ENCLOSURE B

CORPS AQUATIC RESOURCE FUNCTIONAL ASSESSMENT BY PROJECT AREA

For locations of the wetlands, see Figures 1 (Miller and Walker Creek basins) and 2 (Des Moines Creek basin).

MILLER CREEK BASIN

A. Runway Safety Area/North Airfield

Aquatic resources located in this area include: Wetlands 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, a portion of Wetland A1, FW5, FW6, a portion of Miller Creek

Water Quality Functions

Some of the wetlands in this area have limited opportunity to perform nutrient/sediment trapping, due to the limited input of surface water or sediments to the wetlands (Wetlands 10,11,12,13,14,15), and therefore rate low for this function. However, the wetlands associated with the Lake Reba/Miller Creek detention facility (Wetlands 3, 4, 5, 6, 7, 8, 9 and A1 associated with Lora Lake) present substantial opportunity for moderate to high water quality functioning, given the hydrologic connectivity of the wetlands to one another, the introduction of untreated stormwater into the complex, and the slope and depressional landscape positions which this wetland complex occupies. Direct evidence of the wetlands performing trapping functions was observed in the field, especially in Wetlands 3, 4, 5, and 6, where evidence of sediment build-up was apparent. In addition to the Lake Reba wetland complex, other wetlands in this area (A1, FW5, FW6) receive untreated storm runoff from streets, lawns, or farmland, and provide biofiltration functions directly related to water quality conditions in Miller Creek, and were rated moderate to high for this function (FW5 and FW6 rated moderate, while A1 rated high because of an intact emergent marsh community).

Hydrologic Functions

Wetlands 3, 4, 5, 6, 7, 8, 9, 10, 11, and A1 are all hydrologically connected and provide important base flow functions to Miller Creek. Miller Creek proper bisects Wetlands 8 and 9 and during periods of heavy rain, all the wetlands associated with and/or a part of the Lake Reba (Miller Creek) detention facility play an important role in attenuating and desynchronizing flood flows and reducing erosion by slowing down flood waters. This wetland complex rates high for flood storage functions and base flow support for Miller Creek.

Wetlands in this area which are not within the mapped floodplain of Miller Creek are particularly important in reducing peak flows by slowing runoff rates to Miller Creek. These wetlands include 3, 4, 5, 10, 11, 12, 13, 14, 15, and a portion of A1. Wetlands A1, FW5, FW6, 7, 8, and 9 are located in the floodplain of Miller Creek.

Groundwater seasonally surfaces in many of these wetlands. Wetland 5, a slope wetland, contains surface seepage throughout the year, thus providing baseflow

support to Miller Creek. Wetlands 13 and 14 rate moderate to high in the groundwater exchange function because shallow groundwater seasonally surfaces in these wetlands and infiltrates downslope near the edge of the wetlands.

Habitat Suitability Functions - Some terrestrial animals are likely dependent to some degree on the aquatic habitat and animal production of the Lake Reba wetland complex and the part of Miller Creek in this portion of the project area. Insectivorous birds forage on semi-aquatic insects hatching from the creek sediments or riverine wetlands, great blue heron may feed on small fish, larger invertebrates, and amphibians inhabiting this area. Additionally, some small mammals (such as raccoon) feed in the creek and wetland complexes on invertebrates (such as crayfish). Wetland plant production in this area is fairly high (except for the farmed wetlands) supporting bacterial and detritivoire insect populations. Plant matter and insects provide food resources for semi-aquatic amphibians, terrestrial birds, and terrestrial small mammals.

Fish Habitat - Wetland A1 includes portions of Miller Creek supporting fish habitat and adjacent riverine areas. There is no other fish use in the wetlands, with the rare exception of flood events when the entire Lake Reba/Lora Lake complex is flooded and Miller Creek overtops its banks, and backfloods into the Vacca Farm area. When this occurs, there is a possibility for fish to get stranded in these wetlands. Wetland A1 rated moderate for fish habitat because it provides detrital/organic matter to Miller Creek important in food chain support functions for fish.

Waterfowl and passerine bird habitat - All the wetlands in this area rated moderate to high for passerine bird habitat functions. Passerine bird habitat rated lower when there was the presence of young forest and shrub habitats, and the presence of non-native species in the understory. Wetlands A1, FW5 and FW6 rated moderate for waterfowl use because of emergent marsh and open farmland aspects of these wetlands. These wetlands contain a forage base for waterfowl. Wetland A1 contains some open water suitable for waterfowl nesting (e.g. mallard ducks). The open water areas of Lake Reba provide forage and resting (and potentially some nesting) opportunities for waterfowl. The other wetlands in this area have very limited waterfowl use because there is no prolonged standing water and contain fairly dense forested and shrub components, and therefore, rated low for this function.

Amphibian Habitat - The wetlands have limited opportunity for amphibian breeding except for Wetland A1, which contains a ditch with year-round water and contains upright emergents in which amphibians can attach egg masses. Most of the wetlands have habitat connections to aquatic habitat areas of Miller Creek providing moderate to high habitat for non-breeding amphibians.

Invertebrate Habitat - The wetlands perform moderate to high in this function owing to the variety of hydroperiods, microtopographic variations, diverse vegetation species and strata, and a variety of soil structures and types within the wetland complex.

Small Mammal Habitat - The wetlands all rated high for this function because to the diversity of plant species, existing woody debris piles, microtopographic variations within the wetland complex, and a corridor connection.

Carbon Export - This function rated moderate to high in this area because of the connectivity of the wetlands to Miller Creek. Although existing roads with culverts likely blocks the delivery of large woody debris to downstream reaches of Miller Creek, particulates, detritus, and dissolved organics can get through. These wetlands are extremely important in providing this source of detritus and other organic matter to Miller Creek. Wetlands 3/4 and 5/6 are mosiac systems with interspersion of water and emergent marsh communities which contain seasonal open water. Large Woody Debris (LWD) (6-36") was observed in these wetlands, a source of particulate and dissolved organic carbon. Wetland A1 rates particularly high in this function because flood waters can and do transport large woody debris and plant material from the wetland to Miller Creek (there are no obstructions limiting Wetland A1 in performing this function), and contains peat soils, an important source of organic carbon.

B. Vacca Farm Mitigation Area/Relocation of Miller Creek

Aquatic resources located in this area include: Portion (most of) A1, Lora Lake, FW1, FW2, FW3, FW8, FW9, FW10, FW11, A2, A3, A4, Water V1 and V2

Water Quality Functions

The farmed wetlands at the Vacca Farm site receive storm runoff from streets, lawns, and/or farmland and perform biofiltration functions (nutrient and sediment trapping) at a low to moderate level due to sparse vegetation in the existing farm fields. Farming activities at the site likely contribute to degradation of water quality in Miller Creek due to introduction of contaminants from fertilizers, pesticides, and herbicides. Wetland A1 complex performs water quality functions at a high level when the area floods, because it is well vegetated with a well defined emergent marsh stratum. Emergent wetlands are particularly efficient at performing biofiltration functions. Lora Lake provides an opportunity for nutrient/sediment trapping functions to occur at a relatively high level when the area is flooded because of water depths which facilitate particulate settlement (the area drains slowly during flood events because of the flat topography).

Hydrologic Functions

The wetlands in this area rated high for flood storage. This whole area backfloods during a 2-year storm event. These wetlands also appear to be areas where groundwater discharge occurs and perches on low permeability substrates. These wetlands function highly in baseflow support to Miller Creek and reducing erosion to downstream areas of Miller Creek.

Habitat Suitability Functions

Fish Habitat - With the exception of Wetland A1, the wetlands in this area lack fish habitat. Wetland A1 includes portions of Miller Creek supporting fish habitat, and

Lora Lake. The lack of riverine vegetation around some of Lora Lake reduces the value of the shoreline area for fish. About 980 linear feet of Miller Creek will be relocated to allow construction of the runway. The portion of creek channel to be relocated is a linear, constructed channel that was straightened and manipulated to divert the creek around agricultural fields. This portion of Miller Creek provides potential habitat for resident cutthroat trout, and resident warm water fish (pumpkinseed, sunfish and sculpin).

Waterfowl and Passerine Bird Habitat - Wetland A1 and the farmed wetlands provide moderate function for waterfowl because they contain crop residues for forage. Wetland A1 contains areas of open water in a ditch providing nesting habitat for species such as mallard ducks. Wetlands A2, A3, and A4 are dominated by blackberry and do not provide waterfowl habitat. The lawn areas around Lora Lake provide foraging opportunities for waterfowl. Other shoreline areas may provide breeding habitat for mallard ducks and foraging opportunities for dabbling ducks and great blue heron.

The farmed wetlands and Wetlands A2, A3, and A4 generally provide low habitat functions for passerine birds. The habitat function they provide is limited by the land uses (farming and other vegetation disturbance) that have removed vegetation leaving plowed ground and non-native weedy species as habitat. A limited number of bird species would use these wetlands for nesting and foraging. The forested and willow dominated shrub habitat of Wetland A1 would support a much broader array of bird species. The agricultural ditch in Wetland A1 provides habitat for species such as red-winged blackbirds and forage areas for great blue heron.

Amphibian Habitat - The wetlands in this area contain fairly low habitat quality for amphibians because they lack suitable breeding areas (areas of standing water from late fall through late spring). Wetland A1 provides some breeding habitat within the open water ditch portion. The farmed wetlands have poor vegetation cover providing little habitat for non-breeding amphibians. The lack of riverine vegetation around some of Lora Lake decreases the value of the shoreline for breeding and non-breeding amphibians. However, areas of the lake shoreline containing erect vegetation (there are some small stands of emergent vegetation, such as bullrush), could provide breeding substrate for some amphibians.

Invertebrate Habitat - The farmed wetlands do not provide much in the terms of permanent invertebrate habitat because of ground disturbance activities. However, on a temporal basis, the farmed wetlands, immediately and shortly after disturbance, likely expose invertebrates to the surface offering forage opportunities for many species of birds and small mammals. Wetland A1, containing a diversity of palustrine wetland vegetation strata (forested, scrub/shrub, emergent, and open water) rates high in invertebrate habitat functions by providing a mosaic of communities increasing invertebrate species richness.

Small Mammal Habitat - Small mammals utilizing these wetlands include raccoon, opossum, squirrels, mice, rats, and in some areas voles, and moles. Most of

the farmed wetlands provide little cover or habitat but may be used as forage habitat, especially during the night and when crop residues are present, or immediately after plowing (see above). Wetlands A1, A2, A3, and A4 provide shrub and/or forest cover, and likely provide denning areas. Nearby residential areas and the lack of a healthy riverine area around Lora Lake reduces the value of most of the shoreline as foraging habitat for small mammals (the NE corner is forested). The farmed wetlands in peat soils typically do not support burrowing animals due to seasonally saturated and inundated soils. Large mammals (except coyote and an occasional deer) are absent from the project area due to the urban setting.

Carbon Export - The riverine portions of Wetland A1 perform this function at moderate to high levels by providing organic matter export functions to Miller Creek. The creek channelization (which limits the riverine edge) in this area limits this function somewhat, but because of the PFO and PSS components of this wetland directly adjacent to the channel, small and large woody debris and detrital matter recruitment would occur during flood events. The presence of reed canary grass lining most of the Miller Creek channel in this location is also a good source of detrital matter. There are periods of seasonal flow from, as well as flooding of, the farmed wetlands adjacent to Miller Creek, providing a source of organic carbon to the creek due to the peat soils in the area. However, the quality and amounts of organic matter export does not mimic natural floodplain systems because of farming practices.

C. Riverine Wetlands

Aquatic resources located along the Miller Creek riverine area includes:
Wetlands R1, R2, R3, R4, R4b, R5, R5b, R6, R6b, R7, R7a, R8, R9, R9a, R10, R11, R12, R13, R14a, R14b, R15a, R15b, R17

Portion of Wetland 18 - approximately 0.50 of an acre would be considered riverine - the remainder of Wetland 18 is a slope wetland.

Portion of Wetland 37 - approximately 1.75 acres would be considered riverine - the remainder is also a slope wetland.

Water Quality Functions

Untreated surface water runoff from streets and residential development enter most of the wetlands located west of 12th Avenue South. Sediments, nutrients, and other chemicals (like heavy metals) are removed from runoff by these wetlands, before they enter Miller Creek. Flooding of the riverine areas of Miller Creek affects the soil chemistry by producing anaerobic conditions, importing and removing organic matter, and replenishing mineral nutrients. Nutrients such as phosphorus and other chemical pollutants that adsorb to particulates are likely to accumulate in the riverine wetlands associated with Miller Creek. These wetlands are sites for denitrification when soils are saturated for fairly long periods (as in Wetlands 18/37).

Hydrologic Functions

The wetlands in riverine areas are generally formed in areas of groundwater discharge, and are rated high for this function. Portions of the riverine wetlands associated with Miller Creek occur in its floodplain, where they rate high for flood conveyance and storage functions. During flooding events, riverine wetlands in the project area attenuate flood flows and reduce erosion impacts to the creek, creating the opportunity to perform these functions at a high level.

Habitat Suitability Functions

Fish Habitat - Wetlands 18, 37 and all the riverine wetlands have the potential to provide fish habitat (refuge and forage opportunities) during flood events, at a moderate level, when their riverine portions are flooded. Aside from the stream channel itself, the wetlands lack fish habitat (except for the direct food sources which the wetlands provide) during normal low periods.

Waterfowl and Passerine Bird Habitat - The riverine wetlands do not provide waterfowl habitat. Most of these wetlands contain forested and shrub components and provide moderate to high habitat functions for passerine birds. Residential land uses adjacent to Miller Creek limit the use of this area to species tolerant of human activities. The migratory and resident birds use the large areas of both upland and wetland urban habitat in the area for breeding and migration.

Amphibian Habitat - The wetlands in this area contain fairly low habitat quality for amphibians because they lack suitable breeding areas (areas of standing water from late fall through late spring). Wetland A1 provides some breeding habitat within the ditch. The farmed wetlands have poor vegetation cover so they provide little habitat for non-breeding amphibians. The lack of riverine vegetation around some of Lora Lake decreases the value of the shoreline for breeding and non-breeding amphibians. However, areas of the lake shoreline containing erect vegetation (there are some small stands of emergent vegetation, such as bullrush), provide breeding substrate for some amphibians.

Invertebrate Habitat - The riverine wetlands rate fairly high for invertebrate habitat in areas where there is diversity in vegetation species and structure. Overhanging vegetation along the creek provides habitat elements for dispersal of terrestrial insects into the creek, where they would become part of the food chain support. Miller Creek, although degraded, still contains a variety of invertebrates such as stoneflies, dragonflies, crayfish, arachnids, and annelids. These are all important prey species for trout, salmon and other fish. This function is rated high for the riverine areas of Miller Creek.

Small Mammal Habitat - Most of the riverine wetlands provide some low to moderate habitat to small mammals (the same species as mentioned before). The wetlands typically do not support burrowing animals due to saturated soil conditions. However, the riverine wetlands along Miller Creek provide a very important migration

corridor for small mammals and rated high in this particular aspect because of a fairly intact migration corridor along most of Miller Creek in an urbanized setting.

Carbon Export - The forested riverine portions of the wetlands export plant and insect detritus to Miller Creek and rank high in this function. However, vegetation management by property owners adjacent to Miller Creek (mowing, removing LWD or overhanging vegetation) often limits this function.

D. Third Runway Area (West Airfield/West Acquisition Area)

Aquatic resources located in this area of the project include:
A5, A6, A7, A8, A9, A10, A11, A12, A13, A14a, A14b, A15, A16, A17 a-d, A18, A19a, A19b, A20, W1, W2, 16, 17, 18, 19, 20a, 20b, 21, 22, 35 a-d, 37 a-f, 39, 41a, 41b, Waters A, B, C, D, W

Water Quality Functions

Surface water runoff from streets and residential development enter most of the wetlands located west of 12th Ave. S. Sediments, nutrients, and other chemicals and contaminants are removed from runoff by these wetlands. Removal of sediments and nutrients would be somewhat reduced during heavy rainfall in wetlands with channelized flow compared to wetlands without channelized flow. Wetlands 18, 35, 37, and A18 have portions containing channels. For wetlands east of 12th Ave. S., moderate to high water quality functions occur.

Hydrologic Functions

Hillside seeps are the source of water (besides direct precipitation) for Wetlands 18, 19, 20, and 37. Wetlands 18 and 37 are hydrologically connected and contiguous although they received separate wetland designations. Wetland 18/37 is an adjacent wetland to Miller Creek and captures water from hillslope seeps originating in the Vashon Recessional Outwash aquifer. This wetland system, along with Wetlands 19 and 20, provide an important function in the watershed by buffering Miller Creek from hydrologic and temperature extremes through groundwater baseflow support. These wetlands are all rated high for this function. Natural and created channels (Water A, B and W) help convey this water to the downslope wetlands and into the creek. Wetlands 35, A6, A7, A8 and A12 are rated moderate for the groundwater exchange function because during the winter and spring months, the perched water collects in these wetlands and discharges to downslope areas. Other wetlands occur in shallow depressions or on gentle slopes where rainwater collects during the winter months.

Portions of Wetland 18/37, located downslope of the project, occur in the floodplain of Miller Creek and provide flood storage and/or flood conveyance and rate high in this function. The remaining wetlands in this area do not occur in floodplains, but do provide reduced peak flows by slowing runoff rates to Miller Creek.

Habitat Suitability Functions - The existing system of hillslope seeps and wetlands feeding Walker and Miller Creeks has a dendritic habitat structure confined to the west side of the existing airport. The original complexity has been degraded historically by

the construction of the airport and related facilities and by past property development practices. What remains is a system of wetland habitats that are somewhat hydrologically connected to each other and to the hillslope to the east. There are three discernable drainages (Waters A, B, and W) originating on the hillslope east of 12th Avenue South, feeding adjacent wetlands and Miller and Walker creeks.

Fish Habitat - Wetlands 18, 37 are adjacent to Miller Creek and its aquatic habitat. The wetlands have the potential to provide fish habitat (refuge and forage opportunities) during flood events, when their riverine portions are flooded. Aside from the stream channel itself, the wetlands lack fish habitat (except for the direct and indirect food sources which the wetlands provide) during normal low periods.

Waterfowl and Passerine Bird Habitat - Several of the wetlands located in this area (18, 19, 20, 21, 22, 35, 37, 40, A6, and A7) provide moderate to high habitat functions for passerine birds. These wetlands provide a diversity of vegetation species, age, and strata and because of their close proximity to one another in a forested landscape provide overlapping territories of uplands and wetlands, both of which are utilized by passerine birds in the area. This connection provides a green belt and habitat corridor utilized by a wide variety of passerine bird species. The wetlands in this area do not provide waterfowl habitat because they lack open water, flooded emergent vegetation, large expanses of lawn, or other conditions conducive for use by waterfowl.

Amphibian Habitat - The wetlands in this area contain fairly low habitat quality for amphibians because they lack suitable breeding areas (areas of standing water from late fall through late spring). These wetlands have some habitat connection to the aquatic habitat areas of Miller Creek, and likely provide habitat for non-breeding amphibians. This is especially true for forested areas of Wetlands 18, 19, 20, and 37, all of which rated high for non-breeding amphibian habitat.

Invertebrate Habitat - The wetlands in this area rate fairly high for invertebrate habitat in areas where there is diversity in vegetation species and structure. Invertebrate species richness rates moderate to high in these interconnected systems. Aquatic invertebrate species richness rates low except in those areas of Wetland 18/37 immediately adjacent to Miller Creek, in the channel areas, and in wetlands that contain standing water well into late spring/early summer (portions of Wetland 18/37).

Small Mammal Habitat - These wetlands provide habitat to small mammals and rate high in this function because of the habitat corridor existing along Miller Creek and the entire vegetated hillslope area east of Miller Creek.

Carbon Export - The forested riverine portions of Wetlands 18/37 provide plant and insect detritus to Miller Creek and rate high in this function. Wetland 20, connected to Wetland 37 and Miller Creek through natural and artificial channels, also rates high for this function. Wetlands 19 and A12 contribute seasonal flow to downslope wetlands and are rated moderate for this function. All wetlands hydrologically connected in this

area rated moderate for this function; wetlands not hydrologically connected by surface waters rated lower.

WALKER CREEK BASIN (subset of Third Runway Area)
Aquatic resources in the project area within the Walker Creek Basin include: Wetlands 23, 24, 25, 26 (these wetlands are located on the existing airfield) 44a, 44b, 43

Water Quality Functions
Surface water runoff from streets and residential development enter Wetland 44 from 12th Ave. S., S. 176th St. and adjacent areas. Sediments, nutrients, chemicals, and other contaminants are removed from runoff by this large wetland. A part of Wetland 44 includes a shallow conveyance channel, limiting a portion of the wetland's capacity to perform this function at a relatively high level. Wetlands on the airfield, as closed depressions, likely have high capacities for sediment, nutrient, and contaminant (especially those associated with airport activities like glycols and heavy metals) removal functions. By default, these wetlands on the airfield act as retention/detention ponds. During heavy storm events these wetlands overtop and the water flows down the adjacent hillside slope by sheet flow and seeps; eventually making its way to Walker Creek.

Hydrologic Functions
Wetland 44 provides stormwater conveyance functions and rates high for this function. Wetland 44 is also an area of perennial groundwater discharge and is part of the headwaters wetland system to Walker Creek. This wetland is seasonally saturated at its upslope end by perched water and stormwater runoff. The wetland depressions on the airfield are areas where rainwater and stormwater runoff seasonally perches. These wetlands provide some limited groundwater recharge functions, contributing baseflow support to Walker Creek. The stormwater capacity function of the wetlands on the airfield are limited due to their relatively small sizes and shallow depth. One of these airfield wetlands (Wetland 23) contains a stormwater conveyance pipe, which eventually discharges to Walker Creek.

Habitat Suitability Functions

Fish Habitat - Portions of Wetland 44 contain fish habitat, but fish would have very limited access. During flood events, floodwaters back up into Wetland 43 and 44 and the entire area becomes inundated, providing opportunity for fish to access the culvert connecting the two wetland systems. However, it is doubtful if fish could traverse the intricate network of culverts and catch basins in this area. The channel portion of Walker Creek begins just downslope of Wetland 44, in Wetland 43. These two wetland systems are separated by SR 509 with water being conveyed via a culverts and catch basins into the Walker Creek channel in Wetland 43. Wetlands 44 and 43 contain habitat for coho salmon and cutthroat trout. The indirect habitat elements of Wetland 44 for fish include food chain support functions for downstream areas that fish can readily access. Wetland 43 rated moderate to high for fish habitat, while Wetland

44 rated low to moderate because of the access issue. The wetlands on the airfield do not contain fish habitat and therefore rated low for this function.

Waterfowl and Passerine Bird Habitat - Wetland 44 provides high habitat functions for passerine birds. Wetlands on the airfield provide limited functions to birds because of their small size, on-going vegetation management, and waterfowl and flocking bird hazard management. Waterfowl periodically use the mowed wetland areas on the airfield, but hazing or removal as part of the wildlife hazard management necessary to maintain aviation safety discourages use. Wetland 44 does not provide waterfowl habitat because it lacks open water for prolonged periods, flooded emergent vegetation, large expanses of lawn, or other conditions conducive for use by waterfowl.

Amphibian Habitat - Wetland 44 rates high for habitat for non-breeding amphibians, and moderate for breeding amphibians because of very little suitable breeding areas available in the wetland (there may be ponded areas of Wetland 44 containing standing water for the requisite breeding period of certain amphibian species). Wetland 44 is connected to the aquatic habitat of Wetland 43 where breeding habitat is abundant. The depressions on the airfield are managed and are not useful habitat for breeding and non-breeding amphibians.

Invertebrate Habitat - Wetland 44 rates high for this function because of its size, diversity, and connection to the large expanse of Wetland 43 and Walker Creek. Wetland 44 has a variety of hydrologic regimes which adds to invertebrate species richness. The wetlands on the airfield rate fairly low in this function due to their small size and manipulation.

Small Mammal Habitat - Wetland 44 provides varied habitat to small mammals and rates high in this function because of its size. The habitat corridor in this area has been severely limited, by creating an island geography, wedging Wetland 44 between the existing airport fill to the east and SR 509 to the west.

Carbon Export - Wetland 44 provides plant and insect detritus export to Wetland 43 and Walker Creek. Both dissolved and particulate organic carbon are exported as well. The intermittent channel located in the project footprint provides this function during storm flows. However, LWD export does not occur due to the culvert connecting Wetland 44 and 43. The wetlands on the airfield rate low for this function. Some dissolved organic carbon originating in these airfield wetlands could eventually make it downslope to other channels conveying to Wetland 44 and ultimately to Walker Creek.

DES MOINES CREEK BASIN

E. SASA (East Branch Des Moines Creek)

Aquatic resources within this area include: E1, E2, E3, 52 (including Tyee Pond), 53, G1, G2, G3, G4, G5, G6, G7, G8

Water Quality Functions

Topographic and runoff conditions surrounding Wetlands 52 and 53 provides the opportunity for these systems to function at moderate to high levels for water quality functions. Other wetlands in this area are rated low for water quality functions because of their relatively small sizes and lack of surface flows. Wetlands on the golf course may be a net source of nutrients and other chemicals due to golf course maintenance.

Tyee Pond was constructed as a water quality detention pond for fuel spills at the airport in the early 1970's. The East Branch (a constructed channel) of Des Moines Creek flows through this pond. The pond is surrounded by fairly dense forested and shrub wetland communities (a portion of Wetland 52). The pond plays an integral role in water quality conditions in Des Moines Creek and rated high in this function.

Hydrologic Functions

Several of the wetlands in this area (Wetlands 52, E2, E3, G1, G2, G3, G4, G5, and G7) occur on gentle slopes in areas where seasonal groundwater discharge occurs. Groundwater discharge is perennial in Wetland 52 which is fed by many hillside seeps, mostly which flow throughout the summer months. The groundwater flows downslope to Des Moines Creek and plays an important role in baseflow conditions in the creek. Tyee Pond has a control structure at the downstream end of the pond which can be closed during major storm events or in case of an accidental fuel spill at the airport or surrounding areas. Wetland 53 occurs in a shallow depression where rainwater collects during the winter months or during periods of heavy rain. Wetlands 52 and 53 and G5 rated high for groundwater exchange functions. The remainder of the wetlands in this area rated low for this function.

The wetlands in this area are not a part of the Des Moines Creek floodplain and therefore, do not provide much in terms of flood storage. Wetland 52 may hold some flood waters in the riverine area of the wetland but most of these areas are elevated above the high water mark of the east branch of the creek. The other wetlands in this area (especially Wetlands 53, E2, and E3) reduce peak flows by slowing runoff rates to Des Moines Creek.

Habitat Suitability Functions

Fish Habitat - Wetland 52 is a riverine wetland associated with the East Branch of Des Moines Creek. The wetland is elevated above the creek channel so does not provide direct fish habitat, therefore, rated low for this function. However, detrital matter originating from Wetland 52 provides food chain support functions to downstream areas that fish access in Des Moines Creek. Wetland 52 rated high for indirect fish habitat. Fish access at the golf course is very limited by the S. 200th Street culvert and a weir/control structure at the downstream end of the East Branch. Therefore other wetlands in this area that are not riverine, rated low for fish habitat functions. Immediately south of S 200th St., the main stem of Des Moines Creek begins. Fish use in the main stem of Des Moines Creek is well documented and is discussed in the biological assessment prepared for the project.

Waterfowl and Passerine Bird Habitat - Wetland 52 and 53 provide forested habitat for passerine birds. The habitat function is somewhat limited (rated moderate) by the young age of the forest habitats (approximately 30 - 40 years old) and by the presence of non-native species in the understory. Nearby commercial land uses also limit the function to passerine bird species fairly tolerant of moderate to high levels of human disturbance. Other wetlands are dominated by blackberry shrub or are mowed portions of the Tyee Golf Course and provide low habitat for passerine birds.

Because of a lack of open water and flooded emergent vegetation in this area of the golf course, the wetlands do not provide breeding habitat for waterfowl. Limited waterfowl forage, especially during the winter months occurs on Wetlands G1-G5, but the use is fairly restricted by year round operation of the golf course.

Amphibian Habitat - The wetlands in this area contain fairly low habitat quality for amphibians because they lack suitable breeding areas (areas of standing water from late fall through late spring). Wetlands E2, E3, G1, G2, G3, G4, G5 and G7 typically do not provide non-breeding habitat for amphibians because they are fairly isolated from other aquatic areas or are mowed turfgrass. Wetland 52 has a habitat connection to the aquatic habitat areas of Des Moines Creek and provides habitat for non-breeding amphibians.

Invertebrate Habitat - Wetlands 52 and 53 rate fairly high for invertebrate habitat in areas where there is diversity in vegetation species and structure. Invertebrate species richness rated moderate to high in Wetland 52. Aquatic invertebrate species richness is relatively low except in those areas of Wetland 52 immediately adjacent to Des Moines Creek, in the channel of the East Branch, and in Tyee Pond.

Small Mammal Habitat - Most of these wetlands provide habitat to small mammals such as raccoon, opossum, squirrels, mice and rats. The wetlands typically do not support burrowing animals due to seasonally saturated soils. Large mammals (except coyote and an occasional deer) are absent from this area due to the lack of large undeveloped areas of native vegetation. Wetlands on the golf course probably receive limited use by small mammals during nocturnal hours. Wetlands 52 and 53, E2 and E3 provide habitat for foraging and denning animals.

Carbon Export - The forested riverine portions of Wetland 52 provides plant and insect detritus to Des Moines Creek and ranks high in this function. Other wetlands in this area are distanced from surface waters and/or are mowed for golf course maintenance so rated low for this function.

F. Tyee Mitigation Area/IWS Lagoon Area (West Branch Des Moines Creek)
Aquatic resources within this area include: IWSa, IWSb, 28, DMC, WH, G9, G10, G11

Water Quality Functions
Wetland 28 is a large diverse wetland complex that includes the Northwest Ponds (detention ponds on the West Branch of Des Moines Creek). This wetland has two linear features beginning in the area of the IWS lagoons. Topographic and runoff conditions coupled with dense forest and shrub vegetation and turfgrass in the golf course area result in a high rating for Wetland 28 in water quality functions, particularly nutrient and sediment trapping. The golf course is likely a net source of chemicals and nutrients due to maintenance applications of fertilizers and other chemicals. Wetland IWS is a slope wetland rating moderate in water quality functions due to a fairly steep gradient which does not detain stormwater for prolonged periods. The IWS wetland is forested with very little understory, reducing water quality functions even further. The other golf course wetlands (DMC, WH, G9, G10, G11) rate low in this function because of their small size and lack of connection to surface waters.

Hydrologic Functions
Wetland 28 appears to be an area where rainfall and flooding result in a seasonally high groundwater table. Groundwater discharge and/or recharge in Wetland 28 contribute to baseflow conditions in Des Moines Creek, especially the recharge potential the large forested arm of Wetland 28, located in a depression on the east side of the IWS lagoons, provides. The IWS wetland is an area of perennial groundwater discharge in the form of seeps - these wetlands are located just upslope of Wetland 28 and contribute to the hydrologic regime of the Wetland 28 system by locally recharging the shallow groundwater expressed from the IWS wetland.

A large portion of Wetland 28 is located in the floodplain of Des Moines Creek and rates very high for flood storage function. The golf course wetlands rate moderate for this function by storing rainwater in their shallow depressions, especially the water hazard (WH) wetland, which is deeper than the other golf course wetlands. The IWS wetland rates low in flood storage functions since the wetland does not have potential to store water - the wetland may reduce peak flows slightly before reaching Des Moines Creek.

Habitat Suitability Functions

Fish Habitat - Wetland 28 is riverine to a constructed channel of Des Moines Creek (the West Branch). The wetland itself does not provide fish habitat because it is elevated above the creek channel, however, during flood events, it could receive some use by fish, especially resident fish residing in the Northwest Ponds. Wetland 28 rated moderate for fish habitat because it provides opportunity for fish refuge during flood events and provides indirect habitat support by contributing food chain support to downstream areas where fish are known to occur. Other wetlands in this area do not provide suitable fish habitat and rated low for this function.

Waterfowl and Passerine Bird Habitat - The large expanse of Wetland 28, along with the diversity of habitats present (large areas of open turfgrass, scattered with large trees, POW of the NW Ponds, PFO, PSS, and PEM) make this wetland rate high for both passerine and waterfowl use. Year round operation of the golf course and hazing of wildlife for safety purposes discourage use by waterfowl in this area, but observations indicate, especially in the winter months, the turfgrass is heavily utilized by waterfowl (primarily geese). The open water area of NW Ponds and its PSS/PEM fringe offers valuable habitat for dabbling ducks and forage and nesting opportunities for passerine birds. The other wetlands in the area have low passerine and waterfowl functions due to their small sizes; however, because of the forested condition with a salmonberry understory, the IWS wetland rates moderate in passerine bird habitat functions.

Amphibian Habitat - The fringe wetland along the NW Ponds and the Ponds themselves offer high habitat conditions for breeding and non-breeding amphibians. The habitat connection of Wetland 28 with Des Moines Creek offers a large habitat corridor for amphibian rearing. The WH wetland on the golf course could offer some breeding opportunities for amphibians because it contains year-round water and erect emergent vegetation on which amphibians could lay their eggs. IWS wetland provides moderate habitat for non-breeding amphibians since it is located in close proximity to the large expanse of Wetland 28.

Invertebrate Habitat - Wetland 28 rates fairly high for invertebrate habitat in areas where there is diversity in vegetation species and structure. Invertebrate species richness is rated moderate to high in this interconnected system. Aquatic invertebrate species richness rated low except in those areas of Wetland 28 immediately adjacent to NW Ponds and Des Moines Creek.

Small Mammal Habitat - Wetland 28 provides a variety of habitats for small mammals and rates high in this function because of the habitat corridor linking Wetland IWS, Wetland 28, the NW Ponds, the large expanse of turfgrass, and Des Moines Creek. Once Des Moines Creek crosses under S. 200th St. via a culvert, there is a large forested ravine containing the main stem of Des Moines Creek, continuing west to the creek outlet in Puget Sound. Lower use by small mammals is expected in the golf course area.

Carbon Export - Mowing of the golf course reduces this function in this part of Wetland 28. The remainder of Wetland 28 is all hydrologically connected to Des Moines Creek (as well as the IWS wetland, part of the headwaters system hydrologically connected to Wetland 28 via groundwater and sheet flow). This function is rated high especially in terms of dissolved and particulate organic carbon export. Recruitment of LWD is limited in downstream reaches of Des Moines Creek because of control structures and culvert placement in the East and West Branches of Des Moines Creek.

G. Borrow Sites (main stem Des Moines Creek)

Aquatic resources located here include: B1, B4, B5, B6, B7, B9a, B9b, B10, B11, B12, B14, B15a, B15b, 29, 30, 32, 48, 51, Water S

Water Quality Functions

Most of the wetlands in the borrow areas are located on slopes or shallow depressions. Topographic and runoff conditions result in moderate to high retention of nutrients and sediments in these wetlands. Because the borrow areas are located in old neighborhood buy out areas from the 1970's, these wetlands currently do not receive urban runoff, except for Borrow Area 3, receiving some untreated runoff from residential areas to the west of this borrow area.

Hydrologic Functions

Some of the wetlands in the borrow areas contain seasonal groundwater discharge contributing important baseflow functions to Des Moines Creek. The wetlands within the borrow areas situated in depressions are areas of groundwater recharge. The wetlands in the borrow areas are not located in the Des Moines Creek floodplain (all the borrow areas are located 100-200 feet above Des Moines Creek), and therefore rated low for floodwater storage. However, many of the wetlands in the borrow areas have the capacity and opportunity to hold/store rainwater. The borrow area wetlands provide the opportunity to reduce peak flows at moderate to high levels, by slowing runoff rates to Des Moines Creek.

Habitat Suitability Functions

Fish Habitat - Most of the borrow area wetlands do not provide direct fish habitat, with the exception of Wetlands B12 and B4, which connect directly to Des Moines Creek. These wetlands provide moderate indirect habitat support functions to the creek. These are small headwater seep areas, located in small ravines directly adjacent to and flowing into the creek, and present the opportunity to supply detritus and invertebrates into the food chain support function. Portions of Wetland 51 are adjacent to the creek and provide fish habitat because this wetland is within the floodplain of Des Moines Creek. Wetland 51 rated moderate for this function because it provides opportunity for direct and indirect food chain support for fish. Fish may be able to seek refuge during storm events in Wetland 51 but the opportunity for this is extremely limited due to the very limited access for fish above the S. 200th St. culvert.

Waterfowl and Passerine Bird Habitat - Several of the wetlands located in this area provide moderate to high habitat functions for passerine birds. These wetlands provide a diversity of vegetation species, age, and strata, some of which contain forested riverine areas. The borrow areas are in fairly close proximity to one another in an overall forested landscape (both native and ornamental forest species are located in the borrow areas, which are abandoned neighborhoods). The borrow areas are all connected by green space, with few active roads intersecting the area. There is moderate human use of the area that is a park, and the proximity of this area to noise from the airport, likely attracts passerine birds acclimated to urban and semi-urban

conditions. The borrow areas provide overlapping territories of uplands and wetlands, both utilized by passerine birds in the area. The wetlands in this area do not provide waterfowl habitat because they lack open water, flooded emergent vegetation, large expanses of lawn, or other conditions conducive for use by waterfowl.

Amphibian Habitat - Most of the wetlands in this area contain fairly low habitat quality for amphibians because they lack suitable breeding areas (areas of standing water from late fall through late spring). The exception is an area of Wetland 29, containing the requisite standing water for amphibian breeding. Because some of these wetlands have some habitat connection to the aquatic habitat areas of Des Moines Creek, they provide habitat for non-breeding amphibians.

Invertebrate Habitat - The wetlands in this area rate fairly high for invertebrate habitat in areas where there is diversity in vegetation species and structure. Invertebrate species richness rate moderate to high in these interconnected systems. Aquatic invertebrate species richness rates low except in those areas of Wetland 51, B12, and B4 immediately adjacent to Des Moines Creek, in the channel areas, and in wetlands that contain standing water well into late spring/early summer (portions of Wetland 29 and 51).

Small Mammal Habitat - These wetlands and adjacent uninhabited and undisturbed upland provide habitat to small mammals and rate high in this function because of the interconnected habitat corridor existing between the wetlands, uplands and Des Moines Creek.

Carbon Export - The wetlands without any hydrologic connection to Des Moines Creek perform low in this function. However, those hydrologically connected and/or containing forested riverine components provide plant and insect detritus to Des Moines Creek and rank high in this function. Several of the wetlands in and adjacent to the Borrow Areas are hydrologically connected to Des Moines Creek (contained in ravines or in the riverine zone of the creek). These wetlands include 51, B4, B12, and an unnamed wetland adjacent to B12.

GREEN RIVER

H. <u>Auburn off-site compensatory mitigation area</u>
Aquatic resources located in this area include: Auburn Wetland 1, 2, and 3

<u>Water Quality Functions</u>
The landscape position of this wetland complex (depressional flow-through), along with the dense unmowed emergent community offers the opportunity for these wetlands to perform water quality functions at a high level. The existing land uses in the immediate vicinity of this site contribute sediments, and nutrients and toxins from chemical fertilizers and pesticides, that run-off from adjacent active farmland. The wetlands at Auburn have the potential to detain and adsorb these pollutants, before they enter the Green River, an important salmonid resource for the area.

Hydrologic Functions

Hydrologic functions of the wetlands on the mitigation site include temporary storage of surface water, groundwater infiltration, and surface water conveyance. The wetlands store small amounts of surface water during periods of heavy rain. This water appears to infiltrate during drier periods recharging the shallow groundwater table. The wetland swale bisecting the site conveys surface water across the site during periods of heavy rain. The shallow ponding occurring in the wetlands during rainy periods indicates the wetlands provide opportunity for stormwater storage functions at a moderate level.

Habitat Suitability Functions - Habitat quality of the existing wetlands and the adjacent grassy uplands is relatively low due to a number of factors. The relatively uniform pasture grass vegetation is dominated by non-native plant species, lacks structural diversity, has a somewhat low plant species diversity, and lacks habitat complexity.

Fish Habitat - The mitigation site consists of abandoned agricultural land dominated by grasses and forbs. Wetlands within the Auburn mitigation site do not contain permanent standing water and do not provide direct habitat for aquatic species or fish. The Green River provides aquatic habitat near the eastern site boundary.

Waterfowl and Passerine Bird Habitat - For most passerine bird species, the site lacks habitat structure for nesting, protection from predators, thermal cover, or perching. A narrow band of shrub vegetation along the southern boundary provides limited forage and perching habitat. Species observed on the site include kingfisher, short-eared owl, barn owl, common snipe, red-tailed hawk, northern harriers, common yellowthroat, and mallard duck. Most of these species appeared to be most abundant in the eastern portion of the site next to the Green River.

The wildlife habitat functions provided by these wetlands are similar to the non-wetland grassland surrounding them. Besides providing foraging habitat for raptors, the existing wetlands also provide foraging opportunities for a number of song bird species such as house and fox sparrow, American crow, American goldfinch, dark-eyed junco, and chickadees.

The lack of standing water on the site during the nesting season and the presence of unmowed grass prevent significant nesting or forage by waterfowl species.

Amphibian Habitat - Amphibian habitat on the site is currently limited by a lack of seasonally inundated pools, forest cover, and large woody debris.

Invertebrate Habitat - The existing PEM wetlands plant matter, semi-aquatic insects, and terrestrial insects supporting small mammals and terrestrial bird life. The wetlands rate moderate for this function and do not support aquatic insects.

Small Mammal Habitat - Small mammals likely use the wetlands for feeding and breeding, but there is insufficient cover to provide adequate habitat for many small mammal species. Small rodents do not overwinter in the wetlands because the high

water tables would flood their burrows. The site provides foraging habitat for raptors, such as Northern harriers and red-tailed hawks. Apart from the tall pasture grasses there is a general lack of cover from predators and a lack of habitat complexity (e.g., pits and mounds, large woody debris) providing for breeding, resting, and/or thermal cover for small mammals. Tracks or scat of coyote, mink, deer, and raccoon were observed on or near the mitigation site during the site assessment.

Carbon Export - During wet periods, some organic matter export to other ditch systems likely occurs, but the lack of intermittent flow in or near the wetlands result in a low assessment for this function.