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September 28, 2007

Ms. Sarah Good
Toxics Cleanup Program
Washington Department of Ecology
Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008-5452

RE: Final Summary of Existing Information and Identification of Data Gaps Report, Lower Duwamish Waterway Early Action Area 7

Dear Ms. Good:

Please find enclosed the final Summary of Existing Information and Identification of Data Gaps (SEIIDG) Report for the Lower Duwamish Waterway Early Action Area 7. This version of the report incorporates comments provided by Ecology on the April 5, 2007 revised draft SEIIDG report as well as additional information gathered since preparation of the revised draft report.

Please contact me at (206) 624-9537 ext. 3603, or at mlongtine@ene.com if you have any questions regarding this deliverable.

Sincerely,
ECOLOGY AND ENVIRONMENT, INC.

Mark Longtine

Mark Longtine
E & E Project Manager

Cc: Dan Cargill, Washington Department of Ecology
Kris Flint, USEPA

Lower Duwamish Waterway
Early Action Area 7
Final Summary of Existing Information and Identification of Data Gaps
Report

Contract No. C0700036
Work Assignment No. EANE001

September 2007

Prepared for:

WASHINGTON DEPARTMENT OF ECOLOGY
Toxics Cleanup Program
3190 160th Avenue SE
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Acronyms/Abbreviations

2LAET	Second Lowest Apparent Effects Threshold
AOC	Area of Concern
AST	Above ground storage tank
BDC	Boeing Developmental Center
bgs	below ground surface
BMPs	best management practices
BNAs	base neutral acids
BTEX	benzene, toluene, ethylbenzene, and xylene
cm	centimeters
CSCSL	Confirmed and Suspected Contaminated Site List
CSL	Cleanup Screening Level
CSO	combined sewer overflow
DOT	Department of Transportation
dw	dry weight
EAA-7	Early Action Area 7
EBDRP	Elliott Bay/Duwamish Restoration Program
ECHO	Enforcement and Compliance History Online
Ecology	Washington Department of Ecology
E & E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
GIS	Geographic Information System
HPAH	high molecular weight PAH compound
KCDNRP	King County Department of Natural Resources and Parks
KCIA	King County International Airport
LAET	Lowest Apparent Effects Threshold
LDW	Lower Duwamish Waterway
LUST	leaking underground storage tank
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^2/d$	micrograms per meter squared per day
MFC	Military Flight Center
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOF	Museum of Flight
MTCA	Model Toxics Control Act
NDPES	National Pollutant Discharge Elimination System
NFA	No Further Action
NWRO	Northwest Regional Office
OC	organic carbon
ORC	Oxygen Release Compound

Acronyms/Abbreviations (Continued)

PCB	polychlorinated biphenyl
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
ppb	parts per billion
RCRA	Resource Conservation and Recovery Act
SD	storm drain
SCAP	Source Control Action Plan
SPU	Seattle Public Utilities
sq. ft.	square feet
SQS	Sediment Quality Standards
SWMU	Stormwater Management Unit
SWPPP	Stormwater Pollution Prevention Plan
TCE	trichloroethene
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TPH-G	gasoline-range total petroleum hydrocarbon
TRI	Toxics Release Inventory
TSS	total suspended solids
UST	underground storage tank
VCP	Voluntary Cleanup Program
VOA	volatile organic analysis
VOC	volatile organic compound
WSDOT	Washington State Department of Transportation

1.0 Introduction

1.1 Background and Purpose

Early Action Area 7 (EAA-7) was identified as a high priority site for sediment cleanup on the Lower Duwamish Waterway (LDW) Superfund site. The LDW Superfund site is made up of approximately 5.5 miles of the downstream portion of the Duwamish River that flows into Elliott Bay in Seattle, Washington. The U.S. Environmental Protection Agency (EPA) added this site to the National Priorities List in September 2001 due to chemical contaminants in sediments.

EAA-7 is located on the eastern side of the LDW adjacent to the Norfolk combined sewer overflow (CSO)/storm drain (SD) outfall (Figure 1). The Norfolk CSO/SD system is part of the county wastewater system and discharges stormwater as well as untreated sewage during periods of heavy rainfall when the sewer system is inundated with water. This system includes surface drainage for approximately mixed residential, commercial, and industrial property on the southeast end of the LDW basin (King County and Seattle Public Utilities 2005).

EAA-7 was first identified as part of the Elliott Bay/Duwamish Restoration Program (EBDRP), which was established in 1991 to implement requirements of a Consent Decree. The EBDRP Panel was composed of Federal, State, and Tribal natural resource trustees, the King County Department of Natural Resources and Parks (KCDNRP) (then Metro), and the City of Seattle. EBDRP settlement projects included sediment remediation, habitat development and improvements, and pollution source control measures. The Norfolk CSO/SD was one of 24 sediment sites identified, and one of three selected for cleanup.

The Washington Department of Ecology (Ecology) is the lead agency for source control for the LDW Superfund site. Source control is the process of finding and stopping or reducing to the maximum extent practicable (or "as much as is feasible") pollution releases to waterway sediments. The goal of source control is to prevent sediments from becoming recontaminated following cleanup. Before further sediment cleanup work can begin, Ecology must determine the source control actions that are necessary for EAA-7.

EAA-7 includes the area of contaminated sediments near the Norfolk CSO/SD that were dredged, as discussed further below. For the purposes of this document, EAA-7 also includes the larger area of interest for LDW source control purposes, located along the LDW approximately between river miles 4.8 and 5.0. The areas of the sediment dredging and the larger area of interest for LDW source control are illustrated in Figure 2.

As part of source control efforts for EAA-7, Ecology tasked Ecology and Environment, Inc., (E & E) to prepare this Summary of Existing Information and Identification of Data Gaps report. The purpose of this report is to document readily available information regarding potential sources of sediment recontamination and contaminant migration pathways in the EAA-7.

1.2 Organization of Document

Section 2 of this report provides a summary of background information on EAA-7, including a description of the Norfolk CSO/SD drainage basin, chemicals of concern to LDW sediments, and potential migration pathways. Section 3 describes potential sources of contaminants to EAA-7 sediments, including upland facilities of concern, groundwater, stormwater, bank erosion, and atmospheric deposition. Section 3 also summarizes data gaps that must be addressed to complete the development of a Source Control Action Plan (SCAP) for EAA-7. Section 4 provides a list of documents cited in the report.

Information presented in this report was obtained from the following sources:

- Ecology Northwest Regional Office (NWRO) Central Records
- Washington State Archives
- EPA file logs
- Seattle Public Utilities Business Inspection reports
- Ecology Underground Storage Tank (UST) and Leaking Underground Storage Tank (LUST) lists
- Ecology Facility/Site Database
- Washington Confirmed and Suspected Contaminated Sites List (CSCSL)
- EPA Enforcement and Compliance History Online (ECHO)
- EPA Envirofacts Warehouse
- King County Geographic Information System (GIS) Center Parcel Viewer and Property Tax Records
- King County GIS files
- GIS shape files provided by Seattle Public Utilities
- GIS files provided by the City of Tukwila

2.0 Early Action Area 7

EAA-7 is located between 4.8 and 5.0 miles from the south end of Harbor Island on the east bank of the LDW. This area is adjacent to the Norfolk CSO/SD (Figures 1 and 2) and the Boeing Developmental Center (BDC).

The Norfolk CSO/SD system includes the municipal storm drain system for the 769 acre Norfolk SD and the King County combined sewer system for a 4,900 acre service area. The Norfolk CSO/SD system discharges stormwater and untreated sewage during periods of heavy rainfall when the sewer system is inundated with water. The 769 acre Norfolk SD basin includes mixed residential, commercial, and industrial property (King County 2007a). A photograph of the Norfolk CSO/SD storm drain outfall is shown in Figure 3. The Norfolk CSO/SD is described in further detail below in Section 2.3.1.1.

The boundary for the EAA-7 sediments has not been officially determined by EPA; however, for the purposes of this document, EAA-7 includes the area where King County dredged contaminated sediments located near the Norfolk CSO/SD outfall in 1999 and the area where Boeing removed contaminated sediments near the Boeing south storm drain outfall in 2003. For source control purposes, we are evaluating an area that includes the 1999 and 2003 dredge sites and that also encompasses the area adjacent to other outfalls near the previously dredged area. These outfalls are included to assess their potential as sources of recontamination to the area. The areas of the 1999 and 2003 sediment dredging, the larger area of interest for LDW source control, and the additional outfalls considered in this report are illustrated in Figure 2.

In 1999, King County dredged the area of the LDW near the Norfolk CSO/SD and backfilled the dredged area with clean sediment. Chemicals of concern at the site prior to cleanup activities included: mercury; 1,4-dichlorobenzene; bis(2-ethylhexyl)phthalate; and polychlorinated biphenyls (PCBs). Potential sources of contamination to EAA-7, and recontamination to the sediments capped in 1999, include stormwater discharges, CSO/SD discharges, residual sediment contamination, and contamination in banks adjacent to the waterway. Following the 1999 sediment cleanup, King County initiated a five-year sampling program to monitor the clean sediment backfill for potential recontamination by metals and organics contaminants. Potential sources of recontamination included the sediments between the northern extent of the dredging and the shoreline. Potential recontamination by PCBs was of particular concern. Due to concern about the possibility of recontamination of the sediment, Ecology's Toxics Cleanup Program conducted an assessment of PCB concentrations in the vicinity of the monitoring program locations in 2002. The results of the Ecology study were generally consistent with previous findings from the post-remedial monitoring conducted by King County, which were interpreted to indicate that the most likely source of PCB recontamination was erosion of PCB-contaminated sediments located inshore of the remediation site and adjacent to the Boeing south storm drain outfall (Ecology 2003). The King County and Ecology monitoring results are summarized in Section 2.2 below.

In order to address the issue of PCB sediment contamination, beginning in 2000, Boeing has conducted several phased investigations and removal actions at the south storm drain line and the LDW sediments near its outfall, including source control measures and a sediment removal action completed in 2003. The location of the south storm drain outfall is illustrated in Figure 4. These investigations and source control measures are discussed further in Section 3.1.1.3. During the 2003 cleanup of sediments near the Boeing south storm drain line, a vacuum truck equipped with hose extension and hand tool was used to remove approximately 60 cubic yards of contaminated sediment. The excavated area was backfilled with clean sand (Project Performance Corporation 2003). Boeing has conducted post-removal monitoring to evaluate the effectiveness of source-control measures in the south storm drain system. Although this monitoring has shown that PCBs are still present within an inaccessible portion of the south storm drain system, the 2005 report concluded, based in the sediment monitoring results, that the source control measures have significantly reduced PCB inputs to the LDW at the point of discharge (Calibre Systems 2005). However, samples of solids collected by Boeing at locations within the south storm drain system contained elevated levels of PCBs, indicating that elevated concentrations of PCBs remain in the system. Boeing indicated that it is planning to evaluate the feasibility and expected efficiency of additional source control measures for the south storm drain (Calibre System 2006). The south storm drain outfall sediment cleanup and subsequent monitoring by Boeing are discussed further in Section 2.2 and 3.1.1.3.

2.1 Site Description

General background and site description of the LDW Superfund site is provided in the Phase I Remedial Investigation Report (Windward 2003a), which describes the history of dredging/filling and industrialization of the Duwamish River and it environs, as well as the physiography, physical characteristics, hydrogeology, and hydrology of the area.

Most of the upland areas adjacent to the LDW have been heavily industrialized for many decades. Historical and current commercial and industrial operations include cargo handling and storage, marine construction, boat manufacturing, marina operations, concrete manufacturing, paper and metals fabrication, airplane parts manufacturing (Windward 2003a).

The LDW is a receiving water body for different types of industrial and municipal wastewater. There are currently no permitted industrial discharges of wastewater directly into the LDW. However, there are industrial and municipal stormwater discharges that currently enter the LDW. In addition, the CSO system, (including the Norfolk CSO/SD), which receives wastewater from a variety of industries, discharges into the LDW intermittently during periods of high rainfall (Windward 2003a).

Groundwater within the Duwamish Valley alluvium is typically encountered under unconfined conditions within approximately 10 feet (3 meters) of ground surface. Groundwater in this unconfined aquifer is found within fill and native alluvial deposits. The direction of groundwater flow in the unconfined aquifer is generally toward the LDW, although the direction may vary locally depending on the nature of subsurface material, and temporally based on proximity to the LDW and the influence of tidal action. Although high tides can cause temporary groundwater flow reversal, the net groundwater flow direction for the unconfined aquifer is believed to be toward the LDW. The area affected by tide-related flow direction reversals is generally within 300 to 500 feet (100 to 150 meters) of the LDW (Windward 2003a). A confined groundwater zone is present beneath the unconfined aquifer. Flow in this confined zone is to the north toward Elliott Bay. The bottom of the unconfined aquifer is located at the top of a layer of marine sediment at a depth of 45 to 50 feet (Cook 2001).

The Norfolk CSO/SD drainage basin includes several facilities of potential concern that could be sources of ongoing or future recontamination to LDW sediments. These facilities are the BDC; the Boeing Military Flight Center (MFC); the southern portion of King County International Airport (KCIA); Associated Grocers, Inc; Affordable Auto Wrecking; Northwest Auto Wrecking; and the Arco Gas Station. The Norfolk CSO/SD drainage basin and locations of the sites of concern are shown in Figure 5. Table 1 lists the identified facilities of potential concern.

Point discharges to the LDW in EAA-7 include King County's Norfolk CSO/SD and five private discharge points or outfalls owned by Boeing (BDC Discharge Points 17, 4, 16, 3, and 2), illustrated in Figures 2 and 4. According to the Stormwater Pollution Prevention Plan (SWPPP) for the BDC, a sixth private storm drain system owned by Boeing connects to the Norfolk CSO/SD at BDC Discharge Point 1, located a short distance upstream of the Norfolk CSO/SD's outfall into the LDW. However, a photograph provided by Ecology appears to show a Boeing storm drain outfall discharging directly in to the LDW a short distance downstream of the Norfolk CSO/SD outfall (see Figure 6). Discussion of BDC Discharge Point 1 is included in the discussion of the Norfolk CSO/SD below. Known private and public drain lines and discharge points to the LDW are discussed in Section 2.3.1.

In addition to point discharges, erosion from bank soils could have the potential to contribute to the recontamination of the LDW. The BDC is the only facility of potential concern that is located along the bank of the LDW. No information during the file review indicated that bank soils at the BDC are a continued source of contamination.

Facilities of concern within EAA-7 are described in Section 3.

2.2 Chemicals of Concern in Sediments

Sediments within EAA-7 have been documented to be impacted at levels of concern by the several organic compounds based on results of sampling conducted between 1999 and 2005. The Washington State SMS (Chapter 173-204 WAC) establish Marine Sediment Quality Standards (SQS) and Sediment Impact Zone Maximum Level and Sediment Cleanup Screening Level (CSL)/Minimum Cleanup Level for some chemicals that may be found in sediments. The SQS identify chemical concentrations in surface sediments that have no adverse effects on biological resources and no significant health risk to humans. CSLs represent "minor adverse effects" levels used as an upper regulatory threshold for making decisions about source control and cleanup. For the purposes of this report, a chemical was identified as a chemical of potential concern for EAA-7 if the detected concentration in one or more EAA-7 sediment samples exceeded the SQS or CSL value. On this basis, the following chemicals were identified as chemicals of concern for EAA-7:

- Benzo(g,h,i)perylene
- Bis(2-ethylhexyl)phthalate
- Butyl benzyl phthalate
- Hexachlorobenzene
- PCBs

Additional chemicals were identified as chemicals of concern if the chemical was not detected in the EAA-7 sediment sample but the associated method detection limit exceeded the SQS or CSL value. The following are identified as chemicals of concern to EAA-7 on this basis:

- 2,4-dimethylphenol
- 2-methylnaphthalene
- Dibenzo(a,h)anthracene
- Dibenzofuran.
- Hexachlorobutadiene
- N-nitrosodiphenylamine

Under the SMS, the SQS and CSL values for some organic compounds are organic carbon (OC) normalized. As such, the detected concentrations (dry weight basis) for these compounds in sediment samples are normalized to the total organic carbon (TOC) concentration in the samples, as appropriate, to allow comparison with the SQS and CSL values. For those samples with TOC concentrations considered to be outside an acceptable range, the dry weight concentrations of the constituents were compared to the Puget Sound Lowest Apparent Effects Threshold (LAET) or Puget Sound Second Lowest Apparent Effects Threshold (2LAET) values.

Contaminant concentrations detected in storm drain sediment/solids samples presented in this document also were compared to SQS/CSL and/or LAET/2LAET values in order to provide a rough indication of contaminant levels in the storm drain sediments/solids. It should be emphasized that the SQS/CSL and LAET/2LAET values do not apply to storm drain sediments/solids. Any comparison of contaminant concentrations in storm drain sediment/solids samples to these sediment quality criteria is most likely conservative given that sediments/solids discharged from storm drains are highly dispersed upon being discharged into in the receiving environment.

A summary of sediment sampling conducted in EAA-7 between 1999 and 2005 is provided below. Those sediment sample results for which the detected concentration exceeded the SQS/CSL values, or for which the method detection limit was greater than the SQS/CSL values, are presented in Table 2.

As stated above, in 1999, King County dredged LDW sediments in the area of the Norfolk CSO/SD outfall and backfilled the dredged area with clean sediment. Following the cleanup, King County initiated a five-year sampling program to monitor the clean sediment cap for potential recontamination by metals and organics contaminants. Monitoring results are presented in Sections 2.2.1 through 2.2.3. Results of the 2002 Ecology sediment sampling event near the Norfolk CSO/SD are summarized in Section 2.2.4. Results of Boeing's 2003 sediment cleanup near the south storm drain are presented in Section 2.2.5, and subsequent monitoring results for the south storm drain system are summarized in Sections 2.2.6 and 2.2.7. The south storm drain sediment cleanup and follow-up monitoring are also discussed in Section 3.1.1.3.

2.2.1 Norfolk CSO Sediment Remediation Project, Five-Year Monitoring Program, April 1999 Monitoring Report (King County Department of Natural Resources 1999)

For the first year of King County's five-year post-dredge monitoring program, four sediment samples from four locations (NFK501, NFK502, NFK503, and NFK504) were collected in 1999 to establish baseline data on the chemical characteristics of the sediment used as backfill material. The purpose of the five-year program was to monitor sediment placed as backfill material at the site for potential recontamination from CSO and other discharges. Samples were collected from the top 10 centimeters (cm) of sediment. The samples were analyzed for percent solids, TOC, 13 priority pollutant metals, base neutral acids (BNAs), and PCBs. Results are summarized below. The report noted that normalization to organic carbon can produce biased results when the organic carbon content of the sample is very low (e.g., near 0.1 or 0.2 %). TOC concentrations in samples collected from NFK501, NFK502, and NFK504 were all below 0.2%, and the TOC concentration in the sample collected from NFK503 was just above 0.3%. A number of chemicals in these samples exceeded the SQS or CSL, although they did not exceed the LAET or 2LAET on a dry weight basis. Results are summarized below:

- Percent solids ranged from 76.9 to 77.6%.
- TOC ranged from 1,210 to 3,180 milligrams per kilogram (mg/kg) dry weight (dw).
- No metals exceeded their SQS chemical criteria.
- 2,4-dimethylphenol was not detected in any of the samples above the method detection limit of 35 micrograms per kilogram (μg/kg) dw, which exceeded the SQS and CSL of 29 μg/kg dw for all four samples.
- For two samples, the method detection limits for 2-methylnaphthalene (46 mg/kg and 44 mg/kg OC) exceeded the SQS criteria of 38 mg/kg OC, although they were below the CSL of 64 mg/kg OC.
- Benzo(g,h,i)perylene was detected in two samples at concentrations of 62.6 and 56.0 mg/kg OC, which exceed the SQS of 31 mg/kg OC, but does not exceed the CSL of 78 mg/kg OC.
- Dibenzo(a,h)anthracene was not detected above the method detection limits (ranging from 18 to 46 mg/kg OC) in any of the samples. All of these method detection limits exceeded the SQS of 12 mg/kg OC, and two exceeded the CSL of 33 mg/kg OC.
- Hexachlorobenzene was detected in one sample at 0.80 mg/kg OC, which exceeds the SQS of 0.38 mg/kg OC, but not the CSL of 2.3 mg/kg OC. In two samples,

hexachlorobenzene was not detected above the method detection limits, but the method detection limits of 0.51 and 0.71 mg/kg OC exceeded the SQS.

- Butyl benzyl phthalate was not detected above the method detection limits, which ranged from 6.6 to 17 mg/kg OC, all of which exceeded the SQS of 4.9 mg/kg OC.
- Dibenzofuran was not detected above the method detection limits; in three samples the method detection limit (ranging from 20 to 29 mg/kg OC) exceeded the SQS of 15 mg/kg OC.
- Hexachlorobutadiene was not detected above the method detection limits, which ranged from 11 to 29 mg/kg OC, all of which exceeded the SQS of 3.9 mg/kg OC and the CSL of 6.2 mg/kg OC.
- N-nitrosodiphenylamine was not detected above the method detection limit, but the method detection limits for three samples (ranging from 20 to 29 mg/kg OC) exceeded the SQS and CSL of 11 mg/kg OC.
- Total PCBs were not detected above the method detection limits, but the method detection limits for three samples (ranging from 13 to 18 mg/kg OC) exceeded the SQS of 12 mg/kg OC.
- Bis(2-ethylhexyl)phthalate was not detected above the method detection limits, which ranged from 6.6 to 17 mg/kg OC, below the SQS (47 mg/kg OC) and CSL (78 mg/kg OC).
- None of the following analytes were detected above their respective method detection limits, all of which were below their SQS criteria: benzoic acid; benzyl alcohol; 2-methylphenol; 4-methylphenol; pentachlorophenol; and phenol.

2.2.2 Norfolk CSO Sediment Remediation Project, Five-year Monitoring Program, Annual Monitoring Report – Year Two, April 2001 (Mickelson 2001)

For year two of the King County post-dredging monitoring program, eight sediment samples from four locations (NFK501, NFK502, NFK503, and NFK504) were collected in 2001. Samples were collected from the top 2 cm and the top 10 cm of sediment. The sampling location for NFK503 was approximately 22 feet closer to the shore than for the 1999 sampling event. This location is near the edge of the clean sediment cap. The samples were analyzed for percent solids, TOC, 12 priority pollutant metals, BNAs, and PCBs:

- Percent solids ranged from 52.7 to 74.4%.
- TOC concentrations ranged from 2,770 to 15,600 mg/kg dw.
- Arsenic, cadmium, and silver were not detected above their respective detection limits, all of which were below the SQS (57, 5.1, and 410 mg/kg dw, respectively) and CSLs (93, 6.7, and 960 mg/kg dw, respectively). Concentrations of all the other metals were at levels reported to be typical of natural, area-wide concentrations.

- Benzoic acid was detected in all eight samples at concentrations ranging from 67.6 to 299 µg/kg dw. These concentrations are below the SQS and SCL criteria of 650 µg/kg dw. No other ionic organic chemicals were detected.
- Anthracene was detected at concentrations ranging from 0.98 to 1.4 mg/kg OC in four samples collected from 0 to 2 cm, below the SQS (220 mg/kg OC) and the CSL (1,200 mg/kg OC).
- Phenanthrene was detected in all but one sample from 0 to 10 cm, at concentrations ranging from 1.0 to 7.98 mg/kg, below the SQS criterion of 100 mg/kg OC and CSL criterion of 480 mg/kg OC.
- High-molecular weight polycyclic aromatic hydrocarbons (HPAHs) were all below their SQS and CSL criteria.
- Chlorobenzenes were not detected above there respective method detection limits (ranging from 0.03 to 0.15 mg/kg OC) in any samples.
- Bis(2-ethylhexyl)phthalate was detected in all eight samples, ranging from 24.9 to 42.7 mg/kg OC, below the SQS criterion of 47 mg/kg OC and CSL criterion of 78 mg/kg OC.
- Butyl benzyl phthalate was detected in samples NFK501, NFK502, and NFK504 at concentrations ranging from 2.24 to 6.63 mg/kg OC. Concentrations in two samples (6.63 and 5.03 mg/kg OC) exceeded the SQS of 4.9 mg/kg OC.
- Dibenzofuran was not detected above the detection limits, which ranged from 1.7 to 6.8 mg/kg OC, below the SQS and CSL criteria of 15 and 58 mg/kg OC, respectively.
- Hexachlorobutadiene was not detected above the detection limits, which ranged from 0.091 to 0.36 mg/kg OC, below the SQS and CSL criteria of 3.9 and 6.2 mg/kg OC, respectively.
- N-nitrosodiphenylamine was not detected above the detection limits, which ranged from 2.4 to 9.7 mg/kg OC, below the SQS and CSL criteria of 11 mg/kg OC.
- PCBs (as total Aroclors) were detected in all eight samples, four of which (concentrations ranging from 18.6 to 677 mg/kg OC) exceeded the SQS (12 mg/kg OC) and CSL (65 mg/kg OC).

Based on these data, Boeing and Ecology conducted additional site characterization in 2002, and Boeing implemented cleanup actions in the area near the south storm drain outfall in 2003.

2.2.3 Norfolk CSO Sediment Remediation Project, Five-year Monitoring Program, Annual Monitoring Report – Year Three, April 2002 (Mickelson 2002)

For year three of the King County post-dredging monitoring program, eight sediment samples from four locations (NFK501, NFK502, NFK503, and NFK504) were collected in 2002 from the Norfolk CSO/SD sediment remediation site. Samples were collected from the top 2 cm and the top 10 cm of sediment. The samples were analyzed for percent solids, TOC, 12 priority pollutant metals, BNAs, and PCBs.

- Percent solids ranged from 47.4% to 84.2%.
- TOC ranged from 980 to 26,200 mg/kg dw.
- Cadmium and silver were not detected in any samples. The detection limits were below their respective SQS values of 5.1 and 6.1 mg/kg dw. All other metal concentrations are at levels reported to be typical of natural area-wide concentrations and were below SQS chemical criteria.
- Benzoic acid was detected in seven of the samples at concentrations ranging from 84.3 to 210 µg/kg dw, below the SQS criterion (650 mg/kg dw).
- Anthracene and phenanthrene were detected in samples collected from both depth intervals. Anthracene concentrations ranged from 0.55 to 3.70 mg/kg OC, which is less than the SQS (220 mg/kg OC), and phenanthrene concentrations ranged from 3.76 to 7.96 mg/kg OC, below the SQS (100 mg/kg OC).
- Dibenzo(a,h)anthracene was detected in three of six samples, and the other eight high molecular weight PAH compounds were detected in all six samples collected from the two depth intervals. The concentrations did not exceed the SQS criteria.
- 1,4-dichlorobenzene was detected in all samples (ranging from 0.0452 to 1.6 mg/kg OC) below the SQS of 3.1 mg/kg OC.
- Benzyl butyl phthalate concentrations ranged from 2.23 to 3.75 mg/kg OC, below the SQS (4.9 mg/kg OC).
- Bis(2-ethylhexyl)phthalate was detected in samples at concentrations ranging from 40.6 to 63.3 mg/kg OC. One sample (63.3 mg/kg OC) exceeded the SQS (47 mg/kg OC).
- Di-n-butyl phthalate was detected in samples at concentrations ranging from 0.39 to 1.2 mg/kg OC, below the SQS (220 mg/kg OC).
- Dibenzofuran was not detected above the detection limits, which ranged from 1.2 to 18 mg/kg OC. The SQS and CSL criteria are 15 and 58 mg/kg OC, respectively.
- Hexachlorobutadiene was not detected above the detection limits, which ranged from 0.059 to 0.94 mg/kg OC, below the SQS and CSL criteria of 3.9 and 6.2 mg/kg OC, respectively.
- N-nitrosodiphenylamine was not detected above the detection limits, which ranged from 1.6 to 25 mg/kg OC. The SQS and CSL criteria are 11 mg/kg OC.
- PCBs (as total Aroclors) were detected in six samples with concentrations ranging from 3.61 to 30.4 mg/kg OC. The highest concentration (30.4 mg/kg OC) exceeded the SQS (12 mg/kg OC).

2.2.4 Norfolk Combined Sewer Overflow (Duwamish River) Sediment Cap Recontamination, Phase I Investigation (Ecology 2003)

In July 2002, Ecology collected twenty-two sediment samples from 21 sample stations from the inshore area between the Norfolk CSO/SD outfall and the Boeing south storm drain outfall. The primary objective of the study was to determine whether there may be PCB-contaminated sediment not removed during the 1999 cleanup that could potentially erode and be transported onto the clean backfill sediment cap. Samples were analyzed for TOC, percent solids, grain size, and PCBs as Aroclors. TOC ranged from 0.4 to 4.62%. Total PCB concentrations, based on detected Aroclors, ranged from 0.6 to 330 mg/kg OC. The total PCB concentrations in six of these samples (including a field duplicate) exceeded the SQS of 12 mg/kg OC, and of these, three exceeded the CSL of 65 mg/kg OC.

2.2.5 Cleanup Action Report, Sediment Removal near South Storm Drain Outfall (Project Performance Corporation on behalf of Boeing 2003)

Boeing completed a removal of approximately 60 cubic yards of PCB-contaminated sediments in the area ear the south storm drain outfall in 2003. As part of the removal action confirmatory sampling in the area of the south storm drain outfall, eighteen confirmation sediment samples (consisting of 12 initial confirmation samples and six secondary confirmation samples) were collected in October 2003 from the area where contaminated sediment removal activities took place. These samples were analyzed for PCBs as Aroclors and TOC. Results for TOC ranged from 0.18% to 2.20%. Total PCB concentrations ranged from non-detect to 2,190 mg/kg OC, and exceeded the SQS (12 mg/kg OC) in four samples, at concentrations ranging from 61 to 2,190 mg/kg OC. The report concluded that almost all sediment containing total PCBs above the SQS was removed, and that only a small area of sediment containing total PCBs above the CSL of 65 mg/kg OC was not removed.

2.2.6 2004 Annual Sampling Report, South Storm Drain System (Boeing Developmental Center) (Calibre Systems 2005)

In 2004, Boeing collected four sediment samples (S01, S02, S03, and a duplicate S06) from the LDW in the area near the south storm drain where contaminated sediment removal activities took place (Figure 7). The samples were analyzed for total PCBs and TOC. PCB concentrations ranged from non-detect to 27 µg/kg dw. TOC concentrations ranged from 0.128% to 0.242%. The results for all samples were below the SQS and LAET for PCBs.

In addition to the LDW sediment samples, on December 16, 2004 two solids samples were collected from the south storm drain. The samples were collected at manhole locations MH2 and MH3, which are located downstream and upstream of a combined sediment trap/oil-water separator, respectively (Figure 8). The samples were collected using 1-micron filter bags connected to steel frames that were bolted to the base and interior side walls of the storm drain so that stormwater would flow naturally through the filter bag. The accumulated solids were analyzed for PCBs, TOC, and percent solids. TOC results were 13.8% and 19.7%, respectively.

Total PCB results were 7,100 µg/kg dw for the sample collected from MH 2 (downstream of the sediment trap/oil-water separator), and 20,000 µg/kg dw for the sample collected from MH3 (upstream) of the sediment trap/oil-water separator. Each of these PCB concentrations exceeded the LAET (130 µg/kg dw) and 2LAET 1,000 µg/kg dw) values.

2.2.7 2005 Annual Sampling Report, South Storm Drain System (Boeing Developmental Center) (Calibre Systems 2006)

Boeing collected four sediment samples (S1-05 and duplicate S4-05, S2-05, and S3-05) in the LDW from the area where contaminated sediment removal activities took place (Figure 9). The samples were analyzed for total PCBs and TOC. TOC concentrations ranged from 0.53% to 1.56%. PCB concentrations ranged from non-detect to 353 µg/kg dw (S1-05). The PCB result of the duplicate sample (S4-05) at this location was below the method detection limit. The difference between these results was attributed to sample heterogeneity. The organic carbon normalized concentration of S1-05 is 22.6 mg/kg OC. The PCB concentration in S1-05 exceeded the SQS (12 mg/kg OC) and LAET (130 µg/kg dw), but was below the CSL (65 mg/kg OC) and 2LAET (1,000 µg/kg dw). Total PCB results for S2-05, S3-05, and S4-05 were below the detection limits of 31 and 32 µg/kg dw, below the LAET value and corresponding to organic carbon-normalized values of 2.1 mg/kg OC and 5.8 mg/kg OC, below the SQS.

In addition to the LDW sediment samples, in November 2005 two solids samples were collected from the south storm drain at manhole locations MH2 and MH3, located downstream and upstream of a sediment trap/oil-water separator, respectively (Figure 8). The samples were collected using 10-micron filter bags connected to steel frames that were bolted to the base and interior side walls of the storm drain so that stormwater would flow naturally through the filter bag. The accumulated solids were analyzed for PCBs, TOC, and percent solids. TOC results ranged from 6.09% to 22.70%. Total PCB results ranged from 12,600 µg/kg dw (MH 2) to 61,500 µg/kg dw (MH3). In addition to samples collected from MH2 and MH3, two samples of accumulated solids were collected from the sediment trap/oil-water separator (ST0905-1 and ST0905-2). Total PCBs concentrations were 15,100 and 15,800 µg/kg dw. Concentrations of the storm drain solids and accumulated solids exceeded the LAET (130 µg/kg dw) and 2LAET (1,000 µg/kg dw).

2.3 Potential Contaminant Migration Pathways to Sediment

LDW sediments in EAA-7 have been impacted by chemical contaminants from various historical and potentially ongoing sources. Ecology identified several industrial facilities within the drainage basin that discharge to EAA-7 as facilities of concern. These facilities and other potential sources of contamination to EAA-7 sediments are illustrated in Figure5 and discussed below. To assess whether a facility could be a source of sediment recontamination, it is necessary to evaluate potential contaminant migration pathways that may exist between the potential sources and the LDW. Media relevant to source control that can potentially be impacted by human activities are water, soil, and air. Such contaminated media can impact sediments through several migration pathways, including direct discharges, stormwater discharges, CSOs, groundwater, bank erosion/leaching, atmospheric deposition, and spills. The potential contaminant migration pathways evaluated for EAA-7 are described below and are discussed in more detail in Section 3.

2.3.1 Piped Outfalls

Properties near the LDW in the vicinity of EAA-7 are served by a combination of storm drain, sanitary sewer, and combined sewer systems. Storm drains convey stormwater runoff collected from streets, parking lots, roof drains, and residential, commercial, and industrial properties to the LDW. There are both public and private storm drain systems that drain upland areas to EAA-7. Most of the waterfront properties along the LDW are served by privately owned systems that discharge directly to the LDW. The other upland areas are served by a combination of private and publicly owned systems.

Stormwater

Stormwater enters EAA-7 via storm drains and pipes, or directly from properties adjacent to the waterway. Stormwater runoff from urban areas can contain a wide variety of pollutants including bacteria, metals, oil, detergents, pesticides, and other chemicals that are washed off the land surface during rain events. These pollutants are transported in dissolved and particulate phases to the waterway by a combination of public and private storm drain systems. Storm drains can also convey materials from businesses with permitted discharges (i.e., National Pollutant Discharge Elimination System [NPDES] industrial stormwater permits), vehicle washing, runoff from landscaped areas, erosion of contaminated soil, groundwater infiltration, and materials illegally dumped into the system.

Sanitary Sewer System

The sanitary sewer system collects municipal and industrial wastewater from throughout the LDW area and conveys it to King County's West Point wastewater treatment plant, where it is treated before being discharged to Puget Sound. The smaller trunk sewer lines, which collect wastewater from individual properties, are owned and operated by the individual municipalities (e.g., Cities of Seattle and Tukwila) and local sewer districts. The large interceptor system that collects wastewater from the trunk lines is owned and operated by King County.

Combined Sewer Systems

Some areas adjacent to the LDW, including the area upland of EAA-7, are also served by combined sewer systems, which carry both stormwater and municipal/industrial wastewater in a single pipe. Combined sewer systems were generally constructed (typically before about 1970) because it was less expensive to install a single system rather than separate storm and sanitary systems. During large storm events, the flow of stormwater can sometimes exceed the capacity of the combined sewer system. The collection system designed for the West Point treatment plant contains relief points (CSOs) to control the amount of combined sewage and stormwater that could enter the system, including the Elliott Bay Interceptor. The CSOs prevent the combined system from backing up and creating flooding problems. During large storm events, these CSOs release a mixture of stormwater and sanitary sewage to the LDW.

CSO events are combined discharges of stormwater, municipally permitted industrial discharges, and untreated sewage that are released directly into the waterway during heavy rainfall when the sewers have reached their capacity. CSO discharges can carry chemicals that impact sediments. The City of Seattle and King County are individual municipal NPDES permittees for CSOs. The City of Seattle owns about 100 CSOs and King County owns 38 CSO outfalls. Within the LDW site there are 9 CSOs that discharge in the LDW that are managed by King County. The King County CSO Control Program Review (April 2006) states that the King County Wastewater Treatment Division took a fresh look at existing information, reviewed new information, and completed studies to assess—both quantitatively and qualitatively—the health benefits to the public, environment, and endangered species, of bringing all CSOs under control. The assessment drew from studies describing existing environmental conditions and predicted conditions at the completion of the program. It built on the findings of King County's 1998 Water Quality Assessment of the Duwamish River and Elliott Bay and 1999 Sediment Management Plan—both done in support of the Regional Wastewater Services Plan—and on subsequent annual RWSP water quality reports.

Many recent studies have focused on the Duwamish River because of sediment cleanup projects in the area. With regard to protection of human health, information generated from the LDW Superfund process is increasing our understanding of fish consumption and human health risk. Studies underway may shed more light on whether these risks result from historical sediment contamination or from an ongoing contribution from CSOs and other sources. If an ongoing human health risk from CSOs in the Duwamish Waterway is identified, King County may consider changes in the control schedule to accelerate the CSO control projects in these locations. Determining relative priorities will be difficult because comparable information is not as available for other areas where CSOs occur, such as Elliott Bay, the Ship Canal, and the East and West Waterways of the Duwamish.

National Pollution Discharge Elimination System Permits

In 2004 the City of Seattle conducted a comprehensive survey of outfall or outfall-like structures terminating in the LDW. The survey identified 227 outfalls or structures. Of these, 42 are municipal owned outfalls, 101 were identified as privately owned outfalls, and 84 are of unknown ownership. Discharges from many of these outfalls are permitted under NPDES. There are six types of NPDES permits covering the LDW, described below:

- The **Phase I Municipal Storm Water Permit** covers stormwater discharges from outfalls owned by the City of Seattle, the Port of Seattle, and King County. The Phase I Municipal Storm Water Permit requires more monitoring than the general permits do, including the monitoring of the solids portion (sediments). Monitoring requirements are detailed in special conditions S8 in the Phase I permit. The Permit was issued on 17 January 2007. The analyte list is tiered depending on how much sediments are collected. The storm water monitoring portion of the permit does not require monitoring on all outfalls. The monitoring is limited to only 3 basins or sub basins considered representative of residential, commercial, and industrial use. Any monitoring required under this permit is of limited value to the LDW source control effort. The Phase I permit is heavily dependent on best management practices (BMPs) of the permitee, such as street sweeping and catch basin cleaning. Another key component of the permit is the requirement placed on the permit holders to detect, remove, and prevent illicit connections and illicit discharges, including spills into the municipal separate storm sewers (Special Condition 5.8.). This condition has resulted in the City, and County programs and ordinances governing storm water and surface water within their jurisdictions.

- The **Phase II Municipal Storm Water Permit** includes any City of Tukwila outfall. Part of the area that drains to EAA-7 is located within the city of Tukwila. Section S8 of the permit states:

  > "Permittees are not required to conduct water sampling or other testing during the effective term of this Permit, with the following exceptions:
  >
  > 1. Any water quality monitoring required for compliance with TMDLs, pursuant to section S7 Compliance with Total Maximum Daily Load Requirements and Appendix 2 of this Permit, and
  > 2. Any sampling or testing required for characterizing illicit discharges pursuant to section S5.C.3. or S6.D.3. of this Permit."

- The **General Storm Water Permit for Industrial Activities** covers 112 industries within the natural drainage basin of the LDW. This permit covers BDC, Boeing MFC, KCIA, Associated Grocers, Inc., Northwest Auto Wrecking, and Affordable Auto Wrecking. Coverage under the General Storm Water Permit for Industrial Activities requires monitoring of storm water discharge for Copper, Zinc, Oils, and Total Suspended Solids (TSS).

- The **General Sand and Gravel Permit** provides coverage for discharges of process water, stormwater, and mine dewatering water associated with sand and gravel operations, rock quarries and similar mining activities, including stockpiles of mined materials, concrete batch operations, and hot mix asphalt operations. There are five Sand and Gravel Permit holders along the LDW. The Sand and Gravel Permit generally requires monitoring for pH, turbidity, TSS, TDS, Temperature, Oils, and flow rate. There are no Sand and Gravel operations within the area that drains to EAA-7.

- The **General Boat Yard Permit** covers a commercial business engaged in the construction, repair, and maintenance of small vessels, 85% of which are 65 feet or less in length, or revenues from which constitute more than 85% of gross receipts. The permit generally requires monitoring for Copper, Oils, and TSS. These permits do not specifically require monitoring of the solids portion of storm water flow. There are two permitted boatyards in the LDW, neither of which is located within EAA-7.

- An **Individual Permit** is written for a specific discharge at a specific location. The individual permit is highly tailored to regulate the pollutants in the discharge. An individual permit may be a NPDES permit for discharges to surface waters. NPDES individual permits may be issued to an industry or to a municipality. There are four individual permits issued within the LDW. Individual permits for La Farge Cement and Duwamish Shipyard, which are located outside the EAA-7 drainage basin, are crafted for their respective industrial activity. The remaining two individual permits are for City of

Seattle and King County CSO system. The Norfolk CSO/SD is the only CSO discharge point in the EAA-7 drainage basin.

Piped Outfalls in the EAA-7 Area

The 84-inch Norfolk CSO/SD is the largest storm drain system in the vicinity of EAA-7. The Norfolk CSO/SD discharges to EAA-7 and is discussed in further detail in Section 2.3.1.1. In addition, there are five private storm drains owned by Boeing that discharge to EAA-7 (Figures 2 and 4):

- BDC Discharge Point 17
- BDC Discharge Point 4
- BDC Discharge Point 16
- BDC Discharge Point 3
- BDC Discharge Point 2

These private discharges are described in Section 2.3.1.3.

Another storm drain system, operated by the Washington State Department of Transportation (WSDOT), discharges stormwater to the LDW approximately 1,400 feet upstream of EAA-7 and is discussed in further detail in Section 2.3.1.2.

Potential sources that may contribute pollutants to these outfalls include:

- Chemicals carried by stormwater runoff (e.g., street dust, atmospheric deposition, automobile emissions, fertilizers, household pesticides, etc.)
- Industrial and municipal wastewater discharged through the Norfolk CSO/SD during CSO events
- Contaminated groundwater that may have infiltrated into the system through breaks in conveyance lines
- Materials improperly disposed of in the storm drain and/or combined/sanitary systems

2.3.1.1 Norfolk CSO/SD

The Norfolk CSO/SD discharges to EAA-7, and serves as both a CSO for the King County wastewater system and as a storm drain outfall for the Municipal Storm Drain System operated by the City of Seattle and the City of Tukwila.

The Norfolk Drainage Basin (comprising approximately 769 acres) and the combined sewer service area (comprising approximately 4,900 acres) contributing to the Norfolk CSO/SD are shown in Figure 10. The Norfolk CSO/SD system and outfall, near BDC Discharge Point 2, and a portion of the Municipal Storm Drain System are also illustrated in Figure 4 (labeled as “King County Storm Sewer System”). The 769 acre area of the Norfolk Drainage Basin includes the

100-acre I-5 drainage basin because low flows from this drainage system discharge to the Norfolk CSO/SD. The predominant land uses in the Norfolk Drainage Basin are industrial (32 percent) and right-of-way (32 percent), with smaller amounts of residential (16 percent) and vacant land (17 percent). (Schmoyer 2007).

The Norfolk drainage basin can be divided into 8 subbasins, described below (Schmoyer 2007):

- **Washington State Department of Transportation (WSDOT) Interstate 5 (I-5) Subbasin.** The I-5 subbasin comprises the central portion of the Norfolk basin, consisting of I-5 and the Military Road and Beacon Avenue subbasins. Runoff is conveyed in a series of pipes and ditches, and eventually discharges to the LDW in a 60-inch pipe. Low flows from the WSDOT I-5 system are routed to a stormwater treatment facility that discharges through a natural wetland system that drains to the Norfolk CSO/SD drainage system.
- **Military Road Subbasin.** The Military Road subbasin is located east of I-5 and west of Beacon Avenue South. Land use in this area is primarily residential. Runoff is transported by sheet flow along the streets and unpaved areas, eventually discharging to a ditch that runs along the east side of Military Road South and connects to the WSDOT I-5 drainage system.
- **Airport Way Subbasin.** The Airport Way subbasin runs along Airport Way South on the west side of I-5, collecting runoff from Airport Way South, the adjacent Burlington Northern-Santa Fe railroad track, and a small portion of the steep hillside east of I-5. Runoff from the southern half of the subbasin discharges to the LDW via the Norfolk CSO/SD. The northern half drains to the KCIA drainage system, which discharges to the LDW north of the EAA-7.
- **Beacon Avenue Subbasin.** The Beacon Avenue subbasin is located between I-5 and Beacon Avenue South. This area consists predominantly of a steep forested hillside with some residential areas along the eastern border. Runoff is conveyed in a ditch that runs along the east side of I-5 and connects to the WSDOT I-5 system.
- **East Henderson Subbasin.** The East Henderson subbasin is a residential neighborhood located on top of a steep forested hillside located east of I-5 and north of South Norfolk Street. There is no formal drainage system in this area, although there is a combined sewer system with some inlets and catch basin serving the area. However, because of poorly graded streets and insufficient catch basins, most of the runoff from this subbasin sheetflows down the steep hillside on the south end of this basin and collects in a ditch/depression on the north side of South Norfolk Street.
- **Martin Luther King Junior Way Subbasin.** The Martin Luther King Junior Way subbasin is located on the eastern edge of the Norfolk basin, draining the predominantly industrial area along Martin Luther King Junior Way South and steep, forested hillsides on both sides of the industrial area. Runoff is collected in a piped system that runs along Martin Luther King Junior Way South and then turns west through private property, discharging into a ditch that runs along the east side of I-5. This ditch crosses under I-5, discharging into the WSDOT stormwater treatment system at the head of the serpentine swale.

- **Ryan Way Subbasin.** The Ryan Way subbasin, which comprises residential and undeveloped forested areas within the City of Tukwila, is located at the southern end of the Norfolk basin. There is an existing drainage system along Ryan Way that collects runoff from the road and some adjacent parcels, and then discharges into the ditch described above on east side of I-5.
- **Norfolk Street Subbasin.** The Norfolk Street subbasin comprises the lower portion of the Norfolk basin, located on both the east and west sides of I-5. The portion on the east side drains to the ditch east of I-5. The portion on the west side includes the area between East Marginal Way South, Boeing Access Road, and Airport Way South, including the southern portion of KCIA. Runoff is collected in a series of informal culverts that drain to the LDW via the Norfolk CSO/SD outfall.

The Norfolk Drainage Basin contains several upland facilities that could pose a threat of sediment recontamination in EAA-7. Information on the storm drain system at each upland facility of concern is provided in Section 3.

The configuration of the City of Tukwila's storm drain system, based on a GIS provided by City of Tukwila, is illustrated in Figures 11 through 14. King County sewer lines are also illustrated in these figures. The City of Tukwila storm drain system and the King County sewer lines appear to be at least partially interconnected along East Marginal Way South (Figure 13), which runs between the BDC, the eastern portion of the MFC, the western part of Associated Grocers, Inc., and Northwest Auto Wrecking. Many of the catch basins identified in the City of Tukwila's storm drain GIS are in the same approximate locations as those shown on the BDC storm drain system (Figures 4 and 14). This interconnection includes a part of piping and four catch basins, located in the southeastern portion of the BDC, that connects to the Municipal Storm Drain System. A City of Tukwila storm drain catch basin located south of the Arco Gas Station that has been sampled by Seattle Public Utilities is shown in Figure 8. The Norfolk CSO/SD system and its components are described below.

Information regarding discharges to the Norfolk CSO/SD from the identified upland facilities of concern is summarized in the following subsections. The BDC also has one discharge point that discharges to the Norfolk CSO/SD line immediately upstream of its discharge to the LDW.

Permitted Discharges

In EAA-7, six industrial sites (BDC, MFC, KCIA, Associated Grocers, Inc., Northwest Auto Wrecking, and Affordable Auto Wrecking) that are identified sites of concern are authorized to discharge under the general NPDES permit for industrial stormwater (Industrial Stormwater General Permit). In addition, individual Wastewater Discharge Authorizations are issued by King County for BDC and Associated Grocers, Inc. These permits are listed in Table 3 and are described briefly below.

In addition, the BDC has a Wastewater Discharge Authorization (No. 526-04) under the King County Industrial Waste Program to discharge wastewater generated from the vactor decant station operations, composite parts wash stall operations, photo processing, water jet cutting operations, and groundwater remediation activities to the County combined sewer system. The maximum volume for this permit is 25,000 gallons per day and 25,000 gallons per day allocated for groundwater remediation activities.

Associated Grocers, Inc. has been issued a Minor Discharge Authorization No. 732-01 from the King County Industrial Waste Program. This allows the site to discharge limited amounts of industrial wastewater into King County's sewer system in accordance with effluent imitations and other requirements and conditions listed in the document. According to the permit, discharge is to the south treatment plant for wastewater generated by contaminated stormwater with an oil/water separator as a pre-treatment process. The maximum volume allowed is 25,000 gallons per day.

Improvements to the Norfolk CSO System

In the spring of 2005 the King County Wastewater Treatment Division completed the construction of the Henderson/Norfolk CSO Treatment Facility to eliminate CSOs into Lake Washington and the LDW. The system consists of the inlet regulator; the 14-foot 8-inch inside diameter, 3,100-foot long 42nd Avenue Storage and Treatment Tunnel; the outlet regulator; several junction manholes, and auxiliary equipment. The system is located between South Henderson Street and South Norfolk Street just west of Martin Luther King Jr. Way. These facilities provide storage and treatment of potential CSO during peak storm events. The diversion of wastewater into the tunnel prevents the discharge of CSO to surface waters during all but the most severe storms. CSOs that are discharged receive primary treatment by settling, screening, disinfection, and dechlorination. If the tunnel fills before the peak event is over, it will overflow the tunnel at the outlet regulator. The overflow is dechlorinated with sodium bisulfite, and passed through fine screens to remove floatable debris. Treated CSO discharges to the LDW through the treated CSO pipeline connect to the Norfolk CSO/SD (King County Department of Natural Resources 2006).

The Henderson/Norfolk CSO Control facility began operating in May 2005. During the annual reporting period of 2005-2006, the treatment tunnel did not need to operate, and there were no discharge events from any of the facilities controlled by this control facility. One-hundred percent of the volumes that previously discharged untreated at those CSOs was captured and received full secondary treatment and disinfection. The King County Wastewater Treatment Division concluded that, although it appears the project was successful, it will require a more normal rain pattern to fully assess effectiveness (King County Department of Natural Resources 2006).

Improvements to the Municipal Storm Drain System

Seattle Public Utilities (SPU) is currently designing improvements to the stormwater drainage system in the Martin Luther King Jr. Way South subbasin to accommodate runoff from the newly constructed drainage system along Martin Luther King Jr. Way South (built by Sound Transit) and to fix a damaged section of the system. A 36-inch private storm drain located between Martin Luther King Jr. Way South and I-5 has collapsed in several places and has many breaks along its length (SPU 2006). This line serves as a major trunk line in the Martin Luther King Jr. Way subbasin, conveying runoff from the road and properties east of Martin Luther King Jr. Way South to the ditch that runs along the east side of I-5. The ditch has also become plugged due to lack of maintenance, effectively blocking the downstream end of the 36-inch line. As a result, runoff from the Martin Luther King Jr. Way subbasin backs up, overflows into an adjacent sanitary sewer, and is routed north along Martin Luther King Jr. Way South to a City pump station. The pump station connects to the King County combined sewer system on South Norfolk Street. King County has notified the City of Seattle that stormwater discharges to the sanitary sewer system must be eliminated (Schmoyer 2007).

The proposed improvements, which consist of replacing the damaged section of the 36-inch line, restoring the hydraulic capacity of the existing ditch along the east side of I-5, and constructing a stormwater wet pond west of I-5 to treat runoff from this basin is currently scheduled for construction in 2008-2009 (Schmoyer 2007).

2.3.1.1.1 In-Line Sediment Sampling

Sediments near the Norfolk CSO/SD outfall contain elevated levels of contaminants, primarily PCBs, mercury, 1,4-dichlorobenzene, and bis(2-ethylhexyl) phthalate. In an effort to help identify potential sources of Norfolk CSO/SD sediment recontamination, SPU collected samples of sediment deposited within the drainage system (i.e., at maintenance holes and from the WSDOT stormwater pond in the system). The eight sampling locations are shown in Figure 15. A summary of dates and locations of in-line sediment samples collected is provided in Table 4. Analytical results are summarized below and provided in Appendix B.

- **MH1.** Zinc concentrations in both samples from MH1 (1,150 mg/kg dw and 1,230 mg/kg dw) exceeded the SQS value (410 mg/kg dw) and the CSL value (960 mg/kg dw). Bis(2-ethylhexyl) phthalate concentrations in both samples (324 mg/kg OC and 343 mg/kg OC) exceeded the SQS value (47 mg/kg OC) and the CSL value (78 mg/kg OC). The samples contained total petroleum hydrocarbon (TPH) diesel at concentrations ranging from 2,300 mg/kg dw to 3,200 mg/kg dw and TPH-oil at concentrations ranging from 5,300 to 7,600 mg/kg.
- **MH3.** The sample collected in 2003 contained zinc (1,060 mg/kg dw) at a concentration greater than both the SQS value and the CSL value. The zinc concentration in the 2005 sample (847 mg/kg dw) exceeded only the SQS value. The 2003 and 2005 samples contained concentrations of bis(2-ethylhexyl) phthalate (309 mg/kg OC and 438 mg/kg OC, respectively), exceeding both the SQS and CSL values. TPH-diesel was detected in the 2003 sample at 2,200 mg/kg dw, and TPH-oil was detected at 5,000 mg/kg dw. TPH-diesel and TPH-oil concentrations were not available for the sample collected in 2005.
- **MH4.** Both the 2003 and 2005 samples contained zinc at concentrations (416 mg/kg dw and 415 mg/kg dw, respectively) that exceeded the SQS value. The 2003 sample contained TPH-oil at 2,900 mg/kg dw. TPH-diesel and TPH-oil concentrations were not available for the sample collected in 2005. The 2005 sample contained the following PAHs at concentrations exceeding the respective SQS values: benzo(a)pyrene (119 mg/kg OC) in exceedance of the SQS (99 mg/kg OC); benzo(g,h,i)perylene (32 mg/kg OC) in exceedance of the SQS value (31 mg/kg OC); chrysene (131 mg/kg OC) in exceedance of the SQS (110 mg/kg OC); fluoranthene (165 mg/kg OC) in excess of the SQS (160 mg/kg OC); and indeno(1,2,3-c,d)pyrene (36 mg/kg OC) in excedance of the

SQS (34 mg/kg OC). Both samples contained concentrations of bis(2-ethylhexyl) phthalate (119 mg/kg OC and 444 mg/kg OC) in exceedance of the SQS value (47 mg/kg OC) and CSL value (78 mg/kg OC). The 2003 sample contained butylbenzylphthalate (6 mg/kg OC) in exceedance of the SQS value (5 mg/kg OC).

- **MH5-N2.** The sample contained TPH-oil at 3,600 mg/kg dw. The sample contained bis(2-ethylhexyl) phthalate (148 mg/kg OC) in exceedance of both the SQS value and the CSL value, and butylbenzylphthalate (41 mg/kg OC) in exceedance of the SQS value (4.9 mg/kg OC). The sample also contained n-nitrosodiphenylamine (20 mg/kg OC) in exceedance of both the SQS value (11 mg/kg OC) and CSL value (11 mg/kg OC).
- **MH5-N3.** The sample contained zinc at a concentration (9,980 mg/kg dw) significantly exceeding both the SQS and CSL values.
- **MH6.** The detected concentration of 627 mg/kg dw zinc was in exceedance of the SQS value.
- **MH7.** Neither sample contained concentrations of any contaminants in exceedance of SQS or CSL values.
- **Norfolk 20.** The detected zinc concentration (651 mg/kg dw) was in exceedance of the SQS value.
- **Norfolk 21.** No contaminants were detected at concentrations in exceedance of SQS or CSL values.

The in-line sediment sampling results characterize contaminant levels in the largest and most heavily industrialized part of the Norfolk SD drainage basin. In-line sampling data are not currently available for other portions of the Norfolk SD drainage basin.

2.3.1.2 WSDOT Storm Drain

The 60-inch WSDOT storm drain discharges to the LDW approximately 1,400 feet upstream of the Norfolk CSO/SD (Figure 10). This drain serves approximately 100 acres, including 1.5 miles of I-5, and other areas adjacent to I-5. The WSDOT system also accepts overflows from the MLK Way subbasin of the Norfolk drainage basin via an overflow structure located just south of the Associated Grocers property (Schmoyer 2007).

In 1999, WSDOT constructed a stormwater treatment system, consisting of a two-celled pond and a serpentine swale to treat runoff from the I-5 subbasin. The system is designed to treat runoff from the water quality design storm. Higher flows are routed around the treatment system to the WSDOT 60-inch storm drain. Flows up to and including the water quality design storm are routed through the treatment system and then in a culvert under the railroad right-of-way, where it ties into the Norfolk CSO/SD system. Runoff from the Martin Luther King Jr. Way subbasin enters the WSDOT system just below the pond and passes through the swale system.

2.3.1.3 Private Stormwater Discharges

Private stormwater discharges to the LDW in EAA-7 include five outfalls from BDC's storm drain system. The BDC covers a 174-acre area on the east bank of the LDW. Catch basins within the site collect stormwater and discharge it to the LDW at a total of 18 locations, five of which discharge directly to the LDW within EAA-7. These outfalls are: BDC discharge points DC17, DC4, DC16, DC3, and DC2 (Figures 2 and 4). A sixth private stormwater discharge owned by Boeing, discharge point DC1, connects to the Norfolk CSO/SD a short distance upstream of the Norfolk CSO/SD outfall into the LDW. Nine main lines have in-line oil/water separators installed in the system immediately prior to discharge. Smaller lines are not serviced with oil/water separators and discharge directly into the LDW because they drain areas of relatively low activity and small surface area (Boeing 2003a).

The six private storm drain systems with outfalls that discharge to the LDW within EAA-7 are illustrated in Figure 4 and described below:

- **Discharge Point DC17.** This outfall drains a small roof area of the southwest corner of the large 9-101 building, half the roof areas of each of the 9-140 and 9-130 buildings, and the parking and driving areas around portions of these buildings. Stormwater is collected into a drain system that discharges to the LDW. This is considered a small volume outfall (Boeing 2003a).
- **Discharge Point DC4.** This outfall drains the southwest corner of the roof of the small 9-140 building and the pavement and planted areas around this portion of the building. Stormwater is collected into a drain line which then discharges into the LDW. This is considered a very small volume outfall (Boeing 2003a).
- **Discharge Point DC16.** This outfall drains a small roof area of the southwest corner of the small 9-140 building and the pavement and planted areas around this part of the building. Stormwater is collected in one drain which then discharges into the LDW. This is considered a small volume outfall (Boeing 2003a).
- **Discharge Point DC3.** This outfall drains half of the roof of each of the small 9-140 and 9-130 buildings, the parking and driving areas around each of those buildings, and a small landscaped park-like area for employee use. Stormwater is collected into a drain line running through the area and discharges to the LDW. This is considered a small volume outfall (Boeing 2003a).
- **Discharge Point DC2.** This outfall drains half of the roof of the large 9-101 building, all of the small 9-110 building, and the parking and driving areas surrounding portions of those buildings. Stormwater is collected into a primary drain line which runs under part of the south end of the facility, discharging into the LDW. This is considered a large volume outfall (Boeing 2003a). This storm drain is also referred to as the south storm drain.
- **Discharge Point DC1.** This outfall drains into the Municipal Storm Drain System, which then discharges into the LDW via the Norfolk CSO/SD outfall. The BDC outfall collects stormwater primarily from parking and drive areas and discharges to the county system via an oil/water separator (Boeing 2003a).

2.3.2 Groundwater

Contaminated groundwater may enter directly into the LDW via seeps or infiltration into storm drains/pipes, ditches, or creeks that discharge to the waterway. Contaminants in soil resulting from spills and releases to adjacent (and possibly upland) properties may be transported to groundwater and subsequently be released to EAA-7. In general, shallow groundwater in the Duwamish Valley is typically encountered within about 3 meters (10 feet) of the ground surface and exists under unconfined conditions. The general direction of shallow groundwater flow in the Duwamish Valley is toward the LDW, although the direction may vary locally depending on the nature of the subsurface material and temporally based on proximity to the LDW and the influence of tidal action. High tides can cause temporary groundwater flow reversals, generally within 100 to 150 meters (300 to 500 feet) of the LDW (Cargill et al. 2006).

2.3.3 Bank Erosion/Leaching

Waterway bank soil, contaminated fill, waste piles, landfills, and surface impoundments may release contaminants directly to EAA-7 through erosion, soil erosion to stormwater, or leaching to groundwater.

2.3.4 Atmospheric Deposition

Air pollution can enter the LDW directly or through stormwater, thus becoming a possible source of sediment contamination to EAA-7. Air pollution can be localized, such as paint overspray, sand-blasting, and fugitive dust and particulates from loading/unloading of raw materials such as sand, gravel, and concrete, or it can be widely dispersed from vehicle emissions, industrial smokestacks, and other sources.

King County has been monitoring atmospheric deposition to assess whether atmospheric deposition is a potential source of phthalates, particularly bis(2-ethylhexyl) phthalate, in stormwater runoff (King County and Seattle Public Utilities 2005). Passive deposition samplers (i.e., stainless steel bowls that drain into a glass bottle), were placed at four locations in the LDW area as well as in surrounding neighborhoods to collect samples of both wet and dry atmospheric deposition. Results showed PAH, benzyl butyl phthalate, and bis(2-ethylhexyl)phthalate in the Duwamish Valley at concentrations two to three times higher than outside the valley (Beacon Hill) during the winter months compared to the spring months (King County and Seattle Public Utilities 2005). This finding is consistent with previous sampling results by Puget Sound Clean Air Agency showing atmospheric particulate concentrations trending higher during fall/winter months than during spring/summer months.

King County (King County and Seattle Public Utilities 2005) concluded that the LDW sample results compared well with studies conducted within the same airshed (i.e., Georgia Basin) and with other regions (i.e., Great Lakes and Roskilde Fjord [Denmark] studies). PAH values observed in LDW samples (0.006 to 0.28 micrograms per meter squared per day [$\mu g/m^2/day$]) were comparable to the average values reported for the Georgia Basin airshed (0.004 to 0.36 $\mu g/m^2/day$). The LDW bis(2-ethylhexyl) phthalate values (0.23 to 3.5 $\mu g/m^2/day$) were higher than the Georgia Basin average values (0.3 to 0.6 $\mu g/m^2/day$), but were comparable with the results from the Denmark study (0.068 to 2.16 $\mu g/m^2/day$). The study noted that further atmospheric deposition testing was needed to evaluate the reproducibility of results and to perform correlations with existing atmospheric measurements (e.g., particulate concentrations).

Available information (e.g. EPA's Toxics Release Inventory [TRI] database) does not indicate that any of the identified facilities of concern are sources of the chemicals of concern in EAA-7 sediments.

2.3.5 Spills

Spills of waste materials containing contaminants of concern may occur directly to the LDW or onto the ground within the drainage area that discharges into the LDW near EAA-7. Activities occurring directly adjacent to the EAA-7 at this time may result in spills. Storm Water Pollution Prevention Plans outline areas of risk to storm water pollution for each facility of potential concern.

3.0 Potential Sources of Sediment Recontamination

LDW sediments in the EAA-7 have been impacted by chemical contaminants from a variety of historical and potentially ongoing sources. Several industrial facilities within the drainage basin that discharge to EAA-7 have been identified as facilities of concern. These facilities and other potential sources of contamination to EAA-7 sediments are illustrated in Figure 5 and discussed below. To assess whether a facility could be a source of sediment recontamination, it is necessary to evaluate potential contaminant migration pathways that may exist between the potential sources and the LDW. Media relevant to source control that can potentially be impacted by human activities are water, soil, and air. Such contaminated media can impact sediments through several migration pathways, including direct discharges, stormwater discharges, CSOs, groundwater, bank erosion/leaching, atmospheric deposition, and spills. The potential contaminant migration pathways evaluated for EAA-7 are described below.

3.1 Upland Facilities

Upland sites may contribute contamination to EAA-7 through stormwater, illegal discharges, and spills that could enter into the piped drain systems that discharge to the LDW. In addition, contaminated groundwater from upland sites could discharge directly to the LDW or infiltrate into storm drains that discharge into the LDW. If chemicals of concern from an upland site reach the LDW, they could recontaminate the sediments. Ecology identified the following upland facilities of concern due to their potential to contaminate the sediments in EAA-7:

- BDC
- MFC
- KCIA
- Associated Grocers, Inc.
- Northwest Auto Wrecking
- Affordable Auto Wrecking
- Arco Gas Station.

The locations of these facilities are illustrated in Figures 11 through 14.

This section discusses current and historical land uses and summarizes environmental investigations and cleanups at the facilities of interest. Current land use information was obtained from existing reports and Ecology databases and was inferred from aerial photographs. The Ecology online databases were searched for information on current NDPES permit numbers, USTs, LUST release incidents, hazardous waste facilities, and for inclusion of the property on the CSCSL. Property ownership information was obtained from King County tax records and from existing reports. Table 1 summarizes property information, and Table 3 summarizes the regulatory database listings.

3.1.1 Boeing Developmental Center

3.1.1.1 Current Operations

The BDC is located at 9725 East Marginal Way South in Tukwila Washington. Boeing has operated on portions of this site continuously since 1956. The BDC facility layout is illustrated in Figure 16. The BDC is primarily an aircraft and aerospace research and development complex. Operations include manufacturing airplanes and missiles, which involves machining metal aircraft hardware, electroplating, chemical milling, conversion coating, painting, parts cleaning, and assembly (Bower 2002).

The BDC comprises about 174 acres. Fifty-four designated buildings are located on the site, including office buildings, the 9-101 high-rise manufacturing building, and buildings that house various aerospace manufacturing and support operations, which include manufacturing, fabrication, composite material assembly, painting, and other activities (Boeing 2001).

The land surrounding the facility is used primarily for industrial and commercial activities. It is located within a large, contiguous industrial area, which extends from Harbor Island to near the head of navigation of the Duwamish waterway. To the east is the Boeing MFC, and further east is the southernmost portion of the KCIA. The Duwamish waterway lies along the southern and the western portions of the property boundary. To the north, Slip No. 6 separates the BDC from the former Rhone Poulenc Company Chemical Manufacturing Facility (Bower 2002).

According to the King County tax assessor website (King County 2007b), the BDC is listed as being located at 9905 East Marginal Way South, which corresponds to parcel 0003400018. This 52-acre property is owned by Boeing and includes the following nine structures:

- A two story, 11,12,432-square foot (sq. ft.) industrial heavy manufacturing building (built in 1957);
- A 177,470-sq. ft. industrial light manufacturing building (built in 1957);
- A 143,575-sq. ft. office building (built in 1961);
- A 217,537-sq. ft. office building (built in 1961);
- A 145,382-sq. ft. office building (built in 1962);
- A 47,874-sq. ft. storage warehouse (built in 1957);
- A 18,594-sq. ft. cafeteria (built in 1961);
- A 17,110-sq. ft. office building (built in 1957); and
- A 13,110-sq. ft. industrial engineering building (built in 1983).

The BDC also includes the following parcels, also owned by Boeing (King County 2007b):

- Parcel 0003400028 – 2.25 acres, zoned for commercial use and used for parking;

- Parcel 5624201032 – 25.78 acres, zoned for commercial/industrial use and contains four structures: a 244,121-sq. ft. office building (built in 1990), a 76,744-sq. ft. service repair garage (built in 1986), a 70,964-sq. ft. industrial engineering building (built in 1986), and a 9,022-sq. ft. cafeteria (built in 1991);
- Parcel 5624201036 – 3.25 acres, zoned for commercial/industrial use;
- Parcel 5624201038 – 3.78 acres, zoned for commercial/industrial use; and
- Parcel 0423049183 - 0.81 acres, zoned for commercial/right of way/utility road use.

The following parcels are leased by Boeing from East Marginal Associates (King County 2007b):

- Parcel 0423049016 – 3.07 acres, zoned for commercial use and used as vacant land;
- Parcel 0003400048 – 1.38 acres, zoned for commercial use and used for parking;
- Parcel 0003400026 – 3.88 acres, zoned for commercial use and used for parking.

The following parcel is part of the BDC but is not owned by The Boeing Company (King County 2007b):

- Parcel 5624200990 – 14.21 acres, zoned for commercial/industrial use and owned by Mellon Trust of Washington – Desimone. There are three structures on this parcel: a 70,235-sq. ft. industrial light manufacturing building (built in 1969); a 140,045-sq. ft. industrial engineer building (built in 1957); and a 9,365-sq. ft. office building (built in 1987).

The following surrounding land-use information was also obtained from the King County tax assessor website (King County 2007b):

- To the north of the site (9229 East Marginal Way South, parcel 5422600010) is a 19.93-acre property owned by Container Properties LLC. This parcel contains five buildings, two of which are used as office buildings, one as a storage warehouse, one for industrial light manufacturing, and one as an open office.
- To the northeast of the site (no listed address, parcel 5624201034) is a 5.48-acre property that is part of the MOF. This parcel is owned by the King County MOF and contains two buildings used as a storage warehouse and an office building.
- To the east of the site (9404 East Marginal Way South, parcel 3324049019) is the MOF. This 11.44-acre parcel is owned by the Museum of Flight Foundation and contains five buildings, two of which are used as a museum, one as a restaurant, one as an office building, and one for industrial heavy manufacturing.
- To the southeast of the site is the MFC site; this facility is discussed further in Section 3.1.2.
- To the south of the site (no listed address, parcel 0423049002) is the Strick Lease Storage Yard. This 2.86-acre property is a vacant lot owned by John Roach.

The BDC has been issued an Industrial Stormwater General Permit No. SO3000146D by Ecology. The permit expires on September 20, 2007. Ecology plans to reissue Industrial Stormwater General Permits on August 20, 2007. Based on Ecology's online database, the parameters for this permit are for pH with a minimum of 6.5 and a maximum of 8.5 standard pH units. (Ecology 2007d)

The BDC is listed as a Hazardous Facility on Ecology's online Hazardous Site Facility Search database and has a Resource Conservation and Recovery Act (RCRA) ID No. WAD093639946 (Boeing A&M Developmental Center) (Ecology 2007e). According to the BDC SWPPP (Boeing 2001), solid and liquid hazardous wastes are accumulated at collection stations inside buildings where hazardous wastes are generated. These wastes are managed per the Hazardous Waste Management Plan, with liquid wastes held in areas with secondary containment. Most waste is generated in the 9-101 building. No documents indicated that Boeing is out of compliance.

The facility has been issued a Wastewater Discharge Authorization No. 526-04 from the King County Industrial Waste Program to discharge wastewater generated from the vactor decant station operations, composite parts wash stall operations, photo processing, water jet cutting operations, and groundwater remediation activities. This authorization is effective November 17, 2005, through November 16, 2010.

According to Ecology's online NPDES and State Waste Discharge Permit database, this site does not have an Individual Wastewater Discharge permit (Ecology 2007c).

EPA's online TRI database (http://www.epa.gov/triexplorer/) was searched for information on the BDC. In general, the database contains information on toxic chemical releases and other waste management activities reported annually by certain industry groups as well as federal facilities. Release Reports, Waste Transfer Reports, and Waste Quantity Reports were searched in this database. In general, the databases for Release Reports and Waste Transfer Reports contain data for the years 1988 through 2004, and the database for Waste Quantity Reports contains data for the years 1991 through 2004. Data for the BDC are provided in the Release Reports and Waste Transfer Reports for the years 1988 through 1994, and in the Waste Quantity Reports for the years 1991 through 1994.

Quantities of the releases are summarized by report type in Appendix A. In the Release Reports and Waste Transfer Reports for the years 1988 and 1989, 1,1,1-trichloroethane, acetone, Freon 113, methyl ethyl ketone, and toluene were listed for the BDC. For 1990, Freon 113, methyl ethyl ketone, and toluene were listed. For the years 1991-1994, the only chemical listed is 1,1,1-trichloroethane. In the Waste Quantity Reports for the years 1991 through 1994, 1,1,1-trichloroethane is the only chemical listed.

3.1.1.2 Historic Use

Prior to 1918, the site was farmland until the U.S. Army Corps of Engineers channelized the Duwamish waterway. The earliest known commercial operations at the site began in 1927. Information on land use between 1927 and 1956 is not available. Boeing has operated on portions of this site continuously since 1956. Prior to 1980, the Military Airplane Company Division of Boeing operated this facility. The BDC began operations in October 1980. In November 1987, the operation was transferred to the Boeing Advanced Systems Company Division. In 1990, as part of reorganization, Boeing separated the BDC from the MFC (SAIC 1994).

In the mid-1930s, the southeastern portion of the property contained a grocery store and gasoline station. Part of the grocery store building was leased, with a tavern and warehouse occupying the building. A fire destroyed the building in the 1940s. The gas station operated for a short time period. In 1938, a winery owned by American Winegrower's Association occupied the property south of Washington Compressed Gas and adjacent to East Marginal Way. The winery expanded in 1946 and again in 1968, when it occupied 60,000 sq. ft. The winery closed in the mid-1970s. There were two 1,000-gallon underground concrete settling tanks associated with the winery that are no longer on site (SAIC 1994).

An auto wrecking yard occupied the area of the BDC south parking lots until 1956. Pamco Construction Company owned and operated a construction yard and commercial parking lot north and west of the auto wrecking yard. The construction yard closed in 1955. Boeing has a long term lease on the parking lot. Between 1958 and 1963, Pro Gas, a propane distributor, was located between East Marginal Way and the Step 3 area. A commercial trucking operation (Dallas-Mavis) occupied the location of the 9-04 building and the adjacent parking lot areas (part of the former winery) until 1989. A 77,000 sq. ft. granary was located north and west of the winery. It ceased storing grain in 1973 and functioned as a warehouse until 1985 (SAIC 1994).

Monsanto Fund purchased the northern 38 acres of the BDC at an unknown time. The area included warehouse and office buildings, winery buildings, the granary, Dallas-Mavis, and Slip No. 6. During the time that Monsanto owned the 38 acres they leased out the property. The Port of Seattle purchased the property and took over the leases in 1976. They leased the northeastern 5 acres in two 2.5-acre parcels to Kenworth Truck Company and Transport Pool granary for storage. Terminal 128 Corporation leased Slip No. 6 and intended to develop the slip as a marina. However, those plans never materialized and the Port sold Boeing the property in 1985 (SAIC 1994).

A Department of Transportation (DOT) aerial photo from 1984, obtained from Ecology, appears to show a barge operation located on parcel 0423049016. This area is now a paved parking lot. This property is leased by Boeing from East Marginal Associates. The Memorandum of Lease, dated May 31, 1985, states that the lease is for 20 years, ending on July 31, 2006. There is no sampling information from this portion of the property. It is not known if Boeing has renewed this lease.

Boeing has operated on portions of this site continuously since 1956. Prior to 1980, the Military Airplane Company Division of Boeing operated this facility. The BDC began operations in October 1980. In November 1987, the operation was transferred to the Boeing Advanced Systems Company Division. In 1990, as part of reorganization, Boeing separated the BDC from the MFC (SAIC 1994).

Historic activities conducted by Boeing at the site include manufacturing of airplanes and missiles, which involves machining metal aircraft hardware, electroplating, chemical milling, conversion coating, painting, parts cleaning, and assembly. Past projects at the BDC include research on supersonic transportation and development of military aircrafts (Johnstone 1993).

3.1.1.3 Environmental Investigations and Cleanup Activities

The BDC is listed on several databases, including Ecology's online CSCSL database, Ecology's online Hazardous Waste Facility search database, and Ecology's online Industrial Stormwater General Permit databases. The BDC has had several environmental cleanup activities at the site, including RCRA corrective actions for groundwater and soil contamination, groundwater monitoring at the Museum of Flight (MOF) at Gate J-28, and soil remediation at the south storm drain (the outfall of which is also referred to as DC2).

The BDC is a RCRA-corrective action site with remedial activities conducted under the Ecology Voluntary Cleanup Program (VCP). Investigative activities have been conducted to determine if soil contamination and a historical gasoline leak have impacted groundwater (IT Corporation 2004).

On Ecology's CSCSL database, the BDC (Facility ID No. 4581384) is listed as having soil contamination below Model Toxics Control Act (MTCA) cleanup level for PCBs (Ecology 2007a). The BDC (listed as the Boeing A&M Developmental Center, Facility Site ID No. 2101) is also listed as having confirmed groundwater and soil contamination, and suspected surface water, air, and sediment contamination. The contaminants are listed as base/neutral/acid organics, EPA priority pollutant- metals and cyanide, petroleum products, and non-halogenated solvents. In addition to these contaminants, chlorinated solvents, including tetrachloroethene, cis-1,2-dichloroethene, and vinyl chloride, were identified as contaminants of concern in groundwater as part of the EPA RCRA investigations and corrective actions (Jacob 2004). RCRA corrective actions are discussed further below.

The BDC (identified as the Developmental Center on Ecology's online UST database) is reported to have eleven USTs at the facility. Four of these USTs are listed as being removed, one as closed in place, three as exempt, and three as operational and containing diesel fuel or unleaded gasoline. According to Ecology's online LUST database, the site (Facility Site ID No. 2101) is listed as having soil and groundwater contamination. The database lists that the cleanup for both the soil and groundwater contamination has been started, at Building 9-52 (Ecology 2007b). The December 2003 SWPPP (Boeing 2003a) identifies the following five USTs located on site:

- DC16, a 1,000-gallon tank with diesel located south of building 9-101;
- DC18, a 550-gallon tank with diesel located north of building 9-52;
- DC19, a 1,100-gallon tank with unleaded gasoline located north of building 9-52;
- DC20, a 20,000-gallon tank with fuel oil located west of building 9-72; and
- DC21, a 20,000-gallon tank with fuel oil located west of building 9-72.

RCRA Corrective Actions

Under its RCRA corrective action authority, EPA conducted a RCRA Facility Assessment in 1994, and identified 157 Stormwater Management Units (SWMUs) and five Areas of Concern (AOCs) at the BDC. Subsequent investigation determined most of these do not pose a threat to human health or the environment. Following submittal of a Summary Report by Landau Associates (Landau 2002), Ecology determined the following areas required continued monitoring and evaluation: SWMU-17 and SWMU-20, and AOCs 01, 02, 03, 04, and 05. Two consecutive quarters of monitoring at AOC 01 through 04 showed contaminants of concern were not detected. (Jacob 2004).

RCRA corrective actions have been taken at AOC-5, SWMU-17, and SWMU-20. These areas are illustrated in Figure 17. The RCRA corrective actions are described below for each of these areas. Each of these RCRA corrective action areas is located north of the area that drains into the EAA-7 area of interest.

AOC-05

AOC-05 contained a former 1,000 gallon UST, DC-01, which was used for storing unleaded gasoline. UST DC-01 and an associated pump island were located approximately 30 to 25 feet south of the southwest corner of Building 9-61 (Jacob 2004). According to Boeing's stormwater drainage map (Boeing 2003a), stormwater in the area of AOC-05 drains to the LDW at discharge point 9 (DC9), which is located to the north of the six private Boeing outfalls and the Norfolk CSO/SD, and thus lies outside of EAA-7. Based on water level measurements taken in May 2006, groundwater in the AOC-05 area flows to the west, as illustrated in Figure 18.

Between August 23 and 25, 1985, the DC-01 reportedly leaked approximately 830 gallons of unleaded gasoline. The UST was removed in September 1985, along with 500 to 600 gallons of product recovered from the excavation. An unreported volume of gasoline-contaminated soil was also excavated. Two monitoring wells, BDC-01-1 and BDC-01-2, were installed in 1985, and groundwater samples were collected in 1986. At BDC-01-1, the monitoring well located west of the former UST, benzene was detected at a concentration of 20 µg/L. These wells were abandoned in October 1989 (IT Corporation 2001).

At AOC-05, Oxygen Release Compound (ORC) was injected in May 2002 to address gasoline-range total petroleum hydrocarbons (TPH-G) and benzene, toluene, ethylbenzene, and xylenes (BTEX) present in groundwater. After injection, groundwater was monitored quarterly and then semiannually through November 2003. Samples were analyzed for TPH and BTEX (Jacob 2004).

Additional groundwater monitoring has occurred since 2003. The latest report reviewed for this report summarized groundwater sampling conducted in May 2006. The groundwater sample from well BDC-103, located to the south of Building 9-61 and within the AOC-05 area (Figures 17 and 18), had a TPH-G concentrations of 86 milligrams per liter (mg/L). The sample also contained benzene at a concentration of 1,600 micrograms per liter (µg/L), toluene at 3,800 µg/L, ethylbenzene at 3,100 µg/L, and total xylene at 12,000 µg/L. The samples from wells

BDC-101 and BDC-102, which are both downgradient of the ORC injection points, had no detected TPH or BTEX. Implementation of bioremediation at AOC-05 was recommended (Bet 2006). Pilot testing began in January of 2007 (Bet 2007).

SWMU-17

SWMU-17 consists of a former 67-gallon sump and associated 4,000 gallon steel UST, designated DC-05. The UST was located east of Building 9-75's water tank (Figure 17) (Jacob 2004). According to Boeing's stormwater drainage map (Boeing 2003a), the area where SWMU-17 is located drains to the LDW to DC9, which is north of the six private Boeing outfalls and thus outside of EAA-7.

The sump and UST were installed in 1957 and removed in 1986. Waste oil generated by hydraulic testing shops, automotive maintenance shops, and various other operations at the BDC was reportedly poured into the sump and flowed into the UST. After removal of the UST, minor amounts of hydrocarbons were present in the soil. Eight monitoring wells were installed, and groundwater samples collected from the wells have been analyzed for volatile organic compounds (VOCs) and priority pollutant metals.

In August 1988, Ecology stated no further work was required at SWMU-17, and the monitoring wells could be abandoned (Jacob 2004). Nonetheless, sampling continued from 1988 through 2006. Samples have been collected on an annual or semiannual basis for VOCs, TPH, and metals analysis. During the most recent sampling event in May 2006, all the samples from monitoring wells surrounding SMUW-17 had detectable concentrations of VOCs and metals. A summary of sampling results is provided in Table 5 (Bet 2006).

SWMU-20

SWMU-20 was a vapor degreaser located in the northwest corner of Building 9-101 (Figure 17) (Jacob 2004). According to Boeing's stormwater drainage map, this area of Building 9-101 drains to the LDW at discharge point (DC9), which is north of the six private Boeing outfalls and thus outside of Early Action Area 7.

Other Remedial Activities

Remediation activities have taken place at two other sites of documented contamination at the BDC: the MOF property (Gate J-28) and sediments from the south storm drain outfall. A summary of these activities is provided below.

Groundwater Monitoring at the Museum of Flight

Groundwater monitoring has been conducted at the MOF property, formally identified as Gate J-28, at the BDC. This portion of the site is not covered by the RCRA corrective actions. This property is no longer part of the BDC and is no longer owned by Boeing. In 2001, when this portion of the property was owned by Boeing, soil and groundwater samples were collected as part of a Phase II Environmental Site Assessment (ESA) completed before Boeing transferred the property to the MOF. Boeing investigated groundwater quality near the 9-04 building (Figure 18) (Bach 2003).

The results of the March 2001 Phase II ESA, indicated that the potential for subsurface contamination from hazardous substances at the facility was low with one exception. Diesel-range hydrocarbons were detected in a groundwater sample in the southeast corner of the T-128 property at the location named Gate J-28. Further groundwater monitoring was recommended (Fraese 2001).

In 2001, Ecology determined TPH in the soil no longer posed a threat to human health or environment, and declared no further action for soil was necessary under MTCA. However, Ecology determined groundwater monitoring was required to assure the TPH-contaminated groundwater plume did not migrate away from the location and pose a threat to human health or environment (Maeng 2001).

Diesel-range and gasoline-range petroleum hydrocarbons were detected in the groundwater from upgradient well DC-MW-9 during each of two semiannual monitoring events conducted in 2003 and 2004. Gasoline-range petroleum hydrocarbons were detected at concentrations of 2.2 mg/L and 2.0 mg/L, and diesel-range petroleum hydrocarbons were detected at concentrations of 1.6 mg/L and 2.2 mg/L. These gasoline-range and diesel-range petroleum hydrocarbon concentrations exceed the MTCA Method A groundwater cleanup levels of 0.8 mg/L and 0.5 mg/L, respectively (Landau 2004).

The 2004 Annual Groundwater Monitoring Report concluded the source of contaminants detected in groundwater is at the upgradient edge of the property and appears to be located off-property. Additionally, the petroleum hydrocarbon concentrations observed over the past 11 monitoring events suggested the concentrations were stable and the petroleum hydrocarbon concentrations would likely not decrease until the source is removed. Boeing recommended further groundwater monitoring be discontinued until the off-site source of petroleum hydrocarbons could be identified and remediated (Landau 2004). Groundwater flow during this annual monitoring event was reported to be to the west (Landau 2004). The groundwater in the area of the MOF likely discharges to the LDW north of the Norfolk CSO/SD and EAA-7 since the facility is located to the north of the CSO/SD.

Groundwater in this area flows in a westerly direction. The groundwater in the area of the MOF likely discharges to the LDW north of the Norfolk CSO/SD and EAA-7. According to Boeing's drainage plans, stormwater at the 9-04 building does not drain to any of the six private outfalls that are of concern to EAA-7; stormwater in the 9-04 building appears to be discharged to the LDW via a private storm drain system that discharges to outfall DC9, located to the north of the EAA-7 area of interest (Boeing 2003a).

PCB Sampling in South Storm Drain System

During 2001 samples of construction materials and accumulated solids were collected from and around the storm drain system in the vicinity of Building 9-101 at the BDC. The storm drain system in this area (also referred to as the south storm drain), south of the 9-101 Building, discharges to the LDW through outfall DC2, an outfall located approximately 120 feet downstream of the Norfolk CSO/SD outfall. The sampling was undertaken to determine if the storm drain system from this area contains PCBs at levels that could potentially impact the clean cap placed on the previously dredged area near the Norfolk CSO/SD outfall (Project Performance Corporation 2001).

Sampling was conducted over four phases. In Phase I, samples of accumulated solids were collected from selected locations within the storm drain system. In Phase II, samples of a variety of surface construction materials (primarily joint compounds used to seal adjoining concrete slabs) were collected. Phase III involved collecting samples of additional surface construction materials (primarily roofing materials) and samples of additional solids from locations within the storm drain system. In Phase IV, water samples were collected from the outfall at the point of discharge and samples of road paint were collected in the area of one catch basin. (Project Performance Corporation 2001)

For Phase I sampling, PCBs were detected in some solids samples from manholes and catch basins upstream from the outfall. The analytical results indicated samples from some locations contained high levels of PCBs, specifically Aroclor 1254. The initial laboratory results indicated that the concentration in the field duplicate differed from the regular sample by more than two orders of magnitude. Based on this large difference, the laboratory was directed to re-extract and re-analyze all of the samples in a subsequent split analysis of each sample. This second round of analyses showed a high degree of variability in concentrations between the original and split analysis (up to three orders of magnitude), which was attributed to a highly heterogeneous distribution of PCBs in the samples. Concentrations of Aroclor 1254 in manhole and catch basin samples ranged from 0.19 to 760 mg/kg dw for the initial analyses, and from 0.3 to 1,100 mg/kg dw in the split analysis. For example, sample CB-1 had an Aroclor 1254 concentration of 510 mg/kg dw for the initial analysis and 0.3 mg/kg dw for the split analysis. Sample CB-1-D, the duplicate of sample CB-1, had an Aroclor 1254 concentration of 0.64 mg/kg dw for the initial analysis and 0.3 mg/kg dw for the split analysis. Sample MH-3 had an Aroclor 1254 concentration of 0.19 mg/kg dw for the initial analysis and 1,100 mg/kg dw for the split analysis (Project Performance Corporation 2001). PCB concentrations in a number of these samples exceeded the LAET (130 µg/kg dw) and 2LAET 1,000 µg/kg dw) values.

For Phase II sampling, materials sampled included caulk, roofing materials, tar used as sealant, asphalt sealant at joint, and felt in sidewalk joint. Detected Aroclor 1254 concentrations ranged from 0.500 mg/kg dw (from older joint sealant caulking) to 2.1 mg/kg dw (from newer joint sealant caulking). Detection limits for non-detect results for Aroclor 1254 ranged from 0.980 mg/kg dw (felt material in joint) to 160 mg/kg dw (for newer joint sealant caulk).

Phase III sampling included additional sampling of roof materials, as well as soil accumulation on roofs and water from manholes (5 and 6) and organic sludge/solids from catch basins. The Phase III results indicated that some of the roofing materials contain Aroclor 1248 at concentrations ranging from 0.660 to 28 mg/kg dw. The water sample from manhole 6, located upstream of manhole 5 on the south end of 9-101 building, contained Aroclor 1248 at a concentration of 0.0042 mg/L. Organic sludge/solids samples from catch basins contained Aroclor 1254 at concentrations of 2.60 and 3.7 mg/kg dw, exceeding the LAET (130 µg/kg dw) and 2LAET 1,000 µg/kg dw) values for total PCBs. (Project Performance Corporation 2001)

The Phase IV outfall discharge sampling indicated that the two samples of stormwater discharged from the storm drain system did not contain PCBs at levels above the method detection limit of 1 µg/L. The report presents the results of an order of magnitude mass flux estimate based on the stormwater sample results. The calculated flux of PCBs in the stormwater (based on 10 gallons per minute flow and PCBs assumed at ½ the detection limit, 0.5 micrograms per liter [µg/L]) is less than 0.02 pounds/year (Project Performance Corporation 2001).

PCB Sampling at Oil/Water Separators

Sampling for PCBs was conducted at oil/water separators located throughout the BDC during August and September of 2002. There were four sampling events during the project for the collection of aqueous and sediment/sludge samples. All aqueous samples and the first four sediment/sludge samples sent to the lab were extracted after the allowed holding period of seven days, and resulting concentrations of these samples were therefore qualified as estimated. Various Aroclors were detected above the detection limit in all 10 sediment/sludge samples (at total PCB concentrations ranging from 340 to 16,700 µg/kg dw) and in five of the 10 aqueous samples (ranging from 0.4 to 4.4 µg/L). The report noted that the water samples were collected after sampling solids/sludge samples from the separators and the water results are suspect due to the elevated turbidity resulting from the sludge sampling. (Boeing 2003c)

South Storm Drain Cleanout Work

In 2002, Boeing completed pressure cleaning of a segment of the south storm drain system located on the south side of the 9-101 Building in order to remove PCBs from the interior of the south storm drain line. High-levels of PCBs were found to be generally limited to the side-wall scum/organic material found on pipe interiors along the older storm drain line segment located downstream of manhole MH-6. Drain line solids were sampled; concentrations of Aroclor 1254 ranged from 0.22 to 32 mg/kg dw, all of which exceeded the LAET (130 µg/kg dw) value and some of which exceeded the 2LAET (1,000 µg/kg dw) value for total PCBs. The discharge water sampled at the outfall indicated nondetect levels of PCBs at detection limits of 1 µg/L. (Project Performance Corporation 2002).

Approximately 500 feet of 24-inch diameter concrete pipe was cleaned. Following completion of the cleanout work, a visual inspection using a video camera was completed in the 500 foot length of drain line that was cleaned. The video inspection indicated that the line cleaning was effective in removing the side-wall scum and solids adhered to the pipe side walls, and the concrete pipe appeared clean (Project Performance Corporation 2002).

Based on the video inspection, one segment of the south storm drain line still contained some solid material approximately 120 feet from the LDW. This segment, between manholes MH2 and MH3, was reported to have sand/gravel accumulation apparently several inches thick. Water was ponded on the upstream side of the section to a depth of approximately 6 inches. This sand/gravel accumulation appeared to cover somewhere between 25 to 50 feet in the line. Downstream of this accumulated solid material, there appeared to be an offset in the pipe connection. The accumulation was thought to be derived from the pipe anomaly in this area. It was concluded that the estimated offset of the pipe connection (approximately 4 to 6 inches) made slip-lining repair methods infeasible to implement, and excavation and repair of the section was expected to be the only feasible repair method. It was recommended by Boeing that when the pipe is excavated for repair that solids be removed from the storm drain (Project Performance Corporation 2002). Excavation and repair of the damaged storm drain was conducted in conjunction with the installation of a sediment trap/oil-water separator, discussed below (Bet 2007).

In 2003, Boeing installed a sediment trap/oil-water separator in the south storm drain upstream of manhole MH2 as a source control measure to help prevent stormwater solids from reaching the LDW by settling out the solids. Subsequent to installation of the sediment trap/oil-water separator, samples of stormwater solids have been collected from manholes located upstream and downstream of this unit as part of the annual monitoring for the south storm drain system (see Sections 2.2.6 and 2.2.7 above). The sediment trap/oil-water separator unit is cleaned annually.

South Storm Drain Outfall Sediment Cleanup Activities

As discussed in Section 2.2, in September 2003, Project Performance Corporation, on behalf of Boeing, conducted sediment removal activities in the LDW immediately offshore of the south storm drain outfall. This work was conducted under Ecology's Voluntary Cleanup Program. A prior sediment removal action was completed in the adjacent areas in 1999 by King County. The 2003 removal was implemented to address nearshore sediments adjacent to the Boeing south storm drain outfall that were not addressed in the 1999 sediment removal and capping action conducted by King County near the Norfolk CSO/SD outfall (Project Performance Corporation 2003).

The south storm drain sediment removal area is located approximately 130 ft downstream of the Norfolk CSO/SD outfall. The area is illustrated in Figure 19. The sediment was removed between the South 102nd Street Bridge (upstream) and the Boeing pedestrian bridge (downstream). The purpose of the removal was to protect the clean cap material installed during the Norfolk CSO/SD remediation project and to meet the SMS for PCBs in the removal area. The cleanup objective was to remove or cap all sediments containing PCBs above the CSL or 65 mg/kg OC (Project Performance Corporation 2003).

The 2003 removal activities involved excavation of about 60 cubic yards of sediments containing PCBs. Confirmation sampling indicated sediment located in a small area near the upper portion of the outfall drainage channel contained PCBs at concentrations above the CSL. Following the initial removal of sediment using a vacuum hose, the area was reworked twice using a pressure wash and vacuum recovery approach. Visual observations indicated this process was effective in removing sediment adhered to surfaces and trapped in cracks between rocks. A permeable carbon fabric layer was placed over the excavation surface and covered with clean sand fill. The purpose of the permeable carbon fabric beneath the fill was to limit potential upward migration of residual PCBs into the clean sand cap. The area underneath the engineered cap encompasses a small "hotspot" area where the highest total PCB concentrations have been consistently identified (e.g., sample CHBMS3; 2,190 mg/kg OC total PCBs). This area is limited to a small segment of the drainage channel located just below the south storm drain outfall (Project Performance Corporation 2003).

Post-removal monitoring is being conducted to evaluate the effectiveness of source control measures that have been implemented in the south storm drain system. Two years of post-cleanup sampling (2004 and 2005) has been completed, discussed below.

In the September 2004 sampling event, three sediment samples were collected from the sand cap (Figure 7). Each sample was collected at a depth of 0 to 2 inches. The only PCB detected was Aroclor 1248 at 27 µg/kg dw in sample S01. This was below the total PCB background concentration reported by King County for the last several years of sampling sediments in the general area. The 2004 monitoring report concluded that the results suggest that source control measures have met the objective of minimizing PCB inputs to the river at the point of discharge (Calibre Systems 2005). However, the results of solids sampling from the south storm drain indicate that a segment of the south storm drain system likely contain some PCB residues. Solids were collected at locations both downstream (MH2) and upstream (MH3) of the sediment trap/oil-water separator. The samples were collected using 1-micron filter bags connected to steel frames that were bolted to the base and interior side walls of the storm drain so that stormwater would flow through the filter bag. The solids accumulated in the filter were analyzed for PCBs, TOC, and percent solids. Total PCB results were 7,100 µg/kg dw for the sample collected from MH 2 (downstream of the sediment trap/oil-water separator), and 20,000 µg/kg dw for the sample collected from MH3 (upstream) of the sediment trap/oil-water separator. TOC results were 13.8% and 19.7%, respectively (Calibre Systems 2005). These TOC values are considered too high for organic carbon normalization of the PCB results. The PCB concentrations exceed the LAET (130 µg/kg dw) and 2LAET 1,000 µg/kg dw) values.

As part of the November 2005 monitoring event, Boeing collected four sediment samples (S1-05, S4-05, S2-05, and S3-05) from three locations within the area of the sand cap that was emplaced following the sediment removal work completed by Boeing in 2003 (Figure 9). Each sample was collected at a depth of 0 to 2 inches. The samples were analyzed for total PCBs and TOC. Two Aroclors (1254 and 1260) were detected in one sample with a total PCB concentration of 353 µg/kg dw. The PCB result of the duplicate sample of at this location was below the method detection limit. The difference between these results was attributed to heterogeneity in PCB concentrations. TOC concentrations ranged from 0.53% to 1.56%. Total PCB results for S2-05, S3-05, and S4-05 were below the detection limits of 31 and 32 µg/kg dw, corresponding to organic carbon-normalized values of 2.1 mg/kg OC and 5.8 mg/kg OC, below the SQS (12 mg/kg OC). The organic carbon-normalized total PCB result for sample S1-05 (22.6 mg/kg OC) was above the SQS (12 mg/kg OC) but below the CSL (65 mg/kg OC) for total PCBs.

In addition to the LDW sediment samples, in November 2005 four solids samples were collected from the south storm drain at manhole locations MH2 and MH3, located downsteam and upsteam of a sediment trap/oil-water separator, respectively (Figure 8). The samples were collected using 10-micron filter bags connected to steel frames that were bolted to the base and interior side walls of the storm drain so that stormwater would flow naturally through the filter bag. The samples of solids that accumulated in the filters were analyzed for PCBs, TOC, and percent solids. Total PCB results ranged from 12,600 µg/kg dw (MH2) to 61,500 µg/kg dw (MH3). In addition to samples collected from MH2 and MH3, two samples of accumulated solids were collected from the sediment trap/oil-water separator (ST0905-1 and ST0905-2).

Total PCBs concentrations were 15,100 and 15,800 µg/kg dw. TOC results ranged from 6.09% to 22.70%. These PCB concentrations exceeded the LAET (130 µg/kg dw) and 2LAET 1,000 µg/kg dw) values for total PCBs.

The 2005 monitoring report concluded that 2005 sampling results indicate that source control measures have met the objective of minimizing PCB inputs to the LDW at the point of discharge (Calibre Systems 2006). However, the results of the solids sampling from the south storm drain for both the 2004 and 2005 sampling event indicate that PCBs remain in the south storm drain system. To address this, Boeing has implemented annual servicing and cleanout of accumulated solids from the solids trap/oil-water separator (Calibre Systems 2006). The source of the remaining PCBs in the system is suspected to be associated with a segment of storm drain line located beneath Building 9-101. Due to limited access under Building 9-101, only a portion of the storm drain system could be cleaned during the 2002 system cleanout activities (Calibre System 2006).

The data from the storm drain sampling indicate that further source control measures are needed to further reduce PCB inputs into the storm drain system. Based on the results of the solids sampling, Boeing indicated its intent to evaluate the feasibility and expected efficiency of additional source control measures for the south storm drain system. One option reportedly under consideration is additional cleaning of the storm drain segment located beneath Building 9-101. Further evaluation was to focus on re-routing roof drainage only, which represents the majority of flow into this segment of the storm drain system (Calibre System 2006).

Stormwater Pollution Prevention Plan

The 2003 revision of Boeing's SWPPP for the BDC (for Ecology Permit # S03-000146) includes a potential pollutant source inventory. The potential source inventory identifies activities or practices that may be a source of stormwater pollution and includes storage, waste handling, manufacturing, building processes, and transportation. The potential sources identified by Boeing for the BDC are listed below (Boeing 2003a):

- Roof contaminants are considered to be a minor stormwater risk at this site. Drums are considered to be a risk to stormwater. Five USTs are listed in the SWPPP as being located the BDC facility: DC16, a 1,000-gallon diesel tank located south of building 9-101; DC18, a 550-gallon diesel tank located north of building 9-52; DC19, a 1,100-gallon unleaded gasoline tank located north of building 9-52; DC20, a 20,000-gallon fuel oil tank located west of building 9-72; and DC21, a 20,000-gallon fuel oil tank located west of building 9-72.
- Portable tanks are considered to pose no risk to stormwater. One 180-gallon tank is used indoors at the 9-99 building for hydraulic testing.
- Oil and gas tanks are considered to be a moderate risk to stormwater. Fourteen diesel tanks are located at the site. Seven of these are located outdoors, and each one has secondary containment to hold at least the volume of the tank contents.
- Hazardous waste tanks and drums are considered to be a minor risk to stormwater. Most wastes are generated in the 9-101 building. There is one bulk hazardous waste storage

tank on site, by the 9-51 building, which collects steam clean wastewater from the automotive maintenance shop.

- Tank and drum storage of hazardous materials are considered a minor risk to stormwater. Solid and liquid hazardous materials are centrally stored at the 9-52 and 9-60 Chemical Management Facilities at the BDC. The largest containers are 55-gallon drums.
- The storage of chemical materials and products are considered to be a minor stormwater risk. For the most part, chemicals are used inside of building 9-101 for aircraft part manufacturing and testing. The 9-52 and 9-60 chemical management facilities handle all central chemical storage.
- Fueling stations are considered a minor risk to stormwater. There is one fueling station near the fence north of the 9-52 building. The fueling station dispenses gasoline, diesel, and propane. This area is impervious and protected by a sump that drains to a nearby oil/water separator.
- Material handling activities are considered to be a moderate risk to stormwater. The 9-52 and 9-60 buildings are where the majority of load/unloading activities take place. Most buildings have large roll-up doors that permit a great deal of loading and unloading to be done indoors.
- The handling of hazardous waste is considered to be a moderate risk to stormwater. Solid and hazardous wastes are accumulated in closed containers in indoor waste collection stations. A potential stormwater pollution risk at the site is located at the load area for the wastewater collection tank, BMA-30. This is located near the southwest corner of the 9-51 building. This tank is managed as if it was a hazardous waste tank. About six times a year, the tank is emptied and the waste is shipped off site.
- Transportation is considered to be a moderate risk to stormwater pollution. Materials to be stored indoors or outdoors may be transported on-site by flatbed trucks or other vehicles and unloaded or loaded either indoors and outdoors by forklift or by personnel. A significant amount of loading/unloading operations occurs primarily at four locations: the area north of the 9-101 building between the 9-50 and 9-67 buildings; the covered canopy area west of the 9-51 building; the 9-60 building; and the 9-52 building.
- Vehicle maintenance and cleaning activities are considered to be a minor risk to stormwater pollution. There is an automotive maintenance shop in the southwest corner of the 9-51 building. Parts may be steam cleaned here within containment. Infrequent vehicle repair and maintenance can occur outdoors when equipment fails. Vehicle washing is infrequent and there is no fleet washing of vehicles at this site. The floor of the wash stall is sloped to a containment sump from which the wastewater is pumped into tank BMA-030.
- Dust and particulate generation activities are considered to be a minor risk to stormwater pollution. There are no specific outdoor operations that generate dust or particulate. Dust collectors, servicing various shops, are located outside the buildings throughout the plant. A wet dust collector, located on the north side of the 9-101 building, supports the Tool Grind shop.

- Non-stormwater discharges are considered to be a minor risk to stormwater pollution. These discharges include, on occasion: dewatering for construction projects; infrequent flushing of municipal water from fire sprinkler systems; discharges of groundwater or stormwater that accumulates in utility vaults; and discharges of condensate from air handling units to the storm drainage system.
- A decant station near the 9-60 building is considered to be a minor risk to stormwater pollution. The decant station is used for street sweeping run-off and effluent from annual cleaning of catch basins. The area by this building drains to the LDW at discharge point (DC9), which is north of the six private Boeing outfalls and thus outside of EAA-7.

3.1.1.4 Potential Pathways of Contamination

Stormwater

The BDC covers a 174-acre area on the east bank of the LDW. Stormwater from the BDC is collected by a conventional stormwater drainage system. Catch basins within the site collect stormwater and discharge it to the LDW at a total of 18 locations, five of which are located within EAA-7 (Figure 4). Information on each of the five outfalls is summarized below and in Table 6. Nine main lines have in-line oil/water separators installed in the system immediately prior to discharge. Smaller lines are not serviced with oil/water separators and discharge directly into the LDW because they drain areas of relatively low activity and small surface area (Boeing 2003a).

The five private stormwater drainage system outfalls that discharge to the LDW in the EAA-7 area of interest and the Norfolk CSO/SD are described below.

Discharge Point DC17

This outfall drains a small roof area of the southwest corner of the large 9-101 building, half the roof areas of each of the 9-140 and 9-130 buildings, and the parking and driving areas around portions of these buildings. Stormwater is collected into a drain system that discharges to the LDW (Figure 4). This is considered a small volume outfall (Boeing 2003a).

Discharge Point DC4

This outfall drains the southwest corner of the roof of the small 9-140 building and the pavement and planted areas around this portion of the building. Stormwater is collected into a drain line which then discharges into the LDW (Figure 4). This is considered a very small volume outfall (Boeing 2003a).

Discharge Point DC16

This outfall drains a small roof area of the southwest corner of the small 9-140 building and the pavement and planted areas around this part of the building. Stormwater is collected in one drain which then discharges into the LDW (Figure 4). This is considered a small volume outfall (Boeing 2003a).

Discharge Point DC3

This outfall drains half of the roof of each of the small 9-140 and 9-130 buildings, the parking and driving areas around each of those buildings, and a small landscaped park-like area for employee use. Stormwater is collected into a drain line running through the area and discharges to the LDW (Figure 4). This is considered a small volume outfall (Boeing 2003a).

Discharge Point DC2

This outfall drains half of the roof of the large 9-101 building, all of the small 9-110 building, and the parking and driving areas surrounding portions of those buildings. Stormwater is collected into a primary drain line which runs under part of the south end of the facility, discharging into the LDW (Figure 4). This is considered a large volume outfall (Boeing 2003a).

Sediment sampling has been conducted in the vicinity of this south storm drain system. In September 2003 removal activities were completed in this area, and involved the excavation of contaminated sediment and backfilling with clean sand. Details of the sampling and removal activities are provided in Section 3.1.1.3, South Storm Drain Sediment Cleanup Activities.

Discharge Point DC1

This outfall drains into the King County Municipal Storm Sewer System, which then discharges into the LDW via the Norfolk CSO/SD. The BDC outfall collects stormwater primarily from parking and drive areas and discharges to the county system via an oil/water separator (Boeing 2003a).

The stormwater drainage system does not go through areas of known or suspected soil or groundwater contamination, thus it would not be likely a contaminant migration pathway from areas of subsurface contamination to the LDW.

Groundwater

There are four areas in the BDC that have known groundwater contamination: RCRA Corrective Action areas AOC-05, SMWU-17, and SMWU-20; and the MOF (Gate J-28), which is no longer owned by Boeing. RCRA Corrective Action areas AOC-05, SMWU-17 and SMWU-20 are all located near Building 9-101 of the BDC (Figures 17 and 18). These areas were discussed in Section 3.1.1.3. Groundwater conditions at these areas are summarized below.

In the general area of SMWU-20, SMWU-17, and AOC-05, a shallow, unconfined aquifer is present at a depth of approximately 10 to 12 ft bgs. Groundwater in this aquifer flows through fill and native alluvial deposits in a generally westerly direction to the LDW where it discharges. A confined groundwater zone is present beneath the unconfined aquifer. Flow in this confined zone is to the north toward Elliott Bay. The bottom of the unconfined aquifer is located at the top of the marine sediment at a depth of 45 to 50 ft (Cook 2001).

The most recent groundwater monitoring event at the SMWU-20, SWMU-17, and AOC-05 areas was performed in May 2006. At the time of this sampling event, groundwater was determined to flow generally toward the north-northwest (Figure 18). The results of this monitoring event indicated that since the most recent electron donor injection at SWMU-20 on June 17, 2004, concentrations of contaminants decreased. Boeing recommended that the injection program and groundwater monitoring at SWMU-20 be continued, and also that bioremediation at AOC-05 be considered because of the positive results shown at SWMU-20 (Bet 2006).

Some downgradient wells exhibit higher concentrations of contaminants than upgradient wells. For example, wells BDC-05-3, BDC-05-4, and BDC -05-7 exhibited concentrations above those of upgradient wells. From the May 2005 to May 2006 sampling events, BDC-05-2 through BDC-05-7 showed increases in some volatile organic analysis (VOA) and metals analysis. This area is approximately 700 feet northwest of the area draining to the six Boeing private outfalls and approximately 1,600 feet to the northwest of the Norfolk CSO/SD. MW-23A had a concentration of naphthalene of 69 μg/L in the last sampling event in May 2006, which is an increase from the February sampling event when MW-23A contained 45 μg/L naphthalene. MW-23A is located approximately 800 feet northwest of the area draining to the six private Boeing outfalls and approximately 1,500 feet northwest of the Norfolk CSO/SD. Groundwater appears to flow toward the west, and likely discharges to the LDW downstream of the EAA-7 area of interest. The potential exists for groundwater contamination to reach the LDW downstream of the Norfolk CSO/SD.

Groundwater monitoring is also being conducted at the MOF property, identified as Gate J-28 of the BDC, although this property is no longer part of the BDC nor is any longer owned by Boeing. In 2001, when this property was owned by Boeing, soil and groundwater samples were collected as part of a Phase II ESA from this portion of the property (Bach 2003).

Landau Associates, Inc., has investigated groundwater quality for Boeing near the 9-04 building from 2001 to 2004 (Landau 2004). Ecology issued a determination of NFA for the soil on June 28, 2001, but required additional groundwater monitoring (Bach 2003).

In the area of groundwater monitoring at the MOF, shallow groundwater appeared to exist under unconfined conditions in the fill and native soil materials. Groundwater levels encountered during monitoring well installation ranged from 9.5 to 13 feet below ground surface (bgs). The groundwater flow direction was not determined during the Phase II ESA. Based on topography and the proximity of the LDW west of the site, it was concluded the shallow groundwater beneath the site probably flows toward the west-northwest (Cook 2001). Following well installation in 2001, the groundwater flow direction was determined to be west-southwest (Landau, 2004).

In the latest groundwater sampling event, conducted in April 2004, concentrations of petroleum hydrocarbons above MTCA Method A cleanup levels were detected in monitoring well MW-9, an upgradient well. No petroleum hydrocarbons have been detected in soil in the vicinity of MW-9. In the 2004 Annual Groundwater Monitoring Report, it was concluded that the source of contaminants detected in groundwater is located at the upgradient edge of the property and appears to be located off the property. Additionally, it was concluded the petroleum hydrocarbon concentrations observed over the previous 11 monitoring events indicated concentrations are stable and petroleum hydrocarbon concentrations are not likely to decrease until the source is removed. Boeing requested groundwater monitoring be discontinued until the off-site source of petroleum hydrocarbons could be identified and remediated. Groundwater flow was determined to be to the west-southwest (Landau 2004). The area with known groundwater contamination is located approximately 2,400 feet north of the Norfolk CSO/SD and approximately 1,400 feet north of the area draining to the six Boeing private outfalls. The downgradient wells did not have petroleum hydrocarbon concentrations greater than MTCA Method A cleanup levels in the last sampling event. It appears there is a low probability that petroleum-contaminated groundwater from the MOF area could impact the EAA-7 or other areas of the LDW.

Bank Erosion

The BDC is located along the bank of the LDW. Available information was reviewed to evaluate the potential for bank erosion or leaching of near-bank soils to recontaminate LDW sediments. Available information did not indicate the potential for sediment recontamination as a result of bank erosion or leaching of near bank soils.

Data Gaps

Annual sediment sampling in the LDW at the south storm drain outfall (also referred to as DC2) at the BDC started in September 2004 following 2003 sediment removal activities. Two of the three annual sampling events required by Ecology have been completed. LDW sediment sampling results presented in the 2004 and 2005 monitoring reports (Calibre Systems 2005 and 2006) show that PCB inputs to the LDW have been significantly reduced. In-line storm drain solids sampling results show that source control measures to date have significantly reduced PCB impacts to EAA-7; however, the data also show that the south storm drain system still contains PCBs. Based on the solids sampling results, Boeing indicated that it is planning to evaluate the feasibility and expected efficiency of additional source control measures for the south storm drain system. One option reportedly being considered is additional cleaning of the storm drain segment located beneath Building 9-101. Further evaluation is to focus on re-routing roof drainage only, which represents the majority of flow into this segment of the storm drain system. (Calibre Systems 2006)

Results of the 2006 sampling event and subsequent monitoring events are expected to provide additional information on whether the objective of minimizing PCB input to the LDW at the south storm drain is being met.

Boeing has completed extensive materials testing for PCBs in the area of the south storm drain system. Information on materials testing for other portions of the BDC is not currently available to assess potential sources of sediment recontamination.

Parcel 0423049016, located at the southern portion of the BDC, is leased by Boeing from East Marginal Associates. A 1984 WSDOT aerial photo obtained from Ecology appears to show a barge operation located on the parcel. This area has been used by Boeing since 1986 for employee parking, and is currently paved. No sampling information exists for the property. It is not known if historic operations at the parcel have resulted in contamination that could result in contamination of EAA-7 sediments.

The following data gaps have been identified:

- Sediment monitoring in the vicinity of the south storm drain sediment removal activities is insufficient to evaluate the potential for sediment recontamination from existing sources at the BDC.
- The source of PCBs found in solids in the storm drains is unkown.
- Monitoring of solids in the storm drains is insufficient to assess the potential for sediment recontamination from any ongoing sources.
- The SWPPP needs to be reevaluated; changes may need to be made.
- Groundwater and soil sampling are needed at parcel 0423049016 to assess possible historic contamination.

3.1.2 Boeing Military Flight Center

3.1.2.1 Current Operations

The Boeing MFC is located at 10002 East Marginal Way South, Seattle, Washington. It is situated approximately 1200 feet northeast of LDW's eastern bank. The MFC location is illustrated in Figures 11 and 13. The site consists of 24.6 acres of land owned by Boeing. Major facilities at the site support the flight line and consist of aircraft storage, preparation for flight, general servicing, and maintenance and repair. Processes conducted at the MFC include: coating, conversion coating, cold solvent cleaning, machining, sealing, bonding, adhesion, facilities/stores/automotive/equipment maintenance/airplane washing, laboratory operation, photographic/graphic processing, and airplane hydraulic/fuel testing (Johnstone 1993).

According its 2003 SWPPP, five buildings are located on the site and occupy 1.69 acres. Two buildings are general office areas; one is a maintenance/servicing shed, and two are guard buildings. There are several small portable maintenance sheds located on site. The military flight line occupies 17.05 acres, parking areas occupy 5.04 acres, and the remaining area is occupied by buildings and surrounding surfaces. This entire site is covered impervious surfaces (Boeing 2003b).

According to the King County online tax assessor website, the property is located on tax parcel 0003400021, which is 24.17 acres and is owned by the Boeing Company.

An access road on the southern edge of the flight line separates the flight line from the buildings occupying the southern end of the property. There is an impervious surface of the runway to the west of the property and a grassy boundary to the south.

The MFC has an Industrial Stormwater General Permit No. SO3000150D, which expires on September 20, 2007. Based on Ecology's online database the parameters for this permit are for pH, with a minimum of 6.5 and a maximum of 8.5 standard pH units (Ecology 2007d). Ecology plans to reissue Industrial Stormwater General Permits on August 20, 2007. These reissued permits would be effective on September 20, 2007, and would expire on September 20, 2012

(Ecology 2007d). According to Ecology's online NPDES and State Waste Discharge Permit database, this site does not have an Individual Wastewater Discharge permit (Ecology 2007c).

This site was issued a Wastewater Discharge Authorization No. 363-02 from the King County Industrial Waste Program to discharge wastewater generated by airplane washing operations to the county combined sewer system. Wastewater is pretreated in a gravity separator. The permit allows a maximum discharge of 25,000 gallons per day and is effective April 18, 2002, through April 18, 2007 (King County 2002).

The MFC is listed on Ecology's online Hazardous Site Facility Search and has a RCRA ID No. WAD988475943, which has been inactive since December 31, 1996 (Ecology 2007e).

EPA's online TRI database (http://www.epa.gov/triexplorer/) was searched for the MFC. Release Reports, Waste Transfer Reports, and Waste Quantity Reports were also searched. The MFC is not listed in any of the three reports.

3.1.2.2 Historic Use

Little historic use information was found for the MFC, and no purchase information was provided on the King County online tax assessor website. In 1990, as part of a reorganization, Boeing separated the BDC from the MFC.

3.1.2.3 Environmental Investigations and Cleanup Activities

The MFC is not listed as a Confirmed and Suspected Contaminated Site on Ecology's CSCSL database (Ecology 2007a). The site is not listed in Ecology's online LUST or UST databases (Ecology 2007b).

PCB Remediation

In July 2005 the EPA approved remediation plans from Boeing to conduct sampling and removal of PCB contamination and PCB bulk product waste caulk at the MFC (Downey 2005). In March, April, and July of 2005, an investigation was conducted to characterize the material filling concrete expansion joints at the MFC. During the investigation, joint materials with similar characteristics (e.g. color, sheen, texture, etc.) were grouped and identified as one type of material and given an alphabetical designation from Q to Y. A total of nine different material types were identified. Samples from the nine materials were collected and tested for the presence of PCBs. The results indicated that five of the nine types of material contained PCBs at concentrations ranging from 3.9 to 99,000 mg/kg dw. Type U material had PCB concentrations less than 10 mg/kg dw. Results for at least one sample of each of the other four types of material (identified as types Q, R, S, and V) indicated a total PCB concentration greater than 50 mg/kg dw. Joint material that contained total PCB concentrations above 50 mg/kg dw was removed. A total of 14,300 linear feet of types Q, R, S, and V material were removed from stalls 76, 77, and 80 from May through July of 2005 (Boeing 2006).

Additional removal activities were conducted from May through September of 2006. A total of 11,250 linear ft of PCB-containing joint material was removed during the 2006 activities. A total of 25,550 linear ft of PCB-containing joint material has been removed from the MFC (Landau 2007).

During these removal activities, control measures were implemented to capture wastewater, slurry, and debris. Control measures included the use of air-powered drum vacuums to vacuum the wastewater and slurry during cutting and pressure washing. At each catch basin located within 25 ft of removal activities, covers were placed over the catch basin and inflatable plugs, if needed, were placed in the discharge and inflow pipes to minimize contaminated water from entering the storm drain system during the joint removal activities. Following removal of the joint material within an area, a pressure washer was used to clean the concrete surface in the work area and remove any accumulated debris from the joint prior to refilling the joint. Immediately following removal of all joint material within an area, the joints were filled by Boeing Maintenance (Boeing 2006).

The 2007 Removal Report states that all planned primary and residual concrete expansion joint material containing PCB concentrations greater than 50 mg/kg dw at the MFC has been completed. Some Type Q, R, S, and V, primary and residual joint material containing PCBs at concentrations greater than 50 mg/kg dw may be present in concrete expansion joints beneath the buildings or structures (Landau 2007).

Stormwater Pollution Prevention Plan

According to the SWPPP, the site is essentially completely impervious. A grassy boundary to the south of the MFC is not impervious. Stormwater from the entire site is collected by a conventional storm drain system with catch basins and associated piping. Two oil/water separators are located within the system. All collected stormwater is discharged to the LDW through the Norfolk CSO/SD (Boeing 2004b).

The 2003 revision of Boeing's SWPPP for the MFC (for WDOE Permit No. S03-000150) includes a potential pollutant source inventory (Boeing 2004b). The inventory identifies activities or practices that may be sources of stormwater pollution and includes storage, waste handling, manufacturing, building processes, and transportation. The potential sources identified by Boeing for the MFC are listed below:

- Roof contaminants are considered a minor stormwater risk at the site.
- Solid waste management practices are considered moderate stormwater risks at this site. Ten outside dumpsters are used for non-hazardous waste.
- Material and equipment storage at this site is considered a moderate stormwater pollution risk. Some large equipment and aircraft maintenance equipment can be found at 13-01 Building's loading dock and to the west of the building.
- Surplus storage is considered a minor stormwater risk. Metal equipment and tub skids are stored in a yard area at the southeast side of the site. The metal containers and the residue they may contain could potentially impact stormwater through rainwater collecting in them and leaching out metals as well as debris they may contain.

- Tanks and drums may pose a threat to stormwater. Chemicals for use in industrial processes and hazardous waste and materials can be stored in drums or tanks.
- Portable tanks are considered a significant stormwater pollution risk. Aircraft are fueled on the flightline from tanker trucks, and portable diesel tanks are used to fuel support equipment.
- Oil and gas tanks are considered a minor stormwater pollution risk. A 200-gallon above ground storage tank (AST) containing diesel fuel is located southeast of the 13-03 building, within a fenced area. This double-walled tank supports an emergency generator.
- Hazardous waste tanks and drums are considered a moderate stormwater pollution risk. Seven waste collection stations are used for accumulated solid and liquid hazardous wastes. There is secondary containment at these stations to prevent a spill or release of waste.
- Hazardous material tanks and drums are considered a moderate stormwater pollution risk. There are no permanent stationary hazardous material tanks at the site. Solid and liquid hazardous materials are centrally stored at the 9-52 and 9-60 Chemical Management Facilities at the BDC. The largest containers are 55-gallon drums. Raw materials and chemicals used on the flightline and in the various shops are stored inside of the 13-01 building. Typically, these chemicals are stored in covered areas that have secondary containment.
- Chemical materials and products are considered a moderate stormwater pollution risk. Material storage is on the BDC at buildings 9-52 and 9-60. Some small hazardous material storage cabinets are in sheds located on the flightline. Hazardous materials typically stored here are solvents, hydraulic oils, paints, lubricants, aerosols, and adhesives, with an average container size of less than 1 quart.
- Fueling stations are considered a moderate risk to stormwater pollution. There are no permanent fueling stations on the site. Aircraft are fueled by tanker or by portable fueling carts.
- Material handling activities are considered a moderate stormwater pollution risk. The highest potential for chemical spills during material handling are at the flight line maintenance sheds where the majority of chemicals are handled.
- Hazardous waste handling is considered a moderate risk to stormwater pollution. A significant amount of outdoor waste loading occurs at a flightline at Stall 75, where a waste collection station is located.
- Transportation is considered a moderate stormwater pollution risk.
- Vehicle maintenance and cleaning are considered minor stormwater pollution risks.
- Dust and particulate generators are considered minor risks to stormwater pollution.
- Several non-stormwater discharges and pollutants are considered minor stormwater pollution risks. These non-stormwater discharges may include the following: dewatering for construction projects (typically, King County Industrial Waste is contacted to obtain

authorization to discharge the dewatered groundwater to the sanitary sewer system); flushing of municipal water from fire sprinkler systems; groundwater or stormwater that accumulates in utility vaults; and discharges of condensate that may accumulate in air handling units, ventilation equipment, humidifiers, hot water heaters, and other equipment.

- Outdoor industrial activities are considered a moderate risk to stormwater pollution. These activities include an aircraft wash area at Stall 75, which has containment curbing to control outflow of rinse water and discharges to the sanitary sewer in accordance with King County discharge authorizations.

The site files contain no other information regarding current or historic monitoring or remediation. No information regarding facility inspections is available.

3.1.2.4 Potential Pathways of Contamination

Stormwater

The MFC covers a 24.6-acre area, east of the BDC. Runoff from the site is collected and routed to the municipal storm drain system on East Marginal Way South, which discharges to the LDW via the Norfolk CSO/SD outfall. The stormwater drainage system at the MFC is illustrated in Figure 20.

The flight line was constructed so a high point exists mid-line, trending roughly north-south and splitting the flight line into two separate drainage areas with surface water moving either east or west from mid-line. A series of catch basins run along the western edge of the flight line and connect to the municipal storm drain system in East Marginal Way South via a 15-inch, 18-inch, and a 24-inch line. These catch basins collect runoff from the MOF parking lot located just north of the MFC. Runoff then passes through an oil/water separator before entering an 84-inch line that also collects the combined sewer overflow originating from a pump station at the southeast corner of the property. Runoff from the eastern side of the flight line drains generally to the east. The northeast section drains into grassy areas adjacent to the KC IA. The southeast section drains into an asphalt-lined ditch east of the blast fence. The ditch is served by an oil/water separator and eventually drains into a 42-inch line running east along the northern edge of the site to the 84-inch municipal line described above (Boeing 2003b).

Three of the five storm drains are serviced by the two oil/water separators; these storm drains drain the three northernmost drainage areas of the MFC (Areas 1, 2, and 4 in Figure 20). These areas include the MOF parking and roadway areas, several parked museum-displayed planes, all flight line stalls, the 13-03 office building (with some small hazardous material/waste storage areas in the building), storage sheds, trailers, equipment storage areas, four hazardous waste storage buildings, six hazardous material storage buildings, six covered dumpsters, portable fuel spill vacuum equipment, and a liquid nitrogen tank. The two southernmost drainage areas of the site (Areas 5 and 3 in Figure 20) discharge to the municipal storm drain system on East Marginal Way South (which discharges to the LDW via the Norfolk CSO/SD outfall) without passing through an oil/water separator. These drainage areas contain a transportation access corridor to the flight lines to the north, the 13-01 office building, the 13-02 maintenance building, storage sheds, trailers, equipment storage areas, hazardous material and waste storage areas in the buildings, two hazardous material storage buildings, two covered dumpsters, and two liquid nitrogen tanks (Boeing 2003b).

The MFC storm drain system does not pass through areas of known or suspected soil or groundwater contamination. Based on available information, infiltration of subsurface contamination into the storm drain system has not been identified as a likely source of sediment contamination in EAA-7.

Groundwater

There is no known soil or groundwater contamination at the MFC facility. Groundwater in the vicinity of this facility likely flows to the north-northwest, toward the LDW.

Bank Erosion

This site is not located along the banks of the LDW; therefore, bank erosion is not a potential source of recontamination of the LDW sediments.

Data Gaps

The following data gaps were identified:

- Reports of any further PCB caulk removal efforts and testing are needed to assess the effectiveness of the removal of PCB contaminated material.
- The SWPPP needs to be reevaluated; changes may need to be made.
- It is unknown whether the MFC is in compliance with its Industrial Stormwater General Permit. An inspection is needed to ensure that pollutant prevention practices are adequate to control the discharge of pollutants from this site.

3.1.3 King County International Airport

3.1.3.1 Current Operations

KCIA, also known as Boeing Field, is located at 7277 Perimeter Road South, Seattle, Washington. This facility is also listed as located at 6518 Ellis Ave, Seattle, Washington, on Ecology's online UST database. Only the southern portion of the site is located in the Norfolk Drainage Basin, as illustrated in Figures 5 and 13. This portion of the airport consists of the southern end of the runway, known as 13R-31L, and the surrounding landscaped areas.

KCIA is a general aviation airport owned and operated by King County as a public utility. The site covers about 615 acres, 435 of which are impervious surface covered by buildings and paved areas. The remaining 180 acres consist of grass and landscape area (Cargill et al. 2006).

KCIA averages more than 300,000 operations (takeoffs and landings) each year and serves small commercial passenger airlines, cargo carriers, private aircraft owners, helicopters, corporate jets, and military and other aircraft. The airport also is home to the Boeing 737 aircraft flight-test program along with other Boeing operations (KCIA 2007a).

According to the King County tax assessor website, the portion of the KCIA located within the Norfolk drainage basin is part of parcel 2824049007, the listed address of which is 6505 Perimeter Road South (King County 2007b). This parcel consists of 564.77 acres and 101 buildings that have various uses, including office buildings, storage hangers, industrial light manufacturing, material storage sheds and warehouses, and service repair garages (King County 2007b). Available aerial photos and site layout maps indicate no buildings are located on the parcel. East of this portion of the parcel (no listed address, parcel 0323049035) is a 7.75-acre vacant railroad operating property. The Boeing MFC site is located to the west, and the Associated Grocers, Inc., facility is located to the south (King County 2007b).

KCIA does not have an Industrial Stormwater General Permit for the portion of the facility located within EAA-7.

According to Ecology's online NPDES and State Waste Discharge Permit database, the portion of KCIA that is located in the Norfolk CSO/SD drainage basin does not have an Individual Wastewater Discharge permit (Ecology 2007c).

3.1.3.2 Historic Use

Airport construction began in 1928. The airport served as the community's aviation center until the U.S. Army took it over on December 6, 1941, for strategic and production reasons. The airport remained under military jurisdiction through the end of World War II. In the late 1940s, the airport reopened for passenger and other commercial traffic. After Sea-Tac International Airport opened in 1947, KCIA usage evolved to general aviation, serving industrial, business, and recreational purposes (Cargill et al. 2006).

3.1.3.3 Environmental Investigations and Cleanup Activities

According to Ecology's online UST database, the KCIA does not have any USTs within the portion of the facility that is located within the Norfolk SD drainage basin (Ecology 2007b). According to Ecology's online LUST database, no groundwater or soil contamination from leaking USTs are identified within the portion of the KCIA that is located within the Norfolk SD drainage basin (Ecology 2007b).

No facilities located in the southern portion of the KCIA within the area that drains to the EAA-7 area of the LDW are listed on Ecology's online CSCSL database (Ecology 2007a).

No cleanups on the portion of the KCIA facility that is located within the Norfolk SD drainage basin are documented.

The site files contain no mention of facility inspections by King County and/or SPU. There are also no current or historic monitoring or remediation activities mentioned in the site files conducted in the portion of the KCIA property located within the Norfolk SD drainage basin.

3.1.3.4 Potential Pathways of Contamination

Stormwater

There are approximately 15 miles of storm drain pipe within in the entire KCIA storm drain system. Stormwater drainage at KCIA is illustrated in Figure 21. Based on available information, it is unclear whether any of the collected stormwater discharges to EAA-7. Stormwater from some KCIA properties along East Marginal Way South drains into a combination of Boeing and City of Tukwila storm drainage systems (KCIA 2006). Part of the southern portion of the KCIA facility drains to "Discharge # 3" (Figure 21). The remainder of the southern portion of KCIA drains to "Discharge # 4". It is not apparent from the available KCIA SWPPP (KCIA 2006) or CAD files (KCIA 2007b) where "Discharge # 3" or "Discharge # 4" drain into the LDW; however, it is unlikely that "Discharge # 4" drains into the EAA-7 area. According to SPU, most of the KCIA drains to Slip 4, the former Slip 5, and Slip 6, all of which are located downstream of EAA-7 (Schmoyer 2007). According to SPU, this KCIA storm drain crosses the Boeing Thompson property and discharges to the LDW at the former Slip 5 (Schmoyer 2007).

Based on available information, the KCIA storm drain system does not pass through areas of known or suspected subsurface soil or groundwater contamination. However, contaminants that may be present on the surface could potentially migrate to the LDW via the stormwater system. For example, joint caulk that could contain PCBs may be present at the southern end of the KCIA. In the North Boeing Field area, located north of the area of concern for EAA-7, Boeing has been removing concrete joint caulk that contains PCBs at concentrations up to 79,000 mg/kg from the facility (Cargill et al. 2006). Approximately 80,000 lineal feet of joint caulk has been removed. An additional 1,400 lineal feet of caulk was scheduled for removal in 2006, most of which is located between stalls C-3 and C-4.

Groundwater

The southern portion of this facility is located within the Norfolk CSO/SD drainage basin. There are no buildings, USTs, or known areas of groundwater or subsurface soil contamination identified on this portion of the KCIA. PCBs could be present in joint sealant material at the southern portion of KCIA that is located in the Norfolk CSO/SD drainage basin. Due to a lack of information about the locations of stormwater discharges from the southern portion of the KCIA into the LDW, it is not clear whether or not some stormwater discharges from the southern portion of KCIA into the EAA-7 area of interest.

Bank Erosion

This site is not located along the banks of the LDW; therefore, bank erosion is not a potential source of recontamination of the LDW sediments.

Data Gaps

The following data gaps were identified:

- It is unknown where the KCIA storm drain system connects to the Norfolk CSO/SD.
- The SWPPP needs to be reevaluated; changes may need to be made.

3.1.4 Associated Grocers, Inc.

3.1.4.1 Current Operations

Associated Grocers, Inc., is located at 3301 South Norfolk Street, Seattle, Washington. The facility is situated in the southeast quadrant of the intersection of East Marginal Way, South Norfolk Street, and north of South Boeing road, as illustrated in Figure 22**.** The LDW is located approximately 1,000 feet west of the facility.

Associated Grocers, Inc., is a wholesaler providing food, general merchandise, and retail services to stores throughout Washington, Alaska, Oregon, Hawaii, Guam, and the Pacific Rim. Founded in 1934, Associated Grocers, Inc., has grown to over 320 customer locations. According to the Associated Grocers, Inc., website (Associated Grocers, Inc. 2007), activities at the site include the procurement and distribution of a variety of perishable and nonperishable commodities, including: grocery, meat, produce, deli, natural, specialty, ethnic, service deli, service bakery, general merchandise, and health and beauty care products.

According to the King County tax assessor website, the facility at 3301 South Norfolk Street consists of parcel 0323049024, which is a 17.66-acre property owned by Sea-Tuk Warehouse LLC. The 15 structures contained on this parcel listed are below (King County 2007b):

- 296,752-sq. ft. distribution warehouse built in 1952;
- 49,493-sq. ft. distribution warehouse built in 1963;
- 68,691-sq. ft distribution warehouse built in 1961;
- 116,655-sq. ft. distribution warehouse built in 1960;
- 34,445-sq. ft. office building built in 1961;
- 7,720-sq. ft. service repair garage built in 1951;
- 4,800-sq. ft. storage warehouse built in 1952;
- 28,697-sq. ft. warehouse office built in 1983;
- 504-sq. ft. equipment shed built in 1952;
- 74,570-sq. ft. distribution warehouse built in 1975;
- 20,528-sq. ft. warehouse office built in 1978;
- 14,100-sq. ft. distribution warehouse built in 1978;
- 2,997-sq. ft. service repair garage built in 1985;
- 646-sq. ft. warehouse office built in 1985; and

- 4,800-sq. ft. storage warehouse built in 1988.

The northern portion of this parcel extends north of South Norfolk Street (King County 2007b).

In addition to parcel 0323049024, 24 other parcels comprise the Associated Grocers, Inc., facility, all of which are owned by Sea-Tuk Warehouse LLC. No addresses are listed for these additional parcels, which are listed below:

- Parcel 0003400024 - 0.93 acres, zoned for commercial/warehouse use;
- Parcel 0323049048 - 1.42 acres, zoned for commercial/warehouse use;
- Parcel 0423049099 - 0.98 acres, zoned for commercial/warehouse use;
- Parcel 0003400049 - 0.81 acres, zoned for commercial/warehouse use;
- Parcel 0003400042 - 0.21 acres, zoned for commercial/warehouse use;
- Parcel 0003400015 - 1.25 acres, zoned for commercial/warehouse use;
- Parcel 0003400041 - 0.93 acres, zoned for commercial/warehouse use;
- Parcel 0003400046 - 0.33 acres, zoned for commercial/warehouse use;
- Parcel 0323049128 - 0.4 acres, zoned for commercial/warehouse use;
- Parcel 0323049045 – 2.81 acres, zoned for commercial/warehouse use;
- Parcel 0423049066 - 0.07 acres, zoned for commercial/warehouse use;
- Parcel 0323049072 - 0.22 acres, zoned for commercial/warehouse use;
- Parcel 0323049070 - 0.11 acres, zoned for commercial/warehouse use;
- Parcel 0323049073 - 0.28 acres, zoned for commercial/warehouse use;
- Parcel 0323049028 – 2.77 acres, zoned for commercial/warehouse use, contains one structure: a 284,067sq. ft. storage warehouse (built in 1979);
- Parcel 0323049240 – 1.82 acres, zoned for commercial/warehouse use;
- Parcel 0323049080 – 4.05 acres, zoned for commercial/warehouse use;
- Parcel 0323049228 - 0.73 acres, zoned for commercial/warehouse use;
- Parcel 0323049061 – 1.4 acres, zoned for commercial/warehouse use;
- Parcel 0323049229 - 0.73 acres, zoned for commercial/warehouse use;
- Parcel 0323049058 – 4.69 acres, zoned for commercial/warehouse use;
- Parcel 0323049230 - 0.75 acres, zoned for commercial/warehouse use; and
- Parcel 0323049171 – 1.61 acres, zoned for commercial/warehouse use.

Associated Grocers, Inc. has reportedly been sold recently; however, information regarding the sale is not yet available on the King County tax assessor website. (King County 2007b)

The following surrounding land-use information was also obtained on the King County online tax assessor site (King County 2007b):

- Northwest of the site (10016 East Marginal Way South, parcel 000340029) is Randy's Restaurant. One building sits on this 0.76-acre property, which is owned by Michigan Properties.
- North of the site (10008 East Marginal Way South, parcel 0003400021) is the Boeing MFC Site. This 24.17-acre property contains a building used as a service repair garage and a building used as an industrial engineering building. The Boeing Company owns this parcel.
- Northeast of the site (6505 Perimeter Road South, parcel 2824049007) and across South Norfolk Street is the KCIA, also known as Boeing Field. Only the southern tip of the airport, which consists of part of the runway and landscaped fields, lies within the Norfolk drainage basin. This parcel consists of 564.77 acres and 101 buildings.
- East of the site and across Airport Way South (no listed address, parcel 0323049035) is a 7.75-acre vacant railroad industrial property.
- Southeast of the site (no listed address, parcel 0323049060) is a 20.97 right of way owned by Northern Pacific Railway Company.
- South of the site (10650 27th Avenue South, parcel 0323049095) is Northcoast Chemical. This 0.96-acre property contains one storage warehouse and is owned by East Marginal Way Properties, LLC.
- Southwest of the site (10625 East Marginal Way South, parcel 0423049083) is a 0.85-acre site containing three storage warehouses and is owned by Harris Trust NA.
- Southwest of the site (10325 East Marginal Way South, parcel 0423049117) is a restaurant, Annex Tavern. One building sits on this 0.15-acre property, which owned by Bob Massa.
- Also southwest of the site (10315 East Marginal Way South, parcel 0423049051) is a restaurant, The Voyeur. One building sits on this 0.9-acre property, which is owned by Chase Property Management.
- West of the site (no listed address, parcel 0423049002) is a vacant storage yard, Strick Lease Storage Yard. This 2.86 acre property is owned by John Roach.
- Also west of the site, on various parcels, is the BDC, discussed above.

On the Ecology online Industrial Stormwater General Permit database, this site is listed as having Permit SO3002040D. Based on Ecology's online database (Ecology 2007d) parameters for this permit are for pH with a maximum of 8.5 and a minimum of 6.5 standard pH units. The permit expires on September 20, 2007. Ecology plans to reissue Industrial Stormwater General Permits on August 20, 2007. These reissued permits would be effective on September 20, 2007, and would expire on September 20, 2012 (Ecology 2007d).

This site is listed on Ecology's online Hazardous Site Facility Search and has RCRA ID No. WAD007942535 (Ecology 2007e).

No Wastewater Discharge Permits were discovered on searching the King County Industrial Waste files (King County Industrial Waste 2006).

According to Ecology's online NPDES and State Waste Discharge Permit database, this site does not have an NPDES permit (Ecology 2007c).

3.1.4.2 Historic Use

The site files contained no information on historic use at this site.

3.1.4.3 Environmental Investigations and Cleanup Activities

According to the Ecology's online UST database, Associated Grocers, Inc., has two operational USTs. These 20,000 gallon tanks were installed in January 1979 and contain diesel fuel. The database also shows 12 tanks have been removed from the site and one tank was closed in place (Ecology 2007b).

According to Ecology's online LUST database, the site initiated soil and groundwater cleanup activities in February1997. These activities have not been not completed (Ecology 2007b).

According to Ecology's online CSCSL database, the site (Facility Site ID No. 73338176) has suspected and confirmed soil and groundwater contamination. These include halogenated organic compounds, petroleum products, and non-halogenated solvents. A site discovery report was completed in July 2001, an initial investigation was completed in November 2001, and an Early Notice Letter was sent by December 2001. Ecology's status on this site is awaiting assessment (Ecology 2007a).

Three areas on the Associated Grocers, Inc., site have known groundwater and/or soil contamination: the former truck shop; former USTs by the maintenance building; and the former Humble service station. The following summarizes the activities at each of these areas.

Former Truck Shop

Ongoing groundwater monitoring has been performed at the former truck shop since at least June 2002. This shop consists of a building currently used for dry storage. The location and layout of the area of the former truck shop are illustrated in Figure 23. There are currently no USTs at the truck shop site, and no truck repairs are presently conducted in the building. The former truck shop consists of a 9,000-sq. ft. building, a pump island canopy, and the surrounding driveway and parking areas (Lie 2006). According to notes from an October 2005 inspection at the facility, the former truck shop is contracted out to Penske (Tuomisto 2005a).

The latest round of groundwater sampling took place in June 2006. The following compounds were detected at concentrations greater than the MTCA Method A groundwater cleanup levels. Benzene was detected in MW-6 at 7.0 µg/L. TPH in the diesel range was detected in MW-8, MW-205, and MW-206 at 920 mg/L, 6,400 mg/L, and 2,000 mg/L, respectively. TPH in the gasoline range was detected in MW-8 and MW-205 at 1,300 mg/L and 970 mg/L, respectively.

Free product consisting of a mixture of gasoline and diesel fuel has been found in MW-1, MW-2, MW-3, and MW-201. All of these monitoring wells are located in the vicinity of the former pump island, which is east of the former truck shop facility. MW-2 has not contained significant free product since 2004. The amount of free product from the other three wells has varied widely. Manual bailing of free product is conducted on a semi-weekly basis. Recovery of approximately 50 liters of free phase product has been recorded to date; recovery of product is not currently being measured (Lie 2006).

Sampling by Terra Associates in June of 2006 indicates that the plume of groundwater contamination is not migrating off site, however not all monitoring wells were sampled. Terra Associates also concluded the area producing free product has not expanded, and there has been no increase in the amount of free product (Lie 2006).

Former USTs near the Maintenance Building

In April 1995, two USTs (450-gallon and a 300-gallon) were removed from the southern end of the maintenance shop. The locations of these USTs are illustrated in Figure 24. It is suspected that the maintenance shop was formerly a dry cleaning facility and the USTs were abandoned cleaning solvent tanks. Upon removal of the tanks, no odors or visibly contaminated soils were noted. Four soil borings were advanced in the area of the former USTs following their removal (Figure 24). Soil samples from the borings were analyzed for volatile organics. The highest concentrations of volatile organic compounds were detected in a soil sample from Boring 3 at 10 feet: 54 parts per billion (ppb) ethylbenzene; 130 ppb m,p-xylene; 1,000 ppb n-prophlbenzene; 410 ppb 1,3,5-trimethylbenzene; 25 ppb butylbenzene; 1,600 ppb 1,2,4-trimethylbenzene; 230 ppb s-butylbenzene; and 91 ppb 1,2-dichlorobenzenne (Fladseth 1996). The ethylbenzene and xylene concentrations are below MTCA Method A soil cleanup levels for unrestricted land use. There is no information in the site files regarding groundwater sampling.

Former Humble Service Station

In 1991, a site remediation was conducted by Terra Associates, Inc., at the former gasoline service station (Former Humble Oil Service Station), illustrated in Figure 25. This facility was first developed in 1965 and consisted of two pump islands, three USTs for gasoline storage for retail, and one heating oil tank for on-site use. There was also a repair garage, a drum storage area, and a catch basin with an oil/water separator in the repair area of the building. This catch basin appears to have drained toward a dry well northeast of the structure (Lie 1991).

Terra Associates, Inc. determined, after the removal of the pump island and USTs, that soils at the dry well required remediation. It appeared waste oils had been disposed of in this sump. All the soils exceeding Ecology's recommended maximum contaminant levels, comprising 500 cubic yards, were removed from the site and disposed of at landfills. In addition, 11,000 gallons of water with elevated levels of hydrocarbons were pumped and removed from the site for treatment. Groundwater samples were taken after soil removal activities were complete. Two groundwater samples contained contaminants above detection limits. The March 21, 1991, sample from monitoring well B-7A contained 22 ppb benzene, exceeding the MTCA Method A groundwater cleanup level (5 µg/L). The December 13, 1990, sample from sample point RS-1 contained 13 ppb benzene, 17 ppb ethylbenzene, 6 ppb m,p-xylene, and 9 ppb o-xylene. (Lie 1991)

Terra Associates, Inc. recommended groundwater monitoring be performed and stated that additional groundwater remediation may be required. Groundwater samples and water level measurements were taken at the six on-site monitoring wells in 1990 an 1991. Groundwater appeared to flow towards the northwest. Terra Associates, Inc. stated the site may be affected by tides and that water levels will fluctuate somewhat through the year due to variations in rainfall (Lie 1991).

In 1992, a sample from monitoring well B-7 contained a benzene concentration of 3 ppb, down from 13 ppb seven months before.

Ongoing groundwater monitoring continued until 1993. A No Further Action (NFA) determination was requested in 1998 (Lie 1998). Ecology issued a NFA through the VCP program December 29, 1998 (Ecology 2007f).

Business Inspections

The area of the former truck shop facility, grocery warehouse, and maintenance shop on the Associated Grocers, Inc., property was inspected as part of the LDW source control program on October 25, 2005. During the inspection, it was noted that no pretreatment was provided for industrial wastes discharged to the sewer. The seven or eight catch basins on site are not equipped with outlet traps and are cleaned quarterly. There was no evidence of contaminants in the catch basins at the time of the inspection, and there were no signs of leaks from vehicles stored on site (Tuomisto 2005a).

In the area containing the two operational diesel USTs, the fueling area was not covered and the fuel pad did not have a separate drainage system. There were also two gasoline ASTs on this part of the facility. There were catch basins in the vicinity of the fueling locations, along with required non-water absorbent materials. A storm drain cover and plug kit were not present. It was noted that storage areas were paved and there was no oil staining or visible sheen observed (Tuomisto 2005a).

The following corrective actions were specified:

- Complete a spill prevention and cleanup plan and post the plan at appropriate locations at the facility.
- Obtain a drain cover for the spill kit located at the fueling pad and on the mobile fueling truck. The drain cover should be the first thing pulled out of the kits and used during a spill.
- Clearly mark the spill kits.

- Install outlet traps in all of the catch basins.
- Cover the scrap metal dumpster to keep stormwater from collecting at the bottom of the dumpster and leaching metal into the storm drains.

A follow-up inspection of the facility by SPU completed on December 16, 2005, determined the site was in compliance with the City's Stormwater, Grading, and Drainage Code (SMC 22.800) (Tuomisto 2005b,c).

The portion of the site known as the former truck shop, which is currently contracted to Penske, was inspected by SPU on October 25, 2005. The results of the inspection indicated the site was in compliance with the City's Stormwater, Grading, and Drainage Code (SMC 22.800).

3.1.4.4 Potential Pathways of Contamination

Stormwater

The surface drainage flow direction, drainage sub-area boundaries, and storm drainage system configuration of Associated Grocers, Inc. are illustrated in Figure 26. Runoff from the southern portion of the property discharges from the west side of the property through a 60-inch storm drain into the WSDOT storm drain, and runoff from the northern portion of the property discharges into the Norfolk CSO/SD.

Associated Grocers' storm drain system appears to run through areas of known groundwater and/or soil contamination, and therefore is a possible source of sediment recontamination to EAA-7. There are three areas within the Associated Grocers, Inc., facility with known groundwater and/or soil contamination: the former truck shop; former USTs by the maintenance building; and the former Humble service station.

Groundwater contamination has been identified at the former truck shop (Figure 22). USTs were removed from the southern end of the maintenance shop. These areas are drained by drainage sub-area C of Associated Grocers' storm drainage system (Figure 26). Groundwater and soil contamination has been identified at the former Humble service station, located in drainage sub-areas A and B of Associated Grocers' storm drainage system (Figure 26). Drainage sub-areas A, B, and C drain into the Norfolk CSO/SD system.

Groundwater

Three areas at the Associated Grocers, Inc., site have had known groundwater and/or soil contamination: the former truck shop; the maintenance shop; and the former Humble gas station (Figures 22 through 25). These areas are described in detail in Section 3.1.4.3.

At the former truck shop, Terra Associates, Inc., concluded the groundwater contamination plume was not migrating off site. Terra Associates, Inc., also concluded the area containing free product has not expanded and there has been no increase in the amount of free product (Lie 2006). The area of the facility is relatively flat and ranges in elevation from approximately 43 to 45 feet above mean sea level. There is a slight slope towards the east in the pavement surrounding the east, south, and north sides of the truck shop building, where groundwater monitoring has been taking place. The area is underlain by up to 10 feet of fill. Low plasticity silt is present beneath the fill. Below the silt is fine- to-medium-grained sand. Groundwater is generally found at depths between 5 and 12 feet below existing surface grades, and the overall groundwater gradients appear to be towards the west (Lie 2006).

Based on the most recent sampling results, the documented groundwater contamination at the former truck shop does not appear likely to migrate directly to the LDW because the groundwater contamination plume does not appear to be migrating off site and the area containing free product has not expanded. However, not all the monitoring wells were sampled in the last sampling event of June 2006. It should be noted that contaminated groundwater from the site could potentially infiltrate into the storm drain system and migrate to the LDW.

At the maintenance shop, a 450-gallon and a 300-gallon UST were removed in April 1995 (Figure 24). Following removal of the tank, no odors or visibly contaminated soils were reported. Soil samples were collected from four soil borings advanced in the area around the former USTs. The highest concentration of volatile organic compounds were detected in the soil sample from Boring 3 at 10 feet: 54 ppb ethylbenzene; 130 ppb m,p-xylene; 1,000 ppb n-prophlbenzene; 410 ppb 1,3,5-trimethylbenzene; 25 ppb butylbenzene; 1,600 ppb 1,2,4-trimethylbenzene; 230 ppb s-butylbenzene; and 91 ppb 1,2-dichlorobenzenne (Fladseth 1996). The ethylbenzene and xylene concentrations are below MTCA Method A soil cleanup levels for unrestricted land use. The site files contain no information regarding groundwater sampling. There is not enough information available on groundwater conditions to assess the likelihood of potential groundwater contamination at the site, although available soil sampling results do not suggest a high likelihood for groundwater contamination.

The former Humble gasoline service station was the subject of site remediation activities by Terra Associates, Inc., in 1991. These activities are detailed in Section 3.1.4.3. Five hundred cubic yards of soil were removed from the site and disposed of at off-site landfills. Additionally, 11,000 gallons of hydrocarbon-contaminated water was pumped and removed from the site for treatment. In the area by the former gasoline service station, the depth to groundwater ranges from 8.7 to 11.0 feet below grade. Groundwater levels on the site may be affected by tides and may fluctuate seasonally. In general, the area is underlain by a layer of fill comprising silty sand about 2 to 4 feet in thickness. A stiff to medium stiff plastic silt underlies the fill and extends to approximately 10 feet below existing grade. Below 10 to 12 feet, the site is underlain by the medium dense fine to medium sands.

Groundwater samples were taken after soil removal activities were complete. On March 21, 1991, Monitoring well B-7A had a concentration of 22 ppb benzene. On December 13, 1990, sample point RS-1 had 13 ppb benzene, 17 ppb ethylbenzene, 6 ppb m,p-xylene, and 9 ppb o-xylene. Terra Associates, Inc., recommended groundwater monitoring be performed and concluded additional groundwater remediation may be required. At the time of the 1991 sampling event, groundwater appeared to flow towards the northwest (Lie 1991). In 1992, monitoring well B-7 had a benzene concentration of 3 ppb, down from 13 ppb seven months before. These concentrations were above Ecology cleanup criteria. No information regarding further groundwater sampling was available. In 1998, an NFA was requested (Lie 1998). Ecology issued the NFA December 29, 1998 (Ecology, 2007f).

The latest round of groundwater sampling at the former truck shop took place in June 2006. The following compounds were detected at concentrations greater than the MTCA Method A groundwater cleanup levels. Benzene was detected in MW-6 at 7.0 µg/L. TPH-diesel range was detected in MW-8, MW-205, and MW-206 at 920 mg/L, 6,400 mg/L, and 2,000 mg/L, respectively. TPH-gasoline range was detected in MW-8 and MW-205 at 1,300 mg/L and 970 mg/L, respectively. Free product consisting of a mixture of gasoline and diesel fuel has been found in MW-1, MW-2, MW-3, and MW-201. All of these monitoring wells are located in the vicinity of the former pump island, which is east of the former truck shop facility. Contaminated groundwater from the former truck shop could potentially infiltrate into the storm drain system and eventually discharge into the LDW in the EAA-7.

Bank Erosion

This site is not located along the banks of the LDW; therefore, bank erosion is not a potential source of recontamination of the LDW sediments.

Data Gaps

The following data gaps have been identified:

- Groundwater flow or the extent of the contaminant plume is not well understood.
- Effectiveness of its product removal strategy for source control is unknown.
- It is unknown whether additional groundwater and soil assessment is needed for the maintenance building where USTs removal activities took place in 1995.
- A SWPPP was not available for review.

3.1.5 Northwest Auto Wrecking

3.1.5.1 Current Operations

Northwest Auto Wrecking is located at 10230 East Marginal Way South, Tukwila, Washington. The location and layout of the facility are illustrated in Figure 27. The auto wrecking facility is located on tax parcels 0423049102 and 0323049062, and is owned by Northwest Auto Wrecking Company (King County 2007b). Parcel 0423049102 is 1.84 acres in size and contains four structures: a 1,500-sq. ft. service repair garage built in 1962; a 1,800-sq. ft. retail store built in 1958; a 1,560-sq. ft. material storage shed built in 1922; and a 2,064-sq. ft. material storage shed built in 1922. Parcel 0323049062 is 3.51 acres in size and zoned for commercial use.

The land use surrounding Northwest Auto Wrecking is described below (King County 2007b):

- Northwest of the facility (10200 East Marginal Way South, parcel 0423049184) is Sound Community Bank. This 0.7-acre property is owned by Martin Burton/Buty LP.
- Northeast of the facility (no listed address, parcels 0423049101 and 0003400024) and south-southwest of the facility (no listed address, parcels 0323049048 and 0423049099) are properties of 1, 0.93, 1.42, and 0.98 acres in size that are part of Associated Grocers, Inc., and are owned by Sea-Tuk Warehouse LLC.
- East of the facility (3301 South Norfolk Street, parcel 0323049024) is a 17.66-acre property that is part of Associated Grocers, Inc., and owned by Sea-Tuk Warehouse LLC. The 15 buildings on this parcel are used as warehouses, garages, and offices.
- Southwest of the facility (10320 East Marginal Way South, parcel 0423049015) is Trimline Transmission. This 1.43-acre property is owned by Haapla & Haapla and contains two buildings used as service repair garages.

On the Ecology online Industrial Stormwater General Permit database, this facility is listed as having Permit SO000961D. Based on Ecology's online database (Ecology 2007d) the parameters for this permit are for pH with a maximum of 8.5 and a minimum of 6.5 standard pH units. The permit expires on September 20, 2007. Ecology plans to reissue Industrial Stormwater General Permits on August 20, 2007. These reissued permits would be effective on September 20, 2007, and would expire on September 20, 2012 (Ecology 2007d).

According to Ecology's online NPDES and State Waste Discharge Permit database, this facility does not have a NPDES permit (Ecology 2007c).

This site was not listed as a Hazardous Waste Facility on Ecology's online Hazardous Waste Facility Search database (Ecology 2007e).

3.1.5.2 Historic Use

Review of available information did not identify prior uses or ownership of the property.

3.1.5.3 Environmental Investigations and Cleanup Activities

Northwest Auto Wrecking is not listed on Ecology's online UST or LUST database (Ecology 2007b).

According to Ecology's CSCSL online database, the facility (Facility Site ID No. 2287) has confirmed soil and sediment contamination, and suspected groundwater, surface water, and air contamination. The confirmed and suspected contaminants are halogenated organic compounds, EPA priority pollutant metals, and cyanide, metals, PCBs, petroleum products, and non-halogenated solvents. According to the database, a Site Discovery/Report was received and determined completed on October 31, 1990. The current status is awaiting Site Hazard Assessment (Ecology 2007a).

In 1993, meetings were held between Jerry Haapla of Northwest Auto Wrecking, Inc., and Ecology to discuss cleanup options for high levels of lead contamination located on the property (Chaitin 1993).

In 1997, a letter to Dan Marsh of Marsh Industrial Research from David Hohmann of Ecology's Hazardous Waste and Toxics Reduction program stated some soils failing the TCLP test for lead leachability may be awaiting final cleanup on the site. Marsh Industrial Research performed bench testing and proposed stabilizing the remaining soils by adding Portland cement so metals are fixed and stabilized. Ecology responded that for this process to be done, it must be performed at the site where waste is generated and conducted to prevent a release of waste and waste constituents. Ecology also stipulated the resulting concrete could not be buried in the ground unless a solid waste disposal permit was acquired, and that a Waste Analysis Plan would need to be developed and approved by Ecology (Hohmann 1997).

No information was located regarding subsequent cleanup plans or actions for this site after 1997, nor was information regarding analytical data or information regarding the suspected groundwater, surface water, or air contamination.

3.1.5.4 Potential Pathways of Contamination

Stormwater

Northwest Auto Wrecking is located west of Associated Grocers, Inc., and east of the LDW in EAA-7. No information regarding Northwest Auto Wrecking's drainage system, including a SWPPP, was available for review. Subsurface contamination that may exist at this facility could potentially be a source of sediment recontamination of the LDW via the on-site storm drain system. However, there is insufficient information to determine if Northwest Auto Wrecking's storm drain system passes through areas of subsurface soil or groundwater contamination, or whether contaminants at the surface could enter into the storm drain system.

Groundwater

According to Ecology's CSCSL online database, the facility (Facility Site ID No. 2287) has confirmed soil and sediment contamination, and suspected groundwater, surface water, and air contamination. The confirmed and suspected contaminants are halogenated organic compounds, EPA priority pollutant metals, and cyanide, metals, PCBs, petroleum products, and non-halogenated solvents. According to the database, a Site Discovery/Report was received and determined completed on October 31, 1990. The site is currently awaiting a Site Hazard Assessment (Ecology 2007a). No soil or groundwater sampling information for the site was found during the site file review.

It is assumed groundwater in the area of this facility flows generally westward toward the LDW. Because the facility Facility Site Identification No. was listed on the CSCSL for potential groundwater contamination, it is possible groundwater exists at the site and such groundwater contamination could migrate toward the LDW.

Bank Erosion

This site is not located along the banks of the LDW; therefore, bank erosion is not a potential source of recontamination of the LDW sediments.

Data Gaps

The following data gaps have been identified:

- Soil, groundwater, surface water, and sediment sampling, is needed.
- Facility inspection results are needed.
- A SWPPP was not available for review.
- No information was available pertaining to the stormwater drainage system.
- It is unknown whether the storm drain system connects to the Norfolk CSO/SD.

3.1.6 Affordable Auto Wrecking

3.1.6.1 Current Operations

Affordable Auto Wrecking is located at 9802 Martin Luther King Jr. Way South, Seattle, Washington. The area of Affordable Auto Wrecking is illustrated in Figure 28. This facility salvages and sells miscellaneous vehicle parts, then crushes and sells the remaining vehicle components in bulk to local metal salvage businesses. Cars are processed at the southern end of the property, where the car crusher is located. At the southern end of the facility, fluids are removed from incoming automobiles. Some of these automobiles are later crushed. Cars not crushed at this time are moved to the northern end of the property, where they are used for parts salvage.

According to King County tax assessor records, the facility is located on tax parcel number 0323049092 (King County 2007b). Ecology analyzed aerial images of the Affordable Auto Wrecking facility in 2004 and determined the facility spans a total of three parcels. The two additional parcels are numbers 0323049091 and 0323049107 (Wood 2004). The area of these parcels is illustrated in Figure 29.

According to King County tax assessor records, parcel 0323049092 is 3.58 acres in size, zoned for commercial use, and contains one structure: a 864-sq. ft. discount store built in 1968. The owner of this parcel is Corky Morris LLC. Parcel 0323049091 is 1.76 acres in size, zoned for commercial use, and contains one structure: a 1,200-sq. ft. discount store built in 1948. The owners of this parcel are Ronald and Carol Settergren. Parcel 0323049107 is zoned for commercial use and is listed as a commercial auto wrecking yard. It is 1.75 acres in size and is leased by Ronald and Carol Settergren from Central Puget Sound Regional Transit Authority (King County 2007b).

The following land-use information for surrounding properties was obtained on the King County online tax assessor website (King County 2007b):

- North of the facility is a 2.36-acre property (no address listed, parcel 0323049233) zoned for commercial use. The property name is listed as Anderson Auto Wrecking and is owned by Ronald Settergren. There is no listed address and no structures on this parcel.

- Northeast of the facility is a 14.9-acre residential property (no address listed, parcel 0323049003) owned by Seattle Farm LLC and Ann Martha.
- To the east of the facility are: a 2.49-acre residential property (no address listed, parcel 0323049093) owned by Crillion and Edna Lockhart; a 0.13-acre residential property (4600 South Gazelle St, parcel 0323049159) owned by Janet Finch; and a parcel to the east (4601 South Gazelle St, parcel 0323049158) owned by Otis Pimpleton.
- Southeast of the facility is a 1.63-acre residential property (9911 46th Ave. South, parcel 0323049209) owned by Angeles Eastey.
- Southwest of the facility is a 2.95-acre Arco Gas Station (9834 Martin Luther King Jr. Way South, parcel 0323049008) owned by John Eastey.

According to Ecology's online Industrial Stormwater General Permit database, Affordable Auto Wrecking is listed as having Permit SO000843D. Based on Ecology's online database, the parameters for this permit are for pH with a maximum of 8.5 and a minimum of 6.5 standard pH units. Ecology plans to reissue Industrial Stormwater General Permits on August 20, 2007. These reissued permits would be effective on September 20, 2007, and would expire on September 20, 2012. (Ecology 2007d)

This facility has been issued a Minor Discharge Authorization No. 732-01 (EPA ID No. 2-473944-236520) from the King County Wastewater Treatment Division to discharge limited amounts of industrial wastewater into King County's sewer system in accordance with effluent imitations and other requirements and conditions listed in the document. According to the permit, discharge is to the south treatment plant for wastewater generated by contaminated stormwater with an oil/water separator as a pre-treatment process. The maximum volume allowed is 25,000 gallons per day. The permit is effective April 1, 2003, through April 1, 2008.

This facility is not listed on Ecology's online NPDES and Waste Discharge Permit Database (Ecology 2007c) or on Ecology's Hazardous Waste Facility Search Database (Ecology 2007e).

3.1.6.2 Historic Use

Review of available information did not identify prior uses or ownership of the property.

3.1.6.3 Environmental Investigations and Cleanup Activities

On Ecology's online CSCSL database, Affordable Auto Wrecking (Facility Site ID No. 7163112) is listed as having suspected groundwater contamination and confirmed surface water and soil contamination. The contaminants are listed as EPA priority pollutants metals and cyanide, petroleum products, non-halogenated solvents, and PAHs. In July 2006, the site was added to the Hazardous Sites List with a rank of 5 (This ranking is based on a scale of 1 to 5. On this scale, "1" represents the highest relative risk, and "5" represents the lowest relative risk. This ranking is designed to estimate the potential threat to human health and/or the environment, relative to all other sites in Washington State). The site is awaiting remedial action (Ecology 2007e).

The facility is not listed on the Washington Department of Ecology's online LUST database (Ecology 2007b). There are no USTs listed for this facility on Ecology's online UST database (Ecology 2007b).

Ecology Hazardous Waste and Toxics Reduction Program

In May 2000, this facility was inspected by Ecology's Hazardous Waste and Toxics Reduction Program. Work was done at the facility by Hazardous Waste and Toxics Reduction and Seattle Public Utilities (Surface Water). On June 16, 2000, a Notice of Correction was issued to the site to outline steps needed to bring the site into compliance. A follow-up inspection was completed on November 21, 2000, at which time no hazardous waste violations were noted (Zimmermann 2000).

This facility was inspected by Ecology's Hazardous Waste and Toxics Reduction Program on August 3, 2004. Agencies involved in this inspection were: Ecology Hazardous Waste and Toxics Reduction, Ecology Water Quality, Washington State Patrol, Seattle Police Department, Fire Marshal's Office, Seattle Public Utilities, and King County Industrial Waste. The agencies' main issue of concern was whether the management of waste gasoline and the general environmental management practices at the site could be improved by better "housekeeping practice" (Zimmermann 2004).

During the August 3, 2004 site visit the integrity of the concrete covering could not be assessed because many areas of concrete were covered by a thick layer of dirt and debris. Deep grooves cut into the concrete slab were noted in several areas. The inspection concentrated on the southern end of the property where fluids were removed from incoming automobiles and some of the automobiles were crushed. It was observed that lead-acid batteries were sometimes stored in a manner that could allow the acid to drain to the ground. This same situation was observed during a May 2000 inspection. Waste antifreeze was also found to be improperly managed and stored. It was not determined if waste gasoline was being properly managed. It also was not determined if wastewater separated from gasoline drained from the automobile fuel tanks was being properly managed and disposed of (Zimmermann 2004).

Business Inspections

SPU inspected Affordable Auto Wrecking on the following dates: October 30, 2001; December 4, 2002; December 20, 2002; March 5, 2003; August 3, 2004; November 10, 2004; December 15, 2004; and December 29, 2004; October 26, 2005; and January 27, 2006.

The following actions were identified during inspections conducted prior to October 2005 (Bassett 2005):

- Removing a by-pass line to route runoff through an oil/water separator before discharge to the sanitary sewer.
- Implementing BMPs to minimize the amount of contaminants discharged to the sanitary sewer: keeping lids on drums, buckets, and drip pans with petroleum products or other hazardous liquids so stormwater would not accumulate and overflow the containers.

- Implementing appropriate spill control procedures to ensure that leaks and spills are immediately and effectively cleaned up, to collect and properly dispose of spilled material and cleanup materials, and to install and maintain an oil/water separator at the north side of the yard.

In a follow-up inspection conducted on October 26, 2005, the following two corrective actions were identified:

- Provide spill containment and clean-up materials for the crushing area at the south end of the property. These were to be clearly marked and easily accessible.
- Educate employees at the site about the spill plan and spill containment and clean-up materials.

Both these items were completed by the facility, and during the re-inspection on January 27, 2006, it was determined the facility did not have any environmental compliance problems.

King County Industrial Waste Program

On January 28, 2005, the King County Industrial Waste Program requested that Affordable Auto Wrecking was asked to clean the oil/water separator. The follow-up inspection on May 18, 2005, found the oil/water separator (pretreatment system) had not been cleaned. A Notice of Violation letter was sent on May 27, 2005, for failure to clean the pretreatment system. A 14-day report was received on June 16, 2005, that stated the costs for cleaning were prohibitive. At the time, temporary steps were taken to remove some of the solids from the sump pump intake and to place the sump pump above the level of contaminated dirt. Samples collected on February 2, 2006, indicated the discharge was back in compliance with discharge standards. King County Industrial Waste stated the contaminated solids accumulated in the separator must be removed and disposed of in accordance with environmental regulations (Haberman 2006).

3.1.6.4 Potential Pathways of Contamination

Stormwater

Affordable Auto Wrecking has recently diverted all contaminated stormwater runoff to the sanitary sewer, which suggests that Affordable Auto Wrecking may not discharge to EAA-7 via the Norfolk CSO/SD except during CSO events. A current and accurate description of Affordable Auto Wrecking's storm drain system is necessary to further evaluate potential impacts to EAA-7.

Groundwater

Following an initial investigation on August 4, 2004, Ecology issued an Early Notice Letter to the owners of Affordable Auto Wrecking to serve notice that the property was known to be contaminated by hazardous substances. The following contaminants of concern were listed for surface water, soil and groundwater at the site: metals-priority pollutants; petroleum products; non-halogenated solvents; and PAHs. This site was added to the Hazardous Sites Listing with a rank of five in July 2006 and is awaiting Remedial Action.

No groundwater data were available in the site files. This site is located to the north of the Arco Gas Station site, where groundwater flow is toward the south-southwest, toward the LDW. It is likely groundwater flows generally toward the south-southwest at the Affordable Auto Wrecking facility.

It is possible the facility may be a source of groundwater contaminants that could migrate toward the Norfolk CSO/SD and LDW.

Bank Erosion

This site is not located along the banks of the LDW; therefore, bank erosion is not a potential source of recontamination of the LDW sediments.

Data Gaps

The following data gaps were identified:

- Surface water, soil, and groundwater sampling is needed.
- It is unknown where the storm drain system connects to the Norfolk CSO/SD.
- Inspections of the facility need to be conducted to make sure that the recent changes made to the drainage system are currently functioning and that no contaminated runoff gets into the municipal storm drain system on MLK Way.
- The SWPPP needs to be reevaluated.

3.1.7 Arco Gas Station

3.1.7.1 Current Operations

An Arco Gas Station facility was formerly located on King County tax parcel 0323049008, which is identified on the King County tax assessor online parcel database as having an address of 9834 Martin Luther King Junior Way South, Seattle, Washington (King County 2007b). The reported address of the former Arco Gas Station facility on Ecology's UST and LUST databases is 9830 Martin Luther King Way South, Seattle, Washington (Ecology 2007b). In various Ecology documents, the Arco Gas Station is reported to have a street address of 9840 Martin Luther King Junior Way South, Seattle, Washington. The area of the site is illustrated in Figure 30. Parcel 0323049008 is a 2.95-acre property zoned for commercial use and owned by John Eastey.

The facility is no longer an operating gas station. Twenty-six USTs are reported to have been removed from the 9830 Martin Luther King Junior Way South facility (Ecology 2007b). All of the USTs had contained petroleum products.

The following land-use information for surrounding properties was obtained on the King County online tax assessor website (King County 2007b):

- North of the facility is Affordable Auto Wrecking (9820 Martin Luther King Junior Way South, parcel 0323049091), which is owned by Ronald and Caryl Settergren. This is a commercial property of 1.76-acres landing size, with one building used predominantly as a discount store.
- East of the facility is a 1.63-acre residential property (9911 46th Ave. South, parcel 0323049209) owned by Angeles Eastey.
- South of the facility is Fine Line Pacific Countertops (no address listed, parcel 0323049106), located on a 2.05-acre property owned by Jacks Auto Parts, Inc.
- Southwest of the facility is a 3.57-acre commercial property (10013 Martin Luther King Junior Way South, parcel 0323049237) on land owned by Carolina Pump and Supply. The property has one building used as a distribution warehouse.
- West of the facility is a 3.39-acre property (no address listed, parcel 0323049236) with a commercial warehouse owned by Frank Collucio Construction Company.
- Northwest of the facility is a 3.15-acre commercial property (9801 Martin Luther King Junior Way South, parcel 0323049235) used as a terminal for automobiles and buses owned by 9801 MLK LLC. There is one building on this property used as an office building.

According to Ecology's online NPDES and State Waste Discharge Permit database, this facility does not have a NPDES permit (Ecology 2007c). The facility does not have an Industrial Stormwater General Permit (Ecology 2007d) and is not listed on Ecology's online Hazardous Waste Facility Search Database (Ecology 2007e).

3.1.7.2 Historic Use

Review of available information did not identify prior uses or ownership of the property.

3.1.7.3 Environmental Investigations and Cleanup Activities

The facility is listed on Ecology's online CSCSL database as a contaminated site (Facility Site ID 29429665), with groundwater contamination determined to be below the cleanup level and soil contamination that has been remediated (Ecology 2007a). The facility owner is pursuing a NFA determination by Ecology under the Voluntary Cleanup Program (Adams 2005).

According to Ecology's online UST and LUST databases, 26 USTs have been removed from the facility, and the site is awaiting soil cleanup. There are no USTs remaining on site (Ecology 2007b).

The 26 former USTs reported to have existed at the site included: sixteen 10,000-gallon unleaded gas USTs; five 20,000-gallon diesel USTs; one 20,000-gallon unleaded gas UST; two 8,500-gallon unleaded gas USTs; and two 7,500-gallon unleaded gas USTs (Peterson 2005). The general locations of these former USTs are shown in Figure 30.

The USTs were removed in 1991 and 1992, and a verbal notice of release was provided to Ecology in 1994 (Adams 2005). No soil sampling data associated with the tank removal have been submitted to Ecology, and Ecology is not aware of any other soil characterization data for the site. The nature and extent of soil contamination reported in 1994 by the site owners are unknown to Ecology (Adams 2005). Ecology did not receive an Underground Storage Tank Removal Report or Site Assessment Report for the tank closures. Bison Environmental, the firm that reportedly completed the UST closure site assessment, is no longer in business. Ecology identified a number of concerns to be addressed before issuing a NFA determination. First, if the site is to proceed with containment of the unknown contamination as the selected cleanup action, an alternative point of compliance for compounds in soil associated with petroleum fuel tank farms would need to be established. Second, to demonstrate groundwater flowing through the site is uncontaminated based on the three on-site monitoring wells, a conditional point of compliance would need to be established for groundwater. Third, institutional controls, likely including a restrictive covenant, would need to be established to assure integrity of the contaminated system (Adams 2005).

Three monitoring wells are located on site. No well completion information is available for these wells. HWA GeoSciences, Inc. conducted a groundwater sampling event on December 14, 2004. The samples were analyzed for: gasoline range TPH, benzene, etheylbenzene, toluene, xylene, TPH- diesel range, and TPH-lube oil range. The samples from MW-1, MW-2, and MW-3 contained <50 µg/L gasoline, <1 µg/L Benzene, <1 µg/L ethylbenzene, <1 µg/L toluene, <3 µg/L xylene, <130 µg/L diesel, and <250 µg/L lube oil. Results for all samples were reported below the MTCA Method A cleanup levels (Peterson 2005).

In December 2005, HWA GeoSciences, Inc. installed two temporary hand-driven piezometers to further characterize groundwater flow at the site. Groundwater levels were measured at the two piezometers and three monitoring wells on December 8, 2005; January 5, 2006; and February 1, 2006. The apparent groundwater gradient was reported to be to the south and west.

A third piezometer was installed in May 2006 at the request of Ecology, and another set of groundwater measurements were taken on May 11, 2006. Groundwater in the area of the former USTs was reported to flow to the south and southwest. HWA GeoSciences, Inc. asserted that the three monitoring wells were located downgradient of the former USTs, making them favorably positioned to monitor groundwater quality. In 2006, HWA GeoSciences, Inc. recommended continued groundwater sampling from the three wells to evaluate groundwater compliance (Sugar 2006). No documents available for review indicate that further groundwater sampling has been conducted.

In September 2006, Ecology agreed with the conclusions of HWA GeoSciences, Inc. (Sugar 2006) that the three monitoring wells were favorably positioned to monitor groundwater quality relative to the former UST locations. Ecology recommended that Geoprobe borings be conducted within the edges of the tank nest excavations to evaluate both internal backfill and exterior native soils (Adams 2006). No documents available for review indicate that further soil boring installation has been conducted.

As part of the LDW source control program, SPU collected in-line sediment samples from eight locations in the Norfolk CSO/SD system in 2003-2005, as discussed in Section 2.3.1.1. Some of the sample locations, including MH4 and MH5, are located downgradient of the Arco Gas Station. Samples from these locations contained elevated concentrations of TPH-oil range.

3.1.7.4 Potential Pathways of Contamination

Stormwater

Arco Gas Station is located just southeast of Affordable Auto Wrecking. No information regarding Arco Gas Station's storm drain system, including a SWPPP, was available for review. Thus, it is not possible to definitively determine how the storm drain system serving the Arco Gas Station facility could facilitate the migration of contaminants to the LDW in EAA-7 via the stormwater pathway.

There are no documented areas of groundwater contamination at the site; however, follow-up sampling specified by Ecology in the area of the former USTs has apparently not been completed, and thus there remains uncertainty about the presence of subsurface contamination through which an on-site storm drain system could potentially pass.

Limited information provided by SPU indicates that diesel contamination has been investigated within Arco Gas Station's storm drainage system, and a wash pad has been found at the Coluccio yard that was incorrectly plumbed to the storm drain system. The facility owner was directed to replumb to the sanitary sewer in 2005 (Schmoyer 2007).

Groundwater

The facility is listed on Ecology's online CSCSL database as a contaminated site (Facility Site ID 29429665), with groundwater contamination determined to be below the cleanup level and soil contamination that has been remediated (Ecology 2007a). The facility owner is pursuing a NFA determination by Ecology under the Voluntary Cleanup Program (Adams 2005).

At the Arco Gas station, groundwater monitoring has been conducted at the site of the former UST locations. The latest groundwater samples, collected in December 2004, were analyzed for gasoline, benzene, etheylbenzene, toluene, xylene, diesel, and lube oil. All samples were below the MTCA Method A cleanup levels (Peterson 2005). Soil boring samples are needed in the area adjacent to the tank farm to determine if soils are impacted and if those soils will need to be remediated in order to control this potential contaminant pathway.

Bank Erosion

This site is not located along the banks of the LDW; therefore, bank erosion is not a potential source of recontamination of the LDW sediments.

Data Gaps

The following data gaps have been identified:

- It is not known whether soils in the area adjacent to the former tank farm need to be remediated in order to control this potential contaminant pathway.
- Groundwater conditions are not adequately understood in the former tank farm area.
- A SWPPP was not available for review.
- The storm drain system and possible historic or present connections to the Norfolk CSO/SD is not understood.

3.2 Stormwater/Norfolk CSO/SD

The components of the Municipal Storm Drain System and Norfolk CSO/SD within the Norfolk drainage basin are described in Sections 2.3.1. The stormwater drainage systems that drain each of the identified facilities of potential concern, and the potential for these stormwater systems to transport on-site contaminants to the EAA-7, are discussed in Section 3.1.

3.2.1 Data Gaps

Information available for review pertaining to the location and configuration of the Norfolk CSO/SD and its components was limited to the following: GIS files obtained from the city of Tukwila showing locations pipes, ditches, and catch basin locations; GIS files from King County showing the locations of drain lines; and maps and drawings of individual facilities of concern (BDC, MFC, and Affordable Auto Wrecking) that illustrate the layout of on-site storm drainage systems. It should be noted that the city of Seattle has completed a study of the portion of the Norfolk CSO/SD drainage area that lies within the Seattle city limits; however, only limited information from this study was available for the preparation of this Action Plan.

Due to limitations of the available data, there is an incomplete understanding of the configuration of portions of the Norfolk CSO/SD system and the relationships and interconnections of on-site storm drain systems at the identified facilities of concern (discussed below). In order to better evaluate the potential for surface or subsurface (soil or groundwater) contamination to migrate via the Norfolk CSO/SD to EAA-7, it is necessary to obtain a better understanding of the configurations, relationships, and interconnections of the various drainage systems.

The in-line sediment sampling data described in Section 2.3.1.1 identify accumulations of contaminated sediments within a significant portion of the Norfok CSO/SD. To date, in-line sediment sampling data for other portions of the Norfolk CSO/SD system are not available.

The following data gaps have been identified:

- GIS data pertaining to stormwater and sewer drainage systems is needed in order to gain a better understanding of the configurations, relationships, and interconnections of the various systems. If such additional as-built information is not available, dye testing or other source tracing techniques should be employed to map out the system components.
- Drainage plans for private properties along East Marginal Way South are needed to better delineate drainage basin boundaries in this area.
- Further source tracing and sampling is needed in the Norfolk CSO/SD drainage system.

3.3 Atmospheric Deposition

Air pollution can enter the LDW directly or through stormwater, thus becoming a possible source of sediment contamination to EAA-7. Air pollution can be localized, such as paint overspray, sand-blasting, and fugitive dust and particulates from loading/unloading of raw materials such as sand, gravel, and concrete, or it can be widely dispersed from vehicle emissions, industrial smokestacks, and other sources.

King County has been monitoring atmospheric deposition to assess whether atmospheric deposition is a potential source of phthalates, particularly bis(2-ethylhexyl) phthalate, in stormwater runoff (King County and Seattle Public Utilities 2005). Passive deposition samplers (i.e., stainless steel bowls that drain into a glass bottle), were placed at four locations in the LDW area as well as in surrounding neighborhoods to collect samples of both wet and dry atmospheric deposition. Results showed PAH, benzyl butyl phthalate, and bis(2-ethylhexyl)phthalate in the Duwamish Valley at concentrations two to three times higher than outside the valley (Beacon Hill) during the winter months compared to the spring months (King County and Seattle Public Utilities 2005). This finding is consistent with previous sampling results by Puget Sound Clean Air Agency showing atmospheric particulate concentrations trending higher during fall/winter months than during spring/summer months.

King County (King County and Seattle Public Utilities 2005) concluded that the LDW sample results compared well with studies conducted within the same airshed (i.e., Georgia Basin) and with other regions (i.e., Great Lakes and Roskilde Fjord [Denmark] studies). PAH values observed in LDW samples (0.006 to 0.28 $\mu g/m^2$/day) were comparable to the average values reported for the Georgia Basin airshed (0.004 to 0.36 $\mu g/m^2$/day). The LDW bis(2-ethylhexyl) phthalate values (0.23 to 3.5 $\mu g/m^2$/day) were higher than the Georgia Basin average values (0.3 to 0.6 $\mu g/m^2$/day), but were comparable with the results from the Denmark study (0.068 to 2.16 $\mu g/m^2$/day). The study noted that further atmospheric deposition testing was needed to evaluate the reproducibility of results and to perform correlations with existing atmospheric measurements (e.g., particulate concentrations).

Available information (e.g. EPA TRI database) does not indicate that any of the identified facilities of concern are sources of the chemicals of concern in EAA-7 sediments.

3.3.1 Data Gaps

Atmospheric deposition should be further evaluated to assess whether atmospheric deposition is a potential source of phthalates (particularly bis(2-ethylhexyl) phthalate) and other contaminants (such as PCBs) in stormwater runoff.

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Appendix A. Toxics Release Inventory, Quantities of Releases Summarized by Report Type

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Table A-1: Summary of TRI Release Reports for Boeing Developmental Center

Facility/Chemicals	Date	Fugitive Air	Stack Air	Total Air Emissions	Total On-site disposal or other releases	Total Off-Site Disposal-Landfill/Surface Impoundments	Off-Site Disposal-Other Off-site Management	Total Off-site disposal or other releases	Total On- and Off-site disposal or other releases
BDC: 1,1,1-Trichloroethane	1994	18,000	250	18,250	18,250	0	0	0	18,250
BDC: 1,1,1-Trichloroethane	1993	18,000	0	18,000	18,000	0	0	0	18,000
BDC: 1,1,1-Trichloroethane	1992	27,000	0	27,000	27,000	0	0	0	27,000
BDC: 1,1,1-Trichloroethane	1991	27,000	0	27,000	27,000	0	0	0	27,000
BDC: 1,1,1-Trichloroethane	1990	28,432	3,268	31,700	31,700	0	750	750	32,450
BDC: Freon 113	1990	77,328	0	77,328	77,328	0	250	250	77,578
BDC: Methyl Ethyl Ketone	1990	3,660	7,503	11,163	11,163	0	6,588	6,588	17,751
BDC: Toluene	1990	1,639	6,284	7,923	7,923	250	4,781	5,031	12,954
BDC: 1,1,1-Trichloroethane	1989	27,000	3,000	30,000	30,000	0	1,000	1,000	31,000
BDC: Acetone	1989	1,400	7,000	8,400	8,400	250	3,600	3,850	12,250
BDC: Freon 113	1989	94,000	0	94,000	94,000	0	250	250	94,250
BDC: Methyl Ethyl Ketone	1989	3,100	6,500	9,600	9,600	0	5,700	5,700	15,300
BDC: Toluene	1989	1,800	6,600	8,400	8,400	250	5,100	5,350	13,750
BDC: 1,1,1-Trichloroethane	1988	35,000	3,800	38,800	38,800	0	0	0	38,800
BDC: Acetone	1988	16,000	750	16,750	16,750	0	0	0	16,750
BDC: Freon 113	1988	85,000	0	85,000	85,000	0	0	0	85,000
BDC: Methyl Ethyl Ketone	1988	28,000	750	28,750	28,750	0	0	0	28,750
BDC: Toluene	1988	6,200	6,200	12,400	12,400	0	0	0	12,400

All measurements are in pounds

Key:

Fugitive Air: Fugitive Air emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Data from Section 5.1 on the TRI Form R.
Stack Air: Stack or point source air emissions occur through confined air streams suck as stack, vents, ducts, or pipes. Data from Section 5.2 on the TRI Form R.
Total Air Emissions: includes both fugitive air emissions and point source air emissions. Data from Section 5.1 plus Section 5.2 o the TRI Form R.
Total On-site disposal or other releases: include emissions to the air, discharges to bodies of water, disposal at the facility to land, and disposal in underground injection wells. Disposal or other releases are reported to TRI by media type. On-site disposal or other releases are reported in Section 5 of the TRI Form R.
Total Off-Site Disposal-Landfill/Surface Impoundments: Transferred to landfills and disposal surface impoundments. Data from Section 6.2, Code M72, on the TRI Form R.

Off-Site Disposal-Other Off-Site Management: Chemicals in waste sent to sites where the waste is managed by techniques not specifically listed in Section 6.2. Data from Section 6.2, Code M90, on the TRI Form R.

Total Off-site disposal or other releases: a discharge of a toxic chemical to the environment that occurs as a result of a facility's transferring a waste containing a TRI chemical off-site disposal or other release, as reported in Section 6 of the TRI Form R.

Total On- and Off-Site Disposal and other releases: the sum of total on-site disposal or other release and total off-site disposal or other releases as reported in Section 5 and 6 on the TRI Form R.

Table A-2: Summary of TRI Waste Transfer Reports for Boeing Developmental Center

Facility/Chemical	date	Transfers to Recycling	Transferred to Energy Recovery	Transfers to treatment	Transfers to POTWs Non Metals	Transfers Off-Site for Disposal or Other Releases	Total Transfers Off-site for Further Waste Management
BDC: 1,1,1-Trichloroethane	1994	250	0	505	0	0	755
BDC: 1,1,1-Trichloroethane	1993	250	0	1,505	0	0	1,755
BDC: 1,1,1-Trichloroethane	1992	250	750	250	0	0	1,250
BDC: 1,1,1-Trichloroethane	1991	250	.	750	0	0	1,000
BDC: 1,1,1-Trichloroethane	1990	0	0	0	15	750	755
BDC: Freon 113	1990	0	0	0	0	250	250
BDC: Methyl Ethyl Ketone	1990	.	.	750	5	6,588	7,343
BDC: Toluene	1990	.	.	250	5	5,031	5,286
BDC: 1,1,1-Trichloroethane	1989	0	0	0	0	1,000	1,000
BDC: Acetone	1989	.	.	250	250	3,850	4,350
BDC: Freon 113	1989	0	0	0	0	250	250
BDC: Methyl Ethyl Ketone	1989	0	0	250	0	5,700	5,950
BDC: Toluene	1989	.	.	250	0	5,350	5,600
BDC: 1,1,1-Trichloroethane	1988	0	0	330	1	0	331
BDC: Acetone	1988	0	0	1,650	20	0	1,670
BDC: Freon 113	1988	0	0	1,200	0	0	1,200
BDC: Methyl Ethyl Ketone	1988	0	0	3,350	4	0	3,354
BDC: Toluene	1988	0	0	4,050	4	0	4,054

All measurements are in pounds

Key

Transfers to Recycling: the total among of toxic chemical in the waste stream transferred from the facility to an off-site location during the calendar year (January 1 - December 31) for recycling to manage the toxic chemical. This refers to the ultimate disposition of the toxic chemical, not the intermediate activities used for the waste stream. Data from Section 6.2, Codes M20, M24, M26, M28, M93, on the TRI Form R.

Transferred to Energy Recovery: the total amount of the toxic chemical in the waste stream transferred from the facility to an off-site location during the calendar year for energy recovery to manage the toxic chemical. Data from Section 6.2, Codes M56 and M92, on the TRI Form R.

Transfers to treatment: the total amount of toxic chemical in the waste stream transferred from the facility to an off-site location during the calendar year for treatment to manage the toxic chemical. Data from Section 6.2, Codes M40, M50, M54, M61, M69, and M95 on the TRI Form R.

Transfers to POWs Non Metals: the total amount of the toxic chemical in the waste stream transferred from the facility to all POTWs during the calendar year. Data from Section 6.1 on the TRI Form R.

Transfers Off-Site for Disposal or Other Releases: sum of transfers to underground injection, RCRA Subtitle C landfills, other landfills, storage, solidification/stabilization of metals and metal category compounds, RCRA Subtitle C surface impoundments, other surface impoundments, land treatment, other land disposal, other off-site waste management, waste broker for disposal, and unknown.

Total Transfers Off-Site of Further Waste Management: the sum of transfers to recycling, transfers to energy recovery, transfers to treatment, transfers to POTWs and other off-site transfers, including transfers to disposal or other releases.
POTW = Publicly Owned Treatment works
"." means the facility left that particular cell blank in its Form R submission (a zero in a cell demotes either that the facility reported "0" or "NA" in its Form R submission

Table A-3: Summary of TRI Waste Quantity Reports for Boeing Developmental Center

Facility/Chemical	date	Recycled On-site	Recycled Off-site	Energy Recovery On-site	Energy-Recovery Off-site	Treated On-site	Treated Off-site	Total Quantity Disposed or Otherwise Released On- and Off-site	Total Production-related Waste Managed	Non-production related Waste Managed
BDC: 1,1,1-Trichloroethane	1994	0	20	0	0	0	100	18,000	18,120	0
BDC: 1,1,1-Trichloroethane	1993	0	220	0	0	0	950	18,000	19,170	0
BDC: 1,1,1-Trichloroethane	1992	0	60	0	860	0	320	27,000	28,240	0
BDC: 1,1,1-Trichloroethane	1991	1	210	0	0	0	870	27,000	28,080	0

All measurements are in pounds

Key

Recycled On-site: the amount of the toxic chemical recycled on-site during the calendar year for which the report was submitted. Data from Section 8.4 from the TRI Form R.

Recycled Off-site: the total amount of the toxic chemical sent off-site for recycling during the calendar year for which the report was submitted. Section 8.5 on the TRI Form R.

Energy Recovery On-site: the total amount of the toxic chemical in waste burned for energy recovery on-site during the calendar year for which the report was submitted. Data from Section 8.2 on the TRI Form R.

Energy Recovery Off-site: the total amount of the toxic chemical in waste sent off-site to be burned for energy recovery during the calendar year for which the report was submitted. Data from Section 8.3 on the TRI Form R.

Treated On-site: the total amount of the toxic chemical treated on-site during the calendar year for which the report was submitted. Data from Section 8.6 on the TRI Form R.

Treated Off-site: the total amount of the toxic chemical sent for treatment off-site during the calendar year for which the report was submitted. Data from Section 9.7 on the TRI Form R.

Total Quantity Disposed or otherwise released On- and Off-site: the total amount of the toxic chemical disposed of or release due to production related events by the facility to all environmental media both on and off site during the calendar year for which the report was submitted. Data from Section 8.1 on the TRI Form R.

Total Production-related Waste Managed: the sum of recycled on-site, recycled off-site, energy recovery on-site, energy recovery off-site, treated on-site, treated off-site, and quantities disposed of or otherwise released on- and off-site. Data from Sections 8.1 through 8.7 on the TRI Form R.

Non-production related Waste Managed: the total amount of the toxic chemical released directly to the environment or sent off-site for recycling, energy recovery, treatment, or disposal during the reporting year due to remedial actions, catastrophic events, such as earthquakes or floods, and one-time events not associated with normal or routine production processes. Data from Section 8.8 on the TRI Form R.

Appendix B. In-Line Sediment Sampling Analytical Results

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Appendix B
In-line Sediment Sampling Results (Dry Weight)
Early Action Area 7

Source: SPU 2005

Basin	SQS	CSL	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk
Sample ID			MH1[e]	MH1-D	MH3[e]	MH3[e]	MH4[e]	MH4[e]	MH5-N2	MH5-N3	MH6	MH7[e]	MH7[e]	Norfolk20	Norfolk21
Date			10/01/03	10/01/03	10/01/03	03/16/05	10/01/03	03/16/05	10/01/03	10/01/03	10/01/03	10/02/03	03/16/05	09/30/04	09/30/04
TOC (%)			7.4	7	8.1	6.4	4.7	4.96	4.6	NA	7.7	2.2	1.21	5.34	1.65
Metals (mg/kg DW)															
Arsenic	57	93	20	20	10	10	8 U	8 U	8	120	11	20 U	6 U	10	7
Copper	390	390	147	181	153	131	55.7	74.8	73	3,960	118	51.1	24.6	149	39.9
Lead	450	530	217	261	183	226	79	82	66	700	198	51	16	245	38
Mercury	0.41	0.59	0.4	0.2	0.2	0.2	0.09	0.11	0.06 U	0.04 U	0.33	0.05 U	0.05 U	0.18	0.06 U
Zinc	410	960	1,150	1,230	1,060	847	416	415	357	9,980	627	127	90	651	108
Total petroleum hydrocarbons (mg/kg DW)															
TPH-diesel	2,000[a]		2,300	3,200	2,200	NA	1,400	NA	1,800	NA	650	88	NA	140	43
TPH-oil	2,000[a]		5,300	7,600	5,000	NA	2,900	NA	3,600	NA	1,700	300	NA	580	200
LPAH (ug/kg DW)															
Acenaphthene			930 U	600 U	480 U	640 U	120 U	490	170 U	NA	NA	70	120 U	98	20 U
Acenaphthylene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Anthracene			930 U	600 U	480 U	640 U	120 U	1,900	170 U	NA	NA	330	120 U	98	20 U
Fluorene			930 U	600 U	480 U	830	200	670 U	170 U	NA	NA	95	120 U	98 U	20 U
Naphthalene			930 U	600 U	480 U	640 U	120 U	300 U	190	NA	NA	38 U	120 U	98 U	20 U
Phenanthrene			930 U	610	1,800	2,700	1,600	4,000	490	NA	NA	930	130	190	20 U
HPAH (ug/kg DW)															
Benzo(a)anthracene			930 U	1,000 M	1,400	640 U	1,000	1,000	380 M	NA	NA	250	120 U	200	20 U
Benzo(a)pyrene			1,000	910	960	2,400	1,200	5,900	240	NA	NA	410	120 U	300	20 U
Benzo(b)fluoranthene			930	920	1,100	1,100	1,100	2,800	260	NA	NA	260	120 U	400	20 U
Benzo(g,h,i)perylene			1,000	910	1,200	1,100	910	1,600	250	NA	NA	130	120 U	410	20 U
Benzo(k)fluoranthene			930	920	1,100	1,500	1,100	2,900	260	NA	NA	260	120 U	300	20 U
Chrysene			930 U	1,000 M	1,700	2,700	1,100	6,500	380 M	NA	NA	810	120	340	20 U
Dibenzo(a,h)anthracene			930 U	600 U	480 U	640 U	230	490	170 U	NA	NA	76 Y	120 U	98	20 U
Fluoranthene			1,800	1,600	2,800	3,300	2,600	8,200	790	NA	NA	1,100	230	450	20 U
Indeno(1,2,3-c,d)pyrene			930 U	690	1,000	860	970	1,800	200	NA	NA	170	120 U	320	20 U
Pyrene			2,200	1,900	2,900	3,000	1,700	6,600	820	NA	NA	1,100	200	320	20 U
Phthalates (ug/kg DW)															
Bis(2-ethylhexyl)phthalate			24,000	24,000	25,000	28,000	5,600	22,000	6,800	NA	NA	670	400	620	63
Butylbenzylphthalate			930 U	750 M	990 M	640 U	300	300 U	1,900	NA	NA	61	120 U	120 U	20 U
Diethylphthalate			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Dimethylphthalate			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Di-n-butylphthalate			930 U	600 U	480 U	640 U	120 U	300 U	320	NA	NA	38 U	120 U	98	20 U
Di-n-octyl phthalate			2,300 M	2,300 M	2,500 M	2,200	570 M	1,400	1,100	NA	NA	91 M	120 U	98 U	20 U
PCBs (ug/kg DW)															
Aroclor 1016			20 U	20 U	20 U	73 U	19 U	20 U	20 U	NA	NA	19 U	19 U	20 U	20 U
Aroclor 1242			20 U	20 U	20 U	73 U	19 U	20 U	20 U	NA	NA	19 U	19 U	20 U	20 U
Aroclor 1248			59 Y	32 Y	100 Y	73 U	19 U	20 U	20 U	NA	NA	19 U	19 U	20 U	20 U
Aroclor 1254			33	42	36	110	21 J	25	22 J	NA	NA	14 J	19 U	67	20 U
Aroclor 1260			46	61	46	200 Y	22	50 Y	21 J	NA	NA	11 J	19 U	41	20 U
Aroclor 1221			39 U	40 U	39 U	73 U	38 U	20 U	39 U	NA	NA	38 U	19 U	20 U	20 U
Aroclor 1232			20 U	20 U	20 U	73 U	19 U	20 U	20 U	NA	NA	19 U	19 U	20 U	20 U
Total			79	103	82	110	43 J	25	43 J	NA	NA	25 J	19 U	108	20 U
Other organic compounds (ug/kg DW)															
1,2,4-Trichlorobenzene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
1,2-Dichlorobenzene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
1,3-Dichlorobenzene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
1,4-Dichlorobenzene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
2,2'-Oxybis(1-chloropropane)			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
2,4,5-Trichlorophenol			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U

Appendix B
In-line Sediment Sampling Results (Dry Weight)
Early Action Area 7

Source: SPU 2005

Basin			Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk
Sample ID	**SQS**	**CSL**	**MH1[e]**	**MH1-D**	**MH3[e]**	**MH3[e]**	**MH4[e]**	**MH4[e]**	**MH5-N2**	**MH5-N3**	**MH6**	**MH7[e]**	**MH7[e]**	**Norfolk20**	**Norfolk21**
Date			10/01/03	10/01/03	10/01/03	03/16/05	10/01/03	03/16/05	10/01/03	10/01/03	10/01/03	10/02/03	03/16/05	09/30/04	09/30/04
2,4,6-Trichlorophenol			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
2,4-Dichlorophenol			2,800 U	1,800 U	**1,400**	3,200 U	350 U	1,500 U	520 U	NA	NA	110 U	580 U	490 U	99 U
2,4-Dimethylphenol[a]	29	29	930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
2,4-Dinitrophenol			9,300 U	6,000 U	4,800 U	6,400 U	1,200 U	3,000 U	1,700 U	NA	NA	380 U	1,200 U	980 U	200 U
2,4-Dinitrotoluene			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	**2,100**	NA	NA	190 U	580 U	490 U	99 U
2,6-Dinitrotoluene			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
2-Chloronaphthalene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
2-Chlorophenol			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
2-Methylnaphthalene			930 U	600 U	1,400 U	**2,300**	**1,200**	**1,100**	**690**	NA	NA	38 U	120 U	**98**	20 U
2-Methylphenol[a]			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
2-Nitroaniline			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
2-Nitrophenol			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
3,3'-Dichlorobenzidine			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
3-Nitroaniline			5,600 U	3,600 U	2,900 U	3,200 U	700 U	1,500 U	1,000 U	NA	NA	230 U	580 U	490 U	99 U
4,6-Dinitro-2-methylphenol			9,300 U	6,000 U	4,800 U	6,400 U	1,200 U	3,000 U	1,700 U	NA	NA	380 U	1,200 U	980 U	200 U
4-Bromophenyl-phenylether			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
4-Chloro-3-methylphenol			1,900 U	1,200 U	960 U	3,200 U	230 U	1,500 U	350 U	NA	NA	76 U	580 U	490 U	99 U
4-Chloroaniline			2,800 U	1,800 U	1,400 U	3,200 U	350 U	1,500 U	520 U	NA	NA	110 U	580 U	490 U	99 U
4-Chlorophenyl-phenylether			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
4-Methylphenol[a]	670	670	930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
4-Nitroaniline			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
4-Nitrophenol			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
Benzoic acid[a]	650	650	9,300 U	6,000 U	4,800 U	6,400 U	1,200 U	3,000 U	1,700 U	NA	NA	380 U	1,200 U	980 U	200 U
Benzyl alcohol[a]			930 U	600 U	480 U	**3,900**	120 U	**380**	170 U	NA	NA	38 U	120 U	98 U	20 U
bis(2-Chloroethoxy) methane			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Bis-(2-chloroethyl) ether			1,900 U	1,200 U	960 U	640 U	230 U	300 U	350 U	NA	NA	76 U	120 U	98 U	20 U
Carbazole			930 U	600 U	480 U	640 U	**160**	**350**	170 U	NA	NA	**110**	120 U	98	20 U
Dibenzofuran			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Hexachlorobenzene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Hexachlorobutadiene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Hexachlorocyclopentadiene			4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
Hexachloroethane			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Isophorone			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
Nitrobenzene			930 U	600 U	480 U	640 U	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U
N-Nitroso-di-n-propylamine			1,900 U	1,200 U	960 U	3,200 U	230 U	1,500 U	350 U	NA	NA	76 U	580 U	490 U	99 U
N-Nitrosodiphenylamine			930 U	600 U	480 U	640 U	120 U	300 U	**910**	NA	NA	38 U	120 U	98 U	20 U
Pentachlorophenol[a]	360	690	4,600 U	3,000 U	2,400 U	3,200 U	580 U	1,500 U	870 U	NA	NA	190 U	580 U	490 U	99 U
Phenol[a]	420	1,200	930 U	600 U	480 U	**660** B	120 U	300 U	170 U	NA	NA	38 U	120 U	98 U	20 U

a. SMS based on dry weight concentration.
b. MTCA Method A soil cleanup level for unrestricted use.
J = Concentration is less than the reporting limit.
M = Estimated value due to low spectral match parameters. Chemical is detected and confirmed by analyst.
P = High RPD on dual column analysis without obvious interference.
U = Chemical not detected at concentration shown
Y = Chemical not detected at concentration shown. Reporting limit raised due to background interference.

Appendix B
In-line Sediment Sampling Results (Organic Carbon Normalized)
Early Action Area 7

Basin			Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk
Sample ID	SQS	CSL	MH1[e]	MH1-D	MH3[e]	MH3[e]	MH4[e]	MH4[e]	MH5-N2	MH5-N3	MH6	MH7[e]	MH7[e]	Norfolk20	Norfolk21
Date			10/01/03	10/01/03	10/01/03	03/16/05	10/01/03	03/16/05	10/01/03	10/01/03	10/01/03	10/02/03	03/16/05	09/30/04	09/30/04
TOC (%)			7.4	7	8.1	6.4	4.7	4.96	4.6	NA	7.7	2.2	1.21	5.34	1.65
LPAH (ug/kg DW)															
Acenaphthene	16	57	13 U	9 U	6 U	10 U	3 U	10	4 U	NA	NA	3	10 U	2	1 U
Acenaphthylene	66	66	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Anthracene	220	1,200	13 U	9 U	6 U	10 U	3 U	38	4 U	NA	NA	15	10 U	2	1 U
Fluorene	23	79	13 U	9 U	6 U	13	4	14 U	4 U	NA	NA	4	10 U	2 U	1 U
Naphthalene	370	780	13 U	9 U	6 U	10 U	3 U	6 U	4	NA	NA	2 U	10 U	2 U	1 U
Phenanthrene	100	480	13 U	9	22	42	34	81	11	NA	NA	42	11	4	1 U
HPAH (ug/kg DW)															
Benzo(a)anthracene	110	270	13 U	14 M	17	10 U	21	20	8 M	NA	NA	11	10 U	4	1.2 U
Benzo(a)pyrene	99	210	14	13	12	38	26	119	5	NA	NA	19	10 U	6	1.2 U
Benzo(b)fluoranthene			13	13	14	17	23	56	6	NA	NA	12	10 U	7	1.2 U
Benzo(g,h,i)perylene	31	78	14	13	15	17	19	32	5	NA	NA	6	10 U	8	1.2 U
Benzo(k)fluoranthene			13	13	14	23	23	58	6	NA	NA	12	10 U	6	1.2 U
Chrysene	110	460	13 U	14 M	21	42	23	131	8 M	NA	NA	37	10	6	1.2 U
Dibenzo(a,h)anthracene	12	33	13 U	9 U	6 U	10 U	5	10	4 U	NA	NA	3 Y	10 U	2	1.2 U
Fluoranthene	160	1,200	24	23	35	52	55	165	17	NA	NA	50	19	8	1.2 U
Indeno(1,2,3-c,d)pyrene	34	88	13 U	10	12	13	21	36	4	NA	NA	8	10 U	6	1.2 U
Pyrene	1,000	1,400	30	27	36	47	36	133	18	NA	NA	50	17	6	1.2 U
Phthalates (ug/kg DW)															
Bis(2-ethylhexyl)phthalate	47	78	324	343	309	438	119	444	148	NA	NA	30	33	12	4
Butylbenzylphthalate	5	64	13 U	11 M	12 M	10 U	6	6 U	41	NA	NA	3	10 U	2 U	1 U
Diethylphthalate	61	110	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Dimethylphthalate	53	53	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Di-n-butylphthalate	220	1,700	13 U	9 U	6 U	10 U	3 U	6 U	7	NA	NA	2 U	10 U	2	1 U
Di-n-octyl phthalate	58	4,500	31 M	33 M	31 M	34	12 M	28	24	NA	NA	4 M	10 U	2 U	1 U
PCBs (ug/kg DW)															
Aroclor 1016			0.3 U	0.3 U	0.2 U	1.1 U	0.4 U	0.4 U	0.4 U	NA	NA	0.9 U	1.6 U	0.4 U	1.2 U
Aroclor 1242			0.3 U	0.3 U	0.2 U	1.1 U	0.4 U	0.4 U	0.4 U	NA	NA	0.9 U	1.6 U	0.4 U	1.2 U
Aroclor 1248			0.8 Y	0.5 Y	1.2 Y	1.1 U	0.4 U	0.4 U	0.4 U	NA	NA	0.9 U	1.6 U	0.4 U	1.2 U
Aroclor 1254			0.4	0.6	0.4	1.7	0.4 J	0.5	0.5 J	NA	NA	0.6 J	1.6 U	1.3	1.2 U
Aroclor 1260			0.6	0.9	0.6	3.1 Y	0.5	1.0 Y	0.5 J	NA	NA	0.5 J	1.6 U	0.8	1.2 U
Aroclor 1221			0.5 U	0.6 U	0.5 U	1.1 U	0.8 U	0.4 U	0.8 U	NA	NA	1.7 U	1.6 U	0.4 U	1.2 U
Aroclor 1232			0.3 U	0.3 U	0.2 U	1.1 U	0.4 U	0.4 U	0.4 U	NA	NA	0.9 U	1.6 U	0.4 U	1.2 U
Total	12	65	1.1	1.5	1.0	1.7	0.9 J	0.5	0.9 J	NA	NA	1.1 J	1.6 U	2.0	1.2 U
Other organic compounds (ug/kg DW)															
1,2,4-Trichlorobenzene	0.8	1.8	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
1,2-Dichlorobenzene	2.3	2.3	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
1,3-Dichlorobenzene			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
1,4-Dichlorobenzene	3.1	9.0	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
2,2'-Oxybis(1-chloropropane)			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
2,4,5-Trichlorophenol			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
2,4,6-Trichlorophenol			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
2,4-Dichlorophenol			38 U	26 U	17	50 U	7 U	30 U	11 U	NA	NA	5 U	48 U	9 U	6 U
2,4-Dinitrophenol			126 U	86 U	59 U	100 U	26 U	60 U	37 U	NA	NA	17 U	99 U	18 U	12 U
2,4-Dinitrotoluene			62 U	43 U	30 U	50 U	12 U	30 U	46	NA	NA	9 U	48 U	9 U	6 U
2,6-Dinitrotoluene			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
2-Chloronaphthalene			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
2-Chlorophenol			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
2-Methylnaphthalene	38	64	13 U	9 U	17 U	36	26	22	15	NA	NA	2 U	10 U	2	1 U
2-Nitroaniline			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
2-Nitrophenol			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U

Appendix B
In-line Sediment Sampling Results (Organic Carbon Normalized)
Early Action Area 7

Basin			Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk	Norfolk
Sample ID	**SQS**	**CSL**	**MH1[e]**	**MH1-D**	**MH3[e]**	**MH3[e]**	**MH4[e]**	**MH4[e]**	**MH5-N2**	**MH5-N3**	**MH6**	**MH7[e]**	**MH7[e]**	**Norfolk20**	**Norfolk21**
Date			10/01/03	10/01/03	10/01/03	03/16/05	10/01/03	03/16/05	10/01/03	10/01/03	10/01/03	10/02/03	03/16/05	09/30/04	09/30/04
3,3'-Dichlorobenzidine			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
3-Nitroaniline			76 U	51 U	36 U	50 U	15 U	30 U	22 U	NA	NA	10 U	48 U	9 U	6 U
4,6-Dinitro-2-methylphenol			126 U	86 U	59 U	100 U	26 U	60 U	37 U	NA	NA	17 U	99 U	18 U	12 U
4-Bromophenyl-phenylether			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
4-Chloro-3-methylphenol			26 U	17 U	12 U	50 U	5 U	30 U	8 U	NA	NA	3 U	48 U	9 U	6 U
4-Chloroaniline			38 U	26 U	17 U	50 U	7 U	30 U	11 U	NA	NA	5 U	48 U	9 U	6 U
4-Chlorophenyl-phenylether			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
4-Nitroaniline			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
4-Nitrophenol			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
bis(2-Chloroethoxy) methane			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Bis-(2-chloroethyl) ether			26 U	17 U	12 U	10 U	5 U	6 U	8 U	NA	NA	3 U	10 U	2 U	1 U
Carbazole			13 U	9 U	6 U	10 U	**3**	**7**	4 U	NA	NA	**5**	10 U	**2**	1 U
Dibenzofuran	15	58	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Hexachlorobenzene	0.4	2.3	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Hexachlorobutadiene	3.9	6.2	13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Hexachlorocyclopentadiene			62 U	43 U	30 U	50 U	12 U	30 U	19 U	NA	NA	9 U	48 U	9 U	6 U
Hexachloroethane			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Isophorone			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
Nitrobenzene			13 U	9 U	6 U	10 U	3 U	6 U	4 U	NA	NA	2 U	10 U	2 U	1 U
N-Nitroso-di-n-propylamine			26 U	17 U	12 U	50 U	5 U	30 U	8 U	NA	NA	3 U	48 U	9 U	6 U
N-Nitrosodiphenylamine	11	11	13 U	9 U	6 U	10 U	3 U	6 U	**20**	NA	NA	2 U	10 U	2 U	1 U

a. SMS based on dry weight concentration.
b. MTCA Method A soil cleanup level for unrestricted use.
J = Concentration is less than the reporting limit.
M = Estimated value due to low spectral match parameters. Chemical is detected and confirmed by analyst.
P = High RPD on dual column analysis without obvious interference.
U = Chemical not detected at concentration shown
Y = Chemical not detected at concentration shown. Reporting limit raised due to background interference.

Figures

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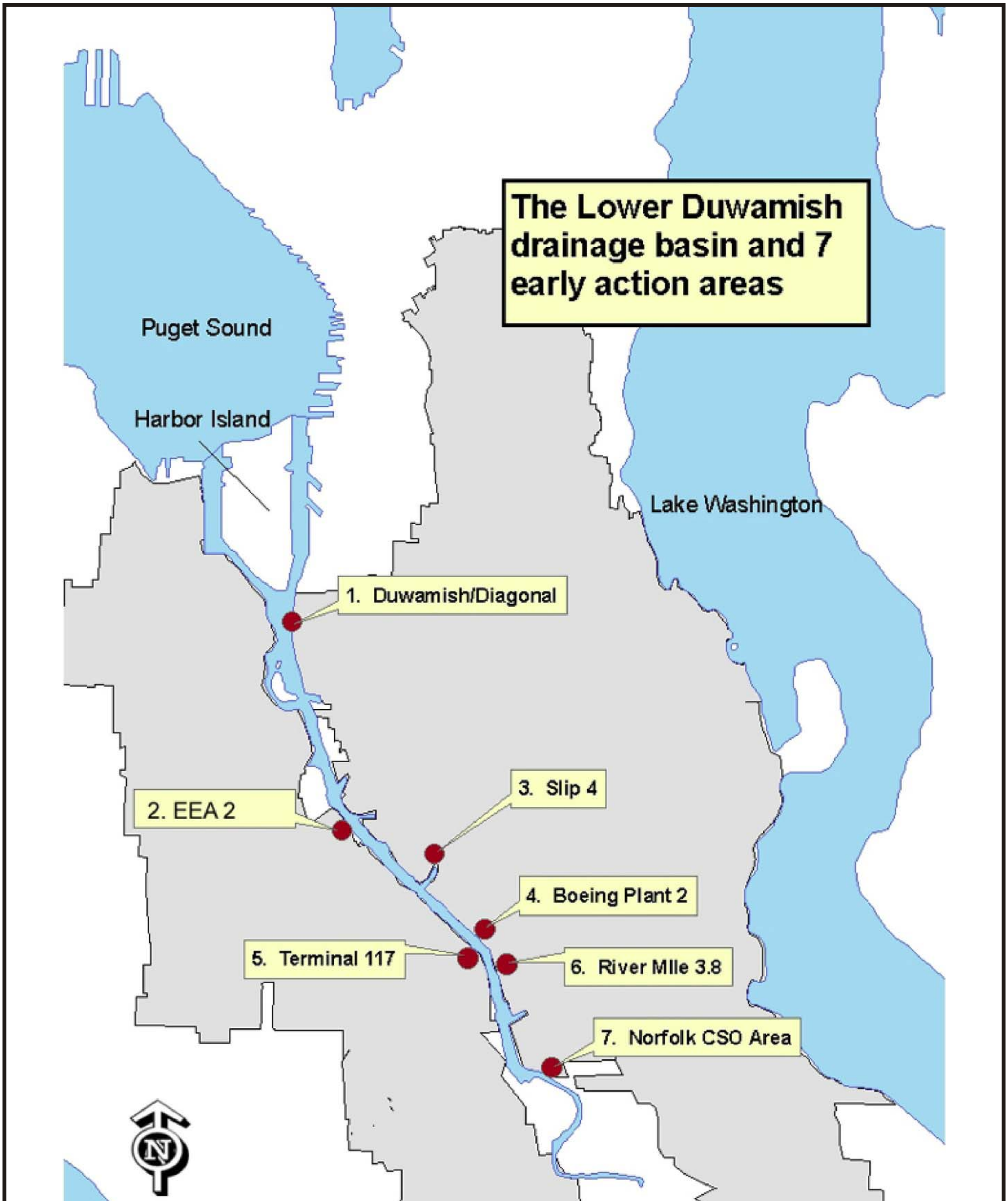
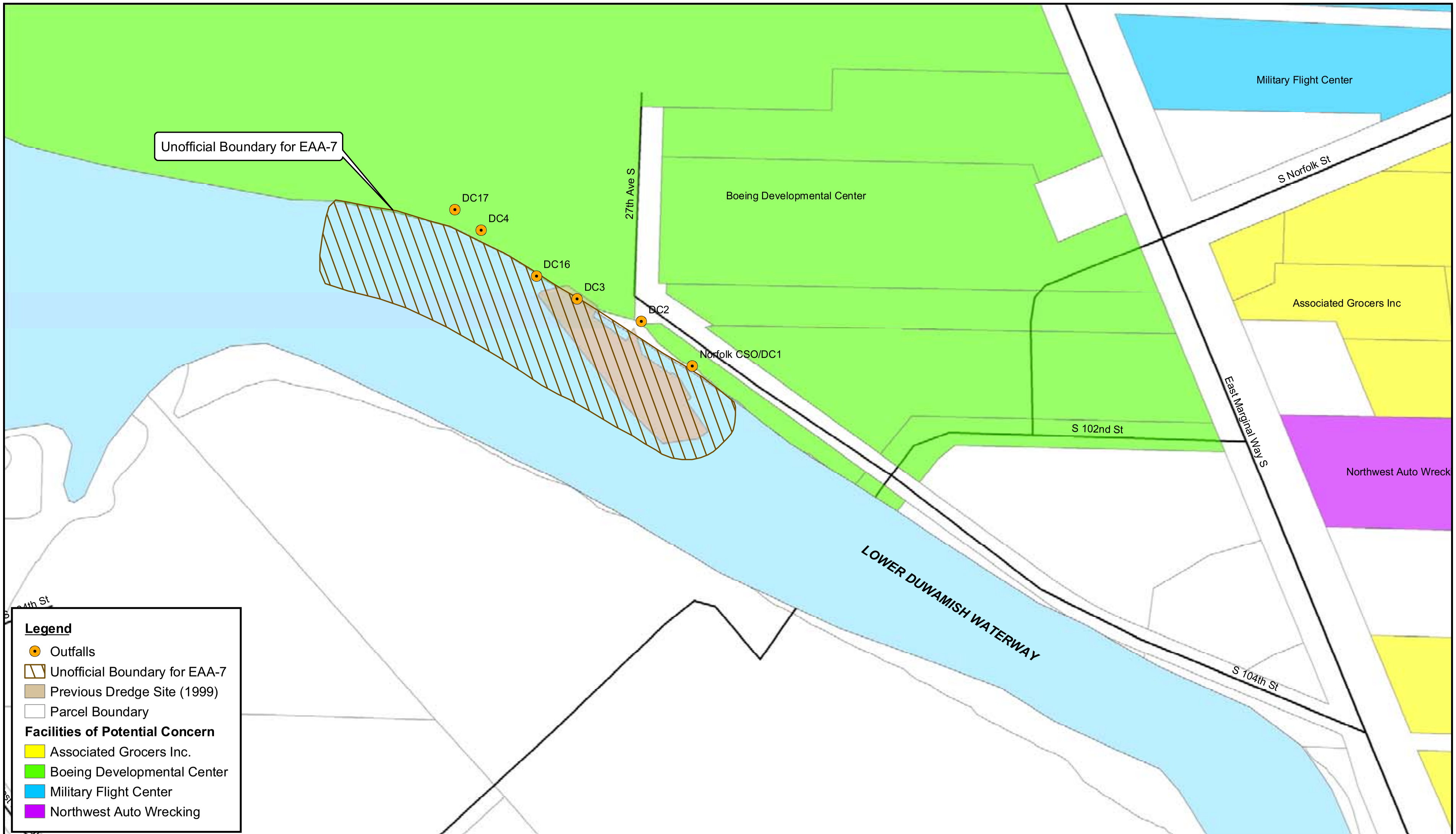


ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 1 LOWER DUWAMISH WATERWAY EARLY ACTION AREAS	
	Base Map Reference: Ecology 2006.	Date: 4-4-07	Drawn by: AES	10:002330WD0402\fig 1



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

Map Source Information: King County GIS Data, June 2003. City of Tukwila Storm Drain Data.

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7

Seattle/Tukwila, WA

Figure 2
EARLY ACTION AREA 7
APPROXIMATE SOURCE CONTROL BOUNDARY LINE

Date:	GIS:	Job Number:
4/3/2007	avh	002330.WD04.02

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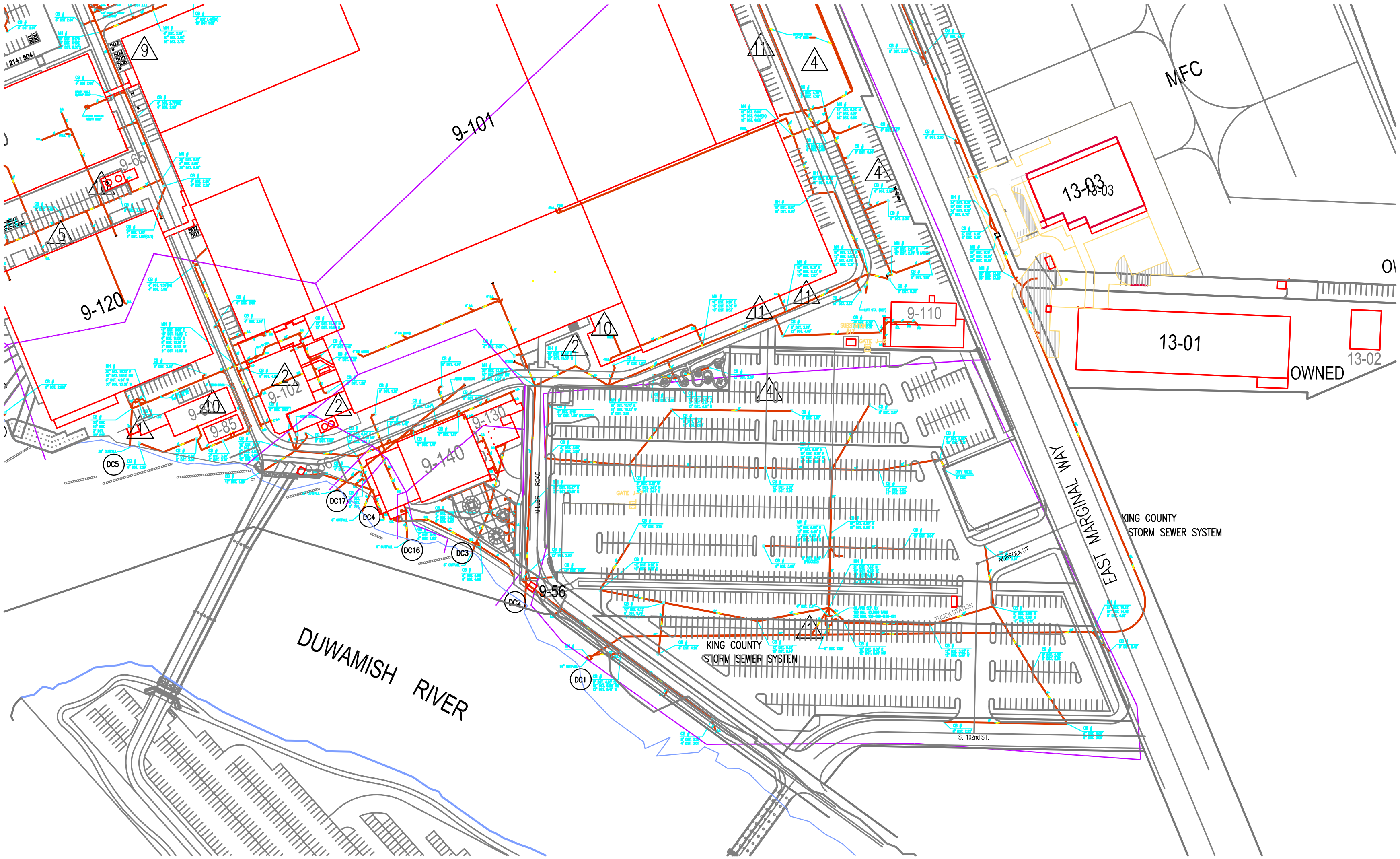
ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 3 NORFOLK CSO STORM DRAIN OUTFALL		
	Base Map Reference: Ecology 2007.	Date: 5/30/07	Drawn by: AES	10:002330WD0402\fig 3



LEGEND:

- DCX DISCHARGE POINT AT DUWAMISH RIVER
- 1 OIL/WATER SEPERATOR (STORM)
- 2 OUTSIDE FUEL TANKS (NOT INCLUDING COMPRESSED GASES)
- 3 HAZARDOUS MATERIALS AND HAZARDOUS WASTE BUILDING.
- 4 EQUIPMENT STORAGE
- 5 SOLID WASTE CONTAINERS
- 6 DATA DESTROY, PAPER SHREDDER
- 7 CONTAINER, KITCHEN GREASE
- 8 OIL/WATER SEPARATOR, SANITARY
- 9 GROUND WATER PUMP AND TREAT
- 10 COOLING TOWERS
- 11 DUST COLLECTOR (OUTDOORS)
- 12 FUEL STATION
- CATCH BASINS
- DRAINAGE AREAS

SCALE IN FEET: 1" = 1000'
0 1000 2000 3000

ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

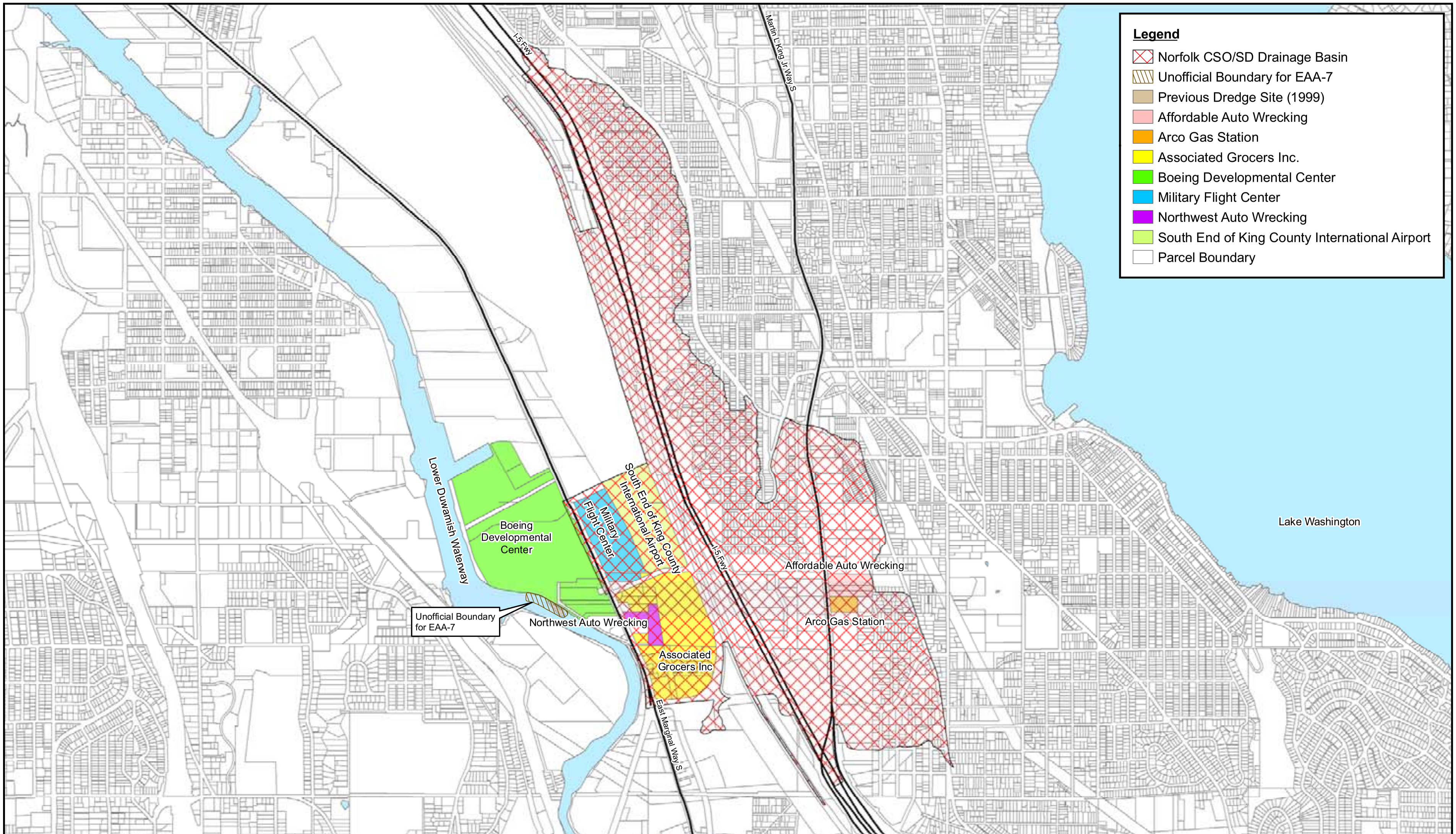
DESIGNED BY:
CHECKED BY:
DRAWN BY: V. RAYNER

BASE MAP REFERENCE: THE BOEING COMPANY 2003

Figure 4
BOEING DEVELOPMENTAL CENTER STORM WATER DRAINAGE SYSTEM

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Tukwila, Washington

SCALE	DATE ISSUED	CAD FILE NO.
NOTED	05-29-07	EAA-7_Norfolk CSO\SCAP Report\CAD\DC_052907.dwg



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Seattle, Washington

Map Source Information: King County GIS Data, June 2003.
City of Tukwila Storm Drain Data.

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7

Seattle/Tukwila, WA

Figure 5
NORFOLK DRAINAGE BASIN and POTENTIAL SOURCES of SEDIMENT RECONTAMINATION

Date:	GIS:	Job Number:
4/3/2007	avh	002330.WD04.03

\edms-projects\norfolk\scap report\figure 5.mxd

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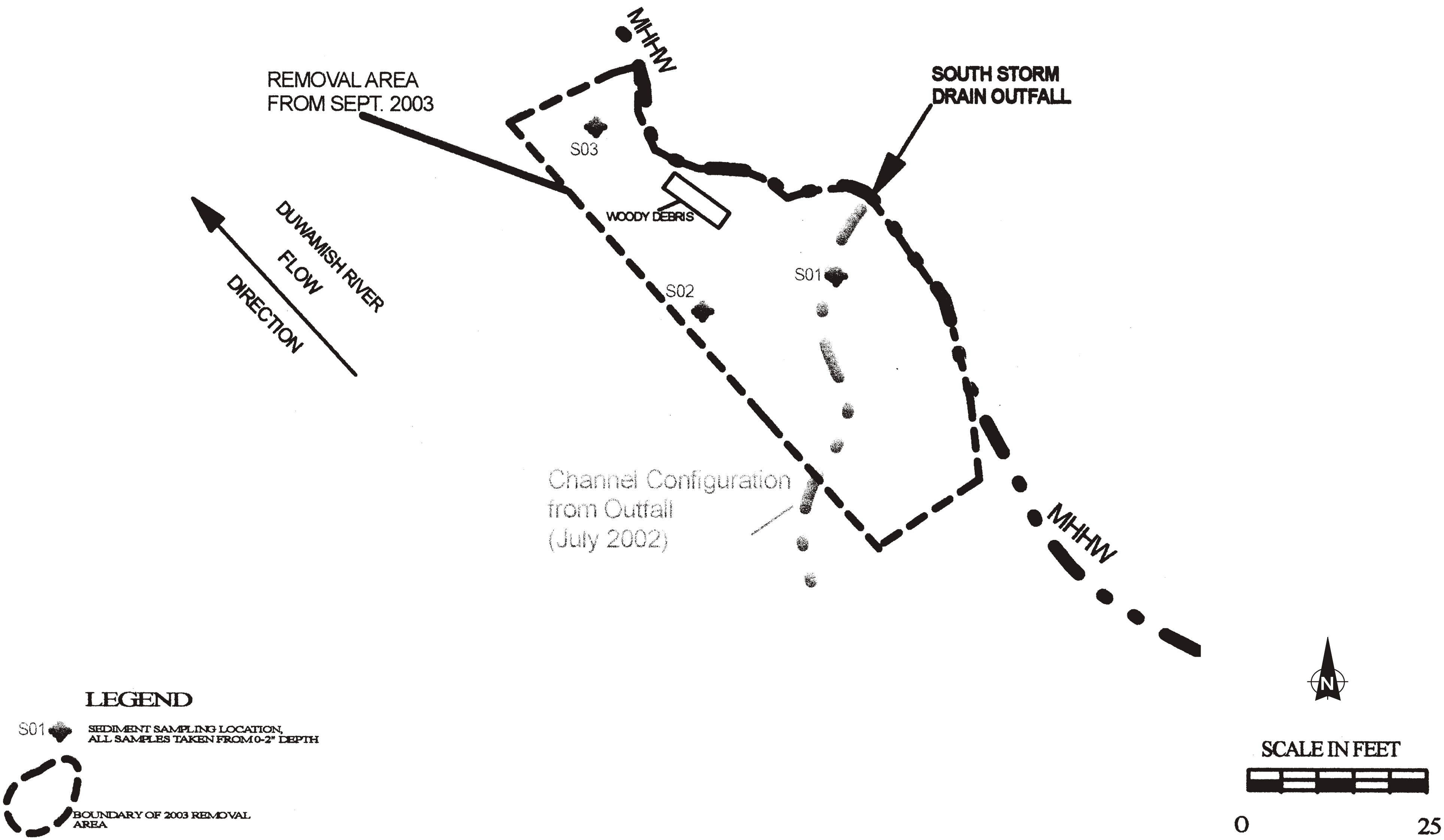
Base Map Reference: Ecology 2007.

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Figure 6
NORFOLK CSO/SD AND BOEING OUTFALL

Date:	Drawn by:	
5/30/07	AES	10:002330WD0402\fig 6



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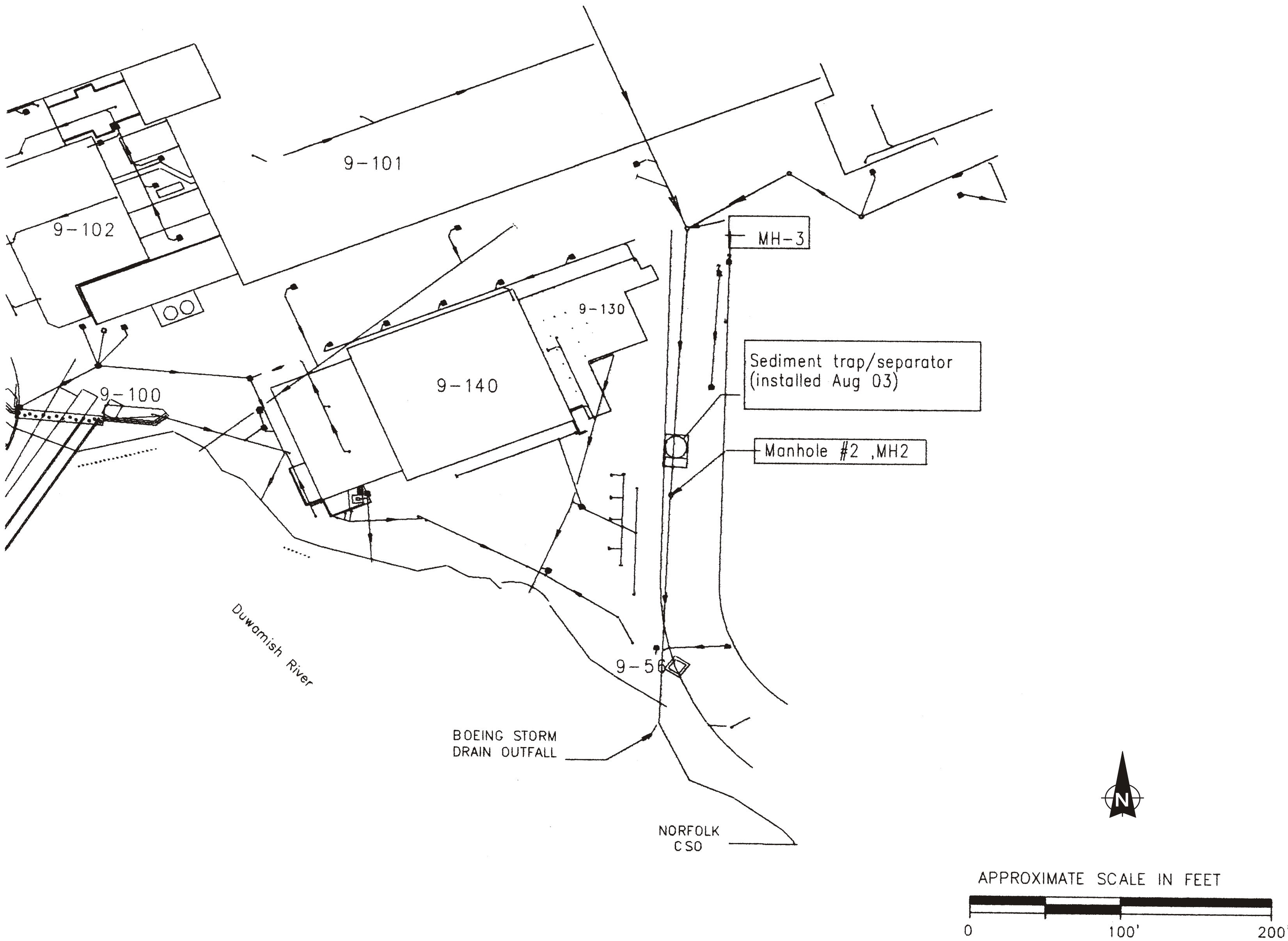
LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Base Map Reference: Boeing 2004.

Figure 7
2004 SEDIMENT SAMPLING LOCATIONS
BOEING DEVELOPMENTAL CENTER

Date: 5/30/07 | Drawn by: AES | 10:002330WD0402\fig 7



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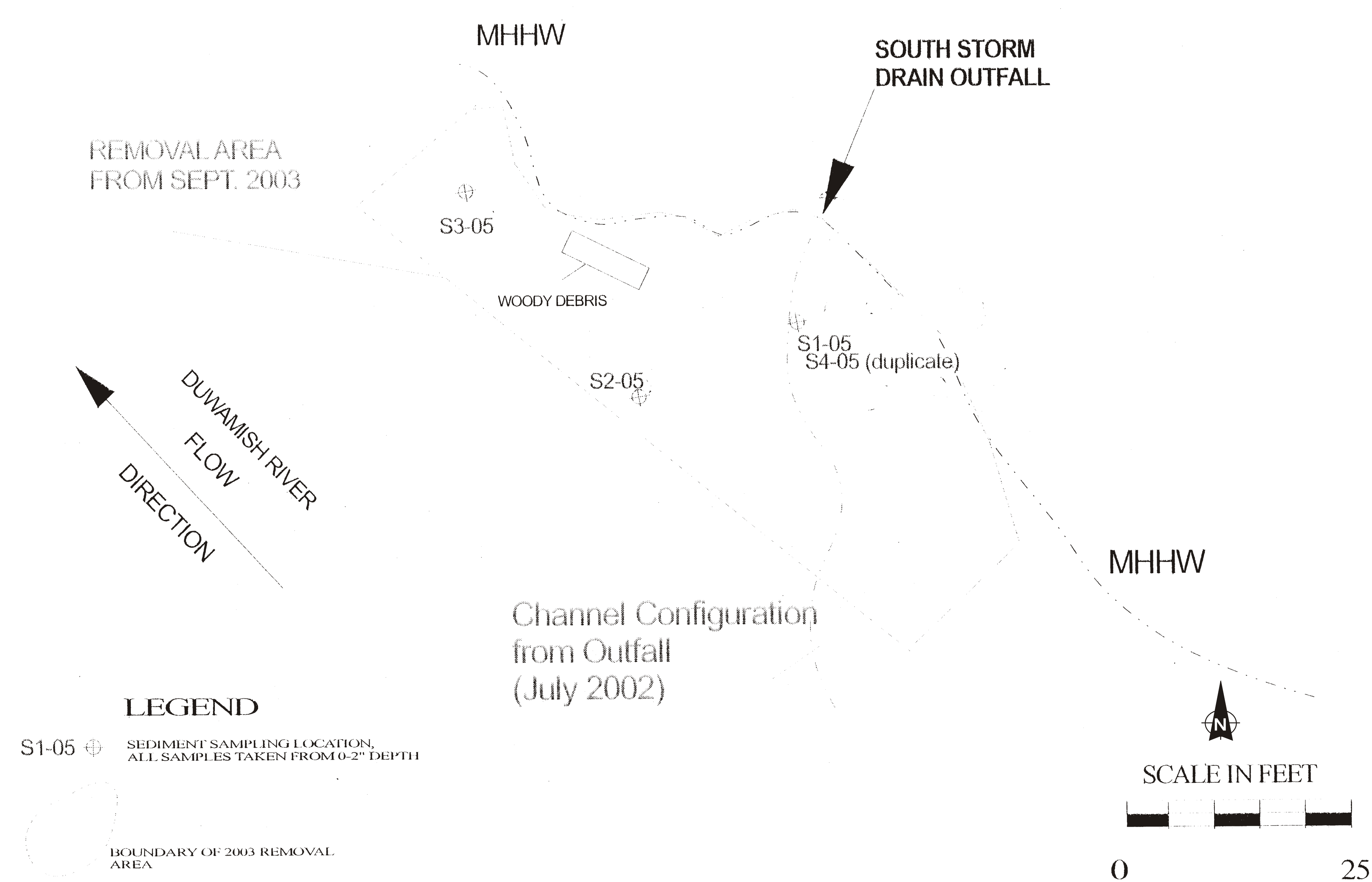
Seattle, Washington

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

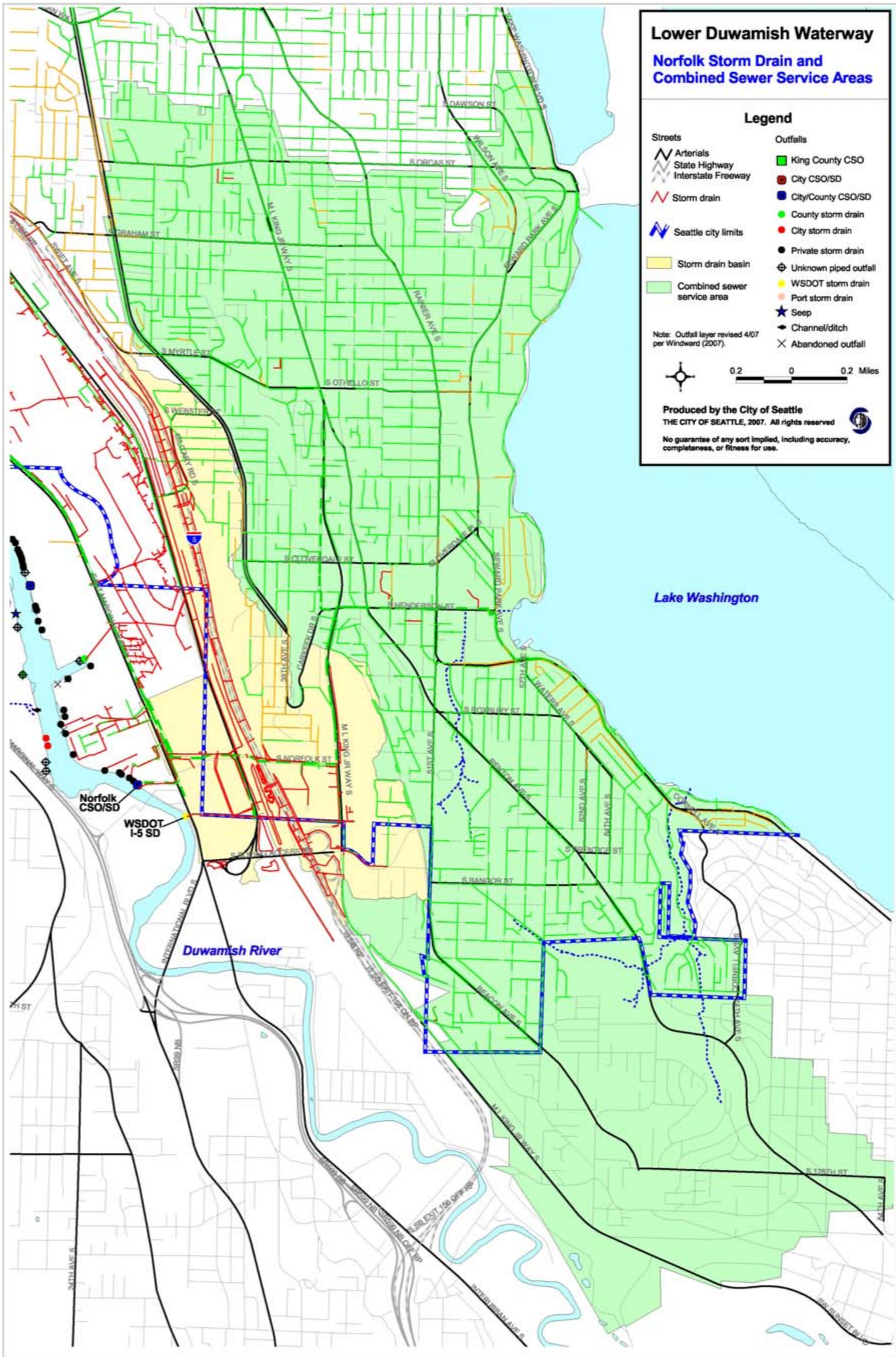
Base Map Reference: Boeing 2004.

Figure 8
STORMWATER SOLIDS
SAMPLING LOCATIONS, (BDC)

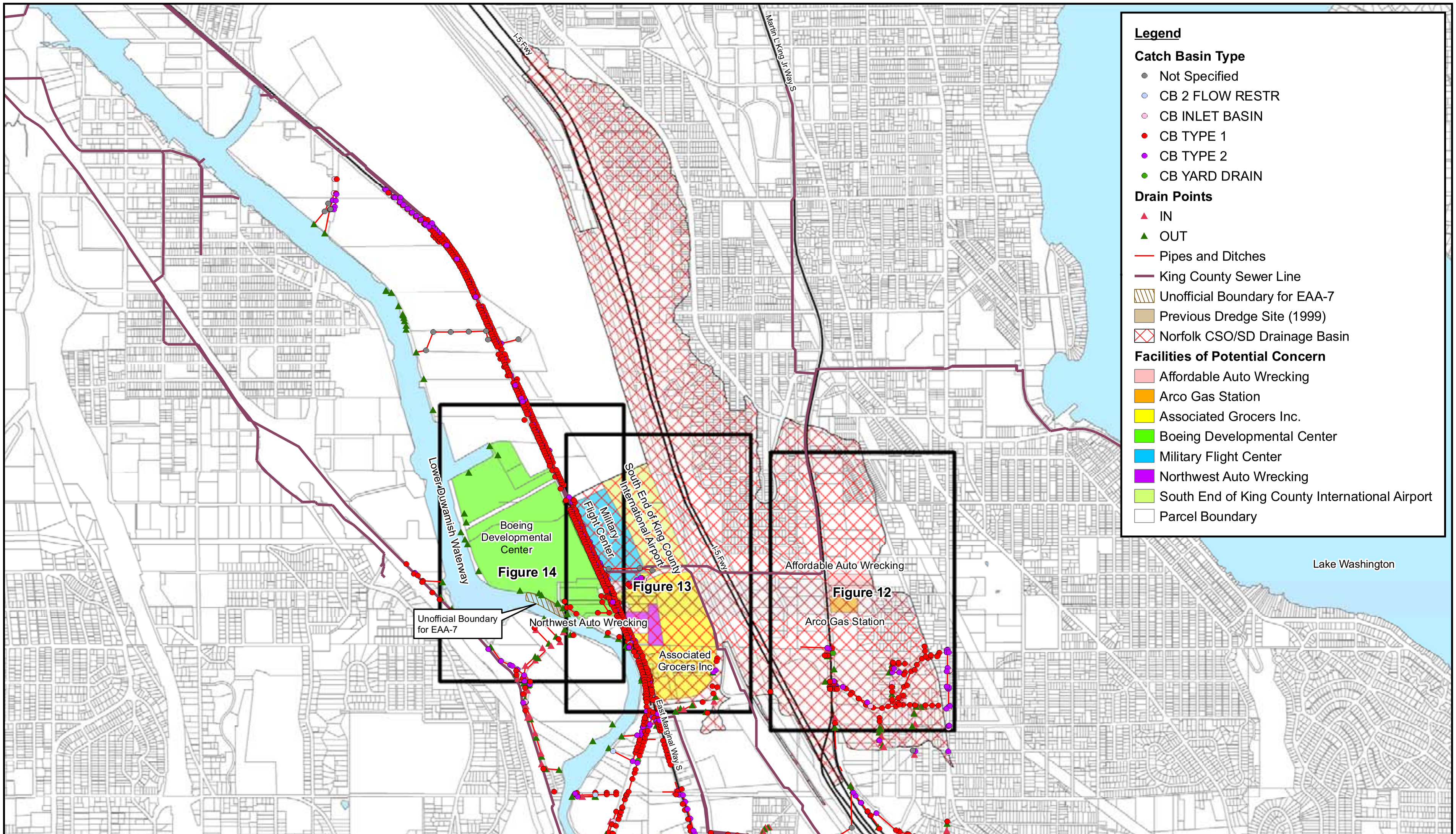
Date:	Drawn by:	
6/1/07	AES	10:002330WD0402\fig 8



ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 9 2005 SEDIMENT SAMPLING LOCATIONS BOEING DEVELOPMENTAL CENTER		
	Base Map Reference: Boeing 2005.	Date: 5/30/07	Drawn by: AES	10:002330WD0402\fig 9



ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 10 NORFOLK COMBINED SEWER OVERFLOW/ STORM DRAIN AREA
	Base Map Reference: SPU 2007.	Date: 5/30/07 · Drawn by: AES · 10:002330WD0402\fig 10



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

Map Source Information: King County GIS Data, June 2003.
City of Tukwila Storm Drain Data.

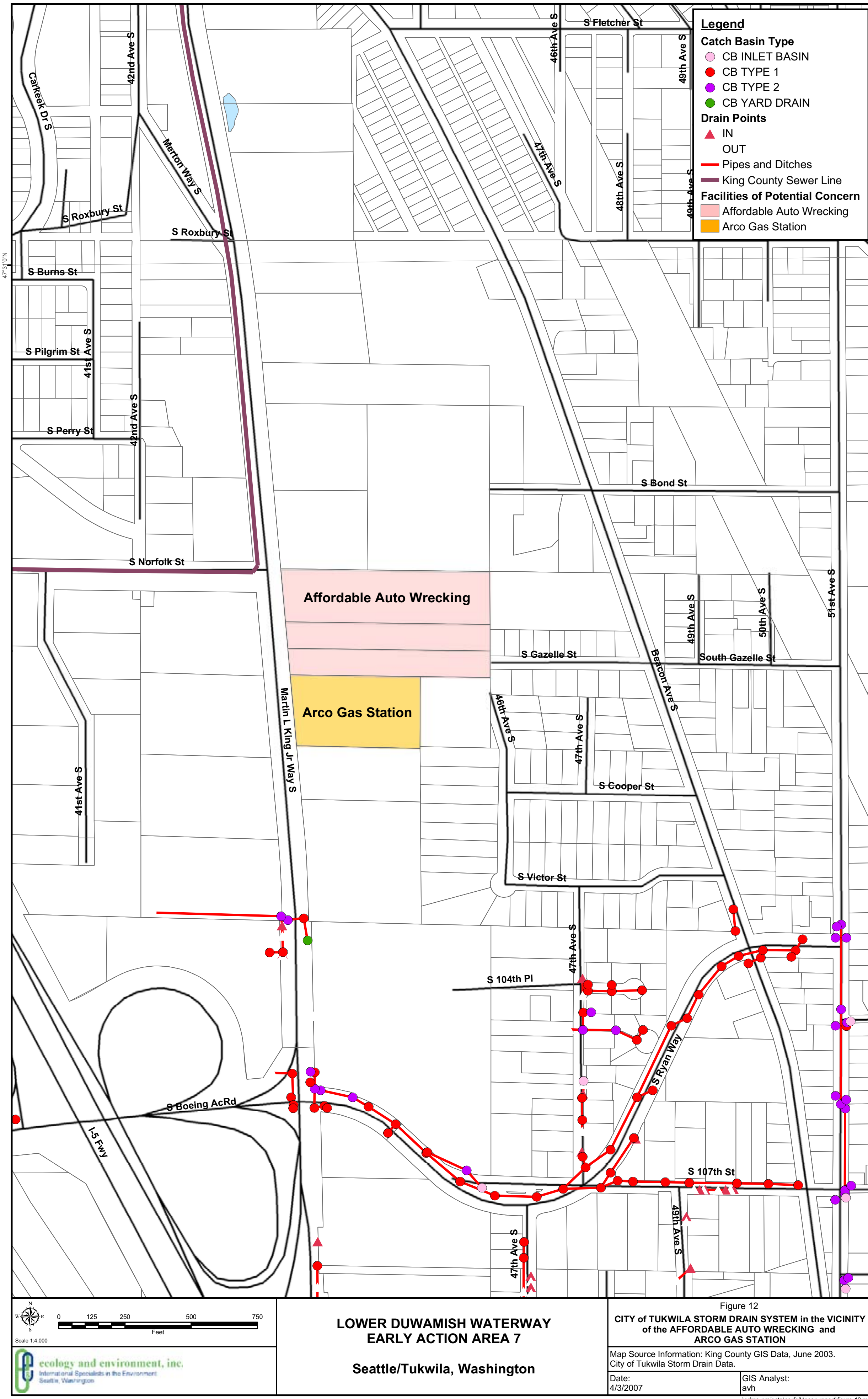
LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7

Seattle/Tukwila, WA

Figure 11
NORFOLK DRAINAGE BASIN and STORM DRAIN and SEWER SYSTEMS

Date:	GIS:	Job Number:
4/3/2007	avh	002330.WD04.03

\edms-projects\norfolk\scap report\figure 11.mxd



Legend
Catch Basin Type
CB INLET BASIN
CB TYPE 1
CB TYPE 2
CB YARD DRAIN
Drain Points
IN
OUT
Pipes and Ditches
King County Sewer Line
Facilities of Potential Concern
Affordable Auto Wrecking
Arco Gas Station
Affordable Auto Wrecking
Arco Gas Station
S Fletcher St
46th Ave S
49th Ave S
42nd Ave S
Carkeek Dr S
Merton Way S
47th Ave S
48th Ave S
S Roxbury St
S Roxbury St
S Burns St
S Pilgrim St
41st Ave S
42nd Ave S
S Perry St
S Bond St
S Norfolk St
51st Ave S
49th Ave S
50th Ave S
S Gazelle St
South Gazelle St
Beacon Ave S
Martin L King Jr Way S
46th Ave S
47th Ave S
S Cooper St
41st Ave S
S Victor St
47th Ave S
S 104th Pl
S Ryan Way
S Boeing AcRd
I-5 Fwy
S 107th St
49th Ave S
47th Ave S
0 125 250 500 750
Feet
Scale 1:4,000
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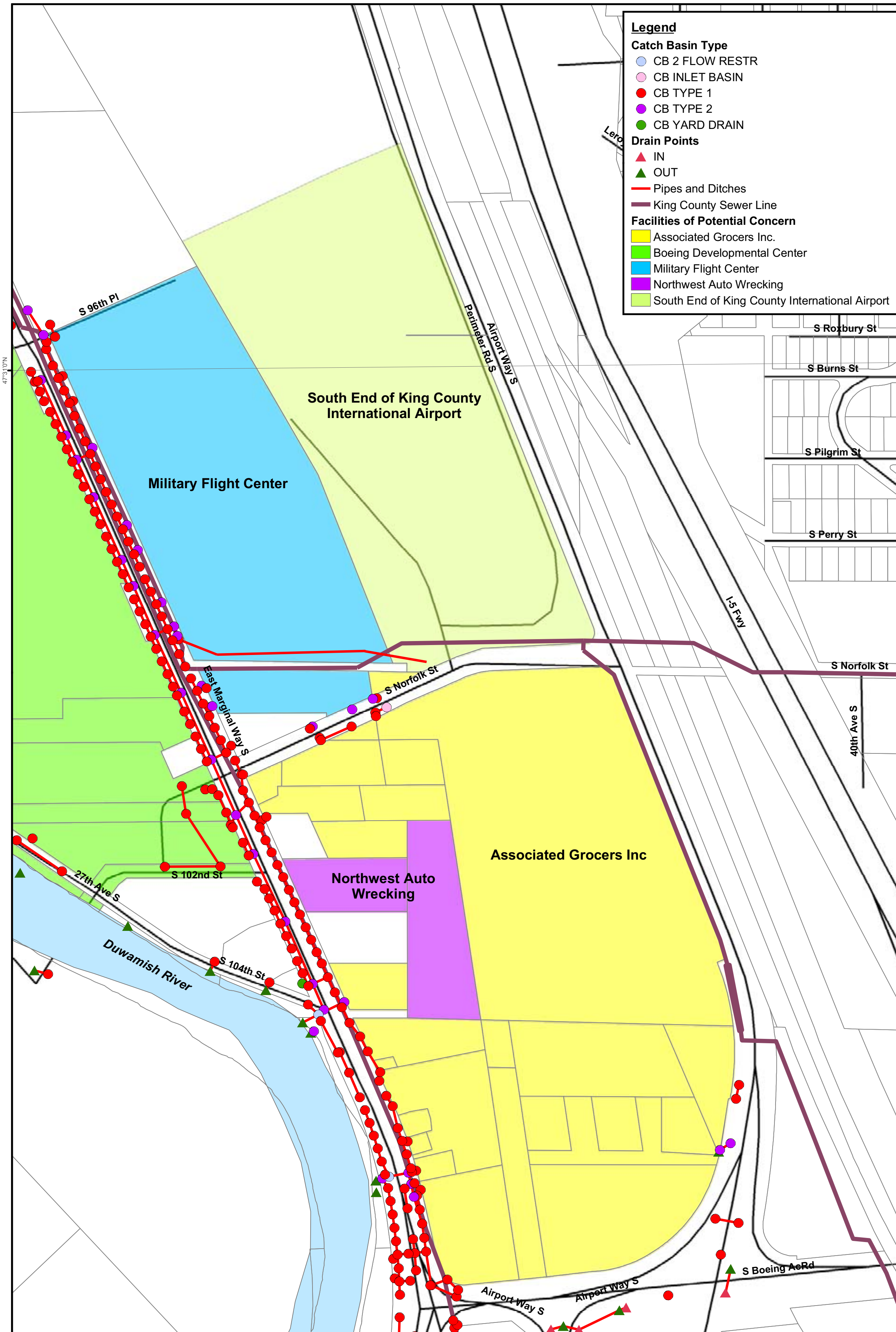
Seattle, Washington
LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle/Tukwila, Washington
Figure 12
CITY of TUKWILA STORM DRAIN SYSTEM in the VICINITY of the AFFORDABLE AUTO WRECKING and ARCO GAS STATION
Map Source Information: King County GIS Data, June 2003.
City of Tukwila Storm Drain Data.
Date:
4/3/2007
GIS Analyst:
avh
\edms-projects\norfolk\scap report\figure 12.mxd



0 125 250 500 750
Feet
Scale 1:4,000

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Seattle, Washington

LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7

Seattle/Tukwila, Washington

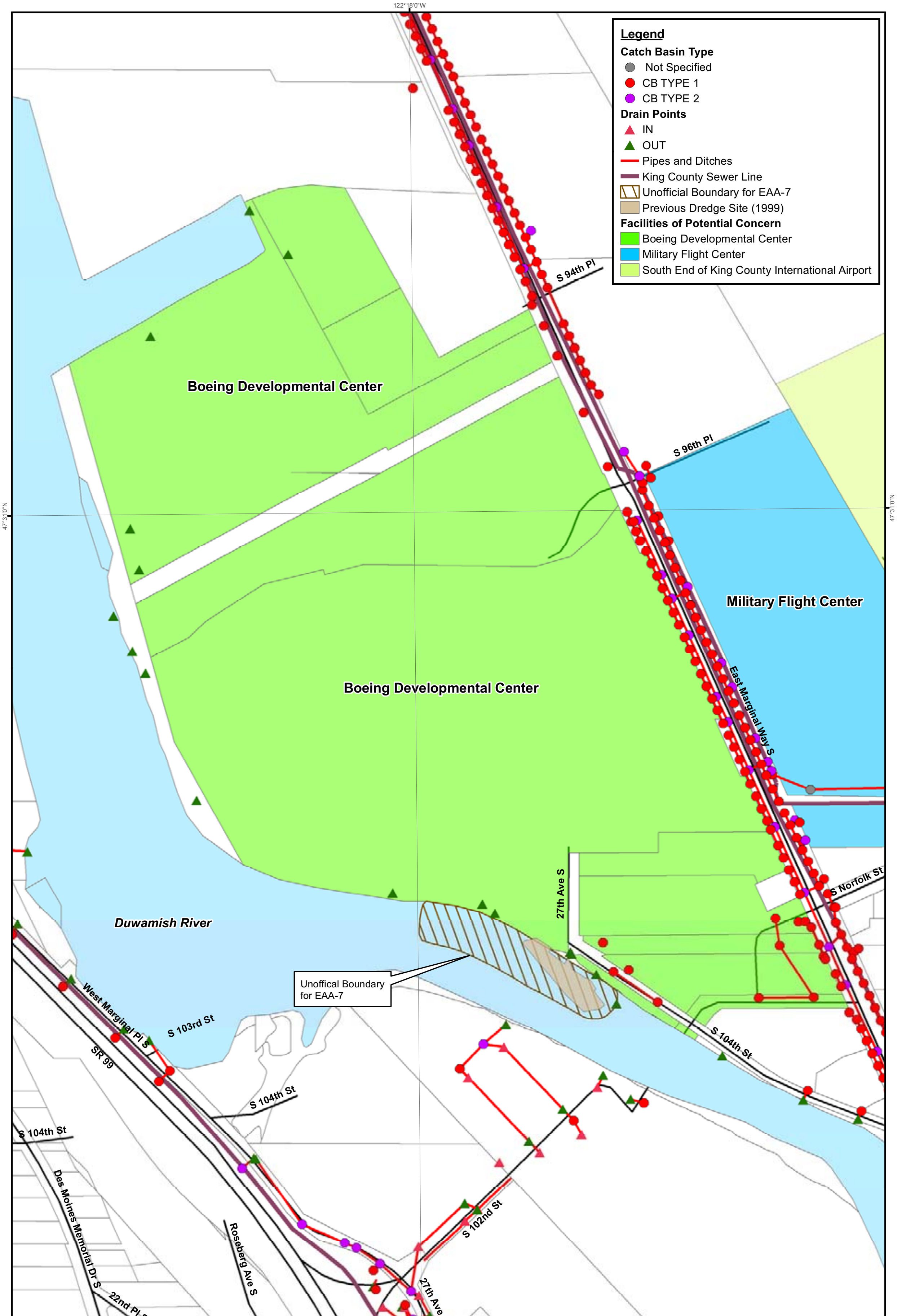
Figure 13

CITY of TUKWILA STORM DRAIN SYSTEM in the VICINITY of the ASSOCIATED GROCERS, K.C. INTL. AIRPORT, MILITARY FLIGHT CENTER and NW AUTO WRECKING

Map Source Information: King County GIS Data, June 2003.
City of Tukwila Storm Drain Data.

Date:	GIS Analyst:
4/3/2007	avh

\edms-projects\norfolk\scap report\figure 13.mxd



0 125 250 500 750

Feet

Scale 1:4,000

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LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7

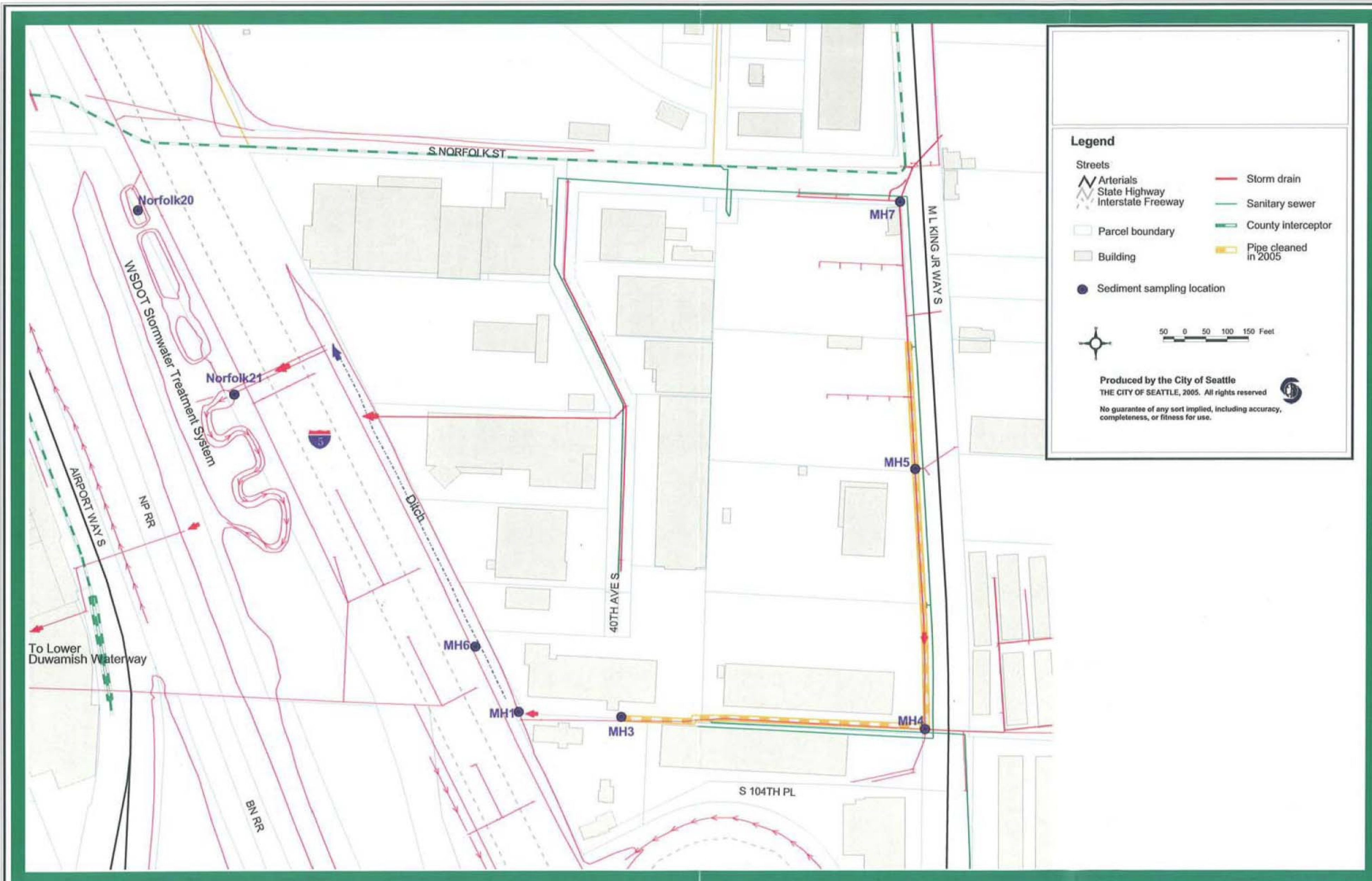
Seattle/Tukwila, Washington

Figure 14
CITY of TUKWILA STORM DRAIN SYSTEM in the VICINITY of the BOEING DEVELOPMENTAL CENTER

Map Source Information: King County GIS Data, June 2003.
City of Tukwila Storm Drain Data.

Date:	GIS Analyst:
4/3/2007	avh

\edms-projects\norfolk\scap report\figure 14.mxd



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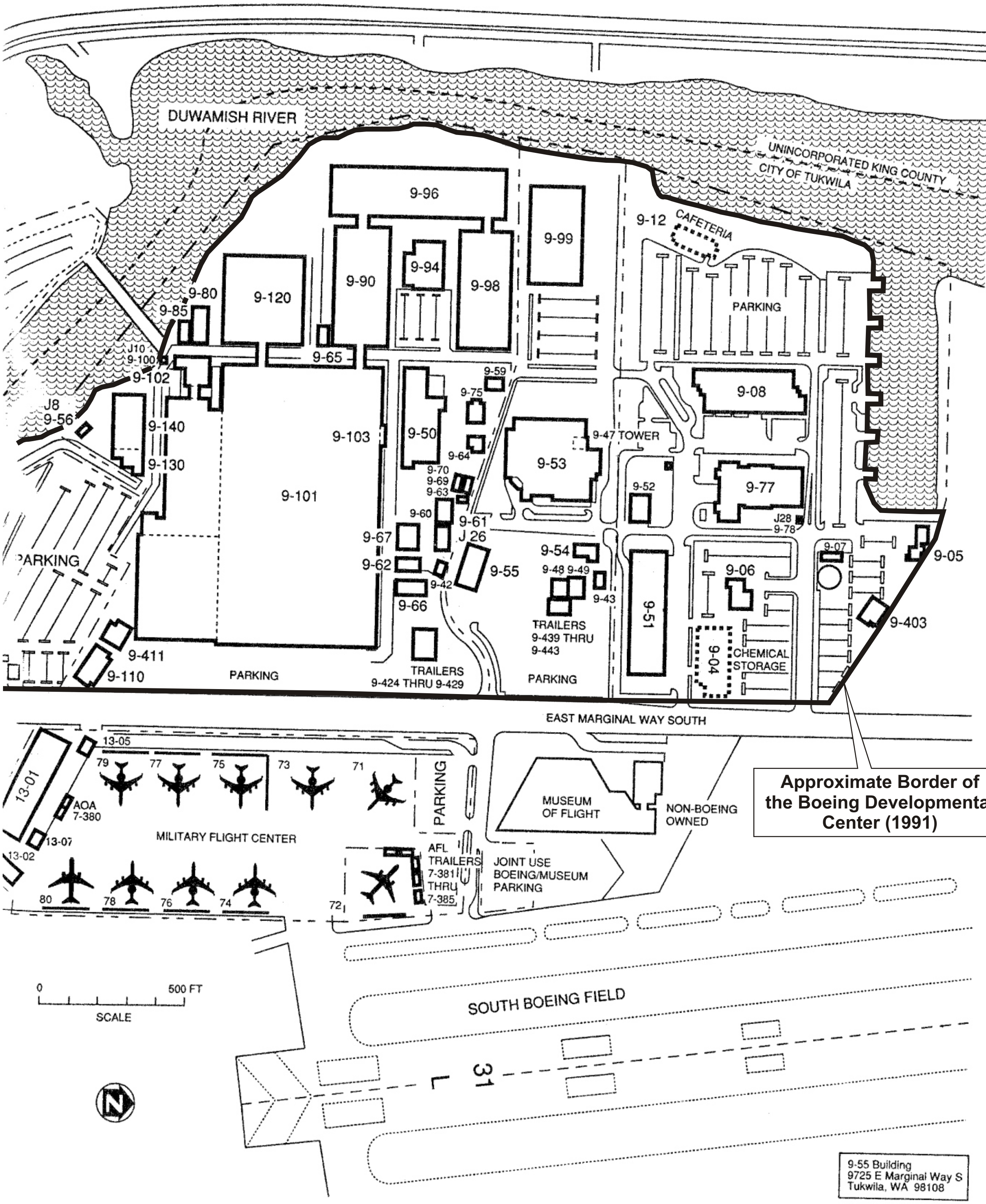
LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Base Map Reference: The City of Seattle 2005.

Figure 15
SEDIMENT SAMPLING LOCATIONS IN NORFOLK CSO DRAINAGE SYSTEM

Date: 5/30/07 | Drawn by: AES | 10:002330WD0402\fig 15



Approximate Border of the Boeing Developmental Center (1991)

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LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Figure 16
1991 BOEING DEVELOPMENTAL CENTER
FACILITY MAP

Base Map Reference:
Boeing Defense & Space Group, July 1991

Date:	Drawn by:	
5-30-07	AES	10:002330WD0402\fig 16

ecology and environment, inc. International Specialists in the Environment Seattle, Washington	**Base Map Reference:** Landau Associates 2004.	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 17 BOEING DEVELOPMENTAL CENTER SMWU-17, SMWU-20, AND AOC-05 LOCATIONS Date: 6/25/07 · Drawn by: AES · 10:002330WD0402\fig 17

Notes:

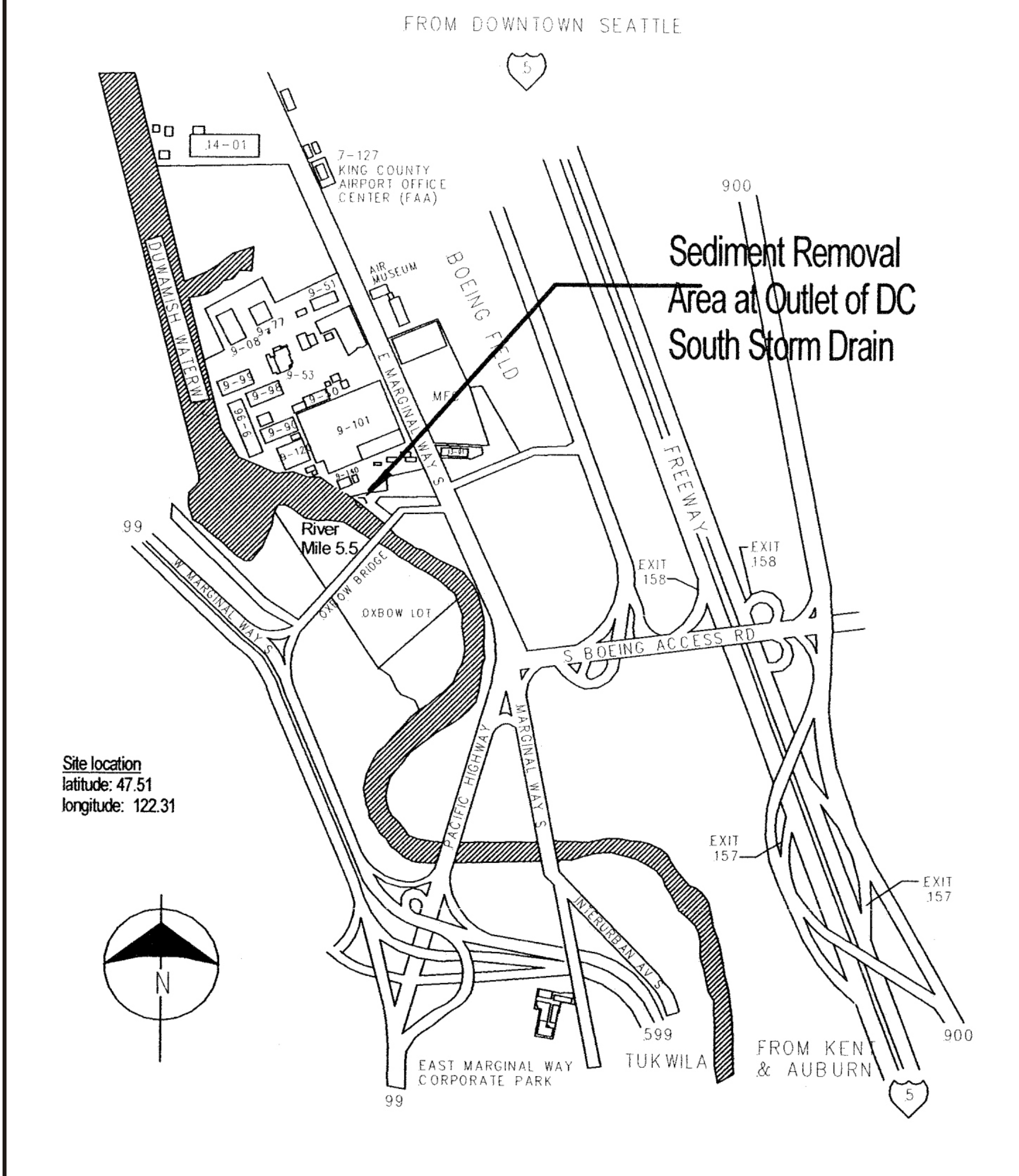
1. Water level measurements were made during May 2006.
2. Groundwater elevation contours are for shallow (A-Horizon) monitoring wells.

Legend

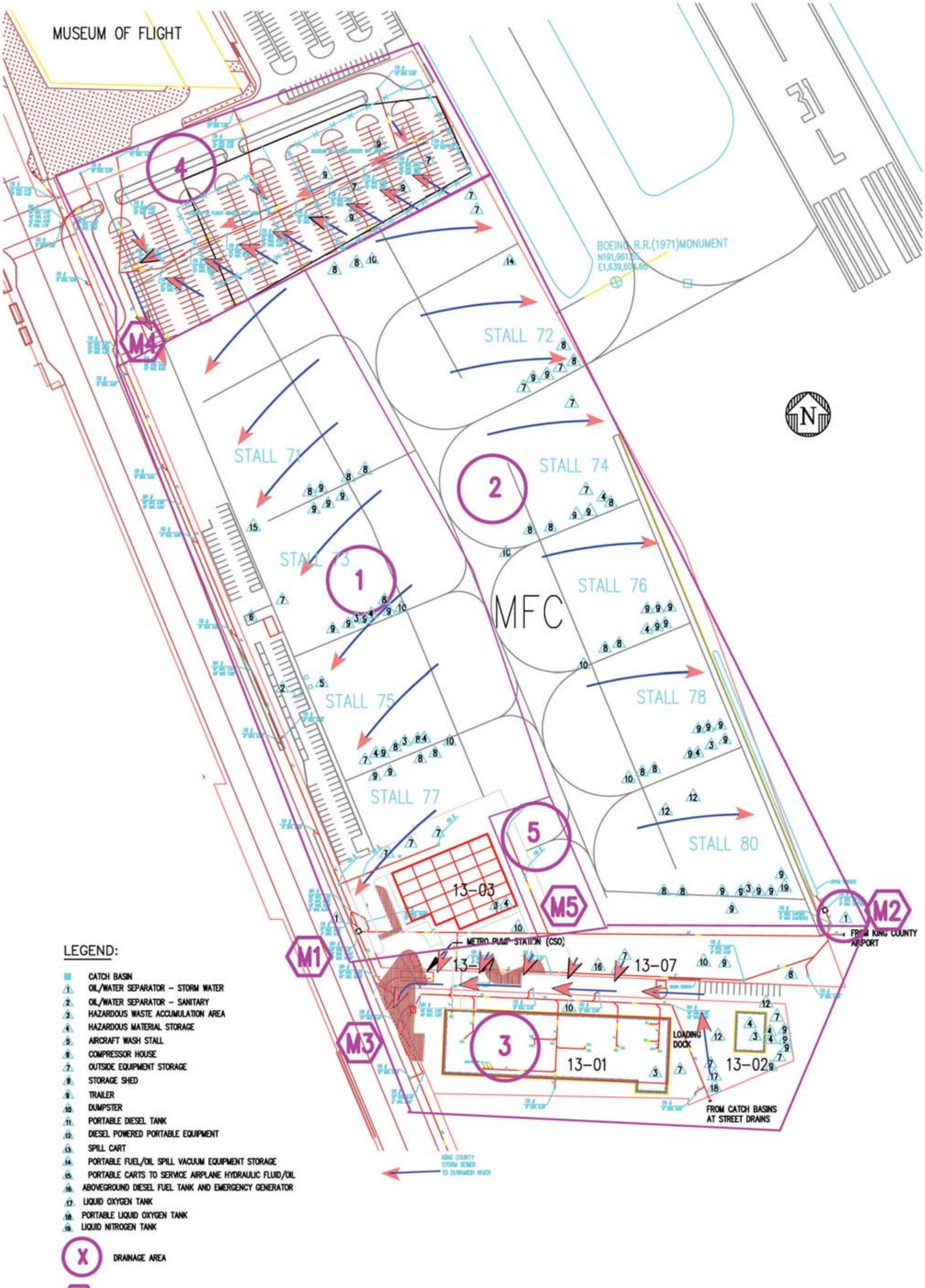
(1.97) Measured Groundwater Elevation, Ft. - Relative to NGVD 29

2.1 Estimated Groundwater Elevation Contour, Ft. - Relative to NGVD 29

ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 18 BOEING DEVELOPMENTAL CENTER GROUNDWATER ELEVATION CONTOUR MAP	
	Base Map Reference: Landau Associates, July 2006	Date: 6/25/07	Drawn by: AES — 10:002330WD0402\fig 18



ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 19 BOEING DEVELOPMENTAL CENTER SOUTH STORM DRAIN SEDIMENT REMOVAL AREA
	Base Map Reference: The Boeing Company, 2003	Date: 6-25-07 · Drawn by: AES · 10:002330WD0402\fig 19



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Seattle, Washington

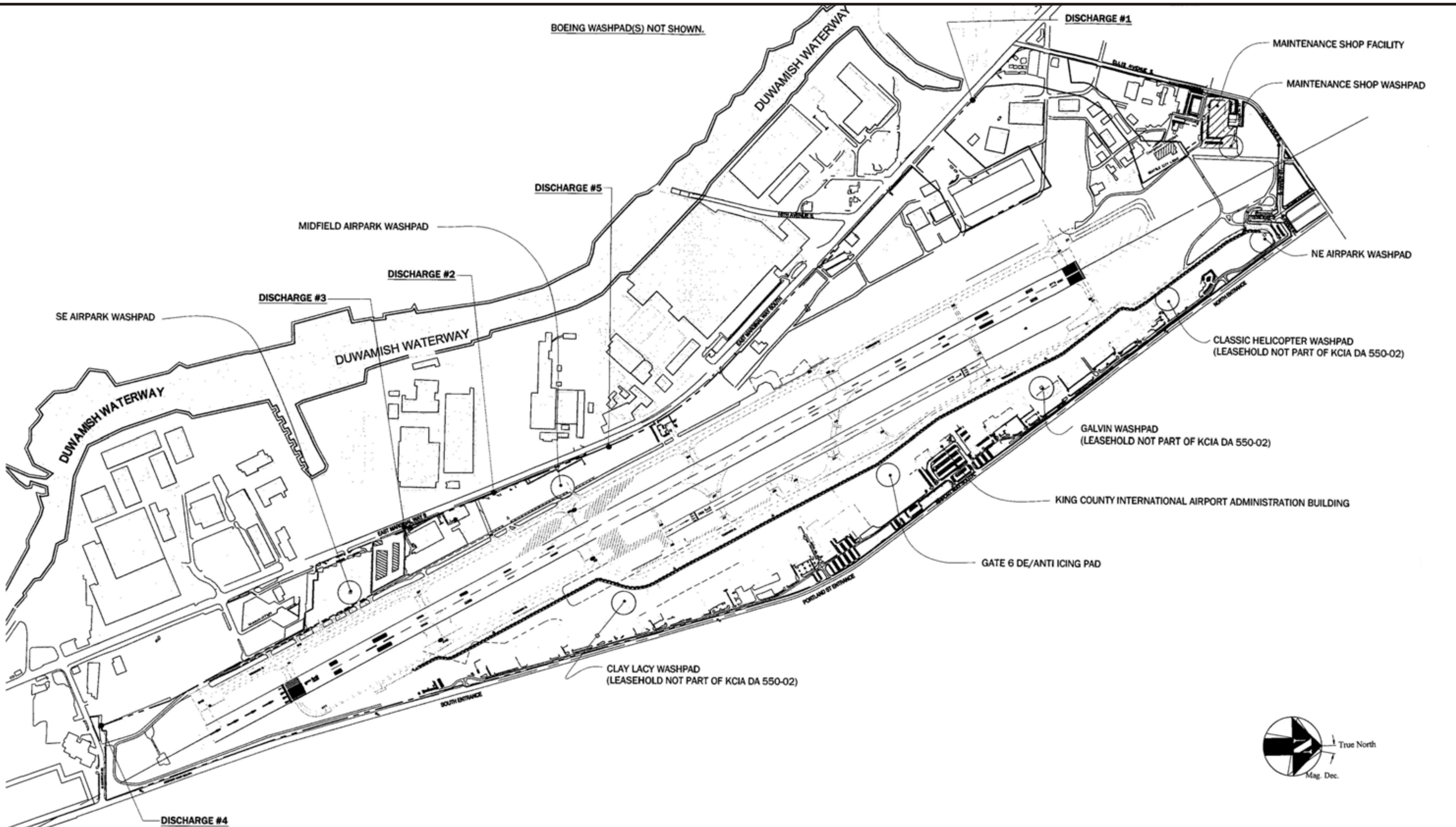
DESIGNED BY:
CHECKED BY:
DRAWN BY: Y. BAYNER

BASE MAP REFERENCE: THE BOEING COMPANY 2003

Figure 20
MILITARY FLIGHT CENTER
STORM WATER DRAINAGE SYSTEM

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Tukwila, Washington

SCALE: NOTED | DATE ISSUED: 05-29-07



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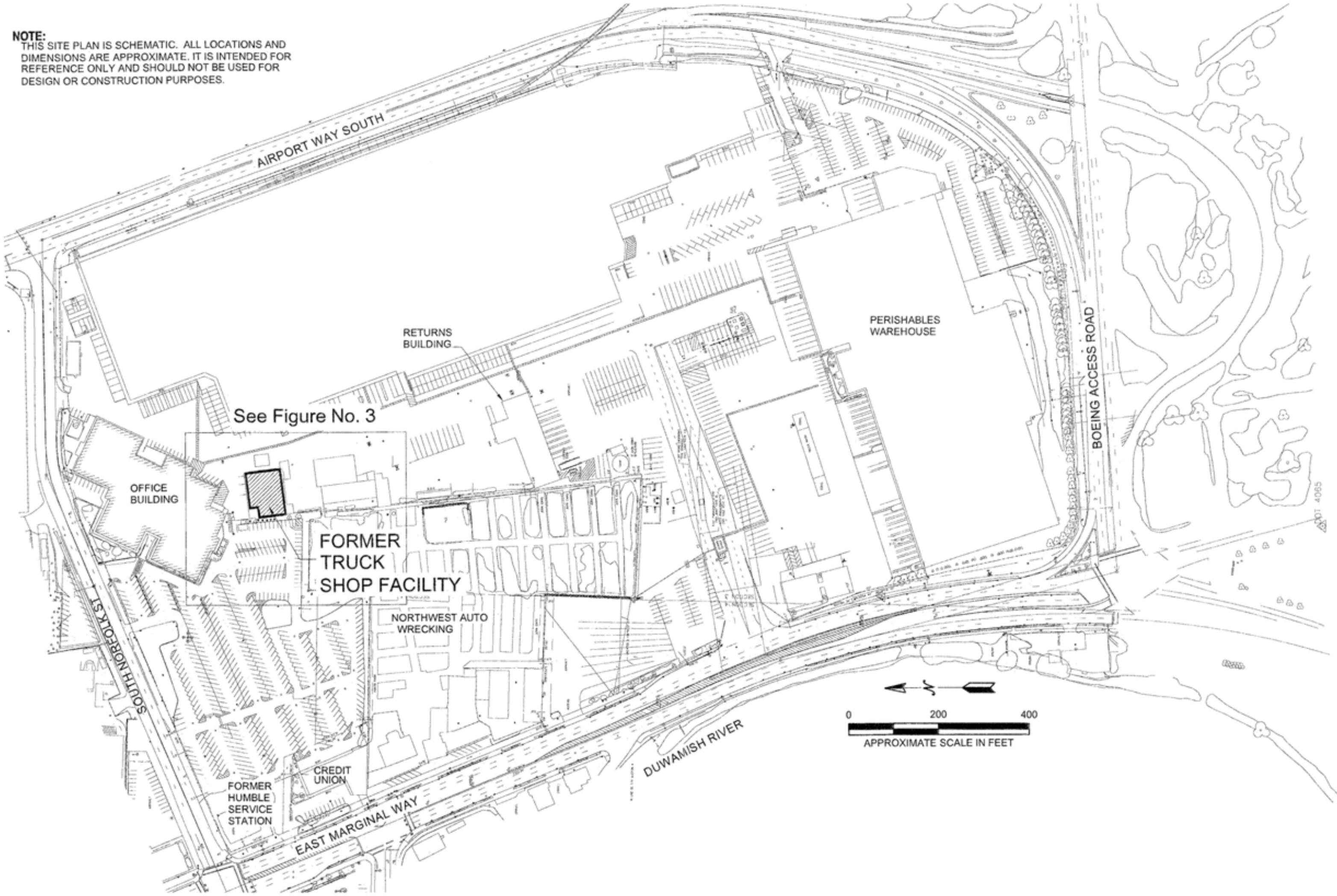
Seattle, Washington

Base Map Reference: King County International Airport, 2006.

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Figure 21
KING COUNTY INTERNATIONAL AIRPORT
STORMWATER OUTFALL SITE MAP

Date:	Drawn by:	
6/25/07	AES	10:002330WD0702\fig 21



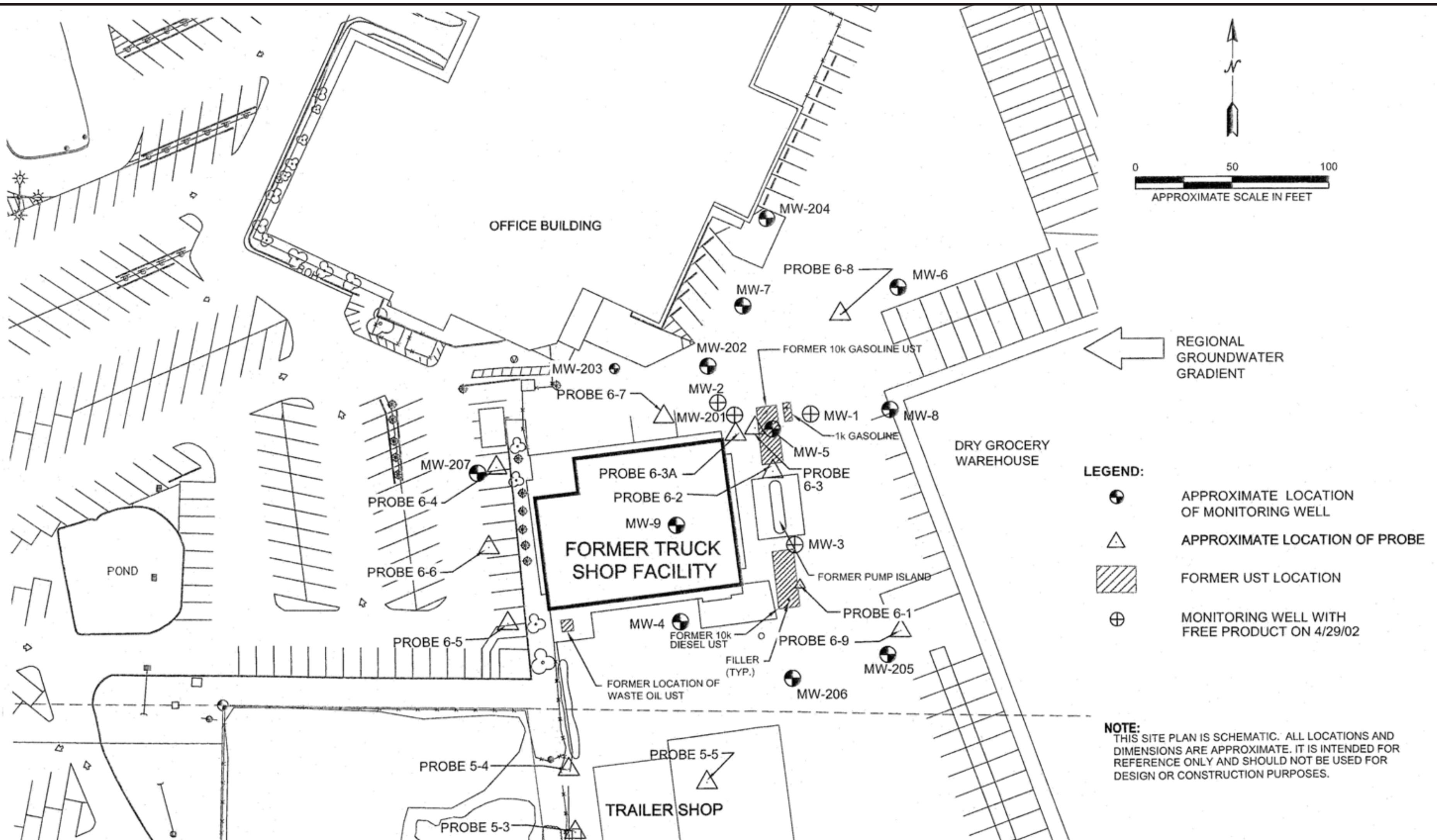
ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

Base Map Reference: Terra Associates, Inc., September 2006

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Figure 22
ASSOCIATED GROCERS, INC.
FACILITY MAP

Date:	Drawn by:	
6/25/07	AES	10:002330WD0402\fig 22



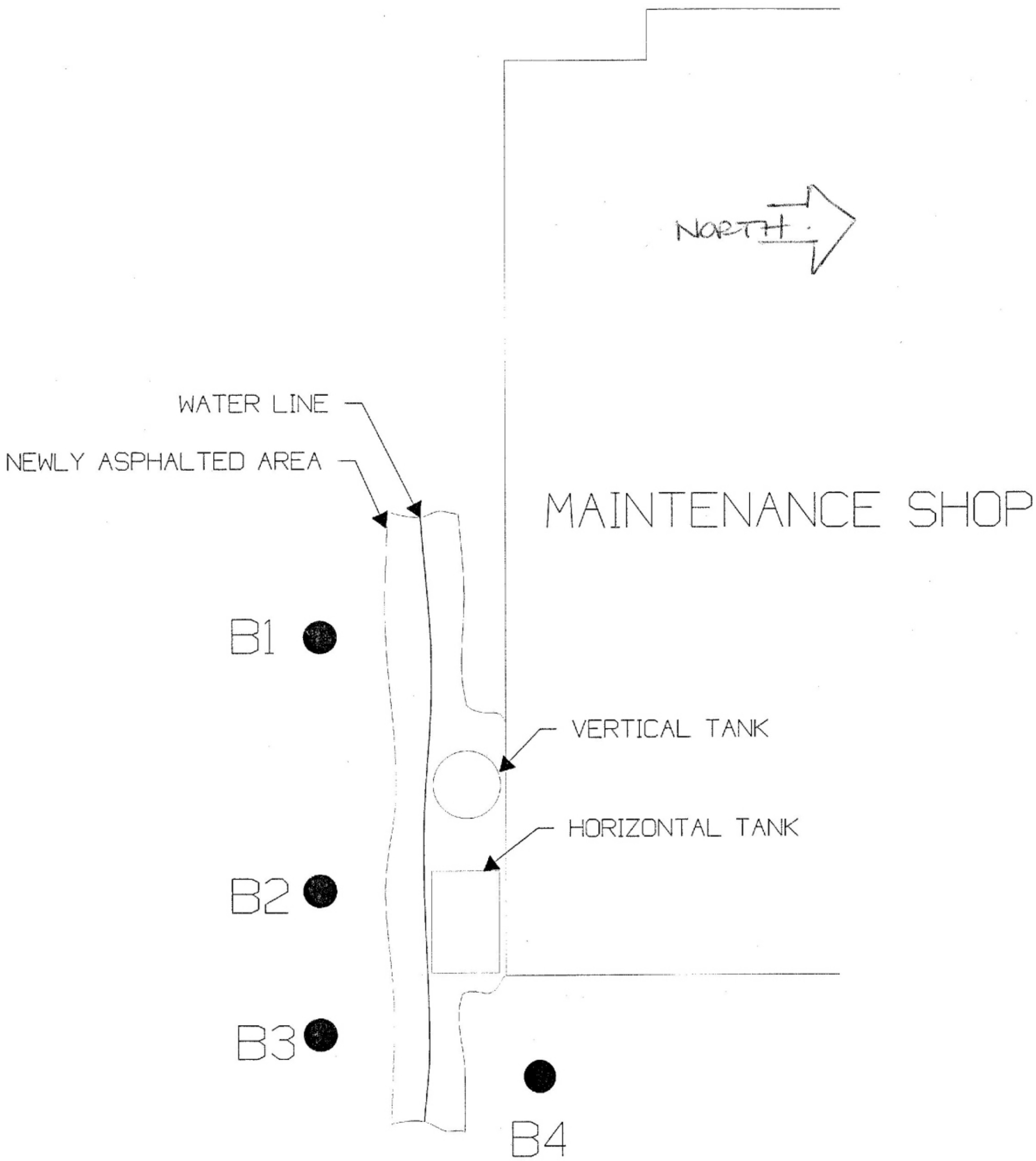
ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

Base Map Reference: Terra Associates, Inc., September 2006

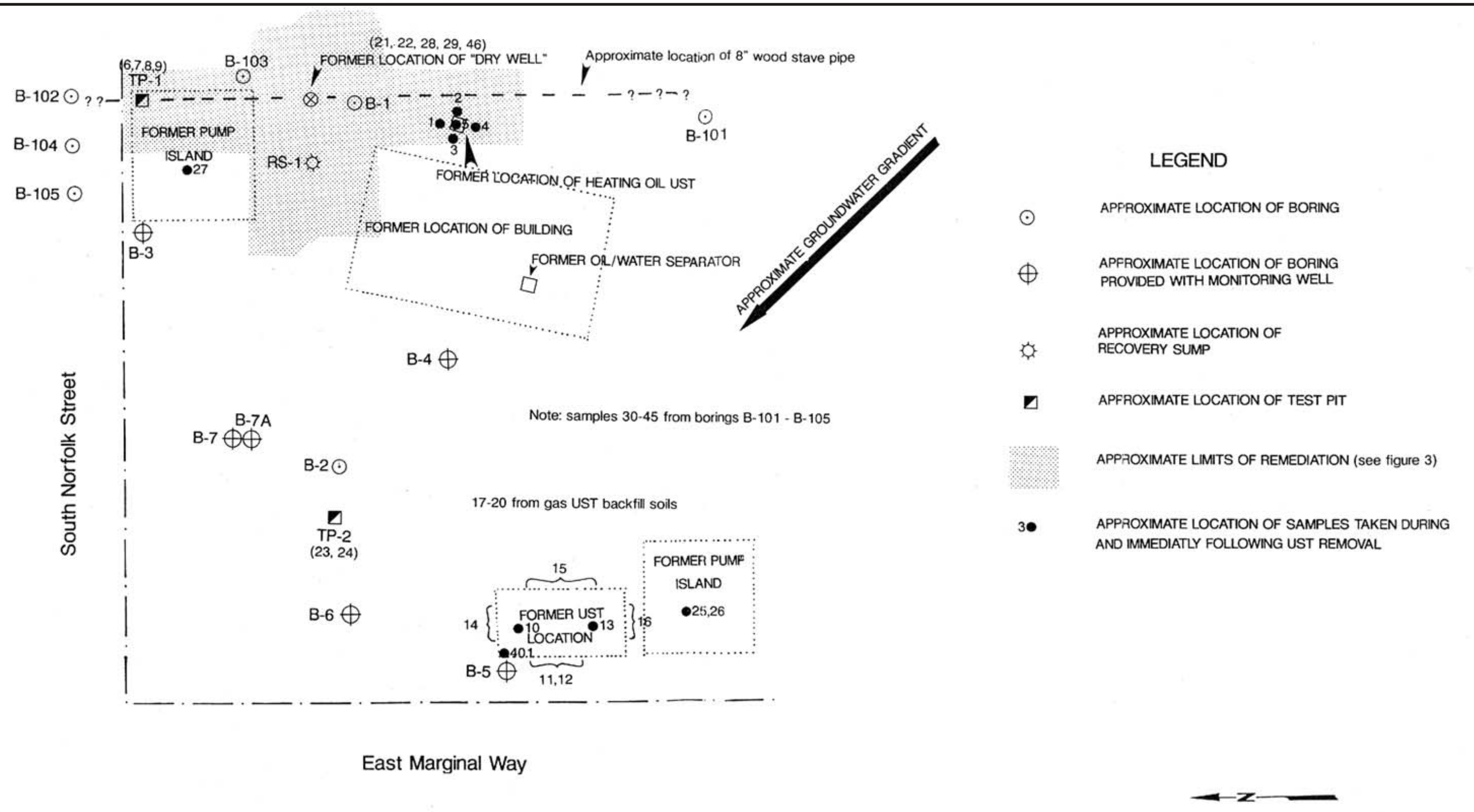
LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Figure 23
ASSOCIATED GROCERS, INC.
FORMER TRUCK SHOP FACILITY

Date:	Drawn by:	
6/25/07	AES	10:002330WD0402\fig 23

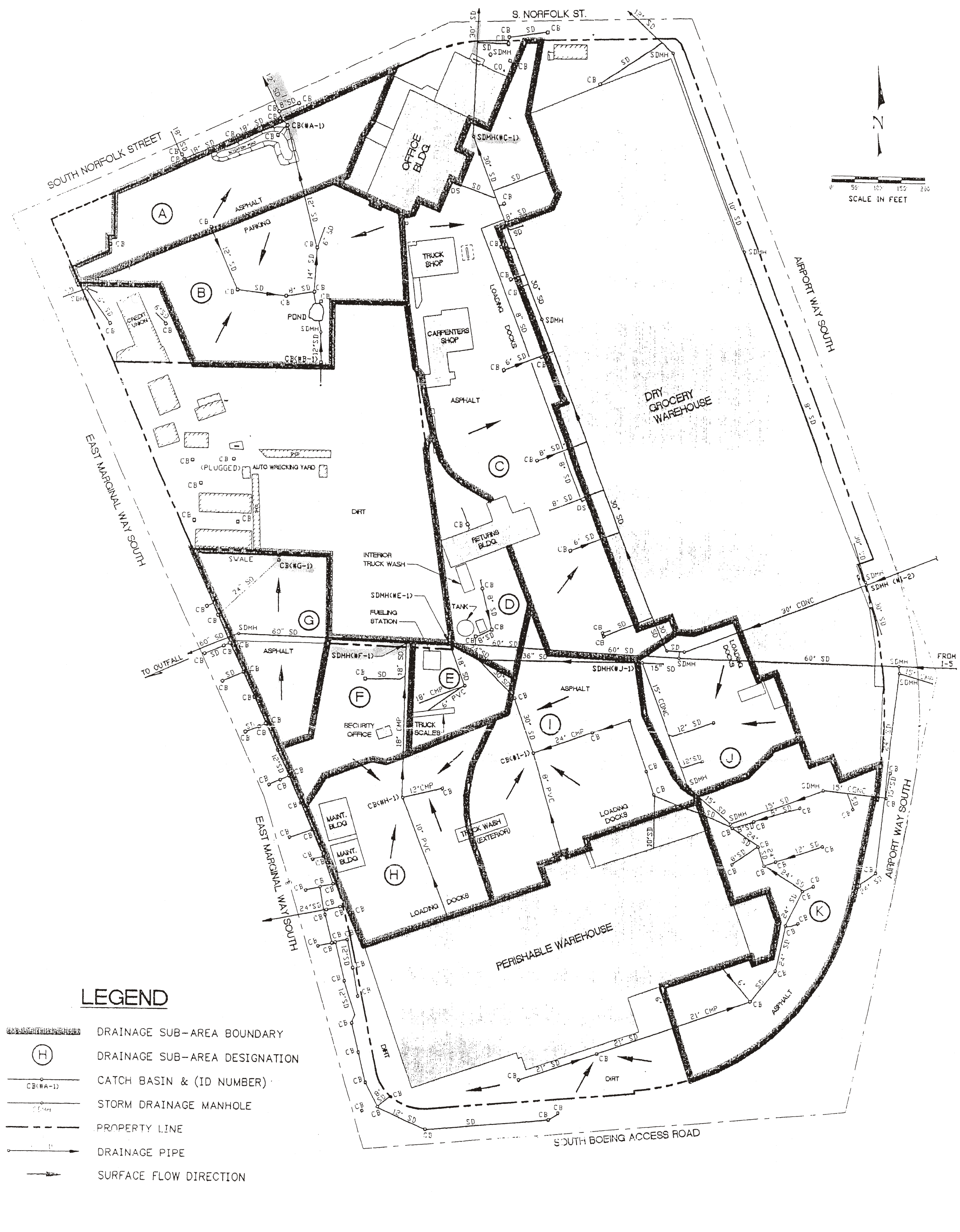


ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 24 ASSOCIATED GROCERS INC. MAINTENANCE SHOP AND UST REMOVAL AREA		
	Base Map Reference: Global Environmental 1996.	Date: 6-25-07	Drawn by: AES	10:002330WD0402\fig 24

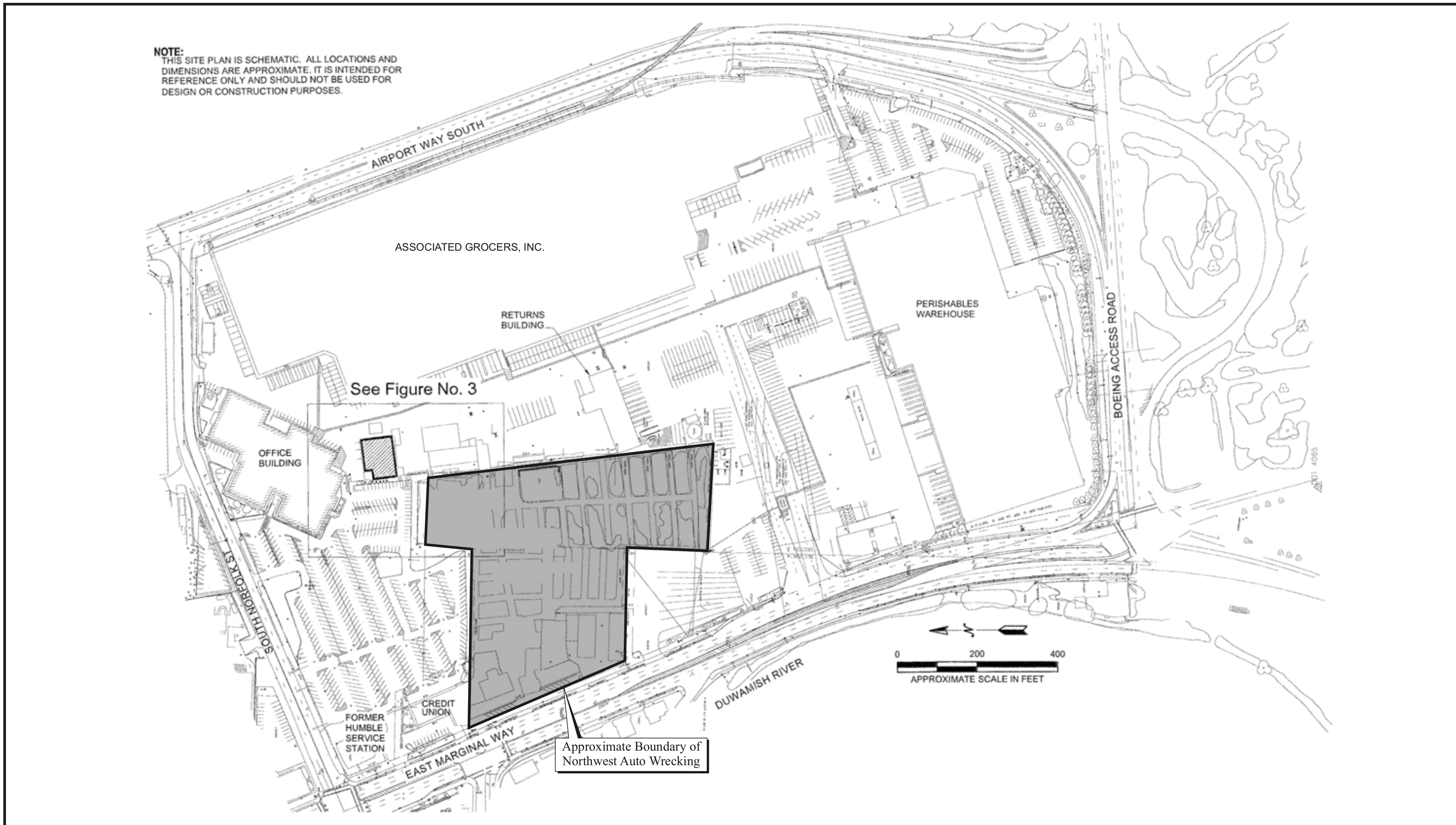


NOTE: THIS DRAWING IS BASED ON FIELD MEASUREMENTS REFERENCED TO THE FORMER BUILDING. PROPERTY LINE LOCATIONS ARE AS SUCH ASSUMED AND ARE SCHEMATIC IN NATURE.

ecology and environment, inc. International Specialists in the Environment Seattle, Washington	**Base Map Reference:** Terra Associates, Inc., February 1991	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 25 ASSOCIATED GROCERS, INC. FORMER HUMBLE SERVICE STATION AREA Date: 6/25/07 — Drawn by: AES — 10:002330WD0402\fig 25



ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 26 ASSOCIATED GROCERS INC. STORM DRAINAGE SYSTEM
	Base Map Reference: Barrett Consulting Group	Date: 6/25/07 · Drawn by: AES · 10:002330WD0402\fig 26



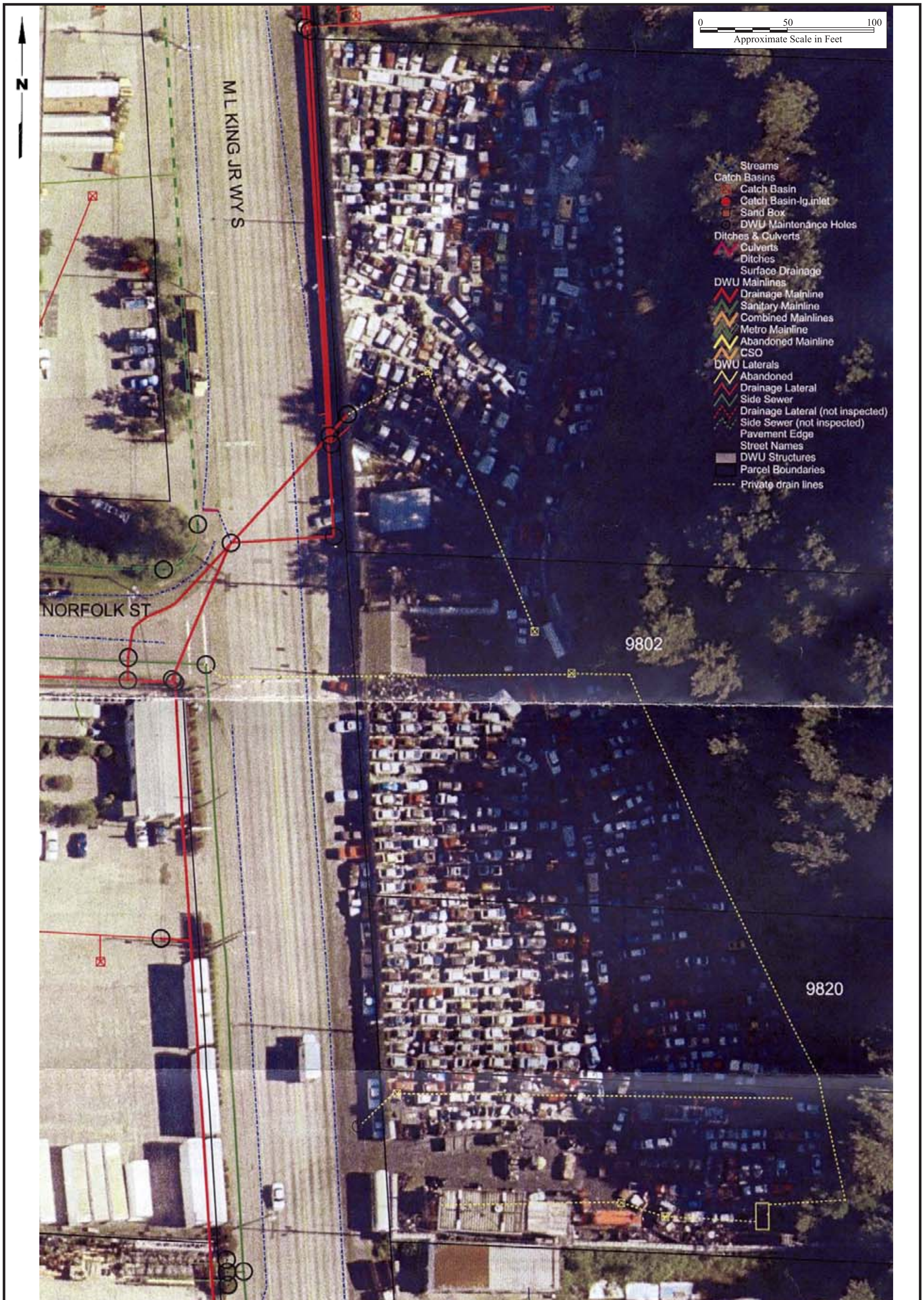
ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

Base Map Reference: Terra Associates, Inc., September 2006

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Figure 27
NORTHWEST AUTO WRECKING FACILITY MAP

Date:	Drawn by:	
6/25/07	AES	10:002330WD0402\fig 27



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

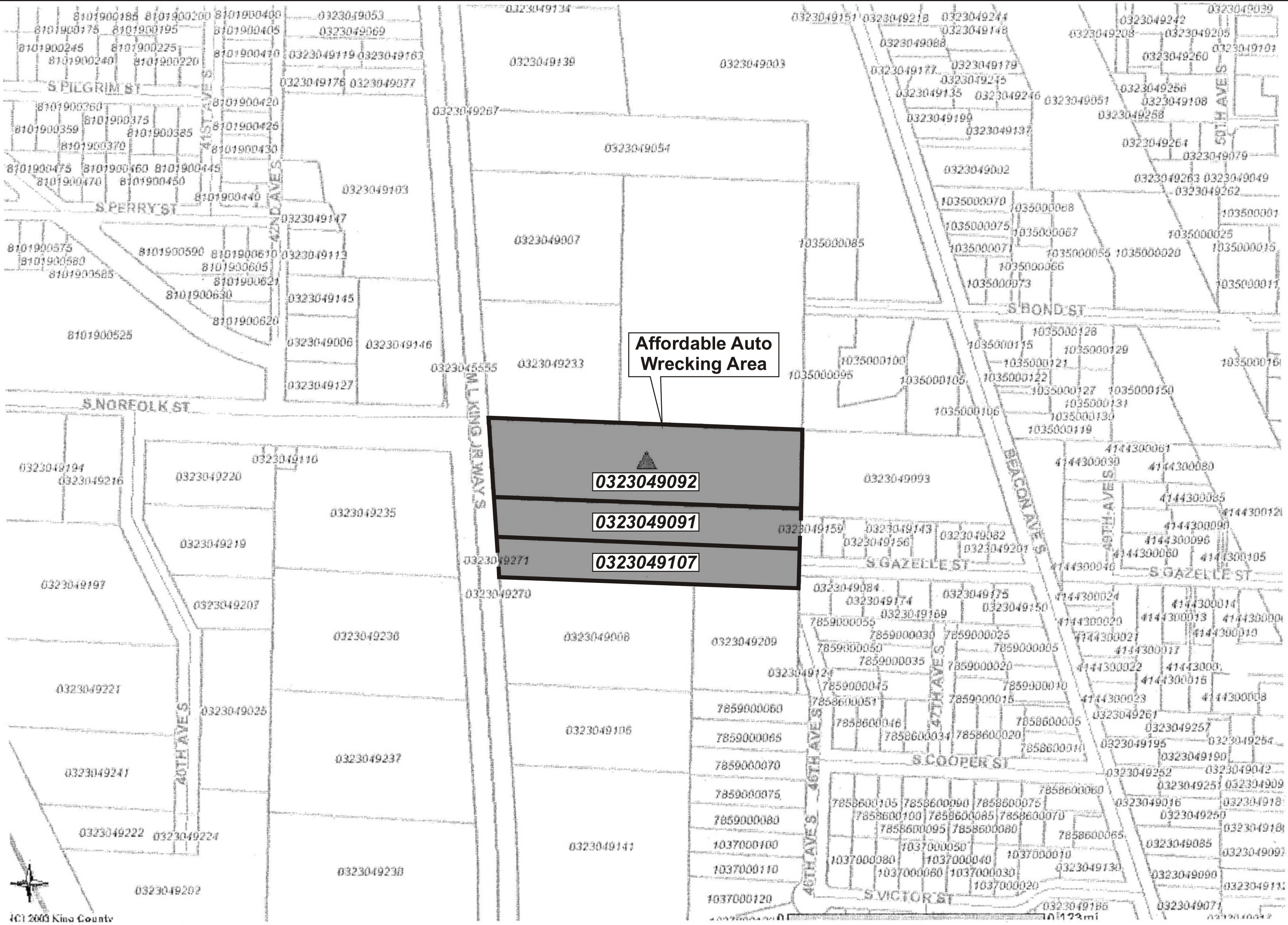
Figure 28
AERIAL PHOTOGRAPH OF
AFFORDABLE AUTO WRECKING AREA

Base Map Reference: City of Seattle, 2006.

Date: 6/25/07

Drawn by: AES

10:002330WD0402\fig 28



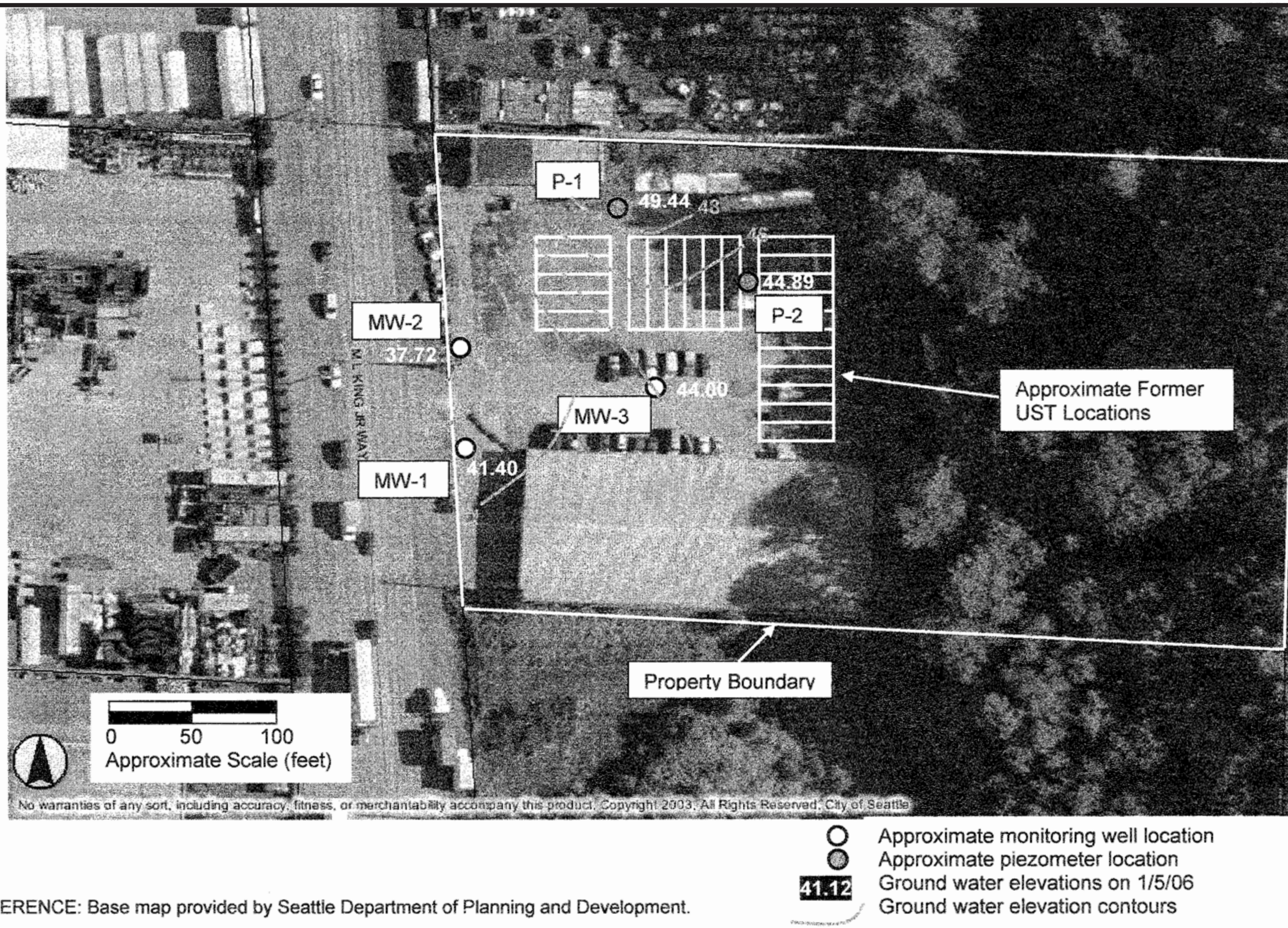
ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

LOWER DUWAMISH WATERWAY
EARLY ACTION AREA 7
Seattle, Washington

Base Map Reference: King County 2003.

Figure 29
AFFORDABLE AUTO WRECKING AREA
AND TAX PARCELS

Date:	Drawn by:	
6/25/07	AES	10:002330WD0402\fig 29



REFERENCE: Base map provided by Seattle Department of Planning and Development.

ecology and environment, inc. International Specialists in the Environment Seattle, Washington	LOWER DUWAMISH WATERWAY EARLY ACTION AREA 7 Seattle, Washington	Figure 30 ARCO GAS STATION MAP
	Base Map Reference: HWA GeoSciences Inc., February 2006	Date: 9/28/07 · Drawn by: AES · 10:002330WD0402\fig 30

Tables

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Table 1: Identified Facilities of Potential Concern

Facility Name	Facility Physical Address	Facility Mailing Address	Facility Phone Number	Facility Owner Name, Title, and Contact Information	Facility Operator Name, Title, and Contact Information	Property Owner (if different from Facility Owner/Operator) Name, Address, and Phone Number (King County tax assessor)	Regulatory Contact
Affordable Auto Wrecking	9802 Martin Luther King Jr Way South, Seattle, WA 98118	9802 Martin Luther King Jr Way South, Seattle, WA 98118	206-723-9820	Ronald Settergren	Ronald Settergren, Cognizant Official 206-723-9820	Corky Morris LLC and Ronald and Carol Settegren	
Arco Gas Station	9840 Martin Luther King Jr. Way South, Seattle, WA 98118. Note: Also shown as 9830 Martin Luther King Jr. Way South, Seattle, WA 98118 in Ecology online databases	9840 Martin Luther King Jr. Way South, Seattle, WA 98118. Note: Also shown as 9830 Martin Luther King Jr. Way South, Seattle, WA 98118 in Ecology online databases	206-722-4188	Peter Eastey, Jack's Auto Parts Inc. 9423 Martin Luther King Jr. Way South, Seattle WA 98118	Peter Eastey, Jack's Auto Parts Inc. 9423 Martin Luther King Jr. Way South, Seattle WA 98118	Estate of John Kline Eastey	
Associated Grocers Inc Seattle	3301 South Norfolk Street, Seattle, WA 98168	3301 South Norfolk Street, Seattle, WA 98168	206-762-2100	Associated Grocers Inc . President and Chief Executive Officer, John Runyan	David McDonald, Cognizant Official 206-764-7627	Sea-Tuk Warehouse LLC	Richard W Newton II P.O. Box 3763 3301 South Norfolk Street 206-647-7802
Boeing Developmental Center	9725 East Marginal Way South, Tukwila, WA 98108	The Boeing Company, P.O. Box 3707,MS 4H-26, Seattle, WA 98124	206-679-0433	Boeing Commercial Airplane Group P.O. Box 9707 MS 5R-14, Seattle, WA 98124 and The Boeing Company Office of the General Council 100 N Riverside Chicago, Il 60606	Integrated Defense and Space Division (IDS) of the Boeing Space Company P.O. Box 3707 M/C 80-RX	The Boeing Comany P.O. Box 3707, Seattle, WA 98124	Enviromental contact, James Bet (206) 679-0433 Cindy Naucler, General Contact 206-773-8571
Boeing Military Flight Center	10002 East Marginal Way South, Seattle, WA	P.O. Box 3707 MC 46-23, Seattle, WA 98124	206-679-0433	Boeing Commercial Airplane Group P.O. Box 9707 MS 5R-14, Seattle, WA 98124	Integrated Defense and Space Division (IDS) of the Boeing Space Company	The Boeing Company P.O. Box 3707, Seattle, WA 98124	Enviromental contact, James Bet (206) 679-0433Thomas D. Gallacher, regulatory contact and cognizant official P.O. Box 3707 MC 46-23 Seattle, WA 98124 206-544-1230
King Co. International Airport (Boeing Field)	7277 Perimeter Rd South, Seattle, WA 98108. Note, also listed as 6505 Perimeter Road South, Seattle	P.O. Box 80245, 7277 Perimeter Rd South, Seattle, WA 98108	206-296-7380	Department of Construction and Facilities Management P.O. Box 80245 Seattle, WA 98108	Operations and Compliance, 206-296-7334 7299 Perimeter Rd S	King County	Rick Renaud (206) 296-7427
Northwest Auto Wrecking	10230 East Marginal Way South, Tukwila, WA 98188	10230 East Marginal Way South, Tukwila, WA 98188	206-762-0220	Northwest Auto Wrecking Company , Jerry Haapla	Herb Pierce, Cognizant Official 425-201-6848		

Lower Duwamish Waterway
Early Action Area 7
Table 2: Chemicals of Potential Concern in EAA-7 Sediment

Source	Sample Location	Chemical	Concentration	TOC mg/kg DW	SQS	CSL	LAET	2LAET	Units
KC DNR, 1999	NFK501	2,4-Dimethylphenol	<MDL (35)	1,760	29	29			µg/kg DW
	NFK502	2,4-Dimethylphenol	<MDL (35)	1,210	29	29			µg/kg DW
	NFK503	2,4-Dimethylphenol	<MDL (35)	3,180	29	29			µg/kg DW
	NFK504	2,4-Dimethylphenol	<MDL (35)	1,260	29	29			µg/kg DW
	NFK502	2-Methylnaphthalene	<MDL (46)	1,210	38	64			mg/kg OC
	NFK502	2-Methylnaphthalene	<MDL (56)	1,210			670	1,400	µg/kg DW
	NFK504	2-Methylnaphthalene	<MDL (44)	1,260	38	64			mg/kg OC
	NFK504	2-Methylnaphthalene	<MDL (55)	1,260			670	1,400	µg/kg DW
	NFK502	Benzo(g,h,i)perylene	62.6	1,210	31	78			mg/kg OC
	NFK502	Benzo(g,h,i)perylene	75.7	1,210			670	720	µg/kg DW
	NFK504	Benzo(g,h,i)perylene	56	1,260	31	78			mg/kg OC
	NFK504	Benzo(g,h,i)perylene	70.5	1,260			670	720	µg/kg DW
	NFK501	Dibenzo(a,h)anthracene	<MDL (32)	1,760	12	33			mg/kg OC
	NFK501	Dibenzo(a,h)anthracene	<MDL (56)	1,760			230	540	µg/kg DW
	NFK502	Dibenzo(a,h)anthracene	<MDL (46)	1,210	12	33			mg/kg OC
	NFK502	Dibenzo(a,h)anthracene	<MDL (56)	1,210			230	540	µg/kg DW
	NFK503	Dibenzo(a,h)anthracene	<MDL (18)	3,180	12	33			mg/kg OC
	NFK503	Dibenzo(a,h)anthracene	<MDL (56)	3,180			230	540	µg/kg DW
	NFK504	Dibenzo(a,h)anthracene	<MDL (44)	1,260	12	33			mg/kg OC
	NFK504	Dibenzo(a,h)anthracene	<MDL (55)	1,260			230	540	µg/kg DW
	NFK501	Hexachlorobenzene	<MDL (0.51)	1,760	0.38	2.3			mg/kg OC
	NFK501	Hexachlorobenzene	<MDL (0.90)	1,760			31	70	µg/kg DW
	NFK502	Hexachlorobenzene	0.80	1,210	0.38	2.3			mg/kg OC
	NFK502	Hexachlorobenzene	<MDL (0.89)	1,210			31	70	µg/kg DW
	NFK504	Hexachlorobenzene	<MDL (0.71)	1,260	0.38	2.3			mg/kg OC
	NFK504	Hexachlorobenzene	<MDL (0.89)	1,260			31	70	µg/kg DW
	NFK501	Butyl Benzyl Phthalate	<MDL (12)	1,760	4.9	64			mg/kg OC
	NFK501	Butyl Benzyl Phthalate	<MDL (21)	1,760			63	900	µg/kg DW
	NFK502	Butyl Benzyl Phthalate	<MDL (17)	1,210	4.9	64			mg/kg OC
	NFK502	Butyl Benzyl Phthalate	<MDL (21)	1,210			63	900	µg/kg DW
	NFK503	Butyl Benzyl Phthalate	<MDL (6.6)	3,180	4.9	64			mg/kg OC
	NFK503	Butyl Benzyl Phthalate	<MDL (21)	3,180			63	900	µg/kg DW
	NFK504	Butyl Benzyl Phthalate	<MDL (17)	1,260	4.9	64			mg/kg OC
	NFK504	Butyl Benzyl Phthalate	<MDL (21)	1,260			63	900	µg/kg DW
	NFK501	Dibenzofuran	<MDL (20)	1,760	15	58			mg/kg OC
	NFK501	Dibenzofuran	<MDL (35)	1,760			540	700	µg/kg DW
	NFK502	Dibenzofuran	<MDL (29)	1,210	15	58			mg/kg OC
	NFK502	Dibenzofuran	<MDL (35)	1,210			540	700	µg/kg DW
	NFK504	Dibenzofuran	<MDL (28)	1,260	15	58			mg/kg OC
	NFK504	Dibenzofuran	<MDL (35)	1,260			540	700	µg/kg DW
	NFK501	Hexachlorobutadiene	<MDL (20)	1,760	3.9	6.2			mg/kg OC
	NFK501	Hexachlorobutadiene	<MDL (35)	1,760			11	120	µg/kg DW
	NFK502	Hexachlorobutadiene	<MDL (29)	1,210	3.9	6.2			mg/kg OC
	NFK502	Hexachlorobutadiene	<MDL (35)	1,210			11	120	µg/kg DW
	NFK503	Hexachlorobutadiene	<MDL (11)	3,180	3.9	6.2			mg/kg OC
	NFK503	Hexachlorobutadiene	<MDL (35)	3,180			11	120	µg/kg DW
	NFK504	Hexachlorobutadiene	<MDL (28)	1,260	3.9	6.2			mg/kg OC
	NFK504	Hexachlorobutadiene	<MDL (35)	1,260			11	120	µg/kg DW
	NFK501	N-Nitrosodiphenylamine	<MDL (20)	1,760	11	11			mg/kg OC
	NFK501	N-Nitrosodiphenylamine	<MDL (35)	1,760			28	40	µg/kg DW
	NFK502	N-Nitrosodiphenylamine	<MDL (29)	1,210	11	11			mg/kg OC
	NFK502	N-Nitrosodiphenylamine	<MDL (35)	1,210			28	40	µg/kg DW
	NFK504	N-Nitrosodiphenylamine	<MDL (28)	1,260	11	11			mg/kg OC
	NFK504	N-Nitrosodiphenylamine	<MDL (35)	1,260			28	40	µg/kg DW
	NFK501	Total PCBs	<MDL (13)	1,760	12	65			mg/kg OC
	NFK501	Total PCBs	<MDL (22)	1,760			130	1,000	µg/kg DW
	NFK502	Total PCBs	<MDL (18)	1,210	12	65			mg/kg OC
	NFK502	Total PCBs	<MDL (22)	1,210			130	1,000	µg/kg DW
	NFK504	Total PCBs	<MDL (17)	1,260	12	65			mg/kg OC
	NFK504	Total PCBs	<MDL (22)	1,260			130	1,000	µg/kg DW
Mickelson, S., 2001	NFK501 (0-10 cm)	Butyl Benzyl Phthalate	6.63	8,670	4.9	64			mg/kg OC
	NFK501 (0-10 cm)	Butyl Benzyl Phthalate	246	8,670			1,300	1,900	µg/kg DW
	NFK502 (0-10 cm)	Butyl Benzyl Phthalate	5.03	4,990	4.9	64			mg/kg OC
	NFK502 (0-10 cm)	Butyl Benzyl Phthalate	192	4,990			1,300	1,900	µg/kg DW
	NFK502 (0-2 cm)	Total PCBs	24.8	6,510	12	65			mg/kg OC
	NFK502 (0-2 cm)	Total PCBs	161	6,510			130	1,000	µg/kg DW
	NFK 502 (0-10 cm)	Total PCBs	18.9	4,990	12	65			mg/kg OC
	NFK 502 (0-10 cm)	Total PCBs	94.1	4,990			130	1,000	µg/kg DW
	NFK503 (0-2 cm)	Total PCBs	677	2,770	12	65			mg/kg OC
	NFK503 (0-2 cm)	Total PCBs	1,880	2,770			130	1,000	µg/kg DW
	NFK503 (0-10 cm)	Total PCBs	369	3,600	12	65			mg/kg OC
	NFK503 (0-10 cm)	Total PCBs	1,330	3,600			130	1,000	µg/kg DW

Mickelson, S., 2002	NFK504 (0-2 cm)	Bis (2-ethylhexyl) Phthalate	63.3	10,800	47	78			mg/kg OC
	NFK504 (0-2 cm)	Bis (2-ethylhexyl) Phthalate	682	10,800			1,300	1,900	µg/kg DW
	NFK503 (0-10 cm)	Total PCBs	30.4	25,500	12	65			mg/kg OC
	NFK503 (0-10 cm)	Total PCBs	777	25,500			130	1,000	µg/kg DW
	NFK503 (0-2 cm)	Total PCBs	260	26,200			130	1,000	µg/kg DW
	NFK501 (0-2 cm)	Total PCBs	168	23,000			130	1,000	µg/kg DW
	NFK501 (0-10 cm)	Total PCBs	174	21,300			130	1,000	µg/kg DW
Ecology, 2003	Station 4	Total PCBs	330	23,200	12	65			mg/kg OC
	Station 5	Total PCBs	22	12,100	12	65			mg/kg OC
	Station 6	Total PCBs	16	9,200	12	65			mg/kg OC
	Station 7	Total PCBs	160	29,200	12	65			mg/kg OC
	Station 7 - duplicate	Total PCBs	230	26,100	12	65			mg/kg OC
	Station 11	Total PCBs	18	8,000	12	65			mg/kg OC
Project Performance Corporation, 2003	DNC2S3	Total PCBs	61	6,200	12	65			mg/kg OC
	CHSSS2	Total PCBs	110	22,000	12	65			mg/kg OC
	CHBMS3	Total PCBs	2,190	21,000	12	65			mg/kg OC
	CHBSS1	Total PCBs	90	22,000	12	65			mg/kg OC
Calibre Systems, 2006	SI-05	Total PCBs	22.6	15,600	12	65			mg/kg OC
	SI-05	Total PCBs	353	15,600			130	1,000	µg/kg DW

2LAET = Puget Sound second lowest apparent effects threshold
CSL = Washington State Sediment Management Standard, Sediment Impact Zone Maximum Level and Sediment Cleanup Screening Level
DW = Dry Weight Normalized
LAET = Puget Sound lowest apparent effects threshold
OC = Organic Carbon Normalized
SQS = Washington State Sediment Management Standards, Marine Sediment Quality Standard

Lower Duwamish Waterway
Early Action Area 7
Table 3: Regulatory Database Listings for Identified Facilities of Potential Concern

Facility	Address	Industrial Stormwater General Permit	UST list (#UST/Status)	LUST list (#Reported Release/Status)	Hazardous Waste Facility (RCRA SITE ID)	CSCSL	NPDES and State Waste Discharge
Boeing Developmental Center	9725 East Marginal Way South, Tukwila	SO3000343D	Not Listed	Not Listed	WAD093639946 Discharge Authorization #526-04	Site ID 4581384	Not Listed
Boeing Military Flight Center	10002 East Marginal Way South, Tukwila	SO3000150D	Not Listed	Not Listed	WAD988475943 (Inactive as of 12/31/1996) Discharge Authorization #363-02	Not Listed	Not Listed
King County International Airport	7277 Perimeter Road South, Seattle	SO3000343D	5 closed	2 Reported Cleaned Up	WAD980986848 (For Airport Maintenance: 6518 Ellis Ave South) Discharge Authorization #4109-01	Not Listed	Not Listed
Associated Grocers, Inc.	3301 South Norfolk Street, Seattle	SO3002040D	2 operational	2 Cleanup Started	WAD007942535 Discharge Authorization #732-01	Site ID 73338176	Not Listed
Northwest Auto Wrecking	10230 East Marginal Way South, Tukwila	SO000961D	Not Listed	Not Listed	Not Listed	Site ID 2287	Not Listed
Affordable Auto Wrecking	9802 Martin Luther King Jr. Way South, Seattle	SO000843D	Not Listed	Not Listed	Not Listed	Site ID 7163112	Not Listed
Arco Gas Station	9840 Martin Luther King Jr. Way South, Seattle	Not Listed	26 removed	1 Cleanup Started	Not Listed	Site ID 29429665	Not Listed

Key:
NPDES: National Pollutant Discharge Elimination System
UST List: Ecology Underground Storage Tank List
LUST list: Ecology Leaking Underground Storage Tank List
CSCSL: Ecology Suspected and Confirmed Contaminated Sites List
RCRA: Resource Conservation and Recovery Act

Table 4: In-line Sediment Sampling Locations

Basin	Sample Location ID	Date	Location	Description	Sample ID
Norfolk	MH1[e]	10/01/03	Norfolk-MLK Way SD 36" outfall to ditch	Sediment from hole at buried outfall	MH1-100103-N
Norfolk	MH2[e]	10/01/03	Norfolk-MLK Way SD 36" outfall to ditch	Duplicate of MH1	MH2-100103-N
Norfolk	MH3[e]	10/01/03	MH adjacent to wash pad at 9892 40th Ave S (36")	Hyster	MH3-100103-N2
Norfolk	MH3[e]	03/16/05	MH adjacent to wash pad at 9892 40th Ave S (36")	Hyster	MH3-031605
Norfolk	MH4[e]	10/01/03	MH ML King Jr Wy S and driveway, NW corner		MH4-100103-N2
Norfolk	MH4[e]	03/16/05	MH ML King Jr Wy S and driveway, NW corner		MH4-031605
Norfolk	MH5-N2[e]	10/01/03	MH SE corner 9901 MLK Jr Way S		MH5-100103-N2
Norfolk	MH5-N3	10/01/03	Black sand/grit stored at 9901 MLK Jr Way S	Coluccio yard	MH5-100103-N3
Norfolk	MH6	10/01/03	Norfolk ditch opp. fueling pad at 9892 40th Ave S		MH6-100103-N1
Norfolk	MH7[e]	10/02/03	MH ML King Jr Wy S and S Norfolk St, NE corner		MH7-100203-N1
Norfolk	MH7[e]	03/16/05	MH ML King Jr Wy S and S Norfolk St, NE corner		MH7-031605
Norfolk	Norfolk20	09/30/04	WSDOT pond: first cell		Norfolk20-093004
Norfolk	Norfolk21	09/30/04	WSDOT pond: head of swale (at outlet SPU drain)		Norfolk21-093004

Source: SPU 2005

Lower Duwamish Waterway
Early Action Area 7

Table 5
Boeing Developmental Center
SWMU-17 (Former DC-05 Waste Oil Tank) May 2006 Groundwater Sampling Results

	BDC-05-2	BDC-05-3	BDC-05-4	BDC-05-5	BDC-05-7
VOA (µg/L)					
cis-1,2-Dichloroethene	1.3	9.5	1.6	U	10
1,1,1-Trichloroethane	5.8	U	U	U	4.1
Trichloroethene	31	6.4	U	1.4	23
Tetrachloroethene	30	3.2	U	U	29
1,1-Dichloroethane	U	1.2	U	U	1.7
Total Metals (mg/L)					
Aluminum	0.1	1.66	0.09	0.95	0.73
Arsenic	0.001	0.007	0.018	0.009	0.002
Barium	0.015	0.024	0.018	0.035	0.025
Calcium	27.7	22.5	16.3	42.6	23.5
Cobalt	U	0.008	U	0.084	0.01
Copper	0.004	0.01	0.002	0.014	0.018
Iron	10.6	25.4	24	17	4.97
Lead	U	U	U	0.002	U
Magnesium	13	8.77	6.94	12.6	10.6
Molybdenum	U	U	U	0.008	U
Nickel	U	U	0.01	0.01	0.01
Zinc	U	0.009	0.008	0.042	0.006
Dissolved Metals (mg/L)					
Aluminum	U	U	U	U	0.12
Arsenic	0.001	U	U	U	U
Barium	0.012	0.008	0.006	0.01	0.011
Calcium	26.8	21.8	15.5	39.2	23.7
Cobalt	U	U	U	U	U
Copper	U	0.003	U	U	0.009
Iron	8.07	3.58	2.54	0.07	0.14
Magnesium	13.2	8.86	7	11.8	10.8
Zinc	U	U	U	0.01	U

Table 6: Summary of EAA-7 Stormwater Outfalls, Boeing Developmental Center

Name	Outfall Diameter (Inches)	Latitude (Degrees, Minutes, Seconds)	Longitude (Degrees, Minutes, Seconds)	Description
Discharge Point DC17	15	47, 30, 37	122, 17, 51	Drains a small roof portion of the southwest corner of building 9-101, half the roof of each of the 9-140 and 9-130 buildings, and the parking and driving areas around portions of these buildings.
Discharge Point DC4	8	47, 30, 47	122, 17, 51	Drains the southwest corner of the roof of building 9-140 and the pavement and planted areas around this portion of the building.
Discharge Point DC16	5	47, 30, 46	122, 17, 51	Drains a small roof portion of the southwest corner of building 9-140 and the pavement and planted areas around this part of the building.
Discharge Point DC3	6	47, 30, 46	122, 17, 49	Drains half of the roof of each of buildings 9-140 and 9-130, the parking and driving areas around each of those buildings, and a small planted employee-use park-like area.
Discharge Point DC2	24	47, 30, 45	122, 17, 48	Drains half of the roof of building 9-101, all of building 9-110, and the parking and driving areas surrounding applicable portions of those buildings.

Source: Boeing 2003a