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A SUPPLEMENTAL SOCIO-ENVIRONMENTAL DECISION TOOL: VALUE CONFLICTS ON LONG ISLAND

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ABSTRACT

In the portion excluding New York City, Long Island's water supply depends entirely on subsurface water. Originally an excellent source of water supply, now through the historic discharge of sewage through hundreds of thousands of cesspools and septic tanks, its quality is in jeopardy. The problem has been identified and an initial plan of sewering is being implemented. From this plan, the following environmental impacts are expected; decreasing water table elevations, water supply depletion, decreasing stream flows, increasing bay salinity, decreasing nutrients into the bays, increased encroachment of the saline wedges under the north and south shores, destruction of estuary marsh land, aesthetic, and primary productivity effects, in the bays and at the ocean outfall. All the environmental effects are discussed from a value conflict position. Such identification of value conflict can be used as a supplemental tool and is an excellent procedure for large scale environmental projects to be successfully developed without mass citizen protest.

Introduction

Until very recently little attention has been paid to environmental values in large scale water resource development.

In the past there was no legal mechanism by which citizens could proclaim their environmental rights. Perhaps in the past environmental values were not

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as strong as they are today and, hence, a mechanism was unnecessary. Indeed, at present man has more time at his leisure and a greater need to escape the concrete urban environment. Consequently man seeks what before this time was readily accessible–"The Natural Retreat." However, the natural retreat is no longer in close proximity. Frustration and anxiety develops a new awareness which is transformed into a genuine concern for the environment and its preservation. The result of repeated experiences of the like manifest themselves in what is called an environmental value.

Hence, the engineer and planners of today must of necessity know the community for which a project or development will become a reality. In developing objectives and goals, least cost can be considered as a major objective but certainly not the only objective. How are the objectives and goals obtained? Presumably in planning for a region one plans for the people in that region. Hence, it is logical that the involved population determines goals which are suited to them. What priorities they see, what attitudes they have, are all a function of the value structures. For a planner not to have a clear idea of the value structure of the community with which he is involved is not only poor planning but poor economics as he runs the risk of citizens halting the project. Indeed, with the advent of the National Environmental Policy Act and a host of other environmental laws guaranteeing certain environmental rights to citizens, this entirely new supplement to planning is reinforced. Many planners who did not take the time to investigate a community's environmental values for which a project was planned have suffered the consequences. Indeed, many of the plans are being held up in court under contest with NEPA or similar legislation.

Values, however, are an elusive commodity. Rath in his book supports this saying, "One can find consensus for no definition of values" [1]. The only definition people agree on is "something important in human existence." Can we then ascertain a community's value structure by investigating what it considers as important? It would appear in theory that one can. Is the value structure of a community, however, what we really seek? To answer this question consider the case of a suburbanite who feels it is important to save energy but nevertheless invests in a central air conditioning unit. Obviously it is an awareness of the trade off of values or the conflicts values created that we need for effective planning. Knowledge of these conflicting values can:

1. help identify alternatives to the proposed action
2. help identify interested citizen groups
3. channel citizen participation efforts to alleviate the conflict
4. establish realistic and attainable goals

What follows is an identification of possible value conflicts that arise due to

the implementation of Long Island's plan to sewer the Island. This is intended to exemplify the type of preliminary investigation that should precede a large scale project. No analysis of uncertainty is attempted as it is beyond the scope of this investigation.

At the present time Long Island, New York has a population of 2.7 million people in the portion excluding New York City (i.e., Nassau and Suffolk Counties). Except for certain eastern sections of Nassau, the entire water supply comes from groundwater. Long Island groundwater was of exceptional quality at one time, but now because of continual recharge by individual waste disposal systems (cesspools and septic tanks) the quality has steadily decreased to the point of a health hazard, specifically from nitrates. The link with nitrates was made by Pearlmutter and Kock (1972), who attribute a dangerous increase in nitrate levels to sewage effluent being discharged from cesspools and septic tanks. The actual levels measured by them range from 0-to more than twice the accepted health standards of 10 mg/l of NO_3-N. According to the Nassau County Department of Health [2] about one quarter of the public water supply wells out of 256 show dangerous increasing concentrations of nitrate. They also believe that sewage via cesspools and septic tanks is the primary source of this increase. With Nassau County's population growth rate at about 4 per cent and Suffolk County's at 69 per cent over the past 10 years [3], it seems inevitable with the increased urbanization that the system as it exists now will surely deteriorate. At present the governments of Nassau and Suffolk Counties, New York are undertaking a massive effort to sewer Long Island in order to alleviate the increase in nitrate concentration. The focus of this paper is the delineation of the value conflicts expected from the environmental impacts caused by such a plan. As such, the concept of total water management and its effects must be considered. This will be developed from the following problematic situation existing on Long Island. With the advent of sewers eliminating the existing sanitary disposal system, the majority of nitrate pollution is halted by physically transporting the wastewaters away from the aquifer. However, this implies that the water that was previously recharged back into the aquifer is also eliminated. The fresh water supply demand without this recharge cannot be met indefinitely [4].

To consider the values that may be disturbed by a health hazard such as increasing nitrate levels, investigation as to the nature of the hazard is necessary. Specific medical facts show newborn children are affected by high nitrate levels in their blood. The sometimes fatal disease is called methemoglobinemia (a baby's stomach up to one to two years of age has not developed enough acid to control bacteria that converts the nitrate ion to nitrite which is considered toxic. When nitrate ion is then ingested it complexes the hemoglobin in the blood and thereby starves the baby's cells of oxygen [5].)

In addition, at small concentrations it has been suggested that although nitrates themselves are benign, their chemical derivatives may be carcinogenic [6]. So the values that the degrading groundwater quality is encroaching upon would be people's good health, their baby's survival, their own survival, and perhaps man's sense of immortality (preservation of the family name). It is imperative that elimination of this health hazard play a direct role in the management process by reason of the goals of the health department to maintain standards to protect the health of the people. The difficulty of this situation, from a managerial standpoint, lies in the fact that the health department having broad managerial powers, provides solutions which focus on health values to the exclusion of all others.

In considering what has been discussed it would seem that Long Island is faced with a problem of continual increasing magnitude. One for which a solution must be sought.

One way to abate the nitrate problem is to eliminate the source of nitrates. This can be performed by, sewering the island treating the sewage and then diverting the effluent into the ocean and Long Island Sound. Therefore, a preliminary suggestion to sewer Long Island was made and implemented in 1938 by Nassau County. Nassau County proposed construction of sewers to alleviate the health problems incurred by nitrate pollution. If sewers are to be constructed, values involving economics–due to the cost of sewers and treatment plants; inconvenience and aesthetics–due to excavation, rerouting and detouring of streets, will be disturbed. It is presumed then that if one's decision is to sewer the island, then the value of health and perhaps the convenience of a dependable, maintenance and odor free waste disposal system is more important than the values of aesthetics and economic well-being. We will see later that these are not the only values that interact. Other values that will emerge in the subsection on environmental impacts will be discussed and tradeoffs will begin to become more evident, more complicated, and more difficult to resolve.

THE ENVIRONMENTAL IMPACT

The environmental impact can be looked at as an analysis for the prediction of what the effects of such a solution will be. Quite often when one enters this area the problem takes on an entirely new perspective. The increasing number of conflicting values and tradeoffs make the problem increasingly more complex. But this is the crux of the National Environmental Policy Act (1970). N.E.P.A., in a sense, says that the environment is indeed a highly intricate, highly complex series of interactions and that in order to prevent the quality of life from decreasing, one must consider them to the best of one's ability. The effects in our case have been studied in ample detail,

especially in the area of water supply depletion. The major environmental effects to be expected can be subdivided into three areas:

1. those expected from sewering itself;
2. those expected from constructing treatment plants; and
3. those expected from the effluent.

In the area of environmental effects expected from sewering the island, foremost on the list would be the abatement of nitrates. When, however, will this abatement occur? Most assuredly there will be a lag time before the well water will evidence the effects of the abolishment of individual waste treatment facilities [7]. Phillips conceptualizes the process by describing the transport mechanisms [8]. He shows that things must get worse before they can get better. This could be a very important input since his model describes the decrease in nitrate levels in well water as being anything but rapid. Indeed, as described for the water supply well at Carle Place N2747, it is estimated that it would take approximately thirty years to reach an acceptable limit of nitrate concentration. Knowing this, one might wish to abandon groundwater as a water supply for the present and concentrate on seeking water from another source, *or* perhaps treat the groundwater prior to distribution. Hence, the concept of time becomes a viable value conflicting with the values associated with the alleviation of the pollution.

One of the first effects of sewering the island will be a decrease in water table elevations due to the absence of recharge from cesspools and septic tanks. In an M.I.T. study, a physical Hele-Shaw Model [9] simulated the groundwater table in response to various rates of recharge and consumptive use. The behavior of the water follows intuitive expections; that is the more consumptive use and less recharge the lower the water table. Indeed, according to the New York State Department of Environmental Conservation, the water table showed a definite lowering trend between the years 1903 to 1967 (see Figure 1). However, this lowering may have been amplified by other causes such as droughts, increased urbanization, etc. In another study, Franke [4] attributes a seven foot average decline in water table elevation in Southwestern Nassau over the period from 1951 to 1966 solely to sewering. Increased sewering, increased population and increased per capita use will only amplify the present trends. It therefore becomes quite obvious that sewering the island will very quickly place its water supply in jeopardy.

The lowering of the water table creates other environmental effects. Of primary concern is salinity intrusion. Concern over the movement of the saline wedges landward contaminating the wells in the immediate area is a major issue. This is exactly what has occurred in Queens and Kings Counties, which are located at the westernmost point of Long Island [5]. One can also expect a decrease in stream flows on Long Island due to a lowering of the water table. Indeed, 95 per cent of the total discharge of all streams comes

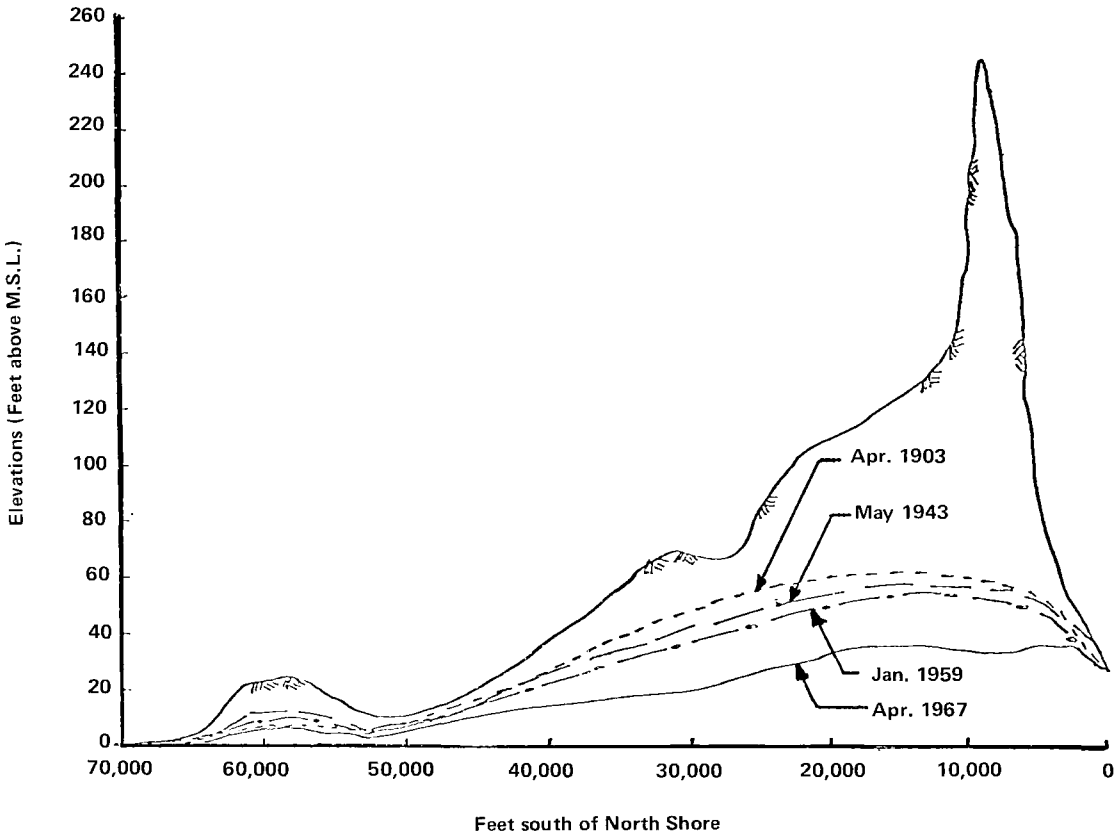

Figure 1. Typical water table behavior in Nassau County.

solely from seepage from the groundwater aquifer [5]. If one sewers the island, not only will the discharges be less in rivers but the nutrient entering the rivers will also decline. Hence, the nutrient loading entering the bays will decrease. This is expected to effect the primary productivity of the bays for they are understood to be nitrogen limited ecosystems [3]. By decreasing fresh water stream flow into the bays, one necessarily increases the salinity of the bay. The gradual increase of salinity into the bays may cause specific changes. This environmental perturbation will cause the organisms best able to cope with the new environment to survive and those that cannot to perish. This may cause the diversity and stability of the aquatic ecosystem to decrease. Bays and estuarine environments, however, are usually populated by organisms that can tolerate variability in salinity due to the seasonal variability that exists naturally [10]. Such organisms are generally called euryhaline. Nevertheless to say the effect of increased salinity will be absorbed by the environment or will cascade a series of undesirable ecological events is largely uncertain.

In another area the construction of treatment plants and in some cases the expansion of old ones require additional land. Some projects such as the Suffolk County Southwest Sewer District #3 facility is to be constructed on a reclaimed tidal marsh. Yet marshes are known to be the most productive biological ecosystems known to man and a link in food chains of the marine system [10]. There is so much concern over marshes that Congress passed (PL 90454) a bill which emphasizes the need to protect, conserve, and restore these marshes in a way that maintains a balance between man and nature. In addition to the proposed Facility #3 of the Southwest Sewer District, "landfill and dredging have reduced original acreage of wetlands" [3]. The construction of these plants may also produce unappealing sights and odors.

The discharge of the sewage effluent through ocean outfalls will also have its effect. One such effect will be the contamination of the immediate area in the ocean in which it is discharged. Dredging and filling are required in the construction of the outfall itself. This will occur in the bays, across the barrier beaches and even in the ocean. This operation could cause increased turbidity (which would decrease the euphotic zone decreasing primary productivity) siltation and loss of bentic organisms. Careless beach fill and excavation could be disasterous. Disposal of sludge also presents a problem. Nassau County proposes to barge it out to sea. What this will do to the sea is being studied, but high nutrient, high B.O.D. and trace heavy metals may be very important in analyzing the impact to occur. Suffolk County Southwest Sewer District plans to use the wet-air oxidation method of burning sludge.

VALUE CONFLICTS

The environmental impacts associated with the single task of sewering Long Island have been cited. Consideration of the value conflicts in hopes of

attaining some insight into what people feel is important will be presented next. The question of a time delay till amelioration of nitrate pollution can be realized, is an extremely important one. Assuming Long Island authorities believe this delay to be fact, they are in effect saying that even though the problem exists now, they will plan for a solution in the future. This time delay must necessarily effect how much emphasis one places on health values previously discussed.

The direct decrease in water table places the water supply in jeopardy and creates an entire set of value disturbances: sustenance of life itself; recreation; ammenities such as growing shrubs, a lawn, or a garden; and increasing the risk of loss of life and property through inadequate fire protection. All of these add to the quality of life or the protection of it and the real estate prices of Nassau and Suffolk Counties reflect a high quality of life–rich neighborhoods, large estates and recreational atmospheres. Water shortage in these areas has the potential to change the entire economic structure of the region. Clearly then, water supply is a very important parameter in planning. Water is a necessary part of life and many values depend directly or indirectly on it. All too often it is taken for granted; the simple act of turning on the faucet in the kitchen is never appreciated until a water shortage occurs.

As mentioned, lowering the water table has the effect of causing salinity intrusion. Although not thought to be a problem of large magnitude [11], salinity intrusion would make Long Island's well water unpalatable, thus disturbing values already discussed besides the health effects of increased chloride concentration. Decreasing stream flow would affect the aesthetic and recreational fresh water activities there are on the island. As was discussed previously, the nutrient loading entering the bay would be decreased. The waters off the coast of southern Long Island are highly productive for sport and commercial fisheries. Decreasing the nutrient load, and increasing the salinity of the bays may all lead to ecological changes in fish population and fish species. Value disturbance here would primarily be economic from commercial fishing, and recreation from sport fishing. There is also a genuine value disturbance difficult to define which emanates from the public's increasing concern over ecological diversity, stability linked with the "food web." The construction of treatment plants claiming land and on or near deliberate or essential ecosystems such as salt marshes would conflict with ecological values. And the potential ocean outfall would disturb similar values as it involves dredging and a high nutrient waste load.

In summary, the tradeoffs as described so far in sewering Long Island are the abatement of nitrate pollution versus the economic cost of the project, plus all the adverse environmental impacts. The value conflicts that follow from this, respectively are summarized in Table 1.

Table 1. Summary of Value Conflicts With the Implementation of Sewers

Pro		*Con*	
Consideration	*Value*	*Consideration*	*Value*
Collect human waste water	Health	Cash Flow	Economic
Protect quality of ground water	Health Survival of off-springs	Construction of latterals, inter-ceptors along streets and the treatment plan claiming land	Inconveniences Aesthetic Frustration
Central processing and control of waste water with licensed personnel	Sense of assurance Dependability Convenience	Time	Expediency
Increased tax base	Economic	Water supply depletion	Survival Ammenities Recreation Fire Protection
No odors on premises	Aesthetic Annoyance	Salinity Intrusion Unpalatable water supply	Health pleasure
No periodic maintenance	Convenience Health	Decrease fresh water discharge of river	Recreation (Economic—from fishing, tourism, industry)
		Increase salinity of Bays	Recreation Ecological Aesthetic
		Contamination of ocean outfall area	Ecological Aesthetic
		Change in Specie	Ecological Recreational Economic
		Decrease in primary pro-duction	Ecological Recreational Economic
		Decrease in di-versity and stability	Ecological Recreational Aesthetic Economic

Conclusion

Our final product is displayed in Table 1. The question arises as to the usefulness of this summary as a supplemental planning tool. The usefulness of this approach is exemplified by the following applications.

USEFUL APPLICATIONS

The identification of alternatives to the proposed action–By investigation of Table 1 we see that most values disturbed originate from a depletion of groundwater. This implies that an alternative that not only addressed the question of groundwater depletion but has as its objective the stabilization of groundwater levels would eliminate many of the value conflicts. Such an alternative that considered recharge of treated sewage to replenish the water withdrawn from the system is technologically feasible and environmentally sound.

Identification of citizen groups most interested in specific conflicts–Briefly reviewing Table 1 indicates very clearly the local interest groups that could be affected by the proposed action. For example with the rapid degradation of recreational water resources, many local organizations have initiated programs to preserve the bays. There is even a Society for the Preservation of Long Island Sound. So the ecological, recreational and aesthetic value disturbance implies quite clearly which organization may be affected by this proposed action. Once these groups are identified they can be used as representatives of their fraction of the social value spectrum.

Channel citizen participation efforts to alleviate value conflicts–The citizen groups identified should have a profound and beneficial effect on the planning process. Undoubtedly, however, it will make the study more complicated. They bring to bear the spotlight of exposure on their specific desires and in so doing educate and involve other members of the populous into a more active role. The more active a citizen participation program, the more effective the planning process.

Establish realistic and attainable goals–Through local interest groups forcing exposure of the project through their particular desires, more and more people are motivated into involvement. With an active community a planner has the major necessary ingredient to develop realistic attainable goals. However, without such support a planner can only guess at how a community would like this project planned.

In conclusion it would appear that a detailed summary of all value conflicts is not only desirable but may be manditory for effective citizen participation and sound environmental planning.

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