Stream studies conducted by Rensselaer Fresh Water Institute

Completed by

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During 1982 the Fresh Water Institute (FWI) staff was involved in studying two streams which empty into Lake George. The first of these was a study of Smith Brook, which has been shown to contribute large numbers of coliform bacteria to Lake George. FWI and NYS Department of Environmental Conservation personnel developed a plan to map this stream in an attempt to locate the source of the coliforms. During four sampling trips to the site, the source of the coliforms was located. The property owner was made aware of the problem and subsequently discovered a broken pipe on the property and affected repairs. The coliform inputs to Lake George from Smith Brook were thereby substantially reduced.

A second study involved an investigation of Stewart Brook. Stewart Brook is located in Bolton Landing and empties into Meyer's Pond, which also receives waters from curtain drains associated with the Bolton Landing sewage treatment plant and drainage from adjacent residential areas. The data obtained on this system (before, during and after a rainstorm) demonstrated the influence of the curtain drains on water quality in Stewart Brook.

INTRODUCTION

The Rensselaer Fresh Water Institute, with support from the Lake George Association Fund, has conducted a water quality monitoring program on Lake George since April 1980. In addition, short term studies related to Lake George water quality have been and continue to be done.

During the summer of 1982 two such studies were done on streams which empty into Lake George.

SMITH BROOK

The first stream study involved Smith Brook whch empties into Lake George near Diamond Point. A fecal coliform contamination problem has been observed on this brook since 1977, however the source of the problem had not been determined.

In cooperation with the NYS Department of Environmental Conservation (NYSDEC), the FWI staff initiated a survey of coliform levels in the north and south branches of Smith Brook and the region where they join, approximately 50 feet from the lake. From this initial sampling it was determined that the coliform levels became elevated somewhere between Route 9N and

the Lake, thus narrowing our survey to this area. Sampling both branches upstream from the confluence, it became apparent that the observed bacterial influx was occurring in the north branch of the brook. Total coliform levels in the north branch were routinely 100 to 1000 times greater than those in the south branch. The brook was then sampled at approximately 50 foot intervals on the lake side of Route 9N. Conductivity, phosphorus and total coliform bacteria were measured. During sampling, a grayish effluent was seen entering the stream and a sample of this effluent was collected. The samples were analyzed independently by both the FWI laboratory and the Queensbury Water Treatment Plant laboratory. Both analyses showed an increase of 3 to 4 orders of magnitude in the coliform counts from samples upstream of this point. Conductivity readings taken at the same 50 foot intervals did not show as dramatic an increase.

This new data was discussed with the property owner on August 22. During that meeting the area in question was found to contain an overflow pipe from a small septic system leading to the main system. The owner agreed to have the area excavated in an effort to determine if a leak had occurred in the line. Digging ensued on August 23 and an overflow pipe was found to have separated at a connection. The separation was then repaired by the owner.

On August 27 five new samples were taken by DEC around the area of the previously separated pipe to determine if the source of the bacteria had been eliminated. At that time, the surrounding ground did not appear to show any contamination and the analysis of the samples showed that the problem had been

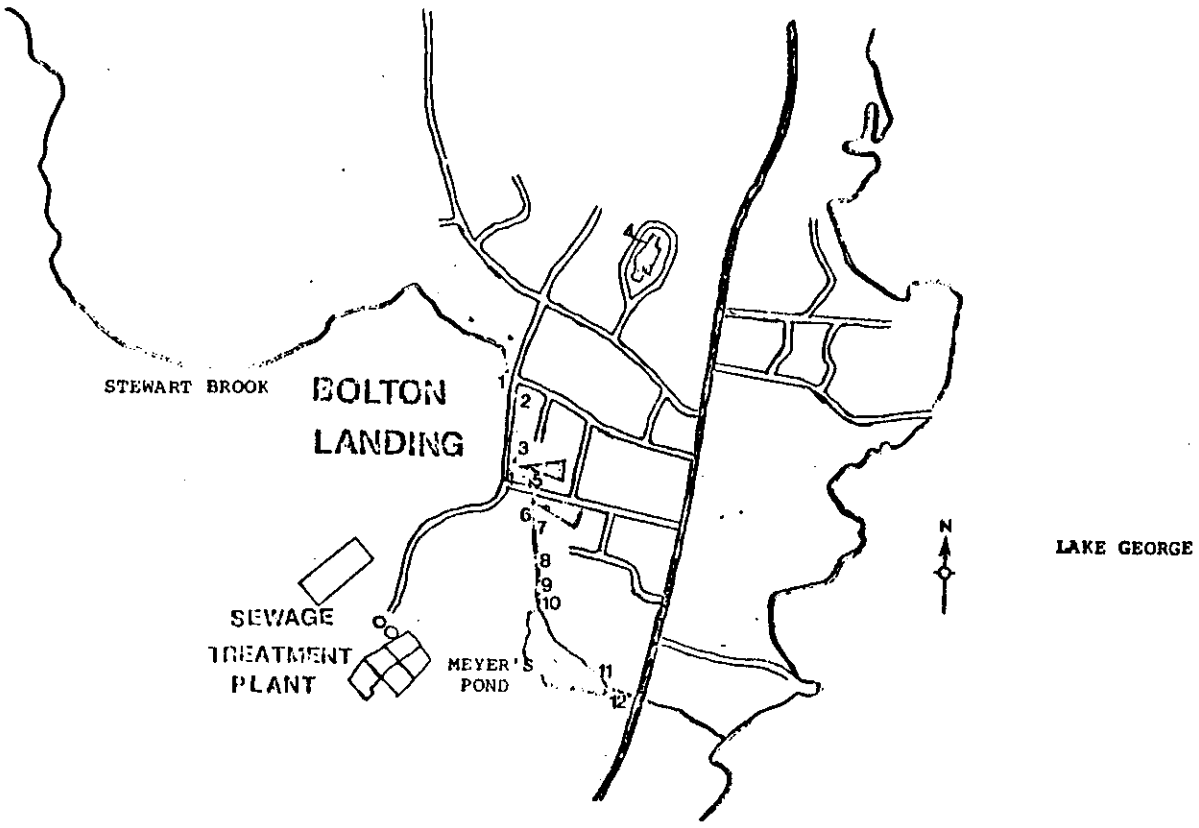
The second stream study during 1982 was conducted on Stewart Brook, which runs along the western edge of Bolton Landing and emptys into Meyer's Pond near Route 9N. Meyers Pond drains into Lake George below the Bolton Town Beach (Figure 1).

After a tour of the Bolton Landing Sewage treatment facility in July the FWI staff became aware of a curtain drain which discharge into Stewart Brook. Two curtain drains are located below a series of final treatment sand beds to collect both ground water and sand bed seepage. Flow is directed away from nearby homes through a culvert which subsequently empties into Stewart Brook (see Aulenbach this volume). We also noticed a large amount of aquatic vegetation (Elodea sp.) growing in Meyer's Pond, which is actually an impoundment of Stewart Brook created by an earthen dam. By late August, growth of aquatic vegetation made rowing a small boat in the Pond extremely difficult.

Because of the large amount of aquatic vegetation observed in Meyer's Pond and the possibility that the curtain drain discharge might be providing nutrients for this growth, it was

decided to study this system. During three consecutive days (August 24,25,26) before, during and after a rainstorm, water samples were collected at 12 locations along this system (see Fig. 1) beginning 300 feet above the curtain drain input, and working downstream to 50 feet below Meyer's Pond. On August 24 the stream appeared to be at normal summer low flow. On the following day (August 25) an eight-hour rainstorm of approximately 0.3 inch had caused an elevation in stream flow and sediment load. Samples on this day were collected within one hour after the rain had stopped. By the time of sampling on the next day, the stream had returned to near its pre rainstorm level. No measurements of stream flow were taken during this period, but it was obvious that the rainstorm was transitory in relation to stream flow.

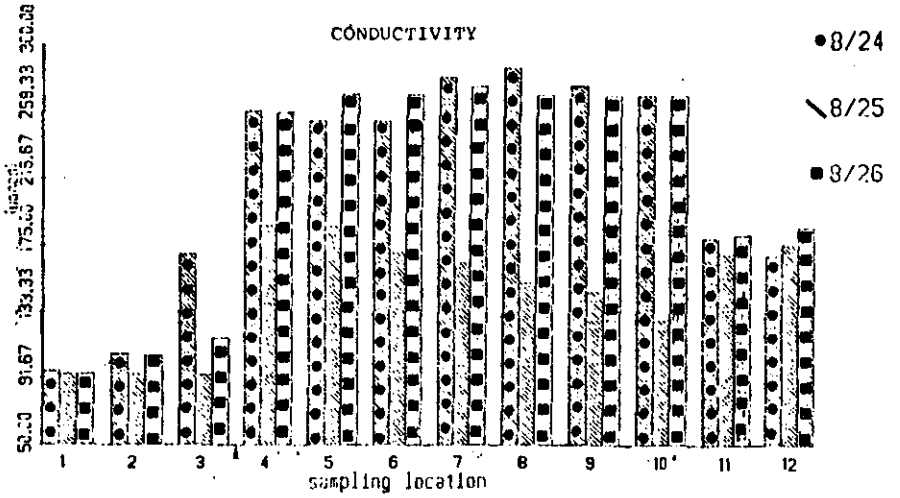
FIGURE 1



Figures 2-6 summarize the data for conductivity, chloride, nitrate, total phosphorus and total filterable phosphorus analysis on the samples collected during this three day sampling effort. Reading from left to right (Fig. 2-6) sampling locations 1-10 are at intervals ranging from 50 to 300 feet working downstream to Meyer's Pond. Sampling location 11 is the pond surface near the dam, and number 12 is the stream 50 feet below the dam. The small arrow between locations 3 and 4 indicates the curtain drain input.

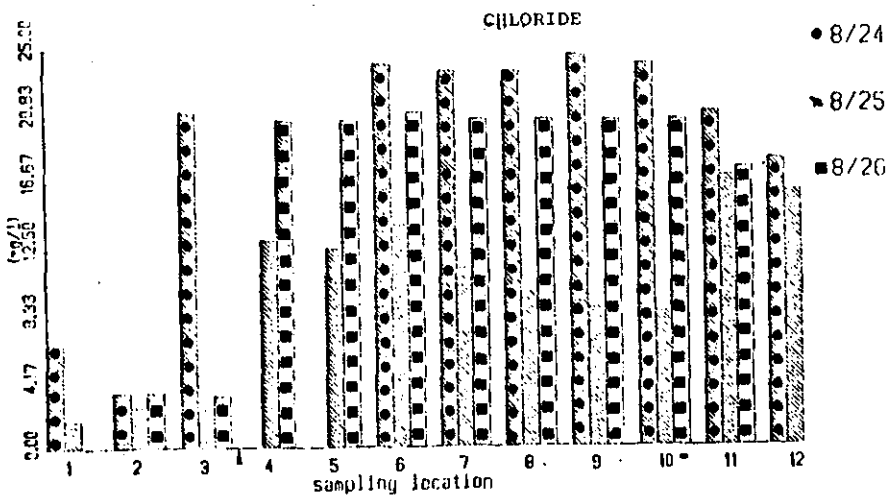
Total ionic concentration, as estimated by conductivity, increased sharply below the curtain drain discharge (Fig. 2). This increase may be attributable to an increase in chloride concentration, as natural sand bed filtration has been found to be ineffective in the removal of chlorides from sewage

Figure 2



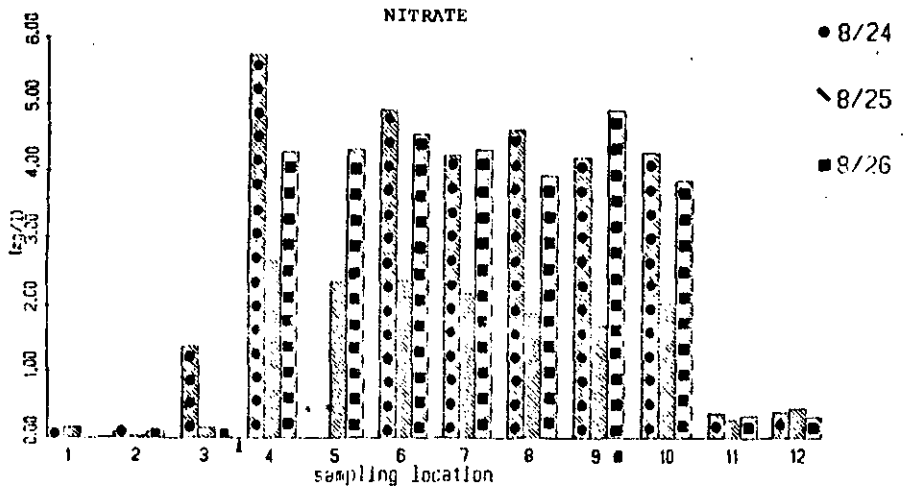
(Aulenbach et al; 1970; 1973). Several of the samples for chloride analysis on August 24 were inadvertently lost but the trend of increasing concentration after the discharge is still apparent from the August 25 and 26 values (Fig. 3). The nitrate

Figure 3



concentration increased dramatically below the curtain drain input (Fig. 4). However it was not found to be in excess of the levels allowable under the New York State pollution discharge permit (10 mg/l). As was the case with conductivity and chloride, the storm had the effect of diluting the impact of the curtain drain discharge on Stewart Brook. The nitrate concentration in the stream was 2 to 4 mg/l higher below the discharge than at the upstream locations both before and after the rainstorm with the exception of samples from the pond and outfall. Pond and outfall nitrate concentrations were 2.0 to 4.0 mg/l lower than those upstream from the discharge and did not appear to be influenced by the rainstorm.

Figure 4



Total phosphorus (TP) levels (Fig. 5) did not change in relation to the curtain drain input. In non-storm related samples, TP concentrations ranged from 4 to 16 µg/l at upstream locations 1-10 with the high value at location 2 which is upstream from the discharge. At locations 1-10 TP values increased from a mean of 7 µg/l before the storm to a mean of 94 µg/l directly after the rain. TP concentrations returned to 8 µg/l the following day; indicating surface runoff as the probable source. TP concentrations in the pond did not show this dramatic increase associated with the storm. The pond (location 11) had higher TP concentrations before and after the storm (13 and 16 µg/l) than did the stream at the point (location 10) where it enters the pond (4 and 7 µg/l). The TP concentration below the pond (location 12) increased slightly during the storm and had a three day mean concentration of 18.6 µg/l.

Total filterable phosphorus (TFP) concentrations, also appeared to be influenced by the curtain drain discharge (Fig. 6). An unexplainable increase in TFP concentration was noticed during the storm downstream from a county storm drain discharge (arrow between location 5 and 6) and again at location 8. TFP concentration in the pond did not increase during the event.

Figure 5

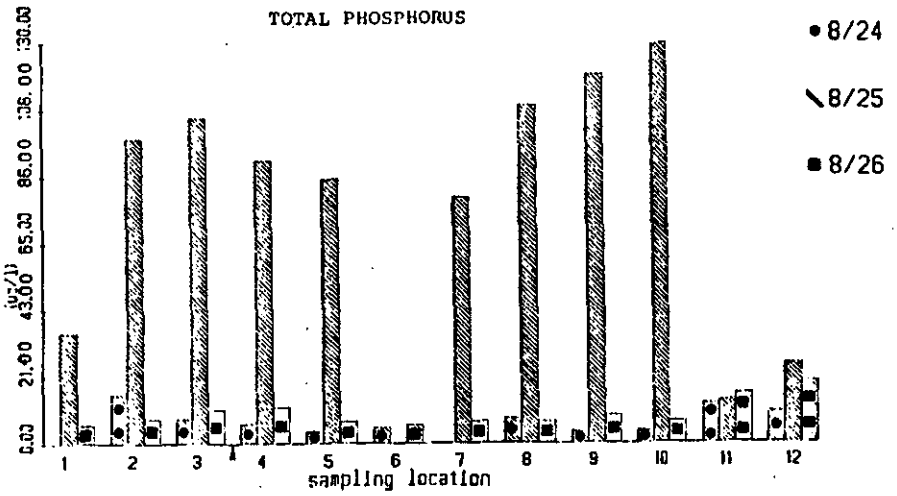
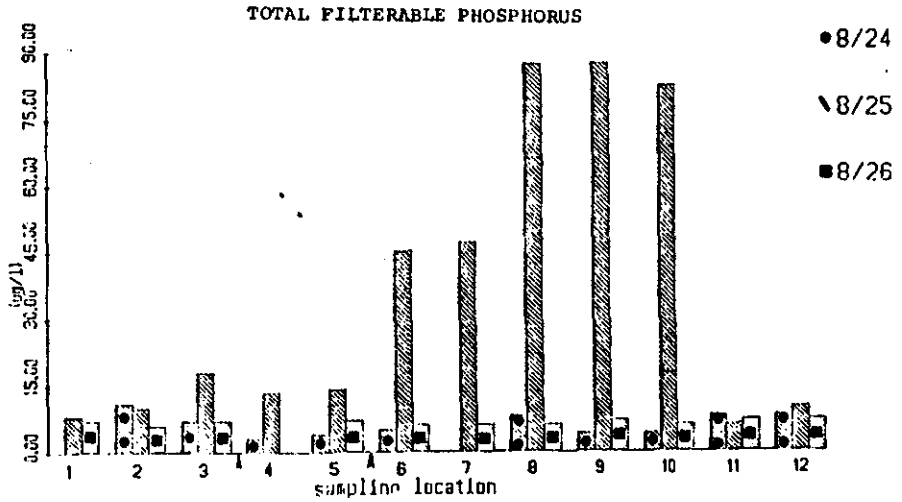


Figure 6



It appears that ground water sand bed seepage from the Bolton Sewage Treatment Plant, collected by curtain drains and discharged into Stewart Brook, has the effect of increasing the nitrate and chloride content and associated conductivity of the water in the Brook. These results are similar to those obtained in studies conducted on West Brook, which receives seepage from the Lake George Village Treatment Plant sand beds (Aulenbach et al. 1974).

The curtain drain discharge did not appear to influence the total phosphorus or filterable phosphorus levels in Stewart Brook. During a rainstorm however, phosphorus levels in the brook increased dramatically indicating surface runoff as the probable source. The storm also had the effect of diluting the influence of the discharge on Stewart Brook.

Meyer's Pond and the brook 50 feet before the dam had much lower levels of nitrate than the levels observed in Stewart Brook from its entrance to the pond, upstream to the discharge. Because of the decreased nitrate levels observed in and below the pond it may be assumed that the curtain drain discharge is a factor in supporting the enormous amount of aquatic vegatation found there, and subsequently most of the nitrate is retained in plant material and does not leave the pond. Areas of such exceptionally large amount of plant growth in lakes and inpoundments of rivers and streams are recognized as fertility traps, reducing the amount of nutrients that would otherwise continue downstream (Hynes; 1970). Phosphorus levels in the brook which became elevated during the storm also appeared to be "trapped" in the pond. Chloride levels and associated conductivity not considered plant nutrients remained elevated above pre-discharge levels during the study period.

Although this short term preliminary study demonstrated the influence of the sand bed seepage discharge on Stewart Brook and Meyer's Pond, further studies are necessary and must be conducted over a longer period with more sampling locations below Meyer's pond downstream to Lake George before conclusions as to impacts on the lake can be drawn. The FWI plans to conduct further studies on this system and its relation to Lake George as time and funding allow.

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