BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 96-1

Olympic Pipe Line Company

Cross Cascade Pipeline Project

PRE-FILED TESTIMONY OF KEVIN A. LINDSEY

ISSUE:

COSTS AND ENVIRONMENTAL RISKS OF
PROPOSED CROSS CASCADE PIPELINE
RELATED TO THE COLUMBIA RIVER CROSSING

SPONSOR:

City of North Bend, Washington
City of Snoqualmie, Washington
Cascade Columbia Alliance

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Could you please identify yourself?

My name is Kevin A. Lindsey. I am a senior geologist at Daniel B. Stephens & Associates, Inc.

Would you please summarize your experience and education relevant to your work?

My expertise is in geohydrologic characterization, geologic mapping, geologic databases, drilling projects, and sedimentary basin analysis. I have a Ph.D., a Masters, and a Bachelor of Science in geology. I have been senior geologist at Daniel B. Stephens & Associates since 1995 and previously worked as a senior scientist at CH2M Hill Hanford, Inc. for one year while I taught geology and acted as a consultant part-time. Prior to working for CH2M Hill, I was a senior scientist at Westinghouse Hanford Company for four years.

Are you familiar with the Cross Cascade Pipeline proposal submitted to the Energy Facility Site Evaluation Council by Olympic Pipe Line Company?

Yes. I have reviewed Olympic Pipe Line Company's Cross Cascade Pipeline proposal Application submitted to EFSEC, the Draft Environmental Impact Statement prepared by Jones & Stokes, and numerous other documents relevant to my particular area of expertise regarding the project.

What specific issues did you focus on with regard to this proposal?

I evaluated geologic and geotechnical conditions along the proposed Cross Cascade Pipeline route east of the Cascade Crest to Pasco, Washington. I also focused my attention on the geologic and geotechnical conditions at the Columbia River crossing, looking closely at the potential environmental risks and costs related to that crossing.

My report on that issue is presented in Chapter Six of Exhibit HGL-1, the Environmental Risks of the Cross Cascade Pipeline Proposal Report.

What is your overall opinion of the proposal with regard to the Columbia River crossing?

I have built an interpretation of site conditions on publicly available, published, information and data. This interpretation is significantly different than what is presented in, and used by the Application to provide a design basis for the Columbia River crossing. In other words, previously published, publicly available information presents a very different picture of the site conditions at

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the Columbia River crossing than what Olympic presents. Surprisingly, Olympic did not mention any of this information. As a result, Olympic presents an inaccurate description of site conditions. The implication of the discrepancy in conditions is significant because it increases the risk of construction and operational threats to the Columbia River and to users of the Columbia River.

It is our basic conclusion that available information relevant to the crossing refutes the description of site conditions presented in the Application, and consequently invalidates the proposed design.

What is Olympic's design and construction premise for the directional drill crossing of the Columbia River?

According to the Application, drilling will be used to place a boring beneath the Columbia River, through which the pipeline will be pulled until it is fully in place. The planned boring, and eventually the pipeline, will be placed entirely within material described in the Application as Quaternary glaciofluvial sand and gravel. It will be placed at depths greater than 25 ft below the bottom of the river channel and above bedrock.

Based on how the Application describes site conditions and drilling requirements we interpreted this basic premise to be very important for Olympic for two reasons. First, a depth of greater than 25 ft below the bottom of the river protects the river from both constructions and operational (fuel leak) impacts. Second, placement entirely within sand and gravel (instead of bedrock) equates to a readily achievable construction scenario from a cost and schedule point-of-view.

What is your opinion of Olympic's plans to drill across the river?

Based on the materials and information we described in our review the basic premise of the drilled crossing appears to be highly flawed.

Why is it flawed?

One major problem is that Olympic is incorrect about the location of bedrock surface beneath the Columbia River. Where Olympic states it was gravel, it is bedrock. The materials and reports we referenced in our review indicates the top of the bedrock surface beneath the Columbia River is somewhere between 6 feet and 20 feet below the base of the river channel (and bedrock, as you may know, goes down for thousands of feet). But the Application indicates an intention to place the pipeline at a minimum depth of 25 feet and states that it

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will be placed through gravel. The Application assumes that the top of the bedrock is approximately 80 to 100 feet below the base of the river channel. Consequently, if OPL opts to keep the pipeline at the planned depths it will have to be placed in a boring drilled through hard, unweathered, basalt bedrock. This will significantly increase the cost of a drilling option and the time to complete it. This increase will be such that the cost estimates and proposed schedule in the Application are invalid.

If, on the other hand, OPL places the boring and pipeline solely within gravel overlying bedrock, as it appears they plan to do, the location of the bedrock surface beneath the river bottom will force the pipeline to be placed as little as five feet below the bottom of the river. This is significantly less than the 25 foot minimum described in the Application.

Drilling in basalt bedrock will probably also lead to the increased use of drilling muds to lubricate and cool drill bites. As more mud is pumped into the ground, the volume of material available to leak into the river increases, especially if drilling encounters open cracks in the basalt that lead upwards to the top of basalt just a few feet below the bottom of the river channel. These cracks will act as pathways for leaking drilling muds pumped into the boring under pressure.

Are there any other examples of flaws?

Yes. Olympic understated the significance of the type of gravel that overlays the bedrock at the proposed crossing site (that is, the gravel that it assumes it is drilling through). Pleistocene cataclysmic flood deposited sand, gravel, and boulders (referred to as Quaternary fluvial gravel in the Application) forms the vast majority of the material overlying basalt bedrock at the proposed crossing site. One to five foot diameter boulders, generally consisting of hard basalt and granite rock types, are a common feature in these strata at such locations as that occupied by Wanapum Dam. Namely, locations where the great cataclysmic Pleistocene floods (also referred to as the Bretz floods) scoured canyons into basalt bedrock. The presence of these one to five foot boulders at and near Wanapum Dam is confirmed by the reports we referenced in our review, surface inspection of the area, and even the Dames and Moore geophysical survey and drilling records. In fact, everything we know about cataclysmic flood deposits, the geologic history of the area, and geologic conditions at Wanapum Dam argues strongly for the presence of these large boulders. Yet, the presence of boulders at the crossing is downplayed by the Application.

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Considering the likely presence of boulders at the site, there are several effects on the project that need to be considered. Drilling through large basalt boulders will be just as difficult as drilling though the basalt bedrock that the Application wishes to avoid. In addition, if these boulders, which are not cemented into place, begin to move during drilling, interruptions to drilling, potential loss of drilling mud, and damage to drill string could all occur. The irregular shape and orientation of boulders as they are encountered in the subsurface will make controlling the direction of the boring more difficult as the drill bite is deflected by boulders and/or is forced to change direction to bypass these rocks.

Everything that occurs during drilling to increase construction time due to slow drilling, redrilling, equipment repair, etc., will increase the chances for construction impacts to the Columbia River, such as drilling fluid loss, to occur. This becomes even more true because the design premise will force the pipeline to be placed much closer to the bottom of the river channel as I summarized above.

The presence of boulders also has operational impacts. The proposed construction plan indicates that once the boring is complete, the pipeline will be dragged through the open boring to get it in place beneath the Columbia River. If boulders become dislodged from the boring wall either before this "pullback" or during, they can potentially wedge against and or gouge the pipe as it is pulled through the borehole. This could lead to damage to the pipe. During subsequent operation such damaged spots become the most likely points for leaks as the pipeline degrades during operations and as a result of natural weathering.

The likelihood of boulder collapse and dislodgement in this material is pretty high given the fact that these strata have been found to be typically uncemented everywhere they have described.

Are there any earthquake faults in the vicinity of the Columbia River crossing?

Yes. Faults with evidence of Quaternary activity are present in the vicinity of the crossing and we listed these in Chapter Six of Exhibit HGL-1, the Environmental Risks Report. These faults are all sources of potential earthquakes (ground motion). Also, in the immediate area of the proposed crossing, the pipeline will be constructed on two very different substrates, basalt bedrock and uncemented sediment (alluvium or cataclysmic flood deposits).

In the event of an earthquake, the two substrates the pipeline is constructed on will move very differently. At those locations where the pipeline crosses from

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one substrate to the other, such as at Getty's Cove, it will be subject to one set of stresses on the basalt substrate and a different set of stresses on the sediment substrate. The effect of this may be to, in effect, pull the pipeline in two different directions during an earthquake, causing stresses on it where it crosses from one substrate to the other that cause it to break. Our reading of the Application suggests to us that Olympic does not account for this phenomena in any of its proposed designs.

Earthquakes can also generate landslides. The proposed pipeline crosses a very large landslide of unknown origin north of Wanapum Dam. Given the presence of potential Quaternary faulting in the area of the crossing and the presence of the landslide we are forced to take pause and question if; 1) the landslide provides additional evidence of earthquake activity that went unrecognized in the Application, 2) if an earthquake occurred, would the landslide move and break the pipeline, and 3) is this landslide related to other processes that can be reactivated by pipeline construction and operation? Such basic geotechnical issues are unaddressed by the Application as far as we can tell.

What is the nature of the groundwater at the Columbia River crossing?

As we described in our review, available, published information indicates the geologic material forming the unconfined aquifer at the crossing, namely cataclysmic flood gravels, is extremely permeable. Ground water moves through these types of aquifers very fast. Consequently, any fluids introduced into this aquifer will also move quickly through it. In addition, where flood gravels form unconfined aquifers next to the Columbia River there is a great deal of movement of water back and forth between the aquifer and the adjacent river. As a result, during construction, drilling muds will encounter little resistance to movement and could easily be discharged into the Columbia River. The likelihood of this will increase if the pipeline is placed at shallower depths than planned if the basic design premise to stay in gravel is followed. Also, once in operation, any leak above the water table will quickly migrate downwards to ground water, at which point it will migrate laterally with ground water into the Columbia River. If the leak occurs beneath the river channel, such as at a weak spot in the pipe caused by boulder gouging during construction, fuel with a lower specific gravity than water will quickly migrate upwards into the river. Given the shallow construction depths necessitated by likely site conditions, leaked fuels will undergo only limited dilution and degradation before entering the river through the channel bottom gravel.

Are there any issues concerning impacts to surface water at the Columbia River crossing?

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As I mentioned earlier, the position of the basalt bedrock surface beneath the Columbia River channel plays a role in how the finished pipeline will be effected by scouring of the channel bottom by the river. The design premise to place the pipeline above the basalt bedrock surface will force it to be at depths of less than 20 feet, and more likely less then 6 feet, below the bottom of the river channel. As described in Application, materials, depth of scour into the river channel bottom is predicted to be as much as 25 feet. Given this condition, the pipeline will be subject to river erosion, probable undermining, and eventual failure. Such as event will lead to a catastrophic rupture and leak of fuel into the Columbia River.

The effects of such an event have to be evaluated in light of the likely site conditions reported by the several previous investigations at the site. However, because the Application does not describe users and activities at and downstream of the crossing, this can't be done.

Are there any impacts to fish in the Columbia River caused by this proposal?

Yes. There is fall chinook salmon spawning habitat at the crossing. The Application fails completely to cite relevant materials that describe the presence of salmon redds directly overlying the crossing. Given site conditions as described in the materials we cite in our review, and the basic design premise for the crossing, we reach several conclusions with respect to this habitat.

First, drilling operations during construction will be occurring directly under the redds under conditions where drilling fluid losses are quite probable because no recognition is given to site physical conditions (such as large boulders, high permeability, no natural cement) where borehole collapse and/or drilling fluid loss is possible. These drilling fluids could migrate into salmon redds overlying the boring, destroying them. Drilling muds could also change ground water flow patterns into the Columbia River from the gravel underlying the river, rendering these gravels unsuitable for subsequent spawning.

Second, any fuel leak from an in place pipeline will migrate upwards through high permeability gravel underlying the river channel into the redds directly overlying and downstream of the pipeline crossing. Leaked fuel will pose both chronic and acute risks to spawning salmon, salmon eggs, and juvenile salmon.

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