

Massachusetts Bays Program (MBP)/
Shellfish Bed Restoration Program (SBRP)

"Pollution Source Assessment"

Interim Report

Whale Meadow, Cohasset, MA

Introduction

This report summarizes pollution source assessment work completed by Gray Environmental and others through June 1996, at the SBRP site known as Whale Meadow in Cohasset, MA. Work completed to date, additional work required, and the project budget is detailed below.

Tasks

Task 1 - Compile Existing Data

Massachusetts Division of Marine Fisheries (MDMF) Data

The Whale Meadow culvert discharges into Cohasset Harbor, MDMF Growing Area MB10.4 (Figure 1). Growing Area MB10.4 is currently classified as a prohibited resource based on historical pollution source water quality data (stations PS#C7 and PS#C8) that the MDMF has characterized as widely variable and unrelated to precipitation events. Station PS#C7 is located at the outlet of the Whale Meadow culvert and PS#C8 is located at the discharge of the Whale Meadow Marsh into the Whale Meadow Channel (downstream of PS#C7). MDMF historical pollution source data is summarized below and sampling stations are shown on Figure 2.

Sampling Date	Fecal Coliform (CFU/100 ml)	
	PS#C7	PS#C8
6/24/93	540	400
7/7/93	50	180
7/20/93	1,200	<100
9/29/93	40	<10
12/9/93	120	<10
3/7/94	<10	<10

Conversations with Harold Litchfield/Cohasset DPW, Hap Pompeo/Private Contractor, and Susan McVeigh/Owner at #55 Whitehead Road.

The Whale Meadow culvert is privately-owned and appears to convey only intermittent flow from a seasonal creek transecting the property at 62 White Head Road (Map 31, Lot 22 of the 1996 Cohasset Assessors Map). Because the culvert discharges in the inter tidal zone, it became buried

and plugged periodically with sand from tidal action, creating backwater flooding in the headwater creek.

Historically, the Cohasset DPW cleaned-out the culvert upon request of an impacted property owner, Susan McVeigh. However, last year the Cohasset DPW informed Ms. McVeigh that they would no longer be responsible for maintaining the privately-owned culvert. Therefore, in 1995, Ms. McVeigh hired a private contractor (Hap Pompeo) to construct an approximate 80-foot extension to the culvert and an associated channel (Whale Meadow Channel) to alleviate the headwater flooding.

Tutela Engineering Waste Water Facilities Plan (Work In Progress)

Tutela Engineering is currently performing a Waste Water Facilities Plan for the Town of Cohasset. The scope of the study includes an alternatives analysis for relocating the waste water treatment plant outfall from James Brook to Cohasset Cove, and the installation of a sewer force main along portions of Atlantic Avenue and Howard Gleason Road.

Tutela has conducted a dye study between James Brook and the Outer Harbor (not yet published) and is preparing a hydrodynamic model of the harbor system. This information may prove helpful in determining the potential impacts of Cohasset Harbor on Whale Meadow.

Task 2 - Delineate Drainage System

Whale Meadow is a private development, and the Cohasset DPW does not maintain mapping or repair records on the drainage system. However, based on preliminary site investigations and a conversation with Hap Pompeo (private contractor), an approximate 3,500 linear foot culvert was identified that conveys intermittent flow from a seasonal creek transecting the property at 62 White Head Road. The culvert is serviced by at least two manholes; one of which (MH #2) is located in the marsh approximately 200 feet from the discharge, and the second (MH#1) buried under sand near the rack line of Whale Meadow.

A summary of the efforts to delineate the drainage system are outlined in chronological order below.

Site Visit (4/2/96)

Participants: Diedre Kimball, MBP/SBRP
Bill Clark/Metro-South CZM

Neil Churchill, MDMF
Dave Gray, Gray Environmental

- Initial site walk.
- MH#2 was located in the fragmites approximately 200-feet upstream of the outlet. Investigation of the manhole showed only single inlet and outlet, 15-inch corrugated metal piping.
- Unsuccessfully attempted to locate MH#1 near the Whale Meadow rack line.

Meeting with Board of Health and Site Investigation (4/23/96)

Participants: Dr. Joe Godzik, Cohasset Health Agent
Hap Pompeo, Private Contractor (Site Investigation only)
Dave Gray, Gray Environmental

- Investigated utility manhole located on Whitehead Road near the potential alignment of the culvert - determined to be a flooded underground electric structure.
- Hap Pompeo described installation of Whale Meadow culvert extension - which included installing approximately 80 linear feet of 15-inch concrete pipe to the outlet of the existing discharge pipe. Work also included dredging of a meandering channel through the Whale Meadow salt marsh to Cohasset Harbor.

Excavation of Manhole (MH#1) and Dye Testing (5/20/96)

Participants: Dave Gray, Gray Environmental

- Using a metal detector, MH #1 was located and excavated. The Manhole was located at the rack line, buried under approximately 2-feet of sand.
- Inspection of MH#1 showed only a single inlet and outlet.
- Tidal influence was observed in MH#1 and MH#2.
- Dye testing showed positive connectivity between the headwaters, MH#2, MH#1, and the outlet of the Whale Meadow culvert.
- No additional drainage infrastructure was observed.

Smoke Testing (6/5/96)

Participants: Dr. Joe Godzik, Cohasset Health Agent
Neil Churchill, MDMF
Dave Gray, Gray Environmental

- Performed a 20-minute smoke test on the Whale Meadow culvert at low tide. Test was performed at MH#1 by utilizing a gas-powered blower equipped with a smoke canister. (The Cohasset Fire Department was notified prior to the test).
- Smoke was observed at the exposed Whale Meadow culvert outlet, MH#2, along the drainage alignment between MH#2 and the headwaters inlet, and the headwaters inlet at Whitehead Road. The pipe outlet was temporarily plugged with sand at the midpoint of the test to increase the volume of smoke available to migrate in the upstream direction.
- Smoke observed along the alignment of the culvert between MH#2 and the headwaters inlet suggests that the pipe has leaking joints or cracks, and may not be continuous.
- According to the Cohasset Fire Department's daily log, no emergency calls reporting smoke were received during the test period.

Task 3 & 4- Inventory, Map and Prioritize Potential Pollution Sources

Suspect potential pollution sources initially included septic systems, non-domestic wildlife, natural sources, and impact from Inner Cohasset Harbor. Based on initial site visits, Potential Pollution Sources (PPS) were determined (Figure 2) and are qualitatively prioritized below based on likelihood of impact.

PPS1: Wildlife and Natural Sources on Whale Meadow and Mud Flats (Photo 4/2-8)

Whale Meadow and associated mud flats are located in the inter tidal zone and appear to be popular feeding and breeding areas for waterfowl and other non-domestic wildlife. The meadow is also a rich source of a variety of organic matter.

PPS2: Impact from Inner Cohasset Harbor

Inner Cohasset Harbor (MDMF MB10.1) is currently classified as prohibited shellfish growing area. The Cohasset Waste Water Treatment Plant outfall discharges to James Brook, a major tributary to the Inner Harbor. Many boats large enough to contain heads are moored or travel throughout Cohasset Harbor.

PPS3: Wildlife and Natural Sources on "Dreier Marsh" (Photo 5/28-4)

The Dreier Marsh is located at the headwaters to the Whale Meadow Culvert and may be tidally influenced. The marsh appears to be popular feeding and breeding areas for waterfowl and other non-domestic wildlife.

PPS4: Septic system at Ralston property (Photos 6/5-2 & 4)

The Ralston property appears to be occupied year-round and serviced by a series of cesspools (Cohasset BOH files). The home is built on a steep ledge face immediately adjacent to the headwaters of the Whale Meadow Culvert.

PPS5: Septic system at Thayer "shack" (seasonal source)

According to the Cohasset BOH, the Thayer "shack" is occupied seasonally and is serviced by a cesspool (no drawings or service records on file). Presumably, the septic system is located on the Whale Meadow side of the property, potentially within 100-feet of the Whale Meadow rack line and within 200-feet of the Whale Meadow Culvert alignment.

PPS6: Thayer garden runoff (seasonal source)

Fertilizers (e.g., animal manure) used in the Thayer garden could be a seasonal source of bacteria. The garden is located immediately adjacent to the easterly flowing Thayer Creek. The creek flows into the Whale Meadow fragmites, where it flows hidden or subsurface into the salt marsh. The creek does not appear to be tidally influenced during normal tides, but may see flood waters during spring tides.

Task 5 - Conduct Field Testing

Seven (7) rounds of field testing were completed between April 2, and June 25, 1996. Testing included collecting water quality samples from 14 stations and analyzing for fecal coliform, fecal streptococci, optical brighteners, temperature, and salinity. (Enterococci testing of some samples was requested, however the laboratory did not have the required sampling media available at the time of analysis). Field testing completed during this period is detailed below. Sampling stations are shown on Figure 2 and sampling results are summarized in Table 1 and Figure 3.

Sampling Date: 4/2/96

Participants: Diedre Kimball, MBP/SBRP
Bill Clark/Metro-South CZM
Neil Churchill, MDMF
Dave Gray, Gray Environmental

Time: 1445-1550
Tide Conditions: Ebb->Low
Precipitation: 0.6 inches within 24 hours

of Samples: 6
Analyses: Fecal Coliform, Temperature, Salinity
Laboratory: MDMF/Lakeville

Sta DMF			Temp.	Sal.	
ID	PS#	Sample Location	(°F)	(%)	FC
X	C7	Whale Meadow Culvert outlet (P7)	45	5	>50
X1		End of Whale Meadow Channel (P0)	41	31	4
X2	C9	Bellemine Channel(P40)	-	0	14
X3		MH#2 (P8)	-	3	36
X4		Bellemine Creek (P20)	-	0	<2
X5		Thayer Creek (P30)	46	2	4

- Notes: 1. "DMF PS#" indicates historical DMF Pollution Source Station
2. "(P7)" indicates renumbered Station ID for current study
3. FC = Fecal Coliform in CFU/100 ml
4. "-" indicates data not collected

Sampling Date: 5/21/96

Participants: Dr. Joe Godzik, Cohasset Health Agent

Time: 0930-0935

Tide Conditions: Low

Precipitation: Trace within 48 hours

of Samples: 2

Analyses: Fecal Coliform

Laboratory: G&L Laboratories/Quincy

Sta DMF

ID	PS#	Sample Location	FC
# 1		Whale Meadow Culvert inlet (P2)	40
# 2	C7	Whale Meadow Culvert outlet (P7)	14

Sampling Date: 5/28/96

Participants: Neil Churchill, MDMF
Dave Gray, Gray Environmental

Time: 0945-1035

Tide Conditions: High->Ebb

Precipitation: 0.0 inches within 144 hours

of Samples: 6

Analyses: Fecal Coliform, Temperature, Salinity

Laboratory: MDMF/Lakeville

Sta DMF

ID	PS#	Sample Location	Temp. (°F)	Sal. (%)	FC
P1		MH#1	-	4	1,000
P2		Whale Meadow Culvert inlet	57	9	780
P3		Headwater creek near Ralston's tennis courts	-	9	100
P4		Headwater ditch, upstream of "Dreier Marsh"	-	6	100
P5		Headwater ditch, upstream of P4	-	7	10
P6	C8	Salt marsh pool prior to Whale Meadow Channel	-	15	140

Sampling Date: 6/5/96

Participants: Dr. Joe Godzik, Cohasset Health Agent
Neil Churchill, MDMF
Dave Gray, Gray Environmental

Time: 0931-1000
Tide Conditions: Low->Flood
Precipitation: 0.22-inches within 48 hours

of Samples: 6
Analyses: Fecal Coliform, Temperature, Salinity
Laboratory: MDMF/Lakeville

Sta DMF			Temp.	Sal.	
ID	PS#	Sample Location	(°F)	(%)	FC
P1		MH#1	59	20	130
P2		Whale Meadow Culvert inlet	63	22	60
P3		Headwater creek near Ralston's tennis courts	63	21	130
P6	C8	Salt marsh pool prior to Whale Meadow Channel	61	18	230
P7	C7	Whale Meadow Culvert outlet	61	20	100
P8		MH#2	-	20	330

Participants: Dave Gray, Gray Environmental

Time: 1255-1350
Tide Conditions: Flood
Precipitation: 0.22-inches within 48 hours

of Samples: 6
Analyses: Fecal Coliform (Duplicate Analyses)
Laboratory: Toxikon/Woburn

Sta DMF			FC	FC	FC
ID	PS#	Sample Location	-01	-02	Mean
P0		End of Whale Meadow Channel	90	70	80
P1		MH#1	100	80	90
P2		Whale Meadow Culvert inlet	140	90	115
P6	C8	Salt marsh pool prior to Whale Meadow Channel	320	310	315
P10		Salt Marsh Channel, upstream of P6	780	600	690

Sampling Date: 6/20/96

Participants: Dave Gray, Gray Environmental

Time: 1210-1330

Tide Conditions: Flood

Precipitation: 0.1 inches within 24 hours

of Samples: 4

Analyses: Fecal Coliform and Streptococci (Duplicate Analyses)

Laboratory: Toxikon/Woburn

Sta ID	DMF PS#	Sample Location	FC -01	FC -02	FC Mean
P0		End of Whale Meadow Channel	30	30	30
P7	C7	Whale Meadow Culvert outlet	30	30	30
P10		Salt Marsh Channel, upstream of P6	<10	<10	<10
P11		Salt Marsh Channel, upstream of P10	190	250	220

Sta ID	DMF PS#	Sample Location	FS -01	FS -02	FS Mean
P0		End of Whale Meadow Channel	<10	<10	<10
P7	C7	Whale Meadow Culvert outlet	<10	<10	<10
P10		Salt Marsh Channel, upstream of P6	<10	<10	<10
P11		Salt Marsh Channel, upstream of P10	<10	<10	<10

Note: 1. FS = Fecal Streptococci in CFU/100 ml

Sta ID	DMF PS#	Sample Location	FC Mean	FS Mean	FC:FS Ratio
P0		End of Whale Meadow Channel	30	<10	>3:1
P7	C7	Whale Meadow culvert outlet	30	<10	>3:1
P10		Salt Marsh Channel, upstream of P6	<10	<10	1:1
P11		Salt Marsh Channel, upstream of P10	220	<10	>22:1

Note: 1. FC:FS = Fecal Coliform to Fecal Streptococci Ratio. However, the ratios should be considered unreliable since the FC and FS concentrations are too low (i.e., <100 CFU/100 ml).

Sampling Date: 6/20/96-6/26/96

Participants: Dave Gray, Gray Environmental

of Samples: 15

Analyses: Presence/Absence of Optical Brighteners (grab and extended period sampling)

Two types of Optical Brightener (OB) tests were conducted on the Whale Meadow waters: grab sampling and extended period sampling. Grab sampling involved collecting up to 250 ml of volume from a sampling station and inserting a cotton pad into the sample bottle. Extended period sampling was accomplished by installing Gray Optical Brightener (GOB) samplers at specific sampling stations. GOB samplers consist of a porous PVC housing attached to vertical rod that is driven into the mud at a specific elevation (e.g., to sample the entire inter tidal zone or high tide zone only). The PVC housing holds a cotton pad and rotates around the vertical rod with the flow (tide). GOB samplers are designed to expose the cotton pads to the water column during an extended time period and multiple tide cycles.

The cotton pads are removed from either the sample bottle or GOB sampler and dried. The cotton pads are then exposed to UV light. Pads that fluoresce are presumed to have been exposed to optical brighteners.

A total of 15 OB tests were completed between 6/20/96 and 6/26/96; ten (10) grab samples and five (5) GOB samples. Grab samples were collected on 6/20 and 6/26; four (4) GOB samplers were installed continuously from 6/20 to 6/26, and one (1) GOB sampler was set on 6/26. Results of the OB tests are summarized below.

Sta	DMF				
ID	PS#	Sample Location	Grab	GOB	Zone

6/20 Samples

P0		End of Whale Meadow Channel	A	A	Mid
P2		Whale Meadow Culvert inlet	A	A	Mid
P7	C7	Whale Meadow Culvert outlet	A	A	Mid
P10		Salt Marsh Channel, upstream of P6	A	-	-
P11		Salt Marsh Channel, upstream of P10	A	X	Mid
CC		Blank (tap water)	A	-	-
CC		Control (tap water + detergent)	P	-	-

6/26 Samples

P2		Whale Meadow culvert inlet	A	-	-
P7	C7	Whale Meadow culvert outlet	A	NC	Mud
P12		Salt Marsh Channel, between P10 and P11	A	-	-
P40	C9	Salt Marsh Channel east of Bellemine House	A	-	-
P50		Cohasset Harbor, north of the Bellemine dock	A	-	-

- Notes:
1. "Mid" indicates sampler set at the middle tide elevation
 2. "Mud" indicates sampler set at the mudline elevation
 3. "P" or "A" indicates optical brighteners Present or Absent
 4. "X" indicates cotton pad(s) missing from GOB Sampler
 5. "-" indicates no sample
 6. "NC" indicates sampling/analysis not complete

Conclusions

Based on site investigations and sampling performed to date, the most likely sources of fecal coliform bacteria detected at Whale Meadow include wildlife feces and organic matter originating from the mud flats, the Whale Meadow salt marsh, and the headwaters to the Whale Meadow Culvert; and influence from the Cohasset Inner Harbor during flood tides (especially spring high tides). A review of the data collected yields the following specific conclusions:

Whale Meadow Drainage

- Based on a review of salinity measurements, the Whale Meadow Culvert and headwaters to the Dreier property appear to be tidally influenced.
- Smoke testing showed no interconnections (illegal or otherwise) to the Whale Meadow Culvert.
- Bellemine and Thayer Creeks appears to flow seasonally only.

Fecal Coliform Concentrations

- Approximately 80 percent of all samples collected (23 of 29) exceed the MDMF criteria for an approved shellfish growing area of 14 CFU/100 ml)

- Concentrations (ranging from <2 to 1,000 CFU/100 ml) are highly variable with no apparent correlation with precipitation events or salinity levels (Figures 4 and 5).
- The highest concentrations were observed during high/ebbing tides or downstream flow (Figure 6); and bacteria may be carried into, or re-suspended in, the Whale Meadow Marsh and headwaters during spring tides.
- The April 2, 1996 sample in Thayer Creek (Station P30) yielded a concentration of only 4 CFU/100 ml. However, realizing that this sampling round was performed prior to the growing season, potential impact from the Thayer Garden cannot be fully assessed. (Additional sampling was prohibited because the creek went dry).

Fecal Differentiation (FC:FS Ratios)

- All samples analyzed for fecal streptococci yielded concentrations less than 10 CFU/100 ml. Fecal coliform concentrations in these same samples ranged from <10 to 220 CFU/100 ml, yielding potential FC:FS ratios ranging from <1:1 to greater than 22:1. However, since fecal concentrations should be orders of magnitude greater than these (i.e., in the 100s or 1,000s) in order to accurately estimate a FC:FS ratio, these ratios should be considered very unreliable for source determination.

Optical Brightener Tests

- Since optical brighteners were not detected in any sample, either domestic sewage/laundry discharges were not present, or detection of these chemical(s) were prevented by dilution.

Additional Work Required

- Collect additional data (i.e., salinity, tide, and rainfall data on bug sheets) from historical MDMF pollution source stations PS#C7, #C8, and #C9.
- Obtain Cohasset Harbor dye study data from Tutela Engineering.
- Obtain Cohasset BOH beach sampling data as it becomes available.
- Perform a limited number of additional fecal differentiation analyses (fecal coliform:fecal streptococci ratios).

- Analyze additional samples for enterococci. The enterococci indicator is a subgroup within the fecal streptococcus group, are generally more human-specific than the larger group, and survive well in salt water.

MASSACHUSETTS DIVISION OF MARINE FISHERIES - DESIGNATED SHELLFISH GROWING AREA



STATION TYPE

- CLASSIFICATION
- POLLUTION SOURCE
- AD-HOC
- PRIMARY PSP
- SECONDARY PSP
- TERTIARY PSP
- CHEMICAL
- MARINA

BOUNDARY LINES

- GROWING AREA
- CLASSIFICATION AREA
- TOWN BOUNDARY

CLASS AREA TYPE

- APPROVED
- CONDITIONALLY APPROVED
- CONDITIONALLY RESTRICTED
- RESTRICTED

Produced: October 12, 1995

GROWING AREA CODE: MB10
 AREA NAME: COHASSET HARBOR
 AREA TOWN(S): COHASSET/SCITUATE

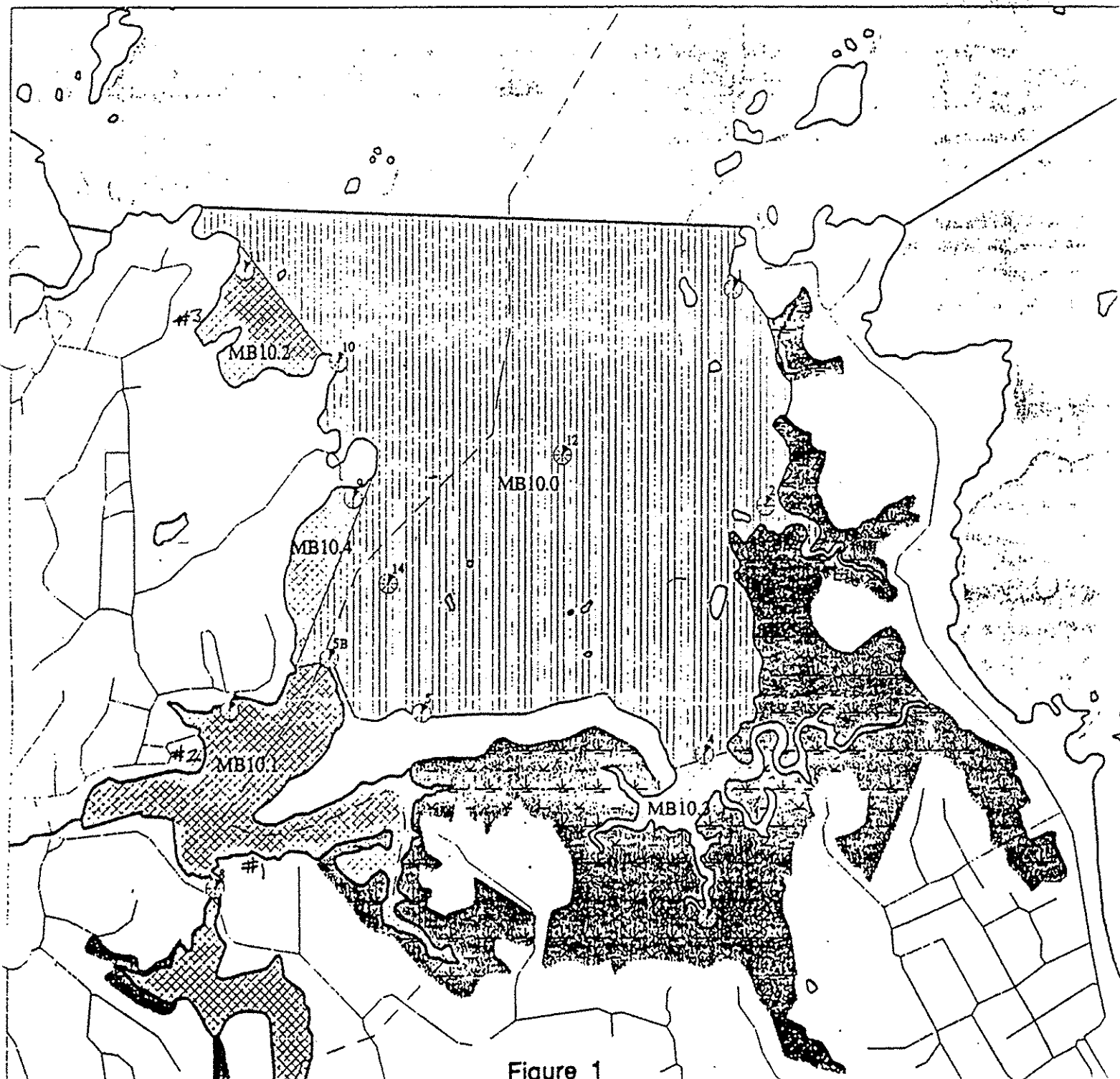


Figure 1

MASSACHUSETTS DIVISION OF MARINE FISHERIES - DESIGNATED SHELLFISH GROWING AREA

BOUNDARY LINES CLASS AREA TYPE, AS OF 07/01/95

STATION TYPE



- CLASSIFICATION
- POLLUTION SOURCE
- AD-HOC
- PRIMARY PSP
- SECONDARY PSP
- TERTIARY PSE
- CHEMICAL
- MARINA

- GROWING AREA
- CLASSIFICATION AREA
- TOWN BOUNDARY

- APPROVED
- CONDITIONALLY APPROVED
- CONDITIONALLY RESTRICTED
- RESTRICTED
- MANAGEMENT CLOSURE
- PROHIBITED

This product is for planning and educational purposes only. It is not to be used by itself for legal boundary definition or regulatory interpretation.

GROWING AREA CODE: MB10
 AREA NAME: COHASSET HARBOR
 AREA TOWN(S): COHASSET/SCITUATE

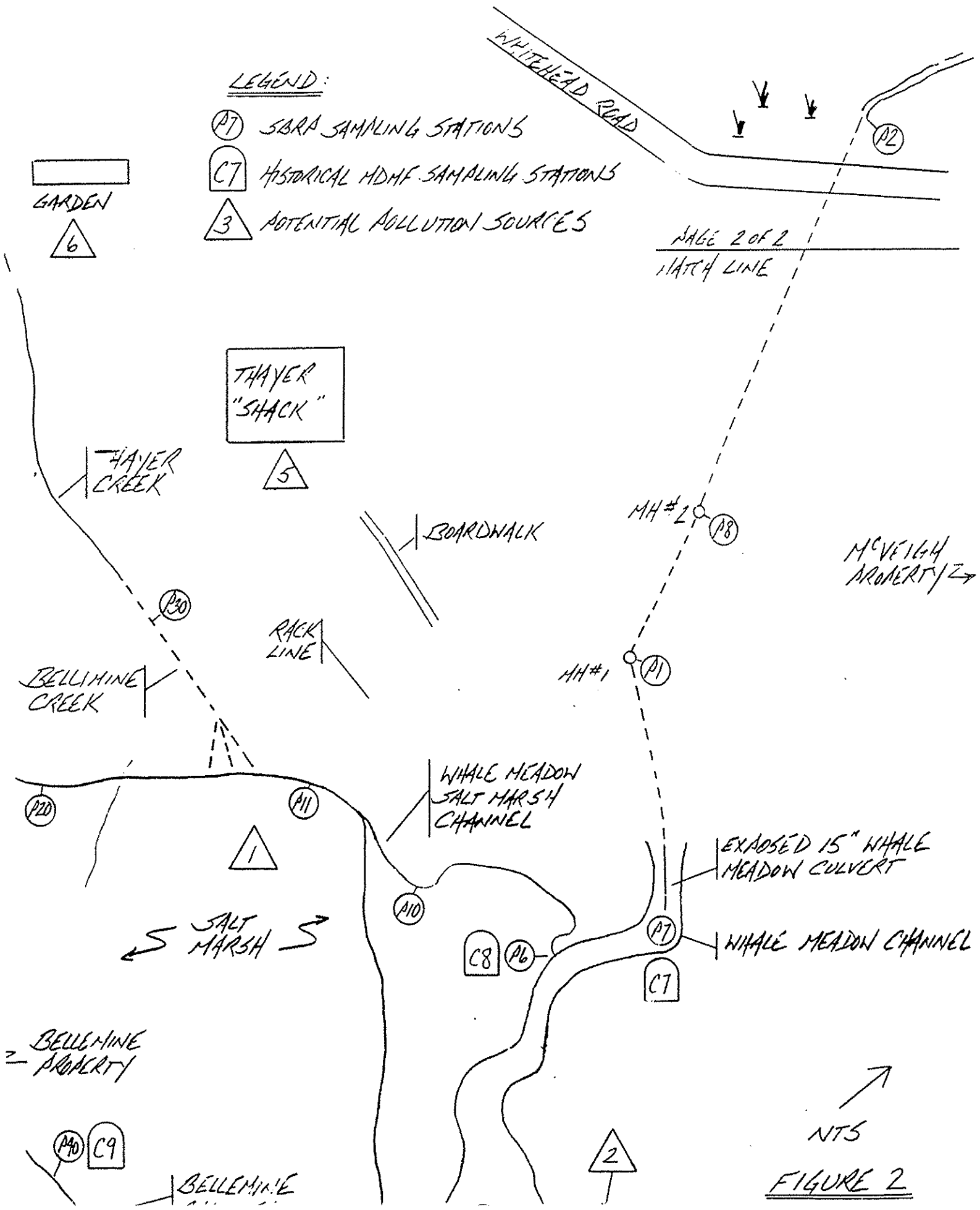
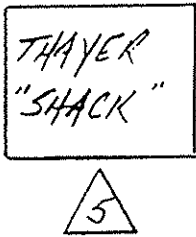
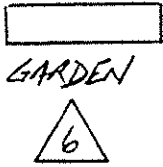
Produced: October 12, 1995



Figure 1 (cont.)

LEGEND:

- (P7) SBRA SAMPLING STATIONS
- (C7) HISTORICAL MDHF SAMPLING STATIONS
- (3) POTENTIAL POLLUTION SOURCES

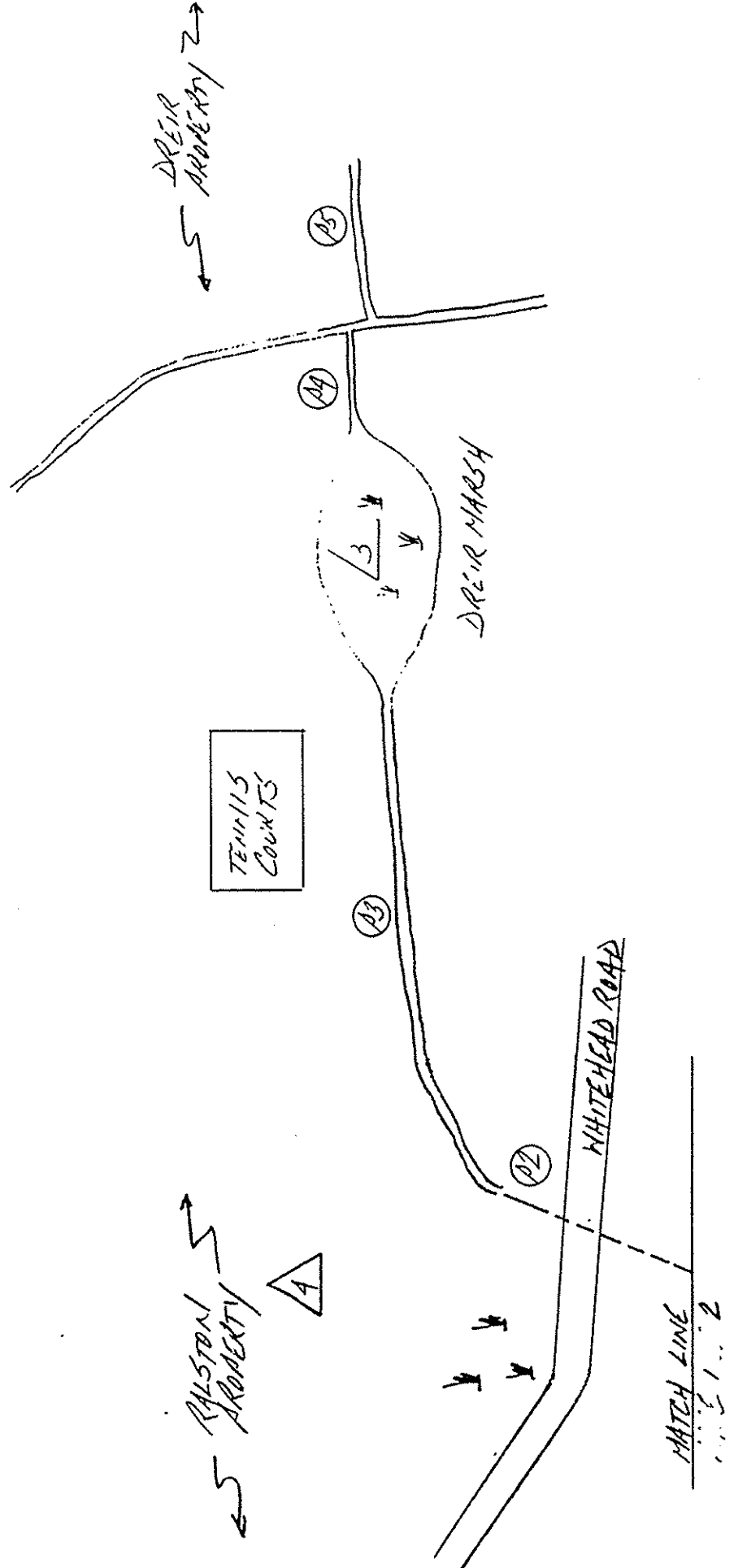


PAGE 2 OF 2
MATCH LINE

MCVEIGH PROPERTY

BELLEMINE PROPERTY

NTS
FIGURE 2



7

NTS

FIGURE 2

Figure 3
Fecal Coliform vs. Station

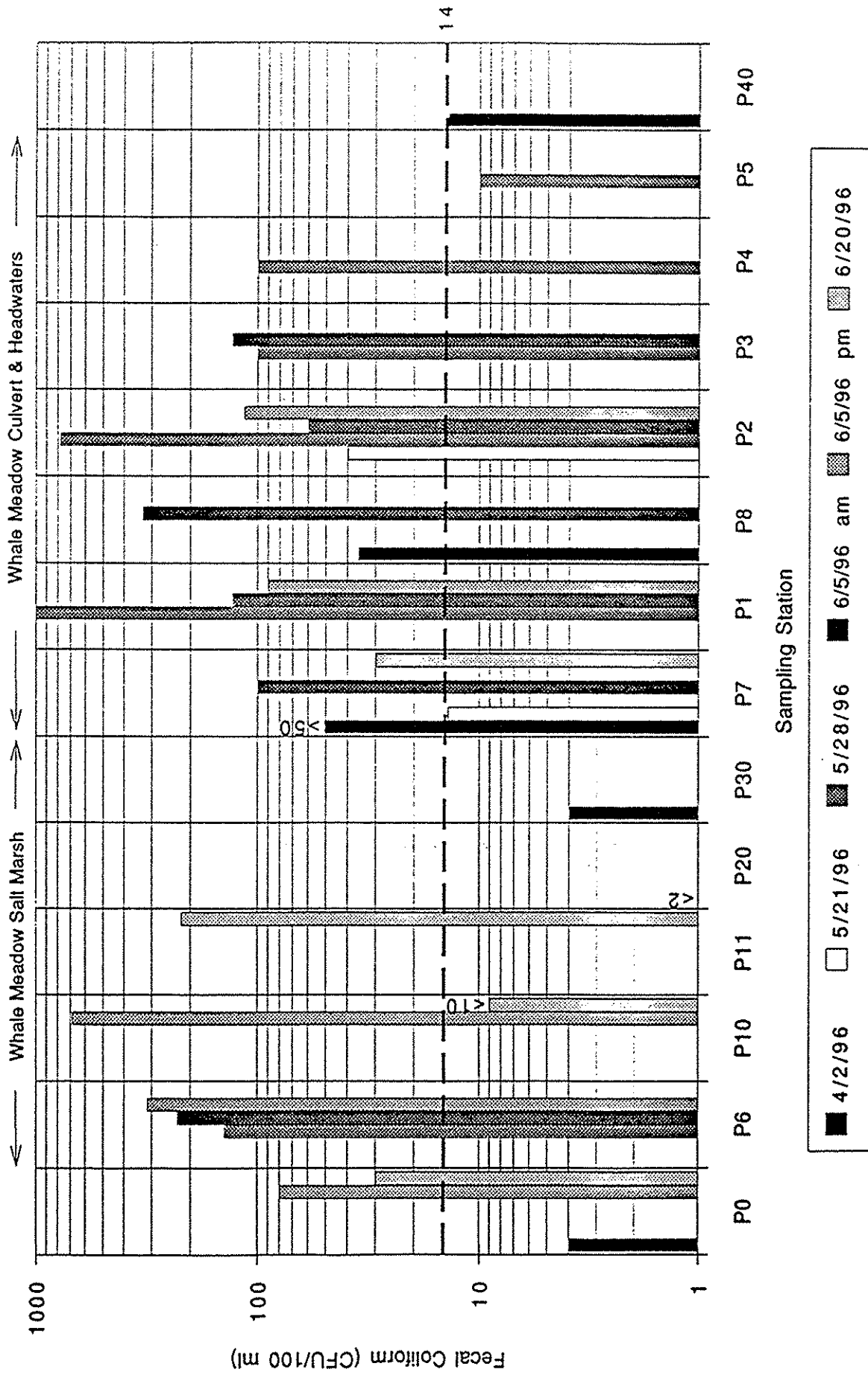


Figure 4
Fecal Coliform vs. Rainfall

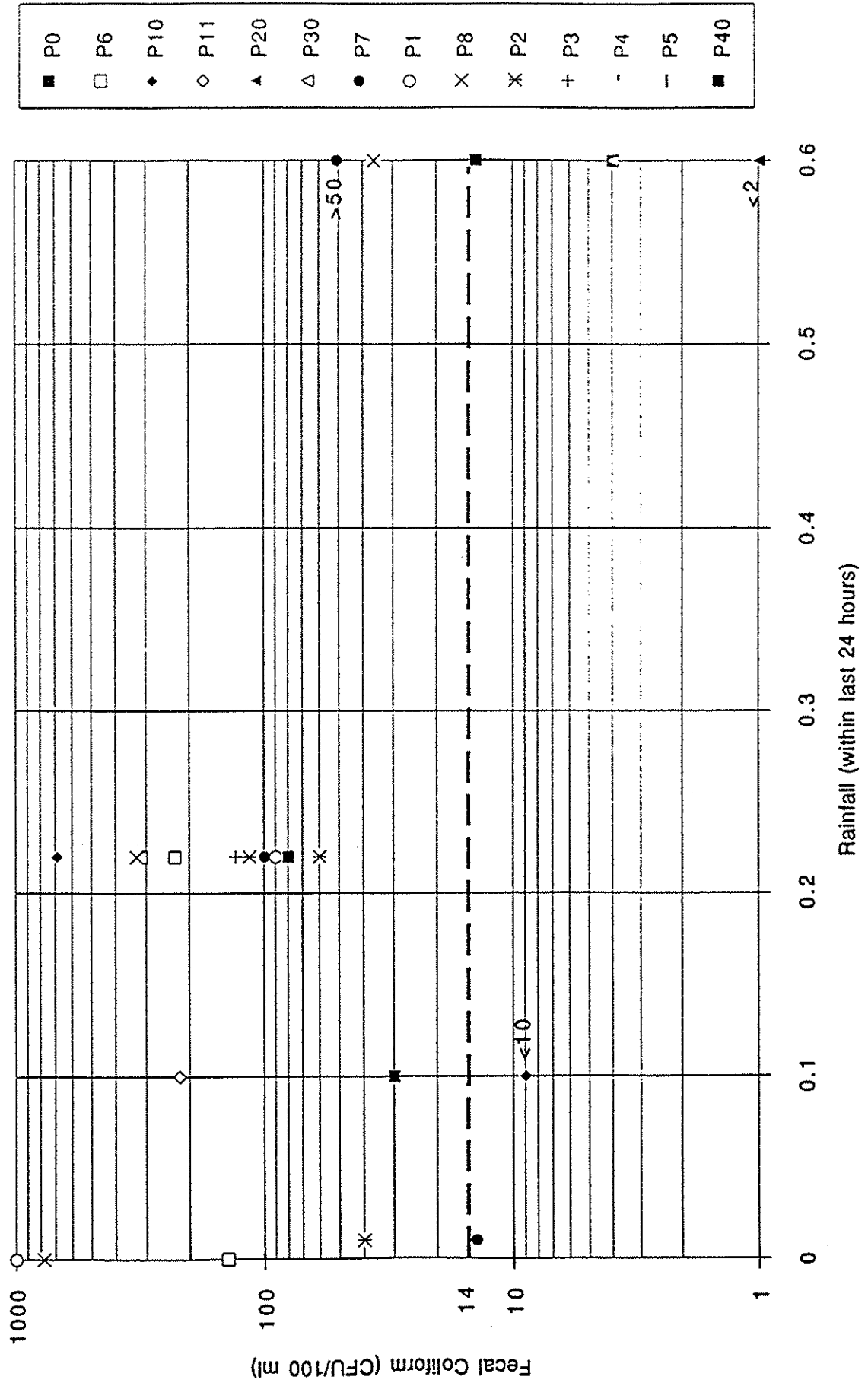


Figure 5
Fecal Coliform vs. Salinity at Select Stations

