CSO PLAN FIVE-YEAR UPDATE

1986-1991

METRO
Municipality of Metropolitan Seattle

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Enclosed is Metro's CSO Plan Five-Year Update 1986-1991 as required in WAC-173-245.

The update contains:

* Status reports on CSO control projects
* Annual summaries of CSO volumes for 1989-1991
* Frequency of overflow events data for 1990-1991
* CSO monitoring program data
* Discussion of monitoring data results

The update does not contain a detailed evaluation of the effectiveness of the program thus far as only one project (Hanford/Bayview) is complete and fully operational.

If there are any questions or concerns regarding the update, please call Laura Wharton at 684-1238 or Danya Crosby at 684-1240.

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Introduction

In 1988 the Metro Council adopted a comprehensive combined sewer overflow (CSO) control plan for the Metro system. The plan identified ten separate CSO control projects and an implementation schedule to achieve a 75 percent CSO volume reduction by the year 2005. Metro's long term goal is to reduce CSOs to no more than one overflow event per site per year.

CSO Annual Reports are submitted to the Washington Department of Ecology (WDOE) every year in compliance with WDOE regulations (WAC 173-245). The reports provide control program status, overflow volume summary information, monitoring program data, and summaries of data analyses.

Five-year CSO Plan updates are also required in the regulations. Metro and WDOE agreed that the 1991 CSO Plan Five-Year Update would not be required to provide a detailed evaluation of the effectiveness of the program thus far, since only one project (Hanford/Bayview), is completed and fully operational. The 1991 CSO Plan five-year update will provide status reports on all scheduled projects, annual summaries of CSO volumes for the last two years compiled from previous CSO annual reports, frequency data for the 1990/1991 reporting period, summaries of all monitoring program data for CSO flows and sediments, and a discussion of the results to date.

COMBINED SEWER OVERFLOW CONTROL PROGRAM IMPLEMENTATION

Introduction

The 1988 CSO Control Plan identified ten separate CSO control projects and an implementation schedule to achieve a 75 percent CSO volume reduction by the year 2005.

Program Schedule	Design Initiation	On-Line
Parallel Fort Lawton Tunnel	1987	1991
CATAD Modifications	1987	1992
Hanford/Bayview/Lander	1986	1992
University Regulator	1986	1993
Carkeek Transfer/CSO Treatment Facility	1988	1994
Alki Transfer/CSO Treatment Facility	1989	1996
Denny Way Separation	1993	1999
Diagonal Separation	1995	1999
Michigan Separation	1991	2003
Kingdome Separation	1991	2006

Status of Initiated CSO Control Projects

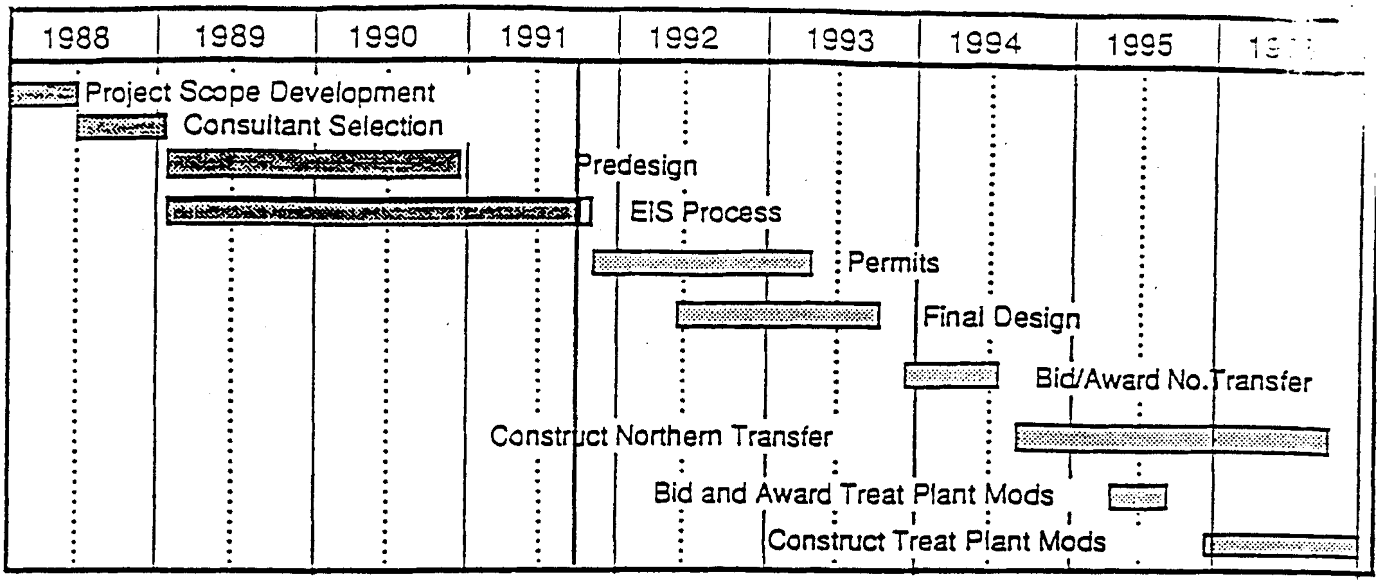
Alki Transfer/CSO Treatment Facility

Scope

The Alki project is designed to transfer base flows (2.25 X AWWF) from the Alki drainage basin to the West Point plant for secondary treatment. Flows above this level, to a maximum of 74 million gallons per day (mgd), will receive primary treatment and disinfection at Alki. The existing facility will be modified to permit intermittent discharges and flows will be discharged from the existing outfall. Specific permit conditions for operation of the Alki stormweather plant have been negotiated with WDOE. Full utilization of this project is contingent on West Point being on-line in 1995.

Status

The following schedule depicts 1988-1996 project tasks:



Predesign was completed in 1990 and writing of the EIS began in September 1991.

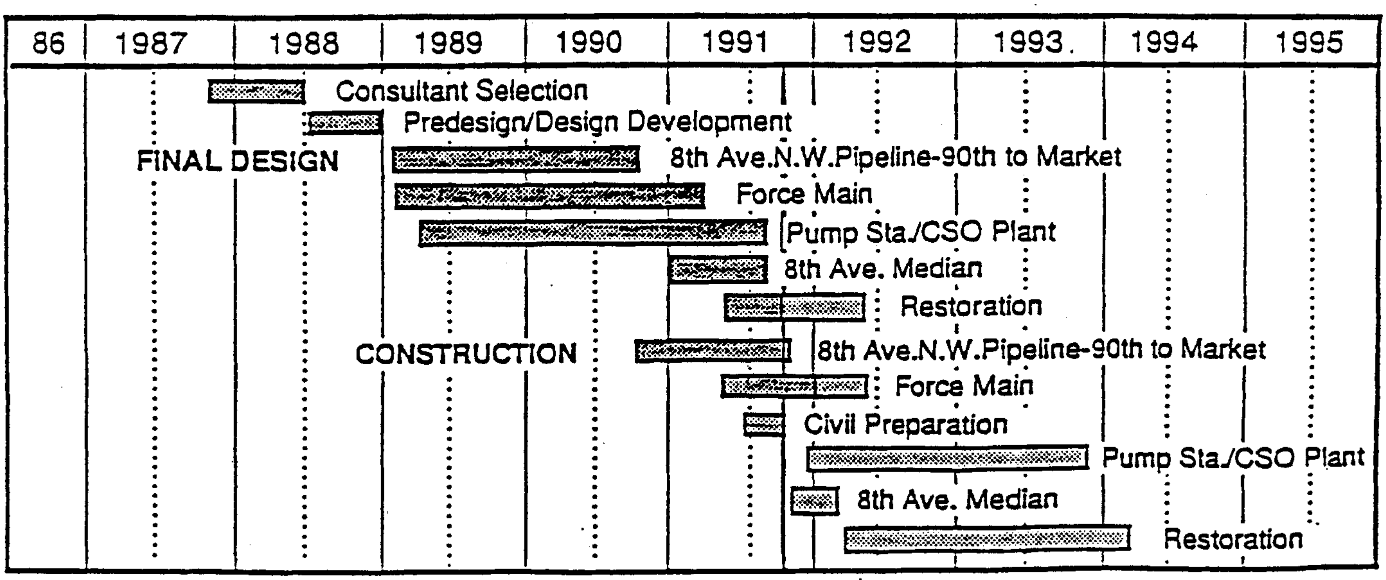
Carkeek Transfer/CSO Treatment Facility

Scope

The Carkeek project is designed to transfer base flows (2.25 X AWWF) from the Carkeek drainage basin to the West Point plant for secondary treatment. Flows above this level, to a maximum of 20 mgd, will receive primary treatment and disinfection at the existing Carkeek treatment plant and be discharged through the existing outfall. The existing facility will undergo minor modifications to allow treatment of peak storm-related flows up to 20 mgd. Specific permit conditions for operation of the Carkeek stormweather plant have been negotiated with WDOE.

Status

The following schedule depicts 1987-1994 project tasks:



Construction of the 8th Ave. N.W. pipeline began in late 1990. Final design of all elements will be completed in 1992. Full utilization of this project is contingent on West Point being on-line in 1995.

Computer Augmented Treatment and Disposal (CATAD) System Modifications

Scope

Modifications to the CATAD control system are designed to improve system efficiency by more fully utilizing the storage capacity in existing sewers.

The previous computer control system utilized 17 to 28 million gallons (MG) or 28 to 47 percent of the storage within the system's estimated 60 MG capacity. Planning level estimates anticipate the improvements will increase capture rate to approximately 44 MG or 73 percent and reduce CSO volumes in the West Point service area by about 175 MG annually from the 1981-83 estimated total of 2.4 billion gallons.

Status

-Project Elements

* Hydraulic and hydrological models were completed in 1987.
* Flow forecast programs were completed at the end of 1988.
* Predictive (Adaptive) Control development was completed in 1991.
* Predictive Control testing and tuning began in October 1991 and will continue through March 1992.
* Five new depth sensors were purchased and installed at selected sites in 1991 to increase collection system flow information. Sensor installation was completed in June 1991.
* Five new rain gauges were installed to more effectively measure rainfall in the West Point service area.
* Facilities Planning System (FPS) was completed in 1991 and documented. The FPS package allows Metro staff to utilize models and programs developed for the Predictive Control program.
* The system will be fully operational in April 1992.

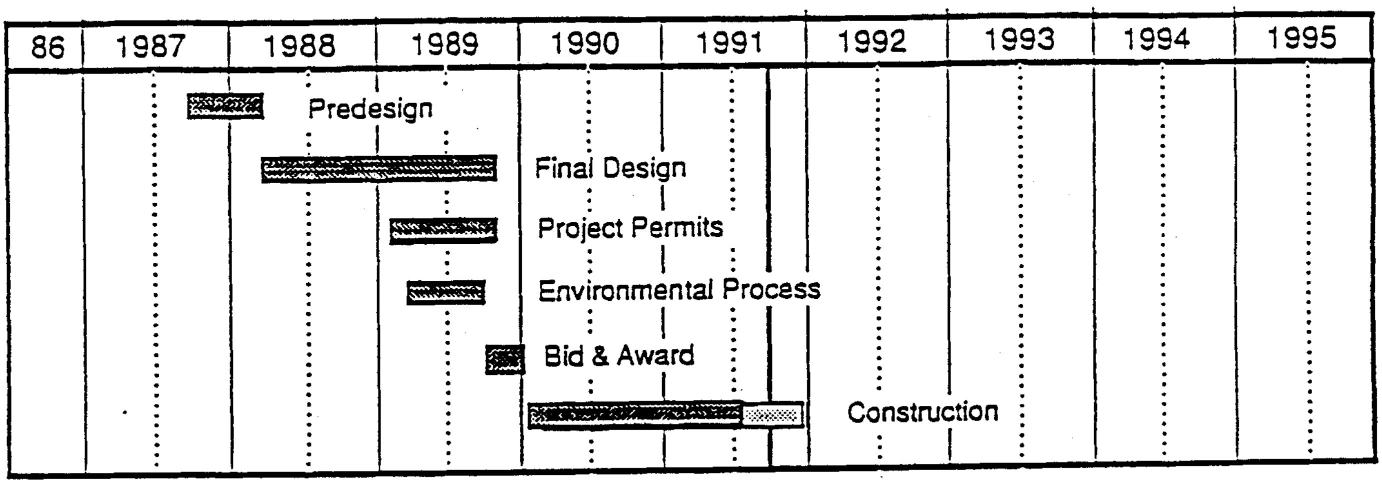
Fort Lawton Parallel Tunnel

Scope

The West Point Secondary Treatment Plant has a peak capacity of 144 mgd. The new parallel tunnel will store and transport 82 mgd of combined sanitary and stormwater flows over the secondary base flow capacity of 358 mgd to West Point. When completed this project will provide CSO reduction at the Ballard Regulator and Third Avenue West weir.

Status

The following schedule depicts 1987-1991 project tasks:



Construction was completed in the summer of 1991 and the tunnel was activated in the fall of 1991.

Hanford/Bayview/Lander Sewer Separation

Scope

This project consists of partial separation of the Lander and Hanford drainage basins and activation of the previously abandoned Bayview Tunnel.

Hanford

The Hanford separation project was completed in October 1987. The project partially separated (removed street storm drains) about 1,132 acres of combined sewers upstream of the existing Hanford tunnel. The project also included installation of a new 36-inch sanitary sewer line inside the existing 108-inch Hanford tunnel. The 36-inch line is used to convey partially separated flow to the Elliott Bay Interceptor. The 108-inch tunnel conveys stormwater to the Diagonal Way storm drain and then to the Duwamish River. The project eliminated CSOs from the Hanford No. 1 Regulator.

Lander/Bayview

The Lander Separation Project was conducted in two phases. Phase I provided partial separation of the Lander basin through the installation of a new 96-inch sanitary trunk line and conversion of the existing 84-inch line to convey stormwater. The new 96-inch line provides about 1.4 million gallons of storage capacity. Metro removed 500 tons of debris from the 84-inch line. The City of Seattle will maintain the line in the future. Phase II of the project requires installation of a new stormwater collection system in the basin that will be operated and maintained by the City of Seattle. The Bayview Tunnel will be used to divert flows from the Hanford Basin to the 96-inch Lander sanitary trunk line. The components of Phases I and II are as follows:

Phase I:

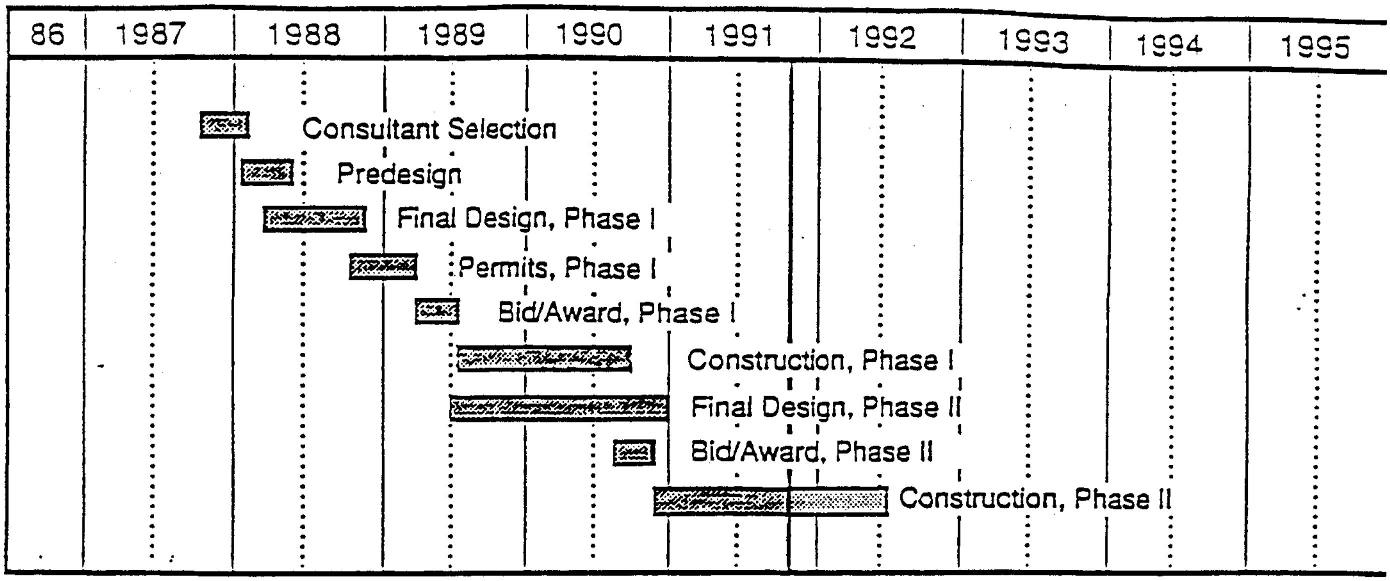
* 96-inch Lander sanitary trunk
* New Lander regulator station
* Elliott Bay Interceptor connection
* Bayview diversion structure
* New stormwater collection system from existing 84-inch Lander trunk to the limits of the Lander street right-of-way
* Connection of existing combined collection system to new 96-inch sanitary trunk through drop manhole structures

Phase II:

* New stormwater collection pipeline in Lander Basin
* Connection of existing street drainage and parking lots to new stormwater collection pipelines within right-of-way limits

Status

The following schedule depicts 1987-1992 project tasks:



Consultant selection, predesign and final design of Phase I occurred in 1988. Phase I construction began on schedule and was completed in October 1990. The 96-inch line is currently conveying sewage to the Elliott Bay interceptor for conveyance to West Point for eventual secondary treatment. The 84-inch stormwater line will be utilized as needed. Phase II construction began in November 1990 and was substantially completed in September 1991. Administrative project closeout will occur in mid-1992.

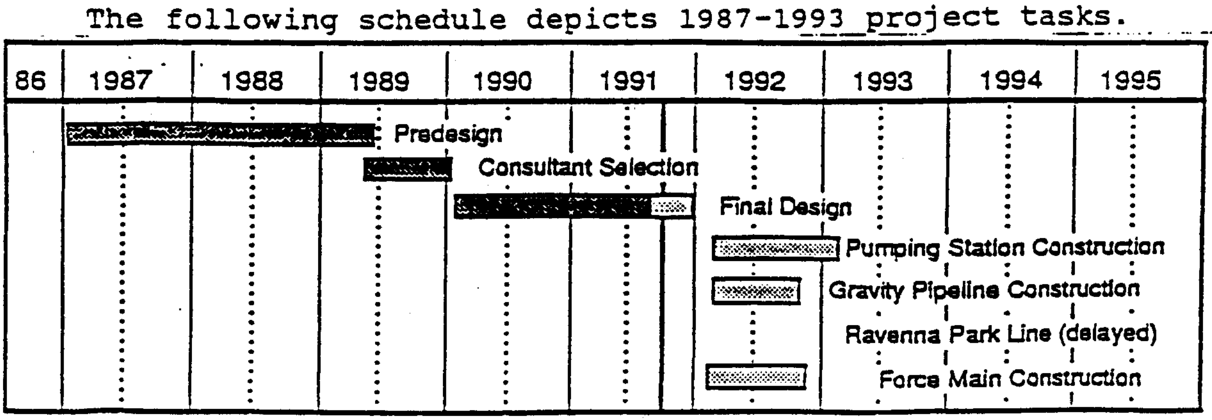
University Regulator

Scope

As a result of the University Regulator Project, storm runoff from the Densmore drain, Interstate-5, and outflow from Green Lake will be diverted from Metro's North Interceptor sanitary sewer system to a new storm drain. CSOs into Portage Bay and ultimately to the Ship Canal-Lake Union system will be reduced by an estimated 111 million gallons annually.

Status

The following schedule depicts 1987-1993 project tasks.



Metro completed final 90% plans in October 1991. Restoration designs were reviewed with the Department of Natural Resources, Seattle Engineering Department, and the community in September 1991. Construction is scheduled to begin in the first quarter of 1992.

__Additional CSO Abatement Projects__

Predesign is underway on the Kingdome and Michigan Separation projects. The purpose of predesign is to identify what, if any, project elements should be constructed to avoid conflict with City of Seattle transportation improvement projects. With the exception of the Kingdome separation, there is no indication that substantial savings or avoidance of environmental impacts would be realized by accelerating completion of these projects. Consequently, work on these and other remaining CSO projects is not anticipated until after 1993 based on current scheduling. Remaining projects include the Diagonal, Denny Way, and Michigan separation projects.

__Additional CSO Related Projects__

Denny Way Sediment Capping Project

Scope

A sediment capping project was conducted offshore of the Denny Way CSO as an experimental demonstration project to evaluate the benefits of capping as a means of improving sediment quality in Elliott Bay. A total of thirteen barge loads of clean dredged sand were delivered and spread over a rectangular capping site (200 ft X 600 ft) in a cooperative effort between the Seattle District, U.S. Army Corps of Engineers (COE) and Metro. In support of the capping operation, Metro conducted pre-dredge testing of capping sediments; dissolved oxygen testing during cap placement; and measured at six diver-installed rods and plates to determine foundation settlement and cap thickness. Metro is currently conducting a five-year post-capping monitoring program that includes surface grab sediment sampling to measure cap chemistry for recontamination and benthic taxonomy for recolonization evaluation; video camera surveying to view overall bottom condition; coring with sediment chemical testing to determine cap effectiveness in isolating chemicals; and preparing reports during the monitoring period.

Status

The capping was completed in March 1990. The monitoring program runs from 1990 to 1995 with monitoring reports scheduled to be completed in 1990, 1991, 1992, and 1994. A 5-year project review will be conducted in 1995.

1989-1991 CSO VOLUMES

Introduction

The volume and frequency of CSOs at 18 regulator stations in the West Point system are monitored by Metro's CATAD system. Metro's West Point system is divided into the Northern Service Area (NSA) and the Southern Service Area (SSA). NSA flows are transported to West Point via the North or Central Trunk and flows from the SSA are transported to West Point via the Elliott Bay Interceptor. Overflow reports are generated daily, evaluated by staff and archived for future reference. Metro deploys portable flow meters at two stations not currently monitored by CATAD - the overflow weir at Third Avenue West and at the Ballard No. 1 regulator station at 11th Ave. N.W.

Discussion of Baseline Conditions

The volume and frequency of CSOs will change as the amount of rainfall changes from the average. In order to estimate the variability of CSO volume and frequency, 42 years of hourly rainfall data were entered into a model developed to predict CSOs from the Metro system. The model was used to calculate the annual CSO volume that would have occurred in the collection system as it existed in 1981 to 1983 for the rainfall from each of the years 1943 through 1984. WDOE proposed 1981-1983 CSO conditions as a baseline for judging CSO control. It was found that the 1981-1983 CSO volume and frequency would be exceeded (even if the collection system and all other aspects of the regulators, CATAD, etc., remained unchanged) about once every five years because of year-to-year variations in rainfall. Thus, the baseline condition for 1981-1983 represents the physical characteristics of the collection and CATAD system during this time period, rather than a not-to-be-exceeded CSO volume.

The relationship between CSO volume and rainfall is approximated by the following formulas:

Baseline NSA

CSO Volume(in MG)=(19.3 X Annual Rainfall in inches)-190

Baseline SSA

CSO Volume(in MG)=(66.7 X Annual Rainfall in inches)-460

Baseline Total

Total = Baseline NSA + Baseline SSA

By entering the averaged historical annual rainfall of 36 inches into the above formulas baseline conditions were established as follows:

Baseline NSA

CSO Volume = (19.3 X 36 inches) - 190 = 458 MG

Baseline SSA

CSO Volume = (66.7 X 36 inches) - 460 = 1941 MG

Baseline Total = 2399 MG

While the establishment of baseline conditions identifies average annual volume and frequencies of discharge, year-to-year comparisons to baseline conditions can be misleading. Yearly annual rainfall cannot indicate year-to-year variations in CSO volumes for individual basins as rainfall can be extremely variable in the Seattle area. Individual storm events can disproportionately influence total overflow volume since peak storm events may contribute significant rainfall accumulations in relatively short periods of time resulting in large overflow volumes while storms of low intensity and long duration may be equated with overflows of a lesser volume. Rainfall should ideally be compared by basin to derive an accurate understanding of system response.

1989/1990 Overflow Volume Comparison to Baseline Conditions

Development of Metro's CATAD system was underway from June 1989 to October 1989. As a result, overflow volume information is not available for this period of time. Overflow volumes from the period June 1990 to October 1990 were substituted for the period of missing data. Although this method of substitution is not absolutely accurate, it does provide a reasonable estimate of expected overflow volumes for the drier summer and autumn months.

Actual overflow volumes used for the period June 1989 to October 1989 differ slightly from the overflow volumes used in the same period for 1990 because of differing methods of accessing overflow data ; during the 1989/1990 reporting period, staff accessed computer-generated daily overflow volumes and manually added numbers to arrive at a monthly total while for the 1990/1991 reporting period staff accessed computer-generated monthly overflow volume reports for monthly overflow volumes. Different monthly overflow totals result due to differences in manually rounding off several-digit numbers. Resulting overflow volumes are approximately the same.

Overflow volumes from Canal St. were inadvertently excluded from the 1989/1990 CSO Annual Report. Canal St. overflow volumes are included in the 1989/1990 Volume Summary by Service Area table (Table 1, Page 13). The 1989/1990 total overflow volume has been adjusted accordingly, increasing 1989/1990 total overflow by 23 MG.

A total overflow volume of 1872 MG was recorded for the period June 1989 through May 1990, 537 MG below baseline conditions. Overflows in the SSA totalled 1490 MG, 451 MG under baseline conditions. Overflows in the NSA totalled 381 MG, 77 MG under baseline conditions as summarized in Table 2.

TABLE 2

Service Area	1988 CSO Plan	1989/1990
NSA	468 MG	381 MG
SSA	1941 MG	1490 MG
TOTAL	2409 MG	1872 MG

Rainfall for the 1989/1990 reporting period was below average with 30.2 inches as shown in Figure 1 (Page 14).

Total overflow volumes for this reporting period were exacerbated by a 100-year storm which occurred during the period January 8-10, 1990. This extreme storm event alone accounted for over 400 MG of CSO contributing to a 779 MG total for the month of January, over 40 percent of the 1989/1990 total.

Monthly and total overflow volumes for each station and comparisons to baseline conditions are reported in Table 1 (Page 13).

1989/1990 SSA Overflow Volume Discussion

SSA overflow volumes were approximately 451 MG under baseline conditions with significant reductions at the Hanford #2, Lander, and Michigan regulator stations. Reductions at Hanford #2 can partially be attributed to completion of the Hanford portion of the Hanford/Bayview/Lander project. Lower volumes at Michigan may be attributed to higher volumes at the adjacent Brandon and Norfolk regulator stations. For these three regulators, the sum of CSOs for 1989/1990 (271 MG) is approximately equivalent to baseline conditions (290 MG).

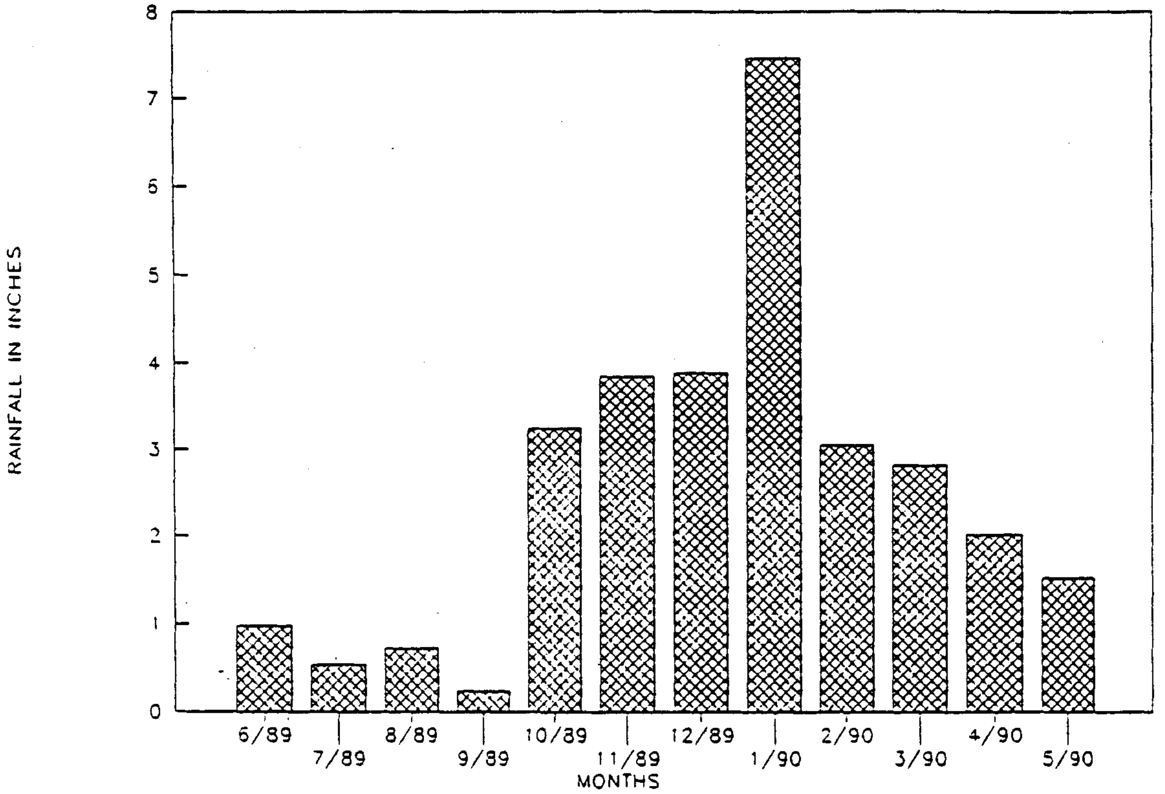
TABLE 1

1989/1990 Volume Summary by Service Area
(volumes in million gallons)

STATION	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	1989/1990 TOTAL	CSO PLAN BASELINE
	CATAD not on-line during this period. 1990 Representative Data Substituted.					1989			1990					
SSA														
Denny Way	23.30	3.36	0.00	0.36	67.18	57.76	150.05	228.91	66.16	28.82	9.18	11.63	646.71	370.00
King St.	5.18	0.62	0.00	0.00	1.54	6.66	8.88	13.89	0.00	0.00	2.31	0.00	39.08	70.00
Connecticut	10.90	1.00	0.11	0.00	4.91	14.81	27.50	41.21	12.03	11.00	1.46	1.11	126.04	90.00
Hanford #2	9.81	0.13	0.00	0.00	3.00	16.78	33.35	108.42	36.50	9.46	0.00	1.49	218.94	680.00
Lander St.	0.00	0.00	0.00	0.00	15.71	15.74	30.16	64.61	4.80	4.06	0.00	0.00	135.08	215.00
Harbor	2.26	0.28	0.09	0.00	1.60	1.51	11.00	24.74	0.98	1.77	0.88	1.27	46.38	55.00
Chelan	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.55	0.00	0.00	0.00	0.00	1.56	25.00
West Michigan	0.00	0.02	0.00	0.00	0.00	0.00	0.29	0.76	0.00	0.00	0.00	0.00	1.07	2.00
8th Ave.	0.45	0.00	0.00	0.00	0.00	0.00	0.09	3.58	0.00	0.00	0.00	0.00	4.12	15.00
Brandon St.	0.22	3.29	0.22	0.00	6.74	74.88	0.95	44.59	2.68	3.90	0.57	11.16	149.20	35.00
Michigan St.	3.45	0.73	0.00	0.00	0.22	0.12	13.36	30.38	0.21	1.22	0.00	3.61	53.30	250.00
Norfolk	0.85	0.00	0.00	0.00	3.85	2.85	23.88	34.75	0.00	2.41	0.00	0.22	68.81	4.00
Duwamish P.S.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	130.00
												TOTAL SSA	1490.29	1941.00
NSA														
Ballard	0.00	0.00	0.00	0.00	16.83	0.00	55.11	44.02	0.84	1.40	0.00	0.00	118.20	90.00
Dexter	1.05	1.63	0.00	0.00	3.47	0.50	3.08	10.31	0.00	0.00	0.49	1.82	22.35	12.00
University	0.00	0.00	0.00	0.00	0.26	0.00	3.99	18.28	0.00	0.00	0.00	0.00	22.53	211.00
Montlake	0.38	1.12	0.00	0.00	0.00	1.47	21.75	63.58	0.00	0.00	0.00	0.00	88.30	40.00
Canal St.	2.03	0.00	0.00	0.00	2.07	12.67	2.92	1.49	0.61	0.76	0.00	0.00	22.55	0.00
3rd Ave. W.	0.00	0.00	0.08	0.00	4.71	9.51	24.04	38.06	0.00	0.00	0.03	0.00	76.43	105.00
Ballard No. 1 (11th Ave. NW)	0.81	0.00	0.00	0.00	2.91	8.96	12.63	5.60	0.00	0.00	0.00	0.21	31.12	0.00
												TOTAL NSA	381.48	458.00
TOTAL	60.69	12.19	0.50	0.36	135.00	224.22	423.03	778.73	124.81	64.80	14.92	32.52	1871.77	2399.00

FIGURE 1

1989/1990 RAINFALL



West Duwamish Interceptor regulator stations (Harbor, Chelan, Eighth Ave., and W. Michigan) overflowed 53.3 MG in 1989/1990, considerably less than baseline conditions (97 MG). This decreased overflow volume is likely a result of the below-average precipitation experienced in 1989/1990.

Denny Way overflowed a total of 647 MG during 1989/1990 compared to a baseline of 370 MG.

1989/1990 NSA Overflow Volume Discussion

1989/1990 overflows in the NSA were approximately 77 MG under baseline conditions. Overflow volumes at E. Ballard, Dexter Ave., Third Ave. W. and Ballard correspond well with baseline conditions. Overflow volumes were approximately 50 MG higher at Montlake and 190 MG lower at University as a result of a misprogrammed programable logic controller (PLC). The misprogrammed PLC and its effects on NSA overflow sites is discussed in the 1990/1991 NSA Overflow Volume Summary section.

1990/1991 Overflow Volume Comparison to Baseline Conditions

A total overflow volume of 2556 MG was recorded for the period June 1990 through May 1991, 157 MG over established baseline conditions. Overflows in the SSA totalled 2029 MG, 88 MG over baseline conditions. Overflows in the NSA totalled 526 MG, 68 MG over baseline conditions as summarized in Table 3.

Table 3

Service Area	1988 CSO Plan	1990/1991
NSA	468 MG	526 MG
SSA	1941 MG	2029 MG
TOTAL	2399 MG	2556 MG

Monthly and total overflows for each station and comparisons to baseline conditions for each station are reported in Table 4 (Page 16).

Peak storm events may have contributed significantly to overflow volumes. Three storm events account for nearly half (48 percent) of the total overflow volume for the 1990-1991 reporting period. This illustrates the effects of peak storm events that contribute to large volumes of overflow in relatively short periods of time. Table 5 lists the dates of these storm events and corresponding overflow volumes:

TABLE 4

1990/1991 Volume Summary by Service Area
(volumes in million gallons)

STATION	June (1990)	July (1990)	Aug. (1990)	Sept. (1990)	Oct. (1990)	Nov. (1990)	Dec. (1990)	Jan. (1991)	Feb. (1991)	March (1991)	April (1991)	May (1991)	1990/1991 TOTAL	CSO PLAN BASELINE
SSA														
Denny Way	23.36	3.36	0.00	0.36	67.64	140.76	43.54	53.88	83.93	134.62	112.66	2.24	666.35	370.00
King St.	5.20	0.62	0.00	0.00	1.54	13.18	10.59	5.26	7.73	12.64	13.45	0.00	70.21	70.00
Connecticut	10.92	1.00	0.11	0.00	4.93	30.02	7.62	12.82	16.43	25.08	34.05	0.13	143.11	90.00
Hanford #2	9.84	0.13	0.00	0.00	3.00	37.10	2.04	83.25	229.83	21.34	52.73	0.00	439.26	680.00
Lander St.	0.00	0.00	0.00	0.00	15.71	55.94	11.52	11.91	10.84	62.26	98.92	0.00	267.10	215.00
Harbor Ave.	2.27	0.28	0.09	0.00	1.60	11.14	2.19	2.06	3.58	3.97	8.60	0.07	35.85	55.00
Chelan	0.00	0.01	0.00	0.00	0.00	5.03	1.24	0.14	2.07	1.29	4.62	0.00	14.40	25.00
West Michigan	0.00	0.02	0.00	0.00	0.00	0.63	0.00	0.01	0.00	0.12	1.01	0.00	1.79	2.00
8th Ave.	0.45	0.00	0.00	0.00	0.00	11.02	0.14	0.00	4.42	0.57	5.97	0.00	22.57	15.00
Brandon St.	4.37	3.29	0.21	0.00	6.74	36.67	17.87	16.53	27.92	25.25	23.90	0.17	162.92	35.00
Michigan St.	3.44	0.73	0.00	0.00	0.22	8.66	0.08	1.43	1.23	7.61	13.11	0.00	36.51	250.00
Norfolk	0.85	0.00	0.00	0.00	3.85	76.85	25.35	6.53	17.17	9.57	28.95	0.00	169.12	4.00
Duwamish P.S.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	130.00
NSA												TOTAL SSA	2029.19	1941.00
Ballard	0.00	0.00	0.00	0.00	16.80	71.05	12.80	5.51	12.48	6.31	20.64	0.00	145.59	90.00
Dexter	1.05	1.62	0.00	0.00	3.47	11.49	2.79	0.00	1.52	6.20	6.52	0.00	34.66	12.00
University	0.00	0.00	0.00	0.00	0.26	14.55	13.36	0.00	0.00	2.30	45.06	0.00	75.53	211.00
Montlake	0.38	1.12	0.00	0.00	0.00	12.09	9.13	7.82	4.61	13.62	37.75	0.00	86.52	40.00
Canal St.	2.03	0.00	0.00	0.00	2.07	12.67	2.92	1.49	0.61	0.30	0.47	0.00	22.56	0.00
3rd Ave. W.	0.00	0.00	0.00	0.00	11.37	43.86	11.89	10.90	9.50	4.03	38.99	0.00	130.54	105.00
Ballard No. 1 (11th Ave. NW)	1.30	0.14	0.00	0.00	3.90	13.16	4.74	2.40	0.94	4.45	0.00	0.00	31.03	0.00
												TOTAL NSA	526.43	458.00
TOTALS	65.46	12.32	0.41	0.36	143.10	605.87	179.81	221.94	434.81	341.53	547.40	2.61	2555.62	2399.00

Table 5

Date	Overflow Volume
Mar. 01-04 1991	310 MG
Nov. 23-25 1990	395 MG
Apr. 03-06 1991	509 MG

The rainfall for the reporting period was 35.5 inches as shown in Figure 2 (Page 18). As a result of the approximately average rainfall, CSO volumes for June 1990 through May 1991 were average. Because most CSO control programs are not completed, CSO reduction benefits have not yet been realized. Reduction benefits from the Parallel Fort Lawton Tunnel and completed CATAD modifications will be partially reflected in the 1991-1992 CSO Annual Report. As other CSO Control Programs are completed and implemented, greater CSO reductions are expected to occur.

1990/1991 SSA Overflow Volume Summary

1990/1991 overflows in the SSA were approximately 88 MG over established baseline conditions.

Denny Way overflowed 666 MG compared to a baseline of 370 MG. Metro staff are currently evaluating possible causes of this apparent fluctuation from baseline conditions.

Hanford #2 overflowed 439 MG compared to a baseline of 680 MG, a reduction of 141 MG. This reduction can be attributed to partial completion of the Hanford/Lander/Bayview CSO Sewer Separation Project.

Michigan St. overflowed 37 MG compared to a baseline of 250 MG, a reduction of 213 MG. Lower overflow volumes at the Michigan Regulator may be attributed to higher overflow volumes at the adjacent Brandon and Norfolk Regulators. For these three regulators, the total overflow for 1990/1991 (369 MG) is greater than their total baseline (289 MG).

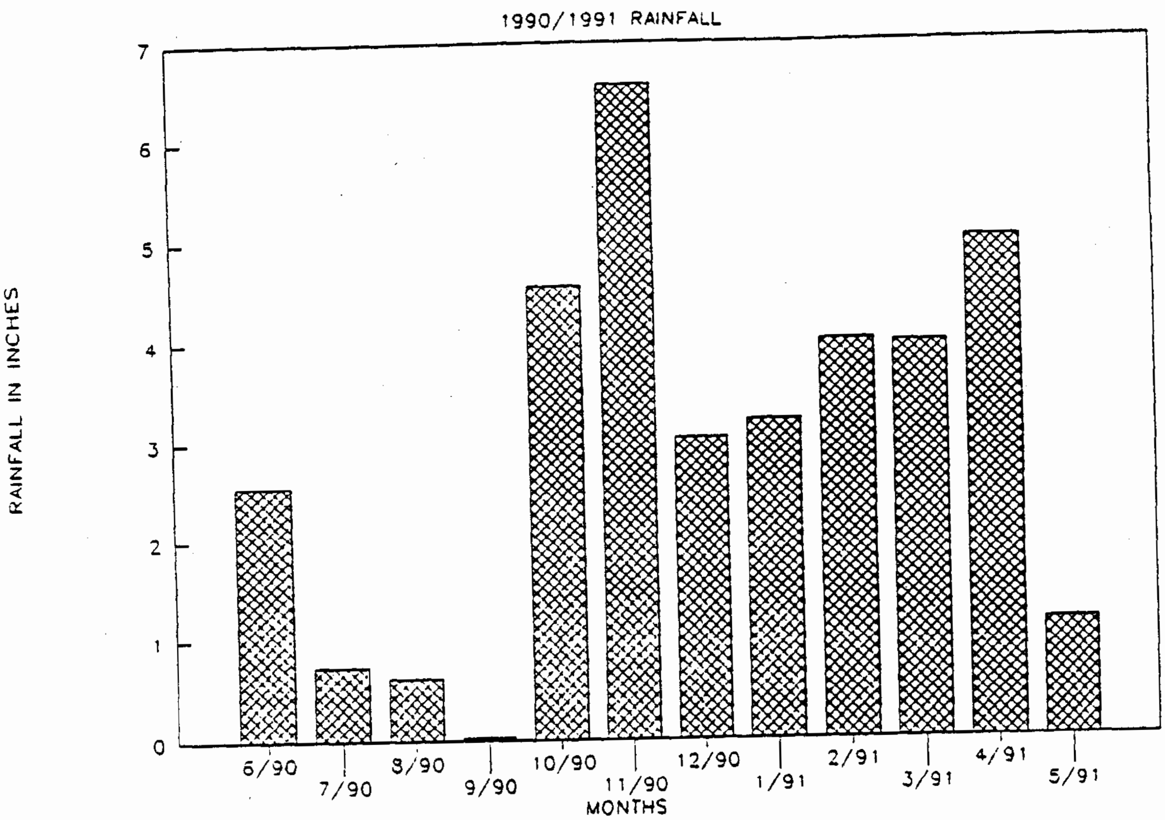
Metro staff are currently evaluating possible causes of these fluctuations from baseline conditions.

1990/1991 NSA Overflow Volume Summary

1990/1991 overflows in the NSA were approximately 68 MG over baseline conditions.

University overflowed 76 MG compared to a baseline of 211 MG. Montlake overflowed 90 MG compared to a baseline of 40 MG.

FIGURE 2


1990/1991 RAINFALL
RAINFALL IN INCHES
0
1
2
3
4
5
6
7
6/90
7/90
8/90
9/90
10/90
11/90
12/90
1/91
2/91
3/91
4/91
5/91
MONTHS

The discrepancy between baseline conditions and actual recorded overflow volumes for University and Montlake regulator stations was also noted in the 1989-1990 CSO Annual Report. In the 1989/1990 CSO Annual Report, overflow volumes were approximately 50 MG higher at Montlake and 190 MG lower at the University Regulator. As a result of these apparent fluctuations from baseline conditions noted in last year's report, Metro began evaluating possible causes within the scope of the University Regulator CSO Control Project.

After extensive investigation, it was determined that no known fundamental changes to the system explained the discrepancies between baseline conditions and actual University and Montlake overflow volumes. Metro then examined the setpoints for the downstream North Trunk and the University Regulator. It was determined that the programable logic controller (PLC), which controls the interceptor level downstream of the University Regulator by utilizing the surface water level signal to control the operation of the regulator gates was misprogramed. This allowed the North Trunk to rise an additional 6.5 feet before the University Regulator station allowed a combined sewer overflow to occur. Because more flow was allowed into the downstream North Trunk, there was less capacity for the Montlake flow, thus explaining the doubling of overflow at the Montlake regulator and the decrease of the University Regulator frequency and volume of overflow.

As a result of the programable logic controller, flows which normally would have overflowed at University continued to flow into the North Interceptor and increased overflows at Third Avenue West and Canal Street. Third Avenue West overflowed 131 MG compared to a baseline of 105 MG. Canal St. overflowed 23 MG compared to a baseline of 0 MG.

Although the higher than normal downstream trunk levels resulted in an overall decrease in the volume of discharge from CSOs, staff from the University of Washington's medical center complex experienced sewage backup. This was a major reason for resetting the PLC in April 1991.

1989/1990 and 1990/1991 Overflow Volumes Discussion

Rainfall in 1989/1990 was less-than-average rainfall (30.2 inches) while rainfall in 1990/1991 was approximately average (35.5 inches). The variations in rainfall for these two reporting periods contribute to differences in CSO volumes.

In addition to variations in rainfall for the two reporting periods, higher volumes for the 1990/1991 reporting period may be attributed to the fact that most CSO control programs have not been completed and therefore CSO reduction benefits have not been realized. With the completion of CATAD modifications and Phase II of the Lander/Bayview portion of the Hanford/Lander/Bayview project in 1992, greater CSO reductions are expected to occur. In addition, reduction benefits from the completed Fort Lawton Parallel Tunnel project, which was activated in the fall of 1991, are expected to be partially reflected in the 1991/1992 CSO Annual Report. Metro is confident that completion of these and other projects will result in realization of the goal of 75 percent CSO reduction by the year 2005.

1990-1991 FREQUENCY OF OVERFLOW EVENTS

Frequency of overflow events information is available for the 1990-1991 reporting period only. Table 6 (Page 22) summarizes overflow events per overflow site and provides baseline frequency of events information.

As a result of partial completion of the Hanford/Bayview/Lander CSO Control Project, overflows were eliminated from Hanford #1, thus achieving the goal of zero overflow events per year for Hanford #1.

Frequency of overflow events were notably higher than baseline at Norfolk (25 compared to a baseline of 7), Brandon (40 compared to a baseline of 25), Connecticut (37 compared to a baseline of 46), Canal St. (11 compared to a baseline of zero), and Dexter (13 compared to a baseline of 4).

Michigan's frequency of events decreased from baseline (18 compared to a baseline of 31). University's frequency of events also decreased from baseline (5 compared to a baseline of 14). As noted in the 1990/1991 NSA Overflow Volume Summary section, University overflows decreased as a result of a malfunctioning PLC. Canal St., Third Avenue West, and Montlake overflows and frequency of events increased as a result of the misprogrammed PLC. The PLC was reset in April 1991.

Metro staff will be reviewing operating strategies for all locations that show a significant deviation from baseline.

TABLE 6

1990-1991 FREQUENCY OF OVERFLOW EVENTS

Overflow Location	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total 1990/1991 Station Overflows	CSO Plan Baseline	At 75% Volume Reduction
SSA															
King	5	1	1	0	5	5	4	3	5	2	2	0	33	31	1
Norfolk	3	0	0	0	4	3	4	1	3	5	2	0	25	7	1
West Michigan	0	2	0	0	1	1	0	1	1	1	1	0	8	8	1
Michigan	3	1	0	0	3	3	2	1	2	1	2	0	18	31	1
Duwamish P.S.	0	0	0	0	0	0	0	0	0	0	0	0	---	---	1-2
Brandon	3	2	3	0	7	5	2	4	5	3	4	2	40	25	1-2
Chelan	4	1	0	0	0	1	1	1	1	1	2	0	12	16	2-5
8th Ave.	1	0	0	0	0	3	1	0	2	1	1	0	9	12	2-5
Denny Way	4	2	0	2	7	7	4	3	5	3	4	2	43	51	5-10
Connecticut	4	1	1	1	4	5	4	3	5	3	5	1	37	25	10-25
Harbor	4	3	3	1	8	7	7	5	8	5	6	2	59	46	10-25
Hanford															
Hanford #1	0	0	0	0	0	0	0	0	0	0	0	0	---	27	---
Hanford #2	5	1	0	0	2	3	3	1	5	1	1	0	22	23	10-25
Lander	0	0	0	0	1	3	1	1	2	1	1	0	10	19	10-19*
NSA															
Canal Street	3	0	0	0	1	1	1	1	2	1	1	0	11	---	<1
Ballard	0	0	0	0	4	3	1	1	2	1	1	0	13	13	1-2
Ballard No. 1 (11th Ave. NW)	2	1	0	0	2	4	1	2	1	2	0	0	15	13	5-10
Dexter	2	2	0	0	3	1	1	0	2	1	1	0	13	4	1-2
University	0	0	0	0	1	1	1	0	0	1	1	0	5	14	5-10
Third Avenue West	0	0	0	0	1	1	1	2	2	1	1	0	9	---	1-2
Montlake	1	1	0	0	0	2	1	1	3	1	1	0	11	16	5-10
Total # Events	44	18	8	4	54	59	40	31	56	35	37	7	393	381	

* Volume at Lander will be reduced by 51% and frequency will be reduced to less than 19 events per year.

CSO OVERFLOW MONITORING PROGRAM

Introduction

Metro's NPDES sampling program calls for discharge sampling of five CSO sites annually through 1992 to meet requirements of WAC 173-245-040 (2) (a) (i) and condition S11.C1 of the West Point Treatment Plant's National Pollutant Discharge Elimination System (NPDES) permit. Appendix A lists stations, sample numbers, dates when samples were taken, and the status of each site in the monitoring program. Nine stations were selected for sediment quality sampling and four discharge samples for each CSO under overflow conditions were to be collected to supplement previous monitoring efforts. Sediment sampling requirements were completed in 1990.

1988-1991 CSO Discharge Organics Analyses Results

Organics analyses results are presented in Table 7 (Pages 24-35) and Appendix B describes Metro's trace organics analyses procedures. Summaries of organics analyses results are available for Ballard Siphon, Brandon, Connecticut, East Ballard #1, Norfolk St., and Third Ave. West.

Ballard Siphon CSO

No pesticides or PCBs were detected in the Ballard CSO sample. BNA and VOA results were typical of wastewater. Chlorinated solvents, acetone, and xylene were detected in the VOA analysis while phenols, polycyclic aromatic hydrocarbons (PAHs), and phthalates were present in the BNA analysis. Acetone, a common solvent frequently detected in wastewater, was present at 31 ppb, methylene chloride at 13 ppb, and tetrachloroethylene at 16 ppb. All remaining organics which were detected had concentrations less than 5 ppb.

Brandon CSO

No pesticides or PCBS were detected in the Brandon CSO sample. Volatile organics included low levels of chloroform and 1,1,1-trichloroethane. BNAs included low levels of polycyclic aromatic hydrocarbons (PAHs), phthalates, methylphenol, and benzoic acid. The highest concentration noted was 15 ppb of 1,1,1-trichloroethane and BNAs did not exceed 10 ppb.

TABLE 7A

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8800302	8800301	8800300
Station	Denny Way	Lander St.	Michigan St.
NPDES Serial Number	WO27	WO30	WO39
PRIORITY POLLUTANT ORGANICS			
ACIDS			
PHENOL	4.00	3.20	
2-CHLOROPHENOL			
4-CHLORO-3-METHYL PHENOL		0.71	
2,4-DICHLOROPHENOL			
2,4,5-TRICHLOROPHENOL			
2,4,6-TRICHLOROPHENOL			
2,3,4,6-TETRACHLOROPHENOL			
PENTACHLOROPHENOL			
2-NITROPHENOL			
4-NITROPHENOL			
2,4-DINITROPHENOL			
2,4-DIMETHYLPHENOL			0.64
4,6-DINITRO-2-METHYLPHENOL			
2-METHYLPHENOL (O-CRESOL)			
3-METHYLPHENOL (M-CRESOL)			
4-METHYLPHENOL (P-CRESOL)			
BENZOIC ACID	37.00		
BASES			
N-NITROSODIMETHYLAMINE			
N-NITROSODI-N-PROPYLAMINE			
N-NITROSODIPHENYLAMINE			
BENZIDINE			
3,3-DICHLOROBENZIDINE			
PYRIDINE			
ANALINE			
4-CHLOROANILINE			
2-NITROANILINE			
3-NITROANILINE			
4-NITROANILINE			
NEUTRALS			
1,2-DICHLOROBENZENE	6.60		
1,3-DICHLOROBENZENE			
1,4-DICHLOROBENZENE			
1,2,4-TRICHLOROBENZENE			
HEXACHLOROBENZENE			
NITROBENZENE			
HEXACHLOROETHANE			
HEXACHLOROCYCLOPENTADIENE			
HEXACHLOROBUTADIENE			
TRICHLOROBUTADIENE			
TETRACHLOROBUTADIENE			

TABLE 7B

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8800302	8800301	8800300
Station	Denny Way	Lander St.	Michigan St.
NPDES Serial Number	WO27	WO30	WO39
NEUTRALS			
PENTACHLOROBUTADIENE			
BIS (2-CHLOROETHYL) ETHER			
BIS (2-CHLOROISOPROPYL) ETHER			
4-CHLOROPHENYL PHENYL ETHER			
4-BROMOPHENYL PHENYL ETHER			
BIS (2-CHLOROETHOXY) METHANE			
2,4-DINITROTOLUENE			
2,6-DINITROTOLUENE			
NAPHTHALENE	2.10	1.20	0.71
2-METHYLNAPTHALENE	1.20	3.60	1.70
FLUORENE		0.58	0.48
ACENAPHTHENE		0.22	
ACENAPHYTHYLENE			
ANTHRACENE			
PHENANTHRENE	0.32	1.40	1.90
FLUROANTHENE		1.20	2.30
PYRENE		1.00	1.90
CHRYSENE		0.61	1.40
BENZO (A) ANTHRACENE			0.77
BENZO (A) PYRENE			
BENZO (B) FLUORANTHENE			
BENZO (K) FLUORANTHENE			
INDENO (1,2,3-C,D)PYRENE			
DIBENZO (A-H) ANTHRACENE			
BENZO (G,H,I) PERYLENE			
2-CHLORONAPHTHALENE			
DIMETHYL PHTHALATE			
DIETHYL PHTHALATE	2.80	0.42	0.42
DI-N-BUTYL PHTHALATE			
BENZYL BUTYL PHTHALATE	1.30	1.10	1.40
DI-N-OCTYL PHTHALATE			2.20
BIS (2-ETHYLHEXYL) PHTHALATE	15.00	6.30	18.00
BENZYL ALCOHOL	7.60		
DIBENZOFURAN		0.37	
1-2, DIPHENYLHYDRAZINE			
ISOPHORONE			
PCBS AND PESTICIDES			
TOTAL PCBs			
AROCLOR 1016			
AROCLOR 1221			
AROCLOR 1232			
AROCLOR 1242			
AROCLOR 1248			

TABLE 7C

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8800302	8800301	8800300
Station	Denny Way	Lander St.	Michigan St.
NPDES Serial Number	WO27	WO30	WO39
PCBS AND PESTICIDES			
AROCLOR 1254			
AROCLOR 1260			
ALPHA-BHC			
BETA-BHC			
DELTA-BHC			
GAMMA-BHC (LINDANE)			
4,4-DDE			
4,4-DDD			
4,4-DDT			
ALDRIN			
DIELDRIN			
ENDRIN			
ENDRIN ALDEHYDE			
CHLORDANE			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
METHOXYCHLOR			
ENDOSULFAN I			
ENDOSULFAN II			
ENDOSULFAN SULFATE			
TOXAPHENE			
2,3,7,8-TCDD			
DEMETON			
GUTHION			
MALATHION			
MIREX			
PARATHION			
VOLATILES			
METHYL CHLORIDE			
METHYLENE CHLORIDE	2.50	3.00	
CHLOROFORM	2.00		
CHLOROMETHANE			
CHLOROETHANE			
1,1-DICHLOROETHANE			
1,2-DICHLOROETHANE			
1,1,1-TRICHLOROETHANE	1.50		
1,1,2-TRICHLOROETHANE			
1,1,1,2-TETRACHLOROETHANE			
1,1,2,2-TETRACHLOROETHANE			
VINYL CHLORIDE			
1,1-DICHLOROETHYLENE			
TRANS-1,2-DICHLOROETHYLENE			
CIS-1,2-DICHLOROETHYLENE			

TABLE 7D

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8800302	8800301	8800300
Station	Denny Way	Lander St.	Michigan St.
NPDES Serial Number	WO27	WO30	WO39
VOLATILES			
TRICHLOROETHYLENE	2.00		
TETRACHLOROETHYLENE	4.50		
1,1,2-TRICHLOROETHYLENE			
1,2-DICHLOROPROPANE			
CIS-1,3-DICHLOROPROPENE			
TRANS-1,3-DICHLOROPROPENE			
METHYL BROMIDE			
DICHLOROBROMOMETHANE			
CHLORODIBROMOMETHANE			
BROMOFROM			
DICHLORODIFLUOROMETHANE			
TRICHLOROFLUOROMETHANE			
ACROLEIN			
ACRYLONITRILE			
CARBON TETRACHLORIDE			
BENZENE			
TOLUENE	7.00	2.00	
ETHYLBENZENE	2.00		
BIS (CHLOROMETHYL) ETHER			
2-CHLOROETHYL VINYL ETHER			
CARBON DISULFIDE			
ISOBUTANOL			
ACETONE	43.00	4.00	10.00
VINYL ACETATE			
2-BUTANONE (MEK)			
4-METHYL-2-PENTANONE (MIBK)			
2-HEXANONE			
TOTAL XYLENE	5.50		
STRYENE			

TABLE 7E

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
PRIORITY POLLUTANT ORGANICS			
ACIDS			
PHENOL	1.60		
2-CHLOROPHENOL			
4-CHLORO-3-METHYL PHENOL			
2,4-DICHLOROPHENOL			
2,4,5-TRICHLOROPHENOL			
2,4,6-TRICHLOROPHENOL			
2,3,4,6-TETRACHLOROPHENOL			
PENTACHLOROPHENOL			
2-NITROPHENOL			
4-NITROPHENOL			
2,4-DINITROPHENOL			
2,4-DIMETHYLPHENOL			
4,6-DINITRO-2-METHYLPHENOL			
2-METHYLPHENOL (O-CRESOL)			
3-METHYLPHENOL (M-CRESOL)			
4-METHYLPHENOL (P-CRESOL)	2.30	1.60	
BENZOIC ACID		10.00	
BASES			
N-NITROSODIMETHYLAMINE			
N-NITROSODI-N-PROPYLAMINE			
N-NITROSODIPHENYLAMINE			
BENZIDINE			
3,3-DICHLOROBENZIDINE			
PYRIDINE			
ANALINE			
4-CHLOROANILINE			
2-NITROANILINE			
3-NITROANILINE			
4-NITROANILINE			
NEUTRALS			
1,2-DICHLOROBENZENE			
1,3-DICHLOROBENZENE			
1,4-DICHLOROBENZENE			
1,2,4-TRICHLOROBENZENE			
HEXACHLOROBENZENE			
NITROBENZENE			
HEXACHLOROETHANE			
HEXACHLOROCYCLOPENTADIENE			
HEXACHLOROBUTADIENE			
TRICHLOROBUTADIENE			
TETRACHLOROBUTADIENE			

TABLE 7F

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
NEUTRALS			
PENTACHLOROBUTADIENE			
BIS (2-CHLOROETHYL) ETHER			
BIS (2-CHLOROISOPROPYL) ETHER			
4-CHLOROPHENYL PHENYL ETHER			
4-BROMOPHENYL PHENYL ETHER			
BIS (2-CHLOROETHOXY) METHANE			
2,4-DINITROTOLUENE			
2,6-DINITROTOLUENE			
NAPHTHALENE	0.62		
2-METHYLNAPTHALENE	0.58	0.85	
FLUORENE		0.68	
ACENAPHTHENE			
ACENAPHYTHYLENE			
ANTHRACENE			
PHENANTHRENE	0.46	3.50	
FLUROANTHENE	0.52	5.50	
PYRENE	0.53	2.90	
CHRYSENE	0.33	2.50	
BENZO (A) ANTHRACENE	0.21	1.20	
BENZO (A) PYRENE		1.20	
BENZO (B) FLUORANTHENE		1.60	
BENZO (K) FLUORANTHENE		1.30	
INDENO (1,2,3-C,D)PYRENE		1.10	
DIBENZO (A-H) ANTHRACENE			
BENZO (G,H,I) PERYLENE			
2-CHLORONAPHTHALENE			
DIMETHYL PHTHALATE			
DIETHYL PHTHALATE	0.60		1.30
DI-N-BUTYL PHTHALATE		9.50	
BENZYL BUTYL PHTHALATE	0.76	6.60	0.82
DI-N-OCTYL PHTHALATE			
BIS (2-ETHYLHEXYL) PHTHALATE	5.40	9.80	
BENZYL ALCOHOL	1.20		
DIBENZOFURAN			
1-2, DIPHENYLHYDRAZINE			
ISOPHORONE			
PCBS AND PESTICIDES			
TOTAL PCBs			
AROCLOR 1016			
AROCLOR 1221			
AROCLOR 1232			
AROCLOR 1242			
AROCLOR 1248			

TABLE 7G

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)			
Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
PCBS AND PESTICIDES			
AROCLOR 1254			
AROCLOR 1260			
ALPHA-BHC			
BETA-BHC			
DELTA-BHC			
GAMMA-BHC (LINDANE)			
4,4-DDE			
4,4-DDD			
4,4-DDT			
ALDRIN			
DIELDRIN			
ENDRIN			
ENDRIN ALDEHYDE			
CHLORDANE			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
METHOXYCHLOR			
ENDOSULFAN I			
ENDOSULFAN II			
ENDOSULFAN SULFATE			
TOXAPHENE			
2,3,7,8-TCDD			
DEMETON			
GUTHION			
MALATHION			
MIREX			
PARATHION			
VOLATILES			
METHYL CHLORIDE			
METHYLENE CHLORIDE	13.00		
CHLOROFORM		1.40	
CHLOROMETHANE			
CHLOROETHANE			
1,1-DICHLOROETHANE			
1,2-DICHLOROETHANE			
1,1,1-TRICHLOROETHANE	1.90	15.00	
1,1,2-TRICHLOROETHANE			
1,1,1,2-TETRACHLOROETHANE			
1,1,2,2-TETRACHLOROETHANE			
VINYL CHLORIDE			
1,1-DICHLOROETHYLENE			
TRANS-1,2-DICHLOROETHYLENE			
CIS-1,2-DICHLOROETHYLENE			

TABLE 7H

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)			
Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
VOLATILES			
TRICHLOROETHYLENE			
TETRACHLOROETHYLENE	16.00		6.20
1,1,2-TRICHLOROETHYLENE	1.10		
1,2-DICHLOROPROPANE			
CIS-1,3-DICHLOROPROPENE			
TRANS-1,3-DICHLOROPROPENE			
METHYL BROMIDE			
DICHLOROBROMOMETHANE			
CHLORODIBROMOMETHANE			
BROMOFROM			
DICHLORODIFLUOROMETHANE			
TRICHLOROFLUOROMETHANE			
ACROLEIN			
ACRYLONITRILE			
CARBON TETRACHLORIDE			
BENZENE			
TOLUENE			
ETHYLBENZENE			
BIS (CHLOROMETHYL) ETHER			
2-CHLOROETHYL VINYL ETHER			
CARBON DISULFIDE			
ISOBUTANOL			
ACETONE	31.00		20.00
VINYL ACETATE			
2-BUTANONE (MEK)			
4-METHYL-2-PENTANONE (MIBK)			
2-HEXANONE			
TOTAL XYLENE	2.40		
STRYENE			

TABLE 71

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8900177	8900174	8909689
Station	East Ballard #1	3rd Ave. West	Connecticut
NPDES Serial Number	WOO4	WOO8	WO29
PRIORITY POLLUTANT ORGANICS			
ACIDS			
PHENOL		3.20	
2-CHLOROPHENOL			
4-CHLORO-3-METHYL PHENOL			
2,4-DICHLOROPHENOL			
2,4,5-TRICHLOROPHENOL			
2,4,6-TRICHLOROPHENOL			
2,3,4,6-TETRACHLOROPHENOL			
PENTACHLOROPHENOL			
2-NITROPHENOL			
4-NITROPHENOL			
2,4-DINITROPHENOL			
2,4-DIMETHYLPHENOL			
4,6-DINITRO-2-METHYLPHENOL			
2-METHYLPHENOL (O-CRESOL)		1.40	
3-METHYLPHENOL (M-CRESOL)			
4-METHYLPHENOL (P-CRESOL)			2.80
BENZOIC ACID			12.00
BASES			
N-NITROSODIMETHYLAMINE			
N-NITROSODI-N-PROPYLAMINE			
N-NITROSODIPHENYLAMINE			
BENZIDINE			
3,3-DICHLOROBENZIDINE			
PYRIDINE			
ANALINE			
4-CHLOROANILINE			
2-NITROANILINE			
3-NITROANILINE			
4-NITROANILINE			
NEUTRALS			
1,2-DICHLOROBENZENE			
1,3-DICHLOROBENZENE			
1,4-DICHLOROBENZENE			
1,2,4-TRICHLOROBENZENE			
HEXACHLOROBENZENE			
NITROBENZENE			
HEXACHLOROETHANE			
HEXACHLOROCYCLOPENTADIENE			
HEXACHLOROBUTADIENE			
TRICHLOROBUTADIENE			
TETRACHLOROBUTADIENE			

TABLE 7J

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8900177	8900174	8909689
Station	East Ballard #1	3rd Ave. West	Connecticut
NPDES Serial Number	WOO4	WOO8	WO29
NEUTRALS			
PENTACHLOROBUTADIENE			
BIS (2-CHLOROETHYL) ETHER			
BIS (2-CHLOROISOPROPYL) ETHER			
4-CHLOROPHENYL PHENYL ETHER			
4-BROMOPHENYL PHENYL ETHER			
BIS (2-CHLOROETHOXY) METHANE			
2,4-DINITROTOLUENE			
2,6-DINITROTOLUENE			
NAPHTHALENE			
2-METHYLNAPTHALENE			
FLUORENE			0.70
ACENAPHTHENE			
ACENAPHYTHYLENE			
ANTHRACENE			
PHENANTHRENE	0.52	0.71	3.20
FLUROANTHENE	1.20	0.77	3.20
PYRENE	1.00	0.83	3.80
CHRYSENE	0.54	0.46	2.40
BENZO (A) ANTHRACENE	0.36	0.31	1.30
BENZO (A) PYRENE			
BENZO (B) FLUORANTHENE			
BENZO (K) FLUORANTHENE			
INDENO (1,2,3-C,D)PYRENE			
DIBENZO (A-H) ANTHRACENE			
BENZO (G,H,I) PERYLENE			
2-CHLORONAPHTHALENE			
DIMETHYL PHTHALATE			
DIETHYL PHTHALATE	1.30	1.80	1.80
DI-N-BUTYL PHTHALATE			
BENZYL BUTYL PHTHALATE	0.81	1.20	4.70
DI-N-OCTYL PHTHALATE			
BIS (2-ETHYLHEXYL) PHTHALATE			22.00
BENZYL ALCOHOL			
DIBENZOFURAN			
1-2, DIPHENYLHYDRAZINE			
ISOPHORONE			
PCBS AND PESTICIDES			
TOTAL PCBs			
AROCLOR 1016			
AROCLOR 1221			
AROCLOR 1232			
AROCLOR 1242			
AROCLOR 1248			

TABLE 7K

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)			
Sample #	8900177	8900174	8909689
Station	East Ballard #1	3rd Ave. West	Connecticut
NPDES Serial Number	WOO4	WOO8	WO29
PCBS AND PESTICIDES			
AROCLOR 1254			
AROCLOR 1260			
ALPHA-BHC			
BETA-BHC			
DELTA-BHC			
GAMMA-BHC (LINDANE)			
4,4-DDE			
4,4-DDD			
4,4-DDT			
ALDRIN			
DIELDRIN			
ENDRIN			
ENDRIN ALDEHYDE			
CHLORDANE			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
METHOXYCHLOR			
ENDOSULFAN I			
ENDOSULFAN II			
ENDOSULFAN SULFATE			
TOXAPHENE			
2,3,7,8-TCDD			
DEMETON			
GUTHION			
MALATHION			
MIREX			
PARATHION			
VOLATILES			
METHYL CHLORIDE			
METHYLENE CHLORIDE	5.60		
CHLOROFORM	1.20		
CHLOROMETHANE			
CHLOROETHANE			
1,1-DICHLOROETHANE			
1,2-DICHLOROETHANE			
1,1,1-TRICHLOROETHANE			
1,1,2-TRICHLOROETHANE			
1,1,1,2-TETRACHLOROETHANE			
1,1,2,2-TETRACHLOROETHANE			
VINYL CHLORIDE			
1,1-DICHLOROETHYLENE			
TRANS-1,2-DICHLOROETHYLENE			
CIS-1,2-DICHLOROETHYLENE			

TABLE 7L

CSO DISCHARGE ORGANICS DATA

(in ppb or ug/L)

Sample #	8900177	8900174	8909689
Station	East Ballard #1	3rd Ave. West	Connecticut
NPDES Serial Number	WOO4	WOO8	WO29
VOLATILES			
TRICHLOROETHYLENE			
TETRACHLOROETHYLENE	6.50	2.80	
1,1,2-TRICHLOROETHYLENE			
1,2-DICHLOROPROPANE			
CIS-1,3-DICHLOROPROPENE			
TRANS-1,3-DICHLOROPROPENE			
METHYL BROMIDE			
DICHLOROBROMOMETHANE			
CHLORODIBROMOMETHANE			
BROMOFROM			
DICHLORODIFLUOROMETHANE			
TRICHLOROFLUOROMETHANE			
ACROLEIN			
ACRYLONITRILE			
CARBON TETRACHLORIDE			
BENZENE		1.50	1.70
TOLUENE		1.00	5.20
ETHYLBENZENE			
BIS (CHLOROMETHYL) ETHER			
2-CHLOROETHYL VINYL ETHER			
CARBON DISULFIDE			
ISOBUTANOL			
ACETONE			
VINYL ACETATE			
2-BUTANONE (MEK)			
4-METHYL-2-PENTANONE (MIBK)		9.80	
2-HEXANONE			
TOTAL XYLENE		11.00	
STRYENE			

Connecticut Regulator CSO

No pesticides or PCBs were detected. The only volatile organics detected were low levels of benzene, toluene, and xylene, and acetone (a common solvent). The primary contaminants in the BNA fraction were PAHs, 4-methylphenol, and benzoic acid. With the exception of 22 ppb of the ubiquitous plasticizer bis (2-ethylhexyl) phthalate, all of the BNA concentrations were less than 5 ppb. PAHs are fuel combustion products that are commonly detected in stormwater and wastewater samples. Methylphenol is a common disinfectant found in wastewater. Benzoic acid is a naturally occurring compound (most berries contain 0.05 percent).

East Ballard #1 CSO

Only low levels of organics were present. No PCBs or pesticides were detected. The volatile organics found were those found in fuels (benzene, toluene, and xylene), degreasers (tetrachloroethylene and methylene chloride) and drinking water (chloroform). Phthalates, PAHS, and phenol, semivolatile organics commonly found in storm and wastewater samples, were detected.

Norfolk St. CSO

Very few organics were detected in the Norfolk CSO sample. No pesticides or PCBs were present. Volatile organics detected in the Norfolk sample included low levels of tetrachloroethylene and acetone. Semivolatile organics for the Norfolk sample included traces of two phthalates.

Third Ave. West CSO

Only low levels of organics were present. No PCBs or pesticides were detected. The volatile organics found were those found in fuels (benzene, toluene, and xylene), degreasers (tetrachloroethylene and methylene chloride) and drinking water (chloroform). Phthalates, PAHs, and phenol (semivolatile organics commonly found in storm and wastewater samples) were detected.

1988-1991 CSO Discharge Metals and Conventionals Analyses Results

Metals and conventionals analyses results were compared to typical CSO pollutant levels (see Metro's Toxicant Pretreatment Planning Study Technical Report A2: Collection System Evaluation, 1984) in Table 8 (Pages 37-39). These "typical" pollutant levels were derived from an analysis of CSO discharges and West Point treatment plant influent during storm events. They represent a theoretical average Metro CSO. Some variation from these values on an

TABLE 8A

CSO DISCHARGE METALS/CONVENTIONALS DATA

NPDES#		WOO3 Ballard				WO41 Brandon St. Outfall				WO44 Norfolk Reg.			
METALS	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
ALUMINUM	4/4	1.3000	1.5000	1.3500	4/4	1.5000	9.5000	4.9750	4/4	2.8000	3.7000	3.4250	4.600000
ARSENIC	1/3	0.0020	0.0020	0.0020	3/4	0.0040	0.0080	0.0060	1/4	0.0040	0.0040	0.0040	0.010000
BERYLLIUM	0/4				0/4				0/4				0.000067
CADMIUM	0/4				0/4				0/4				0.002800
CHROMIUM	4/4	0.0060	0.0100	0.0075	4/4	0.0100	0.0600	0.0275	4/4	0.0070	0.0100	0.0090	0.033000
COPPER	4/4	0.0270	0.0480	0.0365	4/4	0.0290	0.0860	0.0565	4/4	0.0200	0.0440	0.0333	0.072400
IRON	4/4	1.5000	1.9000	1.7000	4/4	2.2000	14.0000	7.0000	4/4	3.5000	5.1000	4.5250	3.700000
LEAD	4/4	0.0600	0.0700	0.6250	4/4	0.0400	0.1000	0.0750	3/4	0.0300	0.0400	0.0333	0.140000
MANGANESE	4/4	0.0410	0.0590	0.0478	4/4	0.0490	0.3200	0.1780	4/4	0.1000	0.1500	0.1375	0.100000
MERCURY	2/4	0.0003	0.0003	0.0003	2/4	0.0002	0.0004	0.0003	4/4	0.0002	0.0007	0.0004	0.000260
NICKEL	0/4				4/4	0.0200	0.0500	0.0350	2/4	0.0100	0.0100	0.0100	0.034000
SELENIUM	0/3				2/4	0.0070	0.0070	0.0070	1/4	0.0100	0.0100	0.0100	
SILVER	0/4				2/4	0.0060	0.0070	0.0060	0/4				0.005000
ZINC	4/4	0.1400	0.2200	0.1700	4/4	0.1300	0.3400	0.2350	4/4	0.0870	0.1500	0.1143	0.210000

NPDES#		WOO3 Ballard				WO41 Brandon St. Outfall				WO44 Norfolk Reg.			
CONVENTIONALS	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
BOD	4/4	22.00	35.00	27.75	4/4	7.40	22.00	15.35	4/4	35.00	60.00	49.00	60.00
COD	4/4	64.00	115.00	89.75	4/4	66.00	176.00	105.50	4/4	73.00	190.00	133.25	140.00
TOTAL-SS	4/4	58.14	84.00	71.79	4/4	72.00	300.00	169.29	3/3	139.00	218.00	179.67	112.00
VOLATILE-SS	4/4	23.26	37.33	31.15	4/4	27.00	68.00	43.25	3/3	52.00	74.00	60.00	60.00
OIL-GREASE	3/4	5.70	8.00	6.93	2/4	12.00	12.00	12.00	3/4	6.10	12.00	8.97	8.60

NOTE: A BLANK CELL INDICATES THAT A CONSTITUENT WAS NOT DETECTED

TABLE 8B

CSO DISCHARGE METALS/CONVENTIONALS DATA

NPDES#		W029 Connecticut				W008 3rd Ave. West				W004 E. Ballard #1			
METALS	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
ALUMINUM	4/4	2.7000	13.6000	7.3250	3/3	1.6600	2.3500	2.1100	3/3	1.1200	1.4200	1.2300	4.600000
ARSENIC	1/2	0.0040	0.0040	0.0040	1/3	0.0043	0.0043	0.0043	1/1	0.0012	0.0012	0.0012	0.010000
BERYLLIUM	0/3				1/3	0.0030	0.0030	0.0030	0/3				0.000067
CADMIUM	2/4	0.0020	0.0070	0.0045	0/3				0/3				0.002800
CHROMIUM	4/4	0.0100	0.0640	0.0310	3/3	0.0070	0.0110	0.0090	2/3	0.0070	0.0080	0.0075	0.033000
COPPER	4/4	0.0340	0.1750	0.0875	3/3	0.0320	0.0490	0.0380	3/3	0.0160	0.0280	0.0240	0.072400
IRON	4/4	3.4000	19.4000	9.9000	3/3	2.0400	2.9500	2.5933	3/3	1.2500	1.6700	1.4200	3.700000
LEAD	4/4	0.0500	0.3400	0.1350	3/3	0.0300	0.0700	0.0533	3/3	0.0300	0.0700	0.0633	0.140000
MANGANESE	3/3	0.0740	0.3840	0.2293	3/3	0.0660	0.0740	0.0697	3/3	0.0300	0.0690	0.0466	0.100000
MERCURY	4/4	0.0003	0.0013	0.0006	3/3	0.0003	0.0010	0.0006	1/3	0.0002	0.0002	0.0002	0.000260
NICKEL	3/4	0.0200	0.0500	0.0333	0/3				0/3				0.034000
SELENIUM	0/2				0/1				0/1				
SILVER	3/4	0.0040	0.0150	0.0077	1/3	0.0060	0.0060	0.0060	0/3				0.005000
ZINC	4/4	0.1500	0.7090	0.3272	3/3	0.1120	0.1610	0.1333	3/3	0.0720	0.1350	0.1020	0.210000

NPDES#		W029 Connecticut				W008 3rd Ave. West				W004 E. Ballard #1			
CONVENTIONALS	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
BOD	4/4	25.00	270.00	97.50	3/3	30.90	46.30	38.40	3/3	8.60	17.60	13.07	60.00
COD	4/4	58.00	200.00	129.00	3/3	98.40	133.66	117.35	3/3	50.00	88.36	71.12	140.00
TOTAL-SS	4/4	104.00	428.00	252.50	3/3	86.00	130.00	110.18	3/3	58.00	78.00	66.66	112.00
VOLATILE-SS	4/4	34.00	112.00	70.42	1/1	53.33	53.33	53.33	1/3	30.00	30.00	30.00	60.00
OIL-GREASE	4/4	8.20	29.00	18.05	3/3	5.00	17.20	10.93	1/3	8.70	8.70	8.70	8.60

NOTE: A BLANK CELL INDICATES THAT A CONSTITUENT WAS NOT DETECTED

TABLE 8C

CSO DISCHARGE METALS/CONVENTIONALS DATA

NPDES#	WO39 Michigan	WO30 Lander	WO27 Denny	
METALS	MEAN VALUE (MG/L)	MEAN VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
ALUMINUM	5.80000	5.10000	2.90000	4.600000
ARSENIC	0.00910	0.01000	0.01000	0.010000
BERYLLIUM	0.00100	0.00009	0.00003	0.000067
CADMIUM	0.00410	0.00510	0.00200	0.002800
CHROMIUM	0.04200	0.07100	0.02300	0.033000
COPPER	0.06000	0.15000	0.07300	0.072400
IRON	5.10000	4.90000	2.30000	3.700000
LEAD	0.22000	0.11000	0.15000	0.140000
MANGANESE	0.11000	0.19000	0.06000	0.100000
MERCURY	0.00027	0.00011	0.00039	0.000260
NICKEL	0.02900	0.07700	0.02700	0.034000
SELENIUM				
SILVER	0.00420	0.00170	0.01400	0.005000
ZINC	0.20000	0.28000	0.22000	0.210000

NPDES #	WO39 Michigan	WO30 Lander	WO27 Denny	
CONVENTIONALS	MEAN VALUE (MG/L)	MEAN VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
BOD	49.00	55.00	72.00	60.00
COD	100.00	130.00	180.00	140.00
TOTAL-SS	98.00	130.00	100.00	112.00
VOLATILE-SS		64.00	60.00	60.00
OIL-GREASE		7.00	10.00	8.60

NOTE: A BLANK CELL INDICATES THAT A CONSTITUENT WAS NOT DETECTED

individual basis are to be expected and do not represent a violation of regulatory standards. Other studies have reported large variations in toxicant concentrations in CSOs, however for Metro's Toxicant Pretreatment Planning Study Technical Report A2 the variability was less significant.

A value of zero is assumed for constituents below the detection limit in computing arithmetic mean values in Table 8. The typical CSO pollutant level is not available for selenium. Typical CSO pollutant levels are geometric mean values.

Ballard CSO

The mercury mean constituent level was above the typical CSO pollutant level in the Ballard CSO sample. All other mean constituent concentrations were at or below typical CSO pollutant levels.

Brandon CSO

Aluminum, iron, manganese, nickel, silver, zinc, total suspended solids, and oil-grease mean constituent levels were above the typical CSO pollutant levels in the Brandon CSO sample. All other mean constituent concentrations were at or below typical CSO pollutant levels.

Connecticut CSO

Aluminum, cadmium, copper, iron, manganese, mercury, silver, zinc, BOD, total suspended solids, volatile suspended solids, and oil-grease mean constituent levels were above typical CSO pollutant levels in the Brandon CSO sample. All other mean constituent concentrations were at or below typical CSO pollutant levels.

Denny Way CSO

Copper, lead, mercury, zinc, BOD, COD, and oil-grease mean constituent levels were above typical CSO pollutant levels in the Denny Way CSO. All other mean constituents were at or below typical CSO pollutant levels.

East Ballard #1

The oil-grease mean constituent level was above the typical CSO pollutant level. All other mean constituent concentrations were at or below typical CSO pollutant levels.

Lander St. CSO

Aluminum, beryllium, cadmium, chromium, copper, iron, manganese, nickel, zinc, total suspended solids, and volatile suspended solids mean constituent levels were above typical CSO pollutant levels. All other mean constituent levels were at or below typical CSO pollutant levels.

Michigan CSO

Aluminum, beryllium, cadmium, chromium, iron, lead, manganese, and mercury mean constituent levels were above typical CSO pollutant levels. All other mean constituent concentrations were at or below typical CSO pollutant levels.

Norfolk CSO

Iron, total suspended solids, and oil-grease mean constituent levels were above the typical CSO pollutant levels in the Norfolk CSO sample. All other mean constituent concentrations were at or below typical CSO pollutant levels.

Third Ave. West CSO

Mercury, silver, and oil-grease mean constituent levels were above the typical CSO pollutant levels in the Third Ave. West CSO. All other mean constituent concentrations were at or below typical CSO pollutant levels.

1988-1991 CSO Marine Sediments Organics Analyses Results

Organics analyses results for CSO marine sediments are reported in Table 9 (Pages 42-53).

1988-1991 CSO Marine Sediments Metals/Conventionals Analyses Results

Metals/conventionals analyses results are presented in Table 10 (Page 54).

TABLE 9A

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb dry or ug/L)			
Sample #	8900560	8900561	8900563
Station	Ballard Siphon	East Ballard #1	3rd Ave. West
NPDES Serial Number	WOO3	WOO4	WOO8
PRIORITY POLLUTANT ORGANICS			
ACIDS			
PHENOL			
2-CHLOROPHENOL			
4-CHLORO-3-METHYL PHENOL			
2,4-DICHLOROPHENOL			
2,4,5-TRICHLOROPHENOL			
2,4,6-TRICHLOROPHENOL			
2,3,4,6-TETRACHLOROPHENOL			
PENTACHLOROPHENOL			
2-NITROPHENOL			
4-NITROPHENOL			
2,4-DINITROPHENOL			
2,4-DIMETHYLPHENOL			
4,6-DINITRO-2-METHYLPHENOL			
2-METHYLPHENOL (O-CRESOL)			
3-METHYLPHENOL (M-CRESOL)			
4-METHYLPHENOL (P-CRESOL)			
BENZOIC ACID			
BASES			
N-NITROSODIMETHYLAMINE			
N-NITROSODI-N-PROPYLAMINE			
N-NITROSODIPHENYLAMINE			
BENZIDINE			
3,3-DICHLOROBENZIDINE			
PYRIDINE			
ANALINE			
4-CHLOROANILINE			
2-NITROANILINE			
3-NITROANILINE			
4-NITROANILINE			
NEUTRALS			
1,2-DICHLOROBENZENE			
1,3-DICHLOROBENZENE			
1,4-DICHLOROBENZENE		482.759	
1,2,4-TRICHLOROBENZENE			
HEXACHLOROBENZENE			
NITROBENZENE			
HEXACHLOROETHANE			
HEXACHLOROCYCLOPENTADIENE			
HEXACHLOROBUTADIENE			
TRICHLOROBUTADIENE			
TETRACHLOROBUTADIENE			

TABLE 9B

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)

Sample #	8900560	8900561	8900563
Station	Ballard Siphon	East Ballard #1	3rd Ave. West
NPDES Serial Number	WOO3	WOO4	WOO8
NEUTRALS			
PENTACHLOROBUTADIENE			
BIS (2-CHLOROETHYL) ETHER			
BIS (2-CHLOROISOPROPYL) ETHER			
4-CHLOROPHENYL PHENYL ETHER			
4-BROMOPHENYL PHENYL ETHER			
BIS (2-CHLOROETHOXY) METHANE			
2,4-DINITROTOLUENE			
2,6-DINITROTOLUENE			
NAPHTHALENE	264.000	127.586	577.778
2-METHYLNAPTHALENE	1200.000	465.517	288.889
FLUORENE	760.000	396.552	511.111
ACENAPHTHENE	520.000	362.069	1022.222
ACENAPHYTHYLENE	76.000	58.621	188.889
ANTHRACENE	960.000	448.276	1111.111
PHENANTHRENE	5600.000	2241.379	3777.778
FLUROANTHENE	10000.000	2413.793	4222.219
PYRENE	6800.000	1706.896	8666.664
CHRYSENE	4800.000	1051.724	4222.219
BENZO (A) ANTHRACENE	3200.001	913.793	3111.111
BENZO (A) PYRENE	4800.000	879.310	4666.664
BENZO (B) FLUORANTHENE	5200.000	1000.000	3555.555
BENZO (K) FLUORANTHENE	5600.000	965.517	4000.000
INDENO (1,2,3-C,D)PYRENE	1360.000	327.586	1933.333
DIBENZO (A-H) ANTHRACENE		139.655	955.555
BENZO (G,H,I) PERYLENE	1800.000	413.793	2111.111
2-CHLORONAPHTHALENE			
DIMETHYL PHTHALATE	304.000	41.379	113.333
DIETHYL PHTHALATE			
DI-N-BUTYL PHTHALATE			
BENZYL BUTYL PHTHALATE	8000.000	258.621	
DI-N-OCTYL PHTHALATE			
BIS (2-ETHYLHEXYL) PHTHALATE			
BENZYL ALCOHOL			
DIBENZOFURAN	308.000	162.069	177.778
1-2, DIPHENYLHYDRAZINE			
ISOPHORONE			
PCBS AND PESTICIDES			
TOTAL PCBs			
AROCLOR 1016			
AROCLOR 1221			
AROCLOR 1232			
AROCLOR 1242			
AROCLOR 1248			

TABLE 9C

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)			
Sample #	8900560	8900561	8900563
Station	Ballard Siphon	East Ballard #1	3rd Ave. West
NPDES Serial Number	WOO3	WOO4	WOO8
PCBS AND PESTICIDES			
AROCLOR 1254	248.000	1017.241	62.222
AROCLOR 1260	248.000	1017.241	80.000
ALPHA-BHC			
BETA-BHC			
DELTA-BHC			
GAMMA-BHC (LINDANE)			
4,4-DDE			
4,4-DDD			
4,4-DDT			
ALDRIN			
DIELDRIN			
ENDRIN			
ENDRIN ALDEHYDE			
CHLORDANE			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
METHOXYCHLOR			
ENDOSULFAN I			
ENDOSULFAN II			
ENDOSULFAN SULFATE			
TOXAPHENE			
2,3,7,8-TCDD			
DEMETON			
GUTHION			
MALATHION			
MIREX			
PARATHION			
VOLATILES			
METHYL CHLORIDE			
METHYLENE CHLORIDE	152.000		128.889
CHLOROFORM			
CHLOROMETHANE			
CHLOROETHANE			
1,1-DICHLOROETHANE			
1,2-DICHLOROETHANE			
1,1,1-TRICHLOROETHANE			
1,1,2-TRICHLOROETHANE			
1,1,1,2-TETRACHLOROETHANE			
1,1,2,2-TETRACHLOROETHANE			
VINYL CHLORIDE			
1,1-DICHLOROETHYLENE			
TRANS-1,2-DICHLOROETHYLENE			
CIS-1,2-DICHLOROETHYLENE			

TABLE 9D

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)

Sample #	8900560	8900561	8900563
Station	Ballard Siphon	East Ballard #1	3rd Ave. West
NPDES Serial Number	WOO3	WOO4	WOO8
VOLATILES			
TRICHLOROETHYLENE			
TETRACHLOROETHYLENE		14.828	
1,1,2-TRICHLOROETHYLENE			
1,2-DICHLOROPROPANE			
CIS-1,3-DICHLOROPROPENE			
TRANS-1,3-DICHLOROPROPENE			
METHYL BROMIDE			
DICHLOROBROMOMETHANE			
CHLORODIBROMOMETHANE			
BROMOFROM			
DICHLORODIFLUOROMETHANE			
TRICHLOROFLUOROMETHANE			
ACROLEIN			
ACRYLONITRILE			
CARBON TETRACHLORIDE			
BENZENE		29.310	
CHLOROBENZENE	1017.241		
TOLUENE	108.000		
ETHYLBENZENE	26.000		
BIS (CHLOROMETHYL) ETHER			
2-CHLOROETHYL VINYL ETHER			
CARBON DISULFIDE		12.241	
ISOBUTANOL			
ACETONE	560.000	344.827	222.222
VINYL ACETATE			
2-BUTANONE (MEK)			177.778
4-METHYL-2-PENTANONE (MIBK)			
2-HEXANONE			
TOTAL XYLENE	88.000	14.138	
STRYENE			

TABLE 9E

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb dry or ug/L)			
Sample #	8900564	8900565	9006687
Station	Montlake	Dexter Ave	Brandon St.
NPDES Serial Number	WO14	WOO9	WO41
PRIORITY POLLUTANT ORGANICS			
ACIDS			
PHENOL			
2-CHLOROPHENOL			
4-CHLORO-3-METHYL PHENOL			
2,4-DICHLOROPHENOL			
2,4,5-TRICHLOROPHENOL			
2,4,6-TRICHLOROPHENOL			
2,3,4,6-TETRACHLOROPHENOL			
PENTACHLOROPHENOL			
2-NITROPHENOL			
4-NITROPHENOL			
2,4-DINITROPHENOL			
2,4-DIMETHYLPHENOL			
4,6-DINITRO-2-METHYLPHENOL			
2-METHYLPHENOL (O-CRESOL)			
3-METHYLPHENOL (M-CRESOL)			
4-METHYLPHENOL (P-CRESOL)	94.805		
BENZOIC ACID	75.325		616.438
BASES			
N-NITROSODIMETHYLAMINE			
N-NITROSODI-N-PROPYLAMINE			
N-NITROSODIPHENYLAMINE			
BENZIDINE			
3,3-DICHLOROBENZIDINE			
PYRIDINE			
ANALINE			
4-CHLOROANILINE			
2-NITROANILINE			
3-NITROANILINE			
4-NITROANILINE			
NEUTRALS			
1,2-DICHLOROBENZENE			
1,3-DICHLOROBENZENE			
1,4-DICHLOROBENZENE	42.857		
1,2,4-TRICHLOROBENZENE			
HEXACHLOROBENZENE			
NITROBENZENE			
HEXACHLOROETHANE			
HEXACHLOROCYCLOPENTADIENE			
HEXACHLOROBUTADIENE			
TRICHLOROBUTADIENE			
TETRACHLOROBUTADIENE			

TABLE 9F

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)

Sample #	8900564	8900565	9006687
Station	Montlake	Dexter Ave	Brandon St.
NPDES Serial Number	WO14	WOO9	WO41
NEUTRALS			
PENTACHLOROBUTADIENE			
BIS (2-CHLOROETHYL) ETHER			
BIS (2-CHLOROISOPROPYL) ETHER			
4-CHLOROPHENYL PHENYL ETHER			
4-BROMOPHENYL PHENYL ETHER			
BIS (2-CHLOROETHOXY) METHANE			
2,4-DINITROTOLUENE			
2,6-DINITROTOLUENE			
NAPHTHALENE		160.000	
2-METHYLNAPTHALENE		733.333	
FLUORENE	36.364	2166.667	89.041
ACENAPHTHENE	12.987	1933.333	84.932
ACENAPHYTHYLENE		36.667	
ANTHRACENE	272.727	1333.333	106.849
PHENANTHRENE	311.688	7333.332	520.548
FLUROANTHENE	753.247	4666.664	808.219
PYRENE	870.130	5666.664	698.630
CHRYSENE	415.584	2333.333	520.548
BENZO (A) ANTHRACENE	363.636	1766.667	452.055
BENZO (A) PYRENE	207.792	1766.667	273.972
BENZO (B) FLUORANTHENE	259.740	2200.000	273.972
BENZO (K) FLUORANTHENE	337.662	2266.667	246.575
INDENO (1,2,3-C,D)PYRENE	106.493	800.000	150.685
DIBENZO (A-H) ANTHRACENE			
BENZO (G,H,I) PERYLENE	114.286	966.667	136.986
2-CHLORONAPHTHALENE			
DIMETHYL PHTHALATE			
DIETHYL PHTHALATE			
DI-N-BUTYL PHTHALATE		2333.333	
BENZYL BUTYL PHTHALATE		466.667	
DI-N-OCTYL PHTHALATE			
BIS (2-ETHYLHEXYL) PHTHALATE			
BENZYL ALCOHOL			
DIBENZOFURAN		1400.000	49.315
1-2, DIPHENYLHYDRAZINE			
ISOPHORONE			
PCBS AND PESTICIDES			
TOTAL PCBs			
AROCLOR 1016			
AROCLOR 1221			
AROCLOR 1232			
AROCLOR 1242			
AROCLOR 1248			

TABLE 9G

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)

Sample #	8900564	8900565	9006687
Station	Montlake	Dexter Ave	Brandon St.
NPDES Serial Number	WO14	WOO9	WO41
PCBS AND PESTICIDES			
AROCLOR 1254			82.192
AROCLOR 1260	29.870		136.986
ALPHA-BHC			
BETA-BHC			
DELTA-BHC			
GAMMA-BHC (LINDANE)			
4,4-DDE			
4,4-DDD			
4,4-DDT			
ALDRIN			
DIELDRIN			
ENDRIN			
ENDRIN ALDEHYDE			
CHLORDANE			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
METHOXYCHLOR			
ENDOSULFAN I			
ENDOSULFAN II			
ENDOSULFAN SULFATE			
TOXAPHENE			
2,3,7,8-TCDD			
DEMETON			
GUTHION			
MALATHION			
MIREX			
PARATHION			
VOLATILES			
METHYL CHLORIDE			
METHYLENE CHLORIDE	79.221		
CHLOROFORM	16.883		
CHLOROMETHANE			
CHLOROETHANE			
1,1-DICHLOROETHANE			
1,2-DICHLOROETHANE			
1,1,1-TRICHLOROETHANE			
1,1,2-TRICHLOROETHANE			
1,1,1,2-TETRACHLOROETHANE			
1,1,2,2-TETRACHLOROETHANE			
VINYL CHLORIDE			
1,1-DICHLOROETHYLENE			
TRANS-1,2-DICHLOROETHYLENE			
CIS-1,2-DICHLOROETHYLENE			

TABLE 9H

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)

Sample #	8900564	8900565	9006687
Station	Montlake	Dexter Ave	Brandon St.
NPDES Serial Number	WO14	WOO9	WO41
VOLATILES			
TRICHLOROETHYLENE			
TETRACHLOROETHYLENE		60.000	
1,1,2-TRICHLOROETHYLENE			
1,2-DICHLOROPROPANE			
CIS-1,3-DICHLOROPROPENE			
TRANS-1,3-DICHLOROPROPENE			
METHYL BROMIDE			
DICHLOROBROMOMETHANE			
CHLORODIBROMOMETHANE			
BROMOFROM			
DICHLORODIFLUOROMETHANE			
TRICHLOROFLUOROMETHANE			
ACROLEIN			
ACRYLONITRILE			
CARBON TETRACHLORIDE			
BENZENE			
	7.662	26.000	
TOLUENE		220.000	
ETHYLBENZENE		113.333	
BIS (CHLOROMETHYL) ETHER			
2-CHLOROETHYL VINYL ETHER			
CARBON DISULFIDE			
ISOBUTANOL			
ACETONE		276.667	
VINYL ACETATE			
2-BUTANONE (MEK)	106.493		
4-METHYL-2-PENTANONE (MIBK)			
2-HEXANONE			
TOTAL XYLENE		600.000	
STRYENE			

TABLE 9I

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb dry or ug/L)

Sample #	9006691	9006690	9006688
Station	S.W. Michigan	Eighth Ave.	Norfolk St.
NPDES Serial Number	WO42	WO40	WO44
PRIORITY POLLUTANT ORGANICS			
ACIDS			
PHENOL			
2-CHLOROPHENOL			
4-CHLORO-3-METHYL PHENOL			
2,4-DICHLOROPHENOL			
2,4,5-TRICHLOROPHENOL			
2,4,6-TRICHLOROPHENOL			
2,3,4,6-TETRACHLOROPHENOL			
PENTACHLOROPHENOL			
2-NITROPHENOL			
4-NITROPHENOL			
2,4-DINITROPHENOL			
2,4-DIMETHYLPHENOL			
4,6-DINITRO-2-METHYLPHENOL			
2-METHYLPHENOL (O-CRESOL)			
3-METHYLPHENOL (M-CRESOL)			
4-METHYLPHENOL (P-CRESOL)			
BENZOIC ACID	233.766		725.806
BASES			
N-NITROSODIMETHYLAMINE			
N-NITROSODI-N-PROPYLAMINE			
N-NITROSODIPHENYLAMINE			
BENZIDINE			
3,3-DICHLOROBENZIDINE			
PYRIDINE			
ANALINE			
4-CHLOROANILINE			
2-NITROANILINE			
3-NITROANILINE			
4-NITROANILINE			
NEUTRALS			
1,2-DICHLOROBENZENE			
1,3-DICHLOROBENZENE			
1,4-DICHLOROBENZENE			596.774
1,2,4-TRICHLOROBENZENE			
HEXACHLOROBENZENE			
NITROBENZENE			
HEXACHLOROETHANE			
HEXACHLOROCYCLOPENTADIENE			
HEXACHLOROBUTADIENE			
TRICHLOROBUTADIENE			
TETRACHLOROBUTADIENE			

TABLE 9J

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)

Sample #	9006691	9006690	9006688
Station	S.W. Michigan	Eighth Ave.	Norfolk St.
NPDES Serial Number	WO42	WO40	WO44
NEUTRALS			
PENTACHLOROBUTADIENE			
BIS (2-CHLOROETHYL) ETHER			
BIS (2-CHLOROISOPROPYL) ETHER			
4-CHLOROPHENYL PHENYL ETHER			
4-BROMOPHENYL PHENYL ETHER			
BIS (2-CHLOROETHOXY) METHANE			
2,4-DINITROTOLUENE			
2,6-DINITROTOLUENE			
NAPHTHALENE			
2-METHYLNAPTHALENE			
FLUORENE	27.273		59.677
ACENAPHTHENE	23.377		41.935
ACENAPHYTHYLENE	19.481		20.968
ANTHRACENE	83.117		106.452
PHENANTHRENE	259.740	59.459	661.290
FLUROANTHENE	1090.909	132.432	838.710
PYRENE	948.052	93.243	741.936
CHRYSENE	506.493	71.622	483.871
BENZO (A) ANTHRACENE	454.545	60.811	387.097
BENZO (A) PYRENE	402.597	39.189	354.839
BENZO (B) FLUORANTHENE	441.558	56.757	354.839
BENZO (K) FLUORANTHENE	298.701	43.243	370.968
INDENO (1,2,3-C,D)PYRENE	155.844		225.806
DIBENZO (A-H) ANTHRACENE			62.903
BENZO (G,H,I) PERYLENE	142.857		209.677
2-CHLORONAPHTHALENE			
DIMETHYL PHTHALATE			
DIETHYL PHTHALATE			
DI-N-BUTYL PHTHALATE			
BENZYL BUTYL PHTHALATE			
DI-N-OCTYL PHTHALATE			
BIS (2-ETHYLHEXYL) PHTHALATE			
BENZYL ALCOHOL			
DIBENZOFURAN			
1-2, DIPHENYLHYDRAZINE			
ISOPHORONE			
PCBS AND PESTICIDES			
TOTAL PCBs			
AROCLOR 1016			
AROCLOR 1221			
AROCLOR 1232			
AROCLOR 1242			
AROCLOR 1248			

TABLE 9K

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)			
Sample #	9006691	9006690	9006688
Station	S.W. Michigan	Eighth Ave.	Norfolk St.
NPDES Serial Number	WO42	WO40	WO44
PCBS AND PESTICIDES			
AROCLOR 1254			96.774
AROCLOR 1260			48.387
ALPHA-BHC			
BETA-BHC			
DELTA-BHC			
GAMMA-BHC (LINDANE)			
4,4-DDE			
4,4-DDD	2.468		
4,4-DDT			
ALDRIN			
DIELDRIN			
ENDRIN			
ENDRIN ALDEHYDE			
CHLORDANE			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
METHOXYCHLOR			
ENDOSULFAN I			
ENDOSULFAN II			
ENDOSULFAN SULFATE			
TOXAPHENE			
2,3,7,8-TCDD			
DEMETON			
GUTHION			
MALATHION			
MIREX			
PARATHION			
VOLATILES			
METHYL CHLORIDE			
METHYLENE CHLORIDE			
CHLOROFORM			
CHLOROMETHANE			
CHLOROETHANE			
1,1-DICHLOROETHANE			
1,2-DICHLOROETHANE			
1,1,1-TRICHLOROETHANE			
1,1,2-TRICHLOROETHANE			
1,1,1,2-TETRACHLOROETHANE			
1,1,2,2-TETRACHLOROETHANE			
VINYL CHLORIDE			
1,1-DICHLOROETHYLENE			
TRANS-1,2-DICHLOROETHYLENE			
CIS-1,2-DICHLOROETHYLENE			

TABLE 9L

CSO MARINE SEDIMENT ORGANICS DATA

(in ppb or ug/L)			
Sample #	9006691	9006690	9006688
Station	S.W. Michigan	Eighth Ave.	Norfolk St.
NPDES Serial Number	WO42	WO40	WO44
VOLATILES			
TRICHLOROETHYLENE			
TETRACHLOROETHYLENE			
1,1,2-TRICHLOROETHYLENE			
1,2-DICHLOROPROPANE			
CIS-1,3-DICHLOROPROPENE			
TRANS-1,3-DICHLOROPROPENE			
METHYL BROMIDE			
DICHLOROBROMOMETHANE			
CHLORODIBROMOMETHANE			
BROMOFROM			
DICHLORODIFLUOROMETHANE			
TRICHLOROFLUOROMETHANE			
ACROLEIN			
ACRYLONITRILE			
CARBON TETRACHLORIDE			
BENZENE			
TOLUENE			
ETHYLBENZENE			
BIS (CHLOROMETHYL) ETHER			
2-CHLOROETHYL VINYL ETHER			
CARBON DISULFIDE			
ISOBUTANOL			
ACETONE			
VINYL ACETATE			
2-BUTANONE (MEK)			
4-METHYL-2-PENTANONE (MIBK)			
2-HEXANONE			
TOTAL XYLENE			
STRYENE			

TABLE 10

CSO MARINE SEDIMENT METALS/CONVENTIONALS DATA

NPDES#	W003	W004	W008	W014	W009	W041	W042	W040	W044
STATION	BALLARD SIPHON	EAST BALLARD #1	3RD AVE. WEST	MONTLAKE OVER.	DEXTER AVE.	BRANDON ST.	S.W. MICHIGAN	EIGHTH AVE.	NORFOLK ST.
% SOLIDS	25	58	45	77	30	73	77	74	62
METALS									
ALUMINUM	12400.0000	10793.1000	10177.7800	6246.7500	20266.6700	7123.2850	8571.4300	8918.9180	15967.7400
ARSENIC	31.6400	44.4830	13.9330	7.4550	27.8330	9.5890	12.9870	8.1080	14.5160
BERYLLIUM	0.1600	0.3450	0.2220	0.1300	0.6670			0.1080	0.3230
CADMIUM	3.6000	2.7590	0.4440		2.3330	0.2740	0.2600		0.3230
CHROMIUM	80.4000	68.1030	44.4440	17.4030	78.6670	60.2740	27.2730	13.5140	22.5810
COPPER	361.2000	182.7590	105.7780	20.7790	750.0000	39.7260	37.6620	17.5680	40.3230
IRON	37680.1000	33965.5200	19000.0000	9116.8830	28700.0000	1568.4920	14285.7100	14864.6800	20967.7400
LEAD	520.0000	470.6890	142.2220	81.8180	1173.3330	27.3970	168.8310	12.1620	38.7100
MANGANESE	356.8000	382.7590	218.6670	140.2600	393.3330	356.1640	181.8180	162.1620	241.3960
MERCURY	0.8400	0.6379	0.4667	0.0519	2.7000	0.1781	0.3896	0.0405	0.9032
NICKEL	56.0000	63.7930	37.7780	15.5840	66.6670	164.3840	20.7790	11.3510	17.7420
SELENIUM									
SILVER									0.4840
ZINC	856.0000	539.6550	222.2220	62.9870	540.0000	102.7400	111.6880	45.9460	111.2900

NPDES#	W003	W004	W008	W014	W009	W041	W042	W040	W044
	BALLARD SIPHON	EAST BALLARD #1	3RD AVE. WEST	MONTLAKE OVER.	DEXTER AVE.	BRANDON ST.	S.W. MICHIGAN	EIGHTH AVE.	NORFOLK ST.
CONVENTIONALS									
SULFIDE	1212.00	270.90	190.00	4.03	1273.00	71.20	24.68	7.80	95.20
COD	640000.00	206896.00	266666.00	155844.00	533333.00	32876.70	11688.00	13513.00	48387.00
TOT VOL SOLIDS	256000.00	91379.00	55555.00	24675.00	106666.00	21917.80	15584.00	13513.00	46774.00
TOC	84000.00	36206.00	22000.00	11039.00	33333.00	6849.00	3766.00	6351.00	22580.00
OIL-GREASE	2600.00	4400.00	1800.00	410.00	20000.00	1780.70	441.60	148.60	1097.00

NOTE: A BLANK CELL INDICATES THAT A CONSTITUENT WAS NOT DETECTED

NPDES CSO MONITORING PROGRAM CHECKLIST

DISCHARGE MONITORING

CSO	NPDES #	DATE	SAMPLE #	STATUS OF PROGRAM
MICHIGAN	W039	03/26/88	8800300	PERMIT REQUIREMENTS MET
LANDER	W030	03/26/88	8800301	PERMIT REQUIREMENTS MET
DENNY	W027	03/25/88	8800302	PERMIT REQUIREMENTS MET
E. BALLARD #1	W004	02/22/89	8900177	PERMIT REQUIREMENTS MET
		04/06/88	8800352	
		01/14/88	8800052	
		11/02/88	8802026	
3RD AVE.W.	W008	02/22/89	8900174	PERMIT REQUIREMENTS MET
(EWING)		01/14/88	8800053	
		03/26/88	8800303	
		11/02/89	8802027	
BALLARD SIPHON	W003	12/02/89	8909776	PERMIT REQUIREMENTS MET
		03/09/90	9000286	
		10/04/90	9000880	
		01/06/90	9000002	
CONNECTICUT	W029	08/22/89	8900832	PERMIT REQUIREMENTS MET
		10/22/89	8909689	
		04/23/90	9000394	
		02/07/90	9000215	
BRANDON ST.	W041	03/14/90	9000289	PERMIT REQUIREMENTS MET
		06/03/90	9000510	
		10/04/90	9000881	
		12/04/90	9010003	
NORFOLK ST.	W044	10/14/90	9000887	PERMIT REQUIREMENTS MET
		06/06/90	9000524	
		04/03/91	9100612	
		12/04/90	9010006	
EIGHTH AVE.	W040			SAMPLING IN 1992
CHELAN AVE.	W036			SAMPLING IN 1992
DEXTER AVE.	W009			SAMPLING IN 1992/1993
MONTLAKE AVE.	W014	04/03/91	9100609	ADDITIONAL SAMPLING IN 1992
		12/04/90	9010009	
S.W. MICHIGAN	W042	01/12/91	9100012	ADDITIONAL SAMPLING IN 1992
		04/03/91	9100613	

SEDIMENTS	NPDES#	DATE	SAMPLE #	STATUS OF PROGRAM
BALLARD SIPHON	W003	05/30/89	8900560	PERMIT REQUIREMENTS MET
EAST BALLARD #1	W004	05/30/89	8900561	PERMIT REQUIREMENTS MET
3RD AVE. WEST	W008	05/30/89	8900563	PERMIT REQUIREMENTS MET
DEXTER AVENUE	W009	05/30/89	8900565	PERMIT REQUIREMENTS MET
MONTLAKE OVER.	W014	05/30/89	8900564	PERMIT REQUIREMENTS MET
EIGHTH AVE.	W040	05/23/90	9006690	PERMIT REQUIREMENTS MET
BRANDON ST.	W041	05/23/90	9006687	PERMIT REQUIREMENTS MET
S.W. MICHIGAN	W042	05/23/90	9006691	PERMIT REQUIREMENTS MET
NORFOLK ST.	W044	05/23/90	9006688	PERMIT REQUIREMENTS MET

QA/QC Procedures for Metro's Trace Organics Analyses

Metro's Trace Organics QA/QC consists of reagent water blank, duplicate matrix spikes, and surrogates. Reagent water blanks are run to ensure that laboratory contaminants or artifacts are not reported for the samples. A matrix spike consists of an actual sample spiked with a representative group of the compounds being analyzed for by the various procedures. By running the matrix spike in duplicate, variability is monitored and a relative percent difference (RPD) is calculated in addition to the percent recovery of the spikes.

Surrogate spikes are compounds that are added to every sample prior to extraction. After analysis, the percent recovery of the surrogates are calculated and this data is used to monitor extraction efficiency. The surrogates are compounds not generally found in environmental samples and are often isotopically labelled analogs of the compounds of analysis for GC/MS work. These compounds would be expected to behave similiarly to the analytes but do not interfere with analysis.

For extractable samples consisting of base/neutral/acids (BNAs) and pesticides/PCBs a minimum of ten percent QC is run. For every ten extractions, blank and duplicate matrix spikes are analyzed in addition to the surrogate. More than ten percent QC is frequently run as often there are not ten samples to run at a time. A set is done for every group of extractions. For volatile organics, surrogates are added to every sample, daily reagent water blanks are analyzed, and duplicate matrix spikes are run for every fifteen analyses. Fewer duplicate matrix spikes are run for volatiles as there is less variability than for extractables.

EPA Methods 608, 624, and 625 recommend five percent QC. While Metro's QC is consistent with these methods, it goes beyond EPA requirements by performing more than the prescribed amount of QC and is more similiar to that recommended by the EPA Contract Laboratory Program (CLP). Metro also routinely performs various tasks to ensure that instruments are functioning and calibrated properly. A three- to five- point curve is initially run to calibrate instruments and daily standards are analyzed. The GC/MS systems are tuned to EPA specifications for DFTPP for BNAs and BFB for volatiles and the tune is checked on a daily basis.