RESTORATION ALTERNATIVES

Descriptions of Reasonable Alternatives

Reasonable alternatives, including the No Action alternative were evaluated during the NEPA process. Possible alternatives include active restoration at Otter Point (Alternative 2); and a No Action alternative as required under NEPA (Alternative 1).

Screening Criteria and Included Restoration Actions

The project alternatives proposed were evaluated by NPS, and the Otter Point interdisciplinary team. The team developed criteria to evaluate whether the restoration actions were suitable for the project site. The evaluation criteria ensure that the selected restoration actions not only comply with laws, policies, and regulations pertinent to NPS, but also are technically feasible and consistent with the restoration goals of the park.

The interdisciplinary team and NPS evaluated each restoration alternative against screening criteria to determine whether they met the minimum level of acceptability required to merit further consideration. Evaluations ascertained whether the alternative is consistent with NPS restoration goals. Evaluation criteria also included public health and safety criteria which ensured that the alternative poses no threat to the health or safety of the public or agency staff, and it complies with applicable health or safety requirements and guidelines. Furthermore, the alternative was screened to certify that it complies with the policies and procedures of NPS and confirm that the action can be implemented in a manner consistent with established policies and procedures applicable to the park. Finally, the alternative was screened to affirm that the proposed restoration action complies with all applicable federal, state, and county laws and regulations. The evaluation of each action against each of the screening criteria resulted in either a "yes" or "no" response, for meeting or not meeting the criteria, respectively (See Table 2-1).

Technical Feasibility

One of the primary screening factors in determining technical feasibility of restoration alternatives is whether it would meet the cultural resource restoration goals of NPS. In order to recreate the historic landscape conditions of Fort Clatsop, NPS desires to restore historic channels transecting the Otter Point wetland that will hydrologically reconnect the wetland with the Lewis and Clark River.

During the 2 phased design process to develop potential active restoration alternatives for the Otter Point site, the project engineers reviewed the LiDAR data provided by NPS and conducted ground surveys within the wetland complex. Both LiDAR and field survey data were then integrated into a baseline data set that established boundaries and topographic conditions for the entire project area. LiDAR, confirmed by field surveys of the Otter Point ground surface, revealed 2 historical estuarine channels that formerly traversed the project site (Henderson Land Services 2010: 5). Knowledge of the location and extent of historic channels allowed engineers to perform a hydraulic and hydrologic analysis of the site to determine the extent of tidal inundation if the historic channels at Otter Point were restored. The extensive modeling and analysis performed enabled the interdisciplinary team to evaluate whether the proposed action alternative would achieve the desired goal of

hydrologic reconnection of the Otter Point wetland with the Lewis and Clark River to recreate conditions experienced during the winter of 1805- 1806.

Natural resource restoration goals were also important screening factors in determining the technical feasibility of the restoration alternatives at Otter Point. As per the 2008 Biological Opinion, federal agencies, such as NPS, have a legal responsibility to implement projects that benefit Columbia River Basin salmon. The interdisciplinary team evaluated proposed alternatives based on their ability to meet the cooperative goal of restoring critical habitat for salmonids.

Public health and safety related to flood protection was another chief consideration in screening potential restoration alternatives at Otter Point. In order to ensure that the selected alternative produces no undue burden to the local community, the hydraulic and hydrologic analysis was utilized to determine the extent of tidal inundation expected for the proposed restoration alternatives. A geotechnical analysis of soils at the project site was conducted to determine whether the soil composition was suitable to build a structurally sound realigned levee structure if the historic tidal channels were restored.

Table 2-1 presents an assessment of all reasonable wetland restoration actions against the evaluation criteria, which are described above.

Table 2-1. Restoration Actions Evaluation Table

	Screening Criteria				
Restoration Actions	**Technically Feasible**	**Complies with NPS Policies and Procedures**	**Complies with Laws and Regulations**	**Consistent with NPS Restoration Goal**	**No Threat to Public Health and Safety**
No Active Restoration	Yes	Yes	Yes	No	No
Partial Levee Removal	Yes	Yes	Yes	Yes	Yes
Full Levee Removal	No	No	Yes	Yes	No

Alternative 1: No Action

The first alternative considered for the Otter Point Restoration is the No Action alternative. As implied, under this alternative NPS would not implement the proposed active restoration methods described under Alternative 2. However, the park would continue managing the site through existing methods as part of the General Management Plan.

Current management actions performed at the Otter Point site include wildlife monitoring and invasive vegetation control. Wildlife presence is monitored through elk surveys and wildlife cameras posted within the wetland complex. The Otter Point site is also treated for non-native plants such as Himalayan blackberry and reed canary grass. These existing

management activities are considered part of the No Action alternative for the evaluation process.

Figure 2-1. Existing Otter Point Conditions Map

Alternative 2: Active Restoration of Tidal Wetlands at Otter Point

The second alternative involves active restoration methods to restore historic tidal connection between the Lewis and Clark River and the Otter Point wetland. Preliminary designs for this project were completed in 2008. This initial design phase included ground surveys, soil surveys, hydraulic and hydrologic analysis, geotechnical analysis, a wetland delineation, a preliminary cultural analysis, and an engineering feasibility study to develop a restoration design with the goal of improving estuarine habitat connectivity with the greatest ecological benefit possible while at the same time ensuring that there will be no negative impacts to adjacent landowners.

The project engineer reviewed LiDAR data provided by NPS, while concurrently conducting ground surveys of the site. Both LiDAR and field survey data were then integrated into a

baseline data set that established boundaries and topographic conditions for the entire project area (Henderson Land Services 2010: 5). Examination of LiDAR imaging, as well as ground surveys indicated that 2 historic channel networks transect the Otter Point wetland. Design engineers determined that by removing dredge material within the historic channel networks, and breaching the dike at the 2 locations, the park could effectively restore tidal connectivity to the Otter Point wetland (See Figure 2-2). In order to ensure that the neighboring pasture would not also be inundated, design engineers proposed utilizing the excavated dredge materials from the historic tidal channels to construct a realigned section of the dike along the northern border of the wetland. Along with the constructed enhanced levee, an additional culvert and tide gate would be installed below the levee in the northwestern corner of the property in order to provide additional drainage to the adjacent pasture. The existing culvert and tide gate in the northeastern corner would be replaced with a new culvert and tide gate in the existing location to ensure that current drainage patterns are not negatively altered. Furthermore, a bioswale would be constructed on the northern side of the enhanced levee to provide adequate water storage capacity for surface water drainage during high water events.

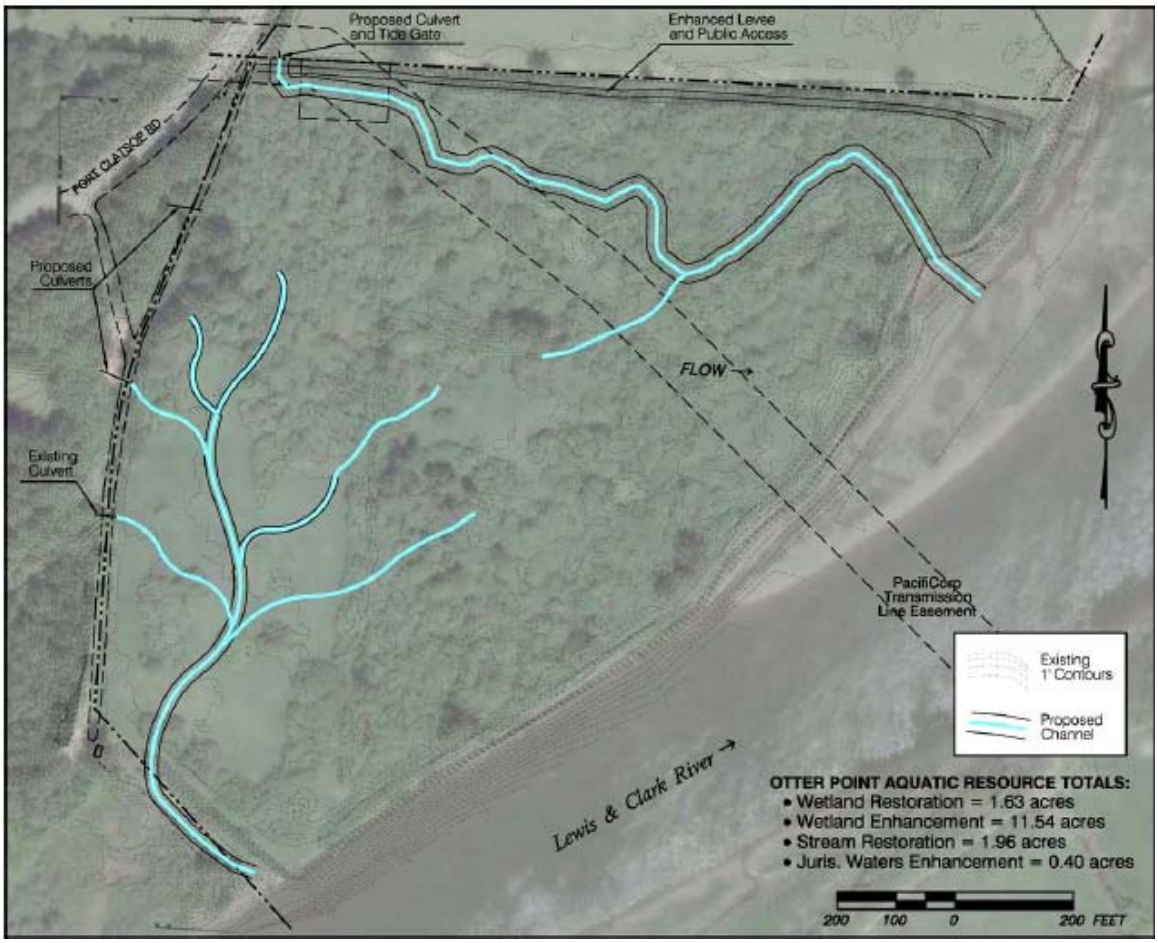

Figure 2-2. Otter Point Alternative 2 Conceptual Map

Selecting the partial dike removal method satisfies the park's General Management Plan by restoring the cultural landscape of Otter Point back to the tidal marsh environment that existed during the 1805-1806 occupation by the Corps of Discovery. This design also complies with the 2008 Biological Opinion by restoring 13 acres of off-channel juvenile salmonids forage and rearing habitat within the Columbia River Basin.

The preliminary design work enabled the park, along with its partners to determine the most practical alternative, and to seek additional funding for advanced design work. Full project designs were completed in March 2010. The refined designs further developed the ideas and models presented in the preliminary project designs, and clarified specifications for construction of the realigned northern levee.

Alternative 2, the enhanced partial levee removal, balances excavation and fill activities on the Otter Point Restoration site. This preferred design restores tidal influence within Otter Point and provides a surface hydrologic connection to the Lewis & Clark River. Restored dendritic tidal channels (totaling 4,952 lineal feet) transecting the site provide tidally-influenced habitat with diverse salinity profiles for salmonid refugia and rearing. Freshwater input from upslope seeps, springs, and intermittent streams is directed into these channels to increase diversity and seasonal productivity of this estuarine habitat. Establishment of small-scale channels and alcoves off of the larger restored channels will provide a diversity of refugia for juvenile salmonids. With reestablished surface connectivity with upslope seeps, springs and intermittent streams, coupled with the anticipated intersection of channel excavation with ground water *in situ*, juvenile salmonids will be presented with a diversity of salinities throughout the project site; this will allow these fish to undergo osmotic regulation and transition while occupying the restored project site. The juxtaposition of small channels and alcoves with upland margin vegetation on portions of the site will enhance opportunities for macroinvertebrate recruitment – an essential component of juvenile salmonid use of historical estuarine channels that has been lost throughout large portions of the Columbia River estuary (Henderson Land Services 2010: 13).

This alternative will also restore topographical diversity found in similar salt marshes by placing and shaping excavated native material adjacent to portions of the levee where spruce trees have become established (typically above the 11-feet NAV88 elevation). These restored and/or enhanced 'islands' will add to the habitat diversity of the Otter Point site, providing such functions as shading and macroinvertebrate recruitment over salmonid-bearing channels, nesting and roosting areas for passerines and waterfowl, and the like (See Figure 2-3). Enhancement of these islands will provide for placement of excess excavated material over that required for enhancement of the northern levee. Slopes of these shaped upland islands are very gradual (minimum 3:1) providing for establishment of a diversity of native plantings. At the toe of each slope, a broad, shallow swale provides for introduction of freshwater and saline-tolerant native herbaceous species as well as provides opportunities for surface drainage back into the Lewis & Clark River (Henderson Land Services 2010: 16).

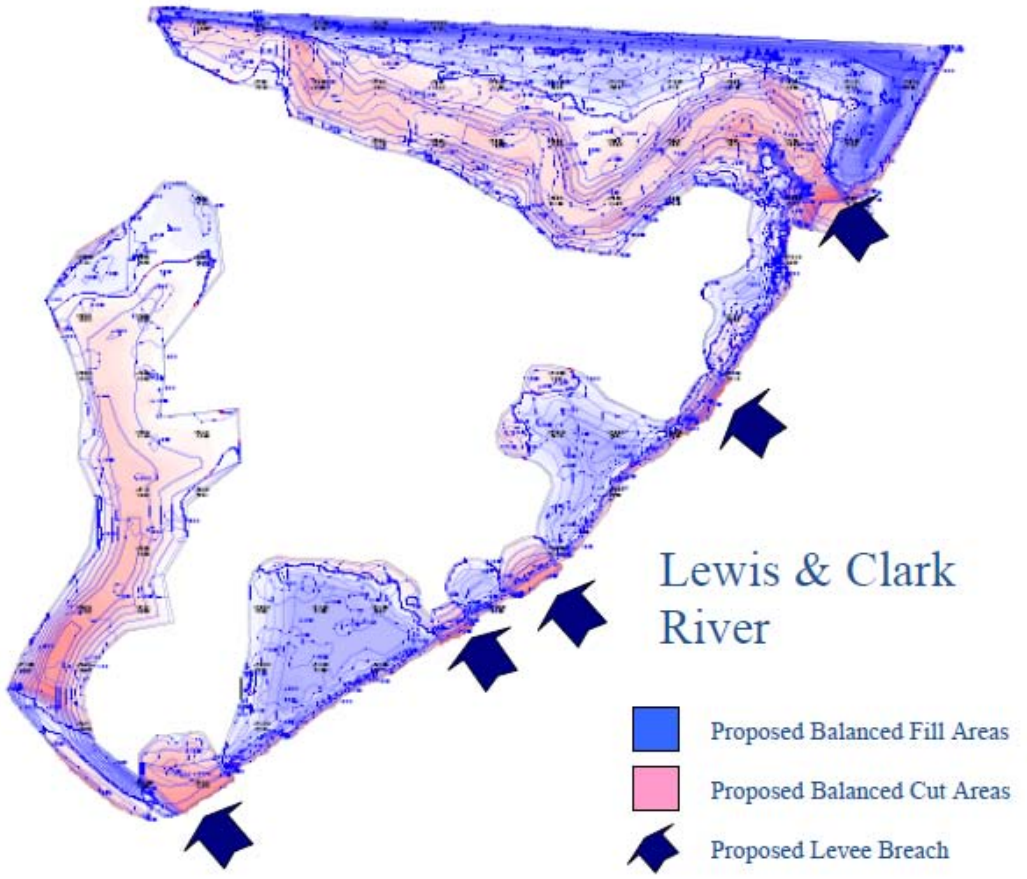

Figure 2-3. Proposed Topographic Diversity at Otter Point Restoration Site

To mitigate the risk of flooding private properties downstream (north) of the project site, the levee along the northern site boundary will be structurally enhanced. This enhancement will involve using dredge spoils obtained adjacent to the existing levee on the riverbank as well as material generated from levee breaching on the eastern edge of the Otter Point site (Henderson Land Services 2010: 16).

Organic material is present in the root zone throughout the restoration portions of Otter Point dominated by reed canary grass. Organic strippings can be blended into proposed structural fill such that the final product contains no more than 10 percent organic content by dry weight. It may be feasible to bury soils with a higher organic content below a depth of 5 feet in the enhanced levee soil matrix, but confirmation of this point will require future analysis. The project design therefore proposes that organic materials are to be excavated and used to fill the existing ditch located on the north of the site; the proposed enhanced levee will extend over and above this buried material.

As designed, the enhanced northern levee will be approximately 1,400 feet long, with a height of 15 feet. The sides of the levee will be constructed with a 2-feet horizontal to 1-foot vertical (2H: lV) slope on the riverward side, and 3-feet horizontal to 1-foot vertical (3H: lV)

on the landward side. Proposed borrow material will be from dredge spoils and the existing Lewis & Clark River levee on the eastern edge of the project site. Segregation of organic rich material and large fragments of wood and plant matter will require visual inspection and a high level of quality control. It is not anticipated that all organic material can be screened from the berm fill; therefore a small amount of organic material is acceptable. Based on site soil sampling, it appears than this material generally consists of fine sand with a varying fraction of particles finer than the U.S. Standard No. 200 Sieve (fines). Some material generated from breaching the existing levee will also be used; this material consists primarily of fines with a varying sand fraction. USACE states that almost any soil is suitable for construction of levees, except very wet, fine-grained soils and highly organic soils (Henderson Land Services 2010: 17).

In addition to breaching the dike and regrading historic tidal channels, NPS elected to further enhance the wetland by removing invasive reed canary grass, and replanting over 15 acres of the wetland with native plant varieties (See Figure 2-4). Although project designs indicate that restoration and diversification of Otter Point's native vegetation communities will be achieved, in part, through the reintroduction of site hydrology and salinity, as well as the physical removal of significant areas of reed canary grass, planting of native species will significantly increase riparian and estuarine wetland habitat diversity – including critical 'edge' habitat – for native mammals and birds (Henderson Land Services 2010: 24).

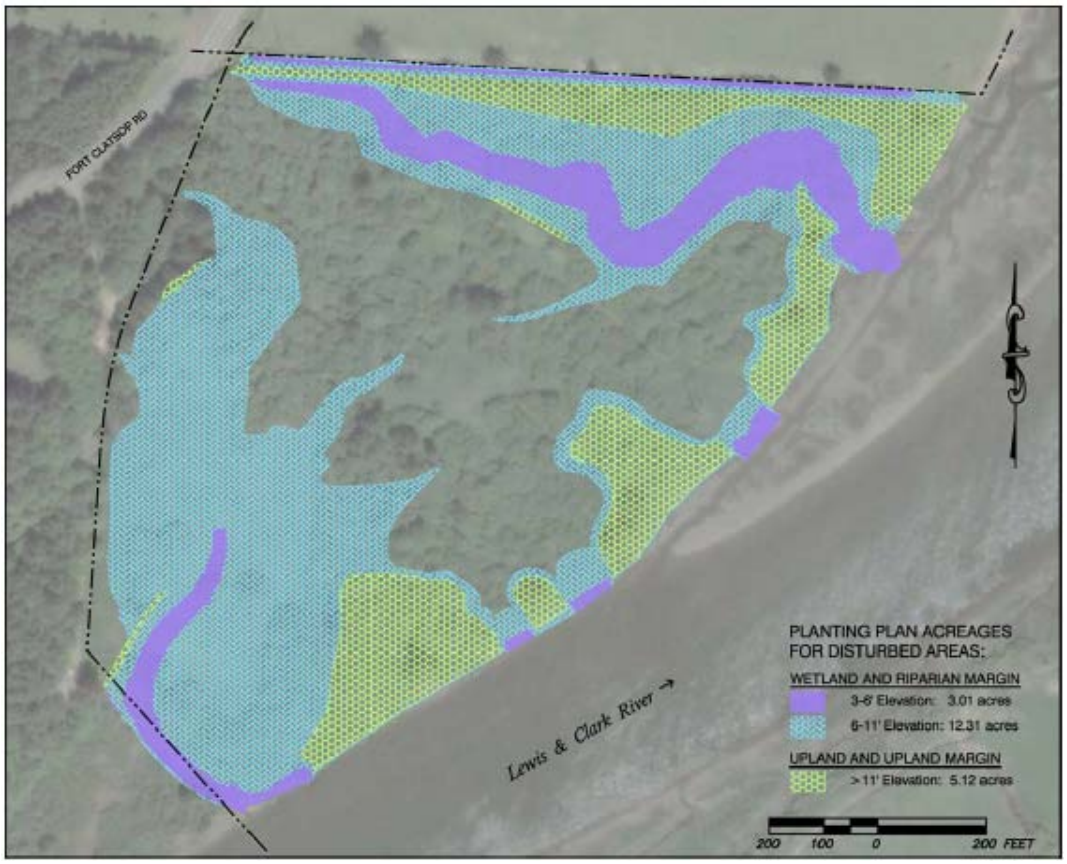

Figure 2-4. Proposed Planting Plan for Otter Point Restoration Site

Tidal wetland acreage restored, in terms of habitat utilization, includes 1.63 acres of uplands that were historically filled with dredge material or diked off and 11.5 acres of low quality fresh water wetlands. Another 8.5 acres of low quality fresh water wetlands would be rendered off-channel habitat for fish usage and salmon refugia. Similar dike breach projects on the Lewis and Clark River have demonstrated increased water quality (e.g. higher oxygen and lower temperatures) after restoration (Henderson Land Services 2010: 24).

Other Alternatives Considered but Eliminated

During the development of this project, several technical restoration actions were considered. The most notable alternative was the design alternative known as the "Full Levee Removal". This alternative involved removing the entire levee, as opposed to portions in specific areas. Ultimately this alternative was not chosen for the following reasons:
1.) Pacific Power and Light has a high voltage transmission line, known as the "Warrenton Spur" that bi-sects the project site. It is the main electrical connection between Astoria and Tillamook. Full removal of the levee could mean complete flooding of the property during extreme flood events. Recent extreme flooding events and severe windstorms in December, 2007 resulted in many downed power lines that crews were not able to access because of flooding and left many customers without power for an extended period of time. This poses a health and public safety concern. Pacific Power and Light must have access to this transmission line in order to repair or protect the transmission line when necessary; if this line goes down, Warrenton and Tillamook are without power. Pacific Power and Light possesses an easement within the project site that allows them access for maintenance, repair and construction. Full removal of the existing levee would compromise the right of access granted in the easement, and would result in potentially intrusive methods of alternate access to the power poles that would nullify portions of the restoration benefits.
2.) The preliminary estimate for grading for full levee removal would have required approximately 50,000 cubic yards of excavation. Construction of the northern levee would 'use' 30,000 cubic yards. The remaining 20,000 cubic yards would have to be disposed of off-site at considerable expense as well as the difficulty in finding a legal location to take the material.
3.) Maintaining or preserving winter habitat for the resident Roosevelt elk in the park is a priority for the NPS. Full levee removal would allow flooding of the Otter Point site, even though it may be an uncommon event; it may prevent higher elevation vegetation communities from transitioning to a spruce/hemlock forest that provides habitat and cover for the resident elk.

NPS Preferred Alternative

The preferred alternative was determined through evaluation by NPS and project stakeholders based on its ability to meet restoration objectives, as well as its potential impact on the environment and surrounding properties. Alternative 2 is the NPS preferred alternative based on its ability to satisfy the requirements of both the NPS General Management Plan/ EIS and the 2008 Biological Opinion, while also meeting other project goals such as having no foreseeable adverse impacts on adjacent properties.

Environmentally Preferred Alternative

The environmentally preferred alternative is the alternative that would promote the national environmental policy expressed in the National Environmental Policy Act.

Section 101(b) of the National Environmental Policy Act identifies six criteria to help determine the environmentally preferred alternative. The act directs that federal plans should:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
- Achieve a balance between population and resource use that will permit high standards of living and wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Generally this means the alternative that causes the least damage to the biological and physical environment. It also means the alternative that best protects, preserves, and enhances historic, cultural, and natural resources (CEQ, 1981). Continuing the current conditions under Alternative 1, the No Action Alternative, NPS would fail to enhance the quality of renewable resources. The Otter Point wetlands system would continue to exist in its degraded condition that provides minimal habitat value to native fish and wildlife. The wetland site would also continue to exist in a condition that does not reflect the historic conditions that were experienced by Lewis and Clark's Corps of Discovery during the 1805-1806 occupation of Fort Clatsop.

Table 2-2. Comparison of Impacts to the Alternatives

	Alternative 1 No Action	Alternative 2 Active Restoration
Physical Environment	The continued isolation from natural nutrient cycling and hydrologic floodplain connectivity would result in minor long-term adverse impacts.	This alternative will actively enhance approximately 21 acres of tidal wetland through removal of invasive vegetation, combined with revegetation of 18 acres with native plants. Reestablishing 4,952 feet of historic tidal wetland will result in minor long-term benefits in flood storage and nutrient deposits within lower portion of the Lewis and Clark River, and major long-term benefits for overall conditions of the Otter Point site itself.
Fish and Wildlife	The continued existence of degraded wetland with limited wildlife habitat value would result in minor long-term adverse impacts. However, elk currently utilize this wetland and seasonal habitat, and would therefore not be negatively impacted.	This alternative would increase the diversity of habitats within the Otter Point wetland system, and therefore would result in major long-term beneficial effects. However, there is a potential for minor short-term adverse effects on elk due to displacement during construction.
Threatened and Endangered Species	The continued isolation from riverine flows and exclusion of juvenile salmonids from off-channel habitat would result in minor long-term adverse impacts.	This alternative would increase off-channel salmonid refugia and provide rearing habitat for juvenile salmon. The end effect would result in major long-term benefits for endangered species.
Historical and Cultural Resources	This alternative would have negligible long-term adverse impacts on historical and cultural resources.	This alternative would help to meet the goals set in the park's General Management Plan to restore diked pasturelands to recreate the historic setting of Fort Clatsop, thereby creating moderate long-term beneficial effects.
Recreation and Visitor Experience	The No Action alternative would not enhance visitor experience; therefore would result in negligible long-term adverse impacts.	This alternative would create the opportunity to use the restored wetland as an educational tool, as well as provide the potential for an expanded trail system and improved viewshed. The end effect would result in moderate long-term beneficial effects.
Land Use	This alternative would not create land use conflicts with adjacent properties, but also would not improve existing conditions. Therefore, the result would be negligible long-term adverse effects.	This alternative would provide increased drainage to the neighboring pasture, thereby creating minor long-term beneficial impacts. However, there is also potential for minor short- term adverse effects due to construction activities.

Table 2-3. Summary of Alternatives Considered

Alternative	Result/ Considerations
Alternative 1: No Action	• Further degradation of the wetland system may occur due to continued spread of invasive vegetation. • Wildlife and endangered species would not benefit from restored off-channel salmonid habitat and diversified estuarine wetland habitat. • Action would not meet Park management goals to restore diked pasturelands to estuarine wetlands, and to recreate the historic riverine setting of Fort Clatsop.
Alternative 2: Restoration Using Active Restoration Approach	• Restoration actions have the potential to improve current wetland conditions by reducing invasive vegetation and restoring tidal flow. • Alternative provides potential for off-channel habitat for endangered species of salmonids as well as a more diverse wetland ecosystem. • Action is consistent with Park management goals to restore diked pastureland and recreate historic setting. • Provided that all regulatory standards are met, action will not adversely affect adjacent land uses.

Mitigation

The action alternative for this project would primarily result in beneficial effects. In areas where there is the potential for either short- term or long-term adverse effects, mitigation measures will be used to minimize negative impacts. Mitigation measures include best management practices (BMPs). BMPs proposed include but are not limited to the following:

- Clearing/grading will be limited to minimum practicable extent.
- There will be no tree cutting or vegetation removal outside of the project area.
- Sediment fencing will be installed along the ordinary high water line to prevent siltation from any adjacent upland work.
- All completed bank sloping & stream channel work will be covered with biodegradable coconut jute mesh netting and re-vegetated.
- All disturbed areas of the project will be seeded with native grass seed and covered with straw after construction is complete to prevent erosion and sedimentation out to Lewis and Clark River.