Saw Mill River:

the effects of urbanization on water quality

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Environmental Science 102
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Doris Gruenfeld, Mary Lou McClure, and the firemen of Yonkers Fire Headquarters on New School Street...
for helping me to collect my samples.

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for giving up many hours to help me analyze for PCBs and organize this paper.

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The Department of Environmental Conservation in White Plains and the Westchester County Health Department...
for providing me with information about the Saw Mill River.

Basin Description

The Saw Mill River rises in a small pond northwest of Chappaqua, in the town of New Castle, New York at an elevation of 500 feet above sea level. It flows in a southward direction through the towns of New Castle, Mount Pleasant (which includes the communities of Pleasantville, Hawthorne, and Thornwood), and Greenburgh (which includes the villages of Elmsford, Irvington, and Ardsley) and through the City of Yonkers. In Yonkers, it flows through an 800 foot covered concrete conduit before entering the Hudson River at sea level. From river mile 1.4 to 2.9, the river flows through a concrete channel that is 20 feet wide and ten feet deep. This is part of one of several flood control projects on the Saw Mill River.

The river is 23.5 miles long and drains a narrow basin of 26.5 square miles which is surrounded by hills, some with steep slopes. The main tributaries are Tertia Brook at Chappaqua, Nannyhagen Brook at Thornwood, Tarrytown Lakes Brook south of Hawthorne, and Rum Brook in Elmsford. All are less than two miles long.

The basin is underlain by metamorphic rocks, primarily gneiss, schist, and marble, and by limestone. Bedrock outcrops are common and the area has been glaciated. Till of varying thickness is found in the higher terrain, and stratified drift and alluvium covers most of the low-lying areas.[1]

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[1]Robert J. Rogers, "Chemical Quality of the Saw Mill River, Westchester County, New York, 1981-83." U.S. Geological Survey, Albany, New York, 1984, p. 5.

Average annual precipitation in the basin is 46.2 inches. Mean discharge of the Saw Mill River at a gage located 1.2 miles from the mouth of the river is 32.3 cubic feet per second.[2]

The Saw Mill River Parkway runs parallel to the river for most of its length and a county trunk sewer was laid under it below the streambed elevation to carry residential and industrial sewage. Parks and small wooded areas are abundant in the northern part of the basin. Commercial establishments are scattered throughout the basin and industry is located primarily in Yonkers.

Approximately 100,000 people live in the river basin.[3] Population density increases southward.[4]

municipality	*population/ square mile*[5]	*% of basin*[6]
New Castle	705	10.18
Mount Pleasant	1045	42.16
Greenburgh	2312	33.47
Yonkers	10222	14.19

The population of the Saw Mill River Basin is not expected to increase.[7]

There are stringent controls on discharge of wastewater into the river and only three permits have been issued that allow

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[2]Ibid.

[3]Ibid., p. 7

[4]"Concentration, Distribution, and Source of Heavy Metals and Trace Organic Compounds in the Saw Mill RIver, Westchester County, NY." Courtesy of DEC, Mamaroneck Ave., White Plains, NY, p. 2

[5]"Population and Population Change, 1980-1990." Census '90 Data Sheet, Department of Planning, Michaelian Office Building, White Plains, NY 10601.

[6]Lower Hudson River Series Report No. 6 - Saw Mill River Drainage Basin, New York State Department of Health Water Pollution Control Board; August, 1953, p. 11.

[7]"Concentration, Distribution..." p. 1.

industrial discharges.[8] However, Westchester County officials often receive reports of illegal or accidental discharges of industrial waste into the river. Broken pipes and other malfunctions sometimes cause untreated domestic sewage to enter the river, especially in the lower few miles.[9] In addition, the southern end of the river is littered with debris, including shopping carts, tires, and bottles.

Description of Sampling Points

Samples were collected at eight locations along the length of the river at intervals of between two and five miles. Water samples were collected from points 1, 2, 3, 4, and 5 on March 24, 1991; from points 6 and 8 on March 25, 1991; and from point 7 on March 28, 1991. Sediment was collected from sampling points 4, 6, and 8 on April 14 and April 18, 1991. (see attached map and photographs)

Sampling point 1 is located at the intersection of Route 120 and Mill River Road in New Castle at approximately river mile 22. The sample was collected below a small waterfall flowing out of a pond created by a dam. The pond appeared clean with a great deal of dead leaves collected at its bottom. The area is rural with scattered houses and minimal traffic. Water flows into the pond from various small streams which flow through backyards and wooded areas.

The area between sampling points 1 and 2 is mostly residential. Commercial establishments are located in the Chappaqua business district and the Pleasantville business district. Also located in the basin between these two points is the Town of New Castle

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[8]Rogers, p. 37.
[9]Rogers, p. 2.

Recycling Center, Plastic Injection Molder Company, Biomedical Systems Conference Center, and a Con Edison Power Plant. Tertia Brook enters the Saw Mill River less than a mile south of sampling point 1.

The second sample was collected at the intersection of Bedford Road and the Saw Mill River Parkway at approximately river mile 19. The river is faster flowing here and in the small wooded area alongside the river there is considerable litter including oil cans, wrappers, and paper.

The area south of this point is progressively more commercial. It includes the business districts of Thornwood and Hawthorne. A fuel and heating oil company and an engineering firm specializing in heating and air-conditioning are among the businesses located along Route 141 between sampling points 2 and 3. Between these two points, Nannyhagen Brook flows into the Saw Mill River.

Sampling point 3 is located just south of the Hawthorne Circle interchange of the Taconic Parkway, Route 100, Route 9A, and the Saw Mill River Parkway where there is an extremely high volume of traffic. This is at river mile 16. The river is ten to 15 feet wide and is located between the parkway and a residential area. A drainage pipe from the parkway, presumably one of many, flows into the river at this spot. There is minimal litter on the banks of the river.

Between sampling points 3 and 4, there are numerous office parks, motels, and restaurants and at least three nurseries. A large Con Edison plant, Westchester Medical Center, and an old Union Carbide site are located in this part of the basin. There is also a capacitator burial ground in the area.[10] Nearer to downtown Elmsford, there are some warehouses and numerous gas stations and auto-part stores. Tarrytown Lakes Brook joins the Saw Mill River in this area.

Sample 4 was taken on Tarrytown Road in downtown Elmsford at approximately river mile 11. The river is narrower at this point and appears to have a greenish tinge. Despite signs reading "No Dumping," there is a considerable amount of refuse dumped along the river including several large appliances.

Between sampling points 4 and 5, the basin is largely residential except for the Ardsley business district. The Ardsley business district is comprised of several stores and professional buildings, and RSA Corporation Research Laboratories which is a custom manufacturer of chemicals with no discharge into the river. Rum Brook enters the Saw Mill River north of Ardsley. In Ardsley, the river flows through an open concrete channel which is part of the Ardsley Flood Control Project. For the length of this section, the river runs parallel to the New York State Thruway.

Sampling point 5 is just south of Ashford Avenue in Ardsley near river mile 7. There is some litter on the river banks and little vegetation. An oily discharge is entering the river through pipes which seem to be coming from a gas station on the other side of Saw Mill River Road.

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[10]letter from Hudson River Fishermen's Association to the NYS Dpartment of Environmental Conservation, July 27, 1978, courtesy of DEC, White Plains.

Between sampling points 5 and 6, there are several chemical companies including Akzo and Ciba-Geigy Corporation. There are also a few large cemetaries and some residential areas.

The sixth sample was collected at the intersection of Farragut Parkway and the Saw Mill River Parkway just upstream from an abandoned gas station at approximately river mile 4.5. There were old rusted cans in the river and the water had suds on it. There are several small inlets coming from a residential area to the west. The river is seven to nine feet wide at this point.

The Yonkers City line is just south of sampling point 6. From here to the point where the Saw Mill River enters the Hudson River, the basin is completely urban. Traffic volume is high as is population density. Between point 6 and point 7, there are many warehouses and factories. There is a compacting station, various fuel companies, and a tremendous bus company depot as well as a graphite metalizing company.

The busy intersection of Nepperhan Avenue and Old Nepperhan Avenue, near river mile 3, is the site of sampling point 7. Here the water is very fast flowing and the banks are fairly steep. As the river flows under Old Nepperhan Avenue it enters a 1.5 mile long concrete channel which is part of the Yonkers Flood Control Project.

Between Old Nepperhan Avenue and the final sampling point, there are scrap iron and metal companies, lumber yards, a milk distribution center, and various industries.

Sampling point 8 is located at New School Street and John Street in downtown Yonkers below river mile 1 and at a short distance from the beginning of the closed concrete conduit that leads into the Hudson River. The water is fast flowing and carries a significant load of refuse.

Sample Analysis

All of the water samples were analyzed for cations and anions. Analysis for sodium, calcium, magnesium, and potassium was done with the atomic absorption spectrophotometer. The ion chromatograph was used to analyze for chloride, nitrate, and sulfate. Alkalinity and pH were measured with a pH meter. Sediment samples from Tarrytown Road, Farragut Parkway, and New School Street were analyzed for PCBs with the gas chromatograph, equipped w/ a J+W DB-5 column (capillary 25m X 0.32mm, 0.25um film thickness). Electron capture detector used, w/detection limit of 25 ug/L.

Data

<u>cations</u>

sample #	*Na^{+}(mg/L)*	*Ca^{+2}(mg/L)*	*Mg^{+2}(mg/L)*	*K^{+}(mg/L)*
1	22.1	19.3	5.7	2.9
2	27.7	29.2	9.4	2.8
3	34.3	39.4	13.5	2.8
4	42.0	38.5	13.6	2.4
5	47.6	37.5	13.9	2.5
6	47.2	40.8	15.1	2.5
7	53.6	45.4	17.6	2.9
8	50.8	43.3	16.1	2.9

<u>anions</u>

sample #	*Cl^{-}(mg/L)*	*NO_3^{-}(mg/L)*	*SO_4^{-2}(mg/L)*
1	25.6	5.13	15.4
2	31.2	4.75	17.9
3	38.6	5.16	20.4
4	43.0	4.37	20.2
5	51.2	4.69	21.5
6	50.4	4.38	22.6
7	54.4	4.21	23.9
8	54.0	4.50	23.8

<u>pH and ANC</u> / <u>PCBs</u>

sample #	*pH*	*ANC*	*sample #*	*dry weight PCBs(ppb)**
1	7.59	40		
2	7.98	72		
3	8.04	232		
4	8.05	184	4	62.53
5	8.15	166		
6	8.20	178	6	296.80
7	8.24	112		
8	8.24	174	8	412.73

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* see appendix 3

Analysis of Data

Levels of sodium, calcium, magnesium, chloride, and sulfate increase substantially between sample point 1 and sample point 8 indicating a downstream deterioration in water quality. (see figures 1-5) These cations and anions seem to be steadily entering the system. Therefore, they are probably entering through runoff and not coming from any particular point sources. It is interesting to note that each of these substances reaches its peak at sampling point 7, not sampling point 8. This may be due to the fact that for most of the distance between points 7 and 8, the river flows through a concrete flood prevention structure that probably prevents a lot of urban runoff from entering the river. Potassium and nitrate values do not seem to reflect any trend in relation to location.

Correlations between certain of these anions and cations help to explain the high levels found in the Saw Mill River. For instance, there are strong correlations between the values for sulfate and calcium and between the values for magnesium and calcium. (see figures 6 and 7) This confirms the existence of dolomite (Ca_2MgCO_3) in the basin and suggests that there is also gypsum ($CaSO_4$) in the area.

Levels of sodium above 4 mg/L and levels of chloride above 1.4 mg/L generally indicate pollution. The almost direct correlation between sodium and chloride indicates the presence of NaCl which is usually found in sewage. (see figure 8) Sodium chloride seems to be present for the length of the river. It is therefore possible that sewage is entering the system from the county trunk sewer which begins in New Castle and runs parallel to the river for almost its entire length.

The correlation between chloride and calcium is more easily explainable. (see figure 9) Calcium chloride ($CaCl_2$) is the major component of road salt. It is to be expected that one of the major pollutants found in the Saw Mill River is road salt. The river runs parallel to the Saw Mill River Parkway for almost its entire length and runoff from the parkway flows into the river through drainage pipes.

Strong correlations also exist between sodium and sulfate, chloride and sulfate, sodium and magnesium, chloride and magnesium, and sulfate and magnesium. (see figures 10-14) These correlations probably only reflect the fact that the concentrations of all these substances increase between point 1 and point 8. It is not likely that they reflect discharges into the river because the correlations occur along the entire length of the river. The sulfate level, which is consistently above 15 mg/L, indicates that at least some of the sulfate in the river is the result of contamination.

High sulfate levels probably have no connection to acid rain because the pH indicates that the water is basic for the entire length of the Saw Mill River. (see figure 15) This is unusually high pH for a river but the Saw Mill seems to have a tradition of high pH. A 1951 study found pH to range between 7.25 and 9.1.[11]

Surprisingly, the correlations between ANC and calcium and between ANC and magnesium are not very strong. (see figures 16

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[11] Lower Hudson River Series Report No. 6, p. 17.

and 17) Usually these items correlate well because carbonate rocks such as dolomite and marble cause the ANC to be high. The ANC, after sampling point 3, is at levels that strongly suggest the presence of carbonate rocks. However, in this case, something else may be affecting the ANC and subsequently the pH. The pH rises steadily ⇒ but not by much from the northern end of the river to the southern end. However, the ANC rises suddenly at point 3 which happens to be the point with the highest concentration of nitrates. It drops suddenly at point 7, where the concentration of nitrates is lowest. (see figure 18) However, there is virtually no correlation between ANC and nitrate concentration at other points along the river. (see figure 19) It is possible that nitrate levels are being affected by point sources and not just urban runoff. Nitrate levels at all of the sampling points are high and indicate pollution and little growth. High concentrations of nitrates generally occur when there are not many plants using the nutrients in the soils within a basin.

PCB levels in the sediment of the Saw Mill River are also alarming. PCB concentrations rise almost five fold between points 4 and 6. The level then doubles between points 6 and 8. (see figure 20) This indicates that either the PCBs are coming from one point source north of Elmsford, probably the capacitator burial ground, and collecting in the sediments downstream or that they are originating from a few sources. In 1976, a report published by the U.S. Geological Survey indicated that no PCBs were detected north of Elmsford and that PCB contamination at sampling point 4 was 38 ppb.[12] The findings of this 1991 study are significantly higher but may simply be a result of the samples being taken at slightly different locations or changing detection methods. In addition, the PCBs detected in this study appear to have undergone extensive biodegradation. However, it is not unlikely that additional leachate has flowed into the river from the PCB point source. PCB contamination has been detected in the American eel in the Saw Mill River. It is recommended that no more than one meal (1/2 pound) is eaten per month.[13] The PCBs here are mostly Aroclor 1242.

Polychlorinated biphenyls (PCB) were first reported in environmental samples in 1966. In 1976, Congress banned the manufacture and use of PCBs except in completely closed systems. During the 45 years that they were in use, PCBs served as coolants and dielectric fluids in transformers and capacitators, as heat transfer fluids, and as a coating to reduce the flammability of wood products. They were also incorporated in paints, inks, dust control agents, carbonless paper, and pesticides. A PCB is any of one of 209 congeners of the general formula $C_{12}H_xCl_{10-x}$. PCBs have low water solubility and are strongly absorbed into sediment, clay, and soil. They are transported by runoff, precipitation, erosion, and wind.[14]

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[12] letter from Hudson River Fishermen's Association.

[13] New York State Water Quality 1990; prepared by Bureau of Monitoring and Assessment, Division of Water, NYS Department of Environmental Conservation, April 1990, p. 41.

[14] Ann L. Alford-Stevens, "Analyzing PCBs." Environmental Science Technology, Vol. 20, No. 12, 1986, pp. 1194-1196.

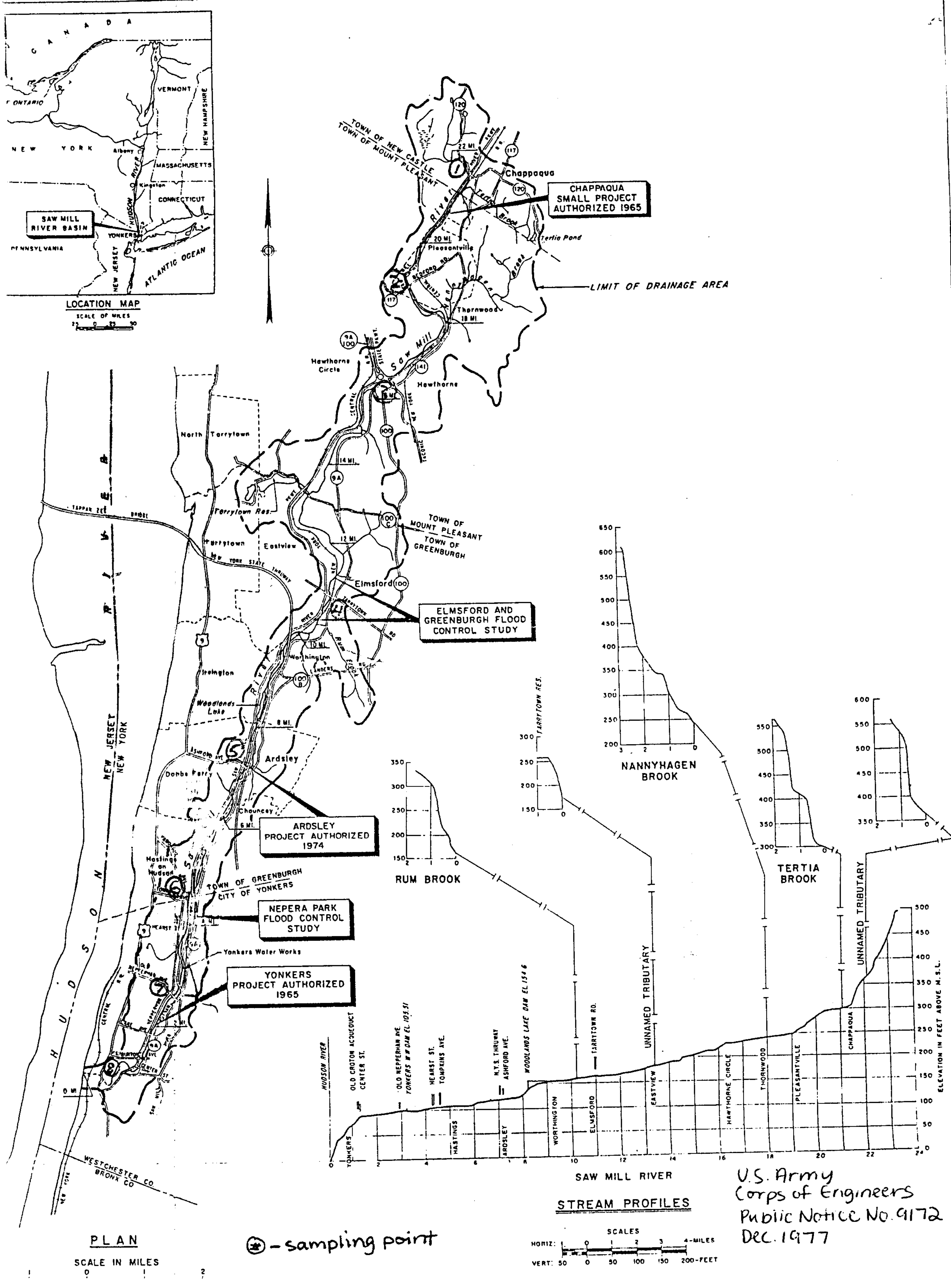
Conclusions

The locational trends followed by sodium, chloride, magnesium, sulfate, and calcium demonstrate that urban runoff is the primary cause of the high levels of pollution in the Saw Mill River. Their steady introduction into the system proves that they are not coming from point sources. Runoff of road salt, sewage, and industrial discharge, whether illegal or accidental, occurs along the length of the river.

As one proceeds downstream from the headwaters in rural New Castle, NY to the river's final miles in urban, industrial Yonkers, NY, runoff contains increasing amounts of pollutants. Greater percentages of impervious surfaces at the southern end of the river cause greater amounts of runoff to enter the river in all areas except the flood control channels. The gradient of population densities, as well as increasing densities of commercial and industrial areas as one moves downstream, explains why the river is far more polluted at sampling point 8 than at sampling point 1.

To say that pollution in the Saw Mill River is primarily due to urban runoff is not to say that there are no point sources. For instance the PCB contamination is probably the result of a point source north of Elmsford. It is quite probable that certain sources contribute more than their share of pollutants to the Saw Mill River. However, it is safe to surmise that any attempt to locate and eliminate point sources in the Saw Mill River Basin would not result in a clean river.

Appendix 1:
map and photographs

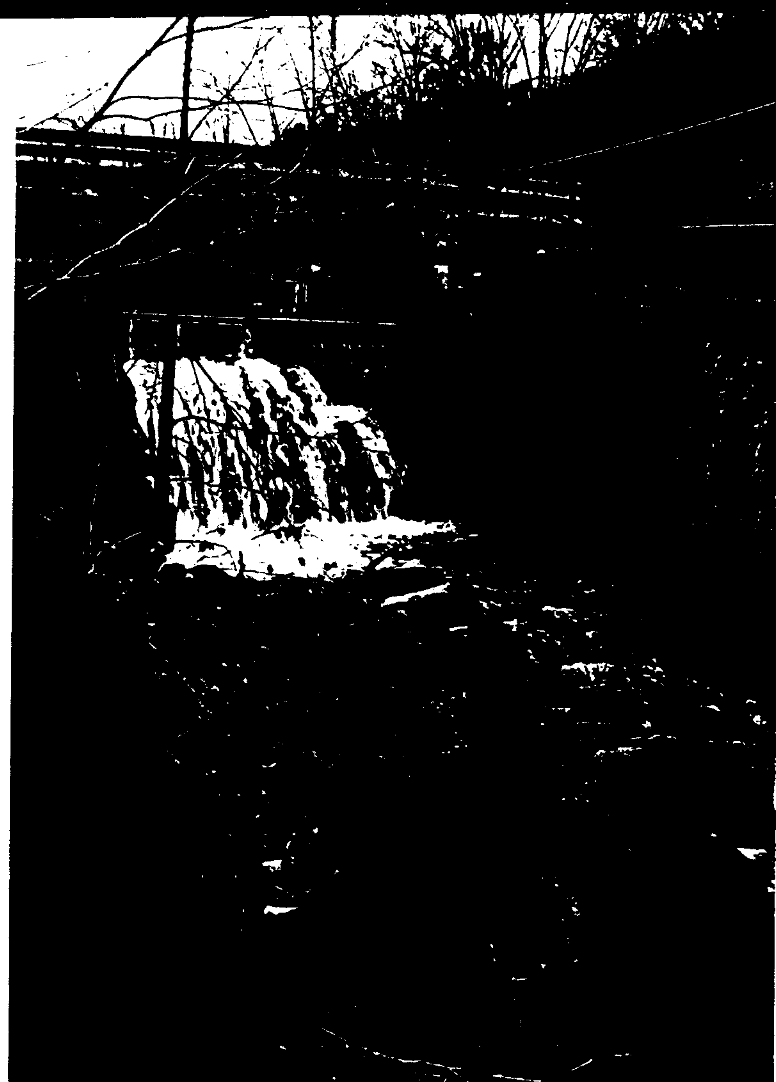


⊛ - sampling point

U.S. Army
Corps of Engineers
Public Notice No. 9172
Dec. 1977

Sampling point 1

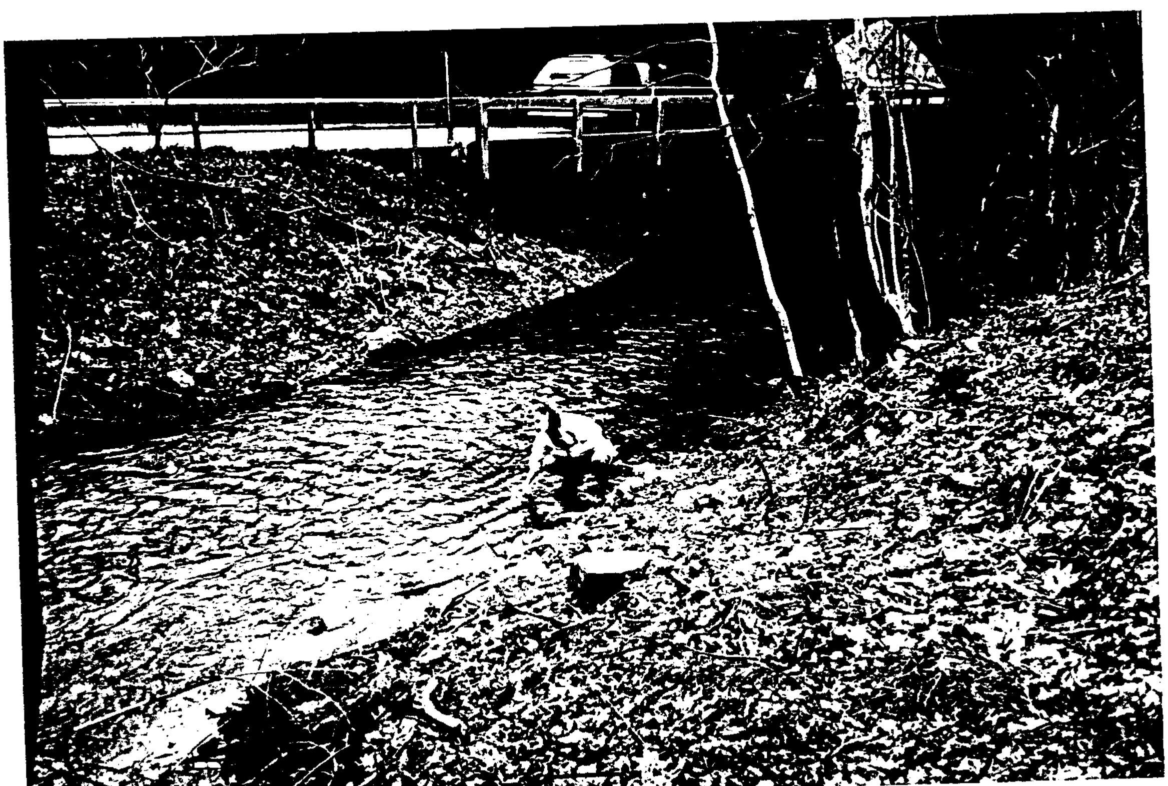
Intersection of Route 120 and Mill River Road



Sampling point 2

intersection of Bedford Road and Saw Mill River Parkway

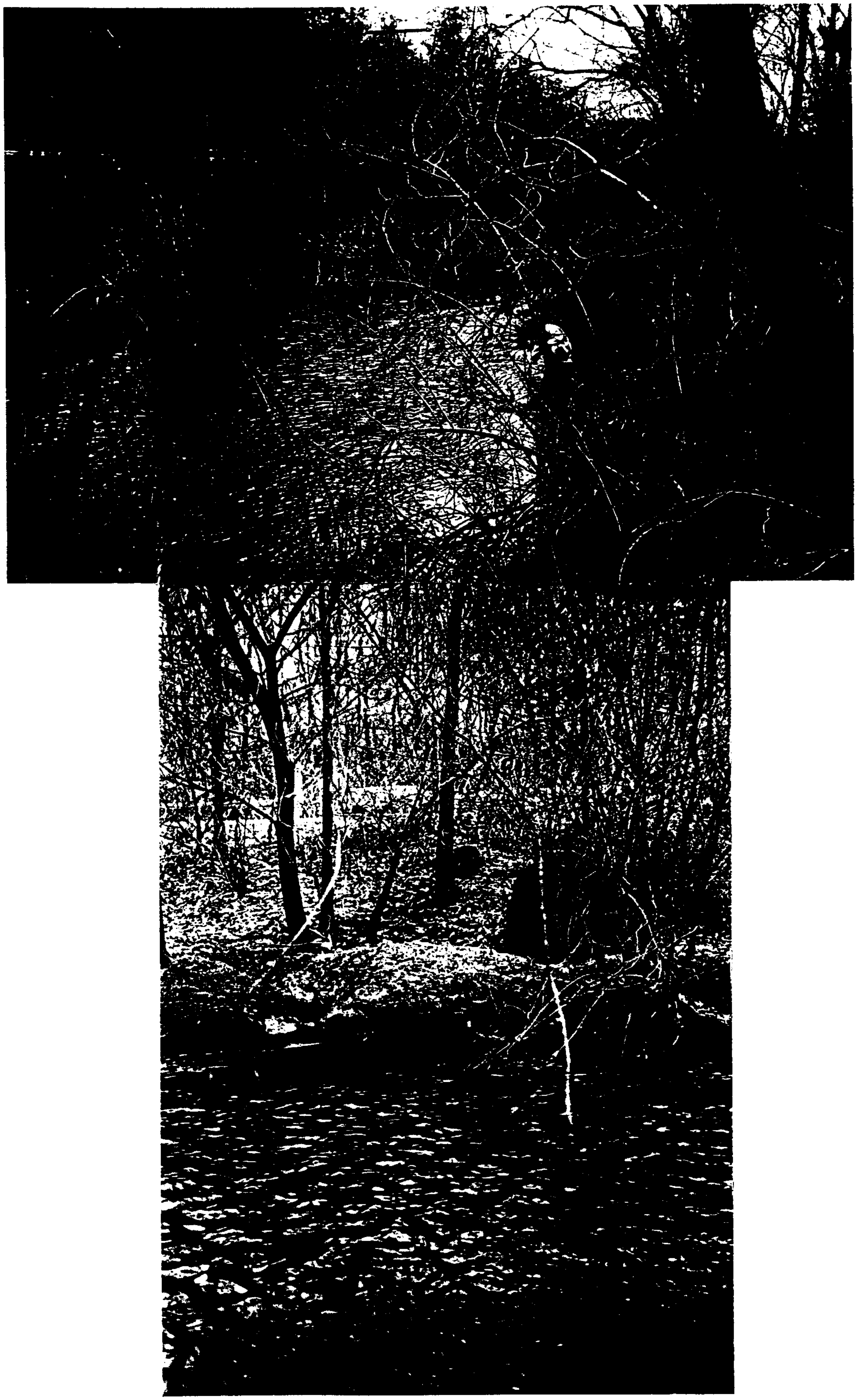
↑ view upstream



↑ view downstream

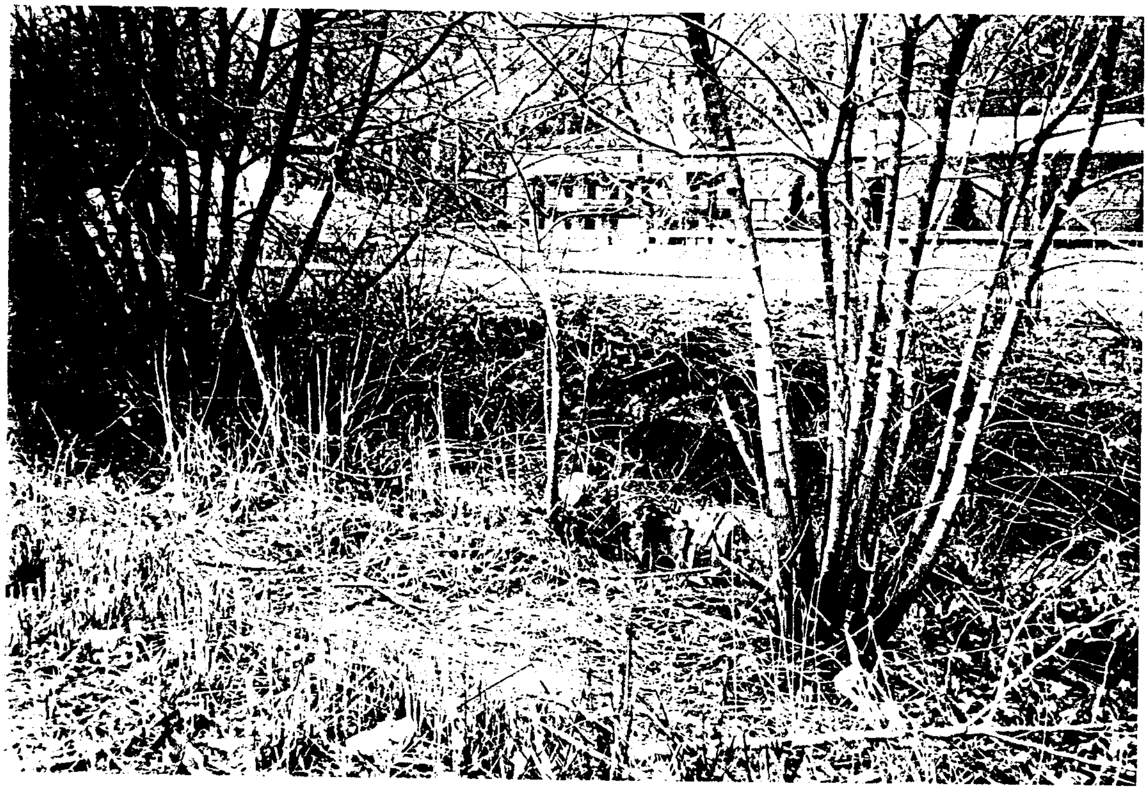
Sampling point 3

Hawthorne Circle



Sampling point 4

Tarrytown Road



Sampling point 5

Ashford Avenue

↑ Ardsley Flood Prevention Control Channel

pipes (from gas station?)

Sampling Point 6

intersection of Farragut Parkway and Saw Mill River Parkway

(no photo)

Sampling point 7

Old Nepperhan Avenue

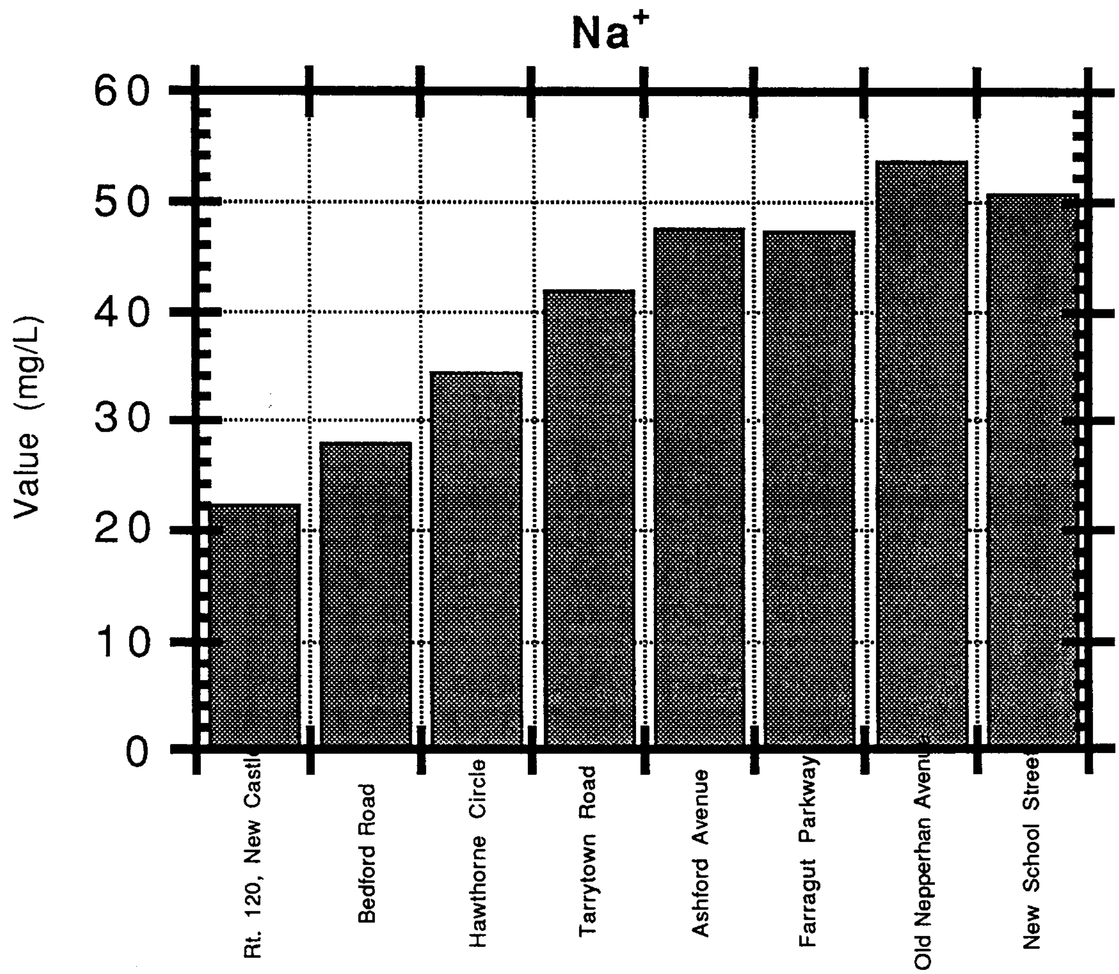
beginning of 1.5 mile Yonkers Flood Prevention control Channel

Sampling Point 5

intersection of New School Street and John Street

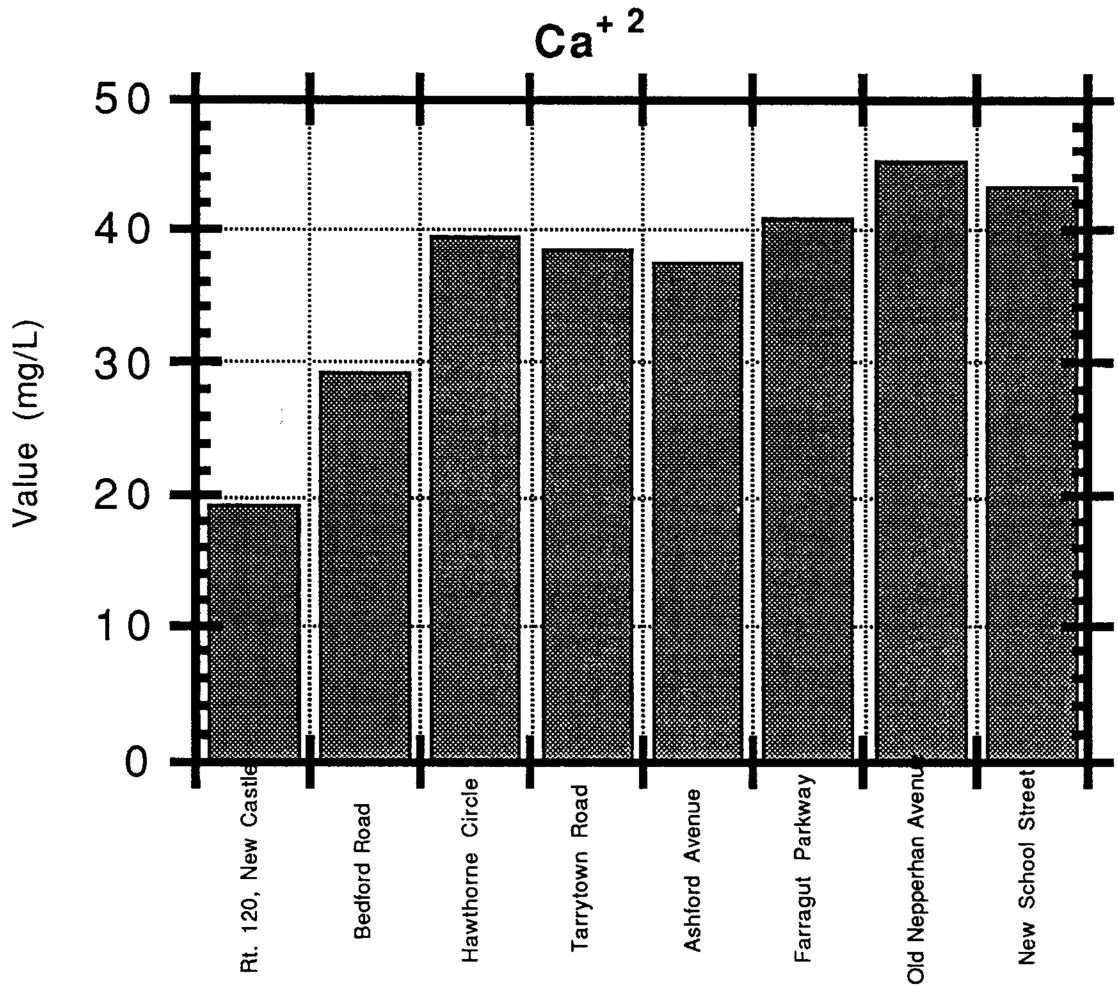
Appendix 2:
figures 1-20

figure 1



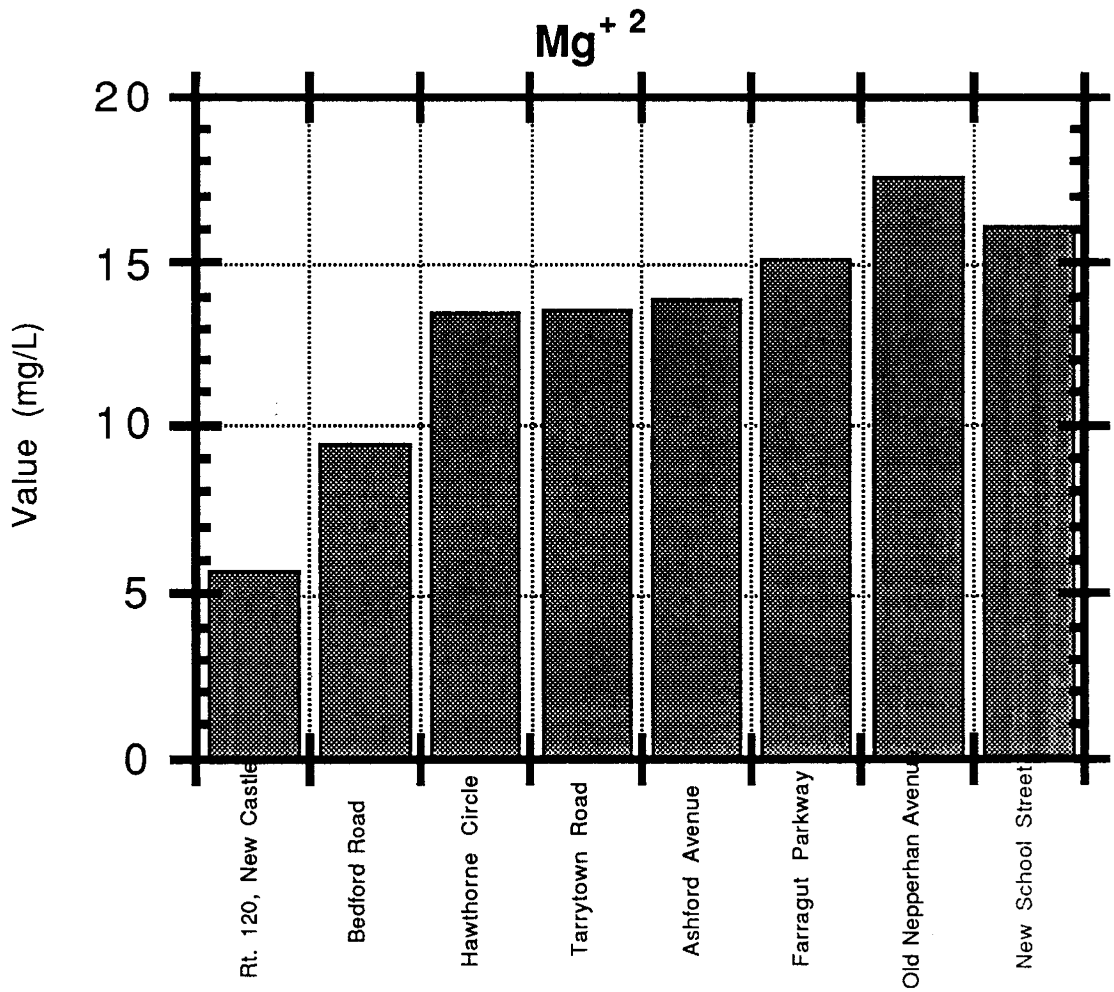
Na+
60
50
40
30
20
10
0
Value (mg/L)
Rt. 120, New Castl
Bedford Road
Hawthorne Circle
Tarrytown Road
Ashford Avenue
Farragut Parkway
Old Nepperhan Avenu
New School Stree

figure 2



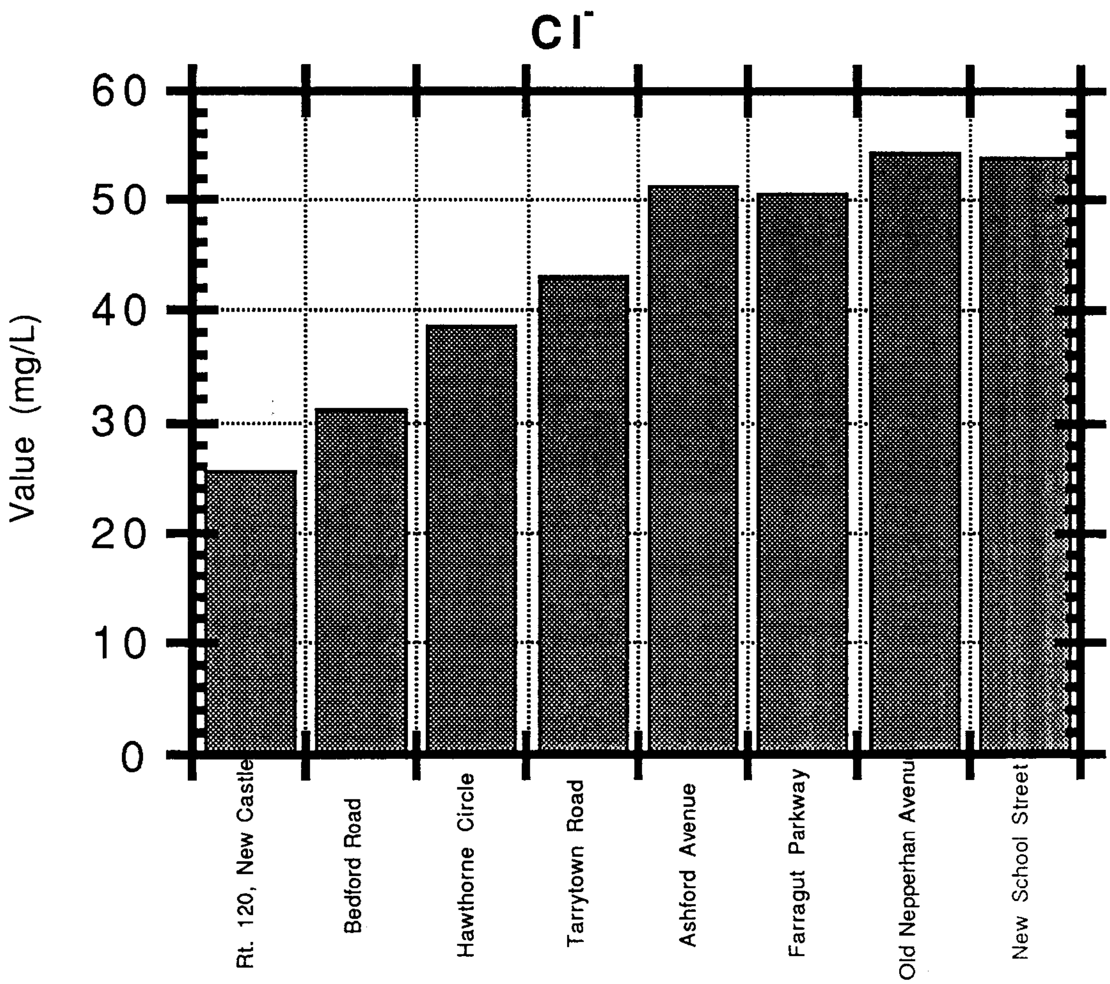
Ca^{+2}
Value (mg/L)
50
40
30
20
10
0
Rt. 120, New Castle
Bedford Road
Hawthorne Circle
Tarrytown Road
Ashford Avenue
Farragut Parkway
Old Nepperhan Avenue
New School Street

figure 3



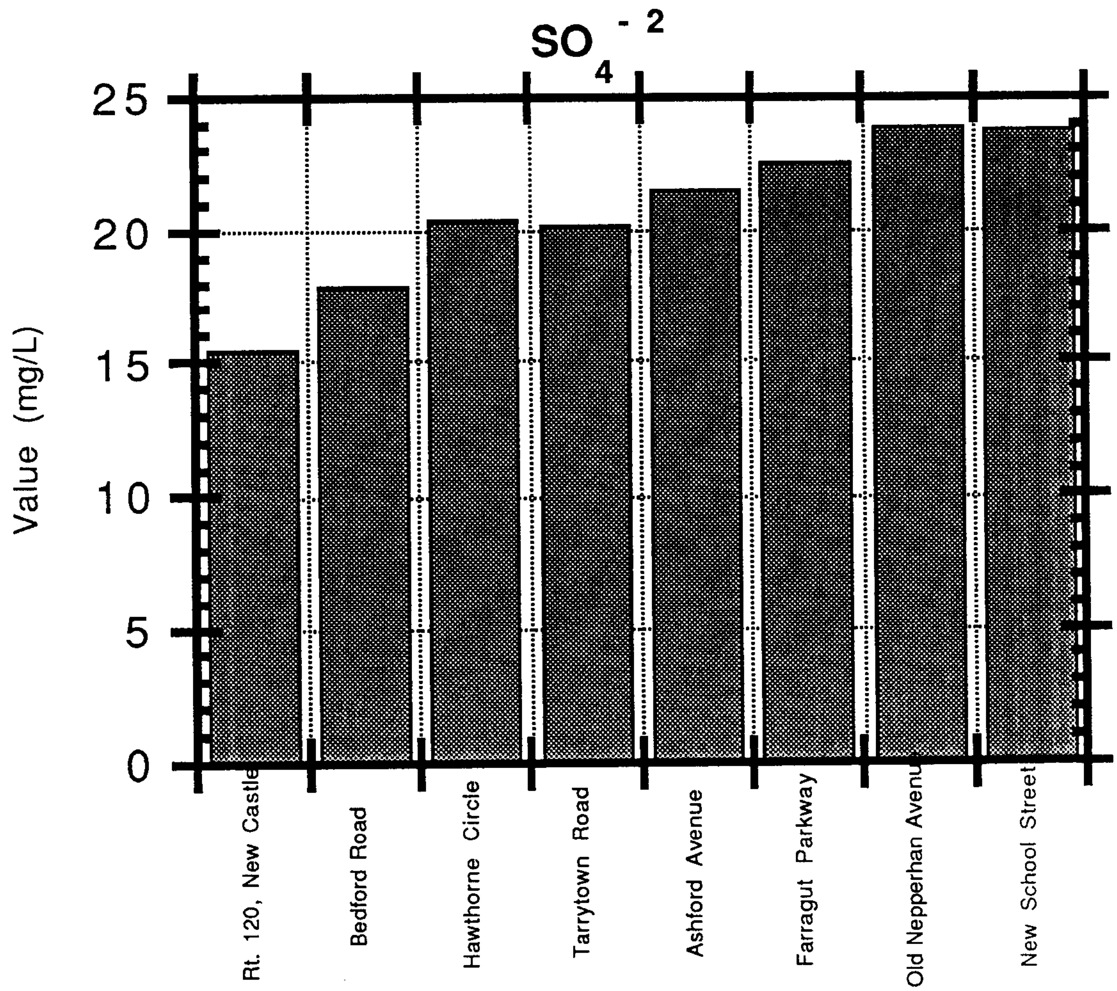
Mg+ 2
Value (mg/L)
20
15
10
5
0
Rt. 120, New Castle
Bedford Road
Hawthorne Circle
Tarrytown Road
Ashford Avenue
Farragut Parkway
Old Nepperhan Avenue
New School Street

figure 4



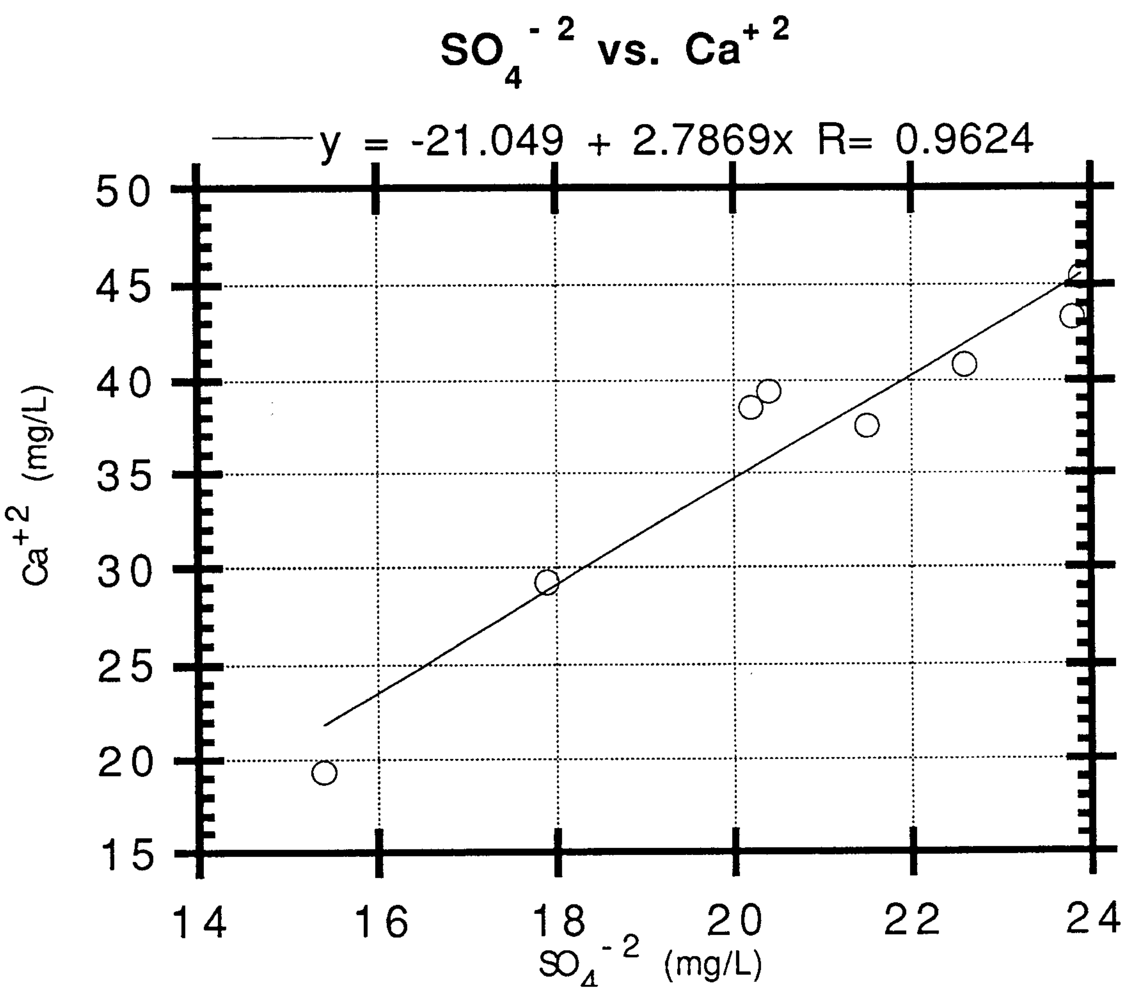
Cl-
Value (mg/L)
60
50
40
30
20
10
0
Rt. 120, New Castle
Bedford Road
Hawthorne Circle
Tarrytown Road
Ashford Avenue
Farragut Parkway
Old Nepperhan Avenu
New School Street

figure 5



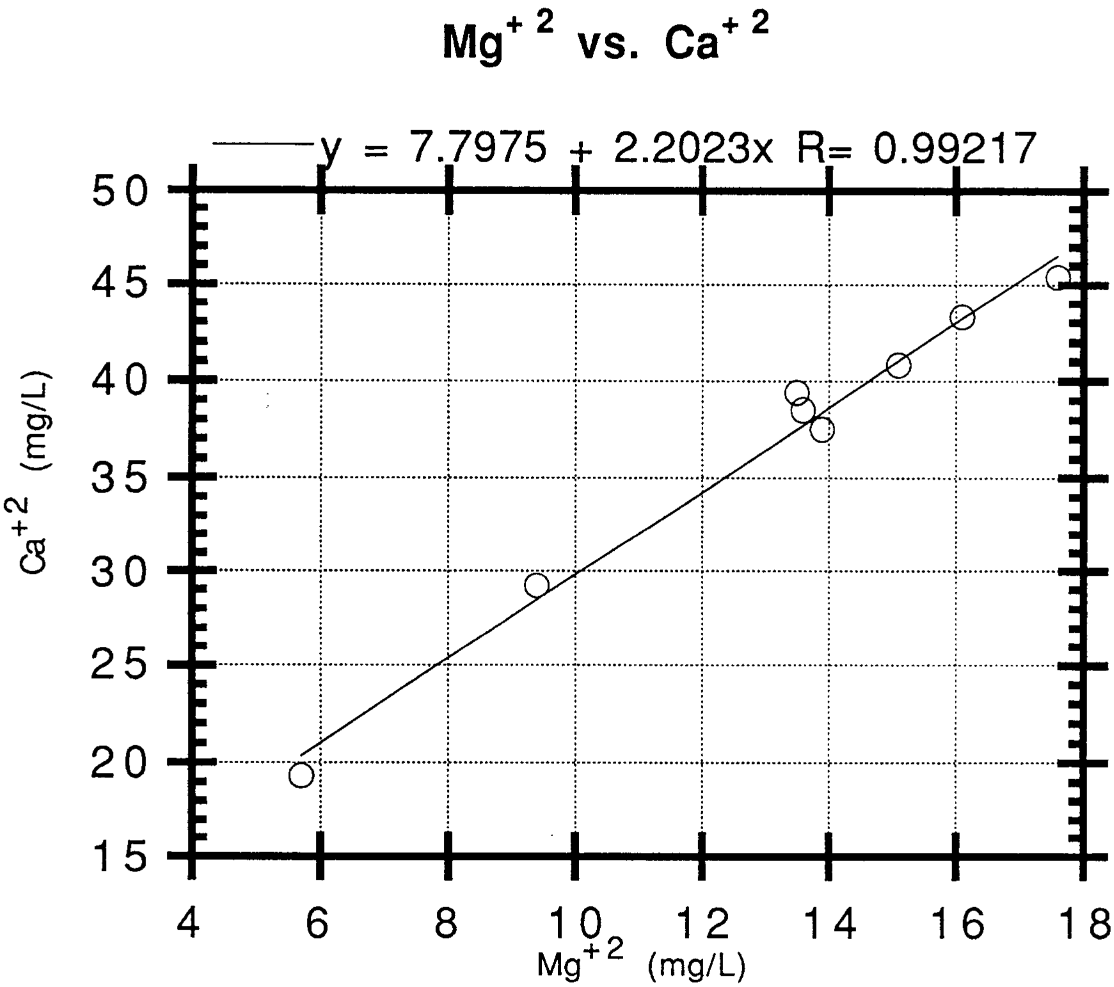
SO_4^{-2}
Value (mg/L)
25
20
15
10
5
0
Rt. 120, New Castle
Bedford Road
Hawthorne Circle
Tarrytown Road
Ashford Avenue
Farragut Parkway
Old Nepperhan Avenue
New School Street

figure 6



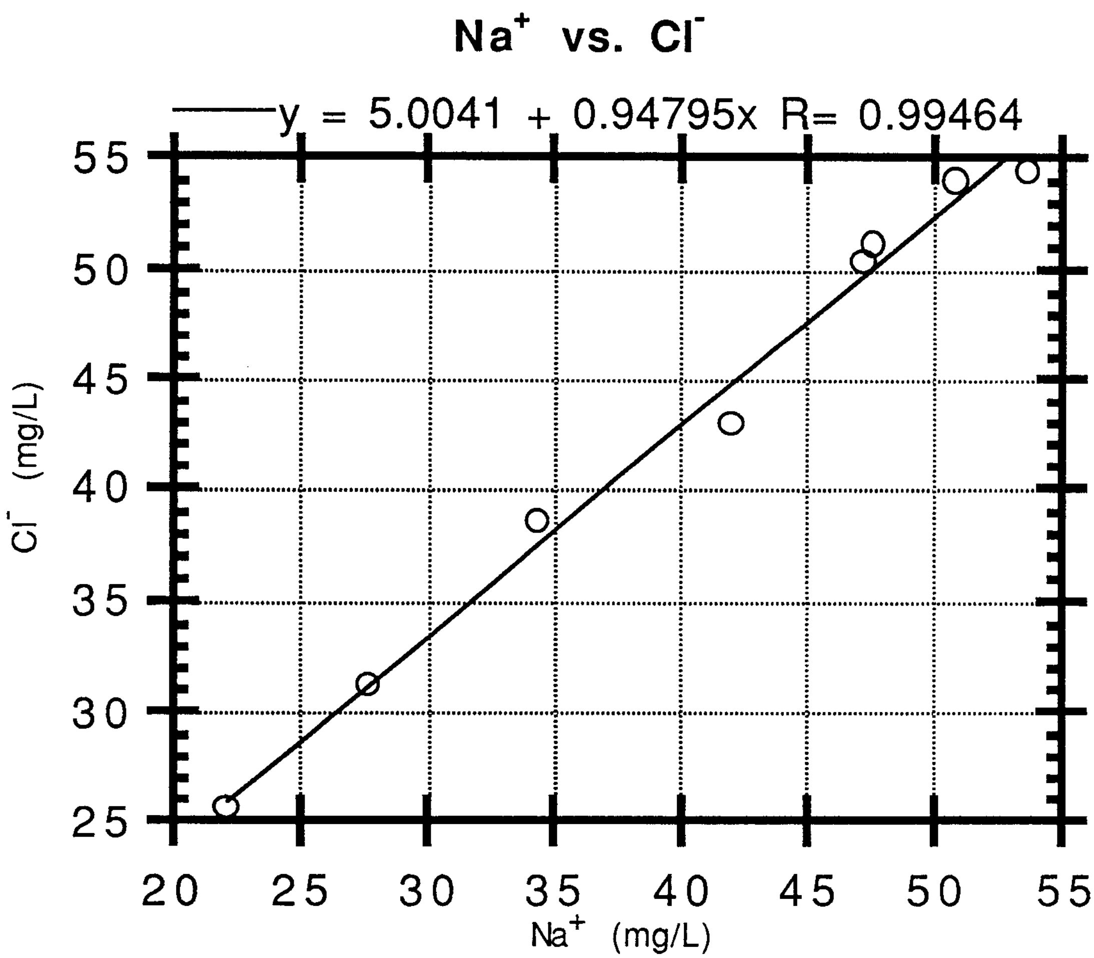
SO4 -2 vs. Ca+2
y = -21.049 + 2.7869x R= 0.9624
50
45
40
35
30
25
20
15
14
16
18
20
22
24
Ca+2 (mg/L)
SO4 -2 (mg/L)

figure 7



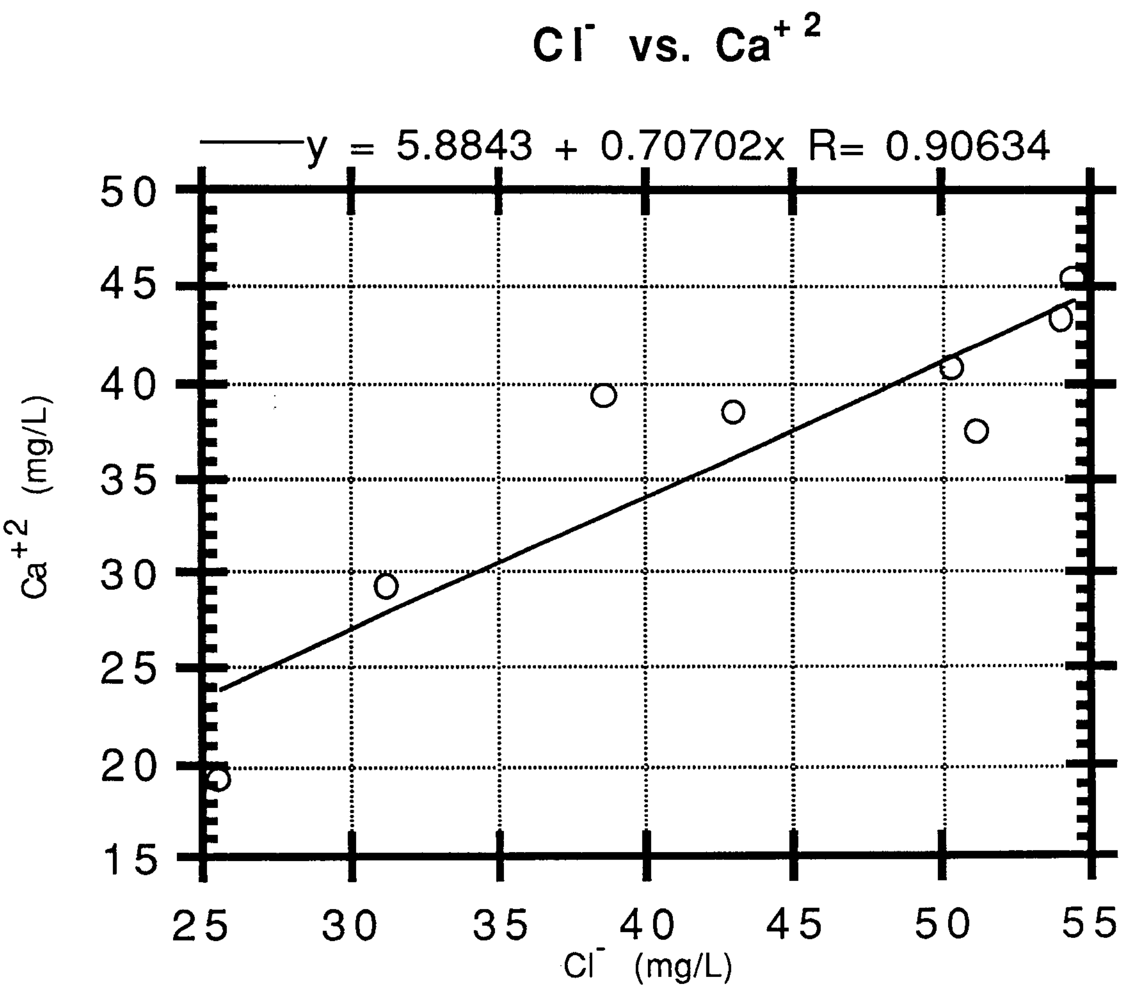
Mg+2 vs. Ca+2
y = 7.7975 + 2.2023x R= 0.99217
50
45
40
35
30
25
20
15
Ca+2 (mg/L)
4
6
8
10
12
14
16
18
Mg+2 (mg/L)

figure 8



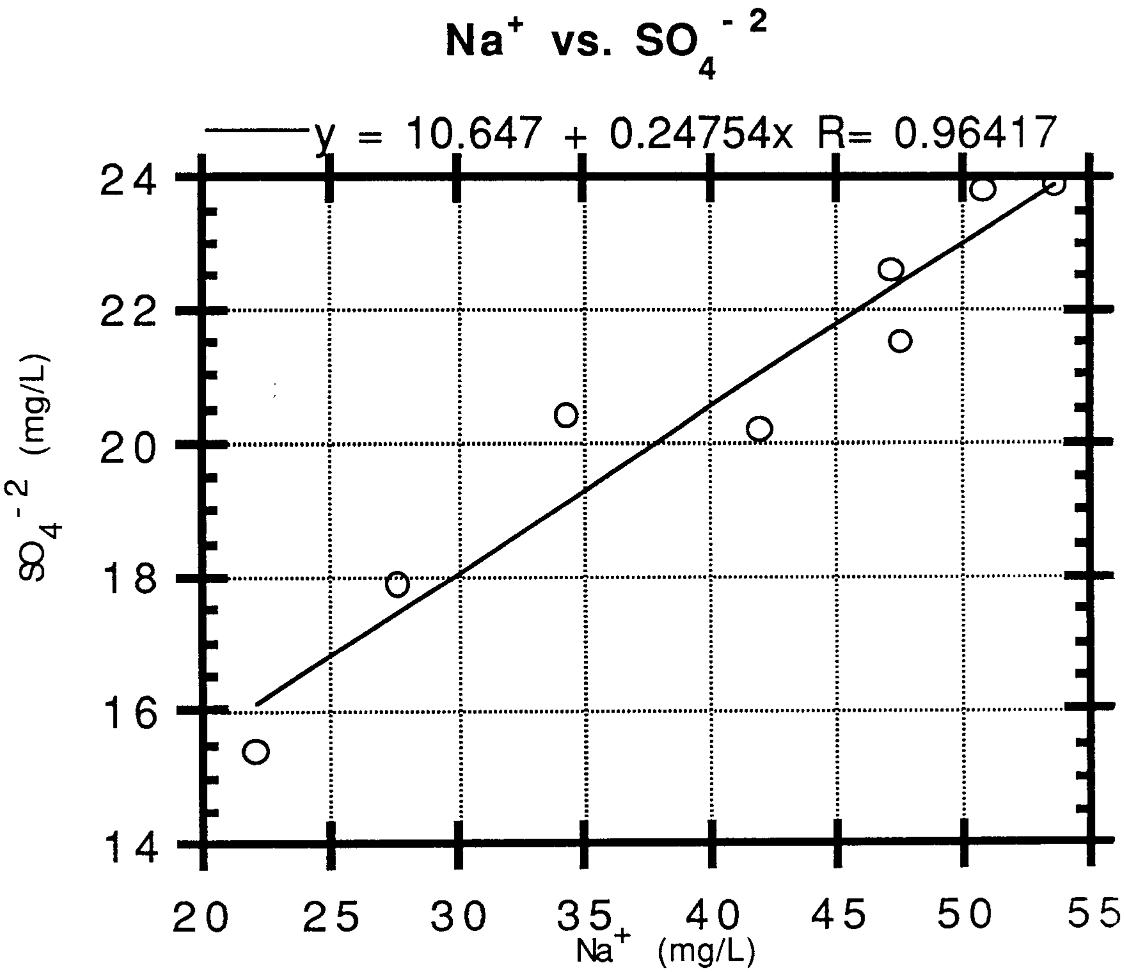
Na+ vs. Cl-
y = 5.0041 + 0.94795x R= 0.99464
55
50
45
40
35
30
25
Cl- (mg/L)
20
25
30
35
40
45
50
55
Na+ (mg/L)

figure 9



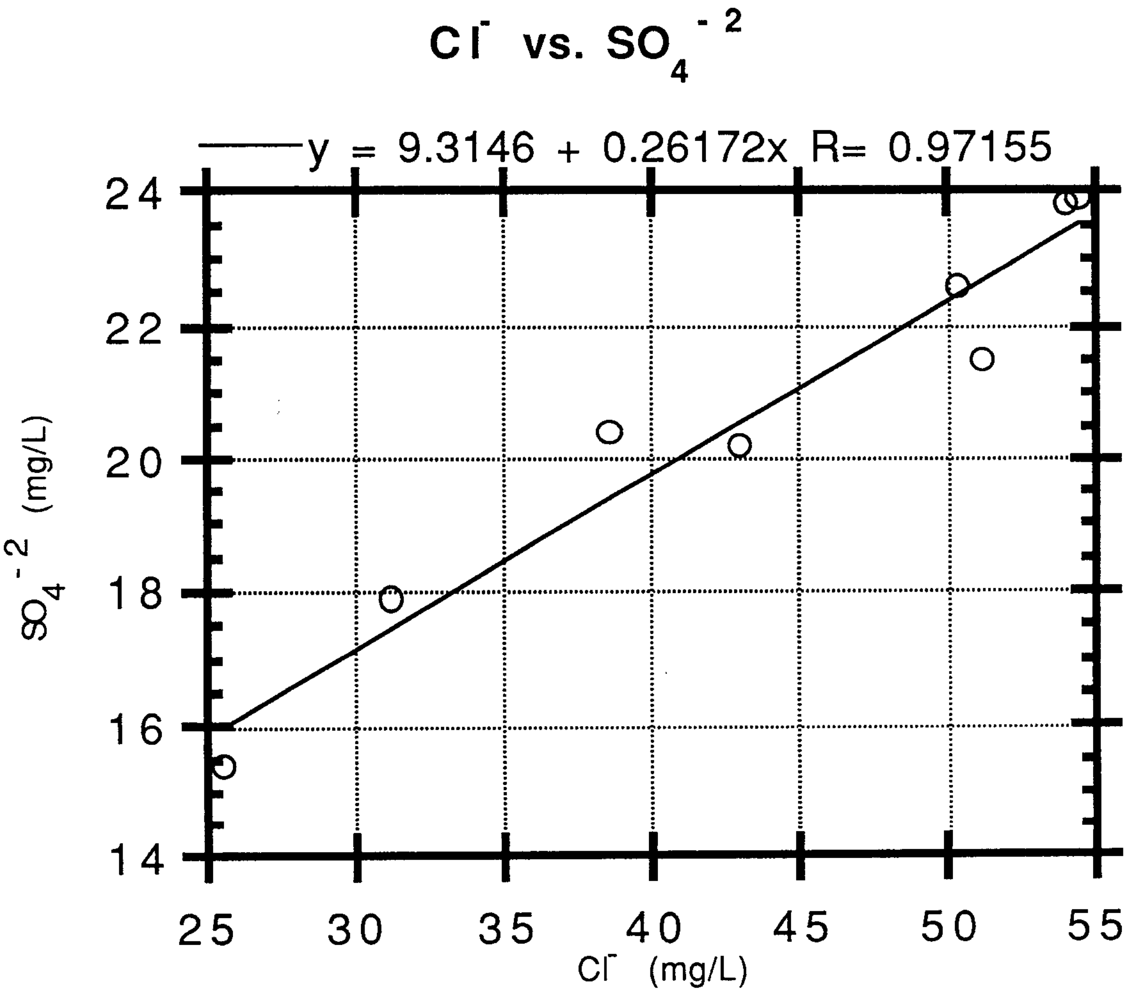
Cl⁻ vs. Ca⁺²
y = 5.8843 + 0.70702x R= 0.90634
50
45
40
35
30
25
20
15
Ca⁺² (mg/L)
25
30
35
40
45
50
55
Cl⁻ (mg/L)

figure 10



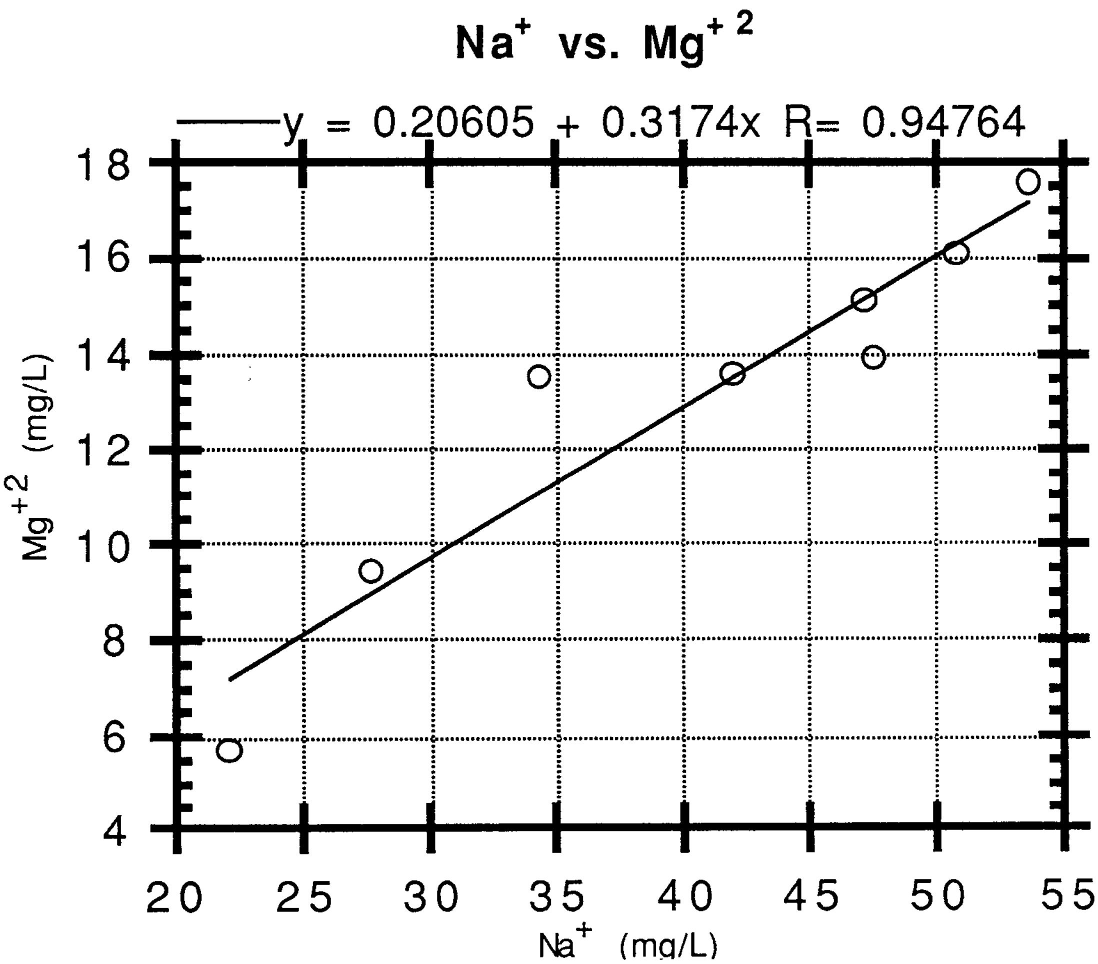
Na+ vs. SO4 -2
y = 10.647 + 0.24754x R= 0.96417
24
22
20
18
16
14
SO4 -2 (mg/L)
20
25
30
35
40
45
50
55
Na+ (mg/L)

figure 11



Cl⁻ vs. SO_4^{-2}
y = 9.3146 + 0.26172x R= 0.97155
24
22
20
18
16
14
SO_4^{-2} (mg/L)
25
30
35
40
45
50
55
Cl⁻ (mg/L)

figure 12



Na+ vs. Mg+2
y = 0.20605 + 0.3174x R= 0.94764
18
16
14
12
10
8
6
4
Mg+2 (mg/L)
20
25
30
35
40
45
50
55
Na+ (mg/L)

figure 13

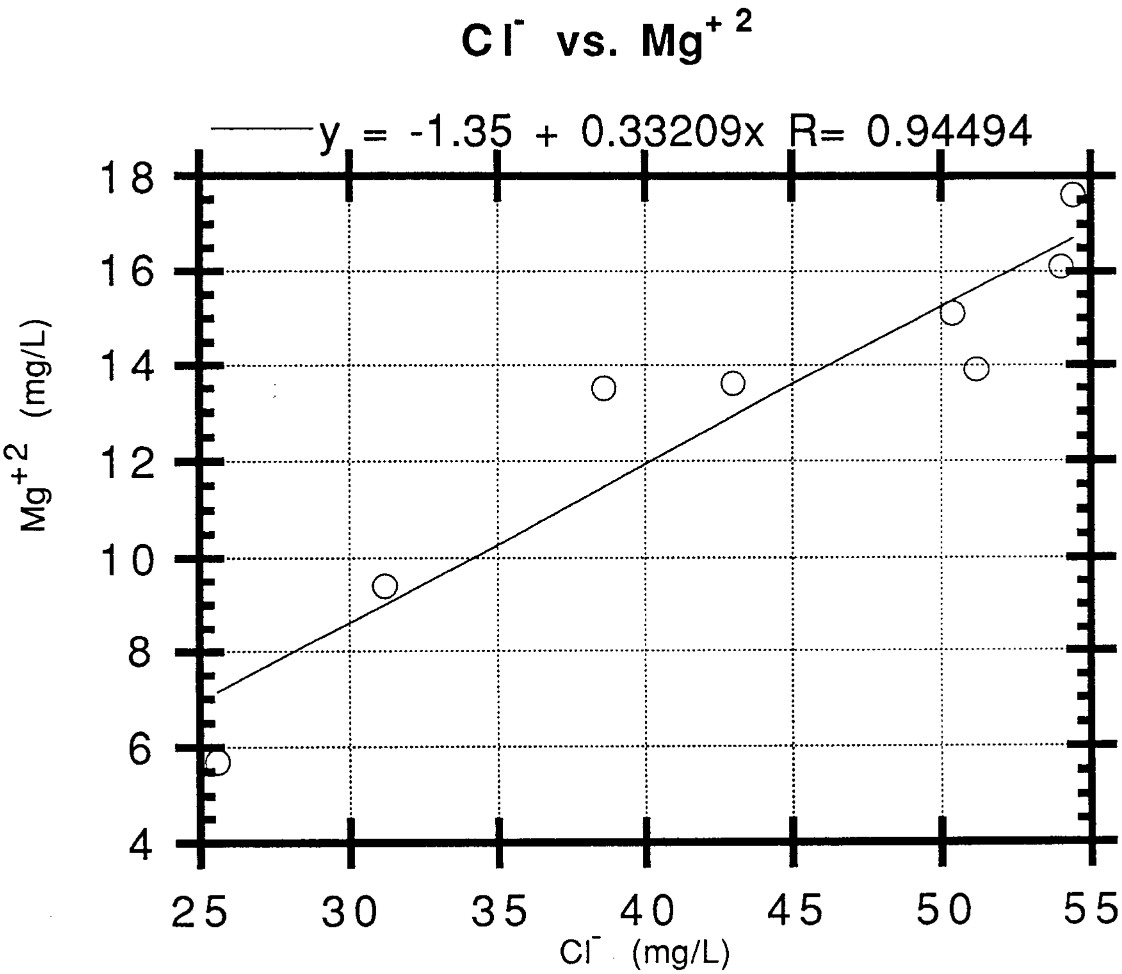
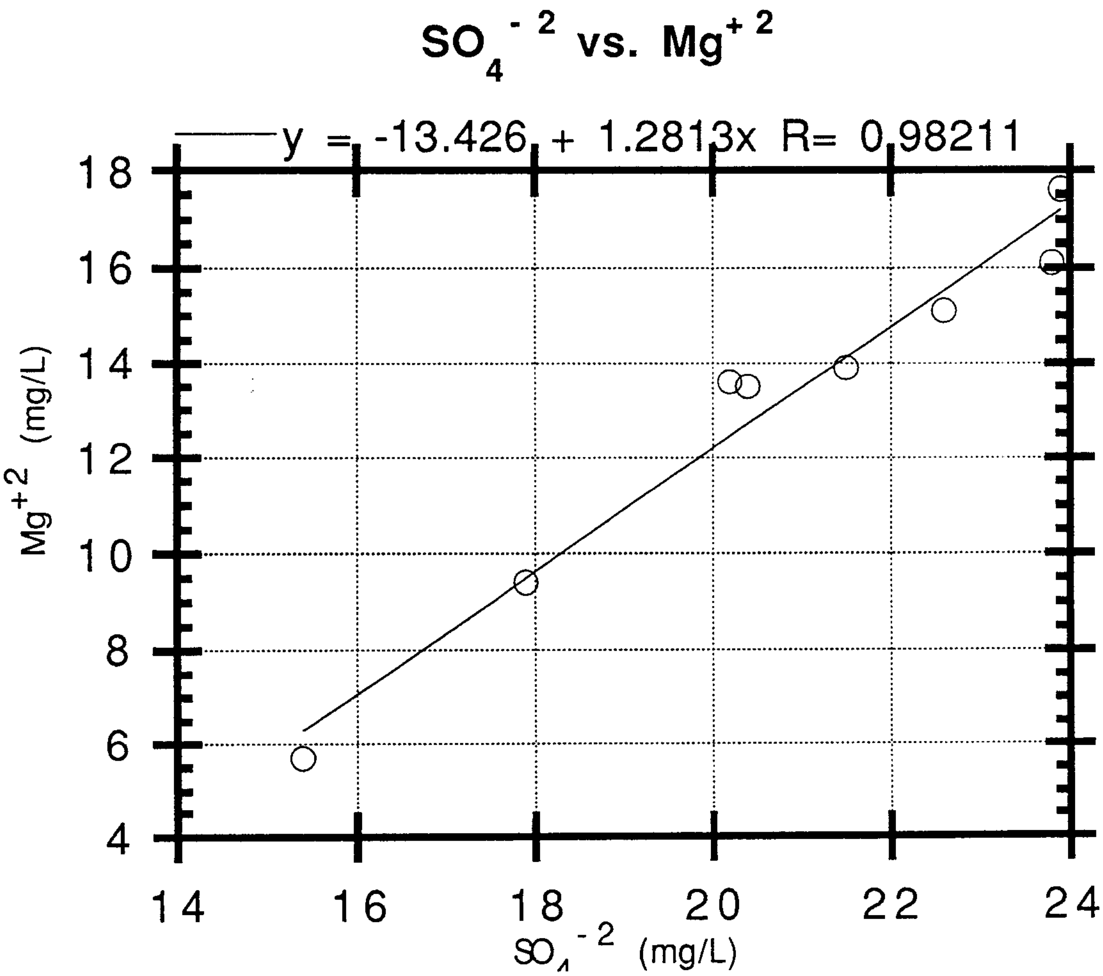
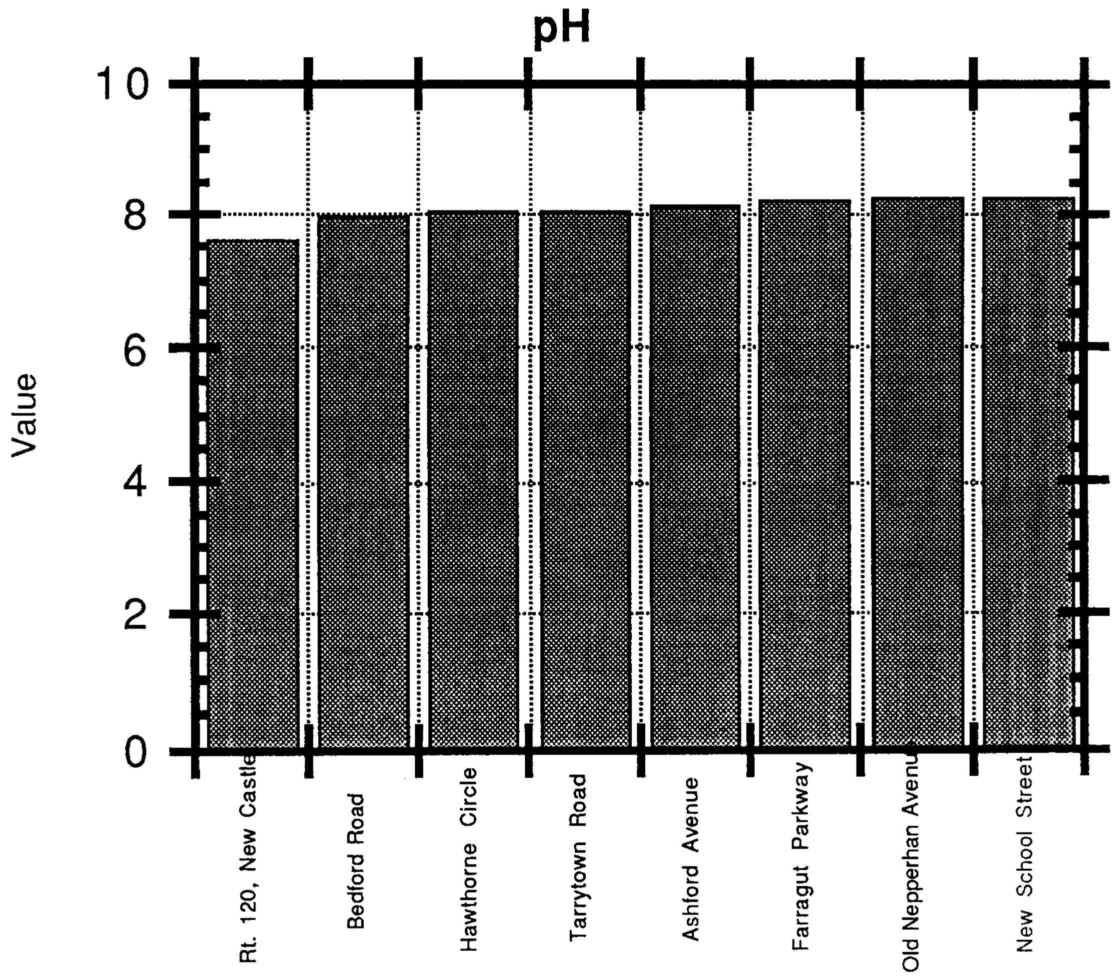

Cl⁻ vs. Mg+2
y = -1.35 + 0.33209x R= 0.94494
18
16
14
12
10
8
6
4
Mg+2 (mg/L)
25
30
35
40
45
50
55
Cl⁻ (mg/L)

figure 14



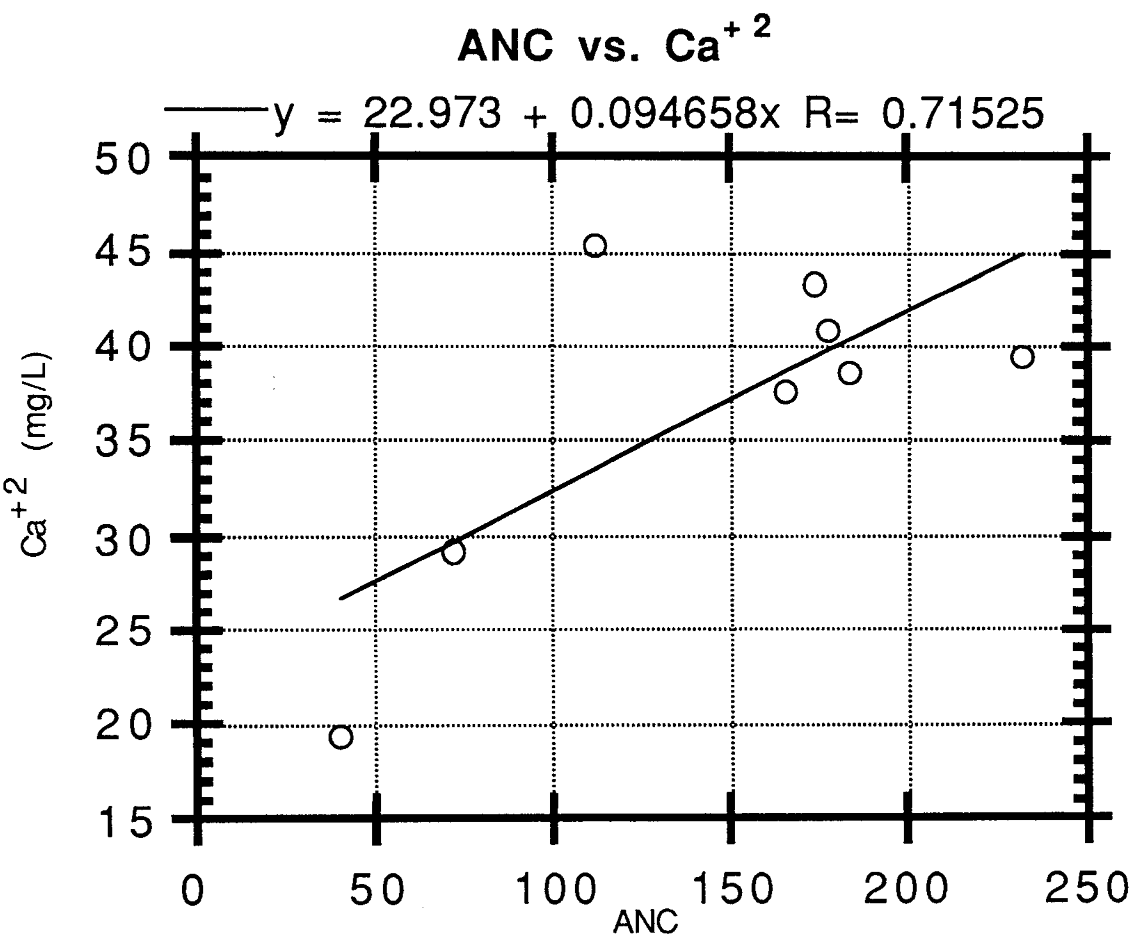
SO4 -2 vs. Mg+2
y = -13.426 + 1.2813x R= 0.98211
18
16
14
12
10
8
6
4
14
16
18
20
22
24
Mg+2 (mg/L)
SO4 -2 (mg/L)

figure 15



pH
10
8
6
4
2
0
Value
Rt. 120, New Castle
Bedford Road
Hawthorne Circle
Tarrytown Road
Ashford Avenue
Farragut Parkway
Old Nepperhan Avenue
New School Street

figure 16



ANC vs. Ca+2
y = 22.973 + 0.094658x R= 0.71525
50
45
40
35
30
25
20
15
Ca+2 (mg/L)
0
50
100
150
200
250
ANC

figure 17

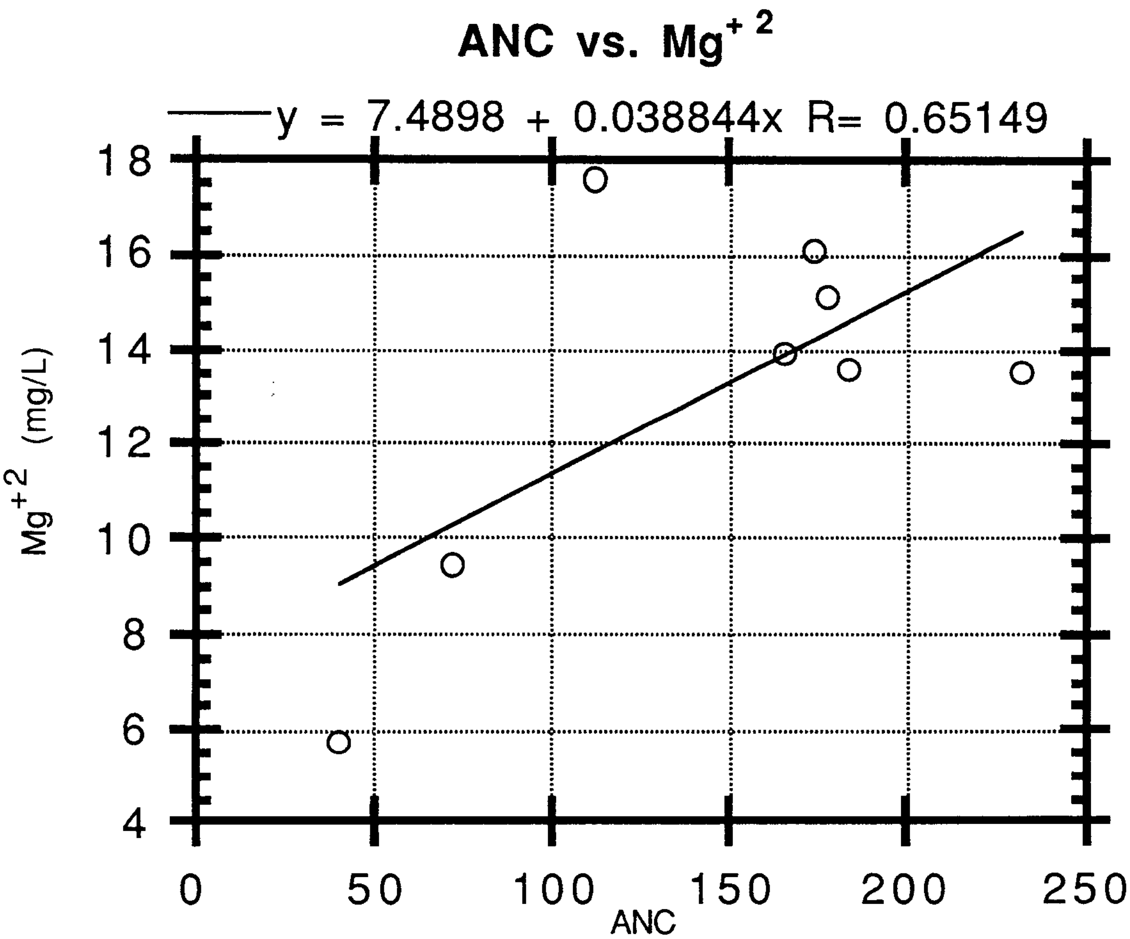

ANC vs. Mg+2
y = 7.4898 + 0.038844x R= 0.65149
18
16
14
12
10
8
6
4
Mg+2 (mg/L)
0
50
100
150
200
250
ANC

figure 18

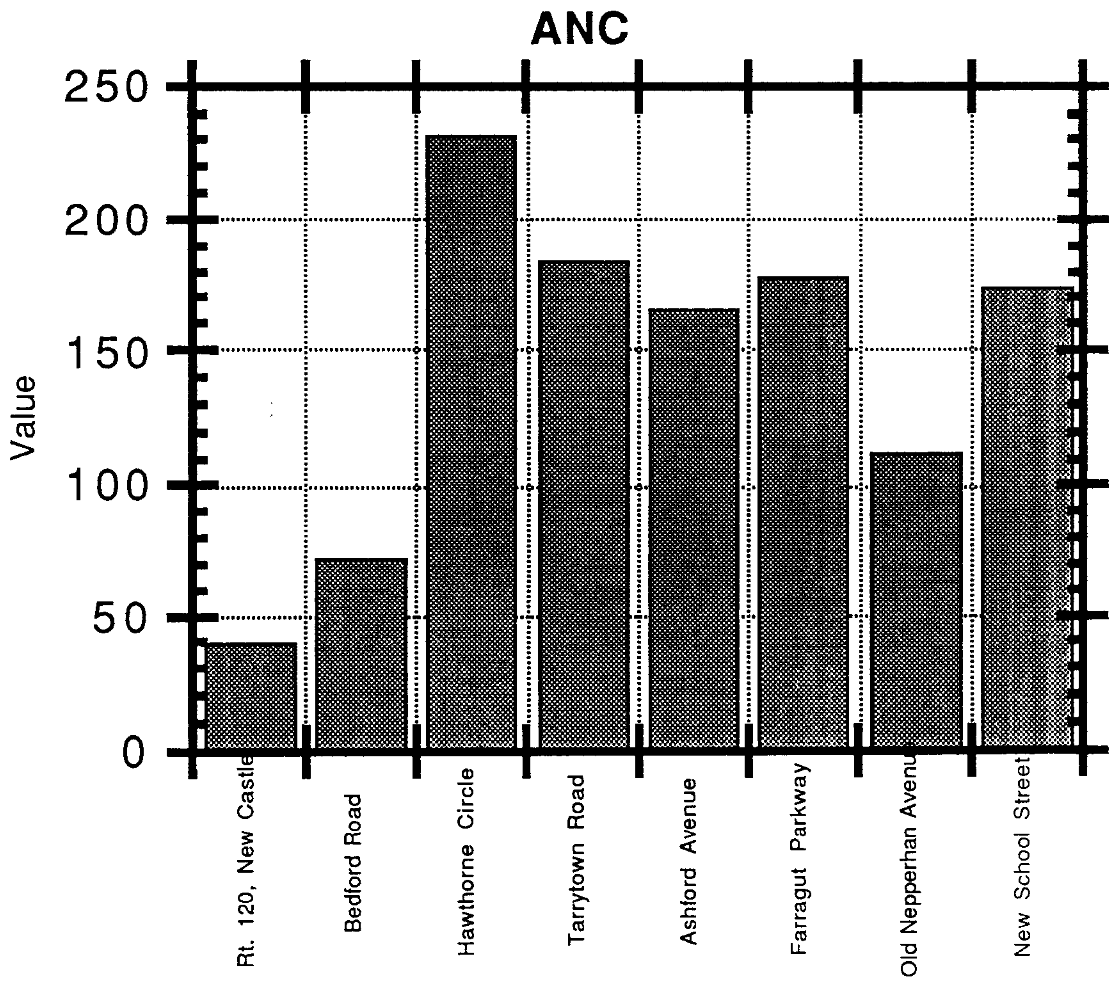
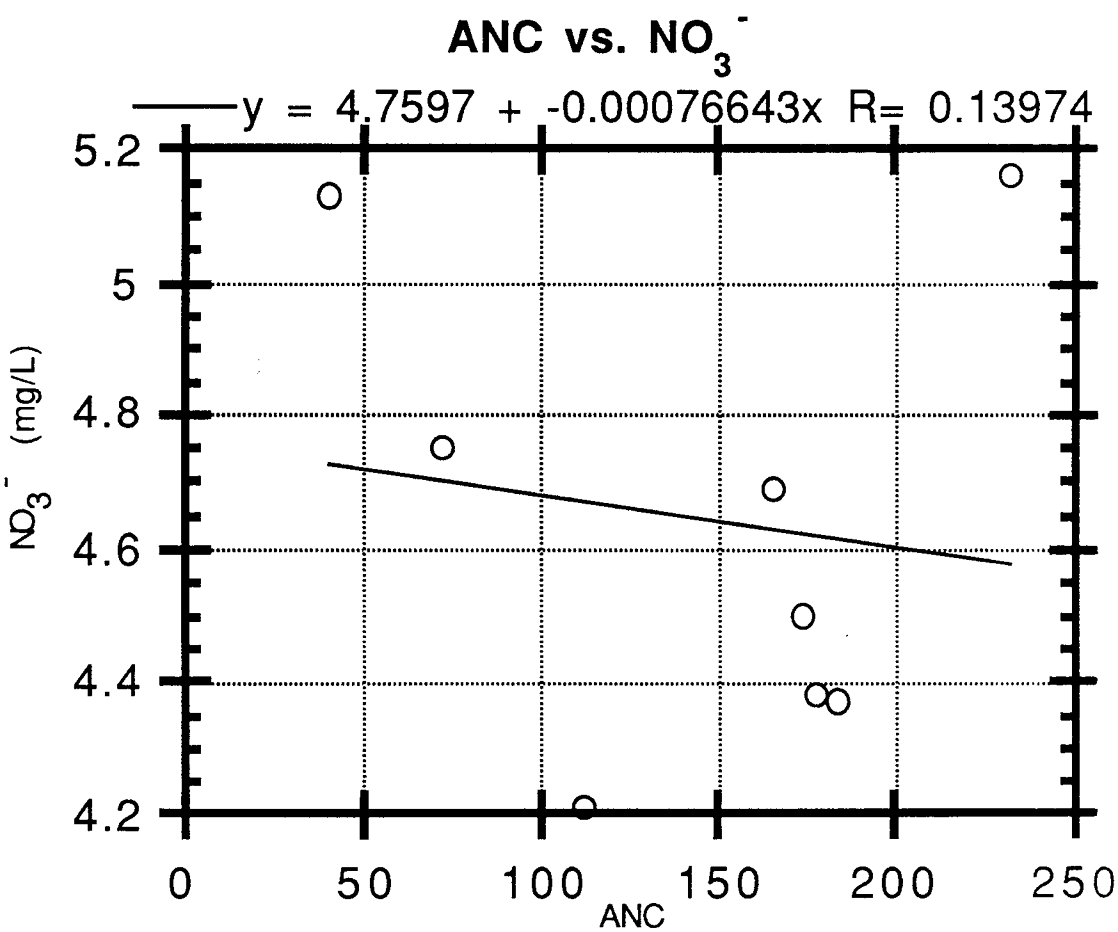
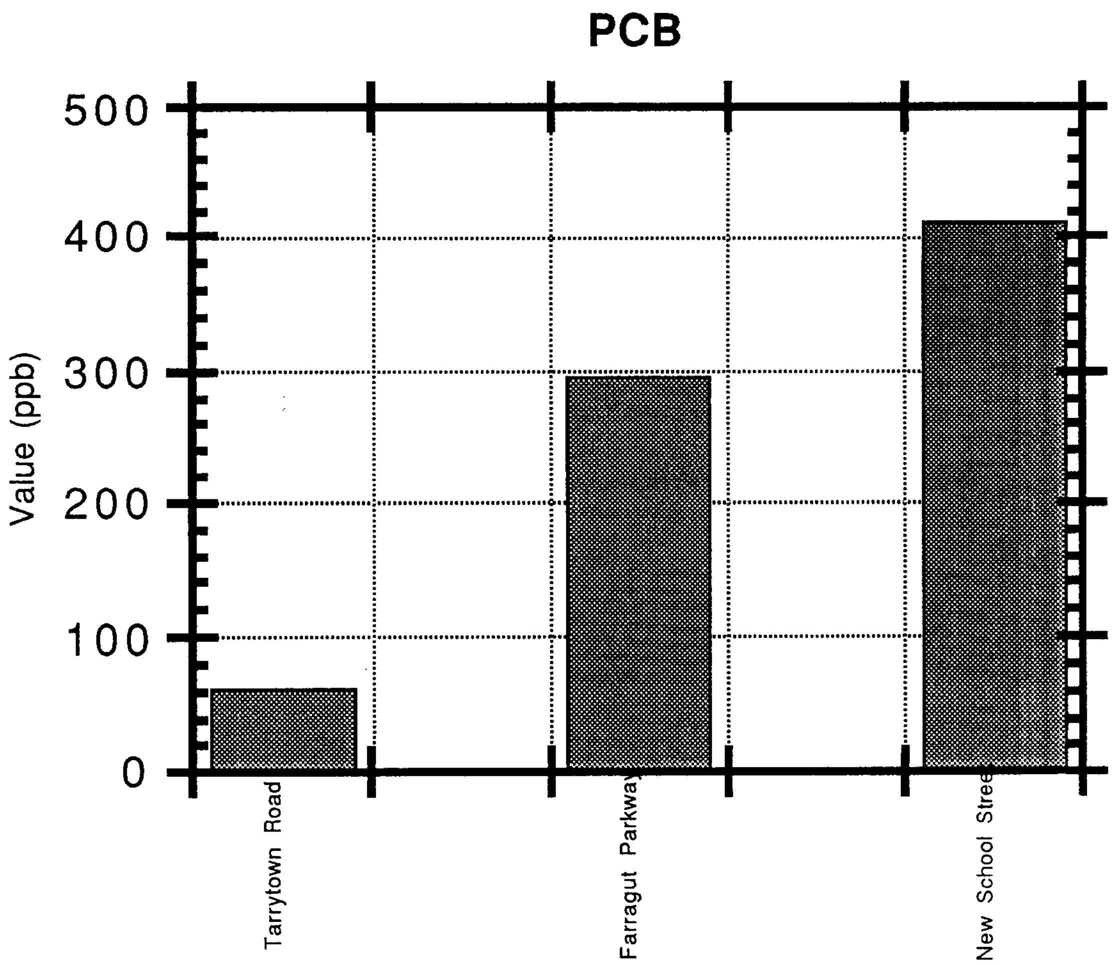

ANC
250
200
150
100
50
0
Value
Rt. 120, New Castle
Bedford Road
Hawthorne Circle
Tarrytown Road
Ashford Avenue
Farragut Parkway
Old Nepperhan Avenu
New School Street

figure 19



ANC vs. NO3-
y = 4.7597 + -0.00076643x R= 0.13974
5.2
5
4.8
4.6
4.4
4.2
NO3- (mg/L)
0
50
100
150
200
250
ANC

figure 20



PCB
500
400
300
200
100
0
Value (ppb)
Tarrytown Road
Farragut Parkway
New School Stree

Appendix 3:
PCB graphs and calculations

Sample 4 – PCB calculations

<u>no dilution</u>

5.94 g wet = 4.52 g dry

$$\% \text{ water} = \frac{5.94 - 4.52}{5.94} = 23.9\%$$

30.08 g wet sample = 22.89 g dry sample

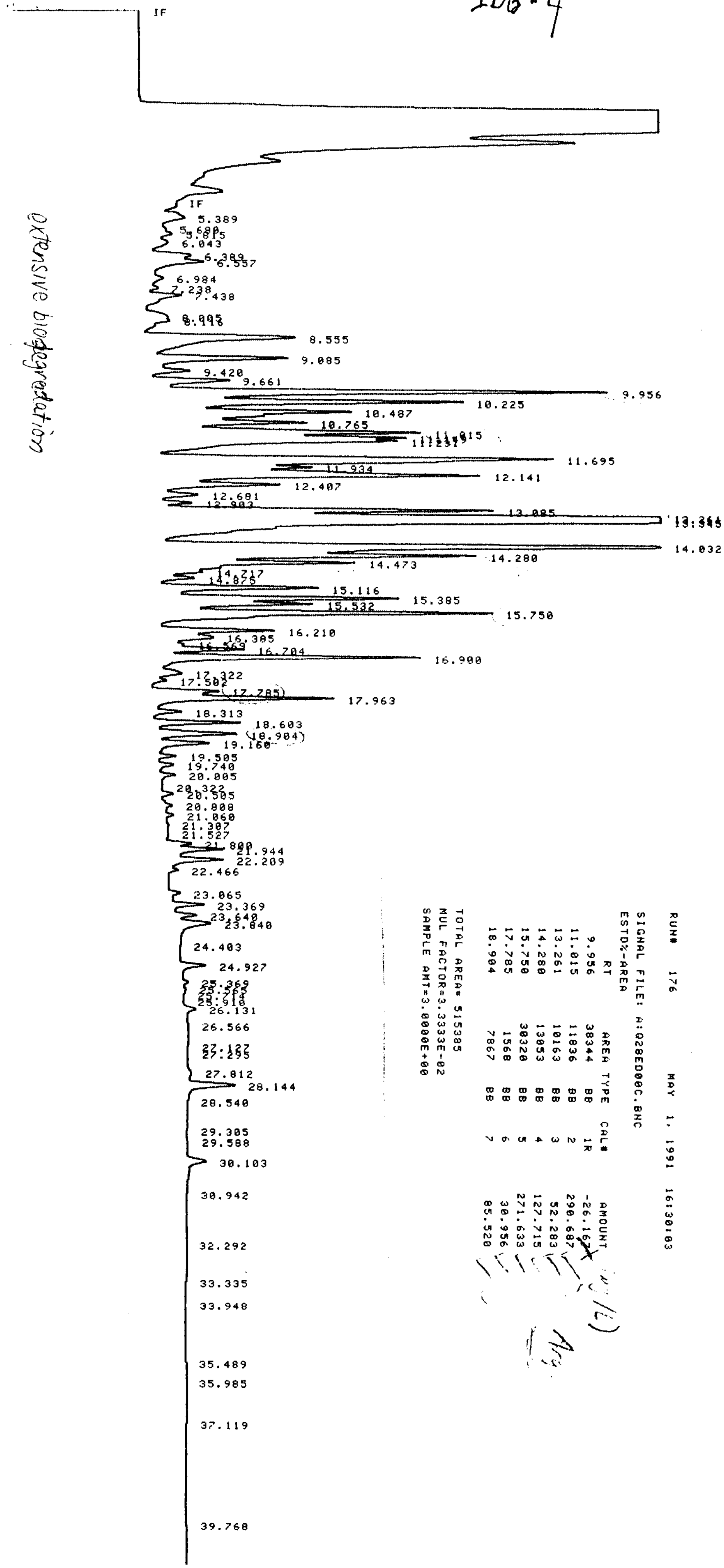
cal #	dry value
2	$(290.687\ \mu g/L)(10\ mL)\left(\frac{1L}{1000 mL}\right) = 2.90687\ \mu g$ $\frac{2.90687\ \mu g}{0.02289\ kg} = 126.99$ ppb
3	$\frac{0.52283\ \mu g}{0.02289\ kg} = 22.84$ ppb
4	$\frac{1.27715\ \mu g}{0.02289\ kg} = 55.80$ ppb
5	$\frac{2.71633\ \mu g}{0.02289\ kg} = 118.67$ ppb
6	$\frac{0.30956\ \mu g}{0.02289\ kg} = 13.52$ ppb
7	$\frac{0.85520\ \mu g}{0.02289\ kg} = 37.36$ ppb

avg. dry concentration = 62.53 ppb

RUN # 176 MAY 1, 1991 16:30:03

ID6-4

extensive biodegradation



RUN# 176 MAY 1, 1991 16:30:03

SIGNAL FILE: A:Q28ED00C.BNC

ESTD%-AREA

RT	AREA	TYPE	CAL#	AMOUNT
9.956	38344	BB	1R	-26.167
11.015	11836	BB	2	290.687
13.261	10163	BB	3	52.283
14.280	13053	BB	4	127.715
15.750	30320	BB	5	271.633
17.785	1568	BB	6	30.956
18.904	7867	BB	7	85.520

TOTAL AREA= 515385

MUL FACTOR=3.3333E-02

SAMPLE AMT=3.0000E+00

Sample 6 – PCB calculations

1:10 dilution

6.64 g wet = 5.29 g dry

$\% \text{ water} = \frac{6.64 - 5.29}{6.64} = 20.3\%$

30.06 g wet sample = 23.96 g dry sample

cal #	dry value
1R	$\frac{3.03908\ \mu g}{0.02396\ kg} = 126.84$ ppb x 10
2	$\frac{0.93949\ \mu g}{0.02396\ kg} = 39.21$ ppb x 10
3	$\frac{0.11562\ \mu g}{0.02396\ kg} = 4.83$ ppb x 10
4	$\frac{0.20229\ \mu g}{0.02396\ kg} = 8.44$ ppb x 10
5	$\frac{0.50548\ \mu g}{0.02396\ kg} = 21.10$ ppb x 10
6	$\frac{0.02848\ \mu g}{0.02396\ kg} = 1.19$ ppb x 10
7	$\frac{0.14728\ \mu g}{0.02396\ kg} = 6.15$ ppb x 10

avg. dry concentration = 296.80 ppb

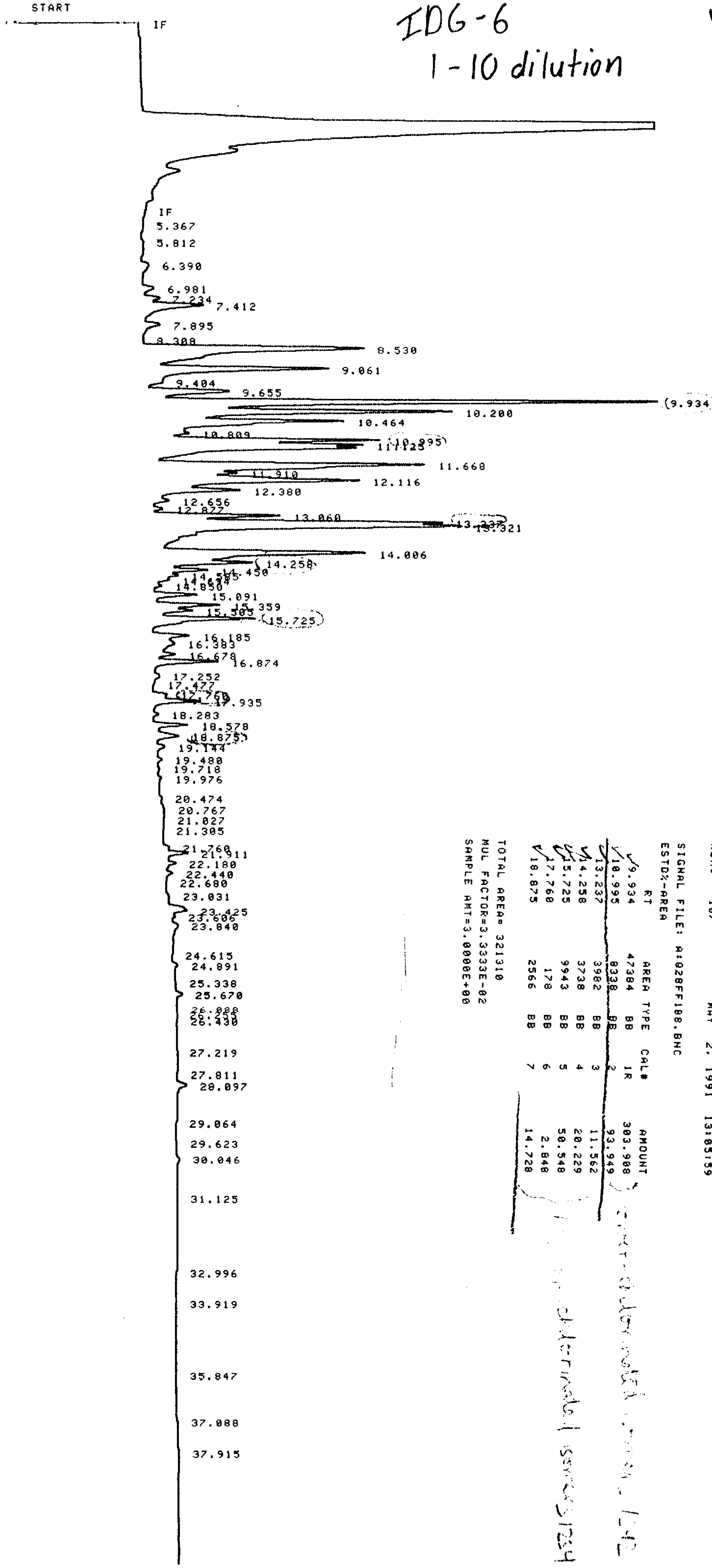
* RUN # 187 MAY 2, 1991 13:05:59

START

IDG-6

1-10 dilution

SU.2256



RUN# 187 MAY 2, 1991 13:05:59

SIGNAL FILE: A:02BFF188.BNC

ESTD%-AREA

RT	AREA	TYPE	CAL#	AMOUNT
9.934	47384	BB	1R	303.908
10.995	8338	BB	2	93.949
13.237	3982	BB	3	11.562
14.258	3738	BB	4	20.229
15.725	9943	BB	5	50.548
17.760	178	BB	6	2.848
18.875	2566	BB	7	14.728

TOTAL AREA= 321310

MUL FACTOR=3.3333E-02

SAMPLE AMT=3.0000E+00

Sample 8 – PCB calculations

1:10 dilution

7.44 g dry = 5.94 g wet

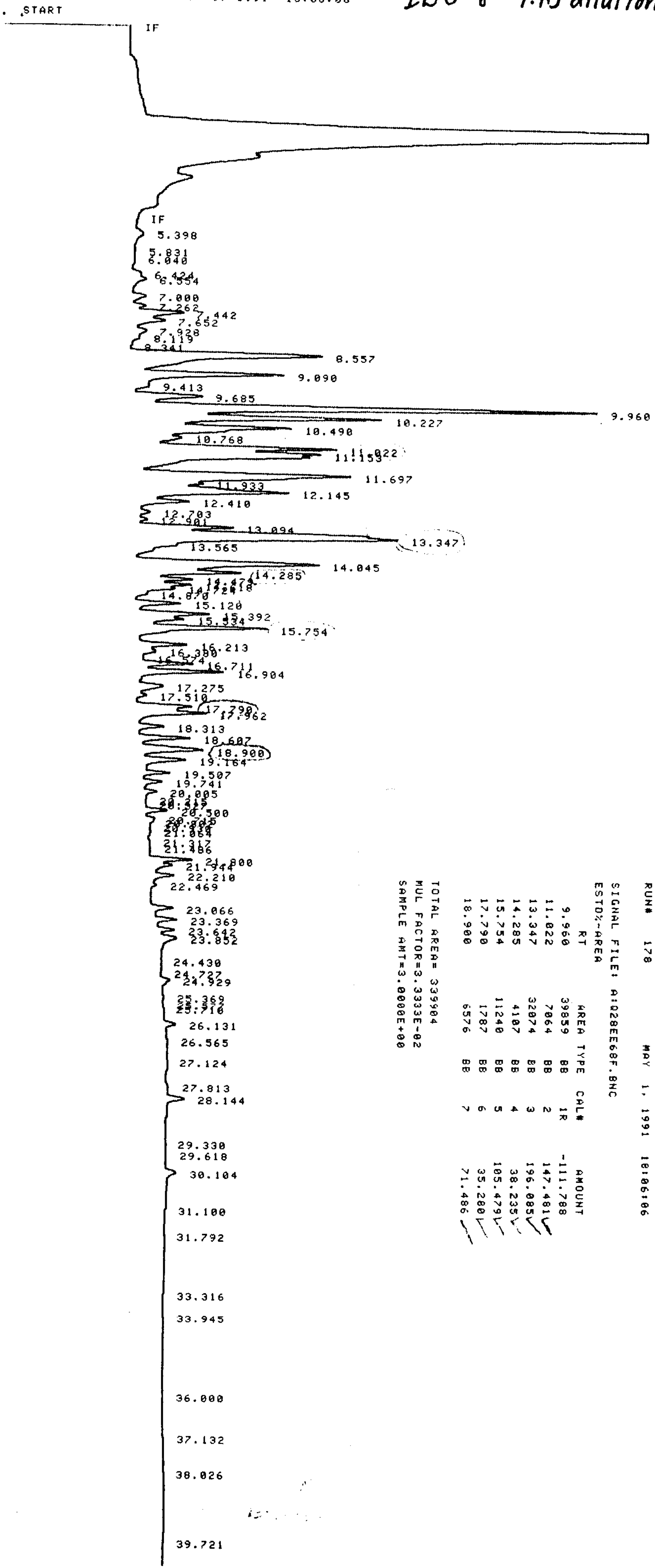
$$\% \text{ water} = \frac{7.44-5.94}{7.44} = 20.2\%$$

30.05 g wet sample = 23.99 g dry sample

cal #	dry value
2	$\frac{1.47481\ \mu g}{0.02399\ kg} = 61.48$ ppb x 10
3	$\frac{1.96085\ \mu g}{0.02399\ kg} = 81.74$ ppb x 10
4	$\frac{0.38235\ \mu g}{0.02399\ kg} = 15.94$ ppb x 10
5	$\frac{1.05479\ \mu g}{0.02399\ kg} = 43.97$ ppb x 10
6	$\frac{0.35280\ \mu g}{0.02399\ kg} = 14.71$ ppb x 10
7	$\frac{0.71486\ \mu g}{0.02399\ kg} = 29.80$ ppb x 10

avg. dry concentration = 412.73 ppb

* RUN # 178 MAY 1, 1991 18:06:06 *IDG-8 1:10 dilution*



RUN# 178 MAY 1, 1991 18:06:06

SIGNAL FILE: A:028EE68F.BNC

ESTD%-AREA

RT	AREA	TYPE	CAL#	AMOUNT
9.960	39859	BB	1R	-111.788
11.022	7064	BB	2	147.481
13.347	32074	BB	3	196.085
14.285	4107	BB	4	38.235
15.754	11240	BB	5	105.479
17.790	1787	BB	6	35.280
18.900	6576	BB	7	71.486

TOTAL AREA= 339904

MUL FACTOR=3.3333E-02

SAMPLE AMT=3.0000E+00