FINAL WITHDRAWAL

OF TOTAL MAXIMUM DAILY LOADS (TMDLS)

FOR COPPER IN THE ARTHUR KILL

AND THE KILL VAN KULL

AND

FINAL ESTABLISHMENT OF A TMDL

FOR NICKEL IN THE

HACKENSACK RIVER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
Division of Environmental Planning and Protection
290 Broadway
New York, New York 10007

December 1999

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Section 303(d)(1)(C) of the Clean Water Act (CWA) and EPA's implementing regulations (40 CFR Part 130) require States to identify those waterbodies that do not meet water quality standards after application of the technology-based limitations required by the Act. The States of New York and New Jersey have identified certain waters within the New York- New Jersey Harbor complex as "water quality-limited" due to specific metals and have assigned them a high priority for TMDL development.

This document summarizes the basis for two actions EPA has taken regarding metals in the New York-New Jersey Harbor. The two actions are: withdrawal of TMDLs for copper in the Arthur Kill and Kill Van Kull because those waters are not impaired for copper and effluent limitations required of point sources under Section 301(b) of the CWA are stringent enough to implement water quality standards for copper applicable to such waters; and the establishment of a TMDL for nickel in the Hackensack River. EPA is establishing the TMDL in the Hackensack River at the request of the New Jersey Department of Environmental Protection. In addition, EPA has determined that the Passaic River and Newark Bay are not water quality-limited for nickel and, at this time, do not require TMDLs for nickel.

INTRODUCTION

Section 303(d)(1)(C) of the Clean Water Act and EPA's implementing regulations (40 CFR Part 130) require States to identify those waterbodies that do not meet water quality standards after application of the technology-based limitations required by the Act. The States of New York and New Jersey have identified certain waters within the New York- New Jersey Harbor complex as "water quality-limited" due to specific metals and have assigned them a high priority for TMDL development.

By definition, a TMDL specifies the allowable pollutant loading from all contributing sources (e.g., point sources, nonpoint sources, and natural background) at a level necessary to implement the applicable water quality standards, with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

On August 11, 1994, the U.S. Environmental Protection Agency (EPA), in cooperation with the New York State Department of Environmental Conservation (NYSDEC) and the New Jersey Department of Environmental Protection (NJDEP) public noticed (59 FR 41293) the proposed establishment of phase I Total Maximum Daily Loads/Waste Load Allocations/Load Allocations (TMDLs/WLAs/LAs) for copper, mercury, nickel and lead in New York-New Jersey Harbor. The supporting technical bases for these TMDLs/WLAs/LAs are contained in EPA's document entitled, *Total Maximum Daily Loads (TMDLs) for Copper, Mercury, Nickel and Lead in NY-NJ Harbor* (July 26, 1994).

Based on the applicable water quality standards and use of a water quality model employed for the TMDL effort, certain waters were projected to exceed water quality standards. However, because of the limited ambient and loading data, the state of the model calibration was considered uncertain for the Raritan River/Bay, the Hackensack and Passaic Rivers, and Newark Bay. While the model projected exceedances in these waters, the available ambient data indicated that existing loads were adequate to meet applicable water quality standards. The proposed phase I TMDLs for these Harbor waters (Hackensack River, Passaic River, Newark Bay, and Raritan River/Bay) required that municipal and industrial loads be limited to their existing loads. As part of the phase I TMDL, additional data collection and modeling were required for these waters. The New Jersey Harbor Dischargers Group (NJHDG), agreed to undertake the monitoring and modeling effort needed to develop phase II TMDLs for these waters.

Since the time of the public notice, EPA issued a "Stay of Federal Water Quality Criteria for Metals; Water Quality Standards; Establishment of Numeric Criteria for Priority Pollutants; States' Compliance - Revision of Metals Criteria' Final Rules" (60 FR 22228, May 4, 1995), amending the National Toxics Rule. This action established dissolved criteria, for the protection of aquatic life, for nickel and lead in New Jersey. It was determined that, based on the dissolved nickel and lead criteria, insufficient data were available to establish phase I TMDLs for nickel and lead. The final TMDLs/WLAs/LAs, established on January 24, 1996 (61 FR 1930), were only for copper and mercury and required further data collection and modeling. A requirement of the final phase I TMDL was to conduct further data collection and modeling to assess whether the Hackensack River, Passaic River, and/or Newark River/Bay were water quality-limited for copper, nickel and lead.

Subsequent to the establishment of TMDLs/WLAs/LAs for copper and mercury, the NJHDG's consultant, the Great Lakes Environmental Center, prepared a monitoring plan designed to enhance the ambient data base for the four metals of concern (copper, mercury, nickel, lead) in the Hackensack River, Passaic River, Newark Bay, and Raritan River/Bay (the NJ Harbor waters). The initial phase of the monitoring effort was designed to collect sufficient ambient data to determine if these NJ Harbor waters were water quality-limited for any of the metals of concern. Based on the results of this data collection effort, certain metals and/or waters might require additional monitoring and modeling to develop TMDLs.

The results of the ambient data collected in the above-mentioned NJ Harbor waters are contained in *Summary of the Phase I Metals Sampling and Analysis Program for the New Jersey Component of the New York/New Jersey Harbor Estuary Program* (March 5, 1996) and in data evaluation supplement, *Revisions to the Metals Report* (March 26, 1996). Probability distributions were utilized to determine the potential for ambient exceedances of water quality criteria in these NJ Harbor waters. The distributions were designed to reflect the 4-day duration and once-in-three-year frequency of the ambient chronic aquatic-life based criteria (i.e., 99.63% exceedance frequency). The probability distributions of ambient data indicated the following:

- the mercury criterion is exceeded everywhere except in Raritan Bay;
- the copper criterion is not exceeded in the Hackensack River, Passaic River, Newark Bay, and Raritan River/Bay;
- the lead criterion is not exceeded in the Hackensack River, Passaic River, Newark Bay, and Raritan River/Bay; and
- the nickel criterion is exceeded in the Hackensack River and potentially in the Passaic River.

Based upon the above findings, EPA, therefore, withdrew the phase I copper TMDLs in the NJ Harbor waters (Hackensack and Passaic Rivers, Raritan River/Bay and Newark Bay) which had been established in January 1996. EPA public noticed its intent to withdraw the copper TMDLs in these NJ Harbor waters on January 10, 1997 (62 FR 1454). The final action to withdraw was on September 19, 1997 (62 FR 49226).

The findings above indicated that the Hackensack River was water quality-limited and that the Passaic River was potentially water quality-limited for nickel. Based on the data, EPA concluded that the Hackensack River would require a TMDL and the Passaic River required further data collection to determine whether the nickel criterion is exceeded. The NJHDG, with assistance from EPA, undertook further monitoring and modeling to provide data for TMDL assessment and development. In addition, because the copper TMDL was still in effect in the remainder of the Harbor, the NJHDG questioned whether certain parts of the Harbor. the Arthur Kill and Kill Van Kull (the Kills), were actually water quality-limited for copper. Therefore, the NJHDG and EPA , undertook a joint monitoring and modeling effort to provide data for TMDL development for nickel in the Hackensack and Passaic Rivers, as necessary, and to assess the need for copper TMDLs in the Kills. These actions fulfill the requirements established under the Memorandum of Agreement (May 12, 1999) between NJDEP and EPA outlining the schedule for development of TMDLs in New Jersey. Under this Agreement, EPA had committed to completing the necessary TMDLs for metals in the New York-New Jersey Harbor by June 30, 1999.

PART A

WITHDRAWAL OF COPPER TMDLS IN THE ARTHUR KILL AND KILL VAN KULL

EPA established phase I TMDLs on January 24, 1996 (61 FR 1930) for copper and mercury in several areas of the Harbor, including the Kills. These TMDLs were established for the Kills because modeling projections indicated a potential exceedance of the applicable aquatic life-based copper criterion. Ambient data did not indicate any exceedances. The original modeling projections did not include any combined sewer overflows (CSO) or storm water (SW) data specific to New Jersey waters. Lacking these data, the modeling projections only included CSO and SW data from New York.

As described in the Introduction, several areas of the NJ Harbor waters (Hackensack and Passaic Rivers, Raritan River/Bay and Newark Bay) were determined not to be water quality limited for copper. Therefore, on September 19, 1997 (62 FR 49226) EPA withdrew the phase I TMDLs for copper in the above waters. This action did not affect the Kills. As part of this monitoring effort, the NJHDG, with assistance from EPA, conducted additional monitoring and modeling to reevaluate whether the Kills are still water quality-limited for copper.

The NJHDG undertook a monitoring and modeling program for the Kills in order to reconcile the differences between the ambient data and modeling projections. The modeling projections were updated with data from New Jersey CSOs and SW. The monitoring program included the collection of dissolved copper in ambient water samples and associated parameters (e.g., total suspended solids, dissolved organic and particulate carbon) three times under wet and six times under dry weather conditions at two sampling stations each in the Arthur Kill and the Kill Van Kull during the period May to October 1997. The municipal effluents discharging to the Arthur Kill (Joint Meeting, Linden Roselle and Rahway Valley) were sampled monthly. Two CSOs and one SW discharge were monitored five times during the period from July 1997 to February 1998. The data and modeling analyses are summarized in the report, *Monitoring and Modeling of Nickel in the Hackensack and Passaic Rivers and Newark Bay and Monitoring and Data Analysis for Copper in the Arthur Kill and Kill Van Kull (August 27, 1998).*

The ambient copper data collected under this current effort (May to October 1997) were combined with data collected in the initial monitoring phase (1991) to form a probability distribution. The distribution, shown in Figure 1, indicates that there is no probability of exceedance of the chronic aquatic life-based copper criterion (5.6 $\mu g/L$) at the 99.63 percentile (the chronic compliance frequency). Note, that there is a high copper value of 7.96 $\mu g/L$ which is believed to have been contaminated and therefore, not an accurate value. Therefore, analysis of the ambient dissolved copper data indicate compliance with the criterion.

The CSO and SW data collected as part of this monitoring effort indicate that the total copper concentrations, measured as total recoverable concentrations, based on New Jersey data are much lower than those used in the original modeling effort which were based on New York data. Based on the New Jersey data, the mean CSO concentration is 19.1 $\mu g/L$, as compared to the

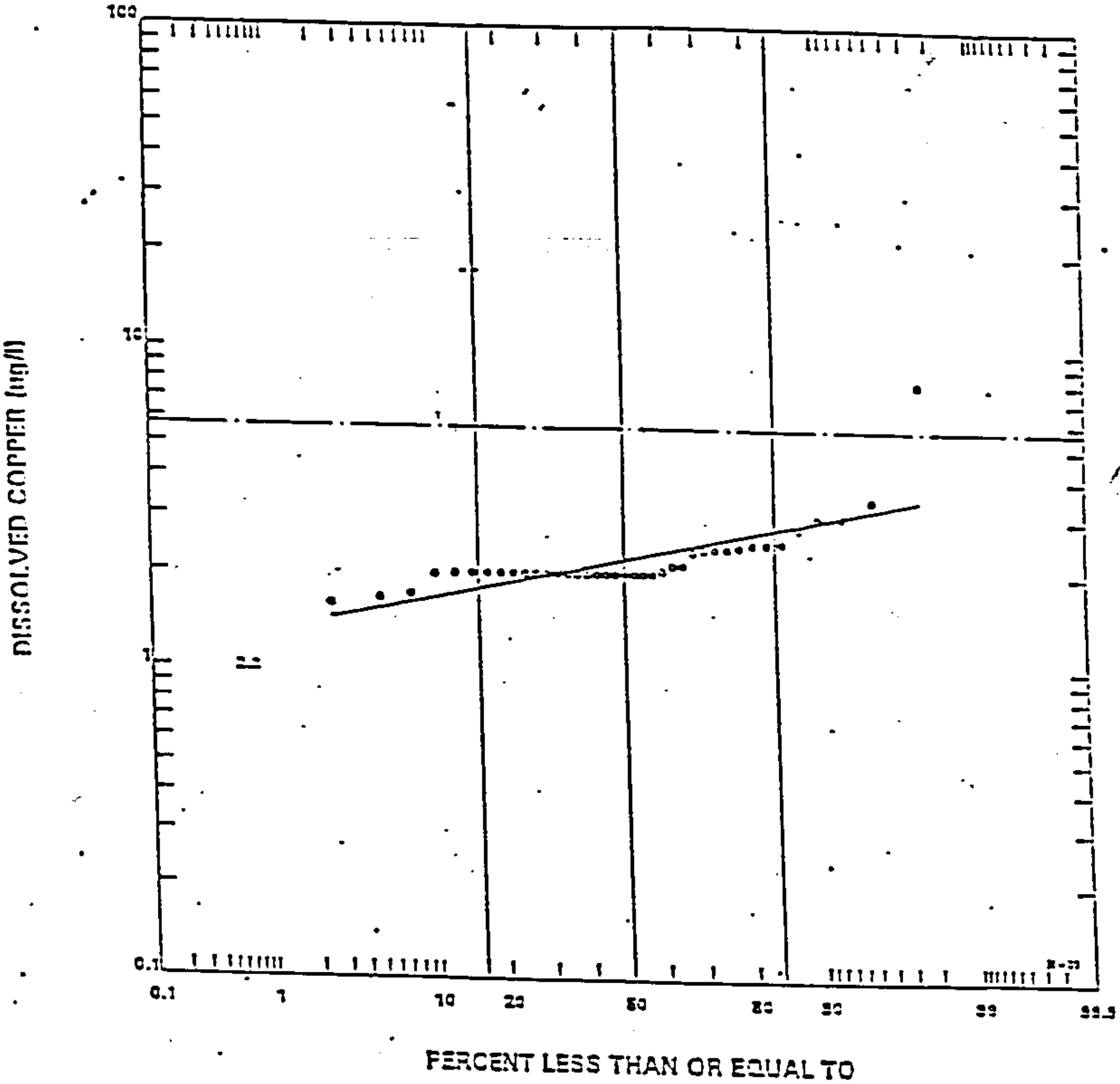


Figure 1 Arthur Kill and Kill Van Kull ambient dissolved copper data collected by EPA and the New Jersey Harbor Dischargers Group (GLEC,1998)

original New York value of 152.9 μg/L (total recoverable metal). The mean SW concentration is 17.5 μg/L, as compared to the original New York value of 66. 6 μg/L (total recoverable metal). The municipal effluent data collected during this monitoring effort indicate significantly lower total recoverable copper concentrations as compared to data collected during the 1991 survey. These reductions may be the result of improved treatment efficiency and the implementation of industrial pretreatment programs at the New Jersey municipal treatment plants.

The water quality model employed for the 1991 TMDL calculations was revised for the Kills to include the updated CSO and SW data. This model is described under Part C, Section IV. The resulting modeling projections indicate that the copper criterion is not exceeded (refer to Figure 2). Figure 2 shows the dissolved copper concentrations projected by the model during January and October 1991 using the updated CSO and SW data. These projections include municipal plant effluent data collected during 1991. If the 1997 municipal plant effluent data were used, the resulting modeling projections would be even lower than what is shown in Figure 2.

In conclusion, both the ambient data analysis and modeling projections now indicate that the applicable copper criterion is not likely to be exceeded in the Kills. EPA has, therefore, concluded, that the TMDLs for copper in the Kills are not necessary because those waters are not impaired for copper and effluent limitations required of point sources under Section 301(b) of the CWA are stringent enough to implement water quality standards for copper applicable to such waters (i.e., the Kills are not water quality-limited for copper and no TMDL is required for copper). EPA is withdrawing the copper TMDLs in the Kills. The data analysis and modeling projections also support delisting the Kills from subsequent New Jersey 303(d) lists.

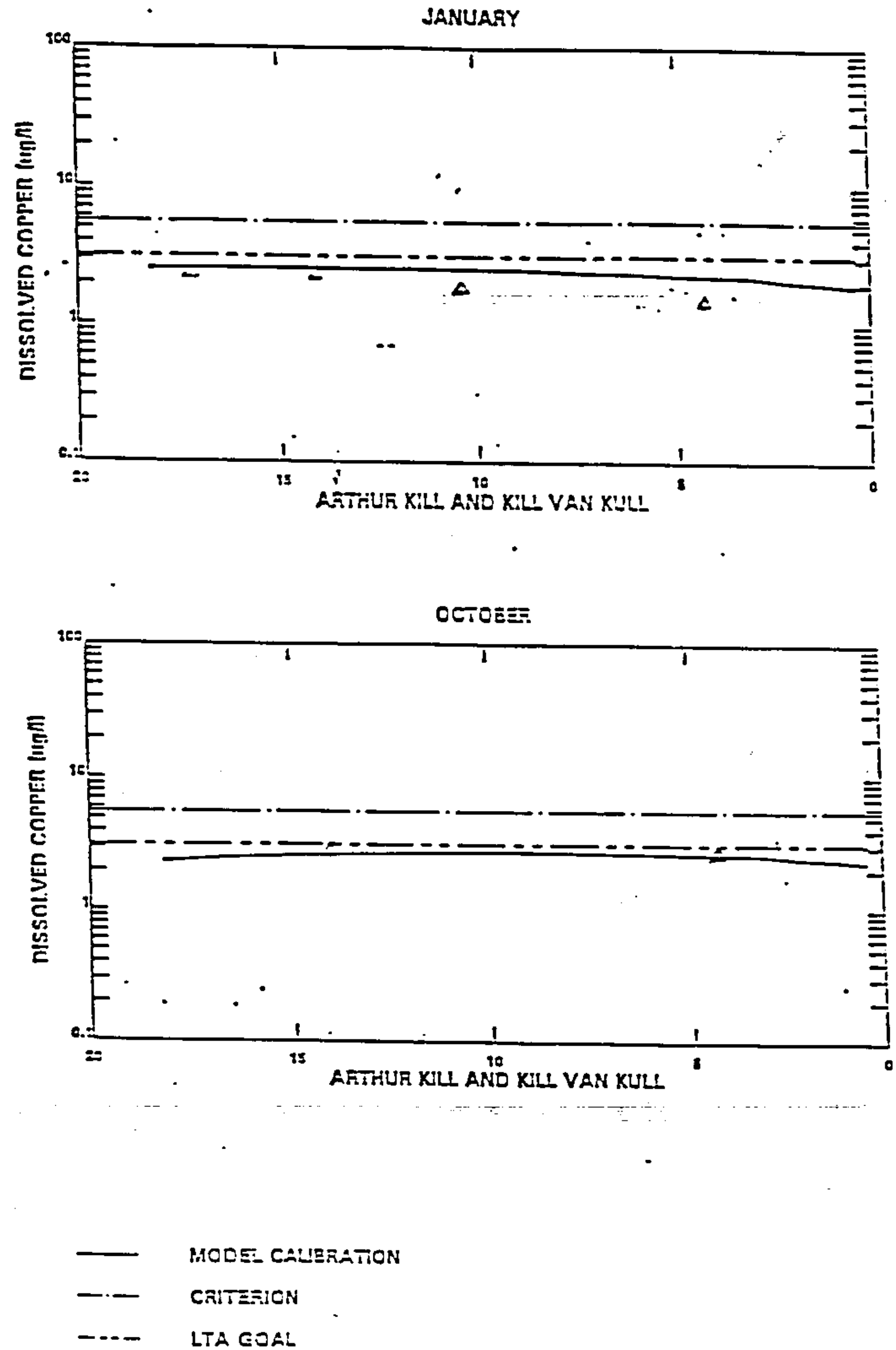


Figure 2 January and October 1991 comparison of model results to long term average goal (GLEC, 1998)

PART B

EVALUATION OF NICKEL DATA IN THE HACKENSACK AND PASSAIC RIVERS AND NEWARK BAY

I. Section 303(d) Listing and Applicable Water Quality Standards

The Hackensack and Passaic Rivers and Newark Bay have been listed on New Jersey's Section 303(d) list for nickel (as well as other pollutants) since 1992. The use impairment is aquatic life. The saline portions of the Hackensack River are classified by the NJDEP as follows:

- The mainstem and saline tributaries from Oradell Dam to the confluence with Overpeck Creek is classified as Class SE-1. The designated uses for SE-1 waters are: shellfish harvesting; primary and secondary contact recreation; maintenance, migration and propagation of aquatic biota; and, any other reasonable uses.

- The mainstem and saline tributaries from Overpeck Creek to the Route 1 and 9 crossing is classified as Class SE-2. The designated uses for SE-2 waters are: secondary contact recreation; maintenance, migration and propagation of aquatic biota; migration of diadromous fish; maintenance of wildlife; and, any other reasonable uses.

- The mainstem from the Route 1 and 9 crossing to the confluence with Newark Bay is classified as Class SE-3. The designated uses for SE-3 waters are: secondary contact recreation; maintenance and migration of aquatic biota; migration of diadromous fish; maintenance of wildlife; and, any other reasonable uses.

The saline portions of the Passaic River are classified by NJDEP as follows:

- The main stem from Dundee Lake Dam to the confluence with Second River is classified as Class SE-2.

- The main stem from Second River to the confluence with Newark Bay is classified as Class SE-3.

All portions of Newark Bay are classified as SE-3.

The applicable nickel criteria for all saline portions of both the Hackensack and Passaic Rivers and Newark Bay are:

- 74 $\mu g/L$ (expressed as the dissolved form of the metal), which intended to protect aquatic life from acute effects; and,

- 8.2 $\mu g/L$ (expressed as the dissolved form of the metal), which intended to protect aquatic life from chronic effects.

The above nickel criteria were promulgated by EPA for the State of New Jersey on May 4, 1995 as part of the "Stay of Federal Water Quality Criteria for Metals; Water Quality Standards; Establishment of Numeric Criteria for Priority Pollutants; States' Compliance - Revision of Metals Criteria' Final Rules." The more stringent chronic criterion of 8.2 $\mu g/L$ has been applied for the TMDL assessment and development.

II. Water Quality Monitoring in the Hackensack and Passaic River Systems and Newark Bay

Ambient water quality sampling for nickel was conducted over a ten-month period (May 1997-February 1998) for dissolved and total recoverable nickel concentrations and associated water parameters (e.g., total suspended solids, total organic/dissolved organic/particulate carbon, etc.) under wet and dry-weather conditions. A total of eight water sampling stations were included: three in the Hackensack River, three in the Passaic River, one in Newark Bay, and one at the southern mouth of Newark Bay. In addition, samples were also collected from the Oradell Dam on the Hackensack and the Dundee Dam on the Passaic River, representing the boundary locations for each River.

Pollutant sources were also monitored, including: seven CSOs and nine SW outfalls discharging to the Hackensack and Passaic Rivers, and effluent from three municipal sewage treatment plants (STPs) (Bergen County Utilities Authority, North Bergen STP, Secaucus STP) discharging to the Hackensack River. There are no STPs discharging directly to the saline segment of the Passaic River. Industrial dischargers, which were considered minor contributors, were not sampled during these monitoring events. [They were, however, considered during model calibration and TMDL development.] Samples were also collected from tributaries to the Hackensack River (Overpeck Creek, Berry's Creek, and Kingsland Creek), and to the Passaic River (Saddle River). A complete description of the sampling program can be found in the August 27, 1998 Report. Figure 3 shows the sampling stations in the study area.

II. Evaluation of Ambient Nickel Data in the Hackensack and Passaic Rivers and Newark Bay

A. Analysis of Ambient Data

Data collected during the monitoring surveys are summarized in the August 1998 report. Figure 4 shows the wet and dry-weather means of observed dissolved nickel concentrations at each station in the Hackensack and Passaic Rivers and Newark Bay. The graph indicates the following:

- the Hackensack River has the highest dissolved nickel concentration, while Newark Bay has the lowest concentration;
- there are no significant differences between the wet and dry-weather ambient water dissolved nickel concentrations; and
- ambient dissolved nickel concentrations approach the water quality criterion of 8.2 $\mu g/L$ in the Hackensack R.

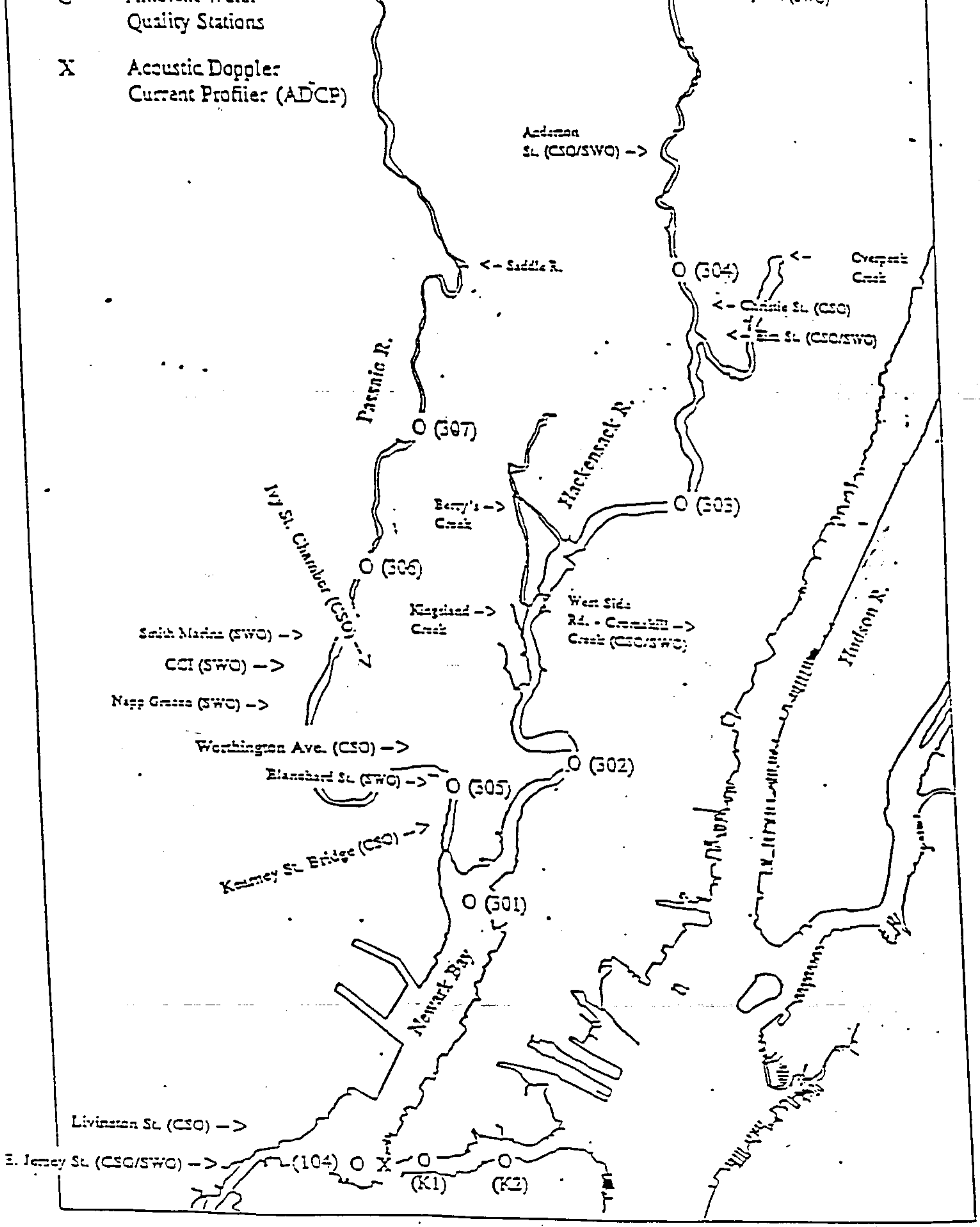


Figure 3 Location of sampling stations for the nickel-related sampling program (GLEC, 1998)

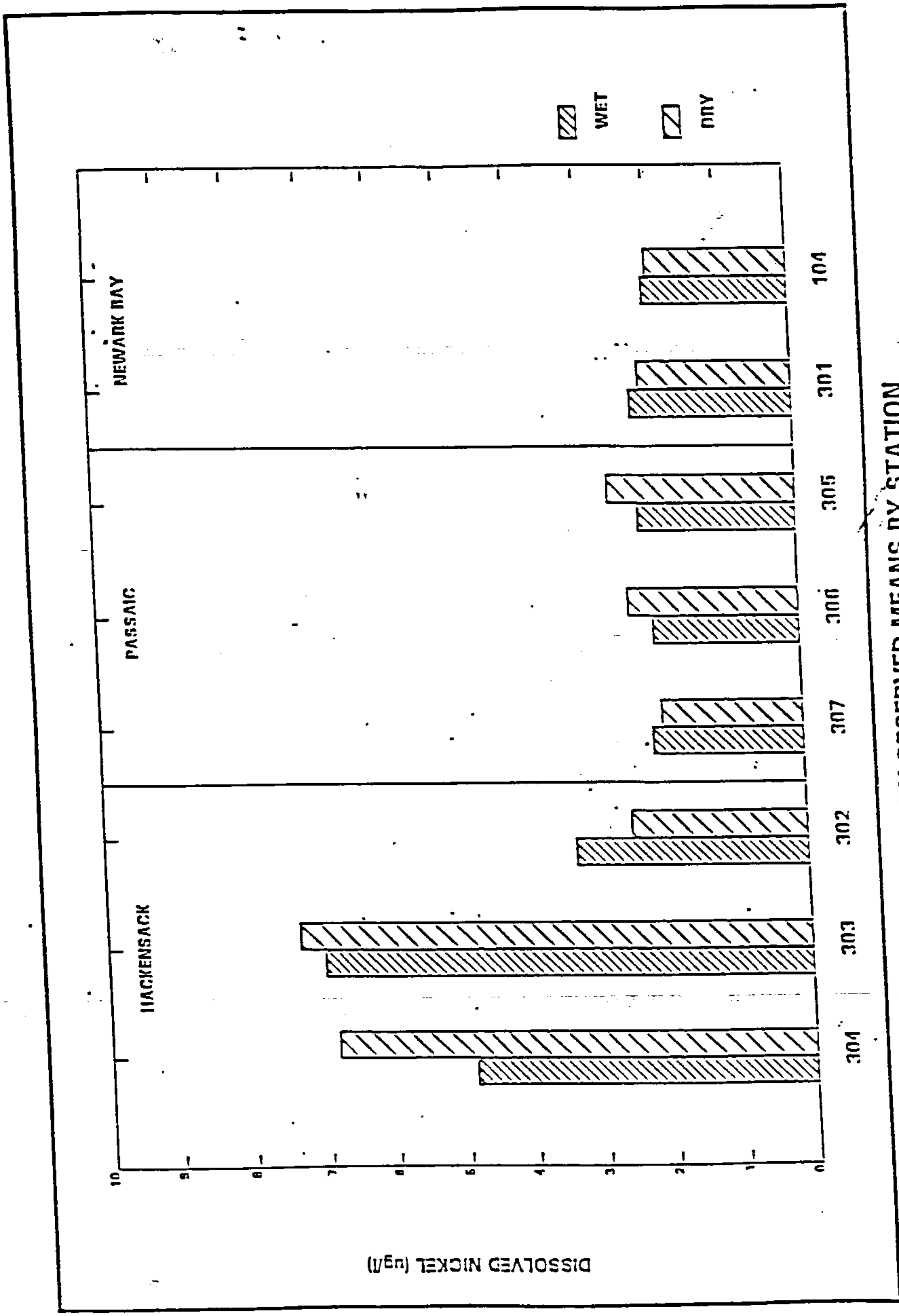


Figure 4 (HYDROQUAL, INC. 1998)

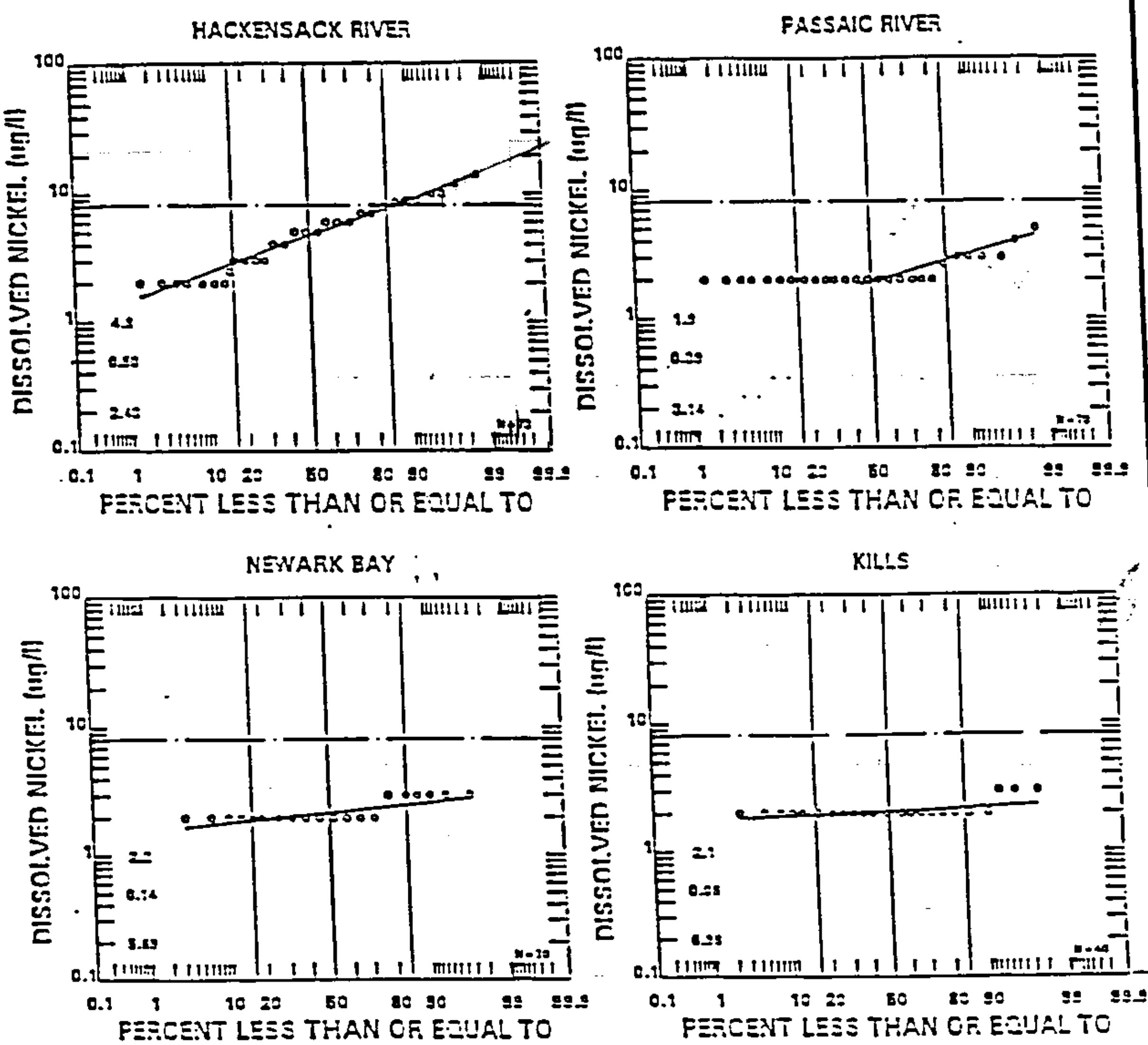
B. Probability Distributions

Probability distributions were developed to determine compliance with the nickel ambient water quality criterion for nickel. The criterion, which is based on chronic toxicity, is expressed as a four-day average not to be exceeded more than once in a three year period. A methodology was developed to convert the criteria to a long-term average concentration (refer to August 1998 report). Based on this methodology, the criterion corresponds to compliance frequency of 99.63%. Probability distributions were developed, using data collected during both wet- and dry-weather monitoring surveys, for the Hackensack River, Passaic River and Newark Bay Figure 5. Analysis of the distributions indicate the following:

- the nickel criterion is not projected to be exceeded in the Passaic River and Newark Bay; and
- the nickel criterion is projected to be exceeded in the Hackensack River.

Based on this analysis, EPA has concluded that the Hackensack River is water quality-limited for nickel and requires a TMDL. Probability distributions indicate that the Passaic River and Newark Bay are not water quality-limited for nickel. In addition, modeling projections under the critical low flow conditions do not indicate water quality criterion exceedances for the Passaic River and Newark Bay.

Based on the above analysis, EPA has concluded that the Passaic River and Newark Bay are not water quality-limited for nickel. EPA recommends that, in the next Section 303(d) listing cycle, the Passaic River and Newark Bay be delisted for nickel.



Regional Dissolved Nickel Distributions
Hackensack and Passaic Rivers and Kills and Newark Bay

FIGURE 5 (GLEC, 1998)

PART C

DEVELOPMENT OF TMDL/WLAs/LAs/ FOR NICKEL IN THE HACKENSACK RIVER

I. Section 303(d) Listing

The Hackensack River has been listed on New Jersey's 303(d) list since 1992 for several pollutants. This TMDL is being developed for nickel.

II. Applicable Water Quality Standards

The applicable water quality standards are described in Part B, Section I of this report. The applicable criterion for nickel is 8.2 $\mu g/L$, expressed in the dissolved form.

III. Pollutant Sources and Loadings

The sources of nickel into the Hackensack River include municipal discharges, CSOs, storm water, tributaries and atmospheric deposition. A summary of the loadings is shown in Table 1.

Table 1. Summary of existing nickel loads to the Hackensack River (based on observed data collected during calibration period May '97- Feb. '98).

Source	Mean total recoverable nickel ($\mu g/L$)	Flow (mgd)	Load (lbs/day)
Bergen County Utilities Authority (BCUA) [NJ0020028]	17.8	76	11.3
North Bergen STP [NJ0034339]	4.6	7.2	0.28
Secaucus STP [NJ0025038]	1.5	3.2	0.04
CSOs	3.2	3.82	0.10
Storm Water	2.6	37.2	0.81
Boundary	2.0	22.2	0.37
Atmospheric	Not applicable	Not applicable	1.06

The BCUA is the largest contributor of nickel to the Hackensack River. It accounts for 81% of the total load.

IV. Water Quality Modeling

HydroQual Inc., the firm contracted by the NJHDG, used the same modeling framework for this effort as in the previous metals modeling conducted for the Harbor (*Development of Total Maximum Daily Loads and Waste Load Allocations for Toxic Metals in NY/NJ Harbor-Modeling Report*, HydroQual, Inc., 1995) The modeling framework, the Chemical Transport and Analysis Program (CTAP), is a steady-state mass balance model which includes the following processes:

- advective/dispersive transport;
- solid phase vertical transport;
- phase partitioning and kinetic reactions;
- transport across the water column/sediment interface;
- transport across the air/water interface; and
- point and nonpoint source loading.

The modeling framework consists of 91 water column segments plus and additional 91 sediment segments. The geographic scope of the model is the Hackensack River from the Oradell Dam, the Passaic River from the Dundee Dam, Newark Bay, Kill Van Kull and the Arthur Kill. A schematic of the model segmentation is shown in Figure 6.

The physical transport used in CTAP is based upon calibrating observed salinity measurements collected during the period May 1997 through February 1998. Freshwater flows were based on data collected at USGS gaging stations located above the heads of tide of the Hackensack and Passaic Rivers. Runoff from storm water and CSOs were calculated using the Rainfall Runoff Modeling Program developed by HydroQual.

Solid phase vertical transport within the model includes: water column settling, settling from the water column to the bed, resuspension from the bed to the water column, and burial of bed solids. Solid phase vertical transport rates were determined through calibration to suspended solids collected during the calibration period. The data indicate that there is little significant net deposition of solid phase matter from the water column to the bed. For the calibration period, the amount of material leaving the water column and entering the bed is equal to the amount of solid phase material that is resuspended from the bed to the water column.

In CTAP, the rates of adsorption and desorption relative to one another are defined by a partition coefficient. The partition coefficient is the metal-specific ratio of the solid phase metal to the dissolved phase metal. For a given partition coefficient and quantity of total recoverable metal, the amount of metal in the dissolved and particulate forms is dependent upon the suspended solids concentration. Based on data collected during this study, partition coefficients for nickel were calculated to be 41,000 for Newark Bay and the Passaic River and ranging from 11,600 to 22,500 for the Hackensack River.

Using this modeling framework, a good calibration was achieved for nickel in the Hackensack

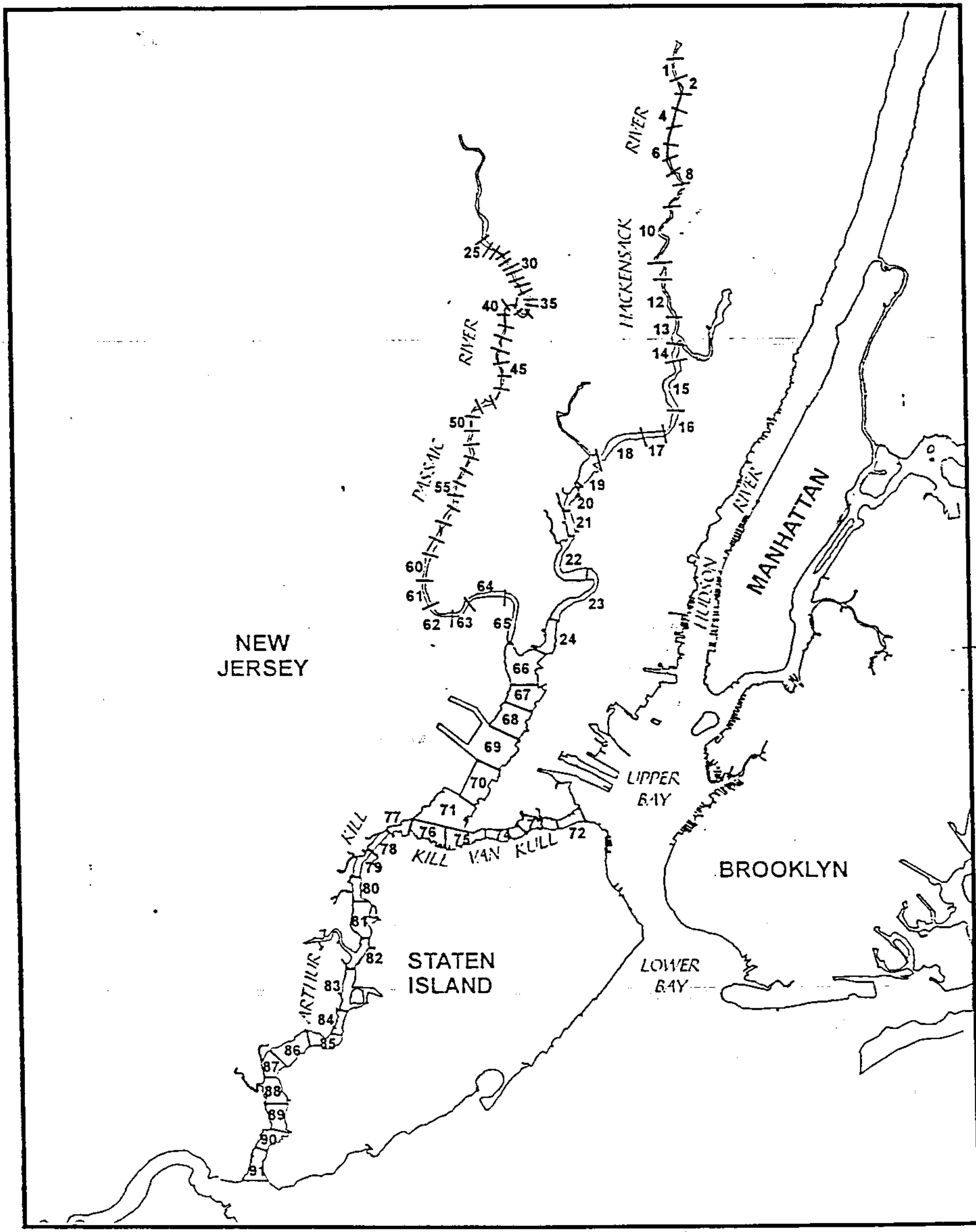


FIGURE 6
SCHEMATIC OF MODEL SEGMENTATION
(GLEC, 1998)

River (see Figure 7).

V. TMDL/WLAs/ LA for the Hackensack River

To facilitate the task of developing the TMDL, spreadsheets of load matrices which summarize calibrated model results were developed by HydroQual. The spreadsheets allow the user to specify loadings and predict the response in each of the water segments of the Hackensack and Passaic Rivers and Newark Bay. The total response is compared to the criterion to determine compliance. The criterion used in the spreadsheet is the long-term average from the probability distribution at an exceedance frequency of 99.63%.

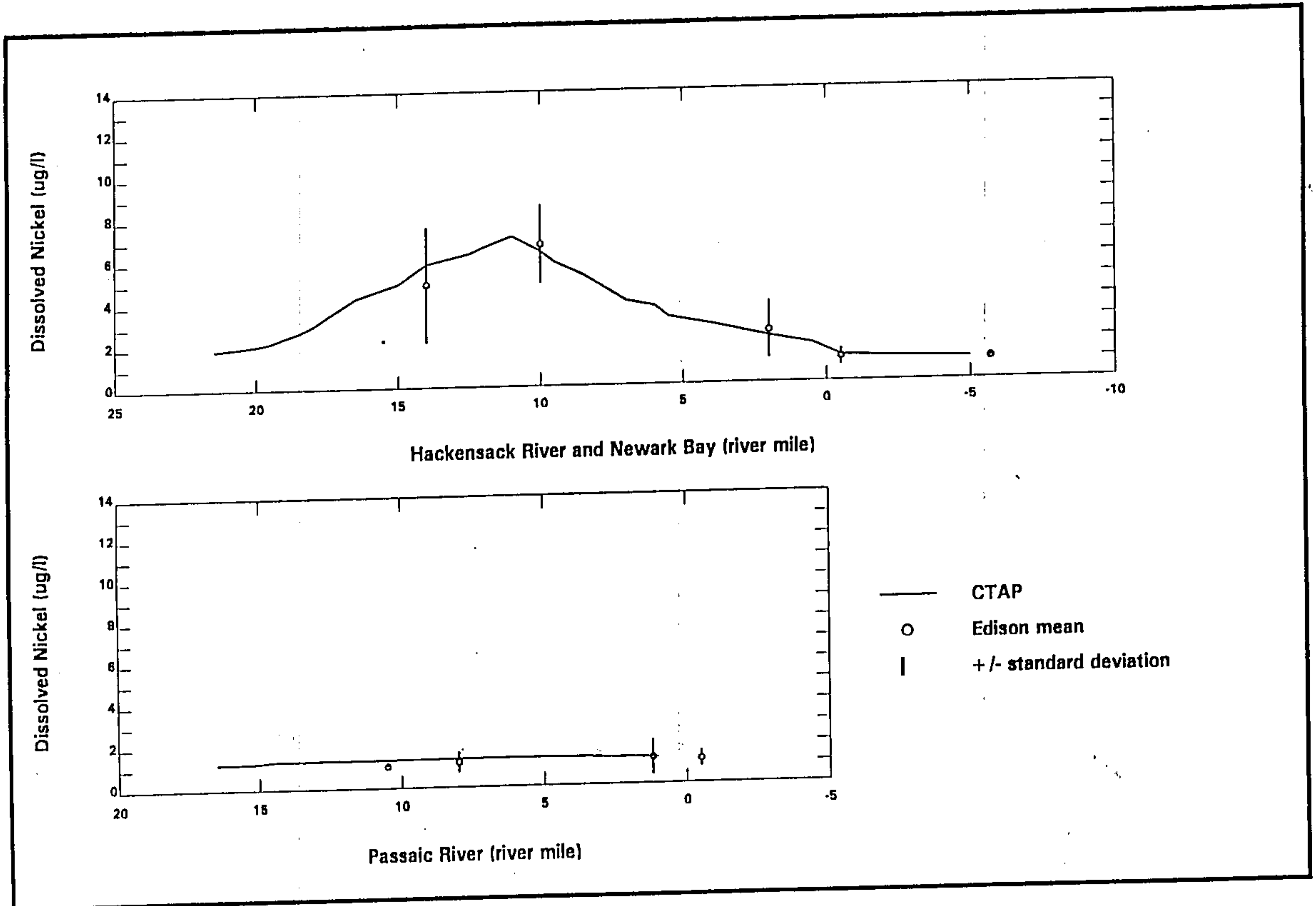
The October low flow transport condition was chosen as the critical condition for TMDL development in the Hackensack River. This is consistent with previous TMDL efforts for the Harbor. Data collected in the Hackensack River indicate that nickel concentrations are not significantly different during wet- vs. dry-weather conditions. The Hackensack River is an effluent-dominated stream. The ambient water quality in the Hackensack River is dominated by the BCUA discharge. While the BCUA flow is around 75 mgd, the Hackensack River dry-weather October 1991 flow is 0.6 mgd. The impact from the BCUA discharge on receiving water quality is expected to be more significant during dry-weather conditions.

Seasonal Variation

The Clean Water Act and accompanying regulations require that a TMDL be established with seasonal variations. CWA 303(d)(1)(C) and 40 CFR § 130.7(d)(2). As previously described, the concentration of nickel does not vary significantly between wet-weather and dry-weather conditions. Therefore, it is expected that using the October low flow condition will result in meeting criteria during all times of the year. By calibrating the model and developing the TMDL under the low flow condition, and by evaluating ambient nickel concentrations under wet and dry weather conditions, seasonal variation has been accounted for.

Margin of Safety

The Clean Water Act and EPA regulations require that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between effluent limitations and water quality. CWA 303(d)(1)(C) and 40 CFR § 130.7 (c)(1). EPA guidance explains that the margin of safety may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the margin of safety. The previous TMDL established by EPA for metals in the Harbor utilized conservative assumptions for the margin of safety. Similarly, the margin of safety for this TMDL is incorporated into the TMDL through the following conservative assumptions: the use of low flow conditions as a critical condition for the TMDL analysis and, calculating the TMDL so the criterion is met at the 99.63% exceedance frequency.



COMPARISON OF CALCULATED AND MEASURED DISSOLVED NICKEL
APRIL 1997 - FEBRUARY 1998

FIGURE 7 (GLEC, 1998)

As described previously, the Hackensack River is an effluent-dominated stream; the ambient concentration of nickel is driven by the BCUA nickel effluent concentration. Running the load matrices under various reduction scenarios indicates that reducing all the loads, except BCUA, has little effect on the ambient River nickel concentration. Compliance with the nickel criterion can only be achieved by significantly reducing the BCUA discharge. A reduction of around 80% (in the BCUA nickel concentration) is required to meet the criterion. The current flow from the BCUA facility is around 75 mgd. However, this facility has an ultimate design capacity of 109 mgd. There is some question as to what the appropriate permitted design flow should be. BCUA and NJDEP are in the process of determining this flow. The current mean effluent concentration of nickel at BCUA is 17.8 μg/L, expressed as total recoverable metal. Therefore, in order to calculate the TMDL/WLA, the load matrices were run under both treatment plant flow scenarios. These calculations indicate that, at a BCUA flow of 75 mgd, the effluent nickel concentration must be reduced to approximately 3.6 μg/L (total recoverable); while at a BCUA flow of 109 mgd, the effluent concentration must be reduced to 3.7 μg/L (total recoverable). There is little difference between the required effluent nickel concentration at 75 mgd and that at 109 mgd. Because there is little or no dilution available in the Hackensack River, the concentration of nickel from the BCUA discharge directly impacts the receiving water nickel concentration. The effluent nickel concentration dictates the ambient nickel concentration, not the mass load of nickel. In order to ensure compliance with the nickel criterion, the WLA must specify a concentration-based limit. Because the appropriate design flow has not been determined for BCUA, the TMDL and WLA will be based on the more stringent nickel effluent concentration of 3.6 μg/L (total recoverable), which is required to meet the nickel criterion. When the WLA is translated to a permit limit, the limit must, at a minimum, be expressed as a concentration-based limit, and if necessary, a mass-based limit. The concentration water quality-based limit will ensure compliance with the ambient nickel criterion. This is consistent with EPA's regulations under 40 CFR § 122.44(d)(1)(vii) which requires that water quality-based limits must be consistent with applicable water quality standards and any assumptions and requirements of the waste load allocations that have been established by the State (or EPA) under 40 CFR § 130.7.

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to existing and future point sources. 40 CFR § 130.2(g). In addition, the regulations require that a TMDL include LAs, which identify the portion of the loading capacity allocated to existing and future nonpoint sources and to natural background. 40.CFR § 130.2(h). Load allocations may range from reasonably accurate estimates to gross allotments. 40 CFR § 130.2(g).

The TMDL for nickel is shown in Table 2. For purposes of calculating the TMDL, the WLA for BCUA is expressed in lbs/day. For the other sources, the WLA is also expressed in lbs/day, however, there is no water quality-based concentration that must be met. All WLAs are calculated as long-term averages in order to meet the chronic criterion.

Table 2. TMDL/WLAs/LAs for nickel in the Hackensack River.

Source	Existing Load (lbs/day)	WLA/LA (lbs/day)
BCUA [NJ0020028]	11.3	2.2[1]
North Bergen STP [NJ0034339]	0.28	0.38[2]
Secaucus STP [NJ0025038]	0.04	0.06[3]
CSOs	0.10	0.10
Storm Water	0.81	0.81
	$\sum$ WLAs	3.55
Atmospheric	1.06	1.06
Boundary(Background)	0.37	0.37
	TMDL	4.98

[1] The WLA of 2.2 lbs/day is established at an effluent concentration of 3.6 μg/L (total recoverable) and flow of 75 mgd; if the effluent flow is 109 mgd, the WLA is 3.3 lbs/day with an effluent concentration of 3.6 μg/L.
[2] Based on design flow of 10 mgd and mean effluent concentration of 4.6 μg/L (total recoverable).
[3] Based on design flow of 5.12 mgd and mean effluent concentration of 1.5 μg/L (total recoverable).

The TMDL for nickel in the Hackensack River can be summarized as follows:

$$\text{TMDL} = \sum \text{WLAs} + \text{LA} \div \text{Background}$$

$$4.98 \text{ lbs/day} = 3.55 \text{ lbs/day} + 1.06 \text{ lbs/day} \div 0.37 \text{ lbs/day}$$

The WLAs for North Bergen and Secaucus STPs are based on existing mean effluent concentrations and their design flows of 10 and 5.12 mgd, respectively. The WLAs for CSOs and SW are based on current loads. The LA of 1.06 lbs/day is based on atmospheric deposition of nickel to the Hackensack River. The background load of 0.37 lbs/day is calculated at the boundary condition at the Oradell Dam and represents the load of nickel coming into the River upstream of the Dam.

VI. Implementation Plan

Current EPA regulations do not require EPA to include an implementation plan with TMDLs it establishes. Nevertheless, EPA has chosen to include an implementation plan with this TMDL to provide New Jersey with guidance as to how it might ensure that the TMDL achieves the applicable water quality standards. NJDEP may choose to implement this plan, or may implement the TMDL differently, as long as the overall provisions of the TMDL are met. EPA understands that NJDEP will implement portions of the TMDL through its New Jersey Pollutant Discharge Elimination System (NJPDES) permitting program.

Bergen County Utilities Authority (BCUA)

The plan to achieve the required reduction at the BCUA plant (NJPDES permit number NJ0020028) should be a two phase process. Phase 1, which may be implemented through the NJPDES permit or through an alternative enforceable agreement, should include the following provisions:

- Source identification program for nickel;
- Evaluation of nickel quantitation issues such as test method sensitivity and establishment of appropriate quantitation levels for the BCUA effluent and within the BCUA collection system, so that sufficient information is available to evaluate compliance with the wasteload allocation/permit limit which could be near or below the detection limit and to assist in the source identification program;
- Nickel reduction feasibility study which evaluates source reduction and treatment alternatives necessary to meet the proposed nickel limit; and
- Outfall relocation study, which identifies options for discharge relocation either downstream in the Hackensack River or elsewhere, if nickel reduction at the existing location is not feasible.

The studies/reports under Phase 1 should include a recommended alternative which meets the goals of the TMDL and should be completed by March 2001, so that the chosen alternative could be incorporated in the re-issued NJPDES permit. In summary, Phase 1 is a planning effort which should result in an alternative recommended by BCUA which either meets the WLA included in this TMDL or which identifies an alternate discharge location.

Phase 2 of the implementation plan for BCUA involves reissuance or modification of the NJPDES permit. The permit must be consistent with this TMDL and should include implementation of a plan chosen by NJDEP. It is anticipated that the permit would include a compliance schedule outlining interim steps necessary to achieve the required nickel reductions or to relocate the outfall. If the existing discharge location is maintained, the permit should include a numeric nickel limitation consistent with the wasteload allocation. This limitation should take effect within the term of the permit. If outfall relocation is planned, a project completion date within the term of the permit should be included.

The existing BCUA permit expires in July of 2001. Timely reissuance of the permit would result in a new permit which expires in July of 2006. Therefore, it is expected that any compliance schedule to implement the chosen alternative would not extend beyond July 2006.

North Bergen Municipal Utilities Authority and Town of Secaucus

In order to ensure that nickel loads from the North Bergen "Central" (NJ0034339) and Secaucus (NJ0025038) plants do not increase, these two permits should include "existing effluent quality" (EEQ) limits.

Concurrent with the establishment of the EEQ limits, NJDEP should consider whether the NJPDES permits should require the permittees to evaluate the need for local limits for nickel. Development and implementation of local limits would ensure that industrial sources do not cause or contribute to an exceedance of the EEQ limits. In addition to controlling industrial sources, the permittees may choose to impose nickel control requirements for commercial sources (e.g., automotive facilities, machine shops) if such controls are deemed appropriate. As an alternative, a pollution prevention audit program could be implemented as a voluntary program outside of the NJPDES program.

The North Bergen permit expires in July of 2001, and the Secaucus permit expires in October of 2003. EPA believes that it would be reasonable for NJDEP to incorporate the appropriate terms into these two permits by the end of 2001.

Combined Sewer Overflows

Regulation of CSOs in New Jersey is achieved through individual NJPDES permits issued to wastewater treatment plants and through the NJPDES general permit for CSO collection system operators. These permits are the means to implement the CSO wasteload allocation included in this TMDL. Based on a preliminary analysis, EPA has identified four CSO collection system operators which discharge to the Hackensack River system (City of Hackensack, Village of Ridgefield Park, North Bergen Township, and Jersey City Sewerage Authority). There are three wastewater treatment plants which serve these combined sewer areas (Bergen County Utilities Authority, North Bergen, and Passaic Valley Sewerage Commissioners).

NJDEP has considerable flexibility to establish appropriate permit conditions in its NJPDES permits to control nickel discharges from CSOs to the Hackensack River system. NJDEP may choose to impose numeric limitations on CSOs, although EPA does not recommend this approach in this circumstance, since the WLA for CSOs is an aggregate number rather than outfall-specific. In the absence of numeric limitations, NJDEP should impose conditions in NJPDES permits to ensure that special emphasis is placed on minimizing CSO discharges.

Two related techniques which should be evaluated for the CSO dischargers to the Hackensack River are the maximization of flow to the sewage treatment plant and the maximization of storage capacity in the combined system. NJDEP is already implementing these techniques as part of its base program activities. However, EPA recommends that NJDEP evaluate available information developed by CSO dischargers and require implementation of any additional, feasible actions which could mitigate CSO discharges to the Hackensack River. In other words, EPA suggests that NJDEP and the CSO dischargers evaluate the status of ongoing CSO mitigation efforts and seek opportunities to enhance the effectiveness of pollution control efforts in the Hackensack River watershed.

Storm Water

Implementation of the storm water wasteload allocation should be done through the NJPDES storm water permitting program. NJDEP has considerable flexibility in identifying the municipal and industrial storm water dischargers which are likely contributors of nickel to the Hackensack River system, and in developing storm water permit conditions to control the discharges. NJDEP may choose to impose numeric permit limitations for nickel, but EPA does not recommend this approach, since the storm water WLA is an aggregate number rather than outfall-specific. In addition, as explained in EPA's August 1, 1996 Interim Permitting Approach for Water Quality-Based Effluent Limitations in Storm Water Permits, the Agency recommends Best Management Practices (BMPs) in first round storm water permits, and expanded or better-tailored BMPs in subsequent permits, to provide for the attainment of water quality standards.

The most common sources of nickel in storm water appear to be associated with automotive use. Nickel contamination of runoff results from deposition of tail-pipe exhaust, leaks and dumping of coolant and oil. BMPs that target roads and parking lots would likely be the most effective way to control nickel pollution in storm water runoff. Some BMPs associated with roadways and parking lots include vegetative swales, protection of storm drains, and porous pavement.

Another source of nickel may be the marinas located on the Hackensack River. Nickel is a component of fuel, and also may be used in metal hulls, boat parts and paint. Storm water discharges from marinas that practice vehicle maintenance or equipment washing are covered under the Phase I storm water program. Other marinas are addressed under guidance documents (but not regulations) related to the Coastal Zone Act Reauthorization Amendments (CZARA).

Development of a schedule for storm water permitting actions should take into account the expected issuance of EPA's Phase II final storm water rule in October 1999. This rule is expected to initiate a new round of permitting activities for municipalities in urbanized areas. EPA believes that it would be prudent for NJDEP to integrate its Phase II base program actions with this special effort to implement more specific, targeted controls on storm water discharges to the Hackensack River system. Based on current projections, the new round of permits should be in place by November 2002.

REFERENCES

HydroQual, Inc. 1994. Development of Total Maximum Daily Loads and Wasteload Allocations (TMDLs/WLAs) Procedure for Toxic Metals in NY-NJ Harbor. Modeling Report. U.S. Environmental Protection Agency, Region 2, NY. Report dated February 1994.

U.S. Environmental Protection Agency, Region 2. 1994. Total Maximum Daily Loads (TMDLs) for Copper, Mercury, Nickel and Lead in NY-NJ Harbor. Report dated July 26, 1994.

Great Lakes Environmental Center. 1996. Summary of Phase I Metals Sampling and Analysis Program for the New Jersey Component of the New York/New Jersey Harbor Estuary Program. Report dated March 5, 1996 with supplement "Revisions to the Metals Report" dated March 26, 1996.

U.S. Environmental Protection Agency. 1996. Memorandum from Robert Perciasepe, Assistant Administrator, "Interim Permitting Approach for Water Quality-Based Effluent Limitations in Storm Water Permits. Memorandum dated August 1, 1996.

U.S. Environmental Protection Agency. 1999. Letter from Jeanne Fox, Regional Administrator to Robert Shinn, Commissioner establishing the Memorandum of Agreement for the schedule for TMDL development. Letter with attachments dated May 1, 1999.

Great Lakes Environmental Center. 1998. Monitoring and Modeling of Nickel in the Hackensack and Passaic Rivers and Newark Bay and Monitoring and Data Analysis for Copper in the Arthur Kill and Kill Van Kull. Report dated August 27, 1998.

G:\USER\SHARE\SWQB\TES\NYHARBOR\P2TMDLS\TMDLDOC.DEC

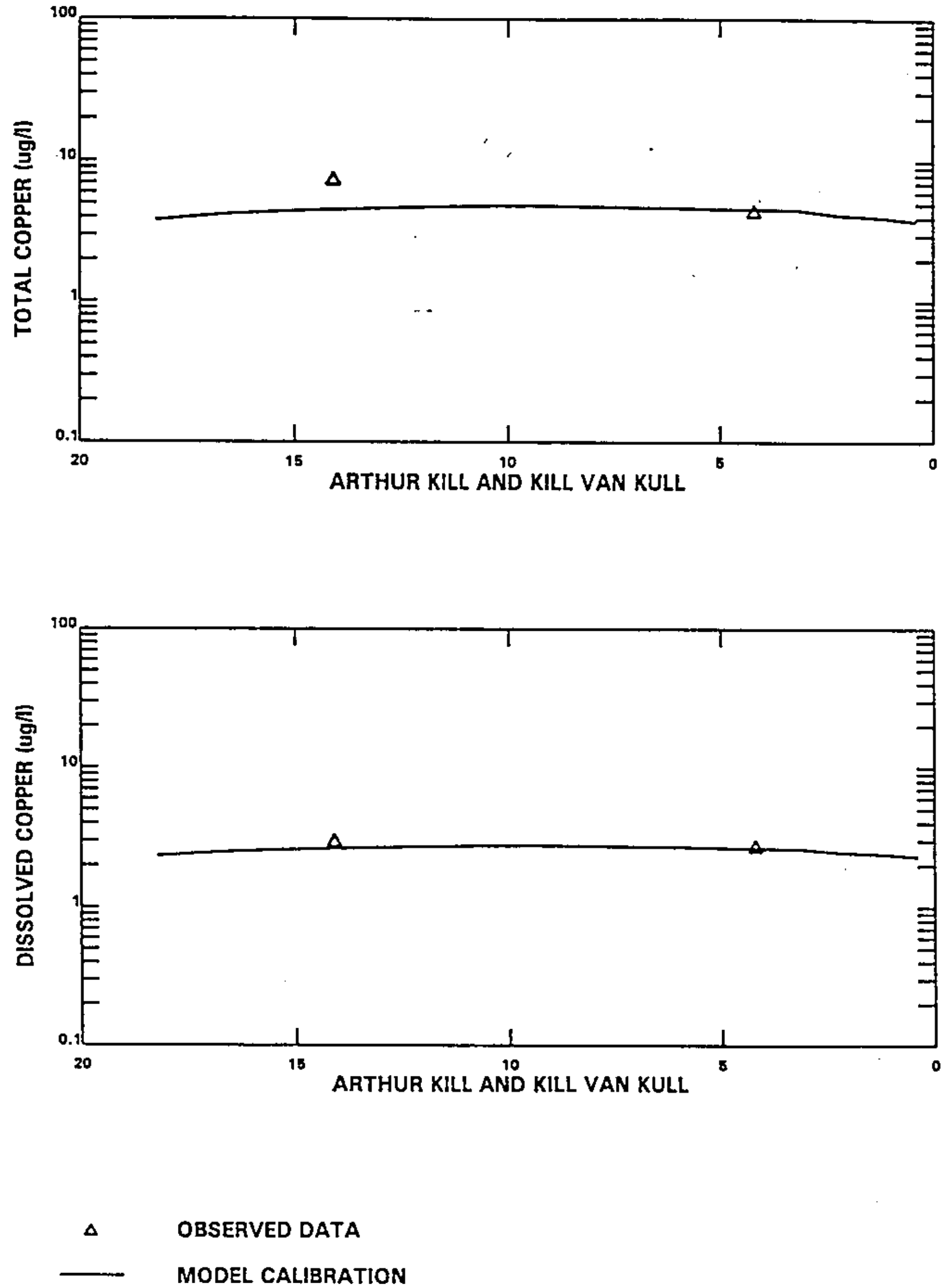


Figure 2-6 October 1991 model calibration with revised NJ CSO + SWO copper loads

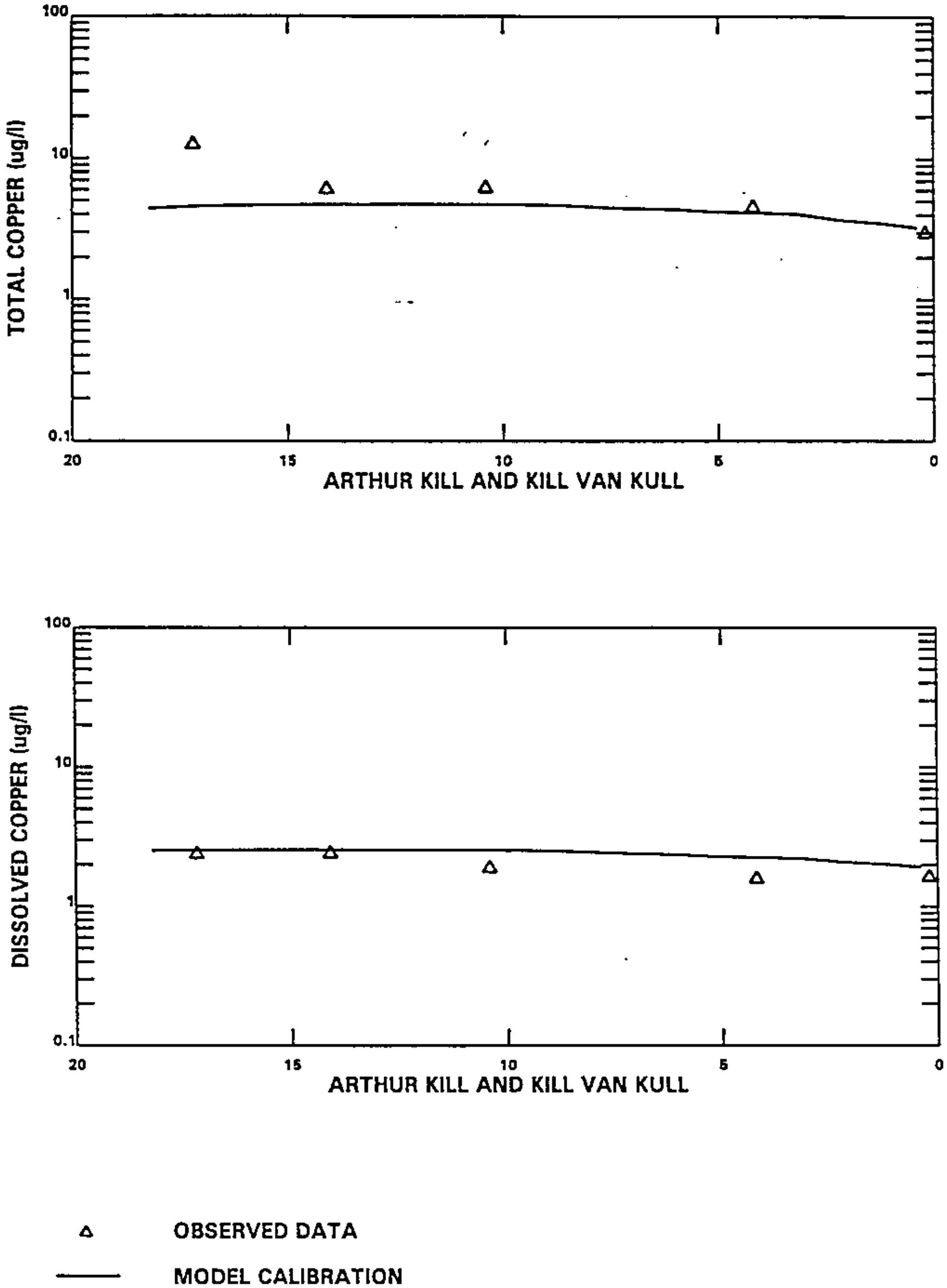
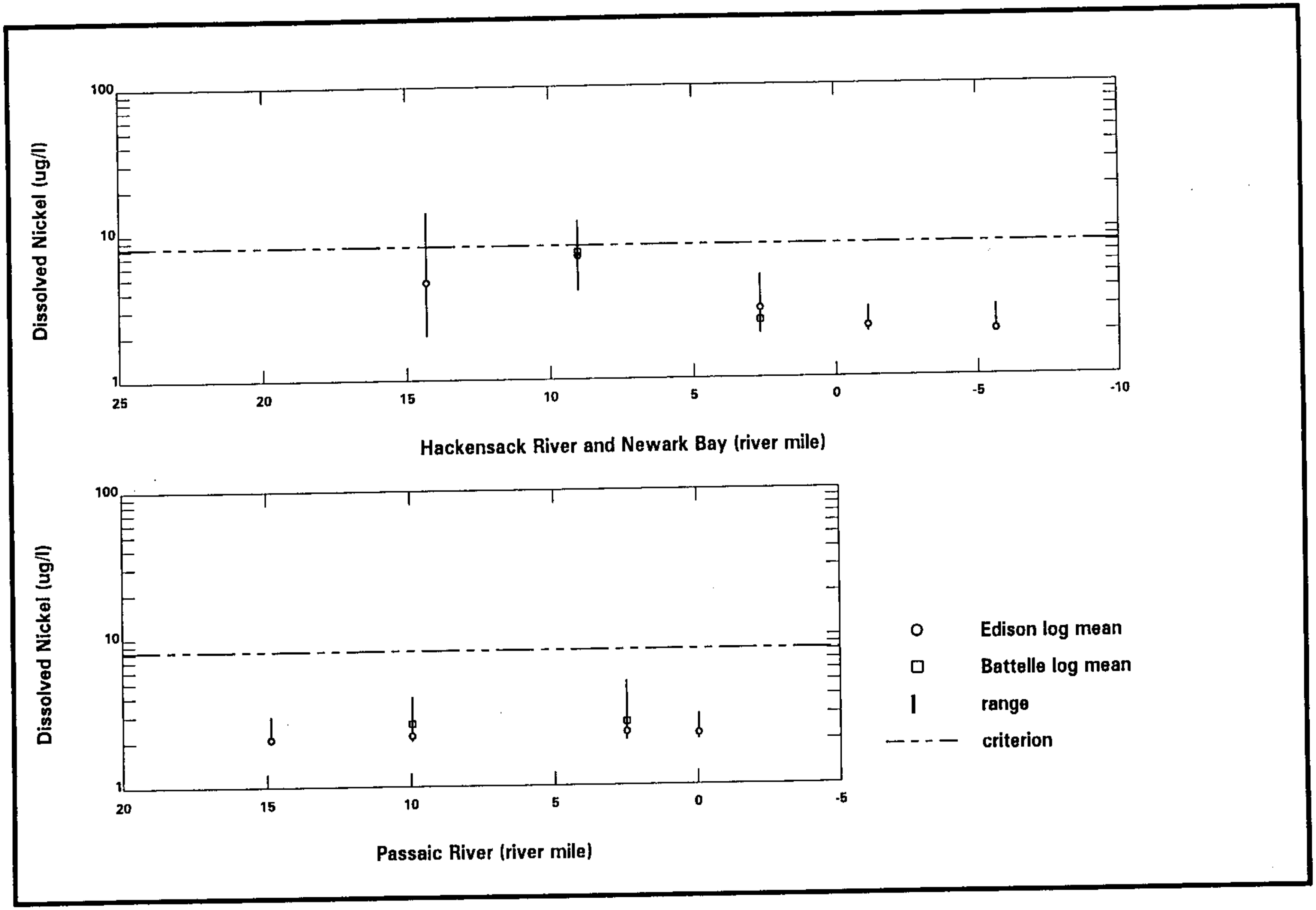
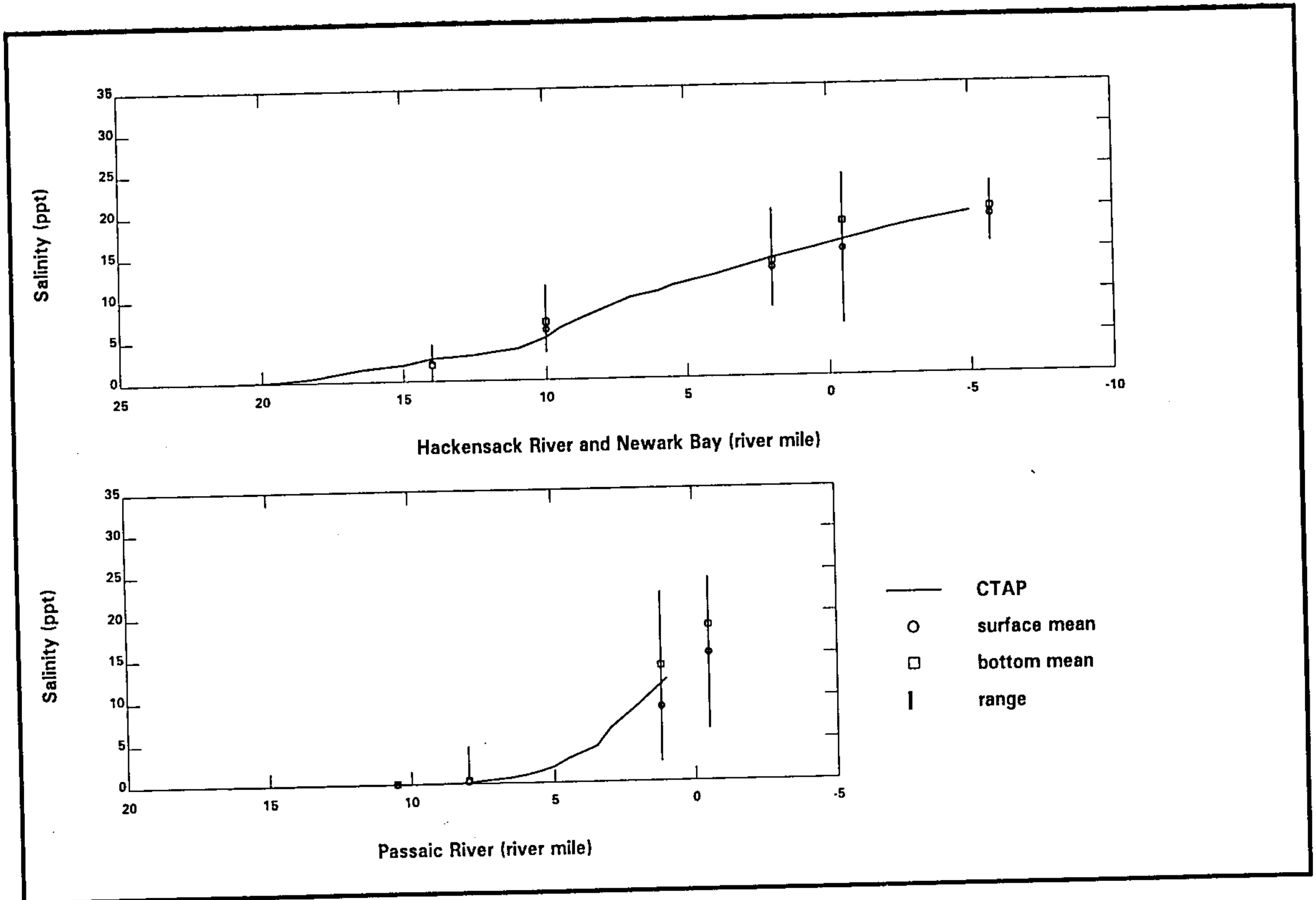


Figure 2-5 January 1991 model calibration with revised NJ CSO + SWO copper loads

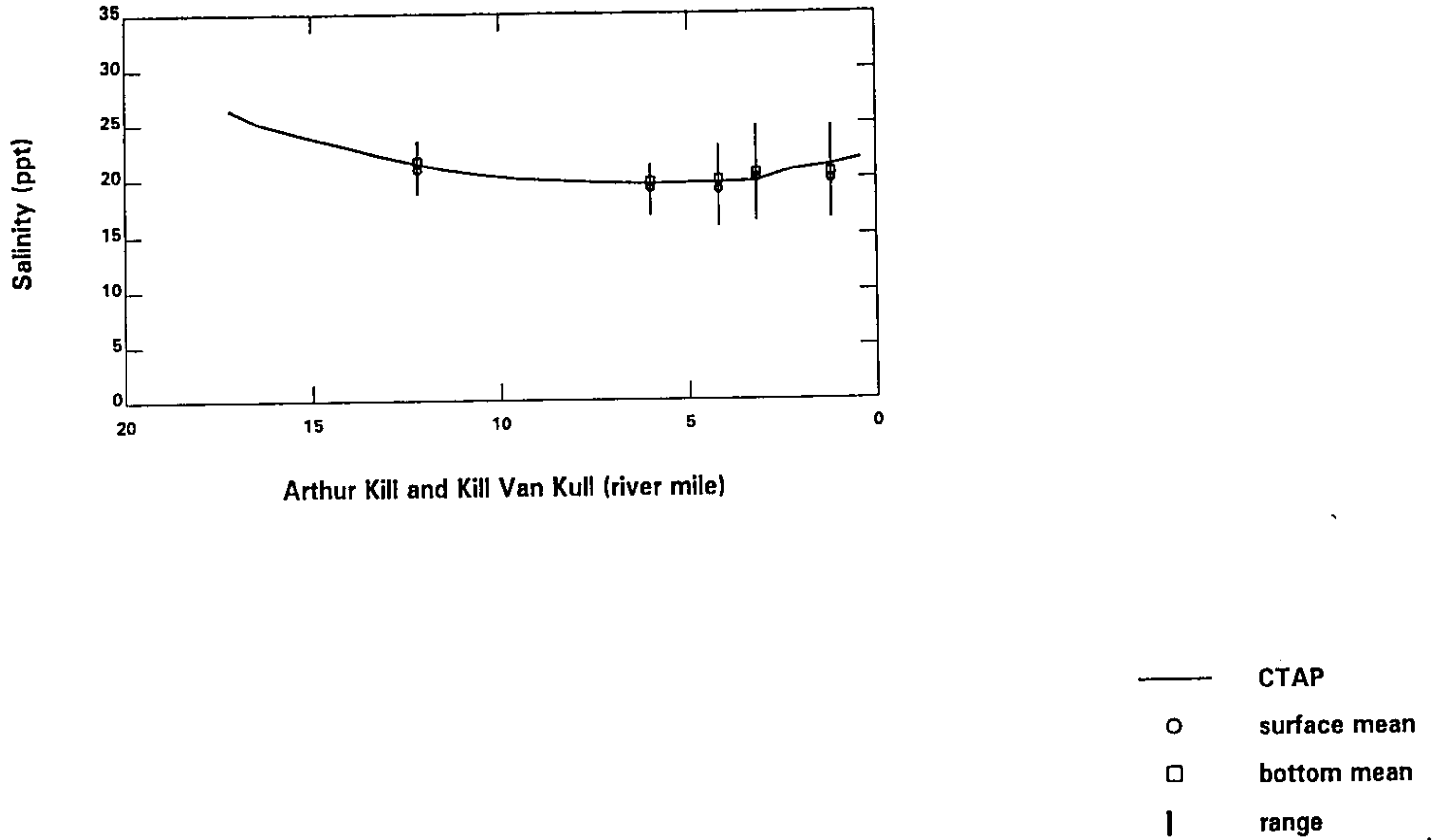


DISSOLVED NICKEL SPATIAL PROFILES



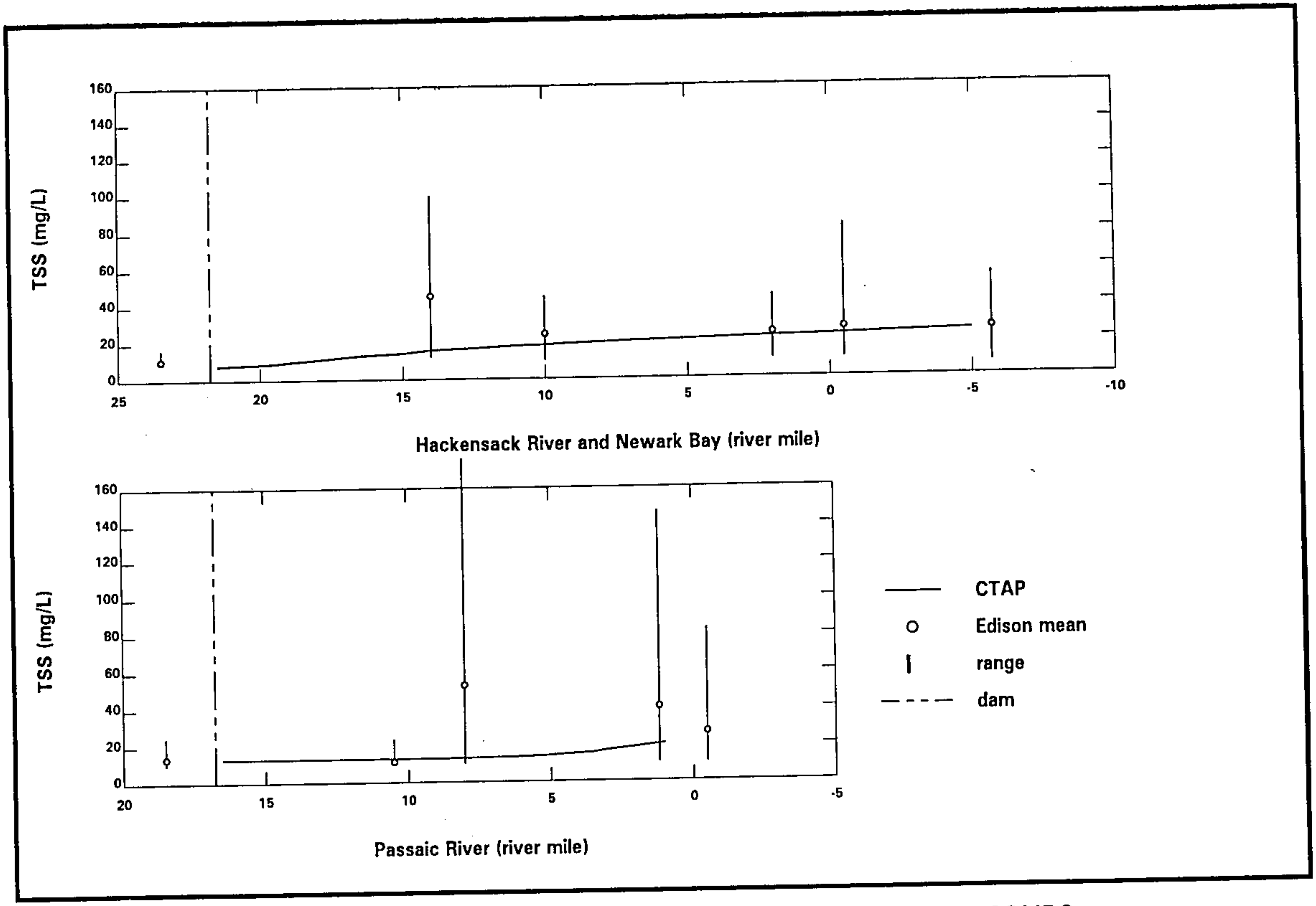
COMPARISON OF CALCULATED AND MEASURED SALINITY
APRIL 1997 - FEBRUARY 1998

FIGURE A-2



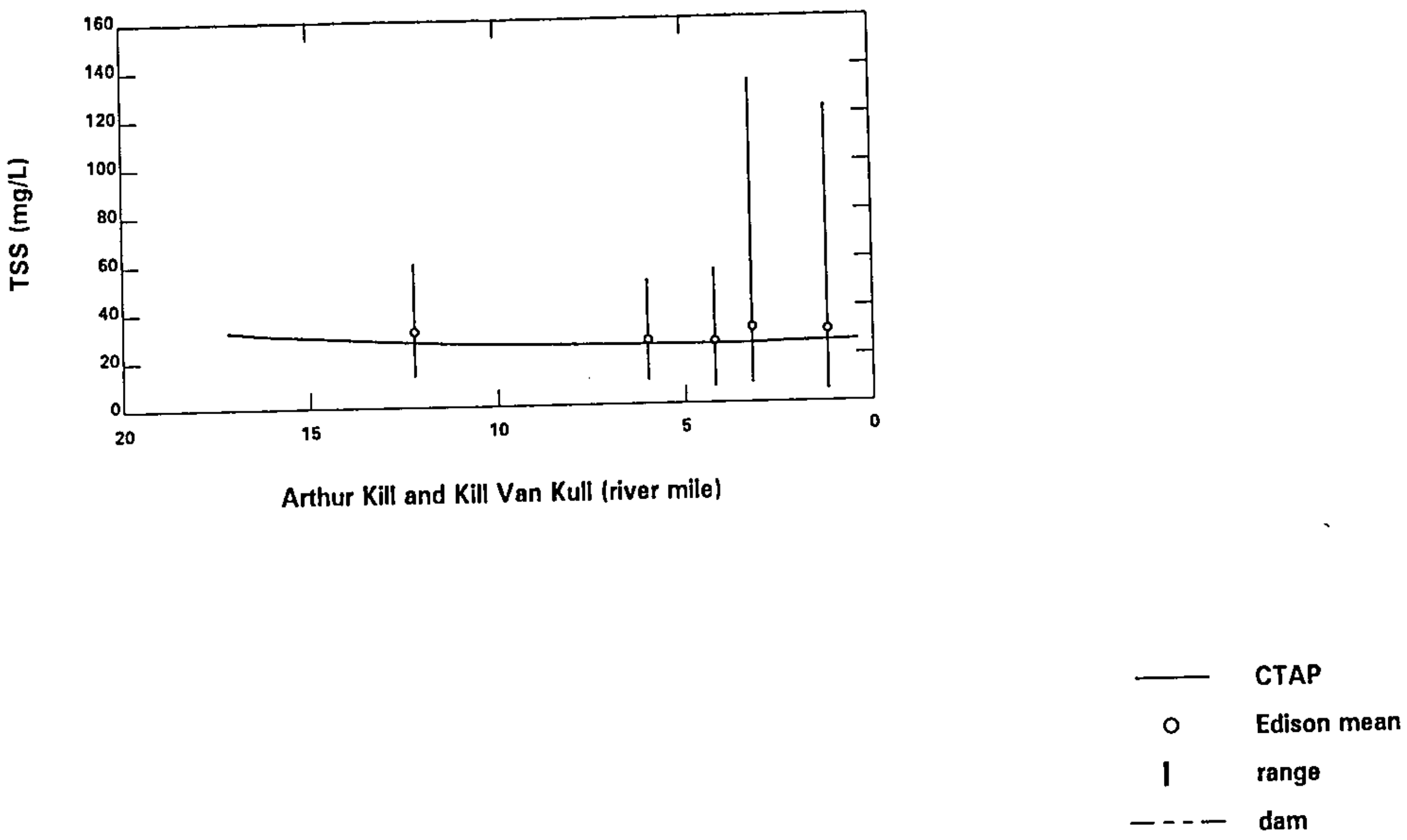
COMPARISON OF CALCULATED AND MEASURED SALINITY
APRIL 1997 - FEBRUARY 1998

FIGURE A-3



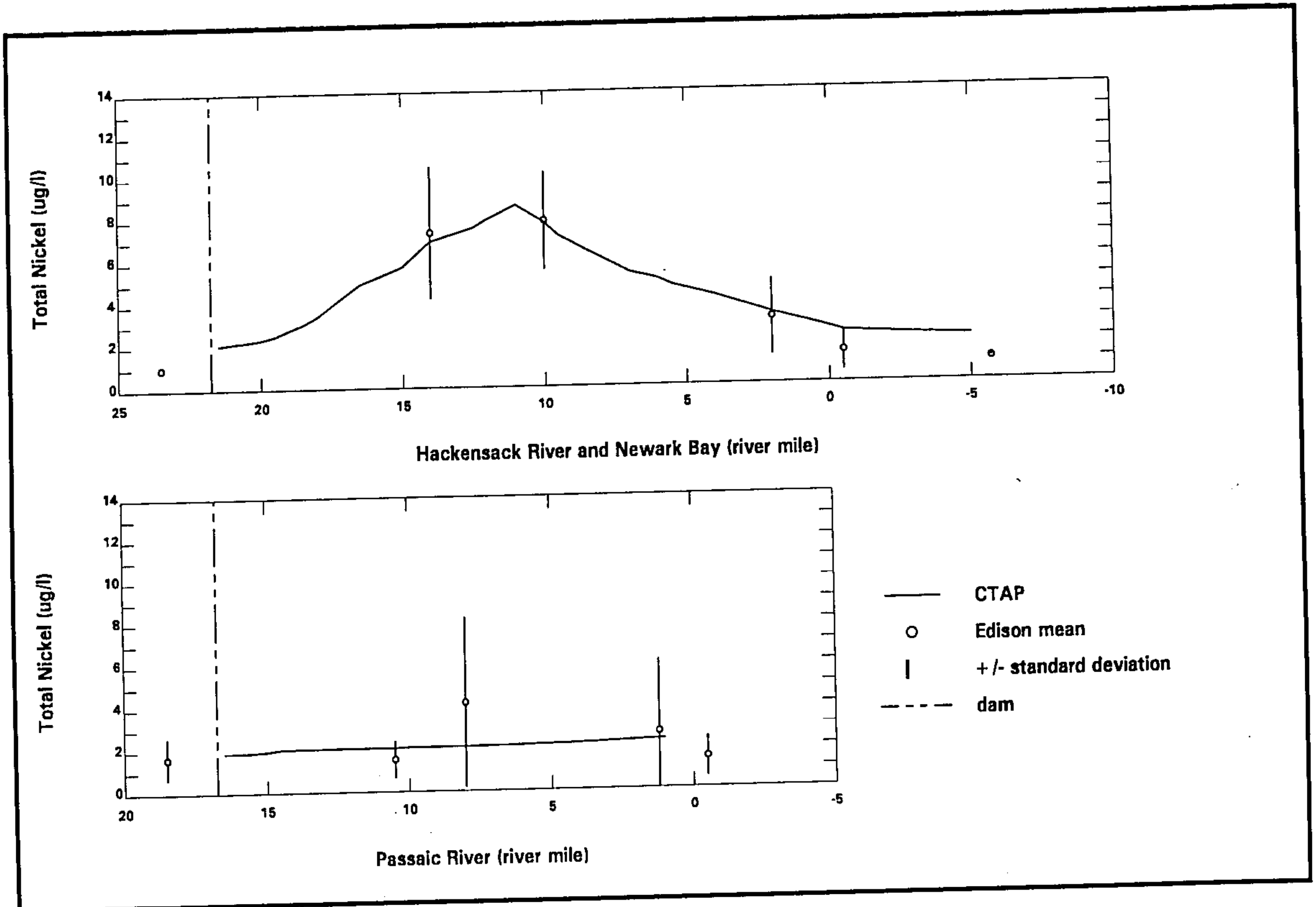
COMPARISON OF CALCULATED AND MEASURED SUSPENDED SOLIDS
APRIL 1997 - FEBRUARY 1998

FIGURE A-4



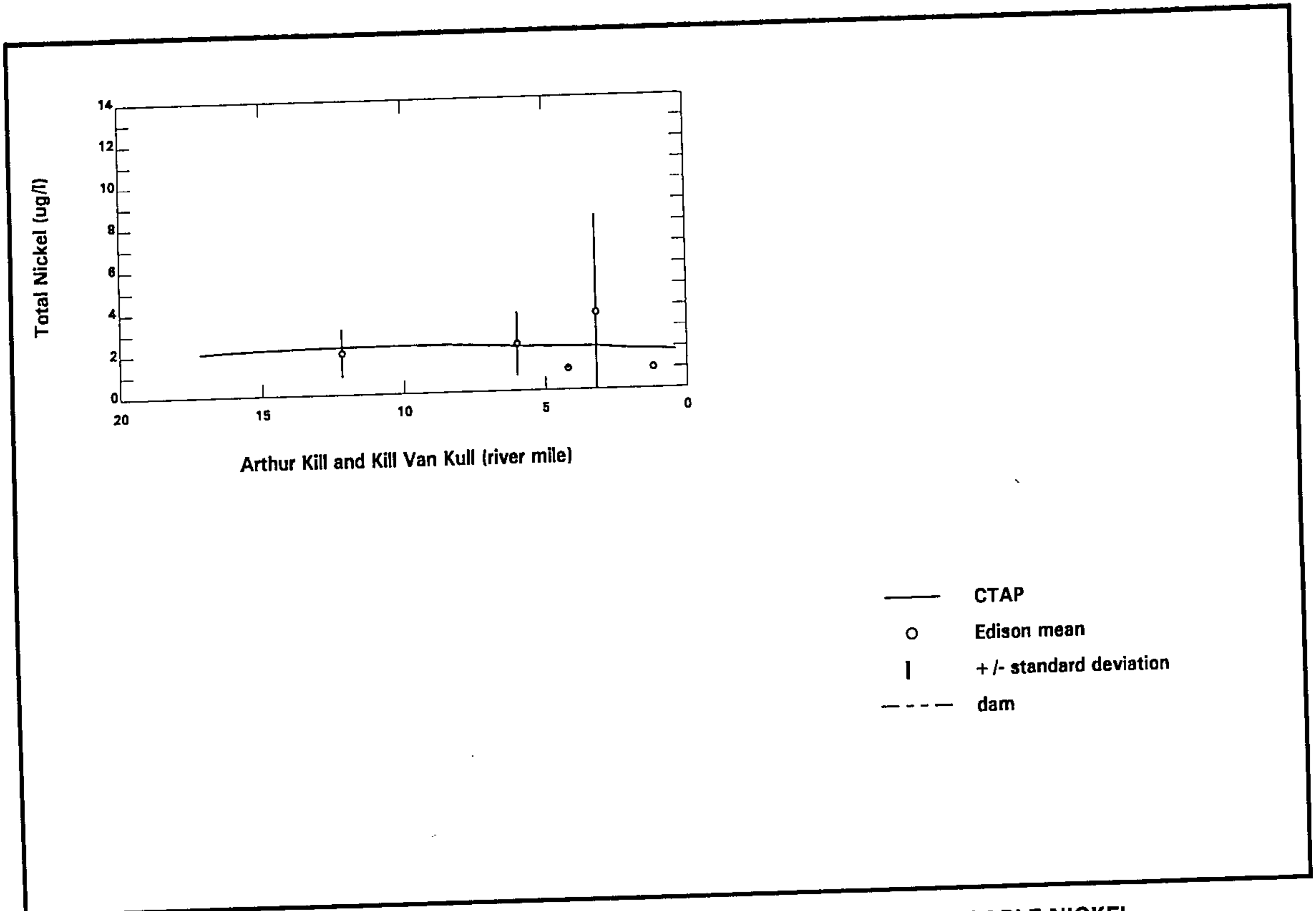
COMPARISON OF CALCULATED AND MEASURED SUSPENDED SOLIDS
APRIL 1997 - FEBRUARY 1998

FIGURE A-5



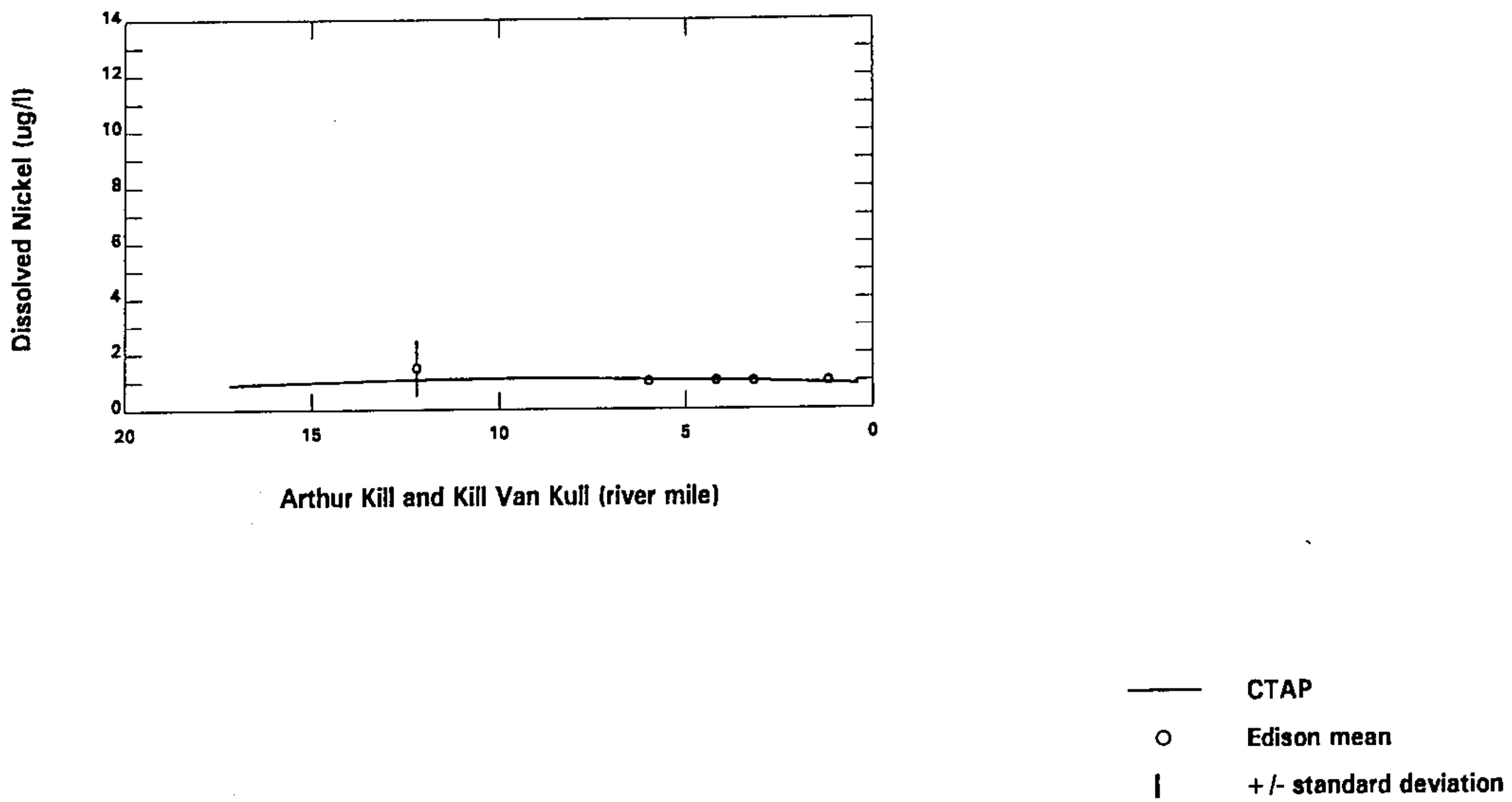
COMPARISON OF CALCULATED AND MEASURED TOTAL RECOVERABLE NICKEL
APRIL 1997 - FEBRUARY 1998

FIGURE A-6



COMPARISON OF CALCULATED AND MEASURED TOTAL RECOVERABLE NICKEL
APRIL 1997 - FEBRUARY 1998

FIGURE A-7



COMPARISON OF CALCULATED AND MEASURED DISSOLVED NICKEL
APRIL 1997 - FEBRUARY 1998

FIGURE A-9