GOOSE HAVEN LAKE
WILDLIFE MITIGATION UNIT

THE COEUR D'ALENE TRIBE

DRAFT WILDLIFE MANAGEMENT PLAN

March 2008

GOOSE HAVEN LAKE

WILDLIFE
MANAGEMENT PLAN

ALBENI FALLS

WILDLIFE MITIGATION

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THE COEUR D'ALENE TRIBE

DRAFT REPORT

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Gerald Green, Coeur d'Alene Tribe

Introduction

The Goose Haven Lake Wildlife Mitigation Project (Subject Property) is located on the northeastern portion of the Coeur d'Alene Indian Reservation within the St. Joe River subwatershed of the Coeur d'Alene Subbasin.

Much of the wildlife habitat in the Coeur d'Alene Subbasin has been developed or modified through changes in vegetation type and structure (NPCC 2004). The development of Albeni Falls Dam resulted in the direct loss of wildlife and wildlife habitats in the Pend Oreille Subbasin, north of the Coeur d'Alene Subbasin. Mitigation for the construction of Albeni Falls Dam is required to offset adverse effects to terrestrial resources traditionally used by the Coeur d'Alene Tribe (CDAT). Albeni Falls wildlife mitigation is implemented in part by the CDAT, and is approximately 17 percent complete. Completion of Albeni Falls wildlife mitigation is a high terrestrial resources priority of the CDAT.

Wildlife mitigation projects implemented by the CDAT rely heavily on habitat acquisition and habitat protection, enhancement, and restoration strategies (see NPCC 2004 for details). Biologists understand that specific habitat elements influence the value of wildlife habitat types to individual wildlife species. However, information on site-specific habitat elements is critical to determine habitat suitability for wildlife. An initial effort to identify habitat elements on the Subject Property was completed in 2003 by Tetra Tech, Inc. In addition, RHT Consultants completed a baseline Habitat Evaluation Procedure in July 2002 to evaluate habitat suitability. Habitat enhancement alternatives and management objectives for successful project implementation and maintenance were developed.

Section 1 Background Information

Dams built to generate power, control flooding, and provide navigation, irrigation, and recreation have altered streams draining the Columbia River Basin. Twenty-nine federal hydroelectric dams and numerous privately operated dams now regulate the flow of many of these streams. The development of the hydropower system has had far-reaching effects on wildlife and wildlife habitat. Floodplain and riparian habitats important to wildlife were inundated by construction of the dams. Streams were channelized as roads and power distribution facilities were constructed (CBFWA 1998). Area drainage features and their ecosystems have been adversely affected.

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Act) (Public Law 96-501) directed that measures be implemented to protect, mitigate, and enhance fish and wildlife to the extent affected by development and operation of hydropower projects on the Columbia River and its tributaries. The Act created the Northwest Power and Conservation Council (NPCC), which in turn developed the Columbia River Basin Fish and Wildlife Program (Program). The Program established a four-part process to mitigate wildlife habitat losses resulting from the development and operation of the federal hydropower system that included 1) wildlife mitigation status reports; 2) wildlife impact assessments; 3) wildlife protection, mitigation, and enhancement plans; and 4) project implementation.

Albeni Falls Dam was built on the Pend Oreille River in Bonner County, Idaho and began operation in 1955. Albeni Falls Dam significantly affected the balance of water and wildlife in the Inland Northwest. The *Albeni Falls Wildlife Protection, Mitigation and Enhancement Plan* (Martin et al. 1987), known as the "brown book," was adopted by the Bonneville Power Administration (BPA) in 1988. The brown book documents habitat conditions before and after the construction of the dam (loss assessment). It is also used by local biologists to estimate the benefits of proposed habitat acquisitions and enhancement projects.

To document habitat impacts, biologists used the Habitat Evaluation Procedure (HEP). Eight wildlife species were identified as indicator species by which to evaluate the quality and quantity of habitat impacted by construction of the dam. The HEP indicates that the construction of Albeni Falls Dam resulted in the loss of 28,587 Habitat Units (HUs). Biologists estimated wetland losses of 6,617 acres within the fluctuation zone created by the dam and ongoing losses of 30 acres per year due to bank erosion caused by saturated soils and wave action. Beginning in 1995, a combination of protection and enhancement projects has been implemented annually to mitigate these impacts. To date, 4,822 HUs (16.8%) of the total losses have been mitigated for Albeni Falls Dam (NPCC 2004).

A Memorandum of Agreement (MOA) was developed in 1996 between the CDAT and BPA to implement wildlife mitigation activities associated with Albeni Falls Dam. In 2001, the acquisition of the Subject Property resulted in the addition of 638 acres and 267 HUs, which were credited toward BPA's mitigation obligation resulting from habitat losses associated with Albeni Falls Dam.

Section 2 General Site Description

The Subject Property is located in Benewah County approximately six miles northwest of St. Maries, Idaho (Figure 1). The Subject Property consists of three parcels located within township 46 North, range 3 west of the Boise Meridian. The Subject Property is comprised of 238 acres of upland and 400 acres of open water and marshland. An unpaved gravel road bisects the Subject Property from southeast to northwest and is visible in aerial photographs (Figure 2). Photographs of the Subject Property are included in Appendix A.

The Subject Property includes a barn and miscellaneous outbuildings. The 400 acre wet meadow spans the southern portion of the property at an elevation of approximately 2,120 feet. The outbuildings are located in the central portion of the property. The northern portion of the property consists of 238 acres of forested uplands that reach an elevation of approximately 3,000 feet.

2.1 Climate

The climate and hydrology of the area are influenced by maritime air masses from the Pacific Coast and prevailing westerly winds, modified by continental air masses from Canada. Summers are mild and relatively dry, while fall, winter, and spring bring abundant moisture as both rain and snow.

The total annual precipitation is about 25 to 29 inches. Of this, 33 percent usually falls from April through September. The growing season for most crops falls within this period. Thunderstorms occur approximately 15 days each year, occurring mostly in summer. The average seasonal snowfall across Benewah County is 55 inches and varies from 10 inches to over 100 inches. At least one inch of snow is on the ground an average of 28 days. The average snowfall at Plummer (15 miles west of the Subject Property) is about 16.1 inches annually.

In winter, the average temperature is 29º F and the average daily minimum temperature is 23º F. The lowest recorded minimum temperature in the greater area is -36º F. In summer, the average temperature is 65º F, and the average daily maximum temperature is 82º F. The highest recorded temperature in the area is 111º F (NRCS 2002).

2.2 Topography

The river valleys of the lower St. Joe and Coeur d'Alene River evolved into broad, widely meandering depositional river channels with extensive, frequently flooded zones and wetlands adjacent to the main channel. Alpine glaciation in the upper reaches of the St. Joe watershed resulted in alluvial valleys.

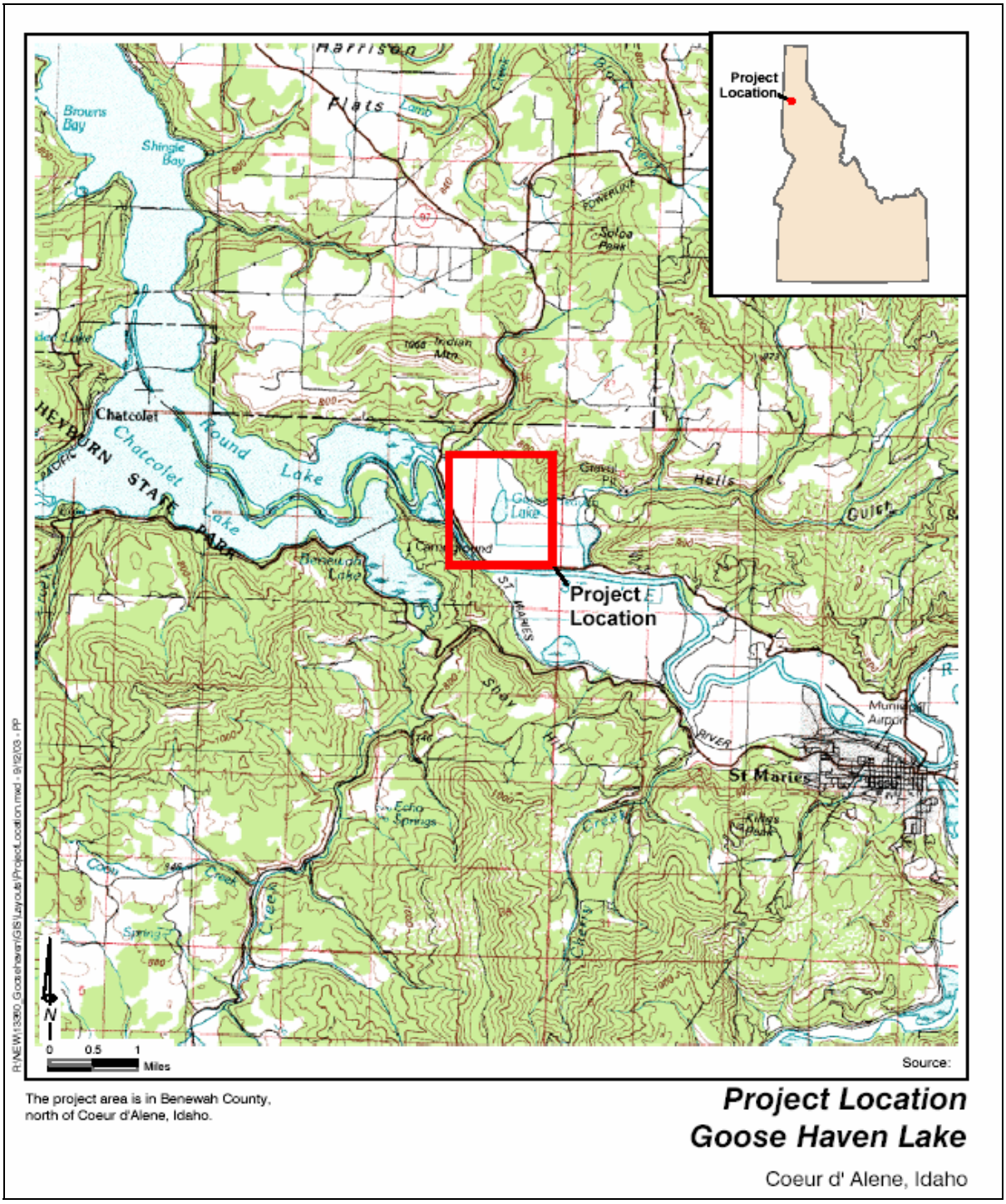

Figure 1. Goose Haven Lake project location map (Tetra Tech 2003).

Figure 2. Aerial photograph of the Goose Haven Lake Wildlife Mitigation Project (USGS 1998).

The topography of the Subject Property was formed through geologic uplift, volcanism, glaciation, and catastrophic flooding because of repeated ice dam breaks at glacial Lake Missoula. Approximately 50,000 years ago during an older ice age, glacial deposits blocked the mouth of the St. Joe River to impound Lake Coeur d'Alene. Approximately 7,000 years ago, the eruption of Mt. Mazama at Crater Lake, Oregon coated the Northwest with yellow/orange-colored ash, including all of Idaho, nearly all of Oregon, Washington, and Nevada, and significant portions of Montana, California, Wyoming, and Utah. Layers of this ash are often found in area basins. The Subject Property consists of approximately 63 percent floodplain, including Goose Haven Lake, and approximately 37 percent uplands. The elevation of Goose Haven Lake is 2,116 feet. Floodplain areas are bounded naturally to the north and east by hillsides, and by a dike to the south and west. State Highway 3 runs along the top of the dike, and the St. Joe River abuts the southwestern side of the dike. The area of the lake basin is about 1,400 acres.

2.3 Soils

The meandering St. Joe River frequently flooded and coursed across the Subject Property prior to the construction of a dike in the 1930s. On-site soils were formed from basalt and Belt rock, ash, and loess. These materials have settled within area basins to create less permeable linings within those basins. Soil types are listed in Table 1.

Approximately 60 percent of the Subject Property is comprised of hydric soils. The remainder of the property consists of Belt or basalt parent rock that is covered with volcanic ash and loess. Alluvial lowland soils are level, deep, and poorly drained. Loess-derived soils on hillsides are typically deep and moderately well drained.

Table 1. Soil types on the Goose Haven Lake Wildlife Mitigation Project (Tetra Tech 2003).

ID #	Name of Soil	Location of Soil	Type
14	Chatcolet Silt Loam, 3 to 20 % Slopes	Low Stream Drainage	Upland
15	DeVoignes Silt Loam	Majority of Floodplain	Hydric
31	Lacy-Rock Outcrop Complex; 5 to 35 % Slopes	High Elevation Upland Plains	Upland
41	Miesen Silt Loam[a]	Along Diked Areas	Pos. Hydric
54	Pywell Muck[b]	Immediately Surrounding Lake	Hydric
55	Ramsdell-DeVoignes Association	Low Stream Drainage	Pos. Hydric
57	Santa Silt Loam; 3 to 20 % Slopes	High Elevation Upland Plains	Upland
71	Tekoa Shaly Slit Loam, 35 to 60 % Slopes	Majority of Forested Hillside	Upland

[a] The Benewah survey depicts soil type 65-Southwick Silt Loam (a well-drained soil) as located in the subject floodplain. Interviews with NRCS officials indicated that the listing of the Southwick in the floodplain at the property was a mistake on the survey, and that the area was determined to be closer to the Miesen soil type.

[b] The Benewah County Soil Survey depicts soil type 54-Pywell Muck as extending far beyond the lake. Interviews with NRCS officials in Coeur d'Alene, Idaho, indicated that recent measurements indicate this soil extends only approximately 100 or so feet from the current lake edge.

Hydric soils are those that have been saturated, flooded, or ponded long enough during the growing season to develop anaerobic (oxygen-depleted) conditions in upper zones. Indicators of hydric soils included soil color, mottles, oxidized rhizospheres (root channels), and concretions of iron or manganese. Hydric soils include DeVoignes silt loam and Pywell muck. Soils uncovered at test pits near the wetland interface averaged 3/2 on the Munsell 10YR and 7.5YR pages of soil color. True hydric soil appears to extend into the floodplain. It is likely that prior to farming the hydric soils supported a higher diversity of plants, such as the type normally found in scrub-shrub wetland communities.

2.4 Hydrology

The Subject Property lies within the Coeur d'Alene Subbasin. Coeur d'Alene Lake lies in a naturally dammed river valley with the outflow controlled by Post Falls Dam, which creates a backwater effect in the lower Coeur d'Alene, St. Joe, and St. Maries rivers. The St. Joe river watershed drains an area of approximately 1,726 mi^2 and contains more than 739 miles of streams with over 78 principle tributaries (NPCC 2004).

Tetra Tech used the Hydrologic Simulation Program – FORTRAN (HSPF) to evaluate Subject Property hydrology. This model can represent the hydrologic response to rainfall resulting from a number of physical processes. It simulates these responses over time, and it is capable of simulating the hydraulics of natural and manufactured drainage systems.

The results of the modeling effort indicate that both spring and summer duration analyses do not show significant lake level fluctuations (Tables 2 and 3). It is presumed that fluctuations may occur because of snowmelt, unusually large precipitation events in winter, dike seepage, and flap gate leakage in culverts or subsurface piping at pump stations. However, the data obtained from the modeling effort indicate stable lake levels. Modeling results also indicate the lake elevation to be consistently greater than 2,117.9 feet and no greater than 2,118.7 feet for the spring modeling period. Lake depth during the summer months stayed consistently greater than 2,117 feet, but not greater than 2,118.2 feet. The maximum spring lake elevation modeled was 2,118.67 feet, and the maximum summer lake elevation modeled was 2,118.15 feet. Minimum lake level elevations were 2,117.99 feet (spring), and 2,116.32 feet (summer), respectively.

Lake level averages are shown in Figure 3, and monthly averages for the period of 1953-1986 are shown in Figure 4. The lake level averages also show very little seasonal variation between spring and summer, on average staying at approximately 2,118 feet elevation.

Table 2. Duration analysis for summer (July-September) (Tetra Tech 2003).

Lake Elevation (ft)	Exceedance Probability[a]
2117	1.0000
2117.2	0.9999
2117.4	0.9992
2117.6	0.9986
2117.8	0.9943
2118	0.9706
2118.2	0.0000

[a] Probability that the water surface elevation will meet or exceed the elevation at any given hour.

Table 3. Duration analysis results for spring (May-June) (Tetra Tech 2003).

Lake Elevation (ft)	Exceedance Probability[a]
2117.9	1
2118	0.9987
2118.1	0.0310
2118.2	0.00778
2118.3	0.0059
2118.4	0.0051
2118.5	0.0040
2118.6	0.0021
2118.7	0

[a] Probability that the water surface elevation will meet or exceed the elevation at any given hour.

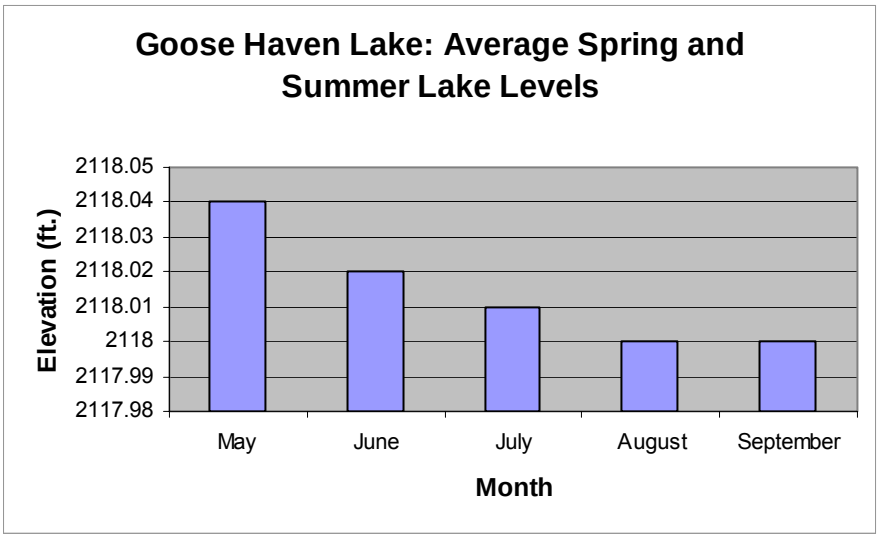

Figure 3. Modeled average lake levels for spring and summer (Tetra Tech 2003).

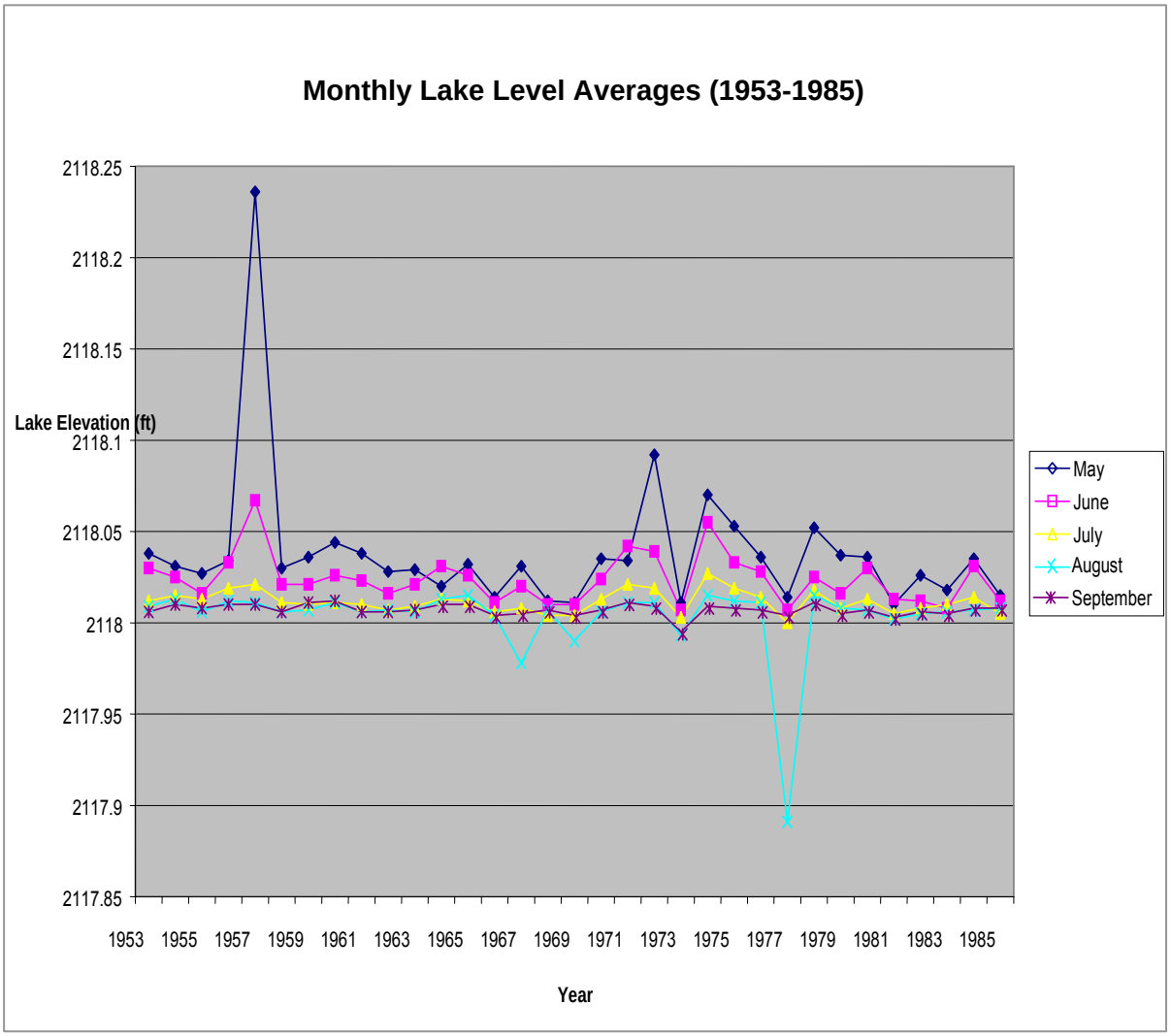

Figure 4. Modeled monthly lake level averages (1953-1985) (Tetra Tech 2003).

Two pump stations were constructed to relieve the Goose Haven Lake floodplain area of floodwaters. One pump station is no longer in use, but is located next to Highway 3 near the western edge of the property. The southern pump station is located off-site near Highway 3, approximately 500 feet from the southern edge of the lake, and controls flooding of surrounding fields. Water flows south through Goose Haven Lake. Tetra Tech initially estimated the maximum pumping rate to be approximately 5 cubic feet per second (cfs). However, the drainage district confirmed the pumping rate to be 13,000 gallons per minute (gpm), or approximately 35 cfs (F. Shoenick personal communication).

2.5 Vegetation

Vegetation in the Coeur d'Alene Subbasin is dominated by interior mixed conifer forest, with small amounts of montane mixed conifer and lodgepole pine. Agriculture is largely confined to the valley bottoms along the lower Coeur d'Alene, St. Joe, and St. Maries rivers (NPCC 2004).

Tetra Tech completed a vegetation survey of the Subject Property in July 2003. Plant species and cover types identified during the survey are listed in Table 4.

Table 4. Identified plant species on the Goose Haven Wildlife Mitigation Project (Tetra Tech 2003).

Cover Type	Common Name	Scientific Name	Native/ Non-native
Seasonal Wetland	Broadleaf filaree	Erodium botrys	Non-native
Seasonal Wetland	Italian rye-grass	Lolium multiflorum	Non-native
Seasonal Wetland	Reed canary grass	Phalaris arundinaceae	Non-native
Seasonal Wetland	Bristly oxtongue	Picris echiodes	Non-native
Seasonal Wetland	Common mullein	Verbascum thapsus	Non-native
Seasonal Wetland	Sheep sorrel	Rumex acetosella	Non-native
Seasonal Wetland/Upland	Hawkweed	Hieracium aurantiacum	Non-Native
Seasonal Wetland	Curly dock	Rumex crispus	Non-native
Seasonal Wetland	Cockleburr	Xanthium strumarium	Native
Permanent Marsh/Open Water	Tall sedge	Cyperus eragrostris	Native
Permanent Marsh/Open Water	Needle spikerush	Eleocharis acicularis	Native
Permanent Marsh/Open Water	Creeping spikerush	Eleocharis macrostaphya	Native
Permanent Marsh/Open Water	Small bedstraw	Gallium trifidum	Native
Permanent Marsh/Open Water	Common duckweed	Lemna minor	Native
Permanent Marsh/Open Water	Eurasian milfoil[a]	Myriophyllum spicatum	Non-native
Permanent Marsh/Open Water	Rocky Mountain pond lily	Nuphar polysepalumor	Native
Permanent Marsh/Open Water	Common reed	Phragmites australis	Native
Permanent Marsh/Open Water	Water smartweed	Polygonum amphibium	Native
Permanent Marsh/Open Water	Common tule	Scirpus acutus	Native
Permanent Marsh/Open Water	Broad-leaf cattail	Typha latifoli	Native
Ephemeral/ Riparian Wetland	Twinberry	Lonicera involucrata	Native
Ephemeral/ Riparian Wetland	Serviceberry	Amelanchier alnifolia	Native
Ephemeral/ Riparian Wetland	Salmonberry	Rubus chamaemorus	Native

Cover Type	Common Name	Scientific Name	Native/ Non-native
Ephemeral/ Riparian Wetland	Red alder	Alnus rubra	Native
Ephemeral/ Riparian Wetland	Dog rose	Rosa caninus	Native
Ephemeral/ Riparian Wetland	Quaking aspen	Populus tremuloides	Native
Ephemeral/ Riparian Wetland	Black cottonwood	Populus balsamifera	Native
Ephemeral/ Riparian Wetland	Red osier dogwood	Cornus sericea	Native
Ephemeral/ Riparian Wetland	Chokecherry	Prunus virginiana	Native
Ephemeral/ Riparian Wetland	Currant	Rubus spp.	Native
Upland	Mountain mahogany	Cercocarpus montanus	Native
Upland	Ponderosa pine	Pinus ponderosa	Native
Upland	Douglas fir	Pseudotsuga menziesii	Native
Upland	Sticky geranium	Geranium viscosissimum	Non-native
Upland	Western meadowrue	Thalictrum occidentale	Native
Upland	Snowberry	Symphoricarpus spp.	Native
Upland	Western red cedar	Thuja plicata	Native

a. Full verification of the actual native/non-native status of this species or the potential for similar species to occur has not been completed.

Cover types are depicted in Figure 5. Plant species diversity on the Subject Property is extremely low, particularly in the seasonal wetlands. Agricultural impacts resulting from livestock grazing and hay production on the Subject Property likely reduced wetland and riparian plant diversity. The seasonal wetlands have been heavily colonized by reed canarygrass (*Phalaris arundinacea*). Vegetative diversity is highest in the upland area, particularly in riparian zones. Although upland areas have been significantly disturbed by logging, understory plant communities along ephemeral hillside streams appear healthy and diverse with a high percentage of native species.

Figure 5. Habitat types of the Goose Haven Wildlife Mitigation Project (Tetra Tech 2003).

2.5.1 Wetlands

Permanent marsh is the primary wetland plant community on the property. The Subject Property contains 11.73 acres of wetlands and an estimated 18.29 acres of open water (Table 5). Greater than 50 percent of the dominant vegetation types are facultative or better in terms of hydrophytic plants present on site. Table 6 depicts the indicator status and the approximate aerial coverage for all plant species observed within the wetland areas.

Dominant plant species included reed canarygrass (*Phalaris arundinaceae*) with approximately 40 percent of coverage, and broad-leaf cattail (*Typha latifolia*) with approximately 60 percent of coverage in the wetland area. Minimal scrub-shrub species were identified.

Table 5. Type and extent of wetland per sample location (Tetra Tech 2003).

Wetland Sites	Sampling Points	Habitat Type	Wetlands or Waters	Area (acres)
Goose Haven Lake perimeter	1a-1b, 2a-2b, 3a-3b	Emergent marsh	Wetlands	11.73
Total Wetlands				**11.73**
Goose Haven Lake interior	Not accessible	Open water	Waters	18.29
Total Waters				**18.29**
Total Jurisdictional Wetlands and Waters				**30.29**

Table 6. Identified plant species in the marsh area of the Goose Haven Wildlife Mitigation Project (Tetra Tech 2003).

Indicator Status	Common Name	Scientific Name	Areal Extent	Native/ Non-native
FACU	Italian ryegrass	Lolium multiflorum	present	Non-native
FACW	Reed canary grass	Phalaris arundinaceae	40 percent	Non-native
NI	Hawkweed	Hieracium aurantiacum L.	10 percent	Non-native
FACW	Curly dock	Rumex crispus	10 percent	Non-native
FAC	Canada Cockleburr	Xanthium strumarium	present	Native
NI	Tall Flatsedge	Cyperus eragrostris	present	Native
OBL	Needle spikerush	Eleocharis acicularis	present	Native
OBL	Creeping spikerush	Eleocharis macrostaphya	present	Native
FACW+	Small bedstraw	Galium trifidum	present	Native
OBL	Common duckweed	Lemna minor	10 percent	Native

OBL	Eurasian milfoil	Myriophyllum spicatum	20 percent	Non-native
OBL	Rocky Mountain pond lily	Nuphar polysepalumor	20 percent	Native
FACW	Common reed	Phragmites australis	5 percent	Native
OBL***	Water smartweed	Polygonum amphibium	present	Native
NI	Common bulrush; tule	Scirpus acutus	5 percent	Native
OBL	Broad-leaf cattail	Typha latifolia	60 percent	Native

* Indicator status is determined using USDA/NRCS criteria for Region 9, which includes Idaho, Washington, Oregon, Western Montana, and Western Wyoming.
** Indicator status was determined using field guide (Cooke 1997).
*** Indicator status estimated through observation.

Because a large portion of the Subject Property was utilized for hay production with large areas represented by reed canarygrass, habitat quality and species diversity are low. Although reed canarygrass may offer forage for large ungulates such as elk and deer, it offers little to other mammals. Because it grows very stiff and dense, it is difficult for smaller mammals, such as coyotes, bobcats, and rabbits to pass through. Habitat quality for species such as Canada goose (*Branta canadensis*) is diminished by the fact that the wetlands are not in proximity to their preferred foraging habitat of pasture and grain fields.

2.5.1.1 Ephemeral Riparian Wetlands

This wetland type is found primarily above Goose Haven Road, in the upland hillside drainages of the Subject Property. Although running water is not found in these drainages during the dry summer months, the soil stays moist from groundwater and the shading effect of dense shrubs and an overstory canopy. Vegetation in this habitat type is stratified, with a dense understory of shrub species such as twinberry (*Lonicera involucrata*), salmonberry (*Rubus chamaemorus*), dog rose (*Rosa caninus*), a midstory of larger shrub or small tree species such as white alder (*Alnus rhombifolia*), various willow species (*Salix* spp.), and dogwood (*Cornis* spp.), and a canopy layer of larger trees such as quaking aspen (*Populus tremuloides*) and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*). This habitat type provides valuable foraging and cover habitat for upland mammals and bird species.

2.5.1.2 Wet Prairie Bottomlands

Most of the Subject Property below the main road that separates the upland area from the rest of the property is comprised of seasonal wetlands, classified as wet prairie bottomlands. Wet prairie bottomlands are those areas that are composed of heavy grass or deciduous brush vegetation (Edelen and Allen 1997). A thick cover of reed canarygrass almost exclusively populates this area of the property.

Of the main habitat types found on the Subject Property, the wet prairie bottomlands have the highest percentage of non-native plant species. Stratified habitat that would have existed in the previous matrix of grassland, slough, and riparian habitat is virtually absent,

further diminishing habitat quality. However, during periods of inundation, the seasonal wetlands provide valuable foraging and resting habitat for migratory waterfowl.

An emergent wetland dominated by a robust, monotypic cattail/bulrush stand would likely not improve water bird use, and could create a management problem (Weller and Fredrickson 1973). Herbivores such as muskrat are important because their feeding and house-building activities change the structure of emergent wetlands. Muskrat activity, while desirable, could either improve or degrade the surrounding wetland community for water birds (Weller and Fredrickson 1973, Chabreck 1988).

2.5.1.3 Permanent Marsh

Permanent marsh is found in several locations on the Subject Property. The largest area of permanent marsh is that which surrounds the open water portion of Goose Haven Lake. This habitat type provides high quality, year-round habitat for migratory and resident bird species, and is marked by rooted, emergent wetland vegetation that is found in ponded conditions or wet or saturated soil. The dominant plant species found in this habitat type are broadleaf cattail (*Typha latifolia*), bulrush (*Scirpus* spp.), and various types of sedges (*Carex* spp.).

2.5.1.4 Open Water

The center of Goose Haven Lake contains 18.29 acres of open water habitat (Table 4). Although the lake was reportedly up to 20 feet deep as recently as the 1930s, Tetra Tech's field survey found that the lake is currently no more than 3.5 feet deep. Spatterdock (*Nuphar polysepalum*) and Eurasian milfoil (*Myriophyllum spicatum*) are found throughout the lake.

Shallow water provides good foraging opportunities for dabbling ducks and large wading birds (Figure 6). However, water quality is diminished by high water temperatures, potential algal blooms, and low dissolved oxygen content. Additionally, the milfoil, if untreated, could develop into a monoculture diminishing the growth and variety of native wetland plant species.

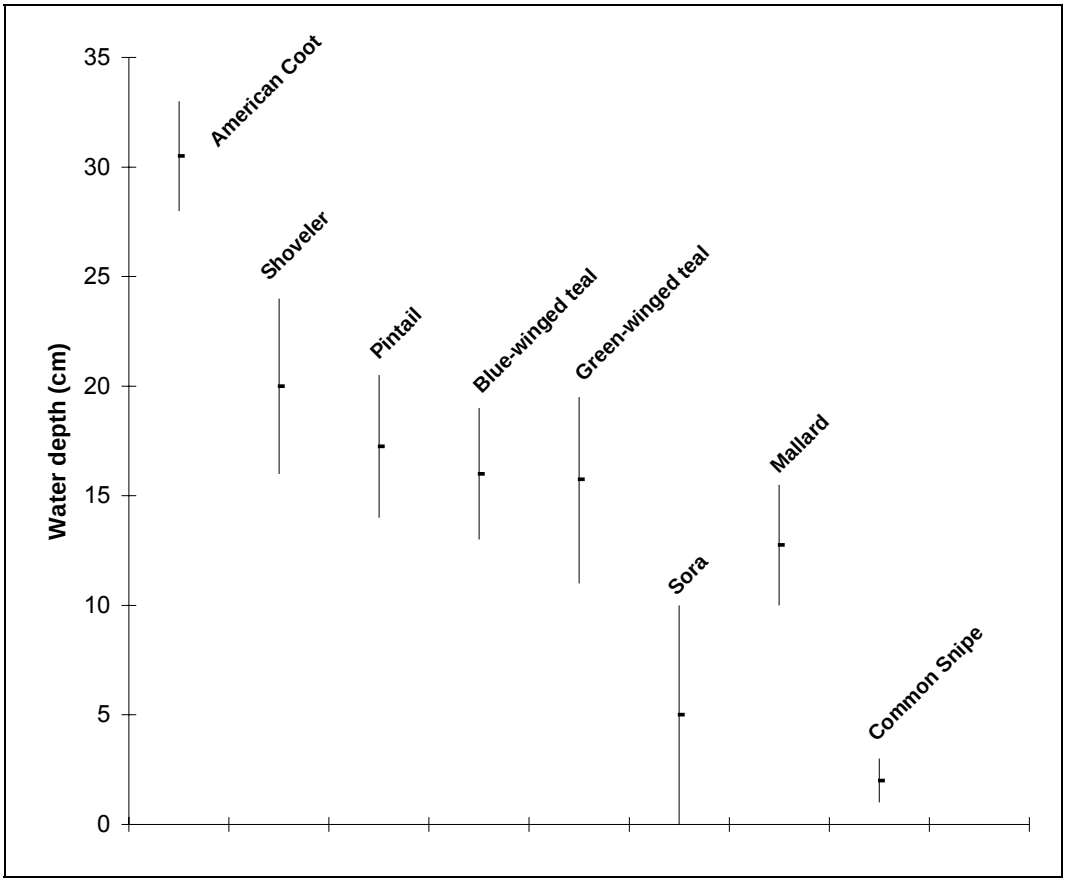

Figure 6. Preferred foraging depths of selected dabbling ducks, waders, and shorebirds (adapted from Fredrickson and Laubham 1996).

2.5.2 Uplands

The upland area is dominated by ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), larch (*Larix* spp.), grand fir (*Abies grandis*), and western red cedar (*Thuja plicata*). Western red cedar is typically found in riparian habitats and extends into lower elevations within wetland and riparian communities (Cooper et al. 1991). The forested areas have largely been logged with no remaining old-growth trees (>300 years old).

The ponderosa pine stands are small with an open canopy and an extensive grass/shrub understory. Representative shrub species include snowberry (*Ceanothus* spp.), mountain mahogany (*Cercocarpus montanus*), and serviceberry (*Amelanchier alnifolia*). Forb species include balsamroot (*Balsamorhiza sagitatta*), western meadowrue (*Thalictrum occidentale*), sticky geranium (*Geranium viscosissimum*), and aster (*Aste*r spp.).

Small, younger (<60 years) even-aged stands of aspen and black cottonwood are found in low gradient areas along the ephemeral drainage that occurs on the east side of the

Subject Property. A brushy understory generally occurs in the moister and shadier sites, often in association with the Douglas fir-grand fir-western red cedar complex. Typical understory species include bracken fern (*Pteridium* sp.), twinberry, thimbleberry (*Rubus parviflorus*), snowberry (*Ceanothus* spp.), maple (*Acer* spp.), chokecherry (*Prunus virginiana*), currant (*Rubus* spp.), and rose (*Rosa woodii*).

Logging that occurred from 1915 - 1930 cleared most of the forested area in the St. Joe river watershed though plant succession has replaced portions of the forest (CDAT, unpublished report). Livestock grazing was an on-going activity in the uplands, and contributed to a decline in species diversity and habitat degradation. Upland habitat quality is further diminished by extensive off road vehicle (ORV) use, which disturbs wildlife, causes severe erosion of upland soils, and leads to increased siltification of Goose Haven Lake. Species such as white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), moose (*Alces alces*), and other ungulates will benefit as habitat conditions in upland areas continue to improve with efforts to limit hunting, ORV use, and livestock grazing.

2.5.3 Sensitive Plant Species

Sensitive plant surveys were carried out when many species were either no longer in bloom, or had not yet bloomed. While Tetra Tech staff found no sensitive plant species on the Subject Property, further surveys during the appropriate flowering season are recommended.

Sensitive species that may occur in the area include rush aster (*Aster junciformis*), least bladdery milkvetch (*Astragalus microcystis*), crenulate moonwort (*Botrychium crenulatum*), mingan moonwort (*B. minganense*), peculiar moonwort (*B. paradoxum*), Constance's bittercress (*Cardamine constancei*), bristly sedge (*Carex comosa*), bristle-stalked sedge (*C. leptalea*), dryland sedge (*C.xerantica*), Howell's gumweed (*Grindelia howelli*), blueflag (*Iris versicolor*), chickweed monkeyflower (*Mimulus alsinoides*), northern beechfern (*Phegopteris connectilis*), Spalding's catchfly (*Silene spaldingii*), white beakrush (*Rhynchospora alba*), hoary willow (*Salix candida*), Utes lady tresses (*Spiranthes porrifolia*), pod grass (*Scheuchzeria palustris*), and short-style tofieldia (*Triantha occidentalis*) (IDFG 2003) may also occur in the area.

2.6 Historic and Current Land Use

Major land uses within the Coeur d'Alene Subbasin that have occurred historically and continue today include mining, forestry, road construction, and agriculture (NPCC 2004).

Goose Haven Lake was also named "Deep Lake," which may indicate that the depth of the lake was significantly greater than it is today. The Subject Property's upland area was historically forested, but has been extensively logged in the last 20 years. The floodplain surrounding Goose Haven Lake was used for livestock grazing and hay production.

Current land use in the surrounding area is approximately 11 percent agricultural, 87 percent forested, and 2 percent urban (BCMP 2002). Pasture comprises the majority of the agricultural land, with the remainder in annual grain crops.

2.7 Wildlife Species

Tetra Tech inventoried wildlife species on the Subject Property in July 2003. Elk, moose, and white-tailed deer were the major ungulate species observed on the Subject Property. Elk winter in the ponderosa pine and spring seeps in the upland areas of Goose Haven Lake. Moose utilize the scrub-shrub wetlands in the winter and have been observed in Goose Haven Lake in the summer (D. Munro, personal communication). During the July field reconnaissance, 39 bird species were observed on or near the Subject Property (Table 7). In addition, Canada goose (*Branta canadensis*) utilizes the lowlands and associated wetlands during their seasonal migration, and there have been sightings of mule deer (*Odocoileus hemionus*) in the uplands.

Table 7. Survey results of avian species found on the Goose Haven Lake Wildlife Mitigation Project (Tetra Tech 2003).

Common Name	Scientific Name
Uplands	
Common raven	Corvus corax
Red-tailed hawk	Buteo jamaicensis
American kestrel	Falco sparverius
Broad-tailed hummingbird	Selasphorus platycercus
Song sparrow	Melospiza melodia
Dark-eyed junco	Junco hyemalis
Great horned owl	Bubo virginianus
American robin	Turdus migratorius
House wren	Troglodytes aedon
Black-capped chickadee	Parus atricapillus
Turkey vulture	Calthartes aura
Downy woodpecker	Picoides pubescens
Hairy woodpecker	Picoides villosus
White-breasted nuthatch	Sitta carolinensis
Black-billed magpie	Pica pica
Flycatchers	Empidomax sp.
Wetlands	
Osprey	Pandion haliaetus
Northern harrier	Circus cyaneus
Great blue heron	Ardea herodias
Sandhill crane	Grus canadensis
Barn swallow	Hirundo rustica
Brewer's blackbird	Euphagus cyanocephalus
Double-crested cormorant	Phalocrocorax auritus
Mallard	Anas platyrynchos
Pintail	Anas acuta
Redhead	Athya americana
Green-winged teal	Anas crecca
Blue-winged teal	Anas discors
Cinnamon teal	Anas cynoptera
Common snipe	Gallinago gallinago
Sora	Porzana carolina
Common tern	Sterna hirundo
Coot	Fulica americana
Red-winged blackbird	Agelaius phoeniceus
Yellow-headed blackbird	Xanthocephalus xanthocephalus
Chipping sparrow	Spizella passerina
Lincoln's sparrow	Melospiza linconii
Yellow warbler	Dendroica petechia
Black tern	Chlidonias niger

Threatened and endangered animal species occurring in northern Idaho are wintering bald eagle (*Haliaeetus leucocephalus*), whooping crane (*Crus americana*), gray wolf (Canis *lupus*), Canada lynx (*Lynx canadensis*), northern Idaho ground squirrel (*Spermophilus bruneuss bruneuss*), white sturgeon (*Acipenser transmontanus*), bull trout (*Salvelinus corifluentus*), and grizzly bear (*Ursus arctos horribilis*). These species were not observed during fieldwork.

2.8 Baseline HEP

A baseline HEP was conducted in July 2002 by RHT Consultants (Appendix B). Four target species (white-tailed deer, black-capped chickadee (*Poecile atricapillus*), mallard (*Anas platyrhynchos*), and muskrat (*Ondatra zibethicus*)) were used in the analysis (Table 8). It is apparent from the baseline HEP that the majority of HUs were generated from the existence of relatively low-quality non-forested wetlands and from a recovering forested hillside.

Table 8. Baseline HEP analysis for the Goose Haven Wildlife Mitigation Project (RHT Consultants 2002).

Target Species	Existing Cover Type	Existing Acres[a]	Existing HSI	Existing HUs
White-tailed deer	Conifer forest	198	0.59	117.42
Black-capped chickadee	Conifer forest	198	0	0
Mallard	Non-forested wetlands/grassland	402	0.49	138.13
Muskrat	Palustrine	38	0.3	11.33
Total		638		**266.88**

[a] Acre figures are estimates based on information provided by project staff. Acre figures appear larger than actual project acreage due to stacking of HUs, i.e., more than one model was used for some cover types.

It should be noted that the Program requires that a HEP be repeated every five years as part of ongoing monitoring and evaluation. It is anticipated that the Subject Property would maintain, within the limits of normal temporal variability, at least the baseline number of 267 HUs. Future HEP analysis should relocate the seven established sampling points, and the remaining 20 sampling points should be randomly generated and their global position established. Another set of randomly generated sample points should also be established. Creating 30 permanent sampling points would serve as the basis for quantitative monitoring. All sampling points should also be permanently marked in the field to facilitate relocation.

2.9 Follow-up HEP

A follow-up HEP was conducted in June of 2007 by the Columbia Basin Fish and Wildlife Authority's Regional HEP Team. Mr. Paul Ashley, formerly of RHT Consultants, led the Regional HEP team and provided the following data. It should be noted that the 2002 HEP was conducted in July, while the 2007 HEP was conducted in June. Some discrepancies in

HSI values may be a result of the difference in vegetative growth because of the time difference during the growing season.

Although additional cover types were identified and surveyed during the 2007 HEP analysis, only those cover types and associated target species used in the 2002 baseline HEP analysis are shown and compared in Table 9. Target species "stacking" was applied to only the conifer cover type on the 2002 baseline HEP surveys while HU "stacking" was applied to all cover types in the 2007 HEP surveys[1]. "Stacking' implies more than one target species being used per cover type as outlined in the Albeni Falls loss assessment matrix.

Table 9. Goose Haven property 2002-2007 HSI/HU comparison.

Target Species[a]	Cover Type[a]	Acres	Baseline HSI (2002)	Baseline HUs (2002)	Follow-up HSI (2007)	Follow-up HUs (2007)
White-tailed deer	Conifer forest	198	0.59	117.42	0.90	178.20
Black-capped chickadee	Conifer forest	198	0	0	0.87	172.26
Mallard	Wetland/wet meadow	402	0.49	138.13	1.00	402.00
Muskrat	Palustrine	38	0.38	11.33	0.57	21.66
Total		638		266.88		774.12

Additional target species were used for wetland/meadow and palustrine cover types in the 2007 HEP surveys consistent with a draft loss assessment matrix for Albeni Falls Dam developed by Ray Entz (Kalispel Tribe). In addition, the upland grassland cover type was added to the 2007 HEP surveys. Only the target species, cover types, HSIs, and HUs used in the baseline (2002) HEP surveys were compared to 2007 HEP results in this Table.

[1] An Albeni Falls Dam cover type/target species matrix is needed. Target species "stacking" is tentative at best prior to development of a matrix for Albeni Falls Dam.

HEP results for mallard were modified, based on best professional judgment, to reflect actual breeding/nesting habitat conditions (Table 10). The mallard HSI (1.00) shown in Table 9 reflects post nesting season field measurements and are not the same conditions present when mallards are nesting. Specifically, visual obstruction measurements (VOR) would be lower during the nesting season due to "lodging" of residual cover.

Table 10. Goose Haven property modified 2002-2007 HSI/HU comparison table.

Target Species[a]	Cover Type[a]	Acres	Baseline HSI (2002)	Baseline HUs (2002)	Follow-up HSI (2007)[b]	Follow-up HUs (2007)
White-tailed deer	Conifer forest	198	0.59	117.42	0.90	178.20
Black-capped chickadee	Conifer forest	198	0	0	0.87	172.26
Mallard	Wetland/wet meadow	402	0.49	138.13	0.50	201.00
Muskrat	Palustrine	38	0.38	11.33	0.57	21.66
Total		638		266.88		573.12

[a] Additional target species were used for wetland/meadow and palustrine cover types in the 2007 HEP surveys consistent with a draft loss assessment matrix for Albeni Falls Dam developed by Ray Entz (Kalispel Tribe). In addition, the upland grassland cover type was added to the 2007 HEP surveys. Only the target species, cover types, HSIs, and HUs used in the baseline (2002) HEP surveys were compared to 2007 HEP results in this Table.

[b] The mallard HSI was modified to better reflect mallard habitat conditions based on best professional judgment.

Moreover, the density of herbaceous vegetation would likely limit movement of ducklings from nesting sites to open water areas further degrading habitat quality for mallards. Therefore, the mallard HSI was reduced from 1.00 to 0.50 to more realistically reflect mallard habitat quality at this site (Table 10).

Although every effort was made to locate and follow the same transects established for the 2002 baseline surveys, relocating transect lines with GPS coordinates is still limited to at

least a ± 20 foot error especially under a forest canopy. As a result, the 2007 HEP surveys likely did not precisely follow the same routes as the 2002 HEP surveys. This is an important consideration, because shifting the location of a transect by even a few feet may result in very different outcomes for habitat variables such as snags. Another factor that can impact transect results is to change habitat variable collection methods.

The drastic change in the HSI for black-capped chickadee in 2007 (from 0.0 in 2002 to 0.87 in 2007) (Table 10) is likely the result of both changing habitat collection methods and not running the transect lines in identical locations. Through 2002, snags data was collected on fixed radius plots (0.10 acre) at 100 foot intervals along the transect line.

This method was not a reliable method to collect snag data. More often than not, surveyors passed snags along the transect line only to find that snags were not present within the fixed radius plots. Therefore, the fixed radius plot method was abandoned after 2002 in favor of the "belt" transect. Belt transects were used in the 2007 HEP surveys to quantify the presence of snags.

HSI differences reported for white-tailed deer are the result of increased shrub production since 2002 and possibly variation associated with altered transect line locations as previously described. Similarly, enhanced muskrat habitat quality is due to an increase in the estimated amount of preferred food available to muskrats within the palustrine cover type in 2007 as compared to the amount estimated in 2002.

Note: Due to the magnitude of discrepancies and changes in data collection, the 2007 HEP should be viewed as a new baseline HEP for the subject property. All subsequent HEPS should mimic this most recent HEP to ensure a more accurate portrayal of target species' HUs. An additional HEP will be conducted in the summer of 2008 to determine the accuracy/consistency of the previous HEPs and obtain a definitive baseline.

Section 3 Enhancement Alternatives

The goals for the restoration and enhancement of the Goose Haven Lake Wildlife Mitigation Project reflect a desire to increase the functional value of the ecosystem and to develop facultative habitat of the target species (Canada goose (*Branta* canadensis), mallard duck, muskrat, white-tailed deer, and blackcap chickadee). Increasing the functional diversity of habitat within the current wetland area and increasing the amount of wetlands and open water can increase ecosystem interactions that will create additional habitat for the target species. An adaptive management approach is used in all enhancement projects.

These goals will be achieved through a three-step process with the intent to:

1. Employ prescriptive techniques to maximize wildlife diversity and habitat productivity by the following methods (adapted from Lunde 1969):

    a. Improve breeding and brood-rearing habitat for waterfowl by increasing water depth to improve interspersion of cover.

    b. Kill or reduce sedge-grass monotypes, noxious weeds, and woody vegetation by flooding and prescribed burning or cutting before seed set to change plant succession from low quality moist-soil and upland types to high-quality moist soil, shallow, and deepwater habitats.

    c. Provide mudflat areas for moist-soil plants produced by natural or artificial seeding for waterfowl food plants.

    d. Allow desirable cover plants to recover after being lost from flooding.

    e. Increase invertebrate production for nesting ducks, ducklings, and shorebirds by flooding to increase aquatic and emergent vegetation.

2. Track progress on a broad scale for wildlife habitat improvement.

3. Follow adaptive management protocols including evaluating the long-term progress of site-specific mitigation measures and management activities through the adoption of standardized, scientifically accepted, and statistically rigorous monitoring methodologies that address both target and non-target species and their habitats. Establishing baseline conditions and then employing regular monitoring will provide an indicator of management effectiveness across spatial, temporal, and biological scales and would include measurement and comparison of:

    - Relative abundances;
    - Relative distributions;
    - Population trends; and

- Trends in overall diversity of site-specific wildlife communities.

Goose Haven Lake offers an excellent opportunity for the creation and enhancement of a large area of high quality seasonal and permanent marshland. Ample water exists on site and can be delivered easily and inexpensively to other areas of the property. The Subject Property's location in the St. Joe river floodplain offers gentle slopes and deep depositional soils that retain moisture and resist rapid percolation. Plant propagules are likely present in the seed bank contained within existing wetland areas and will allow the site to re-vegetate with native wetland plants if the proper conditions are present.

A 1905 land survey map provides a description of historic habitat types present on the Subject Property at that time. Although it would be difficult and impractical to restore the Subject Property to historic (1905) conditions, restoration of the willow shrub, cottonwood riparian forest, and permanent marsh communities presents a reasonable goal. With this in mind, all alternatives share several features; removal of invasive non-native plant species and replacement with native species, and strategically planting wetland species such as sedges and rushes along with cottonwoods (*Populus spp.*) and/or willows (*Salix spp.)* to diversify the habitat available for wildlife.

3.1 Alternative 1: No-Action Alternative

Under this alternative, no action would be taken to enlarge or enhance the wetlands found in and around Goose Haven Lake. Existing conditions would remain as they are now, although the lake would most likely continue to collect sediment and become shallower, eventually turn into a marshy meadow, and reduce wetland diversity even further.

3.2 Action Alternatives

Three action alternatives have been developed to enlarge and enhance the wetland habitat found in and around Goose Haven Lake (Figure 7). A fourth alternative enlarges and enhances the seasonal wetland found near the lake (Figure 8). The first alternative is based solely on the manipulation of the water level by artificial means. The second alternative involves manipulation of topographical features through grading and re-contouring. The third alternative is a combination of grading combined with minimized water manipulation.

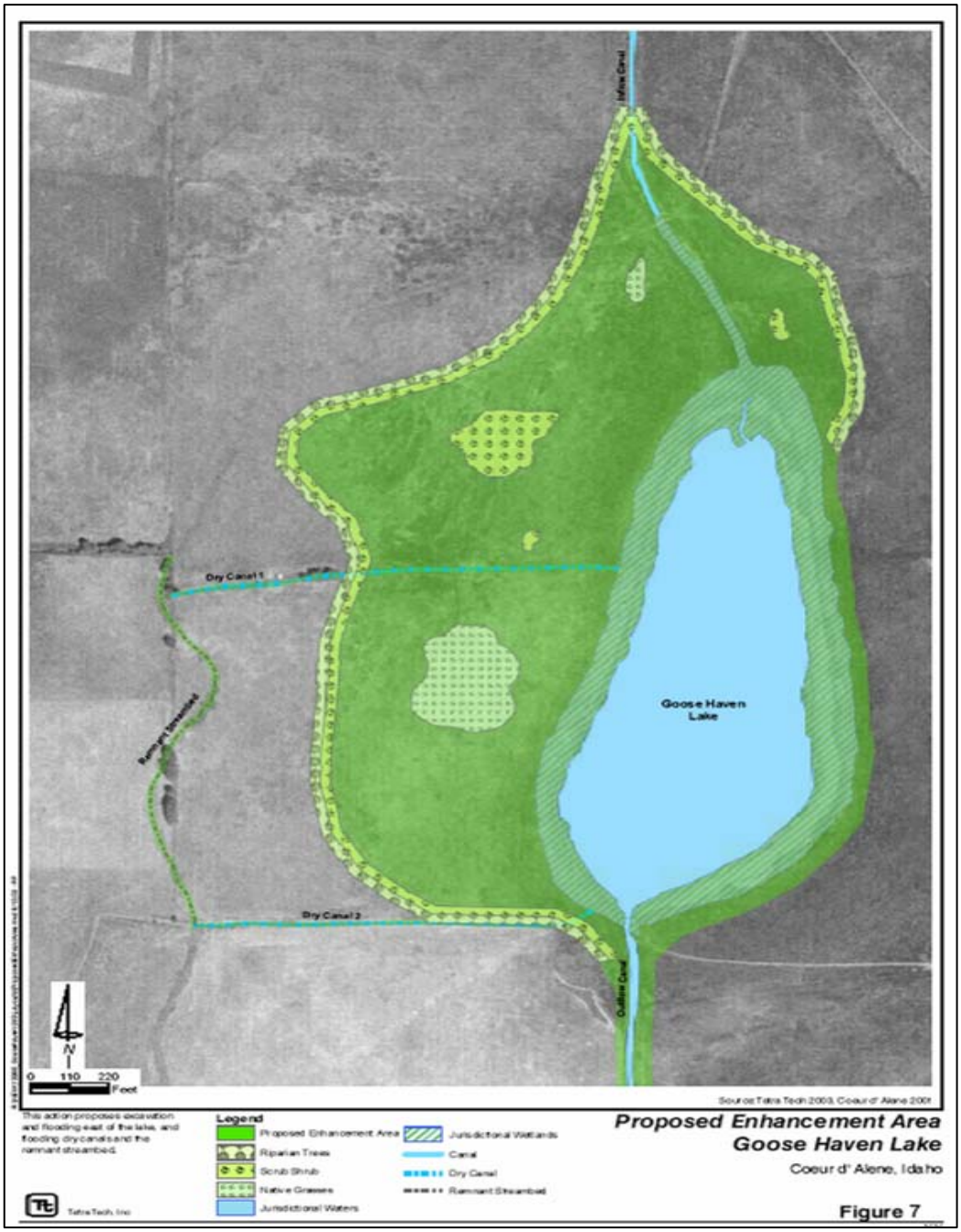

Figure 7. Alternative 3 proposed enhancement area (Tetra Tech 2003).

3.2.1 Alternative 2: Hydrologic Manipulation

Water level manipulation is one of the most important techniques to manage wetland plant communities, and is often integrated with other control methods depending on the wetland type (Fredrickson and Taylor 1982; Payne 1992). Water level manipulation is also a tool that can affect wildlife directly as well as indirectly by controlling plant community structure (Payne 1992).

Goose Haven Lake's primary water source during the dry summer months is inflow from the St. Joe River, which is higher in elevation but shares a hydrologic connection. Such a connection was apparent during a flood anomaly that occurred in early September 2003. At the time of the field surveys in late July, only a small amount of water was entering the lake. Such flow is considered the norm during summer months.

This alternative would require the construction of a relatively inexpensive water delivery system (if one does not already exist at the western pump station) and direct control of the water removal system. Introducing or increasing flow from the St. Joe River would increase surface area with a correspondent increase in evaporation and percolation. On the other end, the rate of pumping would be decreased or halted until the surface level of the lake had risen at least one foot. Pumping would then resume at levels sufficient to maintain the desired water level. Such a rise in lake level is expected to affect an area of approximately 130 percent greater than the existing wetland.

Trees such as black cottonwood, box elder (*Acer negundo*) and quaking aspen would be planted at the upper edge of the wetland after the water had risen to the desired level. Planting smaller scrub species as the next layer inside the wetland would provide further enhancement. This would create a high quality, stratified buffer zone around the marsh.

Direct planting of wetland herbs and forbs such as spikerush, sedge, and bulrush species is recommended in the area that would be inundated by the increased water level. It is assumed that cattails will quickly colonize the area once it is flooded. However, it is recommended that some cattails be removed from the edge of the lake and simply deposited in the inundated area at the same time the water level is raised. Deposited cattails would quickly take root and spread into the area currently occupied by reed canarygrass.

It is possible that under this alternative the interface between the vegetated marsh and the unvegetated open water area of the lake would change. Deepening the lake by 1-2 feet may make the water too deep to sustain cattail in its current location. If that were the case, then this alternative would increase the open water area of the lake, while the cattail would occupy the same niche that it currently does but would do so at a higher elevation. However, the existing cattail may adapt to the change in water level and remain in place, while the overall population could expand into the newly inundated area.

Advantages. This alternative has several advantages over those that are proposed below. This alternative can be implemented with existing resources, resulting in a large area of new wetlands with minimal effort and expense (see Table 9 for a preliminary cost estimate). If the manipulation of the hydrological regime did not have the desired effect or caused unforeseen negative impacts, then it could be easily terminated by restoring the previous water levels.

Disadvantages. This alternative has several disadvantages over alternatives 3 and 4. This alternative would not provide the opportunity to create other types of wetland habitat aside from those that currently exist. The wetlands created by this alternative would not differ

from the habitat that currently exists, and would be primarily a mix of cattail marsh and open water.

Two land use issues would need to be resolved before this alternative could be implemented. The first is whether project managers are able to draw more water from the St. Joe River. The amount of water that can potentially be diverted may need to be negotiated with the local drainage district. In addition, raising the water level at Goose Haven Lake on a permanent basis may raise the water table under adjacent farmland. Adjacent property owners may object to the plan, as it could alter agricultural production. A hydrologic model would be useful in predicting whether this would occur. One possible solution, should this alternative be implemented either in part or whole, is to develop drainage canal(s) between the project property and adjacent landowners. Additional berming may be required along property boundaries to help retain water in its desired location.

3.2.2 Alternative 3: Excavation of Upland Surrounding the Marsh

This alternative entails excavation of lands immediately surrounding Goose Haven Lake and its wetlands. Under this alternative, Goose Haven Lake and the associated wetlands will be managed to provide a variety of water depths to meet the critical habitat requirements of foraging water birds. Fredrickson and Reid (1986) noted that of 81 species of water birds using wetlands in the Southwest, 38 species forage in water less than 10 centimeters in depth. These conditions are not necessarily maintained for extended periods because wetland plants and wildlife are adapted to water fluctuations in natural wetlands. However, the ratio of vegetation to water should be kept between 30 and 70 percent, with 50 percent optimum (Veery 1985a, 1989). Any practice that retards or reverses plant succession in water bodies usually benefits waterfowl (Payne 1992). For maximum waterfowl production, the water level must be maintained between 15 cm and 3.7 m, with 0.3 m - 1.2 m being optimum depth across the growing season (Bookhout et al. 1989; Pederson et al. 1989). Such areas are used more by diving ducks than by dabbling ducks.

The purpose of the excavation is to re-grade upland or seasonal wetland areas to an elevation that would allow inundation of a larger area and establish a 1-2% gradient 150 – 300 feet outward from the edge of the existing marsh. Deeper excavation or grading at a gentler slope could create a larger wetland area. The area could be further enhanced by installing berms and culverts to allow varying water levels in different areas, resulting in a more diverse assemblage of wetland types. This would increase shallow water habitat suitable for dabbling ducks and waders such as great blue heron, and further diversify the habitat found near the lake. Excavation should also take place along the flow line of the canals that feed and drain the lake. This would take advantage of the minimal flow that is provided through the canals, reducing stagnation, and helping to maintain stable water temperatures.

Small islands could be created within the flooded area in order to allow resting and breeding habitat for waterfowl with a low probability of predation. Islands would be planted

with various native shrub and grass species to diversify the functional characteristics of the newly created habitat. Close proximity to open water and the availability of vegetation for cover/foraging is positively correlated with a decrease in predation (Braun 2005).

As with Alternative 2 a combination of scrub-shrub species and large deciduous trees would be planted along the upper edge of the wetland, and along the edges of the canals and the historic meander. The creation of a stratified buffer area around the marsh would be advantageous for both target and non-target wildlife species, such as cavity nesting ducks. Control of water inflow, distribution, and discharge would create extensive water and soil conditions suitable for the germination and growth of desirable plant communities for food and cover (Fredrickson 1991). The initial capital investment associated with the implementation of this alternative is detailed in Table 12. Long-term operations and maintenance costs are the low due to high value enhancements that more closely resemble a prior natural state of hydro function.

Advantages. This alternative has at least three advantages over Alternative 1: 1) it will allow for the creation of increased habitat diversity within the excavated area. Small islands allow nesting, escape, and loafing habitat for waterfowl; 2) Newly created wetland areas can be controlled; and 3) Water levels would remain unchanged from existing conditions, so there is no threat of adjacent lands being impacted by a rise in water table.

Disadvantages. There is an increased expense for implementation when compared to the first alternative (see Table 12 for an estimate of the project costs for this alternative). It would require far more planning than the first alternative due to the expense of using scrapers or excavators. The second disadvantage relative to other options is that this alternative would be much more difficult to adjust if monitoring showed that the goals were not being met. Adjusting the results, if needed, could require re-contouring or the installation of water control devices including berms, culverts, or pumps.

Although water levels would not be raised, water would cover a larger surface area resulting in increased evaporation and percolation rates. More water, therefore, may potentially be required from the St. Joe River.

3.2.3 Alternative 4: Combined Hydrologic Manipulation and Excavation

This alternative would require both raising the water level, as described under Alternative 1, and excavation, as described under Alternative 2. Under this alternative, the water level would not be raised to the degree that is recommended under Alternative 1, and the excavation would be less extensive than under Alternative 2.

Excavation would begin at a higher elevation under this alternative. For example, if the water level is currently at 2,120 feet and Alternative 2 called for excavating the adjacent upland area to 2,117 feet to allow for a 1-2% gradient 150-300 feet out from the edge of the existing marsh, then raising the water level by 1.5 feet would reduce the initial excavation by half. This would significantly minimize the expense of this phase of the operation

(projected expenses for this alternative are just above the median price for Alternatives 1 and 2).

Advantages. This action will impose minimal impacts due to flooding on adjacent lands because additional water is retained without significant increase in the water table. This alternative would also retain the advantages of Alternative 2: project managers could plan the size of newly created wetlands and create a wetland mosaic.

Disadvantages. There are risks associated with implementation of this alternative: 1) the water table could be raised, which may negatively affect adjacent lands (although this risk is diminished under Alternative 4); 2) lacking full control of water on the subject property may impair wetland development.

3.2.4 Alternative 5: Enhancement of Seasonal Wetland

This alternative (preferred) allows hydrologic manipulation and excavation of the seasonal wetland located near Goose Haven Lake. One-meter digital elevation maps (DEMs) produced from LiDAR (Light Detection and Ranging) data aided in predicting hydrological flow. The DEMs were overlayed with a mapped outline of the spring flood zone surrounding the seasonal wetland and lake to verify reliability and usability. Hydrological manipulation will be conducted using a water control structure, such as a flashboard riser, attached to the upstream end of the culvert in the main canal crossing. Water levels will be manipulated with the water control structure providing habitat managers control of the newly formed wetland. Minimal excavation is required to create deep pools for open water sustainment, small islands for waterfowl nesting/loafing, and vegetation removal to promote natural black cottonwood regeneration along canal banks.

Advantages. The use of DEMs allow prediction of hydrological manipulation by revealing surface elevations, and mapped spring-time floods allow prediction of water movement after installation of the water control structure. Using both DEMs and mapped flood waters allows for a more accurate prediction of water movements after project implementation. This alternative presents minimal costs to create a more diverse wetland mosaic.

Disadvantages. The elevated water level may sub irrigate to the east of the canal near the seasonal wetland. If the elevated water table produces negative affects, such as the flooding of adjacent properties, the water level may need to be lowered.

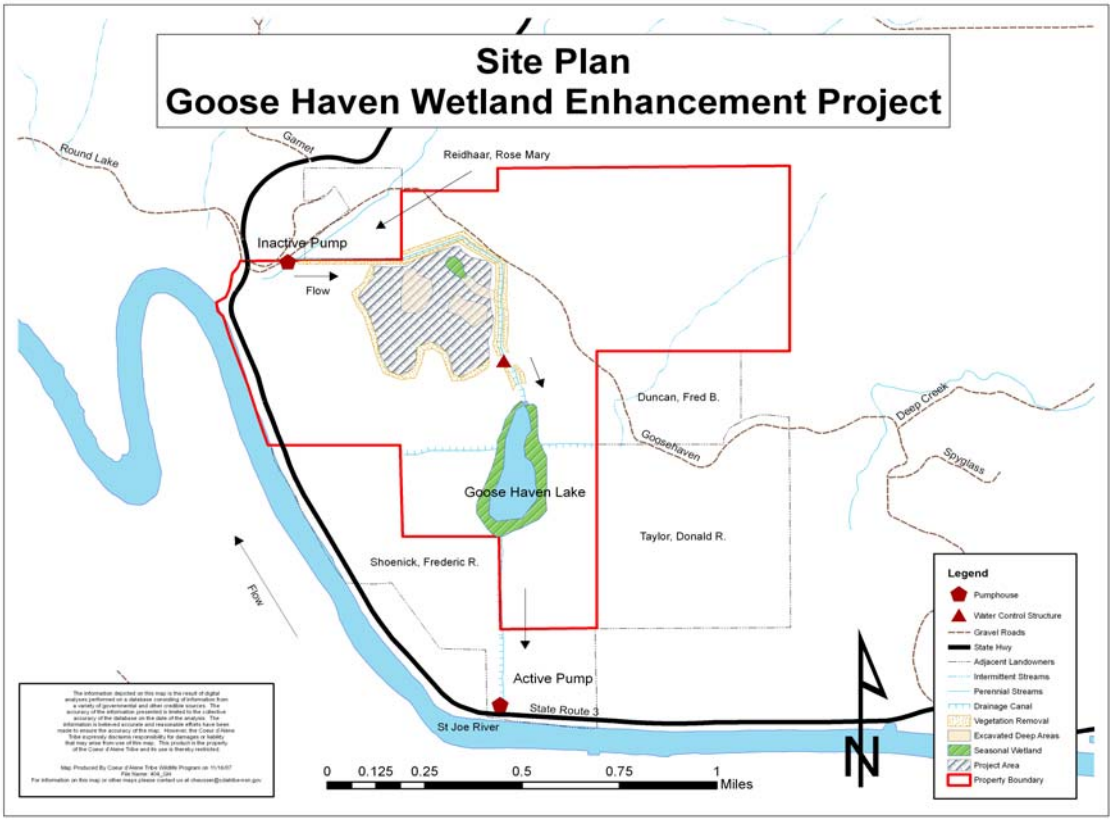

Figure 8: Alternative 5 proposed enhancement area.

3.3 Discussion

Criteria for assessing the suitability of a particular alternative may include cost, reliability of the design, the potential to achieve project goals, and predictability of the outcome. Project managers must also consider the potential for project failure. Each alternative was assessed in terms of the cost and reliability. It was determined that Alternative 5 would provide the lowest cost approach while providing a marked habitat improvement and variability.

Project costs on a per acre basis are considerably lower than the other alternatives (Table 13). Reliability is considered low due to the lack of an adequate topographic survey. This alternative is considered low risk in that the topography would remain unchanged, and it would be relatively simple to reverse the effects of the alternative if the desired results are not obtained.

3.3.1 Alternative 2

Table 11 shows the projected costs associated with the implementation of Alternative 2.

Table 11. Projected costs for implementation of Alternative 2.

Description	Quantity	Units	Unit Cost ($)	Total Cost ($)
Construction Costs				
Mobilization/demob. of tractor	1	ev	5,000	5,000
Earthwork				
Cut and removal of topsoil (Assumes small cut and fills to open canals, repair berms, prepare planting area, dig holes for saplings)	500	yd^3	2.5	1,250
Site Preparation				
Project planning, permitting, and oversight	0.5	yr	50,000	25,000
Site preparation (Assumes 3-yr cycle of pre-burn mowing of periphery, transplant of sensitive species, intensive watering, burning	1	ea	5,000	15,000
CDAT Fire Mgmt crew on standby	1	ea	1,000	1,000
Revegetation				
Riparian saplings (15 gal.)	800	ea	45	36,000
Installation	800	ea	15	12,000
Scrub-shrub seedlings (5 gal.)	1,600	ea	13.50	21,600
Installation	1,600	ea	10	16,000
Wetland herbs (plugs)	34,800	ea	1	34,800
Installation	34,800	ea	0.50	17,400
Sub-total				167,650
Contingency		20	%	33,530
Total Construction				**201,180**

Table 11 continued.

Description	Quantity	Units	Unit Cost ($)	Total Cost ($)

Planning, Maintenance, and Monitoring Costs[a]				
Cultural Resources Oversight	1	yr	1,500	1,500
Biological Monitoring and Evaluation	1	yr	20,000	20,000
Aerial Photo (1every 5 years)	1	ea	1,000	1,000
Weed Control	1	yr	15,000	15,000
Annual Monitoring Report	1	yr	4,000	4,000
5-Yr PM&M Total (including 5% per annum inflation increase)				**229,314**
TOTAL				**430,494**

[a] Excludes costs for preparing permit applications or environmental review.

3.3.2 Alternative 3

This alternative would be far more expensive than Alternative 2 (Table 11). Reliability is considered high because project managers would be able to manipulate the topography to achieve the mosaic of desired habitat types. This alternative is considered high risk because if the desired results were not obtained, pre-existing conditions could not be easily restored.

Table 12. Projected costs for implementation of Alternative 3.

Description	Quantity	Units	Unit Cost ($)	Total Cost ($)
Construction Costs				
Mobilization/demob. of 2 scrapers, 2 dump trucks, and 1 excavator	1	ev	25,000	25,000
Earthwork				
Cut and removal of topsoil (Assumes average cut of 1.5 feet over 65 acres and five % soil expansion factor)	471,250	yd^3	2.5	1,178,125

Table 12 continued.

Description	Quantity	Units	Unit Cost ($)	Total Cost ($)
Site Preparation				
Project planning, permitting,	0.5	yr	50,000	25,000

and oversight				
Site preparation (Assumes 3-yr cycle of pre-burn mowing of periphery, transplant of sensitive species, intensive watering, burning	1	ea	5,000	15,000
CDAT Fire Mgmt crew on standby	1	ea	1,000	1,000
Revegetation				
Riparian saplings (15 gal.)	800	ea	45	36,000
Installation	800	ea	15	12,000
Scrub-shrub seedlings (5 gal.)	1,600	ea	13.50	21,600
Installation	1,600	ea	10	16,000
Wetland herbs (plugs)	34,800	ea	1	34,800
Installation	34,800	ea	0.50	17,400
Sub-total				396,239
Contingency		20	%	79,248
Total Construction				**475,487**
Planning, Maintenance, and Monitoring Costs[a]				
Cultural Resources Oversight	1	yr	2,500	2,500
Biological Monitoring and Evaluation	1	yr	20,000	20,000
Aerial Photo (1every 5 years)	1	ea	1,000	1,000
Weed Control	1	yr	15,000	15,000
Annual Monitoring Report	1	yr	4,000	4,000
5-Yr PM&M Total (including 5% per annum inflation increase)				**234,839**
TOTAL				**1,872,269**

[a] Excludes costs for preparing permit applications or environmental review.

3.3.3 Alternative 5

This alternative was developed to lower the cost and incorporate a long-term approach to wetland habitat enhancement.

Table 13. Projected costs for implementation of Alternative 5.

Description	Quantity	Units	Unit Cost ($)	Total Cost ($)
Construction Costs				
Mobilization/demob. of 1 bulldozer and 1 backhoe	1	ev	5,000	5,000
Earthwork				
Cut and removal of topsoil (Assumes small cuts averaging 1.5m of ≤5 acres, repair berms, prepare planting area, dig holes for saplings)	500	yd^3	2.5	1,250
Site Preparation				
Project planning, permitting, and oversight	0.5	yr	50,000	25,000
Site preparation (Assumes 3-yr cycle of pre-burn mowing of periphery, transplant of sensitive species, intensive watering, burning	1	ea	5,000	15,000
CDAT Fire Mgmt crew on standby	1	ea	1,000	1,000
Revegetation				
Riparian saplings (15 gal.)	800	ea	45	36,000
Installation	800	ea	15	12,000
Scrub-shrub seedlings (5 gal.)	1,600	ea	13.50	21,600
Installation	1,600	ea	10	16,000
Wetland herbs (plugs)	34,800	ea	1	34,800
Installation	34,800	ea	0.50	17,400
Sub-total				167,650
Contingency		20	%	33,530
Total Construction				**201,180**

Table 13 continued.

Description	Quantity	Units	Unit Cost ($)	Total Cost ($)
Planning, Maintenance, and Monitoring Costs[a]				
Cultural Resources Oversight	1	yr	1,500	1,500
Biological Monitoring and Evaluation	1	yr	20,000	20,000
Aerial Photo (1every 5 years)	1	ea	1,000	1,000
Weed Control	1	yr	15,000	15,000
Annual Monitoring Report	1	yr	4,000	4,000
5-Yr PM&M Total (including 5% per annum inflation increase)				**229,314**
TOTAL				**430,494**

[a] Excludes costs for preparing permit applications or environmental review.

Section 4 Management Objectives

4.1 Objective 1: Wetland Restoration

Due to past farming practices, most of the wetlands are now pastureland. In order to recreate this important habitat type, different engineering practices must be used, including the use of heavy equipment, explosives, and/or plantings.

4.1.1 Task 1.1 Develop Hydrologic Model and Contour Map

Develop a site-specific hydrologic model and contour map so that flood magnitude, timing and recession rates, as well as the occurrence of summer pulse flows may be derived. This will allow managers to determine optimal locations for plantings and create realistic drawdown prescriptions that may be used to favor or inhibit the establishment of particular species (Mahoney and Rood 1998; Johnson 1998).

4.1.2 Task 1.2 Increase Emergent Plant Species

Plant moist soil plants such as spikerush and fox sedge to provide substantial food value for waterfowl, wading birds, and shorebirds throughout the growing season (Fredrickson and Taylor 1982). Spikerush and fox sedge are perennials, with spikerush having an early germination period followed by fox sedge with late season germination. Fox sedge and bulrush would also provide valuable cover habitat for waterfowl and wading birds (Fredrickson and Taylor 1982). Although bulrush seeds are consumed by water birds, they are of lesser importance than the seeds of other plants, especially perennials (Fredrickson

and Laubham 1996). The robust structure of bulrush and cattails is important as vertical and horizontal cover for seclusion of waterfowl pairs, sites for nest attachment, nesting for wading birds and some shorebirds, predator avoidance, protection from inclement weather, and food for muskrats.

Once the areas considered for plantings have stable hydrological levels, seedlings will be planted by hand around the shoreline areas of Goose Haven Lake as well as re-created wetland areas that were converted to farmland in the past.

4.1.3 Task 1.3 Establish Scrub-shrub Wetland

Establish scrub-shrub wetlands to provide perennial woody vegetation for both food and cover. Shrubs and trees, in particular, are important thermal cover during periods of inclement weather and provide structure and isolation for nesting passerines. Woody species may provide a good source of carbohydrates for large mammals such as white-tailed deer and moose. Woody species are also known to be integral to the macro invertebrate community, often after leaf-fall (Fredrickson and Laubhan 1996). As trees mature, vertebrates requiring cavities may also benefit. Burrows may be established at the base of larger trees and smaller trees provide nesting and perching habitat for various species of birds.

In the latent canal drainage areas, cottonwood species will be left to compile on their own while in the wetlands that have been stabilized, a suite of deciduous trees comprised of Quaking Aspen, Dogwood and Cottonwood will be planted by hand or with a hydro-insertion tool (to prevent soil compaction) from cuttings.

4.1.4 Task 1.4 Enhance Riparian Wetland

Riparian plant species will be planted in the transition zone as saplings, rather than as cuttings or seedlings in order to maximize riparian habitat establishment. This will help to divert specific browse and forage search images of browsers such as deer and elk.

4.1.5 Task 1.5 Enhance Hydrologic Regime

Manage the timing and amount of intermittent flooding of the Subject Property. Habitat requirements of some invertebrate species change depending on life-cycle stage (Pennak 1978). One habitat may be important for egg laying, whereas a different habitat may be required for feeding. Thus, species with different habitat associations adopt strategies that allow them to exploit a particular hydrologic regime.

For many invertebrate species, short-term hydrologic regimes may be more important than long-term stable regimes (Pennak 1978). The behavior of invertebrates affects the cycling of litter through decomposition and the functioning of the bacterial and fungi community. Flooding may become problematic if the water is too deep and results in anaerobic conditions that restrict the faunal community from undertaking the decomposition process.

4.1.6 Task 1.6 Increase Water Flow to Goose Haven Lake

Increase water flow to Goose Haven Lake to preserve water quality, inhibit algal blooms, and slow the rate of siltification. Wetland areas will be inundated for long periods to control weeds such as reed canarygrass. Although seasonal drawdowns may be instituted as part of operations and maintenance, strict monitoring of seasonally exposed areas should be undertaken with the option to raise water levels if new colonization by reed canarygrass is apparent.

Water control structures will be placed on the drainage canal end of Goose Haven Lake. This structure will maintain the hydrological stability throughout the property when implemented in concert with two wetland recreation zones and possibly one other water control structure. Currently, control of the pumping station in that area resides outside the tribe's purview.

4.1.7 Task 1.7 Controlled Burning

A controlled burn in wetland areas would provide new green shoots, roots, and rhizomes of grasses and sedges for waterfowl. Fire would also expose fallen seeds for ducks and generally make the wetland more suitable by eliminating decomposed organic matter, decreasing the biomass of impenetrable growth of the climax reed canarygrass and cattail community. Fire also has the potential to create deeper pools and edge for nesting and foraging waterfowl. Brood rearing habitat may also be improved by converting solid stands to more open and diverse habitat. Burning allows for the removal of decadent litter, which inhibits and/or eliminates new shoot growth and decreases noxious weed infestations.

Although burning may not kill all the reed canarygrass, burning the aboveground portion of the plant would allow native species greater access to sunlight, water, and space to grow, thus increasing carrying capacity. Burning would also release nutrients that are currently locked up in the stems of reed canarygrass.

Several factors should be considered if a controlled burn is implemented:

- The burn should take place after bird nesting and brood rearing (February – August) or before if weather allows, to avoid disturbance. Excessive burning could have the effect of concentrating nesting ducks into unburned cover, and thus increase vulnerability to predation. Excessive burning could also substantially reduce the invertebrate prey base (Payne 1992).

- A rotational burn schedule should be implemented that includes no more than one-third of the entire area. A rotational burn should be conducted several months in advance of the earliest nesting ducks (e.g., December), and to avoid critical migratory or over wintering periods for Canada geese (October – December).

  A rotational or spot burn would create a mosaic pattern and increase edge for nesting waterfowl in the season following the burn. The spot fire consists of a series of burns set at predetermined spacing throughout the project area. Experience

suggests that each area should not exceed 40 by 40 meters, which is far enough apart to prevent too many junction zones of high-intensity fire. Spot fires are also less intense, if fuels are light and uniform and are conducted under conditions of low temperatures and high moisture content (Payne 1992).

- To minimize smoke emission effects in the near term, burning should occur only on days authorized by the local Clean Air Authority.

4.2 Objective 2: Upland Forest Management

4.2.1 Task 2.1 Prescribed Burns and Stand Thinning

Restore the ponderosa pine ecosystem to more natural conditions through a combination of prescribed burning and stand thinning. Previous research has shown that although prescribed burning alone (without thinning or removal of forest floor fuels) can reduce surface fuel loads, stimulate nitrogen availability, and increase herbaceous productivity, it can also cause high tree mortality (60% mortality over a 20-year period) and lethal soil temperatures under tree canopies (Covington et al. 1997). Although some tree thinning can be accomplished by prescribed burning, results are localized, unpredictable, and difficult to control. Timber forest fuels reduction crews can remove the predominant under-story, secondary growth and woody-herbaceous layers, and thin existing decadent growth with tillers/chainsaws and hand piling burning techniques to promote low intensity prescribed burns.

Project managers are currently working with the Coeur d'Alene Tribe Fuels Planner to establish a comprehensive long-term fuels management plan. Active management of the upland areas adjacent to Goose Haven Lake is limited to noxious weed control due to monetary constraints and associative habitat management priorities (i.e. wetland creation).

4.3 Objective 3: Pasture Management

4.3.1 Task 3.1 Mowing and Haying

Restore and enhance high quality Canada goose brood habitat to increase the available habitat present on the Subject Property. Mackey et al. (1987) found that grazing broods generally remained within 30 m of the security of water. Management of brood pasture will entail keeping grass lengths at 4" or less, during the brood season (April-July 15). Pastures should be managed out to 100 m from the edge of Goose Haven Lake to provide visual security. Based on these parameters and planned wetland expansion, there are an estimated 120 acres of brood pasture that could be enhanced. Annual mowing or haying will occur following to prevent invasion by undesired species and maintain the vigor of grasses. Hay operations will help to offset operation and maintenance costs to BPA that can be put back into the management of the property.

4.4 Objective 4: Noxious Weed Control

4.4.1 Task 4.1 Control and Maintenance

Weed species, life cycles, abundance and dispersion will dictate the mechanism(s) for control and/or elimination. Several types of control mechanisms are likely to be used individually or in combination. In most cases, the initial weed compositions are such that large-scale chemical treatments will likely be necessary. Subsequent treatments may consist of spot spraying, manual removal, controlled burns, short-term inundation, and reseeding and planting desired species of native vegetation.

Current noxious weed control consists of annual burns, mowing, spot spraying and large scale chemical treatments. Further investigation may yield inundation as a possible course of action should it not conflict with an established hydrological regime.

4.5 Objective 5: Monitoring and Evaluation

The CDAT will implement the *Monitoring and Evaluation Plan for the Albeni Falls Wildlife Mitigation Project* (AFIWG 2001). The CDAT will monitor wildlife populations and vegetative cover, and the results will be correlated with a HEP analysis to be conducted every five years.

Reference data relative to changes in the baseline condition will be collected throughout the life of the Goose Haven Wildlife Mitigation Project. Habitat and vegetation responses will be measured and correlated with trends in wildlife populations. Permanent plots in each habitat type will be established and measured every five years using HEP and transect data.

The HEP sites in each of the cover types were randomly selected and permanently marked to monitor habitat and crediting value. Parameters to be measured include HEP variables; species of trees, shrubs, forbs and grasses; height, density and distribution of these species; percent tree and shrub canopy cover; and acres of wetlands and riparian forest successfully established. Water table levels will be monitored and correlated with vegetation development. Annual photographic documentation will occur at each HEP site and at each planting site to record vegetation development.

Techniques for deriving field data are currently being developed by Eastern Washington University (2005).

4.6 Objective 6: Operations and Maintenance

The CDAT will conduct operations and maintenance (O&M) activities to assure long-term management success of the Subject Property effective adaptive management. O&M activities will follow the *Guidelines for Enhancement, Operation, and Maintenance Activities for Wildlife Mitigation Projects* (CBFWA 1998).

Section 5 Budget

Table 14. Total Operation & Maintenance and Monitoring & Evaluation Budget for the Goose Haven Lake Property.

Costs by Fiscal Year					
Objective	**2009**	**2010**	**2011**	**2012**	**2013**
Operations & Maintenance					
Noxious weed control+*	6,000	6,300	6,615	6,946	7,293
Controlled burning	1,500	1,500	1,500	1,500	1,500
Equipment maintenance/lease+*	5,000	5,250	5,513	5,788	6,078
Materials & Supplies+	12,500	13,125	5,038	5,290	5,554
Vehicle Lease/Fuel*	7,420	7,791	8,181	8,590	9,019
Monitoring & Evaluation					
Wildlife surveys*	3,333	3,500	3,675	3,858	4,051
HEP			5,000		
Total Annual Costs	**35,753**	**37,466**	**35,522**	**31,972**	**33,495**

+ Excluding Personnel

* 5% per annum Inflation Increase

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Appendix A: Site Photographs

Figure A-1. Looking south across the property from near the farmhouse on site. The property has been farmed for straw for many years.

Figure A-2. Looking southwest at a canal on site. The property displays a monoculture of reed canarygrass.

Figure A-3. Looking west across the Subject Property at sparsely forested hillside. Upland areas of the property have been deforested previously and are currently in a state of recovery. The St. Joe River, and Chatcolet and Benewah Lakes are in view.

Figure A-4. Looking west across Goose Haven Lake at cattails, Nuphar, reed canarygrass, and cottonwoods beyond. The site currently offers minimal plant species diversity.

Figure A-5. Looking southwest across the lake at a perching great blue heron. The site does offer a promising diversity of animal species.

Figure A-6. Upland areas include ephemeral drainages with cedar, Douglas fir, and ponderosa pine. This shop building is located near the edge of hydric soil mapped on the Subject Property. The road in the foreground was found inundated in early September of 2003.

Figure A-7. Looking southeast along the northeast edge of the lake at CDAT personnel traversing the two primary species that exist at the lake: cattails and reed canarygrass.

Figure A-8. Looking southwest across the property at the lake and adjoining lands.

Figure A-9. Looking east across the property from the western property boundary near Highway 3.

Figure A-10. Looking along Highway 3 at CDAT property along the St. Joe River. Highway 3 runs along a dike that isolates the subject floodplain somewhat from the St. Joe and nearby lakes.

Figure A-11. Looking west near a point of suspected seepage. This area is located near the western edge of the Subject Property near the western pump station. No culvert was identified connecting the floodplain to the St. Joe River.

Figure A-12. Looking northeast along the southern canal. Flow appeared to run south within this canal, toward the St. Joe.

Figure A-13. Looking at the reportedly abandoned western pump station from Goose Haven Lake road. Near the station, the slope increases dramatically and access is difficult.

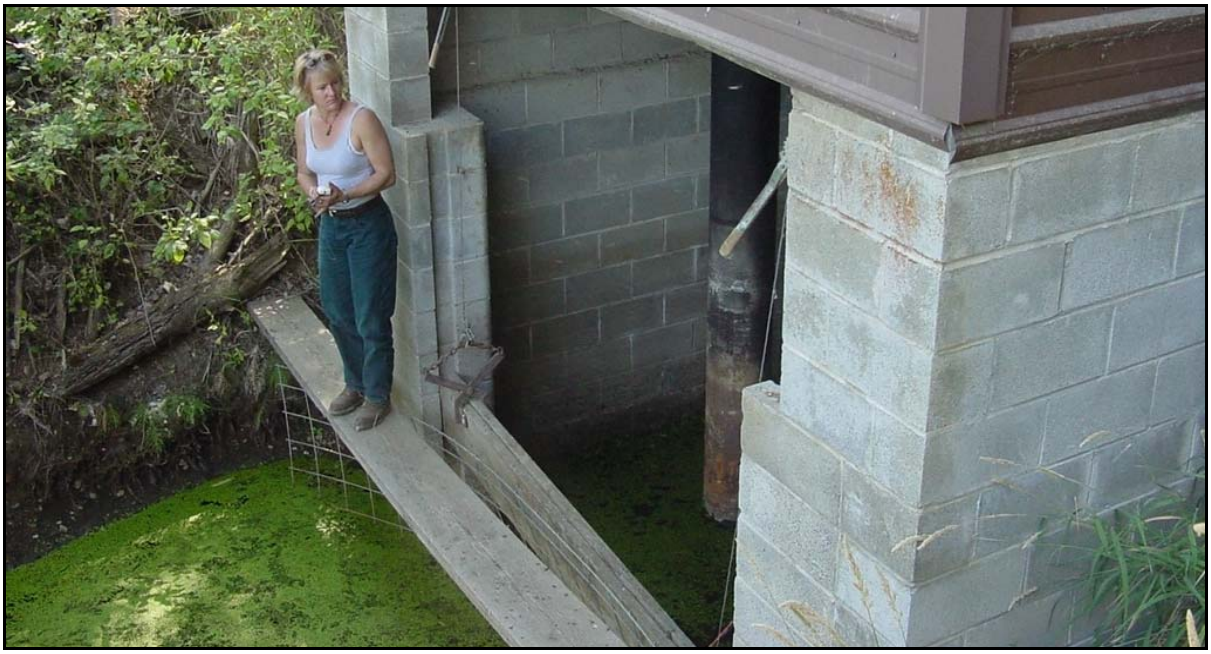

Figure A-14. Tetra Tech engineer, Caroline Barnes, examines the western pump station. Photo taken on July 23, 2003.

Figure A-15. Looking at the western pump station water levels during the flooding of early September 2003. Photo taken on September 2, 2003.

Figure A-16. Looking southeast at the northern drainage canal on site. Photo taken on July 23, 2003.

Figure A-17. Looking southeast at the same northern drainage canal above during early September flooding. A great blue heron can be seen on the right of the photo. Photo taken September 2003.

Figure A-18. Looking south from near the barn feature on site at flooding of the roadway that occurred in early September of 2003. Soil was saturated just beyond the bales in the photo.

Figure A-19. Looking at deer crossing Goose Haven Lake Road. The roadway runs the base of adjoining hillsides on the Subject Property.

Figure A-20. Looking southwest at a cow in a pasture on an adjoining property during the early September floods. Further study and possibly diking may be desired to implement site prescriptions.

Appendix B: Baseline HEP Analysis

**NOTE: *Due to the discrepancies between the initial HEP and the follow-up HEP in 2007 and the fact that the initial HEP report was never completed, the 2007 HEP report, once completed and approved by the Coeur d'Alene Tribe Wildlife Program, it will be added to this management plan as the Baseline HEP Analyses.*

Attach HEP report

Appendix C: Monitoring and Evaluation Plan for the Albeni Falls Wildlife Mitigation Project

**NOTE: *Upper Columbia United Tribes (UCUT) is currently in the process of developing a regional monitoring and evaluation (M & E) program. Once the program is functional, an M & E plan will be added to this management plan.*

Attach M&E Plan