Wetlands Evaluation
Technical Memorandum

Agreement 36893013
DOT&PF Project 67698
Federal Project ACHP-0922(5)

Prepared for
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Department of Transportation
and Public Facilities
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1—Introduction

The Alaska Department of Transportation & Public Facilities (DOT&PF) is evaluating alternatives to improve access between Revillagigedo Island and Gravina Island in southeastern Alaska. HDR Alaska, Inc., is supporting the DOT&PF through the process mandated by the National Environmental Policy Act that entails preparation of an environmental impact statement (EIS) in which the effects of project build alternatives and the no-build option are disclosed and evaluated.

A consideration for siting and selection of Gravina Access Project build alternatives is the presence of wetlands. Federal regulations and policies require projects to minimize their impacts on wetlands, and to locate projects in wetlands only if there is no practicable alternative with lesser adverse environmental impact. Wetland identification and analysis of potential wetland-related impacts have been ongoing during development of the project alternatives.

This memorandum describes the wetland identification process, briefly describes the extent and types of wetlands found in the project area, identifies functions and values of those types of wetlands, and compares the wetland impacts (in terms of acres) of the alternatives currently under consideration.

Wetlands. Wetlands, as referenced in the this memorandum, are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 Code of Federal Regulations [CFR] Part 328.3(b)).

Waters of the U.S. Note that this does not include unvegetated areas such as streams, ponds, and most tidal shores; these are other "waters of the U.S.". Large, year-round open water bodies in the project area are mapped as ponds. All mapped ponds are on Gravina Island and are coded as PUBH (palustrine, unconsolidated bottom, permanently flooded bodies of water).

Uplands. Non-water and non-wetland areas are called uplands.

2—Wetland Functions Background

Wetland functions are the chemical, physical, and biological processes or attributes that contribute to the self-maintenance of a wetland and relate to the ecological significance of wetland properties without regard to subjective human values (ASTM 1999). Based on discussions with wetland and wildlife specialists from state and federal regulatory agencies, on-site observations, and review of literature on the wetlands of southeastern Alaska, the impacted wetlands may have some of the following functions. Some of these functions are not exclusive to wetlands.

Not all wetlands perform all functions, nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic or water quality functions. The principal factors that determine how well a wetland will perform these functions are climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem (Novitzki et al., 1997).

2.1 Groundwater Recharge and Discharge

Groundwater recharge is the infiltration of groundwater from a wetland into the underlying aquifer. Groundwater discharge is the net upward vertical movement of water from an aquifer to the surface (Mitsch and Gosselink, 1993). Often under natural conditions, wetlands manifest near groundwater recharge or discharge areas (Adamus Resource Assessment, 1987). While less detail on groundwater recharge through wetlands exists, the groundwater discharge function of wetlands is well documented (USFWS, 1984).

The function of Alaskan wetlands in groundwater recharge varies. Groundwater recharge by southeastern Alaska wetlands has not been well documented. Discharge is common in muskeg peatlands, springs, and gaining streams throughout southeastern Alaska and northern Canada (Adamus Resource Assessment, 1987). In the project area, wetlands without thick peat accumulations that are at toes of slopes are presumed to discharge groundwater.

2.2 Stream Flow Moderation

In many areas of Alaska, wetlands have been documented as important in flood control. Wetlands may reduce the magnitude of peak flows and associated flood stages, delay the release of water downslope and downstream immediately after storms, sustain streamflows during dry seasons by providing a steady outflow, and reduce bank erosion and channel bed scour (Adamus Resource Assessment, 1987). This function adds to the stability of the aquatic environment and, in populated areas, may provide some social and economic value related to flood control. Wetlands with a surface outlet and wetlands along streams are presumed to moderate surface flows to varying degrees. Wetlands with fluctuating water tables are presumed to perform this function more effectively. Additionally, wetlands with dense vegetation can retain more water than other wetland types (USFWS, 1984).

2.3 Shoreline, Stream Bank, and Soil Stabilization

Wetland vegetation can stabilize stream banks and lake and ocean shores against erosion in various ways. Vegetation can bind and stabilize substrates; it can dissipate wave and current action; and it can trap sediments during flood periods. The effectiveness of shoreline vegetation in controlling erosion depends on the plant species present, the width of the vegetation, the efficiency of the vegetation in trapping sediments, the soil composition of the bank or shore, the height and slope of the bank or shore, and the elevation of the toe of the bank relative to mean high water (MHW) (USFWS, 1984). In Alaskan streams, erosion and collapse of undercut banks can reduce the availability of cover, degrade water quality, and reduce the suitability of coarse sediment important for salmon spawning, at least temporarily (Adamus Resource Assessment, 1987). The vegetation in wetlands also stabilizes the wetland soils against erosion by water that may pass through the wetland by sheetflow and shallow flow through the soils.

2.4 Nutrient Cycling, Primary Production, and Carbon Export

In some regions, usually associated with urban or farming areas, the removal or retention of nitrogen and phosphorus is viewed as one of the most positive attributes of wetlands, because downstream waterways could become so enriched that algae flourish and decompose, causing deoxygenation of waters. However, because few artificial sources of nutrients and no nutrient overenrichment are documented upstream from wetlands within the project area, removal of nutrients is not an important function of these wetlands.

Often, wetlands support higher levels of net primary production (NPP) (i.e., plant growth) than other ecosystems. This plant tissue may be consumed directly by some vertebrates and invertebrates or chemically and physically altered through decomposition prior to use by other consumers. Decomposition and the rate at which nutrients are transformed to usable forms influence NPP and, ultimately, food chain dynamics. Wetland systems that have lower levels of nutrients, lower pH, peat soils, and evergreen vegetation are presumed to have lower NPP. Nutrients and organic carbon transported out of wetlands by moving water or consumers may support food webs of other ecosystems. Wetlands with outlets, those that flood, and those used by highly mobile fish and wildlife species are presumed to export more organic matter and nutrients that support food webs outside of the wetland itself.

2.5 Fish and Wildlife Habitat

Fish and wildlife species are dependent on wetland habitat factors such as the availability of cover, freedom from disturbance, availability of food, availability of specialized habitat features, and interspersion of different vegetation forms and water. The fish and wildlife habitat function considers the effectiveness of the wetland in providing habitat for various types and populations of resident and migratory species typically associated with wetlands and the wetland edge (USACE, 1995).

Relatively few mammals are truly wetland-dependent. However, many mammal species have populations that are highly wetland-dependent at certain times of the year. Many birds depend on wetland habitats during all or parts of their life histories.

2.6 Human Values

Wetland values are the benefits to humans that are derived from a wetland's features, processes, or setting. If something has "value," it is deemed worthwhile, beneficial, or desirable. Wetland characteristics may be valuable for "consumptive" uses such as subsistence harvesting (e.g., fishing, hunting, and berry-picking) and the support of commercial harvesting of natural resources, or for "nonconsumptive" uses such as aesthetics, recreational and educational uses, and flood control protection of downstream developments).

Gravina Island is considered one of the most important subsistence and recreational hunting areas in the Ketchikan Gateway Borough because of its high densities of Sitka deer and the high cost of living in Ketchikan and Saxman. In addition, many of the muskeg and shrub/scrub areas of Gravina Island are important sites for subsistence harvesting of berries. Wetland values are not easily measured. Often values are subjective and may be specific to certain groups or individuals; that is, a wetland feature valuable to one group may have little value to other groups.

3—Wetland Determination Methods

The wetland determination was completed in four phases: office-based premapping, discussions with regulatory agency personnel, field delineation, and office-based GIS mapping and final delineation.

3.1 Office-Based Premapping

Initially, scientists premapped wetlands in a broad project area encompassing the area of all the potential alternatives. This mapping entailed stereoscopic interpretation of color aerial photographs (with a scale of 1" = 400'). Initial wetland/upland boundaries and boundaries between wetland types were drawn on mylar overlays of the photos. Wetland areas were delineated based on vegetation characteristics (e.g., small plant size and low-density stands), hydrologic indicators (such as stream locations and ponding), and topographic clues (such as concave topography). Upland locations were based on the lack of surface water visible on aerial photographs, the presence of tall and dense forest, and steep topography that would allow good surface drainage. Several information sources were examined initially:

- Aerial photographs from AeroMap U.S. (taken 7/2/99, scale 1" = 400'; and taken 8/15/97, scale 1" = 1000'), true color.
- Detailed topographic maps.
- National Wetlands Inventory (NWI) map for quadrangles Ketchikan B-5 and B-6. The NWI maps are based largely on interpretation of aerial photographs and are presented at a coarse scale.
- The detailed preliminary wetland determination prepared by Dunn Environmental Services for the Alaska Department of Transportation & Public Facilities in July 2000. The report provides wetland mapping and a wetland function assessment specifically for the current update of the Ketchikan International Airport Master Plan.
- Existing GIS layers including streams, water bodies, NWI mapping, soil data, slope, and elevation data.

Wetland/upland boundaries drawn in the office were used to plan the field efforts and determine potential problem areas. Initial mapping showed that most of the project area on Gravina Island is wetland.

3.2 Discussions with Agency Personnel

HDR completed interviews of knowledgeable agency representatives regarding the physical and ecological processes that occur in the project area wetland types. During spring of 2000, HDR met with key ADF&G and USFWS staff members in Ketchikan to hear their views on the importance and functions of the wetlands present in the area. A literature review was completed to identify known functions of forested, muskeg, and intertidal wetlands in southeastern Alaska. In addition, HDR met with a representative of the U.S. Army Corps of Engineers in Ketchikan on site to review wetland delineation techniques and discuss wetland functions.

3.3 Field Delineation

Scientists verified wetland boundaries in the field during the summer and fall of 2000. The primary activity of these trips was to ground-truth the office-based preliminary delineation and adjust premapped boundaries to actual on-the-ground conditions. HDR and Corps of Engineers staff met in the field in May 2000 to discuss the delineation methods that would be used. The ground-truthing included identification of wetlands based on the wetland identification methodology described in the Corps of Engineers Wetland Delineation Manual (USACE, 1987). This methodology followed a three-parameter approach to wetland identification and delineation, using the criteria of hydric soils, dominant hydrophytic vegetation, and wetland hydrology. For questionable locations (as determined from office premapping) and at other selected locations throughout the project area, Corps of Engineers' data sheets and photographs of the project area wetlands were completed. These will be provided to the Corps of Engineers in a Preliminary Jurisdictional Determination report. Where wetland sites were similar to areas where a data form had previously been completed, scientists completed a less detailed examination. Geographic coordinates were logged at all data collection locations. Qualitative information was also collected for identification of wetland functions and values. Much of the fieldwork was done in the vicinity of alternatives that are no longer under consideration, but the findings are applicable throughout the project area.

3.4 Office-Based GIS Mapping and Final Delineation

Upon return from the field, the project team mapped sites and amended the office-delineated wetland boundaries on georeferenced aerial photographs using geographic information systems (GIS) technology. The NWI wetland types were determined based on a review of field notes, data forms, and site photographs. Boundaries were digitized into the GIS using existing spatially rectified base mapping and the project's preferred alternative alignments. The final mapping has been prepared for a ¼-mile-wide corridor along each current alternative. To aid in the final mapping, the following resources were used:

- Premapped wetland/upland boundaries
- Digital georeferenced aerial photograph mosaic taken 7/2/99 with 6'-pixel resolution
- Detailed field notes, data forms, and photographs
- GPS coordinates of field observation locations
- COE wetland data forms

4—Wetland Determination Results

Figures 1 and 2 delineate the wetland/upland boundaries and the boundaries between wetland types along the proposed project alignment of each alternative. Ponds are also mapped. On Gravina and Pennock islands, fieldwork confirmed that nearly all of the alternative areas are wetlands. Uplands on those islands are limited to disturbed areas near the airport, some beach fringes, and some steep slopes along streams and shores. On Revillagigedo Island, uplands were found in disturbed areas and on some steep slopes and high knobs; other sloping areas are wetlands.

Four major wetland types exist in the Gravina Access Project area:

Marine Areas:

Intertidal marshes and meadows

Freshwater Wetlands:

Muskegs

Shrub/scrub wetlands

Forested wetlands

Following are general descriptions of these wetland types and their associated functions in the project area.

4.1 Intertidal Marshes and Meadows

General Description. These saltwater-influenced wetlands were found on slightly sheltered shores, where the substrate is not bedrock or loose rock, but is sandy. They occur along a narrow band from about the MHW mark to the high tide line. Vegetation in these areas is limited to a dense ground covering of grasses and herbs; dominant species are *Carex lyngbyei* (50-90% cover), *Deschampsia caespitosa* (5-20% cover), and *Potentilla egedii* (10%). These wetlands were found only along the shoreline areas of Gravina Island; none was found on the shores of Pennock or Revillagigedo Island.

NWI Code. The NWI code for these wetlands is E2EM1N (estuarine [saltwater] intertidal areas, vegetated with erect herbs, and regularly flooded by tidal waters).

Project Area Functions. Estuarine sites are often considered unique, valuable, and scarce throughout southeastern Alaska. Estuarine beach meadows are found in protected areas along the shore of Gravina Island, generally associated with a stream. Intertidal beaches and meadows are important components in maintaining a stable shoreline. They are highly productive habitats, and much organic matter produced within them washes into the marine ecosystem, where it supports food webs. These areas are important sources of faunal and floral diversity. The beach meadows are important feeding areas for many terrestrial and aquatic species of wildlife, including deer, black bear, river otter, mink, shorebirds, waterfowl, and songbirds. They provide succulent forage in spring when other habitat types may be snow-covered. They also serve as nurseries for young fish. Estuarine habitats are considered relatively scarce in southeastern Alaska. Because of the high wildlife use in these areas, they tend to be aesthetically important sites for viewing wildlife.

Impacts. Estuarine meadow areas that potentially could be affected by alternatives include shorelines at Lewis Point, the Government Creek outlet, and the site where Alternative G3 (ferry from downtown) enters Gravina Island (Table 2). No impacts on estuarine meadow areas are expected to occur along the shores of Pennock and Revillagigedo islands.

WETLAND DELINEATION ALONG ALTERNATIVES C3(a), C3(b), C4, D1, G2, and G4

GRAVINA ACCESS PROJECT

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND
PUBLIC FACILITIES

A Gateway to the Future
Gravina Access Project

MAP NOTES:

1. Aerial photograph taken 07/07/99, by Aeromap U.S.
2. Aerial photograph is not orthorectified. The photograph has been georeferenced to match existing mapping in Alaska Stateplane zone 4, NAD27.
3. Gravina Access Alternatives shown are based upon current alternative options as of 08/01/02.

0 500 1000 1500 2000 Feet

N

MAPPING CODES

E2EM1N	-Intertidal marshes and meadows
PEM1B	-Muskeg
PSS4/EM1B	-Evergreen scrub tree/muskeg
PSS4B	-Shrub/scrub wetlands
PFO4/SS1B	-Open evergreen forest with deciduous shrub understory
PFO4/SS4B	-Open evergreen forest with evergreen scrub understory
PFO4B	-Closed canopy forested wetlands
PUBH	-Ponds
U	-Upland (non-wetlands)

LEGEND

Wetland/Upland or Wetland Type Boundaries
Alternative Road Routes
Estimated Fill Limit
Ferry Alternatives

DATE: December 2002

FIGURE 1

WETLAND DELINEATION ALONG ALTERNATIVES F1, F3 and G3

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LEGEND

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FIGURE 2

4.2 Muskegs

General Description. These wetlands are extensive on the relatively flatter ground on Gravina and Pennock islands, and even on ground that slopes substantially. Most of these muskegs include many bedrock outcrops. They support a sparse cover of shrub-form shore pine, a lesser cover of shrubby yellow and red cedar and western hemlock, and a dense ground cover dominated by sedges (*Trichophorum caespitosum*, *Carex pluriflora* and other *Carex* species, *Eriophorum* species), crowberry (*Empetrum nigrum*), Labrador tea (*Ledum groenlandicum*), and other herbs. They are saturated to the surface and include many small ponds. Muskegs include many small "islands" of scrub/shrub wetlands.

NWI Code. All of these wetlands were mapped by NWI. The NWI code for the muskeg areas is PEM1B (palustrine, saturated herbaceous meadows). The NWI code for muskeg areas with substantial amounts of shrubby vegetation is PSS4/EM1B (palustrine, evergreen needle-leaved shrub/grass-like, saturated herbaceous meadows).

*Soils and Water**.*** While organic soils were expected in these wettest sites, field scientists found that the organic surface layers were generally quite shallow (1-12"), and mineral material was often exposed on the surface of channels and ponds.

Project Area Muskegs. Little is known about the specific functions of the open, muskeg-type wetlands in the project area. The term "muskeg" describes extensive northern wetlands with open, often evergreen, vegetation with a mossy ground cover, and typically with deep peat soils. In the project area, the areas mapped as muskeg encompass wetlands dominated by tall sedges (grass-like plants), short sedge fens, and bogs, as described below.

Tall-Sedge Fens. Tall sedge fens[1] tend to be found at toes of slopes where groundwater discharges, as well as around the margins of muskegs and in drainage tracks. They are thought to have the highest nutrient status and be the best aerated and most productive of the muskeg wetland types. They may support a greater diversity and abundance of wildlife. Because they are productive and tend to have water flowing through them, they may export organic material that supports downstream ecosystems and help maintain natural chemistry and low flows in those creeks. These rich fens may be particularly susceptible to disturbance of hydrology by upslope activities. They are considered relatively scarce in southeastern Alaska. The agency representatives interviewed for this project generally believed that, because fens are more productive than bogs, they should be more highly valued. Further discussion with them indicated that, more specifically, it is the fens dominated by tall sedges that are most productive and important.

Short-Sedge Fens. Short sedge fens dominate the open wetlands in the project area. These areas have less water flowing through them and are not as nutrient-rich as are the tall sedge fens. The muskeg areas nearest creeks are considered important for maintaining base flows to those creeks. Organic material produced in these wetlands, particularly in the more sloped wetlands and those nearest streams, washes into creeks and supports the food webs of the aquatic system. The less-sloped fens would be effective at retaining sediments in the event of ground disturbance. They are probably not highly effective at moderating high stream flows for most of the year because their soils are already saturated and cannot hold more water. Fens will act to filter and buffer water conveyed through them. Little is known about wildlife use of these extensive habitats. Deer and black bear are thought to feed in them seasonally, and some shorebirds and passerine species and blue grouse are known to use these areas. Waterfowl often use intermixed open freshwater ponds as resting and nesting habitat. Humans use these areas for subsistence, as they are important berry-harvesting locations.

[1] Fens are wetlands with peat soils and contact with relatively mineral-rich water. The "fens" in the project area generally do not meet the technical definition because the organic soil accumulation (peat) is too shallow, but no term describes them better.

Bogs. True bogs[2] are also present, but not common, in the project area. These areas have deep peats, are highly acidic, and support plants that can tolerate acidic, nutrient-poor conditions. They are relatively scarce in southeastern Alaska and therefore contribute to biodiversity. The deep peats in these wetlands are usually water-saturated. During periods of little precipitation, they may continue to release water slowly to creeks downstream, thus maintaining low flows. These are not thought to be highly productive wetlands, although they may support certain species of shorebirds and songbirds, as well as deer and black bear. Both bogs and fens can function as ground water discharge and recharge areas (Siegel, 1988).

Impacts. The most prominent muskeg impacts will occur if areas south of the Ketchikan International Airport on Gravina Island are crossed. Depending upon muskeg depth and slope, a road across muskeg wetlands could alter both surface and subsurface flows.

4.3 Shrub/Scrub Wetlands

General Description. This wetland type dominates areas adjacent to muskeg wetlands and other areas where tree growth is limited by soil saturation. The tree canopy is sparse enough to allow light to penetrate, promoting a dense shrub and scrub tree understory. Scrub/shrub wetlands often form slightly drier "islands" within the muskegs. They also tend to occur on the slightly better drained (sloping) ground along the streams that run through muskegs. This wetland type has an open canopy (about 15-50%) of western or mountain hemlock (*Tsuga heterophylla, Tsuga mertensiana*). Shore pine (*Pinus contorta*), small Sitka spruce, and red and yellow cedar may also be present. Tall blueberry and rusty menziesia form a dense shrub layer. Prominent herbs are bunchberry, deer cabbage (*Fauria crista-galli*), skunk cabbage, and fernleaf goldthread (*Coptis aspleniifolia*), in addition to a dense ground covering of sphagnum moss (60-70%).

NWI Code. These sites were mapped as wetland by NWI. The NWI code for these wetlands is PSS4B (palustrine, evergreen needle-leaved shrub/scrub dominated areas that are saturated).

Soils and Water. Scientists in the field noted that soils in the scrub/shrub wetlands were generally saturated near the surface and often exhibited a sulfidic odor within 10" of the surface. There was little surface water on these sites.

Functions. Many of these wetlands share the same functions as forested wetlands, described below. As with forested wetlands, shrub/scrub wetlands function as streamflow moderators and stream bank stabilizers, and provide important foraging habitat for Sitka deer, black bear, and mink. Humans may use these areas for collecting berries.

4.4 Forested Wetlands

General Description. On Gravina and Pennock islands, most of the forested areas near project alternatives are forested wetlands; on Revillagigedo Island, the flatter forested areas are generally wetlands. This wetland type generally has a closed canopy (about 45-85%) of western hemlock and red and yellow cedar (*Thuja plicata* and *Chamaecyparis nootkatensis*). Sitka spruce (*Picea sitchensis*) and Pacific crab apple (*Malus fusca)* are also present in several areas. Tall blueberry, red huckleberry, and rusty menziesia (*Vaccinium ovalifolium* or *V. alaskaense*, *Vaccinium parvifolium*, *Menziesia ferruginea*) form the shrub layer (30-50% cover). Prominent herbs are bunchberry (*Cornus canadensis*), deer fern (*Blechnum spicant*), false lily-of-the-valley (*Maianthemum dilitatum*), and sometimes skunk cabbage (*Lysichiton americanum*). Except for skunk cabbage, the understory plants are not particularly indicative of wet conditions. However, the smaller growth form of the trees indicates that water may limit growth.

[2] Bogs are wetlands with deep peat soils in which most of the water is derived from precipitation.

NWI Code. The forested wetlands mapped by HDR were generally also mapped as wetland by NWI. The NWI code for the more open forested wetlands is PFO4/SS1B (palustrine, open forested wetlands with deciduous shrub understory, saturated) and PFO4/SS4B (palustrine, open forested wetlands with evergreen shrub understory, saturated). The NWI code for the closed-canopy forested wetlands is PFO4B (palustrine, needle-leaved evergreen forest, saturated).

Soils and Water. Forested wetlands are generally the best drained of the wetlands. They often occur on the beach fringe, on steep slopes, and along streams, where topographic relief allows the soils to drain somewhat. Soils in the project area include moderately deep organic deposits (10") with depth to saturated soils ranging from 4" to about 12" below the surface. Scientists in the field noticed a sulfidic odor at most sites within a foot of the surface. They saw little surface water, although they sometimes observed water ponded below exposed tree roots or in other depressions.

Functions in Near-Shore Areas. Forested areas form a fringe just inland from the high-tide line on Gravina and Pennock islands. On Gravina Island, the trees in these forests are generally larger than in adjacent areas farther inland, the result of slightly better drainage. Forested beach fringes—whether wetland or upland—are highly valued throughout southeastern Alaska, primarily for the important habitat they provide. They serve as cover for animals feeding along the beaches, and as den sites for terrestrial species like river otter and mink that feed in the marine environment. Bald eagles typically nest in trees in this fringe. If these forested fringes were located downslope from human developments, they would provide a buffer to improve runoff water quality before its discharge into the sea, as well as a visual buffer between that development and the sea.

Functions in Ravines and Riparian Areas. Streams are often bordered by forested wetlands on both Gravina and Revillagigedo islands. The trees in these corridors are among the largest in the project area. South of the airport on Gravina Island, the forested strips are narrower and open wetlands may abut the streams. Most of the functions of these areas relate more to their position next to streams than to their status as very wet sites. Many riparian forests, particularly north of the airport, may not be wetlands but serve the same function as wetland forests. Groundwater may be discharged in some of these streamside areas, which is important for maintenance of base flows in the streams. These riparian corridors shade the creeks, provide woody debris that maintains the streams' structure and supportsinvertebrates, bind creek banks, and produce other organic matter that washes into the creek to support the aquatic food webs. Riparian areas serve as travel corridors and as feeding and resting habitat for many species, such as mink and black bear. Riparian areas along streams that support anadromous fish receive rich nutrient input each year when animals feed upon the fish and scatter their carcasses over the forest floor. If ground-disturbing activities were to occur nearby, the riparian areas could serve as important filters of sediments and other pollutants that might otherwise be discharged into streams.

Functions of Other Forested Wetlands. Important functions of forested wetlands away from streams and beaches are less well known. These wetlands may help regulate stream flows, particularly those forests that have deeper peat accumulations. They likely export dissolved organic matter that supports downstream aquatic ecosystems. They provide habitat for forest-dwelling wildlife like Sitka deer, black bear, and breeding Vancouver Canada geese. The forest edges are used by other species, such as certain songbirds. Forested habitat is relatively rare on the lowlands on the eastern side of Gravina Island, but wetland forests are not scarce in southeastern Alaska.

Human Values. Forested wetlands have both consumptive and nonconsumptive human use values (see Table 1). For many people, forested wetlands serve as a buffer zone between developed, commercially used areas of the islands and undeveloped, recreational use areas. Commercially, the large trees found in these wetlands have been historically used for the timber harvest in southeastern Alaska.

Impacts. Forested wetland impacts would be potentially greatest on Revillagigedo Island approximately ½-mile northwest of the airport ferry terminal and on Gravina Island near Lewis Point.

5—Comparison of Alternatives

Footprint Acreages. Table 1 quantifies (in terms of footprint acres) the anticipated impacts of each alternative on the different wetland types. These calculations were obtained by overlaying the footprint of each alternative on the wetland mapping using GIS analysis functions. The values are shown as acreage comparisons only.

TABLE 1
IMPACTS ON WETLANDS, PONDS, AND UPLANDS (ACRES)

	No Action Alternative	*Bridge Alternatives*[1]						*Ferry Alternatives*[2]		
Wetland Type[3]	No Action	C3(a)	C3(b)	C4	D1	F1	F3	G2	G3	G4
Forested Wetlands	0.0	15.6	14.2	10.6	8.0	24.5	13.0	14.2	10.0	7.7
Shrub/Scrub Wetlands	0.0	3.1	3.0	3.1	3.0	17.9	14.4	2.9	6.5	2.9
Muskegs	0.0	25.3	25.1	25.1	25.1	60.9	57.7	25.3	29.4	24.8
Intertidal Marshes and Meadows	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.7	0.1
Total Wetland Impacts	0.0	44.1	42.4	39.0	36.3	103.3	85.2	42.5	47.5	35.4
Ponds	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Uplands (Nonwetlands)	0.0	5.1	9.1	10.4	8.6	10.7	4.8	7.6	7.0	4.7

[1] Bridge Alternatives:
Alternative C3(a) = 200' Bridge between Signal Road and South of Airport Terminal
Alternative C3(b) = 120' Bridge between Signal Road and Airport Terminal
Alternative C4 = 200' Bridge Between Tongass Avenue (North of Cambria Drive) and South of Airport Terminal
Alternative D1 =120' Bridge Between Tongass Avenue (near Existing Ferry) and Airport Terminal
Alternative F1= Bridges (200' East and 120' West) Between Tongass Avenue and Airport, via Pennock Island
Alternative F3 = Bridges (60' East and 200' West) Between Tongass Avenue and Airport, via Pennock Island
[2] Ferry Alternatives:
Alternative G2 = Ferry Between Peninsula Point and Lewis Point
Alternative G3 = Ferry Between Downtown and South of Airport
Alternative G4 =Ferry Between New Terminals Adjacent to Existing Ferry Terminals
[3] Impacts on marine waters other than mapped intertidal marshes and meadows are shown in Table 5-14 (Potential Impacts on Essential Fish Habitat (Acres)).

6—Wetland Impact Mitigation

Federal regulations and guidelines associated with Section 404 of the Clean Water Act require that project proponents eliminate or reduce adverse impacts on wetlands by taking certain specific steps during project planning. These steps are as follows (emphasis added):

1. Design the project to *avoid adverse impacts*.

2. Incorporate measures to *minimize adverse impacts*.
3. Plan to *restore sites* that must be temporarily adversely affected by the project.
4. *Compensate for unavoidable adverse impacts* through preservation, restoration, or creation of wetlands.

Each of the steps listed above is to be implemented to the extent feasible before moving on to the next step. Together, these steps mitigate (i.e., lessen) the overall adverse effects of a project.

6.1 Impact Avoidance

Suitable non-wetland (upland) alternatives cannot be defined because of the extremely wet climate of southeastern Alaska; Ketchikan on average receives approximately 169" of precipitation annually. Nearly all lands in the general vicinity of the Ketchikan International Airport on Gravina Island are wetlands. Similar to Gravina Island, all alternative locations on Pennock Island would impact wetlands. Few areas with substantial uplands exist within the entire Tongass Narrows vicinity; therefore, substantial impacts on wetlands are unavoidable by any alternative that includes much new road on land. Several upland areas do occur on Revillagigedo Island, but these areas tend to be steep slopes, where sufficient drainage occurs so wetlands have not developed. These areas are not practicable road locations. Total avoidance of wetlands with this project is unachievable.

6.2 Impact Minimization

The following minimization measures are suggested for consideration.

Bridges

Bridges should be located to avoid direct disturbance of the estuarine beach meadows and adjacent shorelines and river mouths.

Ferry

- Ferry parking areas should be constructed on existing filled or disturbed sites, if available.

Construction Methods

- Erosion and sedimentation control measures should be employed during construction and permanent measures should be employed as early in construction as possible.
- Only clean fill material should be used for the roadway embankment.
- Staking should be done at the planned outside limits of disturbance prior to construction to ensure that impacts are limited to that area.

- The roadway should be constructed using the minimum-width fill footprint necessary to provide a stable road base.
- The roadway should be constructed with a low-profile embankment to limit the fill footprint.
- Rock should be used to stabilize toes of slopes at ponds and stream crossings.
- Road slopes should be revegetated. Topsoil should be applied to the surface of road slopes to promote revegetation. To protect the integrity of the natural plant communities, plant species indigenous to the area should be used for vegetating road slopes, except that nonnative annual grasses may be used to provide initial soil cover.
- No clearing or grubbing should be done outside of the fill footprint.
- Silt fences should be used adjacent to waterways just beyond the estimated toe of fill.
- Ditch checks should be used to reduce erosion during construction.
- Sedimentation basins should be used, as necessary, during construction.
- Roadside swales should be designed to keep surface water within the natural drainage basins.
- Culverts should be installed through fill slopes in appropriate locations to maintain natural flow patterns for surface water.

7—Sources

7.1 Bibliographic References

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7.2 Interviews of Agency Personnel

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