# APPENDIX C

# CHEMICAL SUCCESS CRITERIA (CSC1-2)

## CHEMICAL SUCCESS CRITERION 1
## SEDIMENT / SOIL QUALITY

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**SEDIMENT / SOIL QUALITY.** *The organic content and nutrient content of the sediments and riparian soils should be comparable to reference or comparison sites.*

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***Monitoring Tasks:***

- If plantings do not satisfy BSC1, 2, and 3 above an investigation of soil conditions, such as testing organic and nutrient content of sediments and soils.

- All soil sampling will be done randomly among predetermined 10 -12 meter transects, including 4-6 cores. The transects will be along selected elevations so replicate samples are under a similar tidal regime. Samples subject to seasonal variation may be taken quarterly. Particle size (conducted under PSC5) of marsh soils will be addressed through traditional ecological methods (hydrometer and sieve) to identify sand, silt and clay percentages.

- A measure of total nitrogen in the soil will not differentiate between the organic and inorganic forms of nitrogen yet it will provide valuable information. Nitrogen is either measured as NH4+ after Kjeldahl digestion (APHA 1986) or directly with a CNH analyzer.

***Schedule:***

- Depending on failure to reach BSC1, 2, and 3 above, as needed.

***Contingency Measures:***

- If the sediments do not reflect the necessary anticipated increase in fines or organic material, or if the soils do not have adequate nutrient levels to support target vegetation, soil amendments will be considered.

***Discussion:***

Soil conditions have a major influence on vegetation growth and on organisms that inhabit the rhizosphere of plants (*e.g.*, amphipods, nematodes, microbes). Four variables are especially helpful and may be implemented in predicting the ability of a site to support a functional salt marsh: soil salinity, nitrogen dynamics, organic matter concentration, and redox potential. Nutrient dynamics, organic matter, and redox conditions all interact to control growth rates, which in turn affect the consumers that live among the plant roots. Soils with low organic matter will have low nitrogen-fixation rates and low supplies of the main nutrient that limits plant growth. Soils with high organic matter will develop very negative redox potential, which may restrict the growth of some marsh plants. For example, Cantilli (1989) showed that low redox affected the growth of picklweed. The patterns of salinity, nitrogen dynamics, organic matter accumulation, and redox potential vary. Wetland hydrology determines the chemical and physical nature of salt marsh substrate to a great extent (Mitsch and Gosselink 1986).

## CHEMICAL SUCCESS CRITERION 2
## WATER QUALITY

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**WATER QUALITY.** *In areas where a low salinity marsh is the goal, freshwater quantity needs to be sufficient to provide a surface water salinity regime (<12 parts per thousand) to support emergent intertidal plant species over the entire year. Water quality needs to be high enough to support a healthy growing plant and animal community. Water temperature should not exceed 65 degrees Fahrenheit to support fishery resources.*

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***Monitoring Tasks:***

- Surface water salinity should be determined at multiple locations on the intertidal plant surface using a hand-held salinity meter and probe or a hand-held salinity refractometer (to the nearest ppt). In addition, a data logger may be used to provide a greater range of information, including water temperature, over a period of time.
- Dissolved oxygen may be measured as deemed appropriate.

***Schedule:***

- Periodic and during post-construction Years 1, 2 and 5, especially during spring growth seasons for emergent intertidal marsh plants and, if funding is available, Years 7 and 10.

***Contingency Measures:***

- If emergent intertidal marsh vegetation does not flourish and begin to spread, additional monitoring of quantity and quality of the water needs to be initiated as part of an adaptive management effort. If adequate quality (or in the case of a lower salinity marsh - freshwater quantity) cannot be delivered over the long term then emergent marsh development may need to modified to match the prevailing hydrological conditions.

***Discussion:***

The interface between the high salinity (>25 ppt) marine waters of central Commencement Bay and the fresh water of the Puyallup River and the various shoreline streams, creeks, and seeps provides conditions of intermediate to high salinity where emergent plant communities survive. Historically, extensive marshes edged the Puyallup River delta providing organic debris input to the food chain, habitats for invertebrates, mammals, and birds, and refuges for small invertebrates and juvenile fishes.