RESPONSIVENESS SUMMARY

Port Angeles Harbor
Sediment Characterization Study
Port Angeles, Washington
and
Port Angeles Harbor
Supplemental Data Evaluation to the
Sediment Investigation Report
Port Angeles, Washington

February 23 - May 23, 2012 Public Comment Period

Prepared by
Washington State Department of Ecology
Southwest Regional Office
Toxics Cleanup Program
300 Desmond Drive
Olympia, Washington 98504-7775

December 2012

Contents

Introduction

Port Angeles Harbor is one of seven Puget Sound embayments that the Washington State Department of Ecology (Ecology) is investigating as part of the Puget Sound Initiative. Ecology is using special funding from this initiative to investigate sediment pollution and develop a strategy for cleaning up Port Angeles Harbor (harbor).

Ecology collected sediment and tissue samples throughout the harbor to help determine:

- The nature and extent of contamination in the harbor.
- Risks to human health and the environment.
- Possible sources of contamination to the harbor.

Rayonier will also incorporate data from the Port Angeles Harbor Sediment Investigation into reports for the Rayonier Mill cleanup site.

The results of the sediment investigation are presented in two reports: the Sediment Investigation Report (SIR) and the Supplemental Data Evaluation (SDE). The Sediment Investigation Report describes the sampling data. The Supplemental Data Evaluation analyzes the data and recommends next steps.

This responsiveness summary addresses comments received during the February 23 – May 23, 2011 public comment period on the draft reports.

Ecology has notified Potentially Liable Persons (PLPs) in Port Angeles Harbor and has begun working with the PLPs on next steps for cleanup.

Format of the Responsiveness Summary

Ecology has reviewed all comments received. Comments from different reviewers often covered the same topics. We have grouped and responded to common concerns, as well as many other comments and questions. Comment letters are attached in Appendix A.

The rest of this responsiveness summary is organized into the following sections:

- Changes Made to the SIR and SDE
- Summary of Public Involvement
- List of Commenters
- Acronyms and Abbreviations
- Summary of Comments
- Responses to Common Concerns about the SIR and SDE
- Responses to Common Concerns about the SIR
- Responses to Common Concerns about the SDE
- Responses to Specific Comments about the SDE
- References
- Appendix A: Comment Letters

Changes Made to the SIR and SDE

Based on comments we received, Ecology has made the following changes to the SIR and SDE.

Changes to the SIR

- Removed "Public Review Draft" from title.
- Removed *Screening-Level Fingerprint Analysis* from Appendix J. Left *Potential for Fingerprinting Analysis using Sediment Data* Memorandum in Appendix J.
- Changed table of contents, lists of tables and figures, and text to remove any references to the *Screening-Level Fingerprinting Analysis*.
- Changed title of Appendix G: *Human Health and Ecological Risk Assessment* to "*Screening Level Human health and Ecological Risk Assessment*."
- Added additional text to disclaimer to clarify how the SIR was written. Ecology will continue to refer to the SIR using the reference E&E 2012.

Changes to the SDE

- Removed "Public Review Draft" from title.
- Minor text changes through the text to help clarify language and intent.
- Figure 7, Sediment Transport Pathways, updated with deemphasized arrows for southern longshore transport. This more realistically portrays the relative significance of this transport pathway.
- Figure 8, Sediment Fines, updated with the inclusion of data from 765 sample locations to provide better spatial coverage.
- Table 11 updated with information about the types of pulping processes at each mill and City of Port Angeles combined sewer overflow information.
- Removed reference to Draft Report *Preliminary Cleanup Goals for Sediment in Port Angeles Harbor*, NewFields 2011. This draft document was not used as a reference for the analysis presented in the SDE.

Summary of Public Involvement

The Model Toxics Control Act (MTCA) mandates public involvement in the site cleanup process. The public comment period for the SIR and SDE ran February 23 – May 23, 2012. Public involvement process included a public meeting and presentations, a fact sheet and other outreach materials.

Fact Sheets and Other Outreach

Ecology used the following fact sheets and notices to advertise for the public comment period:

- Fact sheet mailer – Sent to about 390 neighboring residents and stakeholders.
- Email announcement – Sent to about 250 interested residents and stakeholders.
- News release
- Blog – Posts about the comment period and follow-ups to questions.
- Website - http://www.ecy.wa.gov/programs/tcp/sites_brochure/portAngelesHarborSed/paSed_hp.htm
- Other - Notices on Ecology's Public Involvement Calendar and Site Register. Legal ads in the Peninsula Daily News.

Public Meetings and Presentations

Ecology hosted a public open house and presentation on March 13, 2012 at the Olympic Medical Center. Approximately 50 people attended the event.

Public Comment Period

The public comment period was open from February 23 through May 23, 2012. The original 30 day comment period was extended 60 days after requests from several reviewers.

Contacts

Connie Groven, Project Manager
Washington Department of Ecology
PO Box 47775
Olympia WA 98504-7775
(360) 407-6254
Connie.Groven@ecy.wa.gov

Diana Smith, Public Involvement Coordinator
Washington Department of Ecology
(360) 407-6255
Diana.Smith@ecy.wa.gov

More Information

The Port Angeles Harbor Sediment Characterization Study Report, the Port Angeles Harbor Supplemental Data Evaluation to the Sediment investigation Report and other study documents are available at these information repositories:

North Olympic Library System
Reference Desk
2210 South Peabody Street
Port Angeles, WA 98362
(360) 417-8500

Peninsula College Library
Reference Desk
1502 East Lauridsen
Port Angeles, WA 98362
(360) 452-9277

Washington Department of Ecology
Southwest Regional Office
300 Desmond Drive SE
Lacey WA 98503
(360) 407-6243

Documents are also available on the Washington Department of Ecology's website at http://www.ecy.wa.gov/programs/tcp/sites_brochure/portAngelesHarborSed/paSed_hp.htm

The Washington Department of Ecology (Ecology) has compiled a list of interested parties, organizations, agencies, and residents. If you would like to be added to the mail list, please contact Diana Smith at (360) 407-6255 or Diana.Smith@ecy.wa.gov.

List of Commenters

Date	Name	Affiliation
3/7/2012	Bill Beckley, Ridolfi	Lower Elwha Klallam Tribe
3/12/2012	Rory Henneck	Community Member
3/13/2012	Rebecca Davison	Community Member
3/13/2012	Rose Marschall	Community Member
3/13/2012	Janet Marx	Community Member
3/15/12	James E. Wilcox	Community Member
3/23/12	Robert Sextro	Community Member
4/12/2012	Karl Spees	Community Member
5/17/12	Craig Jones, Sea Engineering, Inc.	Rayonier
5/21/12	Jeff Robb, incorporating comments from Floyd|Snider	Port of Port Angeles
5/21/2012	Paul f. Perlwitz	Nippon
5/22/2012	Dan McKeen, incorporating comments from Intergral	City of Port Angeles
5/22/2012	Michael Hassett	Georgia-Pacific
5/22/2012	Carol Johnson	North Olympia Timber Action Committee
5/22/2012	Environmental Stewardship Concepts, LLC	Olympic Environmental Council
5/22/2012	Carla Yetter	Rayonier
5/22/2012	Kathy Godtfredsen, Windward	Rayonier
5/23/12	Erica A. Shaffer	Washington State Department of Natural Resources

Acronyms and Abbreviations

COPC	contaminant of potential concern
E&E	Ecology & Environment, Inc.
Ecology	Washington State Department of Ecology
ERA	ecological risk assessment
HHRA	human health risk assessment
MTCA	Model Toxics Control Act
PLP	potentially liable person
QA/QC	quality assurance/quality control
RI/FS	remedial investigation and feasibility study
SDE	Supplemental Data Evaluation
SIR	Sediment Investigation Report
SMS	Sediment Management Standards
STA	Sediment Trend Analysis
WAC	Washington Administrative Code

Summary of Comments

At the close of the comment period Ecology received comments from 18 reviewers. The majority of comments were on the fingerprinting analyses in both the SIR and Supplemental reports. In addition to comments on the fingerprinting analysis, the major comment topics for the SIR included: human health risk assessment, ecological risk assessment, sediment transport, bioassay, and general combined comments on both risk assessments. Commenters on the Supplemental Data Evaluation Report were primarily concerned with fingerprinting, sediment transport, conceptual site model, calculation of background concentrations, combined sewer overflows, and data gaps.

Responses to Common Concerns About the SIR and SDE

Relationship between the SIR and SDE

Comment: Several commenters had questions about the relationship between the SIR and the SDE. Questions included why the SDE wasn't referenced in the SIR and if Ecology accepted the SDE. Another commenter stated that the two reports conflict in some areas.

Ecology Response: The SIR presents data from the 2008 sediment investigation study. The SDE evaluates the 2008 data plus additional data from Rayonier and Nippon studies.

The draft SIR was completed first and doesn't rely upon the SDE. Since the SDE provides conclusions and evaluation based on the combined data from 5 studies[1], the conclusions vary slightly from the conclusions based on the SIR data alone. Both documents were contracted and approved by Ecology.

Ecology originally asked Ecology and Environment (E&E) to create a single report – the SIR. As we worked through several drafts of the report, it became clear that E&E was not able to provide some of the data evaluation and mapping that Ecology required. We decided to end the contract with E&E and switch to NewFields to provide the final data evaluation. We also asked NewFields to review and include data from additional sources in their evaluation. As a result, we provided the NewFields work as a separate, supplemental document – the SDE. NewFields also provided some substantial edits and organizational changes to the SIR to bring it to a public review draft. The beginning of the SIR has a disclaimer explaining E&E's and NewFields' involvement.

[1] The SDE uses data from the SIR, Rayonier's Remedial Investigation for the Marine Environment (Malcolm Pirnie 2007a), Phase 2 Addendum Remedial Investigation (Malcolm Pirnie 2007b), Nippon's Environmental Baseline Investigation (Exponent 2008), and Nippon's Sediment Grab Sampling and Log Density Survey (Anchor 2005).

Comparison to other Harbor Cleanups

Comment: One commenter asked for more information on other harbor cleanups and how this harbor compares relative to costs, time to cleanup, final results and future prevention methods. They also asked how cleanup standards are determined and if contamination in all harbors is measured the same way.

Ecology Response: Site managers follow state regulations and Ecology guidance to provide consistent requirements for cleanups. State regulations also provide for site-specific considerations, so each site is evaluated for its individual differences. Sampling methods used in different harbors are similar but can also vary. Sampling methods are chosen based on differences in each harbor, the contamination present, and the purpose of the sampling being done.

To compare the Port Angeles Harbor cleanup with other harbor cleanups, Ecology encourages interested parties to use our website to view documents, fact sheets, and decisions for Port Angeles Harbor and other harbors.

- Ecology's website: www.ecy.wa.gov
- Ecology's Toxics Cleanup Program's Puget Sound Initiative website: http://www.ecy.wa.gov/programs/tcp/sites_brochure/psi/overview/psi_baywide.html,

Visit the Toxics Cleanup Program website at http://www.ecy.wa.gov/cleanup.html for more information on state cleanup standards and the cleanup process.

Air Deposition into Port Angeles Harbor

Comment: Several commenters asked why the state would move forward with work on cleaning up Port Angeles Harbor while Nippon was being allowed to build another biomass cogeneration plant that would recontamination the harbor. In particular, commenters were concerned about dioxins that are released from burning wood.

Response: Ecology agrees that there is evidence that burning wood can release dioxin. Dioxins are known to form at relatively low burning temperatures, which were common in older, less efficient boilers (and also in fireplaces, outdoor burning and wood stoves). It has been shown that burning salty wood, such a wood rafted in the harbor, at these lower temperatures contributes to forming greater amounts of dioxins. The chlorine in the salt and incomplete combustion from low-temperature burning can result in high levels of dioxin in the ash and air emissions.

Air deposition from the wood burners was not the only likely source of dioxin in Port Angeles Harbor. Several pulp mills discharged untreated wastewater from bleaching processes directly into the harbor. Bleach process wastewater from pulp mills is one of

major historical sources of dioxin nationwide. Ash from the boilers was also discharged directly into the harbor and used in fill materials in areas of the shoreline.

Nippon's new biomass cogeneration facility would replace an existing boiler currently fueled by oil and biomass. The new boiler will have increased capacity, operation temperature, and operation pressure. The new boiler would generate steam for paper production, and it would also supply excess steam to a turbine generator to create electrical power. The new system will have state-of-the art air pollution controls meeting standards as required by Olympic Region Clean Air Agency (ORCAA) and the Washington State Clean Air Act.

Ecology believes that the high levels of dioxin in the harbor today are the result of many years of untreated, uncontrolled sources. The likelihood of significant deposition of dioxin or other chemicals into the harbor from the proposed biomass boiler is much less than from historical operations. Only clean (non-salt laden, non-treated, uncontaminated) wood would be allowed to be used as fuel in the proposed biomass boilers. Advanced pollution control devices and modern burning technologies using high temperatures also reduce potential dioxin releases to extremely low levels.

Responses to Common Concerns About the SIR

Human Health Risk Assessment and Ecological Risk Assessment

Many comments remarked on both the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) (SIR Appendix G). These comments fell into several broad and overlapping categories:

- Fish/shellfish consumption rates.
- Whether the HHRA and Ecological Risk Assessment (ERA) should be considered a screening level risk assessment.
- The toxicity assessment, risk characterization, and exposure factors.
- The relationship between the calculated contaminant of potential concern (COPC) risk levels and the background concentrations of those contaminants.

Comment: Several commenters expressed concern about the fish/shellfish consumption rate used in the HHRA. Fish consumption surveys conducted by the Suquamish Tribe and later adopted by the Lower Elwha Klallam Tribes estimated that the rate was 583 grams/day (about 1 ¼ pounds).

Ecology Response: A fish consumption rate shows how much of that type of food is eaten each day. Estimating how much of food is eaten is an important part of a risk assessment. The fish and shellfish consumption rates for the HHRA were based on a survey conducted on the Suquamish Indian Tribe (Suquamish Tribe 2000). The survey found that adult tribal members consumed primarily shellfish including Dungeness crabs and Horse clams, and pelagic and bottom fish to a much lesser extent. (Pelagic fish live near the surface or in the water column but not on the bottom of a sea or lake.) The Lower Elwha Klallam Tribe surveyed their members and determined their diet was similar to the Suquamish Tribe. The amounts used in the HHRA are shown below.

Fish or shellfish type	Consumption rate
Pelagic fish	56 grams/day (about 2 ounces/day)
Bottom fish	29 grams/day (about 1 ounce/day)
Shellfish	498 grams/day (about 17.6 ounces/day)
Total	583 grams/day (about 20.6 ounces/day)

Ecology believes that this rate represents consumption by typical high-end consumers and is protective of the most vulnerable population.

Comment: Several commenters raised questions about whether the HHRA and ERA should be considered a screening level risk assessment since the assessment generalized risk for the entire harbor and not to a specific company, site, or industrial activity.

Ecology Response: A screening level risk assessment is done to look at potential risks when limited information is available. This type of evaluation looks at the types of contaminants and how they can be passed on to humans, plants, or animals, as well as

the general risks contamination poses. They also often look at whether a more detailed assessment is needed and what would be needed in order to do a more detailed assessment.

Ecology agrees that due to the limited number of tissue samples collected, the HHRA and ERA are more appropriately considered screening level assessments. Ecology has changed the title.

Comment: Several comments concerned the toxicity assessment and risk characterization, particularly lead blood levels in children, using the Integrated Exposure Uptake Biokinetic model to determine the toxicity, and potential risk of elevated blood levels. One commenter was concerned that the modifications made to the model to account for the high consumption of fish/shellfish might mean that meat consumption was double counted. Other comments involved checking data conversion factors for uptake and model assumptions regarding multiple species in a diet on a given day.

Ecology Response: Ecology recognizes the concern and believes the assessment was correctly completed given the assumptions made in the model.

Comment: Several commenters were concerned about verifying inorganic arsenic measurements because different types of arsenic have different risk and toxicological potential. In addition, the added risk from arsenic, which accounted for 58% of the human health risk, was based on only two shellfish samples (geoduck and horse clams). Arsenic levels in those samples were only slightly higher than background arsenic concentrations.

Ecology Response: Ecology has checked and verified arsenic measurements and the conversion factor calculations. Inorganic arsenic was measured in most tissue with the exception of lingcod, where only total arsenic was available. In the HHRA, the lingcod estimate is based on scientific literature. Approximately 85% to 90% of the arsenic in the edible parts of marine fish and shellfish is organic arsenic and approximately 10% is inorganic arsenic (U.S. EPA 2003). As a result, the exposure point concentration was multiplied by 10% to determine the inorganic fraction. These results were used to evaluate risks and hazards.

Comment: A second set of comments concerned identifying toxicity factors for compounds for which there is no toxicity data (i.e., resin acids and other similar COPCs) and whether those factors should be used to evaluate the potential for risk.

Ecology Response: A literature search for human health risks from resin acids was done for the SIR. The search yielded little information. A body of studies does exist relating the ecological risk from these compounds. Peng et al. (2000) examined the solubility and toxicity of several resin acids on the arthropod *Daphnia* and on the

rainbow trout and found both were sensitive at concentrations less than 1 mg/L. Further research and evaluation is beyond the scope of this project.

Comment: Several commenters noted that arsenic, polychlorinated biphenyls (PCBs), and dioxins, which drove the major portion of the risk, may resemble risks posed by background concentrations of these contaminants. Arsenic levels in tissues from two samples (geoducks and horse clams) were only slightly higher that concentrations found in geoducks in the Dungeness Bay reference area. Site risks from arsenic were actually lower than risks from reference concentrations for a number for fish species that were sampled.

Depending on the species, some PCB and dioxin concentrations were higher than or more consistent than reference concentrations. This indicates that some portion of the HHRA and ERA risks may resemble risks posed by "background" constituents like arsenic.

Ecology Response: Ecology recognizes that the HHRA and ERA would have benefited from additional samples of geoduck and horse clam tissue from other areas within Port Angeles Harbor. However, individuals of both species were not found in all areas of the harbor or from multiple areas at the reference site. While Ecology did not originally plan on doing a screening level risk assessment, the small number of samples collected did not support a full risk assessment. As a result, Ecology later agreed to label it a screening level risk assessment.

Ecological Risk Assessment-Specific Comments

Several commenters made remarks specific to the Ecological Risk Assessment (ERA, Appendix G). These comments fell into the following broad and overlapping categories:

- Bioassays and how the results related the benthic risk evaluation.
- Wood debris.
- Risk to fish and marine plants, and habitat quality.

Comment: Several commenters remarked on the bioassays. Questions and comments concerned the selection of test species, the relationship between test results, and the physical characteristics of the sediment.

Ecology Response: E&E reviewed and performed an extensive quality assurance/ quality control (QA/QC) review of the three bioassays. The quality review is presented in Appendix K of the SIR. The review was based on guidelines found in several publications and guidance manuals for validating sediment bioassays including: the Puget Sound Estuary Program Protocols (PSEP 1995), Sediment Management Standards Marine Bioassays Recommended Quality Assurance and Quality Control Deliverables

(Ecology 1996), Data Validation Guidance Manual for Selected Sediment Variables (PTI 1989), and Ecology's Sediment Sampling and Analysis Plan Appendix (2008).

E&E concluded that despite several minor deviations from established guidelines in temperature and dissolved oxygen in each of the tests, the results for the amphipod, juvenile polychaete, and larval echinoderm are usable as reported. This included the salinity for the amphipod and larval test. Ecology agrees with this finding.

Comment: Some commenters remarked that, given the very different results among the three bioassay tests, multivariate statistical tests should have been used to look for correlations among the tests and the concentration of ammonia, sulfides, and COPCs. One commenter noted that the layout of Table 4-5 makes it impossible to verify correlations made in the SIR.

Ecology Response: The question of potential correlations is important. However, since E&E completed the first draft of the SIR in 2010, the scientific community has become aware that Larval tests, which are the type of tests E&E used, may have been compromised due to the presence of flocculent material that may have trapped healthy larva. The trapped larva may have been missed during the counting at the completion of the test, resulting in false failed bioassay tests.

Given this finding, Ecology believes it would not be productive to conduct extensive statistical analysis on these data. Regarding Table 4-5, Ecology agrees that percent survival data would have been more useful than mortality data and the numerical results from all tests should have been included instead of a dash. However, Ecology is not changing Table 4-5 since Table 6-2 in the SIR contains all the numerical data for each bioassay.

Comment: Several commenters expressed concern that using the presence of wood debris in the harbor as evidence for degraded benthic communities is unsupported. These commenters stated that this conclusion is based on a qualitative characterization and broad generalizations of the data. This is especially important given that of the three lines of evidence for degraded benthic communities, only the sediment profile imaging survey was semi-quantitative.

Related comments state that the presence of wood debris in 20 to 25% of the harbor cannot be equated with effects. If the presence of wood debris has been affecting the benthic community there should be a correlation between the amount of wood debris and the concentration of ammonia and sulfides, which has not occurred.

Ecology Response: Ecology recognizes that the three line of evidence (the approximate amount of wood debris; the concentration of TOC, sulfides, and ammonia; and results of the SPI survey) are qualitative in nature and were not intended for rigorous statistical analysis. Rather, they were conducted to point out general trends in the distribution of wood debris and conventional parameter data. While the mere presence of wood debris

does not mean there will be effects, its presence has been shown to affect benthic communities. Research on the effects of organic enrichment to benthic communities has been thoroughly documented (Pearson & Rosenberg (1978), Weston (1990), Rosenberg (2002), Gray et al. (2002), Goldberg and Solan (2009)). Organic enrichment (be it from wood debris, sewage sludge, or from decaying algal material) reduces species richness and diversity. It also leads to other species dominating the benthic community. This can negatively impact the food chain. In addition, when a large amount of wood debris is present in sediment, it decays more slowly than normally expected.

Comment: Reviewers expressed concern that the risk to fish in Port Angeles Harbor may have been underestimated because too few samples and species were collected and analyzed for COPCs in tissue. Further concerns were expressed that toxicity reference value and the risk based concentrations (RBCs) may be poorly understood, are controversial, and may not be accurate predictors of risk. In particular, arsenic comes in many forms with variable toxicity. Concern was also expressed that chlorinated pesticides (i.e., DDT) were listed as a COPC but no data was presented that these contaminates were present in whole body tissues.

Ecology Response: Ecology recognizes these concerns. Ling cod were all collected for the SIR at stations in the inner Ediz Hook area of the western Port Angeles Harbor. No ling cod were observed for collection in the Dungeness Bay reference area. As a result, the Port Angeles Harbor screening risk assessment used RBCs from literature. Ecology concurs that chlorinated pesticides were only detected in a subsurface core sample off the Ferry Terminal and not in any other tissue samples.

Sediment Transport

Comment: Several commenters noted that both the Sediment Trend Analysis (STA; Appendix E of the SIR) and Geographic Report (Appendix I of the SIR) present only a qualitative discussion and cursory evaluation of sediment transport process in the harbor. They further commented that that the extreme events that deposit sediment into the parting zones as described in the STA were discussed but no quantitative information was provided and that the nature and quality of sediment being delivered into the harbor were not measured but were estimated.

Ecology Response: The STA is based on quantitative sampling and analysis of sediment grain size using accepted methods. The subsequent analyses of the results take into account several assumptions, some of which rely on best professional judgment that leads the conclusions to be qualitative. The developers of the sediment trend analysis method acknowledge the qualitative nature of the results and indicate that the results must be considered with other hydrodynamic knowledge about the study area.

In the case of extreme events, which are short-lived and irregular, the amount and quality of the sediment deposited in the parting zones cannot be adequately measured. The STA results describe average sediment distribution conditions over an unknown time period. For the method to clearly characterize an extreme event, the sampling would have to occur immediately following the event (Hughes 2005).

Ecology acknowledges the qualitative nature of the results, but also finds that the results do explain some of the depositional patterns seen in the harbor. Given the complexity of the hydrodynamic and sediment transport processes in the harbor Ecology believes the STA is a good first step in identifying these processes.

Comment: Commenters noted that the calculated sedimentation rates in the harbor were based on only two radioisotopic sediment cores, which were not representative of the entire harbor. Some commenters also noted that calculated contributions of sediment by creeks to the harbor were based on limited location information and assumptions about the nature of the creeks.

Ecology Response: As indicated in the Geomorphic Report, the locations for radioisotopic analysis were selected before the results of the STA were reported. Thus, areas where sediments may accumulate more were not yet identified. Results showed that the two cores are representative of their portions of the harbor. They do not represent the entire harbor.

The authors of the Geomorphic Report also looked at deltas created by creeks entering the harbor. They estimated the volume of sediment entering the harbor by comparing their current shape and size with those found on historic nautical charts. Tumwater Creek was chosen to help estimate sediment input from other creeks because it was large enough and was protected from erosion since its formation. Ecology realizes that positional information from historical nautical charts have limitations. However, the results present a general picture of sedimentation into the harbor.

Chemical Fingerprinting

Ecology received several comments on the fingerprinting analysis (Appendix J in the SIR). Fingerprinting is a method used to differentiate potential sources of specific contaminants. The SIR uses fingerprinting on dioxins/furans (dioxins) and polycyclic aromatic hydrocarbons (PAHs). Appendix J contains two documents: the Fingerprinting Memorandum and the Screening Level Fingerprinting Analysis.

Comment: Some commenters expressed concerns about the approach taken for the fingerprinting analysis given the complexity in the distribution of COPCs in the harbor. Concerns included whether it was appropriate for the data set and whether it was carried too far or not far enough.

Ecology Response: The distribution of COPC in the harbor is very complex depending on the movement of water, sediment, and the location of possible sources. The *Potential for Fingerprinting Analysis using Sediment Data* Memorandum was conceived to determine whether a quick and simplistic approach could be taken to identify the type, location, and potential sources of PAHs and dioxins in the harbor. The *Screening-Level Fingerprinting Analysis* provides a more in-depth analysis of PAH and dioxin types and sources. The results of the fingerprint analysis were inconclusive. Ecology is deleting it from the SIR (see below). Ecology did further fingerprint analysis in the SDE (see page 27 of this responsiveness summary).

Comment: Some commenters noted errors in the Fingerprinting Analysis. The majority of these referred to differences between data presented in tables, figures, and text.

Ecology Response: The text of *Screening-Level Fingerprinting Analysis* included many places where results in the figures and tables were reported incorrectly in the text. Parts of several early, incorrect versions of the fingerprinting analysis were inadvertently included in the public review draft of the SIR. Ecology recognizes that there are multiple errors in the report and is deleting it from the SIR.

Comment: Some comments concerned the number and handling of contaminants that were not detected and whether the analysis was appropriate given the number of non-detects.

Ecology Response: Ecology decided to handle non-detects differently in the *Screening-Level Fingerprinting Analysis* than in the SIR. We used the method detection limit as the default value for fingerprint analysis as opposed to a value of zero or one-half the method detection limit.

Bioassays

Comment: Several commenters noted the larval bioassay failures could be explained by the limitations in the methodology. They noted that in some cases a flocculent layer formed as a result of the presence of fine grain materials. The flocculent layer prevents counting some normally developed larvae. Thus, it is inaccurate to conclude these samples "fail" the bioassays. Rather, the method was inadequate for the conditions.

Ecology Response: Ecology acknowledges these comments and realizes that the methodology may have been responsible for some false positive results. The larval bioassays were conducted using approved bioassay methods, according to an approved sampling and analysis plan. The possible problems with the method were not recognized until after these bioassays were completed. Ecology is following the technical discussion on new methods and agrees that the resuspension method may provide better information for future studies.

Comment: Comments stated that in the Sediment Investigation Report, the implication in multiple statements was that broad toxicity was observed in the harbor; however bioassay failures were not strongly correlated with elevated chemical concentrations of either COPCs or conventional parameters. Only 5 of 59 bioassay locations showed chemical Sediment Management Standard (SMS) exceedances. Yet the report states "... [t]he cause of these failures may be the result of cumulative effects of multiple chemicals, individual chemicals without criteria, and or physical factors."

Ecology Response: Ecology recognizes that there are still a number of unknowns regarding toxicity in the harbor. Only a small number of stations with bioassay failures also showed chemicals higher than SMS standards and many stations with SMS chemical failures did not have synoptic bioassays. It has long been known in the environmental community that many chemicals for which criteria have not yet been developed (e.g., resin acids and guaiacols) may have toxic effects. Many chemicals may have additive, synergistic, or antagonistic effects on benthic communities. The EPA Science Advisory Board has recognized this issue as a potential significant problem. Many of these other chemicals are not typically analyzed for in sediment. Bioassays were not taken at every location with an SMS exceedance. Comprehensive chemical analysis was also not done at every station with a bioassay failure.

Comment: Some reviewers commented on the study design and bioassay sample collection methods. These included that the decision to conduct bioassays prior to chemical testing is highly unusual and presents challenges in the evaluation of sediment quality; and that sediment samples earmarked for bioassay testing were stored in plastic bags which is not an EPA-approved method. Plastic bags are sources of phthalates and other chemicals used in the manufacturing of plastics. Because there was no chemical analysis of the bioassay sediments following storage in plastic bags, the bioassay results may not represent conditions in the harbor

Ecology Response: The study was an exploratory sediment investigation and not a remedial investigation or dredge material evaluation. The design of the study in no way jeopardizes the determination of the ecological meaning of the results. Concerns regarding the use of plastic bags may be valid in some circumstances. However, in the Port Angeles study the 10 liter, 4 mil plastic bags were supplied by Newfields NW and were special ordered by the laboratory to be free of chemical contaminants including phthalates.

Circulation

Comment: Several commenters stated that, based on the limited data, lack of correlation between stations, and lack of supporting information, it is difficult to characterize the hydrodynamics across the harbor. Some noted that current

measurements were collected for only one month and at only three locations, which was insufficient to characterize the complex hydrodynamics in the harbor. Commenters noted that there were no extreme rain or wind events during data collection that could be expected to significantly affect hydrodynamics. Because of the complexity of the system it is not feasible to extrapolate potential extreme conditions. They also noted that spatially there was little correlation between events observed at individual monitoring locations, making interpretation of these events difficult.

Ecology Response: The Current Data Collection Analysis Report was the first study of Port Angeles Harbor where near bottom currents were quantified. While it would have been nice to have taken measurements for a longer time period, a 30-day deployment is standard for these investigations. While the deployment did not occur during extreme weather events, the data is high quality and adds to the database for the harbor.

Comment: In the Current Data Collection Analysis Report, commenters noted some discrepancies between the stated deployed instruments (Table 2) and the discussion of data plots. For example, Table 2 states that an ADP and an ADVo were deployed at Station 1, both with pressure sensors, while in Section 3.0, it states "Water level has no time history line because the ADCP did not have a pressure sensor."

Ecology Response: Table 2 states that Station 1 had an Acoustic Doppler Profiler (Table 2, ADP), while the text in section 3 states there was an ADCP (the two instruments are slightly different). This was a typographic error since there was no ADCP at Station 1.

Discussions with Evans-Hamilton, Inc indicated the pressure sensor on the ADP must have failed and pressure from the ADP was not recorded, thus the statement "water level has no time history from the ADCP." Pressure data from these instruments are used to measure water level. Pressure data from Station 1 was obtained from the Sontek Acoustic Doppler Velocimeter Ocean Probe (ADVo) and the PAROS pressure sensor.

Comment: A commenter noted that on page 49 of Appendix I (Geomorphic Report), the second paragraph states: "At Station #3, there are extremely strong currents to the west at just a few meters off the bed, but they do not persist near the bed (Figure 2). Currents appear most often towards the east; however, they are not as strong as those towards the west. Despite the lack of strong currents measured at the tripods, the currents observed are broadly consistent with the STA observations at the tripod deployment sites." The statement that there are extremely strong currents to the west at Station #3 contradicts the following statement"...[d]espite the lack of strong currents measured at the tripods..."

Ecology Response: Station 3 was located immediately off of the tip of Ediz Hook where currents move rapidly around the tip of the hook. The Tripod Stations 1 in the western end of the harbor and Station 2 were located along the southern shoreline of the harbor. Both Stations 1 and 2 are in areas with slower current speeds. The tripods sat on the floor of the harbor with additional monitoring instruments attached to cables

above the tripods to measure currents in the water column. The extremely strong currents to the west were noted a few meters above the tripod at Station 3, not at the tripod.

Source Identification

Comment: Some comments noted that Areas of Potential Concern should be identified during the RI/FS process and that to identify them in the SIR without a rigorous investigation to link sediment contamination to potential upland sources is problematic.

Ecology Response: Ecology and E&E used the term AOPC to identify and group stations in relation to their location in the harbor. They were not intended to link chemical contamination to actual sources.

Comments: Some comments noted that the history of the site should include that the K-Ply manufacturing facility reopened in 2010 under new ownership as Penply, then closed in early 2012. This section should also indicate that pulp and paper mill effluents continue to be discharged into the harbor today, as Nippon mill is still in operation.

Ecology Response: Ecology realizes that the K-Ply plant was reopened under the Pen-Ply name and is working with the responsible party. The Nippon plant does not currently discharge effluent in the harbor. The outfalls for the plant were redirected into the Strait of Juan de Fuca during the 1960s and 1970s.

Tissue

Comment: Several comments questioned why Ecology tested only geoducks and horse clams. Commenters felt these long-lived species, and the particular individuals that were sampled, may not fully represent present conditions.

Ecology Response: Ecology sampled horse clams, geoducks, kelp, eelgrass, and lingcod. We sampled these species because they represent different parts of the marine food web, are-long-lived, and are likely to take up contamination that accumulates in plants and animals (bioaccumulates). Ecology also selected geoducks and horse clams because humans commonly eat them.

Summary of Existing Information

Comment: Commenters were concerned that the Summary of Existing Information section discussed old information and data, but left the impression that those conditions

still existed in the harbor when the issues had been completely or partially resolved. In particular, one commenter asked how the PCBs and metals referenced in Section 2.1.3 of the SIR were deposited in the harbor. Another commenter noted that the language and lack of referencing chemical concentrations to state standards in Section 2 makes it appear that the harbor is highly contaminated.

Ecology Response: In some locations in the Summary of Existing Information section of the SIR, state standards are not cited and adjectives such as "high", "very high", "significant" were used in place of empirical data. These descriptions of the data were made in a general context to note areas where COPCs appeared to be elevated. To delineate and quantify COPCs, these areas were slated for more sampling and analysis in the SIR.

The results presented elsewhere in the SIR show the current conditions in the harbor and clearly show areas where COPCs have been found in high concentrations. The Port Angeles Harbor Supplemental Data Evaluation was prepared to include data from other studies along with the SIR data and to further analyze the data.

Responses to Common Concerns about the SDE

Premature Suggestions of Remedial Actions

Comment: Several commenters felt that the potential cleanup activities suggested in the SDE were inappropriate at this stage of the cleanup process. They emphasized that this report is not a remedial investigation and feasibility study (RI/FS). One commenter requested that a cost benefit analysis be included as part of the cleanup process.

Ecology Response: Ecology agrees that the SIR and the SDE are not intended to be an RI/FS. Ecology does believe enough information has been gathered to begin to suggest general conclusions and recommendations, such as those included in the SDE.

Ecology will require a full RI/FS from any PLPs identified in the harbor before cleanup actions are determined in a cleanup action plan. The final cleanup action plan will identify the preferred cleanup methods and specify cleanup standards and other requirements at the site.

In the state cleanup process, a RI will fully define the extent and magnitude of contamination at the site, and a FS will evaluate alternative cleanup technologies. The FS includes an evaluation of which cleanup alternatives are technically possible and of the cost benefits of each. Alternatives that are clearly too costly for the benefits provided are eliminated from consideration.

See Ecology's website at http://www.ecy.wa.gov/programs/tcp/cu_support/cu_process__steps_defns.htm for more information about steps in the cleanup process.

Reference to Preliminary Cleanup Goals

Comment: Two commenters questioned a reference made in Section 3.0 of the SDE to a document *Preliminary Cleanup Goals for Sediment in Port Angeles Harbor* (NewFields, 2011). One commenter stated that this document had not been made available and the SDE was incomplete without making available all referenced documents. Another asked to see the report.

Ecology Response: Ecology has been transparent about our plans to develop a set of preliminary cleanup goals for Port Angeles Harbor. Ecology's intent in developing these goals, or screening levels, was to facilitate a framework for setting preliminary cleanup standards for cleanup in the harbor with multiple PLPs. All PLPs in the harbor would be expected to incorporate these levels in the RI/FS. Ecology will also expect them to either (a) incorporate these levels, as appropriate, when proposing preliminary cleanup standards for use in Port Angeles Harbor cleanups, or (b) to demonstrate to Ecology why a different number should be used for a particular action. Preliminary

cleanup standards remain preliminary and draft until they are set by Ecology in the future during the finalization of cleanup action plan(s).

Ecology wanted to state our plans for developing these screening levels within the SDE, but the reference to a very early draft of the preliminary cleanup goals document was incorrectly made. No information from this early internal draft was used in writing the SDE. The incorrect reference has been removed. Ecology expects to complete and release the preliminary screening levels in early 2013.

Selection of Data Sets

Comment: One commenter questioned the existence of additional data that were not included in the SDE. It was noted that some of these data sets were listed in the SIR in Section 1.2. The commenter stated that all existing data should be included. The commenter also asked whether the data used was obtained from Ecology's Environmental Information Management (EIM) database and whether the database has been reviewed.

Ecology Response: Ecology recognizes the existence of other additional data that was not evaluated in this report. Ecology chose to include only recent data (2005-2010) since our objective was to evaluate the existing conditions in the harbor. Prior data is useful in evaluating changes over time.

EIM was the initial source of this data. Ecology did a 100% quality assurance check of the EIM data used for the SIR. SAIC did a 100% review for location presence and correctness of the EIM data from the *Remedial Investigation for the Marine Environment near the former Rayonier Mill Site* (Malcolm Pirnie 2007a) and the *Phase 2 Addendum Remedial Investigation for the Marine Environment near the former Rayonier Mill Site* (Malcolm Pirnie 2007b). For the chemical and bioassay information, SAIC did a 100% review for presence and a random 5% review for correctness. Ecology knows of no documented reviews of the EIM data in Nippon Paper Industries' *Sediment Grab Sampling and Log Density Survey* (Anchor 2005) or *Environmental Baseline Investigation* (Exponent 2008).

Combined Sewer Overflows (CSOs), Outfalls, and Stormwater

Comment: One commenter felt that the SDE failed to discuss in enough detail the potential amount of fine-grained sediment and contamination associated with urban areas that the current and former city of Port Angeles CSOs may deliver to Port Angeles Harbor. The commenter noted that that industrial wastes and toxic pollutants are contained in CSO and raw sewage overflows. The comment suggested CSO locations should be mapped more often in the SDE.

Other comments asked for an expanded discussion of historical outfalls and regional stormwater non-point source inputs. The historical outfalls may be sources of historical contamination. Regional stormwater inputs may be important sources of diffuse contaminants including dioxins/furans.

Ecology Response:

CSO Locations and Contributions

CSOs are discharges of untreated wastewater and storm water released directly into marine waters, lakes, and rivers during periods of heavy rainfall. Under normal conditions all wastewater (from combined or separate systems) is transported to the city's wastewater treatment plant. During heavy rainfall, the overflows occur because the pipelines have a limited capacity and the added storm water causes the flows to exceed those capacities.

CSOs may introduce contamination and pathogens into these water bodies. Typical types of contamination found in CSO discharges would include those associated with urban areas, such as petroleum products, pesticides, metals, and solvents. The city of Port Angeles is currently working on a plan to eliminate CSOs.

The average total yearly discharge from Port Angeles CSOs in recent years has been estimated at 31.4 million gallons per year. It is likely that this discharge contained some fine-grained sediment, but the amount has not been measured. In reality, this probably doesn't amount to much when compared to the average waste volumes release by industrial sources in the past. Rayonier's waste volume was reported to be 35.66 million gallons per day in 1967 and Fibreboard's volume was reported to be 4.2 million gallons per day (U.S. Department of the Interior, 1967).

Patterns of chemical contamination found in the harbor during the SIR show that CSOs may have contributed to contamination in the harbor. Ecology feels the SIR and SDE acknowledge the CSOs in an adequate manner. The locations of CSOs are shown on figure 2-1 of the SIR and discussed in Section 2.1.5. Locations of current CSOs are shown in figures throughout the SDE.

Historical Outfalls and Regional Stormwater Inputs

Fine-grained sediments have relatively more surface area than coarser-grained sediments. Many types of contamination are attracted to and attach to these surfaces. Therefore, fine-grained sediments are often found co-located with contamination. Today small creeks and discharges related to human activities, including CSOs, are the major sources of sediment to the harbor. Development and bulk heads along the harbor shoreline have eliminated many of the cliffs and beaches that previously provided sediment to the harbor.

Though the SDE acknowledges small creeks and human-caused discharges (including current and historic CSOs and outfalls) are sources to sediment in the harbor, we agree that more information on regional stormwater inputs and historical outfalls would be helpful. As we move forward working with PLPs in the harbor, we will ask them to include this information in their RI/FS.

Fingerprinting

Five reviewers had comments about the dioxin/furan fingerprinting described in Section 4.

Comment: Several of the comments challenged the description of the method used.

Ecology Response: Ecology has made several minor changes to the text of Section 4 to make the method description clearer.

Comment: One commenter questioned the elimination of dioxin data with less than 10 of the 17 congeners detected from the fingerprinting analysis as described in Section 4.1, paragraph 2. The commenter stated this might delete unique samples that may be highly informative.

Ecology Response: It is incorrect to include all samples regardless of the number of non-detected congeners. In this analysis, non-detect concentrations were estimated at one-half the detection limit. By including samples with a large number of non-detects, artificial data is created by assuming a value equal to one-half the detection limit and this may influence variance and potentially diminish patterns of real data.

Comment: Several commenters questioned the need to include the fingerprinting analyses in the SDE and in Appendix J of the SIR since the reports were inconclusive and were not consistent with each other. Others questioned the mention of a need for more intensive fingerprinting approach.

Ecology Response: There is value in including the results of all attempted studies whether the results are conclusive or not. Future studies and decisions build on the base of knowledge gathered. A report with inconclusive results may still provide information to avoid repeating studies that do not help, or help with designing studies that will yield more useful information.

The fingerprinting analysis in Appendix J of the SIR was also inconclusive. An early, incorrect version of this analysis was inadvertently included in the public review draft of the SIR. Ecology recognizes that there are multiple errors in the report and is deleting it from Appendix J. The fingerprinting analysis in the Supplemental Data Evaluation was completed using different methods than the analysis in Appendix J. This fingerprinting analysis in the SDE has separate results and did not attempt to resolve inconsistencies between the two.

Ecology, in an effort to better understand dioxins in Port Angeles Harbor, is doing another analysis using multivariate statistics. Ecology already has draft results of this analysis and plans to have a report ready for release in early 2013.

Data Gaps and the Need for More Sampling

Comment: Several commenters addressed the recommendations given in Section 8 of the SDE for additional sampling. Some commenters agreed that more sampling was necessary. Other commenters felt enough sampling has been completed or could wait until an evaluation of alternatives for cleanup showed they were necessary.

Ecology Response: Adequately characterizing the vertical and areal extent of contamination is required by MTCA. How much sampling is needed to complete this remains a site-specific decision. When making a decision about whether enough sampling has been completed, Ecology considers the decisions that need to be made about cleanup. We look at whether we have adequate information to understand the type, amount, and location of contamination to consider cleanup options. If so we move ahead to the feasibility study or alternatives evaluation without additional sampling. If not, we need to continue investigating until the necessary data is collected. We call this filling data gaps.

Sometimes, enough information is known to consider and evaluate cleanup options, but additional sampling may be needed to refine the detailed information needed to design the cleanup action plan. This data can be collected as part of the feasibility study.

A large amount of data has been collected in Port Angeles Harbor. The data is sufficient for the broad assessment of the primary source locations in the harbor. Collection of additional data could focus the borders of the areas that exceed state criteria and need to be addressed with cleanup actions. Additional data may also help to pinpoint the location of particular sources.

Ecology was able to identify several additional Potential Liable Persons (PLPs) in the harbor as a result of this study. These PLPs will have an opportunity to provide information and complete their own remedial investigation and feasibility studies. Ecology will work closely with the PLPs to insure adequate RI/FS are completed. Ecology has identified several areas that we consider data gaps in the SDE, and the PLPs will be expected to fill those gaps or provide information that shows we have enough data already. Ecology does not have plans for further studies at this time, with the exception of completing the chemometrics and preliminary screening levels reports.

Background Concentrations in Sediment

Comments: Several commenters objected to the background values calculated in Section 3 of the SDE. The most common criticism focused on the selection of the Port Angeles Proximal Area data set, instead of the Puget Sound-wide or Puget Sound Reference Areas data sets. The selected data set was criticized for being generally coarser-grained than the samples from the SIR. One commenter asked that the data be provided in an appendix.

Ecology Response: MTCA requires that when "…defining background concentrations, samples shall be collected from areas that have the same basic characteristics as the medium of concern at the site, have not been influenced by release from the site and, in the case of natural background concentrations, have not been influenced by releases from other localized human activities." (WAC 173-340-709 (2))

Ecology adds that an appropriate background data set would have a reasonable sample size, comparable character, and be collected from a region proximal to the investigation area. A comparable character would include similar mineral composition, grain size distribution, and organic carbon content.

The Washington State Sediment Management Standards (SMS) do not state a minimum number of samples required for setting sediment background levels, but Ecology is following MTCA requirements of a minimum of 10 samples for natural background and 20 samples for area background. The background threshold values discussed in Section 3 are natural background values, not area background levels. MTCA sets cleanup levels at the highest of the human health risk-based value, natural background, or the practical quantitation limit. Ecology plans to set preliminary screening levels in Port Angeles Harbor based on this calculation. Actual cleanup levels will not be finalized until a cleanup action plan is approved in the future. We are not considering area background levels (or regional background levels, as are being considered for inclusion in the SMS revisions) at this time. Area or regional background levels will be discussed in the future as appropriate for developing cleanup action plans.

The SDE considers three different natural background data sets. All of the data can be easily obtained through Ecology's Environmental Information Management System (EIM) on Ecology's website at http://www.ecy.wa.gov/eim/. None of these datasets provide a perfect background dataset for Port Angeles Harbor. The Port Angeles Proximal Area data set was selected by Ecology because it is most likely to encompass similar natural and anthropogenic source as those found in Port Angeles Harbor. Ecology recognizes that the generally coarser-grain size of the data set may cause the natural background concentrations to be more conservative than the other two data sets. Each of the other data sets also has drawbacks. In the SDE, Ecology clearly states that collection of a more robust data set may be warranted.

Bioassay Failures

Comment: Several commenters thought the larval development bioassay results using *Dendraster exentricus* should be disregarded because the presence of wood debris or other forms of excess organic matter in the sediment samples may cause inaccurate counts of larvae as they become trapped in a flocculant layer that develops over the normal course of the test. This issue of larval toxicity failures is under regulatory review right now. The commenters noted that only a few of the bioassay failures corresponded

with chemical SMS exceedances and the results are more appropriately considered "apparent" exceedances.

Ecology Response: The larval bioassays were conducted using approved bioassay methods, according to an approved sampling and analysis plan. The possible problems with the method were not recognized until after these bioassays were completed. Ecology is following the technical discussion on new methods and agrees that the resuspension method may provide better information for future studies. We have included appropriate caveats about this method in the SDE text.

Only a few of the bioassay failures correspond with chemicals that were present at levels higher than SMS standards. Ecology agrees that sediment toxicity in Port Angeles Harbor would be better labeled "apparent." The text in Section 6.4 has been modified to clarify this.

Potential Primary Contaminant Sources

Comment: One reviewer provided additional information about historical site uses and production process to clarify the information in Table 11.

Ecology Response: This information is helpful and Table 11 has been updated.

Comment: The SDE states that hypothesized sediment transport pathways can be used in conjunction with sediment chemistry results to determine likely point sources of chemical contamination. One commenter objected saying the sediment transport analysis should only be used to define areas where sediment deposition and erosion are occurring and that point sources can be measured if they exist.

Ecology Response: Point sources, such as streams and upland sources (including current industrial outfalls), can only be measured if they currently exist. Some historical point sources, such as industrial outfalls, no longer exist and can't be sampled today. Analyzing sediment chemistry results with hypothesized sediment transport pathways can help us determine likely locations of point sources, including current and historical sources.

Comment: Section 6.2.2 of the SDE concludes that the former Rayonier Mill property was not the main source of dioxin to the inner harbor. One commenter objected to this conclusion, stating that it is possible that fine-grained material could have eroded, transported, and mixed with other sediments in the inner harbor and other portions of the outer harbor in the years since Rayonier ceased operation in the late 1990s. Other changes at the Rayonier Mill property, such as the removal of approximately 2,000 logs from the log pond and shortening of the jetty would have increased the susceptibility of sediment erosion from the log pond.

Ecology Response: The strong footprint of metal contamination and co-located dioxin in the western harbor with the maximum concentration decreasing with distance into the deeper harbor, indicates the dominant source or sources were located in the western harbor. Rayonier's high-energy location likely causes it to be a contributor of dispersed dioxins throughout much of the harbor, but it is unlikely to be a source for dioxin contamination in the inner harbor.

Comment: Several commenters questioned conclusions about Rayonier's contribution to contamination in the harbor. Contradictions in the wording of the report were pointed out in several places.

Ecology Response: Ecology has clarified the SDE text in several places to remove any contradictions and clarify the conclusions that Rayonier appears responsible for chemical exceedances of SMS close to the former mill property, such as PCBs, phenols, and PAHs; and Rayonier also appears to contribute to diluted and diffuse contamination in the central and outer harbor (dioxin/furans, and other organic contaminants). The organic contaminants that appear to be sourced from Rayonier are occasionally found at detected concentrations below SMS in other areas; however, they are generally not present at detectable concentrations across the rest of the harbor. Though the existence of some longshore transport is supported by physical evidence in the Geomorphic Report, longshore transport is not supported by chemical spatial patterns. The importance of longshore transport has been deemphasized in the report.

Sediment Transport

Comment: A few commenters had comments about currents in the harbor. Some pointed out that several previous reports concluded there is a counterclockwise net circulation direction in the harbor. Another report shows a clockwise pattern. The commenters argue that the longer-term net circulation direction dictates sediment and subsequent contaminant transport. One commenter asked Ecology to inform the reader that since the sampling was only collected for one month for the Current Data Collection Analysis Report, it does not reflect the seasonal variability of currents in the harbor.

Ecology Response: The net circulation pattern of surface currents is not the only factor to consider when identifying source areas of contaminated sediment. There are a number of previous reports with conflicting directions of surface currents. Even if net surface circulation does correlate with net sediment transport, bi-directional currents and high energy events inevitably move some sediment in other directions. The previous studies dealt only with surface currents and Ecology deemed these insufficient to determine likely sediment transport paths; therefore, the Current Data Collection Analysis, Sediment Trend Analysis, and Geomorphic Reports were prepared as part of the SIR. Ecology's studies focus on the movement of sediments and the bottom currents. Ecology has added text to SDE Section 5.1.1 stating the data collected during the Current

Data Collection Analysis did not reflect the seasonal variability of currents, but does encompass the timing of currents associated with spring tides.

Comment: Several comments were related to references and conclusions from the Geomorphic Report, included in Appendix I of the SIR and used to develop sediment transport conclusions in the SDE. The comments questioned whether the Geomorphic Report was based upon methods, theories, principles or techniques generally accepted in the relevant scientific community. One commenter stressed that the observation of transport directions presented in the Geomorphic Report were qualitative and subjective. Two commenters particularly objected to a statement in the last paragraph of SDE Section 5.1.3 comparing sediment deposition rates in the inner harbor to stream outputs.

Ecology Response: The Geomorphic Report was conducted by an expert in Puget Sound beach morphology who has many peer reviewed publications on the subject. The qualitative conclusions were based on field observations and common practice. The Geomorphic Report is a single assessment tool that is considered in the context of other pieces of evidence. The statement in the SDE raising objections has been removed.

Comment: Several commenters questioned the validity of the Sediment Trend Analysis (STA) included in Appendix E of the SIR and used to develop sediment transport conclusions in the SDE. Comments questioned whether the STA was based upon methods, theories, principles, or techniques generally accepted in the relevant scientific community. It was pointed out that the methodology has not been rigorously peer-reviewed and has been rejected for use in several other major studies in Washington. One commenter pointed out a number of uncertainties associated with the methodology. It was also noted the STA results are used to hypothesize the presence of parting zones and transport fronts, but these "features" have not been documented with independent data or observations.

Ecology Response: The STA is a single assessment tool that is considered in context of other pieces of evidence. The parting zones and transport front are features that may be present. This information should be and was presented and evaluated in the SDE. The STA is the only study for Port Angeles Harbor that derives sediment transport pathways through the quantitative analysis of sediment samples. Ecology recognizes there are some uncertainties associated with the method. However, STA has also been successfully used in Puget Sound (Dyes Inlet and Hylebos Waterway) and for U.S. Army Corps of Engineers, NOAA, and Navy clients.

Comment: A number of comments discussed southern longshore transport. Some commenters felt the longshore transport identified from east to west along the southern shore was not emphasized enough and potential migration of contaminants from eastern and southern sources to the inner harbor was not included often enough. Others

felt there was little evidence that the longshore transport exists and its existence is not supported by chemical exceedance patterns.

Ecology Response: Evidence that the southern longshore transport exists is provided through physical evidence in the Geomorphic Report (SIR, Appendix I). Chemical distribution in the harbor does not support this being a pathway for transporting contaminants associated with fine-grained sediment. Contaminants associated with fine-grained sediments include dioxins/furans, metals, and organic contaminants, such as PCBs and PAHs. Ecology has reworded parts of SDE Sections 6 and 9 to deemphasize the significance of southern longshore transport for introducing contaminants associated with fine-grained sediments to the inner harbor.

Comment: Several comments questioned how the area around the former Rayonier mill could be net erosional and yet still have areas of higher fine sediments (clay and silt) and remaining contamination. One stated that if this area was net erosional, there should be no remaining contamination near the site since several decades have passed since any significant contaminant discharge. Another argued that the disappearance of the highly organic sludge beds once found in the area was not due to erosion, but attributable to organic material decay (e.g., sediment diagensis). One commenter argued that the STA arrows show sediment trending toward the former Rayonier mill area from the parting zone instead of away. Another commenter questioned how dioxins could be dispersed in the harbor, but PCBs be "effectively trapped" near where they were originally deposited.

Ecology Response: There are not enough areas with higher amounts of fines around the former Rayonier mill to indicate active deposition of fines. The existence of fine-grained material a couple decades after the mill closed may be related to the large amount of material that originally existed. Fine-grained sediments are still being delivered to the area through Ennis Creek. Fine-grained material is always found to some extent with coarse-grained sediment. The lack of sediment that is mostly fine-grained indicates that much of the fine grained material reaching the area does not deposit there.

The fact that contamination is still present is not contrary to an area being net erosional. The SDE suggests that material in shallow marine areas near the shore can be resuspended in water, move offshore, and deposit in areas of slower currents and fewer waves.

Many of the organic sludge beds once found near the Rayonier Mill property have disappeared. Similar sludge beds in the western harbor still exist. If harbor conditions were causing a rapid decay of the organic sludge beds, they would also be causing those in the inner harbor to decay and disappear.

Although sediment transport processes are likely to have dispersed PCBs into the harbor in a similar manner as other contaminants, PCBs are usually found in such low levels that they were not detected in most samples. The high PCB concentrations in the

western harbor (PCB congeners) and in the Rayonier log pond (PCB aroclors) suggest those areas have trapped a portion of the contaminant releases from the nearby properties. The PCB and dioxin spatial patterns may also differ because they had different specific source locations and different source strengths.

STA vectors show only one half of the sediment loading/ unloading conveyor belt. STA vectors only indicate transport after the system is loaded. They show how the sediment could leave the area, but not how it got there. The arrows do not show parting zone loading, which is believed to come from the remobilization of deposited sediment in shallow regions (by waves) and from new sediment entering the harbor during extreme events. STA arrows pointing toward the former Rayonier mill area and other areas of the southern shore show sediment sorting by depicting both erosional and dynamic equilibrium pathways.

Conceptual Site Model

Comment: A large number of comments concerned the conceptual site model (CSM) presented in Section 5.2 and Figure 7 of the SDE. Many comments addressed the differences between Ecology's model and one presented by Windward (Windward 2011). Some argued that Ecology should use a single CSM showing long-term net hydrodynamic conditions and deposition. Some comments pointed out text that seemed to be contradictory.

Ecology Response: Port Angeles Harbor is a complex system and multiple lines of evidence must be considered when developing a conceptual site model. These lines of evidence include currents, geomorphic studies, sediment trend analysis, winds, tides, historical studies, and chemical distributions. Ecology has presented a model with high and low energy conditions that we feel best describe the physical processes that drive sediment transport in the harbor. Further evidence may refine or change this explanation of what we are seeing in the harbor. Future remedial investigations will be expected to present Ecology's CSM, but can also present a refined or contrasting model with supporting evidence.

Sediment transport is more complicated than all material being moved counterclockwise by surface currents. Net circulation doesn't indicate net sediment transport. The Windward CSM dismisses recent Ecology studies such as the Sediment Trend Analysis and the Geomorphic Study and relies too heavily on a net counterclockwise surface current which does not explain the chemical distribution in the harbor. The Windward CSM does not account for uncertainty in deposition created by high energy events or dispersion.

The text in section 5 was clarified and tightened in several places to remove contradictions noted.

Wood Debris

Comment: Wood debris comments came from several commenters. One commenter said there was no data to support the conclusion the extensive presence of wood debris on the seafloor likely impairs the quality of benthic habitat. Since the sediment bioassay failures were being questioned, the reviewer felt there was no proof of benthic habitat impairment and this statement should be removed. Another commented that Ecology attempts to correlate wood debris and total organic carbon. Another commented on the lack of water quality data in the water overlying the wood debris areas. Another asserted that wood is not a hazardous substance, does not contain any hazardous substances, and that Ecology has no regulatory authority to require cleanup of wood debris.

Ecology Response: Ecology acknowledges that the sediment coring methodology used in the SIR resulted in data that made understanding the distribution and depth of wood debris difficult. The lack of comparable sediment core data makes it difficult to determine the extent of subsurface sediment contamination and whether or not sediment quality in the harbor is improving. Further study is needed to provide answers to these questions.

Enough data does exist to show that extensive wood debris exists in some areas of Port Angeles Harbor. Extensive wood debris can smother aquatic habitat and animals, causing a break in the food chain. The presence of Beggiatoa mats in parts of the harbor with large amounts of wood debris indicates that the sediment/water interface may have inadequate oxygen and possibly a complete lack of oxygen. Beggiatoa is a sulfur oxidizing bacteria that utilizes hydrogen sulfide as an energy source. Large amounts of wood debris breaking down uses up oxygen at the sediment/water interface. This leads to an environment rich in hydrogen sulfide. The extent of wood waste and its effect on the benthic community needs to be studied further.

This study does support a correlation between areas of wood debris and areas of higher total organic carbon.

Wood waste alone is not likely to be a hazardous substance under MTCA. However, Ecology can require cleanup of wood waste incidental to the cleanup of other actionable hazardous substances at a site, and hazardous substances can be produced by the breakdown of large volumes of wood in the marine environment. Wood debris is also an "other … deleterious substance" under the Sediment Management Standards, Chapter 173-204 WAC, which apply at this site.

Responses to Specific Concerns about the SDE

City of Port Angeles and Nippon Common Interest Agreement

Comment: One commenter questioned how Ecology would move forward working with Potentially Liable Parties when Nippon and the City of Port Angeles have signed a mutual agreement not to share information on their polluting activities with public agencies or the public.

Ecology Response: The agreement between the city and Nippon is a common interest agreement. Its purpose is to share, between the two entities, any information that can be used for a "joint defense against any and all claims asserted against them." Its intent is not to keep information from the public or public agencies. Ecology is developing a positive working relationship with both the city and Nippon and doesn't believe this agreement will hinder us moving forward with remedial actions in the Harbor.

Radioisotopic Analysis

Comment: One comment pointed out that the two radioisotopic analyses for MA06 and RL03 have no calibration or validation and argue that the results are not in agreement with the CSM or the creek sediment inputs.

Ecology Response: The data for these analyses, preformed by TestAmerica, are presented in the Geomorphic Report with calculated uncertainties. The core samples suggest low sedimentation rates near the parting zone (RL03) and far from shore near the boundary between the inner harbor and the central harbor. Four additional cores collected and analyzed by Exponent near Nippon show much higher deposition rates. These are results are all consistent with Ecology's CSM.

PCBs

Comment: One commenter questioned the apparent contradiction in two statements in Section 6.2.3: "The highest total PCB congener concentration was measured in close proximity to Terminal 5, being an order of magnitude greater than any other samples. Total PCB congener concentrations were also in exceedance of SQS/LAET criteria in the vicinity of the Port Angeles Marina and the former Rayonier Mill log pond and dock" and "The spatial distribution of PCBs suggests the former Rayonier Mill property as a primary source of PCBs to Port Angeles Harbor.

Ecology Response: There are two different types of PCB data in the harbor, PCB Aroclors and PCB congener data. Fewer sediment samples in the harbor have been analyzed for PCB congeners. This limited number of samples prevented us from using

spatial interpolation of the data (Figure 21) the way we can with PCB Aroclor data (Figure 20). The PCB Aroclor data lead to the conclusion that Rayonier is a source near the former Rayonier mill. There appear to be other sources of PCBs elsewhere in the harbor, but there is not yet enough data to point to other specific sources. Changes have been made to the text in Section 6.2.3 to clarify our current understanding of PCB contamination.

Rayonier Deepwater Outfall

Comment: One commenter noted that Rayonier's deepwater outfall, used during the last 25 years of the mill's operations, was not along the southern shoreline but in the outer harbor. This outfall discharged approximately 20 tons of solids per day, and this continuous discharge may have been greater than all other discharges combined. This should be acknowledged in the report.

Ecology Response: Ecology agrees that the deepwater outfall could have been better acknowledged in the report and has added text about this to the SDE. It is still unknown how much of a contribution the deepwater outfall would have to the parting zones or contamination in the harbor. The outfall was placed in its location to keep effluent out of the harbor. Prevailing currents outside the mouth of the harbor would have moved much of the effluent out of the harbor; however, a later study showed the outfall was not entirely effective at doing this (US EPA 1974).

References

Anchor. 2005. Sediment Grab and Log Density Survey Sampling and Analysis Report. Prepared for Nippon Paper Industries by Anchor Environmental, L.L.C. June 2005.

Centers for Disease Control and Prevention, 2012. Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention. Report of the Advisory Committee on Childhood Lead Poisoning Prevention of the Centers for Disease Control and Prevention. Pp 54. January 4, 2012.

City of Port Angeles. 2008. Common Interest Agreement – City of Port Angeles and Nippon Paper Industries; July 22, 2008.

Exponent. 2008. Environmental baseline Investigation DNR Lease 22-077766. Prepared for Nippon Paper Industries by Exponent. October 2008.

Goldberg JA and M. Sloan. 2009 Relative importance of biodiversity and the Abiotic environment in mediating an ecosystem process. Mar Ecol Prog Ser. 396:273-282

Gray, J. 2002. Species richness of marine soft sediments: Review. Marine ecology progress series. Vol. 244: 285–297, 2002

Hughes, S.A., 2005. Use of Sediment Trend Analysis (STA®) for Coastal Projects. US Army Corps of Engineers ERDC/CHL CHETN-VI-40: 17p.

Malcolm Pirnie. 2007a. Remedial Investigation for the Marine Environment Near the Former Rayonier Mill Site (Public Review Draft). Prepared for Rayonier by Malcolm Pirnie, Seattle, Washington; February 2007.

Malcolm Pirnie. 2007b. Phase 2 Addendum Remedial Investigation for the Marine Environment near the Former Rayonier Mill Site (Agency Review Draft). Prepared for Rayonier by Malcolm Pirnie, Seattle, Washington; February 2007.

Pearson TH, Rosenberg R (1978) Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanography Marine Biology Annual Review 16:229-313

Peng G. and Roberts J.C. (2000) Solubility and toxicity of resin acids, *Vat. Res.*, 34(10), 2779-2785.

PSEP. 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Interim Final Report. Puget Sound Estuary Program, U.S. Environmental Protection Agency Region 10, Seattle, WA.

PTI. 1989. Data validation guidance manual for selected sediment variables. Prepared for the Washington Department of Ecology, Olympia, WA. PTI Environmental Services, Bellevue, WA.

Rosenberg, R, S. Agrenius, B. Hellman, H. C. Nilsson, K. Norling. 2002. Recovery of marine benthic habitats and fauna in a Swedish fjord following improved oxygen conditions. Marine ecology progress series. Vol. 234: 43–53, 2002.

Suquamish Tribe, 2000. Fish Consumption Survey of the Squamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region, August.

U.S. Environmental Protection Agency. 1974. Evaluation of ITT Rayonier, Inc. Outfall, Port Angeles Harbor, Washington. Office of Enforcement National Field Investigations Center-Denver, Colorado. EPA 330/3-74-001. Pp. 102.

U.S. Environmental Protection Agency. 2003. Technical Summary of information available on the bioaccumulation of arsenic in aquatic organisms. Washington, DC: U.S. Environmental Protection Agency. EPA822R03032. December 2003.

Weston DP (1990) Quantitative examination of macrobenthic community changes along an organic enrichment gradient. Mar Ecol Prog Ser 61:233–244

Appendix A: Comment Letters

CITY OF PORT ANGELES
WASHINGTON, U.S.A.
City Manager's Office

May 22, 2012

Ms. Connie Groven
Site Manager/Environmental Engineer
Toxics Cleanup Program, Southwest Regional Office
Washington State Department of Ecology
P.O. Box 47775
300 Desmond Drive
Olympia, WA 98503

Re: Port Angeles, WA - Harbor Sediment Investigation
Comments on February 2012 Public Review Draft Reports:
Sediment Investigation Report & Supplemental Data Evaluation

Dear Ms. Groven:

Thank you for affording us the opportunity to comment.

Attached are technical comments on DOE's Sediment Investigation Report (E&E 2012) and Supplemental Data Evaluation Report (Newfields 2012) prepared by Betsy Day of Integral. These are submitted as the technical comments of the City of Port Angeles.

These technical comments are summary in nature, but they indicate the need for significant revisions. The comments point to the need for a much better evaluation of the data for the Port Angeles harbor. For these reasons, the City urges Ecology not to finalize these documents.

Instead, we suggest that a number of "next steps" need to occur. These additional steps would include: a more thoughtful and statistically-based evaluation of the existing data; development of a site-specific, risk-based strategy to determine if (and where) a cleanup might be warranted; data collection to evaluate risk; and development of the appropriate risk-based data evaluations. These steps are typically performed in a remedial investigation/feasibility study (RI/FS).

Fortunately there are now lots of data for the harbor which will reduce the scope of data collection during an RI/FS. This process also will allow parties along the waterfront more chance to participate. Moreover, this process could go a long way to providing a solid

Phone: 360-417-4500 / **Fax**: 360-417-4509 / **TTY**: 360-417-4645
Website: www.cityofpa.us / **Email**: citymanager@cityofpa.us
321 East Fifth Street - P.O. Box 1150 / Port Angeles, WA 98362-0217

characterization of sediment quality in the harbor and will be very helpful for development of an RI/FS work plan.

Very truly yours,

Dan McKeen
Interim City Manager

DM:jd
Encl.

G:\LEGAL\a LETTERS\LETTERS.2012\DOE.HarborSediment.May 22.2012.wpd

Integral Consulting Inc.
411 1st Avenue S.
Suite 550
Seattle, WA 98104

telephone: 206.230.9600
facsimile: 206.230.9601
www.integral-corp.com

MEMORANDUM

To:	Bill Bloor
From:	Betsy Day
Date:	May 22, 2012
Subject:	Preliminary Review of Port Angeles Harbor Sediment Investigation Report and Supplemental Data Evaluation Report
Project No.:	C935-0101

Integral Consulting Inc. (Integral) has conducted a preliminary review of the public review draft of the *Sediment Investigation Report for Port Angeles Harbor* prepared for the Washington Department of Ecology (Ecology) by Ecology and Environment (E&E) and the associated *Supplemental Data Evaluation* prepared by NewFields. As we discussed, our work focuses on identification of major issues and is not intended to be a line by line review. Report sections/appendices were reviewed by individuals with specific expertise with the given subject matter. This technical memorandum provides general comments on the report and its appendices. We provide more detailed comments on the risk assessment appendix because of the critical role of risk assessment in identifying the potential need for cleanup.

STUDY OBJECTIVES

Ecology initiated a comprehensive study of sediment quality in Port Angeles Harbor in 2008 following a number of earlier studies performed by private industries along the harbor, Ecology, and the U.S. Environmental Protection Agency (EPA). Goals included:

1. Assess nature and distribution of chemical contamination and wood debris in the harbor and in the area adjacent to the Rayonier Mill property.

2. Determine fate and transport of chemicals of potential concern (COPCs) by 1) measuring water currents, 2) identifying sediment depositional areas, and 3) evaluating geomorphology.

3. Assess potential adverse risks to human health and ecological receptors.

The E&E report states the investigation was not intended to be a remedial investigation/feasibility study (RI/FS). However, the NewFields report discusses the need for cleanup and provides a greater level of interpretation than does the E&E report.

COMMENTS ON THE SEDIMENT INVESTIGATION REPORT

Section 1. Introduction

The third objective of the Harbor-Wide study (Section 1.3.1) was to identify sources and prioritize areas for cleanup. This is typically one of the end results of a remedial investigation/feasibility study (RI/FS). However, this section goes on to say "The study is not intended to be an RI/FS." The overall goal of the work in the context of a site cleanup process is unclear. The study should be considered a site investigation only.

In Section 1.4 the harbor is divided into Areas of Potential Concern (AOPCs). Traditionally, AOPCs are defined in a feasibility study. AOPC terminology should be removed from the report. The areas shown on Figure 1-3 could be considered investigation areas.

Figure 1-3 suggests all of the areas shown as "AOPCs" are problematic. This is not supported by the data which show no exceedances of chemical criteria in much of the harbor. Also, shoreline sources of contamination typically have the greatest impact near the shoreline yet this figure ties shoreline areas with the center of the harbor where no chemical exceedances occurred. These investigation areas should be redefined.

The risk assessment conducted at the site was, at best, a screening level risk assessment. Section 1.4.3 should be revised accordingly.

Section 2. Summary of Existing Information

As written the draft report provides the reader with the sense that the harbor is highly contaminated. In particular, Section 2 repeatedly uses adjectives such as "high", "very high", "significant", etc to describe chemical concentrations without any reference to state standards or background concentrations. In the absence of comparisons to standards, the reader is left with the image that the harbor is highly polluted. The lack of appropriate scientific writing casts the entire document in a poor light.

The authors have compiled a very significant amount of information, however, in numerous locations the information is unsupported. For example, in Section 2.1.3, para. 1

the statement "Significant amounts of PCBs and metals may have dropped into the water" is referenced to a personal communication. Is there any data behind this statement or is this a person's unsupported opinion? How is "significant" defined? How did PCBs and metals get "dropped" into the water?

In other places the authors have provided inaccurate information. For example, in Section 2.2.2, para. 2 the report states PCBs "can easily cycle between air, water and soil. Consequently they are found all over the world." This statement is inaccurate and is not referenced. Furthermore, in Section 2.2.1 E&E ignores the production of dioxins/furans through forest fires and atmospheric deposition, only citing an Ecology report from 1998. The authors should cite Ecology's 2011 studies of dioxin/furan concentrations in rural state parks and in six urban neighborhoods in Seattle, as well as data for the Lower Duwamish Waterway which also receives stormwater runoff (a potential source).

There are many examples of text that misrepresent scientific fact, or that are inappropriately suggestive. For example, in Section 2.2.4, para. 1, the report states "Low molecular weight PAHs dissolve more readily in the water column than do heavier PAH compounds." While this is true, the sentence gives the perception that HPAHs are routinely found in the water column which is not the case. In addition, since there is no water column data for the harbor, this sentence can not be tied to harbor conditions.

In numerous places the authors report old information but have not attempted to provide more recent information. For example, in Section 2.1.5 the authors note the city wastewater treatment plant began discharging through an outfall in 1969. They then report "Since that time, the WWTP has had occasional untreated effluent discharges to the harbor (Ecology 1976)." This reference is for a Class II inspection that occurred 36 years ago. They also cite a release in 2006 but do not provide any useful information to help understand harbor conditions today or the magnitude and frequency of past releases. Another example is outdated information provided for the Unocal facility (Section 2.1.6). The report says that an RI/FS will occur and cites an Ecology (2005) Agreed Order; later the report incorrectly cites an Ecology (2007) document as the Agreed Order when in fact the Ecology (2007) document appears to be a monitoring report for the K-Ply Mill. The report never reports what activities and results have occurred since that time under the RI/FS. Any new information that may affect the harbor should've been evaluated, reported and used in the identification of data gaps and creation of the sampling design.

Report figures should show the facilities that are discussed in the report. They should show locations of the storm drain system discussed in Section 2.1.5. A bathymetric figure should also be included.

Section 2 should be substantially re-written to accurately reflect the understanding of the harbor prior to collection of new data. Sweeping statements ("Dioxins in the aquatic environment are highly lipophilic and are removed from the system primarily by bioaccumulation in plants, fish, and invertebrates,...") should be supported by technical references. In its present form, this discussion of conditions in Port Angeles Harbor is not of use for future studies, presents limited value to the understanding of current conditions, and is not useful for source identification, i.e., linking upland sources to in-water conditions.

Section 3 – Sampling and Analytical Methods

This section is a synopsis of the sampling plan. It fails to provide any rationale for the identification of sampling locations. At a minimum it should bring forth a concise presentation of key data gaps and the strategy for filling them based on the earlier data gaps report prepared by E&E. An investigation report that lacks rationale for its sampling design can't be evaluated for whether the data have achieved data quality objectives (EPA 2006).

Although not precluded by the Washington State Sediment Management Standards (WAC 174-204), the decision to conduct bioassays prior to chemical testing is highly unusual and presents challenges in the evaluation of sediment quality. Test organisms may react to physical and chemical conditions in the laboratory exposure that do not reflect conditions in the environment. (As reported by Newfields, this in fact did occur for the larval test.) Consequently, understanding the ecological meaning of a bioassay response, and determining practical solutions to reducing or accounting for that response, may not be possible. Additionally, the cost of the investigation may have been greater than needed because chemical analysis of sediment samples was triggered by bioassay response.

The sampling design did not to consider potential uptake of chemicals of concern from water.

Sediment samples earmarked for bioassay testing were stored in plastic bags which is not an EPA-approved method. Plastic bags are sources of phthalates and other chemicals used in the manufacturing of plastics. Because there was no chemical analysis of the bioassay sediments following storage in plastic bags, the bioassay results may not represent conditions in the harbor.

Collection of fish and shellfish tissue should always be done such that organisms of similar size are included in composite samples. The "rule-of-thumb" used on CERCLA sites is the length of the smallest fish in the composite must be at least 75 percent of the total length of

the largest fish in the composite. There appears to have been little thought given to selection of fish and shellfish in this study, with organisms of substantially different sizes being analyzed. Also, there are no details on how fish and shellfish were processed in the lab prior to analysis. Were ling cod fillets analyzed? Whole bodies? What part of the molluscs were analyzed?

In Section 3.12, third bullet, the text states "B" core intervals were selected, in part, based on sediment that "appeared to have a chemical residue". How was this defined?

Section 4. Data Validation

Integral assumed, but did not verify in this preliminary review, that the data were appropriately validated and reported with qualifiers per EPA guidance.

Section 5. Sediment Chemistry Results and Comparison with Criteria

The introduction to this section needs to provide a complete discussion of how data are evaluated under the SMS. There should be ample discussion of how the SQS/LAET/ERL/ERM values are screening values and that when bioassay data exist, the bioassay data overrule the chemical data. Because E&E has chosen to present sediment chemical results first, even though they initially ran bioassays first, and because they haven't been transparent with respect to how sediment quality decisions are made when biological data are present, the reader is left with the impression that benthic conditions in the harbor are more degraded than they are.

In Figure 5.4-1 the SQS criterion for zinc at Station IH02A is incorrect. It was only by chance that this error was noticed; all mapped data should be verified for accuracy. Similarly, comparisons between reported results and tabulated data have not been made during this preliminary review. This time-consuming quality assurance/quality control task is needed to verify the results presented in Section 5.

Section 6. Sediment Toxicity Test Results

Three bioassay tests were performed on sediments from 59 stations.

1. Amphipod test: One sample, located along the Rayonier dock, showed toxicity. This sample also had the lowest larval survivorship.

2. Polychaete test: One sample, located off the marina, showed reduced growth.

3. Larval test: Wide scale test failures, especially in the inner half of the harbor.

E&E erroneously concludes "metal exceedances in western Port Angeles Harbor were associated with failure of the larval development bioassay." Review of Table 6-3 shows just the opposite. Station IH01A had the highest cadmium, mercury and zinc concentrations in the entire study yet all three bioassays passed all SMS criteria. Statistical analyses of bioassay response and chemical concentrations should be presented.

E&E calculated correlation coefficients relating bioassay response with conventional parameters and the most frequently detected resin acid compounds (Table 6-4). Their purpose was to determine whether bioassay response was correlated with the presence of wood debris. They fail to identify which relationships were statistically significant, however, they identify two coefficient values as indicative of "a strong correlation". E&E should use standard statistical tests to identify significant relationships based on a reported probability (p) level for accepting/rejecting a stated null hypothesis.

Amphipod mortality was "strongly" (and potentially significantly) correlated with ammonia (r^2=0.87; note the apparent typo in Section 6.4 where E&E writes r^2=87). The ammonia concentration observed at Station ED04A, where amphipod mortality was 100 percent, was an order of magnitude greater than the next highest ammonia concentration and would appear to be largely responsible for the high degree of correlation. Interestingly, Station ED04A had no wood in the sample indicating the ammonia value was either due to other decaying material (e.g., algal mats) or is an erroneous value. E&E fails to make this observation, instead leaving the reader to incorrectly conclude that the high ammonia (and amphipod mortality) was due to wood debris.

E&E reports larval survival had a "moderately strong relationship" with percent fines (i.e., silt and clay) (r^2=0.63) though E&E did not indicate whether this was a statistically significant relationship. They write "This indicates that as percent fines increased so did the survival of the echinoderm larvae." Closer inspection of the data suggests the opposite: the percent fines reported on Figure 5.1-1 for stations with CSL exceedances of the larval test is approximately 67 percent while that for stations with SQS exceedances is about 52 percent. In other words, higher mortality is associated with finer-grained sediment. The observed increase in mortality in samples with finer-grained sediment may be an artifact of the test protocol as suggested by NewFields, or may be related to fine-grained material having a negative physical effect on the larvae. This conclusion is supported by the apparent lack of correlation with chemicals of potential concern and indicators of wood debris (Table 6-4).

Section 6.3 compares locations with bioassay failures to SMS chemical exceedances. However, no statistical relationships are shown so none of the relationships can be evaluated. This section should be re-written and include appropriate statistical analyses.

Section 7. Distribution of Chemical Compounds in Tissue Samples

Why were geoduck and horse clam collected for tissue analysis? These long-lived species may potentially have tissue concentrations that do not reflect current conditions and would therefore not be useful for determining whether a remedy is needed. Furthermore, individuals within a species were of various sizes making comparative analyses uncertain.

Paragraph 2 of Section 7.2 starts with "Harbor-wide sediment samples were found to have SMS exceedances of arsenic, cadmium, mercury, and zinc." This is not true based on Figure 5.4-.1. Exceedances occurred at relatively few stations and only in the far western portion of the site as summarized below:

1. Arsenic had no CSL exceedances in the study and exceeded the SQS only at Station IH02A, located off M&R Timber.

2. Cadmium exceeded the CSL only at Station IH01A, located between Nippon and M&R Timber, and exceeded the SQS only at Station LA01A located in the lagoon.

3. Mercury exceeded the CSL at four stations in the Inner Harbor Area and the SQS at the three stations in the Lagoon and one station in the Inner Harbor Area.

4. Zinc exceeded the CSL at only one station and the SQS at three stations; these four stations were located in the Inner Harbor Area.

The presence of such statements which are clearly not supported by the data casts doubt on the entire report.

Paragraph 2 of Section 7.2 continues "These metals were also found in detected concentrations in tissue samples." The presence of <u>detected</u> metals concentrations is not relevant as metals are typically found in tissue samples even in reference areas (albeit in low concentrations). Statistically significant relationships between sediment metals concentrations and tissue concentrations would be relevant, but there were insufficient tissue samples taken to perform such an evaluation. Furthermore, the uptake of metals from sediments may not be linear, and with some metals, including arsenic, speciation is important as some species are more toxic than others. The authors do appropriately state that the tissue sample at reference area RF05 also had one of the highest concentrations of

zinc, but then fail to interpret the tissue concentrations near the Mill Dock in light of an comparable reference station concentration.

The final sentence in Section 7.4 says two PAHs were "...also present in high concentrations...", which implies that there were other "high" concentrations. Again, high relative to what?

Section 8. Wood Debris Characteristics and Distribution in Port Angeles Harbor Sediments

Ecology collected data on the presence of wood debris using sediment profile imaging/plane view camera, evaluation of wood content in sediment grabs, and during the Sediment Trend Analysis. Each method qualitatively or semi-quantitatively determines wood debris presence, and collectively these methods provide a reasonable estimate of wood debris presence in sediment.

Section 9. Summary of Sediment Transport Processes

It is concluded from the geomorphic evaluation that the tributaries are providing an ongoing, constant sediment load of 0.22 to 1.25 cm/yr, and that these results are corroborated by the results of the STA analysis. However, the STA report states "...there is not...evidence for a significant input of materials from the Strait of Juan de Fuca, nor do the streams entering the bay seem to be providing sediment in sufficient quantities to leave a "transport signature" into the harbor." The STA concludes that the harbor is approaching dynamic equilibrium. The report summary does not fully integrate the supporting studies.

As stated in the report, the hydrodynamics and sediment transport processes in the harbor are extremely complex. The studies performed to support the Sediment Investigation provide some qualitative understanding of these processes, but do not provide a complete or quantitative characterization. See comments on Appendices D, E and I.

The impact of the Elwha River dam removal project should be considered in future sediment transport and budget evaluations.

Section 10. Summary of Screening-Level Human Health and Ecological Risk Assessment

See comments on risk assessment appendices.

Section 11. Summary, Conclusions, and Recommendations

The sections summarizing earlier results should be evaluated in light of previous comments.

The conclusion regarding bioassay failures should acknowledge possible problems with the larval test, as discussed by Newfields.

The sentence "Sediment habitat degradation by wood debris and the presence of metals and organic contaminants appear to be the critical stressors" is incorrect. No data tying habitat degradation, as expressed by ecological indicators, to wood debris has been provided. Bioassay failures were not related to potential indicators of degradation caused by wood debris. Furthermore, no statistically significant relationships between metals/organic contaminants and bioassay response has been provided.

The identification of Areas of Potential Concern (APOCs) occurs during a feasibility study and is inappropriate here. As the report itself notes, this work is not intended to be an RI/FS.

The repeated recommendation to collect and analyze many more samples to determine reasons for bioassay failures is not appropriate. As noted by Newfields, there was likely a problem with the test itself. These data should be set aside and not used for decision-making.

There is no compelling reason to collect additional samples "in a grid" until a better understanding of the potential risks posed by harbor sediments is developed based on a more rigorous evaluation of the existing data and additional data collection, as warranted, to evaluate risk. No additional sediment sampling should be contemplated until this work is done. It is remarkable that there are no recommendations regarding development of a more comprehensive risk assessment.

Appendices A, B and C

Not reviewed.

Appendix D. Current Data Collection Analysis Report

There are some discrepancies in the report between the stated deployed instruments (Table 2) and the discussion of data plots. For example, Table 2 states that an ADP and an ADVo were deployed at Station 1, both with pressure sensors, while in Section 3.0, it states "Water level has no time history line because the ADCP did not have a pressure sensor."

The study provides one month of data at three locations, which is insufficient to characterize the complex hydrodynamics in the harbor both spatially and temporally. Spatially, there was little observed correlation between "events" observed at the individual monitoring locations, making interpretation of these events difficult. Examples include, at Station 2:

> "There was one period of high currents near the beginning of the deployment (March 30 and 31). The event is limited to the upper half of the water column (B.4). It is difficult to correlate this event to anything specific. It did occur just following several days of measurable rainfall. However, neither of the other two sites showed a similar signature."

Another example at Station 1:

> "Of note is the increase in turbidity during the last week of the deployment. At the time of the bottom mount retrieval a CTD cast was made and increased turbidity was measured with depth."

Given the lack of correlation among the stations and the lack of supporting information to support interpretation of the observed data, it is difficult to characterize the hydrodynamics across the harbor.

The current measurements were collected for a period of one month. During this time no extreme events (rainfall or wind) occurred that could be expected to significantly affect hydrodynamics. These data do not characterize the range of flow conditions that occur in the harbor, and given the complexity of the hydrodynamics, it is not feasible to extrapolate potential extreme conditions.

Appendix E. Sediment Trend analysis Report

This study provides a qualitative discussion of general sediment transport patterns but does not provide a quantitative characterization of what forces move sediments, under what conditions are sediments moved, and the magnitude of sediment transport.

The author identifies parting zones within the harbor as "...relatively small areas of the sea bottom that appear to be the source areas for the sediments in the rest of the harbor." It is suggested that these areas are replenished during extreme events which are followed by everyday transport processes that redistribute the sediments. The source of these sediments during extreme events is not known, nor is a physical conceptualization provided to support the accumulation of sediments in these areas during extreme events.

The results of the STA are compared with other studies, including data collection and modeling studies and the current meter measurements that were collected as part of this investigation. The correlation of the STA results with the physical processes is relatively poor. This is likely due largely to the fact that the hydrodynamic and sediment transport patterns in the harbor are not well understood, and the STA results do not fully characterize sediment transport patterns in the harbor.

Appendix F. Cultural Resources Monitoring Report

Not reviewed.

Appendix G. Human Health and Ecological Risk Assessment

Substantial comments are provided for the human health and ecological risk assessments as this work is expected to be a cornerstone of future discussion for the harbor. As discussed earlier, potential acute and chronic toxicity to benthic receptors is largely absent or unrelated to sediment quality despite the presence of some sediment with CSL exceedances. Potential adverse risk associated with bioaccumulation of COPCs is an important issue that is addressed in the human health and ecological risk assessments.

General Comments

Both the human health and the ecological risk assessment suffer from too few samples in biological media. For most chemicals of interest, risks attributed to chemical concentrations in plants and animals are driven by maximum values. This limitation makes the risk assessment little more than an advanced screening level evaluation for most chemicals of interest.

Results of both human health and the ecological risk assessments make broad generalizations concerning risk in Port Angeles Harbor. However, neither advances our understanding of specific areas of concern that could benefit from further investigation or development of a focused management strategy.

The amphipod sediment toxicity test merits critical review. The amphipod test resulted in a single location with 100 percent mortality that exceeded SMS criteria. A highly significant correlation between amphipod mortality and sediment ammonia is also reported. However, the validity of this correlation cannot be readily determined because Table 4-5 only reports mortality for the single location that exceeded the SMS standard and does not report the concurrent sediment chemistry values for chemicals of interest (e.g., ammonia, sulfides, SMS metals). Given the nature of these data, it is possible that most of the test

results are either non-significant in comparison with reference samples or are close to reference values. The correlation then may be entirely dependent on a single outlier (i.e., 100 percent mortality). Consequently, this aspect of the amphipod test should be presented in more detail beginning with a multivariate analysis of the data to identify chemical stressors in general and a complete representation of the data used for the correlation analysis in particular.

The larval echinoderm toxicity test also merits critical review. The echinoderm larval test exceeded SQS or CSL criteria at 29 (52%) of the stations in Port Angeles Harbor, whereas the amphipod and polychaete tests each exceeded criteria at 1 (2%) of the stations. This is an extreme result because the echinoderm test does not demonstrate concordance with either the other sediment toxicity tests or the sediment chemistry results other than grain size (percent fines). Of the 29 stations where the echinoderm test failed SMS criteria, there is only agreement at one location (3.4%) for each of the other tests. Consequently, the methods and results of this test should be independently QA'd and evaluated to assure that there is no consistent bias in the test that could lead to this kind of result. For example, the echinoderm test depends on accurate calculation of larval densities in a stock culture and unbiased withdrawals from that culture to achieve nominal target densities of larvae in test chambers at test initiation. Actual densities that are less than nominal target densities would yield a low biased result giving the appearance of low survival. Additionally, the Newfields report suggests problems with the test itself and should be consulted for more detail.[1]

Habitat quality expressed as wood debris in sediments is presented as a line of evidence in the ecological risk assessment. However, arguments in support of this line of evidence are based on qualitative characterization of the data and broad generalizations that are not technically compelling. General statements concerning wood waste presence, decomposition, and impacts to benthos are only part of the story. For example, the Pearson-Rosenberg model for benthic community stress associated with organic matter in sediments should be cited to indicate that benthic community affects are proportional to the amount of wood debris, and are transient pursuant to natural processes of decomposition and remineralization. This should then lead to a discussion of how wood debris is characterized on a categorical scale and whether it can reasonably be associated with the presence and duration of benthic community effects. Other generalities concerning risk to eelgrass also seem unsupported since eelgrass is adapted to living in

[1] At the recent (May 2, 2012) Sediment Management Annual Review Meeting (SMARM) sponsored by the DMMP agencies, a protocol change was recommended for the bivalve larval test to mitigate for the loss of larvae due to the physical effects of fine-grained sediments and floccular materials (e.g., wood debris) in the test chambers which resulted in increased mortality that is unrelated to sediment chemical levels. Newfields was the champion of this protocol change which involves resuspending sediments in the test chamber prior to test termination to free larvae entrained on the bottom.

anoxic sediments. A more convincing approach would be to evaluate habitat stress and potential disturbance to eelgrass directly based on sulfide concentrations in porewater (Koch 2001).

Specific Comments

1. Introduction – No comments
2. Background
    a. Weak ecological perspective. Contains many inaccuracies. Almost entirely dependent on Shea et al.'s (1981) categorizations and does not contain any meaningful ecological insights or concepts developed either before Shea et al. published their work or in the intervening 33 years.
    b. Chemical migration pathways. Ignores ammonia and sulfate as important substances in the remineralization of organic matter.
    c. Commercial fish. Chemicals of interest seem hypothetical based on generalizations about the net pen industry.
    d. Fate and effect of PAH in Port Angeles Harbor. Here and elsewhere E&E cites their own project plans as a primary source for broad and often poorly conceived generalizations (e.g., sediment uptake by filter-feeding organisms). To the extent that PAH accrues in sediments, a more reasonable generalization would be that detritus and deposit-feeding organisms would be exposed.
3. Human Health Risk Assessment
    a. Selection of IHS
        i. Sediment ammonia as an IHS. Inaccurate and poorly justified. EPA only provides values for ammonia as a gas.
        ii. Tissue – Need to understand the dichotomization of into viscera vs. edible fractions.
        iii. Subsistence fish consumption – The subsistence consumption rates expressed in the SAB reports are highly uncertain and seem to be based on a presentation that cites an unpublished consulting report, which was not available for this review. Also, additional uncertainties concern whether the high assumed fish consumption rate is entirely attributable to fish and whether 100% fish diet is site-related and is a reasonable worst case assumption.

iv. Assumptions for consumption of bull kelp are tenuous and unnecessary since this exposure pathway was not evaluated
v. Arbitrary rules (i.e., 4 X median) used to define background thresholds needs better justification

b. Revised CSM – A priori risk management decisions to eliminate risk via consumption of seafood for residential exposure. This is limiting if there is nearby residential exposure associated with upland contamination associated with any of the shoreline industries.
c. Exposure point concentrations – Poorly presented with many questions
    i. Small sample sizes yield risk based on maximum values for seafood exposure.
    ii. Uncertainty in how statistics were calculated for compound groups (e.g., PCDD/Fs) when all other substances had insufficient sample sizes.
    iii. Not clear which tissue samples were selected for the HHRA
    iv. Details in Appendix G should be mentioned at beginning of EPC section.
d. Exposure factors – Requires more explanation.
    i. Needs better justification for assuming that Reasonable Maximum Exposure (RME) are equal to Central Tendency (CT) values for subsistence exposure, but RME are greater than CT values for recreational exposure.
    ii. Fish consumption rates – Needs more explanation. For example the high 'fish' consumption rate used for subsistence (583 g/d) appears to be the sum of seafood ingestion rates for pelagic fish, bottom fish and shellfish. Also, need to verify accuracy of statements attributed to SAB, especially since preliminary review of SAB meeting minutes indicates many uncertainties and need for additional information.
    iii. Shellfish consumption rates are much higher than fish consumption rates. This seems unusual in comparison to past studies of the U.S. population where fish consumption was far greater than shellfish consumption. This may be a result of the Lower Elwha Klallam Tribe fish consumption survey. If so, then cross cultural bias may be introduced into the assumptions used for recreational exposure based on the proportions of fish and shellfish in the diet of the LEKT.

iv. Need to verify agreement between Table 3-8 (Summary of Exposure Factor) and Attachment C (Exposure Parameters/Tables).

v. Exposure assumptions for many scenarios do not seem to deviate from the screening assumptions, especially when max values are used as the EPC concentration in tissue. This suggests that the HHRA is an advance screening level evaluation dependant on default assumptions rather than site-specific considerations and maximum values due to limited data.

e. Toxicity Assessment

i. Need to check units on data conversion for intake term used in the IEUBK model.

ii. IEUBK model modified to account for extreme consumption of fish. Check for double counting by simultaneously assuming maximum meat consumption.

iii. Need to check model for assumptions regarding multiple species in diet on a given day.

iv. Need to verify measurement of inorganic arsenic in fish and invertebrate samples. Inorganic arsenic may occur as As(III) or As(V) which differ in their toxicology and risk potential.

f. Risk Characterization

i. Limited data

ii. Incremental arsenic risk is 2 to 3 X background and limited to geoduck and horse clam. Other species are below background.

4. Ecological Risk Assessment

a. Introduction – No comments.

b. Problem Formulation

i. Site Ecology description of marine ecology is weak and relies on an out of date report (Shea et al. 1981)

c. Indicator Hazardous Substances. Table 4-1 relies on MacDonald et al. (1999, BC Ministry Report) which is a laundry list for freshwater, estuarine and marine sites. Data drawn from multiple sources which may have undocumented and uncertain assumptions, QA and validity. Does little to focus on chemicals, receptors and areas of concern.

d. Ecological Conceptual Site Model - Simplistic. Doesn't distinguish between bull kelp and eelgrass. Doesn't acknowledge water exposure for bull kelp.

Doesn't demonstrate how bull kelp can be exposed to sediment. Doesn't acknowledge that saltwater fish drink seawater.

e. Assessment Endpoints and Measures. Table 4-3 poorly executed. Lists "data needs" which seems to be vestige of the project plans. Identifies sediment habitat quality as a measure and wood waste distribution as a data need, but does not provide an explicit statement of how the presence of wood waste that is reported qualitatively can be used as meaningful indicator of effects on survival, growth or development in the selected species of concern.

f. Risks to Marine Plants and Macroalgae
    i. Needs to explain how chemicals in sediment may affect bull kelp. Bull kelp are attached by holdfasts to hard substrates, but have no vascular connection to sediment.
    ii. Risk characterization based on presence of wood waste, which is expressed qualitatively
    iii. Portrays anoxic sediments as degraded habitat for eelgrass (Zostera). However, eelgrass is adapted to live in anoxic sediments and has rhizospheres that create oxygenated space.

g. Benthic Risk Evaluation – Benchmarks. Needs to express SMS and benthic toxicity testing in context of total number of stations tested and whether toxicity was aggregated into groups of contiguous stations or was confined single locations.

h. Benthic Risk Evaluation – Sediment Bioassays.
    i. Selection of *Eohaustorius estuarius* – Performance standard should include upper salinity tolerance threshold for this mesohaline organism adapted to salinities <25 ‰.
    ii. Reporting amphipod test - test results should be expressed as survival, which is the empirical result observed and is the standard for the practice
    iii. Selection of the larval test. If low salinity was a concern for the amphipod test, then it is also a concern for the larval test, which should not be run if interstitial (i.e., porewater) salinities are <10 ‰. Need to verify that this test met this performance standard.
    iv. Reporting amphipod test. Table 4-5 is virtually unusable. All values with the exception of Station ED04A that exceeded the SMS standard

are reported as '-'. All values for amphipod survival should be reported along with sediment chemistry results that are associated with sediment toxicity. This is particular important in light of the significant correlations reported for ammonia.

v. Reporting larval test. The larval test measures developmental toxicity and is expressed as a combined endpoint for abnormality-survival. However, the ERA expresses results as larval survival. Since most sediment samples tested were reported toxic the methods and results of this test should be independently QA'd and evaluated.

vi. Relationships with conventional parameters (ammonia, sulfide, percent wood debris, resin acids)
    1. Multivariate analysis should be used to explore all parameters (i.e., both sediment chemistry and conventional parameters)
    2. Percent wood debris was not reported in the sediment investigation report
    3. If wood debris is the source of ammonia there should be a positive correlation between percent wood debris and ammonia. In the absence of such a correlation, the report should consider other sources of organic matter at the sediment-water interface.

vii. Sediment habitat quality
    1. Citation of E&E (2008). This is a summary report. To the extent possible such statements should cite the original literature.
    2. General statements concerning wood waste presence, decomposition, and impacts to benthos are only part of the story. Pearson-Rosenberg model should be cited to indicate that benthic community affects are proportional to the amount of wood debris, and are transient pursuant to natural processes of decomposition and remineralization.
    3. Presence of wood debris in 20 to 25% of the harbor area cannot be reasonably equated with effects. Since wood debris decomposes, any effects imputed from observations >10 years ago are highly uncertain.

4. Wood debris in Rayonier log pond –this area accumulates large amounts of algal matter (e.g., Ulva lactuca, bull kelp fronds). Consequently, any effects attributed to wood debris need to be separated from those associated with decomposition of other plant material.
5. "… it seems reasonable to hypothesize that the ability of Port Angeles Harbor to support a healthy benthic invertebrate community has been compromised in some areas." This is a risk hypothesis, which belongs in the problem formulation and risk assessment work plan, but should not be the risk result unless yet another study is proposed.
6. Benthic risk summary – Overinflated statement of risk based on three lines of evidence that are not tied together in a weight of evidence for affected areas. Some questions are:
    a. Do sediment chemistry exceedances, bioassay hits and the presence of wood waste occur at the same locations?
    b. Where are the areas with elevated chemistry and toxicity?
    c. Where are the areas with elevated chemistry but no toxicity?
    d. Are there contiguous affected stations by any one of the lines of evidence that are indicative of discrete areas of concern?

i. Fish Risk Evaluation
    i. Tissue RBCs are controversial and may not be an accurate predictor of risk and should be used in combination with other lines of evidence.
    ii. Arsenic tissue RBC needs to be verified. Although Dyer et al. (2000) is cited, it is derived from a presentation that was summarized in a conference proceedings.
    iii. There are too few samples to yield meaningful judgments of risk
    iv. We need a better understanding of the toxicity reference value used to judge arsenic risk. There are many forms of arsenic. Arsenic in

fish is largely metabolized to organic arsenic, which has a lower toxicity than inorganic arsenic.

j. Wildlife Risk Evaluation
    i. Exposure to water (Racoon, brant, scaup) is inconsistent with the CSM
    ii. Exposure point concentrations
        1. Limited data (N=1 or 2) for herbivore foraging on eelgrass or bull kelp
        2. Horse clams - How can you get an N=27 in the risk assessment from a sample of 17 clams?
        3. High bias average EPC for shellfish. EPCs for coonstripe shrimp, Dungeness crab, geoduck and horse clam were averaged to yield an average EPC. The 'average' EPC is effectively an average of maximum values for all but the horse clam.
        4. High bias average EPC for fish. Averages maximum values for two species.
    iii. Ecological Effects Assessment – No comment
    iv. Wildlife Risk Characterization. Raccoon risk to arsenic – Needs to acknowledge that the EPC is biased towards maximum values. Also needs a caveat regarding arsenic species present in shellfish. Needs to evaluate the basis for the arsenic TRV for consistency with the exposure assumptions.

k. Uncertainty Discussion Bullet 7 – Risk results biased toward Rayonier site because that is where most of the samples were collected. Not necessarily true. Because of limited data, risks were often based on maximum values in fish and shellfish. Consequently, the bias depends on the sample locations for the individual samples, which may not be the Rayonier site.

Appendix H. Chemistry Data Validation Memoranda

Not reviewed.

Appendix I. Geomorphic Report

It is stated that a primary objective of this study is to characterized long-term changes in sediment input over time. This evaluation is performed by an evaluation of the time series of peak rainfall. Although there was no reported trend in the recorded peak rainfall, the authors then conclude that land uses have changed, resulting in increased sediment loads. There is no supporting information for this conclusion.

Nearshore sediment transport (to a water depth of 55 feet) direction was determined based on a set of visual observations. It is not clear how these observations (from the shoreline) could provide a complete characterization of sediment transport.

The authors estimate sediment loading from the tributaries using an empirical equation. The author assumes that the sediment loading rate has been and remains constant. There is no discussion of the origins of the sediment in the tributary watersheds or support of the assumption of constant loading for the past 77 to 116 years.

The authors estimate the sediment volume in the delta at the mouth of Tumwater Creek based on limited positional information and assumptions about the geometry. It is not clear how the width of the delta features (the topset and the foreset) were measured, and there is no discussion of how the uncertainty impacts the overall evaluation

The sedimentation rates were calculated from two sediment cores, characterized as not necessarily being representative of the harbor, and then applied to calculate an average sedimentation rate in the harbor. An assumption of 150 years for lead decay, which is not referenced, is the basis for the calculation of sedimentation rates. The lack of sufficient data and the suggested lack of representativeness of the Pb-210 data suggest that the calculated sedimentation rates should be applied with caution to the understanding of sediment dynamics in the harbor.

A sediment budget is estimated assuming that the radiochemistry cores can be applied harborwide (following a discussion of why these cores do not necessarily provide estimates of sedimentation rates that can be provided harborwide), and only tributary sediment loadings and sedimentation rate are included in the sediment budget. The STA report suggests there may be a source of sediments entering the harbor around Ediz Hook, yet the relative magnitude of this source is not considered in the sediment budget.

Appendix J. Fingerprinting Memo and Analysis

While the document uses standard recognized techniques in analyzing the forensics of PAH compounds and dioxin/furan compounds, it does not provide much useful

information about sources of compounds. For example, it does not point to differences in forensic signatures among different source areas, among different classes, or compare upland source signatures to sediment data. Therefore, the usefulness of this study is limited. In addition, the work does not use ratios that involve non- detected data which limits the data's usefulness. In forensic analysis, it is often very useful to characterize where chemicals are not found in addition to where chemicals are found. Therefore, eliminating data points based on non-detect data can create biases in the study.

Review of Port Angeles Harbor Fingerprinting Assessment

The technical memorandum outlining the feasibility of fingerprinting materials in the Port Angeles harbor is an adequate analysis of the data available for fingerprinting. Ecology's conclusion that total petroleum hydrocarbon (TPH) data is of little use in the fingerprinting exercise is appropriate as is their conclusion that there is adequate data for fingerprinting both PAH compounds and dioxin/furan compounds. This brief data review, however, suffers from the lack of analysis of the distribution of specific compounds in the harbor. Tying the fingerprinting work into a concentration distribution analysis, analysis of sedimentation rates, and description of past dredging in the harbor is essential. For example, there is some work that shows that the concentrations and chemical signatures of PAH compounds in sediments have changed over the years where there is input of urban runoff (e.g. Van Metre et al. 2000). Also it may not be a useful exercise to conduct fingerprinting were concentrations are below action levels for chemicals of concern.

Review of Fingerprinting Analysis

The actual fingerprinting work conducted by E&E greatly suffers from the lack of context in the analysis of the data. At no point in this document is there any discussion of particular locations where specific fingerprints are observed, comparison of fingerprints in sediments to sources surrounding the harbor, or any discussion of changes in fingerprints over time as may be illustrated in the stratigraphic record of sediments.

The analysis of PAH data particularly lacks context. For example, the phenanthrene to anthracene ratio and the fluoranthene to pyrene ratio are used to describe petrogenic and pyrogenic sources contributing to sediments. No specific sources of PAH to sediments are described in the harbor or in any upland areas contributing to the harbor despite the fact that several obvious sources are identified on the harbor map. For example, marinas and oil terminals could contribute petrogenic PAHs to sediment while storm water outfalls could contribute pyrogenic PAHs to sediment.

The PAH analysis is also limited by the choice of diagnostic ratios used. Many of the ratios, including the naphthalene to phenanthrene and the naphthalene to benzo(a)pyrene ratios, are ratios of PAH compounds that have vastly different chemical and physical properties. These different chemical and physical properties will result in differing environmental fates, which may result in a loss of signature that these ratios may have initially shown. PAH fingerprinting studies do not typically use these ratios as diagnostic ratios. The ratio analysis is also limited and biased by the selection of samples and the use of non-detect data. For example the phenanthrene to anthracene ratio is said to be diagnostic of petrogenic PAH contribution when the ratio is greater than 10. Of 167 sediment samples, 60 were non-detect for phenanthrene while 93 were non-detect for anthracene. By eliminating all ratios where phenanthrene was detected and anthracene was not detected, the analysis eliminated samples showing a petrogenic signature because they contained high levels of phenanthrene and low levels of anthracene below detection.

Similar to the PAH analysis, the dioxin/furan analysis suffers from lack of context. There is some indication in tables that the harbor wide stations and the Rayonier Mill stations are compared, but there is little discussion of this comparison in the text. In addition the dioxin/furan analysis is presented relative to other samples from Puget Sound but the significance of this comparison is not discussed. Like PAHs, the dioxin/furan analysis does not compare sediment concentrations to any upland sources, conduct any analysis of the spatial distribution of signatures, or evaluate any temporal distribution of signatures. No indication is given whether concentrations are increasing or decreasing over time or whether sources are appearing or disappearing over time. This sort of spatial and temporal analysis connecting receptor sediments to source materials is the essence of fingerprinting analysis. Ecology has done none of this work.

Finally, the graphics illustrating the PAH and dioxin/furan fingerprinting are woefully inadequate. Specific data points are not identified, many of the graphs are not legible, and specific samples cannot be tracked throughout the analysis. The scales of many graphs are not appropriate and many samples are bunched together and illegible. Figures showing the spatial distribution of chemical signatures would be useful in addition to figures showing the relationship of chemical signatures with concentrations of chemicals.

Overall, the fingerprinting analysis of sediments from Port Angeles Harbor provides little information about the sources of materials, the timing of past releases, the extent of past releases, or the evolution of chemical signatures over time. As these sorts of facts are generally the essence of fingerprinting analyses, this work provides very little insight into the harbor, and is woefully inadequate for supporting potential future cleanup efforts.

Appendix K. Bioassay Data Validation Report

Not reviewed.

COMMENTS ON THE SUPPLEMENTAL DATA EVALUATION REPORT

The *Supplemental Data Evaluation* report by NewFields is largely an interpretation of the E&E data as well as some other data collected in the harbor. The two reports conflict in some areas. Also, NewFields makes broad sweeping conclusions that in some cases are unsupported by the data.

The Introduction states the Washington Department of Ecology (Ecology) used special funding from the Puget Sound Initiative "to investigate sediment pollution and develop a strategy for cleaning up the harbor." This objective differs from the objectives in the draft Sediment Investigation Report (E&E 2012) by including development of a strategy for cleaning up the harbor. As noted on page 3 of E&E's report, the "study is not intended to be an RI/FS." Yet in the Newfields report, Ecology has called for remediation of wood debris, upland source control, and the cleanup of hotspots at the former Rayonier Mill and in the Western Harbor. These are FS elements and demonstrate that Ecology has gotten significantly ahead of an RI/FS process. Section 9 should be eliminated from the report.

Many of the comments made for the *Sediment Investigation Report* also apply to the *Supplemental Data Evaluation* report. For example, in Section 4 the authors eliminate dioxin data when fewer than 10 detected congeners are present in a sample. This may have the effect of deleting unique samples that may be highly informative. All samples should be included in the analysis. Section 4 doesn't link upland sources with patterns observed in sediments and is therefore not informative.

Section 5 attempts to better define sediment transport patterns but remains a poor understanding of factors driving transport.

Section 6 presents theories regarding fate and transport. Given the level of uncertainty regarding sediment transport, the ideas should be viewed with caution. The maps showing interpolated chemical data are currently the most valuable tool for evaluating fate and transport. More sophisticated fingerprinting may advance the understanding of fate and transport.

Section 6 contains an important discussion of performance of the larval bioassay. NewFields stops short of recommending the data be set aside, however, they point out that physical effects may have caused the low larval counts and note a new method has been

developed to compensate for this effect. They do not state if this method has been approved by EPA or ASTM. Given the uncertainty with this method, the larval results should be set aside.

Regarding wood debris in sediments, NewFields states "its extensive presence on the seafloor likely impairs the quality of benthic habitat." However, they present no data to support this conclusion. Furthermore, they dismiss sediment toxicity results in areas with wood debris. This sentence should be removed.

REFERENCES

Koch, E.W. 2001. Beyond Light: Physical, Geological, and Geochemical Parameters as Possible Submersed Aquatic Vegetation Habitat Requirements. Estuaries 24:1-17.

U.S. Environmental Protection Agency. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA/240/B-06/001.

Van Metre, P., B. J. Mahler, and E. T. Furlong. 2000. Urban Sprawl Leaves Its PAH Signature. Environmental Science and Technology 34: 4064-4070.

From:	Dorn, Carol (ECY)
To:	Rebecca Davidson
Cc:	Zimmer-Fallon, Melani (ECY); ECY RE TCP Webmail; ECY RE WEBMASTER; Huether, Barb (ECY); Groven, Connie (ECY); Aoyagi, Hannah (ECY)
Subject:	RE: Port Angeles Clean up?
Date:	Wednesday, March 14, 2012 6:59:40 AM

Hello Rebecca,

I am forwarding your comments and concerns on to the Ecology project manager Connie Groven, and the Public Involvement coordinator for the Port Angeles Harbor Sediments Investigation, Hannah Aoyagi for follow-up.

Here is a link to our website which may provide some additional information for you.
http://www.ecy.wa.gov/programs/tcp/sites_brochure/portAngelesHarborSed/paSed_hp.htm

Thank you,
Carol Dorn
Ecology

From: Rebecca Davidson [mailto:email_from_becky@yahoo.com]
Sent: Tuesday, March 13, 2012 9:36 PM
To: Dorn, Carol (ECY); Huether, Barb (ECY); ECY RE TCP Webmail; ECY RE WEBMASTER
Subject: Port Angeles Clean up?

Greetings,
I have just attended a meeting about the Port Angeles Harbor clean up.
Having recently moved to Sequim in order to live in a cleaner environment, I am absolutely appalled that Port Angeles city counsel has given permits to Nippon and PT Paper for BioMass Burn units to be built upwind from my new home.

I cannot understand why Port Angeles city counsel would be allowed to issue such permits that affect so many other people who were not made aware of any public hearings on the matter beforehand, nor do I comprehend why they would issue such permits since the Biomass Burn units will be producing more of the exact same pollutants (Dioxins,etc.) that are currently trying to be removed from Port Angeles Harbor.

This should be illegal. It is certainly an immoral act with complete disregard for the health of all the other residents of Clallam county and should not be allowed to stand.
Legal action should be taken against Port Angeles city counsel for issuing permits that will allow these industrial units to be built and certainly state tax dollars should not be involved in building nor running these industrial units. Tax breaks and "discount" electricity should be reserved for ecologically sound industrial pursuits only.

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

Caring for
your natural resources
... now and forever

May 23, 2012

Connie Groven, Toxics Cleanup Program
Washington State Department of Ecology
P.O. Box 47775
Olympia, WA 98504-7775

Re: Port Angeles Harbor Sediment Investigation Report

Dear Ms. Groven:

The Washington State Department of Natural Resources (DNR) would like to thank you for the opportunity to comment on the Sediment Investigation Report for Port Angeles Harbor. DNR's comments are based on principles of stewardship and proprietary management derived from our legislative defined goals to protect State-Owned Aquatic Lands (SOAL) and preserve them for the public's benefit. We appreciate Ecology's consideration of these and any future comments related to sediment investigation and characterization in Port Angeles Harbor.

Sections 2.2.5, 5.1.9, 5.2.9, 5.3.9, Tables C-12, C-B11, C-C11: Though no regulatory standards exist for resin acids and guaiacols, referencing any available existing quantitative toxicity data for the compounds would be valuable in evaluating the contribution of these compounds to sediment toxicity and in understanding what impact these compounds may have on the suitability of sediments for habitat.

Section 3.1.1.1: A brief summary of the fingerprinting analysis would be useful in the body of the main investigation report document. A summary sentence of the results would allow better public understanding of the analysis.
Section 9.0: Sediment transport models described do not appear to take human activity (vessel traffic) into account. As the harbor is used by a variety of vessels, in areas where the depths are shallow enough for vessel traffic to affect sediments through prop wash, scour, and other processes. It is important to consider the anthropogenic causes of sediment transport, especially in a harbor that is heavily utilized by humans.

Section 11.0: Please clarify if guaiacols and resin acids are to be retained as contaminants of potential concern, or if presence of wood debris and high total organic carbon will be used as a surrogate for these compounds based upon the correlation of these results in the current sediment investigation.

Sincerely,

Erika A Shaffer, MS
Aquatics Division, Sediment Specialist

Georgia-Pacific LLC

133 Peachtree Street NE (30303-1847)
P.O. Box 105605
Atlanta, Georgia 30348-5605
(404) 652-6874 office

(404) 654-4701 fax

Ms. Connie Groven
Site Manager / Environmental Engineer
Toxics Cleanup Program, Southwest Regional Office
Washington State Department of Ecology
PO Box 47775
300 Desmond Drive
Olympia, WA 98503

Re: Port Angeles, WA – Harbor Sediment Investigation
Comments on February 2012 Public Review Draft Reports:
Sediment Investigation Report & *Supplemental Data Evaluation*

Dear Ms. Groven

Following their recent release for public comment, Georgia-Pacific LLC ("G-P") reviewed the Washington Department of Ecology's ("Ecology") February 2012 Public Review Draft Reports: *Sediment Investigation Report and Supplemental Data Evaluation, Port Angeles Harbor, Washington*. The *Sediment Investigation Report* prepared by Ecology & Environment, Inc., presents sampling and analysis data collected in 2008 throughout Port Angeles Harbor, while the *Supplemental Data Evaluation* prepared by NewFields presents preliminary interpretations of these data and recommended next steps. G-P appreciates the opportunity to review the reports and respectfully submits the comments detailed below.

Overall, the data and preliminary interpretations contained in the reports provide a good foundation to identify and appropriately focus future sediment cleanup activities in discrete areas of Port Angeles Harbor, consistent with the current requirements of the Washington State Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS), and also with the likely SMS rule revisions. However, we have identified a number of technical deficiencies in the public review draft reports, which should either be revised or appropriately qualified in the final reports to ensure that the data are appropriately used going forward. The identified technical deficiencies include:

1. The geomorphic report appended to the *Sediment Investigation Report* presents only a cursory evaluation of sediment transport in Port Angeles Harbor, and reaches conclusions that are not supported by more detailed evaluation of the data;

2. Both the *Sediment Investigation Report* and *Supplemental Data Evaluation* need expanded discussions of the bioavailability of potentially bioaccumulative chemicals such as polychlorinated biphenyls (PCBs) and dioxins/furans, consistent with both the SMS and the current scientific literature;

3. The fish consumption rate and other key assumptions used in the human health risk assessment appended to the *Sediment Investigation Report* are overly conservative and do not reflect current or reasonable exposure conditions in Port Angeles Harbor;

4. The background threshold values (BTVs) presented in the *Supplemental Data Evaluation* reflect natural background conditions that are of little practical relevance to sediment cleanup decisions in Port Angeles Harbor;

5. In contrast to preliminary conclusions presented in the reports, our review of Ecology' dioxin/furan fingerprinting data suggests the importance of ongoing diffuse, non-point source dioxin/furan sources to Port Angeles Harbor surface sediments;

6. Both the *Sediment Investigation Report* and *Supplemental Data Evaluation* need expanded discussions of the importance of regional stormwater non-point source inputs, building on other relevant investigations in the Puget Sound region; and

7. Presumptive remedy recommendations are inappropriate at this stage of the cleanup process and such discussion should be removed from the *Supplemental Data Evaluation*.

These technical deficiencies are further outlined in the sections below.

1. Geomorphic Report

The Geomorphic Report (Appendix I of the *Sediment Investigation Report*) presents only a cursory evaluation of sediment transport conditions in Port Angeles Harbor, and reaches conclusions that are not supported by more detailed evaluation of the data. For example, the Geomorphic Report currently states that sediments at water depths of up to 55 feet below mean lower low water (MLLW) are susceptible to erosion. However, this is an oversimplification of the actual sediment transport potential in the harbor and is not consistent with more careful analyses of these data. That is, while peak wind wave events in Port Angeles Harbor (3.4 foot wave height) could initiate movement (e.g., grain shifting) in cohesive sediments in up to 55 feet of water, scour depths during these infrequent storm events are very limited, and do not contribute to larger-scale sediment transport. Using standard sediment scour analyses as used in other regional sediment evaluations, we calculate peak scour depths of less than 1 centimeter (cm) in water depths shallower than 10-15 feet MLLW, and peak scour depths of less than 0.1 cm in water depths shallower than 20-30 feet MLLW. The report should be clarified to more accurately represent scour depths and associated sediment transport potential in the conceptual site model. Please let us know if our preliminary scour depth calculations would assist Ecology's review.

2. Bioavailability

Both the *Sediment Investigation Report* and *Supplemental Data Evaluation* need expanded discussions of the sediment bioavailability of potentially bioaccumulative chemicals such as PCBs and dioxins/furans, consistent with both the SMS and the current scientific literature. Specifically, the conceptual site model discussion should provide a better discussion of the current science of bioavailability assessment (e.g., organic/black carbon normalization of sediment PCBs and dioxins/furans), building on recent literature such as the Interstate Technology and Regulatory Council (ITRC) publication: "*Incorporating Bioavailability Considerations in the Evaluation and Remediation of Contaminated Sediment Sites*" http://www.itrcweb.org/contseds-bioavailability/ and EPA's updated (June 2011) "*Procedures for the Derivation of Site-Specific Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Nonionic Organics*". These documents describe the fundamental concepts of bioavailability and the mechanisms controlling the bioavailability of sediment contaminants, which are important to setting appropriate risk management and remedial objectives in Port Angeles Harbor.

3. Fish Consumption Rates

The fish consumption rate and other key assumptions used in the Human Health Risk Assessment (Appendix G of the *Sediment Investigation Report*) are overly conservative and do not reflect current or reasonable future exposure conditions in Port Angeles Harbor. Specifically, the fish consumption rate used in the risk assessment represents a significant expansion beyond existing default assumptions under MTCA or the State Water Quality Standards and is inappropriate to apply to SMS cleanup sites. Additional consideration must be given to the following two factors: salmon as an aspect of overall fish consumption rates; and, reasonable assumptions regarding diet fraction and modifying assumptions. Salmon make up the overwhelming (typically greater than 80 percent) portion of the total amount of seafood consumed in Washington State, and recent studies by the Washington Department of Fish and Wildlife and others have shown that salmon can accumulate bioaccumulative chemicals such as PCBs and dioxins/furans during the period of their life cycle when they migrate and live in Pacific Ocean coastal or open waters, outside waters of our state (e.g., see *O'Neill, S.M., and J.E. West. 2009. Marine distribution, life history traits and the accumulation of polychlorinated biphenyls (PCBs) in Chinook salmon (Oncorhynchus tshawytscha) from Puget Sound, Washington. Transactions of the American Fisheries Society 138:616-632*.) A more targeted approach, focused on consumption of shellfish and non-migratory finfish species would be more appropriate.

4. Background Threshold Values (BTVs)

The BTVs presented in the *Supplemental Data Evaluation* reflect natural background conditions that are of little practical relevance to sediment cleanup decisions in Port Angeles Harbor, and are influenced by ongoing inputs from diffuse, non-point sources within the developed watershed. For example, ubiquitous contamination from stormwater inputs, particularly municipal storm drains, currently influence dioxin/furan concentrations in Port Angeles Harbor, and need to be appropriately considered when evaluating more relevant regional background concentrations and local recontamination potential. The forthcoming SMS rule revisions will further describe how regional background and regional recontamination potential are more appropriately used in setting appropriate risk management and remedial objectives in Port Angeles Harbor. The importance of ongoing non-point source stormwater inputs (e.g., dioxin/furan loading from surface soil erosion in the watershed which continues to wash out into the harbor) needs to be discussed more fully in the report, as described below.

5. Dioxin/Furan Fingerprinting

In contrast to preliminary conclusions presented in Appendix J of the *Sediment Investigation Report* and in the *Supplemental Data Evaluation*, our review of Ecology' dioxin/furan fingerprinting data suggests the importance of ongoing diffuse, non-point source dioxin/furan sources to Port Angeles Harbor surface sediments (e.g., not historical hog fuel boiler emissions), consistent with G-P's August 28, 2011 comments on Ecology's *Public Review Draft of the Rayonier Mill Off-Property Soil Dioxin Study*. We understand that Ecology is currently revising the fingerprinting analysis using an un-mixing model analysis, and we would like to further discuss with Ecology in additional detail the appropriate design and limitations of this analysis.

6. Regional Stormwater Inputs

Both the *Sediment Investigation Report* and *Supplemental Data Evaluation* need expanded discussions of the importance of regional stormwater non-point source inputs, building on other relevant investigations in the Puget Sound region. As discussed in the reports, most of the current sediment deposition in the bay (0.14-0.21 cm/year; with higher rates in parts of the West Harbor) is

attributable to sediment input from the surrounding watershed. Regional stormwater inputs from the watershed are also important diffuse sources of contaminants, including dioxins/furans.

Average surface soil dioxin/furan levels in forested (non-urban) areas of Port Angeles range between approximately 10-20 parts-per-trillion (ppt) toxicity equivalent (TEQ) and are attributable at least in part to diffuse non-point source inputs in the watershed (refer to G-P's August 28, 2011 letter to Ecology). Similarly, average surface soil dioxin/furan levels in urban areas removed from potential influences of hog fuel boiler emissions average approximately 19 ppt TEQ (refer to Ecology's September 2011 "*Urban Seattle Area Soil Dioxin and PAH Concentrations: Initial Summary Report*"). These diffuse urban sources of dioxins/furans, as well as other chemicals, contribute the current loading to Port Angeles Harbor. Ongoing non-point source dioxin/furan inputs continue to maintain surface sediment TEQ levels well above any of the natural background-based BTVs discussed in the reports (0.95 to 2.2 ppt TEQ). Additional information on regional stormwater loadings of a range of chemicals (though not including dioxins/furans) is available in Ecology's recent document "*Control of Toxic Chemicals in Puget Sound: Phase 3 Data and Load Estimates*" (Publication No. 11-03-010). Again, expanded discussion of the importance of regional stormwater non-point source inputs is needed in both reports.

7. Presumptive Remedies

Presumptive remedy recommendations (e.g., "removal of wood debris") are inappropriate at this stage of the cleanup process and such discussion should be removed from the *Supplemental Data Evaluation*. The recommendation in the report that: "*Remediation of Port Angeles Harbor sediments will likely require removal of significant deposits of wood debris, controlling ongoing upland releases of contaminants to the harbor, and cleanup of contaminated sediment hotspots*" needs to be appropriately caveated. Wood waste does not necessarily need to be removed (i.e., dredged) to provide effective sediment remediation and habitat restoration – capping has been shown to be highly effective in Puget Sound at numerous locations (e.g., G-P Log Pond and Simpson Tacoma caps). Additionally, the presumptive remedy recommendations are premature and inconsistent with the MTCA rules because the *Supplemental Data Evaluation* was not designed to be and does not fulfill the requirements of a remedial investigation/feasibility study ("RI/FS") under WAC 173-340-350. Under the MTCA rules, remedial alternatives and preferred remedies must be evaluated in an FS based on the findings of a completed RI. The *Sediment Investigation Report*, by Ecology's own admission, is not an RI performed pursuant to the MTCA rules and therefore the *Supplemental Data Evaluation* cannot function as a MTCA FS and evaluate or recommend specific remedies.

If you have any questions regarding the comments provided above, please feel free to contact me at (404) 652-6874 or via e-mail at Mike.Hassett@gapac.com, or contact Clay Patmont at (206) 300-1543 or via e-mail at cpatmont@anchorqea.com. We would also welcome the opportunity to meet with Ecology to discuss the scope of Ecology's forthcoming Technical Memorandum on preliminary sediment cleanup goals for Port Angeles Harbor, as well as the updated fingerprinting/un-mixing analyses.

Sincerely,

Michael Hassett, P.E.

cc: Rebecca Lawson, Toxics Cleanup Program
Marian Abbett, Toxics Cleanup Program
J. Michael Davis, Esq., Georgia-Pacific LLC
David Massengill, Georgia-Pacific LLC
Steven Thiele, Stoel Rives LLP
Clay Patmont, Anchor QEA, LLC

From:	Rory Henneck
To:	Groven, Connie (ECY)
Subject:	Port Angeles Harbor sediments investigation data evaluation report
Date:	Sunday, March 11, 2012 12:48:38 PM

Ms. Groven,

I agree strongly with conclusion in the first paragraph of section 8.1 that there are data gaps not addressed in the existing data sets. There are very few points directly north of CSO 10. In Figure 11, I find the boundary very exact between the western edge of the sulfides, ammonia, arsenic, mercury, dioxin, etc. plumes around the Rayonier mill plume and the plume extending from the western end of the harbor, especially because there is a roughly 0.5-mile gap between some of the points in that area.

Without vertical delineation of points along the western part of the Rayonier dock area and more sampling in the MD03 and ED04, ED01 areas at 1-2 feet and 3-6 feet, I don't think any remedial action plan generated from this data would be inadequate.

Thank you for your consideration and time.

Rory Henneck

From:	Larry Dunn
To:	Groven, Connie (ECY)
Cc:	Matt Beirne
Subject:	RE: Port Angeles Harbor Sediment Investigation Reports
Date:	Wednesday, May 30, 2012 8:41:56 AM

Connie please consider these as the tribes comments on the SIR. Thanks, Larry

From: Groven, Connie (ECY) [mailto:cgro461@ECY.WA.GOV]
Sent: Tuesday, May 29, 2012 4:41 PM
To: Matt Beirne; Larry Dunn
Cc: Bill Beckley
Subject: Port Angeles Harbor Sediment Investigation Reports

Larry,

As I am reviewing comment received today, I realized I have not received any additional comments from the Tribe other than the preliminary ones attached. The message below said these were not the Tribe's final comments. Would you please let me know if you have additional comments or would like these to stand as your final comments now?

Thank you,
Connie

Connie Groven
Site Manager/Environmental Engineer
Department of Ecology
Southwest Regional Office/Toxic Cleanup Department
(360) 407-6254
cgro461@ecy.wa.gov

From: Bill Beckley [mailto:bill@ridolfi.com]
Sent: Tuesday, March 20, 2012 11:11 AM
To: Groven, Connie (ECY)
Cc: Larry Dunn; Matt Beirne
Subject: RE: PA Harbor SSL Figure

Connie

Larry asked that I forward the attached comments on to you for your review. These do not represent the Tribe's final comments on the documents currently undergoing public review, but highlight a few issues the Tribe believes warrant further discussion prior to or in association with the development of preliminary cleanup goals or other cleanup decisions.

Thanks,
Bill

William H. Beckley
Senior Environmental Scientist

Port Angeles Harbor Sediment Investigation
Preliminary Discussion Issues

Based on a review of the Port Angeles Harbor Sediment Investigation Report and related documents, including draft documents related to the development of preliminary cleanup levels, the Lower Elwha Klallam Tribe has identified a few preliminary issues that warrant further discussion as we look toward the future development of cleanup options. The Tribe does not intend these to be formal comments on the documents currently out for public review, and intends to provide more complete comments on those documents in the near future.

Carcinogenic PAHs

We have known since reviewing the initial Marine RI data that cPAHs in shellfish are likely one of the cancer risk drivers associated with the Rayonier Mill site, although probably to a lesser extent than PCBs and dioxins. In the human health risk assessment completed for the Port Angeles Harbor Sediment Investigation, **cancer risks to subsistence fishers from cPAHs are in the range of $3x10^{-4}$**. However, based on our review of the draft final Preliminary Cleanup Goals technical memo (Newfields, June 2011), it appears that **cPAHs are not included as an indicator hazardous substance for the purpose of developing preliminary cleanup goals, despite the fact that cancer risks to subsistence fishers are more than two orders of magnitude above the acceptable risk threshold**. One reason for this, according to the memo, is the fact that cPAHs represent only a small portion of the overall cancer risk, primarily because the calculated risks from arsenic tend to overwhelm other risks. However, as noted in the human health risk assessment, "potentially all risk due to exposure to arsenic in sediment is related to reference concentrations", and arsenic is unlikely to be the focus of remedial actions.

We had earlier commented relative to this issue, in December 2010 (12/9/2010 email to Connie Groven), although we have not had much discussion since then. An excerpt of our email is below:

> *One question regarding the RBC memo: Even though cPAHs in tissue are not identified as a risk driver, since they contribute a small percentage of the risk compared to arsenic, PCBs and dioxins, risks from cPAHs to subsistence fishers are still in the 10-4 range. If human health risks from cPAHs are not addressed when developing sediment cleanup levels, there could be unacceptably high risks from remaining contaminants at the site. It's not completely clear…whether areas of high sediment cPAH concentrations would be adequately addressed by cleanup of other COCs. How will this be addressed?*

An evaluation of risk-based concentrations (considering a tribal fish consumption rate), Puget Sound "background" concentrations, and laboratory practical quantitation limits for cPAHs has been conducted by Ecology for Port Gamble Bay. The preliminary cleanup goal for cPAHs, based on Puget Sound main basin background, is 16 ppb (even though the 90^{th} percentile of background is less than 10 ppb). Assuming that Ecology might approach development of sediment cleanup goals for Port Angeles

Harbor in a similar manner, **most areas of Port Angeles Harbor would exceed cleanup levels** (see the Newfields figure below).

The areas exceeding cleanup levels for cPAH TEQ may greatly exceed the areas requiring cleanup for other cancer risk drivers, including dioxins and PCBs; and may involve a number of other PLPs. In the December 8, 2010 technical memo *Evaluation of Port Angeles Sediment Investigation Background Data Sets,* Newfields compared sample results from the Sediment Investigation to various background threshold values (BTVs). Except for dioxins in comparison to the Port Angeles Proximal BTV, the PAHs most frequently exceeded all of the background threshold values. Most of the carcinogenic PAHs exceeded BTVs in 60 to 70 percent of samples.

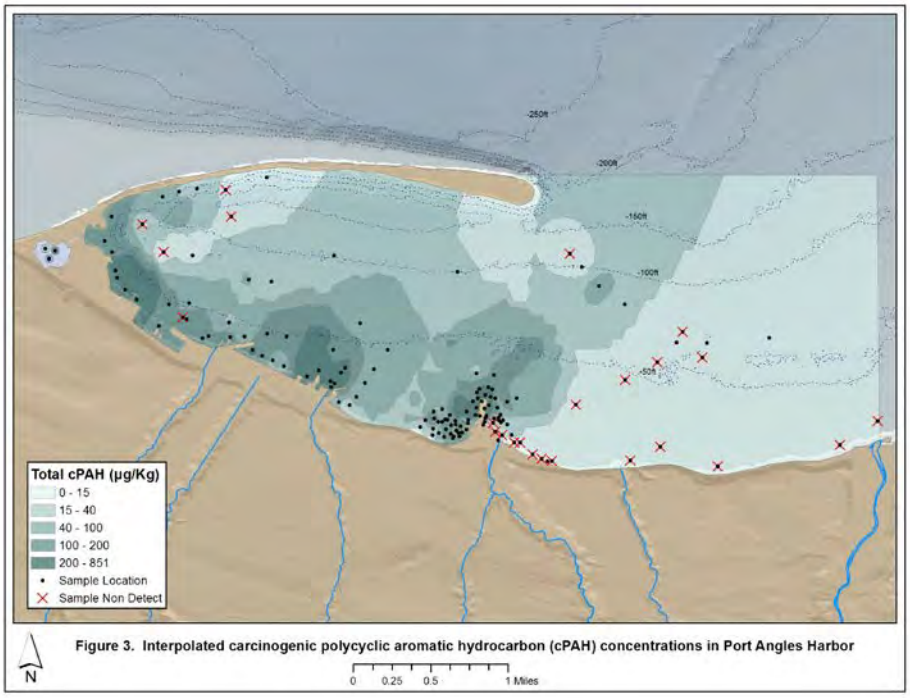


Figure 3. Interpolated carcinogenic polycyclic aromatic hydrocarbon (cPAH) concentrations in Port Angles Harbor

PCBs

Data Correlation

We have had several discussions over the last few years regarding PCB data, both for sediments and for biota. Different studies have looked at different areas and different species using different approaches to PCB analysis, including PCB Aroclor analysis, full PCB congener analysis, and analysis of only the dioxin-like PCB congeners. It has even been challenging to correlate similar PCB analyses from similar areas between the different studies. One area we commented on when first reviewing the SIR data was the inconsistency between the PCB Aroclor analysis in the original Marine RI (2002) and the Aroclor analysis in the SIR (2008). Aroclors appeared much more widespread and at higher concentrations in the Marine RI data set than in the SIR data set.

In June 2009, we made the following comments in an email to Marian Abbett and Cynthia Erickson (6/4/2009):

> *I was also surprised that PCB Aroclors were only rarely detected in sediments in the SIR sampling - Aroclors were detected in only about 10% of the harbor-wide samples (including the Rayonier Mill samples). In Rayonier's Marine RI sampling, Aroclors were detected in over 90% of the samples, and in the Phase 2 RI sampling, PCB congeners were detected in all samples. (The SIR sample located closest to the Rayonier Phase 2 sample with the highest PCB concentration had no detected Aroclors).*
>
> *Aroclor 1260 was frequently detected in the Marine RI at levels well above the reported detection limits in the SIR, so it's a little baffling as to what may be going on.*
>
> *I was wondering if you had thought about this issue and had ideas on how we can address it. PCBs are one of our primary risk drivers, and I'm struggling with aligning the data that we've got with our upcoming objectives.*

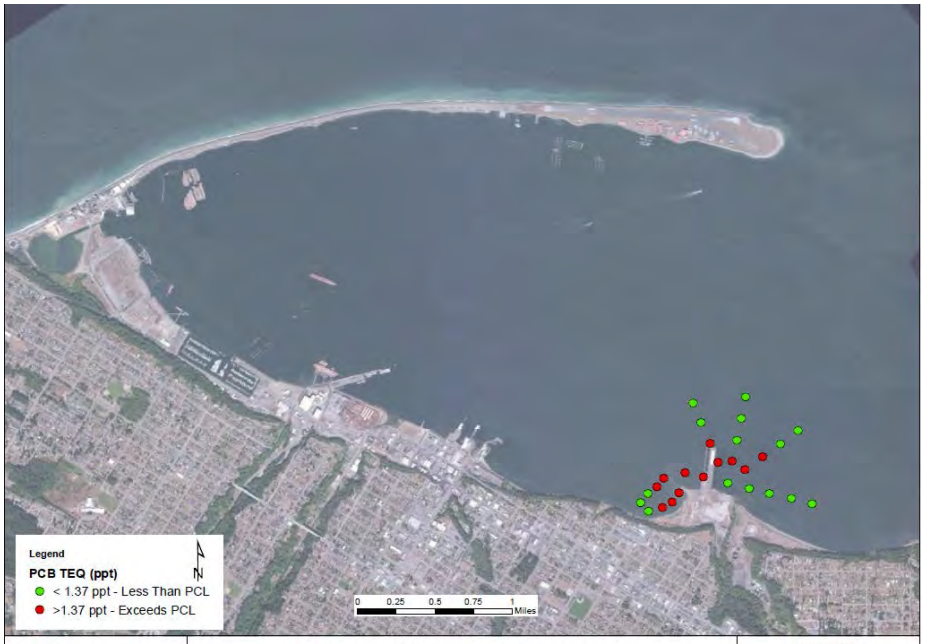
The statement above referencing the highest PCB concentration from the Rayonier Phase 2 Addendum relates to sample WP-11, which had a total PCB concentration of 2,930 ppb. The SIR sample located closest to this sample was IH-02, and was within less than 200 feet of WP-11. However, IH-02 had no detected PCB Aroclors at a detection limit of 34 ppb. Additionally, the West PA Harbor samples from the Phase 2 Addendum had the highest average total PCB concentration (395 ppb), yet the SIR samples most closely located to this area (Boat Launch and Marina samples) had no detected Aroclors.

Additionally, as discussed further below, the PQL for total PCB Arcolors included in the Preliminary Cleanup Goals technical memo is **5.5 ppb**. However, detection limits for the SIR samples are routinely higher than this level. **In fact, the average "total PCB" detection limit for samples with no detected Aroclors was 11 ppb, or twice the PQL**. In many cases the detection limits for individual Aroclors in the SIR data set were even higher than the "maximum PQL" noted in the Preliminary Cleanup Goals memo. It is not clear why detection limits from the SIR for the Aroclors are so high, and, particularly since the results do not seem to correlate well with other studies, the results do not seem very reliable as a basis for cleanup decisions.

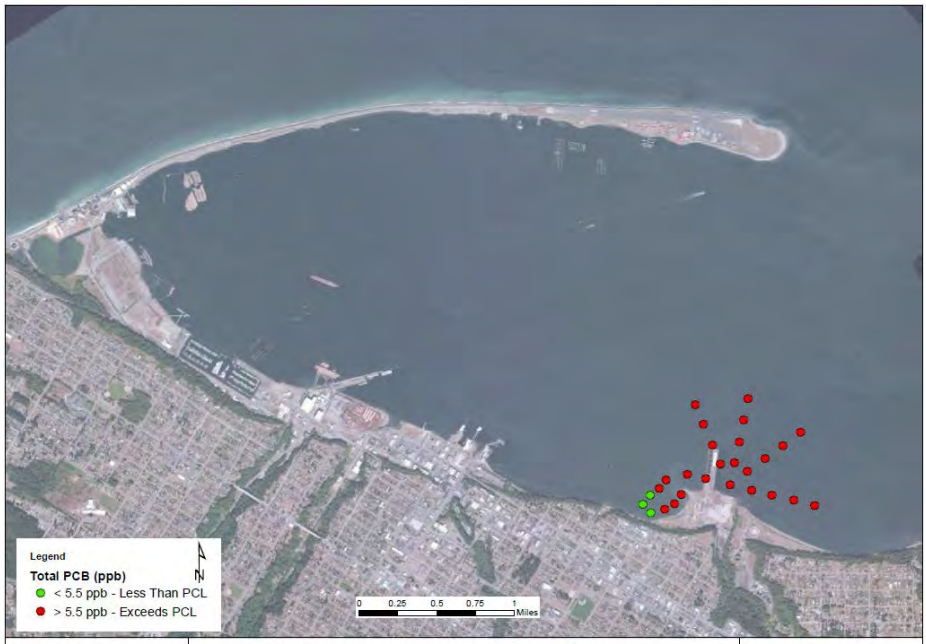
PQL-Based Preliminary Cleanup Goals for PCBs

In the June 2011 Preliminary Cleanup Goals memo, PQL-based preliminary cleanup goals for total PCB Aroclors and for PCB TEQ were developed. Based on a review of the approximately 50 samples from the Phase 2 Addendum that included a full PCB congener analysis, we compared cancer risks for each sample using both a total PCB concentration and a PCB TEQ concentration using the 12 dioxin-like PCB congeners. On average, risks calculated using these two approaches were not drastically different. **However, the use of PQL-based cleanup goals would lead to very different cleanup decisions based on the approach used** (see the figures below comparing PCB methods and cleanup levels). The PQL for total PCB Aroclors is listed as 5.5 ppb. Based on the calculated sediment RBC, this PQL corresponds to a risk level of about 1.3×10^{-5}. The PQL for PCB TEQ is listed as 1.37 ppt.

Based on the calculated sediment RBC, this PQL corresponds with a risk level of about 1.3 x 10^{-4}, an order of magnitude higher. **In other words, using a PCB TEQ approach would allow 10 times more risk to remain at a site remediated to the PQL, compared to a total PCB approach.** The two figures below compare the Rayonier Marine RI Phase 2 data to preliminary cleanup levels for PCB TEQ (first figure), and for total PCBs (second figure).



RIDOLFI	Port Angeles - PCB Cleanup Level Comparison (PCB TEQ)	March 2012
	Prepared for the Lower Elwha Tribe, Port Angeles, WA	Figure 1



RIDOLFI	Port Angeles - PCB Cleanup Level Comparison (Total PCB)	March 2012
	Prepared for the Lower Elwha Tribe, Port Angeles, WA	Figure 1

Port Angeles Supplemental Sediment Data Evaluation
Issues for Discussion

Section 5.2.1

p. 16: This section states "**This proposed low energy CSM for Port Angeles Harbor is in many ways similar to one developed by Windward (2011) at the request of Rayonier**."

It is not clear what the basis is for this statement, since most of the elements of the Windward CSM are inconsistent with the current, STA, and geomorphic study conclusions. The only similarity seems to be that it is based on an interpretation of "net hydrodynamic conditions."

p. 16: "**Together these studies suggest that net counterclockwise circulation throughout the harbor, as described in the Windward CSM, is not the only process driving sediment transport**."

It may be more accurate to say that net counterclockwise circulation does not appear to be the **primary** process driving sediment transport.

Section 5.2.3

p. 19: **"it is evident that material derived from the former Rayonier Mill property and other nearby sources has the potential to be transported both into and out of Port Angeles Harbor."**

It is not clear how this is evident. According to the geomorphic report (as noted here in bullet #2 on p. 15) "most, if not all, sediment discharged to the harbor remains there." What additional evidence supports this conclusion? Also, what was the impetus for changes in the new Figure 7?

Section 5.3.1

p. 19: **"The majority of potential COPCs and sediment sources to Port Angeles Harbor are located along the southern harbor shoreline or contribute to runoff that enters the harbor along the southern shoreline**."

There should be some acknowledgement that the Rayonier deepwater outfall, for its last 25 years of operation, was not along the southern shoreline but in the outer harbor, and was a primary source of sediment to the Harbor. The outfall discharged 20 tons of solids per day, and the continuous discharge was greater than all other inputs to the harbor combined (including all creeks and all other discharges).

p. 20: **"The orientation of the jetty has protected the area adjacent to the former mill property from wave energy, likely minimizing westward longshore transport of sediment within the "log pond"."**

It is not clear what the object of this paragraph is. Much of the sediment previously trapped in the log pond was likely from historical nearshore outfalls, and since the log removal, removal of a portion of the jetty, and removal of log booms, a significant amount of material has been eroded and removed from the log pond.

Section 5.3.2

p. 20-21: Is there any evidence to support the transport of sediment or effluent out of the lagoon and into the inner harbor?

Section 5.3.3

p. 21: It is likely that the discharge of 20 tons per day of solids from the Rayonier deepwater outfall was a significant contributor to the large parting zone. It is not evident that sediment around the Mill would have moved north toward the parting zone. What evidence is there to support this?

Section 6.1.2

p. 24: **"The relatively small wood debris footprint in the vicinity of the former Rayonier Mill property suggests that either the property was a much smaller source of wood debris than inner harbor sources or that wood debris is effectively removed from the property and transported elsewhere. Historically, the former Rayonier Mill was the principal source of both sulfite pulp and discharged solids among the Port Angeles mills (WPCC 1957; DOI 1967). Therefore, it is unlikely that the former Rayonier Mill was a smaller source of wood debris than inner harbor facilities. Instead, small pieces of wood debris initially deposited in the vicinity of the former mill property are most likely eroded to the parting zone during extreme events and then gradually dispersed both into and out of the harbor. Such dynamics would lead to a diffuse wood debris source signal for the former Rayonier Mill property."**

Rayonier leased extensive areas along inner Ediz Hook ("Inner Ediz" area) which is where the majority of their log rafting occurred, and rafted a much smaller number of logs near the Mill.

Section 6.2.3

P. 26: **The highest total PCB congener concentration was measured in close proximity to Terminal 5, being an order of magnitude greater than any other samples. Total PCB congener concentrations were also in exceedance of SQS/LAET criteria in the vicinity of the Port Angeles Marina and the former Rayonier Mill log pond and dock.**

p. 27: **"The spatial distribution of PCBs suggests the former Rayonier Mill property as a primary source of PCBs to Port Angeles Harbor. "**

How are these two statements consistent?

Section 6.3.2

p. 28: "**This suggests that there has not been a radical long-term change in either the magnitude or location of dioxin sources to the system**."

How does this correlate with our knowledge of known historical sources? We know there have been radical changes in the magnitude and location of sources (closing of Fibreboard in 1970, relocation of Crown-Zellerbach outfalls in 1960's, change in location of Rayonier outfalls in 1972, closure of Rayonier Mill in 1997).

Section 6.4

p. 30: "**For this reason, a modified endpoint to the larval development bioassay has been developed that includes sediment resuspension to obtain a more accurate count of larvae. The modified endpoint method was not used for Port Angeles Harbor bioassay samples."**

The larval bioassays were conducted using approved PSEP bioassay methods, according to an approved sampling and analysis plan. The resuspension method has not yet been approved.

Section 6.5

p. 31: **"Hydrodynamics of the inner harbor cause it to act as a sediment trap for both local contaminant sources and those transported by longshore currents from sources along the southern harbor. Despite the potential mixing of local and distant sources in the inner harbor, the spatial pattern of chemical data suggests that western harbor sources overwhelm any potential distant sources."**

Why can't these "overwhelming" sources be identified?

p. 31: **“While high concentrations of PCB congeners were observed in the inner harbor, these are likely from localized sources and not the former Rayonier property, as PCB Aroclors were not detected throughout most of the inner harbor.”**

How is this consistent with previous statements that **“The spatial distribution of PCBs suggests the former Rayonier Mill property as a primary source of PCBs to Port Angeles Harbor.”** ?

Section 9.2.3

p. 42: It is stated that “**removal of these sediments** [around the Rayonier Mill and dock] **will likely eliminate a primary source of PCBs and other organic COPCs to the harbor”,** however, on p. 31 it is indicated that **“the organic COPCs sourced from Rayonier generally are not present at detectable concentrations across the rest of the harbor.”** How are these statements consistent? If organic COPCs from Rayonier are generally not detected across the rest of the harbor, how will their removal eliminate a primary source to the harbor?

DEPARTMENT OF ECOLOGY
State of Washington

Port Angeles Harbor Sediments Study Results Public Comment Form

You can submit your formal comment tonight or complete it at home and mail it to Connie Groven, Southwest Regional Office, Toxics Cleanup Program, PO Box 47775, Olympia, 98504-7775.

Ecology will respond to your comments in a responsiveness summary, which will be available online and at the Port Angeles Public Library and the Peninsula College Library. Please provide your name and address if you wish to receive a copy of the responsiveness summary.

NAME: Rose Marschall

ADDRESS: 162 S. Barr Rd

CITY: Port Angeles WA **ZIP:** 98362

COMMENTS
Please use back side of this form if you need more room

I would like to know why the State would spend money cleaning up a Harbor including carcingenic dioxins while allowing an Incinerator (Nippon) from being built that will put out dioxins?

This is not logical and is a waste of taxpayer money.

Why is there no state standards for dioxins?

Why is the state allowing this plant to go into planning stages while the Federal Goverment is requiring the EPA to put out new up to date Air quality standards?

DEPARTMENT OF ECOLOGY
State of Washington

Port Angeles Harbor Sediments Study Results Public Comment Form

You can submit your formal comment tonight or complete it at home and mail it to Connie Groven, Southwest Regional Office, Toxics Cleanup Program, PO Box 47775, Olympia, 98504-7775.

Ecology will respond to your comments in a responsiveness summary, which will be available online and at the Port Angeles Public Library and the Peninsula College Library. Please provide your name and address if you wish to receive a copy of the responsiveness summary.

NAME: Janet Marx

ADDRESS: 112 Lakerbie Pl
Port Angeles 98362

CITY: _____ **ZIP:** _____

COMMENTS
Please use back side of this form if you need more room

One of your "Next steps" is to work with PLP ~~to~~ how will you manage this when Nippon + the city have signed a mutual agreement not to share with public agencies or the public information on their polluting activities.

NIPPON PAPER
INDUSTRIES USA

VIA EMAIL

May 21, 2012

Connie Groven, Project Manager
WA Department of Ecology
Toxics Cleanup Program, SWRO
PO Box 47775
Olympia, WA 98504-7775

RE: Comments
Draft Port Angeles Harbor Sediment Investigation Report

Dear Ms. Groven:

The Department of Ecology released two draft reports for public comment on February 23, 2012. These are *Port Angeles Harbor Sediment Characterization Study, Port Angeles, Washington* dated February 2012 and *Port Angeles Harbor Supplemental Data Evaluation to the Sediment Investigation Report, Port Angeles, WA* dated February 2012. Nippon Paper provides technical comments to both those reports attached to this letter.

We look forward to Ecology's consideration of these comments and are willing to meet with you to provide additional clarification if needed.

Sincerely,

Paul F. Perlwitz
Environmental Manager

cc: Harry Grant

MEMORANDUM

TO: Connie Groven, Project Manager Toxics Cleanup Program, SWRO

FROM: Nippon Paper Industries USA Co., Ltd.

DATE: May 17, 2012

SUBJECT: Comments on the Port Angeles Harbor Sediment Investigation

---

This memorandum presents comments submitted by Nippon Paper Industries USA Co., Ltd. ("NPIUSA") regarding the Port Angeles Harbor Sediment Investigation prepared by Washington State Department of Ecology (Ecology) and their contractors. The documents reviewed in this memorandum include:

- Port Angeles Harbor Supplemental Data Evaluation to the Sediment Investigation Report, Port Angeles, WA, Summary Report, Public Review Draft (Supplemental Data Evaluation, Newfields 2012)
- Port Angeles Harbor Sediment Characterization Study, Port Angeles, Washington, Sediment Investigation Report, Public Review Draft (Port Angeles Harbor SIR, E&E 2012)
- Port Angeles Harbor Sediment Investigation—Two Draft Reports Available for Public Review and Comment (Fact Sheet)

The Supplemental Data Evaluation contains a reference to Preliminary Cleanup Goals for Sediment in Port Angeles Harbor, Port Angeles, WA: *Draft Report. Prepared for the Washington State Department of Ecology Toxics Cleanup Program, Lacey, WA by NewFields. February 2011.* Ecology did not make that document available to the public for review and comment in this process. The content of the report on preliminary cleanup goals for Port Angeles Harbor may be significant, particularly if it is used as a component or section of a feasibility study or sets controlling standards for feasibility study in Port Angeles Harbor and its absence from this review process may impair effective and meaningful public participation. WAC 173-340-600.

Port Angeles Harbor Supplemental Data Evaluation to the Sediment Investigation Report, Port Angeles, WA, Summary Report, Public Review Draft

Section 1.0 Introduction

Text: Third paragraph and last paragraph on page 1.

Comment: This report should summarize all substantive existing data, not only that from E & E, Rayonier, Inc. and NPIUSA. Other studies are referenced in the Sediment Investigation Report (E & E 2012, see section 1.2 Previous Investigations) and presented in the EIM online system (Environmental Information Management) that should be identified in this summary and Ecology should cite in the responsiveness summary whether or not it has reviewed or relied upon data indexed in the EIM for this Site.

Fourth full paragraph (first below bullet list): When will preliminary sediment cleanup goal memorandum be available? Reference to it, without making it available for public review and comment, results in an incomplete presentation of the Supplemental Data Evaluation.

Section 2.0 Spatial Analysis Models

Comment: This report should summarize all substantive existing data, not only that from E & E, Rayonier, Inc. and NPIUSA (see comment above).

Sub-section 2.1 Geodatabase Development

See comment above and below.

Sub-section 2.2 Data Interpolation

Comment: In addition to the comment regarding the use of a limited data set for the analysis contained in this document, the following limitations of spatial modeling should be presented in this section. The precision of the contouring would be improved with the use of additional, available data sets as described above.

Prior investigations conducted in the Harbor over the past 15 years reported in the sampling and analysis plan (E & E 2008) include:

- EPA Dioxin and Furan Concentrations in Puget Sound Crabs (EPA 1991)
- EPA Expanded Site Investigation (ESI) of Rayonier Mill (E & E 1998 and 1999)
- Ecology Marine Sediment Monitoring Program (MSMP) (Ecology 1998a and b)
- Ecology Port Angeles Harbor Wood Waste Study (SAIC 1999)
- Rayonier Log Pond Survey for Remedial Investigations (Foster Wheeler 2001)
- Washington State Department of Transportation Port Angeles Graving Dock (GeoEngineers 2003)
- Remedial Investigation and Phase 2 Addendum for the Marine Environment near the Former Rayonier Mill Site (Malcolm Pirnie 2007a)
- Ecological Risk Assessment for the Marine Environment near the Former Rayonier Mill Site (Malcolm Pirnie 2007b)

- Washington Department of Health Consultation: Rayonier Mill Site Exposure Investigation (WDOH 2005)
- Environmental Baseline Investigation, Washington State Department of Natural Resources (WSDNR) Lease 22-077766: Nippon Paper Industries USA Co., Ltd., Port Angeles, Washington (Exponent 2008)
- Sampling and Analysis Report, Sediment Grab Sampling and Log Density Survey (Anchor 2005)

These studies are discussed in detail in the Port Angeles Harbor Summary of Existing Information and Identification of Data Gaps Report (E & E 2008b).

Section 3.0 Background Sediment Concentrations

Comment: In WAC 173-340-200, natural background concentrations are defined as "the concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities."[1] Determining what *natural background* concentrations are for sediment is difficult because of the ambiguity in what is meant by "localized human activities." Studies have documented atmospheric deposition of dioxin/furans[2][3], for example at Ozette Lake in Clallam County, tracing it to sources likely in Asia. These are not "localized activities." The Sediment Management Standards (SMS) rule does not specify how background is defined when setting sediment cleanup standards for human health protection, but does allow an area background to be used in some cases. By limiting the discussion and evaluation to a handful of samples collected from areas dissimilar to the harbor (i.e., with coarser grain size, stronger current activity, and flushing) and that are not affected by the "localized human activities" (i.e., non-point runoff from upland areas) that Port Angeles Harbor receives, is misleading and inappropriate. The report should recognize that this is a one-sided discussion on background that considers only the lowest possible concentrations**.**

Sub-section 3.1 Compilation of Background Data Sets

Comment: The Model Toxics Control Act (MTCA) regulations also present the topic of area background: "'Area background' means the concentrations of hazardous substances that are consistently present in the environment in the vicinity of a site which are the result of human activities unrelated to releases from that site." The report states "Because Port Angeles Harbor

---

[1] WAC 173-340-200. "**Natural background** means the concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities. For example, several metals and radionuclides naturally occur in the bedrock, sediments, and soils of Washington State due solely to the geologic processes that formed these materials and the concentration of these hazardous substances would be considered natural background. Also, low concentrations of particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due to global distribution of these hazardous substances. The low concentrations would be considered natural background. Similarly, concentrations of various radionuclides that are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background."

[2] Christmann, W., K.D. Kloppel, H partscht, and W. Rotard 1989. Determination of PCDD/PCDF in Ambient Air. Chemosphere, Vol. 19, Nos. 1-6., pp. 521-526.

[3] Citation: Cleverly, D.H., D. Winters, J. Ferrario, J. Schaum, G. Schweer, J. Buchert, C. Greene, A. Dupuy, C. Byrne. The National Dioxin Air Monitoring Network (NDAMN): Results of the First Year of Atmospheric Measurements of CDDs, CDFs, and Dioxin-Like PCBs in Rural and Agricultural Areas of the United States: June 1998 – June 1999. Presented at Dioxin '00, 20th International Symposium on Halogenated Environmental Organic Pollutants & POPS, held Aug 13-17 at Monterey, CA. Short paper in, Organohalogen Compounds 45:248-251.

is located along the Strait of Juan de Fuca, a very different environmental setting than the majority of Puget Sound, Lower Elwha Klallam tribal (LEKT) stakeholders have expressed interest in using datasets collected in close proximity to Port Angeles Harbor to define local background." The data set that the LEKT stakeholders are interested in has a considerable difference in grain size and the quantity of samples is smaller than MTCA uses for determining natural background for soil (see WAC 173-340-709(4); ten or more for natural background and twenty of more for area background[4]).

Sub-section 3.2 Suitability of Background Data Sets

Comment: MTCA requires that samples used to determine background should be collected from samples that "…have the same basic characteristics…"[5]

Comment: The report notes that "reference and investigation-derived sediments must have similar grain size to draw meaningful conclusions." The report then points out that the grain size characteristics of the candidate reference areas do not match site characteristics. Ecology points out that data from the Port Angeles Proximal Area, with its coarser grain size, provide the most conservative Background Threshold Values (BTVs). Ecology further notes that BTVs for most organic chemical of potential concerns (COPCs), including polychlorinated biphenyls (PCBs), are below detection limits. Use of the Proximal Area to derive BTVs for the site is inconsistent with Ecology's own rule that similar grain size is a necessity to draw meaningful conclusions.

Sub-section 3.3 Background Threshold Values

Comment: Detailed information for the individual samples that were used for the calculation of the background values contained in Table 3 should be provided in an appendix for public review and comment. Information on concentration, location, and type of sample are critical factors in the calculation of these values.

Sub-section 3.4 Background Summary

Comment: The evaluation of background concentrations for Port Angeles Harbor should be based on MTCA regulations and use samples from a location with similar characteristics to Port Angeles Harbor sediments. As Ecology notes in paragraph four of Sub-section 3.4, "…sediment samples that constitute [the Port Angeles Proximal Area] background data set are generally coarser-grained than those found in Port Angeles Harbor. Because coarse sediments are generally associated with lower COPC concentrations, the Port Angeles Proximal Area data set may underestimate the natural background concentrations associated with the finer material found in Port Angeles Harbor…." Despite acknowledging the Port Angeles Proximal Area

---

[4] WAC 173-340-709 (4) Sample size. When determining natural background concentrations for soil, a sample size of ten or more background soil samples shall be required. When determining area background concentrations for soil, a sample size of twenty or more soil samples shall be required. The number of samples for other media shall be sufficient to provide a representative measure of background concentrations and shall be determined on a case-by-case basis.

[5] See WAC 173-340-709(2) Background concentrations. For purposes of defining background concentrations, samples shall be collected from areas that have the same basic characteristics as the medium of concern at the site, have not been influenced by releases from the site and, in the case of natural background concentrations, have not been influenced by releases from other localized human activities.

differs in physical characteristics from the Harbor and that data from the Proximal Area will likely underestimate natural background for the Harbor, Ecology recommended its use for calculating BTVs. This recommendation is inconsistent with MTCA guidance for identification of area background and contradictory to Ecology's conclusion about the lack of similarity between the two areas. Ecology appears to dismiss the significance of this selection by noting in paragraph six that the BTVs will not necessarily end up being the preliminary cleanup goals, they are just one of the three candidates (along with PQLs and risk-based concentrations). This last point is irrelevant; either the BTVs should be based on an appropriately chosen data set or they should not be derived.

Comment: In the last sentence of the second paragraph a very broad statement about the diversity of contaminant sources is made. This statement should be removed or supported by references. Further, all sources should be identified, including those from non-point sources discharging into the Port Angeles Harbor over the past century and a half.

Comment: The first sentence of the first full paragraph states "Due to the regionally specific nature of the Port Angeles Proximal Area background data set, it encompasses similar natural and anthropogenic sources as those found in Port Angeles Harbor." This needs to be supported by references or removed. The Port Angeles Harbor is a unique geomorphic setting as described in Appendix I Geomorphic Report of Port Angeles Harbor (E & E 2012). The San Juan Island and the Strait of Juan de Fuca samples originate in very different environments that are poor comparisons.

Section 4.0 Chemical Fingerprinting

Text: "Chemical fingerprinting is a statistical technique used to differentiate potential sources of COPCs. The process is carried out under the assumption that locations with similar profiles of COPCs have similar sources."

Comment: Chemical fingerprinting is not a statistical technique. Also, the locations with similar profiles must be proven to have been impacted by similar sources present in the area. To merely assume this is inappropriate and arbitrary. Principal component analysis (PCA) and Fingerprint Analysis of Leachate Contaminants (FALCON) are statistical methods for understanding compositional variability among a group of samples.

Text: "The results of the fingerprinting can be compared against the spatial distributions of COPC concentrations to determine the relative contribution of various sources."

Comment: How this is done is unclear from the Supplemental Data Evaluation. It sounds precise, but what it means in practice is unclear unless Ecology discloses all data and assumptions in the chemical fingerprinting.

Sub-section 4.1 Fingerprinting Methodology

Text: "Fingerprint analysis with dioxin/furan congeners involves determining the relative amount of each congener in each sample."

Comment: Standardizing the concentrations of the 2,3,7,8-substituted congeners is a common and accepted practice in dioxin fingerprinting; however, suggesting that it is a required step for all dioxin fingerprinting is not correct.

Text: "PCA is a statistical method that is used to reduce the number of variables in complex data sets. In the case of dioxin/furan congeners, there are 17 possible variables (one per congener)."

Comment: PCA creates new variables as linear combinations of the input parameters, which in this case are the relative contributions of each congener to the total dioxin/furan concentration. To state that PCA reduces the number of congeners is misleading. PCA compresses the original data set into a few new variables that are each a linear combination of all 17 of the input parameters.

Text: "The goal of PCA is to find the correlation between the individual congeners and then to group all correlated congeners together on one variables, or component."

Comments: The objective of PCA is to explain the largest amount of variability between samples using orthogonal linear combinations of the input variables. The statement in the Supplemental Data Evaluation about grouping correlated congeners is meaningless. A component is by definition comprised of all 17 congeners, including negatively and positively correlated congeners. For example, Table 4 indicates Component 1 is negatively correlated with octachlorodibenzo-*p*-dioxin (OCDD), but positively correlated with many other congeners.

Sub-section 4.2 Results

Text: "Components with eigenvalues greater than one were retained in the analysis and an orthogonal rotation was applied."

Comments: The PCA method requires that the resulting components are orthogonal to one another. Stating that an orthogonal rotation was applied is unclear. Please explain. The specific rotation method used should be identified along with justification for the choice of method.

Text: "The orthogonal rotation results in uncorrelated components, meaning each component accounts for the presence of separate congeners."

Comment: This statement is unclear and likely incorrect. The original components, i.e., without further rotation, are orthogonal and therefore uncorrelated. Prior to rotation, each component explains the largest amount of variability that remained after the variability explained by preceding components.

Text: "The congener patterns explained by each of the three components are presented in Table 4. For each congener, the maximum loading has been highlighted."

Comment: Table 4 provides the component loadings for each congener for the three components retained. The loadings provided are the correlation estimates between the component and each congener. Highlighting the maximum value for each congener is

meaningless, as it is the magnitude of the correlations within a component that indicates which congeners are attributable for the variability between samples explained by that component.

Sub-section 4.3 Conclusions

Text: "Because the described chemical fingerprinting technique was unable to differentiate multiple sources of dioxin/furan congeners to sediments of Port Angeles Harbor, Ecology is pursuing a more intensive fingerprinting approach. Multivariate chemometric analyses (un-mixing analyses) of the Port Angeles sediment dioxin/furan congener data set is planned subsequent to this report. A similar chemometric analyses was performed for Port Angeles soil dioxin/furan congener data as a part of the Rayonier Mill Off-Property Soil Dioxin Study (E & E and Glass 2011). This chemometric evaluation was able to quantitatively differentiate three unique source patterns that account for the dioxin/furan profiles observed in soils."

Comment: What is meant by a "more intensive fingerprinting approach"? The chemometric analyses used in the Rayonier Mill Off-Property Soil Dioxin Study are not necessarily more powerful, but are based on assumptions of what the congener profiles of sources may have been. Such techniques may use quantitative calculations, but that does not make the results definitive. The assumptions still limit the interpretation. Additionally, un-mixing analyses are only as reliable as the sources are distinct. Any additional methods applied to these data should incorporate a reliability or goodness-of-fit assessment to indicate how well the method was able to distinguish between "sources". Furthermore, if a multivariate chemometric analysis is performed public review and comment are needed.

The so-called "more intensive fingerprinting approach" must also be a procedure within the limits of supporting science and must be generally accepted in the scientific community. If not, it will be speculative and arbitrary.

This section of the report does not discuss or consider the fingerprinting analysis provided in Appendix J of the E & E (2012) report. Many inconsistencies exist between this discussion and those of Appendix J in addition to many inconsistencies within Appendix J (see specific comments to Appendix J below).

Section 5.0 Sediment Transport

Text: "The hypothesized sediment transport pathways can be used in conjunction with the Port Angeles Harbor sediment chemistry results to determine the likely point sources of chemical contamination and the regions of the harbor influenced by these sources (Sections 6.0 and 7.0)."

Comment: The sediment transport analyses should be used to define those areas of sediment deposition and erosion that are occurring as a result of physical process that exist within the Harbor. Point sources can be measured if they exist (i.e., outfalls, CSOs, streams, upland sources, etc.).

Sub-section 5.1 Summary of Field Studies in Support of the Port Angeles Sediment Investigation

No comments.

Sub-section 5.1.1 Current Data Collection and Analysis

Text: "In the current study (Evans-Hamilton 2008), three current monitoring stations were deployed to measure currents, waves, and suspended sediment (turbidity) over a one-month period (March 2008)."

Comment: Evans-Hamilton (2008) (see Appendix D, E & E 2012) only collected current data for one month from March 26 to April 25, 2008. The reader should be informed of this shortcoming. This limited current dataset does not reflect the seasonal variability of currents in the harbor nor does it provide the opportunity to understand the seasonal variations that occur. Any mention of current magnitude or direction should reflect the fact that it represents a very short duration and sampling set.

Sub-section 5.1.2 Summary of Sediment Trend Analysis

Comment: The Sediment Trend Analysis (GeoSea 2009) of Appendix E of the Port Angeles Harbor SIR (E & E 2012) does not contain a section describing the uncertainties of sediment trend analysis. A very detailed analysis of sediment trend analysis was prepared by the U.S. Corps of Engineers (USACE) in 2005 in a report titled *Use of Sediment Trend Analysis (STA) for Coastal Projects* by Steven A. Hughes (ERDC/CHL-VI-40, June 2005[6]). This report provides a good uncertainty analysis for the use of sediment trend analysis and states:

> The basic assumption inherent in STA is that differences in sediment grain-size distributions **can be due to sediment transport**. In other words, the grain-size distribution may change as sediment moves along a pathway, and every deposit is a result of the processes responsible for sediment movement. This implies active periods of sediment transport occurring at the site at least part of the time…
>
> "Voiced (but unpublished) criticism of STA methodology stems from specific project application of STA that yielded results different from what other coastal engineering experts believe is occurring in the nearshore sediment transport regime at that particular site. Whether or not the criticism is deserved depends on substantiating evidence for each specific application. It is always important to keep in mind that **STA results must never be used without evaluating the result in the context of all other available information at the project site including hydrodynamics, known sediment transport trends, etc**.

Furthermore, the USACE report continues with a detailed discussion of the topics listed below.

Developers of the STA technique list several uncertainties associated with the methodology including the following:

a. Transport model assumptions
b. Temporal fluctuations
c. Sample spacing
d. Sediment size distribution
e. Random environmental and measurement uncertainties

---

[6] http://chl.erdc.usace.army.mil/library/publications/chetn/pdf/chetn-vi-40.pdf

This information should be included in the appropriate sections the Port Angeles Harbor SIR (E & E 2012), Appendix E (GeoSea 2009) and in the Supplemental Data Evaluation (NewFields 2012). This would provide a more rounded view of the STA for the public to consider.

The STA in Development of a Conceptual Model Section 7.1 of Appendix E of the Port Angeles Harbor SIR (E & E 2012) states that the Port Angeles Harbor is not getting significant input of sediments from the Straits of Juan de Fuca nor the streams that enter the bay. Appendix I Geomorphic Report (E & E 2012) quantifies the amount of sediment input from the streams. Neither of these reports even considers the huge amount of combined sewer outfall (CSO) flow into the harbor. Undoubtedly, this CSO overflow carries considerable fine grained materials. This is a major flaw in the assumption of inputs for both reports and should be reconciled by Ecology.

Michael Puntenney, City Engineer, made a presentation on October 11, 2011[7] recognizing that industrial wastes and toxic pollutants are contained in CSO and raw sewage overflows. He also presented information indicating that "…the annual discharge volume from CSO events is approximately 31.4 million gallons per year." This occurs at four current and five eliminated CSOs located along the southern shoreline.

The city provides location maps and other information of the current and eliminated CSOs on its website at http://www.cityofpa.us/CSO.htm. These should have appeared in this report.

Ecology should recognize this potentially significant load of metals and other contaminants to the southern harbor shoreline and revise the discussion of unknown sources near the inner harbor.

Finally, it is unclear whether the Sediment Trend Analysis, as employed by Ecology in this report, is based upon methods, theories, principles or techniques generally accepted in the relevant scientific community.

Sub-section 5.1.3 Summary of Geomorphic Report

First paragraph should include a discussion of the factors that Herrera (2008) used in developing the sedimentation rates. Namely, that they did only a qualitative estimate of the potential sediment loadings from CSOs and creeks to the harbor.

Last paragraph of section: It should also be noted that "…all the sediment discharged west of Lees Creek..." is based on a very qualitative estimate of CSOs and creeks to the harbor as presented in Appendix I Geomorphic Report. It should be clarified that no sediment loading measurements were collected.

Comment: The Geomorphic Report (E & E 2012) quantifies the amount of sediment input from the streams, but does not even discuss the CSO input to the harbor. Undoubtedly, this CSO overflow carries considerable fine grained materials. This is a major flaw in the assumption of inputs for both reports and should be reconciled by Ecology (see Sub-section 5.1.2 above).

---

[7] http://www.cityofpa.us/PDFs/PWorks/CS0Presentation10-2011.pdf

It is unclear whether the Geomorphic Report by Herrera, adopted by Ecology in this report, is based upon methods, theories, principles or techniques generally accepted in the relevant scientific community.

Sub-section 5.2 Conceptual Site Models of Sediment Transport

Comment: As noted above in Section 5.1, any conceptual site model (CSM) of sediment transport that does not consider the impact of significant CSO overflow events that have been supplying fine grain material in large quantities and have been occurring over a long time frame in Port Angeles Harbor must be flawed.

Sub-section 5.2.1 Low Energy CSM for Sediment Transport

See comments to Section 5.1.

Sub-section 5.2.2 High Energy CSM for Sediment Transport

Comment: The last two sentences of this section clearly define the area near Rayonier as erosional and the inner harbor as the "…terminus of some sediment transport pathways." The erosion of material derived from Rayonier may have come to be located in the inner harbor and other areas throughout the central and outer harbor. The Supplemental Data Evaluation should state that and the potential need for additional study of sediment transport.

Sub-section 5.2.3 CSM Summary

Comment: The CSM correctly notes that the inference of a counterclockwise net sediment transport does not account for the absence of fine-grained material offshore from Rayonier Mill property (Windward 2011).

Section 5.3 Overview of Sediment Transport Pathways

Sub-section 5.3.1 Southern Harbor Sediment Transport

Comment: The CSOs are included in the bullet list, but were not included as sources of sediment input in the evaluation contained in the Port Angeles Harbor SIR (E & E 2012) Appendix E Sediment Trend Analysis (GeoSea 2009). In fact, Figure 21 of the GeoSea (2009) report shows the yet to be built City outfall off the former Rayonier Mill site. This discussion and those of the STA should include the existing and eliminated outfalls. The city provides location maps and other information of the current and eliminated CSOs on its website at http://www.cityofpa.us/CSO.htm.

Sub-section 5.3.2 Inner Harbor Sediment Transport

Comment: Sediment transport and loadings discussed in this section are theoretical and were not measured.

Sub-section 5.3.3 Central Harbor Sediment Transport

Comment: The report states that sediment loading to the parting zone is coming from sediment eroded by storm wave energy from the southern harbor in the vicinity of the Rayonier Mill property.

The second sentence of the second paragraph is somewhat misleading indicating the "…strongest near-bed current at the location of the parting zones(s) is to the west". Evans-Hamilton (2008) (see Appendix D, E & E 2012) only collected current data from March 26 to April 25, 2008 not in all four quarters or seasons. The sentence should reflect this shortcoming of not having an evaluation of near sediment current data over a longer, and more importantly seasonal basis.

Section 6.0 Environmental Fate of Contaminants of Concern

Comment: This discussion of environmental fate of contaminants does not discuss the large quantities of fine materials delivered by CSOs over the urban history of Port Angeles (similar to the Sediment Trend Analysis [GeoSea 2009] and the Geomorphic Report [Herrera 2011] in the Port Angeles Harbor SIR). Undoubtedly, this CSO overflow carries considerable fine grained materials and COPC's well known to be associated with urban areas. This is a major flaw in the assumption of inputs for both reports and the discussion in this section and should be reconciled by Ecology. (See comments on CSOs in Sub-section 5.1.2 above).

Sub-section 6.1 Surface Sediment Conventional Parameters

See comment to Section 6.0 and 6.2.1.

Sub-section 6.1.1 Fines

See comment to Section 6.0 and 6.2.1.

Sub-section 6.1.2 TOC as a Proxy for Wood Debris

Comment: The last paragraph of the section should include a discussion of the removal of approximately 2,000 sunken logs from the log pond that may have had a destabilizing effect, increasing the susceptibility of sediment erosion from within the log pond (see section 5.3.1 of the Supplemental Data Evaluation (Newfields 2012). Also, the third specific objective of the harbor-wide investigation (Final Port Angeles Harbor Sediment Characterization Study SAP/QAPP, June 26, 2008 prepared by E & E, Section 2.3.1) was to "Identify terrestrial and aquatic sources of chemical contaminants, wood waste, and woodwaste-related degradation products".

Sub-section 6.1.3 Sulfides and Ammonia

No comments.

Sub-section 6.2 Surface Sediment COPCs

No comments.

Sub-section 6.2.1 Metals

Text: "Although some of this metal contamination may be attributable to southern harbor sources transported to the inner harbor by longshore transport, the spatial footprint does not suggest distant sources are responsible for the majority of these metals. Metals carried to the inner harbor by longshore transport would be expected to move with the fine-grained sediment fraction and disperse eastward after reaching the neck of the Ediz Hook (Figure 7)."

Comment: The City of Port Angeles is currently reviewing and upgrading their CSO system. Stormwater from creeks, urban runoff, and combined sewer overflows has long been recognized as one of the sources of potential contamination to the harbor and western harbor (see CSOs in Sub-section 5.1.2 above).

Sub-section 6.2.2 Dioxin/Furan Congeners

Text: "If the former Rayonier Mill property were the main source of dioxin to the inner harbor, dioxin concentrations similar to those found in the inner harbor would be expected along the clockwise longshore transport path in the areas that accumulate equally fine-grained sediment... While the former Rayonier Mill property is a likely contributor of dispersed dioxins/furans throughout the entire harbor, it is likely not the predominant source responsible for the observed spatial pattern of dioxin/furan contamination in the inner harbor."

Comment: The Rayonier Mill property and near shore environments have been eroding since the facility ceased operations in the late 1990s. In Section 5.3.1, this report notes the destabilizing effect of removal of 2,000 logs "…increasing the susceptibility of sediment erosion from within the log pond." The STA (GeoSea 2009) notes that the sediment is transported along the southern shoreline (see Section 5.0 of this report). Therefore, it is just as possible that over the last 15 to 20 years, the fine grained sediments from the Rayonier site have eroded, transported, and mixed with other sediments in the inner harbor and other portions of the outer harbor.

Sub-section 6.2.3 PCBs

No comments.

Sub-section 6.2.4 Other SMS Chemicals

No comments.

Sub-section 6.2.5 Resin Acids/Guaiacols

No comments.

Sub-section 6.3 Subsurface Sediments

On a more positive note, the fact that surface concentrations may be lower provides some indication that natural recovery may be occurring with the reduction of historic sources to this net depositional area of the harbor.

Sub-section 6.3.1 Metals

No comments.

Sub-section 6.3.2 Dioxin/Furan Congeners

No comments.

Sub-section 6.3.3 PCBs

No comments.

Sub-section 6.3.4 Other SMS Chemicals

No comments.

Sub-section 6.4 Bioassays

Comment: This Section makes several important points concerning interpretation of the bioassay results.

- The larval development bioassay was the most frequent bioassay with SMS exceedances. In fact, as summarized in Figure 26, outside of the area around the former Rayonier site, only one sample had an exceedance of SQS (but not CSL) for polychaete growth and none for amphipod mortality. Thus, a conclusion of SMS bioassay exceedance is based primarily on larval development.
- Ecology states in paragraph 2, "Sediment toxicity in Port Angeles Harbor cannot be easily attributed to co-occurring SMS COPCs. Toxicity testing failures (Figure 26) were frequently, but not always, associated with chemicals that exceeded SMS criteria (Figures 13 and 14)."

This overstates the correlation between chemical and bioassay exceedances. In fact, SMS exceedances for chemical and bioassay results were not correlated on a sitewide basis at all. Only five stations had both chemical and bioassay exceedances, whereas 7 of 13 locations that exceeded SMS chemical criteria did not have bioassay exceedances (Table 6-3). Furthermore, the specific chemical responsible for the chemical exceedances varied by station. Therefore, bioassay exceedances cannot be attributed to chemical concentrations on a sitewide basis. A more accurate statement is: "Apparent bioassay exceedances in Port Angeles Harbor are not correlated with SMS chemical exceedances for site CoPCs." Further, Ecology should consider and address in its responses, the following:

- The larval development bioassay exceedances cannot be explained by sulfide or ammonia because those chemicals are removed from the matrix as part of the methodology.
- The larval development bioassay exceedances could be explained by fine grained material causing a flocculant that entrains normally developed larvae and prevents counting.

The last point is critical for interpretation of the bioassay results. Because of the method limitations, the results are more appropriately considered "apparent" exceedances of the larval development bioassay. As Ecology notes, "a modified endpoint to the larval development bioassay has been developed that includes sediment resuspension to obtain a more accurate count of larvae." Interpretation of bioassay testing will only be possible when limitations in the prior larval development bioassay results are addressed by application of the modified method to additional samples.

Sub-section 6.5 Summary of Chemical Transport and Fate

Text: "Although dispersion and transport mechanisms likely cause the former Rayonier Mill property to be a contributor to chemical contamination throughout Port Angeles Harbor, the organic COPCs sourced from Rayonier generally are not present at detectable concentrations across the rest of the harbor."

Comment: This statement is not true. Dioxins are found in detectable concentrations in the inner harbor. The shoreline transport of the chlorine bleach mill effluent from the former Rayonier mill outfalls could have contributed to the concentration observed in the inner harbor.

Rayonier mill had bleaching operations. The Summary Report fails to state this and the failure to acknowledge that COPCs "sourced" from Rayonier is linked with this failure to clearly state historic facts. The general process flow diagram in E & E (1998) Expanded Site Inspection Report shows in Figure 2-3 the presence of elemental chlorine in the process.

Text: "Despite the potential mixing of local and distant sources in the inner harbor, the spatial pattern of chemical data suggests that western harbor sources overwhelm any potential distant sources."

Comment: This statement is highly speculative given that Ecology acknowledges the east to west sediment transport along the southern shoreline, heavy erosion occurring for 15 to 20 years from the Rayonier Mill site and no definitive sources in the western harbor have been identified.

Section 7.0 Source Identification

Comment: The sampling and analysis plan (E & E 2008) and STA reports (GeoSea 2009) were prepared more than three year in advance of the sediment report (E & E 2012). Given that Ecology has completed fate and transport and sediment transport sections to this report, Ecology should consider this in the evaluation of the areas of potential concern. A brief discussion of the impacts of sediment transport pathways should be included in this discussion because most of the source areas are located along the southern shore of Port Angeles Harbor and impacted by the "…southern harbor longshore transport pathway.." as described in Section 5.3.1.

Sub-section 7.1 Harbor-wide Sub-Areas

Comment: The second paragraph first sentence does not take into account the potential migration from east to west along the southern harbor longshore transport pathway to the inner harbor. Fine grain sediments often contain the COPCs. As noted in Sub-section 5.3.1, the southern shoreline is a longshore transport pathway capable of moving these fine grain sediments (E & E 2008, Appendix E Sediment Trend Analysis report) to the inner harbor. Table 9 shows a higher maximum dioxin concentration trending from east (i.e., Rayonier Mill area) to west (Inner Harbor area) when viewed by area.

Sub-section 7.2 Rayonier Mill Sub-Areas

This discussion does not take into consideration that 2,000 logs were removed by Rayonier, along with an unknown amount of sediment fines and 15 to 20 years of subsequent erosion have been occurring in the Rayonier Mill Sub-Areas. This fact should be included in this discussion of source areas.

Sub-section 7.3 Summary of Primary Source Areas

Text: Facilities that are potential sources of high COPC concentrations to sediments of the inner harbor and the vicinity of the former Rayonier Mill property are presented in Table 11, Potential Primary COPC Sources to Inner Harbor and Rayonier Mill Regions.

Comment: The table lists three pulp mills that have operated in the harbor and identifies whether these were bleach mills or not. A key aspect missing from this description is whether the bleach process was a chlorine based process. For Nippon, the bleaching process is a sodium hydrosulfite reductive bleaching process. A past bleaching practice at the former Crown Zellerbach mill was zinc hydrosulfite as described in Exponent 2008. Rayonier bleached using elemental chlorine and then in recent years it also used chlorine dioxide. The Fibreboard Paper Products mill should be described more accurately as information contained in the 1957 Washington Pollution Control Commission technical bulletin No. 23 titled "An Investigation of Pollution in the Vicinity of Port Angeles." Fibreboard was not a lumber and plywood mill as described in Table 11. It was a pulp and boxboard mill whose pulping methodology was sulfite based. This document also describes sources of domestic sewage (i.e. municipal) on page 8 also contain COPC sources. These sources should also be listed in Table 11. Additionally, Fibreboard used some type of bleach since the 1967 report titled "Pollutional Effects of Pulp and Paper Mill Wastes in Puget Sound" prepared by the Federal Water Pollution Control Administration, Portland, Oregon. Northwest Region indicated in Figure 33-1 on page 392 that the process included a building housing a bleach process. Further description of the bleach process is on page 394.

Text: The last sentence of the section, "Without the investigation of sediment trends across the entire harbor, the influence of dynamic processes that act to transport materials between sub-areas is lost."

Comment: The original intent of the Port Angeles Harbor SIR (E & E 2012) was to delineate source areas by using a very simplistic approach of identifying sub-areas associated with potential sources areas to the harbor without benefit of fate and transport analysis in a complex oceanographic environment. The recommendations of Sub-section 11.2 of the Port Angeles Harbor SIR (E & E 2012) are contradictory to those in the Supplemental Data Evaluation Section 8, which provides a discussion of the spatial analysis and evaluates data gaps and data needs (NewFields 2012).

Section 8.0 Data Gaps and Data Needs

Comment: The discussion contained in this section and Sub-section 11.2 of the Port Angeles Harbor SIR (E & E 2012) seems to indicate differing data gaps and data needs. Sub-section 11.2 provides a summary of the significant findings and recommendations for further investigations. All but three areas of potential concern (AOPCs) are said to require extensive additional sampling. The three areas where no further action is discussed are the Red Lion area, the Outer Harbor area, and the Eastern Intertidal/Subtidal areas. See the comments for the following sub-sections of Section 8.

Sub-section 8.1 Sediment Chemistry

Comment: This section identifies the area between 1,500 and 4,000 feet from the Rayonier Mill requires additional sampling. Sub-section 11.2 of Port Angeles Harbor SIR (E & E 2012) indicates that the Red Lion is in this area that does not require further action. How additional samples from the inner harbor would aid in identifying the source(s) is unclear. This discussion does not, but should, include a review of historical outfalls that no longer exist. This would aid in identifying sources to the inner harbor. Several of these outfalls may have been sources to the inner harbor. Some of these historical outfalls located at the shoreline of the Rayonier Mill are shown on Figure 2-4 of the Rayonier Pulp Mill Expanded Site Inspection (E & E 1998).

Sub-section 8.2 Surface and Subsurface Wood Debris

Comment: This section does not discuss the 788 grab samples that were collected for the STA nor the Anchor (2005) report. In addition, discussing potential cleanup activities in a report of this nature is premature.

Sub-section 8.3 Sediment Radioisotopes

No comments.

Sub-section 8.4 Sediment Toxicity

See comments in section 6.4.

Sub-section 8.5 Chemical Fingerprinting

Comment: As discussed in Section 4.0, a more "intensive fingerprinting approach" of unmixing analyses is not necessarily more powerful, but is based on assumptions of what the congener profiles of source may have been. Such techniques may use quantitative calculations, but that does not make the results definitive, it merely makes the output appear to be quantitatively derived. The assumptions still limit the interpretation. Additionally, un-mixing analyses are only as reliable as the sources are distinct. Any additional methods applied to these data should incorporate a reliability or goodness-of-fit assessment to indicate how well the method was able to distinguish between "sources".

Sub-section 8.6 Sediment Background Concentrations

Comment: See discussion in Section 3.0. In WAC 173-340-200 the MTCA regulations address natural background concentrations. "The concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities." (See footnote 2.)

At this point, discussing any relationship to cleanup levels is premature. The focus should be to obtain sediments of similar grain size.

Sub-section 8.7 Identification of Western Harbor Upland Sources

Comment: The City of Port Angeles is currently reviewing and upgrading their CSO system. Stormwater from creeks, urban runoff, and combined sewer overflows has long been recognized as one of the sources of potential contamination to the harbor and western harbor. As an example, the City of Port Angeles provided a map of CSOs and stormwater outfalls to the major

creeks and harbor in their January 2012 presentation[8] for a Port Angeles City Council Briefing on CSOs. Gregory Zentner, a Supervising Engineer with Ecology, presented materials that the four existing CSOs in Port Angeles "contain a potent blend of raw sewage, stormwater, commercial and industrial waste."

In a letter to Mr. Tyler Ahlgren (resident of Port Angeles),[9] Ted Sturdevant, Director of Ecology stated, "During that time, raw sewage would continue to spill into Port Angeles Harbor on a weekly basis in the winter. The sooner the City stops spilling sewage into the harbor, the better for Puget Sound."

Michael Puntenney, City Engineer, made a presentation on October 11, 2011[10] recognized that industrial wastes and toxic pollutants are contained in CSO and raw sewage overflows. He also presented information indicating that "…the annual discharge volume from CSO events is approximately 31.4 million gallons per year."

The city provides location maps and other information of the current and eliminated CSOs on its website at http://www.cityofpa.us/CSO.htm.

Section 9.0 Summary

Comment: It is inappropriate and premature to suggest any potential remedial or removal actions at this time. The Port Angeles Harbor SIR (E & E 2012, Sub-section 1.3.1) states: "The Harbor-Wide study was designed to provide data to support risk-based decisions for the harbor. The study is not intended to be an RI/FS."

This report clearly identifies the Rayonier Mill (a chlorine bleach mill) as a source of sediments and chemical contaminants to the "parting zones" and other areas throughout the harbor. However, the third full sentence in the second paragraph concludes that "…they are not present at detectable concentrations across the rest of the harbor." Several places in this document clearly state that contaminants from the Rayonier Mill likely have migrated to the inner harbor. Dioxin fingerprinting or fate and transport analysis have not been completed and the statement that Rayonier contaminants "are not present at detectable levels across the rest of the harbor," is unsupported and speculative.

Text: Third paragraph.

Comment: Again, dioxin fingerprinting and fate and transport have not been completed at this time. To speculate on "spatial patterns" within the net depositional inner harbor without considering the bathymetry within the inner harbor is arbitrary. The first sentence of this paragraph says that sources along the southern shoreline contribute. That is ambiguous. By 1971, all effluent discharges from the Crown Zellerbach Mill to the lagoon and the inner harbor were replaced by a deepwater outfall to the Strait of Juan de Fuca. There are no discharges from

---

[8] http://www.cityofpa.us/PDFs/PWorks/CSO-CityPresentation1-9-2012.pdf
http://www.cityofpa.us/PDFs/PWorks/CS0Presentation10-2011.pdf

[9] http://www.cityofpa.us/PDFs/PWorks/DeptofEcology-LettertoAhlgren12-2011.pdf

[10] http://www.cityofpa.us/PDFs/PWorks/CS0Presentation10-2011.pdf

the current NPIUSA Mill to the inner harbor or lagoon and there have not been any since 1988 when NPIUSA purchased the Mill, nor since 1971 where the Mill outfalls were directed to the Strait of Juan de Fuca.

Sub-section 9.2 Recommendations

Comment: To suggest any potential remedial or removal actions at this time is inappropriate and premature. The Port Angeles Harbor SIR (E & E 2012, Sub-section 1.3.1) states, "The Harbor-Wide study was designed to provide data to support risk-based decisions for the harbor. The study is not intended to be an RI/FS."

Sub-section 9.2.1 Wood Debris

Comment: Implying that removal of logs is a likely remedy I speculative because no feasibility study has been performed to evaluate the feasibility of such a remedial action. Sub-section 5.3.1 of this report (NewFields 2012) notes, "The removal of approximately 2,000 sunken logs from the log pond may have had a destabilizing effect, increasing the susceptibility of sediment erosion from within the log pond." This suggests one serious potential problem in wood or log removal.

More important, wood does not contain any hazardous substances and wood is not a hazardous substance, itself. In Arkema, Inc. v. Asarco, Inc., 2007 WL 1821024 (W.D. Wash. 2007), 2007 U.S. Dist. LEXIS 45511, Judge Leighton ruled in an unpublished opinion concerning the Head of the Hylebos remediation, with respect to "Wood Debris Accumulation" that:

- Wood is a naturally occurring substance comprised of three long-chain polymers cellulose, hemicellulose, and lignin.
- Wood does not contain any hazardous substances. Wood is not a hazardous substance.
- During the biological degradation process of wood, microorganisms may excrete hazardous substances such as ammonia, hydrogen sulfide and 4-methylphenol under very specific conditions, but such substances are not contained within the wood.
- While certain regulated phenols (2-methylphenol, 4-methylphenol, 2,4-dimethylphenol, benzyl alcohol, and benzoic acid) are considered to be wood-related chemicals, they are not chemicals contained in wood but are excreted by microorganisms feeding on wood during the biological degradation process under very specific conditions.

Ecology was involved in the Hylebos remediation and certainly aware or should certainly have taken notice of Judge Leighton's decision. Judge Leighton's decision in Arkema, Inc. is rich in scientific factual support for the Finding of Fact and Conclusion of Law that "Wood is not a hazardous substance." Nevertheless, in this report that Ecology plainly acknowledges is not a remedial investigation or feasibility study, Ecology states that "removal of significant deposits of wood debris" will "likely" be required remediation. That is speculative and arbitrary. Secondarily, Ecology's vague statement that "best management practices for reducing wood debris would also need to be implemented following wood debris remediation" is arbitrary and may be beyond Ecology's statutory authority under MTCA and the SMS. Further, if Ecology wants to declare that wood is a hazardous substance, particularly when it has been involved previously at sites like the Hylebos where wood was ruled as a matter of law to not be a

hazardous substance, Ecology must use notice and comment rulemaking to declare wood a hazardous substance—not oblique comments in a report like this that is not even an RI/FS.

Sub-section 9.2.2 Upland Source Control

Comment: The results of the Port Angeles Harbor SIR did not identify "western harbor contaminant source(s)". This has yet to be performed and therefore control of any potential sources is a very premature discussion. These inferences of source should be removed until such potential sources have been identified.

Stormwater from creeks, urban runoff, and combined sewer overflows should be listed as one of the sources of potential contamination. (See comments on CSOs in Sub-section 5.1.2 above).

Sub-section 9.2.3 Cleanup of Sediment Hotspots

Comment: As discussed previously, suggesting potential remedial or removal actions at this time is inappropriate and premature. The Port Angeles Harbor SIR (E & E 2012, see Sub-section 1.3.1) states, "The Harbor-Wide study was designed to provide data to support risk-based decisions for the Harbor. The study is not intended to be an RI/FS."

Section 10.0 References

No comments.

Port Angeles Harbor Sediment Characterization Study, Port Angeles, Washington, Sediment Investigation Report, Public Review Draft

Disclaimer

Text: "At the direction of Ecology, E & E's data analysis was subsequently edited and reorganized to produce this Public Review Draft data report. All data analysis and recommendations presented in this report are based upon E & E's data results, presentation, and evaluation."

Comment: The use of this disclaimer in an Ecology lead report is difficult to understand. What does it mean? The report was contracted and directed by Ecology, detailing the environmental conditions in Port Angeles Harbor presented to the public. Does Ecology stand by this report? The recommendations in this report differ from those in the Supplemental Data Evaluation (NewFields 2012)? Why do recommendations presented in the two reports differ? The Supplemental Data Evaluation (NewFields 2012) is not listed in the reference list; it should be added.

Executive Summary

Introduction

Comment: The third paragraph in the introduction identifies several of the studies performed in the Harbor. It is unclear whether certain of these studies are based on methods, theories,

principles or techniques generally accepted in the relevant scientific community, or whether the conclusions of these reports are scientific in nature, at all. Further, the discussion does not mention Appendix J – Fingerprinting memo and analysis (E & E 2012). Is there a reason for leaving this out of the discussion?

Sampling and Analysis

Text: "In this report, sediment chemistry results are only compared to LAET criteria when total organic carbon (TOC) concentrations are outside the range of 0.5 to 3.5 percent or when SMS criteria do not exist for an analyte."

Comment: What is the basis for using this range?

Summary of Surface Sediment Chemistry and Bioassay Results

Comment: Why did Ecology see such a high percentage of bioassay failures with no exceedances of chemical sediment criteria?

Screening-Level Human Health and Ecological Risk Assessment

As noted in the document, the human health risk assessment (HHRA) and ecological risk assessment (ERA) are screening level assessments. The few site-specific assumptions applied are conservative assumptions that overestimate exposure and/or effects. Screening level assessments are useful tools for identifying risk drivers and major areas of uncertainty for more detailed analysis in a site-specific assessment. However, any decisions on remedial actions at the site should be based on site-specific assessments, not the screening level assessments included in this report. In addition, consistent with the terminology used in Section 10 of the report, Appendix G should be titled "Screening-Level Human Health and Ecological Risk Assessment**.**

Section 1.0 Introduction

Comment: The third paragraph in the introduction mentions several of the studies performed in the harbor, but does not mention Appendix J (i.e., Fingerprinting memo and analysis). Section 4.0 of the Supplemental Data Evaluation (NewFields 2012) summarized some fingerprinting analyses, but does not reference the analyses of Appendix J (E & E 2012). The likely reason for this is that the analyses of Appendix J overly simplistic and not particularly useful (see comments on Appendix J below).

Sub-section 1.1 Overview of Investigation Area

No comments.

Sub-section 1.2 Previous Investigations

No comments.

Sub-section 1.3 Goals and Objectives

No comments.

Sub-section 1.3.1 Harbor-Wide Study Area

Text: The bottom of page 3 states, "The Harbor-Wide study was designed to provide data to support risk-based decisions for the harbor. The study is not intended to be an RI/FS."

Comment: This statement should be carried throughout the document. In various sections of this and the Supplemental Data Evaluation (NewFields 2012), discussion of cleanup, remedial, and removal actions are discussed. These discussions are inappropriate for documents of this type that are not MTCA equivalent remedial investigations or feasibility studies, much less cleanup action plans. Neither report should contain discussion of cleanup, remedial, and removal actions.

Sub-section 1.3.2 Rayonier Mill Study Area

Text: The Rayonier Mill study was intended to fill data gaps and augment data and information from previous studies. The data were intended to be interpreted and reported as part of the Harbor-Wide study. Separate interpretation and reporting of the results within the marine portion of the Rayonier Mill study area was not an objective of this study.

Comment: This text is confusing. Any data collected for the Rayonier Mill study should clearly be used in the evaluation of Harbor-Wide issues. Is this the intent of Ecology?

Sub-section 1.4 Study Design

Sub-section 1.4.1 Harbor-Wide Investigation Study Design

Comment: The specific objectives of the harbor-wide investigation (Final Port Angeles Harbor Sediment Characterization Study SAP/QAPP, June 26, 2008 prepared by E & E, Section 2.3.1) were to:

1. Characterize sediment quality and conditions at locations throughout the Harbor.
2. Fill data gaps in existing knowledge, as identified in the Port Angeles Harbor Summary of Existing Information and Data Gaps Report (E & E 2008b).
3. Identify terrestrial and aquatic sources of chemical contaminants, wood waste, and woodwaste-related degradation products.
4. Evaluate human health and ecological risk from Harbor sediments. For further information on the Risk Assessment, refer to the Human Health and Ecological Risk Assessment Work Plan for Port Angeles Harbor Marine Environment, which is in Appendix D.
5. Evaluate bottom currents and sediment transport in the Harbor. See Appendix E and F for detailed information on field implementation of these studies.

Ecology should note that Section 11 of this Port Angeles Harbor SIR (E & E 2012) clearly details that Ecology did not meet the objectives of Items 1 and 2 above. Based on Section 11, significant additional work is required to characterize all, but three of the APOCs and sources have not been identified. How does Ecology reconcile not meeting these objectives?

Sub-section 1.4.2 Rayonier Mill Investigation Study Design

Comment: Ecology stated in the Final Port Angeles Harbor Sediment Characterization Study SAP/QAPP, June 26, 2008 prepared by E & E, Section 2.3.1 that the goals of the Rayonier Area Investigation was to supplement existing data and information collected in previous Marine Remedial Investigation (MRI) studies. The specific objectives of the Rayonier area investigation were to:

1. Further delineate the horizontal and vertical distribution of mill-related contaminants in marine sediments around the former mill;
2. Characterize the depth of wood waste and debris around the Mill Dock and the Log Pond areas; and
3. Characterize the presence of mill-related contaminants at and near the mouth of Ennis Creek.

The goals of this study were not met, as Section 11.2 of this Port Angeles Harbor SIR (E & E 2012) state that further work is required to delineate the spatial extent of the dioxins/furans between the Rayonier Mill area and the Red Lion area. How does Ecology reconcile not meeting these objectives?

Sub-section 1.4.3 Human Health and Ecological Risk Assessment Study Design

Comments on the human health risk assessment (HHRA) and ecological risk assessment (ERA) are provided for Section 10 and Appendix G, which describes those studies and are incorporated here by reference. However, consistent with Section 10, reference to the HHRA and ERA in this and other sections should state that they are “screening-level” risk assessments.

Sub-section 1.4.4 Sediment Trend Analysis Study Design

No comments.

Sub-section 1.4.5 Current Analysis Study Design

No comments.

Sub-section 1.4.6 Geomorphic Report Study Design

Comment: The geomorphic report intended to provide a qualitative model of sediment transport in the harbor. This section should contain a discussion of the assumptions and major qualifying factors in the analysis such as:

- Only one month of current data was evaluated
- Extreme events were discussed but no quantitative information was provided to determine the magnitude, timing or effects of such events
- The nature and quality of the sediments being delivered to the harbor were not measured, but merely estimated

Sub-section 1.4.7 Deviations from Study Design

See discussion in Section 1.4.1, 1.4.2, and 3.1.2.

Sub-section 1.5 Report Organization

No comments.

Section 2.0 Summary of Existing Information

Comment: NewFields (2012) uses only five studies in their spatial analysis instead of all the studies from the last 15 years that are listed in this section. NewFields should use the available data in their analysis.

Sub-section 2.1 Potential Sources of Contamination

Comment: Stormwater from creeks, urban runoff, and combined sewer overflows should be listed as one of the sources of potential contamination. (See CSO comments in previous sections above).

Sub-section 2.1.1 Rayonier Mill Site

No comments.

Sub-section 2.1.2 Wood-Debris-Producing Facilities

No comments.

Sub-section 2.1.3 Marine Shipping and Services

Shipbreaking (or dismantling) of an aircraft carrier in 1990 at Terminal 1 is reported, but Ecology should identify the operation or operator responsible. This should be based on more than a "personal communication." Because such activity can result in releases of hazardous substances, it is very important and should not be treated otherwise.

Sub-section 2.1.4 Creosote-Treated Marine Lumber

No comments.

Sub-section 2.1.5 Municipal Facilities

See comments on CSOs above related to the Supplemental Data Evaluation Sub-section 5.1.2.

Sub-section 2.1.6 Petroleum Storage Facilities

Ecology should identify the operator responsible for "the largest spill in Washington State History" in the Arco Anchorage grounding.

Sub-section 2.1.7 Commercial Fishing and Shellfish Harvesting

No comments.

Sub-section 2.2 Contaminants of Potential Concern

No comments.

Sub-section 2.2.1 Polychlorinated Dibenzo-P-Dioxins and Polychlorinated Dibenzofurans

Comment: The concentrations of TCDD TEQs are only presented as dry weight basis. Reviewing these and other "lipophilic" chemicals on an organic carbon normalization basis would be useful.

Text: "study results found high concentration"

Comment: In addition, the inference that "study results found high concentration" is a misleading conclusion and should be removed.

Sub-section 2.2.2 PCBs

Sub-section 2.2.3 Chlorinated Pesticides

Sub-section 2.2.4 Semivolatile Organic Compounds: PAHS, Phenols, and Phthalates

Sub-section 2.2.5 Resin Acids/Guaiacols

Are resin acids and guaiacols in Port Angeles Harbor in chlorinated form and linked to chlorine bleach pulping effluents? Ecology should identify the historic kraft mills in the harbor that it is referring to.

Sub-section 2.2.6 Butyltins

Sub-section 2.2.7 Metals

Sub-section 2.3 Summary of Existing Biological Information

The last paragraph of the section discussed data and conditions regarding paper mill discharge and sulfides in the harbor in 1968. Current conditions in these areas are significantly different. Specifically, near shore mill discharges to the inner harbor from various locations was discontinued. The former Crown Zellerbach facility discontinued discharging to the western harbor from historic outfalls in these areas in 1971.

Sub-section 2.4 Physical Oceanography: Current Modeling

Section 3.0 Sampling and Analytical Methods

Sub-section 3.12 Deviations from Sampling and Analysis Plan

The fourth bullet in this section is significant. The reference sediment samples for the bioassay study are NOT representative of the grain size observed in the bay-wide samples. They were predominantly sandy. This has a significant impact on the analysis of bioassay results and should be noted in this bullet.

The last bullet indicates unplanned sampling. Please identify those samples identifications.

Section 4.0 Data Validation

Text: Analytical results from the sediment chemical analysis underwent a QA1 review by E & E staff to determine whether the data were acceptable for use (Section 4). A third-party QA Level 2 (QA2) review was also conducted at the request of Ecology so that sufficient documentation would exist if regulatory actions required a high level of validation."

And in Appendix H:

"The analytical data provided by the laboratory were reviewed for precision, accuracy, and completeness per Washington Department of Ecology (Ecology) Quality Assurance Review Guidance for the quality assurance review level 1 review (QA1) of sediments (PTI, 1989). Specific criteria for QC limits were obtained from the project QAPP and Ecology Sediment Sampling and Analysis Plan Appendix. Compliance with the project QA program is indicated on the in the checklist and tables. Any major or minor concern affecting data usability is summarized below. The checklist and tables also indicate whether data qualification is required and/or the type of qualifier assigned."

Comment: As noted, the data validation was performed to level 1 and 2. Does Ecology plan on a more in-depth QA/QC analysis? If so, when will this be provided for review?

Section 5.0 Sediment Chemistry Results and Comparison with Criteria

Text: third bullet

Comment: It is in appropriate to be comparing sediment chemistry results to the NOAA sediment quality guidelines (SQGs).

Section 6.0 Sediment Toxicity Test Results (Michael to add)

Sub-section 6.1 Sediment Toxicity Tests

Sub-section 6.1.1 Acute 10-Day Amphipod Test

No comments.

Sub-section 6.1.2 Acute Larval Echinoderm Development Bioassay

Ecology states in this section that 29 of the 59 stations did not meet the SQS criteria for this test, and 12 of those also did not meet the CSL criteria. Although this may be strictly true, it is misleading without the full context of the tests. As noted in Section 6.4 of the *Supplemental Sediment Investigation Report*, the apparent assay failures could very well be explained by the limitations in the assay methodology whereby a flocculant layer formed as a result of the presence of fine grain materials prevents counting of normally developed larvae. Thus, it is inaccurate to conclude these samples "fail" the bioassays. Rather, the method was inadequate for the conditions. Ecology notes in Section 6.4 of the *Supplemental Sediment Investigation Report* that a modified larval development bioassay has been developed that includes sediment resuspension to obtain a more accurate count of larvae. This method was not used in the Port Angeles sediment investigation but will need to be applied in order to derive conclusions for bioassay testing. This point is critical considering the few exceedances for other bioassays.

Interpretation of bioassay testing will only be possible when limitations in the prior larval development bioassay results are addressed by application of the modified method to additional samples.

Sub-section 6.1.3 Chronic Juvenile Polychaete Test

No comments.

Sub-section 6.2 Surface Sediment Bioassays Summary

This section requires a more complete summary of bioassay results, including:

- The inadequacy of the methodology used in the larval development bioassay that limit interpretation. As discussed in comments on sub-section 6.1.2, it is inaccurate to conclude these samples "failed" the bioassays.
- The spatial distribution of the bioassay results. The larval development bioassay was the most frequent bioassay with SMS exceedances. But outside of the area around the former Rayonier site, only one sample had an exceedance of SQS (but not CSL) for polychaete growth and none for amphipod mortality. The brief summary of the bioassay results provides little sense of the concentration of bioassay failures around the Rayonier facility and lack of true exceedances elsewhere in the Harbor.

Sub-section 6.3 Relationship Between Bioassay and Surface Chemistry SMS Exceedances

This section requires a fuller characterization the potential relationship between SMS chemical and bioassay results. Ecology states: "Of the locations with co-occurring SMS chemical and bioassay exceedances, metal exceedances in western Port Angeles Harbor were associated with failure of the larval development bioassay." For several reasons, this statement is misleading. First, out of 59 stations, only 5 had exceedances of both SMS chemical and bioassay criteria. Second, the specific chemical responsible for the chemical exceedances varied by station. Third, there were 7 stations that exceeded chemical criteria but not bioassay criteria. Fourth, only one station in the western portion of the Harbor had an exceedance on a bioassay other than the larval echinoderm development bioassay. As noted in comments above, because of limitations in the larval development bioassay as conducted on site samples, it is inaccurate to conclude these samples "failed." Thus, not only is there no correlation between SMS chemical and bioassay test results, most bioassay "exceedances" should not be considered exceedances at all. As Ecology notes in Section 6.4 of the *Supplemental Sediment Investigation Report*, "sediment toxicity in Port Angeles Harbor cannot be easily attributed to co-occurring SMS COPCs."

Sub-section 6.4 Regression Analysis of Bioassay Results and Conventional Parameters

For the purpose of interpreting the bioassay results, this section should also include the most important information from Section 6.4 of the *Supplemental Sediment Investigation Report*: the most common bioassay exceedance, the echinoderm larval development bioassay (and outside of the area around the former Rayonier property, virtually the only bioassay exceedance), cannot be explained by sulfide and ammonia because they are removed as part of the assay methodology.

Section 7.0 Distribution of Chemical Compounds in Tissue Samples

No comments.

Section 8.0 Wood Debris Characteristics and Distribution in Port Angeles Harbor Sediments

Comment: Historically, a large number of mills and timber related industries located along the harbor. From its founding in the mid-1800s, Port Angeles' primary industry in was the processing of wood and products from the surrounding forests. The operations listed are only a subset of the historic operations and this should be noted, or Ecology should be complete in its listing.

8.1 Wood Debris in Surface Sediments

8.1.1 SAIC 1999 Sediment Profile/Plane View Survey of Port Angeles Harbor

Comment: The first sentence cites Figure 8-1 and represents recent log rafting areas. Historic outfalls are not mentioned. The city provides location maps and other information of the current and eliminated CSOs at http://www.cityofpa.us/CSO.htm.

Sub-section 8.1.3 Percentage Wood Debris in Surface Samples Collected in 2008 for the Sediment Investigation Study

Sub-section 8.1.4 Comparison of the Distribution of Wood Debris among Studies

Sub-section 8.2 Wood Debris in Subsurface Sediments

Section 9.0 Summary of Sediment Transport Processes

Sub-section 9.1 Sediment Sources and Budget

Comment: Because the sediment input to the harbor are estimated and not measured, this discussion of sediment sources and budget should be highly caveated. It is at best a qualitative estimate of what is actually occurring. Additionally, Appendix I does not include a discussion of the CSOs and their impact as sources to the harbor. Port Angeles has a long history of reported CSO impact on the harbor. This lack of information on the known source inputs to the harbor is irreconcilable in the document. See comments on CSOs above related to the Supplemental Data Evaluation Sub-section 5.1.2.

Sub-section 9.2 Wave Action and Alongshore Drift

Sub-section 9.3 Tidal Currents

Text: "A key finding of the current study was that, contrary to results of previous numerical and laboratory modeling, the strongest current events at each tripod occurred at different times, with no significant current being observed at the other tripods during each of these events. This is interpreted to indicate that a single tidal eddy postulated in some previous studies likely does not represent the most important current events that initiate or maintain sediment transport. The most intense currents observed during the deployment (particularly at Station #2) were consistent with highly localized tidal eddies (Appendix I).

Comment: The current study collected data on current profiles for only a one month period from March 26 to April 25, 2008. The instrument used at Station 2 had a manufacturing defect that was not detected until recovery of the instrument, and resulted in 26-days of current data collection versus the month long (30-day) data collection time frame at Stations 1 and 3.

Evans-Hamilton (2008) (see Appendix D, E & E 2012) only collected current data for one month from March 26 to April 25, 2008. This section should reflect this shortcoming of not having an evaluation of near sediment current data over a longer, and more importantly seasonal basis.

Sub-section 9.4 Counterflow Currents

Sub-section 9.5 Sediment Gravity Flows

Sub-section 9.6 Extreme Weather Events

Sub-section 9.7 Summary

Section 10.0 Summary of Screening-Level Human Health and Ecological Risk Assessment

Comment: Section 10 of the Sediment Investigation Report provides a very brief summary of results for the HHRA (Section 10.1) and ERA (Section 10.2), which are included as Appendix G. Comments on the HHRA and ERA are referenced to the applicable sections in Appendix G.

As noted in the document, the human health risk assessment (HHRA) and ecological risk assessment (ERA) are screening level assessments. The few site-specific assumptions applied are conservative assumptions that overestimate exposure and/or effects. Screening level assessments are useful tools for identifying risk drivers and major areas of uncertainty for more detailed analysis in a site-specific assessment. However, any decisions on remedial actions at the site should be based on the site-specific assessments, not the screening level assessments included in this report. In addition, consistent with the terminology used in Section 10 of the report, Appendix G should be titled "Screening-Level Human Health and Ecological Risk Assessment."

Sub-section 10.1 Human Health Risk Assessment Summary

See comments at Section 10.0.

Sub-section 10.2 Ecological Risk Assessment Summary

See comments at Section 10.0.

Section 11.0 Summary, Conclusions, and Recommendations

Comment: Sub-section 11.2 of this report details the conclusions and recommendations that find that only three of the 16 AOCs (i.e., Red Lion, Outer Harbor, and Eastern Intertidal/Subtidal areas) require no further action. The data gaps identified as remaining after this expensive and time consuming set of studies are extensive and fall into several categories:

- Lack of understanding of the depth of contamination
- Lack of delineation of the lateral extent of contamination
- Lack of understanding why samples failed bioassay when no chemical exceedances were observed
- Lack of geoduck tissue samples
- A request for "grid" sampling to determine the spatial extent in the surface and subsurface sediment concentrations.

Why are these recommended actions so much greater than and completely different and inconsistent with those contained in the Supplemental Data Evaluation (NewFields 2012)? The Supplemental Data Evaluation provides a further in-depth analysis and has the following recommendations:

- Section 8.1: "…addition(al) samples in the inner harbor would help delineate…"
- Section 8.4: "…additional sampling for toxicity testing is warranted in the inner harbor and lagoon…"
- Section 8.7: "Suspect outfalls should undergo sampling and chemical analysis of effluent water and solids….
- Section 9.2.2: "…Identification of western harbor contaminant source(s) will likely require sampling and analysis of stormwater, surface runoff, and industrial outfalls discharging to the western harbor and lagoon."

The inconsistency between these two documents cannot be reconciled.

Sub-section 11.1 Summary

See comments at Section 11.0.

Sub-section 11.1.1 Surface Sediment Chemistry and Bioassays

See comments at Section 11.0.

Sub-section 11.1.2 Subsurface Sediment Chemistry

See comments at Section 11.0.

Sub-section 11.1.3 Tissue Chemistry

See comments at Section 11.0.

Sub-section 11.1.4 Distribution of Wood Debris

See comments at Section 11.0.

Sub-section 11.1.5 Sediment Transport

See comments at Section 11.0.

Sub-section 11.1.6 Human Health and Ecological Risk Assessment

See comments at Section 11.0.

Sub-section 11.2 Conclusions and Recommendations

See comments at Section 11.0.

Section 12.0 References

No comments.

Appendix A Field Data Log Sheets

No comments.

Appendix B Station Locations and Sample Descriptions

No comments.

Appendix C Sediment Investigation Data Tables

No comments.

Appendix D Current Data Collection Analysis Report

See comments to the two reports E & E (2012) and NewFields (2012).

Appendix E Sediment Trend Analysis Report

See comments to the two reports E & E (2012) and NewFields (2012), Section 5.0.

Appendix F Cultural Resources Monitoring Report

No comments.

Appendix G Human Health and Ecological Risk Assessment

Sub-section 3.5.1.1 Adult Subsistence Fisher
Sub-section 3.5.1.2 Child Subsistence Fisher
Sub-section 3.5.2.2 Child Recreational Fisher
Attachment C Human Health Exposure Parameters and Risk Characterization Tables

Comments: Specific Comments on Exposure Factors Used in the HHRA

Sediment Ingestion Rate – Ecology applied a sediment ingestion rate during shellfishing activities equal to the default soil ingestion rate (100 mg/day for adults; 200 mg/day for children) with the rationale that there is no default sediment ingestion rate available. This would significantly overestimate typical sediment ingestion relative to soil ingestion for two reasons:

1. The soil ingestion is a function of both outdoor soil/dust and indoor dust ingestion and, in fact, dust ingestion accounts for more than half of the soil ingestion rate. For example, in EPA's IEUBK lead model the default assumption is that indoor dust accounts for 55% of total daily soil ingestion.

Thus, at most, the sediment ingestion rate during shellfishing activities should be only 45% of a soil ingestion rate.

2. The outdoor soil/dust component of the soil ingestion rate is largely a function of a) hand to mouth transfer of soil adhering to the skin, and b) soil/dust that is inhaled, the majority of which is subsequently transferred to the gastrointestinal tract via the mucociliary escalator. Wet sediment would not adhere to the skin to the same degree as dry soil/dust, nor would there be the airborne, inhaled component as there is with soil. Therefore, sediment ingestion would be less than the 45% soil component of the soil ingestion rate.

Seafood Consumption Rate – Ecology applied an adult subsistence seafood consumption rate of 583 g/day (pelagic fish 56 g/d; bottom fish 29 g/d; shellfish 498 g/d). This seafood consumption rate was recommended by the LEKT, based on an EPA Region 10 analysis of data from the Suquamish fish consumption survey, excluding salmon (in the "*Framework*" document [11]). It represents an extreme upper percentile consumption rate (95th percentile, as calculated by EPA in their *Framework* document) from a very high seafood consuming population. The underlying data from the Suquamish study are not publicly available, only the summary results. EPA's analysis and EPA's *Framework* document, in which the analysis is presented, have not received external peer review or public comment. It is inappropriate for use in the Port Angeles Harbor HHRA for several reasons, including:

1. Ecology released a draft Fish Consumption Rates Technical Support Document (TSD) in September 2011.[12] The draft TSD states, "Ecology believes that a default fish consumption rate (or rates) should be protective of all people in Washington who eat fish, including those individuals that eat a lot of fish, such as Native Americans, Asian and Pacific Islanders, and some recreational fishers." Based on this premise, Ecology reviewed available regional subsistence seafood consumption data (including the Suquamish Tribe study) and recommended use of a seafood consumption rate in the range of 157 to 267 g/day as protective of "both the general population and high exposure groups." The seafood consumption rate applied in the Port Angeles Harbor HHRA (583 g/day) is more than double the upper end of the range of seafood consumption rates (267 g/day) Ecology believes is protective for subsistence seafood consumers, including Native Americans.
2. Port Angeles Harbor is not likely to sustainably support the level of shellfish harvest implied by the seafood consumption rate assumed in the HHRA. Future development plans for the Harbor will further limit shellfish availability.

---

[11] U.S. EPA. 2007. Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-based Decision-making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia. Working Document. Rev. 00. Office of Environmental Cleanup, Office of Air, Waste, and Toxics, Office of Environmental Assessment, U.S. Environmental Protection Agency Region 10, Seattle, Washington. August.

[12] Ecology. 2011. Fish Consumption Rates Technical Support Document. A Review of Data and Information About Fish Consumption in Washington. Washington Department of Ecology. Publication no. 11-09-050, Version 1.0. September.

3. EPA Region 10 recommends a lower consumption rate (97.5 g/day, excluding salmon, based on data from the Tulalip Tribe fish consumption study) for areas that don't have "high-quality" shellfish beds. While LEKT members may consume high amounts of shellfish, only the portion that is derived from the Harbor should be included in the HHRA shellfish consumption pathway exposure estimate. The HHRA needs to present documentation to demonstrate the Harbor supports high-quality shellfish beds that could sustainably support this level of shellfish consumption. It is noteworthy that there were relatively few shellfish available for sampling, suggesting the Harbor would not support high shellfish consumption.

Fractional Intake of Seafood from the Site – Ecology applied a fractional intake from the site for subsistence seafood consumption of 1.0, assuming that all seafood consumed by the Tribe is harvested from the Harbor (excluding salmon). This is inconsistent with the MTCA default assumption (FI=0.5), highly unlikely given the extreme seafood consumption rate used vs. the availability of the resource in the Harbor both currently and in the future, and inconsistent with actual harvest patterns.

Skin Surface Area for Dermal Contact with Sediment – Ecology assumes a skin surface area in contact with sediment of 6,125 cm^2 for adults and 2,800 cm^2 for children 0 to 6 years of age, citing the 1997 version of EPA's Exposure Factors Handbook. These skin surface areas correspond to the sum of the mean surface areas of the head, forearms, hands, lower legs, and feet. This assumes these skin areas would be in contact with sediment for the entirety of the exposure time (i.e., 24 hours per event; see next comment). It is unlikely this skin surface would have a layer of sediment adhered to it for each of the assumed 104 shellfish harvesting days per year assumed in the HHRA for both adults and children. In particular, it is unlikely the head would come into any significant contact with sediment and should be removed from the total. EPA updated Exposure Factors Handbook in 2011.[13] The updated version should be used and referenced.

Event Time for Dermal Contact with Sediment – Ecology applies an event frequency of 1 event per shellfishing day, consistent with EPA (2004) Dermal Exposure guidance.[14] However, this is based on assumptions for soil contact and the underlying assumption is that soil would remain in contact with skin for 24 hours after each event:

> "…the equation for DAD [dermally absorbed dose] presented in this guidance assumes (by default) that the event time is 24 hours, (i.e., that no washing occurs and the soil remains on the skin for 24 hours). This assumption probably overestimates the actual exposure time for most site-specific exposure scenarios and is likely to result in an overestimate of exposure." EPA (2004)

---

[13] U.S. EPA. 2011. Exposure Factors Handbook: 2011 Edition. U.S. Environmental Protection Agency. EPA/600/R-090/052F. September.

[14] U.S. EPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final. U.S. Environmental Protection Agency. EPA/540/R/99/005. July.

As EPA (2004) notes, this is likely to overestimate soil contact time with skin. This would be an even larger overestimate of sediment contact time with skin. Even under the unlikely scenario where a layer of sediment remained in contact with the entire skin surface area assumed in the HHRA during the shellfishing event, it would almost certainly be washed off most of that skin surface area by the end of the event. EPA (2004) states, "sediments which are consistently covered by considerable amounts of water are likely to wash off before the individual reaches the shore." Thus, the dermal dose should be adjusted by an event time (a fraction of 24 hours) not to exceed the expected duration of the shellfishing event.

Sub-section 4.3 Risk Evaluation for Marine Plants and Macroalgae

Comment: One of the major conclusions of the ERA is that "marine vegetation and benthic invertebrates are the receptor groups most at risk from current environmental conditions in Port Angeles Harbor. The benthic invertebrates are discussed in the next comment. Regarding marine vegetation, Ecology states "20 to 25% of the sediment surface area of Port Angeles Harbor is affected by wood debris and that most of the debris is located in the inner portion of the harbor." Ecology supports this conclusion by citing the following:

- a sediment profile imaging/plane view camera survey conducted by SAIC (1999)
- estimation of the amount of wood debris in sediment grab samples from the 2008 investigation
- a "sediment trend analysis" by GeoSea (2009)

Ecology states that results were similar from these three studies. However, this overstates the similarity of endpoints evaluated in the three studies. Taken together, these studies do not adequately support Ecology's conclusion that the ability of the Harbor to support a plant and macroalgae community is compromised. Only SAIC (1999) examined the sediment surface, providing the possibility for direct evaluation of the community. But that study is over a decade old. The two more recent studies examined the extent and/or ratio of wood waste in sediment samples, which only indirectly addresses the health of the plant and macroalgae communities. Given that effects on marine vegetation are one of the few conclusions from the ecological risk assessment and could drive remedial actions, a stronger basis for the conclusion is necessary. Ecology's rationale is based on the following: 1) wood waste is prevalent, to some extent, in a significant percentage of the harbor; 2) areas of sediment with heavy wood waste accumulation found by SAIC (1999) were "generally" characterized by high oxygen demand and, in some areas, methane bubbles and bacterial mats, indicating that the sediments were found to be anoxic; 3) wood waste can be associated with anoxic conditions detrimental to plant growth. Ecology concluded, "it seems reasonable to hypothesize that the ability of Port Angeles Harbor to support marine plants and macroalgae has been compromised."

Although one could potentially hypothesize the plant and algae community in Port Angeles Harbor has been compromised, it does not rise to the level of a risk assessment conclusion, nor is it supportable as a risk assessment prediction. Key elements required to evaluate this hypothesis include:

1. A more detailed analysis of the amount of wood waste in specific areas and the association with plant and algae community degradation.
2. A more comprehensive, and up to date, video survey of the Harbor, including both wood waste impacted areas and unimpacted areas. Ecology makes the point that the three studies are consistent despite being conducted 10 years apart. However, only SAIC (1999) included a video survey and it is unclear how comprehensive that study was and how well characterized the degree of impact on plant and algae communities.
3. Based on an analysis of an updated video survey in conjunction with the past survey, an evaluation of both the current health of the plant and algae community and of the current trajectory of progression of plant, algae, and benthic communities (i.e., towards degradation or recovery).

Sub-section 4.4 Benthic Invertebrate Risk Evaluation
Sub-section 4.4.2 Sediment Bioassays

Comment: Ecology indicates that "…Section 6.4 of the revised [Supplemental] Sediment Investigation Report examines relationships between bioassay results, conventional parameters (e.g. sulfide and ammonia), and wood debris parameters (e.g., percent wood debris and organic acids)," then discusses relationships with these parameters and the bioassay results. For the purpose of interpreting the bioassay results, this section should also include the most important information from Section 6.4 of the Supplemental report: the most common bioassay exceedance, the echinoderm larval development bioassay (and outside of the area around the former Rayonier property, virtually the only bioassay exceedance), cannot be explained by sulfide and ammonia because they are removed as part of the assay methodology. Rather, the apparent assay failures could very well be explained by the limitations in the assay methodology whereby a flocculant layer formed as a result of the presence of fine grain materials prevents counting of normally developed larvae. Thus, it is inaccurate to conclude these samples "fail" the bioassays. Instead, the method was inadequate for the conditions. As noted in Section 6.4 of the *Supplemental Sediment Investigation Report*, a modified larval development bioassay has been developed that includes sediment resuspension to obtain a more accurate count of larvae. This method was not used in the Port Angeles sediment investigation but will need to be applied in order to derive conclusions for bioassay testing. This point is critical considering the few exceedances for other bioassays.

Appendix G, Attachment H

Comment: The letter included as Attachment H to Appendix G states that Ecology's SAB recommended a fish consumption rate for the site of 583 g/day, based on the Suquamish study data. However, the letter does not provide a citation to support this recommendation. To our knowledge the SAB never made a formal recommendation for a fish consumption rate for the Port Angeles sediment investigation. The SAB's actual conclusion is different, and does not imply agreement with the fish consumption rate calculated by EPA Region 10 from the Suquamish study data, nor did they weigh in on how to apply that rate in a risk assessment for Port Angeles harbor:

"The Board concluded that it is scientifically defensible to use the fish consumption survey completed by the Suquamish Tribe to estimate fish and shellfish consumption exposures for members of the LEKT."[15]

Appendix G, Attachment I

Comment: This attachment presents exposure assumptions used in the IEUBK lead model (for child exposures) and the adult lead model (ALM). The IEUBK and ALM are designed to be applied using average/central tendency values as input. A geometric standard deviation (GSD) for blood lead values in the general population is then applied to account for variability and predict an upper end blood lead value. Thus, the output of the model using central tendency input provides the equivalent of a RME output. In some cases Ecology used central tendency input (e.g., average lead concentrations). For other input parameters Ecology used upper end assumptions, most notably the fish consumption rate in the ALM. The fish consumption rate of 583 g/day is an extreme upper end consumption rate from a high consuming population (the Suquamish Tribe) in an area with high quality shellfish beds.

Appendix H Chemistry Data Validation Memoranda

Text: "The analytical data provided by the laboratory were reviewed for precision, accuracy, and completeness per Washington Department of Ecology (Ecology) Quality Assurance Review Guidance for the quality assurance review level 1 review (QA1) of sediments (PTI, 1989). Specific criteria for QC limits were obtained from the project QAPP and Ecology Sediment Sampling and Analysis Plan Appendix. Compliance with the project QA program is indicated on the in the checklist and tables. Any major or minor concern affecting data usability is summarized below. The checklist and tables also indicate whether data qualification is required and/or the type of qualifier assigned."

Comment: As noted in this section, the data validation was performed to level 1 and 2. Does Ecology plan on a more in-depth QA/QC analysis? If so, when will this be provided for review?

Appendix I Geomorphic Report

See comments to the two reports E & E (2012) and NewFields (2012).

[15] Ecology. 2008. MTCA Science Advisory Board March 11, 2008 Meeting Summary. Washington State Department of Ecology.

Appendix J Fingerprinting Memo and Analysis

E&E. 2010. Technical Memorandum. Port Angeles Harbor Sediment Characterization Study, Potential for Fingerprinting Analysis using Sediment Data. Prepared for Washington Department of Ecology, Toxics Cleanup Program, Lacey, WA. Ecology and Environment, Inc., Seattle, WA.

Section 1 Introduction

Fingerprinting of data (unclear what this means). Description is unclear. Fingerprinting techniques can be used on more media than just sediments.

Appendix J: "For this initial evaluation, three lines of forensic evidence were investigated to indicate how well the data can support differentiation between sources of containments: total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), and dioxins/furans"

Comment: TPH, PAHs, and dioxins/furans are compound groups. If these compound groups are multiple lines of evidence, what question is Ecology addressing?

Section 2 Fingerprinting Usability

Appendix J: "In developing this preliminary indication of the usefulness of the analytical data to differentiate between sources of contaminants, only un-annotated data measured at concentrations three times or more above the PQL are used to estimate the viability of the data for further analysis."

Comment: Does this statement mean that Ecology is excluding unqualified low concentration data? If the PQL is 3 to 5 times the MDL, 3 times the PQL would be 9 to 15 times the MDL. Ecology should clarify with precision. See also the comments to Sub-section 4.3 of the Supplemental Data Evaluation report.

Section 3 Port Angeles Harbor Sampling

Appendix J: "For this screening level evaluation, samples identified as the first subsurface depth interval analyzed below surface were combined and are referred to as "shallow" subsurface samples. The "shallow" sample intervals were generally 15–30 cm or 30–61 cm, with some deeper intervals. Samples that came from the second or other subsurface horizons were combined and are referred to as "deeper" subsurface samples. "Deeper" samples were generally taken from greater than 90 cm in depth, although there were some shallower samples."

Comment: This kind of grouping may be inappropriate without considering deposition rates and the age of the sediments.

Section 4 Analytes Considered for Fingerprinting

Appendix J: "The following subsections discuss the fingerprinting potential of TPH, PAH, and dioxin/furan sediment data from the Port Angeles Harbor Sediment Characterization Study."

Comment: Why are metals and polychlorinated biphenyls (PCBs) not reviewed?

Sub-section 4.1 Total Petroleum Hydrocarbons (no text)

Overall, this kind of fingerprinting is inappropriate for a site as complex as Port Angeles Harbor as the results of the evaluation indicate.

Sub-section 4.1.1 Nature of Petroleum Hydrocarbons

No comments.

Sub-section 4.1.2 Petroleum Hydrocarbon Analysis

Appendix J: Discusses quantitative results for diesel and motor oil and semi-quantitative results for gasoline.

Comment: Qualitative data are often inappropriate for fingerprinting studies, especially for sediments with a complex mix of contaminant compounds.

Appendix J: "In addition to the uncertainties associated with low level gasoline, diesel, and motor oil concentrations discussed in Section 2, TPH fingerprinting uncertainties are associated with an inherent limitation in the method: based on their operating parameters, different chromatographic instruments yield unequal spectra. Chromatograms from one gas chromatograph may not be directly comparable with spectra from other gas chromatographs or even the same instrument operating at different times. Significant effort would be required to convert spectral data using relative retention times and peak heights or areas normalized to known standards in order to accurately compare sample results."

Comment: Additional analyses of the spectral data are unlikely to produce data that could produce meaningful fingerprinting analysis. This should not be pursued. If quantitative data are warranted for the saturated hydrocarbons, an appropriate laboratory and method should be selected and the samples reanalyzed.

Sub-section 4.1.3 Summary of Port Angeles Harbor Petroleum Hydrocarbon Analysis Results

No comments.

Sub-section 4.1.4 Utility of Petroleum Hydrocarbon Data for Fingerprinting

No comments.

Sub-section 4.2 Polycyclic Aromatic Hydrocarbons

This analysis falls short in that it does not evaluate how many samples have the same PAHs detected and whether they are suitable for use in diagnostic ratios.

Sub-section 4.2.1 Nature of Polycyclic Aromatic Hydrocarbons

No comments.

Sub-section 4.2.2 Polycyclic Aromatic Hydrocarbon Analysis

Appendix J: "Sediment samples were analyzed for 17 distinct PAHs using USEPA SW-846 method 8270 (EPA 1986)."

Comment: If the intent of the PAH data is fingerprinting, the alkylated PAHs should have been analyzed.

Sub-section 4.2.3 Summary of Port Angeles Harbor Polycyclic Aromatic Hydrocarbon Analysis Results

A more appropriate assessment would be to determine how many samples have PAHs detected that can be used for diagnostic ratios.

Sub-section 4.2.4 Utility of Polycyclic Aromatic Hydrocarbons Data for Fingerprinting

Appendix J: "Assuming, for discussion purposes only, that a minimum of five individual PAHs must be present in a sample at concentrations above three times the PQL, approximately one third of the stations would have sufficient data at one or more depth intervals to fingerprint the PAHs using relative ratios of the individual PAH concentration."

Comment: These would need to be the same PAHs. The analysis is highly speculative because it is looking at overall counts, not the specific PAHs that were detected. Also, the discussion should address detection limits and whether they were low enough to meet the objectives of a fingerprinting analysis.

Appendix J: "The use of more powerful chemometric tests (for example, principal component analysis) may help overcome some of the limitations in the data. However, these tests are not within the scope of this project."

Comment: More powerful chemometric tests cannot overcome a high frequency of non-detected compounds.

Appendix J: "Visual comparisons of ratios of the PAH analyte concentrations to published concentration ratios in materials such as creosote may provide some indication of the nature of potential source material."

Comment: Visual comparisons can be very subjective and becomes increasingly difficult as the number of profiles reviewed increases. The potential complexity of sources and mixing in the harbor suggest that visual comparisons could only serve as a preliminary analysis. Diagnostic ratios and principal component analysis may be more informative.

Section 4.3 Dioxin/Furans

No comments.

Sub-section 4.3.1 Nature of Dioxins/Furans

Appendix J: "It is generally accepted that dioxins and furans do not occur naturally and are not deliberately manufactured."

Comment: This is incorrect. Natural sources of dioxins and furans include forest fires and brush fires, among others.

See U.S. EPA. An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the U.S. for the Years 1987, 1995, and 2000 (Final, Nov 2006). U.S. Environmental Protection Agency, Washington, DC, EPA/600/P-03/002F.

Sub-section 4.3.2 Dioxins/Furans Analysis

No comments.

Sub-section 4.3.3 Summary of Port Angeles Harbor Dioxins/Furans Analysis Results

No comments.

Sub-section 4.3.4 Utility of Dioxins/Furans Data for Fingerprinting

Appendix J: "Fingerprinting may be appropriate for surface and shallow subsurface samples, where 36% and 34%, respectively, of the unannotated, congener only, dioxin/furan data are greater than three times the PQL. While only 21% of the un-annotated, congener only, deeper subsurface samples dioxin/furan data are greater than three times the PQL, it may be useful to fingerprint these data as well."

Comment: This analysis is overly simplistic and speculative. Whether data are appropriate for fingerprinting cannot be determined by such low percentages, only overwhelming results in either direction provide usable information; otherwise, exploratory data analysis is needed with the real possibility that fingerprinting attempts may produce ambiguous results.

Appendix J: "Assuming, for discussion purposes only, that a minimum of five congeners must be present in a sample at concentrations above three times the PQL, approximately two thirds of the stations would have sufficient data at one or more depth intervals to fingerprint dioxin/furan congeners using relative ratios of the congener concentrations."

Comment: These would need to be the same congeners. The analysis is highly speculative because it is looking at overall counts, not the specific congeners that were detected. Also, the discussion should address detection limits and whether they were low enough to meet the objectives of a fingerprinting analysis.

Appendix J: "The use of more powerful chemometric tests (for example, principal component analysis) may help overcome some of the limitations in the data. However, these tests are not within the scope of this project."

Comment: As noted earlier in these comments, more powerful chemometric tests cannot overcome a high frequency of non-detected compounds or uncertainty introduced by low concentration data.

Section 5 Summary

It is unclear that the "fingerprinting" employed and further contemplated in this report is based upon methods, theories, principles or techniques generally accepted in the relevant scientific community, or whether the "fingerprinting" conclusions are scientific in nature, at all.

References

No comments.

E&E. 2012. Port Angeles Harbor Sediment Characterization Study, Port Angeles, Washington, Screening-Level Fingerprinting Analysis Public Review Draft. Prepared for Washington State Department of Ecology Toxics Cleanup Program, Lacey, WA. Ecology and Environment, Inc., Seattle, WA.

Overview Comment: When considering the text, tables, and figures of this document, almost every sentence has an inconsistency/error in it. This document cannot be relied upon with confidence regarding the accuracy of the information presented. Interpretations were made regarding the nature of the PAHs present in some samples (i.e., petrogenic or pyrogenic); however, these must be re-evaluated again after the inconsistencies and errors are addressed.

Section 1.0 Introduction

Appendix J: "The Port Angeles Harbor Sediment Investigation Study was designed to evaluate SMS chemicals and other COPCs rather than compounds specific for forensic fingerprinting. However, E & E evaluated the data from three contaminant groups to determine whether data from the 2008 sampling event is sufficient for fingerprinting. Detailed results of the evaluation are provided in the Technical Memorandum, 'Port Angeles Harbor Sediment Characterization Study, Potential for Fingerprinting Analysis using Sediment Data' (Appendix J)."

Comment: The utility of some of the analyses in the evaluation is unclear (see comments above). The memorandum should not be considered a reliable basis that fingerprinting of PAHs and dioxin/furans will be possible.

Appendix J: "Data were sufficient to partially fingerprint the LPAH and HPAH compounds and dioxins/furans; however, some PAH compounds were undetected at a frequency of occurrence greater than 50 percent. After discussions with Ecology, the MDL was used as a value for undetected data (except as noted below)."

Comment: The technical memorandum does not indicate that data were sufficient to "partially fingerprint" PAHs and dioxins/furans. The concept "partially fingerprint" makes little sense and would be an unreliable basis to determine sources. After qualifying that the data are either highly censored or have a significant percentage of low concentration results, the technical memorandum says that some fingerprinting may be possible; however, the analysis does not properly support this by determining if enough of the same compounds/congeners are present in the samples. Also, the success of fingerprinting cannot be pre-determined by the number of detected data. It has more to do with the understanding of sources, mixing, and timing of contamination. The statement that these compounds/congeners can be "partially fingerprinted" is misleading. First, the meaning of "partially fingerprinted" is unclear. Secondly, only until some exploratory data analysis is complete can an assessment be made.

Appendix J: "As a result the proportional analysis displays the distribution of COPCs between the Port Angeles Harbor and the Rayonier Mill study sites."

Comment: What this means is unclear.

Appendix J: "Such analysis is described below and the related ratios were calculated and summarized but not evaluated as part of this report…"

Comment: How can this appendix be called "Port Angeles Harbor Screening-Level Fingerprinting Analysis" when the results are not evaluated? It would be more appropriately referred to as "possible fingerprinting calculations." The utility of the fingerprinting exercise can only be determined by evaluation/interpretation of the results. Also, too much of the text that describes PAH chemical behavior is without appropriate citations.

Sub-section 1.1 Fingerprinting Polycyclic Aromatic Hydrocarbons

Appendix J: "As explained above, PAH compounds in harbor sediment were fingerprinted using a Partial EPA FALCON Analysis and a ratios analysis of various PAH compounds. Undetected data were not used in the analysis of PAH data due to the large number of non-detects within the data set."

Comment: To state that the "PAH compounds in harbor sediment were fingerprinted" is misleading. A FALCON analysis was conducted, but claiming that the sediments were fingerprinted suggests a level of success in determining sources that is still unclear because the results were not evaluated.

Sub-section 1.1.1 FALCON Analysis of PAH Compounds in Surface Sediments

Appendix J: "The proportion of each individual PAH in surface sediments as it contributes to the total PAHs in the study area is shown in Figure J-1."

Comment: Standardizing the individual PAH concentrations to total PAHs is an appropriate first step before performing a principal component analysis; however, the report text almost meaningless. What does it mean by "much variation"? It appears to be a general comparison of percentages. More quantitative tests exist to determine variation and are used routinely fingerprinting analyses.

Appendix J: "The data show that while there was much variation, fluoranthene contributed 15 to 20% on a dry weight basis of the total PAHs in both the Harbor-Wide and Rayonier Mill stations. Of the total, 10 to 15% is contributed by pyrene, and 10% (on average) by chrysene. The HPAH compounds benzo(b)fluoranthene, benzo(a)anthracene benzo(a)pyrene, and the LPAH compound phenanthrene each accounted for roughly 7 to 8% of the total PAH in the study area."

Comment: Table J-1 has the mean proportion of fluoranthene to be 25 percent and 34 percent for the Harbor-Wide stations and the Rayonier Mill stations, respectively. The percentages are also inconsistent for pyrene and chrysene. Why are these different from the text?

Sub-section 1.1.2 Ratio Analysis of PAH Compounds in Surface Sediments

Appendix J: "The ratio of LPAH to total PAH indicates that, on average, 26% of the total PAHs in the sediment are LPAH compounds (Figure J-2, Table J-2)."

Comment: Table J-2 has only four stations with LPAH/TPAH ratios above 0.26 (i.e., IE15A 0.29, LA02A 0.27, MA02A 0.74, RF02A 1.0). Thus, how the average contribution of the total PAHs can be 26% LPAHs with a total sample count of 96 in all is unclear.

Appendix J: "The highest ratios (up to 0.82) were at MA02A."

Comment: Why is the value 0.74 in Table J-2? Why is the value plotted on Figure J-2 0.42?

Figures J-2 and J-3 are very misleading in that samples with values of "NA" in Table J-2 are included though the Introduction states that they are excluded. For example, Stations IE03A and RF03A are both "NA" in Table J-2 for Total LPAH/Total PAH; however, they are included in Figure J-2 at values of 0.05 for IE03A and 0.50 for RF03A.

Appendix J: "The naphthalene and phenanthrene/benzo(a)pyrene ratios can be seen in Table J-2 and Figure J-2. The ratio of naphthalene to benzo(a)pyrene was highest at IE15A (2.88) and FT11A (1.95)."

Comment: In Table J-2, the ratio of naphthalene to Benzo(a)pyrene is listed as NA for Station IE15A, but plotted as 2.88 on Figure J-2. These and other errors need to be corrected.

Appendix J: "The ratio of phenanthrene/benzo(a)pyrene showed a very similar pattern, with peak ratios occurring in the same locations as the naphthalene/benzo(a)pyrene peaks. However, the two stations with the highest ratios had a ratio of phenanthrene/benzo(a)pyrene that was almost double the ratio of naphthalene/benzo(a)pyrene. These stations were IE15A (3.63) and BL08A (1.06)."

Comment: Again, Station IE15A has a value of NA where the text claims it to be a "peak ratio". BL08A also has a value of NA for naphthalene/benzo(a)pyrene and phenanthrene/benzo(a)pyrene in Table J-2; though it is plotted otherwise in Figure J-2. Any errors need to be fixed in the tables, figures, and text.

Appendix J: "Figure J-3 shows phenanthrene/anthracene and fluoranthene/pyrene ratios at stations in the harbor. Results show that no stations had a phenanthrene/anthracene ratio greater than 10. This indicates that the PAHs were pyrogenic in origin. Ratios ranged from 0.4 at OH02A to 7.5 at FT11A."

Comment: Table J-2 has values for FT11A to be NA and 1.28 for phenanthrene/anthracene and fluoranthene/pyrene, respectively. Errors need to be fixed.

Appendix J: "To see the relationship between the phenanthrene/anthracene and fluoranthene/pyrene ratios, the two were plotted (Figure J-4)."

Comment: Data presented in Table J-2 and those used for all figures need to be checked for accuracy. Figures may need to be plotted with correct data. FT10A and FT11A are plotted in Figures J-3 and J-4 with values greater than 7 for phenanthrene/anthracene, but are listed as NA in Table J-2.

Sub-section 1.1.3 FALCON Analysis of PAH Compounds in Subsurface "B" Core Sediments

Appendix J: "While there was much variation, pyrene contributed on a dry weight basis an average of 17% of the total PAHs in Harbor-Wide stations, and 12.5% at Rayonier Mill stations (Table J-3). Fluoranthene contributed 13.1% of the PAHs at Harbor-Wide stations and 14.3% at Rayonier Mill stations, while phenanthrene contributed on average 8 to 9%."

Comment: Again, what is meant by "much variation"? The comment is made with no context. Is this observed for PAHs in general or is it a site specific comment?

Table J-1 has the mean proportion of pyrene to be 25 percent and 27 percent for the Harbor-Wide stations and the Rayonier Mill stations, respectively. The percentages are also inconsistent for fluoranthene and phenanthrene. Why are these different from the text?

Sub-section 1.1.4 Ratio Analysis of PAH Compounds in Subsurface "B" Core Sediments

Appendix J: "As with the surface sediment stations, the subsurface B core sediment stations with the highest LPAH to total PAH ratios were primarily those at which a large number of the PAH compounds were undetected and the concentrations were reported as MDLs. This led to low total PAH values, causing high ratios for stations IE16B, KP07B, KP08B, FT06B, FT12B, ED01B, DO05B, and EI02B (Table J-4 and Figure J-6)."

Comment: How the reader can be directed to Table J-4 to find the stations with the highest ratios and find the values for all of them to be listed as NA is contradictory. If the authors are including non-detected results in the text calculations and not in the tables, this should be clear and the text and tables should be consistent or clearly defined; however, the text indicated that not detected results would not be used (i.e., not detected results should be assigned a value of zero in the calculations). In addition, the figure is misleading because stations with ratios of NA in Table J-4 are included at a value of one (which may explain why they were mistaken for "peak ratios". Any errors need to be fixed.

Appendix J: "Discounting stations with high undetected total PAH values, the station with the highest ratio was EC03B (75%), followed by LA02B (54%) and CO03B, where 51% of the total PAHs were represented by LPAH compounds (Table J-4 and Figure J-6)."

Comment: The value presented for Station EC03B in Table J-4 is 72 percent. Why is this different in the text?

Appendix J: "At EC03B, the ratio of naphthalene to benzo(a)pyrene shows the highest value (14.19), indicating there was 14 times more naphthalene than benzo(a)pyrene. The next-lower ratios were at IE09B (5.5) and LA02B (5.13)."

Comment: The value presented for Station LB02B in Table J-4 is NA. Why is this different in the text?

Appendix J: "The plotted ratios of phenanthrene/anthracene and fluoranthene/pyrene at stations in the Harbor-Wide study area can be seen in Figure J-7."

Comment: Based on the inconsistencies in the text and Table J-4, the data for this figure needs to be verified. In addition, the figure is misleading because stations with ratios of NA in Table J-4 are included at a value of one.

Appendix J: "The phenanthrene/anthracene ratios ranged from 0.26 at IH06B to 19.5 at IH02B. Figure J-7 shows two stations with values greater than 10. These are EC03B (13.5) and IH02B (19.5)."

Comment: The value presented for Station IH02B in Table J-4 is NA. Why is this different in the text and figure?

Appendix J: "The fluoranthene/pyrene ratios ranged from 0.34 at IH02B to 2.86 at ED02B. The plotted ratio of fluoranthene/pyrene can be seen in Figure J-7, which shows that 15 stations had ratios less than 1.0, indicating the PAHs may have been petrogenic in origin."

Comment: The value presented for Station ED02B in Table J-4 is NA. Why is this different in the text and figure? Until the calculations are verified, any conclusions regarding the source of the PAHs should be revisited.

Appendix J: "The remaining stations had values greater than 1.0, indicating the PAHs were pyrogenic in origin."

Comment: This is misleading. The remaining stations had values of NA or greater than one.

Appendix J: "The scatterplot shows IH02B with a value less than 1.0 for fluoranthene/pyrene (0.34) and greater than 10 for phenanthrene/anthracene (19.5), indicating the PAHs at this station to be petrogenic."

Comment: This conclusion must be reassessed after the ratio calculations are verified.

Sub-section 1.1.5 FALCON Analysis of PAH Compounds in Subsurface "C" and "D" Core Sediments

Appendix J: "The majority of the PAH compounds were undetected at low MDLs, which accounts for the lack of variation seen in Figure J-9."

Comment: What is the basis for this statement? What analysis was done to show that it is low concentrations controlling variability and not a common source?

Appendix J: "The proportion of each individual PAH in subsurface C core sediment samples as it contributes to the total PAHs in the study area is shown in Table J-5 and in Figure J-9. At Harbor-Wide stations, pyrene and fluoranthene contributed 9.4% and 10.0% (respectively) on a dry weight basis of the total PAHs at subsurface C and D core sediment stations. The remaining PAH compounds contributed from 4.6 to 8.2% to the total amount. Phenanthrene accounted for 8.2% and naphthalene for 6.8% of the total amount at Harbor Wide stations. The same pattern can be seen with the Rayonier Mill stations. Pyrene and fluoranthene contributed the greatest amount to the total PAH, accounting for 8.6% and 8.5%, respectively, to the total amount. Phenanthrene accounted for 7.9%, benzo(b)fluoranthene for 6.5%, and benzo(k)fluoranthene for 6.4% of the total amount, but the remaining PAH compounds contributed less than 5.9%."

Comment: Similar to sub-sections 1.1.1 and 1.1.3, the data presented in the text does not match that presented in the corresponding table. This needs to be resolved. Also, how can the text attribute 19.4 of the TPAH to pyrene and fluoranthene and then stat that the remaining PAHs contribute "4.6 to 8.2%", and then go on to list the contributions of other PAHs. This section needs to have the data verified and then re-edited.

Appendix J: "Again, the majority of the PAH compounds were undetected at low MDLs, which accounts for the lack of variation."

Comment: What is the basis for the conclusion that the lack of variability is driven by low concentrations?

Sub-section 1.1.6 Analysis of PAH Compounds in Subsurface "C" and "D" Core Sediments

Appendix J: "The total PAH was represented by undetected concentrations at 19 of the 32 subsurface C and D core stations (Table J-6 and Figure J-10)."

Comment: Table J-6 lists 20 stations represented by NA.

Appendix J: "The highest ratio of naphthalene to benzo(a)pyrene for subsurface C core sediments was at EC03C (52.5). The next highest ratio was at ED02C (2.7)."

Comment: The naphthalene to benzo(a)pyrene value in Table J-6 is NA for Station ED02C.

Appendix J: "The ratio of phenanthrene to benzo(a)pyrene showed a similar pattern, with peak ratios occurring in the same locations as the naphthalene/benzo(a)pyrene peaks. The highest ratio was at EC03C (80.8), followed by ED02C (4.1)."

Comment: The phenanthrene to benzo(a)pyrene value in Table J-6 is NA for Station ED02C.

Appendix J: "For the subsurface D core station (DO04D) the ratio of naphthalene to benzo(a)pyrene was 1.1, and was 1.0 for phenanthrene to benzo(a)pyrene. However, these three PAH compounds were undetected at DO04D."

Comment: If PAH analyses exclude compounds that were not detected, how can ratios be reported for Station DO04D in the text?

Appendix J: "The ratios of phenanthrene to anthracene and fluoranthene to pyrene at stations in the Harbor-Wide study area were plotted and can be seen in Figure J-11. Phenanthrene to anthracene ratios in subsurface C and D core sediments ranged from 1.1 at IE16C to 14.1 at EC03C. Station EC03C was the only station with a phenanthrene to anthracene ratio greater than 10, indicating that the PAHs from that station may be petrogenic in origin. The ratio of fluoranthene to pyrene ranged from 0.29 at EE03C to 1.78 at EC03C. Figure J-11 shows four stations whose samples had values less than 1.0 and thus may have been petrogenic in origin; these are EE03C (0.29), KP03C (0.62), MD02C (0.83), and IE14C (0.92)."

Comment: Similar to sub-sections 1.1.2 and 1.1.4, the data presented in the text does not match that presented in the corresponding table. This needs to be resolved. In addition,

determinations on the nature of the PAHs (i.e., pyrogenic or petrogenic) in various samples needs to be re-evaluated once the errors and inconsistencies are addressed.

Appendix J: "To show the relationships between the phenanthrene to anthracene and the fluoranthene to pyrene ratios, the two were plotted; results are displayed in Figure J-12. The scatterplot shows there were no stations with both a value less than 1.0 for the ratio of fluoranthene to pyrene and a value greater than 10 for the ratio of phenanthrene to anthracene."

Comment: Only five samples have data for both ratios that does not included non-detected data. How ~16 data points can be plotted is unclear.

Appendix J: "Each ratio taken separately indicates that PAHs five stations may have been petrogenic in origin,"

Comment: Any conclusions regarding this dataset are inappropriate until the inconsistencies are addressed.

Sub-section 1.2 Fingerprinting Dioxins/Furans

No comments.

Sub-section 1.2.1 FALCON Analysis of Dioxin/Furan Congeners in Surface Sediments

Appendix J: "The data show that OCDDs contributed up to 78.8%, on a dry weight basis, of the total dioxins/furans at the Harbor-Wide stations and 77.2% at the Rayonier Mill stations. On average, 9.8% and 9.3% of the total was contributed by HPCDD and roughly 6% by OCDF. TCDD and PeCDD accounted for less than 0.5% of the total dioxins/furans in the study area (Table J-7)."

Comment: The OCDD value for the Rayonier Mill stations is 79.4 percent in Table J-7. The percentages for the congeners that follow are also inconsistent. Why does it not match the text? Such descriptions of the data presented in narrative are not particularly useful; when the text and tables do not match, they are of no value as all data become questionable.

Appendix J: "Congener profiles of natural and anthropogenic sources in the U.S. were compiled by the U.S. EPA National Center for Environmental Assessment (EPA 2005). These profiles showed the relative percent distribution of each congener for various natural and industrial activities (Figure J-14)."

Comment: This statement directly conflicts with the statement in the preceding Technical Memorandum in Appendix J that "It is generally accepted that dioxins and furans do not occur naturally and are not deliberately manufactured." The documents should be consistent.

Appendix J: "The proportion of OCDD at Port Angeles Harbor-Wide stations is much greater than seen in either the diesel truck exhaust or autos burning unleaded gasoline profiles. The profile for the oil-fired electrical generation has a similar OCDD signature, but the proportion of OCDF is much less than was found in the Port Angeles area. The remaining two profiles are bleached pulp and paper effluent and forest fires."

Comment: This visual analysis is very simplistic and does not address weathering or mixing.

Sub-section 1.2.2 FALCON Analysis of Dioxin/Furan Congeners in Subsurface "B" Core Sediments

Appendix J: "Each congener's contribution to total dioxins/furans in the study area is shown in Figure J-15 and in Table J-8. Of the total dioxins/furans at the Harbor-Wide and the Rayonier Mill stations OCDDs contribute up to 74.1% and 76.7%, respectively, on a dry weight basis."

Comment: The OCDD value for the Rayonier Mill stations is 76.3 percent in Table J-8. The inconsistencies here are less egregious than in other sections, but they persist. Similar to the previous section, the profile comparison has the same limitations of being very simplistic.

Sub-section 1.2.3 FALCON Analysis of Dioxin/Furan Congeners in Subsurface "C" and "D" Core Sediments

Comments: Issues are similar to Sub-sections 1.2.1 and 1.2.2 in that values in the text do not match those in the corresponding table and the visual analysis is very simplistic.

Sub-section 1.2.4 Proportional Distribution of Dioxin/Furan TEQs in Surface Sediments

Appendix J: "The TEQ of individual dioxin/furan congeners at each Harbor-Wide and Rayonier Mill station was calculated by multiplying the concentration of each individual congener by its unique toxic equivalent factor (TEF). The method calculated the proportion of each individual congener TEQ to the total station TEQ to identify patterns in their distribution for comparison with patterns at other locations in the study area. Figure J-17 shows the proportional distribution of TEQs at Harbor-Wide and Rayonier Mill stations."

Comment: How this analysis is relevant to fingerprinting is unclear. By TEF-adjusting the concentrations, a toxicity profile is being assessed, which is not the stated intent of this document. The descriptions of the relative abundance of the TEF-adjusted concentrations in the text are not meaningful and the values are inconsistent with those in Table J-10.

In addition, the text does not indicate how non-detected values were treated in the TEQ calculations (i.e., were not detected congeners set to zero).

Sub-section 1.2.5 Proportional Distribution of Dioxin/Furan TEQs in Subsurface "B" Core Sediments

Comments: Same as previous section, but related to Table J-11.

Sub-section 1.2.6 Proportional Distribution of Dioxin/Furan TEQs in Subsurface "C" and "D" Core Sediments

Comments: Same as previous section, but related to Table J-12.

Sub-section 1.3 Comparison of TEQ Proportions with those of RV Bold Study

Appendix J: "The relative proportion that each congener contributed to the total dioxin/furan TEQ at the Harbor-Wide and Rayonier Mill study areas and the four regions sampled in the RV Bold survey can be seen in Figure J-20."

Comment: Why is this comparison being made? What is the objective? It appears to be a flawed fingerprinting exercise. To start, how non-detected congeners were included in the calculations is not addressed. This is important to know because the Bold dataset has many results that were non-detect (even the detected values tend to be low). This use of the Bold data conflicts with the Technical Memorandum by using data that has a high number of non-detects, is highly qualified (i.e., estimated values), etc. If the point is to compare the congener patterns, the data are inadequate to do this.

Appendix J: "Two major differences can be seen between the two studies. The first was that the proportion of the total dioxin/furan TEQs accounted for by 2,3,7,8-TCDD and 1,2,3,7,8-PeCDD was greater at both Port Angeles study areas than in areas sampled during the survey conducted by the RV Bold. The second was that the proportion of 1,2,3,4,6,7,8-HpCDD in the Port Angeles study areas was much greater than found in the four RV Bold study areas (Table J-13)."

Comment: These comparisons are inappropriate because the report does not discuss how the values are calculated, the number of values that are not detected, etc. A cursory review of the Bold dataset suggest that not one sample had a detected value for 2,3,7,8-TCDD, yet the report in Appendix J provided summary statistics and comparisons for those results.

Sub-section 1.4 Summary

Appendix J: "A screening-level fingerprint analysis was conducted to compare the relative abundance of selected contaminants in the Harbor-Wide and Rayonier Mill study areas. Two groups of chemicals had sufficient numbers of detected results for analysis: PAHs and the dioxin/furan congeners."

Comments: Aside from some visual inspection and misrepresentations of the data in the figures used, the report does not provide a screening level analysis that can determine if the datasets are robust enough for fingerprinting. The inconsistencies between the text, tables, and figures must be resolved before any conclusions can be made on the dataset. The conclusions of this report must be disregarded until corrections and a re-evaluation are made. Any conclusions made with respect to the Bold dataset should also be disregarded.

Section 2.0 References

Comment: Not many references for a fingerprinting evaluation. It is also incomplete.

Appendix K Bioassay Data Validation Report

Port Angeles Harbor Sediment Investigation—Two Draft Reports Available for Public Review and Comment (Fact Sheet)

What did the study conclude?

Comment: The first two bullets in this section imply that cleanup and or removal actions were developed in the two reports. This should be removed from the fact sheet and reports as there was no feasibility study performed.

What are the next steps in cleanup?

No comments.

Supplemental Data Evaluation

Where did contamination come from and who is responsible for cleanup?

There is no mention of the streams or combined sewer overflows to the harbor in this discussion. Do you plan to include these in the future?

From: NOTAC
To: Groven, Connie (ECY)
Subject: Port Angeles Harbor Sediment Investigation
Date: Tuesday, May 22, 2012 2:35:23 PM

To Whom It May Concern;

The North Olympic Timber Action Committee has been following the Rayonier Site Cleanup and the P.A. Harbor Sediment Investigation and will comment specifically on the Harbor Sediment investigation as part of the public comment period. The Port Angeles Harbor has been an industrial harbor for a century and continues to provide water dependent multiple uses for a variety of industries supporting 600 to 1000 family wage jobs. It is difficult to interpret the technical data produced from your sampling of the harbor areas but several areas caught our attention. The closed end of the harbor at the west end appears to be a collection point of contaminants and is probably the area of most concern to NOTAC because it is an area that has been used for log storage. Your February 2012 newsletter pointed out your concerns for harmful levels of contaminants and wood debris. Your statement said that "Protecting the harbor will likely require: Cleaning up sediment contamination hotspots, removing wood debris & preventing future pollution."

The Department of Ecology has the heavy hand of authority to require the levels of cleanup. We ask that any DOE requirements for cleanup in the harbor have a cost/benefit analysis as a part of cleanup requirement. This should identify the costs of cleanup and corresponding benefits based on the cost. This should help prioritize cleanup efforts and not waste time and money on questionable benefits.
DOE must clearly define the costs/benefits of preventing future pollution. NOTAC believes that significant improvements have been accomplished over the past 25 years so we are concerned with over-reaching and costly regulations moving ahead into the future. Your goal should be to protect existing jobs and plan for future new uses of our waterfront areas to produce new industries and expanded family wage jobs.

The DOE had hired a contractor Ecology & Environment, Inc. to provide harbor sediment data and it is not clear why DOE hired a new company, SAIC, for "in-depth analysis." Could you explain the need for the change and the costs of each of the consultants and how their work differed?

There are other areas with industrial harbors and similar toxins and wood debris and it would help understand how you have dealt with these situations relative to costs, time to cleanup, final results and future prevention methods. Do you measure all levels of contaminants the same in every harbor and how are your standards of allowable contaminants determined?

Our concerns are focused on the impacts to our community. The community has already been held hostage on the Rayonier site cleanup and do not want the Harbor cleanup to become the same type of barrier.

Respectfully,

Carol Johnson
Executive Director
North Olympic Timber Action Committee

Port Angeles Harbor Sediment Characterization Study February 2012: Port Angeles Harbor Sediment Investigation Report and Supplemental Data Evaluation to the Sediment Investigation Report Comments by: Environmental Stewardship Concepts, LLC May 22, 2012

These comments were prepared on behalf of the Olympic Environmental Council (OEC).

Introduction

The Port Angeles Harbor Sediment Characterization study involves two major documents: the *Sediment Investigation Report* (SIR) and the *Supplemental Data Evaluation to the Sediment Investigation Report*. The SIR has eleven appendices (Appendix A-K), which include several important reports, such as the *Sediment Trend Analysis Report*, *Human Health and Ecological Risk Assessment*, and *Geomorphic Report,* and others. As indicated from the number of documents involved in this effort, there is a large amount of information presented to characterize the sediment of the Port Angeles Harbor. The Harbor has a long industrial history, and the data from previous studies investigating the impact on terrestrial and aquatic environments have been incorporated into this effort. Contaminants of potential concern (COPCs) remain a problem; analyzed sediments indicate they continue to exceed quality criteria for protection of human and ecological health.

Recommendations

The major omission from the investigation is the lack of specific water quality measures in the water overlying the wood debris area. The bottom water needs to be measured to assess oxygen, carbon dioxide (measured as dissolved carbon dioxide) and pH, along with chemicals leaching from the wood debris. Such sampling can be conducted this summer, and repeated one time in late summer or early fall, prior to winter conditions.

The Ecology data on hypoxia in the harbor can be used as reference to guide the design of such a sampling effort.

Sediment Investigation Report (SIR)
General Comments

This report makes an important contribution to understanding how anthropogenic activities, largely from the former Rayonier Mill site, contributed to the degradation of Port Angeles Harbor, including raising risks to human health and the environment. With limited resources, the investigation provides high quality data on sediment chemistry across the harbor, focusing on areas used by the former Rayonier Mill operations.

The characterization of the Port Angeles Harbor sediments is comprehensive and fills some gaps in previous studies regarding toxic chemicals and wood debris, with some related chemicals. However, the analysis of the major objectives of this study, identifying and quantifying wood debris and COPCs (toxic chemicals) in the harbor, indicated that the two types of contamination are not co-located with great fidelity (i.e. large amounts of wood debris did not also show high COPC concentrations). As this question was an important component of the investigation, further studies will need to be conducted or previous studies re-done, to better understand the occurrence of COPCs in the harbor.

The examination of chemical fingerprints is important and applies newer analysis and computational approaches to the investigation of complex contamination conditions, such as Port Angeles Harbor. The report accurately uses the sediment chemistry data to compare chemical profiles in a "fingerprinting" analysis that seeks to associate combinations of chemicals among sample sites. This method and the resulting analysis are commendable and the outcome provides important information for a better understanding of the harbor conditions.

The report describes two types of contamination problems:
1) the toxic chemicals in sediments and biota, including the risks to ecological receptors and the risks to human health from those chemicals;

2) woody debris that has direct and indirect effects on ecosystems and the chemicals that derive from the wood debris.

One of the major problems with wood debris contamination is that this material is organic and decomposes, releasing chemicals and altering ambient conditions. The decomposition of organic material in aquatic systems is the basic process underlying eutrophication, the over-enrichment of an aquatic system with organic matter, especially nutrients (nitrogen and phosphorous) summarized and described by the National Research Council (NRC. 2000. Clean Coastal Waters. National Academy Press, Washington DC. 405 pp). Excess organic matter decomposes (via bacterial action), thereby consuming oxygen and producing carbon dioxide. Carbon dioxide reacts with water to form carbonic acid. Even though carbonic acid is a weak acid and seawater is buffered, sufficient addition of carbon dioxide can and will cause water pH to decline (become more acidic). The hypoxia is accompanied by hypercapnia and acidic conditions.

The State of Washington recognized the problem with hypoxia in listing Port Angeles Harbor as impaired by low oxygen conditions in the 303 (d) report in 2009.

Two further consequences of simultaneous hypoxic and acidic waters is a change in the ambient conditions under which the wood debris is exposed. The acidic waters will enhance leaching of toxic chemicals, particularly metals such as mercury and other metals, out of the wood debris.

The sediment investigation did not examine the water that overlies the woody debris to determine the extent to which decomposition has altered ambient conditions, further degraded the habitat, and limited the growth and abundance of benthic flora and fauna.

The sediment report examined the possible risks from the chemicals, but not the interactions of the chemicals among themselves, nor combined with hypoxic conditions. There are few analytical tools to examine such combined risks, either as multiple stressors or as cumulative risks, which

are not the same problems. Briefly, multiple stressors refers to several different agents acting at the same time and place, such as toxic chemicals combined with temperature changes and/or exotic species. Cumulative risk assessment addresses multiple stresses and the properties of the system (human or ecological) that affect the response to the stresses. The co-occurrence of hypoxia and toxic chemicals in the benthic habitat certainly increases the effects of either, and may have a synergistic effect. The quantitative result would be a lower toxicity threshold for the combined exposures than predicted for the toxic chemicals alone.

In the two months or so since the sediment report was released to the public, two actions at the federal level have enhanced the toxicological database for chemicals at this site. The two chemicals are dioxin (and related compounds) and lead. In February 2012, EPA published a non-cancer health reference dose for dioxin (and related chemicals), referred to as the Reference Dose (RfD). The value published by EPA is lower by 30% than the previous number which had been used by ATSDR and on several specific projects by EPA. The toxicity of lead was recently recognized by CDC as greater than previously acknowledged, by a factor of two. As a result, CDC now uses a blood lead level of 5.0 ug/dL as the level of concern for children's exposure, a decrease of 50% from the previous level of concern of 10 ug/dL. These two changes, taken together, mean that the health risks from site contaminants are greater than predicted in the risk assessment in the sediment report.

Specific Comments:

SIR Appendix G - Human Health and Ecological Risk Assessment

Human Health Risk Assessment

Section 2.2

- The history of the site should include that the K-Ply manufacturing facility reopened in 2010 under new ownership as Penply, then closed in early 2012.
- This section should also indicate that pulp and paper mill effluents continue to be discharged into the harbor today, as Nippon mill is still in operation.

Section 2.4

- The Municipal Works need to be better characterized, and should include the exact number of the "several stormwater outfalls". A description of each type of outfall should be included to distinguish between the different point sources to the Harbor.

Section 3.0

- Clearly define each sediment type that is being considered in the human health and ecological risk assessments (beach/intertidal, subsurface, and marine). Include an explanation of why the exposure to each type is different.
- Additional exposure pathways should be considered. Ingestion and dermal contact with surface water and inhalation of volatiles from sediment were not evaluated for persons exposed.

Section 3.1.4

- The *Frequency of Detection* section indicates that numerous SVOCs had maximum detection limits greater than the screening level; the list should be included in this section.

Section 3.2

- Please indicate in which Human Receptor group residential users who regularly fish would fall under.
- The *Revised Conceptual Site Model for Human Receptors* states different groups of receptors than those listed in the *Screening Values* section. This is potentially confusing to the reader and should state why there is a difference.

Section 3.6.4

- As there is no human toxicity data for resin compounds, another similar contaminant should be used to quantitatively evaluate the potential risk of exposure.

Section 3.6.6

- There is, in fact, a toxicity value for lead which has recently been lowered. The blood lead level of concern for children has been lowered from 10 micrograms/deciliter to a reference value of 5 micrograms/deciliter by the CDC. This change should be reflected in the IEUBK modeling of lead exposure used in this human health risk assessment. The resulting lowering of the lead level of concern will

result in a greater risk from lead exposures.

Ecological Risk Assessment

Section 4.2.3.1

- Every ecological sample collected at the Harbor was not also collected at the reference site, Dungeness Bay. This section states that surrogate samples were used instead. This adds a considerable level of uncertainty when comparing conditions between the Port Angeles Harbor site and the reference site.

Section 4.5

- Although chlorinated pesticides, such as DDT which has been banned in the U.S. due to causing harmful effects to wildlife, are identified as contaminants of potential concern (COPCs) at the site, there are no data available for these contaminants in fish whole-body samples.

Section 4.6.1.2

- Wildlife exposure was not estimated for COPCs without reference values, including organic acids, motor oil, and diesel fuel.

Section 4.6.1.3

- A very limited amount of fish (five) and plant (two) samples were used to assess risk to other animals that consume these fish and plants.

Figure 2-4

- The tissue sample locations are too limited to adequately characterize the potential exposure harbor-wide.
- Ecological samples were collected in localized areas within the harbor, and therefore do not necessarily fully characterize harbor-wide contamination.

Supplemental Data Evaluation to the Sediment Investigation Report

General Comments:

Please explain how information and results in this report will be incorporated into the larger Sediments Investigation Report.

Specific Comments:

Section 2.2

- This section states that an interpolation method was used to estimate "values at unknown locations." As these estimations were used to further analyze the extent and impact of contamination in the harbor, the exact amount of estimated points and the percentage of estimated points to the complete dataset should be defined in this report.

Section 3.1

- The Human Health and Ecological Risk Assessments, conducted as part of the Port Angeles Harbor Sediments Investigation Study, rely on Dungeness Bay as a reference site. Section 3.1, however, states that, "The small number of sampling points from Dungeness Bay studies and the limited number of analytes investigated in Freshwater Bay (polychlorinated biphenyl [PCB] congeners and dioxin/furan congeners) make these data sets alone insufficient for calculating BTVs [background threshold values] for most COPCs." How does this lack of data affect the usefulness of the HHRA and ERA? Will these studies be redone considering any additional samples from the Dungeness Bay area?

Section 3.3

- This section states that the Model Toxics Control Act (MTCA) does "not specify a minimum number of samples for defining sediment BTVs." Please specify any protocol that will be followed to establish BTVs for this particular case.

Section 4.1

- This section describes the principal component analysis fingerprinting methodology. The PCA groups correlated congeners together to create one component. Please discuss the uncertainty that this generalization creates. How much does this affect the accuracy of the fingerprinting method?

Section 8.0

- Data gaps and additional data needs are listed in Section 8.0 and described throughout the report. Will any additional sampling activities be conducted to fill these data gaps? As is, the PCB congener analysis is incomplete and likely underestimates concentrations. Additional data is needed to provide sufficient background levels, and an alternate fingerprinting analysis should be conducted as well. Please explain how these gaps will be addressed.

Funding for this product was provided by a Public Participation Grant from the Washington State Department of Ecology. Grant funding does not constitute endorsement of opinions or recommendations expressed herein.

PORT
OF PORT ANGELES
WASHINGTON

May 21, 2012

Connie Groven, Project Manager
WA Department of Ecology
Toxics Cleanup Program, SWRO
P.O. Box 4775
Olympia, WA 98504-7775

RE: DOE Sediment Investigation Report

Dear Ms. Groven:

The Port of Port Angeles submits the attached technical comments with reference to the Sediment Investigation Report. As previously discussed, the Port would like to facilitate a meeting with DOE and other potentially liable persons to discuss the next steps in this process. I would like to take a few minutes outside our meeting on May 30 to discuss how we may coordinate such a meeting.

We look forward to working closely with the Department of Ecology to effectively and efficiently implement a mutually acceptable process to achieve measurable actions.

Sincerely,

PORT OF PORT ANGELES

Jeffery K. Robb
Executive Director

Enclosure

338 West First Street
P.O. Box 1350
Port Angeles, WA 98362

(360) 457-8527
Fax: (360) 452-3959
info@portofpa.com

FLOYD | SNIDER
strategy • science • engineering

Two Union Square
601 Union Street, Suite 600
Seattle, WA 98101
tel: 206.292.2078 fax: 206.682.7867

May 21, 2012

Ms. Connie Groven
Site Manager / Environmental Engineer
Toxics Cleanup Program, Southwest Regional Office
Washington State Department of Ecology
PO Box 47775
300 Desmond Drive
Olympia, WA 98503

SUBJECT: COMMENTS ON WASHINGTON STATE DEPARTMENT OF ECOLOGY PORT ANGELES SEDIMENT REPORTS

Dear Ms. Groven:

This letter presents our technical comments on the Washington State Department of Ecology (Ecology) Port Angeles sediment reports on behalf of the Port of Port Angeles. Since these two related documents (*Port Angeles Harbor Sediment Characterization Study: Sediment Investigation Report* dated February 2012, and the *Port Angeles Harbor Supplemental Data Evaluation to the Sediment Investigation Report*, dated February 2012) are out for public comment at the same time, and the documents are interrelated, we have prepared comments for both documents.

INTRODUCTION AND GLOBAL COMMENTS

Overall, while we appreciate that Ecology has prepared these sediment reports, we found their conclusions to be largely premature. In particular, the attempted human health and ecological risk assessments and the approach to the derivation of background are based on very limited data and very conservative assumptions. The attempt at source identification is also premature, based on insufficient information and potentially flawed assumptions. Furthermore, the reports contain statements concerning the need for specific remedial actions, yet do not meet the requirements for a Remedial Investigation/Feasibility Study (RI/FS) required under the Model Toxics Control Act (MTCA). These premature conclusions are not supported by the available data or the initial phase of the project. In addition, the reports provide insufficient information in key subject areas, such as the vertical extent of chemical contamination or wood waste, necessary to describe potential cleanup actions.

In general, our biggest concerns involve the following:

- the attempt at setting precedent with the risk assessment calculations,
- the approach to the determination of background,
- the difficulty interpreting vertical extent of contamination,
- issues concerning the hydrodynamic conceptual site model, particularly with regard to wood debris, and
- unsupported source identification efforts.

What the data does suggest is that only limited areas of the harbor are impacted. It is premature to conclude that significant areas of the harbor require wood debris removal, as stated in the Supplemental Data Evaluation Report, because, depending on the age of the release and the nature of the wood debris, capping and/or natural recovery are viable technologies for consideration. Again, because these reports do not meet the MTCA requirements for a Remedial Investigation, nor is there the equivalent of a Feasibility Study included, statements regarding potential remediation actions are inappropriate at this time.

Based on the nature of the reports and the interrelated nature of the topics, it would make more sense to present the information as one report. The split between reports seems more to do with subcontractor changes than an actual technical need, and similar information is presented in both reports in some cases with different mapping approaches, unnecessarily complicating review.

We have organized our comments around these topics and several others below. In general, we intend these comments to be constructive input to the Harbor Study process, and anticipate working cooperatively with Ecology.

PORT ANGELES HARBOR SEDIMENT INVESTIGATION REPORT

Human Health and Ecological Risk Assessment Approach—High Fish Consumption Rates and Small Sample Size

The human health and ecological risk assessments, included as Appendix G to the report, for the most part acknowledge the technical limitations and uncertainties of the approach: uncertainties surrounding the fish consumption rates used in the human health risk assessment, a very small sample size, and comparisons to the reference site, Dungeness Bay. More detailed comments on these topics are included below.

Fish Consumption Rates

The fish consumption rates in the human health risk assessment calculations of the *Port Angeles Harbor Sediment Investigation Report* consist of a subsistence fisher consumption rate of 583 g/day, and a "recreational fisher" value of 76 g/day. The 583 g/day value is the highest fish consumption value that has ever been proposed for application in the state of Washington and comes from recommendations of the Lower Elwha Tribe (LEKT). The recreational fisher value was taken from U.S. Environmental Protection Agency (USEPA) guidance.

The LEKT subsistence rate appears to be based on the Suquamish Seafood Consumption Survey; therefore making an assumption that the LEKT uses resources similar to the Suquamish Tribe. The 583 g/day consumption rate is extremely heavy for shellfish (498.4 g/day) with the remainder split between pelagic fish (56 g/day) and bottom fish (29.1/day). In addition to the unreasonably large amount of fish expected to be consumed by a person in a day, the obvious issue is whether Port Angeles Harbor, based on the available habitat and sustainability of harvest, could support the intense shellfish harvest that the rate implies. The fish consumption rates stated in the Suquamish survey, LEKT's recommendations, or even the USEPA's Region X guidance document itself have never been peer reviewed. This report

contains very little justification concerning the application of this very high rate, other than citing MTCA science advisory board proceedings and USEPA's Region X fish consumption guidance.

To illustrate the conservatism of the subsistence scenario portrayed by this report, the adult subsistence reasonable maximum exposure scenario assumes that during an average 70-year life span, an individual will harvest and eat raw (without any attenuation of chemicals from cooking) exclusively from Port Angeles Harbor (no store-bought fish or fish harvested from outside the harbor) according to the following:

- Eat 583 g/day of fish (represented in the calculations by tissue concentrations from ling cod, rock sole, coonstripe shrimp, horse clam, Dungeness crabs, and geoduck)
- Harvest clams 104 days per year, every year, during which 0.1 g/day of sediment is also incidentally ingested.

The scenario assumes that during clamming the head, forearms, hands, lower legs, and feet are all exposed to water and sediment. In addition to other conservative assumptions in the calculations, this scenario is extremely conservative to the point of being unrealistic. According to applicable guidance, fish consumption scenarios should represent the "reasonable maximum exposure"—with the emphasis being on "reasonable." The conservative nature of the selected exposure scenarios should be discussed to provide readers with a frame of reference.

The recreational fisher value (76 g/day), taken from USEPA guidance and higher than MTCA's default 54 g/day value, is also conservative. The report is unclear as to why this higher rate, rather than MTCA's default value was applied to Port Angeles Harbor, and does not provide any justification for the use of the higher value. Additionally, the USEPA 2011 exposure factors handbook cites the 95th percentile fish consumption for marine recreational fish ingestion as 6.8 g/day, much lower than the 76 g/day value used. The unreasonably conservative risk assessments result in unsupported conclusions about the need for remediation.

Small Sample Size and Comparison to Reference Samples

The human health and ecological risk assessments have a number of limitations due to small sample size. Tissue samples were, for instance, compared against samples from Dungeness Bay, but not all species were able to be collected, and very limited sediment data are available for Dungeness Bay. In the ecological risk assessment, the chemical data for eel grass and bull kelp are extremely limited—only one sample size of each species was available. The biological sample data available for use in the ecological risk assessment were also not ideal. For example, large predatory species (ling cod and rock sole) had to be used in lieu of more appropriate species. Finally, tissue data were collected during the Rayonier study, so that area may be over-represented versus the rest of the harbor.

When screening for ecological risk, the Washington State Sediment Quality Standards (SQS) for organic chemicals were normalized to 1 percent total organic carbon for screening purposes. But the sediment total organic carbon content in Ecology's data for Port Angeles Harbor was typically greater than 1 percent; in some cases quite significantly, so this conservative assumption concerning the organic content in sediments likely resulted in a greater number of chemicals being identified as potential indicator hazardous substances in sediments.

Importantly, for arsenic (which contributes a majority ([58%] of human health risk), site concentrations in tissue from a number of species are less than the reference concentrations.

Site concentrations in tissue from only two species (geoduck and horse clam) slightly exceed the reference concentrations. Site concentrations in geoduck and horse clam were 1.41 mg/kg and 1.35 mg/kg, respectively, compared to reference concentrations of 0.4 mg/kg and 0.74 mg/kg. Therefore, excess risks and hazards attributable to arsenic for two species only slightly exceeds the risks from exposure to reference concentrations. Site risks from arsenic are actually *less* than the risks from reference concentrations for a number of other fish species.

Polychlorinated biphenyls (PCBs) and dioxins in tissues, which drive 23% and 11% of the human health seafood consumption risk, respectively, also vary as to whether they are higher than or more consistent with reference, depending on species. For instance, in Dungeness crab muscle, PCB values are similar between reference and harbor samples. In horse clam edible tissue, dioxins are extremely similar between the reference and harbor samples.

Ultimately, this means that some portion of the hypothetical human health and ecological risks from the site (as calculated in the screening level risk assessment) may resemble risks posed from "background" constituents like arsenic. It may be difficult or impossible for a remedial action in Port Angeles Harbor to achieve risk reduction for certain hypothetical risks that are generally the same or lower than background conditions.

Measurement of Wood Debris and Mapping of Wood Debris

Wood debris has been mapped qualitatively by three different surveys using three different methodologies. It is important to attempt to compare the three methods. The mapping approach in the document presents the figures from each survey without a comparison between them, and without sample locations to understand the basis of mapping.

The biggest issue in mapping wood debris is a lack of information about the depth of wood debris in these areas based on the Ecology & Environment (E&E) cores. The core processing methodology E&E used, as discussed further below, did not provide much useful information about the depth or nature of wood debris, nor did it, for the most part, bound wood debris vertically. This means it is extremely difficult to determine volume estimates and age of the wood debris in question. In fact, the Supplemental Sediment report calls out this very issue and notes it as a data gap. In general, the utility of the E&E cores for vertical profiling is very limited.

The study—correctly, in our experience—determines that there is not a relationship between wood debris and ammonia; however, it does attempt to correlate wood debris and total organic carbon (TOC; which is further discussed in the Supplemental Sediment Report). This correlation should be used with caution, as the sample mass for TOC is very small (as low as 25 g, or less than 1 ounce), and whether there is a small chunk of wood in the sample or not can make a big difference in the result. Furthermore, there are other sources of TOC, as evidenced by the high TOC present in the Dungeness Bay reference samples, which have no wood debris noted in the sample log. Therefore, while this association might be correlative, it should be used with caution. For this reason, the more common parameter used on Washington marine sites with wood debris present is total volatile solids (TVS).

Finally, statements in the Supplemental Data Evaluation Report concerning the need to remove wood debris are speculative and premature. These documents do not constitute a formal Remedial Investigation nor Feasibility Study in accordance with MTCA; therefore, the need for and suitability of specific remedial technologies has not been determined. These statements should be removed.

Additional concerns about wood debris are discussed below relating to the treatment of wood in Ecology's proposed hydrodynamic Conceptual Site Model (CSM).

Hydrodynamic Concerns—Treatment of Conceptual Site Model and Wood Debris

While we are in general agreement with the hydrodynamic CSM as presented in the document indicating a net westward sediment transport, it appears that the Sediment Investigation Report and Supplemental Data Evaluation stretch the results of the Evans-Hamilton 2008 current profile study well beyond what the data support. For example, the Supplemental Data Evaluation states on Page 17 that "[i]n the vicinity of the Rayonier deepwater outfall, bottom currents responsible for sediment transport oscillate in a bi-directional manner (east-west) but are of strongest magnitude in the westerly direction (Evans-Hamilton 2008)." However, the near bottom current speeds and directional occurrence for the current profiler that was nearest the Rayonier outfall (Station #2), as presented in the Evans-Hamilton document (SIR Appendix D) shows that the low flow was in the northwest and southeast directions at low speeds that were relatively the same in both directions, and the strongest magnitude flow was not present in the westerly direction.

Sediment Transport and Treatment of Wood Debris

The Sediment Investigation Report should include a description of how wood debris associated with mill and/or log boom/rafting operations behaves differently in the water column because the various wood components have varying physical properties and densities that differ from the behavior of sediments. Some components would float for a short duration before sinking and could be transported in surface currents, and others would sink sooner upon release and would be more likely to be transported in near-bed currents/circulation. This is not discussed nor addressed in the sediment transport discussions in the report. Instead, there is minimal discussion of the potential relationship between wood and observed sediment transport and no acknowledgement of how the hydrodynamic CSM may apply to wood debris.

Radioisotopic Analyses and Sediment Accumulation Rates

Radioisotopic dating to determine rates of sediment deposition can be a useful tool to calibrate and verify sediment transport models. These sedimentation data can provide valuable information concerning the anticipated rate of sediment deposition, which in turn can assist in fate and transport assessments. However, for the Port Angeles data, there appears to be no information about the calibration or validation of the radioisotopic dating data to the typical nuclear testing maxima in subsurface sediments in the Sediment Investigation Report, Supplemental Data Evaluation, nor any associated appendices. This data quality and dating accuracy check is absolutely necessary and particularly important because the radioisotopic data do not appear to be in agreement with the CSM or the creek sediment input, and the Syvitski model predicted sediment accumulation rates that are much greater. This is partially explained in the report as being potentially the result of dredging in the inner harbor, but in general, we would regard the radioisotopic data as suspect without more confirmation that subsurface maxima were observed for at least cesium-137. The revised report must include this information as an appendix or otherwise point to a separate report or document containing this information.

Specific Comments on Hydrodynamic Analyses

- It would be helpful if Figure 7 of the Supplemental Data Evaluation also included the locations of the current profile study stations.
- Figure 7 of the Supplemental Data Evaluation shows the cross symbol representing the locations of "sedimentation rate cores" at six locations, yet there are only two recent sedimentation rate cores with radioisotopes (MA06 and RL03) that are discussed in the associated text. If the additional locations are presenting previous sedimentation rate cores, this should be clarified and better presented.
- Section 5.1.2 of the Supplemental Data Evaluation states that "The area in the immediate vicinity of the former Rayonier Mill property is net erosional." However, the term "immediate vicinity" is undefined and the percent fines contours presented in Figure 8 indicate that there are areas around the Rayonier property that have elevated fines. Although this section is summarizing the results of the STA, this statement is not supported by the figure, and more support for this statement would be useful.
- On Page 49 of Appendix I Geomorphic Report, the second paragraph states: "At Station #3, there are extremely strong currents to the west at just a few meters off the bed, but they do not persist near the bed (Figure 2). Currents appear most often toward the east; however, they are not as strong as those toward the west. Despite the lack of strong currents measured at the tripods, the currents observed are broadly consistent with the STA observations at the tripod deployment sites." The statement that there are extremely strong currents to the west at Station #3 contradicts the following statement: "...[d]espite the lack of strong currents measured at the tripods..."

Toxicity, Bioassays, and Interpretation Driven by One Endpoint

In the Sediment Investigation Report, the implication in multiple statements is that broad toxicity was observed in the harbor; however, bioassay failures are not strongly correlated with elevated chemical concentrations. Only 5 of the 59 bioassay locations showed chemical Sediment Management Standards (SMS) exceedances. Yet the report states: "...[t]he cause of these failures may be the result of the cumulative effect of multiple chemicals, individual chemicals without criteria, and/or physical factors".

The vast majority of these bioassay failures are driven by the acute larval echinoderm development bioassay using *Dendraster exentricus*. Twenty-nine stations showed bioassay SQS exceedances versus the reference station, and 12 stations showed cleanup screening level (CSL) bioassay exceedances (41 out of the 59 bioassay locations), but again, only 5 of these 12 corresponded to chemical SMS exceedances. These failures are widespread across the harbor but do not correlate with chemical concentrations. In the Supplemental Sediment report it discusses that "...[t]he presence of wood debris or other forms of excess organic matter in sediment samples may have caused inaccurate counts of larvae at the bioassay endpoint. Fine-grained sediments rich in organic matter tend to aggregate, forming a flocculent sediment layer. Larvae that develop normally over the course of the bioassay test but become entrained in the flocculent layer may not be counted at the test endpoint. For this reason, a modified endpoint to the larval development bioassay has been developed that includes sediment resuspension to obtain a more accurate count of larvae. The modified endpoint method was not used for Port Angeles Harbor bioassay samples..."

This is supported by the observation of larval bioassay failures correlated with fine content. Bioassay larval failures appear to be correlated with percent fines (which represent the more flocculent material), with an R^2 of 0.67.

In fact, this issue of larval toxicity failures in the presence of wood debris is under regulatory review right now. According to the May 2, 2012 Sediment Management Annual Review Meeting in Seattle, multiple projects with larval bioassays conducted with the standard methods have seen indiscriminant failures in sediment with fine clay, and/or fine sediment with flocculent layers and woody debris *even in clean material.* Larval failures are not related to sediment chemistry, but to entrainment of the larvae in the flocculent material, causing miscounting later in the test. A re-suspension method was developed in 2009 to address the issue. Newfields (working with the U. S. Army Corps of Engineers) has a detailed protocol for this method, available now, which involves shaking up samples before the end of the test to minimize entrainment. The recommendation at the meeting was that Ecology may elect to use the re-suspension method if false positives are a possibility.

Therefore, the larval bioassay results should be disregarded and statements about "widespread observed toxicity" in the harbor removed. The other bioassay data should be acceptable for use and indicate very limited areas of toxicity.

PORT ANGELES SUPPLEMENTAL SEDIMENT DATA EVALUATION

Determination of Natural Background

The Supplemental Sediment Report determines a natural background threshold value for use in Port Angeles Harbor. This value is different than the natural background value identified in the Bold Sediment Survey, which is considered as "natural background" for sediment sites elsewhere in Puget Sound. The Supplemental Sediment Report queries the Environmental Information Management (EIM) System for Freshwater Bay and Dungeness Bay data. Since the number of data points is insufficient, they pull in Strait of Juan de Fuca and San Juan Island Bold survey data to calculate a natural background (called the Port Angeles Proximal Area dataset).

The Port Angeles Proximal Area dataset, which is used to determine regional background, is more coarse-grained than the actual harbor study area. The calculated "Port Angeles–specific" background is lower than the Bold Survey background in use at other sediment cleanup sites. Fine grained sediments have a larger surface area and can have a higher organic content and will adsorb contaminants much more readily than coarse grained sediments. In fact, based on the Port Angeles Proximal Dataset, the "background threshold value" (BTV) for most organic chemicals is less than the method detection limit which is part an artifact of the coarse-grained, low organic content sediment samples chosen for the BTV dataset. These data are not a reasonable comparison to Port Angeles sediments, which are in general finer grained.

This effectively means that, if used in an RI/FS process, Port Angeles Harbor would be held to a lower background standard than the rest of Puget Sound. This is not technically appropriate (especially because of the poor match on particle size). We do not agree the Port Angeles Proximal Area Background dataset should be used to determine natural background for the Port Angeles Harbor.

Source Identification Presumptive and Inappropriate

"Fingerprinting" analyses should be evaluated carefully, since subtle differences in fingerprinting approaches can be used to draw fairly different conclusions for the same data set. How the data are partitioned or processed can have relatively large influences on the "interpretation" of the fingerprinting results, particularly when using visual comparisons of datasets to show similarities and differences between components. We have a number of concerns with the "fingerprinting" approach presented in these reports.

The very cursory "fingerprinting" discussions presented in both reports seem, for the most part, out of place and add nothing to the reports. For example, the use of "chemical fingerprinting"—in the case of the Supplemental Data Evaluation Report, Principal Component Analysis with dioxin/furan congeners—was unable to distinguish sources. Given that the stated goal of the harbor study was to identify terrestrial and aquatic sources of chemicals and wood debris and prioritize areas requiring cleanup, the focus should be the current nature and extent of contamination. Any analysis of historic source contribution should consider multiple lines of evidence and be coupled with a thorough discussion of each potential source's operational history. The physical history of site development, including dredging history, should also be considered. If appropriate, it is recommended that identification of historic source contribution be revisited separately. This could be more efficiently done after the development of site history. The site history should consider all historic activities that could help explain the current nature and extent of constituents, including any defunct operations and activities of the United States during and after the WWII era, as well as releases associated with activities authorized under Department of Natural Resources leases.

Sampling Bias, Core Processing, and Specific Mapping Comments

We have an overall significant concern about the identification of potential sources based on the analyses in the reports. As described in the Sediment Investigation Report, there was a considerable effort to "triage" the analyses performed, presumably to minimize analytical cost. That meant that certain analytical groups were only analyzed within some proximity of a nearby source and/or if there was evidence of anthropogenic impacts in the sediment samples. This decision may mean, however, that the presumptive assumptions about source and chemicals associated with that source, may "bias" the results in favor of known or suspected sources. In the worst case, it may mean that the data would not bound an area of impacts and could miss other contributions, since the analyses will bias toward "known" sources and chemicals presumed to be associated with a known source. This concern is elevated if there is limited site historical information presented, as indicated in our comments above.

In general, this triaging, as described above, is not a sound scientific approach. There are better, established approaches, such as determining a surrogate for anthropogenic impacts or a quick screening method to determine whether a sample is likely impacted or not, that does not bias as heavily in favor of "known" sources.

The core processing undertaken, as described, appears to be poorly executed, subjective, and poorly documented. As opposed to setting out with a stated interval processing scheme and adjusting based on field conditions, the interval scheme was determined entirely in the field. There also appears to have not been a surface interval taken from each core—it is not entirely clear why, other than perhaps the surface grabs were presumed to be "co-located." As a result, it is difficult to determine the depth of contamination or wood waste, in particular, or to determine

whether natural recovery is occurring. In fact the Supplemental Data Evaluation Report points this out—a disclaimer that would have been more appropriately contained in the Sediment Investigation Report.

Specific Mapping Comments

An important aspect relevant to the mapping shown in the Supplement Sediment Data Evaluation report pertains to the interpolation methodology used. The report indicates the use of an Inverse Distance Weighted model with a variable radius, but does not appear to specify the Power used, nor indicates the number of neighbors used, and so forth. There are a number of interpolation methods that may be more appropriate for the data and setting. A sensitivity analysis of interpolation methodology and associated parameters is needed to evaluate the representativeness of the mapping presented in the reports.

- The Sediment Investigation Report SQS exceedance figures should have color symbology by analyte group at the harbor-wide scale. This would be more effective at conveying the results (as opposed to callout boxes) and the overall nature and extent of contamination could more readily be understood.
- The Supplemental Data Evaluation chemical contour figures show two different contouring presentations. For some analytes, such as arsenic, the highest concentrations or most contaminated areas are the lighter colors and in others, such as PCBs, the highest concentrations are the darkest colors. The contouring approach should be consistent across analytes and consistent with the industry standard for environmental data where typically the highest concentrations are represented by the darkest or warmest colors. Additionally, the sample location notation is missing from the key box in Figures 9, 11, and 16.
- We strongly recommend inclusion of several 11-inch by 17-inch format figures with concentration labels at the sampling points. This makes detailed technical work easier.

CONCLUSION

The Port of Port Angeles appreciates Ecology's careful consideration of these comments. Please let us know if Ecology has any questions about our comments.

Sincerely yours,
FLOYD | SNIDER

Allison D. Geiselbrecht, Ph.D.
Associate Principal

Encl.:
Copies: Steve Werner, Formation Environmental
Jeffrey Robb, Port of Port Angeles
David Neupert, Steve Oliver; Platt Irwin
William Joyce, Tod Gold; Joyce Ziker Parkinson, PLLC

Rayonier

Value From The Ground Up

Corporate Headquarters

Carla E. Yetter

Vice President, Environmental Affairs

May 22, 2012

Ms. Connie Groven
Washington Department of Ecology
Toxics Cleanup Program, SWRO
Olympia, WA 98504-7775

Re: Comments on Revised Sediment Investigation Report and NewFields Supplemental Report

Dear Ms. Groven:

Thank you for the opportunity to comment on the public review draft of the revised Port Angeles sediment investigation report (SIR) (Ecology and Environment 2012), including the public review draft of the supplemental data evaluation to the SIR (NewFields 2012).

Rayonier operated a pulp mill in Port Angeles from 1930 until 1996 when the mill was closed and razed, and the company entered the Washington MTCA process. Over the years, Rayonier has worked cooperatively with Ecology to identify the extent of its liability for contamination from the former mill by completing numerous investigations, sampling events, studies, and reports. We have provided Ecology with ample data, analyses and multiple lines of evidence demonstrating that the in-water contaminant Site boundary for the former mill is well-defined. We were hopeful that after sixteen years we had completed the investigation phase and were moving on to final clean up. After reading the subject draft reports that appears unlikely anytime soon.

The Department's reports contain statements, assertions and conclusions that are surprising, disappointing and inconsistent with sound science. Ecology's choice to base its conceptual site model for the Port Angeles Harbor primarily on the agency's own work conducted at a single point in time (2008) is surprising given the substantial body of harbor studies and reports available which span nearly fifty years. Not only is this body of work well supported and peer reviewed, it presents information about conditions collected in real time while historic sources were still operating. As pointed out in comments by our technical team, there are multiple lines of evidence contained in this work that lead to conclusions contrary to Ecology's but more consistent with accepted scientific principles and observed conditions in the harbor. In contrast, Ecology's CSM contains several untested theories and approaches that are not supported by science and work by other experts, and do not consistently represent observed conditions in the harbor. In fact, the primary support for Ecology's conclusions appears to be Ecology's own work.

P: 904.357.9100 | Rayonier
F: 904.357.9101 | 1301 Riverplace Boulevard, Suite 2300
www.rayonier.com | Jacksonville, FL 32207

That the Department has chosen to reject a scientifically supported definition of the Rayonier in-water Site in favor of undertaking more investigative studies and initiating a PLP process is very disappointing. We strongly believe that the Rayonier Site is sufficiently defined and characterized under MTCA requirements; that further studies will not change the existing investigation results and conclusions about nature and extent of contamination from the Rayonier mill; and that a final clean up action could be designed right now, without further delay.

Rayonier encourages the Department to review the technical comments provided by our scientists, oceanographer and engineers with an open mind and consider the clear and convincing lines of evidence, which weigh heavily against Ecology's conclusions.

As always, we are available to meet with the Department and work towards a final, certain solution for the Rayonier Site.

Sincerely,

Carla Yetter/WK

cc: Rebecca Lawson, Washington Department of Ecology
Jim Pendowski, Washington Department of Ecology
Sonya Tetnowski, CEO Lower Elwha Klallam Tribe

Sea Engineering, Inc.
200 Washington St. Suite 210
Santa Cruz, CA 95060
Voice: 831.421.0871
Fax: 831.421.0875

To: Ms. Connie Groven, Project Manager
Toxics Cleanup Program, SWRO
P.O. Box 47775
Olympia, WA 98504-7775
Connie.Groven@ecy.wa.gov

From: Craig Jones

Date: May 17, 2012

Re: Port Angeles Harbor Sediment Characterization Study
Sediment Investigation Report (February 2012 Public Review Draft)

Dear Ms. Groven:

As you know, I have been working with Rayonier for over a year as a technical lead providing review and assessment of sediment and contaminant transport in Port Angeles. In this capacity, I have reviewed the draft *Port Angeles Harbor Supplemental Data Evaluation to the Sediment Investigation Report, Port Angeles, WA* (NewFields 2012), hereafter referred to as the Harbor Study, and supporting study reports (Evans-Hamilton 2008; GeoSea 2009; Herrera 2011) and have significant concerns with the Washington Department of Ecology (Ecology) conceptual site model (CSM) presented in these reports.

As part of the Rayonier technical team, I had the opportunity to meet with Ecology and their consultants several times to discuss the areas of disagreement and to present our assessment. The assessment that I have provided to Rayonier and Ecology is based on commonly accepted practice and applied site-specifically to Port Angeles Harbor based on multiple lines of evidence. During meetings last year, it appeared that Ecology and their consultants agreed with many of the key points; however, rather than taking this information into account, the recent Harbor Study continues to propose a CSM that is not supported by the data nor common practice for sediment transport assessment. I have prepared this letter in order to highlight some of my significant disagreements with the NewFields (2012) report, including its acceptance of the Ecology's CSM.

I have extensive experience in sediment and contaminant transport processes in coastal, estuarine, riverine, and lacustrine environments. Over the past 15 years, I have worked closely as project manager and technical lead with the private sector, research organizations, and governmental regulatory

agencies in the analysis and solution of aquatic environmental problems at sites worldwide with a particular emphasis on contaminated sediment projects. In addition, I have led development efforts for state-of-the-science fate and transport modeling techniques in aquatic environments. I stay active in the scientific and engineering communities by continuing basic research, regularly participating in technical reviews, and teaching international workshops on sediment and contaminant transport.

Key Problems with Section 5 of the NewFields (2012) Report

1. Interpretation of circulation patterns

The NewFields (2012) report states, "… a single tidal eddy postulated in some previous studies likely does not represent the most important current events that initiate or maintain sediment transport. Instead, the most intense currents were consistent with highly localized tidal eddies."

Tidal currents in regions of variable bathymetry, such as Port Angeles Harbor (the Harbor), generally induce a net circulation in confined areas (commonly referred to as tidal pumping), which generates a net circulation direction (Dyer 1997). There have been six direct studies and numerous subsequent interpretations on circulation in the Harbor. Summaries are found in Ebbesmeyer, Cox et al. (1979) and Shea, Ebbesmeyer et al. (1981). In three of the previous studies (Stein, Denison et al. 1963; Washington State Pollution Control Comission 1967; EPA 1974), a net counterclockwise circulation was noted. In two reports (Charnell 1958; Tollefson, Denison et al. 1971) flow was predominantly north or south across the mouth of the Harbor and was associated with a tidal eddy east of the Harbor with no discernible circulation in the harbor. A final study (Stein and Denison 1966) reported a net flow directed east by northeast for a site near the southern shore of the mouth of the Harbor. Ebbesmeyer, Cox et al. (1979) also observed the growth and decay of tidal eddies in the system, which were generally calculated to have low kinetic energy (e.g., low transport potential and not "intense" as contended in the NewFields [2012] report). The Windward Environmental LLC (Windward 2011) CSM does not discount the existence of complex ephemeral tidal eddies moving in both flood and ebb directions, which are common in natural turbulent systems, but addresses the longer-term net circulation directions that dictate sediment and subsequent contaminant transport.

The important question is what happens to the effluent discharged along the former Rayonier mill shoreline? The comprehensive U.S. Environmental Protection Agency (EPA 1974) study on sulfite waste liquor concluded that discharges from the former Rayonier mill were transported in an eastward direction, which was enhanced by the dominant westerly wind patterns. Based on observations of the effluent from all facilities in the Harbor, the study also concluded that there was weak counterclockwise circulation in the Harbor. The conclusion Ebbesmeyer, Cox et al. (1979) reached was that the effects of wind and mean current favored eastward transport near the shore where the former Rayonier mill outfalls are located and provided additional lateral dispersion between the offshore and nearshore areas. The Shea et al. (1981) study documented that former Rayonier mill effluent was forcefully transported to the east on a flood tide and "curled" out of the Harbor outside of Ediz Hook during an ebb tide and that only some of the material entered the Harbor. Summaries of previous work also documented the easterly transport of effluent and reported that 95% of the material was flushed from

the Harbor within a 5-to-6-hour period (half of a tidal cycle) (Foster Wheeler Environmental Corporation 1997).

Finally, the net effect of local currents on material deposited from the effluent can be determined by examining the patterns of deposited material near the outfalls. Figure 1 shows toxic equivalent (TEQ) values overlain on the results of sludge surveys from 1961 and 1965 (Denison 1975). The skewing of the sludge and TEQ patterns to the east are an indication of the long-term deposition of materials and associated contaminants that have been transported to the east. Denison (1975) notes:

> *"The orientation of the eastern deposit clearly shows that the net circulation pattern of the Port Angeles Harbor is in a counterclockwise direction. In addition to its elongation to the east, it will be seen that the far end was unstable and showed fluctuations during the survey period. In contrast, the northward extension of the sludge was clearly limited by the eastward transport of material out of the harbor. From these data it was concluded that, 'although there are minor fluctuations, the size and shape of the sludge beds are stabilized.'"*

If the material had been transported to the west, as concluded by the NewFields (2012) report, the deposition would not have such a well-defined and preserved shape to the east. Although the sludge has disappeared as a result of the in-place decay of the organic material, the contaminants remain. The Windward CSM (2011) is based on the general conclusion of the previous studies and observed contaminant deposition patterns (Figure 1). The long-term net transport and deposition of effluent from the former Rayonier mill, and from other facilities to the west as shown by the TEQ's in Figure 1, is to the east.

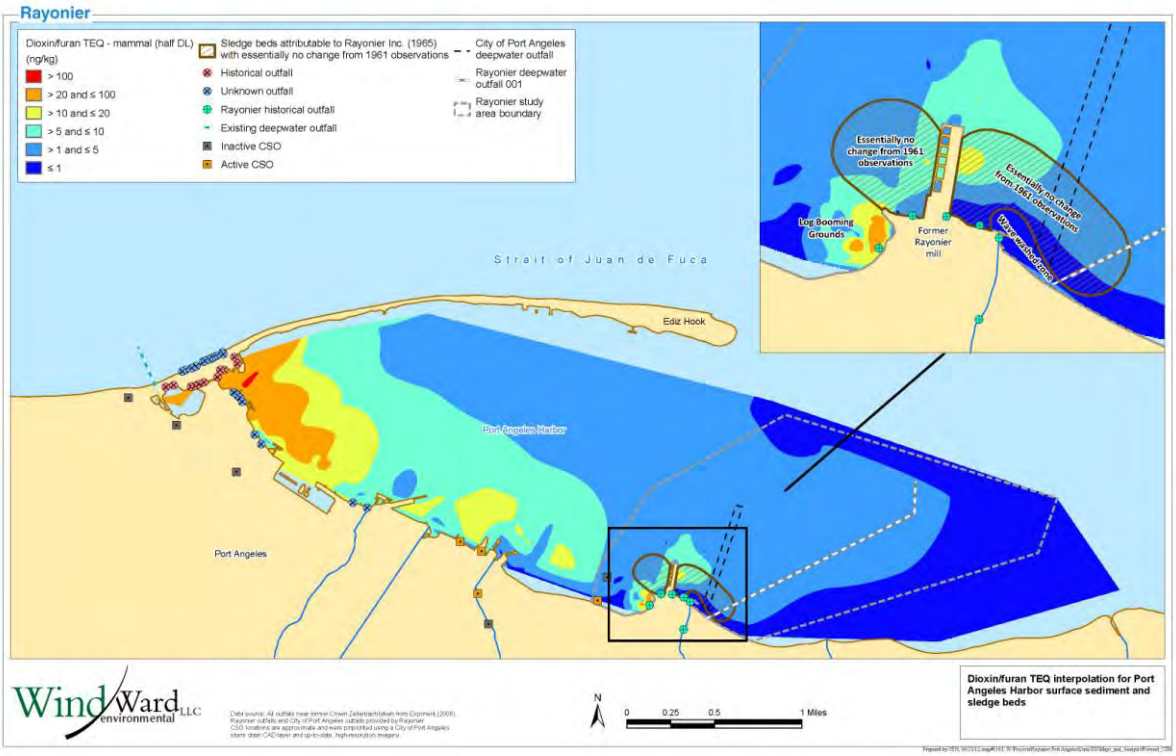


Figure 1. Extent of observed sludge material and TEQ values

2. Interpretation of sediment trend analysis data

The sediment trend analysis (STA) methodology relied upon as a line of evidence in the NewFields (2012) report is based on the statistical analysis of sediment grain size trends. Fundamentally, sediment grading and grain size can be linked to the forces that transport and deposit sediment. The STA uses surface grain size analysis to infer transport direction. Although the physics of the environment responsible for transporting and depositing sediment in different locations is related to grain size in non-cohesive sandy sediment, it is well accepted in the sediment transport professional community that fine cohesive sediment does not mobilize in a manner that can be predicted by grain size alone. In addition, the examination of the grain size of existing surface sediment does not take into account the long-term history of a sediment bed (e.g., contaminants in many locations are buried deep in the sediment and may not be associated with present-day surface sediment). Furthermore, recent peer-reviewed work (Poizot, Mear et al. 2008) concluded that STA is not a mature method and leaves much room for improvement. The responsible conclusion is that STA is not applicable to the fine sediment and fine sediment mixtures of concern in the Harbor. The methodology has not been rigorously peer-reviewed in tidal fine-sediment environments, is not considered to be a mature methodology, and has been rejected by review committees (USEPA, the U.S. Geological Survey [USGS], and the U.S. Army Corps of Engineers [USACE]) for use at other major sites in Washington State (e.g., Lower Duwamish Waterway and Bremerton).

A few key points of contention stated in the (NewFields 2012) report are:

> "Sediment is supplied to parting zones during high energy events and is subsequently redistributed by tidal currents."

The NewFields (2012) report contends that sediment from the former Rayonier mill is supplied to a "parting zone" ; however, there is no significant contamination in this region. The conceptual model of sediment being deposited near the former Rayonier mill, hopping to a "parting zone," and then being distributing throughout the system is totally unsupported by any other observed transport trend in the region (e.g., sludge beds, contaminant distributions). Furthermore, the STA is based on measurements of surface sediment grain size. If the sediment grain sizes are constantly changing during events, as postulated in the report, a single surface sediment grain size measurement cannot define a change over time.

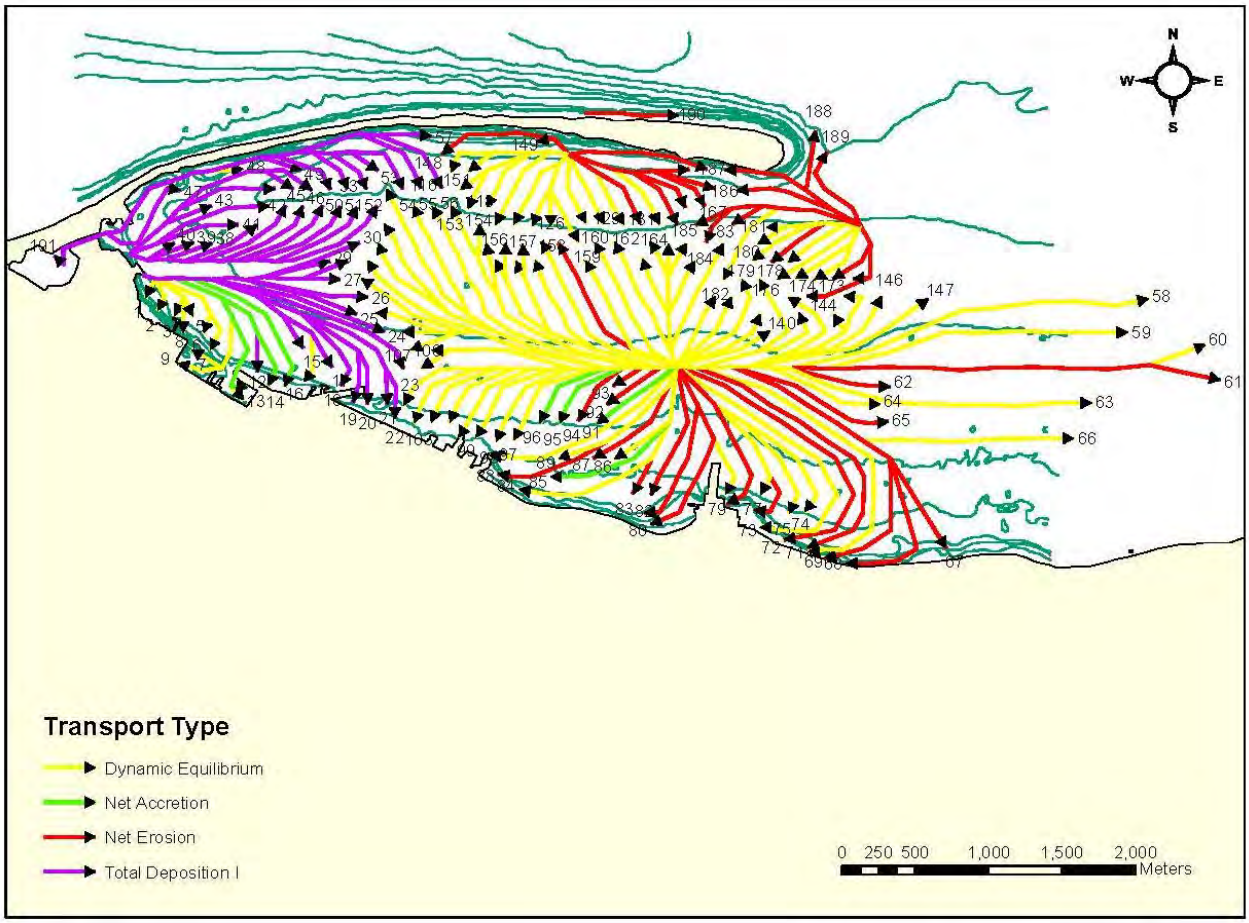
> "The analysis identified the vicinity of the former Rayonier Mill property as being net erosional, suggesting property-derived particles settling in the nearshore during low energy intervals are only temporarily deposited there. This material appears to be scoured from this region during high energy events. Such a mechanism may explain why pulp waste mats…were not apparent in subsequent wood waste surveys…while the STA does not predict the ultimate depositional location of material derived from the former Rayonier Mill property, it suggests the potential for dispersion throughout the harbor. STA identifies the inner harbor as the predominant depositional region of Port Angeles Harbor, suggesting the inner harbor as the terminus of some sediment transport pathways." (NewFields 2012)

If the former Rayonier mill site is net erosional, there should be no remaining contamination near the site decades after any significant contaminant discharge. The disappearance of the highly organic sludge beds once discharge had ceased is directly attributable to the process of organic material decay (e.g., sediment diagensis), which is a well-recognized and relatively rapid process in tidal marine systems. Although the organic material has decayed, the slow degrading contaminants have been left in place, as shown by in Figure 1.

> "The strongest near-bed current at the locations of the parting zones is to the west (Evans Hamilton 2008). This bottom current is a combination of tidal current and counterflow balance to the strong eastward surface currents within the harbor caused by westerly winds. This same westward bottom current is also likely to transport fine-grained sediment emanating from the Rayonier Deep Water Outfall and Port Angeles City Outfall, which discharge into the deep harbor east of the sediment parting zone."(NewFields 2012)

It is unclear how these conclusions have been drawn. There are no near-bed current measurements in the parting zone identified in Figure 7 of the NewFields (2012) report. The STA analysis does not conclude that there is a "strong" westward net transport along the southern shoreline (Figure 2), as contended by the NewFields (2012) report. The transport of sediment to the former Rayonier mill shoreline shown in the STA is inconsistent with the NewFields (2012) report conclusion regarding the erosion of sediment from the former Rayonier mill . The other credible peer-reviewed sources of

information (identify documents) present clear evidence of the eastward transport of former Rayonier mill effluent, and the contaminant patterns near the facility support this evidence.



Source: GeoSea (2009)

Figure 2. Sediment transport patterns presented in the STA analysis

3. Interpretation of geomorphic report

The NewFields (2012) report states, *"*Nearshore sediment transport (< 55 ft of water depth) is clockwise along the southern harbor."

The nearshore-offshore boundary along a coastline is typically considered to be the line along which waves break. However, of more concern to this study of the Harbor is how far out are the waves that are responsible for moving sediment. For practical purposes, coastal scientists and engineers define the depth at which sediment is mobilized by wave activity as the depth of closure. USACE has a standard equation for this depth based on incoming wave height and has outlined its use in the coastal engineering manual (CEM) (USACE, 2002). In general, the wave height is based on the height of the largest, most significant wave during a storm event.

Waves that interact with the former Rayonier mill shoreline are generated by wind. Based on wind measurements made by the U.S. Coast Guard (USCG) station on Ediz Hook, winds that are strong enough to develop significant waves (~ 8 kts) are primarily from the west (Figure 3). However, west winds do not have the ability to generate large waves within the Harbor because of the presence of Ediz Hook. Using a sustained storm wind of 56 mph[1], the depth of closure is calculated to be 2.7 m (8.9 ft), which is considerably shallower than the 55 ft reported in the NewFields (2012) report.

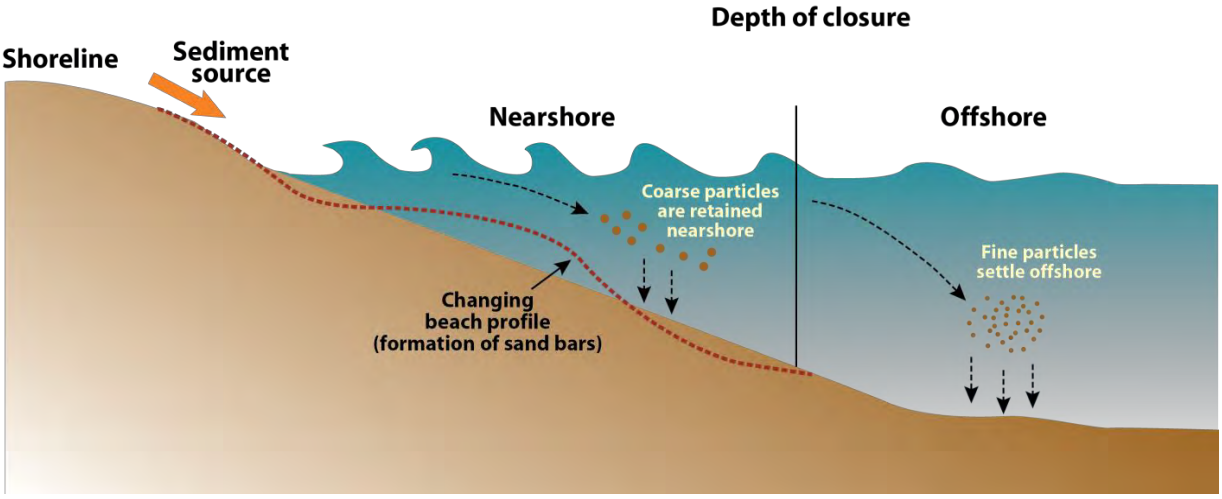


Figure 3. Illustration of the commonly accepted boundary between nearshore and offshore areas known as the depth of closure

[1] This is much greater than the storm winds measured at the Ediz Hook USCG stations but has been used to illustrate the range of closure depths during very strong storm winds.

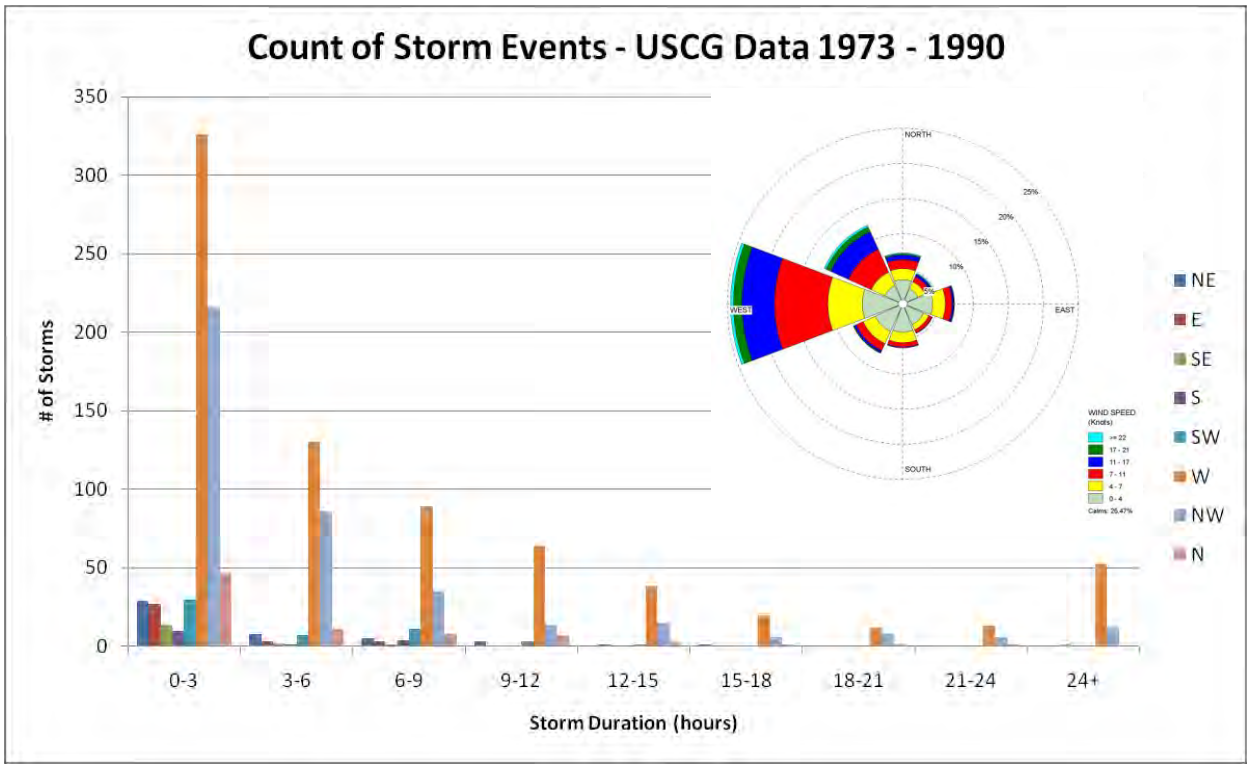


Figure 4. Number of storm events as a function of wind duration and direction at the USCG station on Ediz Hook and a standard wind rose

A more rigorous calculation method based on the force exerted by waves on the bottom can be used to help determine a realistic depth at which sediment can be resuspended by waves. A small percentage (~ 5%) of high-wind events emanate from the north and northeast (Figure 4). Wind events from these directions can be considered a worst-case scenario because they blow uninhibited by Ediz Hook to the former Rayonier mill site. Using standard equations for the prediction of wind waves from the CEM (USACE, 2002), with the 45-km fetch to the northeast of the former Rayonier mill, an average north-northeasterly storm would have a 0.73-m significant wave height and a 3.4-s wave period offshore. As this wave moves closer to shore it would begin to "feel" the bottom and exert a shear stress. The shear stress is the force that can mobilize sediment from the bottom. When the shear stress exceeds a critical shear stress for the sediment, the sediment begins to move. The determination of critical shear stress is from the common shield curve outlined in Van Rijn (1993). For unconsolidated silt at the surface of the sediment bed, the critical shear stress is 0.1 Pa, while a medium sand (typical of most of the Harbor beaches) is 0.2 Pa. Figure 5 illustrates the increasing shear stress (right hand Y -axis) exerted by the wave as it moves into shallower water (X-axis). The depth of water when the silt begins to move is 4.5 m (14.7 ft), while the medium sand begins to move at a depth of 3.0 m (9.8 ft). Although the silt depth of motion is deeper than the calculated depth of closure, it is still considerably shallower than the 55 ft reported by NewFields (2012). It is highly unlikely that nearshore transport resulting from wave activity occurs outside a 4.5-m (14.7-ft) depth, even during infrequent storms from the north and northeast. In addition, the presence of fines outside the 4.5-m contour indicates that fines do accumulate in these regions and the wave-driven transport and erosion hypothesized by NewFields (2012) is not occurring.

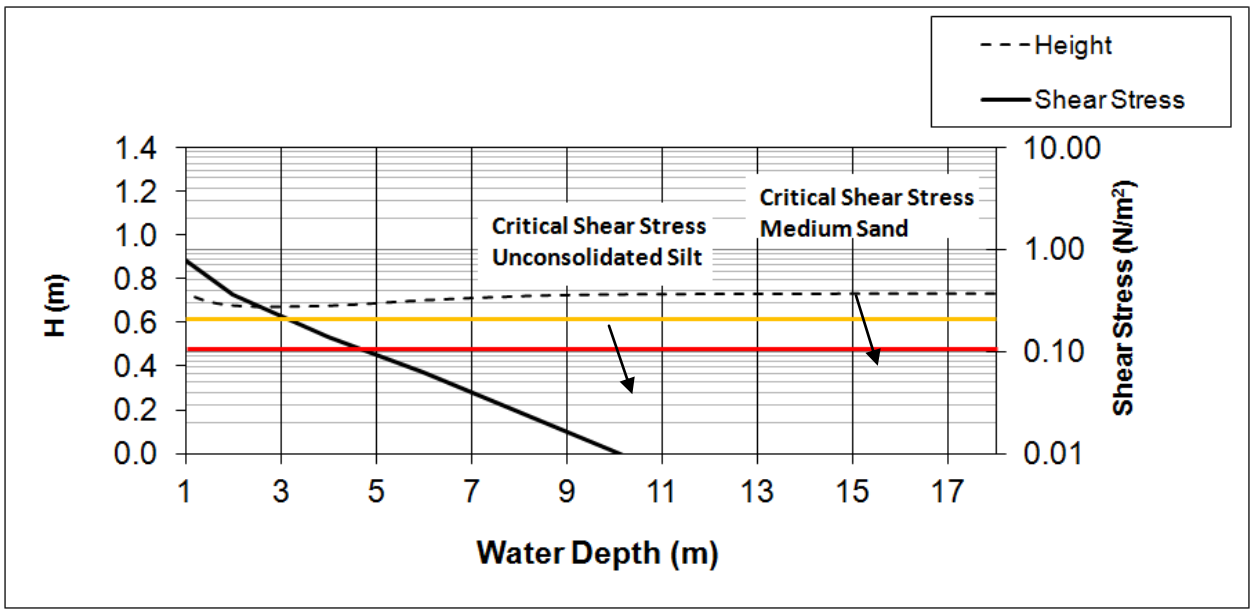


Figure 5. Calculated wave height (H) and shear stress as a function of water depth. Lines are shown for silt critical shear stress (red) and medium sand critical shear stress (yellow)

> "Herrera (2011) suggest that large wind-driven waves, as well as refraction of the swell entering the harbor from the Strait of Juan de Fuca, result in westward longshore sediment transport along the southern harbor. This clockwise sediment transport pathway was determined through observations of newly deposited sediment, lateral coarsening and fining trends alongshore, truncation of deltas in areas of wave erosion, and changes in topography/bathymetry observed in historical documents since 1914." (NewFields 2012)

Large waves in the Strait of Juan de Fuca that originate in the west can reach up to 2 m in size (National Oceanic and Atmospheric Administration [NOAA]). Since the energy of the waves in the Strait, external to the Harbor, refracts and diffracts around the tip of Ediz Hook to enter the Harbor, the energy that reaches the southern shoreline after 90 to 180 degrees of turn would be reduced. Standard wave diffraction diagrams show that wave heights would be reduced by 90 to 99% (USACE, 2002). If it is assumed that only 10% of the energy of a wave reaches the southern shoreline (0.2 m height), the depth of a wave's impact on sediment transport would be limited to water less than 1 m deep. The nearshore waves and currents driven by the prevailing westerly winds would result in a more significant net easterly transport, as concluded by previous studies (Ebbesmeyer, Cox et al. 1979; Shea, Ebbesmeyer et al. 1981).

Furthermore, it has been documented by surveys conducted in the log pond by Rayonier, that for more than a decade, sediment placed to replenish the shoreline on the west side of the former Rayonier mill property has been transported to the east and accumulated on the beach. This movement is outlined in the Windward CSM (2011) and serves as an excellent long-term field demonstration of net shoreline transport at the site (Figure 6).

Figure 6. Log pond at the former Rayonier mill site

The observations of morphologic transport directions presented by (Herrera 2011) are, in fact, qualitative and subjective and are never presented quantitatively in the report. It is not standard practice to present such a significant transport conclusion based on qualitative and subjective information, particularly when it is inconsistent with quantitative lines of evidence provided in other studies.

4. Interpretation of radioisotope results

> "If these accumulation rates (> 2.5 cm/yr in the inner harbor) were typical of the inner harbor, the total accumulation of sediment there could account for all sediment discharged west of Lees Creek (which is east of Rayonier)." (NewFields 2012)

First, accumulation rates vary significantly in the inner harbor as a result of water depth, tidal circulation, and proximity to sediment sources. The 2.5-cm/yr accumulation rate is representative of only one location. Second, sediment enters the Harbor from interior (local creeks) and exterior (the Strait of Juan de Fuca) sources. Based on these facts, it makes no sense to compare a single accumulation rate with a single source of solids located next to the former Rayonier mill and then draw large-scale conclusions regarding mass flux. The conclusions incorrectly suggest that the former Rayonier mill is a significant source of contamination to this location in complete disregard of documented sediment transport patterns.

5. The NewFields (2012) report claims that there is no single CSM for the harbor.

> "The current body of literature for Port Angeles Harbor implies complex conditions that result in multiple transport mechanisms, not all of which can be easily accounted for in a single CSM."

EPA recommends that the development of a CSM encompass the net effects of all processes that occur at a site. The "net" effects are the summation of calm, moderate, and high-energy conditions that affect sediment and contaminant transport. As processes are repeated at a given location over the course of many decades, consistent patterns develop, and these patterns can be described by a single CSM. A

geomorphologic example is the processes that form a delta at the mouth of a river. Although the mouth will move in response to periodic high river flows and prevailing offshore conditions, over the long term, a consistent delta is developed. These are the "net" conditions that the Windward CSM (2011) describes. It is inconsistent to separate out a low- or high-energy condition to describe the "net" transport in a system that is responsible for a persistent, long-term contamination pattern in the Harbor.

6. **"The proposed low energy CSM for PA Harbor is in many ways similar to one developed by Windward (2011) at the request of Rayonier. The Windward CSM is largely based on their interpretation of net hydrodynamic conditions and the subsequent transport of suspended materials…"**

As discussed, net conditions are responsible for the present-day contamination patterns. In addition, as illustrated in the wind-wave examples in this document, the Windward CSM (2011) carefully considers high-energy events.

> "The underlying conditions of the Windward CSM are based upon a select subset of surface current and hydrodynamic modeling studies…numerous studies indicate wide variability…and a high level of uncertainty in the direction of net circulation. Counterclockwise circulation is not constant in the harbor and may not even be the prevalent direction of circulation. A thorough survey of the relevant literature shows that circulation within PA Harbor varies based on tides and winds, resulting in complicated flushing patterns and conflicting reports of surface circulation direction.It has previously been concluded that the pattern of net circulation in the harbor cannot be determined based on available data (Ebbesmeyer et al. 1979). A conclusion of the current study (Evans Hamilton 2008) was that localized tidal eddies were likely more important for initiating and maintaining sediment transport than a single harbor-wide tidal eddy. Together these studies suggest that net counterclockwise circulation throughout the harbor, as described in the Windward CSM, is not the only process driving sediment transport." (NewFields 2012)

As discussed previously , several studies acknowledge that there is variability regarding the circulation conditions in the vicinity of the former Rayonier mill (i.e., turbulent eddies occur on every tide common to every estuary). However, as also discussed, a key question addressed in the Windward CSM (2011) is what happens to the former Rayonier mill effluent. The available literature, including that produced by independent parties, shows a consistent majority of the studies described and observed eastward transport of the effluent. Primarily, this is consistent with a prevailing strong westerly wind, which drives easterly flow along the shallow southern shoreline of the Harbor. Secondarily, Ebbesmeyer, Cox et al. (1979) in fact does summarize multiple studies in which counter-clockwise circulation was reported, and a numerical modeling study by Battelle (2004) helps confirm that these patterns do exist. It is important to note that the Evans-Hamilton (2008) report draws no conclusions regarding circulation and sediment transport, inasmuch as the document is only a data report that has general observations.

> "In particular, counterclockwise net sediment transport presented by Windward (2011) cannot account for the absence of fine-grained material offshore from the former Rayonier Mill

property and the sustained deposition of fine-grained material in the inner harbor suggested through many lines of evidence." (NewFields 2012)

There is fine-grained material offshore of the former Rayonier mill property. The nearshore beaches inside the depth of closure are composed of sandy sediment.[2] Outside of the depth of closure, the percent fines is greater than 12%, and the sediment is considered to be silty sand or silt. It is unclear how the conclusion that there is an "absence of fine-grained material" has been drawn.

7. **"In contrast to what was presented in the Windward CSM, Rayonier concluded during the process of designing their deepwater outfall that circulation in the vicinity of their property is dominated by a clockwise eddy (Tollefson et al. 1971). This clockwise eddy is supported by reported observations of westward migration of the Rayonier deepwater outfall plume (EPA 1974; Foster Wheeler 1997)…**

The deep water outfall plume is located over 1 km offshore of the key shoreline outfalls responsible for the primary contamination. Modeling studies that were conducted to support the outfall design and permitting acknowledged some amount of westward migration during flood tide conditions, yet concluded that net conditions dispersed the material out of the Harbor. The 1971 observations (Tollefson, Denison et al. 1971) regarding the nearshore outfall were visual observations during which tidal conditions were not documented. The Windward CSM (2011) acknowledges that tidal transport is bi-directional (east and west) but is based on consistent observations of net east transport.

"Bottom currents are of strongest magnitude in the westerly direction (Evans Hamilton 2008)." (NewFields 2012)

This is true for the deep location near the tip of Ediz Hook, where Evans-Hamilton (2008) had a measurement platform, thereby supporting the conclusion of net counter-clockwise circulation.

8. **The area in the immediate vicinity of the former Rayonier mill property is characterized as net erosional**

The "immediate vicinity" is not defined. It is clear that wave action can mobilize sediment in the nearshore area (less 4.5-m depth). These regions are sandy, suggesting that fine sediment, with which contaminants are generally associated, does not deposit in these regions. However, in the offshore water, contamination that collected during periods of peak discharge is still present in relatively high concentrations. The presence of this contamination is contrary to the conclusion that the offshore sediment is net erosional. Essentially, material discharged to the nearshore area and retained during low-energy periods can be resuspended and deposited offshore (deeper than 4.5 m), where the shear stresses are lower. The areas of these deposits are clearly outlined in Figure 1.

[2] Sandy sediment is classified by the Unified Soil Classification System as less than 12% silt.

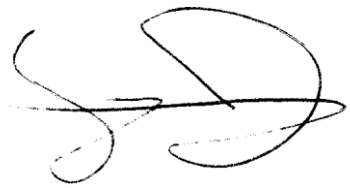
Summary

To summarize, many of the conclusions regarding transport in the NewFields (2012) report are unsupportable.

1. Many of the statements in the report are contradictory, misinterpretations of the available data, and are not based on generally accepted methodology (e.g., STA).
2. Figure 7 (which portrays Ecology's CSMs) is unsupportable and should be revised.
3. The Windward CSM has been mischaracterized (e.g., it does address high-energy events) and does not reach the same conclusions as the NewFields (2012) report.
4. The conclusion that the former Rayonier mill property is net erosional is inconsistent with the presence of relatively high contaminant concentrations immediately offshore of the site.

Thank you for taking the time to review items outlined here. Please let me know if you have any questions.

Sincerely,



Craig Jones, Ph.D.

Senior Environmental and Ocean Engineer

Sea Engineering ,Inc.

cjones@seaengineering.com

References

Battelle (2004). Modeling of effluent dilution, transport and solids deposition, former Rayonier Pulp Mill site, Port Angeles, WA. Seattle, WA.

Charnell, H. (1958). Water Qaulity, Port Angeles Harbor 1956-1958, ITT Rayonier, Inc.

Denison, J. (1975). Port Angeles Sludge Beds: The Natural Attrition of Cellulosic Sludge and Woodroom Deposits, ITT Rayonier Inc. Olympic Research Division. **119:189:** 12.

Dyer, K. (1997). Estuaries - A physical introduction. New York, John Wiley & Sons.

Ebbesmeyer, C. C., J. M. Cox, et al. (1979). Dynamics of Port Angeles Harbor and approaches, Washington. Prepared for MESA (Marine Ecosystems Analysis) Puget Sound Project, Seattle, Washington, Federal Interagency Energy/Environment Research and Development Program. EPA-600/7-70-252. Washington, DC, US Environmental Protection Agency.

EPA (1974). Evaluation of ITT Rayonier, Inc. outfall, Port Angeles Harbor, Washington. EPA 330/3-74-001. Denver, CO, US Environmental Protection Agency, National Field Investigations Center.

Evans-Hamilton (2008). Port Angeles Harbor current data collection and analysis. Seattle, WA, Evans-Hamilton, Inc.

Foster Wheeler Environmental Corporation (1997). Current Situation/Site Copnceptual Model Report for Rayonier Port Angeles Mill Site, Mt. Pleasent Road Landfill, and 13th and M Street Landfill. Port Angeles, WA, Rayonier**:** 281.

GeoSea (2009). A Sediment Trend Analysis (STA) of Port Angeles Harbor. P. McLaren, Washington Department of Ecology.

Herrera (2011). Geomorphic Report, Port Angeles Harbor, Washington Department of Ecology.

NewFields (2012). Port Angeles Harbor Supplemental Data Evaluiation to the Sediment Investigation Report Port Angeles, WA. Summary Report Public Review Draft. Edomnds, WA, Washington State Department of Ecology**:** 93.

Poizot, E., Y. Mear, et al. (2008). "Sediment Trend Analysis through the variation of granulometric parameters: A review of theories and applications

" Earth Science Reviews **86**: 15-41.

Shea, G. B., C. C. Ebbesmeyer, et al. (1981). History, dispersion and effects of pulpmill effluents on receiving waters: Port Angeles, Washington. Prepared for US Department of Justice and US Environmental Protection Agency. Seattle, WA, Northwest Environmental Consultants, Inc.

Stein, J. and J. Denison (1966). Port Angeles water monitoring program, ITT Rayonier Olympic Research Division**:** 23.

Stein, J., J. Denison, et al. (1963). An oceanographic survey of Port Angeles Harbor. Eleventh Pacific Northwest Industrial Waste Conference, Oregon State University Engineering Experiment Station.

Tollefson, R., J. Denison, et al. (1971). Outfall location studies - Port Angeles Washington, ITT REyonier Olympic Research Division. **119:116**.

Van Rijn, L. (1993). Principles of Sediment Transport in Rivers, Estuaries, and Coastal Seas. Amsterdam, The Netherlands, Aqua Publications.

Washington State Pollution Control Comission (1967). Pollutional effects of pulp and paper mill wastes in Puget Sound, U.S. Department of the Interior**:** 474.

200 West Mercer St. • Suite 401 • Seattle, WA 98119
Phone: 206.378.1364 • Fax: 206.973.3048 • www.windwardenv.com

MEMORANDUM

To: Connie Groven

From: Windward

Subject: Comments on Revised Sediment Investigation Report and NewFields Supplemental Report

Date: May 22, 2012

Thank you for the opportunity to review the public review draft of the revised Port Angeles sediment investigation report (SIR) (Ecology and Environment 2012), including the public review draft of the supplemental data evaluation to the SIR (NewFields 2012).

On behalf of Rayonier, the Windward Environmental LLC (Windward) team has been engaged on this site for over a year, reviewing site-related documents and data from the large number of studies that have been conducted in Port Angeles Harbor (Harbor) and, in particular, near the former Rayonier mill. The focus of our review of the revised SIR was on the supplemental data evaluation (NewFields 2012).

This memorandum does not provide line-by-line comments on the SIR (Ecology and Environment 2012) or the NewFields report (2012). Instead, key areas of concern are identified and discussed to provide a concise overview of the most important issues. We would be happy to meet with the Washington State Department of Ecology (Ecology) to provide additional detail and recommendations prior to the next draft of the SIR and its supplemental report.

SUMMARY OF KEY ISSUES

Conceptual Site Model – The NewFields supplemental report (2012) presents a conceptual site model (CSM) for the Harbor based primarily on the sediment trend analysis (STA) (GeoSea 2009) and western longshore transport. This CSM is similar to the CSM put forth in the earlier versions of the SIR. We believe that the fundamental elements of this CSM are unsupportable. We have provided substantial information to Ecology supporting an alternative CSM (referred to herein as the Windward CSM) (see

Windward 2011). The Windward CSM (2011) is based on multiple lines of evidence involving sediment transport, chemical fingerprinting, historical activity, and chemical distributions. We have met with Ecology several times over the past year to discuss specific concerns and provide Ecology with the data and rationale that support the Windward CSM. Although some important modifications have been made to the earlier version of the Ecology CSM, many of the key elements have remained essentially unchanged despite multiple lines of evidence to the contrary.

Sources – The NewFields report (2012) states that there are two primary source locations (i.e., western sources and the former Rayonier mill). References to sources in the central region are never direct, leaving the reader with the impression that no sources exist in this area. The report should be more explicit regarding the volumes of stormwater and wastewater that historically entered the central waterfront each year, and continue to be released, and the potential for these releases to result in sediment contamination by a variety of contaminants. Regarding source fingerprinting, we agree with NewFields' conclusion that more intensive fingerprinting than that presented in the SIR or the supplement was needed. Therefore, we conducted fingerprinting analyses with the sediment dioxin/furan data similar to the analyses conducted by Ecology and Environment and Glass (2011) with the upland soil data. The results clearly show that dioxin/furan data in the Harbor do not exhibit a homogeneous congener profile consistent with a single source; rather, the data show the presence of multiple source profiles that are clearly distinguishable in different parts of the Harbor.

Approach for the Site –The data show that Rayonier is responsible for a "hot spot" that is a relatively small area adjacent to the former Rayonier mill (a site unit) and that upland sources are being addressed through the upland remedial investigation. The data do not support Ecology's suggestions that discharges from the former Rayonier mill are responsible for contamination in other areas (specifically Ecology's unsubstantiated statements that dioxins/furans from the former Rayonier mill have been dispersed throughout the Harbor). We agree that one of the key upcoming issues will involve the assessment of background concentrations but disagree with the presented approach regarding how these background concentrations would be calculated and applied. The application of the background values and approach presented in the NewFields report (2012) could result in years of unproductive administrative process, without directly addressing the key issue at hand – the reduction of potential human health risks.

Additional Sampling – Many of the recommendations made in the NewFields report (2012) are related to the collection of additional data through a number of supplementary studies. Additional data from the former Rayonier mill area are not needed to define a former Rayonier mill site boundary. Existing data are more than sufficient to define an in-water unit boundary; and, in fact, that proposed boundary has been presented to Ecology.

DETAILED COMMENTS

Conceptual Site Model

Sediment Transport

NewFields (2012) proposes multiple CSMs to describe sediment transport processes in the Harbor.

The sediment transport CSMs presented in the NewFields report (2012) are based on data and analyses from three sources: 1) the current study conducted by Evans-Hamilton (2008), 2) the STA conducted by GeoSea (2009), and 3) the geomorphic study conducted by Herrera (2011). The two CSMs, one a low-energy CSM and the other a high-energy CSM, include the following contentions:

- The area in the immediate vicinity of the former Rayonier mill is net erosional with "an absence of fine grained material offshore." (p. 18)
- Sediment is supplied to parting zones during higher-energy events and subsequently redistributed by tidal currents.
- Nearshore sediment transport (< 55 ft of water depth) is clockwise (westward) along the southern harbor (driven primarily by wave action).
- Net deposition is confined to the western harbor.
- Localized gravity flows result in sediment transport downslope to the east from the western harbor to the "transport front."

These conclusions are not supported by the many studies of the Harbor conducted to date. In fact, multiple lines of evidence instead suggest that:

- The nearshore area by the former Rayonier mill site, cited by NewFields (2012) as being evidence of a net erosional environment (p. 18), actually represents an accreting shoreline. Figure 1 is a plate from a study performed at the request of the Port of Port Angeles that mapped changes in the historical shoreline from 1864 to 2007. As can be seen in Figure 1, between 1864 and 2007, the shoreline of the eastern portion of the former Rayonier mill site was advancing bayward. The absence of fine material in shallow water zone sediment is not inconsistent with the observed accreting shoreline. As described by Jones (2012) in his analysis of Port Angeles wind data, winds coming from the North and Northeast do rework the nearshore sediment to a maximum depth of the 14-ft bathymetric contour, resulting in the sorting of shallow water sediment and the loss of fines material. However, sediment immediately beyond the 14-ft bathymetric contour is characterized as containing > 30% fine material. A pattern of well sorted sediment in shallow water bordered by sediment with high fines would not be expected in a net erosional environment, but rather is indicative of an environment where shallow water sediment is sorted through resuspension by

wave action (Figure 1),demonstrating that sediment is not absent of fine-grained material (Figure 2).

- Although wind-derived waves that provide sufficient energy to resuspend sediment particles within the 14-ft contour do occur in the Harbor, they do not represent a significant mechanism for net dispersion away from source areas.
- Net sediment transport is counterclockwise (eastward) along the southern harbor. Figure 3 presents an overlay of the net circulation model developed by Ebbsmeyer et al. (1979) onto an 1898 survey map of the Harbor. The observation of a net counter-clockwise circulation pattern is fully consistent with the historical geomorphological structure of the nearshore environment. Surveyors found extensive sediment flats along the southern shoreline, with the flats widening to the east. This pattern of deposition, along with the lack of any appreciable sediment flats in the inner harbor, is consistent with eastern longshore sediment transport.
- Net deposition occurs in many areas of the Harbor (not just the western harbor).

The letter from Dr. Craig Jones (2012) provides a more detailed critique of the NewFields report (2012) CSMs. In particular, Dr. Jones appropriately disputes the application and interpretation of the STA results, which are used to hypothesize the presence of parting zones and transport fronts. These "features" do not exist and have not been documented with independent data or observation and thus do not play a role in harbor-wide sediment transport processes. Please refer to Jones (2012) and Windward (2011) for details.

Finally, the following text is not supported by the data:

> "As was the case with sediment moving eastward from the inner harbor, sediment being transported westward from the central harbor is unlikely to move across the transport front located in the central harbor (Figure 7). Even high energy events are unlikely to cause sediment to cross the transport front, as the front is located at water depths too deep for the sediment bed to be influenced by wave energy. Transport away from the parting zone to the south and southwest is also likely to occur (GeoSea 2009). Dispersion in these directions has the potential to move sediment into the longshore transport pathway along the southern harbor, allowing this sediment to cross the transport front to the inner harbor." (p. 21)

As depicted in Figure 7 of the NewFields report (2012) and alluded to in the above text, the following sediment transport processes (as illustrated in Figure 4) are said to occur in the shallow offshore environment of the former Rayonier mill site:

- Sediment offshore of the former Rayonier mill (up to a depth depicted by the 55-foot depth contour) is mobilized by wind-induced waves and transported offshore to an area termed a parting zone

- Sediment within the parting zone is then re-mobilized by unknown forces (the analysis does not provide any empirical evidence of the energy forces required to mobilize sediment from the depths of the parting zones) and transported in multiple directions. According to the NewFields analysis (2012), the prevalent sediment transport direction appears to be southerly, toward the shoreline just west of the former Rayonier mill site.
- Once transported back to the shoreline west of the former Rayonier mill site, the sediments are moved progressively westward by wind-induced waves. Winds creating waves that move in a westerly direction must come from the N-NE direction, which happens only infrequently at wind velocities greater than 8 knots (see analysis by Jones 2012).

Figure 7 and the accompanying text is a critical element for the CSM being proposed by NewFields (2012) and implications for the fate and transport of contaminants within Port Angeles Harbor. It is imperative that the text be revised and backup for the statements be provided. We are unaware of any credible evidence in support of these statements or the resulting CSM.

There are abundant data that refute the alleged sediment transport mechanisms depicted in Figure 4 including:

- Existing sediment chemistry data from the area in the vicinity of the hypothesized sediment parting zone do not show elevated concentrations of contaminants.
- Existing sediment chemistry data from deeper areas throughout the Harbor, where sediment from offshore of the former Rayonier mill site are hypothesized to have been deposited in the parting zone and then resuspended and transported, do not show elevated concentrations of contaminants.
- Existing sediment chemistry data for the nearshore environment to the west of the former Rayonier mill site, where some of the material resuspended in the parting zone is supposed to be transported, do not show elevated concentrations of contaminants.
- Although existing sediment chemistry data for the nearshore environment farther to the west (e.g., the central waterfront) show elevated concentrations of some contaminants, they are not the same contaminants found at elevated concentrations in sediment near the former Rayonier mill site, demonstrating that sources other than sediment transported by the mechanisms depicted in Figure 4 are responsible for the observed contamination.
- Harbor-wide surveys of wood pulp waste in 1967 (FWPCA and WSPCC 1967) do not show the presence of wood pulp in areas beyond the nearshore boundary of the pulp mills located along the Harbor shoreline (Figure 5).

Fate and Transport

CSMs for sediment transport are relevant because contaminants introduced to aquatic environments (such as dioxins/furans, polychlorinated biphenyls [PCBs], and many metals) are often associated with sediment particles. Thus, sediment transport has a significant influence on contamination patterns.

Sediment transport is important for all particle-associated contaminants, and conclusions reached for one contaminant (e.g., dioxins/furans) identified as being from a given source should generally be relevant to other contaminants from that source, provided that the contaminants have similar properties (i.e., affinity for particles, degradation rate).

Thus, the environmental fate of contaminants of concern section (Section 6) of the NewFields report (2012) was reviewed with these concepts in mind.

We have the following concerns:

- Some chemicals (dioxins/furans) are claimed to disperse throughout the Harbor, whereas others (PCBs, metals, other Washington State Sediment Management Standards [SMS] chemicals) are claimed to be deposited near localized sources – even though many of the sources are the same, the chemicals have similar physical and chemical properties, and all are associated with sediment particles and would be expected to be subject to similar fate and transport processes and distributions.
- There is strong reliance on the STA (GeoSea 2009) results (i.e., parting zones, transport fronts), particularly with regard to the dioxin/furan CSM. The parting zone concept seems to be referred to in order to justify dispersion throughout the Harbor from the former Rayonier mill. The transport front concept limits eastward transport from the inner harbor. Both of these concepts are very weak from a scientific perspective (Jones 2012), are not applied consistently, and have significant implications that require a more defensible proof of concept.
- One of the key assumptions in the dioxin/furan CSM is that the former Rayonier mill area is highly dispersive (and thus supplying sediment to the parting zone); however, according to the STA (GeoSea 2009), sediment is shown to be trending toward the former Rayonier mill area from the parting zone, instead of away from Rayonier. Thus, it is notable that information the STA, one of the foundations for the NewFields CSMs (2012), is inconsistent with the hypothesized CSM. Furthermore, despite statements that fine sediment is absent from the former Rayonier mill area, fine sediment is plentiful in the former Rayonier mill area (Figure 2).
- If this area is assumed to be highly dispersive for dioxins/furans, it is contradictory to then say that PCBs are "effectively trapped" in the log pond area and thus have a spatial pattern that "varies greatly" from the dioxin/furan pattern because PCBs and dioxins/furans have similar chemical and physical

> properties (i.e., aqueous solubility, organic carbon partition coefficients, and Henry's Law coefficients) that would result in similar dispersal patterns in the aquatic environment. Metals and other SMS chemicals are also said to only deposit close to localized sources. This localized deposition model is well supported and further explained in Windward (2011).

Finally, it is incorrect to repeatedly make statements that the former Rayonier mill area is a "contributor to chemical contamination throughout Port Angeles Harbor" (p. 31) and then include such statements as "Sediment transport mechanisms appear to disperse these COPCs (other SMS chemicals) in a manner that does not lead to diffuse contamination throughout the harbor" (p. 27) and "depositional footprints of these sources may be restricted to the nearshore" (p. 27). We do not believe that these seemingly contradictory statements are justified given accepted principles of chemical behavior once a chemical is introduced into the aquatic environment.

Thus, the evidence presented does not support the suppositions for the dioxin/furan CSM, which appears to suggest that dioxin/furan contamination from the former Rayonier mill area was distributed throughout the Harbor. Furthermore, this model does not appear to be applied consistently to the other contaminants assessed, despite statements such as, "Although some of this metal contamination may be attributable to southern harbor sources transported to the inner harbor by longshore transport, the spatial footprint does not suggest distant sources are responsible for the majority of the metals" or "Although sediment transport processes may have dispersed PCBs through the harbor, they are found in such low levels as not to be detected in the majority of the samples collected from the harbor," which appear to have been added for theoretical consistency but without mechanistic or empirical support.

Instead, the Windward CSM (2011), which is characterized by nearshore "hot spots" from localized sources and minimal transport from these areas into the Harbor, is much more consistent with the contamination patterns observed for all contaminants in the Harbor. Specifically, in the area west of the former Rayonier mill, there are sharp gradients in contamination contours; a perimeter of samples without SMS exceedances in the depositional zone outside the nearshore zone along the shoreline; and unique fingerprints in different areas of the Harbor. Because Ecology's assumptions regarding parting zones, transport fronts, and westward transport are unsupported by the data and would not pass peer review, many of the fate and transport conclusions in the NewFields report (2012) should be significantly revised.

Contaminant Sources

Source identification is a critical component of the remedial process. A sufficiently robust understanding of the various sources of contaminants to the Harbor is needed in order to: 1) ensure that sufficient source control is conducted prior to sediment remediation so that sediment is not recontaminated following remedial actions, and 2) identify the PLPs who will be responsible for conducting source control and remediation. Therefore, it is critical that all potential sources of contaminants to the

Harbor be considered in a manner that is proportional to their potential contributions to sediment contamination. Key points are discussed below.

Mischaracterizations of Former Rayonier Mill

The NewFields report (2012) states the following on p. 24:

> "The relatively small wood debris footprint in the vicinity of the former Rayonier Mill property suggests that either the property was a much smaller source of wood debris than inner harbor sources or that wood debris is effectively removed from the property and transported elsewhere. Historically, the former Rayonier Mill was the principal source of both sulfite pulp and discharged solids among the Port Angeles mills (WPCC 1957; DOI 1967). Therefore, it is unlikely that the former Rayonier Mill was a smaller source of wood debris than inner harbor facilities. Instead, small pieces of wood debris initially deposited in the vicinity of the former mill property are most likely eroded to the parting zone during extreme events and then gradually dispersed both into and out of the harbor. Such dynamics would lead to a diffuse wood debris."

The document should acknowledge all of the mills in the Harbor in the 1900s. The first pulp and paper mills in Port Angeles, the Crown Zellerbach mill and the Fibreboard mill, were constructed between 1918 and 1921. Both mills were situated in close proximity along the western portion of the Harbor. Another lumber mill was constructed on the cooperative colony site to produce spruce lumber for airplane construction. In 1918, the US Army abandoned the uncompleted mill as a result of the cessation of hostilities in Europe. The former Rayonier mill was constructed on this site in 1930 at the eastern end of the Harbor. In 1941, the Peninsula Plywood Company began the manufacture of plywood in a facility located along the central waterfront.

In Port Angeles, logs used in the pulping process were historically brought to the mills via water and then either rafted on the water or stored in local log yards until needed. Whole logs were debarked and then washed to remove dirt and other contaminants. In general, the debarked logs were then chipped in preparation for pulping. Early in its operation, the Crown Zellerbach mill did not chip logs but instead cut them into sections in preparation for mechanical grinding.

Two processes were historically used by the Port Angeles pulp mills to produce wood pulp: chemical and mechanical. Both the Rayonier and Fibreboard mills used the sulfite chemical pulping process, although the Fibreboard mill also had a mechanical grinding operation. The Crown Zellerbach mill primarily relied on mechanical grinding to pulp wood, although it also operated a sulfite mill.

In mills that used chemical pulping, process wastewater included spent cooking liquor that was not recovered, dissolved wood constituents, and wood chips and wood waste (e.g., knots) that were not completely dissolved during the cooking step. In mills that used mechanical pulping operations, process wastewater had large amounts of wood waste (i.e., fibers, chips, and unground bits of wood). Because the mechanical process

was less efficient than the chemical process in extracting cellulose from wood (FWPCA and WSPCC 1967), the amount of wood waste lost during pulping was 6 to 8 times higher for the mechanical process as compared with the chemical process (Lee et al. 1927). Thus, it is quite probable that larger quantities of wood were released in the inner harbor from the mechanical pulping process. In addition, active log booms are still operable in the inner harbor and along the central waterfront, whereas operations at the former Rayonier mill have ceased. Remaining pulp or sludge mats have diminished, likely through decay and diagenesis over the past few decades.

Under-Representation of Potential Sources along the Central Port Angeles Waterfront

Although the NewFields report (2012) does not necessarily name PLPs, in many locations, it refers to "two primary source locations" (i.e., Rayonier and Western sources) (p. 41). Western sources listed in Table 11 include Nippon Paper Industries, Merrill and Ring Timber, Port Angeles Terminals 5 and 7, Fibreboard Paper Products, and Boat Haven Marine and Boat Yard. Language in the report sometimes says "western harbor sources overwhelm any potential distant sources" (p. 30) in the inner harbor, whereas other times it says western sources "may possibly be a significant contributor" (p. 39). Repeated mention of the incorrectly assumed westward longshore transport (without supporting evidence; see Jones 2012) is not technically justified

References to sources in the central region (NewFields 2012) are inadequate (e.g., pp. 19 and 27), leaving the reader with the impression that no sources exist in this area (although combined sewer overflow outfalls [CSOs] and other outfalls are shown on maps). In particular, p. 34 states that "subareas in the central and southern harbor, generally associated with marine shipping, do not appear to contain significant sources of COPCs." The bottom line is that the report should explicitly discuss the volumes of stormwater and wastewater that enter the central waterfront each year and the potential for these releases to result in sediment contamination by a variety of contaminants.

Finally, the NewFields report (2012) speculates that contamination may be ongoing in the western harbor and thus recommends additional source sampling in this location, which is prudent given the presence of CSOs and probable releases from other continuing sources in the central waterfront. Interestingly, the reasoning given for additional sampling is that "the high chemical concentrations in a relatively well-defined footprint of this source suggest that chemical releases may be ongoing rather than just historic" (p. 39). Alternatively, this contamination pattern could simply represent a historical "hot spot" in a source area with low net deposition and little transport, but this will need to be further examined.

Chemical Fingerprinting

Both the revised SIR (2012) and NewFields report (2012) included the results of fingerprinting analyses conducted to identify sources of dioxins/furans in Harbor sediment. Windward has the following comments on the implementation and interpretation of these analyses.

Ecology and Environment (2012) referred to their analysis as a "screening level fingerprinting analysis." They primarily used the Fingerprint Analysis of Leachate Contaminants (FALCON) method of Plumb (2004), along with visual inspection of congener profiles. Their basic approach was to assign sediment samples to one of two primary groups: Rayonier and Harbor-wide (Appendix J, Figures 13 and 15 through 19). The report (2012) ultimately concluded that although some congener pattern differences were evident at depth, Harbor-wide dioxin/furan congener patterns in surface sediment could not be distinguished from those collected near the former Rayonier Mill (Appendix J, pp. 7 and 10). One fundamental problem with the Ecology and Environment (2012) screening-level fingerprinting study is that by its very design, it precludes the identification of sources other than Rayonier. As an example, elsewhere in the report, Ecology and Environment (2012) acknowledged that the highest toxic equivalents (TEQs) in the Harbor were observed not near the former Rayonier mill but in the inner harbor area (the area of the Harbor farthest away from the former Rayonier mill) (p. 80). Inner harbor sediment samples might well exhibit a unique dioxin/furan congener pattern, distinguishable from those of both the former Rayonier mill and other areas of the Harbor. But based on Ecology and Environment's (2012) fingerprinting approach, this potential conclusion could not be reached because those inner harbor samples were classified as "Harbor-Wide." For example, no distinction was made between the inner harbor sample with the highest TEQ in the entire study (H01A at 119 ng/kg dry weight [dw] TEQ) and the outer harbor sample OH03A (at 0.796 ng/kg dw TEQ), which was located well away from any area of elevated TEQs. Therefore, for the purpose of fingerprinting, both of these sediment samples were considered "Harbor-Wide" and lumped together in a comparison with former Rayonier mill samples (Appendix J, Figure 17). Ecology and Environment's (2012) fingerprinting study design is essentially an *a priori* presumption that the former Rayonier mill is the only potential source worth considering.

The Windward CSM (2011) presents a graphical review of dioxin/furan congener patterns in four different areas of the Harbor (i.e., lagoon, inner harbor, central waterfront, and the former Rayonier mill area). Congener patterns were plotted for the three surface sediment samples with the highest TEQs in each of these areas. The congener profiles for samples in each of those four areas were very different, which clearly suggests multiple sources in each of these areas.

Ecology and Environment (2012) acknowledged limitations with their approach, and in that regard they stated:

> "The use of more powerful chemometric tests (for example, principal component analysis) may help overcome some of the limitations in the data. However, these tests are not within the scope of this project." (Appendix J, pp. 23 and 38)

These allegedly "more powerful chemometric tests" were conducted and the results presented in NewFields (2012). NewFields (2012) used both FALCON (the tool used by Ecology and Environment (2012)) as well as a principal components analysis (PCA). NewFields (2012) found the FALCON method to be too cumbersome to use and interpret and therefore abandoned that method. Instead, NewFields (2012) focused primarily on PCA. The primary conclusion reached by NewFields (2012) through their PCA was:

> "… dioxin/furan congener fingerprinting was unable to discern multiple congener profiles for sediments of Port Angeles Harbor. A more intensive fingerprinting approach consisting of multivariate chemometric analyses (unmixing analyses) of the sediment dioxin/furan congener data set is recommended to differentiate sources to harbor sediments. A similar chemometric analysis was performed for Port Angeles soil dioxin/furan congener data as a part of the Rayonier Mill Off-Property Soil Dioxin Study (E & E and Glass, 2011). This chemometric evaluation was able to quantitatively differentiate three unique source patterns that account for the dioxin/furan profiles observed in soils. In addition to the potential dioxin/furan source fingerprints used in the soil study, it will be important to identify fingerprints for different types of mill discharge including effluent, pulp waste, and sludge." (p. 39)

We agree that a more intensive fingerprinting approach was needed and therefore conducted for sediment the type of analysis conducted by Ecology and Environment and Glass (2011) for upland soil. A statistical unmixing analysis of surface sediment in the Harbor was conducted by the Windward team using the method recommended by NewFields (2012) (i.e., multivariate curve resolution – alternating least squares [ALS] - (Tauler et al. 1993)).Using the ALS method, distinct contrasts in dioxin/furan congener profiles were clearly evident. At least three source patterns contributed to the dioxin/furan patterns observed in Harbor sediment. Two of the three resolved fingerprints were similar to the source patterns resolved in uplands soil by Ecology and Environment and Glass (2011). One of these source patterns was consistent with the pattern that Ecology and Environment and Glass (2011) called "Source 3" and interpreted as being consistent with emissions from hog fuel boilers and residential wood burning. Several clear lines of evidence indicated that there are multiple sources of the "Source 3" pattern in Port Angeles.

We conducted this analysis in exactly the manner recommended by Ecology's consultants (Ecology and Environment and Glass and NewFields). The results clearly show that dioxin/furan data in the Harbor do not exhibit a homogeneous congener profile consistent with a single source; rather, the data show the presence of multiple source profiles that are clearly distinguishable in different parts of the Harbor.

We encourage Ecology to reproduce the analysis thus providing an independent review of the data and interpretation that there are multiple dioxin/furan congener profiles and sources in Harbor sediment. In the interim, given the caveats with which both the

Ecology and Environment (2012) and NewFields (2012) qualify their fingerprinting analyses, we request that changes be made to the SIR) (Ecology and Environment 2012) to: 1) remove those sections of the SIR that conclude that "Harbor-Wide" dioxin/furan congener profiles match those at the former Rayonier mill; and 2) remove those sections of the NewFields report (2012) that suggest that Harbor dioxin/furan patterns are a homogeneous suite of samples that cannot be distinguished. Both statements (whether explicit or implied) are demonstrably false. Whether through direct inspection of raw data or sophisticated multivariate analysis, there are at least three distinct congener profiles that contribute to Harbor sediment contamination. A single-source hypothesis for the presence of dioxins/furans in Harbor sediment is entirely untenable.

Sediment Cleanup Goals and Overall Site Approach

The NewFields report (2012) (p. 41) summarizes the overall project vision for Port Angeles as follows: 1) remove wood debris, 2) control ongoing releases, and 3) clean up hot spots.

The data show that Rayonier is responsible for a "hot spot" that is a relatively small area adjacent to the former Rayonier mill (a site unit) and that upland sources are being addressed through the upland remedial investigation (NewFields 2012, p. 42). However, the data do not support Ecology's suggestions that Rayonier is responsible for contamination in other areas (e.g., "While the former Rayonier Mill property is a likely contributor of dispersed dioxins/furans throughout the entire Harbor…").

We would be interested in reviewing the report referenced as NewFields 2011 that reportedly presented preliminary sediment cleanup goals (NewFields 2012, p. 5).

We agree that one of the key upcoming issues will involve the assessment of background concentrations and how they will be applied to the Harbor in order to understand the potential influence of localized sources and estimate the potential for recontamination following sediment remediation.

In Section 3 of the NewFields report (2012), three potential background sediment datasets are summarized (Puget Sound-wide data from the *Ocean Survey Vessel (OSV) Bold* survey (DMMP 2009), a subset of the locations from the *OSV Bold* survey, and "proximal" data from locations in northern Puget Sound); and some key considerations (e.g., grain size) are discussed. NewFields (2012) recommends the use of the proximal area dataset because:

> "Due to the regionally specific nature of the Port Angeles Proximal Area background dataset, it encompasses similar natural and anthropogenic sources as those found in Port Angeles Harbor. Using it to calculate BTVs results in the most conservative estimates of background concentrations… (even though it) may underestimate the natural background concentrations associated with the finer material found in Port Angeles Harbor…" (p. 8).

Selecting the lowest concentrations possible is not necessarily the best approach to managing the site and understanding the natural and anthropogenic sources of contaminants to the Harbor. In addition, the NewFields report (2012) presents application options, including 1) a comparison of individual point concentrations to upper percentiles and 2) a comparison of averages to upper confidence limits on the mean (UCLs). NewFields recommend the individual point approach: "An evaluation of the Port Angeles Harbor data will require the comparison of individual observations, upper percentiles are used to define the BTVs rather than UCLs," although it is not clear if they have ruled out other approaches that could also be used (e.g., an averaging approach).

In Table 3 of the NewFields report (2012), 90th percentiles from all three datasets were presented and compared with detected concentrations from the SIR (Ecology and Environment 2012). A large percentage of concentrations detected in Harbor sediment was greater than the 90th percentiles calculated for the three background datasets (Table 3 of the NewFields report). For example, 82% of the dioxin/furan data, 70% of the low-molecular-weight polycyclic aromatic hydrocarbon (LPAH) data, 73% of the high-molecular-weight polycyclic aromatic hydrocarbon (HPAH) data, and 56% of the bis(2-ethylhexyl) phthalate (BEHP) data were greater than the 90th percentiles presented for the proximal area dataset. If PCB congener data had been used in the comparison (rather than Aroclor data), similar results would likely have been noted for PCBs as well.

The high percentage of sediment chemical concentration data that are greater than the 90th percentile distribution means either that the background datasets are too conservative (i.e., the concentrations are too low) and do not represent natural background conditions in the Harbor or that most of the Harbor is influenced by anthropogenic activities (that may or may not be continuing). Regardless, the blind application of these 90th percentiles as background could result in years of unproductive, administrative process.

It might be worthwhile to consider other approaches, such as those currently being considered in the revisions to the SMS. One such approach, which has the added benefit of being most relevant to human health concerns, is the spatially weighted average concentration (SWAC) approach. Regional background concentration approaches that are currently being considered as part of the SMS revision process may also be considered. The common goal is to reduce risks in the Harbor while minimizing the potential for recontamination from diffuse sources. The challenge is to find a means to do so without years of ineffective process.

Additional Sampling

Many of the recommendations made in the NewFields report (2012) are related to the collection of additional data. A number of additional studies are noted, including additional subsurface sampling, a sediment profile imaging (SPI) survey, additional bioassay testing (including a new method), and various other studies.

Rayonier has already expended a great deal of resources compiling a robust dataset of samples collected near the former Rayonier mill (Table 1). And although the NewFields report (2012) states, "… assuming no new contaminant releases from the upland portion of the former Rayonier Mill property, sediment cleanup in a relatively small area may effectively eliminate this property as a continuing source of negative impacts…" (p. 42), it also calls for additional sediment sampling "between a radius of approximately 1,500 and 4,000 ft from the former Rayonier Mill property" to delineate the extent of the footprint (p. 37). The recommendation by NewFields (2012) for the collection of additional data in the vicinity of the former Rayonier mill is based on their hypothesized CSM that has sediment being transported from the nearshore area to a sediment parting zone, then later redistributed to other areas of the Harbor. As stated above in previous comments, data from multiple sources do not support this CSM and the need to collect additional environmental data is not warranted.

Table 1. Summary of data available for former Rayonier mill Study Area and the remainder of Port Angeles Harbor

Sample Type	Number of Samples Collected by Rayonier		Number of Samples Collected by Ecology		Number of Samples in Windward Dataset[a]	
	Study Area	Rest of Harbor	Study Area	Rest of Harbor	Study Area	Rest of Harbor
Surface sediment	92	34	36	75	164	174
Subsurface sediment	27	0	37	48	64	57
Bioassays	15	0	14	38	29	38
Tissue	70	0	7	8	77	8

[a] The Windward dataset includes data from Ecology and Environment (1998), Anchor (2005), Malcolm Pirnie (2007a, b), Exponent (2008), and Ecology (2009).

[b] Sampling density was substantially higher in the southwest portion of the Study Area (i.e., close to the former Rayonier Mill) than in the northeast portion of the Study Area (i.e., farther offshore).

Furthermore, additional data are not needed to define a former Rayonier mill site boundary. Existing perimeter data already show a sharp gradient of contamination and include a sufficient number of samples (more than 40 samples) without SMS exceedances around the "hot spot" to show the presence of a buffer zone (Figure 6); thus, the collection of new data would not be useful in defining the boundary.

REFERENCES

Anchor. 2005. Sampling and analysis report, sediment grab sampling and log density survey. Nippon Paper Industries USA pulp and paper mill, Port Angeles facility. Anchor Environmental, L.L.C., Seattle, WA.

DMMP. 2009. *OSV Bold* summer 2008 survey. Data report. The Dredged Material Management Program (DMMP) agencies: US Army Corps of Engineers, Seattle District, Seattle, WA; US Environmental Protection Agency, Region 10, Seattle, WA; Washington State Department of Natural Resources; and Washington State Department of Ecology, Olympia, WA.

Ebbesmeyer CC, Cox JM, Helseth JM, Hinchey LR, Thomson DW. 1979. Dynamics of Port Angeles Harbor and approaches, Washington. Prepared for MESA (Marine Ecosystems Analysis) Puget Sound Project, Seattle, Washington, Federal Interagency Energy/Environment Research and Development Program. EPA-600/7-70-252. US Environmental Protection Agency, Washington, DC.

Ecology. 2009. Port Angeles Harbor sediment characterization study, Port Angeles, WA: Sediment investigation report. Draft. October 2009. Toxics Cleanup Program, Washington State Department of Ecology, Lacey, WA.

Ecology and Environment. 1998. Rayonier Pulp Mill expanded site inspection, TDD: 97-06-0010. Prepared for EPA Region 10 Superfund Technical Assessment and Response Team (START). Ecology and Environment, Inc., Seattle, WA.

Ecology and Environment. 2012. Port Angeles Harbor sediment characterization study: sediment investigation report. Public review draft. Prepared for Washington State Department of Ecology. Ecology and Environment, Inc., Seattle, WA.

Ecology and Environment, Glass G. 2011. Rayonier Mill off-property soil dioxin study: Final project report, public review draft. June 2011. Ecology and Environment Inc. and G L Glass, Seattle, WA.

Evans-Hamilton. 2008. Port Angeles Harbor current data collection and analysis. Evans-Hamilton, Inc., Seattle, WA.

Exponent. 2008. Environmental baseline investigation, DNR lease 22-077766: Nippon Paper Industries USA Co., Ltd., Port Angeles, Washington. Exponent, Inc., Bellevue, WA.

FWPCA, WSPCC. 1967. Pollutional effects of pulp and paper mill wastes in Puget Sound. Federal Water Pollution Control Administration, Northwest Regional Office, Portland, OR: Washington State Pollution Control Commission, Olympia, WA.

GeoSea. 2009. A sediment trend analysis (STA) of Port Angeles Harbor. Port Angeles Harbor Sediment Investigation. GeoSea Consulting Ltd., Brentwood Bay, BC, Canada.

Lee HN, Stepheson JN, Hovey RW, Turner SR, Johnsen B, Larchar AB, Thorsen KM, Mason JO, Kloss TE, Hanson HH, Cline M, Hooker Jr. AH, Davis DS, Buncke HJ. 1927. The manufacture of pulp and paper, vol. III, 2nd ed. McGraw-Hill.

Malcolm Pirnie. 2007a. Phase 2 addendum remedial investigation for the marine environment near the former Rayonier Mill site, Port Angeles, Washington. Agency review draft, February 2007. Prepared for Rayonier, Jacksonville, Florida. Malcolm Pirnie, Seattle, WA.

Malcolm Pirnie. 2007b. Remedial investigation for the marine environment near the former Rayonier Mill site, Port Angeles, Washington. Public review draft,

February 2007. Prepared for Rayonier, Jacksonville, Florida. Malcolm Pirnie, Seattle, WA.

NewFields. 2012. Port Angeles Harbor supplemental data evaluation to the sediment investigation report. Prepared for Washington State Department of Ecology. NewFields, Edmonds, WA.

Plumb RH, Jr. 2004. Fingerprint analysis of contaminant data: a forensic tool for evaluating environmental contamination. Technical Support Center issue, EPA/600/5-04-054. US Environmental Protection Agency, Washington, DC.

Tauler R, Kowalski BR, Fleming S. 1993. Multivariate curve resolution applied to spectral data from multiple runs of an industrial process. Anal Chem 65(15):2040-2047.

Windward. 2011. Port Angeles Harbor conceptual site model: Delineation of in-water site boundary. Draft. Prepared for Rayonier, Inc. Windward Environmental LLC, Seattle, WA.

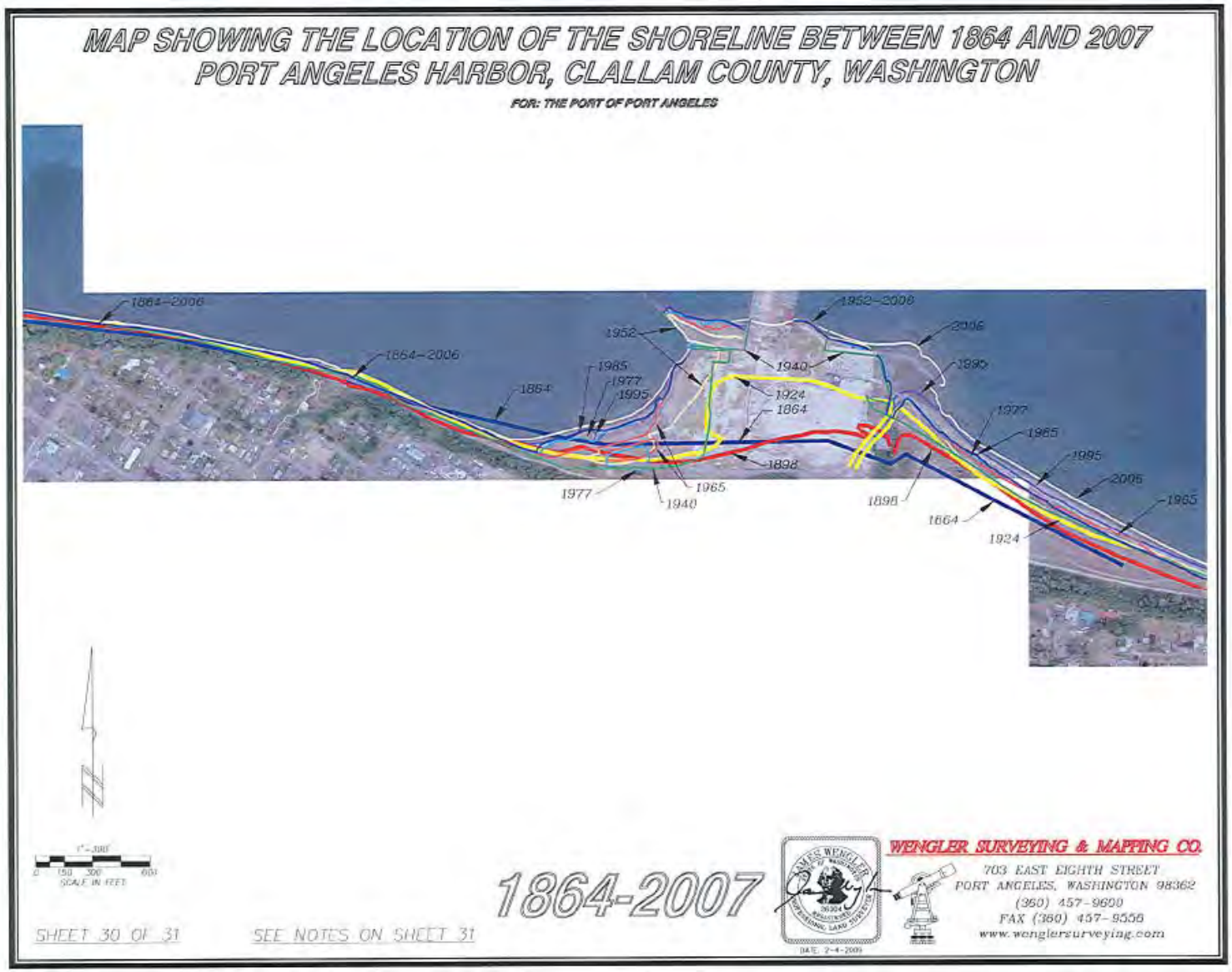


Figure 1. Changes in shoreline configuration for the former Rayonier mill site between 1864 and 2007

Rayonier

Percent fines (%)
- 80 - 100 (0 - 20 % sand)
- 60 - 79 (21 - 40 % sand)
- 30 - 59 (41 - 70% sand)
- 13 - 30 (71 - 87 % sand)
- 0 - 13 (87 - 100% sand)
- % fines sample location
- Hard ground

- Rayonier historical outfall
- Inactive CSO
- Active CSO
- City of Port Angeles deepwater outfall
- Rayonier deepwater outfall 001

Ennis Creek

Lees Creek

Wind Ward environmental LLC

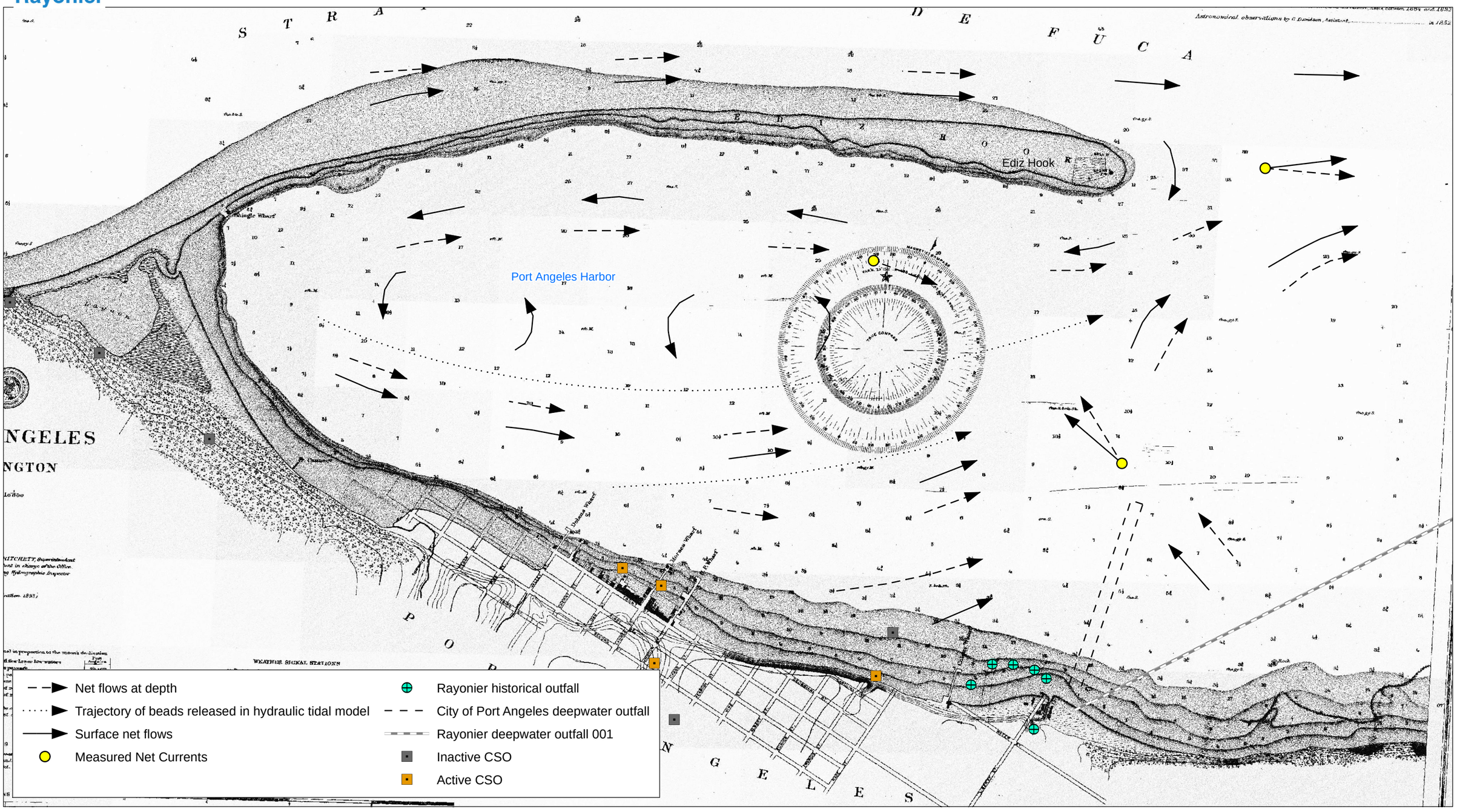
Data source: All outfalls near former Crown Zellerbach taken from Exponent (2008).
Rayonier outfalls and City of Port Angeles outfalls provided by Rayonier.
CSO locations are approximate and were pinpointed using a City of Port Angeles storm drain CAD layer, NOAA electronic charts, and up-to-date, high-resolution imagery.
Mud and sand data taken from STA dataset.

N

0 0.075 0.15 0.3 Miles

Figure 2. Sediment grain size distribution near the former Rayonier mill

Prepared by MTY, 04/12/12, map#5131a; W:\Projects\Rayonier Port Angeles\Data\GIS\Maps_and_Analysis\Storyboards



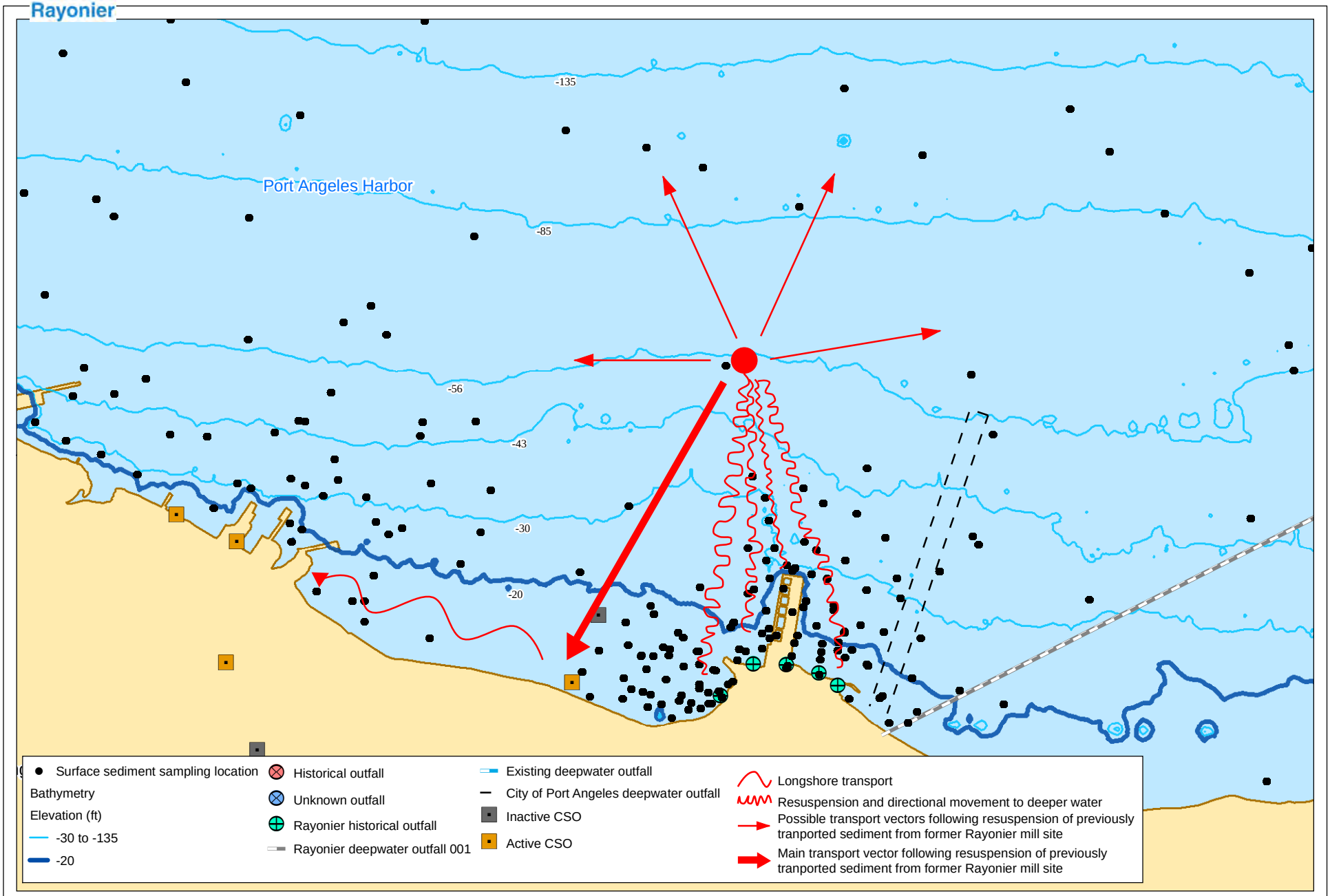
Wind Ward environmental LLC

Data source: Rayonier outfalls and City of Port Angeles outfalls provided by Rayonier. CSO locations are approximate and were pinpointed using a City of Port Angeles storm drain CAD layer, NOAA electronic charts, and up-to-date, high-resolution imagery. Net circulation data from a. Ebbesmeyer, C. C., J. M. Cox, J. M. Helseth, L. R. Hinchey, and D. W. Thomson, 1979. Dynamics of Port Angeles Harbor and Approaches, Washington. U. S. Environmental Protection Agency Interagency Energy/Environment R&D Program Report No. EPA-600/7-79-252, 50 pp.

N

0 0.25 0.5 1 Miles

Figure 3. Overlay of net circulation model on 1898 survey map



WindWard environmental LLC

Data sources: All outfalls near former Crown Zellerbach taken from Exponent (2008). Rayonier outfalls and City of Port Angeles outfalls provided by Rayonier. CSO locations are approximate and were pinpointed using a City of Port Angeles storm drain CAD layer, NOAA electronic charts, and up-to-date, high-resolution imagery.

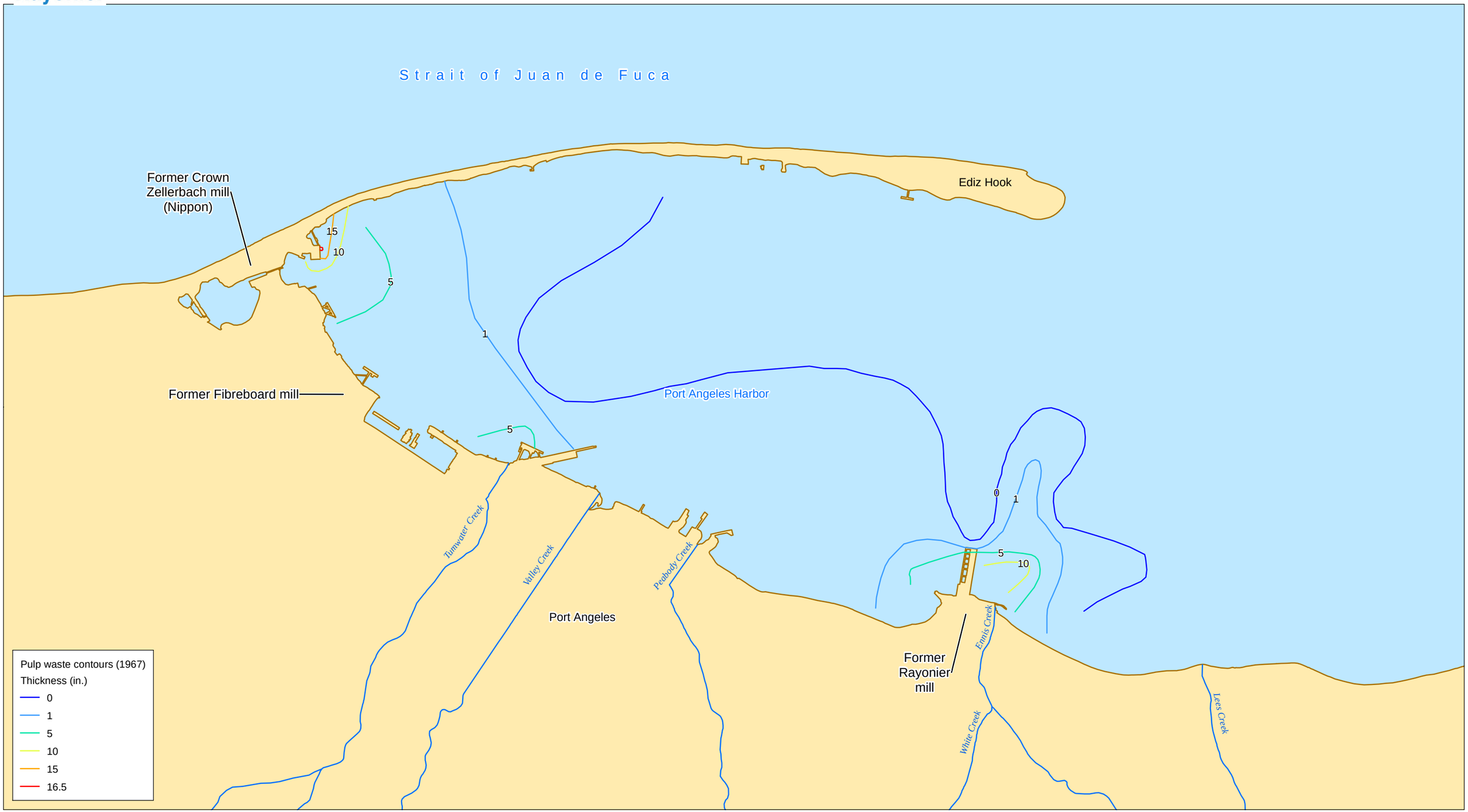
N

0 0.125 0.25 0.5 Miles

Figure 4. Representation of NewFields (2012) hypothesized sediment transport CSM for sediment offshore of the former Rayonier mill

Prepared by MTY, 05/16/12, map#5214a; W:\Projects\Rayonier PA Volume II\Data\GIS\Maps_and_Analysis

Rayonier



Wind Ward environmental LLC

Data sources: 1967 data from USDI (1967), as sited in Northwest Environmental Consultants (1981).

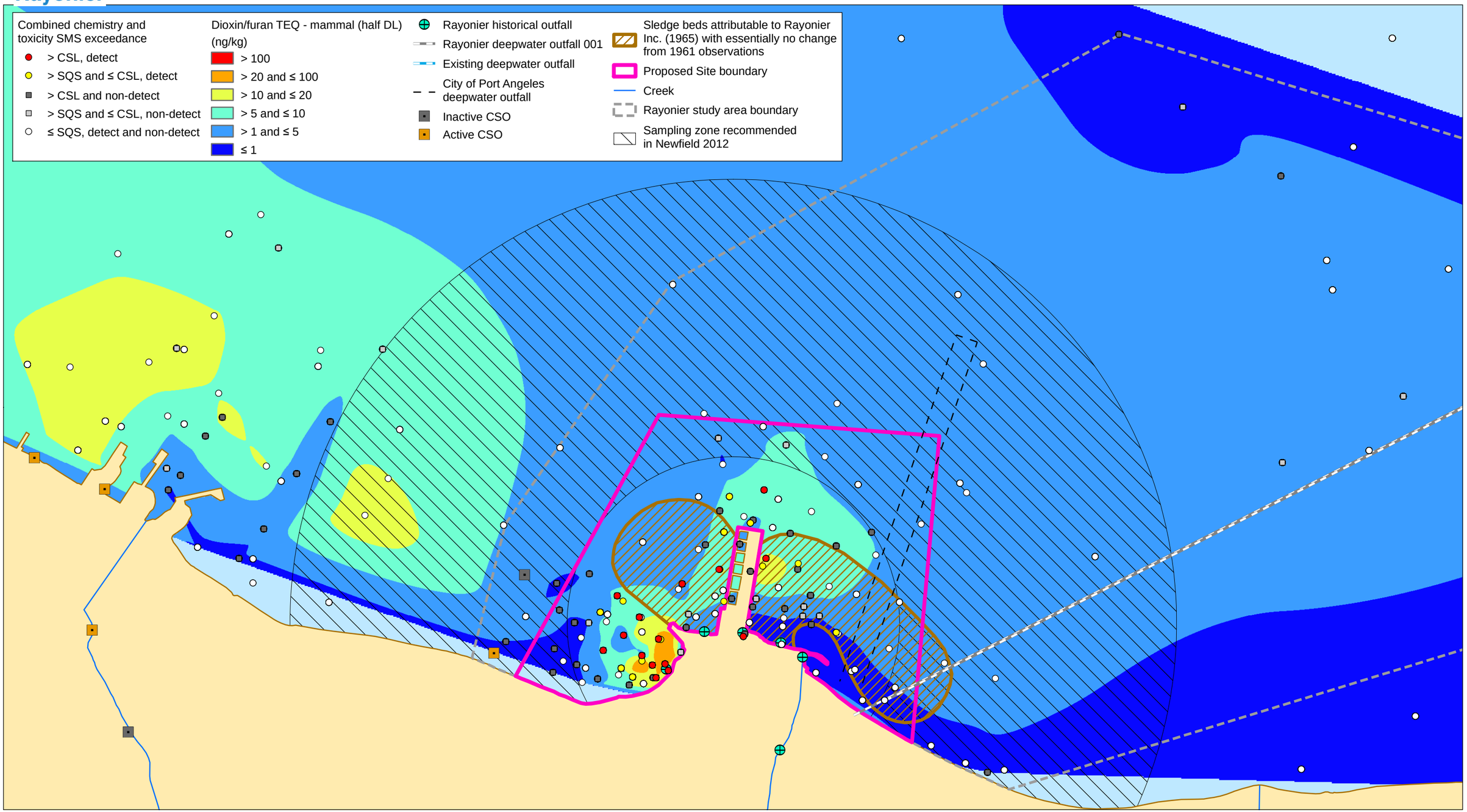
N

0 0.25 0.5 1 Miles

Figure 5. Wood pulp distribution based on a survey published in 1967

Prepared by MTY, 05/10/12, map#5011b; W:\Projects\Rayonier Port Angeles\Data\GIS\Maps_and_Analysis\Storyboards

Rayonier



WindWard environmental LLC

Data source: All outfalls near former Crown Zellerbach taken from Exponent (2008).
Rayonier outfalls and City of Port Angeles outfalls provided by Rayonier.
CSO locations are approximate and were pinpointed using a City of Port Angeles storm drain CAD layer, NOAA electronic charts, and up-to-date, high-resolution imagery.

N

0 0.1 0.2 0.4 Miles

Figure 6. Proposed in-water boundary and area requested for additional sampling

Prepared by MTY, 04/23/12, revised by LSM 4/23/12, map#5055a; W:\Projects\Rayonier Port Angeles\Data\GIS\Maps_and_Analysis\Storyboards

From:	Sextro, Bob
To:	Groven, Connie (ECY)
Cc:	darlenes@olympus.net; Aoyagi, Hannah (ECY)
Subject:	RE: Comments on PA Harbor sediment report and Supplemental NewFields
Date:	Friday, March 23, 2012 11:56:35 AM
Attachments:	image002.png Robert Sextro Comments and questions on Ecology.docx

Connie, see attached my comments on the harbor report, not sure if there is a more formal way to deliver these, let me know if so, thanks, Bob

Bob Sextro

Principal Engineer

Sequim WA

(360) 808-2672 (cell)

(360) 582-1422 (office)

_____
From: Groven, Connie (ECY) [cgro461@ECY.WA.GOV]
Sent: Friday, March 16, 2012 9:04 AM
To: Sextro, Bob
Cc: darlenes@olympus.net; Aoyagi, Hannah (ECY)
Subject: RE: PA Harbor sediment report and Supplemental NewFields

Good Morning, Bob,

Thank you for your interest in the Port Angeles Harbor Investigation.

At the presentation on Tuesday night, we were discussing the contents of two reports, the Port Angeles Harbor Sediment Investigation Report and the Supplemental Data Evaluation. Both reports are the result of work being done by Ecology. Here is a copy of one of the slides from the presentation. The Supplemental Data Evaluation is the report you are referring to as the NewFields report. NewFields is a consultant hired by Ecology to complete this report. Their work has been fully reviewed and accepted by Ecology.

[cid:image002.png@01CD0352.6E0C3DB0]

The Port Angeles Harbor Sediment Investigation Report was completed first and therefore does not reference the Supplemental Data Evaluation. The Sediment Investigation Report is a data summary report and focuses on the data collected for this study only.

The Supplemental Data Evaluation took the data from the Sediment Investigation Report and combined

it with data from other harbor studies to make further recommendations and evaluations, including calculations of background concentrations. You can look at the Supplemental Data Evaluation as a continuation of the Sediment Investigation Report or as an additional volume evaluating the data at a deeper level.

I hope this clears up your questions. Please contact me again if I can answer additional questions.

Connie

Connie Groven

Site Manager/Environmental Engineer

Department of Ecology

Southwest Regional Office/Toxic Cleanup Department

(360) 407-6254

cgro461@ecy.wa.gov

-----Original Message-----
From: Sextro, Bob [mailto:robert.sextro@noblis.org]
Sent: Thursday, March 15, 2012 5:33 PM
To: Groven, Connie (ECY)
Cc: darlenes@olympus.net
Subject: PA Harbor sediment report and Supplemental Newfields

Hi Connie, we spoke briefly at your presentation the other night at PA about background concentrations and then I asked a few questions during and after. I went to ecology's site and downloaded many of the PA harbor docs and appendices.

As I was looking through the docs and appdx, sort of skimming just to see what was there, what caught my eye was Ecology's sediment investigation report and a Newfield's supplemental report.

Ecology's report does not seem to acknowledge Newfield's nor is Newfield's in the reference list, but Newfield's report seems to indicate what their report is supposed to do and references Ecology's report. So I was wondering if what Newfield says and shows in their report has the blessing of Ecology or ??

For instance Newfield has a summary of the background data set and even makes some recommendations for making it more robust and Ecology is pretty silent on the "background data set details". Newfield also has some figures showing spatial interpolations for dioxin results and Ecology has no figures with dioxin results posted, but both reports have figures posting or interpolating metal, PAHs and others. so it is little confusing to me as you do not seem to reference their findings and results/interpolations except for the bioassay work.

so as an outside reviewer how am I supposted to judge Newfield's report vs Ecology's or should I just assume what Newfield presents is as if Ecology has "said" it??

regards, Bob

Bob Sextro

Principal Engineer

Sequim WA

(360) 808-2672 (cell)

(360) 582-1422 (office)

Robert Sextro Comments and Concerns on Ecology's 2012 Port Angeles Harbor Sediment Study

Preamble, points to consider: I believe that the report looks pretty solid, with the data, technical evaluation/assessments, and conclusions/recommendations supportable with the lines of evidence presented. Most of my comments are for clarification and are from the perspective of the independent reviewer. I believe my comments will make the report more complete and more user friendly.

Regarding PA harbor cleanup, Nippon has estimated in the air permit that air emissions from their new biomass co-generation boiler will include numerous "hazardous air pollutants or HAPS" such as phenols, PAHs and a couple of dibenzo-dioxins including 2,3,7,8-TCDD. Much of this will drop out of the air column in or near PA harbor, that could potentially be remediated in hot-spots but then re-contaminated over time. Their emission estimates of various phenols are about 200 #/yr and about 380#/yr for various PAHs, dioxins are much less at a fraction of a pound. But these are just estimates and the actual compounds and mass could be higher if their feed stock has the precursors and the boiler is operated in certain temperature ranges.

Another piece of the puzzle to consider in analyzing the potential PA harbor cleanup and its timing, is the recent demolition of the Elwha River dams and the subsequent outflow of years/decades of sediment. As time goes by and it becomes evident, either visually or with in-harbor sediment monitors, that the Elwha sediment load is reaching Ediz Hook and surrounds, I believe this certainly has to be a factor to consider in evaluating remedial alternatives, including the "no action" alternative and the timing of implementation of any alternative selected.

Both Ecology's and Newfield's reports recommend additional data collection and my overall recommendation is to carry these data gap recommendations into a focused feasibility study or evaluation of alternatives. Taking a page from EPA's TRIAD site investigation program of focused data collection leading to decision making, I recommend that most additional data collection be tabled pending the outcome of the alternatives evaluation using EPA's nine criteria or equivalent as I believe enough data already exists to perform this evaluation. Further, given that one of the alternatives will be "no action" you likely will need no further data at most locations to substantiate this alternative. I have been involved in several US Department of Defense site remediations for vernal pools, bays and estuaries where the decision was made not to clean up the sediment because to do so would entrain/resolute stable or buried contaminants thereby causing more short-term environmental harm than "good".

Specific Comments as follows:

I highly recommend highlighting some of the sediment toxicity results and findings in both the Executive Summary and Introduction, Section 1.0, and in particular referencing the Newfield 2012 report. The introduction should also contain a brief summary of the relationship of Newfield's report to Ecology's report as an independent reviewer does not know if what is stated in Newfield's report represents what Ecology believes and/ or has accepted.

The bases of all the findings, recommendations and further data collection recommendations rely on the analytical data (plus some historic data) presented in this report. Further, the usefulness of all these data depend on their quality as defined by precision, accuracy, representativeness, comparability and completeness or PARCC (as so stated in your 2008 FSP/QAPP). However, Section 4.1 and Appendix H do not provide the independent reviewer Ecology's evaluation of data quality based on PARCC.

Therefore I recommend adding tables in Section 4 to summarize PARCC and QC (for each analytical method and matrix) with direct references to pages or sections in appendix H. Also, consider a Table of Contents for Appendix H so that the data user/reviewer does not have to "wade through" 391 pages to find data quality summaries cited in section 4.1. See examples of the tables I recommend are as follows:

PARCC Summary Table

Parameter/ method	Precision	Accuracy	Representativeness	Comparability	Completeness
SW8270D (sediment)	Acceptable as shown by MS/MSD pairs	Acceptable as shown by surrogate, LCS and MS recoveries	Some qualitative statements that indicate the data represent the population, since no field duplicates were collected, variation of any parameter at a given sampling point is difficult to evaluate.	Acceptable comparability shown by consistent sampling methods; proper method calibration, batch QC and quantitation limits	See next table
SW8270D (tissue)	Acceptable as shown by MS/MSD pairs	Acceptable as shown by surrogate, LCS and MS recoveries	Some qualitative statement	Acceptable comparability shown by proper method calibration, QC and quantitation limits	See next table

Use footnotes as needed to note Representativeness and Comparability, also provide direct page references to Appendix H for the Q2 evaluations performed.

Data Completeness Table

Parameter/method	Sample no.	Analyte no.	Qualified results	Rejected results (individual analytes)	Percent completeness	Data useability
SW8270D (sediment)	50	50	40	40	98.4	>95% so acceptable

SW8270 (tissue)	10	50	50	0	100	>95% so acceptable

The completeness criterion for each analyte/method is stated in the 2008 QAPP to be 95%

Field and Laboratory QC Sample Summary

Parameter/method	Sample no.	MS/MSD pair No.	Sample Batches	LCS	Method Blanks
SW8270D (sediment)	50	4	10	10	10

This type of table provides a summary of the sampling and analytical QC that was specified in the 2008 QAPP. Also, good for review of analytical batch QA/QC.

These type of summary data QA/QC tables make it much easier for the reviewer and data user to see at a glance the "quality and usability" of the results and if the completeness goals and analytical batch QC goals have been met or not. This will help satisfy what is clearly stated in section 7.1 of the final FSP/QAPP of 2008, that data will be evaluated for quality/usability using PARCC.

Two key QC samples were not collected in this investigation, field duplicates and equipment rinseate blanks. Ecology performed equipment decontamination as stated in section 3.5.1 but no field QC was collected to show the effectiveness of the decontamination procedure. Perhaps a qualitative statement can be made as to lack of or no sign of cross contamination in performing sample collection?? Lack of field duplicates affects your ability to make a strong statement about sample representativeness as you do not have any data indicating homo/heterogeneity of samples!!

I recommend posting the individual dioxin results in figures as the report does for other contaminants and then referencing those figures in Sections 5.1.11, 11.1.1 and 11.1.2. The reference to Newfield's report and figures in section 5.1 is too general. Therefore I recommend expanding that reference to specific sections and figures in their report. Also, since you reference Newfield's 2012 supplemental report, it should be included in the reference list in section 12.

For the record I reviewed selected sections of the 2008 FSP/QAPP for this sampling program in the PA Harbor. Section 7.1 references the EPA's DQO process and uses an old reference to a 1996 EPA document. The current reference available at the time of this QAPP preparation is EPA QA/G-4, EPA/240/B06/001 and is dated February 2006. As Section 7.1 is written it implies that the EPA DQO process was followed, but there is really no indication or summary that "the quality and quantity of data needed to meet project DQOs" was outlined or that the 7-step DQO process was used.

From: earnest spees
To: Groven, Connie (ECY)
Subject: ****Public Testimony on Port Angeles Harbor Sediment Investigation
Date: Thursday, April 12, 2012 5:38:53 PM

Comment Deadline 22 May 12. kes

Website:
http://www.ecy.wa.gov/program/tcp/sites_brochure/portAngelesHaborSed/paSed_hp.htm

Contract Person: Connie.Groven@ecy.wa.gov.

Port Angeles, WA Harbor Sediment Investigation (PAWA-HSI)- Public Comment
When industries in Port Angles, WA (PAWA) were polluting the harbor the State government was on the wrong side of the issue. Now that the businesses/industries of PAWA are no longer polluting the local harbor the State government is again on the wrong side of the issue. This time they have turned malignant.

The investigation of the PAWA Harbor at this time is a small part of a much bigger pattern of Radical-Environmental central-governmental abuse of power (think PSP, think corruption). The objectives of the PAWA-HSI are primarily political and minimally environmental. Christine Gregoire and her surrogate agency the DoE is ruling and acting against the will of the people. Even the election of 'governor' Gregoire was orchestrated in a devious highly questionable manner. Despite wide spread distrust of our current elected regime and their appointed surrogates particularly the DoE, one would not normally describe an investigation in such scathing terms. One can make the statements reasonably without seeing the study. They fit into a predictable template. The predetermined outcome is inevitable. They were well aware of the pollution in the past. They knew before they did the study they would find a problem. The only surprises they may have found is how some areas have cleaned themselves. The numbers within these studies are of minimal relevance. They will distort and focus on the problems and minimize the surprising evidence of resolution of the problem in some areas. It has nothing to do with what would be helpful to citizens, things like: the pollution has stopped. There is little public danger unless one …. The crabs and fish are dangerous only if one ….

Again, they ignore the financial realities. They ignore the time frame. They ignore the risks and benefits. They ignore the reality that the damage has stopped and is actually resolving by natural processes. They have an agenda/template that they are fulfilling (It has little practicality. The people paying for these nerds receive almost no benefit from the diversion of the public treasury.) There is a predictable conclusion.
Detrimental/untoward unintentional consequences of the study or cleanup are ignored. 'The evil greedy unscrupulous big corporations' will be punished for sins committed by their predecessors with full knowledge and approval of the central government at the time. The government's duplicity will be completely ignored. **Our out-of-control, over-reaching current central government is playing gotcha.** Both past and present governmental bureaucrats are as culpable or more so than the business/industry that polluted in the first place.

Questions I would pose are:
What is the public danger? Will you even bother to let us know it's OK?
Can one safely eat the Dungeness Crabs in the PAWA Harbor?
Can one safely eat the bottom fish? Is anything you say credible?
Can one safely eat the bass, ling cod, squid, shrimp, etc?
How much of each is a dangerous amount. Do you have a clue?
At what rate are the various pollutants 'decaying'? At what rate is the problem resolving itself spontaneously.
If the 'clean up' is done all at once will it not release/stir-up a toxic amount of the pollutant(s)?

(Knowing the trend of the government incompetence, one wonders if the current ideological earth-worship-cult inspiring-bureaucrats' cure will be worse than the problem

they are claiming to fixing. A phased clean up after determining the natural rate of decay/resolution would be prudent. Perhaps natural process will do the work without squandering more public or private funds. In the meantime, warning signs and other public education may be sufficient to avoid undue problems.)

Where is the balance in doing these 'gang green's' superfluous studies and providing for more valuable public functions? Our funds are not unlimited. **In fact we are in massive public debt.** Money is being stolen from 401K's by printing money and our children are being unscrupulously put into debt to China without having earned a penny or voted a single time (taxation without representation). **When one keep adding enough unwise decisions, eventually one reaches a critical mass and the system will be collapsed (Cloward-Pivens Strategy).** Is all this simultaneous Radical-Environmental-activism conscious-self-destruction (cult leaders) or just mindless-reality-ignoring governmental-incompetence (cult followers)? It really doesn't matter the verdict will be the same.

In the mean time don't eat the sediment.
Karl Spees - Concerned Citizen

Addendum:
On 4/5/12 a friend and I were talking about the rush to judgment used by the mainstream media, the US President, and Congressional members of the Democrat Party in the lead story of the day about Tryavon Martin/Zimmerman legal case in Sanford, Florida. The conversation moved to the use of templates to promote the Leftist's Agendas. The subject of the Shakedown Template used on Boeing for $500,000 by Jesse Jackson and the Rainbow Coalition. Why wasn't Jesse Jackson and the Rainbow Coalition indicted immediately for 'blackmail'/extortion? His instantaneous answer was Christine Gregoire was Washington State's Attorney General. The problem was not Boeing's racism or Port Angeles pollution. Using our less pressing issues as a distractions and diversions of resources while ignoring much greater problems and issues like reckless over-spending, over-regulating and the faltering economy. **The problem is the corruption and abuse of power in Olympia, WA. Ultimately this is about destroying a system that can work and replacing it by a system that hasn't worked and will not work because of the arrogance of a group of grandiosity deluded bureaucrats who think they are the ONES.**

From: wilcoxj@katewwdb.com [mailto:wilcoxj@katewwdb.com]
Sent: Thursday, March 15, 2012 8:05 AM
To: Aoyagi, Hannah (ECY)
Cc: Bruce Treichler
Subject: Port Angeles Harbor Pollution - Impacts to Atlantic salmon reared in open pen feedlots within PA Harbor

Ms. Aoyagi,

The DOE findings regarding the pullution within the Part Angeles Harbor are shocking!
http://www.ecy.wa.gov/programs/tcp/sites_brochure/portAngelesHarborSed/paSed_hp.htm

The following are concerns of those who fish for and consume consume salmon and other fish from this area:

1. The Atlantic salmon raised in open pen feedlots sited within the PA Harbor need to be tested for PCB's, other chemicals, diseases and parasites given that they are being reared in this highly polluted environment.

2. Atlantic salmon that escape from the open pen feedlots sited within the PA Harbor carry these chemicals and diseases into the natural world where they are consumed by humans and a host of fish and wildlife species; including Orca whales.

3. Wild salmon and marine mammals live and feed within this polluted mess - As reported, these chemicals accumulate and are passed on when consumed

4. The marine floor under the open pen salmon feedlots is most likely very contaminated as well with chemicals, excess feed, dead fish. feces, etc.. This material is exposed to and consumed by other marine species.

5. With $325 million in restoration efforts ongoing in the Elwha River system, it is most important to clean up the PA Harbor and surrounding marine environments in order to keep these contaminants out of this otherwise pristine river system

6. Chemical contamination in the PA Harbor will also impact the fish proposed for rearing in open pen salmon and steelhead feedlots sited near the mouth of the Elwha River.

Sincerely,

JAMES E. WILCOX
Publisher / Co-editor: LEGACY
Wild Game Fish Conservation International
Web: http://WGFCI.blogspot.com
SKYPE: Steelhead.Salmon
(360) 352-7988