United States
Environmental Protection
Agency
Environmental Services Division

Region 10
1200 Sixth Avenue
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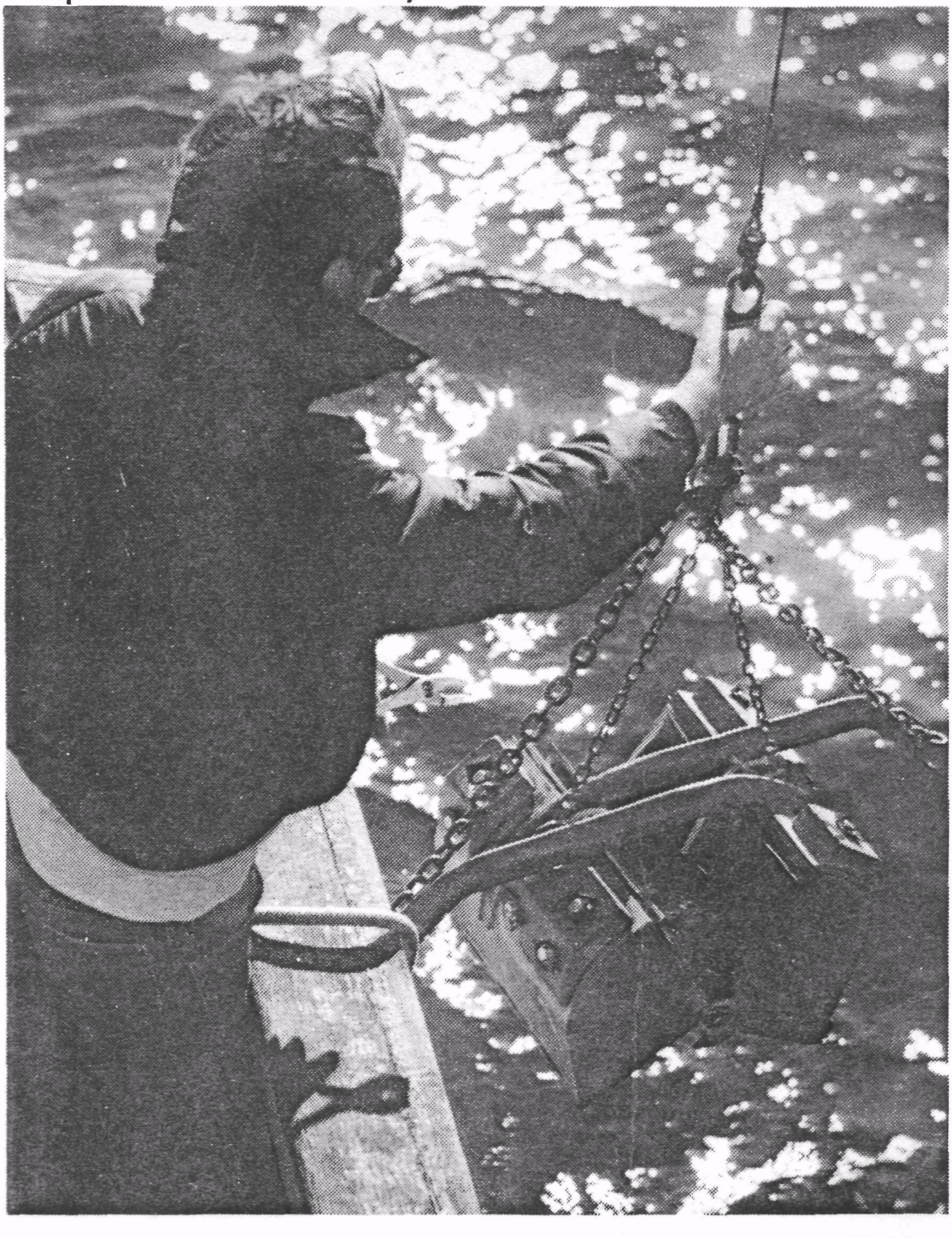
Alaska
Idaho
Oregon
Washington
July, 1983

EPA

Commencement Bay Deep Water Sediment Investigation

Tacoma, Washington
September 15-17, 1982



COMMENCEMENT BAY DEEP WATER SEDIMENT INVESTIGATION

TACOMA, WASHINGTON

SEPTEMBER 15 - 17, 1982

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JULY 1983

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INTRODUCTION

Commencement Bay is located at the southern end of the Main Basin of Puget Sound (Figure 1). It serves as a natural deep water port for the City of Tacoma. Located along the southeastern shore are eight commerical waterways, one of which is the Puyallup River, the principal source of fresh water to the Bay. The nearshore land areas are heavily industrialized. Serious concerns have been raised about the effects of current and past waste disposal practices and their effects on the marine environment. For several years, investigations to determine the sources, distribution, fate and effects of toxic wastes have been conducted by the National Oceanic and Atmospheric Administration (NOAA), the Washington State Department of Ecology (WDOE), the Environmental Protection Agency (EPA), and other agencies. These studies have documented elevated levels of contaminants, toxicity to bottom-dwelling biological organisms, increased incidence of diseased fish, and accumulation of some contaminants in edible portions of fish and shellfish.

Most of the investigations have focused on the shallower waters near the shore and the industrilized waterways. A limited amount of work was done in the deeper, central portions of the bay. Concerns have been raised regarding the levels and distribution of contaminants in the deepwater areas by records of waste dumping at designated sites, by the use of the Bay as a disposal site for dredge spoil, and by the possibility of the migration of contaminants from the shallow areas to deeper water. During the period of September 15 to 17, 1982, 46 sediments were collected from the deepwater portions of Commencement Bay. This study was conducted to obtain additional data on the distribution of contaminants in the deep water bottom sediments. The results are presented as a data report to complement evaluations of contamination problems in the Bay.

STUDY SCOPE

The study covered the entire area inside of a line from Point Defiance to Dash Point. The survey area and locations of stations are shown in Figure 2. Within the area, sample locations were selected in two ways. One set of samples was taken on a rectangular grid pattern with 1/2 mile spacing, and a second set of samples was taken at discretionary locations chosen from acoustic sub-bottom profiling information. For the purpose of this study deep water was defined as water depth of 100 feet or greater.

SAMPLING AND ANALYTICAL PROCEDURES

SAMPLING PROCEDURE

Prior to obtaining sediments samples, 3.5 kHz acoustic sub-bottom tracklines were run across the Bay to determine the thickness of bottom sediment and to locate possible dumpsites or other areas of high sediment accumulation. A radar ranging system was used for navigational control. Navigational accuracy was $\pm$ 2 meters to a distance of 40 nautical miles.

One sediment sample was collected per station using a .1 meter Van Veen grab sampler. The sediment (approximately the top 10 cm.), not in direct contact with the interior of the sampler was transferred to the sample containers with stainless steel spatulas.

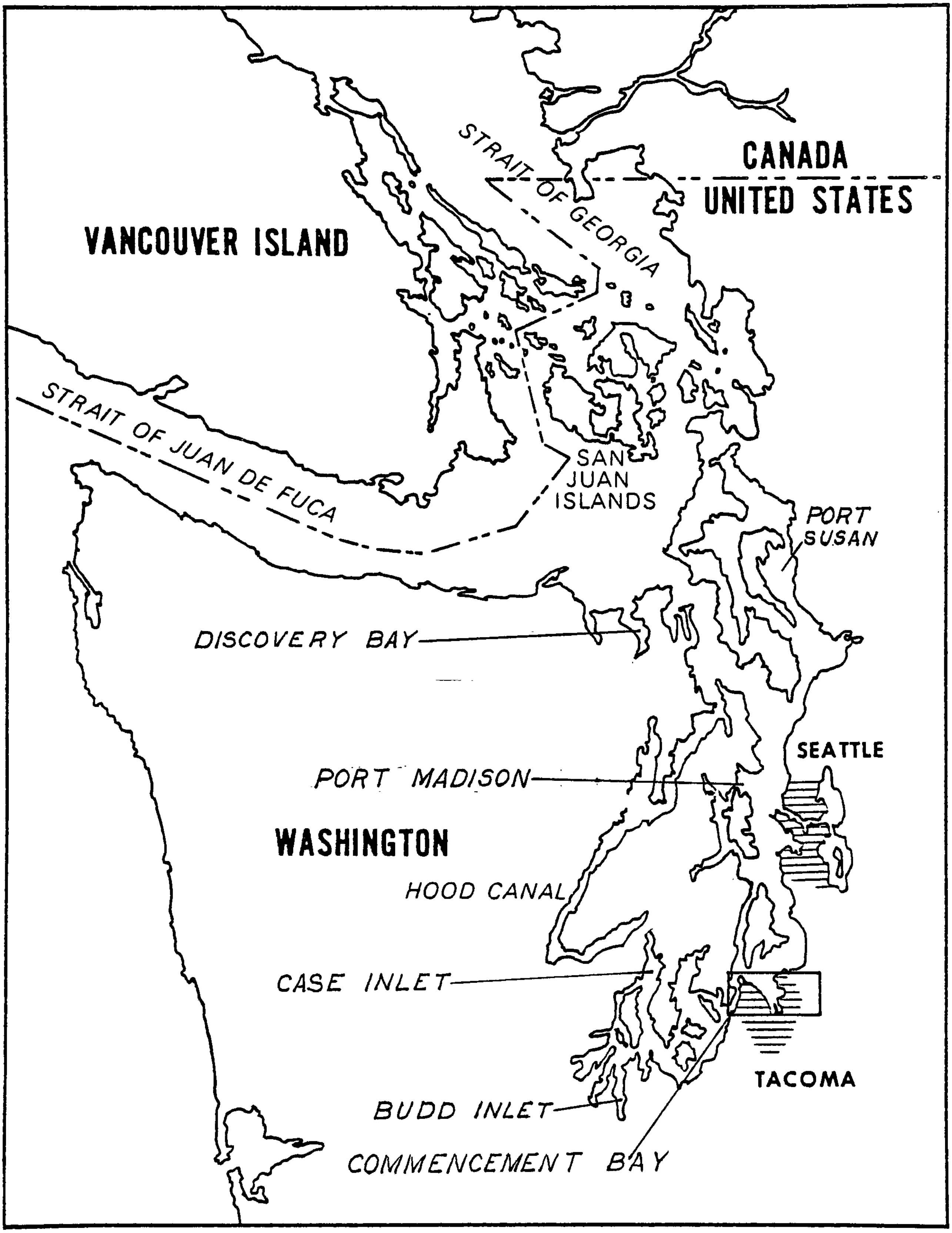


FIGURE 1

LOCATION MAP

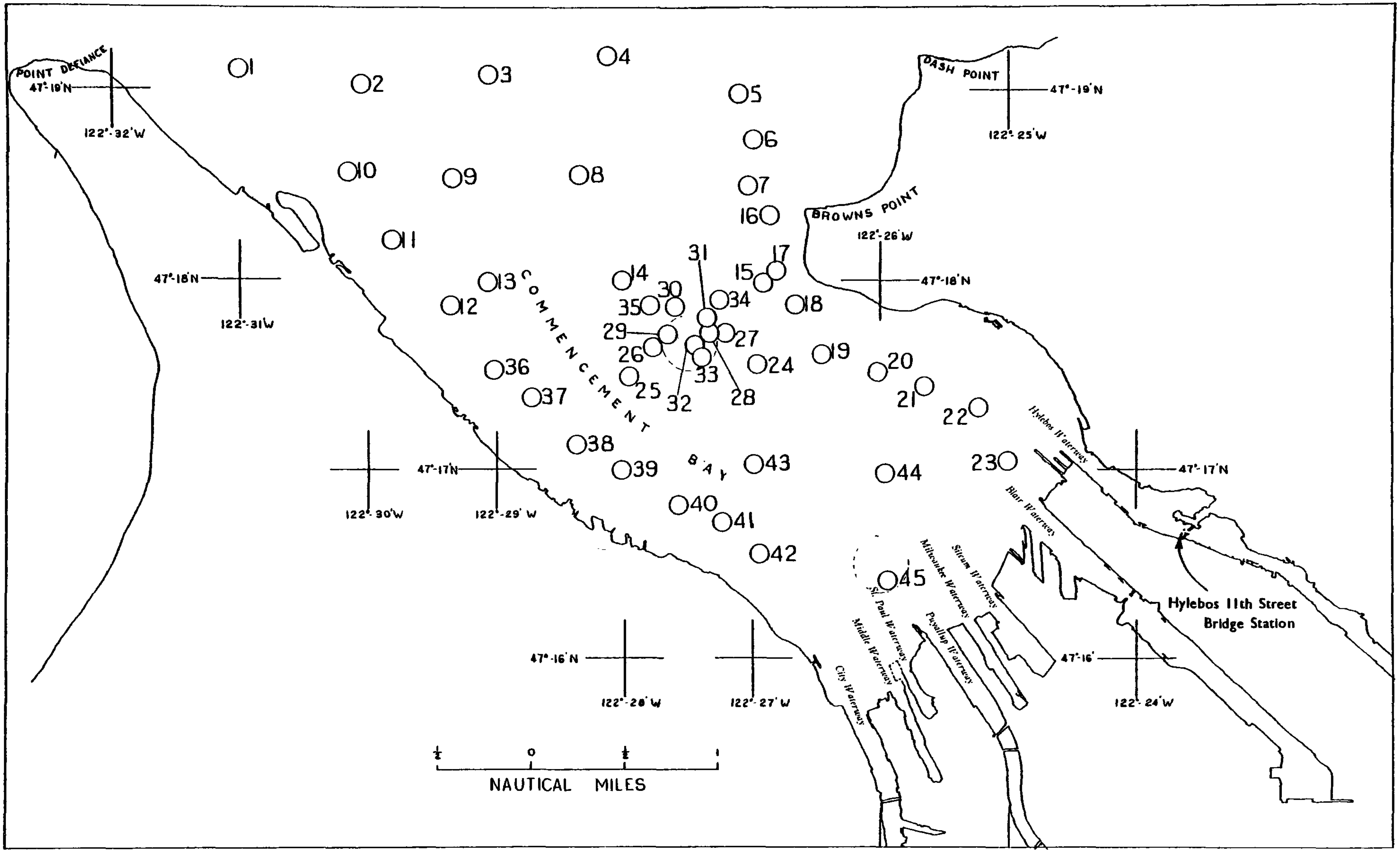


FIGURE 2

STATION LOCATION MAP

The grab sampler was thoroughly rinsed with sea water between stations and the spatulas were rinsed with sea water and deionized water between samples. The samples were then sealed in pint glass containers with teflon lined lids, iced and shipped each day to the EPA Lab located at Manchester, Washington.

Summary of Analytical Methods

Procedures for organic compounds. Samples of thoroughly mixed wet sediments were extracted with acetone using a Soxhlet extractor. After extraction, the extract was concentrated, added to organic free water and extracted with methylene chloride. This extraction was performed at both pH 6-8 and pH 2. The combined extracts were dried, concentrated and divided for pesticide/chlorinated hydrocarbon analysis and semivolatile compound analysis.

The fractions used for pesticide, polychlorinated biphenyls (PCBs), (EPA METHOD 608), and polychlorinated butadienes (PCBDS)(EPA METHOD 612) analyses were further cleaned on a Florisil column; pentane was used to elute the PCBDS, PCBs and some of the chlorinated pesticide compounds. Mixtures of diethylether/petroleum ether were used to elute the other pesticides. These fractions were analyzed by gas chromatography/electron capture with dual column confirmation. When the concentrations of chlorinated species were sufficiently high, confirmation was obtained by a Halogen-specific detector and/or fused silica capillary chromatography/mass spectrometry (FSCC/MS). The semi-volatile portion was analyzed without further cleanup by FSCC/MS. Volatile organic compounds were analyzed by the gas purge/GC/MS procedure.

Procedures for metals. Samples of dry sediment were digested with a mixture of nitric acid and hydrogen peroxide until the organic matter was destroyed. The metals were determined by Atomic Absorption Spectrometry using a graphite furnace or flame following EPA methods. Mercury was determined on a wet sample by manual cold vapor technique, similar to that described by EPA METHOD 245.5.

Procedures for phenolics and cyanides. Phenolics and cyanides were distilled, and the distillate analyzed by automated spectrophotometery following EPA METHODS.

Procedures for solids (percent). Samples were dried at 103-105 degrees C according to EPA METHODS.

RESULTS

All of the sediment samples collected were analyzed for inorganic and organic chemicals. The concentration of selected chemicals are reported in Appendices A and B. Appendix A contains a complete listing of all results including the minimum quantifiable limits for chemicals that were not detected. Appendix B contains the same data as Appendix A with the exclusion of those below the minimum quantifiable limits. All data displayed on a wet weight basis in Appendix A were converted to a dry weight basis in Appendix B.

Appendix C contains the depth, percent solids and a qualitative description of the sediment found at each station. Area maps showing concentration and distribution information by chemical are contained in Appendix D. The Appendix D maps also include average levels of contaminants (based upon two to four stations) observed at other locations in Puget Sound for comparison. These data areas were obtained from the NOAA Technical Memorandum OMPA-2. Chemical levels found in the sediment of the Hylebos Waterway near the 11th Street bridge are also presented in Appendix D.

Appendix E contains a loacation map and summary of NOAA data collected from various reference areas within Puget Sound.

In the following discussion, Commencement Bay study results are presented for the specific contaminants which were detected. Background information on these chemicals and compounds are also presented. All of the background material was extracted from either the NOAA Technical Memorandum OMPA-20, "Effects, Pathways, Processes, And Transformations Of Puget Sound Contaminants Of Concern", by Konasewich et al., (1982) or the "Draft Report No. 1, Water Quality Management Program For Puget Sound, EPA Work Assignment No. 2 ", by Jones & Stokes Associates, Inc. et al., 1983.

ACENAPHTHENE (See Figure D-3)

Levels of acenaphthene in the surface sediments of Commencement Bay ranged from 4.7 to 42 parts per billion (ppb) with an average of 11.5. The highest levels of acenaphthene were found at station #39 and #40 (32.7 and 42 ppb respectively). A level of 23.5 ppb was detected in the Hylebos 11th Street Bridge sediment station.

Background (Konasewich et al., 1982)

Acenaphthene was found in most sediment samples of Puget Sound at levels from 0.1 to 1,300 ug/kg(Brown, 1979,c; Seattle METRO, 1980). It was generally detected at low levels in biota. Acenaphthene has been shown to affect plants through improper nuclear division, and microorganisms may be similarly affected (EPA, 1978). Acute toxicity determination, although limited in number, have shown 96-hour LC50 values of 2,230 ug/L for sheepshead minnow and 970 ug/L for mysid shrimp (EPA, 1978). The potential effects of acenaphthene on Puget Sound biota require additional assessment.

ACENAPHTHALENE (SEE Figure D-4)

Levels of acenaphthalene in the surface sediments of Commencement Bay ranged from 5.1 to 65.4 ppb with an average of 16.3 ppb. The highest level of acenaphthalene was detected at station #39 (65.4 ppb). A level of 75.8 ppb was detected in the Hylebos 11th Street Bridge sediment sample.

Background (Konasewich et al., 1982)

Acenaphthalene was found in sediment samples throughout Puget Sound at concentration from 0.1 to 310 ug/kg. Levels in biota were often generally less than detection limits; however, detectable levels were reported, particularly in crabs (Malins et al., 1980). Derivatives such as nitro-acenaphthalene are known to be carcinogenic. An evaluation of this compound by the International Joint Commission (1980) designated this compound not to be of concern to human health. Similar evaluations of the effects of acenaphthalene on aquatic biota have not been undertaken.

Fluoranthene (See Figure D-5)

Levels of fluoranthene in the surface sediments of Commencement Bay ranged from 4 to 181 ppb (dry weight basis) with an average of 73.5 ppb. The highest levels of fluoranthene were found at station #33, #35 and #39 (143, 162 and 181 ppb respectively). A level of 704 ppb was detected in the Hylebos 11th Street Bridge sediment sample.

Background (Konasewich et al., 1982)

Fluoranthene has been specified as a potent cocarcinogen in the EPA (1978) Ambient Water Quality Criteria Document.

The concentrations of fluoranthenes were generally less than detection limits in most biota samples from Puget Sound; however, the levels in sediments were extremely high. In many samples, for example, fluoranthenes and benzofluoranthenes were the most dominant Polynuclear Aromatic Hydrocarbons (PAHs).

Both natural and man-made sources appear to be responsible for fluoranthene levels in the environment. Man-made sources appear to be shipping and harbor oil discharges and industrial effluents from oil refineries, coke production industries, plastic and dyestuff industries, and industries using high temperature furnaces. Borneff and Kunte (1965) indicated that road runoff can be a source of fluoranthene as a result of bituminous road surfaces, car tire wear, and vehicle exhausts.

The EPA review of fluoranthene levels in discharges indicates that timber products processing is a significant source of fluoranthenes.

Konasewich et al. (1982) reached the following general conclusions concerning fluoranthenes within Puget Sound.

1. The fluoranthenes are the most predominant PAHs in terms of concentration within Puget Sound.

2. Despite their high partition coefficients, fluoranthene concentrations in biota are in most cases low, indicative of possible rapid metabolism.

3. Sorption is an important fate process.

4. Microbial biodegradation of fluoranthenes and benzofluoranthenes is probably minimal within the marine environment.

NAPHTHALENE (See Figure D-6)

Levels of naphthalene in the surface sediments of Commencement Bay ranged from 4 to 186 ppb with an average of 52 ppb. The highest level of naphthalene was detected at station #40 (186 ppb). A level of 63.5 ppb was detected in the Hylebos 11th Street Bridge sediment sample.

Background (Konasewich et al., 1982)

Naphthalene is the most abundant single constituent of coal tar. It is used as an intermediate in production of dye compounds and in the formulation of solvents, lubricants, and motor fuels. One of its principal uses is as a feedstock for synthesis of phthalate anhydride which is subsequently used for the manufacture of alkyd and polyester resins, dyes, pharmaceuticals and insecticides.

Naphthalene is one of the EPA's 129 Priority Pollutants. It is moderately toxic to aquatic biota. However, the alkylated forms of naphthalene and metabolites of naphthalene are much more toxic to aquatic biota. Naphthalene is currently being tested as a carcinogen. Naphthalene, its derivatives and its metabolites are, therefore, considered to be of concern to Puget Sound.

Naphthalene has a rapid flux rate to sediments; concentrations as low as 2ppm in sediments have been suggested to be able to restrict many species of biota.

Konasewich et al. (1982) reached the following general conclusions concerning naphthalenes within Puget Sound.

1. On the basis of the literature review, naphthalene appears to be readily biodegraded in water and sediments. The high concentrations of naphthalene in sediments of Elliott and Commencement Bays implies that there are constant inputs of naphthalenes to these areas.

2. The prevalence of naphthalenes within Puget Sound may have an effect on the fauna. Sublethal effects of low levels of naphthalenes are possible for species such as the ctenophore, Pleurobrachia pileus, zoea of the crab, Cancer magister, and various stages of the spot shrimp, Pandalus platyceros.

3. Of particular concern are the effects of metabolites of the naphthalenes. Some have been shown to be extremely toxic and others have been suggested as possible carcinogens.
4. Fecal pellets of zooplankton furnish a primary mode of introduction PAHs to sediments.

PHTHALATE ACID ESTERS (See Figure D-7 & D-8)

Five phthalate acid esters (PAEs) were detected in the surface sediments of Commencement Bay. Bis-(2-ethyl hexyl) phthalate (DEHP) and di-n-butyl phthalate (DBP) were found at nearly all of the sampled stations.

Levels of DEHP ranged from 36 to 34,853 ppb with an average of 1,372 ppb. The highest levels of DEHP were found at stations #3, #4, #2, #21 and #6 (1,364, 2,372, 5,382, 6,358 and 34,853 ppb respectively). A level of 271 ppb was detected in the Hylebos 11th Street Bridge sediment station.

Levels of DBP ranged from 29 to 984 ppb with an average of 211 ppb. DBP in the Hylebos 11th Street Bridge sediment sample was less than 3 ppb (minimum quantifiable level).

Background (Konasewich et al., 1982)

Phthalate acid esters (PAEs) are used as plasticizers in the production of polyvinyl chloride. Over $5x10^8$ kilograms of PAEs are manufactured annually in the United States. The high rate of production of PAEs and the detection of PAEs in the freshwater and marine environments has resulted in a significant amount of concern to environmental agencies. In particular, there is concern about the sublethal effects to aquatic biota at low PAE levels. In 1972 at a National Institute of Environmental Health Science symposium, scientists concluded that PAEs "do not appear to pose an imminent threat to human health" but that their apparent widespread distribution in the environment raised questions regarding the "possible subtle effects of persistent exposure" to those compounds (Marx, 1972). As a result, phthalate acid esters have been classified within the EPA's 129 Priority Pollutants List.

Phthalate esters have a variety of uses ranging from antifoam agents in the paper industry to perfume vehicles in cosmetic production. However, they are mainly used as plasticizers in the production of polyvinyl chloride. Within some plastic formulations, PAEs can comprise up to 60% of the total weight of plastic depending upon the degree of flexibility or workability required. The market for PAEs is therefore, extremely diversified, and PAEs are used in the automobile construction, clothing, home furnishings, medical, and packaging industries. Contamination of the environment by PAEs may occur by discharge of effluents from such industries, by incineration of plastics, or by leaching of PAE containing materials from land disposal sites.

Konasewich et al. (1982) reached the following general conclusions concerning PAEs within Puget Sound.

1. The concern for phthalate acid esters in the environment is a result of the high production of the compounds and their subsequent release into the environment. Considerable resources are being utilized To determine the magnitude of dispersion of the compounds within the environment. On the basis of the literature, there is conflicting evidence as to whether phthalate esters deserve the attention or perhaps the priority they are receiving.

2. The major concern appears to be the possible chronic effects of low concentrations of PAEs. In this instance, data are unfortunately minimal, especially for marine species. If more efforts could be placed to determine the chronic effects of PAEs on aquatic biota, more appropriate assessments could be made of the actual potential hazard, if any, that PAEs pose to the environment.

3. Very high concentration of PAEs are required before acute toxic effects on aquatic biota are observed.

4. Natural mixed bacteria populations appear to be capable of degrading PAEs. Fish likewise appear to metabolize PAEs to seemingly non toxic metabolites.

5. Elimination of PAEs from biota appears to occur readily.

6. Another concern, illustrated in this review, is that relevant data are sometimes conflicting. For example, there appears to be a discrepancy in observations about anaerobic decomposition of PAEs. Significantly different bioconcentration factors are also reported.

FLUORENE (SEE Figure D-9)

Levels of fluorene in the surface sediments of Commencement Bay ranged from 4.2 to 38 ppb with an average of 14.1 ppb. The highest levels of fluorene were found at stations #39 and #4 (30.8 and 38 ppb respectively). A level of 39.7 ppb was detected in the Hylebos 11th Street Bridge sediment sample.

Background (Konasewich et al., 1982)

There is no evidence for carcinogenicity of fluorene (NIOSH, 1979) and aquatic toxicity data are minimal. Fluorene was found in most sediment samples at concentration from 0.4 to 2,400 ug/kg (Malins et al., 1980; Seattle METRO, 1980). Fluorene was not detected at quantifiable levels in most samples of biota; however, Elliott Bay crab, shrimp, worms and clams contained detectable quantities. Riley et al. (1980) detected fluorene in two water samples from the Seattle and Tacoma areas (30 +- 8 and 3 +- 2 ng/L, respectively) and found between 0.01 to 0.07 mg/kg of fluorene in suspended solids.

PYRENE (See Figure D-10)

Levels of pyrene in the surface sediments of Commencement Bay ranged from 5.1 to 212 ppb with an average of 93 ppb. The highest level of pyrene was found at station #39 (212 ppb). A level of 776 ppb was detected in the Hylebos 11th Street Bridge sediment sample.

Background (Konasewich et al., 1982)

Pyrene itself has a higher partition coefficient and lower vapor pressure than fluorene, phenanthrene, and anthracene. Callahan and Slimak (1979) predicted that sorption to sediments and biodegradation would be the most significant fate processes for pyrene. Bioaccumulated pyrene was assumed to be susceptible to metabolism by biota.

In Puget Sound, pyrene was one of the more predominant PAHs found in biota and sediments. Levels in Elliott Bay sediments varied from 20 to 11,000 ppb (dry weight), and levels in Commencement Bay sediments varied from 20 to 10,000 ppb (Konasewich et al., 1982). Levels in fish livers from Elliott Bay varied from less than 8 ppb to 570 ppb (dry weight), and levels in worms, crab, shrimp, and clams from Elliott Bay varied from 20 to 1,600 ppb. Many fish livers contained less than detection values of pyrene. This information indicates that sorption to sediments is a significant fate process for pyrene. In most instances, fish appeared more able to metabolize pyrene than other organisms.

BENZO(A)ANTHRACENE / CHRYSENE (See Figure D-11)

Benzo(a)anthracene and chrysene are presented in this report as one value due to resolution uncertainty in the analytical method.

Levels in the surface sediments of Commencement Bay ranged from 5.0 to 816 ppb with an average of 95 ppb. The highest levels of benzo(a)anthracene/chrysene were found at stations #4 and #15 (255 and 816 ppb respectively). A level of 235 ppb was detected in the sediment of the Hylebos 11th Street Bridge sample.

Background (Konasewich et al., 1982)

Benzo(a)anthracene, 7-methyl benzo(a)anthracene and dibenzo(a,h)anthracene are listed in the tentative carcinogen list of the Occupational Safety and Health Administration. All compounds (including each isomer of methyl benzo(a)anthracene) are categorized as carcinogens and/or neoplastigens in the NIOSH (1979) Registry of Toxic Effects of Chemical Substances.

Probable sources of this compound are engine exhaust, cigarette smoke, coal-tar pitch, and soot and smoke of industrial and domestic origin. Environmental contamination of benzo(a)anthracene, for example, is widespread. It has been detected in North American drinking waters at levels from 1 to 23 ng/L (ppt) and in industrial and municipal effluents at levels from 25 to 10,360 ng/L (Radding et al., 1976).

Konasewich et al. (1982) reached the following general conclusions concerning benzo(a)anthracene within Puget Sound.

1. On the basis of the literature review, the environmental compartment most susceptible to contamination by benzo(a)anthracene is the bottom sediment.

2. Benzo(a)anthracene bioaccumulates readily in biota; however, its persistence on biota may be affected by metabolic processes.

3. Metabolites may be formed which may be as toxic and/or as persistent as the parent compound itself.

4. Other fate processes do not appear to be significant, although the degree of photochemical degradation in a large body of water such as Puget Sound is uncertain.

5. The levels of the benzanthracenes in biota of Puget Sound are higher than most other areas reported in the literature. The persistence and widespread distribution of the compounds implies a need for efforts to evaluate the "real" hazards of the compounds to the environment.

Callahan and Slimak (1979) indicated that sorption and biodegradation are important fate processes for chrysene. Dichlorochrysene will probably bioaccumulate to a more appreciable degree than chrysene. Metabolism within organisms will probably remain significant.

ANTHRACENE / PHENANTHRENE (See Figure D-12)

Anthracene and phenanthrene are presented in this report as one value due to resolution uncertainty in the analytical method.

Levels in the surface sediment ranged from 4 to 620 ppb with an average of 181 ppb. The highest level of anthracene / phenanthrene was found at station # 40 (620 ppb). A level of 451 ppb was detected in the sediment of the Hylebos 11th Street Bridge sample.

Background (Konasewich et al., 1982)

Callahan and Slimak (1979) implied there is insufficient information in the literature to permit assessment of the aquatic fate of anthracene. Fate processes which were considered of possible significance were: volatilization, sorption and movement via sediment, and biodegradation.

Rapid metabolism of bioaccumulated anthracene was presumed. Elliott Bay sediments contained from 3 to 2,400 ppb (dry weight) anthracene, and sediments from Commencement Bay had 8 to 2,200 ppb anthracene (Malins et al., 1980). Anthracene was virtually absent in fish livers from Elliott Bay, but present in crab, worms, shrimp, and clams at levels from 10 to 210 ppb. Similar results were observed for biota from Commencement Bay, although fish livers did contain more frequent detections of anthracene.

In a review by Callahan and Slimak (1979), environmental fate data specific for phenanthrene were sparse. Sorption and movement via sediment and biodegradation were considered to be the important fate processes. Biodegradation were considered to be the important fate processes. Bioaccumulated phenanthrene was assumed to undergo rapid metabolism. The significant fate processes are apparent from the data provided by Malins et al., (1980) for Puget Sound. Phenanthrene concentration in Puget Sound biota were generally low. Levels up to 0.51 ppm (dry weight) were found in worms and crab hepatopancreas from Duwamish and Hylebos Waterways (Malins et al., 1980). Sediments from the vicinity of Tacoma and Seattle Harbors had phenanthrene levels up to 7.3 ppm.

CHLORINATED BUTADIENES (See Figure D-13)

Chlorinated butadienes (CBD) were detected in all of the 45 sediment samples obtained from Commencement Bay. Total CBDs (sum of tri, tetra, penta and hexachlorobutadiene) ranged from below the minimum quantifiable limit (1 ppb) to 1297 ppb with an average of 134 ppb. A level of 321 ppb was detected at the 11th Street Bridge station. The Highest levels of total CBDs were found at stations #4, #5 and #6 (1297, 890 and 704 ppb respectively). Of the four CBDs analyzed, tetrachlorobutadiene was the primary compound found.

Background (Konasewich et al., 1982)

Chlorinated butadienes (CBD) are used or formed as by-products in a number of industrial processes including the manufacture of hexachlorobenzene and trichloroethylene. Hexachlorobutadiene affects behavior and causes histological damage in aquatic life at very low concentrations and is a known animal carcinogen. Hexachlorobutadiene is one of the EPA's 129 Priority Pollutants. Data on toxicities of other chlorobutadienes are limited, but toxicity is proportional to the degree of chlorine substitution of butadienes, particularly those with five or fewer chlorines are minimal. Generally, data on the less chlorinated butadienes are restricted to the Russian literature. Chlorinated butadienes have been detected in all compartments of the Puget Sound ecosystem and are therefore chosen as compounds of concern.

Since carcinogenicity is known or suspected for butadiene molecules with six chlorine atoms, it seems that molecules containing two to five chlorine atoms should be considered as potential carcinogens in the absence of data to the contrary. The LD50 data suggest that butadienes with three to five chlorine atoms would have systematic toxicity approaching that of HCBD.

In one set of experiments in Puget Sound, concentrations of HCBD in English sole muscle were 6-100 times less than concentrations in liver (Malins et al., 1980). Analyses for chlorinated butadienes in other biota showed that, in most cases, levels were nondetectable. However, positive values included 9 ppb (ug/kg) in clams from Commencement Bay Waterways, 60 ppb in clams from Hylebos Waterway, 200 ppb in shrimp from Hylebos Waterway and 70 ppb in crab hepatopancreas from Hylebos Waterway. Two samples of worms from Hylebos were found to have concentrations from 40 to 360 ppb.

HCBD levels up to 2.4 ng/L have been measured in waters from Blair and Hylebos Waterways (Riley et al., 1980). These levels were associated with up to 147.5 ppb (dry weight) in suspended matter/water concentration ratios for HCBD were generally about four orders of magnitude. Distribution analyses showed that relative concentrations of HCBD between suspended matter and water varied from 0:100 to 70:30 (suspended matter:water).

The tri-, tetra-, and pentachlorobutadienes were generally detected at greater levels than HCBD in Puget Sound sediments. Considering that these lower chlorobutadienes would be more water soluble suggests that they may also be present in the water at much higher levels than HCBD.

Hexachlorobutadiene is thought to be present in water as a significant by-product of production wastes from the manufacture of hexachlorobenzene (Laseter et al., 1976), tetrachloroethylene, trichloroethylene, and tetrachloromethane (EPA, 1975). It is used as a solvent for natural and synthetic rubber and other polymers, as a heat transfer liquid, transformer liquid and hydraulic fluid, and as a washing liquor for removing hydrocarbons (Verschueren, 1977).

The largest domestic users of HCBD are chlorine producers, which use it to recover chlorine from "snift" gas which is cleaned by passage through HCBD (EPA, 1978). It is known to be extensively used in Europe as a vineyard aphicide.

No information is available on sources of butadienes containing two to five chlorine atoms per molecule, although they may derive from the same sources as HCBD by-products. The compound 2-chloro-1,3-butadiene (Chloroprene) is used in the manufacture of the polymer Neoprene. The sources of the chlorinated butadienes in Puget Sound are uncertain, and will require identification.

Konasewich et al. (1982) reached the following general conclusions concerning chlorobutadiene within Puget Sound.

1. There is high probability of chronic effects in biota which are exposed to very low levels of HCBD.

2. The relatively high quantities of pentachlorobutadiene in Puget Sound appear to be unique in the literature. There have been no previous references to the existence of penta-CBD in the environment, except for quantities relative to HCBD.

3. The literature indicates that highly chlorinated butadienes should tend to concentrate in sediment (and tissue) compartments because of their moderate lipophilic properties. However, photolysis in aerated water may degrade the many chlorinated butadienes near the water surface where there is minimal attenuation of solar radiation.

4. As the degree of chlorination of butadienes decreases, their ability to volatilize will increase because of their vapor pressures and lower tendency to associate with organic matter. They are also more susceptible to chemical degradation.

5. Uptake data for chlorinated butadienes by biota is restricted to HCBD, and those data are generally erratic for unexplained reasons.

6. Studies with chlorinated butadienes have been minimal, and these studies did not appear to carefully consider variable parameters such as lipid levels in biota, organic content in sediments, etc.

POLYCHLORINATED BIPHENYLS (See Figure D-14 & D-15)

Polychlorinated biphenyls (PCBs) were detected at all stations in Commencement Bay. PCB-1260 ranged from 4 ppb to 126 ppb with a averaged of 16.3 ppb. Station #6 had the highest level of PCB-1260 (126 ppb). Levels of 240 and 210 ppb were detected in the sediment of the Hylebos 11th Street Bridge station for PCB-1254 and PCB-1260.

Background (Konasewich et al., 1982)

Polychlorinated biphenyls are one of the most widely distributed pollutants on earth. Their persistence is generally considered to be greater than that for most chlorinated pesticides. PCB residues are found in fat deposits of numerous warm- and cold-blooded animals, including man. In the aquatic environment PCBs have been detected in water, sediments, invertebrates, fish, and waterfowl with the highest levels being recorded in predatory organisms at the end of the food chain (IJC, 1977).

The probable sources of PCB contamination are: leaks from transformers, heat exchangers, and hydraulic systems; vaporization from formulations; vaporization from poorly operated incinerators; and landfill leachates. The discharges may be direct (i.e., municipal and industrial discharges) or indirect (i.e., atmospheric fallout).

Bioaccumulation of PCBs in aquatic organisms appears to occur primarily through direct uptake of PCBs from water and is strongly dependent upon lipid levels in organisms. Uptake rates increase and depuration rates decrease with increasing degrees of chlorination. PCBs are more rapidly depurated from biota than are DDT and metabolites of DDT. If PCB inputs to Puget Sound are eliminated, it is expected that PCBs with five or more substituted chlorine groups will continue to persist in biota for a long time.

Konasewich et al., (1982) reached the following general conclusions concerning PCBs within Puget Sound.

1. PCB levels in Puget Sound fish, crab, and claims, particularly those from Elliott and Commencement Bays, may affect consumers of such biota.

2. Many sediments of Puget Sound exceeded the maximum levels of 500 ppb total PCB recommended by Pavlou et al. (1978). The limits by Pavlou et al. were suggested to assure an ambient water level of total PCBs of no more than 5 ng/L.

3. A rapid decrease of PCB levels in the Puget Sound water column may be occurring. For example, during the MESA effort, Brown (1979) indicated high levels of PCBs in sediments, particularly sediments from Elliott and Commencement Bays, and Riley et al. (1980) indicated that PCB levels in suspended solids and water from the areas were below detection limits. Pavlou et al. (1977), in earlier studies, indicated that PCB levels in sediments and suspended solids in the water column of Puget Sound were quite similar in concentration, indicative of a system which was in equilibrium. These results may indicate that while PCBs are rapidly removed from the water column, PCB levels in biota may be rapidly decreasing. PCBs in sediment would, however, decrease very slowly.

4. There are few data on physical chemical properties of PCBs in seawater and the effects of photolysis on PCBs in seawater.

5. Data on uptake of PCBs from sediments by biota do not conclusively indicate whether release from sediments is of environmental significance. This review suggests that PCBs must be released to the water column to enable subsequent uptake by biota. Annual monitoring of, for example, estuarine yearling fish may define the amount of release of PCBs from Puget Sound sediments in the apparent absence or decrease of additional inputs.

6. Environmental processes of significance to the fate of PCBs are dependent upon the degree of chlorination of the PCB molecules. Mono-, di- and trichlorobiphenyls appear to be metabolized to variable degrees by biota. Biphenyls with more than 5 substituted chlorines are not readily metabolized.

7. Sedimentation and adsorption to suspended matter is probably the most significant fate process for PCBs in Puget Sound. Adsorption to suspended matter would result in advection of PCBs from the sound on the basis of water transport. Volatilization may be of subsequent importance; however, quantification of its significance is difficult.

8. Metabolites of chlorinated biphenyls may be of ecological significance, due to their apparently higher degree of toxicity compared to parent PCB molecules.

CHROMIUM (See Figure D-16)

Chromium was detected in all Commencement Bay sediment samples. Chromium levels ranged from 7 to 31 parts per million (ppm) with an average of 16.7 ppm. A level of 28 ppm was detected in the sediment of the Hylebos 11th Street Bridge station.

Background (Jones & Stokes Associates, inc. et al., 1983)

Properties and Fates. Chromium exists in two oxidation states, hexavalent and trivalent. Chemical processes affecting these states are important in fate determination. Hexavalent chromium is quite soluble, and reacts with reducing materials to form trivalent chromium, which is primarily hydrolized and precipitates as chromium hydroxide. This precipitation is felt to be the dominant fate process, and the trivalent form is the most stable under normal water conditions. Both forms adsorb only weakly to inorganic solids. Photolysis and volatilization are not considered important fate processes (Chapman et al. 1979).

As an essential nutrient, chromium is bioaccumulated by both flora and fauna to greater concentrations than in the water column, although it is generally less than those in sediments. There is no evidence that methylation occurs, although its occurrence in reducing environments has been speculated (Callahan et al., 1979).

There appears to be little concern about chromium at the moment. Konasewich et al., (1982) do not consider it a metal of concern because levels within Puget Sound sediments fall within normal expected levels. Dexter et al., (1981) and Crecelius (pers. comm. 1982) do not consider it of concern.

Sources and Distribution. Potential sources include automotive repair shops, electroplating industries, carwashes and landfill leachate. Chromium has also been observed in small concentration in sewage treatment plant effluent.

BERYLLIUM (See Figure D-17)

Beryllium ranged from .16 to .49 ppm with an average of .34 ppm. A level of .34 was detected in the sediment of the Hylebos 11th Street Bridge station.

Background (Jones & Stokes Associates, Inc. et al., 1983)

Beryllium has very low solubility in water, and tends to be in particulate form, either adsorbed to clays or to other mineral surfaces, rather than in dissolved form. Under normal pH conditions it is hydrolized to form insoluble compounds; this is the controlling mechanism for beryllium in the aquatic environment. Photolysis and volatilization are not considered important fates. Beryllium is bioaccumulated in low amounts, but there is no evidence of biomagnification through the food chain. Nothing on biotransformation processes has been reported.

Sources and Distribution. Beryllium is used in production of alloys, copper and brass (Sittig 1980).

Because beryllium concentrations were not elevated above background levels, it was not considered to be a contaminant of concern by Konasewich et al., (1982).

COPPER (See Figure D-18)

Copper levels ranged from 12.5 to 83.9 ppm with an average of 46.1 ppm. The highest levels of copper was found at station #39 (83.9 ppm). A level of 112.4 was detected in the Hylebos 11th Street Bridge sediment station.

Background (Konasewich et al., 1982)

Copper is a heavy metal which is found in all compartments of the ecosystem. It is an essential element in the respiratory pigments of some saltwater species, especially crustaceans. Saltwater plants have enzymes containing copper which are necessary for photosynthesis.

However, copper may be appreciable concern when it is found at concentrations in excess of ambient levels because it is one of the most toxic metals to marine organisms.

Copper is found in Puget Sound sediments at levels from 10 to 1600 mg/kg (dry weight). EPA quidelines for classifying sediments within the Great Lakes consider sediments with levels in excess of 50 mg copper/kg sediment (dry weight) as "heavily polluted."

Sources or Inputs. Copper enters marine systems by a number of natural processes including runoff, geothermal sources, and airborne particles. Copper also enters the environment as a result of industrial activities such as smelting and the employment of antifouling paints, algicides, and pesticides (Lewis and Cave, 1979).

Loadings of copper to Puget Sound have been quantified by Schell and Nevissi (1977), and natural rather than man-made sources appear to contribute most of the trace elements to Puget Sound. The relative values of input quantities (metric tons per year) to Puget Sound as determined by Schell and Nevissi (1977) were: rivers, 787; Seattle METROs West Point Plant, 29; other municipalities, 22; atmospheric input, 450; vessel's protective measures, 360-590; urban runoff, 15; and advective transport, 306. Copper smelting in Tacoma may be the cause of the relatively high levels detected at stations in Commencement Bay (Schell and Nevissi, 1977).

Bioaccumulation of copper occurs in benthic invertebrates to a much greater extent than in fishes. Depuration does occur; however, it is affected by many factors.

Adsorption to particulate matter and sediments is an important fate process for copper in marine waters. The adsorption desorption processes are affected by many physical, chemical, and biological parameters. Release of copper from sediments may occur in the presence of aerobic conditions.

The following general conclusions were reached by Konasewich et al., (1982) concerning copper.

1. In the marine environments copper is generally associated with particulates (sediments and suspended solids).

2. The most toxic species of copper is Cu2+, the levels of which are diminished by the presence of ligands or several anions including chloride.

3. Copper is extremely toxic to marine biota with 96-hour LC50 values as low as 5 ug copper/L.

4. It is not possible to predict the effects of copper contaminated sediments on biota, because of the complexity of metal-binding associations within the sediment. Individual studies are required to assess those effects.

5. Copper release for sediments may occur, dependent upon various conditions including changes in pH, Eh, oxygen levels, microbial activity, etc.

6. Copper bioaccumulates particularly within invertebrates.

NICKEL (See Figure D-19)

Nickel was detected at all stations. Concentrations ranged from 6 to 30 ppm with an average of 17.4 ppm. A level of 15 ppm was detected in the sediments of the Hylebos 11th Street Bridge station.

Background (Jones & Stokes Associates, Inc. et al., 1983)

Properties and Fates. Nickel is the most mobile of the heavy metals, and adsorption and precipitation do not appear as important as with other heavy metals. Adsorption to organic materials and hydrous iron and manganese oxides is the dominant factor in its mobility, and partitioning into dissolved and particulate fractions is related to iron, manganese and suspended material concentrations. Photolysis and volatilization are not important fate processes. Nickel is bioaccumulated, but concentrations indicate that neither this nor biotransformation is a dominant process.

Sources and Distribution. Nickel is used in alloys and electroplating.

Because nickel concentrations were not elevated above expected background levels, it is not considered to be a contaminant of concern by Konasewich et al., (1982).

ZINC (See Figure D-20)

Levels for zinc ranged from 27 to 121.2 ppm with an average of 60.7 ppm. A level of 132.2 ppm was detected in the Hylebos 11th Street Bridge sediment station.

Background (Jones & Stokes Associates, Inc. et al., 1983)

Properties and Fate. Zinc is readily transported and one of the most mobile of heavy metals. It adsorbs to clay, hydrous iron and manganese oxides, and organic materials, but adsorption is influenced by concentrations of materials. Adsorption increases with pH, and increased Eh releases zinc to the water column. In a reducing situation, or in areas of high zinc concentration, precipitation of zinc sulfide is important in reducing zinc mobility.

The release of zinc from sediments is dependent on a combination of ion exchange and complex formation; stability of the complex determines solubility. Generally, organic material in polluted waters affects the form in which zinc is present, and complexes will predominate. In unpolluted areas, zinc normally will be a divalent cation, and easily adsorbed. Volatilization and photolysis do not appear to be important fate processes (Callahan et al. 1979).

Zinc is strongly bioaccumulated by marine biota, and fish may accumulate it from both food and water, but bioaccumulation appears to be a minor sink compared to the sediments. No biomethylation has been observed (Callahan et al., 1979).

Sources and Distribution. Zinc is produced in alloy production and plating processes (Sittig 1980). The greatest anthropogenic source appears to be atmospheric (Dexter et al.,1981), and dust from the Harbor Island smelter is a major source of pollution in the Duwamish estuary area. CSO and storm drains, such as the Diagonal Way overflow, Hanford Street overflow, and Denny Way overflow, have also been identified as contributors to zinc contamination in the Duwamish estuary area. Dexter et al., (1981) summarize concentrations of zinc in water and suspended particulate matter for various areas of Puget Sound and estimate inputs for individual rivers, municipal and industrial effluent, storm drains, and CSOs. They provide an estimation of annual loading for both natural, (riverine input, erosion and advection) and anthropogenic sources. Zinc loading is estimated by Dexter et al., (1981) to be much greater than that of arsenic, copper of mercury, with the bulk of the input projected to come from natural sources.

Highest levels were observed in the Duwamish River estuary, but high levels have also been observed in Hylebos and City Waterways of Commencement Bay, in Budd and Sinclair Inlets, and in Elliott Bay.

Zinc, although elevated in the sediments, has not been identified as a contaminant of concern by Konasewich et al., (1982). Because zinc does not appear elevated to any appreciable extent in the water or biota, Crecelius (pers. comm. 1982) considered it to be of little concern.

ARSENIC (See Figure D-21)

Arsenic levels ranged from 1.3 to 29 ppm with an average of 9.3 ppm. A level of 34.4 ppm was detected at the Hylebos 11th Street Bridge station.

Background (Jones & Stokes Associates, Inc. et al., 1983)

Properties and Fates. Arsenic exists in four oxidation states, each having different properties. It is quite mobile, and cycles through water, sediment and biota. Photolysis is not considered an important fate process. olatilization is considered unimportant by Callahan et al., (1979) except in extreme reducing environments, where anaerobic bacteria can reduce arsenic compounds to dimethyl and trimethyl arsene, which are extremely toxic and volatile. Konasewich et al., (1982) believe volatilization may be of significance to the fate of arsenic in Puget Sound. In most cases sediments and ocean water are the primary sinks for arsenic, but metabolism to organic arsenicals by bacteria and benthic organisms recycles much of it.

Bioaccumulation occurs, but is most significant at lower trophic levels. Fish may accumulate arsenic through both water and food, but uptake from the water column appears to be more important (Konasewich et al., 1982). Reported concentrations in organisms are generally low, because high toxicity prevents great accumulation.

Adsorption-desorption to and from particulates does not appear significant in estuarine or marine environments (Konasewich et al., 1982). Crecelius, (pers. comm. 1982) estimated an arsenic budget for Puget Sound; the estimated budget indicates that discharge to the Strait of Juan de Fuca is the major sink, with the remainder primarily deposited in the sediments.

Arsenic is considered to be either a carcinogen or cocarcinogen, with a latent period of 20-30 years. It is considered by Dexter et al. (1981) to be one of the metals having greatest potential for toxicity to organisms, and Konasewich et al. (1982) have identified it as a contaminant of concern for Puget Sound. Crecelius (pers. comm. 1982) does not consider arsenic to be of concern because there is no evidence that it is elevated in the tissues of biota, contribution by man is relatively small, and seawater already has a relatively high concentration.

Sources and Distribution. Sources are both natural and anthropogenic. Arsenic is present in soils, but is also formed as a by-product of ore smelting, and is used in herbicides, preservatives, drugs, ceramics and glass, and a number of other industries (Sittig 1980; Metro 1980).

The northern rivers which enter Puget Sound (Skagit, Snohomish, Stillaguamish and Duwamish) have arsenic concentrations approximately six times those of the more southern rivers, which primarily reflects the mineralogic differences of the drainage basins (Dexter et al., 1981). Shoreline erosion and advection (transport of water through Admiralty Inlet) are sources, as are municipal treatment plant effluent and atmospheric input. Estimated input for municipal and industrial discharges, riverine sources, erosion, and advection are given by Dexter et al. (1981); and by Crecelius (pers. comm. 1982). In both cases natural sources are estimated to be greatly predominant. Although relative contribution from anthropogenic sources seems minor, some regional areas are heavily impacted, and arsenic in considered to be one of the metals having greatest potential for producing toxic response in organisms and their consumers (Deter et al. 1981).

Arsenic measurements for all major areas of Puget Sound sediments are summarized by Dexter et al. (1981). It has been found in high concentrations in sediments of all four urban embayments (Elliott and Commencement Bays, and Budd and Sinclair Inlets). In Tacoma, liquid and slag discharges from the ASARCO smelter, storm drains, and sewer overflows have produced very high concentrations of arsenic (and antimony) along the western bay. but atmospheric emissions are also a likely source. Northwesterly flow along the southwest shore of Commencement Bay minimizes impact there, but sediments in Quartermaster Harbor and to the south of Fox Island have significantly higher arsenic levels than other areas. Deep sediments in East Passage also have elevated levels (Dexter et al. 1981). Measurements in the water column indicate arsenic associated with particulates is minor in comparison to the concentration of dissolved material (Konasewich et al. 1982).

MERCURY (See Figure D-22)

The mercury levels in the deepwater sediments of Commencement Bay ranged from .03 to.25 ppm with an average of .1 ppm. The highest level of mercury was detected at station #39 (.25 ppm). A level of .23 ppm mercury was detected at the Hylebos 11th Street Bridge station.

Background (Jones & Stokes Associates, Inc. et al., 1983)

Structure and Fate. Mercury has been well researched in comparison to many other metals. The great majority is rapidly removed from the water column by strong adsorption to particulates, and sediments are the primary sink (Callahan et al. 1979). However, rapid decreases in Puget Sound sediments have been documented, indicating either methylation or dissolution is occurring, and that the sediments in Puget Sound may not be a permanent sink (Konasewich et al. 1982).

Transformation processes in the sediments include precipitation as HgS in a reducing environment, and methylation by bacteria. Methylation potential is increased in areas of highly organic sediments favoring bacterial growth. These processes may release ionic or metallic mercury back into the water column. Resuspension of sediments by organisms or turbulence can also release compounds to the water.

Mercury adsorbed to sediments in river water may dissolve when it reaches an estuary, and dissolved levels tend to be higher in estuaries than in either inflowing rivers or the ocean receiving waters.

Photolysis is of importance in the atmosphere, and may affect aquatic fates as well. Volatilization is probably an important process for the movement in and out of the aquatic environment, particularly for methylmercury.

Mercury is strongly bioaccumulated by absorption from water and through the food chain. Most bioaccumulation is connected to methylated forms of mercury, which have a half-life of 1-3 years in most aquatic organisms. Uptake and release of mercury also are affected by season and life state of the organisms. Mercury is one of the few contaminants that is also biomagnified.

Marine invertebrates have some ability of detoxify low level chronic pollution by means of metal binding proteins. There is also some interaction between selenium and mercury, which appears to protect marine organisms from mercury exposure to some extent, although the mechanism is not well understood.

Sources and Distribution. Both natural and anthropogenic sources contribute to mercury loadings. Natural sources include volcanic activity and leaching of natural deposits. Anthropogenic sources include industrial processes such as manufacture of electrical equipment, chlorine, caustic soda, paint, pulp and paper, drugs, smelting and other sources (Sittig 1980). Possible sources in Puget Sound include chlor-alkali plants and sewage treatment plants, smelter stack dust, and industrial discharges to the Duwamish River (Konasewich et al. 1982).

Dexter et al. (1981) and Malins et al. (1982) summarize mercury levels in sediments for all major areas of the Sound. Mercury has been observed in high concentrations in nearly all Puget Sound urban areas. Highest concentrations were found in the lower Duwamish River estuary sediments, but high levels have also been found in Sinclair Inlet, Hylebos and City Waterways, and Elliott Bay sediments. Crecelius et al. (1975) indicated that mercury in Bellingham Bay had a half-life of about 1.3 years; elevated mercury levels have also been noted in the water column and organisms (Crecelius pers. comm. 1982).

Konasewich et al. (1982) consider mercury to be contaminant of concern in Puget Sound because of its toxicity and potential effects on consumers of aquatic life. Because it has been observed at elevated concentration in water, sediments and organisms, Crecelius (pers. comm. 1982) considers mercury to be a metal of concern, which should be researched in more detail. Mercury is also one of the four compounds on the priority pollutant listing singled out by Chapman et al. (1979) as being of special significance because of its high toxicity, demonstrated presence in effluent, ability to accumulate in sediments and biota, and because it is one of the few pollutants known to be biomagnified.

CADMIUM (See Figure D-23)

Cadmium levels, in Commencement Bay deep water sediments, ranged from .06 to .48 ppm with an average of .24 ppm. A level of .65 ppm was detected in the Hylebos 11th Street Bridge station.

Background (Jones & Stokes Associates, Inc. et al., 1983)

Properties and Fates. Cadmium is relatively mobile because it dissolves readily in water. As such, it may pose a hazard to all forms of aquatic biota. Adsorption to suspended matter reduces concentrations in the water column, and in polluted or organic-rich areas; cadmium adsorption to organic matter is considered the most important fate process. In unpolluted areas, adsorption to clay, hydrous iron and manganese is the most important (Callahan et al. 1979). There is also a tendency for it to be associated with fine grained sediment and high organic carbon levels (Malins 1980 in Konasewich et al. 1982).

Bioaccumulation is considered an important fate process. Cadmium is strongly bioaccumulated at all trophic levels, and uptake increases with increased temperature and decreased salinity. It can be accumulated to much higher levels than water concentrations, although usually to a level lower than that of the sediments. It is not known to be methylated.

The form of cadmium within the sediments is dependent upon redox conditions. In oxidizing conditions, carbonate formation is the controlling process and soluble chlorides are the major complexes. In reducing conditions, the formation of generally insoluble sulphides regulates the amount of dissolved cadmium available.

When river particulates enter an estuary, cadmium is probably released to the water. The release of cadmium from Puget Sound sediments appears to occur readily, and may be of importance to health of the biota (Konasewich et al. 1982). Photolysis and volatilization are not considered important fates.

Sources and Distribution. Cadmium is used industrially in plating, and in manufacture of paint, varnish, batteries, plastics, fungicides, fertilizers, rubber tires, and motor oil (Sittig 1980; Konasewich et al. 1982). It can also be released to the atmosphere in smelting of zinc, copper, and lead ores. Crecelius (pers. comm. 1982) has roughly estimated an annual input of 44 tons to the Sound, the majority contributed through advection, with riverine, sewage and atmospheric input considered of less importance.

Crecelius (pers. comm. 1982) does not consider cadmium to be a metal of concern, because there is no evidence of elevation in tissues of biota, and contribution by man is minor compared to that of advection. On the other hand, Konasewich et al. (1982) consider it as a contaminant of concern because sediment levels are highly elevated compared to regulatory criteria for classifying sediments. Cadmium is one of the four compounds on the priority pollutant listing singled out by Chapman et al. (1979) as being of special significance because of its high toxicity, demonstrated presence in effluent, and ability to accumulate in sediments and biota.

Concentration of cadmium for various areas of Puget Sound sediment are given in Malins et al. (1981). Effects of levels found in Puget Sound are discussed in Konasewich et al. (1982). Dexter et al. (1981) do not discuss it in detail, because data were considered limited and of unknown quality, and regional impacts were considered to be minor.

LEAD (See Figure D-24)

Lead levels ranged from 6 to 50 ppm with an average of 25.8 ppm in the deepwater sediments of Commencement Bay. A level of 116 ppm was detected in the sediment of the Hylebos 11th Street Bridge station.

Background (Jones & Stokes Associates, Inc. et al., 1983)

Properties and Fate. Chemical speciation affects transport and fate of lead, and may also affect toxicity and bioavailability. At pH values of 7.5-8.5 (ambient Puget Sound levels), lead exists predominately as free lead. Free metal ion concentrations are highest at a 1:1 seawater to freshwater ratio, and the most toxic effects occur at this range, probably within an estuary environment.

Adsorption is an important process in Puget Sound (Konasewich et al. 1982). Lead tends to form complexes, and adsorption to inorganic solids, organic materials and hydrous iron and manganese oxides controls lead's mobility. Adsorption and sediment enrichment are important fates in natural waters, but in polluted areas precipitation may be an important process in controlling mobility. Adsorption is highly pH-dependent; lead is more mobile in acidic water.

Volatilization is probably not an important fate process except for alkylated lead compounds. Photolysis is important in determining the form in which lead enters the water, but its importance within the water is unknown.

Marine plants and invertebrates bioaccumulate lead to a greater extent than fish, but it is not biomagnified, and bioconcentration decreases with increased trophic level. Benthic microorganisms can methylate lead, resulting in the more toxic and volatile compound tetramethyl lead. This may be a mechanism for lead removal from the sediments (Callahan et al. 1979).

Sources and Distribution. Lead sources are both natural and anthropogenic. Anthropogenic sources include combustion of leaded gasoline, ore smelting, sewage treatment plant effluent, urban runoff, paint and battery manufacturing plants and similar sources (Sittig 1980).

Konasewich et al. (1982) estimate loadings from anthropogenic sources. Dexter et al. (1981) estimate loadings from both anthropogenic sources and natural sources such as advection, riverine inputs and shoreline erosion. Crecelius (pers. comm. 1982) estimates a mass balance, and indicates atmospheric input is significant. The main removal mechanism appears to be sedimentation. Although anthropogenic input is small relative to natural sources, obvious contamination exists in localized areas.

Lead is one of the metals receiving greater attention in Puget Sound. It has been observed in high concentrations in nearly all urban area sediments. Dexter et al. (1981) summarize known lead levels in sediments (and water and suspended matter where available), for all major areas of Puget Sound. Malins et al. (1982) summarize concentration data and discuss contaminants in relation to biological abnormalities. Health effects are discussed by Sittig (1980).

Especially high lead levels were observed in Hylebos and City Waterways sediments, but highest concentrations were noted in the lower Duwamish River sediments. Metal concentrations in the water column have received much less attention.

Konasewich et al. (1982) consider lead to be a contaminant of concern because of the heavy concentrations observed in the sediments. Crecelius (pers. comm. 1982) considers it to be a metal of some concern that should be examined in more detail because lead levels are elevated in sediments, the water column, and biota.

APPENDIX A

COMPLETE LISTING OF CHEMICAL CONCENTRATIONS INCLUDING THE MINIMUM QUANTIFIABLE LIMITS

INORGANICS -- METALS

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: METALS UG/GM (PPM) DRY WEIGHT BASIS
PHENOLICS UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	ITR NUM	DATE	TIME	AL	CR	BA	BE	CO	CU	FE	NI
	01		S		820915	1117		16		.16		12.5		27
	02		S		820915	1141		15		.16		15.4		24
	03		S		820915	1213		17		.23		19.4		24
	04		S		820915	1236		17		.31		37.8		15
	05		S		820915	1318		31		.49		60.5		25
	06		S		820915	1338		28		.48		62.4		25
	07		S		820915	1356		19		.35		33.8		22
	08		S		820915	1436		17		.39		49.6		18
	09		S		820915	1503		16		.23		16.1		23
	10		S		820915	1524		19		.21		20.1		29
	11		S		820915	1542		22		.24		34.3		30
	12		S		820915	1606		24		.34		56.6		27
	13		S		820915	1627		21		.31		52.0		23
	14		S		820915	1653		20		.38		55.4		16
	15		S		820915	1721		17		.35		43.2		18
	16		S		820915	1738		17		.36		45.7		19
	17		S		820915	1750		13		.34		38.9		12
	18		S		820915	1805		16		.43		58.6		15
	19		S		820915	1819		16		.33		49.8		11
	20		S		820915	1831		16		.36		54.0		10
	21		S		820915	1842		19		.36		57.8		11
	22		S		820915	1854		15		.34		44.4		11
	23		S		820915	1903		13		.39		44.5		15
	24		S		820916	0946		16		.39		49.2		13
	25		S		820916	1009		16		.41		53.2		17
	26		S		820916	1023		16		.40		52.9		16
	27		S		820916	1042		12		.36		43.8		12
	28		S		820916	1055		12		.35		43.9		11
	29		S		820916	1122		18		.43		65.9		19
	30		S		820916	1135		15		.39		55.0		17
	31		S		820916	1156		13		.39		54.6		18
	32		S		820916	1210		16		.44		69.8		22
	33		S		820916	1237		20		.39		55.7		18
	34		S		820916	1253		9		.28		30.8		10
	35		S		820916	1321		21		.40		59.2		25
	36		S		820916	1348		18		.31		54.3		21
	37		S		820916	1403		20		.36		73.5		15
	38		S		820916	1420		14		.26		49.3		14
	39		S		820916	1439		22		.36		83.9		22
	40		S		820916	1454		14		.34		42.1		12
	41		S		820916	1512		14		.33		44.1		16
	42		S		820916	1532		12		.31		41.9		7
	43		S		820916	1554		12		.30		36.5		9
	44		S		820916	1615		7		.28		25.8		12
	45		S		820916	1629		9		.24		28.2		6
HYLEBOS 11ST BRIDGE	46		S		820916	1705		17		.34		112.4		15

INORGANICS -- METALS

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: METALS UG/GM (PPM) DRY WEIGHT BASIS
PHENOLICS UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	ITR NUM	DATE	TIME	MN	ZN	B	V	AG	AS	SB	SE
	01		S		820915	1117		31.2			.05 U	1.3	.25 U	.1 U
	02		S		820915	1141		43.5			.05 U	5.8	.25 U	.1 U
	03		S		820915	1213		48.1			.05 U	4.8	.25 U	.1 U
	04		S		820915	1236		50.6			.05 U	8.0	.25 U	.1 U
	05		S		820915	1318		87.5			.05 U	11.5	.25 U	.1
	06		S		820915	1338		85.1			.05 U	12.5	.25 U	.1 U
	07		S		820915	1356		50.4			.05 U	8.3	.25 U	.1 U
	08		S		820915	1436		63.7			.05 U	9.5	.25 U	.1 U
	09		S		820915	1503		45.5			.05 U	7.5	.25 U	.1 U
	10		S		820915	1524		58.7			.05 U	10.8	.25 U	.1 U
	11		S		820915	1542		61.1			.05 U	10.0	.25 U	.1 U
	12		S		820915	1606		76.8			.05 U	15.0	.25 U	.1 U
	13		S		820915	1627		68.5			.05 U	11.3	.25 U	.1 U
	14		S		820915	1653		68.5			.05 U	10.3	.25 U	.1 U
	15		S		820915	1721		53.5			.05 U	8.0	.25 U	.1 U
	16		S		820915	1738		55.3			.05 U	8.5	.25 U	.1 U
	17		S		820915	1750		46.3			.05 U	6.5	.25 U	.1 U
	18		S		820915	1805		66.6			.05 U	9.0	.25 U	.1
	19		S		820915	1819		48.0			.05 U	6.0	.25 U	.1 U
	20		S		820915	1831		50.8			.05 U	5.5	.25 U	.1 U
	21		S		820915	1842		57.5			.05 U	7.0	.25 U	.1 U
	22		S		820915	1854		43.3			.05 U	5.3	.25 U	.1 U
	23		S		820915	1903		45.2			.05 U	5.5	.25 U	.1 U
	24		S		820916	0946		54.2			.05 U	7.8	.25 U	.1 U
	25		S		820916	1009		59.3			.05 U	8.3	.25 U	.1
	26		S		820916	1023		63.9			.05 U	9.5	.25 U	.1
	27		S		820916	1042		52.7			.05 U	6.8	.25 U	.1 U
	28		S		820916	1055		51.1			.05 U	6.8	.25 U	.1 U
	29		S		820916	1122		121.2			.05 U	19.3	.25 U	.1
	30		S		820916	1135		66.3			.05 U	13.0	.25 U	.1 U
	31		S		820916	1156		89.0			.05 U	15.3	.25 U	.1 U
	32		S		820916	1210		107.2			.05 U	29.0	.25 U	.1 U
	33		S		820916	1237		93.8			.05 U	18.3	.25 U	.1 U
	34		S		820916	1253		33.6			.05 U	4.5	.25 U	.1
	35		S		820916	1321		72.2			.05 U	10.8	.25 U	.1 U
	36		S		820916	1348		72.3			.05 U	13.0	.25 U	.1
	37		S		820916	1403		78.9			.05 U	12.0	.25 U	.1 U
	38		S		820916	1420		62.1			.05 U	10.8	.25 U	.1
	39		S		820916	1439		98.6			.05 U	17.5	.25 U	.1 U
	40		S		820916	1454		48.7			.05 U	6.3	.25 U	.1 U
	41		S		820916	1512		47.7			.05 U	6.3	.25 U	.1 U
	42		S		820916	1532		46.9			.05 U	5.8	.25 U	.1 U
	43		S		820916	1554		38.1			.05 U	5.0	.25 U	.1 U
	44		S		820916	1615		27.0			.05 U	2.8	.25 U	.1 U
	45		S		820916	1629		29.4			.05 U	3.0	.25 U	.1 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705		132.2			.05 U	34.4	1.5	.1 U

INORGANICS -- METALS

U NOT DETECTED
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

ANALYSES: EPA LAB -- MANCHESTER
UNITS: METALS UG/GM (PPM) DRY WEIGHT BASIS
PHENOLICS UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	ITR NUM	DATE	TIME	---- M E T A L S TL	HG	SN	CD	PB	P A R A M E T E R S ---- PHENOLIC	CN
	01		S		820915	1117	.1 U	.05		.06	14	129 U	.13 U
	02		S		820915	1141	.1 U	.06		.14	20	128 U	.12 U
	03		S		820915	1213	.1 U	.06		.14	20	139 M	.14 U
	04		S		820915	1236	.1 U	.09		.22	26	182 M	.18 U
	05		S		820915	1318	.1 U	.15		.30	43	246 M	.24 U
	06		S		820915	1338	.1 U	.13		.30	42	268 M	.27 U
	07		S		820915	1356	.1 U	.09		.20	22	170 M	.17 U
	08		S		820915	1436	.1 U	.11		.24	25	219 M	.22 U
	09		S		820915	1503	.1 U	.03		.11	21	140 M	.14 U
	10		S		820915	1524	.1 U	.04		.11	24	132 M	.13 U
	11		S		820915	1542	.1 U	.10		.20	29	141 M	.14 U
	12		S		820915	1606	.1 U	.16		.23	38	177 M	.18 U
	13		S		820915	1627	.1 U	.13		.21	34	191 M	.19 U
	14		S		820915	1653	.1 U	.14		.25	31	229 M	.23 U
	15		S		820915	1721	.1 U	.09		.18	24	186 M	.18 U
	16		S		820915	1738	.1 U	.10		.21	26	163 M	.16 U
	17		S		820915	1750	.1 U	.07		.15	21	142 M	.14 U
	18		S		820915	1805	.1 U	.10		.29	31	201 M	.20 U
	19		S		820915	1819	.1 U	.09		.41	22	183	.18 U
	20		S		820915	1831	.1 U	.10		.24	22	196 M	.20 U
	21		S		820915	1842	.1 U	.10		.35	27	193	.19 U
	22		S		820915	1854	.1 U	.07		.23	18	166 M	.16 U
	23		S		820915	1903	.1 U	.06		.27	24	158	.16 U
	24		S		820916	0946	.1 U	.09		.23	19	182 M	.18 U
	25		S		820916	1009	.1 U	.10		.25	24	206 M	.21 U
	26		S		820916	1023	.1 U	.11		.21	29	214 M	.21 U
	27		S		820916	1042	.1 U	.10		.33	25	192 M	.19 U
	28		S		820916	1055	.1 U	.09		.48	22	183 M	.18 U
	29		S		820916	1122	.1 U	.13		.26	42	210 M	.21 U
	30		S		820916	1135	.1 U	.13		.24	29	221 M	.22 U
	31		S		820916	1156	.1 U	.10		.27	27	209 M	.21 U
	32		S		820916	1210	.1 U	.12		.36	34	207 M	.21 U
	33		S		820916	1237	.1 U	.09		.23	32	179 M	.18 U
	34		S		820916	1253	.1 U	.05		.23	10	175 M	.18 U
	35		S		820916	1321	.1 U	.15		.24	31	214 M	.21 U
	36		S		820916	1348	.1 U	.13		.30	29	186 M	.18 U
	37		S		820916	1403	.1 U	.17		.27	39	242 M	.24 U
	38		S		820916	1420	.1 U	.16		.21	32	178 M	.18 U
	39		S		820916	1439	.1 U	.25		.42	50	192 M	.19 U
	40		S		820916	1454	.1 U	.08		.23	18	300	.20 U
	41		S		820916	1512	.1 U	.09		.23	18	181 M	.18 U
	42		S		820916	1532	.1 U	.09		.24	14	172 M	.17 U
	43		S		820916	1554	.1 U	.07		.18	15	171 M	.17 U
	44		S		820916	1615	.1 U	.03		.14	6	158 M	.16 U
	45		S		820916	1629	.1 U	.05		.20	11	158	.16 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	.1 U	.23		.65	116	180 M	.18 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS
PHENOL DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	ACID COMPOUNDS: 2,4,6 TRI CHLORO PHENOL	P-CHLORO -M- CRESOL	2-CHLORO PHENOL	2,4,DI CHLORO PHENOL	2,4,DI METHYL PHENOL	2-NITRO PHENOL	4-NITRO PHENOL	2,4,DI NITRO PHENOL
	01		S		820915	1117	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	02		S		820915	1141	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	03		S		820915	1213	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	04		S		820915	1236	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	05		S		820915	1318	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	06		S		820915	1338	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	07		S		820915	1356	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	08		S		820915	1436	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	09		S		820915	1503	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	10		S		820915	1524	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	11		S		820915	1542	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	12		S		820915	1606	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	13		S		820915	1627	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	14		S		820915	1653	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	15		S		820915	1721	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	16		S		820915	1738	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	17		S		820915	1750	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	18		S		820915	1805	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	19		S		820915	1819	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	20		S		820915	1831	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	21		S		820915	1842	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	22		S		820915	1854	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	23		S		820915	1903	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	24		S		820916	0946	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	25		S		820916	1009	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	26		S		820916	1023	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	27		S		820916	1042	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	28		S		820916	1055	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	29		S		820916	1122	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	30		S		820916	1135	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	31		S		820916	1156	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	32		S		820916	1210	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	33		S		820916	1237	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	34		S		820916	1253	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	35		S		820916	1321	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	36		S		820916	1348	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	37		S		820916	1403	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	38		S		820916	1420	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	39		S		820916	1439	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	40		S		820916	1454	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	41		S		820916	1512	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	42		S		820916	1532	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	43		S		820916	1554	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	44		S		820916	1615	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
	45		S		820916	1629	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	6 U	6 U	3 U	12 U	12 U	6 U	40 U	20 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS
PHENOL DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	ACID COMPOUNDS: 2,6,DI NITRO PHENOL	ACID COMPOUNDS: PENTA CHLORO PHENOL	ACID COMPOUNDS: PHENOL
	01		S		820915	1117	15 U	70 U	3 U
	02		S		820915	1141	15 U	70 U	3 U
	03		S		820915	1213	15 U	70 U	3 U
	04		S		820915	1236	15 U	70 U	27
	05		S		820915	1318	15 U	70 U	12
	06		S		820915	1338	15 U	70 U	3 U
	07		S		820915	1356	15 U	70 U	3 U
	08		S		820915	1436	15 U	70 U	3 U
	09		S		820915	1503	15 U	70 U	3 U
	10		S		820915	1524	15 U	70 U	3 U
	11		S		820915	1542	15 U	70 U	3 U
	12		S		820915	1606	15 U	70 U	44
	13		S		820915	1627	15 U	70 U	12
	14		S		820915	1653	15 U	70 U	3 U
	15		S		820915	1721	15 U	70 U	3 U
	16		S		820915	1738	15 U	70 U	3 U
	17		S		820915	1750	15 U	70 U	3 U
	18		S		820915	1805	15 U	70 U	3 U
	19		S		820915	1819	15 U	70 U	3 U
	20		S		820915	1831	15 U	70 U	3 U
	21		S		820915	1842	15 U	70 U	3 U
	22		S		820915	1854	15 U	70 U	3 U
	23		S		820915	1903	15 U	70 U	3 U
	24		S		820916	0946	15 U	70 U	3 U
	25		S		820916	1009	15 U	70 U	3 U
	26		S		820916	1023	15 U	70 U	35
	27		S		820916	1042	15 U	70 U	3 U
	28		S		820916	1055	15 U	70 U	3 U
	29		S		820916	1122	15 U	70 U	3 U
	30		S		820916	1135	15 U	70 U	3 U
	31		S		820916	1156	15 U	70 U	3 U
	32		S		820916	1210	15 U	70 U	3 U
	33		S		820916	1237	15 U	70 U	3 U
	34		S		820916	1253	15 U	70 U	3 U
	35		S		820916	1321	15 U	70 U	3 U
	36		S		820916	1348	15 U	70 U	3 U
	37		S		820916	1403	15 U	70 U	3 U
	38		S		820916	1420	15 U	70 U	24
	39		S		820916	1439	15 U	70 U	3 U
	40		S		820916	1454	15 U	70 U	3 U
	41		S		820916	1512	15 U	70 U	3 U
	42		S		820916	1532	15 U	70 U	3 U
	43		S		820916	1554	15 U	70 U	3 U
	44		S		820916	1615	15 U	70 U	3 U
	45		S		820916	1629	15 U	70 U	3 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	15 U	70 U	3 U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	PESTICIDES: ALDRIN	DIELDRIN	CHLOR-DANE	4,4'-DDT	4,4'-DDE	4,4'-DDD	A-ENDO SULFAN	B-ENDO SULFAN
	01		S		820915	1117	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	02		S		820915	1141	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	03		S		820915	1213	1 U	1 U	1 U	1 U	2	1 U	1 U	1 U
	04		S		820915	1236	1 U	1 U	1 U	1 U	3	1 U	1 U	1 U
	05		S		820915	1318	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	06		S		820915	1338	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	07		S		820915	1356	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	08		S		820915	1436	1 U	1 U	1 U	1 U	2	1 U	1 U	1 U
	09		S		820915	1503	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	10		S		820915	1524	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	11		S		820915	1542	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	12		S		820915	1606	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	13		S		820915	1627	1 U	1 U	1 U	1 U	2	1 U	1 U	1 U
	14		S		820915	1653	1 U	1 U	1 U	1 U	2	1 U	1 U	1 U
	15		S		820915	1721	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	16		S		820915	1738	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	17		S		820915	1750	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	18		S		820915	1805	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	19		S		820915	1819	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	20		S		820915	1831	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	21		S		820915	1842	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	22		S		820915	1854	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	23		S		820915	1903	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	24		S		820916	0946	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	25		S		820916	1009	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	26		S		820916	1023	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	27		S		820916	1042	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	28		S		820916	1055	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	29		S		820916	1122	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	30		S		820916	1135	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	31		S		820916	1156	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	32		S		820916	1210	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	33		S		820916	1237	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	34		S		820916	1253	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	35		S		820916	1321	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
	36		S		820916	1348	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	37		S		820916	1403	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	38		S		820916	1420	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	39		S		820916	1439	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	40		S		820916	1454	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	41		S		820916	1512	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	42		S		820916	1532	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	43		S		820916	1554	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	44		S		820916	1615	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	45		S		820916	1629	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

							PESTICIDES								
STATION DESCRIPTION	NUM	MILE	M	NUM	DATE	TIME	ENDO SULFAN SULFATE	ENDRIN	ENDRIN ALDEHYDE	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	A-BHC	B-BHC	D-BHC	G-BHC LINDANE
	01		S		820915	1117	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	02		S		820915	1141	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	03		S		820915	1213	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	04		S		820915	1236	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	05		S		820915	1318	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	06		S		820915	1338	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	07		S		820915	1356	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	08		S		820915	1436	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	09		S		820915	1503	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	10		S		820915	1524	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	11		S		820915	1542	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	12		S		820915	1606	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	13		S		820915	1627	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	14		S		820915	1653	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	15		S		820915	1721	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	16		S		820915	1738	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	17		S		820915	1750	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	18		S		820915	1805	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	19		S		820915	1819	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	20		S		820915	1831	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	21		S		820915	1842	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	22		S		820915	1854	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	23		S		820915	1903	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	24		S		820916	0946	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	25		S		820916	1009	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	26		S		820916	1023	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	27		S		820916	1042	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	28		S		820916	1055	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	29		S		820916	1122	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	30		S		820916	1135	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	31		S		820916	1156	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	32		S		820916	1210	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	33		S		820916	1237	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	34		S		820916	1253	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	35		S		820916	1321	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	36		S		820916	1348	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	37		S		820916	1403	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	38		S		820916	1420	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	39		S		820916	1439	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	40		S		820916	1454	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	41		S		820916	1512	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	42		S		820916	1532	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	43		S		820916	1554	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	44		S		820916	1615	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	45		S		820916	1629	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	PCB PCB-1242	PCB PCB-1254	PCB PCB-1221	PCB PCB-1232	PCB PCB-1248	PCB PCB-1260	PCB PCB-1016	TOXA-PHENE	TCDD DIOXIN
	01		S		820915	1117	10 U	10 U	10 U	10 U	10 U	10 U	10 U	30 U	
	02		S		820915	1141	10 U	10 U	10 U	10 U	10 U	10 U	10 U	30 U	
	03		S		820915	1213	10 U	10 U	10 U	10 U	10 U	10 U	10 U	30 U	
	04		S		820915	1236	15 U	15 U	15 U	15 U	15 U	15 U	15 U	45 U	
	05		S		820915	1318	20 U	20 U	20 U	20 U	20 U	20 U	20 U	60 U	
	06		S		820915	1338	20 U	20 U	20 U	20 U	20 U	126	20 U	60 U	
	07		S		820915	1356	3 U	3 U	3 U	3 U	3 U	21	3 U	10 U	
	08		S		820915	1436	5 U	5 U	5 U	5 U	5 U	28	5 U	15 U	
	09		S		820915	1503	3 U	3 U	3 U	3 U	3 U	10	3 U	9 U	
	10		S		820915	1524	2 U	2 U	2 U	2 U	2 U	2 U	2 U	6 U	
	11		S		820915	1542	2 U	2 U	2 U	2 U	2 U	2 U	2 U	6 U	
	12		S		820915	1606	3 U	63	3 U	3 U	3 U	18	3 U	9 U	
	13		S		820915	1627	3 U	3 U	3 U	3 U	3 U	25	3 U	9 U	
	14		S		820915	1653	4 U	4 U	4 U	4 U	4 U	25	4 U	12 U	
	15		S		820915	1721	3 U	21	3 U	3 U	3 U	10	3 U	9 U	
	16		S		820915	1738	3 U	27	3 U	3 U	3 U	13	3 U	9 U	
	17		S		820915	1750	2 U	11	2 U	2 U	2 U	6	2 U	6 U	
	18		S		820915	1805	3 U	32	3 U	3 U	3 U	22	3 U	9 U	
	19		S		820915	1819	3 U	24	3 U	3 U	3 U	14	3 U	9 U	
	20		S		820915	1831	3 U	16	3 U	3 U	3 U	9	3 U	9 U	
	21		S		820915	1842	3 U	21	3 U	3 U	3 U	12	3 U	9 U	
	22		S		820915	1854	3 U	14	3 U	3 U	3 U	6	3 U	9 U	
	23		S		820915	1903	3 U	14	3 U	3 U	3 U	3 U	3 U	9 U	
	24		S		820916	0946	3 U	22	3 U	3 U	3 U	12	3 U	9 U	
	25		S		820916	1009	3 U	21	3 U	3 U	3 U	10	3 U	9 U	
	26		S		820916	1023	3 U	37	3 U	3 U	3 U	16	3 U	9 U	
	27		S		820916	1042	3 U	16	3 U	3 U	3 U	7	3 U	9 U	
	28		S		820916	1055	3 U	15	3 U	3 U	3 U	3 U	3 U	9 U	
	29		S		820916	1122	3 U	31	3 U	3 U	3 U	12	3 U	9 U	
	30		S		820916	1135	3 U	17	3 U	3 U	3 U	15	3 U	9 U	
	31		S		820916	1156	3 U	21	3 U	3 U	3 U	8	3 U	9 U	
	32		S		820916	1210	3 U	30	3 U	3 U	3 U	15	3 U	9 U	
	33		S		820916	1237	3 U	11	3 U	3 U	3 U	3 U	3 U	9 U	
	34		S		820916	1253	3 U	6	3 U	3 U	3 U	3 U	3 U	9 U	
	35		S		820916	1321	3 U	27	3 U	3 U	3 U	17	3 U	9 U	
	36		S		820916	1348	3 U	24	3 U	3 U	3 U	10	3 U	9 U	
	37		S		820916	1403	4 U	36	4 U	4 U	4 U	19	4 U	12 U	
	38		S		820916	1420	3 U	15	3 U	3 U	3 U	5	3 U	9 U	
	39		S		820916	1439	3 U	34	3 U	3 U	3 U	17	3 U	9 U	
	40		S		820916	1454	3 U	17	3 U	3 U	3 U	6	3 U	9 U	
	41		S		820916	1512	3 U	21	3 U	3 U	3 U	8	3 U	9 U	
	42		S		820916	1532	3 U	18	3 U	3 U	3 U	7	3 U	9 U	
	43		S		820916	1554	3 U	9	3 U	3 U	3 U	3 U	3 U	9 U	
	44		S		820916	1615	3 U	9	3 U	3 U	3 U	4	3 U	9 U	
	45		S		820916	1629	3 U	6	3 U	3 U	3 U	5	3 U	9 U	
HYLEBOS 11ST BRIDGE	46		S		820916	1705	12 U	240	12 U	12 U	12 U	210	12 U	40 U	

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: ACENAPH THENE	BEN ZIDINE	1,2,4- TRICHLOR BENZENE	HEXA CHLORO BENZENE	HEXA CHLORO ETHANE	BIS 2-CHLORO EHTYL) ETHER	2-CHLORO NAPH THALENE	1,2-DI CHLORO BENZENE	1,3-DI CHLORO BENZENE
	01		S		820915	1117	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	02		S		820915	1141	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	03		S		820915	1213	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	04		S		820915	1236	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	05		S		820915	1318	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	06		S		820915	1338	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	07		S		820915	1356	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	08		S		820915	1436	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	09		S		820915	1503	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	10		S		820915	1524	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	11		S		820915	1542	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	12		S		820915	1606	4	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	13		S		820915	1627	4	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	14		S		820915	1653	3	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	15		S		820915	1721	3	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	16		S		820915	1738	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	17		S		820915	1750	3.3	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	18		S		820915	1805	3 M	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	19		S		820915	1819	3	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	20		S		820915	1831	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	21		S		820915	1842	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	22		S		820915	1854	3	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	23		S		820915	1903	3	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	24		S		820916	0946	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	25		S		820916	1009	9	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	26		S		820916	1023	6	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	27		S		820916	1042	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	28		S		820916	1055	3	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	29		S		820916	1122	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	30		S		820916	1135	2.6	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	31		S		820916	1156	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	32		S		820916	1210	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	33		S		820916	1237	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	34		S		820916	1253	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	35		S		820916	1321	3 M	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	36		S		820916	1348	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	37		S		820916	1403	4	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	38		S		820916	1420	6	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	39		S		820916	1439	17	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	40		S		820916	1454	21	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	41		S		820916	1512	7	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	42		S		820916	1532	9	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	43		S		820916	1554	9	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	44		S		820916	1615	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
	45		S		820916	1629	3 U	200 U	3 U	15 U	3 U	3 U	3 U	3 U	3 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	13	200 U	3 U	18	3 U	3 U	3 U	3 U	3 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	B A S E / N E U T R A L S: 1,4-DI CHLORO BENZENE	3,3'- DICHLORO BENZI DINE	2,4- DINITRO TOLUENE	2,6- DINITRO TOLUENE	1,2-DI PHENYLHY DRAZAINE	FLUOR ANTHENE	4-CHLORO PHENYL PHENYL ETHER	4-BROMO PHENYL PHENYL ETHER	BIS(2- CHLOROISO PROPYL) ETHER
	01		S		820915	1117	3 U	15 U	6 U	6 U	3 U	3 U	3 U	6 U	3 U
	02		S		820915	1141	3 U	15 U	6 U	6 U	3 U	3 M	3 U	6 U	3 U
	03		S		820915	1213	3 U	15 U	6 U	6 U	3 U	10	3 U	6 U	3 U
	04		S		820915	1236	3 U	15 U	6 U	6 U	3 U	51	3 U	6 U	3 U
	05		S		820915	1318	3 U	15 U	6 U	6 U	3 U	17	3 U	6 U	3 U
	06		S		820915	1338	3 U	15 U	6 U	6 U	3 U	25	3 U	6 U	3 U
	07		S		820915	1356	3 U	15 U	6 U	6 U	3 U	16	3 U	6 U	3 U
	08		S		820915	1436	3 U	15 U	6 U	6 U	3 U	31	3 U	6 U	3 U
	09		S		820915	1503	3 U	15 U	6 U	6 U	3 U	9	3 U	6 U	3 U
	10		S		820915	1524	3 U	15 U	6 U	6 U	3 U	3 U	3 U	6 U	3 U
	11		S		820915	1542	3 U	15 U	6 U	6 U	3 U	17	3 U	6 U	3 U
	12		S		820915	1606	3 U	15 U	6 U	6 U	3 U	27	3 U	6 U	3 U
	13		S		820915	1627	3 U	15 U	6 U	6 U	3 U	29	3 U	6 U	3 U
	14		S		820915	1653	3 U	15 U	6 U	6 U	3 U	29	3 U	6 U	3 U
	15		S		820915	1721	3 U	15 U	6 U	6 U	3 U	23	3 U	6 U	3 U
	16		S		820915	1738	3 U	15 U	6 U	6 U	3 U	32	3 U	6 U	3 U
	17		S		820915	1750	3 U	15 U	6 U	6 U	3 U	33	3 U	6 U	3 U
	18		S		820915	1805	3 U	15 U	6 U	6 U	3 U	36	3 U	6 U	3 U
	19		S		820915	1819	3 U	15 U	6 U	6 U	3 U	28	3 U	6 U	3 U
	20		S		820915	1831	3 U	15 U	6 U	6 U	3 U	30	3 U	6 U	3 U
	21		S		820915	1842	3 U	15 U	6 U	6 U	3 U	30	3 U	6 U	3 U
	22		S		820915	1854	3 U	15 U	6 U	6 U	3 U	36	3 U	6 U	3 U
	23		S		820915	1903	3 U	15 U	6 U	6 U	3 U	47	3 U	6 U	3 U
	24		S		820916	0946	3 U	15 U	6 U	6 U	3 U	32	3 U	6 U	3 U
	25		S		820916	1009	3 U	15 U	6 U	6 U	3 U	36	3 U	6 U	3 U
	26		S		820916	1023	3 U	15 U	6 U	6 U	3 U	48	3 U	6 U	3 U
	27		S		820916	1042	3 U	15 U	6 U	6 U	3 U	29	3 U	6 U	3 U
	28		S		820916	1055	3 U	15 U	6 U	6 U	3 U	45	3 U	6 U	3 U
	29		S		820916	1122	3 U	15 U	6 U	6 U	3 U	42	3 U	6 U	3 U
	30		S		820916	1135	3 U	15 U	6 U	6 U	3 U	52	3 U	6 U	3 U
	31		S		820916	1156	3 U	15 U	6 U	6 U	3 U	43	3 U	6 U	3 U
	32		S		820916	1210	3 U	15 U	6 U	6 U	3 U	54	3 U	6 U	3 U
	33		S		820916	1237	3 U	15 U	6 U	6 U	3 U	80	3 U	6 U	3 U
	34		S		820916	1253	3 U	15 U	6 U	6 U	3 U	35	3 U	6 U	3 U
	35		S		820916	1321	3 U	15 U	6 U	6 U	3 U	76	3 U	6 U	3 U
	36		S		820916	1348	3 U	15 U	6 U	6 U	3 U	61	3 U	6 U	3 U
	37		S		820916	1403	3 U	15 U	6 U	6 U	3 U	48	3 U	6 U	3 U
	38		S		820916	1420	3 U	15 U	6 U	6 U	3 U	47	3 U	6 U	3 U
	39		S		820916	1439	3 U	15 U	6 U	6 U	3 U	94	3 U	6 U	3 U
	40		S		820916	1454	3 U	15 U	6 U	6 U	3 U	63	3 U	6 U	3 U
	41		S		820916	1512	3 U	15 U	6 U	6 U	3 U	63	3 U	6 U	3 U
	42		S		820916	1532	3 U	15 U	6 U	6 U	3 U	67	3 U	6 U	3 U
	43		S		820916	1554	3 U	15 U	6 U	6 U	3 U	25	3 U	6 U	3 U
	44		S		820916	1615	3 U	15 U	6 U	6 U	3 U	19	3 U	6 U	3 U
	45		S		820916	1629	3 U	15 U	6 U	6 U	3 U	35	3 U	6 U	3 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	3 U	15 U	6 U	6 U	3 U	390	3 U	6 U	3 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

							B A S E / N E U T R A L S								
STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BIS 2-CHLORO ETHOXY METHANE	HEXA CHLORO BUTA DIENE	HEXA CHLOROCY CLOPENT ADIENE	ISO PHORONE	NAPH THALENE	NITRO BENZENE	N-NITROSO DIMETHYL AMINE	N-NITROSO DIPHENYL AMINE	N-NITROSO DIPROPYL AMINE
	01		S		820915	1117	3 U	3 U	200 U	3 U	3 U	3 U		100 U	6 U
	02		S		820915	1141	3 U	3 U	200 U	3 U	3 M	3 U		100 U	6 U
	03		S		820915	1213	3 U	3 U	200 U	3 U	3.8	3 U		100 U	6 U
	04		S		820915	1236	3 U	10	200 U	3 U	44	3 U		100 U	6 U
	05		S		820915	1318	3 U	14	200 U	3 U	13	3 U		100 U	6 U
	06		S		820915	1338	3 U	9	200 U	3 U	17	3 U		100 U	6 U
	07		S		820915	1356	3 U	3 U	200 U	3 U	10	3 U		100 U	6 U
	08		S		820915	1436	3 U	3 U	200 U	3 U	25	3 U		100 U	6 U
	09		S		820915	1503	3 U	3 U	200 U	3 U	3.3	3 U		100 U	6 U
	10		S		820915	1524	3 U	3 U	200 U	3 U	3 U	3 U		100 U	6 U
	11		S		820915	1542	3 U	3 U	200 U	3 U	12	3 U		100 U	6 U
	12		S		820915	1606	3 U	3 U	200 U	3 U	19	3 U		100 U	6 U
	13		S		820915	1627	3 U	5	200 U	3 U	23	3 U		100 U	6 U
	14		S		820915	1653	3 U	5	200 U	3 U	20	3 U		100 U	6 U
	15		S		820915	1721	3 U	3 U	200 U	3 U	33	3 U		100 U	6 U
	16		S		820915	1738	3 U	3 U	200 U	3 M	39	3 U		100 U	6 U
	17		S		820915	1750	3 U	3 U	200 U	3 M	54	3 U		100 U	6 U
	18		S		820915	1805	3 U	3 U	200 U	3 U	40	3 U		100 U	6 U
	19		S		820915	1819	3 U	3 U	200 U	3 U	45	3 U		100 U	6 U
	20		S		820915	1831	3 U	3 U	200 U	3 U	29	3 U		100 U	6 U
	21		S		820915	1842	3 U	3 U	200 U	3 U	46	3 U		100 U	6 U
	22		S		820915	1854	3 U	3 U	200 U	3 U	40	3 U		100 U	6 U
	23		S		820915	1903	3 U	3 U	200 U	3 U	46	3 U		100 U	6 U
	24		S		820916	0946	3 U	3 U	200 U	3 U	31	3 U		100 U	6 U
	25		S		820916	1009	3 U	3 U	200 U	3 U	3 U	3 U		100 U	6 U
	26		S		820916	1023	3 U	3 U	200 U	3 U	25	3 U		100 U	6 U
	27		S		820916	1042	3 U	3 U	200 U	3 U	21	3 U		100 U	6 U
	28		S		820916	1055	3 U	3 U	200 U	3 U	23	3 U		100 U	6 U
	29		S		820916	1122	3 U	3 U	200 U	3 U	13	3 U		100 U	6 U
	30		S		820916	1135	3 U	3 U	200 U	3 U	19	3 U		100 U	6 U
	31		S		820916	1156	3 U	3 U	200 U	3 U	4	3 U		100 U	6 U
	32		S		820916	1210	3 U	3 U	200 U	3 U	17	3 U		100 U	6 U
	33		S		820916	1237	3 U	3 U	200 U	3 U	8	3 U		100 U	6 U
	34		S		820916	1253	3 U	3 U	200 U	3 U	32	3 U		100 U	6 U
	35		S		820916	1321	3 U	3 U	200 U	3 U	10	3 U		100 U	6 U
	36		S		820916	1348	3 U	3 U	200 U	3 U	24	3 U		100 U	6 U
	37		S		820916	1403	3 U	3 U	200 U	3 U	24	3 U		100 U	6 U
	38		S		820916	1420	3 U	3 U	200 U	3 U	46	3 U		100 U	6 U
	39		S		820916	1439	3 U	3 U	200 U	3 U	54	3 U		100 U	6 U
	40		S		820916	1454	3 U	3 U	200 U	3 U	93	3 U		100 U	6 U
	41		S		820916	1512	3 U	3 U	200 U	3 U	33	3 U		100 U	6 U
	42		S		820916	1532	3 U	3 U	200 U	3 U	46	3 U		100 U	6 U
	43		S		820916	1554	3 U	3 U	200 U	3 U	54	3 U		100 U	6 U
	44		S		820916	1615	3 U	3 U	200 U	3 U	10	3 U		100 U	6 U
	45		S		820916	1629	3 U	3 U	200 U	3 U	20	3 U		100 U	6 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	3 U	12	200 U	3 U	33	3 U		100 U	6 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BIS 2-ETHYL HEXYL PHTHALAT	BENZYL BUTYL PHTHALAT	DI-N-BUTYL PHTHALAT	DI-N-OCTYL PHTHALAT	DIETHYL PHTHALAT	DIMETHYL PHTHALAT	BENZO A ANTHRA CENE	BENZO A PYRENE	BENZO B FLUORAN THENE
	01		S		820915	1117	540	3 U	27	3 U	3 U	3 U		70 U	
	02		S		820915	1141	4300	3 U	23	3 U	3 U	3 U		70 U	
	03		S		820915	1213	910	3 U	44	3 U	3.5	3 U		70 U	
	04		S		820915	1236	1300	3 U	50	3 U	3 U	3 U		170	
	05		S		820915	1318	70	3 U	3 U	3 U	3 U	3 U		70 U	
	06		S		820915	1338	13000	3 U	79	125	3 U	3 U		70 U	
	07		S		820915	1356	300	3 U	80	3 U	3 U	3 U		70 U	
	08		S		820915	1436	86	10	180	3 U	3 U	3 U		70 U	
	09		S		820915	1503	200	19	31	3 U	3 U	3 U		70 U	
	10		S		820915	1524	86	22	68	3 U	3 U	3 U		70 U	
	11		S		820915	1542	140	12	22	3 U	3 U	3 U		70 U	
	12		S		820915	1606	35	3 U	107	3 U	4	3 U		70 U	
	13		S		820915	1627	130	5	31	81	3 U	3 U		70 M	
	14		S		820915	1653	85	4	20	3 U	3 U	3 U		70 M	
	15		S		820915	1721	32	3 U	220	3 U	3 U	3 U		70 U	
	16		S		820915	1738	46	3 U	3 U	3 U	3 U	3 U		70 U	
	17		S		820915	1750	520	3 U	96	3 U	3 U	3 U		70 U	
	18		S		820915	1805	88	3 U	490	3 U	3 U	3 U		70 U	
	19		S		820915	1819	26	3 U	51	3 U	3 U	3 U		70 U	
	20		S		820915	1831	82	3 U	3 U	26	3 U	3 U		70 U	
	21		S		820915	1842	3300	3 U	200	3 U	3 U	3 U		70 U	
	22		S		820915	1854	250	3 U	78	3 U	3 U	3 U		70 U	
	23		S		820915	1903	320	3 U	3 U	3 U	3 U	3 U		70 U	
	24		S		820916	0946	43	3 U	3 U	3 U	3 U	3 U		70 U	
	25		S		820916	1009	82	3 U	230	3 U	3 U	3 U		70 U	
	26		S		820916	1023	270	3 U	160	3 U	3 U	3 U		70 U	
	27		S		820916	1042	19	3 U	128	3 U	3 U	3 U		70 U	
	28		S		820916	1055	68	3 U	3 U	3 U	3 U	3 U		70 U	
	29		S		820916	1122	53	3 U	3 U	3 U	3 U	3 U		70 U	
	30		S		820916	1135	3 U	3 U	3 U	3 U	3 U	3 U		70 U	
	31		S		820916	1156	32	3 U	3 U	3 U	3 U	3 U		70 U	
	32		S		820916	1210	100	3 U	50	3 U	3 U	3 U		70 U	
	33		S		820916	1237	85	3 U	45	3 U	3 U	3 U		70 U	
	34		S		820916	1253	240	3 U	3 U	3 U	3 U	3 U		70 U	
	35		S		820916	1321	70	3 U	110	3 U	3 U	3 U		70 U	
	36		S		820916	1348	3 U	3 U	3 U	3 U	3 U	3 U		70 U	
	37		S		820916	1403	57	3 U	3 U	3 U	3 U	3 U		70 U	
	38		S		820916	1420	52	3 U	30	3 U	3 U	3 U		70 U	
	39		S		820916	1439	420	3 U	128	3 U	3 U	3 U		70 U	
	40		S		820916	1454	29	3 U	300	3 U	3 U	3 U		70 U	
	41		S		820916	1512	24	3 U	130	3 U	3 U	3 U		70 U	
	42		S		820916	1532	54	3 U	200	3 U	3 U	3 U		70 U	
	43		S		820916	1554	74	3 U	56	3 U	3 U	3 U		70 U	
	44		S		820916	1615	72	3 U	110	10	3 U	3 U		70 U	
	45		S		820916	1629	180	3 U	3 U	3 U	3 U	3 U		70 U	
HYLEBOS 11ST BRIDGE	46		S		820916	1705	150	3 U	3 U	3 U	3 U	3 U		70 U	

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BENZO K FLUORAN THENE	CHRYSENE	ACENAPH THYLENE	ANTHRA CENE	BENZO GHI PERYLENE	FLUORENE	PHENAN THRENE	DIBENZO A,H ANTH RACENE	INDENO 1,2,3-CD PYRENE
	01		S		820915	1117			3 U		15 U	3 U		70 U	70 U
	02		S		820915	1141			3 U		15 U	3 U		70 U	70 U
	03		S		820915	1213			3 U		15 U	3 U		70 U	70 U
	04		S		820915	1236			3 U		15 U	21		70 U	70 U
	05		S		820915	1318			5.4		15 U	6.8		70 U	70 U
	06		S		820915	1338			5.8		15 U	3 U		70 U	70 U
	07		S		820915	1356			3		15 U	3 U		70 U	70 U
	08		S		820915	1436			10		15 U	3 U		70 U	70 U
	09		S		820915	1503			3 U		3 U	3 U		70 U	70 U
	10		S		820915	1524			3 U		3 U	3 U		70 U	70 U
	11		S		820915	1542			3 U		3 U	3		70 U	70 U
	12		S		820915	1606			6		3 U	5		70 U	70 M
	13		S		820915	1627			7		4	6		70 U	70 M
	14		S		820915	1653			5		3 U	7		70 U	70 U
	15		S		820915	1721			8		3 U	5		70 U	70 U
	16		S		820915	1738			10		3 U	8		70 U	70 U
	17		S		820915	1750			11		15 U	8		70 U	70 U
	18		S		820915	1805			8		15 U	6		70 U	70 U
	19		S		820915	1819			8		15 U	6		70 U	70 U
	20		S		820915	1831			6		15 U	7		70 U	70 U
	21		S		820915	1842			10		15 U	6		70 U	70 U
	22		S		820915	1854			9		15 U	7		70 U	70 U
	23		S		820915	1903			10		15 U	7		70 U	70 U
	24		S		820916	0946			8		15 U	3 U		70 U	70 U
	25		S		820916	1009			6		15 M	3 U		70 U	70 U
	26		S		820916	1023			5		15 U	3		70 U	70 U
	27		S		820916	1042			4		15 U	3 U		70 U	70 U
	28		S		820916	1055			10		15 U	5		70 U	70 U
	29		S		820916	1122			3 U		15 U	3 U		70 U	70 U
	30		S		820916	1135			3 U		15 U	3 U		70 U	70 U
	31		S		820916	1156			3 U		15 U	3 U		70 U	70 U
	32		S		820916	1210			9		15 U	7		70 U	70 U
	33		S		820916	1237			3 U		15 U	3 U		70 U	70 U
	34		S		820916	1253			3 U		15 U	3 U		70 U	70 U
	35		S		820916	1321			3 U		15 U	3 U		70 U	70 U
	36		S		820916	1348			3 U		15 U	3 U		70 U	70 U
	37		S		820916	1403			7		15 U	3 U		70 U	70 U
	38		S		820916	1420			12		15 U	3 U		70 U	70 U
	39		S		820916	1439			34		15 U	16		70 U	70 U
	40		S		820916	1454			3 U		15 U	11		70 U	70 U
	41		S		820916	1512			5		15 U	3 U		70 U	70 U
	42		S		820916	1532			6		15 U	10		70 U	70 U
	43		S		820916	1554			3 U		15 U	6		70 U	70 U
	44		S		820916	1615			3 U		15 U	3 U		70 U	70 U
	45		S		820916	1629			3 U		15 U	3 U		70 U	70 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705			42		15 U	22		70 U	70 U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: PYRENE	BENZO(A)ANTHRACENE/ CHRYSENE	BENZO(B)FLUORANTHENE/ BENZO(K)FLUORANTHENE	ANTHRACENE/ PHENANTHRENE
	01		S		820915	1117	3 U	6 U	100 U	3 M
	02		S		820915	1141	4.1	6 U	100 U	5
	03		S		820915	1213	18	24	100 U	14
	04		S		820915	1236	80	140	100 U	78
	05		S		820915	1318	28	51	100 U	48
	06		S		820915	1338	42	66	100 U	47
	07		S		820915	1356	29	42	100 U	16
	08		S		820915	1436	44	3	100 U	70
	09		S		820915	1503	11	6 U	100 U	21
	10		S		820915	1524	3 U	6 U	100 U	3 U
	11		S		820915	1542	18	28	100 U	26
	12		S		820915	1606	38	22	100 U	70
	13		S		820915	1627	41	21	100 U	76
	14		S		820915	1653	37	18	100 U	66
	15		S		820915	1721	42	440	100 U	41
	16		S		820915	1738	48	54	100 U	51
	17		S		820915	1750	48	11	100 U	64
	18		S		820915	1805	57	49	100 U	63
	19		S		820915	1819	42	46	100 U	55
	20		S		820915	1831	65	5.5	100 U	70
	21		S		820915	1842	66	10	100 U	79
	22		S		820915	1854	56	3	100 U	79
	23		S		820915	1903	85	9	100 U	20
	24		S		820916	0946	54	40	100 U	21
	25		S		820916	1009	72	46	100 U	4
	26		S		820916	1023	37	6 U	100 U	120
	27		S		820916	1042	34	6 U	100 U	130
	28		S		820916	1055	40	52	100 U	93
	29		S		820916	1122	38	6 U	100 U	79
	30		S		820916	1135	30	7	100 U	160
	31		S		820916	1156	55	6 U	100 U	130
	32		S		820916	1210	59	6 U	100 U	170
	33		S		820916	1237	73	6 U	100 U	210
	34		S		820916	1253	36	6 U	100 U	210
	35		S		820916	1321	70	8	100 U	190
	36		S		820916	1348	55	6 U	100 U	100
	37		S		820916	1403	70	6 U	100 U	92
	38		S		820916	1420	68	6 U	100 U	180
	39		S		820916	1439	110	45	100 U	250
	40		S		820916	1454	75	6 U	100 U	310
	41		S		820916	1512	65	6 U	100 U	180
	42		S		820916	1532	77	15	100 U	240
	43		S		820916	1554	38	6 U	100 U	56
	44		S		820916	1615	10	6 U	100 U	3 U
	45		S		820916	1629	29	6 U	100 U	60
HYLEBOS 11ST BRIDGE	46		S		820916	1705	430	130	100 U	250

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

							---- VOLATILES ----								
STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	ACROLEIN	ACRYLO NITRILE	BENZENE	CARBON TETRA CHLORIDE	CHLORO BENZENE	1,2-DICHLORO ETHANE	1,1,1-TRICHLOR ETHANE	1,1-DICHLORO ETHANE	1,1,2-TRICHLOR ETHANE
	01		S		820915	1117	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	02		S		820915	1141	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	03		S		820915	1213	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	04		S		820915	1236	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	05		S		820915	1318	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	06		S		820915	1338	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	07		S		820915	1356	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	08		S		820915	1436	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	09		S		820915	1503	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	10		S		820915	1524	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	11		S		820915	1542	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	12		S		820915	1606	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	13		S		820915	1627	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	14		S		820915	1653	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	15		S		820915	1721	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	16		S		820915	1738	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	17		S		820915	1750	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	18		S		820915	1805	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	19		S		820915	1819	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	20		S		820915	1831	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	21		S		820915	1842	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	22		S		820915	1854	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	23		S		820915	1903	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	24		S		820916	0946	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	25		S		820916	1009	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	26		S		820916	1023	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	27		S		820916	1042	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	28		S		820916	1055	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	29		S		820916	1122	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	30		S		820916	1135	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	31		S		820916	1156	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	32		S		820916	1210	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	33		S		820916	1237	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	34		S		820916	1253	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	35		S		820916	1321	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	36		S		820916	1348	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	37		S		820916	1403	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	38		S		820916	1420	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	39		S		820916	1439	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	40		S		820916	1454	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	41		S		820916	1512	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	42		S		820916	1532	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	43		S		820916	1554	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	44		S		820916	1615	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	45		S		820916	1629	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	10 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	VOLATILES: 1,1,2,2-TETRA CHLORO ETHANE	CHLORO ETHANE	2-CHLORO ETHYL VINLY ETHER	CHLORO FORM	1,1-DICHLORO ETHENE	TRANS-1,2-DICHLORO ETHENE	1,2-DICHLORO PROPANE	TRANS-1,3-DICHLORO PROPENE	CIS-1,3-DICHLORO PROPENE
	01		S		820915	1117	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	02		S		820915	1141	1 U	1 U	1 U	1 M	1 U	1 U	1 U	1 U	1 U
	03		S		820915	1213	1 U	1 U	1 U	1 M	1 U	1 U	1 U	1 U	1 U
	04		S		820915	1236	1 U	1 U	1 U	1 M	1 U	1.8	1 U	1 U	1 U
	05		S		820915	1318	1 U	1 U	1 U	1 M	1 U	5.2	1 U	1 U	1 U
	06		S		820915	1338	1 U	1 U	1 U	1 M	1 U	1.6	1 U	1 U	1 U
	07		S		820915	1356	1 U	1 U	1 U	1 U	1 U	1.6	1 U	1 U	1 U
	08		S		820915	1436	1 U	1 U	1 U	1 U	1 U	1.6	1 U	1 U	1 U
	09		S		820915	1503	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	10		S		820915	1524	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	11		S		820915	1542	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	12		S		820915	1606	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	13		S		820915	1627	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	14		S		820915	1653	1 U	1 U	1 U	1 M	1 U	1 M	1 U	1 U	1 U
	15		S		820915	1721	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	16		S		820915	1738	1 U	1 U	1 U	1 M	1 U	1 M	1 U	1 U	1 U
	17		S		820915	1750	1 U	1 U	1 U	1 M	1 U	1 M	1 U	1 U	1 U
	18		S		820915	1805	1 U	1 U	1 U	1 U	1 U	1.5	1 U	1 U	1 U
	19		S		820915	1819	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	20		S		820915	1831	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	21		S		820915	1842	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	22		S		820915	1854	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	23		S		820915	1903	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	24		S		820916	0946	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	25		S		820916	1009	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	26		S		820916	1023	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	27		S		820916	1042	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	28		S		820916	1055	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	29		S		820916	1122	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	30		S		820916	1135	1 U	1 U	1 U	1 M	1 U	1 M	1 U	1 U	1 U
	31		S		820916	1156	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	32		S		820916	1210	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	33		S		820916	1237	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	34		S		820916	1253	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	35		S		820916	1321	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	36		S		820916	1348	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	37		S		820916	1403	1 U	1 U	1 U	1 M	1 U	1 M	1 U	1 U	1 U
	38		S		820916	1420	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	39		S		820916	1439	1 U	1 U	1 U	1 U	1 U	1 M	1 U	1 U	1 U
	40		S		820916	1454	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	41		S		820916	1512	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	42		S		820916	1532	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	43		S		820916	1554	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	44		S		820916	1615	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	45		S		820916	1629	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	1 U	1 U	1 U	1 U	1 U	2.2	1 U	1 U	1 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	VOLATILES: ETHYL BENZENE	METHYL LENE CHLORIDE	CHLORO METHANE	BROMO METHANE	BROMO FORM	BROMO DICHLORO METHANE	FLUORO TRICHLOR METHANE	DICHLORO DIFLUORO METHANE	CHLORO DIBROMO METHANE
	01		S		820915	1117	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	02		S		820915	1141	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	03		S		820915	1213	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	04		S		820915	1236	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	05		S		820915	1318	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	06		S		820915	1338	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	07		S		820915	1356	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	08		S		820915	1436	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	09		S		820915	1503	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	10		S		820915	1524	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	11		S		820915	1542	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	12		S		820915	1606	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	13		S		820915	1627	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	14		S		820915	1653	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	15		S		820915	1721	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	16		S		820915	1738	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	17		S		820915	1750	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	18		S		820915	1805	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	19		S		820915	1819	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	20		S		820915	1831	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	21		S		820915	1842	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	22		S		820915	1854	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	23		S		820915	1903	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	24		S		820916	0946	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	25		S		820916	1009	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	26		S		820916	1023	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	27		S		820916	1042	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	28		S		820916	1055	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	29		S		820916	1122	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	30		S		820916	1135	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	31		S		820916	1156	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	32		S		820916	1210	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	33		S		820916	1237	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	34		S		820916	1253	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	35		S		820916	1321	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	36		S		820916	1348	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	37		S		820916	1403	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	38		S		820916	1420	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	39		S		820916	1439	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	40		S		820916	1454	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	41		S		820916	1512	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	42		S		820916	1532	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	43		S		820916	1554	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	44		S		820916	1615	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	45		S		820916	1629	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS

							VOLATILES			
STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	TETRA CHLORO ETHENE	TOLUENE	TRICHLOR ETHENE	VINYL CHLORIDE
	01		S		820915	1117	1 U	1 U	1 U	1 U
	02		S		820915	1141	1 U	1 U	1 U	1 U
	03		S		820915	1213	1 U	1 U	1 U	1 U
	04		S		820915	1236	1 M	1 U	1.8	1 U
	05		S		820915	1318	1 U	1 U	1 M	1 U
	06		S		820915	1338	1 U	1 U	1 M	1 U
	07		S		820915	1356	1 U	1 U	1 M	1 U
	08		S		820915	1436	1 U	1 U	1 M	1 U
	09		S		820915	1503	1 U	1 U	1 U	1 U
	10		S		820915	1524	1 U	1 U	1 U	1 U
	11		S		820915	1542	1 U	1 U	1 U	1 U
	12		S		820915	1606	1 M	1 U	1 M	1 U
	13		S		820915	1627	1 U	1 U	1 M	1 U
	14		S		820915	1653	1 M	1 U	1 M	1 U
	15		S		820915	1721	1 U	1 U	1 M	1 U
	16		S		820915	1738	1 M	1 U	1 M	1 U
	17		S		820915	1750	1 M	1 U	1 M	1 U
	18		S		820915	1805	1 M	1 U	1 M	1 U
	19		S		820915	1819	1 M	1 U	1 U	1 U
	20		S		820915	1831	1 M	1 U	1 U	1 U
	21		S		820915	1842	1 U	1 U	1 U	1 U
	22		S		820915	1854	1 U	1 U	1 U	1 U
	23		S		820915	1903	1 M	1 U	1 U	1 U
	24		S		820916	0946	1 M	1 U	1 U	1 U
	25		S		820916	1009	1 U	1 U	1 U	1 U
	26		S		820916	1023	1 U	1 U	1 U	1 U
	27		S		820916	1042	1 U	1 U	1 U	1 U
	28		S		820916	1055	1 U	1 U	1 U	1 U
	29		S		820916	1122	1 U	1 U	1 U	1 U
	30		S		820916	1135	1 U	1 U	1 U	1 U
	31		S		820916	1156	1 U	1 U	1 U	1 U
	32		S		820916	1210	1 M	1 U	1 U	1 U
	33		S		820916	1237	1 M	1 U	1 U	1 U
	34		S		820916	1253	1 U	1 U	1 U	1 U
	35		S		820916	1321	1 M	1 U	1 M	1 U
	36		S		820916	1348	1 U	1 U	1 U	1 U
	37		S		820916	1403	1 M	1 U	1 U	1 U
	38		S		820916	1420	1 U	1 U	1 U	1 U
	39		S		820916	1439	1 M	1 U	1 M	1 U
	40		S		820916	1454	1 U	1 U	1 U	1 U
	41		S		820916	1512	1 U	1 U	1 U	1 U
	42		S		820916	1532	1 U	1 U	1 U	1 U
	43		S		820916	1554	1 U	1 U	1 U	1 U
	44		S		820916	1615	1 U	1 U	1 U	1 U
	45		S		820916	1629	1 U	1 U	1 U	1 U
HYLEBOS 11ST BRIDGE	46		S		820916	1705	1 M	1 U	1 M	1 U

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

							---- POLYCHLORINATED BUTADIENES ----						
STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	MONO CHLORO BUTA DIENE	DI CHLORO BUTA DIENE	TRI CHLORO BUTA DIENE	TETRA CHLORO BUTA DIENE	PENTA CHLORO BUTA DIENE	HEXA CHLORO BUTA DIENE	TOTAL PCBDS
	01		S		820915	1117			1 U	1	1 U	1 U	1
	02		S		820915	1141			1 M	7	3	1 U	10
	03		S		820915	1213			23	31	1 U	1 U	54
	04		S		820915	1236			73	1143	40	41	1297
	05		S		820915	1318			153	700	26	11	890
	06		S		820915	1338			95	569	14	26	704
	07		S		820915	1356			7	63	1 U	3	73
	08		S		820915	1436			28	147	1 U	3	178
	09		S		820915	1503			14	59	3	1 U	76
	10		S		820915	1524			1 M	6	8	1 U	14
	11		S		820915	1542			1 M	16	3	1 U	19
	12		S		820915	1606			17	77	12	1 U	106
	13		S		820915	1627			18	174	6	1 U	198
	14		S		820915	1653			46	288	7	13	342
	15		S		820915	1721			3	43	1 U	3	52
	16		S		820915	1738			1	36	1 U	2	39
	17		S		820915	1750			6	37	1 U	1 U	43
	18		S		820915	1805			45	172	3	1 M	220
	19		S		820915	1819							PRESENT
	20		S		820915	1831			8	29	1 U	1 U	37
	21		S		820915	1842			17	95	1 U	3	115
	22		S		820915	1854			4	5	1 U	1 U	9
	23		S		820915	1903							PRESENT
	24		S		820916	0946			16	60	1 U	2	78
	25		S		820916	1009			35	34	1 U	1 U	69
	26		S		820916	1023			16	49	1 U	6	71
	27		S		820916	1042			21	70	1 U	5	96
	28		S		820916	1055			17	53	1 U	1 U	70
	29		S		820916	1122			14	79	3	6	102
	30		S		820916	1135			21	141	5	3	170
	31		S		820916	1156			1 M	5	1 U	1 M	5
	32		S		820916	1210			1 M	10	1 U	1 U	10
	33		S		820916	1237			1 M	5	1 U	1 U	5
	34		S		820916	1253			1 M	1	1 U	1 U	1
	35		S		820916	1321			98	191	1 U	24	313
	36		S		820916	1348			12	55	1	4	72
	37		S		820916	1403			13	134	1 U	8	155
	38		S		820916	1420			1	19	1 U	1 U	20
	39		S		820916	1439			1 M	18	1 U	1 U	18
	40		S		820916	1454			1 M	8	1 U	1 U	8
	41		S		820916	1512			1 M	20	1 U	1 U	20
	42		S		820916	1532			1 M	8	1 U	1 U	8
	43		S		820916	1554			1	5	1 U	1 U	6
	44		S		820916	1615			1 U	1 M	1 U	1 U	1 M
	45		S		820916	1629			1 U	1 M	1 U	1 U	1 M
HYLEBOS 11ST BRIDGE	46		S		820916	1705			25	230	13	53	321

APPENDIX B

COMPLETE LISTING OF CHEMICAL CONCENTRATIONS ON A DRY WEIGHT BASIS EXCLUDING THOSE BELOW THE MINIMUM QUANTIFIABLE LIMIT

INORGANICS -- METALS

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: METALS UG/GM (PPM) DRY WEIGHT BASIS
PHENOLICS UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	ITR NUM	DATE	TIME	AL	CR	BA	BE	CO	CU	FE	NI
							METALS PARAMETERS							
	01		S		820915	1117		16		.16		12.5		27
	02		S		820915	1141		15		.16		15.4		24
	03		S		820915	1213		17		.23		19.4		24
	04		S		820915	1236		17		.31		37.8		15
	05		S		820915	1318		31		.49		60.5		25
	06		S		820915	1338		28		.48		62.4		25
	07		S		820915	1356		19		.35		33.8		22
	08		S		820915	1436		17		.39		49.6		18
	09		S		820915	1503		16		.23		16.1		23
	10		S		820915	1524		19		.21		20.1		29
	11		S		820915	1542		22		.24		34.3		30
	12		S		820915	1606		24		.34		56.6		27
	13		S		820915	1627		21		.31		52.0		23
	14		S		820915	1653		20		.38		55.4		16
	15		S		820915	1721		17		.35		43.2		18
	16		S		820915	1738		17		.36		45.7		19
	17		S		820915	1750		13		.34		38.9		12
	18		S		820915	1805		16		.43		58.6		15
	19		S		820915	1819		16		.33		49.8		11
	20		S		820915	1831		16		.36		54.0		10
	21		S		820915	1842		19		.36		57.8		11
	22		S		820915	1854		15		.34		44.4		11
	23		S		820915	1903		13		.39		44.5		15
	24		S		820916	0946		16		.39		49.2		13
	25		S		820916	1009		16		.41		53.2		17
	26		S		820916	1023		16		.40		52.9		16
	27		S		820916	1042		12		.36		43.8		12
	28		S		820916	1055		12		.35		43.9		11
	29		S		820916	1122		18		.43		65.9		19
	30		S		820916	1135		15		.39		55.0		17
	31		S		820916	1156		13		.39		54.6		18
	32		S		820916	1210		16		.44		69.8		22
	33		S		820916	1237		20		.39		55.7		18
	34		S		820916	1253		9		.28		30.8		10
	35		S		820916	1321		21		.40		59.2		25
	36		S		820916	1348		18		.31		54.3		21
	37		S		820916	1403		20		.36		73.5		15
	38		S		820916	1420		14		.26		49.3		14
	39		S		820916	1439		22		.36		83.9		22
	40		S		820916	1454		14		.34		42.1		12
	41		S		820916	1512		14		.33		44.1		16
	42		S		820916	1532		12		.31		41.9		7
	43		S		820916	1554		12		.30		36.5		9
	44		S		820916	1615		7		.28		25.8		12
	45		S		820916	1629		9		.24		28.2		6
HYLEBOS 11ST BRIDGE	46		S		820916	1705		17		.34		112.4		15

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: METALS UG/GM (PPM) DRY WEIGHT BASIS
PHENOLICS UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	ITR NUM	DATE	TIME	METALS PARAMETERS: MN	ZN	B	V	AG	AS	SB	SE
	01		S		820915	1117		31.2				1.3		
	02		S		820915	1141		43.5				5.8		
	03		S		820915	1213		48.1				4.8		
	04		S		820915	1236		50.6				8.0		
	05		S		820915	1318		87.5				11.5		.1
	06		S		820915	1338		85.1				12.5		
	07		S		820915	1356		50.4				8.3		
	08		S		820915	1436		63.7				9.5		
	09		S		820915	1503		45.5				7.5		
	10		S		820915	1524		58.7				10.8		
	11		S		820915	1542		61.1				10.0		
	12		S		820915	1606		76.8				15.0		
	13		S		820915	1627		68.5				11.3		
	14		S		820915	1653		68.5				10.3		
	15		S		820915	1721		53.5				8.0		
	16		S		820915	1738		55.3				8.5		
	17		S		820915	1750		46.3				6.5		
	18		S		820915	1805		66.6				9.0		.1
	19		S		820915	1819		48.0				6.0		
	20		S		820915	1831		50.8				5.5		
	21		S		820915	1842		57.5				7.0		
	22		S		820915	1854		43.3				5.3		
	23		S		820915	1903		45.2				5.5		
	24		S		820916	0946		54.2				7.8		
	25		S		820916	1009		59.3				8.3		.1
	26		S		820916	1023		63.9				9.5		.1
	27		S		820916	1042		52.7				6.8		
	28		S		820916	1055		51.1				6.8		
	29		S		820916	1122		121.2				19.3		.1
	30		S		820916	1135		66.3				13.0		
	31		S		820916	1156		89.0				15.3		
	32		S		820916	1210		107.2				29.0		
	33		S		820916	1237		93.8				18.3		
	34		S		820916	1253		33.6				4.5		.1
	35		S		820916	1321		72.2				10.8		
	36		S		820916	1348		72.3				13.0		.1
	37		S		820916	1403		78.9				12.0		
	38		S		820916	1420		62.1				10.8		.1
	39		S		820916	1439		98.6				17.5		
	40		S		820916	1454		48.7				6.3		
	41		S		820916	1512		47.7				6.3		
	42		S		820916	1532		46.9				5.8		
	43		S		820916	1554		38.1				5.0		
	44		S		820916	1615		27.0				2.8		
	45		S		820916	1629		29.4				3.0		
HYLEBOS 11ST BRIDGE	46		S		820916	1705		132.2				34.4	1.5	

INORGANICS -- METALS

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: METALS UG/GM (PPM) DRY WEIGHT BASIS
PHENOLICS UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	ITR NUM	DATE	TIME	---- METALS TL	HG	SN	CD	PB	PHENOLIC	PARAMETERS ---- CN
	01		S		820915	1117		.05		.06	14		
	02		S		820915	1141		.06		.14	20		
	03		S		820915	1213		.06		.14	20	139 M	
	04		S		820915	1236		.09		.22	26	182 M	
	05		S		820915	1318		.15		.30	43	246 M	
	06		S		820915	1338		.13		.30	42	268 M	
	07		S		820915	1356		.09		.20	22	170 M	
	08		S		820915	1436		.11		.24	25	219 M	
	09		S		820915	1503		.03		.11	21	140 M	
	10		S		820915	1524		.04		.11	24	132 M	
	11		S		820915	1542		.10		.20	29	141 M	
	12		S		820915	1606		.16		.23	38	177 M	
	13		S		820915	1627		.13		.21	34	191 M	
	14		S		820915	1653		.14		.25	31	229 M	
	15		S		820915	1721		.09		.18	24	186 M	
	16		S		820915	1738		.10		.21	26	163 M	
	17		S		820915	1750		.07		.15	21	142 M	
	18		S		820915	1805		.10		.29	31	201 M	
	19		S		820915	1819		.09		.41	22	183	
	20		S		820915	1831		.10		.24	22	196 M	
	21		S		820915	1842		.10		.35	27	193	
	22		S		820915	1854		.07		.23	18	166 M	
	23		S		820915	1903		.06		.27	24	158	
	24		S		820916	0946		.09		.23	19	182 M	
	25		S		820916	1009		.10		.25	24	206 M	
	26		S		820916	1023		.11		.21	29	214 M	
	27		S		820916	1042		.10		.33	25	192 M	
	28		S		820916	1055		.09		.48	22	183 M	
	29		S		820916	1122		.13		.26	42	210 M	
	30		S		820916	1135		.13		.24	29	221 M	
	31		S		820916	1156		.10		.27	27	209 M	
	32		S		820916	1210		.12		.36	34	207 M	
	33		S		820916	1237		.09		.23	32	179 M	
	34		S		820916	1253		.05		.23	10	175 M	
	35		S		820916	1321		.15		.24	31	214 M	
	36		S		820916	1348		.13		.30	29	186 M	
	37		S		820916	1403		.17		.27	39	242 M	
	38		S		820916	1420		.16		.21	32	178 M	
	39		S		820916	1439		.25		.42	50	192 M	
	40		S		820916	1454		.08		.23	18	300	
	41		S		820916	1512		.09		.23	18	181 M	
	42		S		820916	1532		.09		.24	14	172 M	
	43		S		820916	1554		.07		.18	15	171 M	
	44		S		820916	1615		.03		.14	6	158 M	
	45		S		820916	1629		.05		.20	11	158	
HYLEBOS 11ST BRIDGE	46		S		820916	1705		.23		.65	116	180 M	

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) WET WEIGHT BASIS
PHENOL DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	ACID COMPOUNDS: 2,6,DI NITRO PHENOL	PENTA CHLORO PHENOL	PHENOL
	04		S		820915	1236			27
	05		S		820915	1318			12
	12		S		820915	1606			44
	13		S		820915	1627			12
	26		S		820916	1023			35
	38		S		820916	1420			24

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	PESTICIDES: ALDRIN	DIELDRIN	CHLOR-DANE	4,4'-DDT	4,4'-DDE	4,4'-DDD	A-ENDO SULFAN	B-ENDO SULFAN
	03		S		820915	1213					2			
	04		S		820915	1236					3			
	07		S		820915	1356					1			
	08		S		820915	1436					2			
	09		S		820915	1503					1			
	10		S		820915	1524					1			
	12		S		820915	1606					1			
	13		S		820915	1627					2			
	14		S		820915	1653					2			
	15		S		820915	1721					1			
	16		S		820915	1738					1 M			
	17		S		820915	1750					1 M			
	18		S		820915	1805					1			
	19		S		820915	1819					1			
	20		S		820915	1831					1 M			
	21		S		820915	1842					1 M			
	22		S		820915	1854					1 M			
	23		S		820915	1903					1 M			
	24		S		820916	0946					1 M			
	25		S		820916	1009					1			
	26		S		820916	1023					1			
	27		S		820916	1042					1 M			
	28		S		820916	1055					1 M			
	29		S		820916	1122					1 M			
	30		S		820916	1135					1 M			
	31		S		820916	1156					1 M			
	32		S		820916	1210					1			
	33		S		820916	1237					1 M			
	34		S		820916	1253					1 M			
	35		S		820916	1321					1			
	36		S		820916	1348					1 M			
	37		S		820916	1403					1 M			
	38		S		820916	1420					1 M			
	39		S		820916	1439					1 M			
	40		S		820916	1454					1 M			
	41		S		820916	1512					1 M			
	42		S		820916	1532					1 M			
	43		S		820916	1554					1 M			
	44		S		820916	1615					1 M			
	45		S		820916	1629					1 M			

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	PCB: PCB-1242	PCB-1254	PCB-1221	PCB-1232	PCB-1248	PCB-1260	PCB-1016	TOXA-PHENE	TCDD DIOXIN
	06		S		820915	1338						126			
	07		S		820915	1356						21			
	08		S		820915	1436						28			
	09		S		820915	1503						10			
	12		S		820915	1606		63				18			
	13		S		820915	1627						25			
	14		S		820915	1653						25			
	15		S		820915	1721		21				10			
	16		S		820915	1738		27				13			
	17		S		820915	1750		11				6			
	18		S		820915	1805		32				22			
	19		S		820915	1819		24				14			
	20		S		820915	1831		16				9			
	21		S		820915	1842		21				12			
	22		S		820915	1854		14				6			
	23		S		820915	1903		14							
	24		S		820916	0946		22				12			
	25		S		820916	1009		21				10			
	26		S		820916	1023		37				16			
	27		S		820916	1042		16				7			
	28		S		820916	1055		15							
	29		S		820916	1122		31				12			
	30		S		820916	1135		17				15			
	31		S		820916	1156		21				8			
	32		S		820916	1210		30				15			
	33		S		820916	1237		11							
	34		S		820916	1253		6							
	35		S		820916	1321		27				17			
	36		S		820916	1348		24				10			
	37		S		820916	1403		36				19			
	38		S		820916	1420		15				5			
	39		S		820916	1439		34				17			
	40		S		820916	1454		17				6			
	41		S		820916	1512		21				8			
	42		S		820916	1532		18				7			
	43		S		820916	1554		9							
	44		S		820916	1615		9				4			
	45		S		820916	1629		6				5			
HYLEBOS 11ST BRIDGE	46		S		820916	1705		240				210			

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: ACENAPHTHENE	BENZIDINE	1,2,4-TRICHLORBENZENE	HEXACHLOROBENZENE	HEXACHLOROETHANE	BIS 2-CHLORO EHTYL) ETHER	2-CHLORONAPHTHALENE	1,2-DICHLOROBENZENE	1,3-DICHLOROBENZENE
	12		S		820915	1606	7.1								
	13		S		820915	1627	7.6								
	14		S		820915	1653	6.9								
	15		S		820915	1721	5.6								
	17		S		820915	1750	4.7								
	18		S		820915	1805	6 M								
	19		S		820915	1819	5.5								
	22		S		820915	1854	5								
	23		S		820915	1903	4.8								
	25		S		820916	1009	18.6								
	26		S		820916	1023	12.8								
	28		S		820916	1055	5.5								
	30		S		820916	1135	5.7								
	35		S		820916	1321	6.4 M								
	37		S		820916	1403	9.7								
	38		S		820916	1420	10.7								
	39		S		820916	1439	32.7								
	40		S		820916	1454	42								
	41		S		820916	1512	12.7								
	42		S		820916	1532	15.5								
	43		S		820916	1554	15.5								
HYLEBOS 11ST BRIDGE	46		S		820916	1705	23.5			32.5					

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: 1,4-DI CHLORO BENZENE	3,3'- DICHLORO BENZI DINE	2,4- DINITRO TOLUENE	2,6- DINITRO TOLUENE	1,2-DI PHENYLHY DRAZAINE	FLUOR ANTHENE	4-CHLORO PHENYL PHENYL ETHER	4-BROMO PHENYL PHENYL ETHER	BIS(2- CHLOROISO PROPYL) ETHER
	02		S		820915	1141						4 M			
	03		S		820915	1213						14			
	04		S		820915	1236						93			
	05		S		820915	1318						42			
	06		S		820915	1338						67			
	07		S		820915	1356						27			
	08		S		820915	1436						68			
	09		S		820915	1503						13			
	11		S		820915	1542						24			
	12		S		820915	1606						48			
	13		S		820915	1627						55			
	14		S		820915	1653						66			
	15		S		820915	1721						43			
	16		S		820915	1738						52			
	17		S		820915	1750						47			
	18		S		820915	1805						72			
	19		S		820915	1819						51			
	20		S		820915	1831						59			
	21		S		820915	1842						58			
	22		S		820915	1854						60			
	23		S		820915	1903						74			
	24		S		820916	0946						58			
	25		S		820916	1009						74			
	26		S		820916	1023						103			
	27		S		820916	1042						56			
	28		S		820916	1055						83			
	29		S		820916	1122						88			
	30		S		820916	1135						115			
	31		S		820916	1156						90			
	32		S		820916	1210						112			
	33		S		820916	1237						143			
	34		S		820916	1253						61			
	35		S		820916	1321						162			
	36		S		820916	1348						113			
	37		S		820916	1403						116			
	38		S		820916	1420						84			
	39		S		820916	1439						181			
	40		S		820916	1454						126			
	41		S		820916	1512						114			
	42		S		820916	1532						116			
	43		S		820916	1554						43			
	44		S		820916	1615						30			
	45		S		820916	1629						55			
HYLEBOS 11ST BRIDGE	46		S		820916	1705						704			

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BIS 2-CHLORO ETHOXY METHANE	HEXA CHLORO BUTA DIENE	HEXA CHLOROCY CLOPENT ADIENE	ISO PHORONE	NAPH THALENE	NITRO BENZENE	N-NITROSO DIMETHYL AMINE	N-NITROSO DIPHENYL AMINE	N-NITROSO DIPROPYL AMINE
	02		S		820915	1141					4 M				
	03		S		820915	1213					5.3				
	04		S		820915	1236		18			80				
	05		S		820915	1318		34			32				
	06		S		820915	1338		24			46				
	07		S		820915	1356					17				
	08		S		820915	1436					55				
	09		S		820915	1503					4.6				
	11		S		820915	1542					16.9				
	12		S		820915	1606					33.7				
	13		S		820915	1627		10			43.9				
	14		S		820915	1653		11			45.8				
	15		S		820915	1721					61.2				
	16		S		820915	1738				5 M	63.6				
	17		S		820915	1750				4 M	76.6				
	18		S		820915	1805					80.3				
	19		S		820915	1819					82.4				
	20		S		820915	1831					56.9				
	21		S		820915	1842					88.6				
	22		S		820915	1854					66.2				
	23		S		820915	1903					72.9				
	24		S		820916	0946					56.5				
	26		S		820916	1023					53.5				
	27		S		820916	1042					40.4				
	28		S		820916	1055					42.2				
	29		S		820916	1122					27.3				
	30		S		820916	1135					41.9				
	31		S		820916	1156					8.4				
	32		S		820916	1210					35.2				
	33		S		820916	1237					14.3				
	34		S		820916	1253					56.1				
	35		S		820916	1321					21.4				
	36		S		820916	1348					44.6				
	37		S		820916	1403					58.1				
	38		S		820916	1420					81.7				
	39		S		820916	1439					104				
	40		S		820916	1454					186				
	41		S		820916	1512					59.9				
	42		S		820916	1532					79.3				
	43		S		820916	1554					92.8				
	44		S		820916	1615					15.8				
	45		S		820916	1629					31.6				
HYLEBOS 11ST BRIDGE	46		S		820916	1705		22			63.5				

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BIS 2-ETHYL HEXYL PHTHALAT	BENZYL BUTYL PHTHALAT	DI-N-BUTYL PHTHALAT	DI-N-OCTYL PHTHALAT	DIETHYL PHTHALAT	DIMETHYL PHTHALAT	BENZO A ANTHRA CENE	BENZO A PYRENE	BENZO B FLUORAN THENE
	01		S		820915	1117	695		35						
	02		S		820915	1141	5382		29						
	03		S		820915	1213	1364		61		4.9				
	04		S		820915	1236	2372		91					310	
	05		S		820915	1318	172								
	06		S		820915	1338	34853		212	335					
	07		S		820915	1356	511		136						
	08		S		820915	1436	188	22	394						
	09		S		820915	1503	280	27	44						
	10		S		820915	1524	86	22	68						
	11		S		820915	1542	197	17	31						
	12		S		820915	1606	62		190		7.1				
	13		S		820915	1627	248	10	59	155				134 M	
	14		S		820915	1653	194	9	46					160 M	
	15		S		820915	1721	59		408						
	16		S		820915	1738	75								
	17		S		820915	1750	738		136						
	18		S		820915	1805	177		984						
	19		S		820915	1819	48		93						
	20		S		820915	1831	161			51					
	21		S		820915	1842	6358		385						
	22		S		820915	1854	414		129						
	23		S		820915	1903	507								
	24		S		820916	0946	78								
	25		S		820916	1009	169		474						
	26		S		820916	1023	578		343						
	27		S		820916	1042	36		246						
	28		S		820916	1055	125								
	29		S		820916	1122	111								
	31		S		820916	1156	67								
	32		S		820916	1210	207		104						
	33		S		820916	1237	152		80						
	34		S		820916	1253	421								
	35		S		820916	1321	150		235						
	37		S		820916	1403	138								
	38		S		820916	1420	92		53						
	39		S		820916	1439	808		246						
	40		S		820916	1454	58		600						
	41		S		820916	1512	44		236						
	42		S		820916	1532	93		345						
	43		S		820916	1554	127		96						
	44		S		820916	1615	114		174	16					
	45		S		820916	1629	284								
HYLEBOS 11ST BRIDGE	46		S		820916	1705	271								

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BENZO K FLUORANTHENE	CHRYSENE	ACENAPHTHYLENE	ANTHRACENE	BENZO GHI PERYLENE	FLUORENE	PHENANTHRENE	DIBENZO A,H ANTHRACENE	INDENO 1,2,3-CD PYRENE
	04		S		820915	1236						38			
	05		S		820915	1318			13.3			16.7			
	06		S		820915	1338			15.6						
	07		S		820915	1356			5.1						
	08		S		820915	1436			21.9						
	11		S		820915	1542	141 M					4.2			
	12		S		820915	1606			10.6			8.9			124 M
	13		S		820915	1627			13.4		8	11.5			134 M
	14		S		820915	1653			11.4			16			
	15		S		820915	1721	186 M		14.8			9.3			
	16		S		820915	1738			16.3			13.1			
	17		S		820915	1750			15.6			11.3			
	18		S		820915	1805			16.1			12			
	19		S		820915	1819			14.7			11			
	20		S		820915	1831			11.8			13.7			
	21		S		820915	1842			19.3			11.6			
	22		S		820915	1854			14.9			11.6			
	23		S		820915	1903			15.8			11.1			
	24		S		820916	0946			14.6						
	25		S		820916	1009			12.4		31 M				
	26		S		820916	1023			10.7			6.4			
	27		S		820916	1042			7.7						
	28		S		820916	1055			18.3			9.2			
	32		S		820916	1210			18.6			14.5			
	37		S		820916	1403			16.9						
	38		S		820916	1420			21.3						
	39		S		820916	1439			65.4			30.8			
	40		S		820916	1454						22			
	41		S		820916	1512			9.1						
	42		S		820916	1532			10.3			17.2			
	43		S		820916	1554						10.3			
HYLEBOS 11ST BRIDGE	46		S		820916	1705			75.8			39.7			

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: PYRENE	BENZO(A)ANTHRACENE/ CHRYSENE	BENZO(B)FLUORANTHENE/ BENZO(K)FLUORANTHENE	ANTHRACENE/ PHENANTHRENE
	01		S		820915	1117				4 M
	02		S		820915	1141	5.1			6
	03		S		820915	1213	25	33		19
	04		S		820915	1236	146	255		142
	05		S		820915	1318	69	125		118
	06		S		820915	1338	113	177		126
	07		S		820915	1356	49.4	71.6		27
	08		S		820915	1436	96.3	6.6		153
	09		S		820915	1503	15.4			30
	11		S		820915	1542	25.4	39.4		37
	12		S		820915	1606	67.4	39		124
	13		S		820915	1627	78.2	40.1		145
	14		S		820915	1653	84.7	41.2		151
	15		S		820915	1721	77.9	816		76
	16		S		820915	1738	78.3	88.1		83
	17		S		820915	1750	68.1	15.6		91
	18		S		820915	1805	114	98.4		126
	19		S		820915	1819	76.9	84.2		101
	20		S		820915	1831	127.5	10.8		137
	21		S		820915	1842	127.2	19.3		152
	22		S		820915	1854	92.7	5		131
	23		S		820915	1903	135	14.3		32
	24		S		820916	0946	98.4	72.9		38
	25		S		820916	1009	148	94.8		8
	26		S		820916	1023	79.2			257
	27		S		820916	1042	65.4			250
	28		S		820916	1055	73.4	95.4		171
	29		S		820916	1122	79.8			166
	30		S		820916	1135	66.2	15.5		353
	31		S		820916	1156	115			272
	32		S		820916	1210	122			352
	33		S		820916	1237	131			376
	34		S		820916	1253	63.2			368
	35		S		820916	1321	150	17.1		406
	36		S		820916	1348	102			186
	37		S		820916	1403	170			223
	38		S		820916	1420	121			320
	39		S		820916	1439	212	86.5		481
	40		S		820916	1454	150			620
	41		S		820916	1512	118			327
	42		S		820916	1532	133	25.9		414
	43		S		820916	1554	65.3			96
	44		S		820916	1615	15.8			
	45		S		820916	1629	45.8			95
HYLEBOS 11ST BRIDGE	46		S		820916	1705	776	235		451

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

							VOLATILES								
STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	1,1,2,2-TETRA CHLORO ETHANE	CHLORO ETHANE	2-CHLORO ETHYL VINLY ETHER	CHLORO FORM	1,1-DICHLORO ETHENE	TRANS-1,2-DICHLORO ETHENE	1,2-DICHLORO PROPANE	TRANS-1,3-DICHLORO PROPENE	CIS-1,3-DICHLORO PROPENE
	02		S		820915	1141				1 M					
	03		S		820915	1213				1 M					
	04		S		820915	1236				1.8 M		3.3			
	05		S		820915	1318				2.5 M		12.8			
	06		S		820915	1338				2.7 M		4.3			
	07		S		820915	1356						2.7			
	08		S		820915	1436						3.5			
	13		S		820915	1627						1.9 M			
	14		S		820915	1653				2.3 M		2.3 M			
	15		S		820915	1721						1.9 M			
	16		S		820915	1738				1.6 M		1.6 M			
	17		S		820915	1750				1.4 M		1.4 M			
	18		S		820915	1805						3			
	20		S		820915	1831						2 M			
	26		S		820916	1023						2.1 M			
	27		S		820916	1042						1 M			
	30		S		820916	1135				1 M		1 M			
	31		S		820916	1156						1 M			
	32		S		820916	1210						2.1 M			
	35		S		820916	1321						2.1 M			
	36		S		820916	1348						1 M			
	37		S		820916	1403				2.4 M		2.4 M			
	39		S		820916	1439						1.9 M			
HYLEBOS 11ST BRIDGE	46		S		820916	1705						4			

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	VOLATILES: TETRA CHLORO ETHENE	VOLATILES: TOLUENE	VOLATILES: TRICHLOR ETHENE	VOLATILES: VINYL CHLORIDE
	04		S		820915	1236	1.8 M		3.3	
	05		S		820915	1318			2.5 M	
	06		S		820915	1338			2.7 M	
	07		S		820915	1356			1.7 M	
	08		S		820915	1436			2.2 M	
	12		S		820915	1606	1.8 M		1.8 M	
	13		S		820915	1627			1.9 M	
	14		S		820915	1653	2.3 M		2.3 M	
	15		S		820915	1721			1.9 M	
	16		S		820915	1738	1.6 M		1.6 M	
	17		S		820915	1750	1.4 M		1.4 M	
	18		S		820915	1805	2 M		2 M	
	19		S		820915	1819	1.8 M			
	20		S		820915	1831	2 M			
	23		S		820915	1903	1.6 M			
	24		S		820916	0946	1.8 M			
	32		S		820916	1210	2.1 M			
	33		S		820916	1237	1.8 M			
	35		S		820916	1321	2.1 M		2.1 M	
	37		S		820916	1403	2.4 M			
	39		S		820916	1439	1.9 M		1.9 M	
HYLEBOS 11ST BRIDGE	46		S		820916	1705	1.8 M		1.8 M	

ORGANIC ANALYSES

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS

STATION DESCRIPTION	STA NUM	RIVER MILE	M	OTR NUM	DATE	TIME	---- POLYCHLORINATED BUTADIENES ---- MONO CHLORO BUTA DIENE	DI CHLORO BUTA DIENE	TRI CHLORO BUTA DIENE	TETRA CHLORO BUTA DIENE	PENTA CHLORO BUTA DIENE	HEXA CHLORO BUTA DIENE	TOTAL PCBDS
	01		S		820915	1117				1			1
	02		S		820915	1141			1 M	7	3		10
	03		S		820915	1213			23	31			54
	04		S		820915	1236			73	1143	40	41	1297
	05		S		820915	1318			153	700	26	11	890
	06		S		820915	1338			95	569	14	26	704
	07		S		820915	1356			7	63		3	73
	08		S		820915	1436			28	147		3	178
	09		S		820915	1503			14	59	3		76
	10		S		820915	1524			1 M	6	8		14
	11		S		820915	1542			1 M	16	3		19
	12		S		820915	1606			17	77	12		106
	13		S		820915	1627			18	174	6		198
	14		S		820915	1653			46	288	7	13	342
	15		S		820915	1721			3	43		3	52
	16		S		820915	1738			1	36		2	39
	17		S		820915	1750			6	37			43
	18		S		820915	1805			45	172	3	1 M	220
	19		S		820915	1819							PRESENT
	20		S		820915	1831			8	29			37
	21		S		820915	1842			17	95		3	115
	22		S		820915	1854			4	5			9
	23		S		820915	1903							PRESENT
	24		S		820916	0946			16	60		2	78
	25		S		820916	1009			35	34			69
	26		S		820916	1023			16	49		6	71
	27		S		820916	1042			21	70		5	96
	28		S		820916	1055			17	53			70
	29		S		820916	1122			14	79	3	6	102
	30		S		820916	1135			21	141	5	3	170
	31		S		820916	1156			1 M	5		1 M	5
	32		S		820916	1210			1 M	10			10
	33		S		820916	1237			1 M	5			5
	34		S		820916	1253			1 M	1			1
	35		S		820916	1321			98	191		24	313
	36		S		820916	1348			12	55	1	4	72
	37		S		820916	1403			13	134		8	155
	38		S		820916	1420			1	19			20
	39		S		820916	1439			1 M	18			18
	40		S		820916	1454			1 M	8			8
	41		S		820916	1512			1 M	20			20
	42		S		820916	1532			1 M	8			8
	43		S		820916	1554			1	5			6
	44		S		820916	1615				1 M			1 M
	45		S		820916	1629				1 M			1 M
HYLEBOS 11ST BRIDGE	46		S		820916	1705			25	230	13	53	321

APPENDIX C

DEPTH, PERCENT SOLIDS, SEDIMENT DESCRIPTION AND LOCATION

COMMENCEMENT BAY DEEP WATER
SEDIMENT SURVEY

Station Number	% Solids	Depth (Fathoms)	Sample Description	Latitude	Longitude
1	77.7	45	Sandy	47° 19' 6.5"	122° 31' 01"
2	79.9	85	Sand, clay & rock	47° 19' 02"	122° 30' 03"
3	72.0	90	Mud	47° 19' 05"	122° 29' 03"
4	54.8	96	Mud	47° 19' 11"	122° 28' 08"
5	40.7	97	Fine mud & soft clay	47° 18' 59"	122° 27' 06"
6	37.3	94	Fine mud & soft clay	47° 18' 44"	122° 27' 00"
7	58.7	80	Fine mud & soft clay	47° 18' 30"	122° 27' 02"
8	45.7	96	Fine mud & soft clay	47° 18' 33"	122° 28' 21"
9	71.3	87	Fine sand & clay	47° 18' 32"	122° 29' 20"
10	75.6	50	Sandy	47° 18' 34"	122° 30' 09"
11	71.0	35	Fine sand	47° 18' 12"	122° 29' 48"
12	56.4	72	Fine mud	47° 17' 52"	122° 29' 22"
13	52.4	85	Fine mud	47° 17' 59"	122° 29' 04"
14	43.7	92	Fine mud	47° 18' 00"	122° 28' 01"
15	53.9	70	Fine mud	47° 17' 59"	122° 26' 55"
16	61.3	49	Fine mud	47° 18' 21"	122° 26' 52"
17	70.5	50	Fine mud	47° 18' 03"	122° 26' 49"
18	49.8	70	Extra fine mud	47° 17' 52"	122° 26' 40"
19	54.6	80	Fine mud	47° 17' 37"	122° 26' 28"
20	51.0	44	Fine mud	47° 17' 31"	122° 26' 02"
21	51.9	52	Fine mud	47° 17' 26"	122° 25' 39"
22	60.4	40	Fine mud	47° 17' 19"	122° 25' 14"
23	63.1		Fine mud	47° 17' 03"	122° 25' 00"
24	54.9	83	Fine mud	47° 17' 34"	122° 26' 58"
25	48.5	87	Fine mud	47° 17' 30"	122° 27' 58"
26	46.7	88	Fine mud	47° 17' 39"	122° 27' 47"
27	52.0	88	Fine mud	47° 17' 44"	122° 27' 13"
28	54.5	88	Fine mud	47° 17' 43"	122° 27' 20"
29	47.6	87	Fine mud & sand	47° 17' 43"	122° 27' 40"
30	45.3	89	Pebbles, fine mud & sand	47° 17' 52"	122° 27' 36"
31	47.8	89	Fine mud	47° 17' 48"	122° 27' 21"
32	48.3	86	Fine mud	47° 17' 40"	122° 27' 27"
33	55.9	85	Fine mud	47° 17' 46"	122° 27' 24"
34	57.0	90	Fine mud	47° 17' 54"	122° 27' 16"
35	46.8	90	Mud	47° 17' 52"	122° 27' 48"
36	53.8	75	Mud & sand	47° 17' 32"	122° 29' 01"
37	41.3	82	Mud	47° 17' 23"	122° 28' 44"
38	56.3	53	Sandy mud	47° 17' 08"	122° 28' 23"
39	52.0	47	Fine mud	47° 17' 00"	122° 28' 02"
40	50.0	78	Fine mud & wood fiber	47° 16' 49"	122° 27' 35"
41	55.1	75	Fine mud & wood fiber	47° 16' 43"	122° 27' 15"
42	58.0	68	Fine mud	47° 16' 33"	122° 26' 57"
43	58.2	74	Fine mud	47° 17' 02"	122° 26' 59"
44	63.4	59	Fine mud & sand	47° 16' 58"	122° 25' 58"
45	63.3	23	Sandy mud	47° 16' 25"	122° 25' 57"
46	55.4				

APPENDIX D

AREA MAPS SHOWING CONCENTRATION AND DISTRIBUTION INFORMATION BY CHEMICAL

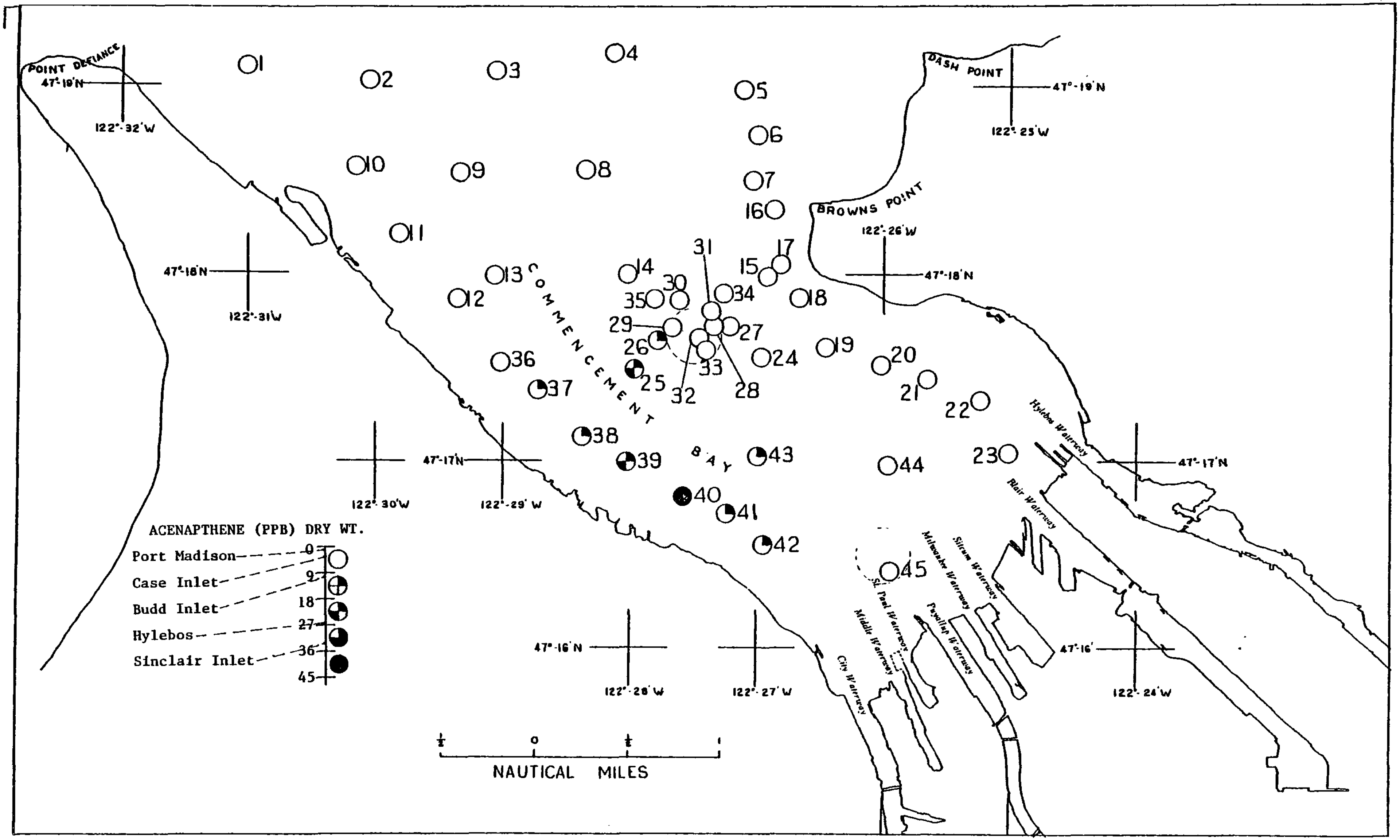

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
ACENAPTHENE (PPB) DRY WT.
Port Madison
Case Inlet
Budd Inlet
Hylebos
Sinclair Inlet
0
9
18
27
36
45
NAUTICAL MILES

FIGURE 3

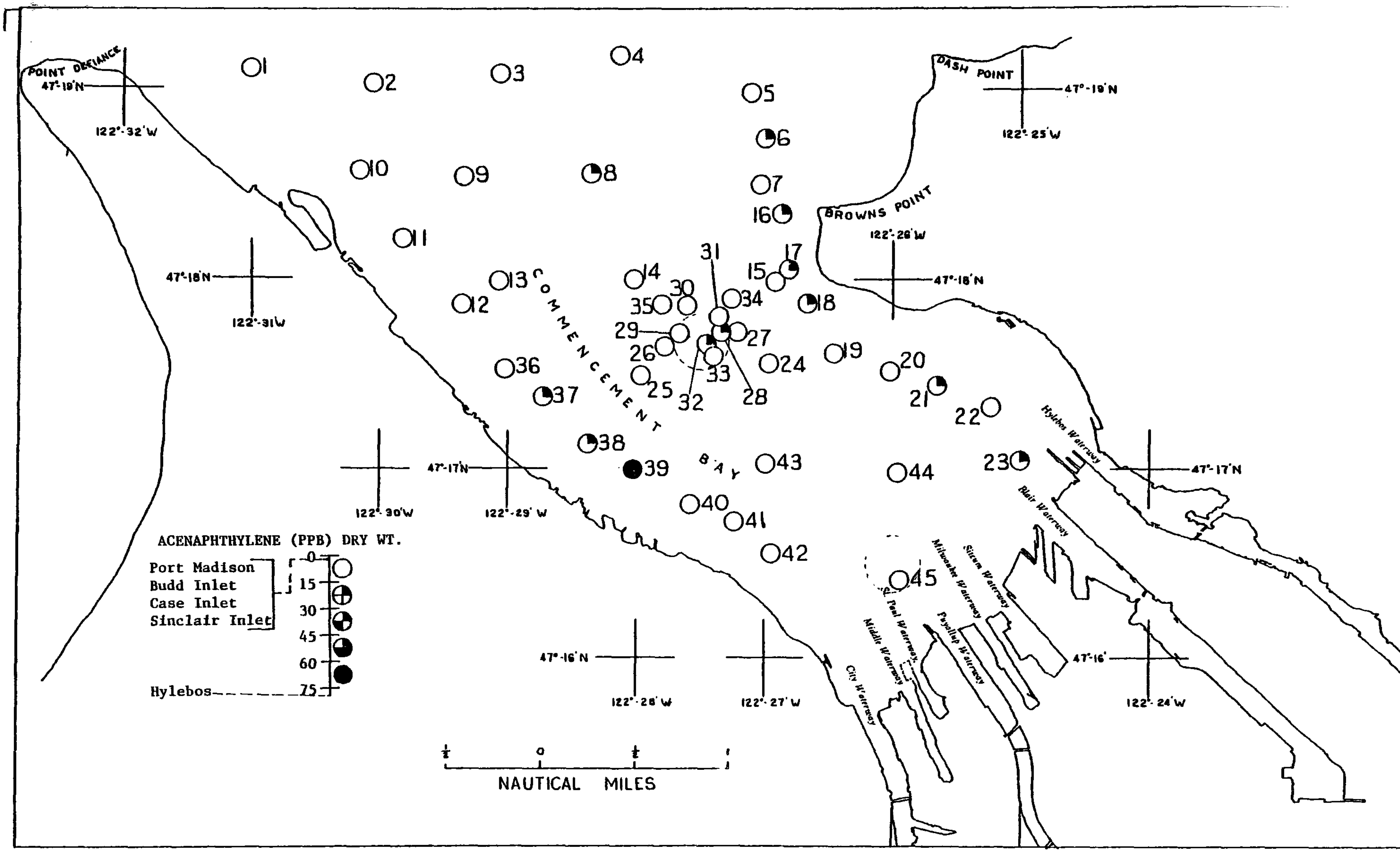
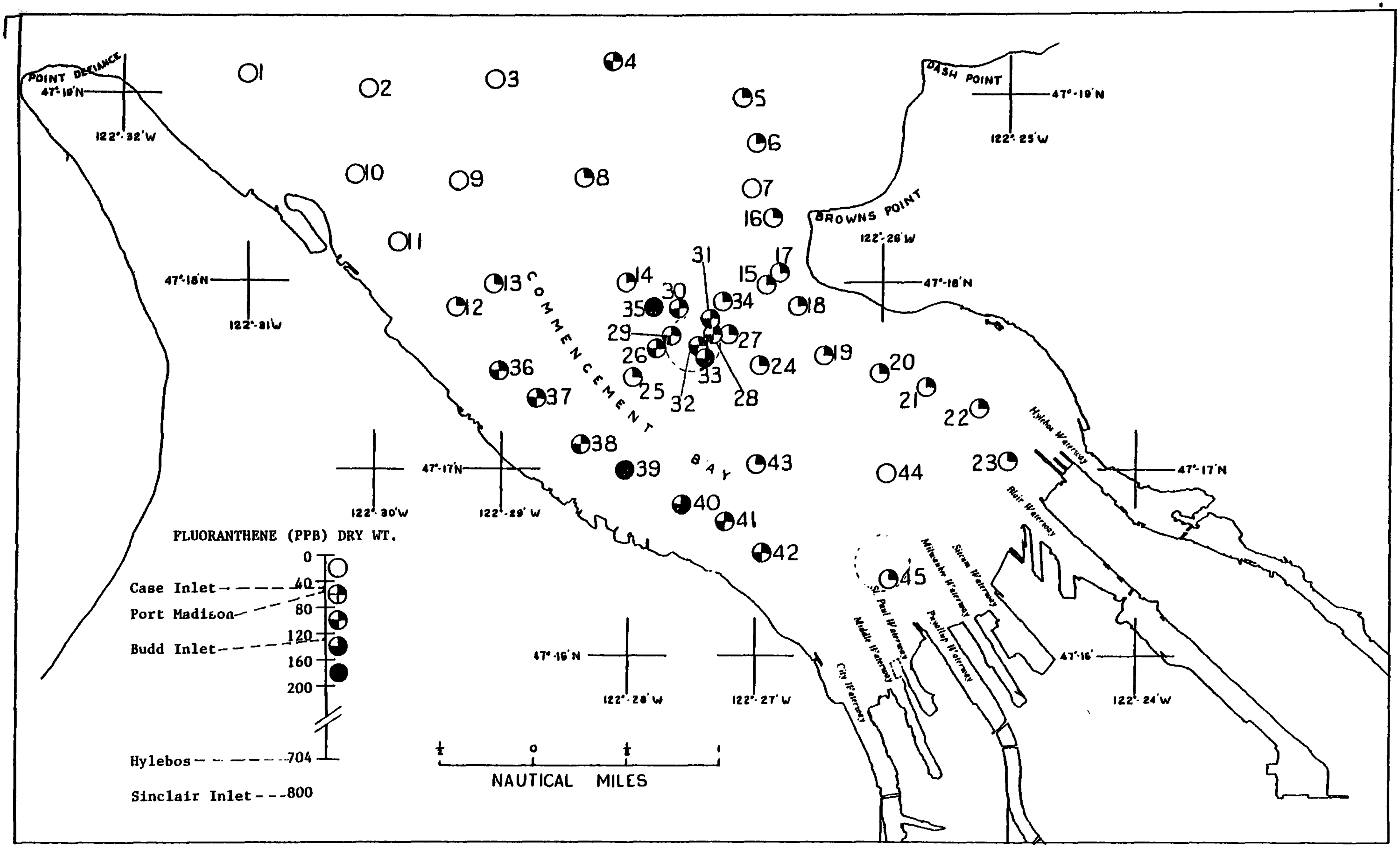

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
47°-19'N
122°-25'W
122°-26'W
47°-18'N
122°-31'W
47°-18'N
47°-17'N
122°-30'W
122°-29'W
47°-17'N
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
ACENAPHTHYLENE (PPB) DRY WT.
Port Madison
Budd Inlet
Case Inlet
Sinclair Inlet
Hylebos
0
15
30
45
60
75
NAUTICAL MILES

FIGURE 4



POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
FLUORANTHENE (PPB) DRY WT.
0
40
80
120
160
200
704
800
Case Inlet
Port Madison
Budd Inlet
Hylebos
Sinclair Inlet
NAUTICAL MILES

FIGURE 5

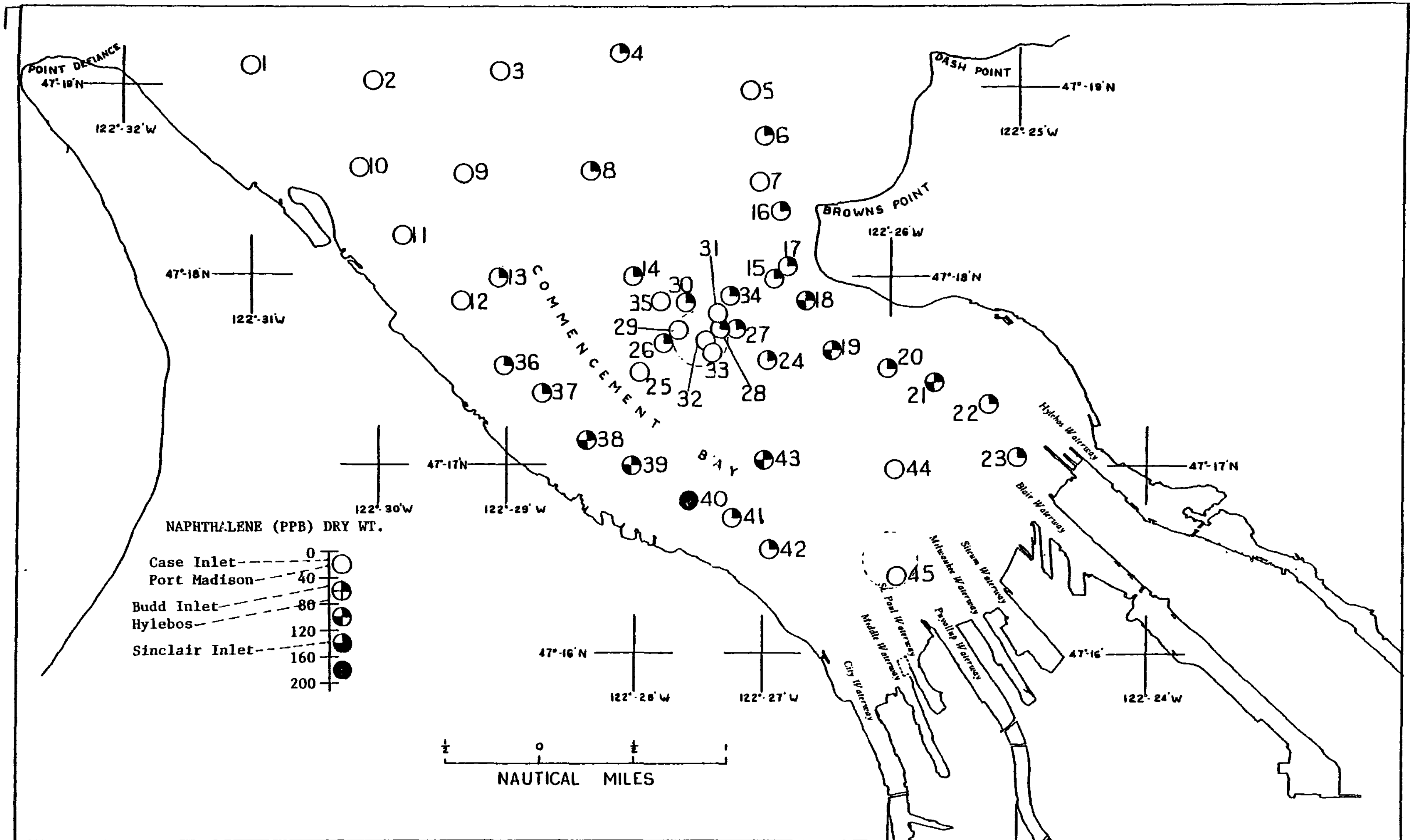

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
47°-18'N
47°-17'N
47°-16'N
122°-32'W
122°-31'W
122°-30'W
122°-29'W
122°-28'W
122°-27'W
122°-26'W
122°-25'W
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
NAPHTHALENE (PPB) DRY WT.
Case Inlet
Port Madison
Budd Inlet
Hylebos
Sinclair Inlet
0
40
80
120
160
200
NAUTICAL MILES
½
0
½
1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45

FIGURE 6

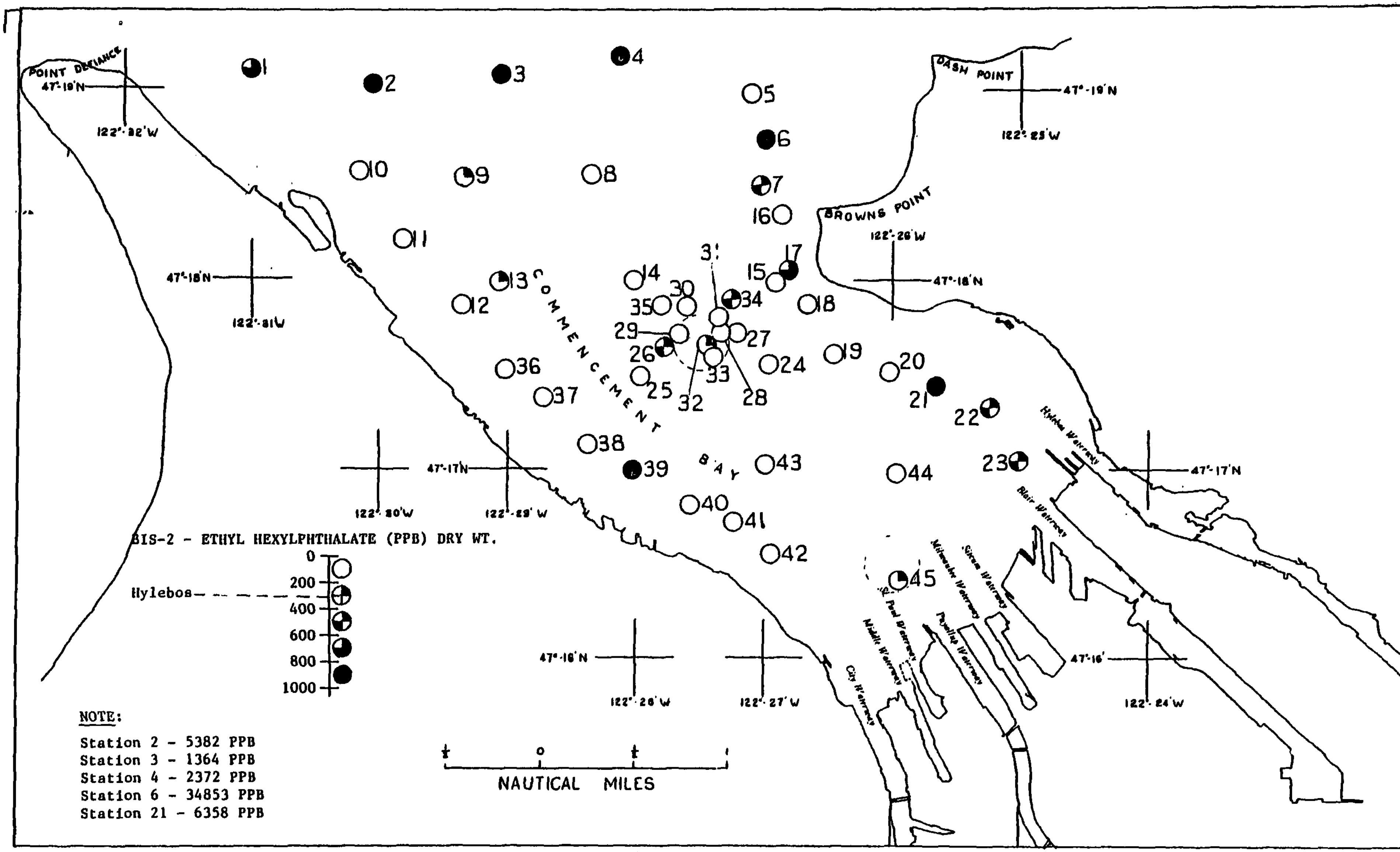

POINT DEFIANCE
47°-19'N
122°-32'W
DASH POINT
47°-19'N
122°-25'W
BROWNS POINT
122°-26'W
47°-18'N
47°-18'N
122°-31'W
COMMENCEMENT BAY
47°-17'N
122°-30'W
122°-29'W
47°-17'N
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
BIS-2 - ETHYL HEXYLPHTHALATE (PPB) DRY WT.
0
200
400
600
800
1000
Hylebos
NAUTICAL MILES
NOTE:
Station 2 - 5382 PPB
Station 3 - 1364 PPB
Station 4 - 2372 PPB
Station 6 - 34853 PPB
Station 21 - 6358 PPB

FIGURE 7

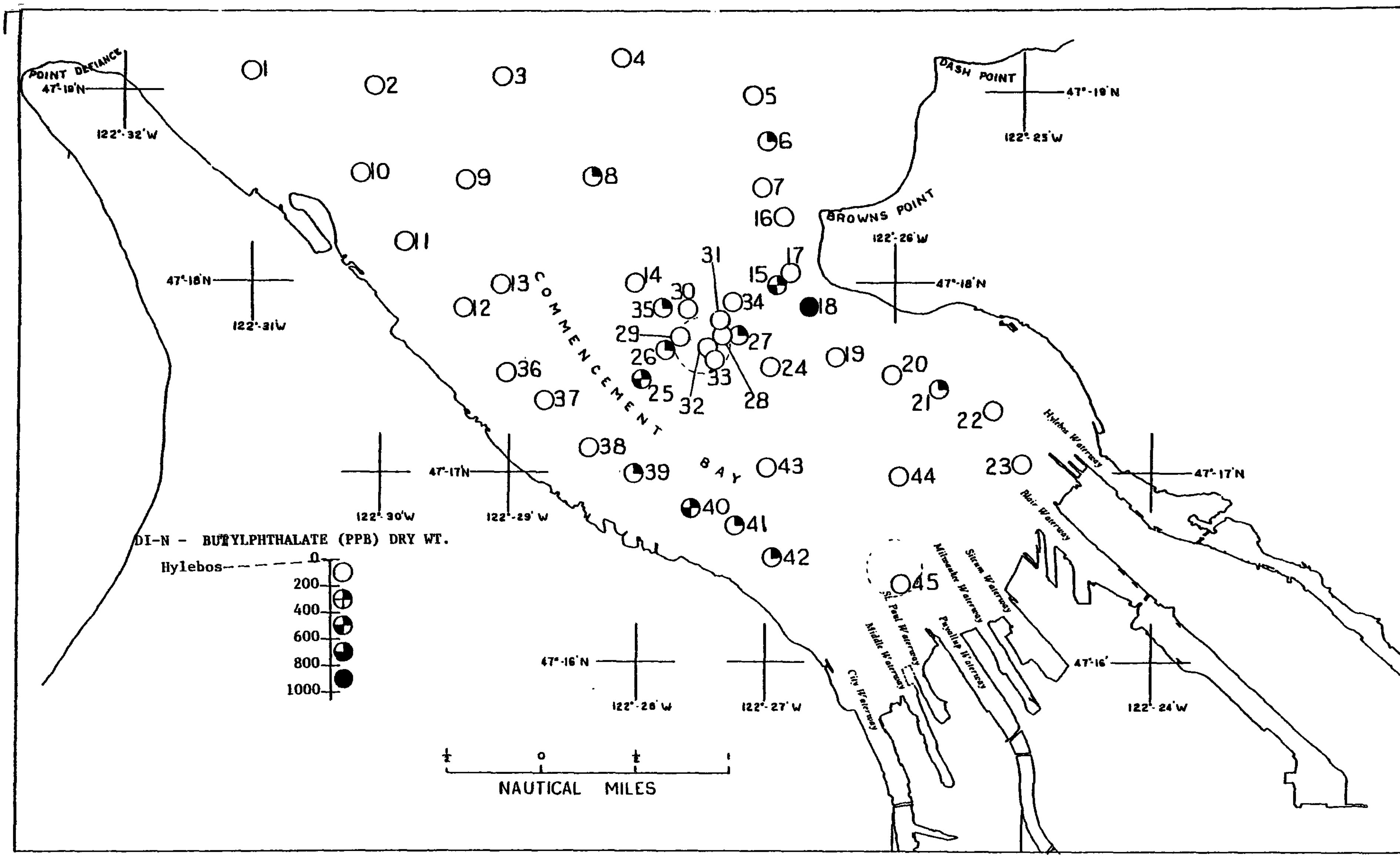

POINT DEFIANCE
47°-19'N
122°-32'W
DASH POINT
47°-19'N
122°-25'W
BROWNS POINT
122°-26'W
47°-18'N
47°-18'N
122°-31'W
COMMENCEMENT BAY
47°-17'N
122°-30'W
122°-29'W
47°-17'N
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
St. Paul Waterway
Puyallup Waterway
Middle Waterway
City Waterway
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
DI-N - BUTYLPHTHALATE (PPB) DRY WT.
Hylebos
0
200
400
600
800
1000
NAUTICAL MILES

FIGURE 8

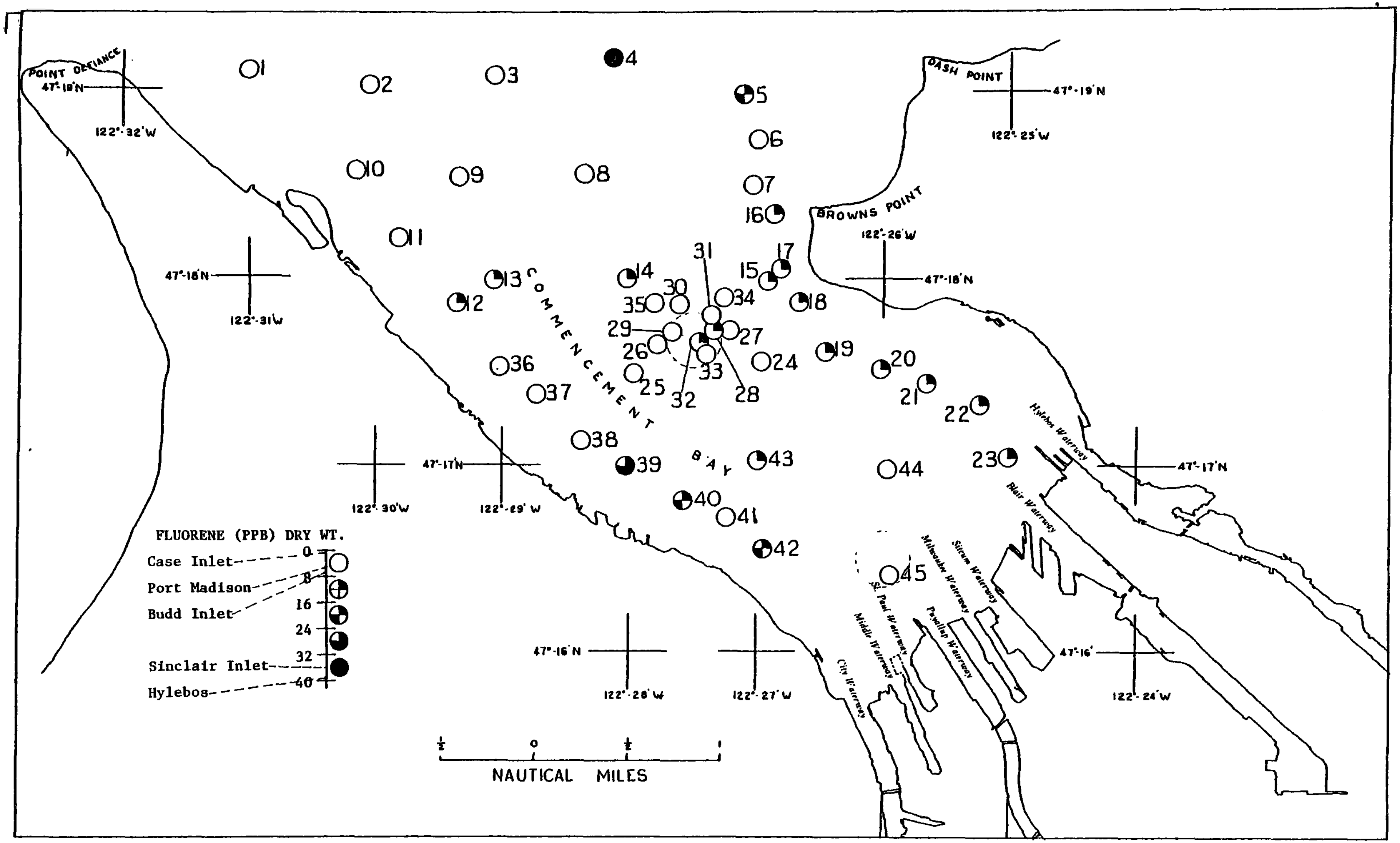

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
122°-25'W
122°-26'W
47°-18'N
122°-31'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
FLUORENE (PPB) DRY WT.
Case Inlet
Port Madison
Budd Inlet
Sinclair Inlet
Hylebos
0
8
16
24
32
40
NAUTICAL MILES

FIGURE 9

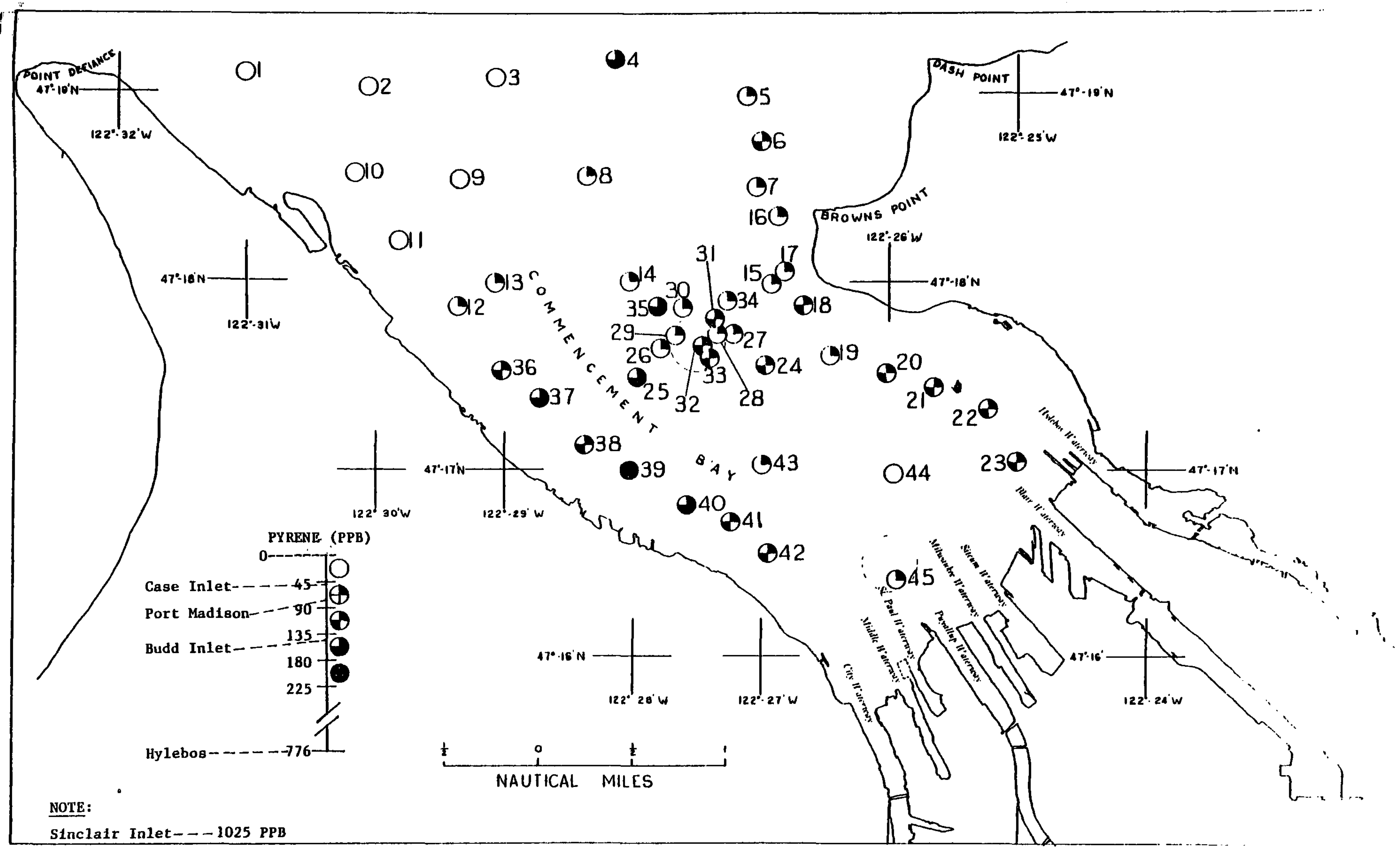
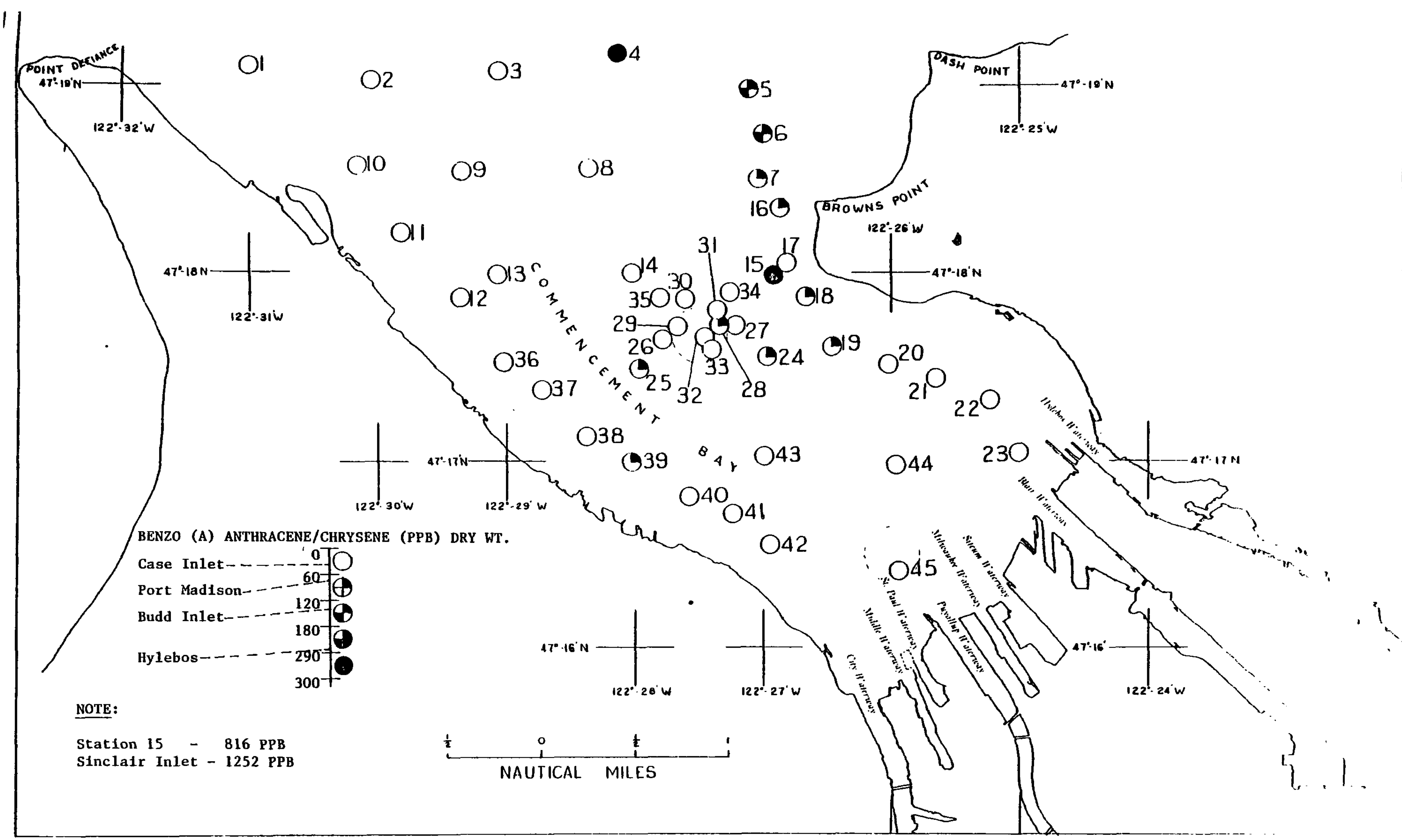
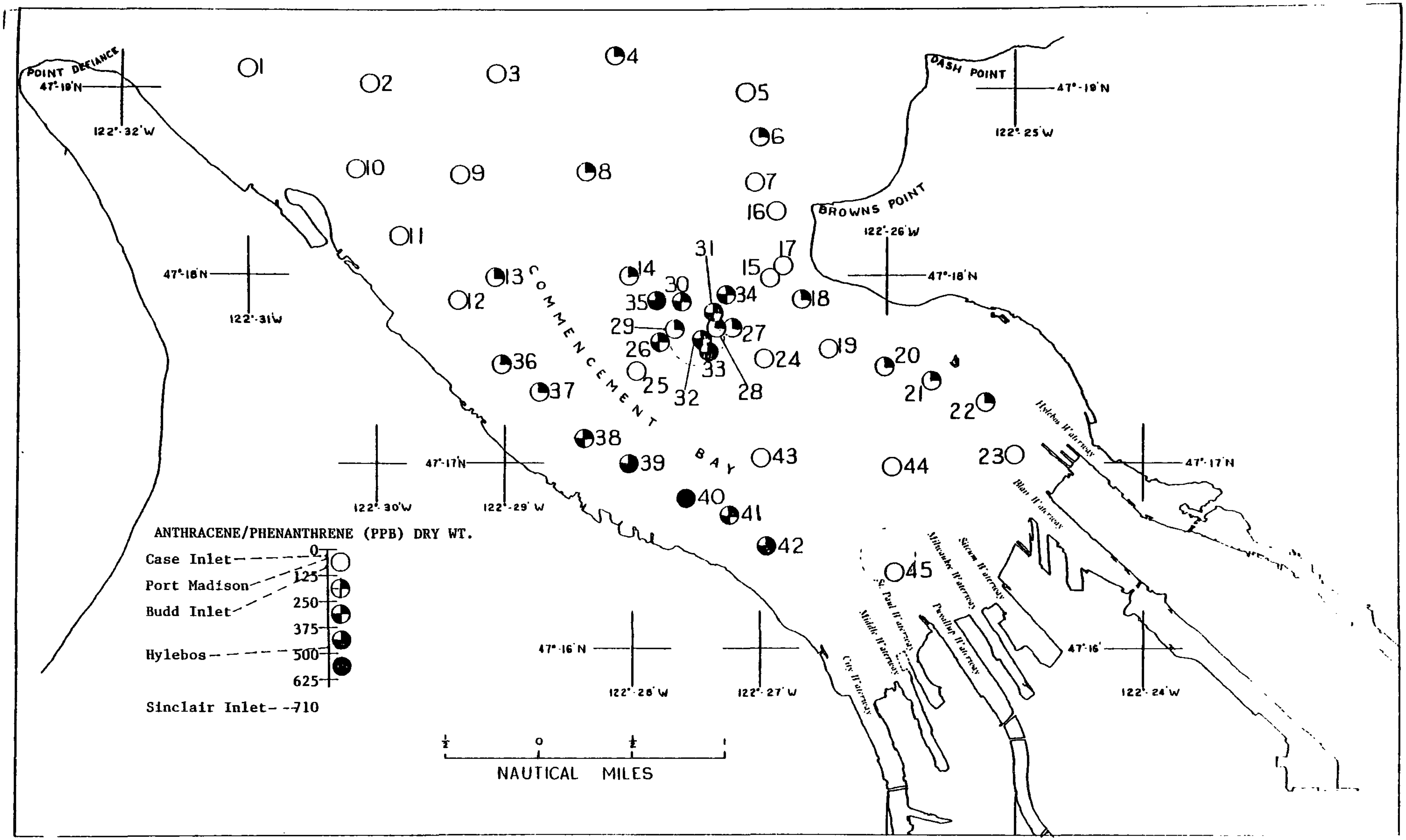

POINT DEFIANCE
47°-19'N
122°-32'W
DASH POINT
47°-19'N
122°-25'W
BROWNS POINT
122°-26'W
47°-18'N
47°-18'N
122°-31'W
COMMENCEMENT BAY
47°-17'N
122° 30'W
122°-29' W
47°-17'N
47°-16'N
122° 28'W
122°-27'W
47°-16'
122°-24'W
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
PYRENE (PPB)
0
Case Inlet
45
Port Madison
90
135
Budd Inlet
180
225
Hylebos
776
½ 0 ½ 1
NAUTICAL MILES
NOTE:
Sinclair Inlet---1025 PPB

FIGURE 10



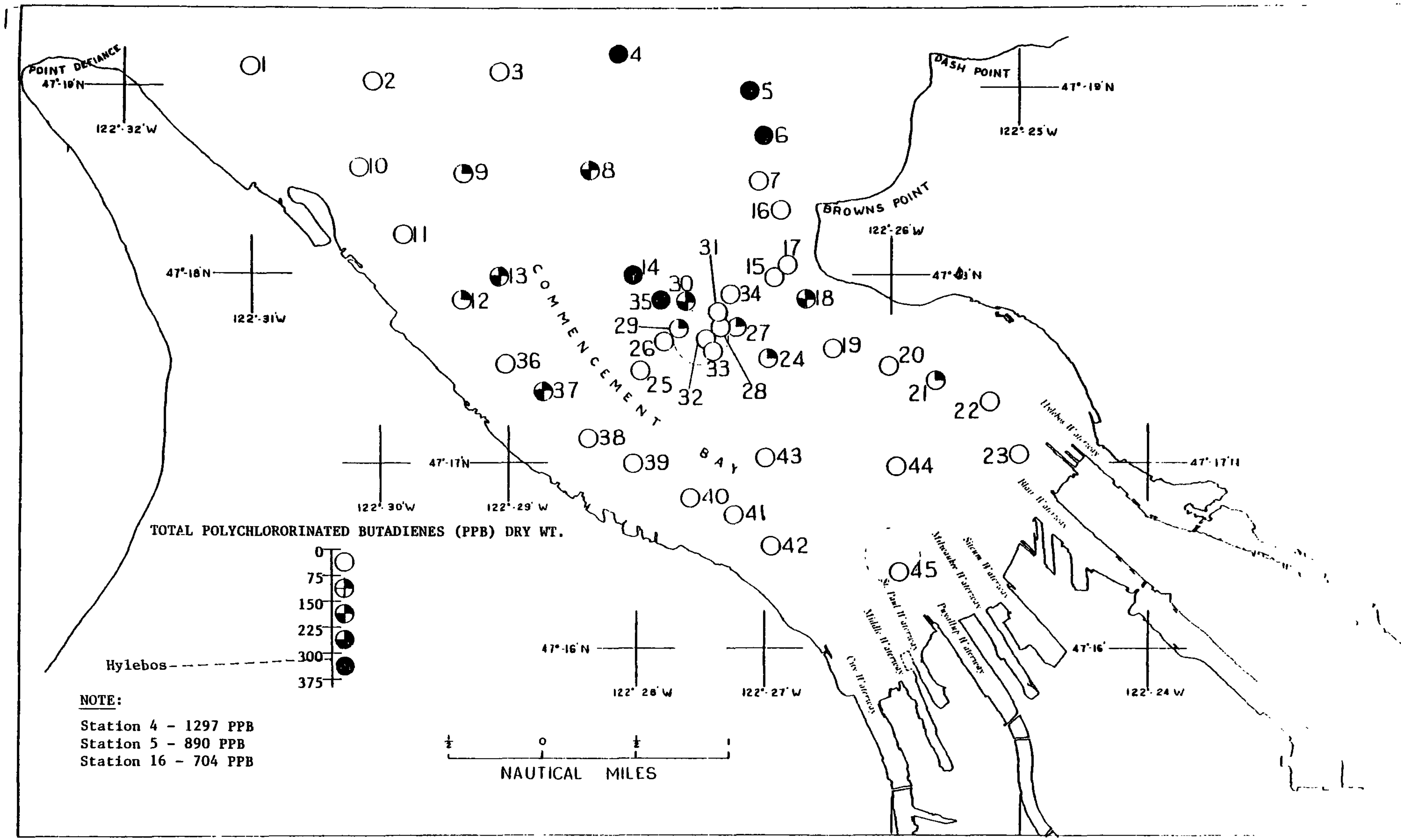
POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
47°-18'N
47°-17'N
47°-16'N
122°-32'W
122°-31'W
122°-30'W
122°-29'W
122°-28'W
122°-27'W
122°-26'W
122°-25'W
122°-24'W
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
BENZO (A) ANTHRACENE/CHRYSENE (PPB) DRY WT.
Case Inlet
Port Madison
Budd Inlet
Hylebos
0
60
120
180
290
300
NOTE:
Station 15 - 816 PPB
Sinclair Inlet - 1252 PPB
NAUTICAL MILES

FIGURE 11



POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
47°-18'N
47°-17'N
47°-16'N
122°-32'W
122°-31'W
122°-30'W
122°-29'W
122°-28'W
122°-27'W
122°-26'W
122°-25'W
122°-24'W
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
ANTHRACENE/PHENANTHRENE (PPB) DRY WT.
Case Inlet
Port Madison
Budd Inlet
Hylebos
Sinclair Inlet--710
0
125
250
375
500
625
NAUTICAL MILES
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway

FIGURE 12



POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
TOTAL POLYCHLORORINATED BUTADIENES (PPB) DRY WT.
0
75
150
225
300
375
Hylebos
NOTE:
Station 4 - 1297 PPB
Station 5 - 890 PPB
Station 16 - 704 PPB
NAUTICAL MILES
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
122°-24'W

FIGURE 13

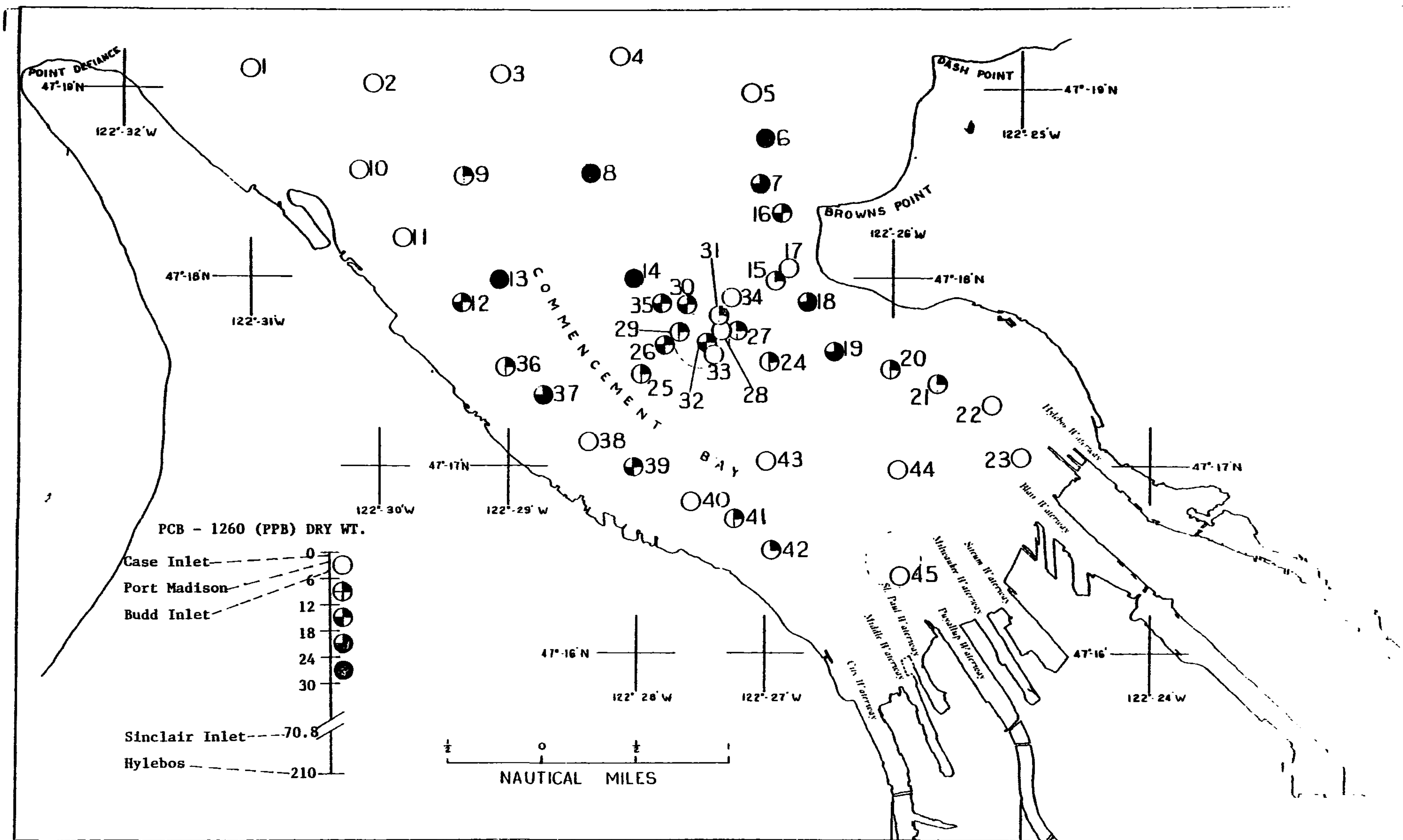

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
PCB - 1260 (PPB) DRY WT.
Case Inlet
Port Madison
Budd Inlet
0
6
12
18
24
30
Sinclair Inlet
70.8
Hylebos
210
NAUTICAL MILES
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway

FIGURE 14

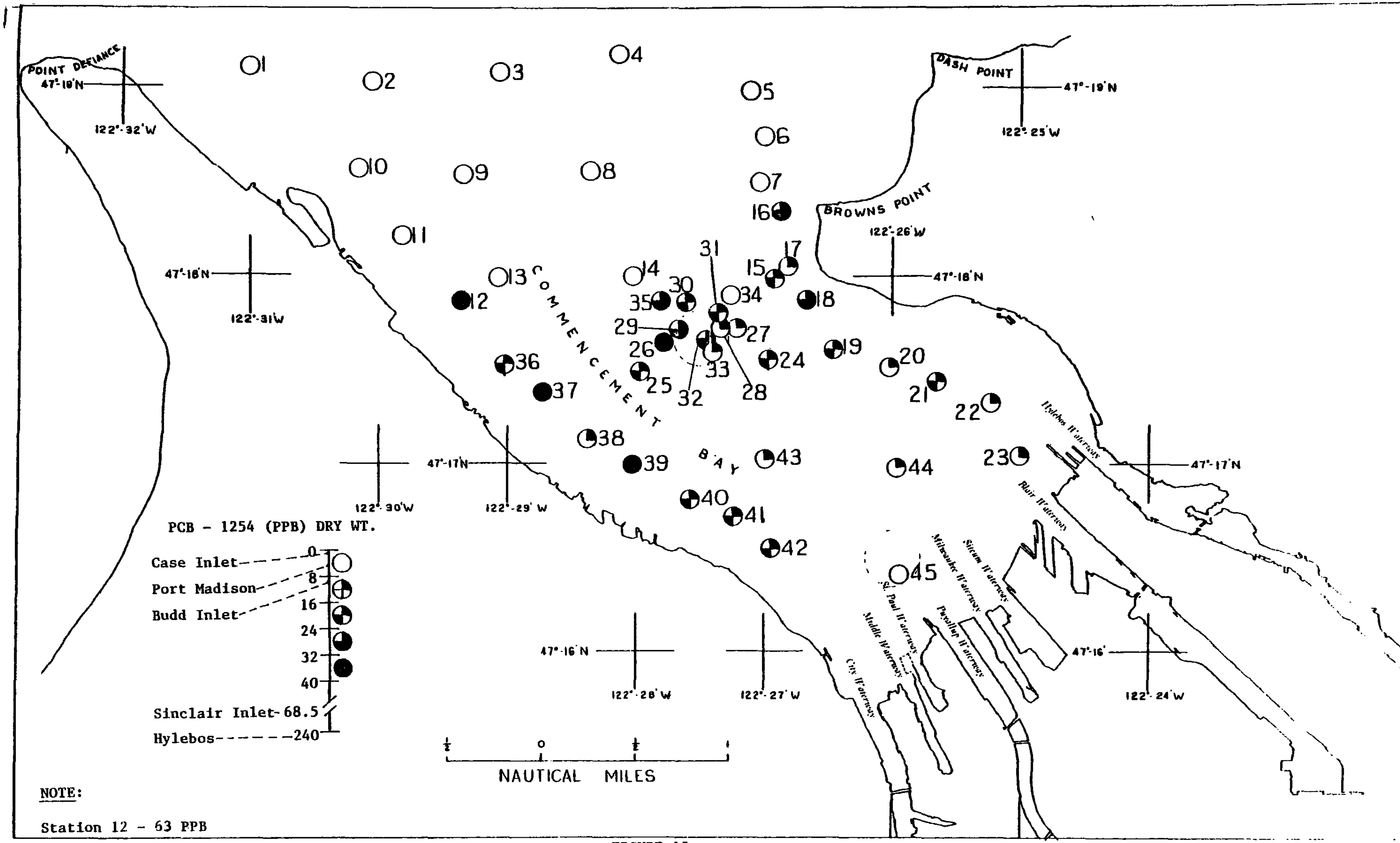

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
122°-28'W
122°-27'W
122°-24'W
47°-16'N
47°-16'
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
PCB - 1254 (PPB) DRY WT.
Case Inlet
Port Madison
Budd Inlet
0
8
16
24
32
40
Sinclair Inlet-68.5
Hylebos------240
NAUTICAL MILES
NOTE:
Station 12 - 63 PPB

FIGURE 15

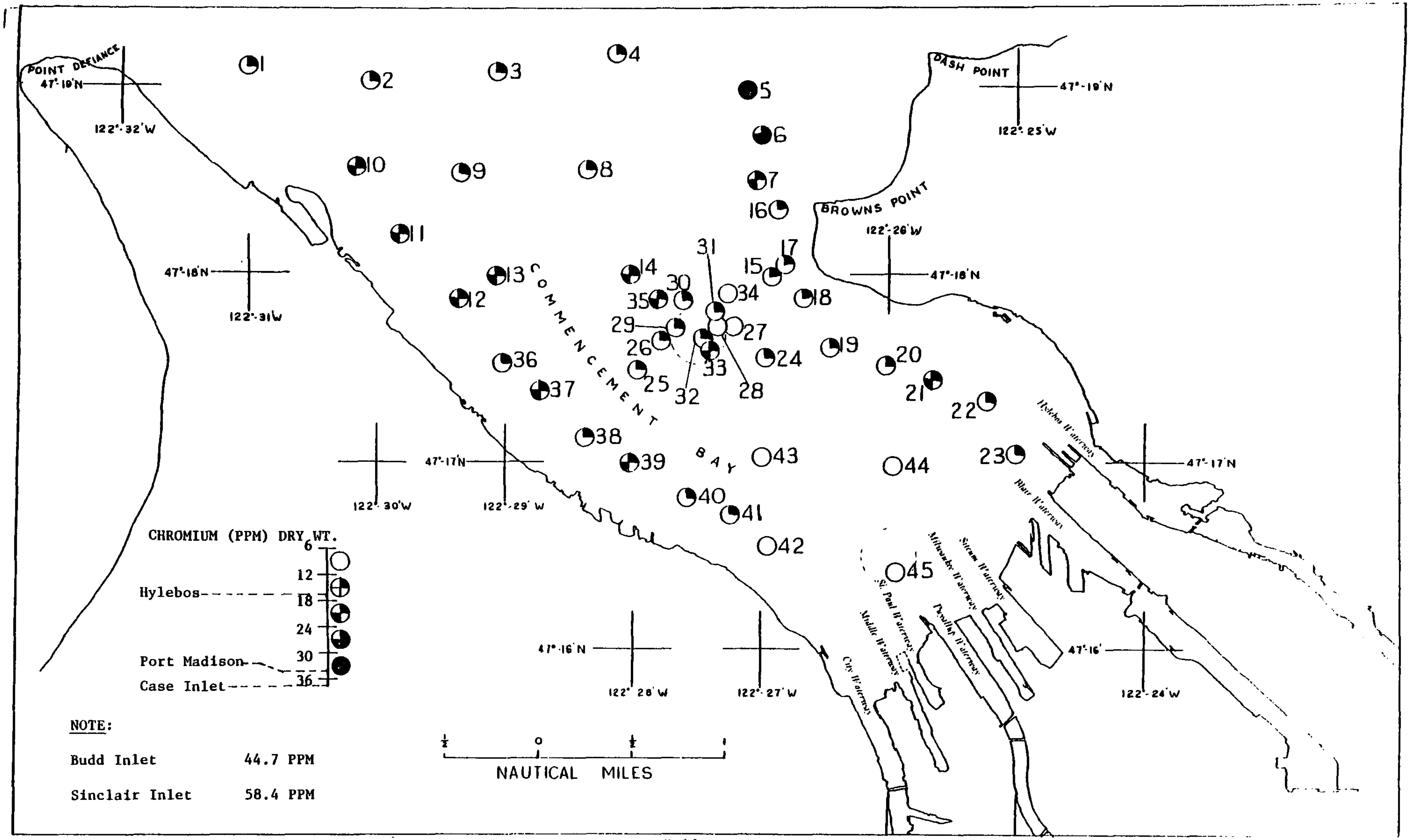

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
47°-18'N
47°-17'N
47°-16'N
122°-32'W
122°-31'W
122°-30'W
122°-29'W
122°-28'W
122°-27'W
122°-26'W
122°-25'W
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
CHROMIUM (PPM) DRY WT.
6
12
18
24
30
36
Hylebos
Port Madison
Case Inlet
NOTE:
Budd Inlet 44.7 PPM
Sinclair Inlet 58.4 PPM
½ 0 ½ 1
NAUTICAL MILES

FIGURE 16

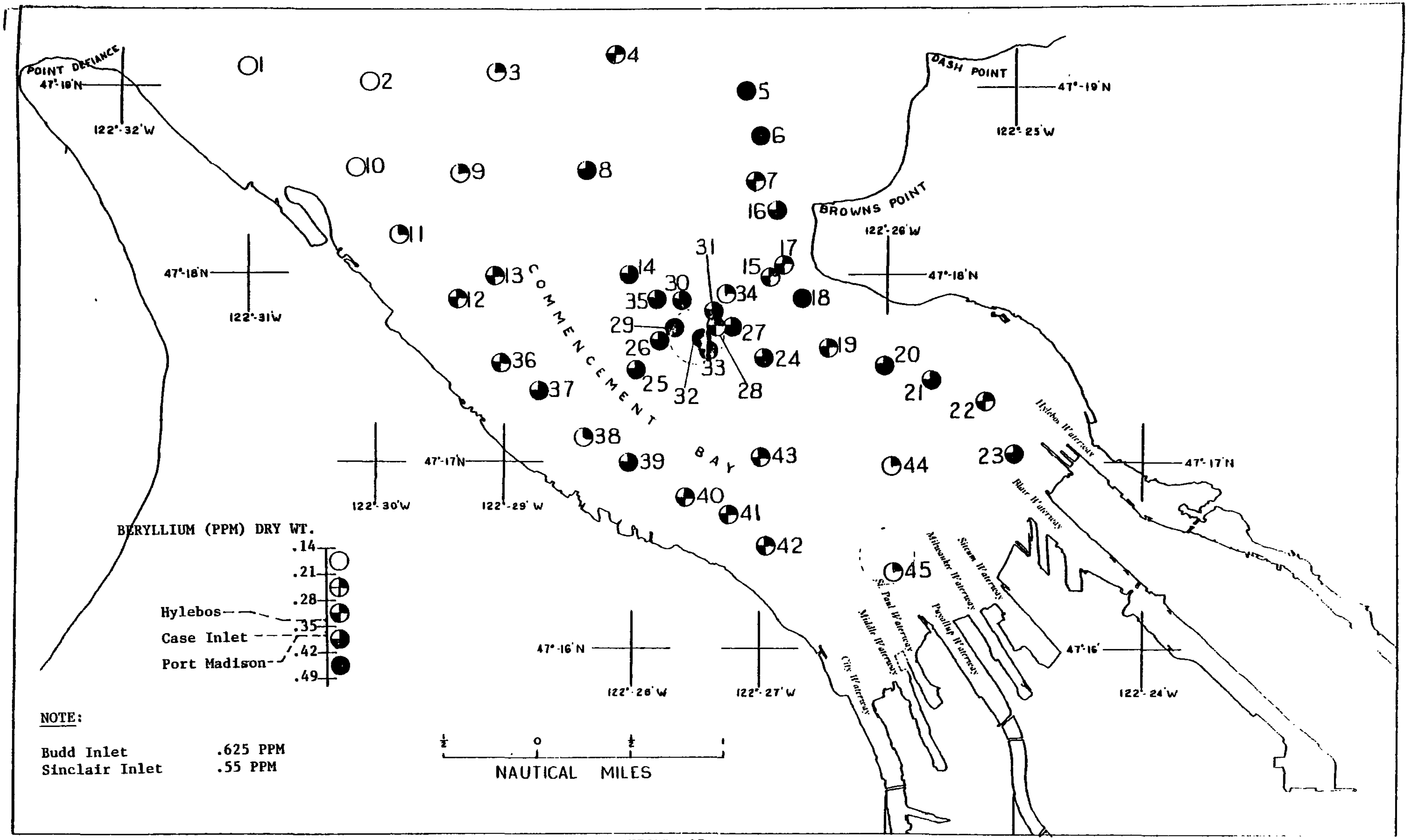

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
BERYLLIUM (PPM) DRY WT.
.14
.21
.28
.35
.42
.49
Hylebos
Case Inlet
Port Madison
NOTE:
Budd Inlet .625 PPM
Sinclair Inlet .55 PPM
½ 0 ½ 1
NAUTICAL MILES

FIGURE 17

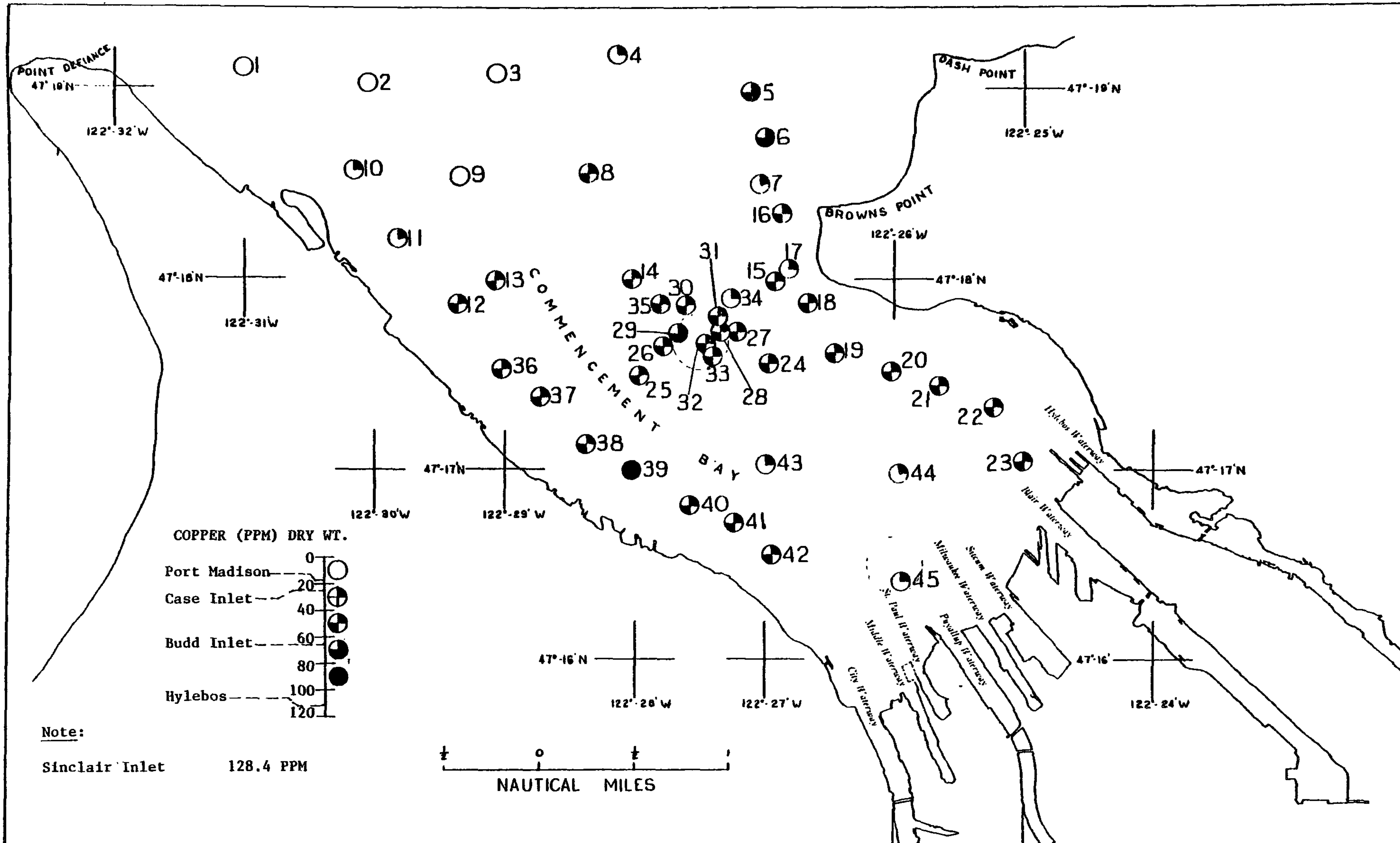

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47° 19'N
47°-19'N
47°-18'N
47°-17'N
47°-16'N
47°-16'
122°-32'W
122°-31'W
122°-30'W
122°-29'W
122°-28'W
122°-27'W
122°-26'W
122°-25'W
122°-24'W
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
COPPER (PPM) DRY WT.
Port Madison
Case Inlet
Budd Inlet
Hylebos
0
20
40
60
80
100
120
Note:
Sinclair Inlet 128.4 PPM
NAUTICAL MILES

FIGURE 18

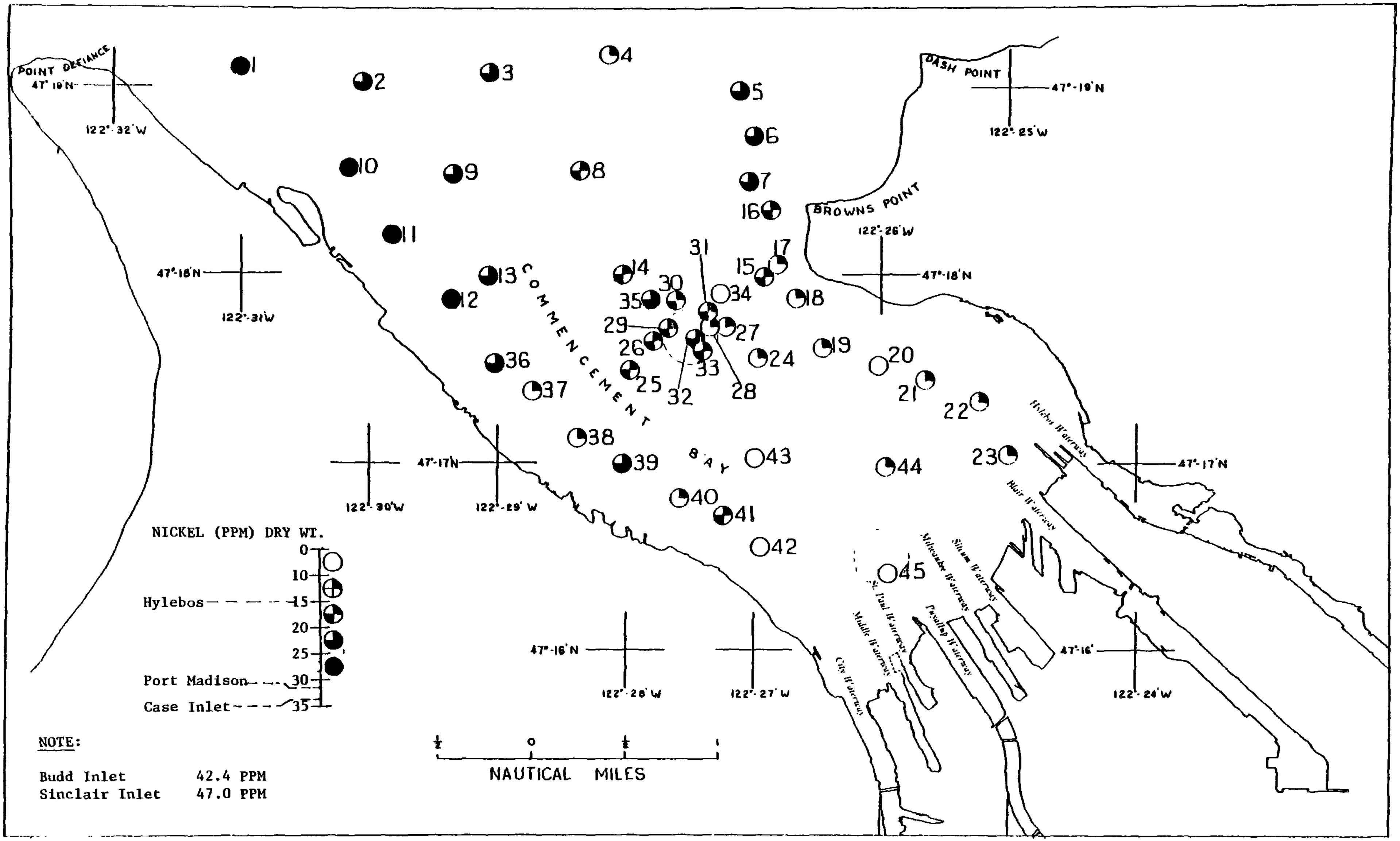
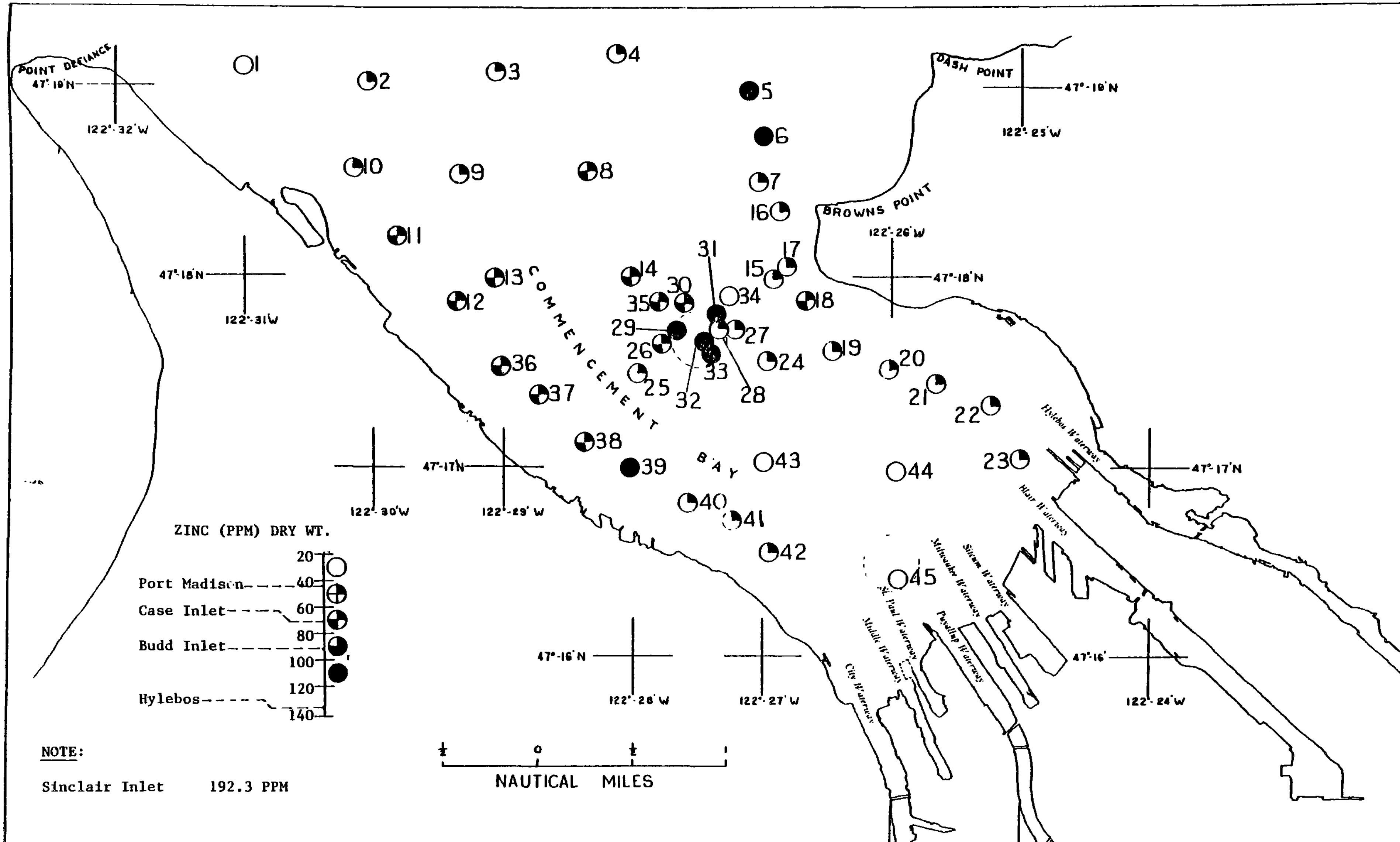

POINT DEFIANCE
47° 19'N
122°-32'W
DASH POINT
47°-19'N
122°-25'W
BROWNS POINT
122°-26'W
47°-18'N
47°-18'N
122°-31'W
COMMENCEMENT BAY
47°-17'N
122°-30'W
122°-29'W
47°-17'N
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
St. Paul Waterway
Puyallup Waterway
Middle Waterway
City Waterway
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
NICKEL (PPM) DRY WT.
0
10
Hylebos
15
20
25
Port Madison
30
Case Inlet
35
NOTE:
Budd Inlet 42.4 PPM
Sinclair Inlet 47.0 PPM
½ 0 ½ 1
NAUTICAL MILES

FIGURE 19



POINT DEFIANCE
47° 19'N
122°-32'W
DASH POINT
47°-19'N
122°-25'W
BROWNS POINT
122°-26'W
47°-18'N
122°-31'W
47°-18'N
COMMENCEMENT BAY
47°-17'N
122°-30'W
122°-29'W
47°-17'N
47°-16'N
122°-28'W
122°-27'W
47°-16'
122°-24'W
ZINC (PPM) DRY WT.
20
40
60
80
100
120
140
Port Madison
Case Inlet
Budd Inlet
Hylebos
NOTE:
Sinclair Inlet 192.3 PPM
NAUTICAL MILES

FIGURE 20

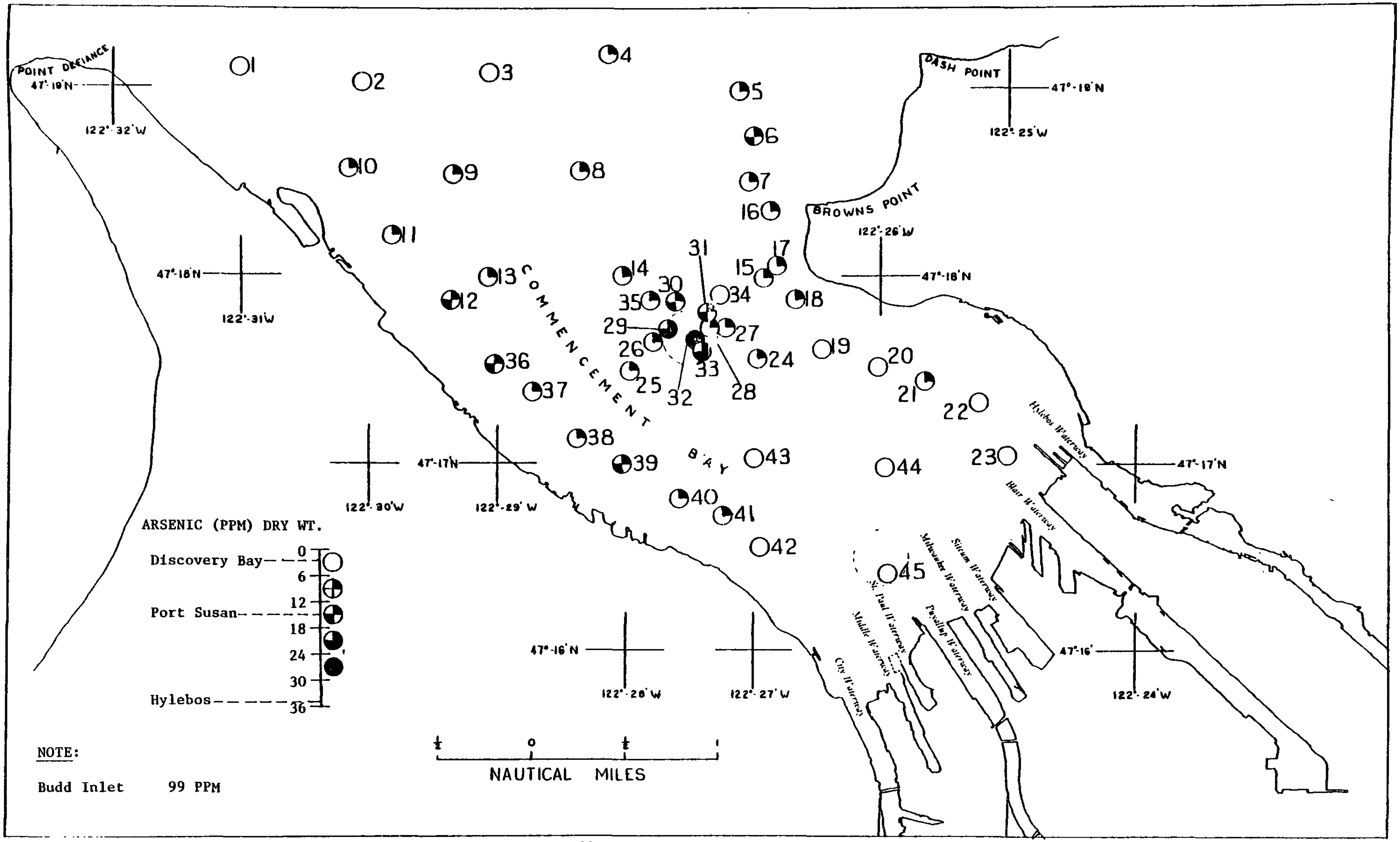

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
122°-24'W
ARSENIC (PPM) DRY WT.
Discovery Bay
Port Susan
Hylebos
0
6
12
18
24
30
36
NOTE:
Budd Inlet 99 PPM
NAUTICAL MILES
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway

FIGURE 21

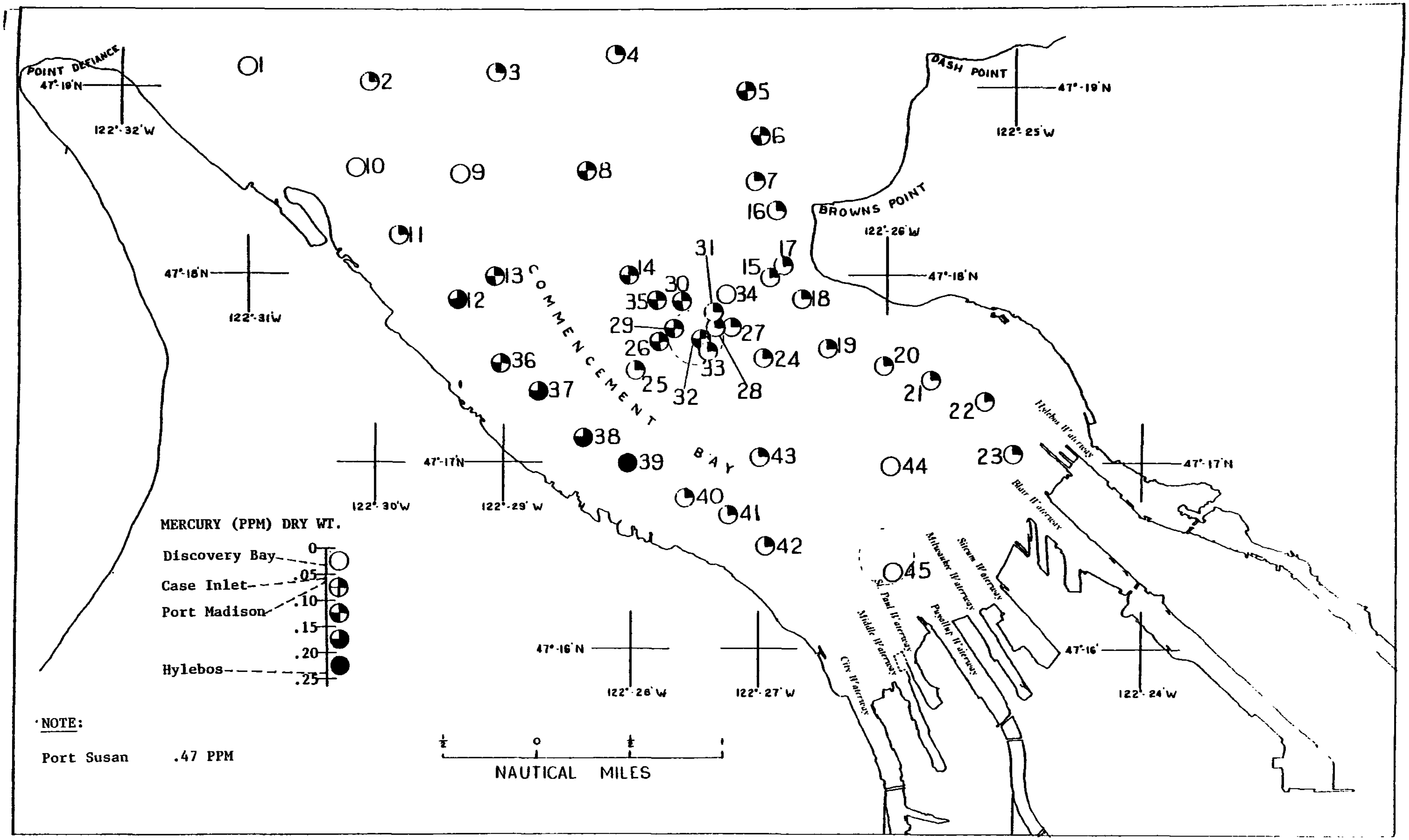
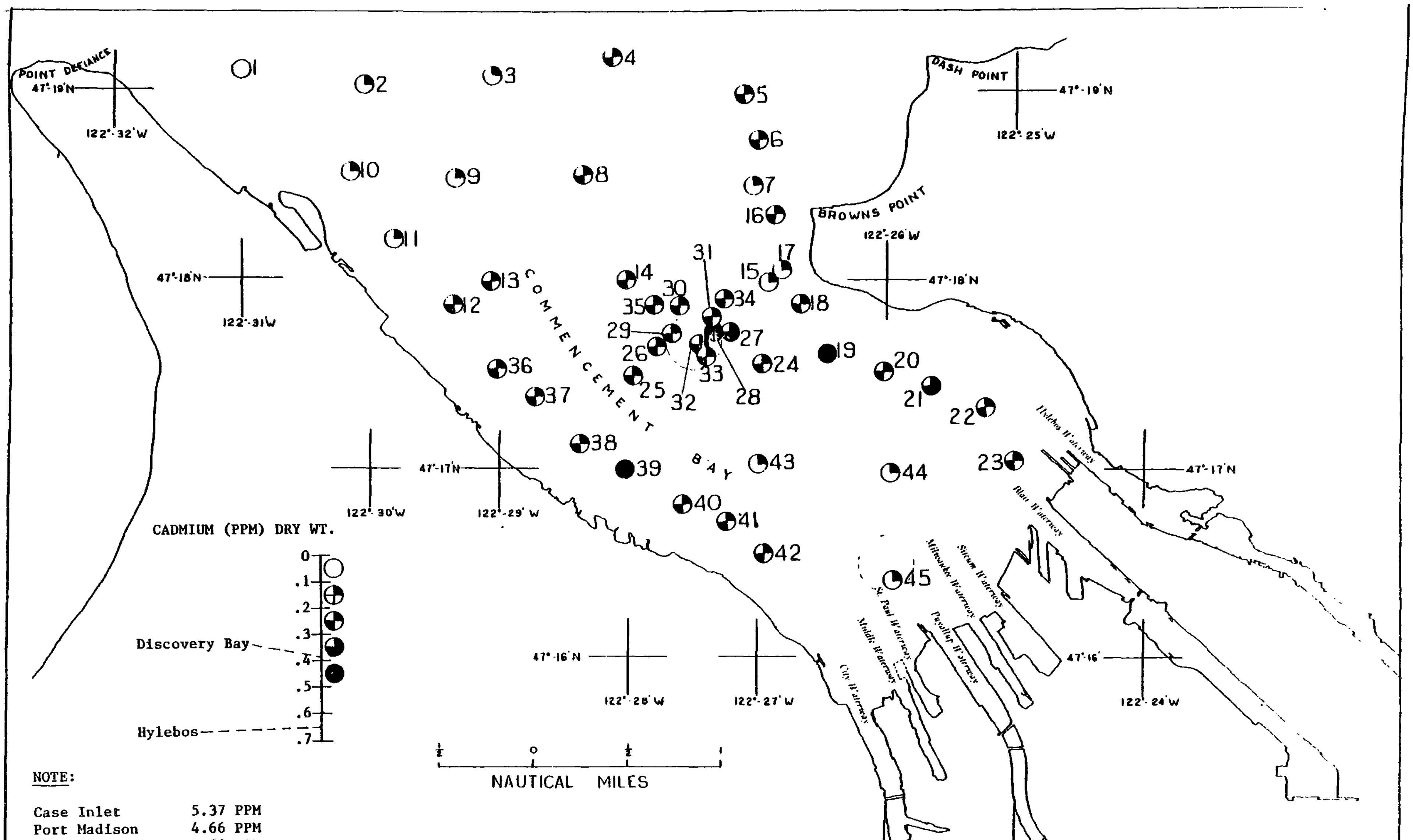

POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47°-19'N
122°-32'W
122°-25'W
47°-18'N
122°-31'W
122°-26'W
47°-17'N
122°-30'W
122°-29'W
47°-16'N
122°-28'W
122°-27'W
122°-24'W
47°-16'
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
MERCURY (PPM) DRY WT.
Discovery Bay
Case Inlet
Port Madison
Hylebos
0
.05
.10
.15
.20
.25
NOTE:
Port Susan .47 PPM
NAUTICAL MILES

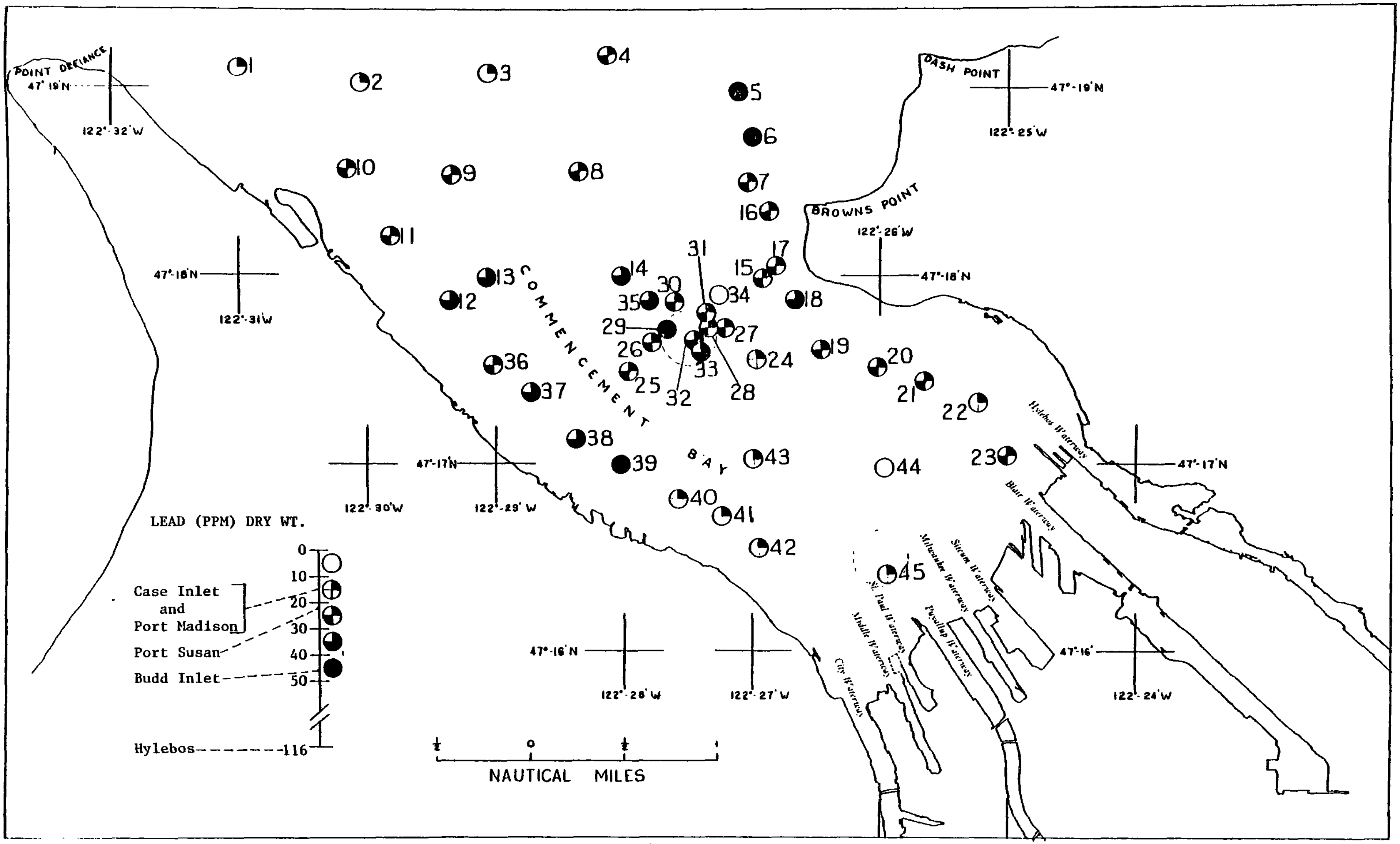
FIGURE 22



NOTE:

Case Inlet	5.37 PPM
Port Madison	4.66 PPM
Port Susan	.88 PPM

FIGURE 23

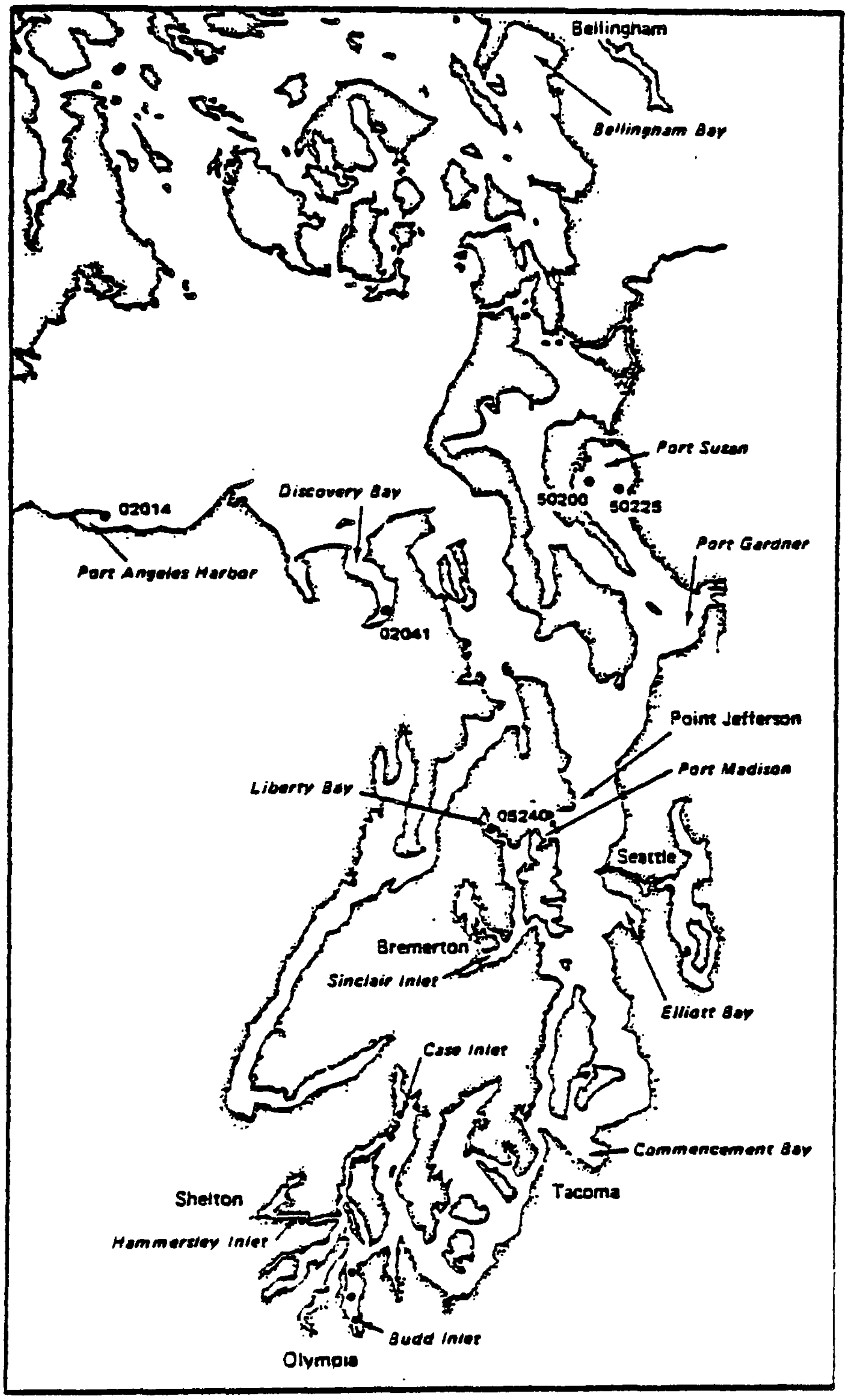


POINT DEFIANCE
DASH POINT
BROWNS POINT
COMMENCEMENT BAY
47° 19'N
47°-19'N
47°-18'N
47°-17'N
47°-16'N
47°-16'
122°-32'W
122°-31'W
122°-30'W
122°-29'W
122°-28'W
122°-27'W
122°-26'W
122°-25'W
122°-24'W
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Milwaukee Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway
LEAD (PPM) DRY WT.
0
10
20
30
40
50
116
Case Inlet and Port Madison
Port Susan
Budd Inlet
Hylebos
NAUTICAL MILES

FIGURE 24

APPENDIX E

NOAA PUGET SOUND AREA SAMPLING SITES AND SUMMARY OF COMPARISION DATA



NOAA PUGET SOUND AREA SAMPLING SITES

COMPARISON OF CONTAMINANT LEVELS AT SELECTED NOAA STATIONS

Parameter	Case Inlet +			Port Madison +			Budd Inlet +			Sinclair Inlet +			Port Susan ++			Discovery Bay ++		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Chromium	20.9	52.7	36.8	22.8	45.6	34.2	34.6	50.1	44.7	39.4	71.5	58.4						
Beryllium	.160	.588	.374	.221	.490	.35	.433	.759	.625	.420	.633	.55						
Copper	10.2	45.0	27.6	10.4	25.8	18.1	36.6	81.1	62.7	46.8	184	128.4						
Nickel	19.4	47.0	33.2	21.5	42.0	31.8	34.8	47.6	42.4	35.5	52.9	47.0						
Zinc	23.2	82.5	52.8	26.8	61.9	44.4	55.1	118	91.4	83.2	292	192.3						
Arsenic							57	140	99				14	15	15		2.6	2.6
Silver	1.83	2.26	2.04	1.48	1.97	1.72	2.66	3.67	3.1	2.02	4.76	3.28						
Antimony	19.0	46.0	32.5	17.8	32.4	25.1	43.7	68.6	57.8	31.1	52.0	43.8						
Selenium	-	28	28	-	22	22	28	74	54	27	30	29	29					
Mercury	.024	.118	.071	.042	.113	.078	.125	.329	.246	.315	1.15	.89	.36	.58	.47		.03	
Cadmium	3.16	7.58	5.37	3.08	6.25	4.66	8.19	11.2	9.64	5.24	8.14	7.06	.860	.907	.880		.39	
Lead	7.93	23.9	15.9	10.3	20.1	15.2	22.6	60.1	44	44.2	136	100.7	21	22	22	N		
Pyrene	8.0	90	49	30	100	70	100	180	150	190	3100	1025						
Fluorene	.10	1.0	0.6	10	.40	5.2	5.0	9.0	7.0	4.0	90	36						
Acenaphthylene	.10	.40	.25	.10	.10	.10	.20	.30	.23	.2	3.0	.9						
Naphthalene	3.0	20	12	8.0	30	19	30	80	53	40	360	132						
Fluoranthene	7.0	100	54	30	80	55	80	160	123	160	2300	800						
Acenapthene	0.2	5.0	2.6	.10	3.0	1.6	9.0	10	9.7	6.0	80	31.5						
Anthracene/Phenanthrene	4.3	58	31.2	23	70	46	50	110	83	90	2180	710						
Benzo (A) Anthracene/Chrysene	6.0	40	23	40	120	80	80	200	137	260	3600	1252						
PCB - 1260	.15	1.2	.67	.40	2.0	1.2	.90	6.0	4.2	13	90	70.8						
PCB - 1254	.34	2.9	1.6	2.2	6.0	4.1	4.3	17	11	16	120	68.5						

+ Malins et.al. Chemical Contaminants and Biological Abnormalities in Central and Southern Puget Sound, NOAA Tech. Memo. OMPA-2

++ Malins et.al. Chemical Contaminants and Abnormalities in Fish and Invertebrates from Puget Sound, NOAA Tech. Memo. OMPA-19