

Feature	Area Affected by Restoration	Type, Function, and Value
Tenasillahe Island Long-term Restoration (Dike Breach)	1,778 acres	Type: Tidal marsh and swamp habitat; shallow water and flats habitat Function: Provide rearing habitat for ocean-type salmonids; increase detrital export Value: High

Project Description:

General Description: The Corps, upon confirmation that Columbian white-tailed deer have been delisted, will breach the existing flood control levees at the present location of the tidegate outlets, at the inlet locations constructed for the interim measure and at other appropriate locations. Habitat development will be passive and will rely upon normal tidal inundation.

Pre-Construction Monitoring Effort

- a. **Juvenile Salmonid/Fisheries Use:** Juvenile salmonid use will be based upon sampling associated with the Interim Measures at Tenasillahe Island. Control locations at the upstream tidal marsh on Tenasillahe Island and at Quinn's Island will be sampled. Sampling and analytical protocol would follow that of **Hinton et al. (1990, 1992a, 1992b and/or 1995)**.
- b. **Benthic Invertebrate Productivity:** Benthic invertebrate productivity will be based upon sampling associated with the Interim Measures at Tenasillahe Island. Control locations at the upstream tidal marsh on Tenasillahe Island and at Quinn's Island will be sampled. Sampling and analytical protocol would follow that of **Hinton et al. (1990, 1992a, 1992b and/or 1995)**.
- c. **Tidal Marsh Primary Productivity:** Sampling locations, methodology and level of effort will be comparable to that described for post-construction monitoring. Control locations at the upstream tidal marsh on Tenasillahe Island and at Quinn's Island will be sampled. Tidal marsh plant production would be assessed in a manner generally comparable to the methodology used for the **Columbia River Estuary Data Development Program (1984)**.

Post-Construction Monitoring Effort

a. Tidal Marsh Primary Productivity: Tidal marsh primary (plant) production would be assessed in a manner generally comparable to the methodology used for the **Columbia River Estuary Data Development Program (1984)**. Sampling would occur in late July and early August. Plant cover and species composition will be determined from 5 sample locations each at Quinn's Island and Tenasillahe Island upstream tidal marsh and within the ecosystem restoration feature. These sampling locations will be permanently staked plus their Global Positioning System location will be recorded to ensure that sample sites are reoccupied in subsequent years. Plant cover data will be recorded from five replicate 0.5m² quadrats randomly placed around each sampling location. Percent live biomass would be determined from nine randomly placed 0.1 m² clip-quadrats at each sampling location. The simple harvest method utilizing peak total standing crop measurements, including both live shoots and attached standing dead material of the same season's growth will be used to estimate primary production.

b. Benthic Invertebrate Productivity: Benthic invertebrate productivity will be measured per the methodology used by NOAA Fisheries in the Columbia River estuary (see **Hinton et al. (1990, 1992a, 1992b and/or 1995)**). The sampling timeframe would be Spring and Fall. Ten sampling stations would be established at Quinn's Island and Tenasillahe Island upstream tidal marsh and within the ecosystem restoration feature. Five of these 10 sampling stations would be paired with the tidal marsh plant production locations. Benthic invertebrate sampling locations would also be established. These sampling locations will be permanently staked plus their Global Positioning System location will be recorded to ensure that sample sites are reoccupied in subsequent years.

c. Juvenile Salmonid/Fisheries Use: Juvenile salmonid use will be measured at Quinn's Island and Tenasillahe Island upstream tidal marsh and within the ecosystem restoration feature. Due to their intertidal location and vegetative cover, trap nets or other appropriate technology would be used. The sampling timeframe would be Spring and Fall. Sampling and analytical protocol would follow that of **Hinton et al. (1990, 1992a, 1992b and/or 1995)**.

Monitoring Schedule: Monitoring efforts would occur the year the long-term feature is constructed plus year one and five after construction. Photographs will be obtained at each sampling location to document control and ecosystem restoration feature conditions.

Correspondence: NOAA Fisheries and the U.S. Fish and Wildlife Service will be notified of contractors employed to accomplish these actions, dates of their notices to proceed and when final reports are due. Each agency will be furnished final reports on each monitoring action as they are received.

Adaptive Management Actions: If tidal marsh sampling results indicate that vegetation establishment has not attained a level of 25% ground cover by five years post-construction, then actions to harvest seeds and propagules for planting in the ecosystem restoration feature will be evaluated and implemented if necessary.

Progress Report: Monitoring reports for each pre- and post-construction monitoring action will be provided by December 1 of each monitoring year. These reports will discuss results to date, provide recommendations on potential methods to improve the specific restoration feature.

Literature Cited:

Columbia River Estuary Data Development Program. 1984. Tidal marsh plant production in the Columbia River estuary. Final Report on the Emergent Plant Primary Production Work Unit of the Columbia River Estuary Data Development Program. Woodward-Clyde Consultants.

Hinton, S. A., R. L. Emmett, and G. T. McCabe, Jr. 1992a. Fishes, shrimp, benthic invertebrates, and sediment characteristics in intertidal and subtidal habitats at Rice Island and Miller Sands, Columbia River estuary, 1991. Report to the U.S. Army Corps of Engineers, Contract E96910025, 44 p. plus appendix. (Available from Northwest Fisheries Center, 2725 Montlake Blvd. E., Seattle, WA 98112).

Hinton, S. A., R. L. Emmett, and G. T. McCabe, Jr. 1992b. Benthic invertebrates and sediment characteristics in subtidal habitats at Rice Island, Columbia River estuary, December 1991 and March 1992. Report to the U.S. Army Corps of Engineers, Contract E96920018, 14 p. plus appendix. (Available from Northwest Fisheries Center, 2725 Montlake Blvd. E., Seattle, WA 98112).

Hinton, S. A., G. T. McCabe, Jr. and R. L. Emmett. 1990. Fishes, benthic invertebrates and sediment characteristics in intertidal and subtidal habitats at five areas in the Columbia River estuary. Report to the U.S. Army Corps of Engineers, Contracts E86880158, E8680107, E86900048, 92 p. plus appendix. (Available from Northwest Fisheries Center, 2725 Montlake Blvd. E., Seattle, WA 98112).

Hinton, S. A., G. T. McCabe, Jr. and R. L. Emmett. 1995. In-water restoration between Miller Sands and Pillar Rock Island, Columbia River: Environmental Surveys, 1992-93.

	O&M Year 7	O&M Year 8	O&M Year 11
Tidal Marsh Primary Productivity			
a. Tenasillahe Island Interior Lands	5 sampling stations	5 sampling stations	5 sampling stations
b.Tenasillahe Island Upstream Marsh	5 sampling stations	5 sampling stations	5 sampling stations
c. Quinn Island Marsh	5 sampling stations	5 sampling stations	5 sampling stations
Benthic Invertebrate Productivity			
a. Tenasillahe Island Interior Lands	10 Sampling Stations; 11 cores/station	10 Sampling Stations; 11 cores/station	10 Sampling Stations; 11 cores/station
b.Tenasillahe Island Upstream Marsh	10 Sampling Stations; 11 cores/station	10 Sampling Stations; 11 cores/station	10 Sampling Stations; 11 cores/station
c. Quinn Island Marsh	10 Sampling Stations; 11 cores/station	10 Sampling Stations; 11 cores/station	10 Sampling Stations; 11 cores/station
Juvenile Salmonid Use			
a. Tenasillahe Island Interior Lands	5 trap net locations	5 trap net locations	5 trap net locations
b.Tenasillahe Island Upstream Marsh	5 trap net locations	5 trap net locations	5 trap net locations
c. Quinn Island Marsh	5 trap net locations	5 trap net locations	5 trap net locations
Point Photography			
a. Tenasillahe Island Interior Lands	Two photos/Veg. Sampling Stn.	Two photos/Veg. Sampling Stn.	Two photos/Veg. Sampling Stn.
b.Tenasillahe Island Upstream Marsh	Two photos/Veg. Sampling Stn.	Two photos/Veg. Sampling Stn.	Two photos/Veg. Sampling Stn.
c. Quinn Island Marsh	Two photos/Veg. Sampling Stn.	Two photos/Veg. Sampling Stn.	Two photos/Veg. Sampling Stn.
Monitoring Report	1-Dec	1-Dec	1-Dec

Tenasillahe Islands



 Remove Levee

Figure S4-9 Tenasillahe Island Phase 3 - Long-Term Ecosystem Restoration Feature

Final SEIS