ROAD RUNOFF SAMPLING

TISBURY GREAT POND TRIBUTARIES

June 29, 1990

Prepared For:

The Martha's Vineyard Shellfish Group

Funded By:

Tisbury Great Pond Riparian Owners

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1.0 Introduction

Historically, the control of stormwater has focused on the collection and disposal of runoff from road areas. Very little thought was given to the quality and impact of contaminated runoff to receiving water bodies.

Recent studies of pond and lake watersheds have focused attention on stormwater runoff as a significant contributor to the pollution of water resources. These nonpoint pollution sources have been identified as major sources of bacteria, heavy metals, nutrients, as well as numerous organic chemicals, such as hydrocarbons and pesticides.

The most important contributor to pollutants to road runoff in a setting such as West Tisbury and Chilmark is the land surface itself. Pollutant sources include debris dropped on roadways; debris and pollutants washed into roads from nearby yards; fecal droppings from dogs, birds, and other animals; exhaust residue and leaks from automobiles, and fallout of air pollution particles.

Rainfall carries these pollutants in solution across road surfaces, and as intensity of rainfall increases, particles are picked up and carried in suspension towards outflows. Without adequate filtering these pollutants are transmitted directly to adjacent streams and ponds.

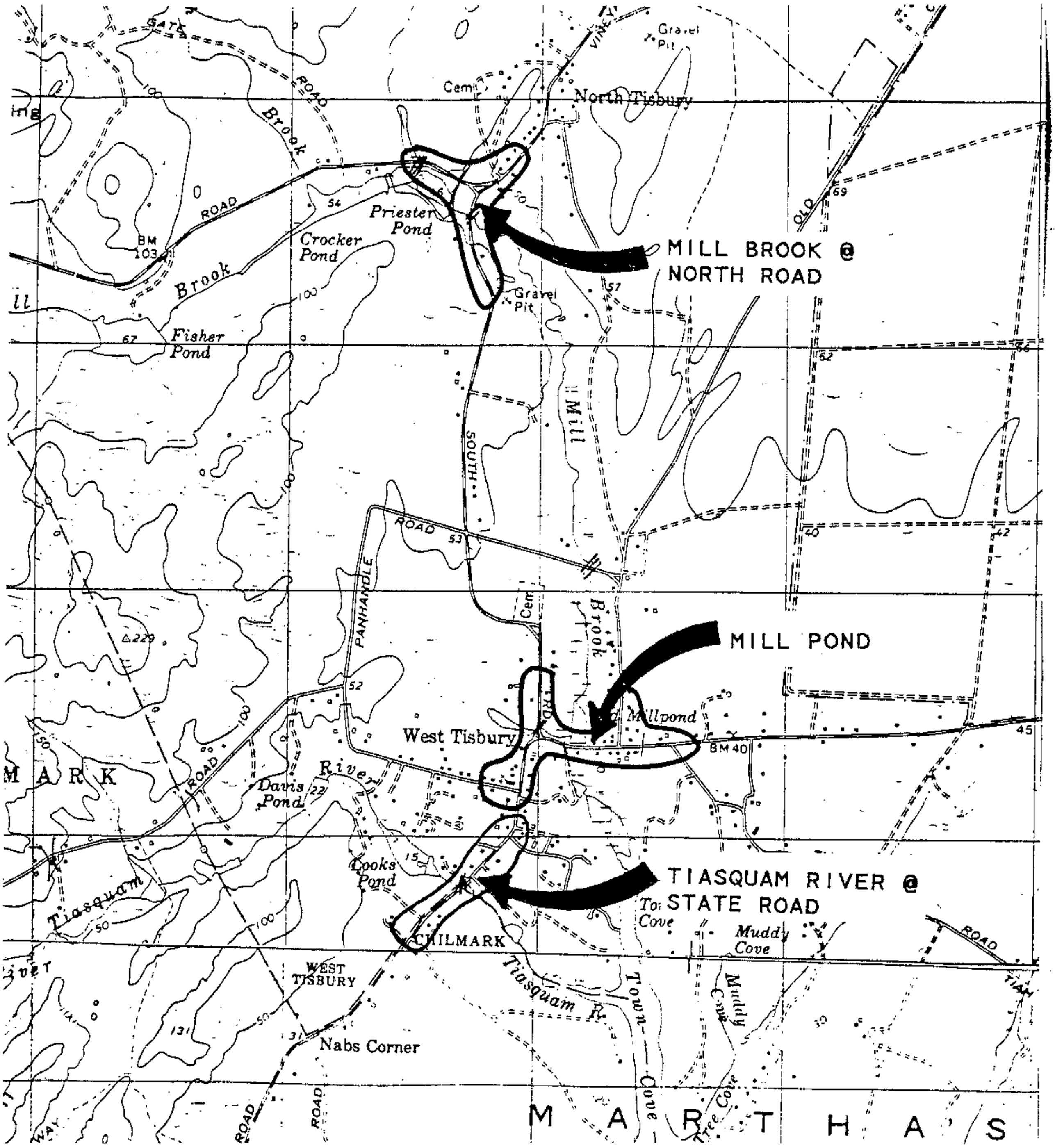
The following report summarizes water quality samples taken from three road crossings along tributaries of Tisbury Great Pond.

2.0 SAMPLING LOCATIONS AND METHODOLOGY

Water samples were collected at two locations along Mill Brook, one near the State Road - North Road Intersection, and one near Mill Pond, and a third sample was collected where State Road crosses the Tiasquam River (figure 1). Samples were collected between 1:30 and 2:00pm on May 29, 1990 approximately 15 minutes after moderate rainfall had begun.

Table 1 below describes the daily rainfall data for the month of May, 1990. It should be noted that more detailed studies of runoff have shown considerable variability in sampling results over time due to 1) the duration of time between rainfall events and 2) the time of sampling during a rainfall event.

FIGURE 1



RUNOFF SAMPLING LOCATIONS

SCALE: 1 Inch = 2,500 ft.

Base Map: USGS

TABLE 1

MAY 1990 RAINFALL DATA

Date	Rainfall(inches)	Date	Rainfall(inches)
1	0.60	17	0.59
2	0.05	18	0.32
3	0.00	19	0.00
4	0.00	20	0.00
5	0.00	21	0.17
6	0.00	22	0.17
7	0.05	23	0.00
8	0.48	24	0.00
9	0.00	25	0.00
10	0.00	26	0.00
11	0.75	27	0.00
12	0.00	28	0.00
13	0.00	29	0.00
14	0.81	30	*1.73
15	0.00	31	0.03
16	0.00		

* rainfall for 24 hour period during the day of sampling

** Source: Vineyard Gazette - four May issues

Samples were collected in a teflon beaker and transferred to acid - rinsed containers for metal analyses, plastic containers for nutrient analyses, and pre-sterilized glass containers for bacterial analyses. Samples for total phosphorus, Ammonia-nitrogen, and kjeldahl nitrogen analyses were preserved with sulfuric acid (ph < 2.0). Samples were refrigerated and delivered or express-mailed to the following laboratories for analyses:

1. Bacterial Analyses: Dukes County Laboratory
2. Nutrient Analyses: Lycott Environmental Research, Inc.
3. Metals Analyses: Groundwater Analytical, Inc.

Although analyses for volatile organic compounds (components of hydrocarbons) were not conducted, it should be noted that all samples collected contained a hydrocarbon sheen.

3.0 Analytical Results and Discussion:

Bacterial Results:

Results of the bacterial analyses from the three runoff sampling locations indicated counts of fecal coliform bacteria that were well above levels set for shellfish closure (14 counts per 100 ml). Previous testing by the West Tisbury Board of Health showed even higher levels of fecal coliform bacteria from samples of runoff in these areas (personal communication with John Powers, health agent). Testing of island ponds by the Martha's Vineyard Commission has shown a strong correlation between high bacterial levels within island water bodies and rainfall events.

A study funded by the EPA in Buzzard's Bay demonstrated that road runoff is a major contributor to bacterial contamination within the bay. Like Tisbury Great Pond, Buzzards Bay has experienced numerous closures to shellfishing in the 80's. Much of the bacterial contamination found in runoff in the Buzzard's Bay Watershed was attributed to animal wastes deposited on roads and adjacent lawns.

Trace metals:

Levels of lead and copper were found in concentrations exceeding threshold levels believed to be harmful to fish (Urban Stormwater Runoff, 1982). Levels of metals detected are similar to concentrations found in analyses of samples taken from runoff in the Seatle, Washington area.

The detrimental effects of metals on marine organisms, especially shellfish, is exacerbated by the ability of these elements to accumulate in bottom sediments and in the flesh of the organism. Ketchum (1972) estimated that lead is bioaccumulated in organisms at a rate of 100 to 1000 times that found in the environment.

Nutrients:

Nutrient analyses of the runoff samples, including forms of nitrogen and phosphorus, indicate that runoff has a substantial impact on the loading of nutrients into Tisbury Great Pond. High levels of total phosphorus found in the

TABLE 2
RUNOFF SAMPLING RESULTS

STATION	Mill Brook @ North Road	Mill Pond	Tiasquam River @ State Road
Parameter:			
pH (1)	5.80	6.1	6.5
Conductivity	110	80	170
<u>Bacteria:</u> (2)			
Total Coliform	432	1440	1264
Fecal Coliform	180	440	40
<u>Nutrients:</u> (3)			
Nitrate-N	1.0	0.7	0.5
Ammonia-N	1.2	1.0	0.33
Kjeldahl-N	1.8	1.4	0.56
Total Phosphorus	0.49	0.42	0.35
<u>Metals:</u> (4)			
Total Cadmium	0.0005	0.002	0.0005
Total Chromium	0.043	0.013	0.026
Total Copper	0.071	0.038	0.038
Total Lead	0.17	0.048	0.082

1) pH and Conductivity Measurements made in field

2) in counts per 100 ml. - Analyses by Dukes County Laboratory

3) in mg per liter - Analyses by Lycott Environmental Research, Inc.

4) in mg per liter - Analyses by Groundwater Analytical

4) samples collected 5-29-90

runoff samples may explain the elevated levels of phosphorus found in Mill Pond and Tisbury Great Pond during former sampling projects (Kendall and Associates, 1988).

Since salt ponds, like Tisbury Great Pond, are vulnerable to the effects of excessive nutrient input it is essential that sources of nutrient input, such as road runoff, be addressed. The end product of excessive nutrient loading to ponds, known as eutrophication, not only leads to the loss of valuable fishing resources, but also can lead to the loss of surrounding land value.

Sources of these nutrients found in runoff include fertilizer from nearby lawns and farms, vehicular emissions, soil erosion and atmospheric contributions from rainfall.

4.0 Conclusions and Recommendations

Sample results from three sampling locations of road runoff into tributaries of Tisbury Great Pond demonstrate the negative impact of the present stormwater control systems within the watershed on pond water quality. Excessive levels of bacteria, nutrients and metals were found.

Direct discharge of stormwater into these tributaries,is not only having an immediate impact on shellfishing within the pond due to high bacterial levels and pond closings, but is having a long range effect on the pond quality resulting from excessive nutrient loading, accumulated metals, oils and other organic chemicals.

In many cases the solutions to runoff contamination are simple and involve a minimal amount of engineering and construction expense. The following recommendations are offered:

1) In conjunction with efforts made by the Tisbury Great Pond Think Tank, the soil conservation service has made recommendations for 11 runoff sites on roads within the watershed. These recommendations include the diversion of flow into wetland areas and the construction of additional catch basins in certain high volume runoff areas.

2) Where possible, the use of existing wetlands or detention ponds with biological control should be encouraged because these natural systems not only filter out metals and bacteria, but they remove nitrogen by denitrification.

3) The Selectmen of the towns of Chilmark and West Tisbury should continue in their efforts to work with local land owners and the state DPW to institute changes in runoff design.

4) It is essential that whenever repairs, repaving or new construction are carried out on the state roads, that efforts are made to make needed changes in runoff control structures.

5) Residents and farmers in the vicinity of runoff sites should be discouraged from using fertilizer and pesticides. The use of vegatative buffer strips to filter runoff from land areas adjacent to roads should be promoted.

REFERENCES

Cooperative Extension Service, 1986, September, Marine News, Vol. 3, No.4.

Kibler, David F., 1982, Urban Stormwater Hydrology, American Geophysical Union - Water Resources Monograph.

Kendall and Associates, 1988, Environmental Impact Statement - Mill Brook Subdivision, prepared for the West Tisbury Planning Board.

Ketchum, B.H. ed. 1972, The Waters's Edge: Critical Problems in the Coastal Zone. Mass. Inst. Technol. Press, Cambridge.

Woodruff, Robert, and Saunders, Craig, Tisbury Great Pond Watershed Study, pp.54.

APPENDIX

GROUNDWATER ANALYTICAL

TRACE METALS (FAA/GFAA)

Field ID:	Mill Brook North Road	Lab ID:	015001
Project:	Runoff Sampling Tisbury Great Pond	Sampled:	05-29-90
Client:	Saunders Associates	Received:	05-30-90
Cont/Prsv:	1L HDPE/HNO3		
Matrix:	Aqueous		

PARAMETER	CONCENTRATION (mg/L)	DETECTION LIMIT (mg/L)	QC BATCH	DATE DIGESTED	DATE ANALYZED	EPA METHOD
Cadmium, Total	0.0005	0.0003	GCD-108	05-30-90	05-31-90	213.2/7131
Chromium, Total	0.043	0.003	GCR-107	05-30-90	05-31-90	218.2/7191
Copper, Total	0.071	0.02	GCU-101	05-30-90	06-01-90	220.2
Lead, Total	0.17	0.003	GPB-107	05-30-90	05-31-90	239.2/7421

BDL = Below Detection Limit. Method References: Methods for Chemical Analysis of Water and Wastes, US EPA EPA-600/4-79-020, Revised (1983) and Test Methods for Evaluating Solid Waste, US EPA SW-846, Third Edition (1986). Graphite Furnace analyses performed with Zeeman background correction and Lvov platform technique.

GROUNDWATER ANALYTICAL

TRACE METALS (FAA/GFAA)

Field ID: Mill Brook Mill Pond
Project: Runoff Sampling Tisbury Great Pond
Client: Saunders Associates
Cont/Prsv: 1L HDPE/HNO3
Matrix: Aqueous

Lab ID: 015003
Sampled: 05-29-90
Received: 05-30-90

PARAMETER	CONCENTRATION (mg/L)	DETECTION LIMIT (mg/L)	QC BATCH	DATE DIGESTED	DATE ANALYZED	EPA METHOD
Cadmium, Total	0.002	0.0003	GCD-108	05-30-90	05-31-90	213.2/7131
Chromium, Total	0.013	0.003	GCR-107	05-30-90	05-31-90	218.2/7191
Copper, Total	0.038	0.02	GCU-101	05-30-90	06-01-90	220.2
Lead, Total	0.048	0.003	GPB-107	05-30-90	05-31-90	239.2/7421

BDL = Below Detection Limit. Method References: Methods for Chemical Analysis of Water and Wastes, US EPA EPA-600/4-79-020, Revised (1983) and Test Methods for Evaluating Solid Waste, US EPA SW-846, Third Edition (1986). Graphite Furnace analyses performed with Zeeman background correction and Lvov platform technique.

GROUNDWATER ANALYTICAL

TRACE METALS (FAA/GFAA)

Field ID: Tiasquam River Crossing
Project: Runoff Sampling Tisbury Great Pond
Client: Saunders Associates
Cont/Prsv: 1L HDPE/HN03
Matrix: Aqueous

Lab ID: 015002
Sampled: 05-29-90
Received: 05-30-90

PARAMETER	CONCENTRATION (mg/L)	DETECTION LIMIT (mg/L)	QC BATCH	DATE DIGESTED	DATE ANALYZED	EPA METHOD
Cadmium, Total	0.0005	0.0003	GCD-108	05-30-90	05-31-90	213.2/7131
Chromium, Total	0.026	0.003	GCR-107	05-30-90	05-31-90	218.2/7191
Copper, Total	0.038	0.02	GCU-101	05-30-90	06-01-90	220.2
Lead, Total	0.082	0.003	GPB-107	05-30-90	05-31-90	239.2/7421

BDL = Below Detection Limit. Method References: Methods for Chemical Analysis of Water and Wastes, US EPA EPA-600/4-79-020, Revised (1983) and Test Methods for Evaluating Solid Waste, US EPA SW-846, Third Edition (1986). Graphite Furnace analyses performed with Zeeman background correction and Lvov platform technique.

GROUNDWATER ANALYTICAL

QUALITY ASSURANCE
Matrix Spike Recovery and
Matrix Spike Duplicate Study

Category: **Trace Metals**
Matrix: **Aqueous**
Units: **mg/L**

ANALYTE	QC BATCH	SPIKED	MEASURED			ACCURACY		PRECISION	
			MS	MSD	AVG	APR	Limits	RPD	Limit
Cadmium	GCD-108	0.001	0.0009	0.0009	0.0009	90 %	80-120	0 %	20
Chromium	GCR-107	0.025	0.022	0.022	0.022	88 %	80-120	0 %	20
Copper	GCU-101	0.025	0.022	0.023	0.023	92 %	80-120	3 %	20
Lead	GPB-107	0.050	0.054	0.056	0.055	110 %	80-120	4 %	20

Terms: MS = Matrix Spike; MSD = Matrix Spike Duplicate; AVG = Average; APR = Average Percent Recovery; RPD = Relative Percent Difference. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.