Wet-Weather Sampling and Water-Quality Evaluation 2003

Township of Cranbury
Environmental Commission

June 29, 2004

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Introduction

This report presents the results of surface-water monitoring during wet weather, conducted in December 2003 in the Township of Cranbury, Middlesex County, New Jersey.

The Cranbury Environmental Commission obtained a grant from the New Jersey Department of Environmental Protection (NJDEP), Environmental Services Program. The purpose of the grant is to support the costs associated with the collection, analysis, and evaluation of surface-water samples in the Township of Cranbury during wet-weather flow conditions. The costs of the program were shared equally between NJDEP and the township.

Land use in Cranbury is changing rapidly as more areas of the town are developed, both residentially and commercially. This development affects surface-water bodies, both in the short term due to increased siltation during construction, and in the long term as runoff quantity is increased after impermeable cover replaces open land. Often, runoff quality deteriorates as well, because runoff from paved areas can transport oil and grease associated with parking areas, and runoff from residential areas can transport pesticides and fertilizers to receiving water bodies.

A previous NJDEP grant (ES02-40) supported the establishment of a baseline water-quality assessment of surface waters in the Township during dry-weather flow conditions. The test results were acceptable overall and generally met NJDEP surface-water quality criteria. A report of those results was submitted to the NJDEP in June 2003.

Purpose and Objectives

The purpose of the project is to characterize changes in surface-water quality in Cranbury during wet-weather flow conditions. The ultimate goal is to help protect Cranbury's surface-water bodies, which are ecological resources used as a habitat by wildlife and by Cranbury residents for fishing, canoeing, and other recreational activities.

The objectives of the wet-weather monitoring program are as follows:

- Conduct sampling during a period of substantial precipitation, to monitor any variations in surface-water chemistry resulting from increased runoff.
- Collect samples soon after the start of the storm, about 5 hours later, and 24 hours after the first collection.
- Collect samples from four locations at each time interval, representative of runoff from the warehouse district of the Township, highways, parklands, and residential areas.

- Analyze each sample at an NJDEP-certified analytical laboratory for general water-quality parameters.
- Tabulate and evaluate the results compared to standards and targets for surface-water quality for similar lakes and streams.

Monitoring Locations

The monitoring locations are shown in the map in Figure 1. Four locations were selected as representative of the types of runoff found in Cranbury Township. They are designated as follows:

- Warehouse District: Cranbury Brook from the east side of the Route 130 bridge (samples designated "WD" in the Accutest report).
- Highway Runoff: A culvert emptying from Route 130 into Brainerd Lake at the south end of the bridge ("HW").
- Parklands: A culvert emptying from Village Park into Brainerd Lake ("VP").
- Residential Area: A culvert emptying into Cranbury Brook at Wynnewood Drive ("RA").

Sampling Events

Samples were collected from all four locations three times during the rainfall event:

- Approximately 2 hours after the beginning of precipitation: December 17, 2003, 09:45 to 10:30 EST (samples designated "-1"; for example, "WD-1").
- Five hours later: December 17, 2003, 14:45 to 15:30 EST ("-2").
- Approximately 24 hours after the first collection: December 18, 2003, 10:20 to 10:45 EST ("-3").

On December 18, it was not possible to collect samples at the highway-runoff and residential-area locations because flow had stopped after the end of the precipitation.

Collection Procedures

At each sampling event, samples were collected into bottles pre-filled with preservatives as appropriate, 9 bottles for each location

Sample Analyses

Surface-water samples were analyzed by Accutest Laboratories, Dayton NJ (NJDEP Certification No. 12129). Samples from all six sampling locations were analyzed for the following parameters:

Parameter	Method
Total Suspended Solids	EPA 160.2
Nitrogen as Nitrate[a]	EPA 353.2/ SM184500
Nitrogen, Nitrate + Nitrite	EPA 353.2
Nitrogen as Nitrite	SM19 4500NO2B
Sulfate	EPA 300/ SW846 9056
Total Phosphorus	EPA 365.3
Petroleum Hydrocarbons	EPA 418.1
Fecal Coliforms	SM18 9222D
Total Coliforms	SM18 9222B

a – Calculated as (Nitrogen, Nitrate + Nitrite) – (Nitrogen as Nitrite)

Pesticides[a]	
Aldrin	Endrin
alpha-BHC	Endosulfan sulfate
beta-BHC	Endrin aldehyde
delta-BHC	Endosulfan-I
gamma-BHC (Lindane)	Endosulfan-II
Chlordane	Heptachlor
Dieldrin	Heptachlor epoxide
4,4'-DDD	Methoxychlor
4,4'-DDE	Toxaphene
4,4'-DDT	

a – Method: EPA 608

Metals	Method
Arsenic	EPA 200.7
Barium	EPA 200.7
Cadmium	EPA 200.7
Chromium	EPA 200.7
Lead	EPA 200.7
Mercury	EPA 245.1
Selenium	EPA 200.7
Silver	EPA 200.7

Results

A report of the test results from Accutest Laboratories is appended as Attachment A. Results of analyses with measurable quantities of analyte are summarized in Table 1. Surface-water quality criteria cited are the NJDEP standards for "Fresh-Water 2 Non-Trout" (FW2-NT) surface-water bodies.

Rainfall Amounts

Precipitation amounts (in inches) reported by the National Weather Service at Trenton/ Mercer County Airport and at Somerset Airport for December 17, 2003 were as follows:

Rainfall for the Hour Ending (EST):	Trenton/Mercer County Airport	Somerset Airport, Somerville
06:53	0.03	0.01
07:53	0.11	0.14
08:53	0.15	0.13
09:53	0.13	0.22
10:53	0.01	0.05
11:53	0.02	0.01
12:53	0.00	0.00
13:53	0.01	0.00
14:53	0.04	0.04
15:53	0.02	0.05
16:53	0.02	0.02
17:53	0.01	0.01
18:53	0.02	0.03
19:53	0.00	0.01
Total	**0.57**	**0.72**

Total Suspended Solids

Total suspended solids were elevated in all samples at the 2-hr sampling and at the Warehouse and Highway sites at 7 hr. Total suspended solids were below the standard at the two sites sampled the next day.

Nitrate

Nitrate concentrations in all samples were less than the NJDEP standard of 10 mg/L.

Sulfate

All reported concentrations of sulfate were considerably less than the standard of 250 mg/L.

Total Phosphorus

The NJDEP standard for total phosphorus in lakes is 0.05 mg/L, and the standard for streams is 0.1 mg/L. The levels of total phosphorus exceeded these standards at all of the sites sampled on the day of the storm. Total phosphorus was below the standards at the two sites sampled the next day.

Dry-weather sampling of surface waters in July 2002 showed that total phosphorus levels in Brainerd Lake were slightly elevated. The phosphorus observed at that time and in the wet-weather samples in December 2003 may be the result of fertilizer runoff in the areas sampled. Excess phosphorus can stimulate aquatic plants and cause excessive plant growth. At this time, plant growth in Brainerd Lake does not appear excessive. However, flushing of phosphorus into our lakes and streams is undesirable and should be reduced if possible.

Chromium

Chromium concentrations in all samples were less than the NJDEP standard of 160 mcg/L.

Lead

The concentration of lead in the 2-hr sample from Village Park exceeded the NJDEP standard of 38 mcg/L for acute (short-term) conditions. Lead concentrations in all other samples met the standard.

Petroleum Hydrocarbons

Surface water should not contain petroleum hydrocarbons, and the NJDEP standard is "None". Significant concentrations of petroleum hydrocarbons were present in the Highway Runoff and Village Park samples at 2 and 7 hr. Petroleum hydrocarbons were below the limit of detection in Village Park at 27 hr and in all the samples from the Warehouse District and the Residential Area.

It seems likely that the petroleum hydrocarbons found at two sites during wet weather represent runoff of pollutants from roads and highways.

Coliforms

Fecal coliforms should not exceed a geometric average of 200 col/100 mL, nor should more than 10% of the samples taken during any 30-day period exceed 400 col/100mL. Elevated levels of fecal coliforms were found in all samples at 2 and 7 hr, except for the samples from the Warehouse District.

Fecal coliforms in wet-weather runoff probably represent excrement from pets and wild animals (for example, geese in Village Park).

Parameters with Very Low Concentrations

Analytes with results uniformly below the reporting limits are listed in Table 2. These included all of the pesticides that were analyzed, and six additional metals.

Summary

The Cranbury Environmental Commission conducted water-sampling events during wet weather on December 17-18, 2003. Samples were collected from four sites, representing runoff from the warehouse district east of Route 130, and from highways, parklands, and a residential area. The samples were analyzed at an NJDEP-certified testing laboratory for general water-quality parameters.

The results of the analyses of the wet-weather water samples indicate the following:

- Runoff of water from township roads, highways, and open spaces during wet weather resulted in the flushing of certain pollutants into Brainerd Lake and the Cranbury Brook.

- Parameters with concentrations exceeding NJDEP standards included total suspended solids, total phosphorus, petroleum hydrocarbons, fecal coliforms, and (in one sample) lead.

- Elevated levels of phosphorus may have resulted from fertilizer runoff from adjacent areas, while petroleum hydrocarbons probably represent runoff of pollutants from roads and highways. Fecal coliforms in wet-weather runoff probably represent excrement from pets and other animals such as wild geese.

- Parameters for which all test results were acceptable included nitrogen, sulfate, 19 pesticides, and seven metals.

The results of this testing program document changes in the quality of surface waters in the Township of Cranbury during wet-weather flow conditions.

Table 2: Analytes with Results Below Reporting Limits

Pesticides		Metals
Aldrin	4,4'-DDT	Arsenic
alpha-BHC	Endrin	Barium
beta-BHC	Endosulfan sulfate	Cadmium
delta-BHC	Endrin aldehyde	Mercury
gamma-BHC	Endosulfan-I	Selenium
(Lindane)	Endosulfan-II	Silver
Chlordane	Heptachlor	
Dieldrin	Heptachlor epoxide	
4,4'-DDD	Methoxychlor	
4,4'-DDE	Toxaphene	

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