Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program

Annual Monitoring Report - Year Two, April 2001

Elliott Bay/Duwamish Restoration Program

Prepared for the
Elliott Bay/Duwamish Restoration Program Panel
by the
King County Department of Natural Resources

Panel Publication 31

November 2001

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The Panel of Managers holds regularly scheduled meetings that are open to the public. Technical Working Group and committee meetings are scheduled on an as-needed basis, and are also open to the public. Meetings are generally held at the National Oceanic and Atmospheric Administration, National Marine Fisheries Service - Regional Directorate Conference Room, Building 1, 7600 Sand Point Way NE, Seattle. The Panel recommends that you contact the Administrative Director at the above phone number to confirm meeting schedules and locations. The panel also holds periodic special evening and weekend public information meetings and workshops.

General Schedule for Panel and Committee Meeting Dates

Panel: quarterly, first Thursday of January, April, July, October, 9:30 A.M. - 12:30 P.M.
Habitat Development Technical Working Group: third Thursday of every month, 9:30 A.M. - 12:30 P.M.
Sediment Remediation technical Working Group: scheduled as needed.
Public Participation Committee: scheduled as needed.
Budget Committee: scheduled as needed.

Environmental Review of Specific Projects

Formal hearings and comment periods on appropriate environmental documents for proposed sediment remediation and habitat development projects will be observed. Please contact the Administrative Director for more information.

This information is available in accessible formats on request at
(206) 296-0600 (voice) and 1-800-833-6388 (TTY/TDD users only).

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1 INTRODUCTION

This report presents the results of the fourth sampling event of a five-year monitoring program at the Norfolk combined sewer overflow (CSO) sediment remediation site. The purpose of the five-year program is to monitor sediment placed as backfill material at the site for potential recontamination from CSO and other discharges. The fourth monitoring event occurred in April 2001, two years after completion of remedial activities. This monitoring event was intended to collect data on the chemical characteristics of the backfill material after the second year and compare those data to baseline chemical conditions. Included in this report are a project background, descriptions of sampling and analytical methodologies, analytical results, and a quality assurance review of the analytical data.

1.1 Project Background

Sediment remediation at the Norfolk CSO site was undertaken to partially fulfill sediment remediation requirements of a 1991 Consent Decree, which defined the terms of a natural resources damage agreement between King County (along with the City of Seattle) and federal, state, and tribal natural resources trustees. The Norfolk CSO site was chosen by the Elliott Bay/Duwamish Restoration Program (EBDRP) Panel as one of four sites prioritized for potential sediment remediation.

A site characterization and cleanup study was performed in 1994 and 1995, and the cleanup study report was issued in 1996 (EBDRP, 1996). Chemicals of concern at the site included mercury, 1,4-dichlorobenzene, bis(2-ethylhexyl) phthalate and polychlorinated biphenyls (PCBs), all present at concentrations exceeding State of Washington Sediment Management Standards (SMS) sediment chemical criteria values that define the cleanup screening levels. PCB "hot spot" concentrations at the site also exceeded Toxic Substances Control Act (TSCA) limits for hazardous waste disposal.

Site remediation began in early February 1999 and was completed by late March 1999. Remedial activities consisted of dredging and disposal of contaminated sediment and backfilling the dredged area to original grade with clean sediment from the Duwamish River Turning Basin. Contaminated sediments were removed from the site by mechanical dredge and dewatered on shore in a containment area first arranged to segregate batches about 50 cubic yards (cy) in size and later reconfigured to handle larger batches.

Sediment samples were collected daily from each 50-cy batch and analyzed for PCB concentrations to determine the appropriate disposal destination. Sediments with a PCB concentration greater than 45 parts per million (ppm) were transported to a Subtitle C landfill in Arlington, Oregon for disposal. Sediments with a PCB concentration less than 45 ppm were transported to a Subtitle D landfill in Bremerton, Washington for disposal. A total of 5,190 cy of sediment was removed during the remediation, of which approximately 1,900 cy were transported to the Subtitle C landfill as hazardous waste. Sediment was generally removed to a depth of three feet, however, remediation in the PCB hot spot areas required removal of sediment up to a depth of nine feet. Confirmational testing subsequent to dredging activities indicated that, in some of the deepest-dredged areas, sediments were left

in place that contained PCB concentrations greater than SMS chemical criteria. Discussions with project oversight personnel from the EBDRP Panel and State of Washington Department of Ecology (Ecology) determined that, at a depth of nine feet below original grade, these PCB-contaminated sediments could be left in place.

Clean backfill sediment was obtained from the Duwamish River Turning Basin during normal, maintenance dredging operations by the Army Corps of Engineers (ACOE). Data collected by the Corps prior to maintenance dredging indicated that this material was suitable for use as backfill material (ACOE unpublished data, 1998). A sample was also collected from the Turning Basin sediment after it was placed on a barge and just prior to backfilling activities. Analytical results from this sample confirmed the suitability of the sediment as backfill material (King County unpublished data, 1999). No organic chemicals were detected in the sample and metals were detected at levels indicative of natural, area-wide crustal sediment concentrations. Approximately 6,700 cy of Turning Basin sediment was used to backfill the dredged area at the Norfolk CSO sediment remediation site. A site closure report was issued in August 1999 (EBDRP, 1999).

The site hydraulic permit, issued by the Washington State Department of Fish and Wildlife prior to remediation, requires that the site be monitored for a period of five years following remedial activities to evaluate possible recontamination of the backfill sediment as a result of continuing CSO or storm water discharges. To comply with this permit, a five-year monitoring plan was prepared which includes sampling and analysis of surficial sediments from four stations in the backfilled area. Analytical data will allow King County to evaluate the chemical characteristics of the sediment and assess possible recontamination over time. Monitoring activities will be performed in accordance with a sampling and analysis plan addendum prepared by King County (King County, 1999).

1.2 Site Description

The Norfolk CSO sediment remediation site is located in the Duwamish River, above the Turning Basin at approximately river kilometer (km) 10 in the City of Tukwila (Figure 1). The site is located upstream of the river reach maintained for commercial navigation and, as such, has maintained its natural channel as well as some riparian habitat (EBDRP, 1996). The shoreline is characterized by a steeply sloping, erosional bank maintained with large concrete riprap. The bank joins a gently sloping, intertidal mud shoreline that is completely exposed during extreme low tides.

The Norfolk CSO outfall originates at King County's Norfolk Street Regulator Station near South 102nd Street and East Marginal Way in Tukwila (EBDRP, 1996). The outfall structure has a flap gate over the 84-inch discharge pipe and a concrete splash plate that is exposed during normal low tides. The remediation site is located adjacent to the outfall structure and is characterized by exposed, intertidal mud habitat as well as subtidal riverbed. The intertidal zone has been channelized, both by the discharge of the Norfolk CSO and by a storm drain outfall that drains a Boeing Company parking lot adjacent to the CSO outfall.

2 SAMPLE COLLECTION

This section describes sampling activities conducted in April 2001. All sampling activities were conducted following guidance suggested in the Puget Sound Protocols (PSEP, 1996a and 1998).

2.1 Sample Locations and Station Positioning

Sampling locations were selected and coordinates determined prior to field activities. Final sampling locations were selected prior to the October 1999 six-month monitoring event (King County, 2000) and were designed to assess potential recontamination at the site and evaluate the chemical characteristics of the backfill material at the following locations:

- within the Norfolk CSO channel, prior to its confluence with the Boeing storm drain channel (NFK501);
- on the delta after the confluence of the Norfolk CSO and Boeing storm drain channels (NFK502);
- within the Boeing storm drain channel prior to its confluence with the Norfolk CSO channel (NFK503); and
- upriver of both the Norfolk CSO and Boeing storm drain channels (NFK504).

Sample station locations were selected to monitor sediment quality in those areas with the greatest potential for recontamination; two stations in the Norfolk CSO channel and one station in the Boeing storm drain channel. The upriver station was selected to provide background or reference data.

The prescribed station location coordinates are presented in Table 1 and sample locations are shown in Figure 2.

Sediment grab samples were collected from the King County research vessel *Chinook*, which is equipped with a differential global positioning system (DGPS). Coordinates, presented in Table 1, were recorded using DGPS for each of the individual grabs as the sampler contacted the river bottom. The DGPS is a satellite-based navigation system that operates using a receiver to calculate ground position by triangulating scrambled data transmitted by a constellation of satellites operated by the Department of Defense (DOD). The ship-board "differential" receiver receives both the scrambled DOD signal and "corrected" signals originating from base stations operated by various agencies including the Coast Guard and King County. System software applies the differential correction and calculates a precise, real-time navigational position.

Two composite sediment samples were obtained from each station. One sample was collected from the 0 to 2 centimeter (cm) depth stratum and the other sample was collected from the 0 to 10 cm depth stratum. Both samples at each station were composited from three separate deployments of the grab sampler. Coordinates for each grab deployment are included in Table 1.

2.2 Sample Collection and Handling

Eight estuarine sediment samples were collected April 24, 2001 from the Norfolk CSO sediment remediation site. Samples were collected from both the top 2 cm and top 10 cm of sediment at each station using a stainless steel, modified, 0.1 m^2 Van Veen grab sampler deployed from the *Chinook* via hydrowire. Both samples at each station were composited from three separate deployments of the grab sampler. Water depth at the four sample stations ranged between 1 and 3 meter (~ 3 to 6 feet) on an ebbing to slack tide of between 2 and -0.3 feet (referenced to mean lower low water). Between 11 and 16 cm of sediment was recovered in each grab, allowing collection of a sample aliquot from the top 10 cm without sampling sediment that had touched the sides or bottom of the grab sampler.

Samples were comprised of sediment aliquots collected from three individual grabs at each station with an equal amount of material collected from each grab. The sediment aliquot for the 0 to 2 cm depth stratum was collected from one side of each grab using a 200 cm^2 stainless-steel "cookie cutter." The sediment aliquot for the 0 to 10 cm depth stratum was collected from the other side of each grab using a stainless-steel spoon. Each of the aliquots were placed into separate stainless-steel bowls, covered with foil, and placed into an ice-filled cooler between grab deployments. After collecting aliquots from three grabs, the sediment sample was thoroughly homogenized and sample aliquots split out into pre-labeled containers. Sample containers were supplied by the King County Environmental Laboratory and were pre-cleaned according to analytical specifications.

Two sets of sample compositing equipment were dedicated to each station, precluding the need for decontamination of the field gear. The Van Veen grab sampler was decontaminated between stations by scrubbing with a brush and river water followed by a thorough *in situ* rinsing.

Samples were stored in ice-filled coolers from the time of collection until delivery to the King County Environmental Laboratory. Samples were delivered under chain-of-custody and were maintained as such throughout the analytical process. Samples were stored frozen (-18°C) by the laboratory until analysis with the exception of samples for particle size distribution (PSD) analysis. PSD samples were stored refrigerated at approximately 4°C. All analyses were conducted by the King County Environmental Laboratory with the exception of PSD, which was analyzed at Rosa Environmental and Geotechnical Laboratory, a subcontracted laboratory accredited by Ecology.

3 SAMPLE ANALYSIS

The eight estuarine sediment samples were submitted for analysis of conventional, metal, and organic parameters. This section describes the type of analyses performed, as well as analytical methodologies used and the associated quality assurance/quality control (QA/QC) procedures followed. Analyses were selected to allow comparison of sediment data to the SMS sediment chemical criteria found in Tables 1 and 3 of Chapter 173-204 WAC (Ecology, 1995).

3.1 Conventionals

Conventional analyses included percent solids, total organic carbon (TOC), and PSD. Percent solids and TOC analyses were performed to provide data necessary to normalize sediment data to dry weight and organic carbon, respectively. TOC analysis also allows evaluation of possible organic enrichment at the site over time. Percent solids analysis was performed following SM 2540-G, gravimetric determination and TOC analysis was performed following EPA Method 9060, high-temperature combustion with infrared spectroscopy. PSD analysis allows evaluation of the gross physical characteristics of the backfill material and any changes imparted by sedimentation. PSD analysis was performed according to method ASTM D422, a combination of sieve and hydrometer analyses.

3.2 Metals

Metal analyses included 12 priority pollutant metals, as well as the crustal metals aluminum, iron, and manganese (see Appendix A). SMS regulates eight of the metals included in this suite of analytes; arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc. Metal analysis allows assessment of potential recontamination at the site over time. With the exception of mercury, all metal analyses were performed following EPA Method 3050A/6010B; strong-acid digestion with inductively coupled plasma optical emission spectroscopy. Mercury was analyzed according to EPA Method 245.5, cold vapor atomic absorption spectroscopy.

3.3 Organics

Organic analyses included base/neutral/acid extractable semivolatile compounds (BNAs) and PCBs (see Appendix A). Organic analysis also allows assessment of potential recontamination to the site over time, especially by PCBs and phthalates. BNA analysis was performed following EPA Method 3550B/8270C (SW-846), gas chromatography with mass spectroscopy (GC/MS). PCBs were analyzed by EPA Method 3550B/8082 (SW-846), gas chromatography with electron capture detection (GC/ECD). This suite of analytes included all organic compounds regulated under SMS.

3.4 Quality Assurance/Quality Control (QA/QC)

All analyses were performed following guidance recommended under Puget Sound Protocols (PSEP 1986, 1996b, and 1996c) including associated QA/QC practices. Laboratory QA/QC practices produced data of sufficient quality to pass QA1 review. Analytical data were reviewed following QA1 guidelines (Ecology, 1989) and flagged with data qualifiers where appropriate. A comprehensive report of analytical data, including qualifier flags is included as Appendix A. The QA1 review narrative is included as Appendix B.

4 ANALYTICAL RESULTS

This section discusses analytical results for the eight estuarine sediment samples collected from the Norfolk CSO sediment remediation site and compares the data to sediment criteria specified under SMS (Ecology, 1995). Tables in this section summarize and compare the data to both Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL)

4.1 Particle Size Distribution (PSD)

PSD results are summarized in Table 2. PSD results indicate that there has been little overall change in the basic structure of the backfill material over the 0 to 10 cm depth stratum at stations NFK502 and NFK503. The samples collected from the 0 to 10 cm depth stratum at stations NFK502 and NFK503 were comprised of 90.7 and 97.0% sand, respectively. The samples collected from to 0 to 10 cm depth stratum at stations NFK501 and NFK504, however, showed increased fine materials over the samples between April 1999 and April 2001. Percent sand content for the 0 to 10 cm depth stratum samples collected from stations NFK501 and NFK 504 was 78.8 and 65.4%, respectively. Three of the four samples collected from the 0 to 2 cm depth stratum also contained higher percentages of fine material, perhaps indicating some recently deposited silts and clays. The sample collected from the 0 to 2 cm depth stratum at station NFK503 continued to be sandy, with a sand content of 95.9%.

4.2 Conventionals

Conventional analytical results are summarized in Table 3 and include percent solids, used to calculate dry-weight sediment concentrations of metal and organic data and TOC, used to normalize certain organic parameters to organic carbon content.

Percent solids results ranged from 52.7 to 74.7%. TOC concentrations in the 0 to 2 cm depth stratum samples ranged from 2,770 to 15,600 milligrams per kilogram (mg/Kg) dry weight, or ~ 0.3 to 1.6%. TOC concentrations in the 0 to 10 cm depth stratum samples ranged from 3,600 to 9,080 mg/Kg, or ~ 0.4 to 0.9%.

4.3 Metals

Sediment metal analytical results are summarized in Table 4. Metals data have been normalized to dry weight for comparison to SMS chemical criteria.

Arsenic, cadmium, and silver were not detected in any samples collected during this monitoring event. Reported concentrations of all other metals (Appendix A) were at levels indicative of natural, area-wide crustal concentrations (Dexter et al, 1981). Metal concentrations or method detection limit (MDL) values for those metals regulated under SMS were all below SQS chemical criteria. Comparison of metals data at both the 0 to 2 and 0 to 10 cm depth strata show very little change in metals concentrations over the first two years of the monitoring program.

4.4 Organics

Organic analytical results are summarized in Tables 5, 6, and 7. Data for ionic organic compounds have been normalized to dry weight for comparison to SMS sediment criteria and are presented in Table 5.

Data for non-ionic organic compounds have been normalized to organic carbon and are presented in Table 6 for comparison to the SQS and CSL. Normalization to organic carbon can produce biased results, however, when the organic carbon content of the sample is very low (Ecology, 1992). When the organic carbon content of a sample is near 0.1 or 0.2% (1,000 to 2,000 mg/Kg dry weight), even background concentrations of certain organic compounds can exceed the SQS or CSL.

For sediment with a TOC content less than 0.5% (5,000 mg/Kg dry weight), Ecology recommends comparing dry weight-normalized, non-ionic organic data to Puget Sound lowest apparent effects thresholds (LAET) and second lowest apparent lowest effects thresholds (2LAET) (EPA, 1988), which are considered to be equivalent to the SQS and CSL values, respectively. This comparison allows a more appropriate evaluation of sediment quality relative to organic compounds (Ecology, 1992). Table 7 presents this comparison.

4.4.1 Ionic Organic Compounds

Benzoic acid was detected in all eight samples at concentrations ranging from 67.6 to 299 micrograms per kilogram (µg/Kg). These concentrations are below the SQS/CSL criterion of 650 µg/Kg and are similar to concentrations detected during previous monitoring events. No other ionic organic chemicals were detected in any of the samples collected during this monitoring event.

4.4.2 Non-Ionic Organic Compounds Compared to SQS/CSL Criteria

Organic carbon values in samples collected during this monitoring event ranged from 0.3 to 1.6%. Samples with organic carbon content less than 0.5% include the sample collected from the 0 to 10 cm depth stratum at station NFK502 and both samples collected from station NFK503.

4.4.2.1 Low-Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs)

Anthracene was detected in all four samples collected from the 0 to 2 cm depth stratum. Organic carbon-normalized anthracene concentrations were all less than 1% of the SQS criterion of 220 mg/Kg organic carbon (OC). Phenanthrene was detected in samples collected from the 0 to 2 cm depth stratum at all four stations as well as three of four samples collected from the 0 to 10 cm depth stratum. Phenanthrene concentrations are all less than 10% of the SQS criterion of 100 mg/Kg organic carbon (OC). No other LPAH compounds were detected in samples collected during this monitoring event.

4.4.2.2 High-Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs)
One or more HPAH compounds were detected in both samples collected from all four stations. Organic carbon-normalized HPAH concentrations were typically less than 10% of the SQS criteria. Concentrations of HPAH compounds have shown some variation over the four monitoring events although the concentrations detected have all been below SQS criteria. The station in the Norfolk CSO channel (NFK501) had the greatest number of HPAH compounds detected but the total HPAH value was still less than 10% of the associated SQS value.

4.4.2.3 Chlorobenzenes
Chlorobenzene compounds were not detected in any samples collected during this monitoring event. All chlorobenzene MDL values were lower than associated sediment chemical criteria, both organic carbon- and dry weight-normalized.

4.4.2.4 Phthalates
Bis(2-ethylhexyl) phthalate was detected in all eight samples collected during this monitoring event. Concentrations ranging from 24.9 to 42.7 mg/Kg OC were reported in samples collected from the three stations with an organic carbon content greater than 0.5%. These concentrations are all less than the SQS of 47 mg/Kg OC with the low value at 53% of the SQS and the high value at 91% of the SQS. Bis(2-ethylhexyl) phthalate was also detected in the method blank associated with this group of samples at a concentration of 14.5 µg/Kg dry weight (see Appendix B). Normalized to the range of organic carbon concentrations found in these samples, method blank concentrations of bis(2-ethylhexyl) phthalate would be 0.93 to 5.23 mg/Kg OC. Bis(2-ethylhexyl) phthalate concentrations in both samples collected from the Boeing storm drain channel (NFK503) were less than five times the method blank concentration and should be discounted as highly biased. Other bis(2-ethylhexyl) phthalate concentrations are legitimate as reported, however, they should be viewed with the possibility of some contribution to the overall concentration from laboratory contamination.

Di-N-butyl phthalate was detected in all eight samples collected during this monitoring event, however, this compound was also detected in the laboratory method blank. All sample concentrations were less than five times the method blank concentration and, as a result, should be disregarded.

Butyl benzyl phthalate was detected in both samples collected from the Norfolk CSO channel (NFK501), the combined channel delta (NFK502), and the upriver reference station (NFK504) at concentrations ranging from 2.24 to 6.63 mg/Kg OC. The concentrations detected in the samples collected from the 0 to 10 cm depth stratum at stations NFK501 and NFK502 (6.63 and 5.03 mg/Kg OC, respectively) exceeded the SQS for butyl benzyl phthalate of 4.9 mg/Kg OC. Both of these reported concentrations, however, are well below the butyl benzyl phthalate CSL of 64 mg/Kg OC. Butyl benzyl phthalate was not detected in the sample collected from the Boeing storm drain channel.

4.4.2.5 Miscellaneous Compounds

Dibenzofuran, hexachlorobutadiene, and N-nitrosodiphenylamine were not detected in any samples collected during this monitoring event. MDL values for these compounds were all below associated SQS criteria.

4.4.2.6 PCBs

PCBs (as total Aroclors®) were detected in all eight samples collected during this monitoring event. The highest reported PCB concentrations were detected in samples collected from the Boeing storm drain channel (NFK503). The organic carbon content of both samples collected from station NFK503 is less than 0.5%, therefore, comparison to PCB chemical criteria should be made to dry weight-normalized LAET values. The PCB concentrations of 1,880 µg/Kg DW (0 to 2 cm sample) and 1,330 µg/Kg DW (0 to 10 cm sample) detected in the Boeing storm drain channel both exceed the 2LAET criterion value of 1,000 µg/Kg DW.

The organic carbon content at the other three stations was greater than 0.5%, therefore, comparison to PCB chemical criteria should be made to organic carbon-normalized SQS/CSL values. The PCB concentrations of 24.8 mg/Kg OC (0 to 2 cm sample) and 18.9 mg/Kg OC (0 to 10 cm sample) detected at the combined channel delta station (NFK502) both exceed the SQS criterion value of 12 mg/Kg OC. PCB concentrations detected in samples collected from the Norfolk CSO channel (NFK501) and the upriver reference station (NFK504) were all less than the SQS criterion value.

4.4.3 Non-Ionic Organic Compounds Compared to LAET/2LAET Criteria

The dry weight-normalized MDL range of 27 to 31 µg/Kg for N-nitrosodiphenylamine exceeded the LAET criterion of 28 µg/Kg for six of eight samples collected during this monitoring event. N-nitrosodiphenylamine was not detected in any of the samples.

All dry weight-normalized, detected concentrations of LPAHs, HPAHs, and phthalates were below LAET criteria.

5 FUTURE MONITORING

Sampling and analysis completed in April 2001 was performed to assess surface sediment conditions of the backfill material two years after placement at the Norfolk remediation site. Future monitoring events will occur on an annual basis, with the next monitoring event scheduled for April 2002. Station locations will remain the same unless the CSO and storm drain discharge channels change significantly over the course of the monitoring period.

All subsequent monitoring events will include collection of two discrete samples from each of the four established locations. One sample will be collected from the top 2 cm of sediment and analyzed to evaluate the chemical characteristics of recently deposited material. Another sample will be collected from the top 10 cm to evaluate the chemical characteristics of the sediment over the entire biologically active zone. The remainder of the five-year monitoring schedule is shown below.

- April 2002 - Year three monitoring event.
- April 2003 - Year four monitoring event.
- April 2004 - Year five (final) monitoring event.

6 SUMMARY AND CONCLUSIONS

Eight estuarine sediment samples were collected in April 2001 from the Norfolk CSO sediment remediation site, two years after completion of remedial activities. Samples were collected from the surface of backfill material placed at the site and analytical results were compared to baseline chemical conditions of the backfill material to evaluate possible recontamination at the site.

Samples were collected from two depth strata at each of four stations: one sample collected from the 0 to 2 cm depth stratum to evaluate chemical concentrations in recently deposited sediment; and one sample collected from the 0 to 10 cm depth stratum to evaluate sediment chemical concentrations over the entire biologically active zone. Analytes included sediment conventionals along with metal and organic parameters required under SMS criteria.

To allow comparison of analytical results from the four monitoring events completed to date, dry weight-normalized data from 0 to 10 cm depth stratum samples from the April 1999, October 1999, April 2000, and April 2001 monitoring events are presented in Table 8. These analytical results show that, after two years, conditions of the backfill material within the 0 to 10 cm depth stratum can be characterized by:

- an increase in organic carbon content at all stations except the Boeing storm drain channel station (NFK503);
- little or no change in grain size distribution at the combined channel delta station (NFK502), an increase in fine materials at the Norfolk CSO channel station (NFK501) and the upriver reference station (NFK504), and a decrease in fine materials at the Boeing storm drain station (NFK503);
- little or no change in metal concentrations at all four stations;
- the presence of low concentrations of a few PAH compounds at some stations, varying both spatially and temporally, with no indication of a trend toward increasing concentrations;
- the presence of butyl benzyl phthalate at the Norfolk CSO channel station (NFK501), the combined channel delta station (NFK502), and the upriver reference station (NFK504), however, this chemical was not detected during previous monitoring events;
- the presence of measurable concentrations of bis(2-ethylhexyl) phthalate at the Norfolk CSO channel station (NFK501), the combined channel delta station (NFK502), and the upriver reference station (NFK504), however, this chemical was previously not quantifiable due to laboratory sample contamination; and
- increasing concentrations of PCBs at all four stations, however, concentrations of this chemical increased dramatically at the Boeing storm drain channel station (NFK503) between the last two monitoring events (April 2000 and April 2001).

A comparison of dry weight-normalized analytical results from the 0 to 2 cm depth stratum between the October 1999, April 2000, and April 2001 monitoring events is presented in Table 9. These analytical results show that, after two years, conditions of the backfill material within the 0 to 2 cm depth stratum can be characterized by:

- an increase in organic carbon content at the Norfolk CSO channel station (NFK501) and the upriver reference station (NFK504);
- a steady decrease in fine materials at the combined channel delta station (NFK502) and the Boeing storm drain channel station (NFK503) and some temporal variability in the quantity of fine materials at the Norfolk CSO channel station (NFK501) and the upriver reference station (NFK504);
- consistent concentrations of metals at area background levels;
- more frequently-detected PAH compounds, although at concentrations well below the SQS (typically, less than 10% of the SQS value);
- the presence of butyl benzyl phthalate at the Norfolk CSO channel station (NFK501), the combined channel delta station (NFK502), and the upriver reference station (NFK504), however, this chemical was not detected during previous monitoring events;
- the presence of measurable concentrations of bis(2-ethylhexyl) phthalate at the Norfolk CSO channel station (NFK501), the combined channel delta station (NFK502), and the upriver reference station (NFK504), however, this chemical was previously not quantifiable due to laboratory sample contamination; and
- increasing concentrations of PCBs at all four stations, however, concentrations increased dramatically at the Boeing storm drain channel station (NFK503).

Metals concentrations throughout the backfill material at the Norfolk sediment remediation site continue to be detected at concentrations indicative of regional background levels (Dexter et al, 1981). Cadmium and silver have rarely been detected in samples collected from the site and arsenic and mercury have been detected infrequently. Discharges from the Norfolk CSO and Boeing storm drain to not appear to be impacting metals' concentrations in the backfill material.

While low levels of bis(2-ethylhexyl) phthalate have been detected in samples collected during previous monitoring events, the concentrations have not been statistically different from concentrations detected in associated analytical method blanks. Bis(2-ethylhexyl) phthalate concentrations detected in samples collected during the April 2001 monitoring event, however, are significantly higher than method blank concentrations at the Norfolk CSO channel station (NFK501), the combined channel delta station (NFK502), and the upriver reference station (NFK504). Organic carbon-normalization of bis(2-ethylhexyl) phthalate concentrations is appropriate at these three stations given the TOC concentrations of 0.5 to 1.6%. Organic carbon-normalized bis(2-ethylhexyl) phthalate concentrations at these three stations range from 24.9 to 42.7 mg/Kg OC. These concentrations are all less than the SQS chemical criterion of 47 mg/Kg OC, however, the concentration detected at the Norfolk CSO channel station (NFK501) is 91% of the SQS, the concentration detected at the combined channel delta station (NFK502) is 67% of the SQS, and the concentration detected at the upriver reference station (NFK504) is 53% of the SQS.

Butyl benzyl phthalate was detected at the Norfolk CSO channel station (NFK501), the combined channel delta station (NFK502), and the upriver reference station (NFK504) at organic carbon-normalized concentrations of 2.24 to 6.63 mg/Kg OC. Butyl benzyl phthalate concentrations in the samples collected from the 0 to 10 cm depth stratum at stations NFK501 (6.63 mg/Kg OC) and NFK502 (5.03mg/Kg OC) exceed the SQS chemical criterion

of 4.9 mg/Kg OC. This compound has not been detected during previous monitoring events and has not been detected at the Boeing storm drain channel station. The low concentrations present and lack of continuous temporal data make it difficult to assess a source at this point, however, there does appear to be a slight concentration gradient for butyl benzyl phthalate toward the Norfolk CSO.

Several HPAH compounds were detected for the first time during the April 2001 monitoring event. Two of these compounds, anthracene and indeno(1,2,3-c,d)pyrene, appear to be the result of significant improvements in analytical method detection limits. HPAH data do not appear to be following any spatial or temporal trends with no apparent concentration gradients. Concentrations of HPAHs detected in samples collected during the April 2001 monitoring event continue to be well below the SQS or LAET with most values less than 10% of the SQS.

Samples collected from two of four stations during the April 2001 monitoring event have PCB concentrations that exceed SMS criteria. The highest PCB concentrations were detected in the samples collected from the Boeing storm drain channel station (NFK503) and the second highest PCB concentrations were detected in the samples collected from the combined channel delta station (NFK502).

The organic carbon content of the samples collected from the Boeing storm drain channel (0.28 and 0.36%) indicates that dry weight-normalized PCB concentrations should be compared to LAET criteria. Dry weight-normalized PCB concentrations in both depth strata at station NFK503 exceed the 2LAET chemical criterion, which is equivalent to the CSL. The Boeing storm drain channel station is located upstream of the combined channel delta station (NFK502), which had a lower PCB concentration; exceeding the SQS but not the CSL in samples collected from both depth strata. The concentration gradient indicates PCBs on the backfill material are coming from the direction of the Boeing storm drain.

PCB concentrations detected at the Norfolk CSO channel station (NFK501) and the upriver reference station (NFK504) were well below the SQS for both depth strata.

A similar pattern of PCB distribution was observed in samples collected at six months (October 1999) and one year (April 2000) after placement of the backfill material. A follow-up sampling event to track potential sources for the apparent PCB re-contamination of the backfill was completed in February 2000. Results from this sampling event revealed an area of high PCB concentrations (4,900 to 8,400 µg/Kg DW) in sediment in front of the Boeing storm drain outfall. This suggests the most likely source of PCB recontamination to the storm drain channel is the erosion of PCB-contaminated sediments adjacent to the Boeing storm drain pipe outfall (King County 2000).

Boeing conducted a source control investigation of their storm drain and found PCB concentrations that exceed the CSL (on a dry weight-basis) in storm drain sediment (Boeing, 2001), however, Boeing discounts the storm drain as a possible PCB source to the storm drain channel and backfill material. Boeing acknowledges the presence of high PCB

concentrations in sediment in front of the storm drain outfall but states that this is not from their storm drain.

Summary of Issues by Monitoring Station

Norfolk CSO Channel (Station NFK501) – The concentration of bis(2-ethylhexyl) phthalate detected in the 0 to 2 cm depth stratum is 91% of the SQS. The reported concentration of this compound does not appear to be compromised by laboratory contamination. The concentration of butyl benzyl phthalate detected in the 0 to 10 cm depth stratum exceeds the SQS. Phthalates are present in both CSO and separated storm water but the greatest potential for recontamination at the Norfolk cleanup site was predicted to be from separated storm water discharged from the Norfolk CSO outfall (EBDRP, 1996).

Combined Channel Delta (Station NFK502) – The concentration of butyl benzyl phthalate detected in the 0 to 10 cm depth stratum exceeds the SQS. The concentrations of PCBs detected in both depth strata exceed the SQS. It appears that PCBs detected at this station originate from the Boeing storm drain channel and phthalates may be related to the Norfolk CSO outfall.

Boeing Storm Drain Channel (Station NFK503) – The concentrations of PCBs detected in both depth strata exceed the 2LAET, which is considered equivalent to the CSL value when organic carbon concentrations are less than 0.5%. The greatest source of PCB recontamination appears to be the erosion of PCB-contaminated sediment directly in front of the Boeing storm drain. Boeing believes this is not related to their storm drain so the issue has been referred to the project regulatory agencies.

Upriver Reference (Station NFK504) – No chemicals of concern at this time, although reportable concentrations of bis(2-ethylhexyl) phthalate and butyl benzyl phthalate are present for the first time in samples collected during this monitoring event.

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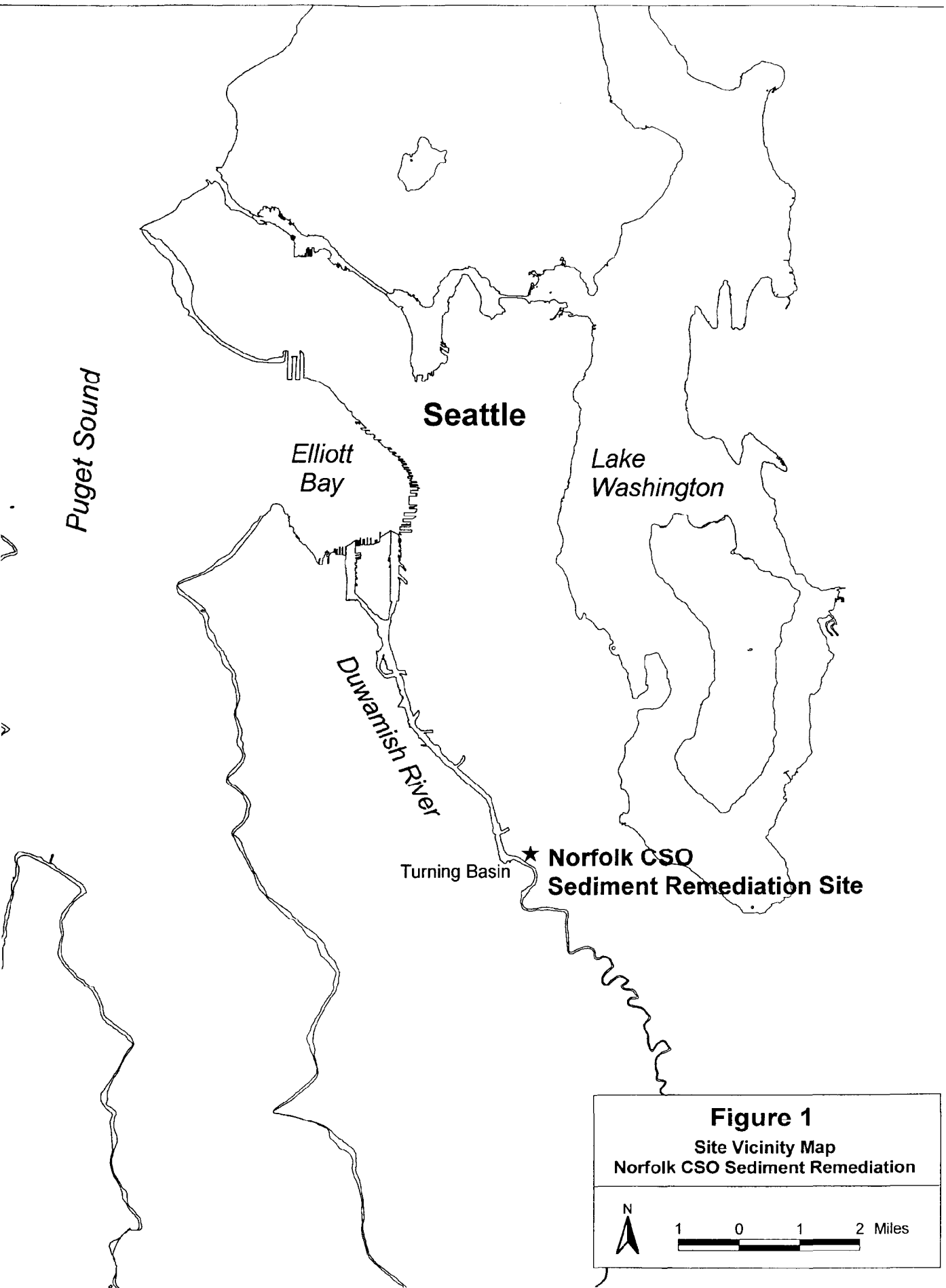

Figure 1
Site Vicinity Map
Norfolk CSO Sediment Remediation

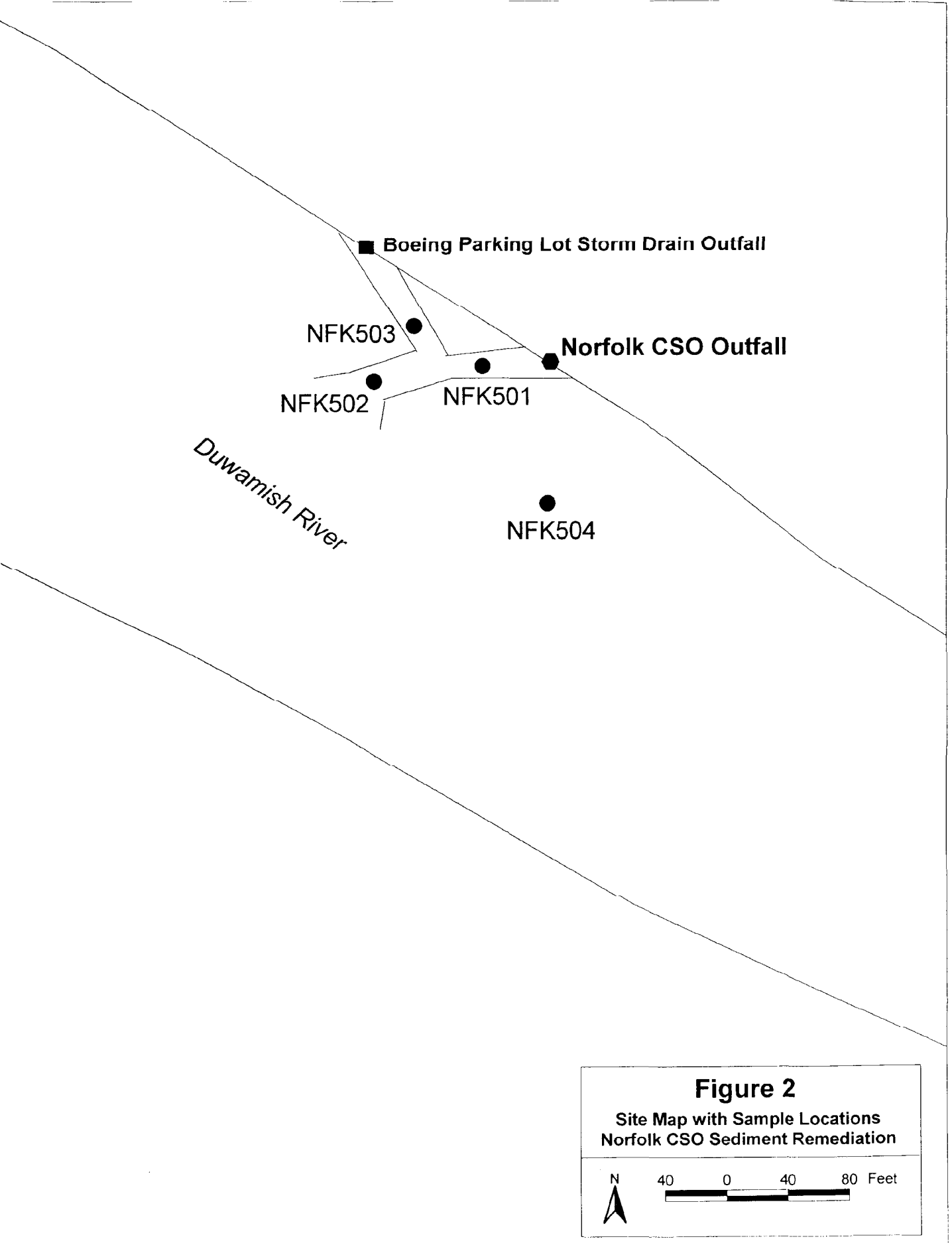

Figure 2

Site Map with Sample Locations
Norfolk CSO Sediment Remediation

Table 1
Sample Location Coordinates
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

Station Name	Northing (NAD83)		Easting (NAD83)	
NFK501 Prescribed Station	190170		1278584	
NFK501 Grab 1		190154		1278590
NFK501 Grab 2		190146		1278581
NFK501 Grab 3		190159		1278577
NFK502 Prescribed Station	190159		1278514	
NFK502 Grab 1		190154		1278509
NFK502 Grab 2		190157		1278513
NFK502 Grab 3		190157		1278514
NFK503 Prescribed Station	190195		1278544	
NFK503 Grab 1		190175		1278555
NFK503 Grab 2		190181		1278547
NFK503 Grab 3		190176		1278545
NFK504 Prescribed Station	190080		1278625	
NFK504 Grab 1		190072		1278628
NFK504 Grab 2		190077		1278624
NFK504 Grab 3		190077		1278622

Notes

NAD83 - North American Datum, 1983

Table 2
Particle Size Distribution
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

		Percent Distribution			
Phi Size	**Class**	**NFK 501 0 - 2 cm**	**NFK501 0 - 10 cm**	**NFK502 0 - 2 cm**	**NFK502 0 - 10 cm**
>p-2.00	Gravel	<MDL (0.1)	<MDL (0.1)	<MDL (0.1)	<MDL (0.1)
p-2.00	Gravel	<MDL (0.1)	0.6	<MDL (0.1)	<MDL (0.1)
p-1.00	Gravel	0.2	0.9	<MDL (0.1)	<MDL (0.1)
	Total Gravel	**0.2**	**1.5**	**< MDL (0.1)**	**< MDL (0.1)**
p0.00	Sand	1.8	1.8	1.0	0.7
p+1.00	Sand	16.3	15.7	19.6	19.2
p+2.00	Sand	42.6	36.5	54.5	58.9
p+3.00	Sand	9.2	11.3	11.2	9.5
p+4.00	Sand	11.6	13.5	2.8	2.4
	Total Sand	**81.5**	**78.8**	**89.1**	**90.7**
p+5.00	Silt	6.1	6.9	1.8	2.2
p+6.00	Silt	3.8	4.5	2.5	2.0
p+7.00	Silt	2.4	3.0	1.8	1.4
p+8.00	Silt	2.2	2.2	1.6	1.2
	Total Silt	**14.5**	**16.6**	**7.7**	**6.8**
p+9.00	Clay	1.5	1.5	1.2	0.9
p+10.00	Clay	1.0	0.8	0.7	0.6
<p+10.00	Clay	1.3	1.4	1.2	0.9
	Total Clay	**3.8**	**3.7**	**3.1**	**2.4**

		Percent Distribution			
Phi Size	**Class**	**NFK503 0 - 2 cm**	**NFK503 0 - 10 cm**	**NFK504 0 - 2 cm**	**NFK504 0 - 10 cm**
>p-2.00	Gravel	<MDL (0.1)	<MDL (0.1)	<MDL (0.1)	<MDL (0.1)
p-2.00	Gravel	<MDL (0.1)	<MDL (0.1)	<MDL (0.1)	0.2
p-1.00	Gravel	1.0	1.0	0.5	0.3
	Total Gravel	**1.0**	**1.0**	**0.5**	**0.5**
p0.00	Sand	4.9	4.1	2.8	2.1
p+1.00	Sand	28.6	32.1	21.7	15.4
p+2.00	Sand	55.7	55.0	43.3	30.4
p+3.00	Sand	5.9	5.2	6.8	6.5
p+4.00	Sand	0.8	0.6	6.1	11.0
	Total Sand	**95.9**	**97.0**	**80.7**	**65.4**
p+5.00	Silt	1.8	1	4.2	14.2
p+6.00	Silt	0.3	0.2	4.8	6.3
p+7.00	Silt	0.3	0.2	3.1	4.2
p+8.00	Silt	0.2	0.1	2.3	3
	Total Silt	**2.6**	**1.5**	**14.4**	**27.7**
p+9.00	Clay	0.1	0.2	1.6	2.2
p+10.00	Clay	0.1	<MDL (0.1)	0.9	1.1
<p+10.00	Clay	0.4	0.4	2.1	3.3
	Total Clay	**0.6**	**0.6**	**4.6**	**6.6**

Notes

<MDL (#) - Analyte not detected above the *method detection limit*. Value is parentheses is the numeric MDL.

Table 3
Sediment Conventionals
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

Conventionals	NFK 501 0 - 2 cm	NFK501 0 - 10 cm	NFK502 0 - 2 cm	NKF502 0 - 10 cm
Solids (%)	68.5	65.4	67.1	66.5
TOC (mg/Kg DW)	8,180	8,670	6,510	4,990

Conventionals	NFK503 0 - 2 cm	NFK503 0 - 10 cm	NFK504 0 - 2 cm	NFK504 0 - 10 cm
Solids (%)	74.7	74.1	52.7	60.1
TOC (mg/Kg DW)	2,770	3,600	15,600	9,080

Notes

TOC - Total organic carbon.

mg/Kg DW - Milligrams per kilogram dry weight, based on percent solids analysis.

Table 4
Sediment Metal Concentrations
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

	Concentration (mg/Kg DW)					
Metal	**NFK501 0 - 2 cm**	**NFK501 0 - 10 cm**	**NFK502 0 - 2 cm**	**NFK502 0 - 10 cm**	**SQS**	**CSL**
Arsenic	<MDL (3.6)	<MDL (3.8)	<MDL (3.6)	<MDL (3.6)	57	93
Cadmium	<MDL (0.22)	<MDL (0.23)	<MDL (0.21)	<MDL (0.23)	5.1	6.7
Chromium	16.1	17.4	16.7	13.3	260	270
Copper	17.2	18.5	15.5	13.1	390	390
Lead	11.6	11.8	9.39	9.62	450	530
Mercury	0.069	0.043	0.031	<MDL (0.030)	0.41	0.59
Silver	<MDL (0.29)	<MDL (0.31)	<MDL (0.28)	<MDL (0.30)	6.1	6.1
Zinc	56.6	59.0	51.6	46.5	410	960

	Concentration (mg/Kg DW)					
Metal	**NFK503 0 - 2 cm**	**NFK503 0 - 10 cm**	**NFK504 0 - 2 cm**	**NFK504 0 - 10 cm**	**SQS**	**CSL**
Arsenic	<MDL (3.3)	<MDL (3.2)	<MDL (4.7)	<MDL (4.2)	57	93
Cadmium	<MDL (0.20)	<MDL (0.20)	<MDL (0.28)	<MDL (0.25)	5.1	6.7
Chromium	13.9	12.0	21.1	17.8	260	270
Copper	11.4	12.9	24.9	18.8	390	390
Lead	7.36	7.83	18.0	13.8	450	530
Mercury	<MDL (0.025)	0.10	0.072	0.038	0.41	0.59
Silver	<MDL (0.27)	<MDL (0.26)	<MDL (0.38)	<MDL (0.33)	6.1	6.1
Zinc	43.4	46.4	68.3	60.6	410	960

Notes

mg/Kg DW - Milligrams per kilogram dry weight, based on percent solids analysis.

<MDL (#) - Analyte not detected above the *method detection limit*. Value is parentheses is the numeric MDL.

Table 5
Sediment Ionic Organic Concentrations
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

	Concentration (µg/Kg DW)					
Ionic Organics	**NFK501 0 - 2 cm**	**NFK501 0 - 10 cm**	**NFK502 0 - 2 cm**	**NFK502 0 - 10 cm**	**SQS**	**CSL**
Benzoic Acid	299	122	162	152	650	650
Benzyl Alcohol	<MDL (8.8)	<MDL (9.2)	<MDL (8.9)	<MDL (9.0)	57	73
2,4-Dimethylphenol	<MDL (10)	<MDL (11)	<MDL (10)	<MDL (11)	29	29
2-Methylphenol	<MDL (28)	<MDL (29)	<MDL (28)	<MDL (29)	63	63
4-Methylphenol	<MDL (23)	<MDL (24)	<MDL (24)	<MDL (24)	670	670
Pentachlorophenol	<MDL (7.3)	<MDL (7.6)	<MDL (7.5)	<MDL (7.5)	360	690
Phenol	<MDL (13)	<MDL (14)	<MDL (13)	<MDL (14)	420	1,200

	Concentration (µg/Kg DW)					
Ionic Organics	**NFK503 0 - 2 cm**	**NFK503 0 - 10 cm**	**NFK504 0 - 2 cm**	**NFK504 0 - 10 cm**	**SQS**	**CSL**
Benzoic Acid	80.9	67.6	268	168	650	650
Benzyl Alcohol	<MDL (8.0)	<MDL (8.1)	<MDL (11)	<MDL (10)	57	73
2,4-Dimethylphenol	<MDL (9.4)	<MDL (9.4)	<MDL (13)	<MDL (12)	29	29
2-Methylphenol	<MDL (25)	<MDL (26)	<MDL (36)	<MDL (32)	63	63
4-Methylphenol	<MDL (21)	<MDL (22)	<MDL (30)	<MDL (27)	670	670
Pentachlorophenol	<MDL (6.7)	<MDL (6.7)	<MDL (9.5)	<MDL (8.3)	360	690
Phenol	<MDL (12)	<MDL (12)	<MDL (17)	<MDL (15)	420	1,200

Notes

µg/Kg DW - Micrograms per kilogram dry weight, based on percent solids analysis.

<MDL (#) - Analyte not detected above the *method detection limit*. Value in parentheses is the numeric MDL.

Table 6
Sediment Non-Ionic Organic Concentrations (Organic Carbon Normalized)
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

	Concentration (mg/Kg OC)					
Non-Ionic Organics	**NFK501 0 - 2 cm TOC 0.82%**	**NFK501 0 - 10 cm TOC 0.87%**	**NFK502 0 - 2 cm TOC 0.65%**	**NFK502 0 - 10 cm TOC 0.50%**	**SQS**	**CSL**
LPAHs						
Acenaphthene	<MDL (1.3)	<MDL (1.2)	<MDL (1.6)	<MDL (2.1)	16	57
Acenaphthylene	<MDL (2.7)	<MDL (2.6)	<MDL (3.4)	<MDL (4.5)	66	66
Anthracene	0.98	1.2	1.1	1.4	220	1,200
Fluorene	<MDL (2.3)	<MDL (2.3)	<MDL (3.0)	<MDL (3.9)	23	79
2-Methylnaphthalene	<MDL (2.5)	<MDL (2.5)	<MDL (3.2)	<MDL (4.2)	38	64
Naphthalene	<MDL (2.5)	<MDL (2.5)	<MDL (3.2)	<MDL (4.2)	99	170
Phenanthrene	7.98	5.40	6.00	6.33	100	480
Total LPAH	9.0	6.6	7.1	7.7	370	780
HPAHs						
Benzo(a)anthracene	7.39	4.71	5.81	7.62	110	270
Benzo(a)pyrene	11.3	7.09	8.72	4.91	99	210
Benzofluoranthenes (Total)	24.2	15.9	19.6	23.5	230	450
Benzo(g,h,i)perylene	3.04	2.12	<MDL (1.8)	<MDL (2.4)	31	78
Chrysene	10.0	7.16	7.53	8.40	110	460
Dibenzo(a,h)anthracene	<MDL (1.3)	<MDL (1.2)	<MDL (1.6)	<MDL (2.1)	12	33
Fluoranthene	19.8	14.3	16.8	20.0	160	1,200
Indeno(1,2,3-c,d)pyrene	4.11	2.47	3.43	<MDL (2.7)	34	88
Pyrene	15.3	11.0	12.2	10.2	1,000	1,400
Total HPAH	95.1	64.8	74.1	74.6	960	5,300
Chlorobenzenes						
1,2-Dichlorobenzene	<MDL (0.046)	<MDL (0.046)	<MDL (0.060)	<MDL (0.078)	2.3	2.3
1,4-Dichlorobenzene	<MDL (0.023)	<MDL (0.023)	<MDL (0.030)	<MDL (0.039)	3.1	9
Hexachlorobenzene	<MDL (0.12)	<MDL (0.12)	<MDL (0.15)	<MDL (0.20)	0.38	2.3
1,2,4-Trichlorobenzene	<MDL (0.046)	<MDL (0.046)	<MDL (0.060)	<MDL (0.078)	0.81	1.8
Phthalates						
Bis(2-ethylhexyl) Phthalate	42.7	28.4	31.6	38.6	47	78
Butyl Benzyl Phthalate	3.63	6.63	3.89	5.03	4.9	64
Di-N-butyl Phthalate	5.73, B	5.03, B	5.01, B	6.11, B	220	1,700
Di-N-octyl Phthalate	<MDL (1.4)	<MDL (1.4)	<MDL (1.8)	<MDL (2.4)	58	4,500
Diethyl Phthalate	<MDL (1.1)	<MDL (1.1)	<MDL (1.4)	<MDL (1.8)	61	110
Dimethyl Phthalate	<MDL (2.0)	<MDL (1.9)	<MDL (2.5)	<MDL (3.3)	53	53
Miscellaneous Compounds						
Dibenzofuran	<MDL (2.5)	<MDL (2.5)	<MDL (3.2)	<MDL (4.2)	15	58
Hexachlorobutadiene	<MDL (0.13)	<MDL (0.13)	<MDL (0.17)	<MDL (0.23)	3.9	6.2
N-Nitrosodiphenylamine	<MDL (3.6)	<MDL (3.5)	<MDL (4.6)	<MDL (6.0)	11	11
PCBs						
Total PCBs	7.4	4.09	24.8	18.9	12	65

Notes

mg/Kg OC - Milligrams per kilogram organic carbon, based on total organic carbon analysis.

<MDL (#) Analyte not detected above the *method dection limit*. Value in parentheses is the numeric MDL.

TOC % - Percent total organic carbon on a dry weight basis, based on total solids analysis.

Shaded Cell with Double Border - Detected concentration exceeds the SQS and/or CSL.

B - Compound detected in laboratory method blank. Sample concentration is less than 5 times the method blank concentration and should be discounted

Table 6 (cont.)
Sediment Non-Ionic Organic Concentrations (Organic Carbon Normalized)
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

	Concentration (mg/Kg OC)					
Non-Ionic Organics	**NFK503 0 - 2 cm TOC 0.28%**	**NFK503 0 - 10 cm TOC 0.36%**	**NFK504 0 - 2 cm TOC 1.56%**	**NFK504 0 - 10 cm TOC 0.91%**	**SQS**	**CSL**
LPAHs						
Acenaphthene	<MDL (3.4)	<MDL (2.6)	<MDL (0.85)	<MDL (1.3)	16	57
Acenaphthylene	<MDL (7.2)	<MDL (5.6)	<MDL (1.8)	<MDL (2.7)	66	66
Anthracene	<MDL (1.9)	<MDL (1.5)	<MDL (0.49)	<MDL (0.73)	220	1,200
Fluorene	<MDL (6.3)	<MDL (4.9)	<MDL (1.6)	<MDL (2.4)	23	79
2-Methylnaphthalene	<MDL (6.8)	<MDL (5.2)	<MDL (1.7)	<MDL (2.6)	38	64
Naphthalene	<MDL (6.8)	<MDL (5.2)	<MDL (1.7)	<MDL (2.6)	99	170
Phenanthrene	3.0	<MDL (1.5)	1.00	1.2	100	480
Total LPAH	3.0	<MDL	1.00	1.2	370	780
HPAHs						
Benzo(a)anthracene	2.94	0.82	1.59	1.98	110	270
Benzo(a)pyrene	<MDL (1.4)	<MDL (1.1)	<MDL (0.36)	<MDL (0.55)	99	210
Benzofluoranthenes (Total)	5.9	<MDL (1.1)	2.15	2.6	230	450
Benzo(g,h,i)perylene	<MDL (3.9)	<MDL (3.0)	<MDL (0.97)	<MDL (1.5)	31	78
Chrysene	2.9	<MDL (1.5)	1.10	0.90	110	460
Dibenzo(a,h)anthracene	<MDL (3.4)	<MDL (2.6)	<MDL (0.85)	<MDL (1.3)	12	33
Fluoranthene	8.84	<MDL (3.0)	3.22	3.02	160	1,200
Indeno(1,2,3-c,d)pyrene	<MDL (4.3)	<MDL (3.4)	<MDL (1.1)	<MDL (1.6)	34	88
Pyrene	2.1	<MDL (1.5)	<MDL (0.49)	<MDL (0.73)	1,000	1,400
Total HPAH	23	0.82	8.06	8.5	960	5,300
Chlorobenzenes						
1,2-Dichlorobenzene	<MDL (0.13)	<MDL (0.097)	<MDL (0.032)	<MDL (0.048)	2.3	2.3
1,4-Dichlorobenzene	<MDL (0.063)	<MDL (0.049)	<MDL (0.016)	<MDL (0.024)	3.1	9
Hexachlorobenzene	<MDL (0.32)	<MDL (0.25)	<MDL (0.080)	<MDL (0.12)	0.38	2.3
1,2,4-Trichlorobenzene	<MDL (0.13)	<MDL (0.097)	<MDL (0.032)	<MDL (0.048)	0.81	1.8
Phthalates						
Bis(2-ethylhexyl) Phthalate	18.4, B	11.8, B	24.9	36.4	47	78
Butyl Benzyl Phthalate	<MDL (2.9)	<MDL (2.2)	2.24	3.08	4.9	64
Di-N-butyl Phthalate	11.4, B	9.40, B	3.60, B	4.32, B	220	1,700
Di-N-octyl Phthalate	<MDL (3.9)	<MDL (3.0)	<MDL (0.97)	<MDL (1.5)	58	4,500
Diethyl Phthalate	<MDL (2.9)	<MDL (2.2)	<MDL (0.73)	<MDL (1.1)	61	110
Dimethyl Phthalate	<MDL (5.3)	<MDL (4.1)	<MDL (1.3)	<MDL (2.0)	53	53
Miscellaneous Compounds						
Dibenzofuran	<MDL (6.8)	<MDL (5.2)	<MDL (1.7)	<MDL (2.6)	15	58
Hexachlorobutadiene	<MDL (0.36)	<MDL (0.28)	<MDL (0.091)	<MDL (0.14)	3.9	6.2
N-Nitrosodiphenylamine	<MDL (9.7)	<MDL (7.5)	<MDL (2.4)	<MDL (3.7)	11	11
PCBs						
Total PCBs	677	369	2.70	3.3	12	65

Notes

mg/Kg OC - Milligrams per kilogram organic carbon, based on total organic carbon analysis.

<MDL (#) Analyte not detected above the *method dection limit*. Value in parentheses is the numeric MDL.

TOC % - Percent total organic carbon on a dry weight basis, based on total solids analysis.

Shaded Cell with Double Border - Detected concentration exceeds the SQS and/or CSL.

B - Compound detected in laboratory method blank. Sample concentration is less than 5 times the method blank concentration and should be discounted.

Station NFK503 - TOC < 0.5%, see Table 7 for dry weight-normalized data compared to LAET/2LAET.

Table 7
Sediment Non-Ionic Organic Concentrations (Dry Weight Normalized)
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
Year Two - April 2001 Monitoring Data

	Concentration (µg/Kg DW)					
Non-Ionic Organics	**NFK501 0 - 2 cm**	**NFK501 0 - 10 cm**	**NFK502 0 - 2 cm**	**NFK502 0 - 10 cm**	**LAET* SQS**	**2LAET* CSL**
LPAHs						
Acenaphthene	<MDL (10)	<MDL (11)	<MDL (10)	<MDL (11)	500	730
Acenaphthylene	<MDL (22)	<MDL (23)	<MDL (22)	<MDL (23)	1,300	1,300
Anthracene	8.0	11	7.3	7.2	960	4,400
Fluorene	<MDL (19)	<MDL (20)	<MDL (19)	<MDL (20)	540	1,000
2-Methylnaphthalene	<MDL (20)	<MDL (21)	<MDL (21)	<MDL (21)	670	1,400
Naphthalene	<MDL (20)	<MDL (21)	<MDL (21)	<MDL (21)	2,100	2,400
Phenanthrene	65.3	46.8	39.0	31.6	1,500	5,400
Total LPAH	73	58	46	39	5,200	13,000
HPAHs						
Benzo(a)anthracene	60.4	40.8	37.9	38.0	1,300	1,600
Benzo(a)pyrene	92.6	61.4	56.8	24.5	1,600	3,000
Benzofluoranthenes (Total)	198	174	128	118	3,200	3,600
Benzo(g,h,i)perylene	24.8	18	<MDL (12)	<MDL (12)	670	720
Chrysene	81.9	62.1	49.0	42.0	1,400	2,800
Dibenzo(a,h)anthracene	<MDL (10)	<MDL (11)	<MDL (10)	<MDL (11)	230	540
Fluoranthene	162	124	110	100	1,700	2,500
Indeno(1,2,3-c,d)pyrene	33.6	21	22	<MDL (14)	600	690
Pyrene	125	95.7	79.1	50.7	2,600	3,300
Total HPAH	778	600	480	373	12,000	17,000
Chlorobenzenes						
1,2-Dichlorobenzene	<MDL (0.38)	<MDL (0.40)	<MDL (0.39)	<MDL (0.39)	35	50
1,4-Dichlorobenzene	<MDL (0.19)	<MDL (0.20)	<MDL (0.19)	<MDL (0.20)	110	120
Hexachlorobenzene	<MDL (0.96)	<MDL (1.0)	<MDL (0.98)	<MDL (0.99)	22	70
1,2,4-Trichlorobenzene	<MDL (0.38)	<MDL (0.40)	<MDL (0.39)	<MDL (0.39)	31	51
Phthalates						
Bis(2-ethylhexyl) Phthalate	349	246	206	192	1,300	1,900
Butyl Benzyl Phthalate	29.6	57.5	22.1	25.1	63	470
Di-N-butyl Phthalate	46.9, B	43.6, B	32.6, B	30.5, B	1,400	5,100
Di-N-octyl Phthalate	<MDL (12)	<MDL (12)	<MDL (12)	<MDL (12)	420	2,100
Diethyl Phthalate	<MDL (8.8)	<MDL (9.2)	<MDL (8.9)	<MDL (9.0)	48	73
Dimethyl Phthalate	<MDL (16)	<MDL (17)	<MDL (16)	<MDL (17)	71	160
Miscellaneous Compounds						
Dibenzofuran	<MDL (20)	<MDL (21)	<MDL (21)	<MDL (21)	540	700
Hexachlorobutadiene	<MDL (1.1)	<MDL (1.1)	<MDL (1.1)	<MDL (1.1)	11	120
N-Nitrosodiphenylamine	<MDL (29)	<MDL (31)	<MDL (30)	<MDL (30)	28	40
PCBs						
Total PCBs	60.9	35.5	**161**	94.1	130	1,000

Notes

µg/Kg DW - Micrograms per kilogram dry weight, based on percent solids analysis.

<MDL (#) - Analyte not detected above the *method dection limit*. Value in parentheses is the numeric MDL.

Shaded Cell - MDL exceeds the LAET and/or 2LAET.

Shaded Cell with Double Border - Detected concentration exceeds the LAET and/or 2LAET.

B - Compound detected in laboratory method blank. Sample concentration is less than 5 times the method blank concentration and should be discounted.

* - LAET/2LAET equivalent to SQS/CSL criteria, respectively.

Table 7 (cont.)
Sediment Non-Ionic Organic Concentrations (Dry Weight Normalized)
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 2001 Monitoring Data

	Concentration (µg/Kg DW)					
Non-Ionic Organics	**NFK503 0 - 2 cm**	**NFK503 0 - 10 cm**	**NFK504 0 - 2 cm**	**NFK504 0 - 10 cm**	**LAET**	**2LAET**
LPAHs						
Acenaphthene	<MDL (9.4)	<MDL (9.4)	<MDL (13)	<MDL (12)	500	730
Acenaphthylene	<MDL (20)	<MDL (20)	<MDL (28)	<MDL (25)	1,300	1,300
Anthracene	<MDL (5.4)	<MDL (5.4)	<MDL (7.6)	<MDL (6.7)	960	4,400
Fluorene	<MDL (17)	<MDL (18)	<MDL (25)	<MDL (22)	540	1,000
2-Methylnaphthalene	<MDL (19)	<MDL (19)	<MDL (27)	<MDL (23)	670	1,400
Naphthalene	< MDL (19)	< MDL (19)	<MDL (27)	<MDL (23)	2,100	2,400
Phenanthrene	8.4	<MDL (5.4)	15.6	10	1,500	5,400
Total LPAH	8.4	<MDL	15.6	10	5,200	13,000
HPAHs						
Benzo(a)anthracene	8.14	3.0	24.9	18.0	1,300	1,600
Benzo(a)pyrene	<MDL (4.0)	<MDL (4.0)	<MDL (5.7)	<MDL (5.0)	1,600	3,000
Benzofluoranthenes (Total)	16	<MDL (4.0)	33.6	25	3,200	3,600
Benzo(g,h,i)perylene	<MDL (11)	<MDL (11)	<MDL (15)	<MDL (13)	670	720
Chrysene	7.9	<MDL (5.4)	17.2	8.2	1,400	2,800
Dibenzo(a,h)anthracene	<MDL (9.4)	<MDL (9.4)	<MDL (13)	<MDL (12)	230	540
Fluoranthene	24.5	<MDL (11)	50.3	27.5	1,700	2,500
Indeno(1,2,3-c,d)pyrene	<MDL (12)	<MDL (12)	<MDL (17)	<MDL (15)	600	690
Pyrene	5.9	<MDL (5.4)	<MDL (7.6)	<MDL (6.7)	2,600	3,300
Total HPAH	62	3.0	126	79	12,000	17,000
Chlorobenzenes						
1,2-Dichlorobenzene	<MDL (0.35)	<MDL (0.35)	<MDL (0.49)	<MDL (0.43)	35	50
1,4-Dichlorobenzene	<MDL (0.17)	<MDL (0.18)	<MDL (0.25)	<MDL (0.22)	110	120
Hexachlorobenzene	<MDL (0.88)	<MDL (0.89)	(MDL (1.3)	<MDL (1.1)	22	70
1,2,4-Trichlorobenzene	<MDL (0.35)	<MDL (0.35)	<MDL (0.49)	<MDL (0.43)	31	51
Phthalates						
Bis(2-ethylhexyl) Phthalate	51.0, B	42.4, B	389	331	1,300	1,900
Butyl Benzyl Phthalate	<MDL (8.0)	<MDL (8.1)	34.9	28.0	63	470
Di-N-butyl Phthalate	31.6, B	33.9, B	56.2, B	39.3, B	1,400	5,100
Di-N-octyl Phthalate	<MDL (11)	<MDL (11)	<MDL (15)	<MDL (13)	420	2,100
Diethyl Phthalate	<MDL (8.0)	<MDL (8.1)	<MDL (11)	<MDL (10)	48	73
Dimethyl Phthalate	<MDL (15)	<MDL (15)	<MDL (21)	<MDL (18)	71	160
Miscellaneous Compounds						
Dibenzofuran	<MDL (19)	<MDL (19)	<MDL (27)	<MDL (23)	540	700
Hexachlorobutadiene	<MDL (1.0)	<MDL (1.0)	<MDL (1.4)	<MDL (1.2)	11	120
N-Nitrosodiphenylamine	<MDL (27)	<MDL (27)	<MDL (38)	<MDL (33)	28	40
PCBs						
Total PCBs	**1,880**	**1,330**	42.2	31	130	1,000

Notes

µg/Kg DW - Micrograms per kilogram dry weight, based on percent solids analysis.
<MDL (#) - Analyte not detected above the *method dection limit*. Value in parentheses is the numeric MDL.
Shaded Cell - MDL exceeds the LAET and/or 2LAET.
Shaded Cell with Double Border - Detected concentration exceeds the LAET and/or 2LAET.
B - Compound detected in laboratory method blank. Sample concentration is less than 5 times the method blank concentration and should be discounted.
* - LAET/2LAET equivalent to SQS/CSL criteria, respectively.

Table 8
Dry Weight Comparison of Detected Sediment Constituents (0 - 10 cm Depth Stratum)
April 1999, October 1999, April 2000, and April 2001 Monitoring Events
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program (Year Two)

	Norfolk CSO Channel (NFK501)				Combined Channel Delta (NFK502)				Boeing Storm Drain Channel (NFK503)				Upriver Reference (NFK504)			
Constituent	**Apr-99**	**Oct-99**	**Apr-00**	**Apr-01**	**Apr-99**	**Oct-99**	**Apr-00**	**Apr-01**	**Apr-99**	**Oct-99**	**Apr-00**	**Apr-01**	**Apr-99**	**Oct-99**	**Apr-00**	**Apr-01**
Total Organic Carbon (mg/Kg dry weight)	1,760	3,240	2,350	8,670	1,210	3,730	1,440	4,990	3,180	3,070	2,010	3,600	1,260	1,890	3,090	9,080
Grain Size (% wet weight)																
Gravel	0.8	0.1	0.3	1.5	0.4	0.5	1.1	0	0.4	1.1	0.8	1.0	0.4	0.9	0.6	0.5
Sand	98.6	95.6	94.3	78.8	95.5	89.9	92.6	90.7	94.3	92.5	96.1	97.0	96.7	96.4	90.0	65.4
Silt	1.0	3.4	4.9	16.6	4.7	9.3	5.8	6.8	5.4	6.2	3.5	1.5	2.9	1.8	9.1	27.7
Clay	0	0.7	0.1	3.7	0	0.9	0	2.4	0	0.7	0	0.6	0	0.7	0.1	6.6
Metals (mg/Kg dry weight)																
Arsenic	<MDL (3.3)	3.5	4.1	<MDL (3.8)	3.7	3.5	4.6	<MDL (3.6)	<MDL (3.2)	4.3	4.4	<MDL (3.2)	3.5	5.7	6.0	<MDL (0.42)
Cadmium	0.20	< MDL (0.20)	< MDL (0.21)	< MDL (0.23)	0.21	< MDL (0.19)	< MDL (0.20)	< MDL (0.23)	<MDL (0.19)	< MDL (0.21)	< MDL (0.21)	< MDL (0.20)	0.21	< MDL (0.19)	< MDL (0.20)	<MDL (0.25)
Chromium	12.9	17.1	14.1	17.4	13.0	13.9	12.5	13.3	14.7	14.1	12.2	12.0	12.2	16.4	14.0	17.8
Copper	11.4	13.4	12.0	18.5	12.2	13.8	11.2	13.1	10.5	14.5	11.2	12.9	11.2	13.7	15.1	18.8
Lead	4.2	5.2	5.7	7.36	5.0	5.7	5.4	7.83	4.4	5.5	6.5	18.0	4.6	5.5	6.7	13.8
Mercury	0.055	< MDL (0.027)	< MDL (0.026)	0.043	0.089	0.043	< MDL (0.027)	<MDL (0.030)	0.066	0.052	< MDL (0.028)	0.10	0.072	< MDL (0.026)	< MDL (0.027)	0.038
Zinc	46.0	51.3	43.7	59.0	43.2	52.5	46.8	46.5	42.1	53.7	44.5	46.4	44.2	52.9	46.8	60.6
Organics (µg/Kg dry weight)																
Anthracene	<MDL (21)	<MDL (21)	<MDL (22)	11	<MDL (21)	<MDL (22)	<MDL (22)	7.2	<MDL (21)	<MDL (22)	<MDL (22)	<MDL (5.4)	<MDL (21)	<MDL (22)	<MDL (21)	<MDL (6.7)
Benzo(a)anthracene	< MDL (21)	< MDL (21)	< MDL (22)	40.8	< MDL (21)	28	< MDL (22)	38.0	< MDL (21)	28	< MDL (22)	3.0	< MDL (21)	< MDL (22)	< MDL (21)	18.0
Benzo(a)pyrene	<MDL (35)	<MDL (36)	<MDL (37)	61.4	<MDL (35)	<MDL (38)	<MDL (37)	24.5	<MDL (35)	<MDL (37)	<MDL (37)	<MDL (4.0)	<MDL (35)	<MDL (37)	<MDL (36)	<MDL (5.0)
Benzofluoranthenes (total)	<MDL (56)	<MDL (58)	<MDL (59)	174	<MDL (56)	<MDL (60)	<MDL (58)	118	<MDL (56)	<MDL (59)	<MDL (59)	<MDL (4.0)	<MDL (56)	<MDL (58)	<MDL (59)	<MDL (25)
Benzo(g,h,i)perylene	< MDL (35)	< MDL (36)	< MDL (37)	18	75.7	< MDL (38)	< MDL (37)	<MDL (12)	70.5	< MDL (37)	< MDL (37)	< MDL (11)	< MDL (35)	< MDL (37)	< MDL (36)	< MDL (13)
Benzoic Acid	< MDL (140)	< MDL (150)	210	122	< MDL (140)	< MDL (150)	150	152	< MDL (140)	< MDL (150)	< MDL (150)	67.6	< MDL (140)	< MDL (150)	150	168
Bis(2-ethylhexyl) Phthalate	<MDL (21)	<MDL (360)**	<MDL (240)**	246	<MDL (21)	<MDL (360)**	<MDL (240)**	192	<MDL (21)	<MDL (360)**	<MDL (240)**	<MDL (73)**	<MDL (21)	<MDL (360)**	<MDL (240)**	331
Butyl Benzyl Phthalate	< MDL (21)	<MDL (21)	< MDL (22)	57.5	< MDL (21)	< MDL (22)	< MDL (22)	25.1	< MDL (21)	< MDL (22)	< MDL (22)	< MDL (8.1)	< MDL (21)	< MDL (22)	< MDL (21)	28.0
Chrysene	< MDL (21)	< MDL (21)	< MDL (22)	62.1	< MDL (21)	29	< MDL (22)	42.0	< MDL (21)	43	< MDL (22)	< MDL (5.4)	< MDL (21)	< MDL (22)	35	8.2
Fluoranthene	< MDL (21)	32	26	124	< MDL (21)	56.7	< MDL (22)	100	< MDL (21)	66.9	26	< MDL (11)	< MDL (21)	< MDL (22)	63.6	27.5
Indeno(1,2,3-c,d)pyrene	<MDL (35)	<MDL (36)	<MDL (37)	21	< MDL (35)	<MDL (38)	<MDL (37)	<MDL (14)	< MDL (35)	<MDL (37)	<MDL (37)	< MDL (12)	<MDL (35)	< MDL (37)	<MDL (36)	< MDL (15)
Phenanthrene	21	< MDL (21)	< MDL (22)	46.8	< MDL (21)	29	< MDL (22)	31.6	< MDL (21)	40.3	< MDL (22)	< MDL (5.4)	< MDL (21)	< MDL (22)	< MDL (21)	10
Pyrene	< MDL (21)	29	< MDL (22)	95.7	< MDL (21)	47.9	< MDL (22)	50.7	< MDL (21)	64.6	< MDL (22)	< MDL (5.4)	< MDL (21)	< MDL (22)	47.9	< MDL (6.7)
Total PCBs	< MDL (22)	20.9	< MDL (5.8)	35.5	< MDL (22)	71.6	10	94.1	< MDL (22)	182	179	1,330	< MDL (22)	< MDL (5.2)	13.2	31

Notes

mg/Kg dry weight - Milligrams per kilogram normalized to dry weight based on percent solids analysis

µg/Kg dry weight - Micrograms per kilogram normalized to dry weight based on percent solids analysis.

< MDL (#) Analyte not detected above the *method detection limit*. Value in parentheses is the numeric MDL.

** MDL raised to 5 X the concentration of bis(2-ethylhexyl)phthalate detected in the method blank.

Table 9
Dry Weight Comparison of Detected Sediment Constituents (0 - 2 cm Depth Stratum)
October 1999, April 2000, and April 2001 Monitoring Events
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program (Year Two)

	Norfolk CSO Channel (NFK501)			Combined Channel Delta (NFK502)			Boeing Storm Drtain Channel (NFK503)			Upriver Reference (NFK504)		
Constituent	**Oct-99**	**Apr-00**	**Apr-01**	**Oct-99**	**Apr-00**	**Apr-01**	**Oct-99**	**Apr-00**	**Apr-01**	**Oct-99**	**Apr-00**	**Apr-01**
Total Organic Carbon (mg/Kg dry weight)	4,170	5,530	8,180	7,030	3,390	6,510	6,490	4,930	2,770	5,510	7,900	15,600
Grain Size (% wet weight)												
Gravel	0.5	0.1	0.2	0.6	0.8	0	1.3	0.5	1.0	1.7	1.0	0.5
Sand	91.0	83.6	81.5	83.6	86.9	89.1	90.8	93.7	95.9	82.3	74.1	80.7
Silt	6.8	14.8	14.5	13.2	12.7	7.7	6.8	5.9	2.6	13.6	23.8	14.4
Clay	1.6	0.9	3.8	3.4	0.1	3.1	1.5	0.1	0.6	3.0	0.9	4.6
Metals (mg/Kg dry weight)												
Arsenic	4.6	5.1	<MDL (3.6)	6.2	5.3	<MDL (3.6)	4.0	5.0	<MDL (3.3)	6.3	7.3	<MDL (4.7)
Chromium	15.6	17.1	16.1	14.7	15.2	16.7	15.4	13.0	13.9	18.2	22.1	21.1
Copper	15.5	14.1	17.2	18.6	13.3	15.5	17.1	13.4	11.4	17.1	18.4	24.9
Lead	6.2	6.4	11.6	9.0	7.0	9.39	6.3	6.5	7.36	8.2	8.7	18.0
Mercury	0.039	0.043	0.069	0.042	0.063	0.031	0.029	0.028	<MDL (0.025)	0.028	0.049	0.072
Zinc	52.4	48.4	56.6	62.2	49.4	51.6	52.6	46.0	43.4	56.6	56.1	68.3
Organics (µg/Kg dry weight)												
Anthracene	<MDL (22)	<MDL (21)	8.0	<MDL (25)	<MDL (22)	7.3	<MDL (22)	<MDL (22)	<MDL (5.4)	<MDL (23)	<MDL (24)	<MDL (7.6)
Benzo(a)anthracene	26	37.5	60.4	56.7	< MDL (22)	37.9	48.8	< MDL (22)	8.14	36	66.0	24.9
Benzo(a)pyrene	< MDL (36)	41	92.6	59	< MDL (37)	56.8	53	< MDL (37)	<MDL (4.0)	< MDL (39)	59	<MDL (5.7)
Benzofluoranthenes (Total)	< MDL (58)	57	198	< MDL (67)	< MDL (59)	128	76	< MDL (59)	16	64	110	33.6
Benzo(g,h,i)perylene	76.2	< MDL (35)	24.8	< MDL (42)	< MDL (37)	<MDL (12)	< MDL (38)	< MDL (37)	<MDL (11)	< MDL (39)	44	<MDL (15)
Benzoic Acid	170	258	299	250	227	162	< MDL (150)	226	80.9	190	380	268
Bis(2 ethylhexyl) Phthalate	<MDL (360)**	<MDL (240)**	349	<MDL (360)**	<MDL (240)**	206	<MDL (360)**	<MDL (240)**	<MDL (73)**	<MDL (360)**	413	389
Butyl Benzyl Phthalate	<MDL (22)	<MDL (21)	29.6	<MDL (25)	<MDL (22)	22.1	<MDL (22)	<MDL (22)	<MDL (8.0)	<MDL (23)	<MDL (24)	34.9
Chrysene	32	58.2	81.9	84.7	29	49.0	72.4	34	7.9	53.1	94.7	17.2
1,4-Dichlorobenzene	< MDL (0.93)	0.99	<MDL (0.19)	< MDL (1.1)	< MDL (0.94)	<MDL (0.19)	< MDL (0.96)	< MDL (0.95)	<MDL (0.17)	< MDL (1.0)	< MDL (1.1)	<MDL (0.25)
Fluoranthene	60.2	101	162	132	54.0	110	119	52.2	24.5	76.1	178	50.3
Indeno(1,2,3-c,d)pyrene	< MDL (36)	< MDL (35)	33.6	46	< MDL (37)	22	< MDL (38)	< MDL (37)	<MDL (12)	< MDL (39)	52	<MDL (17)
Phenanthrene	28	44.7	65.3	62.4	25	39.0	80.1	25	8.4	38	76.5	15.6
Pyrene	59.1	79.0	125	126	37.8	79.1	125	38.4	5.9	75.9	159	<MDL (7.6)
Total PCBs	45.9	6.8	60.9	61.8	70.6	161	306	271	1,830	25	6.6	42.2

Notes

mg/Kg dry weight - Milligrams per kilogram normalized to dry weight based on percent solids analysis.

µg/Kg dry weight - Micrograms per kilogram normalized to dry weight based on percent solids analysis.

< MDL (#) - Analyte not detected above the *method detection limit*. Value in parentheses is the numeric MDL.

** MDL raised to 5 X the concentration of bis(2-ethylhexyl)phthalate detected in the method blank.

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK501	NFK501	NFK502	NFK502
Descrip:	Norfolk CSO Channel	Norfolk CSO Channel	Combined Channel Delta	Combined Channel Delta
Sampled:	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001
Lab ID:	L20703-1	L20703-2	L20703-3	L20703-4
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	68.5	65.4	67.1	66.5

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
	- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis				
COMBINED LABS																				
M=CV ASTM D422																				
Clay *	3.8		0.1		%	3.7		0.1		%	3.1		0.1		%	2.4		0.1		%
Gravel *	0.22	E	0.1		%	0.9	E	0.1		%		<MDL,E	0.1		%		<MDL,E	0.1		%
p+0.00 *	1.8		0.1		%	1.8		0.1		%	0.97		0.1		%	0.7		0.1		%
p+1.00 *	16.3		0.1		%	15.7		0.1		%	19.6		0.1		%	19.2		0.1		%
p+10.0 *	0.96		0.1		%	0.8		0.1		%	0.74		0.1		%	0.58		0.1		%
p+10.0(more than) *	1.3		0.1		%	1.4		0.1		%	1.2		0.1		%	0.93		0.1		%
p+2.00 *	42.6		0.1		%	36.5		0.1		%	54.5		0.1		%	58.9		0.1		%
p+3.00 *	9.2		0.1		%	11.3		0.1		%	11.2		0.1		%	9.5		0.1		%
p+4.00 *	11.6		0.1		%	13.5		0.1		%	2.8		0.1		%	2.4		0.1		%
p+5.00 *	6.1		0.1		%	6.9		0.1		%	1.8		0.1		%	2.2		0.1		%
p+6.00 *	3.8		0.1		%	4.5		0.1		%	2.5		0.1		%	2		0.1		%
p+7.00 *	2.4		0.1		%	3		0.1		%	1.8		0.1		%	1.4		0.1		%
p+8.00 *	2.2		0.1		%	2.2		0.1		%	1.6		0.1		%	1.2		0.1		%
p+9.00 *	1.5		0.1		%	1.5		0.1		%	1.2		0.1		%	0.91		0.1		%
p-1.00 *	0.22		0.1		%	0.9		0.1		%		<MDL	0.1		%		<MDL	0.1		%
p-2.00 *		<MDL	0.1		%	0.59		0.1		%		<MDL	0.1		%		<MDL	0.1		%
p-2.00(less than) *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
Sand *	81.4		0.1		%	78.8		0.1		%	89.1		0.1		%	90.6		0.1		%
Silt *	14.6		0.1		%	16.6		0.1		%	7.7		0.1		%	6.9		0.1		%
M=CV EPA9060-PSEP96 (03-04-002-001)																				
Total Organic Carbon	3180		730	1460	mg/Kg	8670		760	1530	mg/Kg	6510		750	1490	mg/Kg	4990		750	1500	mg/Kg
M=CV SM2540-G (03-01-007-001)																				
Total Solids *	68.5		0.005	0.01	%	65.4		0.005	0.01	%	67.1		0.005	0.01	%	66.5		0.005	0.01	%
M=ES NONE																				
Sampcoordx1 *	1278590				ft						1278509				ft					
Sampcoordx2 *	1278581				ft						1278513				ft					
Sampcoordx3 *	1278577				ft						1278514				ft					
Sampcoordy1 *	190154				ft						190154				ft					
Sampcoordy2 *	190146				ft						190157				ft					
Sampcoordy3 *	190159				ft						190157				ft					
Sample Depth *	1				m	1				m	2				m	2				m
Sample Start Time *	1045				hr	1045				hr	1141				hr	1141				hr
Sampling Method	29243.796				none	30629.969				none	29853.949				none	30123.308				none
Sediment Sampling Depth *	12				cm	13				cm	11				cm	11				cm
Sediment Sampling Range *	0-2 cm				none	0-10 cm				none	0-2 cm				none	0-10 cm				none
Sediment Type	32N20				none	32N20				none	32N20				none	32N20				none
Tidal Condition	E				none	E				none	S				none	S				none

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK501					Locator:	NFK501					Locator:	NFK502					Locator:	NFK502				
Descrip:	Norfolk CSO Channel					Descrip:	Norfolk CSO Channel					Descrip:	Combined Channel Delta					Descrip:	Combined Channel Delta				
Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001				
Lab ID:	L20703-1					Lab ID:	L20703-2					Lab ID:	L20703-3					Lab ID:	L20703-4				
Matrix:	SALTWTRSED					Matrix:	SALTWTRSED					Matrix:	SALTWTRSED					Matrix:	SALTWTRSED				
% Solids:	68.5					% Solids:	65.4					% Solids:	67.1					% Solids:	66.5				
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units		Value	Qual	MDL	RDL	Units		Value	Qual	MDL	RDL	Units	
		- Dry Weight Basis					- Dry Weight Basis						- Dry Weight Basis						- Dry Weight Basis				
COMBINED LABS																							
Tide Height *	2				ft	2				ft		0				ft		0				ft	

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK501					Locator:	NFK501					Locator:	NFK502					Locator:	NFK502				
Descrip:	Norfolk CSO Channel					Descrip:	Norfolk CSO Channel					Descrip:	Combined Channel Delta					Descrip:	Combined Channel Delta				
Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001				
Lab ID:	L20703-1					Lab ID:	L20703-2					Lab ID:	L20703-3					Lab ID:	L20703-4				
Matrix:	SALTWTRSED					Matrix:	SALTWTRSED					Matrix:	SALTWTRSED					Matrix:	SALTWTRSED				
% Solids:	68.5					% Solids:	65.4					% Solids:	67.1					% Solids:	66.5				
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
	- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis				
COMBINED LABS																				
M=MT EPA 245.5 (06-01-004-003)																				
Mercury, Total, CVAA	0.069	<RDL	0.028	0.283	mg/Kg	0.043	<RDL	0.031	0.3	mg/Kg	0.031	<RDL	0.03	0.295	mg/Kg		<MDL	0.03	0.302	mg/Kg
M=MT EPA3050A/6010B (06-02-004-002)																				
Aluminum, Total, ICP	11900	L	7.4	37.2	mg/Kg	13300	L	7.6	38.1	mg/Kg	10900	L	7.2	35.9	mg/Kg	10100	L	7.4	36.7	mg/Kg
Arsenic, Total, ICP		<MDL	3.6	18.5	mg/Kg		<MDL	3.8	19.1	mg/Kg		<MDL	3.6	17.9	mg/Kg		<MDL	3.6	18.3	mg/Kg
Beryllium, Total, ICP	0.34	<RDL	0.074	0.372	mg/Kg	0.382		0.076	0.381	mg/Kg	0.27	<RDL	0.072	0.359	mg/Kg	0.26	<RDL	0.074	0.367	mg/Kg
Cadmium, Total, ICP		<MDL	0.22	1.12	mg/Kg		<MDL	0.23	1.14	mg/Kg		<MDL	0.21	1.08	mg/Kg		<MDL	0.23	1.1	mg/Kg
Chromium, Total, ICP	16.1		0.36	1.85	mg/Kg	17.4		0.38	1.91	mg/Kg	16.7		0.36	1.79	mg/Kg	13.3		0.36	1.83	mg/Kg
Copper, Total, ICP	17.2		0.29	1.49	mg/Kg	18.5		0.31	1.52	mg/Kg	15.5		0.28	1.44	mg/Kg	13.1		0.3	1.47	mg/Kg
Iron, Total, ICP	20700	G	3.6	18.5	mg/Kg	22300	G	3.8	19.1	mg/Kg	19800	G	3.6	17.9	mg/Kg	18600	G	3.6	18.3	mg/Kg
Lead, Total, ICP	11.6		2.2	11.2	mg/Kg	11.8		2.3	11.4	mg/Kg	9.4	<RDL	2.1	10.8	mg/Kg	9.6	<RDL	2.3	11	mg/Kg
Manganese, Total, ICP	629		0.15	0.743	mg/Kg	492		0.15	0.763	mg/Kg	402		0.14	0.717	mg/Kg	355		0.15	0.734	mg/Kg
Nickel, Total, ICP	14.6		1.5	7.43	mg/Kg	15.2		1.5	7.63	mg/Kg	12.6		1.4	7.17	mg/Kg	12.3		1.5	7.34	mg/Kg
Selenium, Total, ICP		<MDL	3.6	18.5	mg/Kg		<MDL	3.8	19.1	mg/Kg		<MDL	3.6	17.9	mg/Kg		<MDL	3.6	18.3	mg/Kg
Silver, Total, ICP		<MDL	0.29	1.49	mg/Kg		<MDL	0.31	1.52	mg/Kg		<MDL	0.28	1.44	mg/Kg		<MDL	0.3	1.47	mg/Kg
Thallium, Total, ICP		<MDL	15	74.3	mg/Kg		<MDL	15	76.3	mg/Kg		<MDL	14	71.7	mg/Kg		<MDL	15	73.4	mg/Kg
Zinc, Total, ICP	56.6		0.36	1.85	mg/Kg	59		0.38	1.91	mg/Kg	51.6		0.36	1.79	mg/Kg	46.5		0.36	1.83	mg/Kg
M=OR EPA 3550B/8082 (7-3-03-002)																				
Aroclor 1016		<MDL	6.1	12.2	ug/Kg		<MDL	6.4	12.7	ug/Kg		<MDL	6.3	12.4	ug/Kg		<MDL	6.3	12.5	ug/Kg
Aroclor 1221		<MDL	6.1	12.2	ug/Kg		<MDL	6.4	12.7	ug/Kg		<MDL	6.3	12.4	ug/Kg		<MDL	6.3	12.5	ug/Kg
Aroclor 1232		<MDL	6.1	12.2	ug/Kg		<MDL	6.4	12.7	ug/Kg		<MDL	6.3	12.4	ug/Kg		<MDL	6.3	12.5	ug/Kg
Aroclor 1242		<MDL	6.1	12.2	ug/Kg		<MDL	6.4	12.7	ug/Kg		<MDL	6.3	12.4	ug/Kg		<MDL	6.3	12.5	ug/Kg
Aroclor 1248	30.4		6.1	12.2	ug/Kg	16.8		6.4	12.7	ug/Kg	93		6.3	12.4	ug/Kg	55.2		6.3	12.5	ug/Kg
Aroclor 1254	30.5		6.1	12.2	ug/Kg	18.7		6.4	12.7	ug/Kg	68.4		6.3	12.4	ug/Kg	38.9		6.3	12.5	ug/Kg
Aroclor 1260		<MDL	6.1	12.2	ug/Kg		<MDL	6.4	12.7	ug/Kg		<MDL	6.3	12.4	ug/Kg		<MDL	6.3	12.5	ug/Kg
M=OR EPA 3550B/8270C (7-3-01-004)																				
1,2,4-Trichlorobenzene		<MDL,G	0.38	0.774	ug/Kg		<MDL,G	0.4	0.81	ug/Kg		<MDL,G	0.39	0.79	ug/Kg		<MDL,G	0.39	0.797	ug/Kg
1,2-Dichlorobenzene		<MDL,G	0.38	0.774	ug/Kg		<MDL,G	0.4	0.81	ug/Kg		<MDL,G	0.39	0.79	ug/Kg		<MDL,G	0.39	0.797	ug/Kg
1,2-Diphenylhydrazine		<MDL	15	29.2	ug/Kg		<MDL	15	30.6	ug/Kg		<MDL	15	29.8	ug/Kg		<MDL	15	30.1	ug/Kg
1,3-Dichlorobenzene		<MDL,G	0.38	0.774	ug/Kg		<MDL,G	0.4	0.81	ug/Kg		<MDL,G	0.39	0.79	ug/Kg		<MDL,G	0.39	0.797	ug/Kg
1,4-Dichlorobenzene		<MDL,G	0.19	0.385	ug/Kg		<MDL,G	0.2	0.404	ug/Kg		<MDL,G	0.19	0.393	ug/Kg		<MDL,G	0.2	0.397	ug/Kg
2,4,5-Trichlorophenol		<MDL	18	35	ug/Kg		<MDL,G	18	36.7	ug/Kg		<MDL,G	18	35.8	ug/Kg		<MDL	18	36.1	ug/Kg
2,4,6-Trichlorophenol		<MDL	19	38	ug/Kg		<MDL,G	20	39.8	ug/Kg		<MDL,G	19	38.7	ug/Kg		<MDL	20	39.1	ug/Kg
2,4-Dichlorophenol		<MDL	23	46.7	ug/Kg		<MDL,G	24	48.9	ug/Kg		<MDL,G	24	47.7	ug/Kg		<MDL	24	48.1	ug/Kg
2,4-Dimethylphenol		<MDL	10	20.4	ug/Kg		<MDL,G	11	21.4	ug/Kg		<MDL,G	10	20.9	ug/Kg		<MDL	11	21.1	ug/Kg
2,4-Dinitrotoluene		<MDL	4.4	8.76	ug/Kg		<MDL	4.6	9.17	ug/Kg		<MDL	4.5	8.94	ug/Kg		<MDL	4.5	9.02	ug/Kg
2,6-Dinitrotoluene		<MDL	15	29.2	ug/Kg		<MDL	15	30.6	ug/Kg		<MDL	15	29.8	ug/Kg		<MDL	15	30.1	ug/Kg
2-Chloronaphthalene		<MDL	23	46.7	ug/Kg		<MDL	24	48.9	ug/Kg		<MDL	24	47.7	ug/Kg		<MDL	24	48.1	ug/Kg

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK501	NFK501	NFK502	NFK502
Descrip:	Norfolk CSO Channel	Norfolk CSO Channel	Combined Channel Delta	Combined Channel Delta
Sampled:	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001
Lab ID:	L20703-1	L20703-2	L20703-3	L20703-4
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	68.5	65.4	67.1	66.5

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
		- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis			
COMBINED LABS																				
2-Chlorophenol		<MDL,G	12	23.4	ug/Kg		<MDL,G	12	24.5	ug/Kg		<MDL,G	12	23.8	ug/Kg		<MDL,G	12	24.1	ug/Kg
2-Methylnaphthalene		<MDL	20	40.9	ug/Kg		<MDL	21	42.8	ug/Kg		<MDL	21	41.7	ug/Kg		<MDL	21	42.1	ug/Kg
2-Methylphenol		<MDL	28	55.5	ug/Kg		<MDL,G	29	58.1	ug/Kg		<MDL,G	28	56.6	ug/Kg		<MDL	29	57.1	ug/Kg
2-Nitrophenol		<MDL	22	43.8	ug/Kg		<MDL,G	23	45.9	ug/Kg		<MDL,G	22	44.7	ug/Kg		<MDL	23	45.1	ug/Kg
4-Bromophenyl Phenyl Ether		<MDL	13	26.3	ug/Kg		<MDL	14	27.5	ug/Kg		<MDL	13	26.8	ug/Kg		<MDL	14	27.1	ug/Kg
4-Chlorophenyl Phenyl Ether		<MDL	19	38	ug/Kg		<MDL	20	39.8	ug/Kg		<MDL	19	38.7	ug/Kg		<MDL	20	39.1	ug/Kg
4-Methylphenol		<MDL	23	46.7	ug/Kg		<MDL,G	24	48.9	ug/Kg		<MDL,G	24	47.7	ug/Kg		<MDL	24	48.1	ug/Kg
Acenaphthene		<MDL	10	20.4	ug/Kg		<MDL	11	21.4	ug/Kg		<MDL	10	20.9	ug/Kg		<MDL	11	21.1	ug/Kg
Acenaphthylene		<MDL	22	43.8	ug/Kg		<MDL	23	45.9	ug/Kg		<MDL	22	44.7	ug/Kg		<MDL	23	45.1	ug/Kg
Aniline		<MDL,X	28	55.5	ug/Kg		<MDL,X	29	58.1	ug/Kg		<MDL,X	28	56.6	ug/Kg		<MDL,X	29	57.1	ug/Kg
Anthracene	8	<RDL	5.8	11.7	ug/Kg	11	<RDL	6.1	12.2	ug/Kg	7.3	<RDL	6	11.9	ug/Kg	7.2	<RDL	6	12	ug/Kg
Benzo(a)anthracene	60.4		2.9	5.84	ug/Kg	40.8		3.1	6.12	ug/Kg	37.9		3	5.96	ug/Kg	38		3	6.02	ug/Kg
Benzo(a)pyrene	92.6	E	4.4	8.76	ug/Kg	61.5	E	4.6	9.17	ug/Kg	56.8	E	4.5	8.94	ug/Kg	24.5	E	4.5	9.02	ug/Kg
Benzo(b)fluoranthene	142	E	4.4	8.76	ug/Kg	97.9	E	4.6	9.17	ug/Kg	93.6	E	4.5	8.94	ug/Kg	83.5	E	4.5	9.02	ug/Kg
Benzo(g,h,i)perylene	24.8	G	12	23.4	ug/Kg	18	<RDL,G	12	24.5	ug/Kg		<MDL,G	12	23.8	ug/Kg		<MDL,G	12	24.1	ug/Kg
Benzo(k)fluoranthene	56.2		4.4	8.76	ug/Kg	40.2		4.6	9.17	ug/Kg	34.1		4.5	8.94	ug/Kg	34.1		4.5	9.02	ug/Kg
Benzoic Acid	299		8.8	17.5	ug/Kg	122	G	9.2	18.3	ug/Kg	162	G	8.9	17.9	ug/Kg	152		9	18	ug/Kg
Benzyl Alcohol		<MDL	8.8	17.5	ug/Kg		<MDL	9.2	18.3	ug/Kg		<MDL	8.9	17.9	ug/Kg		<MDL	9	18	ug/Kg
Benzyl Butyl Phthalate	29.6		8.8	17.5	ug/Kg	57.5		9.2	18.3	ug/Kg	22.1		8.9	17.9	ug/Kg	25.1		9	18	ug/Kg
Bis(2-Chloroethoxy)Methane		<MDL	25	49.6	ug/Kg		<MDL	26	52	ug/Kg		<MDL	25	50.7	ug/Kg		<MDL	26	51.1	ug/Kg
Bis(2-Chloroethyl)Ether		<MDL,G	22	43.8	ug/Kg		<MDL,G	23	45.9	ug/Kg		<MDL,G	22	44.7	ug/Kg		<MDL,G	23	45.1	ug/Kg
Bis(2-Chloroisopropyl)Ether		<MDL	22	43.8	ug/Kg		<MDL	23	45.9	ug/Kg		<MDL	22	44.7	ug/Kg		<MDL	23	45.1	ug/Kg
Bis(2-Ethylhexyl)Phthalate	349	B,L	9.8	20.4	ug/Kg	246	B,L	10	21.4	ug/Kg	206	B,L	10	20.9	ug/Kg	192	B,L	10	21.1	ug/Kg
Caffeine		<MDL,L	8.8	17.5	ug/Kg		<MDL,L	9.2	18.3	ug/Kg		<MDL,L	8.9	17.9	ug/Kg		<MDL,L	9	18	ug/Kg
Carbazole	16	<RDL	10	20.4	ug/Kg	12	<RDL	11	21.4	ug/Kg		<MDL	10	20.9	ug/Kg		<MDL	11	21.1	ug/Kg
Chrysene	81.9	E	5.8	11.7	ug/Kg	62.1	E	6.1	12.2	ug/Kg	49	E	6	11.9	ug/Kg	42	E	6	12	ug/Kg
Coprostanol		<MDL	20	40.9	ug/Kg		<MDL	21	42.8	ug/Kg		<MDL	21	41.7	ug/Kg		<MDL	21	42.1	ug/Kg
Dibenzo(a,h)anthracene		<MDL	10	20.4	ug/Kg		<MDL	11	21.4	ug/Kg		<MDL	10	20.9	ug/Kg		<MDL	11	21.1	ug/Kg
Dibenzofuran		<MDL	20	40.9	ug/Kg		<MDL	21	42.8	ug/Kg		<MDL	21	41.7	ug/Kg		<MDL	21	42.1	ug/Kg
Diethyl Phthalate		<MDL	8.8	17.5	ug/Kg		<MDL	9.2	18.3	ug/Kg		<MDL	8.9	17.9	ug/Kg		<MDL	9	18	ug/Kg
Dimethyl Phthalate		<MDL	16	32.1	ug/Kg		<MDL	17	33.6	ug/Kg		<MDL	16	32.8	ug/Kg		<MDL	17	33.1	ug/Kg
Di-N-Butyl Phthalate	46.9	B	7.3	14.6	ug/Kg	43.6	B	7.6	15.3	ug/Kg	32.6	B	7.5	14.9	ug/Kg	30.5	B	7.5	15	ug/Kg
Di-N-Octyl Phthalate		<MDL	12	23.4	ug/Kg		<MDL	12	24.5	ug/Kg		<MDL	12	23.8	ug/Kg		<MDL	12	24.1	ug/Kg
Fluoranthene	162	L,E	12	23.4	ug/Kg	124	L,E	12	24.5	ug/Kg	110	L,E	12	23.8	ug/Kg	100	L,E	12	24.1	ug/Kg
Fluorene		<MDL	19	38	ug/Kg		<MDL	20	39.8	ug/Kg		<MDL	19	38.7	ug/Kg		<MDL	20	39.1	ug/Kg
Hexachlorobenzene		<MDL	0.96	1.94	ug/Kg		<MDL	1	2.03	ug/Kg		<MDL	0.98	1.98	ug/Kg		<MDL	0.99	2	ug/Kg
Hexachlorobutadiene		<MDL,G	1.1	2.19	ug/Kg		<MDL,G	1.1	2.29	ug/Kg		<MDL,G	1.1	2.24	ug/Kg		<MDL,G	1.1	2.26	ug/Kg
Hexachloroethane		<MDL,G	22	43.8	ug/Kg		<MDL,G	23	45.9	ug/Kg		<MDL,G	22	44.7	ug/Kg		<MDL,G	23	45.1	ug/Kg

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

	Sample 1	Sample 2	Sample 3	Sample 4
Locator:	NFK501	NFK501	NFK502	NFK502
Descrip:	Norfolk CSO Channel	Norfolk CSO Channel	Combined Channel Delta	Combined Channel Delta
Sampled:	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001
Lab ID:	L20703-1	L20703-2	L20703-3	L20703-4
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	68.5	65.4	67.1	66.5

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
		- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					-Dry Weight Basis			
COMBINED LABS																				
Indeno(1,2,3-Cd)Pyrene	33.6		13	26.3	ug/Kg	21	<RDL	14	27.5	ug/Kg	22	<RDL	13	26.8	ug/Kg		<MDL	14	27.1	ug/Kg
Isophorone		<MDL	28	55.5	ug/Kg		<MDL	29	58.1	ug/Kg		<MDL	28	56.6	ug/Kg		<MDL	29	57.1	ug/Kg
Naphthalene		<MDL,G	20	40.9	ug/Kg		<MDL,G	21	42.8	ug/Kg		<MDL,G	21	41.7	ug/Kg		<MDL,G	21	42.1	ug/Kg
Nitrobenzene		<MDL	23	46.7	ug/Kg		<MDL	24	48.9	ug/Kg		<MDL	24	47.7	ug/Kg		<MDL	24	48.1	ug/Kg
N-Nitrosodimethylamine		<MDL,G	29	58.4	ug/Kg		<MDL,G	31	61.2	ug/Kg		<MDL,G	30	59.6	ug/Kg		<MDL,G	30	60.2	ug/Kg
N-Nitrosodi-N-Propylamine		<MDL	13	26.3	ug/Kg		<MDL	14	27.5	ug/Kg		<MDL	13	26.8	ug/Kg		<MDL	14	27.1	ug/Kg
N-Nitrosodiphenylamine		<MDL	29	58.4	ug/Kg		<MDL	31	61.2	ug/Kg		<MDL	30	59.6	ug/Kg		<MDL	30	60.2	ug/Kg
Pentachlorophenol		<MDL	7.3	14.6	ug/Kg		<MDL,G	7.6	15.3	ug/Kg		<MDL,G	7.5	14.9	ug/Kg		<MDL	7.5	15	ug/Kg
Phenanthrene	65.3	E	5.8	11.7	ug/Kg	46.8	E	6.1	12.2	ug/Kg	39	E	6	11.9	ug/Kg	31.6	E	6	12	ug/Kg
Phenol		<MDL,G	13	26.3	ug/Kg		<MDL,G	14	27.5	ug/Kg		<MDL,G	13	26.8	ug/Kg		<MDL,G	14	27.1	ug/Kg
Pyrene	125	E	5.8	11.7	ug/Kg	95.7	E	6.1	12.2	ug/Kg	79.1	E	6	11.9	ug/Kg	50.7	E	6	12	ug/Kg

* Not converted to dry weight basis for this parameter

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK503	NFK503	NFK504	NFK504
Descrip:	Boeing Storm Drain Channel	Boeing Storm Drain Channel	Upriver Reference	Upriver Reference
Sampled:	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001
Lab ID:	L20703-5	L20703-6	L20703-7	L20703-8
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	74.7	74.1	52.7	60.1

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
			- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis		
COMBINED LABS																				
M=CV ASTM D422																				
Clay *	0.65		0.1		%	0.6		0.1		%	4.6		0.1		%	6.5		0.1		%
Gravel *	0.98	E	0.1		%	1	E	0.1		%	0.46	E	0.1		%	0.31	E	0.1		%
p+0.00 *	4.9		0.1		%	4.1		0.1		%	2.8		0.1		%	2.1		0.1		%
p+1.00 *	28.6		0.1		%	32.1		0.1		%	21.7		0.1		%	15.4		0.1		%
p+10.0 *	0.14		0.1		%		<MDL	0.1		%	0.85		0.1		%	1.1		0.1		%
p+10.0(more than) *	0.41		0.1		%	0.36		0.1		%	2.1		0.1		%	3.3		0.1		%
p+2.00 *	55.7		0.1		%	55		0.1		%	43.3		0.1		%	30.4		0.1		%
p+3.00 *	5.9		0.1		%	5.2		0.1		%	6.8		0.1		%	6.5		0.1		%
p+4.00 *	0.75		0.1		%	0.57		0.1		%	6.1		0.1		%	11		0.1		%
p+5.00 *	1.8		0.1		%	1		0.1		%	4.2		0.1		%	14.2		0.1		%
p+6.00 *	0.27		0.1		%	0.18		0.1		%	4.8		0.1		%	6.3		0.1		%
p+7.00 *	0.25		0.1		%	0.16		0.1		%	3.1		0.1		%	4.2		0.1		%
p+8.00 *	0.2		0.1		%	0.12		0.1		%	2.3		0.1		%	3		0.1		%
p+9.00 *	0.1		0.1		%	0.15		0.1		%	1.6		0.1		%	2.2		0.1		%
p-1.00 *	0.98		0.1		%	1		0.1		%	0.46		0.1		%	0.31		0.1		%
p-2.00 *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%	0.17		0.1		%
p-2.00(less than) *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
Sand *	95.8		0.1		%	96.9		0.1		%	80.6		0.1		%	65.4		0.1		%
Silt *	2.5		0.1		%	1.5		0.1		%	14.4		0.1		%	27.8		0.1		%
M=CV EPA9060-PSEP96 (03-04-002-001)																				
Total Organic Carbon	2770		670	1340	mg/Kg	3600		670	1350	mg/Kg	15600		950	1900	mg/Kg	9080		830	1660	mg/Kg
M=CV SM2540-G (03-01-007-001)																				
Total Solids *	74.7		0.005	0.01	%	74.1		0.005	0.01	%	52.7		0.005	0.01	%	60.1		0.005	0.01	%
M=ES NONE																				
Sampccordx1 *	1278555				ft						1278628				ft					
Sampccordx2 *	1278547				ft						1278624				ft					
Sampccordx3 *	1278545				ft						1278622				ft					
Sampccordy1 *	190175				ft						190072				ft					
Sampccordy2 *	190181				ft						190077				ft					
Sampccordy3 *	190176				ft						190077				ft					
Sample Depth *	1				m	1				m	2				m	2				m
Sample Start Time *	1116				hr	1116				hr	1210				hr	1210				hr
Sampling Method	26816.6				none	27033.738				none	38011.385				none	33331.115				none
Sediment Sampling Depth *	11				cm	11				cm	16				cm	16				cm
Sediment Sampling Range *	0-2 cm				none	0-10 cm				none	0-2 cm				none	0-10 cm				none
Sediment Type	30N20				none	30N20				none	23W21				none	32W21				none
Tidal Condition	E				none	E				none	S				none	S				none

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK503					Locator:	NFK503					Locator:	NFK504					Locator:	NFK504				
Descrip:	Boeing Storm Drain Channel					Descrip:	Boeing Storm Drain Channel					Descrip:	Upriver Reference					Descrip:	Upriver Reference				
Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001					Sampled:	Apr 24, 2001				
Lab ID:	L20703-5					Lab ID:	L20703-6					Lab ID:	L20703-7					Lab ID:	L20703-8				
Matrix:	SALTWTRSED					Matrix:	SALTWTRSED					Matrix:	SALTWTRSED					Matrix:	SALTWTRSED				
% Solids:	74.7					% Solids:	74.1					% Solids:	52.7					% Solids:	60.1				
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
	- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis				
COMBINED LABS																				
Tide Height *	1				ft	1				ft	-0.3				ft	-0.3				ft

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PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK503	NFK503	NFK504	NFK504
Descrip:	Boeing Storm Drain Channel	Boeing Storm Drain Channel	Upriver Reference	Upriver Reference
Sampled:	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001
Lab ID:	L20703-5	L20703-6	L20703-7	L20703-8
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	74.7	74.1	52.7	60.1

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
			- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis		
COMBINED LABS																				
M=MT EPA 245.5 (06-01-004-003)																				
Mercury, Total, CVAA		<MDL	0.025	0.26	mg/Kg	0.1	<RDL	0.026	0.262	mg/Kg	0.072	<RDL	0.036	0.368	mg/Kg	0.038	<RDL	0.033	0.329	mg/Kg
M=MT EPA3050A/6010B (06-02-004-002)																				
Aluminum, Total, ICP	10400	L	6.7	33.2	mg/Kg	11000	L	6.5	32.7	mg/Kg	14300	L	9.5	47.2	mg/Kg	13300	L	8.5	42.1	mg/Kg
Arsenic, Total, ICP		<MDL	3.3	16.6	mg/Kg		<MDL	3.2	16.3	mg/Kg		<MDL	4.7	23.5	mg/Kg		<MDL	4.2	21	mg/Kg
Beryllium, Total, ICP	0.25	<RDL	0.067	0.332	mg/Kg	0.28	<RDL	0.065	0.327	mg/Kg	0.38	<RDL	0.095	0.472	mg/Kg	0.37	<RDL	0.085	0.421	mg/Kg
Cadmium, Total, ICP		<MDL	0.2	0.995	mg/Kg		<MDL	0.2	0.978	mg/Kg		<MDL	0.28	1.42	mg/Kg		<MDL	0.25	1.26	mg/Kg
Chromium, Total, ICP	13.9		0.33	1.66	mg/Kg	12		0.32	1.63	mg/Kg	21.1		0.47	2.35	mg/Kg	17.8		0.42	2.1	mg/Kg
Copper, Total, ICP	11.4		0.27	1.33	mg/Kg	12.9		0.26	1.3	mg/Kg	24.9		0.38	1.89	mg/Kg	18.8		0.33	1.68	mg/Kg
Iron, Total, ICP	18200	G	3.3	16.6	mg/Kg	19400	G	3.2	16.3	mg/Kg	25800	G	4.7	23.5	mg/Kg	23100	G	4.2	21	mg/Kg
Lead, Total, ICP	7.4	<RDL	2	9.95	mg/Kg	7.8	<RDL	2	9.78	mg/Kg	18		2.8	14.2	mg/Kg	13.8		2.5	12.6	mg/Kg
Manganese, Total, ICP	234		0.13	0.663	mg/Kg	255		0.13	0.653	mg/Kg	429		0.19	0.943	mg/Kg	451		0.17	0.84	mg/Kg
Nickel, Total, ICP	11.8		1.3	6.63	mg/Kg	12.7		1.3	6.53	mg/Kg	17.6		1.9	9.43	mg/Kg	14.2		1.7	8.4	mg/Kg
Selenium, Total, ICP		<MDL	3.3	16.6	mg/Kg		<MDL	3.2	16.3	mg/Kg		<MDL	4.7	23.5	mg/Kg		<MDL	4.2	21	mg/Kg
Silver, Total, ICP		<MDL	0.27	1.33	mg/Kg		<MDL	0.26	1.3	mg/Kg		<MDL	0.38	1.89	mg/Kg		<MDL	0.33	1.68	mg/Kg
Thallium, Total, ICP		<MDL	13	66.3	mg/Kg		<MDL	13	65.3	mg/Kg		<MDL	19	94.3	mg/Kg		<MDL	17	84	mg/Kg
Zinc, Total, ICP	43.4		0.33	1.66	mg/Kg	46.4		0.32	1.63	mg/Kg	68.3		0.47	2.35	mg/Kg	60.6		0.42	2.1	mg/Kg
M=OR EPA 3550B/8082 (7-3-03-002)																				
Aroclor 1016		<MDL	5.6	11.2	ug/Kg		<MDL	5.7	11.2	ug/Kg		<MDL	8	15.8	ug/Kg		<MDL	7	13.9	ug/Kg
Aroclor 1221		<MDL	5.6	11.2	ug/Kg		<MDL	5.7	11.2	ug/Kg		<MDL	8	15.8	ug/Kg		<MDL	7	13.9	ug/Kg
Aroclor 1232		<MDL	5.6	11.2	ug/Kg		<MDL	5.7	11.2	ug/Kg		<MDL	8	15.8	ug/Kg		<MDL	7	13.9	ug/Kg
Aroclor 1242		<MDL	5.6	11.2	ug/Kg		<MDL	5.7	11.2	ug/Kg		<MDL	8	15.8	ug/Kg		<MDL	7	13.9	ug/Kg
Aroclor 1248	1190		5.6	11.2	ug/Kg	914		5.7	11.2	ug/Kg	16.8		8	15.8	ug/Kg	11	<RDL	7	13.9	ug/Kg
Aroclor 1254	685		5.6	11.2	ug/Kg	416		5.7	11.2	ug/Kg	25.4		8	15.8	ug/Kg	19.5		7	13.9	ug/Kg
Aroclor 1260		<MDL	5.6	11.2	ug/Kg		<MDL	5.7	11.2	ug/Kg		<MDL	8	15.8	ug/Kg		<MDL	7	13.9	ug/Kg
M=OR EPA 3550B/8270C (7-3-01-004)																				
1,2,4-Trichlorobenzene		<MDL,G	0.35	0.71	ug/Kg		<MDL,G	0.35	0.715	ug/Kg		<MDL,G	0.49	1.01	ug/Kg		<MDL,G	0.43	0.882	ug/Kg
1,2-Dichlorobenzene		<MDL,G	0.35	0.71	ug/Kg		<MDL,G	0.35	0.715	ug/Kg		<MDL,G	0.49	1.01	ug/Kg		<MDL,G	0.43	0.882	ug/Kg
1,2-Diphenylhydrazine		<MDL	13	26.8	ug/Kg		<MDL,G	13	27	ug/Kg		<MDL,G	19	38	ug/Kg		<MDL,G	17	33.3	ug/Kg
1,3-Dichlorobenzene		<MDL,G	0.35	0.71	ug/Kg		<MDL,G	0.35	0.715	ug/Kg		<MDL,G	0.49	1.01	ug/Kg		<MDL,G	0.43	0.882	ug/Kg
1,4-Dichlorobenzene		<MDL,G	0.17	0.353	ug/Kg		<MDL,G	0.18	0.356	ug/Kg		<MDL,G	0.25	0.501	ug/Kg		<MDL,G	0.22	0.439	ug/Kg
2,4,5-Trichlorophenol		<MDL,G	16	32.1	ug/Kg		<MDL,G	16	32.4	ug/Kg		<MDL,G	23	45.5	ug/Kg		<MDL,G	20	39.9	ug/Kg
2,4,6-Trichlorophenol		<MDL,G	17	34.8	ug/Kg		<MDL,G	18	35.1	ug/Kg		<MDL,G	25	49.3	ug/Kg		<MDL,G	22	43.3	ug/Kg
2,4-Dichlorophenol		<MDL,G	21	42.8	ug/Kg		<MDL,G	22	43.2	ug/Kg		<MDL,G	30	60.7	ug/Kg		<MDL,G	27	53.2	ug/Kg
2,4-Dimethylphenol		<MDL,G	9.4	18.7	ug/Kg		<MDL,G	9.4	18.9	ug/Kg		<MDL,G	13	26.6	ug/Kg		<MDL,G	12	23.3	ug/Kg
2,4-Dinitrotoluene		<MDL	4	8.03	ug/Kg		<MDL,G	4	8.1	ug/Kg		<MDL,G	5.7	11.4	ug/Kg		<MDL,G	5	9.98	ug/Kg
2,6-Dinitrotoluene		<MDL	13	26.8	ug/Kg		<MDL,G	13	27	ug/Kg		<MDL,G	19	38	ug/Kg		<MDL,G	17	33.3	ug/Kg
2-Chloronaphthalene		<MDL	21	42.8	ug/Kg		<MDL,G	22	43.2	ug/Kg		<MDL,G	30	60.7	ug/Kg		<MDL,G	27	53.2	ug/Kg

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK503	NFK503	NFK504	NFK504
Descrip:	Boeing Storm Drain Channel	Boeing Storm Drain Channel	Upriver Reference	Upriver Reference
Sampled:	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001
Lab ID:	L20703-5	L20703-6	L20703-7	L20703-8
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	74.7	74.1	52.7	60.1

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
		- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis			
COMBINED LABS																				
2-Chlorophenol		<MDL,G	11	21.4	ug/Kg		<MDL,G	11	21.6	ug/Kg		<MDL,G	15	30.4	ug/Kg		<MDL,G	13	26.6	ug/Kg
2-Methylnaphthalene		<MDL	19	37.5	ug/Kg		<MDL,G	19	37.8	ug/Kg		<MDL,G	27	53.1	ug/Kg		<MDL,G	23	46.6	ug/Kg
2-Methylphenol		<MDL,G	25	50.9	ug/Kg		<MDL,G	26	51.3	ug/Kg		<MDL,G	36	72.1	ug/Kg		<MDL,G	32	63.2	ug/Kg
2-Nitrophenol		<MDL,G	20	40.2	ug/Kg		<MDL,G	20	40.5	ug/Kg		<MDL,G	28	56.9	ug/Kg		<MDL,G	25	49.9	ug/Kg
4-Bromophenyl Phenyl Ether		<MDL	12	24.1	ug/Kg		<MDL,G	12	24.3	ug/Kg		<MDL,G	17	34.2	ug/Kg		<MDL,G	15	30	ug/Kg
4-Chlorophenyl Phenyl Ether		<MDL	17	34.8	ug/Kg		<MDL,G	18	35.1	ug/Kg		<MDL,G	25	49.3	ug/Kg		<MDL,G	22	43.3	ug/Kg
4-Methylphenol		<MDL,G	21	42.8	ug/Kg		<MDL,G	22	43.2	ug/Kg		<MDL,G	30	60.7	ug/Kg		<MDL,G	27	53.2	ug/Kg
Acenaphthene		<MDL	9.4	18.7	ug/Kg		<MDL,G	9.4	18.9	ug/Kg		<MDL,G	13	26.6	ug/Kg		<MDL,G	12	23.3	ug/Kg
Acenaphthylene		<MDL	20	40.2	ug/Kg		<MDL,G	20	40.5	ug/Kg		<MDL,G	28	56.9	ug/Kg		<MDL,G	25	49.9	ug/Kg
Aniline		<MDL,X	25	50.9	ug/Kg		<MDL,G,X	26	51.3	ug/Kg		<MDL,G,X	36	72.1	ug/Kg		<MDL,G,X	32	63.2	ug/Kg
Anthracene		<MDL	5.4	10.7	ug/Kg		<MDL,G	5.4	10.8	ug/Kg		<MDL,G	7.6	15.2	ug/Kg		<MDL,G	6.7	13.3	ug/Kg
Benzo(a)anthracene	8.14		2.7	5.35	ug/Kg	3	<RDL,G	2.7	5.4	ug/Kg	24.9	G	3.8	7.59	ug/Kg	18	G	3.3	6.65	ug/Kg
Benzo(a)pyrene		<MDL,E	4	8.03	ug/Kg		<MDL,G,E	4	8.1	ug/Kg		<MDL,G,E	5.7	11.4	ug/Kg		<MDL,G,E	5	9.98	ug/Kg
Benzo(b)fluoranthene	10.6	E	4	8.03	ug/Kg		<MDL,G,E	4	8.1	ug/Kg	21.1	G,E	5.7	11.4	ug/Kg	16	G,E	5	9.98	ug/Kg
Benzo(g,h,i)perylene		<MDL,G	11	21.4	ug/Kg		<MDL,G	11	21.6	ug/Kg		<MDL,G	15	30.4	ug/Kg		<MDL,G	13	26.6	ug/Kg
Benzo(k)fluoranthene	5.8	<RDL	4	8.03	ug/Kg		<MDL,G	4	8.1	ug/Kg	12.5	G	5.7	11.4	ug/Kg	8.5	<RDL,G	5	9.98	ug/Kg
Benzoic Acid	80.9	G	8	16.1	ug/Kg	67.6	G	8.1	16.2	ug/Kg	268	G	11	22.8	ug/Kg	168	G	10	20	ug/Kg
Benzyl Alcohol		<MDL	8	16.1	ug/Kg		<MDL,G	8.1	16.2	ug/Kg		<MDL,G	11	22.8	ug/Kg		<MDL,G	10	20	ug/Kg
Benzyl Butyl Phthalate		<MDL	8	16.1	ug/Kg		<MDL,G	8.1	16.2	ug/Kg	34.9	G	11	22.8	ug/Kg	28	G	10	20	ug/Kg
Bis(2-Chloroethoxy)Methane		<MDL	23	45.5	ug/Kg		<MDL,G	23	45.9	ug/Kg		<MDL,G	32	64.5	ug/Kg		<MDL,G	28	56.6	ug/Kg
Bis(2-Chloroethyl)Ether		<MDL,G	20	40.2	ug/Kg		<MDL,G	20	40.5	ug/Kg		<MDL,G	28	56.9	ug/Kg		<MDL,G	25	49.9	ug/Kg
Bis(2-Chloroisopropyl)Ether		<MDL	20	40.2	ug/Kg		<MDL,G	20	40.5	ug/Kg		<MDL,G	28	56.9	ug/Kg		<MDL,G	25	49.9	ug/Kg
Bis(2-Ethylhexyl)Phthalate	51	B,L	9	18.7	ug/Kg	42.4	G,B,L	9	18.9	ug/Kg	389	G,B,L	13	26.6	ug/Kg	331	G,B,L	11	23.3	ug/Kg
Caffeine		<MDL,L	8	16.1	ug/Kg		<MDL,G,L	8.1	16.2	ug/Kg		<MDL,G,L	11	22.8	ug/Kg		<MDL,G,L	10	20	ug/Kg
Carbazole		<MDL	9.4	18.7	ug/Kg		<MDL,G	9.4	18.9	ug/Kg		<MDL,G	13	26.6	ug/Kg		<MDL,G	12	23.3	ug/Kg
Chrysene	7.9	<RDL,E	5.4	10.7	ug/Kg		<MDL,G,E	5.4	10.8	ug/Kg	17.2	G,E	7.6	15.2	ug/Kg	8.2	<RDL,G,E	6.7	13.3	ug/Kg
Coprostanol		<MDL	19	37.5	ug/Kg		<MDL,G	19	37.8	ug/Kg		<MDL,G	27	53.1	ug/Kg		<MDL,G	23	46.6	ug/Kg
Dibenzo(a,h)anthracene		<MDL	9.4	18.7	ug/Kg		<MDL,G	9.4	18.9	ug/Kg		<MDL,G	13	26.6	ug/Kg		<MDL,G	12	23.3	ug/Kg
Dibenzofuran		<MDL	19	37.5	ug/Kg		<MDL,G	19	37.8	ug/Kg		<MDL,G	27	53.1	ug/Kg		<MDL,G	23	46.6	ug/Kg
Diethyl Phthalate		<MDL	8	16.1	ug/Kg		<MDL,G	8.1	16.2	ug/Kg		<MDL,G	11	22.8	ug/Kg		<MDL,G	10	20	ug/Kg
Dimethyl Phthalate		<MDL	15	29.5	ug/Kg		<MDL,G	15	29.7	ug/Kg		<MDL,G	21	41.7	ug/Kg		<MDL,G	18	36.6	ug/Kg
Di-N-Butyl Phthalate	31.6	B	6.7	13.4	ug/Kg	33.9	G,B	6.7	13.5	ug/Kg	56.2	G,B	9.5	19	ug/Kg	39.3	G,B	8.3	16.6	ug/Kg
Di-N-Octyl Phthalate		<MDL	11	21.4	ug/Kg		<MDL,G	11	21.6	ug/Kg		<MDL,G	15	30.4	ug/Kg		<MDL,G	13	26.6	ug/Kg
Fluoranthene	24.5	L,E	11	21.4	ug/Kg		<MDL,G,L,E	11	21.6	ug/Kg	50.3	G,L,E	15	30.4	ug/Kg	27.5	G,L,E	13	26.6	ug/Kg
Fluorene		<MDL	17	34.8	ug/Kg		<MDL,G	18	35.1	ug/Kg		<MDL,G	25	49.3	ug/Kg		<MDL,G	22	43.3	ug/Kg
Hexachlorobenzene		<MDL	0.88	1.78	ug/Kg		<MDL,G	0.89	1.79	ug/Kg		<MDL,G	1.3	2.52	ug/Kg		<MDL,G	1.1	2.21	ug/Kg
Hexachlorobutadiene		<MDL,G	1	2.01	ug/Kg		<MDL,G	1	2.02	ug/Kg		<MDL,G	1.4	2.85	ug/Kg		<MDL,G	1.2	2.5	ug/Kg
Hexachloroethane		<MDL,G	20	40.2	ug/Kg		<MDL,G	20	40.5	ug/Kg		<MDL,G	28	56.9	ug/Kg		<MDL,G	25	49.9	ug/Kg

King County Environmental Lab Analytical Report

PROJECT: 423056-160
Norfolk CSO Sediment Remediation
Five-Year Monitoring Program
Year Two - April 2001 Sampling Event

Locator:	NFK503	NFK503	NFK504	NFK504
Descrip:	Boeing Storm Drain Channel	Boeing Storm Drain Channel	Upriver Reference	Upriver Reference
Sampled:	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001	Apr 24, 2001
Lab ID:	L20703-5	L20703-6	L20703-7	L20703-8
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	74.7	74.1	52.7	60.1

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
		- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis			
COMBINED LABS																				
Indeno(1,2,3-Cd)Pyrene		<MDL	12	24.1	ug/Kg		<MDL,G	12	24.3	ug/Kg		<MDL,G	17	34.2	ug/Kg		<NDL,G	15	30	ug/Kg
Isophorone		<MDL	25	50.9	ug/Kg		<MDL,G	26	51.3	ug/Kg		<MDL,G	36	72.1	ug/Kg		<NDL,G	32	63.2	ug/Kg
Naphthalene		<MDL,G	19	37.5	ug/Kg		<MDL,G	19	37.8	ug/Kg		<MDL,G	27	53.1	ug/Kg		<NDL,G	23	46.6	ug/Kg
Nitrobenzene		<MDL	21	42.8	ug/Kg		<MDL,G	22	43.2	ug/Kg		<MDL,G	30	60.7	ug/Kg		<NDL,G	27	53.2	ug/Kg
N-Nitrosodimethylamine		<MDL,G	27	53.5	ug/Kg		<MDL,G	27	54	ug/Kg		<MDL,G	38	75.9	ug/Kg		<NDL,G	33	66.6	ug/Kg
N-Nitrosod-N-Propylamine		<MDL	12	24.1	ug/Kg		<MDL,G	12	24.3	ug/Kg		<MDL,G	17	34.2	ug/Kg		<NDL,G	15	30	ug/Kg
N-Nitrosodphenylamine		<MDL	27	53.5	ug/Kg		<MDL,G	27	54	ug/Kg		<MDL,G	38	75.9	ug/Kg		<NDL,G	33	66.6	ug/Kg
Pentachlorophenol		<MDL,G	6.7	13.4	ug/Kg		<MDL,G	6.7	13.5	ug/Kg		<MDL,G	9.5	19	ug/Kg		<NDL,G	8.3	16.6	ug/Kg
Phenanthrene	8.4	<RDL,E	5.4	10.7	ug/Kg		<MDL,G,E	5.4	10.8	ug/Kg	15.6	G,E	7.6	15.2	ug/Kg	10	<RDL,G,E	6.7	13.3	ug/Kg
Phenol		<MDL,G	12	24.1	ug/Kg		<MDL,G	12	24.3	ug/Kg		<MDL,G	17	34.2	ug/Kg		<NDL,G	15	30	ug/Kg
Pyrene	5.9	<RDL,E	5.4	10.7	ug/Kg		<MDL,G,E	5.4	10.8	ug/Kg		<MDL,G,E	7.6	15.2	ug/Kg		<MDL,G,E	6.7	13.3	ug/Kg

* Not converted to dry weight basis for this parameter

KING COUNTY ENVIRONMENTAL LABORATORY
QUALITY ASSURANCE REVIEW

for

ESTUARINE SEDIMENT ANALYTICAL DATA

NORFOLK CSO SEDIMENT REMEDIATION PROJECT
FIVE-YEAR MONITORING PROGRAM
APRIL 2001 SAMPLING EVENT

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September 7, 2001

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INTRODUCTION

This quality assurance (QA) narrative is intended to document the QA review conducted on the chemistry analyses performed for the Norfolk CSO Sediment Remediation Study. The QA narrative is organized into the five sections listed below.

- General Comments
- Sample Collection
- Conventional Analyses
- Metal Chemistry
- Organic Chemistry

An overview of the approach used for the QA review is detailed in the *General Comments* section. Additional information specific to each analysis is included in the appropriate analytical section.

This QA review and narrative (specifically defined as QA1) have been conducted in accordance with guidelines established through the Puget Sound Dredged Disposal Analysis (PSDDA) program and the Sediment Management Standards (WAC 173-204-610). Other approaches incorporated in the QA review have been established through collaboration between the King County Environmental Laboratory (KC Laboratory) and the Washington State Department of Ecology (Ecology) Sediment Management Unit.

GENERAL COMMENTS

Scope of Samples Submitted
This QA review is associated with estuarine sediment samples collected in April 24, 2001 as part of the Norfolk CSO Sediment Remediation Study.

Except where noted in the subcontracting sections of this QA review, all analyses have been conducted by the King County Environmental Laboratory (KCEL). Sediment analytical data are reported with associated data qualifiers and have undergone QA1 review, as summarized in this narrative report.

Completeness
Completeness has been evaluated for this data submission and QA review by considering the following criteria:

- Comparing reported data to the planned project analyses summarized in Table 1.
- Compliance with storage conditions and holding times.
- Frequency of analysis of the complete set of quality control (QC) samples outlined in Table 2.

Subcontracted Analyses
Analyses that have been subcontracted and the issues associated with these subcontracted analyses are noted in this narrative.

Methods
Analytical methods are noted in the applicable analytical sections of this QA review.

Target Lists
The reported target lists have been compared to the target analytes listed in *Table 1 - Marine Sediment Quality Standards Chemical Criteria* and *Table 3 - Puget Sound Marine Sediment Cleanup Screening Levels Chemical Criteria* contained in Chapter 173-204 WAC.

Detection Limits
The KC Laboratory distinguishes between the reporting detection limit (RDL) and the method detection limit (MDL).

- The RDL is defined as *the minimum concentration of a chemical constituent that can be reliably quantified.*
- The MDL is defined as *the minimum concentration of a chemical constituent that can be detected.*

Some subcontracted laboratory data are available with an MDL only, in accordance with the subcontracting laboratory policies. All analytical parameters are reported with detection limit(s). For some methods the detection limits reported may vary from sample to sample depending on the amount of sample analyzed and any additional dilutions required.

Storage Conditions and Holding Times
Storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The approach used to evaluate Total Organic Carbon for holding time has been established between the KC Laboratory and Ecology during previous QA1 review efforts. Extraction and analysis holding times for each method are summarized in each analytical section.

Method Blanks
Method blank results have been used to evaluate the possible laboratory contamination of samples. Method blank results have been reviewed for the presence of analytes detected at or greater than the MDL.

Standard Reference Materials
Standard reference material (SRM) recoveries have been used to evaluate possible low or high analytical bias on a batch-specific basis. SRM analysis is included with metals and selected organic and conventional parameters (see Table 2). SRMs are purchased from the National Institute of Standards and Technology (NIST) or National Research Council of Canada (NRCC) and have certified analyte values. Lab Control Samples (or spiked blanks) may also be analyzed by the analytical laboratory as part of overall quality control but the results are not used to qualify the sample data.

Matrix Spikes
Matrix spike recoveries have been used to evaluate possible low or high analytical bias on a matrix and batch-specific basis. Matrix spikes are analyzed with metals, organics and selected conventionals parameters (see Table 2).

Laboratory Replicate Samples
Replicate analysis (laboratory duplicates or triplicates) is used as an indicator of method precision and is used to qualify data on an analyte and batch-specific basis. Not all replicate data are used, however, as an indicator for data qualification. Only sets of replicate results which include at least one result greater than the RDL are considered for data qualification. These guidelines have been used to account for the fact that precision obtained near the detection limit is not representative of precision obtained throughout the entire analytical range.

Surrogates
Surrogate recoveries have been used to evaluate possible low or high analytical bias on a sample-specific basis. Surrogates are only analyzed for organic parameters.

Data Qualifiers
The data qualification system used for this data submission is presented in Table 3. These data qualifiers address situations that require qualification and generally conform to QA1 guidance. Changes made to SRM data qualification have been discussed with and approved by the Sediment Management Unit of Ecology. The qualifiers shown in Table 3 are also used for the Sedqual electronic data format (except for <MDL and <RDL).

Units and Significant Figures
Data have been reported in accordance with laboratory policy at the time of data generation. Data generally have been reported to three significant figures if above the RDL and two significant figures if equal to or below the RDL.

SAMPLE COLLECTION

This section describes sampling activities associated with the collection of 8 composite sediment samples on April 24, 2001. All sampling activities were conducted following guidance suggested in the Puget Sound Estuarine Protocols (PSEP, 1996 and 1998).

Sampling Locations and Station Positioning

Sampling locations (stations) were selected and the prescribed coordinates determined prior to field activities. Stations were selected to match the historical sampling locations for this on-going monitoring project. The prescribed station coordinates are presented in the following table. Also presented in the table are the actual coordinates recorded during sampling activities. All station coordinates are recorded in state plane coordinate system North American Datum 1983 (NAD83).

Lab ID #	Station Name	Prescribed Northing	Field Northing	Prescribed Easting	Field Easting
L20703-1, -2	NFK501	190170	190154	1278584	1278590
			190146		1278581
			190159		1278577
L20703-3, -4	NFK502	190159	190154	1278514	1278509
			190157		1278513
			190157		1278514
L20703-5, -6	NFK503	190195	190175	1278544	1278555
			190181		1278547
			190176		1278545
L20703-7, -8	NFK504	190080	190072	1278625	1278628
			190077		1278624
			190077		1278622

Sediment grab samples were collected from the King County research vessel *Chinook*, which is equipped with a differential global positioning system (DGPS). Field coordinates were recorded using DGPS for each acceptable deployment of the grab sampler as it contacted the sediment. Coordinates for each grab sampler deployment are included in the previous table.

The average coordinates for the sampler deployments are within 6 meters (19 feet) of the prescribed coordinates. Sampling at Stations NFK501 and NFK503 were slightly offset to the north due to low water levels.

Sample Description Table

Lab Sample #	Locator	Sample Collection	Sediment Depth used for Composite (from surface)	Sample Usage
L20703-1	NFK501	Surface Grabs	2 cm	Chemistry
L20703-2	NFK501	Surface Grabs	10 cm	Chemistry
L20703-3	NFK502	Surface Grabs	2 cm	Chemistry
L20703-4	NFK502	Surface Grabs	10 cm	Chemistry
L20703-5	NFK503	Surface Grabs	2 cm	Chemistry
L20703-6	NFK503	Surface Grabs	10 cm	Chemistry
L20703-7	NFK504	Surface Grabs	2 cm	Chemistry
L20703-8	NFK504	Surface Grabs	10 cm	Chemistry

Sample Collection and Handling

Eight composite samples in total were collected April 24, 2001 from the Norfolk Sediment Cap Monitoring Project site using a stainless steel, modified, 0.1 m^2 dual Van Veen grab sampler deployed from the *Chinook* via hydrowire. For each deployment, samples were collected from both the top 2 cm and top 10 cm of sediment, each from separate Van Veen samplers. Water depth at the four stations ranged between 1 to 2 meters (not corrected for tide). The depth of the grab deployments from the sediment surface ranged from 11 to 16 cm.

Samples were comprised of sediment aliquots collected from three individual grabs at each station with approximately an equal amount of material collected from each grab. The top 2cm samples were collected using a 200 cm2 "cookie cutter" and stainless steel spatula. The 10cm samples were collected using a stainless steel spoon. Both 2cm and 10cm aliquots were taken from each Van Veen cast by sampling each fraction (2cm or 10cm) from a different side of the Van Veen sampler. Each of the aliquots were placed into a separate stainless-steel bowl, covered with foil between grab deployments. After collecting aliquots from three grabs, the sediment sample was thoroughly homogenized and sample aliquots split out into pre-labeled containers. Sample containers were supplied by the King County Environmental Laboratory and were pre-cleaned according to analytical specifications.

Individual sets of sample compositing equipment were dedicated to each station precluding the need for decontamination of the field gear. The Van Veen grab sampler was decontaminated between stations by scrubbing with a brush and ambient water followed by a thorough *in situ* rinsing.

Samples were stored in ice-filled coolers from the time of collection until delivery to the King County Environmental Laboratory. Samples were delivered under chain-of-custody and were maintained as such throughout the analytical process. Samples were stored frozen (-18°C) by the laboratory until analysis with the exception of samples for particle size distribution (PSD) analysis. PSD samples were stored refrigerated at approximately 4°C. A more complete description of sample handling and storage can be found in each analytical chemistry section of this narrative.

CONVENTIONAL ANALYSES

Completeness
Conventional data are reported for all samples and parameters summarized in Table 1. These samples were analyzed in association with the complete set of QC samples outlined in Table 2.

Subcontracted Analyses
Analysis for PSD was subcontracted to Rosa Environmental and Geotechnical Laboratory in Seattle, Washington.

Methods
PSD analysis was performed in accordance with ASTM and Puget Sound Protocols methodologies (*Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound* - page 9 - PSEP, 1986). TOC analysis was performed in accordance with SM5310-B. Total solids analysis were performed in accordance with SM2540-B.

Detection Limits, Units and Significant Figures
For analyses performed at the KC Laboratory, data are reported in accordance with laboratory policy at the time the data were generated. Data are reported to three significant figures for results greater than the RDL and two significant figures for results equal to or less than the RDL. For results reported with less than two or three significant figures, significant zeroes are implied. This may not apply to subcontracted data.

Storage Conditions and Holding Times
Sample storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The dates and holding time criteria for the actual storage conditions used for conventional analyses are listed in the table below.

Parameter	Lab ID#	Date Collected	Date Extracted	Date Analyzed	Sample Holding Time	Extract Holding Time
Particle Size Distribution	L20703-1,2,3,4,5,6,7,8	24-Apr-01	25-Apr-01	25-Apr-01	6 Months at 4°C	NA
Total Solids	L20703-1,2,3,4,5,6,7,8	24-Apr-01	NA	7-May-01	6 months at -18°C	NA
Total Organic Carbon	L20703-1,2,3,4,5,6,7,8	24-Apr-01	7-May-01*	25-May-01	6 months at -18°C	6 months at -18°C

* Preparation Date

Sample storage conditions and holding times were met for all samples in this data submission.

Method Blanks
Method blanks were analyzed in connection with solids and total organic carbon analyses. All method blanks results were less than the MDL.

Standard Reference Materials
An SRM (Buffalo River Sediment) was analyzed in connection with TOC analysis. The percent recovery for the SRM analysis was within the 80 to 120% QC limits.

Matrix Spikes
The selected analytical methods run on these samples do not require matrix spikes.

Laboratory Replicate Samples

Laboratory triplicate samples were analyzed for all conventional parameters. The percent relative standard deviations (%RSD) for all triplicate analyses were less than or equal to the 20% QC limit with the exception of PSD.

The %RSD for the gravel portion of the PSD measurement is greater than 20%. These categories represent less than 10% of the total particle distribution of the sample. Higher variability is expected for categories that represent 10% of less of the total mass. The results have been flagged with an "E" qualifier.

METALS CHEMISTRY

Completeness
Metal chemistry data are reported for all samples and parameters summarized in Table 1. These samples were analyzed for mercury and other metals in association with the complete set of QC samples outlined in Table 2.

Subcontracted Analyses
There were no subcontracted metals analyses for these samples.

Methods
Mercury analysis was performed in accordance with EPA Method 7471. Analysis for other metals was performed in accordance with EPA Methods 3050/6010.

Target List
The reported target list includes all metals specified in Table 1.

Detection Limits, Units and Significant Figures
For analyses performed at the KC Laboratory, data are reported in accordance with laboratory policy at the time the data were generated. Data are reported to three significant figures for results greater than the RDL and two significant figures for results equal to or less than the RDL. For results reported with less than two or three significant figures, significant zeroes are implied. This may not apply to subcontracted data.

Storage Conditions and Holding Times
Sample storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The dates and holding time criteria for the actual storage conditions used for metals analyses are listed in the table below.

Parameter	Lab ID#	Date Collected	Date Digested/ Extracted	Date Analyzed	Sample Holding Time	Digestate/Extract Holding Time
Total Metals	L20703-1 to –8	4/24/01	5/15/01	5/21/01, 6/6/01	2 Years at -18°C	6 months
Total Mercury	L20703-1 to –8	4/24/01	5/14/01	5/15/01	28 days at -18°C	NA

Sample storage conditions and holding times were met for all samples in this data submission.

Method Blanks
All metals method blanks results were less than the MDL

Standard Reference Materials
The SRM analyzed in association with samples included in this data submission is Buffalo River Sediment. This SRM is not certified for Silver, Aluminum, Beryllium, Iron or Thallium. An SRM recovery less than the QC limit of 80% for ICP metals has not been used to qualify data because the digestion technique used for ICP analysis is different from the technique used during analysis to determine the SRM values. Only SRM recoveries greater than 120% will be used to qualify ICP data.

All total ICP metals SRM recoveries were less than the QC limit of 120%. All total mercury SRM recoveries were within the QC limits of 80-120%.

Matrix Spikes

The reported matrix spike recovery of 401% for aluminum is greater than the 125% upper QC limit. Aluminum results for all samples in this data submission have been qualified with the *L* flag. The reported matrix spike recovery of 65% for iron is less than the 75% lower QC limit. Iron results for all samples in this data submission have been qualified with the *G* flag. For the matrix spike, the background concentrations were significantly higher than the spike levels. Variability in the background levels may be responsible for the unacceptable recoveries rather than a true bias.

Laboratory Replicate Samples

The relative percent differences (RPDs) for laboratory duplicate results for all metals were less than or equal to the QC limit of 20%.

ORGANIC CHEMISTRY

Completeness

Organics data are reported for all samples and parameters summarized in Table 1. These samples were analyzed in association with the complete set of QC samples outlined in Table 2.

Methods

BNA analysis was performed in accordance with EPA method 8270. PCB analysis was performed in accordance with EPA methods 8082.

Target List

The reported BNA target list includes all compounds specified in *Table 1 - Marine Sediment Quality Standards Chemical Criteria* and *Table 3 - Puget Sound Marine Sediment Cleanup Screening Levels Chemical Criteria* contained in Chapter 173-204 WAC with the exception of benzo(j)fluoranthene. The KC Laboratory has verified that analytical conditions are sufficient to calculate a total benzofluoranthene result using the reported *b* and *k* isomers.

Reported PCB data include Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

Detection Limits, Units and Significant Figures

For analyses performed at the KC Laboratory, data are reported in accordance with laboratory policy at the time the data were generated. Data are reported to three significant figures for results greater than the RDL and two significant figures for results equal to or less than the RDL. For results reported with less than two or three significant figures, significant zeroes are implied.

Storage Conditions and Holding Times

Sample storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The dates and holding time criteria for the actual storage conditions used for conventional analyses are listed in the table below.

Parameter	Lab ID#	Date Collected	Date Extracted	Date Analyzed	Sample Holding Time	Extract Holding Time
BNAs	L20703-1 to -8	4/24/2001	5/10/01	6/5/01-6/7/01	1 year at -18°C	40 days at 4°C
PCBs	L20703-1 to -8	4/24/2001	5/9/01	6/7/01	1 year at -18°C	40 days at 4°C

Sample storage conditions and holding times were met for all samples in this data submission.

Method Blanks

1. BNAs

The method blank analyzed with BNAs for L20703 had results above the MDL for Bis(2-Ethylhexyl) Phthalate and Di-N-butyl Phthalate. Sample results for Bis(2-Ethylhexyl) Phthalate and Di-N- Butyl Phthalate for that batch (L20703) have been qualified with the B flag. All Bis(2-Ethylhexyl) Phthalate and Di-N-Butyl Phthalate results for these samples must be treated as estimated values.

All other method blank results (PCBs) were less than the MDL.

Surrogate Recoveries

1. BNA

BNA sample data are qualified when the average surrogate recovery for either or both the acid and base/neutral fractions are outside the 50 to 150% QC limits. The following table summarizes the average surrogate recoveries that are outside the QC limits and the appropriate flag. Only those average surrogate values that are outside the acceptance limit have been posted in the table. The first three samples in the list are the MS, MSD and SRM. Sample L20703-1 had no average surrogate value failures.

Lab ID#	Average Acid Surrogate Recovery	Flag Applied to Acid Compounds	Average B/N Surrogate Recovery	Flag Applied to B/N Compounds
L20703-2	43.5	G		
L20703-3	49.25	G		
L20703-5	44.5	G		
L20703-6	28	G	44.5	G
L20703-7	33.5	G	46.5	G
L20703-8	33.25	G	47.5	G

2. PCB

PCB sample data are qualified when both surrogate recoveries are outside QC limits. At least one PCB surrogate recovery was within the 50 to 150% QC limits for all samples in this data submission.

Standard Reference Materials

1. BNA

The sediment SRM analyzed in association with the reported BNA results is SRM 1944a, certified by the National Institute of Standards and Technology (NIST). Only a partial list of BNA parameters have certified values in SRM 1944a and therefore only those are used to qualify the data. Results for this partial list of compounds for the one batch of samples have been qualified based on the SRM recoveries outside the 80 to 120% QC limits. The recoveries and flags are summarized in the following table.

	L20703-1 to 8	
Compound	**% Recovery**	**Flag**
Naphthalene	13	G
Phenanthrene	84	
Anthracene	83	
Fluoranthene	111	
Pyrene	89	
Benzo(a)anthracene	99	
Chrysene	109	
Benzo(b)fluoranthene	100	
Benzo(k)fluoranthene	99	
Benzo(a)pyrene	109	
Indeno(1,2,3-c,d)pyrene	81	
Dibenzo(a,h)anthracene	110	
Benzo(g,h,i)perylene	66	G

2. PCB
The sediment SRM analyzed in association with the reported PCB results is HS-2, certified by the National Research Council of Canada. SRM HS-2 has a certified value for Aroclor 1254. The recovery of the certified parameters must be within 80 to 120% or the appropriate data are flagged. The SRM results for the batch of analyses is summarized below:

	L20703-1 to 8	
Compound	**% Recovery**	**Flag**
Aroclor 1254	100	

Matrix Spikes

1. BNA
The matrix spike recoveries for each BNA compound must be within the 50 to 150% QC limits. If not, all results for those particular compounds within the batch of samples must be flagged as follows. A G flag is applied if the recovery is between 10 and 50%, an X flag is applied if less than 10% recovery and an L flag is applied if greater than 150% recovery. The following table summarizes the matrix spike recoveries for specific compounds that are outside the QC limits and the appropriate flag.

	L20703-1 to 8	
Compound	**% Recovery**	*Flag*
N-Nitrodimethylamine	32	G
Phenol	27.2	G
Bis(2-Chloroethyl)Ether	26	G
2-Chlorophenol	28.3	G
1,3-Dichlorobenzene	23.6	G
1,4-Dichlorobenzene	23	G
1,2-Dichlorobenzene	24.3	G
Hexachloroethane	28	G
1,2,4-Trichlorobenzene	29.7	G
Naphthalene	32.3	G
Hexachlorobutadiene	29.9	G
Fluoranthene	165	L
Bis(2-Ethylhexyl)Phthalate	161	L
Aniline	0	X
Caffeine	155	L

2. PCB
The matrix spike recoveries for PCB compounds must be within the 50 to 150% QC limits. A G flag is applied if the recovery is between 10 and 50%, an X flag is applied if less than 10% recovery and an L flag is applied if greater than 150% recovery. Aroclor 1260 and 1016 only are used as the spiking compounds for PCB analysis.

All PCB matrix spike recoveries are within the QC limits.

Laboratory Replicate Samples
Lab Replicate (duplicate) samples for Organics have a target acceptance limit 100% for the Relative Percent Difference (RPD). All duplicate analyses showed acceptable RPD values except for the following:

1. BNAs

The RPDs for Phenanthrene, Fluoranthrene, Pyrene, Chrysene, Benzo(b)Fluoranthrene, and Benzo(a)pyrene for the duplicate analysis of Sample L20703-6 were 200%. These parameters were detected just above the RDL in the lab duplicate but not in the original sample, resulting in an RPD of 200%. All results for these parameters have been flagged with an "E" for Samples L20703-1 through –8.

2. PCBs
   No RPD limits were exceeded for the compounds reported.

TABLE 1
SEDIMENT SAMPLE INVENTORY

Sample	Locator / Description (see SAP)	PSD	Solids	TOC	Metals[1]	BNA[2]	PCB	Comments
L20703-1	NFK501/Norfolk CSO channel, 0-2inches	X	X	X	X	X	X	
L20703-2	NFK501/Norfolk CSO channel, 0-10 inches	X	X	X	X	X	X	
L20703-3	NFK502/Delta of CSO channel, 0-2 inches	X	X	X	X	X	X	
L20703-4	NFK502/Delta of CSO channel, c0-10 inches	X	X	X	X	X	X	
L20703-5	NFK503/Boeing SD channel, 0-2 inches	X	X	X	X	X	X	
L20703-6	NFK503/Boeing SD channel, 0-10 inches	X	X	X	X	X	X	
L20703-7	NFK504/Upriver of CSO, 0-2 inches	X	X	X	X	X	X	
L20703-8	NFK504/Upriver of CSO, 0-10 inches	X	X	X	X	X	X	

1 Metals = Hg, Al, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Tl, Zn, Fe
2 BNA = includes Chlorobenzenes

TABLE 2
QC SAMPLE FREQUENCY FOR SEDIMENT CHEMICAL AND PHYSICAL PARAMETERS

Parameter	Method Blank	Duplicate	Triplicate	Matrix Spike	SRM	Surrogates
PSD	No	10% of samples	10% of samples	No	No	No
Total Solids	1 per QC batch	5% minimum, 1 per QC batch	5% minimum, 1 per QC batch	No	No	No
TOC	1 per QC batch	5% minimum, 1 per QC batch	5% minimum, 1 per QC batch	No	1 per QC batch	No
Metals	1 per QC batch	5% minimum, 1 per QC batch	No	5% minimum, 1 per QC batch	1 per QC batch	No
BNA (w/ Chlorobenzenes)	1 per QC batch	5% minimum, 1 per QC batch	No	5% minimum, 1 per QC batch	1 per QC batch	Yes
PCB	1 per QC batch	5% minimum, 1 per QC batch	No	5% minimum, 1 per QC batch	1 per QC batch	Yes

TABLE 3 - SUMMARY OF SEDIMENT DATA QUALIFIERS

Condition to Qualify	Flag	Organic QC Limits	Metal QC Limits	Conventional QC Limits	Comment
very low matrix spike recovery	X	< 10 %	< 10 %	< 10 %	
low matrix spike recovery	G	< 50%	< 75%	< 75% *	
high matrix spike recovery	L	> 150%	>125%	>125% *	
low standard reference material recovery	G	< 80%	NA	< 80%	
high standard reference material recovery	L	>120%	>120%	>120%	
high duplicate relative percent difference	E	>100 %	>20%	NA	for organics and metals
high triplicate relative standard deviation	E	NA	NA	> 20 %	for conventionals
less than the reporting detection limit	<RDL **	NA	NA	NA	
less than the method detection limit	<MDL **	NA	NA	NA	
contamination reported in blank	B	>MDL	>MDL	>MDL	
biased data based on very low surrogate recoveries	X	all fraction surrogates <10%	NA	NA	average surrogate recovery for BNA
biased data based on low surrogate recoveries	G	all fraction surrogates <50%	NA	NA	average surrogate recovery for BNA
biased data based on high surrogate recoveries	L	all fraction surrogates >150%	NA	NA	average surrogate recovery for BNA
rejected - unusable for all purposes	R	NA	NA	NA	
a sample handling criteria has not been met	H	NA	NA	NA	container, hold time, preservation

65% to 135% for Total Sulfides.

** For Sedqual files, <MDL uses a "U" flag, <RDL is not flagged.

CONVENTIONAL ANALYSES QC DATA

CONVENTIONAL ANALYSES QC DATA

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

Jun 15 2001, 08:48 am

Work Group: WG55212 (norfolk TOC sed.) for Department: 3 - Conventionals

Created: 08-MAY-01 Due: Operator: gmw

Sample	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
L20703-1	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
L20703-2	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
L20703-3	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
L20703-4	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
L20703-5	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
L20703-6	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
L20703-7	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
L20703-8	423056-160	Norfolk Cleanup Study	SED	S	TOC	SALTWTRSED	DONE	U	22-MAY-01	08-JUN-01
WG55212-1	MB			S	TOC	OTHR SOLID	DONE	U	25-MAY-01	
WG55212-2	SRM			S	TOC	OTHR SOLID	DONE	U	25-MAY-01	
WG55212-3	LD		SED	S	TOC	SALTWTRSED	DONE	U	25-MAY-01	
WG55212-4	LT		SED	S	TOC	SALTWTRSED	DONE	U	25-MAY-01	

Comments:

L20703-1	3-Grab Composite, 0 - 2 cm
L20703-2	3-Grab Composite, 0 - 10 cm
L20703-3	3-Grab Composite, 0 - 2 cm
L20703-4	3-Grab Composite, 0 - 10 cm
L20703-5	3-Grab Composite, 0 - 2 cm
L20703-6	3-Grab Composite, 0 - 10 cm
L20703-7	3-Grab Composite, 0 - 2 cm
L20703-8	3-Grab Composite, 0 - 10 cm
WG55212-2	HICONC
WG55212-3	L20703-1
WG55212-4	WG55212-3 L20703-1

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/15/01 08:50
Run ID: R66822 Workgroup: WG55212 (norfolk TOC sed.)

MB:WG55212-1 Matrix: OTHR SOLID Listtype: CVTOC Method: EPA9060-PSEP96 (03-04-002-001) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Total Organic Carbon	500	1000	mg/Kg	<MDL	

SRM:WG55212-2 Matrix: OTHR SOLID Listtype: CVTOC Method: EPA9060-PSEP96 (03-04-002-001) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Total Organic Carbon	500	1000	mg/Kg		33480	32900	98		80-120			

LD:WG55212-3 LT:WG55212-4 L20703-1 Matrix: SALTWTRSED Listtype: CVTOC Method: EPA9060-PSEP96 (03-04-002-001) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	Truevalue	LT Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Total Organic Carbon	500	1000	mg/Kg	5600		5850					5520				3		20

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

Jun 15 2001, 08:49 am

Work Group: WG55211 (norfolk TOTS) for Department: 3 - Conventionals

Created: 08-MAY-01 Due: Operator: gmw

Sample	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
L20703-1	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
L20703-2	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
L20703-3	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
L20703-4	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
L20703-5	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
L20703-6	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
L20703-7	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
L20703-8	423056-160	Norfolk Cleanup Study	SED	S	TOTS	SALTWTRSED	DONE	U	01-MAY-01	08-JUN-01
WG55211-1	MB			S	TOTS	OTHR SOLID	DONE	U	08-MAY-01	
WG55211-2	LD		SED	S	TOTS	SALTWTRSED	DONE	U	08-MAY-01	
WG55211-3	LT		SED	S	TOTS	SALTWTRSED	DONE	U	08-MAY-01	

Comments:

L20703-1	3-Grab Composite, 0 - 2 cm
L20703-2	3-Grab Composite, 0 - 10 cm
L20703-3	3-Grab Composite, 0 - 2 cm
L20703-4	3-Grab Composite, 0 - 10 cm
L20703-5	3-Grab Composite, 0 - 2 cm
L20703-6	3-Grab Composite, 0 - 10 cm
L20703-7	3-Grab Composite, 0 - 2 cm
L20703-8	3-Grab Composite, 0 - 10 cm
WG55211-2	L20703-2
WG55211-3	WG55211-2 L20703-2

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/15/01 08:51
Run ID: R66144 Workgroup: WG55211 (norfolk TOTS)

MB:WG55211-1 Matrix: OTHR SOLID Listtype: CVTOTS Method: SM2540-G (03-01-007-001) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Total Solids	.005	.01	%	<MDL	

LD:WG55211-2 LT:WG55211-3 L20703-2 Matrix: SALTWTRSED Listtype: CVTOTS Method: SM2540-G (03-01-007-001) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	Truevalue	LT Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Total Solids	.005	.01	%	65.4		65.7					65.4				0		20

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

Jun 15 2001, 08:49 am

Work Group: WG55197 (Norfolk PSD (ROSA)) for Department: 3 - Conventionals

Created: 07-MAY-01 Due: Operator: BP

Sample	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
L20703-1	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01
L20703-2	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01
L20703-3	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01
L20703-4	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01
L20703-5	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01
L20703-6	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01
L20703-7	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01
L20703-8	423056-160	Norfolk Cleanup Study	SED	S	PSD	SALTWTRSED	DONE	U	08-JUN-01	08-JUN-01

Comments:

L20703-1 3-Grab Composite, 0 - 2 cm
L20703-2 3-Grab Composite, 0 - 10 cm
L20703-3 3-Grab Composite, 0 - 2 cm
L20703-4 3-Grab Composite, 0 - 10 cm
L20703-5 3-Grab Composite, 0 - 2 cm
L20703-6 3-Grab Composite, 0 - 10 cm
L20703-7 3-Grab Composite, 0 - 2 cm
L20703-8 3-Grab Composite, 0 - 10 cm

LD, LT performed on L20703-2
TS
6/15/01

Rosa Environmental and Geotechnical Laboratory, LLC

QA SUMMARY

PROJECT: King County Environmental Lab		Project No.: 423056-160
REGL Triplicate Sample ID:	22822	Batch No.: 1011-022 -01
Client Triplicate Sample ID:	L20703-2	Page: 1 of 1

Relative Standard Deviation, By Component

Sample ID	Gravel	Sand	Silt	Clay
L20703-2 A	0.9	78.8	16.6	3.7
L20703-2 B	0.3	77.3	18.6	3.8
L20703-2 C	0.2	78.4	17.4	4.0
AVE	0.44	78.21	17.51	3.84
STDEV	0.40	0.77	0.99	0.17
%RSD	89.72	0.99	5.67	4.43

Notes to the Testing:

1. See narrative for discussion of testing.
2. The shaded box represents <10% of the sample. The QC sample does not need to be re-analyzed, since it is assumed higher variability, is due to the low level of this category in the sample rather than a systematic failure. Please refer to subcontract agreement Section 3.3.5.2 for the full explanation.

METAL CHEMISTRY QC DATA

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 07/12/01 07:06
Run ID: R67265 Workgroup: WG55349 (5/15/01 Norfolk Seds)

SB:WG55349-1 MB:WG55349-2 Matrix: BLANK WTR Listtype: MTICP-SED Method: EPA3050A/6010B (06-01-004-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limit
Silver, Total, ICP	.004	.02	mg/L	<MDL	1.2	1.12	93		85-115								
Aluminum, Total, ICP	.1	.5	mg/L	<MDL	12	11.2	93		85-115								
Arsenic, Total, ICP	.05	.25	mg/L	<MDL	4	3.72	93		85-115								
Beryllium, Total, ICP	.001	.005	mg/L	<MDL	0.4	.383	96		85-115								
Cadmium, Total, ICP	.003	.015	mg/L	<MDL	1.2	1.09	91		85-115								
Chromium, Total, ICP	.005	.025	mg/L	<MDL	1.2	1.14	95		85-115								
Copper, Total, ICP	.004	.02	mg/L	<MDL	1.2	1.15	96		85-115								
Iron, Total, ICP	.05	.25	mg/L	<MDL	50	45.2	90		85-115								
Manganese, Total, ICP	.002	.01	mg/L	<MDL	4	3.84	96		85-115								
Nickel, Total, ICP	.02	.1	mg/L	<MDL	1.2	1.11	92		85-115								
Lead, Total, ICP	.03	.15	mg/L	<MDL	4	3.71	93		85-115								
Selenium, Total, ICP	.05	.25	mg/L	<MDL	2	1.9	95		85-115								
Thallium, Total, ICP	.2	1	mg/L	<MDL	4	3.72	93		85-115								
Zinc, Total, ICP	.005	.025	mg/L	<MDL	4.5	4.5	100		85-115								

MB:WG55349-2 Matrix: BLANK WTR Listtype: MTICP-SED Method: EPA3050A/6010B (06-02-004-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Silver, Total, ICP	.004	.02	mg/L	<MDL	
Aluminum, Total, ICP	.1	.5	mg/L	<MDL	
Arsenic, Total, ICP	.05	.25	mg/L	<MDL	
Beryllium, Total, ICP	.001	.005	mg/L	<MDL	
Cadmium, Total, ICP	.003	.015	mg/L	<MDL	
Chromium, Total, ICP	.005	.025	mg/L	<MDL	
Copper, Total, ICP	.004	.02	mg/L	<MDL	
Iron, Total, ICP	.05	.25	mg/L	<MDL	
Manganese, Total, ICP	.002	.01	mg/L	<MDL	
Nickel, Total, ICP	.02	.1	mg/L	<MDL	
Lead, Total, ICP	.03	.15	mg/L	<MDL	
Selenium, Total, ICP	.05	.25	mg/L	<MDL	
Thallium, Total, ICP	.2	1	mg/L	<MDL	
Zinc, Total, ICP	.005	.025	mg/L	<MDL	

SRM:WG55349-3 Matrix: SALTWTRSED Listtype: MTICP-SED Method: EPA3050A/6010B (06-02-004-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limit
Arsenic, Total, ICP	12	59.5	mg/Kg		211	162	77		120			
Cadmium, Total, ICP	.71	3.57	mg/Kg		2.38	1.9	79		120			
Chromium, Total, ICP	1.2	5.95	mg/Kg		113	56.1	50		120			
Copper, Total, ICP	.95	4.76	mg/Kg		452	402	89		120			
Manganese, Total, ICP	.48	2.38	mg/Kg		470	273	58		120			
Nickel, Total, ICP	4.8	23.8	mg/Kg		44.1	31.3	71		120			
Lead, Total, ICP	7.1	35.7	mg/Kg		404	362	90		120			
Selenium, Total, ICP	12	59.5	mg/Kg		1.09	<MDL	0		120			
Zinc, Total, ICP	1.2	5.95	mg/Kg		824	734	89		120			

note: True value less than the MDL

[illegible] 9/5/01

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 07/12/01 07:06
Run ID: R67265 Workgroup: WG55349 (5/15/01 Norfolk Seds)

LCS CBE 9/5/01

SRM:WG55349-4 Matrix: SOIL Listtype: MTICP-SED Method: EPA3050A/6010B (06-02-004-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Silver, Total, ICP	.99	4.94	mg/Kg		107	110	102		120			
Aluminum, Total, ICP	25	124	mg/Kg		4800	4740	99		120			
Arsenic, Total, ICP	12	61.8	mg/Kg		53.2	52	99		120			
Beryllium, Total, ICP	.25	1.24	mg/Kg		68.3	69.1	101		120			
Cadmium, Total, ICP	.74	3.71	mg/Kg		151	158	105		120			
Chromium, Total, ICP	1.2	6.18	mg/Kg		99.4	97	98		120			
Copper, Total, ICP	.99	4.94	mg/Kg		59.2	59.5	101		120			
Iron, Total, ICP	12	61.8	mg/Kg		9880	11000	111		120			
Manganese, Total, ICP	.49	2.47	mg/Kg		218	228	105		120			
Nickel, Total, ICP	4.9	24.7	mg/Kg		63.3	62.8	99		120			
Lead, Total, ICP	7.4	37.1	mg/Kg		97.8	110	112		120			
Selenium, Total, ICP	12	61.8	mg/Kg		143	143	100		120			
Thallium, Total, ICP	49	247	mg/Kg		103	110	103		120			
Zinc, Total, ICP	1.2	6.18	mg/Kg		123	122	99		120			

LD:WG55349-5 L20703-7 Matrix: SALTWTRSED Listtype: MTICP-SED Method: EPA3050A/6010B (06-02-004-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Silver, Total, ICP	.2	.99	mg/Kg	<MDL		<MDL						20
Aluminum, Total, ICP	4.9	24.7	mg/Kg	7510		7280				3		20
Arsenic, Total, ICP	2.5	12.4	mg/Kg	<MDL		<MDL						20
Beryllium, Total, ICP	.049	.247	mg/Kg	.2		.19						20
Cadmium, Total, ICP	.15	.742	mg/Kg	<MDL		<MDL						20
Chromium, Total, ICP	.25	1.24	mg/Kg	11.1		11.2				1		20
Copper, Total, ICP	.2	.99	mg/Kg	13.1		12.8				2		20
Iron, Total, ICP	2.5	12.4	mg/Kg	13600		13300				2		20
Manganese, Total, ICP	.099	.495	mg/Kg	226		222				2		20
Nickel, Total, ICP	.99	4.95	mg/Kg	9.28		9.4				1		20
Lead, Total, ICP	1.5	7.42	mg/Kg	9.51		8.45				12		20
Selenium, Total, ICP	2.5	12.4	mg/Kg	<MDL		<MDL						20
Thallium, Total, ICP	9.9	49.5	mg/Kg	<MDL		<MDL						20
Zinc, Total, ICP	.25	1.24	mg/Kg	36		36.2				0		20

MS:WG55349-6 L20703-7 Matrix: SALTWTRSED Listtype: MTICP-SED Method: EPA3050A/6010B (06-02-004-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Silver, Total, ICP	.2	1.02	mg/Kg	<MDL	1.2	55.6	91		75-125			
Aluminum, Total, ICP	5.1	25.5	mg/Kg	7510	12	9950	401	L	75-125			
Arsenic, Total, ICP	2.5	12.7	mg/Kg	<MDL	4	185	91		75-125			
Beryllium, Total, ICP	.051	.255	mg/Kg	.2	.4	18.9	92		75-125			
Cadmium, Total, ICP	.15	.764	mg/Kg	<MDL	1.2	54.6	89		75-125			
Chromium, Total, ICP	.26	1.27	mg/Kg	11.1	1.2	66.6	91		75-125			
Copper, Total, ICP	.2	1.02	mg/Kg	13.1	1.2	69.5	92		75-125			
Iron, Total, ICP	2.5	12.7	mg/Kg	13600	50	15200	65	G	75-125			
Manganese, Total, ICP	.1	.509	mg/Kg	226	4	414	92		75-125			
Nickel, Total, ICP	1	5.09	mg/Kg	9.28	1.2	63	88		75-125			

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 07/12/01 07:06
Run ID: R67265 Workgroup: WG55349 (5/15/01 Norfolk Seds)

MS:WG55349-6 L20703-7 Matrix: SALTWTRSED Listtype: MTICP-SED Method: EPA3050A/6010B (06-02-004-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits					RPD/RSD	Qual	Limit
Lead, Total, ICP	1.5	7.64	mg/Kg	9.51	4	191	89		75-125							
Selenium, Total, ICP	2.5	12.7	mg/Kg	<MDL	2	93.4	93		75-125							
Thallium, Total, ICP	10	50.9	mg/Kg	<MDL	4	183	90		75-125							
Zinc, Total, ICP	.25	1.27	mg/Kg	36	4.5	266	100		75-125							

SDIL:WG55349-7 Matrix: SALTWTRSED Listtype: MTICP-SED Method: EPA3050A/60103 (06-02-004-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SDIL Value	% Rec.	Qual	Limits					RPD/RSD	Qual	Limi

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 05/16/01 08:50
Run ID: R66294 Workgroup: WG55347 (5/15/01 Fort Dent Water Reuse)

MB:WG55347-1 Matrix: BLANK WTR Listtype: MTHG-SED Method: EPA 245.5 (06-01-004-003) Project: 423258-10 PKey: STD

Parameter	Mdl	Rdl	Units	MB Value	Qual
Mercury, Total, CVAA	.0002	.002	mg/L	<MDL	

SB:WG55347-2 ME:WG55347-1 Matrix: BLANK WTR Listtype: MTHG-SED Method: EPA 245.5 (06-01-004-003) Project: PKey: STD

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limit
Mercury, Total, CVAA	.0002	.002	mg/L	<MDL	0.005	.00516	103		85-115								

SRM:WG55347-3 Matrix: SOIL Listtype: MTHG-SED Method: EPA 245.5 (06-01-004-003) Project: PKey: STD

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limit
Mercury, Total, CVAA	.094	.943	mg/Kg		6.25	5	80		80-120			

LD:WG55347-4 L20771-12 Matrix: SOIL Listtype: MTHG-SED Method: EPA 245.5 (06-01-004-003) Project: 423258-10 PKey: STD

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limit
Mercury, Total, CVAA	.02	.198	mg/Kg	<MDL		<MDL						20

MS:WG55347-5 L20771-12 Matrix: SOIL Listtype: MTHG-SED Method: EPA 245.5 (06-01-004-003) Project: 423258-10 PKey: STD

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limit
Mercury, Total, CVAA	.02	.198	mg/Kg	<MDL	.005	.514	104		80-120			

ORGANIC CHEMISTRY QC DATA

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

May 15 2001, 10:33 am

Work Group: WG55264 (BS#110-bnall) for Department: 7 - Organics, Trace

Created: 10-MAY-01 Due: Operator: lm/mm

Sample	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
L20703-1	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-2	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-3	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-4	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-5	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-6	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-7	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-8	423056-160	Norfolk Cleanup Study	SED	S	BNALL	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
WG55264-1	MB			S	BNALL	OTHR SOLID	PREP	U	10-MAY-01	
WG55264-2	SB			S	BNALL	OTHR SOLID	PREP	U	10-MAY-01	
WG55264-3	MS		SED	S	BNALL	SALTWTRSED	PREP	U	10-MAY-01	
WG55264-4	MSD		SED	S	BNALL	SALTWTRSED	PREP	U	10-MAY-01	
WG55264-5	LD		SED	S	BNALL	SALTWTRSED	PREP	U	10-MAY-01	
WG55264-6	SRM			S	BNALL	OTHR SOLID	PREP	U	10-MAY-01	

Comments:

L20703-1	3-Grab Composite, 0 - 2 cm
L20703-2	3-Grab Composite, 0 - 10 cm
L20703-3	3-Grab Composite, 0 - 2 cm
L20703-4	3-Grab Composite, 0 - 10 cm
L20703-5	3-Grab Composite, 0 - 2 cm
L20703-6	3-Grab Composite, 0 - 10 cm
L20703-7	3-Grab Composite, 0 - 2 cm
L20703-8	3-Grab Composite, 0 - 10 cm
WG55264-1	MB051001
WG55264-2	WG55264-1
WG55264-3	L20703-5
WG55264-4	WG55264-3 L20703-5
WG55264-5	L20703-6
WG55264-6	1944

7-3-01

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/29/01 09:39
Run ID: R68341 Workgroup: WG55264 (BS#110-bnall)

MB:WG55264-1 Matrix: OTHR SOLID Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
N-Nitrosodimethylamine	20	40	ug/Kg	<MDL	
Phenol	9	18	ug/Kg	<MDL	
Bis(2-Chloroethyl)Ether	15	30	ug/Kg	<MDL	
2-Chlorophenol	8	16	ug/Kg	<MDL	
1,3-Dichlorobenzene	.26	.53	ug/Kg	<MDL	
1,4-Dichlorobenzene	.13	.264	ug/Kg	<MDL	
1,2-Dichlorobenzene	.26	.53	ug/Kg	<MDL	
Bis(2-Chloroisopropyl)Ether	15	30	ug/Kg	<MDL	
N-Nitrosodi-N-Propylamine	9	18	ug/Kg	<MDL	
Hexachloroethane	15	30	ug/Kg	<MDL	
Nitrobenzene	16	32	ug/Kg	<MDL	
Isophorone	19	38	ug/Kg	<MDL	
2-Nitrophenol	15	30	ug/Kg	<MDL	
2,4-Dimethylphenol	7	14	ug/Kg	<MDL	
Bis(2-Chloroethoxy)Methane	17	34	ug/Kg	<MDL	
2,4-Dichlorophenol	16	32	ug/Kg	<MDL	
1,2,4-Trichlorobenzene	.26	.53	ug/Kg	<MDL	
Naphthalene	14	28	ug/Kg	<MDL	
Hexachlorobutadiene	.75	1.5	ug/Kg	<MDL	
2,4,6-Trichlorophenol	13	26	ug/Kg	<MDL	
2-Chloronaphthalene	16	32	ug/Kg	<MDL	
Acenaphthylene	15	30	ug/Kg	<MDL	
Dimethyl Phthalate	11	22	ug/Kg	<MDL	
2,6-Dinitrotoluene	10	20	ug/Kg	<MDL	
Acenaphthene	7	14	ug/Kg	<MDL	
2,4-Dinitrotoluene	3	6	ug/Kg	<MDL	
Fluorene	13	26	ug/Kg	<MDL	
Diethyl Phthalate	6	12	ug/Kg	<MDL	
4-Chlorophenyl Phenyl Ether	13	26	ug/Kg	<MDL	
N-Nitrosodiphenylamine	20	40	ug/Kg	<MDL	
1,2-Diphenylhydrazine	10	20	ug/Kg	<MDL	
4-Bromophenyl Phenyl Ether	9	18	ug/Kg	<MDL	
Hexachlorobenzene	.66	1.33	ug/Kg	<MDL	
Pentachlorophenol	5	10	ug/Kg	<MDL	
Phenanthrene	4	8	ug/Kg	<MDL	
Anthracene	4	8	ug/Kg	<MDL	
Di-N-Butyl Phthalate	5	10	ug/Kg	15.1	B
Fluoranthene	8	16	ug/Kg	<MDL	
Pyrene	4	8	ug/Kg	<MDL	
Benzyl Butyl Phthalate	6	12	ug/Kg	<MDL	
Benzo(a)anthracene	2	4	ug/Kg	<MDL	
Chrysene	4	8	ug/Kg	<MDL	
Bis(2-Ethylhexyl)Phthalate	6.7	14	ug/Kg	14.5	B
Di-N-Octyl Phthalate	8	16	ug/Kg	<MDL	
Benzo(b)fluoranthene	3	6	ug/Kg	<MDL	
Benzo(k)fluoranthene	3	6	ug/Kg	<MDL	
Benzo(a)pyrene	3	6	ug/Kg	<MDL	
Indeno(1,2,3-Cd)Pyrene	9	18	ug/Kg	<MDL	
Dibenzo(a,h)anthracene	7	14	ug/Kg	<MDL	
Benzo(g,h,i)perylene	8	16	ug/Kg	<MDL	
Aniline	19	38	ug/Kg	<MDL	

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/29/01 09:39
Run ID: R68341 Workgroup: WG55264 (BS#110-bnall)

MB:WG55264-1 Matrix: OTHR SOLID Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Benzyl Alcohol	6	12	ug/Kg	<MDL	
2-Methylphenol	19	38	ug/Kg	<MDL	
4-Methylphenol	16	32	ug/Kg	<MDL	
Benzoic Acid	6	12	ug/Kg	<MDL	
2-Methylnaphthalene	14	28	ug/Kg	<MDL	
2,4,5-Trichlorophenol	12	24	ug/Kg	<MDL	
Dibenzofuran	14	28	ug/Kg	<MDL	
Carbazole	7	14	ug/Kg	<MDL	
Coprostanol	14	28	ug/Kg	<MDL	
Caffeine	6	12	ug/Kg	<MDL	

SB:WG55264-2 MB:WG55264-1 Matrix: OTHR SOLID Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
N-Nitrosodimethylamine	20	40	ug/Kg	<MDL	66.6667	57.3	86		50-150								100
Phenol	9	18	ug/Kg	<MDL	66.6667	24.3	36	*	50-150								100
Bis(2-Chloroethyl)Ether	15	30	ug/Kg	<MDL	66.6667	36.3	54		50-150								100
2-Chlorophenol	8	16	ug/Kg	<MDL	66.6667	30.1	45	*	50-150								100
1,3-Dichlorobenzene	.26	.53	ug/Kg	<MDL	66.6667	39.8	60		50-150								100
1,4-Dichlorobenzene	.13	.264	ug/Kg	<MDL	66.6667	39.4	59		50-150								100
1,2-Dichlorobenzene	.26	.53	ug/Kg	<MDL	66.6667	40.4	61		50-150								100
Bis(2-Chloroisopropyl)Ether	15	30	ug/Kg	<MDL	66.6667	38.9	58		50-150								100
N-Nitrosodi-N-Propylamine	9	18	ug/Kg	<MDL	66.6667	49	74		50-150								100
Hexachloroethane	15	30	ug/Kg	<MDL	66.6667	44.7	67		50-150								100
Nitrobenzene	16	32	ug/Kg	<MDL	66.6667	55.4	83		50-150								100
Isophorone	19	38	ug/Kg	<MDL	66.6667	68.4	103		50-150								100
2-Nitrophenol	15	30	ug/Kg	<MDL	66.6667	41.5	62		50-150								100
2,4-Dimethylphenol	7	14	ug/Kg	<MDL	66.6667	<MDL	0	*	50-150								100
Bis(2-Chloroethoxy)Methane	17	34	ug/Kg	<MDL	66.6667	41.4	62		50-150								100
2,4-Dichlorophenol	16	32	ug/Kg	<MDL	66.6667	35.7	53		50-150								100
1,2,4-Trichlorobenzene	.26	.53	ug/Kg	<MDL	66.6667	39.9	60		50-150								100
Naphthalene	14	28	ug/Kg	<MDL	66.6667	41.5	62		50-150								100
Hexachlorobutadiene	.75	1.5	ug/Kg	<MDL	66.6667	41.7	62		50-150								100
2,4,6-Trichlorophenol	13	26	ug/Kg	<MDL	66.6667	30	45	*	50-150								100
2-Chloronaphthalene	16	32	ug/Kg	<MDL	66.6667	40.5	61		50-150								100
Acenaphthylene	15	30	ug/Kg	<MDL	66.6667	59.4	89		50-150								100
Dimethyl Phthalate	11	22	ug/Kg	<MDL	66.6667	42.1	63		50-150								100
2,6-Dinitrotoluene	10	20	ug/Kg	<MDL	66.6667	50.3	75		50-150								100
Acenaphthene	7	14	ug/Kg	<MDL	66.6667	41.5	62		50-150								100
2,4-Dinitrotoluene	3	6	ug/Kg	<MDL	66.6667	53.5	80		50-150								100
Fluorene	13	26	ug/Kg	<MDL	66.6667	48.9	73		50-150								100
Diethyl Phthalate	6	12	ug/Kg	<MDL	66.6667	53.7	81		50-150								100
4-Chlorophenyl Phenyl Ether	13	26	ug/Kg	<MDL	66.6667	45	67		50-150								100
N-Nitrosodiphenylamine	20	40	ug/Kg	<MDL	66.6667	<MDL	0	*	50-150								100
1,2-Diphenylhydrazine	10	20	ug/Kg	<MDL	66.6667	79	119		50-150								100
4-Bromophenyl Phenyl Ether	9	18	ug/Kg	<MDL	66.6667	53.3	80		50-150								100
Hexachlorobenzene	.66	1.33	ug/Kg	<MDL	66.6667	46.1	69		50-150								100
Pentachlorophenol	5	10	ug/Kg	<MDL	66.6667	63.4	95		50-150								100
Phenanthrene	4	8	ug/Kg	<MDL	66.6667	51	77		50-150								100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/29/01 09:39
Run ID: R68341 Workgroup: WG55264 (BS#110-bnall)

SB:WG55264-2 MB:WG55264-1 Matrix: OTHR SOLID Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Anthracene	4	8	ug/Kg	<MDL	66.6667	57.7	87		50-150								100
Di-N-Butyl Phthalate	5	10	ug/Kg	15.1	66.6667	70.6	83		50-150								100
Fluoranthene	8	16	ug/Kg	<MDL	66.6667	68.4	103		50-150								100
Pyrene	4	8	ug/Kg	<MDL	66.6667	62.5	94		50-150								100
Benzyl Butyl Phthalate	6	12	ug/Kg	<MDL	66.6667	65.1	98		50-150								100
Benzo(a)anthracene	2	4	ug/Kg	<MDL	66.6667	63.1	95		50-150								100
Chrysene	4	8	ug/Kg	<MDL	66.6667	58.9	88		50-150								100
Bis(2-Ethylhexyl)Phthalate	6.7	14	ug/Kg	14.5	66.6667	70.7	84		50-150								100
Di-N-Octyl Phthalate	8	16	ug/Kg	<MDL	66.6667	57.3	86		50-150								100
Benzo(b)fluoranthene	3	6	ug/Kg	<MDL	66.6667	70.6	106		50-150								100
Benzo(k)fluoranthene	3	6	ug/Kg	<MDL	66.6667	67.3	101		50-150								100
Benzo(a)pyrene	3	6	ug/Kg	<MDL	66.6667	49.8	75		50-150								100
Indeno(1,2,3-Cd)Pyrene	9	18	ug/Kg	<MDL	66.6667	55.8	84		50-150								100
Dibenzo(a,h)anthracene	7	14	ug/Kg	<MDL	66.6667	53.9	81		50-150								100
Benzo(g,h,i)perylene	8	16	ug/Kg	<MDL	66.6667	52.1	78		50-150								100
Aniline	19	38	ug/Kg	<MDL	66.6667	<MDL	0	*	50-150								100
Benzyl Alcohol	6	12	ug/Kg	<MDL	66.6667	12.4	19	*	50-150								100
2-Methylphenol	19	38	ug/Kg	<MDL	66.6667	<MDL	0	*	50-150								100
4-Methylphenol	16	32	ug/Kg	<MDL	66.6667	<MDL	0	*	50-150								100
Benzoic Acid	6	12	ug/Kg	<MDL	66.6667	27.3	41	*	50-150								100
2-Methylnaphthalene	14	28	ug/Kg	<MDL	66.6667	46.1	69		50-150								100
2,4,5-Trichlorophenol	12	24	ug/Kg	<MDL	66.6667	38.2	57		50-150								100
Dibenzofuran	14	28	ug/Kg	<MDL	66.6667	45.6	68		50-150								100
Carbazole	7	14	ug/Kg	<MDL	66.6667	71.5	107		50-150								100
Coprostanol	14	28	ug/Kg	<MDL	666.6667	455	68		50-150								100
Caffeine	6	12	ug/Kg	<MDL	66.6667	94.2	141		50-150								100

MS:WG55264-3 MSD:WG55264-4 L20703-5 Matrix: SALTWTRSED Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
N-Nitrosodimethylamine	20	40	ug/Kg	<MDL	66.6667	32	48	G	50-150	66.6667	36	54		50-150			100
Phenol	9	18	ug/Kg	<MDL	66.6667	27.2	41	G	50-150	66.6667	25.4	38	*	50-150	8		100
Bis(2-Chloroethyl)Ether	15	30	ug/Kg	<MDL	66.6667	26	40	G	50-150	66.6667	26	39	*	50-150			100
2-Chlorophenol	8	16	ug/Kg	<MDL	66.6667	28.3	43	G	50-150	66.6667	27.4	41	*	50-150	5		100
1,3-Dichlorobenzene	.26	.53	ug/Kg	<MDL	66.6667	23.6	35	G	50-150	66.6667	25.5	38	*	50-150	8		100
1,4-Dichlorobenzene	.13	.264	ug/Kg	<MDL	66.6667	23	35	G	50-150	66.6667	25.7	39	*	50-150	11		100
1,2-Dichlorobenzene	.26	.53	ug/Kg	<MDL	66.6667	24.3	36	G	50-150	66.6667	25.8	39	*	50-150	8		100
Bis(2-Chloroisopropyl)Ether	15	30	ug/Kg	<MDL	66.6667	40.1	60		50-150	66.6667	36.2	54		50-150	11		100
N-Nitrosodi-N-Propylamine	9	18	ug/Kg	<MDL	66.6667	50.1	75		50-150	66.6667	52.7	79		50-150	5		100
Hexachloroethane	15	30	ug/Kg	<MDL	66.6667	28	41	G	50-150	66.6667	29	44	*	50-150			100
Nitrobenzene	16	32	ug/Kg	<MDL	66.6667	41.4	62		50-150	66.6667	40.4	61		50-150	2		100
Isophorone	19	38	ug/Kg	<MDL	66.6667	66.4	100		50-150	66.6667	60.5	91		50-150	9		100
2-Nitrophenol	15	30	ug/Kg	<MDL	66.6667	34.2	51		50-150	66.6667	33.6	50		50-150	2		100
2,4-Dimethylphenol	7	14	ug/Kg	<MDL	66.6667	39.8	60		50-150	66.6667	27.4	41	*	50-150	38		100
Bis(2-Chloroethoxy)Methane	17	34	ug/Kg	<MDL	66.6667	35.2	53		50-150	66.6667	32	48	*	50-150	10		100
2,4-Dichlorophenol	16	32	ug/Kg	<MDL	66.6667	49.4	74		50-150	66.6667	43.5	65		50-150	13		100
1,2,4-Trichlorobenzene	.26	.53	ug/Kg	<MDL	66.6667	29.7	44	G	50-150	66.6667	27.2	41	*	50-150	7		100
Naphthalene	14	28	ug/Kg	<MDL	66.6667	32.3	48	G	50-150	66.6667	28.9	43	*	50-150	11		100
Hexachlorobutadiene	.75	1.5	ug/Kg	<MDL	66.6667	29.9	45	G	50-150	66.6667	28.1	42	*	50-150	7		100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/29/01 09:40
Run ID: R68341 Workgroup: WG55264 (BS#110-bnall)

MS:WG55264-3 MSD:WG55264-4 L20703-5 Matrix: SALTWTRSED Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
2,4,6-Trichlorophenol	13	26	ug/Kg	<MDL	66.6667	56.1	84		50-150	66.6667	50.3	75		50-150	11		100
2-Chloronaphthalene	16	32	ug/Kg	<MDL	66.6667	38.4	58		50-150	66.6667	33.1	50		50-150	15		100
Acenaphthylene	15	30	ug/Kg	<MDL	66.6667	69.4	104		50-150	66.6667	59.7	90		50-150	14		100
Dimethyl Phthalate	11	22	ug/Kg	<MDL	66.6667	50.7	76		50-150	66.6667	44.2	66		50-150	14		100
2,6-Dinitrotoluene	10	20	ug/Kg	<MDL	66.6667	62.5	94		50-150	66.6667	57.4	86		50-150	9		100
Acenaphthene	7	14	ug/Kg	<MDL	66.6667	46.6	70		50-150	66.6667	40.4	61		50-150	14		100
2,4-Dinitrotoluene	3	6	ug/Kg	<MDL	66.6667	65	97		50-150	66.6667	57.2	86		50-150	12		100
Fluorene	13	26	ug/Kg	<MDL	66.6667	60.1	90		50-150	66.6667	50.3	75		50-150	18		100
Diethyl Phthalate	6	12	ug/Kg	<MDL	66.6667	60.6	91		50-150	66.6667	51.6	77		50-150	17		100
4-Chlorophenyl Phenyl Ether	13	26	ug/Kg	<MDL	66.6667	52.8	79		50-150	66.6667	43.8	66		50-150	18		100
N-Nitrosodiphenylamine	20	40	ug/Kg	<MDL	66.6667	49	74		50-150	66.6667	43.8	66		50-150	11		100
1,2-Diphenylhydrazine	10	20	ug/Kg	<MDL	66.6667	92.5	139		50-150	66.6667	81.6	122		50-150	13		100
4-Bromophenyl Phenyl Ether	9	18	ug/Kg	<MDL	66.6667	59.9	90		50-150	66.6667	55	82		50-150	9		100
Hexachlorobenzene	.66	1.33	ug/Kg	<MDL	66.6667	54.2	81		50-150	66.6667	47.9	72		50-150	12		100
Pentachlorophenol	5	10	ug/Kg	<MDL	66.6667	61.3	92		50-150	66.6667	49.6	74		50-150	22		100
Phenanthrene	4	8	ug/Kg	6.3	66.6667	74.7	103		50-150	66.6667	58.4	78		50-150	28		100
Anthracene	4	8	ug/Kg	<MDL	66.6667	87.8	132		50-150	66.6667	73.6	110		50-150	18		100
Di-N-Butyl Phthalate	5	10	ug/Kg	23.6	66.6667	90.4	100		50-150	66.6667	78.8	83		50-150	19		100
Fluoranthene	8	16	ug/Kg	18.3	66.6667	128	165	L	50-150	66.6667	90.2	108		50-150	42		100
Pyrene	4	8	ug/Kg	4.4	66.6667	102	146		50-150	66.6667	73.9	104		50-150	34		100
Benzyl Butyl Phthalate	6	12	ug/Kg	<MDL	66.6667	83.9	126		50-150	66.6667	72.1	108		50-150	15		100
Benzo(a)anthracene	2	4	ug/Kg	6.08	66.6667	86.9	121		50-150	66.6667	69.3	95		50-150	24		100
Chrysene	4	8	ug/Kg	5.9	66.6667	80	111		50-150	66.6667	61.5	83		50-150	29		100
Bis(2-Ethylhexyl)Phthalate	6.7	14	ug/Kg	38.1	66.6667	146	161	L	50-150	66.6667	132	141		50-150	13		100
Di-N-Octyl Phthalate	8	16	ug/Kg	<MDL	66.6667	87.1	131		50-150	66.6667	74.2	111		50-150	17		100
Benzo(b)fluoranthene	3	6	ug/Kg	7.92	66.6667	104	144		50-150	66.6667	79.4	107		50-150	29		100
Benzo(k)fluoranthene	3	6	ug/Kg	4.3	66.6667	87.1	124		50-150	66.6667	69.9	98		50-150	23		100
Benzo(a)pyrene	3	6	ug/Kg	<MDL	66.6667	97.8	147		50-150	66.6667	74.7	112		50-150	27		100
Indeno(1,2,3-Cd)Pyrene	9	18	ug/Kg	<MDL	66.6667	59.7	90		50-150	66.6667	49.5	74		50-150	20		100
Dibenzo(a,h)anthracene	7	14	ug/Kg	<MDL	66.6667	50.8	76		50-150	66.6667	43	64		50-150	17		100
Benzo(g,h,i)perylene	8	16	ug/Kg	<MDL	66.6667	52.4	79		50-150	66.6667	43.1	65		50-150	19		100
Aniline	19	38	ug/Kg	<MDL	66.6667	<MDL	0	X	50-150	66.6667	<MDL			50-150			100
Benzyl Alcohol	6	12	ug/Kg	<MDL	66.6667	33.8	51		50-150	66.6667	37.8	57		50-150	11		100
2-Methylphenol	19	38	ug/Kg	<MDL	66.6667	34	51		50-150	66.6667	30	45	*	50-150			100
4-Methylphenol	16	32	ug/Kg	<MDL	66.6667	39.1	59		50-150	66.6667	34.5	52		50-150	13		100
Benzoic Acid	6	12	ug/Kg	60.4	66.6667	104	65		50-150	66.6667	108	72		50-150	10		100
2-Methylnaphthalene	14	28	ug/Kg	<MDL	66.6667	42.5	64		50-150	66.6667	35.1	53		50-150	19		100
2,4,5-Trichlorophenol	12	24	ug/Kg	<MDL	66.6667	60.8	91		50-150	66.6667	54.1	81		50-150	12		100
Dibenzofuran	14	28	ug/Kg	<MDL	66.6667	53.6	80		50-150	66.6667	45.5	68		50-150	16		100
Carbazole	7	14	ug/Kg	<MDL	66.6667	78.5	118		50-150	66.6667	65.3	98		50-150	19		100
Coprostanol	14	28	ug/Kg	<MDL	666.6667	576	86		50-150	666.6667	561	84		50-150	2		100
Caffeine	6	12	ug/Kg	<MDL	66.6667	103	155	L	50-150	66.6667	89.6	134		50-150	15		100

LD:WG55264-5 L20703-6 Matrix: SALTWTRSED Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
N-Nitrosodimethylamine	20	40	ug/Kg	<MDL		<MDL						100
Phenol	9	18	ug/Kg	<MDL		<MDL						100
Bis(2-Chloroethyl)Ether	15	30	ug/Kg	<MDL		<MDL						100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/29/01 09:40
Run ID: R68341 Workgroup: WG55264 (BS#110-bnall)

LD:WG55264-5 L20703-6 Matrix: SALTWTRSED Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
2-Chlorophenol	8	16	ug/Kg	<MDL		<MDL						100
1,3-Dichlorobenzene	.26	.53	ug/Kg	<MDL		<MDL						100
1,4-Dichlorobenzene	.13	.264	ug/Kg	<MDL		<MDL						100
1,2-Dichlorobenzene	.26	.53	ug/Kg	<MDL		<MDL						100
Bis(2-Chloroisopropyl)Ether	15	30	ug/Kg	<MDL		<MDL						100
N-Nitrosodi-N-Propylamine	9	18	ug/Kg	<MDL		<MDL						100
Hexachloroethane	15	30	ug/Kg	<MDL		<MDL						100
Nitrobenzene	16	32	ug/Kg	<MDL		<MDL						100
Isophorone	19	38	ug/Kg	<MDL		<MDL						100
2-Nitrophenol	15	30	ug/Kg	<MDL		<MDL						100
2,4-Dimethylphenol	7	14	ug/Kg	<MDL		<MDL						100
Bis(2-Chloroethoxy)Methane	17	34	ug/Kg	<MDL		<MDL						100
2,4-Dichlorophenol	16	32	ug/Kg	<MDL		<MDL						100
1,2,4-Trichlorobenzene	.26	.53	ug/Kg	<MDL		<MDL						100
Naphthalene	14	28	ug/Kg	<MDL		<MDL						100
Hexachlorobutadiene	.75	1.5	ug/Kg	<MDL		<MDL						100
2,4,6-Trichlorophenol	13	26	ug/Kg	<MDL		<MDL						100
2-Chloronaphthalene	16	32	ug/Kg	<MDL		<MDL						100
Acenaphthylene	15	30	ug/Kg	<MDL		<MDL						100
Dimethyl Phthalate	11	22	ug/Kg	<MDL		<MDL						100
2,6-Dinitrotoluene	10	20	ug/Kg	<MDL		<MDL						100
Acenaphthene	7	14	ug/Kg	<MDL		<MDL						100
2,4-Dinitrotoluene	3	6	ug/Kg	<MDL		<MDL						100
Fluorene	13	26	ug/Kg	<MDL		<MDL						100
Diethyl Phthalate	6	12	ug/Kg	<MDL		<MDL						100
4-Chlorophenyl Phenyl Ether	13	26	ug/Kg	<MDL		<MDL						100
N-Nitrosodiphenylamine	20	40	ug/Kg	<MDL		<MDL						100
1,2-Diphenylhydrazine	10	20	ug/Kg	<MDL		<MDL						100
4-Bromophenyl Phenyl Ether	9	18	ug/Kg	<MDL		<MDL						100
Hexachlorobenzene	.66	1.33	ug/Kg	<MDL		<MDL						100
Pentachlorophenol	5	10	ug/Kg	<MDL		<MDL						100
Phenanthrene	4	8	ug/Kg	<MDL		10.4				200	E	100
Anthracene	4	8	ug/Kg	<MDL		<MDL						100
Di-N-Butyl Phthalate	5	10	ug/Kg	25.1		22.1				13		100
Fluoranthene	8	16	ug/Kg	<MDL		25.5				200	E	100
Pyrene	4	8	ug/Kg	<MDL		18.1				200	E	100
Benzyl Butyl Phthalate	6	12	ug/Kg	<MDL		<MDL						100
Benzo(a)anthracene	2	4	ug/Kg	2.2		5.71				88		100
Chrysene	4	8	ug/Kg	<MDL		8.48				200	E	100
Bis(2-Ethylhexyl)Phthalate	6.7	14	ug/Kg	31.4		50.2				46		100
Di-N-Octyl Phthalate	8	16	ug/Kg	<MDL		<MDL						100
Benzo(b)fluoranthene	3	6	ug/Kg	<MDL		14.6				200	E	100
Benzo(k)fluoranthene	3	6	ug/Kg	<MDL		5.2						100
Benzo(a)pyrene	3	6	ug/Kg	<MDL		8.64				200	E	100
Indeno(1,2,3-Cd)Pyrene	9	18	ug/Kg	<MDL		<MDL						100
Dibenzo(a,h)anthracene	7	14	ug/Kg	<MDL		<MDL						100
Benzo(g,h,i)perylene	8	16	ug/Kg	<MDL		<MDL						100
Aniline	19	38	ug/Kg	<MDL		<MDL						100
Benzyl Alcohol	6	12	ug/Kg	<MDL		<MDL						100
2-Methylphenol	19	38	ug/Kg	<MDL		<MDL						100
4-Methylphenol	16	32	ug/Kg	<MDL		<MDL						100

LD:WG55264-5 L20703-6 Matrix: SALTWTRSED Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Benzoic Acid	6	12	ug/Kg	50.1		46.4				8		100
2-Methylnaphthalene	14	28	ug/Kg	<MDL		<MDL						100
2,4,5-Trichlorophenol	12	24	ug/Kg	<MDL		<MDL						100
Dibenzofuran	14	28	ug/Kg	<MDL		<MDL						100
Carbazole	7	14	ug/Kg	<MDL		<MDL						100
Coprostanol	14	28	ug/Kg	<MDL		<MDL						100
Caffeine	6	12	ug/Kg	<MDL		<MDL						100

SRM:WG55264-6 Matrix: OTHR SOLID Listtype: ORBNALL Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Naphthalene	53	2800	ug/Kg		1629.3333	220	13	G	80-120			100
Phenanthrene	400	800	ug/Kg		5200	4340	84		80-120			100
Anthracene	400	800	ug/Kg		1746.6667	1450	83		80-120			100
Fluoranthene	800	1600	ug/Kg		8802.6667	9780	111		80-120			100
Pyrene	400	800	ug/Kg		9573.3333	8540	89		80-120			100
Benzo(a)anthracene	200	400	ug/Kg		4658.6667	4620	99		80-120			100
Chrysene	400	800	ug/Kg		4797.3333	5240	109		80-120			100
Benzo(b)fluoranthene	300	600	ug/Kg		5882.6667	5890	100		80-120			100
Benzo(k)fluoranthene	300	600	ug/Kg		2269.3333	2260	99		80-120			100
Benzo(a)pyrene	300	600	ug/Kg		4242.6667	4620	109		80-120			100
Indeno(1,2,3-Cd)Pyrene	900	1800	ug/Kg		2744	2230	81		80-120			100
Dibenzo(a,h)anthracene	53	1400	ug/Kg		418.6667	460	110		80-120			100
Benzo(g,h,i)perylene	800	1600	ug/Kg		2802.6667	1850	66	G	80-120			100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/29/01 09:40
Run ID: R68341 Workgroup: WG55264 (BS#110-bnall)

Sample #	2-Fluorophenol		d5-Phenol		d5-Nitrobenzene		d4-2-Chlorophenol	d4-1,2-Dichlorobenzene	2-Fluorobiphenyl	2,4,6-Tribromophenol	d14-Terphenyl
	50-150		50-150		50-150		50-150	50-150	50-150	50-150	50-150
L20703-1	43	avg=57.25	50	avg=60.75	51		55	39	68	81	85
L20703-2	28 G	avg=43.5	31 G	avg=50.5	36		36 G	32	52	79 G	82
L20703-3	31 G	avg=49.25	39 G	avg=54.25	42		42 G	33	59	85 G	83
L20703-4	29	avg=52.75	43	avg=57.5	42		43	36	65	96	87
L20703-5	26 G	avg=44.5	34 G	avg=54.5	46		43 G	21	57	75 G	94
L20703-6	26 G	avg=28	25 G	avg=44.5	34 G		26 G	0 G	47 G	35 G	97 G
L20703-7	28 G	avg=33.25	37 G	avg=46.5	38 G		33 G	0 G	63 G	35 G	85 G
L20703-8	34 G	avg=33.25	38 G	avg=47.5	40 G		30 G	0 G	64 G	31 G	86 G
WG55264-1	36 G	avg=32.5	25 G	avg=73	63		45 G	64	62	24 G	103
WG55264-2	29 G	avg=41.5	36 G	avg=91	83		47 G	74	81	54 G	126
WG55264-3	35	avg=53	37	avg=76	61		46	48	73	94	122
WG55264-4	29 G	avg=47.25	35 G	avg=69	61		43 G	49	65	82 G	101
WG55264-5	33	avg=52.25	34	avg=62.75	52		48	48	58	94	93
WG55264-6	47	avg=61	69	avg=70.25	68		68	51	74	60	88

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

May 10 2001, 11:12 am

Work Group: WG55245 (PPS#234-pcb) for Department: 7 - Organics, Trace

Created: 09-MAY-01 Due: Operator: lm/mm

Sample	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
L20703-1	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-2	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-3	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-4	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-5	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-6	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-7	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
L20703-8	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	08-MAY-01	08-JUN-01
WG55245-1	MB			S	PCB	OTHR SOLID	PREP	U	09-MAY-01	
WG55245-2	SB			S	PCB	OTHR SOLID	PREP	U	09-MAY-01	
WG55245-3	MS		SED	S	PCB	SALTWTRSED	PREP	U	09-MAY-01	
WG55245-4	MSD		SED	S	PCB	SALTWTRSED	PREP	U	09-MAY-01	
WG55245-5	SRM			S	PCB	OTHR SOLID	PREP	U	09-MAY-01	
WG55245-6	LD		SED	S	PCB	SALTWTRSED	PREP	U	09-MAY-01	

Comments:

L20703-1	3-Grab Composite, 0 - 2 cm
L20703-2	3-Grab Composite, 0 - 10 cm
L20703-3	3-Grab Composite, 0 - 2 cm
L20703-4	3-Grab Composite, 0 - 10 cm
L20703-5	3-Grab Composite, 0 - 2 cm
L20703-6	3-Grab Composite, 0 - 10 cm
L20703-7	3-Grab Composite, 0 - 2 cm
L20703-8	3-Grab Composite, 0 - 10 cm
WG55245-1	MB050901
WG55245-2	WG55245-1
WG55245-3	L20703-2
WG55245-4	WG55245-3 L20703-2
WG55245-5	HS2
WG55245-6	L20703-1

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/25/01 08:35
Run ID: R68221 Workgroup: WG55245 (PPS#234-pcb)

MB:WG55245-1 Matrix: OTHR SOLID Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Aroclor 1016	4.2	8.33	ug/Kg	<MDL	
Aroclor 1221	4.2	8.33	ug/Kg	<MDL	
Aroclor 1232	4.2	8.33	ug/Kg	<MDL	
Aroclor 1242	4.2	8.33	ug/Kg	<MDL	
Aroclor 1248	4.2	8.33	ug/Kg	<MDL	
Aroclor 1254	4.2	8.33	ug/Kg	<MDL	
Aroclor 1260	4.2	8.33	ug/Kg	<MDL	

SB:WG55245-2 MB:WG55245-1 Matrix: OTHR SOLID Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1016	4.2	8.33	ug/Kg	<MDL	25	21	84		50-150								
Aroclor 1260	4.2	8.33	ug/Kg	<MDL	25	22.8	91		50-150								

MS:WG55245-3 MSD:WG55245-4 L20703-2 Matrix: SALTWTRSED Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1016	4.2	8.33	ug/Kg	<MDL	25	36.3	145		50-150	25	34.3	137		50-150	6		100
Aroclor 1221	4.2	8.33	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1232	4.2	8.33	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1242	4.2	8.33	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1248	4.2	8.33	ug/Kg	11		37.3			50-150		34.9			50-150			100
Aroclor 1254	4.2	8.33	ug/Kg	12.2		19.5			50-150		18			50-150			100
Aroclor 1260	4.2	8.33	ug/Kg	<MDL	25	36.3	145		50-150	25	33.9	136		50-150	6		100

SRM:WG55245-5 Matrix: OTHR SOLID Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1254	10	20	ug/Kg		111.4	111	100		80-120			

LD:WG55245-6 L20703-1 Matrix: SALTWTRSED Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1016	4.2	8.33	ug/Kg	<MDL		<MDL						100
Aroclor 1221	4.2	8.33	ug/Kg	<MDL		<MDL						100
Aroclor 1232	4.2	8.33	ug/Kg	<MDL		<MDL						100
Aroclor 1242	4.2	8.33	ug/Kg	<MDL		<MDL						100
Aroclor 1248	4.2	8.33	ug/Kg	20.8		20.2				3		100
Aroclor 1254	4.2	8.33	ug/Kg	20.9		21.4				2		100
Aroclor 1260	4.2	8.33	ug/Kg	<MDL		<MDL						100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/25/01 08:35
Run ID: R68221 Workgroup: WG55245 (PPS#234-pcb)

Sample #	2,4,5,6-Tetrachloro-m-xylene	Decachlorobiphenyl
	50-150	50-150
L20703-1	102	105
L20703-2	96	99
L20703-3	119	122
L20703-4	86	88
L20703-5	85	101
L20703-6	86	112
L20703-7	105	107
L20703-8	96	100
WG55245-1	91	104
WG55245-2	85	106
WG55245-3	139	148
WG55245-4	129	134
WG55245-5	133	148
WG55245-6	92	97