Lower Duwamish Waterway Group

Port of Seattle · City of Seattle · King County · The Boeing Company

TASK 2: SITE CHARACTERIZATION – TECHNICAL MEMORANDA:

4. SUMMARY OF DATA IN THE DATABASE

5. GIS MAPS OF STATION LOCATIONS AND CHEMISTRY

Prepared for

The U.S. Environmental Protection Agency
Region 10
Seattle, WA

The Washington State Department of Ecology
Northwest Field Office
Bellevue, WA

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Acronyms

DGPS	differential global positioning system
DQO	data quality objective
GIS	geographic information system
LDW	Lower Duwamish Waterway
MTCA	Model Toxics Control Act
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RI	remedial investigation
SAP	sampling and analysis plan
SOW	statement of work

1.0 Introduction

The primary goal for Phase 1 of the Lower Duwamish Waterway Remedial Investigation (LDW RI) is to quickly identify candidate sites for early remedial actions. Sites will be identified using a risk-based framework consisting of scoping-phase human health and ecological risk assessments. Data necessary for these risk assessments are being compiled as part of Task 2 (Site Characterization). As described in the first Task 2 deliverable of the LDW RI (Windward Environmental 2001a), a relational database has been compiled for some of the data. Specifically, the database contains data of the following four types:

1. Sediment chemistry
2. Tissue chemistry
3. Benthic invertebrate community
4. Sediment toxicity tests

This document includes the fourth (Summary of data in the database) and fifth (GIS maps of stations and chemical distributions in the LDW) deliverables specified in Task 2.[1] The last Task 2 deliverable will be delivered on July 2, 2001.

Section 2 of this document lists the datasets that are included in the database and provides a brief summary of the available data. Detailed summaries are provided in separate appendices for each data type. Section 3 of this document provides a brief description of each of the attached GIS maps.

2.0 Task 2, Deliverable 4: Summary of Data in the Database

The second Task 2 deliverable (List of reports for historical site characterization) included tables for each of the four data types to be loaded in the database. The tables included report title, year published, survey description, sampling description, document number, sponsor, and preparer. Excerpts of each table are provided below (Tables 2-1 to 2-4), listing the status of each dataset in the database compiled for this project.

[1] 1) criteria for evaluating and accepting data sets, 2) list of reports for historical site characterization, 3) conceptual design for the database, 4) summary of environmental data in the database, 5) GIS-based maps of stations and chemical distributions within the LDW, 6) electronic copy of the final database and GIS files

Table 2-1. Sediment chemistry datasets considered for inclusion in the database

Report Title	Year Published	Year Conducted	Sponsor	Status in Database	Event Codes in Database
Duwamish/Diagonal Cleanup Study-Draft	2000	1994-1996	Elliott Bay/ Duwamish Restoration Program Panel (EBDRP)	Loaded	Duw/Diag-1 Duw/Diag-1.5 Duw/Diag-2
Norfolk CSO Sediment Remediation Project Five-Year Monitoring. Annual Monitoring Report- Year One, April 2000	2000	2000	EBDRP	Loaded	Norfolk-monit3
Norfolk Sediment Cleanup Study - Supplemental Nearshore Sampling	2000	2000	EBDRP	Loaded	Norfolk-monit2b
Sediment Quality in Puget Sound. Year 2 – Central Puget Sound	2000	1998	NOAA and Ecology	Loaded	PSAMP/NOAA98
Dredge Material Characterization Duwamish Yacht Club	1999	1999	Peratrovich, Notingham & Drage	Not loaded (sub-surface)	none
King County Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay - Sediment Task	1999	1997	King County Department of Natural Resources (KCDNR)	Loaded	KC WQA
Norfolk CSO Sediment Remediation Project, Five Year Monitoring Program, Six-month Post-construction Monitoring Report, October 1999	1999	1999	EBDRP	Loaded	Norfolk-monit2a
Norfolk CSO Sediment Remediation Project, Five Year Monitoring Program - April 1999 Monitoring Baseline Report	1999	1999	EBDRP	Loaded	Norfolk-monit1
Sediment Sampling and Analysis James Hardie Gypsum Inc.	1999	1998-1999	James Hardie Gypsum Inc.	Not loaded (sub-surface and material was dredged)	none
Site Inspection Report: Lower Duwamish River (RK 2.5-11.5) Seattle, Washington Volume 1-Report and Appendices	1999	1998	EPA	Loaded	EPA SI
Duwamish Waterway Phase I Site Characterization Report	1998	1997	The Boeing Company	Loaded	Boeing SiteChar
Dredge Material Characterization Hurlen Construction Company & Boyer Alaska Barge Lines Berthing Area	1998	1998	Hurlen Const. Company and Boyer Alaska Barge Lines	Not loaded (sub-surface and material was dredged)	none
Duwamish Waterway Sediment Characterization Study Report	1998	1997	NOAA	Loaded	NOAA SiteChar
Post-bioassay sediment sampling at Chelan, Connecticut, and Hanford CSO outfalls	1997	1996	KCDNR	Loaded	KC CSO 96
Seaboard Lumber Site, Phase II Site Investigation	1997	1996	City of Seattle and EBDRP	Loaded	Seaboard-Ph2
Proposed Dredging of Slip No. 4, Duwamish River, Seattle, WA	1996	1995	Crowley Marine Services	Not loaded (sub-surface and material was dredged)	none

Report Title	Year Published	Year Conducted	Sponsor	Status in Database	Event Codes in Database
1996 USACE Duwamish O&M	1996	1996	US Army Corps of Engineers (ACOE)	Not loaded (sub-surface and material was dredged)	none
Norfolk CSO Sediment Cleanup Study, EBDRP	1996	1994-1995	KCDNR/ EBDRP	Loaded	Norfolk-cleanup1 Norfolk-cleanup2 Norfolk-cleanup3
RCRA Facility Investigation Duwamish Waterway Sediment Investigation, Plant 2, October 1996	1996	1994-1996	The Boeing Company	Loaded	Plant 2 RFI-1 Plant 2 RFI-2a Plant 2 RFI-2b
Rhône-Poulenc RCRA Facility Investigation (RFI) for the Marginal Way Facility, Round 3 data and sewer sediment technical memorandum	1996	1996	Rhône-Poulenc	Not loaded (uncertain coordinates)	none
Rhône-Poulenc RCRA Facility Investigation (RFI) for the Marginal Way Facility. Volume 1: RFI results and conclusions	1995	1994	Rhône-Poulenc	Loaded	Rhone-Poulenc RFI-1 Rhone-Poulenc RFI-2
Lone Star Northwest and James Hardie Gypsum-Kaiser Dock upgrade	1995	1995	Lone Star Northwest and James Hardie Gypsum	Not loaded (sub-surface and material was dredged)	none
Sediment sampling at Chelan, Connecticut, and Hanford CSO outfalls	1995	1995	KCDNR	Loaded	KC CSO 95
Harbor Island Remedial Investigation Report (Part 2-Sediment)	1993	1991	EPA	Loaded	Harbor Island RI
Lonestar Northwest - West Terminal U.S. ACOE – Seattle	1992	1992	Lone Star Northwest	Not loaded (sub-surface and material was dredged)	none
PSDDA Bioassays for Duwamish Channel Sediments (O&M)	1991	1991	ACOE	Not loaded (sub-surface and material was dredged)	none
Sediment Sampling Analysis Brown and Morton Properties Duwamish Waterway	1991	1991	Brown Morton Properties	Not loaded (sub-surface and material was dredged)	none
South Park Marina maintenance dredging, 1991	1991	1991	South Park Marina	Not loaded (sub-surface and material was dredged)	none
Duwamish River Maintenance Dredge, Phase 1	1990	1990	ACOE	Not loaded (sub-surface and material was dredged)	none

Table 2-2. Tissue chemistry datasets considered for inclusion in the database

Report Title	Year Published	Year Conducted	Sponsor	Status in Database	Event Codes in Database
King County Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay - Appendix B2, B3, & B4 Human Health, Wildlife, and Aquatic Life Risk Assessments	1999	1997	KCDNR	Loaded	KC WQA
Waterway Sediment Operable Unit Harbor Island Superfund Site Assessing Human Health Risks from the Consumption of Seafood	1999	1998	Port of Seattle	Loaded	WSOU
Puget Sound Ambient Monitoring Program – annual sampling	2001	1992-1998	Puget Sound Water Quality Action Team	Loaded	PSAMP-fish
Elliott Bay/Duwamish River Fish Tissue Investigation	1995-1996	1995	Port of Seattle	Loaded	EVS 95
NOAA chinook salmon bioaccumulation study	1993	1989-1990	NOAA	Loaded	NOAA-salmon

Table 2-3. Benthic macroinvertebrate datasets considered for inclusion in the database

Report Title	Year Published	Year Conducted	Sponsor	Status in Database
Sediment Quality in the Puget Sound	2000	1998	NOAA and Ecology	Loaded in SEDQUAL format only
Alternative Dredge Disposal Sites	1999	1998	Port of Seattle	Epibenthic analysis not yet completed
King County Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay - Benthic Task	1999	1997	KCDNR	Loaded in SEDQUAL format only
Duwamish Coastal America Restoration and Reference Sites: Results from 1997 monitoring studies	1998	1997	Coastal America	Not loaded (permission not received)
Duwamish Coastal America Restoration and Reference Sites: Results from 1996 monitoring studies	1997	1996	Coastal America	Not loaded (permission not received)
Duwamish Coastal America Restoration and Reference Sites: Results from 1995 monitoring studies	1996	1995	Coastal America	Not loaded (permission not received)

Table 2-4. Sediment toxicity datasets considered for inclusion in the database

Report Title	Year Published	Year Conducted	Sponsor	Status in Database
Sediment Quality in the Puget Sound	2000	1998	NOAA and Ecology	Loaded in SEDQUAL format
Duwamish/Diagonal Cleanup Study-Draft	2000	1996	KCDNR	Loaded in SEDQUAL format
Sediment sampling and analysis - James Hardie Gypsum Inc.	1999	1998-1999	James Hardie Gypsum Inc.	Not loaded (material was dredged)
Dredge Material Characterization Hurlen Construction Company & Boyer Alaska Barge Lines Berthing Area	1998	1998	Hurlen Construction Company and Boyer Alaska Barge Lines	Not loaded (material was dredged)
Hanford, Chelan, Connecticut sediment results	1996	1996	KCDNR	Loaded in SEDQUAL format
Proposed Dredging of Slip No. 4, Duwamish River, Seattle, WA	1996	1995	Crowley Marine Services	Not loaded (material was dredged)
1996 USACE Duwamish O&M	1996	1996	ACOE	Not loaded (material was dredged)
Lone Star Northwest and James Hardie Gypsum-Kaiser Dock upgrade	1995	1995	Lone Star Northwest and James Hardie Gypsum	Not loaded (material was dredged)
Lonestar Northwest - West Terminal USACE – Seattle	1992	1992	Lone Star Northwest	Not loaded (material was dredged)
South Park Marina maintenance dredging, 1991	1991	1991	South Park Marina	Not loaded (material was dredged)
Sediment Sampling Analysis Brown and Morton Properties Duwamish Waterway	1991	1991	Brown Morton Properties	Not loaded (material was dredged)
PSDDA Bioassays for Duwamish Channel Sediments (O&M)	1991	1991	ACOE	Not loaded (material was dredged)
Duwamish River Maintenance Dredge, Phase 1	1990	1990	ACOE	Not loaded (material was dredged)

2.1 SEDIMENT CHEMISTRY

Surface[2] sediment chemistry data from 25 separate sampling events have been added to the LDWG database (Table 2-1). Subsurface sediment chemistry data from events which included

[2] For the purposes of the Phase 1 RI, surface sediment samples are those collected from the top 15 cm of the sediment horizon. Sediment samples that include less than 15 cm of sediment are included; samples that include

the collection of both surface and subsurface samples are also included in the database. The number of samples included in each event is summarized in Table 2-5. Additional summary information for each event is provided in Appendix A. The following types of information are provided for each sampling event:

- A table showing the detection frequency and concentration ranges for each parameter
- A figure showing the collection location for each sample
- A summary of the data validation results
- A report describing how data were transformed from the original source to the LDWG database

The chemistry tables include all data that have been loaded in the database, including data from sediment samples in sediment horizons that were subsequently dredged or remediated. The latter data are excluded from the exposure assessment for the scoping-phase human health risk assessment for this project (Windward Environmental 2001b), but they are included here for the sake of completeness. Data from sampling events that included only the collection of sub-surface sediment samples have not been added to the database at this time, but will be added at a future date.

Table 2-5. Number of samples for each Duwamish sediment sampling event that have been loaded to the database

EventName	Number of samples analyzed	Number of surface sediment samples (0-15 cm)	Number of subsurface sediment samples (>15 cm)	Number of Sediment Porewater Samples
Norfolk-monit1	4	4	0	0
Norfolk-monit2a	8	8	0	0
Norfolk-monit2b	3	3	0	0
Norfolk-monit3	8	8	0	0
PSAMP/NOAA98	3	3	0	0
EPA SI	348	300	33	15
KC WQA	57	57	0	0
Boeing SiteChar	91	91	0	0
NOAA SiteChar	328	328	0	0
KC CSO 96	8	0	0	0
KC CSO 95	20	20	0	0
Norfolk-cleanup1	24	21	3	0
Norfolk-cleanup2	33	6	27	0
Norfolk-cleanup3	16	16	0	0

the top 15 cm, but also include deeper sediment in the same sample are not included here because analyses were not performed separately on the two horizons (<15 cm and >15 cm).

EventName	Number of samples analyzed	Number of surface sediment samples (0-15 cm)	Number of subsurface sediment samples (>15 cm)	Number of Sediment Porewater Samples
Duw/Diag-1	52	40	12	0
Duw/Diag-1.5	12	12	0	0
Duw/Diag-2	47	10	37	0
Seaboard-Ph2	20	20	0	0
Rhone-Poulenc RFI-1	7	7	0	0
Rhone-Poulenc RFI-2	7	7	0	0
Plant 2 RFI-1	88	66	22	0
Plant 2 RFI-2a	54	54	0	0
Plant 2 RFI-2b	82	38	44	0
Harbor Island RI	57	54	0	3

Note: Sample counts do not include field duplicates. Results for field duplicate pairs are presented as averages in the Appendix A summary tables.

2.2 Tissue Chemistry

Tissue chemistry data from five sampling events have been added to the LDWG database (Table 2-2). Summary information for each event is provided in Appendix B. The following types of information are provided for each sampling event:

- A table showing the detection frequency and concentration ranges for each parameter
- A summary of the data validation results
- A report describing how data were transformed from the original source to the LDWG database

2.3 Benthic Macroinvertebrate Community

Benthic macroinvertebrate data from two sampling events have been loaded in SEDQUAL (Table 2-3). These data have not been added to the LDWG database, but they will be added at a future date. Appendix C provides a summary of the benthic invertebrate results for the NOAA/Ecology (Sediment Quality in Puget Sound) and King County Water Quality Assessment data sets.

2.4 Sediment Toxicity Tests

Sediment toxicity test data from three surface sediment sampling events have been loaded in SEDQUAL (Table 2-4). These data have not been added to the LDWG database, but they will be added at a future date. Most of the sampling events listed in Table 4 involved

characterization of sediment that has subsequently been dredged. These data are not summarized in this report. Appendix D provides a summary of toxicity test results for the NOAA/Ecology (Sediment Quality in Puget Sound), King County CSO, and Duwamish/Diagonal data sets.

3.0 Task 2, Deliverable 5: GIS Maps

The Duwamish RI will make extensive use of the project GIS for both analysis and map production. This deliverable is intended to provide examples of the types of maps that can be produced. It is not intended to be an exhaustive catalog of all the maps that may be produced in the future.

The attached maps are of four types:

- Base map, showing outline of LDW and other prominent landmarks
- Sediment collection locations, surface and subsurface
- Chemical concentrations in surface sediments

3.1 BASE MAP

The base map is attached to this document as a Adobe pdf file titled "**LDW base map.pdf**."

3.2 SEDIMENT COLLECTION LOCATIONS

Four separate maps were created to show surface sediment collection locations. The label for each location is the LocationNum in the database. The LocationNum is a unique numeric value that is used as a primary key field in the database. Table 3-1 lists the LocationNum from the GIS maps along with the corresponding LocationName and the EventName.

The four maps are attached to this document as Adobe pdf files entitled: 1) **LDW surface sed A.pdf**, 2) **LDW surface sed B.pdf**, 3) **LDW surface sed C.pdf**, and 4) **LDW surface sed D.pdf**, for reaches A, B, C, and D, respectively. The reaches are those defined by EPA in their Site Inspection of the LDW.

A single map was created to portray subsurface sediment collection locations.

3.3 CHEMICAL CONCENTRATIONS IN SURFACE SEDIMENTS

Mercury was selected to demonstrate two different methods for portraying chemical concentrations in surface sediment. Two different maps were produced and are attached to this document as Adobe pdf files. The file **LDW mercury point.pdf** shows each surface sediment collection location as a symbol of one of three colors relative to Washington Sediment Management Standards. The file **LDW mercury thiessen.pdf** shows the same data, but represented as Thiessen polygons. Both maps exclude data from samples that have been subsequently dredged or remediated, as described in Windward Environmental (2001b).

Table 3-1. LocationNum, LocationName, and EventName used in GIS maps of surface sediment sampling locations

LocationNum	EventName	LocationName
18	NOAA SiteChar	CH0001
19	NOAA SiteChar	CH0002
20	NOAA SiteChar	CH0003
21	NOAA SiteChar	CH0004
22	NOAA SiteChar	CH0005
23	NOAA SiteChar	CH0006
24	NOAA SiteChar	CH0007
25	NOAA SiteChar	CH0009
26	NOAA SiteChar	CH0010
27	NOAA SiteChar	CH0011
28	NOAA SiteChar	CH0012
29	NOAA SiteChar	CH0013
30	NOAA SiteChar	CH0014
31	NOAA SiteChar	CH0016
32	NOAA SiteChar	CH0017
33	NOAA SiteChar	CH0018
34	NOAA SiteChar	CH0019
35	NOAA SiteChar	CH0020
36	NOAA SiteChar	CH0021
37	NOAA SiteChar	CH0022
38	NOAA SiteChar	CH0023
39	NOAA SiteChar	CH0024
40	NOAA SiteChar	CH0027
41	NOAA SiteChar	CH0028
42	NOAA SiteChar	CH0029
43	NOAA SiteChar	CH0030
44	NOAA SiteChar	CH0031
45	NOAA SiteChar	CH0032
46	NOAA SiteChar	CH1033
47	NOAA SiteChar	CH1034
48	NOAA SiteChar	CH1035
49	NOAA SiteChar	CH1036
50	NOAA SiteChar	CH1037
51	NOAA SiteChar	CH1038
52	NOAA SiteChar	CH1039
53	NOAA SiteChar	CH1040
54	NOAA SiteChar	CH1041
55	NOAA SiteChar	CH1043
56	NOAA SiteChar	EIT044
57	NOAA SiteChar	EIT045
58	NOAA SiteChar	EIT046
59	NOAA SiteChar	EIT047
60	NOAA SiteChar	EIT048
61	NOAA SiteChar	EIT049
62	NOAA SiteChar	EIT051
63	NOAA SiteChar	EIT052
64	NOAA SiteChar	EIT053
65	NOAA SiteChar	EIT054
66	NOAA SiteChar	EIT055
67	NOAA SiteChar	EIT056
68	NOAA SiteChar	EIT057
69	NOAA SiteChar	EIT059
70	NOAA SiteChar	EIT060
71	NOAA SiteChar	EIT061
72	NOAA SiteChar	EIT062
73	NOAA SiteChar	EIT063
74	NOAA SiteChar	EIT064
75	NOAA SiteChar	EIT066
76	NOAA SiteChar	EIT067
77	NOAA SiteChar	EIT068
78	NOAA SiteChar	EIT069
79	NOAA SiteChar	EIT070
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87	NOAA SiteChar	EIT082
88	NOAA SiteChar	EIT083
89	NOAA SiteChar	EIT084
90	NOAA SiteChar	EIT085
91	NOAA SiteChar	EIT086
92	NOAA SiteChar	EIT087
93	NOAA SiteChar	EIT088
94	NOAA SiteChar	EIT089
95	NOAA SiteChar	EIT092
96	NOAA SiteChar	EIT094
97	NOAA SiteChar	EIT095

LocationNum	EventName	LocationName
98	NOAA SiteChar	EIT096
99	NOAA SiteChar	EST098
100	NOAA SiteChar	EST099
101	NOAA SiteChar	EST101
102	NOAA SiteChar	EST102
103	NOAA SiteChar	EST103
104	NOAA SiteChar	EST104
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106	NOAA SiteChar	EST106
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180	NOAA SiteChar	EST190
181	NOAA SiteChar	EST191
182	NOAA SiteChar	EST192
183	NOAA SiteChar	EST193
184	NOAA SiteChar	EST194
185	NOAA SiteChar	EST195

LocationNum	EventName	LocationName
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187	NOAA SiteChar	EST197
188	NOAA SiteChar	EST198
189	NOAA SiteChar	EST199
190	NOAA SiteChar	EST200
191	NOAA SiteChar	EST202
192	NOAA SiteChar	EST203
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211	NOAA SiteChar	EST227
212	NOAA SiteChar	EST228
213	NOAA SiteChar	EST229
214	NOAA SiteChar	EST230
215	NOAA SiteChar	EST231
216	NOAA SiteChar	EST232
217	NOAA SiteChar	EST233
218	NOAA SiteChar	WES234
219	NOAA SiteChar	WES235
220	NOAA SiteChar	WES236
221	NOAA SiteChar	WES237
222	NOAA SiteChar	WES238
223	NOAA SiteChar	WES239
224	NOAA SiteChar	WES240
225	NOAA SiteChar	WES241
226	NOAA SiteChar	WIT242
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245	NOAA SiteChar	WIT262
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268	NOAA SiteChar	WIT289
269	NOAA SiteChar	WIT290
270	NOAA SiteChar	WIT291
271	NOAA SiteChar	WIT292
272	NOAA SiteChar	WIT293
273	NOAA SiteChar	WIT294

LocationNum	EventName	LocationName
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275	NOAA SiteChar	WIT296
276	NOAA SiteChar	WIT297
277	NOAA SiteChar	WIT298
278	NOAA SiteChar	WIT299
279	NOAA SiteChar	WST300
280	NOAA SiteChar	WST301
281	NOAA SiteChar	WST302
282	NOAA SiteChar	WST303
283	NOAA SiteChar	WST304
284	NOAA SiteChar	WST305
285	NOAA SiteChar	WST306
286	NOAA SiteChar	WST308
287	NOAA SiteChar	WST309
288	NOAA SiteChar	WST310
289	NOAA SiteChar	WST311
290	NOAA SiteChar	WST312
291	NOAA SiteChar	WST313
292	NOAA SiteChar	WST314
293	NOAA SiteChar	WST315
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296	NOAA SiteChar	WST318
297	NOAA SiteChar	WST319
298	NOAA SiteChar	WST320
299	NOAA SiteChar	WST321
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310	NOAA SiteChar	WST333
311	NOAA SiteChar	WST334
312	NOAA SiteChar	WST335
313	NOAA SiteChar	WST337
314	NOAA SiteChar	WST338
315	NOAA SiteChar	WST339
316	NOAA SiteChar	WST340
317	NOAA SiteChar	WST341
318	NOAA SiteChar	WST342
319	NOAA SiteChar	WST344
320	NOAA SiteChar	WST345
321	NOAA SiteChar	WST346
322	NOAA SiteChar	WST347
323	NOAA SiteChar	WST348
324	NOAA SiteChar	WST349
325	NOAA SiteChar	WST350
326	NOAA SiteChar	WST351
327	NOAA SiteChar	WST352
328	NOAA SiteChar	WST353
329	NOAA SiteChar	WST354
330	NOAA SiteChar	WST356
331	NOAA SiteChar	WST357
332	NOAA SiteChar	WST358
333	NOAA SiteChar	WST359
334	NOAA SiteChar	WST362
335	NOAA SiteChar	WST363
336	NOAA SiteChar	WST364
337	NOAA SiteChar	WST365
338	NOAA SiteChar	WST366
339	NOAA SiteChar	WST367
340	NOAA SiteChar	WST368
341	NOAA SiteChar	WST370
342	NOAA SiteChar	WST371
343	NOAA SiteChar	WST372
344	NOAA SiteChar	WST373
345	NOAA SiteChar	WST374
350	KC WQA	DD-1
351	KC WQA	DD-2
352	KC WQA	DD-3
353	KC WQA	DD-4
354	KC WQA	DD-5
355	KC WQA	KI-1
356	KC WQA	KI-2
357	KC WQA	KI-3
358	KC WQA	KI-4
359	KC WQA	WQA8AVE
360	KC WQA	WQABRAN
361	KC WQA	WQAHAMM
362	KC WQA	WQAKELL
363	KC WQA	WQASOPK
367	Plant 2 RFI-1	SD-01001
368	Plant 2 RFI-1	SD-01003

LocationNum	EventName	LocationName
369	Plant 2 RFI-1	SD-04101
370	Plant 2 RFI-1	SD-04102
371	Plant 2 RFI-1	SD-04103
372	Plant 2 RFI-1	SD-04104
373	Plant 2 RFI-1	SD-04105
374	Plant 2 RFI-1	SD-04107
375	Plant 2 RFI-1	SD-04108
376	Plant 2 RFI-1	SD-04109
377	Plant 2 RFI-1	SD-04110
378	Plant 2 RFI-1	SD-04111
379	Plant 2 RFI-1	SD-04112
380	Plant 2 RFI-1	SD-04113
381	Plant 2 RFI-1	SD-04115
382	Plant 2 RFI-1	SD-04116
383	Plant 2 RFI-1	SD-04117
384	Plant 2 RFI-1	SD-04121
385	Plant 2 RFI-1	SD-04122
386	Plant 2 RFI-1	SD-04401
387	Plant 2 RFI-1	SD-04402
388	Plant 2 RFI-1	SD-04403
389	Plant 2 RFI-1	SD-04404
390	Plant 2 RFI-1	SD-04405
391	Plant 2 RFI-1	SD-04406
392	Plant 2 RFI-1	SD-04407
393	Plant 2 RFI-1	SD-04408
394	Plant 2 RFI-1	SD-04409
395	Plant 2 RFI-1	SD-04901
396	Plant 2 RFI-1	SD-04902
397	Plant 2 RFI-1	SD-04903
398	Plant 2 RFI-1	SD-04904
399	Plant 2 RFI-1	SD-04905
400	Plant 2 RFI-1	SD-04906
401	Plant 2 RFI-1	SD-04907
402	Plant 2 RFI-1	SD-04908
403	Plant 2 RFI-1	SD-04909
404	Plant 2 RFI-1	SD-04910
405	Plant 2 RFI-1	SD-04911
406	Plant 2 RFI-1	SD-04912
407	Plant 2 RFI-1	SD-04913
408	Plant 2 RFI-1	SD-04914
409	Plant 2 RFI-1	SD-04915
410	Plant 2 RFI-1	SD-04917
411	Plant 2 RFI-1	SD-04918
412	Plant 2 RFI-1	SD-04920
413	Plant 2 RFI-1	SD-04921
414	Plant 2 RFI-1	SD-04922
415	Plant 2 RFI-2a	SD-DUW01
416	Plant 2 RFI-2a	SD-DUW02
417	Plant 2 RFI-2a	SD-DUW03
418	Plant 2 RFI-2a	SD-DUW04
419	Plant 2 RFI-2a	SD-DUW05
420	Plant 2 RFI-2a	SD-DUW06
421	Plant 2 RFI-2a	SD-DUW07
422	Plant 2 RFI-2a	SD-DUW08
423	Plant 2 RFI-2a	SD-DUW09
424	Plant 2 RFI-2a	SD-DUW10
425	Plant 2 RFI-2a	SD-DUW11
426	Plant 2 RFI-2a	SD-DUW12
427	Plant 2 RFI-2a	SD-DUW13
429	Plant 2 RFI-2a	SD-DUW14
430	Plant 2 RFI-2a	SD-DUW15
431	Plant 2 RFI-2a	SD-DUW16
432	Plant 2 RFI-2a	SD-DUW17
433	Plant 2 RFI-2a	SD-DUW18
434	Plant 2 RFI-2a	SD-DUW19
435	Plant 2 RFI-2a	SD-DUW20
436	Plant 2 RFI-2a	SD-DUW21
437	Plant 2 RFI-2a	SD-DUW22
438	Plant 2 RFI-2a	SD-DUW23
439	Plant 2 RFI-2a	SD-DUW24
440	Plant 2 RFI-2a	SD-DUW25
441	Plant 2 RFI-2a	SD-DUW26
442	Plant 2 RFI-2a	SD-DUW27
443	Plant 2 RFI-2a	SD-DUW28
444	Plant 2 RFI-2a	SD-DUW29
445	Plant 2 RFI-2a	SD-DUW30
446	Plant 2 RFI-2a	SD-DUW31
447	Plant 2 RFI-2a	SD-DUW32
448	Plant 2 RFI-2a	SD-DUW33
449	Plant 2 RFI-2a	SD-DUW34
450	Plant 2 RFI-2a	SD-DUW35
451	Plant 2 RFI-2a	SD-DUW36
452	Plant 2 RFI-2a	SD-DUW37
453	Plant 2 RFI-2a	SD-DUW38
454	Plant 2 RFI-2a	SD-DUW39
455	Plant 2 RFI-2a	SD-DUW40
456	Plant 2 RFI-2a	SD-DUW41
457	Plant 2 RFI-2a	SD-DUW42

LocationNum	EventName	LocationName
458	Plant 2 RFI-2a	SD-DUW43
459	Plant 2 RFI-2a	SD-DUW44
460	Plant 2 RFI-2a	SD-DUW45
461	Plant 2 RFI-2a	SD-DUW46
462	Plant 2 RFI-2a	SD-DUW47
463	Plant 2 RFI-2a	SD-DUW48
464	Plant 2 RFI-2a	SD-DUW49
465	Plant 2 RFI-2a	SD-DUW50
466	Plant 2 RFI-2a	SD-DUW51
467	Plant 2 RFI-2a	SD-DUW52
468	Plant 2 RFI-2a	SD-DUW53
469	Plant 2 RFI-2a	SD-DUW54
470	Plant 2 RFI-2b	SD-DUW55
471	Plant 2 RFI-2b	SD-DUW56
472	Plant 2 RFI-2b	SD-DUW57
473	Plant 2 RFI-2b	SD-DUW58
474	Plant 2 RFI-2b	SD-DUW59
475	Plant 2 RFI-2b	SD-DUW60
476	Plant 2 RFI-2b	SD-DUW61
477	Plant 2 RFI-2b	SD-DUW62
478	Plant 2 RFI-2b	SD-DUW63
479	Plant 2 RFI-2b	SD-DUW64
480	Plant 2 RFI-2b	SD-DUW65
481	Plant 2 RFI-2b	SD-DUW66
482	Plant 2 RFI-2b	SD-DUW67
483	Plant 2 RFI-2b	SD-DUW68
484	Plant 2 RFI-2b	SD-DUW69
485	Plant 2 RFI-2b	SD-DUW70
486	Plant 2 RFI-2b	SD-DUW71
487	Plant 2 RFI-2b	SD-DUW72
488	Plant 2 RFI-2b	SD-DUW73
489	Plant 2 RFI-2b	SD-DUW74
490	Plant 2 RFI-2b	SD-DUW75
491	Plant 2 RFI-2b	SD-DUW76
492	Plant 2 RFI-2b	SD-DUW77
493	Plant 2 RFI-2b	SD-DUW78
494	Plant 2 RFI-2b	SD-DUW79
495	Plant 2 RFI-2b	SD-DUW80
496	Plant 2 RFI-2b	SD-DUW81
497	Plant 2 RFI-2b	SD-DUW82
498	Plant 2 RFI-2b	SD-DUW83
499	Plant 2 RFI-2b	SD-DUW84
500	Plant 2 RFI-2b	SD-DUW85
501	Plant 2 RFI-2b	SD-DUW86
502	Plant 2 RFI-2b	SD-DUW87
503	Plant 2 RFI-2b	SD-DUW88
504	Plant 2 RFI-2b	SD-DUW89
505	Plant 2 RFI-2b	SD-DUW90
506	Plant 2 RFI-2b	SD-DUW91
507	Plant 2 RFI-2b	SD-DUW92
508	Plant 2 RFI-2b	SD-DUW93
509	Plant 2 RFI-1	SD-SWY01
510	Plant 2 RFI-1	SD-SWY02
511	Plant 2 RFI-1	SD-SWY03
512	Plant 2 RFI-1	SD-SWY04
513	Plant 2 RFI-1	SD-SWY05
514	Plant 2 RFI-1	SD-SWY06
515	Plant 2 RFI-1	SD-SWY07
516	Plant 2 RFI-1	SD-SWY08
517	Plant 2 RFI-1	SD-SWY09
518	Plant 2 RFI-1	SD-SWY10
519	Plant 2 RFI-1	SD-SWY11
520	Plant 2 RFI-1	SD-SWY12
521	Plant 2 RFI-1	SD-SWY13
522	Plant 2 RFI-1	SS-SWY01
523	Plant 2 RFI-1	SS-SWY02
524	Plant 2 RFI-1	SS-SWY03
525	Plant 2 RFI-1	SS-SWY04
526	Plant 2 RFI-1	SS-SWY05
527	Plant 2 RFI-1	SS-SWY06
537	Harbor Island RI	K-02
538	Harbor Island RI	K-02-1
539	Harbor Island RI	K-03
540	Harbor Island RI	K-04
541	Harbor Island RI	K-05
542	Harbor Island RI	K-06
543	Harbor Island RI	K-07
544	Harbor Island RI	K-08
545	Harbor Island RI	K-10
546	Harbor Island RI	K-11
547	Harbor Island RI	K-12
548	Harbor Island RI	K-13
549	Harbor Island RI	E-01
550	Harbor Island RI	E-02
551	Harbor Island RI	E-03
552	Harbor Island RI	E-06
553	Harbor Island RI	E-07
554	Harbor Island RI	E-08

LocationNum	EventName	LocationName
555	Harbor Island RI	E-09
556	Harbor Island RI	E-11
557	Harbor Island RI	E-12
558	Harbor Island RI	E-13
559	Harbor Island RI	E-14
560	Harbor Island RI	E-15
561	Harbor Island RI	E-16
562	Harbor Island RI	E-17
563	Harbor Island RI	E-19
564	Harbor Island RI	E-20
565	Harbor Island RI	E-21
566	Harbor Island RI	E-22
567	Harbor Island RI	E-23
568	EPA SI	DR001
569	EPA SI	DR002
570	EPA SI	DR003
571	EPA SI	DR004
572	EPA SI	DR005
573	EPA SI	DR006
574	EPA SI	DR007
575	EPA SI	DR008
576	EPA SI	DR009
577	EPA SI	DR010
578	EPA SI	DR011
579	EPA SI	DR012
580	EPA SI	DR013
581	EPA SI	DR014
582	EPA SI	DR015
583	EPA SI	DR016
584	EPA SI	DR017
585	EPA SI	DR018
586	EPA SI	DR019
587	EPA SI	DR020
588	EPA SI	DR021
589	EPA SI	DR022
590	EPA SI	DR023
591	EPA SI	DR024
592	EPA SI	DR025
593	EPA SI	DR026
594	EPA SI	DR027
595	EPA SI	DR028
596	EPA SI	DR030
597	EPA SI	DR031
598	EPA SI	DR032
599	EPA SI	DR033
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603	EPA SI	DR037
604	EPA SI	DR038
605	EPA SI	DR039
606	EPA SI	DR040
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609	EPA SI	DR043
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612	EPA SI	DR046
613	EPA SI	DR047
614	EPA SI	DR048
615	EPA SI	DR049
616	EPA SI	DR050
617	EPA SI	DR051
618	EPA SI	DR052
619	EPA SI	DR053
620	EPA SI	DR054
621	EPA SI	DR055
622	EPA SI	DR056
623	EPA SI	DR057
624	EPA SI	DR058
625	EPA SI	DR059
626	EPA SI	DR060
627	EPA SI	DR061
628	EPA SI	DR062
629	EPA SI	DR063
630	EPA SI	DR064
631	EPA SI	DR065
632	EPA SI	DR066
633	EPA SI	DR067
634	EPA SI	DR068
635	EPA SI	DR069
636	EPA SI	DR070
637	EPA SI	DR071
638	EPA SI	DR072
639	EPA SI	DR073
640	EPA SI	DR074
641	EPA SI	DR075
642	EPA SI	DR076

LocationNum	EventName	LocationName
643	EPA SI	DR077
644	EPA SI	DR078
645	EPA SI	DR079
646	EPA SI	DR080
647	EPA SI	DR081
648	EPA SI	DR082
649	EPA SI	DR083
650	EPA SI	DR084
651	EPA SI	DR085
652	EPA SI	DR086
653	EPA SI	DR087
654	EPA SI	DR088
655	EPA SI	DR089
656	EPA SI	DR090
657	EPA SI	DR091
658	EPA SI	DR092
659	EPA SI	DR093
660	EPA SI	DR094
661	EPA SI	DR095
662	EPA SI	DR096
663	EPA SI	DR097
664	EPA SI	DR098
665	EPA SI	DR099
666	EPA SI	DR100
667	EPA SI	DR101
668	EPA SI	DR102
669	EPA SI	DR103
670	EPA SI	DR104
671	EPA SI	DR105
672	EPA SI	DR106
673	EPA SI	DR107
674	EPA SI	DR108
675	EPA SI	DR109
676	EPA SI	DR110
677	EPA SI	DR111
678	EPA SI	DR112
679	EPA SI	DR113
680	EPA SI	DR114
681	EPA SI	DR115
682	EPA SI	DR116
683	EPA SI	DR117
684	EPA SI	DR118
685	EPA SI	DR119
686	EPA SI	DR120
687	EPA SI	DR121
688	EPA SI	DR122
689	EPA SI	DR123
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691	EPA SI	DR125
692	EPA SI	DR126
693	EPA SI	DR127
694	EPA SI	DR128
695	EPA SI	DR129
696	EPA SI	DR130
697	EPA SI	DR131
698	EPA SI	DR132
699	EPA SI	DR133
700	EPA SI	DR134
701	EPA SI	DR135
702	EPA SI	DR136
703	EPA SI	DR137
704	EPA SI	DR138
705	EPA SI	DR139
706	EPA SI	DR140
707	EPA SI	DR141
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714	EPA SI	DR148
715	EPA SI	DR149
716	EPA SI	DR150
717	EPA SI	DR151
718	EPA SI	DR152
719	EPA SI	DR153
720	EPA SI	DR154
721	EPA SI	DR155
722	EPA SI	DR156
723	EPA SI	DR157
724	EPA SI	DR158
725	EPA SI	DR159
726	EPA SI	DR160
727	EPA SI	DR161
728	EPA SI	DR162
729	EPA SI	DR163
730	EPA SI	DR164

LocationNum	EventName	LocationName
731	EPA SI	DR165
732	EPA SI	DR166
733	EPA SI	DR167
734	EPA SI	DR168
735	EPA SI	DR169
736	EPA SI	DR170
737	EPA SI	DR171
738	EPA SI	DR172
739	EPA SI	DR173
740	EPA SI	DR174
741	EPA SI	DR175
742	EPA SI	DR176
743	EPA SI	DR177
744	EPA SI	DR178
745	EPA SI	DR179
746	EPA SI	DR180
747	EPA SI	DR181
748	EPA SI	DR182
749	EPA SI	DR183
750	EPA SI	DR184
751	EPA SI	DR185
752	EPA SI	DR186
753	EPA SI	DR187
754	EPA SI	DR188
755	EPA SI	DR189
756	EPA SI	DR190
757	EPA SI	DR191
758	EPA SI	DR192
759	EPA SI	DR193
760	EPA SI	DR194
761	EPA SI	DR195
762	EPA SI	DR196
763	EPA SI	DR197
764	EPA SI	DR198
765	EPA SI	DR199
766	EPA SI	DR200
767	EPA SI	DR201
768	EPA SI	DR202
769	EPA SI	DR203
770	EPA SI	DR204
771	EPA SI	DR205
772	EPA SI	DR206
773	EPA SI	DR207
774	EPA SI	DR208
775	EPA SI	DR209
776	EPA SI	DR210
777	EPA SI	DR211
778	EPA SI	DR212
779	EPA SI	DR213
780	EPA SI	DR214
781	EPA SI	DR215
782	EPA SI	DR216
783	EPA SI	DR217
784	EPA SI	DR218
785	EPA SI	DR219
786	EPA SI	DR220
787	EPA SI	DR221
788	EPA SI	DR222
789	EPA SI	DR223
790	EPA SI	DR224
791	EPA SI	DR225
792	EPA SI	DR226
793	EPA SI	DR227
794	EPA SI	DR228
795	EPA SI	DR229
796	EPA SI	DR230
797	EPA SI	DR231
798	EPA SI	DR232
799	EPA SI	DR233
800	EPA SI	DR234
801	EPA SI	DR235
802	EPA SI	DR236
803	EPA SI	DR237
804	EPA SI	DR238
805	EPA SI	DR239
806	EPA SI	DR240
807	EPA SI	DR241
808	EPA SI	DR242
809	EPA SI	DR243
810	EPA SI	DR244
811	EPA SI	DR245
812	EPA SI	DR246
813	EPA SI	DR247
814	EPA SI	DR248
815	EPA SI	DR249
816	EPA SI	DR250
817	EPA SI	DR251
818	EPA SI	DR252

LocationNum	EventName	LocationName
819	EPA SI	DR253
820	EPA SI	DR254
821	EPA SI	DR255
822	EPA SI	DR256
823	EPA SI	DR257
824	EPA SI	DR258
825	EPA SI	DR259
826	EPA SI	DR260
827	EPA SI	DR261
828	EPA SI	DR262
829	EPA SI	DR263
830	EPA SI	DR264
831	EPA SI	DR265
832	EPA SI	DR266
833	EPA SI	DR267
834	EPA SI	DR268
835	EPA SI	DR269
836	EPA SI	DR270
837	EPA SI	DR271
838	EPA SI	DR272
839	EPA SI	DR273
840	EPA SI	DR274
841	EPA SI	DR275
842	EPA SI	DR276
843	EPA SI	DR277
844	EPA SI	DR278
845	EPA SI	DR279
846	EPA SI	DR280
847	EPA SI	DR281
848	EPA SI	DR282
849	EPA SI	DR283
850	EPA SI	DR284
851	EPA SI	DR285
852	EPA SI	DR286
853	EPA SI	DR287
854	EPA SI	DR288
855	EPA SI	DR289
856	EPA SI	DR290
857	EPA SI	DR291
858	EPA SI	DR292
859	EPA SI	DR293
860	EPA SI	DR294
861	EPA SI	DR295
862	EPA SI	DR296
863	EPA SI	DR297
864	EPA SI	DR298
865	EPA SI	DR299
866	EPA SI	DR300
867	EPA SI	DR301
867	EPA SI	DR301
885	Boeing SiteChar	R1
886	Boeing SiteChar	R10
887	Boeing SiteChar	R11
888	Boeing SiteChar	R12
889	Boeing SiteChar	R13
890	Boeing SiteChar	R14
891	Boeing SiteChar	R15
892	Boeing SiteChar	R16
893	Boeing SiteChar	R17
894	Boeing SiteChar	R18
895	Boeing SiteChar	R19
896	Boeing SiteChar	R2
897	Boeing SiteChar	R20
898	Boeing SiteChar	R21
899	Boeing SiteChar	R22
900	Boeing SiteChar	R23
901	Boeing SiteChar	R24
902	Boeing SiteChar	R25
903	Boeing SiteChar	R26
904	Boeing SiteChar	R27
905	Boeing SiteChar	R28
906	Boeing SiteChar	R29
907	Boeing SiteChar	R3
908	Boeing SiteChar	R30
909	Boeing SiteChar	R31
910	Boeing SiteChar	R32
911	Boeing SiteChar	R33
912	Boeing SiteChar	R34
913	Boeing SiteChar	R35
914	Boeing SiteChar	R36
915	Boeing SiteChar	R37
916	Boeing SiteChar	R38
917	Boeing SiteChar	R39
918	Boeing SiteChar	R4
919	Boeing SiteChar	R40
920	Boeing SiteChar	R41
921	Boeing SiteChar	R42
922	Boeing SiteChar	R43

LocationNum	EventName	LocationName
923	Boeing SiteChar	R44
924	Boeing SiteChar	R45
925	Boeing SiteChar	R46
926	Boeing SiteChar	R47
927	Boeing SiteChar	R48
928	Boeing SiteChar	R49
929	Boeing SiteChar	R5
930	Boeing SiteChar	R50
931	Boeing SiteChar	R51
932	Boeing SiteChar	R52
933	Boeing SiteChar	R53
934	Boeing SiteChar	R54
935	Boeing SiteChar	R55
936	Boeing SiteChar	R56
937	Boeing SiteChar	R57
938	Boeing SiteChar	R58
939	Boeing SiteChar	R59
940	Boeing SiteChar	R6
941	Boeing SiteChar	R60
942	Boeing SiteChar	R61
943	Boeing SiteChar	R62
944	Boeing SiteChar	R63
945	Boeing SiteChar	R64
946	Boeing SiteChar	R65
947	Boeing SiteChar	R66
948	Boeing SiteChar	R67
949	Boeing SiteChar	R68
950	Boeing SiteChar	R69
951	Boeing SiteChar	R7
952	Boeing SiteChar	R70
953	Boeing SiteChar	R71
954	Boeing SiteChar	R72
955	Boeing SiteChar	R73
956	Boeing SiteChar	R74
957	Boeing SiteChar	R75
958	Boeing SiteChar	R76
959	Boeing SiteChar	R77
960	Boeing SiteChar	R78
961	Boeing SiteChar	R79
962	Boeing SiteChar	R8
963	Boeing SiteChar	R80
964	Boeing SiteChar	R81
965	Boeing SiteChar	R82
966	Boeing SiteChar	R83
967	Boeing SiteChar	R84
968	Boeing SiteChar	R85
969	Boeing SiteChar	R87
970	Boeing SiteChar	R86
971	Boeing SiteChar	R88
972	Boeing SiteChar	R9
973	Boeing SiteChar	REF-1
974	Boeing SiteChar	REF-2
975	Boeing SiteChar	REF-3
977	KC CSO 95	CH00
977	KC CSO 96	CH00
978	KC CSO 95	CH10E
979	KC CSO 95	CH10N
980	KC CSO 95	CH10S
981	KC CSO 95	CH20N
982	KC CSO 95	CH20S
982	KC CSO 96	CH20S
983	KC CSO 95	CN00
983	KC CSO 96	CN00
984	KC CSO 95	CN10N
984	KC CSO 96	CN10N
985	KC CSO 95	CN10S
986	KC CSO 95	CN10W
987	KC CSO 95	CN1C
988	KC CSO 95	CN20N
988	KC CSO 96	CN20N
989	KC CSO 95	CN20S
990	Duw/Diag-1	DUD001
991	Duw/Diag-1	DUD002
992	Duw/Diag-1	DUD003
993	Duw/Diag-1	DUD004
994	Duw/Diag-1	DUD005
995	Duw/Diag-1	DUD006
996	Duw/Diag-1	DUD007
997	Duw/Diag-1	DUD008
998	Duw/Diag-1	DUD009
999	Duw/Diag-1	DUD010
1000	Duw/Diag-1	DUD011
1001	Duw/Diag-1	DUD012
1001	Duw/Diag-2	DUD012
1002	Duw/Diag-1	DUD013
1003	Duw/Diag-1	DUD014
1004	Duw/Diag-1	DUD015
1005	Duw/Diag-1	DUD016

LocationNum	EventName	LocationName
1006	Duw/Diag-1	DUD017
1007	Duw/Diag-1	DUD018
1008	Duw/Diag-1	DUD019
1009	Duw/Diag-1	DUD020
1010	Duw/Diag-1	DUD021
1011	Duw/Diag-1	DUD022
1012	Duw/Diag-1	DUD023
1013	Duw/Diag-1	DUD024
1014	Duw/Diag-1	DUD025
1015	Duw/Diag-1	DUD026
1016	Duw/Diag-1	DUD027
1016	Duw/Diag-1.5	DUD027
1016	Duw/Diag-2	DUD027
1017	Duw/Diag-1	DUD028
1018	Duw/Diag-1	DUD029
1019	Duw/Diag-1	DUD030
1020	Duw/Diag-1	DUD031
1021	Duw/Diag-1	DUD032
1021	Duw/Diag-1.5	DUD032
1022	Duw/Diag-1	DUD033
1023	Duw/Diag-1	DUD034
1024	Duw/Diag-1	DUD035
1025	Duw/Diag-1.5	DUD036
1026	Duw/Diag-1.5	DUD037
1027	Duw/Diag-1.5	DUD038
1028	Duw/Diag-1.5	DUD039
1029	Duw/Diag-1.5	DUD040
1030	Duw/Diag-1.5	DUD041
1031	Duw/Diag-1.5	DUD042
1032	Duw/Diag-1.5	DUD043
1033	Duw/Diag-1.5	DUD044
1034	Duw/Diag-1.5	DUD045
1035	Duw/Diag-2	DUD200
1036	Duw/Diag-2	DUD201
1037	Duw/Diag-2	DUD202
1038	Duw/Diag-2	DUD203
1039	Duw/Diag-2	DUD204
1040	Duw/Diag-2	DUD205
1041	Duw/Diag-2	DUD206
1042	Duw/Diag-2	DUD207
1043	Duw/Diag-2	DUD208
1044	Duw/Diag-2	DUD209
1045	Duw/Diag-2	DUD250
1046	Duw/Diag-2	DUD251

LocationNum	EventName	LocationName
1047	Duw/Diag-2	DUD252
1048	Duw/Diag-2	DUD253
1049	Duw/Diag-2	DUD254
1050	Duw/Diag-2	DUD255
1051	Duw/Diag-2	DUD256
1052	Duw/Diag-2	DUD257
1053	Duw/Diag-2	DUD258
1054	Duw/Diag-2	DUD260
1055	Duw/Diag-2	DUD261
1057	KC CSO 95	HN00
1058	KC CSO 95	HN10N
1058	KC CSO 96	HN10N
1059	KC CSO 95	HN10S
1060	KC CSO 95	HN10W
1060	KC CSO 96	HN10W
1061	KC CSO 95	HN10C
1062	KC CSO 95	HN20N
1063	KC CSO 95	HN20S
1063	KC CSO 96	HN20S
1064	Norfolk-cleanup1	NFK001
1065	Norfolk-cleanup1	NFK002
1066	Norfolk-cleanup1	NFK003
1067	Norfolk-cleanup1	NFK004
1068	Norfolk-cleanup1	NFK005
1069	Norfolk-cleanup1	NFK006
1070	Norfolk-cleanup1	NFK007
1071	Norfolk-cleanup1	NFK008
1071	Norfolk-cleanup2	NFK008
1072	Norfolk-cleanup1	NFK009
1073	Norfolk-cleanup1	NFK010
1074	Norfolk-cleanup1	NFK011
1075	Norfolk-cleanup1	NFK012
1076	Norfolk-cleanup1	NFK013
1077	Norfolk-cleanup1	NFK014
1078	Norfolk-cleanup1	NFK015
1079	Norfolk-cleanup1	NFK016
1080	Norfolk-cleanup1	NFK017
1081	Norfolk-cleanup1	NFK018
1082	Norfolk-cleanup2	NFK201
1082	Norfolk-cleanup3	NFK201
1083	Norfolk-cleanup2	NFK202
1084	Norfolk-cleanup2	NFK203
1085	Norfolk-cleanup2	NFK204
1086	Norfolk-cleanup2	NFK205

LocationNum	EventName	LocationName
1087	Norfolk-cleanup2	NFK206
1089	Norfolk-cleanup3	NFK301
1090	Norfolk-cleanup3	NFK302
1091	Norfolk-cleanup3	NFK303
1092	Norfolk-cleanup3	NFK304
1093	Norfolk-cleanup3	NFK305
1094	Norfolk-cleanup3	NFK306
1095	Norfolk-cleanup3	NFK307
1096	Norfolk-cleanup3	NFK308
1097	Norfolk-cleanup3	NFK309
1098	Norfolk-cleanup3	NFK310
1099	Norfolk-cleanup3	NFK311
1100	Norfolk-cleanup3	NFK312
1101	Norfolk-cleanup3	NFK313
1102	Norfolk-cleanup3	NFK314
1103	Norfolk-cleanup3	NFK315
1104	Norfolk-cleanup1	NFKUPRIV1
1105	Norfolk-cleanup1	NFKUPRIV2
1106	Rhone-Poulenc RFI-1	A11-01
1106	Rhone-Poulenc RFI-2	A11-01
1107	Rhone-Poulenc RFI-1	A11-02
1107	Rhone-Poulenc RFI-2	A11-02
1108	Rhone-Poulenc RFI-1	A11-03
1108	Rhone-Poulenc RFI-2	A11-03
1109	Rhone-Poulenc RFI-1	A11-04
1109	Rhone-Poulenc RFI-2	A11-04
1110	Rhone-Poulenc RFI-1	A11-05
1110	Rhone-Poulenc RFI-2	A11-05
1111	Rhone-Poulenc RFI-1	A11-06
1111	Rhone-Poulenc RFI-2	A11-06
1112	Rhone-Poulenc RFI-1	A11-07
1112	Rhone-Poulenc RFI-2	A11-07
1113	Norfolk-monit1	NFK501
1114	Norfolk-monit1	NFK502
1115	Norfolk-monit1	NFK503
1116	Norfolk-monit1	NFK504
1117	Norfolk-monit2a	NFK501
1118	Norfolk-monit2a	NFK502
1119	Norfolk-monit2a	NFK503
1120	Norfolk-monit2a	NFK504
1121	Norfolk-monit2b	NFK501
1122	Norfolk-monit3	NFK502
1123	Norfolk-monit2b	NFK503
1124	Norfolk-monit3	NFK504
1125	Norfolk-monit2b	NFK505
1127	Seaboard-Ph2	SD-1
1128	Seaboard-Ph2	SD-2
1129	Seaboard-Ph2	SD-3
1130	Seaboard-Ph2	SD-4
1131	Seaboard-Ph2	SD-5
1132	Seaboard-Ph2	SD-6
1133	Seaboard-Ph2	SD-7
1134	Seaboard-Ph2	SD-8
1135	Seaboard-Ph2	SD-9
1136	Seaboard-Ph2	SD-10
1137	Seaboard-Ph2	SD-11
1138	Seaboard-Ph2	SD-12
1139	Seaboard-Ph2	SD-13
1140	Seaboard-Ph2	SD-14
1141	Seaboard-Ph2	SD-15
1142	Seaboard-Ph2	SD-16
1143	Seaboard-Ph2	SD-17
1144	Seaboard-Ph2	SD-18
1145	Seaboard-Ph2	SD-19
1146	Seaboard-Ph2	SD-20
1162	PSAMP/NOAA	203
1163	PSAMP/NOAA	204
1164	PSAMP/NOAA	205
1243	Norfolk-monit3	NFK501
1244	Norfolk-monit3	NFK503

Table 3.2 LocationNum, LocationName, and EventName used in GIS maps of subsurface sediment sampling locations

LocationNum	EventName	LocationName
364	Plant 2 RFI-1	SB-04117
365	Plant 2 RFI-1	SB-04118
366	Plant 2 RFI-1	SB-04119
367	Plant 2 RFI-2b	SD-01001
374	Plant 2 RFI-1	SD-04107
387	Plant 2 RFI-1	SD-04402
390	Plant 2 RFI-1	SD-04405
395	Plant 2 RFI-1	SD-04901
396	Plant 2 RFI-1	SD-04902
397	Plant 2 RFI-1	SD-04903
398	Plant 2 RFI-1	SD-04904
399	Plant 2 RFI-1	SD-04905
412	Plant 2 RFI-1	SD-04920
418	Plant 2 RFI-2b	SD-DUW04
420	Plant 2 RFI-2b	SD-DUW06
421	Plant 2 RFI-2b	SD-DUW07
427	Plant 2 RFI-2b	SD-DUW13
428	Plant 2 RFI-2b	SD-DUW13D
430	Plant 2 RFI-2b	SD-DUW15
431	Plant 2 RFI-2b	SD-DUW16
441	Plant 2 RFI-2b	SD-DUW26
443	Plant 2 RFI-2b	SD-DUW28
449	Plant 2 RFI-2b	SD-DUW34
454	Plant 2 RFI-2b	SD-DUW39
462	Plant 2 RFI-2b	SD-DUW47
466	Plant 2 RFI-2b	SD-DUW51
467	Plant 2 RFI-2b	SD-DUW52
468	Plant 2 RFI-2b	SD-DUW53
575	EPA SI	DR008
588	EPA SI	DR021
592	EPA SI	DR025
610	EPA SI	DR044
620	EPA SI	DR054
634	EPA SI	DR068
667	EPA SI	DR101
672	EPA SI	DR106

LocationNum	EventName	LocationName
678	EPA SI	DR112
703	EPA SI	DR137
737	EPA SI	DR171
772	EPA SI	DR206
786	EPA SI	DR220
790	EPA SI	DR224
812	EPA SI	DR246
835	EPA SI	DR269
850	EPA SI	DR284
995	Duw/Diag-1	DUD006
1009	Duw/Diag-1	DUD020
1016	Duw/Diag-2	DUD027
1045	Duw/Diag-2	DUD250
1046	Duw/Diag-2	DUD251
1047	Duw/Diag-2	DUD252
1048	Duw/Diag-2	DUD253
1049	Duw/Diag-2	DUD254
1050	Duw/Diag-2	DUD255
1051	Duw/Diag-2	DUD256
1052	Duw/Diag-2	DUD257
1053	Duw/Diag-2	DUD258
1054	Duw/Diag-2	DUD260
1055	Duw/Diag-2	DUD261
1056	Duw/Diag-2	DUD262
1071	Norfolk-cleanup2	NFK008
1072	Norfolk-cleanup1	NFK009
1072	Norfolk-cleanup2	NFK009
1088	Norfolk-cleanup2	NFK207

4.0 References

Windward Environmental. 2001a. Task 2: Site characterization – technical memoranda: 1. Criteria for evaluating and accepting data sets. 2. List of reports for historical site characterization 3. Conceptual design for database. Final, Version 7, May 10, 2001. Prepared for Lower Duwamish Waterway Group. Windward Environmental LLC, Seattle, WA.

Windward Environmental. 2001b. Task 3: Study design for scoping phase risk assessments: Conceptual model, exposure and toxicity assessment for scoping-phase human health risk assessment. Draft, Version 3, May 18, 2001. Prepared for Lower Duwamish Waterway Group. Windward Environmental LLC, Seattle, WA.

APPENDIX A

Sediment Chemistry

Appendix A: Sediment Chemistry

A.1 SUMMARY TABLES

The summary tables of surface sediment chemistry are attached to this document in the file called **sediment summary.pdf**.

The summary tables have the following titles:

Table A-01. Summary of surface sediment chemistry from Norfolk CSO five-year monitoring program-Post-backfill April 1999 (Norfolk-monit1)
Table A-02. Summary of surface (0-10 cm) sediment chemistry from Norfolk CSO five-year monitoring program-6-month post construction October 1999 (Norfolk-monit2a)
Table A-03. Summary of surface (0-2 cm) sediment chemistry from Norfolk CSO five-year monitoring program-6-month post construction October 1999 (Norfolk-monit2a)
Table A-04. Summary of surface sediment chemistry from Norfolk CSO five-year monitoring program-Supplemental sampling February 2000 (Norfolk-monit2b)
Table A-05. Summary of surface (0-10 cm) sediment chemistry from Norfolk CSO five-year monitoring program-12-month post construction April 2000 (Norfolk-monit3)
Table A-06. Summary of surface (0-2 cm) sediment chemistry from Norfolk CSO five-year monitoring program-12-month post construction April 2000 (Norfolk-monit3)
Table A-07. Summary of surface sediment chemistry from sediment quality monitoring in Puget Sound. Year 2- Central Puget Sound (PSAMP/NOAA98)
Table A-08. Summary of surface sediment chemistry from EPA Duwamish River Site Inspection (EPA SI)
Table A-09. Summary of subsurface sediment chemistry from EPA Duwamish River Site Inspection (EPA SI)
Table A-10. Summary of sediment porewater chemistry from EPA Duwamish River Site Inspection (EPA SI)
Table A-11. Summary of surface (0-2 cm) sediment chemistry from King County Water Quality Assessment (KC WQA)
Table A-12. Summary of surface (0-10 cm) sediment chemistry from King County Water Quality Assessment (KC WQA)
Table A-13. Summary of surface sediment chemistry from Phase I Site Characterization (Boeing SiteChar)
Table A-14. Summary of surface sediment chemistry from Duwamish Waterway Characterization chemistry report (NOAA SiteChar)
Table A-15. Summary of surface sediment chemistry from King County CSO sediment monitoring - 1996 (KC CSO 96)
Table A-16. Summary of surface sediment chemistry from King County CSO sediment monitoring - 1995 (KC CSO 95)
Table A-17. Summary of surface sediment chemistry from Norfolk CSO sediment cleanup study-Phase 1 Aug 1994 (Norfolk-cleanup1)
Table A-18. Summary of subsurface sediment chemistry from Norfolk CSO sediment cleanup study-Phase 1 Aug 1994 (Norfolk-cleanup1)
Table A-19. Summary of surface sediment chemistry from Norfolk CSO sediment cleanup study-Phase 2 Aug 1995 (Norfolk-cleanup2)
Table A-20. Summary of subsurface sediment chemistry from Norfolk CSO sediment cleanup study-Phase 2 Aug 1995 (Norfolk-cleanup2)

Table A-21. Summary of surface sediment chemistry from Norfolk CSO sediment cleanup study-Phase 3 Dec 1995 (Norfolk-cleanup3)
Table A-22. Summary of surface sediment chemistry from Duwamish/Diagonal CSO/SD site assessment-Phase 1 Aug 1994 (Duw/Diag-1)
Table A-23. Summary of subsurface sediment chemistry from Duwamish/Diagonal CSO/SD site assessment-Phase 1 Aug 1994 (Duw/Diag-1)
Table A-24. Summary of surface sediment chemistry from Duwamish/Diagonal CSO/SD site assessment-Phase 1.5 Nov 1995 (Duw/Diag-1.5)
Table A-25. Summary of surface sediment chemistry from Duwamish/Diagonal CSO/SD site assessment-Phase 2 May-Sep 1996 (Duw/Diag-2)
Table A-26. Summary of subsurface sediment chemistry from Duwamish/Diagonal CSO/SD site assessment-Phase 2 May-Sep 1996 (Duw/Diag-2)
Table A-27. Summary of surface sediment chemistry from Seaboard Lumber Phase 2 Site Investigation (Seaboard-Ph2)
Table A-28. Summary of surface sediment chemistry from Rhone-Poulenc RFI - Marginal Way Facility - Round 1 March 1994 (Rhone-Poulenc RFI-1)
Table A-29. Summary of surface sediment chemistry from Rhone-Poulenc RFI - Marginal Way Facility - Round 2 August 1994 (Rhone-Poulenc RFI-2)
Table A-30. Summary of surface sediment chemistry from Boeing Plant 2 RCRA Facility Investigation - sediment investigation Phase 1 Sep 1994-Aug 1995 (Plant 2 RFI-1)
Table A-31. Summary of subsurface sediment chemistry from Boeing Plant 2 RCRA Facility Investigation - sediment investigation Phase 1 Sep 1994-Aug 1995 (Plant 2 RFI-1)
Table A-32. Summary of surface sediment chemistry from Boeing Plant 2 RCRA Facility Investigation - sediment investigation Phase 2a Oct 1995 (Plant 2 RFI-2a)
Table A-33. Summary of surface sediment chemistry from Boeing Plant 2 RCRA Facility Investigation - sediment investigation Phase 2b Mar-Apr 1996 (Plant 2 RFI-2b)
Table A-34. Summary of subsurface sediment chemistry from Boeing Plant 2 RCRA Facility Investigation - sediment investigation Phase 2b Mar-Apr 1996 (Plant 2 RFI-2b)
Table A-35. Summary of surface sediment chemistry from Harbor Island Phase II RI (Harbor Island RI)
Table A-36. Summary of sediment porewater chemistry from Harbor Island Phase II RI (Harbor Island RI)

A.2 SAMPLE LOCATIONS

The surface and subsurface sediment collection locations are shown in the figures attached to this document. The figures are Adobe pdf files titled **"LDW surface sed locations.pdf"** and **"LDW subsurface sed locations.pdf".**

A.3 DATA VALIDATION SUMMARIES

Norfolk CSO five-year monitoring program – Twelve-month post construction (Norfolk-monit3; 2000): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional

scrutiny by the data user may be appropriate. Iron was detected in all method blanks; field results were qualified appropriately. All cadmium results were flagged because of high standard reference material recoveries. Aluminum and iron results were flagged because of high and low matrix spike recoveries, respectively. Bis(2-ethylhexyl)phthalate was detected in one method blank; the associated field results were flagged. Chlorobenzene results were flagged because of low surrogate and matrix spike recoveries. Twelve semivolatile organic compound matrix spike recoveries were outside the 50 – 150% QC limits; the associated sample results were flagged.

Norfolk CSO five-year monitoring program – Supplemental nearshore sampling (Norfolk-monit2b; 2000): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. Aluminum results were flagged because of high matrix spike recoveries. Magnesium and zinc results were flagged because of low (<50%) and very low (10%) matrix spike recoveries, respectively. Bis(2-ethylhexyl)phthalate and 1,4-dichlorobenzene were detected in one method blank; the associated field results were flagged. All chlorobenzene results were flagged because of low surrogate recoveries.

Norfolk CSO five-year monitoring program – Six-month post construction (Norfolk-monit2a; 1999): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. All matrix spike recoveries were within the 75 to 125% QC limits, except aluminum and silver. Sample results for aluminum and silver were flagged based on low and high matrix spike recoveries, respectively. Naphthalene and bis(2-ethylhexyl)phthalate were detected in the method blank; the associated field results were flagged. Chlorobenzene surrogate and matrix spike recoveries were below 50%; the associated field results were flagged. All results for semivolatile organic compounds were flagged based on standard reference material (SRM) and matrix spike recoveries outside QC limits. All results for bis(2-ethylhexyl)phthalate were flagged because of duplicate results outside data quality objectives for precision.

Norfolk CSO five-year monitoring program – Post-backfill (Norfolk-monit1; 1999): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. Iron was detected in the method blank; associated field samples with concentration less than 10x the method blank results were qualified as undetected. Cadmium sample results were flagged based on the high concentration detected in the SRM. Sample results for aluminum and manganese were flagged based on high and low matrix spike

recoveries, respectively. Semivolatile organic compounds associated with the acid fraction were flagged based on low surrogate recoveries. Eleven organic compounds were flagged based on SRM recoveries outside the 80 to 120% QC limits. All results for semivolatile organic compounds were flagged based on matrix spike recoveries outside QC limits.

Sediment quality in Puget Sound, Year 2 – Central Puget Sound (PSAMP; 1998): Results from this survey were not formally validated by outside validators, but an internal validation was performed. No data validation report was produced, but qualifiers were added to the database. Approximately 16% of the result records were qualified as estimated values. None of the results were qualified as unusable.

EPA Site Inspection report: Lower Duwamish River (EPA SI; 1998): Roy F. Weston, Inc. performed a data validation on all samples collected for the Site Inspection. Approximately 3,000 pages of QA/QC memoranda are available on the Internet at http://www.epa.gov/r10earth/offices/oec/duwamish/qaqc_memos_and_form_1s/index.htm. Approximately 16% of the detected values were qualified as estimates. None of the results were qualified as unusable.

King County combined sewer overflow water quality assessment for the Duwamish River and Elliott Bay (KC WQA; 1997): The QA review was conducted using the acceptance criteria established by Michael Kluck of Parametrix in Kirkland, WA. The King County Environmental Laboratory in Seattle, Washington performed the QA review and laboratory analyses. Methylmercury analysis was subcontracted to Frontier Geosciences Inc, in Seattle, Washington. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate.

Ammonia was detected in a method blank; associated results were qualified appropriately. Antimony results were flagged due to low matrix spike and SRM recoveries. Sample results for aluminum and iron were flagged based on high and low matrix spike recoveries, respectively. Benzo(a)anthracene and bis(2-ethylhexyl)phthalate were detected in one method blank; the associated field results were flagged. Semivolatile organic compounds associated with the base/neutral fraction and chlorobenzene were flagged based on low surrogate recoveries. All other semivolatile organic compounds were flagged due to low SRM and matrix spike recoveries.

Seaboard Lumber site, Phase II site investigation (Seaboard; 1997): Data validation was conducted by Herrera Environmental Consultants (1997). Approximately 6% of the detected values were qualified as estimates. Antimony was not detected in any sample; detection limits were all qualified as unusable.

Duwamish Waterway Phase I site characterization (Boeing SiteChar; 1997): Analytical Resources, Incorporated (Seattle, WA) conducted all laboratory analyses except sediment grain size, which was performed by Rosa Environmental (Seattle, WA). The quality assurance review was conducted by Exponent of Bellevue, Washington. The laboratory was able to achieve the project-specific DQOs for detection limits for over 99 percent of the reported results. The overall quality of the data was acceptable for the intended screening evaluation with the exception of 53 results for pentachlorophenol, which were rejected because of poor matrix spike recoveries. The laboratories reported 8,064 results. During the quality assurance review, 862 results (11%) were qualified as estimated, two results were restated as undetected, and 53 results were rejected.

Duwamish Waterway sediment characterization study (NOAA SiteChar; 1997): The data validation report summarizes the results of analytical data for 328 sediment samples collected by the Environmental Conservation Division of the Northwest Fisheries Service Center (ECD-NFSC) in the lower Duwamish River between September and November 1997. Data were reviewed by EcoChem Inc. using project and method-specific criteria.

The laboratory reported a total of 9,574 analytical results; no data points were rejected based on the validation process. The laboratory was unable to quantify 77 PCB congener results. One or more PCB congeners were detected at low levels in several of the method blanks. In order to account for the potential effect of low-level contamination, validation action levels were established at five times the concentration detected in the method blanks. Thus, all associated samples that were less than the action levels were qualified as not detected. The recovery values were greater than the upper control limit for PCB congeners 101, 105, 128, and 153. The elevated recoveries were due to coelutions that could not be resolved, thus all associated positive results for these congeners are estimated. The calculated MDL for PCBs and PCTs were less than and greater than the target detection limit, respectively.

RCRA Facility Investigation, Duwamish Waterway sediment investigation, Plant 2 – Phases 1, 2a, 2b (Plant 2 RFI-1,2a,2b; 1995-1996): This data validation was performed by Roy F. Weston, Inc. (Seattle, WA) in accordance with the formats outlined in the *Laboratory Data Functional Guidelines for Evaluating Organic Analyses* (EPA 1994b) and the *Laboratory Data Functional Guidelines for Evaluating Inorganic Analyses* (EPA 1994a). Methylene chloride, acetone, and 2-butanone were classified as undetected due to blank contamination. Trichloroethane concentrations in one pair of field duplicates were qualified as estimated concentrations because the RPD was outside QC limits. Semivolatile compounds in two samples and Aroclors in nine samples were qualified as estimates due to exceedance of holding times. Nine semivolatile organic compounds in five samples all Aroclors in four samples were qualified as estimates due to surrogate recoveries outside of QC criteria.

Some metals were detected in laboratory or field blanks; the associated samples were qualified appropriately. Numerous results for metals were qualified as estimates due to matrix spike recoveries outside QC limits and 83 results were rejected where analytes were not detected and spike recoveries were less than 30%. Results for 14 samples associated with ICP dilution were qualified as estimates. RPDs for laboratory duplicates were outside QC limits for eight metals; the associated sample results were qualified as estimates. Five samples analyzed for hexavalent chromium analysis exceeded the 72-hour holding time limit and were qualified as estimates.

Four samples analyzed for petroleum hydrocarbons exceeded the 14-day holding time limit and were qualified as estimates. Laboratory blank spike recovery QC limits for petroleum hydrocarbons were exceeded in six samples. Sample holding times were exceeded for nine samples analyzed for TOC; associated sample results were qualified as estimates.

Duwamish/Diagonal cleanup study – Phase 2 (Duw/Diag-2; 1996): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. The holding time was exceeded for 13 samples analyzed for mercury; the associated field results were flagged. Antimony and cadmium results were flagged due to low SRM and matrix spike recoveries. Aluminum and mercury results were flagged due to high matrix spike recoveries. Antimony and sodium results were flagged due to low matrix spike recoveries. Some copper, lead and mercury results were flagged because RPDs between laboratory duplicates were outside QC limits.

Bis(2-ethylhexyl)phthalate, di-*n*-butyl phthalate, and butylbenzyl phthalate were detected in one method blank; associated field results were qualified appropriately. Most results for semivolatile organic compounds were flagged due to surrogate, matrix spike, or SRM recoveries outside of QC limits. Aroclor 1260 results were flagged for 14 samples due to low matrix spike recoveries and for 3 other samples due to high matrix spike recoveries. Aroclor 1254 results were flagged due to low SRM recoveries. The RPDs between laboratory duplicates for 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,2,4-trichlorobenzene, and hexachlorobenzene were outside QC limits; associated field results were flagged.

King County CSO sediment monitoring – Post-bioassay sediment sampling at Chelan, Connecticut, and Hanford CSO outfalls (KC CSO 96; 1996): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. Nickel results were flagged due to low SRM and matrix spike recoveries. Cadmium results were flagged due to a high SRM recovery. Aluminum, mercury and zinc results were flagged due to high

matrix spike recoveries. Antimony and nickel results were flagged due to low matrix spike recoveries. The RPDs between cadmium and nickel laboratory duplicate results were outside QC limits; the associated field results were flagged.

Results for phenolic compounds and chlorobenzene were flagged based on low surrogate recoveries. Results for all semivolatile organic compounds were flagged for 8 samples due to SRM and matrix spike recoveries outside QC limits. Results for Aroclor 1254 were flagged due to low SRM recoveries. The RPD between benzoic acid laboratory duplicate results was outside QC limits; the associated field results were flagged.

King County CSO sediment monitoring – Sediment sampling at Chelan, Connecticut, and Hanford CSO outfalls (KC CSO 95; 1995): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. Approximately 36% of the detected results were flagged. None of the results were qualified as unusable.

Duwamish/Diagonal cleanup study – Phase 1.5 (Duw/Diag-1.5; 1995): AVS, grain size, and total sulfide analyses were subcontracted to AmTest, Inc. in Redmond, Washington. Butyltin analysis was subcontracted to Battelle Marine Sciences Laboratory in Sequim, Washington. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. Antimony results were flagged due to low SRM and matrix spike recoveries. Aluminum results were flagged due to high matrix spike recoveries. Antimony and sodium results were flagged due to low matrix spike recoveries. The RPDs between laboratory duplicates for aluminum and arsenic were outside QC limits; associated field results were flagged. All data for semivolatile organic compounds were flagged due to matrix spike recoveries outside of QC limits. The RPD between Aroclor 1260 laboratory duplicate results was outside QC limits; the associated field results were flagged.

Norfolk CSO sediment cleanup study – Phase 3 (Norfolk-cleanup3; 1995): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. None of the analytical results were flagged.

Norfolk CSO sediment cleanup study – Phase 2 (Norfolk-cleanup2; 1995): The King County laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. Approximately 34% of the detected results were flagged. None of the results were qualified as unusable.

Duwamish/Diagonal cleanup study – Phase 1 (Duw/Diag-1; 1994): The METRO Environmental Laboratory performed a QA1 review in accordance with guidelines established through the PSDDA program and in collaboration with the Ecology Sediment Management Unit. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. Matrix interferences caused falsely elevated results for some samples during the hydrometer portion of the grain size analysis. A hydrogen peroxide digestion treatment was used on these samples, but sufficient sample was not available to reanalyze three of these samples. The percent RSD between phi sizes for five triplicate samples were outside the acceptable QC range; all grain size data were qualified as estimated. A high RPD for laboratory duplicates was calculated for several metals due to the difficulty in obtaining a homogeneous sub sample; associated field samples were qualified appropriately. Bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, and butylbenzyl phthalate were detected in one method blank; associated field results were qualified appropriately. Chlorobenzene results were flagged due to low matrix spike recoveries. Additional instances of non-compliant surrogate recoveries were observed in both the pesticide and semivolatile organic data; associated field samples results were flagged. A single value for hexachlorobenzene was qualified as unusable.

Norfolk CSO sediment cleanup study – Phase 1 (Norfolk-cleanup1; 1994): All analyses and QA review were performed by the METRO Environmental Laboratory in Seattle, Washington. Data flags assigned to some values indicate that additional scrutiny by the data user may be appropriate. AVS and grain size analyses were subcontracted to AmTest, Inc in Redmond, Washington. The percent RSD for one of three AVS triplicate results was greater than the QC limit; associated field results have been flagged. The RPD between mercury laboratory duplicate results was outside QC limits; the associated field results were flagged. Antimony results were flagged due to low matrix spike recoveries. Di-n-butyl phthalate was detected in one method blank; associated field results were qualified appropriately. SRM results for twelve PAH compounds were less than QC limits; associated field sample results were flagged. Most results for semivolatile organic compounds and PCBs were flagged due to low matrix spike recoveries.

Rhône-Poulenc RCRA Facility Investigation for the Marginal Way facility – Round 2 (Rhône-Poulenc RFI-2; 1994): CH2M Hill performed data validation for this sampling event. None of the analytical results were qualified as estimated or unusable.

Rhône-Poulenc RCRA Facility Investigation for the Marginal Way facility – Round 1 (Rhône-Poulenc RFI-1; 1994): CH2M Hill performed data validation for this sampling event. None of the analytical results were qualified as estimated or unusable.

Harbor Island Remedial Investigation (Harbor Island RI; 1991): Roy F. Weston, Inc. performed data validation for the Remedial Investigation. Approximately 55% of the detected

values were qualified as estimates. Approximately 2% (105 values) were qualified as unusable for various serious deviations from data quality objectives. Rejected values include metals (2 for beryllium, 24 for selenium, 6 for antimony, 24 for silver, and 37 for cadmium), total sulfides (6 values), and coprostanol (6 values).

A.4 DATA LOADING REPORTS

A.4.1 EventNames: Norfolk CSO 5-year monitoring program (Norfolk-monit3, Norfolk-monit2b, Norfolk-monit2a, Norfolk-monit1)

The Norfolk CSO five-year monitoring (Norfolk-monit) dataset consisted of 2,071 results. It was obtained from Scott Mickelson (KC DNR) and was distributed in one zip file, norfolk-monit.zip, which contained four Microsoft Excel files. These files were structured in SEQUAL-like format. The results are based upon analysis performed on 23 samples, taken from 13 unique locations, collected over a 12-month period in the years 1999 and 2000.

Data from these packages were combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

A.4.1.1 Project/Event/Location Records

Windward Environmental created five events from the source files: Norfolk-monit was the parent event and was related to the child events Norfolk-monit3, Norfolk-monit2b, Norfolk-monit2a, and Norfolk-monit1 through the EventParentNum field. Samples were assigned to each event based on the month they were collected. The main event does not have any samples directly linked to it. The start and end dates of each child event were determined to be the first and last sample collection dates, respectively, of the samples associated with that event. The start and end dates of the main event were taken to be the first and last sample collection dates, respectively, over all four child events. All 5 events are part of the predefined Duwamish project and had no event attributes added to the EventAttribute table for any of the events.

All 13 locations and their coordinates were entered into the Location and LocationAttribute tables, respectively. Coordinate information came in the format of Deg-Min-Sec and was converted into decimal degrees by an Excel function before entry into the database. The datum and coordinate system were evaluated and confirmed by Windward Environmental. The State field was not entered as a location attribute. Windward Environmental provided location attributes “Status” and “Stratum”.

A.4.1.2 Samples

In all there were 23 samples collected between April 23, 1999 and April 6, 2000. All samples were coded as matrix type sediment. The original Excel files provided sample attributes

"Sampling Gear", "Sample Collection Elevation, upper", "Sample Collection Elevation, lower" and "Grab Area"; while the sample attribute "*Newer Colocated Sample*" was supplied by Windward Environmental.

A.4.1.3 Sample Analysis

From a list of unique parameters, abstracted from the original files by Appendix A, Windward Environmental was able to identify the analysis methods that were conducted on each sample. In total, 152 analysis records were added to the SampleAnalysis table. Laboratory information was provided by Windward Environmental.

A.4.1.4 Sample Results

All 2,071 results were loaded into the Appendix A database after mapping parameters, units and laboratory qualifiers. An Excel function was used to round all concentrations to the appropriate number of significant figures. The "InterpretedQualifierCode" field was populated based on mapping from Windward Environmental.

A.4.2 EventName: NOAA/Ecology Sediment Quality in Central Puget Sound (PSAMP/NOAA98)

The sediment chemistry database consists of 869 results in two Access tables: Chemistry and Station Attributes. These tables were part of the Access database called PSAMPNOAA.mdb that was obtained from Washington Department of Ecology. Data for this event were combined and loaded via the use of Access and Excel queries. An Excel spreadsheet with one tab per AppxA database table was ultimately created.

A.4.2.1 Project/Event/Location Records

PSAMP/NOAA98 is one of many events in the already defined Duwamish project. A basic Event record was created from the extracted Survey record. No Event Attributes were defined. The beginning and ending event dates were not in the Survey record, but were taken to be the first and last sample dates, respectively.

The Station Attributes table contained three locations for this event, each of which was added to the Location table in the AppxA database. Easting and Northing coordinates (in feet) were directly mapped from the Station Attributes table. The WA State Plane N coordinate system and NAD83 datum were provided in the Station Attributes table

A.4.2.2 Samples

There were three samples for the PSAMP/NOAA98 event collected on June 22 and 23, 1998. The Depth (top) and Depth (bot) fields in the source Station Attributes table were mapped as sample attributes in the AppxA Sample table. Depth units were in meters as provided by the Station Attributes table.

A.4.2.3 Sample Analysis

Event-related data from the Chemistry table were queried to obtain a list of the unique parameters and reporting groups for the result records. These records were linked against the AppxA Parameter table resulting in 67 unmatched parameters. Many of these were associated with homologue group analyses; consequently 67 new parameters were added to the Parameter table.

The Chemistry table contained analysis method data for each result. The methods were matched to the existing AppxA Method table. Sample analysis dates and extraction dates were also provided in the Chemistry table.

A.4.2.4 Sample Results

QA/QC results, including laboratory replicates, method blanks, matrix spike and matrix spike duplicate, and dilution were included in the source Chemistry table. Chemistry results in the source table were given a Result code, only the results with the code of "Best Result" were loaded. The QA/QC results were not loaded. The remaining results were loaded to the AppxA database after mapping of the units, and laboratory qualifiers. All laboratory qualifiers were mapped to the LabQualifierCode field. The InterpretedQualifierCode field was populated based on a mapping from Windward Environmental. The ResultStatusCode field was set to "Validated" for all imported records.

A.4.3 EventName: EPA Site Inspection (EPA SI)

The EPA Duwamish River Site Inspection (EPA SI) dataset consisted of 65,128 results. It was obtained from Roy F. Weston, Inc. and was distributed in a Microsoft Access database, DuwaSI_20000818.mdb, which contained 4 tables that were relevant to data loading. The results were based upon analysis performed on 348 samples, taken from 300 unique locations, collected over a 2-month period in 1998.

Data from the DuwaSI_20000818.mdb file were combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

A.4.3.1 Project/Event/Location Records

Based on instructions from Windward Environmental, the EPA SI dataset was defined in the Appendix A database Event table as 'EPA SI'. The start and end dates were taken to be the first and last sample collection dates, respectively. No event attributes were added to the EventAttribute table.

All 300 locations and their coordinates were entered into the Location and LocationAttribute tables, respectively. The datum and coordinate system were evaluated and confirmed by

Windward Environmental. Windward Environmental provided location attributes "Status", "Stratum", "5m Overlap" and "Dredge Event Name".

A.4.3.2 Samples

There were 348 samples collected between August 11 and September 23, 1998. Fifteen samples were coded as matrix type porewater and the remaining 333 samples were coded as sediment. The source files provided sample attributes "Sample Collection Elevation, upper" and "Sample Collection Elevation, lower"; while sample attributes "Sampling Gear" and "New Colocated Sample" were supplied by Windward Environmental. The following sample features from the source files were not entered as sample attributes – "ATTRIB01" and "ATTRIB02".

A.4.3.3 Sample Analysis

From a list of unique parameters, abstracted from the original file by Appendix A, Windward Environmental was able to identify the analysis methods that were conducted on each sample. In total, 2,300 analysis records were added to the SampleAnalysis table. Laboratory information was provided by Windward Environmental.

A.4.3.4 Sample Results

After mapping parameters, units, and laboratory qualifiers, a total of 54,208 sample records were loaded in to the Appendix A database. The remaining 10,920 records were for calculated results, primarily TOCN, which Windward Environmental requested not to be loaded into the database.

In the initial mapping of parameters, 58 parameters out of 269 were found not to match existing analytes in the Appendix A Parameter table. Through the use of Chemfinder (www.chemfinder.com) on the Internet and help from Windward Environmental, all these compounds were positively identified. Twenty-three parameters were hand matched with existing parameters and the remaining 35 were added as new parameters into the Parameter table.

A.4.4 EventName: King County Water Quality Assessment (KC WQA)

The KC WQA dataset consisted of 5,207 results. It was distributed in two data packages: package one (DUWRIV97) contained one Excel file derived from SEDQUAL, and package two (WQA) contained four Excel files derived from King County's LIMS. Both packages were structured in a SEDQUAL-like format and contained much of the same information, differing only in number of results reported. The results themselves are based on analysis performed on 57 samples, taken from 14 unique locations, collected over a 7-month period in 1997.

Data from these packages was combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

A.4.4.1 Project/Event/Location Records

The KC WQA dataset was defined as 'KC WQA' event as instructed by Windward Environmental. This event is part of the predefined Duwamish project. The start and end dates were taken to be the first and last sample collection dates, respectively. Event attributes "Event Agency," "Event Chief Scientist," and "Event Program" were added to the EventAttribute table.

All 14 locations and their coordinates were entered into the Location and LocationAttribute table, respectively. Coordinate information came in the format of Deg-Min-Sec and was converted into decimal degrees by an Excel function before entry into the database. The datum and coordinate system were evaluated and confirmed by Windward Environmental. Data in the Sub Basin Description field was mapped to the Location table Comment field. The following fields were not entered as location attributes - Basin Code, Basin Description, Remediated, Elevation, Elevation Units, State, Survey Code and Type Code. Windward Environmental provided location attributes "Status", "Stratum", "5m Overlap" and "Dredge Event Name".

A.4.4.2 Samples

In all there were 57 samples collected between March 6th and September 24th 1997. All samples were code as matrix type sediment. The original Excel files provided sample attribute "Sampling Gear", "Sample Collection Elevation, upper" and "Sample Collection Elevation, lower"; while sample attributes "Penetration Depth, mudline" and "Penetration Depth, water surface" were supplied by Windward Environmental. "Sample Collection Elevation, lower" had 10 depth records corrected by Windward Environmental. The following sample features were not entered as sample attributes - Composite Code, Survey Code, Type Code and Sample Use Code Description.

A.4.4.3 Sample Analysis

From a list of unique parameters, abstracted from the original files by Appendix A, Windward Environmental were able to identify the analysis methods that were conducted on each sample. In total, 478 analysis records were added to the SampleAnalysis table. Windward Environmental provided the name of the laboratory.

A.4.4.4 Sample Results

Of the original 5,207 sample results, 4932 were loaded into the Appendix A database after mapping parameters, units, and laboratory qualifiers. The outstanding 275 records were identified as calculated results and Windward Environmental decided they should not included in the database.

Before the addition of the results to the SampleResult table, the differences between the two data packages had to be identified. The WQA data package had 4,974 results and the DUWRIV97 data package had 4,956. Of these results 4,723 were found to be equal. The WQA file had 251 results that were unique to it, and the DUWRIV97 had 233 results that were unique to it. The difference between these (18), accounts for the differences between the data sets. Merging these results left 5,207 unique records.

Below is a list of analytes having results present in the WQA file but not present in the DUWRIV97 file.

ParameterName WQA
4-Chloroaniline
Aniline
Barium
Caffeine
Dibutyltin
Mercury
Molybdenum
Monobutyltin
Tributyltin

Below is a list of analytes whose results were present in the DUWRIV97 file but were not present in the WQA file.

ParameterName DUWRIV97
Benzofluoranthene (total)
Fines (percent silt + clay)
High-molecular-weight PAH
Low-molecular-weight PAH
PCBs (total)

The TOC results were in units of mg/kg in the WQA file and percent in the DUWRIV97 file. Windward Environmental decided that the TOC results in percent should be stored in the database.

In the initial mapping of parameters, 30 parameters out of 111 were found not to match existing parameters in the Appendix A Parameter table. Of the 30 not corresponding, 29 were hand matched with existing parameters. The remaining parameter was verified with Chemfinder (www.chemfinder.com) to be a valid compound and was added to the Parameter table.

An Excel function was used to round all concentrations to the appropriate number of significant figures. The "InterpretedQualifierCode" field was populated based on a mapping from Windward Environmental.

A.4.5 EventName: Boeing Site Characterization (Boeing SiteChar)

The Boeing Phase I Site Characterization (Boeing SiteChar) dataset consisted of 9,718 results. It was distributed as a self-extracting executable file (Exponent Data.exe) that was obtained from Exponent Inc. This file contained 20 DBF files. Only 8 of these files were necessary for loading data into Appendix A database. The results are based upon analysis performed on 104 samples, taken from 91 unique locations, collected over a 1-month period.

Data from the DBF files were combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

A.4.5.1 Project/Event/Location Records

Based on instructions from Windward Environmental, the Boeing Site Characterization data set was defined in the Appendix A database Event table as 'Boeing SiteChar'. The start and end dates were taken to be the first and last sample collection dates, respectively. No event attribute information was contained in the DBF files and so no records were added to EventAttribute table.

All 91 locations and their coordinates were entered into the Location and LocationAttribute tables, respectively. Coordinate information came in the format of Deg-Min-Sec and was converted into decimal degrees by an Excel function before entry into the database. The datum and coordinate system were evaluated and confirmed by Windward Environmental. Data in the 'Loc_Descr' field were mapped to the Location table Comment field. The following fields in the source files were not entered as location attributes – 'Spc_North', 'Spc_East', 'State', 'Spc_Zone', 'Stn_Type', 'Elevation', 'Elev_Error', and 'Waterdepth'. Windward Environmental provided location attributes "Status", "Stratum", "5m Overlap" and "Dredge Event Name".

A.4.5.2 Samples

There were 104 samples collected between September 8 and September 19, 1997. Ninety-six samples were added to Sample table; eight were excluded as per instructions from Windward Environmental. The excluded samples included seven blank samples and one Standard Reference Material (SRM) sample. There were five pairs of field duplicates included. The duplicate samples were distinguished from the other field samples through the use of the field FieldQCCode. All the samples that were added to the Sample table were coded as matrix type sediment. The original DBF files provided sample attributes "Sampling Gear", "Sample Collection Elevation, upper" and "Sample Collection Elevation, lower"; while the sample attribute "Newer Colocated Sample" was supplied by Windward Environmental.

A.4.5.3 Sample Analysis

From a list of unique parameters, abstracted from the original files by Appendix A, Windward Environmental was able to identify the analysis methods that were conducted on each sample. In total, 721 analysis records were added to the SampleAnalysis table, 49 of which were for duplicate and triplicate grain size analyses. Laboratory information was provided by Windward Environmental.

A.4.5.4 Sample Results

Of the original 9,718 results, 9,648 were loaded into the Appendix database after mapping parameters, units, laboratory qualifiers, and validation qualifiers. The difference between the original and what was loaded is accounted for by the exclusion of the SRM sample and its results. The "InterpretedQualifierCode" field was populated based on a mapping from Windward Environmental.

A.4.6 EventName: NOAA Site Characterization (NOAA SiteChar)

The NOAA Site Characterization dataset consisted of 8,418 results. It was distributed in one Microsoft Excel file, NOAA01.xls, which was structured in SEDQUAL-like format. The results were based upon analysis performed on 328 samples, taken from 328 unique locations, collected over 2-month period in 1997. Data from these packages was combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

A.4.6.1 Project/Event/Location Records

The NOAA dataset was defined as 'NOAA SiteChar' event by Windward Environmental. This event is part of the predefined Duwamish project. The start and end dates were taken to be the first and last sample collection dates, respectively. Event attributes "Event Agency", "Event Chief Scientist", "Event Operator" and "Event Program" were added to the EventAttribute table.

All 328 locations and their coordinates were entered into the Location and LocationAttribute table, respectively. Coordinate information came in the format of Deg-Min-Sec and was converted into decimal degrees by an Excel function before entry into the database. The datum and coordinate system were evaluated and confirmed by Windward Environmental. Data in the Sub Basin Description was modified from 'LDW' to 'Lower Duwamish River' and was entered into the Comment field in the Location table. The following fields were not entered as location attributes - Basin Code, Basin Description, Elevation, Elevation Units, and State. Windward Environmental provided location attributes "Status", "Stratum", "5m Overlap" and "Dredge Event Name".

A.4.6.2 Samples

In addition to 328 field samples collected between September 15 and November 13, 1997, an additional 46 samples were reported as field replicates. Windward Environmental determined these were lab duplicates (or triplicates), not field replicates. Consequently, these samples were not added to Sample table. All samples were coded as matrix type sediment. The original Excel file provided sample attribute "Sampling Gear" and "Sample Collection Elevation, lower"; while sample attributes "Sample Collection Elevation, upper" and "Newer Colocated" were supplied by Windward Environmental. The following sample feature was not entered as a sample attribute - Sample Use Code Description.

A.4.6.3 Sample Analysis

From a list of unique parameters, abstracted from the original files by Appendix A, Windward Environmental was able to identify the analysis methods that were conducted on each sample. In total, 1,399 analysis records were added to the SampleAnalysis table; 89 of these records were for duplicate or triplicate analyses and were distinguished from the original analysis through the use of the LabQCCode field. Windward Environmental provided the names of laboratories used for the event.

A.4.6.4 Sample Results

All 8,418 sample results were loaded into the Appendix A database after mapping parameters, units and laboratory qualifers. In the initial mapping of parameters, 18 parameters out of 24 were found not to match existing parameters in the Appendix A Parameter table. These 18 parameters were verified with Chemfinder (www.chemfinder.com) to be valid compounds and were added to the Parameter table. The "InterpretedQualifierCode" field was populated based on a mapping from Windward Environmental.

A.4.7 EventName: King County CSO Characterization 1996 (KC CSO 96)

The source data set was obtained from Scott Mickelson (King County DNR) and consisted of 968 results in two Microsoft Excel files, 6900CB.xls and 6901CB.xls. Of the 968 results, 792 were laboratory measurements and were all stored in 6900CB. The remaining 176 results were field measurements, which were stored in 6901CB. Each file contained 8 samples from the same 8 locations.

Data for this event were combined and loaded with the use of Microsoft Access and Microsoft Excel. Two Excel workbooks, one for each original data file, were ultimately created. Each workbook contained one spreadsheet per relevant Appendix A database table.

A.4.7.1 Project/Event/Location Records

The source data set was defined as the 'King County CSO sediment monitoring - 1996' event by Windward Environmental. This event was added to the existing Duwamish project in the

database. The start and end dates were taken to be the first and last sample collection dates, respectively. No Event Attributes were defined.

The Locator field in the original dataset listed 8 unique locations for this event, all of which had been previously entered in the database for other events; therefore, no new location information was added for this event.

A.4.7.2 Samples

There were 16 samples in the source data set, 8 in each of the two Excel files. All samples were coded as matrix type sediment. "Sample Start Time," "Sample Depth," and "Sediment Sampling Depth" were added as sample attributes "Sample Start Time," "Depth to Mudline," and "Penetration Depth, mudline," respectively, for samples contained in the 6901CB Excel file. The Client Loc field in both Excel files and the "Sediment Type," "Tidal Condition," and "Tide Height Unit" fields in 6901CB were not mapped to the Appendix A database, as instructed by Windward Environmental. Attributes "Sample Collection Elevation, upper," "Sample Collection Elevation, lower," and "Sampling Gear" were provided by Windward Environmental and were not present in the Excel file.

A.4.7.3 Sample Analysis

The analytical methods were determined from the "Combined Labs" field in the Excel files. Windward Environmental provided the name of the laboratory.

A.4.7.4 Sample Results

Results were loaded into the Appendix A database after mapping parameters, units, and laboratory qualifiers. The Parameter field in the Excel files was queried to obtain a list of the unique parameters, against which the Appendix A Parameter table was linked. This resulted in 37 unmatched parameters, all of which were hand matched with existing parameters.

Windward Environmental decided that the data in the *MDL* field in the source table would be used to populate the "ReportingLimit" field in the SampleResult database table, and that the data in the *RDL* field would not be added to the database. In cases where the lab concentration was blank and the qualifier 'U', the *MDL* value was entered as the concentration. If the lab qualifier was '<MDL', it was stored as 'U' in the SampleResult table; if it contained '<RDL', the '<RDL' part was removed. The "InterpretedQualifierCode" field was populated based on a mapping from Windward Environmental.

A.4.8 EventName: Seaboard Phase II Site Characterization (Seaboard-Ph2)

Data for this event were entered by hand from the hard copy of the Seaboard Lumber Site Phase 2 Site Investigation prepared by Herrera Environmental Consultants, Inc, 1996. They

were combined and loaded using Microsoft Access and Excel. Two Excel workbooks, one for locations and samples and one for results, were ultimately created.

A.4.8.1 Project/Event/Location Records

A basic Event record was created for the Seaboard Phase 2 study. Event attributes were taken from the cover page of the document.

Twenty location records were created. Location Attribute data such as coordinates and datum were not found in the report, so they were created as described below. The locations of 4 station locations present on Figure 4 in the report were estimated and added as points to a GIS shapefile for the LDW. The points were chosen because they were in close proximity to easily recognizable landmarks common to the map in Figure 4 and the GIS project. All other points were triangulated using a ruler based on a minimum of three of the four estimated station locations. Next, the triangulated distance information was transferred to the GIS project using the ArcView 'measure tool" and all other stations were added to the GIS project. All distance information was verified against the hard copy of the Figure 4 using a minimum of three of the original estimated locations. All stations locations were verified to be accurate to within 2.5 m.

A.4.8.2 Samples

There were 20 samples for the Seaboard Ph2 event collected between March 12 and April 7, 1996. All samples were coded as sediment matrix type. Sample Attribute information was gathered from the Seaboard hard copy. Sample attributes "Sampling gear", "Sample collection, upper", and Sample collection, lower" were added based on information in the report.

A.4.8.3 Sample Analysis

A Sample Analysis table was created for this event. Eight sample analysis method records were created for each sample, corresponding to the following methods: EPA 6010, EPA 7471, EPA 8270, EPA 7421, EPA 9045C, EPA 8081, EPA 7060, and PSEP 1986.

A.4.8.4 Sample Results

The data for semivolatile organic chemicals and PCBs in the hard copy of the Seaboard Phase 2 Site Investigation (Table 13 and Table 14) were total organic carbon normalized calculations. These data were converted into dry weight units before being entered into the database. The formula used to unnormalize data was ppb=ppm x (TOC% x 10). Eleven concentrations for hexachlorobenzene in the report were listed as zero values. This is probably due to incorrect rounding. The authors have been contacted to obtain correct values, but null values have been stored temporarily for these results. No QC or duplicate data were entered. No new parameter codes were necessary. The "*InterpretedQualifierCode*" field was populated based on a mapping from Windward Environmental.

A.4.9 EventNames KC CSO 95, Duw/Diag-1, Duw/Diag-1.5, Norfolk-cleanup1, Norfolk-cleanup2, Norfolk-cleanup3

The source data set was obtained from the King County Environmental Laboratory's database (LIMS) and consisted of 19,978 results and was distributed in 15 excel files that were structured in a SEDQUAL-like format. These files were in turn divided into 5 distinct event groupings, with 3 files per group. The results are based upon analysis performed on 227 samples, taken from 129 unique locations, collected over a period of approximately 3 years. An additional source data file (sem-avs.xls) was created by Windward Environmental based on a hard copy of SEM-AVS results for the KC CSO 95 event supplied by Scott Mickelson (KC DNR).

Data for these years were combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created with one spreadsheet per relevant Appendix A database table.

A.4.9.1 Project/Event/Location Records

The source data set was divided into 7 distinct events as instructed by Windward Environmental: 1) KC CSO 95, 2) Duw/Diag-1, 3) Duw/Diag-1.5, 4) Duw/Diag-2, 5) Norfolk-cleanup1, 6) Norfolk-cleanup2, and 7) Norfolk-cleanup3. All of these events were added to the existing Duwamish project. The start and end dates were taken to be the first and last sample collection dates of each event's constituent samples.

All locations and their coordinates were entered into the Location and LocationAttribute table, respectively. The datum and coordinate system were evaluated and confirmed by Windward Environmental. Basin Code and Sub Basin information from the original source file was not transferred into the LocationAttribute table, as instructed by Windward Environmental. Data for location attributes "Status," "Stratum," "5m Overlap," and "Dredge Event Name" were provided by Windward Environmental.

A.4.9.2 Samples

All samples were coded as matrix type sediment. Data for sample attributes "Penetration Depth, mudline," "Sample Collection Elevation, upper," "Newer Colocated Sample," "Penetration Depth, water surface," "Sample Collection Elevation, lower," and "Sampling Gear" were provided by Windward Environmental and were not present in the original Excel files.

As instructed by Windward Environmental, the letter "L" was added to each SampleID in the source file sem-avs.xls to maintain consistency with other SampleIDs for that event.

A.4.9.3 Sample Analysis

Windward Environmental identified the analytical methods conducted for each parameter in each sample and provided the name of the laboratory.

A.4.9.4 Sample Results

Of the original 19,978 sample results in the LIMS source files, 19,917 were loaded into the Appendix A database after mapping parameters, units, and laboratory qualifiers. Windward Environmental identified the remaining 61 results as duplicate records that were included in the source file by mistake; these records were not included in the database.

In the initial mapping of parameters, 80 parameters out of 229 were found not to match existing parameters in the Appendix A Parameter table. Through the use of Chemfinder (www.chemfinder.com) on the Internet, documents provided by King County, and help from Windward Environmental, approximately 57 of these compounds were positively identified. From this group of 57, 6 were hand matched with existing parameter codes in the database. The remaining 74 records that included identified and unidentified were added as new parameters into Parameter table, but were flagged with a RecordStatusCode 951 (Pending). An Excel function was used to round all concentrations to the appropriate number of significant figures.

Of the 36 results in the sem-avs.xls source file, 33 were loaded into the Appendix A database after mapping parameters, units, and laboratory qualifiers. The 3 records not added were SEM/AVS ratio results. On instruction from Windward Environmental, calculated results like this were not added to the SampleResult table. Eight non-detect values, all with no detection limits, were entered into the database with a null concentration and 'U' lab qualifier. The "InterpretedQualifierCode" field was populated based on a mapping from Windward Environmental.

A.4.10 EventNames Boeing Plant 2 RCRA Facility Investigation (Plant 2 RFI-1, Plant 2 RFI-2a, and Plant 2 RFI-2b)

The source data were obtained from a database compiled by Roy F. Weston, Inc. that consisted of over 94,800 results in five Access tables: Survey, Station, AllSamp, Results, and Rptform tables. These results are based on analyses from multiple events spanning 1970 to 1996. Data related to the Plant 2 RFI events (identified in the Survey table as PLNT2RFI) were extracted from the five key tables in the Weston database. This resulted in an event with 14,581 results from 232 samples tied to 164 locations. Data for this event were combined and loaded via the use of Access and Excel queries. An Excel spreadsheet with one tab per AppxA database table was ultimately created.

A.4.10.1 Project/Event/Location Records

PLNT2RFI is one of many events in the already defined Duwamish project. A basic Event record was created from the extracted Survey record with input from Windward Environmental. No Event Attributes were defined. The beginning and ending event dates were not in the Survey record, but were taken to be the first and last sample dates, respectively.

Easting and Northing coordinates (in feet) for the locations were directly mapped from the Station table in the source file. Windward Environmental confirmed the WA State Plane N coordinate system and NAD83 datum.

A.4.10.2 Samples

Eight of the samples in the source file were coded as field duplicates based on the DUP SAMPNO field in the Weston AllSamp table. All samples were coded as matrix type sediment. The TRAFFICNO, SAMPNO EPA, STORET NO, OPUNIT, MEDIAMOD, SOURCE, and ATTRB01, ATTRB02 fields were not mapped to the AppxA database, as per Windward Environmental. The Depth (top) and Depth (bot) fields were mapped as sample attributes. Depth units were taken to be in feet, as per Windward Environmental.

A.4.10.3 Sample Analysis

Event-related data from the Weston Rptform table were queried to obtain a list of the unique parameters and reporting groups for the result records. These records were linked against the AppxA Parameter table resulting in 41 unmatched parameters. Many of these were associated with grain size analyses. Most of the unmatched parameters were hand matched to existing parameters. Four new parameters were added to the Parameter table.

The Weston database did not contain any information on analytical methods. The reporting groups were used to group the parameters and the Draft Remedial Investigation document was used to look up preparation and analysis methods for each parameter group. Six new methods were added to the existing AppxA Method table. Since detailed documentation was available, seven method group records that combined the extraction method with the analysis method were created for documenting the sample analyses. Using existing methods along with the newly created method groups, 1,450 sample analysis records were created to link all samples to the existing sample results.

The list of unique parameters also highlighted the analysis of TPH diesel fraction by two different methods for two of the samples. TPH_8015_D and TPH_HCID_D parameters were both mapped to the parameter TPH – Diesel Range and two different analysis records were created for these results.

A.4.10.4 Sample Results

Based on the Weston reporting groups, 2,339 results were determined to be total organic carbon normalized calculations. These results were not loaded as per Windward Environmental. The remaining results were loaded to the AppxA database after mapping of the units, and laboratory qualifiers. All laboratory qualifiers were mapped to the LabQualifierCode field. The InterpretedQualifierCode field was populated based on a mapping from Windward Environmental. The ResultStatusCode field was set to "Validated" for all imported records.

A.4.11 EventName: Rhone-Poulenc RCRA Facility Investigation (Rhone-Poulenc RFI-1, Rhone-Poulenc RFI-2)

Data for the Rhone-Poulenc RCRA Facility Investigation were retrieved from the Weston Plant II database that consists of over 94,000 results in five Access tables: Survey, Station, AllSamp, Results, and Rptform. The data for Rhone-Poulenc, identified in the Survey table, were extracted from the five key tables in the Weston database. This resulted in 1,311 results that were based upon analysis performed on 16 samples, taken from 14 unique locations, collected over a 6-month period in 1994.

Data from the Weston Plant II database were combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

A.4.11.1 Project/Event/Location Records

Three events corresponding to the survey information contained in the source file were created as instructed by Windward Environmental. 'Rhone-Poulenc RFI' is the main event and is related to the Rhone-Poulenc RFI-1 (Round 1) Rhone-Poulenc RFI-2 (Round 2) events through the EventParentNum field. Samples were assigned to each event based on the month they were collected. The main event does not have any samples directly linked to it. The start and end dates of each child event were determined to be the first and last sample collection dates, respectively, of the samples associated with that event. The start and end dates of the main event were taken to be the first and last sample collection dates, respectively, for the 2 child events. The event attribute "Event Operator" was added to the EventAttribute table. All three events are part of the predefined Duwamish project.

All 14 locations and their coordinates were entered into the Location and LocationAttribute tables, respectively. The datum and coordinate system were evaluated and confirmed by Windward Environmental. They also provided location attributes "Status", "Stratum" and "5m Overlap".

A.4.11.2 Samples

All 16 samples collected between March 3 and August 18, 1994 were added to the Sample table. Included among the 16 samples were 2 field duplicates, which were distinguished from the original samples through the use of the field FieldQCCode. All samples were coded as matrix type sediment. The original data source provided sample attributes "Sample Collection Elevation, upper" and "Sample Collection Elevation, lower"; while the sample attribute "Sampling Gear" was supplied by Windward Environmental. The Attrib01 field in the source file was not represented as a sample attribute in the Appendix A database.

A.4.11.3 Sample Analysis

From a list of unique parameters, abstracted from the original files by Appendix A, Windward Environmental was able to identify the analysis methods that were conducted on each sample. In total, 77 analysis records were added to the SampleAnalysis table. Laboratory information was provided by Windward Environmental.

A.4.11.4 Sample Results

Of the original 1,311 sample results, 754 were loaded into the Appendix A database after mapping parameters, units, and laboratory qualifiers. The remaining records were identified as calculated results, primarily TOCN, and were not loaded per instructions from Windward Environmental.

Windward Environmental identified one incorrect value in the original source file that was subsequently corrected in the Appendix A database. The reported result (200,000 µg/kg) for Aroclor 1254 for sample A-11-08 did not match the value given in the data report; the concentration was changed to 200 µg/kg based on this review.

The "InterpretedQualifierCode" field was populated based on a mapping from Windward Environmental.

A.4.12 EventName: Harbor Island Remedial Investigation (Harbor Island RI)

The Harbor Island Phase II RI (Harbor Island RI) dataset consisted of 4,479 results. It was distributed in one Microsoft Excel file, EPA_HIRIPH2.xls that was obtained from the EPA website, which was structured in a SEDQUAL-like format. The results are based upon analysis performed on 57 samples, taken from 31 unique locations, collected over a 2-month period in 1991.

Data from EPA_HIRIPH2.xls were combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

A.4.12.1 Project/Event/Location Records

Based on instructions from Windward Environmental, the Harbor Island dataset was defined in the Appendix A database Event table as 'Harbor Island RI'. The start and end dates were taken to be the first and last sample collection dates, respectively. Event attributes "Event Agency", "Event Chief Scientist" and "Event Program" were added to the EventAttribute table. This event is part of the predefined Duwamish project.

All 31 locations and their coordinates were entered into the Location and LocationAttribute tables, respectively. The datum and coordinate system were evaluated and confirmed by

Windward Environmental. Data in the Sub Basin Description field was mapped to the Location table Comment field. The following fields were not entered as location attributes - Basin Code, Basin Description, Elevation, Elevation Units, State, Survey Code and Type Code. Windward Environmental provided location attributes "Status", "Stratum" and "5m Overlap".

A.4.12.2 Samples

In all there was 57 samples collected between September 9 and October 10, 1991. All samples were coded as matrix type sediment. The original Excel file provided sample attributes "Grab Area", "Sampling Gear" and "Sample Collection Elevation, lower"; while the sample attributes "Sample Collection Elevation, upper" was supplied by Windward Environmental. The following sample features contained in the source file were not entered as sample attributes - Mesh Size, Time, Trawl Length, Trawl Time, Type Code, Upper Depth and Sample Use Code Description.

A.4.12.3 Sample Analysis

From a list of unique parameters, abstracted from the original files by Appendix A, Windward Environmental were able to identify the analysis methods that were conducted on each sample. In total, 344 analysis records were added to the SampleAnalysis table, 7 of which were for laboratory duplicate analyses for sediment grain size. Laboratory information was provided by Windward Environmental.

A.4.12.4 Sample Results

All 4,479 sample results were loaded into the Appendix A database after mapping parameters, units and laboratory qualifiers. In the initial mapping of parameters, 28 parameters out of 166 were found not to match existing analytes in the Appendix A Parameter table. Through the use of Chemfinder (www.chemfinder.com) on the Internet, 23 were hand matched with existing parameters and the remaining 35 were entered into the Parameter table as new parameters. The "*InterpretedQualifierCode*" field was populated based on a mapping provided by Windward Environmental.

APPENDIX B

Tissue Chemistry

Appendix B: Tissue Chemistry

B.1 SUMMARY TABLES

The summary tables of tissue chemistry are attached to this document in the file called **tissue summary.pdf**.

The summary tables have the following titles:

Table B-01. Summary of Chinook salmon (filet without skin) chemistry from Puget Sound Ambient Monitoring Program (PSAMP-fish)
Table B-02. Summary of Coho salmon (filet without skin) chemistry from Puget Sound Ambient Monitoring Program (PSAMP-fish)
Table B-03. Summary of English sole (filet without skin) chemistry from Puget Sound Ambient Monitoring Program (PSAMP-fish)
Table B-04. Summary of English sole (liver) chemistry from Puget Sound Ambient Monitoring Program (PSAMP-fish)
Table B-05. Summary of Chinook salmon (liver) chemistry from NOAA bioaccumulation study (NOAA-salmon)
Table B-06. Summary of Chinook salmon (whole organism) chemistry from NOAA bioaccumulation study (NOAA-salmon)
Table B-07. Summary of English sole (filet without skin) chemistry from Elliott Bay Duwamish River Fish Tissue Investigation (EVS 95)
Table B-08. Summary of amphipod (whole body) chemistry from King County Water Quality Assessment (KC WQA)
Table B-09. Summary of Dungeness crab (edible meat) chemistry from King County Water Quality Assessment (KC WQA)
Table B-10. Summary of Dungeness crab (edible meat cooked) chemistry from King County Water Quality Assessment (KC WQA)
Table B-11. Summary of Dungeness crab (hepatopancreas) chemistry from King County Water Quality Assessment (KC WQA)
Table B-12. Summary of English sole (filet without skin) chemistry from King County Water Quality Assessment (KC WQA)
Table B-13. Summary of mussel (edible meat) chemistry from King County Water Quality Assessment (KC WQA)
Table B-14. Summary of shiner perch (whole body) chemistry from King County Water Quality Assessment (KC WQA)
Table B-15. Summary of Dungeness crab (edible meat) chemistry from Waterway Sediment Operable Unit (WSOU)
Table B-16. Summary of English sole (filet without skin) chemistry from Waterway Sediment Operable Unit (WSOU)
Table B-17. Summary of pile perch (filet with skin) chemistry from Waterway Sediment Operable Unit (WSOU)
Table B-18. Summary of pile perch (filet without skin) chemistry from Waterway Sediment Operable Unit (WSOU)
Table B-19. Summary of red rock crab (edible meat) chemistry from Waterway Sediment Operable Unit (WSOU)
Table B-20. Summary of Red rock/Dungeness crab (edible meat) chemistry from Waterway Sediment Operable Unit (WSOU)
Table B-21. Summary of striped perch (filet with skin) chemistry from Waterway Sediment Operable Unit (WSOU)
Table B-22. Summary of striped perch (filet without skin) chemistry from Waterway Sediment Operable Unit (WSOU)

B.2 SAMPLE LOCATIONS

Field coordinates for tissue field sampling efforts included in the database are only approximate so GIS maps have not been prepared. For the PSAMP data, specific coordinates associated with

each trawl are available only on paper files maintained by WDFW and were not available in the electronic source files used to load the data. Most of the tissue samples added to the database are composite samples that were formed from multiple locations with the Lower Duwamish Waterway, making it more difficult to accurately portray collection locations on a map.

B.3 DATA VALIDATION SUMMARIES

WSOU HHRA (1998): The sample results for this study were validated by Quality By Design, Hilo, Hawai'i. A Level II data validation was performed on fish and crab tissue in accordance with the format specified in EPA's *Functional Guidelines for Evaluating Organics Analyses* (1994a) and *Functional Guidelines for Evaluating Inorganic Analyses* (1994b) and criteria set forth in the specified methods.

Twenty-four of the 37 samples analyzed for TBT were qualified as estimated due to recoveries exceeding the quality control (QC) limits set for matrix spike and matrix spike duplicate analyses. All results for mercury were qualified as estimated due to sample holding time exceedances. The total PCB results for 12 samples were qualified as estimated due to internal standard recoveries not meeting the specific QC limits. In addition, 16 values for Aroclor 1242, five values for Aroclor 1254, and five values for Aroclor 1260 were qualified as estimated due to continuing calibration not meeting the specified criteria. Although sample results were qualified as estimated, data for all analytes were considered usable as qualified.

Puget Sound Ambient Monitoring Program (WDFW; 1992 to 1998): Salmon and English sole samples were collected from the LDW and analyzed for various chemicals, as described in Table 3-1. Of the detected concentrations, 102 concentrations for Aroclor 1254, 105 concentrations for Aroclor 1260, 2 concentrations for Aroclor 1248, and 28 concentrations for mercury were qualified as estimated by data validators from the Manchester Laboratory in Port Orchard, WA. No specific details on the reasons for the data qualifiers were available, but data validation was conducted according to EPA guidance documents (O'Neill pers. comm. 1998).

King County Water Quality Assessment for the Duwamish River and Elliott Bay (1996/1997): Fish and crab samples were analyzed for PCBs, TBT, metals, mercury, and semivolatile organic compounds by the King County Environmental Laboratory. In accordance with data qualification guidelines set by the laboratory, data were qualified based only on target analytes detected in method blanks and holding time exceedances. Any other data qualification was left up to the end user. These data were not formally validated for this risk assessment. However, two sample results for PCBs may be considered estimates due to surrogate recoveries outside the quality control limits. All method blanks were free of target analytes and all samples were analyzed within the required holding times. No data were qualified by the laboratory based on these guidelines.

Elliott Bay/Duwamish River Fish Tissue Study (1995): This study was conducted by EVS Environment Consultants for the Port of Seattle (unpublished data). Composite samples of English sole were analyzed by Frontier Geosciences (Seattle, WA) for total mercury and methylmercury, and by Battelle Marine Sciences Laboratory (Sequim, WA) for PCBs and TBT.

No anomalies were reported that greatly affected the data. Low levels of mercury and methylmercury were detected in method blanks associated with these samples. Since all field sample concentrations were more than five times the concentration detected in the associated blank, it was determined that the sample results were not affected. Low levels of TBT were also detected in the method blanks associated with these samples. Any sample results less than five times the amount detected in the associated blank were considered undetected. Sample results that were greater than five times the amount detected in the associated blank were not affected. PCBs were not detected in the method blank. Surrogates and matrix spike recoveries for PCBs were within control limits.

NOAA Chinook salmon bioaccumulation study (1989-1990): Data validation for these results was conducted by the NOAA laboratory in Seattle. None of the analytical results were qualified as estimated or unusable.

B.4 DATA LOADING REPORTS

B.4.1 EventName: Waterway Sediment Operable Unit (WSOU)

The WSOU data set was obtained from Environmental Solutions Group and consists of two Microsoft Excel files named pos sample descriptions.xls and tissuewsou.xls. The results are based on analyses from the sampling of one event spanning October 21, 1998 to December 11, 1998. Data for this event were combined and loaded via the use of Access and Excel queries. An Excel spreadsheet with one tab per AppxA database table was ultimately created.

B.4.1.1 Project/Event/Location Records

WSOU is one of many events in the already defined Duwamish project. A basic Event record was created from the WSOU report prepared by Environmental Solutions Group. Event attributes "Event Agency", "Event Chief Scientist", and "Event Program" were added to the EventAttribute table. The beginning and ending event dates were not in the Survey record, but were taken to be the first and last sample dates, respectively.

The location coordinates were not in any of the source files. Easting and Northing coordinates (in feet) were estimated using GIS from a map in the WSOU report. The WA State Plane N coordinate system and NAD83 datum were added as location attributes.

B.4.1.2 Samples

Sample records were added to the Sample table for 38 samples. Sample attributes sex, mean length, mean weight, number of fish in sample, abnormalities, and species were contained in the pos sample descriptions.xls and were added to the SampleAttribute table.

B.4.1.3 Sample Analysis

The source file tissuewsou.xls was queried to obtain a list of the unique parameters and reporting groups for the result records. These records were linked against the AppxA Parameter table; all parameters were matched.

The Excel spreadsheets did not contain any data on analysis methods. The reporting groups were used to group the parameters and the WSOU document was used to look up preparation and analysis methods for each parameter group. Four sample analysis records were created for each sample to link samples to sample results.

B.4.1.4 Sample Results

Based on the tissuewsou.xls table, 228 results were loaded to the AppxA database after mapping of the parameters, units, and laboratory qualifiers. The unique set of laboratory qualifiers was added to the AppxA Code table, linked to this particular event. All laboratory qualifiers were mapped to the LabQualifierCode field. The InterpretedQualifierCode field was populated based on a mapping from Windward Environmental. The ResultStatusCode field was set to "Validated" for all imported records

B.4.2 EventName: Puget Sound Ambient Monitoring Program (PSAMP-fish)

The PSAMP-fish obtained from Jim West (WDFW) database consists of 7,297 results in two Access tables: Chemistry and 89-99 Station Points. The results are based on analyses from the sampling of multiple events spanning 1992 to 1998. Data from 156 samples tied to 2 locations were added.

Data for this event were combined and loaded via the use of Access and Excel queries. An Excel spreadsheet with one tab per AppxA database table was ultimately created.

B.4.2.1 Project/Event/Location Records

PSAMP-fish is one of many events in the already defined Duwamish project. A basic Event record was created from the extracted 89-99 Station Points table records. No Event Attributes were defined. The beginning and ending event dates were not in the 89-99 Station Points table records, but were taken to be the first and last sample dates, respectively. The 89-99 Station Points table contained 2 locations for this event. Easting and Northing coordinates (in feet) were directly mapped from the Station table. Windward Environmental confirmed the WA State Plane N coordinate system and NAD83 datum.

B.4.2.2 Samples

There were 156 samples for the PSAMP-fish event collected between 1990 and 1998. All the samples were coded as matrix type tissue. Sample attributes were taken directly from the source Access file.

B.4.2.3 Sample Analysis

The Chemistry table was queried to obtain a list of the unique parameters and reporting groups for the result records. These records were linked against the AppxA Parameter table resulting in one unmatched parameter, percent lipids. One new parameter was added to the Parameter table.

B.4.2.4 Sample Results

All sample results were loaded. The unique set of laboratory qualifiers was added to the AppxA Code table, linked to this particular event. All laboratory qualifiers were mapped to the LabQualifierCode field. The InterpretedQualifierCode field was populated based on a mapping from Windward Environmental. The ResultStatusCode field was set to "Validated" for all imported records.

B.4.3 EventName: King County Water Quality Assessment (KC WQA)

The King County WQA fish tissue dataset was obtained from the King County website and Scott Mickelson (KC DNR) and was distributed in excel files 7318cb.xls, 7319cb.xls, 8527cb.xls, smfish.xls, muwet.xls, solewet.xls, soledry.xls, musdorg.xls, crabtiss.xls, musdemet.xls, and inverts.xls. These files were originally structured in LIMS format, but were converted using Microsoft Excel to a SEDQUAL-like format. These results are based upon analysis performed on 88 samples, taken from 14 unique locations, collected between October 21, 1996 and July 28, 1997.

Data for this event were combined and loaded with the use of Microsoft Access and Microsoft Excel. One Excel workbook was ultimately created, having one spreadsheet per relevant Appendix A database table.

B.4.3.1 Project/Event/Location Records

The data set was defined as "KC WQA" and added to the predefined Duwamish project. The start and end dates were taken to be the first and last sample collection dates, respectively. Event attributes "Event Agency", "Event Chief Scientist", and "Event Program" were added to the EventAttribute table.

All 14 locations and their coordinates were entered into the Location and Location Attribute tables, respectively. Coordinate information came in the format of Deg-Min-Sec and was converted into decimal degrees by an excel function before entry into the database. The datum

and coordinate system were evaluated and confirmed by Windward Environmental. Data in the Sub Basin Description field were mapped to the Location table Comment field.

B.4.3.2 Samples

All samples were coded as matrix type tissue. The original hard copy report provided sample attribute "Sampling Gear", while Sample attributes of "tissue type", and "species" were provided in the original spreadsheets. Tissue sample attributes have not been used in Appendix A database before, so sample attributes "tissue type" and "species" were added.

B.4.3.3 Sample Analysis

From a list of unique parameters, abstracted from the original file by Appendix A, Windward Environmental was able to provide the analysis methods that were performed on each sample. Analysis records for each sample analysis were added to the SampleAnalysis table. The names of the laboratories that conducted these analyses were supplied by Windward Environmental.

B.4.3.4 Sample Results

All results were loaded into the Appendix A database after mapping parameters, units, and laboratory qualifiers, with the exception of the results from the source file soledry.xls. These results were redundant with results in the source file solewet.xls and differed only in reporting convention (i.e., dry weight vs wet weight).

B.4.4 EventName: Duwamish River fish tissue investigation (EVS 95)

The EVS 95 data set was obtained from Environmental Solutions Group and consisted of Microsoft Excel files named pos sample descriptions.xls and tissuewsou.xls. The results are based on analyses from the sampling of one event from December 15, 1995. Data related to the EVS 95 event, identified in the pos sample descriptions.xls file, were extracted from tissuewsou.xls. This resulted in 90 results from 18 samples.

Data for this event were combined and loaded via the use of Access and Excel queries. An Excel spreadsheet with one tab per AppxA database table was ultimately created.

B.4.4.1 Project/Event/Location Records

EVS 95 is one of many events in the already defined Duwamish project. A basic Event record was created from information in report. Event attributes "Event Agency", "Event Chief Scientist", and "Event Program" were added to the EventAttribute table. The beginning and ending event dates were not in the pos sample descriptions.xls, but were taken to be the first and last sample dates, respectively.

Sample locations were found in the hard copy report "Field sampling log". Easting and Northing coordinates (feet) were hand entered from this report. Windward Environmental confirmed the WA State Plane N coordinate system and NAD83 datum.

B.4.4.2 Samples

Sampling gear was provided in the hard copy report "Field sampling log". The sample attributes species, sex, mean length, and mean weight were added to the sample attributes table. These results were found in the pos sample descriptions.xls table.

B.4.4.3 Sample Analysis

The source file tissuewsou.xls table was queried to obtain a list of the unique parameters and reporting groups for the result records. These records were linked against the AppxA Parameter table resulting in no unmatched parameters. Neither Excel file contained any analysis method data. These data were found in the hard copy reports from the laboratories that conducted the anayses, Frontier GeoSciences and Battelle Marine Research. Both laboratories were added to the Appendix A database Resource table.

B.4.4.4 Sample Results

All results were loaded to the AppxA database after mapping of the parameters, units, and laboratory qualifiers. The unique set of laboratory qualifiers was added to the AppxA Code table, linked to this particular event. All laboratory qualifiers were mapped to the LabQualifierCode field. The InterpretedQualifierCode field was populated based on a mapping from Windward Environmental. The ResultStatusCode field was set to "Validated" for all imported records.

B.4.5 EventName: NOAA salmon bioaccumulation (NOAA-salmon)

The NOAA-salmon event was obtained from the SEDQUAL database and consists of data in Microsoft Excel tables: Survey, Stations, Samples, and Results. The results are based on analyses from the sampling of one event spanning 1989 to 1990. Data for this event were combined and loaded via the use of Access and Excel queries. An Excel spreadsheet with one tab per AppxA database table was ultimately created.

B.4.5.1 Project/Event/Location Records

NOAA-salmon is one of many events in the already defined Duwamish project. A basic Event record was created from the extracted Survey record. The start and end dates were provided in the Survey Table. Event attributes "Event Agency", "Event Chief Scientist", and "Event Program" were added to the EventAttribute table.

The Stations table contained one location for this event. LocationName and Coordinates were entered into the Location and LocationAttribute tables, respectively. Coordinate information

came in the format of Deg-Min-Sec and was converted into decimal degrees by an Excel function before entry into the database. The datum and coordinate system were evaluated and confirmed by Windward Environmental.

B.4.5.2 Samples

The NOAA-salmon event included 11 samples, all of which were coded as matrix type tissue. Sample attributes: sex, mean age, tissue type and species were provided in the Sample table. These sample attributes were also added to the Sample attributes table in the AppxA database.

B.4.5.3 Sample Analysis

The Chemistry table was queried to obtain a list of the unique parameters and reporting groups for the result records. These records were linked against the AppxA Parameter table resulting in 4 unmatched parameters. These were associated with PCB homologues and percent lipids. Four new parameters were added to the Parameter table.

None of the NOAA-salmon worksheets contained any information on analysis method. The source report was used to look up preparation and analysis methods for each parameter. Using existing methods, 22 sample analysis records were created to link all samples to the existing sample results.

B.4.5.4 Sample Results

All results were loaded to the AppxA database after mapping of the parameters, units, and laboratory qualifiers. The unique set of laboratory qualifiers was added to the AppxA Code table, linked to this particular event. All laboratory qualifiers were mapped to the LabQualifierCode field. The InterpretedQualifierCode field was populated based on a mapping from Windward Environmental. The ResultStatusCode field was set to "Validated" for all imported records.

APPENDIX C

Benthic Macroinvertebrate Community

Appendix C: Benthic Macroinvertebrate Community

C.1 Summary Tables

Table C-1. Summary of benthic macroinvertebrate community results for King County Water Quality Assessment survey (September 1997)

Sample	Total Abundance	Taxa Richness	Evenness	Swartz's Dominance Index	Polychaete Abundance	Crustacea Abundance	Amphipod Abundance	Mollusca Abundance	Infaunal Trophic Index
DDS-1	260	10.7	0.50	2.0	78.7	3.3	2.7	0.3	1.0
DDS-3	1,059	44.3	0.40	2.7	887	39.3	5.3	109	62.3
DDS-5	800	47.0	0.70	6.0	320	92.3	4.3	350	63.3
KI-1	1,357	45.3	0.40	3.0	1,045	55.0	10.0	252	65.0
KI-2	555	54.0	0.70	8.7	244	65.7	2.3	222	63.0
KI-4	5,445	31.7	0.40	2.0	3,600	1,674	1,546	32.0	63.7

Note: Results for each sample are mean values from the analysis of three replicates prepared in the field with a 1.0-mm sieve

Table C-2. Summary of benthic macroinvertebrate community results for NOAA/Ecology sediment quality of Central Puget Sound survey (June 1998)

Sample	Total Abundance	Taxa Richness	Evenness	Swartz's Dominance Index	Annelid Abundance	Arthropod Abundance	Mollusca Abundance	Echinoderm Abundance	Misc. Abundance
203	3,764	94	0.426	3	2,970	94	688	0	12
204	1,155	52	0.373	2	1,002	31	117	1	4
205	1,561	65	0.454	3	1,314	17	226	1	3

Notes: Each sample is a single replicate prepared in the field with a 1.0-mm sieve

C.2 Data Validation Summaries

Formal data validation reports have not been prepared for the benthic macroinvertebrate data sets summarized in this appendix.

C.3 DATA LOADING REPORTS

Neither benthic macroinvertebrate data set summarized in this appendix has been loaded to the LDWG database.

APPENDIX D

Sediment Toxicity Tests

Appendix D: Sediment Toxicity Tests

D.1 SUMMARY TABLES

Table D-1. Summary of sediment toxicity test results for King County CSO characterization (June 1995)

LOCATION	SAMPLE	TEST	ENDPOINT	VALUE	SMS STATUS [a]
HN00	L9553-1	*Rhepoxynius* (amphipod) 10-day acute	% mortality	8	Pass
HN10N	L9553-2	*Rhepoxynius* (amphipod) 10-day acute	% mortality	54	SBEC
CH00	L9554-1	*Rhepoxynius* (amphipod) 10-day acute	% mortality	6	Pass
CH10N	L9554-2	*Rhepoxynius* (amphipod) 10-day acute	% mortality	9	Pass
CH10S	L9554-4	*Rhepoxynius* (amphipod) 10-day acute	% mortality	5	Pass
CH20S	L9554-5	*Rhepoxynius* (amphipod) 10-day acute	% mortality	13	Pass
CN00	L9555-1	*Rhepoxynius* (amphipod) 10-day acute	% mortality	27	BEC
CN10S	L9555-4	*Rhepoxynius* (amphipod) 10-day acute	% mortality	10	Pass
CN10W	L9555-5	*Rhepoxynius* (amphipod) 10-day acute	% mortality	16	Pass
Reference	P9552-2	*Rhepoxynius* (amphipod) 10-day acute	% mortality	4	--
Control	West Beach	*Rhepoxynius* (amphipod) 10-day acute	% mortality	6	--
HN20N	L9553-3	*Ampelisca* (amphipod) 10-day acute	% mortality	24	Pass
HN10S	L9553-4	*Ampelisca* (amphipod) 10-day acute	% mortality	22	Pass
HN20S	L9553-5	*Ampelisca* (amphipod) 10-day acute	% mortality	34	BEC
HN10W	L9553-6	*Ampelisca* (amphipod) 10-day acute	% mortality	37	Pass
CH20N	L9554-3	*Ampelisca* (amphipod) 10-day acute	% mortality	18	Pass
CN10N	L9555-2	*Ampelisca* (amphipod) 10-day acute	% mortality	54	SBEC
CN20N	L9555-3	*Ampelisca* (amphipod) 10-day acute	% mortality	100	SBEC
Reference	P9552-1	*Ampelisca* (amphipod) 10-day acute	% mortality	21	--
Control	Native	*Ampelisca* (amphipod) 10-day acute	% mortality	8	--
HN00	L9553-1	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.75	Pass
HN10N	L9553-2	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.64	Pass
HN20N	L9553-3	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.59	Pass
HN10S	L9553-4	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.59	Pass
HN20S	L9553-5	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.61	Pass
HN10W	L9553-6	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.62	Pass
CH00	L9554-1	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.68	Pass
CH10N	L9554-2	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.65	Pass
CH20N	L9554-3	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.57	Pass
CH10S	L9554-4	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.74	Pass

LOCATION	SAMPLE	TEST	ENDPOINT	VALUE	SMS STATUS [a]
CH20S	L9554-5	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.57	BEC
CN00	L9555-1	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.57	BEC
CN10N	L9555-2	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.19	SBEC
CN20N	L9555-3	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.05	SBEC
CN10S	L9555-4	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.64	Pass
CN10W	L9555-5	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.64	Pass
Reference	P9552-1	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.78	--
Reference	P9552-2	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.84	--
Control	West Beach	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	1.07	--
HN00	L9553-1	Echinoderm embryo chronic	effective % mortality	57.9	Pass
HN10N	L9553-2	Echinoderm embryo chronic	effective % mortality	93.2	BEC
HN20N	L9553-3	Echinoderm embryo chronic	effective % mortality	65.0	Pass
HN10S	L9553-4	Echinoderm embryo chronic	effective % mortality	49.1	Pass
HN20S	L9553-5	Echinoderm embryo chronic	effective % mortality	83.3	Pass
HN10W	L9553-6	Echinoderm embryo chronic	effective % mortality	85.4	Pass
CH00	L9554-1	Echinoderm embryo chronic	effective % mortality	74.4	BEC
CH10N	L9554-2	Echinoderm embryo chronic	effective % mortality	47.3	Pass
CH20N	L9554-3	Echinoderm embryo chronic	effective % mortality	62.8	Pass
CH10S	L9554-4	Echinoderm embryo chronic	effective % mortality	54.4	Pass
CH20S	L9554-5	Echinoderm embryo chronic	effective % mortality	58.1	Pass
CN00	L9555-1	Echinoderm embryo chronic	effective % mortality	75.9	BEC
CN10N	L9555-2	Echinoderm embryo chronic	effective % mortality	100	SBEC
CN20N	L9555-3	Echinoderm embryo chronic	effective % mortality	100	BEC
CN10S	L9555-4	Echinoderm embryo chronic	effective % mortality	53.4	Pass
CN10W	L9555-5	Echinoderm embryo chronic	effective % mortality	57.8	Pass
Reference	P9552-1	Echinoderm embryo chronic	effective % mortality	71.6	--
Reference	P9552-2	Echinoderm embryo chronic	effective % mortality	56.4	--
Control	West Beach	Echinoderm embryo chronic	effective % mortality	66.2	--
Control	Seawater	Echinoderm embryo chronic	effective % mortality	23.4	--

[a] Sediment Management Standards status according to King County; Pass = passed Biological Effects Criteria, BEC = failed Biological Effects Criteria, SBEC = failed Severe Biological Effects Criteria

Table D-2. Summary of sediment toxicity test results for NOAA/Ecology sediment quality of Central Puget Sound survey (June 1998)

Location	Sample	Test	Endpoint	Value
Duwamish	203	*Ampelisca* (amphipod) 10-day acute	% survival compared to control	103.3
Duwamish	204	*Ampelisca* (amphipod) 10-day acute	% survival compared to control	92.3
Duwamish	205	*Ampelisca* (amphipod) 10-day acute	% survival compared to control	100.8
Duwamish	203	Echinoderm embryo chronic	% fertilization in 100% pore water compared to control	98.0
Duwamish	204	Echinoderm embryo chronic	% fertilization in 100% pore water compared to control	103.0
Duwamish	205	Echinoderm embryo chronic	% fertilization in 100% pore water compared to control	94.0
Duwamish	203	Microtox, organic solvent extract	EC50 (mg/ml)	3.20
Duwamish	204	Microtox, organic solvent extract	EC50 (mg/ml)	3.33
Duwamish	205	Microtox, organic solvent extract	EC50 (mg/ml)	3.57
Duwamish	203	Cytochrome P-450 Reporter Gene System, organic solvent extract	μg benzo(a)pyrene equivalents/g sediment	96.9
Duwamish	204	Cytochrome P-450 Reporter Gene System, organic solvent extract	μg benzo(a)pyrene equivalents/g sediment	77.0
Duwamish	205	Cytochrome P-450 Reporter Gene System, organic solvent extract	μg benzo(a)pyrene equivalents/g sediment	46.9

Table D-3. Summary of sediment toxicity test results for King County Duwamish/Diagonal CSO/SD Site Assessment Report (September 1996)

Location	Sample	Test	Endpoint	Value	SMS Status [a]
DUD200	L9443-1	*Rhepoxynius* (amphipod) 10-day acute	% mortality	13	Pass
DUD201	L9443-2	*Rhepoxynius* (amphipod) 10-day acute	% mortality	21	Pass
DUD202	L9443-3	*Rhepoxynius* (amphipod) 10-day acute	% mortality	18	Pass
DUD203	L9443-4	*Rhepoxynius* (amphipod) 10-day acute	% mortality	22	Pass
DUD204	L9443-5	*Rhepoxynius* (amphipod) 10-day acute	% mortality	26	BEC
DUD205	L9443-6	*Rhepoxynius* (amphipod) 10-day acute	% mortality	19	Pass
DUD206	L9443-7	*Rhepoxynius* (amphipod) 10-day acute	% mortality	4	Pass
Reference	P9446-1	*Rhepoxynius* (amphipod) 10-day acute	% mortality	6	--
Reference	P9446-2	*Rhepoxynius* (amphipod) 10-day acute	% mortality	8	--
Control A		*Rhepoxynius* (amphipod) 10-day acute	% mortality	3	--
Control B		*Rhepoxynius* (amphipod) 10-day acute	% mortality	1	--
DUD200	L9443-1	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.60	Pass
DUD201	L9443-2	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.55	Pass
DUD202	L9443-3	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.62.	Pass
DUD203	L9443-4	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.59	Pass

LOCATION	SAMPLE	TEST	ENDPOINT	VALUE	SMS STATUS [a]
DUD204	L9443-5	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.51	Pass
DUD205	L9443-6	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.54	Pass
DUD206	L9443-7	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.52	BEC
Reference	P9446-1	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.48	--
Reference	P9446-2	*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.60	--
Control A		*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.82	--
Control B		*Neanthes* (polychaete) 20-day chronic	growth rate (mg/d)	0.77	--
DUD200	L9443-1	Echinoderm embryo chronic	effective % mortality		Pass
DUD201	L9443-2	Echinoderm embryo chronic	effective % mortality		Pass
DUD202	L9443-3	Echinoderm embryo chronic	effective % mortality		Pass
DUD203	L9443-4	Echinoderm embryo chronic	effective % mortality		Pass
DUD204	L9443-5	Echinoderm embryo chronic	effective % mortality		Pass
DUD205	L9443-6	Echinoderm embryo chronic	effective % mortality		Pass
DUD206	L9443-7	Echinoderm embryo chronic	effective % mortality		BEC
Reference	P9446-1	Echinoderm embryo chronic	effective % mortality		--
Reference	P9446-2	Echinoderm embryo chronic	effective % mortality		--
Control A		Echinoderm embryo chronic	effective % mortality		--
Control B		Echinoderm embryo chronic	effective % mortality		--
Seawater		Echinoderm embryo chronic	effective % mortality		--

[a] Sediment Management Standards status according to King County; Pass = passed Biological Effects Criteria, BEC = failed Biological Effects Criteria, SBEC = failed Severe Biological Effects Criteria

D.2 DATA VALIDATION SUMMARIES

Formal data validation reports have not been prepared for the bioassay data sets summarized in this appendix.

D.3 DATA LOADING REPORTS

Neither bioassay data set summarized in this appendix has been loaded to the LDWG database.