AFFECTED ENVIRONMENT

This section describes the environment expected to be affected by the Otter Point restoration alternatives proposed in this assessment. The environments/issues discussed include the physical environment, the biological and natural resources, critical habitat, historical and cultural resources, recreation and visitor experience, human health and safety, aesthetics, and Park operations.

Physical Environment

The Otter Point restoration site is located in the Youngs Bay Watershed near the mouth of the Columbia River in Northwest Oregon. The Young's Bay Watershed is the largest watershed in the Columbia River Estuary. The Columbia River Estuary supports some of the largest anadromous fish runs in the world and provides unique habitat for several sensitive and endangered species. Past research shows that the Young's Bay Estuary is one of the Lower Columbia's most bio-diverse areas. The lower Young's Bay Watershed, including the Lewis & Clark River has undergone considerable modification from its former forested, wetland and estuarine habitats. The lower Lewis & Clark River once contained significant Sitka spruce swamp habitat as well as extensive estuarine marshes, freshwater tidal wetlands and bottomland riparian vegetation. Historical logging, grazing and hydrologic manipulation of the river through construction of levees and river channel dredging as well as more recent rural development prevent the natural tidal interactions between the river and adjacent lands. It is estimated that 95% of all bottomlands within the watershed have been lost to diking. Much of the former tidal, estuarine wetlands are now owned by private landowners who actively manage it for agriculture. Due to active land-use of the watershed, very few restoration opportunities are currently available (Young's Bay Watershed Assessment, 2001).

Geology

During the winter of 1805- 1806, the presidentially appointed Corps of Discovery led by Lewis and Clark encamped at Fort Clatsop, named for the Clatsop Indians who inhabited this area. A modern replica of Fort Clatsop sits in the approximate location of the historical fort, and is located a short distance south of the Otter Point Restoration Project site. In the years following the Corps of Discovery's departure, the Clatsop Indians briefly occupied the site, but soon the Fort fell into ruin. By the mid-19th century, the site was being used by newly arrived agricultural settlers, who grazed livestock and grew modest crops along the banks of the Lewis & Clark River (Henderson Land Services 2010: 1).

In the intervening years, Otter Point's landscape was altered from tidally-influenced wetland and estuarine habitat into pastureland. Protective levees were constructed along the site's river frontage to reduce the influence of tides from Young's Bay as well as Lewis & Clark River flows. Materials dredged from the bed of Young's Bay and Young's River to improve shipping access and commerce were pumped into the Otter Point site as fill. With these changes to site elevation and hydrology, the Otter Point Restoration site no longer sustained a native vegetation community as experienced by the Lewis & Clark Expedition and early explorers to the Pacific (Henderson Land Services 2010: 1).

Water Quality

Currently, the Otter Point site consists of degraded freshwater wetland that is fed by freshwater input from upslope seeps, springs and intermittent streams. However, Otter Point is adjacent to the Lewis and Clark River within the tidal zone of the Columbia Estuary. NOAA Fisheries have placed a conservation emphasis on the oligohaline and brackish aquatic transition zones because of their role in acclimatizing sub-yearling salmon to salt water. Loss of these habitats is a major concern in the lower Columbia River Estuary where more than half of historic tidal floodplains and wetland complex have been altered. In addition to reduced habitat complexity, the Lewis & Clark River is listed for fecal coliform on the state's 303(d) inventory of impaired water bodies (Young's Bay Watershed Assessment, 2001).

A culvert and tide gate at the northeastern corner of the Otter Point wetland drains the neighboring pasture through a hand-dug ditch. This ditch provides very little filtration of nutrients and bacteria from livestock carried through surface water runoff. Lack of filtration of flow from the neighboring property likely contributes to the degraded water quality of the Lewis and Clark River. Furthermore, due to a topographical crown in the neighboring pasture, surface water flow on the western portion of the field is unable to drain to the culvert and tide gate, and therefore ponds in the corner of the property.

Hydrology

The Otter Point site is a 33.5 acre wetland that supports a freshwater dominated habitat, which provides little of its historic value to salmonids. The water levels in the estuarine portion of the Lewis & Clark River are influenced by the semi-diurnal tide in the Columbia River. The mean tide range in Astoria, Oregon is more than 6 feet. The FEMA Flood Insurance Rate Map for the project area provides a 100-year flood elevation of 9 feet NAVD88 (Anchor Environmental, 2008: 3).

In its current state, the Otter Point wetland is hydrologically disconnected from tidal and riverine influence. Water sources for this site are primarily seeps, springs, and seasonal flows from upslope sources that are impounded by the existing Lewis & Clark River levee. A tide gate at the river terminus of the northern excavated drainage allows for limited outflow of these impounded surface waters (Henderson Land Services 2010: 10).

Vegetation

Vegetation on the Otter Point site has been influenced by the historic disturbances mentioned elsewhere in this document. The Lewis & Clark River levee prevents tide waters or river flows (typically below 6 feet in elevation, NAV88) from entering the site, therefore, the majority of the plants identified on site were fresh water wetland species. Reed canary grass is the most widespread invasive plant found throughout the site and inhabited much of the PEM wetland habitat (characterized between 6-feet and 11-feet in elevation). Hooker willow forms almost impenetrable thickets of PSS wetland and stands of Sitka spruce are found on old dredge material piles which accounted for the limited upland vegetation communities within the wetland. The vegetative boundary between upland vegetation stands and wet willow thickets occurs at the drip line of the larger spruce trees, and generally at an elevation above 11-feet, NAV88 (Henderson Land Services 2010: 8).

Reed Canary Grass

Reed canary grass is a rhizomatous perennial grass that can grow up to 6 feet in height. Reed canary grass prefers wetland environments in soils that are saturated or nearly saturated most of the growing season, but does not have standing water that persists for extended periods. Due its highly productive nature, this grass species poses a major threat to many wetland ecosystems. Reed canary grass grows so vigorously that it is able to inhibit and eliminate native wetland species that compete for sunlight and nutrients. Unlike native wetland vegetation, dense stands of reed canary grass have little value for wildlife. Few species eat the grass, and the stems grow too densely to provide adequate cover for small mammals and waterfowl. The species is considered a problem weed along irrigation banks and ditches because infestations can increase siltation. When in flower, the species produces abundant pollen and chaff, which aggravate hay fever and allergies (Pojar, MacKinnon 2004: 370).

Soils

The sectional township of the Otter Point area is 17, and this unit consists of soils in tidal areas along the Columbia River and major streams draining into the river. A pedon is comprised of Coquille-Clatsop complex, protected behind the dike, and having 0 to 1 percent slopes. Protected areas of this unit that are protected and drained are used for hay and pasture. Areas that are not protected are used for wetland and wildlife habitat, and soils consist of very deep, very poorly drained silt, loam and muck on flood plains influenced by tides, these soils formed in alluvium (United States Department of Agriculture 1984: 144-145).

Mean annual soil temperature ranges from 49 to 52 degrees Fahrenheit. The difference in mean soil summer and mean winter temperature is less than 9 degrees. The soil is usually saturated and is inundated by high tides unless protected by dikes or levees (United States Department of Agriculture 1984: 144-145).

Soils in the Otter Point area, where diked and drained, are generally extremely acid to very strongly acid, but in some areas soils are strongly acid or moderately acid below depth of 40 in. Where not diked and drained, the soil is medium acid to neutral (United States Department of Agriculture 1984: 144-145).

Soil surveys of the Otter Point site have found large amounts of dredge material throughout the wetland. Dredge material on the site ranges from sand to silt and is 35 to 64 inches deep. A thin layer of partially decomposed organic material was found below the dredge material signifying the historic ground surface. In general, the dredge material was deepest in the southwest corner of the wetland, and shallowest in the northeastern corner (Henderson Land Services 2010: 9).

Fish and Wildlife

In its current state, the Otter Point wetland provides marginal habitat for wildlife including Roosevelt elk, amphibians and a variety of bird species. As part of the Columbia Estuary, the adjacent Lewis and Clark River is habitat for a variety of fish species including cutthroat trout, starry flounder, banded killifish, three-spined stickleback, peamouth chub, Pacific staghorn sculpin, largemouth bass, largescale sucker, norther pikeminno, American shad,

black crappie, pumpkinseed sunfish, shiner perch, carp, goby (Invasive), green sturgeon and southern DPS Eulachon (Of Concern), as well as several species of anadromous fish that are listed as threatened or endangered, and will be described in detail in the next section.

Roosevelt Elk

The Roosevelt elk were an important source of food for the Lewis and Clark Expedition at Fort Clatsop. Elk populations in western Oregon were severely depleted by 1900. Hunting seasons were closed and the state began an active restoration and protection program. Populations in western Oregon increased and hunting was reestablished in 1938. Oregon Department of Fish and Wildlife data indicate that elk populations in Clatsop County are stable in number. Forest management and agricultural practices enhance habitat for elk on lands surrounding the Memorial. Wetland areas also provide important elk habitat (NPS 2010).

Threatened and Endangered Species

The ESA directs federal and state agencies to protect and conserve listed T&E animals and plants. The habitat of T&E species takes on special importance because of these laws, and conservation of these species requires careful management. Federally listed T&E species that may be present at the Otter Point site, or could be potentially affected by the proposed action are described below.

Lower Columbia River ESU Coho salmon (Endangered)

Oregon Coast ESU Coho salmon

The Coho salmon is a species of anadromous fish in the salmon family. coho spawning habitat is small streams with stable gravel substrates. The eggs hatch in the late winter or early spring after 6 to 7 weeks in the redd. Once hatched, they remain mostly immobile in the redd as the alevin life-stage, which lasts for 1 – 2 weeks. Alevin no longer have the protective egg shell, or chorion, and rely on their yolk sac for nourishment during growth. The alevin life stage is very sensitive to aquatic and sedimental contaminants. When the yolk sac is completely reabsorbed, the alevin leaves the redd. Young coho spend one to two years in their freshwater natal streams, often spending the first winter in off-channel sloughs, before transforming to the smolt life-stage. In their freshwater stages, coho feed on plankton and insects, and switch to a diet of small fishes as adults in the ocean (NOAA 2005).

Smolts migrate to the ocean from late March through July. Some fish leave fresh water in the spring, spend summer in brackish estuarine ponds and then return to fresh water in the fall. Coho salmon live in salt water for one to three years before returning to spawn. Some precocious males known as "jacks" return as two-year-old spawners (Dawley et al. 1983).

This species is a game fish and provides fine sport in fresh and salt water from July to December, especially with light fishing tackle. It is one of the most popular sport fish in the Pacific Northwest of the United States. Its popularity is due in part to the reckless abandon which it frequently displays chasing bait and lure while in salt water, and the large number of coastal streams it ascends during its spawning runs. Its habit of schooling in relatively

shallow water, and often near beaches, makes it accessible to anglers on the banks as well as in boats (National Research Council 1996).

Historically, the coho, along with other species, has been a staple in the diet of several Indigenous Peoples, who would also use it to trade with other tribes farther inland. The coho salmon is also a symbol of several tribes, representing life and sustenance (National Research Council 1996).

The traditional range of the coho salmon runs from both sides of the North Pacific Ocean. Salmonid species on the west coast of the United States have experienced dramatic declines in abundance during the past several decades as a result of human-induced and natural factors. The U.S. National Marine Fisheries Service has identified seven populations, called Evolutionary Significant Units, of coho salmon in Washington, Oregon and California. Four of these ESUs are listed under the U.S. Endangered Species Act. These are the Lower Columbia River (threatened), Oregon Coast (threatened), Southern Oregon and Northern California Coasts (threatened), and Central California Coast (endangered). The long-term trend for the listed populations is still downward, though there was one recent good year with an increasing trend in 2001 (Lamb and Edgell 1986: 36).

More than 680,000 coho returned to Oregon in 2009, double that of 2007. The Oregon Department of Fish & Wildlife required volunteers to herd fish into hatchery pens. There were reports of creeks with so many fish that "you could literally walk across on the backs of Coho," said Grant McOmie, outdoors correspondent for a Portland television station. Lower temperatures in 2008 North Pacific waters brought in fatter plankton which, along with greater outflows of Columbia River water, feeding the resurgent populations. The 2009 run was so large that food banks were able to freeze 40 tonnes for later use (NOAA 2010).

Snake River ESU, fall run Chinook salmon (Threatened)
Snake River ESU, spring/summer run Chinook salmon (Threatened)
Mid-Columbia River ESU summer run Chinook salmon
Lower Columbia River ESU, fall run Chinook salmon (Threatened)
Upper Willamette River ESU, spring run Chinook salmon (Threatened)
The Chinook salmon is an anadromous fish that is the largest species in the salmon family. It is a Pacific Ocean salmon that is typically divided into "races" with "spring chinook", "summer chinook", and "fall chinook" being most common. Races are determined by the timing of adult entry into fresh water. Chinook salmon are highly valued due in part to their relative scarcity versus other salmon along most of the Pacific coast (NOAA 2005).

Chinook salmon may spend 1 to 8 years in the ocean (averaging from 3 to 4 years) before returning to their home rivers to spawn. Chinook spawn in larger and deeper waters than other salmon species and can be found on the spawning redds (nests) from September through to December. After laying eggs, females guard the redd from 4 to 25 days before dying, while males seek additional mates. Chinook salmon eggs hatch, depending upon water temperature, 90 to 150 days after deposition. Egg deposits are timed to ensure that young salmon fry emerge during an appropriate season for survival and growth. Fry and parr (young fish) usually stay in freshwater 12 to 18 months before traveling downstream to estuaries, where they remain as smolts for several months (Dawley et al. 1983).

Chinook salmon range from San Francisco Bay in California to north of the Bering Strait in Alaska, and the arctic waters of Canada and Russia (the Chukchi Sea). Populations occur in Asia as far south as the islands of Japan. In Russia, they are found in Kamchatka and the Kuril Islands. Their populations have disappeared from large areas where they used to flourish, shrinking by as much as 40 percent (Lamb and Edgell 1986: 35).

Chinook salmon need food, spawning habitat, ocean habitat, cold, clean, oxygenated water and other salmon to survive. As with all salmonid species, chinook feed on insects, amphipods, and other crustaceans while young, and primarily on other fish when older. Young salmon feed in streambeds for a short period until they are strong enough to journey out into the ocean and acquire more food. Chinook juveniles are divided into two types: ocean type and stream type. Ocean type Chinook migrate to saltwater in their first year. Stream type Chinook spend one full year in fresh water before migrating to the ocean. After a couple of years in the ocean, adult salmon, then large enough to escape most predators, return to their natal streambeds to spawn. Chinook salmon can have an extended lifespan, where some fish spend one to five years in the ocean reaching age eight. More northerly populations tend to have longer lives (Johnson and O'Neil 2001).

Salmon need adequate spawning habitat. Clean, cool, oxygenated sediment-free freshwater is essential for egg development. Chinook prefer larger sediment sizes for spawning than other pacific salmon. Riparian vegetation and woody debris help juvenile salmon by providing cover and maintaining low water temperatures (Johnson and O'Neil 2001).

Juvenile salmon grow in clean, productive estuarine environments and gain the energy for migration. Later they change physiologically to live in saltwater. They rely on eelgrass and other seaweeds for camouflage (protection from predators), shelter, and foraging habitat as they make their way to the open ocean. Adult fish need a rich, open ocean habitat to acquire the strength that is needed to travel back upstream, escape predators, and reproduce before dying (Johnson and O'Neil 2001).

Nine populations of Chinook salmon are listed under the U.S. Endangered Species Act as either threatened or endangered. Fisheries in the U.S. and Canada are limited by impacts to weak and endangered salmon runs. The fall and late-fall run in the Central Valley population in California is a U.S. National Marine Fisheries Service Species of Concern. Species of Concern are those species about which the U.S. Government's National Oceanic and Atmospheric Administration, National Marine Fisheries Service, has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the U.S. Endangered Species Act (NOAA 2005).

Described and enthusiastically eaten by members of the Lewis and Clark Expedition, the Chinook salmon is spiritually and culturally prized among certain Native American tribes. Many tribes celebrate the first spring chinook caught each year with "First Salmon Ceremonies". While salmon fishing is still important economically for many tribal communities, the chinook harvest is typically the most valuable (National Research Council 1996).

Juvenile fall Chinook salmon have been documented in the shallow near-shore areas throughout the Columbia River estuary. They generally move through the estuary rapidly on their way to sea. Juvenile subyearling fall Chinook move into the estuary between January and September, and display bimodal temporal distribution, with peaks in May/June and July/August. There seems to be a trend towards later migration. Declines in the number of subyearling fall Chinook outmigrants typical of June may be associated with high river flows that generally occurs during this period (Dawley et al. 1983).

Yearling fall Chinook migration timing through the estuary is similar to sub yearlings, with one peak in May/June. Like fall chinook salmon, juvenile summer chinook salmon stocks from upriver (e.g. mid-Columbia River) also migrate downstream as sub-yearlings and therefore can not be differentiated from fall chinook salmon by size. The number of summer run Chinook that reach the estuary is smaller than the number of fall Chinook salmon by comparison (Dawley et al. 1983).

Columbia River ESU Chum salmon (Endangered)
Pacific Coast ESU Chum salmon
The chum salmon is also species of anadromous fish in the salmon family. It is a Pacific salmon, and may also be known as dog salmon or Keta salmon, and is often marketed under the name Silverbrite salmon (Lamb and Edgell 1986: 33)

Most Chum spawn in small streams and intertidal zones. Chum fry migrate out to sea from March through July, almost immediately after becoming free swimmers. They spend one to three years traveling very long distances in the ocean. These are the last salmon to spawn (November to January). They die about two weeks after they return to spawn. They utilize the lower tributaries of the watershed and tend to build redds in shallow edges of the watercourse and at the tail end of deep pools. Juvenile chum eat zooplankton and insects. Chum migrate to sea as subyearlings in the 40 to 50 mm range, spending some time rearing and taking refuge in the tributaries, before heading out in January and February. There are few healthy groups of chum remaining in North America outside of Alaska. This is partially because of dams, which block free flow of water and migration of fish (NOAA 2005).

Two populations of Chum have been listed under the U.S. Endangered Species Act, as threatened species. These are the Hood Canal Summer Run population and the Lower Columbia River Population (NOAA 2005).

Lower Columbia River, summer run Steelhead (Threatened)
Lower Columbia River ESU, winter run Steelhead (Threatened)
Middle Columbia River ESU, winter run Steelhead (Threatened)
Upper Willamette River ESU, winter run Steelhead
Oregon Coast ESU, winter run Steelhead (Species of Concern)
Southwest Washington ESU, winter run Steelhead
Snake River Basin ESU Steelhead (Threatened)
The rainbow trout is a species of salmonid native to tributaries of the Pacific Ocean in Asia and North America as well as much of the central, western, eastern, and especially the northern portions of the United States. The (Anadromous rainbow) salmon are known as steelhead (Behnke 1992:65).

Like salmon, steelhead trout return to their original hatching ground to spawn. Similar to Atlantic salmon, but unlike their Pacific Oncorhynchus salmonid kin, steelhead are iteroparous and may make several spawning trips between fresh and salt water. Steelhead smolts remain in freshwater for about a year before heading to sea, whereas salmon typically return to the seas as smolts. Different steelhead populations migrate upriver at different times of the year. Summer-run steelhead migrate between May and October, before their reproductive organs are fully mature. They mature in freshwater before spawning in the spring. Most Columbia River steelhead trout are summer-run. Winter-run steelhead trout mature fully in the ocean before migrating, between November and April, and spawn shortly after returning. The maximum recorded life-span for a rainbow trout is 11 years (Behnke 1992:65).

Steelhead runs migrate through the estuary with similar timing and peak abundance as sockeye and coho salmon; between March/April through August/September with peak migration period during May/June. Steelhead stocks from upriver generally rear upstream and migrate to the estuary as yearlings (Behnke 1992:65).

Rainbow trout are predators with a varied diet, and will eat nearly anything they can grab. Rainbows are not quite as aggressive as brown trout or lake trout (char). Young rainbows survive on insects, fish eggs, smaller fish (up to 1/3 of their length), along with crayfish and other crustaceans. As they grow, though, the proportion of fish increases in most all populations. Some lake dwelling lines may become planktonic feeders. While in flowing waters populated with salmon, trout eat varied fish eggs, including salmon, cutthroat trout, as well as the eggs of other rainbow trout, alevin, fry, smolt and even salmon carcasses. As rainbow trout grow, they lengthen and increase in weight. Unlike other salmonids, the relationship between length and weight is not linear (Behnke 1992:65).

Steelhead trout populations have declined due to human and natural causes. Two West Coast Evolutionarily Significant Units (ESUs) are endangered under the Federal Endangered Species Act (Southern California and Upper Columbia River) and eight ESUs are threatened. The U.S. National Marine Fisheries Service has a detailed description of threats including habitat loss due to dams, confinement of streams in concrete channels, water pollution, groundwater pumping, urban heat island effects, and other byproducts of urbanization. The U.S. National Marine Fisheries Service has identified 15 populations, called Distinct Population Segments (DPSs), in Washington, Oregon and California. Eleven of these DPSs are listed under the U.S. Endangered Species Act (ESA). One DPS on the Oregon Coast is designated a U.S. Species of Concern. Species of Concern are those species that lack sufficient data to determine whether to list the species under the ESA (NOAA 2005).

Historic and Cultural Resources

The Lewis and Clark National Historical Park is a historically zoned park, and therefore, the park's landscape has been defined as a "cultural landscape" under the NPS Management Policies. The cultural landscape at Fort Clatsop is comprised of approximately 125 acres surrounding the fort replica and associated with the historic use and occupation of the site between 1805 and 1806. As a historic site, the primary cultural landscape resource is the reconstructed physical setting which provides an overall interpretive environment for the site. Primary features contributing to the cultural landscape include the clearing immediately

around the fort, the spring site, Canoe Landing, view sheds from the fort site and the Canoe Landing, the trails linking these resources, and the forest defining/surrounding the development. All of these areas have been physically impacted and highly modified since the historic period. To address these impacts, NPS Management Policies call for the management of the landscape to reflect the scene that prevailed during the historic period. Park managers are thus compelled to recreate, to the extent possible, landscape features, and plant and animal communities comparable to those found there in 1805-06 as they undertake major restoration projects of the sort now considered at Otter Point (Deur 2008: 2). The Otter Point property was not part of the original Fort Clatsop Monument, but was donated to the park by the Fort Clatsop Historical Association. As with all boundary modifications undertaken during and after the General Management Plan process, Otter Point was obtained to protect and enhance the natural and cultural resources at the site, and to present visitors with scenery comparable to that encountered by the Corps of Discovery.

Visitor Use and Experience

Lands and waters within the Fort Clatsop Unit of the Lewis and Clark National Historical Park are utilized mainly for preservation, recreation, education and scientific research. Fort Clatsop is open to the public year-round. Due to the nature of the park and its resources, visitors can experience the park by land or by water. Common activities available within the park include walking, biking, historical reenactments and exhibits, kayaking and canoeing.

Just upstream from the Otter Point wetland on the Lewis and Clark River, Netul Landing serves as a launch for non-motorized boats. The launch is part of the Lewis and Clark Columbia River Water Trail, a 146 mile stretch of water that follows the route taken by the Corps of Discovery on the Lower Columbia River. Guided kayak and canoe tours are also available through the park.

The visitor center at Fort Clatsop marks the trailhead for the Fort to Sea Trail, a 6.5 mile trail that runs from the park to Sunset Beach and Seaside. This trail travels along the coastal streams, lakes and dunes that were once traversed by Lewis and Clark.

Enhancing the natural viewshed of Park property creates indirect benefits for Park visitors. The action alternative considered for this project was also designed as such to include the future potential for extended trails that would link this site with the Fort to Sea Trail. Extended trail systems would allow for interpretive signs and guided tours to educate Park visitors about estuarine wetland habitats. This site and the re-designed levee are included in the Warrenton Trails Master Plan, a 26-mile loop connecting state parks, the national park, and other locations. Incorporating the Otter Point site will help to finalize the Warrenton Trail system, which is currently 80% complete.

Land Use

Past land use practices have determined the patterns of development and landscape at the Lewis and Clark National Historical Park. The Otter Point wetland has undergone significant modification since its historic tidal marsh condition due to a variety of land uses. Past land uses have included logging, grazing, agricultural production and disposal for dredge material. Early logging cleared the area now encompassed in the park of first growth forests and opened up fields for agriculture. Through much of the area's past, the predominant land

use in the Fort Clatsop area was agriculture. The land was cleared and used for pastures and the cultivation of moderate crops such as potatoes. Most of the original park lands reverted to forests following a brief agricultural period. The general pattern of development has resulted in second and third growth forests mixed with marginal wetlands (Henderson Land Services 2010: 1).

Today, land use within the park has transitioned from active agriculture and logging to recreational and educational activities. However, the private property immediately to the north of the park is still actively utilized for grazing cattle. In order to protect the interests of the adjoining land owner and maintain conditions suitable for agricultural use, all analyzed alternatives accounted for continued flood protection and drainage of the neighboring property. The active restoration alternative includes construction of an enhanced levee built to specifications that will increase protection from Lewis and Clark River floods. This alternative also includes the installation of a biological treatment swale on the north side of the enhanced levee to treat and carry surface flows from pasturelands into the head of the northern restored channel through a 36 inch culvert with a self-regulating tide gate, as well as through a culvert and tide gate that currently exists in the northeastern corner of the Otter Point site. This design is intended to increase the drainage capacity of the adjacent pastureland by providing increased surface flow outlets.