the comparative risk of spills from pipelines, barges and trucks.

Q. Explain what method the NRC team chose to assess the risks to resources posed by each of the three Scenarios developed by Dr. Miller.

A. The NRC Team chose to use the matrix approach based upon the work of Dr. Wayne Landis at Western Washington University. (Wiegers et. al., 1997a; Wiegers, et al. 1997b). The assessment of comparative risks to resources and habitats posed by each of the three scenarios for transporting oil is complex. It involves numerous natural resources over a broad range of geographical regions from aquifers, wetlands, rivers and streams on the west and east sides of the Cascades, to the marine waters of the Straits of Juan de Fuca and the outer Washington coast, to the Columbia River. The NRC team chose the matrix approach to reduce the complexities of the analysis while preserving the opportunity to evaluate information at each level of the analysis. The matrix approach has the following attributes which make it an appropriate tool for a complex analysis.

The matrix enables a logical comparison of complex issues by assigning relative rankings to resources based on a standard set of criteria. The matrix addresses multiple variables. For example, to establish resource rank for each resource category within each geographic region, the Team considered the abundance, density, and importance of the resource; the quality and pristine nature of the habitat; and the number of life history stages of the resource present. The matrix was based upon the best scientific information available at this time. The rankings are qualitative, based upon the best professional judgment of experts for each resource, but lead to a quantitative comparison of the relative risks posed by each scenario. The matrix contains levels of detail that are substantiated with back-up rationale and criteria so that the decision-making process can be tracked throughout the matrix process. The results are specific rankings of future risk to Washington State natural resources and habitats by oil transport mode and scenario. The matrix also provides for a sensitivity analysis to evaluate the relative effect of key factors. In other words, if someone believes a resource that was ranked a “3” (highest value) should instead have been a “1” (lowest value), the matrix can easily be re-run to determine how that change in rank affects the ultimate ranking of risk. In this way, it is a powerful tool for decision makers.

Q. What were the components of the matrix analysis?

A. The matrix considered the relative risk to natural resources from three alternative modes of oil transport which are in commercial use- pipeline, barge and truck- used in combination in the three Scenarios developed by Dr. Wes Miller. See Testimony of Dr. Wes Miller, Exh. JWM-T. and JWM-1. The matrix considered the spill volumes projected by Dr. Miller over a 50-year period within each Scenario. The matrix identified the geographic regions within each Scenario, and identified and ranked the natural resources within each of the geographic regions by relative value and occurrence. The matrix finally calculated the interaction of spill volume and resources within each geographic region and within the scenarios as a whole. The result is an overall quantitative rating of the relative risk to natural resources and habitats by transport scenario over the next 50 years.

Q. Describe the three Scenarios developed by Dr. Miller.

A. Scenario A is the proposed Cross Cascade Pipeline (CCP). Exh. SEH-1. The proposed pipeline would originate in Woodinville as a connection to the OPL existing north-south pipeline from the refineries in northwest Washington and would carry product through a 14" pipe to the Kittitas Terminal. At Kittitas a portion of the product would be transferred into tanker trucks for delivery into central Washington. The remaining product would be carried in a 12" pipeline to the terminal in Pasco. There it would be transferred into tanker trucks and transported throughout eastern Washington.

Scenario B, Status Quo, represents the way product is presently transported from the refineries in northwest Washington to central and eastern Washington. Exh. SEH-2. Product is carried by Olympic's existing pipeline from the refineries to Renton. At Renton a portion of the product is transported by pipeline to Harbor Island Terminal where it is transferred into tanker trucks and delivered to central Washington via I-90, Snoqualmie Pass. Product is carried beyond Renton by the existing north-south OPL pipeline to terminals in Vancouver and Portland. Refined oil product also reaches Vancouver and Portland via ocean barges that leave directly from the refineries. Product is transferred from the Vancouver/Portland terminals to Tidewater river barges and transported upriver to Pasco. From Pasco, it is transported by truck throughout eastern Washington.

Scenario C, New North-South Pipeline, is an alternative to the proposed pipeline and to the status quo. Exh. SEH-3. Under this alternative, product is carried by Olympic's existing pipeline from the refineries to Renton. Olympic would construct a new pipeline from Renton to Vancouver/Portland where the product would be loaded onto Tidewater river barges for transport to Pasco and delivery by tanker truck to eastern Washington. Product would also continue to be delivered to central Washington by tanker trucks originating at Harbor Island and traveling over Snoqualmie Pass.

Q. How did you determine the estimated spill volumes over 50 years for Scenarios A, B and C?

A. The values were provided by Dr. Miller, who projected the estimates of actual refined product spills by pipelines, barges and trucks from national and regional databases. Exh. JWM-1. Miller's spill volume estimates assumed equal volumes of product transported for each scenario. Oil spill volumes reported in Exh. SEH-4 represent the estimated volume spilled by scenario, separated by transportation mode and scenario segment, during a 50-year period.

Scenario A, the Cross-Cascade Pipeline, assumed 100% of the project oil (276 million metric tons (mmt)) would enter the Cross Cascade Pipeline and be transported to Kittitas, where 14% of the total would be removed and transported by truck to central Washington retailers. The remaining 86% would continue to Pasco by the new pipeline, then by truck to eastern Washington users.

Scenario B, the Status Quo, assumed that 55% (152 mmt) of project oil during the 50-year period would be transported by ocean barge from North Puget Sound refineries to Vancouver and Portland where it would be transferred to river barges for transport to Pasco. The remaining 45% of project oil would be transported by the existing pipeline to Renton, where 15% (41 mmt) would go to Harbor Island for transport by truck to central Washington and 30% (82.8 mmt) would continue down the existing pipeline to Vancouver and Portland. A total of 85%

(234 mmt) of the project oil would be transported by river barge from Vancouver and Portland to Pasco, then by truck to eastern Washington users.

The proportions used in Scenario B are based upon Olympic's assumptions that without the Cross Cascade Pipeline, the increased demand in eastern Washington would be met solely by increased trucking and barging. Miller assigned 15% of the fuel to go from Harbor Island to central Washington by truck to correlate with the volume the Applicant states would be off-loaded at the Kittitas Terminal. We assumed the existing north-south pipeline would continue to carry the same amount of product bound for Pasco that it currently does. The balance of project oil was assigned to ocean-going barges. It is our opinion that this overestimates the amount of product that will be carried by ocean barge because it fails to take into account fuel transported by tanker from San Francisco to Portland that is barged upriver to Pasco. It also does not consider any increased supply to eastern Washington via the Yellowstone Pipeline from Montana.

Scenario C, the New North/South Pipeline, assumed that 85% of project oil (234 mmt) would be transported down a new North/South Pipeline from Renton to Vancouver and Portland, then transferred to river barge and transported upriver to Pasco, then by truck to eastern Washington users. The remaining 15% of project oil (41 mmt) would be diverted from the existing pipeline in Renton to Harbor Island where it would be transported by truck to central Washington.

Exh. SEH-4 shows the expected spill volume over 50 years in each scenario. Also shown is the percentage of the total spill volume in the scenario associated with each transportation segment.

According to Dr. Miller's estimates, total spill volume over the 50-year period is expected to be approximately 1.80 times greater under the Cross Cascade Pipeline scenario compared to Status Quo:

Expected Volume Spilled (million gallons)

Cross Cascade Pipeline:	1,016,661
Status Quo:	565,114
New North/South Pipeline	906,573

Exh. SEH-5 is a bar graph that presents the expected spill volumes.

The final calculation in Exh. SEH 4 was the Relative Spill Volume Factor (RSVF). The RSVF expresses the volume spilled within each segment of a scenario as the percentage of the total volume spilled in the Status Quo Scenario. For example, it is estimated that the Cross Cascade Pipeline over 50 years would spill 336,000 gallons in the pipeline segment from Woodinville to Kittitas. This represents 33% of the total volume spilled in Scenario A. However, it represents 59% of the total volume spilled in Scenario B, the Status Quo. By expressing volume spilled in each scenario segment as the percentage of the total volume spilled in the Status Quo, it allows a standardized comparison of the impact of the spill volume on the natural resources. The Relative Spill Volume Factor is calculated as follows:

RSVF = (Scenario spill volume/Status Quo spill volume) x (% spill in each transport segment).

Q. Do the Scenarios account for projected spills and impacts from existing pipelines?

A. Spill volumes associated with the existing pipeline were not included in Exh. SEH-4 because the existing north-south system presents a static risk of spills. The comparison that we were asked to make is between the risks to resources posed by the Cross Cascade Pipeline and the risks from transportation of oil products that will take place if the new pipeline is not built. It is Olympic's position that if the Cross Cascade Pipeline is not built, the increasing demand for refined oil products in eastern Washington will have to be met by increased barge and truck transport of oil. Therefore, the comparison of risk which is relevant to the Council's decision is a comparison between the risks from the proposed pipeline with those from trucks and barges. Because Olympic's north-south pipeline and the spur pipelines, including the one to Harbor Island, will continue to operate regardless of whether the Cross Cascade Pipeline is built, they remain a static risk to the resources. That is not to say that the existing pipelines don't pose a risk to the state's resources; they do. And as the north-south line continues to age, it will pose a greater risk. However, an analysis of the risks posed by all existing pipelines in Washington State is beyond the scope of this project. The relevant analysis here is the comparative risk between the proposed pipeline and its alternatives.

This approach is consistent with that taken in the DEIS at p. 2-36:

> Because the existing pipeline system would remain with or without the project, it is a "constant" and the difference between No Action and the proposal can be described in terms of a new line and terminal versus barging/trucking. For this reason, impacts of the existing line itself are not discussed in detail in this EIS with or without the project. They are the same in either case.

Q. What was the basis for determining the geographic regions?

A. We attempted to use natural boundaries when defining geographic areas. For example, we identified and used the Snohomish and Yakima river watersheds where the pipeline intersects a major cross-section of the watershed. The Snohomish watershed is quite large, extending from Puget Sound near Everett to Snoqualmie Pass. Snoqualmie Falls blocks the migration of anadromous salmonids, but resident salmonids utilize the upper watershed and its is conceivable that oil spilled above Snoqualmie Falls could impact anadromous salmonids, including ESA chinook salmon, below the falls. Thus, we chose not to separate this large region based on the salmon migration barrier. The mid-Columbia watershed encompassed the large region between the Yakima watershed and Pasco.

A number of smaller watersheds are associated with the new North/South Pipeline scenario. Some of these were grouped based on the region and resources. For example, the Chehalis River watershed was identified separately because it does not support ESA salmon.

Trucking represented a unique geographic region because the highway system is essentially a "built" corridor that traverses the watersheds. Habitat within the highway corridor is controlled by the Department of Transportation and is quite different from less disturbed habitat crossed by the pipeline. For this reason, we treated highways as separate geographic regions. Three trucking regions were identified because they corresponded to spill data presented by Dr. Miller, Exh. JWM-T and Exh. JWM-1.

Ocean barging was divided into four geographic regions. Puget Sound and coastal Washington are obvious selections, as is the lower Columbia River below the transfer station in Vancouver. We added the Columbia River Bar because this is a small area having relatively greater spill risk due to potentially severe tidal, river and weather interactions. The region between the transfer station in Vancouver and Pasco was identified as a distinct geographic region for the purpose of this analysis.

Q. What are the geographic regions found within each of the Scenarios?

A. Scenario A, the Proposed Cross Cascade Pipeline, covers five geographic regions: Snohomish and Lake Washington Watersheds; Yakima Watershed; Mid-Columbia Watershed;

Kittitas to Central Washington Highways; and Pasco to Eastern Washington Highways. Exh. SEH-6.

Scenario B, Status Quo, includes seven geographic regions: North Puget Sound; Coastal Washington; Columbia River Bar; Lower Columbia River; Portland to Pasco, Columbia River; Harbor Island to central Washington Highways; and Pasco to Eastern Washington Highways. Exh. SEH-7.

Scenario C, New North/South Pipeline from Renton, covers six geographic regions: Puget Sound Watersheds; Chehalis Watershed; Columbia River Tributary Watersheds; Portland to Pasco, Columbia River; Harbor Island to Central Washington Highways; and Pasco to Eastern Washington Highways. Exh. SEH-8.

For a more complete description of the geographic regions, see the Appendix to my testimony, Exh. SEH-15, pp. 1-8.

Q. Why was it important to identify the geographic regions within each Scenario?

A. The Scenarios were divided into segments based upon the different transportation modes included in a scenario. For example, the proposed Cross Cascade Pipeline has four segments: (1) a 14” pipeline from Woodinville to Kittitas; (2) a 12” pipeline from Kittitas to Pasco; (3) tanker trucks from Kittitas to central Washington; and (4) tanker trucks from Pasco to eastern Washington. The scenario was divided into these segments because each one has a separate risk of spill (frequency and volume). Natural resources, however, occur by geographic regions, which do not correspond on a 1:1 basis with scenario segments.

Q. How did you assess the relative spill volume factor by geographic region?

A. To assess the potential spill volume, it was necessary to determine which geographic regions were included within each scenario and determine what the RSVF was for each geographic region. In Exh. SEH-4, the RSVF was determined for each scenario segment. In order to assign a RSVF to each geographic region, it was necessary to determine what percentage of a segment is within a geographic region. For example, the Cross Cascade Pipeline scenario segment from Woodinville to Kittitas (14" diameter) is 120 miles long and spanned both the Snoqualmie and Yakima watersheds, which are 57 miles and 63 miles long respectively. Therefore 48% of the RSVF associated with this scenario segment was assigned to the Snohomish Watershed and 52% was assigned to the Yakima Watershed, based on pipeline miles. Exh. SEH-9. Twenty-four percent of the Kittitas to Pasco pipeline (12" diameter) also spanned a portion of the Yakima Watershed, thus this portion of the risk from the Kittitas to Pasco segment was added to the Yakima geographic region. Exh. SEH-9 documents calculation of RSVF for each geographic area.

Q. What natural resources are at risk from oil spills across Scenarios A, B and C?

A. The NRC Team identified 12 natural resource categories across the routes covered by Scenarios A, B and C:

Endangered/threatened species of marine birds and mammals
Marine Fishes
Marine shellfish
Estuarine communities
Aquatic birds
Salmon
Threatened and endangered salmon
River/stream/lake riparian communities
Wetland communities

Terrestrial communities
Endangered/threatened riparian/terrestrial communities
Groundwater/aquifers

The resource categories were chosen to be representative of the significant natural resources and associated habitats along the oil transportation routes. Not all of the categories are found within each scenario. For a more detailed explanation of the resource categories, see the Appendix to my testimony, Exh. SEH-15, pp. 8-26.

Q. How did you determine the rankings of relative importance for natural resource categories?

A. Natural Resources in each geographic region of each Scenario were given a value ranging from 0 to 3:0 indicates the resource was not present; 0.1 indicates a trace value to indicate that while the resource is of very low importance it is not totally absent; 1 and 2 indicate low and moderate importance respectively; and 3 indicates the highest relative importance of the resource potentially at risk in the geographic region. The rankings were subjectively determined by the Team based on their collective knowledge of the resources in the geographic regions. The rank values express relative resource values across the various geographic regions. Exh. SEH-10.

The following criteria were used to help guide the Team when assigning rank to natural resources within each geographic region:

Rank	**Species Abundance and Density**
3	High Numbers and High Density
2	Moderate Numbers and Density
1	Low Numbers and Low Density
0.1	Rarely occurs in Region
0	Does Not Occur in Region

Percent of Population in Area

3	Major Percent of Population/Habitat of Region is Present
2	Population/Habitat Percentage Important
1	Relatively Low Percentage of the Population
0.1	Infrequent Relative to Other Regions
0	Does Not Occur in Geographic Region

Quality and Pristine Nature of Habitat

3	High Quality Habitat Important at Regional Level
2	Good Quality Habitat is Present
1	Habitat Present but Degraded, Dispersed, Unconnected
0.1	Little Habitat in Region or is Severely Degraded
0	Does Not Occur in Geographic Region

Life History Stages

3	Multiple Critical Stages Occur in Region
2	Major Life History Stages Occur in Region
1	Life History Components Occur, but Less Frequently
0.1	Only Infrequent Portion of Life History in Region
0	No Life History Stages Occur in Region

I will use salmonids to describe the approach the Team took to ranking. Salmon were assigned the highest ranking (3) in the Snohomish and Yakima watersheds in Scenario A because the Cross Cascade Pipeline crosses numerous tributaries supporting abundant and significant salmon populations, including populations that are protected under the Endangered Species Act (listed and proposed). These tributaries provide some high quality habitats that support multiple life stages: spawning, egg incubation, rearing, smolt migration, spawning migration. The mid-Columbia watershed was ranked slightly lower (2) because, although it supports significant populations of salmon and does intersect the highly important Columbia River which supports multiple life stages of salmon (juvenile rearing and migration, adult migration and spawning (Wanapum and Hanford Reach)), fewer streams which provide salmon habitat occur along this section of the pipeline. Truck routes were assigned a relatively low rank (1) because trucks travel along highway corridors that are typically less pristine compared to a pipeline buried in a more pristine area. Trucks traveling along highways are also somewhat isolated from the stream habitat.

In Scenario B, Puget Sound and the Columbia River Bar were assigned a high rank (3) because many significant populations of salmon utilize these areas; the areas provide excellent habitat for rearing (Puget Sound) and migration as juveniles and adults, and relatively high densities can occur on a seasonal basis. Coastal Washington was assigned a somewhat lower value (2) because salmon are less concentrated in this region. The Columbia River from the mouth to Pasco was assigned the highest rank because numerous significant salmon populations in relatively high numbers use good quality habitat in the rivers for rearing, migrating and some spawning (e.g., below Bonneville Dam).

In Scenario C, salmon resources in the Puget Sound, Chehalis, and lower Columbia watersheds were assigned the highest rank because many significant populations of salmon species are present in high numbers, and multiple life stages use the regionally important habitat in these areas.

Q. What was the reason for including both "salmon" and "threatened and endangered salmon" on the resource list?

A. The Team did this to give a double emphasis to salmon. Salmon in their own right are an important resource in Washington and can rate a rank of "3" in a geographic region because of their abundance and density, because a large proportion of the population is present in the region, because the region offers pristine salmon habitat and because multiple life stages of salmon are present. However, none of these factors account for the increased value of stocks of salmon listed as threatened or endangered under the ESA. Given the importance placed on these stocks by such a listing and the enormous amount of money being spent to try and save and restore the stocks, the stocks listed as threatened and endangered must be given an independent value over and above non-listed stocks. See testimony of Dr. Greg Ruggerone, Exh. GTR-T, pp. 15 -18; Exh. GTR-1, pp. 2-4.

Q. Finally, for the matrix, how did you determine the relative risk to the resources posed by each Scenario?

A. We multiplied the RSVF for each geographic region in a scenario, shown on Exh. SEH-9 times the resource rank within each cell on Exh. SEH-10 and summed the totals for each geographic region and all regions within a scenario. For example, for Scenario A, the RSVF for the Snohomish Watershed is 0.28. Therefore, each cell in the Snohomish Watershed on Exh. SEH-10 was multiplied by 0.28, and the product was entered in the corresponding cell on Exh. SEH-11. For aquatic birds, the cell value was 2 times 0.28 equals 0.56, which is rounded to 0.6 for Exh. SEH-11. The values within each geographic region were summed in the right hand column, and the sums were totaled to give the Scenario Totals.

Scenario A: 22.5

Scenario B: 8.9

Scenario C: 18.1

These totals represent the relative risk to resources from oil spills in each scenario and are shown in Exh. SEH-12.

Q. Does the matrix analysis provide a complete picture of the relative risks to resources from the proposed cross Cascade Pipeline versus barges and trucks?

A. No it does not. The matrix gives a picture of the relative risks to resources based upon (1) the amount of oil estimated to be spilled over the 50 years following pipeline construction, and (2) the value of resources proximate to the transportation routes. There are additional factors NRC did not include in the matrix because of the difficulty of assigning numerical rankings to the factors. However, these factors should be included to give a more complete picture of the comparative risks to resources from the proposed Cross Cascade Pipeline versus the Status Quo scenario of barges and trucks. Consideration of these factors shows that the matrix underestimates the relative risk to resources from the pipeline.

Q. What are the additional factors that should be considered?

A. The additional factors include (1) the type of spills (sudden or chronic), (2) likely location of spills, (3) oil concentration, (4) ability of species to avoid the oil, (5) length of time to detect the spill, (6) length of time to respond, (7) access to the spill site, and (8) difficulty in cleaning up the spill. An analysis of these factors leads to the conclusion that spills from pipelines pose a greater risk to resources than spills from barges and trucks.

Pipelines experience both sudden spills due to large leaks or pipeline ruptures, and chronic spills due to smaller long-term leaks. Likely locations for pipeline spills are linked to hazards that can cause pipeline breaks. For the proposed Cross Cascade Pipeline that would cross a mountain pass and traverse many streams and rivers, the primary hazards are mass wasting and stream scour. NRC has identified numerous areas along the proposed route where mass wasting and stream scour create a higher potential for a pipeline break. See the testimony of Greg Ruggerone, Exh. GTR-T, pp. 8-13. All of the identified hazard areas are at or near stream crossings. At such locations, a pipeline rupture would result in high concentrations of oil in the stream and acute toxic effects on aquatic organisms. See testimony of Gary Pascoe, Exh.

GAP-T, p. 11; Exh. GAP-1, pp. 8-9, Tab A. In smaller streams and wetlands, the concentration would remain high for a significant time resulting in continued exposure to resources unable to avoid the oil. This would be particularly damaging in streams with salmon eggs or alevins in the gravel, or juveniles in the water column. It would also create high impact in wetlands where the vegetative resources are entirely immobile.

For a sudden and catastrophic spill from a pipeline, detection should be rapid. However, pinpointing the exact location of the spill may present problems. See testimony of Wes Miller, Exh. JWM-T, regarding Olympic's spill scenarios. Rapid detection does not necessarily equate with rapid response time and easy access for cleanup. Of greatest concern is a wintertime spill at a site in the Snoqualmie Pass region. Olympic has difficulty responding within one hour to spills along its north-south pipeline, which largely parallels I-5. Department of Ecology's comments on DEIS, p. 70; Exh. SEH-14. There is little doubt that response time to a winter time spill in the pass would be much longer than one hour. Access to the spill site to clean up the spill and repair the pipeline would be extremely difficult in the rugged mountainous terrain of the pass.

The primary concerns regarding a chronic spill are the length of time to detect the spill and access to cleanup the spill. According to the Application, Olympic's system cannot detect leaks of less than 1% of the pipeline flow rate. Such spills can result in huge volumes of spilled product. See testimony of Gary Pascoe, Exh. GAP-T, p. 12-13. Chronic spills that go undetected for long periods of time would be those to ground and those into the groundwater. Access to clean up these spills would be difficult.

Olympic experienced such a spill in 1986 on its existing north-south pipeline in the Maplewood neighborhood near Renton. The spill was to ground and eventually into the groundwater. It took an estimated 8-12 months to detect the spill and the total volume spilled was estimated to be 2,000 barrels (84,000 gallons). Exh. SEH-13, Deposition of William Mulkey, p. 66, l. 12-p. 67, l. 1; p. 249, 1. 11-14; p. 250, l. 1-7. Cleanup was complicated and involved vapor extraction, product recovery wells 15-18 feet below the soil, and disposal of the soil which was contaminated by the hydrocarbons becoming tied to the soil matrix. Exh. SEH-13, p. 250, l.8- p. 251, l.9. It is unknown what percentage of the spilled product was cleaned up. Exh. SEH-13, p. 251, l. 10-19. Even after cleanup and 18 months of monitoring, residual pockets of hydrocarbons remain and the levels in two wells are above MTCA cleanup standards. Exh. SEH-13, p. 252, 1. 3-10.

Spills from barges and trucks are very different from pipeline spills. No spills to the environment are good for the resources, however, the spills from barges and trucks present less potential impact than those from a pipeline for several reasons. First, barges and trucks do not have chronic spills because any leaks in barges and trucks are easily noticed for immediate correction. Second, tanker truck and barge capacities are finite which limits the volume of spills due to a catastrophic rupture. Third, tanker truck loads are often divided into two compartments of about 5,000 gallons each while barges are typically equipped with 10-20 cross-tanked but individual compartments, each carrying about 6,000 barrels of cargo. Lastly, another spill limiting factor is that some barges are now double-hulled and federal law requires that all barges must be double-hulled or retired on a set schedule.

Likely locations for spills from barges are at transfer points and at areas such as the Columbia Bar, which present hazardous navigation conditions. Truck spills are most likely to occur during winter months on the mountain passes. Spills from barges would be into larger bodies of water (marine or Columbia River) and oil concentrations would be less than in small streams and wetlands crossed by the pipeline. Trucks could spill from the highway route into similar areas as the pipeline.

No matter the location of the barge or truck spill, it would likely be rapidly detected. Transfers are monitored and spills are readily apparent. Barge accidents, and truck accidents along I-90 would be expected to be reported quickly. Response time to the spills would be expected to be shorter than to a pipeline spill. Tidewater barges carrying oil up the Columbia River have their own spill response equipment on board and at 12 locations along the river.

Their crews are also trained in spill response. (Pers. Comm., Dave Godel, Manager, Tidewater Environmental Services, October, 1997). Truck accidents would occur along the highways where access would be easier than to the pipeline route. Cleanup of marine waters and the Columbia River and areas adjacent to the highways would be easier than cleanup of spills to land, groundwater and small streams, particularly from winter spills. Lastly, spills of highly refined petroleum products in marine waters or in the Columbia River are subject to more rapid evaporation than are spills in terrestrial or confined aquatic areas with low aeration. (Pers. Comm., Dr. Gary Pascoe, February 1999.)

The matrix shows that the Cross Cascade Pipeline poses greater than two times the risk to resources as that posed by barges and trucks. Taking into the consideration these additional factors, the proposed pipeline would present an even greater risk to resources than that calculated by the matrix.

Q. In summary, what is your opinion regarding the relative risks to resources and habitats posed by each scenario for oil spills over the next 50 years?

A. The relative risk to Washington State natural resources from the proposed cross Cascade Pipeline, Scenario A, is more than double the risk to natural resources posed by the existing modes of transport, Scenario B. Exh. SEH-11 and Exh. SEH-12.

The relative risk to Washington State natural resources from the Proposed Cross Cascade Pipeline is slightly higher than the risk to natural resources posed by a New North- South Pipeline Scenario C.

The relative risk to Washington State natural resources from the proposed Cross Cascade Pipeline increases if the additional factors which determine the severity of spills are considered.

Pipelines pose a greater risk to resources for a number of reasons. Given equal volumes of oil transported over 50 years, pipelines will spill the most oil. Scenarios A and C, which are based primarily on pipelines, are projected to spill over 1.5 times that of the Status Quo, Scenario B. Exh. SEH-4 and Exh. SEH-5. Pipeline spills have a history of being larger than spills from trucks or barges. Pipeline spills can be either catastrophic or chronic. Trucks and barges do not have chronic spills. Pipelines are typically less accessible for inspection, maintenance and spill response than trucks and barges. Pipeline construction is damaging to regional habitats; for trucks and barges construction impacts are not an issue. Removal or replacement of pipelines poses an additional risk to natural resources not posed by trucks and barges.

Finally, construction of the Cross Cascade Pipeline would put new resources at risk across a multitude of new habitats. If Olympic is wrong in its assumption that the Cross Cascade Pipeline would eliminate ocean barging and river barging, and would reduce trucking of refined petroleum product, and we believe it is, then approval of the Cross Cascade Pipeline would result in additional resources at risk without elimination of existing risks to resources. Whether or not Olympic's assumption is correct, approval of the pipeline would create construction impacts that would otherwise not occur.