JAMES C. KELLEY, PH.D.

POLLUTION CONTROL HEARINGS BOARD
FOR THE STATE OF WASHINGTON

AIRPORT COMMUNITIES COALITION and CITIZENS AGAINST SEA-TAC EXPANSION, Appellants, v. DEPARTMENT OF ECOLOGY and THE PORT OF SEATTLE, Respondents.	No. PCHB 01-160 PREFILED TESTIMONY OF JAMES C. KELLEY, PH.D.

AR 016441

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1. Professional Qualifications. I am a professional ecologist employed by Parametrix, Inc., an engineering and environmental consulting firm. My educational background includes a Doctoral of Science degree (1985) from the Fisheries and Wildlife Department at Michigan State University where my studies focused on aquatic ecology. I have a Master of Science degree from the Department of Botany and Plant Pathology (1980) at Michigan State University where my studies focused on plant ecology and plant taxonomy. My Bachelor of Science is from the Botany Department (1978) at the University of Vermont. I have completed postdoctoral research at the University of Minnesota-Duluth (1985-1987), where I studied wetland and riparian processes.

2. In 1997, I served on the Riverine Assessment Team and Depressional Assessment Team to help develop *Methods for Assessing Wetland Function Volume I Riverine and Depressional Wetlands in the Lowlands of Western Washington* (Ecology Publication #99-115). I have professional training and practical experience in the planning, design, implementation, and maintenance of constructed wetlands for water quality treatment, and have completed treatability studies that evaluate the ability of constructed wetland systems to remove excess metals from surface water. I have developed and implemented wetland restoration plans as part of sediment remediation (including dredging, capping, and natural recovery) actions. I have prepared over a dozen presentations and publications on wetland ecology and related topics, which are included with my resume attached as Exhibit A.

3. Familiarity with Project. I serve as the principal consulting ecologist for the Master Plan Update (MPU) projects at Seattle-Tacoma International Airport ("Airport"). In that capacity, I have directed and managed the wetland and natural resource studies for the MPU, which includes the Third Runway Project, the runway safety area extensions, the South Aviation Safety Area, and the development of on-site borrow areas. I and others working under my direction have been primarily responsible for the identification of impacts to wetlands and other aquatic resources, the assessment of wetland functions, and the design of compensatory mitigation for the MPU projects. The scientific analysis and conclusions on which this declaration is based are provided in the *Wetland Delineation*

Report, the *Wetland Functional Assessment and Impact Analysis Report* (WFAIA), and the *Natural Resource Mitigation Plan* (NRMP).

4. Outline. In this testimony, I describe the work I have conducted in regard to the 401 Water Quality Certification issued by Ecology for the Port's MPU projects, including:

- Environmental conditions in the project area;
- The studies and analysis that I completed, including the wetland delineation, impact analysis, and mitigation planning.
- A summary of how the project was designed to avoid wetlands.
- An explanation of wetland mitigation issues related to aviation safety and why some mitigation if off-site.
- A discussion on the reliability of wetland mitigation, and
- An explanations of how the suite of mitigation activities replace the functional attributes of the filled wetlands.

5. Some MPU projects at the Airport result in the permanent filling of 18.37 acres of wetland. During construction, an additional 2.05 acres of wetland will be impacted and will be treated as permanent wetland impacts, even though they will be restored after construction. The project will also fill 0.92 acres of Prior Converted Cropland as explained in prior Section 404/401 Public Notices for the project (Exhibit B). A complete and comprehensive mitigation plan has been developed to replace the ecological functions these wetlands provide to the Miller, Walker, and Des Moines Creek basins.

6. Conditions Prior to the Port's MPU Project. I am thoroughly familiar with the baseline conditions of the area where the Port's construction is planned. I began examining property in the acquisition area (the medium density residential neighborhood located west of the Airport) in 1997. I have also examined historic aerial photographs and maps of the area. This evaluation is documented in the *Cumulative Impacts to Wetlands and Stream Reports* (Parametrix 2001) and in *Wetland Photographs and Maps* (Parametrix 2001). The development and land-use practices that I have observed in the area did not protect wetlands or stream buffers. Past logging and farming practices historically modified vegetation, drainage, and channel conditions in the Miller, Walker, and Des Moines Creek basins. More recent urban development has also modified stream, wetland, and upland habitats. Many wetland areas have been cleared of native vegetation and used as lawn, as plant nurseries, for crop production, or for

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pasture. In many locations Miller Creek has been modified by ditching, with rock riprap, by tire riprap, or with concrete bulkhead. Like most urban streams, residents cleared fallen trees from the channel and banks, a process that destroys fish and invertebrate habitat.

7. As a result, environmental conditions in the project area are significantly degraded. Increased impervious surfaces have resulted in increased erosion, increased sedimentation and habitat degradation. Runoff from residential, commercial, and agricultural areas located in wetlands and uplands has increased input of sediment, nutrients, and pollutants to the stream. Upland and wetland riparian areas adjacent to the stream have been altered from the original forest and/or shrub cover to impervious surfaces, agricultural fields, residential lawns, or ornamental landscaping. Native plant and animal habitats have been reduced in size and fragmented, resulting in a loss of species diversity.

8. These disturbances have significantly degraded many of the functions of the area wetlands. For example, the historic conversion of forested riparian wetlands to farmland, lawn and pasture (as has occurred in portions of Wetland 18, 37, near the Vacca Farm, and wetlands on the Tyee Valley Golf Course) reduced habitat value, nutrient and carbon cycling processes, and carbon export capabilities. Their riparian functions are also affected, as their ability to deliver woody debris and organic matter to creek ecosystems is severely diminished. In many locations, the land adjacent to Miller Creek, Walker Creek, and Des Moines Creek fails to meet the definition of a buffer provided in the Section 404 guidelines which state that "*mowed lawns are not considered vegetated buffers because they provide little or no aquatic habitat functions and values*"[1,2].

9. The channel morphology of Miller Creek has also been altered throughout the project area. Extensive areas of the channel have been armored with riprap or retaining walls, and dredged or straightened to protect property adjacent to the stream or to drain land for agricultural uses. Dredging or

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[1] see page 12899, Federal Register 65(47), March 9,2000. *Final Notice of Issuance and Modification of Nationwide Permits*, Army Corps of Engineers.

[2] See page 119 in *Final Regional Conditions, 401 Water Quality Certification Conditions, Coastal Zone Management Condition Consistency Responses, for Nationwide Permits for the Seattle District Corps of Engineers For the State of Washington.* Special Public Notice. Army Corps of Engineers, Regulatory Branch, Seattle Washington.

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straightening of the channel has occurred to increase stormwater conveyance because most non-Airport development in the area lacked stormwater management. Ecologically valuable logs and other woody debris are nearly absent. These conditions have reduced aquatic habitat complexity, shading from riparian vegetation, and floodplain storage, and they have degraded water quality.

10. Channel modifications to Miller Creek are most pronounced in the Vacca Farm area (Sheet 1, Exhibit C, and Exhibit D). Here the channel is ditched, re-aligned near the perimeter of a peat deposit, and cleared of native riparian vegetation. These modifications were made prior to 1938, and have persisted since then to allow farming of up to about 25 acres of wetland.

11. Similar historic land uses resulted in similar degraded wetlands and streams in the Des Moines Creek basin. In this basin, wetlands located on the Tyee Valley golf course were farmed prior to 1938. Some wetlands have been subjected to excavation and peat mining.

12. Wetland Delineation and Classification. The Port has used scientifically accepted methods and standards to evaluate the presence of wetlands, the function of these wetlands, project impacts to these wetlands, and mitigation measures to avoid and compensate for project impacts.

13. The identification and delineation of wetlands are described in the *Wetland Delineation Report for Seattle-Tacoma International Airport Master Plan Update Improvement*. These studies were completed using the methods required in the *Washington State Wetland Identification and Delineation Manual* and the *Wetland Delineation Manual* of the U.S. Army Corps of Engineers (ACOE). Areas that were determined to be wetland were flagged, surveyed and mapped. Data was collected in the wetlands and adjacent uplands to document the dominant vegetation types, soil conditions, shallow groundwater conditions, and the general ecological condition of the area.

14. In addition to identifying vegetated wetlands, the studies identified streams and other drainage features that convey natural surface waters at least seasonally. Where these areas were independent of wetlands and were determined by the ACOE to be "waters of the U.S." they were surveyed, mapped, and included in further analysis. The ACOE made site visits to confirm wetland

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identifications and boundary delineations between July 1998 and November 2000. The ACOE review of delineated wetland is documented in a *Memorandum for the Record (MFR): Field Review and Jurisdictional Summary* in February 2001. All modifications requested by ACOE during those site visits have been made and are reflected in the wetland mapping and analysis for the project.

15. Independent of the ACOE wetland determination, Ecology also reviewed wetland conditions and the wetland delineation. Ecology determined in July of 1998 that certain areas on the Vacca Farm that meet the wetland hydrology criteria but are exempt from federal regulations (the Prior Converted Cropland) would be considered wetland and waters of the State. Project impacts to these waters of the State have been identified and mitigation provided. The mapping of Prior Converted Cropland has also been provided in the wetland delineation or mitigation plans since 1999 (NRMP Figure 2.1-4). The mitigation plan provides on-site and off-site mitigation both for the fill impacts (0.92 acres), and for the 980 linear feet (0.25 acres) of the Miller Creek channel impacts.

16. Ecology assigns wetland ratings (Category I, II, III, and IV) based on rarity, general habitat conditions, and other features. Categories are assigned independent of any specific evaluation of all the wetland functions that a more detailed functional assessment would provide. While the rating approach helps identify a general ecological value that a wetland may provide, it cannot be used to infer what the specific functional performance of a wetland may be. Likewise, the ratings are assigned independent of the level of human disturbance or degradation that a wetland may have been subjected to. Most of the wetlands filled by the project are rated as Category II and Category III wetlands. Even the supposedly higher quality Category II wetlands here are functionally degraded wetlands. For example, the Category II wetlands that occur in the Vacca Farm area are degraded by farming and hydrologic alterations. The Category II Wetland 18 and Wetland 37 are functionally degraded by residential development, grazing, ditching, land clearing and logging.

17. In her testimony, Ms. Azous claims a large percentage of wetlands hydrologically connected to Miller Creek as been filled. Ms. Azous is correct. I have prepared graphs showing the

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actual percentages of the impacts to the various wetland categories (Exhibit E). These graphs are similar to those prepared by Amanda Azous, except that my analysis is based on current data. That relevant data includes the wetlands in Tub lake, Lake Reba and from recent Port studies north of the Airport. Even this updated data undoubtedly underestimates the wetland acreage in the area because the Port does not have access to most properties and aerial surveys (such as those relied on by Ms. Azous) are notoriously unreliable.

18. The MPU impact of the project to hydrologically connected wetlands in the Miller, Walker, and Des Moines Creek watersheds are presented below. When addressing potential impacts to the Miller Creek estuary and nearby Puget Sound, the wetland impacts to both Miller and Walker Creek watersheds must be combined as the two creeks confluence upstream of the estuary and Puget Sound. For this analysis, wetlands and waters of the US total 149.5 acres[3] and a net loss of 7.44 acres (about 5%) of wetlands connected to the creek systems occurs.

Table 1. Summary of impacts to "hydrologically connected" wetlands and waters of the U.S. located in the upper watersheds[a] of Miller, Walker, and Des Moines Creeks.

Watershed[b]	Total	Impact	Change
Miller Creek	79.1/ 112.8	10.48	-9.3/ -13.2%
with mitigation		7.18	-6.4/ -9.1%[c]
Walker Creek	36.5	0.26	- 0.7%
Des Moines Creek	59.5	1.29	- 2.2%

[a]The upper watersheds are as follows: upstream of SR 509 for Miller Creek, upstream of Des Moines Memorial Drive for Walker Creek, and upstream of Borrow Area 1 for Des Moines Creek.

[b]The range for the Miller Creek watershed results from including 33.7 acres of Arbor Lake and Burien Lake because lake ecosystems provide many physical, biological, and ecological functions that wetlands provide. Lake Reba, Tub Lake, and Northwest Ponds are open water (aquatic bed, and unconsolidated bottom) palustrine wetlands that are integrated into larger wetland areas and are also included in the relevant calculations.

[c]The calculation represents a net impact that accounts for wetland restoration at the Des Moines Way Nursery, Lora Lake, and Wetland A17 sites (3.30 acres). The restoration of 6.6 acres of prior converted cropland to jurisdictional wetland at the Vacca Farm site is not included.

19. No matter what the "percentage" loss, the Port's mitigation plans will compensate for all of the functions lost the filling of wetland areas identified in these tables. I am not aware of any

[3] This value underestimates the actual value as it includes only wetlands in the upper watershed and not those downstream of SR 509 and Des Moines Memorial Drive.

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scientific research that shows scientifically based critical thresholds, above which water chemistry, food web support, or invertebrate communities in downstream areas are significantly altered (as alleged by Ms. Azous).

20. Assessing Wetland Impacts and Functions. In addition to determining wetland areas affected by the project, impacts to wetland functions were evaluated. This study identified the beneficial biological and physical (hydrologic and water quality) functions that wetlands provide to the local area and their larger basins. The assessment was based on observing the physical and biological characteristics of the wetlands and surrounding areas, and using professional judgement to categorize the opportunity for wetlands to provide various functions. This is a common method used to characterize wetland functions. Exhibit F provides a summary of the Port's functional assessment.

21. Functional assessment methodologies for wetlands typically identify and evaluate a suite of physical and biological attributes of wetlands that are indicative of wetland functions. Several functional assessment methodologies were used for guidance in preparing the functional assessment[4]. There are no standard quantitative procedures for obtaining direct measurements of wetland functions, nor are any required by the Department of Ecology or the Army Corps of Engineers.

22. The scientific literature documenting most wetland functions generally consists of a relatively small number of direct measurements of function made at a relatively small number of wetlands. From this data, attempts are made to characterize various physical and ecological attributes that would indicate the functional performance of other wetlands, but there are no standard assessment methods that are applicable to the range of wetlands types found in Washington State or the project area.

23. The Department of Ecology has recently developed a predictive model to estimate wetland functions in a variety of wetland types in western Washington (Washington Functional

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[4] These methods include locally developed *Wetland and Buffer Functions: Semi-Quantitative Assessment Methodology Draft Users Manual* (Cooke Scientific Services 1996), *Wetland and Buffer Functions: Semi-Quantitative Assessment Methodology Final Working Draft Users Manual* (Cooke Scientific Services 2000), *Wetland Evaluation Technique*, Department of the Army, U.S. Army Corps of Engineers (1987), and Indicator Value Approaches as described in Hruby, T., W. Cesanek, and K. Miller. 1995. *Estimating relative wetland values for regional planning*. Wetlands 15: 93-106.

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Assessment Methodology or WFAM)[5]. This model was not available at the time the Port's studies were conducted. The models does not model functions of slope wetlands, the most common and functionally important wetland type affected by the project. The model does not quantify wetland functions and does not allow comparison of functions across wetland types. Further, since the assessment methods in WFAM are generalized for all of lowland western Washington, they compare wetlands to the characteristics of typical undisturbed wetlands with optimal function. This is a significant detriment to assessing wetlands in a local urbanized area, because the significance of the functions remaining in degraded wetlands may be underestimated. WFAM also requires "best professional judgement" to assess "opportunity" (e.g. whether a wetland actually performs a function). *See* Exhibit G. The methods assess capability of a wetland to perform a function based on models and the actual environmental characteristic of a wetland. Since in an impact analysis, we ultimately want to know if a wetland is performing a function and if the project will enhance or degrade that function, the most critical component of a WFAM uses the same method used by the Port. It is my opinion the WFAM method provides a framework for users with a relatively limited understanding of wetlands. For experienced wetland ecologists, best professional judgment provides a more thorough analysis of wetland functions.

24. Ms. Sheldon testifies that WFAM could be used on 41 percent of the wetlands affected by the MPU. While it could be used on 41 percent of the individual wetlands, the wetlands it could apply to are small, and account for only about 24 percent of the wetland impact area. This leaves a significant void and the need for a second methodology to address the functions of over 75 percent of the wetland area. In my opinion, using two different functional assessment methodologies for the same project area could result in inconsistencies and would not improve the overall reliability.

25. Regardless of the above concerns, I have recently applied the WFAM method on the two largest impact areas for which it is appropriate (Wetland 23 and impacted wetlands at Vacca Farm). The findings are shown in Exhibit H. These areas collectively represent about 54 percent of the depressional

[5] *Methods for Assessing Wetland Function. Volume I. Riverine and Depressional Wetlands in the Lowlands of Western Washington.* Washington Department of Ecology, publication #99-115. 1999.

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wetlands that WFAM addresses. Comparing the WFAM results to findings of the functional assessment report, I found the report resulted in determinations that were equal to or greater than the WFAM results. There is no merit to the testimony that the Port's functional assessment may underestimate functions.

26. Assessment of Direct Wetland Impacts. The impact analysis used engineering designs for Master Plan projects mapped on wetland and stream maps so direct impacts to streams and wetlands could be determined. These impact areas were calculated using engineering design data and survey maps of delineated wetland boundaries that were incorporated into GIS map layers. Permanent direct impacts occur where fill is permanently placed in wetlands. Temporary direct impacts occur where, on a temporary basis, fill or other activities occur in wetlands during a portion of the construction period. In these areas, following construction, and per Section 404 definitions that state "*Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to preconstruction contours and elevations after construction are not included in the measurement of loss of water of the United States*"[6]. Consistent with Council of Environmental Quality regulations (40 CFR 1508.20), the temporary impacts will be rectified by restoring the affected environment. Temporary impacts[7] result primarily from the need for temporary erosion and sediment control facilities (including sediment fencing, drainage swales, and stormwater management ponds) during the construction period.

27. Assessment of Indirect Wetland Impacts. Indirect wetland impacts to wetland functions were defined as potential wetland impacts (excluding filling) that could affect the existence and ecological function of wetlands located near areas developed as part of the Master Plan. The methodology for evaluating these impacts was to consider the changes to wetland conditions or

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[6] See page 117 in *Final Regional Conditions, 401 Water Quality Certification Conditions, Coastal Zone Management Condition Consistency Responses, for Nationwide Permits for the Seattle District Corps of Engineers For the State of Washington.* Special Public Notice. Army Corps of Engineers, Regulatory Branch, Seattle Washington.

[7] The *Natural Resource Mitigation Plan* proposes wetland mitigation for all permanent and temporary wetland impacts. Because the duration of temporary impacts exceeds 1-year, mitigation for these temporary impacts includes restoration of the affected area (see the *Natural Resource Mitigation Plan*, Section 5.2.4) Parametrix 2000) and restoration of Wetland A17 (2.85 acres of wetland and 8.6 acres of upland) as required by conditions D.4. of the amended Water Quality Certification..

characteristics that could occur from the project, and evaluate what effect these changes could have on wetland functions.

28. The activities that could potentially result in indirect impacts were fully evaluated in the WFAIA.

29. Hydrologic Impacts. A large number of hydrologic and engineering studies were completed to assure the accuracy of the wetland impact analysis and these key studies were included as appendices to the WFA report. The impact analysis also relied on water quality analysis reported in the *Biological Assessment-Master Plan Update Improvement Projects* (Parametrix 2000). Hydrogeologic investigations evaluated the movement of water through the runway embankment using a variety of modeling methods. The studies found that for wetlands located downslope of the embankment, small increases in groundwater would be available. The result would be that wetlands downslope of the embankment would receive increased groundwater during the late spring and summer months.[8] There are no studies that show wetlands would receive less water or be subjected to more drying. Though groundwater monitoring in wetlands located adjacent to the embankment is ongoing and will continue post-construction, the embankment design and the groundwater studies provide reasonable assurance that wetland hydrology will not be significantly altered.

30. For the past several years, I have examined the perimeter of the existing fill embankment for the airport and the base of recently placed fill material. Near the base of the existing embankment, there are several locations where groundwater seeps from the fill and supports wetlands. One of the most prominent area where wetlands exist next to the existing embankment at a portion of Wetland 28, near the IWS 3 lagoon (see Sheet 5, Exhibit C). These observations indicate that embankment construction will eliminate water sources that result in the elimination of wetlands. What is more telling

[8] While the models indicate more groundwater would be discharging into the wetland for an extended period of time, the slope wetlands do not pond water, and hydrologic impacts related to increased flooding would not occur. Native vegetation in the wetlands is tolerant of wet to moist soils throughout the summer months, and plant die-off due to wetness is unlikely. However, monitoring of vegetation will occur. Drainage channels located at the base of the embankment provide an opportunity to decrease or increase water flow to wetlands if monitoring indicates this is necessary.

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are observations made in areas where new embankment has been placed between 1998 and 2001. In these areas pre-construction conditions were residential neighborhoods or other uplands with no pre-existing wetlands, springs, or persistent surface water. Following embankment construction, I have observed several locations where the drainage swales at the base of the embankment contain standing or flowing water for long periods (several weeks or more) between rainy periods. In some cases, wetland vegetation is beginning to grow in these swales, further indicating the extended hydroperiod created by seepage from within or beneath the embankment. Upon completion of the project, the water source from the embankment will be directed to remaining downslope wetlands as shown in the NRMP (See design sheets C5-C9 and L1 in Exhibit D).

31. The concerns of ACC over excess water level fluctuations in the wetlands located downstream of the embankment are not valid. Hydrology studies show that somewhat more water will be present and that water will be more evenly distributed throughout the year. The wetlands occur on slopes and there is no opportunity (due to topographic gradients) for the existing limited areas of shallow surface water that is occasionally present in a few localized depressions (less than 3 inches deep) to impound water further. Thus, increased flooding will not occur and floodwater impacts to vegetation and other wetland functions will not occur. The embankment design and mitigation design for the replacement drainage channels (Appendix D of the NRMP) provide flexibility in distributing this water to the remaining wetlands.

32. Matching pre-fill hydrologic patterns as a performance standard for wetlands located downslope of the embankment is not scientifically warranted. Implementation of such a performance standard would imply that wetland vegetation and is so sensitive to wetland hydrology, that any change in hydroperiod would alter vegetation and functions. In nature, wetlands with similar vegetation and habitat conditions can have varying hydrologic conditions, and the hydrologic condition in any wetland can vary year to year, or seasonally.[9] There are no criteria or detailed studies I am aware of that would

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[9] See Appendix L of the NRMP, pages L-2 through L-5, and pages 108-108 in National Research Council. 2001. *Compensating for Wetland Losses Under the Clean Water Act.* National Academy Press, Washington, D.C.

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allow one to determine if an increase in wetland hydroperiod (increased soil saturation) predicted by the project would impair or enhance wetland functions.

33. For forested and pasture wetlands in Puget Sound, I am not aware of studies that show saturation to the surface will result in greater plant production, nutrient export, or stream flow attenuation compared to saturation at 10 inches. In fact, productivity of red alder may be below average on saturated or nearly saturated soils compared to upland sites.[10] Nutrient export could be reduced if surface flows are eliminated, but there is no evidence this would occur, evaluations indicate groundwater discharge in the wetlands and water discharged from the embankment would increase slightly. Slope wetlands with saturated soil do not provide significant streamflow attenuation functions because they have little or no water storage capacity.

34. The NRMP and Impact Assessment report evaluate potential impacts to these wetlands. Coupled with the detailed hydrologic analysis, the studies show there will be sufficient groundwater and flow that emanates from the embankment to keep existing *and enhanced* functions viable. The embankment and mitigation design affords flexibility in distributing water to these wetlands (See NRMP Appendix D) to optimize wetland conditions during the monitoring period. The NRMP wetland mitigation is designed to actually *improve* the functions of these wetlands through the enhancement plantings and removal of detrimental land uses that currently reduce functional performance below optimal levels.

35. Avoidance and Mitigation of Wetland Impacts. The primary strategy in addressing potential project impacts was avoidance and minimization of impacts to wetlands and streams. A critical part of the impact analysis was to evaluate, at each location where wetlands were impacted, if design alternatives were available to eliminate or reduce wetland and stream impacts. This analysis is summarized in the NRMP at Table 4.1-1, Figure 4.1-1, and Figure 4.1-2. An important element of this review was the determination that a MSE wall along a portion of the west side of the third runway

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[10] Harrington c> and P. Courtin. 1994. *Evaluation of Site Quality for Red Alder.* In:Hibbs, D., D. De Bell, and R. Tarrant. *The Biology and Mangement of Red Alder.* Oregon State University Press, Corvallis, Oregon. See page 147, 151-152.

embankment would reduce wetland and stream impacts. The MSE wall design avoids relocating Miller Creek in a second location and avoids impacts to over 2 acres of higher quality wetlands. If the wall were not part of the project, the potential environmental impacts to Miller Creek and wetlands would be greater.

36. The key actions taken to avoid impacts are listed in Exhibit I. The result is the design of a "least damaging practical alternative" to avoid and minimize wetland and stream impacts. Where impacts to wetlands and streams were found to be unavoidable, compensatory mitigation is proposed such that there is no net loss of wetland functions or area.

37. Mitigation Summary. The compensatory wetland and stream mitigation projects and their area are summarized in Exhibit J. This attachment shows that for the 18.37 acres of permanent and the 2.05 acres of temporary impact, over 178 acres of land will be permanently protected as mitigation. The on-site mitigation includes ecological improvement to over 112 acres of land and over 1.4 miles of streams. On-site mitigation occurs as enhancement of over 22 acres of wetland, re-establishment of 3.30 acres of previously filled wetland, rehabilitation of over 8.6 acres wetland, and enhancement of over 54 acres of stream and wetland buffers. The plan also includes preservation of over 2 acres of wetland and 21 acres forest buffer.

38. The Azous testimony presents a summary of the Port's mitigation proposal. Ms. Azous has presented outdated information. I have corrected the summary and presented it below. In particular, Ms. Azous leaves out a new mitigation area (the Des Moines nursery site) and wetland restoration at Lora Lake; a total of almost 11 acres of mitigation.

Total	Wetland Creation	Wetland Restoration	Wetland Enhancement	Buffer Enhancement /Restoration	Wetland Preservation	Upland Preservation
On-Site						
112.75 (**36.44**)	0 (0.)	11.95 (11.95)	22.32 (11.16)	54.93 (10.13)	2.35 (0.24)	21.20 (2.10)
Off-Site						
65.38 (**42.19**)	29.98 (29.98)	0 (0)	19.50 (9.75)	15.90 (3.18)	0 (0)	0 (0)
Total						
178.13 (**79.35**)	29.98 (29.98)	11.95 (11.95)	41.82 (20.91)	70.83 (14.17)	2.35 (0.24)	21.20 (2.10)

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39. The 401 Certification requires the Port to execute and record restrictive covenants to protect the 167 acres of mitigation area. The covenants require that the mitigation areas be preserved in a natural state, prohibiting future development activity. The geographic scope of the mitigation areas to be protected by the covenants is depicted on the drawings in Exhibit G and elsewhere in the NRMP.

40. The ecological functions that are targeted in the design of the mitigation projects were based on the functions impacted by wetland loss (see Exhibit F). For each mitigation site, I have listed in Exhibit K the planned ecological functions to be provided at the mitigation site and the physical or ecological attributes that are included to assure the sites provide these functions. These are the types of attributes that are generally recognized as indicators of wetland function.[11]

41. Mitigation for the MPU projects focuses on impacts to streams and wetlands by restoring and enhancing stream and wetland functions, especially to Category II wetlands. In the Miller Creek basin, the 401 Certification requires the Port to implement the following specific mitigation:

- Restore natural channel morphology, habitat complexity, and instream habitat along an approximately 1.4-mile reach of Miller Creek extending from south of Lora Lake to Des Moines Memorial Drive.
- Restore and replace floodplain, floodplain wetlands, and riparian areas along the upper reaches of Miller Creek, and re-integrate floodplains and adjacent wetlands with the stream.
- Restore, replace, and enhance wetland and aquatic habitat functions to the currently degraded lacustrine, stream, floodplain, and riparian wetland system along the upper reaches of Miller Creek at the Des Moines Way Nursery site.
- Maintain wetland hydrology and base flow functions in wetlands adjacent to the embankment fill by providing surface water drainage features to convey groundwater and surface water runoff from the new embankment to downslope wetlands.
- Restore and enhance wetland and aquatic functions, and protect the long-term viability of these systems by establishing native forested buffers around wetlands and aquatic systems at Lora Lake.
- Restore habitat connectivity in the upper reaches of the Miller Creek basin by providing a forested wetland and riparian corridor connecting currently fragmented wetland, aquatic, and riparian habitats between Lora Lake and Des Moines Memorial Drive.
- Improve Miller Creek instream aquatic habitat conditions at 4 locations within this area.

[11] See *Methods for Assessing Wetland Functions. Volume I. Riverine and Depressional Wetlands in the Lowlands of Western Washington.* Washington Department of Ecology Publication 99-115. 1999.

42. In the Des Moines Creek basin, mitigation is designed to restore wetland and stream functions, and to mitigate for potential indirect effects to wetland hydrology. To replace functions impacted by Master Plan Update improvements and to restore and enhance aquatic and wetland habitat in the Des Moines basin, the 401 Certification requires the Port to implement the following specific mitigation:

- Enhance water quality and fish habitat, and restore stream conditions in Des Moines Creek by establishing a 100 foot wide forested buffer along at least 1,200 linear feet of the west branch of Des Moines Creek
- Restore and enhance wetland and aquatic habitat by replacing the existing turf grass wetland with a native shrub wetland at the Tyee Valley Golf Course, adjacent to Des Moines Creek
- Avoid, minimize, and mitigate potential indirect hydrology impacts to wetlands adjacent to the borrow areas by directing groundwater seepage and/or surface water runoff to wetlands near the borrow areas

43. The Port will also establish basin trust funds to promote local stream restoration projects in the Miller and Des Moines Creek basins ($150,000 in each basin).

44. Mitigation and Aircraft Safety. The Port's mitigation plan avoids creating new wetlands in the nearby stream basins for reasons of aviation safety. Wetlands provide attractive habitat for waterfowls, flocking birds, and other wildlife that pose serious hazards to aircraft. In the United States, wildlife strikes annually result in over $300 million in direct damage and associated costs, and over 500,000 hours of aircraft down time. Since 1960, at least 78 civilian aircraft and 201 civilian lives have been lost worldwide to wildlife strikes. Since 1960, at least 250 military aircraft and 120 military personnel have been lost because of wildlife strikes.[12] FAA Advisory Circular 150/5200-33 provides that land uses that are wildlife attractants, such as wetlands, must be sited no closer than 10,000 feet from turbine aircraft movement areas. The FAA imposed this requirement as a condition of in its 1997 Record of Decision (at p.26-27).

45. The Port searched for wetland mitigation sites in the Des Moines, Walker, and Miller Creek basins that could be used to provide replacement wildlife habitat; however, these basins are

[12] See *Wildlife Hazard Management at Airports, USDA and FAA,* December 1999. Pages 1-2

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almost totally within the 10,000-ft exclusion area for wildlife habitat mitigation.[13] Areas more than 10,000 ft from existing runways were found to be unsuitable for mitigation due to small size, developed nature, forested condition, or lack of hydrologic conditions necessary to support wetlands.

46. Off-Site Mitigation in Auburn. The Port will construct wetland mitigation off-site on a 65-acre parcel in the City of Auburn. This mitigation will provide high-quality, diverse, forested, shrub, emergent, and open water wetland habitats and functions to a site where these functions are currently absent or degraded.

47. The off-site mitigation involves wetland restoration, wetland creation, and wetland enhancement. The mitigation establishes 17.2 acres of forested wetland, 6.0 acres of shrub wetland, 6.2 acres of emergent wetland, 0.60 acres of open water, and 19.5 acres of emergent wetland habitat. These habitats will be protected with approximately 15.9 acres of forested upland buffers.

48. The area of the Auburn Wetland Mitigation site is located within the *Mill Creek Special Areas Management* (SAMP) planning area, and is part of the aquatic resources restoration plan for the SAMP area.[14] The mitigation at Auburn contributes to the restoration plan by restoring forest, shrub, emergent, open water, and upland greenbelt areas (Exhibit L).

49. In-Basin Mitigation Will Replace Lost Wetland Functions. Contrary to the ACC's allegations, the mitigation plan required by the 401 Certification will fully replace the wetland functions lost to wetland filling. In fact, the in-basin elements of the mitigation plan, alone and without considering the benefits of the Auburn mitigation project will replace the wetland functions lost to filling (except for waterfowl habitat). The amount of mitigation area that the mitigation plan provides for each wetland function is summarized in Exhibit M, where the acres of impact are compared to the acres of mitigation, by function. The following paragraphs describe how the mitigation plan replaces each function

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[13] This issue is addressed in Section 7.2.3 of the *Natural Resource Mitigation Plan*.

[14] Miller Creek Basin, King County Washington Aquatic Resources Restoration Plan. 1997. U.S. Army Corps of Engineers, Seattle District, Seattle, Washington.

identified in the affected wetlands. The mitigation will result in stream and riparian wetland conditions that are at least as good, and possibly better, than they are at present (prior to any fill).

50. The enhancement and restoration of wetlands and riparian buffers in the Miller and Des Moines Creek basins has been carefully planned to replace the functional attributes of the wetlands impacted by the project. The fact that mitigation actions other than wetland creation can replace the wetland functions lost, is the basis for the recommended mitigation ratios present in wetland guidelines and standards.[15] Riparian buffers (wetland and upland) are recognized as providing shade, organic carbon, water quality, and habitat functions that protect adjacent stream systems. The restoration and enhancement actions proposed by the Port's mitigation plan are expected to be especially effective in replacing and restoring functions since, concomitant with the wetland restoration and enhancement actions, because land use practices that have caused on-going degradation of wetlands and streams are being removed and replaced by the mitigation. These methods also take advantage of the naturally occurring soil and hydrologic conditions that promote the establishment of wetland and other native plant communities.

51. Ms. Azous relies on the book *Wetlands and Urbanization – Implications for the Future* that presents the results of the Puget Sound Wetland and Stormwater Management Research Program (PSWSMRP). I have completed a review of this book and visited many of the 19 wetlands that are the focus of these studies. The studies in the book are useful, but their scope is narrowly focused to a subset of 19 wetlands in urban and non-urban areas whose ecology is very dissimilar from the wetlands filled by the Port's project. The PSWSMRP wetlands are nearly all depressional wetlands that impound water, while nearly all wetlands here are slope wetlands or seasonally saturated depressional wetlands, neither of which impound water. The presence of standing water in the study wetlands results in very different wetland functions than occur at the Airport, and in many cases the finding of the study are not relevant to understanding how wetlands will change at the airport.

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[15] see Table 5 in *Water Quality Guidelines for Wetlands*, Washington Department of Ecology, Olympia Washington, 1996.

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52. The following paragraphs discuss each of the functions assessed in the WFA report and describe how the mitigation plan replaces each of the functions that would be lost when the wetlands are filled. The functions considered are: (1) Resident/Anadromous Fish Habitat; (2) Passerine Bird Habitat; (3) Waterfowl Habitat; (4) Amphibian Habitat; (5) Small Mammal Habitat; (4) Organic Matter Export; (5) Groundwater Exchange; (6) Flood Storage/Desynchronization; and (7) Nutrient Retention/Sediment Trapping. The locations of the mitigation sites are mapped in Exhibit D.

53. Functions for Resident/Anadromous Fish. The new Miller Creek stream channel and in-stream enhancements at 4 locations will provide improved fish and other aquatic habitat because the features are designed with a number of beneficial features. The primary characteristics provided by the design are large woody debris (LWD), woody riparian vegetation, and substrate variability. Each of these features will enhance fish and aquatic habitat. Increased amounts of woody riparian vegetation will result in increased shade, allochthonous inputs (food sources in the form of coarse particulate organic matter [CPOM] and terrestrial invertebrates), and sources of woody debris. Increased LWD generally provides habitat complexity, including small plunge pools, fish cover, invertebrate substrates, variable water depths and velocities, etc. These conditions will provide nesting, resting, and forage habitat for fish and other aquatic life. Increased streambed variability in the form of gravel, wood, and CPOM will also increase the diversity of invertebrate habitat. The function of large woody debris and other organic matter in providing fish habitat and food resources for fish is well understood and documented.[16,17]

54. The channel is designed to provide fish habitat despite it gentle slope. The existing ditched channel provides limited fish habitat while the design features of the new channel will improve conditions for fish and invertebrates. The types of habitat and flow regimes that can be established in a low gradient creek have been considered and incorporated into the design. The channel design includes a geotextile liner for geotechnical reasons. This liner is very porous, far more porous than the peat soils

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[16] See Chapter 5 in *Streamside Management: Forestry and Fishery Interactions*, E. Salo and T Cundy eds, Institute of Forest Resources, University of Washington, Seattle.

[17] See Chapter 12 of *Stream Ecology: Structure and Function of Running Waters,* J, Allen. 1995. Kluwer Academic Publisher, Boston.

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it will be placed against, and it would not "clog" because it is incapable of acting as a filter given the large pore size of the fabric compared to the very small sized particles that are mobilized in groundwater flow. If the peat soils and fabric were to "clog," there would be no detrimental affect on the planned functions of the creek or the adjacent wetland.

55. The shallow water along the margin of Lora Lake will be improved aquatic habitat compared to existing conditions. The replacement of lawns and concrete bulkhead with plantings of riparian tree and shrub vegetation will improve aquatic habitat by providing shade and organic matter input (woody debris, leaf matter, and insects) that will support fish and other aquatic life.

56. The more than 51 acres of mitigation in Miller Creek buffer areas occurs along over 1.4 miles of Miller Creek. It consists of riparian uplands and wetland, much of which was developed as residential lawns, pasture, or a small nursery. Over 1,800 linear feet of a small tributary channel in Wetland A17 will be enhanced by removing culverts and fill, providing riparian and wetland plantings, and by placing LWD in the channel. Over 10.25 acres of riparian wetlands will be enhanced and restored in this area by controlling non-native plant species and planting areas with native trees and shrubs.. In addition, throughout the stream reach, fish enhancement including woody debris, bank improvements, and substrate improvements will be added to enhance fish habitat.

57. The Tyee Valley Golf Course Mitigation Area is over 6 acres in size and includes restoration of wetland and buffer functions that are currently lacking due to the golf course. The area includes over 700 linear feet of Des Moines Creek. Enhancement of floodplain wetlands and 100 foot wide stream buffers will provide indirect improvements to fish and aquatic habitat (woody debris, shade, organic matter). In addition, restoration of floodplain wetlands (converting golf course vegetation to shrub wetland) will increase carbon production, some of which will be exported to the stream during flood events, rainy periods, or through movement in groundwater (in the form of dissolved organic carbon).

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58. The 65-acre Auburn mitigation could provide some fish habitat. Some warmwater fish may use the open water and flooded emergent portion of the wetlands.

59. Functions for Passerine Birds. The increased amounts of woody and forest vegetation will provide additional and improved habitat for forest-dwelling bird species. Planting trees and shrubs around Lora Lake will increase forage opportunity for some birds such as kingfisher. Vegetation in the Miller Creek buffer mitigation area, and wetland and buffer plants at the Tyee Valley Golf Course mitigation site, will produce insects that a variety of passerine birds forage upon.

60. The 65-acre Auburn mitigation site will provide multi-canopied forested, shrub, and emergent wetland communities. The complex vegetation structure and plant communities (containing vertical diversity, snags, debris structures, and food sources) will provide high quality habitat to a variety of forest and wetland bird species. These elements will provide resting, nesting, and foraging habitat for passerine birds. Because of the diversity of habitats at this site and the absence of the past and on-going disturbances to the impacted wetlands, the areas will provide increased habitat functions for birds, small mammals, and amphibians (see *Wetlands and Urbanization: Implications for the Future*, pages 187-188).

61. Functions as Waterfowl Habitat. The Miller and Des Moines Creek mitigation sites are not planned to provide waterfowl habitat functions, for reasons of aviation safety. The Auburn mitigation site will provide waterfowl habitat in open water areas, submergent aquatic bed vegetation, and seasonally flooded emergent vegetation. These areas will provide a diversity of cover and food sources that will provide habitat for waterfowl, including feeding, resting, and nesting habitat. The habitat in Auburn will also benefit other wildlife groups such as passerine birds, wading birds, small mammals, and raptors.

62. Functions for Amphibian Habitat. In Puget Sound, amphibian species using non-flooded wetland and riparian wetlands typically prefer habitats dominated by woody plant communities. The conversion of farmland, lawn, golf course and developed buffers to shrub wetlands, forested wetlands

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and forested buffers will improve habitat conditions for amphibians. The restored floodplain wetlands will provide habitat for adult amphibians and breeding habitat (logs and forest soils) for species that breed in non-aquatic habitat (e.g., red-backed salamander, ensatina). The removal of concrete from the margin of Lora Lake will provide breeding habitat for amphibians that require surface water for breeding. The wetland and buffer enhancements that replace lawns and homes in the Miller Creek Wetland and Buffer Mitigation Area and on the Tyee Valley Golf Course will improve provide improved habitat for adult terrestrial amphibians. Improved habitat for terrestrial breeding amphibians (e.g., red-backed salamander, ensatina) will be provided by increased amounts of forest vegetation and woody debris in the Miller Creek buffer and riparian wetlands. The mitigation site will also improve amphibian dispersal because of improved connections to other habitat (e.g. to Vacca Farm, Lake, or other wetlands adjacent to the Golf Course).

63. The 65-acre wetland mitigation site in Auburn will establish open water ponds with flooded emergent vegetation will provide breeding and rearing habitat for several amphibian species. The open water will provide habitat for the adult phases of aquatic species.

64. Habitat Functions for Small Mammals. Small mammal habitat at the mitigation areas will improve as a result of the new vegetation to be planted in the riparian areas. Restoring wetlands will improve habitat for small mammals by creating a diversity of forage and cover habitat for them. Logs and woody vegetation added to the site will provide denning and forage. The new South 154th Street bridge will span the floodplain and allow unimpeded passage of small mammals. The restoration also improves habitat connectivity to Wetlands 1 through 9, which are located north and east of the site.

65. Planting vegetation in riparian areas and restoring wetlands in the Tyee Valley Golf Course mitigation area will improve habitat for small mammals by creating a diversity of forage and cover habitat compared to the existing turf grass.

66. At the wetland mitigation in Auburn, the existing tall grasses on the site provide habitat for small mammals. However, conversion of the area to forest and shrub wetlands will improve habitat

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for forest and wetland-associated mammals. The increased vegetation structure will provide a greater variety of denning areas, a greater diversity of food sources, and greater cover than are on the site at present.

67. Organic Matter Export Functions. There are relatively high levels of dissolved organic carbon (DOC) in Miller Creek (see pages 7-19 through 7-22 of the *Biological Assessment* for the project). The high levels of DOC are found upstream and downstream of wetlands to be filled by the project. The large areas of peat soil in the upper portion of the basins (at Tub Lake –about 15 acres; and at the Vacca Farm area and the wetlands located north of the existing airfield –39 acres) are a likely source of DOC to the creek. The planned mitigation does not result in the destruction of any peat system. In fact, the grading of the Vacca Farm area for mitigation purposes will result in a net removal of only about 0.1 acres of peat soil.[18] The addition of productive wetland plant communities and lowering the land surface elevation would return peat forming processes by reducing the oxidation of organic carbon to carbon dioxide gas, and promote decay pathways that result in production of DOC and further accumulation of peat. For these reasons, there is no reason to believe that DOC concentrations in the creek would be altered. In the Des Moines Creek basin, restoration of shrub plant communities on mowed golf course wetlands that occurs on about 5.5 acres of peat wetland will enhance organic matter production and export to Des Moines Creek.

68. The Port proposes restoring a woody plant community on existing wetlands or riparian areas where vegetation has been removed. In this situation, woody plant parts and leaf litter, which are much more resistant to decay than the algae or other plants expected in open water habitats, will accumulate on the soil surface. In addition, the root system of these plants will contribute organic matter to the deeper soil layers. In an anaerobic soil environment, this organic matter would contribute to accumulation in soils and anaerobic nutrient cycling processes such as denitrification, methanogneisis, etc. The fact that the Port's mitigation sites at Vacca Farm and the Tyee Golf course

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[18] There are 0.59 acres of peat soil that are filled by the project in the Vacca Farm area, as shown in Table 3-1 of the *Wetland Functional Assessment and Impact Analysis Report.*

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currently have organic soils and wetland hydrology, yet lack the critical plant production component because the sites are now lawn or golf course further assures that more natural ecological systems can be readily established.

69. In the Vacca Farm and Miller Creek relocation area, the new creek channel is designed to have overbank flow during the 1-year and higher storm events. Smaller storms will flood portions of the floodplain through backwater flooding. As floodwaters recede, export of dissolved and particulate organic matter from the floodplain to the stream will occur at higher levels than would currently be expected because greater amounts and types of organic matter (leaves, twigs, branches, etc.) will be on site and available for export to the creek. In other mitigation areas, replacing of grass-dominated riparian areas adjacent to the streams or Lora Lake with native woody riparian vegetation will increase the amount and diversity of organic matter (i.e., readily decomposable leaves and woody debris that is slower to decompose) available to aquatic habitats.

70. The high productivity expected in forest and shrub wetlands will result in accumulations of organic matter in the saturated soil of the restored wetland. Groundwater movement through the site and flooding will transport dissolved organic matter to Miller and Des Moines Creeks. Placement of logs in Miller Creek and development of a natural riparian zone will help trap organic debris in the stream channel, where it will be available for processing by aquatic invertebrates, thus benefiting the food chain. At present, for example, the mowed golf course and the plowed fields of Vacca Farm are unable to export organic matter to adjacent streams because they are mowed, plowed, and or harvested each year. There are few or no trees or shrubs present on these sites, and riparian contributions to instream processes are unsupported. As ecological benefits of the mitigation are explained in the documents Ms. Azous claims to have reviewed, her statements that the "*Vacca Farm purposefully lacks habitat for biological processes*" demonstrates her fundamental misunderstanding of the Port's proposals and the ecological conditions in the project area.

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71. Ms Azous has claimed reductions in riparian wetland systems located adjacent to creeks are certain to affect productive capacity and therefore fish production. She cites research by R. Wotton[19] as a source of data relevant to his issue. However, the cited research does not address riparian wetlands, riparian wetland functions, or loss of riparian wetlands. It does not address functional links between wetlands and streams and indeed does not contain the word wetland. In fact, fish habitat and production in the stream will be enhanced by the proposed mitigation. The relevant literature demonstrates the importance of riparian forests (either wetland or upland) to the functioning of stream ecosystems. This research also indicates that the existing wetlands and riparian areas are performing sub-optimally due to the types of vegetation present. [20]

72. Wetland mitigation in Auburn will promote organic matter export functions because, the wetland will be in the floodplain and also have a seasonal hydrologic connection to the Green River. As the flood and other surface waters drain, fine particulate organic matter (FPOM) and dissolved organic matter will be exported to downstream systems via the existing ditch systems. During periods of groundwater discharge, particulate and dissolved organic matter would be discharged from the site.

73. Ground Water Exchange Functions. The ground water exchange functions of the impacted wetlands has been evaluated in detail by the Port (see Appendices B, C, D, E, F, G of the WFAIA report. The project's impacts to this function has been avoided by project design and mitigated through low flow mitigation.

74. Flood Storage. The Vacca Farm and Miller Creek relocation/mitigation site is designed to replace the small amount of floodplain filled by the project (8,500 cubic yards) and provide a net increase (9,600 cubic yards). Additional floodplain will be created in restoration areas near Lora Lake. The overall significance of the wetlands and farmland in providing this function will not change. No other changes to on-site flood storage functions occur. Following construction, the 100-year flood plain of Miller Creek is protected in the mitigation sites.

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[19] Dissolved Organic Matter and Trophic Dynamic. 1988. BioScience 38:172-178.

[20] *Importance of organic debris dams in the structure and function of stream ecosystems.* Ecology 61:1107-1113.

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75. The Auburn mitigation site is hydrologically connected to the Green River floodplain via a series of ditches. The site is designed to store floodwater during 100-year flood events.

76. Nutrient/Sediment Trapping Functions. Although the water quality functions of the existing wetlands will be lost when these wetlands are filled, the overall project, including the planned mitigation, will fully replace these water quality functions and is likely to result in improved water quality in Miller, Walker, and Des Moines Creeks. This is true for several reasons.

77. First, a number of the existing wetlands that will be eliminated or impacted by Master Plan Update improvements do not provide optimal water quality treatment functions. The treatment function in some of these wetlands is sub-optimal due to a short residence time (as inferred by wetlands on slopes, small size, topography that limits ponding and storage of water, and channelized flow) and a lack of dense emergent vegetation.

78. Second, the proposed stormwater management facilities will include water quality treatment. This will primarily consist of biofiltration swales and filter strips, as well as wet vaults where biofiltration is not feasible. These water quality treatment facilities will be constructed to meet Ecology and NPDES requirements. These facilities will be at least partially effective in replacing the water quality functions of the wetlands to be filled.

79. It is noteworthy that existing wetlands (to be filled) receive untreated stormwater runoff from non-STIA areas. For example, existing wetlands downslope of 12th Avenue South receive untreated stormwater runoff from 12th Avenue South and provide treatment (at less than optimal rates) prior to discharge to Miller Creek. Following construction of the embankment, runoff will be treated by water quality treatment BMPs, which should enhance the biological functions of the remaining wetlands.

80. Third, and perhaps most important, construction of Master Plan Update improvements and mitigation measures will improve the quality of water draining to the streams and wetlands because

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existing land uses that contribute pollutants to the wetlands and Miller Creek will be replaced by natural vegetation.[21]

- For areas within development footprints, existing pollution-generating areas within the acquisition area (e.g., lawns, streets and driveways) that currently lack water quality treatment facilities will be removed. These areas will be replaced with embankment and other facilities with stormwater management BMPs.
- For areas to remain undeveloped, but not specified as mitigation, the removal of residential and commercial land-uses will eliminate pollutant sources, including failing septic tanks, fertilizer, runoff, and other potential pollutants (pesticides, pesticide residues). If redevelopment of these areas occurs, then stormwater management standards for water quality treatment and runoff rates must be met at the time of development. These standards would exceed the baseline condition (lacking any stormwater BMPs), and maintain water quality benefits compared to the current condition.
- For areas in the Vacca Farm mitigation area, the restoration of farmed areas in the Miller Creek floodplain with native wetland vegetation will reducing erosion, pollutant sources, and increase the area's water quality treatment capacity to remove nutrients and pollutants from Miller Creek and stormwater runoff from adjacent areas.
- For Miller Creek and Wetland A17 mitigation areas, the enhancement of wetlands and buffers will eliminate pollutant sources, including failing septic tanks, fertilizer, runoff, and other potential pollutants (pesticides, pesticide residues). Planting of these areas native upland and wetland vegetation will reduce erosion, pollutant sources, and increase the area's water quality treatment capacity to remove nutrients and pollutants from Miller Creek and stormwater runoff from adjacent areas.
- For mitigation along on the Tyee Valley Golf Course and along Des Moines Creek, removal of golf course uses would remove fertilizer and pesticide runoff to the creek. Planting of these areas native upland and wetland vegetation will reduce pollutant sources and increase the area's capacity to remove nutrients and pollutants from Des Moines Creek and stormwater runoff from adjacent areas.

81. Amanda Azous[22] asserts that a loss in the wetlands alter the removal of an important plant nutrient, nitrogen. She states that eliminating the nitrogen removal capabilities of wetlands will alter the food web and increase the supply of nitrogen at the mouth of the creeks. She later (paragraph 22) argues that wetlands are "*important sources of nutrients and freshwater to coastal and estuarine environments*". Theses are contradictory statements, and no evidence is offered to support either. In reality, the project will remove sources of pollutants to wetlands, Miller, Des Moines and Walker Creeks by removing land uses that contribute nitrogen and other pollutants to them. The replacement of lawns,

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[21] The influence of land use on the water quality conditions of runoff water is well documented, and include studies in Washington (see *Fundamentals of Urban Runoff Management* R. Horner, J. Skupien, E. Livingston, and H. Shaver. 1994. page 38; as well as other regions (*Los Angeles County 1994-2000 Integrated Receiving Water Impact Report.* Los Angeles County Department of Public Works. 2000; *Sources of Pollutants in Wisconsin Stormwater.* Bannerman et al. 1999. Natural Science and Technology, 28:241-259).

[22] See *Pre filed testimony of Amanda Azous*, paragraph 10.

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golf courses, farmland, streets and driveways, and home sites with natural vegetation would restore a natural pattern of nitrogen cycling to the landscape which would not be beneficial because naturally vegetated wetlands and buffers do not contribute ecologically damaging levels of nitrogen in runoff waters. Riparian buffers and wetlands have high capabilities to remove nitrogen from surface and groundwater by microbial (denitrification) and plant uptake processes. Wetlands and riparian buffers also contribute nitrogen to the system through nitrogen fixation (both microbial and through vegetation, particularly red alder).

82. Water quality functions in the Miller Creek Wetland and buffer mitigation area will improve for several reasons. Many impacts to the riparian wetlands and the stream will be removed as a result of the project and mitigation. For example, several dozen houses and buildings, lawns, driveways, etc. will be removed from the mitigation area, thus removing features and land uses that contribute to the degradation of water quality. There are at least 68 septic systems located near wetlands, and contaminated dirt has been removed on 24 sites that are near wetlands. At least 3 sites near wetlands and streams grazed livestock that contribute to the degradation of water quality and prevent native vegetation from growing in wetlands or buffers. Outside of the mitigation area, removing streets and residential land uses will reduce the amount of pollutant loading to the wetland and stream system. Restoration of these disturbed areas will increase their capacity to provide water quality functions by establishing natural nutrient cycling pathways.

83. At the Tyee Valley Golf Course mitigation area, the removal of turf grass and turf grass management actions from the wetland and buffer areas will remove sources of nutrients and pesticides. Planting shrub and forest vegetation will provide natural pathways for nutrient uptake and cycling.

84. Wetland mitigation in Auburn consists of creating and enhancing depressional wetlands with channelized discharge. The large size of the wetland basins and relatively small amount of discharge water expected during most conditions will result in high retention rates for sediment and nutrients. The site will have a surface water connection to the Green River flood during flow events that

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exceed 8,500 cubic ft per second. At these flow levels, the wetland area will flood as a result of backwater conditions from the Green River. During flood events the wetland is expected to remove nutrients and sediments from floodwaters.

85. Summary. A goal of the mitigation projects is to offer equal or better physical and biological functions and values compared to existing conditions. The planning of the mitigation has included review and modification by Ecology's experts with this goal in mind. Based on my professional opinion and experience, the mitigation proposed does offer equal or better functions than the pre-development wetland functions. This assessment includes consideration of the suite of functions provided by all of the in-basin mitigation and the waterfowl habitat and other of functions provided by the mitigation in Auburn. The in-basin mitigation provides aquatic and terrestrial habitat functions, protects water quality in the creek systems, and restores a more natural level of ecological function to degraded wetland and buffer habitat. These in-basin benefits more than replace the in-basin functions impacted. Out-of-basin, in Auburn, waterfowl and other habitat functions are significantly improved above baseline conditions.

86. In my experience working as a professional wetland ecologist, I have had the opportunity to observe nearly all the wetland mitigation plans for major projects in the Puget Sound area that involve wetland impacts. In my opinion, the wetland mitigation required by this 401 Certification exceeds the mitigation requirements that have typically been imposed on other projects. The mitigation requirements of this 401 Certification are detailed and comprehensive, and they fully mitigate for the impacts of wetland filling. Substantial resources have been devoted to the planning, design, and regulatory review of the mitigation plan, to avoid and minimize direct and indirect impacts to wetlands and other aquatic resources. Avoidance of and mitigation for impacts has been exhaustively considered on a function by function basis, as explained in this declaration. The mitigation will result in one of the largest wetland mitigation sites in Puget Sound. I am unaware of any 1.4-mile reach of stream in Washington where adjacent residential land uses were removed and its riparian wetlands and buffers

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restored to natural conditions. The large ecological lift that will occur at the in-basin mitigation sites and at the site in Auburn will be protected in perpetuity by restrictive covenants. The temporal impacts of the mitigation will be positive and substantial in the long run. The benefits can be thought of as similar to compounding interest, where the ecological benefits gained by over 178 acres of functioning upland, wetland, and riparian areas will increase over time, far outweighing short-term risks that are mitigated by an extensive 15-year monitoring program. The mitigation replaces all functions provided by the impacted wetlands and it will result in water quality and other ecological benefits to the remaining wetlands and streams. There are substantial requirements for monitoring, oversight, and enforcement regarding to assure implementation ultimately provides functioning mitigation. Based on these factors, I conclude that with regard to wetlands and streams, beneficial uses will be protected, water quality will not be degraded, and state water quality standards will be met.

I declare under penalty of perjury under the laws of the state of Washington that the foregoing is true and correct.

Executed at Seattle, Washington, this 6th day of March 2002.

James C. Kelley

James C. Kelley, Ph.D.

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ATTACHMENTS

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A

ATTACHMENT A

Resume of James C. Kelley, Ph.D.

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Bachelor of Science, Botany, 1978, University of Vermont
Postdoctoral Research Associate, University of Minnesota-Duluth
Certified Wetland Specialist – Pierce County, Washington
Washington Department of Natural Resources Watershed Analysis Certified

Dr. Jim Kelley has 16 years of experience working as a professional wetland ecologist. Building on his education and research experience, which emphasized botany, aquatic ecology, and water quality, he has investigated aquatic, terrestrial, and stream riparian ecosystems to support project planning, natural resource impact assessment, permitting, and mitigation design.

Dr. Kelley has extensive experience in planning, permitting, and implementing wetland and terrestrial habitat mitigation and restoration plans for a variety of public and private sector projects. He routinely assists clients with technical and regulatory issues involving wetland resources. He conducts surveys to delineate wetlands and riparian areas, evaluates areas for rare plants, assesses wildlife habitat, determines project impacts to natural resources, completes Section 404 Clean Water Act permitting, and assists with National Environmental Policy Act compliance. Dr. Kelley has prepared biological assessments and coordinated Endangered Species Act compliance for a variety of terrestrial and aquatic plant and animal species. He also provides expert testimony on wetland and other ecological issues.

In addition to the above experience, Dr. Kelley has state-of-the-art training in the planning, design, implementation, and maintenance of constructed wetlands for water quality treatment, and is currently completing treatability studies that evaluate the ability of constructed wetland systems to remove excess metals from surface water. He also assists in designing wetland and biofiltration facilities for storm water treatment. He has developed and implemented wetland restoration plans as part of sediment remediation (including dredging, capping, and natural recovery) actions. He is experienced in conducting cost and feasibility analyses using interdisciplinary teams of engineers, biologists, and economists.

Roads and Highways

Hansard Avenue Infrastructure Improvements – City of Lebanon, OR
Dr. Kelley assisted with the permitting of road and utility improvements for the City of Lebanon. The project involved reconstruction and widening of U.S. Highway 34, extension and reconstruction of existing streets, and construction of a 1.7-mile beltway link. Portions of these improvements were to occur in wetlands. Parametrix wetland biologists completed a wetland delineation, a wetland impact analysis, and a wetland

mitigation plan for the project. We coordinated with the Oregon Division of State Lands and the Corp of Engineers to obtain permit approval for the projects.

SR 509 East-West Corridor EIS Wetland Report – Washington State Department of Transportation, Tacoma, WA

As task manager, Dr. Kelley completed a wetland technical study and EIS section for a NEPA EIS addressing a proposed limited access road around the Port of Tacoma. The wetland report identified wetlands along the project corridor, documented the functional significance of the wetlands, and evaluated project impacts to wetlands. Dr. Kelley coordinated with the design team to minimize and mitigate for project impacts to wetlands. A conceptual wetland mitigation plan was prepared to assist with environmental review and permitting.

Wetland Delineation and Critical Areas Study – Snohomish County, WA

Parametrix is preparing a scope of work and cost estimate to delineate wetlands and prepare a Critical Area Study (CAS) for a road widening project located south of the City of Snohomish on the Lowell-Snohomish River Road.

Air Transportation

Master Plan Update: Natural Resource Mitigation – Port of Seattle, WA

Managed completion of the natural resource mitigation elements of the Port's Proposed Master Plan Update Development Actions at Seattle-Tacoma International Airport (this study evaluates construction of a third dependent runway). Work included planning and design for the relocation of about 2,000 linear feet of Miller and Des Moines creeks, and the design of approximately 30 acres of off-site wetland mitigation. In addition to mitigation design, Dr. Kelley led the permitting effort to obtain a Section 404 permit for filling wetlands and a Hydraulics Project Approval for work in streams. Reports completed for the project included mitigation design reports, project alternatives analyses, and permit documents.

Municipal Airport Wetland Studies – City of Colville, WA

A detailed study of wetlands on the 300-acre site of a proposed new airport was completed. The studies involved extensive coordination with the Corps of Engineers, Department of Ecology, and other resource agencies. Studies included evaluations of threatened and endangered species (Bald Eagle), economic and ecological evaluations of project alternatives, conceptual design and construction cost estimations for a wetland mitigation plan, preparation of a revised NEPA EA for the project, as well as coordination with state and federal agencies to gain permit approval. The City was granted permit approval by the Corps of Engineers and Fish and Wildlife Service for wetland and endangered species permits, respectively.

Aviation Support Facilities, Natural Resource Impacts and Mitigation Studies – Port of Seattle, WA

As task manager for natural resource issues, Dr. Kelley conducted technical studies evaluating wetland and stream environments in support of a NEPA/SEPA EIS for a proposed aircraft maintenance base. Following publication of the EIS, Dr. Kelley assisted with design of a stream restoration/relocation plan for Des Moines Creek. The plan focused on restoration of spawning and rearing habitat for salmonids. Dr. Kelley coordinated with Corps of Engineers and other state and federal agencies to obtain permit approval. The project would result in the filling of wetlands, and the relocation of about 3,000 feet of natural creek. An integrated approach to mitigation was taken where spill control facilities, storm water detention ponds, wetlands, and stream enhancements were designed to increase ecosystem functions for fish, waterfowl, and other wildlife.

Rail Transportation

Everett to Seattle Commuter Rail EIS and Mitigation Planning – Sound Transit, Seattle, WA

Dr. Kelley served as project manager and senior scientist investigating the potential impacts of adding commuter rail service to an existing freight rail line. The analysis evaluated the natural resource impacts of alternatives for new mainline tracks, new passing tracks, passenger stations, parking lots, and other required improvements. The proposed improvements could impact freshwater wetlands, endangered species habitats, streams, and freshwater wetlands. A natural resource report was prepared to document existing conditions and the potential project impacts on these resources. Coordination with Federal and State natural resource agencies was completed to further evaluate project impacts, potential permitting conditions, and mitigation requirements. Concurrent with analysis of natural resources, Dr. Kelley managed completion of water quality and hazardous material studies.

South/North Light Rail Corridor Draft Environmental Impact Statement – Portland Metro, Portland, OR

As senior technical advisor, Mr. Kelley is responsible for assuring the quality and timeliness of all deliverables associated with preparation of the draft EIS for biological resource issues. This study is being conducted to assess construction and operation impacts of a proposed 27-mile-long light rail transit project to biological resources in the Portland metropolitan area. Mr. Kelly is also involved in negotiations with resource agencies regarding Endangered Species Act and Clean Water Act Section 404 permitting.

Light Rail Transit Facilities, Natural Resource Impacts and Mitigation Studies – Portland, OR

Conducted ecological studies evaluating wetland and stream environments in support of a NEPA EIS for the proposed extension of Portland's Light Rail Transit System. As task manager, he coordinated natural resource studies and permitting efforts with the Corps of Engineers and other state and federal agencies staff. The project evaluated impacts resulting from improvements to an existing rail line, proposed stations, park-and-ride facilities, and road system improvements. A conceptual wetland and stream mitigation plan was prepared to compensate for wetland impacts and to restore degraded streams and wetlands near the project. All studies and analysis were completed according to Federal Transit Authority Standards.

Pacific Northwest Rail Corridor Plan and Environmental Impact Statement – Washington State Department of Transportation, OR, WA and BC

Conducted the environmental analysis for the rail plan between Eugene, Oregon and Vancouver, British Columbia. Identified environmental constraints and other issues that needed to be considered in the evaluation of options and rail alternatives for a higher speed rail program. Coordinated with several cities and counties to identify local programs and plans which needed to be considered in the development of the plan. During the development of the Environmental Impact Statement, Dr. Kelley worked on an interagency coordination plan and assisted WSDOT in implementing the coordination program with cities, counties, Ports and Regional Planning Organizations. He is also managing the evaluation and documentation of natural resource impacts and mitigation strategies in the preparation of the NEPA EIS.

LINK Light Rail EIS – Sound Transit, Seattle WA
Assisted with the natural resource studies. Developed on a very tight schedule, the EIS evaluates a new light rail system extending from north Seattle to Sea-Tac International Airport. Public and agency response to the Draft EIS generated over 3,600 separate comments, each of which must be addressed in the Final EIS.

Site Development

City of Myrtle Creek Golf Course Development, Myrtle Creek, OR
The City of Myrtle Creek has planned and constructed a new municipal golf course and incorporated reuse into the irrigation system. Dr. Kelley assisted with the wetland delineation of the project site, assisted in planning golf course features to minimize impacts to wetlands and streams, and planned conceptual mitigation for the site. The delineation and mitigation plans were coordinated with the Oregon Division of State Lands and the Corps of Engineers to obtain permit approval for the project.

Mission Ridge Biological Evaluation – Mission Ridge Mountain Corp., Wenatchee
Dr. Kelley served as a senior biologist in support of a NEPA Environmental Assessment to address issues on threatened, endangered, sensitive, and management indicator species for a proposed ski area expansion located on Forest Service land. Parametrix biologists prepared a wildlife habitat map, using aerial photos to address the amount and type of habitats present. A plant survey determined the occurrence, location, and abundance of sensitive species on the site. Fish and wildlife studies evaluated on-site streams for salmonid habitat, and surveyed the site for spotted owls and other sensitive wildlife species.

Sensitive Areas Ordinance Review – Century Pacific L.P., Seattle, WA
Parametrix assisted a private development group with review of City of Kirkland's Sensitive Areas Ordinance and recommended changes to ordinance to the planning Commission.

Wetland Creation and Restoration – Simpson-Tacoma Kraft Mill, Tacoma, WA
As project manager and technical lead, Dr. Kelley developed a detailed wetland restoration plan for a 2.8-acre intertidal and estuarine wetland adjacent to the Puyallup River. This plan included documentation of wetland fill through aerial photographs, identification of design criteria for the restored wetland, preparation of construction and planting plans, developing a cost estimate for the project, and completing agency coordination. The restoration plan emphasized development of a tidal wetland providing

waterfowl and fish habitat. Dr. Kelley monitored construction and planting of the saltmarsh and has monitored the project annually since construction.

Everett Homeport EIS – U.S. Navy, Everett, WA
Parametrix prepared environmental impact studies and supporting discipline reports for the dredging and disposal of over 1 million cubic yards of marine sediment and for construction of piers and wharfs for the homeporting of Navy vessels. Dr. Kelley evaluated proposed dredge disposal sites for the presence of wetlands, appropriate wetland buffers, and impacts to native vegetation and habitat. These studies were used to determine the feasibility of land disposal of dredge materials.

Simpson/Lowell Mill Site Wetland Study – Simpson Investment Company
Identified wetlands on a 34-acre industrial site to support Corps of Engineers permitting requirements. In addition to delineations, Dr. Kelley used aerial photographs and historical maps to prepare a history of wetland formation and disturbances on the former mill site. He presented findings to the Corps of Engineers and designed conceptual mitigation plans for the relocation of about five acres of wetland.

Wetlands Study for Branch Campus Site Selection – University of Washington, Snohomish County, WA
As task manager, Dr. Kelley conducted field surveys of five alternative project sites for a proposed university campus. These sites, totaling approximately 750 acres, were surveyed to identify and delineate wetlands, document wetland functions, and meet Corps of Engineers and Snohomish County permit requirements. Dr. Kelley coordinated with resource agencies and prepared a technical report and EIS sections documenting wetlands, development impacts, and mitigation measures.

Cherry Point Wetland Assessment – Chevron, Whatcom County, WA
Managed an assessment of wetlands on 900 acres of undeveloped land (pasture and second-growth forest). The project included delineation and mapping of wetlands and coordination with Corps of Engineers. Wetlands throughout the site were farmed, which required careful assessment and documentation of soil and hydrologic conditions to verify as wetland. A report documented the delineations, wetland characteristics, and classification according to the DOE Four-Tier System. Completed a functional assessment of wetland values as a necessary precursor to determine potential mitigation for site development.

Wetlands Inventory – Fourth Corner Economic Development Council, Whatcom County, WA
Managed the completion of a wetland inventory on 5,000 acres of industrially zoned property. Wetlands were mapped using aerial photo interpretation and field studies. Field maps were transferred to a geographic information system (GIS) to evaluate methodology and potential errors. Comparisons between field delineation maps and air photo inventory maps were made. The report summarizing these findings and the GIS database will assist the County in making land use decisions on wetland protection and future land use development.

Lake Tapps County Park Wetland Report – Pierce County, WA
Project manager and technical lead for the survey of a 188-acre park site to identify wetlands and wildlife habitat, evaluate wetland functions, and determine federal, state, and county regulatory requirements. The study was required as part of the park's master development plan so that the wetlands and other sensitive areas in the park would be protected from proposed facility expansion.

Wetland Report – Chief Joseph State Park, WA
Conducted an analysis of a 298-acre proposed state park in eastern Washington to evaluate plant communities, wildlife and wildlife habitat, and identify wetlands on the site. The study was designed so that proposed park developments could be planned while meeting Corps of Engineers, county, and state permit requirements.

Wetland Studies – Benaroya Capital Company, Seattle, WA
Dr. Kelley assisted Benaroya Capital Company in evaluating wetland and stream conditions on several parcels of land in Bothell, Washington. The studies allowed Benaroya Capital to determine potential development footprints and the ultimate economic feasibility of development projects. Dr. Kelley delineated wetlands, reviewed regulatory requirements for protection/alteration of wetlands, streams, and associated buffers. He recommended development strategies to maximize potential development footprints and comply with local, state, and federal wetland requirements.

Sewage Treatment

Shoreline Habitat Enhancement Plan, West Point Sewage Treatment Plant Upgrade – Metro, Seattle, WA
As a member of a consultant team designing an 18-acre shoreline park and beach habitat, Dr. Kelley conducted studies of natural and artificial shorelines to identify plant communities and habitat features to be incorporated into the design of a park system within and adjacent to the West Point Treatment Plant. To assure the park would provide significant ecological functions, a detailed planting schedule using native plants and a long-term monitoring program was developed for the project. Park features also included conceptual and detailed wetland mitigation plans that were developed to meet the conditions of the Corps of Engineers' Section 404 permit. Dr. Kelley also assisted with cost estimating to evaluate project feasibility given Metro's fiscal constraints.

Wetland Permitting/Mitigation for Wastewater Treatment Facilities – LOTT Partnership, Thurston County, WA
Assisted Lacey, Olympia, Tumwater, and Thurston County (LOTT) with the permitting and mitigation of a 1.6-acre wetland fill on Port of Olympia property. The fill was required to implement the Port's Master Plan to construct a new sewage treatment plant outfall to Puget Sound.

Solid Waste Management

Wetland Evaluation Woodwaste Landfill – Simpson Timber Company, Shelton, WA

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Solid Waste Management

Wetland Evaluation Woodwaste Landfill – Simpson Timber Company, Shelton, WA

Conducted a field survey and regulatory assessment of wetlands on the site of a proposed woodwaste landfill. Probable impacts of landfill development to wetlands were determined and regulatory requirements including avoidance and mitigation were assessed.

Vegetation Evaluations – Solid Waste Transfer Stations for Various Clients
Conducted field surveys for vegetation and threatened and endangered plant species, made regulatory assessments, prepared reports and mitigation plans for several proposed solid waste transfer stations in King, Snohomish, Grays Harbor, and Klickitat counties. These studies evaluated vegetation, wetlands, and wildlife habitat on proposed transfer station sites, as well as reviewed regulatory requirements affecting site development.

Wetlands Study and Mitigation – Snohomish County Regional Landfill, Snohomish County, WA
Conducted a field survey of a 400-acre site to identify and delineate wetlands, document wetland functions, and meet Corps of Engineers and County permit requirements for the project. Dr. Kelley coordinated with resource agencies and prepared a report documenting wetlands, development impacts, and mitigation measures. He also provided testimony at public hearings. Dr. Kelley prepared a detailed wetland mitigation report that addressed the filling of on-site wetlands, and sought permit approval for the project. He assisted in the preparation of construction plans and contracts for the mitigation project, and he has completed monitoring reports documenting the success of the project.

Site Clean-up/Reclamation

Pinal Creek Superfund Site Feasibility – Wetland Treatment Studies, WA
Pinal Creek receives acid rock drainage from historic copper mines and contains high concentrations of manganese and other metals. Dr. Kelley is assisting chemical engineers and geochemists who are conducting laboratory and field experiments investigating the feasibility of using a passive wetland treatment system to treat runoff waters to water quality standards. To remove manganese, a variety of aerobic wetland treatment options are under evaluation. Laboratory studies indicate that complete removal of manganese is technically feasible. Bench- and pilot-scale studies are focusing on developing cost-effective techniques to implement wetland treatment options. These options include the integration of wetland treatment with chemical treatment technologies.

Middle Waterway NRDA Mitigation Design, Implementation, and Monitoring – Simpson Tacoma Kraft, Tacoma, WA
Dr. Kelley planned and designed a Natural Resources Damage Assessment (NRDA) riparian wetland mitigation project in the Middle Waterway for the Simpson Tacoma Kraft Mill. The project included negotiations with the NRDA trustees on sampling to assess the nature and extent of contaminated sediments, permitting, design, construction oversight, development of performance standards, and monitoring of the mitigation site. Dr. Kelley is responsible for monitoring the mitigation project, and preparing annual monitoring reports.

Strandley Environmental Services – Seattle City Light, Purdy, WA

Dr. Kelley assisted with scientific and engineering services for a Removal Action and restoration of the Strandley/Manning sites, which is a Superfund hazardous waste site adjacent to Burley Lagoon near Purdy, Washington. He assisted with wetland evaluations and plans for restoration of terrestrial and aquatic habitat.

Forest Management

Port Houghton Timber Sale EIS – Tongass National Forest, Chatham and Stikine Areas, AK

Served as Task Manager for Threatened and Endangered Plant Species, Floodplains, and Biodiversity Tasks for an NEPA EIS addressing a proposed timber sale on a 192,000-acre project area located in southeast Alaska. Dr. Kelley completed literature reviews and field surveys to identify unique habitats, determine the occurrences of unique and rare plant communities and species, identify wildlife habitat corridors, map wetlands, and recommend habitat conservation areas. He also completed GIS mapping and landscape level analysis of plant communities, and assessed changes in forest cover to wildlife and biodiversity conditions. He was responsible for preparation of resource reports describing the affected environments, project impacts, mitigation opportunities, and appropriate monitoring guidelines.

Wetland Delineation and Permitting – Port Blakely Tree Farms, WA

As project manager, Dr. Kelley supervised wetland studies on a 200 acre forest zoned as for industrial landuse. The project included a delineation and mapping of wetlands on the project site so areas of developable land could be determined. The wetland delineation was reviewed and approved by the U.S. Army Corps of Engineers. Completion of the study allows Port Blakely Tree Farms to accurately represent the development potential of the property, as affected by wetlands.

Regulatory Assistance

On-Call Wetland Services – City of Kirkland, WA

Served as Project Manager for delineation of wetlands, wetland impact analysis, and mitigation planning for City and private development projects affecting wetlands and stream resources. Parametrix provided on-call services to the City as needed, and identified wetlands and impacts to wetland function in several of the City's parks, proposed housing projects, and transportation improvements. Dr. Kelley has prepared and reviewed numerous wetland and stream restoration projects for several city and private development projects.

Wetland Inventories – Cities of Puyallup, Sumner, Redmond, WA

Served as Project Manager for completing three inventories of wetlands within the comprehensive planning area for the cities of Puyallup, Sumner, and Redmond, Washington. These inventories were partially funded by the Department of Ecology through a Coastal Zone Management grant. Project management and methodologies were required to meet Department of Ecology Standards. Inventory of the 15 to 30 square mile planning areas used aerial photo interpretation, ground verification, soil survey maps, and National Wetland Inventory maps. The inventories are used by planning departments and land owners to evaluate the impact of proposed wetland regulations on land development and to assist with site planning.

Wetland Inventory – City of Sumner, WA
Responsible as Project Manager for completing an inventory of wetlands within the 15 square mile Sumner Comprehensive Planning area. Wetlands were identified according to Washington Department of Ecology procedures. These included aerial photo interpretation, evaluation of soil and National Wetland Inventory maps, and 100% field verification. Wetlands were identified on aerial photos and mapped on a geographic information system (GIS). The inventory was designed to allow planning staff and development proponents to identify environmental issues in early planning stages, and to minimize project impacts to wetlands.

Sensitive Areas Ordinance – City of Redmond, WA
Managed a field inventory of regulated wetlands within a 28 square mile area. Dr. Kelley provided technical evaluations of proposed ordinance goals, performance standards, and implementation procedures. He also participated in the public involvement process.

Surface Water Management and Water Quality

Miller Creek Regional Detention Facility – King County, WA
Assisted Parametrix engineering staff with permitting issues associated with the development of a regional storm water detention pond that would periodically flood wetlands. Activities directed by Dr. Kelley included wetland delineation, wetland impact analysis, wetland mitigation design, and coordination with Corps of Engineers' staff for Section 404 permit approval. The studies showed that storm water detention would have minor impacts to existing wetland vegetation. A mitigation plan, including wetland creation, was designed to mitigate for fill of wetlands associated with construction of the control structure.

North Creek Regional Detention Facility – Snohomish County, WA
Managed environmental studies and permitting analysis on the site of a proposed regional storm water detention facility. The studies were conducted in support of SEPA analysis of project impacts, and to support Section 404 Individual Permit, and HPA Permit applications. Specific studies included analysis of wetlands, fisheries and wildlife habitat, and the impact of storm water detention on these wetland functions. An important permitting strategy was to emphasize the degraded nature of the wetland and affected stream while identifying opportunities to enhance wetland and fisheries value through mitigation. These studies were coordinated with the engineering design team, County staff, and federal and state resource agencies. Dr. Kelley also presented deposition testimony to help settle property appraisal issues associated with property acquisition for the facilities.

Wetland Study – Swamp Creek Regional Detention Facility Design, Snohomish County, WA
As part of an on call drainage design contract, Dr. Kelley conducted an inventory of forest, bog, and emergent wetlands on a 70-acre site proposed for regional storm water detention. Dr. Kelley prepared a technical report that was included as an appendix to the

County's environmental impact statement assessing the impact of storm water detention on wetland communities. The facility consists of an earth-filled dam and outlet structure designed for a 100-year storm event. Since wetland habitat impacts and fisheries were a major concern, Dr. Kelley completed an analysis of flooding on wetland plant communities. These studies showed that flooding due to storm water detention would not result in significant impacts to wetland plant communities or their habitat benefits.

Hydrologic Control of Nitrogen Cycling Processes (Post-Doctoral Research) – University of Minnesota
Conducted studies to examine how fluctuations in water levels and flooding of wetland communities (caused by beavers) affected wetland ecology and the nutrient status of riparian soils. The project included identification of wetlands from color infrared aerial photographs, studies of nutrients in stream runoff, beaver ponds, soil, and interstitial water. Successional changes in beaver-influenced riparian zones were also examined through aerial photographs and GIS mapping.

Effect of a Marsh on Water Quality (Dissertation Research) – Michigan State University
Designed and implemented a study examining the role of wetland plant communities in cycling nitrogen and phosphorus in a riverine marsh. The study included the identification of wetland plant communities from color infrared aerial photography, construction of hydrologic, nutrient, and sediment budgets for a wetland basin; evaluation of nutrient dynamics in emergent plant communities; and an analysis of wetland water quality. The response of wetland communities to periodic water level fluctuations was documented through field studies and photogrammetric analysis.

Utilities

Pipeline Expansion Wetland Studies – Pacific Gas Transmission, OR and WA
As project manager and technical lead, Dr. Kelley planned and supervised studies to identify, delineate, and document wetlands along a 400-mile natural gas pipeline through central Oregon and Washington. The study was conducted to support permit applications for the construction of a new parallel pipeline through an existing right-of-way. This study used false color infrared photography, true color aerial video of the pipeline corridor, and National Wetland Inventory maps to screen wetland from non-wetland areas for further detailed studies. Field studies included mapping and detailed documentation of soil, vegetation, and hydrologic conditions at all potential wetlands. In addition to the field studies, he assisted with permitting the project through the U.S. Corps of Engineers offices in Washington and Oregon, and State resource agencies.

Tansy Ragwort Biological Control – Seattle City Light, Darrington, WA
As part of an on-call services consultant contract with Seattle City Light Environmental Affairs, Dr. Kelley evaluated the feasibility of biological control of tansy ragwort, a noxious weed, in the utility's powerline right-of-way near Darrington in Snohomish County, Washington. Two insect species that feed on ragwort were released in the study area between 1986 and 1988. Insect populations and ragwort densities were monitored

over a five-year period to evaluate the effectiveness of the biological control program in maintaining tansy ragwort at low densities.

Combustion Turbine EIS – Seattle City Light, Seattle, WA

Seattle City Light selected Parametrix to prepare an Environmental Impact Statement on the siting and construction of a combustion turbine. Dr. Kelley examined and reported on wetland and vegetation impacts to five sites. He identified possible mitigation measures for wetlands and terrestrial habitat, including substantial stream and wetland enhancement at the Duwamish River site.

Novelty Hill Substation and Transmission Lines Hill Natural Resource Assessment – Puget Sound Power and Light Company, King County, WA

As part of an indefinite quantity contract with Puget Sound Power & Light, Parametrix conducted environmental studies in support of new facility and transmission line development in the Puget Sound region. Dr. Kelley assisted with Wetlands Delineation and Characterization, Wildlife Inventories, and a Fishery Habitat Characterization and Stream Channel Stability Assessment

Additional Qualifications

Postdoctoral Associate

University of Minnesota, Natural Resources Research Institute (1985-1987). Dr. Kelley conducted studies to examine how flooding and drainage of wetland and riparian ecosystems by beavers affect the nutrient status and chemistry of riparian soils. Successional changes in beaver-influenced riparian zones were also examined through aerial photograph interpretation and GIS mapping. Dr. Kelley was responsible for designing environmental sampling programs for vegetation, soil, and water, as well as conducting analytical analyses for a variety of chemical constituents.

Effect of a Marsh on Water Quality

(Dissertation Research) Designed and implemented a study examining the role of wetland plant communities in cycling nitrogen and phosphorus in a riverine marsh. The study included the construction of hydrologic, nutrient, and sediment budgets for a wetland basin; evaluation of nutrient dynamics in emergent plant communities; and an analysis of wetland water quality.

Wetland Design for Hazardous Waste/Mining Operations

Dr. Kelley received professional, state-of-the-art training in the planning, design, implementation, and maintenance of wetland systems to treat waste water derived from industrial or other mining facilities.

Presentations and Publications

1988 Naiman, R.J., C.A. Johnson, and J.C. Kelley. Alteration of North American streams by beaver. BioScience 38:753-762.

1985 Kelley, J.C., T.M. Burton, and W.R. Enslin. The effects of natural water level fluctuations on N and P cycling in a Great Lakes marsh. Wetlands. 4:159-175.

1995 Kelley, J.C. and K.A. Lakey. An evaluation of wetlands and wetland functions in Southeast Alaska. Society of Wetland Scientists, Northwest Chapter, Annual Meeting, June 1995. Spokane, Washington

1995 Reak, A. and J. C. Kelley. Monitoring an eelgrass (Zostera marina L.) mitigation project for biological function and transplant success. Society of Wetland Scientists, Northwest Chapter, Annual Meeting, June 1995. Spokane, Washington

1994 Lakey, K.A., J.C. Kelley, and K. Ford. Recovery of functions in farmed Puget Trough wetlands following abandonment. Society of Wetland Scientists annual meeting, May 1994. Portland, Oregon.

1987 Kelley, J.C., C.A. Johnson and R.J. Naiman. Effect of beaver (Castor canadensis) on plant nutrient availability in stream riparian zones. Ecological Society of America Annual Meeting, August 1987, Columbus, Ohio.

1986 Kelley, J.C. Litter decomposition and nutrient dynamics in a freshwater marsh. American Society of Limnology and Oceanography Annual Meeting, June 1986, Kingston, Rhode Island.

1985 Kelley, J.C., and T.M. Burton. Nitrogen flux in a freshwater marsh and the significance of emergent plant production. American Society of Limnology and Oceanography Annual Meeting, June 1985, Minneapolis, Minnesota.

1984 Kelley, J.C., T.M. Burton, and W.R. Enslin. The effects of natural water level fluctuations on N and P cycling in a Great Lakes marsh. Presented at the Society of Wetland Scientists Annual Meeting, May 1984, San Francisco, California.

1984 Kelley, J.C., and T.M. Burton. Patterns of nutrient cycling in emergent plant communities. Great Lakes Coastal Wetland Colloquium, Michigan State University, November 1984, East Lansing, Michigan.

1983 Kelley, J.C., and T.M. Burton. Plant mediated nitrogen and phosphorus movements in a freshwater marsh. Ecological Society of America Annual Meeting, August 1983, Grand Forks, North Dakota.

1982 Kelley, J.C., and T.M. Burton. Nutrient flux and the role of emergent macrophytes in a rivermouth marsh. Ecological Society of America Annual Meeting, August 1982, State College, Pennsylvania.

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ATTACHMENT B

Page 9 from the 1999 and Page 11 of the 2000 Public Notices

Comments are used to determine if supplemental documentation under the NEPA may be required, as appropriate. Comments may also used to determine the overall public interest of the activity.

The evaluation of the impact of the activity on the public interest will include application of the guidelines promulgated by the Administrator, Environmental Protection Agency, under authority of Section 404(b) of the Clean Water Act. This evaluation will include an alternatives analysis.

ADJACENT PROPERTY OWNERS – A list of adjacent property owners is available for review at the Seattle District offices and from the Port of Seattle at the address listed on the first page of this notice.

The State of Washington is reviewing this work for consistency with the approved Washington Coastal Zone Management Program.

The State of Washington is reviewing this work pursuant to the State Hydraulic Project Code.

The State of Washington water quality certification for the proposed work is necessary under the provisions of Section 401 of the Clean Water Act.

The State of Washington is reviewing this work for compliance with the State water quality standards. The Ecology will extend jurisdiction over 7.88 acres of lands as waters of the State considered as prior-converted cropland by the Corps (non-jurisdictional under Federal law) on the Vacca Farm property. Accordingly, impacts being considered under water quality standards include an additional .92 of an acre of waters of the State to be filled at the Vacca Farm site, and an additional 6.92 acres of waters of the State temporarily impacted during construction of mitigation.

The FAA issued a Record of Decision on the SASA on 13 September 1994, and issued a Record of Decision for the Master Plan Update Development Actions on 3 July 1997.

The Port of Seattle, as permitting authority, has concluded that this action is outside the jurisdiction authority of the Shoreline Management Act of 1971.

COMMENT AND REVIEW PERIOD - Comments on these factors will be accepted and made part of the record and will be considered in determining whether it would be in the best public interest to grant a permit. Comments should reach this office, Attn: Regulatory Branch, not later than the expiration date of this public notice to ensure consideration and refer to the following name and file number:

Seattle, Port of
1999-4-02325

Encl
Drawings (34)

ıational concern for both protection and utilization of important resources. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people.

The Corps is soliciting comments from the public; Federal, State, and local agencies and officials; Indian tribes; and other interested parties in order to consider and evaluate the impacts of this activity. Any comments received will be considered by the Corps to determine whether to issue, condition, or deny a permit for the work. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments are used to determine if supplemental documentation under the National Environmental Policy Act (NEPA) may be required, as appropriate. Comments may also used to determine the overall public interest of the activity.

The evaluation of the impact of the activity on the public interest will include application of the guidelines promulgated by the Administrator, Environmental Protection Agency, under authority of Section 404(b) of the Clean Water Act. This evaluation will include an alternatives analysis.

ADJACENT PROPERTY OWNERS - A list of adjacent property owners is available for review at the Seattle District offices and from the Port of Seattle at the address listed on the first page of this notice.

'he State of Washington is reviewing this work for consistency with the approved Washington Coastal Zone Management Program.

The State of Washington is reviewing this work pursuant to the State Hydraulic Project Code.

The State of Washington water quality certification for the proposed work is necessary under the provisions of Section 401 of the Clean Water Act.

The State of Washington is reviewing this work for compliance with the State water quality standards. The Ecology will extend jurisdiction over 7.88 acres of lands as waters of the State considered as prior converted cropland by the Corps (non-jurisdictional under Federal law) on the Vacca Farm property. Accordingly, impacts being considered under water quality standards include an additional .92 of an acre of waters of the State to be filled at the Vacca Farm site, and an additional 6.92 acres of waters of the State temporarily impacted during construction of mitigation.

The FAA issued a Record of Decision on the SASA on 13 September 1994, and issued a Record of Decision for the Master Plan Update Development Actions on 3 July 1997.

The Port has concluded that the portion of this action at STIA is outside the jurisdictional authority of the Shoreline Management Act of 1971.

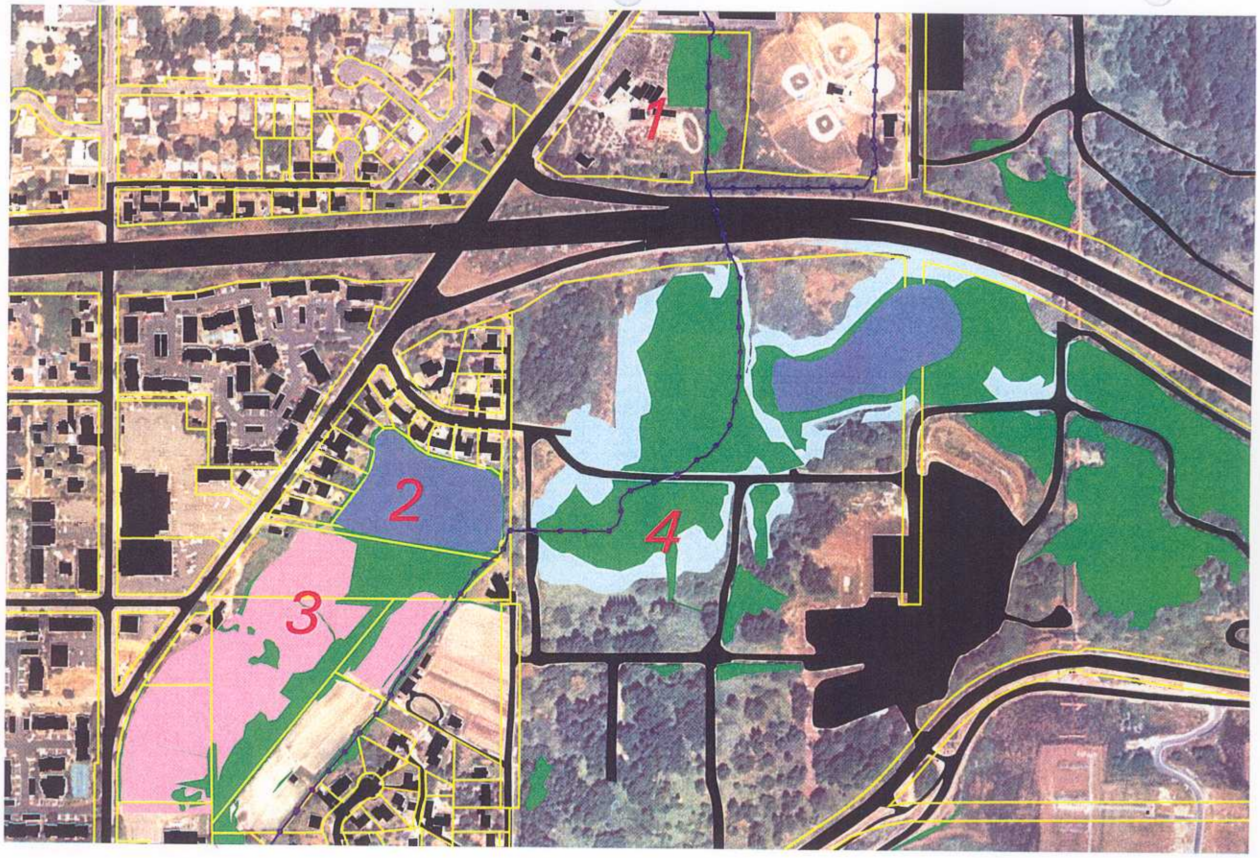
C

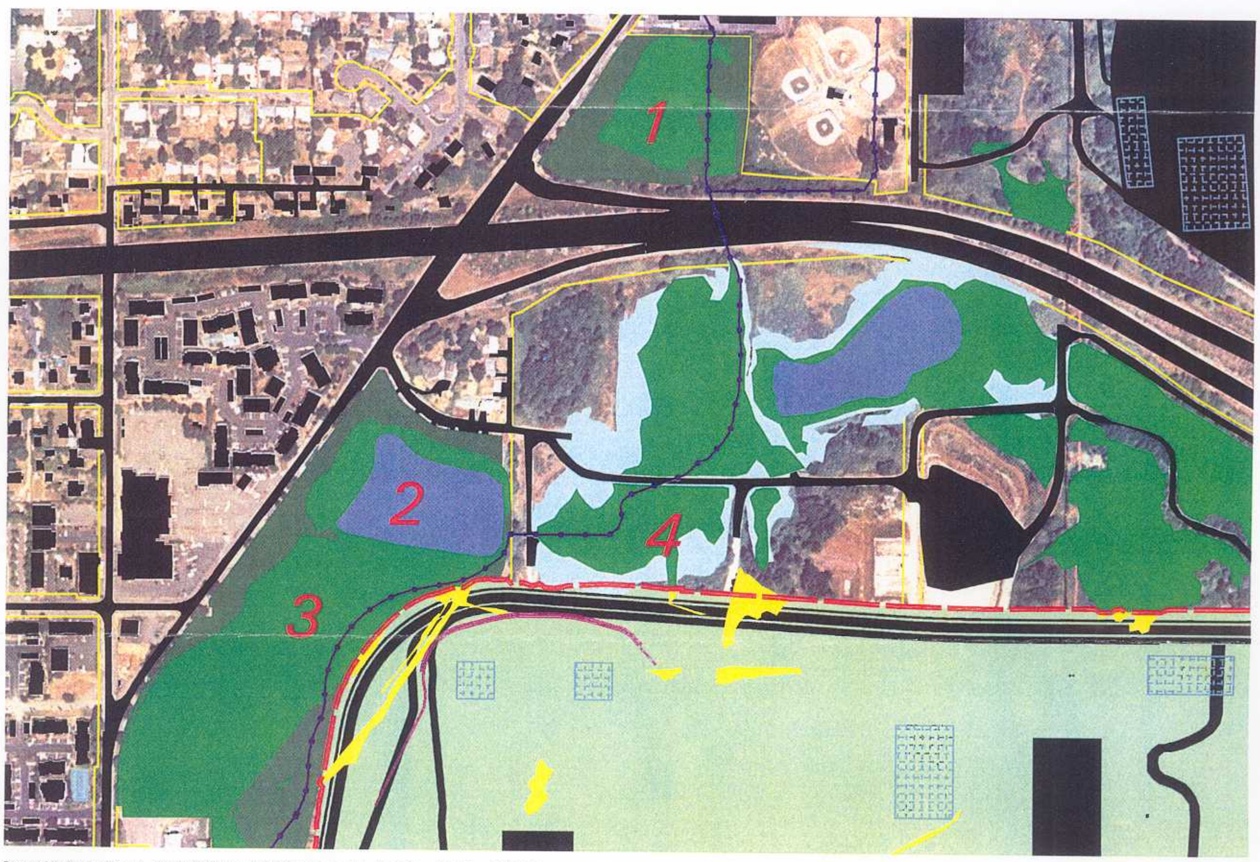
ATTACHMENT C

Existing and Post Project Conditions

Numeric Key to Existing and Post Project Conditions, Sheets 1-8.

Sheet	Number	Description
1	1	Des Moines Way Nursery Mitigation Site
	2	Lora Lake and north end of the Vacca Farm Mitigation Area
	3	Miller Creek Relocation and Vacca Farm Mitigation Areas
	4	Miller Creek and Existing Miller Creek Regional Detention Facility
2, 3	5	Miller Creek Wetland and Buffer Enhancement Area
	6	Wetland A17 Mitigation Area
3	7	Location of Retaining Wall and Wetland 37
4	8	Wetland 43 and Source of Walker Creek
5	9	IWS Lagoon 3
6	10	Wetland 28 and Northwest Ponds
	11	Tyee Valley Golf Course Mitigation Area and Des Moines Creek
	12	Borrow Area 4
	13	South Aviation Support Area (SASA)
7	14	Borrow Area 3
	15	Borrow Area 3 Mitigation Area
7,8	16	Borrow Area 1





Prepared by Parametrix, Inc. File: seatac2/plotamls2002/plots/pre-post-b-1-11x17.gra Date: March 04, 2002

- Impervious Surfaces
- Wetlands
- Impacted Wetlands
- Stormwater Detention Facilities
- Mitigation Area Buffers
- Stormwater Vaults
- Permanent Impact Areas
- Prior Converted Cropland
- Water Features
- Parcel Boundary
- Permanent Impact Line
- MSE Wall
- Miller Creek

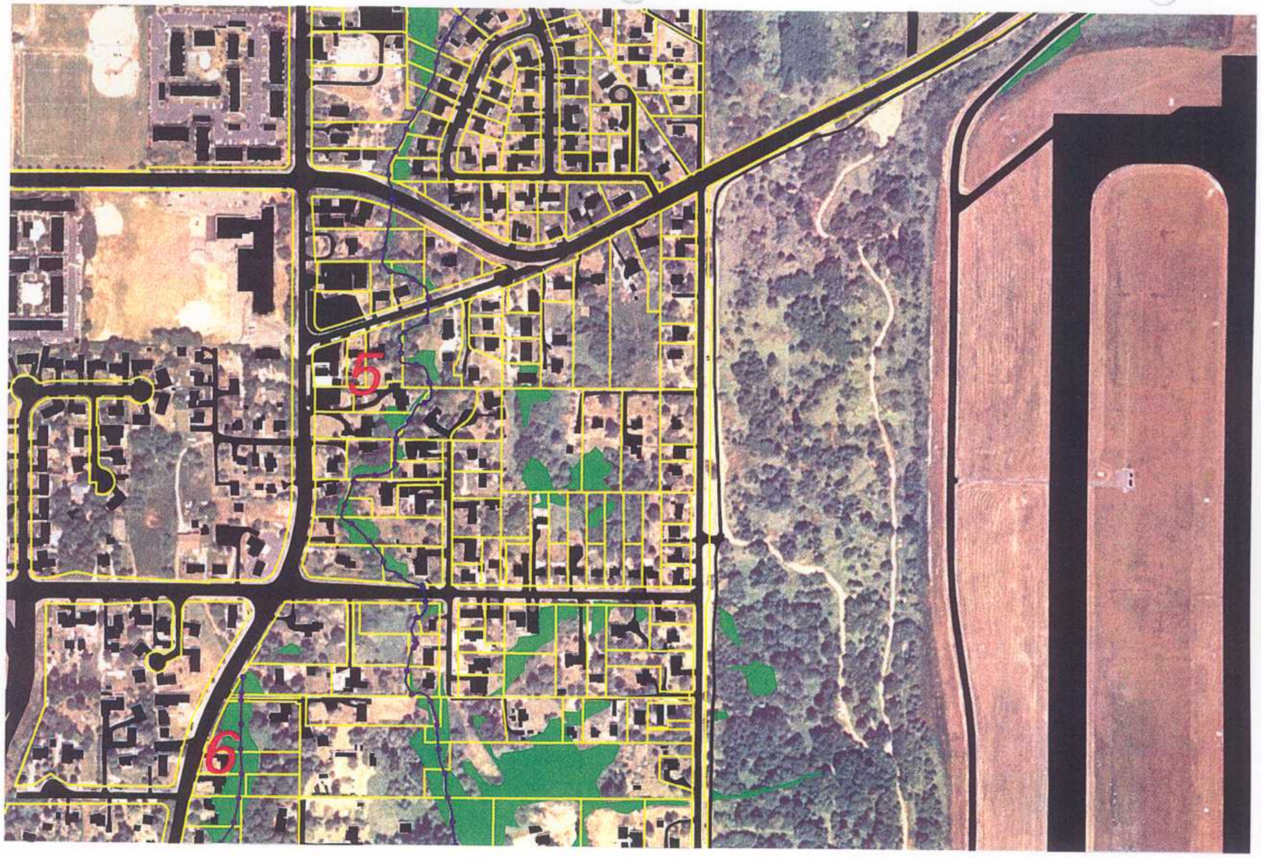
N

0 200 400 600

Scale in Feet

Sheet 1 of 8
Existing (Top) and Post Project Conditions (Bottom)

AR 016493



Prepared by Parametrix, Inc. File: seatac2/plotamls2002/plots/pre-post-b-2-11x17.gra Date: March 04, 2002

- Impervious Surfaces
- Wetlands
- Impacted Wetlands
- Stormwater Detention Facilities
- Mitigation Area Buffers
- Stormwater Vaults
- Airport Navigation Aids
- Permanent Impact Areas
- Parcel Boundary
- Permanent Impact Line
- MSE Wall
- Miller Creek

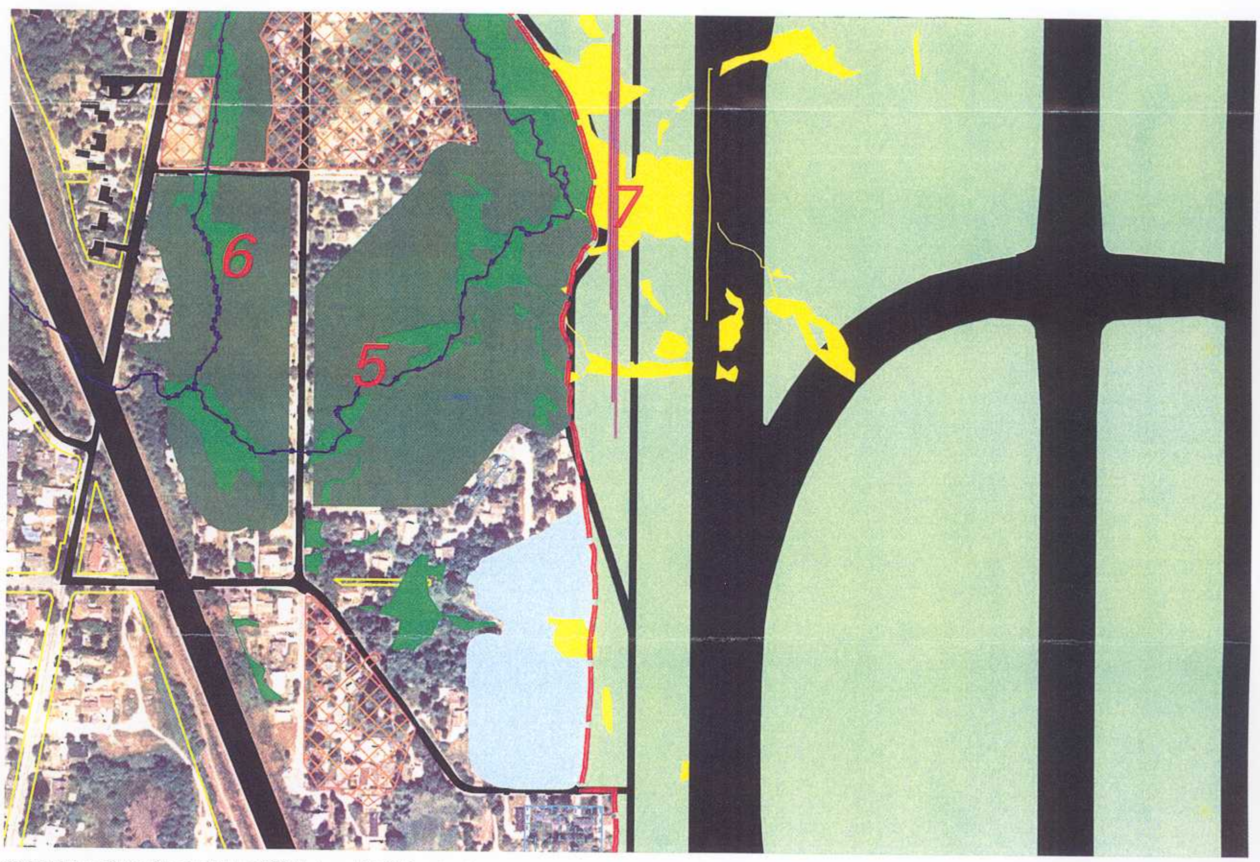
N

0 200 400 600

Scale in Feet

AR 016494

Sheet 2 of 8
Existing (Top) and Post Project Conditions (Bottom)



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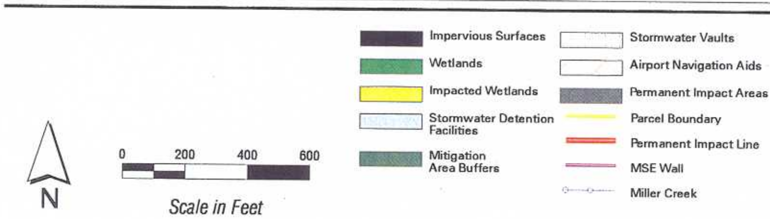
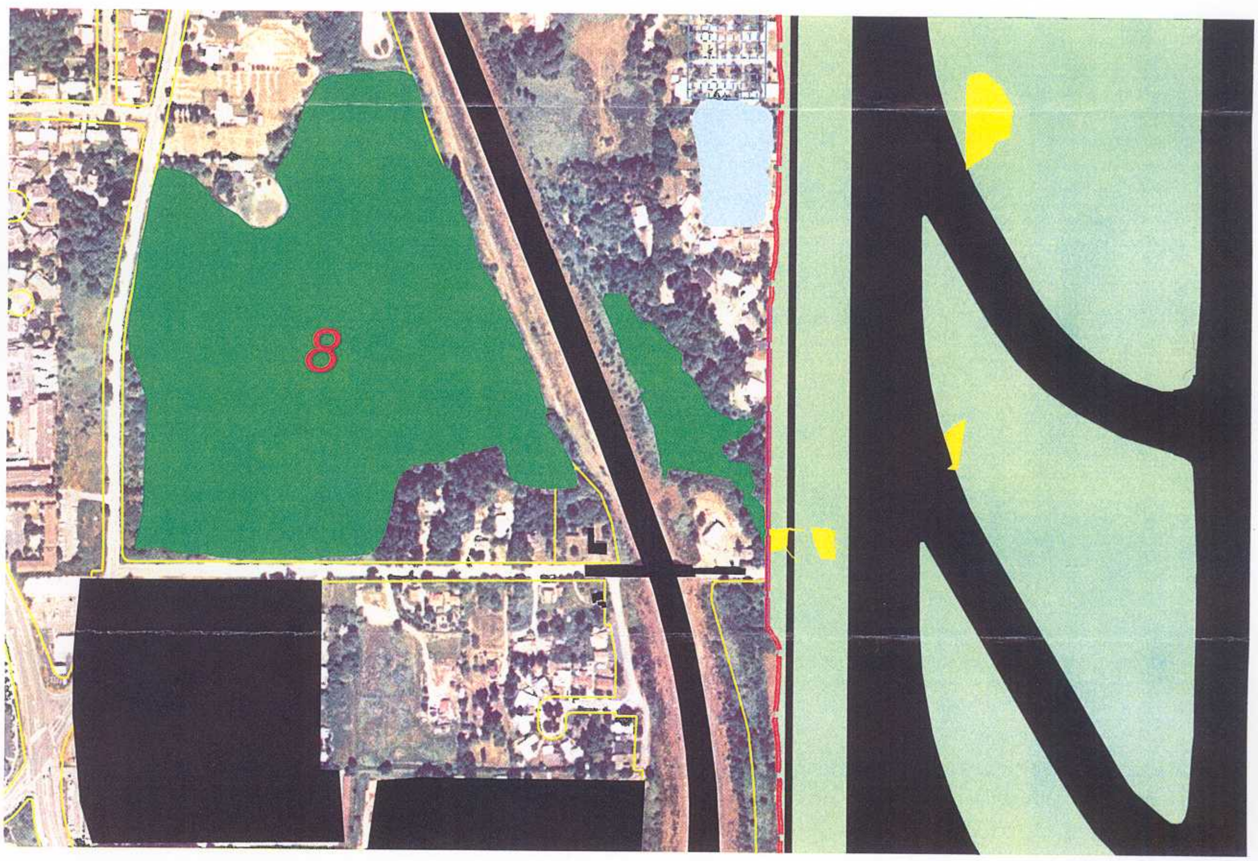


AR 016495

Sheet 3 of 8
Existing (Top) and Post Project Conditions (Bottom)



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- Impervious Surfaces
- Wetlands
- Impacted Wetlands
- Stormwater Detention Facilities
- Stormwater Vaults
- Permanent Impact Areas
- Parcel Boundary
- Permanent Impact Line
- MSE Wall

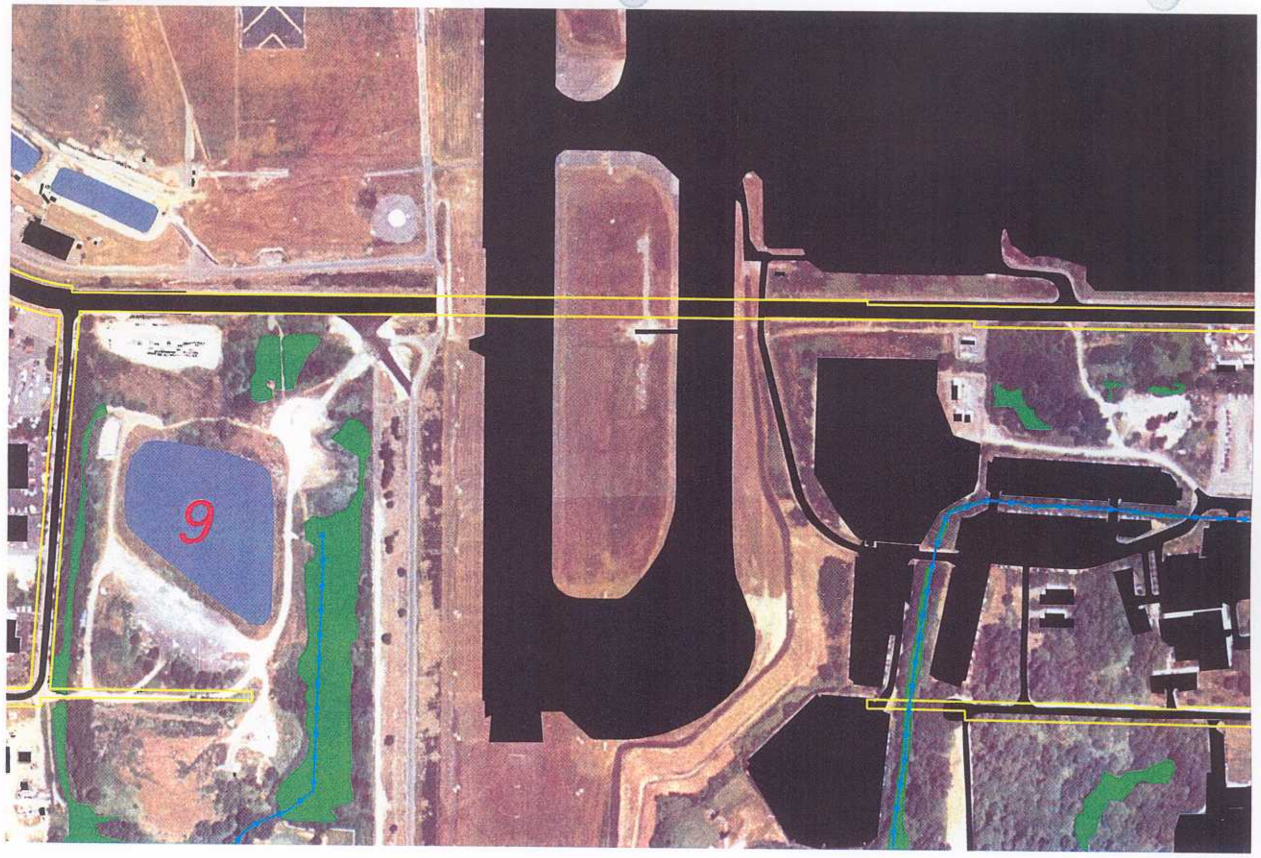
N

0 200 400 600

Scale in Feet

AR 016496

Sheet 4 of 8
Existing (Top) and Post Project Conditions (Bottom)



Prepared by Parametrix, Inc. File: seatac2/plotamls2002/plots/pre-post-b-5-11x17.gra Date: March 04, 2002

Impervious Surfaces

Wetlands

Impacted Wetlands

Stormwater Detention Facilities

Stormwater Vaults

Permanent Impact Areas

Water Features

Parcel Boundary

Des Moines Creek

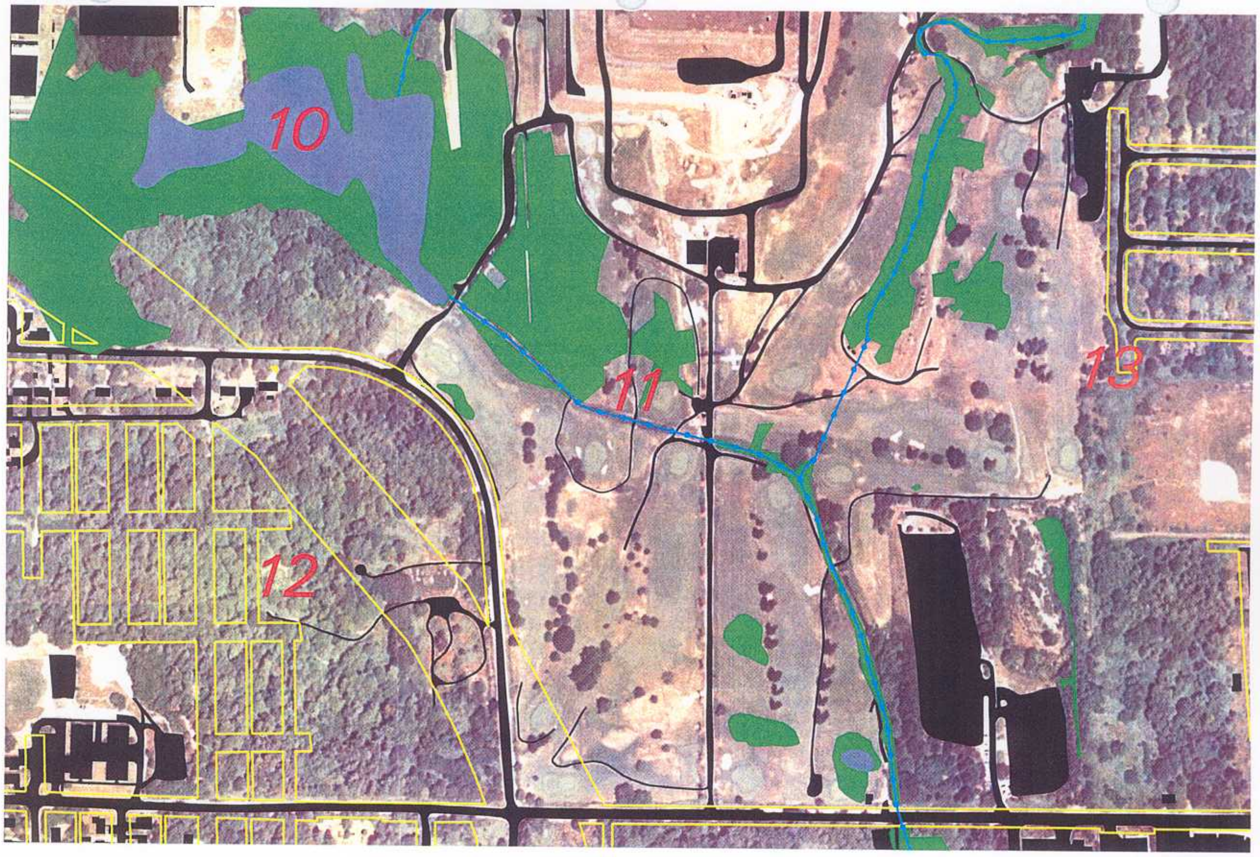
N

0 200 400 600

Scale in Feet

AR 016497

Sheet 5 of 8
Existing (Top)
and Post Project
Conditions (Bottom)



Prepared by Parametrix, Inc. File: seatac2/plotamls2002/plots/pre-post-b-6-11x17.gra Date: March 04, 2002

Impervious Surfaces
Wetlands
Impacted Wetlands
Mitigation Area Buffers
Stormwater Vaults
Borrow Areas
Permanent Impact Areas
Water Features
Parcel Boundary
Des Moines Creek

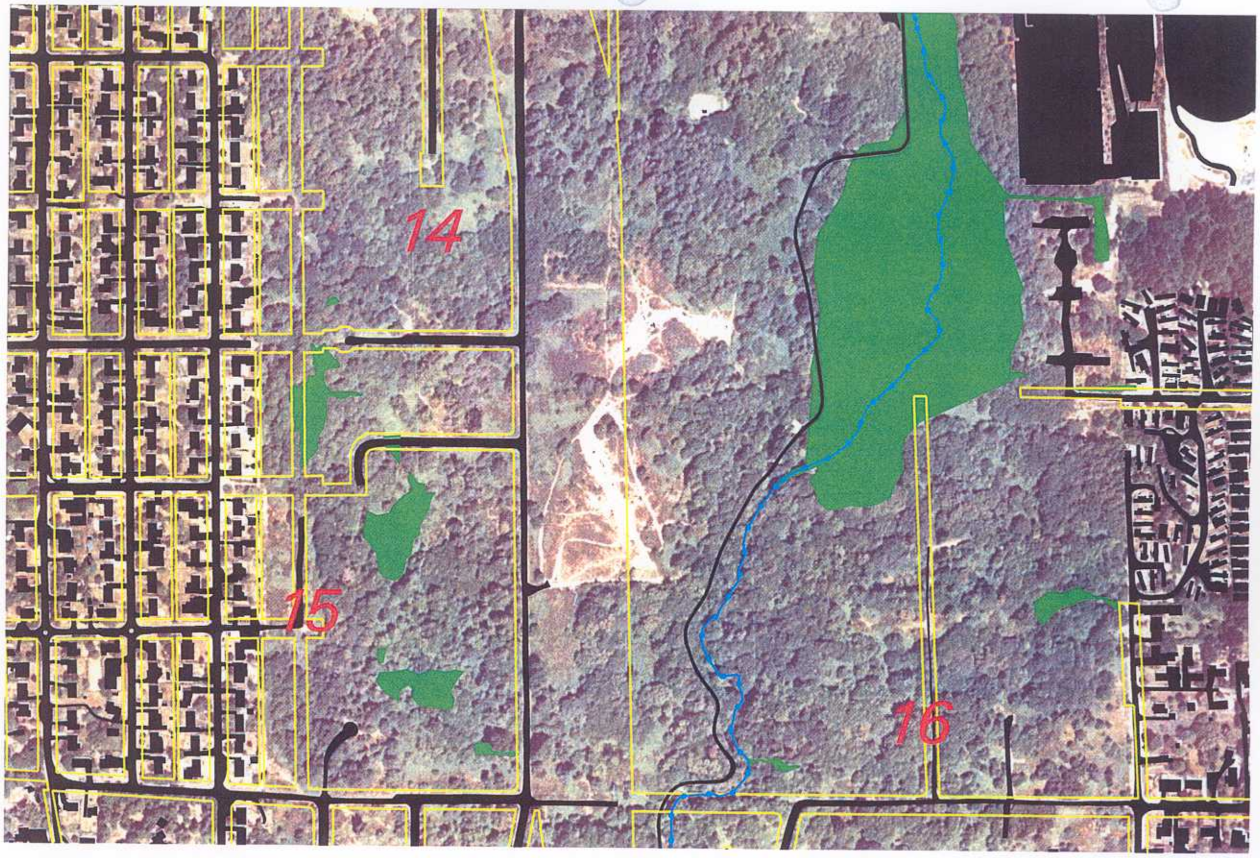
N

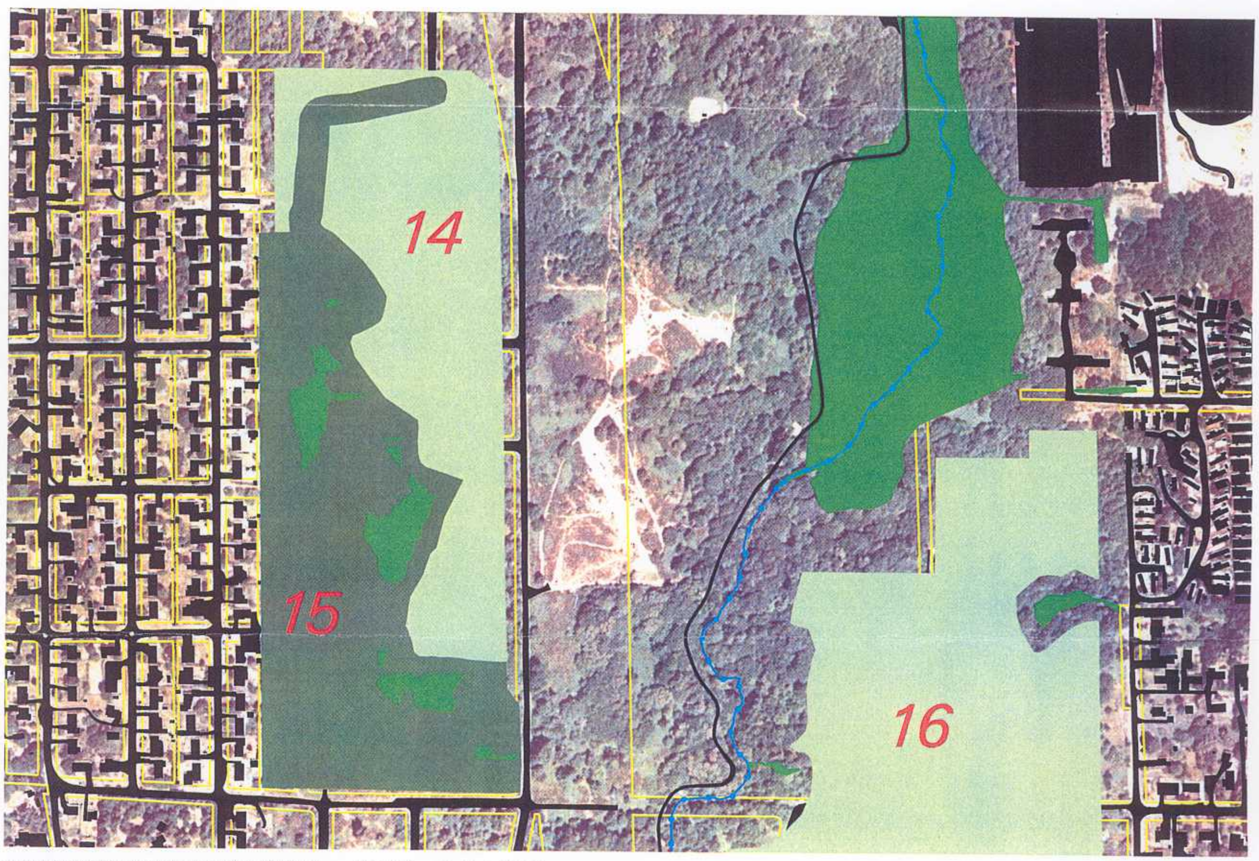
0 200 400 600

Scale in Feet

AR 016498

Sheet 6 of 8
Existing (Top) and Post Project Conditions (Bottom)





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Impervious Surfaces

Wetlands

Mitigation Area Buffers

Borrow Areas

Parcel Boundary

Des Moines Creek

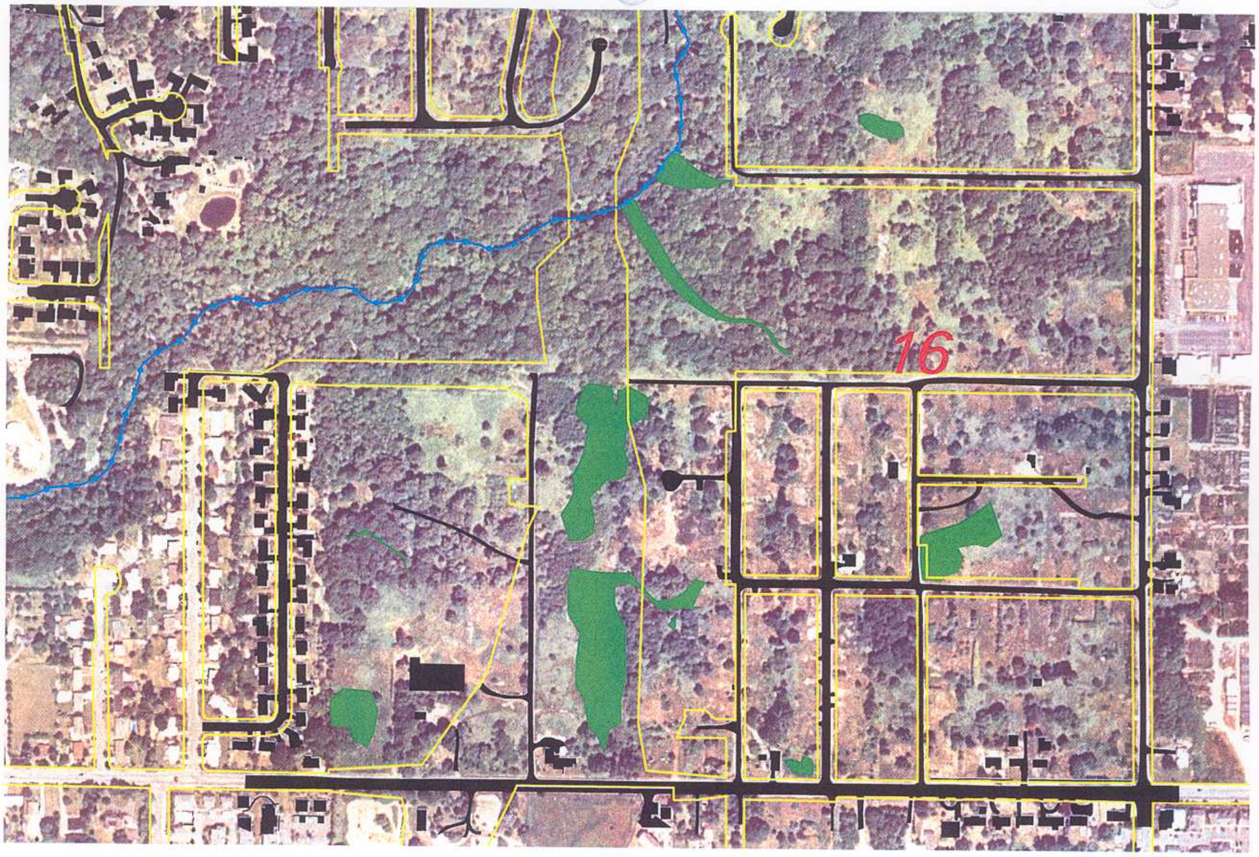
N

0 200 400 600

Scale in Feet

AR 016499

Sheet 7 of 8
Existing (Top) and Post Project Conditions (Bottom)



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Impervious Surfaces
Wetlands
Impacted Wetlands
Borrow Areas
Parcel Boundary
Des Moines Creek

N

0 200 400 600
Scale in Feet

AR 016500

Sheet 8 of 8
Existing (Top) and Post Project Conditions (Bottom)

D

ATTACHMENT D

PHOTOGRAPHS OF THE VACCA FARM AREA AND MILLER CREEK (APRIL 1997)

Figure D1 **Prior Converted Cropland on the Vacca Farm Site. – View Looking Southwest from the Middle of the Site.**

Figure D2 **Prior Converted Cropland on the Vacca Farm Site. View Looking Southeast form near the Middle of the Site.**

Figure D3 Prior Converted Cropland (foreground and right), Farmed Wetland (with standing water), and Wetland A1 (vegetated areas to left of water) at the Vacca Farm Site. View Looking South from near the Center of the Site.

Note:
Pipe used to pump water from Miller Creek for irrigation

Note:
House and barn, now removed

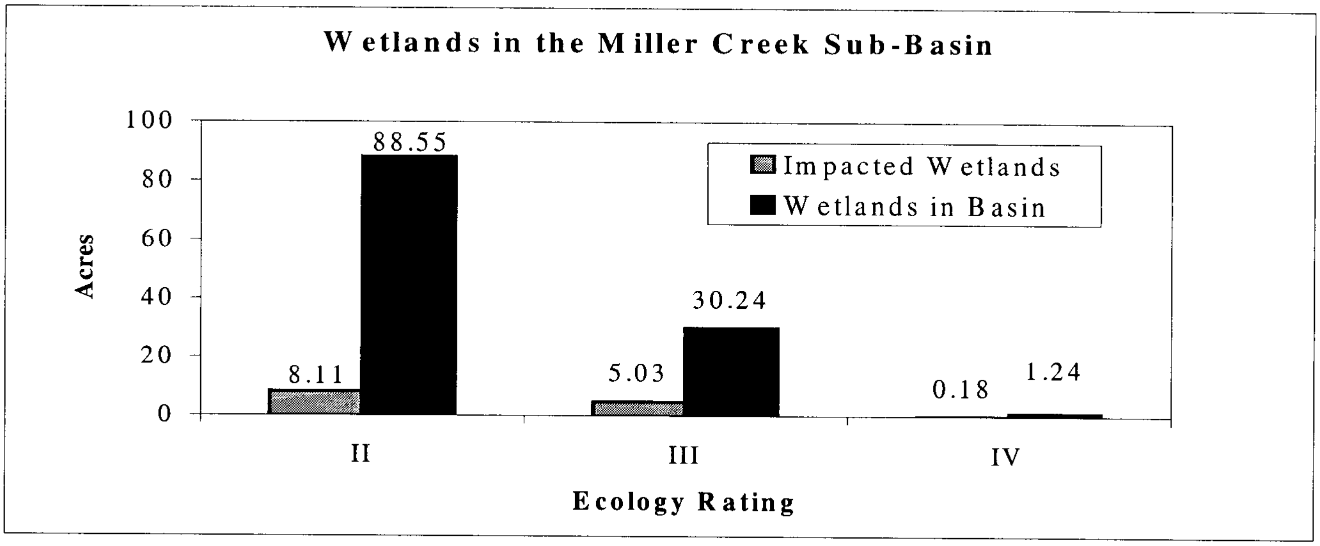
Figure D4
Miller Creek Channel at Vacca Farm Site.
View of the Channel Segment to be relocated,
Looking North from Existing Bridge.

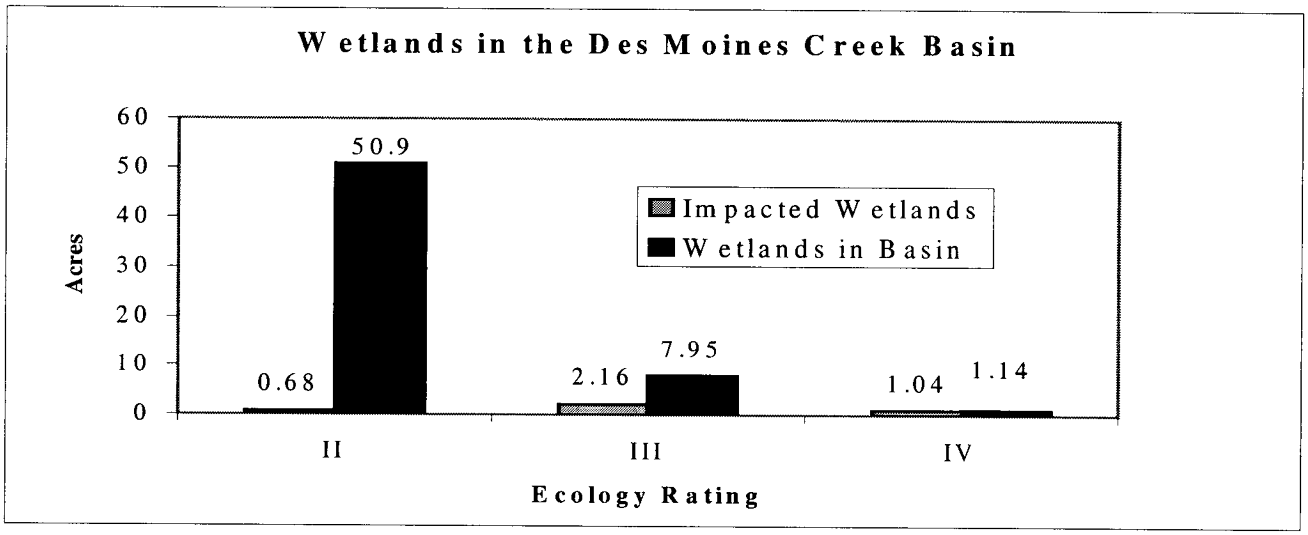
AR 016506

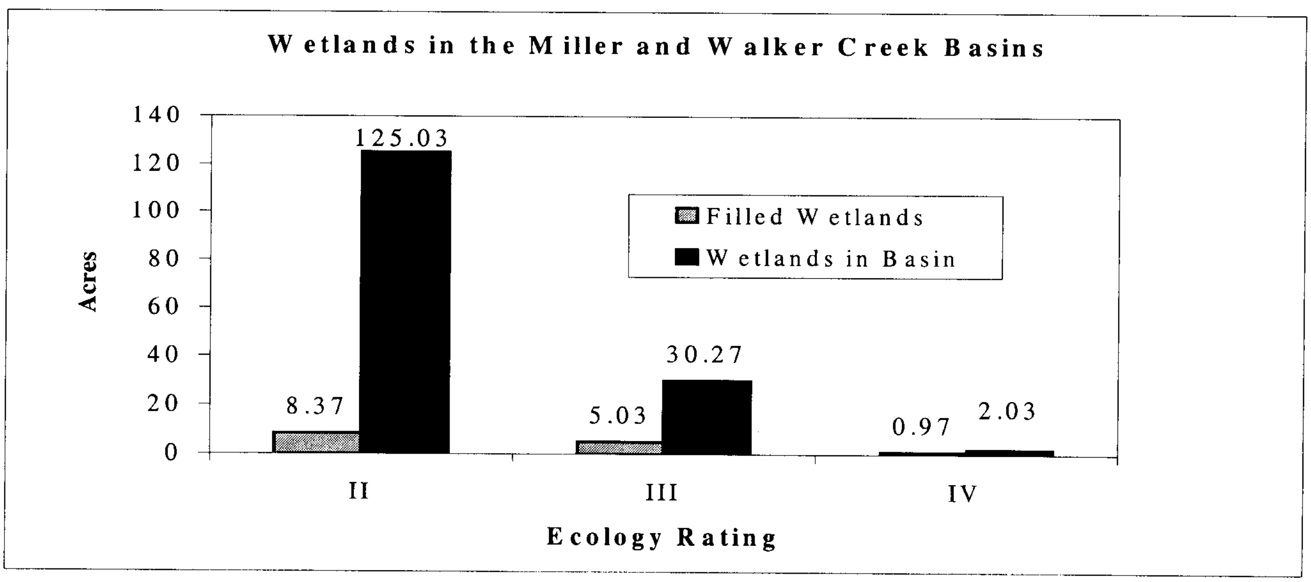
E

ATTACHMENT E

Summary of Project Impacts to Wetlands


Wetlands in the Miller Creek Sub-Basin
100
80
60
40
20
0
Acres
88.55
8.11
30.24
5.03
0.18
1.24
Impacted Wetlands
Wetlands in Basin
II
III
IV
Ecology Rating


Wetlands in the Des Moines Creek Basin
60
50
40
30
20
10
0
Acres
50.9
0.68
7.95
2.16
1.04
1.14
Impacted Wetlands
Wetlands in Basin
II
III
IV
Ecology Rating


Wetlands in the Miller and Walker Creek Basins
140
120
100
80
60
40
20
0
Acres
125.03
8.37
30.27
5.03
0.97
2.03
Filled Wetlands
Wetlands in Basin
II
III
IV
Ecology Rating

MILLER AND WALKER CREEK BASINS

Wetland	Area (Acres)	Drainage	Ecology Rating	Impact (Acres)
N1	0.14	Miller	II	
N2	0.72	Miller	II	
N3	19	Miller	I	
N3b	19.21	Miller	II	
S. 144th	2	Miller	II	
7	6.68	Miller	II	
18	3.56	Miller	II	2.84
20	0.57	Miller	II	0.57
37	5.73	Miller	II	4.11
39	0.9	Miller	II	
43	33.4	Miller	II	
44	3.08	Miller	II	0.26
Tub Lake	17	Miller	I	
A1	4.66	Miller	II	0.59
A17	2.66	Miller	II	
Lora Lake	3.06	Miller	II	
R8	0.4	Miller	II	
R9a	0.74	Miller	II	
R11	0.42	Miller	II	
R15a	0.79	Miller	II	
R17	0.31	Miller	II	
Cat I & II total	**125.03**			**8.37**
N4	0.68	Miller	III	
N5	0.37	Miller	III	
N5b	0.001	Miller	III	
N6	0.003	Miller	III	
N7	0.33	Miller	III	
N11	0.26	Miller	III	
N12	0.28	Miller	III	
N13	0.26	Miller	III	
L1	0.05	Miller	III	
N14	0.65	Miller	III	
1	0.07	Miller	III	
2	0.73	Miller	III	
3	0.56	Miller	III	
4	5	Miller	III	
5	4.63	Miller	III	0.14
6	0.86	Miller	III	
8	4.95	Miller	III	
9	2.83	Miller	III	0.03
10	0.31	Miller	III	
11	0.5	Miller	III	0.5
12	0.21	Miller	III	0.21
13	0.05	Miller	III	0.05
14	0.19	Miller	III	0.19
15	0.28	Miller	III	0.28
16	0.05	Miller	III	0.05
17	0.02	Miller	III	0.02

AR 016510

MILLER AND WALKER CREEK BASINS

Wetland	Area (Acres)	Drainage	Ecology Rating	Impact (Acres)
19	0.56	Miller	III	0.56
21	0.22	Miller	III	0.22
22	0.06	Miller	III	0.06
24	0.14	Miller	III	0.14
25	0.06	Miller	III	0.06
W1	0.1	Miller	III	0.1
W2	0.22	Miller	III	0.22
35a-d	0.67	Miller	III	0.67
40	0.03	Miller	III	0.03
41a and b	0.44	Miller	III	0.44
A6	0.16	Miller	III	0.16
A7	0.3	Miller	III	0.3
A8	0.38	Miller	III	0.38
A9	0.04	Miller	III	
A11	0.02	Miller	III	
A12	0.11	Miller	III	0.08
A13	0.12	Miller	III	
A14a and b	0.19	Miller	III	
A16	0.09	Miller	III	
A18	0.01	Miller	III	0.01
A20	0.17	Miller	III	
R1	0.17	Miller	III	0.13
R2	0.12	Miller	III	
R3	0.02	Miller	III	
R4	0.11	Miller	III	
R4b	0.11	Miller	III	
R5	0.05	Miller	III	
R5b	0.07	Miller	III	
R6	0.21	Miller	III	
R6b	0.09	Miller	III	
R7	0.04	Miller	III	
R7a	0.04	Miller	III	
R9	0.38	Miller	III	
R10	0.04	Miller	III	
R12	0.03	Miller	III	
R13	0.12	Miller	III	
R14a	0.13	Miller	III	
R14b	0.08	Miller	III	
R15b	0.25	Miller	III	
Cat III totals	**30.274**			**5.03**
23	0.77	Miller	IV	0.77
26	0.02	Miller	IV	0.02
FW1	0.03	Miller	IV	
FW2	0.09	Miller	IV	
FW3	0.59	Miller	IV	
FW5	0.08	Miller	IV	0.08
FW6	0.07	Miller	IV	0.07
FW8	0.03	Miller	IV	
FW9	0.01	Miller	IV	

MILLER AND WALKER CREEK BASINS

Wetland	Area (Acres)	Drainage	Ecology Rating	Impact (Acres)
FW10	0.02	Miller	IV	
FW11	0.11	Miller	IV	
A2	0.05	Miller	IV	
A3	0.01	Miller	IV	
A4	0.03	Miller	IV	
A5	0.03	Miller	IV	0.03
A10	0.01	Miller	IV	
A15	0.04	Miller	IV	
A19	0.04	Miller	IV	
Cat IV tot	**2.03**			**0.97**

AR 016512

MILLER CREEK SUB-BASIN

Wetland	Area (Acres)	Drainage	Ecology Rating	Impact (Acres)
N1	0.14	Miller	II	
N2	0.72	Miller	II	
N3	19	Miller	I	
N3b	19.21	Miller	II	
S. 144th	2	Miller	II	
7	6.68	Miller	II	
18	3.56	Miller	II	2.84
20	0.57	Miller	II	0.57
37	5.73	Miller	II	4.11
39	0.9	Miller	II	
Tub Lake	17	Miller	II	
A1	4.66	Miller	II	0.59
A17	2.66	Miller	II	
Lora Lake	3.06	Miller	II	
R8	0.4	Miller	II	
R9a	0.74	Miller	II	
R11	0.42	Miller	II	
R15a	0.79	Miller	II	
R17	0.31	Miller	II	
Cat I & II tota	**88.55**			**8.11**
N4	0.68	Miller	III	
N5	0.37	Miller	III	
N5b	0.001	Miller	III	
N6	0.003	Miller	III	
N7	0.33	Miller	III	
N11	0.26	Miller	III	
N12	0.28	Miller	III	
N13	0.26	Miller	III	
L1	0.05	Miller	III	
N14	0.65	Miller	III	
1	0.07	Miller	III	
2	0.73	Miller	III	
3	0.56	Miller	III	
4	5	Miller	III	
5	4.63	Miller	III	0.14
6	0.86	Miller	III	
8	4.95	Miller	III	
9	2.83	Miller	III	0.03
10	0.31	Miller	III	
11	0.5	Miller	III	0.5
12	0.21	Miller	III	0.21
13	0.05	Miller	III	0.05
14	0.19	Miller	III	0.19
15	0.28	Miller	III	0.28
16	0.05	Miller	III	0.05
17	0.02	Miller	III	0.02
19	0.56	Miller	III	0.56
21	0.22	Miller	III	0.22
22	0.06	Miller	III	0.06

AR 016513

MILLER CREEK SUB-BASIN

Wetland	Area (Acres)	Drainage	Ecology Rating	Impact (Acres)
24	0.14	Miller	III	0.14
25	0.06	Miller	III	0.06
W1	0.1	Miller	III	0.1
W2	0.22	Miller	III	0.22
35a-d	0.67	Miller	III	0.67
40	0.03	Miller	III	0.03
41a and b	0.44	Miller	III	0.44
A6	0.16	Miller	III	0.16
A7	0.3	Miller	III	0.3
A8	0.38	Miller	III	0.38
A9	0.04	Miller	III	
A11	0.02	Miller	III	
A12	0.11	Miller	III	0.08
A13	0.12	Miller	III	
A14a and b	0.19	Miller	III	
A16	0.09	Miller	III	
A18	0.01	Miller	III	0.01
A20	0.17	Miller	III	
R1	0.17	Miller	III	0.13
R2	0.12	Miller	III	
R3	0.02	Miller	III	
R4	0.11	Miller	III	
R4b	0.11	Miller	III	
R5	0.05	Miller	III	
R5b	0.07	Miller	III	
R6	0.21	Miller	III	
R6b	0.09	Miller	III	
R7	0.04	Miller	III	
R7a	0.04	Miller	III	
R9	0.38	Miller	III	
R10	0.04	Miller	III	
R12	0.03	Miller	III	
R13	0.12	Miller	III	
R14a	0.13	Miller	III	
R14b	0.08	Miller	III	
R15b	0.25	Miller	III	
Cat III totals	**30.274**			**5.03**
FW1	0.03	Miller	IV	
FW2	0.09	Miller	IV	
FW3	0.59	Miller	IV	
FW5	0.08	Miller	IV	0.08
FW6	0.07	Miller	IV	0.07
FW8	0.03	Miller	IV	
FW9	0.01	Miller	IV	
FW10	0.02	Miller	IV	
FW11	0.11	Miller	IV	
A2	0.05	Miller	IV	
A3	0.01	Miller	IV	
A4	0.03	Miller	IV	

AR 016514

MILLER CREEK SUB-BASIN

Wetland	Area (Acres)	Drainage	Ecology Rating	Impact (Acres)
A5	0.03	Miller	IV	0.03
A10	0.01	Miller	IV	
A15	0.04	Miller	IV	
A19	0.04	Miller	IV	
Cat IV tot	**1.24**			**0.18**

AR 016515

DES MOINES CREEK BASIN

Wetland	Area (Acres)	Drainage	Ecology Rating	Impact (acres)
B1	0.27	Des Moines	II	
B12	0.63	Des Moines	II	0.07
29	0.74	Des Moines	II	
30	0.88	Des Moines	II	
B6	0.55	Des Moines	II	
28	35.45	Des Moines	II	0.07
52	4.7	Des Moines	II	0.54
DMC	1.08	Des Moines	II	
B	6.6	Des Moines	II	
	50.9			**0.68**
32	0.09	Des Moines	III	
48	1.58	Des Moines	III	
B4	0.07	Des Moines	III	
B11	0.18	Des Moines	III	0.18
B14	0.78	Des Moines	III	0.78
B15 a and b	2.05	Des Moines	III	
B5	0.08	Des Moines	III	
B7	0.03	Des Moines	III	
B10	0.02	Des Moines	III	
53	0.6	Des Moines	III	0.6
G7	0.5	Des Moines	III	0.5
WH	0.25	Des Moines	III	
IWS a and t	0.67	Des Moines	III	
E1	0.23	Des Moines	III	
E2	0.04	Des Moines	III	0.04
E3	0.06	Des Moines	III	0.06
B2	0.52	Des Moines	III	
C	0.1	Des Moines	III	
M	0.1	Des Moines	III	
	7.95			**2.16**
B9	0.05	Des Moines	IV	
G1	0.05	Des Moines	IV	0.05
G2	0.02	Des Moines	IV	0.02
G3	0.06	Des Moines	IV	0.06
G4	0.04	Des Moines	IV	0.04
G5	0.87	Des Moines	IV	0.87
G6	0.01	Des Moines	IV	
G8	0.04	Des Moines	IV	
	1.14			**1.04**

F

ATTACHMENT F

Wetland acreage impacts by wetland function[1].

Wetland Function	Acres of Impact	Comments – *Rating Threshold*
Resident/ Anadromous Fish	8.6	Most wetlands rated for this function do not provide direct habitat for fish or aquatic organisms. These wetlands were rated at least low-moderate when at least indirect support of fish habitat through organic matter export, hydrologic functions, or other water quality functions would be expected.
Passerine Birds	14.9	Generally, areas providing nesting and foraging habitat for some birds were rated at least low-moderate. These ratings reflect the fact that even disturbed wetland areas in urban areas provide some habitat for birds when trees or shrubs are present in or near the wetlands.
Waterfowl	1.9	Wetlands that provide areas of forage (wetlands on the golf course and Vacca Farm) or emergent wetlands with nesting habitat were rated at least low-moderate.
Amphibians	9.8	When forest or shrub habitat occurred in wetlands or their buffers, they were rated at least low-moderate for this function.
Small Mammals	13.2	Generally, wetlands with shrub or forest cover provide some habitat to small mammals, and were rated at least low-moderate. These ratings reflect the fact that small disturbed wetland areas, even in urban environments are used by small mammal species.
Exports Organic Matter	10.9	Wetlands with surface water connections to streams or channels were generally rated at least low-moderate for this function.
Ground Water Exchange	13.0	Wetlands where groundwater discharges (perennial or seasonal) were observed were rated at least low-moderate for this function.
Flood Storage	4.6	Wetlands in floodplains or those formed in shallow depressions, were rated at least low to moderate for this function.
Nutrient/Sediment Trapping	16.3	Wetlands in floodplains, in shallow depressions, or on slopes where channelized inflow was absent, were rated at least low-moderate for this function.

[1] If functional assessment for a wetland was rated greater than low, the impact acreage is included in this table.

G

ATTACHMENT G

Washington Functional Assessment Rating Guidelines for Opportunity

6.1.6 Qualitative Rating of Opportunity

The opportunity of AUs in this subclass to remove sediment is a function of the level of disturbance in the landscape. Relatively undisturbed watersheds in the lowlands in western Washington will carry much lower sediment loads than those that have been impacted by development, agriculture, or logging practices (Hartmann et al. 1996, and Reinelt and Horner 1995). The opportunity that an AU has to remove sediment is, therefore, linked to the amount of development, agriculture, or logging present in the upgradient part of its contributing basin.

Users must make a qualitative judgement on the opportunity of the AU to actually trap sediment by considering the land uses in the contributing watershed and the condition of its buffer. The opportunity for an AU in the depressional outflow subclass to remove sediments is "**Low**" if most of its contributing watershed is undeveloped, not farmed, or not recently logged. Densely vegetated watersheds (e.g., undisturbed forest) stabilize soils, reduce runoff velocity, and thus export less sediment (Bormann et al. 1974, and Chang et al. 1983).

The opportunity is "**Low**" if the AU receives most of its water from sheetflow rather than from an incoming stream, and it has a good vegetated buffer. Vegetated buffers will trap sediments coming from the surrounding landscape before they reach the AU. A buffer that is only 5 m wide will trap up to 50% of the sediment while one that is 100 m wide will trap approximately 80% of the sediments (Desbonnet et al. 1994). The opportunity is also "**Low**" if the AU receives most of its water from groundwater since this source of water does not carry any sediments.

The opportunity for the AU to remove sediments is "**High**" if the contributing watershed is mostly agricultural, or it contains recent construction, or clear-cut logging. In contrast to undisturbed watersheds, urban, agricultural, or logged watersheds have more exposed soils and thus higher sediment loadings. AUs with upgradient disturbances to the watershed will have a greater opportunity to remove sediment and improve water quality than those in undisturbed watersheds. In general, AUs that are in urban or rapidly urbanizing watersheds will usually have some on-going construction. These AUs can all be assumed to have a "**High**" opportunity for sediment removal. Some watersheds may also have a high sediment load from natural geologic processes such as landslides or avalanches. If you know that the AU is in a watershed with "geologically" induced sediment loads, its opportunity should also be rated as "**High**".

The opportunity to remove sediment is "**Moderate**" if the activities that generate sediment are a small part of the contributing watershed, or if they are relative far away from the AU. The user must use their judgement in deciding whether the opportunity is moderate or high, and document their decision on the summary page of the assessment.

AR 016521

6.2.6 Qualitative Rating of Opportunity

The opportunity of AUs to remove nutrients should be judged based on the characteristics of its upgradient watershed. Relatively undisturbed watersheds in the lowlands in western Washington will carry much lower nutrient loads than those that have been impacted by development, agriculture, or logging practices (Hartmann et al. 1996, and Reinelt and Horner 1995). The opportunity that an AU has to remove nutrients is, therefore, linked to the amount of development and agriculture present in the upgradient part of its contributing basin. In addition, there are areas in western Washington that have naturally high phosphorus levels in groundwater (Van Denburgh and Santos 1965). AUs in these areas will have an increased opportunity to remove phosphorus if groundwater is a major source of water to the AU.

Users must make a qualitative judgement of the opportunity the AU actually has to remove nutrients by considering the land uses in the contributing watershed. The opportunity for an AU in the depressional outflow subclass to remove nutrients is "**Low**" if most of its contributing watershed is undeveloped, or not farmed.

The opportunity for the AU to remove nutrients is "**High**" if the contributing watershed is mostly agricultural.

The opportunity to remove nutrients is "**Moderate**" if the activities that generate nutrients are a small part of the contributing watershed, or if they are relatively far away from the AU. It should also be considered moderate if the AU is located in a region of high concentrations of phosphorus in groundwater. AUs fed by groundwater high in phosphorus content have a greater opportunity to remove phosphorus through soil adsorption. [See results from study of groundwater phosphorus and removal in the Patterson Creek 12 AU discussed in Reinelt and Horner (1995)]. Areas in western Washington with high levels of phosphorus in groundwater can be identified from data presented in Van Denburgh and Santos (1965).

The user must use their judgement in rating the opportunity, and document their decision on the data sheet (see Part 2).

AR 016522

6.3.6 Qualitative Rating of Opportunity

The opportunity of AUs in these subclasses to remove metals and toxic organic compounds should be judged using the characteristics of the upgradient watershed. Those land uses or activities that contribute metals and toxic organics to surface waters include urban and residential areas and agricultural activities involving pesticide/herbicide applications.

Relatively undisturbed watersheds in the lowlands in western Washington will carry much lower loads of toxic chemicals than those that have been impacted by residential, urban development or agriculture (Reinelt and Horner 1995). The opportunity that an AU has to remove toxic compounds is, therefore, linked to the amount of development and agriculture present in the upgradient part of its contributing basin

Users must make a qualitative judgement of the opportunity the AU actually has to remove toxic compounds by considering the land uses in the contributing watershed. The opportunity for an AU in the depressional outflow subclass to remove toxic compounds is "**Low**" if most of its contributing watershed is undeveloped, and not farmed.

The opportunity for the AU to remove nutrients is "**High**" if the contributing watershed is mostly agricultural, urban, commercial, or residential.

The opportunity is "**Moderate**" if the activities that generate toxic compounds are a small part of the contributing watershed, or if they are relative far away from the AU.

The user must use their judgement in deciding whether the opportunity is moderate or high, and document their decision on the summary sheet (Part 2).

AR 016523

6.4.6 Qualitative Rating of Opportunity

The opportunity for an AU to reduce peak flows will increase as the water regime in the upgradient watershed is destabilized. Research in western Washington has shown that peak flows increase as the percentage of impermeable surface increase (Reinelt and Horner 1995). The opportunity should therefore be judged by the amount of upgradient watershed that is developed.

Users must make a qualitative judgement on the opportunity of the AU to actually reduce peak flows by considering the land uses in the contributing watershed. The opportunity for an AU in the depressional outflow subclass is **"Low"** if most of its contributing watershed is undeveloped, not farmed, or not recently logged.

The opportunity is also **"Low"** if the AU receives most of its water from groundwater, rather than from an incoming stream, ditches, or storm drains).

The opportunity for the AU is **"High"** if the contributing watershed is mostly urban or high density residential. The opportunity is **"Moderate"** if the development is a small part of the contributing watershed, if the upgradient watershed is mostly agricultural, or if these areas are relative far away from the AU. Clear cut logging can also increase peak flows if a significant part of the watershed has recently been cut. These areas, however, will re-vegetate and within 5-7 years the peak flows may again be close to those found before logging. Too many variables are involved in trying to assess the increase in peak flows from logging (e.g. road density, time of cutting, % of watershed cut, etc.) and the rating for opportunity is too difficult to describe in a rapid method. Users must use their judgement to decide whether the opportunity is low, moderate or high, and document their decision on the summary sheet (see Part 2).

AR 016524

6.5.6 Qualitative Rating of Opportunity

The opportunity for an AU to decrease erosion will increase as the water regime in the upgradient watershed is destabilized. Research in western Washington has shown that peak flows and velocities increase as the percentage of impermeable surface increase (Reinelt and Horner 1995). The opportunity should therefore be judged by the amount of upgradient watershed that is developed.

Users must make a qualitative judgement on the opportunity of the AU to actually decrease erosion by considering the land uses in the contributing watershed. The opportunity for an AU in the depressional outflow subclass is **"Low":** if most of its contributing watershed is undeveloped, not farmed, or not recently logged.

The opportunity is also **"Low"** if the AU receives most of its water from groundwater, rather than from an incoming stream, ditches, storm drains , or other surface water sources.

The opportunity for the AU is **"High"** is the contributing watershed is mostly urban or high density residential. The opportunity to is **"Moderate"** if the development is a small part of the contributing watershed, if the upgradient watershed is mostly agricultural, or if these areas are relative far away from the AU. Users must use their judgement in deciding whether the opportunity is low, moderate or high, and document their decision on the summary sheet (Part 2).

AR 016525

6.6.6 Qualitative Rating of Opportunity

Groundwater is an integral component of the water cycle throughout western Washington. The Assessment Teams have judged that all AUs in the lowlands of western Washington have a **"High"** opportunity to recharge either interflow or an unconfined aquifer if the surface soils within the AU are permeable enough. The assumption is that all AUs have some link to groundwater.

6.7.6 Qualitative Rating of Opportunity

The land-use patterns within the upland buffer and surrounding landscape influences the opportunity that an AU has to provide general habitat. Connectivity of AUs to other protected areas affects specific use of the habitat within the AU, in particular those species whose life history needs include a large range of landscape types (e.g. the larger predators, raptors, etc.). For some populations, the connectivity between wetland habitats may be crucial to the survivability of the population.

The opportunity that an AU has to provide habitat for a broad range of species should be judged by characterizing the landscape in which an AU is found. An AU may have many internal structural elements that indicate it provides good habitat. Its landscape position, however, may reduce the actual performance because it is not accessible to the populations that would use it.

Users must make a qualitative judgement on the opportunity the AU has in providing habitat for a broad range of species by considering the land uses in the contributing watershed, the condition of the AU's buffer, and its connection to other habitat areas. Two data on the data sheets can be used to help guide your judgement (D43 on corridors and D42 on buffers).

In general, the opportunity for an AU in the depressional outflow subclass to provide habitat is **"High"** if it has extensive natural buffers and forested or riparian corridors to other habitats. Other habitats may include undisturbed grasslands, open water, shrubs, or forested areas. The opportunity is **"Moderate"** if the AU has some connections to other habitat areas or less extensive undisturbed buffers. It is **"Low"** if the AU is surrounded by development and has no naturally vegetated corridors to other habitat areas.

The user must use their judgement in deciding whether the opportunity is low, moderate or high, and document their decision on the data sheet.

AR 016527

6.10.6 Qualitative Rating of Opportunity

The Assessment Teams decided that an AU does have the opportunity to provide habitat for anadromous fish if its surface water outlet has a direct connection that is passable by fish to a stream with anadromous fish in it. Information on locations used by anadromous fish is more readily available than for other wildlife. The Washington State Department of Fish and Wildlife maintains an extensive database of streams used by anadromous fish, and this can be used as a guide in rating the opportunity. Local sources may also be contacted for information on the presence of anadromous fish.

If the AU has an unobstructed passage to a stream or river with anadromous fish it should be rated as having a **"High"** opportunity to provide habitat. If there is no passage, or the passage is obstructed, the opportunity is **"Low"**.

Potential for Primary Production and Organic Export

[The WAFAM does not provide guidance to evaluate opportunity for this function.]

H

ATTACHMENT H

Washington Functional Assessment Ratings For Wetlands 23 and Wetland A1

Summary of Washington State Functional Assessment Results for Wetlands 23 (0.77 acres). (Wetland 23 is the largest *depressional closed* wetland filled by the project for which the WAFAM could be used to determine functions.)

Function	Washington Functional Assessment Method Results: Capability Rating	Opportunity Rating[B]	Opportunity Rating Justification	Port of Seattle Assessment[A]: Opportunity Rating	Justification
Removing Sediment	10	Low - Moderate	The small contributing watershed is densely vegetated with turf grass. There is no incoming stream, and no farming or logging in the watershed. Some sediment could be generated from runoff from the airfield perimeter road.	High	Runoff from the airport perimeter road or nearby ground disturbance could generate sediments that would be effectively removed by the wetland.
Potential for Removing Nutrients	10	Low - Moderate	There is no agriculture or other activities that generate nutrients in the watershed.		Runoff from the airport perimeter road or nearby ground disturbance could transport nutrients to the wetland where they would be effectively removed.
Removing Heavy Metals and Toxic Organics	6	Moderate	There is no agriculture, pesticide applications or other significant sources of metal or organics in the watershed of this wetland. Runoff from the perimeter road could transport some pollutants to the wetland where they would be effectively removed.		Runoff from the airport perimeter road could transport pollutants to the wetland where they would be effectively removed.
Reducing Peak Flows	10	Low	Streams, ditches or storm drains do not appear to convey stormwater to the wetland. There is little storage capacity in the wetland due to topography.	Low - Moderate	Streams, ditches or storm drains do not appear to convey stormwater to the wetland. There is little storage capacity in the wetland due to topography.
Reducing Decreasing Downstream Erosion	10	Low	The contributing watershed is not farmed or recently logged. Streams, storm drains or ditches do not direct surface water to the wetlands.		Streams, ditches or storm drains do not appear to convey stormwater to the wetland. There is little storage capacity in the wetland due to topography. Down stream areas are well vegetated and do not appear to be subject to erosion hazards.
Groundwater Recharge	3	Low	Observations of till derived fill soils in the wetland and the presence of seasonally perched in a basin with a small contributing	Low	Observations of till derived fill soils in the wetland and the presence of seasonally perched in a basin with a small contributing

Function	Washington Functional Assessment Method Results: Capability Rating	Opportunity Rating[B]	Opportunity Rating Justification	Port of Seattle Assessment[A]: Opportunity Rating	Justification
			watershed indicated relatively low infiltration rates. During the wettest periods, there appears to be outflow from the wetland, indicating recharge may be less than adjacent non-wetland soils.		watershed indicated relatively low infiltration rates. During the wettest periods, there appears to be outflow from the wetland, indicating recharge may be less than adjacent non-wetland soils.
General Habitat	1	Low	There are few structural elements that provide wildlife habitat in or near the wetland.	(Low)	Rating as a Class 3 wetland indicates significant wildlife habitat is absent.
Habitat for invertebrates	1	-	-		-
Habitat Amphibians	1	-	-	Low	The lack of sufficient surface water prevents breeding of aquatic species. There are few suitable habitat elements present for adult species.
Habitat Anadromous Fish	N/A	-	-	Low	The wetland is not associated with fish bearing streams.
Habitat for Resident Fish	N/A	-	-		The wetland is not associated with fish bearing streams.
Habitat Wetland Associated Birds	3	-	-	Low	There is no breeding or nesting habitat present. Waterfowl using the area would be subject to hazard management by the airport.
Habitat Wetland Associated Mammals	2	-	-	Low	There are no significant habitat features in the wetland that is suitable for wetland associated small mammals. Habitat for non-wetland associated small mammals is low due to mowing.
Native Plant Richness	1	-	-	-	-
Primary Production and Export	N/A	-	-	Low	There is no significant outflow to provide this function.

	Washington Functional Assessment Method Results			Port of Seattle Assessment[A]	
Function	Capability Rating	Opportunity Rating[B]	Opportunity Rating Justification	Opportunity Rating	Justification
Passerine Bird	-	-	-	Low	There are few habitat features in or near the wetland to support non-wetland associated passerine birds.

[A]Shading identifies related functions that were similarly assessed because, within the project area, the major variables controlling these functions are similar.

[B]Opportunity ratings and justifications are not provided where the manual does not provide any guidance. In these cases opportunity was assumed to be equivalent to capability.

Summary of Washington State Functional Assessment Results for Wetlands A1, FW6, and FW8. (The fill of the farmed wetland, prior converted cropland, and portions of Wetland A1 (1.66 acres) is the largest area of fill in the *depression outflow* HGM class which the WAFAM addresses.)

Function	Washington Functional Assessment Method Results: Capability Rating	Washington Functional Assessment Method Results: Opportunity Rating[B]	Washington Functional Assessment Method Results: Opportunity Rating Justification	Port of Seattle Assessment[A]: Opportunity Rating	Port of Seattle Assessment[A]: Justification
Removing Sediment	3	Moderate	Adjacent agricultural land has the potential to generate sediment in runoff that could enter the wetland. Urban areas west of the wetland contribute runoff to the wetland, and during flood events, backwater flooding could result in removal of sediment from Miller Creek streamflow.	High	Adjacent agricultural land has the potential to release sediment in runoff to the wetland. Urban areas west of the wetland contribute runoff to the wetland, and during flood events, backwater flooding could result in removal of sediment from Miller Creek stream flow. The Miller Creek Regional Detention Facility, upstream of the project may reduce the opportunity for the wetland to remove sediment because this facility would receive a high rating for the function.
Potential for Removing Nutrients	4	Moderate	Urban and agricultural areas adjacent to the wetland are likely to generate runoff with excess nutrients. Conditions in the wetland would promote removal. Use of fertilizers to improve crop production may result in nutrient loading to Miller Creek during wet periods.		Urban and agricultural areas adjacent to the wetland are likely to generate runoff with excess nutrients. Conditions in the wetland would promote removal. Use of fertilizers to improve crop production may result in nutrient loading to Miller Creek during wet periods.
Removing Heavy Metals and Toxic Organics	5	Moderate	Potential pesticide and herbicide applications, as well as urban runoff create opportunity for this function to occur in the wetland. Conditions in the wetland would promote removal. Use of agricultural chemicals to improve crop production may result in runoff to Miller Creek during wet periods.		Potential pesticide and herbicide applications, as well as urban runoff create opportunity for this function to occur in the wetland. Conditions in the wetland would promote removal. Use of agricultural chemicals to improve crop production may result in runoff to Miller Creek during wet periods.
Reducing Peak Flows	2	Low	The area is in the Miller Creek floodplain and has the opportunity to store floodwaters that could reduce peak flows. The opportunity rating is low because of	High	The area is in the Miller Creek floodplain and has the opportunity to store floodwaters that could reduce peak flows.

	Washington Functional Assessment Method Results			Port of Seattle Assessment[A]	
Function	Capability Rating	Opportunity Rating[B]	Opportunity Rating Justification	Opportunity Rating	Justification
			the low capability rating.		
Reducing Decreasing Downstream Erosion	2	Low	The rating is low because peak flow reduction is low.		If peak flow reduction occurs, then downstream erosion is reduced.
Groundwater Recharge	1	Low	The area appears to be a groundwater discharge site.	Moderate	The Port assessed "ground water exchange", the site is rated moderate because portions of the area appear to be areas of groundwater discharge.
General Habitat	5	Low	There are few structural elements that provide wildlife habitat in or near the wetland.	(High)	Rating as a Class II wetland indicates significant wildlife habitat is present.
Habitat for invertebrates	5	-	-	-	-
Habitat for Amphibians	2	-	-	Low	The agricultural drainage ditch provides some standing water that could support amphibian breeding. Adjacent land uses provide marginal habitat for adults.
Habitat for Anadromous Fish	4	Moderate	The wetland is connected to a salmon bearing stream and may have poor or marginal accessible to coho salmon.	High	The wetland is associated with fish bearing streams. In stream conditions could provide passage and some habitat functions to coho salmon.
Habitat for Resident Fish	5	-	-		The wetland is associated with fish bearing streams. Warm water fish use the area. It may provide habitat and passage for cutthroat trout.
Habitat for Wetland Associated Birds	5	-	-	Medium	The area provides forage habitat for waterfowl. The ditch could provide limited breeding habitat for mallard ducks.
Habitat for Wetland	3	-	-	Medium - High	The Port assessed suitability for all mammals. Small mammals common in urban areas are

Function	Washington Functional Assessment Method Results: Capability Rating	Opportunity Rating[B]	Opportunity Rating Justification	Port of Seattle Assessment[A]: Opportunity Rating	Justification
Associated Mammals					likely to use the wetland, riparian corridor. Habitat for small mammals is reduced due to agriculture, but crop residues and vegetated margins provide some food and cover.
Native Plant Richness	4	-	-		
Primary Production and Export	4	-	-	High	Crop residues may be exported from the site during flood periods. Overhanging reed canarygrass and shrubs contribute organic matter to the creek. Organic soils release dissolved organic matter to surface waters, especially when partially drained. Plowing may also generate erosion of organic soils.
Passerine Bird	-	-	-	Moderate	The combination of crop residues, open areas, field margins and creek riparian areas provides habitat to birds that use non-forested areas.

[A]Shading identifies related functions that were similarly assessed because, within the project area, the major variables controlling these functions are similar.

[B]Opportunity ratings and justifications are not provided where the manual does not provide any guidance. In these cases opportunity was assumed to be equivalent to capability.

WETLAND 23

SITE	0	#AU-	0

Depressional Closed

Summary of Function Assessments

Function	Index
Potential for Removing Sediment	10
Potential for Removing Nutrients	10
Potential for Removing Heavy Metals and Toxic Organics	6
Potential for Reducing Peak Flows	10
Potential for Reducing Decreasing Downstream Erosion	10
Potential for Groundwater Recharge	3
General Habitat Suitability	1
Habitat Suitability for Invertebrates	1
Habitat Suitability for Amphibians	1
Habitat Suitability for Anadromous Fish	N/A
Habitat Suitability for Resident Fish	N/A
Habitat Suitability for Wetland Associated Birds	3
Habitat Suitability for Wetland Associated Mammals	2
Native Plant Richness	1
Primary Production and Export	N/A

	Depressional Closed	
SITE		
		#AU-
Date		2/26/2002 WL 23
	LANDSCAPE DATA	
D1	Area of AU	1.9
D2	Area of contributing basin (upgradient watershed)	1.5
D3	Land use within 1km of AU	
D3.1	Undeveloped Forest	20
D3.2	Agriculture (field and pasture)	0
D3.3	Clear cut logging (<5yrs since clearing)	0
D3.4	Urban/commercial	10
D3.5	High density residential (> 1residence/acre)	40
D3.6	Low density residential (<= 1 residence/acre)	
D3.7	Undeveloped areas,	30
	WATER REGIME	
D4		
D4.1		
D4.2		
D5		
D6		
D7		
D8	Inundation	
D8.1	Percent ponded or inundated for >1 month	0
D8.2	Percent of AU with permanent standing water	0
D8.3	Percent of AU with permanent open water	0
D8.4	Percent of AU with unvegetated bars or mudflats	0
D8.5	Unvegetated bars or mudflats	0
D9	Inundation regimes	
D9.1	Permanently Flooded	0
D9.2	Seasonally Flooded	0
D9.3	Occasionally Flooded (<= 1 month)	1
D9.4	Saturated but seldom inundated	1
D9.5		
D9.6		
D10		
D11		
D11.1		
D11.2		
D11.3		
D12	water depths present in AU	
D12.1	0-20cm (<8in)	1
D12.2	20-100cm(8-40in)	0
D12.3	>100cm (>40in)	0
D13		
D13.1		
D13.2		
D13.3		
D13.4		
	VEGETATION	
D14	Cowardin Classes (as % area of AU)	

D14.1	Forest - evergreen	0
D14.2	Forest -deciduous	0
D14.3	Scrub-shrub - evergreen	0
D14.4	Scrub Shrub - deciduous	0
D14.5	Emergent	100
D14.6	Aquatic Bed	0
D15	Does D8.3 + D8.4 + sum (D14.1 to D14.6) = 100 ?	1
D16	% area of herbaceous understory	0
D17	% area of AU with >75% closure of canopy	0
D18		
D19	Plant Richness	
D19.1	number of native plant species	2
D19.2	number of non- native plant species	4
D20	The number of plant assemblages	1
D21	The maximum number of strata	1
D21.1	"vine" stratum dominated by non-native Blackberries	0
D22	Mature trees present in AU	0
D23	Sphagnum bogs	
D23.1	Sphagnum bog component is > 75% of area in AU	0
D23.2	Sphagnum bog component is 50%-75% of area in AU	0
D23.3	Sphagnum bog component is 25%-49% of area in AU	0
D23.4	Sphagnum bog component is 1 - 25% of area in AU	0
D23.5	NO Sphagnum bog component in AU	0
D24	Dominance by non-native plant species	
D24.1	% area of non-native species >75%	1
D24.2	% area of non-native species 50-75%	0
D24.3	%area of non-native species 25-49%	0
D24.4	% area of non-native species 1-24%	0
D24.5	NO cover of non-natives in the AU	0
	HABITAT CHARACTERISTICS	
D25	structure categories in aquatic bed vegetation	
D26	pH	
D26.1	pH of interstitial water	7
D26.2	pH of open or standing water	7
D27	AU is within 8 km (5mi) of estuary	1
D28	AU is within 1.6km (1 mi) of a lake	1
D29	AU is within 5km (3 mi) of an open field (	1
D30	>1 hectare (2.5 ac) of preferred woody vegetation	0
D31	snags	
D31.1	At least one snag has a DBH greater than 30cm	0
D32		
D33	AU has upland islands	0
D34		
D35	Key for rating egg-laying structures for amphibians	0
D36	Tannins present in surface waters	0
D37	Steep banks suitable for denning	0
D38	Interspersion between vegetation and open water	0
D39	Interspersion between Cowardin vegetation classes	0
D40		
D41	EDGE of AU:	0
D42	BUFFER of AU:	3
D43	CORRIDORS of AU:	2
D44	large woody debris in AU **outside of perm. water**	0

D45	large woody debris **in permanent water** of AU	0
	SOILS and SUBSTRATES	
D46	Composition of surface layer (above soil)	
D46.1	deciduous leaf litter	0
D46.2	other plant litter	1
D46.3	decomposed organic	0
D46.4	exposed cobbles	0
D46.5	exposed gravel	0
D46.6	exposed sand	0
D46.7	exposed silt	0
D46.8	exposed clay	0
D47	Soil Types	
D47.1	Peat	0
D47.2	Muck	0
D47.3	Mineral with clay fraction <30%	1
D47.4	Clay (clay fraction >30%)	1
D48	Permeability of soils in seasonally inundated areas	
D48.1	High	0
D48.2	Moderate	1
D48.3	Slow	0
D49		
D49.1		
D49.2		
D49.3		

AR 016541

WL A1, FW6, FW8, PCC

Depressional Outflow

Summary of Function Assessments

Function	Index
Potential for Removing Sediment	3
Potential for Removing Nutrients	4
Potential for Removing Heavy Metals and Toxic Organics	6
Potential for Reducing Peak Flows	2
Potential for Reducing Decreasing Downstream Erosion	2
Potential for Groundwater Recharge	1
General Habitat Suitability	4
Habitat Suitability for Invertebrates	6
Habitat Suitability for Amphibians	2
Habitat Suitability for Anadromous Fish	4
Habitat Suitability for Resident Fish	6
Habitat Suitability for Wetland Associated Birds	4
Habitat Suitability for Wetland Associated Mammals	3
Native Plant Richness	4
Primary Production and Export	4

	Depressional Outflow	
SITE		
Wetland		#AU- Vacca-
Date		2-Mar-02
	LANDSCAPE DATA	
D0	AU surrounded by dikes with control structure	0
D1	Area of AU	4
D2	Area of contributing basin (upgradient watershed)	686
D3	Land use, within 1km of AU	
D3.1	Undeveloped Forest	5
D3.2	Agriculture (field and pasture)	5
D3.3	Clear cut logging (<5yrs since clearing)	0
D3.4	Urban/commercial	20
D3.5	High density residential (> 1residence/acre)	40
D3.6	Low density residential (<= 1 residence/acre)	30
D3.7	Undeveloped areas,	0
	WATER REGIME	
D4	Channels or streams in AU with identifiable banks	1
D4.1	Channels have permanently flowing water	1
D4.2		
D4.3	Only surface outflow is through a culvert	0
D5		
D6		
D7		
D8	Inundation	
D8.1	Percent ponded or inundated for >1 month	10
D8.2	Percent of AU with permanent standing water	5
D8.3	Percent of AU with permanent open water	0
D8.4	Percent of AU with unvegetated bars or mudflats	0
D8.5	Unvegetated bars or mudflats	0
D9	Inundation regimes	
D9.1	Permanently Flooded	1
D9.2	Seasonally Flooded	1
D9.3	Occasionally Flooded (<= 1 month)	1
D9.4	Saturated but seldom inundated	1
D9.5	Permanently flowing stream	1
D9.6	Intermittently flowing stream	0
D10	Average annual height of flooding	0.3
D11	Cross section of AU	
D11.1	Cross section 1	0
D11.2	Cross section 2	0
D11.3	Cross section 3	1
D12	water depths present in AU	
D12.1	0-20cm (<8in)	1
D12.2	20-100cm(8-40in)	1
D12.3	>100cm (>40in)	0
D13	Constriction of outlet	
D13.1	Unconstricted or only slightly constricted	0
D13.2	Moderately constricted	0
D13.3	Severely constricted	0
D13.4		
	VEGETATION	

AR 016543

D14	Cowardin Classes (as % area of AU)	
D14.1	Forest - evergreen	0
D14.2	Forest -deciduous	5
D14.3	Scrub-shrub - evergreen	0
D14.4	Scrub Shrub - deciduous	5
D14.5	Emergent	90
D14.6	Aquatic Bed	
D15	Does D8.3 + D8.4 + sum (D14.1 to D14.6) = 100 ?	1
D16	% area of herbaceous understory	5
D17	% area of AU with >75% closure of canopy	5
D18		
D19	Plant Richness	
D19.1	number of native plant species	30
D19.2	number of non- native plant species	15
D20	The number of plant assemblages	4
D21	The maximum number of strata	3
D21.1	"vine" stratum dominated by non-native Blackberries	1
D22	Mature trees present in AU	1
D23	Sphagnum bogs	
D23.1	Sphagnum bog component is > 75% of area in AU	0
D23.2	Sphagnum bog component is 50%-75% of area in AU	0
D23.3	Sphagnum bog component is 25%-49% of area in AU	0
D23.4	Sphagnum bog component is 1 - 25% of area in AU	0
D23.5	NO Sphagnum bog component in AU	0
D24	Dominance by non-native plant species	
D24.1	% area of non-native species >75%	1
D24.2	% area of non-native species 50-75%	
D24.3	%area of non-native species 25-49%	
D24.4	% area of non-native species 1-24%	
D24.5	NO cover of non-natives in the AU	
	HABITAT CHARACTERISTICS	
D25	structure categories in aquatic bed vegetation	0
D26	pH	
D26.1	pH of interstitial water	7
D26.2	pH of open or standing water	7
D27	AU is within 8 km (5mi) of estuary	1
D28	AU is within 1.6km (1 mi) of a lake	0
D29	AU is within 5km (3 mi) of an open field (	1
D30	>1 hectare (2.5 ac) of preferred woody vegetation	0
D31	snags	0
D31.1	At least one snag has a DBH greater than 30cm	0
D32	Overhanging vegetation	1
D33	AU has upland islands	0
D34	Undercut banks present	0
D35	Key for rating egg-laying structures for amphibians	1
D36	Tannins present in surface waters	0
D37	Steep banks suitable for denning	0
D38	Interspersion between vegetation and open water	1
D39	Interspersion between Cowardin vegetation classes	2
D40		
D41	EDGE of AU:	0
D42	BUFFER of AU:	1
D43	CORRIDORS of AU:	1

D44	large woody debris in AU **outside of perm. water**	0
D45	large woody debris **in permanent water** of AU	0
	SOILS and SUBSTRATES	
D46	Composition of surface layer (above soil)	
D46.1	deciduous leaf litter	1
D46.2	other plant litter	1
D46.3	decomposed organic	1
D46.4	exposed cobbles	0
D46.5	exposed gravel	0
D46.6	exposed sand	0
D46.7	exposed silt	1
D46.8	exposed clay	0
D47	Soil Types	
D47.1	Peat	1
D47.2	Muck	1
D47.3	Mineral with clay fraction <30%	0
D47.4	Clay (clay fraction >30%)	0
D48	Permeability of soils in seasonally inundated areas	
D48.1	High	0
D48.2	Moderate	0
D48.3	Slow	1
D49		
D49.1		
D49.2		
D49.3		

ATTACHMENT I

Summary of mitigation actions and their relation to National Environmental Policy Act, State Environmental Policy Act, and Clean Water Act mitigation sequencing requirements.

Mitigation Requirement	Proposed Mitigation Action
New Third Runway	
Avoid the impact by not taking a certain action or parts of an action.	Avoid fill in wetlands and Miller Creek by designing the runway to meet the minimum operational, engineering, safety, and maintenance standards. Locate, where feasible, permanent stormwater detention ponds in uplands. Avoid excavation within 50 ft of Category II and III wetlands in Borrow Area 3. Avoid wetlands in Borrow Area 1 where practical.
	Construct retaining walls at the northwest end of the runway to reduce impacts to Miller Creek and Category II wetlands (Wetlands 8, 9, and A1) located at the north end of the project. Install a retaining wall near the west-central portion of the embankment to reduce impacts to Category II Wetlands 18 and 37 and avoid relocating a second segment of Miller Creek.
Minimize the impact by limiting the degree or magnitude of the action.	Place a retaining wall near the southwest end of the runway to reduce impact to a Category II wetland (Wetland 44). Design Borrow Areas 1 and 3 with a 150- to 200-ft setback from Des Moines Creek to minimize potential impact to the stream and its buffers. Implement stormwater pollution prevention plans (SWPPPs) prior to any construction project.
Rectify the impact by restoring the affected environment.	Remove temporary stormwater management facilities located in wetlands following construction. These disturbed areas will be restored to pre-construction conditions
Reduce the impact over time by preservation and maintenance actions during the life of the action.	Establish and enhance a 100-ft average (minimum 50-ft) forested buffer on both banks of Miller Creek to reduce potential construction and operational impacts to riparian wetlands and aquatic resources. Maintain hydrology to wetlands by directing seepage water from the embankment to wetlands downslope of the embankment (Hart Crowser 2000c, 2001b; Appendix Q). Provide water quantity and water quality mitigation to protect aquatic habitat in Miller Creek from stormwater impacts during operation. Reduce temporal losses from construction by adding additional mitigation (Wetland A17).

AR 016547

Summary of mitigation actions and their relation to National Environmental Policy Act, State Environmental Policy Act, and Clean Water Act mitigation sequencing requirements (continued).

Mitigation Requirement	Proposed Mitigation Action
Compensate for the impact by replacing, enhancing, or providing substitute resources.	Restore the Vacca Farm wetland/floodplain area, including fill removal, creating new floodplain, restoring wetland hydrology and vegetation, and providing protective buffers.
	Restore and enhance Miller Creek instream habitat in the Vacca Farm area.
	Restore natural channel morphology to a ditched and channelized reach of the stream.
	Restore wetlands and shoreline areas surrounding Lora Lake by removing fill and planting trees and shrubs.
	Enhance instream habitat and place LWD in Miller Creek and enhance adjacent riparian buffers between Vacca Farm and Des Moines Memorial Drive.
	Enhance wetlands along Miller Creek within the 100-ft buffer by restoring native vegetation and removing invasive non-native species.
	Construct replacement drainage channels west of the embankment to replace filled drainage channels.
	Restore wetlands on the Tyee Valley Golf Course, including restoring wetland vegetation to reduce wildlife hazards and improve water quality.
	Restore and enhance wetlands, buffers, and Miller Creek at the Des Moines Way Nursery site.
	Reduce temporal losses by providing wetland additional enhancement as mitigation for temporary impacts.
	Enhance aquatic habitat in Des Moines Creek by restoring a 100-ft-wide forest/shrub buffer along the stream between the Northwest Ponds and the proposed SR 509 right-of-way (ROW).
	Provide a $300,000 trust fund to enhance fisheries habitat in Miller and Des Moines Creeks.
	Create replacement wetlands at an off-site location for the loss of wildlife habitat within 10,000 ft of the airport runways.
	Monitor mitigation projects for compliance with performance standards and other permit conditions.
	Monitor stormwater runoff for compliance with National Pollutant Discharge Elimination System (NPDES) requirements.
	Monitor remaining wetlands downslope of the new embankment (i.e., between the embankment and Miller Creek) for indirect impacts to wetland hydrology.
Runway Safety Areas	
Avoid the impact by not taking a certain action or parts of an action.	Construct retaining walls to support relocated South 154th Street and avoid permanent fill in Wetlands 3 and 4.
Minimize the impact by limiting the degree or magnitude of the action.	Construct retaining walls to support relocated South 154th Street and reduce permanent fill and minimize temporary impacts in Wetland 5.
	Implement SWPPPs prior to any construction project.
Rectify the impact by restoring the affected environment.	Restore wetland areas temporarily impacted by required TESC facilities and provide additional mitigation (Wetland A17) to reduce temporal losses.

AR 016548

Summary of mitigation actions and their relation to National Environmental Policy Act, State Environmental Policy Act, and Clean Water Act mitigation sequencing requirements (continued).

Mitigation Requirement	Proposed Mitigation Action
Reduce the impact over time by preservation and maintenance actions during the life of the action.	Provide water quantity and water quality mitigation to protect wetlands and other receiving waters from stormwater impacts during operation.
Compensate for the impact by replacing, enhancing, or providing substitute resources.	Restore the Vacca Farm wetland/floodplain area to provide hydrologic and water quality functions.
	Create replacement wetlands for wildlife habitat (greater than 10,000 ft from the airport runways at the Auburn site).
Monitor the impact and take appropriate corrective actions.	Monitor remaining wetlands for indirect impacts to hydrology.
	Monitor mitigation projects for compliance with performance standards and other permit conditions.
	Monitor stormwater runoff for compliance with NPDES requirements.
South Aviation Support Area	
Avoid the impact by not taking a certain action or parts of an action.	Design the SASA footprint to avoid relocation of Des Moines Creek.
	Temporary impacts to Des Moines Creek and Wetland 52 are not anticipated.
Minimize the impact by limiting the degree or magnitude of the action.	Design the SASA to avoid direct impacts to forested wetland (Wetland 52) that provides groundwater discharge functions.
Reduce the impact over time by preservation and maintenance actions during the life of the action.	Design water quantity and water quality mitigation to protect wetlands from stormwater impacts.
Rectify the impact by restoring the affected environment.	Restore potential temporary impacts to Des Moines Creek and Wetland 52.
Compensate for the impact by replacing, enhancing, or providing substitute resources.	Restore wetlands on the Tyee Valley Golf Course to provide water quality and hydrologic benefits to replace lost wetland functions.
	Construct replacement wetlands for wildlife habitat (greater than 10,000 ft from the airport runways at the Auburn site).
	Enhance and restore a 100-ft-wide forest/shrub buffer along Des Moines Creek to enhance aquatic habitat.
	Provide a trust fund for enhancement of fisheries habitat of Des Moines Creek.
Monitor the impact and take appropriate corrective actions.	Monitor Wetland 52 for indirect impacts to wetland hydrology.
	Monitor mitigation projects for compliance with performance standards and other permit conditions.
	Monitor stormwater runoff for compliance with NPDES requirements.
On-site Borrow Source Areas	
Avoid the impact by not taking a certain action or parts of an action.	Redesign development areas within Borrow Areas 1 and 3 to avoid excavation of 12 wetlands (Wetlands B1, B4, B5, B6, B7, B9, B10, B15a, B15b, 29, 30, and 48).

AR 016549

Summary of mitigation actions and their relation to National Environmental Policy Act, State Environmental Policy Act, and Clean Water Act mitigation sequencing requirements (continued).

Mitigation Requirement	Proposed Mitigation Action
Minimize the impact by limiting the degree or magnitude of the action.	Establish a 150- to 200-ft buffer between Borrow Area 1 and Des Moines Creek to avoid impacts to stream hydrology and riparian buffers.
	Follow a TESC Plan to eliminate siltation reaching wetlands or Des Moines Creek from excavation activities.
	Establish final surface grades in Borrow Area 1, and construct interceptor swale system in Borrow Area 3, to direct surface water runoff and groundwater seepage to wetlands near borrow areas, and minimize and avoid indirect hydrology impacts.
Reduce the impact over time by preservation and maintenance actions during the life of the action.	Maintain BMPs throughout the operating period to ensure adjacent wetlands will be protected from adverse construction-related activities.
	Preserve wetlands and buffers adjacent to Borrow Area 3.
Compensate for the impact by replacing, enhancing, or providing substitute resources.	Restore wetlands on the Tyee Valley Golf Course to compensate for water quality and hydrologic support functions impacted in the Des Moines Creek basin.
	Enhance a 100-ft-wide forest/shrub buffer along Des Moines Creek to enhance aquatic habitat.
	Provide a trust fund for enhancement of fisheries habitat of Des Moines Creek.
Monitor the impact and take appropriate corrective actions.	Monitor Wetlands B1, B4, B5, B6, B7, B9, B10, B15a, B15b, 29, 30, and 48 for potential indirect impacts to wetland hydrology from excavation activities.
	Monitor stormwater runoff and TESC for compliance with NPDES requirements.

AR 016550

J

ATTACHMENT J

Summary of wetland mitigation credit for Seattle-Tacoma International Airport Master Plan Update improvements. (All impacts and mitigation occur in WRIA 9).

Mitigation	Mitigation Area (ac)	Mitigation Credit
ON-SITE		
Wetland Restoration – **Credit ratio 1:1**		
Remove Fill Adjacent to Lora Lake	**1.00**	**1.00**
Remove Fill at Des Moines Way Nursery Site	**2.00**	**2.00**
Remove Fill at Wetland A17	**0.30**	**0.30**
Vacca Farm (prior converted cropland and other upland)	**6.60**	**6.60**
Temporary Impacts	**2.05**	**2.05**
Subtotal	**11.95**	**11.95**
Wetland Enhancement – **Credit ratio 1:2**		
Des Moines Way Nursery	**0.86**	**0.43**
Vacca Farm (Farmed Wetland, Other Wetlands, Lora Lake)	**5.70**	**2.85**
Wetlands in Miller Creek Wetland and Riparian Buffer	**10.25**	**5.12**
Tyee Valley Golf Course	**4.50**	**2.25**
Wetland in Des Moines Creek Buffer	**1.01**	**0.51**
Subtotal	**22.32**	**11.16**
Buffer Enhancement- **Credit ratio 1:5**		
Miller Creek Buffer, South of Vacca Farm	**40.86**	**8.17**
Vacca Farm	**4.58**	**0.92**
Lora Lake	**1.81**	**0.36**
Tyee Valley Golf Course Mitigation Area Buffer	**1.57**	**0.31**
West Branch Des Moines Creek Buffer	**3.38**	**0.68**
Des Moines Way Nursery	**2.73**	**0.55**
Subtotal	**54.93**	**10.99**
Preservation – **Credit Ratio 1:10**		
Borrow Area 3 Wetland	**2.35**	**0.24**
Borrow Area 3 Buffer	**21.20**	**2.10**
Subtotal	**23.55**	**2.34**
Total On-Site [a, b]	**112.75**	**36.44**
OFF-SITE		
Wetland Creation[b] - **Credit ratio 1:1**		
Forest (17.20 acres), shrub (6.0 acres), emergent (6.20 acres), and open water (0.60 acres)	**29.98**	**29.98**
Wetland Enhancement - **Credit ratio 1:2**	**19.50**	**9.75**
Buffer Enhancement - **Credit ratio 1:5**	**15.90**	**3.18**
Total Off-Site	**65.38**	**42.91**
TOTAL	**178.13**	**79.35**

[a] Mitigation credit has not been assigned for relocating a portion of Miller Creek channel, instream enhancement projects, drainage channel replacement, or a $300,000 trust fund for watershed restoration.

[b] Based on maps of hydric soils, mitigation can be also characterized as restoration.

AR 016552

K

ATTACHMENT K

Summary of compensatory mitigation (on and off site) for watershed, wetland, and stream impacts at Seattle-Tacoma International Airport.

Impact	Mitigation Action	Target Functions to Replace	Explanation and Key Attributes that Provide Target Functions[a]
ON-SITE MITIGATION			
Permanent Impacts			
Approximately 980 linear ft of Miller Creek channel will be filled to accommodate third runway embankment and South 154th Street relocation.	Relocate approximately 1,080 ft of Miller Creek channel. Enhance 450 ft of Miller Creek channel at Des Moines Way Nursery.	Fish and aquatic habitat Amphibian habitat Organic matter export	The channel design includes instream habitat features, including improved substrate conditions, LWD, channel diversity, and increased channel length. A buffer around the new channel will be vegetated with native trees and shrubs to provide shade and organic matter inputs to the stream.
Drainage channels will be filled near 12th Avenue South to accommodate the third runway embankment.	Create new permanent drainage channels.	Organic matter export functions Groundwater exchange functions	Approximately 1,290 ft of new permanent drainage channels will provide ecological functions by planting the channel margins with native vegetation to provide buffer functions. Functions include shade to control water temperatures and provide organic matter input. The channels will be designed to connect to the embankment drainage layer material to promote groundwater discharge. Connection to wetlands and Miller Creek will promote organic matter transport and export to the creek.
Approximately 8,500 cy of Miller Creek floodplain will be filled to accommodate third runway embankment and South 154th Street relocation.	Replace lost floodplain.	Flood storage	Approximately 9,600 cubic yards of soil will be excavated to suitable elevations that achieve storage of 5.94 acre-ft of floodwaters. Suitable grades and elevations will allow overbank and backwater flooding to occur in this floodplain.

AR 016554

Summary of compensatory mitigation (on- and off-site) for watershed, wetland, and stream impacts at Seattle-Tacoma International Airport (continued).

Impact	Mitigation Action	Target Functions to Replace	Explanation and Key Attributes that Provide Target Functions[a]
Approximately 18.37 acres of wetland will be filled during construction of the third runway embankment and other construction-related projects.	Restore about 12.3 acres of prior converted cropland, farmed wetland, or other wetland on the Vacca Farm site to shrub-dominated wetlands (including removal of 1 acre of fill west of Lora Lake).	Nutrient and sediment trapping functions Organic matter export Groundwater exchange Small mammal habitat Reduced waterfowl habitat	Plowed farmland will be stabilized with dense shrub and herbaceous plantings. Overbank and backwater flooding will occur to promote organic matter export. Subsurface drainage systems will be removed to promote natural groundwater discharge and flow patterns. Hummocks vegetated with dense native vegetation in wetlands and buffers will be provided as habitat for small mammals. This attribute will be augmented with LWD in wetlands and buffers. Large areas of emergent vegetation, open water, or long-term flooding that could promote waterfowl use will be avoided.
	Restore about 2.8 acres of the Des Moines Way Nursery site to shrub dominated wetlands (Including removal of 2 acres of fill).		
	Restore wetland buffer conditions (1.81 acre) around the north and west sides of Lora Lake.	Fish, amphibian, and aquatic habitat Organic matter export Reduce wildlife attractants	Converting lawn areas to riparian buffer communities will be established by planting with native wetland and upland shrub vegetation (refer to Table 5.1-1 in Section 5). Overhanging dense shrub vegetation will improve aquatic habitat, reduce waterfowl use of shoreline areas, and promote export of organic matter from shoreline to aquatic habitats. Removal of a concrete bulkhead along the Lora Lake shoreline will improve shoreline habitat for amphibians, fish, and aquatic insects.
	Enhance approximately 10.25 acres of wetlands along Miller Creek	Nutrient and sediment trapping Small mammal habitat	Removing structures and restoring native wetland vegetation (Table 4.1-3) will enhance riparian and other wetlands. Areas of non-native vegetation will be removed and native trees and shrubs planted in the wetland.

AR 016555

Summary of compensatory mitigation (on- and off-site) for watershed, wetland, and stream impacts at Seattle-Tacoma International Airport (continued).

Impact	Mitigation Action	Target Functions to Replace	Explanation and Key Attributes that Provide Target Functions[a]
	Restore wetlands on the Tyee Valley Golf Course.	Nutrient and sediment trapping Organic matter export Reduce waterfowl habitat Small mammal habitat	Dense native shrub vegetation will be planted in Des Moines Creek floodplain and riparian areas (see Table 4.1-3). The wetland and riparian vegetation will promote increased export of organic matter to Des Moines Creek compared to the existing turf vegetation.[b] Shrub communities will reduce waterfowl use and improve habitat for small mammals.
Temporary Impacts			
Construction of temporary stormwater management ponds and other projects may temporarily impact up to 2.05 acres of wetland.	Restore forest and shrub communities to Wetland A17. Restore approximately 125 ft of Water D. Restore wetland areas after construction is complete.	Nutrient and sediment trapping Organic matter export Groundwater exchange Small mammal habitat	Restoration of wetlands that will be temporarily filled or disturbed will restore functions that previously existed on these sites. Restoration will include establishing pre-disturbance topography, removing three culverts in Water D, and planting the area with native shrub or forest vegetation. Integration of these areas with the replacement drainage channel mitigation and the embankment drainage layer will promote restoration of pre-existing hydrologic and water quality functions.
Indirect and Cumulative Impacts			
Filled wetlands near Miller Creek will reduce aquatic habitat value of the stream.	Establish and enhance buffers along Miller Creek.	Nutrient and sediment trapping Organic matter export Small mammal habitat	Conversion of residential landuses to vegetated stream buffers will promote nutrient and sediment trapping functions and reduce pollutant loading. Greater densities of riparian vegetation will increase shade, instream habitat, and organic matter export to Miller Creek. Riparian buffer vegetation will contribute to bank stabilization, sediment, and nutrient removal. It will also provide small mammal habitat (see Table 4.1-3).

AR 016556

Summary of compensatory mitigation (on- and off-site) for watershed, wetland, and stream impacts at Seattle-Tacoma International Airport (continued).

Impact	Mitigation Action	Target Functions to Replace	Explanation and Key Attributes that Provide Target Functions[a]
Additional development in the watersheds could result in additional cumulative impacts.	Participate in developing and implementing Miller Creek and Des Moines Creek basin plans.	Aquatic habitat Stream and/or watershed hydrology	These planning processes will identify effective, long-term solutions to restore additional fish habitat functions to Miller and Des Moines Creeks. Projects are anticipated to focus on restoring watershed hydrology through increased regional stormwater detention facilities and improved fish habitat through habitat restoration projects. The Port will contribute staffing resources and funds to support these efforts. The Port will work with other cooperating jurisdictions to plan and implement appropriate watershed restoration projects.
	Provide trust fund to watershed restoration projects.	Cumulative impacts to aquatic habitat	The Port will establish a trust fund to help promote aquatic habitat and other watershed restoration actions.
The runway fill or borrow area excavation may eliminate water sources that contribute to remaining wetlands downslope of the runway.	Design internal drainage and conveyance channels to promote and retain wetland hydrology and streamflow. Monitor wetlands adjacent to the third runway embankment and borrow areas to ensure wetland hydrology is maintained.	Groundwater exchange Organic matter export	Subsurface and surface replacement channels will continue to collect and distribute groundwater currently surfacing near 12th Avenue South to Miller Creek and associated wetlands. Surface drainage patterns and conveyance swales will be designed to collect and distribute groundwater seepage and surface runoff to wetlands downslope of the borrow areas.
OFF-SITE MITIGATION			
Permanent Impacts			
Approximately 18.37 acres of wetland wildlife (avian) habitat will be lost.	Replace high quality wetland and avian habitat functions off-site at an overall ratio of 2:1.	Passerine bird habitat Waterfowl habitat Small mammal habitat Flood storage	A variety of wetland classes and vegetation types on a large protected site will provide high quality habitat for a diverse array of birds and small mammals. Open water habitat (including vegetated aquatic beds) will support waterfowl and other bird species that require small ponds for forage or nesting.

AR 016557

Summary of compensatory mitigation (on- and off-site) for watershed, wetland, and stream impacts at Seattle-Tacoma International Airport (continued).

Impact	Mitigation Action	Target Functions to Replace	Explanation and Key Attributes that Provide Target Functions[a]
			Waterfowl and other marsh birds will use flooded persistent and non-persistent emergent plant communities for forage and nesting. These communities will produce organic matter and aquatic insects that provide forage in open water areas.
			Shrub wetland will fringe marsh communities and provide nesting and forage habitat for songbirds as well as export organic matter to emergent areas.
			Multi-storied forest communities will provide habitat to songbirds, raptors, and small mammals.
			A densely vegetated 100-ft-wide buffer will provide additional upland habitats and protect interior upland and wetland habitats from potential disturbances if off-site areas are developed.
			Microhabitat features-including LWD, vegetated hummocks, interspersion of vegetation types, and proximity to the Green River riparian corridor-will further enhance the area for wildlife.
			Excavation of portions of the site below an elevation of 45 ft and connection to the floodplain of the Green River by enhancing existing drainage channels will provide flood-storage functions.

a Analyses of the ecological functions provided at each wetland mitigation site are found in Tables 4-13 to 4-16 in the *Wetland Functional Assessment and Impact Analysis* (Parametrix 2001b). All mitigation areas (including, but not limited to, streams, wetlands, buffers, and floodplains) located within 10,000 ft of a runway shall be subject to the provisions of the Port's *Wildlife Hazard Management Plan* (USDA 2000) for the management of wildlife and wildlife attractant areas. On-site mitigation may provide replacement habitat functions for birds, but credit is not sought for this function, as management of birds pursuant to the WHMP may restrict this function.

b These enhancements will be coordinated with the Des Moines Creek Basin Committee's proposed RDF.

L

ATTACHMENT L

Aquatic Resources Restoration Plan

Mill Creek Basin, King County Washington

MILL CREEK BASIN, KING COUNTY, WASHINGTON

AQUATIC RESOURCES RESTORATION PLAN

DRAFT

JUNE 1997

<u>SPONSORS:</u>

CITY OF AUBURN

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KING COUNTY

U.S. ENVIRONMENTAL PROTECTION AGENCY

U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT

also consulted. Recommendations were developed in two formats: one, site-specific recommendations summarized in Chapter 4; second, a description of typical restoration measures/techniques summarized in the last section of this chapter and in the Mill Creek Flood Control Plan, Phase II.

3.2 THE RESTORATION PLAN

3.2.1 Overview

The SAMP area (both the valley, and western plateau and hillside), contains a total of about 2,400 acres of wetlands and uplands that can potentially be restored or preserved. This figure does not include the hillside greenbelt or large blocks of upland forest in the western plateau area. Roughly 1,200 acres out of the 2,400 acres are not practicably restorable either because restoration is generally restricted by the King County Farmland Preservation Program or because existing wetlands already function at a high level and could not be further restored. About 1,200 acres of wetland are practicably restorable of which about 1,000 acres have a high or medium restoration potential. In addition, about 114 acres of former wetlands, now converted to uplands, have a medium or high restoration potential. **Figures 3-3 and 3-4** show the minimum and maximum extent restoration plans. **Table 3-1** shows the acres of restored and preserved wetland by cover type associated with each. **Table 2-1** shows restored-condition IVA scores for wetlands and uplands with medium and high restoration potential compared to current-condition IVA scores.

Table 3-1 Restoration Acreage by Proposed Cover Type

Cover Type	Action	Minimum	Maximum[6]	
Forested/Scrub Shrub Wetland	Restore	300	800	
	Preserve	200	200	
Emergent/Open Water Wetland	Restore	50	500	
	Preserve[7]	900	900	
Greenbelt	Preserve	300	300	

[6] Includes 113 acres of wetlands.
[7] Includes lands in floodway, Farmlands Preservation Program, existing compensatory wetland mitigation sites.

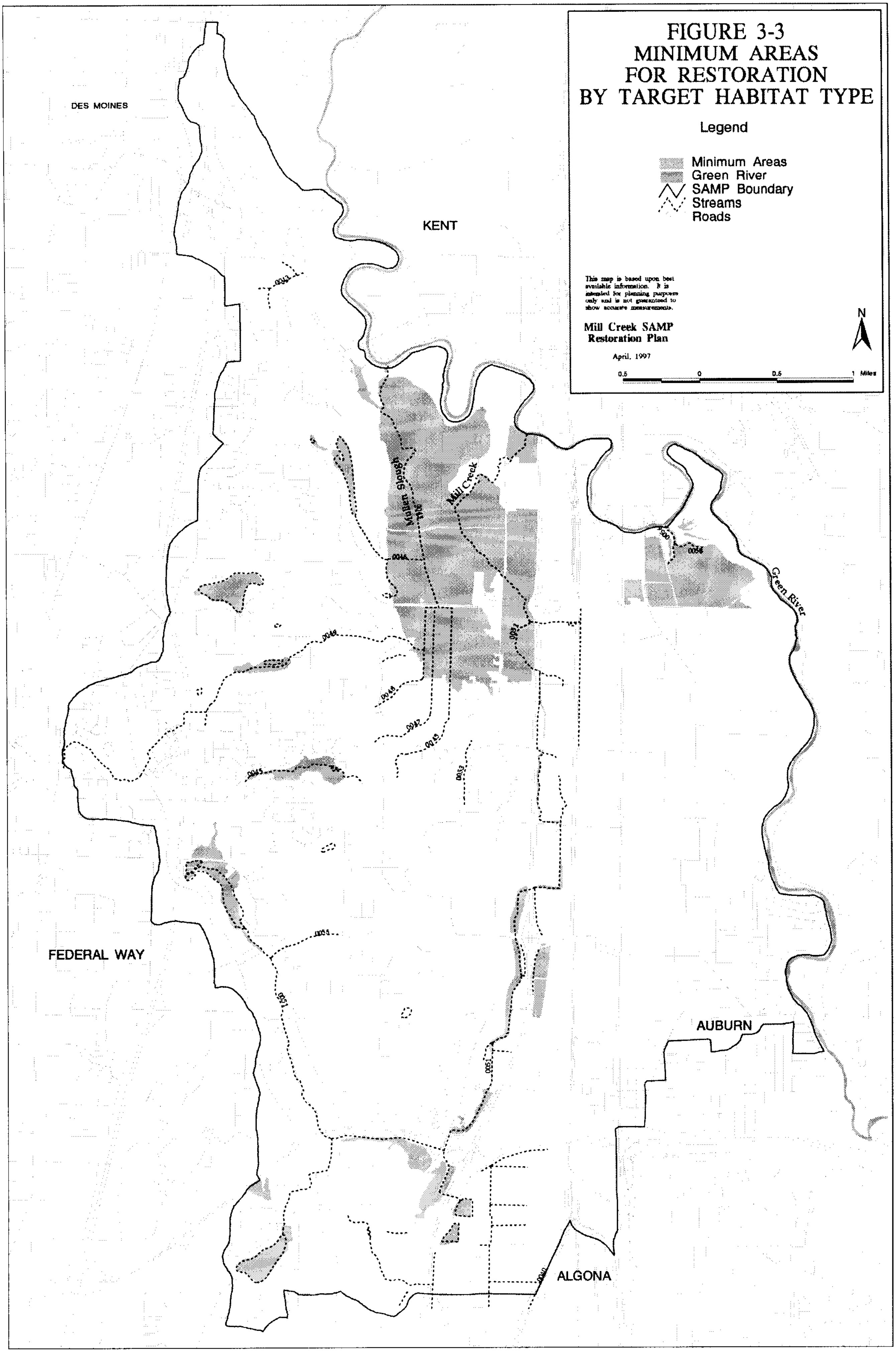

FIGURE 3-3
MINIMUM AREAS
FOR RESTORATION
BY TARGET HABITAT TYPE

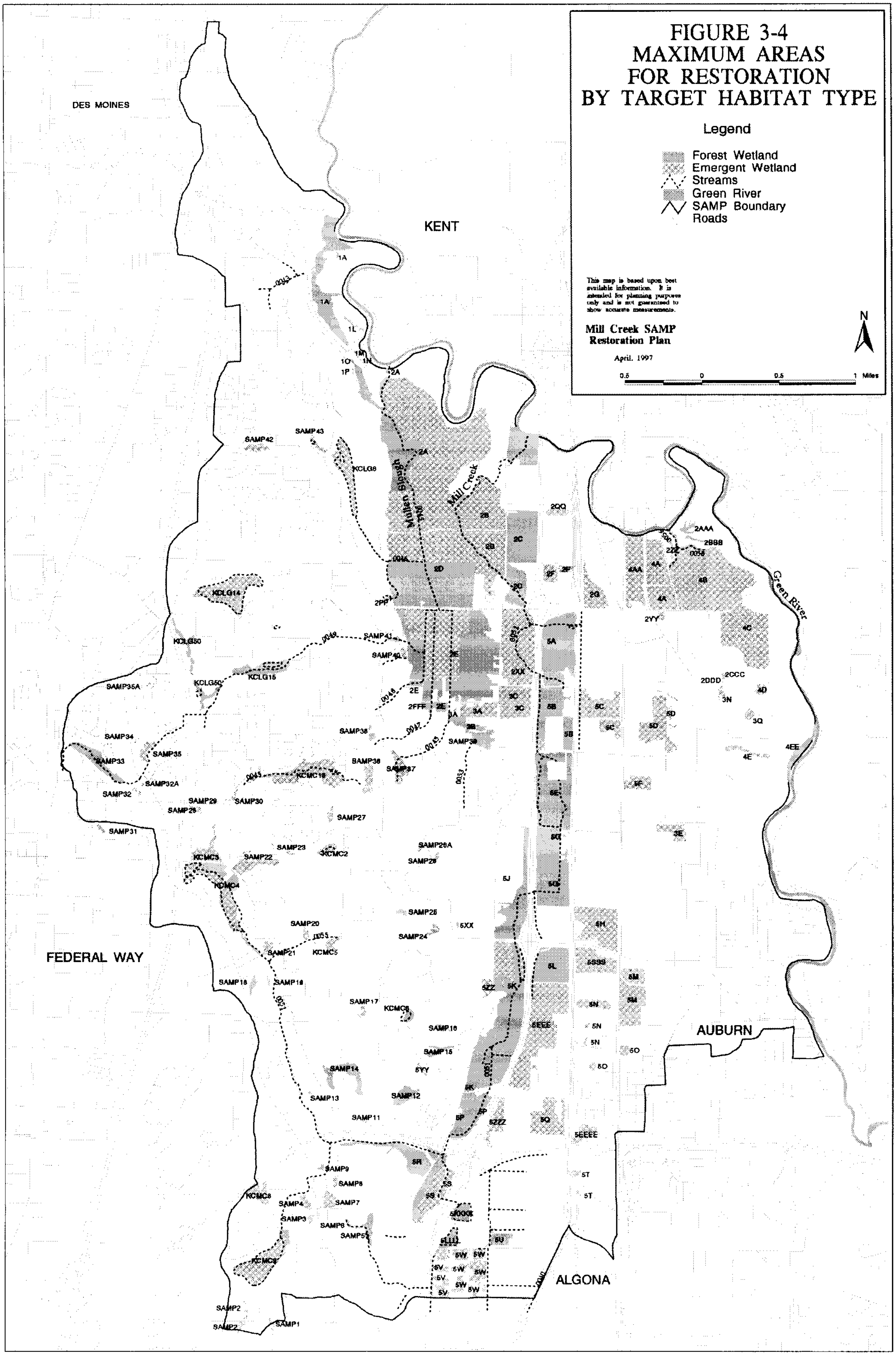

FIGURE 3-4
MAXIMUM AREAS
FOR RESTORATION
BY TARGET HABITAT TYPE

AR 016564

M

ATTACHMENT M

Wetland acreage impacts and mitigation by wetland function.

Function	Impact[b]	On-Site[a] Acres	On-Site[a] Credit	Auburn Acres	Auburn Credit	Comment
Resident/ Anadromous Fish	8.6	74.60	30.42	-	-	On-site mitigation includes mitigation for direct impacts to Miller Creek and indirect impacts that may occur through alteration of riparian and hydrologically connected wetlands. For the Miller Creek enhancement areas, buffer averaging areas greater than 100-feet from Miller Creek were excluded from providing this function.
Passerine Birds	14.9	-	-	65.38	42.91	On-site mitigation credit is not sought for this function due to potential wildlife management actions.
Waterfowl	1.9	-	-	6.80	6.80	On-site mitigation credit is not sought for this function due to potential wildlife management actions.
Amphibians	9.8	87.05	31.95	65.38	42.91	The Lora Lake shoreline restoration, restoration at the nursery site, removing human uses, and establishing native plant communities provided by the on-site mitigation will provide habitat for several species.
Small Mammals	13.2	87.05	31.95	65.38	42.91	Wetland restoration and enhancement, eliminating human uses, and establishing native plant communities provided by the on-site mitigation will provide habitat for several species.
Exports Organic Matter	10.9	87.05	31.95	-	-	On-site mitigation includes increasing production and quality of organic matter in wetlands and riparian areas through restoration and enhancement. Maintenance actions that remove organic matter from wetlands, streams, and buffers will also be removed.
Ground Water Exchange	-	-	-	-	-	Impacts to this function, provided by slope and riparian wetlands (13.6 acres), are avoided by project design and by low flow augmentation.
Flood Storage	4.6	4.6	4.6	25	25	This function is mitigated on-site by new flood storage at Vacca Farm and by stormwater detention facilities that are designed to maintain or decrease peak stream flows during flood events.
Nutrient/Sediment Trapping	16.3	87.05	31.95	65.38	42.91	In basin mitigation for this function is provided by wetland restoration and enhancement and by the changes in land use that convert pollution generating land uses in mitigation areas to native vegetation. The retrofitting of existing pollution generating surfaces with BMPs for water quality treatment also improve water quality of runoff.

[a] Preservation of wetland and buffer near Borrow Area 3 is excluded from this table.

[b] Functional ratings for Wetlands that exceed low are included in these values.