Appendix D

A Review of the White Paper Entitled:

"Evaluating the Potential for Improvements to Habitat Condition to Improve Population Status for Eight Salmon and Steelhead ESUs in the Columbia Basin"

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The draft paper entitled "Evaluating the Potential for Improvements to Habitat Condition to Improve Population Status for Eight Salmon and Steelhead ESUs in the Columbia Basin" (Draft, Aug 18, 2004) presented the methodology and conclusions to the central question "Is there potential to improve anadromous salmonid population status through improvements to habitat conditions in tributary or estuarine environments?" The assessments made were intended to identify potential to make positive change in salmon and steelhead population status.

The assessment provides results for 8 ESUs affected by the Federal Columbia River Power System (FCRPS). The evaluation was based on GIS analysis of historical and current tributary habitat condition to predict areas *"likely to be impaired."* But it is also admitted that *"historical characteristics are almost universally unknown."* Consequently, the intrinsic potential of the landscape to support Chinook and steelhead was estimated from theoretical principles. If the historic condition were actually known with certainty in addition to current condition, there would be no doubt about the amount of change from historic condition.

There is significant uncertainty, however, regarding the extent to which existing levels of tributary habitat degradation could be reversed. This is a question because some impairments are likely permanent alterations in system capacity and also because the social and legal structure is not set up to address even the restoration opportunities that do exist. Unfortunately, many of these social/political uncertainties stem from internal NOAA processes that result in continuing to grant permission via habitat review Biological Opinions (BiOp) on actions that impair habitat or perpetually defer restoration. Other federal agencies (e.g., USFS, BLM) are also responsible for this situation in

proposing actions that further degrade the available high quality habitat, not directing funds to restoration of degraded habitat due to budget constraints, and not maintaining infrastructure that protects habitat quality (e.g., not maintaining the extensive road system that is responsible for a significant proportion of the sedimentation of the stream systems).

The document indicates that *"we identified areas with minimal habitat or population status disruption"* as areas *"that may be important areas to maintain or protect."* The ambivalence about whether remaining high quality areas are important to maintain and protect is strange. When a very large percentage of the Columbia Basin is already totally inaccessible and much of the remainder is high compromised, it is all the more incongruous that NOAA might consider high quality habitat possibly not meriting maintenance and protection.

The foregoing statements indicate various areas of uncertainty:

1) Ability to accurately identify the historical condition from a theory of intrinsic potential.

2) Ability to accurately identify current condition for the entire Columbia Basin in order to assess the deviation from historic condition.

3) Allowing further degradation in the best remaining habitats that provide all the habitat elements (capacity, which is a function of habitat area and habitat quality; diversity; spatial structure) needed by populations that continue to decline due largely to hydrosystem effects.

4) Proposing minimal critical habitat areas. For example, the agency recently proposed limiting bull trout critical habitat (essentially the headwaters of salmon habitat) to less than 10% of the original proposal, which in itself was a minimalist effort.

5) The track record of federal agencies, such as the Forest Service and BLM, in continuing to propose actions that degrade habitat quality, defer restoration, and do not keep pace with maintenance needs, such as forest road quality.

SCOPE OF AND LIMITS TO THE EVALUATION

The scope of the analysis is described as "large-scale." Large-scale here is not used in the geographic sense of map scale where it would imply a relatively fine-grained analysis, but apparently

means coarse resolution. This scale of analysis may be inescapable given the size of the Columbia Basin and the fact that resources have never been devoted to producing a reach-by-reach analysis of current condition except in the general way that habitat analysis has been treated in recent subbasin plans. However, the NOAA analysis does not even indicate that they have made use of the crude habitat analysis available in subbasin plans.

- Data are needed on land use activities to show its effect on instream habitat.

  "[T]ributary habitat analyses are based largely on land use, and are aimed at identifying likely impairments or disruptions to natural landscape processes that appear to affect in-stream habitat conditions."

  This assumed link between land use and instream habitat condition makes general sense. Watersheds that are more intensively developed are also those that tend to have more extensive habitat degradation. However, the theory linking land use, instream habitat condition, and fish population health is not provided. There are no data mentioned that indicate how percentage of land in irrigated agriculture, non-irrigated agriculture, private forestry, federal forestry, road density, etc. translate to instream habitat condition. There is no correspondence given between acres of urban, range, forest, or farmland in terms of impact on fish survival. Consequently, the link between habitat condition, land use, and survival can only be the most crude, qualitative one. There is no assurance that 10% forest land means the same thing throughout the Columbia Basin, given the different ways that forests are managed and the inherent differences in the forests and their watersheds.

- Several potential impacts were not addressed.

  The range of potential impacts investigated *"was limited to sedimentation, riparian and floodplain corridor alterations, water quality (restricted to pesticide and herbicide applications), changes to in-stream flows, potential for entrainment in irrigation diversions, and barriers to passage."* Not addressed were *"exotic species, impacts of mining (either instream habitat alteration or water quality impacts), nutrient cycling, or nutrient cycling and availability."*

The analyses done were "intended to identify impairment to habitat-forming processes that influence in-stream habitat condition" based on current land use and condition. NOAA admits that "additional impacts may be associated with these factors." Also, impacts that occurred in the past may not be indicated.

Problems with this methodology then involve the fact that: (1) current land use is assumed to be linked to instream habitat condition, (2) some impacts associated with those factors analyzed are not represented at all, (3) some past impacts that influence instream conditions are not represented, (4) some key habitat conditions are not directly represented, such as water temperature, which is a key water quality parameter. Water temperature is related to extent of riparian vegetation loss, channel widening, loss of pool volume, loss of wetlands. Many of these important characteristics are not surveyed or considered at all. Change in riparian condition was considered, but the accuracy, representativeness, and extensiveness of the analysis done was not revealed.

A bootstrap statistical analysis was used on the samples of riparian cross-sections (see Appendix B: Anthropogenic Alterations to Habitat Forming Processes), but the various iterations of drawing samples did not involve resampling the original population (i.e., all potential cross sections) but merely continuing to draw samples from an initial sampling. If the initial sampling were biased, there would be no way to indicate this from repeatedly drawning samples from a biased sample.

- Many key habitat forming conditions were overlooked.

It is claimed that watershed or riparian condition would represent habitat forming processes, but as mentioned, many of the key habitat forming conditions were not captured at all. And the one (riparian condition) that was evaluated, was done by methods and to an extent not really revealed. Good intentions and not having time enough to complete a thorough analysis do not make for a reliable evaluation capable of deciding the fate of listed species. When it is known and admitted in this NOAA document that most watersheds aside from the Middle Fork Salmon River have been extensively

altered, it is inconceivable that the conclusion would be that only some of them need to be restored. NOAA does not assign any responsibility at all for other federal agencies to take actions that would mitigate for hydro-losses, yet it appears to place some hope in their ability to do something that might provide a benefit to fish. In this sense, NOAA offers to assurance of how it would regulate federal actions proposed for implementing timber harvest, grazing, mining, or road development projects in salmon/steelhead watersheds—the very actions that are responsible for the majority of sediment and temperature problems that are extensively described in most subbasin plans.

OVERVIEW OF METHODS

The document is bereft of any methodology that would link riparian condition with water temperature. Given that riparian condition has an impact on water temperature, the effect of buffer width change, change in vegetation density, or rooting strength (change in species composition leading to differences in streambank stability and channel width) are not connected to water temperature in this document.

The document states that "*it is currently not clear how much water is removed from streams.*" And also claims that "*impairments to normal temperature regimes may be associated with impairment or alteration to natural riparian functions*." Water temperature also is closely connected to the amount of water in the channel. If a significant percentage of water is diverted from the channel, this could lead to an exacerbation of water temperature.

It is clear that riparian condition has an important linkage to potential and current water temperature. However, there are so many additional key determinants of water temperature that the actual effect of water temperature in limiting the abundance and productivity of salmonids is not apt to be adequately calculated. NOAA wisely does not make any significant claims about the accuracy of

its analysis. However, an analysis with highly dubious results is not an adequate basis for determining the fate of listed species. It is especially not a suitable decision-making tool for deciding not to undertake actions on watersheds known to have suffered significant habitat impacts.

- Mass wasting and surface erosion on forested lands.

  "We summarized an estimated difference between current and reference condition sediment supply for each population using road density, timber harvest rates and land-use and land cover information."

No specifics were given as to data sources for road density. ICBEMP data are typically incomplete, only providing a sampling of the road network in various basins. NOAA did not indicate using data on erosion rates from different classes of roads (paved, unpaved, etc.). Differences in erosion rates on different slope classes or geological or soil types were not mentioned. No data were available for amount of forest harvest on the John Day, Grande Ronde, Deschutes, or many other basins. (See also, Appendix B). It is not clear that timber harvest rates were specific to land types. From the description, it appears that timber harvest rates were simply forest-wide averages for extensive time periods. Data are not provided to allow independent evaluation of the adequacy of the analysis and nothing more than a cursory description of the methodology is given. Given the uncertainties in methods and incompleteness of analysis, there can be little confidence given to the result.

- Instream Flows.

"Data limitations include incomplete accounting of all diversions, withdrawals are not measured at each diversion, and return flows are difficult to account for."

We are sympathetic to the difficulties in obtaining meaningful data on instream flows and many other factors. However, the uncertainties in data quality make the analysis questionable. These uncertainties justify taking a precautionary approach to managing the habitats of listed species. Perhaps it can be argued that if very little work is applied on a very small portion of the habitat for an ESU, it makes little difference where one starts working. In that case, it makes little difference

whether there is a draft process in place that, based on a very limited set of habitat variables, would indicate that the John Day is more damaged than the Klickitat. But, we believe that all watersheds are in desperate need of restoration and protection and that the value of a limiting factors analysis is to most effectively address the individual needs of each basin.

- Irrigation Diversion Entrainment.

  "Data limitations, as with in-stream flows, include incomplete accounting of all diversions, withdrawals not measured at each diversion, and a lack of information about the presence or status of screen on any diversions. We therefore treat the number of diversions each population encounters as a relative measure of the impact of entrainment on the population."

  NOAA uses incomplete and ambiguous data to make estimates of only a potential for effect. This potential is based on a faulty assumption that if a diversion is present, the probability of an impact would be uniformly expressed. For example, if a basin has 100 diversions but 100% are screened and the diversions are well-maintained, the probability of impact is far different from another basin with 100 diversions that are all unscreened and unmaintained. The amount of water entering a diversion is also a key to the level of effect.

  Given all the uncertainties, it is questionable whether this analysis provides any useful estimate of probability of impact. It is commendable that diversions would be considered; they are known to cause significant fish losses, but they are also subject to social conflict. If water rights as well as other habitat issues are subjects that NOAA claims no ability to regulate on private land, NOAA then should not be relying on in-basin management to be maintaining listed populations. Purchasing water rights is no guarantee that water will remain in the stream for fish if systems are not in place to regulate water usage. Projections of recovery should be based on those factors that NOAA can and will take responsibility to regulate, not on those factors that it cannot or could but will not.

- Habitat Restoration and Population Decline.

The time required for habitat restoration also needs to be accounted for relative to the projected rate of population decline. Habitat recovery that could be effective if implemented could also require so long to be implemented and work that the population would become extirpated.

- Pesticides and Herbicides.

  "50 different pesticides were recently detected by the U.S. Geological Survey in the Willamette basin." and "their effects on salmon are also poorly understood."
  "We calculated an index of likely exposure to pesticides based on land-use patterns and associated pesticide use."

We are greatly concerned about the effects of pesticides and herbicides on salmon as well as on people. The analysis contained in this document on this subject raises many questions considering the cursory treatment in discussing the methodology. What was the source of the data on pesticide use? Was it specific to watersheds at the HUC 5 or 6 level? What is the relationship between pesticide use and the amounts that are present in streams? Are all pesticides considered to be equal in toxicity to salmon? If this is the threat that is claimed, what will NOAA's response be to plans to use these pesticides on federal and private lands? At this stage, would the argument be that not enough is known about these pesticides to restrict their use? Is NOAA actually reviewing the use of pesticides or is it allowing EPA to make all determinations of the suitability of pesticides in listed watersheds?

In the Results section the document states:"*This water quality metric is very coarse, and provides only a relative measure of potential pesticide impacts."* This would only have a possibility of being a valid statement if all pesticides and herbicides are equal in toxicity, the total pounds per acre applied is known, application is done equally in all watersheds, and the material all has an equal ability to enter streams. Has it ever been determined that 1 acre of dryland wheat in Washington is equal to 1 acre in Oregon for pesticide risk? In other words, the analysis is lacking since it does not consider a series of critical variables.

- Barriers.

"our evaluation of areas rendered inaccessible by anthropogenic barriers was limited by data availability. Thus, our results should be viewed as an initial investigation of blocked areas rather than a definitive analysis."

It is normal that certain types of analyses would take a long time to complete. But the uncertainty that is generated in the decision process by preliminary analyses makes the decisions themselves very uncertain. Even if an adaptive management process is contemplated, the net result is that any decision whatsoever is considered acceptable so long as the decision authorities permit the proposed action and allow agencies to monitor and adjust over an extended timeframe.

DISCUSSION AND SYNTHESIS

- No accounting for the varying levels of impact of the eight metrics.

The number of factors that were impaired in each population were counted, given a list of eight different metrics. However, there is no guarantee that the level of impact would be substantially worse with eight factors than with one, provided that the severity of the impact in a single factor is very great. For example, if the stream sedimentation is extreme and the water temperatures are very high, it might make little difference whether the stream also ranked high on pesticides, diversions, and flow diversion. (Of note, there was no accounting for water temperature here). Each factor considered is not necessarily of equal rank in conveying an impact, so it would then be inappropriate to simply add the number of impacts to get a total impact.

- Evaluating metal concentrations and pesticides.

"Trace metals and petroleum-based products also enter surface waters in high concentrations in urban areas (Wentz et al. 1998), and their effects on salmon are also poorly understood."

No apparent attempt to index metals concentrations was given. Also, only pesticide use was mentioned being incorporated into the index, even though herbicides were mentioned elsewhere. This distinction (if there is one) is not illuminated or defined. (There is also – and perhaps it is unnecessary – no reference to whether the term "pesticide" includes herbicides and other related products such as

insecticides, fungicides, and fertilizers). No distinction was made in type of application (e.g., aerial vs. ground-based) among the pesticides and watersheds. It is also not clear whether amount of chemical use was also considered. Heavy metals concentrations were not considered from mining operations. This is evident in tables of water quality effects, where Panther Creek was listed as a stream of greatest purity, despite having extremely high heavy metals concentrations.

- Population status.

  "First, for those populations for which a total population estimate was available, we calculated the geometric mean number of spawners for the last five years of the time series."

  Population status was described in terms of abundance/capacity, productivity, spatial structure, and diversity according to definitions in McElhaney et al. (2001). The method for estimating current population size is fine, but the method for estimating historic population size was not mentioned.

- Ecoregions.

  Diversity was indexed to the number of ecoregions and the distribution across those ecoregions. Although this might be construed to be a useful hypothesis, there is no real guarantee that an ecoregion at the scale used has any significant relationship to life history, genetic or morphological diversity, or stream potential. Ecoregion designations can use different characteristics among regions for classification. Also, it is not likely that within one level of ecoregional classification that every pair of ecoregions is equally different in potential to generate different life history types. Likewise, it has not been demonstrated that ecoregion hierarchy has any causal relationship to genetic hierarchies except for the coincidental fact that the greater the distance separating any two watersheds, the greater is the likelihood that fish population genetics and watershed characteristics would diverge. However, some ecoregions span subbasin boundaries where one population in one subbasin could be separated in stream miles by a great distance from a population in another subbasin, but in direct air miles the

distance could be very small. This poses the logical problem of whether life history or genetic similarity is more attributable to ecoregion or to drainage boundaries.

- Riparian and floodplain functions.

Riparian and floodplain corridors in agricultural, urban, forest, and rangeland areas were evaluated for changes from historic buffers. The objective is to detect change in function of riparian and floodplain areas. A variety of functions are mentioned but no indication is given to how all desired functions in total are synthesized by buffer width. No discussion is given from whatever papers are reviewed how a buffer width of 1 m can maintain anywhere from 1% to 90% of ability to retain sediment. (See Fig. B-5). No mechanism is mentioned to relate percentage of buffers for either riparian or floodplain with level of maintenance of the entire set of physical functions or in provision of biological abundance, productivity, spatial structure, or diversity. No connection is made between riparian function and water temperature regulation, one of the most critical issues in land management.

IMPLICATIONS OF HABITAT AND POPULATION STATUS FOR OFF-SITE MITIGATION

> *"It is in these areas that there is the greatest likelihood that habitat process impairments have substantially affected population status. The greatest potential to improve population status through habitat actions thus also probably lies in these situations."*

Highly compromised habitats have many factors identified as impaired, according to the system of indexing degree of impact developed in this document. This system of accounting for habitat impacts assumes that total magnitude of impact is linearly related to the number of factors that are considered to merely have the potential for impact. This amounts to only counting presence of the factor, not calculating the magnitude of actual impact in terms of survival. For this reason, it is very likely that severe impacts can be present in certain watersheds where there may be extreme sedimentation, for example, but the presence of pesticide use and other factors may be missing. Such a watershed might be ranked as a low impact watershed, despite a severe impact in one particular factor.

Cumulative impact assessment involves incorporation of all key sources of impact (a good start was made here, but the list is only partial), but it also requires examining the extent, frequency, and history of impacts for any individual source (e.g., sediment input).

A good example of this type of problem can be found with Joseph Creek steelhead (GRJOS-s) in the Grande Ronde system. The habitat ratings indicate a high rating for non-forest increase) in sediment (index value 8) and a relatively high potential for increase in forest sediment (index value 6). Floodplain conversion, riparian conversion, toxics, entrainment, and instream flow were all rated low. Joseph Creek scored only 1 value with a rating of =8. By creating two separate categories for potential increase in sediment (i.e., forested and non-forested), the indexing system allows streams that are only forested to be ranked lower than streams that have both forest and non-forest areas. Even if the forested stream has extreme sediment potential, its significance would be reduced dramatically in this scoring system if it has no non-forest sedimentation potential. The Grande Ronde subbasin plan completed in 2004 indicates that Joseph Creek is managed as a wild-only steelhead stream. Joseph Creek and its tributaries are listed as having these limiting factors: temperature, sediment, habitat modification.

In the subbasin plan, ODFW had estimated a 74% reduction in summer steelhead returns in Joseph Creek from historic levels, whereas only a 67% reduction was estimated for the upper Grande Ronde. The subbasin plan states: "The EDT model predicts relatively large (75%) changes in abundance through restoration of 1) Lower Chesnimius, 2) Lower Joseph Creek, 3) Upper Joseph, 4) Swamp Creek, 6) Crow Creek (Figure 25)." Almost all of the Joseph Creek drainage has roads in the riparian area. Removal of these roads was cited as an important part of sediment reduction. "Overall this is one of the most heavily roaded watersheds in the Grande Ronde Subbasin."

Grazing was also cited as being heavy and extensive in the Joseph Creek drainage. The kinds of habitat improvement projects that have taken place in the Joseph Creek drainage included road obliteration, streambank stabilization, riparian planting and seeding, livestock fencing, upland seeding

and erosion control, road improvements, improvement of stream crossings. The NOAA method of scoring habitat limiting factors places Joseph Creek in the same category as Chamberlain Creek in the Salmon River. Despite the significant habitat problems itemized in the subbasin plan, NOAA considers that Joseph Creek has no potential for improvement in productivity, spatial structure, and diversity. The tributaries to Joseph Creek were all implicated in the habitat limiting factors described, including Cottonwood, Tamarack, Swamp, Elk, and Chesnimnus creeks.

> *Those populations with minimally compromised habitat, for instance, provide little apparent opportunity for habitat restoration (across the range of factors that we examined); engaging solely in tributary habitat actions to improve population status in these cases would be a relatively high risk strategy, if local information does not indicate other problems. A lower-risk strategy for these populations would include actions with greater certainty of achieving a response. Those populations with highly and moderately compromised habitat are more likely to show a response to habitat improvements. Importantly, the likelihood of a response will be affected not only by the diversity of habitat factors impaired in an area, but also by the magnitude of change from historic conditions, the certainty with which changes (improvement) in a particular factor can be linked to population response.*

We agree that in watersheds with minimally compromised habitat, there are minimal opportunities to restore habitat. That is, if it is not greatly divergent from historical habitat conditions, there is little ability to improve population status via habitat restoration, unless a largely pristine watershed is only significantly altered in a strategic location. For example, if 90% of spawning habitats are nearly pristine, but the 10% that were significantly altered historically accounted for 50% of the production, then one could say that a single factor with strategically located impacts could be responsible for restoration in disproportion to the spatial extent of the impact.

More importantly, for the many watersheds, such as exist in the Middle Fork Salmon River, the Wenaha, the East Fork of the Umatilla, White Sand Creek on the Lochsa, etc., where tributary habitats are in high condition and there is little opportunity to make conditions better, NOAA admits that to undertake only habitat improvement on these habitats would place the populations at relatively high risk. Even though the populations in these watersheds have the benefit of having all the tributary conditions necessary to optimize abundance/capacity, productivity, spatial structure, and diversity, the

tributary conditions do not provide the limiting factor. In these populations, the limiting factors exist in the mainstem hydrosystem.

This same system has similar impact on all other tributary populations arising from either pristine or moderately or heavily compromised habitats. If even the populations from the minimally compromised habitats have non-sustaining growth rates, it is not realistic to think that simply by improving habitat quality for populations in heavily compromised habitats that one can cause these populations to be restored and somehow rise above the downstream limiting factors.

> *The Snake River fall chinook ESU generally showed minimal impact in the habitat factors we evaluated. However, these fish, which use mainstem habitats as a spawning area are more likely to be affected by other habitat factors, such as mainstem temperatures and flows.*

This statement is a partial statement of the limiting factors for Snake River fall Chinook. Water temperature and flows are a significant impact on this population. However, sedimentation of the mainstem and accessible tributary habitats (e.g., lower Grande Ronde) is significant. In addition, habitat loss has reduced system capacity and population spatial structure and diversity. Even within the currently accessible mainstem habitat below Hells Canyon dam there has been substantial spawning habitat loss due to excessive water depth and sedimentation and the rearing habitat has been degraded due to prolonged high temperatures and shifts in the temperature peaks.

> *"The Snake River sockeye ESU, clearly challenged in many ways, shows minimal impact in the habitat screens completed. However, we have not yet conducted analyses relating to water diversions for this population. Nonetheless, opportunities for habitat improvement for this ESU are likely to be low."*

NOAA applied a minimal set of habitat screens leading to an underestimate of difficulties for sockeye. The opportunities to improve habitat may be limited in Redfish Lake. However, there has been much discussion about the nutrient limitations in the lake causing a limitation in productivity. In addition, the mainstem temperature regime is significantly shaped by the hydrosystem and significant

past thermal impacts (i.e., significant adult mortality) to adult sockeye migration have been recorded in the Columbia River.