

INCREASED APPLICATION OF RESEARCH WITHIN
THE ADIRONDACK PARK

By:

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November, 1974

FWI Report #74-17

First Progress Report on:

"Increased Application of Research within the Adirondack Park"

Submitted to: The New York State Science and Technology Foundation

Submitted by: Rensselaer Polytechnic Institute

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In compliance with NYSSTF Proposal Register No. J-42-74

RPI Proposal No. 163(74R)H115(5)

Date: November 27, 1974



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GENERAL OVERVIEW

Basically, support from the New York State Science and Technology Foundation (NYSSTF) for "Increased Application of Research within the Adirondack Park" has been an important factor in enabling the Fresh Water Institute (FWI) to continue the process of combining basic research and data gathering with practical applications in the Park. These efforts have also enabled the FWI to attract new sources of support and in some cases, to increase support from current sources.

For example, installation of equipment and development of related monitoring procedures have been completed and will be discussed herein. Other activities, all relating to the overall FWI goal of preserving the Park's and northeastern freshwater assets, include salary allocations for technical/administrative staff and equipment purchases, examination of Adirondack soil types in order to specify their phosphorus adsorption/desorption capabilities, important new funding from the Environmental Protection Agency (EPA) to further investigate the capacity of soil for the disposal of liquid effluent at the Lake George Village Treatment Plant, the continuation of monitoring at a reduced level within the Lake George basin, and research regarding prominent fish species in Lake George. A detailed evaluation of soils research will be included in the final report regarding FWI research in the Adirondack Park. Looking ahead, these activities in combination may lead to increased monitoring activities in Warren County at various lakes including Lake George in cooperation with the Warren County Planning Board, thereby supplementing research for the Adirondack Park Agency.

IMPORTANT NEW FUNDING

Since 1968, considerable studies have been conducted by the

FWI in the area of the Lake George Village Treatment Plant. These studies in the past and currently have been supported in part by the NYSSTF's funding. A brief summary of these activities is outlined herein. The plant was put into operation in 1939. Since summer season flows approximate three times the winter flows, the plant was constructed essentially in triplicate with six sand beds for final dispersal. Over the years, flows have increased requiring the present total of twenty-one sand beds, based upon summer flows of approximately 1 mgd.

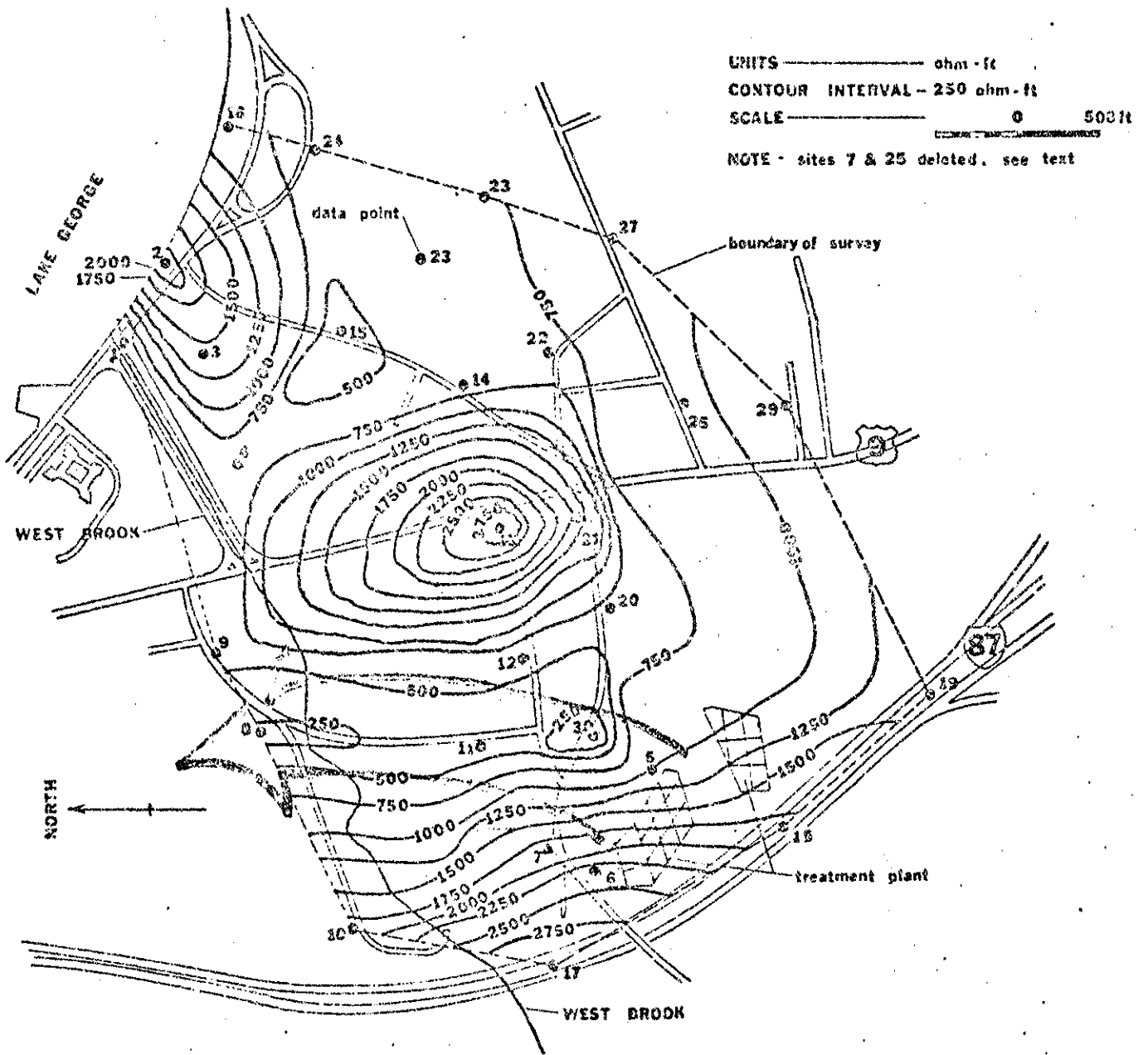
Initial FWI studies evaluated the purification capacity of two of the sand beds and disclosed that there was little phosphorus removal in the bed constantly used vs. significant removal in the bed which had not been used for a number of months. Other detrimental organisms, compounds, etc., however, were removed. It was concluded that phosphorus removal may be an ion exchange phenomenon and that the bed in continuous use had its ion exchange capacity exhausted. Subsequent research involved a resistivity survey, as sewage has a lower resistivity than natural groundwater. This survey disclosed low resistivity water (sewage) flowing north from the plant toward West Brook (Figure 1). Followup of this disclosure led to the discovery of seepage along the southern bank of West Brook in the spring of 1973.

In order to more specifically determine the groundwater flow and type, a series of wells was installed to analyze groundwater samples and in turn the effectiveness of the soils for purification of the effluent. Eleven wells were installed at six locations plus two wells in the sand beds (Figure 2). Preliminary results disclose that there could be problems involving nitrate transport and possible viral contamination.

Overall, this research points up the fact that the Lake George Village plant offers a rare opportunity to study the long-term effects

FIGURE 1

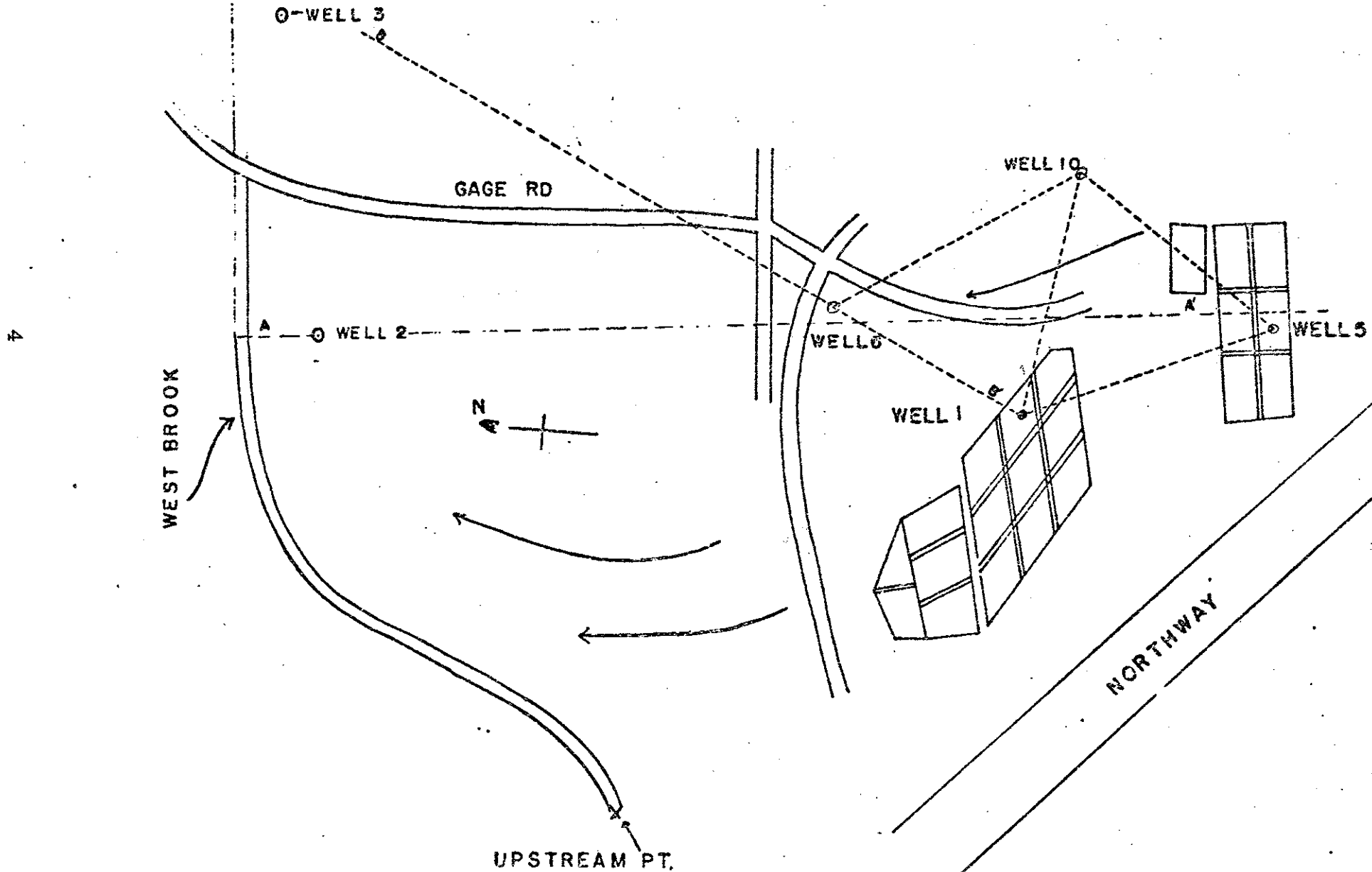
ISO RESISTIVITY MAP WITH INTERPRETATION



DOWNSTREAM PT.

Figure 2

LOCATION OF WELLS AT
LAKE GEORGE SEWAGE DISPOSAL BEDS



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of discharging secondary treated effluent onto natural sand beds. If it can be demonstrated that the sand beds are still achieving satisfactory phosphorus removal after thirty-five years, it can be assumed that systems containing greater amounts of clay could offer even better phosphorus adsorption capacity. Therefore, a proposal in this regard was submitted to the Environmental Protection Agency (EPA) this summer and has just been funded in an amount exceeding \$100,000 over two years beginning 11/1/74.

Specifically, this major grant will enable the FWI to pursue the following activities: to install additional test wells in the area of the plant's seepage beds, to measure the flow in West Brook and the seepage emanating near Gage Road, to perform more precise tracer studies which will allow determination of the direction and time or flow of effluent from the sand beds, and to perform water quality tests to confirm that the plant is performing an outstanding job of wastewater purification. In addition, the results will be evaluated in terms of the economics of the system, comparing it with other methods of tertiary treatment which would accomplish the same purification. The results will also be interpreted so that they will be useful for and applicable to other areas with similar potential for recharging groundwater using treated effluent. A letter from Village of Lake George Mayor Blais regarding this research is attached.

FWI OPERATING PURPOSES

In association with the various research programs described herein, important equipment purchases were made in conjunction with monitoring and Adirondack Park Agency activities, and related administrative/technical charges incurred. These are itemized as follows:

<u>Equipment</u>	<u>Salaries</u>
\$ 1,634.13	\$ 17,384.37

LAKE GEORGE BASIN MONITORING

A brief review of overall FWI funding is in order here. In spite of the present economic downturn, FWI funding for 1974-75 has not decreased greatly, although there has been a decrease in federal support. Basically, what this represents is a change in research emphasis, from the monitoring and collection of data within the Lake George basin to the evaluation and compilation of data in order to prepare reports. Practically speaking, this means a reduction - but not total elimination - of the continuing process of monitoring the quality of Lake George's waters. In other words, federal research priorities and important state and local interests don't match.

Support from NYSSTF has prevented having to totally phase out monitoring within the Lake George basin, and the process of hydrologic and chemical monitoring has been continued, although at a reduced level. Flow measurements of principal tributaries are being made, and one climatology (weather) station is operating, plus precipitation collectors. This information provides nutrient input information, and estimates of lake storage and stream flow yields. Nutrient analysis of Lake George's waters is also being continued at two stations located in the north and south basins in order to provide analyses of nitrogen and phosphorus concentrations. Combined with the hydrologic data, a nutrient budget will be maintained which could continue to be useful for management purposes.

FISHERIES RESEARCH

The second year of research has just been completed at Lake George involving the top of the food chain or lake trout. This work was also supported in part by funding from the NYSSTF. Including other species, approximately 5,000 fish were processed. Species new to the lake were discovered and preserved, such as the rainbow

smelt, which was also found to be spawning. In addition, it was concluded that the Cisco population is declining, possibly severely, while the Yellow Perch - generally not a good source of food for other fish - has increased substantially. This demonstrates the importance of the smelt, for they may help limit perch population growth while also serving as food for the lake trout and thereby offsetting the Cisco decline. These preliminary results indicate that the little-studied area of the feeding habits of forage fish which are in turn eaten by lake trout is an important factor in trout stocking success and may be a limiting factor for trout populations in Lake George and elsewhere.

ADIRONDACK PARK AGENCY (APA) WATER QUALITY MONITORING PROGRAM

The FWI is in the process of developing within the 6.2 million acre Adirondack Park a specific body of data which will be used by the APA in evaluating man's impact upon Park lakes. Four typical lakes are being analyzed to provide this data: Lake of the Pines (Lewis Co.), Crystal Lake (Warren Co.), Second Lake (Warren Co.), and Bass Lake (Franklin Co.).

Data have and are being collected regarding total and soluble reactive phosphorus, ammonia, nitrate and total kjeldahl nitrogen, particulate and dissolved organic carbon, and other physical and chemical parameters (i.e., pH, temperature, transparency, dissolved oxygen, etc.). These determinations allow identification of the sources, quantity, and seasonal fluctuations of nutrients so that lake nutrient budgets can be established. These budgets can be used to evaluate the potential effects of increases in nutrient levels upon the biological stability of these lakes in relation to development or second home activities.

In addition, biological parameters are being regularly monitored.

These include numbers and biomass of fish species, microbial decomposition activity, identification of aquatic weeds, and identification, enumeration, and stimulation kinetics of indigenous algal populations. It is important to have available the basic data on various parameters to permit projections of environmental impacts using established ecologic technology. Table I is a summary of average physical and chemical data from samples taken during the first phase of the Adirondack Park monitoring study.

TABLE 1: Select Average Physical and Chemical Data of Adirondack Park Lake Monitoring Study

Parameter	Lake of the Pines	Second Lake	Crystal Lake	Bass Lake
Temperature (°C)	16.3	9.38	13.5	12.9
Dissolved Oxygen (mg/l)	9.7	10.52	8.56	7.6
pH	6.49	6.48	6.83	4.52
Nitrite (ug/l)	2.4	2.9	1.5	1.9
Nitrate (ug/l)	69.9	66.6	42.3	86.3
Ammonia (ug/l)	67.3	44.1	84.4	284.4
Total Kjeldahl Nitrogen (ug/l)	450.0	120.4	---	---
Orthophosphate (ug/l)	2.9	1.6	1.6	3.3

It is apparent from the concentrations of these nutrients listed plus the average concentration of dissolved oxygen that each of these lakes possesses a trophic state which is characteristically oligotrophic (small nutrient supply or literally, poorly fed) in nature.

The amount of time which has elapsed since a regular sampling and monitoring schedule was initiated has not as yet allowed the level of nutrient loadings necessary to fully perturb these systems to be

fully established, as is illustrated in Table 2. The data shown in this table describe the response of indigenous algae to increases in nutrients as measured by radioactive labeling technique.

However, as these investigations continue, the additional information obtained will enable FWI investigators to more fully define the system of water resources in the Adirondack Park for realistic impact assessment purposes.

This additional information (i. e., soil type, geomorphologic features of the watershed, population numbers, hydrologic budgets, etc.) will allow use of both qualitative and quantitative methodologies in order to project perturbation effects on these lakes. In other words, the FWI team of aquatic specialists will be able to assess the biological and chemical integrity of the lakes in response to system stress or improvements. Also, the team expertise will be complemented by a systems analysis technique known as simulation modeling. When sufficient data are available, the currently functioning FWI model, known as CLEANER, will be employed as the diagnostic technique for evaluating potential impacts on a projected basis. This model is spatially and temporally effective to function in this capacity and the data being collected will be used to verify the model's diagnoses.

SUMMARY AND FUTURE PLANNING

As illustrated throughout this report, the FWI's "watchdog" role in terms of monitoring and predictive capability continues to expand. In addition, these and related activities such as soils and fish research plus further research at the Lake George Village Treatment Plant take place in Warren County. Where possible and feasible, it is planned to continue and expand these activities.

Within this context, one of the principal concerns of the Warren County Planning Board is now the problem of lakefront development

TABLE 2: ALGAL STIMULATION BIOASSAY

	<u>Lake of the Pines</u> 5/21/74	<u>Second Lake</u> 5/22/74	<u>Crystal Lake</u> 5/23/74	<u>Bass Lake</u> 5/28/74
Control	39,105	7,060	72,676	11,813
<u>Increase in Nutrient Level</u>				
5ugP/l (as orthophosphate)	36,036	7,296	87,355	11,844
15ugP/l	40,236	6,654	71,943	12,484
50ugP/l	39,078	6,251	84,385	11,604
150ugN/l (as nitrate)	36,950	6,814	70,438	11,832
500ugN/l	38,333	7,009	78,141	12,102
1500ugN/l	42,171	6,374	73,888	12,767
25ugN/l (as ammonia)	40,296	6,800	72,114	
75ugN/l	45,055	7,048	81,424	
225ugN/l	41,616	6,784	56,776	
300ugN/l				11,215
1000ugN/l				10,888
3000ugN/l				10,456
2mgSi/l (as silica)			72,594	
6mgSi/l			79,623	
20mgSi/l			34,202	
0.05mgSi/l				260
0.15mgSi/l				186
0.50mgSi/l				99

and its related pollution potential. The Board is also concerned with the numerous other agencies having extensive or some regulatory power or influence in this area such as: The New York State Department of Health and Department of Environmental Conservation, the Adirondack Park Agency, the Lake George Park Commission, the Lake George Association, the Fresh Water Institute, the Department of Parks and Recreation, Local Government, and the Resource Conservation and Development Commission. The FWI has been aware for some time of the pluralistic structure of state and local government and the question of whether this structure can serve the collective environmental needs of Lake George and other regional constituencies. In response to this problem, it should be noted that the FWI has prepared a specific proposal in this area for the Office of Water Research and Technology (OWRT-US Department of the Interior) in response to OWRT Priority Research Subject I - "Improving Water Resources Planning and Management." The proposal is entitled "Analysis of the Potential for Regional Water Resource Management."

The lakes of particular concern to the County Planning Board are Brant, Friends, George, Loon, Luzerne, and Schroon. Because of these concerns, Warren County retained the firm of Crandell Associates Architects of Glens Falls, which specializes in planning, to prepare a report for the Planning Board on various agencies and programs that affect or relate to water quality and lakefront development within the County. In this context, one of the organizations evaluated by Crandell Associates was the FWI.

Briefly, the report states "current research of the Fresh Water Institute in the area of soils and their retention of nutrients on septic systems, and their work on part of the North American Project, is of substantial interest to the County Planning Board. The work of the Institute in general, on ecosystems, and the ecology of freshwater lakes is also of concern, especially its practical applications."

In its concluding recommendations, the report suggests that a public information program should be established regarding the problems of nutrient pollution and of septic tank operation and maintenance within lakefront areas with particular emphasis upon the lakes cited above. One of the participants in this program would be the FWI. The report also recommends a similar program within the Lake George basin and in addition, a complete evaluation of all septic systems within the basin in conjunction with the FWI. Support for the FWI to sustain these and related activities is also recommended.