Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1

Discharge Point: N1-2

Date: 10/2/96 Time: 3:15 p.m.

Weather: Dry

Location: Manhole on Oxbow Rd.
Needham, MA

ANALYTICAL DATA

pH: NS

Conductivity: NS umhos

Chloride: 35 mg/l

Fluoride: ND mg/l

Fecal Coliform Bacteria: 11 MPN/100ml

Temperature: NS °c

SAMPLING DATA

Pipe Size: 24 in

Pipe Material/Condition: RCP/Good

Flow Estimate: 20 gpm

Last Precipitation: 9/29/96

Clarity of Flow/Turbidity: Clear

Comments: Visually clean water was observed flowing from this pipe.

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Figure 3.9

File name: N1-2.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1

Discharge Point: N1-3

Date: 10/16/96 Time: 2:35 p.m.

Location: On Charles River St. Needham, MA

Weather: Dry

ANALYTICAL DATA

pH:	6.30		Fluoride	ND	mg/l
Conductivity	270	mohms	Fecal Coliform Bacteria	22	MPN/100ml
Chloride:	39	mg/l	Temperature	11.6	°c

SAMPLING DATA

Pipe Size:	36	in	Flow Estimate:	20	gpm
Pipe Material/Condition	RCP/good		Last Precipitation:	10/9/96	
			Clarity of Flow/Turbidity:		Clear

Comments: Visually clean water was discharging from the pipe.

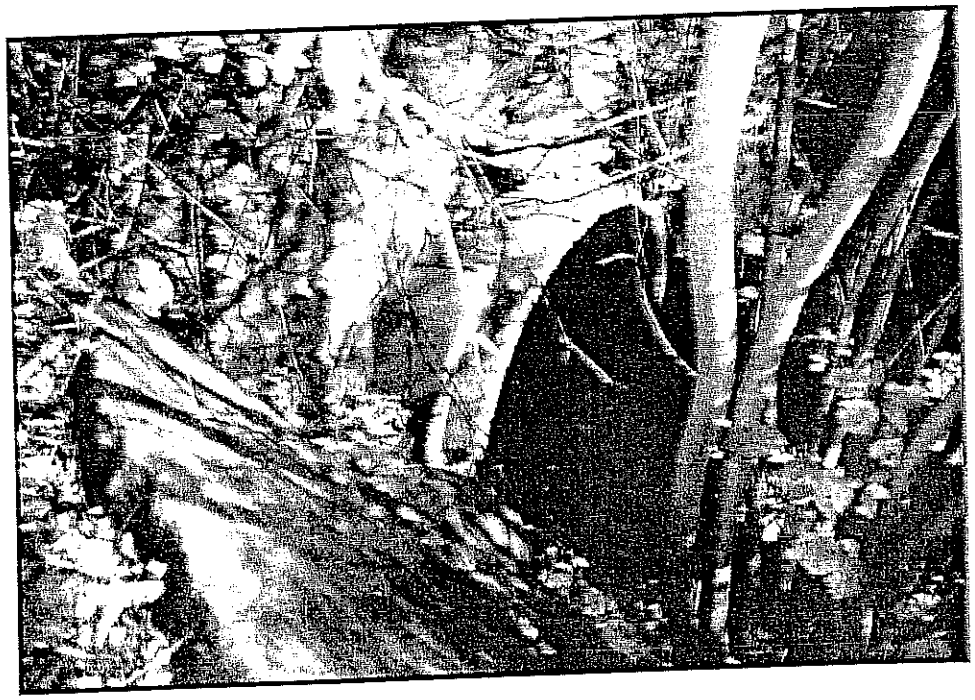

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Figure 3.10

File name: N1-3.pm6

Section III. Dry Weather Sampling Procedure and Results, and Drainage Area Descriptions

Dry Weather Sampling Procedure

As previously mentioned, ten (10) drainage areas were identified for this study in the Consent Order and Memorandum of Understanding. All ten drainage areas discharge to the Charles River through either a pipe, stream, or pond. These areas vary significantly in size, land use and number of sub-areas within them.

A sub-area consists of a defined segment of the drainage area that was sampled. The drainage from these sub-areas eventually flows into the Charles River. The sub-areas were sampled to identify specific areas of potential dry weather pollution within the drainage areas.

The main focus of the Consent Order and Memorandum was to identify "illicit connections" to the stormwater drainage system. This was the primary goal of the field investigations. This involved a physical inspection of each of the ten (10) drainage areas and their associated sub-areas.

The first task involved an inventory of each drainage area, including an inspection and photographing of each discharge to the Charles River. Three (3) areas (N1B, N6C, and N14B) were considered to have no sub-areas. The remaining seven (7) areas (N1B, N8, N10A, N11, N14, N19, and N22) were divided into sub-areas to isolate the source of flow and/or contamination.

Each of the ten (10) areas were physically inspected for flow during dry weather conditions. Samples were taken at each discharge to the Charles River, or, in larger areas, at sub-area boundaries. Dry weather samples were analyzed for fecal coliform bacteria, chloride, fluoride, pH and conductivity (in situ). Additionally, visual observations were made with respect to flow quantity, turbidity, organic matter, pipe material, pipe condition and pipe size.

In large areas, or where elevated fecal coliform bacteria or organic matter were detected, further investigations were conducted. Further investigations included physical inspections of sub-area pipes and manholes upstream of the discharges, to identify the source(s) of contamination. Additionally, an attempt was made to correlate fluoride and chloride levels with fecal coliform bacteria, as these can be an indication of potable water and/or sanitary sewage.

Sampling of residential sub-areas was conducted during periods of anticipated sewer use, such as morning and daytime hours. In large sub-areas, samples were taken at a time which reflected time of travel through the sub-area drainage system. Testing times of commercial and industrial sub-areas were conducted similarly, and reflected those periods when businesses were observed operating with a full staff, such as mid-day.

If no flow existed during all dry weather inspections, the area was determined to have no illicit connections. This was true for areas N-11 and N-22, where the discharge pipes were dry, and there was no indication of flow during dry weather conditions.

During the inspections, numerous outfalls were noted to have an organic brown flocculent present. Analytical testing revealed the flocculent was iron bacteria, which chemically oxidize reduced iron. These bacteria pose no threat to water quality, and actually reduce levels of dissolved iron in stormwater. They do form a residual flocculent, however, which ranges in color from orange to brown. These bacteria are discussed further in Section 4.0.

The following sections provide a discussion of each drainage area, including land use issues, acreage and lengths of drainage pipes. Also included for each drainage area is a map reflecting dry weather sampling results. A summary of the dry weather sampling results with the corresponding sampling times are provided at the end of this section.

Drainage Area Descriptions and Sampling Results

Drainage Area - N1B

This drainage area consists of approximately 150 acres. The area is characterized entirely by residential land use. There are two sub-area discharge points located in this drainage area. The discharge point into the Charles River is south of Whitman Road, as shown in Figure 3.1 and 3.2)

Some of the characteristics which could effect the water quality of this area include the following:

- total length of drain pipe in this area is approximately 2,280 linear feet
- all of the area is sewered
- few birds or animals were observed in the area, except geese in a field near the cul-de-sac of Whitman Road
- the water discharges into a wetland approximately 100 feet from the Charles River

Sub-area - N1B-1

This 36 inch reinforced concrete pipe discharges directly into a wetland south of Whitman Road (see Figure 3.3). The length of pipe in this sub-area is approximately 1,680 linear feet.

Dry Weather Sampling #1

The first dry weather sampling was conducted on September 24, 1996 at 1:40 p.m., following a three day dry period. BETA observed that there was stagnant water in the pipe, but no actual flow. A quarter of the pipe was filled with water and BETA sampled the water in the stagnant pipe to determine if the organic material may be from sewage. The laboratory results revealed the following:

- chloride - 230 mg/l
- fluoride - None Detected (ND)
- fecal coliform - 900 MPN/100 ml.

Dry Weather Sampling #2

The second dry weather sampling was conducted on October 16, 1996 at 3:30 p.m. BETA observed that there was a slow flow in the pipe of approximately 0.1 gpm. The water was slightly turbid. The laboratory results revealed the following:

- chloride - 200 mg/l
- fluoride - ND
- pH - 6.92
- conductivity - 1020 umhos
- fecal coliform - ND

Dry Weather Sampling #3
The third dry weather sampling was conducted on November 14, 1996 at 6:55 a.m. The water in the pipe was stagnant. The laboratory results revealed the following:

- fecal coliform - ND

Sub-area - N1B-2
This twelve (12) inch reinforced concrete pipe discharges into a manhole on Charles River Street. The length of pipe in this sub-area is approximately 600 linear feet (see Figure 3.4).

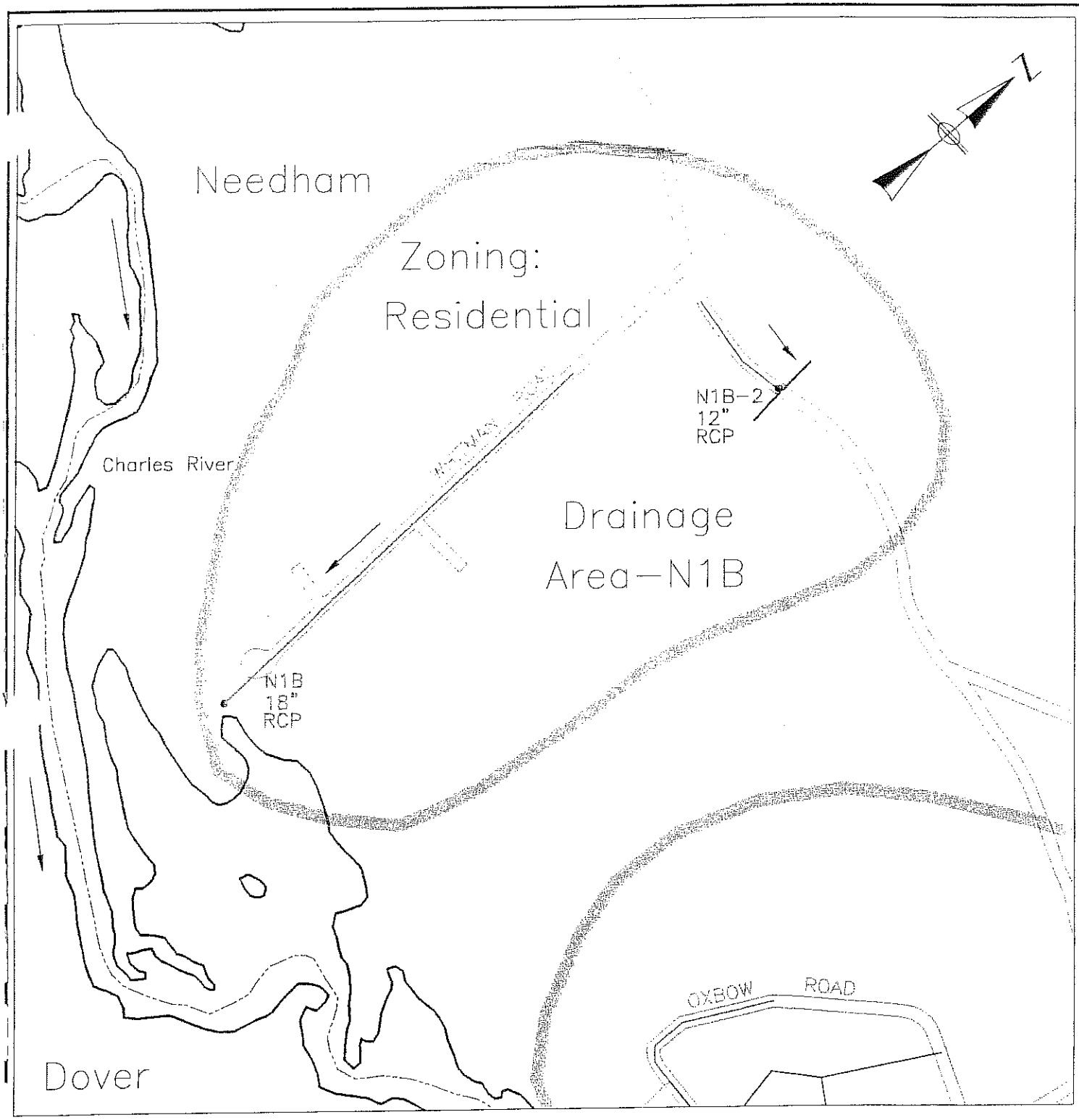
Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 11:45 a.m. No evidence of recent flow was observed.

Table 3.1 summarizes the dry weather sampling locations and results.

Table 3.1 Summary of Dry Weather Sampling for N1B

Sampling Location #	Sampling Location	Pipe Size (in.)-Material	Flow (gpm)	Date	Time	Chloride (mg/l)	Fluoride (mg/l)	Fecal Coliform Bacteria (MPN/100 ml)
N1B								
N1B-1	South of Whitman Road	18-RCP	Stagnant	9/24/96	13:40	230	ND	900
N1B-1	South of Whitman Road	18-RCP	0.1	10/16/96	15:30	200	ND	4
N1B-1	South of Whitman Road	18-RCP	Stagnant	11/14/96	6:55	NS	NS	ND
N1B-2	Culvert at Charles River St.	12-RCP	Dry	11/5/96	11:45	NA	NA	NA

Abbreviations:
AC - Asbestos Concrete
PVC - Polyvinylchloride Pipe
RCP - Reinforced Concrete Pipe
VC - Vitrified Clay
NA- Not Applicable
ND- Not Detected
NS- Not Sampled



Legend

- N1B-1 – Sub-area Discharge/Sampling Location
- N1B – Discharge Point
- 12" – Pipe Size in Inches
- RCP – Pipe Material
- Water
- Town Line
- Drainage Area Boundary
- Stormwater Flow Direction

Not to Scale

Figure 3.1 – Area Layout
Drainage Area – N1B
Needham Stormwater Management

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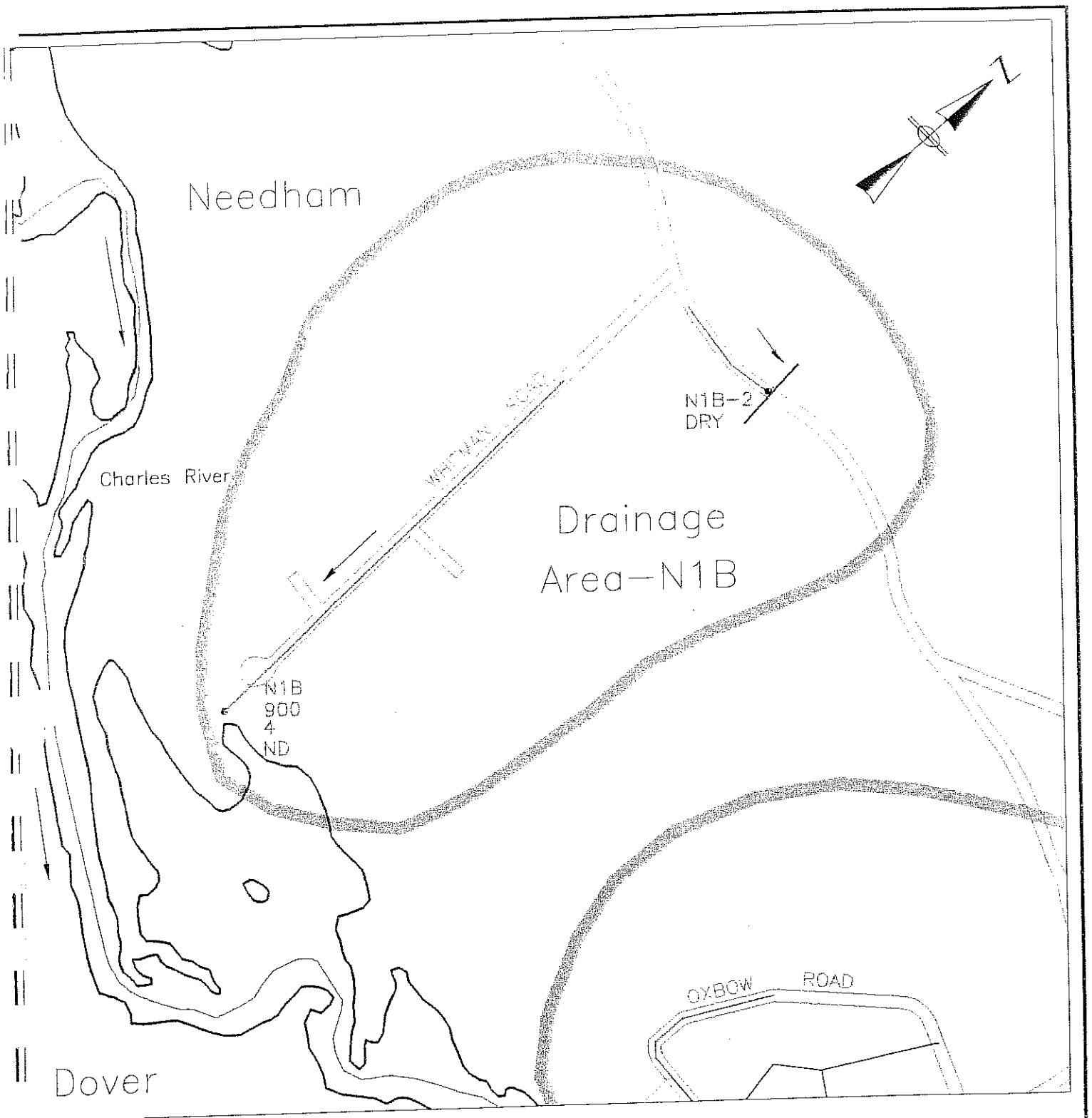

Not to Scale

Figure 3.2 — Sampling Results
Drainage Area — N1B
Needham Stormwater Management

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Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1B

Discharge Point: N1B-1

Date: 10/16/96 Time: 3:30 p.m.

Location: South of Whitman Rd. Needham, MA

Weather: Dry

ANALYTICAL DATA

pH: NS

Conductivity: NS uohms

Chloride: 200 mg/l

Fluoride: ND mg/l

Fecal Coliform Bacteria: 4 MPN/100ml

Temperature: 14.0 °c

SAMPLING DATA

Pipe Size: 18 in.

Pipe Material/Condition: RCP/Good

Flow Estimate: 0.1 gpm

Last Precipitation: 10/9/96

Clarity of Flow/Turbidity: Clear

Comments: Iron bacteria noted.

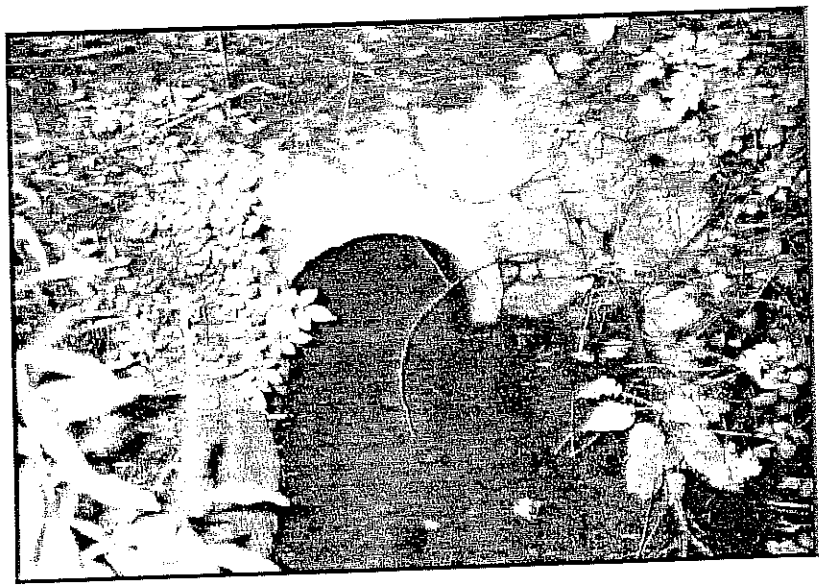

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Figure 3.3

File name: N1B-1.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1B

Discharge Point: N1B-2

Date: 11/5/96 Time: 11:45 a.m.

Location: Culvert at Charles River St. Needham, MA

Weather: Dry

ANALYTICAL DATA

pH: NA

Conductivity: NA umhos

Chloride: NA mg/l

Fluoride: NA mg/l

Fecal Coliform Bacteria: NA MPN/100ml

Temperature: NA °c

SAMPLING DATA

Pipe Size: 12 in.

Pipe Material/Condition: RCP/Good

Flow Estimate: Dry gpm

Last Precipitation: 10/30/96

Clarity of Flow/Turbidity: NA

Comments: The pipe was partially submerged.

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Figure 3.4

File name: N1B-2.pm6

Drainage Area - N1

This drainage area consists of approximately 200 acres. The area is characterized by residential land use. There are six sub-area discharge points within the area. All of the cumulative flow enters the Charles River through a 42-inch RCP located south of Oxbow Road, as shown in Figure 3.5.

Some of the characteristics which could effect the water quality of this area include the following:

- total length of drainage pipe in this area is approximately 7,550 linear feet
- drainage systems within area N1 include 37 catch basins
- most of the area is sewered with a few remaining septic systems
- Country Way is now sewered, but was a problem due to the soils and shallow bedrock in the 1980's
- various breeds of wild life, specifically Canada Geese, migrate in the area. Many geese were noted in Walker Gordon Pond (numerous geese feces also observed) and adjacent athletic fields
- septic systems are located along Walker Gordon Pond
- the Walker Gordon Pond acts as a detention/retention pond half of the discharge area
- Walker Gordon Pond discharges directly to drainage pipes that flow to the Charles River.
- stormwater discharges from a 42 inch reinforced concrete pipe directly to Charles River

Discharge Point - N1

This discharge point is located off of Oxbow Road behind a private residence. The pipe discharges directly into the Charles River. Instead of sampling at this discharge point, BETA sampled from the manhole at Oxbow Road (see Figure 3.6 and 3.7). This manhole is where two separate drainage systems combine and flow to the river. To help distinguish between the two flows, BETA sampled from the manhole instead of the submerged outfall. The length of pipe in this sub-area is approximately 300 linear feet.

Dry Weather Sampling

The sampling was conducted on November 14, 1996 at 7:05 p.m. A flow of approximately 25 gpm was observed discharging from the pipe. Some suds were located at the outfall. The laboratory results revealed the following:

- chloride - 42 mg/l
- fluoride - ND
- fecal coliform - 20 MPN/100 ml.

Sub-area - N1-1

This sampling point was from a manhole located on Oxbow Road (see Figure 3.8). The pipe collects the drainage area north of the manhole. The length of pipe in this sub-area is approximately 1,110 linear feet.

Dry Weather Sampling
The first dry weather sampling of this discharge point was conducted on October 2, 1996 at 3:15 p.m., following a three day dry period. BETA sampled from a manhole on Oxbow Road and observed visually clean water flowing at approximately one (1) gpm. The laboratory results revealed the following:

- chloride - 29 mg/l
- fluoride - ND
- fecal coliform - 130 MPN/100 ml.

Sub-area - N1-2
This sampling point was from the same manhole as N1-1. The pipe collects the drainage area south of the manhole (see Figure 3.9). This discharge point is fed by water from the Walker Pond. The length of pipe in this sub-area is approximately 1,620 linear feet.

Dry Weather Sampling
The dry weather sampling of this discharge point was conducted on October 2, 1996 at 3:15 p.m. BETA sampled from the same manhole referenced above, and observed visually clean water flowing at approximately twenty (20) gpm. The laboratory results revealed the following:

- chloride - 35 mg/l
- fluoride - ND
- fecal coliform - 11 MPN/100 ml.

Sub-area - N1-3
This sampling point is located on Charles River Street and west of Moseley Avenue. The pipe discharges through a culvert below Charles River Street (see Figure 3.10). BETA sampled from the 36 inch culvert. The length of pipe in this sub-area is approximately 2,400 linear feet.

Dry Weather Sampling
The sampling was conducted on October 16, 1996 at 2:35 p.m. A flow of approximately twenty (20) gpm was observed discharging from the pipe. No discoloration of the water was noticed in the flow discharging from the culvert. The laboratory results revealed the following:

- chloride - 39 mg/l
- fluoride - ND
- pH - 6.30
- conductivity - 270 umhos
- fecal coliform - 22 MPN/100 ml.

Sub-area - N1-3A
This sample was taken from Walker Gordon Pond, behind the Walker Pond Ballfield, and west of Charles River Street. BETA sampled from the edge of the pond (see Figure 3.11).

Sub-area - N1-6A

This sampling point is located adjacent to sampling point N1-6. This six (6) inch asbestos concrete pipe is possibly an old floor drain.

Dry Weather Sampling

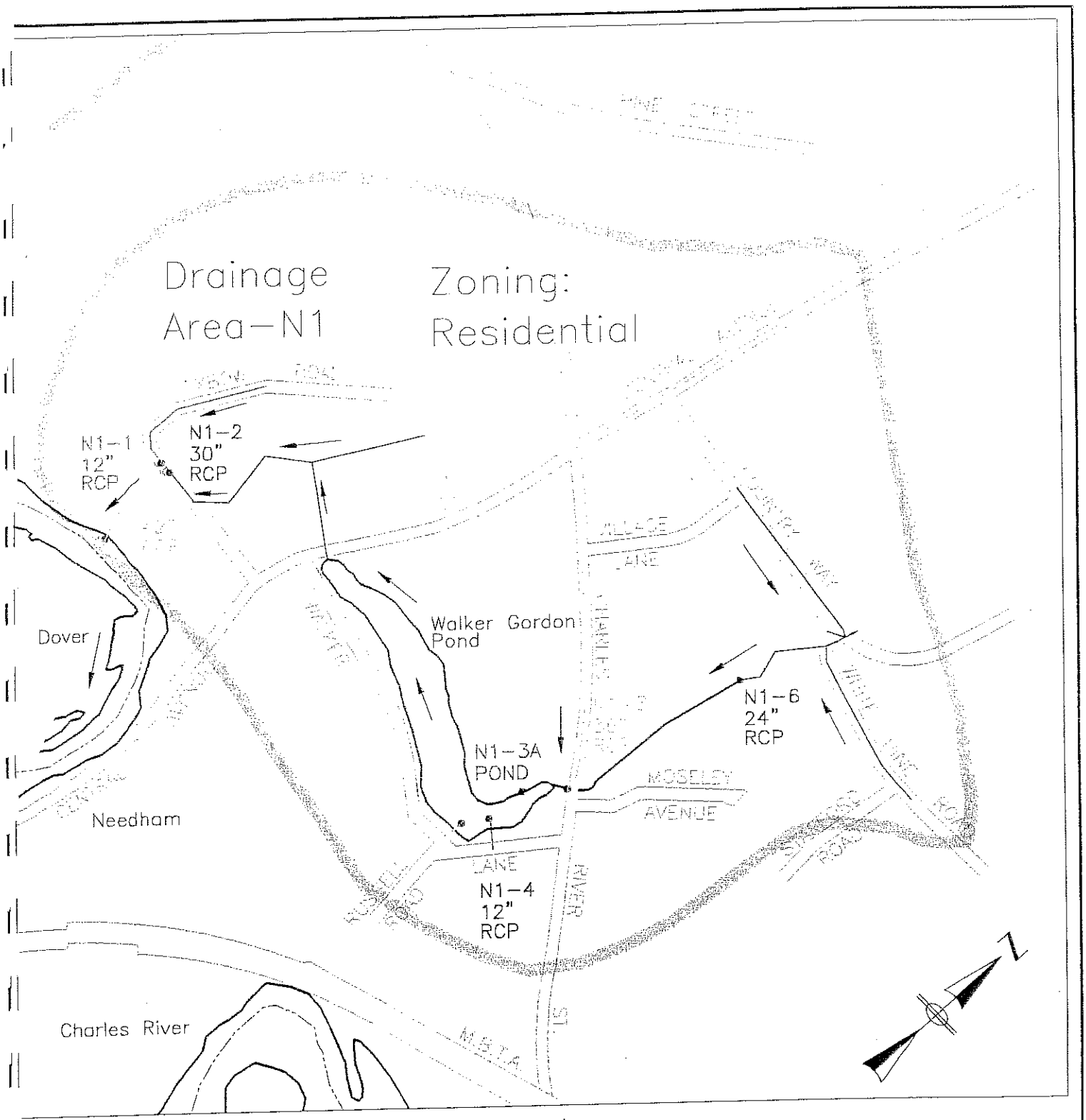
The discharge point was dry on October 16, 1996 at 2:55 p.m. No evidence of recent flow from the pipe was observed.

Table 3.2 summarizes the dry weather sampling locations and results.

Table 3.2 Summary of Dry Weather Sampling for N1

Sampling Location #	Sampling Location	Pipe Size (in.)-Material	Flow (gpm)	Date	Time	Chloride (mg/l)	Fluoride (mg/l)	Fecal Coliform Bacteria (MPN/100 ml)
N1								
N1	South of Oxbow Road	42-RCP	25	11/14/96	7:05	42	ND	20
N1-1	Oxbow Road	12-RCP	1	10/2/96	15:15	29	ND	130
N1-2	Oxbow Road	30-RCP	20	10/2/96	15:15	35	ND	11
N1-3	Culvert at Charles River St.	36-RCP	20	10/16/96	14:35	39	ND	22
N1-3A	Walker Gordon Pond	Pond	NA	10/16/96	14:40	32	ND	16,000
N1-4	Northwest of Walker Lane	12-RCP	Dry	10/16/96	15:05	NA	NA	NA
N1-5	North of Walker Lane	12-RCP	Dry	10/16/96	15:10	NA	NA	NA
N1-6	Southwest of Country Way	24-RCP	7	10/16/96	14:55	33	ND	8
N1-6A	Southwest of Country Way	6-AC	Dry	10/16/96	14:55	NA	NA	NA

Abbreviations:
AC - Asbestos Concrete
PVC - Polyvinylchloride Pipe
RCP - Reinforced Concrete Pipe
VC - Vitrified Clay
NA- Not Applicable
ND- Not Detected
NS- Not Sampled



Legend

- N1–6 – Sub–area Discharge/Sampling Location
- N1 – Discharge Point
- 12" – Pipe Size in Inches
- RCP – Pipe Material

- Water
- Town Line
- Drainage Area Boundary
- Stormwater Flow Direction

Not to Scale

Figure 3.5 – Area Layout
Drainage Area – N1
Needham Stormwater Management

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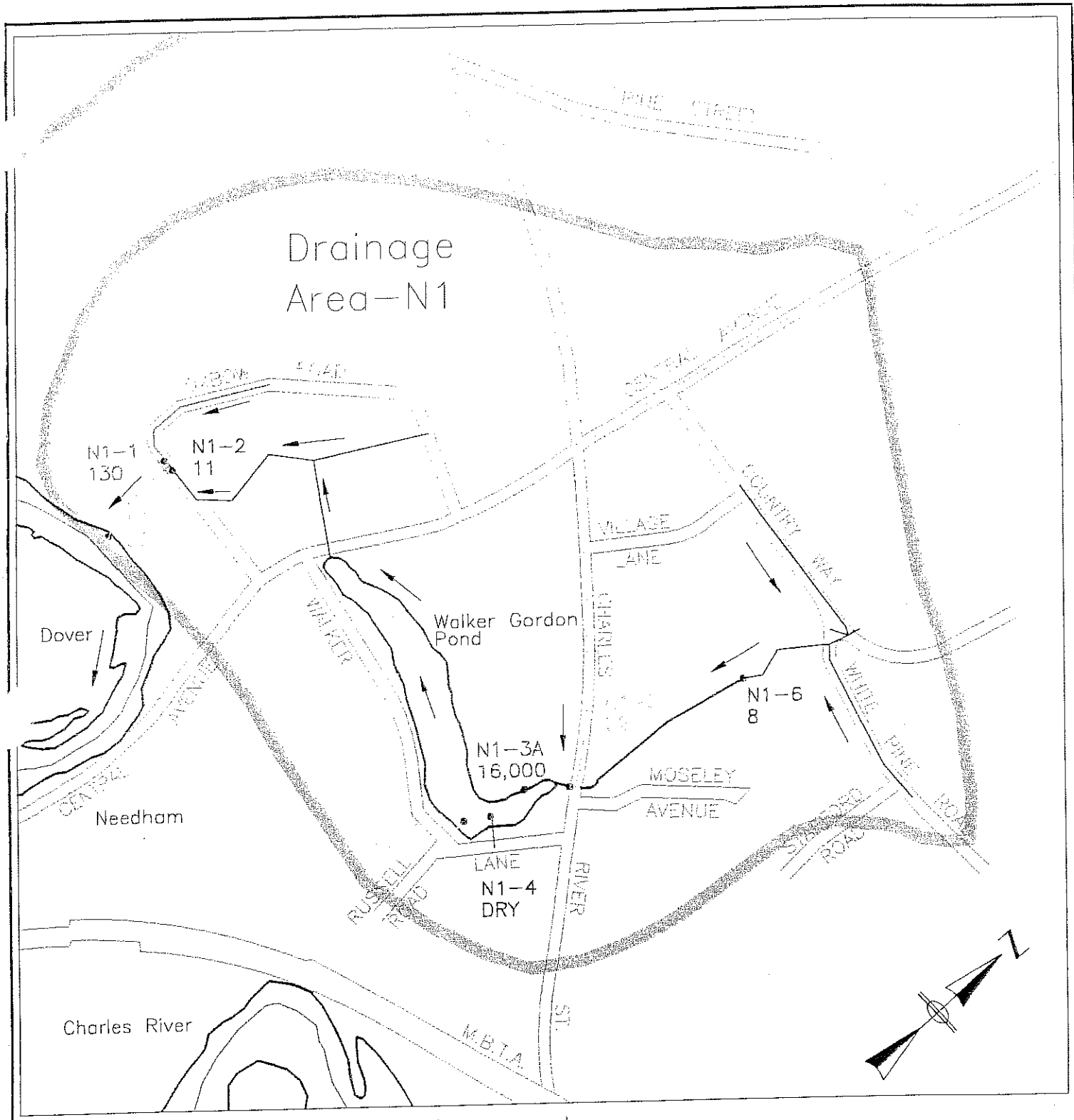

Legend

N1–6	– Sub–area Discharge
N1	– Discharge Point
300	– Fecal Coliform Bacteria
•	– Sampling Location
———	– Water
———	– Town Line
———	– Drainage Area Boundary
←———	– Stormwater Flow Direction

Not to Scale

Figure 3.6 – Sampling Results
Drainage Area – N1
Needham Stormwater Management

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Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1

Discharge Point: N1

Date: 11/14/96 Time 7:05 a.m.

Weather: Dry

Location: South of Oxbow St. Needham, MA

ANALYTICAL DATA

pH:	NS		Fluoride:	ND	mg/l
Conductivity	NS	mohms	Fecal Coliform Bacteria	20	MPN/100ml
Chloride:	42	mg/l	Temperature:	10.2	°c

SAMPLING DATA

Pipe Size:	42	in.	Flow Estimate:	25	gpm
Pipe Material/Condition:	RCP/Good		Last Precipitation:	11/9/96	
			Clarity of Flow/Turbidity:	Clear	

Comments: Visually clean water was discharging from the pipe.

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Figure 3.7

File name: N1.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1

Discharge Point: N1-1

Date: 10/2/96 Time: 3:15 p.m.

Location: Manhole in Oxbow Rd. Needham, MA

Weather: Dry

ANALYTICAL DATA

pH: NS

Conductivity: NS umhos

Chloride: 29 mg/l

Fluoride: ND mg/l

Fecal Coliform Bacteria: 130 MPN/100ml

Temperature: NS °c

SAMPLING DATA

Pipe Size: 12 in.

Pipe Material/Condition: RCP/Good

Flow Estimate: 1 gpm

Last Precipitation: 9/29/96

Clarity of Flow/Turbidity: Clear

Comments: Visually clean water was flowing from this pipe.

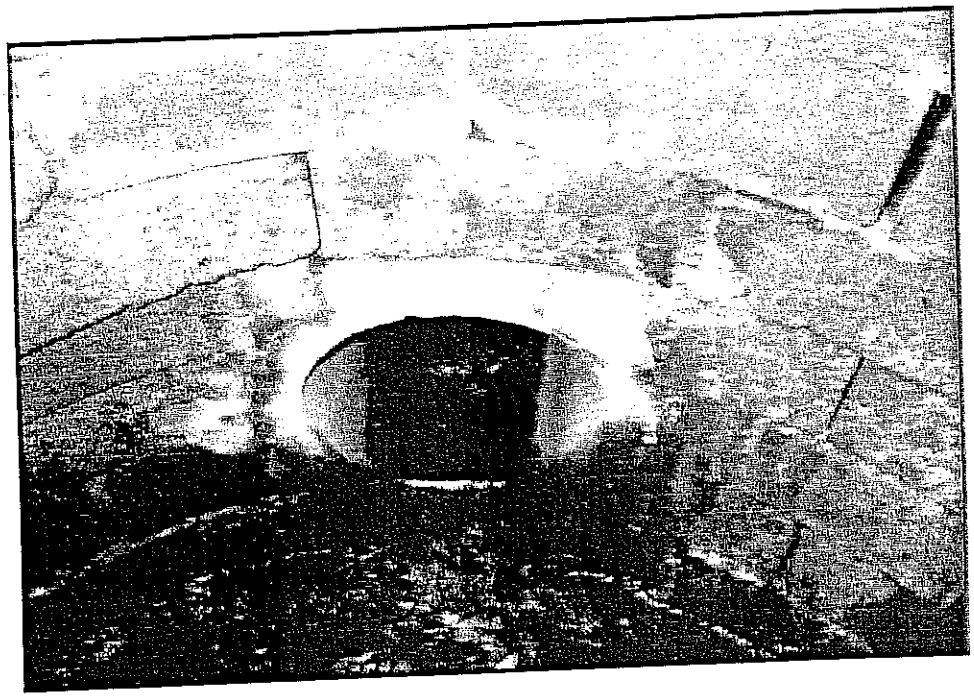

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Figure 3.8

File name: N1-1.pm6

Photograph Log

Job. No. : 917
Date : October 2, 1996
By : SMS

Job Name : Stormwater Management Sudy
Charles River Watershed

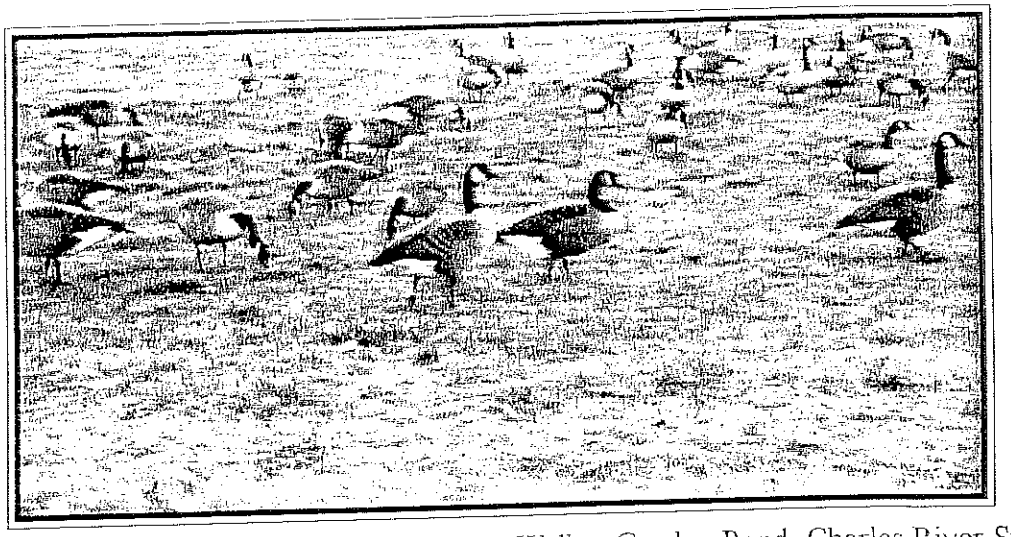

Photo 1: Geese population within sub-area N1 at Walker Gordon Pond, Charles River Street.

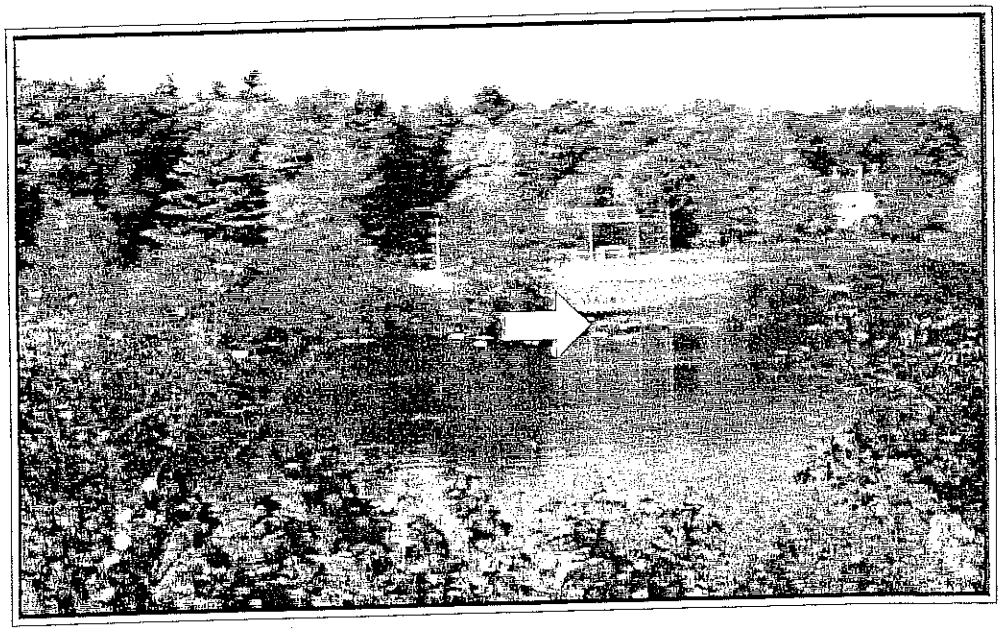

Photo 2: Sampling location N1-3A (refer to the arrow above), Walker Gordon Pond, Charles River Street.

FILE NO. Needham.PM6

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FIGURE 3.11

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1

Discharge Point: N1-4

Date: 10/16/96 Time: 3:05 p.m.

Weather: Dry

Location: Northwest of Walker Lane
Needham, MA

ANALYTICAL DATA

pH: NA

Conductivity: NA umhos

Chloride: NA mg/l

Fluoride: NA mg/l

Fecal Coliform Bacteria: NA MPN/100ml

Temperature: NA °c

SAMPLING DATA

Pipe Size: 12 in

Pipe Material/Condition: RCP/Good

Flow Estimate: Dry gpm

Last Precipitation: 10/9/96

Clarity of Flow/Turbidity: NA

Comments: Discharges directly into Walker Pond. Animal feces were observed at the outfall (refer to the arrow below).

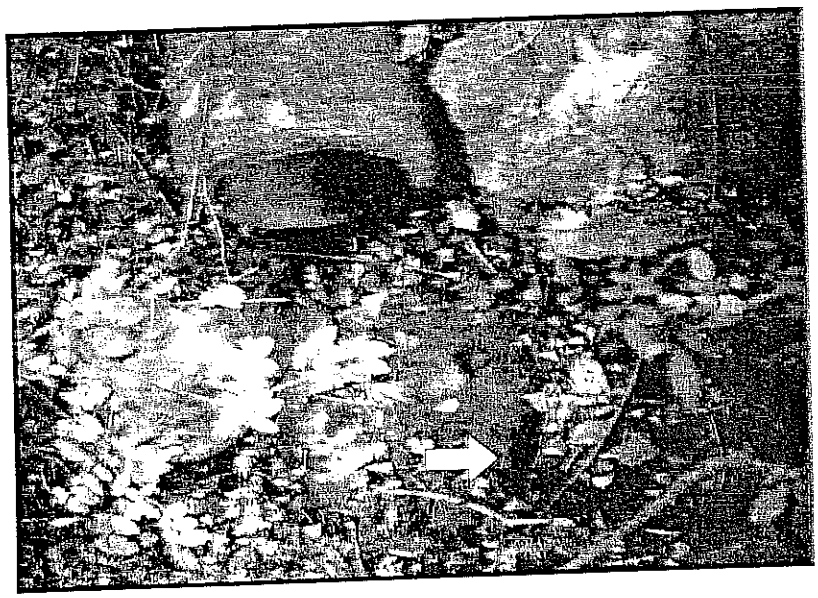

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Figure 3.12

File name: N1-4.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1

Discharge Point: N1-5

Date: 10/16/96 Time: 3:10 p.m.

Location: North of Walker Lane, Needham, MA

Weather: Dry

ANALYTICAL DATA

pH: NA

Conductivity: NA umhos

Chloride: NA mg/l

Fluoride: NA mg/l

Fecal Coliform Bacteria: NA MPN/100ml

Temperature: NA °c

SAMPLING DATA

Pipe Size: 12 in

Pipe Material/Condition: RCP/Good

Flow Estimate: Dry gpm

Last Precipitation: 10/9/96

Clarity of Flow/Turbidity: NA

Comments: No debris was located at the outfall.

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Figure 3.13

File name: N1-5.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N1

Discharge Point: N1-6

Date: 10/16/96 Time: 2:55 p.m.

Location: Southwest of Country Way Needham, MA

Weather: Dry

ANALYTICAL DATA

pH:	6.2		Fluoride	ND	mg/l
Conductivity	260	umhos	Fecal Coliform Bacteria:	8	MPN/100ml
Chloride:	33	mg/l	Temperature:	NS	°c

SAMPLING DATA

Pipe Size:	24	in	Flow Estimate:	7	gpm
Pipe Material/Condition:	RCP/good		Last Precipitation:	10/9/96	
			Clarity of Flow/Turbidity:	Clear	

Comments: Minor dark brown organic material was observed in the discharge pipe. Flow appears to be constant.

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Figure 3.14

File name: N1-6.pm6

Drainage Area - N6C

This drainage area consists of approximately 100 acres. The area is dominated by residential land use. There is one discharge point located in the drainage area. The 12 inch RCP discharge flows into a wetland west of Crestview Road (see Figure 3.15).

Some of the characteristics of this area include the following:

- total length of drain pipe in this area is approximately 1,080 linear feet
- drainage systems within area N6C include six (6) catch basins
- none of the area is sewered
- nine (9) septic systems are located in the drainage area
- the outfall is located 1,000 feet from the Charles River
- historic problems of MWRA sewer overflows have occurred in December of 1994, several MWRA sewer manholes surcharged and overflowed, releasing approximately two (2) million gallons of wastewater
- no wildlife impacts to surface water were noted
- dry weather flows and small storm flows infiltrate into the muck and organic soils of the wetland and Charles River flood plain. This allows for volatile organic compounds (VOC) volatilization, a reduction in oil, grease, total solids and total suspended solids prior to discharge into the Charles River.

Sub-area - N6C-1

This pipe discharges into a wetlands located behind a home southwest of Crestview Road (see Figure 3.16 and 3.17). The outfall to the Charles River is located 1,000 feet from this sampling point.

Dry Weather Sampling #1

BETA sampled the discharge pipe on September 24, 1996 at 1:50 p.m. There was no observed flow in the pipe. A sample was taken from the stagnant pool at the end of pipe to determine if the water may be from sewage. The laboratory results are as follows:

- chloride - 54 mg/l
- fluoride - ND
- pH - 6.60
- conductivity - 330 umhos
- fecal coliform - 240 MPN/100 ml.

Dry Weather Sampling #2

BETA sampled the discharge pipe on November 15, 1996 at 7:10 a.m. There was no observed flow in the pipe. A sample was taken from the stagnant pool at the end of pipe. The laboratory results are as follows:

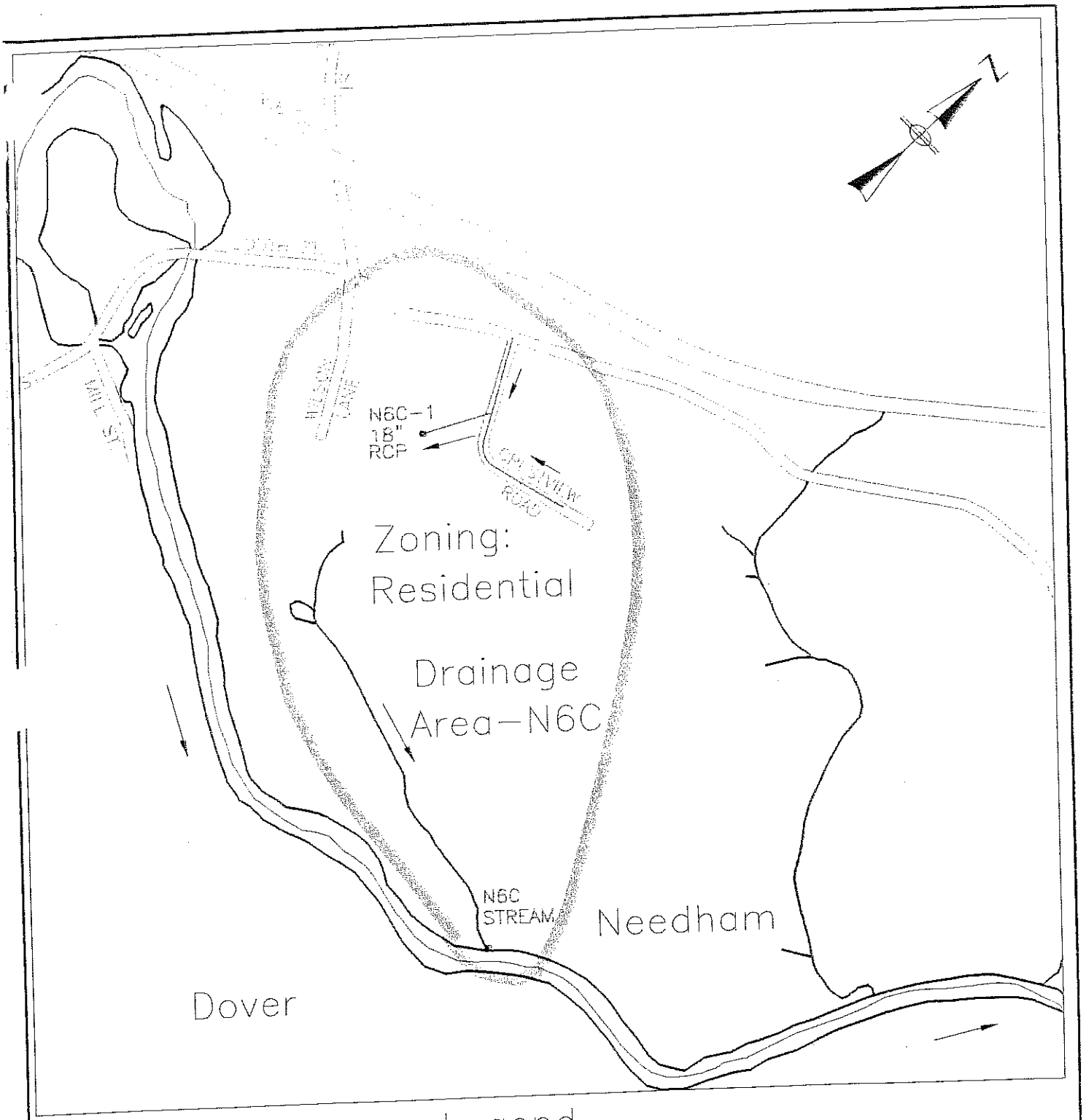
- fecal coliform - ND

Table 3.3 summarizes the dry weather sampling locations and results.

Table 3.3 Summary of Dry Weather Sampling for N6C

Sampling Location #	Sampling Location	Pipe Size (in.)-Material	Flow (gpm)	Date	Time	Chloride (mg/l)	Fluoride (mg/l)	Fecal Coliform Bacteria (MPN/100 ml)
N6C								
N6C	Southwest of Crestview Road	18-RCP	Stagnant	9/24/96	13:50	54	ND	240
N6C	Southwest of Crestview Road	18-RCP	Stagnant	11/15/96	7:10	NS	NS	ND

Abbreviations:
AC - Asbestos Concrete
PVC - Polyvinylchloride Pipe
RCP - Reinforced Concrete Pipe
VC - Vitrified Clay
NA- Not Applicable
ND- Not Detected
NS- Not Sampled



Legend

- N6C-1 – Sub-area Discharge/Sampling Location
- N6C – Discharge Point
- 12" – Pipe Size in Inches
- RCP – Pipe Material

- Water
- Town Line
- Drainage Area Boundary
- Stormwater Flow Direction

Not to Scale

Figure 3.15 – Area Layout
Drainage Area – N6C
Needham Stormwater Management

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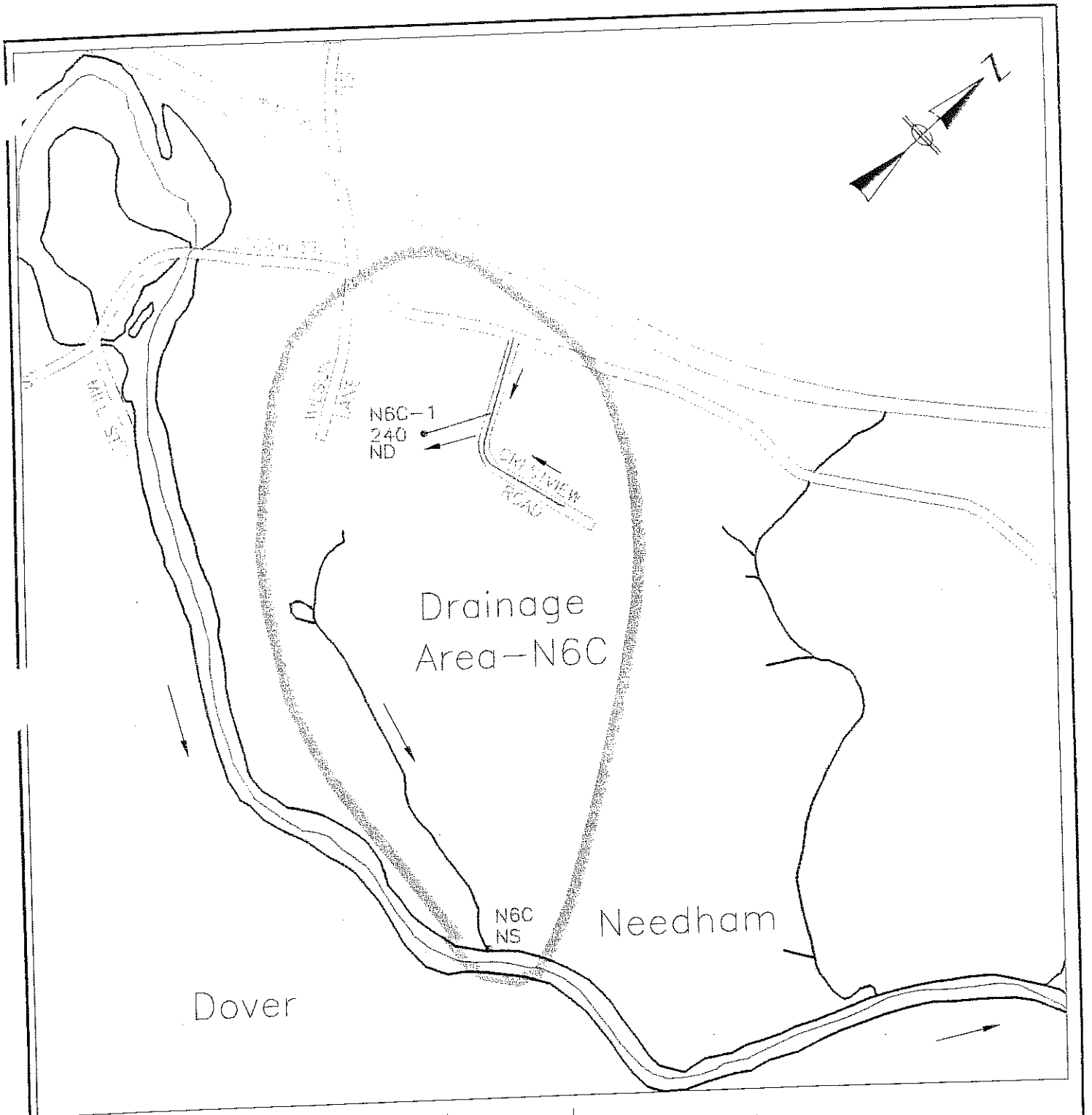

Legend

N6C-1 – Sub-area Discharge
N6C – Discharge Point
300 – Fecal Coliform Bacteria
• – Sampling Location

– Water
– Town Line
– Drainage Area Boundary
– Stormwater Flow Direction

Not to Scale

Figure 3.16 – Sampling Results
Drainage Area – N6C
Needham Stormwater Management

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Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N6C

Discharge Point: N6C-1

Date: 9/24/96 Time: 1:50 p.m.

Location: Southwest of Crestview Rd. Needham, MA

Weather: Dry

ANALYTICAL DATA

pH: 6.60

Conductivity: 330 uohms

Chloride: 54 mg/l

Fluoride: ND mg/l

Fecal Coliform Bacteria: 240 MPN/100ml

Temperature: 10.9 °c

SAMPLING DATA

Pipe Size: 18 in.

Pipe Material/Condition: RCP/Good

Flow Estimate: Stagnant gpm

Last Precipitation: 9/18/96

Clarity of Flow/Turbidity: Clear

Comments: Visually clean water was observed at the outfall.

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Figure 3.17

File name: N6C-1.pm6

Drainage Area - N8

This drainage area is approximately 175 acres in size. The area is characterized by residential land use. There are five (5) sub-area discharge points located in the area (see Figure 3.18).

Some of the characteristics which could effect the water quality of this area include the following:

- total length of drain pipe in this area is approximately 11,670 linear feet
- drainage systems within area N8 include 90 catch basins
- all except one (1) street in the sub-area have sanitary sewers
- septic systems are located along South Street
- four (4) of the five (5) discharges flow through a small pond
- various breeds of wildlife, specifically Canada Geese, migrate in the pond adjacent to the Charles River. Many geese and geese feces were observed.
- the pond retains dry weather and stormwater flows of area N-8. This accomplishes the following:
    - allows sediments to settle out (sediment/suspended solids)
    - provides retention/detention of stormwater effluent and extended (>3 day detention) for effluent during dry periods
    - the pond likely results in a reduction of solids, suspended solids, and metals discharged to the Charles River. The fecal coliform bacteria, which would normally tend to die-off during detention in the pond, are increased by the geese population.

Discharge Point - N8

This sampling point is from a culvert that discharges directly into the Charles River. The culvert is fed by a pond which is supplied by discharge pipes N8-1 and N8-2 (see Figures 3.19 and 3.20). Numerous geese were found to be living around the pond.

Dry Weather Sampling

A dry weather sample was taken from the inlet of this ten (10) feet arch culvert on September 24, 1996 at 1:15 p.m. An approximate flow of five (5) gallons per minute (gpm) of visually clean water was observed discharging from this point. Laboratory results revealed the following:

- chloride - 54 mg/l
- fluoride - ND
- fecal coliform - 300 MPN/100 ml.

The fecal coliform bacteria exceeded swimmable water criteria. Geese and water fowl are problematic in this vicinity, and undoubtedly impact fecal coliform. Geese numbers have exceeded fifty (50) during several site inspections of this study.

Sub-area - N8-1
This sampling point is located south of Wildwood Drive. Stormwater discharges into the pond before discharging to the Charles River (see Figure 3.21). This pond acts as a detention pond for some pollutant removal. The total length of pipe in this sub-area is approximately 3,540 linear feet.

Dry Weather Sampling #1
A sample was taken on September 24, 1996 at 1:20 p.m. An approximate flow of five (5) gpm was observed. The water was visually clean water with no evidence of suspended solids. The laboratory results revealed the following:

- chloride - 79 mg/l
- fluoride - ND
- fecal coliform - 140 MPN/100 ml.

Dry Weather Sampling #2
A sample was taken on November 14, 1996 at 6:45 a.m. An approximate flow of twelve (12) gpm was observed. The water was visually clean water with no evidence of suspended solids. The laboratory results revealed the following:

- chloride - 74 mg/l
- fluoride - ND
- fecal coliform - 40 MPN/100 ml.

Sub-area - N8-2
This sampling point is located south of Wildwood Drive. Stormwater discharges into the pond before discharging to the Charles River (see Figure 3.22). This pond acts as a detention pond for some pollutant removal. The length of pipe in this sub-area is approximately 4,980 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on September 24, 1996 at 1:25 p.m. and October 16, 1996 at 1:40 p.m. The pipe is partially submerged.

Sub-area - N8-3
This 15 inch corrugated metal pipe discharges in back of a house southeast of Fox Hill Road. The water is carried to the Charles River through a small stream (see Figure 3.23). The length of pipe in this sub-area is approximately 390 linear feet.

Dry Weather Sampling
The sampling was conducted on October 16, 1996 at 1:25 p.m. A flow of approximately one (1) gpm was observed discharging from the pipe. The flow was likely increased by the recently watered lawn adjacent to the discharge. No discoloration of the water was noticed in the flow. The laboratory results revealed the following:

- chloride - 56 mg/l
- fluoride - ND
- pH - 6.10
- conductivity - 280 umhos
- fecal coliform - 500 MPN/100 ml.

Sub-area - N8-4
Sampling location N8-4 is located south of High Rock Street. The discharge pipe is a 20 inch reinforced concrete pipe (see Figure 3.24) The length of pipe in this sub-area is approximately 900 linear feet. A 4 inch PVC pipe was noted, which was tied into roof drains of the adjacent residence (see Figure 3.25)

Dry Weather Sampling
The sampling was conducted on October 16, 1996 at 1:15 p.m. A flow of approximately 0.1 gpm was observed discharging from the pipe. No discoloration of the water was noticed in the flow. The laboratory results revealed the following:

- chloride - 66 mg/l
- fluoride - ND
- pH - 6.30
- conductivity - 630 umhos
- fecal coliform - 80 MPN/100 ml.

Sub-area - N8-5
This sampling point located south of Lantern Lane. The discharge pipe is a 12 inch metal pipe (see Figure 3.26). The length of pipe in this area is approximately 1,860 linear feet.

Dry Weather Sampling
A sample was taken on October 16, 1996 at 1:30 p.m. An abundance of iron bacteria flocculent was noticed in the pipe and in the discharging stream. A flow of approximately three (3) gpm was noted. Also, a thin shiny film was observed on the surface of the water in the outfall area. The laboratory results revealed the following:

- chloride - 61 mg/l
- fluoride - 0.42 mg/l
- pH - 6.10
- conductivity - 310 umhos
- fecal coliform - 2 MPN/100 ml.

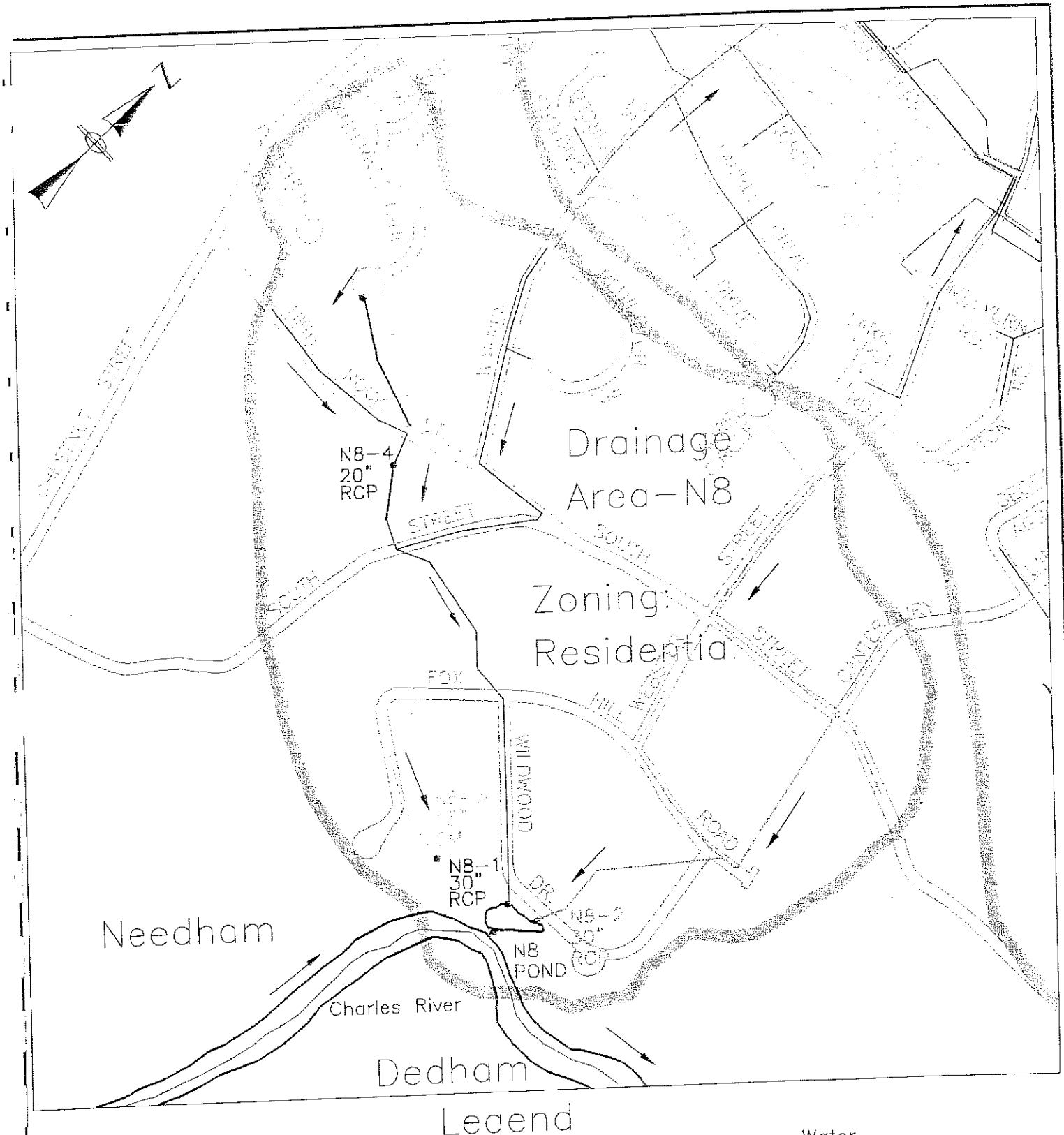
Table 3.4 summarizes the dry weather sampling locations and results.

Table 3.4 Summary of Dry Weather Sampling for N8

Sampling Location #	Sampling Location	Pipe Size (in.)-Material	Flow (gpm)	Date	Time	Chloride (mg/l)	Fluoride (mg/l)	Fecal Coliform Bacteria (MPN/100 ml)
N8								
N8	South of Wildwood Drive	10'-Archway	5	9/24/96	13:15	54	ND	**300**
N8-1	South of Wildwood Drive	30-RCP	5	9/24/96	13:20	79	ND	**140**
N8-1	South of Wildwood Drive	30-RCP	12	11/14/96	6:45	74	ND	**40**
N8-2	South of Wildwood Drive	30-RCP	Dry	9/24/96	13:25	NA	NA	**NA**
N8-2	South of Wildwood Drive	30-RCP	Dry	10/16/96	13:40	NA	NA	**NA**
N8-3	Southeast of Fox Hill Road	15-CM	1	10/16/96	13:25	56	ND	**500**
N8-4	South of High Rock Street	20-RCP	0.1	10/16/96	13:15	66	ND	**80**
N8-5	South of Lantern Lane	12-AC	3	10/16/96	13:30	61	0.42	**2**

Abbreviations:
AC - Asbestos Concrete
PVC - Polyvinylchloride Pipe
RCP - Reinforced Concrete Pipe
VC - Vitrified Clay

NA- Not Applicable
ND- Not Detected
NS- Not Sampled



Not to Scale

Figure 3.18 – Area Layout
Drainage Area – N8
Needham Stormwater Management

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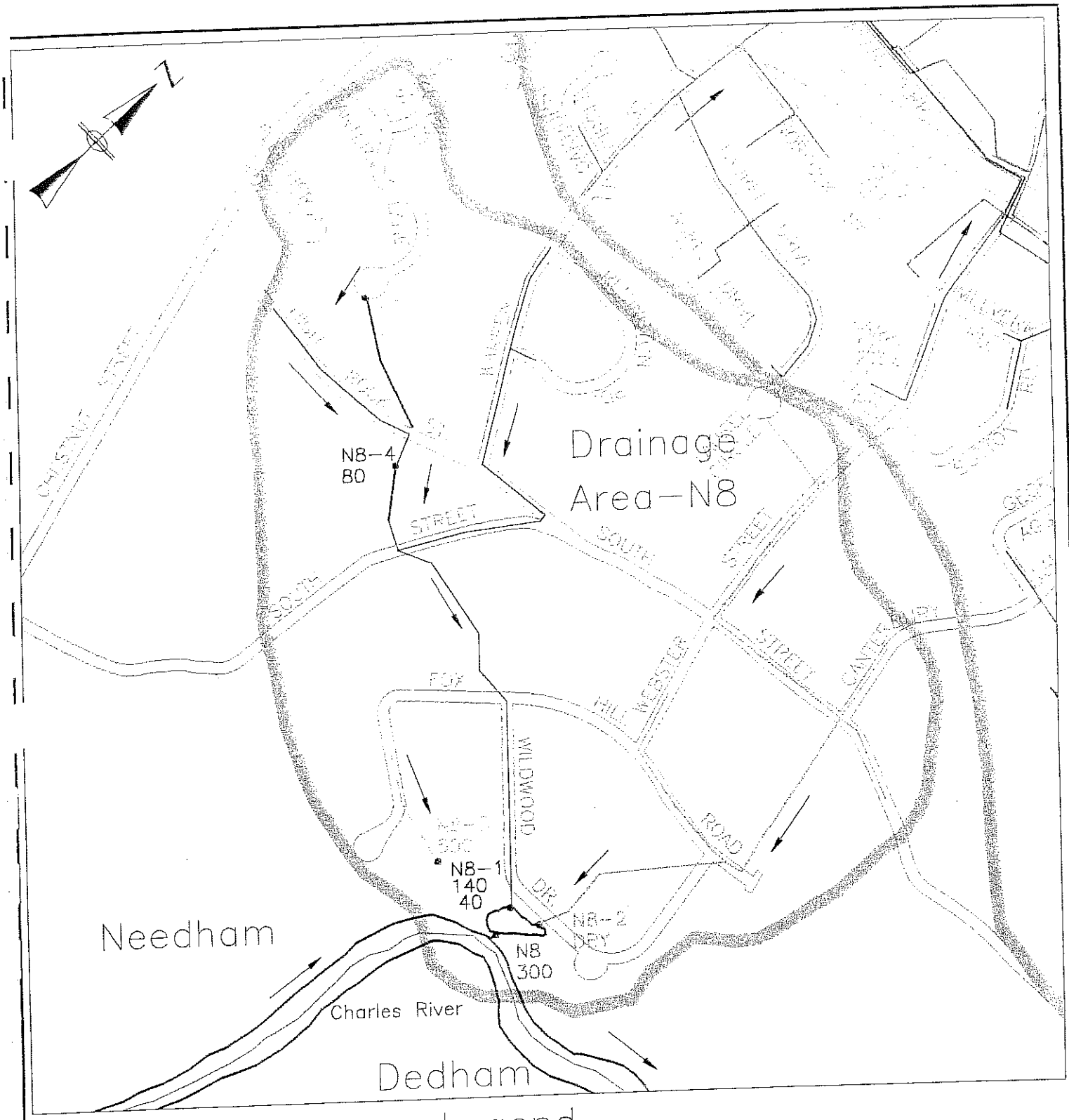

Legend

N8-3	– Sub-area Discharge
N8 300	– Discharge Point – Fecal Coliform Bacteria
•	– Sampling Location
———	– Water
———	– Town Line
▒▒▒	– Drainage Area Boundary
←———	– Stormwater Flow Direction

Not to Scale

Figure 3.19 – Sampling Results
Drainage Area – N8
Needham Stormwater Management

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Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N8

Discharge Point: N8

Date: 9/24/96 Time: 1:35 p.m.

Weather: Dry

Location: South of Wildwood Drive
Needham, MA

ANALYTICAL DATA

pH: NS

Conductivity: NS umhos

Chloride: 54 mg/l

Fluoride: ND mg/l

Fecal Coliform Bacteria: 300 MPN/100ml

Temperature: 12.6 °c

SAMPLING DATA

Pipe Size: 10 feet in.

Pipe Material/Condition: Concrete Archway

Flow Estimate: 5 gpm

Last Precipitation: 9/18/96

Clarity of Flow/Turbidity: Clear

Comments: Visually clear water was discharging through the archway.

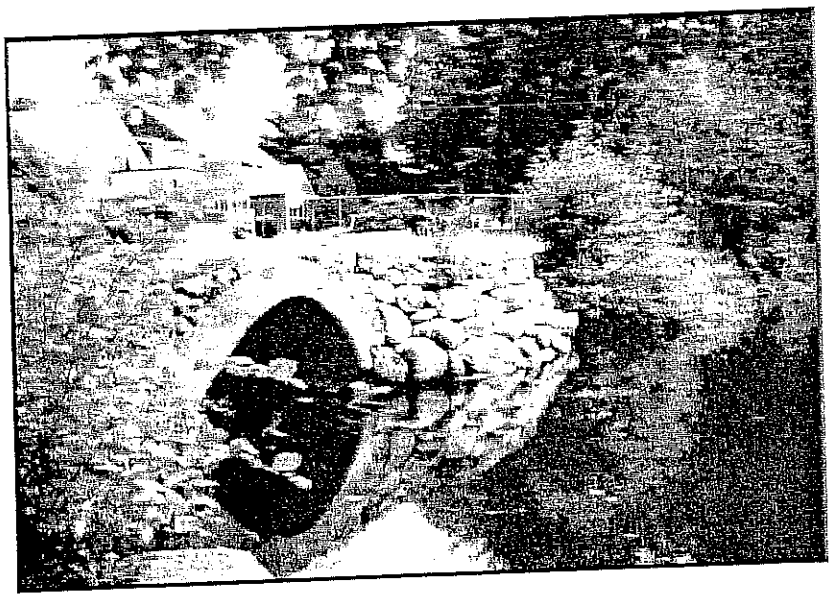

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Figure 3.20

File name: N8.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N8

Discharge Point: N8-1

Date: 11/14/96 Time: 6:45 a.m.

Location: South of Wildwood Drive Needham, MA

Weather: Dry

ANALYTICAL DATA

pH: NS

Conductivity: NS umhos

Chloride: 74 mg/l

Fluoride: ND mg/l

Fecal Coliform Bacteria: 40 MPN/100ml

Temperature: 13.6 °c

SAMPLING DATA

Pipe Size: 30 in

Pipe Material/Condition: RCP/Good

Flow Estimate: 12 gpm

Last Precipitation: 11/9/96

Clarity of Flow/Turbidity: Clear

Comments: Visually clean water was discharging with no evidence of suspended solids.

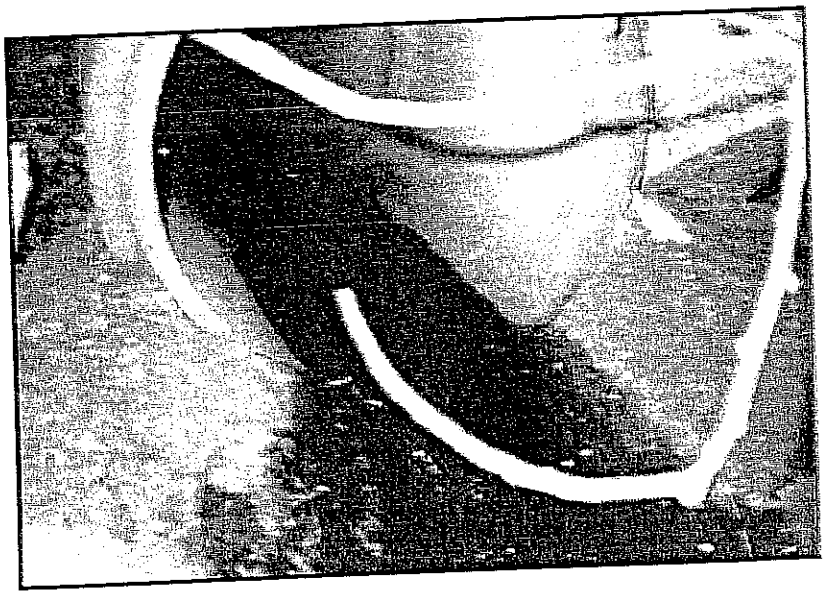

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Figure 3.21

File name: N8-1.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N8

Discharge Point: N8-3

Date: 10/16/96 Time: 1:25 p.m.

Location: End of Fox Hill Road
Needham, Massachusetss

Weather: Dry

ANALYTICAL DATA

pH:	6.1		Fluoride:	ND	mg/l
Conductivity:	280	uohms	Fecal Coliform Bacteria:	500	MPN/100ml
Chloride:	56	mg/l	Temperature:	13.2	°c

SAMPLING DATA

Pipe Size:	15	in.	Flow Estimate:	1	gpm
Pipe Material/Condition:	Corrugated metal pipe/Fair		Last Precipitation:	10/9/96	
			Clarity of Flow/Turbidity:	Clear	

Comments: Flow could be attributed to the sprinklers next to the discharge. Geese populations in the area.

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Figure 3.23

File name: N8-3.pm6

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N8

Discharge Point: N8-4

Date: 10/16/96 Time: 1:15 p.m.

Weather: Dry

Location: South of High Rock St.
Needham, MA

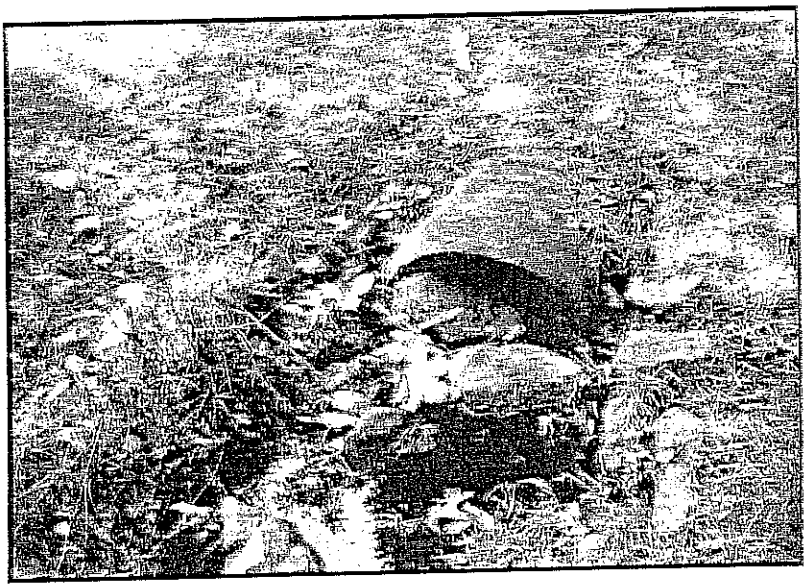
ANALYTICAL DATA

pH:	6.30		Fluoride:	ND mg/l
Conductivity:	630	uohms	Fecal Coliform Bacteria:	80 MPN/100ml
Chloride:	66	mg/l	Temperature:	13.2 °c

SAMPLING DATA

Pipe Size:	20	in.	Flow Estimate:	0.1 gpm
Pipe Material/Condition:	RCP/Good		Last Precipitation:	10/9/96
			Clarity of Flow/Turbidity:	Clear

Comments: Clear water was observed in the stream.



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File name: N8-4.pm6

Figure 3.24

Stormwater Drain Outfall Inspection Report

PROJECT NAME: Needham, MA Stormwater Investigation

Subarea: N8

Discharge Point: N8-4A

Date: 10/16/96 Time: 1:15 p.m.

Location: South of High Rock St. Needham, MA

Weather: Dry

ANALYTICAL DATA

pH: NA

Conductivity: NA umhos

Chloride: NA mg/l

Fluoride: NA mg/l

Fecal Coliform Bacteria: NA MPN/100ml

Temperature: NA °c

SAMPLING DATA

Pipe Size: 4 in.

Pipe Material/Condition: PVC/Good

Flow Estimate: Dry gpm

Last Precipitation: 10/9/96

Clarity of Flow/Turbidity: NA

Comments: One pipe appeared to be running from the backyard of the abutting house. It could possibly be tied into the roof drains.

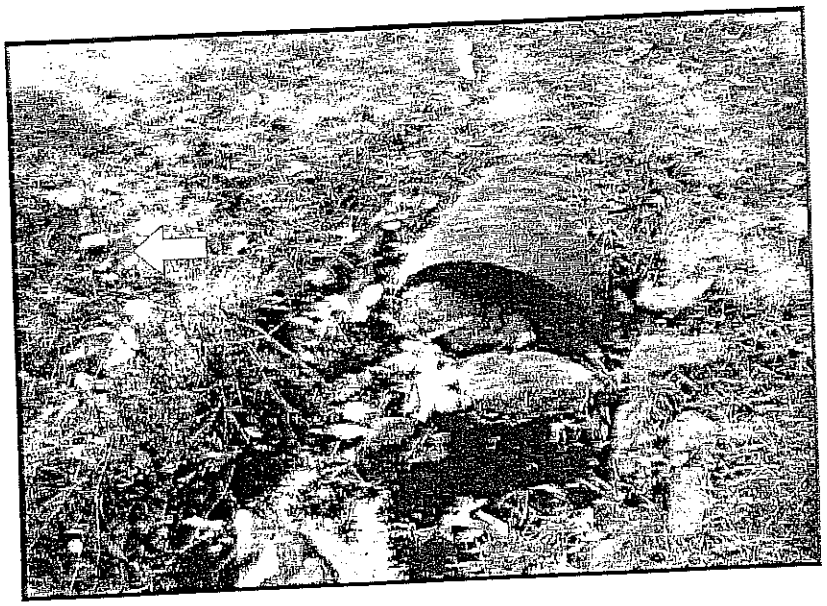

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Figure 3.25

File name: N8-4A.prn6

Drainage Area - N10A

This drainage area is approximately 1,000 acres in size, and is the largest area of our study. The area is characterized by residential housing, commercial businesses, a pond (Needham Reservoir), the Needham Golf Course, the Town of Needham DPW, the MBTA Railroad, several schools and athletic fields. There are twenty-three (23) discharge points located throughout the area. All of the cumulative flow enters the Charles River through Alder Brook, located west of Dedham Avenue (see Figure 3.27 and Figure 3.28).

Some of the characteristics which could effect the water quality of this area include the following:

- total length of drain pipe in this area is approximately 96,750 linear feet
- drainage systems within area N10A include 885 catch basins
- all of the area is sewered. A small percentage of homes have septic systems.
- fertilizers and pesticides are used at the Needham Golf Course and Town of Needham athletic fields
- the Needham Reservoir collects a portion of the drainage area before discharging to the Alder Brook. This reservoir serves as a retention/detention pond for flows from several sub-areas prior to discharge to the Charles River.
- the Alder Brook also allows settling time for stormwater before discharging into the Charles River. This allows for some VOC volatilization, and settlement of oil; grease; total solids; total suspended solids, including associated metals; and increased fecal coliform die-off.

Sub-area - N10A-1

The first sampling point located in this sub-area is located 1,000 feet west of Green Street. This 24 inch reinforced concrete pipe discharges into a tributary stream which flows into the Needham Reservoir (see Figure 3.29). The length of pipe in this sub-area is approximately 1,020 linear feet.

Dry Weather Sampling

BETA observed no flow from this discharge point on October 8, 1996 at 1:20 p.m. No evidence of recent flow was noted.

Sub-area - N10A-1A

The sampling point is located west of Green Street, adjacent to N10A-1 (see Figure 3.30). This 12 inch reinforced concrete pipe, which appears to collect runoff from the golf course, discharges into a tributary stream which flows into the Needham Reservoir.

Dry Weather Sampling

BETA observed no flow from this discharge point on October 8, 1996 at 1:20 p.m. No evidence of recent flow was noted.

Sub-area - N10A-1B
The sampling point is located west of Green Street, adjacent to N10A-1. This twelve (12) inch reinforced concrete pipe, which appears to collect runoff from the golf course, discharges into a tributary stream which flows into the Needham Reservoir (see Figure 3.31).

Dry Weather Sampling
The sampling was conducted on October 8, 1996 at 1:20 p.m. There was a flow of approximately two (2) gpm discharging from the pipe. No discoloration of the water was noticed in the flow from the outfall. The laboratory results revealed the following:

- chloride - 130 mg/l
- fluoride - ND
- pH - 6.92
- conductivity - 600 umhos
- fecal coliform - 3,000 MPN/100 ml.

Sub-area - N10A-2
This discharge pipe is located south of Great Plain Avenue. The length of pipe in this sub-area is approximately 120 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 1:28 p.m.

Sub-area - N10A-3
This 12 inch reinforced concrete pipe located in the DPW parking lot discharges into a down gradient stream of the Needham Reservoir (see Figure 3.32). This piping collects runoff from the DPW parking lot and roads. The length of pipe in this sub-area is approximately 780 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on October 8, 1996 at 1:30 p.m. Some iron bacteria flocculent was observed at the discharge area.

Sub-area - N10A-4
This 12 inch reinforced concrete pipe discharges to a culvert underneath Dedham Avenue. This pipe collects runoff from Dedham Avenue. The length of pipe in this sub-area is approximately 900 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 1:35 p.m.

Sub-area - N10A-5
Sampling point N10A-5 is located west of the Needham Athletic Fields (west of first base). This 48 inch reinforced concrete pipe discharges into a stream which flows into the Needham Reservoir (see Figure 3.34). The length of pipe in this sub-area is approximately 4,500 linear feet.

Dry Weather Sampling #1
The sampling was conducted on October 8, 1996 at 12:48 p.m. There was a flow of approximately ten (10) gpm discharging from the pipe. A slime layer was noticed on the inside of the pipe. No discoloration of the water was noticed in the flow from the outfall. The laboratory results revealed the following:

- chloride - 78 mg/l
- fluoride - ND
- pH - 6.70
- conductivity - 380 umhos
- fecal coliform - 80 MPN/100 ml.

Dry Weather Sampling #2
The sampling was conducted on November 14, 1996 at 7:25 a.m. There was a flow of approximately fifteen (15) gpm discharging from the pipe. No discoloration of the water was noticed in the flow from the outfall. The laboratory results revealed the following:

- chloride - 86 mg/l
- fluoride - ND
- fecal coliform - 60 MPN/100 ml.

Sub-area - N10A-5A
This sampling point is located on the Needham Golf Course. This 36 inch reinforced concrete pipe discharges into a stream which flows into the Needham Reservoir (see Figure 3.35).

Dry Weather Sampling
The sampling was conducted on October 8, 1996 at 12:40 p.m. There was a flow of approximately three (3) gpm discharging from the pipe. Clear water was noticed in the discharge flow from the outfall. The laboratory results revealed the following:

- chloride - 120 mg/l
- fluoride - ND
- pH - 6.88
- conductivity - 510 umhos
- fecal coliform - 170 MPN/100 ml.

Sub-area - N10A-6
This 24 inch reinforced concrete pipe is located northwest of Harris Avenue (see Figure 3.36). The length of pipe in this sub-area is approximately 1,800 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on October 8, 1996 at 12:55 p.m.

Sub-area - N10A-7
Sampling point N10-7 is a 48 inch pipe located south of Ivy Road. This pipe discharges to a stream that feeds the Needham Reservoir. The length of pipe in this sub-area is approximately 29,040 linear feet. Figure 3.37 provides a detailed map of this sub-area. A photograph of this sampling point is given in Figure 3.38.

Dry Weather Sampling #1
The sampling was conducted on October 8, 1996 at 1:40 p.m. There was a flow of approximately 1.5 gpm discharging from the pipe. Clear water was observed discharging from the pipe. The laboratory results revealed the following:

- chloride - 130 mg/l
- fluoride - ND
- pH - 6.80
- conductivity - 600 umhos
- fecal coliform - 900 MPN/100 ml.

Dry Weather Sampling #2
The pipe was re-sampled on October 8, 1996 at 2:40 p.m. BETA revisited the discharge point later in the day and observed a cloudy pool of water at the discharge location. The laboratory results revealed the following:

- chloride - 120 mg/l
- fluoride - ND
- pH - 7.30
- conductivity - 580 umhos
- fecal coliform - 90,000 MPN/100 ml.

Dry Weather Sampling #3
The pipe was again re-sampled on October 17, 1996 at 2:10 p.m. BETA observed suds at the outfall consistent with detergent. The sample was taken from the suds area of the outfall basin. The laboratory results revealed the following:

- chloride - 99 mg/l
- fluoride - ND
- fecal coliform - 5,000 MPN/100 ml.

Dry Weather Sampling #4
The pipe was re-sampled on October 18, 1996 at 2:20 p.m. BETA observed some foam located at the outfall. A flow of approximately twenty (20) gpm was discharging from the pipe. The laboratory results revealed the following:

- chloride - 110 mg/l
- fluoride - ND
- fecal coliform - 1,100 MPN/100 ml.

Dry Weather Sampling #5
The pipe was re-sampled on November 7, 1996 at 9:30 a.m. The laboratory results revealed the following:

- fecal coliform - 1,700 MPN/100 ml.

Manhole Sampling
To help determine if there was a possible illicit connection in the system, BETA began to sample manholes that feed the discharge point N10A-7. A map is provided to show the locations of the sampling in relation to the discharge point. To help define the locations of flow, BETA opened different manholes to determine if a flow was present. The samples taken from the manholes are discussed below while the dry manholes are only indicated on the map.

Manhole N10A-7-Ivy Court
This manhole is located at the end of Ivy Road. The sampling location was from a twelve (12) inch RCP.

Dry Weather Sampling
The manhole was sampled on October 18, 1996 at 2:35 p.m. Iron bacteria flocculent was noticed on the wall of the manhole in the area the pipe discharges. A flow of approximately 0.5 gpm of turbid water was noticed discharging from the pipe. A large amount of animal feces and groundwater were found to be the cause of constant elevated fecal coliform bacteria (see Figure 3.39). No illicit connections were found during the television inspection. The laboratory results revealed the following:

- fecal coliform - 9,000 MPN/100 ml.

Dry Weather Sampling
The manhole was re-sampled on November 5, 1996 at 12:00 p.m. A brown flocculent was noticed at the invert of the discharge pipe. A flow of approximately 0.5 gpm of clear water was noticed discharging from the pipe. The laboratory results revealed the following:

- fecal coliform - 1,900 MPN/100 ml.

Manhole N10A-7-C1
This manhole is located in a residential home's backyard south of Wilshire Park. The manhole had one 42 inch RCP entering and exiting the structure.

Dry Weather Sampling
The manhole was sampled on October 18, 1996 at 12:15 p.m. The laboratory results revealed the following:

- chloride - 69 mg/l
- fluoride - ND
- fecal coliform - 1,700 MPN/100 ml.

Manhole N10A-7-C2
This manhole is located northwest of the intersection of Wilshire Park and Great Plain Avenue. Please refer to the attached drawing for the approximate location. The manhole had one 36 inch RCP entering and exiting the structure.

Dry Weather Sampling
The manhole was sampled from the 36 inch RCP on October 18, 1996 at 12:20 p.m. The laboratory results revealed the following:
fecal coliform - 700 MPN/100 ml.

Manhole N10A-7-C3
This manhole is located northwest of the intersection of Wilshire Park and Great Plain Avenue. Please refer to the attached drawing for the approximate location. The manhole had one 24 inch RCP (N10A-7-C3), one 42 inch RCP (N10A-7-C4), and one 36 inch RCP (N10A-7-C5) entering the manhole and one 42 inch RCP exiting the manhole. This 24 inch RCP collects runoff from Beaufort Street.

Dry Weather Sampling
The manhole was sampled from the 24 inch RCP on November 6, 1996 at 11:30 a.m. The laboratory results revealed the following:
- chloride - 57 mg/l
- fluoride - ND
- pH - 7.14
- conductivity - 390 umhos
- fecal coliform - 300 MPN/100 ml.

Manhole N10A-7-C4
This manhole is located northwest of the intersection of Wilshire Park and Great Plain Avenue. Please refer to the attached drawing for the approximate location. There was one 24-inch RCP (N10A-7-C3), one 42 inch RCP (N10A-7-C4), and one 36 inch RCP (N10A-7-C5) entering the manhole and one 42 inch RCP exiting the manhole. This 42 inch RCP collects runoff from Holmes Street.

Dry Weather Sampling
The manhole was sampled from the 42 inch RCP on November 6, 1996 at 11:30 a.m. The laboratory results revealed the following:
- chloride - 86 mg/l
- fluoride - ND
- pH - 7.19
- conductivity - 360 umhos
- fecal coliform - 170 MPN/100 ml.

Manhole N10A-7-C5
This manhole is located northwest of the intersection of Wilshire Park and Great Plain Avenue. Please refer to the attached drawing for the approximate location. There was one 24 inch RCP (N10A-7-C3), one 42 inch RCP (N10A-7-C4), and one 36 inch RCP (N10A-7-C5) entering the manhole and one 42 inch RCP exiting the manhole. This 36 inch RCP collects runoff from Washington Street.

Dry Weather Sampling
The manhole was sampled from the 36 inch RCP on November 6, 1996 at 11:30 a.m. The laboratory results revealed the following:

- chloride - 73 mg/l
- fluoride - ND
- pH - 7.25
- conductivity - 200 umhos
- fecal coliform - 2,200 MPN/100 ml.

Manhole (N10A-7) - Sergeant Street
This manhole is located on Sergeant Street, west of Washington Avenue. The approximate location is shown on the attached map. There was one 24-inch RCP entering and exiting the manhole.

Dry Weather Sampling #1
The manhole was sampled on October 18, 1996 at 3:15 p.m. The laboratory results revealed the following:

- chloride - 77 mg/l
- fluoride - ND
- fecal coliform - 40 MPN/100 ml.

Manhole (N10A-7) - Washington Avenue
This manhole is located at the intersection of Washington Avenue and Sergeant Street. The approximate location is shown on the attached map. There was one 24 inch RCP and one twelve (12) inch RCP entering the manhole and one 24 inch RCP exiting the manhole.

Dry Weather Sampling #1
The manhole was sampled on November 6, 1996 at 10:20 a.m. The laboratory results revealed the following:

- chloride - 53 mg/l
- fluoride - ND
- pH - 7.12
- conductivity - 200 umhos
- fecal coliform - 2,400 MPN/100 ml.

Manhole (N10A-7) - Wash./GT Plain Street
This manhole is located at the intersection of Washington Avenue and Great Plain Street. The approximate location is shown on the attached map. There was one 24-inch RCP and one 18 inch RCP entering the manhole and one 36 inch RCP exiting the manhole.

Dry Weather Sampling #1
The manhole was sampled on November 6, 1996 at 11:15 a.m. The laboratory results revealed the following:

- pH - 7.27
- conductivity - 200 umhos
- fecal coliform - 1,400 MPN/100 ml.

Manhole (N10A-7) - Ellicot Street
This manhole is located at the intersection of Ellicot Street and Powers Street. The approximate location is shown on the attached map. The manhole had one 18 inch RCP and one twelve (12) inch RCP entering the manhole and one 18 inch RCP exiting the manhole.

Dry Weather Sampling #1
The manhole was sampled on November 6, 1996 at 10:20 a.m. The laboratory results revealed the following:

- chloride - 28 mg/l
- fluoride - 0.21
- pH - 7.3
- conductivity - 200 umhos
- fecal coliform - 1,700 MPN/100 ml.

Sub-area - N10A-8
This sampling point is located southwest of Canterbury Lane. The twelve (12) inch RCP discharges into Adler Brook approximately 2,200 feet from the Charles River (see Figure 3.40). The length of pipe in this sub-area is approximately 510 linear feet.

Dry Weather Sampling
The sampling was conducted on October 8, 1996 at 2:45 p.m. There was a flow of approximately one (1) gpm discharging from the pipe. Iron bacteria flocculent was abundant in the pipe and at the outfall. The laboratory results revealed the following:

- chloride - 75 mg/l
- fluoride - ND
- pH - 7.18
- conductivity - 410 umhos
- fecal coliform - 80 MPN/100 ml.

Sub-area - N10A-9
This sampling point is located east of Webster Street. The 36 inch RCP discharges to Alder Brook approximately 3,600 feet from the Charles River. The length of pipe in this sub-area is approximately 9,960 linear feet. Figure 3.41 provides a detailed map of sub-area 10A-9. A photograph of the outfall is provided in Figure 3.42.

Dry Weather Sampling #1
The dry weather sampling was conducted on October 2, 1996 at 3:00 p.m. BETA observed a flow of three (3) gpm of visually clean water. The bottom of the discharge pipe was also noted to be relatively clean, with no organic material evident. The laboratory results revealed the following:

- chloride - 50 mg/l
- fluoride - ND
- fecal coliform - 110 MPN/100 ml.

Dry Weather Sampling #2
BETA re-sampled the discharge on October 17, 1996 at 1:50 p.m. The laboratory results revealed the following:

- fecal coliform - 1,600 MPN/100 ml.

Dry Weather Sampling #3
BETA re-sampled the discharge on November 7, 1996 at 9:40 a.m. The laboratory results revealed the following:

- fecal coliform - 3,000 MPN/100 ml.

Sub-area - N10A-9A
This sampling point is located east of Webster Street. The 24 inch RCP discharges to Alder Brook approximately 3,600 feet from the Charles River adjacent to the N10A-9 discharge (see Figures 3.41 and 3.43). The length of pipe in this sub-area is approximately 15,600 linear feet.

Dry Weather Sampling #1
The dry weather sampling was conducted on October 2, 1996 at 3:00 p.m. BETA observed a flow of ten (10) gpm of visually clean water. A slime layer was noticed on the bottom of the discharge pipe. The laboratory results revealed the following:

- chloride - 120 mg/l
- fluoride - ND
- fecal coliform - 160,000 MPN/100 ml.

This elevated level of fecal coliform indicated a possible illicit connection to the storm drain system.

Dry Weather Sampling #2
Due to the elevated levels, BETA re-sampled the discharge on October 11, 1996 at 2:20 p.m. The laboratory results revealed the following:

- fecal coliform - 3,000 MPN/100 ml.

Dry Weather Sampling #3
A duplicate sample was taken from the discharge on October 11, 1996 at 2:30 p.m. The laboratory results revealed the following:

- fecal coliform - 3,000 MPN/100 ml.

Dry Weather Sampling #4
BETA re-sampled the discharge on October 16, 1996 at 1:00 p.m. A flow of approximately five (5) gpm was discharging from the pipe. The laboratory results revealed the following:

- pH - 6.50
- conductivity - 390 umhos
- fecal coliform - 16,000 MPN/100 ml.

Dry Weather Sampling #5
BETA re-sampled the discharge on October 17, 1996 at 1:50 p.m. The laboratory results revealed the following:

- fecal coliform - 9,000 MPN/100 ml.

Dry Weather Sampling #6
BETA re-sampled the discharge point on October 18, 1996 at 12:00 p.m. The laboratory results revealed the following:

- chloride - 130 mg/l
- fluoride - ND
- fecal coliform - 3,000 MPN/100 ml.

Dry Weather Sampling #7
BETA re-sampled the discharge on November 5, 1996 at 2:30 p.m. The laboratory results revealed the following:

- fecal coliform - 9,000 MPN/100 ml.

Dry Weather Sampling #8
BETA re-sampled the discharge on November 7, 1996 at 9:40 a.m. The laboratory results revealed the following:

- fecal coliform - 3,000 MPN/100 ml.

Manhole Sampling
To help determine if there was an illicit connection is in the system, BETA began to sample manholes that feed the discharge point N10A-9A. A map is provided to show the locations of the sampling in relation to the discharge point. To help define the locations of flow, BETA inspected different manholes to determine if a flow was present. The samples taken from the manholes are discussed below. Dry manholes are indicated on the map.

Manhole N10A-9A - C1
This manhole is located on Webster Street after the railroad easement. One 24 inch RCP enters and exit the manhole. For the approximate location, refer to the attached map.

Dry Weather Sampling
The manhole flow was sampled on October 18, 1996 at 12:15 p.m. The laboratory results revealed the following:
- chloride - 130 mg/l
- fluoride - ND
- fecal coliform - 5,000 MPN/100 ml.

Manhole N10A-9A - C2
This manhole is located on Webster Street after the MTBA railroad easement. One 24 inch RCP and one 15 inch clay pipe enters the manhole and one 24 inch RCP exits the manhole. For the approximate location, refer to the attached map.

Dry Weather Sampling #1
The manhole flow was sampled on October 18, 1996 at 12:20 p.m. The laboratory results revealed the following:
- fecal coliform - 3,000 MPN/100 ml.

Dry Weather Sampling #2
The manhole flow was sampled on November 7, 1996 at 11:00 a.m. The laboratory results revealed the following:
- chloride - 57 mg/l
- fluoride - ND
- fecal coliform - 230 MPN/100 ml.

Manhole N10A-9A - C3
This manhole is located on Webster Street before the MTBA railroad easement. One 24 inch RCP enters and exit the manhole. For the approximate location, refer to Fig. 3.41.

Dry Weather Sampling
The manhole flow was sampled on October 18, 1996 at 12:30 p.m. The laboratory results revealed the following:
- fecal coliform - 16,000 MPN/100 ml.

Manhole (N10A-9A) - Corner of Howland and Pleasant
This manhole is located at the corner of Howland Street and Pleasant Street. Please refer to the attached map for the approximate location.

Dry Weather Sampling #1
The manhole flow was sampled on October 17, 1996 at 3:00 p.m. The laboratory results revealed the following:

- chloride - 210 mg/l
- fluoride - ND
- fecal coliform - 110 MPN/100 ml.

Manhole (N10A-9A) - 90 Norfolk Street
This manhole is located on Norfolk Street in front of #90 Norfolk. Two (2) pipes enter the manhole. BETA sampled from the twelve (12) inch clay pipe entering Norfolk Street from an easement. For the approximate location, refer to the attached map.

Dry Weather Sampling
The manhole flow was sampled on October 18, 1996 at 1:50 p.m. A flow of approximately two (2) gpm was discharging through this pipe. BETA visually observed the flow to increase while sampling (a possible indication of flushing). The laboratory results revealed the following:

- chloride - 160 mg/l
- fluoride - ND
- fecal coliform - 300 MPN/100 ml.

Manhole (N10A-9A) - 302 Warren Street
This manhole is located on Warren Street in front #302 Warren. One 24 inch clay pipe, one 12 inch clay pipe, and one 12 inch RCP enters the manhole and one 24 inch RCP exits the manhole. BETA sampled from the 12 inch clay pipe. For the approximate location, refer to the attached map.

Dry Weather Sampling
The manhole was sampled on October 18, 1996 at 1:00 p.m. A flow of approximately four (4) gpm was discharging through this pipe. Clear water was observed flowing through the pipes. The laboratory results revealed the following:

- chloride - 120 mg/l
- fluoride - ND
- fecal coliform - 40 MPN/100 ml.

Sub-area - N10A-9B
This sampling point is located east of Webster Street. The eight (8) inch asbestos concrete pipe is a former sub-drain for the sewer line (see Fig. 3.44).

Dry Weather Sampling #1
The sampling was conducted on November 7, 1996 at 10:30 a.m. There was a flow of five (5) gpm discharging from the pipe. Brown organic flocculent was noticed at the outfall which was not visually consistent with iron bacteria. The laboratory results revealed the following:

- chloride - 93 mg/l
- fluoride - ND
- pH - 5.98
- conductivity - 420 umhos
- fecal coliform - 24,000 MPN/100 ml.

Dry Weather Sampling #2
A duplicate sample was taken at the outfall on November 7, 1996 at 10:30 a.m. The laboratory results revealed the following:

- fecal coliform - 160,000 MPN/100 ml.

Sub-area - N10A-10
This sampling point is located northwest of Sutton Road behind a residence. The twelve (12) inch RCP discharges to the Alder Brook approximately 2100 feet from the Charles River (see Figure 3.45). The length of pipe in this sub-area is approximately 780 linear feet.

Dry Weather Sampling
The sampling was conducted on October 8, 1996 at 2:22 p.m. There was stagnant water in the pipe. The pipe was partially submerged. The laboratory results revealed the following:

- pH - 6.97
- conductivity - 440 umhos
- fecal coliform - 3,000 MPN/100 ml.

NOTE: Elevated coliform was likely due to upstream discharge of 10A-9A and 10A-9B.

Sub-area - N10A-11
This sampling point is located east of Dedham Avenue. The 42 inch RCP flows into Alder Brook approximately 2,600 feet from the Charles River (see Figure 3.46). The length of pipe in this sub-area is approximately 24,960 linear feet.

Dry Weather Sampling #1
The sampling was conducted on October 2, 1996 at 3:20 p.m. There was a flow of approximately ten (10) gpm discharging from the pipe. No floatables or discoloration was noticed in the outfall or discharging pipe. The laboratory results revealed the following:

- chloride - 75 mg/l
- fluoride - ND
- fecal coliform - 80 MPN/100 ml.

Dry Weather Sampling #2
The sampling was conducted on November 14, 1996 at 7:30 a.m. There was a flow of approximately twenty (20) gpm discharging from the pipe. No floatables or discoloration was noticed in the outfall or discharging pipe. The laboratory results revealed the following:

- chloride - 71 mg/l
- fluoride - 0.24 mg/l
- fecal coliform - ND

Sub-area - N10A-11A
This sampling point is located east of Dedham Avenue. The twelve (12) inch RCP discharges to Alder Brook approximately 2,500 feet from the Charles River (see Figure 3.47).

Dry Weather Sampling #1
The sampling was conducted on October 8, 1996 at 12:30 p.m. There was a flow of approximately three (3) gpm discharging from the pipe. Iron bacteria flocculent was abundant at the outfall. No discoloration of the water was noticed in the flow from the outfall. The laboratory results revealed the following:

- chloride - 38 mg/l
- fluoride - ND
- pH - 6.50
- conductivity - 390 umhos
- fecal coliform - 500 MPN/100 ml.

Dry Weather Sampling #2
The sampling was conducted on November 15, 1996 at 7:30 a.m. There was a flow of approximately two (2) gpm discharging from the pipe. Abundant iron bacteria was noticed at the outfall and in the pipe. The laboratory results revealed the following:

- fecal coliform - ND

BETA sampled the orange flocculent (iron bacteria) to determine if the material was possibly a petroleum by-product or actually an iron compound. The sample was taken on October 17, 1996 at 1:30 p.m.. The laboratory results revealed the following:

- total hydrocarbons - ND (detection limit of 1.0 mg/l)
- total iron - 130 mg/l
- iron bacteria test: Positive

Sub-area - N10A-12

This sampling point is located east of Canterbury Lane at the end of the cul-de-sac. The twelve (12) inch RCP discharges into the Alder Brook approximately 2,300 feet from the Charles River (see Figure 3.48). The length of pipe in this sub-area is approximately 210 linear feet.

Dry Weather Sampling

The sampling was conducted on October 8, 1996 at 2:50 p.m. There was a flow of less than 0.5 gpm discharging from the pipe. An orange flocculent was observed in the pipe and at the outfall. The laboratory results revealed the following:

- chloride - 74 mg/l
- fluoride - ND
- pH - 7.15
- conductivity - 390 umhos
- fecal coliform - 23 MPN/100 ml.

Sub-area - N10A-13

This sampling point is located in the middle of a culvert below the street. BETA observed the discharge point by pulling a manhole cover within George Aggot Road (see Figure 3.49).

Dry Weather Sampling

BETA observed no flow from this discharge point on October 8, 1996 at 2:15 p.m. However, when BETA pulled the manhole cover during the dry weather sampling, an abundance of animal feces were within the invert of the pipe.

Sub-area - N10A-14

This sampling point is located west of Great Plain Avenue. The 24 inch RCP discharges to a stream that fed the Needham Reservoir (see Figure 3.50). The length of pipe in this sub-area is approximately 180 linear feet.

Dry Weather Sampling

BETA observed no flow from this discharge point on October 8, 1996 at 2:55 p.m.

Sub-area - N10A-15

This sampling point is located west of Great Plain Avenue. The sampling point was an old brick structure that had water flowing out of the ground (see Figure 3.51). Please refer to the attached photograph log.

Dry Weather Sampling
The sampling was conducted on October 8, 1996 at 2:10 p.m. There was a flow of approximately 0.2 gpm discharging from the structure. The water appeared to be groundwater seeping form the ground. The laboratory results revealed the following:

- chloride - 120 mg/l
- fluoride - ND
- pH - 6.70
- conductivity - 550 umhos
- fecal coliform - 300 MPN/100 ml.

Sub-area - N10A-16
This sampling point is located southwest of Great Plain Avenue. The 21 inch pipe flows into a pond on the Needham Golf Course (see Figure 3.52). The length of pipe in this sub-area is approximately 3,300 linear feet.

Dry Weather Sampling
The sampling was conducted on November 5, 1996 at 11:30 a.m. There was a flow of approximately fifteen (15) gpm discharging from the pipe. No floatables or discoloration was noted in the outfall or discharging pipe. Laboratory analysis revealed the following:

- chloride - 94 mg/l
- fluoride - ND
- pH - 6.23
- conductivity - 450 umhos
- fecal coliform - 500 MPN/100 ml.

Sub-area - N10A-16A
This sampling point is located southwest of Great Plain Avenue, adjacent to N10A-16 (see Figure 3.53). The 15 inch pipe flows into a pond on the Needham Golf Course.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 11:30 a.m.

Sub-area - N10A-17
This sampling point is located northwest of Livingston Circle. The twelve (12) inch RCP pipe discharges into a backyard which eventual flows into the Needham Reservoir (see Figure 3.54). The length of pipe in this sub-area is approximately 180 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 1:10 p.m.

Sub-area - N10A-18
This sampling point is located southwest of South Street. The twelve (12) inch PVC pipe discharges into an adjacent woodlands which eventually discharges to the Charles River (see Figure 3.55). The length of pipe in this sub-area is approximately 210 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 1:20 p.m.

Sub-area - N10A-19
This sampling point is located southwest of Great Plain Avenue. The fifteen (15) inch PVC pipe discharges into a woodlands which eventual flows into the Needham Reservoir (see Figure 3.56). The length of pipe in this sub-area is approximately 120 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 1:25 p.m.

Sub-area - N10A-20
This sampling point is located south Washington Avenue. The length of pipe in this sub-area is approximately 300 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 1:45 p.m.

Sub-area - N10A-21
This sampling point is located at the intersection of South Street and Dedham Avenue. The length of pipe in this sub-area is approximately 2,400 linear feet.

Dry Weather Sampling
BETA observed no flow from this discharge point on November 5, 1996 at 1:23 p.m.

Sub-area - N10A-22
This sampling point is located in the Department of Public Works parking lot. The twelve (12) inch PVC pipe discharges into a stream that discharges to the Charles River (see Figure 3.57).

Dry Weather Sampling
The sampling was conducted on November 6, 1996 at 10:00 a.m. There was a flow of approximately 0.5 gpm discharging from the pipe. No floatables or discoloration was noticed in the outfall or discharging pipe. Iron bacteria flocculent was observed on the bottom of the pipe. The laboratory results revealed the following:

- chloride - 410 mg/l
- fluoride - 0.23 mg/l
- pH - 6.55
- conductivity - 410 umhos
- fecal coliform - ND MPN/100 ml.

Sub-area - N10A-23
This sampling point is located south of Dedham Avenue. The twelve (12) inch RCP pipe discharges into the Charles River (see Figure 3.58).

Dry Weather Sampling
The sampling was conducted from the submerged pipe on November 6, 1996 at 2:00 p.m. There was a stagnant water inside the pipe. The laboratory results revealed the following:

- fecal coliform - 130 MPN/100 ml.

Stream Sampling

The streams surrounding the Needham Reservoir (refer to Figure 3.28) were sampled to determine if the reservoir was providing a sufficient holding time for the fecal coliform to die off. The laboratory results included the following:

- Stream #2 (downstream of Needham Reservoir and N10A-9A) had fecal coliform of 130 MPN/100 ml.
- Stream #3 (downstream of Needham Reservoir) had fecal coliform of 80 MPN/100 ml.
- Stream #4 (downstream of N10A-9A) had fecal coliform of 500 MPN/100 ml.
- Stream #5 (downstream of N10A-5) had fecal coliform of 220 MPN/100 ml.
- Stream #6 (downstream of N10A-7) had fecal coliform of 1,300 MPN/100 ml.

Table 3.5 summarizes the dry weather sampling locations and results.

Table 3.5 Summary of Dry Weather Sampling for N10A

Sampling Location #	Sampling Location	Pipe Size (in.)-Material	Flow (gpm)	Date	Time	Chloride (mg/l)	Fluoride (mg/l)	Fecal Coliform Bacteria (MPN/100 ml)
N10A								
N10A-1	West of Green Street	24-RCP	Dry	10/8/96	13:20	NA	NA	NA
N10A-1A	West of Green Street	12-RCP	Dry	10/8/96	13:20	NA	NA	NA
N10A-1B	West of Green Street	12-RCP	2	10/8/96	13:20	130	ND	3,000
N10A-2	South of Great Plain Avenue	NS	Dry	11/5/96	13:28	NA	NA	NA
N10A-3	DPW Parking Lot	12-RCP	Dry	10/8/96	13:30	NA	NA	NA
N10A-4	Dedham Avenue	12-RCP	Dry	11/5/96	13:35	NA	NA	NA
N10A-5	West of Needham Athletic Fields	48-RCP	10	10/8/96	12:48	78	ND	80
N10A-5	West of Needham Athletic Fields	48-RCP	15	11/14/96	7:25	86	ND	60
N10A-5A	Dedham Golf Course	36-RCP	3	10/8/96	12:40	120	ND	170
N10A-6	Northwest of Harris Avenue	24-RCP	Dry	10/8/96	12:55	NA	NA	NA
N10A-7	South of Ivy Road	48-RCP	15	10/8/96	13:40	130	ND	900
N10A-7	South of Ivy Road	48-RCP	15	10/8/96	14:40	120	ND	90,000
N10A-7	South of Ivy Road	48-RCP	NS	10/17/96	14:10	99	ND	5,000
N10A-7	South of Ivy Road	48-RCP	20	10/18/96	14:20	110	ND	1,100
N10A-7	South of Ivy Road	48-RCP	NS	11/7/96	9:30	NS	NS	1,700
N10A-7-Ivy Road	Ivy Road	12-RCP	0.5	10/18/96	14:35	NS	NS	9,000
N10A-7-Ivy Road	Ivy Road	12-RCP	0.5	11/5/96	12:00	NS	NS	1,900
N10A-7-C1	South of Wilshire Park	42-RCP	NS	10/18/96	12:15	69	ND	1,700
N10A-7-C2	Great Plain Avenue	36-RCP	NS	10/18/96	12:20	NS	NS	700
N10A-7-C3	Great Plain Avenue	24-RCP	5	11/6/96	11:30	57	ND	300

N10A-7-C4	Great Plain Avenue	42-RCP	25	11/6/96	11:30	86	ND	170
N10A-7-C5	Great Plain Avenue	36-RCP	5	11/6/96	11:30	73	ND	2,200
N10A-7-Beaufort	Beaufort Street	NS	DRY	11/18/96	15:00	NA	NA	NA
N10A-7-Ellicot	Ellicot Street	18-RCP	20	11/6/96	10:20	28	0.21	1,700
N10A-7-Greenwood	Greenwood Avenue	NS	DRY	11/6/96	9:40	NA	NA	NA
N10A-7-Wash/GT. Plain	Corner of Washington and Great Plain Avenue	36-RCP	NS	11/6/96	11:15	NS	NS	1,400
N10A-7-Washington	Washington Avenue	24-RCP	5	11/6/96	10:20	53	ND	2,400
N10A-7-Washington #2	Washington Avenue	NS	DRY	11/6/96	10:30	NA	NA	NA
N10A-7-Seargent St.	Sergeant Street	24-RCP	NS	10/18/96	15:15	77	ND	40
N10A-7-Woodlawn	Woodlawn Avenue	NS	DRY	11/6/96	9:30	NA	NA	NA
N10A-8	Southwest of Canterbury Lane	12-RCP	1	10/8/96	14:45	75	ND	80
N10A-9	East of Webster Street	36-RCP	3	10/2/96	15:00	50	ND	110
N10A-9	East of Webster Street	36-RCP	NS	10/17/96	13:50	NS	NS	1,600
N10A-9	East of Webster Street	36-RCP	NS	11/7/96	9:40	NS	NS	3,000
N10A-9A	East of Webster Street	24-RCP	10	10/2/96	15:00	120	ND	160,000
N10A-9A	East of Webster Street	24-RCP	NS	10/11/96	14:20	NS	NS	3,000
N10A-9A	East of Webster Street	24-RCP	NS	10/11/96	14:30	NS	NS	3,000
N10A-9A	East of Webster Street	24-RCP	5	10/16/96	13:00	NS	NS	16,000
N10A-9A	East of Webster Street	24-RCP	NS	10/17/96	13:50	NS	NS	9,000
N10A-9A	East of Webster Street	24-RCP	NS	10/18/96	12:00	130	ND	3,000
N10A-9A	East of Webster Street	24-RCP	NS	11/5/96	14:30	NS	NS	9,000
N10A-9A	East of Webster Street	24-RCP	NS	11/7/96	9:40	NS	NS	3,000
N10A-9A-C1	Webster Street	24-RCP	NS	10/18/96	12:15	130	ND	5,000
N10A-9A-C2	Webster Street	15-CLAY	NS	10/18/96	12:20	NS	NS	3,000
N10A-9A-C2	Webster Street	15-CLAY	NS	11/7/96	11:00	57	ND	230
N10A-9A-C3	Webster Street	14-RCP	NS	10/18/96	12:30	NS	NS	16,000
N10A-9A-C4	Webster Street	NS	DRY	10/18/96	11:30	NA	NA	NA
N10A-9A-Corner of Howland and Pleasant	Corner of Howland and Pleasant	NS	NS	10/17/96	15:00	210	ND	110
N10A-9A-90 Norfolk St.	90 Norfolk Street	12-CLAY	2	10/18/96	13:50	160	ND	300
N10A-9A-302 Warren St.	302 Warren Street	12-CLAY	4	10/18/96	13:00	120	ND	40
N10A-9B	Northeast of Webster Street	8-AC	5	11/7/96	10:30	93	ND	24,000
N10A-9B	Northeast of Webster Street	8-AC	5	11/7/96	10:30	NS	NS	160,000
N10A-10	Northwest of Sutton Road	12-RCP	NS	10/8/96	14:22	NS	NS	3,000
N10A-11	East of Dedham Avenue	42-RCP	10	10/2/96	15:20	75	ND	80
N10A-11	East of Dedham Avenue	42-RCP	20	11/14/96	7:30	71	0.24	ND
N10A-11A	East of Dedham Avenue	12-RCP	3	10/8/96	12:30	38	ND	500
N10A-11A	East of Dedham Avenue	12-RCP	2	11/15/96	7:30	NS	NS	ND