Final Report

Valsetz Water Storage Concept Analysis

Appendix D
Terrestrial Resources/ Wildlife/ Vegetation

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Terrestrial Resources/ Wildlife/ Vegetation

1 Introduction

This Valsetz Water Storage Concept Analysis is funded by a Senate Bill 1069 [2008] Water Conservation, Reuse, and Storage Grant Program grant awarded by the Oregon Water Resources Commission on November 20, 2008. The grant provides funding for developing information needed to evaluate development of a water conservation, reuse, or storage project in the South Fork Siletz Basin. The funded planning study includes collection of streamflow and environmental information, completion of hydrologic, streamflow, and water demand analyses, development of baseline environmental impacts assessments and completion of a storage concept and alternative analysis.

The purpose of this study is to conduct an appraisal level assessment of potential environmental effects and potential benefits of the Valsetz water storage project. The assessment focuses on three storage concept alternatives determined by dam height and reservoir storage. This analysis serves as a preliminary, concept-level review of the resources that may be affected if a project were developed. This initial investigation relies on existing information, an extremely limited amount of field data and some preliminary modeling and analysis. This is a first step in understanding potential effects in the area that would be inundated by a project and the Siletz and Luckiamute Rivers. Further investigation and technical studies will be required to definitively evaluate the magnitude and type of impacts and feasibility of project development.

The purpose of this Appendix is to estimate where important and existing wetland and terrestrial habitats are located within the immediate vicinity of the historic Valsetz Lake and adjacent uplands and provide a preliminary evaluation of potential impacts of the Valsetz Water Storage Project on those resources. This information is used to examine potential differences between the three reservoir concept alternatives. Known and likely wildlife presence and habitat distribution are provided in this Appendix. Information utilized in this assessment includes established habitat relationships, existing sources of information, contact with resource management agencies, and publicly available information.

Potential impacts of the three dam options on terrestrial resources that were evaluated included direct and indirect impacts of dam construction, operation, and inundation under the three alternatives as well as potential impacts from proposed pipeline routes. Direct impacts of existing wetland habitats were estimated using Oregon Wetlands Geodatabase data. Riparian and other upland habitat impacts were estimated using data from the Northwest GAP Analysis (USGS 2010). Field verification of data were limited.

This document is based on limited data and relies upon many assumptions. The document provides a preliminary assessment of potential project impacts and does not constitute a feasibility analysis for the project. A feasibility analysis would include an assessment of a continuum of data and a broader range of alternatives.

2 Existing Conditions

2.1 Location

The lake and surrounding uplands in the Siletz and Luckiamute watersheds lie within the Coast Range Eco-region as defined by US EPA (Pater et al. 2000) which is characterized by wet winters and relatively dry summers. This climatic regime, topography, soils, historic

development and land uses and other natural conditions influence the vegetation cover types and processes that occur in the eco-region.

Most of the land within the potentially affected areas of the Project consists of commercially managed timberlands. Forests in the project vicinity are composed predominately of even aged stands of Douglas fir (*Pseudotsuga menziesii*) interspersed with low numbers of other tree species. Leave strips of riparian forest habitats are left unharvested within riparian management zones adjacent to streams. These riparian forest associations tend to be composed of older and more diverse tree assemblages and understory associates.

2.2 Wetland Habitats

Wetlands and freshwater aquatic habitats are among the conservation strategy habitats for conserving sensitive and other species of fish and wildlife within Oregon (ODFW 2006). Among the stated goals of the conservation strategy are to maintain healthy fish and wildlife populations by maintaining and restoring functioning habitats, preventing declines of at-risk species, and reversing declines in these resources where possible. This strategy focuses on a suite of species and habitats that are in greatest need of conservation.

The distribution of wetland habitats is based on data from Oregon Wetlands Explorer for wetlands (Oregon Wetlands Geodatabase 2009), which follows the USFWS classification system (Cowardin et al. 1979). This database includes wetlands identified by The Wetlands Conservancy identified through interpretation of aerial photographs from 2005, the National Wetlands Inventory, and other sources. ENVIRON staff conducted limited reconnaissance-level field verifications of this data.

The Oregon Wetlands Explorer identifies moderately extensive palustrine forested (PFO) and scattered scrub-shrub (PSS), emergent (PEM) and excavated (PUBH) wetlands within the historic footprint of the old lake (Figure 1). In addition, the Natural Resources Conservation Service has mapped relatively extensive areas within the floodplain on the valley floor in the vicinity of the historic lake bed as Brenner Silt Loam series soil (Figure 2), a hydric soil (NRCS 2010). Areas on the valley floor mapped as having hydric soils may contain additional wetlands. Though some of these areas are within areas mapped as wetlands in the Oregon Wetlands Explorer database, large areas identified as having hydric Brenner Silt Loam soil are outside the areas mapped as wetland. In addition, there may be additional narrow fringing forested, scrub-shrub, or emergent wetlands associated with the numerous small intermittent and perennial streams that flow into the old lake bed that also are not mapped as wetlands.

Some early studies of the old lake bed were completed for Boise Cascade (now Forest Capital, LLC) from 1989 to 1993 to evaluate the change in wetland area after removal of the old dam at Valsetz. The study used the outdated Unified Federal Manual wetland delineation methods[1] (FICWD 1989). Another study of existing wetland vegetation communities and wildlife use was completed to identify existing resources and assess potential impacts from a proposal to raise

[1] Delineation of wetlands now requires the use of the Western Mountains Valleys and Coast Region supplement to the 1987 Corps wetland delineation manual (Corps 2010)

the dam height, which was later abandoned by Boise Cascade. These studies provide somewhat old, but site-specific data on plant species composition, geomorphology, and hydrology of wetlands evolving within the old pool area and tributary streams following dam removal. The post dam removal wetland study concluded the acreage of wetlands after dam removal was similar to the area that existed before removal of the dam, though the types of wetlands changed (Sharp and Wilson 1992).

The total estimated wetland area within the old lake bed, based on the five year monitoring program, was 170 acres (69 hectares), consisting of a mixture of palustrine forested (PFO), scrub-shrub (PSS), and emergent (PEM) wetlands. Palustrine broad-leaved deciduous forested wetlands, which have evolved in organic-rich sediments deposited behind the old dam near the north end of the historic lake, comprise most of the estimated total acreage within the proposed project vicinity. In 1992, four years after the old dam was removed, trees were about 10 feet tall (Sharp and Wilson 1992). Trees are much larger now as is evident on the contemporary aerial photograph and during the reconnaissance-level surveys. Species observed in these forested wetlands include early successional tree species, such as red alder (*Alnus rubra*), willows (*Salix* spp.), which are species typical of wetlands within the eco-region. Understory associates include small-fruited bulrush (*Scirpus microcarpus*), northern bugleweed (*Lycopus uniflorus*), water parsley (*Oenanthe sarmentosa*), and various sedges.

PFO, PSS, PEM, and unconsolidated bottom (PUB) and unconsolidated shoreline (PUS) wetlands are relatively minor cover types that comprise the balance of wetlands in the vicinity of the potential project. Plant species typical of scrub-shrub and emergent wetlands in the eco-region and observed in the wetlands within the old lake bed include a mixture of broad-leaved shrubs, emergent plants, grasses, sedges, and rushes. Some of the species common in these wetland types and observed in lake bed wetland communities include willows, red-osier dogwood (*Cornus sericea*), spiraea (*Spiraea douglasii*), European burreed (*Sparganium emersum*), lady's thumb (*Polygonum persicaria*), marshpepper (*Polygonum hydropiperoides*), marsh seedbox (*Ludwigia palustris*), devil's beggar-ticks (*Bidens frondosa*), weak mannagrass (*Puccinellia pauciflora*), western water-hemlock (*Cicuta douglasii*), soft rush (*Juncus effusus*), sawbeak sedge (*Carex stipata*), spike bentgrass (*Agrostis exarata*), and small-fruited bulrush. Historical studies (Davis 1985; Sharp and Wilson 1992) provide a more detailed list of plant species observed in wetlands at the historic lake.

In addition to the more common PFO, PSS, and PEM wetland types found throughout the region, there are some less common PSS and PEM fen wetland plant associations that are part of the Fanno Meadows Preserve in the headwaters of the Little Luckiamute River. Fens are a type of peatland and less common in the eco-region and statewide and support a number of rare plants. Fanno Meadows Preserve, a series of peatlands and associated upland plant communities, contains 20 native plant associations and is one of only two known high-elevation peatlands in the Coast Range eco-region, which share elements of both low elevation coastal peatlands and those of the northern Cascade Range (Christy 2001). Fens are among identified high priority conservation habitats (ODFW 2006) in part because of the rare plant populations that they often support.

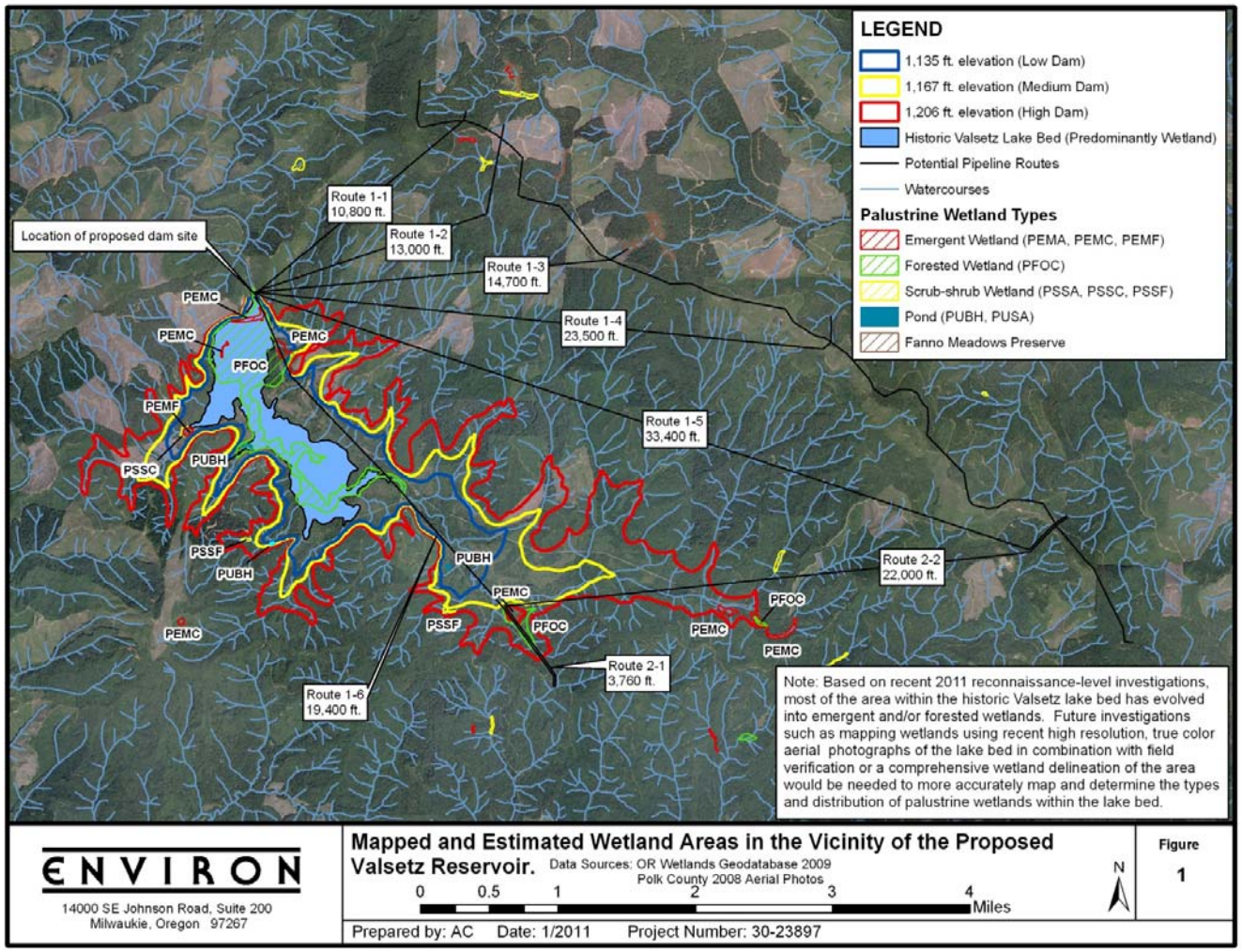

Figure 1. Mapped and Estimated Wetland Areas in the Vicinity of the Proposed Valsetz Reservoir.

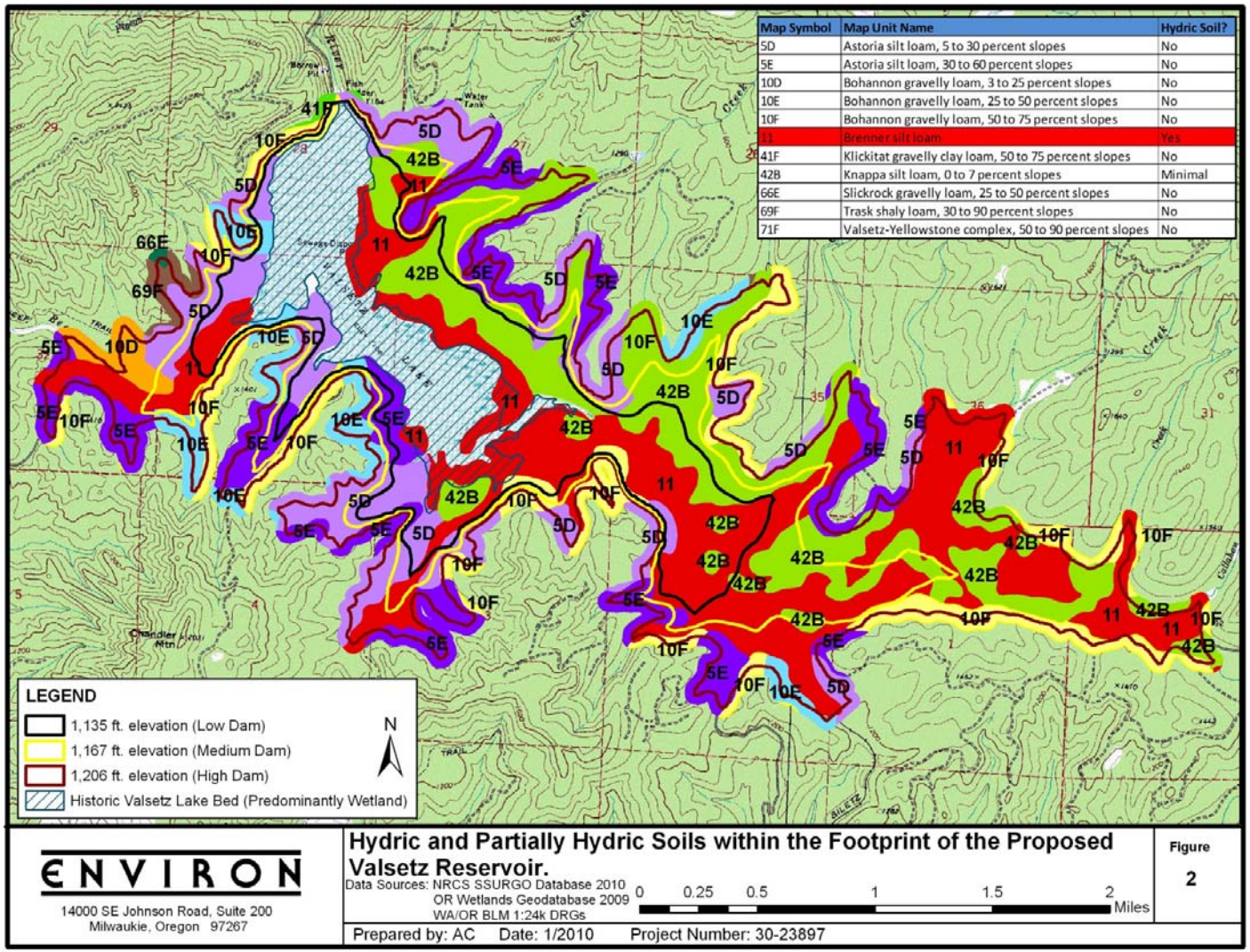

Figure 2. Hydric and Partially Hydric Soils within the Footprint of the Proposed Valsetz Reservoir.

2.3 Riparian, Forested, and Grassland Upland Habitats

The primary source of terrestrial habitat types used to identify existing conditions and evaluate potential impacts of the alternatives included cover or habitat typing identified by the Northwest GAP Analysis Program (USGS 2004). The Gap Analysis cover types are based on the National Vegetation Classification Standard. This National Vegetation Classification Standard (NVCS) has many different classification levels. Because of the managed nature of the vegetation in the vicinity of the proposed project, level 3 of the NVCS was used. According to the NVCS (Federal Geographic Data Committee 2008), level 3 is a vegetation classification unit of high rank defined by combinations of dominant and diagnostic growth forms that reflect global macroclimatic conditions as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions. Cover type data from this database has been supplemented by limited site-specific investigations done by others and limited reconnaissance-level, field verification of the mapped habitat types by ENVIRON staff.

Riparian forest types are water influenced plant assemblages associated with streams and rivers terraces, shorelines of lakes, and floodplains. These may consist of predominantly broad-leaved deciduous stands or a mixture of evergreen and broad-leaved deciduous tree species. Forested uplands are typically found on the steeper slopes and are characterized by more well drained soils and drier-adapted plant associations. Upland forests may consist of a mixture of evergreen and broad-leaved deciduous forest types. In the Coast Range eco-region and throughout Oregon, conifer forests dominate the landscape (Franklin and Dyrness 1988).

According to the Northwest GAP Analysis data, the five most common cover types (level 3 NVCS) in the vicinity of the lake and/or pipeline routes are (in descending order of abundance) (Figure 3):

- Harvested Forest – Tree Regeneration
- North Pacific Maritime Mesic to Wet Douglas fir – Western Hemlock Forest
- North Pacific Maritime Dry-Mesic Douglas fir – Western Hemlock Forest
- North Pacific Lowland Riparian Forest and Shrubland
- North Pacific Lowland Mixed Hardwood - Conifer Forest and Woodland

Four other cover types are much less common within the project vicinity. The last three are among identified priorities for conservation:

- North Pacific Dry Douglas fir – (Madrone) Forest
- North Pacific Oak Woodland
- North Pacific Herbaceous Bald and Bluff
- North Pacific Bog and Fen

2.4 Harvested Forest Habitats – Tree Regeneration

Harvested, regenerating forest types are, by far, the most abundant cover types in the project vicinity. They are typically characterized by relatively young, even-aged stand conditions and

are prevalent throughout the eco-region. These include small areas where most of the vegetative cover may now be formed by grasses or shrubs. Some small, recently burned areas that have been replanted with conifers also are included. Regenerating forests are characterized by a mixture of native and introduced species. Douglas fir (*Pseudotsuga menziesii*) is among the dominant tree species in these managed stands. Understory associates vary depending on stand age but include a mix of common native, non-native, and invasive trees, shrubs, and forbs, such as those identified as occurring in the cover types described below.

North Pacific Mesic-Wet Douglas fir – Western Hemlock Forest

North Pacific Maritime Mesic to Wet Douglas fir - Western Hemlock Forest is an abundant habitat covering relatively large, contiguous areas predominantly on the slopes above the proposed reservoir. According to the NatureServe Explorer (2011) description of this association, it differs from the North Pacific Maritime Dry-Mesic Douglas fir-Western Hemlock Forest primarily in having more hydrophilic understory associates, moister soils, higher abundance of shade tolerant trees, higher stand productivity, and lower fire frequency. Dominant trees include Douglas fir, western hemlock (*Tsuga heterophylla*), and sometimes western red cedar or Port Orford cedar (*Chamaecyparis lawsoniana*). Big-leaf maple and red alder are codominant in managed forests, such as this area. Depending on canopy structure shrub and herb layers range from poorly to well developed. Salmonberry, Devil's club (*Oplopanax horridus*), sword fern (*Polystichum munitum*), and Oregon oxalis (*Oxalis oregona*) are typical understory associates. More detailed information about the native coniferous forest plant associations and habitats in the Coast Range eco-region can be found in Franklin and Dyrness (1988) and McCain and Diaz (2002).

North Pacific Maritime Dry-Mesic Douglas fir-Western Hemlock Forest

This forest type also is abundant and covers large areas primarily on the higher slopes within the project area. Douglas fir is the dominant overstory tree beneath which is generally a subcanopy of western hemlock (NatureServe Explorer 2011). Understory associates are characterized by species of this somewhat drier ecotype and include salal (*Gaultheria shallon*), dull Oregon grape (*Mahonia nervosa*), vine maple (*Acer circinatum*), rhododendron, twinflower (*Linnaea borealis*), vanilla leaf (*Achlys triphylla*), evergreen huckleberry (*Vaccinium ovatum*) and sword fern. The shrub layer varies from poorly to well developed, depending on canopy closure.

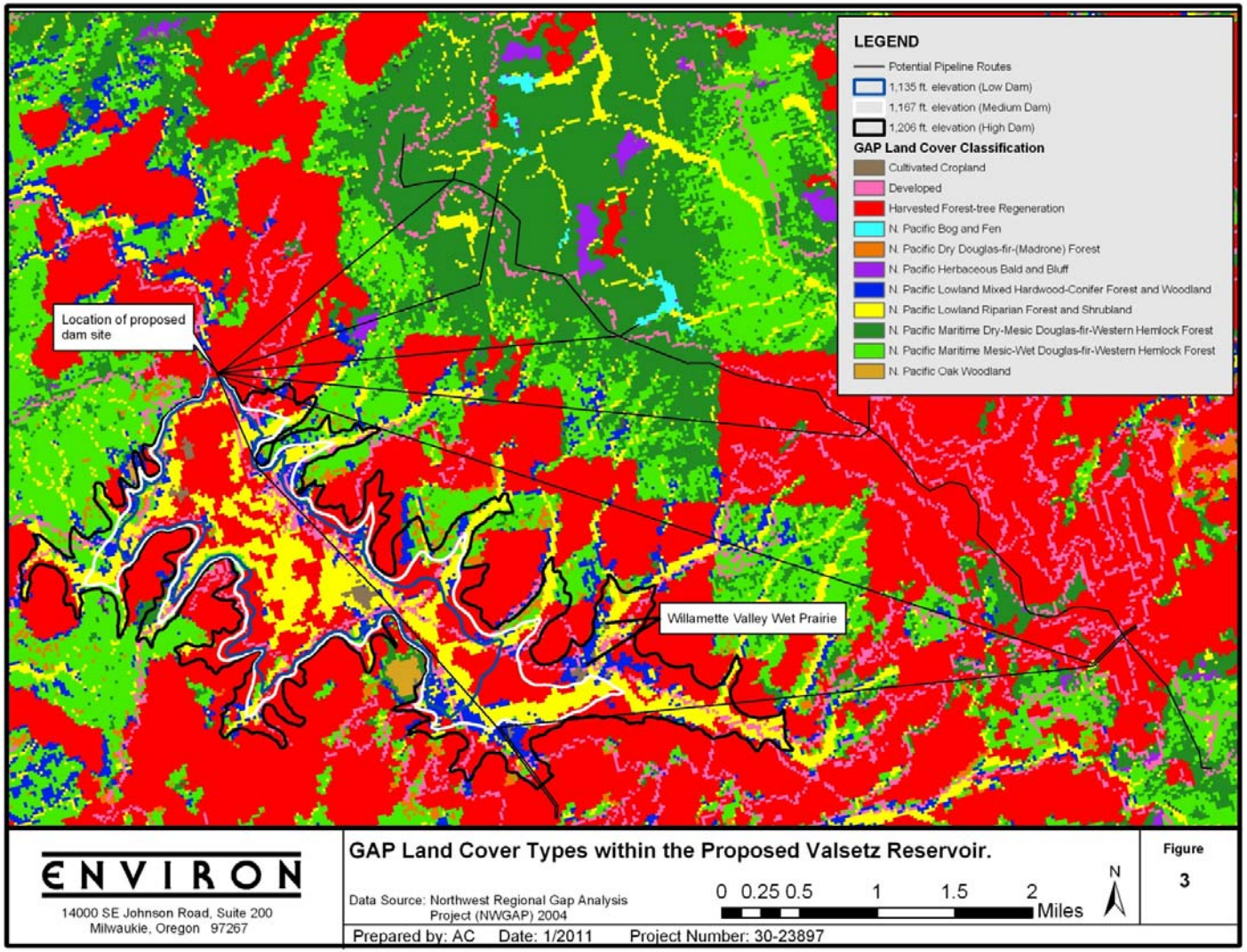

Figure 3. GAP Land Cover Types within the Proposed Valsetz

North Pacific Lowland Riparian Forest and Shrubland

Riparian forest cover types are another abundant habitat type that covers relatively large expanses within the proposed reservoir and adjacent upland areas and in association with the many streams flowing into the South Fork Siletz River valley bottom. These habitats are associated with floodplains and lower terraces of streams. Where associated with streams, these tend to be relatively narrow, linear features. Red alder, willows, black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), big-leaf maple (*Acer macrophyllum*), western red cedar, and Oregon ash (*Fraxinus latifolia*) are among the dominant tree species in North Pacific Lowland Riparian Woodland and Shrubland. Common understory associates include salmonberry (*Rubus spectabilis*), red-osier dogwood, lady fern (*Athyrium filix-femina*), and many other broad-leaved shrubs and forbs. Franklin and Dyrness (1988) and McCain (2004) are excellent sources for more detailed descriptions of plant associations, structure, and functions of riparian forest ecotypes in the Coast Range. Riparian cover types provide many important functions (Naiman et al. 2005; Apostle and Sinclair 2006). The canopies of these forests help maintain cool water temperatures by providing shade, which is critical to cold water dependent species, such as salmonids. Roots of trees and shrubs help stabilize streambanks preventing erosion and also filtering suspended sediments in overbank, flood flows. Riparian vegetation also provides leaves and large woody debris that provide food and habitat for aquatic organisms. LWD recruited from riparian zones is a critical component of aquatic habitats contributing to the formation of pools and sorting substrate. Composition of riparian plant communities is influenced by the punctuated disturbance regimes, such as flooding and debris torrents (ODFW 2006, Naiman et al. 2005). This disturbance regime contributes to the dominance of early successional or pioneer species.

North Pacific Lowland Mixed Hardwood-Conifer Forest and Woodland

North Pacific Lowland Mixed Hardwood-Conifer Forest and Woodland is another relatively common upland habitat primarily found on valley terraces and slopes at lower elevations (NatureServe Explorer 2011) around the margins of the proposed reservoir. On unmanaged lands, these forests are typically composed of large Douglas fir, western red cedar (*Thuja plicata*), grand fir (*Abies grandis*), western hemlock and/or Sitka spruce (*Picea sitchensis*). Deciduous trees are usually codominant and include big-leaf maple, Oregon white oak (*Quercus garryana*), red alder, cascara (*Frangula purshiana*), and mountain dogwood (*Cornus nutallii*). In the absence of disturbance, succession is towards dominance by conifers though big-leaf maple may persist in the overstory. Characteristic understory associates include vine maple, beaked hazelnut, Indian plum, Pacific blackberry (*Rubus ursinus*), common snowberry (*Symphoricarpos albus*), and poison oak (*Toxicodendron diversilobum*). Evergreen shrubs, including salal, dull Oregon grape and forbs, such as sword fern and Oregon oxalis, can be dominant.

North Pacific Dry Douglas fir-(Madrone) Forest

This is one of the less abundant cover types, which occurs in small patches within the project vicinity but is more common in the Willamette Valley. It tends to be associated with dry to mesic sites up to elevations of about 4,000 ft (1,220 m) in the mountains (NatureServe Explorer 2011). Within the project area, it is mapped as occurring in relatively small patches. Dominant trees in this forest type are Douglas fir, Pacific madrone (*Arbutus menziesii*), shore pine (*Pinus*

contorta), big-leaf maple, and grand fir. Salal, oceanspray (*Holodiscus discolor*), and baldhip rose (*Rosa gymnocarpa*), and poison oak are among the dominant understory associates.

North Pacific Oak Woodland

Within the vicinity of the project, this is a minor habitat type occurring in small patches on drier, well drained, low elevation sites, which historically had a high fire frequency. Vegetation is variable, according to NatureServe Explorer (2011), but is generally characterized by more open savanna dominated by Oregon white oak. Douglas fir is commonly a codominant tree. Roemer's fescue (*Festuca roemeri*), poison oak and blue wildrye (*Elymus glaucus*) are among the dominant understory associates reported for oak woodlands within the eco-region (Kagan et al. 2004).

North Pacific Herbaceous Bald and Bluff

North Pacific Herbaceous Bald and Bluff is another less common community occurring in small patches, which is important to conservation of populations of a number of rarer plants and animals. Montane grasslands, such as balds, are another conservation strategy habitat identified by ODFW (2006). These habitats often support rare plant species and associate sensitive invertebrate pollinators, such as butterflies. Within the Oregon Coast Ranges, these are associated with thin soils on top of bedrock on or near mountain summits that support meadow vegetation generally described as grass balds (Franklin and Dyrness 1988). There are a few bald habitats, such as the one associated with Fanno Peak, in the vicinity of the project but no site-specific information regarding plant species composition. Franklin and Dyrness (1988) describe some of the plant associations and characteristics of grasslands or balds often associated with mountains in the Coast Range. According to ODFW (2006), grasslands in the Coast Range eco-region are particularly important to the conservation to some species of rare plants and invertebrates because an estimated 99 percent of these have been lost since European settlement and such habitats are now rare. Conservation strategy species supported by these grasslands vary by eco-region but are reported by ODFW (2006) to include elegant fawn lily (*Erythronium elegans*), bristly-stemmed sidalcea (*Sidalcea hirtipes*), Cascade Head catchfly (*Silene douglasii* var. *oraria*), Nelson's Sidalcea (*Sidalcea nelsoniana*), Lawrence's milk-vetch (*Astragalus collinus* var. *laurentii*), Spalding's campion, and Tygh Valley milk vetch (*Astragalus tyghensis*).

North Pacific Bog and Fen

North Pacific Bog and Fen is another uncommon ecotype that is limited to some low lying, flat areas within the Little Luckiamute River. This peatland wetland is found in association with upland plant associations that are part of the Fanno Meadows Preserve and is described in more detail above in Section 1.2 Wetland Habitats.

2.5 Wildlife and Plants

The old Valsetz Dam was removed in 1988. Prior to removal of the dam, an inventory of plant and animals around the historic Valsetz Lake was conducted in 1984 and 1985 for Boise Cascade (Davis 1985). Llewellyn and Bayer (1994) recorded incidental observations of waterbirds at Valsetz Lake in January 1985 and June 1988, before removal of the dam. Other sources of information on likely presence or rare, threatened, or endangered animals and plant

and the use of existing habitats by these biota include data obtained from the Oregon Biodiversity Information Center, Oregon Wetlands Explorer, Oregon Flora Project, USFWS Threatened and Endangered Species Program, Oregon Department of Fish and Wildlife's (ODFW) Oregon Conservation Strategy (2006), and consultations with natural resource professionals working for the ODFW, U.S. Forest Service, and Confederated Tribes of Siletz Indians. Because most of the lands within the project vicinity are privately owned, natural resource professionals with these agencies have no site-specific data.

A variety of species of fish and wildlife are associated with the habitat types within the proposed project area. In general, species diversity is directly correlated with habitat complexity and diversity. Because most of the lands within the proposed project area are working timberlands and relatively young, they generally do not contain the structural diversity and complexity of older, unmanaged wetland and forest cover types in eco-region and support a less diverse array of native flora and fauna. The structure and complexity of the managed forests is likely to change over time as timber reaches a harvestable size and is removed. Microhabitat diversity and habitat structures found in older, more mature, unmanaged wetlands and upland forests such as large snags and downed logs in various decay classes are likely uncommon or absent. In addition, invasive plants and animals are often more common on disturbed lands, further reducing the quality of habitat to which native flora and fauna have adapted and depend upon to complete their life histories and have sustainable populations. Habitat fragmentation caused by roads and other development within the eco-region has also reduced the quality of remaining existing habitats. Consequently, populations of habitat generalists are more pervasive than those of habitat specialists.

There are a multitude of common plants and animals found in the wetlands, riparian, and other forested habitats in and around Valsetz within the vicinity of the water storage project. Davis 1985) compiled a list of observed bird species observed in and around Valsetz Lake and adjacent wetland and upland habitats in monthly surveys completed between June 1984 and July 1985. Her observations included numerous neotropical migrant and resident songbirds, waterfowl, and raptors, including several sensitive species. A list of observed or likely animals that may be present in the vicinity and habitat associations is provided in Attachment A.

In addition to birds, existing wetlands, riparian, and other forested habitats are known to support a variety of other animals common in the region as well as some sensitive species. In a comment letter on the Boise Cascade proposal to construct a hydroelectric project at the lake, the USFWS (1984) identified Columbia black-tailed deer (*Odocoileus hemionus columbianus*) and elk (*Cervus canadensis*) as the primary big game animals in the area but indicated black bear (*Ursus americanus*) also are present. Wildlife officials also added that upland game, furbearers, small mammals, reptiles, and amphibians are common in the area.

Riparian forests and wetlands are widely recognized for supporting a variety of wildlife species because they provide food, water, shelter, and cover. Brown (1985) reported that 359 species use riparian zones or wetlands during some season(s) or part(s) of their life cycle. A number of species of plants and animals are wetland dependent, including some rare or species of concern. Wetland dependent species include beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and Oregon spotted frog (*Rana pretiosa*). Many mammals, including elk, deer,

black bear and bats, forage in or over wetlands on the plants or insects produced by them. Riparian areas also are important as they function as migration corridors for various species between aquatic, wetland, and terrestrial habitats.

In addition to supporting diverse array of ecologically important species, riparian areas, wetlands, and adjacent forests also support culturally important species. Culturally important species for the Confederated Tribes of Siletz Indians include a variety of traditionally important plants and animals use as sources of food, for rituals, medicine, and other uses. Traditional uses likely varied depending on the time of year that these sources of food were available. Some of the species that were likely important for tribal peoples include Columbian black-tailed deer, elk, bald eagle, salmon and steelhead, black bear, and smaller game animals. Other animals, such as porcupine, various birds, and mustelids may havebeen prized as both sources of food and for quills, feathers, or fur that were used to decorate or make clothing more functional. Tillamook Indians reportedly had distinct summer and winter resource use patterns. Various berries, for example, ripen at different seasons typically in the summer and fall. Other fall foods included Chinook, coho and chum salmon.

2.5.1 Threatened and Endangered Animals and Plants

According to the USFWS (2010), there are 50 species of federally-listed threatened or endangered species that occur in Oregon. Far fewer federally-listed threatened or endangered species are identified on the USFWS list of species that may occur in Polk County, Oregon (Table 1). According to this list, there are three bird, two invertebrate, and eight plant species listed as threatened or endangered under the Endangered Species Act (16 U.S.C. § 1531 et seq.) or Oregon's Endangered Species Act (ORS 496.171 to 496.192 and 498.026) that may occur within the vicinity. Based on known habitat requirements and distributions of species identified in USFWS species fact sheets and recovery plans and by data published by the Oregon Biodiversity Information Center (OBIC 2010) and the Oregon Flora Project (2011), there does not appear to be suitable habitat for many of these species within the potential reservoir footprint, pipelines, or waters of the South Fork Siletz River and Little Luckiamute River that would receive discharges from the pipelines being considered or they are not known to occur within the Coast Range eco-region. For example, marbled murrelet and northern spotted owl are two species that are typically found within late successional or old-growth forests. There appears to be little, if any, late successional or old-growth forests within the vicinity of the proposed project, though the USFWS critical habitat mapper identifies some marbled murrelet habitat near the east end of the valley that is within about 100 feet of the pool area for the high dam option. Golden paintbrush is reportedly extirpated in Oregon and is typically found in gravelly glacial outwash prairie (USFWS 2011b), which does not appear to occur within areas potentially affected by the proposed project.

Table 1. Federal- and state-listed threatened or endangered plants and animals that may occur within the project area.

Scientific Name	Common Name	Federal Status[a]	State Status[b]	Habitat Associations
Birds				
Brachyramphus marmoratus	Marbled murrelet	T	T	Late successional or old-growth forests
Haliaeetus leucocephalus	Bald eagle		T	Riparian forests, rivers
Strix occidentalis caurina	Northern spotted owl	T	T	Late successional or old-growth forests
Invertebrates				
Icaricia icarioides fenderi	Fender's blue butterfly	E		Native prairie, balds
Speyeria zerene hippolyta	Oregon silverspot butterfly	T		Montane grasslands, balds
Plants				
Castilleja levisecta	Golden paintbrush	T	E	Extirpated in OR; gravelly, glacial outwash prairie
Erigeron decumbens var. *decumbens*	Willamette daisy	E	E	Native prairie, Willamette Valley Wet Prairie
Erythronium elegans	Elegant fawn-lily	SOC	T	Meadows, fens, open forests
Howelia aquatilis	Water howelia	T	T	Ponds, sloughs, lakes
Lilium occidentale	Western lily	E	E	Fens, forested wetlands
Lomatium bradshawii	Bradshaw's Lomatium	E	E	Wet prairie
Lupinus sulphureus ssp. *kincaidii*	Kincaid's lupine	T	T	Native prairie, balds
Sidalcea nelsoniana	Nelson's checker mallow	T	T	Meadows, open forests, balds

[a] USFWS (2011a) threatened and endangered species list for Oregon and the Polk County, Oregon list http://www.fws.gov/oregonfwo/Species/Lists/ accessed on January 28, 2011.
[b] OBIC (2010, 2011) and Oregon Department of Agriculture Status (plants).

Though there are no known bald eagle nests in the immediate vicinity, they do forage on spawned out salmon and steelhead, which are present in the S.F. Siletz and Luckiamute Rivers, and are known to be in the area. Bald eagles may roost in larger trees within riparian forests along the streams and rivers supporting salmon, such as the South Fork Siletz River and Little Luckiamute River. It is noted that there are a number of federal- and state-listed anadromous fish species that are found in the S.F. Siletz and Luckiamute Rivers. These are addressed in the aquatic habitat report.

Both species of butterflies (invertebrates) could occur in the vicinity if suitable habitat is present within grassland habitats that support the plants these species are often associated. Fender's blue butterfly and Oregon silverspot butterfly may occur in the North Pacific Herbaceous Bald and Bluff habitats which occur in the project area (Figure 3).

The eight listed plants species are associated with various habitat types present in the eco-region or area. Elegant fawn lily is known to occur in wet meadows at the Fanno Meadow

Preserve in the vicinity of one of the pipeline routes. Western lily (*Lillium* occidentale) is also known to occur in fens but has somewhat broader habitat tolerances and also may be found in forested wetlands and other habitat types. The distribution map for Western lily shows that it is present in Polk County near the vicinity of the project. Nelson's checker-mallow has even broader habitat range reportedly (Oregon Flora Project 2011) occurring in relatively open areas on damp soil, in meadows, wet prairie remnants, fencerows, roadsides, deciduous forest edges, occasionally Oregon ash wetlands. Though there are no known occurrences of this species within Polk County in the Coast Range Eco-region, systematic surveys would need to be conducted to conclusively determine presence or absence of all plant and animal species for which there is suitable habitat within the proposed project area.

Upland forest associations are all relatively early successional cover types. Though these provide habitat for a number of common species of animals and plants, they provide limited opportunities to federal- or state-listed threatened or endangered animals and plants. Systematic studies of potentially suitable habitat for listed species are needed to more accurately determine presence or absence and use of various habitats by listed species.

2.5.2 Other Species of Concern

Other species of concern include plants and animals include those species listed by the federal government as species of concern, candidates for listing, and species that are relatively uncommon or rare in the eco-region. These species are often associated with habitat types that have suffered a high percentage of loss compared to historic conditions or are vulnerable to impacts from loss of habitat from future land use conversions and habitat fragmentation. Many of these are identified as conservation priorities (ODFW 2006; OBIC 2010), such as wetlands and riparian forests.

Wetlands and riparian habitat types within the vicinity support a large number of dependent and associated species. OBIC (2011) and Oregon Natural Heritage Advisory Council (2010) identify many plant associations and sensitive species that are of conservation concern. All wetlands riparian forests, and montane grasslands or balds are among the high conservation priority habitat types that occur in the project area. Attachments B and C list a number of at risk wetland-associated animals and plants. Many of these species are among the sensitive species and a number of these, such as various amphibians, songbirds, and species of waterfowl are among those supported by the habitats within the project area.

3 Alternatives Analysis

Potential direct impacts to existing wetland, riparian, and other terrestrial habitats has been estimated using GIS analysis of proposed pool levels associated with the different dam alternatives. Potential impacts of pipeline routes also have been incorporated into the graphic depicting potential habitat impacts and incorporated into this analysis. It is assumed that impact corridors of about 16 feet (5 meters) would be required to accommodate the pipeline and a maintenance road parallel to the pipeline. Power lines that may be required for powering pump stations on pipeline routes are anticipated also to be located within these impact corridors. The pipelines, maintenance roads, and power lines can be relocated to avoid significant impacts areas, so the assessment of the potential impacts of these features describes the kind of

impacts that could occur. Most of the impacts associated with the linear features can be avoided or at least minimized through careful routing.

3.1 Wetlands

A preliminary estimate of the potential wetland impacts from inundation of the old lake bed and construction of the eight potential pipeline routes is provided in Table 2. This impact estimate is based on the identified wetland polygons shown in Figure 1 and calculation of the historic lakebed area outside mapped wetlands using GIS. Estimated impacts in Table 2 would be even larger if portions of the areas mapped as hydric Brenner silt loam soils which are outside of the historic lake bed and mapped wetlands or riverine wetland are included. There are numerous small streams flowing into the lake and may be wetlands associated with these. Future investigations, such as mapping wetlands using recent high resolutions, true color or infrared aerial photographs of the lake bed and adjacent areas in combinations with field verification or a comprehensive wetland delineation, would be needed to more accurately map and determine existing wetland types and potential wetland impacts.

Table 2. Comparison of Total Wetland Habitat Impacts by Option (in acres)

Palustrine Wetland Classification[1]	Low Dam	Medium Dam	High Dam
Forested wetlands	242.1	243.1	257.8
Scrub-shrub wetlands	0.9	1.1	2.9
Emergent wetlands	10.8	11.0	21.9
Unconsolidated bottom	1.7	1.8	1.8
Historic lake bed[2]	212.9	212.9	212.9
Total	**468.4**	**469.9**	**497.3**

Source: Estimates of wetland vegetation class impacts calculated from the Oregon Wetlands Geodatabase data (2009).

[1] All wetlands follow the USFWS classification system(Cowardin et al. 1979)

[2] Much of the historic lake bed outside of the mapped wetlands shown in Figure 1 has evolved into wetland based on ENVIRON's reconnaissance-level observations. This value assumes the entire area is wetlands and reflects a worst case estimate. As noted in the text above, future investigations are required to more accurately estimate wetland impacts.

Rather than a net loss of wetlands from the potential water storage, there would be a shift in wetland types. Previous studies (Davis 1985; Sharp and Wilson 1992) completed for Boise Cascade demonstrate this. However, the directional shift will be exactly opposite in this case. When the dam was removed, the wetlands were primarily unconsolidated bottom and relatively narrow fringing lacustrine wetlands. These shifted to the more diverse array of palustrine forested, scrub-shrub, and emergent wetland types that are now present. If a new dam is constructed, the more convoluted mosaic of palustrine and riverine wetlands now present in the old lake bed will shift to a primarily lacustrine unconsolidated bottom and shoreline and fringing lacustrine wetlands near the ordinary high water mark. Potential fringing wetlands could be a combination of forested, scrub-shrub and emergent wetlands. Where the shoreline is relatively steep, such as near the dam, wetlands will likely be quite narrow, perhaps less than 10 feet (3 m) wide. Near stream deltas, such as Fanno Creek, where topography is less steep and sediment deposits will likely accumulate over time, a continuum of aquatic bed, emergent, scrub-shrub or forested fringing wetlands will likely form. More extensive aquatic bed wetland vegetation, such as yellow pond-lily (*Nuphar lutea* var. *polysepalum*) and pondweeds (*Potamogeton* spp.) would be expected to form in shallower waters (< 10 ft [3 m]), such as

those that would be expected towards the southern end of the new lake. Where the topography surrounding the potential pool is more gradual and water depths are shallower, it is likely that broader aquatic bed wetlands would form in these areas. Seasonally inundated areas upslope of this would be expected to evolve into emergent, scrub-shrub, or forested wetlands depending on the timing, frequency, and duration of inundation.

Davis (1985) investigated and identified wetland vegetation around and within Valsetz Lake before the dam was removed. Though no wetland vegetation mapping was completed as part of that investigation, it is clear that aquatic bed, emergent, scrub-shrub, and forested wetland vegetation classes were present. Davis reported observing two aquatic bed community types in shallow, open water with floating leaved and submerged vegetation, which she reported as *Potamogeton natans-Myriophyllum* sp. (floating-leaf pondweed – water milfoil) and *Nuphar polysepalum-Brasenia schreberi* (yellow pond-lily – water shield). Similarly, three emergent plant communities were reported around the shoreline of the historic lake, including (*Ludwigia palustris*) water purslane; *Sparganium emersum-Puccinelia pauciflora* (narrow-leaf burred-weak alkali grass); and *Scirpus microcarpus-Juncus effusus-Typha latifolia* (small-fruited bulrush-soft rush-common cattail). Two scrub-shrub and/or forested wetland communities were observed: *Spiraea douglasii-Scirpus microcarpus-Agrostis tenuis* (Spiraea-small-fruited bulrush-colonial bentgrass) and *Salix* sp.*-Scirpus microcarpus-Bidens vulgata*. The former shrub community reportedly was often associated with drainage channel. Detailed review and analysis of historic aerial photos could be used to more accurately reconstruct and quantify the historic wetland types and distribution in and around the lake.

Such a shift from palustrine to more lacustrine wetland vegetation classes would not be expected to result in significant changes in the distribution and abundance of these systems within the eco-region. The Nature Conservancy (Bauer 2010) compiled total lacustrine and palustrine wetland vegetation class data for the Coast Range eco-region from the Oregon Wetlands Geodatabase, which is the same source of GIS data used to create Figure 1. Table 3 is adapted from The Nature Conservancy eco-region report. Estimated loss of palustrine wetland vegetation classes are expressed as a relative percentage of the total acreage for each type in the eco-region. As noted above, it is expected that there would be a shift in various palustrine wetland vegetation classes to lacustrine wetland vegetation and unconsolidated bottom (unvegetated) wetland classes. Though a loss is noted, for the various palustrine wetland types in the table, these estimates likely would be smaller. Even if this adjustment is not made, it is clear that the potential shifts represent a very small percentage of the totals of the various palustrine wetland types within the eco-region. This is an indicator that all wetland habitat types are relatively common. In addition, there are many of the same habitat types within the vicinity and in the same systems (i.e., palustrine as opposed to lacustrine).

For all proposed dam types, pipeline route 1-3 could potentially impact approximately 0.07 acres of meadows habitat at the Fanno Meadows Preserve. The preserve is a complex of wetland and upland habitat types, including relatively rare fens, a kind of peatlands. If a pipeline were routed through this area, fen hydrology would likely be altered (timing, duration, and frequency of saturation or seasonal flooding) from discharges associated with the potential pipeline. Such discharges could alter the nutrient loading and water chemistry of the fens, which are very sensitive to such changes. Changes in hydrology and water chemistry from potential

discharges from the pipeline may contribute to undesirable shifts in native plant associations and rare plant species that are conservation priorities. For these reasons, locating the pipeline within the Fanno Meadows Preserve, which includes multiple habitat types identified as important conservation areas that support known rare plant associations and species, should be avoided.

Table 3. Total estimated acreages and potential estimated percentage of wetland type changes within the Coast Range Eco-region from the water storage project.[1]

Wetland Type[2]	Total eco-region (acres)	Relative Percent loss of Total[3]		
		Low Dam	Medium Dam	High Dam
Lacustrine – Limnetic[4]	13,034	NA	NA	NA
Lacustrine - Littoral[5]	1,569	NA	NA	NA
Palustrine aquatic bed (PAB)	438	0	0	0
Palustrine emergent (PEM)	69,569	0.02	0.02	0.03
Palustrine scrub-shrub (PSS)	21,503	0.004	0.005	0.013
Palustrine forested (PFO)	21,362	1.13	1.14	1.21
Palustrine Unconsolidated bottom (PUB)	2,524	0.067	0.071	0.071
Total	129,999			

[1] These estimates do not include wetlands within the historic lake bed or wetlands that may occur in areas with mapped hydric soils, which would increase these numbers some.
[2] All wetlands follow the USFWS classification system(Cowardin et al. 1979)
[3] Relative percent loss assumes 100% loss of mapped wetlands identified in Oregon Wetlands Geodatabase (see Figure 1), which is unlikely. As noted in the text there will be a shift from palustrine wetlands to various lacustrine wetlands contributing to a net gain in lacustrine wetlands.
[4] Lacustrine – limnetic is defined as areas deeper than 6.6 ft (2 m) at mean low water.
[5] Lacustrine-littoral is defined as areas shallower than 6.6 ft (2 m) at mean low water.

There would be no additional pipeline impacts with the high dam since all habitats would be inundated by the reservoir. However, with the low and medium dams, approximately 1.2 acres of forested wetlands and 0.4 acres of emergent wetlands could be impacted (Pipeline Route 2-1 and south end of Pipeline Route 1-6).

Potential impacts from the low and medium dam alternatives are quite similar. The medium dam alternative would result in a few acres more direct impacts from the pool. Assuming areas mapped as having hydric soils include additional, unmapped wetlands, the medium and high dam alternatives could affect proportionally more wetlands at the south end of the lake (Figure 2). The high dam alternatively proportionately affects the greatest acreage of wetlands.

The re-creation of Lake Valsetz may be beneficial to some species, such as waterfowl and cavity-dependent species. Located on the Pacific Flyway, shifts in wetland types that include increases in PUB and permanently flooded areas may benefit migratory waterfowl, including some sensitive species. There likely would be an increase in snag density along the lake shoreline where trees are drowned. Snags would provide additional foraging opportunities and roosts for woodpeckers and flycatchers and over time additional habitat for cavity-dependent species, including some species of concern, such as purple martin (*Progne subis*).

3.2 Riparian, Forested, and Grassland Uplands

Road construction, conversion to agricultural and other developed land uses, and creation of dams and reservoirs have contributed to the loss and degradation of riparian habitats in the eco-region. These same activities and are among the threats to remaining high quality riparian habitats (ODFW 2006). The Valsetz water storage project would directly and indirectly impact riparian and other upland forests. A majority of the direct impacts would be drowning of riparian and upland forest types within the footprint of the proposed pool. There would also be a much smaller direct impact from construction of one of the the six pipeline routes to the Siletz and Luckiamute Rivers. Additional potential impacts to primarily riparian forest types also could occur from drawdown operations and discharges to the rivers. Potential impacts to riparian forest types that likely would evolve around the perimeter of the reservoir at the ordinary high water level would be influenced by rates of drawdown, timing, frequency and duration of drawdown events which influence plant establishment, growth, and survival. Pool operations also influence processes such as wind and wave erosion, which influence riparian community composition.

As shown in Figures 1 and 3 and Table 4**,** the amount of impact varies significantly between the alternatives. The low dam alternative impacts the least amount of priority riparian forest and wetland habitats. The medium and high dam options would impact proportionally more area. The largest impacts to priority conservation habitats would occur under the high dam option. This option would not only affect the most area of wetlands and riparian forest but also other identified habitat conservation priorities, including prairie or grassland habitats (Willamette Valley Prairie and North Pacific Herbaceous Bald and Bluff) and North Pacific Oak Woodland. Additional field verification would need to be conducted to confirm these potential habitat types are present as mapped in Figure 3 and could potentially be affected by the various dam options and pipeline routes. Sensitive habitats such as those located near the head of the highest reservoir could be avoided or minimized through reducing the size of the dam and subsequent reduction of the inundation area.

3.3 Threatened and Endangered Animals and Plants

Excluding fish, none of the water storage project dam options appear to have any direct impacts on critical habitat for any federal- or state-listed threatened or endangered species. However, critical habitat maps for marbled murrelet show mapped critical habitat within the McFall Creek drainage as just outside (approximately100 feet) of the estimated reservoir boundary for the high dam option. There is also mapped critical habitat about 3,000 feet due west from the terminus of pipeline route 2-1 and this mapped unit is about 1,000 feet from the estimate reservoir pool level for the high dam option. Approximately 5,300 feet of pipeline route 1-5 and 3,000 feet of the main pipeline (see southeast corner of Figure 1) would encroach on identified marbled murrelet critical habitat. As stated above, forest habitat types in the vicinity are predominantly early successional phases and not the late successional or old-growth forest types typically used by marbled murrelet. Additional field studies would be required to confirm whether there is late successional forest types in areas mapped as critical habitat and they might support marbled murrelet or northern spotted owl. If present, the pipeline routes can be modified to avoid those habitats.

Table 4. Comparison of Total Habitat Impacts by Option (in acres)			
GAP Habitat Type	**Low Dam**	**Medium Dam**	**High Dam**
Cultivated Cropland	24.0	24.5	33.1
Developed, Open Space	114.5	147.9	240.8
Harvested Forest- Tree Regeneration	456.5	628.9	1122.9
North Pacific Broadleaf Landslide Forest and Shrubland	0.7	1.1	2.4
North Pacific Dry Douglas Fir (Madrone) Forest	2.7	6.4	28.0
North Pacific Herbaceous Bald and Bluff	0.0	0.0	0.2
North Pacific Lowland Mixed Hardwood-Conifer Forest and Woodland	57.8	135.9	301.6
North Pacific Lowland Riparian Forest and Shrubland	420.3	563.3	812.0
North Pacific Maritime Dry-Mesic Douglas Fir-Western Hemlock Forest	3.1	6.4	20.7
North Pacific Maritime Mesic-Wet Douglas Fir-Western Hemlock Forest	24.2	53.2	190.6
North Pacific Oak Woodland	0.4	0.9	3.1
Willamette Valley Wet Prairie	0.0	0.0	1.1
Total GAP Habitat Acres	1104.4	1568.6	2756.6
Total Proposed Reservoir Inundation Acres	1106.0	1570.3	2752.6
Source: Northwest Regional GAP Analysis Project (USGS 2004)			

There are no known bald eagle nests or communal winter roosts in the area of the lake or pipeline routes. Over the long-term, the lake may have beneficial impacts for bald eagle by creating new potential nesting habitat. The lake would likely increase potential foraging opportunities of migratory waterfowl, which could also be a beneficial impact. Total estimated reservoir inundation areas are approximately 1106, 1570 and 2753 acres, respectively for the low, medium and high dam options.The high dam option will form the biggest pool and best opportunities for additional migratory waterfowl use and not adversely impact other potential food sources. Medium and low dams would presumably provide incrementally lower potential benefits.

Several federal and state listed threatened or endangered species are associated with native prairie or grassland habitats. Fender's blue butterfly and Oregon silverspot butterfly, Willamette daisy, elegant fawn-lily, Bradshaw's lomatium and Kincaid's lupine are all found in native prairie habitat types. It is uncertain if any of these species may occur in the identified Willamette Valley Wet Prairie or North Pacific Bald and Bluff habitats in the vicinity. Neither the low or medium dam options under consideration directly or indirectly affect native prairie habitats. The high dam option appears to inundate 1.1 acre of Willamette Valley Wet Prairie. This impact could be avoided by modifying the dam height. Other potentially suitable habitat for some of these species may occur in the North Pacific Herbaceous Bald and Bluff upslope and northeast of the lake that is associated with Fanno Peak. Pipeline route 1-2, as mapped, would traverse this habitat. This habitat could be avoided through careful selection of pipeline routes.

Additional field investigation would need to be completed to verify if this habitat are present and whether it support any of the federally- or state-listed threatened or endangered invertebrates and plant species associated with these wet prairie/meadow or grassland habitat types.

As noted above, Fanno Meadows Preserve, is a fen wetland complex. There are known populations of elegant fawn-lily (state-listed threatened) within the preserve and could be populations of western lily (federally- and state-listed endangered) though none were identified in the earlier survey (Christy 2001). Pipeline Route 1-3 could potentially alter wetland hydrology, fen water chemistry and adversely affect known populations of fawn lily and possibly the endangered western lily. More systematic surveys would be required to better determine the presence or absence of western lily. The pipeline route can be modified to avoid this habitat.

Nelson's checker mallow is the only other federally-listed species of plant that may occur in habitats within the vicinity. These species has broader habitat tolerances and more systematic surveys would be required to determine whether it is present within meadows, forests, and grasslands within the vicinity, particularly in the old lake bed.

3.4 Other Species of Concern

There are many other species of concern within the Coast Range. Quite a few of these occur within wetlands and western Oregon riparian habitats within the vicinity (Attachments A, B, and C). The low dam option has the lowest impacts to wetlands and riparian habitats as well as known or likely populations of wetland and riparian dependent animals and plants. Consequently, the low dam option would have the least amount of impact on identified terrestrial and wetland priority conservation habitats and species.

Medium and high dam options would affect proportionally more wetlands and riparian habitat types. These options would result in proportionally greater shifts in vegetation palustrine wetlands (PFO, PSS, PEM, PAB) to lacustrine unconsolidated bottom (LUB) and perhaps smaller amounts of fringing lacustrine vegetated wetland classes (LFO, LSS, LEM, LAB). This would likely negatively affect some palustrine wetland-dependent species and populations, such as amphibians that bread in existing lake bed wetlands. Shifts in the location, and distribution of emergent, aquatic bed, scrub-shrub, and forested wetland vegetation classes from palustrine system to lacustrine system may only cause temporary impacts to population size and structure of wetland dependent species. There would likely be some reduction in each of the wetland vegetation classes with a substantial shift and net gain in unvegetated, unconsolidated bottom and also lacustrine limnetic or deepwater habitat (>6.6 ft [2 m] at mean low water). Such shifts will likely lead to at least temporary changes in the distribution and abundance of wetland vegetation dependent animals and plants associated with seasonally inundated or shallower permanent waters.

Amphibian species that could be affected by such habitat changes include western toad (*Anaxyrus boreas*), clouded salamander (*Aneides ferreus*), coastal tailed frog (*Ascaphus truei*), and northern red-legged frog (*Rana aurora*). Furthermore changes in water levels can result in death of amphibian eggs laid on emergent vegetation through desiccation. Such potential impacts would depend on the timing and rate of drawdown and could potentially be mitigated by

maintaining stable water levels until after amphibian eggs have hatched. Timing of breeding, egg laying and maturation varies depending on species, water temperature, and elevation. Western toad breeding activity was observed in Fish Lake in the Oregon Cascades at an elevation of 3,116 ft (950 m) in April (Nussbaum et al. 1983). Others (Leonard et al. 1993) have noted breeding from February to April at lower elevations west of the Cascades and extending into early July at higher elevations.

The increase in the amount of LUB and deepwater habitat will likely be beneficial to other sensitive species. Diving ducks and other migratory waterfowl attracted to lakes would be expected to benefit. Bufflehead (*Bucephala albeola*), western grebe (*Aechmophorus occidentalis*), Aleutian Canada goose (*Branta hutchinsii leucopareia*), Dusky Canada goose (*Branta canadensis occidentalis*) are among the sensitive species that could benefit from additional unconsolidated bottom habitat. Proportionally greater benefits would be anticipated with each of the increments in dam size. The least amount of LUB and deepwater habitat would be created by the low dam option and most by the high dam, assuming potential for supporting larger migratory populations of waterfowl. While there could be some beneficial impacts to migratory waterfowl, increasing concentrations may make them more susceptible to outbreaks of avian cholera, avian botulism, and avian influenza (Table 5). Such detrimental impacts would be dependent on creation of conditions that were favorable to the populations of disease organisms. Some researchers (Blanchong et al 2006; Samuel 2002) have indicated that disease organisms do not persist for long (months) in wetlands where outbreaks have occurred.

An increase in the amount of permanent water, such as would occur with the various dam options, could be favorable to bullfrog populations (*Rana catesbeiana*) and detrimental to native amphibians and fish. The bullfrog is an introduced species that is highly aquatic and rarely found far from the vegetated banks or shorelines of permanent water bodies (Leonard et al. 1993; Nussbaum et al. 1988). They are known to prey on other amphibians, fish, small turtles, snakes, birds, and small mammals. Permanent warm waters that are at least about 70°F (≥ 21.1°C) are required for reproduction (Jones et al. 2005). Modeling of the reservoir (see Hydrology report) indicates that these water temperatures will be reached under all three alternatives, but not until later in the summer after the normal breeding season for bullfrogs.

4 Conclusions and Recommended Next Steps

There are hundreds of acres of palustrine forested, scrub-shrub, and emergent wetlands within the old lake bed. These are interspersed within the floodplain and existing stream channels. In addition to wetlands, there are substantial quantities of riparian forest plant associations. All forest types within the lake bed, riparian zones, and adjacent uplands are predominantly early successional types that have regrown or regenerated following timber harvesting.

Table 5. Naturally occurring wildlife diseases of greatest concern in Oregon (Source: ODFW 2006).

Disease or Disease-causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Saprolegnia ferax, an egg-destroying water mold	All amphibians but some are more vulnerable	Conditions that weaken immune response (e.g., UV-B light, pesticides)	Maintain high water quality; investigate role of introduced fish in spread between water bodies
Batrachochytrium dendrobatidis, a skin fungus	All amphibians but some appear more susceptible	Conditions that weaken immune response (e.g., UV-B light, pesticides)	Maintain high water quality, investigate the natural distribution of Chytrid infection to determine if it is spreading
Ribeiroia spp., a trematode parasite that causes deformities	All amphibians but most common in some frog species	High nutrient levels that increase densities of intermediate hosts (snails)	Maintain high water quality, monitor incidence of amphibian deformities
Avian cholera caused by the bacterium *Pasteurella multocida*	Waterfowl are particularly vulnerable but can impact gulls, terns, coots, and crows also	Concentration of waterfowl during migration. Waterfowl concentrations increase when the amount of open water is reduced, such as during drought, freezing, or habitat loss	Maintain and restore wetland habitats important to migratory waterfowl; manage major die-offs to minimize impacts to populations
Avian influenza	Many wild bird species are hosts	Waterfowl and other wild birds may serve as hosts to non-pathogenic strains of the virus; mutated or pathogenic strains can have devastating impacts to the poultry industry & human health	Monitor and conduct surveillance in captured or translocated birds such as mountain quail, turkeys and farmed game birds
Avian botulism caused by a toxin produced by the bacterium *Clostridium botulinum*	Waterfowl and shorebirds	Associated with shallow wetland habitats during warm weather; can be made worse by fluctuating water levels; sometimes associated with fish kills	Manage water levels at important migratory bird refuges to prevent botulism; manage major die-offs to minimize impacts to populations
Diseases caused by fungi, including toxins produced by molds: Aspergillosis, aflatoxins	Many species, including waterfowl and shorebirds are very susceptible	Transmitted from moldy corn or acquired from soil or damp organic materials; stressed or diseased animals may have higher susceptibility	Monitoring and surveillance; manage major die-offs to minimize impacts to populations
Canine distemper	Raccoons, foxes, skunks & coyotes	Occurs in high density or concentrated raccoon populations; unvaccinated domestic pets can contract and transmit to wildlife	Promote prevention by not feeding raccoons; use caution when moving nuisance animals and promote domestic pet vaccination program benefits
Parvovirus, including closely related viruses (e.g., feline panleucopenia)	Bobcat and cougar	Unvaccinated domestic and feral cats can contract and transmit to wildlife	Promote pet vaccination program benefits
Salmonellosis and mycoplasma conjunctivitis	Songbirds, primarily finches	Concentrations of susceptible species at feeders where feeder surfaces or food is contaminated by feces	Education and outreach to instruct bird lovers how to maintain clean feeders and prevent disease transmission

All wetland types and riparian forest habitats are priority conservation areas that support many wetland- and riparian-dependent animals and plants. A number of the species these habitats support are priorities for conservation. Many species of wetland dependent plants and animals likely would be adversely affected, such as those associated with palustrine wetlands that would shift to deep water lacustrine habitat (i.e., >6.6 ft [2 m]). Some species of migratory waterfowl would likely benefit from re-creation of lacustrine wetlands through increased foraging and resting opportunities.

The low dam option would result in the least amount of impacts to wetlands and lowland riparian areas, priority conservation habitat types and associated priority species. Medium and high dam options would result in proportionally greater impacts to priority habitat conservation priorities and the species they support. Estimated wetlands impacts may be underestimated based on the extent of mapped hydric soils. More accurate mapping of wetlands and calculation of impact estimates are recommended using a combination of true color, contemporary aerial photographs and limited field verification of the produced map.

There would not be a large loss of wetland areas so much as a shift in wetlands types from palustrine vegetated wetlands to lacustrine vegetated and unconsolidated bottom wetlands. Proportionally greater amounts and shifts to LUB and deeper water habitats (lacustrine limnetic) would occur with the medium and high dam options. Development of a historic wetland map using aerial photographic interpretation of photographs before the dam was removed in 1988 would provide a predictive tool for better estimating shifts in wetland types that could likely be expected from the re-creation of the lake.

Pipeline routes could result in additional impacts to priority wetland habitats and species both direct and indirect. Pipeline routes 1-2 and 1-3 could impact potential or known populations of federal- or state-listed threatened or endangered species. Pipeline route 1-2 would traverse a bald associated with Fanno Peak that may support populations of Fender's blue butterfly (federal endangered), Oregon silverspot butterfly (federal threatened), Kincaid's lupine (federal/state threatened), and Nelson's checker mallow (federal and state threatened). In addition, there is a known population of elegant fawn lily (state threatened) and possibly unknown populations of a western lily (federal endangered) in the Fanno Meadow Preserve that would be adversely affected by a pipeline routed through the area. Pipeline routes should be selected to avoid these sensitive habitats.

Systematic surveys of existing wetlands for potential populations of rare, threatened or endangered species are recommended to better understand potential impacts, particularly of habitats that may support populations of these species. In particularly, identified Willamette Valley Wet Prairie and fens, and wet meadows and grasslands associated with the Fanno Meadows Preserve in the Little Luckiamute should be investigated to determine the extent of these habitats and their importance to the species they support. This information would provide a better definition of sensitive areas that should be avoided by pipeline routes. As currently defined, the high dam alternative would inundate 1.1 acres of the Willamette Valley Wet Prairie habitat. Further refinement of the extent of this habitat can also be used to refine project alternatives to avoid inundation of this habitat.

The mapped North Pacific Herbaceous Bald and Bluff associated with Fanno Peak also should also be the subject of future systematic studies for rare, threatened or endangered species to ensure that the extent of this habitat is well understood, so impacts can be avoided. Though it is unclear if this mapped habitat contains suitable habitat for listed species, several are known to be associated with montane grasslands in this eco-region.

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