To: Quinault Indian Nation

Karen Allston

From: Natural Systems Design, Inc.

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Date: April 29, 2022

Re: **Critical Review of the Chehalis River Basin Flood Damage Reduction Project**
February 22, 2022, HDR Airport Levee Wetland Avoidance Technical Memorandum

PURPOSE AND UNDERSTANDING

An expandable flood retention facility (FRE), situated on the Chehalis River, and levee improvements at the Chehalis-Centralia Airport have been proposed by the Chehalis River Basin Flood Control Zone District (FCZD, Applicant) for the reduction of flood damage impacts. The stated purpose of the FRE facility and airport levee improvements is to store water in the upper watershed to alleviate flood damage to developed areas of the lower floodplain near the towns of Centralia and Chehalis, Washington. The FRE facility and airport levee improvements are being reviewed under the National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA) by the U.S. Army Corps of Engineers (Corps) and the Washington State Department of Ecology (Ecology), respectively. As part of that review process, the Corps and Ecology have requested the FCZD provide additional analyses and supporting documentation to inform regulatory decision making.

Specific to the proposed Chehalis-Centralia Airport levee improvements components (proposed levee project), HDR prepared the *2022 Airport Levee Wetland Avoidance Technical Memorandum* (Technical Memo) for the FCZD to detail proposed alternatives for levee improvements which could be considered to avoid and/or minimize wetland impacts. The Technical Memo provides additional information regarding methods for raising the existing levee, including anticipated height relative to existing conditions. Natural Systems Design, Inc. (NSD) reviewed the Technical Memo to evaluate the information provided regarding the design alternatives for the proposed airport levee improvements and the conclusions regarding wetland impact avoidance and minimization measures. NSD also considered the constructability of proposed levee project alternatives and related potential direct and indirect impacts to waters of the U.S., in particular jurisdictional wetlands.

In addition to the Technical Memo, NSD reviewed the applicable components of the NEPA and SEPA Draft Environmental Impact Statement (DEISs) relating to the proposed levee project and the existing conditions and wetland impacts analyses. NSD also reviewed the following previously completed technical review documents which are specifically incorporated herein by reference:

1. Cascade of FRE Facility Ecosystem Effects Technical Memo (SEPA Cascade of Ecosystem Effects Technical Memo) (NSD 2020a)
2. Hydrology Technical Memo 1: Observed and Predicted Flows Relative to FRE Facility Operation (SEPA Hydrology Technical Memo 1) (NSD 2020b)
3. Hydrology Technical Memo 2: Hydrology and Climate Change Technical Analyses Review (SEPA Hydrology 2 Technical Memo) (NSD 2020c)

4. Critical Review of Proposed Chehalis River Basin Flood Damage Reduction Project NEPA DEIS: Addendum to Cascade of FRE Ecosystems Effects Technical Memo (NEPA Ecosystems Addendum) (NSD 2020d)
5. Critical Review of Proposed Chehalis River Basin Flood Damage Reduction Project NEPA DEIS: Climate Change Impacts (NEPA Climate Change memo) (NSD 2020e)
6. Earth Discipline Report–Geology Technical Analyses Review (SEPA Geology Technical Memo) (NSD and Saturna Watershed Sciences 2020a)
7. Critical Review of Proposed Chehalis River Basin Flood Damage Reduction Project NEPA DEIS: Geology Discipline Report Review (NEPA Geology Addendum) (NSD and Saturna Watershed Sciences 2020b)

Proposed Levee Project

As stated in the NEPA and SEPA DEISs (NEPA DEIS page 33; SEPA DEIS page 22) the proposed levee project would:

- Add 4 to 7 feet of height along the existing 9,511-foot-long levee with earthen backfill or floodwalls
- Raise up to 810 linear feet of NW Louisiana Avenue
- Widen portions of the existing levee base (disclosed in SEPA DEIS only)
- Replace existing utility infrastructure

Quantification of wetland impacts in both the NEPA and the SEPA DEISs relied on a 2019 wetland delineation prepared by Anchor QEA, LLC for Ecology and the Corps (Anchor 2019). Figure 1, taken from the SEPA DEIS depicts wetlands as delineated by Anchor.

Preliminary, potential direct impacts to wetlands were disclosed in the draft NEPA and SEPA DEISs. The SEPA DEIS estimated 6.6 acres of direct, permanent impacts to Category II and III wetlands and 44.2 acres of direct, permanent impact to Category II and III wetland buffers (SEPA DEIS Appendix O, page O-ii). These wetland and wetland buffer impacts are specific to airport levee improvements and do not include additional impacts disclosed in the SEPA DEIS which are specific to construction of the FRE facility.

In contrast, the NEPA DEIS estimated 4.54 acres of direct, permanent impacts to Category II and III wetlands, and 16.61 acre of wetland buffer impact associated with widening the airport levee base (NEPA DEIS Appendix J, page 71). The 4.54 acres of impacts assumed that the linear drainage ditch present near the base of the levee, which was mapped as Wetlands C, D, and F (Anchor 2019) would be filled and relocated. These wetland and wetland buffer impacts are specific to airport levee improvements and do not include additional impacts disclosed in the NEPA DEIS which are specific to construction of the FRE facility.

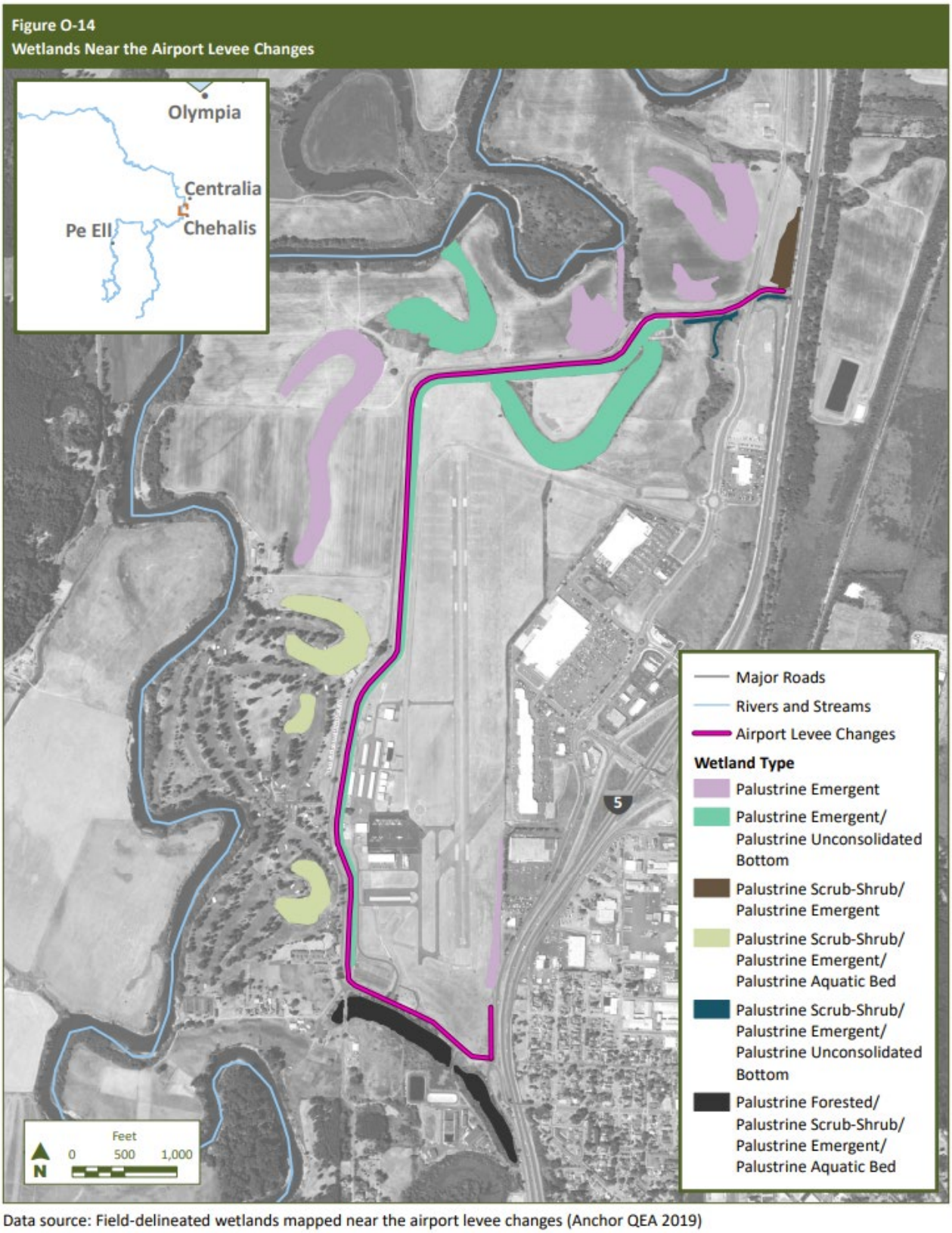

Figure 1. Wetlands Within and Near the Airport Levee Improvements Project Area
Image source: SEPA DEIS, Appendix O, Figure O-14

TECHNICAL MEMO SUMMARY

The Technical Memo is 10 pages in length and includes four attachments. Attachment A contains a figure depicting the location of delineated and estimated wetlands relative to the exiting levee configuration, two figures depicting hydraulic modeling outputs for the Proposed Action 100-year flood event and the No Action 100-year flood event, and one figure depicting two mechanically stabilized levee raising conceptual details. Attachment B presents levee design elevation and raising height data. Appendix C presents temporary flood barrier systems. Attachment D contains 10% design-level, conceptual construction plans.

Proposed Alternatives

The Technical Memo presents figures which appear to be derived from the 2019 Anchor Wetland Delineation Report, illustrating delineated wetlands along the toe of the levee slope on the eastern/airport side of the levee (Technical Memo Figure 1) as well as wetland proximate to the western/riverward side of the levee characterized as "estimated wetland."

The Technical Memo presents the following three design alternatives which HDR indicates could be constructed in a manner that would avoid impacts to existing wetlands.

- **Alternative1 – Type 1 Levee Fill**
  - Placement of Type 1 levee fill material to raise levee height. Requires topsoil stripping and replacement with compacted fill.
  - Levee segments with an existing crest width of a minimum of 12- feet would be raised within the existing footprint.
  - Levee segments with an existing crest width of less than 12-feet would be widened at the toe of the levee, along the floodplain side of the levee (western, riverward side of levee).
- **Alternative 2 – Mechanically Stabilized Backfill**
  - Placement of Type 1 levee fill material and lateral geogrid placement to increase side slopes up to 67%. Requires topsoil stripping and replacement with compacted fill.
  - Does not propose widening levee base – therefore construction would occur within the existing levee footprint.
  - Potential placement of an impervious cutoff (I.e., sheet pile wall) may be required to address potential for increased seepage through the permeable levee (required for maintenance of steep, earthen slopes).
  - For use in areas where the existing levee footprint is "restricted by wetlands or right-of-way constraints."
- **Alternative 3 – Concrete Flood Wall**
  - Cantilever concrete flood wall constructed on top of existing levee.
  - Requires topsoil stripping and additional excavation for placement of concrete footing and inspection trench.
  - Potential placement of an impervious cutoff (I.e., sheet pile wall) may be required to address potential for increased seepage through the permeable levee (required for maintenance of steep, earthen slopes).
  - Constructed entirely within existing levee footprint.

The Technical Memo concludes that "With careful design and construction management, including best management practices to protect the wetland, a concept can be implemented that would avoid impacts to jurisdictional wetlands." (Technical Memo page 10)

Comparison of Alternatives

The Technical Memo indicates that direct wetland impacts could be avoided with any of the proposed alternatives, or a combination of the alternatives applied to different portions of the levee. They conclude that all alternatives "meet the project purpose of constructing the requisite levee raise within the existing Airport Levee footprint to avoid wetlands and cultural resource impacts …" (Technical Memo, page 8). The Technical Memo then compares alternatives based on site access, constructability, cost, and potential performance risk relative to need for additional geotechnical analyses. In summary:

- **Alternative 1 – Type 1 Levee Fill**
  - Expansion of levee-footprint required along western (floodplain side) incorporates floodplain fill which may cause a rise in water surface elevation during extreme flood events.
  - Potential conflicts with existing utilities.
  - Alternative maintains existing access.
  - Relatively low cost alternative.
- **Alternative 2 – Mechanically Stabilized Backfill**
  - Construction feasibility limited by need for excavation and placement of geogrid.
  - Most structurally-stable alternative, however geotechnical conditions are unknown.
  - Lowest cost alternative.
- **Alternative 3 – Concrete Flood Wall**
  - Construction feasibility limited by need for increase in area of excavation for concrete footer forms and inspection trench.
  - Least impact to floodplain and existing utilities.
  - Highest cost alternative

Based on the cost and constructability analysis criteria, HDR recommends Alternative 1 (Type 1 Levee Fill) be applied wherever possible. The Technical Memo notes that in some segments Alternative 1 requires floodplain fill which may conflict with existing utilities. Where such conflicts exist, HDR recommends Alternative 2 (Mechanically Stabilized Backfill). HDR notes that Alternative 3 (Concrete Flood Wall) is a possible alternative for the entirety of the levee, however it is the most expensive, and would have the highest construction impact on the existing levee and may present access challenges.

FINDINGS

The Technical Memo presents a comparison of design alternatives and construction methods without consideration of the accuracy or completeness of several considerations relative to the ultimate design and construction of the proposed levee improvements, including no consideration for indirect wetland impacts. Because the following considerations were not evaluated, the conclusion that the construction alternatives presented could completely avoid wetland impacts is not justified. Thus, regulatory decision makers cannot determine, based on this Technical Memo, that the proposed levee project has appropriately applied mitigation sequencing to avoid, minimize, and mitigate for impacts to jurisdictional wetlands and Waters of the U.S.

Inappropriate Climate Change Analysis for Determination of Freeboard

To determine the necessary design levee elevation, HDR relied upon hydraulic modeling, including climate change scenarios, prepared for the SEPA DEIS; climate change impacts were not considered in NEPA DEIS analyses. A critical review of the SEPA DEIS performed in April 2020 by NSD concluded that multiple shortcomings in DEIS hydraulic modeling analyses resulted in a substantial underestimation of local and downstream flooding impacts (SEPA Hydrology 2 Technical Memo, NSD 2020c). In particular, the integration of mid-century and late-century climate change projections failed to represent a true "high-end" scenario for projected peak flows, therefore the maximum impacts of implementation of the FRE facility and airport levee improvements were underestimated in the SEPA DEIS (NSD 2020c).

The levee design elevation as currently presented relies upon this underestimation of local and downstream flooding impacts with climate change. Thus, creating the potential that with refined hydraulic and hydrologic modeling, the freeboard height may need to be raised from the design heights presented in the Technical Memo. This potentially negates the conclusion that the airport levee can be raised using any of the three alternatives considered and that the levee can be raised without wetland impacts. As the underlying hydraulic and hydrologic analyses underestimate flood conditions under climate change scenarios, the freeboard determination is insufficient as proposed, and thus the conclusion that any of the three alternatives considered could be constructed without wetland impacts is not justified.

Omission of NW Louisiana Avenue Component

Both DEISs present "raising 810 feet of NW Louisiana Avenue along the southern extent of the airport to a height equal to the raised levee height to protect against flooding" (NEPA DEIS, page 33; SEPA DEIS, page 22) as a component of the proposed levee project. Although the Technical Memo notes that "the [FCZD] proposes to… raise the elevation of a section of connected road embankment (NW Airport Road) as part of the [project]" (Technical Memo, p. 1), it does not evaluate this element of the proposed project. Aside from this mention, the Technical Memo is altogether silent on the proposed construction methods for completing this portion of the proposed levee project.

It is unclear in all documents where exactly the 810-foot segment of road slated for raising is situated, however the most detail on location of road raising is provided in NEPA DEIS Figure 3.6-3, a clip of which is included herein as Figure 2. The 2019 Delineation (Figure 3) documented a large wetland, Wetland H, at the northern terminus of the delineation study area, along a portion of NW Louisiana Avenue. The Technical Memo fails to characterize this element of the proposed project and has therefore omitted critical evaluation of potential impacts to Wetland H and its buffer. Without this characterization, it is impossible for decision makers to evaluate whether the alternative construction methods evaluated would avoid wetland impacts related to raising the NW Louisiana Avenue component of the proposed levee project.

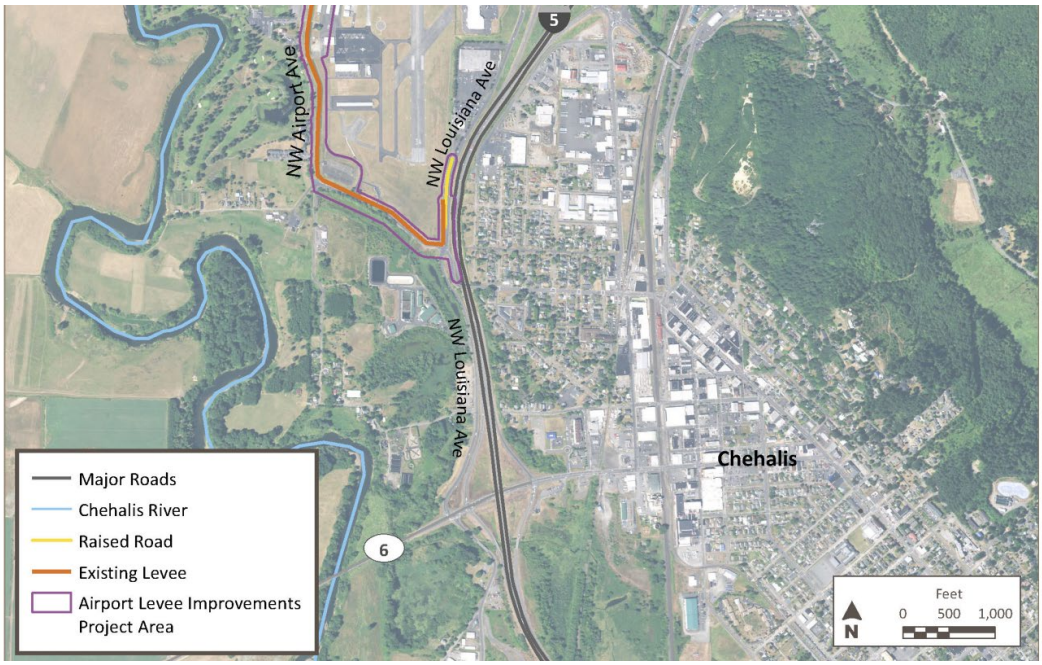

Figure 2. Location of Raised Road Improvement
Image Source: Clip of NEPA DEIS Figure 3.6-3

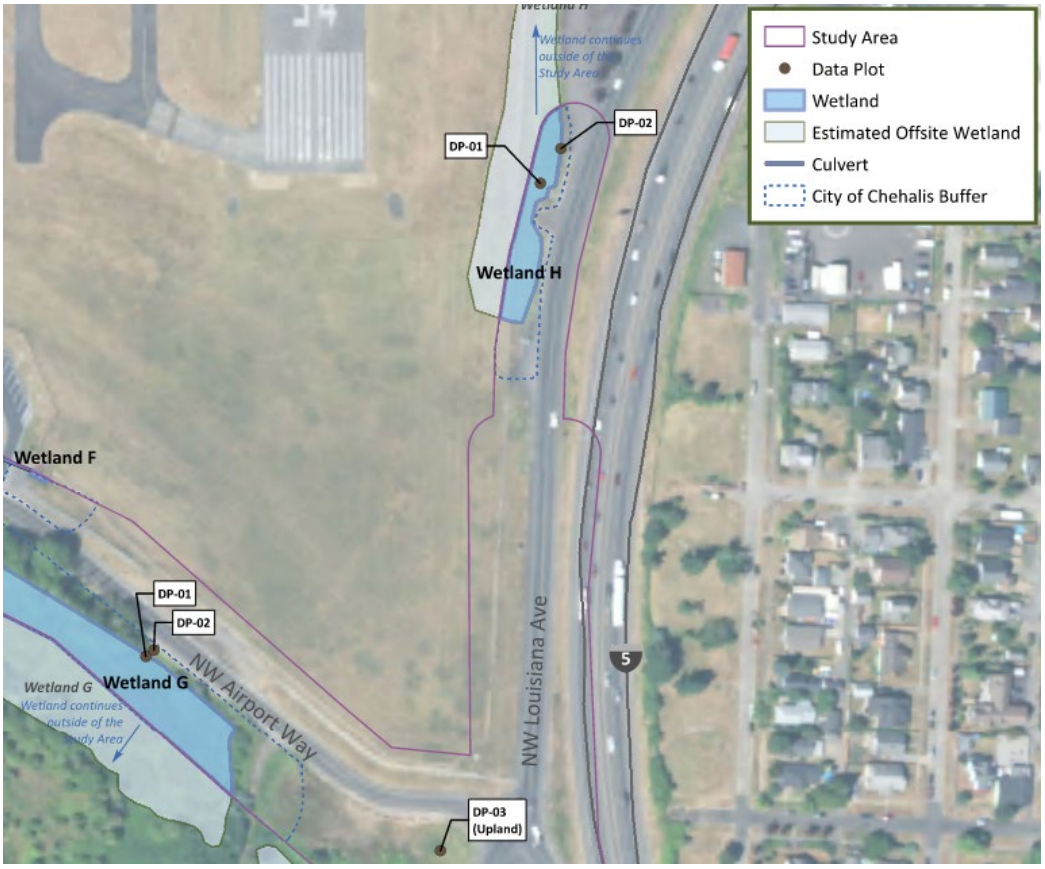

Figure 3. Location of Wetland H Along NW Louisiana Ave
Image Source: Clip of 2019 Wetland Delineation Report Figure 9

Inconsistent and Incomplete Representation of Existing Wetlands

The supplemental information provided fails to consistently represent the location and elevation of existing wetlands adjacent to the levee in both Attachment A. Figures, and Attachment D. 10% Conceptual Plans. Clear representation of the location of existing wetlands is key to evaluating the potential for the alternative levee construction methods to avoid wetland impacts.

Attachment A: Figures

The figures included in Attachment A contain inconsistent wetland data. Attachment A *Figure 1. Chehalis Airport Levee Configuration and Wetland Map*, contains what appears to be both the delineated and estimated wetlands consistent with the 2019 Wetland Delineation Report (Anchor 2019). Although included, the scale of the figure is such that it is impossible to decipher the distance between the existing levee footprint and the wetland boundary, thus a decision maker cannot accurately determine the proximity of construction impacts to existing wetlands.

In contrast, *Attachment A Figures 2 and 3*, presenting the hydraulic modeling results, do not include the 2019 delineated and estimated wetlands; instead, they depict wetland polygons more generally from U.S. Fish and Wildlife's publicly available National Wetland Inventory (NWI) dataset. NWI does not map any wetland along the eastern side of the levee toe, where the 2019 Wetland Delineation Report (Anchor 2019) maps approximately 4.54 acres of depressional wetland (Wetlands C, D, and F; Anchor QEA 2019). It is therefore impossible to assess the potential for the alternative levee construction methods considered to cause direct or indirect wetland impacts under the modeled 100-year flood event.

Attachment D: 10% Conceptual Plans

The Overall Levee Site Plan, Sheet 01 (cover) of the 10% Conceptual Plans also depicts only the generalized NWI wetlands and does not include the site specific 2019 delineated wetlands. Neither the delineated wetlands nor even NWI wetlands are represented on any other sheet of the 10% Conceptual Plans.

All 10% Conceptual Design cross-sections (labeled as profiles on sheets CP-01 and CP-02) lack depiction of existing wetlands. Each cross-section shows approximately 2 feet of over excavation, presumably denoted by the "degrade line." Over excavation of the existing levee is not discussed in the Technical Memo, although the term "topsoil stripping" is included in the proposed construction sequence for each alternative. Arguably, it is fundamentally cost prohibitive and difficult to excavate to a precise extent presumably immediately adjacent to a wetland without incurring either a direct or indirect impact. The Technical Memo fails to provide specific and sufficient detail in these cross sections to justify the conclusion that the alternatives considered and represented in the 10% Conceptual Designs will not result in wetland impacts.

Insufficient Information to Evaluate Constructability

The Technical Memo notes additional analyses are necessary to fully evaluate the feasibility of the presented alternatives and comply with FEMA regulations to obtain FEMA certification for the proposed levee improvements.

The following specific analyses are noted in the Technical Memo as being required to fully inform a proposed design (Section 8, page 9):

- Exiting condition of levee, including analysis of existing foundation soils and their ability to accommodate the raised levee.

- Geotechnical investigations (i.e., seepage and stability), required by FEMA, to provide documentation of adequate protection for a 100-year flood event.
- Analysis of ability of proposed alternatives to meet construction, maintenance, and operation standards.

Further, proposed Best Management Practices (BMPs) and provisions for means and methods to restrict construction activities in proximity to wetlands are not addressed in any detail other than to state that "exclusion zones and best management practices will be identified that restrict any construction activities (including staging areas) within or affecting the existing wetlands" (Technical Memo, page 9).

Failure to Consider Potential for Indirect Impacts

The Technical Memo does not address or evaluate potential for indirect wetland impacts and fails to consider potential direct impacts along the stream associated with Wetland D and the hydraulic connection via culvert between Wetland C and an unnamed Chehalis River tributary. Specifically, the Technical Memo lacks sufficient detail and attention to hydrologic connections beyond the existing levee and the potential for alteration of near-surface hydrologic inputs which support the existing wetlands.

Failure to Consider Hydrologic Connections

Technical Memo, Figure 1 appears to show at least four culverts connecting delineated wetlands and "estimated wetlands" through the existing levee. While it is challenging to decipher the presence of culverts because of the small scale and poor resolution of Technical Memo Figure 1, it is clear the Technical Memo does not discuss or present any information on the continued operation of these culverts, pump stations, or any need for modifications relative to the proposed levee improvements. Additional detail and analysis will be necessary to determine if these existing culverts have sufficient load-bearing capacity to support the added load from proposed levee improvements. If it is determined that they are not capable of supporting the additional load, it may be necessary to replace or modify them which present additional potential for direct and/or indirect impacts to adjacent wetlands.

Additionally, the 2019 Delineation Report, both DEISs, and the Technical Memo fail to consider the potential for direct or indirect impacts to Wetlands C and D which are associated with at least three culverts which convey tributary flow to the Chehalis River (Figure 4; 2019 Delineation Report). Wetland C appears to have a direct hydraulic connection to "offsite Wetland OS-3" (Anchor 2019) and the Chehalis River tributary visible in Figure 4, however these hydraulic and hydrologic connections and potential impacts from construction of the proposed levee project are not discussed. According to two WFDW fish passage inventory reports that assessed two culverts located along Wetland D (indicated by red circles in Figure 4), the portion of Wetland D outside of the levee delineation study area is overflow from Salzer Creek (a tributary of the Chehalis River) or Airport Lake (Schotman and Young 2019; Arams and Schotman 2019) which is appears to be illustrated in the 2019 delineation as Wetland C (Figure 4). The Technical Memo fails to consider the direct, indirect, or cumulative impacts to fish and wildlife and/or habitat functions associated with modifications to the levee, this drainage, or these culverts.

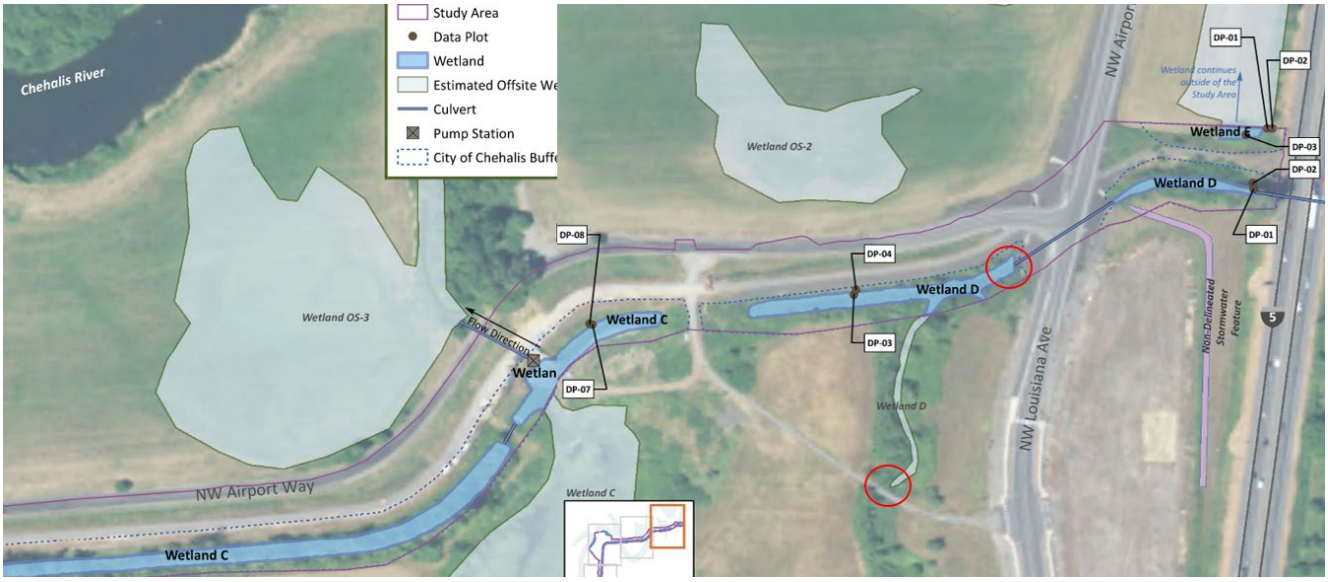

Figure 4. Wetland and Tributary Connections to Wetlands C and D
Image Source: Splice of 2019 Wetland Delineation Figures 3 and 4. Assessed culvert locations identified with red circles. Note tributary connection to Chehalis River in image upper center is covered by the figure legend.

Failure to Consider Sources of Wetland Hydrology

Finally, both Alternative 2 and 3 include installation of "impervious cutoffs" such as sheet pile walls which the Technical Memo notes may be necessary to cut off seepage flow through potentially permeable layers added to the levee. Both raising the levee and installing additional impervious layers within the levee prism present the potential for altering near surface hydrology supporting wetland conditions on either side of the levee prism. The Technical Memo fails to consider the potential for such direct or indirect impacts to the conditions which create wetland hydrology. Thus, the Technical Memo fails to justify the conclusion that the alternatives considered and represented in the 10% Conceptual Designs will not result in wetland impacts.

Failure to Address Wetlands Buffer Impacts

Discussion of wetland buffer extents and potential impacts is altogether absent from the Technical Memo and its attachments. Inconsistent wetland boundaries from two separate sources are used in the Technical Memo figures. None of these figures, nor any of the construction plan sheets depict the extent of wetland buffers. Wetland buffers are regulated at a local level and are thus derived from the City of Chehalis Wetland Rating and Standard Buffer Widths (Anchor 2019). According to the 2019 Delineation, Wetlands C, D, and F are situated along the eastern toe of the existing levee. The wetlands are rated either Category II or Category III, affording the wetlands a buffer width of either 150 feet or 80 feet respectively, measured perpendicularly from the delineated wetland edge. It is therefore impossible to construct any of the alternatives considered in the Technical Memo without directly impacting wetland buffers.

Similarly, potential wetland buffer impacts are not discussed, evaluated, or otherwise disclosed for the proposed road modifications to an 810-foot segment of either NW Airport Way or NW Louisiana Way. NSD assumes that this work would be performed in the vicinity of "the southern extent of the Airport" (NEPA DEIS, page 33), where Wetland H is present. Wetland H was rated as a Category III wetland in the 2019 Delineation, affording it an 80-foot buffer. The lack of detail on where this work is to occur makes it impossible for a local decision maker to properly evaluate the potential for impacts to wetland buffers.

Although not quantified, both the NEPA and SEPA DEISs also disclose continued impacts to wetland buffer functions through continued vegetation disturbance from operations (I.e., mowing, weed control, etc.) (NEPA Appendix J, page 74). The Technical Memo does not address continuous operational impacts to wetland buffers or the potential indirect and cumulative impacts the activities pose to their vegetative and hydrologic functions.

CONCLUSIONS

Although the Technical Memo does provide information on potential alternative methods to avoid and minimize impacts to wetlands, the memo fails to justify its conclusion that the levee construction alternatives presented could be used to completely avoid wetland impacts. The memo considers only direct impacts, ignoring the potential for indirect or cumulative impacts. Thus, regulatory decision makers cannot determine based on this Technical Memo that the proposed levee project has appropriately applied mitigation sequencing to avoid, minimize, and mitigate for direct, indirect, and cumulative impacts to jurisdictional wetlands and Waters of the U.S. The analysis presented in the Technical Memo offers regulatory decision makers no basis by which to definitively determine that any of the proposed approaches would result in a less damaging alternative than that presented in the NEPA and SEPA DEISs.

At a minimum, the following information must be included to enable meaningful environmental review under SEPA and NEPA and informed decision making as to whether the proposed levee improvements have demonstrated mitigation sequencing and could actually be constructed as anticipated in the Technical Memo:

1. Revision to hydraulic modeling effort to adequately represent flood potential under a true “high-end” climate change scenario for projected peak flows to properly evaluate the necessary freeboard design height and thus levee width and applicable construction techniques.
2. Accurate representation and graphic depiction of existing wetland features and their buffers across all figures and design plans to accurately evaluate the potential for wetland impacts relative to the proposed actions.
3. Evaluation of temporary, indirect, and cumulative impacts to wetland and wetland buffer area and function relative to the proposed actions.
4. Additional detail on existing infrastructure including the state of existing levee structures, culverts, pumps, and associated infrastructure, and their ability to accommodate the proposed changes.
5. Disclosure of appropriate detail to determine the location, extent, and scope of the “810-foot road modifications” for evaluation of potential direct, indirect, and cumulative impacts to wetlands.

REFERENCES

Anchor QEA, LLC. 2019. Chehalis-Centralia Airport Levee Wetland Delineation Report. Prepared for Washington Department of Ecology and the U.S. Army Corps of Engineers in support of the Chehalis River Basin Flood Damage Reduction Proposed Project. Portland, Oregon. May 2019.

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Natural Systems Design. 2020a. Cascade of FRE Facility Ecosystems Effects Technical Memo. Prepared for Quinault Indian Nation for Proposed Chehalis River Basin Flood Damage Reduction Project. Draft Environmental Impact Statement SEPA review. April 23, 2020.

Natural Systems Design. 2020b. Hydrology Technical Memo 1: Observed and Predicted Flows Relative to FRE Facility Operation. Prepared for Quinault Indian Nation for Proposed Chehalis River Basin Flood Damage Reduction Project. Draft Environmental Impact Statement SEPA review. April 23, 2020.

Natural Systems Design. 2020c. *Hydrology Technical Memo 2: Hydrology and Climate Change Technical Analyses Review*. Prepared for Quinault Indian Nation for Proposed Chehalis River Basin Flood Damage Reduction Project. Draft Environmental Impact Statement SEPA review. April 23, 2020.

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Natural Systems Design and Saturna Watershed Sciences. 2020a. *Earth Discipline Report - Geology Technical Analysis Review.* Prepared for Quinault Indian Nation for Proposed Chehalis River Basin Flood Damage Reduction Project. Draft SEPA Environmental Impact Statement review. April 23, 2020.

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