The City of New York

The City of New York's Comments on the Proposed Plan for the Gowanus Canal Superfund Site

April 26, 2013

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Introduction

The City of New York ("City") appreciates the opportunity to comment on EPA's Proposed Plan for the Gowanus Canal Superfund Site (December 2012) ("Proposed Plan"). The City supports a cleaner Gowanus Canal ("Canal"), and has already expended well over $150 million under its Clean Water Act ("CWA") program to achieve this goal. Notably, the City's rehabilitation of the Gowanus Flushing Tunnel, which will bring cleaner water from Buttermilk Channel into the Canal, is slated to be completed this year. In addition, the City will be constructing a large number of "green infrastructure" projects in the neighborhoods surrounding the Canal, with the goal of further improving water quality by reducing the volume of combined sewer overflows ("CSOs").

The City strongly believes that the plan for a cleaner Canal under EPA's Superfund program must be guided by sound science and adherence to the National Contingency Plan ("NCP"). The Proposed Plan must also take into account how it will affect important City resources such as parkland and shorelines. Unfortunately, the current Proposed Plan for the Canal does not yet achieve these fundamental benchmarks. The Proposed Plan is compromised by several major technical flaws, and does not comply with the NCP. The City is concerned that, unless these significant issues are addressed by EPA before it issues its Record of Decision ("ROD"), the Proposed Plan will result in an unnecessary and onerous commitment on the part of City taxpayers and ratepayers, will result in recontamination of the Canal, and will have long-term adverse impacts on the surrounding communities. The City is very concerned that the remedy, as currently proposed, is likely to fail, as the Proposed Plan does not include adequate measures to control the significant sources of contamination (and recontamination) from groundwater contaminated with Non-Aqueous Phase Liquids ("NAPL"), originating from the properties adjacent to the Canal.

The City's primary technical concern is that EPA is proposing a remedy for the Gowanus Canal on the basis of an incomplete conceptual site model ("CSM"). Development of a reliable CSM is one of the most important objectives of a Remedial Investigation/Feasibility Study ("RI/FS") process under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"). A CSM identifies sources of contamination and describes fate and transport mechanisms. Here, the absence of an adequate CSM has led EPA to overstate the impacts of CSOs on the levels of hazardous substances in sediments in the Canal. Relying on incomplete data and erroneous calculations, EPA concludes that new CSO source controls are necessary for outfalls RH-034 and OH-007 in order to prevent sediment discharged from these outfalls from re-contaminating the remedy. The City disagrees with EPA's interpretation of its limited data and furthermore has collected additional data that show conclusively that existing CSO discharges do not contribute CERCLA hazardous substances at levels that pose unacceptable risks to human health and the environment. Similarly, the City disagrees with EPA's proposed reduction targets for RH-034 and OH-007 of 58 to 74 percent. EPA has based these reduction targets on unsupported assumptions that surface sediment contamination is the result of CSO solids. The City's data demonstrate that CSOs are not the source of elevated contaminants in Canal sediments. The City's data further demonstrate that CSO solids do not exceed EPA's Preliminary Remediation Goals ("PRGs") proposed for the protection of human health and the environment, even though those goals are based on flawed science. Further, EPA's presumptive remedy for two in-line tanks to achieve this reduction is not based on site specific data or modeling, but instead on a single study examining stormwater discharges, not CSO discharges, in an area near Los Angeles that is not comparable to New York City in terms of topography, rainfall patterns, or land use. This issue requires a site-specific technical analysis, not reliance on a single study whose author questions its applicability to the Canal (*see* Appendix B).

EPA's development of a presumed remedy to meet these flawed reduction targets also fails to comply with the NCP. EPA presumes that two in-line tanks – one for each outfall – would be necessary to achieve the proposed reduction targets, and that these tanks will cost a total of $78 million. EPA's development of this alternative fails to comply with the NCP because, among other things, it fails to properly assess this alternative individually against all nine NCP criteria and comparatively against the other alternatives that survived the screening analysis contained in the Addendum to the Feasibility Study ("FS Addendum"). As just one example, EPA, without explanation, has excluded the costs of operation and maintenance from its cost estimate – a substantial omission given that such an analysis is required by the NCP, and given the high ongoing costs of operating and maintaining these facilities. Furthermore, EPA's analysis incorrectly assumes that the tank proposed for RH-034 can be constructed and located on inalienable public parkland. This assumption not only runs contrary to applicable, relevant and appropriate New York State law, but also does not adequately consider the loss of a valuable parkland resource on the surrounding community. Moreover, EPA has significantly underestimated the capital cost of the proposed facilities.

The Proposed Plan also violates the NCP because it fails to analyze against the NCP criteria the other source control measures EPA concedes are required to implement this remedy. Notably, the Proposed Plan and underlying documents do not evaluate individually or comparatively against the nine NCP criteria the source control measures associated with groundwater contaminated with NAPL from former Manufactured Gas Plants ("MGPs"), contamination on other upland sites, or contaminated groundwater. There is no evaluation of whether the controls, which EPA assumes will take place for these sources, will be sufficient for protecting the remedy from recontamination by NAPL in groundwater and other sources. Because, as EPA agrees, these measures are essential for preventing recontamination of the Canal sediments, EPA must subject these source control measures to a full evaluation under the NCP, and not merely presume that these sources may someday be controlled under an unspecified DEC or other remedial program. Instead, EPA delegates to the State decision-making for these source control remedies, which delegation itself violates the NCP. Indeed, failure to control these sources would effectively negate the effectiveness of the Superfund cleanup, and indeed negate any source control measures related to CSOs.

Despite its deficiencies, the Proposed Plan does make some progress in moving toward a more practical framework. The City is encouraged by EPA's willingness to continue to review new data collected by the City, including data that will be collected following the completion of the current CWA upgrades. The City believes these data are essential for understanding what additional controls, if any, would be needed for CSOs to prevent recontamination of the Superfund remedy. The City is also encouraged by EPA's acknowledgment that the forthcoming Long Term Control Plan ("LTCP") process should be the predominant legal framework for planning and developing CSO control measures, in accordance with, and based upon, the appropriate criteria and schedule that apply to the LTCP process. As described more fully in the comments below, to the extent that the Proposed Plan seeks to impose additional CSO controls under CERCLA in the form of a presumed in-line tank remedy, separate and apart from the LTCP process, the City contends that EPA has not complied with CERCLA's mandatory remedy selection process for that presumed remedy. Furthermore, the City continues to urge EPA to adopt the recommendations of EPA's Contaminated Sediments Technical Advisory Group

("CSTAG"), and develop and issue an Interim ROD focused on the serious NAPL contamination currently impacting the Canal.

Overview of Comments and Reservation of Rights

The City's individual comments on the Proposed Plan and FS Addendum are consecutively numbered and generally categorized by their subject matter. The City expects that EPA will specifically respond to each individual comment, any narrative portion or annexed document elaborating on the individual comment, and to all questions or issues listed under each individual comment. In addition, any attachments to this document should be viewed as fully incorporated herein, and EPA should specifically respond to the issues raised in these attachments. The categories for the comments are for ease of reference and, thus, if an individual comment raises issues relevant to another category, EPA should respond to those issues as well.

Pursuant to 40 C.F.R. § 300.825, the City reserves the right to supplement the administrative record after the public comment period for the Proposed Plan and after the ROD has been signed. First, 40 C.F.R. § 300.825(a)(1) authorizes EPA to add documents to the administrative record after the ROD has been signed if "the documents concern a portion of a response action that the decision document does not address or reserves to be decided at a later date." The Proposed Plan expressly states that several portions of the proposed response action are reserved to be decided at a later date, including but not limited to, selection of the final remedies for the MGP sites, selection of the final remedies for the upland sites, selection of interim remedies for further CSO controls, if any, whether the presumptive remedy for further CSO controls must be implemented, selection of locations for further CSO controls, if any, and selection of the precise further percent reduction of CSOs, if any, needed to meet remedial action objectives. Any documents related to these issues submitted after the ROD is issued should be included in the administrative record.

Second, 40 C.F.R. § 300.825(c) requires EPA to consider comments submitted by interested persons after the close of the comment period to the extent "the comments contain significant information not contained elsewhere in the administrative record file which could not have been submitted during the public comment period and which substantially support the need to significantly alter the response action." As EPA is aware, the City continues to collect and analyze samples relating to current CSO discharges to the Canal and sediments in the Canal. To the extent the City receives such validated analytic data after April 28, 2013, such data may constitute "significant information not contained elsewhere in the administrative record" that "could not have been submitted before the public comment period." In addition, to the extent such data demonstrates that the concentrations of PAHs in the CSOs and/or in the sediment in the Canal do not require further control remedies as specified in the Proposed Plan, the data may "substantially support the need to significantly alter the response action" as currently proposed in the Proposed Plan.

Technical Review of the Proposed Plan And the FS Addendum

Introduction to Technical Section

Before discussing the City's concerns in detail, the City would like to outline its ongoing sampling efforts. The City has conducted an extensive sampling effort in the Canal to understand the nature of contamination in the Canal and alleged contamination in the CSOs that discharge to it. These samples are also intended to address some of the limitations of EPA's data set. In particular, the City has obtained both dissolved and suspended matter samples from each of the four major CSOs to the Canal on at least four separate occasions. These samples represent time-weighted averages of most or all of the discharge during discrete rainfall events that cause overflows at each outfall. The samples have been analyzed for an extensive set of parameters including polycyclic aromatic hydrocarbons ("PAHs"), metals, polychlorinated biphenyl ("PCB") congeners, and many supporting parameters like total suspended solids ("TSS"). Additionally, the City has sampled from the CSO pipes adjacent to National Grid's Fulton MGP facility on two separate occasions. The City has also collected surface sediment samples for use in benthic toxicity tests which the City has also conducted. Finally, the City has collected surface water from within the Canal as well as from Gowanus Bay to examine water column conditions during dry periods when the CSOs are not discharging. The City will continue these sampling programs, plans to expand its surface sediment collection effort, and will continue to provide the results of these studies to EPA. The sample results received to date provide important insights into the nature of contaminant loads to the Canal and have been used extensively in preparing the comments provided below. This document provides a summary of the results and analysis from NYC's field work that are available to date for the physical characteristics and COPC concentrations in the CSOs and WWTPs. The City is continuing the efforts described in the QAPP to further expand our understanding of these discharges. Note that the City is still awaiting additional laboratory results for certain samples obtained from the affected CSO, which will be presented in subsequent data reports.

The Canal has been extensively contaminated by discharges from upland sources. PAH contamination in the sediments of the Canal can be readily tied to the three MGP sites along its banks. However, EPA has not sufficiently quantified the magnitudes of PAH transport via direct seepage of coal tar NAPL from these facilities, PAH transport via groundwater, and PAH transport via the numerous private and unpermitted pipe discharges, to evaluate their relative importance in formulating the Proposed Plan.

Lacking information on the relative importance of the sources of contaminants to the system, EPA has resorted to speculation about the character of CSO discharges relative to surface sediment observations in the Canal. The City notes that the contaminant patterns of several chemicals in the Canal (and the magnitudes of their concentrations) simply cannot be the product of any combination of CSO discharge and harbor solids alone. Significant other sources of contamination exist and these sources must be considered before a reliable chemical mass balance can be completed. Such a mass balance is critical to understanding the role of CSO solids with respect to surface sediment chemistry in the Canal.

While EPA proceeds to remedy selection based on an inadequate CSM, the City has begun an intensive investigation of contamination in the Canal and of the City's allegedly contaminated CSO discharges, and continues to study and sample. Based on the data developed under its investigations in concert with EPA's data, the City has demonstrated that, while EPA's low PAH cleanup goal is unjustified and technically indefensible, the CSO discharges actually meet that goal. While more work remains to be done to provide a complete understanding of all of the important sources of contamination to the Canal, the City's investigations clearly show that CSO discharges do not contribute unacceptable risk related to contaminant concentrations in the surface sediments. Taken together, the City's findings indicate that there is no technical basis for requiring CSO controls under CERCLA. It is evident from the data that all of the risk related to PAHs and PCBs that warrants CERCLA intervention is attributable to contamination from other sources (*e.g.*, adjacent MGP sites), which may not as yet be fully characterized, or in some cases may not even have been identified by EPA.

Many of the problems with the Proposed Plan that the City has identified have been the subject of ongoing discussions with EPA over the course of a year or more. In the comments below, the City presents the results of its recent sampling efforts which confirm and support the City's concerns. The City believes that the information gathered by EPA does not form a sufficient basis to make reliable decisions regarding the remediation of the Canal. As a result, the City cannot support the remedy described in the Proposed Plan.

NYC Comment 1: There is no basis under CERCLA for requiring a 58 to 74 percent reduction in CSO discharges. The CSO reduction requirement is based on several incorrect assumptions and technically indefensible PRGs, and will fail to achieve the targeted contaminant reductions in surface sediments.

In its FS Addendum, EPA derived estimates of required solids reduction for CSO outfall RH-034 on the order of 58 to 74 percent to meet its PRGs in the Upper Canal for total PCBs ("TPCBs"), total PAHs ("TPAHs"), copper, and lead. In deriving these proposed solids reductions, EPA asserts that CSOs are, and will be, the only source of surface sediment contaminant concentrations in the Upper Canal that will be controlled. Therefore, EPA incorrectly assumes that the only way for surface sediment concentrations to decline is for the CSO loads to decline.

EPA did not measure PAH concentrations on the solids from CSO discharges. Instead, EPA analyzed PAHs in whole water only. EPA then approximated PAH concentrations on the solids from CSOs using the measured whole water concentrations and TSS measurements. In this methodology, EPA simplistically (and incorrectly) assumed that the entire mass of PAHs as reported by a measured whole water concentration was carried by the solid phase and that the dissolved PAH concentration was zero.

In contrast, the City performed a more detailed and comprehensive analysis by collecting and measuring the actual PAH concentrations on the solids from CSO discharges. Based on the City's more refined data set, contaminant concentrations on CSO solids do not exceed the risk-based PRGs developed by EPA. Under CERCLA, if contaminant concentrations do not pose unacceptable risk to human health and the environment, no remedial action is required (EPA,1988; EPA 1999). EPA's preferred remedy will fail to achieve the targeted reduction in surface sediment concentrations in the Canal because EPA has failed to consider the full range of significant sources of contaminants. As discussed in NYC Comment 3, there are important sources of PAHs and PCBs that cannot be ascribed to CSOs. These sources are responsible for the elevated concentrations of PAHs and PCBs in the surface sediments of the upper and middle sections of the Canal. Additionally, the surface sediments that serve as EPA's basis to estimate the percent reductions in CSO contributions are actually more affected by other major contaminant sources that EPA has failed to quantify, or in the case of PCBs and lead, even to recognize. The failure on EPA's part to identify and quantify these additional sources properly is symptomatic of the poor CSM.(*see* NYC Comment 3).

As shown below, no reduction of CSO discharges will be sufficient to reduce surface sediment contaminant levels to the PRG since the CSOs are equivalent to or below the PRG for PAHs and PCBs. In addition, the PRGs that EPA developed for copper and lead are without merit. In preparing this analysis, the City included the reference area data for New York Harbor obtained as part of the Newtown Creek investigation. For the Newtown Creek RI/FS, an evaluation to determine appropriate background locations was conducted by collecting surface sediments at several candidate reference sites for contaminant and physical characterization. These sites were classified into four categories: industrial with CSO input, industrial with no or minimal CSO input, non-industrial with CSO input and non-industrial with no or minimal CSO input. The City determined Background Threshold Values ("BTVs") (*see* NYC Comment 6) for TPAHs, TPCBs, copper and lead (*see* Table 6-1) in each of the four categories of background areas using EPA's ProUCL Version 4.1 software (Singh et al., 2010), and then compared CSO data to the BTVs.

1) CSO solids do not exceed EPA's PRG for Total PAHs.

In the case of PAHs, recent data collected by the City on the solids fraction discharged by CSOs indicate an average TPAH concentration of 30 mg/kg, with a lower confidence limit ("LCL") of 25 mg/kg and an upper confidence limit ("UCL") of 36 mg/kg. This range is significantly lower than the TPAH concentration of 56 mg/kg and confidence bounds of 41 to 78 mg/kg used by EPA (based only on the EPA RI data) to represent CSO discharge solids in determining its proposed solids percent reduction. When the TPAH concentrations in the surface sediments of the Upper Canal are calculated using EPA RI data, EPA's Emergency Response Team ("ERT") data, and the City's data, the average TPAH concentration is 261 mg/kg (LCL 130 mg/kg, and UCL 423 mg/kg), which is significantly greater than the average TPAH concentration on CSO solids (30 mg/kg). This is more clearly demonstrated in NYC Comment 2, where the distributions in CSO solids are directly compared with solids in the Canal and the reference areas. It is clear from these observations that CSO solids are significantly less contaminated than Canal surface sediments.

When the TPAH concentrations on CSO solids are evaluated on an organic carbon-normalized basis, it is clear that these concentrations are well below EPA's PRG. The TPAH PRG set forth by EPA is 20 mg/kg for sediment exhibiting 6 percent total organic carbon ("TOC"). While the City believes that this PRG is not technically defensible, the TPAH concentrations on solids discharged by the CSOs readily meet this threshold. The average observed concentration of TOC on CSO solids is 40 percent, based on recent data collected by the City. The average TPAH concentration on the CSO solids on an equivalent 6 percent organic carbon basis is 5 mg/kg, less than one-quarter of the EPA's PRG of 20 mg/kg in sediments at 6 percent TOC. It is clear therefore that the Proposed Plan is incorrectly focused on CSOs as a substantive source of PAHs when, in fact, CSO solids are already in compliance with EPA's incorrectly calculated PRG (*see* NYC Comment 7 below for the City's major concerns with the development of the PAH PRG).

Based on this information, the City reconstructed the figure from the FS Addendum (*see* FS Addendum 7, Attachment) that EPA used to estimate the required CSO percentage reduction at RH-034 based on TPAHs. This is shown as Figure 1-1. The figure shows EPA's original calculation based on its estimate of TPAH concentrations in the surface sediments of the Upper Canal. Also shown on the diagram are two important additions. First, the TPAH concentration for CSO solids is shown, on a 6 percent TOC basis, *i.e.*, 5 mg/kg TPAH / 6 percent TOC. As noted above, this value is well below the PRG, indicating that CSO solids already satisfy the PRG value. Also shown on the diagram is the City's estimate of surface sediment concentrations in the Upper Canal. This value is more than five times greater than the estimate presented in the Proposed Plan. For the City's estimate, all data available for the Upper Canal were used, including the RI data obtained by EPA, data obtained by EPA's ERT and data obtained by the City during its own investigation of the Canal. The original EPA value was based only on the EPA's RI data, which appears biased substantially lower than the other two data sets.

This revised version of the EPA Percent Reduction Diagram yields two important conclusions. First, that CSOs are already in compliance with the proposed PAH PRG and no further CSO reduction is justified for TPAH control; and second, that surface concentrations and the source(s) of PAH contamination to the Upper Canal are indicative of a much more substantial load of PAHs to the Canal than that delivered by the CSOs, and will require a substantially greater reduction of PAH contamination (92 percent) to meet the EPA PRG than originally estimated in the Proposed Plan. The results for PCBs yield a similar conclusion and are discussed below.

As a last basis of comparison, TPAH BTVs (*see* NYC Comment 6) derived for the four categories of reference sites for Newtown Creek range from 16 to 48 mg/kg on a 6 percent TOC basis. These BTVs are higher than TPAH concentrations observed for CSO solids that discharge to the Canal on a TOC basis. From these data, it is clear that there is no combination of CSO solids and harbor solids that will yield the surface sediment concentrations observed in the Upper Canal. Taken together, these observations indicate that EPA's proposed CSO solids reduction requirement for TPAHs is not warranted.

2) CSO solids do not exceed EPA's PRG for TPCBs.

For TPCBs, recent data collected by the City on the solids fraction discharged by CSOs indicate an average TPCB concentration of 0.42 mg/kg (LCL of 0.31 mg/kg and UCL of 0.54 mg/kg). This TPCB concentration range is slightly lower than the average TPCB concentration of 0.54 mg/kg and confidence bounds of 0.42 to 0.67 mg/kg estimated by EPA to represent CSOs in determining the proposed solids percent reduction. As shown in NYC Comment 2 below, the TPCB concentrations in the surface sediments of the Upper Canal have an average of 0.96 mg/kg (LCL of 0.50 mg/kg, and UCL of 1.57 mg/kg), which is substantially greater than the TPCB concentrations on CSO solids. In the Middle Canal reach, surface sediment PCB concentrations are even greater, averaging around 5.5 mg/kg. Similar to TPAHs, the CSO discharges cannot explain the elevated PCB concentrations in surface sediments in the Canal, which means that there is a much more substantial load of PCBs to the Canal than that delivered by the CSOs. This is even more apparent when viewed on an organic carbon-normalized basis, as shown in NYC Comment 2 below, where it is observed that normalized CSO solids concentrations are more than an order of magnitude less than those for reference area samples. Therefore, it is clear that the CSO solids serve to dilute PCB concentrations delivered by other sources to the Canal. EPA's basis for reducing CSOs to meet its PRG for PCBs is flawed, and again reflects the underdeveloped CSM.

For TPCBs, the City repeated the reconstruction of the figure from the FS Addendum that EPA used to estimate the required CSO discharge percentage reduction at RH-034 (*see* FS Addendum 7, Attachment). This is shown as Figure 1-2. The figure shows EPA's original calculation based on its estimate of TPCB concentrations in the surface sediments of the Upper Canal. The City's figure has two important additions. First, the TPCB concentration for CSO solids is shown at 0.42 mg/kg. As noted above, this value is just below the PRG, indicating that again the CSO solids already satisfy the PRG value. The diagram also shows the City's estimate of surface sediment TPCB concentrations in the Upper Canal. In this instance, the City's value is twice EPA's value, at 0.96 mg/kg. This value was derived in a similar manner as for the TPAH samples, but limited to those samples with reported PCB congener results. Again, the original EPA value was based only on data collected in EPA's RI investigation; these data appear biased substantially lower than concentrations found in the other data sets.

This revised version of the EPA Percent Reduction Diagram yields the same two important conclusions as the TPAH results. First, that CSOs are already in compliance with the proposed PCB PRG and no further CSO reduction is justified for TPCBs control; and second, that surface concentrations and the source(s) of PCB contamination to the Upper Canal are substantially greater and will require a substantially greater reduction to meet the EPA PRG than originally estimated in the Proposed Plan.

The average CSO discharge for TPCBs of 0.42 mg/kg is slightly less than EPA's TPCB PRG of 0.48 mg/kg. However, as EPA's stated purpose was to define a regional signal as the TPCB PRG, it is important to consider the range of BTVs for TPCBs calculated for Newtown Creek candidate reference areas. The BTVs for TPCBs are in the range of 0.16

to 2.7 mg/kg (*see* Table 6.1), further indicating that the CSOs are not different from background. Therefore, EPA's proposed CSO solids reduction requirement is not warranted on the basis of TPCBs.

3) EPA's PRGs for metals are entirely without merit.

EPA's PRGs for copper and lead are scientifically untenable since they are based solely on background levels and not risk. By the agency's own analysis and conclusions, these metals do not pose risk and therefore no remediation is required (*see* NYC Comment 8 below). The Proposed Plan did not, and could not, present evidence of unacceptable risks to humans or the environment due to the presence of these metals in the sediments of the Canal. Although the Proposed Plan states that these metals are the most likely to cause adverse effects, there is no evidence presented to support this. Additionally, the Proposed Plan notes that metals are not bioavailable and therefore do not present toxicity in the sediments:

> "…Based on measured concentrations in sediment, copper and lead were identified as the metals most likely associated with adverse effects. However, geochemical analyses (*i.e.*, SEM/AVS) indicate that these metals currently are not bioavailable and should not cause toxicity." *See* Proposed Plan, p. 17.

Despite the observation that these metals are not bioavailable, the Proposed Plan then goes on to state:

> "However, metals may become bioavailable in the future if geochemical conditions in the canal change and do not favor the formation of insoluble sulfides. Therefore, PRGs for copper and lead are necessary in the event that metals become bioavailable and toxic in the future…." *See* Proposed Plan, p. 17.

As clearly stated here, these PRGs are based on the speculation that geochemical conditions may change in the future. As such, EPA was unable to develop toxicity-based PRGs pertaining to existing site-specific conditions. Developing a realistic understanding of future geochemical conditions posing toxicity would require estimating both the timing and the degree of geochemical changes as well as the changes in bioavailability and toxicity. No attempt has been made for purposes of the Proposed Plan to develop a model capable of predicting these changes. Instead, it is simply asserted that such a change is possible and then PRGs are proposed based on the maximum Gowanus Bay and Upper New York Bay concentrations for the reference stations that showed no overall toxicity, without any demonstration that current or future levels of these metals are toxic. In fact, as part of the Newtown Creek candidate reference area background site assessment, sediment concentrations of copper and lead in the Canal are shown to be comparable to background levels in similar settings throughout New York Harbor.

Additionally, the supposition that geochemical conditions of Canal sediments would become sufficiently oxidized so as to change the bioavailability and toxicity of these metals is without merit. Extensive studies of sediment conditions throughout New York Harbor show that sediments are reducing essentially everywhere in the harbor, with ratios of acid volatile sulfide ("AVS") to simultaneously extracted metals ("SEM") much greater than 1.0. A detailed discussion of harbor AVS and SEM levels is provided in NYC Comment 8 below. It is clear from the above discussion, and from the lack of scientific support for the toxicity of copper and lead in Canal sediments, that the PRGs for these metals do not satisfy EPA's requirements under CERCLA.

NYC Comment 1 Inquiries

The City requests that EPA respond to the following questions:

- Is EPA confident that it has sufficient information to quantitatively decide the degree of CSO reduction for the Canal when it lacks quantitative information on any of the major sources of PAHs or PCBs to the Canal? If so, please provide the technical basis for this, since the reduction analysis in the Proposed Plan for PAHs and PCBs is not valid. *See* NYC Comment 1(1) & (2) above.

- Given that concentrations of TPAHs and TPCBs on CSO solids are below EPA's PRGs for these compounds even before accounting for possible dilution by harbor suspended solids, what would be the technical basis for requiring reductions of CSO discharges?

- Why did EPA develop PRGs for copper and lead given that the agency's data indicate they do not pose risk and similar reducing conditions are characteristic of conditions essentially everywhere in the harbor?

- Why did EPA ignore its own guidance regarding AVS/SEM metal toxicity, guidance that has been extensively tested and has existed for more than 15 years? What is the technical basis that supports superseding this guidance?

- How were projections of future attainment of PRGs evaluated if quantitative models were not used? In order to support its concern about metal toxicity in the future, will EPA develop the necessary geochemical and toxicological models to estimate future conditions?

- Under what conditions does EPA estimate that Canal sediments could become sufficiently oxidized so as to consume the excess AVS and potentially free the sulfide-bound metals? How long would these conditions take to develop? Is there any evidence that these conditions exist in similar areas in the New York/New Jersey Harbor area?

NYC Comment 2: CSO solids cannot be (and have not been) responsible for observed sediment contamination (PCBs, PAHs, and metals) in excess of CERCLA risk-based thresholds.

The data set obtained in the RI process was insufficient to support the necessary analyses for remedial decision-making. A simplistic interpretation of the limited RI data set has led to a failure to recognize the major ongoing sources of the primary contaminants, *i.e.*, PAH and PCB compounds, to the sediments and water column of the Canal. Instead, the Proposed Plan has focused inordinately on the City's CSO discharges which cannot be responsible for the levels of contamination that now exist in the Canal. Failure to properly recognize and address these major sources of contamination will lead to the failure of the remedy, irrespective of any improvements or changes that may be implemented in connection with the City's CSOs since these CSOs are not responsible for this contamination.

For example, the Proposed Plan incorrectly states:

> "CSO and stormwater solids have a significantly greater influence on the quality of sediments in the 0-2-foot depth interval in the upper reach of the canal than incoming sediments from Upper New York Bay." *See* Proposed Plan, p. 11.

Several lines of evidence are cited to support this contention; each one of them is incorrect and indicates an unduly simplistic analysis of a very complex system. Based on these flawed analyses, the Proposed Plan selects a remedy that is almost certain to fail. The City notes the following flaws in the CSM developed for the site:

Throughout the Proposed Plan and FS Addendum, EPA asserts that contaminant concentrations are principally the result of CSO discharges in the upper portion of the Canal. For example:

> "CSO solids contributions dominate the canal's upper reach." *See* FS Addendum, p. 3.
>
> "However, physical and chemical characteristics of the newly deposited sediments indicate that CSO solids have a greater influence on the quality of shallow sediments in the upper reach of the canal than incoming suspended sediments from Upper New York Bay." *See* FS Addendum, p. 4.
>
> "The physical and chemical characteristics of the shallow sediments in the upper reach of the canal more closely resemble CSO solids than reference sediments from Gowanus Bay and Upper New York Bay." *See* FS Addendum, p. 5.
>
> "Multiple lines of evidence indicate that CSOs to the Gowanus Canal adversely affect canal sediment quality and are contributing to unacceptable risks that must be addressed under CERCLA." *See* FS Addendum, p. 11.

EPA based these assertions on the limited data set obtained by EPA for the RI in 2009. It did not include data obtained by EPA's ERT in 2007. Since the Proposed Plan was issued, the City has also received the results of samples (*See* Appendix A1.1 – Summary of CSO Sampling Program) collected over the past several months from the upper reach, as well as the rest of the Canal. Inclusion of these two additional data sets yields a very different set of conditions than those initially presented by EPA. As a result, many of the assertions made by EPA in the Proposed Plan have been shown to be incorrect and should be replaced with those described in the comments to follow. Findings of the City's evaluation of all the available data relative to EPA's assertions are presented below.

1) Total organic carbon content

The Proposed Plan states:

> "CSO solids have high TOC content. The TOC content of the surface sediment is about 6 percent. Based upon the results of the RI and EPA (1998), the TOC levels in Upper New York Bay sediments are, on average, about 3 percent. Accordingly, if suspended sediments in tidal inflow or Flushing Tunnel flows from Upper New York Bay were contributing the majority of the deposited mass, the TOC of the surface sediment would be closer to 3 percent." *See* Proposed Plan, p. 11.

EPA incorrectly asserts that the 6 percent TOC content found in Upper Canal sediment is sufficiently high relative to the 3 percent TOC levels observed in the Upper New York Bay and Gowanus Bay reference areas, indicating that CSOs are contributing the majority of the sediments in the 0 to 2-foot depth interval in the upper reach of the Canal.

EPA's evaluation of the TOC data in the FS Addendum was based on:

- An assumption that the TOC concentration in the upper reach of the Canal is equivalent to the discharge from the CSO (therefore, EPA provided only a single data plot to describe CSO discharge impacts on the Canal, *i.e.*, Figure 6 in the FS Addendum, which considers only the upper reach of the Canal and the Gowanus Bay reference area); and

- A qualitative solids balance inferred from the surface sediments and the reference area sediments, without consideration of the TOC measured on the solids delivered by the CSOs.

From this limited examination, EPA reasoned that since 3 percent TOC on solids from the reference area is less than 6 percent on surface sediment in the Canal, CSO discharges must dominate the solids contribution. EPA contends that if solids from the reference area were dominating the TOC input, Canal surface sediment would necessarily contain just 3 percent TOC.

Each of these assumptions is incorrect and reflects an underdeveloped CSM, as discussed in greater detail below in NYC Comment 3. As part of the contaminant fate and transport analysis performed by the City using recent TOC data collected from the four largest CSOs, the City observes the following:

- The average concentration of organic carbon on CSO solids is 40 percent as compared to 3 percent on harbor solids (reference area, Figure 2-1) and 6 percent on sediments of the Upper Canal (Upper Reach, Figure 2-1). Thus, Upper Canal surface sediments are significantly closer in TOC content to harbor solids delivered by the Flushing Tunnel or by tidal exchange than they are to CSO solids, indicating they are primarily comprised of harbor solids.

- If an empirical mixing model with two TOC contributors consisting of the CSO solids and the sediments from the reference area is used to explain TOC content on the surface sediments of the Upper Canal (setting aside potential contributions from MGP facilities and other industrial discharges and assuming TOC to be conservative), the TOC from the CSO would have to be diluted about 9-fold with harbor solids to create surface sediments at 6 percent TOC.

- When TOC is used as a normalizer for organic compounds, the results indicate that the CSOs cannot explain the organic chemical contamination in the Canal (*see* comments on PAHs and PCBs below).

Based on these observations, if CSO solids were the dominant contributor of solids, then the TOC concentration on the surface sediments in the Upper Canal would necessarily be much greater than 6 percent.

2) Total PAH concentrations on CSO solids and Canal sediments

The Proposed Plan makes a related assertion:

> "The concentrations of PAHs, copper and lead in the surface sediment and in the CSO solids are similar. The concentrations of these chemicals are much lower in the reference sediments in the harbor; therefore, deposition of suspended sediments in harbor water (or from the Flushing Tunnel which brings in harbor water) could not be the predominant source of high concentration of PAHs, copper and lead in the canal surface sediments." *See* Proposed Plan, p. 11.

EPA incorrectly asserts that the concentrations of TPAH and selected individual PAH compounds in the CSOs are similar to concentrations in Upper Canal sediments. EPA then incorrectly concludes that the CSOs therefore have a significantly greater influence in the Upper Canal surface and soft sediments with respect to PAHs.

In the FS Addendum, EPA's evaluation of PAHs was undermined by:

- Incorrectly assuming that whole water concentrations of all PAHs compounds are entirely particle-bound. This resulted in significant overestimates of the TPAH concentrations on CSO solids and the variability of these concentrations.

- Using these incorrectly derived estimates of TPAHs, acenaphthene, benzo(b)fluoranthene, benzo(k)fluoranthene, and phenanthrene in CSO solids to assert that the CSO solids concentrations were similar to concentrations in the upper reach of the Canal, and significantly higher than reference sediments based on its very limited and apparently not representative data set (*See* Figures 8 and 9 in the FS Addendum Report).

- Conducting an analysis which excluded the data on PAHs, collected by EPA's own ERT, which includes 4 transects collected at the head of the Canal. The average concentration in the surface sediment from these transects is approximately 950 mg/kg, which is significantly higher than solids concentrations of PAHs in CSO discharges. EPA's RI sediment data in the same location as these ERT transects showed an average of 62 mg/kg.

- Basing proposed reductions for CSO RH-034 on the average TPAH value of 56 mg/kg (standard deviation of 40 mg/kg) observed in the surface sediments in the upper reach of the Canal. This value based on EPA RI data is not representative of the area since it is an order of magnitude less than the TPAH concentrations observed in the sediments collected by EPA's ERT team (average TPAH of 950 mg/kg) and also the data collected by the City during the toxicity sampling program (average TPAH of 217 mg/kg). Furthermore, the CSO solids measurements conducted by the City show that the solids from RH-034 have an average value of 30 mg/kg (standard deviation of 12 mg/kg) and hence cannot be responsible for the contamination observed in the Upper Canal since they are much too low in concentration. This is a clear indication that the basis used by EPA to derive conclusions regarding the impact of CSOs on the upper reach of the Canal is inaccurate.

- Failing to consider other sources of PAHs to the system, especially in the middle reach of the Canal, which likely impact sediments in the upper reach of the Canal.

- Incorrectly concluding that these relationships indicate that solids from CSO discharges have a greater influence on surface sediment quality in the upper reach of the Canal than suspended sediment contributions from Gowanus Bay and Upper New York Bay, when it is clear from EPA data alone that other sources of PAHs have far greater influence on Upper Canal sediments than either the CSOs or the reference area.

- Incorrectly concluding that the CSO solids which are asserted to dominate the Upper Canal exceeded the TPAH PRG.

The City collected samples of the CSO discharges and measured the particulate phase of PAHs directly, as shown in Figure 2-2a, the concentrations of TPAHs on CSO solids are substantially lower than those observed in surface sediments. This can be seen spatially in the upper diagram of Figure 2-2a. The City has analyzed the CSO data along with the available Canal sediment data and observes the following:

- Concentrations of TPAHs in CSO solids, which average 30 mg/kg, are substantially lower than surface sediment concentrations in the Upper Canal (average of 270 mg/kg) and Middle Canal (average of 920 mg/kg). Similar patterns exist for acenaphthene, benzo(b)fluoranthene, benzo(k)fluoranthene, and phenanthrene on CSO solids, relative to concentrations in the Canal (*see* Figures 2-3 to 2-6).

- In shallow sediments (0 to 2 feet), concentrations of TPAH, which average 490 mg/kg, are higher than TPAH in CSO solids (*see* Figure 2-2b). Similar patterns exist for acenaphthene, benzo(b)fluoranthene, benzo(k)fluoranthene, and phenanthrene in shallow sediments in the Upper Canal relative to CSO solids (*see* Figures 2-3b to 2-6b). This observation is contrary to the assertion in the FS Addendum that CSOs are responsible for TPAH contamination in shallow sediments.

- The substantially higher PAHs concentrations in the Canal, relative to CSO solids and the reference area, indicate that there are additional sources of PAHs to the Canal's sediments. In particular, Middle Canal sediments are substantially higher in PAH concentrations than Upper Canal sediments which, in turn, are higher than the CSO solids, especially on a TOC-normalized basis. These results demonstrate that surface sediment concentrations are not due to CSO solids contamination, but rather that there is one or more major sources of these compounds in the Canal, particularly in the Middle Canal area. When normalized using organic carbon content, concentrations of PAHs for the CSO solids are more than an order of magnitude lower than similarly normalized concentrations in the Canal. Therefore, the concentrations of PAHs in the Canal cannot be achieved with a combination of only CSO solids and reference area sediments.

- The concentrations on the sediments of the Canal are at least an order of magnitude greater than those on the CSO solids on an organic carbon basis. The much higher concentrations of the Canal sediments are also apparent in the statistical presentations displayed in Figure 2-2b.

- As discussed in NYC Comment 1, concentrations measured directly on the CSO solids when expressed on a 6 percent TOC basis do not exceed EPA's TPAH PRG. Note that NYC Comment 7 demonstrates that the PAH PRG itself is not technically defensible because of miscalculation in the application of EPA's guidance, as well as uncertainties in the toxicity tests used to derive the PRGs.

Given these observations, the proposed reduction in CSO discharges under CERCLA is not warranted because the CSO solids do not exceed the risk-based TPAH PRG. The City believes that EPA's failure to understand and quantify the effects of other major sources of PAHs to the Canal sediment (including the three MGP sites, unpermitted pipes and groundwater) would significantly affect the performance of the preferred remedy.

3) PCB Concentrations in CSO solids and Canal sediments

The FS Addendum did not compare PCB data from CSOs to PCB concentrations found in the Canal and reference area, perhaps because PCBs were reported as non-detected in the EPA CSO data. Human exposure to PCBs via fish consumption is a significant potential risk associated with the Canal. Yet in the Proposed Plan, EPA dismisses the PCB levels found in the Canal as simply related to sediment contamination, and therefore did not investigate PCB sources. Because PCBs in the CSO solids are at levels comparable to background, EPA's hypothesis that CSOs have a significantly greater influence in the Upper Canal than the reference area and other inputs is not scientifically supported.

The City has evaluated the PCB data collected by EPA for the RI. In the process of analyzing RI PCB data for the Proposed Plan, a number of errors were made, not the least of which was to compare Aroclor results in the Canal sediments with congener results in the reference area. While this comparison is often done on PCB-contaminated sites, it is problematic in this instance due to significant differences between the results reported by EPA for each method. For example, EPA's RI data for matched pairs of Aroclor and congener analysis show the congener results to be as much as 5 times greater than the detected concentration reported by Aroclor analysis. One non-detect Aroclor result at a detection limit of 0.05 mg/kg per Aroclor had a reported congener result at 8.13 mg/kg. In the FS Addendum entitled Preliminary Estimate of Solids Reductions Needed to Achieve Remediation Goals (p. 3), EPA recognized that "PCB congener analysis is more sensitive and accurate than PCB Aroclor analysis." Yet the Proposed Plan states the highest observed PCB concentration in the Canal (3.4 mg/kg) on the basis of its Aroclor results. The congener total for this sample was 15.1 mg/kg based on the City's review of the data, while EPA's stated congener sum total was 4.03[1] mg/kg.

The City reviewed all of the EPA congener data for comparison with its own congener analyses. In compiling these results, the City maintained consistency in the congener sums across all reported programs. With newly collected congener data on CSO solids discharge, the City has analyzed the fate and transport of TPCBs and offers the following observations:

- TPCB concentrations found in CSO solids average about 0.42 mg/kg. This average concentration is lower than the average concentration in Upper Canal surface sediments of 0.67 mg/kg and lower than EPA's PRG of 0.48 mg/kg. Notably, PCB levels on CSO solids are comparable to or lower than the reference area sediments, so the PCB source to Upper Canal sediments is unrelated to CSO discharge.

- In shallow sediments (0 to 2 feet), concentrations of TPCB, which average 3 mg/kg, are higher than TPCB in CSO solids (*see* Figure 2-7b). This observation is contrary to the assertion in the FS Addendum that CSOs are responsible for TPAH contamination in shallow sediments.

- As can be seen in Figure 2-7, PCB concentrations in the Canal are not comparable to those in EPA's reference area and are, in fact, nearly 10 times greater than the highest reference area sample. Notably, EPA dismissed its highest reference area value for TPCBs (1.7 mg/kg) so that the agency's estimate of background PCB levels based on congener analysis is 0.48 mg/kg.

- There is an as-yet unidentified PCB source in the Middle Canal area resulting in surface sediment TPCB concentrations with an average above 3 mg/kg. The presence of such high PCB levels in areas of the Canal that are depositional is clear evidence for the existence of at least one significant on-going PCB source to the surface sediments of the Canal at approximately 0.8 miles from Gowanus Bay (turning basin across from the Citizens MGP Site).

- Given the high concentrations found in the Lower Canal as well, it is likely that the source in the Middle Canal area is substantial enough to affect concentrations in both the Upper and Lower Canal as indicated in Figure 2-7.

- TOC-normalized TPCB concentrations indicate that the CSO TPCB concentration relative to TOC is more than an order of magnitude lower than in the reference area and in the surface sediments of the entire Canal.

- A principal components analysis of the PCB congener pattern shows that the highest concentrations of PCBs in sediments are associated with a unique PCB pattern, one that is unlike that of the reference area or the CSOs. This pattern is significantly heavier than that associated with CSO or reference area solids and is likely attributable to a source contributing an Aroclor 1260-like mixture. This is

[1] The City has not been able to establish why EPA's sums of PCB congeners as listed in their reports do not consistently equate to the total of the detected congeners reported in their database. However, the sums of the congeners in the EPA database closely match the congener sums of samples collected at reoccupied locations and analyzed by the City.

illustrated in Figure 2-8, which is based on the distribution of solids from CSOs, reference area solids and the surface sediments of the Canal (0-6 in).

Based on these observations, the TPCB data indicate that the existence of one or more important sources of TPCB is not accounted for in the FS Addendum. The hypothesis of a dominant CSO contribution is not supported by TPCB data. The Proposed Plan fails to estimate the needed reduction in an on-going source, whose impact on surface sediments of the Canal is clearly orders of magnitude greater than any CSO contribution. While the remedy described in the Proposed Plan may temporarily reduce surface concentrations of PCBs by dredging and capping, this on-going source of PCBs will serve to re-contaminate the sediment surface of the Canal, presumably to current levels. Failure to address this source of PCBs would be yet another basis for failure of the proposed remedy.

4) Metals concentrations in CSO solids and surface sediments in the Canal

While concentrations of copper and lead are higher in CSO solids than in the reference area, the inference by EPA that solids from CSO dominate the Canal cannot be supported given the significant dilution of harbor solids required to explain copper concentrations in the Canal, as well as the likely presence of additional sources of metals to the system, including active junkyards on the Canal that have been cited for numerous violations.

In the FS Addendum, EPA compared concentrations of copper and lead to reference area and Upper Canal concentrations. EPA also used aluminum and iron as normalizers and determined that concentrations in the Upper Canal are highly enriched with copper and lead as a basis to support its assertions that CSO discharges dominate the 0 to 2-foot (surface) sediments in the Canal. EPA did not consider the impact of other metals sources, and the effect of harbor solids in diluting the inputs of metals discharged from the CSOs. EPA also did not note that the level of enrichment of lead and copper in CSO solids are distinctly different from the enrichment levels in surface sediments of the Upper Canal.

As part of the contaminant fate and transport analysis performed by the City (*see* Appendix A3 – Chemical Concentrations and Mass Balance in Gowanus Upper Canal) using recent data collected from the four largest CSOs, the City makes the following observations regarding metals:

- CSO solids contribute substantially higher copper concentrations (average of 300 mg/kg) to the Upper Canal, but these solids must be significantly diluted by cleaner sediments to achieve an average concentration of 190 mg/kg in the Upper Canal surface sediments and 220 mg/kg in the Upper Canal shallow sediments (*see* Figure 2-9). This dilution is more pronounced when copper is normalized to aluminum (*see* Figure 2-9a).

- In the case of lead (*see* Figure 2-10), concentrations in the CSO solids (average of 295 mg/kg) compare to the surface sediment concentration in the Upper Canal (average of 350 mg/kg). This is inconsistent with the observation of copper where significant mixing of cleaner solids is required to explain Upper Canal concentrations. This indicates that another source of lead is likely contributing to the system. In shallow sediments in the Upper Canal, concentration of lead averages 450 mg/kg, slightly higher than average CSO solids concentrations.

- The likelihood of another source of lead was further explored by looking at the multivariate relationship amongst lead, copper and aluminum for the CSO solids, the reference area sediments and sediments in the Canal. Figure 2-11 presents a ternary plot used to display three metal components. Note that in this plot each metal component is presented on a scale from 0 to 100 percent, and each sediment or solid displays their fraction of the total. This graphical procedure represents a simple, direct way to grasp the broad characteristics of the entire data set and to see the intrinsic relationships amongst the CSO solids, the Canal sediments and the reference area sediments. From the figure, it is clear that the reference area sediments, which are finer in texture, have a dominant aluminum component. The CSO solids on the other hand are dominated by copper, although they do contribute lead to some extent. However, the sediments in the Canal plot out above the CSO and reference area sediments towards the lead apex of the diagram. This characteristic strongly indicates that another source of lead is likely contributing to the lead burden in the surface sediments in the Canal.

- Three other metals of importance to understanding contaminant fate and transport are cadmium, chromium and cobalt. For all three metals, the CSO solids concentrations are, on average, 50 percent lower than concentrations in the Upper Canal. Furthermore, surface sediment concentrations in the Middle Canal and sometimes the Lower Canal are substantially higher than the CSO solids. Again if the Proposed Plan were correct and the CSO solids were the dominant input to the Canal, concentrations of these metals in the Canal would not be substantially higher than CSOs.

Based on these observations, the City concludes there are other sources of these metals to the Canal that likely also include lead and need to be considered in the selection and design of any remedy.

5) Fecal coliform concentration in surface sediments

In the Proposed Plan EPA states that, "Sewage indicators, such as fecal coliform and steroids are found consistently in surface sediment in the Canal. The highest concentrations are located in the upper portion of the Canal where most CSOs are located." To support this statement, EPA is citing the study conducted by GEI, consultant for National Grid, in 2011 where 10 sediment samples were collected in the immediate vicinity of CSO outfalls (20 – 40 feet from the outfall location). This represents a biased sample set that by its design cannot be spatially representative of the surface sediments of the Canal and thus cannot be used to draw a conclusion regarding the distribution of CSO-related impacts in the Canal.

The City also notes that fecal coliform by its nature is not persistent and therefore is not a conservative tracer for CSO solids. Moreover, modern analytical methods permit the detection of fecal coliform at extremely low levels. Thus, the mere presence of fecal coliform in the surface sediments does not at all indicate that these sediments are derived exclusively from CSOs or even from the CSOs that contribute to the Canal. The City has examined several other compounds that may serve as tracers for CSO-related solids. The results show an extensive series of contaminants whose presence cannot be explained by CSO solids. The analysis also indicates the presence of harbor solids throughout the length of the Canal.

NYC Comment 2 Inquiries

Based on the observations noted in the comments above, the City requests that EPA respond to the following:

- Given this quantitative assessment, does EPA continue to believe that CSO solids (discharged with an average TOC content of 40 percent) can be the dominant component of Canal solids with only 6 percent TOC? If so, on what basis?

- Given the importance EPA placed on TOC in inferring sediment transport in the Canal, please explain why TOC normalization was not used to understand the fate and transport of organic compounds like PAHs and PCBs?

- Please explain why the EPA ERT transect data were not used in the assessment of PAHs.

- Please explain what EPA plans to do before selecting the remedy to quantify the other major sources of PAHs to the Canal and evaluate their impacts under future conditions with respect to the proposed remedy.

- Given the TPCB data presented and the analyses showing that CSO solids have a lower TPCB concentration per unit mass of TOC or per unit mass of solids than any other source (together with other data-based observations presented), does EPA continue to believe the hypothesis that solids from the CSO have a substantially greater influence in the 0 to 2-foot interval of surface sediment in the Upper Canal than any other source? If so, on what basis?

- Does EPA plan to continue to explore metals contamination and sources given the likely presence of other metals sources even though the metals themselves are not bioavailable?

- This evidence clearly shows the processes that produce sediment contamination at the head of the Canal to be far more complicated than that suggested by hypotheses presented in the Proposed Plan. How will EPA address this complex system before selecting the remedy so as to be sure that the selected remedy is successful?

- The distributions of PAHs, PCBs, lead, and other metals indicate the presence of ongoing sources to the Canal that have not been identified or quantified by EPA. How can EPA be confident that its selected remedy will be protective in the absence of quantitative estimates of these loads and an understanding of the processes responsible for them?

- While the Proposed Plan presents only anecdotal evidence of loading from CSO compared to regional sources (*i.e.*, TOC content, copper and lead content, steroids, proximity to CSOs), how will these anecdotal sources be used to establish a quantitative evaluation in the 5-year post remedial evaluations?

NYC Comment 3: EPA's risk management decision-making and remedy development is based on an underdeveloped CSM and incorrect conclusions regarding the nature and extent of the contamination, as well as contaminant fate and transport.

1) **The Proposed Plan demonstrates a lack of understanding of contaminant fate and transport and lack of a proper contaminant mass balance to support the CSM.**

Development of a CSM is one of the most important objectives and requirements of a CERCLA RI/FS process (*see* EPA, 2005). The CSM should identify sources of contamination and describe fate and transport mechanisms, exposure pathways, and receptors. Contaminant sources and transport pathways are poorly characterized in the RI, FS, and Proposed Plan, and the City believes that the lack of a properly developed CSM that informs risk management decision-making will have serious consequences for the selection and future performance of EPA's proposed remedy.

The inadequate understanding of the magnitude and extent of PAH and PCB sources as presented in the Proposed Plan has led to the assumption that risk drivers can be controlled simply by dredging the Canal, controlling CSO discharges, and relying on upland investigations still underway to identify and control any remaining sources. This approach clearly conflicts with much of EPA guidance, as noted by both of EPA's advisory panels (CSTAG and NRRB). Before a complete understanding of contaminant fate and transport for the Canal can be developed, all sources of contamination must be quantified. The Canal has been extensively contaminated by discharges from upland sources. PAH contamination in Canal sediments can be readily tied to the three MGP sites along its banks. However, the magnitudes of PAH transport via direct seepage of coal tar NAPLs from these facilities, via groundwater, and via the numerous private and unpermitted pipe discharges have not been sufficiently quantified to identify their relative importance.

Lacking information on the relative importance of the sources of contaminants to the system, EPA resorted to speculation about the character of CSO discharges relative to surface sediment observations in the Canal. The City notes that the contaminant patterns of several chemicals in the Canal (and the magnitudes of their concentrations) cannot be the product of any combination of CSO discharge and harbor solids alone. Significant other sources of contamination exist and these sources must be considered before a reliable chemical mass balance can be completed. Such a mass balance is critical to understanding the role of CSO solids with respect to surface sediment chemistry in the Canal.

To improve on the understanding of the CSM that is absent from the Proposed Plan, the City conducted several analyses to assess the solids and contaminant fate and transport in the Upper Canal (*see* Appendix A3 – Chemical Concentrations and Mass Balance in Gowanus Upper Canal). The following is a summary of the City's findings.

- Because hydrophobic organic contaminants and heavy metals typically adsorb strongly to sediment particles, sediment transport is important in understanding the fate and transport of their associated contaminants. Knowledge of sediment transport can be obtained directly through observations of suspended solids, sediment bed stability and numerical modeling, or it can be inferred from a chemical mass balance of contaminant concentrations and patterns. One independent data set that can be used to understand sediment stability is bathymetry. EPA used two single-beam bathymetric surveys conducted in 2003 and 2010 to map changes in bottom elevation. As discussed in part 6 of this comment, there are many uncertainties in the small-scale bathymetric changes estimated from these surveys. However, hypothetical calculations can be done to determine how the volume of solids from CSO discharges compare to the volume of sediment accumulated on the Canal bottom based on mean bathymetric changes over a large area. Integrating the bathymetric differences in the Upper Canal from 2003 to 2010, the average annual net deposition is estimated as 1,100 cubic yards. Assuming a typical particle density of 0.8 kilograms per cubic/cm^3, the net annual volume change is equivalent to 675 metric tons of solids per year. The total CSO discharge to the Upper Canal, from RH-034 and other CSOs, is estimated as 125 million gallons on an average annual basis. The average TSS concentration in CSO discharge is 200 mg/L (see Appendix A1-Summary of the City's CSO Sampling Program). Given this discharge volume and TSS concentration, the average CSO solids load to the Upper Canal is estimated at 95 metric tons of solids per year. This value is not directly comparable to the net accumulation, however. Before the solids load from CSOs can be compared to the estimated solids accumulation based on bathymetric change, the solids capture efficiency within the Upper Canal is needed. Based on the City's sampling program, the grain size composition of CSO discharge contained an average of 64 percent fines. The majority of these fines will likely not be captured within the Upper Canal due to their tendency to remain suspended in the water column. This is consistent with the observation of a higher sand fraction closer to the head of the Canal. Regardless of what the true capture efficiency is, the simple volume-based comparison given above (675 *vs.* 95 metric tons/yr) indicates that the solids discharge from CSOs are a small component of the estimated net accumulation of solids in the Upper Canal. By inference then, the harbor solids are likely the most significant contributor to the net accumulation of solids in the Upper Canal. While the CSOs and harbor solids are the two principal solids contributor to the canal, there are multiple sources of contaminants (including, groundwater and NAPL flowing upwards through the sediment bed) and these sources of contaminant contribute differently to risk depending on their fluxes and concentrations. Therefore, a mere ratio of solids contribution to the canal is not an appropriate means to determine contribution of risk to the Canal.

- The significant contribution of harbor solids to the Upper Canal is confirmed by TOC observations, although the City cautions that TOC is not a conservative parameter. TOC concentrations on CSO solids average about 40 percent, and a significant addition of harbor solids, which have TOC concentration of about 3 percent, is required to reduce the overall TOC found in the Upper Canal surface sediments to 6 percent.

- To further investigate the relationship between sediment transport and contaminant transport, the City developed an empirical chemical mass balance model for estimating the concentrations of chemicals in surface sediments in the Upper Canal for various hypothetical scenarios of solids contribution from CSOs, based on the enrichment of the chemicals relative to aluminum. In the model, two important solids inputs to the Canal were considered, including, the CSOs and the harbor solids. The chemical mass balance further assumed that the chemical burden on the solids from these two inputs were the only chemical contribution to the Upper Canal. Each solids contributor was represented by the average ratio of the chemical to aluminum. Aluminum was selected as a normalizer to account for differences in particle composition in the system. Using this model, the City tested EPA's assertion of a significant CSO influence by simulating surface sediment concentrations for copper, lead, chromium, cadmium, zinc, acenaphthene, benzo(b)fluoranthene, benzo(k)fluoranthene, phenanthrene, pyrene, TPAH and TPCB for five hypothetical scenarios of CSO solids contributions: 10 percent, 30 percent, 50 percent, 70 percent and 90 percent. Figures 3-1 through 3-5 present the results of percentage deviation between the model results and observed concentrations for the Upper Canal. Note that a positive deviation indicates that the inputs to the Canal are greater than required to yield the observed surface sediment concentration, while a negative deviation indicates that significant additional sources are needed to yield the observed surface sediment concentration. For each scenario, it was impossible to simulate a mixture of the two inputs that agreed well with the observed data. For much of the time, negative deviations were obtained, indicating that sources to the system are poorly characterized. For a hypothetical scenario of 90 percent CSO contribution, for example, statistical tests of comparison confirm that the surface concentrations simulated are significantly different from the observed surface sediment concentrations, disproving the hypothesis of a dominant CSO influence. The results from this analysis highlight the uncertainties in the solids and chemical balance for the Upper Canal. Regardless of which solids contribution is assumed, the balance of several of the chemicals cannot be explained. This indicates that the process that produces the surface sediment concentration in the Upper Canal is far more complicated than is understood at the moment.

These observations, while disproving EPA's assertions on CSO contribution, provide an indication of how uncertainties in source characterization undermine the CSM and mass balance for the system. The fact that the chemical mass balance model for the Upper Canal cannot simultaneously explain all the chemicals evaluated suggests that large uncertainties exist with regard to the sources of contamination to the Canal. More importantly, it indicates that there is no correlation between sediment inputs and contaminant burden in the Canal. Therefore, any attempt to allocate responsibility for contamination in the Canal based on solids contribution will be incorrect. Failure to develop a complete and technically rigorous CSM for the Canal is inconsistent with EPA's requirements for conducting an RI/FS under CERCLA. Development of the CSM cannot be deferred to the remedial design phase. Given the unknown nature of these large contaminant loads, it is unclear that the current assemblage of upland investigation and remediation efforts will be able to control them all. The City believes that it is highly likely that, given the failure to correctly characterize these on-going sources, the proposed remedy will fail to protect human health and the environment irrespective of any actions taken to address the CSOs, and will waste the resources used in controlling CSO discharges in an attempt to address risks they are not causing.

2) The Proposed Plan demonstrates a lack of understanding of the inextricable link between surface water and groundwater discharge, which is a critical aspect of the CSM.

The Proposed Plan states that PAH contamination in the surface sediment in the Upper Canal is from CSO discharge and that only deeper sediments are contaminated by NAPL. The following is an excerpt:

> "While the NAPL accounts for the majority of the PAH mass and the highest PAH concentrations in canal sediments, PAH concentrations in the top 6 inches of

sediments (the bioactive zone) in the upper reach of the canal are primarily associated with contaminants introduced through CSO discharges. Existing sediments in the canal are covered by newer contaminated CSO sediments and, to a much lesser extent, solids transported from the harbor through tidal transport or through the Flushing Tunnel when it is in operation. Thus, surface sediments are newer and deeper sediments are older. The deeper sediments become more heavily contaminated over time by NAPL or NAPL-derived contaminants migrating upward from below." *See* Proposed Plan, p. 9.

This conjecture is speculative and demonstrably incorrect. EPA has not measured or estimated the rate at which NAPL or groundwater-borne contaminants are migrating upward through the sediment column, nor has EPA estimated the mass loading that occurs from the groundwater and NAPL to either the water column or the newly arrived sediment. The City strongly disagrees that CSO solids are the main constituent of surface sediment in the Canal. In fact, evaluation of sediment and surface water data collected by the City shows that discharge of contaminated groundwater and NAPL through the sediments and along the sides of the Canal continues to be the primary source of contamination to surface sediment and the water column (as well as to the deeper sediments below them). By comparison, CSO contributions are minor and inconsequential for the remediation of the Canal sediments. In the analysis below, the City presents evidence for a groundwater link based on surface water observation, and results from sediment coring data.

a. Evidence of the groundwater link from surface water observations

The City has collected dry-weather water column samples (*see* Appendix A 2.1 – Summary of the Surface Water Sampling Program) from the Canal and Gowanus Bay, which were analyzed for PAHs and other parameters during a dry weather period (three-day antecedent dry weather). Figure 3-6 shows where the surface water samples were collected. The TPAH concentrations found in the Canal under these conditions are orders of magnitude greater than those found in Gowanus Bay; the average concentration in samples collected from the Canal is about 3000 ng/L, while the average concentration found in the bay samples is just 118 ng/L.

Figures 3-7 through 3-12 show the concentrations of TPAHs (sum of 17 PAHs) and six other PAH compounds found in the Canal during the dry weather sampling. The surface water samples were collected at least three days (more than six tide cycles) after any potential CSO discharge event. Where the water was 7 feet deep or greater, samples were collected from both 2 feet above the bottom and 2 feet below the surface. Where the water was shallower, only a sample from 2 feet above the bottom was collected. Two samples per station were collected in the reference area (Gowanus Bay) from 5 locations, and from the Canal at Locations 1 through 9 and 12; only one sample per station was collected at Canal Locations 10, 11, and 13 through 15, and in the turning basins.

Note that an average CSO discharge is about 5 million gallons, while at low tide the Canal contains about 200 million gallons of water and 250 million gallons at high tide. The volume of water in the Canal is therefore about 40 to 50 times larger than a CSO discharge event, providing substantial dilution for the CSO discharge. The surface water samples collected after more than 6 tidal cycles following a CSO discharge represent Canal water impacted by contaminants from discharges other than the CSOs. Any contribution by CSOs would have been diluted more than 100 fold by tidal exchange. Rather, the high level of TPAH in the water column of the Canal can only be attributed to the migration of contaminants with groundwater and NAPL through the Canal sediments, and discharges along the sides of the Canal.

On a simple mass basis, the standing inventory of TPAH as given by the TPAH concentrations in surface water (shown on Figure 3-7) equates to a TPAH mass of about 1.4 kg resident in the water column. Assuming these conditions are typical water column concentrations and that tidal exchange removes water at average Canal concentrations, approximately 20 to 25 percent of this inventory would be lost with each tidal cycle or 0.56 to 0.7 kg/day. This represents a substantial flux of TPAH out of the Canal, which must be regularly replaced to maintain the water column inventory. In comparison, the mass of PAHs delivered from CSOs to the Canal during a CSO discharge event is on average about 0.09 kg, or equivalent to roughly 0.017 kg/day. The elevated concentration of TPAH and corresponding resident mass in the Canal water column when the CSOs are not discharging shows there is continuing influx of PAHs to the Canal on the scale of 0.56 to 0.7 kg/day. It is clear this cannot be the result of CSO discharge and is, in fact, the result of uncontrolled discharges of groundwater and NAPL from the MGP sites. The greatest TPAH concentrations in the surface water of the Canal are found in areas adjacent to MGP plants where NAPL is known to be present in the sediment column. The predominant sources of the PAHs are groundwater discharging to the Canal and, potentially, NAPL bubbling up to the surface (ebullition).

The existence of a substantial PAH flux to the Canal unrelated to CSOs is evident even if the tidal exchange flux is ignored. The most prominent PAH compound found in the Canal surface water during the dry-weather sampling was acenaphthene (*see* Figure 3-8), which had an average whole water concentration of 1,374 ng/L (with a highest concentration of 4,420 ng/L), compared to the average acenaphthene whole water concentration in CSO discharges of 119 ng/L (and a highest concentration of 487 ng/L). Because the CSO acenaphthene concentration is a full order of magnitude less than the concentration resident in the Canal, and the approximate dilution of CSO discharge to the Canal is 40-fold (5MG to 200MG), the CSOs cannot be delivering the mass of acenaphthene found in the Canal. Again, the concentrations of acenaphthene found in the surface water of the Canal during the dry weather sampling event are most likely due to NAPL and groundwater discharge.

The observed patterns of PAHs in the surface water and CSOs further substantiates the City's assertion that the Proposed Plan has failed to identify the major source of PAHs to the entire Canal, MGP-site related groundwater and NAPL. The average mass fractions of the PAHs compounds in surface water were further compared to mass fraction of PAH in groundwater and mass fraction of PAHs in CSO discharge (Figure 3-13). These mass fraction scatter diagrams are intended to demonstrate how the composition of two inputs, groundwater and CSOs, compare to the composition observed of the surface water. In addition, the similarities or differences in PAH composition were quantitatively assessed by the coefficient of divergence ("CD"),[2] which has been used in PAH studies to compare PAH concentrations and composition at different sites (Wongphatarakul *et al.*, 1998; Zhang *et al.*, 2000) as well as in biological studies. If the PAH compositions of the compared media shown in the scatter plot are similar, the points fall close to the 1:1 line and the CD approaches zero. If PAH compositions in the media are very different, the points fall far from the line and the CD approaches one. As seen in Figure 3-13, there is close agreement between the composition in groundwater and that observed in surface

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[2] $CD = \sqrt{\frac{1}{p}\sum_{i=1}^{p}\left(\frac{Xisw-Xij}{Xisw+Xij}\right)^2}$, where Xisw and Xij are the average mass fraction of the ith chemical component mass fraction for surface water, and either groundwater or CSO, respectively, and p is the number of chemical components.

water. This good agreement is validated by the low CD of 0.2. Conversely, CSO PAH composition is significantly different from groundwater or surface water composition, with a high CD of 0.71 between CSO and surface water observations. These results indicate that groundwater and surface water PAH patterns are closely linked, identifying groundwater as the major contributor of PAH contamination to the Canal.

b. Evidence of the groundwater link from sediment coring observations

In addition to incorrectly asserting that CSOs are the primary source of PAHs to the Upper Canal, the Proposed Plan also asserts that the NAPL is being buried by new sediment deposition. Due to the different fate and transport properties, mechanisms and processes for individual PAH compounds, some move more quickly through the environment than others or are degraded more quickly than others. A comparison of compounds that make up the low-molecular-weight ("LMW") PAH suite of compounds in the sediment column was conducted to test the Proposed Plan's assertion that NAPL is being isolated by sediment burial. Examination of the sediments of the Canal also shows that groundwater and NAPL are responsible for contamination of the entire sediment column, including the surficial sediment. Evaluation of the proportions of individual compounds making up LMW and high molecular weight ("HMW") PAHs in surface sediment compared to the patterns found at depth in the sediment column show that the relative percentages of the compounds remain consistent when naphthalene is excluded. Naphthalene is more biodegradable, more soluble, and more volatile than the other PAHs and is therefore not conservative in the sediments.[3] (*See* Appendix A2.2 – Evidence for degradation of Naphthalene in the Gowanus Canal System.) The consistency of the patterns of LMW and HMW suites of PAHs exclusive of naphthalene throughout the sediment column shows that sediment in the interval from 0 to 1 foot in depth is contaminated by the same source as at sediment at 8 feet in depth. These patterns are similar to those detected in NAPL samples, but are not similar to those found on CSO solids. Figures 3-14 to 3-16 show the relative proportions of 6 LMW compounds in the lower, middle and upper reaches of the Canal, respectively, while Figures 3-17 to 3-19 present the relative proportions of 10 HMW compounds for the same reaches. This assessment showed that the pattern of the main PAH constituents (except for naphthalene) remains the same from deeper sediments to the surface sediments. Note that even with the introduction of 'urban' PAHs in shallower sediments, there is little change in which PAHs dominate the patterns. The changes that are seen are attributable to variations of transport and fate processes for different compounds, which is the expected condition. This analysis further confirms that CSOs are not responsible for PAH burden in the surface sediments over background.

Given the close link of surface and deep sediment PAH patterns, an analysis was conducted to assess if the distribution of PAHs in the shallow sediments is statistically linked to the presence of NAPL in the deeper sediment. A comparison of shallow sediment (GEI samples from the 0-3 foot interval) TPAH concentration means and standard deviations to the visible presence of NAPL in the sediment column (at any depth,

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[3] In environmental fate and transport, a conservative substance is one that is subject to a limited number of physical transport processes whose effects can be easily accounted for. For the purposes here, it is a substance that is strongly associated with suspended matter and sediments. The mass of a conservative substance introduced to a system must be conserved. In this context, the substance is not subject to significant losses due to biodegradation, gas exchange or other processes that significantly change the mass of the substance in the system. Thus, if a substance is introduced to the Canal via particles that originate from the harbor, the concentration of the substance per unit mass of particles remains the same unless additional particles with a different concentration of the substance or the substance itself are added directly to the Canal. Based on the degree of change or lack of change, the presence of additional sources of a substance can be inferred. If a substance is not conservative, then it may be subject to loss from the system, as is the case for naphthalene in this instance.

usually in a deeper core interval) was conducted with two categories: *i.e.*, 'Contains NAPL' in the sediment core, and 'No NAPL' present in the sediment core (the mere presence of a sheen on a sample was not considered to indicate the presence of NAPL). Figure 3-20 shows the results from this analysis. A Tukey-Kramer statistical test shows that the 'Contains NAPL' and 'No NAPL' groups represent statistically different data sets (shown by the circles on the right, representing two standard errors around each mean, having little to no overlap), with the mean of the TPAH concentrations in 'Contains NAPL' samples being significantly higher than the mean of 'No NAPL' sample TPAH concentrations. This shows that the highest concentrations of TPAH in the shallow sediments are correlated with (and most likely controlled by) the presence of NAPL in the subsurface. These processes do not appear to have been contemplated or investigated, and are not considered in the characterization of contaminant sources, FS, or Proposed Plan.

c. Summary of the groundwater link

Based on consideration of both surface water and sediment data, the rate of upward contaminant migration in the sediment and arrival at the water column is greater than the rate of sedimentation. This conclusion is contrary to the conjecture that sediment is being deposited faster than it can be contaminated by groundwater and NAPL. It also shows a significant problem with the remedial strategy described in the Proposed Plan: there is no data-based estimate of the contribution by groundwater and NAPL of contaminants to the proposed cap. Given the results of these analyses, there will be a significant amount of PAHs arriving, which has grave ramifications for the longevity of the cap. As these findings demonstrate, the Proposed Plan incorrectly attributes far more influence of the CSO discharges on surface sediment PAH concentrations than warranted, and ignores the far more critical influence of NAPL releases from adjacent upland MGP sites.

3) The Proposed Plan demonstrates inadequate characterization of CSO solids, undermining the CSM.

To characterize PAH concentrations on the solids from CSO discharges, EPA conducted an analysis of Semi Volatile Organic Compounds ("SVOCs") on a whole water basis, providing no separate information on dissolved and suspended matter concentrations. EPA then approximated PAH concentrations on the solids from CSOs using the measured whole water concentrations and TSS measurements. In this methodology, EPA simplistically (and incorrectly) assumed that the entire mass of PAHs as reported by a measured whole water concentration was carried by the solid phase and that the dissolved PAH concentration was zero. The City, in its comments to CSTAG and NRRB and in meetings with EPA, has previously raised concerns regarding this approach since the whole water data measured by EPA was dominated by LMW PAHs, which are likely to be in the dissolved phase.

The City's previously articulated concern is supported by the data that the City subsequently collected to characterize the suspended solids in CSO discharges. For this investigation, the City analyzed samples from the CSO discharges in separate dissolved and particulate phases. Figure 3-21 provides a comparison of the Total PAH concentration on CSO solids measured by the City with those estimated by EPA for the four largest CSOs. Data collected by the City show that the average TPAH concentration on CSO solids is approximately 30 mg/kg, as compared to the 60 mg/kg derived by EPA using the whole water data and assuming that all of the contaminant mass is on the solids. In addition, EPA's TPAH results show a much higher degree of variability as compared to the measured values. The coefficient of variation ("CV") for the values derived by EPA is

0.9, as compared to the CV of 0.3 on the City's measurements, representing a three-fold decrease in variance by the City's method relative to the EPA's.

This simplistic assumption used by EPA also leads to an incorrect estimate of the LMW fraction of PAHs on the CSO solids. This arises in large part because the compound naphthalene, which comprises an important fraction of the PAH mass, is nearly all in the dissolved phase, but EPA has ascribed the entire PAH mass to the solids fraction of the samples. A comparison among the different PAHs (Figure 3-22) indicates that LMW PAHs account for just 23 percent of the total PAH mass on the solids, based on direct measurements, as opposed to 40 percent calculated based on EPA's assumptions. This clearly demonstrates that the methodology used by EPA to derive TPAH concentrations on solids from CSOs produces estimates that are biased high, two times the actual measured TPAH concentrations. This is a significant flaw in EPA's characterization of CSO solids since the biased estimates are used to make inferences regarding their relationship with the surface sediments in the upper reaches of the Canal.

4) **The CSM described in the Proposed Plan reflects an insufficient understanding of groundwater and NAPL transport.**

As EPA points out in the Proposed Plan, NAPL exists at all depths penetrated in samples beneath the Canal, and at almost all points along the Canal's length. Given the history of the Canal and of groundwater use in Brooklyn, where saltwater intrusion was induced just as NAPL was being released to the Canal, this is to be expected. The important factor that is missed in the Proposed Plan is that this source of groundwater contamination, which is by far the greatest source, exists *beneath* the Canal, not just adjacent to it. This reservoir of contamination is not being characterized in DEC's upland investigations, and it has not been fully characterized in EPA's investigation. Not only is the NAPL itself potentially mobile, groundwater must pass through the NAPL to discharge into the Canal. EPA has not investigated the occurrence of the NAPL and the movement of groundwater in relation to it. Because of the potential for contaminated groundwater to shorten the effective lifespan of the cap included in the proposed remedy, and the virtually unlimited supply of PAHs represented by the NAPL at depth, this data gap represents a significant shortcoming in the CSM.

5) **The Proposed Plan substitutes speculation in the CSM for knowledge about sediment transport processes, mechanisms and their impacts, such as propeller wash, sediment stability, erosion and deposition.**

EPA did not conduct the rigorous analysis of sediment transport, deposition and erosion needed for a remedy of this scope and cost and instead provides only speculation on sediment transport mechanisms. Sediment accumulation in sheltered water bodies such as the Canal is controlled largely by tidal currents and bottom topography relative to sea level.[4] An understanding of sediment transport is essential to understanding current solids and associated contaminant loads as well as to understanding future conditions that may result from the Proposed Plan. Yet the Proposed Plan does not provide any rigorous analysis and instead speculates as to the possible causes of sediment accumulation and erosion patterns. For example, the FS Addendum p.5 states:

> "Bathymetric differences between 2003 and 2010 showed an overall lack of sediment accumulation in the middle reach of the canal, even though two major

[4] Perillo, G.M.E. (editor), 1995. Geomorphology and Sedimentology of Estuaries. Elsevier, May 16, 1995.

> CSO outfalls are located in this reach (Figure 3). The lack of accumulation in this reach is most likely due to frequent resuspension of solids by vessel propeller wash and redistribution by tidal and possibly flushing tunnel currents."

The suggestion that sediment accumulation over such a large area could be controlled by propeller wash is speculative at best, and highly unlikely given the low level of boat traffic in the Middle Canal area. There is not sufficient evidence to demonstrate that boat traffic, as the Proposed Plan suggests, is truly a significant mechanism for control of sediment deposition and erosion. Net sediment accumulation is a process governed much more by the steady day-to-day tidal processes and solids loads. Thus, the analysis presented in the Proposed Plan is not supported by the data and is incorrect. This concern is symptomatic of the failure to develop a robust CSM.

6) In the Proposed Plan, EPA fails to recognize the uncertainty in its bathymetric analysis and then proposes unlikely mechanisms in its CSM to explain its observations.

The Proposed Plan makes several broad statements concerning the nature of sediment deposition in the Canal and provides very detailed maps of changes in bathymetry over time. In doing so, the Proposed Plan fails to disclose or perhaps recognize that nearly all of the surface elevations being compared are interpolated estimates of bathymetry and not direct measurements. Given the limited coverage, particularly in 2003, the real changes in elevation can only be identified by integrating over much greater distances than those shown in the plan figures. Failure to recognize this uncertainty yields many apparent changes in surface elevation that have little basis in reality.

For example, as shown in Figure 3-23, the survey lines of the 2003 and 2010 EPA bathymetric surveys do not align closely, and the 2003 survey is particularly sparse in coverage. While alignment is not a requirement for a comparison of surveys, use of unaligned surveys does introduce significant uncertainty into the analysis. Offset between survey lines means that there are few, if any, direct comparisons of elevation changes between surveyed locations. Even at this scale, the dots on the figure representing the surveyed points are much larger than the actual area surveyed at each location. Thus as noted above, the vast majority of the bottom is un-surveyed. As a result, nearly all comparisons are between interpolated locations of one survey with interpolated locations of the other. Individual survey uncertainty for a measured point is typically ±3 to 6 inches vertically. However, the uncertainty of interpolated locations is much greater. Thus, given the sparse coverage of the 2003 survey and the lack of close alignment between survey lines, the estimates of changes between surveys on the small scale presented by EPA are highly uncertain and probably not meaningful below 1 to 2 feet of change and possibly more.

Yet the Proposed Plan interprets this information as if it had no uncertainty or error of any concern. For example, Area A (shown on the inset portion of Figure 3-23) indicates erosion with a bathymetric change between 1 and 2 ft. Yet there is only 2010 bathymetry data in this area. The locations where 2003 and 2010 data intersect at the boundaries of the area show no erosion between the survey events. This assertion of an erosional area is an artifact of EPA's interpolation process that fails to account for the uncertainties in the interpolation. Clearly, there is insufficient bathymetric data in this area to indicate such a level of erosion. Failure to recognize this uncertainty has led EPA to provide a highly speculative and unlikely sediment transport process.

In this area, the Proposed Plan identifies Area A and the area north of it as erosional (*see* the blue-green shaded areas in the inset of Figure 3-23) and then speculates on a possible mechanism as well as a subsequent re-deposition process:

> "Currents generated by the Flushing Tunnel apparently eroded sediments near the outlet of the tunnel, but the sediments settled out where the current velocities decreased farther down the canal between Sackett and 3rd Streets." See Proposed Plan, p. 10.

From sediment transport science, the suggestion that sediments eroded from areas near the Flushing Tunnel exit would quickly resettle downstream is without merit. If the water velocity were sufficient to scour the sediments 100 feet or more from the Tunnel outlet, it would also have been sufficient to distribute those sediments throughout the Canal and possibly out to the harbor. Fine grained sediments, which constitute the vast majority of surface sediments in the Canal, require a high shear stress (and high flow velocity) to be re-suspended due to their inter-particle attraction. Once suspended, however, they settle extremely slowly due to their small diameter. Thus, re-suspended fine-grained sediments in the Upper Canal would be widely dispersed throughout the Canal and probably the harbor as well, and not re-deposited between Sackett and 3rd Streets, as stated in the Proposed Plan.

The spatial distribution of these erosional areas in the Upper Canal are also inconsistent with any likely Flushing Tunnel flow regime (*see* Figure 3-23). The Flushing Tunnel delivers water and fine grained suspended matter from Upper New York Bay to the Canal. Given their small size, these particles are unlikely to settle near the entrance to the Canal. Even if this indication of deposition at the Tunnel discharge point is correct, if the flow from the Tunnel were sufficient to cause scour anywhere in the Canal, it would likely occur in the general vicinity of the discharge point, which is also the shallowest area of the Canal, and not hundreds of feet downstream of the discharge point where the turbulence from the Tunnel discharge would already have begun to dissipate.

This discussion highlights both the high degree of uncertainty in EPA's bathymetric analysis and its interpretation. It also points out a much more important deficiency, the lack of a quantitative basis to understand ongoing sediment transport and to predict future conditions in response to any remedial activity. The City believes that the actual nature of sediment transport in the Canal must be better understood if a successful remedy is to be selected and implemented.

7) **The radionuclide profiles obtained by National Grid do not indicate a high degree of disturbances from CSOs in the Canal, and EPA's interpretation in the CSM is incorrect.**

The Proposed Plan implies that the radionuclide results obtained by National Grid document frequent disturbances from CSOs when the core profiles are typical of profiles obtained elsewhere in the harbor. The profiles also document that the lead-210 result are particularly suspect, an observation EPA fails to note. As noted in FS Addendum:

> "Radioisotope profiles of Cesium-137 and Lead-210 in sediment cores collected by National Grid in the upper reach of the canal (Figure 5) do not resemble the ideal

profiles that would form in an undisturbed depositional environment such as continuous settlement of suspended sediments from the water column. The evidence of disruption in the core profiles is consistent with episodic deposition of solids from CSOs and/or other disturbances." *See* FS Addendum, p. 5.

This assertion is without merit. The City has evaluated the six radionuclide cores collected by National Grid, all from the Upper Canal, and notes that the cesium-137 results in particular are consistent with profiles obtained throughout the harbor, showing a maximum at depth and gradually decreasing in concentration to the surface. In particular, the uppermost portions of the cesium-137 profiles obtained by National Grid are fairly smooth with little layer to layer variation. More importantly, EPA provides no data on levels of cesium-137 present in CSO solids as a basis to know how such discharges would affect these profiles. Thus, the Proposed Plan provides unconfirmed speculation on the existence of disturbances due to CSOs. The lead-210 profiles are not interpretable as they show no decline over time. However, they are very typical of lead-210 profiles seen throughout the New York-New Jersey Harbor.

EPA asserts that the highly variable lead-210 profiles present in the Canal sediments can be used to calculate deposition rates for the Canal and that any inconsistencies in the profile are due to CSO discharges and episodic disturbances. This is not the case. Any episodic disturbances would also be captured in the cesium-137 profile. As an example, National Grid core 1 is shown in Figure 3-24. The "disturbances" in the lead-210 profile are not reflected in the cesium-137 curve, which is relatively smooth over the last 2 meters of deposition, unlike the lead-210. This core is located closest to RH-034 and would have been the most subject to CSO "disturbances," had they occurred. In Figure 3-25 showing National Grid core 12, the cesium-137 profile again shows the expected pattern but the lead-210 significantly increases with depth, making the lead-210 data inconsistent and difficult to interpret. These poor lead-210 profiles are not indicative of CSO events, but rather are characteristic of sediment accumulation levels in the harbor. Figure 3-26 depicts profiles of a core obtained from Newark Bay (Tierra Solutions, 2011[5]) as an example of a core from a slower deposition rate site with interpretable cesium-137 but an inconsistent lead-210 profile. Figure 3-27 presents the profile for National Grid core 88, also from the Upper Canal. This core has some consistency in its lead-210 values in that they generally decline with depth. Nonetheless, the cesium-137 and lead-210 -derived time horizons within the core are inconsistent, again indicative of issues regarding the lead-210 results.

This disagreement between the lead-210 and cesium-137 profiles suggests that it is likely that the lead-210 data in the Canal and elsewhere in the harbor do not appear to satisfy the basic requirements for interpretation, which may be indicative of poor data quality or changes in the nature of depositing solids. These concerns would result in varying levels of lead-210 that were not due to disturbances, but rather due to changes in the Canal drainage watershed and its solids load over time. The above conclusion is supported by work done in other parts of the New York/New Jersey Harbor area, such as Newark Bay. Radionuclide results obtained from cores in Newark Bay indicate that it is challenging to obtain a reliable lead-210 profile that can be used to date the sediment column. On this basis, EPA should not use the radionuclide profiles of lead-210 to infer sediment disturbances. The available cesium-137 profiles suggest typical sediment accumulation processes and do not show evidence of CSO-related disturbances.

[5] Tierra Solutions, Inc., 2011. Final Phase I and Phase II Sediment Deposition Report, Newark Bay Study Area Remedial Investigation. Revision 1. October 2011.

8) EPA's assessment of risks to human health from ingesting fish and crab fails to take into account regional sources of such contamination, which the remedy for the Canal is incapable of addressing.

The Proposed Plan states:

> "The HRRA indicated completed human risk exposure pathways with unacceptable risk levels for surface water/sediment contact and fish consumption." *See* Proposed Plan, p. 14.

However, the stated carcinogenic risks to human health from ingesting fish and crabs identified in the Proposed Plan are not driven solely by chemical quality of sediments in the Canal, but are also driven by regional sources of PCBs in fish and crabs. The regional component of the risks will not change regardless of the remedial action selected for the Canal.

NYC Comment 3 Inquiries

Given the observations above, the City requests that EPA respond to the following:

- Considering the information developed by the City as agreed upon with EPA, will EPA adjust its schedule for issuing a ROD until more data become available and a better understanding of contaminant sources fate and transport can be developed to address the uncertainties identified? If not, why not?
- Since the City's data clearly demonstrate that the Proposed Plan's focus on CSOs as the primary source of surface sediment contamination is incorrect, can EPA be confident that the other, much larger (but of indeterminate magnitude) sources of PAHs and PCBs will be sufficiently controlled by the currently proposed remedy?
- Given the City's observations that surface sediment contamination is correlated with the presence of underlying NAPL, and that surface sediment concentrations are orders of magnitude higher than concentrations on CSO solids, does EPA agree that surface concentration of PAHs are not due to CSO discharges? If not, why not?
- The City's evidence indicates that essentially all surface PAH concentrations over the PRG are due to external sources to the Canal unrelated to CSOs. Does EPA agree? If not, why not?
- Does EPA intend to investigate these PAH sources further before implementing a ROD? If not, why not?
- Given the analysis presented above, does EPA still believe that solids delivered by CSOs will yield surface sediment concentrations above the PRGs? If so, what is the basis for this belief?
- An additional source of contamination to the Canal that is not addressed in the RI/FS or Proposed Plan is direct loading of solids from eroding fill material along the shoreline through broken bulkheads. Fill is known to contain ash and other

wastes that are high in PAHs, metals and other contaminants. What is the current rate of solids and contaminant loading from eroding fill on shorelines in the Canal? How will the effect of fill from eroding shorelines be evaluated during the 5 year post-remedial evaluations?

- If EPA chooses to move forward in spite of the identified uncertainties, when does EPA estimate that conditions in the Canal will meet the PRGs, since the CSOs will clearly not be limiting?

- What are the relative sources of sediment deposition attributable to the sources identified in the Proposed Plan and from regional transport?

- If sediment transport modeling was performed to inform decision making, why was this information not reported in the RI/FS or the Proposed Plan?

- How will the new bathymetric profile to be established after the completion of the dredging component of the remedial action alter the sediment transport dynamics of the Canal and influence recontamination?

- Given the stated importance of solids sedimentation after the remedial action as a potential means to re-contaminate the Canal bottom, why didn't EPA perform sediment transport modeling and why won't this important work be done in the coming months prior to final selection of the remedial action?

- How will the Flushing Tunnel alter rates of sediment influx and loading to the Canal?

- How will the operation of the Flushing Tunnel alter the sediment transport dynamics of the Canal and influence recontamination?

- Given the concerns the City has raised regarding the uncertainties in EPA's interpretation of the bathymetric data, does the EPA plan to revise its analysis so as to obtain better estimates of sediment deposition and its associated uncertainty on a scale supported by the data?

- What are the relative sources of sediment deposition attributable to the sources identified in the Proposed Plan and from regional transport?

- How will the remedial action 5-year evaluations assess recontamination of the Canal if relative inputs of solids are not known and how will improvements be quantified if baseline loadings have not been established?

- What specific investigations will EPA perform, what data will be collected and what evaluation would be performed to verify NAPL/coal tar mobility at specific locations?

- Given that no investigations have yet been performed by EPA deeper than six feet into the native sediments, what investigation criteria will be utilized to determine the lateral and vertical dimensions of NAPL/coal tar in native deposits beneath the soft sediments?

- Without an operable sediment transport model, how can these vital questions be answered by EPA to assure the public that a proper remedial action has been selected, that the remedial action has not been over-prescribed, or that unforeseen rates of recontamination may not occur?

NYC Comment 4: EPA has failed to recognize the need to control upland sources adequately before implementing sediment remediation; in particular, EPA has failed to document the importance of NAPL release processes originating from MGP sites.

As noted above, the Proposed Plan asserts that the current source of PAH contaminants to the surface sediments is CSO discharges and that solids from the CSOs have buried MGP-contaminated sediments and isolated them, removing them as a source. This assessment is clearly incorrect: the distribution of PAH compounds in the Canal bottom sediment, both vertically and horizontally, and the presence of PAHs at significant concentrations in dry-weather water column samples displaying similar distribution patterns, show that PAHs in the deeper subsurface sediment and groundwater continue to be the major sources of PAHs to the surface sediments. As discussed in NYC Comment 2, CSO solids do not contain PAHs at sufficiently high concentrations nor the correct mixture of PAHs to account for the PAH concentrations and patterns found in the surface sediments. These observations conclusively show that the characterization of contaminant sources presented in the Proposed Plan does not account for the major processes that are currently contaminating surface sediments. Without accurately identifying and quantifying the current PAH loading mechanisms, an appropriate remedial strategy cannot be developed and the efficacy of any proposed strategy cannot be determined with assurance.

1) Impact of groundwater on the Canal

The impact of contaminated groundwater on the Canal has not been evaluated by EPA. As described in NYC comments 3(2) and 3(4) above, EPA has underestimated the impacts of groundwater contamination and NAPL movement. EPA is relying on remedies being implemented under DEC oversight for the MGP sites adjacent to the Canal to control groundwater and NAPL. However, the DEC actions are limited and do not address the mass of NAPL and contaminated groundwater already beneath the Canal. If NAPL and groundwater from the upland sites and beneath the Canal are not adequately controlled when the remedy is implemented, they have great potential to reduce the effectiveness and sustainability of the remedy.

The extent of contamination by coal tar NAPL and its impact on the Canal, groundwater, and CSOs are not known. GEI's coring program found NAPL in the sediment or below the sediment at almost all points in the Canal, but no estimates of the existing mass and flux of contaminants from this source have been made. Anecdotal information on one of the MGP facilities indicates the presence of extensive volumes of coal tar NAPL beneath the site and is supported by observations of coal tar by the City during construction related to Gowanus facilities upgrade. In its RI/FS, EPA has not quantified the flux of contaminants via groundwater to the Canal. The City's analysis shows that the discharge of groundwater to the Canal is approximately 2 cubic feet per second ("cfs"). The concentrations of chemicals of potential concern ("COPCs"), particularly PAHs and metals, observed during the RI in the soils and sediments through which the groundwater flows are orders of magnitude higher than the concentrations observed on CSO solids, as observed both from EPA's CSO solids data and from the CSO data collected by the City. The movement of groundwater through these soils and sediments will continue to deliver these contaminants to the Canal unless measures to control groundwater are implemented. Using the estimated groundwater discharge and the concentrations of PAHs in upland groundwater areas, the City estimated potential groundwater loads of PAHs and compared to them to estimates from the CSOs. Note that the estimated groundwater loads used are likely the minimum possible loads to the Canal, because as the groundwater is transported, additional PAHs from the NAPL already in the sediments will likely partition to the groundwater and will be transported upwards. Therefore, when the effect of NAPL on the groundwater is considered, the estimated loadings of PAHs to the Canal via groundwater may be significantly higher than the loads presented in Table 4-1.

Table 4-1. Comparison of estimated PAH loads from groundwater and CSOs

Analyte	Mean GW Concentration (ug/L)	Potential Annual Loads from GW (kg/yr)	Mean CSO Concentration (ug/L)	Potential Annual Loads from CSOs (kg/yr)
Acenaphthene	59.7	116	0.26	0.2
Acenaphthylene	10.9	21.2	0.06	0.1
Anthracene	5.9	11.4	0.17	0.1
Benzo(a)anthracene	1.47	2.9	0.46	0.4
Benzo(a)pyrene	1.34	2.6	0.51	0.4
Benzo(b)fluoranthene	0.82	1.6	0.57	0.5
Benzo(g,h,i)perylene	0.6	1.2	0.44	0.3
Benzo(j,k)fluoranthene	0.58	1.1	0.52	0.4
Chrysene	1.47	2.9	0.77	0.6
Dibenz(a,h)anthracene	0.14	0.3	0.12	0.1
Fluoranthene	3.99	7.7	1.24	1.0
Fluorene	17.6	34.2	0.17	0.1
Indeno(1,2,3-cd)pyrene	0.55	1.1	0.40	0.3
Naphthalene	1,340	2,590	1.54	1.2
Phenanthrene	33.4	64.7	0.99	0.8
Pyrene	4.95	9.6	1.2	0.9
Sum of 16 PAHs*	1,480	2,870	9.4	7.4
Sum of 15 PAHs* (excluding naphthalene)	143	278	7.9	6.2

*Data are not available for 2-methylnaphthalene

A comparison of potential PAH loads from groundwater and CSOs to the Canal demonstrates that even lower-bound estimates of the groundwater contributions are several times higher than loads from CSOs. In particular, for benzo(a)pyrene, groundwater loads to the Canal are estimated to be at least four times greater than the corresponding CSO contribution.

Although these are just first-order estimates of PAH loads to the Canal, it should be noted that the estimate of PAHs delivered by groundwater annually either with (2870 kg/yr) or without nonconservative naphthalene (278 kg/yr) identify a load that is comparable to the estimate of PAH transport out of the Canal by tidal exchange discussed in NYC Comment 3(2) (0.56 to 0.7 kg/day or 200 to 260 kg/yr). These analyses are preliminary but provide a clear indication of the magnitude of the PAH fluxes in and out of the Canal, the dominance of the groundwater contribution to the Canal, and the de minimis contribution by CSOs.

The City also estimated potential loads for several metals from groundwater and CSOs (Table 4-2). The estimated potential groundwater loads for heavy metals are mostly higher than loads from CSOs, except for copper and lead. However, for copper the loads from CSOs will be less than or comparable to the loads from groundwater due to the reductions implemented by the City under the Water Quality Improvement Plan ("WQIP") for the Canal. Also, note that for copper and lead, CSO solids concentrations are comparable to regional background threshold values developed using the candidate reference areas selected for the Newtown Creek Superfund site.

Table 4-2. Comparison of estimated metals loads from groundwater and CSOs

Analyte	Mean GW Concentration (ug/L)	Potential Annual Loads from GW (kg/yr)	Mean CSO Aqueous Concentration (ug/L)	Potential Annual Loads from CSOs (kg/yr)
Arsenic	9	18	4	3
Barium	308	598	57	45
Cadmium	0.7	1.4	1	0.5
Chromium, Total	5	9.5	10	8
Copper	22	42	77	61
Lead	10	19	72	57
Mercury	0.10	0.2	0.23	0.2
Nickel	10	20	7	6
Silver	0.7	1.4	1	1

2) Other sources to the Canal:

The Proposed Plan is premised on a remedial investigation that lacks a complete CSM and, as a result:

- Has failed to identify several significant upland sources of contamination,
- Lacks the information needed to quantify the tentatively identified sources it has identified, and
- Incorrectly applies inadequate data to draw conclusions regarding the current nature of contaminant loads to the Canal.

EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA, 2005, p. 2-7[6]) states that one of the "essential elements" of the CSM is to "include information about contaminant sources." EPA should further develop the following areas.

a. Upland sources

[6] EPA, 2005. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. EPA-540-R-05-012, OSWER 9355.0-85, December 2005.

The RI does not adequately characterize current and former industrial, upland properties and processes that have historically contributed and may continue to contribute hazardous substances and petroleum contamination to the Canal. This data gap must be addressed prior to developing remedial alternatives; otherwise, loads to the Canal from these sources may ultimately undermine the remedy. This area has been extensively used by various industries for the past 140 years, but there have been relatively few cleanup activities on upland industrial properties under governmental regulatory programs. Upland sites along the Canal that are currently the subject of remedial investigation or are otherwise regulated include the three former MGP sites and over 20 other properties regulated under the New York State Brownfield Cleanup Program ("BCP"), the Voluntary Cleanup Program ("VCP"), the spill program, the Petroleum Bulk Storage ("PBS") program, the Chemical Bulk Storage ("CBS") program, and the Major Oil Storage Facility ("MOSF") program. The CSM for the Canal should provide, at a minimum, a summary of the current status of the remedial program at each of these sites, and any existing data and information about the contamination, as recommended by EPA's guidance (EPA, 2005, p. 2-7). The City's May 25, 2011 comments on the Draft Remedial Investigation ("City RI Comment Letter") describe several existing sources of information that can be used in this assessment, including a City analysis of upland properties and environmental assessments or other technical documents that were produced in response to its various 104(e) requests. The City is particularly concerned about the progress of the on- and off-site investigations at the former Fulton and Metropolitan MGPs, since full characterization of the location, magnitude, and extent of all coal tar emanating from these sites is an essential component of the investigation of the Canal.

b. Discharges from facilities with SPDES Permits

EPA's contaminated sediment guidance (EPA, 2005, p. 1-2) identifies all "direct pipeline or outfall discharges into a water body from industrial facilities" as potential sources of sediment contamination. While EPA performed sampling of the permitted CSO outfalls, the RI does not evaluate publicly-available information about other discharge points or provide a full examination of other permitted outfalls discharging to the Canal. The City's RI Comment Letter contains an analysis of the State Pollutant Discharge Elimination System ("SPDES") permits for facilities with permitted discharges to the Canal and Gowanus Bay. The City recommends that the CSM be revised to incorporate information regarding these permitted and illegal discharges, because they could contribute to recontamination.

c. Unpermitted outfalls and surface runoff

EPA's contaminated sediment guidance (EPA, 2005, p. 1-2) identifies "direct pipeline or outfall discharges into a water body from … stormwater discharges" as a potential source of contaminants in sediment. As part of the RI, EPA conducted a survey of the Canal and identified 247 outfall features (Phase 1 and Phase 2 combined, not including CSO and municipal stormwater outfalls). However, EPA only performed dry weather sampling of the discharge from 12 of the identified outfall features. As contaminated stormwater from industrial sites is likely to be discharging from these outfalls, the City recommends that EPA also collect and analyze wet weather samples from a representative number of these 247 outfalls. EPA (2005, p. 1-1) also identifies surface runoff or erosion of soil from floodplains and other contaminated sources on land, such as waste dumps, chemical storage facilities or urban areas as a potential source of sediment contamination. There are several scrap yards, bulk storage facilities, and open equipment yards along the Canal which are likely contributing contaminated overland runoff to the Canal during certain wet weather events. The City recommends that EPA attempt to quantify the loadings from contaminated runoff by conducting additional field investigations or, at a minimum, estimate potential contaminate loadings by using existing data resources such as EPA's National Urban Runoff Program Report ("NURP"). If left unexamined, these potential sources could continue to contribute contaminated runoff into the Canal and interfere with the ultimate remedy.

EPA's contaminated sediment remediation guidance (EPA, 2005, p. 2-20) states that "controlling contaminant sources typically is critical to the effectiveness of any Superfund sediment cleanup." The above-mentioned sources of contamination, including the MGP sites, groundwater, upland sites, and unpermitted discharges, should be fully characterized and controlled.

NYC Comment 4 Inquiries

Given the observations above, the City requests that EPA respond to the following:

- Does EPA agree with the conclusions presented here that there are major sources of PAHs and PCBs that are not well characterized? Does EPA still believe these can be entirely controlled by upland activities or will the remedy for the Canal require additional in-Canal controls that will need further development?

- Does EPA intend to investigate these PAH sources further before issuing a ROD? If not, why not?

- There is almost no discussion or detail on the referenced coordinated schedule, or discussion of what occurs if National Grid does not meet EPA's expected schedule. As the upland remediation plan is essential for the successful remediation of the Canal, EPA needs to provide substantial additional detail concerning management, oversight, and coordination of this work.

- What specific upland properties other than MGP sites have been identified by EPA that are discharging, or have the potential to discharge, hazardous substances to the Canal?

- What is EPA's schedule for cleanup of upland properties that are discharging, or have the potential to discharge hazardous substances to the Canal?

- Have all upland properties with potential to discharge hazardous substances been identified or is further investigation required to identify them?

- What is this schedule for implementation of MGP cleanups?

- If MGP site cleanup is not complete in time, will the Canal remedial action be deferred until the MGP remedial actions are complete?

- If further investigation is required, when will that work be performed and who will perform it? Will this work be done before the ROD is issued?

- What are the calculated rates of discharge of contamination from upland properties other than the MGP sites in groundwater?

- Given that groundwater discharge has a high potential to re-contaminate the sediment remedy, what are EPA's goals for reduction in these rates of hazardous substance discharge to the Canal from upland properties other than MGP sites?

- How will the reduction in these rates be monitored during the post-remedial 5 year reviews?

NYC Comment 5: The 2007 draft NewFields report on PAH forensics that EPA relies upon does not support EPA's conclusion that additional CSO controls are required under CERCLA.

To support its assertion that CSO discharges have the greatest impacts on the shallow sediments in the upper reaches of the Canal near CSO outfalls RH-034 and OH-007, EPA used results of high resolution hydrocarbon fingerprints for shallow sediment samples from the 2007 draft NewFields report.[7] Section 3.5 of this section of the FS Addendum asserts:

> "A subset of sediment samples collected by National Grid in 2005 were analyzed for an expanded list of PAHs and other hydrocarbons to facilitate identification of the likely origins of PAHs in Gowanus Canal sediments (NewFields 2007). Figure 15 presents high resolution hydrocarbon fingerprints for shallow sediments in the upper reach of the canal (0 - 1.5 ft interval). The NewFields analysis concludes that the shallow sediments are dominated by an unresolved complex mixture (UCM) with multiple sources of PAHs. The UCM fingerprint is consistent with impacts from urban runoff in CSO discharges. The fingerprints of the native sediments are characteristic of coal tar." FS Addendum, p. 10.

For the following reasons, the 2007 draft NewFields report and EPA's interpretation of that report do not support EPA's conclusion that additional CSO controls are required under CERCLA:

1) **The NewFields data set is of poor quality, and is incomplete.**

NewFields did not analyze field duplicate, field blank, equipment blank and trip blank samples as part of their high resolution hydrocarbon fingerprinting analysis. While 17 of the 124 samples were analyzed twice as laboratory duplicates, laboratory duplicates are not equivalent to field duplicates. NewField's failure to analyze field duplicate, field blank, equipment blank, and trip blank samples as part of the forensic high resolution hydrocarbon evaluation conflicts with both EPA's standard data validation protocols and accepted scientific methodology for the acquisition of environmental data.

2) **Both NewFields and EPA arbitrarily selected a limited number of samples to draw their respective conclusions that CSOs contribute the bulk of PAHs to the shallow sediments in the Canal.**

Of the 124 samples analyzed by NewFields, 102 sediment samples represented the "shallow sediments (less than 2')," the "soft" sediment (between the shallow sediment and the native sediment), and the "native sediment" as referred to by EPA. NewFields' dataset also includes five soil samples from borings taken from the Canal banks, two product samples[8] from the Citizens MGP, one floating product sample, six pavement samples, and eight seep samples.

The text and illustrations in the 2007 draft NewFields report provide no justification for a limited interpretation of only a portion of the 124 samples that were analyzed. NewFields'

[7] NewFields 2007. "Environmental Forensic Investigation. Gowanus Canal, Brooklyn, New York". Draft Report. Prepared for Tracey Bell, KeySpan Corporation.

[8] In Comment 5, the word "product" is used to refer to the coal tars that were produced at the three MGP facilities.

draft report did not include the interpretation and illustration of half of the transects for the Canal sediment samples; in particular, NewFields omitted illustrations to represent most of the samples taken in proximity to National Grid's MGPs (specifically, NewFields omitted the illustration of sediment samples from transects B, E, I, J, L, M, N, P, Q, S, T, W, X, and Z). The contribution of MGPs and other sources in proximity to these transects are therefore not illustrated or otherwise discussed in the report, even though the vast majority of PAHs in Canal sediments originated in close proximity to the omitted transects.

Similarly, and even more problematic, the FS Addendum relies on only four samples identified in the 2007 draft NewFields report. In particular, EPA compared two shallow sediments (GC-SED-03 (0-1.5') and GC-SED-10 (0-1.5')) to two native sediment samples (GC-SED-01 (19-20') and GC-SED-18 (7-8')). Based on these four samples only, EPA asserts that (i) shallow sediments in the Canal are dominated by an unresolved complex mixture ("UCM"), (ii) the UCM fingerprint is consistent with impacts from urban runoff indicative of CSO discharges, and (iii) the presence of a UCM in the two shallow sediment samples and its absence in the two native sediment samples demonstrate that CSOs are contributing the bulk of PAHs in the shallow sediments in the Canal.

A review of all of the chromatograms presented in the 2007 draft NewFields report demonstrates that UCMs are common and prevalent not just in the shallow sediments, as EPA asserts, but throughout the soft sediments, the native sediments and even the soil samples taken from Canal banks. Therefore, contrary to EPA's assertion, the presence of UCM in the two shallow sediment samples EPA selectively and arbitrarily chose is not diagnostic as to the CSOs and the origins of PAHs in the shallow Canal sediments.

NewFields' and EPA's selective use of the data is not consistent with proper scientific methodology.

3) **Review of the NewFields data also shows that there is an uneven application of the assignment of UCM to the chromatograms used for illustration purposes in the report.**

At low hydrocarbon concentrations a "baseline rise" is a natural part of the chromatographic analysis. The "baseline rise" has nothing to do with the presence of petroleum but instead represents column bleed of the stationary phase from the capillary column. In the 2007 draft NewFields report, there are instances where "baseline rise" has been incorrectly attributed to the presence of a petroleum product. However, as no data have been supplied in the report to allow a determination of what proportion of UCM could be attributed to "baseline rise," the use of the presence of a "UCM" indication as support for a petroleum source in samples was not reliable science.

4) **EPA should not attribute the presence of petrogenic (petroleum-based) PAHs in the shallow sediments primarily to urban runoff associated with CSOs.**

There are multiple potential sources of petrogenic PAHs in the shallow sediments that are unrelated to CSOs, including petroleum spills (large-quantity, documented historical petroleum spills occurred at the MGPs), bulk petroleum storage, leaking underground and above ground fuel tanks, and bilge water from barges and boats. Urban runoff is only one potential source. It is therefore incorrect for EPA to determine that the primary source of petrogenic PAHs in the shallow sediments is likely the runoff from the CSOs. As shown in the ratio analysis below, the PAHs on CSO solids are not petrogenic.

5) Diagnostic PAH ratio analysis of CSO solids data collected by the City shows that CSO PAH fingerprint is different from that obtained by NewFields in Canal surface sediments.

One of the tools used by forensic scientists in understanding and distinguishing pyrogenic sources of PAH is the double ratio scatter plot (Costa and Sauer, 2005[9]). In its report, NewFields used the PAH ratios (FL0/PY0) and (BBF+BKF)/BAP[10] for the purpose of resolving the source specific differences among the pyrogenic PAHs in their field samples. Using this pair of ratios, the City re-created Figures 4f, 4e and 4d of the NewFields report with the following additions: high resolution surface sediments data collected as part of the City's toxicity test, split sediment samples collected by the City during National Grid's program to collect Canal sediments in the vicinity of CSO outfalls, and CSO solids data. The results are given in Figures 5-1 to 5-3. From this figure the City observes the following:

- Canal sediments analyzed for high resolution PAH analysis by the City plot within the cloud of Canal sediments reported by the same high resolution PAH analysis for NewFields. Therefore, both data sets can be combined for quantitative analysis.

- The CSO solids are distinct in their fingerprint compared to the surface sediments in the Canal, the heavy and middle petroleum sources, and the coal tar product used by NewFields to represent the Citizens MGP NAPL product. The same observation applies with respect to the PAH patterns in deeper accumulated sediment and native sediments in the Canal.

- The surface sediments of the Canal as well as the Citizens MGP NAPL product are consistent with the fingerprint defined by NewFields as petroleum tar. On the other hand, the CSO data is more consistent with heavy PAHs including many forms of creosote and building materials.

It is clear from the figure that the surface sediments of the Canal cannot be dominated by the discharges from the CSOs. Rather, the Canal sediments, which are classified as petroleum tars plot more closely to the Citizen MGP signature. Therefore, contrary to EPA's assertion, this plot reveals that most of the PAHs in the Canal were derived from petroleum tar dominated by the Citizen MGP product. In addition to the ratios, the concentrations from the CSO solids are substantially lower than surface sediment concentrations in the Canal, and therefore, CSO discharge cannot be responsible for the high concentrations of PAHs in the Canal.

6) The 2007 draft NewFields report relies on a deficient mixing model that does not properly account for the origin of the PAHs in the shallow sediments.

Mixing processes redistribute PAHs in the Canal both vertically (through compaction, ebullition, turbulence, bioturbation and groundwater discharge to the Canal) and horizontally (through erosion, re-suspension and re-deposition). These mixing processes result in the commingling of older and more recent sources in the Canal. Therefore, having on an accurate mixing model is imperative. As an example, since PAH concentrations in the native sediment and soft sediment attributable to the MGPs (coal tar)

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[9] Costa H.J. and T.C. Sauer, 2005. "Forensic approaches and considerations in identifying PAH background." Environmental Forensics. 6: 9-16.

[10] Note: FL0 = fluoranthene; PY0 = pyrene; BBF = benzo(b)fluoranthene; BKF = benzo(k)fluoranthene; BAP = benzo(a)pyrene

are more than an order of magnitude higher than PAH concentrations in the shallow sediments, incorporation of as little as 10 percent of native or soft sediments in to the shallow sediments by mixing can explain the totality of the PAH concentrations in the shallow sediment.

NewFields acknowledges the critical importance of its mixing model in its claim that the precision of its mixing model is on the order of +/- 10 percent. NewFields' assertions regarding the precision of its mixing model have no support in scientific methodology or in the data upon which NewFields relies. In fact, for the following reasons, NewFields' mixing model biases in a way that exaggerates the asserted contribution of PAHs in CSOs to shallow sediments as opposed to PAHs from coal tar related to the MGPs and from other sources:

First, NewFields incorrectly assumes that there are only two sources of PAHs to the Canal sediments, namely the MGPs and the petroleum attributed to runoff/CSOs. The MGPs are the major contributors of PAHs to the Canal sediments; however, by considering the pavement petroleum as the only other contributor, the mixing model mischaracterizes the CSO fingerprint and exaggerates the CSO source contributions. As a threshold matter, this assumption is biased and inaccurate because it does not include many other potential PAH sources, such as fuels, coal and air emissions.

Second, NewFields assumes that the contribution of National Grid's three MGPs can be represented by two product samples collected from one of its three MGPs. This assumption is not supported by sufficient data. It is unlikely that the two selected samples would, in fact, represent the diversity of the three MGPs' contributions.

Third, NewFields assumes that pavement samples represent the petrogenic PAH contributions to the Canal sediments and that this source represents petroleum sources attributable to CSOs. Again, NewFields ignores other more logical and prevalent petroleum discharge sources to the Canal, historical and current, including known petroleum usage at the MGPs and at other petroleum storage facilities.

Fourth, in its mixing model NewFields attempted to quantify the relative contributions of petroleum and coal tar in sediment samples by using only 16 PAH compounds (EPA PAHs subset). This procedure ignores 35 of the 51 PAHs compounds that were analyzed for and are present in the Canal sediments, mostly from the MGPs. Using all 51 PAHs in the mixing model yields very different results. For example, applying the mixing model to SED-90B(6.5-7') using the 16 EPA PAHs yields a contribution of 52 percent to MGP sources compared with 82 percent if one uses the 51 PAHs that GEI actually analyzed. This demonstrates that the mixing model is biased and inaccurate.

Fifth, NewFields' mixing model produces results that allocate more than 100 percent of the PAHs in shallow sediments to one source, demonstrating that their mixing model is not scientific, and yields inaccurate and unreliable results.

The mixing model in NewFields' draft report is deficient, biased, highly uncertain, inaccurate, and therefore unreliable.

7) **A review of the NewFields sediment chemical data as a complete data set, including PAH data, alkyl homologues data and data from the transects in the Upper Canal locations (Transects A-I), the Middle Canal locations (Transects J-V) and the Lower Canal locations (Transects W-AA) demonstrates that both vertically and horizontally, coal tar related to the MGPs is the predominant source of PAHs in the Canal regardless of location.**

In locations near the three MGPs and in the turning basins, the source of PAHs is so strongly related to coal tar from the MGPs that it overwhelms all other hypothetical potential sources. While the data show some limited influence of petroleum-derived PAHs, these can be found in widely separated spots and could be attributable to multiple potential petroleum sources other than just CSOs. In fact, contrary to EPA's assertions, pavement samples were not involved in PAH source mixing within the Canal sediments. Rather, petroleum-derived PAHs appear to be more related to releases of distillate petroleum products to the Canal, in soils and on the banks of the Canal.

8) The 2007 NewFields report is in draft form.

EPA should not base significant conclusions on a draft report containing NewFields' preliminary interpretations.

NYC Comment 6: EPA's selection of reference areas is ill considered.

EPA's Gowanus Bay and Upper Hudson reference area is a poor choice as a background area for the Canal based on two important observations. First, the reference locations are open water areas that are not as protected as the Canal. As a result, the sediments that accumulate in the reference areas are likely to be different from those in the Canal. This concern was recognized as part of the Newtown Creek RI reference/background site study. In response, 14 areas around the harbor similar in hydrodynamic setting to Newtown Creek, (and effectively to the Canal) were selected for background sampling. The Canal reference areas are dissimilar to the Canal in two important respects: (i) given their lack of shelter, these areas tend not to accumulate sediment, so they experience little to no recent deposition, and (ii) these areas are subject to periodic navigational dredging, which may have removed recently accumulated material.

This concern was borne out by the surface sediment radionuclide results obtained by the City in its sediment collection program for its toxicity texts. Beryllium-7 was frequently detected in the surface sediments of the Canal, in approximately 8 of the 12 samples collected, indicating the presence of very recent deposition (less than 1 year old) in these 8 locations (see Figure 6-1). Cesium-137 was detected in 11 of the 12 locations, indicating post-1954 deposition in nearly all areas sampled (*see* Figure 6-2). This is in sharp contrast to EPA's reference areas, which only yielded one confirmed, and one marginal, detection for beryllium-7, while three samples were non-detect. Clearly, the reference areas do not have much very recent deposition. The concern is even greater for cesium-137. Three of the five reference locations were non-detect or nearly non-detect for this radionuclide as well. The absence or very low level of cesium-137 indicates the absence of deposition over the last 60 years. Thus three of the five reference area locations do not represent conditions that would be considered background for the Canal since they have not accumulated any sediment since 1954 (the year of cesium-137 appearance).

Given the lack of post-1954 deposition at three of the five reference sites, and therefore the dissimilarity to conditions in the Canal, the City recommends that EPA use the Newtown Creek reference area study as a basis to establish background concentrations and any related PRGs for the Canal.

Since the Canal is an industrially impacted site with discharges from CSOs and other sources, EPA should consider the data collected as part of the Newtown Creek RI/FS for this type of setting as candidate areas when evaluating background for the Canal. For the Newtown Creek RI/FS, an evaluation to determine appropriate background locations was conducted by collecting surface sediments at several candidate sites for contaminant and physical characterization. These waterbodies were classified into four categories including: industrial with CSO input, industrial with no or minimal CSO input, non-industrial with CSO input and non-industrial with no or minimal CSO input. The City determined BTVs (95th percentile of the upper prediction limit) for these four categories for TPAHs, TPCBs, copper, and lead.[11]

[11] In Table 6-1, data identified by Pro UCL Version 4.1 as outliers were excluded in estimating BTVs.

Table 6-1: Background Threshold Values for Candidate Reference Site in Newtown Creek Area

Chemical	Industrial, No CSOs	Industrial with CSOs	Non-Industrial No CSOs	Non-Industrial with CSOs
TPAH (mg/kg) at 6 % TOC	44	62	16	69
TPCB (mg/kg)	0.16	0.49	0.18	2.72
Copper (mg/kg)	288	388	232	182
Lead (mg/kg)	280	526	157	232

(1) Data identified by Pro UCL as outliers were excluded in estimating BTVs.

The following discusses the City's concerns regarding EPA's analysis on a contaminant-by-contaminant basis. The City performed non-parametric hypothesis testing to determine whether the Canal CSOs are statistically significantly higher than the BTVs. Figures 6-3 to 6-6 show the Canal CSO concentrations, along with concentrations in the four reference area categories for TPAH, TPCB, copper and lead. The BTV for each reference category is indicated in the figures. The following summarizes the City's observations in the Canal relative to the four categories:

- For TPAHs, on a 6-percent organic carbon basis, the CSO concentrations are lower than the BTVs from the various background areas.

- For TPCBs, the CSO median concentrations are higher than the BTVs for industrial with no or minimal CSO input and non-industrial with no or minimal CSO input. PCBs in the CSOs compare with the BTV in the industrial with CSO input category, and are significantly lower than the BTV in non-industrial with CSO input.

- For copper, the CSO median concentration is higher than the BTVs for non-industrial with no or minimal CSO input and non-industrial with CSO input. The CSO median copper concentration compares to the industrial with CSO input and industrial with no or minimal CSO input categories.

- For lead, the CSO median concentration is higher than BTVs for non-industrial with no CSOs and non-industrial with CSOs. CSO median lead concentration compares to industrial with CSO and industrial without CSO.

NYC Comment 6 Inquiries

Based on the observations above, the City requests that EPA respond to the following:

- Does EPA agree that the background sites initially selected by the EPA for the Canal are not appropriate given the differences in estuarine setting and lack of post-1954 deposition in three of the five sites? If not, why not?

- Will EPA consider substituting use of the "industrial sites with CSOs" category from the Newtown Creek site as a basis for the Canal background in lieu of the Gowanus Bay and Upper New York Bay reference areas identified in the Proposed Plan? If not, why not?

NYC Comment 7: The PAH PRG calculated by EPA is flawed.

The PRG calculated in the FS Addendum for total PAHs is undermined by:

- The failure to follow a cited method for the reference envelope approach (Ingersoll *et al.*, 2009[12]);
- The use of toxicity test data derived from samples that exceeded EPA recommended holding times for toxicity test samples by approximately 16 weeks.
- The total disregard for EPA's explicit definition of the No Observed Effect Concentration ("NOEC");
- An erroneous assumption that the variability in the NOEC is reflected in the central tendency of all measured values that are equal to or less than the No Observed Adverse Effect Concentration ("NOAEC");
- An incorrect application of the cited method (NAVFAC, 2010[13]) used recently at a Region 1 EPA Superfund site for calculating a TPAH PRG.

(*See* NYC Comment 7(6) below in which the City provides a calculation of a PRG for TPAHs based on correct application of the cited method (NAVFAC, 2010)).

1) EPA failed to follow a cited method for the reference envelope approach (Ingersoll *et al.*, 2009).

The FS Addendum (section 4.1, p. 14) states that "On each plot, a horizontal line (green) represents the lowest toxicity test result for a reference sample (considered the lower bound of the reference envelope)." This citation of the reference envelope approach derives from EPA's Ecological Risk Assessment guidance (EPA, 2011, section 5.1, p. 5-5) which states that: "Therefore, a baseline of conditions in the reference area was established using a 'reference envelope' approach (Ingersoll *et al.*, 2009) to differentiate between site- and non-site-related toxic responses." EPA applies this approach by using the station with the lowest toxic response among four reference area stations to specify toxicity (EPA, 2011; Table 6-2). EPA then extends this approach into the FS Addendum by incorporating this "lower bound of the reference envelope" into a graphical approach for which the FS Addendum provides no reference to any technical literature or EPA guidance that supports such a "graphical approach."

The method cited by EPA (Ingersoll *et al.*, 2009) uses the reference envelope approach to evaluate samples from the Ashtabula River with respect to toxicity to the amphipod *Hyalella azteca* in 28-day tests. Toxicity was established by comparing the test response (survival or length of amphipods) in site sediments to the response of amphipods exposed to reference sediments. This method designates site samples as toxic if the toxic response in those sediments is lower than the lower limit of the normal range of responses for the reference sediments. That lower limit is defined as the fifth percentile response of organisms exposed to reference sediments, not simply the lowest response value in a reference area sample. The cited method (Ingersoll *et al.*, 2009) is

[12] Ingersoll, C.G., N.E. Kemble, J.L. Kunz, W.G. Brumbaugh, D.D. Macdonald, and D. Smorong. 2009. Toxicity of Sediment Cores Collected from the Ashtabula River in Northeastern Ohio, USA, to the Amphipod *Hyalella azteca*. *Arch. Environ. Contam. Toxicol.* Vol. 57, no. 2. pp. 315–29.

[13] NAVFAC (Naval Facilities Engineering Command). 2010. Record of Decision: Site 2B – Area A Wetland, Naval Submarine Base – New London, Groton, Connecticut. August 2010.

consistent with other applications of the reference envelope approach which depend not on the lowest measured value of a toxic response among reference area samples, but depend upon the toxic threshold based on the statistical distribution of all measured samples from a reference area or reference areas (*see* Appendix A4.1 - Technical Basis for Reference Envelope Approach).

2) The FS Addendum uses toxicity test data derived from toxicity tests encumbered by significant uncertainties.

The PAH-based PRGs are based on highly uncertain toxicity tests and an incorrect application of EPA guidance in the calculation process. Among many concerns, the City notes in that the Proposed Plan EPA:

- Did not use the EPA definitions of the NOEC;
- Incompletely applied a cited method for calculating a PRG for total PAHs (NAVFAC, 2010);
- Used an averaging of the range of values among the non-toxic samples to incorrectly represent variability in the NOEC; and
- Used toxicity test data derived from samples that exceeded EPA-recommended holding times for toxicity test samples by approximately 16 weeks.

As a result, EPA's PAH PRG is not defensible. The City has repeated the toxicity tests conducted by EPA, correctly applied EPA guidance and derived a set of more accurate and supportable NOECs. The City's review of the PAH analysis presented in the FS Addendum for ecological risks uncovered many concerns with regard to the data and procedures used to derive the NOEC value that was applied as the PAH PRG (20 mg/kg on sediments at 6 percent TOC). The FS Addendum uses data derived from toxicity tests encumbered by significant uncertainties (*see* Appendix – A4.3 Critique of EPA Toxicity Test Data) including:

- Employing three "re-starts" due to poor organism health;
- Failing to describe the sample handling, distribution, and storage necessitated by these restarts;
- Exceeding recommended holding times for these toxicity tests by as many as 15 weeks; and
- Failing to address the potential uncertainties introduced into the toxicity testing due to the number of samples that were described as having "heavy" or "tar-like" sheens and odors.

A detailed description of these uncertainties is found in Appendix – A4.3 Critique of EPA Toxicity Test Data. The City was sufficiently concerned about the uncertainties introduced by these analysis issues that it conducted a separate toxicity study of its own, using sediments obtained from the same locations as originally occupied by EPA, and toxicity testing methodology prescribed by EPA in published guidance.[14] This study yielded

[14] EPA, 2001. EPA 600/R-01/020, March 2001, Method for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod Leptocheirus plumulosus. Office of Research and Development, Western Ecology Division, U.S. Environmental Protection Agency.

PRGs based on strict adherence to the EPA guidance described in NAVFAC (2010), with values that were substantively different from those obtained by EPA; specifically 138 mg/kg TPAHs in bulk sediment assuming 6 percent TOC in the Canal for the growth endpoint; and 412 mg/kg TPAHs in bulk sediment assuming 6 percent TOC in the Canal for the survival endpoint.

3) The FS Addendum ignored EPA's explicit definition of the NOEC.

EPA's definition for the NOEC in the EPA guidance for toxicity testing using *Leptocheirus plumulosus* is:

> "The highest concentration of a toxicant to which organisms are exposed in a test that causes no observable adverse effect on the test organisms (*i.e.*, the highest concentration of a toxicant in which the value for the observed response is not statistically significantly different from the controls)." *See* EPA, 2001[15] subsection 3.1.1.1.

This definition in its characterization of the NOAEC as the highest concentration that causes no observable effect on the test organisms is consistent with EPA's definition of No Observed Adverse Effect Level (EPA, http://www.epa.gov/risk_assessment/glossary.htm) and EPA's definition of No Observed Effect Level in its Framework for Ecological Risk Assessment (EPA, 1992[16]). Explicit in all these definitions is that the no effect level is the highest concentration in an experiment that is not significantly different from an appropriate control.

For growth and reproduction, the FS Addendum used a "graphical approach." This approach estimated a NOEC by first estimating a Lowest Observed Effect Concentration ("LOEC"). This LOEC was defined as the lowest concentration at a location where the average value of an endpoint was less than the lowest response (most toxic) of that endpoint among reference area samples. The NOEC was then defined as the concentration of TPAHs in a sample that was immediately below the LOEC. This approach ignores the EPA definition of NOEC, which is the highest concentration in a sample in which the value of the observed response is not statistically different from the control. The City was unable to find prior references that employ the "graphical approach" used in the FS Addendum.

The FS Addendum selected 7.8 mg/kg TPAH as the NOEC for growth based on this non-standard definition (*i.e.*, a comparison of an average to a LOEC). This method ignores the EPA definition of a NOEC which requires that the NOEC be the highest concentration of a toxicant in which the value for the observed response is not statistically significantly different from an appropriate control.

If EPA's selection of reference station 333 as the appropriate control is accepted (*i.e.*, the reference response used in EPA's graphical method), then the NOEC (following EPA definitions) should be based on the sample that has the highest concentration of TPAHs and whose value for the growth endpoint is not significantly different from the value at

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[15] EPA, 2001. EPA 600/R-01/020, March 2001, Method for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod Leptocheirus plumulosus, Office of Research and Development, Western Ecology Division, U.S. Environmental Protection Agency.

[16] EPA, 1992. Framework for Ecological Risk Assessment, Risk Assessment Forum, EPA/630/R-92/001 February 1992.

sample 333. That sample is 303, where the concentration of TPAHs is 39 mg/kg. Note that the toxic response at station 303 is also not significantly different from laboratory controls (EPA, 2011) and is not significantly different from the pooled reference area samples (*see* FS Addendum).

Using similar methods, EPA uses the average value of the reproductive response measured at station 329 as the appropriate control to estimate a reproductive NOEC (*i.e.*, the reference response used in EPA's graphical method). If EPA's selection of reference station 329 as the appropriate control is accepted (*i.e.*, the reference response used in EPA's graphical method), then the NOEC should be based on the sample that has the highest concentration of TPAHs and whose value for the reproduction endpoint is not significantly different from the value at sample 329. That sample is 303 where the concentration of TPAHs is 39 mg/kg. Therefore, the appropriate NOEC for reproduction and growth is 39 mg/kg.

4) The FS Addendum erroneously assumes that the variability in the NOEC is reflected in the central tendency of all measured values that are equal to or less than the NOEC.

The FS Addendum incorrectly identifies the uncertainty in the NOEC as "a measure of (the) central tendency…" of all concentrations in the *L. plumulosus* toxicity testing that were equal to or less than the NOEC. This method is inherently incorrect because:

- It ignores all EPA definitions of NOEC as explained above (*See* NYC Comment 7(3)), and
- It does not address variability in the NOEC; rather it attempts to address the variability in all measured values equal to or less than the NOEC. If the FS Addendum were to address the variability in the NOAEC, it would have to measure the NOAEC in several series of toxicity tests, and calculate the appropriate statistics. The FS Addendum illogically assumes that those values that are less than a defined parameter somehow express variability in the parameter.

5) The FS Addendum incorrectly applies the cited EPA method for calculating a PRG.

The FS Addendum cites a study done in EPA Region I (NAVFAC, 2010) as an example of the method that the FS Addendum used to develop a PRG. However, the cited study used a method that adhered to the EPA definition of NOEC. Specifically, the cited study:

- Used the growth endpoint in estimating NOEC and LOEC;
- Defined toxicity based on a statistical comparison of the results at each site station to the results at combined reference area stations;
- Tabulated all non-toxic samples and their respective TPAH concentrations;
- Selected the sample with the maximum concentration in that group of non-toxic samples as the NOEC;
- Tabulated all the toxic samples and their respective PAH concentrations;

- Selected the LOEC as the lowest concentration in a toxic sample that is greater than the maximum concentration in a non-toxic sample; and

- Calculated the geometric mean of the NOEC and LOEC as the PRG.

The City notes that if the FS Addendum had followed this method:

- Among the Canal stations, the only sample that was non-toxic for growth was the sample tested from station 303, which had a total PAH concentration of 39 mg/kg;

- Therefore, the NOEC is 39 mg/kg;

- The LOEC is derived from station 310 and is 66.9 mg/kg; and

- The geometric mean of these values is 51 mg/kg, which is the PRG using the method cited by EPA in the FS Addendum.

6) The City's calculation of PRGs for TPAH based on valid toxicity test data returned a PRG of 138 mg/kg TPAH in bulk sediment assuming 6 percent TOC in the Canal for the growth endpoint and 392 mg/kg TPAH in bulk sediment assuming 6 percent TOC in the Canal for the survival endpoint.

The City has calculated PRGs based on survival and growth of *Leptocheirus plumulosus* for TPAHs in the Canal using:

- Recently obtained sediment toxicity data (*see* Table 7-1, which reproduces Table 1 from Toxicity Test Appendix A4.2 City of New York Calculation of PRGs for Total PAH) that did not require restarts and was conducted within EPA recommended holding times (2 weeks of sampling date);

- EPA definitions of NOEC and LOEC; and

- A direct application of the method cited by EPA (NAVFAC, 2010) for the calculation of PRGs.

Table 7-2 and Table 7-3 (which reproduces Table 2 from Toxicity Test A4.2 City of New York Calculation of PRGs for Total PAH) provide the estimated PRGs for TPAHs based on survival and reproduction, respectively.

Table 7-1. Toxicity test results – comparison with Pooled Reference Site results

Test Day 28			
Test Sample	Mean Percent Survival (SD)	Mean Dry Weight per Amphipod in Milligrams (SD)	Mean # Offspring Per Adult (SD)
Pooled Reference	**55(34)**	**1.0(0.37)**	**1.9(1.8)**
NYCDEP-GC-TX-303	30(17)	0.47(0.08)**	0.91(0.98)
NYCDEP-GC-TX-307A	2(3)*	NA	NA
NYCDEP-GC-TX-307B	30(19)	0.50(0.36)**	0(0)**
NYCDEP-GC-TX-309	0(0)*	NA	NA
NYCDEP-GC-TX-310	0(0)*	NA	NA
NYCDEP-GC-TX-313	0(0)*	NA	NA
NYCDEP-GC-TX-314	0(0)*	NA	NA
NYCDEP-GC-TX-315	0(0)*	NA	NA
NYCDEP-GC-TX-318	0(0)*	NA	NA
NYCDEP-GC-TX-319	0(0)*	NA	NA
NYCDEP-GC-TX-321	45(9)	0.72(0.28)	0.15(0.29)**
NYCDEP-GC-TX-324	79(20)	1.10(0.33)	1.06(0.85)
Reference Sites			
326	48(26)	0.88(0.45)	48
328	50(39)	0.92(0.43)	50
329	73(41)	1.33(0.29)	73
330	60(38)	1.01(0.44)	60
333	42(41)	0.85(0.17)	42

* Significantly reduced when compared to the Pooled Reference samples. Due to the reduction in survival, the sub-lethal endpoints for this test sample were omitted from further statistical comparisons.

** Significantly reduced when compared to the Pooled Reference samples.

Table 7-2. Ecological PRG development - based on L. plumulosus survival

Sample ID	Sample concentrations		
	Total PAHs (mg/kg)	**TOC (ug/g)**	**Total PAH (mg/kg) TOC Normalized**
Non-Toxic Samples			
303	437	110,000	3,973
307B	91	92,000	989
321	64	48,000	1,333
324	43	49,000	878
NOEC(1)			**3,973**
Toxic Samples			
307A	122	96,000	1,271
309	460	160,000	2,875
310	169	120,000	1,408
313	167	5200	32,115
314	6,149	120,000	51,242
315	2,129	81,000	26,284
318	1,508	140,000	10,771
319	936	82,000	11,415
LOEC(2)			**10,771**
Geometric Mean of NOEC and LOEC			**6,542**
Bulk Value (based on 6% TOC in Gowanus Canal)			**392**

(1) Maximum concentration in a non-toxic sample.

(2) Lowest concentration in a toxic sample that is greater than the maximum concentration in a non-toxic sample.

Table 7-3. Ecological PRG development - based on L. plumulosus growth

Sample ID	Sample concentrations		
	Total PAHs (mg/kg)	TOC (ug/g)	Total PAH (mg/kg) TOC Normalized
Non-Toxic Samples			
321	64	48,000	1,333
324	43	49,000	878
NOEC(1)			**1,333**
Toxic Samples			
303	437	110,000	3,937
307B	91	92,000	989
LOEC(2)			**3,937**
Geometric Mean of NOEC and LOEC			**2,301**
Bulk Value (based on 6% TOC in Gowanus Canal)			**138**
No Growth Data(3)			
307A	NA		
309	NA		
310	NA		
314	NA		
315	NA		
318	NA		
319	NA		

(1) Maximum concentration in a non-toxic sample.
(2) Lowest concentration in a toxic sample that is greater than the maximum concentration in a non-toxic sample.
(3) Samples had zero survival and growth could not be measured.

Sources of uncertainty in development of the PRG derive from the nature of the toxicity data. Specifically, there is a small sample size to use in calculating a PRG for PAHs because:

- Most of the Canal stations (seven of 12) cannot be used to estimate a PRG for PAHs because the sample exhibited visible oil in the lab. Therefore the test organisms were potentially affected by the physical effects of oil (*e.g.*, interference with respiration, ingestion of oil) before the toxic effects of PAHs from uptake and exposure would occur;

- Among the remaining five (non-oily) stations, the low survival in the reference areas results in only one toxic sample (for survival endpoints) and only two toxic samples (for growth endpoint) in the Canal (relative to the pooled reference area sample); and

- The survival in the reference area is low and highly variable (*see* Appendix A4.4 Toxicity Tests: Summary of Methods and Results).

NYC Comment 7 Inquiries

Given the observations presented above, the City requests that EPA respond to the following:

- Please explain the ramifications of the rationale for proceeding with the development of a PRG based on toxicity data encumbered by the various uncertainties noted including: employing three “re-starts” due to poor organism health; failing to describe the sample handling, distribution, and storage necessitated by these restarts; exceeding recommended holding times for these toxicity tests by as many as 15 weeks; and failing to address the potential uncertainties introduced into the toxicity testing due to the number of samples that were described as having “heavy” or “tar-like” sheens and odors.

- Given the strict adherence to EPA guidance and the better analytical results obtained by the City, the City requests that EPA adopt the PRGs developed by the City or explain why EPA’s approach should be used instead.

- Please explain why the FS Addendum ignores the EPA definition of NOEC by employing a comparison of an average concentration in direct comparison to a LOEC, rather than using the statistical comparison to a control explicit in EPA definitions.

- Please provide technical references that support the “graphical approach” used in the FS Addendum. Is this approach a standard method employed at other EPA CERCLA sites for estimating a PRG?

- Please explain why the FS Addendum does not follow EPA definitions and select a concentration of 39 mg/kg at station 303 for the NOEC for growth. This concentration fits EPA’s definition of a NOEC based on statistical comparison to either the laboratory control, the reference area selected as the basis of comparison in EPA’s ecological risk assessment (EPA, 2011), or a comparison to pooled reference area results.

- Please explain why the FS Addendum does not follow EPA definitions and select the concentration, 39 mg/kg at station 303, for the NOEC for reproduction. This concentration fits EPA’s definition of a NOEC based on statistical comparison to the reference area selected as the basis of comparison in EPA’s ecological risk assessment (EPA, 2011).

- Please explain the logical or statistical basis upon which the FS Addendum estimates the variability in a well-defined parameter (the NOEC) by averaging a series of values that measure something other than that well-defined parameter.

- Please explain why the FS Addendum attempts to address only the uncertainty in the NOEC and does not similarly attempt to address the uncertainty in the LOEC.

- The FS Addendum ignores data from two stations, 313 and 326. What is the effect on the analysis of maintaining all stations? Specifically, what is the effect of retaining station 326 as a reference station and what is the effect on the analysis of retaining station 313 as a Canal station?

NYC Comment 8: PRGs stated for metals, as well as the future bioavailability analysis, are not scientifically tenable.

EPA should not develop a PRG for lead and copper because EPA's ecological risk characterization demonstrates no bioavailability and therefore no toxicity from benthic exposures to copper and lead. In addition, EPA's selection of PRGs for copper (80 mg/kg) and lead (94 mg/kg) in sediment is based on an assumption regarding future geochemical conditions that is not supported by the available data.

1) EPA should not develop PRGs for copper or lead.

EPA should not develop a PRG for either copper or lead because EPA's risk characterization results indicate that neither is toxic to benthic dwelling organisms. The FS Addendum (Supplemental Section 4.2 p. 17) explicitly states that metals (including copper) should not cause toxicity: "The results of the AVS and SEM analyses provided in the RI report were used to calculate SEM-AVS/f_{OC} for each toxicity test sample. The results are reported in Table 4-7. The results strongly suggest that the metals currently are not bioavailable and should not cause toxicity." The referenced table (Table 4-7) shows that, among 11 stations sampled for AVS/SEM, ten indicated toxicity was unlikely and one indicated uncertain potential for toxicity. None indicated likely toxicity. Therefore, EPA should not calculate a PRG for chemicals (copper and lead) that do not pose a risk in the baseline risk characterization.

2) EPA's development of PRGs for copper and lead is based on an unfounded assumption.

New York Harbor-specific AVS/SEM and fraction organic carbon data (EPA, 1998; NYC DEP, 1992) show that it is unlikely that future geochemical conditions in the Canal will result in exposure to metals that are toxic to benthic organisms. These data indicate that divalent metals are not bioavailable and are unlikely to cause toxicity over a broad spatial range in New York/New Jersey Harbor in general, and in Upper New York Harbor in particular. Future geochemical conditions in the Canal are likely captured by the range of geochemical conditions extant in Upper New York Harbor. (It is unreasonable to assume that future geochemical conditions in the Canal will be unique and outside the broad range of conditions currently encountered). Future geochemical conditions will result in sediments whose properties are not likely to cause toxicity to benthic organisms. Therefore, there is no reason to establish a PRG that is based on the unlikely projection in the FS Addendum that "…metals may become bioavailable in the future if geochemical conditions in the Canal change and do not favor the formation of insoluble sulfides."

a. EPA's development of PRGs for copper and lead

The FS Addendum (Supplemental Section 4.2 p. 17) provides the following rationale for the development of PRGs for metals: "The results strongly suggest that the metals currently are not bioavailable and should not cause toxicity. However, metals may become bioavailable in the future if geochemical conditions in the canal change and do not favor the formation of insoluble sulfides." EPA bases the strong suggestion that metals are "…not currently available and should not cause toxicity" on the probabilities of toxicity at different TOC normalized values of AVS-SEM demonstrated by EPA (EPA, 2005). EPA used this approach for assessing the likelihood of sediment toxicity in the Risk Assessment (EPA, 2011a), the FS (EPA, 2011a) and the FS Addendum (EPA, 2012).

Although EPA acknowledges that current geochemical conditions in the Canal strongly suggest that metals are not currently bioavailable and should not cause toxicity, they make the unsupported projection that future geochemical conditions may change in some manner that does not favor the formation of insoluble sulfides. Therefore, EPA suggests (without explanation) a PRG reflecting copper and lead concentrations in the reference area (80 mg/kg copper and 94 mg/kg lead in bulk sediment). These bulk sediment PRGs are asserted with the full and explicit knowledge that divalent metal toxicity is not dependent on bulk metal concentrations.

b. EPA's basis for predicting bioavailability and toxicity

EPA's current model to explain divalent metal bioavailability relies on equilibrium partitioning theory, which is based on the idea that divalent metals (cadmium, copper, nickel, lead, and zinc) partition in sediment among AVS (principally iron monosulfide), interstitial water, benthic organisms, and other sediment phases such as organic carbon (Di Toro *et al.*, 1990[17]). According to the theory, the availability (and hence, toxicity) of metals depends on the difference between the molar concentrations of the SEMs and AVSs in sediment ("SEM -– AVS"). The model adjusts for the fraction total organic carbon in sediment (f_{OC}) because metals also can bind to organic carbon (EPA, 2005).

This model predicts that toxicity is:

- likely when the (SEM-AVS/f_{OC}) is greater than 3,000 micromoles (μmol) per gram organic carbon (g_{OC}),
- uncertain when the concentration is between 130 and 3,000 μmol/g_{OC}; and
- not likely when the concentration is less than 130 μmol/g_{OC} (USEPA, 2005)

Obviously, the geochemical conditions in this model that predict toxicity from sediment exposures (due to divalent metals) are the various combinations of: concentrations of sulfides, concentrations of extractable metals, and the fraction of organic carbon in sediments reflected in the equation:

$$(SEM\text{-}AVS)/f_{OC} \qquad \text{(Equation 1)}$$

3) Data from New York Harbor do not support EPA's assumptions

The City makes the reasonable assumption that the future geochemical conditions in the Canal expressed as Equation 1 are likely to lie within the range of values found over the broad range of geochemical environments currently occurring in the Upper New York Harbor. That is, the future geochemical conditions in the Canal are not likely to be unique and outside the range of geochemical conditions extant in Upper New York Harbor.

EPA's Regional Environmental Monitoring and Assessment Program ("REMAP") data (EPA, 1998; Figure 8-1) and DEP's 1992 sediment sampling data (DEP, 1992; Figure 8-2) provide the information necessary to calculate (SEM-AVS)/f_{OC} at sediment sampling stations in New York/New Jersey Harbor, and in Upper New York Harbor specifically. An examination of these data demonstrates that it is unlikely that geochemical conditions (f_{OC} and SEM-AVS) will result in effects on benthic communities (as toxicity).

[17] Di Toro, D. M., J D. Mahony, D J. Hansen, K J. Scott, M B. Hicks, S M. Mayr, and M S. Redmond. "Toxicity of Cadmium in Sediments: The Role of Acid Volatile Sulfide." *Environ. Toxicol. Chem.* 9 (1990): 1487-1502.

The City evaluated data from the New York/New Jersey Harbor region (REMAP, 1998; DEP, 1992) with respect to (SEM-AVS)/f_{OC}. The REMAP program measured the parameters of interest (AVS, SEM and TOC) in 167 samples from the New York/New Jersey Harbor region (Figure 8-1). The DEP 1992 sediment sampling program measured the same parameters from 21 additional sites (Figure 8-2). These sampling sites can be viewed together in Figure 8-3. Figure 8-5 shows that the vast majority of the samples (177 of 188, or 94 percent) had (SEM-AVS)/f_{OC} ratios less than 130 umol/g_{OC}, and would therefore be considered unlikely to be toxic. Just 11 of the 188 samples, or 6 percent, had (SEM-AVS)/f_{OC} ratios greater than 130 umol/g_{OC} (toxicity uncertain), and none of the samples had (SEM-AVS)/f_{OC} ratios greater than 3000 umol/g_{OC} (likely toxic).

In Upper New York Harbor in particular, at all sampled stations, the geochemical conditions (expressed as a combination of SEM, AVS, and f_{OC}) indicate that divalent metals are not available and are unlikely to cause sediment toxicity. These stations represent a broad spatial range (Figure 8-4) covering the Hudson River, the East River from Throgs Neck to the southern tip of Manhattan, and various stations in the Upper Harbor to Verrazano Narrows. These data for Upper New York Harbor (Figure 8-5) indicate that only one of the 35 samples had an (SEM-AVS)/f_{OC} ratio greater than 130 umol/g_{OC} (at 233 umol/g_{OC}), and none of the ratios were above 3000 umol/g_{OC}, the level at which toxicity is thought to be likely.

These data demonstrate that there is no widespread combination of geochemical conditions in Upper New York Harbor that would result in the likelihood of divalent metals bioavailability and toxicity. The assumption that future conditions in the Canal will result in some geochemical conditions that are unique to the extant range of conditions is unfounded and, in fact, contradicted by these data. Therefore, EPA's rationale for asserting PRGs for the two divalent metals, lead and copper, based on the assumption that "…metals may become bioavailable in the future if geochemical conditions in the Canal change and do not favor the formation of insoluble sulfides" is not supported by regional-specific data.

NYC Comment 8 Inquiries

Given the observations noted above, the City requests that EPA respond to the following:

- On what empirical basis does EPA assume that future geochemical conditions in the Canal will result in increased bioavailability of metals, given the extensive spatially and temporally diverse data that demonstrates the non-bioavailability of metals (including copper and lead) in New York Harbor?

NYC Comment 9: Conceptual design parameters for the proposed remedy are unrealistic.

EPA's current understanding of the Canal, groundwater watershed, and related processes, as presented in the Proposed Plan, are too simplistic to support a reliable estimate of the impacts of the proposed remedy. EPA fails to incorporate in its evaluation the impact of the improvements in water and sediment quality that will result from the CSO reduction efforts and Flushing Tunnel rehabilitation that the City is undertaking pursuant to its CWA Consent Order with DEC. This failure has resulted in the use of conceptual design assumptions that are unrealistic for addressing actual site risks.

1) **Contaminant transport processes identified in the Proposed Plan are too simplistic.**

The Proposed Plan attributes surface sediment concentrations to contaminant sources without regard to the natural mixing and transport processes that exist in the Canal, a direct outcome of the lack of a robust CSM. The FS incorrectly identifies CSO solids as the major source of contaminants in surface sediments in the Canal. As a result, the proposed remedial actions place insufficient focus on the true major sources of PAHs to the Canal (*i.e.*, groundwater, NAPL, and seeps). This has significant ramifications for the remedy since sufficient focus will not be brought to bear on the control of the true major sources.

Based on contaminant mass balance and other analyses, the pattern of contaminants accumulating in surface sediments cannot be derived from CSOs or reference area solids and, therefore, must be due to other poorly characterized and un-quantified sources. The analyses provided by the City in these comments provide clear evidence for the existence and relative magnitude of these sources. The Proposed Plan does not consider the potential for these sources to re-contaminate the Canal after a remedy has been implemented or the consequences of implementing the proposed remedy without addressing these sources.

The impact of groundwater on water quality in the Canal has only been given cursory treatment in the FS and Proposed Plan. The FS merely acknowledges the NAPL concentrations in groundwater outside the Canal and does not consider that the groundwater must pass through NAPL at almost all points prior to discharging into the Canal. No attempt has been made to quantify the associated loading.

During construction, following the removal of the soft sediment that currently retards upward groundwater flow, gradients between the groundwater and the Canal will be at their greatest. The influx of contaminated water and NAPL has the potential to deplete the adsorptive capacity of the oleophilic clays planned to control the NAPL, even as the material is placed.

The changes in channel geometry due to deep dredging will drastically change (and likely increase) the ratio of harbor solids to CSO solids accumulating in the Canal. The plan to deepen the Canal as part of the remedy will change the dynamics of sediment accumulation. More harbor sediments will be deposited in the Canal due to the decrease in velocity associated with the deepening. For this reason, any CSO solids that settle in the Canal will be diluted to a greater extent than prior to the remedy. The Proposed Plan fails to consider this important ramification in its requirements for CSO reduction.

The Flushing Tunnel will partially offset the increase in water residence time within the Canal that will result from deepening of the Canal. The Flushing Tunnel will also distribute cleaner harbor solids throughout the length of the Canal. The Proposed Plan does not account for the changes in circulation in the Canal when the Flushing Tunnel is restored (with increased capacity). As a result of restoring the Flushing Tunnel, there will be both a continuous flow out of the Canal and delivery of additional harbor solids to the Canal. This will partially offset the increase in water residence time resulting from the Canal deepening but should still increase the overall sediment accumulation rate by delivering harbor solids to the head of the Canal, and increase the standing inventory of harbor solids in the water column. This will result in less residence time in the Canal of CSO-delivered water relative to the Canal deepening alone, and will provide additional dilution of CSO solids by harbor solids. The Proposed Plan does not acknowledge these mechanisms and outcomes and does not attempt to estimate the quality of sediments that will be deposited after the City has implemented the changes to the CSO system and the Flushing Tunnel that are currently underway. The City notes however, that since CSOs are already compliant with the PRGs for TPAHs and TPCBs, these modifications could only further reduce the already low contaminant levels on CSO solids upon deposition on the Canal bottom (assuming that the actual causes of contamination that are currently present will have otherwise been addressed).

2) Critical technology effectiveness assumptions are unrealistic.

a. Lack of understanding of the performance of oleophilic clay for use in reactive caps to NAPLs

EPA is proposing to use a layer of oleophilic clays to capture NAPL migrating from the groundwater and underlying sediments to the surface sediments above the remedy's cap. However, EPA has not conducted any studies or analyses to understand how such a layer will react under the conditions in the Canal. There is ample supply of NAPL that could quickly expend capacity of the clay to treat further releases. If the clay swells due to adsorption of NAPL (as happens when used to treat other contaminants) and blocks flow paths, contaminated groundwater and NAPL could be diverted to other locations, either in the Canal or into basements, utility corridors, or other subsurface openings around the Canal.

EPA has presented no information or analyses on how the clay will handle dissolved contaminants. Based on the surface water data discussed above (*See* NYC Comments 1 and 2), loading of dissolved PAHs is likely significant. However, because the mass of NAPL associated with the MGP sites is unknown, the required thickness of an oleophilic clay layer in a reactive cap cannot be reliably estimated and the FS did not include any estimate of the depletion rate of oleophilic clay once placed. Since there is a large amount of NAPL that will not be recovered, determining the feasibility of using oleophilic clays requires quantifying depletion rates and understanding the ramifications for costs as well as any unintended consequences that could arise from using the clays. The studies of NAPL seepage that have been done did not consider the removal of soft sediments and the conditions anticipated to prevail during construction, and therefore grossly underestimate the amount of NAPL that may discharge. The proposed replacement of the oleophilic clay layer if found to have an inadequate life is an unacceptable surrogate for knowledge and would effectively require reconstruction of a new cap as a maintenance item.

b. Lack of understanding of potential impacts from in-situ stabilization and the parameters of applicability to the entire remediation target area

EPA provides no technical justification, analytical or pilot testing results, case studies, or other studies that document the benefits of the use of in-situ solidification ("ISS") in its proposed application. Similarly EPA has not evaluated the risks posed by the widespread application of ISS in the Canal. EPA has proposed the use of ISS to stabilize low-strength, native deposits at the base of the Canal following dredging, but prior to capping. While the use of ISS in upland areas is relatively common, its use in a marine setting for the purpose of strengthening underlying soils and creating a low hydraulic conductivity barrier to NAPL migration was not documented in the FS, and the City is not aware of any precedent for such an action. The closest example of its use in a similar setting that was cited in the FS was a pilot study conducted in Newark Bay to assess whether ISS could be used to stabilize the contaminated sediment enough to minimize re-suspension of contaminants during planned dredging operations. This study was not designed to assess the factors that will be important in its proposed application in the Canal.

In Table ES-1 of the FS, EPA acknowledges the lack of technical justification for ISS, stating that "…if additional evaluations and pilot studies indicate that in situ solidification (ISS) is implementable and effective within the canal…" and "this technology is not commercially proven for application to marine environments for the control of NAPL migration.." as well as "is **expected** to provide additional protectiveness" (emphasis added). These or similar qualifiers are repeated a number of times throughout Table ES-1. In the same table EPA acknowledges that "ISS is an emerging technology" and "there are few contractors with a proven performance of ISS implementation in marine environments."

Appendix A of the FS also refers to ISS as a "promising technology" for controlling NAPL in saturated sediments and identified four ***potential benefits*** of this process as follows:

i. NAPL saturation heterogeneity would be homogenized.

This implies that NAPL concentrations, as the result of adding the reagent by mixing, would be more evenly distributed throughout the sediment bed. However, mixing technologies are not perfect in the subsurface, which can result in separation of masses or blobs of the NAPL from the stabilizing agent. Mixing, then, has the potential to mobilize the NAPL within the mixing column, releasing it to the surface water or forming isolated NAPL blobs that might not be captured by the ISS matrix. This is of particular concern in the NAPL-saturated conditions present in portions of the Canal.

ii. NAPL saturation potentially could be lowered to residual levels by ISS, preventing further NAPL migration.

This outcome might be expected where the mixing is occurring in contaminated soils above the water table, a common use for ISS. It is not clear that this would occur in the saturated native sediments present beneath the Canal. Because of the lack of historical data in a similar environmental setting, it is not possible to determine what the impact will be of a large-scale application of ISS such as envisioned in the Canal for the proposed remedy.

iii. Hydraulic conductivity of the ISS treated sediment would be greatly reduced, resulting in reduced upward groundwater velocities that can cause NAPL migration.

While it is possible that the addition of Portland cement to the material will reduce its hydraulic conductivity, the volume of Portland cement required in this setting has not been established and may vary substantially from place to place within the Canal due to variations in the native sediments. It is not proven that reducing the hydraulic conductivity across the majority of groundwater discharge zone(s) to the Canal will be an overall environmental benefit. Reducing hydraulic conductivity in one area is likely to divert groundwater flow to another location, potentially to basements and crawl spaces of houses and buildings in the area. This could distribute the contaminants in the groundwater into previously uncontaminated areas. Differential settling within the sediment could result in cracks in the ISS barrier and create preferential flow paths for contaminants, increasing the upward gradient and hence the migration of contaminant mass. The lack of geotechnical data, geotechnical analyses, and modeling results in a great deal of uncertainty regarding the potential impacts of reducing the hydraulic conductivity into the bed of the Canal.

iv. <u>ISS has been pilot tested on soft sediment using cement deep soil mixing ("CDSM").</u>

The referenced pilot study was conducted in Newark Bay on a small volume of material in an open setting and lasted less than six months. The intent of the program was not to improve the stability of the underlying low-strength material to allow placement of a reactive cap, rather it was intended to stabilize the soft contaminated sediment to allow dredging of the solids and their off-site disposal with minimal re-suspension of contaminants into the water column. This pilot study does not provide a true comparison for evaluating ISS in its planned application in the Canal.

While there was discussion of the potential, although unproven, benefits of the use of ISS, what the FS did not consider were the ***potential risks*** of the process.

- No field data has been gathered on the strength of the native deposits throughout the soil column; FS investigations of the native sediments stopped at a depth of approximately 5 feet. While one of the purposes of ISS is to create a layer that can support the cap, EPA has not documented any investigation as to whether the underlying sediments have the ability to support the weight not only of the cap but of the ISS layer. EPA's proposed approach may just transfer the problem of unstable soils to a greater depth in the soil column. In addition, soil borings suggest that in a number of locations, more granular soils are present at depth; compressing soils deeper in the soil column could result in spreading the groundwater contamination problem downward and outward through more porous soils.

- The justification for the ISS layer is the concern that the cap weight will mobilize the NAPL outward. It is not clear why adding the weight of a five-foot ISS layer across much of the bed of the Canal would not have the same result. In addition, as noted previously, the mixing process used has the potential to mobilize the NAPL in the sediment.

- The uncontrolled hydration of Portland cement by its incorporation into the sediment through the ISS process has the potential to release high pH leachate to the Canal containing toxic levels of heavy metals derived from the cement. The FS documents do not consider the potential risks associated with the addition of large volumes of Portland cement or similar reagents to the Canal. The bench scale testing currently underway to identify the proposed reagent does not address this question.

- While the FS documents discuss the ISS process as creating a continuous low hydraulic conductivity layer that will prevent contaminated groundwater from entering the Canal, this seems an unlikely outcome. The underlying sediments vary in depth and material characteristics. Different portions of the underlying soils will react differently to the weight that is applied through the cap and ISS layer, resulting in differential settling and the formation of cracks in the ISS layer. These cracks may provide flow paths for contaminated groundwater and gas to enter the surface water of the Canal.

EPA needs to conduct a more complete and thorough evaluation of the ISS process in a marine environment before proposing its use in a large-scale project. This analysis should include a geotechnical evaluation of underlying soils to determine the impact of installing not only a soil cap but an ISS layer as well. This evaluation should include an assessment of the stability of the ISS layer as well as the potential for consolidation of underlying contaminated layers and the redistribution of contaminants; an assessment of the potential impact of the mixing process both on the release of chemicals from the reagent used in the ISS process and the release of NAPL in the native sediment deposits; and modeling of the local hydrogeology to determine the impact of a reduction of the hydraulic conductivity within the base of the Canal on the path of contaminant plumes.

The FS does not provide an evaluation of some of the fundamental assumptions used in the conceptual design for the recommended remedy. The approach taken in the FS to defer these and other critical evaluations until the Remedial Design phase without providing any contingency for addressing problems that will arise at that time is inconsistent with EPA's RI/FS and Contaminated Sediment Remediation guidance (EPA, 1988; EPA, 2005).

3) The conceptual design of the cap is flawed.

The Proposed Plan chose a cap design without considering its efficacy or its consequences to the groundwater system. The chosen cap design includes a 1-foot thick layer of oleophilic clay as an adsorptive barrier to NAPL discharge. The only justification for this choice is that a similar cap was used at the McCormick & Baxter Creosote Superfund Site in Portland, Oregon in 2005. While EPA correctly points out in the FS that there are important hydraulic and contaminant occurrence differences between the McCormick and Baxter site and the Canal (including large differences in the hydraulic and NAPL gradients), it does not mention the most important difference – that of scale of the capping effort. An oleophilic clay mat was used at the McCormick & Baxter site to cover an area of roughly 24,150 square feet and used 600 cubic yards of clay. In comparison, the FS indicates the remedy for the Canal will cover an area of 330,000 square feet and will require over 40,000 cubic yards of clay. The analogy between the sites is weak and does not support the proposed remedy without additional evaluation. Other detailed evaluations of cap effectiveness are needed, but were not presented in the FS. If the oleophilic clay is expended much more quickly than anticipated, removing and disposing of this NAPL-saturated material will be a significant, and expensive, undertaking.

The proposed cap does not consider lateral migration of contaminants in groundwater that discharges into the Canal. The proposed cap would be located 15 to 20 feet below the water surface in most areas of the Canal. Lateral migration of groundwater into the Canal containing NAPL from the upland sites, would be entering the surface water **above** the reactive cap and would not be treated. This process will lead to recontamination of the cap from the surface. This issue was not addressed in the FS or Proposed Plan.

NYC Comment 9 Inquiries

Given the observations noted above, the City requests that EPA respond to the following:

- The lack of a technically supported, robust CSM for the Canal has resulted in the use of unfounded and undocumented conclusions being drawn not only about the source of the contaminants but about the long-term implications of the proposed remedy. Additional information on the fundamental processes that drive contaminant flow and contaminant deposition and control conditions in the Canal need to be provided.

- The FS and the Proposed Plan contain no evaluation of the effective life of the reactive cap or the timing or costs of its replacement. The FS does not address fundamental questions about the life of the reactive layer in the cap or the cost to replace the cap when the reactive layer fails. Under CERCLA, potential costs that will accrue during the assumed 30 year life of the remedy need to be included in the cost estimate – without an estimate of the life of the cap, this has not happened and it is not clear that enough data has been generated on NAPL flux to make this estimate.

- No consideration is given to the potential impacts associated with the use of ISS in the Canal. The use of ISS is based on unproven assumptions about its potential benefits that have not been verified based on field testing under conditions likely to exist in the Canal. Adequate testing should be conducted in the FS to assess both the potential benefits and the risks of using ISS in the Canal before it is proposed for inclusion in the recommended remedy. At this time, EPA has not established any criteria for acceptable performance of the ISS or means for evaluating lab and pilot scale testing deferred to the Remedial Design phase.

- EPA has left a number of key questions unanswered in the FS about the technical feasibility, and suitability, of the cap design. Additional study and analysis of the ability of the proposed cap design to address site conditions in a cost effective manner need to be performed before it can be included in the proposed remedy.

NYC Comment 10: EPA incorrectly and inappropriately relied on the article by Stein et al. (2006) regarding stormwater runoff to establish its "first flush" standard for CSO discharge capture. EPA should instead use sufficiently representative site-specific measurements to inform remedial decision-making.

As part of the justification for EPA's CSO reduction requirements, the Proposed Plan states:

> "Scientific literature suggests that it can be assumed that the "first flush" comprises approximately 20% of the total discharge volume and contains between 30% and 60% of the total PAH load of the discharge (Stein, 2006)." *See* Proposed Plan, p. 19.

EPA incorrectly uses this observation, which is based on storm water drainage in a western arid region, as a basis to estimate the nature of CSO in a humid, eastern setting. EPA is assuming that 20 percent of the total Canal CSO discharge volume for outfalls RH-034 and OH-007 is equivalent to a storm drainage first flush volume and includes 30 to 60 percent of the PAH loading. This assumption is based on the work of Stein *et al.* (2006).[18] The work of Stein *et al.* is not applicable to the Canal, and EPA should not have relied on it in the Proposed Plan. The work of Stein *et al.* (2006) describes conditions related to stormwater discharge in the Los Angeles area, which are significantly different from the CSO and drainage area and precipitation conditions of the Canal, and produce releases of fundamentally different character. EPA's reliance on Stein *et al*. to characterize the releases from CSOs discharging to the Canal and select remedial actions is not appropriate for the following specific reasons. *See also* Appendix B.

1) **Combined sewer systems and separated storm sewer systems have fundamentally different hydrological responses**

There are fundamental differences in character between the initial tipping flow for a CSO and the true "first flush" for a separated stormwater system. Typically, combined sewer systems are designed so that approximately two times the dry weather flow is captured and treated. Very often, in a combined sewer system, much of the initial rainfall runoff volume is actually captured and treated rather than released. Only when the rain is sufficiently long in duration and intensity does a CSO tipping event occur. Many smaller rain events do not yield any CSO discharge at all. This is in contrast to separated storm sewer systems, where essentially all rain events that cause surface runoff yield some storm sewer discharge.

Recognition of the capture of "first flush" for CSOs is found in *EPA's Combined Sewer Overflows Guidance for Monitoring and Modeling*, EPA/823-B-99-002 (January 1999) where it says "using overflow quantity and average concentrations, inaccuracies may result, particularly if the 'first flush' is effectively captured by the POTW or storage." Additionally, in a combined sewer system, when a portion of the "first flush" from the stormwater runoff is not captured and is released during initial tipping of the CSO, its contaminant concentrations are the result of surface runoff mixed with sanitary sewage. In contrast, a true "first flush" is released in a separated storm sewer system since there is

[18] Stein, E.D., L.L. Tiefenthaler, and K. Schiff, 2006. "Watershed-Based Sources Of Polycyclic Aromatic Hydrocarbons (PAH) In Urban Storm Water." *Environmental Toxicology and Chemistry.* 25:373–385.

typically no provision for capture or storage of flow, and its associated contaminant concentrations result exclusively from rainfall runoff.

Further, even for a given CSO location, a high level of variation in the solids and contaminant concentrations released during initial tipping of the CSO will exist, depending on storm event conditions (such as intensity, duration, and timing of peak intensity), tidal conditions and the elapsed time since the previous runoff event. These highly variable conditions would require extensive data collection for characterization and determination of the appropriate remedial action. As stated in EPA's *Combined Sewer Overflows Guidance for Long Term Control Plan* (EPA, 1995[19]):

> "Historically, the control of CSOs has proven to be extremely complex. This complexity stems partly from the difficulty in quantifying CSO impacts on receiving water quality and the site-specific variability in the volume, frequency, and characteristics of CSOs."

2) The areas drained by storm sewers in the Stein *et al.*, 2006 study are inherently different from those associated with the Canal

In addition to the fundamental hydrological differences in the highly variable properties and volumes of releases from the blended initial tipping flow from CSOs and the true "first flush" from separated storm sewer systems (especially from widely divergent climates), the stormwater drainage area considered by Stein *et al.* is very different from the Canal drainage area. The nature and volume of any first flush is highly dependent on drainage area. As stated in *EPA's Combined Sewer Overflows Guidance for Monitoring and Modeling*, (EPA, 1999[20]):

> "To characterize first flush, a sample should be collected as close to the beginning of the CSO event as feasible. Appropriate sampling intervals depend on such factors as drainage area sizes, slopes, land uses, and percent imperviousness."

Stein *et al*. considered fourteen individual events across eight stormwater in-river mass emission sites for nine storms occurring between February 2001 and February 2004. In-river mass emission sites are engineered flood control open channels or highly modified rivers that integrate runoff from all the land use types in their contributing watersheds. The in-river mass emission sites considered by Stein *et al*. included both developed and undeveloped land use sites in the arid greater Los Angeles, California region. In addition, 15 homogeneous land use sites were considered. Homogeneous land use categories considered by Stein *et al*. included high-density residential, low-density residential, commercial, industrial, agricultural, recreational, and transportation. Unlike the sites considered by Stein *et al*., the Canal's drainage area does not include in-river mass emission sites nor does it include undeveloped areas. The Canal's drainage area is largely commercial/industrial and does not include all of the land use categories considered by Stein *et al.* More importantly, unlike the sites considered by Stein *et al.*, the

[19] EPA, 1995. *Combined Sewer Overflows Guidance for Long Term Control Plan*, EPA/823-B-95-002, August 1995.

[20] EPA, 1999. *Combined Sewer Overflows Guidance for Monitoring and Modeling*, EPA/823-B-99-002, January 1999.

Canal is not in an arid region and the surrounding impervious surfaces do not accumulate large quantities of wind-blown dust, unlike the areas around Los Angeles.

The Los Angeles drainage area considered by Stein *et al.* is commonly known to be a “closed” basin subject to frequent smog, since it is surrounded by a series of mountain ranges and hills. Many of these mountains reach 10,000 feet in elevation. The hills and mountains create steep slopes and therefore generate high energy in water flowing over land to the in-river mass emission sites sampled by Stein *et al.* The high energy in overland flow has implications for mobilizing particles from the land surface and would be expected to increase particulate phase transport and associated contaminant concentrations in Los Angeles area stormwater, especially during the “first flush.” The hills and mountains surrounding the Los Angeles area also have the effect of constraining aerial transport of contaminants in the atmosphere, which is particularly important for PAHs since the dominant source identified by Stein *et al*. is automobile and other vehicle emissions. In direct contrast, the drainage area of the Canal is not enclosed by hills and mountain ranges. Accordingly, unlike the drainage areas considered by Stein *et al.*, the drainage area of the Canal does not have extremely steep slopes, nor does the Canal drainage area experience any buffering or constraining of regional aerial transport of contaminants in the atmosphere. As a result CSO solids discharged to the Canal have shown relatively low variability in contaminant concentrations per unit mass of solids, typically less than ± 50 percent variability.

3) **The patterns of precipitation in the areas studied by Stein et al. (2006) are intrinsically different from those associated with the Canal, resulting in significant differences in chemical composition and concentration in Los Angeles storm water discharges relative to Canal CSO discharges**

According to Stein *et al.:*

> “The discharge of PAHs from urban watersheds is exacerbated in arid regions. … Moreover, the long antecedent periods without rain in arid regions potentially enhance the dry deposition of PAHs to urban landscapes from these atmospheric sources. When rainfall does occur, the precipitation is often short but intense. Storm flows in urban watersheds from the Los Angeles region can range from 0.5 cubic meters per second (cms) to 1,000 cms in less than 1h. Runoff from these largely impervious urban surfaces efficiently mobilizes deposited material, including PAHs, in the resulting surface runoff.”

Not only were Stein *et al.* considering stormwater in an arid region (*i.e.*, just 10 to 12 precipitation events annually), but the PAH measurements in Stein *et al.* are also biased by early rainy-season storm events which emit more PAHs than later-season storm events. The bias is the result of a seasonal flushing of the land that occurs in the Los Angeles area, presumably due to the build-up of aerosol deposition on land surfaces over the dry season. Antecedent conditions for the storm events sampled by Stein *et al.* ranged from 2 to 142 days without measurable rain. As indicated by Stein *et al.*:

> “Antecedent dry period (expressed as cumulative rainfall) was strongly correlated with total PAH concentration, load, and flux in an exponentially nonlinear manner. Early-season storms have significantly higher PAH loads than late-season storms both within and between watersheds, even when rainfall quantity is similar.”

For CSOs in the Canal drainage area, there is no evidence of a seasonal flush or bias and an antecedent dry period as long as 142 days would not be expected for any Canal CSO outfalls.

4) **The Stein *et al.* 2006 study has little relevance to the Canal and should not be used to support remedial decisions with regard to the Superfund site; rather, sufficiently representative site-specific measurements are needed.**

In conjunction with the City's concerns over the incorrect application of Stein *et al.* study to the Canal, the City contacted the author for his opinion. The letter from the author is provided as a separate attachment to the City's comments. *See* Appendix B. In his letter, the author confirms that his study results cannot be extrapolated to the Canal study area without substantial additional data related directly to the Canal. Therefore his study is inapplicable to the Canal.

For all of these reasons (*i.e.*, collection system, drainage area, precipitation, and PAH compound differences), the work of Stein *et al.* (2006) should not be used as the technical basis for drawing any conclusions about Canal CSOs. Rather, a statistically significant number of measurements of the discharge of Canal CSO effluent over the course of a representative number of storm events would be appropriate for determining if time-dependent phenomena, such as "first flush", are occurring. The extensive set of Canal CSO discharge measurements do not show the existence of such a phenomena and in fact show a narrow range of contaminant concentrations on CSO solids (most values fall within ± 50 percent of the mean concentration per unit mass of solids). Such Canal-specific measurements must be considered by EPA before drawing conclusions regarding the purported "first flush" from CSOs.

NYC Comment 10 Inquiries

Given these observations, the City requests that EPA respond to the following:

- Since the Stein *et al*. work clearly does not apply to Gowanus conditions, what other basis does the EPA have to supports its assertions and conclusions concerning "first flush" including the proposed sizes of in-line CSO retention tanks, or the initial tipping flow from CSOs?

- How can EPA reconcile the PAH patterns of the surface sediments of the Upper Canal with those observed in CSO discharges since they are distinctly different from each other and unlike the patterns measured by Stein *et al*.?

- What is EPA's response to the concerns expressed in Dr. Stein's letter, annexed as Appendix B?

NYC Comment 11: The proposed remedy is based on inadequate information and lacks scientific support.

1) Lack of a reliable CSM will result in a high risk of failure of remedial actions.

a. *By deferring critical analyses to the remedial design stage, EPA has based its remedy selection on inaccurate and incomplete information, ultimately leading to proposal of a suboptimal alternative with a high risk of failure.*

The intent of the RI/FS process is to conduct a thorough site-specific investigation to establish the nature and extent of contaminants that pose a risk to human health and/or the environment, and then to develop and evaluate potential alternatives for addressing the risk. The RI/FS does not meet this standard and is missing key components critical to the selection of an effective remedy for the Canal. The FS acknowledges a number of these significant data gaps in the Executive Summary (p. vii). At a minimum, the following data gaps exist:

- No groundwater model was prepared for the watershed. The lack of a groundwater model means that no contaminant fate and transport/particle tracking assessment of groundwater impacts from contaminated upland sites was prepared nor an assessment of the potential impacts on water quality from the upland sites; no evaluation was prepared on potential impacts to groundwater elevations from installing sheet pile walls around the majority of the Canal, disrupting normal groundwater flow patterns; no assessment was prepared on the effectiveness of the cap and ISS layer in controlling the upward flow of NAPL from contaminated groundwater under the Canal; and no assessment was prepared on the impact to groundwater elevations by installing a barrier to groundwater flow (*i.e.*, the ISS layer) in the Canal.

- No hydrodynamic model of the Canal was prepared. The lack of a hydrodynamic model of flow in the Canal means that there was no evaluation of the impact of the Flushing Tunnel (following the resumption of pumping) on the flow, sediment deposits, or water quality in the Canal; no evaluation was prepared on the impact to flow and scour rates in the Canal during construction from the dredge cell sheet pile walls (when the treatment cells are in place); and no evaluation was prepared on the armor design using flows from the Flushing Tunnel following the resumption of pumping.

- No geotechnical evaluation of conditions in the Canal was prepared. The lack of geotechnical information means that no evaluation of the design assumptions used in the conceptual design of the sheet pile walls (either as reinforcement for the failing bulkheads or for contaminant around the dredge cells) was performed; no assessment was prepared on the strength of the native sediments and the ability to support a soil cap or ISS layer; no assessment was prepared on the hydraulic conductivity of the sediments following capping and/or ISS and the impact on sediment stability; no assessment was prepared on the amount of consolidation or differential settlement in the cap/ISS layers and its impact on the overall effectiveness of the remedy; and no assessment was prepared on alternatives to ISS to stabilize the underlying sediments.

- No estimate was prepared on the flux rate of NAPL through the cap under current conditions, with a cap (sand or reactive media) by itself, or with a cap and ISS layer. No estimate was prepared on the expected effective life of the oleophilic clay layer in containing NAPL or the estimated time until replacement will be required.

- No evaluation was performed on site-specific conditions at the proposed site for the near-shore confined disposal facility ("CDF"), to determine if the site was suitable for construction of a CDF.

- No waste characterization was conducted for treatment or disposal purposes.

The missing information is critical to evaluating the technical feasibility and constructability of the various components of the alternatives being evaluated in the RI/FS Addendum as well as in assessing the potential benefits and possible risks the technologies present. Without collecting the necessary data and performing the associated analyses, one can only guess at the implications of the planned actions. At a minimum, the lack of geotechnical data represents a serious flaw in EPA's analysis of potential alternatives. For example, without this data, the ability of the sediment to support the ISS and cap cannot be evaluated; the potential for release of NAPL from the sediment due to consolidation cannot be assessed; and the potential for differential settlement and its impact on the long-term effectiveness of the remedy cannot be evaluated. Overly optimistic assumptions about the likely outcomes can lead to the selection of inappropriate or potentially damaging systems that will exacerbate conditions in the area of the Canal not solve them.

b. EPA has not conducted an adequate technical evaluation of either the technical feasibility or implementability of disposing of sediment from RTA 3 through beneficial use or in a near-shore CDF in Gowanus Bay, with the likely result being offsite disposal in a landfill at a substantial increase in the cost compared to the estimated costs in the FS.

The Proposed Plan identifies two potential options for managing the approximately 280,000 cubic yards of sediment generated in Remediation Target Area ("RTA") 3 – either through beneficial use of the material as daily cover at a landfill or disposal in a near-shore CDF to be constructed in the Gowanus Bay area. Neither of these options was evaluated in any meaningful manner in the FS and it is unlikely that either approach could be implemented.

<u>Beneficial Use</u>: The availability of lightly contaminated material that could be used as landfill daily cover far exceeds the demand for the material and landfills can be very selective in choosing material for this purpose. Sediment from a highly contaminated environment such as the Canal is unlikely to be accepted at most facilities. Since daily cover takes up landfill capacity, a tipping fee is likely to be charged for the material – this cost was not included in the cost estimate.

Landfill daily cover is typically a high permeability granular material. EPA proposes to solidify/stabilize ("SS") the contaminated sediment with Portland cement or other pozzolanic material to prevent leaching of contaminants. No testing has been conducted to: 1) determine physical characteristics of the material following SS and whether it is suitable for its intended use; 2) verify mixing ratio; 3) evaluate potential interferences with contaminants in the sediment; or 4) determine hydraulic conductivity following treatment. The Canal sediment is heterogeneous and is likely to remain so following SS, making its suitability as daily cover suspect.

It is unlikely that any landfill site would commit to the use of the sediment as daily cover without extensive testing and evaluation of the final product. This type of evaluation has not been conducted. During the FS, no specific beneficial use sites were identified, no material characterization (physical or chemical) was conducted, and no material specifications for daily cover as a beneficial use product were established.

CDF: The proposed location for the CDF is not identified in the Proposed Plan, although a location off Columbia Street is mentioned. A draft United States Army Corps of Engineers ("USACE") Technical Memorandum entitled *Gowanus Canal & Bay Navigation Analysis* (August 8, 2007) indicated that Mr. John Quadrozzi was considering developing a CDF at his industrial park at 685 Columbia Street in the Red Hook area (in the Henry Street Basin area). This site is adjacent to the Red Hook Recreational Area, a widely used public park with riparian access to the Henry Street Basin.

There is no information provided in the Proposed Plan or other documents that suggests any site evaluation work has been conducted to determine if the proposed site is suitable for construction of a CDF. At a minimum, the following analyses and studies need to be conducted to determine site suitability.

- Preliminary evaluation of soil stability, depth to bedrock, stability of bedrock, and groundwater flow.
- Bathymetric surveys of the site to assess site slope and potential obstructions.
- Evaluation of tidal impacts on contaminants in the CDF.
- Preliminary historical/archaeological investigation of the proposed area impacted by construction of the CDF. As was noted in the FS Addendum, there are a number of historical sites in the area.
- Material handling procedures of surficial materials removed during CDF construction. These materials are likely to require disposal in a CDF or confined aqueous disposal while the deeper, cleaner soils can go to the Historic Area Remediation Site.
- An Environmental Impact Statement would likely be required, adding one to two years (or more) to the project schedule.

The FS did not address any of these areas in even a peripheral manner, nor does it include the costs for conducting these studies in the cost estimates. Given the proposed location (Gowanus Bay), it is likely a limited number of sites would be available.

Construction of a CDF within Gowanus Bay presents a number of unresolved issues:

- The FS documents did not address the potential impacts of a CDF on the Bay or the surrounding property. No information is provided on the proposed end use of the CDF and its potential impacts on the surrounding land uses, such as traffic.
- The construction of a 10-acre CDF would result in the permanent loss of 10 acres of bay bottom requiring mitigation for the lost habitat at a 3:1 ratio, or 30 acres. The average cost for purchase of credits from a mitigation bank is currently approximately $700,000 per acre, or $21 million. This cost was not included in cost estimate for RTA 3.
- Removing approximately 10 acres of water surface in the Bay may increase channelization of flow within the Canal, exacerbating existing flooding problems.

- The proposed site of the Red Hook CDF is within 250-500 feet of the ball fields at Red Hook Park. The City is concerned about potential impacts from this CDF location on the park.

- The City possesses the riparian rights associated with the shorefront section of Red Hook Park along Henry Street Basin, which have been affirmed in several court rulings. *See, e.g.*, *City of New York v Gowanus Indus. Park, Inc.*, 65 A.D.3d 1071 (N.Y. App. Div. 2d Dep't 2009). Construction of the proposed Red Hook CDF includes filling a portion of Henry Street Basin, with private ownership of the filled land, thus expanding private property on the Brooklyn waterfront and substantially obstructing the City's riparian rights.

Opposition to the proposed construction of a CDF in the Gowanus Bay is likely, based on opposition to the construction of CDFs for contaminated sediment disposal at other sites in the area. Addressing these concerns is likely to increase project costs and lengthen the project schedule, none of which is discussed in the FS.

2) The lack of site specific data on geotechnical conditions and groundwater modeling in the Canal prevent a realistic assessment of bulkhead replacement requirements.

Sheet piling is proposed as a replacement for failing bulkheads around the majority of the Canal. According to Table 1 of the revised cost memorandum in the FS Addendum, in RTA 1 and 2, the costs are based on piles approximately 35 feet long, driven into the native sediment to a depth of 10 feet (including the 3 foot cap results in a total embedment of 13 feet). Slightly longer piles are used in RTA 3.

- A typical "rule of thumb" approach to estimating sheet pile design is that for every one foot of wall above the soil, two feet should be embedded in competent soil (*i.e.*, soil that is capable of supporting the design load of the sheet pile). The conceptual design in the FS inverts this ratio with one foot installed depth for two feet above the soil. No geotechnical calculations are provided to suggest that the system is capable of supporting the anticipated loads.

- No geotechnical investigations have been performed to assess whether the native sediment is even capable of supporting the proposed sheet pile wall (*i.e.*, is competent soil). The purpose of the proposed ISS layer is to strengthen the native sediment under the cap, which suggests that the native sediment is not competent, otherwise no ISS layer would be needed.

- No provisions have been made for controlling groundwater behind the wall and groundwater modeling has not been performed to assess the risk. The Canal serves as a major discharge point for area groundwater and cutting off the flow towards the Canal will result in increasing groundwater levels near the wall; the potential for contaminated groundwater to enter structures, basements, utility vaults, or other similar structures; changes in groundwater flow patterns in the area and the migration of the contaminant plume to new locations; unknown impacts to existing and proposed remediation systems in the area due to changing groundwater flow patterns; potential localized failure of the bulkhead; and other unintended consequences.

- The conceptual design assumes that the 3-foot capping layer will provide additional support to the wall. While this may be true in the long term, the critical time for wall stability will be during excavation of the sediment when the cap will not be in place.

- The conceptual design does not consider the number of pipelines, utility crossings, and bridges in the Canal that will impact the ability to construct a bulkhead in the manner proposed.

- The conceptual design includes tiebacks to help stabilize the wall. There are a number of locations along the Canal where structures are located such that tiebacks cannot be installed. Given the lack of geotechnical sampling and analysis, the suitability of the upland soil for the use of tiebacks has not been confirmed, and the number and spacing of tiebacks has not been evaluated. Also, given the depth to groundwater in the area, it is not clear that tiebacks can be installed at a suitable depth to stabilize the wall without major excavation on adjacent properties.

- No information is provided as to whether installation would be land-based or water based.

  - If land-based, there are a number of locations where existing structures will impact access in portions of the site. In addition, it is not clear that the existing bulkheads and the material behind the bulkheads are strong enough to support the equipment loads necessary to construct a sheet pile wall. The ability of the upland soils to support the required equipment has not been assessed.

  - If water based, will equipment barges be able to access areas where sediment has accumulated to install the sheet piling. The FS repeatedly states that the reason to dredge portions of the Canal would be to allow access to the upper reaches – what assurances are there that the bulkheads can be installed without first removing the sediment, undermining the integrity of the existing bulkheads.

- The vibrations from sheet pile wall installation can destabilize or damage surrounding structures if constructed on soft materials.

- No evaluation was done assessing the potential impact of reducing the depth of dredging on the need to replace the bulkheads.

- The Proposed Plan refers to a historical and archaeological study conducted as part of the FS. (*See* Proposed Plan, p. 7.) One of the recommendations of the study was removal or stabilization of the timber cribwork bulkheads with documentation of sample bulkheads and potentially mitigation of the adverse effects of remediation. The Proposed Plan also states the following:

> "Where new bulkhead construction is required, bulkhead configurations that are in keeping with the historic character of the setting should be considered." *See* Proposed Plan, p. 8.

Sheet pile bulkheads are hardly in keeping with the historic character of the setting.

3) **EPA proposes installing temporary sheet piling around dredge cells to contain contaminants disturbed by remediation activities. The lack of technical analysis in the FS raises serious questions about the effectiveness of these units.**

The conceptual design calls for the construction of treatment cells by installing sheet pile walls within the Canal, to isolate areas during sediment removal, ISS (Alternative 7 only), capping, and water treatment.

- Not enough information is provided to effectively evaluate the conceptual design approach presented in Table 1 of the FS Addendum (*see* Technical memorandum – *Revised Cost Estimates for Preferred Remedial Alternatives*). If the piling length is similar to that used for the bulkheads (35 feet in RTAs 1 and 2), and the piling is embedded to a depth of 25 feet, the wall will extend approximately 10 feet above the native sediments; if the piling is embedded to a depth of 15 feet, then the piling will extend approximately 20 feet above the native sediment. (Note: these depths are based on the pricing information backup and were not described in the FS.) No stability evaluation has been prepared on the construction of the sheet pile walls for the treatment cells. As noted previously, the proposed sheet pile wall approach presented for the bulkheads inverts the standard rule of thumb for sheet pile walls and is unclear what the proposed approach will be for the treatment cells. In addition, there are numerous references in the FS regarding the low strength of the native deposits suggesting that this material may not be able to sustain the walls.

- The impact of flows from the Flushing Tunnel on the stability of the treatment cell wells has not been evaluated. No consideration has been given to the rerouting of the Flushing Tunnel around the treatment cells when working in RTA 1.

- A hydrodynamic model will be required to evaluate the potential impacts to flow within the Canal due to the construction of the treatment cells. In essence the cells will cut the width of the Canal by half, which will increase the flow rate and scour in the remaining Canal width. This will be of particular concern immediately downstream of the Flushing Tunnel. In addition, solids deposition may increase immediately upstream of the cell.

- No assessment was made on the impact to navigation in the Canal due to the installation of the treatment cells. In some locations, the width of the Canal will be reduced to less than 50 feet.

- As presented in Appendix E of the FS, the native sediment surface ranges from approximately -12 feet to -26 NAVD88 with an average depth of -19 feet NAVD88. Assuming a 35-foot pile, if embedded 25 feet into the native sediment, the piling will extend only 10 feet above the native sediments. Mean sea level is approximately 3 feet NAVD88, meaning that some of the treatment cells will be inundated the majority of the time. If the piling is embedded to a depth of 15 feet, on average, the piling will extend only 20 feet above native sediments. Approximately 42 percent of the sampling points showed that the top of the native sediments were at depths of -20 feet NAVD88 or greater, suggesting that a significant portion of the treatment cells in RTA 1 and 2 will be inundated during some portion of the tidal cycle eliminating much of the value of the walls.

- No consideration is given to pipelines, utilities, and bridges that will impact the sheet pile installation for the treatment cells.

4) **EPA's ill-conceived approach to controlling contaminants during dredging and ISS operations in a treatment cell and dewatering the cell after cap installation will contaminate the cap materials during placement.**

The conceptual design calls for pumping two volumes of water out of the treatment cell following dredging and cap placement with the water to be treated and discharged back to the Canal. There are several basic problems with this approach:

- This design assumes that dredge cell water would be removed ***after*** the cap is installed, meaning that the clean material used in the cap will be exposed to the contaminants (primarily NAPL) in the water column, contaminating the cap material and defeating a major purposed of the dredge cell water treatment.

- The section on the treatment cell design states:

> "Sheet piling would be used to contain turbidity and NAPL release during remedial activities but would not be designed to withstand differential head pressures created by lowering water within the cell (except for up to 5 feet differential due to tidal fluctuation). Sheet pile wall joints would not need to be completely water tight because no significant pressure differential would exist." *See* FS Addendum, Table 1, p. 4.

No stability assessment was performed on the ability of the sheet pile walls to withstand the pressure differential that would develop as water was pumped from cell. No evaluation was provided as to the effect of pumping at 750 gallons per minute ("gpm") in a confined area on the cap stability. Because the sheet pile walls will not be watertight, it is anticipated that a significant volume of the water removed from the cell will be replaced by water flowing through the sheet pile wall - no evaluation was provided or discussion on methods that would be used to prevent short circuiting during pumping.

5) **Potential remedial alternatives cannot be effectively identified or evaluated based on available information.**

a. Initial alternative identification and evaluation arbitrarily eliminated possible alternatives. For example, partial removal of sediment is a viable remediation alternative at a substantial savings as compared to full depth sediment removal but was not adequately evaluated during the FS process.

EPA provided very little analysis or technical justification for the elimination of the partial sediment removal alternatives (Alternatives 2 and 3) before any technical analyses were conducted. The reasoning included in Table 4-2 of the FS is vague, unsubstantiated, and inconsistent with remediation activities at other CERCLA sites. Other unsubstantiated assumptions were used to eliminate alternatives that conflicted with the presumed remedy.

i. <u>Untreated waste is left in the canal (Alternatives 2 and 3).</u>

While the preference under CERCLA is for the removal of untreated waste, this is not an absolute condition in assessing the viability of an alternative, particularly if the remaining material can be successfully contained. Greater consideration should have been given to the partial dredging options.

ii. An armored sand cap may not be sufficient to control long term flux of contaminants (Alternative 2).

No evaluation of the anticipated flux rate of NAPL contaminants from underlying sediments was provided and no estimate was made of the required depth of the sand layer that would be necessary to provide adequate protection. Until this analysis has been completed incorporating site-specific alternatives, it is premature to eliminate a sand cap alternative.

iii. Numerous technical challenges are associated with successfully capping very soft sediments (Alternatives 2 and 3).

Capping of contaminated sediment has been successfully performed at a number of CERCLA sites as discussed in several EPA documents. No data was collected and no geotechnical evaluations were performed to assess the strength of the soft sediment and its ability to support a cap. No consideration was given to the variety of cap construction procedures that could be used to place the capping material. No consideration was given to alternatives to strengthen the underlying material to allow cap placement. While additional evaluation may have reached the conclusion that capping is impracticable, this evaluation needs to take place based on site-specific conditions.

iv. Future uses of the canal would be restricted to a greater degree by depth limitations (Alternatives 2 and 3).

The only federally authorized navigational channel is located south of Hamilton Ave. Minimal dredging would be required to maintain the authorized navigation depth. In RTAs 1 and 2, there is no navigation channel established and limited justification has been provided for the need to dredge the full depth of the soft sediment. According to a draft of a USACE memo on shipping in the Canal, limited beam at bridges poses as much of a restriction to the commercial use of the Canal as the draft. In addition, there appears to be some question as to the long term development plans for the upper reaches of the Canal, so it appears premature to extend the termination point of the navigation channel.

Although not included in Table 4-2, the justification for eliminating Alternatives 2, 3 and 4 cited in the FS text is based on the following:

> "The physical characteristics of the soft sediments in the canal suggest that they may have insufficient load bearing capacity to support a cap or could be destabilized by the uneven placement of cap material. Capping over these could destabilize any NAPL present in the soft sediments." *See* FS, p. 4-13.

This conclusion was based on very limited physical testing (grain size, bulk density) and no geotechnical analyses. EPA has based its design for the Canal on unproven assumptions that have not been confirmed by site data or analyses.

b. EPA's selection of two essentially identical alternatives for detailed evaluation represents an unwillingness to consider alternatives to site remediation that do not conform to a narrow view of possible solutions.

Two alternatives were selected for detailed evaluated (Alternatives 5 and 7). These alternatives were ranked essentially the same in the FS with the only difference being the presence or absence of the ISS layer in Alternative 7. Except for the cost of the ISS layer, the construction costs were essentially the same for the two alternatives. The Proposed Plan identifies Alternative 7 as the selected remedy for RTAs 1 and 2 because of the supposed (albeit unproven) benefits of the ISS layer. No technical justification or supporting calculations are provided.

This raises several questions and concerns regarding use of the ISS layer and its value in the design:

- If the ISS layer is a critical component of the selected remedy, its technical feasibility (constructability, effectiveness, benefits, risks) should have been assessed during the FS stage. No alternatives to the ISS layer are discussed in the FS in the event that testing does not support the use of ISS.

- If the ISS layer controls the upward migration of contaminants, as suggested in the FS, the need for a reactive layer as part of the cap is not clear – if ISS is effective, only a sand cap may be required to control the flux. However the conceptual design in the FS includes the same capping components for both Alternative 5 and 7.

- If the ISS layer stabilizes the native sediment as claimed in the FS, the cost of cap construction for Alternative 7 should be lower than for Alternative 5. However, the same construction costs are used for cap construction for both alternatives.

The volume and type of capping material are the same for both Alternative 5 and 7, and the two alternatives were ranked the same in the FS screening matrix, suggesting that there is no discernible added environmental benefit to the use of ISS in controlling the release of NAPL to the Canal. This appears contrary to Appendix A of the FS, which stated that ISS would lower the hydraulic conductivity and homogenize NAPL concentrations, both reducing the rate of flux into the cap and stabilizing the sediment. If so, it would suggest that under Alternative 7, the reactive capping requirements could be reduced or eliminated and construction costs would be reduced.

Use of ISS in the proposed remedy adds approximately $20M to the project costs with no apparent savings in other areas and no documentation as to its effectiveness. In Table ES-1, the FS acknowledges that ISS is unproven, stating "if ISS is implementable and effective." If testing does not verify the technical feasibility and implementability, the default position appears to be to construct the cap without the ISS layer, suggesting that the ISS layer is not critical to the success of the remedy. But if it is technically feasible to construct the cap itself without the ISS layer (*i.e.*, Alternative 5) at roughly the same cost as with the ISS (*i.e.*, Alternative 7), and there are no proven environmental benefits then the value of including ISS in the selected remedy is suspect.

EPA needs to evaluate the technical feasibility of the use of ISS in this setting prior to its inclusion in the proposed remedy. This should include a combination of laboratory and field tests in a marine environment similar to the Canal. Standards for evaluating the results of the testing need to be established based on anticipated outcomes and acceptable performance. Verification that the results can be scaled up to full scale implementation needs to be documented by real world pilot testing.

Capping of sediments has been used as a remedy at numerous contaminated sediment sites and additional documentation (*e.g.* geotechnical evaluation of native sediments) should be provided as to why this approach alone is not applicable in this setting. If testing shows that some support is necessary to maintain the integrity of the cap in this setting, alternatives to ISS that may be more cost-effective than ISS should also be evaluated (*e.g.*, geogrids).

c. Dredging to the proposed depths outlined in the Proposed Plan will negatively impact dissolved oxygen concentrations in the Canal and will reduce the benefits of DEP's NYSDEC-approved Gowanus Canal Waterbody Watershed Facility Plan ("WWFP").

Dredging the Upper Canal to the proposed depths would increase the cross-sectional area of the Canal through which water must pass. This would decrease the amount of flushing that could be achieved in the Upper Canal from the Flushing Tunnel, thus increasing the residence time of pollutants in this area. As a result, organic pollutants within the Upper Canal would undergo oxidation for a longer time period, stressing dissolved oxygen concentrations beyond that planned in DEP's "WWFP".

In addition, dredging the Canal to the proposed depths would decrease the surface area-to-volume ratio, effectively reducing the ability of naturally-occurring processes, such as surface re-aeration, to replace the oxygen consumed by dissolved organic materials and/or organic matter decaying within the sediment.

The City has used the water quality model developed during the preparation of the WWFP to calculate the impacts of the proposed dredging action on Canal dissolved oxygen concentrations. The results of these analyses are provided in Figure 11-1, which supports the following conclusions:

- **Bottom Dissolved Oxygen Concentrations** – The minimum bottom layer dissolved oxygen concentration in the Canal is projected to be reduced by about 0.5 mg/L by dredging the Canal, as planned by EPA. Additionally, Figure 11-1 shows that the minimum dissolved oxygen concentration is projected to be never less than 3.0 mg/L, although it is very close in large sections of the Canal. Nevertheless, achievement of the current DEC Class SD dissolved oxygen criteria would be expected under average conditions.

- **Compliance with Dissolved Oxygen Standards** – For the design year, compliance with the current applicable Interstate Environmental Commission ("IEC") dissolved oxygen standard of 4 mg/L would be reduced about 5 percentage points. DEC has been considering upgrading the water quality classification of Gowanus Canal to Class I, which would also require a dissolved oxygen concentration of no less than 4 mg/L. The proposed dredging would further reduce compliance with the DEC's potential upgrade of the water quality classification.

In summary, the City believes that the extent of dredging proposed by EPA and the resulting water depths would prove detrimental from a dissolved oxygen standpoint, substantially reducing some of the benefits attained by the WWFP. In essence, the dredging activity would counteract the water quality benefits of DEP's current $150 million investment of rehabilitating the Gowanus Pumping Station and Flushing Tunnel.

6) The extent of the sediment removal program appears intended to fulfill other non-remediation objectives.

a. *EPA has arbitrarily proposed the excavation of soil and sediment in the former 1st Street Turning Basin at a cost in excess of $20 million, based on very limited data, no evaluation of alternatives, and unrealistic cost estimates.*

In the FS (*see* Appendix B, Technical Memo), EPA screened upland sites and identified seven sites that presented NAPL risks to the Canal, five of which are already in DEC-supervised remediation programs. In the FS Addendum (*see* Technical Memorandum-*Supplemental Evaluation of Upland Site*), based on the same screening process, 16 upland sites with potential water quality impacts were identified. Of these 16 sites, the former 1st Street Turning Basin was the only upland site identified proposed for remediation under CERCLA; the other upland sites have either been referred to DEC for future action, or their regulatory status is unclear based on the information provided.

The former 5th Street Basin was another of the 16 sites identified in the FS Addendum and ranked similarly to the former 1st Street Basin. The basin was filled during the same period as the former 1st Street Basin and has a number of similarities. No information is provided in the FS Addendum on the proposed plans for this basin; it was not listed as having been referred to DEC for remediation and it has not been proposed for remediation under CERCLA.

EPA based its decision to excavate the former 1st Street Basin on the analytical results of one groundwater sample collected in MW-27i with a score in excess of 100 (a limit set by EPA based on an undocumented standard) even though:

- The sample from MW-27s (*i.e.*, a sample from the same location but at a shallower depth) was ranked as "no risk";
- Groundwater sampling results from samples taken from MW-26s and MW-26i, also located within the limits of the former basin (approximately 75 feet from MW-27), were ranked as "no risk"'
- Groundwater sampling results from samples taken from MW-25s and MW-25i (located approximately 190 feet from MW-27), were ranked as "no risk." The boring log results (*see* RI Appendix D) suggest that MW-25s/i was filled at the same time as the former basin area using similar material and therefore may have been located within the limits of the basin;
- No additional investigation of the site was conducted or has been proposed to verify the nature and extent of the contamination in the former basin;
- No alternatives to excavation were identified or evaluated if remediation were determined to be necessary; and
- There is no indication that the current property owners were contacted regarding the proposed remediation activities and offered an opportunity to participate in the process.

The cost estimate prepared for the excavation significantly underestimates the remediation costs:

- The design costs are low given the complexity of the work involved.

- There are no provisions for any additional investigations of the site – it appears that EPA is planning a $20 million remediation program based on one sampling point.

- There are no costs included for geotechnical analyses required for the design of the replacement bulkheads.

- A number of costs were not addressed as part of the cost estimate, including the purchase of the land encompassing the basin.

- The former basin area is landlocked and for the construction of a proposed public access for a boat launch as mentioned in the FS Addendum, it would be necessary to purchase additional land to allow street access.

- The costs included for a permanent bulkhead around the perimeter of the basin are based on similar assumptions as the replacement bulkheads elsewhere on the Canal. As noted previously, this design is unlikely to be stable.

- As noted previously, productivity rates for the project are too high based on the limited site access in the Canal. This will be a particular issue in the former basin area where there are structures on either side of the basin and all material must be hauled to the Canal end for removal. This is likely to entail double- or triple-handling material, slowing the work and increasing the costs.

- The dredge cell dewatering costs do not include additional equipment rental time, only additional chemicals. As noted in NYC Comment 12, the dewatering schedule assumes full capacity is required to dewater the treatment cells leaving no additional time for dewatering the 1st Street Basin.

- In general, site access restrictions will increase time and costs.

- Site restoration costs are low. Given site restrictions, it will be necessary to stage some of the work on the adjacent property. These areas will need to be decontaminated and restored as part of the remediation process.

7) By its actions, EPA is proposing expansion of the existing navigation channel into the middle and upper reaches of the Canal as justification for removal of the entire soft sediment in the Canal. This expansion is not justified by current and projected navigational patterns on the Canal.

Alternatives 5 and 7 were developed based on an apparently preconceived need for a deep channel throughout the length of Canal, even though this need is not supported by current use patterns. According to information in the FS (*see* Section 1.2.2, p. 1-4), there are no federal, state, or local requirements to maintain a navigation channel of any particular depth above Hamilton Ave. Between Hamilton Ave and Sigourney Street, the federally authorized channel depth is -21 feet NAVD88; between Sigourney Street and the south end of the study area, the federally authorized depth is -33 feet NAVD88.

In the FS, EPA cites a 2007 memo, based on a 2006 study prepared by the USACE, on navigation in the Canal. (Note: only an early draft of this memo was available to the City.) Given the critical design assumptions that were made based on the information in this document, this memo needs to be provided to the City. The draft memo indicated that primary commercial usage is located south of 9th Street with no commercial navigation north of 4th Street.

- One commercial operation was located north of the 9Th Street Bridge – Ferrara Brothers; other uses were primarily recreational craft and environmental groups monitoring conditions in the Canal.

- Bridges north of 9th Street were opened less than 30 times per year.

- There has been a declining trend in vessel trips in the Canal between 1985 and 2005 with a more than 50 percent decrease in the use of the Canal even during a period when industrial activity and jobs in the area were increasing.

- The typical draft of vessels using the channel was 34 feet until 2000, since then it has generally been less than 30 feet. The typical draft of vessels in the Canal since 1990 has been 13 to 14 feet or less, consisting mostly of tug/tow barges.

- The volume of material shipped through the Canal has been on a downward trend for the last 20 years.

- While the depth of sediment in the Canal has had an impact on the size of vessels using the Canal according to some users, the allowable beam is as much a controlling factor as draft in the use of the Canal for commerce. There is a 45 foot beam limitation with economical payloads. (Note: this information was included in the draft memo available to the City but needs to be confirmed based on the final memo cited in the FS but not provided to the City).

The FS presupposes that removal of the entire column of the soft sediment is required to maintain navigation (*see* Section 2.4.3). This is based on a number of flawed assumptions:

- While maintaining navigation may be important, it is neither a legal nor regulatory requirement north of the Hamilton Ave Bridge. The Canal no longer serves as the means of transport for industries along the Canal. Bridges play a significant role in restricting the commercial use of the Canal.

- While the zoning along the Canal itself consists mostly of manufacturing districts, allowing a variety of commercial and industrial uses, there is also zoning that permits residential development. Additionally, longstanding residential districts are mapped in very close proximity to the Canal. Scattered throughout the manufacturing zoning districts are also long existing, non-conforming residential uses. Based on the historical development of the neighborhood, there are no clear functional boundaries between industrial and residential areas. The long-term development of the area as an industrial area using the Canal for large scale shipping is not supported by current land use.

- The data on the depth of the sediment in the Canal was collected along the shorelines where slow velocities would encourage settlement of solids (*see* FS Figure 3-8a-h) thereby overestimating the depth of the soft sediment in the navigational channel; no samples were collected in the navigational channel (down the center of the Canal). In fact, the bathymetric survey results (*see* FS Figure 3-1 c) for RTA 3B suggest that the depth in the channel meets the authorized depth; for RTA 3A, the depth appears to meet the navigation channel depth for the majority of the channel.

- For both RTA 3a and RTA 3b, to meet the required depth for the navigation channel, only limited dredging is required. The current plan to remove all of the soft sediment is unnecessary to meet navigational requirements, even with allowances for a soil cap. Some dredging of individual slips may be necessary to provide deep water access.

- For RTA 2, EPA is proposing to remove all soft sediment, not only in the navigation channel but from all of the turning basins. In addition, it is proposed that the native sediment underlying the soft sediment be removed to create a **new** navigation channel with a depth of -16 feet NAVD88. Local businesses currently navigate the Canal without a maintained navigation channel. Across much of this area, the average depth of the top of the soft sediment layer is -5 to -10 feet NAVD88 (as noted above, this was measured along the shoreline and does not necessarily reflect conditions in the center of the Canal). By this action, EPA is proposing to create a navigational channel where one has not existed in the past, and which will require maintenance in the future to ensure its continued use.

- As for the need to remove all sediment in RTA 1, no justification has been provided. The City has proposed maintenance dredging of the upper 800 feet of the Canal such that the top of the cap would be 3 feet below mean lower low water at all times. This will allow recreational boating (which has a limited draft) in the upper reach of the Canal and equipment access for maintenance of the waterway. Because the width of the Canal is only 100 feet in this area, if equipment cannot access the area from the water, land-based equipment can be used for maintenance purposes if necessary.

The proposed removal of all soft sediment from the waterway has no justification based on the need to provide navigational access for the entire length of the Canal, either from a legal or regulatory requirement. From a practical standpoint, where feasible, navigation should be maintained for businesses operating in the area. However, the creation and maintenance of a 16 foot navigation channel for the entire length of the Canal is neither necessary nor warranted by the current and anticipated usage of the waterway. The FS cites two technical memoranda by the USACE to justify the navigation channel in the middle reach of the Canal. These documents are not available online and have not been made available to the City. An early draft of one of the memos does not appear to support such a wide-ranging extension of the navigation channel based on historical usage of the Canal for shipping. Will EPA make these documents available to provided full disclosure on the results of the analyses?

EPA needs to provide greater justification for the need to remove all soft sediment from the waterway along with economic justification for maintenance of a 16 foot navigational channel north of Hamilton Ave.

NYC Comment 11 Inquiries

In addition to the observations above, the City requests that EPA respond to the following:

- To finalize the FS in a technically supportable manner, the studies listed in Comment 11(1)(a) need to be completed **before** alternatives are identified and evaluated. These studies include, but are not limited to, groundwater modeling of the Canal watershed, hydrodynamic modeling of the Canal (including an assessment of the impact of the Flushing Tunnel once it is operable again), and geotechnical investigations of site conditions both in sediments underlying the Canal and in the immediately surrounding upland areas. Once this information is available, alternatives can be identified and appropriately evaluated. The current

FS screening process relied heavily on conjecture and assumptions about site specific conditions and their impact. In evaluating the technical feasibility and implementability of alternatives during the FS process, site specific information needs to be included in the process. This was not done in evaluating either of the alternatives selected for disposal of sediment from RTA3 – beneficial use or a CDF.

  - No information was provided on the demand for daily cover at area landfills or the material specifications that would have to be met for its use.

  - No testing was performed on the material to determine the chemical and geotechnical properties of the material following SS to verify that it can meet the required material specifications once stabilized.

  - No information was provided on the proposed location, its suitability for construction of a CDF, the impacts of the site on the surrounding land use, on the Bay or Canal. No site specific studies were conducted to assess the technical feasibility of the site,

  - Because of the lack of specificity in the proposed analysis of the CDF, stakeholders will not have an opportunity to provide meaningful input into the planning process.

  - If, as appears likely, neither alternative can be implemented, the fall back will be off-site disposal of the material, increasing the project costs by approximately $35M.

- Both of the alternatives identified in the Proposed Plan were inadequately characterized and have substantial data gaps that need to be resolved before either can be selected.

- The implications of failure of a significant portion of the bulkheads along the Canal due to dredging operations can be catastrophic but are given little consideration in the FS.

- To realistically assess the **cost** and **technical feasibility** of installing a sheet pile bulkhead along the perimeter of the Canal, a geotechnical assessment of in-water and upland soil conditions is critical. This work has not been completed as part of the FS.

- To realistically assess the **impact** of installing a sheet pile bulkhead around the majority of the Canal, effectively cutting off much of the groundwater flow into the Canal, a groundwater model must be prepared. Without the model, the potential impact on groundwater flow patterns and contaminant transport cannot be evaluated; changes in upward migration of contaminants into the surface water cannot evaluated; and the effectiveness of the cap with or without an ISS layer cannot be evaluated.

- Site specific data on conditions in the Canal and a more complete analysis of the technical feasibility and implementability of the use of treatment cells is necessary in the FS. As currently conceived and presented in the FS, the use of treatment cells is unworkable: the system does not appear to be constructible; the length of the piling does not appear adequate to retain TSS with tidal variations in water levels; the impact of the Flushing Tunnel was not evaluated; the restriction in the width of the Canal will increase scour and the movement of contaminated sediment; no consideration was given to other users of the Canal and their impact on operations; and no consideration was given to the impact of obstructions.

- The conceptual design presented in the FS does not consider any of the ramifications of high pumping rates in an enclosed area to dewater the treatment cells. This raises more questions as to the overall technical feasibility of the alternatives.

- As noted in NYC Comment 11(1)(a), there are significant data gaps in the FS. Only once this information is available can alternatives can be identified and appropriately evaluated. The current FS preliminary evaluation process relied heavily on conjectures and assumptions about site specific conditions and their impact on the technical feasibility and implementability of the various alternatives. Without geotechnical data and modeling results, these conclusions cannot be supported making the entire process suspect.

- The FS failed to evaluate the potential impacts of dredging alternatives on water quality. The failure to develop a hydrodynamic model of the Canal limited the ability of the EPA to effectively evaluate the impact of its proposed remedy on the Canal. The City's model of the Canal, developed as part of ongoing work to address conditions in the Canal, indicates that rather than improving conditions in the Canal dredging the Upper Canal to the depths proposed by EPA will have a detrimental impact on dissolved oxygen concentrations resulting in the inability to meet water quality standards for a SD-classified water.

- The detailed evaluation of the two "remaining" alternatives is not supported by technical data, calculations or systematic analysis. The need for the ISS layer was not evaluated in a meaningful manner in the FS, nor were alternatives to the ISS considered. To justify the inclusion of ISS in the recommended remedy, additional evaluation and testing is required. The lack of specific information on the technical feasibility and implementability of the ISS process makes its inclusion in the recommended remedy questionable.

- The remediation of the former 1st Street Basin is not supported by existing data, is impractical as currently conceived in the FS, and underestimates the project costs. Justification for this activity is weak and not consistent with the handling of other upland sites along the Canal. The decision to excavate the basin does not comply with any remedy selection requirements under CERCLA. Even if additional data supported the need to remediate the area, no alternatives to excavation were evaluated. There is no indication that property owners or neighboring landowners were contacted and offered an opportunity to participate in the process.

- The FS relies upon, and cites, two studies prepared by the USACE on the Canal. An early draft of one memo on navigation in the Canal was available for review but does not appear to support the conclusion presented in the FS. Studies conducted by the USACE on the Canal need to be made available the City for their review and comment if the information is being used to justify decisions on the proposed remedy.

- Expansion of the navigation channel beyond Hamilton Ave is not warranted based on available information. In addition, development along the Canal is in a state of flux and may not be compatible with the EPA's vision of the area. It is important for the Proposed Plan to acknowledge the presence of residents, workers, and business patrons in close proximity to the Canal, and ensure that the remedy does not preclude the wide variety of activities that occur around the Canal.

NYC Comment 12: The cost estimates included in the FS Addendum and Proposed Plan grossly underestimate the likely project costs.

1) The dredging and sediment management costs consistently underestimate likely costs based on site-specific conditions

EPA has consistently underestimated the costs of implementing the proposed remedy. EPA has estimated that remediation costs will range from $350 to $454 million. Based on analyses by the City, the costs of implementing the proposed remedy are likely to be in a range that is twice those amounts, which is outside the acceptable tolerance for a CERCLA FS compared to the final remedy cost (*i.e.*, -30 to +50 percent). Insufficient site characterization and overly optimistic technical assumptions used to justify the design concepts have resulted in an underestimation of the probable costs for each of the alternatives.

The sections below address individual elements of the cost estimate where issues have been identified. In these paragraphs, "Table 1" refers to Table 1 in the FS Addendum (*see* Technical Memorandum – *Revised Cost Estimates for Preferred Remedial Alternatives*).

a. Institutional controls

Although Table 1 makes reference to institutional controls (maintaining fish advisory, protection of the cap and ISS layer, construction limitations within the Canal, bulkhead maintenance, and navigational dredging) no details are provided on the requirements of the controls and there is no cost estimate for the institutional controls. While some of these items will be relatively inexpensive, others – such as navigational dredging – could be significant, particularly if EPA is successful in extending the navigational channel to the head of the Canal.

b. Predesign sampling and testing

The cost estimate identifies a number of tests that will need to be conducted during the predesign investigation phase, including sediment treatability testing, waste characterization for disposal, and additional (unspecified) characterization for design. The FS assumed that all of these tests could be performed for a cost of $500,000 – ***including sample collection*** which is unrealistic. No information is provided on the number of samples to be collected, length of cores, analyses to be performed, or sampling costs, for example. No information is provided on the purpose of the geophysical testing. Geotechnical analysis is not included in the estimate, although this will be a major concern of the design process and geotechnical sample collection and analysis is substantially more expensive than for chemical analysis or treatability testing. Equipment mobilization/demobilization costs for the sample collection, bathymetry, and geophysical testing costs are not addressed in the estimate.

c. Remedial design

Remedial design costs are estimated at 4 percent of the remediation costs. Based on DEP's experience, typically, design costs range from 5 to 15 percent of the projects costs on environmental remediation projects. The estimated cost is at the low end of the scale for similar projects. According to Table 1, the remedial design budget is intended to cover the following tasks:

- Treatability studies for ex-situ treatment (including sample collection),
- Bulkhead inspection,
- Design phase activities,
- Contractor prequalification,
- Construction plans and specifications, and
- Bidding services.

The estimated cost for remedial design significantly underestimates the likely costs or does not cover the range of activities likely to be necessary.

d. Pre-remediation site work

The pre-remediation site work appears aimed at preparing the staging area, but has a number of costs that are unclear. Costs are included for constructing approximately 24,000 square yards of temporary access roads on a parcel of land near the mouth of the Canal. Given the area, the need for this amount of temporary roadwork is unclear. Streets in the area are already paved as well as many of the properties that may be available for use as a staging area. Approximately 2000 feet of temporary fencing is provided at a cost of $7.13 per linear foot (Means 01 56 26.50.0100). According to the RS Means reference number, this fencing is only six feet tall and can be installed with no equipment. Temporary fencing is typically installed in concrete supports so that it can be moved easily during construction; however, it provides little security for the job site. To allow docking at processing sites, either a temporary or permanent dock will need to be installed unless one is already available at the site. Temporary docking facilities cost upwards of $40,000 per month to rent, or almost $3 million over the life of the project.

e. Upgrading and restoration of bulkheads

Sheet piling is proposed as replacement bulkheads. According to Table 1, the costs are based on piles approximately 35 feet long, driven into the native sediment to a depth of 10 feet with a 3 foot cap (13 feet of total embedment, 22 feet above soil). Based on typical design standards, the length of embedment should be twice the amount above soil, or approximately 44 feet. This standard increases the required length of the pile to approximately 60 feet, or almost twice the current design length, adding $28 million to the sheet piling installation cost−assuming the unit price stays the same, which is unlikely. This estimate also assumes that the native sediment is competent soil.

In pricing sheet piling, no consideration was given to site access, soil stability behind the existing bulkhead, obstructions (pipeline, utilities, bridges), site restoration, or the vibration impact on adjacent older structures from driving pile. Debris removal costs were significantly underestimated based on the linear feet of bulkhead requiring replacement and information on the volume of debris as described in several reports. The cost for the crushed rock (Means 32 11 23.23.1513) placed behind the bulkhead is based on the placement of crushed rock in a large open area such as a roadway or parking lot where large equipment can quickly place and spread the material. This will not be the case in the bulkhead repair work. Smaller equipment will be required to access the site operating around numerous obstructions at each site. In addition, there is no cost estimate for processing/decontaminating or disposing of debris removed from the Canal. Compliance with the historical and archaeological study recommendations referenced in the Proposed Plan (*see* Proposed Plan, p. 7) would further increase sheet piling costs.

f. Installation / removal of sheet pile cells

The conceptual design calls for the construction of the treatment cells using sheet pile walls within the Canal, to isolate areas during sediment removal, ISS (Alternative 7 only) capping, and water treatment.

- The estimate assumes approximately 15,000 square feet of sheet pile will be purchased and installed at a cost of $39.53 per square feet (ref: RS Means 31 41 16.10.1800). The material will then be extracted and reinstalled several times at a cost of $17.15 per square feet (ref: RS Means 31 41 16.10.1300). According to the RS Means references provided, the cost for the initial installation is based on material being driven to a depth of 25 feet and left in place; the cost for the reinstallation is based on the cost to drive the pile to a depth of 15 feet and then removed and salvaged (*i.e.*, sold for reuse). No information is provided on the planned depth of installation but the permanent bulkheads were embedded to a depth of 10 to 15 feet. These costs are inconsistent with the design concepts presented in the FS for the treatment cells.

- The per-square-foot cost for sheet pile wall installation is roughly 2/3 the cost for the sheet pile installed as the replacement bulkhead. No explanation is provided for the reduced cost for the treatment cells.

- There is no cost estimate for debris removal in the middle of the Canal prior to sheet pile wall installation, nor for processing/decontaminating or disposing of debris removed from the Canal.

g. Sediment removal

Sediment removal costs are based on a production rate of 800 to 1000 cubic yards per day. In May 2012, DEP, as part of its Consent Order with DEC, contracted with a consulting firm to prepare a Basis of Design report (BODR) for dredging the upper 825 feet of the Canal to a depth approximately five feet below mean lower low water. As part of the BODR, a cost estimate was prepared for the work. While preparing this estimate, dredging firms operating in similar canals in the City were contacted regarding equipment requirements and dredging production rates. Based on this information a maximum production rate of 45 cubic yards per hour, and approximately 30 percent down time (*i.e.*, during a 12- hour work day, approximately 8 hours of dredging could be performed) was estimated. The productivity and work schedule is due to the limited space available in the Canal for equipment storage and maneuvering, traffic restrictions based on bridge opening limitations (schedule and heights), and other obstructions in the waterway. This design did not include the use of treatment cells, as proposed in the FS, which would further restrict and slow operations. Based on the BODR, the maximum production rate that should be used in estimating the production schedule is approximately 360 cubic yards per day, or less than half the rate assumed in the FS and FS Addendum. This production rate could be even lower if consideration is given to the constraints imposed by use of the treatment cells (*e.g.*, double handling, increased traffic restrictions in the Canal).

The FS assumed that dredging operations would be performed 7 days per week, 12 hours per day. As noted previously, this does not include down times for equipment movement or other inefficiencies from operating in a confined spaced like the Canal and does not reflect likely local opposition to the proposed 7-day per week operations. For planning purposes, a more realistic assumption in the production schedule would be 5 days per week, 12 hours per day.

No cost is provided for management (processing, decontamination if appropriate, transport or disposal) of debris removed from the Canal.

Based on a lower production rate, the dredging schedule would increase from approximately 25 months to approximately 75 months, adding a minimum of $10 to $15 million to the project cost. Debris processing and disposal costs would be in addition to this amount.

h. ISS (Alternative 7 only)

- Table 1 indicates that the "*remaining native sediment in targeted areas*" would be treated. Later in the same section, it is noted that "*[r]eagents would be delivered to a depth of 5 feet below the dredge surface.*" Numerous figures in the RI and FS show that native sediments are believed to extend to a depth of more than 40 feet below ground surface (bgs). It is not clear how injecting and mixing the reagent to a depth of 5 feet in the native sediments will treat the remaining native sediments as stated in Table 1.

- The estimate includes a cost to construct an additional 11,732 square yards (2.5 acres) of "temporary access road", in addition to the approximately 5 acres of "temporary access road" mentioned under the Pre-remediation Site Work section of the table. Given the location of the staging area, the purpose of the temporary access roads is unclear.

- The base implementation cost section includes a cost for a "temporary storage area" at a cost of $100,000 per month. For the ISS costs, there is a monthly charge for "temporary storage area" at a cost of $1,000 per month – this appears to be a typographical error since other costs in this category remain the same. For the 7.7 months required for ISS operations (based on the FS estimate), this underestimates costs by $763,000.

- The ISS process is assumed to take approximately 7.7 months based on a production rate of 1,400 square feet per day, assuming 12-hour per day operations, 7 days per week. As noted previously, this operating schedule does not reflect the operating limitations within the Canal due to site and project specific limitations. If the same reduction in productivity was applied to the ISS process as was noted for the dredging operations, productivity would be reduced by one third, to approximately 900 square feet per day, and extending the operating period from 7.7 months to 11.6 months. This would increase the ISS costs by approximately $3 million. Given the complexity of the ISS operations, space limitations, and lack of experienced contractors, this cost is likely to significantly under estimate the actual costs.

- There are a number of questions about the constructability of the ISS layer, based on the information presented in Table 1. Addressing the simple logistics questions posed by the conceptual design presented in the FS would add substantially to the cost of the project.

- According to the work sequence presented in Table 1, all work would be performed within a treatment cell until the water within the cell is pumped out and treated. Based on this approach, it is not clear how the equipment barge would get into the treatment cell to conduct ISS operations. The average width of each treatment cell will be approximately 50 feet (100 feet Canal width divided by 2). Vertical augers such as are typically used for soil mixing operations typically operate close to the equipment platform because of the torque on the drilling arm, which limits the reach of the equipment. Removing a section of the treatment cell wall to allow equipment access would defeat the purpose of the treatment cell. It is not clear that the auger would be able to reach all sections of a treatment cell from outside the cell.

- It is noted in Table 1 that the production rate was based on "two delivery platforms" working simultaneously. Since no discussion is provided suggesting that dredging would be performed in more than one cell at a time, it appears that the plan is for two ISS rigs to operate in one treatment cell at time. It is not clear that this will be feasible given the width is only 50 feet (on average). In addition to the two ISS rigs, some mechanism would be required in the cell to move the barges around as the work progresses. Having more than one rig in the cell at a time would potentially interfere with the movement of the equipment.

- The cost estimate is based on having two teams of support equipment (scow and tug) to deliver reagent to the ISS rigs. This may be adequate if the rigs are working in the same location (*i.e.*, treatment cell). However, if the work locations are separated, a second scow and potentially a second tug would be needed at each site to allow continuous operation. Otherwise, the ISS operation would need to shut down while the reagent stockpile is replenished. Given the proposed staging area (near the mouth of the Canal) and the number of obstacles between the mouth and the headwaters of the Canal (bridges), a single support scow per ISS rig could result in significant delays.

i. Sediment capping

As noted previously, the site restrictions both in working in and around the treatment cells as well as those related to the Canal, will impact the productivity in cap placement.

j. Dredge cell water treatment

- No redundancy is provided in the pumping system design and the system relies on one pump to operate continuously throughout the dewatering process.

- No down time is included for media changeout in the wastewater treatment plant, fueling of the pumping system or other routine repairs to the system.

- The water treatment plant has a capacity of 750 gpm and will be used to dewater barges containing sediment as well as the dredge cell water. To achieve the schedule in the FS, the dredge cells will need to be pumped at a rate of 750 gpm, meaning there is no excess capacity for handling water from the barges. There is no allowance for stormwater management at the staging area. It is anticipated that stormwater from a portion of the staging area will be classified as contact water and will need to be captured and treated. There is no allowance for equipment decontamination water. There is no allowance for dewatering the former 1st Street Basin.

k. Long-term operations and maintenance cost for sediment cap

There is very little long-term monitoring of the site proposed following remediation – even though contaminants remain in the groundwater and no plan has been proposed to address the contaminant plume in the area. Monitoring is proposed to be conducted once every five years:

- Surface sampling is proposed to check if the surface soils have been re-contaminated at a frequency of one sample per acre of Canal surface.

- Biota sampling is proposed at a frequency of 1 sample per acre of Canal surface.

No monitoring of subsurface soils or porewater is proposed to check for breakthrough of NAPL (for cap replacement) or to monitor the effectiveness of the remedy in controlling the migration of NAPL from native sediment. In addition, because no baseline standards have been set, it is unclear how a determination will be made as to the remedy's effectiveness in controlling NAPL releases from groundwater adjacent to and underneath the Canal.

Essentially, the monitoring program does not address what was identified as the primary concern for the Canal – PAH contamination.

As presented in Tables 1 and 7, the remainder of the operation and maintenance ("O&M") costs is limited to maintaining cap integrity. Table 1 indicates that up to 5 percent of the cap footprint will be replaced every 10 years; the costs in Table 7 show this replacement happening every 5 years. In the cost estimate, costs are limited to the addition of new cap material to address erosion or scour issues. Given the multiple layers in the cap, how this work will be performed is unclear. As noted previously, no flux calculations are provided on the NAPL and no estimate was prepared on the anticipated life of the oleophilic clay. The FS acknowledges that replacement of the clay is likely to be required but no determination is made as to when this will happen. If breakthrough is anticipated to occur during the 30-year cost estimating period under CERCLA, the cost to remove and dispose of the existing layers of material and replace the cap needs to be included in the site maintenance costs. Because the NAPL flux rate was not estimated, the life of the reactive cap material cannot be estimated and therefore, the need to include the cost for replacing the oleophillic materials in the cap has not been addressed.

The initial cost for cap construction is approximately $20 million; the cost to replace the cap once the oleophilic clay has been expended will be many times that amount and will need to include the following costs:

- Design and Construction Oversight related to dredging of Canal and cap construction.

- Dredging of Canal to remove old cap and accumulated sediment.

- Disposal of old cap material and accumulated sediment.

- Placement of new multi-layered cap.

A rough calculation of this cost (using information from the FS) is approximately $200 million per round of replacement. This cost does not consider the potential cost/impact of dredging over the ISS layer.

l. *Sediment management*

No information is provided on the commercial availability of sites to treat contaminated sediment. Sites that accept this type of material (sediment) for the contaminants of potential concern should be identified. Because sampling to characterize the sediment for use in identifying sites that are permitted to treat and or disposal of the material was not conducted during the FS, it is not possible to verify the availability of potential treatment or disposal sites.

The availability of beneficial use sites is unknown. However, it is unlikely that the material would be accepted at a landfill for use as daily cover without being assessed a tipping fee. There are a large number of waste streams that have been proposed for use as daily cover at landfills. Landfills are aware of the revenue potential for accepting relatively clean material for use as daily cover and will charge accordingly. Material that presents a potential risk to the landfill is unlikely to be acceptable as daily cover at no cost.

2) EPA's approach to controlling CSO discharges to the Canal is arbitrary and does not reflect the ongoing control measures being developed. No consideration was given to the impacts associated with construction of large tanks in a highly urbanized area.

DEP has performed extensive CSO planning, design, and construction over the past several decades as part of its NYC CSO abatement program. Capital investments by the City have included the construction of CSO storage tanks with a total capacity of approximately 120 million gallons of combined sewage, resulting in the capture of more than 2.7 billion gallons in CSO discharges annually. These tanks made sense for certain locations that were either beach sensitive or connected to thousands of acres of sewer drainage areas that drained to large single outfalls and negatively impacted water quality.

DEP's approach to CSO abatement is not limited to designing tanks but includes other cost-effective and innovative grey and green infrastructure to take advantage of existing opportunities on a site-specific basis in terms of topography and infrastructure optimization. For the Canal, this includes the significant expansion of the Gowanus Canal Wastewater Pumping Station and Flushing Tunnel that will reduce CSO discharges by 34 percent from baseline conditions. This work is being performed under a Consent Order with DEC. Construction is scheduled to be completed in 2014 and water quality in the Canal is projected to improve to levels that may support upgrading the waterbody to Class I to support secondary contact recreation. Further planned investments in and around the Canal include green infrastructure for two of the largest outfalls, RH-034 and OH-007, that is projected to achieve an additional 11 percent reduction in CSO discharges. Finally, DEP is constructing high level storm sewers in two phases to reduce an additional 5 percent of CSO discharge volume.

DEP is required to develop and submit to DEC a CSO LTCP in June 2015 to quantify water quality improvements from the ongoing construction on the Gowanus Canal Wastewater Pumping Station and Flushing Tunnel, and to evaluate additional control measures that may be necessary to meet water quality standards. The LTCP process is occurring for waterbodies throughout the City and allows DEP to cost-effectively plan for additional water quality improvements as needed while also balancing the competing needs and investments in each waterbody and across the DEP water and wastewater systems as a whole. DEP's approach to CSO reduction in the Canal is a microcosm of the City-wide approach being undertaken that includes a practical mix of cost-effective grey and green infrastructure to protect and enhance water quality throughout the City while fulfilling the fiduciary responsibility that DEP has to ensure water rate payer dollars are spent wisely.

a. The FS cost estimate significantly underestimates CSO storage tanks costs

Figure 12-1 presents the DEP's LTCP CSO tank cost curves for design and construction of CSO storage tanks. These cost curves were developed based on the DEP's experience building tanks in New York City and more accurately reflect costs in the City as compared to the estimates presented in the FS Addendum for several reasons.

The LTCP cost curve relies on actual construction costs for CSO tanks built in New York City, specifically the Paerdegat Basin, Alley Creek and Flushing Bay CSO tanks. A comparison of the actual DEP tank costs and the CH2M-HILL planning level estimates shows a wide discrepancy.

The table below shows the estimated costs of constructing the two tanks using the LTCP cost curve, with a total cost for the two tanks of $357 million. EPA estimated that the two tanks would cost $77.7 million to construct: $31.3 million for a 4-MG CSO storage tank for outfall OH-007 and $46.4 million for an 8-MG CSO storage tank for outfall RH-034 (FS Addendum, Technical memorandum *CSO Storage Tanks Draft Cost Estimates, Gowanus Canal, Brooklyn, New York* ("Tank Cost Estimates") (refer to Figure 12-1).

Project Site	NYCDEP Built Tanks Curve Probable Construction Cost	Accuracy -50%	Accuracy 100%
4 MG OH-007	$129 M	$64.5 M	$258 M
8 MG RH-034	$228 M	$114 M	$456 M
Total	$357 M	$178.5 M	$714 M

Note: At this time the costs for CSO tanks at OH-007 and RH-034 are parametric, or capacity, factored estimates. Parametric or capacity factored estimates are considered Estimate Class 5 by the Association for the Advancement of Cost Engineering (AACE), with an expected level of accuracy of -50% to +100%. Based upon DEP experience in building highly complex projects within NYC, as-built project costs typically approach or exceed the higher range of preliminary project Class 5 cost estimates.

While estimated cost for the proposed 4-MG tank at outfall OH-007 is $31.3 million in the FS, the actual construction cost for a similarly-sized CSO storage tank (Alley Creek, 4.6 MG) recently constructed by DEP, was approximately $101 million.

The following is a breakdown of the Alley Creek tank costs:

- **Contract ER-AC1:** Total cost of $98 million for the construction of upstream sewers and the tank, of which approximately $43 million (40 percent) was attributable to the tank. This apportionment is based on a review of contract as-built plans in which the portion of the contract associated with the tank structures was identified; costs for sewers leading to the tank site and other upstream sewer work was removed from the total. Although this contract included considerable construction of upstream sewers to address drainage and flooding issues, these the costs were not attributed to the Alley Creek CSO tank.

- **Contract ER- AC2**: Total cost of $38 million of which 100 percent is associated with the tank mechanical equipment and internals – screens, air handling equipment, flushing equipment, piping, instrumentation and control equipment, and improvements to the Old Doug Pumping Station for tank pump-out.

- **Contract ER-AC3**: Total $20 million for Alley Park restoration of which 100 percent of these costs are attributed to the Alley Creek tank. As experienced with all other CSO tanks constructed in the City, some level of community amenities can be expected when constructing a CSO facility.

The total construction costs directly attributable to the 4.6-MG Alley Creek CSO tank totaled $101 million ($43 million + $38 million + $20 million).

The costs for constructed projects included on Figure 12-1 were converted to September 2012 dollars so as to be in the same time frame as the costs provided in the FS Addendum. For example, for Alley Creek costs for ER-AC1 were escalated from August 2002 to September 2012; costs for ER-AC2 were escalated from August 2006 to September 2012; and costs for ER-AC3 were escalated from July 2007 to September 2012, using the escalation methodology in the DEP CSO Long Term Control Plan project.

DEP understands that cost estimates are variable but based on DEP's actual final costs of building CSO storage tanks as detailed on Figure 12-1, DEP estimates that it would cost approximately $357 million to construct a 4M-gallon tank at OH-007 and an 8M-gallon tank at RH-034. In other words, construction of both tanks is likely to cost over four times EPA's estimate of $77.7 million. Because DEP's estimate of $357 million is based on its actual experience building tanks in New York City, DEP believes they are more accurate than the estimates presented in the FS Addendum.

b. EPA's cost estimate did not include a number of costs required for construction.

EPA's capital cost estimate for the CSO storage tanks did not include a number of costs typically associated with CSO tank construction including capital cost markups and costs associated with property acquisition, demolition, rebuilding the site surfaces, addressing unknown soil conditions, staging and hauling, and heavy dewatering. In addition, the tank cost estimates did not account for New York City general conditions overhead and contractor profit; enhanced EH&S requirements; construction of appurtenant tank ventilation, flushing, and personnel facilities; site rehabilitation; and difficulty of construction.

In the FS Addendum, EPA presents estimated construction costs for tanks ranging in size from 2 to 17 MG for the RH-034 outfall, and for tanks ranging in size from 2 to 8.2 MG for the OH-007 outfall (*see* Tank Cost Estimates, p.1) assuming a Class 5 planning level estimate as defined by the AACE. The estimates include the following components in addition to the tanks themselves:

- Sewers from the outfall to the storage tanks;

- Coarse screens;

- Pump stations and force mains for tank pumpback;
- Instrumentation and SCADA;
- Odor control; and
- Brownfields remediation.

On page 15 of the Tank Cost Estimates, the Class 5 construction costs estimate assumptions state that "the construction costs accounts for excavation, sheeting and bracing, and backfill…, and dewatering," but exclude "capital cost markups, property costs, demolition, rebuilding of site surface, extra costs from unknown soil conditions, extra costs for staging and hauling, and heavy dewatering." The cost estimates (Tank Cost Estimates, p.10) are based on RS Means cost data, EPA documents and information, in-house cost databases, vendor quotes, and project bid information (such as Metropolitan Sewer District of Greater Cincinnati Engineer's Estimates in 2006). The estimated costs were converted to NYC/September 2012 dollars using the ENR construction cost indexes (*see* Tank Cost Estimate, p. 15)

Considering the significant difference between the DEP actual tank costs and those presented in the Proposed Plan, it appears that several important considerations may not be accounted for in the estimates provided in the FS Addendum.

c. EPA's cost estimate did not include O&M costs.

The CSO storage tank cost estimates in the Proposed Plan and FS Addendum do not include any estimate of O&M costs for the tanks. These costs are significant and must be taken into account. O&M costs should be taken into account for any new capital facility and must also be included in the calculation of a total present worth cost.[21]

d. The FS does not address the issue of implementability of the CSO storage tanks

DEP's years of experience with site selection, engineering, construction and operation of CSO facilities should not be overlooked by EPA. One major technical challenge the DEP has faced with CSO storage tanks is the hydraulic interaction between the existing drainage system and any new end-of-pipe facility. The conveyance of flows to, and through, the tank without impacting the surrounding drainage area is especially critical. Detailed hydraulic models and drainage plan calculations are necessary to ensure no street flooding or basement backups occur. These analyses require large investments in engineering resources to thoroughly understand the existing system and design new facilities that are hydraulically neutral or minimally impact the existing hydraulic grade line. Analyses and designs at this level of detail entail years of work at high cost. To make recommendations with regard to specific tank sizes and locations without understanding the engineering feasibility and cost of these facilities is premature. The City has faced these difficult technical issues over the history of its CSO program and this experience provides the basis for the following comments on the CSO remedy in the Proposed Plan.

e. EPA did not account for the complexities of constructing and operating two multi-million gallon CSO storage tanks in a dense urban neighborhood.

[21] *See* NYC Comment 21 regarding the NCP's requirement that O&M costs be included in cost calculations for remedies.

The Proposed Plan and FS Addendum did not account for a number of significant impediments to construction of large infrastructure works in a dense urban environment, such as: lack of sufficient laydown, staging, and parking areas; excavation/dewatering concerns; maintenance and protection of traffic; buried utilities; community impacts during construction; land use and zoning considerations; and other environmental and logistic impacts. Figures 12-2 and 12-3 depict a possible configuration of each of the proposed tanks at the suggested site, to further illustrate these difficulties described in further detail below.

i. Excavation and dewatering

The close proximity of the proposed tank sites to the Canal would add to the complexity of having to perform deep excavations adjacent to or near open water. As was the case for the Paerdegat CSO Tank, complex slurry walls would be required for construction. The two suggested sites may not afford sufficient space for this type of heavy construction. In addition, groundwater cut off systems requiring extensive dewatering and providing resistance to uplift during excavation would pose costly challenges. For example, configuring a 4-MG tank at the proposed OH-007 site would require a tank depth exceeding 30 feet to enable it to fit on the relatively narrow site while providing the needed volume.

ii. Traffic, Noise and Other Community Disruption

Use of the Douglass & DeGraw Pool/Thomas Greene Playground site for a CSO storage facility to serve outfall RH-034 would require construction of 1,700 linear feet of large combined sewer in City streets to convey the flow from outfall RH-034 to the proposed tank location. EPA's cost estimate does not appear to consider the construction of this new large sewer. This type of project would be very disruptive to traffic and the community. Pile driving, if necessary, could be highly disruptive, causing significant adverse impacts. The proximity of construction to sensitive receptors such as residences, businesses, schools, and medical facilities, would have to be carefully considered and impacts mitigated, particularly as they relate to traffic, parking, maintaining access, noise, dust, and vermin control. Similar considerations concerning traffic and community disruption during construction also apply to the DSNY truck facility site.

Operating and maintaining a CSO facility located beneath a pool would create significant challenges, as multiple access manholes and hatches to the enter the tank from the surface would be needed for O&M of the equipment within the tank. DEP would also need to place permanent above-ground facilities at this location for odor control, pumping and screening facilities, similar to those at its Paerdegat and Flushing Bay CSO tanks.

Similarly, operating and maintaining a CSO facility located beneath the triangular unimproved parcel owned by the City and managed by DSNY, located at 2nd Avenue and 5th Street (Block 977, Lot 3) adjacent to the Canal, would pose challenges. This parcel is currently being used by DSNY as an equipment and plow storage yard and seasonal salt storage location. A community composting facility, which is strongly supported by area Council members and is planned to expand in the near future, is also located here. Making the site usable for DSNY and community composting purposes following construction could also add substantial cost to the CSO structure. The structure would have to be designed with a foundation, walls and a roof capable of supporting the DSNY equipment accessing the site, as well as the weight of salt, composting equipment, and product.

iii. Interference with Underground Utilities

Installing underground tanks and associated sewers in urban areas can involve significant delays and complications relating to existing subsurface utilities. Identifying all such utilities prior to construction can be difficult, and utilities may require relocation, which may not be feasible and/or could cause further neighborhood disruption.

iv. Other Environmental Impacts

An environmental assessment will be required; a full EIS may be needed. In addition to the above issues, the EIS would examine natural and archaeological resources, hazardous materials, water and sewer infrastructure, historic and cultural resources, solid waste and sanitation services, air quality and greenhouse gases, and open space/neighborhood character. Investigation of these issues and preparation of an EIS could be a lengthy process and result in significant costs that should be considered as an additional project cost.

NYC Comment 12 Inquiries

In addition to the observations above, the City requests that EPA respond to the following issues:

The cost estimates significantly underestimate the likely remediation project costs in a number of areas:

- The estimate does not include costs for institutional controls.
- The estimate does not include the additional site investigation activities that were not addressed under the FS. This is a particular issue given the numerous data gaps remaining in the site analysis.
- The estimate does not consider the impact on productivity associated with working in the confines of the Canal.
- The estimate does not consider the reduced working hours/down time likely given the site constraints.
- The estimate does not consider the time losses cost associated with the traffic restrictions due to the low bridges crossing the Canal.
- The estimate does not consider the access restriction on upland properties in installing the bulkheads and other activities.
- The estimate does not consider the double or triple handling of material likely necessary with the use of the treatment cells and other space restrictions.
- The estimate does not consider the equipment requirements for ISS installation and the treatment cells.
- The estimate does not consider the use of unproven technology (ISS) with inexperienced contractor and the impact on the production rates.

- The estimate does not consider the space limitations and the impact on equipment staging and what this will do to the schedule.

- The estimate does not consider seasonal shutdowns due to weather and the cost for restarting construction. Even if year round operations are assumed, winter weather will result in lower productivity at times and it may not be possible to do certain activities during parts of the year.

- The project schedule is based on overly optimistic assumptions. Because a number of the costs are based on the estimated number of days/weeks/months, slippage in the schedule will significantly increase project costs.

The conceptual design presented in the FS does not consider these and other variables that will impact the project schedule and overall project costs.

EPA has significantly underestimated the cost to construct the CSO storage tanks proposed in the FS Addendum, due primarily to a failure to consider site specific conditions. In particular the following items, standard to construction in heavily developed urban areas, were not addressed:

- The Tank Cost Estimates did not include the cost of acquiring and developing property on which to build CSO storage tanks.[22]

- The Tank Cost Estimates did not include the cost of demolishing the existing swimming pool and DSNY garage. The costs of obtaining necessary permits, conducting zoning and land use review, displacement and relocation of the park and garage facilities, and site restoration must be included when estimating construction costs for the proposed tanks.

- The Tank Cost Estimates did not include the cost of rebuilding the existing swimming pool and DSNY garage. These costs should include a new pool and park on top of the proposed RH-034 tank to replace the existing public park, and a new truck garage on top of the proposed OH-007 tank that currently houses a garage.

- The Tank Cost Estimates did not include costs for handling soil and/or groundwater that contains hazardous materials. While the estimate added a 5 percent multiplier for disposal of contaminated soil (nonhazardous), it ignored the potential for hazardous constituents at the sites even though one of the sites is part of the former Fulton MGP. The Tank Cost Estimates should address the cost of properly removing and disposing of soil and groundwater containing hazardous materials, which may be required for the presumed tank locations.

- The Tank Cost Estimates did not include the cost of heavy dewatering even though the sites are located in proximity to the Canal and excavations of plus 40 feet are anticipated, indicating the likely need for heavy dewatering.

- The Tank Cost Estimates did not include New York City general conditions and contractor overhead and profit costs. Under current economic conditions, these factors include 25 percent for general conditions, 10 percent overhead, 5 percent profit, and 3 percent for bonding and insurance.

[22] *See* NYC Comment 13, regarding the reasons why a City-owned park is unavailable for use as the site of a CSO storage tank.

- The Tank Cost Estimates did not include the costs of implementing Enhanced Environmental Health and Safety requirements.

- The Tank Cost Estimates did not include costs for constructing, operating, and maintaining tank ventilation, odor, tank washdown/flushing facilities, and personnel facilities during construction.

- The Tank Cost Estimates did not include costs for handling challenging site conditions, such as existing utilities, small property lots, protection of adjacent lots/structures, poor soils, proximity to receiving waters, and depth to competent rock. For example, the proposed OH-007 tank would be constructed adjacent to Gowanus Canal where water intrusion during construction would have to be addressed and may require significant dewatering.

- The Tank Cost Estimates did not account for subsurface conditions that could entail special foundations and/or construction techniques such as slurry walls since bedrock can be up to 150 feet deep in many locations.

- The Tank Cost Estimates did not consider the additional costs of mitigating impacts to traffic, parking, and noise.

- The Tank Cost Estimates do not address the issue of interim control measures identified in the Proposed Plan as being necessary. No information is provided in the FS on the required control or the associated costs.

- The Tank Cost Estimates did not include the O&M costs for the tank facilities were completely omitted from the Tank Cost Estimates.

- The Tank Cost Estimates did not account for the costs of employing and training staff to operate the tank facilities.

- The Tank Cost Estimates did not account for the costs of preventative and corrective maintenance of the tank facilities.

- The Tank Cost Estimates did not account for the cost of electric power and other utilities necessary to operate the tank facilities.

In addition, O&M costs were not also included in the total present worth analysis for the CSO storage tanks. These costs are significant and result in a heavy burden on the City's expense budget. Over the lifetime of the tank facility, these costs would contribute significantly to the total present worth cost. For example, for the Alley Creek tank, DEP's operating costs have been approximately $1 million per year, and grit removal at the Flushing CSO storage tank facility has cost up to $2 million per year.

The FS failed to consider the technical feasibility or implementability of constructing two large CSO tanks in a highly urbanized environment. There are a significant number of factors that need to be considered, all having substantial cost implications. For example:

- The Proposed Plan does not consider the implementability of or account for the costs of installing slurry walls.

- The Proposed Plan does not consider the implementability of installing two underground tanks where existing subsurface utilities are present.

- The Proposed Plan does not consider the lack of sufficient laydown, staging, and parking areas near the construction sites.

- The Proposed Plan does not consider the implementability of extensive dewatering near the Canal.

- The Proposed Plan does not consider impact of traffic, noise, and other community disruption from installing 1,700 linear feet of large combined sewer in city streets.

- The Proposed Plan does not consider the noise disruption and potential for vibration related damage on older structures from pile driving.

- The Proposed Plan does not include the costs of conducting environmental review.

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Community Impacts

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NYC Comment 13: The Proposed Plan does not adequately address community impacts and siting considerations of locating a CSO in-line tank at Douglass & Degraw Pool/Thomas Green Playground.

As stated above, EPA's presumed remedy for CSOs includes an in-line tank on the site of the Douglass & Degraw Pool/Thomas Green Playground. *See* CH2MHILL, FS Addendum, Technologies for Combined Sewer Overflows Controls, Screening and Evaluation Using Established Criteria Gowanus Canal, Brooklyn, New York ("Technologies for CSO Screening and Evaluation") at 4 and 5; CH2MHILL, Tank Cost Estimate, p. 1. *See also* U.S. EPA Region 2, Gowanus Canal Public Meeting, Presentation, Slide 36. The City takes issue with any assumption that City parkland is available for other uses. Although EPA states its intention to confirm the availability of this location during the design phase of the project, there is no reference to the use of parkland in the Proposed Plan. The reader only finds mention of the park by name in the FS Addendum. Given the constitutional and statutory protection of parkland in New York State discussed in NYC Comment 27, this omission is highly problematic since the Proposed Plan fails to distinguish parkland in any way from other City-owned land. Important considerations for the Douglass & Degraw Pool site include:

- **Loss of Use**. The City has estimated that the construction of a storage tank at the site of Douglass & Degraw Pool would take five to six years. The extended loss of use of the Douglas & Degraw Pool site is an unacceptable burden on the public. Furthermore, there is the possibility that placement of a storage tank underneath the current site of the Douglas & Degraw Pool would effectively eliminate most park uses, including that of a pool, while the storage tank was in place. There has been no evaluation to date as to what type of land use could be located above such a storage tank.

- **Loss of Investment.** The City has invested a total of $4.1 million in recent capital improvements to public parks in this neighborhood. Adjoining the Douglass & Degraw Pool, Thomas Green Park was renovated at a cost of $1.1 million. The loss of this facility that would result from the siting of a storage tank there represents a loss of existing value that is increased by recent investment.

- **Community Need.** The Douglass & Degraw Pool is the nearest public pool for the neighborhoods of Boerum Hill, Cobble Hill and Park Slope. Significantly, 3,500 units of low- and moderate-income NYCHA housing are located nearby at the Wyckoff Gardens, Gowanus and Warren Street housing developments. Although usership statistics for the pool do not include residency information, it is likely that a large proportion of the more than 37,000 annual visitors are drawn from NYCHA housing because of their proximity. The community and local elected officials have strongly supported the pool when it was threatened with closure due to budget shortfalls in recent years. Any loss of use at this facility would be a significant loss of recreational opportunity for the surrounding community.

- **Former Fulton MGP Site.** A portion of this former MGP site coincides with the current site of the Douglass & Degraw Pool. EPA has reviewed the site investigation reports and agreed to coordinate the scheduling of clean-up efforts at this site with DEC. The City has concerns, though, that the site remediation may impact the Douglass & Degraw Pool. Neither DEC nor EPA have clarified how the on-going operation of the pool will be addressed during clean-up of the former MGP. Any plans for significant excavation work at the pool site associated with the clean-up of the former MGP site should ensure the full renovation or replacement of the pool and other recreational amenities that may be displaced. It should also be noted that there are no known health risks associated with the former MGP site that currently impact the pool or pool operations.

NYC Comment 14: The Proposed Plan does not adequately address community impacts and siting considerations of locating a CSO in-line tank at 2nd Avenue and 5th Street (Block 977, Lot 3).

EPA's presumed remedy for CSOs includes an in-line tank retention basin on a triangular unimproved parcel owned by the City and managed by DSNY, located at 2nd Avenue and 5th Street (Block 977, Lot 3). *See* Technologies for CSO Screening and Evaluation, at 4 and 5; Tank Cost Estimate, p. 1.

- **Land use impacts**. This parcel is currently being used by DSNY as an equipment and plow storage yard and seasonal salt storage location. A community composting facility, which is strongly supported by area Council members and is planned to expand in the near future, is also located here. The placement of a CSO storage tank on this site near OH-007 would normally require land use approvals, environmental review, and public review under the New York City Charter. DSNY requests that EPA engage with the City and the local communities to address concerns about potential effects on surrounding land uses and properties.

- **Loss of use**. The construction of a CSO storage tank at this location would make this facility unavailable to DSNY for an extended period of time. Since such construction would require relocation of the DSNY equipment and plow storage yard and seasonal salt storage location, a suitable alternative site must be secured and operational before construction could begin. Similar accommodations would have to be made for relocating the community composting facility, which could be relocated to a separate site.

NYC Comment 15: The Proposed Plan does not adequately address concerns related to siting of the potential Red Hook Confined Disposal Facility ("CDF").

The Proposed Plan states:

> "EPA has identified a potential CDF location on privately-owned property at the Gowanus Bay Terminal on Columbus Street in Red Hook. The CDF could be constructed within an existing slip there or within other areas of the property." Proposed Plan, p. 23.

- **Impacts on Red Hook Park:** The proposed site of the Red Hook CDF is within 250-500 feet of the ball fields at Red Hook Park. The City is concerned about potential impacts from this CDF location on the park. In particular, EPA states in the Proposed Plan that it assumes no leachate collection system will be needed as part of this disposal alternative. No rationale for the absence of either collection or monitoring of leachate is given, even though other long-term monitoring (of the surface capping) will be necessary.

- **Impact on the City's Riparian Rights:** The City asserts the riparian rights associated with the shorefront section of Red Hook Park along Henry Street Basin, and these riparian rights have been affirmed in several court rulings. *See, e.g.*, City of New York v Gowanus Indus. Park, Inc., 65 A.D.3d 1071 (N.Y. App. Div. 2d Dep't 2009). Construction of the proposed Red Hook CDF includes filling a portion of Henry Street Basin, with ownership of the filled land by a private party proposed, thus expanding private property on the Brooklyn waterfront and substantially obstructing the City's riparian rights. The City strongly opposes the siting of the CDF at this location.

NYC Comment 16: EPA Should Consider the Land Use Impacts of Any Changes to Canal Basins

The filling in of land in or near the Henry Street Basin and the excavation and restoration of the 1st Street Turning Basin (discussed in NYC Comment 11) require land use approvals, environmental review, and public review under the New York City Charter. The City requests that EPA engage with the City and the local communities to address concerns about potential effects on surrounding land uses and properties. These may include the creation of land outside the current pierhead line where no zoning district is currently designated, and changes to the ability of future developments to provide required waterfront public access. In light of these changes to the City's shoreline, EPA's engagement with the City is critical to the City's ability to coordinate with local property owners in determining the land use approvals that may be necessary to develop their property.

NYC Comment 17: The Proposed Plan should not preclude the wide variety of industrial, commercial and residential activities in the Canal's vicinity.

It should be noted that the Canal, while an industrial waterway, has significant residential populations in its immediate vicinity. In addition to the long industrial history of the Canal, there is also a long history of a mix of uses including commercial, residential and community facilities. While the zoning along the Canal itself consists mostly of manufacturing districts (which allows a variety of commercial and industrial uses), there is also zoning that permits residential development, notably the mixed-use district (M1-4/R7-2) immediately adjacent to the Canal between 2nd Street and Carroll Street. Additionally, longstanding residential districts are mapped in very close proximity to the Canal, including districts that contain NYCHA developments at the head of the Canal and residential communities to the west in Carroll Gardens and to the east in Gowanus and Park Slope. Scattered throughout the manufacturing zoning districts are also long-existing, non-conforming residential uses, including concentrations on the east side of the Canal near Carroll Street. Based on the historical development of the neighborhood, there are not clear functional boundaries between industrial and residential areas, and people living in the nearby neighborhoods cross the Canal on a daily basis for access to the MTA subway stations and bus lines, as well as to access jobs, recreation/open space, and goods and services.

Portions of the land along the Canal have a strong industrial character. Commercial and light industrial activities are scattered through much of the area, with the greatest concentration of industrial uses in areas south of 3rd Street. These areas, on the east side of the Canal north of Hamilton Avenue and along both sides of the Canal south of Hamilton Avenue in Red Hook and Sunset Park, are within an Industrial Business Zone, wherein the City has established policies and provided assistance to support business activity.

It is important that in any final remedy for the Canal, EPA acknowledges the presence of residents, workers, and business patrons in close proximity to the Canal, and ensures that the remedy does not preclude the wide variety of activities that occur around the Canal. Specifically:

- **Shoreline Area:** Zoning requires that commercial or residential developments fronting on the Canal provide publicly accessible open space along the edge of the Canal. The remedial design should not compromise the ability of property owners to comply with these requirements.

- **Bulkhead stability:** Remedial activities should account for the need to maintain structurally sound bulkheads and avoid adverse effects on land adjacent to the Canal.

- **Impacts from Remedial Activities:** EPA has proposed to conduct dewatering on either land (in Red Hook) or on barges within the Canal. Any needs identified for localized sites for equipment staging, barge access, and processing of dredge material should be carefully considered. When requirements for on-land activities and barge docking/anchoring are finalized and sites are selected to serve these functions, EPA should work with the City and the local communities to minimize effects on traffic (including bridges), parking, air quality, open space and recreation, and other neighborhood priorities.

- **Long-term Remedial Activities**: If long-term remedial activities are planned on land near the Canal, such as continued operation of extraction wells, the scope and location of these activities should be identified as soon as possible to enable property owners and the City to incorporate them into future land use plans for the area.

- **Remedial Activity Siting**: The siting of land-based remedial operations should consider proximity of residences and open spaces, and minimize adverse effects or disruptions.

NYC Comment 18: EPA Must Ensure that the Proposed Plan Does Not Exacerbate Flooding

The Proposed Plan should take into account its potential effect on flood risk during coastal storm surge events.

- For instance, the proposed excavation of the 1st Street Basin should consider the extent to which it could subject adjacent and nearby properties to increased risks of flooding. The possibility of excavating the 1st Street basin should also consider the effect on potential future uses of the adjacent properties, which are irregularly shaped and have limited street access.

- The interim and permanent effects of the Proposed Plan and its design should be analyzed to ensure that they do not hamper or preclude measures to reduce risks of flooding from coastal storm surge events, or storm water management measures that the City may implement in the area.

- Replacement or modification of bulkheads should take into account flood hazards and projections for sea level rise, and consider establishing appropriate shoreline elevations to reduce risks of inland flooding.

NCP Compliance

NYC Comment 19: EPA's failure to perform a screening evaluation and/or a detailed evaluation of source control remedies violates the mandatory remedy selection requirements of the NCP.

The Proposed Plan states that four separate categories of source control must be implemented to prevent recontamination of the proposed remedy for the Canal. Specifically, the Proposed Plan states that

> "the upland sources of hazardous substances, including discharges from the former manufactured gas plants (MGPs), combined sewer overflows (CSOs) to the Canal, other contaminated areas along the Canal [upland source areas] and unpermitted pipes along the Canal, *must be controlled.*" *See* Proposed Plan, p. 1 (emphasis added and footnotes omitted).

Consistent with this statement, the Proposed Plan generally discusses potential remedies for each of these four source categories.

With respect to the MGP sites, EPA chooses to rely on New York State regulations governing the State Superfund program. EPA states that those regulations require source removal or control. *See* Proposed Plan at 19, 30. EPA acknowledges that DEC has not even approved a remedy at two of the three MGP sites.[23] However, EPA concludes that it is sufficient that EPA has developed a coordinated schedule with DEC to implement cleanups at the three MGP sites consistent with the remedy for the Canal.[24] *See* Proposed Plan at 19, 30.

With respect to the other upland source areas located adjacent to the Canal, the Proposed Plan states that sites will be "referred to DEC for investigation and remediation, if necessary," under the State Superfund program. *See* Proposed Plan, pp.4, 33.[25]

With respect to CSOs, the FS Addendum screens and retains five potential CSO remedies that are in addition to the CSO controls the City is implementing pursuant to its CWA Consent Order with DEC. The Proposed Plan does not perform a detailed evaluation of each of those potential remedies. Instead, the Proposed Plan states that a reduction of CSO solids loading of between 58 and 74 percent would be required to achieve PRGs for contaminants in the Canal. To meet this percentage reduction standard, the Proposed Plan states that it is

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[23] *See* NYC Comment 20 below, regarding the inadequacy of the detailed evaluation of the MGP sites remedy against the nine NCP criteria.

[24] *See* NYC Comment 27 below, which demonstrates that the NCP does not permit EPA to delegate responsibility for remedy selection to the DEC.

[25] *See* NYC Comment 20 below, regarding the inadequacy of the detailed evaluation of the upland source remedy against the nine NCP criteria.

> "presumed that in-line storage tanks would have to be constructed near outfalls RH-034 and OH-007." *See* Proposed Plan, pp.19, 30.[26]

The Proposed Plan also acknowledges, however, that during remedial design of the remedy for the Canal and the City's contemporaneous LTCP process for CSOs under the CWA,

> "these efforts may identify more efficient cost-effective and protective alternatives to achieve the remedial goals." *See* Proposed Plan, pp. 19, 30.

With respect to discharges from the unpermitted pipe outfalls along the Canal, the Proposed Plan states that EPA will work in coordination with the City and DEC to either permit or permanently seal these pipes.

The NCP provides a mandatory, specific procedure for remedy selection as part of the FS, Proposed Plan and ROD. *See* 40 C.F.R. § 300.430(e). Indeed, the "primary objective of the FS is to ensure that appropriate remedial alternatives are developed and evaluated . . ." *See* 40 C.F.R. § 300.430(e)(1). Specific to source control actions, the NCP mandates that the lead agency (here EPA, not the State) develop a range of alternatives. *See* 40 C.F.R. § 300.430(e)(3). These alternatives are then to be screened against three criteria: effectiveness, implementability, and cost. *See* 40 C.F.R. § 300.430(e)(7).

Once the alternatives are screened, EPA must perform a detailed evaluation for each alternative. On this critical requirement, the NCP states:

> *Detailed analysis of alternatives*. (i) a detailed analysis shall be conducted on the limited number of alternatives that represent viable approaches to remedial action after evaluation in the screening stage. *See* 40 C.F.R. § 300.430(e)(9)(i) (emphasis added)

The NCP defines the scope of the detailed evaluation as follows:

> (ii) The detailed analysis consists of an assessment of individual alternatives against each of the evaluation criteria and a comparative analysis that focuses upon the relative performance of each alternative against those criteria. *See* 40 C.F.R. § 300.430(e)(9)(ii) (emphasis added).[27]

EPA is then required to document this alternative evaluation in the Proposed Plan.

At a minimum, the Proposed Plan shall:

[26] *See* NYC Comment 21, regarding the inadequacy of the detailed evaluation of CSO remedies against the nine NCP criteria.

[27] EPA and New York State must also identify their ARARs related to specific alternatives in a timely manner and no later than the early stages of the comparative analysis. *See*, 40 C.F.R. § 430(e)(8) and (a)(9)(ii). EPA did not identify any ARARs in the FS or the FS Addendum for source control remedies.

provide a brief summary description of the remedial alternatives evaluated in the detailed analysis established under paragraph (e)(9) of this section. *See* 40 C.F.R. § 300.430(f)(2)(i) (emphasis added).

In sum, the non-discretionary remedy selection process mandated by the NCP requires EPA to perform, at a minimum, the following actions regarding the proposed source control remedies in the Proposed Plan: (1) screening of alternatives against three criteria: effectiveness, implementability, and cost; (2) identifying ARARs for the screened alternatives; (3) performing a detailed evaluation of each of the screened alternatives against the nine NCP criteria; (4) performing a comparative analysis of the screened alternatives that focuses on the relative performance of each alternative against the nine NCP criteria; and (5) providing in the Proposed Plan a summary description of the remedial alternatives evaluated in the detailed analysis.

EPA violated the NCP by failing to follow these mandatory remedy selection procedures for each of the four categories of source controls in the Proposed Plan. For the MGPs, other upland source areas, and unpermitted pipe sources, EPA failed to screen source control remedies, failed to identify ARARs in the FS, failed to perform a sufficiently detailed evaluation of alternatives against the nine NCP criteria,[28] failed to perform a comparative analysis of alternatives relative to performance against the nine NCP criteria, and failed to provide in the Proposed Plan a summary of the remedial alternatives evaluated in the detailed analysis.

For the CSOs, EPA did issue an FS Addendum simultaneously with issuance of the Proposed Plan. The FS Addendum screened seven potential CSO remedies for effectiveness, implementability, and cost and eliminated two of the potential CSO remedies. However, EPA then failed to identify in the FS Addendum ARARs that applied to those remaining potential CSO remedies, failed to perform a detailed evaluation of those potential remedies against the nine NCP criteria, failed to perform a comparative analysis of the alternatives' relative performance against the nine NCP criteria and failed to provide in the Proposed Plan a summary of the remedial alternatives evaluated in the detailed analysis.

NYC Comment 20: EPA did not provide a sufficiently detailed evaluation of the remedial measures necessary to control sources from the three MGPs and other upland sites as required by 40 C.F.R. § 300.430(e)(9)(ii) and (iii).

As stated in NYC Comment 19 above, the NCP requires a detailed evaluation of each alternative remedy against the nine NCP criteria. The NCP requires specifically that this analysis "<u>shall</u> reflect the scope and complexity of site problems and alternatives evaluated and consider the relative significance of the factors within each criteria." *See* 40 C.F.R. § 300.430(e)(9)(iii). In addition to EPA's failures specified above (including failure to screen alternatives, to identify ARARs in the FS and failure to compare alternatives), EPA's evaluation of individual remedial alternatives for control of MGPs and other upland source areas against the nine NCP criteria fails to comply with 40 C.F.R. § 300.430(e)(9)(ii) and (iii).

[28] *See* NYC Comment 20 below which details why EPA's evaluation of MGP and upland remedies, which are not specified does not satisfy the requirements of 40 C.F.R. § 430(e)(9)(ii).

Instead, the Proposed Plan and FS provide only generic statements that the NAPL from the MGPs will be sufficiently controlled through ongoing State-supervised remedial actions. *See* Proposed Plan at 3 - 4. With respect to the MGPs, the Proposed Plan also acknowledges that DEC has not even completed the remedy selection process for either the Fulton or Metropolitan MGP sites. *See* Proposed Plan, at 19.

The Proposed Plan and FS are even less specific regarding source control activities at the dozens of other upland properties, even though EPA states that, based on the results of the RI, additional upland areas were found to have the potential to contribute contaminated groundwater to the Canal and were referred to DEC for investigation and, if necessary, remediation under the State Superfund program.

EPA's evaluation of remedial alternatives for these source controls was deficient for the following reasons. The City therefore requests that EPA respond to each of the following comments, separately.

1) Analysis of Overall Protection of Human Health and the Environment

This NCP criterion requires a detailed evaluation of whether the selected alternative "as a whole, achieves and maintains protection of human health and the environment." *See* Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, OSWER Directive 9355.3-01, (Oct. 1988), at 6-5 ("OSWER Directive 9355.3-01"). It requires that the agency focus on whether a specific alternative achieves adequate protection, and describe how site risks posed through each pathway being addressed by the FS are eliminated, reduced, or controlled through treatment, engineering, or institutional controls." *Id*., at 6-6.

EPA's evaluation is generic, and offers no detailed analysis of whether the unspecified remedial measures on the upland parcels will be sufficient to maintain the remedy over the long term. Instead, its analysis is limited to the following:

> The upland former MGP source controls (and other upland source areas) that have been or are anticipated to be selected by NYSDEC are expected to be protective of human health and the environment by removing the primary source areas and minimizing migrations pathways to the Canal. *See* Proposed Plan, p. 25.

The City believes that this does not provide even close to enough analysis or information to ensure that the upland remedial actions will be sufficient to protect human health and/or the environment. Therefore, EPA has not provided the following information, and must do so before selecting the remedy:

- How EPA has determined that the remedial techniques EPA *assumes* will be implemented at the upland sites will be capable of achieving adequate protection of the remedy.

- How EPA has determined that the *assumed, unspecified* controls at the upland sites will prevent recontamination from contaminated groundwater or NAPL in groundwater media (a recognized source of contamination in the Canal).

2) Analysis of Long-term Effectiveness and Permanence

This criterion requires EPA to evaluate the magnitude of residual risk remaining at a site. Residual risk is typically measured by numerical standards such as cancer risk levels, or the volume or concentration of contaminants in the waste, media, or treatment residuals remaining on the site. This criterion also requires EPA to evaluate the effectiveness and reliability of controls used to manage any remaining contaminated media. Therefore, EPA has not provided the following information, and must do so before selecting the remedy:

- Whether and how EPA assessed the risk of recontamination from upland sites, including the MGPs, to ensure that residual risks are below the numerical values set forth in the Proposed Plan.

- Whether and how EPA assessed the effectiveness and reliability of controls at upland sites when there has been no evaluation of what controls will even be established on the vast majority of properties adjoining the Canal.

3) Analysis of Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion addresses "the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element." *See* OSWER Directive 9355.3-01, at 6-6. Pursuant to EPA guidance, each remedial alternative should focus on following specific factors: (i) the treatment processes the remedy will employ; (ii) the amount of hazardous material that will be destroyed or treated, including how the principal threats will be addressed; (iii) the degree of expected reduction in toxicity, mobility, or volume measured as a percentage of reduction (or order or magnitude); (iv) the expected degree to which the treatment will be irreversible; (v) the type and quantity of treatment residuals that will remain following treatment; (vi) whether the alternative would satisfy the statutory preference for treatment as a principal element." *Id.*

EPA does not evaluate any upland site against these factors, including the assumed remedial technologies that will be necessary for preventing NAPL and contaminated groundwater from recontaminating the sediments in the Canal. By not conducting this evaluation, EPA could not have been able to determine whether the remedy satisfies the statutory preference for treatment over other remedial measures. This is particularly true with respect to EPA's presumption that barrier walls will be the primary engineering control at the upland sites. As barrier walls do not treat hazardous substances, but merely contain them, it is unlikely that EPA at this juncture can attest that the remedy has fulfilled the statutory preference for treatment. Therefore, EPA has not provided the following information and must do so before selecting a remedy:

- What treatment technologies, if any, will be employed on each upland site contributing hazardous substances to the Canal.

- The degree of groundwater and/or NAPL treatment that is necessary to prevent recontamination of the Canal remedy.

- The degree (expressed in a percentage or as an order of magnitude) that EPA expects to reduce toxicity, mobility, or volume of groundwater and/or NAPL contamination at the upland sites.

- Whether and how the barrier wall technologies presumed to be implemented for the three upland MGPs fulfill CERCLA's statutory preference for treatment technologies at Superfund sites.

- Any and all evaluations that EPA undertook to document the use of treatment technologies on the upland sites, including the three MGPs.

4) Analysis of Short-term Effectiveness

This criterion "addresses the effects of the alternative during the construction and implementation phase until … a cleanup target has been met." *See* OSWER Directive 9355.3-01, at 6-9. Among the factors that EPA should consider in the assessment of short-term effectiveness are the timing of the various remedial measures, and what environmental impacts are expected during construction and implementation of the alternative, including measures to mitigate any identified impacts.

The Proposed Plan does not provide any assessment of the overall timing of upland remediation projects, nor does the Proposed Plan assess the environmental impacts potentially arising from these actions. Given the dozens of potentially contaminated sites that could be subject to remedial action in and around the Canal, EPA needs to conduct a full evaluation of the cumulative environmental impacts of these activities, especially when combined with the potential impacts of the dredge activities proposed in the Proposed Plan. Potential environmental impacts could include, among other things:

- Traffic impacts arising from contemporaneous response actions on the upland properties, including truck traffic associated with transporting any contaminated soils and equipment;

- Potential air, dust and noise impacts associated with remedial construction at upland sites; and

- Impacts to local groundwater flow through the potential use of technologies such as barrier walls and groundwater recovery wells.

EPA has not provided the following information, and must do so before selecting the remedy:

- A detailed description of potential remedial technologies that will be employed at each parcel adjacent to the Canal, and when remedial measures will be implemented on each parcel.

- A detailed analysis of potential cumulative environmental impacts arising from the upland response actions.

If EPA has conducted this analysis, please provide the analysis in the Responsiveness Summary. If EPA has not conducted this analysis, please provide this analysis.

5) Implementability

The implementability criterion "addresses the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during implementation." *See* OSWER Directive 9355.3-01, at 6-9. The implementability evaluation should include, among other things: (i) an evaluation of the uncertainties associated with constructing and operating a specific remedial technology; (ii) whether a particular technology is reliable or whether there is the potential for construction delays; (iii) the difficulty of undertaking the prescribed remedial measures; and (iv) the steps that are required to coordinate with other agencies, over the short and long term.

EPA did not evaluate the implementability of upland remedial actions, except to vaguely state that

> "[the] former MGP and upland source control actions which have been or are anticipated to be selected are expected to be implemented successfully. Excavation, capping, NAPL extraction and containment wall technologies have been successfully implemented at other MGP sites." *See* Proposed Plan, p. 29.

The Proposed Plan further states that

> "Given the number of affected former MGP and other source areas, extensive coordination among landowners, responsible parties and local, state, and federal agencies will be required." *Id.*

Yet, despite acknowledging that these required efforts will be "extensive," EPA provides no detail on what the activities will actually consist of, where these activities will be implemented, and how this extensive work will be coordinated with the in-Canal remedy. EPA's current plan for the upland sites is so lacking in detailed or specificity, it is difficult to comment on this component of the Proposed Plan.

Therefore, EPA has not provided the following information, and must do so before selecting the remedy:

- Information concerning the "other MGP sites" evaluated by EPA in assessing the implementability criteria, and an explanation of EPA's analysis regarding these sites.
- The amount and location of excavation, capping, and NAPL extraction remedial activities that will be performed at each MGP site in this response, and how EPA determined that these activities are sufficient to protect the remedy in the Canal from recontamination.
- An evaluation of the implementability criteria for each upland site where remedial activities are planned or expected.

6) Cost

The cost criterion requires an evaluation of direct capital costs and annual operation and maintenance costs associated with the remedial action. It typically includes an assessment of the accuracy of the cost estimates, a present worth analysis, and a cost sensitivity analysis. *See* 40 CFR 300.430(e)(9)(iii)(G) (requiring evaluation of capital costs, including both direct and indirect costs, annual operation and maintenance costs, and a net present value of both capital and O&M costs); *see also* OSWER Directive 9355.3-01, at 6-10 – 6-13.

EPA did not undertake any assessment of costs regarding necessary remedial actions on the non-MGP upland sites. The Proposed Plan states:

> The costs to address the other (non-MGP) upland sources will vary from parcel to parcel and will depend on the source control options that may include excavation, cutoff walls, and other measures. EPA has not estimated the costs of remediating these additional parcels as part of the FS and, thus, those costs are not included in the overall remedy costs. However, EPA believes that, in comparison to the overall anticipated canal remedy costs, the costs of addressing these parcels would be small …. *Based upon discussions with property owners willing to implement such measures for redevelopment voluntarily, such measures are likely to cost several million dollars or less per property.* See Proposed Plan, p. 20.

Excluding the MGPs, there are approximately 70 individual parcels of land along the approximately 3.6 miles of shoreline adjacent to the Canal. If the costs of remedial action could *"cost several million dollars"* per property, upland remedial costs could, by EPA's own estimate, exceed $100 million. Indeed, when this figure is combined with the $525 million that EPA estimates the MGP sites will cost, the total cost of remediating the upland sites could actually exceed the amount of the in-Canal remedy. Further, when the in-Canal remedy is combined with this figure, the total cost of the cleanup action could easily exceed $1 billion, which is double the amount that EPA has estimated for the remedy. EPA needs to provide a detailed, thorough cost analysis for each element of the remedy, including remedial actions on the upland properties, so that the total potential costs of this cleanup are fully disclosed and available for public comment.

Therefore, EPA has not provided the following information and must do so before selecting the remedy:

- An analysis of the cost of upland remedial actions necessary to protect the remedy in the Canal.
- Information on how EPA estimated that remediation will "cost several million dollars or less per property."
- Which upland properties EPA evaluated to reach its determination that each upland property would cost several million dollars or less per property.
- The total amount of capital costs and O&M costs that EPA estimates will be expended on upland remedial projects.
- Whether EPA's estimate of "several million dollars or less" included any evaluation of controls necessary to prevent recontamination of the remedy from upland sources above EPA's remedial goals.
- EPA's total estimated cost of the in-Canal remedy, upland remedies (including MGP and non-MGP remedial actions), and CSO source control actions.

NYC Comment 21: EPA did not provide an adequately detailed evaluation of the presumptive remedial measure to further control CSOs.

In addition to EPA's failures specified above (including failure to identify ARARs in the FS and failure to compare alternatives), EPA's detailed evaluation of the presumptive remedial measure for further CSO controls (in-line tanks) against the nine NCP criteria fails to comply with 40 C.F.R. § 300(e)(9)(ii) and (iii). EPA's detailed evaluation of the presumptive remedy was deficient for the following reasons and therefore the City requests that EPA respond to each of these comments separately.

1) Analysis of Overall Protection of Human Health and the Environment

The Proposed Plan states the following with respect to this NCP criterion:

> "By reducing discharges and accumulation of CSO solids, contaminant concentrations in surface sediments after remedy implementation are expected to meet the PRGs, which are considered protective of human health and the environment." *See* Proposed Plan, p. 25.

EPA's evaluation is highly generic and offers no detailed analysis of how and why in-line tanks will maintain the remedy over the long term. *See also* NYC Comment 10. Therefore, EPA has not provided the following information:

- Why in-line tanks of this size are needed to achieve adequate protection of the remedy.
- Why in-line tanks are needed if the proposed 58 – 74 percent reduction in CSO discharges is based on incorrect assumptions and technically indefensible PRGs. (*See* NYC Comment 1.)
- Why in-line tanks are needed if CSOs are not, and have not been, responsible for observed sediment contamination (PCBs, PAHs, and metals) in excess of CERCLA risk-based methods. (*See* NYC Comment 2.)

2) Analysis of Long-Term Effectiveness and Performance

The Proposed Plan states the following with respect to this NCP criterion:

> "CSO controls can be designed and implemented to provide reliable control of discharges at the selected design criteria, thus, reducing the potential for recontamination and the residual risk after the remedy implementation. . . .
>
> The reliability of CSO solids control would require regular inspections and maintenance of controls to ensure they are operated in accordance with design criteria." *See* Proposed Plan, pp. 26-27.

EPA states that CSO remedies can be implemented to control discharges at the level of "the design criteria" and that operation and maintenance of these CSO controls is necessary. However, the Proposed Plan does not specify the design criteria. Instead, the Proposed Plan merely establishes a performance standard in the nature of a range of 58 to 74% reduction of CSO solid discharges. Moreover, the Proposed Plan specifically excludes costs for operation and maintenance of the CSO controls, while at the same time saying that such operation and maintenance is required. Therefore, EPA has not provided the following information:

- What is the cost of operation and maintenance of the CSO controls.

- What is the scope of operation and maintenance of the CSO controls.

- What are the design criteria for the CSO controls.

3) Analysis of Reduction of Toxicity, Mobility or Volume Through Treatment

The Proposed Plan states the following with respect to this NCP criterion:

> The controls would permanently reduce the mobility of contaminants by capturing and containing solids prior to being discharged to the Canal. The captured solids would then undergo appropriate treatment and/or disposal, with the specific methods to be determined during remedial design . . . CSO reductions needed to achieve the PRG's in surface sediments after remedy implementation are estimated to be in the range of 58 to 74%. *See* Proposed Plan, pp. 27-28.

On its face, the Proposed Plan concedes that EPA has only "estimated" the reduction in CSO volume. The Proposed Plan also concedes that an evaluation of the treatment methods have not been determined, but has been deferred until after issuance of the ROD. As a result, EPA cannot and has not evaluated the CSO controls against the six specific factors set forth in the OSWER Guidance at 6-6. Therefore, EPA has not provided the following information:

- What treatment technologies, if any, will be employed for the CSO controls.

- The exact degree of CSO controls necessary to prevent recontamination of the Canal remedy.

- Any and all evaluations or studies EPA undertook or relied upon to document the use of treatment technology or extent of treatment needed for the CSO controls.

4) Analysis of Short-term Effectiveness:

The Proposed Plan states the following with respect to this NCP criterion:

> "Temporary CSO control measures (*e.g.*, solids capture in upper reach with periodic removal) may be needed to maintain remedy protectiveness while the permanent CSO solids controls are being implemented." *See* Proposed Plan, p. 28.

As stated in NYC Comment 12, EPA fails to identify and evaluate in detail interim CSO controls. Further, EPA does not address the exact timing of these interim CSO controls and their respective environmental impacts, traffic impacts, and potential air, dust and noise impacts.

Therefore, EPA has not provided the following information:

- A detailed description of potential interim CSO controls and the timing for their implementation.

- Whether EPA has conducted any analysis of potential environmental impacts from these interim CSO controls. If EPA has conducted this analysis, please provide the analysis in the Responsiveness Summary. If EPA has not conducted this analysis, please state the reason for EPA's failure to do so.

5) Implementability:

The Proposed Plan states the following with respect to this NCP criterion:

> Various approaches to CSO solids control exist and have been successfully implemented elsewhere. NYCDEP has demonstrated that CSO discharges can be reduced through successful implementation of various grey and green infrastructure techniques. *See* Proposed Plan, p. 29.

EPA failed to address this criterion at all with respect to the presumptive in-line tank remedy. In fact, the Proposed Plan refers only to the implementability of green and gray infrastructure. In addition, EPA failed to evaluate the four critical factors regarding implementability as set forth in OSWER Guidance 6-9. Furthermore, EPA's Proposed Plan fails to address issues regarding construction of in-line tanks above an existing City park. *See* NYC Comment 13. In sum, EPA's evaluation of the implementability of in-line tanks is so lacking in detail, it is not even possible to comment on this component of the Proposed Plan.

Therefore, EPA has not provided the following information:

- The other CSO controls EPA evaluated in assessing the implementability criterion, and an explanation of EPA's analysis regarding those other controls.

- The other in-line tank sites EPA evaluated in assessing the implementability criterion, and an explanation of EPA's analysis regarding those sites.

- EPA's evaluation of the implementability criterion for each potential location for the proposed in-line tanks.

6) Cost:

See NYC Comment 12.

NYC Comment 22: EPA did not provide an adequate estimate of the cost of constructing two CSO storage tanks, which must include annual operations and maintenance costs pursuant to CERCLA and the cost criterion set forth in the NCP.

CERCLA and the cost criterion of the NCP require EPA to assess the following costs: "(1) capital costs, including both direct and indirect costs; (2) annual operations and maintenance [O&M] costs; and (3) net present value of capital and O&M costs." 40 C.F.R. § 300.430(e)(9)(iii)(G); *see also* 42 U.S.C. § 9621(a) (requiring EPA to select "cost-effective" remedies taking into account short- and long-term costs "including the costs of operation and maintenance for the entire period during which such activities will be required").

EPA presumes that a 3- to 4-million gallon CSO storage tank for outfall OH-007 and a 6- to 8-million gallon CSO storage tank for outfall RH-034 will be constructed. *See* Proposed Plan, at 19. For costing purposes, EPA estimated that construction costs would be $31.3M for the 4-million gallon tank and $46.4M for the 8-million gallon tank. *See* Proposed Plan, at 19; FS Addendum, "CSO Storage Tanks Draft Cost Estimates, Gowanus Canal, Brooklyn, New York," prepared by CH2M-HILL.

However, EPA acknowledges that

> "[t]hese estimates do not include operation and maintenance costs associated with CSO controls." *See* Proposed Plan, at 19.

In the City's experience, CSO storage tanks cost approximately $1 million annually to operate. In addition, grit removal, part of the regular maintenance of a CSO storage tank, costs up to $2 million annually. *See* NYC Comment 12.

Therefore, EPA has not provided the following information and must do so before selecting the remedy:

- The total amount of O&M costs that EPA estimates will be expended to operate and maintain two CSO storage tanks.
- A detailed analysis of the cost of operating and maintaining CSO storage tanks in the present worth analysis in the Proposed Plan.

NYC Comment 23: EPA did not adequately evaluate the cost-effectiveness of the remedy, particularly the presumed construction of two CSO storage tanks.

CERCLA requires that all remedies selected by EPA must be "cost-effective." 42 U.S.C. § 9621(a). To evaluate cost-effectiveness, EPA first evaluates the "effectiveness" of the remedy by considering its long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Then, EPA must compare overall effectiveness to cost to ensure that the remedy is cost-effective. A remedy is "cost-effective" if its costs are proportional to its overall effectiveness. *See* 40 C.F.R. § 300.430(f)(ii)(D), 42 U.S.C. § 9621(a).

In its Proposed Plan and FS Addendum, EPA vastly underestimates the capital costs of constructing two large CSO storage tanks in dense urban neighborhoods, and completely omits any O&M costs in its cost estimate. *See* NYC Comments 12, 22.

Therefore, EPA has not provided the following information and must do so before selecting the remedy:

- An evaluation on the cost-effectiveness of the remedy, including the presumed construction of two CSO storage tanks.

NYC Comment 24: EPA's selection of a range of percentage solid reductions for CSO controls violates the NCP remedy selection requirements.

In the FS Addendum and the Proposed Plan, EPA asserts that a reduction in CSO solids of 58 to 74 percent is needed to attain PRGs for certain contaminants in the Canal. Selecting a percentage reduction as the remedial standard violates the NCP remedy selection requirements.

Specifically, without specifying what actual CSO control alternatives can meet that standard, there is simply no way to evaluate alternatives against the nine NCP criteria, either individually or comparatively. That is why the FS contains no such individual or comparative detailed analysis of further CSO control alternatives and why the Proposed Plan defines one potential alternative, in-line tanks, as only a "presumptive" remedy subject to change during the design phase and the LTCP that the City is implementing under the CWA. The NCP simply does not allow EPA to select a performance standard[29] as the remedy and allow EPA to defer detailed analysis of alternatives until after issuance of the ROD. The proper manner for EPA to deal with such uncertainties is to follow CSTAG's recommendation and, at this juncture, develop and issue an interim ROD focused on the NAPL contamination impacting the Canal.

NYC Comment 25: EPA's determination that it will develop interim CSO controls during the remedial design phase violates the remedy selection requirements of the NCP.

EPA recognizes that the planning and construction of "long term permanent Superfund controls for the Superfund remedy might not take place by the time remedial dredging is carried out." *See* Proposed Plan, at 20. Therefore, EPA states in the Proposed Plan that in consultation with DEC, EPA "would develop interim CSO solids control measures during the remedial design to control the discharges until the permanent measures are implemented." *See* Proposed Plan, at 21, 31. However, EPA does not identify any potential interim CSO solids control measures, let alone screen them, or perform a detailed individual or comparative evaluation of interim CSO solids control measures against the nine NCP criteria as required by the NCP.

NYC Comment 26: The Proposed MGP and upland source controls and interim control remedies are so vaguely defined that they deprive the City of a meaningful opportunity to comment.

The Proposed Plan fails to provide the City and other interested parties with a meaningful opportunity to comment on the controls for the MGP sites and other upland source areas. CERCLA requires that the Proposed Plan "include sufficient information as may be necessary to provide a reasonable explanation of the Proposed Plan and alternative proposals considered." 42 U.S.C. § 9617(a). Similarly, the NCP provides that the purpose of the Proposed Plan is to "provide the public with a reasonable opportunity to comment on the preferred alternative for remedial action, as well as alternative plans under consideration, and to participate in the selection of a remedial action at a site." 40 C.F.R. § 300.430(f)(2). Both of these provisions require EPA to provide the public with sufficient information so that it can intelligently comment on the matter. As a consequence, any deficiencies in EPA's notice raise due process issues.

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[29] The FS and the Proposed Plan concede that even the performance standard may be revised in the design phase and in the LTCP process. *See* Proposed Plan at 19, 27-28, 33.

The adequacy of the opportunity to comment is particularly important in light of CERCLA's restrictions on the judicial review of remedies. Section 113(h) generally prohibits judicial review of remedy decisions prior to the institution of a cost recovery or civil enforcement action. *See* 42 U.S.C. § 9603(h). Furthermore, section 113 limits judicial review of remedies to the administrative record. *See id.* § 113(j)(1). Multiple courts considering due process challenges to section 113(h)'s bar on pre-enforcement review have noted that the opportunity for public comment satisfies due process concerns that might otherwise be raised by section 113(h).

The Proposed Plan does not provide the City and other interested parties with adequate notice of the control measures for the MGP sites and other upland source areas. The Proposed Plan only refers to the New York Superfund Program's requirements for "source removal or control," Proposed Plan 19, 30, but fails to discuss the methods by which these sources might be addressed. Without specifying at all how the MGP site contamination and other upland sources could be addressed, the City (and the public) do not know what alternative methods (*e.g.*, contaminant removal or engineering controls) might be used and how the surrounding area could be affected. Likewise, the Proposed Plan fails to even identify what interim CSO remedies will be evaluated. The Proposed Plan effectively requires all interested parties to guess what cleanup approach might be used at the three MGP sites, the upland sources area and as interim CSO remedies. It is precisely when the agency notice turns the comment period "into a guessing game" that agency action violates due process rights.

NYC Comment 27: Under CERCLA, EPA cannot delegate the responsibility for remedy selection to DEC.

The remedy described in the Proposed Plan provides that New York will select the precise remedial measures to be implemented for the former MGP sites and other upland source areas as part of the overall remedy for the Canal. *See* Proposed Plan at 19, 25 – 29, 32. CERCLA and the NCP, however, limit a state's role in remedy selection at EPA-lead sites. They both provide that a state may have input in the remedy selection process, but not select the actual remedy. As a consequence, the measures proposed in the Proposed Plan for the MGP sites and other upland source areas place New York in a role that is contrary to CERCLA and the NCP.

CERCLA provides for a state role in remedy selection that does not encompass actual decision-making authority. Section 121(f) sets out the ways in which states can participate in the development and selection of remedial actions. 42 U.S.C. § 9621(f). None of the ways specified in Section 121(f) include selection of a remedy. Rather, CERCLA provides states opportunities to comment, concur, or, in some instances, intervene in actions in which a consent decree has been proposed. *See*, *e.g.*, *id.* § 9621(f)(1)(E), (2)(A)-(B).

Similarly, the NCP provides that "[t]he lead agency, as specified in § 300.515(e), makes the final remedy decision, which shall be documented in the ROD." 40 C.F.R. § 300.430(f)(1)(ii). In the same subparagraph, the NCP specifies that the lead agency must "review the public comments and consult with the state." *Id.* Read together, this language contemplates EPA, as the lead agency for the Canal, selecting a remedy, while the state is limited to a consulting role, not that of the decision-maker.

The NCP further provides that for "all EPA-lead sites, EPA shall prepare the ROD and provide the state with an opportunity to concur with the recommended remedy." *Id.* § 300.515(c)(2)(i). The state's role is to concur, not develop the actual remedy. The very next subparagraph reemphasizes that the state does not make remedial decisions, specifying that "state concurrence on a ROD is not a pre-requisite to EPA's selecting a remedy." *Id.* § 300.515(c)(2)(ii).

The preamble to the NCP states that "EPA retains the responsibility for selecting the remedy." 55 Fed. Reg. 8666, 8730 (Mar. 8, 1990). In the preamble, EPA considered the precise question of whether states could select remedies at NPL sites and answered that they could not. EPA explained "that it is not appropriate at this time to turn over final decision-making authority on remedy selection to states." *Id.* Even in those situations in which a state had already taken action under site remediation authorities, the preamble states that "EPA will not be bound by state action" on the issue of remedy selection. *Id.* In sum, EPA intended that states cannot select remedial measures for EPA-lead sites, like the Canal, under the NCP. That is what the EPA has done for the MGP sites and other upland source areas and that violates CERCLA and the NCP.

NYC Comment 28: EPA and New York State failed to identify New York State's constitutional and statutory protection of parkland as an ARAR.

The Proposed Plan does not identify New York State's public trust doctrine that limits parkland alienation as an ARAR. *See* Gowanus Canal Feasibility Study, Table 2-5 (list of location-specific ARARs). The EPA should explain why EPA and New York State did not identify New York State's restrictions on parkland alienation as an ARAR. Applicable Requirements are defined as "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent." 40 C.F.R. § 300.5 (2013).

In New York, the public trust doctrine restricting parkland alienation provides that dedicated parkland is "impressed with a public trust for the benefit of the people of the State. Their use for other than park purposes, either for a period of years or permanently, requires the direct and specific approval of the State Legislature, plainly conferred." *Friends of Van Cortlandt Park v. City of New York*, 95 N.Y.2d 623, 631-632 (N.Y. 2001) (internal quotation omitted). This common law public trust doctrine is also codified in state statute. General City Law provides that city-owned parklands are "inalienable" and thus require legislative approval to alienate. 1 N.Y. Gen. City Law § 20(2) (2013). EPA and New York State should identify the public trust protections for dedicated municipal parkland an ARAR because they fall within the NCP definition of ARAR as: "substantive requirements . . . or limitations promulgated under . . . state environmental . . . laws that specifically address a . . . location . . . found at a CERCLA site" and are more stringent than federal protections for municipal parkland. *See* 40 C.F.R. § 300.5 (2013). Though the NCP requires State ARARs to be timely, when the location-specific ARARs were developed for the FS, EPA had not yet developed any remedial alternatives that impacted parkland. *See* 40 C.F.R. § 300.5 (requiring State ARARs to be timely identified).

EPA's failure to identify or consider the public trust doctrine in its proposed CSO remedial components renders the analysis of this proposal flawed, incomplete, and likely to result in serious impacts to much needed community recreational facilities in this neighborhood. *See* NYC Comment 13.

NYC Comment 29: The Proposed Plan fails to address the cost and uncertainty related to legally alienating the Douglas and Degraw Pool/Thomas Green Playground in the cost estimates for constructing an in-line tank there and in the evaluation of its feasibility.

EPA should explain why it did not include the cost and uncertainty related to legally alienating the Douglas and Degraw Pool/Thomas Green Playground in the cost estimates for constructing an in-line tank there, and in the evaluation of its feasibility. It should also be noted that the approval of a City ULURP de-mapping action may be required for the construction of an in-line storage tank at the site because both the Douglass & Degraw pool are mapped parkland. This action would also require approval from the New York State legislature.

The City requests that EPA answer the following questions in the Responsiveness Summary:

- How does EPA distinguish the proposed in-line tank from the water treatment facility in ***Friends of Van Cortland Park v. City of New York***, 95 N.Y.2d 623 (N.Y. 2001) given that an in-line tank is a non-park use, construction is estimated to take five to six years, and "some future uses of the land will be inhibited by the presence of the underground structure"? *See id.* at 630, 631.

- What replacement parkland does EPA expect to provide in order to secure State Legislative approval for the temporary alienation of the Douglass & Degraw Pool/Thomas Green Playground during construction and what is the estimated cost of its acquisition?

- What replacement parkland does EPA expect to provide to secure State Legislative approval for the permanent alienation of any permanent above-ground components of the in-line tank and what is the estimated cost of its acquisition?

NYC Comment 30: Information contained in the City's comments requires significant changes to the Proposed Plan, and therefore EPA must issue a revised Proposed Plan, seek additional public comment on the revised Proposed Plan, and submit the revised Proposed Plan to the NRRB.

The NCP directs EPA to issue a revised proposed plan and seek additional public comment in the following circumstances:

> (ii) After publication of the proposed plan and prior to adoption of the selected remedy in the record of decision, if new information is made available that significantly changes the basic features of the remedy with respect to scope performance, or cost, such that the remedy significantly differs from the original proposal in the proposed plan and the supporting analysis and information, the lead agency shall: . . .
>
> (B) Seek additional public comment on a revised proposed plan, when the lead agency determines the change could not have been reasonably anticipated based on the information available in the proposed plan or the supporting analysis and information in the administrative record.

> 40 C.F.R. § 300.430(f)(3)(ii).

As the City's comments demonstrate, the scope, performance and cost of the remedies identified in the Proposed Plan should change significantly. In particular, there must be significant changes to: (1) the scope and cost of the remedies for the MGP sites and upland sites (which EPA says are required for the remedy, but does not identify or evaluate specifically in the Proposed Plan); (2) the scope and cost of interim CSO controls (again, which EPA says may be required, but does not identify or evaluate specifically in the Proposed Plan); and (3) the scope, performance and costs of the CSO remedies (where EPA identified only a presumptive remedy (in-line tanks), but underestimated the capital costs of that remedy by five-fold, failed to include O&M costs for that remedy, and acknowledged that even the performance standards for that remedy, consisting of a range of 58%-74% reduction in CSO solids, may change.)

In addition, the scope of the changes in the Proposed Plan could not reasonably be anticipated pursuant to 40 C.F.R. § 300.430(f)(3)(ii)(B). As the City's comments show, there has been no detailed evaluation of any of these future remedy components. In sum, it is impossible for the public to reasonably anticipate the scope, performance and cost of a remedy component that EPA acknowledges explicitly will be determined in the future. Therefore, the NCP requires EPA to revise its Proposed Plan to include these remedy elements and allow for public comment.

Moreover, the revised Proposed Plan must be submitted to the NRRB. The NRRB review criteria state as follows:

> Board reviews will also occur for NPL sites following changes made after the release of the Proposed Plan where: A different or modified alternative (which was included in the original Proposed Plan) is selected by the region that costs more than 20 percent when compared to the original proposal and these costs trigger review criteria (even when the earlier proposed action had undergone Board review).
>
> (http://www.epa.gov/superfund/programs/nrrb/reviewcr.htm)

Therefore, NRRB review is required where the different or modified alternative will increase costs more than 20%, and that 20% increase amounts to more than $25 million (which is the dollar threshold for triggering review). The City's comments demonstrate that different or modified alternatives for source control will increase costs by more than 20% (it is a five-fold increase) and $25 million. Thus, a second NRRB review is required.

Implementation

NYC Comment 31: The City supports EPA's decision in the Proposed Plan to wait for implementation of any additional permanent CSO controls until after currently planned infrastructure upgrades for the mid and lower reaches of the Canal are completed.

NYC Comment 32: The City supports EPA's decision in the Proposed Plan to evaluate any additional permanent CSO controls as part of the LTCP process.

The Proposed Plan states:

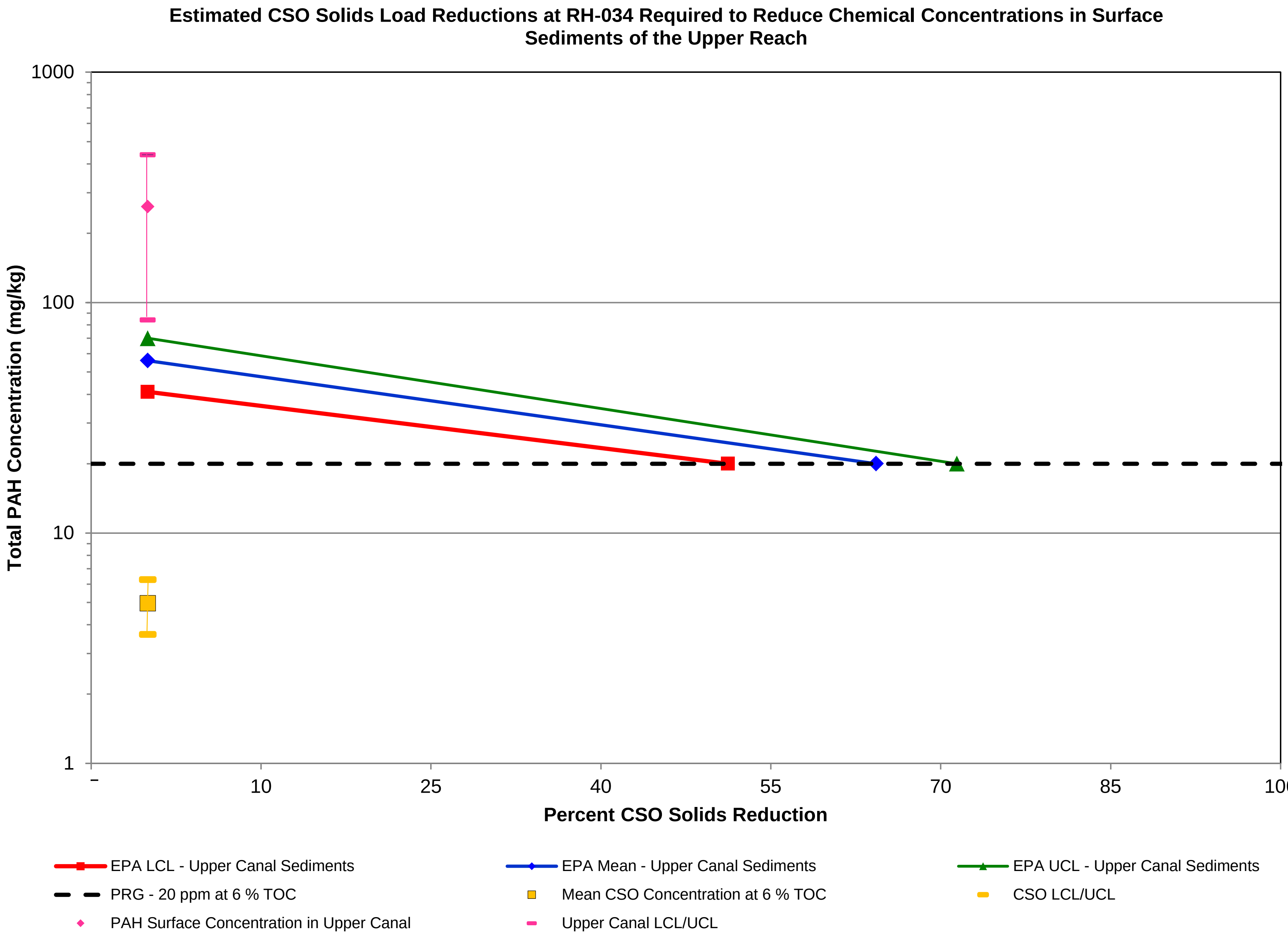
> "EPA is committed to achieving cost savings by working closely with NYCDEP to accomplish an effective Superfund cleanup while also realizing CSO benefits through synergies and economies of scale. NYCDEP will complete full assessment of achieving CWA goals with submission of the LTCP in June 2015 pursuant to the CSO Consent Order." Proposed Plan, at 33.

The City supports evaluation of additional CSO controls, to the extent such controls are necessary to address CERCLA risks and are supported by sound science, as part of the LTCP process.

NYC Comment 33: The Proposed Plan does not require any additional permanent CSO controls to be implemented prior to commencement of the preferred remedial alternative for in-Canal sediments. The City supports this approach.

While the City takes issue with EPA's assessment and recommendation regarding permanent CSO controls related to Superfund, the City does support EPA's determination that any additional permanent controls should take place following the implementation of the in-Canal remedy. This determination is more consistent with CSTAG's recommendations concerning the timing of response actions, and it will also allow EPA to focus on the extensive, uncontrolled NAPL contamination currently impacting the Canal.

Figures



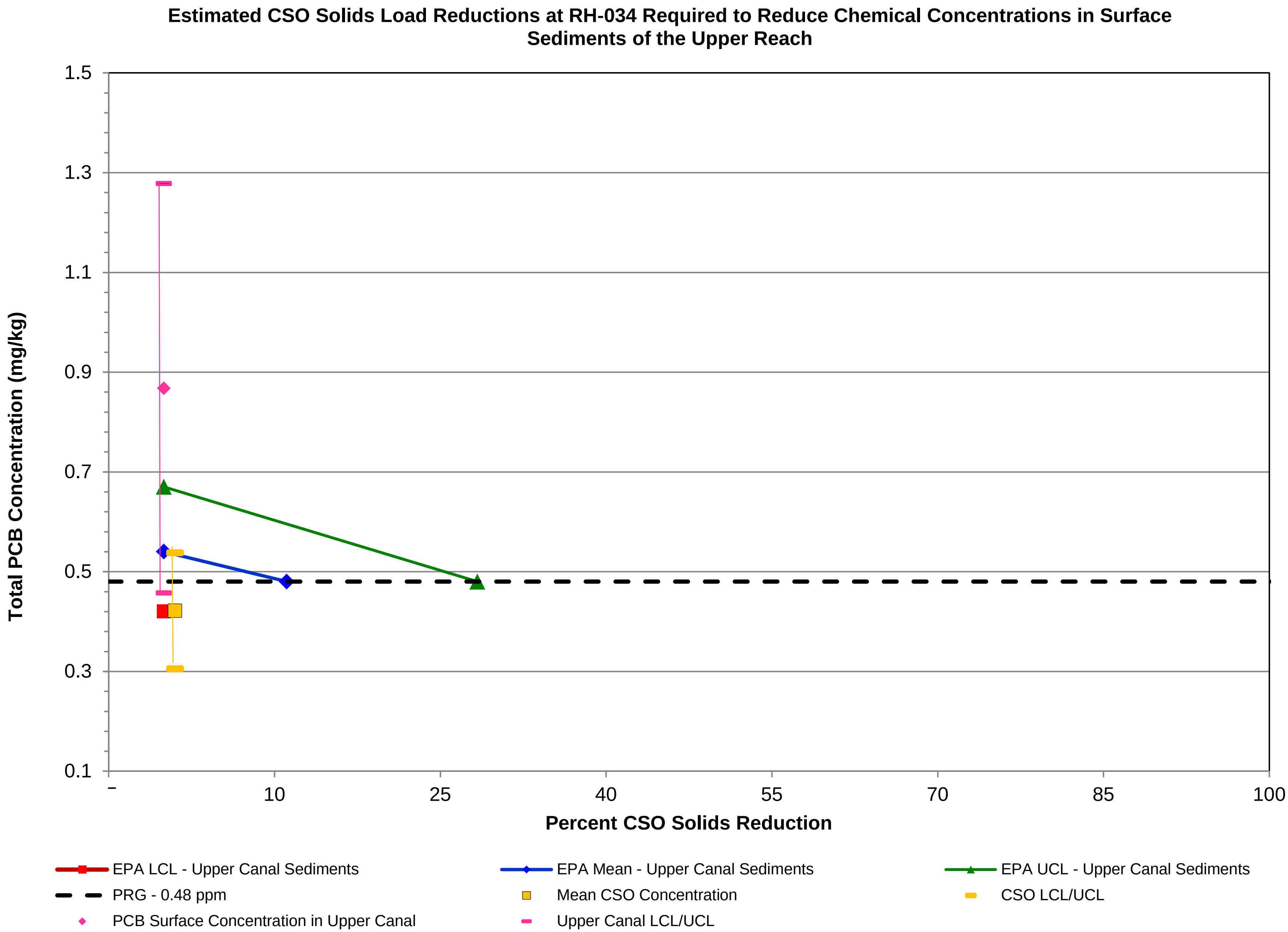
NYC Environmental Protection

Percent Reduction Diagram for TPAH From EPA Addendum to Proposed Plan

Gowanus Canal Superfund Site

Figure 1-1

April 2013



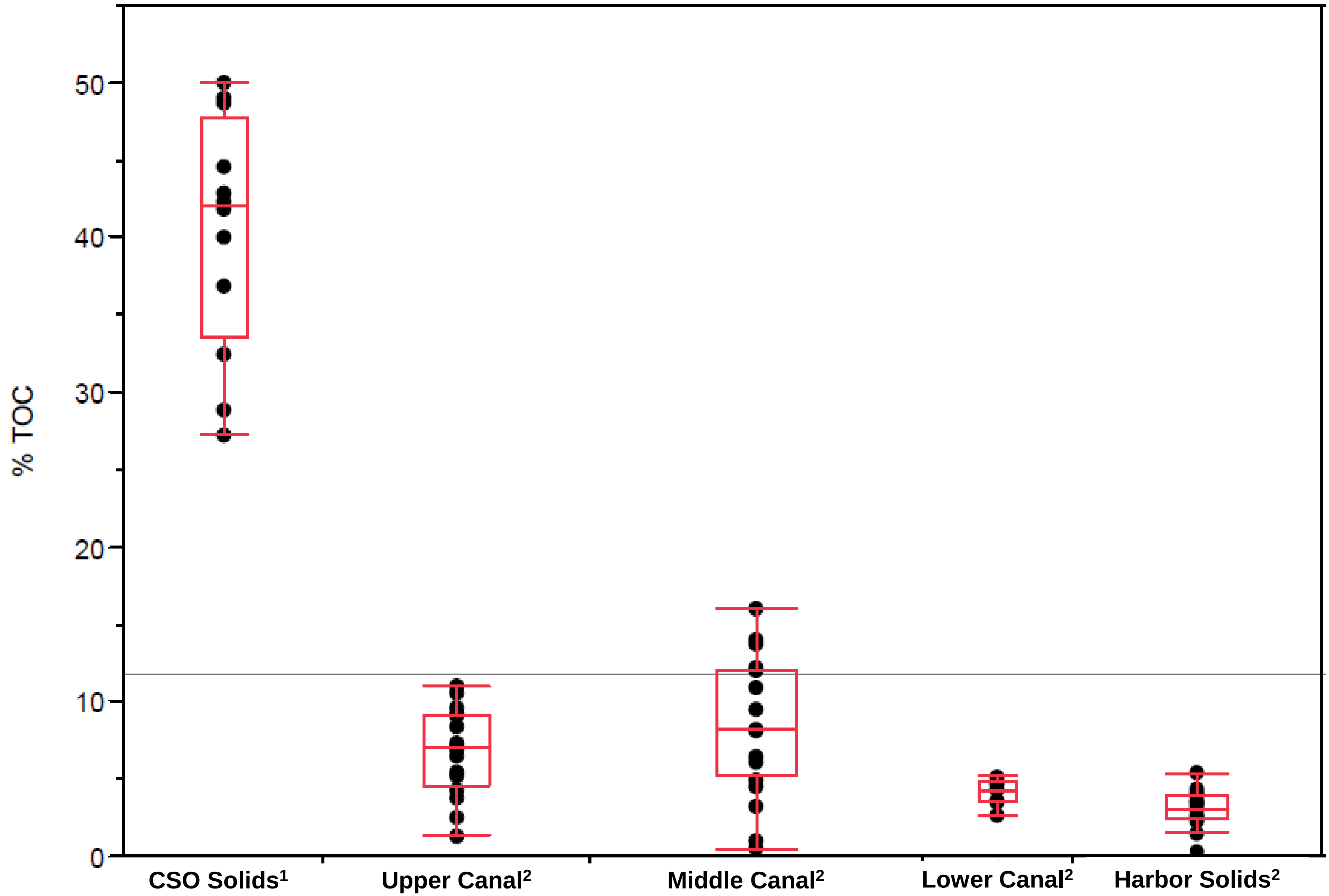
NYC Environmental Protection

Percent Reduction Diagram for TPCB From EPA Addendum to Proposed Plan

Gowanus Canal Superfund Site

Figure 1-2

April 2013



Notes:

1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.

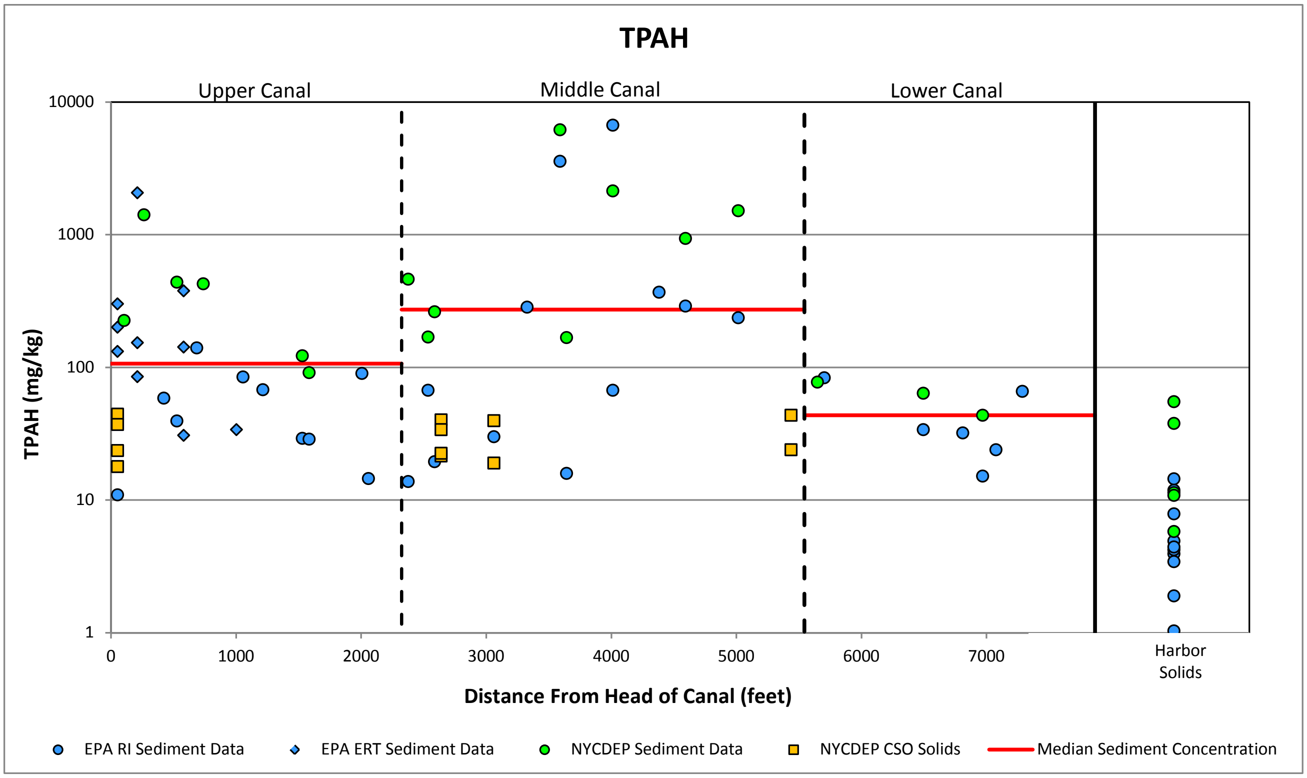
Environmental Protection

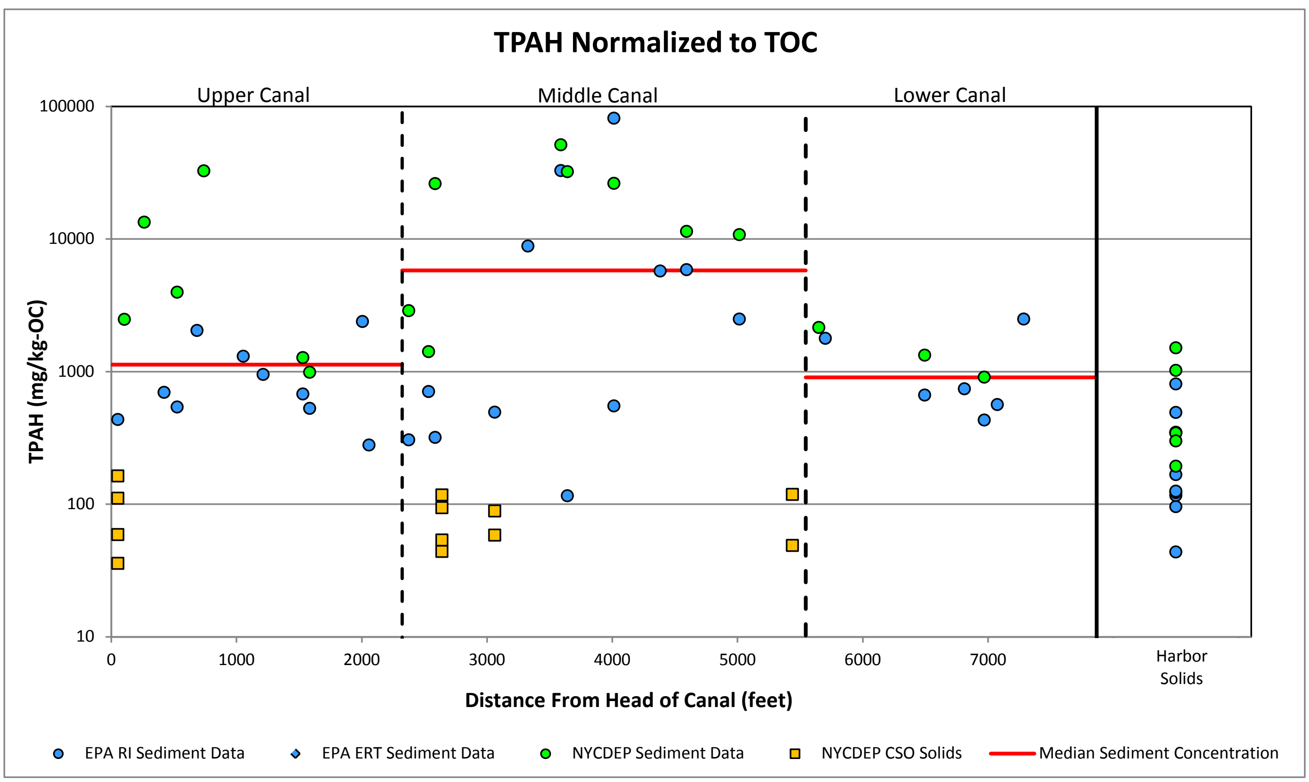
TOC Concentrations in CSOs and Surface Sediments

Gowanus Canal Superfund Site

Figure 2-1

April 2013





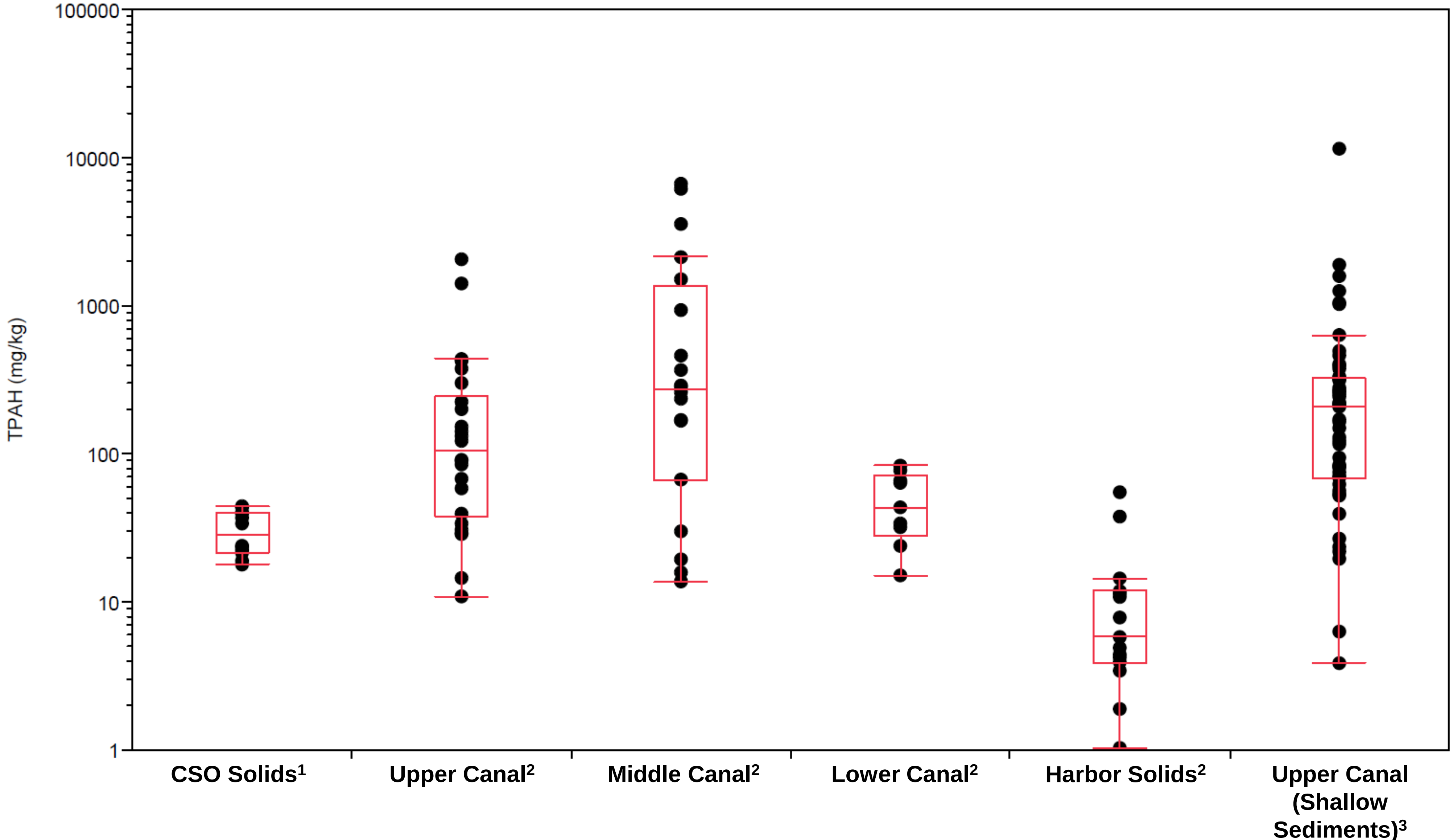
NYC Environmental Protection

Comparison of TPAH Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-2a

April 2013



Notes:

1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
3. Canal Shallow Sediment data are from depths within the 0 to 2 feet horizon (excludes 0-0.5 feet data from Note 1). EPA, ERT, and NYCDEP data.

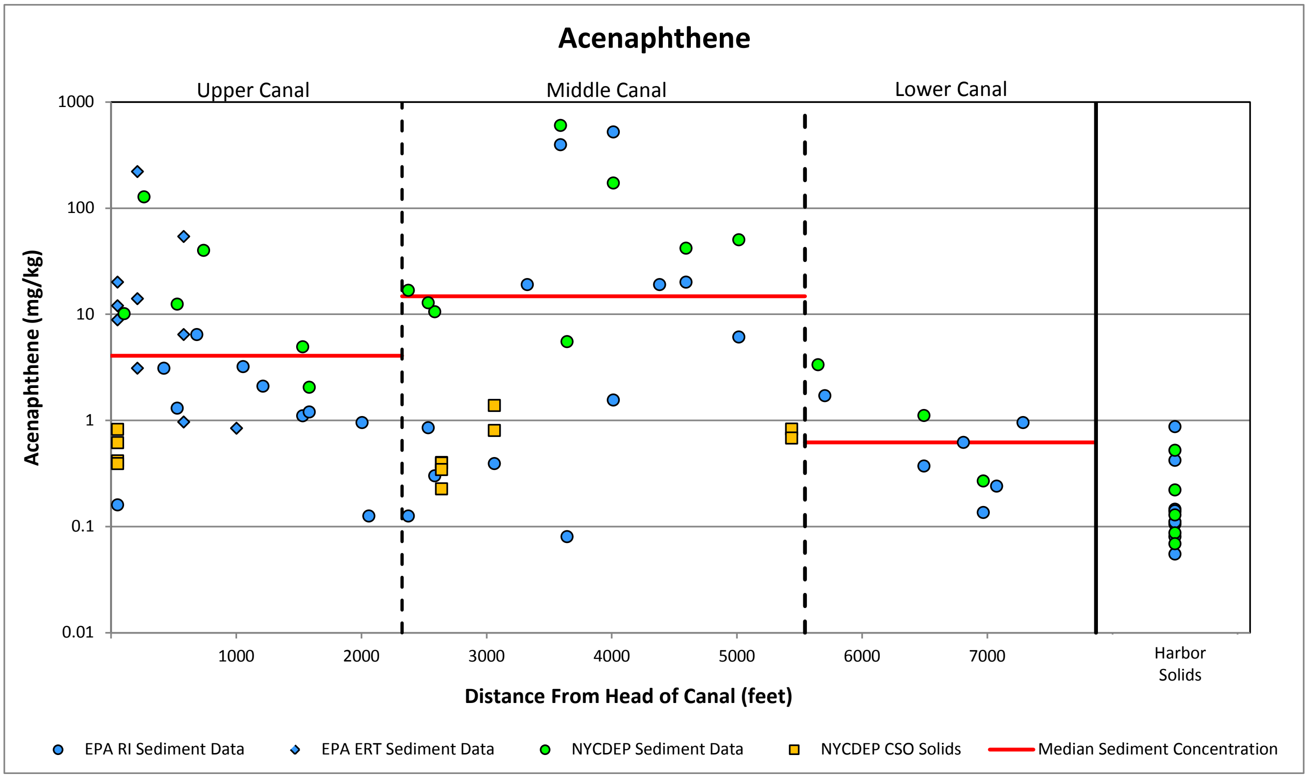
NYC Environmental Protection

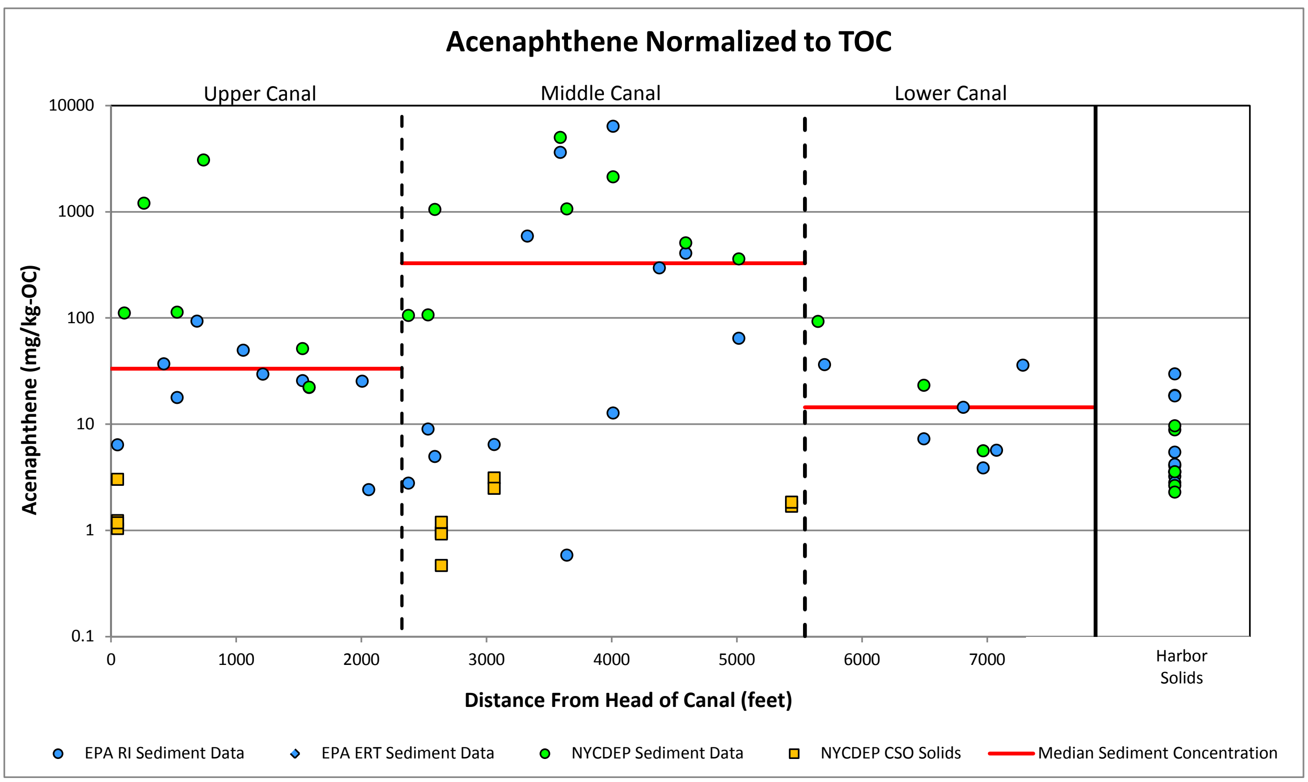
Total PAH Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

Figure 2-2b

April 2013





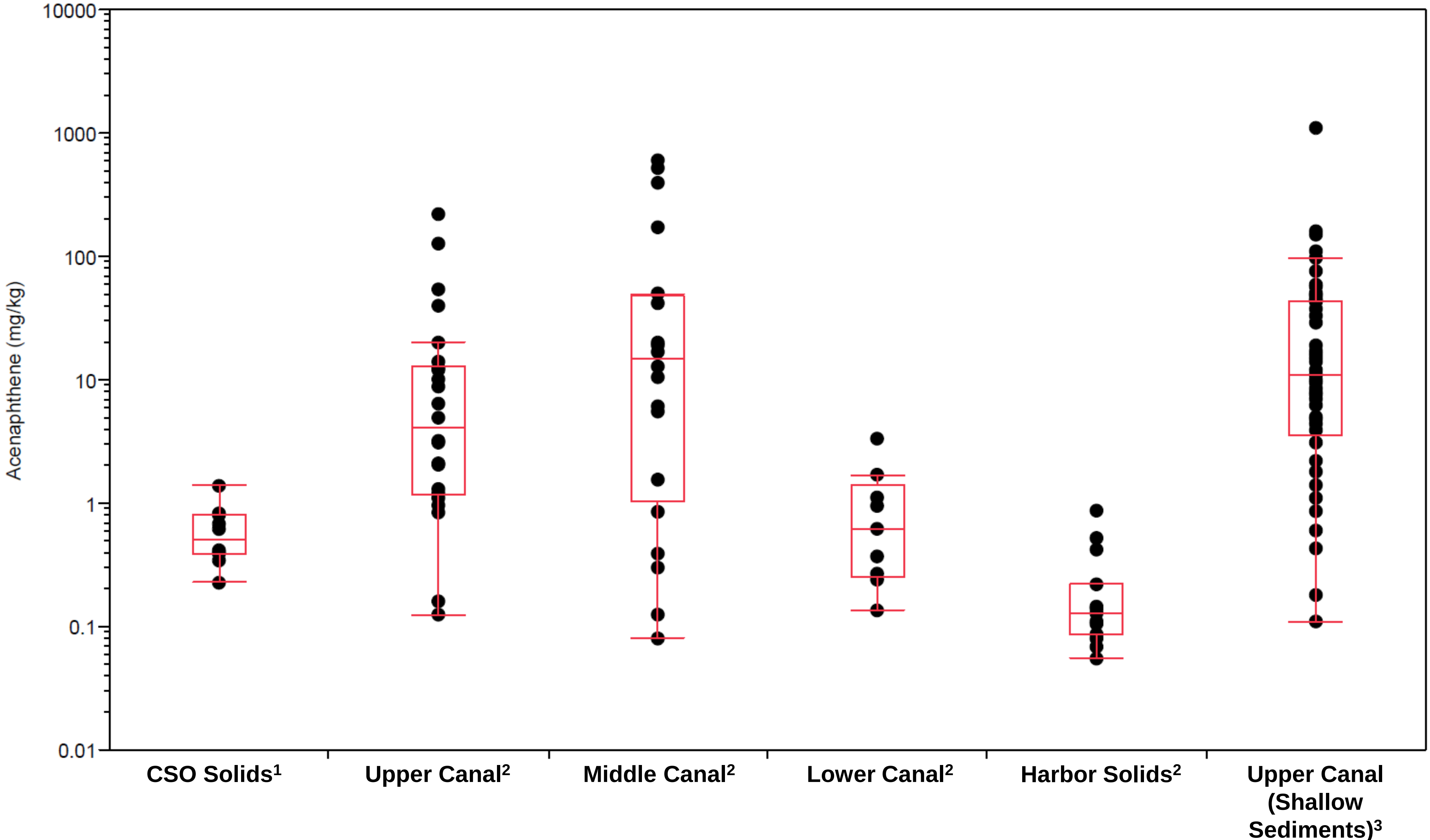
NYC Environmental Protection

Comparison of Acenaphthene Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-3a

April 2013



Notes:
1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
3. Canal Shallow Sediment data are from depths within the 0 to 2 feet horizon (excludes 0-0.5 feet data from Note 1). EPA, ERT, and NYCDEP data.

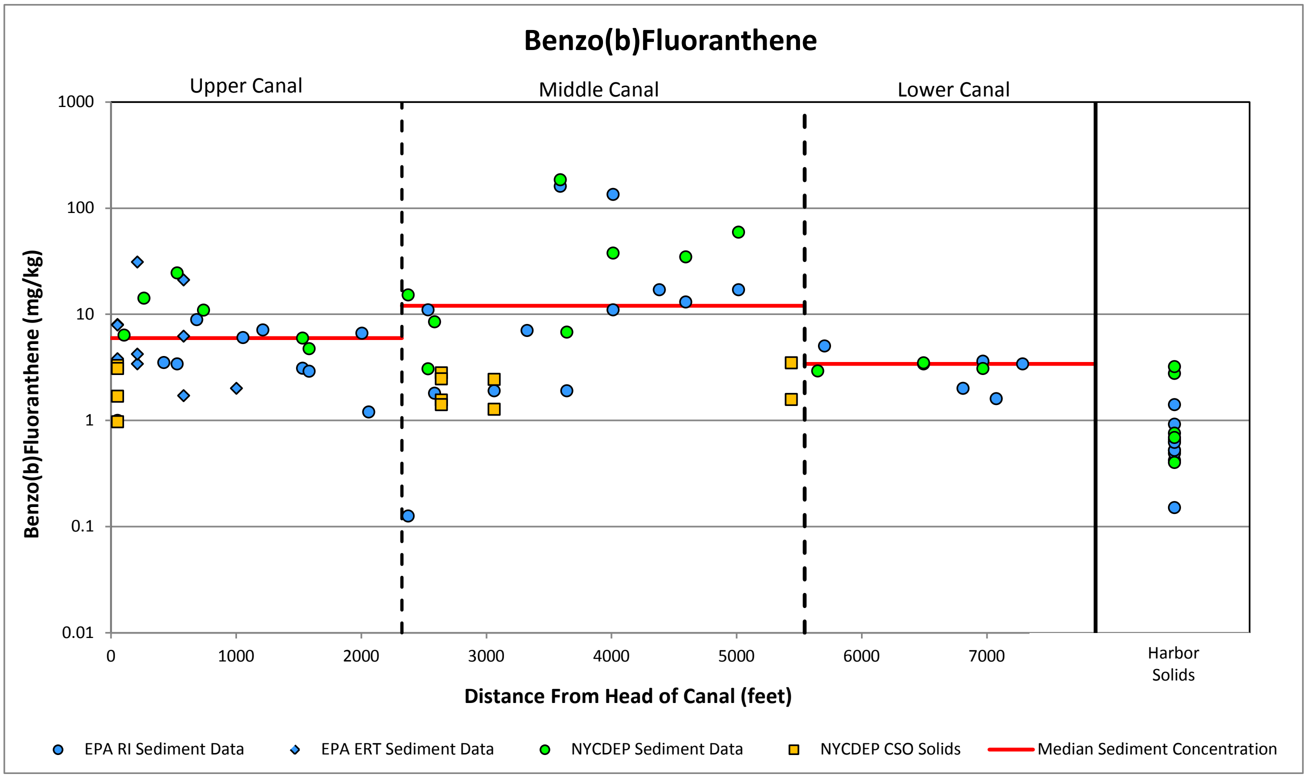
NYC Environmental Protection

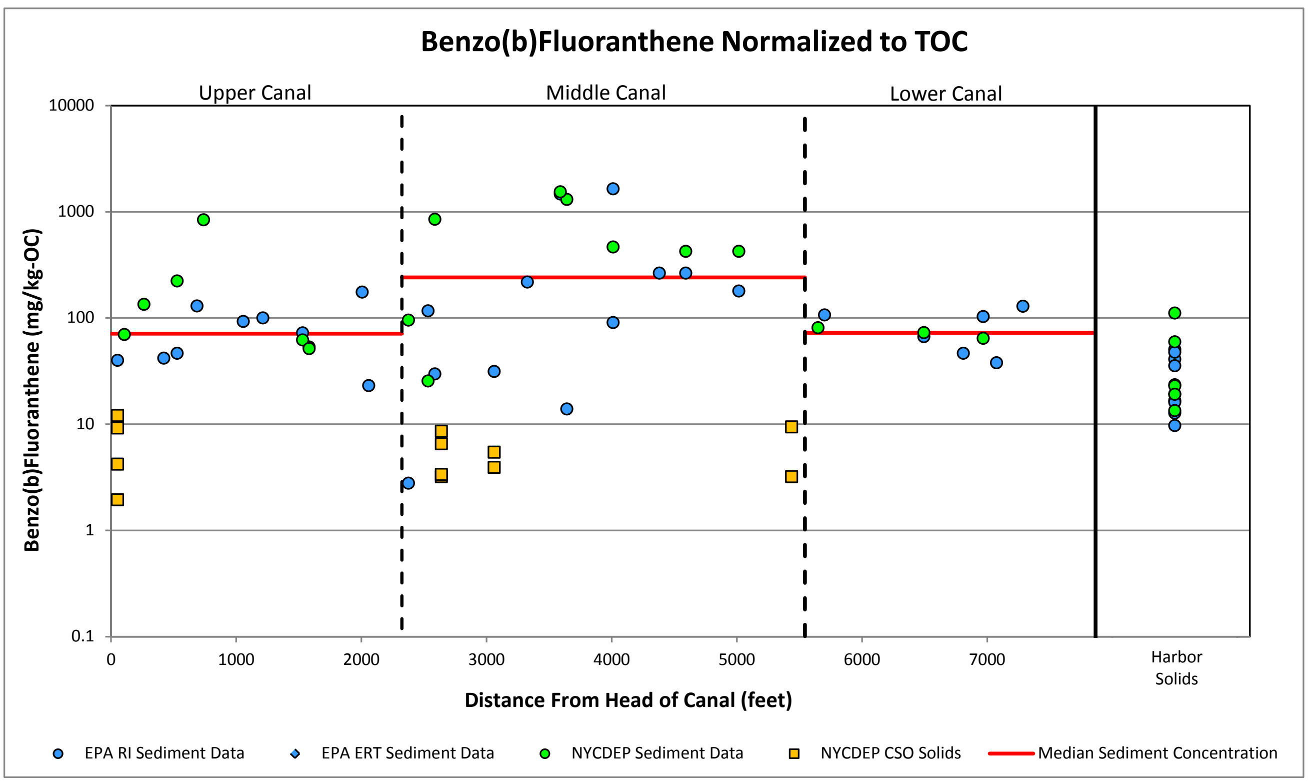
Acenaphthene Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

Figure 2-3b

April 2013





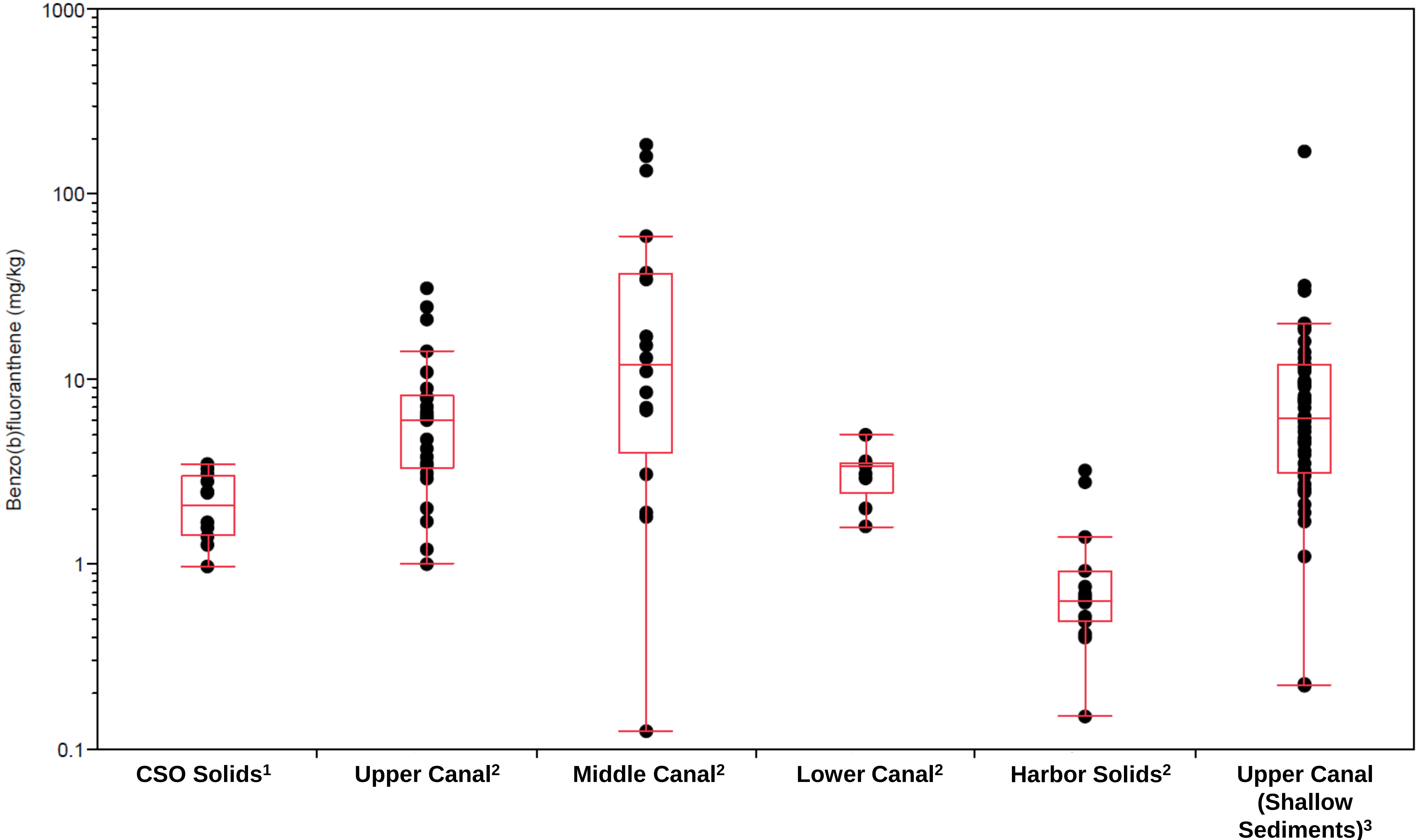
Environmental Protection

Comparison of Benzo(b)Fluoranthene Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-4a

April 2013



Notes:
1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
3. Canal Shallow Sediment data are from depths within the 0 to 2 feet horizon (excludes 0-0.5 feet data from Note 1). EPA, ERT, and NYCDEP data.

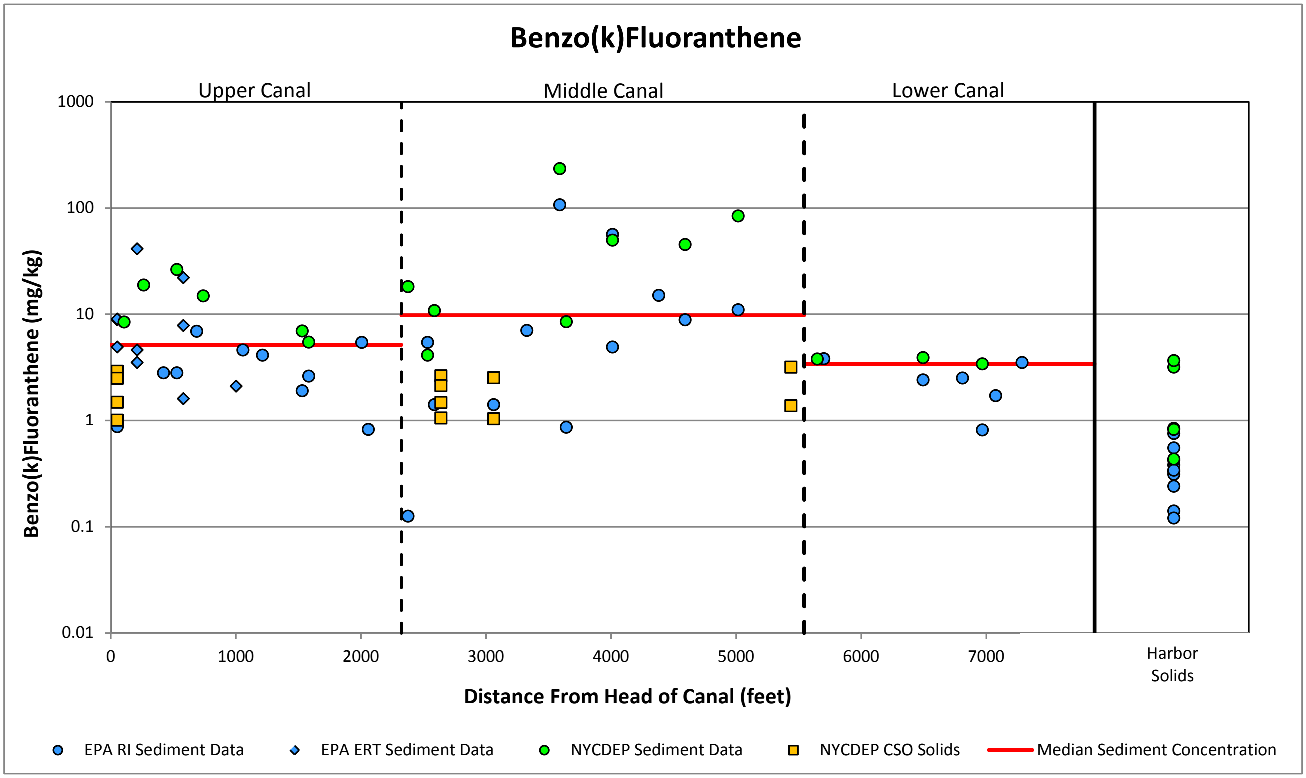
Environmental Protection

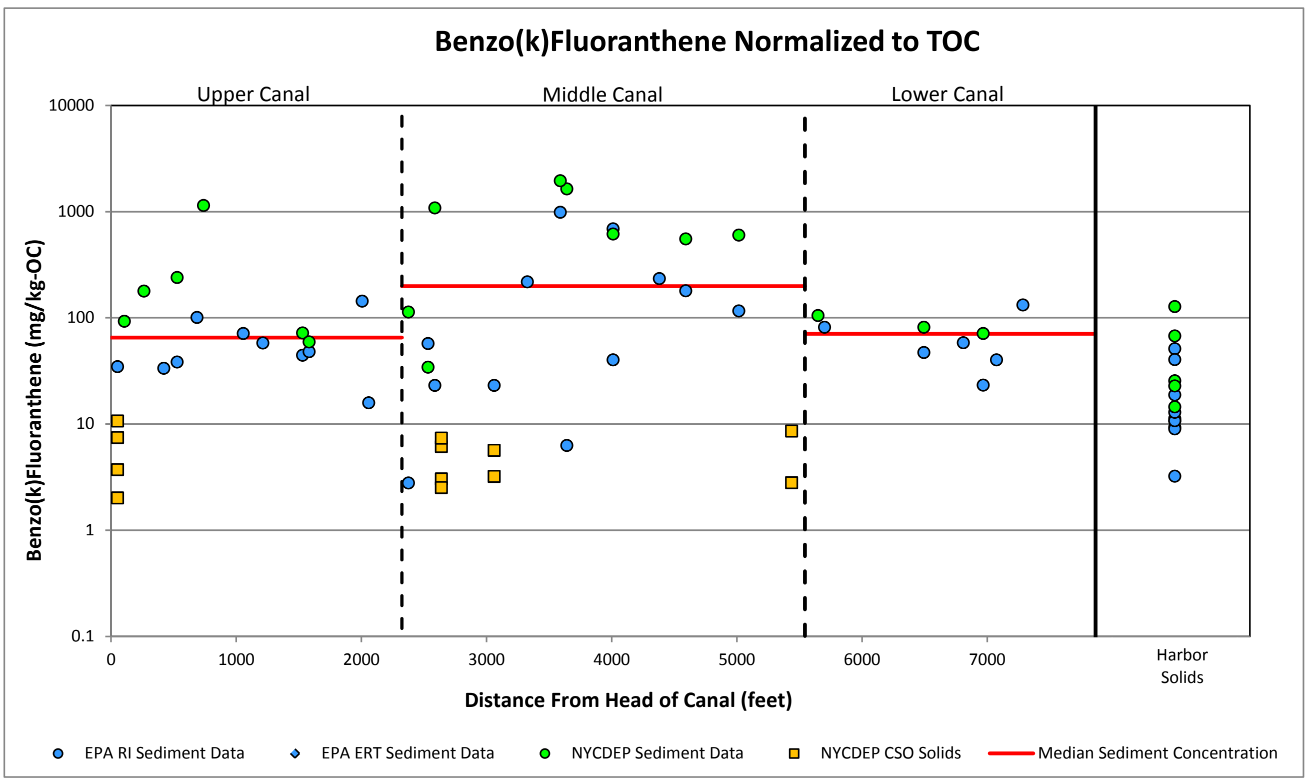
Benzo(b)fluoranthene Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

Figure 2-4b

April 2013





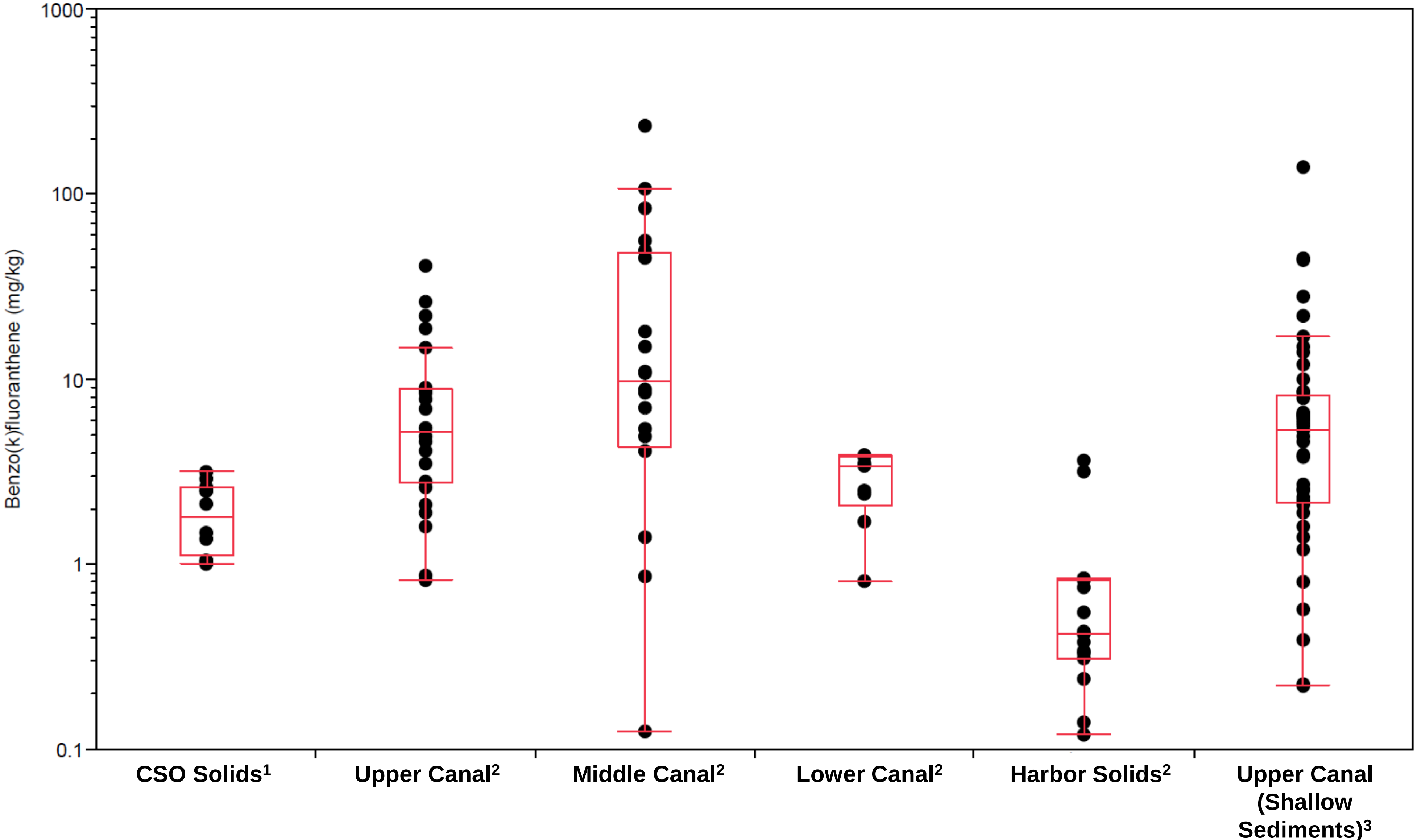
Environmental Protection

Comparison of Benzo(k)Fluoranthene Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-5a

April 2013



Notes:
1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
3. Canal Shallow Sediment data are from depths within the 0 to 2 feet horizon (excludes 0-0.5 feet data from Note 1). EPA, ERT, and NYCDEP data.

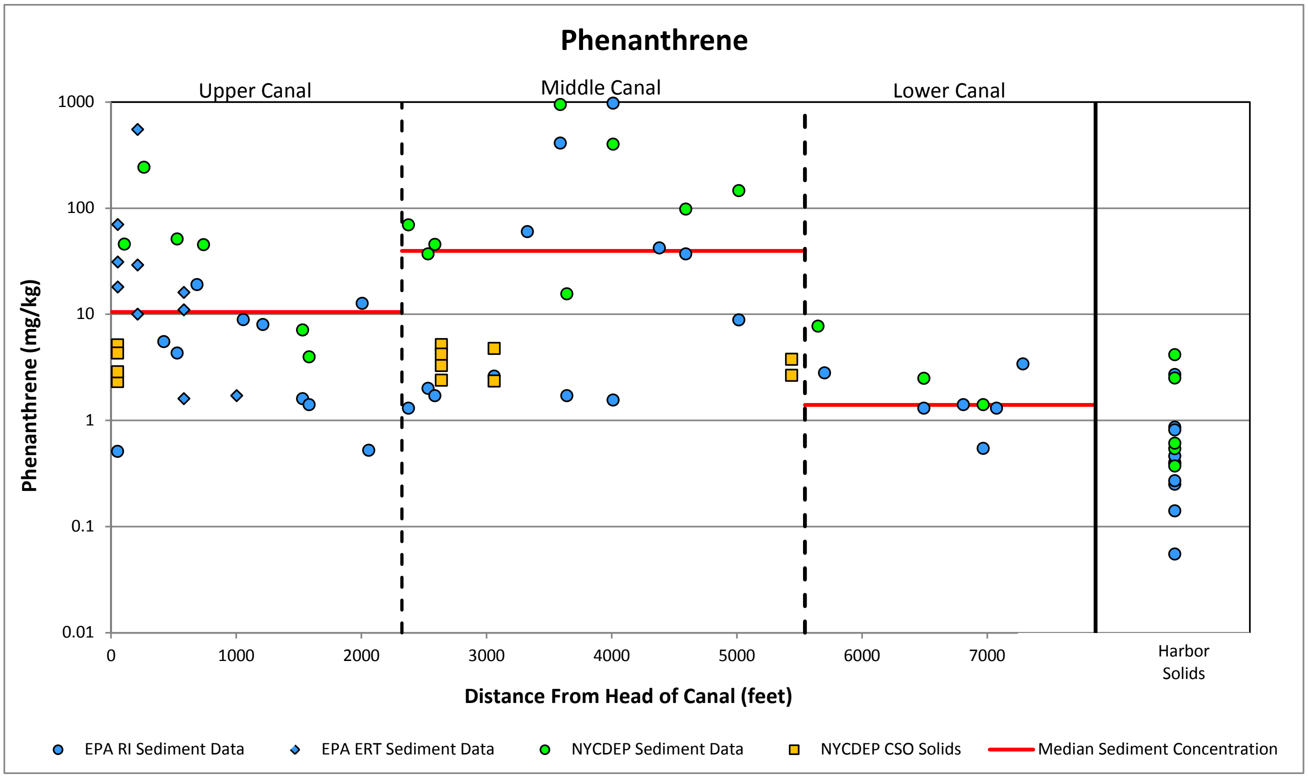
NYC Environmental Protection

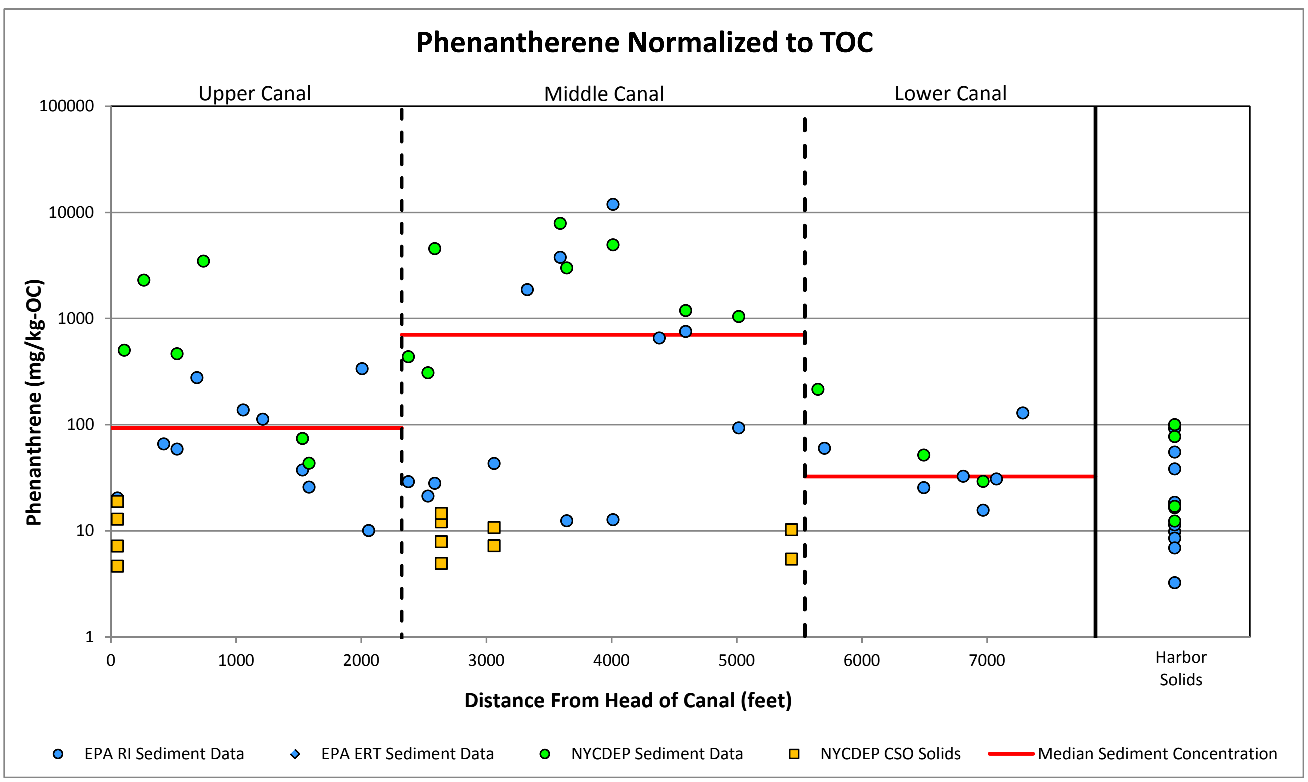
Benzo(k)fluoranthene Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

Figure 2-5b

April 2013





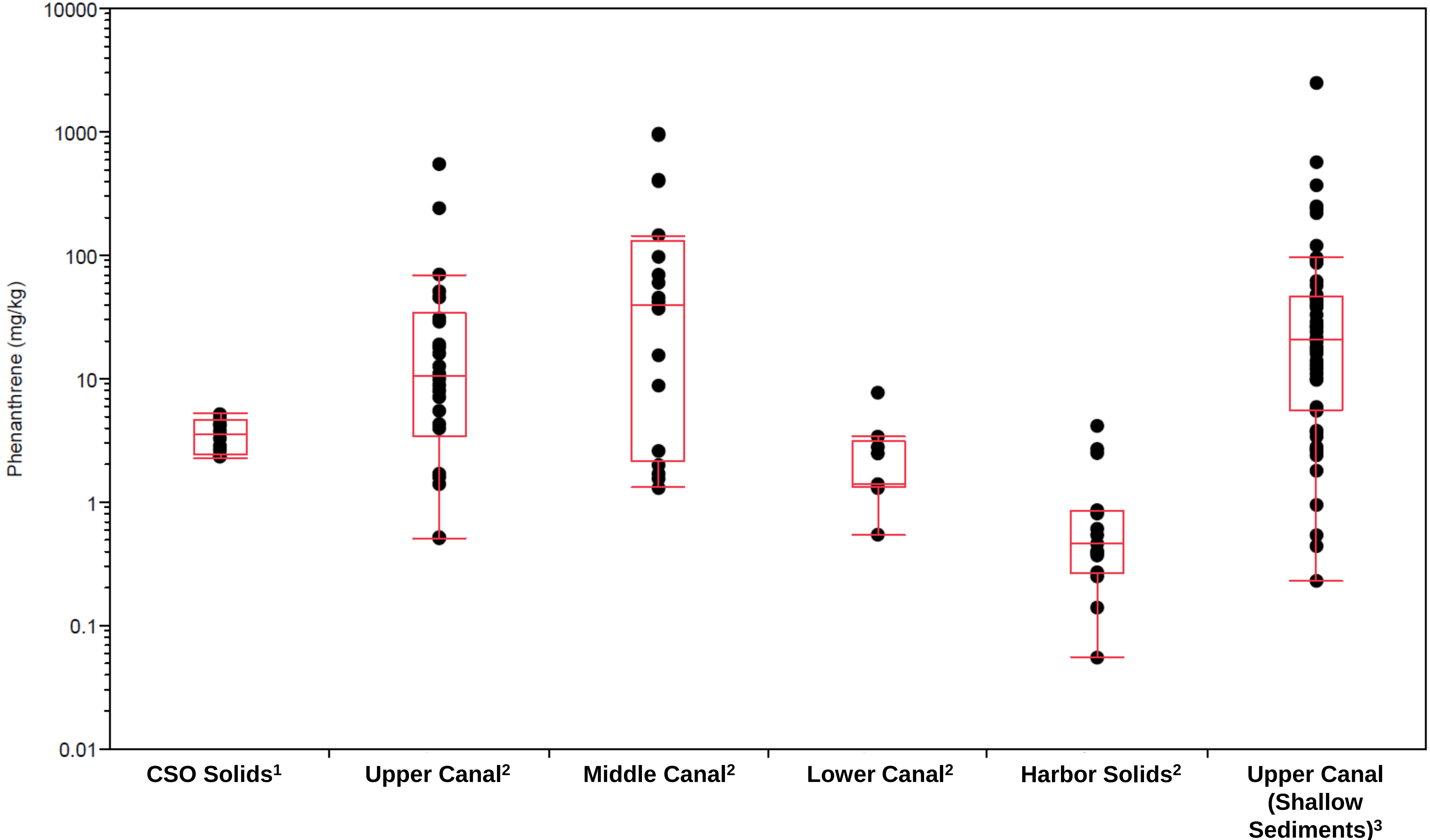
Environmental Protection

Comparison of Penanthrene Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-6a

April 2013



Notes:
1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
3. Canal Shallow Sediment data are from depths within the 0 to 2 feet horizon (excludes 0-0.5 feet data from Note 1). EPA, ERT, and NYCDEP data.

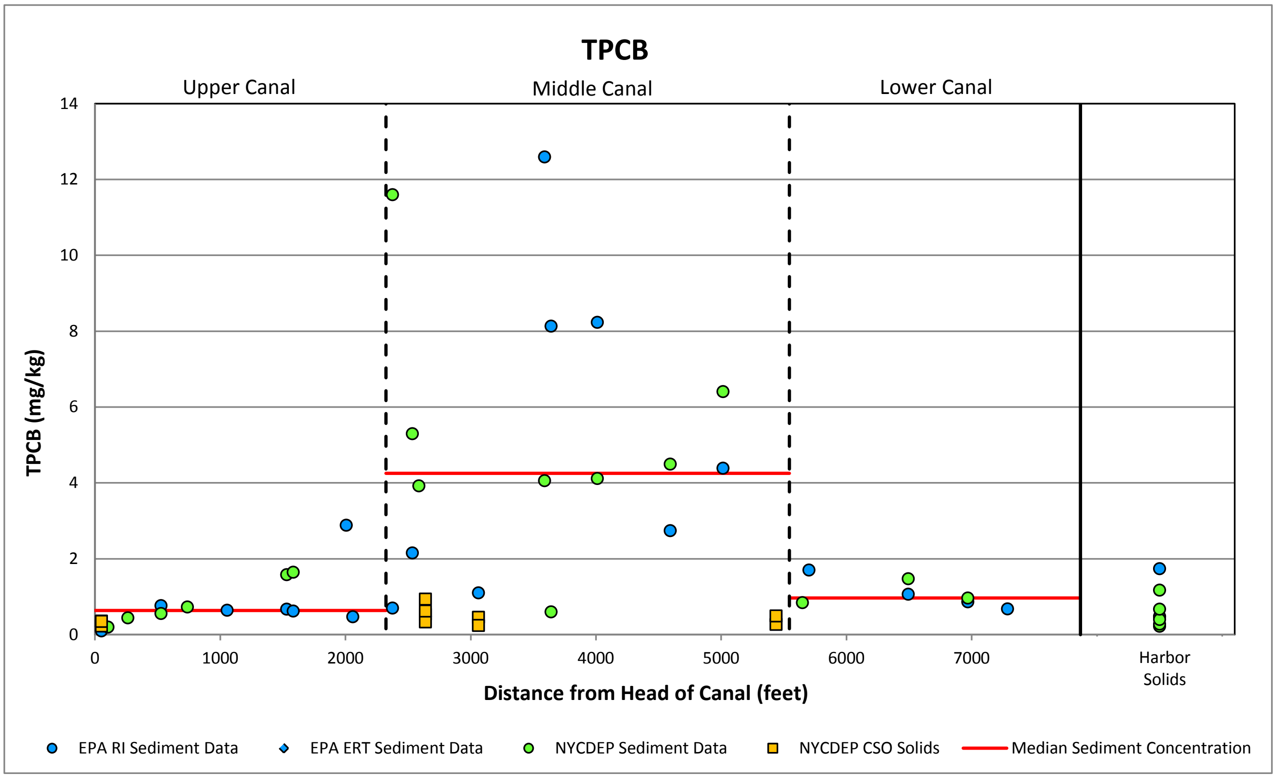
NYC Environmental Protection

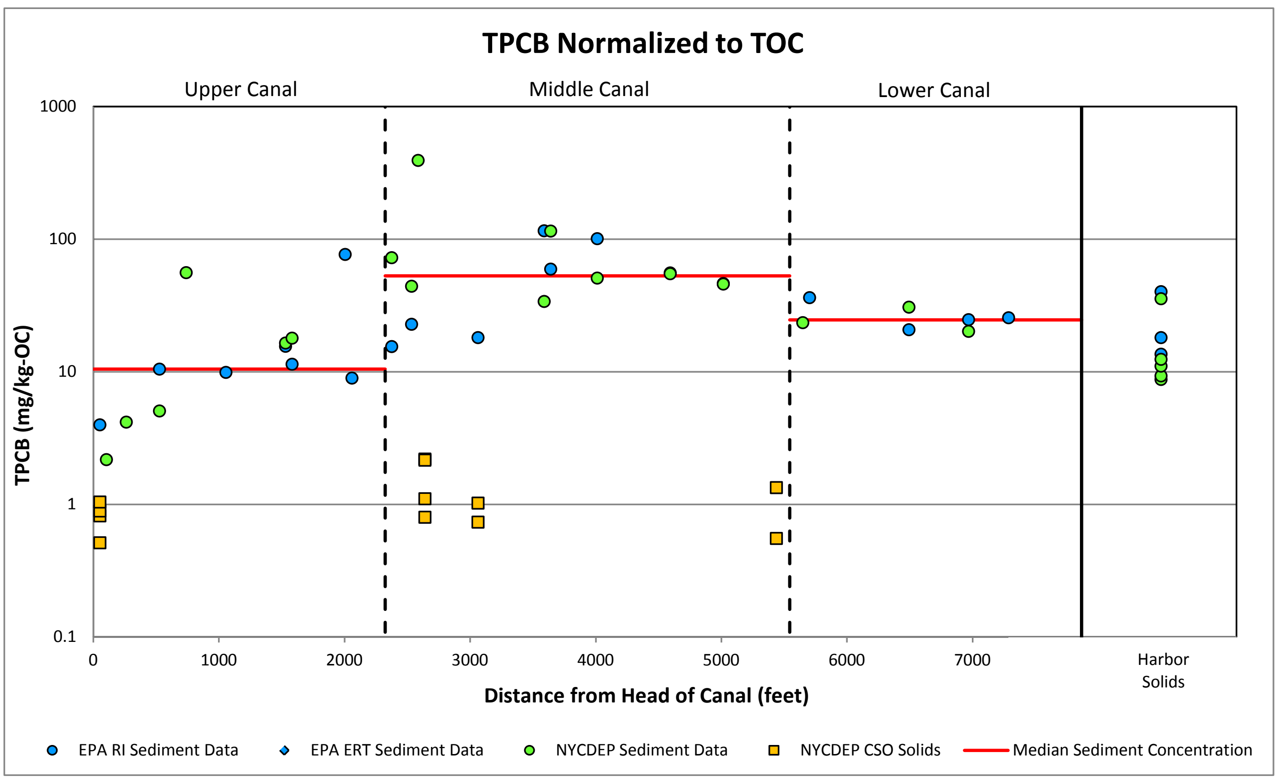
Phenanthrene Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

Figure 2-6b

April 2013





Note: TPCB concentrations were calculated as the sum of all PCB congeners.

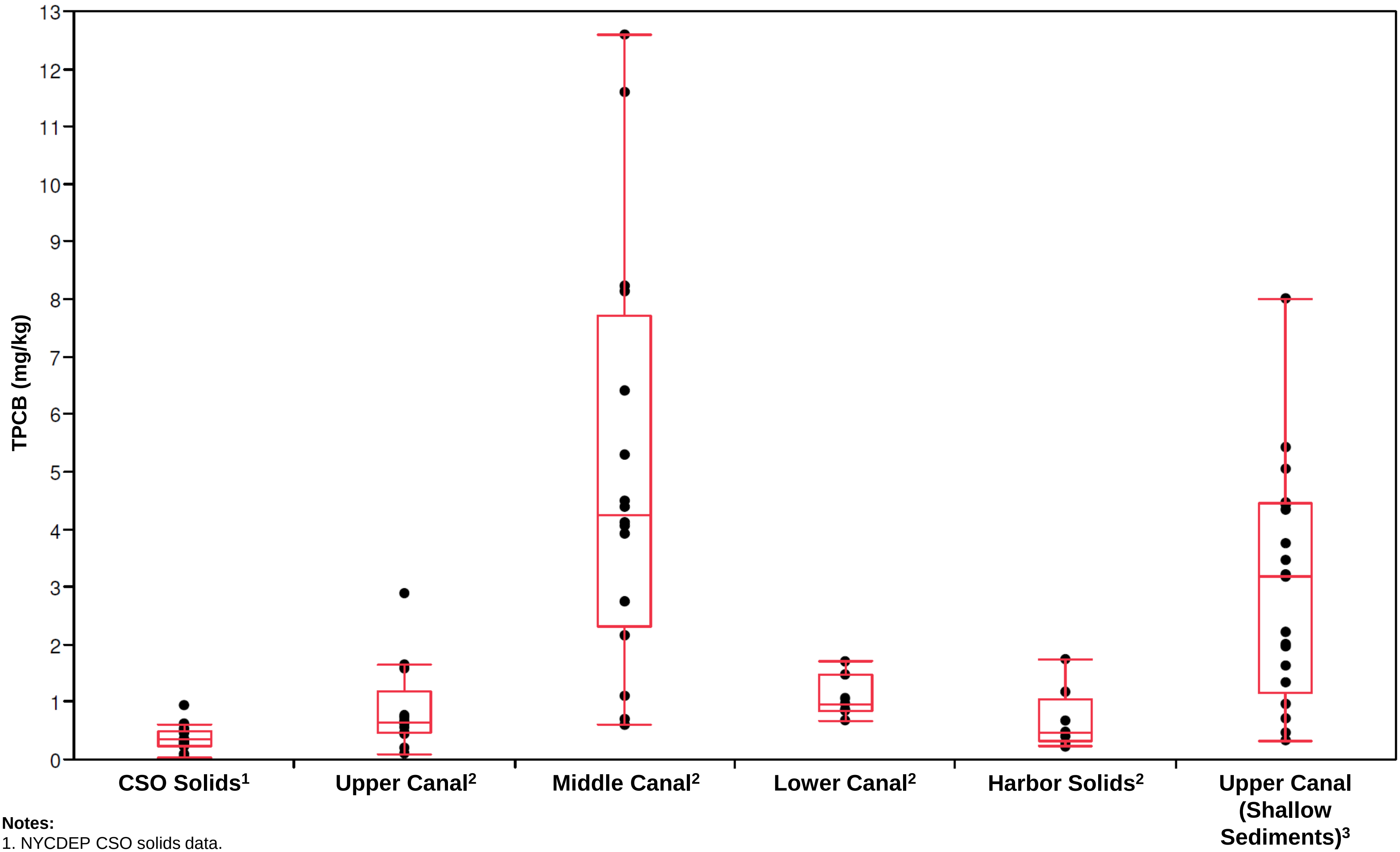
Environmental Protection

Comparison of TPCB Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-7a

April 2013



Notes:
1. NYCDEP CSO solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. TPCB concentrations are the sum of PCB congeners. EPA and NYCDEP data.
3. Canal Shallow Sediment data are from depths of 0 to 2 feet. TPCB congener concentrations were calculated using paired PCB aroclors from EPA data set. TPCB congener data was approximately four times higher than TPCB aroclor data. EPA and NYCDEP data.

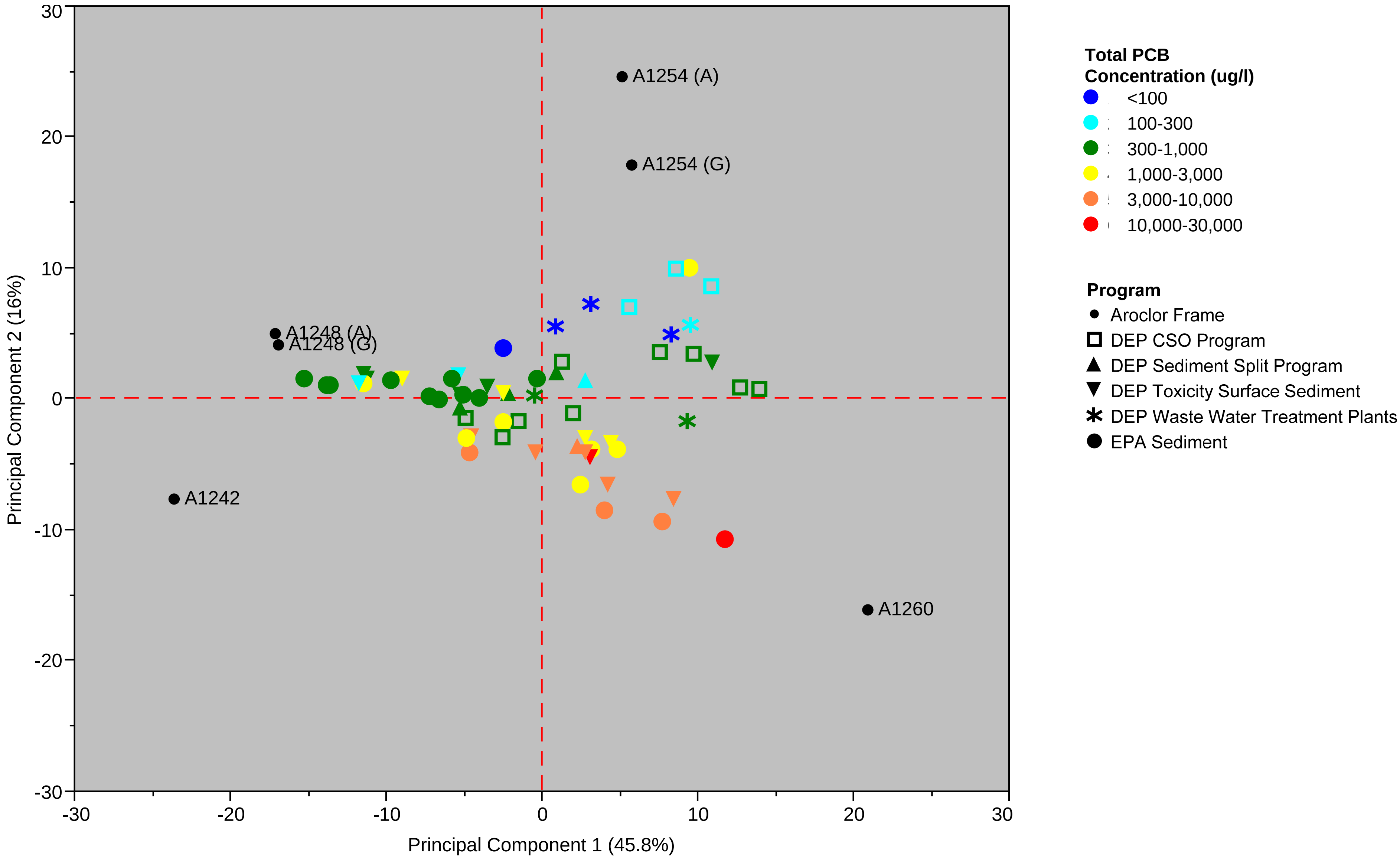
NYC Environmental Protection

Total PCB Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

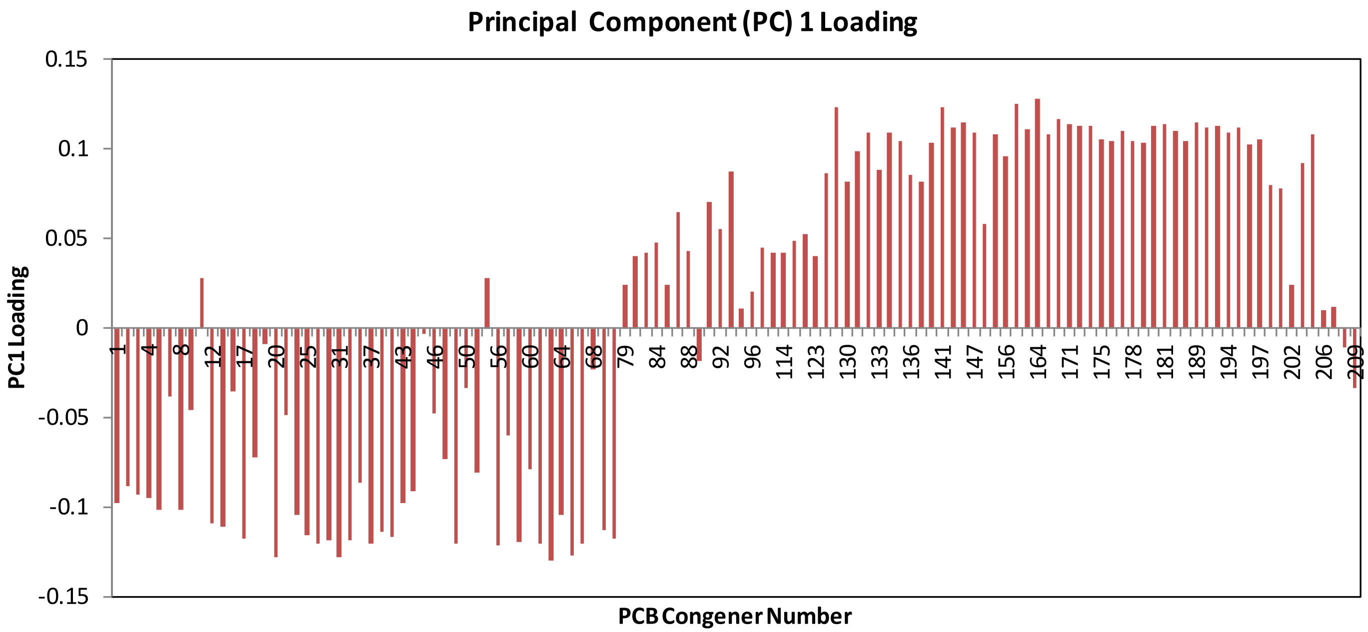
Figure 2-7b

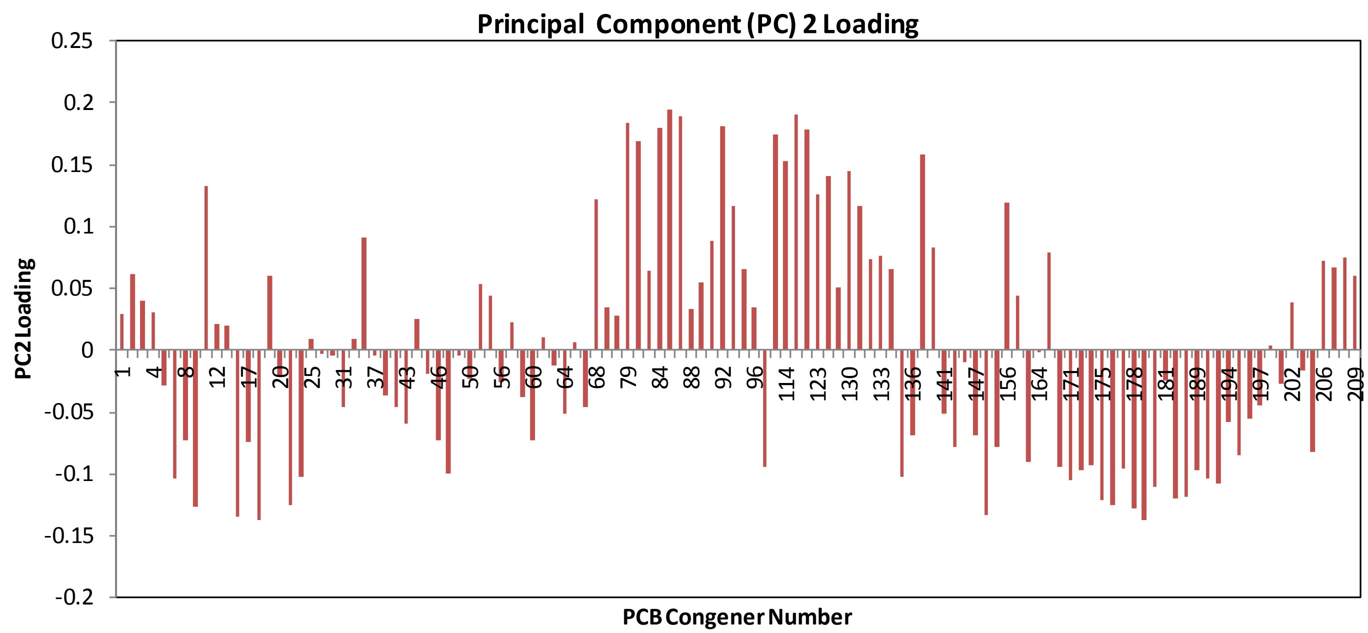
April 2013



Notes:
(A) and (G) indicate aroclor lot number. Lot A is from AccuStandard (New Haven, CT, USA). Lot G is from Monsanto Corp., St. Louis, MO, USA

NYC Environmental Protection	Principal Component Analysis of PCB Concentrations in CSOs and Surface Sediments *Gowanus Canal Superfund Site*	Figure 2-8a April 2013



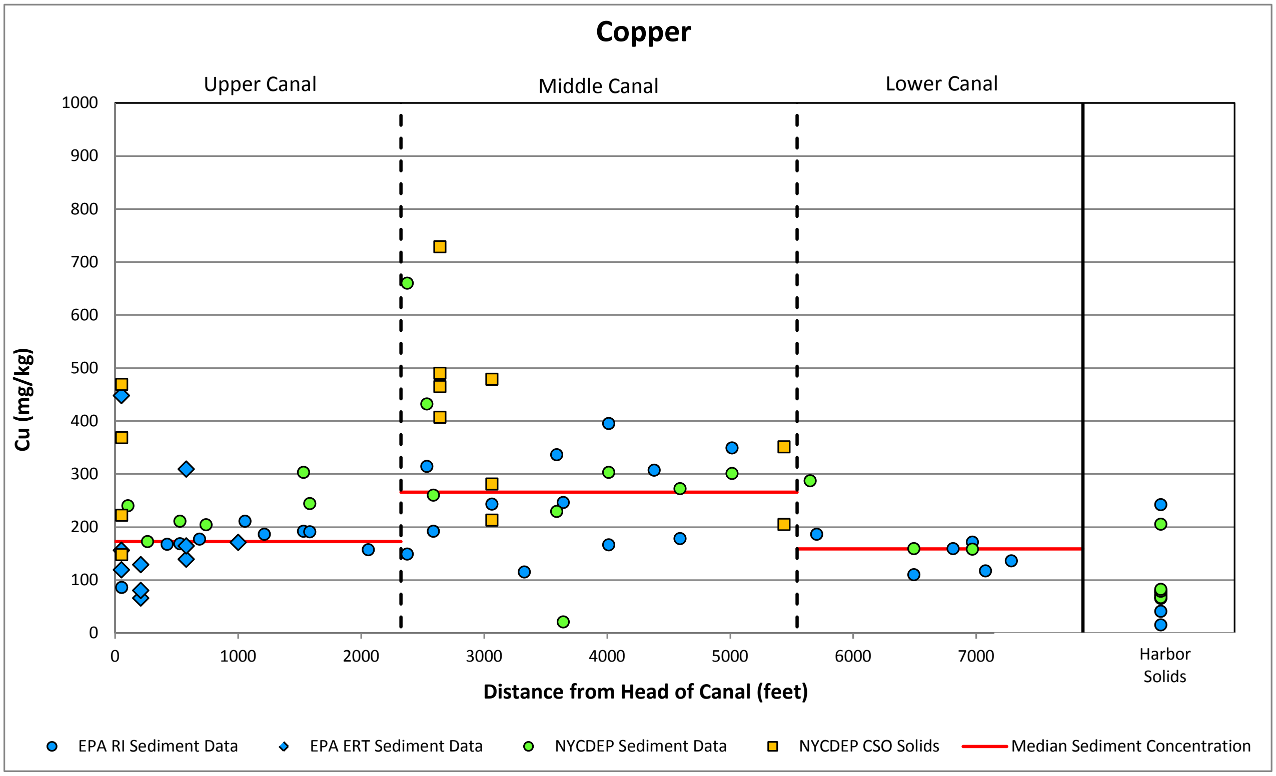


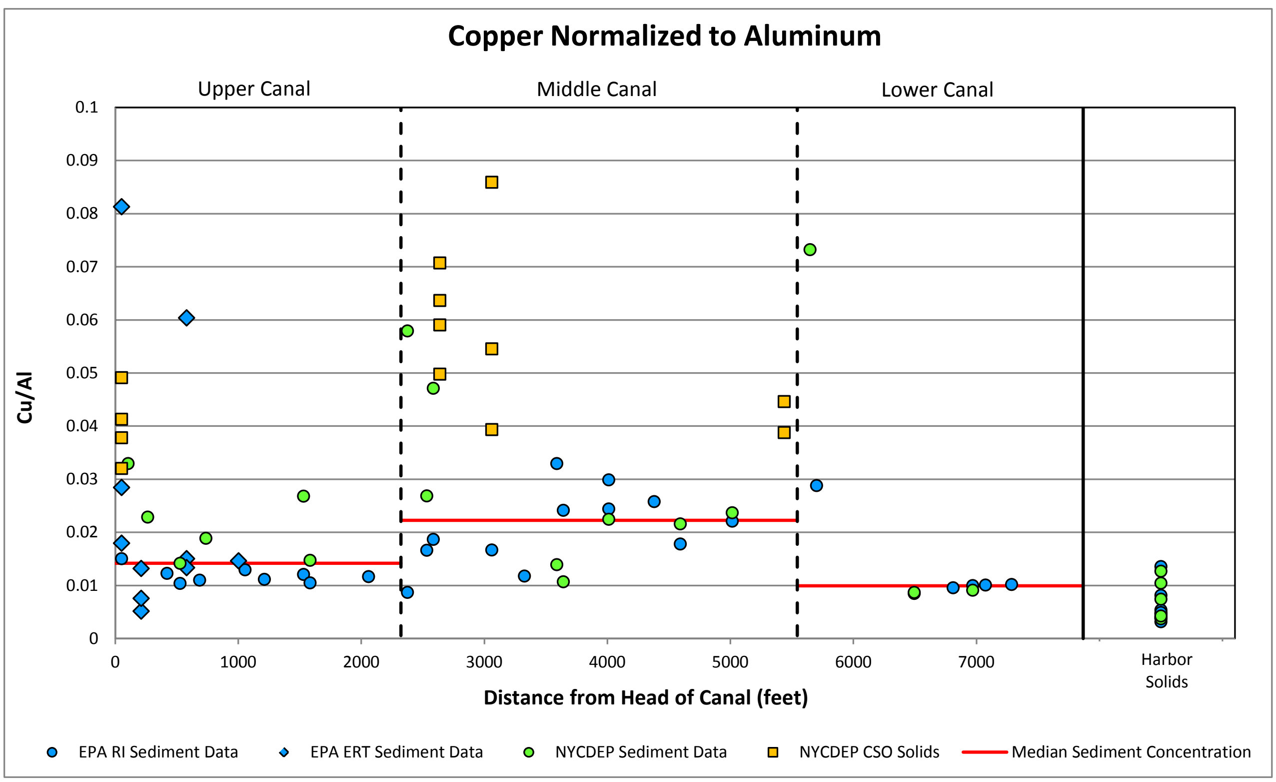
Environmental Protection

Principal Component Analysis
PCB Congeners
Gowanus Canal Superfund Site

Figure 2-8b

April 2013





Note: EPA RI Sample 308A is an outlier and is not included in the plots above.

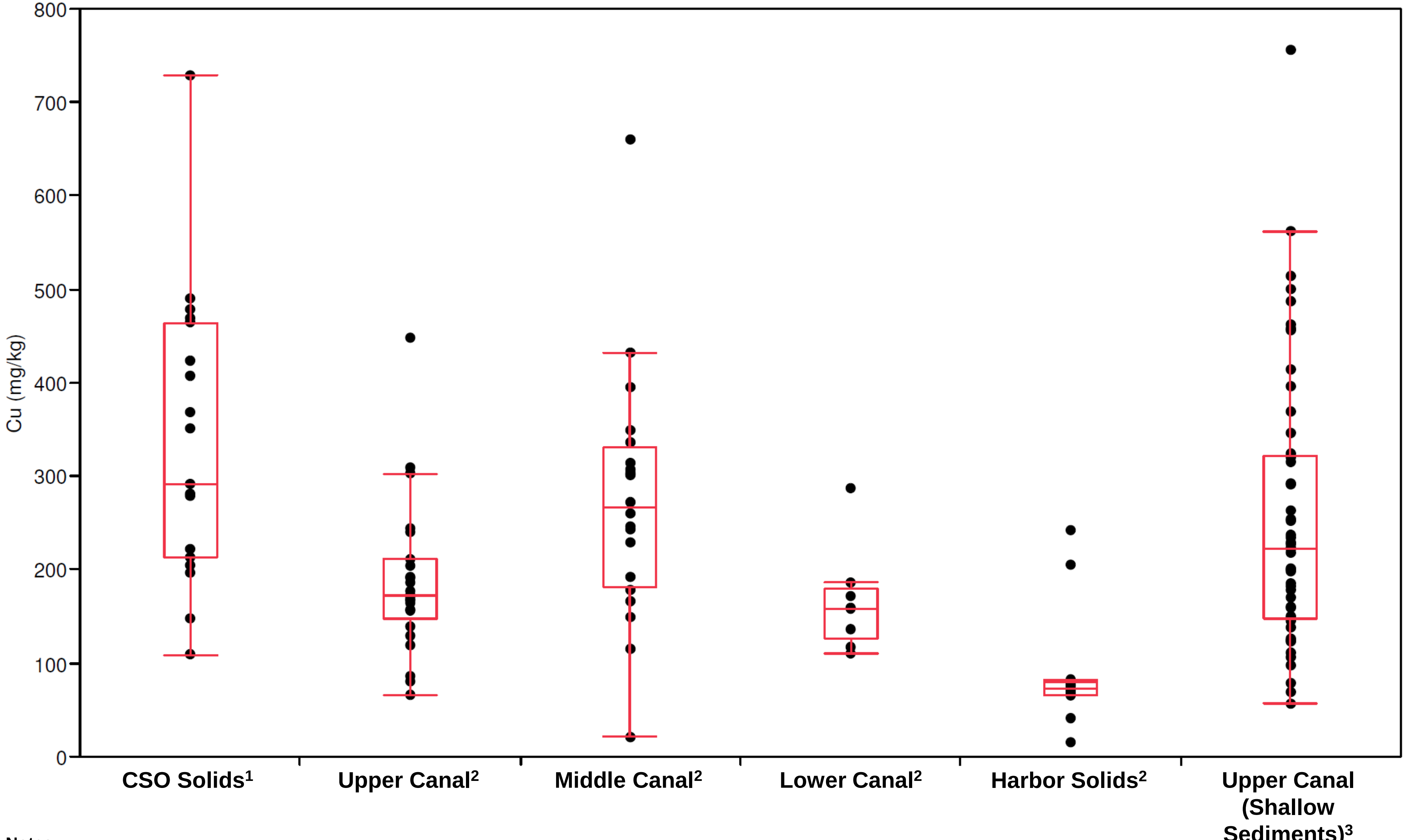
Environmental Protection

Comparison of Copper Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-9a

April 2013



Notes:
1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
3. Canal Shallow Sediment data are from depths within the of 0 to 2 feet horizon (excludes 0-0.5 feet data from Note 1). EPA, ERT, and NYCDEP data.

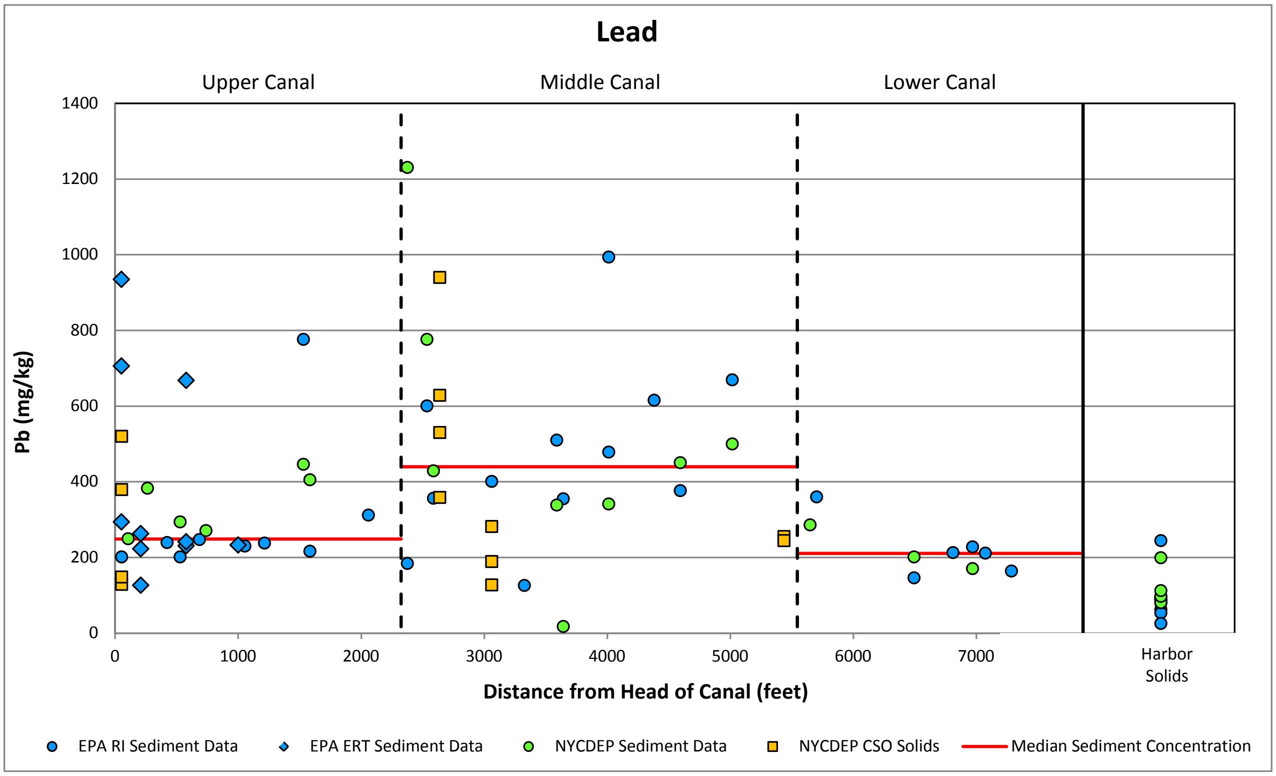
NYC Environmental Protection

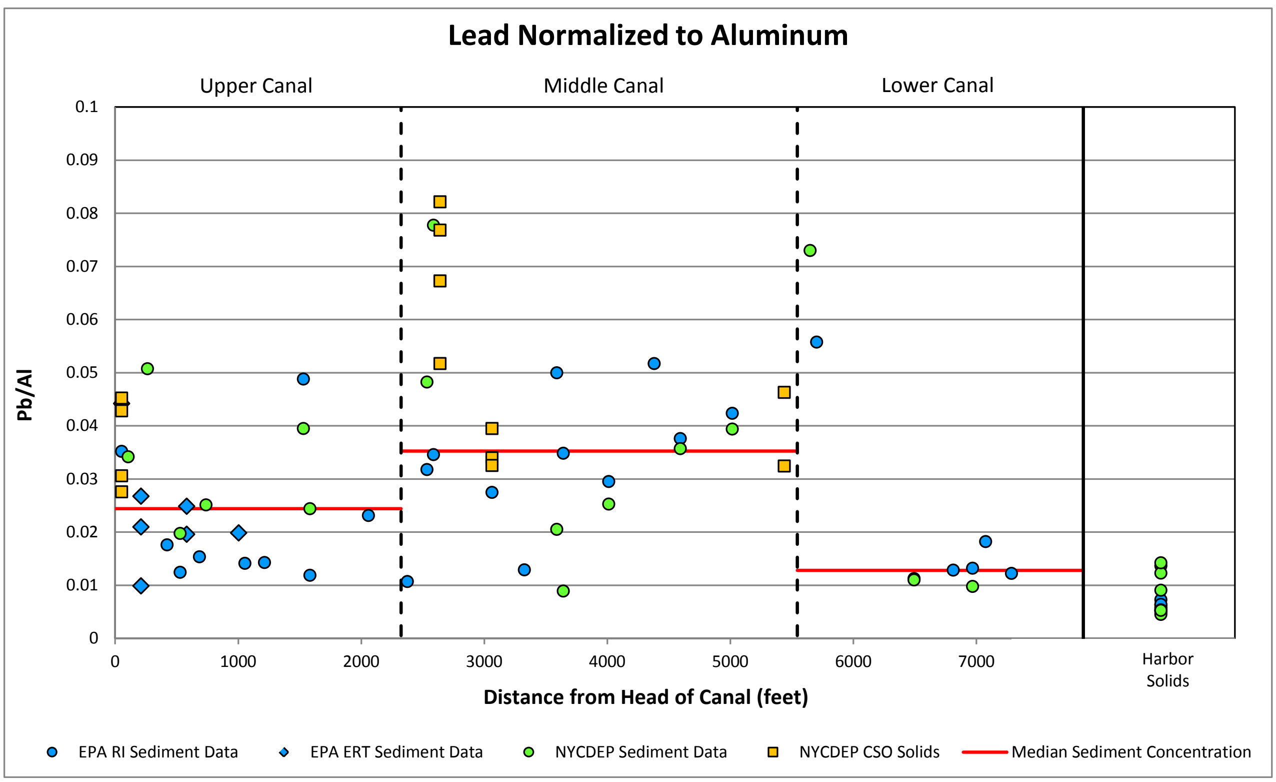
Copper Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

Figure 2-9b

April 2013





Note: EPA RI Sample 308A is an outlier and is not included in the plots above.

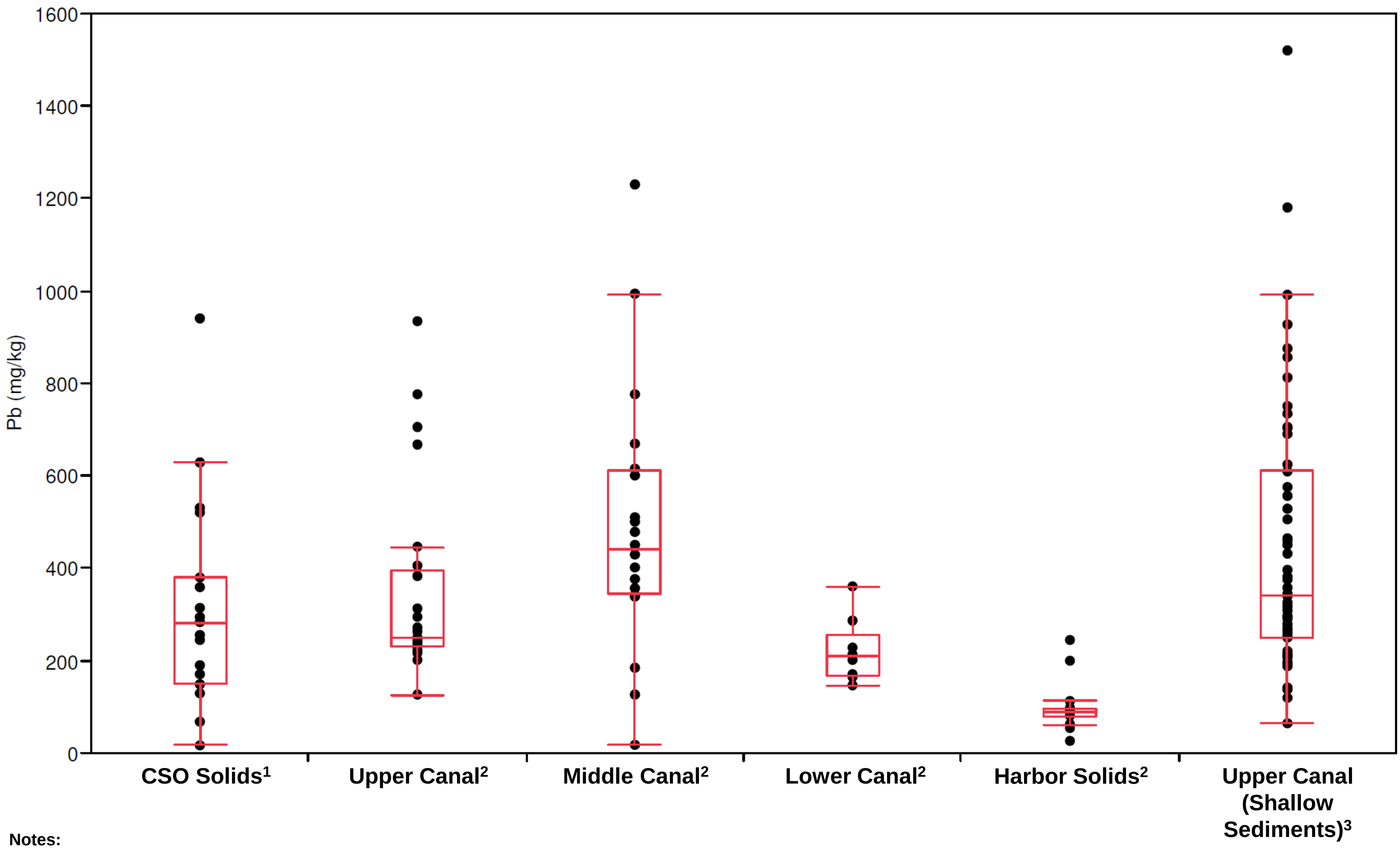
NYC Environmental Protection

Comparison of Lead Concentrations in Surface Sediment and CSO Solids

Gowanus Canal Superfund Site

Figure 2-10a

April 2013



Notes:
1. NYCDEP CSO Solids data.
2. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
3. Canal Shallow Sediment data are from depths within the of 0 to 2 feet horizon (excludes 0-0.5 feet data from Note 1). EPA, ERT, and NYCDEP data.

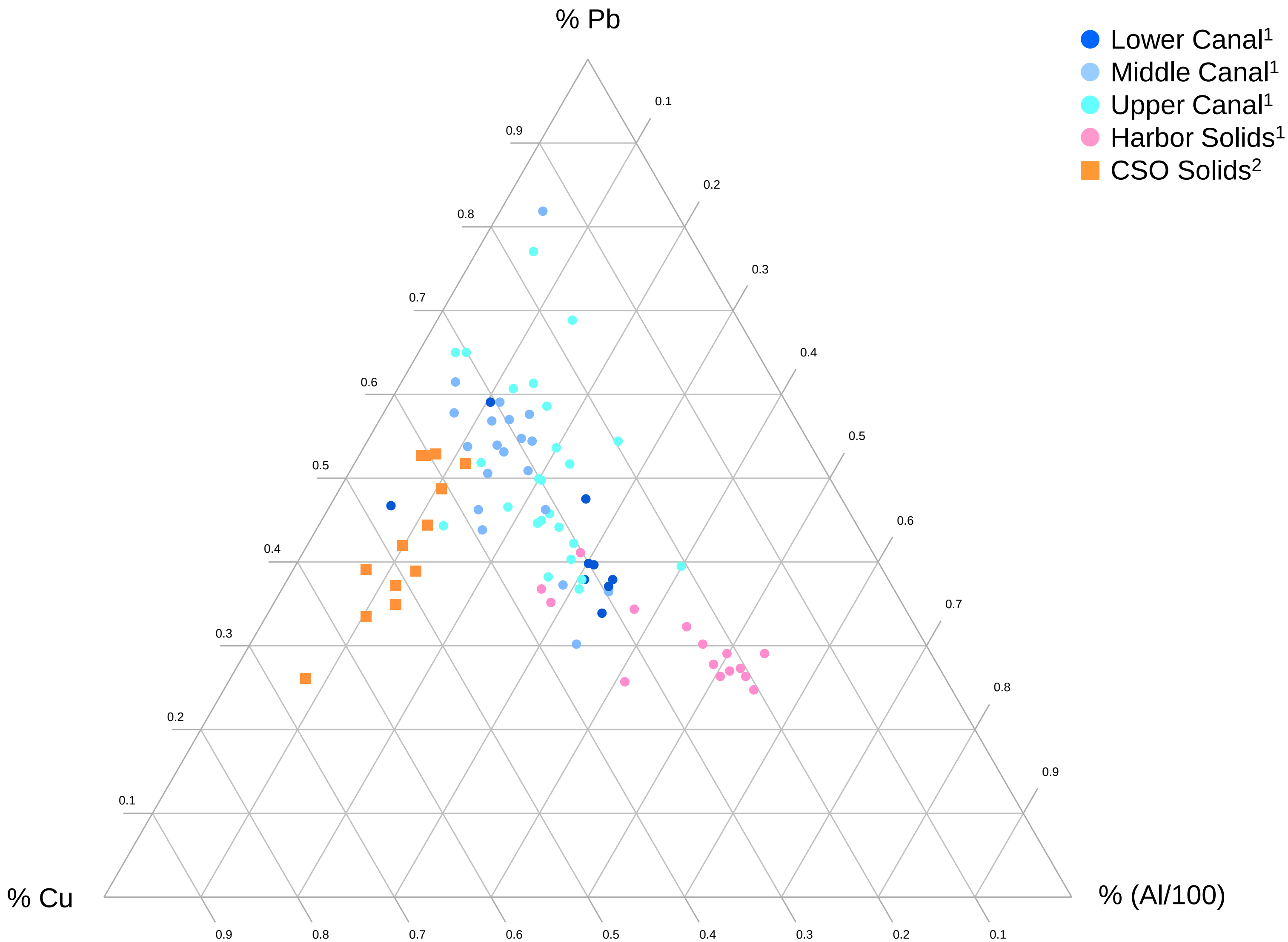
NYC Environmental Protection

Lead Concentrations in CSOs, Surface Sediments and Shallow Sediments

Gowanus Canal Superfund Site

Figure 2-10b

April 2013



Notes:
1. Canal Sediment data are from depths of 0 to 0.5 feet. EPA, ERT, and NYCDEP data.
2. NYCDEP CSO Solids data.

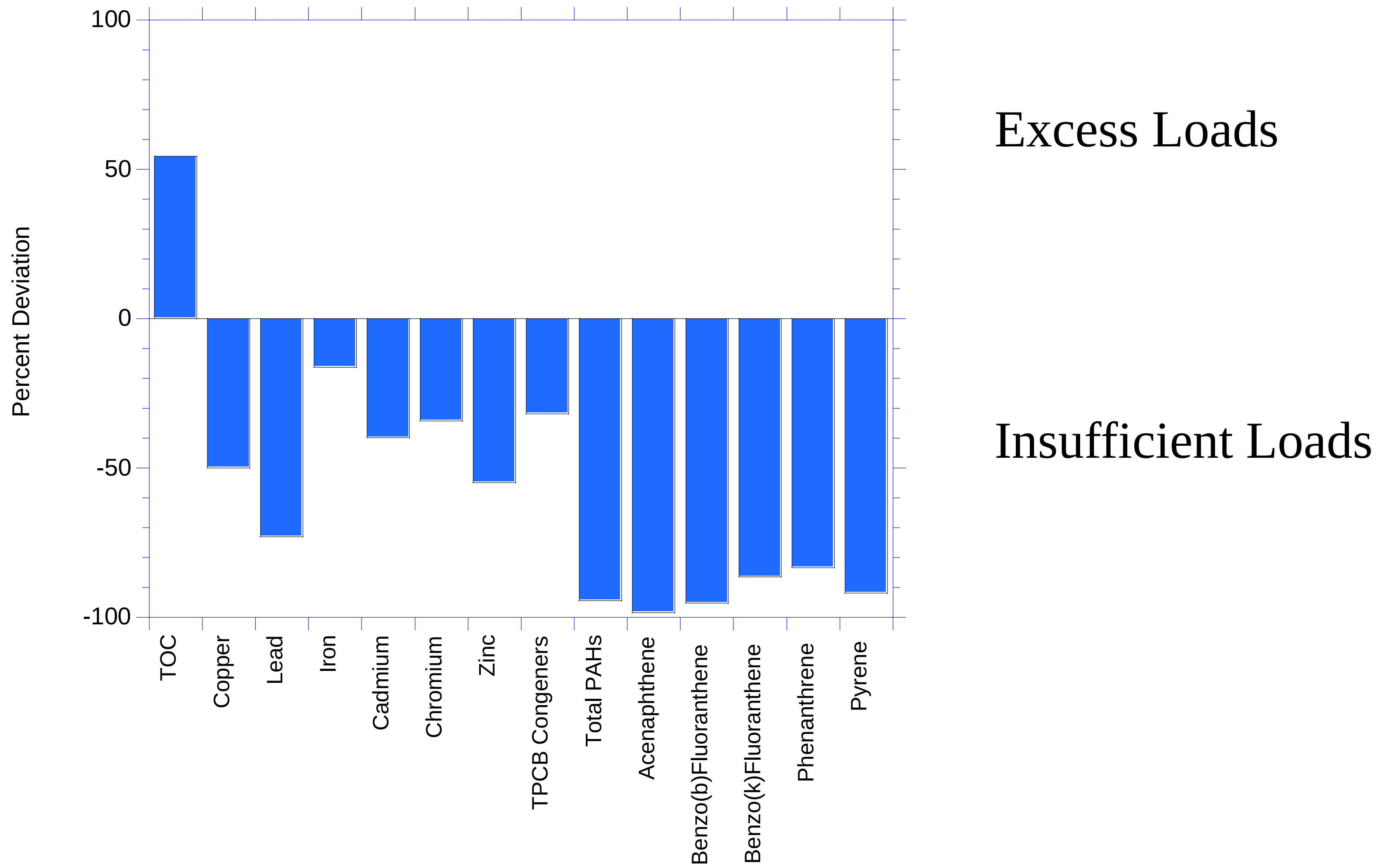
NYC Environmental Protection

Copper, Aluminum, and Lead Comparison in CSOs and Surface Sediments

Gowanus Canal Superfund Site

Figure 2-11

April 2013



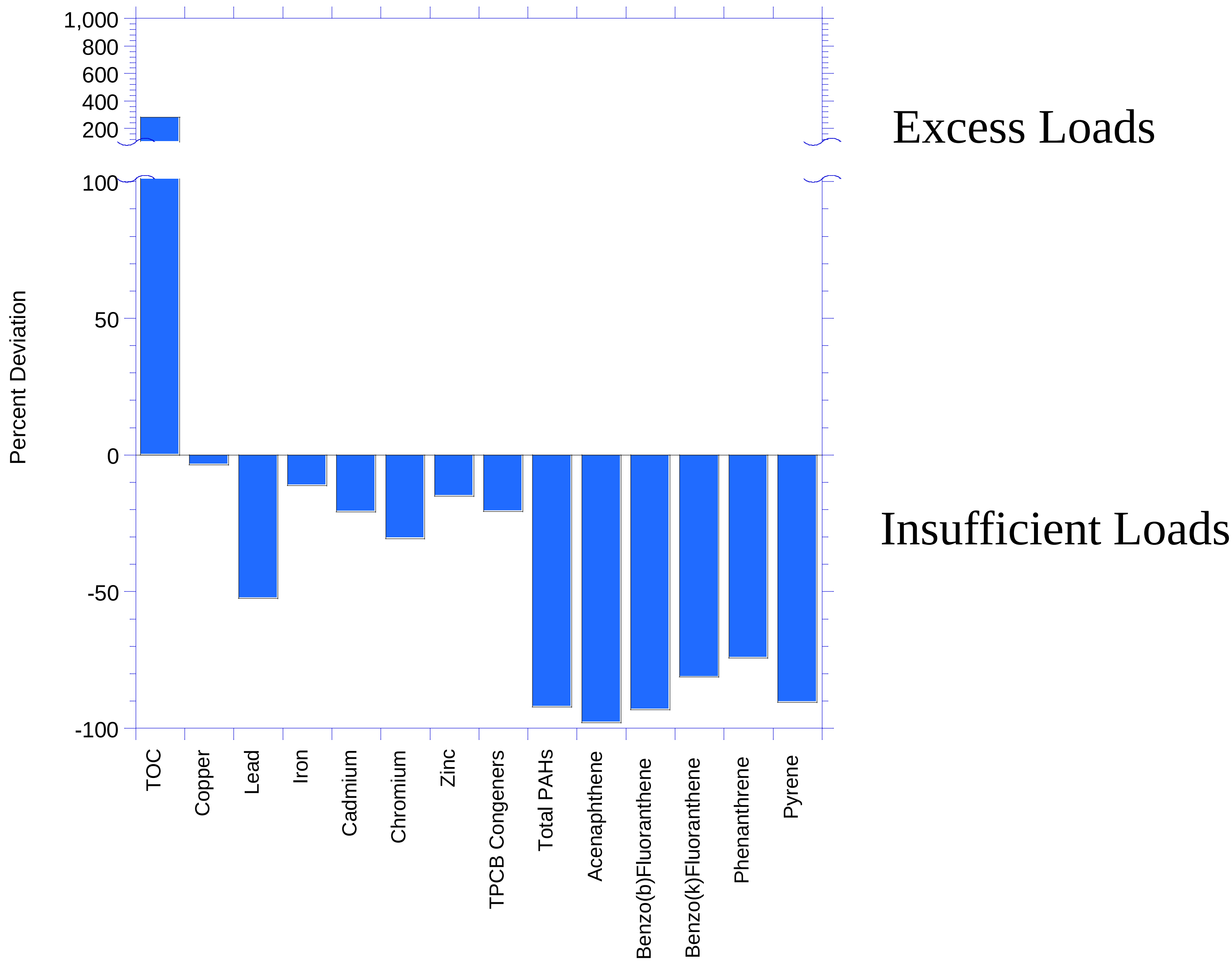
NYC Environmental Protection

Chemical Mass Balance Model Performance for 10% CSO Solids Contribution Hypothetical Scenario

Gowanus Canal Superfund Site

Figure 3-1

April 2013



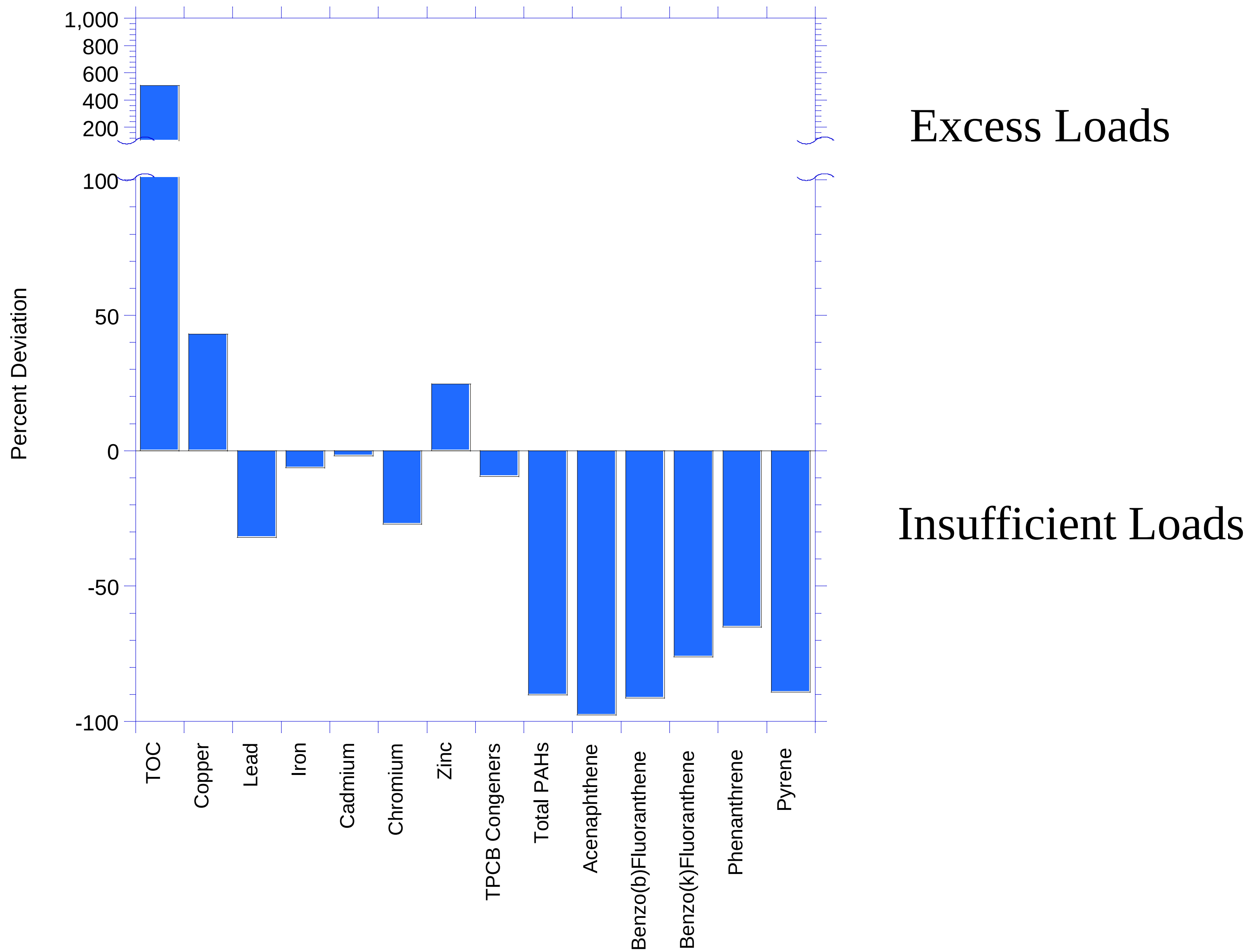
NYC Environmental Protection

Chemical Mass Balance Model Performance for 30% CSO Solids Contribution Hypothetical Scenario

Gowanus Canal Superfund Site

Figure 3-2

April 2013

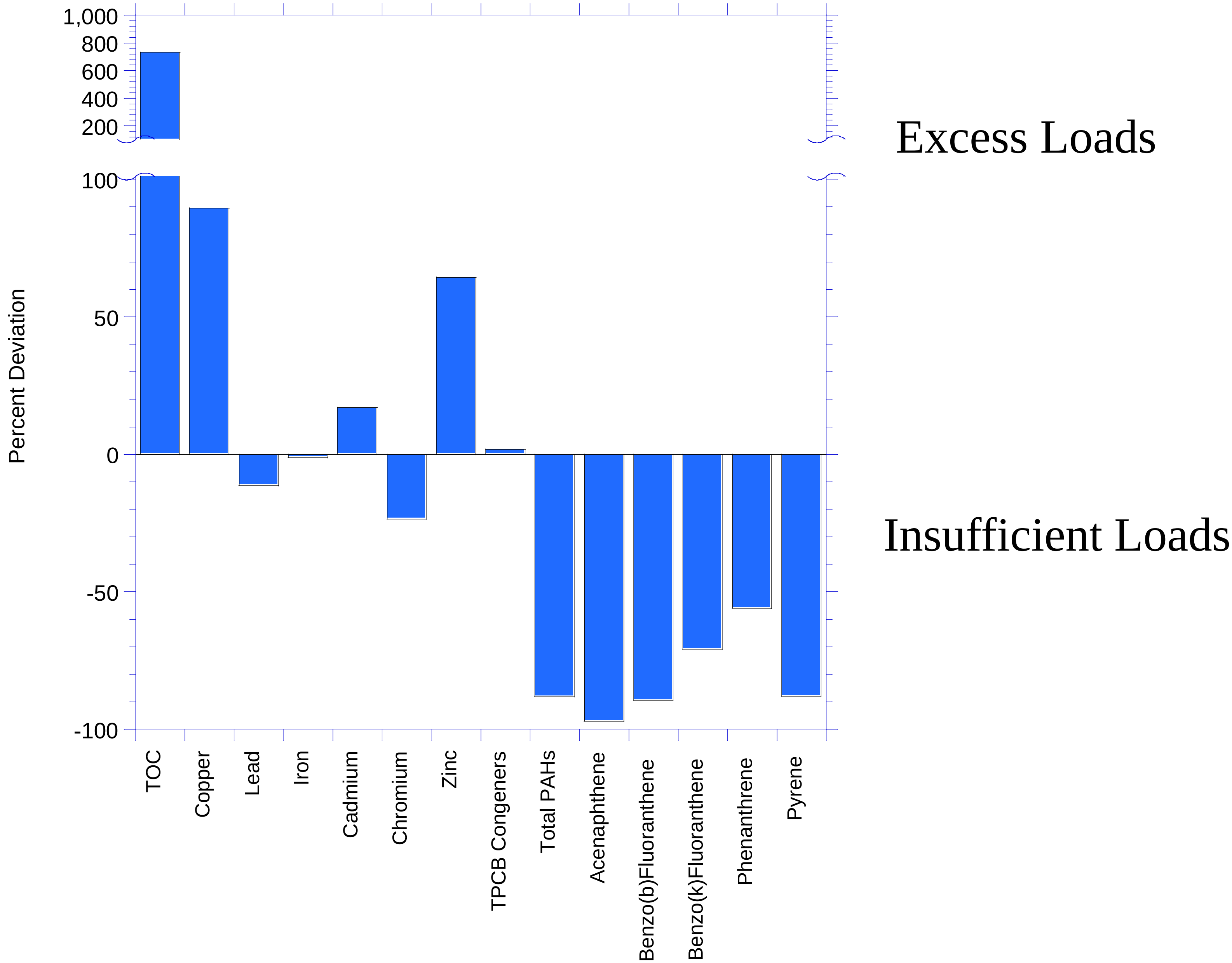


Chemical Mass Balance Model Performance for 50% CSO Solids Contribution
Hypothetical Scenario

Gowanus Canal Superfund Site

Figure 3-3

April 2013



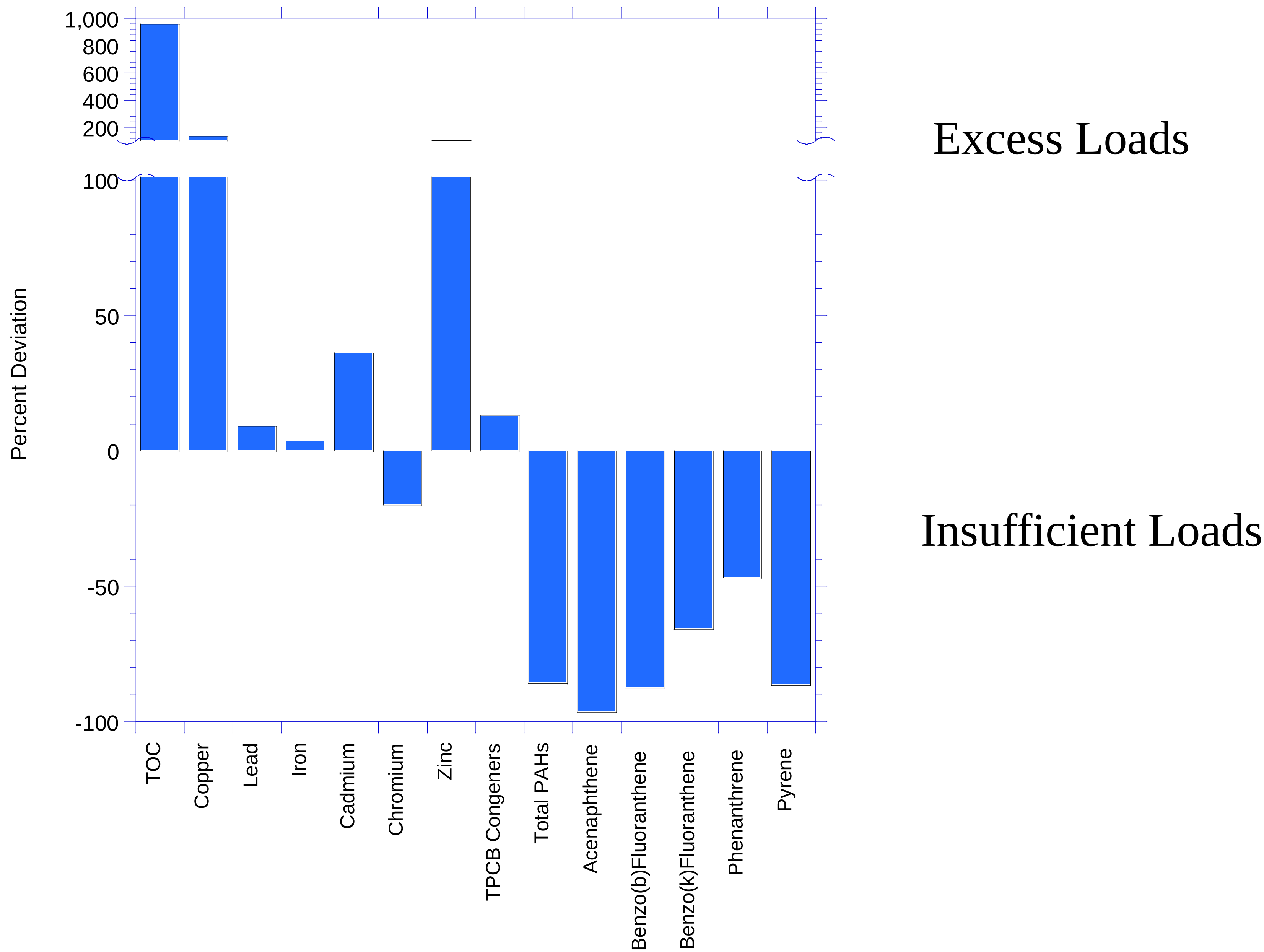
NYC Environmental Protection

Chemical Mass Balance Model Performance for 70% CSO Solids Contribution Hypothetical Scenario

Gowanus Canal Superfund Site

Figure 3-4

April 2013



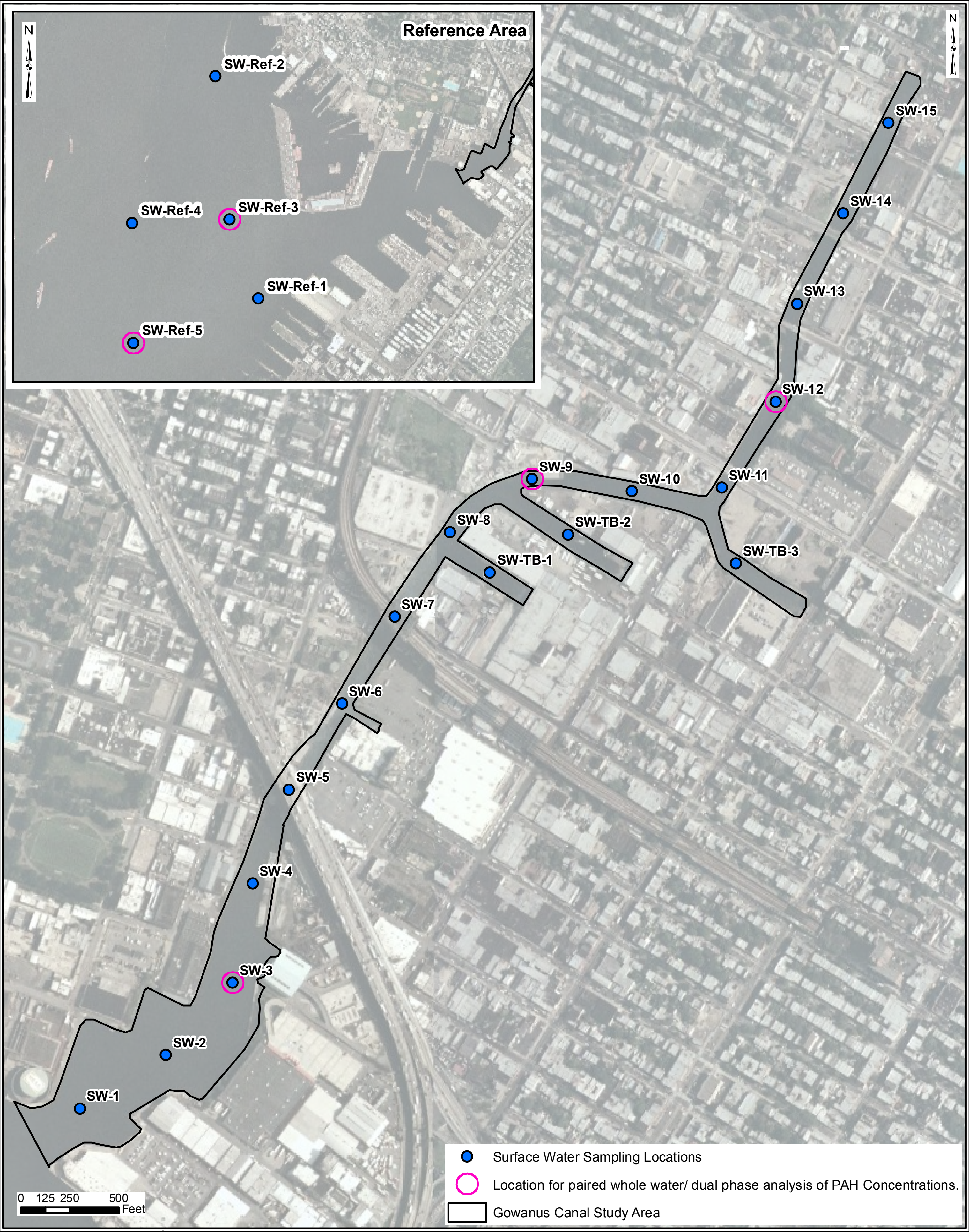
Environmental Protection

Chemical Mass Balance Model Performance for 90% CSO Solids Contribution
Hypothetical Scenario

Gowanus Canal Superfund Site

Figure 3-5

April 2013



Environmental Protection

Sampling Locations - Surface Water

Gowanus Canal Superfund Site

Figure 3-6

April 2013

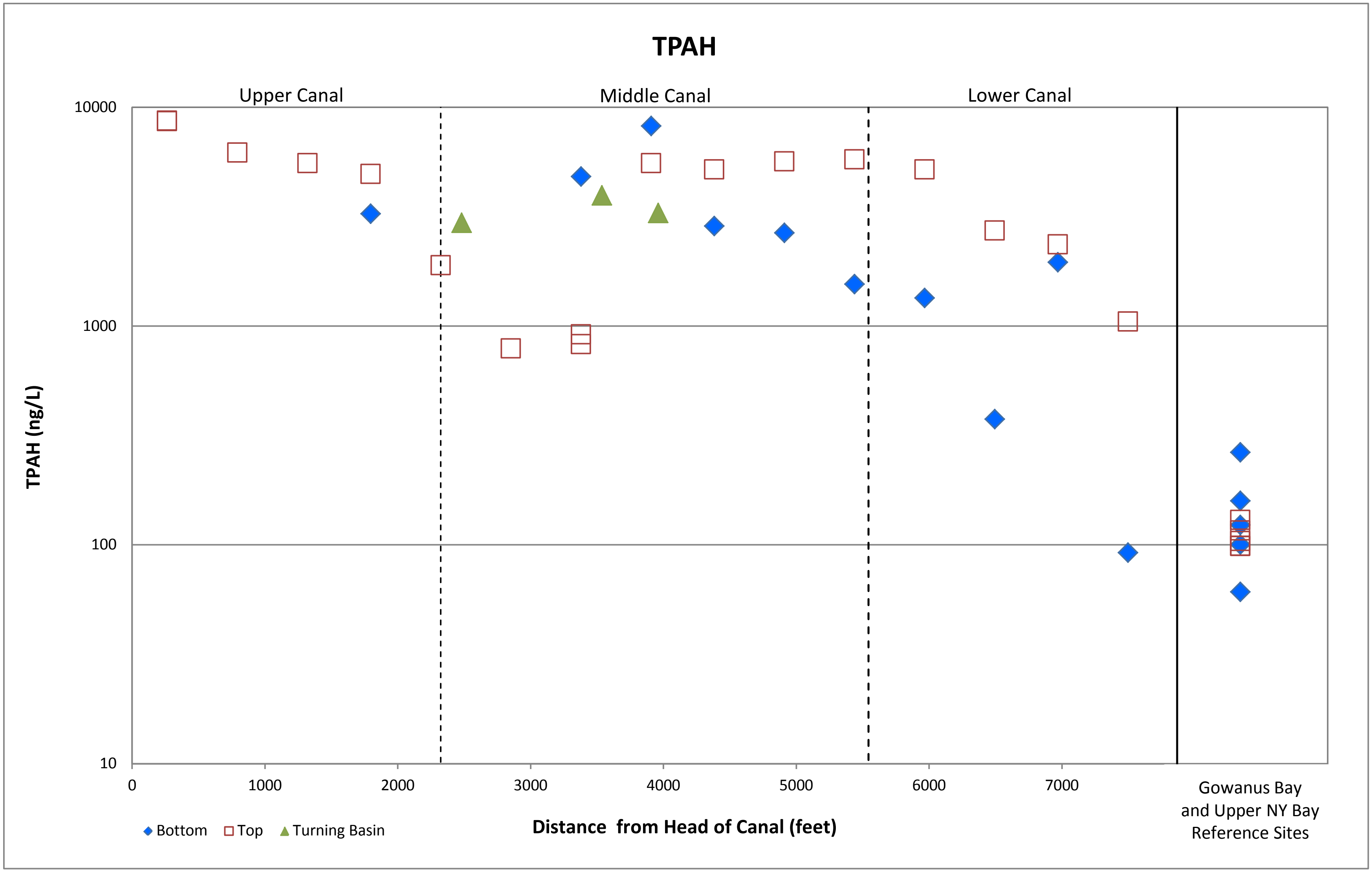


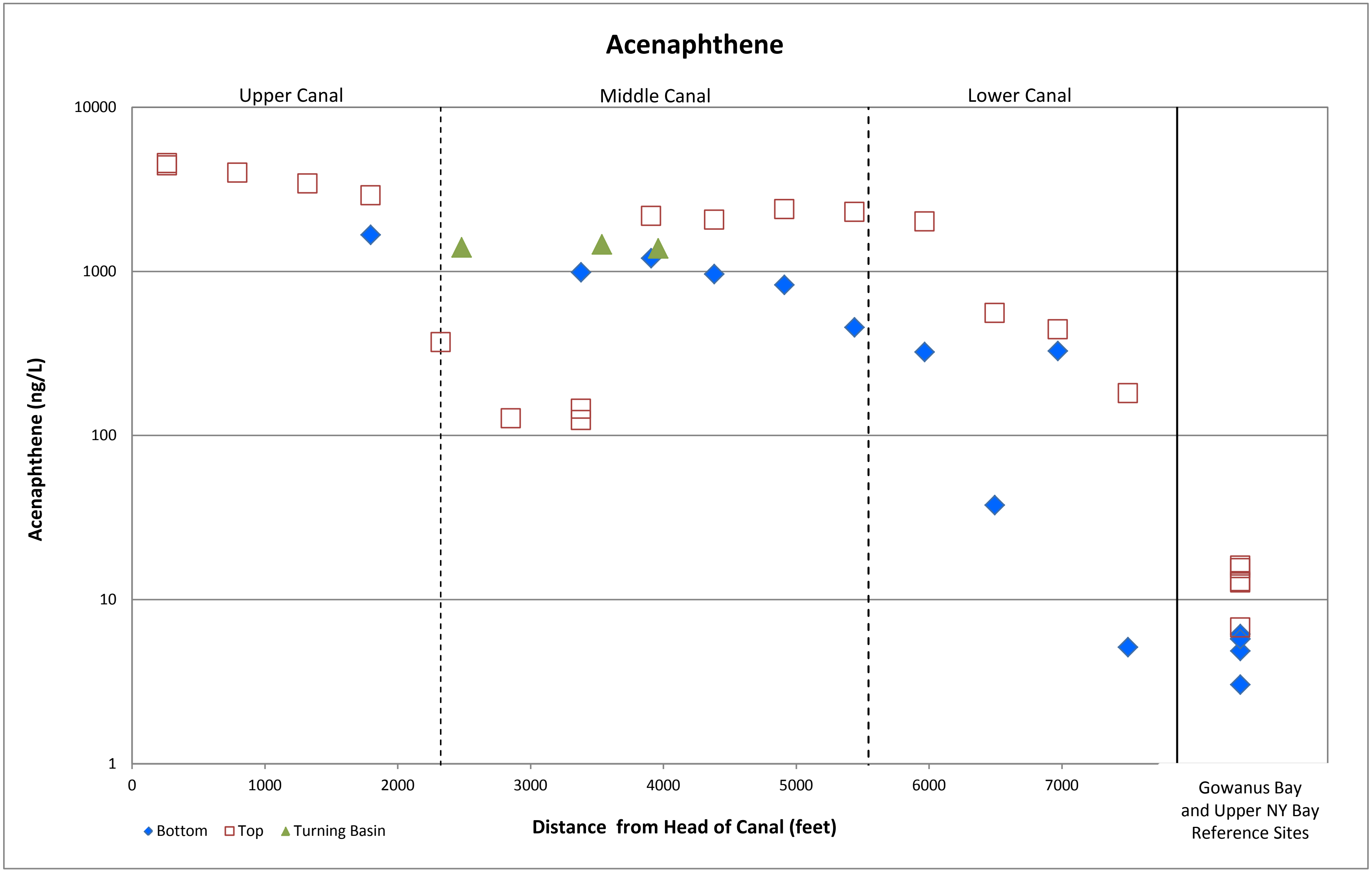
Figure 3-7

Water Column Whole Water Concentrations – TPAH

Gowanus Canal Superfund Site

April 2013

Environmental Protection



Environmental Protection

Water Column Whole Water Concentrations – Acenaphthene

Gowanus Canal Superfund Site

Figure 3-8

April 2013

NYC Environmental Protection

Water Column Whole Water Concentrations – Fluorene

Gowanus Canal Superfund Site

Figure 3-9

April 2013

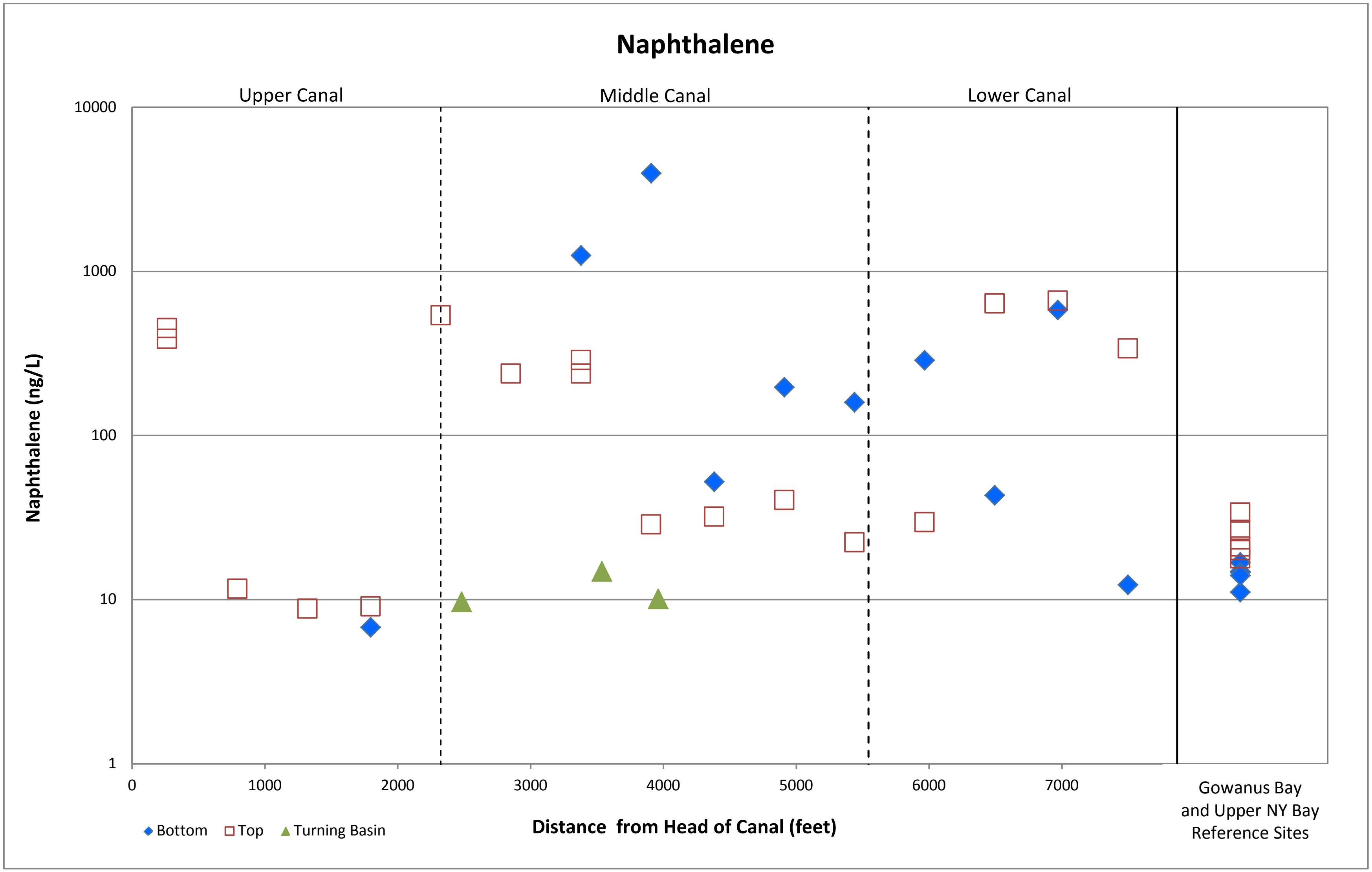
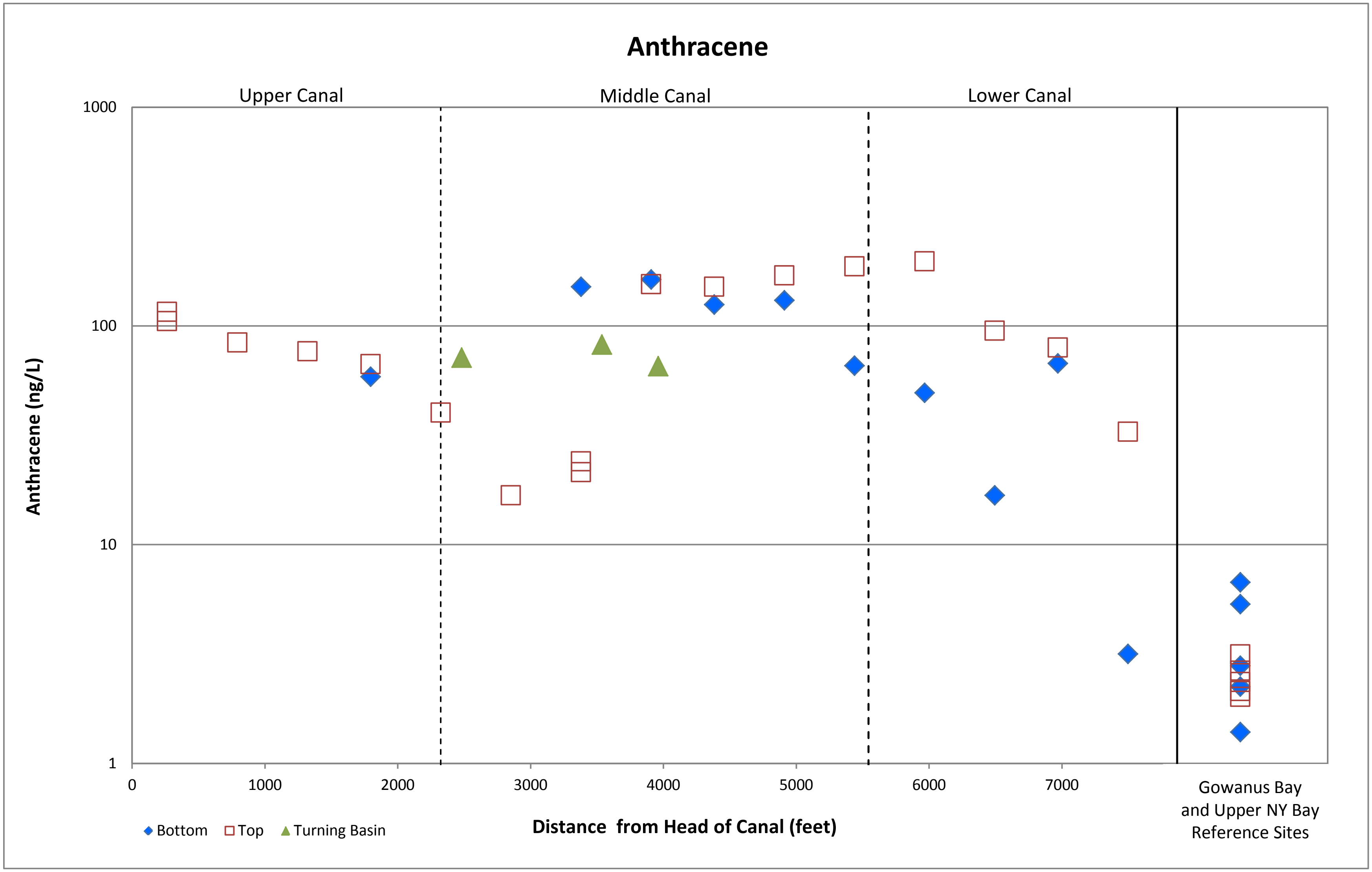


Figure 3-10

Water Column Whole Water Concentrations – Naphthalene

Gowanus Canal Superfund Site

April 2013



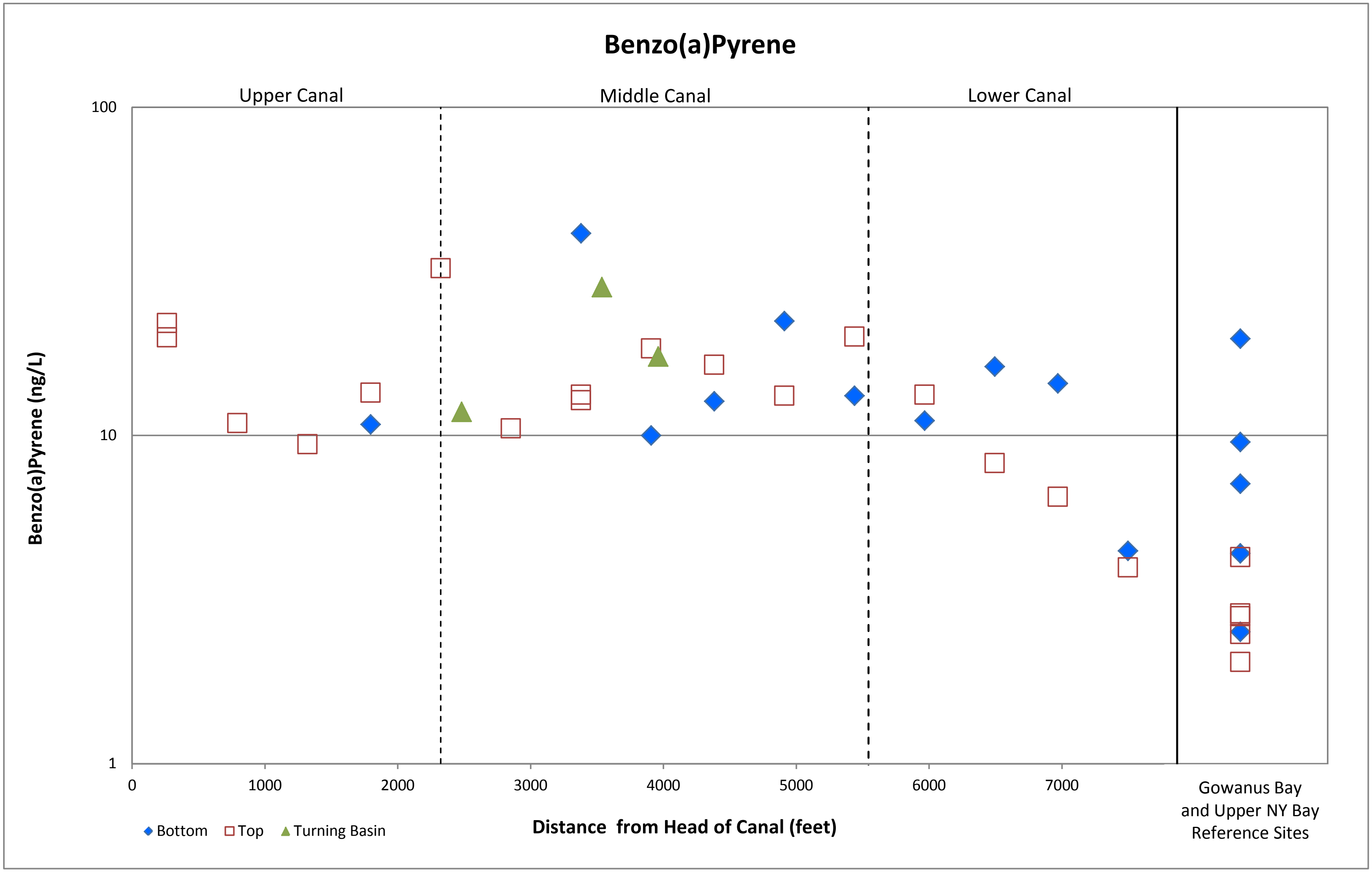
Environmental Protection

Water Column Whole Water Concentrations – Anthracene

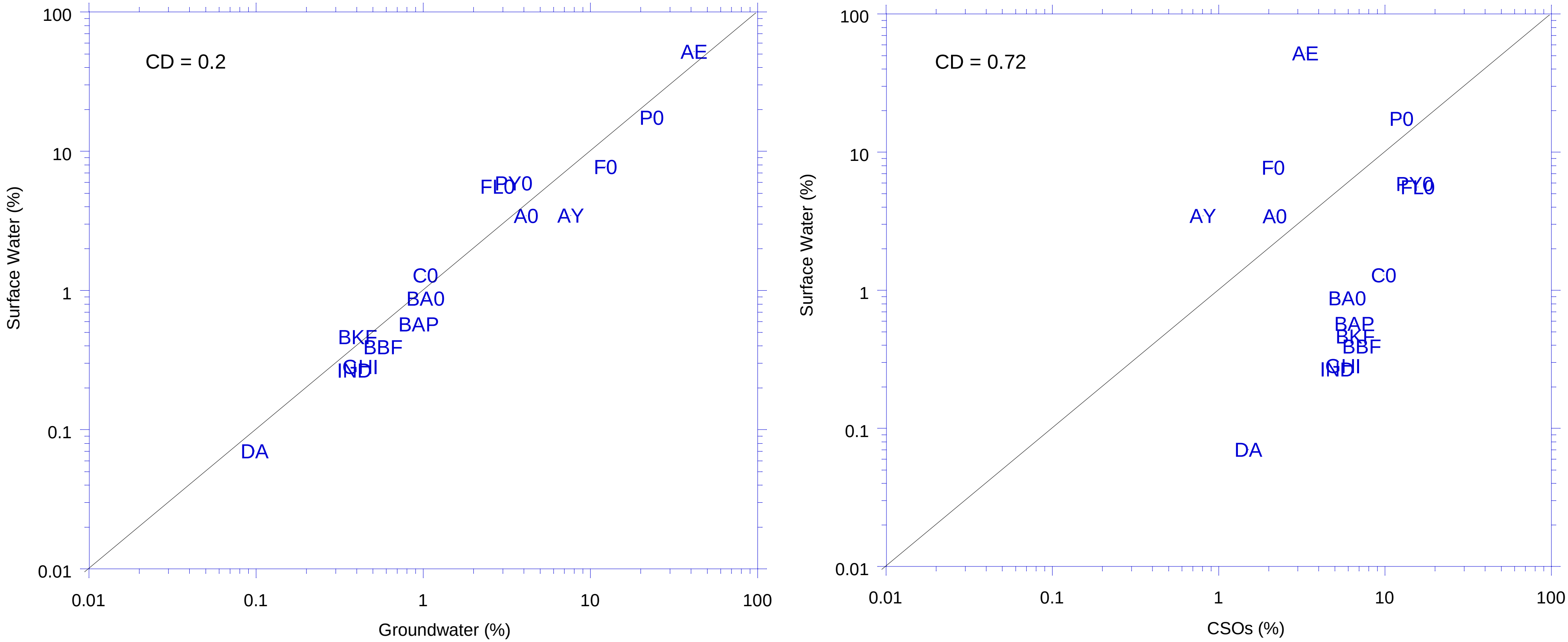
Gowanus Canal Superfund Site

Figure 3-11

April 2013



NYC Environmental Protection	Water Column Whole Water Concentrations – Benzo(a)Pyrene	Figure 3-12
	Gowanus Canal Superfund Site	April 2013



Note:

AE - Acenaphthene
AY - Acenaphylene
A0 - Anthracene
BA0 - Benzo(a)Anthracene
BAP - Benzo(a)Pyrene
P0 – Phenanthrene
PY0 – Pyrene
C0 - Chrysene
DA - Dibenz(a,h)Anthracene
FL0 - Fluoranthene
F0 - Fluorene
IND - Indeno(1,2,3-cd)Pyrene
BBF - Benzo(b)Fluoranthene
GHI - Benzo(g,h,i)Perylene
BKF - Benzo(k)Fluoranthene

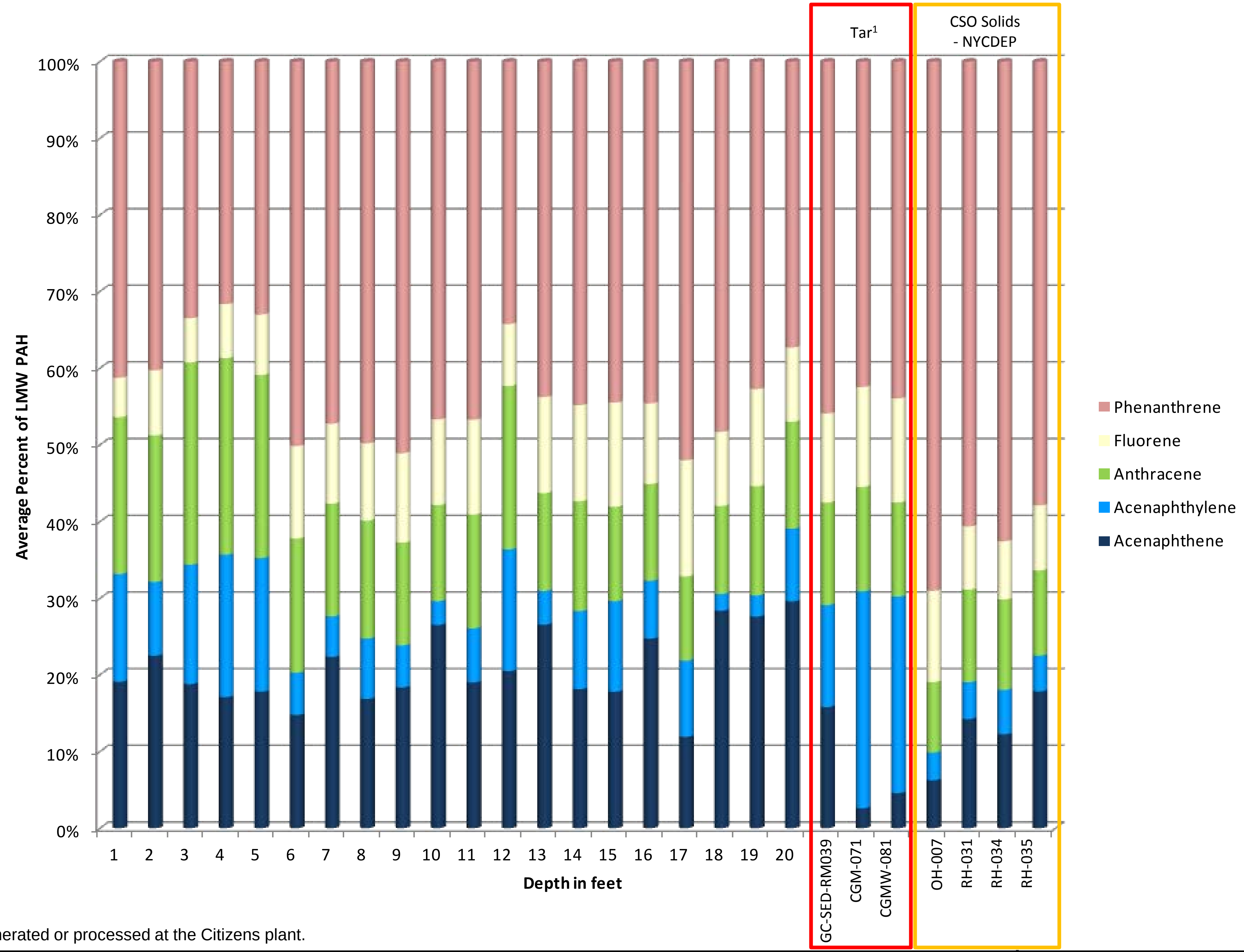
Environmental Protection

Comparison of Observed PAH Patterns in Surface Water, Groundwater, and CSOs

Gowanus Canal Superfund Site

Figure 3-13

April 2013



Notes:
1.Tars generated or processed at the Citizens plant.

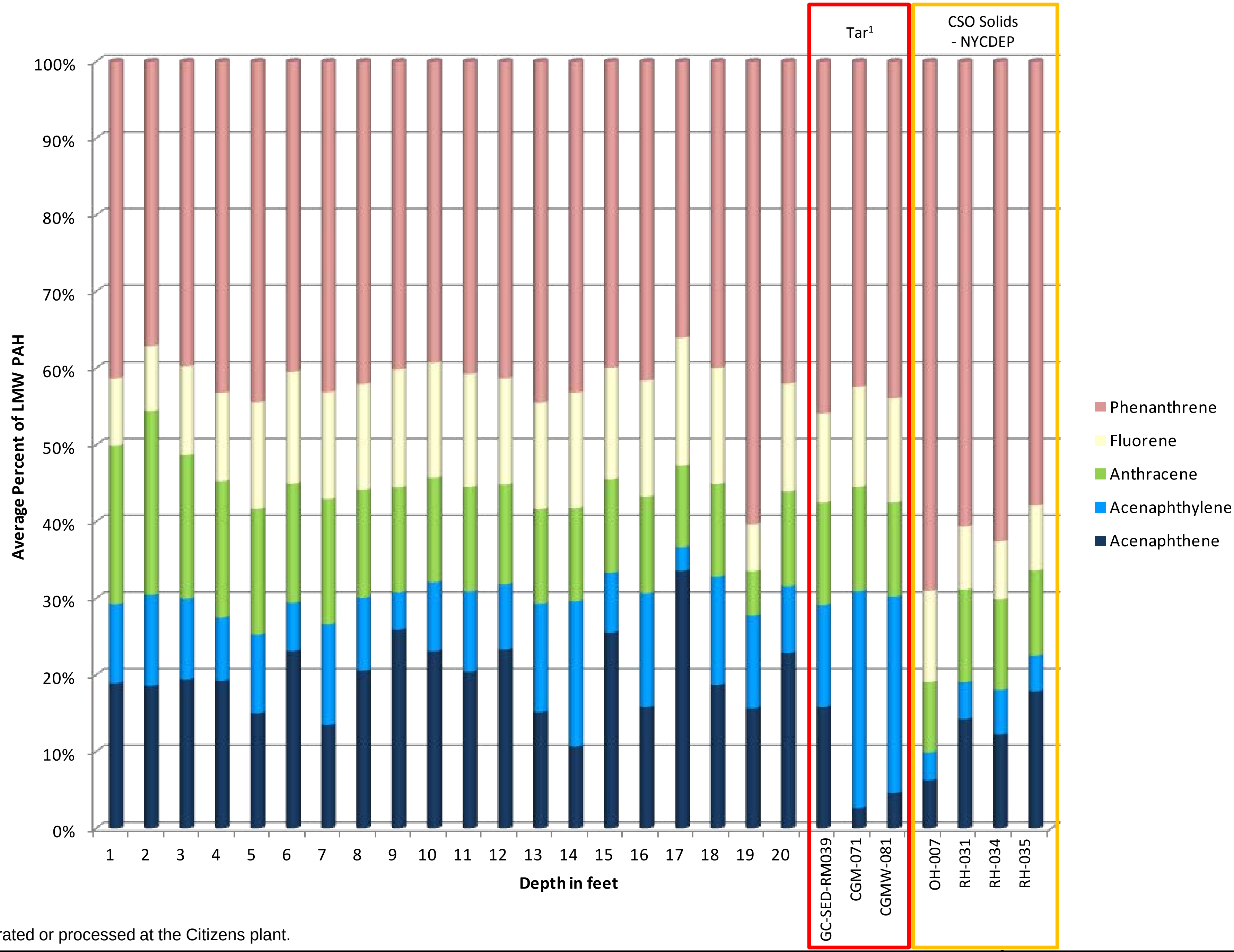
NYC Environmental Protection

Percentage Proportions of LMW Compounds in Sediment, Lower Canal

Gowanus Canal Superfund Site

Figure 3-14

April 2013



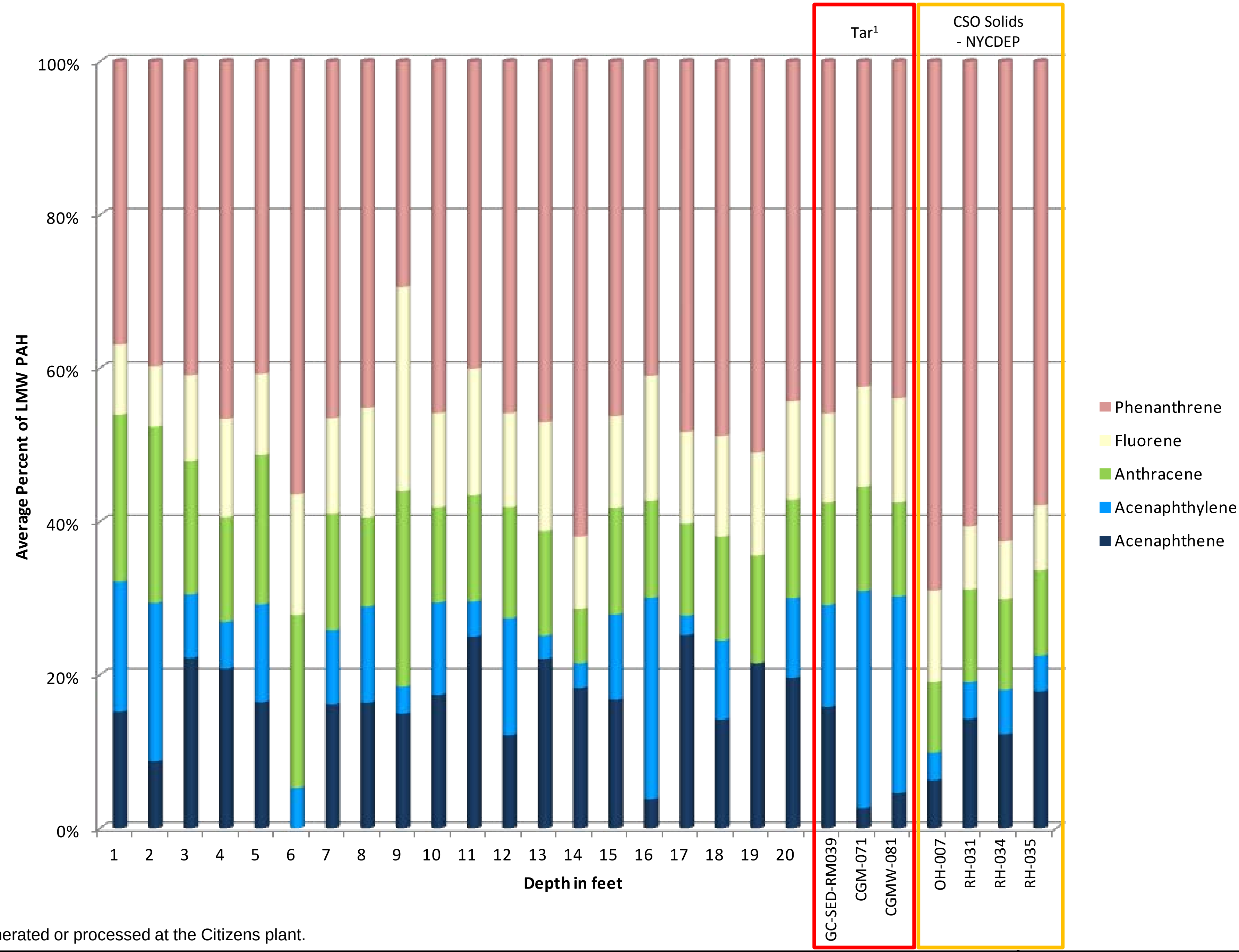
Notes:
1.Tars generated or processed at the Citizens plant.

Percentage Proportions of LMW Compounds in Sediment, Middle Canal

Gowanus Canal Superfund Site

Figure 3-15

April 2013



Notes:
1.Tars generated or processed at the Citizens plant.

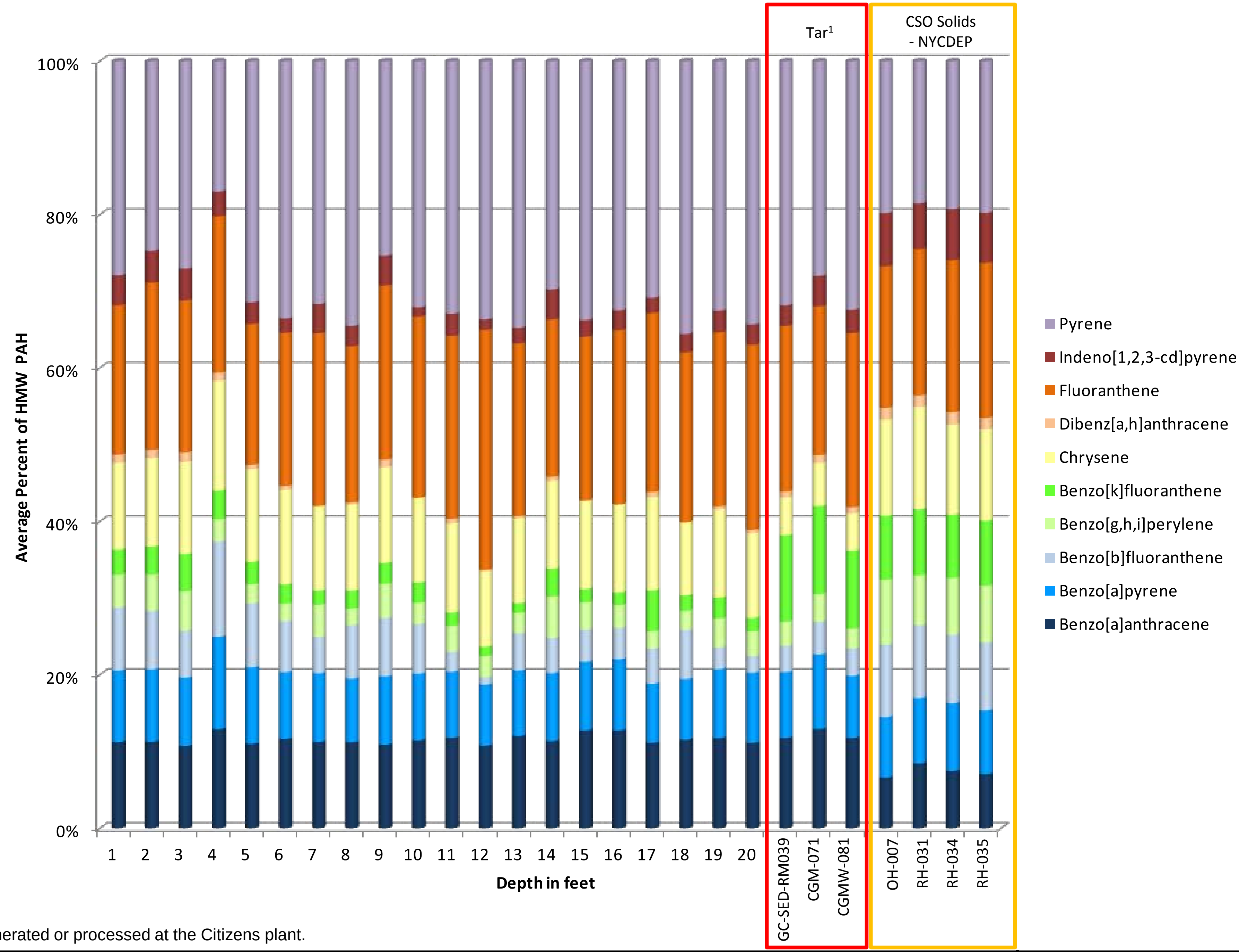
NYC Environmental Protection

Percentage Proportions of LMW Compounds in Sediment, Upper Canal

Gowanus Canal Superfund Site

Figure 3-16

April 2013



Notes:
1.Tars generated or processed at the Citizens plant.

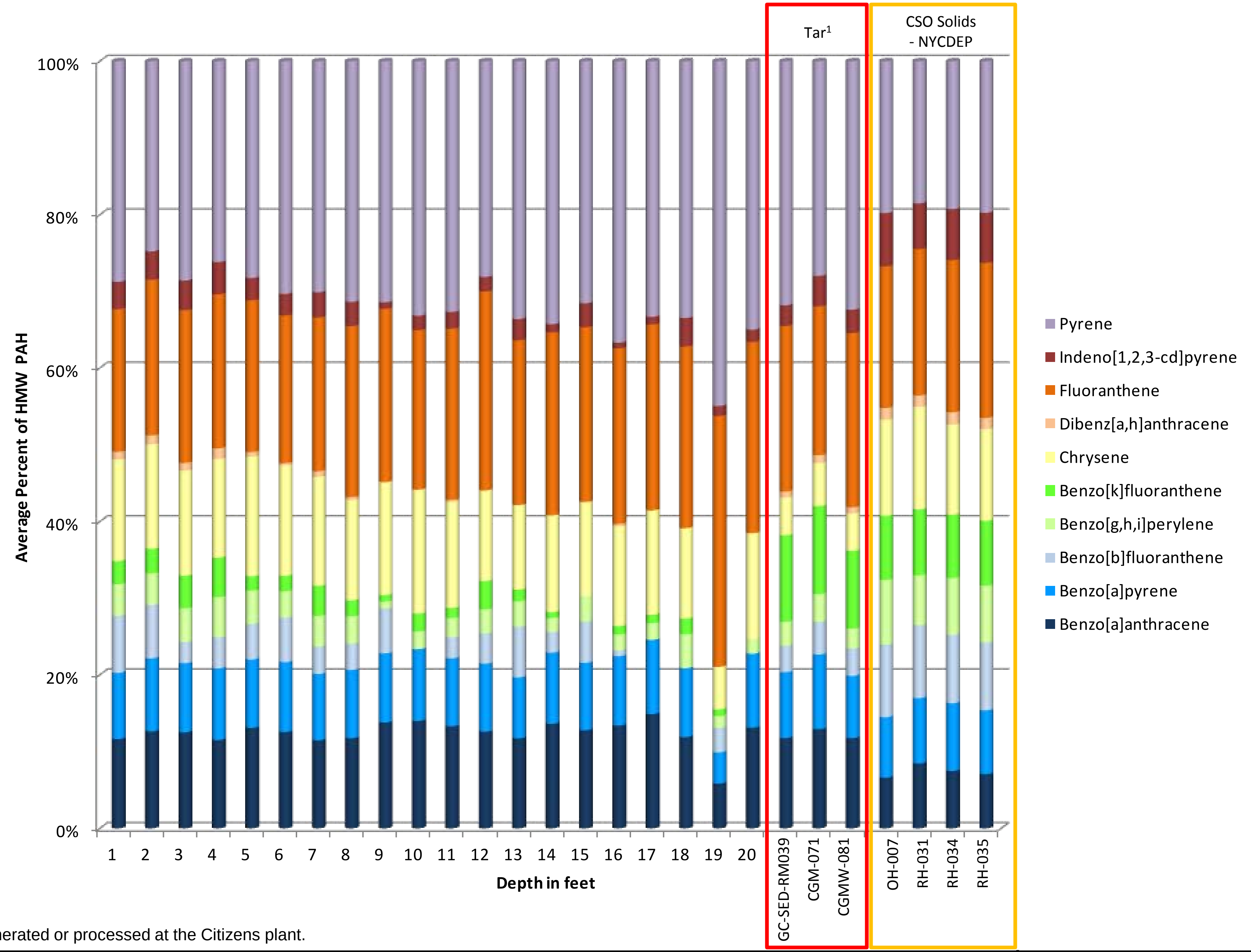
Environmental Protection

Percentage Proportions of HMW Compounds in Sediment, Lower Canal

Gowanus Canal Superfund Site

Figure 3-17

April 2013



Notes:
1.Tars generated or processed at the Citizens plant.

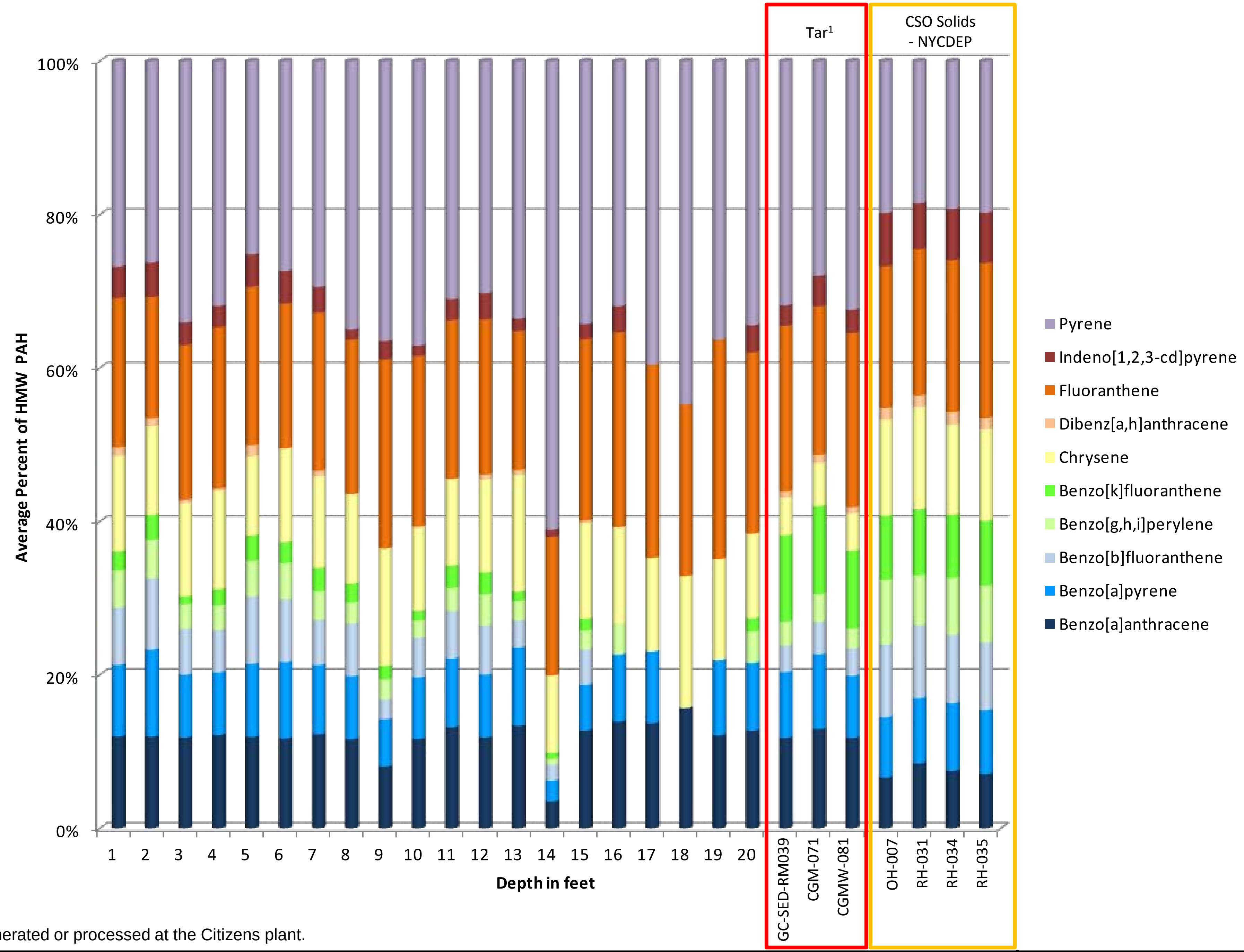
NYC Environmental Protection

Percentage Proportions of HMW Compounds in Sediment, Middle Canal

Gowanus Canal Superfund Site

Figure 3-18

April 2013



Notes:

1.Tars generated or processed at the Citizens plant.

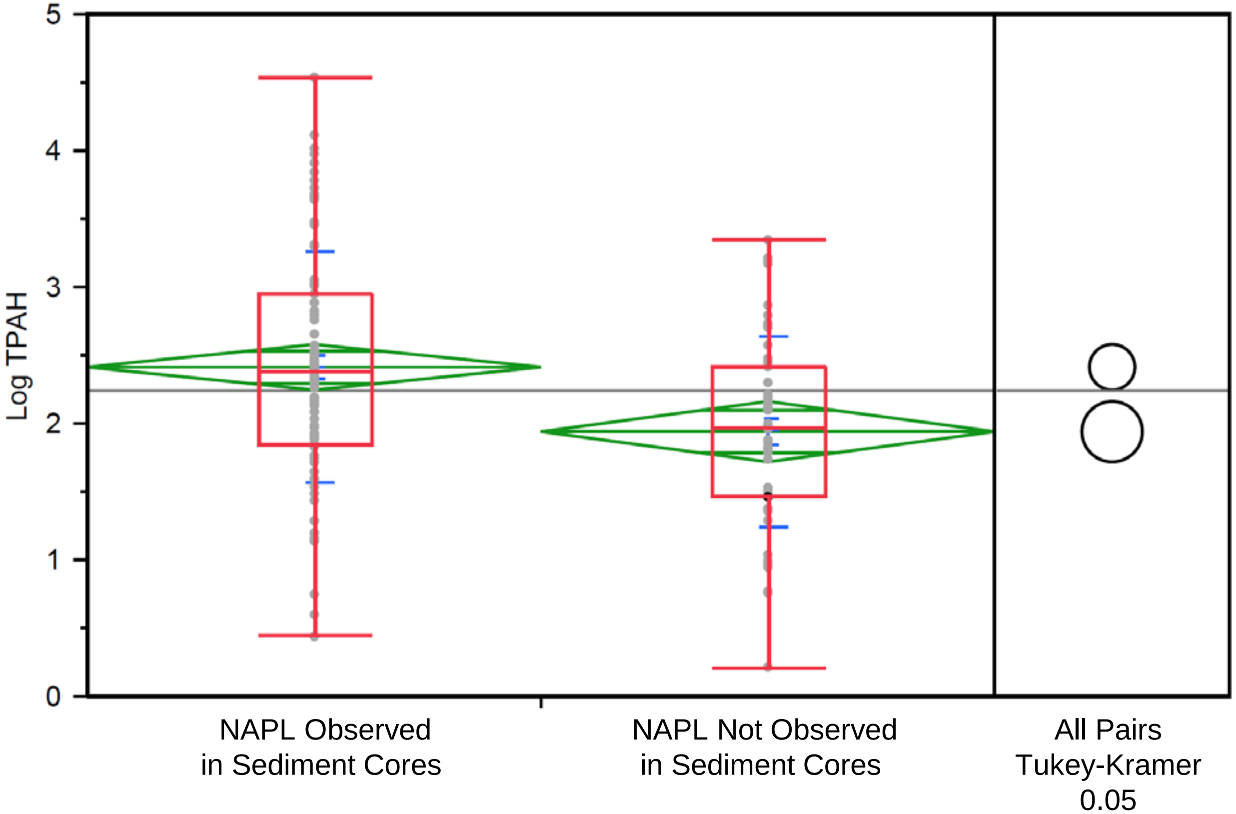
NYC Environmental Protection

Percentage Proportions of HMW Compounds in Sediment, Upper Canal

Gowanus Canal Superfund Site

Figure 3-19

April 2013



Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Contains NAPL	0.439964	1.442661	1.84648	2.384262	2.950449	3.679206	4.537441
No NAPL	0.214022	0.978797	1.463744	1.959995	2.416973	2.852929	3.346666

Oneway Anova

Summary of Fit

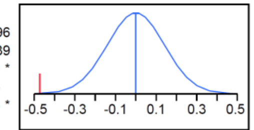
Rsquare	0.075573
Adj Rsquare	0.068922
Root Mean Square Error	0.800007
Mean of Response	2.242102
Observations (or Sum Wgts)	141

t Test

No NAPL-Contains NAPL

Assuming equal variances

Difference	-0.47266	t Ratio	-3.37096
Std Err Dif	0.14022	DF	139
Upper CL Dif	-0.19543	Prob > |t|	0.0010 *
Lower CL Dif	-0.74989	Prob > t	0.9995
Confidence	0.95	Prob < t	0.0005 *



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Core Type 2	1	7.272680	7.27268	11.3634	0.0010 *
Error	139	88.961561	0.64001		
C. Total	140	96.234241			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Contains NAPL	90	2.41306	0.08433	2.2463	2.5798
No NAPL	51	1.94040	0.11202	1.7189	2.1619

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Contains NAPL	90	2.41306	0.852660	0.08988	2.2345	2.5917
No NAPL	51	1.94040	0.696506	0.09753	1.7445	2.1363

Means Comparisons

Comparisons for all pairs using Tukey-Kramer HSD

q*	Alpha
1.97718	0.05

Abs(Dif)-HSD

	Contains NAPL	No NAPL
Contains NAPL	-0.23579	0.19543
No NAPL	0.19543	-0.31323

Positive values show pairs of means that are significantly different.

Level			Mean
Contains NAPL	A		2.4130647
No NAPL		B	1.9404030

Levels not connected by same letter are significantly different.

Median Test (Number of Points Above Median)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Contains NAPL	90	53.000	44.681	0.588889	2.906
No NAPL	51	17.000	25.319	0.333333	-2.906

2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
17	-2.90588	0.0037 *

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
8.4441	1	0.0037 *

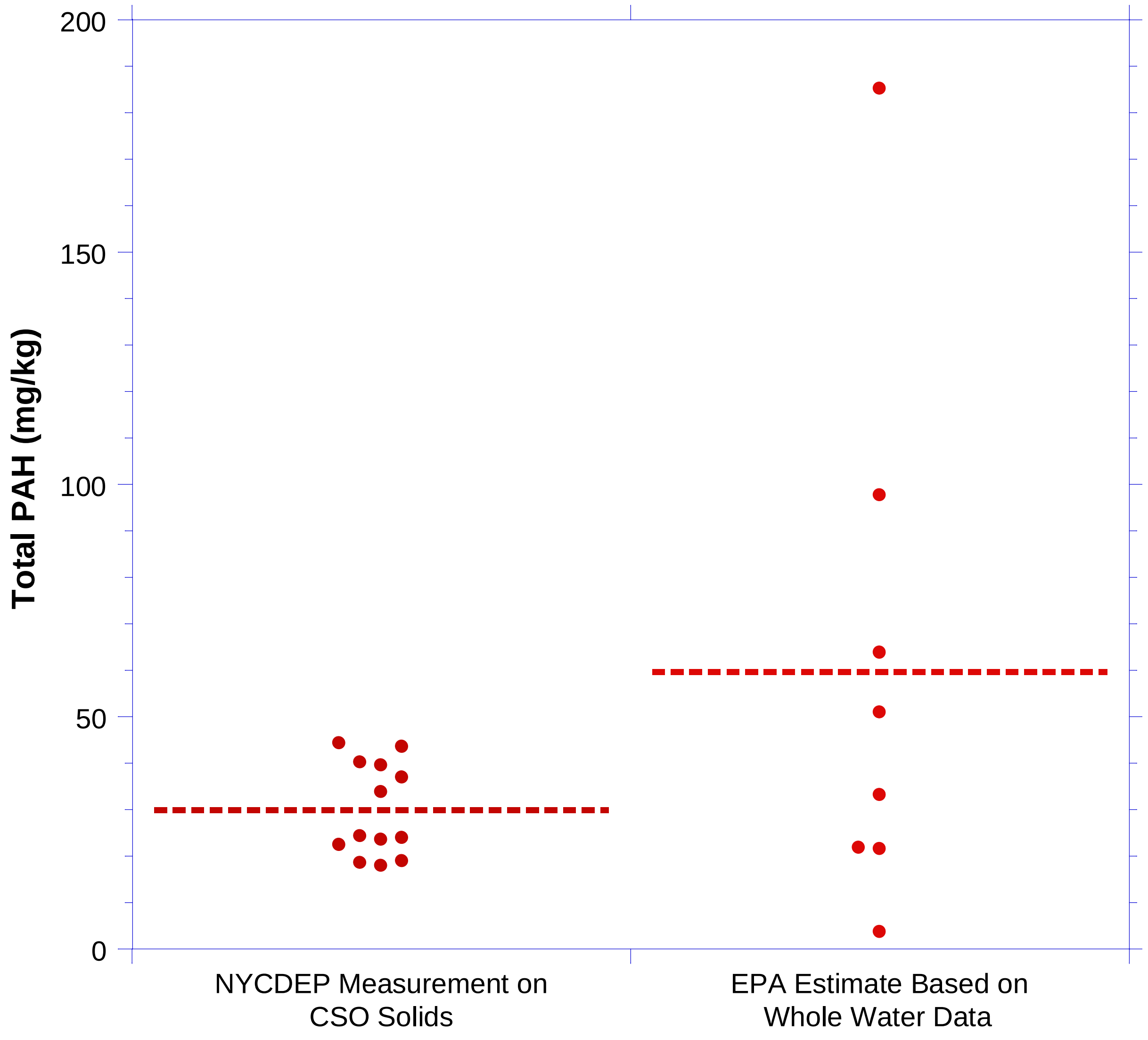
Environmental Protection

Analyses of Means and Standard Deviations of Shallow Sediment TPAH Concentrations

Gowanus Canal Superfund Site

Figure 3-20

April 2013



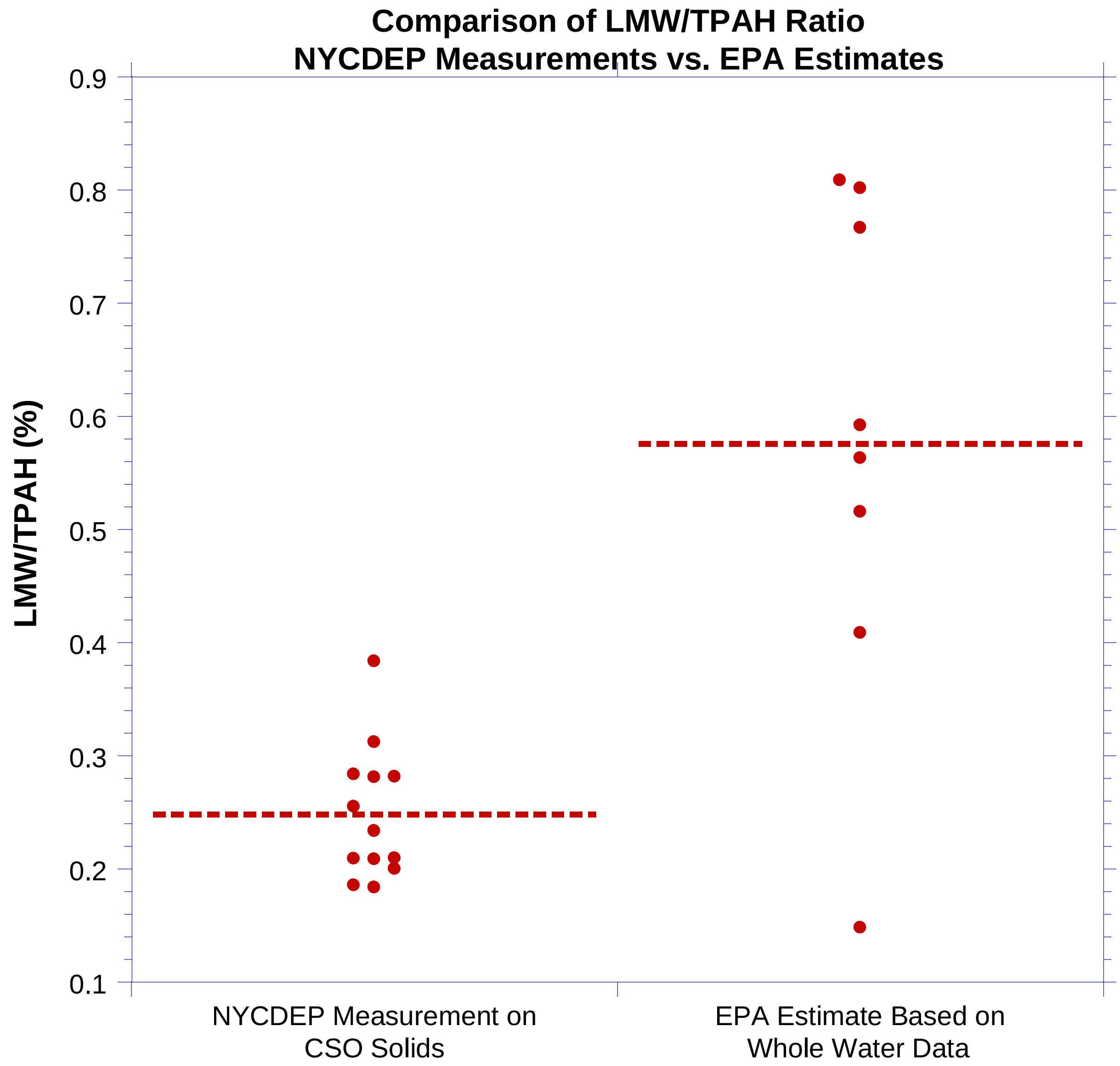
Environmental Protection

Comparison of Total PAH Concentrations in Solids from CSOs
NYCDEP Measurements vs. EPA Estimates

Gowanus Canal Superfund Site

Figure 3-21

April 2013



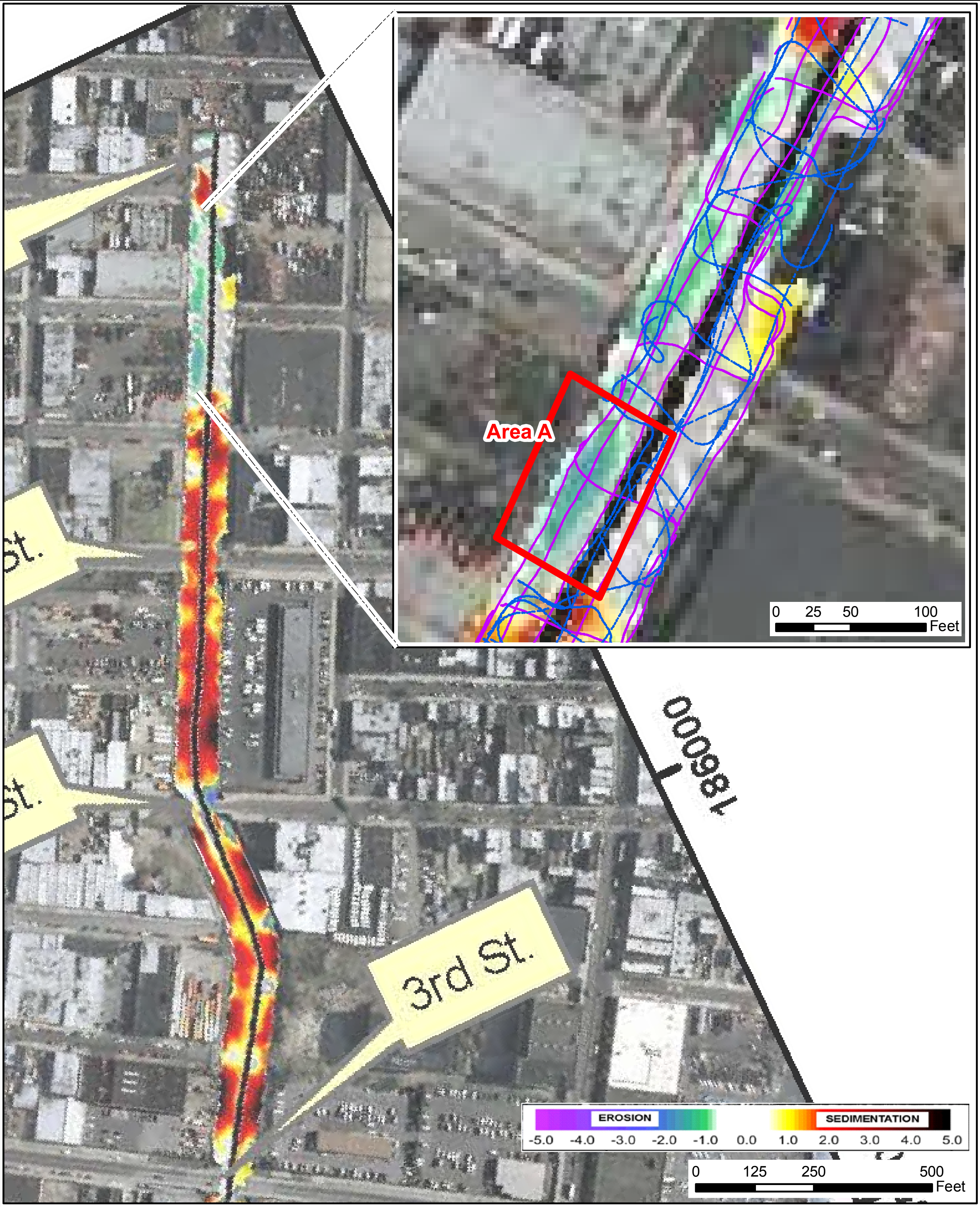
Environmental Protection

Comparison of LMW/TPAH Ratio in Solids from CSOs
NYCDEP Measurements vs. EPA Estimates

Gowanus Canal Superfund Site

Figure 3-22

April 2013



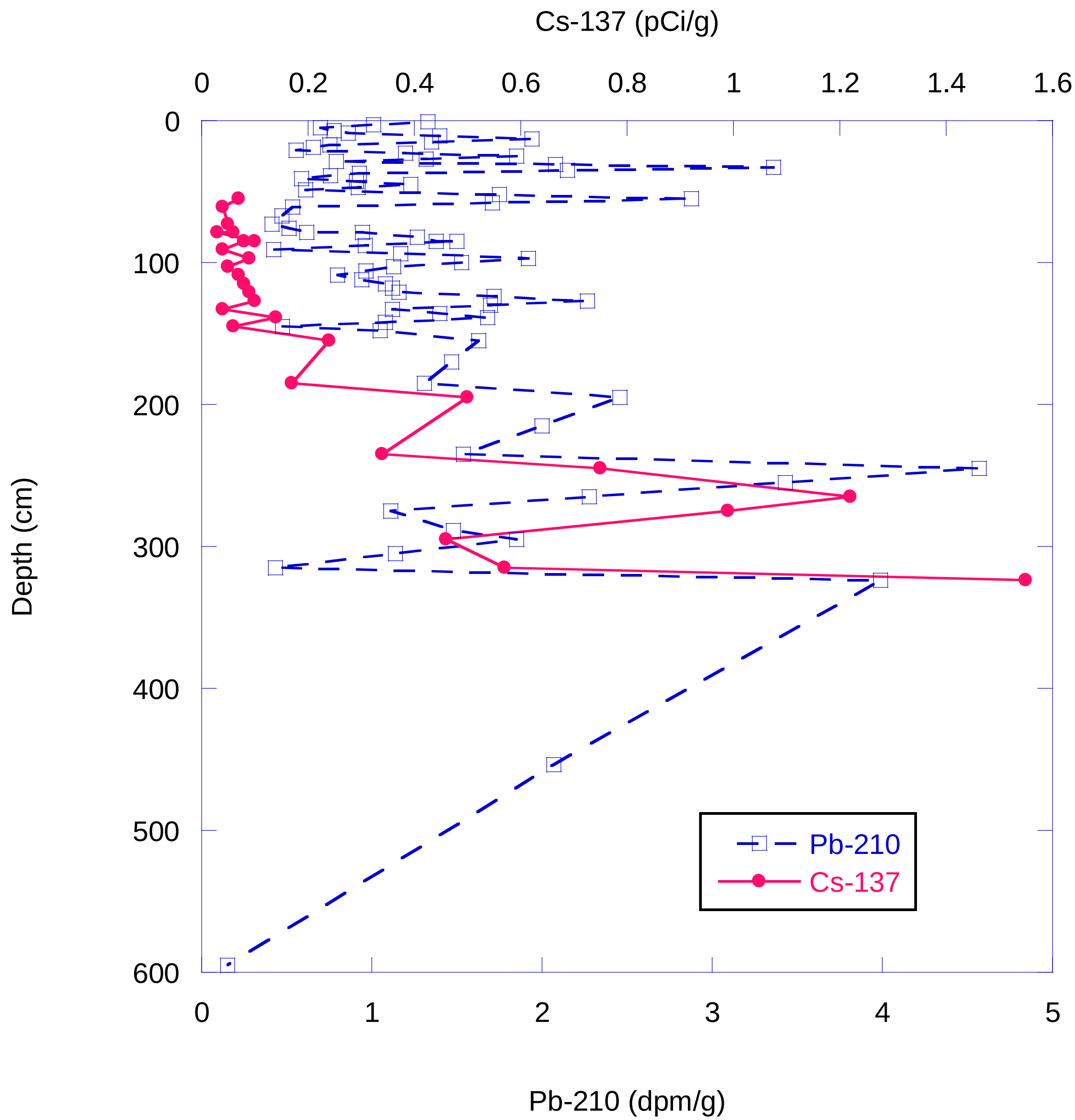
NYC Environmental Protection

Comparison of the 2003 and 2010 Bathymetric Surveys

Gowanus Canal Superfund Site

Figure 3-23

April 2013



Environmental Protection

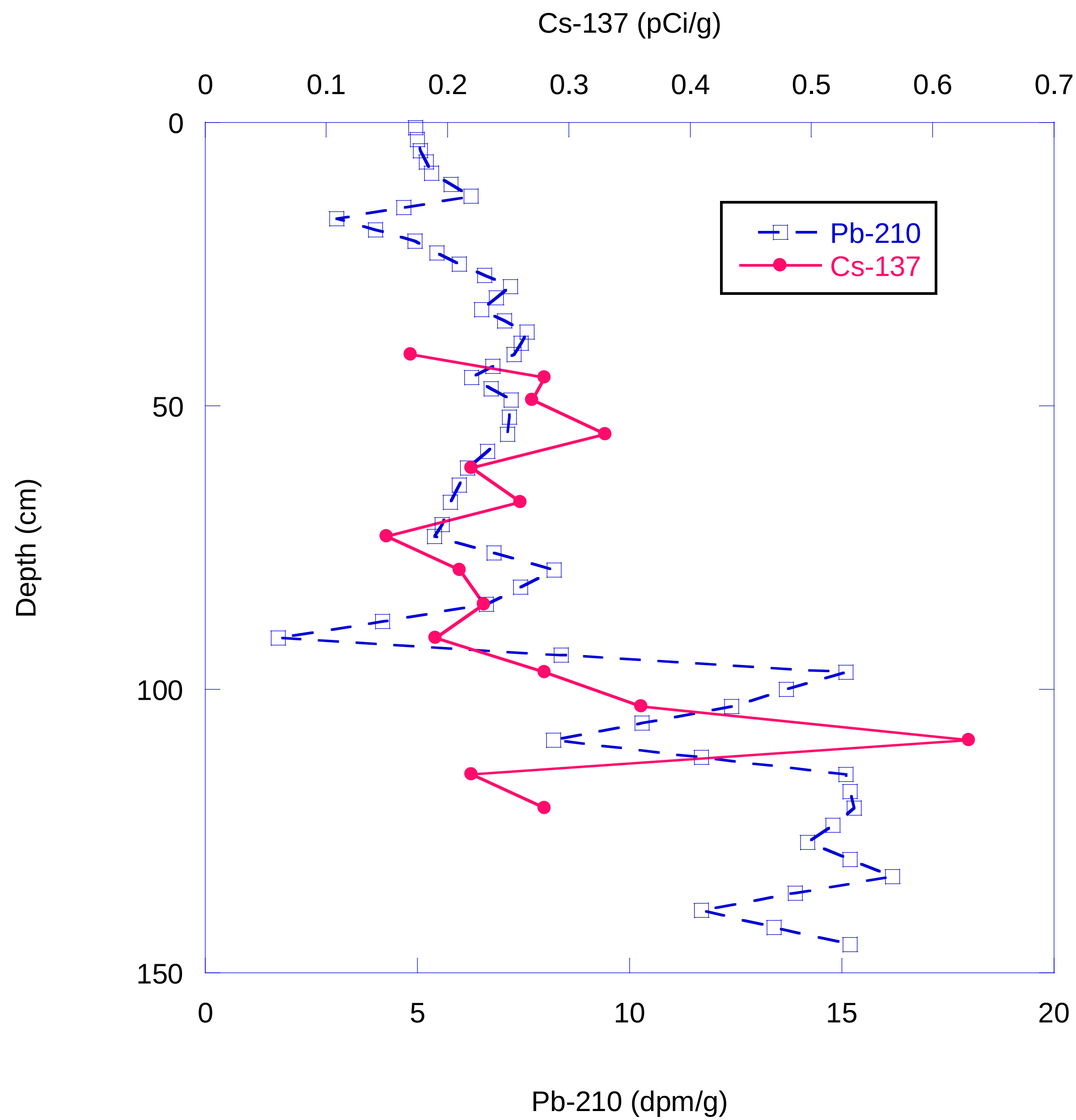
Core 1 – Gowanus Canal

Cs137 and Pb210 Radioisotope Profile

Gowanus Canal Superfund Site

Figure 3-24

April 2013



Environmental Protection

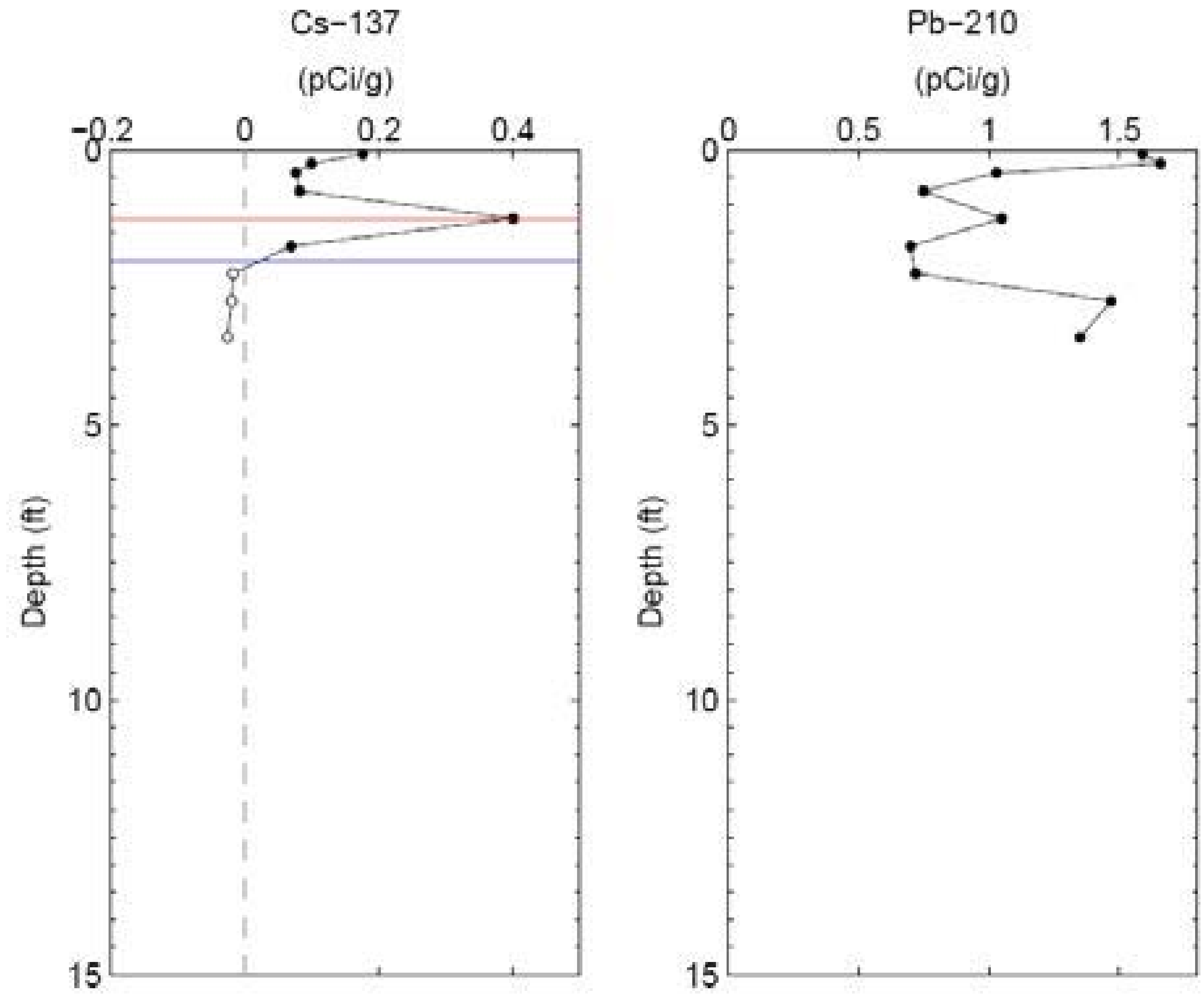
Core 12 – Gowanus Canal

Cs137 and Pb210 Radioisotope Profile

Gowanus Canal Superfund Site

Figure 3-25

April 2013



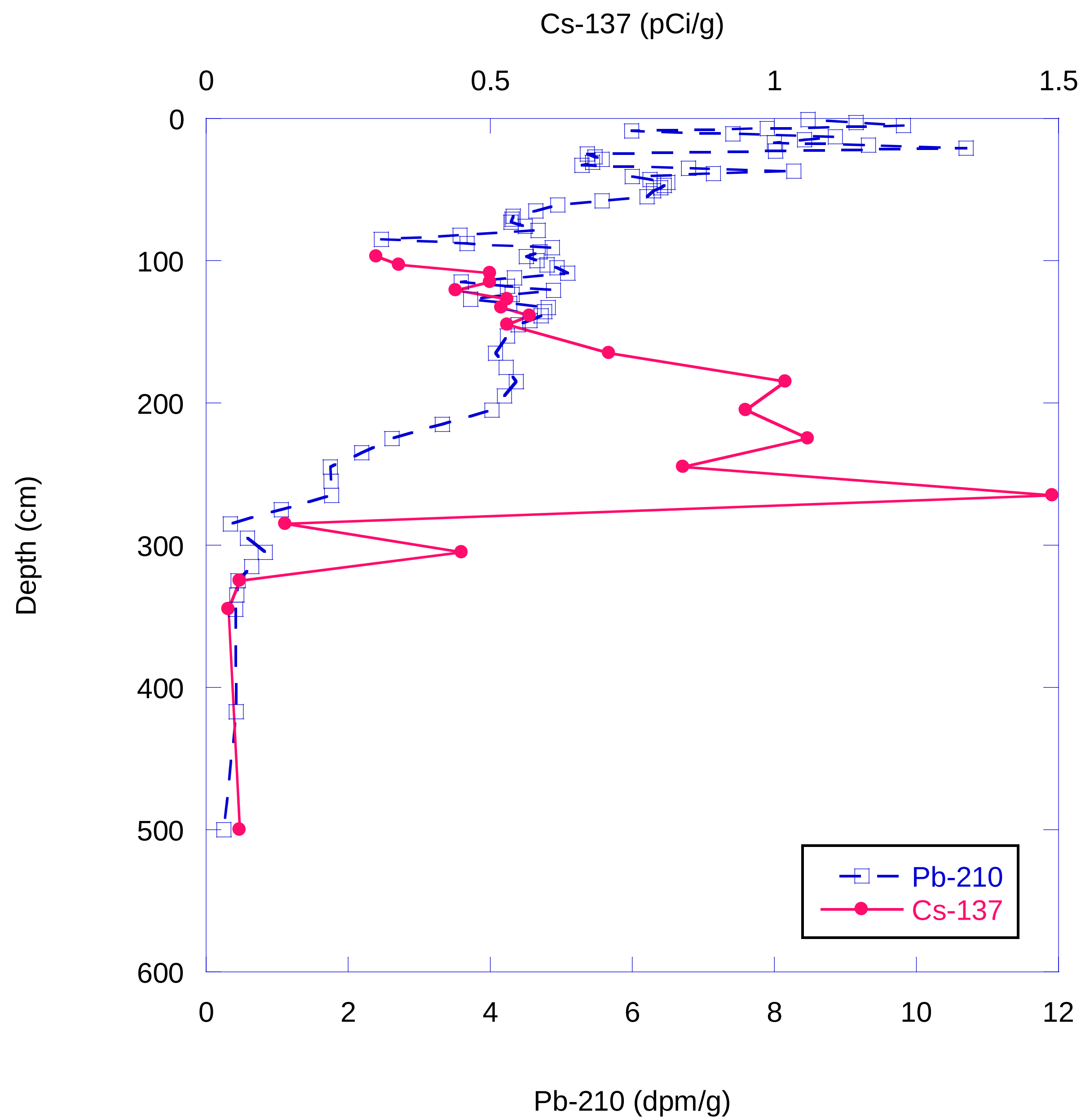
Newark Bay Core 23

Cs137 and Pb210 Radioisotope Profile

Gowanus Canal Superfund Site

Figure 3-26

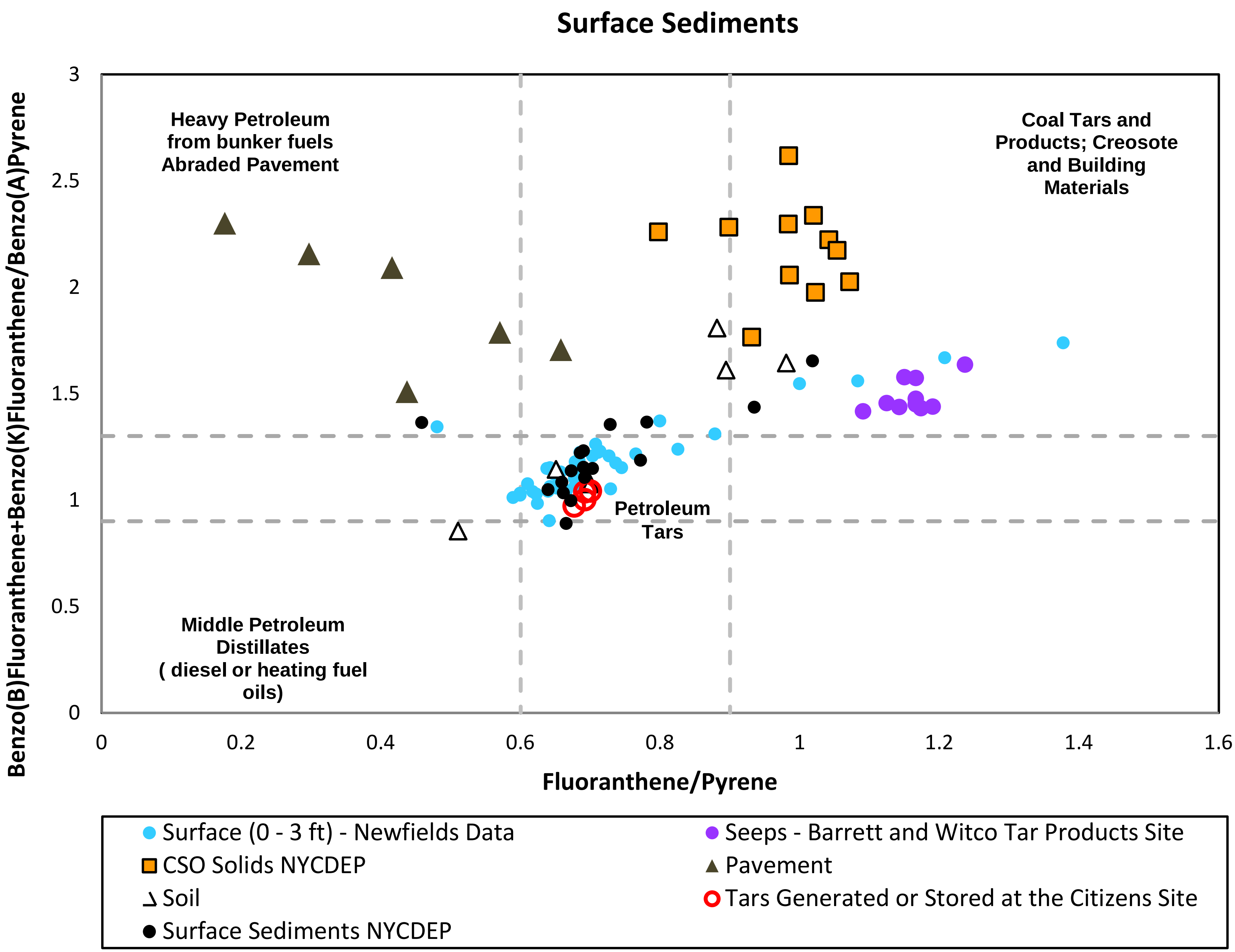
April 2013



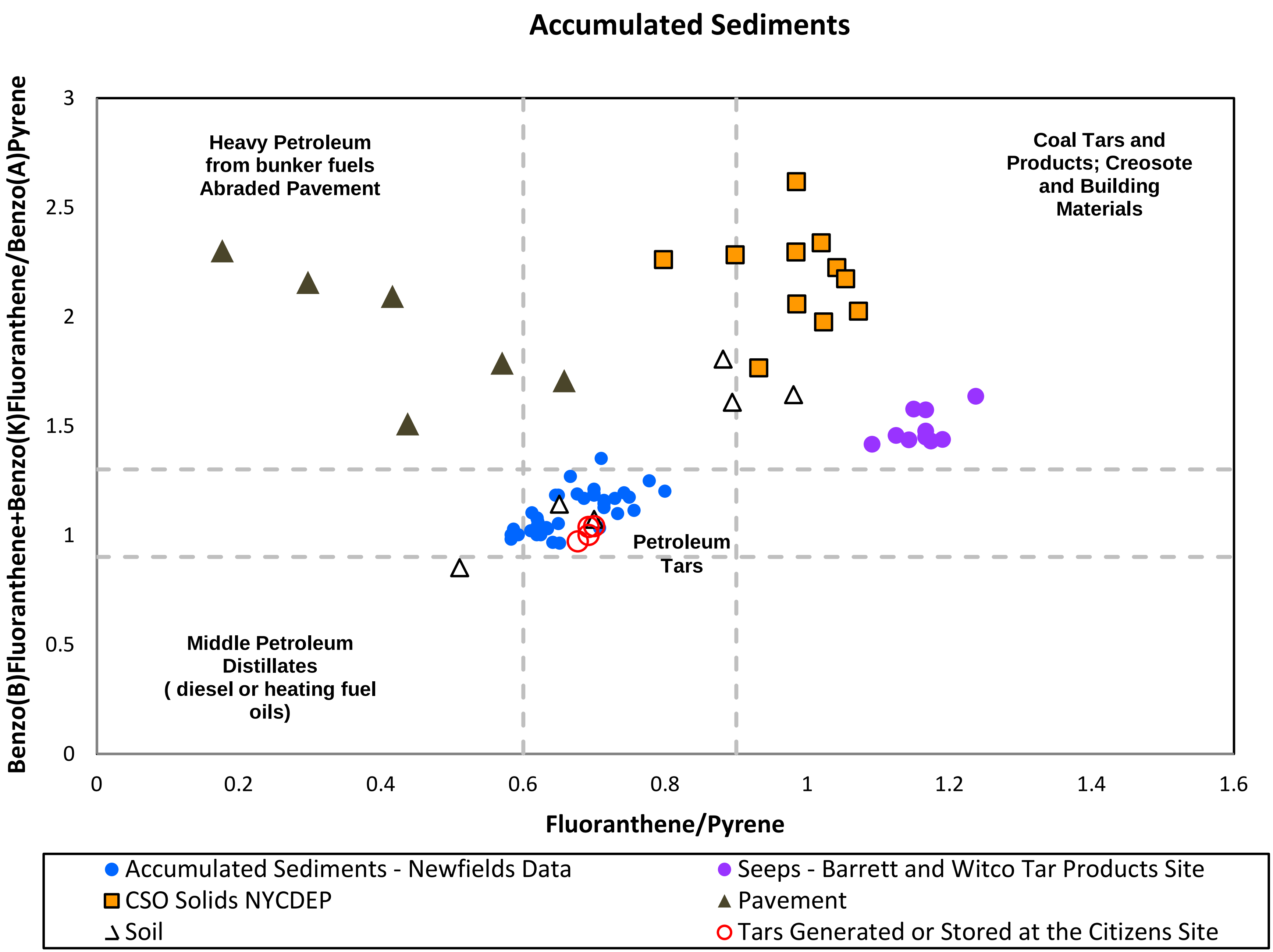
Core 88 – Gowanus Canal
Cs137 and Pb210 Radioisotope Profile
Gowanus Canal Superfund Site

Figure 3-27

April 2013



Environmental Protection	PAH Double Ratio Plot – Surface Sediments *Gowanus Canal Superfund Site*	Figure 5-1 April 2013



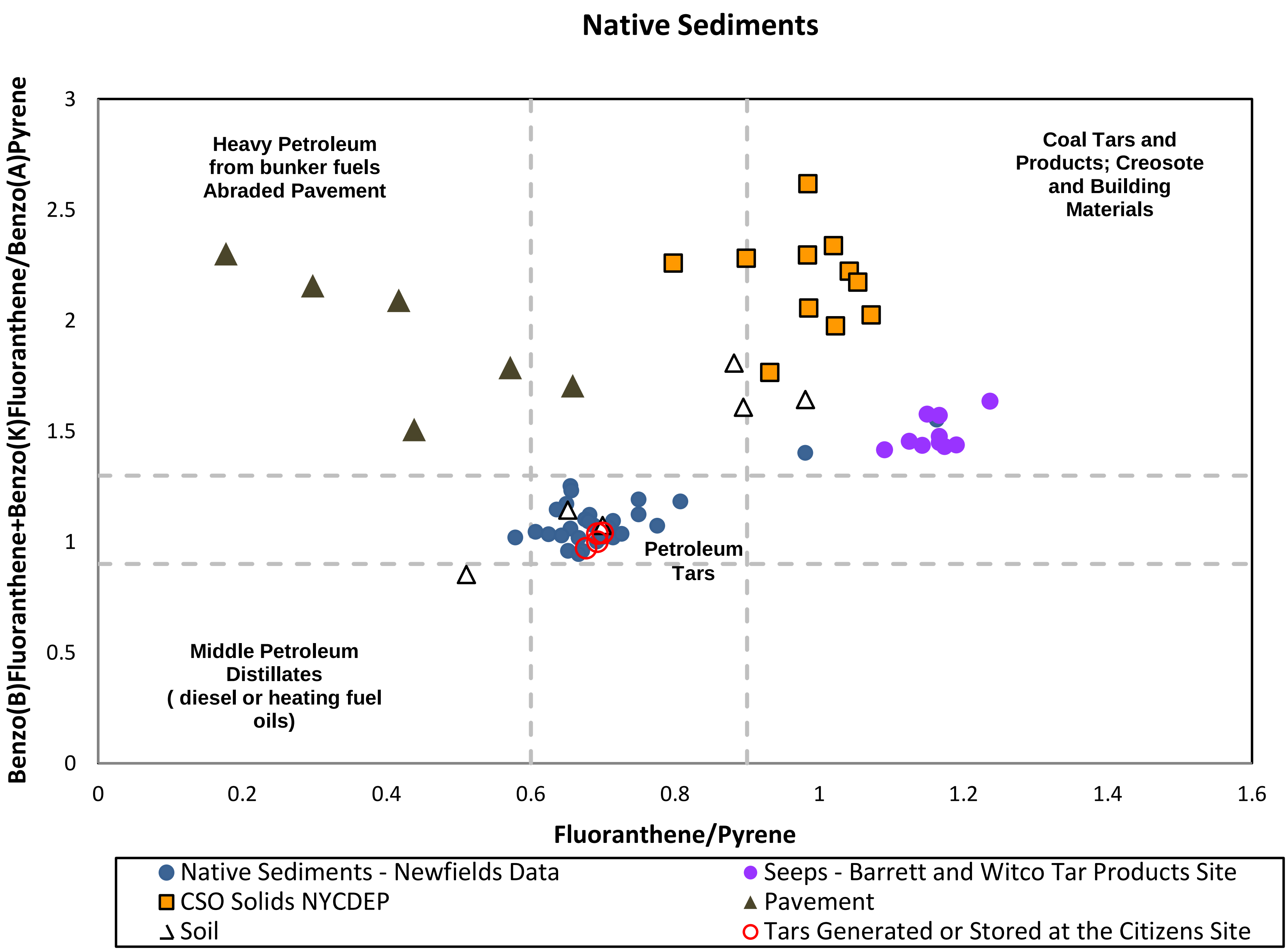
Environmental Protection

PAH Double Ratio Plot – Accumulated Sediments

Gowanus Canal Superfund Site

Figure 5-2

April 2013



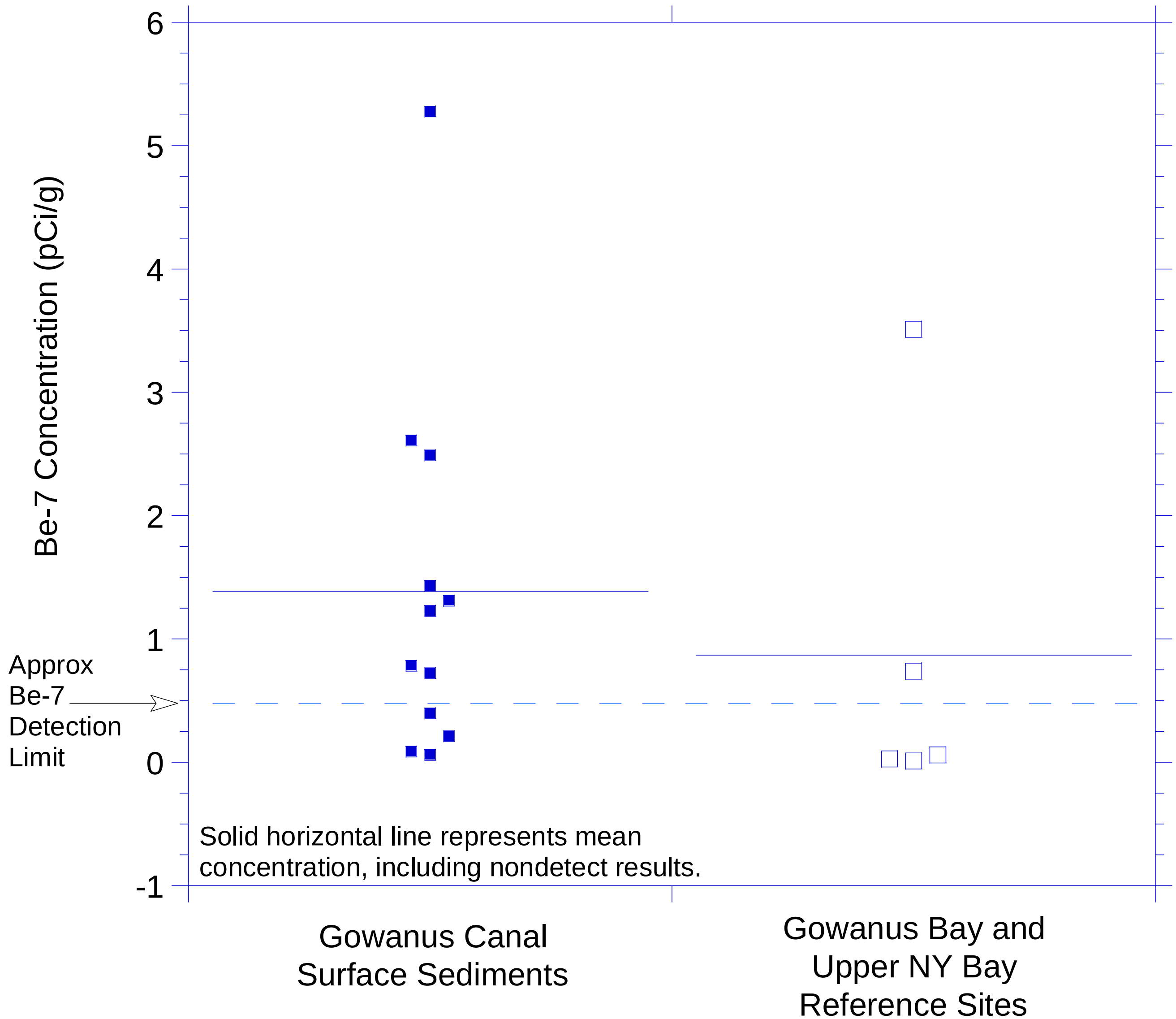
NYC Environmental Protection

PAH Double Ratio Plot – Native Sediments

Gowanus Canal Superfund Site

Figure 5-3

April 2013



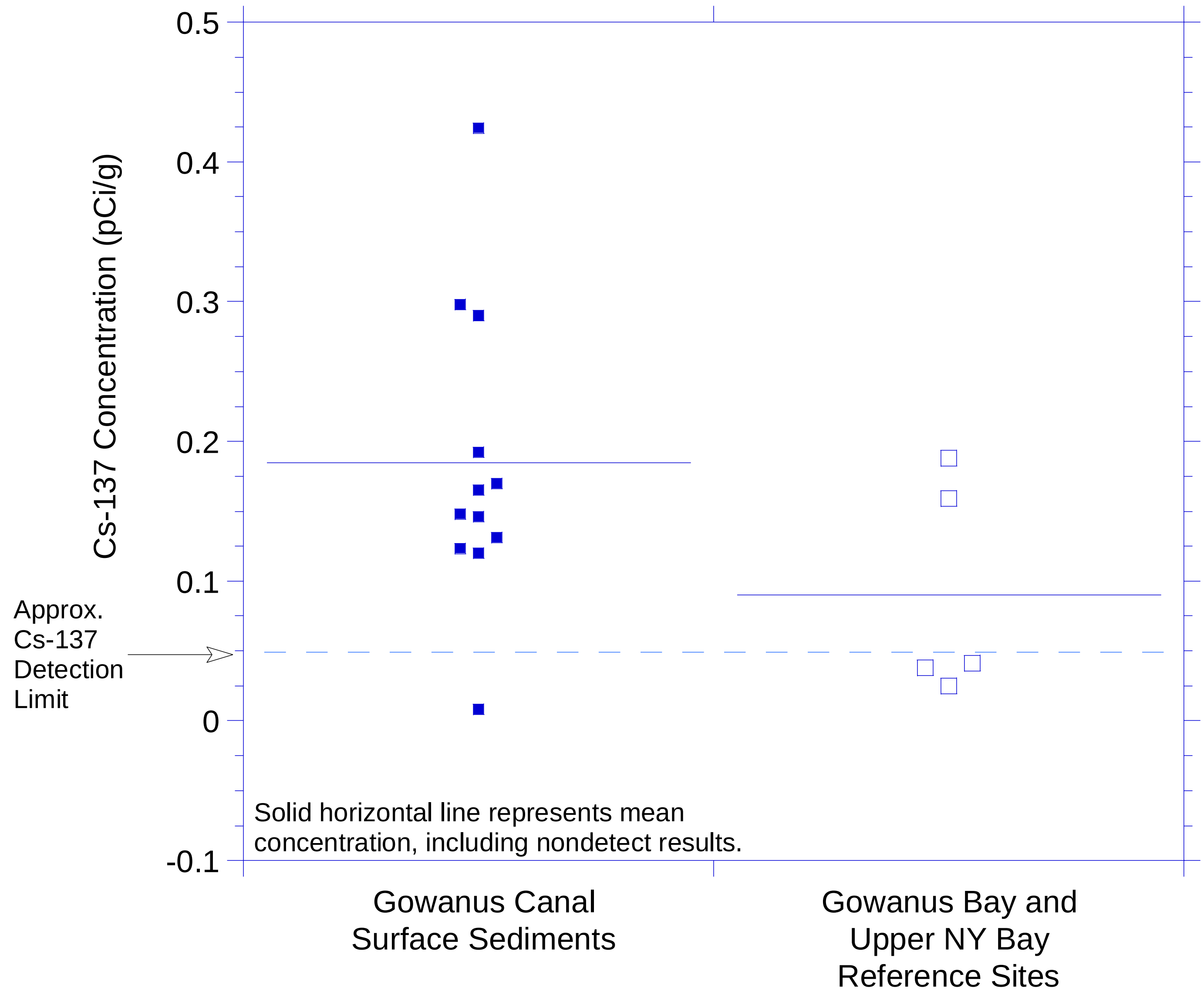
Environmental Protection

Be-7 Concentrations in Surface Sediments (0-2cm)

Gowanus Canal Superfund Site

Figure 6-1

April 2013



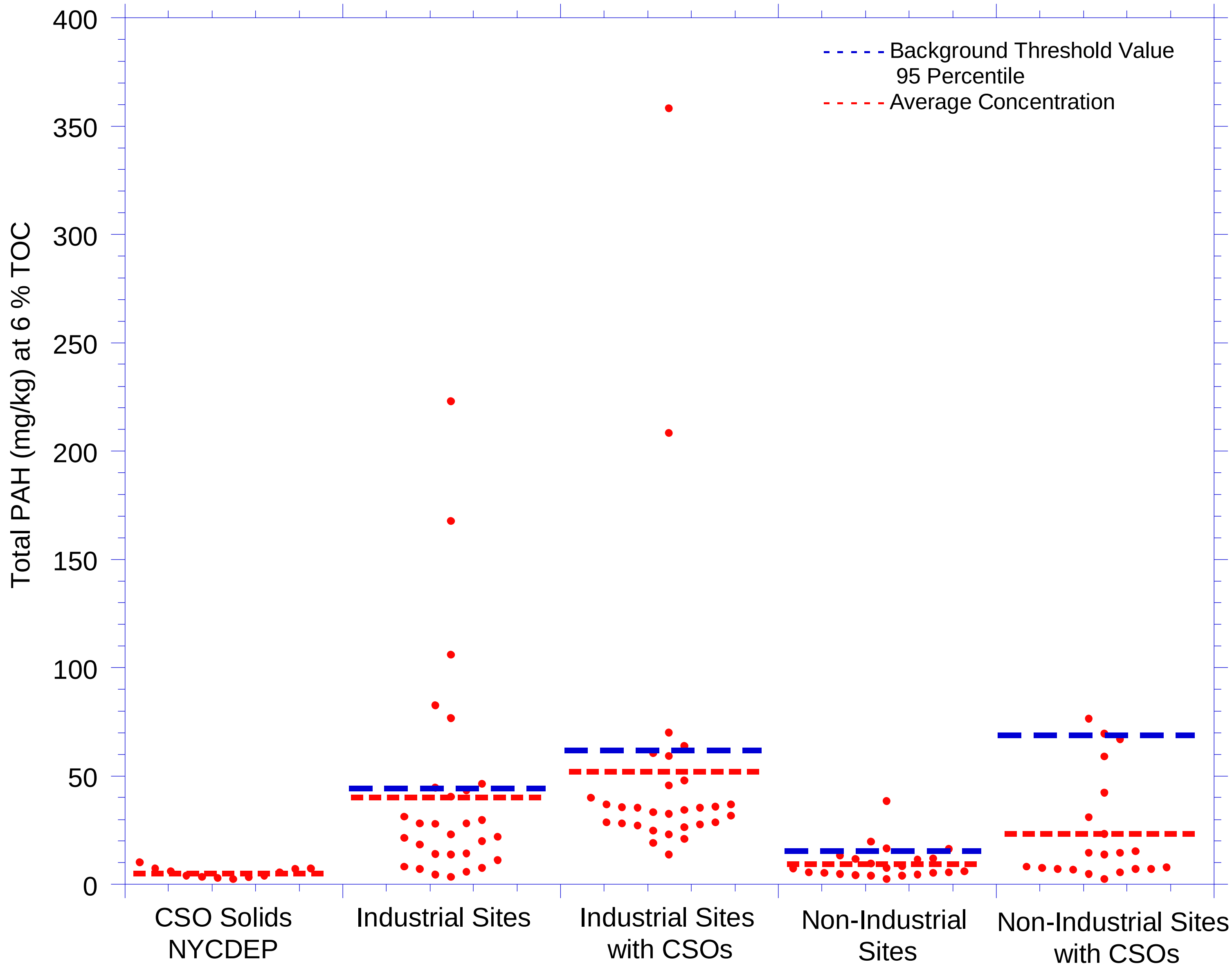
Environmental Protection

Cs-137 Concentrations in Surface Sediments (0-2 cm)

Gowanus Canal Superfund Site

Figure 6-2

April 2013

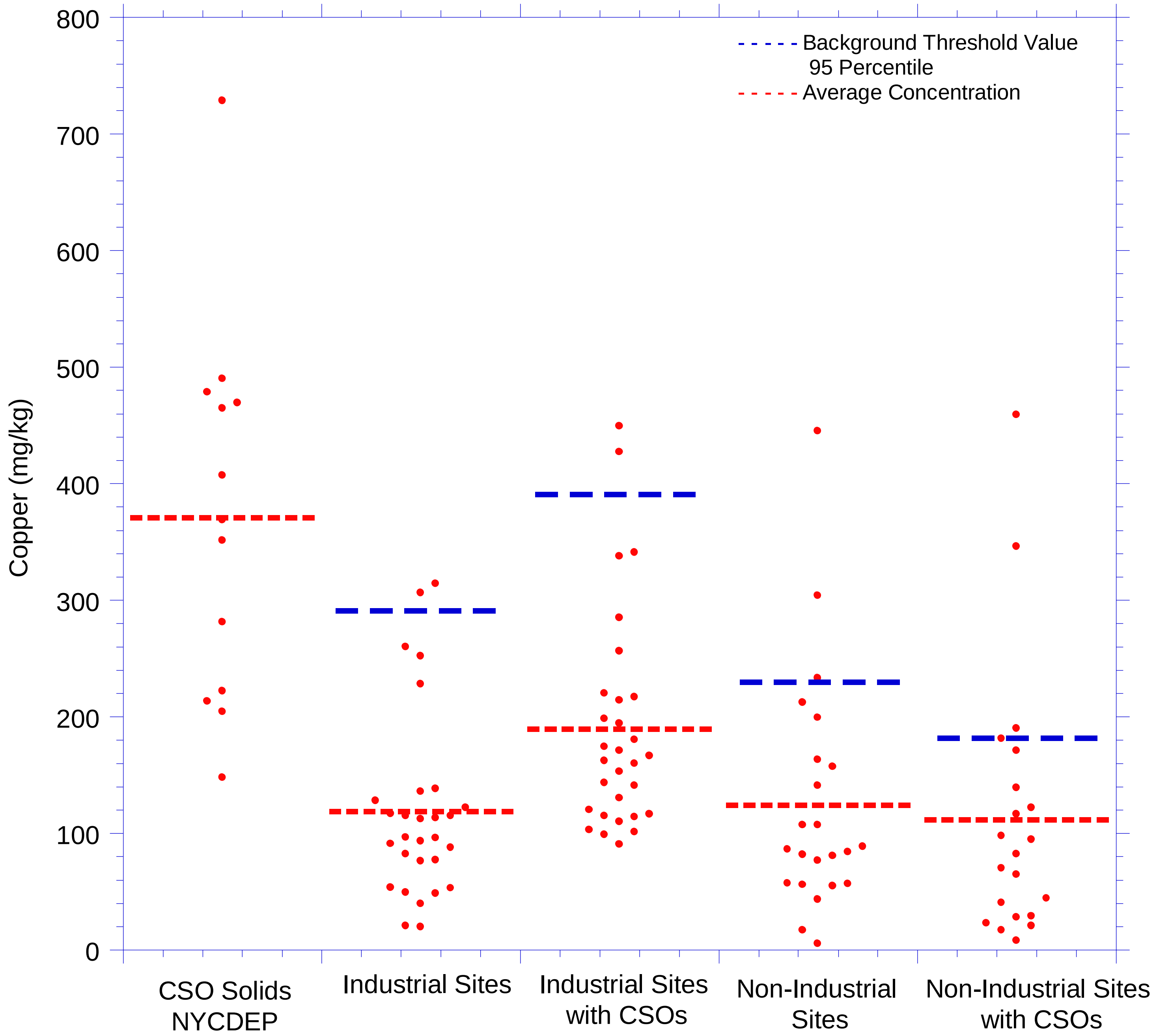


Comparison of CSO Solids and Candidate Reference Areas for Newtown Creek – TPAH at 6% TOC

Gowanus Canal Superfund Site

Figure 6-3

April 2013



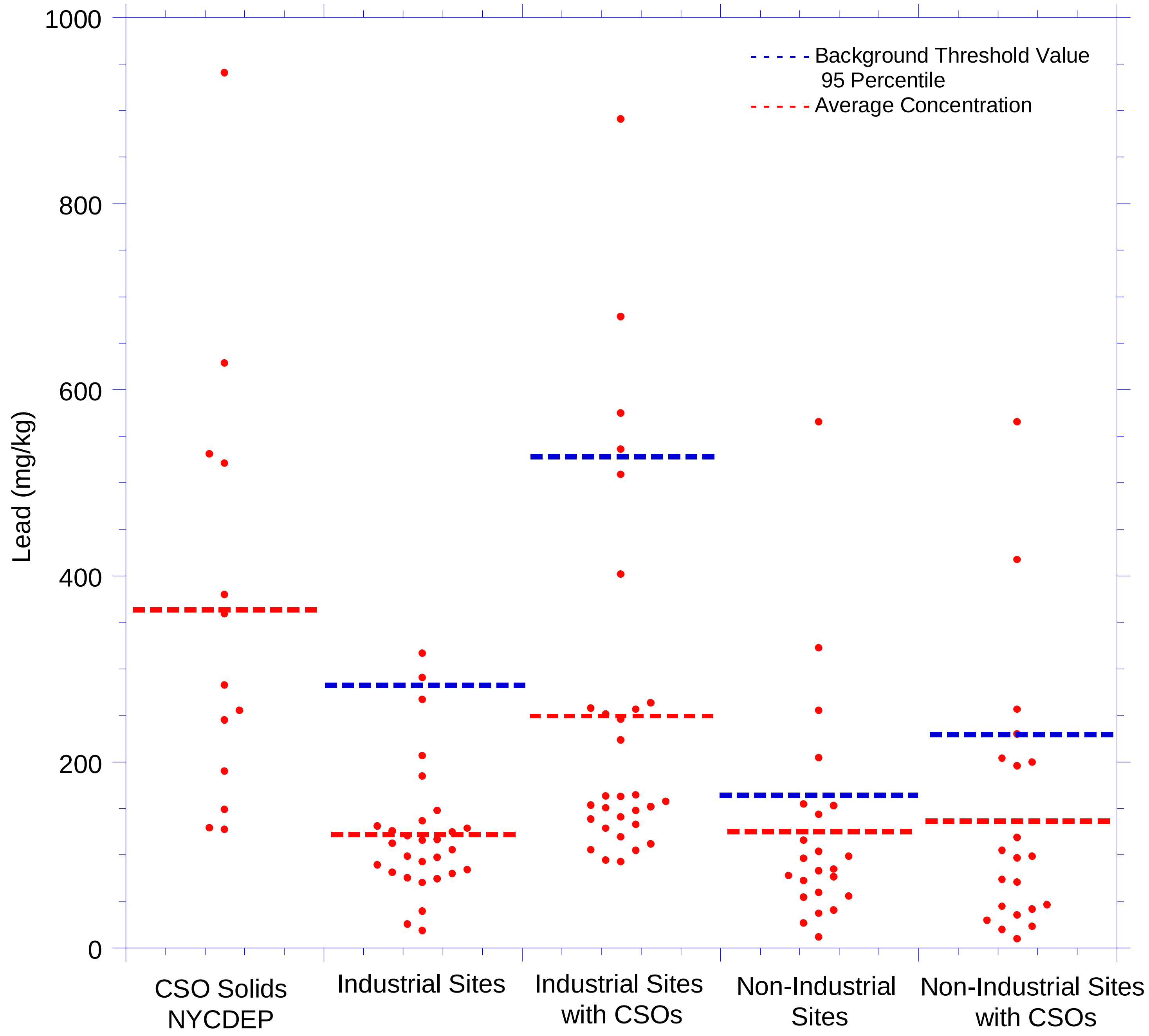
Environmental Protection

Comparison of CSO Solids and Candidate Reference Areas for Newtown Creek - Copper

Gowanus Canal Superfund Site

Figure 6-4

April 2013



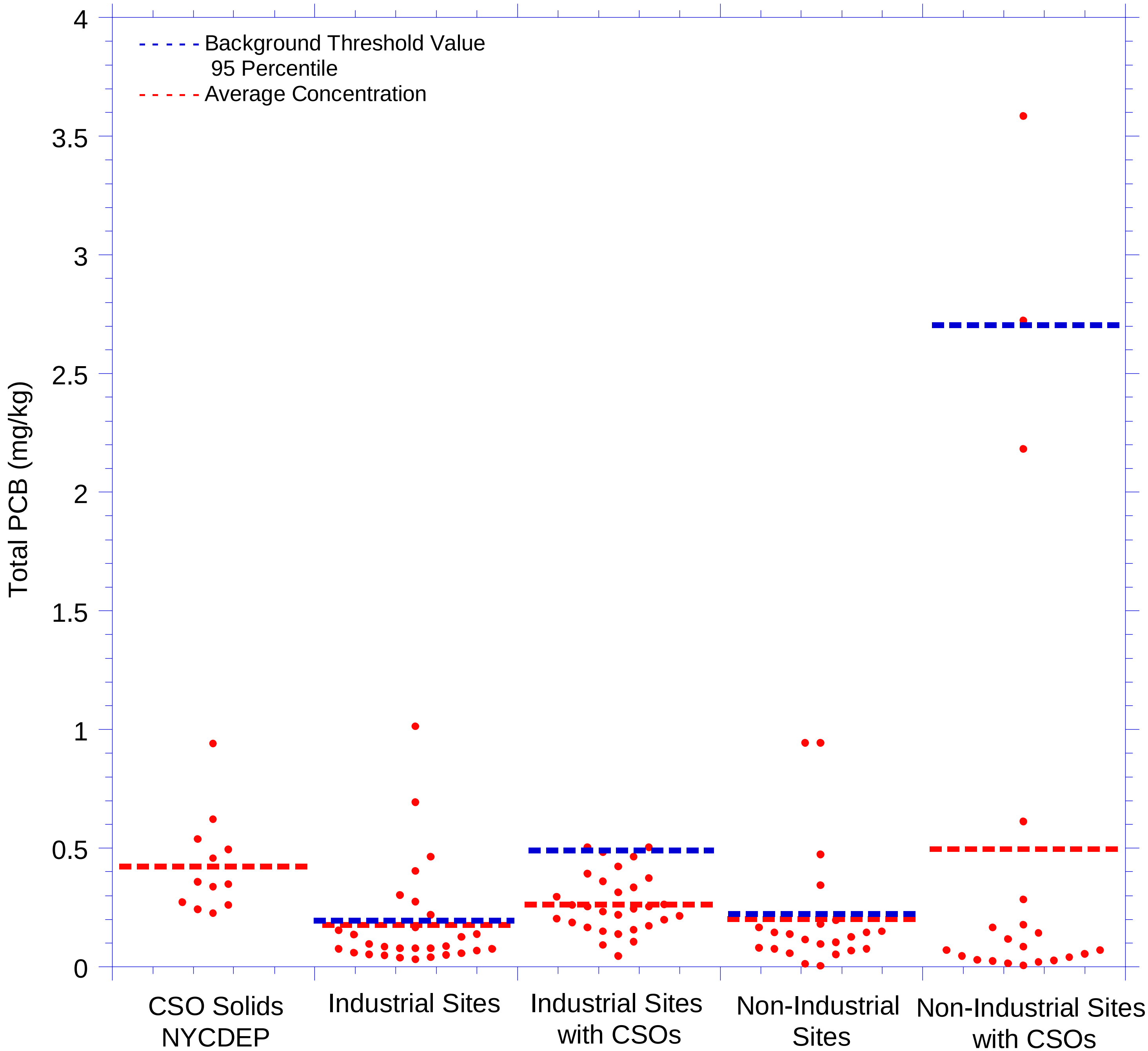
Environmental Protection

Comparison of CSO Solids and Candidate Reference Areas for Newtown Creek - Lead

Gowanus Canal Superfund Site

Figure 6-5

April 2013



Environmental Protection

Comparison of CSO Solids and Candidate Reference Areas for Newtown Creek - TPCB

Gowanus Canal Superfund Site

Figure 6-6

April 2013

Environmental Protection

EPA REMAP Stations in New York and New Jersey Harbors

Gowanus Canal Superfund Site

Figure 8-1

April 2013

New York City Department of Environmental Protection
Sediment Sampling Stations from 1992

Gowanus Canal Superfund Site

Figure 8-2

April 2013

Note: NYC DEP sampling sites from 1992 are displayed in purple. EPA 1998 sampling sites are displayed in black.

Environmental Protection	All Sampling Stations REMAP 1998 and NYCDEP 1992 *Gowanus Canal Superfund Site*	Figure 8-3 April 2013

Note: Upper harbor sites are displayed in red. All other sites are displayed in black.

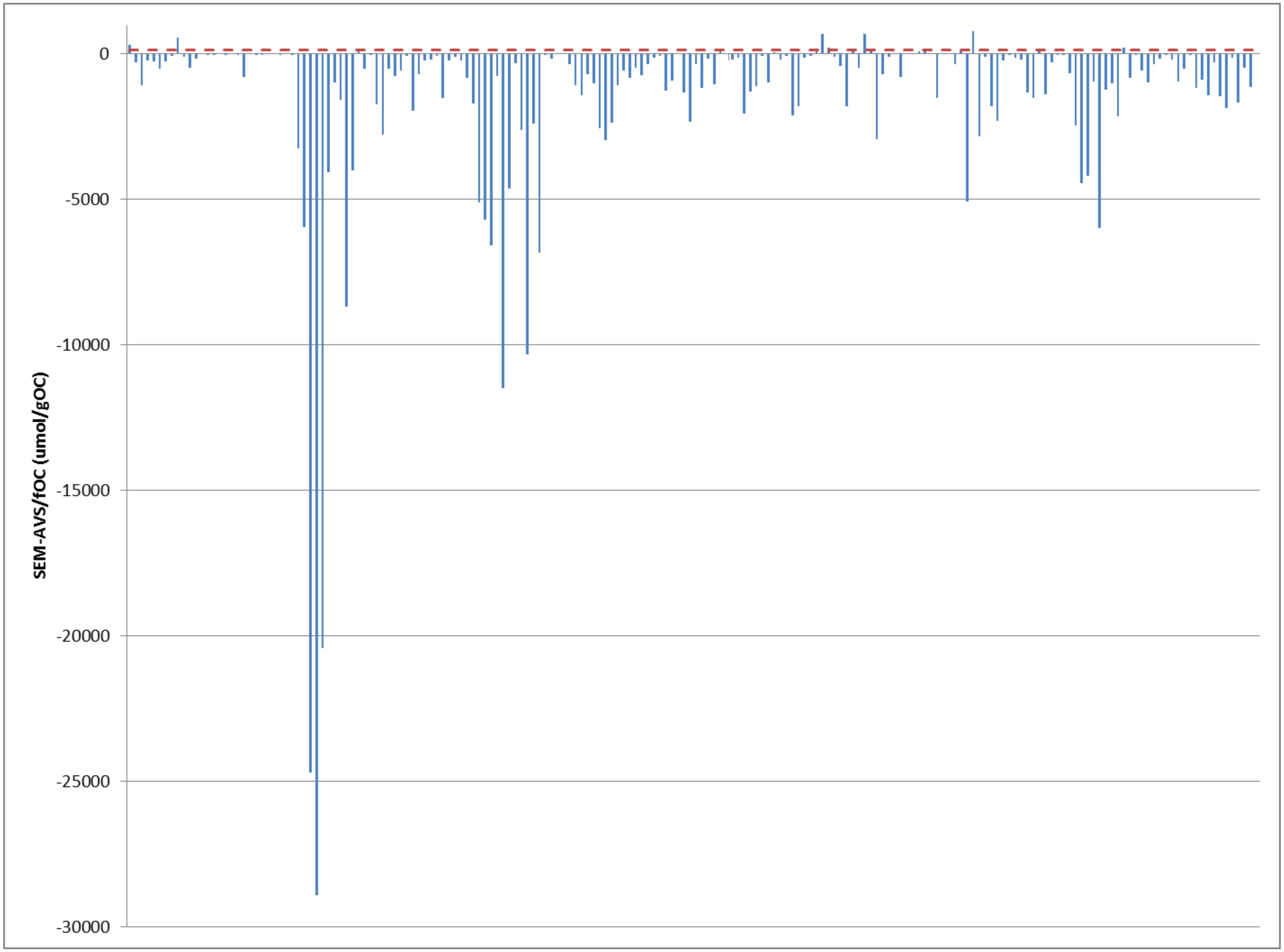
NYC Environmental Protection

Upper Harbor Sites from Combined 1992 and 1998 Sampling Programs

Gowanus Canal Superfund Site

Figure 8-4

April 2013



Note:
Toxicity is likely when the (∑SEM-AVS)/*f*OC is >3,000 µmol/gOC, uncertain when the concentration is between 130 and 3,000 µmol/gOC, and not likely when the concentration is <130 µmol/gOC (EPA 2005). The red line represents ∑SEM-AVS)/*f*OC = 130. Of a total of 188 samples, only 11 are higher than 130 µmol/gOC, and the maximum value was 775 µmol/gOC (well below the 3,000 µmol/gOC threshold).

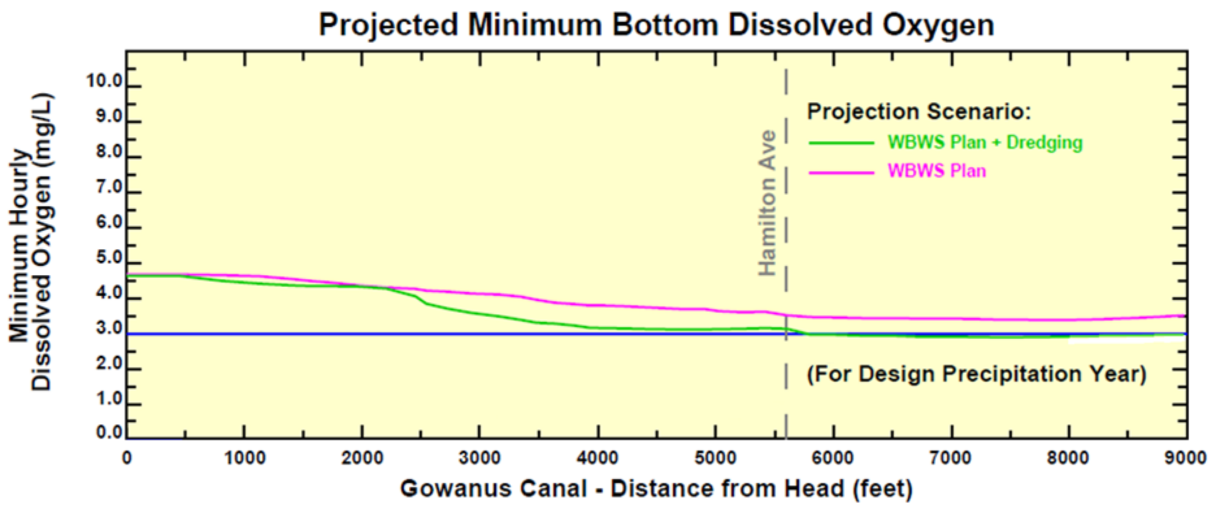
Environmental Protection

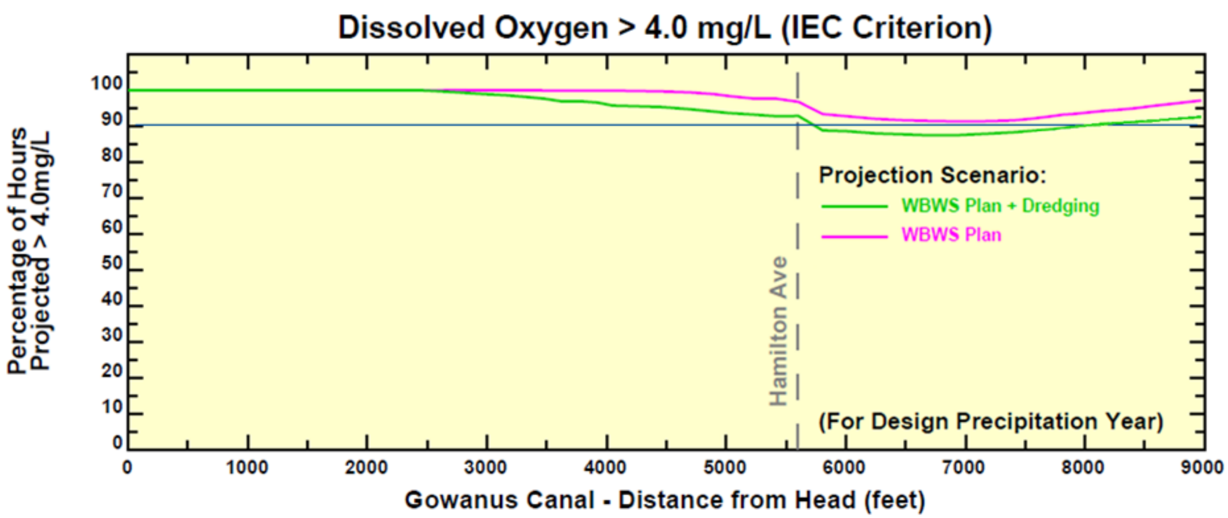
All New York/New Jersey Harbor Sediment Sampling AVS-SEM Results

Gowanus Canal Superfund Site

Figure 8-5

April 2013





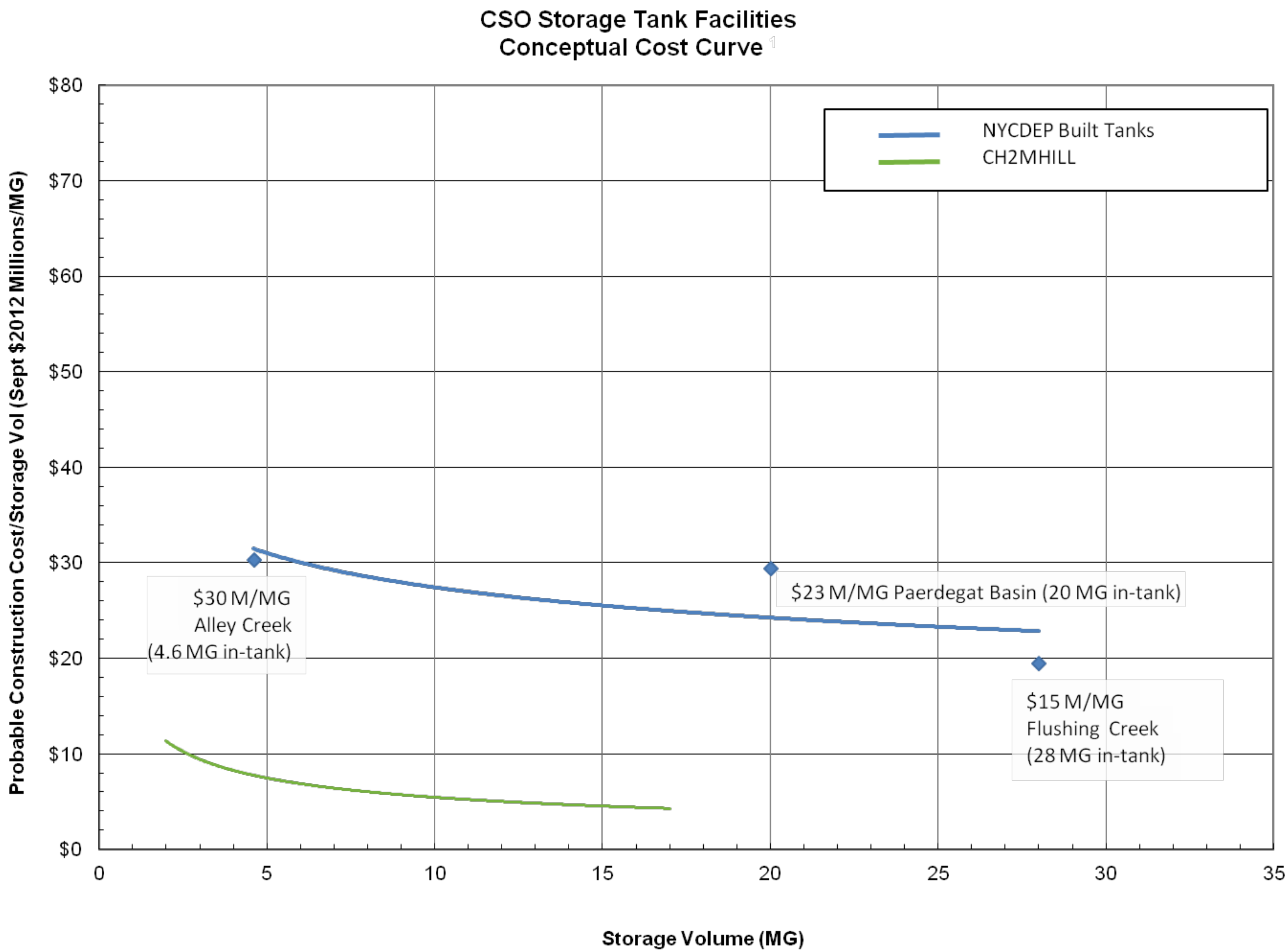
NYC Environmental Protection

Dissolved Oxygen in the Canal Post WQIP

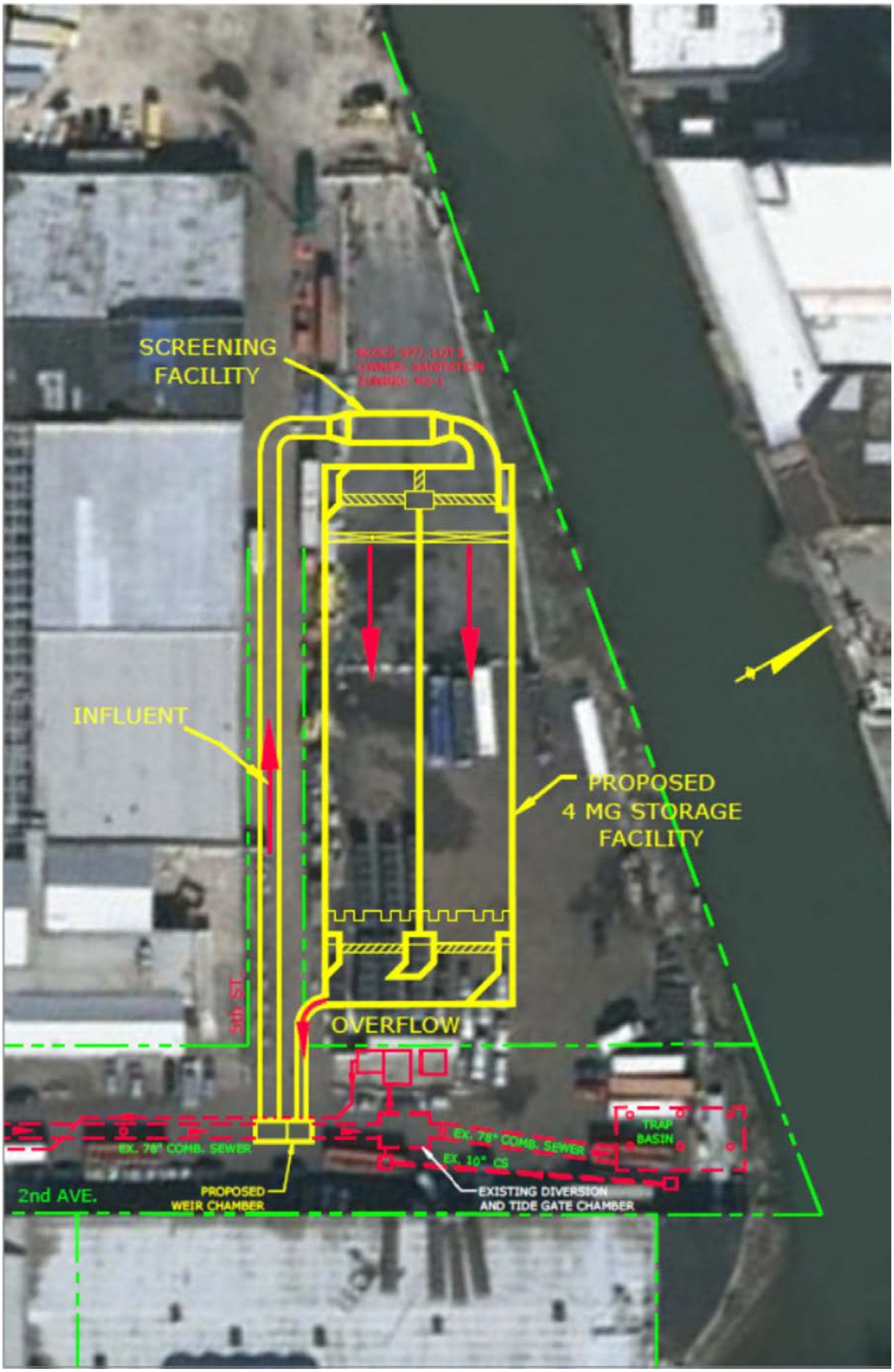
Gowanus Canal Superfund Site

Figure 11-1

April 2013



	DEP LTCP CSO Tank Costs	Figure 12-1
	Gowanus Canal Superfund Site	April 2013



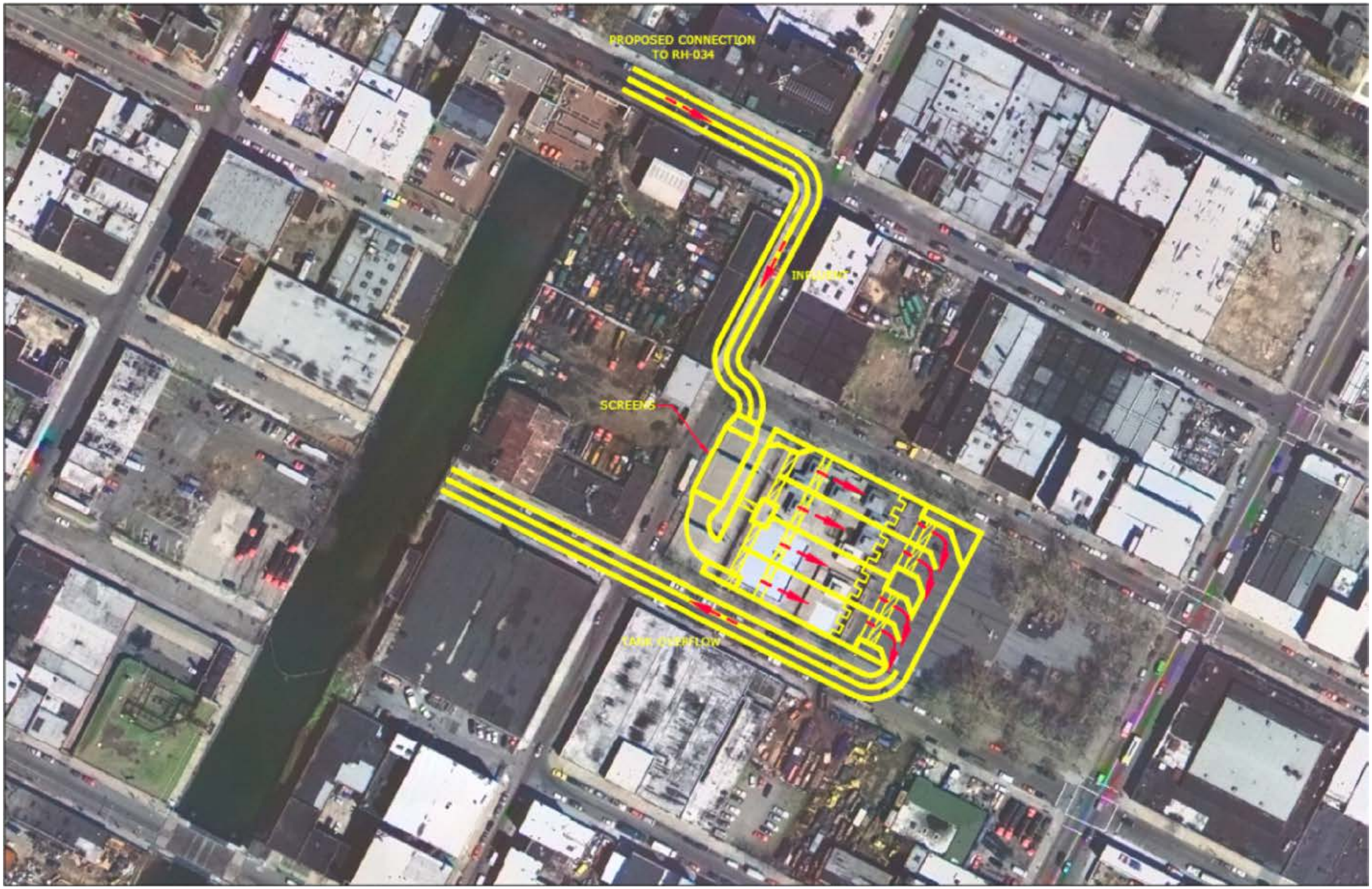
Environmental Protection

Proposed 4-MG CSO Tank at DOS Site

Gowanus Canal Superfund Site

Figure 12-2

April 2013



Configuration of 8-MG CSO Tank at Parks Department Site

Gowanus Canal Superfund Site

Figure 12-3

April 2013

NYC Environmental Protection