



Cowlitz Indian Tribe

November 28, 2016

Millennium Bulk Terminals EIS,
c/o ICF International,
710 Second Avenue, Suite 550,
Seattle, WA 98104

RE: Comments Regarding the Draft Environmental Impact Statement (Draft EIS) Concerning the Proposed Millennium Bulk Terminals-Longview.

Dear Colonel Buck and U.S. Army Corps of Engineers, Seattle District,

The Cowlitz Indian Tribe is a Federally Acknowledged Government entity in the region. We are not confined or bound by the public comment periods under this process. We plan to request additional follow up communications regarding this proposal through government-to-government consultations. We strongly believe that this documentation is highly flawed and contains inaccurate information as well as key omissions in regards to preparing yourselves for an informed decision.

Our historic area includes a large portion of the Lower Columbia River Basin that spans on both sides of the Columbia River and into Oregon State. The proposed Millennium Bulk Terminal (also identified further as "Coal Terminal") lies within our homeland. This proposal would have direct and indirect consequences to our people.

This letter formally documents our opposition to the Millennium Bulk Terminals proposal. It also is a response to the Draft Environmental Impact Statement (Draft EIS), detailing specific areas which require additional assessment or project details which were inadequately reviewed or studied.

We have relied on the once bountiful regional resources for survival since time immemorial. Our Tribe continues to depend on the precious resources, many of which are in a depressed state, which carry high significance to our way of life. Our Tribe carries natural resource management authorities, rights, and obligations within the Columbia Basin that would be impacted by the alternative presented in the Draft EIS. The proposed Coal Terminal is another threat to our way of life, culture, and subsequently our future generations' right to the use and enjoyment of natural resources within our homelands.

Before and after Federal Acknowledgement, we have taken the "high road" in regards to being a good neighbor, establishing positive relations with numerous Federal, State, Tribal, and Local entities. We have numerous ongoing regional activities addressing concerns associated with our depleted first foods and working on recovery of such significant resources.

Summary of Objections

The Cowlitz Tribe does not believe that this proposal is good for our environment or for the health and stability of the communities of the Lower Columbia River and threatens our Government and people's "fundamental and inalienable right to a healthful environment."

To begin our assessment of the DEIS's project evaluation failures; let us begin with the project scope.

- Construction will take six years.
 - In order to increase dock capacity, a new double dock will be created. This will involve driving over 610 piles, shading 9.83 acres, and dredging 48 acres of the Columbia River.
 - Redevelopment of the former Reynolds site will increase the industrial footprint from ## acres to 190 acres. 26.93 acres of wetlands will be filled.
 - 2.1 million cubic yards of soil will be brought on site and compacted to 'pre-load' for the eventual placement of coal. 2.5 million cubic yards will be removed.
- Operational timeframe is not well defined, but during operations:
 - Eight trains with 125 cars, 122 tons of coal per car, would arrive each day.
 - Coal would be placed on conveyor belts to move it around the site and onto ships.
 - 4900 of 16100 lineal feet of the conveyor belts are proposed to be enclosed.
 - 70 ships would come and go from the docking facilities each month (840 annually). They would on average hold 65,000 tons of coal. They would have to be loaded and refueled (which would occur offsite).
 - In total, 49 million tons of coal would be annually exported from this facility.

Despite this massive undertaking, direct and indirect study areas are very small. Most direct areas are merely a cartoon bubble approximately 1 mile in diameter. Many direct effects have been omitted from study entirely. As an example, dredge disposal sites have not been identified or included as part of the area of potential effect. Table 5.0-3 describes the Direct and Indirect Effect Study Areas and does not include any identified disposal sites. Clearly, dredge disposal is a direct effect of dredging.

We will return to this point repeatedly throughout this letter: the direct and indirect effect areas are not accurate. **The reduced and inaccurate scope underrepresents the risk and associated impacts to natural systems throughout the lower Columbia River.**

The proposed action that presented in the DEIS is a threat to our restoration activities and our cultural practice continuity in the region. We have been and continue significant activities in regards to addressing and implementing restoration activities of our traditional first foods within our homeland. Several of our significant resources continue to be listed under the Endangered Species Act (ESA). Significant areas of our work towards restoration are within the footprint of potential impacts associated with the Coal terminal proposal. There are numerous other entities in the potential impact area that have invested considerable resources regarding restoration within the Columbia River system, especially the Columbia Estuary.

The estuary is also an “ecologically critical area,” 40 CFR § 1508.27(b)(3), that is essential to the survival of juvenile salmon and steelhead, waterfowl, and many other species. A considerable amount of resources have been invested from Federal and State tax dollars, as well as “rate payer” dollars from utilities in the region. There are significant restoration plans that have been and will be implemented in the region in the foreseeable future. We and many others maintain the goal of restoring habitat and other conditions for natural resources within the Columbia Basin. Much of this work is due to habitat loss, poor water quality, and other factors of which industrial developments have been a significant contributor to.

We believe that activities and future plans toward Environmental Restoration in the potential impact area of the proposed Millennium Bulk Terminal should also be analyzed as “existing conditions and reasonably foreseeable future actions” within the study area and documented within the Draft EIS. Currently, there is little to no characterization in this regard in the Draft EIS. These actions are just as significant, if not more significant to consider as part of your decision. We respectfully request that this component (investment in environmental restoration activities, future plans, and potential impacts) be incorporated into the analysis and documented into a new Draft EIS for the public to review. Just one significant spill or accident event could likely wipe out several years of investment in this regard. The Draft EIS you present serves to reaffirm our opposition to this proposed development.

We believe that there is no amount of mitigation possible to fully compensate the deleterious impacts the proposed action would have to our community, our natural environment, and future outlook towards restoration. Of considerable note, the Draft EIS fails to acknowledge any of the considerable restoration efforts completed, or underway, and future projects to repair the already depressed state of the regions environment due to previous industrial developments and their continued negative impacts to area species that are listed under the Endangered Species Act.

Objections Specific to Tribal Entity

The Cultural Resources section is badly lacking appropriate context and content. The Draft EIS appears to signify that no new ground studies relevant to the project impacts were completed. Additionally, they minimize or ignore the Cowlitz’ presence in their own territory. Significant burial grounds at Mount Coffin, once just upstream of the project site, but now mined to river level, are noted in 4.4.4.4 that Mount Coffin is “significant to the Confederated Tribes of the Grande Ronde of Oregon.” While the burial location may have been significant to many tribes, it is also SIGNIFICANT that the report does not include the Cowlitz in its discussion of any archeological resources. Three village locations are also known to occur, one at or near the project site. In fact, 4.5.4.1 notes that “a village was located in the vicinity of the project area and known to both Chinookan and Cowlitz informants.” The proposed project location lies within the exclusive use and occupancy area as defined through Federal case law of our Indian Claims Commission case, known as Docket 218.

Fill of 2.1 million cubic yards of material over approximately 190 acres of land is proposed. Another 2.5 million cubic yards of material would be removed during compression of on-site soils. The DEIS does not include a discussion of where the removal areas would be, under which circumstances, or if the proposed fill will go into the excavation areas. There is no proposed elevation mapping described in the generalized cut/fill discussion. An archeological assessment is not proposed.

The DEIS notes that over 100 geotechnical borings were completed in the project area. These borings were completed, in part, to guide placement of additional deep test borings. Figure 5.4.5 shows a series of testing locations that are highly clustered and omit several broad project areas of 20+ acres in size. Additionally, there is no documentation indicating that geotechnical borings were completed in areas that might be archeologically significant, rather than an engineering necessity.

Finally, to highlight the importance of archeological due diligence, this project will destroy any archeology at the site completely. The DEIS acknowledges this when it states that surface grading and compaction will occur to a depth of 25 feet and pile driving to 70 feet. **Impacts will occur below historically recent fill.** The DEIS specifically states that construction and operations would alter any characteristic of cultural resources. The off-site alternative has a high potential of archeological resources – as does the proposed project site. The two sites are immediately adjacent to one another, and the proposed project site has not had adequate archeological investigation to rule out burials, village sites, or other archeological features and are culturally significant to the Cowlitz Indian Tribe would be destroyed entirely by the site compaction.

We request, based on this alone, that the Section 106 consultation begin anew and will take a full view of the possible and probably resources on the site.

Regarding fishing and treaty rights, because the Area of Potential Effect (APE) is so limited in scope and because Fish are inappropriately stated to only be at or downstream of the project area, the DEIS only evaluates harvest by Treaty tribes adjacent to or near the project site. There is considerable doubt that the DEIS statement is accurate on several levels. As the Cowlitz and other tribes have highlighted this concern and it has gone without response, we request this permit process be suspended, or denied, until the appropriate level of study and understanding of tribal treaty and trust responsibilities have been completed.

The DEIS identifies several culturally significant plants which are not on the project site. However, the project site would have been suitable for western red cedar, camas, wapato, and other culturally significant species prior to industrial site development. That the project site does not currently have culturally significant plants is not indicative of its lack of suitability. The current and prior owners have purposely maintained cleared areas to minimize the likelihood of sensitive or important species or features. The DEIS appears to suggest that because the site does not currently have culturally significant plants the Cowlitz would not request seasonal excursions. This is without basis.

Columbian White Tailed deer are a culturally significant wildlife species that has been recorded on the project site. The DEIS does not suggest any mitigation for the loss of Columbian White Tailed deer habitat, either as a culturally significant species or for the species' habitat.

Coal

The Millennium Bulk Terminals proposal is a proposal to move 49,000,000 tons of coal annually from the Powder River Basin to the West Coast and Longview via rail, then stockpile it and ship it to Asia. The Washington State Environmental Protection Act (SEPA DEIS) document reviewed both the shipping impacts from Powder River and the likely effects associated with coal burning in various Asian countries. This DEIS evaluates only the transportation from the main rail line in Kelso to the project site in Longview, a distance of 7.1 miles.

There are some real issues with coal transportation, storage, and export exactly as portrayed in the DEIS. But we want to start out with a note that the very assumptions used to determine how much fugitive coal dust loss would occur appears to be biased and under-reported.

Michael Riordan, Ph.D. provided comments on the SEPA DEIS process. He writes that the coal dust estimate input numbers are 'unwarranted, optimistic input parameters" and that the model applies "unjustified and unreasonably high efficiency factors for dust control measures." The DEIS uses, as an example, 35.5 million tons to estimate stockpile dust not the earlier stated 49 million tons. It underestimates the actual silt content in the Powder River coal types. A mean value used by Western Surface Coal Mining is 8.6%, while the DEIS uses 2.2%. However, even if a lower percentage was used, and a 90% effectiveness given to coal dust wetting – the amount of fugitive dust at the site rises to **three times the estimate in the DEIS.**

Dr. Riordan estimates that fugitive coal may be, reasonably, 10.1 tons per year (DEIS: 5.25 tons/year) during materials handling, and 12.6 tons/year (DEIS: same 5.25 tons/year as for materials handling) during ship loading. Page 8 of Dr. Riordan's informative comment letter contains a table, estimating that overall on-site fugitive coal emission rates, conservatively, could be between 26.7-46.3 tons/year. In opposition to the DEIS' stated rate of 9.86 tons' per year. This is 2.7 to 4.7 times higher than the DEIS estimates.

As recently reported, Burlington Northern Sante-Fe (BNSF) Railroads will be studying the use of physical covers for coal and petroleum coke trains as part of a recent agreement with environmental groups. BNSF will also pay \$1 million towards cleaning up hotspots where coal has been accumulating near along rail tracks near waterways. We suggest that this study inform the next step of the EIS process, which we again, recommend to be a through reevaluation of the project scope and impacts.

As we now turn back to evaluate direct "proposed" coal impacts, we will remind you of the actual emissions that are likely to be higher to much higher than the proposed amounts in the DEIS.

Additionally, even if these emissions were not actually higher, **coal has a high likelihood of long term, sustained damage to natural systems.**

First; coal dust deposition figures show the heaviest coal dust deposition occurring over the Columbia River.

In the following section – Operations Indirect Impacts – Contaminants, the DEIS uses the minimum one day flow and the maximum mixing to provide a suspended sediment concentration of approximately 1 part per billion. The DEIS states in another section that coal sinks (denser than water) as stormwater, and is expected to be retrieved from settling ponds on the project site. However, when it is entrained in the Columbia it remains suspended? This is feasible, but as with most sediments, it will drop out of the sediment column and this should be studied and understood, not occluded.

In reviewing sediment and sediment movement in the Columbia River, however, it becomes clear it is desirable to the applicant to avoid determining where coal goes after it enters the Columbia River. When it enters the Columbia River, it becomes part of the Columbia River sedimentation process. When it settles to the bottom, which will occur, it impacts benthic organisms disproportionality. The DEIS details impacts such as tissue abrasion and smothering or clogging of respiratory and feeding organs. This would have a higher impact on benthic invertebrates and bottom feeding fish, including sturgeon. Further up the food chain, invertebrate community changes could impact fish such as salmon and other higher order species.

The DEIS suggests that coal will not impact benthic or higher order organisms. This is patently false.

The second and perhaps more terrible impact would be the accretion of coal sediments in the Columbia River estuary. Lower Columbia River Sand Supply and Removal: Estimates of Two Sand Budget Components (Templeton and Jay, 2013) note that, though ‘tidal currents at the mouth of the system are strong, there is very little net sand transport from the estuary to the ocean under the present regulated flow conditions.’ The DEIS states that toxins could leach from coal to the pore water in sediments. A contaminant sink of coal, exported over time downriver, would likely largely remain trapped in the Columbia River estuary, a place so key to the Columbia River’s salmon population that millions and millions of dollars have been put towards restoring it for future generations. This proposal does not even address what a contaminant sink might do to local resources, let alone to the lower Columbia River estuary.

The DEIS notes that trace amounts of toxic elements are present in coal. The DEIS states that coal is a naturally occurring substance. Dirt is also naturally occurring and rarely toxic, however uncontaminated sediment from streams have damaged salmon runs throughout the Pacific Northwest. Coal, however, does contain antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, selenium, and uranium in trace amounts. The DEIS describes the Columbia River as a dynamic riverine environment where toxic concentrations are unlikely to develop. Again, this discounts the downriver

estuarine environment, where most sediments do not exit the estuary – quite probably causing a toxic sink at the mouth of the great Columbia River. Sediment moves through natural fluvial process and dredging. Information on how sediment moves is available. The final EIS should evaluate the effect decades of coal dust, coal particles, or coal spills would have on the local and downstream river environment.

The 'Wildlife' section addresses coal spills in the aquatic environment on page 5.8-28. The DEIS uses the example of a coal train derailment and spill in Burnaby, British Columbia. Findings were that there were minor impacts in the coal spill study area. The DEIS uses this as an example of why coal is not particularly bad. So, we looked up the spill details and the report.

First, the spill was limited to just three rail cars spilling coal. The total amount of coal spilled was less than one full car's worth, around 63 tons. A fully loaded coal car carries approximately 100 tons. The amount would be similar to the conservative annual fugitive coal dust estimate offered by Dr. Riordan. The spill occurred adjacent to a fish-bearing creek, and the creek flowed into a small reservoir just downstream.

The 2015 study by Borealis Environmental Consultants did find that the impacts were restricted to a local area. This is because downstream of the coal spill is, as we noted above, a small reservoir. The water stops moving and the coal and attendant pollution dropped out and stopped moving too. Thus most coal was able to be removed in this situation. A coal spill adjacent to the Columbia River would be entirely different. The Columbia River, which is fast and deep through the Gorge where most trains will travel and down to the project site. Through the project area, the Columbia continues to move quickly downstream, where either fugitive coal or a spill would be spread wide and be difficult to capture and remove entirely.

In the case of an earthquake, a collapse or derailment on the Cowlitz River Bridge, or while loading a vessel would be massive and catastrophic.

Also in the Burnaby B.C. example, and not noted in the DEIS, PAH's were recorded above 'approved' guidelines at almost all stations, that sediment samples collected near Station 2 were close to toxic levels for benthic macroinvertebrates. The report suggests that sediment near Station 2 might be bioaccumulative, which is supported by other studies regarding coal. This assessment was completed approximately a year after the coal spill.

The above review just describes the product to move through the proposed bulk terminal site. Let us now move onto secondary project impacts.

Aquatic Environment & Fish

Moving in to focus on the aquatic environment, the DEIS starts off noting that only 0.10 acres of benthic habitat would be affected by pilings. This is a misrepresentation. The 0.10 acre figure refers to the total,

actual area which will contain a piling. The disturbed area which will be encompassing and associated with the new pile array will actually total 48 permanently impacted acres.

In "Pollutants and Turbidity," page 5.5-15, the DEIS clearly identifies that dredging may re-suspend pollutants and sediment as well as increase turbidity. Forty-eight acres would be permanently dredged. The work will occur in the outward lee of a bend in the Columbia River. It will include dredging of shallow water habitats right up to the CDID #1 levee system toe. Throughout the document, no description of the project effects on the levee system stability, or bathymetric stability of the Columbia River is provided.

As we move from direct aquatic affects to specific fish related impacts, we want to start with Sections 4.5.5.1 and 4.5.5.2, which directly contradict one another. Although the DEIS describes impacts to fish, it also states that there will be no measureable impact on tribal fishing. Without any quantification or analysis, this is a very irresponsible and insupportable statement. **The project's indirect effect area should include the entire Columbia River system, including all upriver tributaries, and downstream into the ocean.**

The Fish section in the DEIS describes the NEPA Fish Technical Report as containing the impact models, calculations, and assessments. Which it does. However, it does not assess how these models, calculations, and assessments actually relate to fish, because:

"The impact analysis for fish habitat is quantitative; however, the impact analysis for fish species is qualitative because fish are generally mobile and their presence and abundance within the study area cannot be quantitatively predicted at any one location or time. In addition, a species reaction to an impact mechanism, such as construction-generated noise, can be different for each species given the variability in species' hearing frequencies, mobility, vision, and overall sensitivity (e.g., juvenile fish may be more sensitive and susceptible to potential impacts than adult fish). Therefore, impact mechanisms are identified and a qualitative impact discussion describes the potential effect an impact mechanism could have on species that may be in the study area during construction and operations." NEPA Fish Technical Report Pg. 2-3

This is highly misleading. Studies of fish in general and the specific species in question in particular, are easily available. Estimates of fish impacts should be obtainable by an expert in a reasonable amount of time, with error bars illustrating the validity of the model or extrapolation. Indeed, were it the case that experts had reviewed this data and determined that the models disagreed to too great a degree, this should have been noted. However, science does know the species present at a given time, the generalized expected numbers of that species in a given year (and an estimate may be made with caveats), and the physiological effects have been studied. The Technical Report even details which specific salmon species are present in which months. (Table 2: Status of Focus Species and Seasonal Presences in the Study Area). The table also occurs in the Fish chapter as Table 5.7-3. Ages and species present are indicated on page 5.7-14. And fisheries assessment are available and used by state agencies

and researchers. Oregon State University offers a course called Introduction to Fisheries Assessments. Considering the time taken and money spent, it might have suited someone to take the class, and maybe the follow-on course work, and learn how to appropriately assess population affects.

To further illustrate that the DEIS authors were aware of these tools, but did not employ them, In Commercial, Tribal, and Recreation Fishing (pg. 5.7-17) the DEIS identifies management and assessment tools. As described in the DEIS, the Columbia River Compact requires consideration of escapement, treaty rights, and sports fisheries when setting commercial seasons. **Therefore it follows – Millennium can evaluate its impacts to fisheries using or adapting the same science.** As the second paragraph, fifth sentence notes, the Columbia River Compact addresses ‘allocation of limited resources among users.’ Millennium is not a user, but it has an impact on these limited resources.

With increasing frustration, we must note that the DEIS provides almost enough detail under ‘fish stranding’ to evaluate the increased ship travel on juvenile salmon stranding. It states that many factors affect stranding risk, including but not limited to ‘vessel size, draught and speed, and beach slope and permeability.’ All of this information can be assumed or is available for review. We request an evaluation of increased stranding, i.e. ‘take’ that the estimated shipping traffic will create.

The Draft EIS addresses vessel wakes and fish stranding, noting that estuarine beach stranding makes fish ‘susceptible’ to stress, suffocation, and predation. The Draft EIS does not address mortality, which is the most common outcome of beach stranding. Beach stranding at Barlow Point, just downstream of the project area currently occurs at 53% of observed passages. Subyearling Chinook salmon appear to compose of 80% of the stranded juvenile salmon. This further justifies our opposition to this proposed development.

The Draft EIS discusses vessel wakes in terms of erosion and fish stranding but omits the impacts of vessel wake impacts on wetland systems throughout the lower Columbia River. These systems are composed of several features, and erosion and wake energy disrupt and erode fringe habitats that are critical to long term recovery of the Columbia River estuary ecosystem and would have an impact toward habitat restoration efforts which this Draft EIS fails to recognize.

Let’s move on to evaluate dredging. Dredging is proposed from August 1 to February 28 with pile driving occurring from September 1 to December 31. The proposed time frames do not avoid impacts to several salmon species and in fact occur during the height of the eulachon migrations. The DEIS authors write that ‘eulachon are assumed to occur in the Columbia River adjacent to the project area from December through May.’ Despite this, the DEIS states that ‘applicant-proposed timing would...avoid and minimize impacts on spawning, adult, egg, and larval eulachon.’

In another minimization tactic, the DEIS states that although 48 acres will be dredged, 9.83 acres of area will be shaded by new docks, stating this accounts for just 0.6% of the ‘direct impacts study area.’ The ‘direct impacts study area’ is the area in which the DEIS estimates piling noise could affect fish species.

48 acres is a large to very large dredging operation. Calculating it as a percentage of an impact area associated with impact noise is inappropriate.

So, regarding pilings, which would be driven by multiple rigs. Noise thresholds would be exceeded at distances of 45 feet to 3.92 miles (exceeding the width of the Columbia River at this location), resulting in injury and behavioral impacts to adult salmon. This data considers impacts to adult fish. The DEIS occludes actual impact by measuring impact distance along the shoreline and suggesting an impact area of 0.44 square miles.

Piles will be driven by a vibratory driver, until it meets resistance and then an impact drive would be used. It is expected that it will take 20 -120 minutes to drive each pile. A minimum of 5,000 strikes per day would occur. If taken over a 10 hour work day (assumed), that equates to 8 strikes per minute. Sound pressure levels ranging from 150 to 206 decibels could injure fish or change their behavior. The Columbia River is 3000 feet wide in the project area. Salmon migration varies by species. However, if fish actually are only in the work zone from 20 to 90 minutes, they will experience 166 to 750 strikes while in the 'study area.' The projected injury distance is 1.1 miles, which means that during the pile driving period 100% of the migrating salmon species, either juvenile or adult, could be negatively affected, injured, and fitness reduced.

Injuries to salmon can result in 'reduced fitness, leading to increased vulnerability to predators, reduced ability to locate prey, inability to communicate, or inability to sense their physical environment.' (pgs 5.7-26 & 27) When these effects are temporary, they are able to recover most function within 18 hours. They may be able to recover from more permanent damage over a period of days or weeks. So. The DEIS states that risk of injury from a single strike is 45 feet. The fish will almost never be subjected to just a single strike. Despite this, the final sentence in the Underwater Noise section is "Because the potential injury area would be limited to such a small area, it is extremely unlikely that adult fish would experience injury."

We can also provide more detail that presented in the DEIS by opening an introduction to fish text book. Jawed fish have three semicircular canals and provide fish with information about the space around them. The three canals are 'more or less aligned in the horizontal, vertical, and lateral planes.' (Fishes, an introduction to ichthyology. Moyle and Cech. 2004. These are seen in changes to pitch, yaw, and roll as straight line acceleration or deceleration. The DEIS provides adequate information on the effect that the proposed pile driving will have on the species in the river when the pile driving occurs. Damage to the fishes' hearing has a direct effect on their movement. And, further from Moyle and Cech (2004), 'perhaps no group of fishes has been more studied then that of the Salmonidae.'

This is a major impact on two entire salmon runs, as the pile driving is proposed to occur over two construction seasons, September 1 through December 31. Five threatened salmon runs and four threatened steelhead runs are present during the pile driving window (See Table on page 5.7-3). **This is alarming to us and justifies non-approval of the proposed project.**

The Applicant proposes a trestle that is 8 feet above Ordinary High Water Mark and 24 feet wide. 4.86 acres of aquatic habitat would be shaded by the proposed project's trestle and docks, with an additional 4.7 acres of habitat shaded by docking ships. Although elevating the deck reduces the amount of aquatic shading, it still leaves a substantial shaded band. Juvenile fish generally avoid shaded areas rather than crossing them. The trestle shading may cause fish to migrate around the trestle, dock, and any ships at dock. This would place migration corridors into the deep water zone for fish that may otherwise prefer shallow or moderate depth waters during migration. Low levels of underwater light are favorable for predatory fish. The stated 0.8% (9.56 acres) of the study area would be shaded, which is noted should establish an assumption that the predator-prey relationship would change and an increase in predation would be likely (page 4.7-27). The linear dock feature also increases the risk, maximizing exposure in deep water habitats and to predator fish.

The DEIS alludes that 'many fish species (especially estuarine species) have been documented to prefer higher levels of turbidity for cover from predators and for feeding strategies.' The reference points to an ECORP Consulting document published in 2009. The report is titled "Literature Review (for studies conducted prior to 2008): Fish Behavior in Response to Dredging & Dredged Material Placement Activities (Contract No. W912P7-07-P-00790)." First, this was a report that studied fish in San Francisco Bay. Starting in the report's summary, the document clearly notes that 'juvenile salmonid migration behavior is disrupted (through avoidance response) when encountering dredging activity or sediment plumes,' and 'noise generated from pile driving activities is generally within the range to elicit avoidance by juvenile salmonids.'

The only location supporting the DEIS' statement of 'many fish' is on Table 1a stating that when NTU values are between 0.5 to 87 for sediment suspension, there is some predator avoidance benefit to Chinook salmon. For those unfamiliar with NTU readings: an NTU value of 1-3 is very clear. A stream may be considered turbid, or cloudy, at NTU 50. The Columbia River is generally considered excessively turbid around NTU 100. Very high turbidity can exceed 1000. So the report is stating that from very clear to somewhat cloudy conditions, Chinook salmon juveniles may realize some predator avoidance. The remainder of the table (pages 54-57) describes mortality, particle damage to gills, decreased feeding, decreased mobility, changes in territorial behavior, stress, and increased cough reflex. We are attaching the Table 1a as an appendix.

The Draft EIS appears to infer that floodplain disconnection, altered or eliminated habitat availability, and degraded habitat forming processes have resulted in a situation from which no further impact to salmon could possibly occur. Additionally, the Draft EIS describes the project area shoreline as highly modified by levees and riprap. While the description is accurate, it underplays the very low habitat availability in the Lower Columbia River and the critical role even substandard habitat plays for Endangered Species Act threatened salmon and steelhead stocks. We are disappointed in that, although there have been considerable degradation done in the past regarding habitat and habitat function in the lower Columbia, there is no recognition that there are efforts to improve current conditions. We are

disheartened and state that there needs to be a better analysis of what the proposed action would have toward salmon and steelhead recovery efforts.

The Draft EIS state that its voluntary measures and mitigation measures will reduce impacts on fish, leaving no unavoidable or significant adverse impacts. It is worth noting that Bonneville Power Administration has been actively working to develop and implement tidal and estuary salmon habitat projects for several years. Limited habitat project availability has been a continual problem despite a large network of project sponsors.

Turning our attention to eulachon, it is evident that the DEIS authors were not either aware of, or chose not to, contact the Cowlitz Indian Tribe about their ongoing eulachon research on the Cowlitz and Sandy rivers. This information could have helped inform the DEIS's data gaps. The DEIS states that 'the extent of this area that may be used by eulachon for spawning is unknown.'

Bottom feeding or dwelling fish, such as sturgeon and lamprey, will be disproportionately affected by pollutants and toxins introduced into Columbia River sediments by the project actions. The DEIS only addresses the project area for migration or movements, but does not address the downstream effects of sediment transport and retention in the estuary.

Additional fish-related comments in brief:

- o The Draft EIS does not address fish screening for hydraulic dredging.
- o The Applicant fails to account for the direct project impacts to the unidentified 80 to 110 acre dredge spoil deposition area.
- o Increased vessel noise may cause potential behavioral disturbance for fish and may cause avoidance.

The Cowlitz Indian Tribe objects to the Applicant's impact statement, noting that adult and juvenile fish will not be able to avoid impacts or injury and will likely have increase mortality and/or reduced fitness.

Flooding

EO 11988, Floodplain Management requires federal agencies to avoid short and long term impacts associated with floodplain occupancy and modification wherever there is a practical alternative. The Draft EIS states that because the proposed project site does not currently function as a floodplain, the project does not decrease Columbia River's floodplain capacity.

The Draft EIS presents also the Columbia River Levee as a permanent structure that protects the project area indefinitely from the Columbia River. No discussion is provided about the existing levee condition, the expected life expectancy of the levee, pump, or ditching system, the project's investment into the CDID #1 utility.

The DEIS description of the project site as disconnected from the river is incorrect. The project site is within the floodplain, behind a levee system. Disconnected is a temporal feature and subject to events well outside the scope of the developer's control. Additionally, the project area would continue to be floodplain, as it was historically, without the construction of the levee system in the 1920's. The Magnuson Fisheries' Act describes floodplains as essential fisheries habitat. A review of essential fisheries habitat apparently has not been conducted because the DEIS does not describe this review at any time throughout the document.

Floodplain elevation data was analyzed by the Cowlitz Indian Tribe. The DEIS identifies the project elevation, in general, at 16 feet above sea level (no datum supplied). Elevation data at the project site generally ranges from 5 feet to 11 feet elevation with only the elevated regions near the levee and the closed landfill reaching 16 feet. At this location, 13 feet is major flood stage. Most of the project area elevation is within the 100 year floodplain.

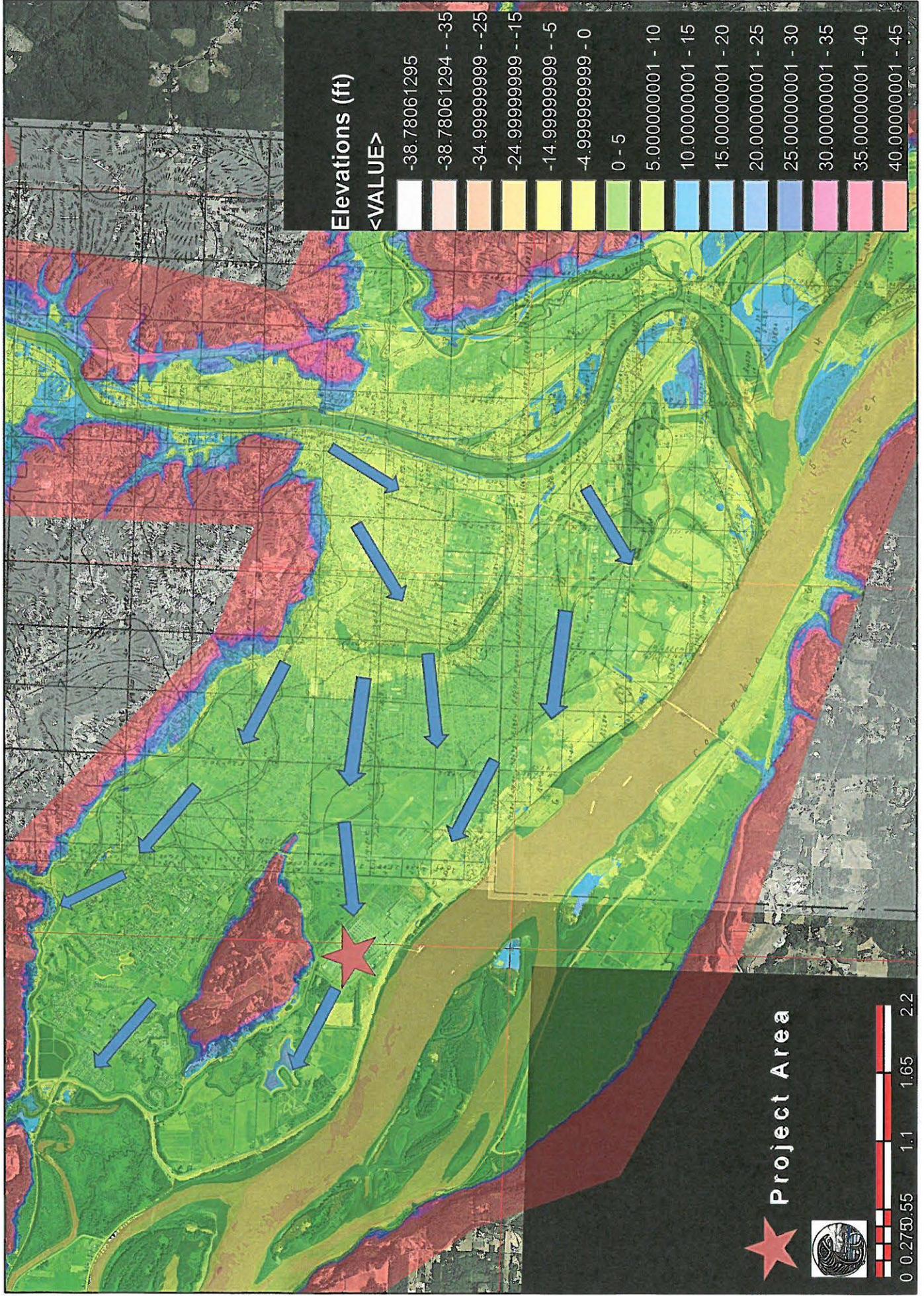
The Columbia River has a historically recorded crest of 24'. More frequently, the river crests between 14 and 18 feet. However, because we don't have a datum, it is impossible to determine the exact correlations between the project area elevation and river surface elevations.

In Section 5.2.2.1, the DEIS refers to the project site as 500 year floodplain. The 500-year floodplain only refers to the level of protection offered by Consolidated Diking Improvement District #1. The site itself is, as described above, is within the 100 year floodplain elevation. Section 5.2.4.1 describes the site as the right-bank floodplain of the Columbia River. 5.2.5.1, Floodwater Retention does note that a 500-year flood 'would...have substantial impacts on the proposed terminal and likely require substantial repair and replacement of facilities, equipment, and infrastructure.' This acknowledgement of risk is commendable, but the brief discussion later in the section only notes that stockpiled coal would be redistributed across the floodplain and in the Columbia River, and no further discussion of impacts occurs. The levee system does not protect against the 500 year or greater event. Perhaps one of the stranger statements regarding flood protection is that the levee system does not 'preclude a 500 year event.' Preclude, of course meaning "to prevent something from happening."

Another point of consideration is that Columbia River flooding is not the sole risk to the project site. CDID #1 also protects the project area from the Cowlitz River. The Cowlitz River is vulnerable to ash deposits from Mount St Helens. Its major flood height is 28.5 feet at the Cowlitz County Courthouse. NOAA Advanced Hydrologic Prediction Service notes that "Above 28.5 feet, major flooding in Kelso occurs, including residential and business areas. Numerous roads are flooded and closed, and levees may be subject to erosion and overtopping at this level."

The project area is downslope from the Cowlitz River at this location. An attached map illustrates how a levee breach on the Cowlitz River portion of the CDID #1 levee system could affect the entire Longview area. Notable is that Millennium would be downgradient of any levee break on this system. The DEIS should consider risks associated with the CDID #1 Cowlitz levee system.

Longview Elevations and Project Area



A concept which was not explored in the DEIS is that the project area could be restored utilizing a setback levee without impairing protection to nearby areas. It is inaccurate and misleading to label it as 500 year floodplain without, at minimum, discussion of the site itself as a possible floodplain restoration project site.

In context of the project area waterward of the CDID #1 levee system, the DEIS notes that water surface elevations must not rise upstream, as a result of the project actions. However, the DEIS does not provide this basic information, required of all other projects large or small.

The DEIS suggests that because the project is inland, it will not be affected by sea level rise. At the project site, the Columbia River has a diurnal tidal range of approximately 4 feet. Channel dynamics (not discussed in the DEIS), such as reduced sediment supply, decreased flow amounts and flood heights, and increased tidal elevations and salinity intrusion make predicting sea level rise in the Columbia River itself particularly complex and challenging. Jay and Naik (2011) notes that tidal amplitudes have been increasing all along the Northeast Pacific coast. "The largest increases approach 0.3 meters for this ~65 year period." The authors also note that the 'riverine [shallow water habitat area] is more tidal than it was historically, because of two factors that re-enforce one another: river flows are lower, and tidal range has increased for any given flow." Sea level rise might not only affect flooding but fragile ecosystems which may remain subtidal more frequently. These citations come from the article titled "Distinguishing human and climate influences on hydrological disturbance processes in the Columbia River, USA." It was published in the Hydrological Sciences Journal October 19, 2011.

The above referenced article suggests that tidal range has been increasing for a long period of time. Increased sea level rise is likely to impact upriver locations. Flooding will become more common. Although the DEIS notes that the project site is protected by 36' levees, reduced floodplain width and increased tidal flooding, and a swifter deeper main channel are complicating features which should not be brushed aside by casual observation.

The DEIS minimizes vessel-related erosion risk to lower Columbia River shorelines because 'shoreline erosion is a natural process' and 'erosion is not intrinsically harmful.' The DEIS minimizes likely impacts in paragraphs one and two, hiding the real assessment mid-page. "Operation of the terminal would increase vessel traffic and probably increase or intensify the extent and/or rate of shoreline erosion and subsequent loss of shoreline vegetation. (5.6-27)" Shoreline erosion and ship wakes have been studied extensively, and this is another area where quantifiable, reproducible data should have been supplied. Instead, the DEIS suggests soft beach armoring, planting native plants, or bank armoring as options available to permitting agencies to reduce erosion risks the project could cause. Suggestion to permitting agencies – deny the project permit!

Earthquake & Geology

The DEIS appears to rely largely on generalized soil mapping and also on geotechnical reports which are not publically available. Earthquakes, tsunamis, or off-site landslides are given criteria for determining

indirect impact area. If these criteria are actually applied, the Cascadia Subduction Zone region would be an appropriate indirect effect area. However, the indirect effects area is a comical bubble and the back side of Mount Solo is included, despite the fact any landslide to the north of the hill would be extremely unlikely to affect any off the project's geology or soils.

The DEIS describes very strong subduction zone earthquakes that are possible in the project area. Since no great earthquakes have occurred in the historical records, the DEIS instead uses the 1949 Olympia, 1965 Seattle, and 2001 Nisqually earthquakes as the only feasible earthquakes likely to impact the project site. The largest of these was a 7.1. Earthquake magnitude is a logarithmic scale, meaning that for each increase in magnitude, the earthquake releases vastly more energy. A subduction zone earthquake is estimated to be between magnitudes 8.0 to 9.0. An earthquake of this size has a predictable risk factor within the project's projected operational period. A magnitude 9 earthquake would release nearly 1000 times the energy as the 7.1 Nisqually quake. Not only would a subduction zone earthquake have a higher magnitude, it would also occur closer than the Nisqually earthquake. The offshore faults are only 60 miles distant, while Nisqually is 90 miles away.

No description is made regarding the Cowlitz River Bridge's seismic rating, nor the plans to manage the site in the event of a very large earthquake. **Damage to infrastructure would dramatically increase the risk of equipment failure and a major coal spill.**

Because the DEIS minimizes earthquake risk, the entire seismic hazard section uses magnitudes ranging from 7.4 to 8.3, without addressing or quantifying why these lower figures have been utilized. The DEIS also minimizes tsunami risk. The DEIS notes that a tsunami at the Columbia River's mouth may be 18 feet high. Contemporary data (Astoria Evacuation Brochure, Oregon Geology (2013)) to the cited Yeh et al 2012 report suggests that tsunamis have been recorded at the shoreline at heights of 20-65 feet but that local conditions may cause wave heights to increase to over 100 feet.

Furthermore, underwater landslides in the Columbia River may be feasible. The DEIS notes that underwater landslides could disrupt the Columbia River navigation channel and adjacent berthing areas. The project proposes to dredge 48 acres to 43 feet, which could destabilize the Columbia River channel, either for erosion or mass wasting. No study of this possibility appears to have occurred. The project occurs in the outside bend of the river. Outside river bends are areas of increased erosion.

The DEIS appears to note in 'Ground Shaking,' page 5.1-16, that complying with International Building Code and Cowlitz County Grading Ordinances, along with as-yet unwritten geotechnical reports will likely reduce potential impacts associated with ground shaking during earthquake events. This response is akin to noting that because a policy is in place, no negative effects can be realized. While geotechnical work would be expected to identify specific methods to reduce ground shaking effects on the proposed buildings, it is irresponsible to evaluate this proposal without the full understanding of soil conditions, expected geotechnical engineering techniques, and impacts associated with geotechnical 'fixes.' Indeed, it is odd that preloading and wick drain information is offered when geotechnical engineering has not

been completed. It appears that there are some guesses about what will need to be done. The DEIS should not, however, be evaluating guesses but rather the actual work that Millennium Bulk Terminals proposes to complete.

Liquefaction, a process in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading, could cause settlement of 7 to 16 inches during a major earthquake. (SEPA DEIS Appendix Volume IIIb, pg. 17) The project area is largely sands and silts. The Cowlitz County Site Class Map notes that the project area soils are the softest soils and have the highest level of potential ground shaking.

- The Draft EIS does not discuss how liquefaction risks affect coal stockpiles or other infrastructure, including the loading booms.

We are very concerned as to the potential of significant damage due to the likelihood for a geologic event in the region. If the facility is built, just one major geologic event would be catastrophic for many years to come and would have significant deleterious impacts to our way of life, culture, and environmental restoration efforts, which is irreplaceable.

Ecology

Lower Columbia River Sand Supply and Removal: Estimates of Two Sand Budget Components (Templeton and Jay, 2013) discusses the interaction of sediment supply and channel geometry, and the changes to the river's hydrology. Specifically, the Columbia River shipping channel and associated channel aids have 'made a narrower, deeper, hydraulically more efficient channel. These changes have lowered the surface elevation of the river for any given flow and increased the tidal ranges. A sand deficit can only exacerbate this problem, by causing bed degradation.' 'To the extent that a sediment deficit contributes to falling water levels, it has negative impacts, including navigation, channel maintenance, Lower Columbia River habitat access, and the stability of the surrounding littoral cells on the Oregon and Washington coasts. If the Lower Columbia River shallow water habitat is lost as the bed degrades, ecosystem effects may also be strong and negative.'

Loss of shallow water habitat has a historical relevance to ecology. Ditching, diking, and dredging have all served to reduce shallow water and intertidal areas which are critical to many species. Further loss is not acceptable.

The DEIS mischaracterizes some landscape functions. Some areas are defined as 'developed lands' which are in fact only disturbed lands, not developed. Also, as noted in our response to the Wetlands chapter, some areas which are listed as uplands are in fact wetlands. Also some stormwater features have strong wetland characteristics. Wetlands are defined as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Man-made feature, such as ditches, are not excluded from this description.

Land use and vegetation type are conflated in Table 5.6-2. In this table, descriptions include 'developed', 'forested', 'herbaceous', and 'agriculture.' Of course, any reasonably informed person would know that 'agriculture' and 'wetland' often overlap, as do 'wetlands' and 'forest,' etc. This table is completely without merit or usefulness and we only bring this up to demonstrate the poor science represented in the DEIS.

The DEIS fails to address a plan to remove noxious weeds on the project site. Not only are they already on the site, the project may increase them. The project construction practices may allow invasive weed colonization, such as stated on page 5.6-23, "preload material piles could provide an area for invasive plant species, including noxious weeds, to colonize." It continues that "[s]uch conditions would provide a seed source that could be readily dispersed into adjacent areas by wind and runoff, increasing the potential for invasive species and noxious weeds to spread and displace native vegetation."

As another example of relevant reports not yet complete, the DEIS states that the special-status plants have not been identified yet, but will be. But their existence and impacts to them cannot be quantified because they are an unknown. Also, no aquatic vegetation survey has been done.

Shrubs and trees adjacent to Docks 2 and 3 would be trimmed or removed, reducing organic material deliveries to the Columbia, native foraging, resting, and perching for birds. Other vegetation along the roads, rail lines, and other facilities would be regularly trimmed. Any vegetation colonization would be removed, controlled, or trimmed. Except invasive plants, which are expected, as shown above, to spread without control.

Coal dust may have an impact on plants through reduced respiration or increased transpiration and other physiological responses. Coal transport and storage may release contaminants such as arsenic and polycyclic hydrocarbons into the soil, but the impacts on vegetation is not known. If a coal spill were to occur into a vegetated area, many factors could harm plants. Primarily crushing. "However, in the long term, coal remaining on the ground after a cleanup effort could leach chemicals from exposure to rain."

Despite the fact that basically no work has been completed regarding actual plant status in the project area, or impacts to plants, the DEIS concludes that direct impacts on vegetation would likely only be limited to the continued existence or possible colonization of noxious weeds around the periphery of the project area.

In the Wildlife section, the Study Area description states that 'extensive modifications...have altered the habitat conditions in the study area available to wildlife species.' They go on to state that 'of the undeveloped areas on the project area, many are small and fragmented, and separated from similar habitat patches.' These statements are true. But these patches are also remnant floodplain habitat, or purposely have been kept disturbed by mowing or regular maintenance to ensure they cannot become habitat. The DEIS describes them as 'disconnected patches of suitable habitat.' Yes.

Columbian White-tailed deer, a Threatened species, have been observed on the site, in Wetland A, a forested wetland that appears to be a remnant floodplain forest. Columbian White-tailed deer habitat is limited in availability throughout the lower Columbia River largely because most floodplain habitat has been developed by industry, commerce, or agriculture. The site's use by these mammals is noteworthy and at minimum, mitigation should be proposed to offset the habitat loss.

Columbian white-tailed deer are threatened by this proposal in three ways. First, Columbian white-tailed deer are good swimmers and frequently cross the Columbia River to reach adjacent habitat. Extreme habitat fragmentation is a major contributing factor to Columbian White-tailed deer's historic decline. Habitat fragmentation continues to threaten recovery. The Applicant's proposed order-of-magnitude of increased shipping presents likelihood for significant mortality. Impacts during migratory movements crossing the Columbia River include ship strikes and drowning. The proposed Coal terminal is located between two populations, located at Diblee Point and Willow Grove. The Draft EIS doesn't address threats to Columbian white-tailed deer through increased vessel traffic in the Columbia River. We believe that addressing this element is well justified. It is alarming to contemplate additional migratory patterns deleteriously impacted by increased shipping traffic.

Second, Columbia white-tailed deer were observed on the project site. The Draft EIS does not discuss the project site's features as existing habitat or as a migration corridor. It does not discuss lost habitat impacts. Mitigation is not addressed in any way.

Third, the Applicant does not discuss or evaluate Columbia white-tailed deer terrestrial or aquatic migration corridors. Industrial developments along their migratory corridor reduce their ability to move freely upstream and downstream. Migration is important for their recovery and sustainability of genetically viable populations. The proposed coal terminal would further exacerbate an already identified problem undermining their health and welfare.

Canada geese have been sighted at the site. No note is made of which variety. A full list of observed water fowl and migratory species was not presented, just a list of common bird species recorded during the two days' site visits.

Furthermore, the DEIS suggests that marbled murrelets, for which all other projects and agencies manage with care, would likely avoid the area, because of 'the presence of construction equipment, vessels, and humans during pile driving.' This does not meet the intent to study impacts on the diving water bird. Rather, it just states that the project makes the bird go somewhere else. That's not the point.

Our environment is already in a depressed State. Existing developments continue to have deleterious impacts on our environment. Why we would consider any new major developments of this nature while still struggling from past problems? The Draft EIS only recognizes the already depressed environment as a rationalization about why the project's impacts are unimportant. We don't think there is any

mitigation that could effectively offset the damages to existing resources. Taken along with the Applicant's fuzzy 'trust us' approach to mitigation, we believe this further justifies our opposition for this proposed development.

Water Quality, Surface Water, Wetlands, & Stormwater

Another area of great concern is the project's short and long-term impacts on water resources. This is a massive proposal. Construction would last six years. Construction related energy uses is estimated at 500 gallons of gasoline, 50 gallons of oil, and 20,000 gallons of diesel fuel per year. Operational related energy use is estimated at 100 gallons of gasoline, 75 gallons of oil, and 865 gallons of diesel. The facility is expected to draw 4% of the total electricity supply available to the Cowlitz PUD service area.

When the site is completed, eight trains with 125 cars, 122 tons of coal per car, would arrive each day. Coal would be placed on conveyor belts to move it around the site and onto ships. 4900 of 16100 lineal feet of the conveyor belts are proposed to be enclosed. 70 ships would come and go from the docking facilities each month (840 annually). They would on average hold 65,000 tons of coal. They would have to be loaded and refueled (which would occur offsite).

Compaction, contaminants, stormwater, surface water, on-site wetland loss, and water quality are all issues that we feel have not been adequately evaluated.

The DEIS states that the construction phase will not have indirect effects on surface water or floodplains because effects are contained to the project area. Superficially, this is nonsense. Even if the leveed area is excluded, construction of the docks and unleveed area construction has a moderate to high possibility of effecting surface waters or floodplains outside the project area. This would be as simple as a minor spill. The project also proposes to redirect stormwater discharge from CDID #1 to onsite treatment facilities and direct Columbia River discharge. And surprisingly, the DEIS also states that by making this change, the overall discharges from the terminal are expected to decrease from 276 million gallons to 138.5 million gallons per year.

A major omission to the DEIS is that no wetland mitigation plan is identified. None. No locations are proposed, no ratios mentioned, and buffers are not even a topic of discussion. Wetland delineation reports are missing from the technical reports. Important wetland features are not discussed, such as high performing wetlands. Washington State classifies Palustrine Forested (PFO) wetlands that are over 1 acre and mature, or performing multiple functions as 'Category 1' wetlands. Category 1 are the highest category and the Washington State Department of Ecology reports that we cannot risk any wetland losses of this type because their functions and values are too high to replace. Within the project site, 6.28 acres are categorized as PFO. Wetland Z is an additional 11.22 acres which was forested until cleared in 2009. Together, these wetlands represent nearly 20 acres of critical wetland habitat that is downplayed as unimportant because of the disturbance that has occurred around or within it.

In addition to downplaying critical wetland features, at least two significant wetland areas are left out of the assessment entirely. These include the wetlands associated with the ditches leading to the pump station to Ditch 14 and also the freshwater pond adjacent to the Columbia on the eastern part of the project area. The DEIS identifies these wetland areas as merely surface or stormwater features without identifying the wetland characteristics attendant to them. These features add up to an additional Palustrine Forested, Temporarily Flooded wetland area of 14.68 acres and 2.9 acres of Palustrine Unconsolidated Shore, Seasonally Flooded wetlands. Wetlands are, by actual definition, defined by their function rather than their origin.

Washington Department of Ecology has an excellent bullet list of things wetlands do for the environment. At the top of the list are flood control, ground water recharge, and water filtration and purification. If this project proceeds as planned, 41.68 acres of wetland will be destroyed within project area. Additional stormwater will be generated by applying water to coal stockpiles and by increased runoff from compacted or impervious soils.

The DEIS states that terminal construction will not displace water into surrounding areas. Stormwater would be treated at an on-site stormwater treatment facility. Wetlands perform water quality functions such as improving water quality, reducing flooding and erosion, and providing habitat for plants and animals. The project design increases stormwater on-site and reduces natural capacity for stormwater filtration and storage.

Because of the size of the project and USACE's lead role in the NEPA process, the Cowlitz Indian Tribe were told that wetland impacts would be addressed through the NEPA DEIS. The Corps is also the lead agency in wetland fill, which requires a Section 404 permit. Cowlitz County, and the Washington Department of Ecology, manage wetland buffer impacts and suggest mitigation ratios based on the Wetland Rating System. The wetland fill application will be filled using the Joint Aquatic Resources Permit (JARPA). In standard practice, information which populates the JARPA is included in scoping or preliminary design documents. The draft EIS documents, which have substantial design details related to the project itself, have but sketchy, incomplete environmental data details. **One of two scenarios is suggested by the paucity of data.**

- First, the Millennium Bulk Terminal investors are wary and uncertain of their proposal or their intent to construct.
- Or, second and more unpleasant, the Millennium Bulk Terminal investors are **unwilling to fund studies which would allow the full impacts to be openly, publically discussed prior to substantive permitting actions.**

The DEIS notes that the project area groundwater is primarily a rising system, with groundwater moving up from deeper aquifers underlying the Columbia River. This shallow aquifer is noted as having depths of less than 5 feet, with complicated competing influences from the Columbia River and the nearby ditching and diking system. Water levels behind the CDID #1 levee system are maintained below those in

the Columbia River. Without the active management of CDID #1 systems, the project area would likely have considerably greater wetland area.

The project area is underlain by an impervious layer of clay and silt between 100 and 200 feet deep. The upper soil layers consist of silt and sand, which may be pre-levee flood deposits or historic to recent fill. Within water layers of less than 5 feet in many (filled areas) and the thick impervious layer, it can be extrapolated that floodplain to wetland soils underlay the project area, which results in the high water table, is similar in elevation to the Columbia River's average water surface elevation. Figure 5.4.4 appears to show a shallow groundwater gradient moving away from the Columbia River, which is consistent with these observations.

The project area is described as composed of silts and sands in the upper layers. However when it comes to coal dust, the soils are now different and largely impervious. But is that the case? Good science suggests that sandy soils, when compacted will still allow infiltration, just at a lower rate. In fact, the word 'reduced' is used elsewhere to describe the infiltration rates. Yet, it makes sense that the DEIS uses this contradictory description because, when assuming impervious soils, coal dust does not permeate and cause contamination. Which would be a problem. So, the DEIS offers a reason to prevent the soil from being contaminated. Also: the DEIS states that soil would filter out coal dust. And: stormwater would be treated (Stormwater being the water which did not infiltrate, so not really applicable at all to discussion of groundwater infiltration, which is where it occurs.)

Proposed wick drains and compaction will change the shallow water aquifer. Less water will be able to be stored as groundwater on the site. On page 5.4-19, the DEIS states that the terminal could 'permanently reduce infiltration due to soil compaction.' How this will impact the project area and adjacent properties should be studied in moderate detail. **The DEIS does not discuss increased surface water.** Items for study should include how groundwater patterns will change, if contaminated groundwater will affect adjacent parcels, and what stormwater and surface water change will result. The DEIS also reports, on page 5.4-17 that stormwater pH could infiltrate the groundwater and affect the shallow aquifer's water quality.

The project area has had groundwater samples including cyanide, fluoride, polycyclic aromatic hydrocarbons, heavy metals, and petroleum hydrocarbons on site. The DEIS explicitly notes that, with the exception of 'two small areas' cleanup actions are not proposed for the project area. Because 'fluoride and cyanide' have limited mobility, groundwater degradation is not to be expected by disturbance of previously contaminated areas. The DEIS does not address how soil compaction will affect contaminated soil and ground water mobility.

The DEIS specifically states that the project is located in Zone 2 of the Mint Farm Industrial Area's wellhead protection area. The Mint Farm wellhead provides the entire City of Longview with drinking water. Figure 5.4-7 actually demonstrates about a quarter of the project is within Zone 1, with the stockpiles and loading facilities located in Zone 2. The rail lines that access the site are within 0.5 mile of

the actual wellheads and nearly the entire project site is within the wellhead protection area. The DEIS describes the applicant's water rights to instantaneous extraction at totally 31,367 acre feet per year (AFY). They currently withdraw 1,994 AFY and expect that to increase during construction to 2,039 AFY. During operations, they expect 3,019 AFY usage. However, with existing water rights, they may withdraw significantly more water from the deeper aquifer. This could change the recharge gradients for the City of Longview water source. This information must be completed to ensure the public water source is protected and the risks associated with the Millennium site's contaminated soils, water pumping and groundwater recharge fully understood.

The DEIS notes that trace toxins are associated with Powder River coal deposits, which are the expected source for the export terminal. Polycyclic aromatic hydrocarbons (PAHC) are known carcinogens that have a strong affinity for organic carbon and can accumulate in substantial sinks in rivers and ocean environments. They are known to bio accumulate in invertebrates. PAHC do not tend to biomagnify. Remnant toxins may be replicated or increased by new toxins from Coal.

A major feature in several sections is placement of dredged materials. Specifically in 5.5.2.1, indirect water quality impacts are cited for 300 feet downstream of dredge spoil disposal sites. These sites are not identified at any time, in any part of the document. Also, CDID #1 ditches, even immediately downstream of the project area are not included as potential indirect effect. While the project proposes to pump all stormwater out directly to the Columbia, it is feasible that some surface water will enter CDID #1 ditch systems from the project site. Additionally, downstream Columbia River effects should not be based on a distance, but rather an average velocity and a time frame. Say, the length of time a particle might travel in an hour, which would be its approximate amount of time to settle. In the case of this project, we suggest using coal dust as the settling particle of note.

As in other sections, Figure 5.5.3 demonstrates drainage present today at the project site. It does not appear to represent the drainage features proposed by the export facility. Future conditions must be demonstrated.

Columbia River flow maximum estimated at 864,000 cfs with an average annual flows of 120,000 to 260,000 cfs. In the area, it is listed as impaired for arsenic, DDE4,4 and PCB. Also, Arsenic, fecal coliform, and dioxin were detected. Sediment testing has demonstrated deepwater areas with silty sands, with low fine content, to meet flow lane or beneficial use dredge disposal criteria. Outfall 002A demonstrates exceedances in the sediments near its exit from the project area.

The DEIS states, on pages 5.5-13 and 5.5-14, that the project requires an NPDES Construction Stormwater General Permit. The permit will require preparation of the Temporary Erosion and Sediment Control Plan (TESC) and a Construction Stormwater Pollution Prevention Plan (SWPPP) detailing best management practices (BMPs). In the following subsections, Surface Water and Contaminants Associated with Equipment and Materials, the DEIS describes the erosion risk as low because the site is

mostly level, and because appropriate erosion and sediment control measure are required by regulatory bodies. The DEIS does not address:

1. The project's proposed compaction and how that will change surface water, i.e. increase surface water because of reduced infiltration;
2. What will happen to the increased stormwater;
3. Address the vast quantities of fill that will be brought onto the site, which will in effect create new topography during construction;
4. Account for the fact that stormwater plans are required because stormwater is difficult to manage and even BMPs do not work if applied mindlessly. In fact, TESC implement must be coordinated by a TESC-certified lead person, and classes focus on how to implement the BMPs to actually be effective. Merely throwing out coir rolls or placing straw will not be sufficient.
5. Regulation ≠ compliance

Furthermore, in the later chapter on Vegetation, the DEIS states that 'construction and staging activities along the edges of the project area could crush and bury adjacent vegetation and compact soil in the direct impact study area...Ground disturbance related to these activities could also increase the opportunity for stormwater runoff to carry sediments, spilled vehicle fluids, or other construction materials into areas outside of the project area, potentially affecting the health and vigor of adjacent vegetation.' Wait a minute! The TESC and SWPPP are supposed to prevent this!

Operations – Direct Impacts – Contaminants continues the DEIS's strategy of using two standards, applying them where best suited, then moving on as if no impact is feasible. In this case, it occurs in a single paragraph at the bottom of page 5.5-17. First: contaminants such as oil, coal dust, and other chemicals could accumulate on the ground and contribute to stormwater. Oil, coal dust, and other chemicals should not be on the ground, per the DEIS operating statements. Equipment should be well-maintained, coal dust should be largely stable in the coal stockpiles, and chemicals contained.

Second: Coal dust can be treated by being allowed to settle in stormwater ponds. Then it can be removed from the stormwater ponds and put back into coal stockpiles. But if stormwater ponds also contain silts, oils, and other chemicals, it seems very unlikely that placing these materials back in stockpiles will be appropriate. Also – it implies coal sinks. Which brings us to: what happens to the coal dust that settles over the Columbia River? It sank. And became part of the sediment pollution problem for the Lower Columbia River.

Water quality is critically important to our region's long-term health. We ask the USACE team to carefully and thoughtfully review our comments on this topic, for which we have many concerns.

Safety

No discussion is made in the DEIS of the localized railways' condition, except in passing that these conditions will be improved. However, the Cowlitz River Bridge, which would be required to be used by 16 total trains per day, is a bridge of concern. It is not proposed for improvement.

The DEIS does not describe at any point that the "350 loaded trains of 100 cars each, and 350 empty trains of 100 cars each" would cross the Cowlitz Rail Bridge in Kelso, WA. By the way, 350 loaded trains represents 43 days of work. An annual estimate of incoming trains would actually be 2,920 through the Longview industrial area and crossing several local and state roadways.

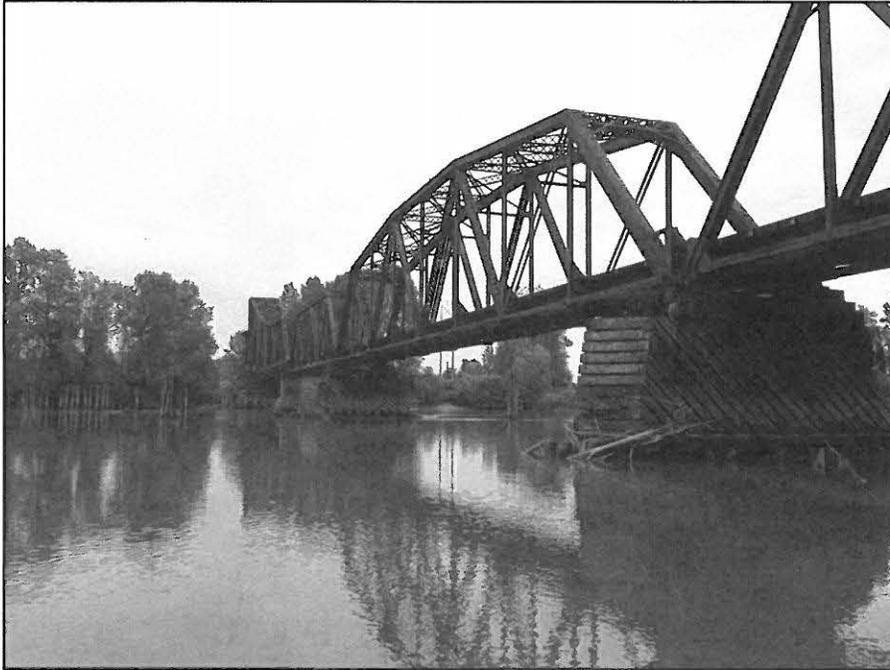
We believe that there is enough concern currently to close industrial rail traffic across the BNSF - Cowlitz River Railroad Bridge. We don't believe that it is designed or intended to handle the Proposed Action's volume of rail traffic in either the short or long-term. We believe that this is a disaster waiting to happen, given that much current public and policy concerns regarding rail safety have been expressed through a variety of media.

The rail line crosses the Cowlitz River near the confluence with the Columbia River and runs near the rivers for the five miles to the project area. Flood risk from sedimentation is increasing, and future precipitation expected to increase. Flooding of the Reynolds Lead is possible. Cowlitz River flooding at this location would likely disrupt rail and terminal operations, and ballast supporting the rail line could be dislodged. Therefore, Proposed Action-related trains could be affected by a Cowlitz River flood.

In no chapter, section, or appendices in this Draft EIS are we able find any information as to the current existing condition of the BNSF – Cowlitz River Bridge. It does speak of potential threats in relation to the future potential issues with the bridge and it does mention a "possibility" of improvements to the bridge, but it doesn't mention why.

The Cowlitz Indian Tribe believes that the Applicant and the Action Agencies are not being forthright in regards to the BNSF – Cowlitz River Bridge condition. To start with, the bridge has a 10 mph speed limit because the condition is poor. Upon our own investigation, we estimate its condition should be reviewed by an engineer regarding current state and future potential risks. This information should be available to the public, who would have to fund and deal with clean-up efforts should a coal train – bridge failure occur.

The following picture was taken by our Natural Resources Department on 06/08/2016:



The bridge is old, rusty, with wood railroad ties surrounding the old concrete footings.

We found very little information about this bridge, however we did determine it was originally constructed in 1908 for use over the San Gabriel River in Long Beach, CA. It was moved to Longview in 1934 following the loss of the original bridge in the 1933 floods. It is a Scherzer rolling lift bridge. **The bridge was not engineered or designed for the Cowlitz River or using modern engineering tools or materials.** The length of the largest span is 200 feet and the total bridge length is 700 feet. (<https://bridgehunter.com/wa/cowlitz/bh38511/#Comments>)

So, massive traffic loads are proposed over an old 1908 bridge that wasn't even designed for the Cowlitz River for current and future industrial rail traffic?

It is indicated that there might be upgrades to this bridge, but no planning, implementations, or funds have gone into any actions for any bridge work is indicated. The Applicant does not discuss the bridge's age, fitness for the 200% increase in rail traffic, or the effect of 16 heavily loaded coal trains using the bridge daily. As the bridge is located on a spur, the Cowlitz Indian Tribe requests the Applicant and Action Agencies provide additional information and analysis to detail the current state of the bridge and what impact the bridge would endure in regards to the current use and the proposed action. A detailed engineer report of existing conditions should have been presented in this Draft EIS.

We request that more analysis and information regarding the BNSF Cowlitz River Bridge and that the Action agencies update the Draft EIS and re-issue another Draft EIS for another comment period before a Final EIS is issued. Specifically:

- We request that the current use, proposed Action and this SEPA process should cease until all issues, concerns, processes, and potential solutions to the BNSF - Cowlitz River Bridge are resolved.
- With current conditions of the BNSF - Cowlitz River Bridge and if railroad users obey the rules attached to the bridge; if there is an accident due bridge failure; who would be the responsible party?
- What would be the potential impact if a derailment would occur at the Cowlitz River Bridge?

The Cowlitz River is considered critical habitat by federal officials for the health of Columbia River stocks of federally Endangered Species listed eulachon and salmonids. In regards to eulachon, the Cowlitz River is considered by many as a key environment for their continued existence within the Columbia River system. Any accident/derailment caused by the failure of the BNSF – Cowlitz River Bridge could have irreparable harm to the status of these threatened species. We believe that it is imperative and necessary that the BNSF – Cowlitz River Bridge is adequately addressed and mitigated today (or yesterday) before any more industrial related rail traffic utilizes this Bridge. The proposed Coal Terminal shouldn't even be considered until the safety and environmental threat associated with the condition of the Bridge's suitability for long-term industrial traffic is adequately addressed.

Washington State projects an average of two accidents per million train miles. Utilizing an analysis that the DEIS was incapable of in the FISH section, and the rail only from the BNSF mainline, there is a project accident (not incident) rate of one accident every two years. If track improvements are completed. Otherwise, the accident rate is approximately 3 to 9 accidents per year, based on volume and 7.1 miles of rail. This incident rate does not include, apparently, the poor condition of the Cowlitz River Bridge, which we just detailed at length.

Economics

It is obvious through media and other sources that the demand for coal has considerably declined and also statements from Asian countries have made it obvious of their intent is to reduce coal burning consumption. We request information as to the apparent or assumed analysis that led to the assertion that other West Coast terminals are unavailable to support this need. Was there a specific analysis completed?

For the long-term proposed development employment outlook, we don't believe that there is any significant reduction in unemployment for Cowlitz County. With a current workforce of around 45,724 (revised in March 2016 noted from fortress.wa.gov) and the outlook of this proposal of adding approximately 135 new long-term jobs; that would only equate to .29% increase (less than 1/3 of a percent) in contributing to the current workforce for Cowlitz County in the long-term "if the Applicant hires locally."

We don't believe that reducing local unemployment is significant enough to justify the proposed coal terminal in relationship to the potential environmental impacts we would have to endure. It also doesn't

describe the potential of displacement of other potential developments that may contribute significantly higher employment outlook for the region. If the action agencies are serious about creating a better jobs outlook, there are other developments that would contribute more employment opportunities for the area; especially developments that may include some sort of manufacturing component of which the proposed Coal terminal falls short.

We believe that there is little justification regarding the need of this development and we believe it falls short in identifying an economic need, locally, regionally, or globally.

Cowlitz County has been progressively improving its economic outlook and we believe the proposed Coal terminal would do little to nothing in regards to this concern based on the few (135) long-term jobs they would bring as it relates to the entire workforce/employment opportunity of Cowlitz County. Actually, the Cowlitz Tribe will likely provide a considerably improved employment outlook for Cowlitz County for the future compared to Millennium's proposal. We also plan to do so in an environmentally friendly manner.

With the uncertainty of the Coal markets, it is likely that the jobs related to this proposal would be under constant threat of continuous or frequent employment layoff conditions. We request that the action agencies consider market volatility related to the coal product exported at the proposed Coal terminal; and to clearly delineate an appropriate interpretation of the data based on best available science and/or information.

Permitting

There are many permitting comments, some of which have been made earlier in this comment letter. We lay out some additional comments related solely to permitting and review in this section.

In conjunction with the scoping document, the DEIS laid out several options at the proposed site as well as the 'alternate site.' The Alternative Site is owned by the Port of Longview. The Millennium Bulk Terminal staff included this as an alternative although they have not even received permission to enter the site to actually evaluate the site conditions. It should not have been considered an alternative, without it actually being contractually feasible to acquire a lease or land use agreement at a basic level.

A Shorelines Conditional Use Permit is required. Construction of this project will impact or interfere with public use of waters. The Cowlitz Indian Tribe intends to attend the Shorelines Hearing and focus our efforts on preventing this restriction of our use of a public waterway.

The scoping framework identified by the applicant identified specific economic criteria. Other coal terminals have been proposed for smaller export amounts. The initial alternatives proposed smaller footprints with smaller coal export outputs. If one of these options had been utilized, the project could have had a smaller terrestrial and aquatic footprint, reducing environmental and civic resource impacts.

In Closing

The Millennium Bulk Terminals Draft SEPA Environmental Impact Statement (EIS) describes a major project as a minor impact. Throughout the document, the Applicant underrepresents project actions, minimizes project outcomes, conflates impact relationships, and states the project has minimal to no impact. Throughout the Draft EIS, Millennium Bulk Terminals describes its 'no action alternative' as 'an increase in bulk terminal actions.' This is misleading and doesn't recognize the efforts and actions toward environmental recovery.

The Draft EIS also entirely fails to recognize pending re-negotiation of the Columbia River Treaty between the US and Canada. The Proposed Action is likely to have considerable impact toward negotiation efforts. We request an analysis of the potential impacts that the Proposed Coal terminal would have on this Columbia River water management Treaty as it pertains to ability of increasing river flows for a better ecosystem function of the Columbia River. Also, if a future amended Treaty that increases water flows of the Columbia River happens, what impact would that potentially have on the Proposed Action?

The project is expected to take six years to construct. Dredging operations will be completed in one season, while pile driving will take two in-water work windows. Dredging will be ongoing, up to once per year and impacting 48 acres per dredging period, resulting in up to 500,000 cubic yards of per dredging operation. In water construction will include 610 piles below ordinary high water mark and over five acres of docks and trestles. Over 155,000 tons per day could be shipped out of the terminal.

Despite these huge numbers, the vast construction area, and the physical impacts associated with the rail, shipping, and construction activities, the Draft EIS claims that such things as fuel spills or coal spills would be "relatively small" and "minor." We disagree with these assumed statement made in the Draft EIS.

The DEIS errors and omissions are significant because the DEIS presents data as if it were scientific and professionally suitable information. This is not the case. So much detail is missing as to make evaluation of the project impacts impossible. The DEIS provides no explanation for why studies are not complete or available during the critical Environmental Impact Statement period. An estimated \$10 million was spent to complete the study. There is powerfully little to show for that figure.

The Applicant and the Action Agencies have a lawful responsibility to evaluate all possible scenarios and provide the public with an accurate description of possible impacts. **It is incomprehensible that a large team of scientists with access to dozens of scientific reports, and a fiscal and temporal budget sufficient to complete independent studies, would fail to review or include *existing* scientific findings in the project review.**

One of the final sections, "Short Term Uses versus Long Term Productivity of the Environment" is the most honest and direct section in the DEIS. It is three pages long.

- “Construction of the proposed export terminal would result in impacts ranging from short-term disturbance to permanent impacts on water resources.” (9-1)
- “Construction...would permanently fill 11 acres of surface water...The loss of these waters would permanently decrease the long-term productivity of this resource. Construction could affect short-term productivity because surface water runoff would transport fine-grained sediments and pollutants, which could alter water body chemistry and affect water quality. Dredging and dock installation could cause short-term productivity losses for aquatic species...Overwater structures could affect the long-term productivity of surface water by such means as temperature changes from shading.”(9.2.1)
- “Terminal operation would involve a relatively minor (in light of available resources and existing water rights) but continuous use of groundwater, resulting in a decrease in long-term groundwater productivity.” 9.2.2
- “Compensatory mitigation would likely be required to offset these adverse impacts (24.10 wetland acres), but depending on the specific compensatory mitigation involved, some long-term wetland productivity loss could still occur.” 9.2.3
- Vegetation losses on 50.36 acres would ‘be permanent and the long-term productivity of vegetation in these areas would be lost.” 9.3.1
- “Wildlife in these are could be displaced to habitats outside the project area.” 9.3.2
- “Constructing the proposed export terminal would result in short-term, localized impacts on fish due to sedimentation and turbidity, underwater noise, and water quality degradation. Permanent overwater structures could affect the long-term productivity of fish due to such factors as behavioral changes and increased predation under the structures. Downstream of the project area, mortality of smaller fish, such as juvenile salmonids, from stranding caused by vessel wakes, could affect long-term productivity of fish.”
- 10.6, Energy Resources, does not consider the irreversible loss of natural resources, coal, to overseas users. One must presume this has already been weighed during the mining lease process.

Just to reiterate the magnitude of the project:

- 48 acres would be dredged to allow the docks to be constructed.
- Eight trains with 125 cars, 122 tons of coal per car, would arrive each day.
- Coal would be placed on conveyor belts to move it around the site and onto ships. 4900 of 16100 lineal feet of the conveyor belts are proposed to be enclosed.
- 70 ships would come and go from the docking facilities each month (840 annually). They would on average hold 65,000 tons of coal. They would have to be loaded and refueled (which would occur offsite).
- Construction is projected to last six years.

We fundamentally oppose this project development adjacent to and within a fragile ecosystem. This development is contradictory to the State of Washington's goals and commitments toward global climate change reduction and local goals of recovery and sustainability within both the economic and environmental arena. We believe it is an ethical responsibility for the Action Agencies to deny any approval for the proposed Millennium Bulk Terminal – Longview; as justified within this comment letter of the Draft EIS associated with this proposal.

Please contact our Natural Resources Department Director, Taylor Aalvik or our Natural Resources Program Assistant, Tiffini Alexander for follow up communications and scheduling. Taylor can be reached at: 360-577-8140, or taylor.a@cowlitz.org, and Tiffini can be reached at: 360-577-8140, or talexander@cowlitz.org,

Sincerely Yours,

A handwritten signature in black ink, appearing to read "William Lyall". The signature is fluid and cursive, with a large, sweeping flourish at the end.

William Lyall, P.E

Chairman of the Cowlitz Indian Tribe

Cc: WA Governor Jay Inslee

Mia Bellen, WA Dept. of Ecology

Cowlitz County Commissioners

Craig A. Bill, Executive Director, Governor's Office of Indian Affairs

Table 1a. Behavioral Affects on Anadromous Fishes from Suspended Sediment Associated with Dredging Activities.

Family	Scientific Name	Common Name	Life Stage	Turbidity (NTU)	Suspended Sediment Concentration (mg/L)	Duration in Hrs	Lethal Effects	Response to Suspended Sediment	Reference ID
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile	0-108				Reduced piscivory with increasing turbidity	Gregory and Levings. 1998
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile	0-250				Reduced reaction distance with increasing turbidity	Gregory and Northcote. 1993
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile	0-810				Reduced feeding activity at lowest and highest turbidity levels, optimum feeding between 35-150 NTU	Gregory and Northcote. 1993
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile	0-250				reduced reaction distance with increasing turbidity	Gregory. 1988
Salmonidae	<i>Oncorhynchus mykiss</i>	steelhead	Juvenile	0-45				Decreased feeding activity with increasing turbidity, decrease in prey capture with increased turbidity	Madej et.al. 2007
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile	70		N/A		Avoidance response	Bisson and Bilby. 1982
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile	0-45				Decreased feeding activity with increasing turbidity, decrease in prey capture with increased turbidity	Madej et.al. 2007
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile	20-30				Reduced reactive distance by 52%	Barrett. 1992
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile	23				Turbid waters reduced magnitude and postexposure recovery time after predator exposure	Gregory. 1993
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile	0.5 - 87				Turbid waters reduce rate of encounter rather than rate of attack or capture	Gregory and Levings. 1996
Acipenseridae	<i>Acipenser transmontanus</i>	white sturgeon	Adult						
Clupeidae	<i>Alosa sapidissima</i>	American shad	Larvae		100	96		Mortality rate 18%, control 5%	Auld and Schubel. 1978, Newcombe and Jensen. 1996
Clupeidae	<i>Alosa sapidissima</i>	American shad	Larvae		500	96		Mortality rate 36%, control 4%	Auld and Schubel. 1978, Newcombe and Jensen. 1996
Clupeidae	<i>Alosa sapidissima</i>	American shad	Larvae		1,000	96		Mortality rate 34%, control 5%	Auld and Schubel. 1978, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus spp.</i>	salmon	Smolt/Juvenile		N/A	N/A		Fish orienting to the channel margin move inshore when encountering the dredge	Carlson, et.al. 2001
Salmonidae	<i>Oncorhynchus spp.</i>	salmon	Smolt/Juvenile		N/A	N/A		Most fish passing inshore moved offshore when encountering plume	Carlson, et.al. 2001
Salmonidae	<i>Oncorhynchus spp.</i>	salmon	Smolt/Juvenile		N/A	N/A		Fish were observed to assume their prior distribution trends within a short time after encountering both the dredging activity and the plume	Carlson, et.al. 2001
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Adult		650	168		No histological signs of damage to olfactory epithelium	Brannon et.al., 1981, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Adult		350	0.17		Disrupt home water preference	Whitman et.al. 1982, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Adult		650	168		Homing behavior normal, fewer test fish returned	Whitman et.al. 1982, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Adult		39,300	24	None: Volcanic ash		Newcombe and Flagg. 1983, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Adult		82,400	6	60% mortality rate		Newcombe and Flagg. 1983, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Adult		207,000	1	100% mortality rate		Newcombe and Flagg. 1983, Newcombe and Jensen. 1996

2009
 Literature Review: (for studies conducted prior to 2008) W912P7-07-P-0079

Table 1a. Behavioral Affects on Anadromous Fishes from Suspended Sediment Associated with Dredging Activities (Continued).

Family	Scientific Name	Common Name	Life Stage	Turbidity (NTU)	Suspended Sediment Concentration (mg/L)	Duration in Hrs	Lethal Effects	Response to Suspended Sediment	Reference ID
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		1400	36	50% mortality rate		Newcombe and Flagg. 1983, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		9400	36	50% mortality rate		Newcombe and Flagg. 1983, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		50-100			increased feeding rates	Gregory. 1988
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		30,000	48		Decreased ability to seek protective cover and reduced swimming speed	Korstrom and Birtwell. 2006
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		39,400	36	90% mortality rate with volcanic ash		Newcombe and Flagg. 1983, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		0-200	96		Particles in gill lamellae and spleen	Martens and Servizi. 1993
Salmonidae	<i>Oncorhynchus mykiss</i>	steelhead	Adult		500	3		Volcanic ash: signs of sublethal stress	Redding et. al. 1987, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus mykiss</i>	steelhead	Adult		500	9		Blood cell count and chemistry change	Redding et. al. 1987, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus mykiss</i>	steelhead	Juvenile		102	336		Growth rate reduced	Sigler et.al. 1984; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus mykiss</i>	steelhead	Juvenile		2,500	48		reduced tolerance to infection	Servizi. 1990
Salmonidae	<i>Oncorhynchus mykiss</i>	steelhead	Juvenile		2,000-3,000	168-192		plasma sodium levels same as control group	Redding et. al. 1987, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus mykiss</i>	steelhead	Juvenile		2,000-3,000	168-192		plasma cortisol levels elevated, reduced feeding	Redding et. al. 1987
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		2,000-3,000	168-192		plasma cortisol levels elevated, reduced feeding	Redding et. al. 1987
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		2,000-3,000	168-192		plasma sodium levels same as control group	Servizi. 1990
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		53.5	0.02		Alarm reaction	Berg. 1982, Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		20	0.05		cough frequency not increased	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		53.5	12		Change in territorial behavior	Berg and Northcote. 1985; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		6,000	1		Avoidance behavior	Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		300	0.17		Avoidance behavior in minutes	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		25	1		feeding rate decreased	Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		100	1		feeding rate decreased to 55 % of max	Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		250	1		feeding rate decreased to 10 % of max	Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		300	1		Feeding ceased	Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		2,460	0.05		coughing behavior within minutes	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		53.5	12		Increased physiological stress	Berg and Northcote. 1985; Newcombe and Jensen. 1996

Table 1a. Behavioral Affects on Anadromous Fishes from Suspended Sediment Associated with Dredging Activities (Continued).

Family	Scientific Name	Common Name	Life Stage	Turbidity (NTU)	Suspended Sediment Concentration (mg/L)	Duration in Hrs	Lethal Effects	Response to Suspended Sediment	Reference ID
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		2,460	1		Cough frequency greatly increased	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		240	24		Cough frequency increased more than 5-fold	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		530	96		Blood glucose level increase	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		1,547	96		Gill damage	Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		2,460	24		Fatigue of cough reflex	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		3,000	48		High level sublethal stress, avoidance	Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		102	336		reduced growth rate (clays: fire, bentonite)	Sigler et.al. 1984; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		8,000	96			Servizi and Martens. 1992; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (U)		22,700	96	50% mortality		Servizi and Martens. 1991; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Fry: swim up		8,100	96	50% mortality		Servizi and Martens. 1991; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile (presmolt)		18,672	96	50% mortality		Servizi and Martens. 1991; Newcombe and Jensen. 1996
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		40,000	96		Gill damage	Lake and Hinch. 1999
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		0-41,000	96		Particles in gill lamellae	Martens and Servizi. 1993
Salmonidae	<i>Oncorhynchus kisutch</i>	Coho	Juvenile		0-200	96		particles in gill lamellae and spleen	Martens and Servizi. 1993
Moronidae	<i>Morone saxatilis</i>	striped bass	Adult		1,500	336		Haematocrit increased (FE)	Newcombe and Jensen. 1996
Moronidae	<i>Morone saxatilis</i>	striped bass	Adult		1,500	336		Plasma osmolality increased (FE)	Newcombe and Jensen. 1996
Moronidae	<i>Morone saxatilis</i>	striped bass	Adult/Juvenile						
Moronidae	<i>Morone saxatilis</i>	striped bass	Juvenile						
Moronidae	<i>Morone saxatilis</i>	striped bass	Larvae		200	0.42		40% reduced feeding rate	Breitberg. 1988
Moronidae	<i>Morone saxatilis</i>	striped bass	Larvae		1,000	68		35% mortality rate, control 16%	Auld and Schubel. 1978, Newcombe and Jensen. 1996
Moronidae	<i>Morone saxatilis</i>	striped bass	Larvae		500	72		42% mortality rate, control 17%	Auld and Schubel. 1978, Newcombe and Jensen. 1996
Moronidae	<i>Morone saxatilis</i>	striped bass	Larvae		485	24		50% mortality rate	Morgan II, et.al.. 1983; Newcombe and Jensen. 1996
Moronidae	<i>Morone saxatilis</i>	striped bass	Egg		800	24	Development rate slowed significantly		Morgan II, et.al.. 1983; Newcombe and Jensen. 1996
Moronidae	<i>Morone saxatilis</i>	striped bass	Egg		100	24		hatching delayed	Newcombe and Jensen. 1996
Moronidae	<i>Morone saxatilis</i>	striped bass	Egg		1,000	168		Reduced hatching success	Auld and Schubel. 1978, Newcombe and Jensen. 1996

Table 1a. Behavioral Affects on Anadromous Fishes from Suspended Sediment Associated with Dredging Activities (Continued).

Family	Scientific Name	Common Name	Life Stage	Turbidity	Suspended Sediment	Duration	Lethal Effects	Response to Suspended Sediment	Reference ID
				(NTU)	Concentration (mg/L)	in Hrs			
Gasterosteidae	<i>Gasterosteus aculeatus</i>	threespine stickleback	Adult		28,000	96		No mortality; test lethal threshold	Newcombe and Jensen, 1996
Sediment Load									
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile					Immunosuppression associated with contaminated estuaries	Arkoosh et. al., 1998b
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		unknown			Increased mortality from <i>Vibrio anguillarum</i> at contaminated estuary containing HCB, PCBs, and CHWSE	Arkoosh et. al., 2001
Salmonidae	<i>Oncorhynchus tshawytscha</i>	Chinook	Juvenile		unknown			Increased mortality from <i>Vibrio anguillarum</i> at contaminated estuary, immunosuppression retained after removal from contaminants.	Arkoosh et. al., 1998a