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Appendix - Section 3

Critical Area Study

Burien Northeast Redevelopment Area

Critical Area Study

Submitted to:

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Burien Northeast Redevelopment Area Critical Area Study

Section 1—Introduction

Introduction

Otak was contracted by the City of Burien Department of Community Development to identify wetland and stream areas within the Northeast Redevelopment Area (NERA). In order to manage land uses within the NERA, the City of Burien is studying existing critical areas in this approximately 162-acre area. Otak delineated five wetlands and identified a perennial stream (West Fork of Miller Creek) within the NERA. Identification of these critical areas will guide land use decisions as this predominantly residential area is converted to commercial and industrial uses (Burien 2008a). This draft report describes the site conditions, wetland and stream characteristics, and wetland functions assessment for properties where access was granted. The report also briefly summarizes applicable regulations relating to wetlands and streams.

Site Location

The Northeast Redevelopment Area is located in the northeast corner of the City of Burien, King County, Washington (see Figure 1). This approximately 162-acre area is bounded by 8th Avenue South on the west, Des Moines Memorial Drive on the east, SR 518 on the south, and South 138th Street on the north. The NERA is located in Sections 17 and 20, Township 23 North, Range 4 East. The West Fork of Miller Creek (Water Resource Inventory Area [WRIA] # 09-0376) bisects the NERA area flowing from northwest to southeast (Williams et al. 1975).

Proposed Action

The proposed action involves changing Comprehensive Plan designations and Zoning Code classifications in all or a portion of the NERA, as well as modifying and expanding the existing Comprehensive Plan language (Edaw 2002). The existing residential, commercial, and industrial Comprehensive Plan designations and zones would be changed to a new designation and zone (Special Planning Area 4), with three subareas that would allow for a mixture of office, commercial, industrial, and airport-compatible uses in a business park setting. Existing Comprehensive Plan language would change and a new Comprehensive Plan section for Special Planning Area 4 would be created. This assumes that the Port of Seattle may purchase and remove residences lying within the Approach Transition Zone and Runway Protection Zone associated with the third runway at SeaTac airport. The conversion of these residential neighborhoods within the flight path to a business park land use may affect critical areas within the NERA.

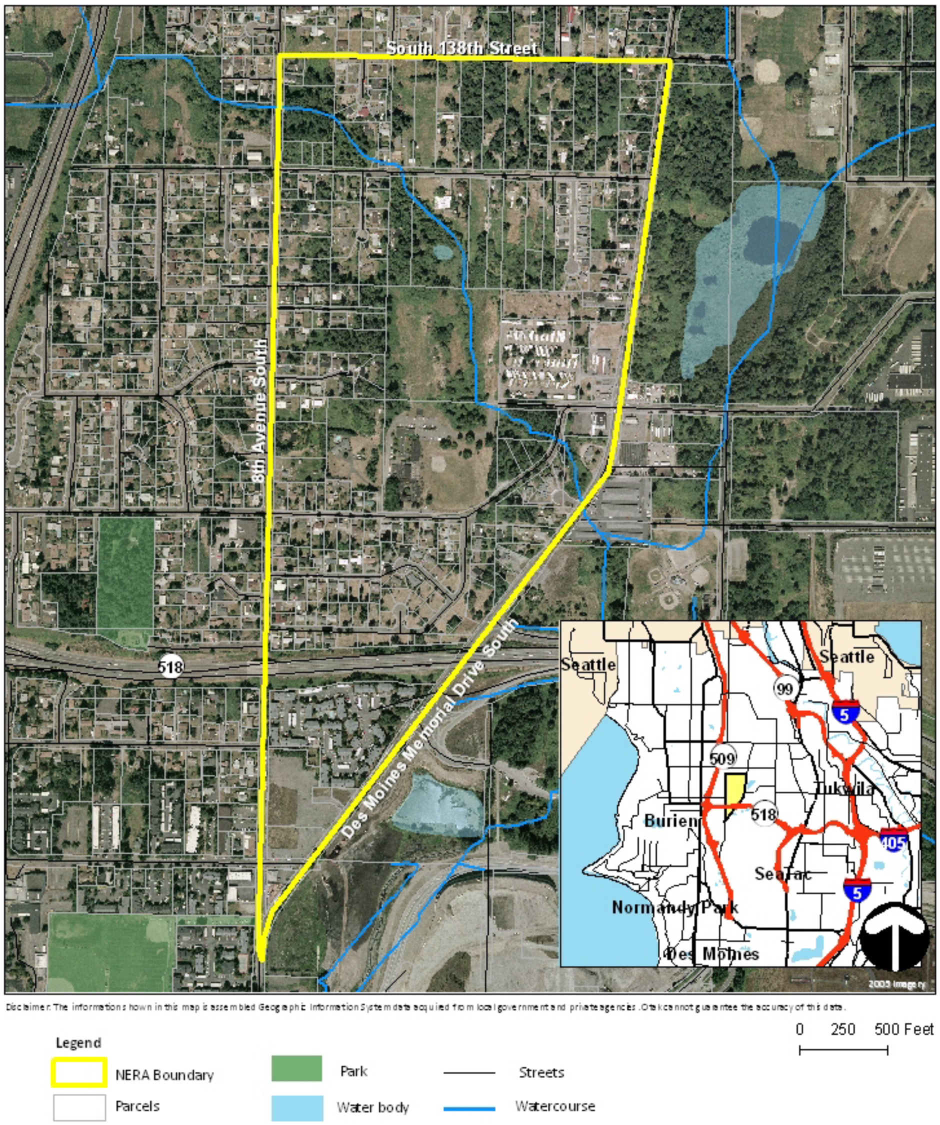

Figure 1—Vicinity map of Burien NERA in Burien, Washington.

Section 2—Methods

Review of Existing Information

Several existing documents were reviewed to gain specific background information on the NERA site. These include aerial photographs, reports, and maps of the site. In addition to the references listed at the end of this report, other information sources and documents reviewed for the preparation of this report included:

- Burien Municipal Code
- Burien Critical Area Map
- King County Soil Survey Map
- National Wetland Inventory (NWI) Map
- King County Sensitive Area Map

OHWM Flagging

The ordinary high water mark (OHWM) of the West Fork of Miller Creek within the NERA was flagged in order to define the stream banks (Olson and Stockdale 2008). This OHWM boundary was surveyed to support any shoreline substantial development permits issued by the City of Burien and Hydraulic Project Approval permits issued by the Washington Department of Fish and Wildlife. The method used to determine the OHWM is based on the RCW 90.58.030(2) (b) definition as follows:

> *"Ordinary high water mark on all lakes, streams, and tidal water is that mark that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation as that condition exists on June 1, 1971, as it may naturally change thereafter, or as it may change thereafter in accordance with permits issued by a local government or the department: provided, that in any area where the ordinary high water mark cannot be found, the ordinary high water mark adjoining salt water shall be the line of mean higher high tide and the ordinary high water mark adjoining fresh water shall be the line of mean high water."*

Otak wetland ecologist, Doug Gresham, flagged the OHWM of the West Fork of Miller Creek on July 17 and August 12, 2008 for the properties where access was granted. This involved hanging sequentially numbered orange flags along both banks where there was evidence of scouring, a change in vegetation, drift lines, and sediment deposits.

Wetland Delineation Method

Otak wetland ecologist, Doug Gresham conducted the wetland delineations on July 23, 25, and 29, and August 18 and 20, 2008 for the properties where access was granted. This involved hanging sequentially numbered pink/black striped flags along the wetland boundary. The wetland delineation followed the Routine Methodology as specified in the *Washington State Wetlands Identification and Delineation Manual* (Washington Department of Ecology 1997). I also relied on methods specified in the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (COE 2008). All of these manuals define wetlands as follows:

> *"Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."*

In determining whether an area meets this definition, both methodologies require examination of three parameters: vegetation, soils, and hydrology. For an area to be classified as wetland, hydrophytic vegetation, hydric soils, and wetland hydrology must be exhibited. During the site visit, the property was walked to gain an overview of site conditions. Following routine methodology, data on vegetation, soils, and hydrology were collected in areas that appeared to have wetland characteristics. These three parameters, and the methods used to assess them, are discussed in the following sections.

Vegetation

Hydrophytic vegetation consists of those plant species that readily grow in water, soil or other substrates, which at least periodically lack oxygen in the root zone due to saturation or inundation. The hydrophytic vegetation criterion is met when more than 50 percent of the dominant species are hydrophytic, based on the wetland plant species indicator status from the Region 9 section of the National List of Plant Species Occurring in Wetlands (Reed 1988; Reed et al., 1993). The plant list separates vascular plants into five basic groups by their wetland indicator status (WIS), which is based on the frequency of occurrence of each species in a wetland. The indicator status rating system is summarized in Table 1.

Table 1 Wetland Plant Indicator Status	
Indicator Status	**Definition**
Obligate Wetland Plants (OBL)	Plants that almost always occur in wetlands under natural conditions - estimated probability of species occurring in wetlands is greater than 99% under natural conditions.
Facultative Wetland Plants (FACW)	Plants that usually occur in wetlands - estimated probability 67%-99%.
Facultative Plants (FAC)	Plants that are equally likely to occur in wetlands or non-wetlands: estimated probability of 34% – 66% to be found in wetlands.
Facultative Upland Plants (FACU)	Plants that usually occur in non-wetlands: estimated probability of 1% - 33% to be found in wetlands.
Obligate Upland (UPL)	Plants that almost always occur in non-wetlands - estimated probability of occurring in wetlands is <1%.

Plant species were identified using several standard taxonomic references (Cooke 1997; Guard 1995; Hitchcock & Cronquist 1973; Polar & MacKinnon 1994). Dominant plant species were determined by the 50/20 rule as defined in the *Washington State Wetlands Identification and Delineation Manual* (Washington State Department of Ecology 1997):

> "*Dominant plants species are those species in each stratum [tree, shrub, vine, herb] that when ranked in descending order of abundance [percent aerial coverage] and cumulatively totaled, immediately exceed 50 percent of the total dominance measure for that stratum, plus any additional plant species comprising 20 percent or more of the total dominance measure for that stratum.*"

Other indicators of hydrophytic vegetation include (in decreasing order of reliability): visual observation of plant species growing in areas of prolonged inundation and/or soil saturation; morphological adaptations to wetland conditions; technical literature references; and physiological and reproductive adaptations to wetland conditions (Washington State Department of Ecology 1997).

Plants live in relatively homogeneous and predictable species assemblages called communities. Plant communities on the site were identified according to a classification system developed by the U.S. Fish and Wildlife Service (Cowardin, et al. 1979). The Cowardin Community Classification System is based on vegetation, hydrology, and substrate (soil) characteristics.

For each data plot, plant species were recorded and their percent aerial coverage was estimated, then the percent aerial coverage was used to determine the dominant species. Vegetation was also sampled at regular intervals along, within, and outside the wetland boundaries for delineation purposes.

Soils

The presence of hydric soils is the second parameter required for wetland determination. Hydric soil is defined as *"... a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part"* (Washington State Department of Ecology 1997). The anaerobic conditions that result from biotic activity in soils saturated for longer than two weeks (generally) cause specific, recognizable changes to the soil. Prolonged anaerobic conditions result in a chemical environment where some soil components, such as iron and manganese, become reduced. Reduction of these minerals results in field indicators in the soil such as redoximorphic features and gleying.

Redoximorphic features are spots or blotches of color occurring within the soil matrix of a contrasting color. Redoximorphic features usually result from alternating anaerobic and aerobic soil conditions. Biotic activity in the saturated soils causes the iron and manganese to become reduced; drying of the soils creates aerobic conditions which lead to the oxidation of the minerals. Movement of the reduced minerals into concentrated zones in the matrix causes the accumulation of colors (redox features) and leaches the surrounding soils of the trace minerals, causing zones of depletion, where the soils are depleted of color. Gleying occurs under long term anaerobic conditions; it is the result of leaching of the reduced iron from the soils leaving the matrix completely depleted of color. Gleyed soils are predominantly neutral gray in color, although they are sometimes greenish or blue-gray.

Soil colors (hue, value, and chroma) were determined using Munsell Soil Color Charts (Gretag Macbeth 2000). Munsell colors are recorded as hue value/chroma (*e.g.* 10YR 4/1). Hydric soil indicators include: organic soils, gleyed soils; soils with redoximorphic features and a matrix chroma of 2 or less; and soils with a matrix chroma of 1 (Washington State Department of Ecology 1997).

Soils were sampled in each data plot to a depth of 16 to 20 inches. The soil was characterized and examined for hydric indicators immediately below the A-horizon or at ten inches, which ever was shallower (Washington State Department of Ecology 1997).

Hydrology

Wetland hydrology, or the presence of water, is the third parameter required for wetland determination (Washington State Department of Ecology 1997). Although direct observations of hydrology are often limited during the dry season, indicators may be present throughout the year. Indicators for wetland hydrology include recorded data, and field data such as: visual observation of inundation or saturation; watermarks; drift lines; sediment deposits; and drainage patterns. Guidelines for duration of inundation and/or soil saturation are based on the growing season.

Growing season is defined (Environmental Laboratory 1987) as, "the portion of the year when soil temperatures at 19.7 inches below the soil surface are higher than biologic zero (5^{o}C). For ease of determination this period can be approximated by the number of frost-free days. For the Pacific Northwest, inundation or saturation to the surface for at least 12.5% of the growing season is the criteria used to establish wetland hydrology, although areas with shorter periods of surface saturation may also qualify as wetland. Based on the typical growing season for the lowlands of King County, the project area should have at least 21 days of continuous inundation or saturation within 12 inches of the surface during the growing season to meet the criteria for wetland hydrology.

Observations of hydrology indicators were made in and around the soil pit of each plot. The level of inundation above the soil surface, or the depth to saturation below the soil surface was recorded. Other visual indicators of hydrology such as sediment deposits, water-stained leaves, and oxidized root channels (rhizospheres) were noted. Hydrology indicators were also examined at regular intervals along, within, and outside the wetland boundaries for delineation purposes.

Wetland Rating and Functions Assessment

Wetlands perform various functions such as purifying water, minimizing shoreline erosion, controlling flood and storm water, exchanging groundwater, providing wildlife and plant habitat, providing food chain support and nutrient cycling, and offering opportunities for education and recreation (Hruby et al. 1999).

The wetland and buffer functions were assessed using the methodology and rating form from the *Washington State Wetland Rating System for Western Washington* (Hruby 2004). The methodology is based on *Methods for Assessing Wetlands Functions. Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington, Parts 1 and 2* (Hruby et al. 1999).

The methodology relies on indicators of functions to assess potential performance and the opportunity to perform the function, rather than direct measurements of functions. Indicators are characteristics of the wetland or its surrounding area that can be correlated to a specific function. For example, rather than trying to sample aquatic mammals directly, the presence of steep banks in the wetland can be used as an indicator of the suitability of the wetland habitat for aquatic mammals. The rating system assesses both the potential and opportunity to perform three general categories of functions: Water Quality, Hydrology, and Habitat. Using guidance from Washington State Department of Ecology (2008), numeric values from the rating forms were assigned qualitative function values of high, moderate, and low.

Water Quality Functions

Sediment Removal: Wetlands can improve water quality by filtering out sediments. This can occur by adhesion of the sediment to vegetation, and by settling which happens when water velocity is decreased. The potential of a wetland to remove sediment is based on a number of factors, including the residence time of the water, and the type and density of vegetation.

Nutrient and Toxicant Removal: Wetlands can also improve water quality by filtering out excess nutrients and toxic chemicals. This can occur through adhesion to clay particles and organic soil components, as well as by uptake and filtration by the vegetation. The capacity of a wetland to purify water is based on a number of factors, including the residence time of the water, presence of clay or organic soils, and the type and density of vegetation.

The opportunity for water quality improvement is based on sediment or pollutants entering the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. Sources for sediment and pollutants include untreated storm water, grazing, agricultural activities, development, etc.

Hydrologic Functions

Flood Flow Alteration: Wetlands can play an important role in flood reduction because of their ability to slow and store flood waters. During high rainfall events, water can be stored in wetlands and released slowly over time, thereby reducing the volume of water downstream during the time of peak flooding. This function is especially important in urbanizing areas. The ability of a particular wetland to reduce flooding is dependent on a number of factors, including the wetland's position in the watershed, its size, shape, outlet configuration, and association with other aquatic systems.

Erosion Control and Shoreline Stabilization: Vegetation in wetlands serves to anchor soil and filter out sediments that are suspended by water. Riparian or lakeshore wetlands where there is water flow or wave action sufficient to suspend and transport sediments are important in stabilizing banks and preventing erosion. The ability of a wetland to reduce erosion is primarily dependent on the characteristics of the vegetation, with dense woody vegetation being the most effective. This function is not significant in low flow areas such as depressional wetlands.

The opportunity for a wetland to perform these functions is dependent on many factors including: position in the landscape, whether the wetland drains to a river or stream that has flooding problems, and whether there are human structures and activities or natural resources located downstream that can be damaged by flooding.

Habitat Functions

Habitat Functions Assessment: Takes into consideration the potential for the wetland to provide different habitat niches by assessing: different water regimes required by different species (amphibians, macroinvertebrates, etc.); plant species richness; the degree of interspersion of habitats; special habitat features such as large woody debris, snags, undercut banks for denning, thin-stemmed vegetation for amphibian eggs, etc.; existing condition of buffers; connectivity of the wetland to other wetlands and priority habitats such as mature forests, urban natural open spaces, estuaries, etc.; and position in the watershed.

Section 3—Findings

General Site Characteristics

The NERA is a roughly trapezoidal area located in the northeast corner of Burien. Major roadways in the area include State Route (SR) 509 to the west, SR 518 in the southwest corner, and Des Moines Memorial Drive along the eastern edge. This area contains a mixture of single-family residential properties, commercial businesses, schools, and an airport parking lot. The eastern edge of the NERA lies within the flight path for the third runway at SeaTac airport, which is oriented from north to south. Several vacant properties exist due to conversion of this area from residential to commercial uses.

The NERA project area consists of rolling terrain with ridges and valleys that are roughly oriented from northwest to southeast. The West Fork of Miller Creek bisects the area flowing from 8^{th} Avenue South to Des Moines Memorial Drive. The elevations range from 295 to 425 feet above mean sea level. The King County soil survey map indicates that Alderwood gravelly sandy loam and Everett gravelly sandy loam cover the NERA project area (USDA 1952). The Alderwood soil is mapped in the northwest and southwest portions, while the Everett soil is shown in the northeast and southeast portions of the NERA. Both soil series are non-hydric (USDA 2008) and consist of somewhat excessively drained soils that formed in very gravelly glacial outwash deposits along terraces.

The National Wetland Inventory map prepared by the U.S. Fish and Wildlife Service (USFWS 2008) does not identify any wetlands within the NERA. Both the City of Burien critical areas map (Burien 2008b) and King County sensitive areas map (King County 2008) identifies a wetland associated with the West Fork of Miller Creek near S 140^{th} Street.

Figure 2 illustrates the location of the West Fork of Miller Creek and its associated wetlands, as well as buffer widths within the NERA. Photographs of the West Fork of Miller Creek and wetlands in the NERA project area are included in Appendix A. Sheets 1 through 3 in Appendix B illustrate the location of the West Fork of Miller Creek and wetlands within the NERA.

West Fork of Miller Creek

The West Fork of Miller Creek originates northwest of the NERA project area in a Category 3 wetland identified on the City of Burien critical areas map (Burien 2008b). The West Fork of Miller Creek is culverted between this headwater wetland and 8^{th} Avenue South where it enters the NERA. The West Fork of Miller Creek within the NERA alternates between open channels, culverts, and concrete-lined ditches. Downstream of the NERA, this tributary flows southeast and combines with the mainstem of Miller Creek flowing out of Tub Lake.

Figure 2. Location of critical areas within the NERA project area.

The West Fork of Miller Creek within the NERA contains eight reaches that alternate between areas with an incised channel, broad floodplain, armored banks, and culverts. Listed below is a description of each reach that proceeds downstream from 8th Avenue South to Des Moines Memorial Drive.

- The first reach between the culvert outlet at 8th Avenue South and several homes along South 140th Street, flows within a forested tract of open space. The stream has an incised channel with steep unstable banks due to erosion during storm events. There are also areas where the banks are armored with riprap and there is no floodplain bench. The riparian zone consists of an upland deciduous forest of both native and invasive species.
- The second reach is located in the front yards of three homes on the north side of South 140th Street. The stream alternates between open ditches, culverts underneath driveways, and a concrete-lined sluiceway. The only vegetation along the stream banks consists of ornamental shrubs and lawn grass that is regularly mowed.
- The third reach is located between South 140th Street and the dog kennel property within a forested tract of open space. Although access was not granted for this property, it appears that there is an incised channel and the riparian zone consists of an upland deciduous forest of both native and invasive species.
- The fourth reach on the dog kennel property is divided into three segments that include an incised channel, depositional area, and artificially straightened channel. At the upstream end, there is an incised channel with steep unstable banks with some riprap armoring. The middle section contains sediment deposits at the transition between the upper and lower segments. The lower end has been artificially straightened with a backhoe so the channel is narrow and deep and the banks are unstable. The vegetation mainly consists of a deciduous tree canopy with grasses because livestock grazing has eliminated a shrub understory.
- The fifth reach on the Ajax Parking property flows through a large wetland complex where the channel loses definition. There is a broad floodplain and the stream braids around clumps of wetland vegetation. The riparian zone consists of palustrine forested, scrub/shrub, and emergent wetland vegetation.
- The sixth reach between the bridge to the Ajax parking lot and South 144th Street is highly disturbed. The channel has been artificially straightened with a backhoe so the channel is narrow and deep and the banks are unstable. The vegetation mainly consists of a deciduous tree canopy and invasive species.
- The seventh reach between South 144th Street and South 144th Way on Port of Seattle property has recently been restored. This restoration involved clearing invasive species in the understory of deciduous trees and supplemental planting of native wetland and buffer species. Although the stream banks are slightly incised, there are some floodplain benches and a meandering channel.

- The eighth reach between South 144th Way and Des Moines Memorial Drive contains an incised channel and some bank armoring. The stream has an incised channel with steep unstable banks, areas where the banks are armored with riprap, and minimal floodplain benches. The vegetation mainly consists of deciduous tree canopy and invasive species.

Upland Vegetation

The upland vegetation that surrounds the West Fork of Miller Creek includes a mixture of deciduous forest, dense thickets of non-native invasive species, and grass fields. Table 2 lists the plant species observed in upland and wetland areas within the NERA.

- The upland surrounding the West Fork of Miller Creek (Reach 1 and 3) on both the downstream and upstream sides of South 140th Street consists of deciduous forest with a mixture of native and invasive species. There is a tree canopy of red alder, black cottonwood, bigleaf maple, Douglas fir, and mountain ash. Some of the plants in the understory include indian plum, holly, cherry laurel, English ivy, and sword fern.
- The upland on the dog kennel property includes a forested slope in the southwest corner and livestock grazing areas surrounding the West Fork of Miller Creek (Reach 4). The plant community on the forested slope includes red alder, Himalayan blackberry, red elderberry, indian plum, and stinging nettle. The livestock grazing area lacks a shrub layer so there is mainly an overstory of red alder with upland grasses in the herbaceous layer.
- The upland surrounding the West Fork of Miller Creek (Reach 5) on the Ajax Parking property consists of red alder, Himalayan blackberry, Scot's broom, and upland grasses.
- A section of the West Fork of Miller Creek channel (Reach 7) on the Port of Seattle property between South 144th Way and South 144th Street has recently been restored. This involved clearing invasive species in the understory of deciduous trees and supplemental planting of native buffer species. This property has a tree canopy of black cottonwood and red alder, which has been planted with Sitka spruce, red cedar, Oregon ash, red-osier dogwood, and Nootka rose. The invasive species that are recolonizing this area includes Himalayan blackberry, holly, cherry laurel, common hawthorn, English ivy, morning glory, and Japanese knotweed.
- A section of the West Fork of Miller Creek channel (Reach 8) between South 144th Way and Des Moines Memorial Drive is incised and lacks riparian wetlands. The plant community in this area consists of Pacific willow, red alder, cherry laurel, Himalayan blackberry, and salmonberry.

Table 2 List of Plant Species Observed in the Burien NERA Site			
Stratum	Scientific Name	Common Name	WIS[a]
Tree	*Acer macrophyllum*	Big leaf maple	FACU
	Aesculus hippocastanum	Horse chestnut	NI
	Alnus rubra	Red alder	FAC
	Populus balsamifera	Black cottonwood	FAC
	Prunus emarginata	Bitter cherry	FACU
	Pseudotsuga menziesii	Douglas fir	FACU
	Salix lucida	Pacific willow	FACW+
	Sorbus aucuparia	Mountain ash	NI
	Thuja plicata	Western red cedar	FAC
Shrub	*Acer circinatum*	Vine maple	FAC-
	Alnus rubra	Red alder sapling	FAC
	Cornus sericea	Red-osier dogwood	FACW
	Corylus cornuta	Beaked hazelnut	FACU
	Crataegus monogyna	Common hawthorn	FAC
	Cytisus scoparius	Scotch broom	FACU
	Fraxinus latifolia	Oregon ash	FACW
	Ilex aquifolium	Holly	FACU
	Lonicera involucrata	Black twinberry	FAC+
	Mahonia nervosa	Oregon grape	FACU
	Oemleria cerasiformis	Indian plum	FACU
	Physocarpus capitatus	Pacific ninebark	FACW-
	Picea sitchensis	Sitka spruce	FAC
	Populus balsamifera	Black cottonwood sapling	FAC
	Prunus laurocerasus	Cherry laurel	NI
	Pseudotsuga menziesii	Douglas fir sapling	FACU
	Rosa nutkana	Nootka rose	FAC
	Rubus spectabilis	Salmonberry	FAC+
	Salix sitchensis	Sitka willow	FACW
	Sambucus racemosa	Red elderberry	FACU
	Spiraea douglasii	Hardhack	FACW

Table 2 List of Plant Species Observed in the Burien NERA Site			
Stratum	Scientific Name	Common Name	WIS[a]
Vine	*Hedera helix*	English ivy	NI
	Rubus armeniacus	Himalayan blackberry	FACU
	Rubus laciniatus	Evergreen blackberry	FACU+
	Rubus ursinus	Trailing blackberry	FACU
Herb	*Agrostis capillaris*	Colonial bentgrass	FAC
	Athyrium filix-femina	Lady fern	FAC
	Cirsium arvense	Canada thistle	FACU+
	Cirsium vulgare	Bull thistle	FACU
	Convolvulus arvensis	Morning glory	NI
	Dactylis glomerata	Orchardgrass	FACU
	Danthonia spicata	Oatgrass	NI
	Epilobium ciliatum	Watson willowherb	FACW-
	Equisetum arvense	Field horsetail	FAC
	Equisetum telmateia	Giant horsetail	FACW
	Festuca arundinacea	Tall fescue	FAC-
	Galium aparine	Bedstraw	FACU
	Glyceria elata	Tall mannagrass	FACW+
	Holcus lanatus	Common velvetgrass	FAC
	Hypochaeris radicata	Cat's ear	FACU
	Iris pseudacorus	Yellow flag iris	OBL
	Juncus effusus	Soft rush	FACW
	Lathyrus polyphyllus	Leafy peavine	NI
	Lolium perenne	Perennial ryegrass	FACU
	Lotus corniculatus	Birdsfoot trefoil	FAC
	Lycopus uniflorus	Bugleweed	OBL
	Lysichiton americanum	Skunk cabbage	OBL
	Maianthemum dilatatum	False lily-of-the-valley	FAC
	Myosotis laxa	Forget-me-not	OBL
	Phalaris arundinacea	Reed canarygrass	FACW
	Plantago lanceolata	English plantain	FAC
	Polygonum cuspidatum	Japanese knotweed	FACU

Table 2 List of Plant Species Observed in the Burien NERA Site			
Stratum	Scientific Name	Common Name	WIS[a]
Herb	*Polygonum hydropiper*	Waterpepper	OBL
	Polystichum munitum	Sword fern	FACU
	Potentilla palustris	Marsh cinquefoil	OBL
	Pteridium aquilinum	Bracken fern	FACU
	Ranunculus repens	Creeping buttercup	FACW
	Rumex acetosella	Sheep sorrel	FACU+
	Scirpus microcarpus	Small-fruited bulrush	OBL
	Solanum dulcamara	Bittersweet nightshade	FAC+
	Tolmiea menziesii	Piggy-back plant	FAC
	Trifolium pretense	Red clover	FACU
	Typha latifolia	Cattail	OBL
	Urtica dioica	Stinging nettle	FAC+
	Veronica americana	American brooklime	OBL
	Vicia sativa	Common vetch	UPL

[a] Wetland indicator status based on Reed (1988 and 1993) are defined as: obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), upland (UPL), and not indicated (NI).

Wetlands

A total of five wetlands (Wetlands A through E) were delineated within the Burien NERA (see Sheets 1 through 3 in Appendix B). These wetlands are associated and hydrologically connected to the West Fork of Miller Creek. Data for wetland and upland plots were recorded on field data sheets and copies are included in Appendix C. Table 3 summarizes the size and classification of Wetlands A through E.

Characteristics of Wetland A

Wetland A is a 0.55-acre riparian wetland associated with the West Fork of Miller Creek near 8th Avenue S. According to the Cowardin system (1979), Wetland A contains palustrine forested (PFO) and palustrine scrub/shrub (PSS) classes. Based on the hydrogeomorphic classification system (Brinson 1993), Wetland A is a riverine wetland.

Table 3 Wetland Classification Summary for Burien NERA				
Wetland	**Area (ft^2)**	**Area (acre)**	**Cowardin Class[1]**	**HGM Class[2]**
A	23,758	0.55	PFO/PSS	Riverine
B	21,733	0.50	PSS/PEM	Slope
C	144,857	3.33	PFO/PSS/PEM	Riverine
D	17,896	0.41	PSS/PEM	Riverine
E	5,256	0.12	PFO/PSS	Riverine

1 –Where PFO is palustrine forested, PSS is palustrine scrub/shrub, and PEM is palustrine emergent classes according to Cowardin et al. (1979).
2 –Hydrogeomorphic classes according to Brinson (1993).

Hydrology

Wetland A primarily receives water from a high groundwater table with occasional overbank flooding. The banks are armored with riprap or are incised so there was little evidence of flooding during the winter season. Indicators of wetland hydrology include flowing water in the West Fork of Miller Creek; and sediment deposits, drift lines, and scour marks in the floodplain fringe of the stream.

Soils

Two soil pits (SP-1 and SP-2) were examined in Wetland A to determine the boundary. Soil pit SP-1 was located on a floodplain bench next to the West Fork of Miller Creek and the soil was a dark (10YR 3/2) sandy silt with mottles starting at three inches. Soil pit SP-2 was located on an upland bench approximately 30 feet north of the West Fork of Miller Creek in an area that was recently cleared of invasive species. The soil in the B horizon (10YR 4/3) did not have any redox features and so did not meet the hydric soil criteria.

Vegetation

This forested area contains invasive and native plants in a mosaic of hydrophytic and upland species. There is tree canopy of black cottonwood and red alder, with native shrubs in the understory that includes salmonberry, hardhack, beaked hazelnut, Indian plum, and red elderberry. Wetland A has emergent vegetation dominated by reed canary grass, giant horsetail, creeping buttercup, and stinging nettle. Invasive species within the area include Himalayan blackberry, holly, cherry laurel, common hawthorn, English ivy, morning glory, and Japanese knotweed.

Characteristics of Wetland B

Wetland B is a 0.50-acre groundwater seep wetland hydrologically connected to the West Fork of Miller Creek. This wetland is formed by groundwater seeps on the north shoulder of South 140th Street that saturate a large area. According to the Cowardin system (1979), Wetland B contains palustrine scrub/shrub (PSS) and palustrine emergent (PEM) classes. Based on the hydrogeomorphic classification system (Brinson 1993), Wetland B is a slope wetland.

Hydrology

Wetland B is saturated by groundwater flowing down a slope into the West Fork of Miller Creek. The groundwater seeps braid around hummocks of trees and forms defined channels in some locations. Indicators of wetland hydrology include flowing water in the West Fork of Miller Creek and saturated soil.

Soils

Two soil pits (SP-3 and SP-4) were examined in Wetland B to determine the boundary. Soil pit SP-3 was located in the groundwater seep wetland near the West Fork of Miller Creek. The soil in SP-3 was a dark (10YR 2/2) mucky silt with mottles that was saturated. Soil pit SP-4 was located on an upland slope approximately 30 feet west of the groundwater seep. The soil in the B horizon was dark (10YR 2/2) but there were no redox features and it did not meet the hydric soil criteria.

Vegetation

The plant community in Wetland B is a mixture of native and invasive species. There are hummocks of slightly higher ground covered with black cottonwood and red alder. The shrub understory includes salmonberry, red-osier dogwood, and Himalayan blackberry. Wetland B has emergent vegetation dominated by reed canary grass, giant horsetail, skunk cabbage, small-fruited bulrush, lady fern, bedstraw, and bittersweet nightshade. Some of the plants along the banks of the West Fork of Miller Creek include indian plum, holly, cherry laurel, English ivy, and sword fern.

Characteristics of Wetland C

Wetland C is a 3.33-acre riparian wetland associated with the West Fork of Miller Creek that is located between South 140th Street and South 144th Street. A portion of this wetland is identified as Category 3 (Wetland D) according to City of Burien critical area map (Burien 2008b). A portion of this wetland was delineated by Habitat Technologies (2004) for the Ajax Parking lot development. According to the Cowardin system (1979), Wetland C contains palustrine forested (PFO), palustrine scrub/shrub (PSS), and palustrine emergent

(PEM) classes. Based on the hydrogeomorphic classification system (Brinson 1993), Wetland C is a riverine wetland.

Hydrology

Wetland C primarily receives water from overbank flooding and a high groundwater table. In many areas near the West Fork of Miller Creek, the soil was saturated to the surface and there was evidence of flooding during the winter season. Indicators of wetland hydrology include flowing water in the West Fork of Miller Creek; and sediment deposits, drift lines, and scour marks in the floodplain fringe of the stream.

Soils

Four soil pits (SP-5 through SP-8) were examined in Wetland C to determine the boundary. Soil pit SP-5 was located west of the West Fork of Miller Creek in the wetland area identified on City of Burien critical area map. The soil in SP-5 was a dark (10YR 2/2) mucky silt with mottles starting at three inches. Soil pit SP-6 was located on an upland bench approximately 50 feet from the Miller Creek tributary in an area that appeared to be fill material. The soil in the B horizon (10YR 3/3) gravelly sand did not have any redox features and it did not meet the hydric soil criteria. Soil pit SP-7 was located on the east side of the West Fork of Miller Creek in an area with evidence of overbank flooding. The soil profile in SP-7 appeared to be sandy flood deposits (2.5Y 4/2 with mottles) that met the hydric soil criteria. Soil pit SP-8 was located on the east side of the West Fork of Miller Creek in a grassy area that was above the water table. The soil in the B horizon (10YR 3/3) gravelly sand did not have any redox features and did not meet the hydric soil criteria.

Vegetation

The plant community in Wetland C is a mosaic of native and invasive species in three canopy layers. The tree canopy includes black cottonwood, red alder, and Pacific willow. There are clumps of native shrubs such as Sitka willow, salmonberry, hardhack, and black twinberry. Wetland C has emergent vegetation consisting of reed canary grass, cattail, small-fruited bulrush, giant horsetail, skunk cabbage, creeping buttercup, and stinging nettle. Invasive species within the area include Himalayan blackberry, common hawthorn, yellow flag iris, and morning glory. The shrub layer on the dog kennel property is limited by livestock grazing and past filling.

Characteristics of Wetland D

Wetland D is a 0.41-acre riparian wetland associated with the West Fork of Miller Creek on Port of Seattle property. According to the Cowardin system (1979), Wetland D contains palustrine scrub/shrub (PSS) and palustrine emergent (PEM) classes. Based on the hydrogeomorphic classification system (Brinson 1993), Wetland D is a riverine wetland.

Hydrology

Wetland D primarily receives water from overbank flooding and a high groundwater table. At the time of the site visit (July 2008), the soil was not saturated to the surface but there was evidence of flooding during the winter season. Indicators of wetland hydrology include flowing water in the West Fork of Miller Creek; and sediment deposits, drift lines, and scour marks in the floodplain fringe of the stream.

Soils

Two soil pits (SP-9 and SP-10) were examined in Wetland D to determine the boundary. Soil pit SP-9 was located on a floodplain bench next to the West Fork of Miller Creek and the soil was a dark (10YR 3/2) sandy silt with mottles starting at three inches. Soil pit SP-10 was located on an upland bench approximately 30 feet north of the West Fork of Miller Creek in an area that was recently cleared of invasive species. The soil in the B horizon (10YR 4/3) did not have any redox features and so did not meet the hydric soil criteria.

Vegetation

The Port of Seattle property was recently cleared of invasive plants and planted with native species so the plant community is a mixture of native and invasive species. There is tree canopy of black cottonwood and red alder, with native shrubs in the understory that includes salmonberry and black twinberry. Wetland D has emergent vegetation dominated by reed canary grass, giant horsetail, skunk cabbage, creeping buttercup, and stinging nettle. Some of the installed plants include red cedar, Sitka spruce, red-osier dogwood, Oregon ash, Nootka rose and live stakes of Sitka and Pacific willow. Invasive species within the area include Himalayan blackberry, holly, cherry laurel, common hawthorn, English ivy, morning glory, and Japanese knotweed.

Characteristics of Wetland E

Wetland E is a 0.12-acre riparian wetland associated with the West Fork of Miller Creek located between Des Moines Memorial Drive and S 144th Way. According to the Cowardin system (1979), Wetland E contains palustrine forested (PFO) and palustrine scrub/shrub (PSS) classes. Based on the hydrogeomorphic classification system (Brinson 1993), Wetland E is a riverine wetland.

Hydrology

Wetland E primarily receives water from overbank flooding and a high groundwater table. At the time of the site visit (August 2008), the soil was not saturated to the surface but there was evidence of flooding during the winter season. Indicators of wetland hydrology include flowing water in the West Fork of Miller Creek; and sediment deposits, drift lines, and scour marks in the floodplain fringe of the stream.

Soils

Two soil pits (SP-11 and SP-12) were examined in Wetland E to determine the boundary. Soil pit SP-11 was located on a floodplain bench next to the West Fork of Miller Creek and the soil was a dark (7.5YR 3/2) gravelly sand with mottles starting at four inches. Soil pit SP-12 was located on an upland slope approximately 20 feet south of the West Fork of Miller Creek in an area covered with invasive species. The soil in the B horizon (10YR 3/4) did not have any redox features and so did not meet the hydric soil criteria.

Vegetation

It appears that the banks of the West Fork of Miller Creek on this property were planted with native buffer species so the plant community is a mixture of native and invasive species. There is tree canopy of red alder, with installed shrubs in the understory that includes Pacific ninebark, vine maple, Oregon grape, and Douglas fir saplings. Wetland E has emergent vegetation such as reed canary grass, giant horsetail, skunk cabbage, creeping buttercup, and Watson's willowherb. Invasive species within the area include Himalayan blackberry, Scots broom, cherry laurel, English ivy, and morning glory.

Wetland Functions Assessment

The wetland and buffer functions were assessed using the methodology and rating form from the *Washington State Wetland Rating System for Western Washington* (Hruby, 2004). Three general categories of wetland functions and the opportunity to perform those functions were assessed: water quality, hydrology, and habitat. Using guidance from Washington State Department of Ecology (2008), numeric values from the rating forms were assigned qualitative function values of high, moderate, and low.

Results of the functional assessment of five wetlands in the NERA project area are discussed below. The hydrogeomorphic class of Wetlands A, C, D, and E are riverine; while Wetland B is slope. Table 4 summarizes the qualitative values for the functions that were assessed. Appendix D contains the Ecology rating forms completed for these wetlands.

Water Quality Functions

Wetlands A, D, and E have a moderate potential to improve water quality. Although the riparian wetland along the stream banks is densely vegetated and there are floodplain benches, there is only a small area that is seasonally ponded.

Table 4
Functional Assessment Rating for Wetlands in the NERA

Wetland	Categories of Assessed Functions					
	Water Quality		**Hydrology**		**Habitat**	
	Potential	**Opportunity**	**Potential**	**Opportunity**	**Potential**	**Opportunity**
A	Moderate	Yes	Moderate	Yes	Moderate	Moderate
B	Low	Yes	Low	Yes	Moderate	Low
C	High	Yes	High	Yes	Moderate	Moderate
D	Moderate	Yes	Moderate	Yes	Moderate	Low
E	Moderate	Yes	Moderate	Yes	Low	Low

Because there is a source of pollutants entering the wetland from upstream, there is an opportunity to perform water quality functions. Wetland B has low potential to improve water quality because this groundwater seep flows down a steep slope and is not detained in depressions. Although there is a limited source of pollutants entering the wetland from South 140th Street, there is an opportunity to perform water quality functions given its proximity to residential areas.

Wetland C has a high potential to improve water quality. The large riparian wetland on the Ajax Parking property is densely vegetated and there is a broad floodplain that allows floodwater to settle out. Because there is a source of pollutants entering the wetland from upstream, there is an opportunity to perform water quality functions.

Hydrology Functions

Wetlands A, D, and E have a moderate potential for hydrologic functions. The wetlands have constricted outlets and some storage capacity to reduce flooding and stream erosion. However, the relative size of the wetlands compared to the contributing basin for storm water runoff is low so they do little to reduce flooding from storm events. Wetlands A, D, and E have the opportunity to provide hydrologic functions because they drain to Miller Creek, which has flooding problems and sensitive resources downstream.

Wetland B has a low potential for hydrologic functions because it does not contain surface depressions that can attenuate storm flows. Wetland B has the opportunity to provide hydrologic functions because it drains to Miller Creek, which has flooding problems.

Wetland C has a high potential for hydrologic functions. The width of the wetland relative to the stream channel provides a large storage capacity to reduce flooding and stream erosion. In addition, the relative size of Wetland C compared to its contributing basin also allows it to reduce flooding. Wetland C has the opportunity to provide hydrologic functions because it drains to Miller Creek, which has flooding problems and sensitive resources downstream.

Habitat Functions

Wetlands A, B, C, and D have a moderate potential to provide habitat. These wetlands have moderate structural diversity, species diversity, interspersion of habitats, and habitat features. The opportunity to provide habitat is rated low to moderate because of their buffer condition, lack of priority habitats, and disturbed connections to other wetlands.

Wetland E has a low potential to provide habitat due to its lack of structural diversity, species diversity, and habitat features. The opportunity to provide habitat is rated low because of its buffer conditions, lack of priority habitats, and disturbed connections to other wetlands.

Wetlands Rating and Buffers

Wetlands A through E were rated using the criteria defined in the Department of Ecology's *Washington State Wetland Rating System for Western Washington* (Hruby 2004) and Burien Municipal Code (Burien 2008a). The Burien Municipal Code (BMC 19.40.300) designates four categories of wetlands: Categories 1, 2, 3, or 4 based on habitat scores from the Department of Ecology's rating system. Table 5 summarizes this information on wetland categories and buffer widths.

Wetlands A and C are rated Category II, while Wetlands B, D, and E are rated as Category III according to the Department of Ecology's *Washington State Wetland Rating System for Western Washington*. According to the Burien Municipal Code (Burien 2008a), Wetlands A and C are rated Category 2, while Wetlands B, D, and E are rated as Category 3.

Burien Municipal Code (BMC 19.40.310) provides for permanent protection of wetlands and their buffers by regulation of development and other activities within them. Wetland buffers provide important functions, including protection of wetland functions, water quality improvement, and wildlife habitat. The Burien Municipal Code requires a 100-foot buffer for Wetlands A and C that are Category 2, and a 50-foot buffer for Wetlands B, D, and E because they are Category 3.

Table 5
Wetland Rating Summary for Burien NERA

Wetland	**Area (ft^2)**	**Area (acre)**	**Ecology Category**[1]	**Burien Category**[2]	**Buffer Width (ft^2)**[3]
A	23,758	0.55	II	2	100
B	21,733	0.50	III	3	50
C	144,857	3.33	II	2	100
D	17,896	0.41	III	3	50
E	5,256	0.12	III	3	50

1–Wetland category based on Ecology rating system (Hruby 2004).
2 –Wetland and stream classification according to Burien Municipal Code (Burien 2008a)
3–Buffer width according to Burien Municipal Code (Burien 2008a)

Stream Rating and Buffer

The Burien Municipal Code (BMC 19.40.340) designates four classes of streams: Types 1, 2, 3, or 4 (Burien 2008a). This classification makes a distinction between perennial and intermittent streams and whether there is salmonid use. We assume there is perennial flow in the West Fork of Miller Creek within the NERA based on flow rates observed in July 2008. The West Fork of Miller Creek within the NERA is identified on the Burien critical area map as a Type 3 stream with a 50-foot buffer (Burien 2008b). The Burien critical area map does not identify any Fish and Wildlife Habitat Conservation Areas within the NERA project area and it does not contain any habitats that are defined by BMC 19.40.380 (Burien 2008b).

The *Miller and Walker Creeks Basin Plan* (King County 2006) identifies the West Fork of Miller Creek within the NERA (Reach 10). This plan assumes there is an impassable barrier to anadromous salmon due to a 150-foot-long culvert that is downstream of the NERA (King County 2006). However, because resident cutthroat trout are reported to occur in the West Fork of Miller Creek within the NERA (King County 2006), this indicates it is a Type 2 stream with a 100-foot buffer (Burien 2008a).

Other Regulatory Issues

Several federal and state regulations affect development in critical areas. Agencies that may have jurisdiction over wetlands and streams include, but may not be limited to: the U.S. Army Corps of Engineers (Corps); Washington State Department of Ecology (Ecology), and Washington Department of Fish and Wildlife (WDFW).

The Corps administers Section 404 of the Clean Water Act, which regulates the discharge of dredged or fill materials into waters of the United States, including adjacent wetlands. The onsite wetlands are likely to be under the jurisdiction of the Corps because they are hydrologically associated with the West Fork of Miller Creek, which eventually outlets to the Puget Sound. Only Corps staff can make a Jurisdictional Determination (JD). It is our opinion that there is good probability that the Corps will take jurisdiction; however that remains to be confirmed.

Ecology administers Section 401 of the Clean Water Act and has the authority to take jurisdiction over the onsite wetlands regardless of whether the Corps takes jurisdiction or not. Again, only Ecology can make the jurisdictional call, but they do have the authority to do so under the water quality provisions in the WAC (Washington Administrative Code).

The West Fork of Miller Creek is reported to be fish-bearing stream (resident cutthroat trout), so it is likely that WDFW will require a Hydraulic Project Application (HPA) approval for any work below the ordinary high water mark.

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