Chehalis River Basin
Flood Control Zone District

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Response to OCB Board question regarding the extent to which the proposed FRE Project would be able to regulate the 100-year flood scenario under projected climate change conditions

Under the Governors directive to more extensively evaluate basin-wide flood damage reduction measures, the OCB Board has inquired about the ability of the proposed FRE to regulate projected 100-year flood flows at the increased flow levels projected under climate change conditions. At issue is the degree to which adequate flood damage reduction would still occur downstream of the FRE under climate change conditions.

The 100-year flood flow (flood with a 1% chance of occurrences in any given year) is projected to increase under climate change conditions by 26 – 50% by 2080 (email communication with Larry Karpack of WSE, 11 January 2021). This projection would mean that the peak 100-year flood flow at the Grand Mound gage would increase from the present value of 75,000 cubic feet second (cfs) by a significant amount. At the FRE project site upstream from the Grand Mound gage the current 100-year peak flood flow is on the order of 24,000 cfs (HDR, 2020); with projected climate change the 100-year peak flow may increase to between 30,240 and 36,000 cfs.

Regulation of the increased 100-year peak flows could occur in two ways; an operational response through the planned regulation of flows and discharge of stored flood waters and reconfiguration of the FRE to store additional water.

Operational Response - The operational response to increased flood flows under climate change conditions entails establishing operational protocols that anticipate the increased flows as part of the facilities planned operations. As part of final design of the FRE an operations manual will be developed that among other subjects provides specific protocols for operation of the facility under different major or greater storm conditions to minimize flood damage within the 100-year flood plain.

As has been discussed in the project description, when a storm forecast issued by the Northwest River Forecast Center is expected to result in flows of 38,800 cfs or greater within 48 hours at the Grand Mound gage (about 48 miles downstream of the proposed FRE site), the conduit gates at the FRE would be closed down resulting in a maximum outflow of 300 cfs and storm waters on the upper Chehalis River would be temporarily impounded in the reservoir As a consequence of this regulation, peak flood flows would be reduced by approximately 23,700 cfs (for a current 100-year flood) just downstream of the FRE with the result of reduced flooding downstream. The temporary reservoir could store up to 65,000

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acre feet of flood water. When the flood peak flow has passed the FRE site, phased release of the stored flood waters from the temporary reservoir would begin and continue for up to 32 days until the reservoir is fully drained. Storms predicted to meet or exceed 38,500 cfs at Grand Mound but that do not reach catastrophic levels may result in less than a full reservoir.

Figure 1 – Planned Operating Protocol – 100-year Event without Climate Change (Anchor QEA)

Under climate change conditions peak inflows to the reservoir for a 100-year recurrence interval event could increase 26% – 50%. If the climate change projection should come to pass, a revised operating protocol would be developed to address flood regulation optimization across a range of different flood events. Depending on the relative peaks in inflow arising from the three major tributaries to the mainstem Chehalis River at, FRE operations may delay gate closure or allow more outflow during the peak of the event, if the travel time and combined peaks of the other two major tributaries would already have passed the downstream major damage area and the increased releases from the FRE facility would not reach the damage area until well after the peak from the uncontrolled tributaries had passed. Or, the gates could be closed as per the current plan and the reservoir would fill and then spill, with perhaps the timing of the spill also occurring after the peak downstream stage had been passed and the additional FRE outflow would backfill behind the downstream peak but not exacerbate flood stages. Overall, the operation of the FRE would likely strategically store and release flows from the FRE with the appropriate timing so as to not increase control flood levels in the affected area.

The future climate change anticipated peak inflow and maximum reservoir level that might be expected in future should the projected climate change scenario occur. This operational curve assumed the hydrograph increases 50% in volume compared to the current event, as projected. The curve reflects the ‘fill-and-spill’ scenario discussed above. Similar to the current operation plan, the outflows from the project would increase after the downstream peak was forecasted to pass, allowing the reservoir to be evacuated and cleared of debris. It should be noted that actual regulation of the reservoir during a flood event in which the FRE structure is activated will require hourly adjustments in gate operation and storage/outflows in response to the evolving inflow hydrograph and downstream flooding potential.

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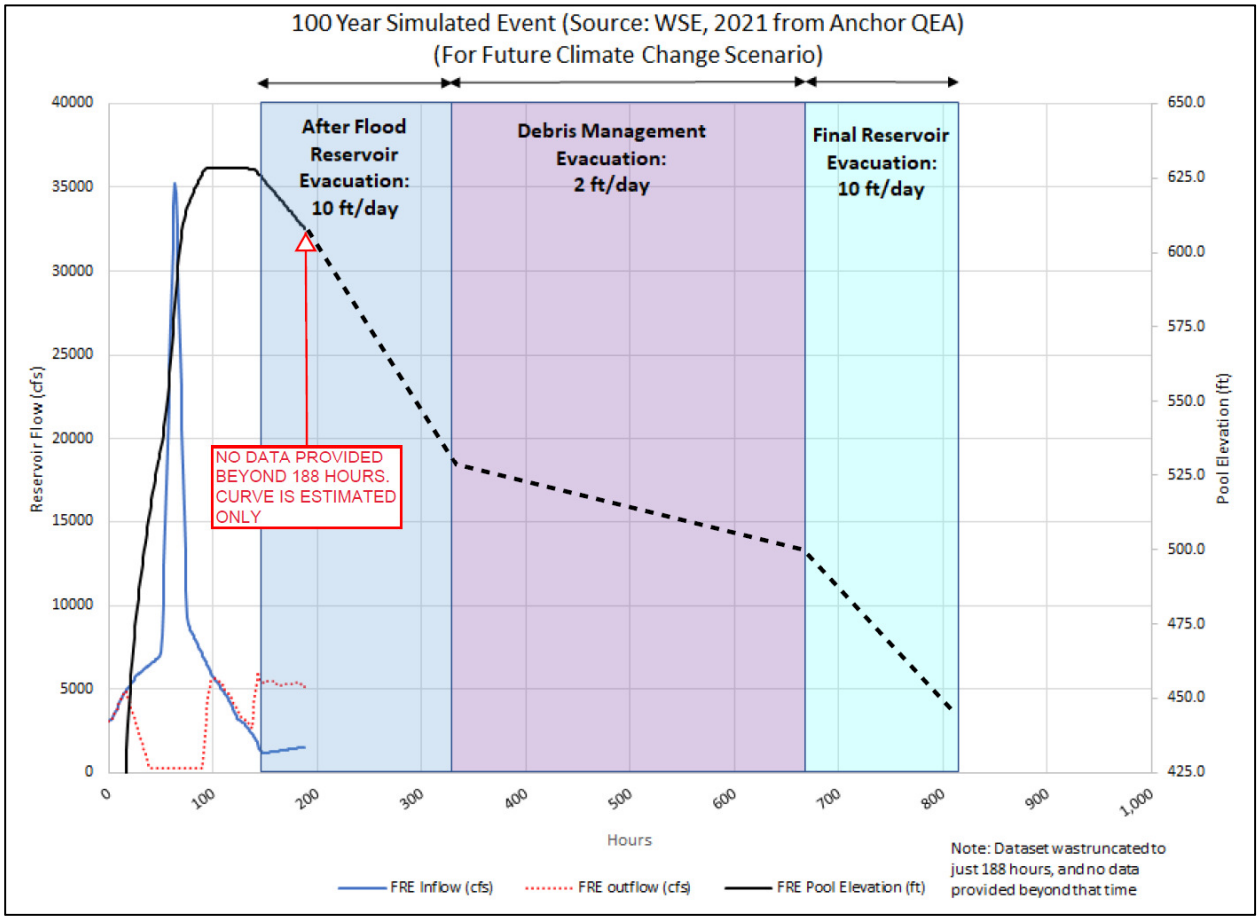

Figure 2 –Operating Protocol – 100-year Event with Climate Change
Source: WSE, 2021 data, obtained from Anchor routing analysis under future climate change conditions)

It is expected that the development of the FRE operations manual will include a number of such contingency protocols to address different projected flood conditions. In practice, whether climate change projections should prove accurate, the operation of the reservoir would be adapted to adjust to changing conditions in order to meet the flood damage reduction objectives of the facility.

Physical Configuration Response – To respond to higher peak flood inflows under predicted climate change conditions, additional storm water temporary storage capacity can also be created by raising the FRE spillway to a higher elevation. The currently proposed FRE project has incorporated a dam foundation that is designed to carry the loads of an expanded (higher) dam should it be determined in the future that additional flood storage in the temporary reservoir is required to respond to climate change. The expanded facility, however, is not part of the currently proposed project. Other than

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foundation design an expanded facility would require additional engineering design and would be required to undergo an entirely new environmental review and permitting process.