ABSTRACT

GEORGICA POND WATER MANAGEMENT ISSUES

by

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BACKGROUND

Numerous coastal ponds on Eastern Long Island go through a traditional "letting" in the spring and fall. The letting discharges freshwater from the pond to bay or ocean. This lowers the pond stage and the surrounding water table and allows an influx of saltwater and anadromous species. This letting is assisted by man by breaching the barrier beach between the pond and ocean or bay. Examples of some of these ponds include:

Oyster Pond in Montauk,
Georgica Pond in East Hampton,
Sag Pond and Mecox Bay in Southampton.

Examples of ponds no longer let include Wainscott Pond which was sealed during the 1938 Hurricane and Hook Pond in East Hampton and a series of ponds in Southampton Village which were stabilized by allowing dune formation and constructing one way overflow pipes to the sea. These stabilized ponds are fresh and no longer support a euryhaline ecology. They are also undergoing eutrophication due to an influx of fertilizers and accumulation of organic material.

Letting has traditionally occurred for hundreds of years and reportedly was initiated by local Indian tribes. With the encroachment of suburbanization surrounding these ponds starting in the 1960s and 1970s, this tradition has come under intense criticism because of the unpredictable water levels, flooding of primarily second homes, and more recently potential shorebird nesting impacts.

In response to flooding complaints at Georgica Pond in 1989 and 1990, these issues were examined relative to the pond's very dynamic hydrology and several management options were evaluated. While the analysis was specific to Georgica Pond, the concepts can be applied to other coastal ponds on Long Island and those similar in Rhode Island.

MANAGING GEORGICA POND

It has been recorded that on December 9, 1686, Governor William Dongan, representing King James II, transferred the ownership of Georgica Pond to the Trustees of the Freeholders and Commonalty of East Hampton. Today nine citizens, elected by the voters of East Hampton, make up the East Hampton Town Trustees. They are entrusted with the conservation of the Pond. As a result of community complaints, the Trustees established the Georgica Pond Advisory Committee. This study was voluntarily prepared to assist this committee make recommendations to resolve the conflicts. Although not formally recorded, the objectives of the Trustees in conserving the pond can be interpreted as:

Maintain a viable fishery,
maintain ecological diversity,
provide for recreational activities and pond access, and
balance property flooding with environmental requirements.

Georgica Pond located on the south shore between East Hampton Village and Wainscott was formed as a glacial outwash channel formed some distance from the Rononkoma moraine. It is likely that it was not formed by streams discharging from the moraine but rather by the gradual accumulation of waters from various sources. The surface water watershed for the Pond is approximately 4750 acres in size and can be divided into four distinct subcatchments, only one, the East Hampton Village, is suburbanized with approximately 18% of the subcatchment hydraulically connected to the Pond by the Cove Hollow drainage pipe. The other subcatchments have approximately 5% hydraulically connected area. The groundwater watershed is approximately 6680 acres is size. The surface area of the Pond is approximately 290 acres. The Pond is relatively shallow with a maximum depth of approximately 6 feet deep. A one day pond opening reduced water table elevations up to 4000 feet from the edge of the Pond. Longer Pond openings likely decrease the water table elevations at a greater distance. Depending on duration since last letting and distance from breaching, salinities vary from 2 to 19 parts per thousand (Valenti et al, 1976). Dissolved oxygen concentrations remain near saturation. Without repeated openings, concern exists for increasing concentrations of N and P and fecal coliform. If not naturally opened, the Trustees regularly open the Pond in March and October of every year. Man-induced openings at other times have been discouraged as they are perceived to conflict with the Trustees management objectives.

Observed flooding impacts include damage to ornamental trees and shrubs, basement flooding, and failure of onsite septic systems. An emergency letting was performed in July 1989 after intense pressure from residential complaints. The number of homes impacted increases at an increasing rate as the pond overtops its banks and the pond stage increases linerally. Even though pond letting is an overall benefit to the preferred ecology of the pond, its regularity has dampened flooding magnitude and frequency. As a result, it has indirectly encouraged development near the pond.

SPREADSHEET MODEL

A spreadsheet simulator or model of the Pond's hydrology was developed to assist in objectively understanding the cause of problems, assist in evaluating the scant data collected and observations made by the public, identify additional data needs, and test alternative or supplementary management techniques. While it was possible to develop a very large surface-groundwater model that could give much improved temporal and spatial information, it appeared to be more beneficial to use a spreadsheet analysis approach to conform to the local problem. The basic idea was to focus the effort on those components of the hydrologic cycle that are most important for this area and problem. Lastly, the sophistication of the modeling should depend on the available data, in this case little were available. The value and versatility of spreadsheet modeling for water resource analysis and management was advanced by Hancock and Heaney (1987).

The simulator accounted for and related the following parameters under transient conditions (daily time steps):

surface water runoff,
surface water evaporation,
non-linear stage, volume and surface water area relationships,

groundwater seepage into the pond,
groundwater table elevations in the surrounding Upper Glacial aquifer,
groundwater seepage from the pond through the barrier beach,
surface water discharge to ocean under riverine dominated conditions during early stages of letting, and
various alternative discharge mechanisms (i.e. pumps, pipes, variable beach width).

The model was calibrated to 1989 water level data (March through August) which included two pond lettings and 1990 water level data February through April) which included one letting of the pond. The following concerns and phenomena were evaluated via the spreadsheet model.

THE POND'S EQUILIBRIUM POSITION.

It was believed that once the Pond reached a certain stage elevation (approximately 6 feet above mean sea level), inflow via groundwater and runoff would equal the outflow via seepage through the barrier beach or a natural beach breaching would correct the problem. This idea was presented by the Georgica Pond Watch Committee with the support of 1985 water level data (Petrie, 1985). As a result of this equilibrium, little to no additional flooding would occur. The flooding observed during the "inter-letting" periods of 1989 and 1990 reached greater than 7 ft MSL resulting in a significant number of residential impacts. Some Trustees and residents attributed this to not only the abnormally wet weather but shoaling in the pond near the barrier beach (the result of washover, aeolian drift, and coastal sediment trapping when the pond was open to the ocean). They speculated this caused a significant reduction of seepage from the pond to the ocean, disrupting the equilbrium position.

The Pond model was able to replicate the equilibrium position observed in 1985. A comparison of long term average annual rainfall for Bridgehampton (45 inches per Nemickas and Koszalka, 1982) with that observed in 1985 (38.85 inches) indicated that 1985 was below normal. A near equilibrium position was illustrated; however, it represented a "dry year" position. The model also indicated that during wet years this equilibrium position would be significantly higher regardless of the barrier beach height and width. Clearly, if the pond was not let in July 1989 on an emergency basis, a higher than usual "equilibrium position" would have been reached causing additional property flooding.

DREDGING AND ITS IMPACT ON POND LEVEL.

Dredging the shoal in the Pond was considered as a means to increase seepage out of the Pond hence reducing flood levels. The model indicates that seepage through the beach accounts for a relatively small percentage of outflow from the pond on an annual basis. This is consistent with calculations by Leatherman (1989). Dredging will increase seepage; however, probably not enough to have a significant effect in relieving flood levels. Evaporation from the pond exceeds seepage through the barrier beach, even after dredging. In addition, the effects of dredging would be temporary and cyclic as the pond reshoals and is redredged in years to come. Dredging is important to maintain the ability of the Trustees to let the Pond. Without letting, significant water quality degradation would occur.

FREQUENCY AND DURATION AND OPENING.

The duration of the letting is unpredictable ranging from one day to months, but generally lasts several weeks. The pond is allowed to close naturally by the littoral drift of sediments on the ocean beach front. Theoretically it is possible to design a channel opening that will allow sufficient tidal prism through the inlet prolonging the duration of the opening. Practically speaking, it is completely dependent on the weather.

During wet periods like 1989-1990, a short opening period is sufficient to relieve immediate flood levels in the pond; however, it is insufficient to lower groundwater water levels in the area to avoid a rapid rebound in this stage. This was observed after the Spring 1989 letting. The model indicates that more planning may be necessary to select the best duration of the pond opening. This would ensure a duration sufficient for fish passage and allow proper freshwater discharge from the pond and aquifer to avoid immediate flood rebound and on the contrary, too low a level not suitable for aesthetics and sailing. The model is able to estimate proper duration based on the rainfall, stage and antecedent water table elevations. Proper discharge may require repeated openings or early closure by man.

STABILIZATION

The most reliable way to stabilize pond levels to avoid flooding is by constructing an overflow pipe and or pump station. Designed properly, such a system could prevent flood levels from reaching a specified level. During wet years, the system would discharge to the ocean for several weeks without a pond letting; therefore, avoiding a flood situation. During average and dry years, the pipe would not discharge. Normal pond lettings would still occur in the spring and the fall. The spreadsheet model indicated that a 36-inch diameter flap gate pipe with an approximate capacity of 3000 gpm (4.3 MGD) would be suitable.

DISCUSSION

Cost-benefit procedures commonly used by the U.S. Army Corps of Engineers to justify water control projects in the 1960's and 1970's would clearly identify stabilization as the preferred alternative to mitigate flood impacts. However, these procedures generally do not adequately address environmental factors. Contemporary water management recognizes environmental factors and the significance of intrinsic or existence values of endangered species or traditional ways of life in the decision making process.

Stabilization will damper the hydroperiod of adjacent freshwater wetlands and not restore salinities that are reduced by the large influx and storage of freshwater. More frequent lettings in the late spring and summer have been discouraged by the baymen because it releases a juvenile fishery to the ocean and by residents because it impacts the summer sailing season. Environmental windows established by the NYSDEC and Nature Conservancy to protect shorebird nesting may also discourage spring and summer lettings. Hence, future emergency spring-summer lettings may not be feasible.

Plans to mitigate future wet weather pond levels have not been formalized by the Trustees. Based on this analysis, the best course of action is to improve planning of the duration of the letting, not only to coincide with migration of anadromous species, but to discharge a specified quantity of freshwater. Using water table elevation data from the Pond's groundwater watershed and the spreadsheet model developed, reasonable estimates of proper duration are possible.

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