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Environmental Management Planning and the Special Area Management Process

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ENVIRONMENTAL MANAGEMENT PLANNING

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THE SPECIAL AREA MANAGEMENT PROCESS

BY

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ABSTRACT

Within coastal areas, growing numbers of resource users, increasingly divergent resource use demands, and loss of indigenous resources combine to exert tremendous pressures on these areas.

The Narrow River is a unique estuary located on the coast of southern Rhode Island. The estuary has experienced a decline in water quality over the last 20 years, primarily attributable to poor development practices and improper disposal of on-site sewage. Increasing levels of development have begun to bring about further changes in the watershed, including alteration of scenic values, conversion and loss of wildlife habitat, additional sources of pollution inputs and increasing conflict between conservation and development interests.

The watershed environment, the unique oceanographic and biological characteristics of the estuary, and the probable sources of pollution inputs are discussed. The natural interrelationships of the estuarine system imposes specific limitations on how the watershed may be developed without damage or significant impairment of its resources. Despite several studies in the past recognizing the value and significance of the estuary and its resources, local and state management programs have been

ineffective in preserving these values, or minimizing conflicts over proper approaches to development within the watershed.

In 1985, a new approach to management of the watershed was initiated by the Rhode Island Coastal Resources Management Council, aimed at developing a long range, comprehensive plan for the estuary. The process, Special Area Management Planning was designed to address shortcomings in other, more traditional planning and regulatory approaches, including the failure of regulatory programs to consider cumulative impacts, the lack of responsiveness of permit standards to unique circumstances, the lack of predictable policies on resource use in planning programs due to varying input by different governmental authorities, and a lack of integration of policy and management mechanisms throughout the governance system. The SAM Plan was organized with the purpose of addressing these problems through a watershed level assessment of natural conditions, providing increased specificity to pertinent regulatory programs, and integrating policies concerning resource use among the various participants.

The framework of management authorities is described, and shortcomings inherent in the design of the system discussed. The majority of problems at the root of the inability to carry out stated goals within the Narrow River watershed arise from organizational problems. These are examined in the context of the statutory authorities available to municipal and state governmental bodies in Rhode Island, the exercise of those authorities, and the structure of the regulatory and

planning programs. These are also examined in comparison to the resource management issues generated by the natural characteristics of the estuary.

The Special Area Management Planning process is discussed and analyzed in its ability to integrate policies concerning the management of the estuary, and effectuate stated resource protection goals within the watershed. A descriptive model is presented, and the design, conduct and results of the SAM Planning process compared with its elements. Conclusions are drawn about the strength of the process, and its ability to address the problems of multijurisdictional coastal management.

Acknowledgements

This thesis is dedicated to Terry and Kay, and all others who put up with the politics of environmental management in their attempts to protect the beautiful places of this Earth, and to Lew Alexander for patience.

It is also dedicated to computers everywhere, and to the triumph of man over technology.

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I. Introduction

The challenges and demands involving the use and management of estuaries and their resources frequently appear as "worst case" scenarios for coastal management practitioners. Growing numbers of resource users, increasingly divergent resource use demands, accelerating degradation of water quality, and declines in living, scenic and open space resources are all problems superimposed on basically poorly understood natural systems. The multiple, often contentious, jurisdictions to whom governance of these areas is entrusted have promulgated legal regimes that are often lengthy, cumbersome, complex and costly. Ironically, despite the number of regulatory and planning programs employed, the expanding pressures on estuarine resources have resulted in an increasing frequency of conflict; over the priorities of policies, the use of fixed resources, and conflicts centered on particular developments and environmental standards [1]. Traditional approaches and methodologies employed through planning and regulatory programs are less than adequately addressing the nature of many of the problems [2]. Shortcomings inherent in these approaches include the failure of regulatory programs to consider the long term, cumulative impacts of individual permitting decisions, the inability of the regulatory process to reach optimal decisions as opposed to simply legally valid ones, the lack of responsiveness of permit standards to unique circumstances, and the

reality that conflicts over policies are often rooted in differing perceptions of environmental conditions [3]. Many planning programs have failed to provide clear, predictable policies on resource use, due to input into public policy decisions by different levels of government and the varying mission objectives of separate resource agencies, as well as the disparities between functional mechanisms utilized by these agencies to effectuate policy. Ultimately, there is often a failure to integrate the two approaches at a level of applicability.

The search for solutions to these problems has given rise to a new generation of hybrid techniques: comprehensive management plans, collaborative planning, conflict resolution techniques, environmental mediation and special area management plans [4]. In December, 1986 the Rhode Island Coastal Resources Management Council (CRMC) adopted a Special Area Management Plan (SAM Plan, SAMP) for the Narrow River, an estuary located in the south of the state (see Figure 1)[5]. The SAM Plan was the third in a series sponsored by the CRMC, aimed at developing long range, comprehensive management plans for specific geographic areas [6]. The SAM planning process had been utilized previously in situations warranting management efforts beyond those provided by existing approaches. Problems along the estuary included deteriorating water quality, a failure to restore pollution sources, cumulative impacts on the estuary associated with increasing levels of development, and legal conflicts between conservation and development interests. The SAM Plan was organized with the purpose of addressing these problems by adopting a watershed-level assessment of natural conditions within the estuary,

To provide for a balance of compatible uses, consistent with the CRMC responsibility for preserving, protecting, and restoring coastal resources; specifically, to guide the actions of private citizens, municipalities and state agencies in the restoration and maintenance of environmental quality in the Narrow River;

To provide a regional plan for the Narrow River that recognizes that the watershed functions as an ecosystem; specifically, to protect restore and maintain the chemical, physical and biological integrity of the Narrow River; to encourage the protection of natural systems and the use of them in ways which do not impair their beneficial functioning; to minimize the transport of pollutants to the waters of the estuary; to maintain and protect groundwater resources; to protect and maintain natural salinity levels in estuarine areas; to minimize erosion and sedimentation; to prevent damage to wetlands; and to protect, restore and maintain the habitat of fish and wildlife;

To create a decision-making process appropriate to the management of the watershed as an ecosystem, specifically, insuring consideration of long term cumulative impacts.

TABLE 1: GOALS OF THE NARROW RIVER SPECIAL AREA MANAGEMENT PLAN

providing increased specificity to the standards and policies of the CRMC's primary management program, the Coastal Resources Management Program (CRMP)[7], by modifying these policies in light of specific findings, outlining recommended management actions for other involved government agencies and the municipalities, and presenting nonregulatory initiatives.

The focus of these efforts was to examine the region in its totality, to design management efforts which reflected the interrelated nature of the watershed and the problems facing it, and to attempt to create a decision making process appropriate to the management of the region as a ecosystem [8].

The success of efforts to manage coastal areas depends, to a great extent, upon the ability to coordinate existing programs and activities and site specific environmental concerns together in a comprehensive framework for decision-making [9]. The question of how existing programs, each with a special purpose or emphasis can be coordinated on specific coastal management objectives has emerged as a central focus of ongoing management programs [10]. Central to achieving the state's policy objectives in the Narrow River was the question of coordinating and integrating the programs, goals and policies of other municipal and state agencies. The lack of coordination of these was a major impediment to resolution of the management problems facing the protection, restoration and continued utilization of the estuary's resources. Therefore, heavy emphasis was placed on consensus among the various management

institutions during the development of the plan's recommendations and management initiatives to promote the success of implementation of the defined objectives (Table 1). The approach represented a significant departure from standard regulatory and planning approaches utilized in the state's coastal region.

In order to evaluate the viability of the SAM planning process, this thesis will examine the nature of the management issues facing the various institutions within the Narrow River, the limitation and restrictions created by the framework of management authorities and processes, and the success of the approach of the SAM planning process in implementing the recommendations of the plan after it's promulgation and adoption. The first chapter contains a description of the natural environment of the estuary and its watershed, and a discussion of the management issues present. Chapter 2 outlines the framework of management authorities controlling resource use and development, and the third discusses the Special Area Management Planning process, its usefulness in integrating the policies governing the estuary, and the specifics of the SAM plan project.

II. Description of the Estuary

A. Geography

The Pettaquamscutt, or Narrow River is a unique estuary along the Rhode Island coastline. The estuary is actually composed of a drowned

river valley, glacial kettle holes, a barrier beach lagoon, and a series of freshwater ponds at its headwaters (Figure 2). The system is oriented parallel to the coastline, running in a north-south direction for some six miles. The riverbed was formed several million years ago, and subsequent effects of the glacial transgression deepened the river valley, steepening the flanking walls and depositing a veneer of outwash soils composed of extremely porous and erosion prone sand and gravel [11]. The topography of the watershed ranges from hilly areas in the northern portion (approximately 200 feet above sea level) to the southern portion which flattens out and approaches sea level. The "middle" of the estuary is characterized by extremely steep walls, and a narrowing of the watershed width. As the topography flattens out, the veneer of sand and gravel thins out, exposing bedrock outcroppings. In these areas, because the bedrock is close to the surface the depth to groundwater is usually less than 3 feet.

B. Physical Oceanography

One of the unique characteristics of the system is the physical oceanography regime, heavily influenced by the effects of the estuary's configuration. Towards the northern end of the tidal portion, below the outlet of Gilbert Stuart stream, the estuary is composed of two deep glacial kettle hole ponds. As one moves south towards the ocean, the estuary becomes extremely narrow and constricted. The lagoon at the southern end, known as Pettaquamscutt Cove, is extremely shallow and wide; depths generally average less than 3 feet. The estuary's

connection to the ocean is through a narrow tidal inlet, appropriately named "The Narrows"(Figure 2). The constrictions at the middle portion of the estuary and the ocean interchange severely limit the rate at which waters are replaced by new water from the ocean, known as the "flushing action". Due to these factors, the overall estuary is often characterized as being "poorly flushed", resulting in long residence times for the water throughout the system [12]. This is extremely important in terms of management considerations within the estuary, as the ability of the system to cleanse itself of anthropogenic pollutant inputs is reduced proportionally; the extended residence time of its waters allows for the acummulation of pollutants which may be suspended in the water column, or absorbed onto bottom sediments. Additionally, the natural volume of freshwater inflows covers a considerable range of variability. While extensive data detailing stream flow measurements are lacking, indications are that the system experiences a small base flow, making the headwaters' quality very sensitive to inputs from melting snows, ground thawing, rainfall and subsequent runoff.

The kettle hole basins found in the northern portion of the system were formed by the melting of glacial remnant iceblocks from the glacial retreat. As these iceblocks melted they created basins which are approximately 15 times deeper than the rest of the system (approximately 12 meters and 20 meters respectively), and have a distinct and separate character. The most prominent characteristic of the basins is a stratification of the waters within them, induced by the sinking of heavier brackish waters on the flood tide below more buoyant fresh water

inputs in the upper layer (Figure 3). This stratification is further enhanced by a reduction in water temperatures of the lower layer, influenced by the basins' depth and consequent reduction in the penetration of sunlight. An important consequence of this stratification is a reduction in the mixing of waters between the layers, with the lower layers becoming sluggish and stagnant. The residence times of the bottom waters has been estimated to be on the order of three to five years [13]. The basins, because of the extremely poor flushing of the lower layers, act as huge catch basins for any substances introduced from the headwaters or transported by surface water runoff or groundwater flow. These substances may remain in the bottom waters of the basins for long periods of time, increasing their availability for interaction with the ecosystem. The potential ramifications of this characteristic is shown in the presence of anoxic zones within the basins. The decomposition of organic matter is a process which utilizes oxygen; because the stratification feature limits the exchange of oxygen between the upper and lower water layers, the available oxygen is quickly consumed during the decomposition of leaves, detritus and other organic substances. This results in a general lack of oxygen in the local environment, a condition known as anoxia. Anoxia, or hypoxia which is a less severe reduction in dissolved oxygen levels, has been suspected in other estuaries such as the Chesapeake Bay as having impacts on living resources. Non-mobile life forms may suffer reductions in populations due to their inability to escape from anoxic areas; the lack of oxygen may force mobile organisms to leave the affected areas. An added complication in the Narrow River is the production of hydrogen sulfide by the various described processes,

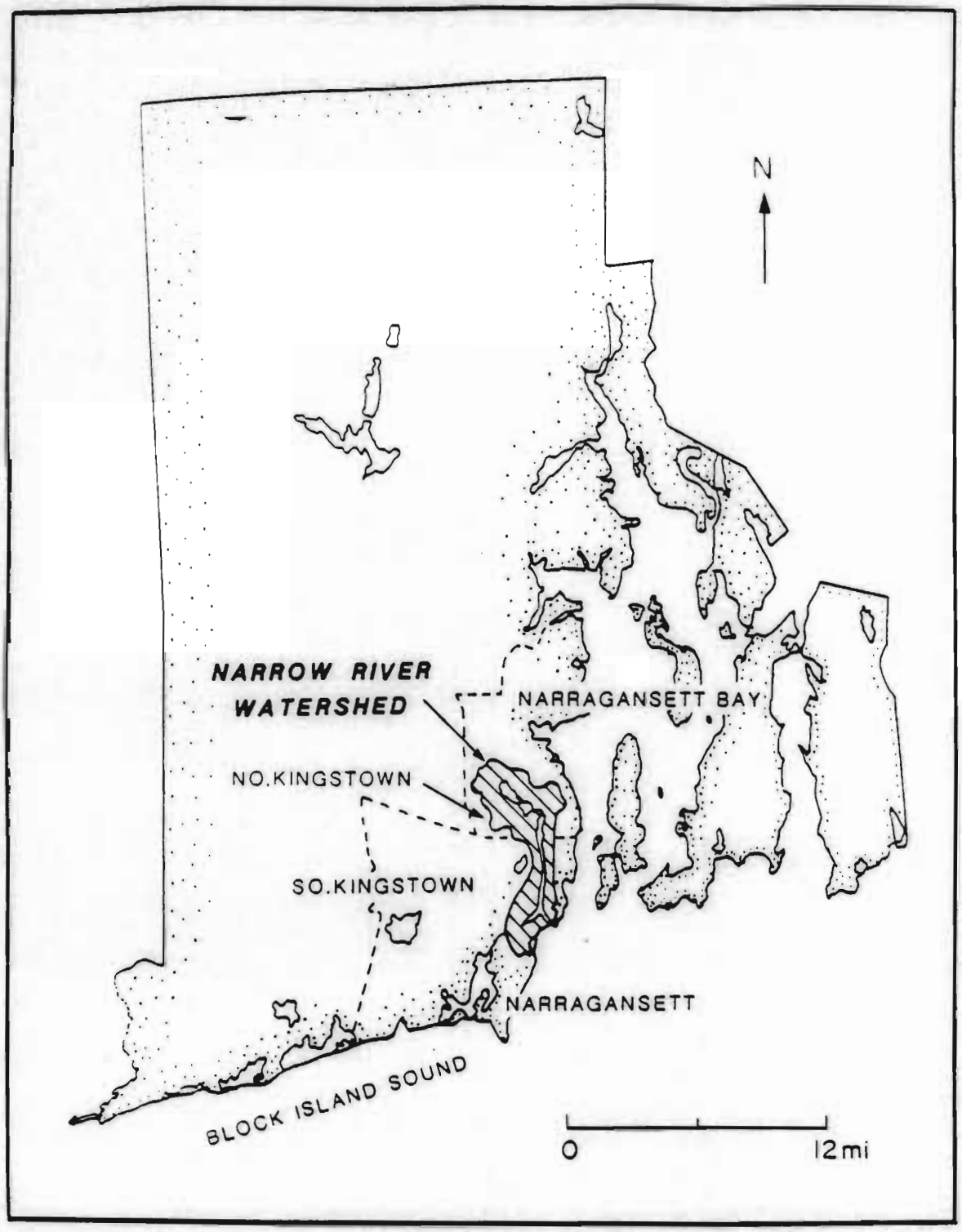

FIGURE 1: Location of Narrow River Watershed in State of Rhode Island (Source: Howard-Strobel, et. al. 1986)

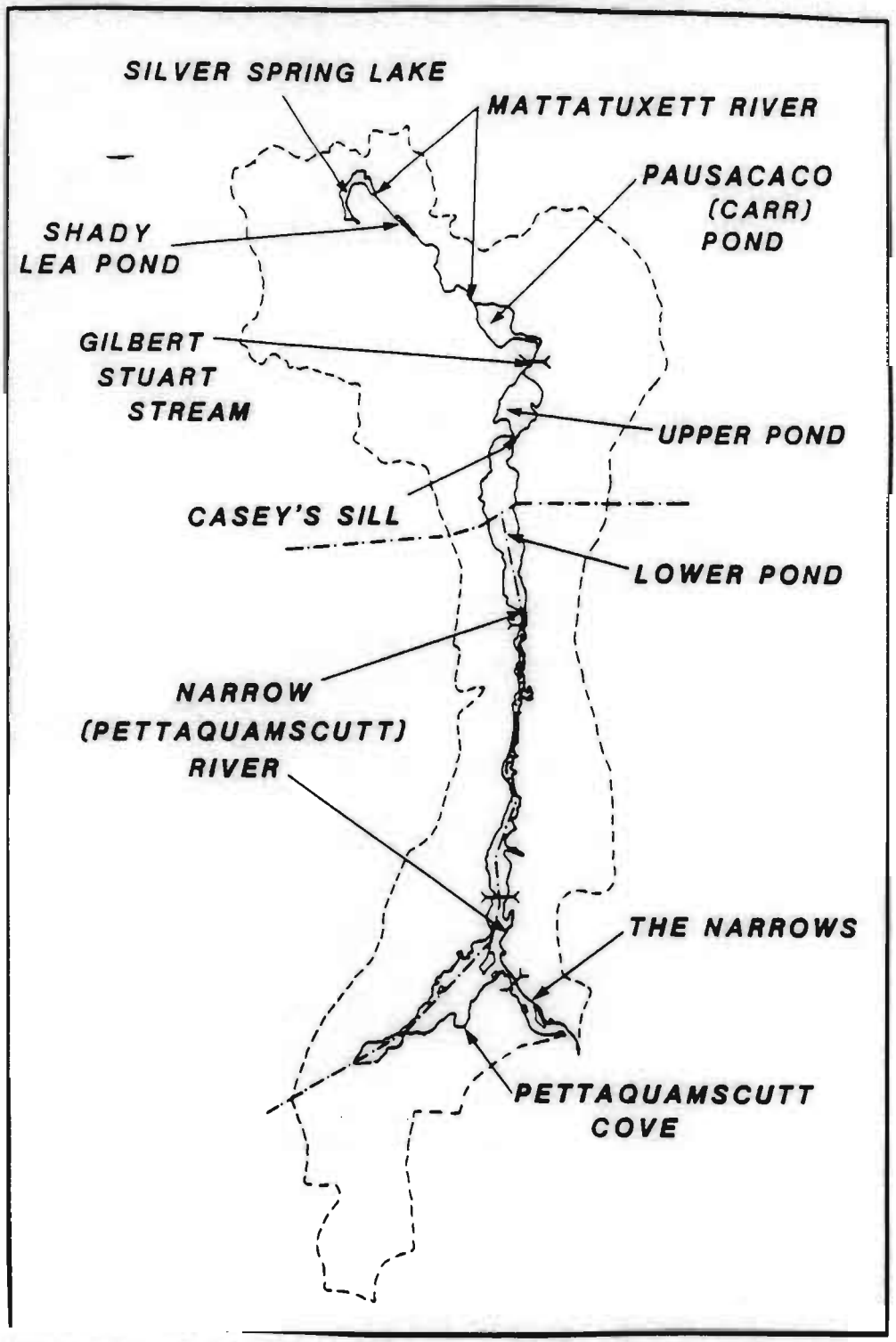

FIGURE 2. Waterbodies of the Narrow River System (Source: Howard-Strobel, et. al. 1986)

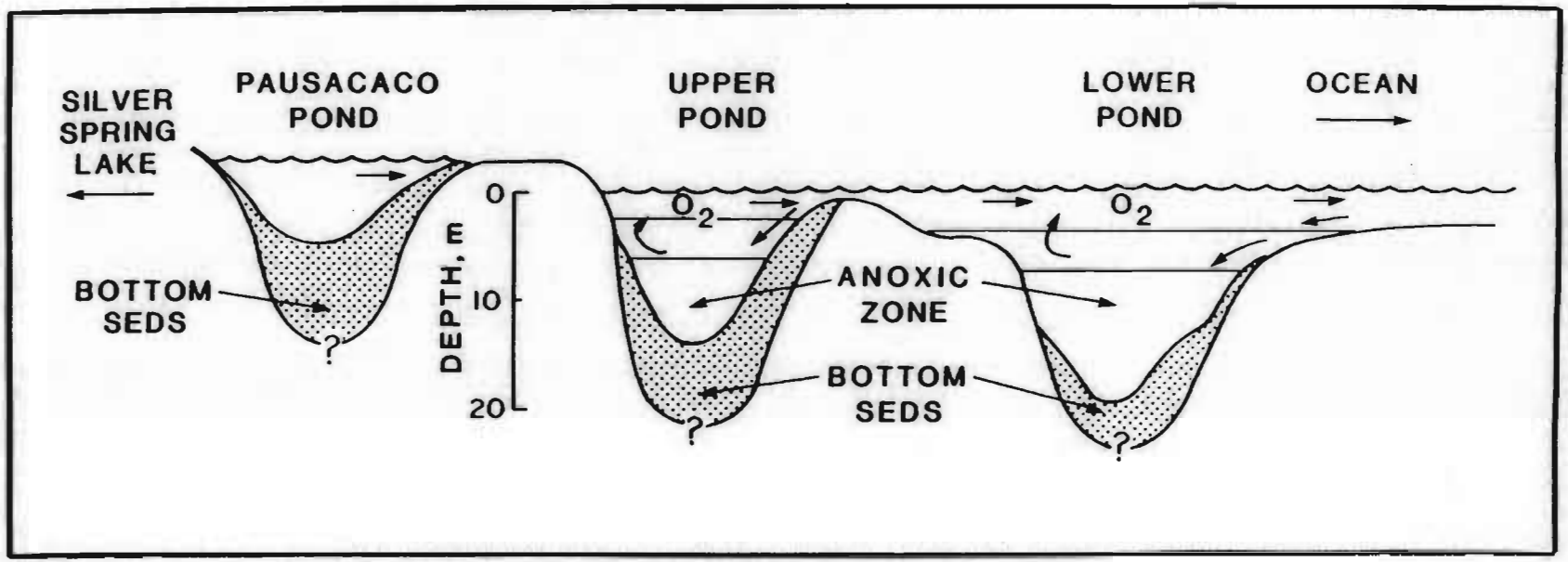

FIGURE 3: Longitudinal Cross-Section of the Two Northern Basins and Carr (Pausacaco) Pond Showing the Dynamics of the Water Regime and Stratification Feature (Source: Gaines, 1975 in Howard-Strobel, et. al. 1986)

which may be lethal to various phytoplankton and fish species. Hydrogen sulfide may be released from the bottom sediments in great quantities during a process known as "overturning", when bottom waters replace surface waters in a single periodic event.

C. Wildlife Habitat

The Narrow River watershed provides habitat for a diverse range of wildlife through various subecosystems and habitat types; salt marsh and freshwater wetlands, transitional areas, upland wooded areas and the open waters of the estuary. The watershed has been noted as having commercially and recreationally harvested populations of finfish and shellfish, providing refuge for migratory and endangered bird species, as well as containing rare and unique species of various life forms.

Wetland areas, both salt marsh and freshwater, have been increasingly recognized as providing a multitude of values to both the natural environment and human society. These broad and well-recognized values include functioning in shoreline stabilization, abatement of storm surge and storage of flood waters, providing important nursery and spawning grounds for estuarine and marine species of fin and shellfish, and as resting, nesting and feeding sites for waterfowl and other bird life. As manmade development replaces open spaces along the coastline, wetland areas are being highly valued for the aesthetic contribution they make to the areas' appearance and attractiveness. In the Narrow River watershed, this is especially true as the broad expanses of salt marsh of

the Cove and middle estuary regions are juxtaposed against the steep river valley walls and narrow width of the watershed. Within the watershed, twenty percent of the undeveloped lands are wetlands, of which 70% are freshwater and 30% salt marsh, as calculated by project staff from aerial photographs during the SAM Plan's development.

The geographic location of the Narrow River makes it a convenient nesting spot for many different species of waterfowl [14]. Additionally, the estuary is primary habitat for many additional species, due in great part to the variety of habitat types present. Both transient and resident species utilize the estuary's wetlands for many different purposes, including nesting, feeding, transient habitat and overwintering. There have also been historical accounts of the area providing habitat for rare and endangered species including the osprey and the least tern. Unfortunately, human intrusion and increased usage of the estuary for recreation appear to have impacted the continued presence of these species [15].

The wetland areas also host several uncommon species of plants, including Olney's Sedge, of which the Narrow River is one of three sites in the state, and the Robust Sedge, of which a stand fifty feet in diameter is one of five sites in the state [16].

The variability of the physical characteristics of the waterbodies throughout the Narrow River estuary creates several differing aquatic habitats and environments. Each supports a different natural community

where the plants and animals present are specifically adapted to the physical and chemical characteristics of their environment. One of the most important aquatic habitats is that of the subtidal portion of the estuary. The combination of natural features of the estuary, including the tidal flow, relative rate and proximity to freshwater inputs, the shallowness and confinement of waters in specific areas all make this subecosystem one of the most productive habitats. The extremely unique occurrence of several planktonic species has been noted by several observers; Hermesinium adriaticum, typically observed in the Black, Adriatic and Mediterranean Seas was recorded by Miller in 1972 [17]. Only two species of this organism are know to exist in the world. The diatom Chaetoceros fallax and the flagellate Ciriosphaora sp. have also been collected in the estuary, and have been seen in only a few locations in the world. One diatom, C. certosporus var. brachysetus is unique to the Narrow River [18]. Further, the plankton community composition for the Lower Pond was found to be very similar to that of a Norwegian anoxic basin, the Hunnebunnen [19]. This biological comparison, preceding Gaines' 1975 physical comparison to the deep anoxic fjords of the boreal zone, further substantiates the unusual character of these estuarine environments.

Submerged Aquatic Vegetation (SAV) forms an integral and critical element of the subtidal ecosystem. SAV provides organic material to the estuary, especially important due to its normally high productivity. The vegetation acts to reduce bottom current velocities, promoting sedimentation, as well as binding those bottom sediments and slowing

erosion. The SAV is also linked to other living resources within the estuary; it provides permanent residence for invertebrates, a nursery for migrating and resident fish species, and acts as a food source for ducks and other waterfowl. Six species of SAV have been documented in the Narrow River [20]. Despite the importance of SAV to estuarine values, it is considered a nuisance by many boaters because of entanglement in propellers, while swimmers are often squeamish of its presence. SAV is also extremely sensitive to alterations in the water column, especially reductions in available sunlight brought about by increased turbidity.

Attracted by the warm, shallow and protected waters, finfish have a long history of proliferation in the Narrow River. Over 50 species of fish have been documented as occurring within the estuary, with considerable spatial overlap between the occurrence of fresh water and marine species. This overlap contributes to the unique and diverse ecosystem in the area of the Upper Pond, with both fresh and marine species cohabitating within the extremes of their preferred natural habitats. During the 1950's, the estuary supported a substantial striped bass fishery, a species whose general decline has been mirrored in the numbers found more recently in the Narrow River.

The estuary supports a modest shellfish population, and was one of the first shellfish management areas established by the state. The existing populations' occurrence and distribution appears to fluctuate and be dependent upon the presence of specific bottom sediment types and salinity regimes throughout the estuary. The fishery has recently

supported a few small commercial operations, concentrated primarily on blue crabs and oysters. However, the economic significance of these operations was minimal, and the major harvesters and consumers of shellfish from the estuary were the year round and summer residents. Both the commercial and recreational fisheries are currently closed due to bacterial contamination problems, discussed below.

D. Land Use

Land use within the Narrow River watershed has been, and remains devoted primarily to residential use and open space (Figure 4). The face of the occurring development has significantly changed in both character and rate over the last forty years. Like much of the southern part of Rhode Island, initial changes from historical agricultural uses were to made accommodate an increasing summer vacation population from the more urban centers surrounding Providence. Communities of small cottages grew up in the central portions of the estuary, in close proximity to the river. Reflecting predominant development trends of the post-World War II period, high density communities were established on those areas where building constraints appeared to be the least. Centered primarily on the level floodplain areas, houses within these communities were commonly built on lots on 5-10,000 square feet. Such high density was both reflected in, and reinforced by, municipal zoning. The communities of Mettatuxet and Middlebridge, in the towns of Narragansett and South Kingstown respectively, are characteristic of this trend and are two of the oldest communities in the watershed. In contrast to these areas, the

greater portion of the watershed has remained in large holdings of open land or farm estates. Newer developments (1960s-1970s) have generally been of lower, yet still moderately high, densities of 1/2-1 acre per dwelling unit. The watershed is in the center of some of the most rapid growth within the state. On a watershed-wide basis, there has been a five-fold increase in the numbers of dwellings between the late 1940's and the present, with the most significant increase in the rate of development beginning in the early 60's. During the period between 1945 and 1985 the numbers of dwellings in the Narragansett portion of the watershed has increased seven times; in South Kingstown the number of houses has doubled; and in North Kingstown there has been a four-fold increase (Figure 5)[21]. As of 1986, 30% of the land area of the watershed was developed, with existing development patterns varying from the early high density communities to more recent lower density residences established less uniformly throughout the watershed. Despite the intensity of existing land use, significant percentages of the land area within each town remains undeveloped; North Kingstown 80%; South Kingstown 70% and Narragansett 46% (1986 figures as calculated from aerial photographs by the SAMP project staff, Figure 6). Part of the reason for the present pattern of development is due to the relatively development-constrained nature of the open areas, characterized by steep slopes and wetland areas. The level of development in the remaining open areas has also been somewhat ameliorated by the relatively early advent of large-lot zoning districts in the towns of South and North Kingstown (Figure 7). Several parcels of land have also been placed in permanent protection through conservation easements and dedications resulting from

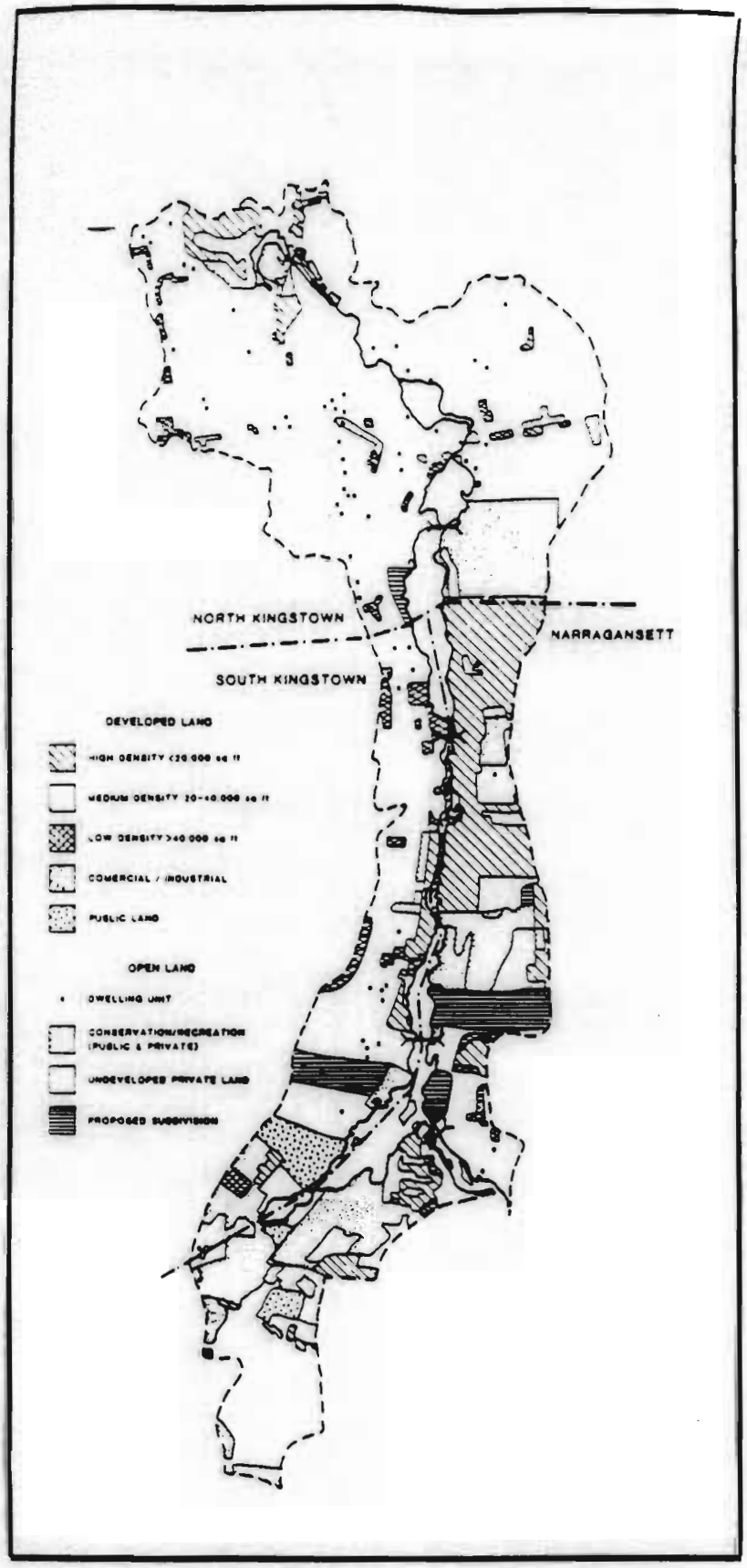

FIGURE 4: Land Use in the Narrow River Watershed, 1986 (Source: Howard-Strobel, et. al. 1986)

public acquisition and development exactions.

E. Water Quality

The quality of water within an estuarine system is the primary indicator of the system's health and ability to support resources and their uses. Through the requirements of the Clean Water Act, the State of Rhode Island has classified its marine and fresh waters according to a methodology which sythesizes present water quality parameters' characteristics and desired and attainable uses [22]. The Rhode Island Department of Environmental Management (DEM), the state's water quality agency, currently classifies the Narrow River system as follows: from the Cove and Narrows region to the Northern limit of salt water influence is classified as SA; from Gilbert Stuart stream to Carr Pond, A; from the Mattatuxet River to Silver Spring Lake and Pendar Pond, B [23]. The classification system is established and interpreted as an interaction between present characteristics of the waterbody, environmental determinants which influence what the quality may be (such as undeveloped surrounding lands, or an urban setting) and goals for its continued and future use. The system does not necessarily represent the actual quality of the waterbody at any given time [24]. Waters within the SA classification are defined by parameters (Biological Oxygen Demanding substances, Dissolved Oxygen levels, bacterial levels, etc.) which indicate the water is of suitable quality for all salt water uses, including shellfishing harvesting for direct consumption, and swimming; A waters are fresh waters suitable for water supply purposes; and B waters

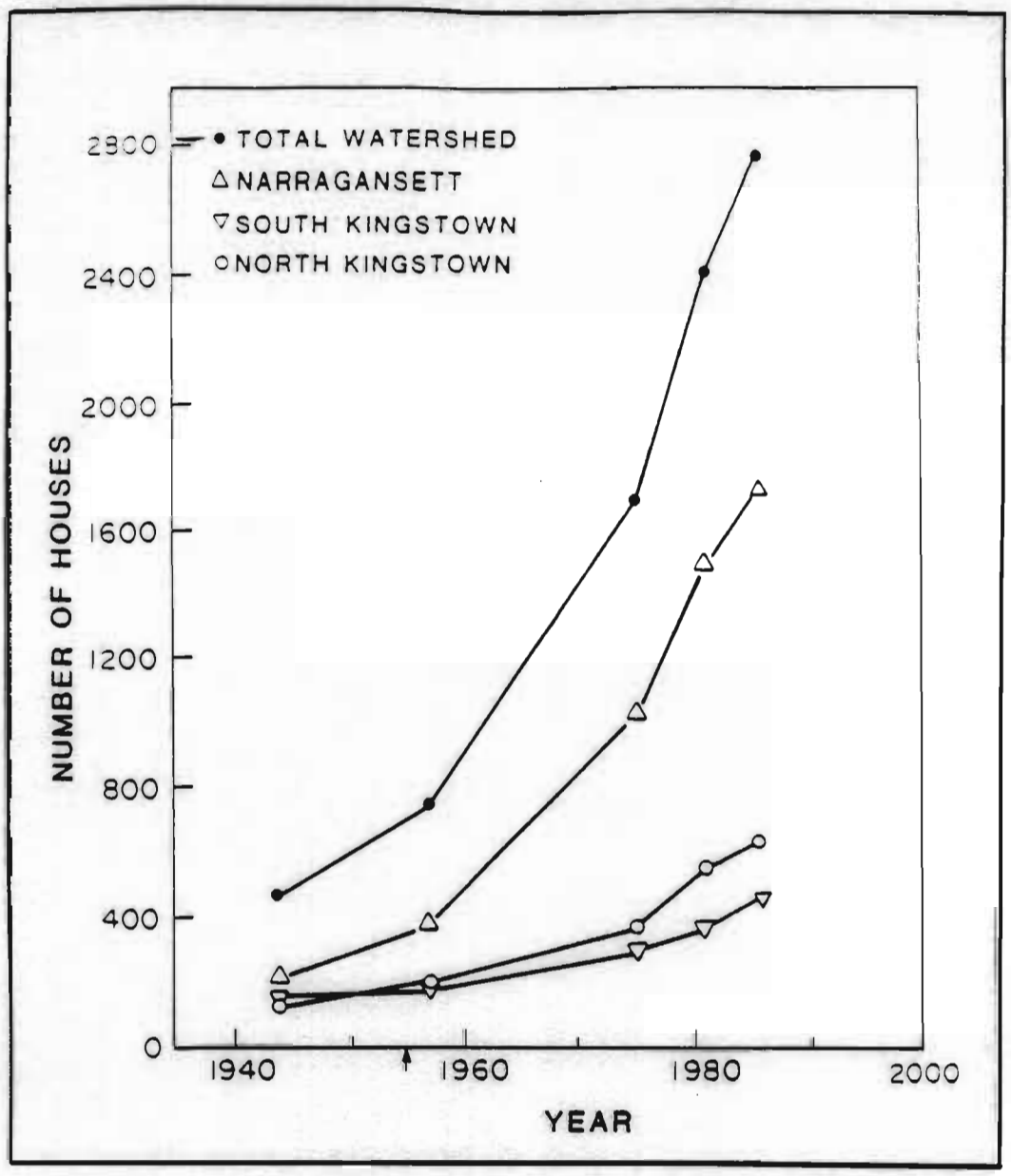

FIGURE 5: The Growth Rate Trend in the Narrow River Watershed, 1944-1985 (Source: Howard-Strobel, et. al. 1986)

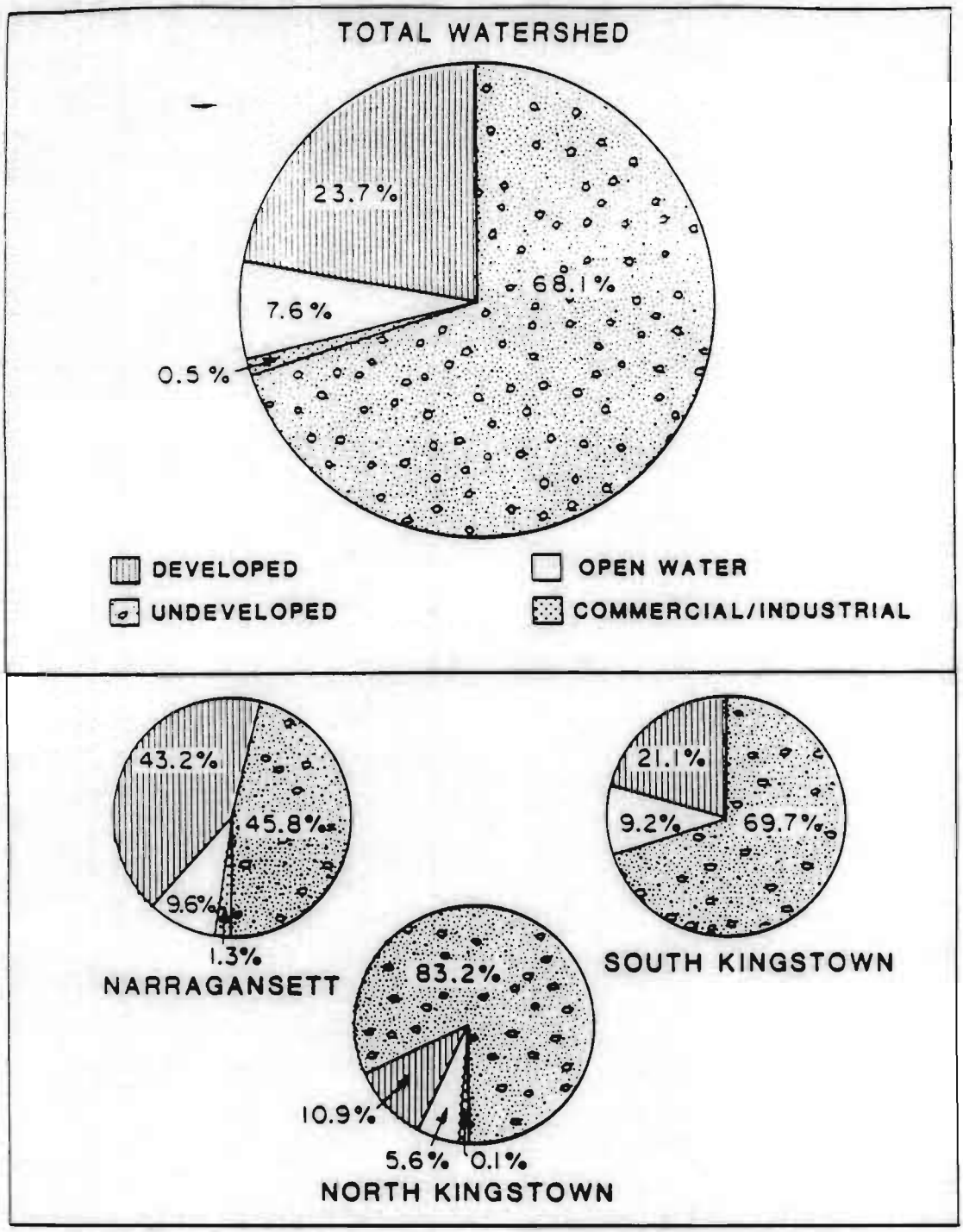

FIGURE 6: Land Use Distribution in the Narrow River Watershed, 1985 (Source: Howard-Strobel, et. al. 1986)

are suitable for bathing and recreational purposes, and wildlife habitat.

While water quality management is based upon the control of various parameters which may influence the waterbody's viability, the most common methodology employed in monitoring programs is the use of indicator bacteria measurements. Coliform bacteria, Eschericheri coli (E. Coli), are bacteria found in the gut of warm blooded animals, including humans. Their measurement is used as an indicator of the probable presence of pathogenic viruses associated with sewage. While public health concerns have traditionally been the focus of these monitoring programs, the association of the bacteria with sewage (which may contain other injurious substances such as nutrients, household chemicals, pesticides) and its relative ease of measurement have popularized its use to indirectly monitor changing water quality. As E. coli levels increase in water quality samples there exists a reasonable probability that the contaminating source is contributing other pollutants to the water body, if that source is anthropogenic in nature. This raises concerns in addition to those associated with shellfish contamination due to bacteria and viruses. Despite the popularity of the use of coliform measurements, the method is not completely reliable. Variable sources, such as high concentrations of waterfowl, as well as certain erratic characteristics of the bacteria's behavior, lessen the validity of the measurements use as a dependable indicator of anthropogenic pollution. However, its use remains strong in the face of a lack of any other methodology as easily employed.

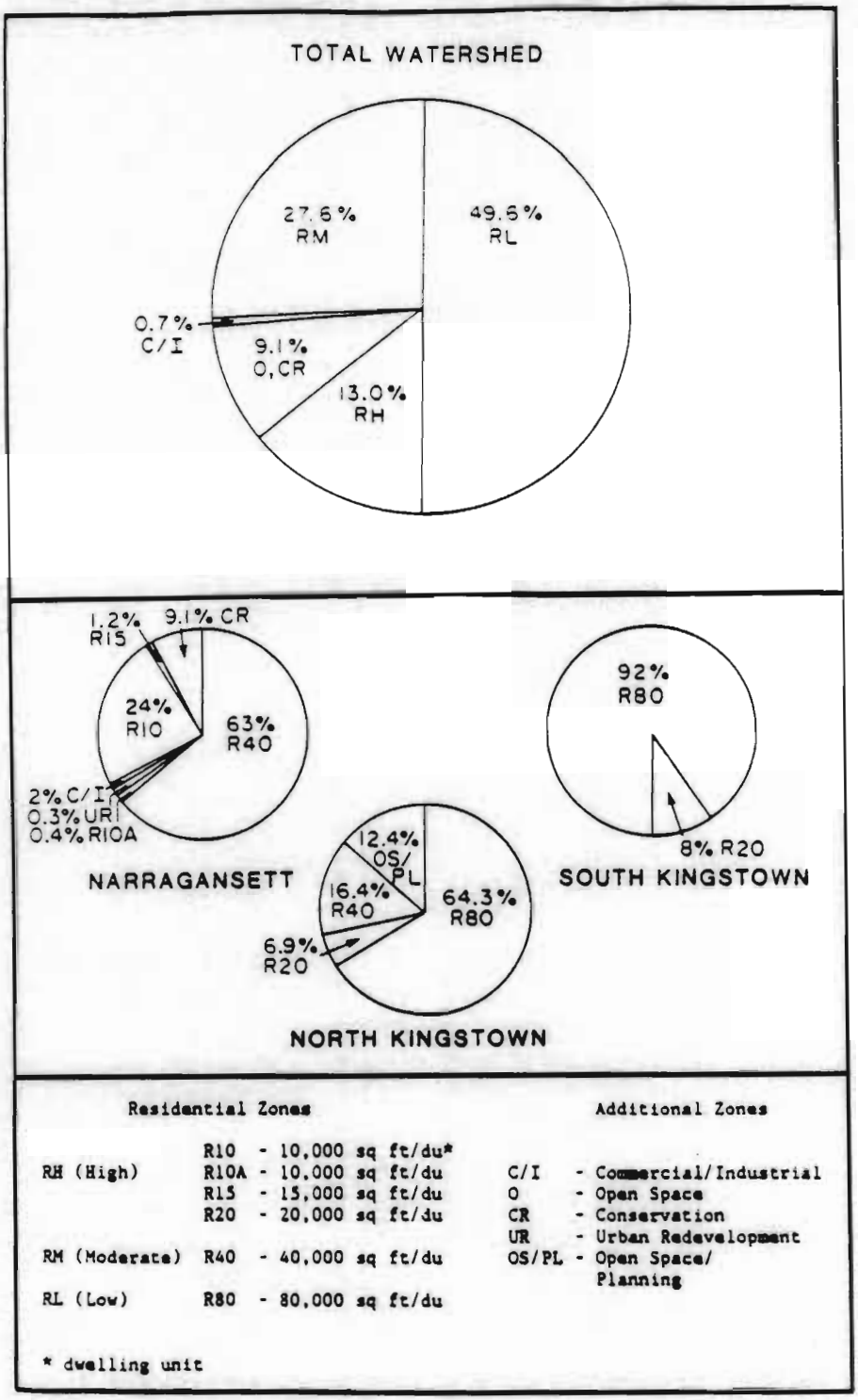

FIGURE 7: Zoning Distribution in the Watershed, 1986 (Source: Howard-Strobel, et. al. 1986)

Water quality trend data collected by the RIDEM show that the waters of the Narrow River system have consistently exceeded state standards for SA waters since 1959 [25]. Since 1980, 24 out of 48 samples taken (50%) were out of compliance with established standards. Consistently high bacteria counts were observed at monitoring stations in proximity to highly developed residential areas. The levels recorded by the ongoing DEM programs were reinforced by several studies conducted by researchers from the University of Rhode Island. The results of these independent research efforts, in part, led to the closing of the estuary to shellfishing in 1979 and 1986. More recent sampling of the estuary continues to indicate bacterial levels several orders of magnitude higher than allowed by state regulations (Figures 8 - 11).

F. Nutrients

Scientific studies of pollution problems facing estuaries nationwide have placed increasing importance on the impacts excessive nutrient levels in these water bodies (26). Nutrients such as nitrogen and phosphorus are essential ingredients in the growth processes governing phytoplankton and algal growth, and often act as limiting factors in the levels of growth occurring. When nutrients are present in levels beyond those required by ecosystem specific processes, excessive growth may occur. This, in turn, may result in several problems affecting the overall viability of the estuary: excessive algal growth may cause a decrease in the clarity of the water, affecting the growth of SAV, the presence of an overabundance of food sources may create shifts in trophic

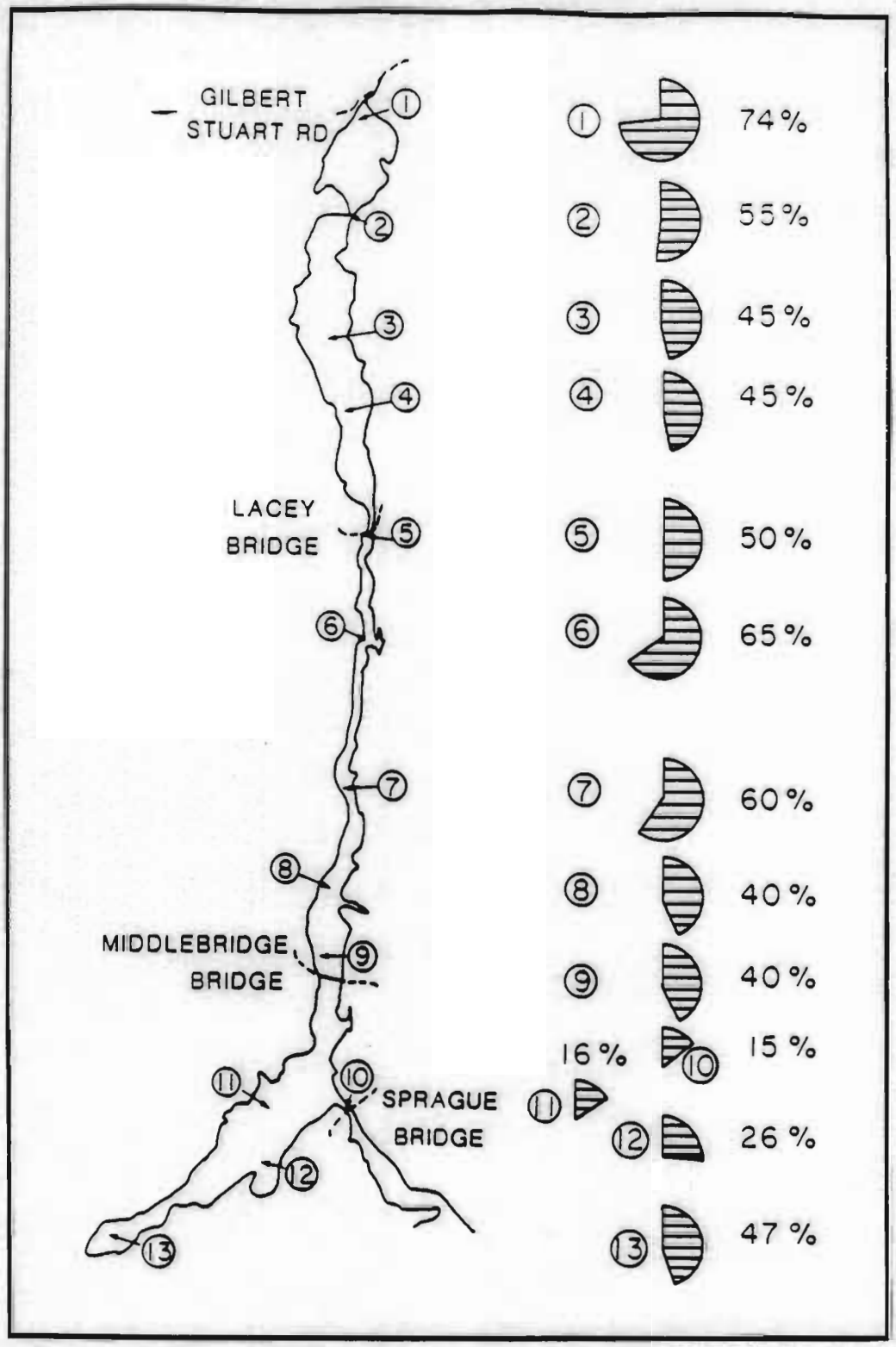

FIGURE 8: Percentage of Samples, Collected By RIDEM, Exceeding State Limits for Total Coliform Levels from 1980-1985 (Source: Howard-Strobel, et. al. 1986)

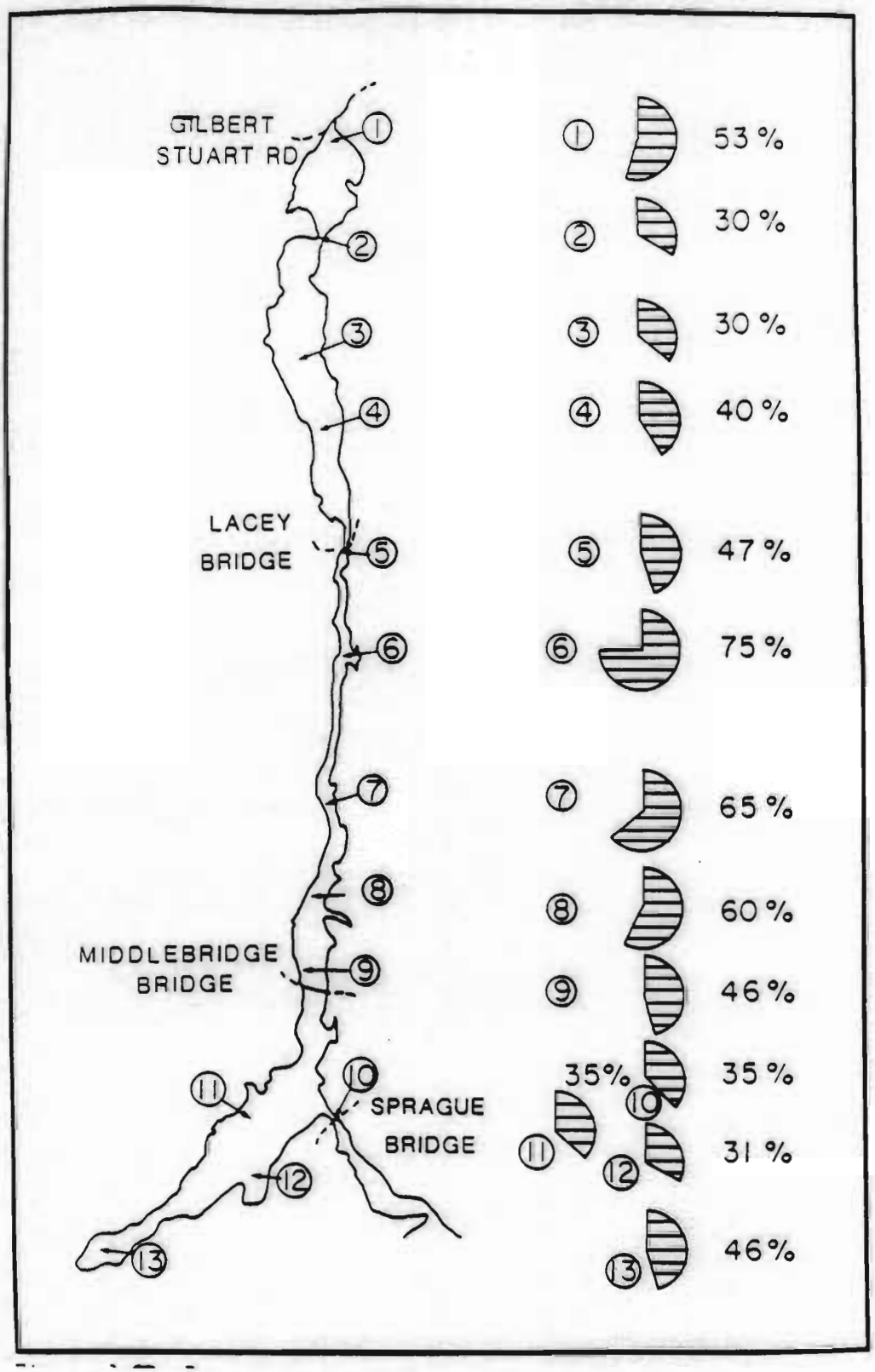

FIGURE 9: Percentage of Samples, Collected By RIDEM, Exceeding State Limits for Fecal Coliform Levels from 1980-1985 (Source: Howard-Strobel, et. al. 1986)

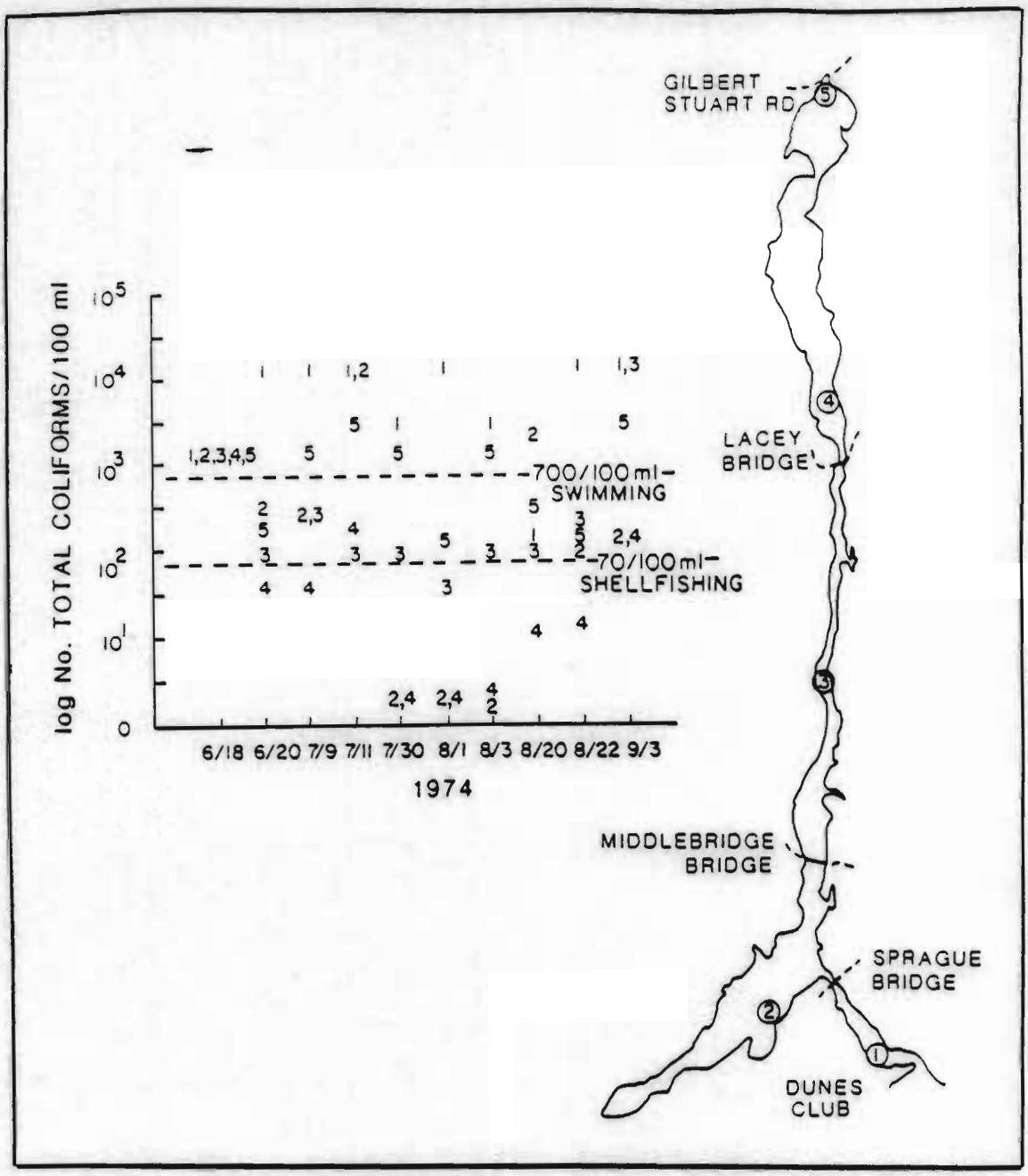

FIGURE 10: Total Coliform Levels Measured During the Summer Months in 1974, Along the Narrow River (Source: Howard-Strobel, et. al.1986)

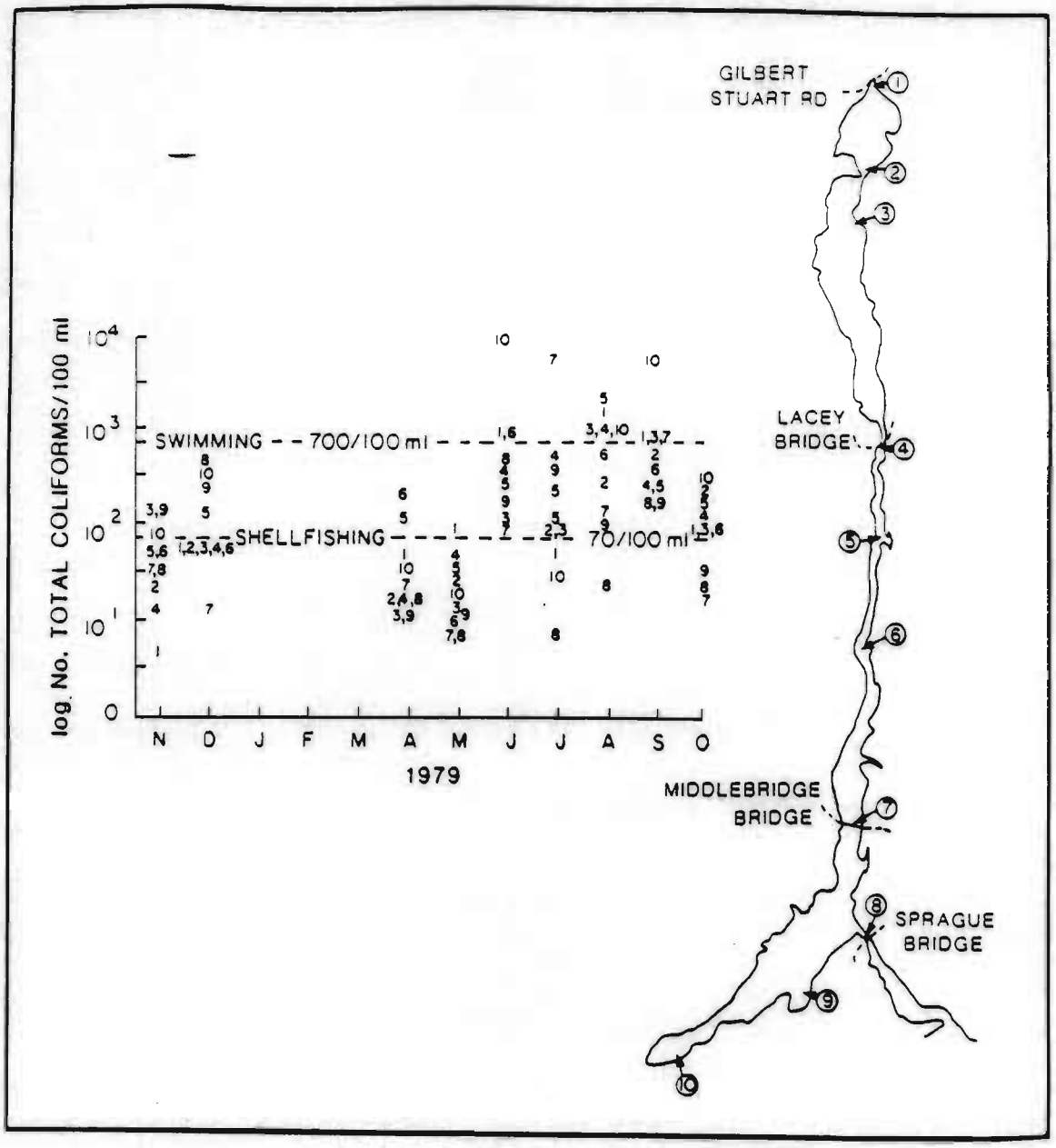

FIGURE 11: Total Coliform Levels Measured Throughout the Year of 1979, Along the Narrow River (Source: Howard-Strobel, et. al.1986)

structures and phytoplankton and zooplankton populations, and the decay of this overabundance of organic matter may create stresses on dissolved oxygen levels in the water column affecting the viability of living resources and aggravating anoxic or hypoxic conditions. While extensive studies on nutrient levels in the Narrow River system have not been conducted, signs of nutrient enrichment have been observed as early as 1972. Indications that this may be occurring are based primarily on observations of accelerating growth of several aquatic plant species and recorded high concentrations of ammonia and nitrate [27].

G. Past Resource Evaluations and Studies

The Narrow River system has been recognized for its outstanding resource values by a series of studies and programs. Several natural area inventories included the estuary within their recommendations for increased protection efforts due to high natural, scenic and recreational values.

The Rhode Island Audobon Society's study on "Significant Natural Areas", conducted in the early 1970's evaluated numerous coastal and inland areas for ecological, cultural, recreational and scenic values [28]. The study noted the occurrence of the Narrow River system as "singularly unique." The estuary was included in the inventory because of "significant and unusual land and water interfaces, the great diversity of its marshes, bogs, swamps, estuarine environments, and [as supporting] unusual or significant aquatic life." The visual impact of the watershed

was classified as "high". The estuary was also recognized within the inventory as having high recreational value, and noted as a spawning area for winter flounder and the use of the area by shore birds.

A publication prepared during the formulation of Rhode Island's coastal management program entitled "Rhode Island's Coastal Natural Areas: Priorities for Protection and Management" included the estuary, noting the aesthetic qualities of the undeveloped woodlands adjacent to the estuary, the valuable spawing and habitat areas, recreational values, cultural resources, the unique oceanographic conditions, and vulnerability of the watershed to contaminated runoff, leachate and other pollutants [29]. The study made recommendations for the protection of scenic resources, dredging restrictions and limitations on increasing sources of bacterial and effluent discharges associated with development activities through municipal zoning actions, and cooperative state and local initiatives.

In 1976, a study was commissioned by the Tri-Town Narrow River Planning Committee of Narragansett, South Kingstown and North Kingstown with funds allocated by the three towns, the Narrow River Preservation Association (NRPA). a matching grant by the Ford Foundation and a planning grant from the Department of Commerce, National Oceanic and Atmospheric Administration under the CZMA. The study produced recommendations concerning growth management emphasizing guiding future watershed development to small village centers and existing neighborhoods, protection of open space, recreational, scientific and

educational assets through the creation of two park areas at either end of the estuary, and recommended stringent zoning, subdivision and other local initiatives to protect environmental values and appearance of the watershed [30]. While the effort produced a comprehensive document, few of the recommendations were ever effectively implemented. This has been attributed to the lack of permanent personnel resources devoted to the implementation of the plan, and its lack of legal force [31].

The Coastal Zone Management Act, the federal act controlling the process of development of the Rhode Island coastal management program, included requirements for the identification and designation of "Geographic Areas of Particular Concern" (GAPC) and "Areas for Preservation and Restoration" (APR) [32]. The Narrow River in its entirety, and its specific resources such as the expansive salt marshes, were assigned to these designation in the Final Environmental Impact Statement for the program [33]. In 1983, the Rhode Island Coastal Resources Management Program (CRMP) underwent extensive revisions, which in part included assignation of Water Type Groups establishing goals and priority uses for individual geographic areas, and incorporated the GAPC and APR designations. The waters of the Narrow River were classified as Type 1 "Conservation Areas" and Type 2, "Low Intensity Use" [34]. Among the criteria for inclusion in these categories under the classification system were "water areas that have retained undisturbed natural habitat or maintain scenic values of unique or unusual significance" and areas with "high scenic value that support low-intensity recreational and residential uses, and where good water quality and fish and wildlife

habitat are maintained." [35].

III. Pollution Inputs to the Estuary

A. Individual Sewage Disposal Systems

Like many rural areas of the country, a lack of public wastewater treatment infrastructure has created in Southern Rhode Island generally, and in the Narrow River watershed specifically, a reliance upon on-site methods of wastewater disposal. Individual Sewage Disposal Systems (ISDS) are a primary method of on-site disposal. These systems utilize leaching fields and the filtration capabilities of soil for treating and disposing of household wastes. Wastewater is conducted from the dwelling to a holding tank where solids are settled out, and effluent passed on to leaching beds. The percolation of the effluent through the soil acts to filter out and retain pollutants. Despite their popularity, ISDS are functionally dependent on specific environmental conditions and proper installation and maintenance for optimal performance. Required environmental conditions include sufficient percolating capabilities of the soil (the ability to allow water pass through at specific rates), the absence of impervious layers such as bedrock within specified distances below the leaching fields, and sufficient elevation above groundwater tables to prevent direct contact with effluent [36]. Additionally, spacing requirements are needed for leaching fields sized to various wastewater input volumes, and separation of drinking water sources from the disposal areas. The siting and installation of ISDS are presently regulated by the

RIDEM, although statewide standards and regulations were not in place prior to 1968.

Malfunctioning, or "failed" ISDS have been identified as a significant source of bacterial contamination in Southern Rhode Island [37]. The lack of consistent engineering-based standards or regulation prior to 1968 resulted in many post World War II houses being equipped with septic systems that are substandard by presents standards [38]. In many cases, these "systems" consisted of direct lines from homes to 50 gallon oil drums, direct discharges to storm sewers, and in many documented cases, directly to waterbodies. More often than not, even those systems which had some semblance of proper engineering have not been maintained for extended periods of time, resulting in clogged leaching fields and other system malfunctions. The lack of siting standards allowed many systems to be sited in areas of high groundwater tables, impervious soil conditions, and close to bedrock layers. The Rhode Island Areawide Wastewater Management Plan (208 Plan) recommended that a minimum of 60,000 square feet be required per house lot where on-site sewage disposal was proposed and no public water utilities were available [39]. As noted above, early development trends in southern Rhode Island often sited dwellings on lots of 10,00 square feet or less, in high densities. The "crowding" of many ISDS systems under these conditions often led to clogging of soils with organic matter, inhibiting the filtration processes upon which the systems depend, and ultimately resulting in community wide failures.

While many of these potential causes of ISDS failure have ostensibly been addressed through the state regulatory program, one predominant soil characteristic is not adequately addressed in the siting criteria. The glacial outwash origin of much of the soil in southern Rhode Island has resulted in many areas being predominated by excessively permeable sandy soils. While these soils meet the percolation requirements of the state regulations, their excessive permeability allows effluent to pass through quickly without filtration. The location of these soils around the coastal ponds and the Narrow River means that effluent from ISDS passes through the soil and directly into groundwater flows connected to the waterbody itself [40]. This characteristic is not adequately accounted for in the percolation rates used by the state to judged effluent renovation properties [41].

Septic system failures have become a notorious characteristic of older developments in the Narrow River watershed. Due primarily to the problems cited above, older communities with the watershed have experienced a range of events associated with inadequate on-site wastewater treatment design and operation. Failure of individual systems is a common occurrence, as are basements filled with sewage contaminated groundwater during rainstorms [42]. The community of Middlebridge experienced such a high incidence of well contamination from ISDS failures that public water was eventually brought into the area. An entire condominium complex was condemned by local public health officials due to numerous failures of its septic system [43]. An extensive survey of Narragansett neighborhoods within the watershed revealed that nearly half

of the homes surveyed maintained septic system pumping programs and use of chemical and acid cleaning agents to counter system malfunctions and failures [44].

B. Storm Drains and Road Runoff

An additional source of bacterial contamination entering the estuary are storm water drains designed to carry water from upland properties and roadways. Many of these storm drains are "straight pipes" to the estuary, aligned at right angles to the waterbody. These alignments parallel road layouts within the watershed, which usually run from the tops of the ridges bounding the river to the water's edge. This configuration maximizes the amount of road runoff that is collected within the storm drains and transported to the estuary. Storm drains were investigated by the RIDEM in April, 1980 and June, 1982 as possible sources of contaminants to the estuary. Of the 33 storm drains along the Narrow River, 22 were selected for sampling. The results of the water quality monitoring indicated that state standards were exceeded by a range of concentrations for bacteria 3 to 3000 times that allowable by regulation. Of the 39 samples taken, only 4 did not exceed fecal coliform standards for Class SA waters. (Figure 12).

C. Surface Water-borne contaminants

Urban development affects the quality and quantity of stormwater runoff. Increased flooding, introduction of freshwater into estuarine

salinity regimes, modification of hydrological regimes of wetlands and changes in species composition, and water quality degradation are all products of uncontrolled runoff [45]. Accumulated residue and debris are washed from the land's surface as runoff passes over it. Detectable levels of many heavy metals, pesticides and hydrocarbons have also been established to be present in stormwater runoff from developed areas [46]. Nutrients may also enter surface water bodies through groundwater or surface water runoff. Groundwater was found to be the major pathway for nutrients in the nearby salt ponds region [47]. Similar environmental characteristics such as high groundwater tables and excessively permeable soils indicate that this may be a potential pathway in the Narrow River watershed. While surface water contributions are generally more difficult to define precisely, high levels of nitrates due to increases in surface water runoff, and in storm drains after rain events have been recorded in the watershed [48]. The sources, types and amounts of nutrients entering a waterbody are heavily influenced by population densities and land uses [49]. The dense residential areas in the Narrow River watershed heighten the probability of nutrient inputs originating from ISDS and lawn and garden fertilizers.

D. Conflicts over Preservation and Development

The nature of the Narrow River watershed, and the history of its development have created two concurrent and opposing movements which the changes to the estuary's environment and impacts to its resources have brought into conflict with increasing frequency: on the one hand is a

FIGURE 12: Results of DEM Storm Drain Survey (Source: Howard-Strobel, et. al.1986)

Station	April 29, 1980	May 21, 1980	June 25, 1982
1	2,900/640	---	23,000/2,300
2	9,300/930	240,000/43,000	2,300/ 23
3	---	15,000/2,300	---
4	---	43,000/15,000	---
5	4,300/43	23,000/9,300	230/ 23
6	---	---	---
7	---	150,000/23,000	---
8	---	---	---
9	---	23,000/1.500	---
10	4,300/290	23,000/9,300	---
11	23,000/930	43,000/23,000	230/ 23
12	43,000/430	43,000/23,000	23,000/ 23
13	23,000/2,300	43,000/7,500	---
14	430/43	23,000/4,300	23,000/230
15	4,300/4,300	240,000/21,000	---
16	930/93	---	---
17	930/4**	---	23,000/930
18	230/ 3**	---	---
19	15,000/230	75,000/75,000	---
20	930/4**	---	---
21	2,300/9**	93,000/9,300	---
22	2,300/230	75,000/4,300	230,000/230,000

**Only samples that do not exceed fecal standards for Class SA waters.

long-standing recognition of the area as a unique collection of natural, recreational and aesthetic resources and a growing sense of the need to preserve its amenities in light of increasing development; on the other has been a widespread desire to access these amenities, and increasing levels of development spurred on by that desire. These two forces are cast against a background of past development carried out in an improper manner, with conspicuous human-induced impacts to the estuary.

The methods and characteristics of past development practices have been the primary causal factor in the degradation of the estuary's water quality, closure of shellfishing beds, contamination of neighborhood drinking water supplies and changes in the overall appearance of the watershed. In reaction to these impacts, citizen's groups have formed throughout the watershed, most notably the Narrow River Preservation Association (NRPA) and the Narrow River Land Trust, sister organizations. The NRPA has been extremely active in monitoring, and in many cases opposing new development projects. The group's opposition to several projects has caused significant delays and modifications to these projects, in some instances to the point of preventing their completion. The opposition has resulted in large cost increases and delays to the developers, frequent conflicts with state resource management agencies over their review of the projects, and litigation. The situation had, by 1985, deteriorated to the point that lengthy public hearings, battles between experts over design characteristics and significant acrimony between local residents, developers and municipal and state management authorities had become "par for the course" for development proposals

within the watershed.

IV. Summary

The Narrow River estuary and its watershed constitute an extremely diverse and complex natural system. The system is composed of a series of closely interrelated subecoystems created by the variability of its oceanographic characteristics, physical dynamics, varying land forms and physical configuration of the estuary. These elements support a wide variety of valuable natural resources, including unique kettle hole basins, uncommon living resources, diverse wildlife habitat, substantial fisheries, recreational and aesthetic resources.

The geological, oceanographic and physical characteristics of the estuary make it extremely sensitive to impacts arising from development activities within the watershed. These impacts have been manifested in the observed declines in water quality, impairment of shellfishing and recreational resources due to septic system related bacterial contamination, diminution of historical occurrences of wildlife species, shellfish and fisheries, and impacts to scenic and aesthetic resources due to the changing appearance of the watershed.

Development activities within the watershed have increased dramatically over the past forty years. These changes in land use have been extremely variable in terms of density, and in rate of occurrence

within the three municipalities. The growth of residential uses has spurred secondary alterations such as storm sewers, sanitary sewers and increased road construction. While significant percentages of the land area within each municipality remain undeveloped, these areas are often characterized by significant constraints to development, including steep slopes and wetland areas.

Improper development practices in the past have been the primary sources of pollution impacts to the estuary. The extreme density of development in older communities, coupled with substandard engineering practices for on-site waste water disposal have resulted in an extremely high incidence of septic system failures. Untreated sewage from these failures has reached the estuary through ground water flows and overland transport. Water quality monitoring within the estuary has established that the waters of the Narrow River have consistently exceeded state standards for bacterial contamination since 1959, resulting primarily from these impacts. Other concerns have also been identified within the estuary relating to nutrient and stormwater borne contaminants carried to the waterbody through storm drains established to support the watershed's development.

Despite the recognition of the estuary as a unique natural area by a series of studies on both the state and local level, insufficient translation of these findings into workable and effective development policies has fostered an atmosphere in which many new development proposal encounter substantial opposition. While the foundation of this

opposition may be primarily over concerns related to impacts arising from older developments, the reaction has forced lengthy public hearings, disagreement over acceptable design standards and litigation involving the new proposals. Several large residential projects have been effectively stalled in the permit review process for lack of acceptable policies which balanced concerns over future types and levels of development.

In 1985, when the Rhode Island Coastal Resources Management Council (CRMC) undertook to develop a comprehensive management plan for the Narrow River, a host of management questions existed, among these were: the challenge of designing policies which would accommodate the variability of the natural components and subecosystems within the estuary to promote utilization of its resources consistent with their conservation; restoring concentrated pollution sources within the older communities; determining the ultimate carrying capacity of future development levels within the watershed; and reaching consensus among environmental and development interests of the acceptability and restrictiveness of both the conclusions reached and policies to be proposed by the management plan. A primary complicating factor in this process was to integrate the findings of the research and proposed policies within the existing legal authorities and multiple jurisdictions within the watershed, and to devise a management approach which would insure their implementation (Table 2).

Table 2: Comparison of Watershed and Resource Characteristics and Management Issues.

Watershed/Resource Characteristic	Management Issues
1. Variability of Watershed and Resource Characteristics	1. Recognition w/in state-local policies & functional management tools of variable site conditions, watershed suitability/limitations for development.
2. Limited Tidal Flushing, Restricted Tidal Circulation, Sensitive Kettle Hole Basins.	2. Recognition w/in state-local policies & functional management tools of sensitivity of waterbody to anthropogenic inputs of pollutants, alteration of salinity regimes.
3. Diverse Range of Wildlife Habitat, Fisheries Resources, Shellfish Populations.	3. Protection of habitat from significant alterations, intrusion impacts; recognition of interrelatedness of habitats; suceptibility of shellfish resources to bacterial contamination and resultant restricted utilization
4. Ongoing Conversion of Open Space, Changing Land Uses, Pressure on Development of Marginally Suitable Land.	4. Assessment of cumulative impacts of development; protection of open space and aesthetic resources; specific development guidelines for areas with limitations; long-range assessment of character of watershed; increased demand for infrastructure development.
5. Bacterial Contamination of Waterbody, Potential Increases in nutrient,other Pollutant inputs.	5. Restrictions on recreational uses, commercial/recreational shellfishing; potential public health impacts; ecosystem impacts such as eutrophication.

6. High Incidence of Failed ISDS, Increases in Stormwater Point Discharges, Surface Runoff.	6. Restoration of concentrated pollution sources; environmental impacts of nonpoint sources and discharges of surface borne pollutants; need for ISDS siting standards with specific recognition of watershed soil characteristics.
7. Conflicts Over Preservation and Development.	7. Need for policies which reasonably balance and incorporate long-range planning for development and environmental protection/preservation.

Chapter 2: The Framework of Management

I. Introduction

In a discussion on ecological considerations pertaining to the development of coastal management programs, Cooper makes the following observation, "In as much as the coastal zone consists of a series of closely related ecosystems, each dependent upon the other in various ways, it logically follows that the management system should look at the [area] as a whole, not in terms of limited portions."[50] Philosophically, the concept is applicable to smaller coastal areas such as the watershed of the Narrow River . The discussion in Chapter 1 on the environmental characteristics of the estuary and of the management issues facing it highlights the thrust of Cooper's observation, that changes, alterations or utilization within specific elements of coastal ecosystems may have direct consequences within other facets of the resource, and that the overall viability of the estuary and its capability to support the various resources is dependent upon maintenance of important ecological linkages. Given the assumption that maintenance of these ecological linkages should be a primary criteria for the design of the management framework governing the protection and utilization of the coastal area, this chapter will examine the structure of decision making processes, policies and functional tools in place within the Narrow River watershed and the limitations and opportunities within those for attaining ecologically-based, integrated management and addressing the present management issues.

In the coastal zone of Rhode Island policy development, planning and management responsibilities, and regulatory authorities concerning the resources of the area are divided among local and state levels and governmental authorities. The Narrow River watershed itself lies within the corporate boundaries of three municipalities: North Kingstown, South Kingstown and Narragansett. These towns exercise primary jurisdiction over land use (including policy development, planning and regulation, and acquisition for preservation), the manner in which land development processes take place, and the extension and management of public infrastructure such as sewers, public water lines and road systems. Superimposed upon those municipal authorities are state-level resources planning, management and regulatory programs centered on the development of state guide plans, coastal resources (as defined within the enabling legislation of the Coastal Resources Management Council, see below), freshwater wetlands, individual sewage disposal system design, operation and siting, living resource management, land acquisition, and water quality protection programs. The state is also involved in the construction and maintenance of state highways and participates in the administration of construction grants involving municipal wastewater treatment facilities (WWTF). These state government functions are carried out by various executive and legislative agencies, primarily the Department of Administration, Division of Planning, the Coastal Resources Management Council, and the Departments of Environmental Management (DEM) and Transportation (DOT). The broad authorities under the jurisdiction of the DEM often results in the delegation of specific projects or elements of regulatory reviews to various divisions within the agency,

differentiated through specialization in discrete policy areas formed by uses, e.g. the Division of Water Resources (ISDS, freshwater wetlands, Water Quality Certification), the Division of Fish and Wildlife (wildlife, fisheries management) and the Office of Environmental Coordination (intraagency planning and coordination).

The division of management authorities among separate governmental bodies creates a decision-making framework that can be described as functionally "networked". That is, a number of individual decisions are made based upon policies and regulations developed by each entity which serve as partial decision criteria towards the broader purpose of management of the resource; in any given decision concerning management or use of the estuary, separate decisions are made by local government, and the different agencies of the state concerning the specific elements of the resource subject to their various jurisdictions. Such a framework places great importance on the need for coordination between the management institutions; both through the overall policy objectives concerning use of the estuary, and in the application of various regulations and management tools in implementing those objectives. Given the interdependent structure of the management framework, a primary failure of not attaining a high degree of coordination is fragmentation of the decision-making process. A fragmented management structure increases the likelihood that resource decisions are made in isolation, without adequate consideration of the consequences of such decisions as they relate to other aspects of the decision-making process, or to the conduct of activities utilizing different aspects of the resource[51]. From

a policy perspective, a highly fragmented set of governmental authorities controlling resource use and development often provides little unity in purpose or methods of public intervention, and a discontinuous structure fails to respond to the decision requirements imposed by the interdependent nature of natural ecosystems.

Organizational deficiencies are often at the root of the problem of fragmented decision-making processes. These deficiencies include: insufficient planning and regulatory authority of any one body or agency to address interdependent issues; lack of coordination among public agencies; lack of clearly stated or coordinated goals for resource management; insufficient data bases and lack of information about the interrelationships of resource characteristics and management issues; and the dominance of short-term decision-making over long range planning.[52]

Public intervention in resource management is based upon statutory authorities defined by several means: geographic limitations, specific uses or resources and impacts from activities based upon statutorily defined goals. The sectorial and functional differentiation of governmental bodies resulting from specialization in discrete policy areas often results in a common incongruence between the jurisdictions of these authorities and environmental problem areas or the extent of the geographical area for which policy and regulatory decisions are recognized as relevant decision premises as regards the overall management of the resource.[53] The limitations on jurisdiction leads to the development of functional management tools, such as zoning powers or

other legal devices which are restricted in their ability to integrate interdependent issues under a common policy framework due to the focus on specific activities.

Absent strong coordinating mechanisms, the division of authorities often leads to piece-meal consideration of effects arising from individual activities, and various policy or regulatory alternatives are not evaluated from an overall perspective.

The differentiation between jurisdictions and management authorities creates several different sets of policy objectives and purposes or methods of public intervention in the management of the resource. Because coastal ecosystems are highly interrelated systems, the potentially numerous different policies and management focsi neglect to respond to the decision requirements imposed by the common property nature of the resource, where significant externalities are likely to occur given alterations to specific elements of the system.[54]

In the Rhode Island coastal zone, the separation of authorities over land use and natural resource protection between local and state levels inhibits a clear and coordinated definition of goals for the exercise of the respective authorities. The definition and pursuit of different sets of goals often engenders intense use conflicts over the proper utilization of coastal resources. The lack of a clear nexus between the potential consequences of a series of decisions concerning resource use, and the long term protection of environmental quality may

focus policy discussions on spectacular events to the neglect of the ramifications of gradual alterations.[55] A lack of clearly stated goals for the use of coastal areas may engender an atmosphere of conflict between advocacy groups, management authorities and development proponents over the suitability of specific environmental policies, the priority of those policies and particular development proposals.[56]

Perhaps the most fundamental impediment to integrated and comprehensive management of coastal estuaries is the handicap of lacking detailed and specific scientific information about the functioning of the resource, and its capacity for utilization. The "state of the art" in estuarine management remains far behind the recognized complexity of the ecosystems. The potential danger of a management structure that has little understanding of the functioning of the resource is that other factors, such as economic considerations, become the basis for decisions, to the exclusion of ecological considerations.

Many of the organizational problems discussed above are present in the framework of management governing the Narrow River estuary. The following discussion examines the various authorities and their capabilities and limitations for addressing the management issues facing the watershed.

II. Management Authorities

A. The Municipalities

As discussed in Chapter 1, land use is a primary factor in environmental impacts to estuarine watersheds such as the Narrow River. Various elements of land use, such as the type and intensity of use, construction processes and oversight, and the extension and control of infrastructure such as roads, sewers and stormwater drainage are all subject to the management authorities of local municipalities. Municipalities within the state of Rhode Island derive their authority to carry out certain police powers from the state legislature, through special and specific enabling statutes. It is well established through case law that the municipalities may not exercise any authority other than what has been specifically delegated to them by the General Assembly.[57] As concerns land use and development, municipal authorities are derived from five chapters of Title 45 (Cities and Towns) of the General Laws of Rhode Island: Chapter 22 Local Planning Boards; Chapter 23 Subdivision of Land; Chapter 24 Zoning Ordinances; Chapter 34 Health and Safety Authorities; Chapter 35 Conservation Commissions and Chapter 36 Conservation of Open Space. Taken together, the programs promulgated under these authorities form the major policies for the development of the community.[58]

1. The Comprehensive Plan

Chapter 22, Local Planning Boards, allows the municipality to create a Planning Board which is empowered to "make studies and prepare plans and reports on the needs and resources of the community with reference to its physical, economic and social growth and development as affecting the health, safety, morals and general welfare of the people."[59] By law, municipal planning boards or commissions are required to develop a comprehensive plan for the development of the city or town.[60] Each plan must:

> among other things, show the general arrangement of and goals, objectives and standards land use, transportation routes and facilities, public facilities and services, renewal or rehabilitation programs, housing programs, conservation areas, historic preservation areas, and environmental protection programs, together with a recommended program of actions deemed necessary to implement the features of said plan.[61]

The comprehensive plan serves two primary purposes: it is the basis on which zoning ordinances and subdivision regulations are developed, and it sets broad outlines or contexts for future actions of the planning board.[62] In this manner, the adopted comprehensive plan, or any element of it, serves as a statement of city and town policy, and as a guide for community action in matters relating to community development.[63]

Public policies concerning the use and protection of certain resource types (coastal areas, water quality) are developed primarily on the state level, often following mandated standards or guidelines developed through federal legislation. These policies are derived from

scientific assessments as to the role of the resource in environmental quality, its capability for use, and often require highly technical evaluations to determine and mitigate impacts from proposals for utilization. Recognition of the highly interrelated nature of natural ecosystems has led to greater emphasis being placed on the role of the entirety of estuarine watersheds in protecting resource viability.[64] This interrelationship implies that the policies governing separate elements of the watershed should be as interrelated as the natural elements. The enabling legislation authorizing the development of comprehensive plans requires that they be in "general conformance with the goals, objectives, policies and general arrangements contained in applicable state plan[s]," however, the legislation does not establish any mechanism for determining such conformity or define specifically what constitutes "general conformity".[65] Neither does the statute require explicit recognition or incorporation of state policies concerning the protection of water quality, coastal resources, freshwater wetlands or water quality protection, despite established state programs seeking these objectives. Therefore, there is no statutorily derived mechanism which would act to insure consistent development of resources protection policies within municipal comprehensive plans. This problem is exacerbated by the limitations of municipal level technical and planning capabilities; despite the efforts of several towns to develop technical planning support, town budget constraints frequently limit staffing capability, and planning staffs are not available or are limited to one individual.[66] Consequently, even if the "general conformity" requirement was more explicitly tied to established state policies and programs, the

towns' ability to develop local plans and ordinances mirroring or complementary to state regulatory standards is limited.

One of the primary continuing responsibilities of the planning board or commission is to provide "advisory opinions" and recommendations on all zoning matters referred to it; however, this function is restricted to an advisory nature, and is only invoked when matters are referred to it - an optional process. The enabling legislation for zoning ordinances and subdivision regulations (see below) require that boards of review be established to oversee the development and implementation of those ordinances, but there is no mandatory linkage to the planning boards; therefore, the board which develops the primary policy document of the town often does not play a direct role in linking the development or amendment of zoning ordinances (an expression of that policy) with the policies outlined in the comprehensive plan. Therefore, zoning decisions related to land use types and intensities may not be directly linked to the assessments of the role of the area in the overall development of the community; an assessment that may already be inadequate in its evaluation of the resources' capability to support such uses. The problems caused by the lack of mandatory linkages between the policies developed by the planning boards as contained within the comprehensive plan are compounded by frequently insufficient communication between local officials.[67] Boards may be unaware of other town bodies's regulations, or may adopt contradictory policies.[68] The effectiveness of the ordinance is often diminished by a lack of specific regulatory language providing implementation responsibility in applicable board operating procedures

and related authorities.[69] Again, the ability to address these inconsistencies is often constrained by staffing limitations.

2. Zoning

The power to promulgate zoning ordinances, and the objectives and scope of these ordinances is defined in Chapter 24 of Title 45. The powers of the town council, and the scope of the ordinances are defined in the statute, thus:

> For the purposes of promoting the public health, safety and morals or general welfare, the (city or town) council...shall have the power ...by ordinance to regulate and restrict the height, number of stories and size of buildings and other structures, the percentage of lot that may be occupied, the size of yards, courts and other open spaces, the density of population, the location and use of buildings, structures and land for trade, industry, residence or other purposes, and to prohibit or limit uses of land in areas deemed to be subject to seasonal or periodic flooding.[70]

Additionally, these powers are further defined by the purposes for which they may be promulgated, as set out in 45-24- 2:

> Such regulations shall be ...designed to lessen congestion in the streets, to secure safety from fire, flood, panic and other dangers, to promote the public health and the general welfare, to provide adequate light and air, to prevent the overcrowding of land, to avoid undue concentration of population, to facilitate the adequate provision of transportation, water, sewerage, schools, parks and other public requirements.

Zoning, originally introduced in the late 1920's was originally favored "not as a means to create an overall comprehensive land use development pattern, or as a methodology for making rational use of natural resources, but to protect the `highest and best' use of an area,

such as residential development, from uses deemed less desirable."[71] Therefore, the primary result of zoning communities has traditionally been to segregate those areas where particular uses of various attributes may be sited. This is achieved through the division of lands within a community into districts, in which uniform regulations are applied for each "class or kind of building" throughout the district.[72] The regulations developed for the separate zoning districts are translated into permit reviews through standards pertaining to lot sizes, percentage of lot coverage, and use of structures allowed, among other considerations. These standards primarily focus on promoting consistency of land use patterns throughout the districts, with minimal consideration given to varying environmental conditions. Additionally, the enabling legislation requires that the same standards apply to all districts of a similar designation, so local municipalities are often constrained in their ability to recognize varying environmental conditions, both within the district itself and between districts of a similar use designation in varying parts of the town. The "broad brush" application of zoning standards required for uniform treatment of each class of land use compounds the restrictiveness inherent in the development of district specific (as opposed to area specific) requirements.

There has been great debate in Rhode Island over the utility of zoning, as authorized under the General Laws, as a methodology for adapting land use regulation to varying environmental conditions, or to utilize it to attempt to influence the regulation of many activities ancillary to land use (such as domestic waste disposal) which are

controlled under separate state laws. While the enabling legislation allows "reasonable consideration" to be given to the "character of the district and its peculiar suitability for particular uses" in establishing zoning districts, the authorization is oriented towards "conserving the value of buildings, and encouraging the most appropriate use of land" rather than explicitly encouraging recognition within the ordinance of the diversity and limitations of environmental conditions.[73] In recent years, several of the towns within the Narrow River watershed (most notably North Kingstown) have established special purpose districts and overlay zones which allow more precise definition of development goals, and control of development patterns in such a way as to protect public health and welfare.[74] Other zoning-oriented initiatives such as the use of cluster development and planned unit development overlay zones have allowed the municipalities more control over the design and application of zoning standards in larger development proposals. However, several factors have acted to limit the widespread adoption of these types of devices. Communities with insufficient professional capability, or without staff assistance have been reluctant to implement local controls which expand upon a conservative interpretation of local authority.[75] Largely volunteer boards are strained in meeting basic review workloads and are unlikely to adopt additional requirements. This is especially true in light of the ambiguous authority the enabling legislation grants to local municipalities in addressing environmental considerations. Successful legal challenges of more aggressive local controls have served to exert a "chilling" effect on other local jurisdictions.[76] This reluctance is reinforced by the complexity of

designing regulatory standards to adequately reflect environmental management considerations, and the constraints to carrying out such a program given the limitations discussed above; where a reasonable justification for pursuing a chosen avenue cannot be conclusively established, many municipalities are reluctant to venture into "unexplored territory". Local municipalities often see themselves as organs of the state, whose primary function in environmental matters is to increase the potential efficiency of state initiatives, and therefore look to the state to provide a strict regulatory interpretation to compensate for conservative municipal decisions.[77]

3. Subdivision Regulation

The regulation of separating land into individually owned parcels is controlled by the municipalities through authority granted to them under Chapter 23, Subdivision of Land.[78] Rules and regulations promulgated under this authority

> shall be designed to make adequate provisions for traffic; to lessen traffic accidents; to promote safety from fires, floods and other dangers; to provide adequate light and air; to prevent overcrowding of land; to prevent the development of unsanitary areas for housing purposes; to secure a well articulated street and highway system; to secure adequate drainage and provisions of erosion control to mitigate stormwater runoff; to promote a coordinated development of unbuilt areas; to secure an appropriate allotment of land in new developments for all the requirements of community life; to conserve natural beauty and other natural resources; to conform to any master plan which may have been adopted; to furnish guidance for the wise and efficient expenditure of funds for public works; and to insure the adequate, efficient, and economic provision of transportation of transportation, water supply, sewerage, recreation and other public utilities and requisites[79]

The original concept behind the development of subdivision regulations was to insure that ancillary features to large scale developments, such as roads, drainage and other aspects which would eventually be public responsibilities, were completed by the developer and that the costs of completion was not transferred to the municipality. Therefore, originally less emphasis was placed on the use of the device as a means of guiding land use and suitability of a development to environmental characteristics than is presently sought.[80] Generally, present day subdivision regulations provide standards for the construction of roadways, utilities, curbs, sidewalks, and building layout including drainage and construction specifications such as erosion control.[81] The application of modern subdivision regulations has also expanded to address growth management considerations, including assessment of fiscal impacts on school systems, and public infrastructure and services.[82]

As is the case with the enabling legislation for zoning, the municipalities in Rhode Island have interpreted the broad authorizations in the subdivision statute with varying degrees of aggressiveness as pertains to environmental considerations explicitly, and the application of facets of the subdivision authorities to environmental considerations.

The need for consistent construction specifications throughout the municipality acts to limit the design flexibility of subdivision requirements in accommodating site specific characteristics. For example, road design requirements calling for curbing and dust-free surfaces may

result in road systems which generate substantial stormwater runoff in areas where hydrological modifications and nonpoint pollution concerns might be better served by uncurbed roads and permeable surfaces. Consideration of these environmental concerns are often not explicitly incorporated in the regulations, and the complexity of variance procedures reduces the likelihood of accommodation. As is the case with zoning ordinances, there is often an inadequate resource evaluation "flagging" the need for variations specific to environmental conditions. The enormity of the task of providing such evaluations on a town-wide basis, and integrating them into a workable process far outstrips available municipal technical resources. Despite certain shortcomings, several attempts have been made within the Narrow River watershed to recognize unique environmental concerns within local subdivision regulations: North Kingstown has incorporated "limitation districts" which limit development and the use of septic systems in high watertable districts, coastal flood hazard districts, seasonal watertable limited areas, and restricted soils areas, as well as areas where public utilities are not available.[83] While the North Kingstown ordinance is the most sophisticated within the watershed, the towns of South Kingstown and Narragansett have both adopted septic system setbacks from watercourses and elementary sedimentation and erosion ordinances within their subdivision ordinances.[84]

4. Health and Safety Authorities.

In addition to the other police powers exercised by the municipalities, the General Assembly has granted cities and towns in Rhode Island the authority to

> pledge the credit of the municipality...for the purpose of providing the municipality...real and personal property or other facilities for use in disposal of liquid wastes and solid wastes.

This authority generally allows the communities control over the development and extension of sewerage facilities within the community, subject to the provisions of applicable state and federal law concerning the siting of Wastewater Treatment Facilities (WWTF) and their operation.[85]

5. Conservation Commissions and Conservation of Open Spaces

The final set of authorities that municipalities may exercise to control the development of the community are those exercised by Conservation Commissions, authorized under Chapter 35, and whose programs are augmented by the provisions of Chapter 36.[86] Conservation Commissions are municipal bodies which may develop programs for the

> "[promotion] and [development] of natural resources, to protect the watershed resources and to preserve natural aesthetic areas within [the] municipality."

The Conservation Commission programs are advisory in nature to the decision-making bodies of the town government. Chapter 36 authorizes the

municipalities to purchase, lease and enter into other agreements to protect open or natural areas within the municipality. The role of the Conservation Commission, and reports developed by it, is therefore analagous to the role the Planning Boards play in the review of zoning changes; there is no mandatory review by, or requirement of consistency with studies developed by, the primary policy making body.

B. The State

In Rhode Island, planning and regulatory powers concerning specific resources and activities has been reserved to various agencies. These include planning, management and regulation of coastal resources, freshwater wetlands protection, regulation of individual sewage disposal systems, water quality protection programs and promulgation of statewide guide plans.

1. The Coastal Resources Management Council (CRMC)

The Rhode Island Coastal Resources Management Council was established in 1971, as a direct result of recommendations by the Governor's Technical Committee on the Coastal Zone, which found that as a matter of public policy the State should provide for the proper planning and management of the resources of this area.[87] This new policy direction was an attempt to address the legal limitations faced by local authorities as they attempted to utilize the enabling and authorizing statutes pertaining to zoning and subdivision regulation to address

potential environmental impacts from developments within the coastal zone. The initial report recommended that a Coastal Zone Council, created by the General Assembly, serve as the primary management mechanism to carry out this objective. Such a Council was brought into being with the passage of Chapter 46-23 of the General Laws of Rhode Island, enacted during the 1971 session.[88]

a. Planning and Management Program Development

The enabling legislation charged the Council with primary responsibility for the "continuing planning for and management of the resources of the state's coastal region".[89] In order to carry out its responsibilities the Council was authorized to make studies of the conditions, activities, and problems of the coastal region through a comprehensive technical/scientific process, which included the following basic phases:

1) Identify all the state's coastal resources, water, submerged land, air space, finfish, shellfish, minerals, physiographic features, and so forth;

2) Evaluate these resources in terms of their quantity, quality, capability for use, and other key characteristics;

3) Determine the current and potential uses of each resource;

4) Determine the current and potential problems of each resource;

5) Formulate plans and programs for the management of each resource, identifying permitted uses, locations, protection measures and so forth.[90]

The legislation related the planning and management programs to the guiding principle established for the CRMC of "restoration and

preservation of coastal ecological systems" by requiring that the formulated programs be developed in terms of "the characteristics and needs of each resource, or group of related resources" and in recognition of explicit basic standards and criteria, including:

a) The need and demand for various activities and their impact upon ecological systems;

b) The degree of compatibility of various activities;

c) The capability of coastal resources to support various activities;

d) Water quality standards set by the Department of Health;

e) Consideration of plans, studies, surveys, inventories and so forth prepared by other public and private sources;

f) Consideration of contiguous land uses and transportation facilities;

g) Consistency with the State Guide Plan.

The legislature granted to the CRMC an extremely broad, and potentially powerful mandate. Its basic management criteria incorporated a wide range of resources, characterization of those resources and geographic scope for its planning process. This broad mandate implied that the legislative intent in the creation of the Council, and its subsequent grant of authority, recognized that individual resources could not be effectively managed in isolation, but rather only in the larger context of coastal ecosystems.[91]

(1) Development of the Coastal Resources Management Program, 1971- 1977

The development of the Coastal Resources Management Program (CRMP)

has been an extremely dynamic process. The program's development has occurred in distinct phases, progressively approaching the legislative charge of ecosystem based management built around the natural characteristics of coastal resources, their ability to support various uses, definition of acceptable uses within these limitations, and clarification of necessary protection measures.

At its inception, the CRMC was faced with simultaneously developing policies by which to define its resource management programs, and establishing decision criteria to implement these.[92] To guide its actions, the Council was provided with little legislative guidance concerning priorities of use of coastal resources outside the broad mandate that "preservation and restoration" would be the guiding principle, and that long range planning should be instituted to "produce the maximum benefit to society."[93] The original draft program document, produced in 1976 emphasized an environmental impact assessment approach to individual decisions, rather than specific or defined policies concerning the permissibility of proposed activities which reflected the variability or characteristics of the coastal area. This approach received a great deal of criticism upon promulgation, primarily centered on its lack of area or resource specific policies.[94] The CRMC abandoned this approach and immediately set out to revise the program such that it focused on resources and issues.

The program document adopted in 1977 contained several major changes over the original approach. Perhaps foremost was the definition of

specific development activities under the CRMC's jurisdiction.[95] More clarity was provided the applicants for permits in discovering whether their proposal was subject to the Council's jurisdiction by listing and describing specific coastal areas. In judging most activities, however, the Council still relied upon the original decision criteria contained within its enabling legislation, enhanced by an expanded, second list of decision criteria which required applicants to define and justify impacts to certain ecological processes . The new document did establish several new, precise policies concerning certain prohibited or conditional activities, primarily in areas designated for conservation or low intensity use. However, the "burden of proof" remained placed on the applicant to discover which of the decision criteria was applicable, and to define the conditions and impacts to these criteria within the specific setting of his project.[96] Despite the expansion of the list of prohibited uses, the Council's decision making process remained focused on the procedural requirements of the state Administrative Procedures Act, rather than well defined, extensive policies concerning proper resource use.[97]

While the CRMC had been empowered with a potentially powerful and comprehensive mandate concerning its planning and management responsibilities, the program evolution prior to 1983 produced a structure that failed to fully embody the expectations and requirements of the enabling legislation.[97] A great part of this failure was due to ever increasing regulatory burdens during the process of federal certification of the program , and an absence of clearly defined

legislative goals or priorities. The 1977 program, in most instances set forth only procedural requirements for the consideration of proposed activities. The determination of compatibility with the CRMC's objectives, the "capacity of coastal resources to support such uses" and the "need for" the proposed activities (criteria established under 46-23-6B) rested solely upon the Council's judgment of the case before it. Such an approach limited the predictability of the resource management program, failed to make it specific to the natural characteristics of the coastal areas, and effectively prevented the prior assessment of cumulative impacts of various uses made of the resources, both by the Council in its deliberations and of the Program in terms of "long range planning and management". The program structure did not make any assessment, in specific terms, of the proper level and mix of uses the resource could support, or necessary protection measures to be implemented. It also resulted in a relatively high rate of legal challenges to the Council's decisions on the basis of arbitrariness and excessive discretion, as well as appeals of assents by objectors who contended that the Council was not acting within the responsibilities and charges of its enabling legislation.[98]

(2) The Red Book - 1983 Revisions of the CRMP

During the early 1980's, the CRMC undertook a major reexamination of the way it did business, prompted primarily by a greatly increased regulatory burden and diminished federal funding. By 1982, the total financial resources available to the Council had dropped to 1978 levels,

while development activity (primarily housing construction) increased by 86% between 1980 and 1983.[99] Much of the increased workload was related primarily to small projects by small property owners.

In 1981, the CRMC began development of a new program document in response to these pressures. The new approach (ultimately called the Red Book for the program document's cover color) emphasized standardized decision criteria keyed to specific "water types", upon which various activities' potential impact and permissibility were regulated with varying degrees of restrictiveness.

The Water Type designations, ranging from Conservation to Industrial Ports were developed primarily to reflect the use of the shoreline at the time. The new programmatic structure established standards for various alterations and activities based upon the past experience of the Council's staff in dealing with different types of projects, and in effect, "compressed" the decision-making process of the Council; preliminary decisions on the permissibility of a project were now enfolded in the established standards. The new approach more explicitly outlined a long-range guide for development and conservation along the state's coastline, identifying specific areas devoted to various uses, and establishing the "necessary protection measures" called for in the Council's enabling legislation. The decision criteria embodied in the Water Type designations and activities' standards reflected the CRMC's assessment of the "capacity of coastal resources to support...uses" and to a certain extent the "need for and demand for various activities and

their impact upon ecological systems" thereby bringing the Council's program closer to the objectives of ecosystem based management envisioned by the legislation. However, while the revised program developed a clearer assessment of the compatibility of certain activities according to where they took place, its primary motivation of establishing a workable administrative process for permit reviews focused it primarily on limited elements of natural coastal ecosystems; determination of the appropriateness of certain alterations and standards governing them applied to a thin margin of the total watershed or ecosystem, determined by the limits of the CRMC's regulatory jurisdiction and powers, as discussed below.

b. Regulatory Powers and Implementation of the CRMP

The enabling legislation empowered the CRMC with the potential to formulate detailed and comprehensive plans for the use of coastal resources. In order to implement these programs, the Council has the authority to exercise three fundamental types of powers and duties: 1) Direct regulatory and management control over specified uses and areas; 2) Coordination of federal, state, local and private actions in or affecting the Rhode Island coastal region; 3) Administration of gifts, grants and donations.[100]

The CRMC was given rule making authority over specified areas and resources as a direct management responsibility.[101] It was authorized to formulate policies and plans and to adopt regulations necessary to

implement its various management programs.[102] These policies and regulations, and the manner in which they are exercised, are segregated into those applying to the resources occurring within, above or beneath the tidal waters of the state below the mean high water mark (MHW), and to those above that limit.[103] The authority of the CRMC below MHW is comparatively more defined and stringent than that above. Any development or operation within the actual water areas (below MHW) is required to demonstrate that the proposal would not: 1) conflict with any resource management plan or program; 2) make any area unsuitable for any uses or activities to which it is allocated by a resource management plan or program; or 3) significantly damage the environment of the coastal region.[104] Any activity occurring within the water area is subject to the Council's authority to approve, modify, set conditions for, or reject the proposal through direct regulatory and management control.[105]

While the relevant sections of the enabling legislation employ similar language concerning the CRMC's direct authority over land areas (above MHW), there are several restrictions which limit the exercise of that authority. The Council's direct authority over land areas is directly linked to its resource management programs occurring below the MHW line. Further, that authority applies to <u>specified</u> activities or land uses when these are <u>related</u> to a water area under the CRMC's jurisdiction (emphasis added).[106] This jurisdiction may only be in situations in which there "is a reasonable probability of conflict with a plan or program...or damage to the coastal environment".[107] These specified uses and activities are:

1) Power generating and desalination plants;

2) Chemical or petroleum processing, transfer or storage;

3) Mineral extraction;

4) Shoreline protection facilities and physiographical [sic] features, and all directly related associated contiguous areas which are necessary to preserve the integrity of such facility and/or features;

5) Coastal wetlands and all directly associated contiguous areas which are necessary to preserve the integrity of such wetlands;

6) Sewage treatment and disposal and solid waste disposal facilities;

A strict interpretation of the relevant passages pertaining to the CRMC's regulatory jurisdiction would indicate that the primary focus of the exercise of this authority was to be on those activities occurring below the MHW. The inland geographic boundary of the "coastal zone" for regulatory purposes extends only to the limit of shoreline physiographic features, coastal wetlands, and "directly associated contiguous areas which are necessary to preserve the integrity" of these features.[108] Any exercise of direct authority over upland areas is limited by the tests of applicability mentioned above. It is interesting to note that one of the burdens of proof required for proposals below MHW, that the activity not "make any area unsuitable for any uses...to which it is allocated" is not explicitly recognized above MHW. The applicability provisions and the limitation on the discretion to be exercised by the CRMC imply that it was the intent of the legislature to limit the Council's reliance on direct implementing authority when addressing issues above the MHW mark. Indeed, the question of jurisdiction was the major impediment to the bill's passage in the previous session of the General Assembly.[109] In

addition to the political necessities required for the bill's passage, the narrow grant of direct authority reflects a philosophical orientation towards what constituted coastal resources during the early 1970's; many coastal zone statutes identified the coastal region as a "geographic interface", failing to recognize the close relationship between alterations to upland areas and impacts to adjacent coastal waters.[110] While the CRMC's legislation recognized the import of planning and management within a broad region, it placed only limited control directly in the hands of the Council. The limitations on the direct implementing authority of the Council is also reflected in the defined operating functions within the legislation; 46-23-6D authorizes the CRMC to:

a) Issue, modify or deny permits for any work in, above, or beneath the areas under its jurisdiction, including any form of aquaculture;

b) Issue, modify or deny permits for dredging, filling, or any other physical alteration of coastal wetlands and all directly related contiguous areas which are necessary to preserve the integrity of such wetlands.

The limitations on the Council's regulatory jurisdiction were directly incorporated into the standardized decision criteria of the 1983 program. The defined "coastal features" reflected the enabling legislation's grant of jurisdiction over coastal physiographic features and wetlands. The "contiguous areas necessary to protect the integrity" of those features and areas in which "there exists a probability of conflict with established programs or damage to the coastal environment" were translated into a 200 foot contiguous zone abutting coastal features where the Council exerted presumptive jurisdiction, and in inland areas

the Council established standardized review over activities related to the seven defined inland uses.[111]

The limitations on the geographic extent of the CRMC's regulatory authority creates several jurisdictional zones within coastal areas, based upon the geographic extent of the proposed action and a threshold of project size and nature.

The first zone encompasses all tidal waters and the coastal features defined within the Council's management program, e.g. coastal wetlands, bluffs, banks, rocky shorelines, man-made shorelines and barrier beaches. Within this zone, the Council is the final and ultimate authority concerning policies on priority of use of the resource and permissible conditions for allowable activities.

The second zone, that being the area contiguous to shoreline features extending inland for 200 feet, the Council also controls through its regulatory program based upon a presumptive finding that within this area there exists a "probability of conflict with established programs or damage to the coastal environment" arising from alterations or activities. However, within this zone the Council does not exert complete authority in establishing policies on priority uses. These are generally derived from municipal zoning districts and the uses allowed under those ordinances, with certain limitations enacted by the Council. In the Narrow River watershed, therefore, the priority use of these areas is residential development of varying densities. Within the second

jurisdictional zone the Council's actions act to modify the characteristics of the municipal designated land use to mitigate aspects incompatible with the policy governing the use and protection of the adjacent coastal feature.

The final zone is predominated by municipal policies over priority of use, and is most commonly described as the upland area. The CRMC's jurisdiction is limited within this area, and may be invoked only under specific circumstances, i.e. when some portion of the a development project of six units or more or requiring one acre or more of parking extends onto a shoreline feature or its contiguous area, is within the watershed of a poorly flushed estuary as defined in the CRMP. The Council may also invoke its jurisdiction in this area when a proposal involves one of the defined land uses specified in the legislation, and can be established to have a reasonable probability of damaging the coastal environment. These restrictions act to prevent the exercise of the CRMC's policies for the coastal area over smaller, or incremental projects and changes within the upland area unless the threshold criteria defined above are met.

1. The Structure of the Regulatory Program

The 1983 program revisions resulted in substantial clarification and codification of the CRMC's policies for specific resources and areas under its jurisdiction. The development of the standardized decision criteria did not, however, substantively alter the geographic scope of

the Council's authority as discussed above; the program remained focused on the regulation of the water areas below MHW, coastal wetlands and other physical features (such as barrier beaches, banks, shoreline protection facilities) and those "contiguous areas necessary to protect the integrity" of those features. Additionally, several key elements of the regulatory process, such as ISDS permitting, water quality certification and alterations to freshwater wetlands remained under the aegis of other management entities, primarily DEM. Land use decisions concerning areas upland of coastal features remained with the local municipalities.

The review of development proposals within Rhode Island's coastal areas takes place in a linear fashion, reflecting the division of decision-making authorities over specific aspects of the project between state and local bodies, and among different state agencies. The CRMC's procedures require that all other necessary approvals be set in place before the application may come before it.[112] The Council is therefore placed at end of a series of decisions: consistency with local land use planning is determined through zoning approval or other certification by the municipality; adequacy of sewage disposal systems required is established by the granting of an ISDS permit by the DEM, as is the acceptability of any potential impacts to water quality and freshwater wetlands; consistency of the proposal with applicable elements of the State Guide Plan is determined by the Division of Planning. These prerequisites are reviewed by the Council's staff, and the necessary biological and engineering determinations are made as to how the project

may impact coastal resources measured against the established standards and policies. The total package is then submitted to the Council which evaluates them, and renders a decision on the proposal. The structure of the regulatory program therefore creates a process in which specific elements or components of the final decision are determined by various institutions. The process prevents the consideration of proposals by the CRMC in which any or several of the components are not acceptable to the institution charged with oversight for that element; in effect, the CRMC has established that they do not desire to review any proposal which is unacceptable to other bodies participating in the review, such as a land use in which local approval has been denied.

Within this structure, the CRMC actually conducts three distinct types of review processes: review of the permissibility of those aspects of a project which take place within the Council's "primary" area of jurisdiction, and those within the contiguous areas and upland areas. In those areas of primary jurisdiction (the water areas below MHW, on defined coastal features) the CRMC's policies are well defined, and the permissibility or acceptability of probable environmental impacts have already been determined and set down within the CRMP as a prohibited, conditional or acceptable activity with accompanying standards which must be met. The review consists mainly of whether these policies and standards are met by the proposal. However, within the contiguous areas the process tends to be one of mitigating the impacts of the proposal to the coastal resource, that is, within 200 feet of the coastal feature the CRMC's decisions relate primarily to setback distances, buffer zones,

densities and other secondary considerations rather than the permissibility of the proposal. The contiguous area then is, in a sense, a gray zone where separate policies are simultaneously at work; the Council's action is aimed towards necessary modifications to the decisions of other agencies or bodies (such as a municipality in deciding a particular land use, or the DEM is certifying ISDS placement) to make the proposal consistent with the objectives of the coastal program.

In the upland areas beyond the contiguous areas, the CRMC's regulations are applied to those aspects of the project which involve one of the seven particular land uses specified in the legislation (see above). The "capture" of most activities comes primarily through the CRMC's jurisdiction over sewage treatment and disposal. In promulgating its regulations, the Council adopted the definition of "sewage" found at 46-12-1 GLRI, and expanded it to include freshwater discharges including surface runoff, because of the potential impact to alterations of salinity regimes of tidal waters.[113] This, coupled with the definition of sewage treatment facilities[114] allows the Council to review and modify the design, location and operation of structures and features which are related to modification of surface water runoff patterns and treatment, including roads, culverts, stormwater basins and in some instances building densities and impervious surface cover. Therefore, the CRMC establishes jurisdiction over these structures and activities through a predetermination of the "probability of conflict with [the] plan or program, or damage to the coastal environment.[115] During the 1983 revisions, this determination was utilized to standardize the review

requirement for residential developments of 6 units or more, or facilities requiring 1 acre of more of parking "any portion of which extends onto a shoreline feature or its contiguous area, or is within the watershed of [defined] poorly flushed estuaries."[116]

The movement of permit reviews through a linear sequence creates a situation in which the regulatory burden falls to the CRMC to correct inconsistencies or unacceptable aspects of a proposal that arise out of requirements instated by other review agencies. The flexibility of the CRMC's response to these inconsistencies is constrained in that often particular aspects of a proposal are the result of variances or exceptions to established standards, gained through lengthy review and public hearing processes. To modify them would require alterations to the conditions of permit approvals, and subsequent re-review by the appropriate body on the acceptability of the changes; such a process is inevitably cumbersome, always time-consuming and rarely utilized. Additionally, while the CRMC has the broadest authority to consider the environmental impacts, its reliance on other standards and programs as partial decision criteria limits its ability to establish prerequisites and contexts for the exercise of those programs consistent with an overall evaluation of their potential contribution to the environmental impacts of the project, and to relay this information forward in the regulatory process.

c. Coordination

The CRMC's enabling statute's objectives called for the preservation and management of Rhode Island's coastal resources through "comprehensive and coordinated long-range planning and management" by "providing adequate resource planning for the control and regulation of the use of natural resources."[117] Implicit in these objectives is a broad geographic scope where areas impacting coastal resources would be the focus of management programs, and the coordination of the organizational structure through which they would be carried out. The CRMC was designated as a coordinating body in order to provide a fundamental link between the broad objectives envisioned and the institutional structure into which the Council was placed. No alterations to that structure were proposed (that is existing management authorities retained their existing powers) and the CRMC was introduced with specific authorities over a limited geographic area and a charge to coordinate the actions of other local and state authorities.

Coordinating relationships between the Council as the state's principal coastal management agency and other units and levels of government are set forth under Sections 46-23-6 and 10 of the General Laws.[118]:

1. (The Council shall) carry out these management programs through implementing authority and coordination of state, federal, local and private activities;

2. The Council shall have the following coordinating powers and duties:

a) Function as a binding arbitrator in any matter of dispute involving the resources of the state's coastal region and the interests of two or more municipalities or state agencies;

b) Consulting and coordinating actions with local, state, regional and federal agencies and private interests;

c) Conducting or sponsoring coastal research;

d) Advising the Governor, the General Assembly and the public on coastal matters.

The coordinating functions assigned to the Council were established to insure "full and effective implementation of resource management plans and programs for the entire coastal region."[119] While the legislature emphasized the concept of cooperative management through a lead agency by authorizing and directing other agencies of the state to "cooperate with and furnish such information as the Council may require,"[120] the onus to initiate many of the aspects entailed in such responsibilities rested with the Council, as there were no statutory requirements for modification of existing programs towards consistent compliance with the management programs to be produced. To compensate for this, the Council chose to exercise its coordinating powers primarily through its regulatory program, as discussed above, and by developing its management programs with consideration of water quality standards as established by (at that time) the Department of Health and applicable elements of the state guide plan.[121] While the coordination of the CRMC's programs with other state authorities took place in this manner, the coordination of local exercises of jurisdiction and authority is a slightly different process.

The Final Environmental Impact Statement[122] submitted during the course of federal approval of Rhode Island's coastal management program found that "the majority of actions undertaken by local governments pursuant to presently adopted comprehensive plans and zoning ordinances do not conflict with the policies and regulations" of the Council's program.[123] However, the findings contained a reservation to this statement, in that "certain local actions and land use decisions by their nature, size or consequence are, or may be, of more than local significance for the purposes of long range management of coastal resources."[124] In further identifying what actions these might be, the FEIS sets forth as criteria a reworking of the basic management criteria on which the Council was to formulate its own programs, e.g. such local actions that would be inconsistent with the water quality standards or the state guide plan, involve tidal waters or the six specified lands uses, or conflict with established plans or programs of the CRMC, make an area unsuitable for uses established by such programs or cause significant damage to the environment of the coastal region.[125] The FEIS asserted that such inconsistencies would be rectified through one or more of three avenues: direct Council permitting actions; regulatory, permitting or management actions exercised by other state agencies; or mandatory municipal conformity of comprehensive plans and subsequent zoning and subdivision actions with applicable elements of state plans as required by 45-22 GLRI.

(1). Addressing Policy Inconsistencies through CRMC Permits

Despite the assertions of the FEIS, the efficacy of these avenues is less than absolute. Reliance upon direct Council permitting actions is restricted by the geographic limitations and tests of applicability established under 46-23-6D; the Council can neither extend its jurisdiction, nor modify a municipal action unless it occurs on a coastal feature, or within the area contiguous to that feature necessary to protect the integrity of that feature - a fact that must be established during the regulatory review - or the action can be established to pose a probability of conflict or damage to the environment. Since municipal zoning and planning actions are not presumptively subject to Council review, CRMC jurisdiction (and therefore the opportunity to correct the policy inconsistency) can only be invoked as a result of an action taken pursuant to the municipal program, i.e. a house, subdivision or other development project is proposed. Even at that point, it is exceedingly difficult, absent direct impacts to the coastal resource, to the establish the contribution of the project to cumulative impacts within coastal watersheds that may ultimately be detrimental to the allocated use of the area by the CRMP. Establishing that contribution to cumulative impacts is further hampered by the fact that the primary focus of the Council's planning and management programs were on the coastal physiographic features, wetland and water bodies under the Council's direct regulatory authority, and not on upland areas.

The developers of the coastal program were not unaware of this

potential problem created by the organizational structure into which the Council entered. However, due primarily to political considerations, the Council limited its response to "encouraging and endeavoring to support local efforts to adopt plans and zoning ordinances" which addressed sources of potential conflict with resource management within the broader context of the coastal region.[126] It is probable that much hope was placed on the passage of "An Act Establishing a State-Local Land Management Program" under consideration by the General Assembly in 1977.[127] The Act's purpose was to establish as law a mechanism for revision of land use management which would relate development under local control to the physical capabilities of the land, recognize the broader impact of certain development decisions, relate intensity of development to availability of public services, to require local zoning recognition of natural resources and sensitive areas, and other comprehensive requirements relating land use to development capacity.[128] While supporting the passage of the bill, the Council restricted its own response to the problem of consistency of local land use with broader state objectives to "implementation of its regulatory and permitting powers relative to coastal physiographic features, coastal wetlands and sewage treatment and disposal" through which the Council adopted policies relative to development of, on or contiguous to barrier beaches, sand dunes, coastal cliffs and other coastal features.[129] The bill, sponsored by the Administration failed to pass the legislature. In 1980, the Statewide Planning Program of the Department of Administration released the "Coastal Community Land Use Review" in which the impacts of the lack of consistency between local and state policies were discussed. The study

concluded that the lack of mandated consistency resulted in local land use regulations serving as the "prime determinants of permissibility and priorities of use in the state's coastal zone". The study asserted that the state's coastal management laws and regulatory functions focus more intensely on the permissibility issue rather than on priorities of use, in which the end result of the process was a predominantly site-by-site impact mitigation process, rather than a comprehensive management approach.[130] This situation has arisen primarily due to the implementing authority restrictions (discussed above) contained in the Council's authorizing statute, and the failure to establish a clear and comprehensive context for the separate applications of the municipal and state regulatory programs. The determination of priority of use of the upland areas as a privilege expressly reserved to the municipalities by law establishes the importance of local land use decisions in the broader context of managing estuarine watersheds such as the Narrow River. However, the CRMC's focus on actions subject to its implementing authorities have generally neglected the potential conflicts with its conservation policies resulting from the exercise of that local perogative.

(2) Addressing Policy Inconsistency through other State Regulatory Programs

As introduced above, local municipalities have primary jurisdiction over upland land use in coastal areas. In the Narrow River watershed, these lands are zoned for residential uses of varying densities. The process of developing these lands is subject to review and modification

through several state regulatory programs as part of, and in addition to CRMC's review, including ISDS, freshwater wetlands, and water quality certification programs. The utility of these programs in addressing policy and management inconsistencies concerning the protection of coastal areas must be examined in the context of the purposes of these programs and their inherent limitations.

(a) Individual Sewage Disposal System Program

The design, placement, and operation of ISDS is subject to statewide minimum standards enforced through a regulatory program carried out by the Division of Groundwater and Freshwater Wetlands of the DEM.[131] The regulations promulgated by this Division establish minimum engineering and siting requirements which must be met in order to obtain a permit, including: soil conditions meeting certain percolation rates, sizing of leaching fields according to flow rates, minimum depths to groundwater and impervious layers, and separation distances from drinking wells and surface water bodies. The current standards and approval processes have long been the focus of criticism and controversy, and are generally accepted to be inadequate from an environmental protection standpoint.[132] These criticisms arise primarily from the ISDS program's heavy emphasis on public health (primarily drinking water) and engineering considerations; ISDS adequacy is judged and regulated on its ability to carry wastewater away from the house and drinking water supplies, with other factors such as proximity to non-drinking water bodies, overall densities and cumulative impacts from numerous permitting decisions being

of lesser priority or neglected. Additionally, many of the engineering standards are considered ill-suited to the variability of soil conditions, and minimum depths to groundwater.[133]

The lack of a planning context for the ISDS permitting (due to the regulatory approach of the program) renders it ineffectual for addressing potential policy inconsistencies between local and state programs. In the Narrow River watershed for example, environmental conditions ill-suited for ISDS operation have long been recognized as contributing to the degradation of the water quality of the estuary, where protection of water quality is a coastal program policy.[134] However, because present siting standards do not adequately guard against permitting ISDS under these conditions, the systems are regularly granted approvals. The regulatory approach of the program prevents it from denying permits based on observed negative impacts within the surrounding area (such as a high incidence of system failures) if the proposal meets the standards established. This problem is exacerbated by the Council's reliance upon DEM/ISDS permits as the determination of system suitability, modified only by other regulatory requirements such as structural setbacks and buffer zones applied to other aspects of the project. Bureaucratic relationships have additionally aggravated the finding of an acceptable solution to the well recognized problem; until recently CRMC staff was provided by the various Divisions within DEM, and the Council has refrained from promulgating superseding or modifying standards applying to the ISDS program.

(b) Water Quality Certification

Water Quality Certifications, authorized under Section 401 of the Clean Water Act[135] are issued by the Division of Water Resources within DEM, and are designed to ensure that all state permits sufficiently provide for compliance with applicable water use designations, and are prerequisites to CRMC assent for most major activities. The process is built around water quality classifications assigned to all the state's waters. These classifications establish permissible uses of the water, and the constituent chemical and biological standards necessary to maintain the quality supporting the designated uses. The efficacy of the water quality certification process as a tool to correct policy inconsistencies suffers from many of the limitations exhibited within the ISDS program.

Foremost is the threshold level at which projects may be denied on the basis of water quality. In order for a denial to be triggered, the proposed discharge associated with the activity must violate the standards established. This threshold level grows out of the program's origins relating to monitoring permits levels for point source discharges, and is extremely limited in its applications to nonpoint source pollution control in the Narrow River and other similar estuarine watersheds. While its is unlikely that individual projects with minimally acceptable construction standards would violate the established criteria, the program's approach neglects, or fails to adequately address, long-term changes in pollutant loadings, hydrological changes and other

more subtle environmental alterations. The program's approach focuses the review on the specific impacts of the proposed discharges of the project in isolation, neglecting its contribution to cumulative impacts in consideration of surrounding characteristics.

Secondly, the review process is not conducted in reference to specific performance or construction standards which might provide for the evaluation of the adequacy of stormwater, erosion and sedimentation control measures and facility design.[136] Therefore, the program provides no technical linkages to the water quality classification of the impacted waterbody when residential development is under review, which limits its ability to be employed to assess the consistency of proposed characteristics with established resources protection policies.

(c) Freshwater Wetlands Regulation

The Wetlands Section of DEM regulates the alteration of freshwater wetlands and a buffer area of 50 feet around statutorily defined wetlands.[137] The Wetlands Section involves the CRMC in permit review where the area of concern is within the coastal contiguous zone. The jurisdiction of the Section is limited by the size and type of the resource: the law allows review of proposals potentially impacting bogs of any size, ponds 1/4 acre or more in size, and wooded swamps exceeding three acres.[137] The differential size threshold limits often results in limiting consideration of impacts to interconnected resource systems by segmenting the components according to the classification system,

restricting the application of protective measures to the smallest juridical zone.[138] The regulatory approach of the program also fails to provide a context for overall evaluation of cumulative impacts when large tracts of land are subdivided and developed separately and sequentially under local land use procedures. Like the ISDS and water quality programs, no legal mechanism exists within the Freshwater Wetlands Act or program to establish specific standards for design and construction of alterations related to a broader resource-specific evaluation or judgement of vulnerability; each permit application is reviewed on an individual basis.

III. Summary and Conclusions

There are many inherent limitations in the design and process of the framework of management in the Narrow River watershed which hinder approaching management efforts from an ecosystem-based perspective.

Primary among these is the division of management authorities among different local and state entities which focus on discrete elements of the natural ecosystem, and are poorly coordinated. The traditional approaches and methodologies employed by the various planning programs and regulatory bodies often are not clearly linked to specific environmental conditions, fail to embody a unified approach on goals in their governance of alterations and development due to differing programmatic purposes and jurisdictions, and often focus on case-by-case regulatory considerations to the exclusion of cumulative impacts.

Up to 1985, no management authority had acted to provide an overall context for development policies based on a comprehensive and consistent evaluation of resource limitations. The CRMC, potentially the one body capable of filling this role, had neglected focusing its broad authority to develop comprehensive management plans for coastal areas and coordinating local and state actions, emphasizing instead development of its regulatory program for areas under the jurisdiction of its implementing authorities.[139] This policy placed increased importance on the role of local land use decisions in establishing the priority use of coastal upland areas, and as an integral decision point in development and alterations affecting the viability of the estuary. Despite the potential importance of this positioning of local decisions within the regulatory framework, the legal authorities and tools available to the municipalities are inadequate, ambiguous and highly variable as regards addressing the environmental impacts of actions taken pursuant to those authorities. While the towns have made several attempts to extend or interpret their existing authorities to address environmental considerations, the lack of technical resources, guidance from the state and questionable authority within the enabling legislation had inhibited any aggressive, coordinated or consistent development of municipal programs specifically centered on the Narrow River. The potential inconsistencies between compliance with state resource protection objectives and the character of development activities resulting from this situation are difficult to rectify through the linear regulatory

process, which functions primarily to mitigate impacts rather than resolve questions over priority of use within the contiguous and upland jurisdictional areas.

TABLE 3
Comparison of Management Issues in NR Watershed and Framework of Management

Management Issue	Management Framework
1. Recognition w/in state-local policies & functional management tools of variable site conditions, suitability and limitations of resource; relationship of state-local policies to overall resource protection.	1. Local: Land Use policies not determined on basis of environmental evaluations; no explicit consistency or incorporation of state resource protection policies; zoning and subdivision ordinances do not make explicit recognition of environmental impact considerations, constrained in ability to recognize varying environmental conditions because of uniform treatment requirements, policy reluctance to attempt aggressive environmental controls which expand upon conservative assessment of local authority; local technical capabilities limited in developing independent environmental assessments. State: Coastal resource policies do not establish priority uses for upland areas, site review/impact evaluation fragmented through linear regulatory process; lack of coordination results in failure of state to provide context for local policies in upland areas in relationship to estuary protection policies; threshold limits for regulatory review discount incremental alterations, long-term modifications; ISDS standards not explicitly tied to certain variations in on-site environmental conditions.
2. Recognition of sensitivity of waterbody to stormwater, anthropogenic pollutant inputs, alteration of salinity regimes.	2. Local: Land use densities established through zoning not tied to potential creation of stormwater; no established stormwater management requirements recognizing potential pollutant inputs or treatment requirements; infrastructure development driven by development. State: CRMC policies on point discharges conditional, allowed when no alternative, not tied to creation/prevention of stormwater; no long term evaluation of watershed-wide

	alterations to runoff/stormwater characteristics because of lack of extension of planning and coordination to upland areas; water quality certification process does not address long-term changes in pollutant loading, hydrological modifications, not conducted in reference to specific standards tied to water quality classifications.
3. Protection of habitats from alterations, intrusion impacts; recognition of interrelatedness of habitats; suceptibility of shellfish resources to bacterial contamination and resultant restrictions on utilization.	3. Local: Zoning and subdivision ordinances do not account for habitat protection, setback and lot configurations not dependent on state wetlands/coastal resource protection policies; no long term acquisition plans for protection of habitat areas; open space requirements predicated primarily on recreational considerations; lot sizes and densities not integrated with functional ISDS requirements; environmental considerations not incorporated as decision criteria for extension/establishment of storm drains, roads and other infrastructure. State: Coastal and freshwater protection policies applied subsequent to subdivision review, and on case-by-case basis; no prior identification of critical habitat areas incorporated into local development policies/ordinances; structure of freshwater wetlands program establishes differential threshold limits restricting application of protective measures to smallest juridical zone, no specific standards for review of alterations related to broader evaluation of resource vulnerability.
4. Assessment of carrying capacity of watershed to support development; protection of open space/aesthetic resources; relationship of development densities, siting in areas of limitations &	Local: Zoning patterns not related to assessment of carrying capacity; comprehensive plans not based on scientific assessment of resource; no guidelines within zoning or subdivision ordinance for protection of aesthetic resources; no relationship between municipal land use policies and state coastal resource protection policies.

resource protection.	State: No extension of coastal resource protection policies to entire watershed, no assessments of long-term resource protection policies; no determination of necessary land use policies related to water quality protection objectives; no implementation of scenic protection policies through regulatory program.
5. Restrictions on recreational uses, shellfishing; potential public health impacts, ecosystem impacts such as eutrophication.	Local: No impact assessment of infrastructure development (e.g. stormdrains, roads) on long term effects to water quality, ecosystem viability. State: Water quality certification process not tied to specific long term evaluations of changes in pollutant loadings; CRMC policies on stormwater dishcharges conditional - evaluation criteria not linked to long term assessment of impacts; ISDS permitting lacks cumulative impact assessment component, not tied to observable problems in surrounding areas, general failure to evaluate long term environmental changes.
6. Restoration of concentrated pollution sources; environmental impacts of nonpoint sources and discharges; need for ISDS siting standards with specific recognition of watershed soil characteristics.	Local: No long term, comprehensive infrastructure extension policies incorporating as objectives restoration of degraded or problem areas; land use policies do not incorporate evaluation of long term nonpoint loadings resulting from densities, development characteristics; municipal stormwater policies linked primarily to flooding, not to environmental considerations; lot sizes, configurations, densities not based upon functional requirements of ISDS. State: No management planning context to provide guidance for municipal infrastructure extensions; no state intiatives concerning restoration of degraded areas; no long term evaluation of changes in pollutant loadings to estuary; see above comments pertaining to ISDS regulation.
7. Need for policies which reasonably balance and establish long-range planning for development and environmental	Local: Comprehensive plans generally not linked to long-term environmental considerations; zoning and subdivision ordinances not designed to promote recognition of variability of

protection/preservation.	environmental characteristics. State: Failure of CRMC to extend planning and coordination activities to entire watershed; policies based on site-by-site mitigation of project impacts, generally no linked to long-term, watershed evaluation of priority of uses; generality of restrictive policies foster conflict between development and preservation interests.

Chapter 3: The Special Area Management Plan

I. Introduction

While the evolutionary development of the CRMP established more defined and explicit policies concerning the alteration and protection of coastal resources as defined within the CRMC's enabling legislation, the standardized decision criteria approach was recognized by the CRMC, its staff and the public as insufficient to address many of the problems of coastal development and management which the state faced [140]. The regulatory approach of the program, and the limitations of many of the functional management tools and the overall governance structure in coastal areas failed to provide mechanisms for addressing the impacts and ramifications of cumulative alterations to coastal ecosystems, the need for greater coordination and integration between policies and management authorities in order to manage ecosystems as a whole, and the problems of achieving long-term protection strategies and restoration of degraded areas neglected by the case-by-case approach [141].

In an attempt to address these problems, the CRMC (through the Coastal Resources Center of URI) adopted and modified the concept of Special Area Management Plans (SAM Plans) incorporated into the 1980 amendments to the Coastal Zone Management Act [142]. As set out by the Office of Coastal Zone Management (now the Office of Coastal Resource

Management) and the legislation, the concept entailed an intraagency collaborative management planning technique to resolve coastal policy conflicts. The "special areas" were envisioned as those where complex resource protection and development issues coexisted within limited geographic areas which had not been resolved by traditional planning and regulatory methods [143]. While the primary thrust of the federal initiative was aimed at simplifying regulatory processes between federal and state agencies, the CRMC invoked its authority to plan for the entire coastal region and coordinate other management authorities and expanded upon the concept as a means of establishing more detailed planning linkages in interrelated coastal areas where specific elements resided with separate municipal and state agency jurisdictions by focusing on a specific region with distinctive problems, decision criteria and pressures. The approach entailed adapting traditional land use planning methods to determine current and potential problems within the special areas, developing management strategies based upon the environmental characteristics and limitations of the entire area, and devising an approach to the resolution of management issues emphasizing the necessary complementary roles of the municipalities and state in implementation. Central to the approach was utilizing scientific information to define the geographic scope of the management area based on ecosystem functions or geographic interrelatedness rather than statutory limitations, and to evaluate alternative policies for action. The expanded scope within the special areas necessarily required greater emphasis on coordinating existing management authorities, and developing specific implementation elements of the program within their statutory responsibilities and

limitations. In doing so, a primary objective of the SAM plans was to develop management initiatives complementary to the Council's existing program, focusing on those issues not adequately addressed by the regulatory program, as well as adding increased specificity to activities potentially subject to CRMC jurisdiction. Robadue and Hennesy's discussion on adaptive implementation and coastal ecosystem management in Rhode Island describes the process as " a deliberate effort to make substantial progress in building consensus on goals, reducing uncertainties about the causal relationships between human activities and environmental conditions, and attempting to ensure that enough of the relevant different public and private actors adjusted their decision making behavior to carry out the actions needed to achieve goals for the special area [144]."

The first two SAM plans undertaken by the CRMC were in very different types of coastal areas of the state: the largely undeveloped southern coastal ponds region and Providence harbor. Despite the widely different issues facing either area, both plans followed a similar process in presenting information based on scientific and planning research, devoted considerable effort to addressing the role of other agencies and levels of government, and focusing the development of goals and policies on the local level in order to achieve political feasibility with those who would subsequently have to implement and abide by the elements of the SAM Plan [145]. This approach allowed for the formulation of a plan by a broad based committee which strengthened the linkages between municipal and state coastal policies within their separate

jurisdictions, increased the specificity and definition of the CRMC's role in policies subject to direct implementation, and provided a long-range context for other state agencies and the use of agency specific management tools. When the special area management planning process was proposed in 1985 to address concerns about management issues in the Narrow River watershed, this approach was accepted as the boilerplate for the development and direction of the project.

II. The Goal: Integrated Management

From the broadest perspective, the goal the CRMC attempted to achieve through the SAM Plan for the Narrow River was to bring about the integration of the management programs and policies carried out by the different authorities concerning a variety of uses and issues within the watershed, consistent with the resource's capacity for use and necessary protection measures.

Underdahl has proposed a model by which the process of policy and management integration may be examined [146]. The model establishes three requirements by which the extent to which policy (or set of policies) is integrated may be measured: comprehensiveness, aggregation and consistency. These requirements refer to three consecutive stages of the policy-making process: comprehensiveness to the input stage; aggregation to the processing of inputs; and consistency to outputs. Underdahl's model can be adopted for the purposes of evaluating the CRMC's SAM Plan project for the Narrow River, the process' ability to address the

management issues identified in Chapter 1, the problems inherent in the management structure discussed in Chapter 2 and its success in achieving the stated goals.

A. Elements of the Model

The comprehensiveness requirement addresses the relationship between decision premises and decision requirements, and is comprised of four elements: time, space, actors and issues [147]. The question of comprehensiveness begs a definition of scope, which can ideally be defined as that in which all significant (interpreted as sufficiently important to potentially affect policy decisions) consequences and implications of policy decisions are recognized as premises in the making of those decisions [148]. Underdahl defines the time element of the comprehensiveness requirement quite simply; " integrating policy over time generally means adopting a long-range view - evaluating policy alternatives not only on their short term merits, but on the basis of consequences accruing to a more distant future [149]." The space dimension refers to the extension of the geographical area for which consequences of policy decisions are recognized as relevant decision premises [150]. The actor element of the model defines the group from whose perspective policy options are being evaluated [151]. There is obviously a close relationship between the defined reference groups within this element, and the geographical scope defined in the space element. Finally, Underdahl states that "along the issue dimension, integration scope can be measured in terms of the proportion of interdependent issues or

issue-aspects that is subsumed under a common policy framework [152]."

The second stage of the policy-making process, aggregation to the processing of inputs, extends the concept of integrating policy beyond simply recognizing a broader scope of policy consequences. To meet Underdahl's requirements, the evaluation of policy alternatives must extend beyond the perspective of each actor, and be based upon an "overall" perspective [153]. The definition of what might constitute an overall perspective is the most ambiguous element of the model; however, Underdahl does recognize that reaching that perspective (and by extension the entire policy integration process) is not purely a technical exercise, but involves the weighing of interests and setting of priorities, presumably among the relevant actors defined within the scope element [154].

Consistency to policy outputs is the final element in the integration model. This element refers to the actual implementation of the policy, and applies to two separate dimensions: vertical and horizontal. Underdahl defines the vertical element as referring to "accord between policy levels [155]." Under this definition, specific implementary measures would conform to more general guidelines and to policy goals between various levels, or among different actors. The horizontal aspect dictates that for any given issue, set of related issues and policy level only one policy is being pursued by all involved agencies [156].

In summary, a perfectly integrated policy is defined as one where all significant consequences of policy decisions are recognized as decision premises, where policy options are evaluated on the basis of their effect on some aggregate assessment, and where the different policy elements are consistent with each other [157]. Underdahl presents it thusly, "A policy is integrated to the extent that it recognizes its consequences as decision premises, aggregates them into an overall evaluation, and penetrates all policy levels and all government agencies involved in its execution [158]."

The model discussed above is useful in examining the SAM Plan effort conducted in an attempt to address the issues of cumulative impacts, coordination of management authorities, restoration of degraded areas and developing long-range estuarine protection strategies. The impetus for attempting to integrate the policies and programs of the various governmental bodies follows from the observations on the interdependent nature of the natural elements and uses of the watershed, as well the networked nature of the framework of management; that is, policy integration can be seen as an attempt to ensure that links among issue-aspects or issue-areas are not neglected in the making or implementation of policy and management decisions [159]. The Narrow River watershed, the activities conducted within it, the existing pollution problems and the actions of the local and state agencies governing resource use and development constitute a distinct interactive system - internally interconnected, externally relatively independent.

III. Addressing the Elements of Policy Integration through Special Area Management Planning

A. The Question of Space: The Watershed Approach

The occurrence of seperate policy development and management authorities between the state and local levels concerning land use and resource protection within the estuary itself was one of the fundamental reasons underlying the management issues faced by the Narrow River project. Specific policy issues emanating from this separation included the lack of environmental considerations in guiding land use policies, no explicit recognition of state resource protection goals within the legal mechanisms utilized by the municipalities, and the traditional failure of the CRMC to provide a context for local policy development and implementation in relation to estuarine protection goals or establish priority uses for upland areas. Overall, there existed in 1985 no clear set of integrated policies which applied to activities with the geographical area affecting the estuary.

In order to establish clear linkages between the geographic areas under separate state and local jurisdictions in relation to activities potentially creating impacts to the estuary, the SAMP project adopted the approach of defining the management area on the basis of resource characteristics rather than statutory limitations or jurisdiction. Essentially, this entailed establishing the watershed of the estuary as the basic project area. In doing so, the project shifted the arena for

discussing the management issues from one defined by what areas or activities were presently addressed by any of the various authorities, to one where basic resource characteristics and interrelatedness of activities was the focus.

Within the defined context of the watershed, the project undertook a series of investigations aimed at defining the resource characteristics of various natural elements within the estuarine system, including: reviews of past studies on geological characteristics of the land areas, past scientific studies on the oceanographic characteristics of the estuary, wildlife inventories; defining and mapping soil characteristics; vegetation patterns, land use, zoning distributions, infrastructure present; reviewing water quality surveys and past studies on pollution problems; as well as compiling general scientific literature on the impacts of land use on water quality, septic system operation, habitat protection, stormwater management, and erosion and sedimentation control practices. The information from the studies specific to the Narrow River were combined and analyzed in light of the more generic literature in an attempt to define the interrelationships between observed activities within the watershed and recorded impacts and pollution problems. The process was aimed at establishing a relatively scientific assessment of the scope of the geographic area influencing conditions within the estuary, clarifying and reducing the uncertainties about causal relationships between ongoing activities and observed impacts, and creating an understanding among the participants in the project of the distinctiveness of the region, highlighting unique decision criteria

predicated by the resource's characteristics and the specific pressures faced.

By defining the watershed as the project area, and shifting the initial discussions from activities or policies solely within the purview of any one of the management authorities, the project was able to frame the issues of concern, such as the interrelationship between land use and long-term protection of the estuary, within a more comprehensive scope. This tack not only established the geographic area (Underdahl's space element) necessary for integrating the set of policies to eventually to influence the plan's success, but laid the groundwork for coordinating the management authorities, and developing management initiatives complementary to the objectives of the coastal program by creating a context for the project in which all necessary "players" had a stake.

B. Bringing the Players to the Table: The Critical Element in Implementation

The designation of the watershed as the management area for the project necessarily expanded the definition of the group from whose perspective policy options would be evaluated and initiatives eventually implemented. An advisory committee established to guide the project included representatives from CRMC, DEM, DOT, the Statewide Planning Program, the RI Historical Preservation Commission, each of the municipalities and local environmental, citizen's and development interests. The advisory committee was heavily weighted towards municipal

representation in anticipation that the majority of management issues would involve activities primarily under their authority, with each municipality having five representatives from a total of 30 on the committee (Table 4). The committee met monthly throughout the year long duration of the project with a subcommittee of the CRMC and consultants hired by the CRMC to provide technical assistance to the project. The Advisory Committee was charged primarily with reviewing work products of the consultants for completeness, and providing feedback on the acceptability and direction of proposed initiatives.

While the SAM plan was conducted under the authority of the CRMC to plan for resource management within the coastal region and to coordinate the actions of local governments and private interests, heavy emphasis was placed on insuring adequate representation from potentially affected parties. This was extremely necessary for two reasons: the SAMP process was attempting to coordinate several sets of policies and to reach agreement on goals, policies and actions necessary to integrate them; there was little intention of significantly altering the networked management framework, meaning that future implementation of any agreed upon modifications would be dependent on the adjustment of decision-making behavior of the relevant public and private actors. These factors highlighted the importance of consensus to the project. The primary actions of agreeing upon goals and policies was carried out by the advisory committee, not the CRMC, although CRMP policies provided the baseline for discussions. The broad representation of most of the actors who would be affected by the plan allowed local and state officials,

TABLE 4.: ADVISORY COMMITTEE MAKEUP

PARTICIPATING COMMITTEE MEMBERS

Narrow River Advisory Committee

Sherrie Blott, Narragansett
Peg Brady, Save the Bay
Patrick Brady, Narragansett
Robert Brown, Dept. of Transportation
Clarkson Collins, Narragansett Environmental Coordinator
Stephen Crolius, Narragansett
Virginia Fitch, Historical Preservation Commission
Joseph Frisella, South Kingstown
Gary Galkin, Save the Bay
Paul Hargraves, South Kingstown
Hazel Hollman, Narragansett
Armand Houston, Building Contractor
Lorraine Joubert, Dept. of Environmental Management
Marty LaFarge, North Kingstown
Robert Leeson, Narragansett
John Maciel, Jr., South Kingstown
Elizabeth MacLaughlin, North Kingstown
Joseph Mannarino, North Kingstown Town Planner
Juan Martinez, Soil Conservation Service
Elaine McGeough, Real Estate Agent
John McAleer, North Kingstown
Scott Millar, Division of Planning
Anna Prager, South Kingstown Town Planner
John Scott, Marine Biologist
Margaret Stone, Narragansett
Alfred Testa, Jr., Narragansett
William Waring, III, North Kingstown
Edward Williams, North Kingstown

CRMC Small Estuaries Subcommittee

Charles "Ted" Wright, Chairman
Donald C. Brown
Kathyrn G. Owen
George L. Sisson, Jr.
Joseph F. Turco
William Miner, Chairman, CRMC

Grover J. Fugate, Executive Director, CRMC

(Source: Howard-Strobel, et.al. 1986)

citizens and developers to voice their opinions on the policies which would guide development in the area, and promoted a program which possessed a high degree of public salience due to the openness of the project [169].

The process of the SAM plan approach had the additional benefit of providing a forum for creating awareness about the environmental issues addressed. The specific resource area, the watershed, created an entity or focus that both the local governments and citizenry could identify with. It capitalized on long-standing concerns for the area, and clarified a distinct identity for the discussions of the planning process. The watershed specific focus allowed a manageable scope for the development of information needed to identify and make credible judgements on future actions, and to develop consensus on the relative restrictiveness and appropriateness of policy options eventually proposed by the plan.

C. Addressing Interdependent Issues and Long Term Considerations

As discussed in Chapter 2, the fragmented management framework in place within the Narrow River watershed had resulted in the development of policies and management tools which focused primarily on specific, single uses under the separate authorities. The development of these policies and tools took place exclusive of considerations relating to the potential consequences of these policies and their implementation as regarded other elements of the estuarine system, long term impacts and

alterations, and consistency with the objectives of the coastal program. As with the approach of centering the research carried out by the project on a watershed-wide basis, the project endeavored to establish connections between existing management policies and tools by developing a greater understanding of the interrelatedness of the uses within the watershed and the characteristics of the resource elements beyond those necessarily made within the single use regulatory and planning regimes. Therefore, the environmental characterizations made by the project were also evaluated from the perspective of how the existing programs influenced the overall viability of the estuary through specific consequences of their implementation. These investigations and evaluations were utilized to discuss policy alternatives, assess the costs and consequences of relatively clear tradeoffs, and make recommendations for alterations in existing policies and implementation mechanisms within the limitations of the separate statutory authorities. By increasing the scope of interrelated or interdependent issues, compensatory arrangements could be designed which acted to subsume a greater proportion of the issues related to protecting the estuary under a common policy framework, to be implemented by mechanisms clearly within the authorities and processes existing.

1. Land Use

The majority of management issues outlined in Chapters 1 & 2 are related to, or a direct consequence of decisions pertaining to land use within the estuary. These can be described as those that are a result of

organizational problems (e.g. lack of environmental evaluations as a basis for land use policies, poor coordination between CRMC policies and land use impacts), those which are a function of established policies (e.g. zoning densities, priority uses of upland areas, CRMC threshold review criteria, infrastructure development) and those affected primarily by the implementation of policies through the functional management tools (ISDS siting criteria, construction setbacks, buffers). The first step in assessing the potential consequences of the implementation of the single use programs was to identify the "gaps" that were not sufficiently addressed in light of the resource characterizations undertaken, described in the above section; that is, to assess the ramifications of implementation of the policies outside of the criteria prescribed by each program. By assessing the last two categories of management issue-types described above, the SAM plan was able to circumvent the primary root of the problems, the organizational considerations. The approach entailed not only examining the interrelatedness of the spectrum of policies and management tools, but assessing their implementation from a long-term perspective; what were the consequences of policy implementation for long-term changes or impacts within the watershed? A series of relatively simple projections allowed the project to extrapolate the future "appearance" of the watershed given existing policies, and to attempt to assess the potential changes to the resource's character and identify the appropriate focus for needed initiatives.

(a). The Build-out Scenario: Linking Municipal Land Use Policies to Estuarine Water Quality Protection.

The discussions in Chapters 1 and 2 identify both the importance of land use as regards its influence on the estuary and the problems created by the management framework in linking local land use decisions with the resource protection policies established by the CRMC. A major initiative of the SAM Plan project was to explore the potential consequences of existing land use policies for the estuary, and to develop mechanisms to clearly coordinate them with the goals of restoring and protecting the environmental health of the Narrow River. This included examining long range trends in land use, potential cumulative impacts of development within the watershed under present policies, and secondary but closely related issues such as on-site implementation of state and local regulatory programs and infrastructure development.

To examine the long-range consequences of existing land use policies, the project conducted a simple exercise in projecting the ultimate "buildout" of the watershed by calculating the potential increase in housing units given the zoning designations in place, previously platted subdivisions of land, restrictions on alterations under state wetlands protection laws, and the occurrence of existing infrastructure. A detailed examination of municipal zoning and tax maps was undertaken to quantify the number of buildable lots, those which currently supported development, and those which were amenable to further subdivision and development. The total land area amenable to further

development (from which calculations of the amount of wetland area had been excluded) was then divided by the allowable densities under current municipal zoning designations to project the potential number of houses. These calculations provided a picture of land use patterns within the watershed at "saturation", or worst-case scenario. The calculations showed that under present policies (1985) the number of housing units within the watershed could potentially triple (Table 5). The projections also provided insight into the general character of land use patterns under the buildout scenario, that is, the relative location and relationship of high and low density areas to each other and the estuary. For the most part, the projections established that the general patterns of existing land use would be reinforced by the zoning designations, although at greater densities; however, the exercise also identified several areas which, while undeveloped at that time, would potentially become areas of high density.

(b) Identifying Interdependent Issues: Assessing Cumulative Impacts

The projections of watershed buildout levels provided the project with a long-term assessment of development levels which could be utilized to examine potential cumulative impacts of related alterations, including: alterations to surface runoff characteristics; ISDS densities: scenic impacts associated with construction clearing activities; erosion and sedimentation impacts; relative intensities of development in relation to critical habitat areas; and identifying areas within the watershed where preventative or remedial measures needed to be

Table 5. Existing and Potential Development

	Existing Houses*	At Saturation**	Increase Factor
North Kingstown	545	858	1.6
Narragansett	1495	2547	1.7
South Kingstown	438	2,050	4.7

*Data calculated from 1985 aerial photos
**Estimates exclude wetlands

(Source: Howard-Strobel et. al. 1986)

implemented based on potential development densities and the current management problems.

1. Surface Runoff

As discussed in Chapter 1, surface water runoff within the Narrow River watershed is the primary source of freshwater in-flow to the system. Additionally, the volume and character of such runoff is heavily influenced by land use. Stormwater from developed areas may potentially carry pollutants such as hydrocarbons, fertilizers, pesticides, nutrients and bacterial contamination. Estuarine salinity regimes, subtidal habitats and wetland areas are all extremely sensitive to alterations of the existing hydrological regimes. Therefore, there is a clear relationship between decisions governing alterations in land use which may modify the naturally occurring surface runoff patterns and the water quality and other natural resource characteristics of the estuary. However, these consequences of land use decisions are not adequately recognized within the decision criteria governing policies and management action concerning land use on both the state and local levels, as outlined in Chapter 2. Because stormwater management is often thought of as an "after the fact" activity, no assessments or mechanisms existed to address the long-term, cumulative impacts of a series of land use decisions as regards the potential creation of additional stormwater or its impacts. Nor were these potential impacts necessarily adequately compensated for through the CRMC level review or the water quality certification process. The CRMC's lack of policies or regulation

pertaining to development densities in the upland areas of the watershed failed to control the creation of stormwater, and while regulations did exist to potentially limit or prohibit its direct discharge to the estuary, these were conditioned on a finding of no reasonable alternative being available. Since the CRMC did not enter the regulatory review sequence until after substantially completed project designs were in place, the opportunity to examine alternatives was often already foreclosed. Stormwater discharges are specifically exempt from the water quality certification process, and as discussed in Chapter 2 the program contains no planning element to address cumulative impacts.

The project undertook an assessment of potential cumulative impacts associated with stormwater runoff by superimposing the development level projections onto environmental characteristics specific to different areas within the watershed. This approach identified those areas where the potential densities and development activities raised different levels of concern given variable site-specific characteristics including: runoff coefficients of soil types; areas of high slope; lot coverage and impervious surface limitations allowed by the zoning designation; proximity to tributary streams and the estuary proper. From these assessment were derived qualitative judgements about potential stormwater creation and impact, i.e. areas with high runoff coefficients, steep slopes and high development densities were considered more apt to generate stormwater impacts than those farther from the estuary. Very general discussions on stormwater creation were taken from literature values to estimate the relative contributions related to varying

densities of development. While the exercise did not establish any quantified assessment of overall changes to surface runoff patterns, volumes or pollutant loadings, it did promote a greater awareness of the potential consequences of development levels attainable under the present policies, and highlight the need for addressing them in light of the deficiencies of the governance structure.

2. ISDS Siting and Densities

The previous closure of the estuary to shellfishing, the well-recognized problems with septic systems within the watershed and the extensive documentation of bacterial levels within the waterbody identified on-site wastewater disposal practices as a major management issue associated with land use. As discussed in Chapters 1 & 2, the policies governing ISDS siting and design are significantly lacking in considerations of potential impacts to surface water quality, do not account for certain soil conditions characteristic of areas within the Narrow River watershed and do not incorporate density or surrounding land use characteristics within the review criteria. These interdependent issues, again, are not incorporated within municipal land use policies or the CRMC regulatory actions as specific decision criteria, despite the documented consequences. The resource evaluations and characterizations described in Section III.A. above were utilized to define areas within the watershed where ISDS siting posed significant concerns to water quality protection, including: areas of rapidly permeable soil types and high water tables adjacent to the estuary; areas of known concentrations

of ISDS failures; areas of high zoning densities. Similarly to the process described above for stormwater, these evaluations did not provide any quantitative assessment of cumulative impacts from ISDS, but rather identified areas of concern not adequately recognized within the review criteria of the individual programs, and where long term impacts could be expected.

3. Impacts from Construction Clearing: Scenic and Erosion Concerns

The steep, flanking walls of the watershed, and their relationship to the estuary below provide what the Rhode Island Audubon Society described as "unique water and land interfaces [161]." The estuary is generally recognized as one of the most scenic areas long the Rhode Island coastline. These qualities served as primary criteria in its classification as Type 1 and 2 areas under the CRMP revisions. The geological origins of these scenic qualities also imparted to the area soil characteristics which are extremely susceptible to erosion. The clearing of land associated with construction activities has the potential to affect both these characteristics: extensive clearing can ruin the visual qualities of the watershed walls while also exposing areas of susceptible soils to the erosive forces of runoff. While all three towns had minimal performance standards in place concerning vegetative removal associated with subdivision development, these standards tended to be very general, did not incorporate scenic considerations, did not set explicit limits on vegetative removal or erosion control tied to the vulnerability of the site, nor were they

amenable to evaluating the long-term impacts on a watershed basis. As with the previous two subjects, the project focused its assessments on potential ramifications of exercising the existing ordinances and policies, rather that quantifying off-site impacts, i.e. identifying areas where significant clearing would impact scenic resources and create potential erosion problems.

4. Critical Habitat Areas

The extensive salt marshes, contiguous freshwater wetlands and differing waterbodies within the Narrow River complex provide valuable habitat to a diverse range of wildlife types. Increasing levels of development within the watershed stresses these environments through several avenues, including: direct intrusion of development activities, reduction of buffer areas between habitats and human activities; alterations caused by stormwater discharges; disruption of wildlife corridors between contiguous habitat areas. As noted in Chapter 2, municipal land use decisions usually make minimal consideration of habitat considerations when regulating densities, lot configurations and layouts and off-site impacts caused by alterations to surface and groundwater patterns. These considerations are relegated to state level regulatory reviews, conducted after initial local decisions are substantially complete. The long-range projections conducted by the SAM plan project team enhanced its ability to define critical or sensitive areas within the context of the overall system by developing general predictions of high density areas, potential intrusion impacts associated

with these varying levels of development and the ordinances governing their completion, and identifying qualitative changes in off-site impacts such as increased surface runoff and erosion. Ultimately, the assessment promoted enhanced recognition and designation of critical habitat areas, and clearer assessments as to the necessary degree of response to maintain habitat values.

(c) Targeting the Application of Remedial versus Preventative Initiatives

The investigations discussed above relate primarily to assessing potential cumulative and long-term impacts from new development proposals. The final set of interdependent issues the project attempted to address dealt with a much broader subject, the relative merits of applying remedial or preventative management efforts to specific areas of the watershed. Primarily, this entailed assessing the relative contributions of existing pollution sources and potential future alterations in land use to the water quality degradation observed in the estuary, and defining the potential improvements to be achieved through remedial actions balanced against the relative costs and restrictiveness of preventative measures as applied to other areas of the watershed. The primary policy questions bound up with this issue were related to municipal programs on infrastructure development, mainly sewers, and their potential role in supporting new development or remedying existing pollution sources. Two separate, but interrelated aspects to this issue presented themselves: to what degree could improvements in water quality be expected if identified areas of community-wide septic system failures

were serviced by sanitary sewers, and to what extent would these improvements be offset by future changes and development activities in other areas of the watershed. Ancillary to this, what level of restrictiveness would be necessary in order to maintain the improvements? While the older communities such as Middlebridge and Mettatuxet had been identified as the primary existing sources of pollution to the estuary, questions existed about the level of improvement attainable due to the stormwater discharges located throughout the watershed. Additionally, concerns existed that the level of restrictiveness necessary to prevent new developments from voiding any gains in water quality improvement would be politically untenable, if on-site septic systems were used. This then raised the issue of priorities for sewering either new development or the old. This situation was further complicated by growing concerns over treatment capacity at the regional sewage treatment plan, which appeared to cast the issue as an either/or question.

The SAM Plan project attempted to lay the groundwork for resolving these concerns by clarifying and reducing the causal uncertainties associated with the impacts of the concentrated septic system failures and through the investigations concerning stormwater, erosion and habitat impacts of new development. Past surveys of homeowner problems with septic systems, a comparison of recorded bacterial levels in proximity to the older developments, and discussions on the promise of other remedial measures, such as septic system replacement or maintenance programs, fairly clearly identified the prominence of the older communities as the primary source of degradation. Examination of on-site conditions such as

existing soil conditions, densities and water table levels within the areas of concern cast serious doubts as to the efficacy of measures short of sewering in resolving the problem. These assessments served to clearly define the interrelatedness of future municipal infrastructure programs and policies with the water quality restoration objectives. While the generality of the other cumulative impact assessments prevented the project from making definitive conclusions about the question of balance between restoration and remediation, they did highlight concerns and focus the discussions about levels of appropriate restrictiveness, discussed below.

(d) Summary

The case for recognizing the interrelatedness of the existing and potential uses within the estuary and its watershed and specific long-term consequences of policies governing their implementation was made by the SAM Plan project primarily through projecting future land use levels and examining alterations possible under that scenario, and their impact upon specific resource elements of the watershed. While this approach did not establish conclusive, quantified or predictive assessments about possible, long-term cumulative changes to the estuary, it did serve to broaden the scope of issues under consideration beyond those endemic to the individual management authorities, and heighten awareness about the ramifications and interrelatedness of existing policies.

D. Aggregation and Implementation: Developing Integrated Policies through Consensus and Coordination

For the Narrow River SAM Plan project, the "overall perspective" of Underdahl's aggregation aspect of the processing of policy inputs had two distinct foundations: the implications and findings of the environmental assessments concerning interdependent issues, and the differing roles and perspectives of local and state authorities. The task was to utilize the information developed about the estuary and its watershed to weigh and develop consistent policies recognizing the requirements of the natural system and acceptable exercises of authority by the various actors. Not only did the policies to be developed to institute long-range protection mechanisms need to subsume the interdependent issues identified under a common policy framework sufficiently precise to address the management issues, they had to be tailored in such a way as to be implemented through the existing authorities. Because of the limitations imposed by the governance framework there was the need to design the management initiatives so that they were complementary, and utilized functional tools available to the municipalities, the DEM and CRMC, as opposed to relying on the development of new institutions or changes in statutory authority. The dependence on utilizing existing authorities, and the participation of all the management authorities also placed increased importance on attaining consensus among the various actors as to the relative costs and appropriateness of any given level of restrictiveness or policy directions proposed. This dynamic occurred primarily between the municipalities and the CRMC, although the acceptability question also

required addressing the concerns of development and environmental interests within the watershed.

1. Land Use Classifications for Water Quality Protection

As maintained throughout this discussion, the majority of management issues within the watershed were linked to policies and decisions pertaining to land use. As a mechanism to integrate the various policy levels and establish an extended planning context for the entire watershed to facilitate the implementation of actions by the municipalities and the state, the SAM Plan project adopted the use of land use classifications which provided linkages between municipal land use authorities, an assessment of environmental "carrying capacity" derived from the environmental characterizations and cumulative impact assessments, and strategies to meet water quality protection objectives codified in the CRMP. The concept of carrying capacity refered to the ability of the natural systems to absorb additional development and use without significantly exceeding threshold limits or incurring unacceptable degradation defined by policies governing their use and protection; i.e. the CRMC policies and objectives defined under the CRMP classifications for Type 1 and 2 Water Areas. Such classifications had originally been developed under the aegis of the SAM Plan for the salt pond region, adopted by the CRMC in 1984 [162]. The classifications were derived from the development status of existing conditions for specific land areas, the extent of authorities available through existing local ordinances and state programs, and the potential success of preventative

or remedial measures as applied to the conditions within the area subject to the classification. The assignment of the different classifications to specific areas within the watershed was the result of agreements on attainable goals between the municipalities and the CRMC, through the SAM Plan project. The approach attempted to balance the burden of restoring the water quality of the estuary between remedial actions and preventative measures that would minimize the impacts from development in presently undeveloped areas to the greatest extent possible, recognizing that little modification to existing land uses would be possible in others. In these developed areas, the land use classifications established priority remedial actions, to be undertaken by the municipalities and reinforced by CRMC oversight. Each classification established policies and regulations for the area and uses made of it, with implementation measures and responsibilities balanced between state and local authorities.

(a) Areas of Critical Concern

Areas of the watershed in which the primary focus of the management initiatives would be preventative were assigned to the classification of "Areas of Critical Concern." The project defined these areas as lands developed or undeveloped at a density of not more than 1 residential unit per 2 acres and that were characterized by natural features that posed severe constraints to development and were located relative to the estuary such that insensitive development posed the greatest threat to water quality. The central focus within these areas was to capitalize on

their predominantly undeveloped state as an opportunity to institute specific management policies which would prevent their future development from exacerbating contributions to water quality degradation, provide enhanced protection for habitat areas, and to protect scenic qualities. The areas assigned to this classification were mostly undeveloped areas abutting the estuary, or tributary streams, contained the majority of the salt marsh areas in the southern cove, and encompassed the steep flanking walls of the watershed in the middle and upper portions of the complex. However, several areas not in direct proximity to the estuary were included in this classification because of their undeveloped state.

The assignation of specific areas of the watershed to this classification, and the development of management policies for them was a concurrent and interwoven process. The initial issue faced by the project and advisory committee was to establish minimum development densities which would subsume the concerns about cumulative and direct impacts, and which was within an acceptable level of restrictiveness from the municipal perspective. This level of restrictiveness would in turn dictate the extent of watershed area to which the municipalities would agree could be assigned to the classification, which was envisioned as being the most strictly regulated. The concurrence of the municipality was essential, as the adopted minimum density would provide the basis for recommendations for zoning density amendments if necessary, and therefore carried extremely sensitive political considerations.

The critical turning point in the discussions between the members

of the Advisory committee on this issue related to the conclusiveness of the environmental assessments conducted by the project team. The undeveloped lands within the watershed were primarily zoned for 2 acre densities, except for certain areas within Narragansett. This designation was the lowest density class available within the zoning ordinance of South Kingstown and North Kingstown. Because the environmental characterizations could not establish any quantifiable assessments of varying levels of impact linked to the established densities, there existed no scientifically based argument with sufficient force to support reducing the densities allowable further. While arguments were made by the environmental concerns represented to reduce densities further (although no specific level was proposed), the municipal and CRMC representatives were hesitant to adopt greater levels of restrictiveness absent clear and conclusive scientific information as to its necessity. Additionally, other studies within the area, specifically those under the Salt Pond SAM Plan, had established the 2 acre minimum as the base density level for water quality protection within that region. While the Salt Pond regulations were based upon the goal of mitigating nutrient impacts to groundwater, as opposed to the surface water concerns present in Narrow River, the existence of the standard served as an acceptable and accepted level within the minds of the municipal and CRMC representatives. Accepting the existing allowable density was also supported by the development interests on the committee, as it represented no change in the status quo or additional level of restrictiveness. Further, the generic literature and other existing management programs researched by the project tended to show that runoff

impacts, site clearing and ISDS siting concerns could be ameliorated within that level of development. Finally, the standard of two acres per unit was acceptable from a political standpoint, as it relieved the municipalities of the potential ramifications of altering the expectations of property owners about allowable development potential.

The consensus on the base density allowed the project the flexibility to consider other mitigating measures, which while more restrictive than existing policies, could be accommodated within the classification. By not pushing a highly restrictive base density, the project was also able to gain agreement among the advisory committee members about applying the Critical Concern classification to broader areas of the watershed. The focus of the discussion then turned to specific on-site measures, and complementary policies designed to reinforce the base density standard. These mitigating measures centered primarily on the establishment of standardized buffer areas and restrictions on sewer extensions, but also included recommended planning practices and non-regulatory initiatives.

The long-term protection strategies for water quality protection depended extensively on the siting of ISDS outside of areas where significant impacts could be expected, and which were characterized by environmental conditions not adequately recognized by the state's regulatory program. The environmental assessments had identified critical zones along the margin of the estuary that were characterized by rapidly permeable soils and high water tables, and which were currently

undeveloped. In order to compensate for the siting criteria deficiencies of the DEM regulatory program, the advisory committee developed the concept of applying large buffer zones along the shoreline of the estuary to prevent siting within the critical areas. Standardized buffers represented a departure from the existing policies of determining buffer widths on a site-by-site basis. In order to attain the maximum mitigation feasible, the committee recommended standard buffer widths of 200 feet be established, the full extent of the CRMC's jurisdiction over individual residential development, within undeveloped areas of the estuary. This not only served to preempt the siting of ISDS within this zone, it provided enhanced treatment of surface water runoff by maintaining existing vegetation, and increased the distances between human activity and wildlife habitat. Additionally, scientific literature existed to support the buffer widths both from the perspective of mitigating movement of bacterial contaminants, and removal of surface water borne sediments and contaminants. While the development interests on the advisory committee raised objections that the distance was not sufficiently supported by scientific investigations, the majority of the committee felt that the proposal was reasonable for two reasons: as applied within the undeveloped areas of the watershed, the regulation would not prevent the development of property under the 2 acre lot size designation; and lots of this size could reasonably accommodate both the buffer and single unit development. In addition to providing increased setbacks for ISDS placement, the large buffers also provided enhance maintenance of the scenic qualities along the estuary's shoreline.

The expanded, standardized buffer zones were to be implemented through the CRMC's regulatory authority, and served to compensate for the problems created by the limitations of the zoning authorities and ISDS programs. The initiatives helped to mitigate some of the deficiencies of the CRMP concerning the lack of identification of priority uses within upland areas, especially as complemented by the 2 acre minimum lot size requirement.

Within the classification, several regulations and initiatives were also adopted by the advisory committee to complement and reinforce the objectives of the base density and buffer zone requirements, and to provide a context for DEM regulatory activities and municipal infrastructure programs, subdivision reviews and non-regulatory programs. These initiatives included restricting the extension of sewers into presently undeveloped areas in order to prevent secondary growth impacts and removal of limitations to densities keyed to on-site wastewater disposal, the requirements of 100 foot buffers adjacent to tributary streams, recommendations for the use of cluster zoning and the institution of septic system maintenance programs and prioritizations of areas within the Critical Concern classification for acquisition.

(b) Self-sustaining Lands

One of the organizational problems facing the long range management of land use within the watershed for water quality protection was the lack of an environmental basis for land use policies and zoning

designations. The project addressed this situation by extending the planning context to areas of the watershed not directly abutting the estuary, but in which future alterations would contribute to cumulative impacts to the estuary. A second land use classification for water quality protection was assigned to these areas, termed "Self-sustaining Lands." The advisory committee defined these areas as lands that were developed or undeveloped at a density of not more than 1 residential unit per 2 acres, or had been developed with "sufficient consideration and management of environmental impacts." Additionally, the classification criteria included that the geographic location of these areas was such that minimal impacts would be expected to the estuary if proper development safeguards were employed [163]. While the areas assigned to this classification posed less potential threat to water quality than the areas within the Critical Concern category, the advisory committee sought to ensure that a proper planning context building on the environmental assessments of the project be established to reinforce municipal zoning, and that the areas be integrated within the policies and regulations of the plan concerning sewer extensions to insure the balance of preventative and remedial strategies, and the nonregulatory initiatives to be instituted under the aegis of the plan.

The Self-Sustaining Lands classification represented not only an extension of the watershed planning context, but a compromise recognizing the balance of jurisdiction and linkage between the municipal authorities and the objectives of the plan. Since the advisory committee had agreed that the 2 acre minimum density should represent an acceptable base level

of development consistent with the findings of the project, the classification in essence reinforced the validity of this standard as being consistent with the environmental concerns, and provided the municipalities with a reference point from which to assess future requests for zoning modifications or changes.

Within the classification several management regulations and initiatives were set forth. These included the codification of the 2 acre density as a minimum standard for future separate and subdivision proposals, recommendations for the use of cluster development techniques as a method to reduce the costs and environmental impacts of development (with implementation guidelines), preserve open space and aesthetic qualities, prohibition of sewer extension into these areas, prioritization of regular septic system maintenance and upgrading, and the establishment of 100 foot buffers around tributary streams. In this way, the SAM Plan proposed minimal changes to existing standards, but rather established distinct contexts for the application of the municipal and freshwater wetlands programs related to the overall interaction and interrelationships with other areas of the estuary's watershed. The prohibition of sewer extensions was the most important of the regulations, as it established that future management actions should act to maintain the capacities of the land to support development within currently allowable levels, and also focused (by implication) the policies on infrastructure extensions into those areas requiring remediation. This new, explicit policy development was a direct consequence of the consensus of the advisory committee on the importance

of addressing the priority areas where community wide ISDS failures were occurring, and acceptance as to their role as the primary and immediate source of pollution to the estuary.

(c) Lands Developed Beyond Carrying Capacity

The final land use classification developed by the project addressed the issues of restoration of degraded areas, and areas in which the application of preventative management initiatives was limited due to the degree of existing alteration to the area. This classification was designated as "Lands Developed Beyond Carrying Capacity." Fundamental to the concept of the classification was the acknowledgment that past development patterns and practices had not been sufficiently cognizant of environmental limitations, giving rise to present conditions which required remediation. The advisory committee defined the areas to which this classification would be assigned as "lands that are developed or zoned at densities less than 2 acres (the agreed upon standard of carrying capacity), frequently at one residential unit per 1/2 acre to 1/8 acre or less; these densities have exceeded the natural ability of the soils and other environmental factors to attenuate the effects of development." The committee also explicitly identified these areas as major causal links in the observed degradation of the water quality of the estuary, stating within the definition that "[t]he consequences of such intense development have been a major source of contamination to the estuary [164]."

The policies established by the advisory committee for this classification pertained mostly to establishing sewering priorities for the various communities encompassed by the classification, establishing watershed based restrictions on sewer extensions to reinforce and focus municipal infrastructure development programs, and recommending mitigating measures to decrease the potential levels of development within the areas, and thus the level of service demand.

The central, older communities which were the focus of the classification were located in close proximity to existing sewer lines in Narragansett. In these areas, the advisory committee established a priority listing for the extension of sewer lines based on community density levels, frequency of reported ISDS failures and high bacterial contamination levels in the adjacent estuarine waters. The recommended priorities made recognition of the timing of extensions, as well as geographic location, and recommended that maintenance and restoration programs be undertaken in the communities farthest from the existing lines prior to extension of sewer lines.

The advisory committee also incorporated long term considerations related to the capacity of the regional sewage treatment plant in its initiatives. Recognizing that the goal of restoring water quality in the near future would be potentially impacted if the immediate remediation needs were not addressed as a priority, the committee enacted a restriction within the plan that would require that the priority areas be addressed prior to consideration of private or municipal extensions to

any areas that did not currently pose a water quality threat, i.e. lands within the Self-Sustaining and Critical Concern classifications.

Finally, in an attempt to mitigate against further exacerbation of conditions which had given rise to the environmental problems observed within the areas under the classification, the advisory committee made recommendations aimed at reducing densities where possible. These initiatives focused on amendments to zoning ordinances where possible to provide for reduced densities, and the required combination of substandard lots in contiguous ownership prior to granting development permits (Table 6).

2. Watershed Controls

The land classification system provided broad policy contexts for the application of state and municipal programs linked to water quality protection objectives. The regulations and requirements within each of the classifications also provided standards for individual residential development projects, such as base densities, buffer requirements and sewer extension policies. Several issues of concern were not addressed within the classifications because of the degree of site variability and a lack of conclusive environmental assessments sufficient to set standards by, or because of their watershed-wide applicability, including: on-site stormwater management, erosion and sedimentation control, comprehensive watershed stormwater management and regional wastewater management. To address these, the SAM Plan project developed a

Table 6: Land Use Classification for Water Quality Protection and Proposed Management Actions.

Land Use Classification	Proposed Management Strategies
1. Areas of Critical Concern	
- Undeveloped lands or lands developed at densities less than 1 unit per 2 acres.	- Maintain minimum 2 acre/unit densities.
- Areas contain natural features which posed potentially severe constraints to development.	- Implement 200 foot undisturbed buffer of natural vegetation.
- Areas located relative to estuary such that insensitive development potentially posed threat to water quality.	- No sewer extensions allowed.
- Areas containing undeveloped lands, salt marsh and wildlife habitat, steep valley walls.	- Maintain 100 foot undisturbed buffers of natural vegetation around tributary streams.
	- Implement cluster zoning techniques
	- Institute septic system maintenance programs.
	- Areas prioritized for acquisition.
2. Self-Sustaining Lands	
- Undeveloped lands or developed at densities less than 1 unit per 2 acres.	- Maintain minimum 2 acre/unit densities.
- Areas located relative to estuary such that minimal impacts expected if proper development safeguards employed.	- Implement cluster zoning techniques
	- No sewer extensions allowed.
	- Institute septic system maintenance programs.
	- Maintain 100 foot undisturbed buffers of natural vegetation around tributary streams.
3. Lands Developed Beyond Carrying Capacity.	
- Areas zoned or developed at densities greater than 1 unit per 2 acres.	- Sewering priorities established based on community densities, frequency of ISDS failures, water quality data.
- Density and character of existing development have exceeded natural ability of soils and other environmental factors to attenuate effects of development.	- Timing of sewer extension priorities established.
	- Institute septic maintenance and restoration programs.
- Areas identified as major sources of contamination.	- Restrictions on extensions of sewer lines to areas not posing immediate water quality threats.
	- Recommendation to amend zoning district designations to provide reduced densities; combine substandard lots.

series of watershed controls and management programs.

(a) Watershed Controls for Surface Water Runoff

One area of concern raised as a consequence of the management framework and existing management tools was the proper management of stormwater created by larger development projects which linked the creation and disposal of stormwater with potential impacts to water quality, groundwater impacts,wildlife habitat and the CRMC's policies governing allowable discharges to the estuary. The project and the advisory committee therefore developed a detailed set of initiatives and management requirements pertaining to stormwater control, to be applied to projects above an established threshold. The threshold criteria reflected the CRMC regulatory review standards, for two purposes: first, it was agreed that only projects of a certain magnitude or nature would be significant enough to require detailed stormwater management measures; secondly, tying the stormwater planning requirements to the CRMC regulatory reviews circumvented concerns about whether the environmental considerations encompassed by the requirements would be within the proper exercise of municipal authorities. Additionally, having the reviews conducted at the state level ensured consistency of application throughout the watershed, adjusting for those municipalities which did not have stormwater controls (Narragansett, South Kingstown) and compensating for any differences among the proposed SAM Plan requirements and existing town ordinances (North Kingstown). The advisory committee agreed that the environmental assessments and characterizations of the

estuary presented sufficient evidence that activities generating substantial runoff posed a "probability of conflict with [the CRMP] and damage to the coastal environment", the burdens established under 46-23 GLRI for extension of CRMC jurisdiction over land areas.

The stormwater management sections of the proposed SAM Plan established the requirement of certain projects to develop an explicit stormwater management plan, set out detailed planning requirements, performance and design standards that had to be met [165]. The planning requirements included examining the existing hydrological conditions of the site, receiving waters and wetlands, the topography of the site, soil conditions, predictions on potential impacts, and detailed discussions on various aspects of the components of the drainage system and any mitigative measures. These requirements had two objectives in the intentions of the advisory committee: to link consideration of the various components of the natural system and the potential consequences of the proposal; and to establish an environmental assessment detailed enough to allow for the examination and consideration of alternative designs within the characteristics of the site. These two subjects were neglected by the present management framework, as outlined in Chapter 2. The level of detail required within the stormwater management plans also allowed the management authorities to address general watershed wide concerns about surface water runoff within the specific context of the proposal site, something not accomplished within the land use classifications.

In order to minimize cumulative impacts from alterations of surface water runoff patterns, the proposed stormwater regulations established performance standards which each individual project had to meet. These included ensuring that after development the runoff characteristics of the site approximated those that would have occurred under pre-development conditions, maintaining the natural hydrodynamic characteristics of the watershed, and protecting or improving the quality of surface or groundwaters, wetland areas, preventing salt water intrusion and protecting natural fluctuations in salinity levels within the estuary. To ensure that the performance standards would be met, the final component of the stormwater management requirements established certain minimum design standards for the stormwater systems. The most important of these was the prohibition of new direct discharges, or enlarging or further degrading existing discharges to the estuary. As outline in Chapter 2, existing CRMP policies allowed such discharges when no reasonable alternatives existed and the discharge would not result in significant impacts. The conditional nature of these policies had resulted in repeated permitting of new discharges because of the lack of control over upland developments and any cumulative assessments as to impact. The findings of the SAM Plan provided sufficient evidence for the advisory committee to justify the added restrictiveness. In this manner, a more explicit linkage was established concerning the potential impacts of upland alterations, long-term protection of the estuary and the CRMP's policies and objectives for the estuary under the Type 1 and 2 Water Classifications.

While prohibiting the establishment of new discharges of stormwater to the estuary, the advisory committee recognized the need to upgrade existing discharges where possible, even though that action may entail maintaining the actual discharge. Also, several areas within the watershed presently had no mechanism, either structural or nonstructural, in place to deal with stormwater conditions. The project therefore proposed avenues for undertaking remedial stormwater management initiatives and the development of a comprehensive watershed stormwater management plan. In situations where no methods of controlling the volume and rate of discharge or reducing pollutant loadings existed, the proposal allowed remedial activities as special exceptions to the prohibition on direct discharges. In these situations, a proposal to undertake the upgrading of existing discharges or the establishment of some stormwater management techniques was allowed if the proposal served a compelling public purpose. took all reasonable steps to minimize environmental impacts, and could provide no alternative means of, or location for the remedial actions. The advisory committee also recommended that a cooperative effort be undertaken by the CRMC, DEM and the towns to upgrade existing discharges which did not presently employ acceptable management techniques. To support the development of such a program, the project outlined necessary scientific investigation that should be undertaken.

(b) Watershed Controls for Septic System Management

The land use classification Lands Developed Beyond Carrying

Capacity identified specific areas within the watershed in which policies pertaining to remediation of septic system failures should be pursued. In order to reinforce these policies, and as an indicator of the level of concern the advisory committee attached to the issue, the project also proposed the development of a specific regional wastewater management plan. The elements of the plan were meant to detail the identification and scheduling of extension of sewers into priority areas, integrating specific considerations pertaining to the future reserve and expansion capacity of the regional sewage treatment plant, as well as setting in place nonregulatory initiatives. These included establishing a watershed-wide ISDS maintenance program (including regular mandatory pumping of septic systems), the identification and phased replacement of individual failed units, the formal designation of state aid program allocations towards these areas, and the development of educational programs. The elements of the proposals included specific management initiatives to be included within each program, and established as policy at the CRMC level the restrictions on sewer line extension approvals embodied in the land use classifications.

(c) Watershed Controls for Erosion and Sedimentation

In an initiative similar to the watershed controls for stormwater, the project established detailed planning requirements and design standards to control direct and cumulative impacts from erosion. The new regulations retained a certain amount of flexibility, in contrast to the threshold criteria established for stormwater, as to situations

warranting the application of the requirements. In situations determined by the CRMC to warrant additional measures, the development of an Erosion and Sedimentation Plan was required. Such plans were required to provide detailed analyses of site conditions, soil characteristics and suitability for use, location and description of proposed changes on the site, and a detailed schedule of the sequence of installation or application of planned erosion controls related to the progress of the project. The requirements established a referenced set of standards which proposed measures had to meet or exceed, as well as calling for a detailed slope stabilization and revegetation plan. The proposed requirements also established minimum design standards, the most significant of which was an explicit restriction on the extent of lot clearing within Areas of Critical Concern.

3. Controls for Habitat Protection

The proposed SAM Plan also included several modifications to existing CRMC policies on habitat protection. Specifically, the prohibitions on alterations to salt marshes and tidal wetland areas were extended to encompass contiguous freshwater and brackish marshes within the watershed. Previously these areas had been subject to dual jurisdiction between the DEM and CRMC, with each program applying its own regulations and policies. The policy served as recognition of the contiguous areas as "areas necessary to protect the integrity" of the coastal wetland habitat values, and therefore became subject to CRMC jurisdiction. The initiative was intended to compensate for the size

thresholds of the Freshwater Wetlands Act by recognizing their interrelationship and importance to the coastal habitat, and to subsume both areas under a common policy framework.

In order to recognize the significance of the subtidal habitats of the estuary, the project also proposed prohibitions on dredging activities and the disposal of dredged materials within the water areas of Narrow River (Table 7).

4. Summary

The land use classifications proposed by the SAM Plan advisory committee were developed as a mechanism to integrate the interdependent management issues within the watershed under a common policy framework that could be utilized in implementation by local and state authorities. The classification system established and translated into specific regulatory standards linkages between the assessments of environmental characteristics within specific areas of the watershed, the problems present, and attempted to balance the burden of water quality restoration between remedial actions and preventative measures. The specific initiatives under each classification were built around the authorities available to the individual management bodies, and agreements as to acceptable policy directions and regulations. The standards and requirements within each area attempted to subsume a number of aspects of the interrelated issues under basic modifications to existing tools, and provided recognition of the interrelationships between the implementation

Table 7: Watershed Controls

Watershed Issue	Proposed Management Strategies
1. Surface Water Runoff	- Requirement of explicit stormwater management plans - Prohibition on direct discharges of stormwater to estuary; no enlargement of existing discharges; no further degradation of existing discharges. - Remedial actions encouraged; special review standards established. - Proposed comprehensive upgrading program for existing discharges. - Standard 200 foot buffer zones around undeveloped areas of estuary.
2. Septic System Management	- Regional wastewater management plan recommended; specific actions detailed. - Watershed wide septic system maintenance program detailed. - Recommended identification and phased replacement of failed systems. - Recommended formal dedication of state aid programs toward identified areas. - Recommended town-wide educational programs.
3. Erosion and Sedimentation	- Detailed Erosion Control Plans required. - Recommended restrictions on lot clearing; mandatory under state reviews.
4. Habitat Protection	- Extension of CRMC prohibitions on wetland alterations to contiguous freshwater and brackish wetlands. - Prohibitions on dredging subtidal habitats; prohibition on in-water disposal of materials. - Standard 200 foot buffers around undeveloped portions of estuary.

of the separate management programs and the overall coastal program objectives of protecting and restoring the water quality of the estuary. The regulations and initiatives provided a focus for the actions of the local and state authorities which had been developed with specific recognition of the potential consequences of the premises of the policy criteria and direction. While the environmental assessments and characterizations conducted by the project failed to provide definitive and conclusive determinations of the potential cumulative impacts of a series of interrelated decisions, they did provide a degree of examination sufficient to allow the development of consensus about the restrictiveness of future policy and management directions among the participants on the advisory committee.

The watershed controls proposed served as compensatory mechanisms to address issues on a site-specific basis for which conclusive standards could not be established through the environmental characterizations. They also integrated interdependent issues pertaining to water quality protection, interrelationships between municipal and state regulatory programs and issues which required a nonregulatory approach toward implementation.

Underdahl's model on policy integration proposes that a necessary element in achieving integration is ensuring consistency of policy outputs through the application of specific implementary measures which conform to consistent guidelines and policies, and by ensuring that a consistent policy is pursued by all involved authorities. As stated,

within the Narrow River watershed these policies and implementation mechanisms had two distinct foundations, the requirements of the natural system viz-a-viz its capacity for use and resource limitations and acceptable exercises of authority by the relevant management entities. The proposals and management mechanisms developed by the SAM Plan project meet the standards of Underdahl's model through several avenues. By utilizing the environmental characterizations as a common baseline for policy development the institution of the land use classifications served as a mechanism by which the policies of each management authority could be coordinated, each providing an element in the overall policies, regulations and implementation contained within the separate classifications. Having gained consensus on the policy directions embodied in the classifications, implementary mechanisms relevant either to the specific individual entities, or to all of them were developed consistent with the broader policy context. This acted to ensure that modifications to existing management programs or implementation of existing regulation would be carried out utilizing the classification as a common reference point, that is to say that each management authority would be pursuing a consistent policy in its actions. Secondly, in those areas where programs proposed by the project did not exist, complementary actions by the separate authorities acted to compensate for the deficiencies of other authorities. For example, the watershed controls for stormwater management contained requirements which could not be met through several existing municipal programs, however, the adoption of the regulations by the CRMC ensured their application through the regulatory review process, within the defined project review thresholds. The same

logic holds true for the policy proposals governing the extension of sewer lines; while the importance of the application of municipal infrastructure programs was exceedingly important to the objectives of restoring water quality, the primary management authorities governing the water quality program, the CRMC and DEM, had no direct ability to implement the needed extensions. However, by exercising its oversight authorities in enforcing the sewer restrictions, the CRMC could act to guide the approval or denial of proposals by private applicants or the municipalities within the context of the plan. The inverse is also true, in that the land use classifications provided the municipalities with guidance for implementation of infrastructure development programs linked to the coastal programs objectives of water quality restoration. The programs developed by the project also established a framework outlining specific future actions which were consistent with the overall policy directions, therefore guiding the direction and substance of these programs at such time as they would be implemented.

In summary, the land use classification and watershed controls proposed by the SAM plan project provided an integrated context for the exercise of existing programs, oversight mechanisms to compensate for deficiencies in the management framework and a long term schedule of new initiatives developed under a consistent policy framework (Table 8).

IV. Adoption and Implementation

The Narrow River Special Area Management Plan was adopted by the

Model Elements	SAMP Elements
1. Comprehensiveness to Inputs	
a. Time	- Based on Projected Buildouts and Potential Associated Impacts Allowable Under Current Policies
b. Space	- Planning Process and Management Initiatives Apply Across Jurisdictional Boundaries to Entire Watershed
c. Actors	- Participants in Plan Development Included Significant User and Governmental Groups Affected
d. Issues	- Plan Addressed Interdependent Issues of Land Use, Stormwater Management, Water Quality Protection, Estuarine Resource Use, Infrastructure Extensions, Habitat Protection, Dredging
2. Aggregation to Processing Policy Inputs	- Regulatory and Management Standards and Intiatives Derived by Consensus Among Advisory Committee - Regulatory and Management Standards and Initiatives Formulated Based on Watershed scope assessments, examining Interrelated Issues and Management Considerations
3. Consistency to Policy Outputs	- Specific Implementation Measures Developed Based on Consistent Evaluation of Resource - Implementation Measures Applied Throughout Watershed; - Recommendations for Modifications to Management Tools Employed by All Levels of Government

TABLE 8:COMPARISON OF UNDERDAHL'S MODEL ON POLICY INTEGRATION AND SPECIAL AREA MANAGEMENT PLAN ELEMENTS

CRMC on December 8, 1986. The adoption received overwhelming support from the municipalities, state agencies and the pubic. The vote of the CRMC to adopt the SAM Plan was unanimous in favor of adoption.

The ultimate measure of the effectiveness of the process and plan must be the extent to which its recommendations and regulations are being implemented and observed.

A. Town of Narragansett

1. Amendments to Municipal Zoning Ordinance

The SAM Plan called for a base density of 2 acres per residential unit in Areas of Critical Concern and Self-Sustaining Lands. The town of Narragansett was the only municipality of the three which did not have the 2 acre zoning requirement in place at the time of adoption of the plan. While the majority of areas of the watershed within Narragansett were not within the Critical Concern or Self Sustaining classifications, several important areas were classified as such which were at the time of adoption zoned for high density development. In 1988, the town council of Narragansett proposed a comprehensive revision to its zoning ordinance. The new zoning ordinance called for the establishment of a low density zone with a minimum lot size requirement of 2 acres per residential unit. Areas assigned to this designation included the areas identified within the SAM Plan as Areas of Critical Concern and Self-Sustaining Lands. The findings and recommendations of the Narrow River SAM Plan were heavily

relied upon by the town as justification for the proposed zoning redistributions. Despite substantial opposition from development interests and land owners, the town council adopted the redistributions for the entire areas of the watershed within the classifications. Conversations with town staff indicate that the environmental assessments and existence of the SAM plan were critical in maintaining the support of the town for the revisions to the zoning ordinance. The revised zoning designation was described within the ordinance as a zone "composed of areas of town which have severe physical limitations for development, or which are within or adjacent to wetlands, intertidal zones, coastal ponds, rivers or watersheds," language closely mirroring the land use classification criteria for Areas of Critical Concern [166].

The revised zoning ordinance also proposed the institutions of new overlay districts. These districts were established encompassing areas of the town "where natural physical limitations render the land unsuitable for development without restrictions. These areas include[d] coastal and freshwater wetlands, coastal waters and shorelines..." [167] The ordinance contained a specific overlay district for Coastal and Freshwater Wetlands and Coastal Resources. Each district utilized the criteria of the CRMP in defining the areas to which it applied, and set forth as objectives protection of environmental values as enumerated by the CRMP and the Narrow River SAM Plan. Greater coordination with CRMC was established through these overlay districts not only through the development of consistent policies pertaining to the use of land areas within the districts, but also through the provisions of the approval criteria which

stated that the Zoning Board of Review may grant a special exception for development within these areas "provided the proposed activity complies with all applicable development standards and other requirements imposed...by the State Coastal Resources Management Council [168]." The Coastal Resources Overlay district also adopted development standards which encompassed the 200 foot buffer mandated by the SAM Plan[169]. The revised ordinance also established overlay zones for steep slope areas, special flood hazard areas, and high water table districts [170].

In addition to the overlay districts, the ordinance contain additional provisions which incorporated many of the recommendations of the SAM Plan. These included requirements for the merger of substandard lots prior to development approval, the institution of supplementary drainage requirements including stormwater management requirements mirroring the design and performance standards of the SAM Plan, and planning requirements for erosion and sedimentation control [171].

2. Establishment of Comprehensive Sewer Plan

Several of the key communities within the Developed Beyond Carrying Capacity classification developed by the SAM Plan were located within the town of Narragansett. As discussed above, the extension of sewer lines into these areas was a primary management initiative proposed by the plan to rectify the contributions of pollution originating in these areas. Prior to the development of the SAM Plan, the town had no comprehensive facilities plan which outlined and scheduled the extension of sewer

lines. In 1987, the town adopted a comprehensive plan establishing areas where sewer lines would be extended, and areas which were not eligible for service. Incorporated within the plan were the areas identified by the SAM Plan as priorities for sewering. The findings and recommendations of the plan were utilized as part of the criteria evaluated by the town in deciding the establishment of service areas. Additionally, in the summer of 1986, using the ongoing discussions of the advisory committee, the town gained financial support for extension of sewers into the neighborhood of Mettatuxet from the state through capital facilities development programs. Again, the findings and ongoing work of the SAM Plan advisory committee in identifying this area as a priority area for sewering, and the determinations as to the importance of the area in relation to water quality restoration within Narrow River were critical arguments in gaining state support.

3. Acquisition of Areas of Critical Concern

In November of 1986, the citizens of the State of Rhode Island overwhelmingly approved the passage of an $86 million bond issue for the acquisition of open space. The bond was, in part, devoted to municipal acquisitions through a grant program administered by the Department of Environmental Management. The town of Narragansett made an application for the purchase of a large area abutting Pettaquamscutt Cove, which was identified as a priority for acquisition in the classification of Areas of Critical Concern, and had previously been slated for development. One of the primary qualifying criteria within the grant program was the

identification of areas proposed for acquisition in a state or municipal plan. The town of Narragansett utilized the findings and recommendations of the SAM Plan in their application. Also based upon the findings of the plan, the CRMC supported the town in its efforts to obtain the parcel. In 1987, a grant of $600,000 was awarded to the town for acquiring the land. Later, the United States Fish and Wildlife Service joined the town in their attempts to acquire the land, and proposed the designation of Pettaquamscutt Cove as a National Wildlife Refuge, setting the stage for the use of federal funding. The information and assessments made by the SAM Plan were fundamental in bringing about both these events.

4. Comprehensive Upgrading of Stormwater Discharges

As discussed above, the SAM Plan recommended that a cooperative effort be undertaken by the towns, the CRMC and the DEM to upgrade existing stormwater discharges to the estuary. In 1988, the town of Narragansett proposed the initiation of a cooperative effort to study the feasibility of undertaking such a program, identify potential funding sources and outline possible remedial engineering techniques which could be utilized [172]. While the project is in initial stages of forming, the staff of the town has stated that they view the restoration of existing pollution sources, such as the stormwater discharges to the estuary, as one of the foremost and important challenges facing the town in coming years [173].

B. Town of South Kingstown

1. Sewering Project for Middlebridge

Within the Town of South Kingstown, the community of Middlebridge was identified as one of the primary sources of bacterial contamination to the Narrow River due to a high concentration of failed septic systems. Due to this, the community was included within the Developed Beyond Carrying Capacity classification of the SAM Plan. In 1987, the town commissioned an engineering study to further define the requirements of a program to upgrade and address the problems of the community-wide failures, and the potential efficacy of sewering the area. The study examined several different scenarios, including the identification and phased replacement of individual failed systems, the potential use of a community based septic system and the extension of municipal sewers into the area. The study extensively utilized the environmental assessments and conclusions of the SAM Plan in its discussions, and eventually returned a recommendation, consistent with the recommendations of the SAM Plan, that the area be sewered [174]. Utilizing this information, the Town has proceeded with a comprehensive plan to finance and undertake the project [175]. Additionally, in the summer of 1988, the DEM announced its state-wide prioritizations of areas qualifying for state financial assistance in facilities improvements projects. The Middlebridge area was ranked third within the state in this listing. Publicly, the DEM has stated that the importance of remediation of existing sources of pollution to the Narrow River was a critical reason in its decision on

extending financial assistance to the town.

C. North Kingstown

The development controls in place within the Town of North Kingstown were substantially in conformance with the recommendations of the SAM Plan, and therefore no changes have been proposed to date. Additionally, there are no sewers extended into the area, nor housing densities requiring the prioritization extended to areas in Narragansett and South Kingstown. The areas of the watershed subject to the plan were, however, substantially larger than those formerly subject to CRMC review. This has resulted in more detailed reviews of large subdivision projects subsequent to the adoption of the plan. Additionally, the Town has utilized the coordinated review provisions of the SAM Plan to gain CRMC preliminary environmental reviews prior to local approvals.

D. DEM

Acting under requirements of amendments to the Clean Water Act, the DEM has recently undertaken a comprehensive assessment of the state of coastal and freshwater areas within the state. Part of the process was the identification of priorities for restoration and prevention management strategies to address the problems of point and nonpoint sources of pollution. The draft list of priority water bodies includes the Narrow River, both within the priorities for restoration and preventative actions. The assessments and water quality findings

developed by the SAM Plan were heavily utilized as base information in reaching decisions concerning the assignment of the state-wide priorities. The priorities list will be used to guide future state water quality protection programs, as well as assign available federal funding.

E. CRMC

Many of the initiatives and regulations developed by the SAM Plan were meant to provide increased specificity to the CRMP. Since the adoption of the plan, only several major projects have come before the Council for review under the regulations of the SAM Plan. Two of these were large government projects: the construction of a new district court building and the upgrading of Route 138, in the northern portion of the watershed. Both projects developed extensive stormwater management plans under the requirements of the watershed controls for stormwater. The reviews conducted by the CRMC staff under these new regulations resulted in major modifications to both proposals. The courthouse project was required to develop detailed plans for the proper management of stormwater created by the project, something which had not been submitted with the original application for approval. The reviews of the roadway upgrading project resulted in major modifications also, including the prohibition of proposed discharges of significant volumes of stormwater directly to tributaries of the estuary, and the institution of innovative methods for minimizing impacts of proposed discharges to wetland areas as originally designed into the project. A third, less intensive residential development has also been reviewed under the SAM Plan. In its final form,

the development utilized cluster development techniques as recommended by the plan, was held to a base density of 2 acres, and incorporated roadway and site designs which minimized the creation of stormwater.

F. Scientific Research

The SAM Plan, recognizing that all necessary work and scientific investigations could not be undertaken within the time frame established for the project, set forth several recommendations for future research. Several of these specific suggestions have been consequently undertaken by researchers from the University of Rhode Island. Recognizing the lack of conclusiveness of many of the environmental assessments, the plan recommended that a critical study of runoff characteristics and further definition of pollutant loadings be conducted. Such a study was funded by Rhode Island Sea Grant in 1987-88. The principal investigator has said that the SAM Plan itself was a vital impetus for justifying the funding for the program (Table 9) [176].

V. Summary

Several years after its adoption, the Special Area Management Plan for the Narrow River has begun to prove its worth as a mechanism for addressing the problems of cumulative impacts, restoring water quality within the estuary, and coordinating local and state management programs. While it is too early to see large improvements in the estuary's water

quality, the recommendations and regulations of the plan have begun to be utilized, and several critical programs have started down the road to implementation.

The land use classifications, watershed controls and nonregulatory initiatives of the plan effectively integrated interdependent management issues which, prior to the development of the SAM Plan, has been significantly fragmented by the existing framework of management. The environmental assessments and characterizations of the project provided a basis for ensuring that the potential consequences of policy decisions were not neglected in the development of decision premises, in the form of functional management tools employed by the various authorities. The cooperative approach of the SAM Plan process acted to provide a management framework in which the existing authorities could be coordinated to act in either a complementary or compensatory manner, and promoted a commitment to the recommendations and policy directions of the plan among the state, local and private interests involved in its development and eventual implementation.

The approach of the SAM Planning process, specifically of extending the management area to encompass the natural region where the consequences of policy decisions should be considered relevant as decision premises, involving the affected parties, assessing interdependent issues and establishing specific implementation measures which conformed to more general policy goals, mirrors the requirements of Underdahl's model on policy integration. To the extent that the plan

TABLE 9: Implementation Actions of Recommended Strategies and Implementing Authority.

Recommended Action	Implementing Authority
1. Zoning Denisities of 2 Acres per Unit Minimum	Comprehensive Rezoning by Town Of Narragansett; Maintenance of 2 Acres Designations by Towns of South Kingstown, North Kingstown
2. Strategic Siting and Extension of Municipal Sewers	Comprehensive Sewering Plan by Town of Narragansett; Watershed Level Restrictions on Siting of Municipal Sewers by CRMC
3. Aquisition of Areas of Critical Concern	Proposed Acquisitions by Town of Narragansett, US Fish and Wildlife Service, State of Rhode Island
4. Comprehensive Upgrading of Stormwater Discharges	Proposed Development of Comprehensive Stormwater Discharge Upgrading by Towns of Narragansett, South Kingstown, North Kingstown
5. Extension of Sewers to Middlebridge Area	Sewering Plan Developed by Town of South Kingstown
6. Expanded Regulatory Review of Projects with Potential Impacts to Estuary Water Quality	Extension of CRMC Regulatory Review throughout Watershed
7. Scientific Research	Research on Stormwater inputs to Estuary undertaken by URI.

resulted in modifications to the framework of management and the functional management tools utilized by the municipalities and the CRMC it can be said to have integrated the policies governing the alteration and utilization of the estuary's resources towards the established CRMP objectives of protecting and restoring the estuary and its water quality.

Chapter 4: Conclusions

I. Introduction

The Special Area Management Plan for the Narrow River, and the process by which it was developed, have resulted in significant changes to the overall governance of the estuary, and furthered the objectives of protecting and restoring its resources. Policy inconsistencies, and their expression through specific management tools, have been addressed by the mechanisms put into place under the SAM Plan. The separate policies, management objectives and tools have been, to a degree, integrated between governmental levels toward a consistent set of goals. Implementation mechanisms utilized by the municipalities and the state have been brought into line with these objectives either through direct modification or compensatory arrangements. The plan and process has served to correct many policy and management problems brought about by the organizational problems in the framework of management. Most importantly, the SAMP has set into place a program for addressing the impacts and ramifications of cumulative alterations, the need for greater coordination and integration between authorities, and the problems of achieving long-term protection strategies and restoration of degraded areas within the watershed.

Despite many strengths inherent in the SAM planning approach,

specific limitations encountered during the Narrow River project highlight weaknesses of the process. Foremost among these is the level of specific and predictive scientific information which is developed to guide the policy and management decision-making process. Additionally, much of the implementation of the management initiatives, especially those of a non-regulatory nature, falls to the municipalities after promulgation of the plan. This may stall timely implementation of these actions, due primarily to the same technical and staffing constraints responsible for many of the initial problems. Finally, poor coordination and relationships between the state-level agencies continue to aggravate inconsistencies and contradictions in management and regulatory programs. The SAM Planning process itself is ill-suited for ensuring that necessary post-adoption actions to effectuate implementation occur.

II. Conclusions Concerning the Process

A. Strengths

The primary strength of the SAM Planning process lies in its ability to address fundamental problems engendered by the organizational structure of the management process. This is made possible by conducting the plan's development essentially "outside" the established regulatory relationships. That is, the SAM Planning approach resulted in "fine-tuning" existing policies and management tools in order to reach accord between policy levels by displacing the forum of discussion from

one of a statutory basis to one linked to the watershed and resource characteristics. Essentially, the problems were defined first, and then necessary actions outlined to be undertaken by the various management authorities. This, coupled with the broad representation of the advisory committee, minimized the all too traditional problem of avoiding resolution of problems by denying authority or capability; instead, given agreement on the nature and degree of problems within the estuary, necessary and acceptable modifications and approaches could be designed which depended on actions by each authority. Additionally, compensatory arrangements could be designed which played to the strengths of the different institutions, and the degree of responsibility each was willing to accept, or which was feasible to undertake from a political and technical standpoint. For example, the issue of stormwater management was addressed by actions tied to municipal authorities (maintenance or modification to zoning designations to provide a 2 acre minimum density) and strengthen by state actions on initiatives not clearly within municipal authorities or capabilities (requirement of stormwater management plans for projects above the state review thresholds). This critical commitment to "backing up" the municipalities in instances of tough decisions was fundamental to gaining local support for modifications and responsibilities solely within their province. A similar example is that of the sewer extension restrictions contained in the Land Use Classifications. Because the CRMC was willing to adopt regulatory restrictions through their authority, the towns could distance themselves to a certain degree from the political problems of the requirements, as well as use the plan for justification of actions they

may have supported, but thought originally politically untenable.

This dynamic of "support and override" established a regulatory and management program that was both complementary and compensatory. This structure served to insure that the linkages between issues were not neglected in the implementation of the policy and management decisions.

Another strength of the process is the flexibility afforded by the comprehensiveness of the scope of the project. By addressing the entire watershed, undeveloped areas as well as developed, the approach was able to balance the burden of restoring the water quality of the estuary between remedial actions and preventative actions. Indeed, one of the first hurdles the project had to pass was consensus that actions to protect the resource had to fall equally on addressing existing problems (primarily ISDS failures) in highly developed areas as well as preventative restrictions on new development. The comprehensive approach avoided any one interest group perceiving that it was "being picked on" or asked to bear the majority of the financial and other costs associated with the project's proposals and thus endangering political support for implementation. The same concept applies to the consistent application of the Land Use Classifications and Watershed Controls to similar areas within each of the three municipalities.

Finally, the design of the management tools utilized by the project to subsume interdependent issues under common policies was important. In general, they were simple, and did not require complex changes to

existing technical capabilities, and they were built upon existing institutions and mechanisms. A common failure of many planning documents is that the proposals often entail esoteric solutions, complex technical and regulatory structures or significant commitment of resources. Similarly, the conditions under which new institutions are introduced into a governance scheme, or significant shifts in jurisdiction or authority occur are specific and difficult to bring about. By relying upon extremely simple tools, achievable through existing institutions, the acceptance of the project's proposals fared much better.

B. Weaknesses

The ability of the SAM Plan project to define, explain and gain acceptance of the interdependency of the policies and management authorities governing land use, the natural ecosystem functions and the uses made of the watershed's resources was fundamental to the objectives of integrating the various programs and establishing long range strategies for restoration and protection. These objectives turned upon the level of scientific certainty associated with the resource characterizations and analysis of the consequences of current policies. The dependence of the project primarily upon existing literature and assessments of the estuary, and the lack of conclusive analytical assessments greatly influenced and limited the project's ability to achieve changes in the management structure. Because the nature of the resource characterizations and the analysis of the interdependent issues

was primarily descriptive and qualitative, the recommended management initiatives were decided upon by a process that was substantially political, as opposed to strictly scientific. The assessments did serve to broaden the scope of issues under consideration beyond those endemic to the individual management authorities and heighten awareness about the ramifications and interrelatedness of existing policies and management tools. This was sufficient to achieve the level of modifications required under the proposed initiatives. However, there remains a significant question as to the adequacy of the restrictiveness or efficacy of the initiatives, due to the inconclusiveness of the scientific basis.

The level of scientific investigation associated with the project is in great part due to the lack of scientific and technical resources available to both the CRMC and the municipalities. This lack casts doubts over the "ease" with which several of the proposed initiatives may be implemented, primarily the watershed stormwater management plan, wastewater management plan and proposals to upgrade areas of high ISDS failure. This is compounded by the fact that carrying out these initiatives has fallen primarily to the municipalities, mostly by default. Given the technical and staffing constraints on the municipal level discussed in Chapter 2, it is doubtful that without significant state participation (either technical or financial) that these initiatives will be implemented without difficulty. This situation is, unfortunately, indicative of a larger failure of the state to act in a technical assistance role towards the municipalities. The exception has been the conduct of initial planning activities, such as the SAM Plan,

but again, many aspects of implementation that are probable inappropriate for the municipalities to take the lead on, often fall to them to undertake.

State agencies in Rhode Island rarely make use of formal coordinating mechanisms to insure consistent actions and review. This traditional reluctance often results in one agency rendering a decision or undertaking a project inconsistently with the policies or requirements of another. Despite the participation of DEM, the Department of Transportation and the Department of Administration in the development of the SAM Plan, and critical roles assigned to these agencies in its provisions, no formal administrative agreements have been executed to date. As a result, several problems with development projects under the control of DOT and the Department of Administration have been encountered since the plan's adoption. At issue was voluntary compliance by those agencies with the stormwater provisions of the SAM Plan. The issues were finally resolved consistently with the plan's requirements, but only after significant efforts on the part of the CRMC to force compliance.

Apart and in addition to necessary administrative agreements, several initiatives within the plan dependent upon the participation of the above mentioned agencies have not, to date, been acted upon. These include provisions for coordinated reviews of major development proposals, participation in the watershed stormwater and wastewater management plans, technical assistance to the municipalities, and consistent enforcement of buffer zones around inland tributaries to the

estuary.

III. Changes to the Approach and Conduct of Coastal Management

The Special Area Management Plans, including the ones developed for the Salt Ponds Region and Providence Harbor as well as the Narrow River project, represent a substantially different approach to coastal management in Rhode Island from that embodied in the "Red Book." Most obvious is the extension of planning considerations and management programs to inland areas beyond the CRMC's direct implementing authority, and the practical result of focusing local authorities and actions into the role of "local coastal zone management programs." The recognition of the importance of integrating activities under municipal control with the broader objectives of coastal management, both from an institutional and policy/management perspective, is a significant departure from the approach of the last 20 years. It also represents a greater emphasis and programmatic development of the CRMC's legislative charge to coordinate the activities of local, state and private interests in the coastal zone. Given the controversy over jurisdictions that surrounded the passage of the Coastal Resources Management Council Act, the SAMPs represent a mechanism which by the municipalities and state can manage to work together towards common ends. That the CRMC took the initiative to sponsor the development and conduct of this approach is significant in that it represents a departure from the Council's traditional reluctance to stray beyond those activities and areas clearly under their direct

regulatory control.

Despite the promise of the SAM planning approach, and their relative success, the approach is limited in its ability to be applied statewide. The process is resource intensive, requiring significant devotion of staff and fiscal resources. This tends to limit the CRMC's ability to utilize the approach beyond areas that can be identified and prioritized as "special areas." However, if the recently adopted comprehensive planning program comes to fruition, that program may lay the foundation for integration of local and state policies on a broader basis.

The promise of the SAM Planning approach does not rectify the pervasive limitations to comprehensive management present in the current Rhode Island governance structure. There exist serious and perhaps, unfortunately, intransigent procedural and structural problems within the framework of management, the existing statutory authorities of the management entities, and conduct of environmental management. In part, the SAM plans were successful in that they did not attempt to go to the heart of these problems. However, while the "side-stepping" of the SAM Plans allowed for the implementation of a management program which compensated for the organizational problems, it did not address or correct them.

The organizational problems encountered in coastal management grow, in great part, from the political landscape of Rhode Island. Rhode Island

is the state of the "Independent Man", and this is clearly manifested in the limitations of statutory authorities of the various management entities. The cultural antipathy towards interference in parochial political affairs, whether they be of a municipality or a state agency, has produced laws and programs which begrudgingly grant the requisite authority and a series of administrative "fiefdoms." The laws controlling coastal management are uncoordinated because each one has been developed for a particular entity, with little review and or coordination required with other relevant management agencies. Attempts to rectify these basic inconsistencies through administrative or interagency processes have been unfruitful, primarily because no one organization is willing to "give up" some form or extent of jurisdiction, or to grant significant intrusions into existing authority. The CRMC was able to do so through the SAM plan, primarily because it served the municipalities' interests to allow them to do so, and because of the added responsibilities the agency assumed.

The SAM planning approach built on fundamental authorities available to each of the management entities, and fine-tuned these to function in a complementary and integrated manner. In doing so, the approach was effective in facilitating the development and adoption of management strategies by the individual entities which implemented specific management requirements of the plan. However, the approach relies to a great degree on the continued voluntary support and participation of each agency, especially outside the regulatory provisions of the plan.

While other structural and procedural approaches to comprehensive management are available, their efficacy in Rhode Island is questionable. One currently proposed approach is the creation of a "superagency" which would subsume all other environmental agencies. While this approach would seem to go directly to issues associated with uncoordinated, multiple review agencies, many fundamental problems would persist. The complexity of environmental management and regulatory reviews will continue to necessitate the division of review authorities based on various aspects of the project. This in turn will require intraagency coordination between these divisions. Current problems with the organizational processes at DEM indicate that such coordination may be no easier that interagency coordination. The approach attempts to address what are essentially procedural problems with a structural solution. The relationship and coordination of state level regulatory programs will continue to be a problem. It is one that is as much one of wasted potential as inefficiency. With modifications, the water quality certification, ISDS, wetlands and coastal programs can be supportive and more effective tools for coastal management. However, a lack of strong working relationships between the agencies involved, and little direction from the state legislature or administration results in the vital impetus needed being absent.

Another potential approach is to shift the placement of certain review authorities and functions within the overall management framework. One logical extension of this approach would be to shift regulatory reviews for coastal and wetland programs to the municipal level. Another

would be to elevate a substantial portion of the decision making process governing land use to the state level. Both approaches have been employed, notably in Massachusetts and Hawaii respectively. However, given the statutory and technical expertise limitations present on the municipal level, the approach of delegating responsibility to the local level would be difficult. As explained in Chapter 2, the municipalities are often hard pressed to carry out current evaluations, and the additional responsibility of assessing environmental impacts would require the development of engineering and biological expertise. Additionally, the concern that the management of coastal resources bears a substantial state level interest argues that some level of state review be involved, if not directly in the initial regulatory process, then at least in the setting of policies governing their use. The present political relationship between the municipalities in Rhode Island, and the state government makes the elevation of substantial involvement in land use decisions unlikely. Land use policies, and their expression through comprehensive plans and zoning is a jealously guarded perogative of the towns. The Comprehensive Land Use Act does provide a reasonable balance between state and local control of land use, and represents an element of state oversight. Under the Act, local comprehensive plans and zonining ordinances must be developed in reference to, and be cognizant of state resource protection policies. This acts to insure some level of consistency, as well as respecting the political realities of seperate jurisdictions and self-determination by the municipalities. The quality and level of consistency achieved through this process remains an unanswered question, but is the most promising approach developed to date

of modifying structural elements of the governance framework.

IV. The Usefulness of Underdahl's Model on Integrated Policy

The discussion on policy integration offered by Underdahl is valuable primarily in that it furthers the discussion on the need for integrated approach's to coastal (and other) resource management. The elements as outlined can be used to scope and frame policy investigations and discussions, and hopefully highlight where limitations resulting from single use institutions and approaches may be expected. The model is lacking in that the specific interrelationships between the elements are not more detailed, or defined in terms of "operational" requirements, e.g. what time frames need to be evaluated for specific resources, what effect does the scope of issues have on that determination. Additionally, the value of the discussions on mechanisms for consistent outputs is subject to the same limitations. However, the discussion can provide the basis for more detailed analysis such as this thesis.

Endnotes

1. Lawrence K.Susskind and Scott McCreary, "Techniques for Resolving Coastal Resource Management Disputes Through Negotiation", American Planning Association Journal, 51(Summer 1985)3:365-374.

2. Lillian F. Dean, "Planning for Environmental Management:New Directions and Initiatives," Coastal Zone Management Journal 5(December 1978)4:285-306.

3. There is extensive discussion ongoing as to the efficiency of program structures and methodologies of traditional regulatory and management programs in achieving their stated objectives, addressing the nature of the management problems, and giving adequate consideration to scientific uncertainty and public acceptance of policy directions. See, e.g. Daniel Ashe, "Fish and Wildlife Mitigation: Description and Analysis of Estuarine Applications" Coastal Zone Management Journal 10(January 1982)1-2:1-52; Donald R. Robadue, Timothy Hennessey and David W. Kaiser, "Adaptive Implementation and Coastal Ecosystem Management: The Rhode Island Coastal Resources Management Council 1971-1986" (Kingston, Rhode Island:University of Rhode Island 1986), 32 pp; Nan Evans, Marc J. Hershman, George V. Blomberg, and William B. Lawrence, The Search For Predictability: Planning and Conflict Resolution in Gray's Harbor, Washington (Seattle, Washington: Washington Sea Grant Program, 1980) 115 pp; Kim Watson,"Ocean Incineration: Science or Politics?" Marine Policy Reports 9(November 1986)2:1-6; Robert E. Stein, "The Use of Mediation and Other Techniques for the Settlement of Environmental and Natural Resource Disputes" Industry and Environment 7(July, August, September 1984)3:45-47.

4. ibid.

5. Mary M. Howard-Strobel, Terry G.Simpson and Timothy P. Dillingham, The Narrow River Special Area Management Plan, (Wakefield, Rhode Island 1986), 146 pp. The author of this thesis served as a program analyst/consultant for the Rhode Island Coastal Resources Management Council in the preparation of the Special Area Management Plan for the Narrow River.

6. The RI Coastal Resources Management Council had previously commissioned two other Special Area Management Plans which focused on the urban harbor area of Providence and the salt pond region of Washington County, Rhode Island. See Donald Robadue, Providence Harbor: A Special Area Management Plan, (Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island 1982), 87 pp; Stephen Olsen and Virginia Lee, Rhode Island's Salt Pond Region: A Special Area Management Plan, (Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island 1984), 113 pp.

7. Stephen Olsen and George L. Seavey, The Rhode Island Coastal Resources Management Program, as amended, (Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island 1983), 144 pp.

8. Olsen and Lee, supra note 6.

9. Bostwick Ketchum, The Water's Edge: Critical Problems of the Coastal Zone, (Massachusetts Institute of Technology, Cambridge, Massachusetts 1972), 393 pp.

10. supra note 2.

11. Arthur G. Gaines, "Papers on the Geomorphology, Hydrography and Geochemistry of the Pettaquamscutt River Estuary" (PhD dissertation, University of Rhode Island, 1975), p.6.

12. ibid, page 139.

13. ibid.

14. Richard Enser, Rhode Island Department of Environmental Management Natural Heritage Program, written communication to the Narrow River Special Area Management Planning Group, 1986.

15. ibid.

16. ibid.

17. B.T. Miller, "The Phytoplankton and related Hydrography in the South Basin of the Pettaquamscutt River", (Master's Thesis, University of Rhode Island, 1972), 119 pp. in Howard-Strobel et. al., supra note 5, pg 92.

18. Paul Hargraves, written communication to the Narrow River Special Area Management Planning Group, 1986.

19. supra note 17.

20. Rhode Island Division of Fish and Wildlife and Narragansett Marine Laboratory, "Pettaquamscutt River Investigation", (1958) 24 pp.

21. supra note 5, page 27.

22. Lorraine Joubert, Rhode Island Department of Environmental Management Office of Environmental Coordination, personal communication 1986.

23. State of Rhode Island, Water Quality Regulations for Water Pollution Control, Department of Environmental Management, Division of Water Resources, (Providence, Rhode Island 1986).

24. supra note 22.

25. Margaret Petruny-Parker, "Information on Bacteria Levels in the Narrow River and Failing Septic Disposal Systems in the Area: A Report submitted to A. Praeger, J. Mannarino, and C. Collins" (1986) 92 pp.

26. infra note 49; Olsen and Lee, supra note 6.

27. Paul Hargraves, "Memo to the Rhode Island Department of Natural Resources, Chief Replinger" (August 1, 1972) 14 pp. in Howard-Strobel et. al., supra note 5, pg 48.

28. Audubon Society of Rhode Island, Report to the Rhode Island Statewide Planning Program by the Rhode Island Natural Areas Project, (Providence, Rhode Island 1974), pg 45.

29. George L. Seavey, Rhode Island's Coastal Natural Areas: Priorities for Protection and Management, (Narragansett, Rhode Island:Coastal Resources Center, University of Rhode Island 1975) Technical Report Number 43, pg 40.

30. Roy Mann Associates, "A Plan for the Narrow River Watershed, prepared for the Tri-Town Narrow River Planning Committee" (Narragansett, South Kingstown, North Kingstown, Rhode Island 1976) 74 pp.

31. "Narrow River Studies Ignored, but New State Effort in Works", Narragansett Times, 5 September 1985, pg 1.

32. 16 U.S.C. Sec. 1451 et. seq.

33. United States Department of Commerce, State of Rhode Island Coastal Resources Management Program and Final Environmental Impact Statement (Washinton DC:Government Publishing Office, 1978) 488 pp.

34. supra note 7, pg 38 and 40.

35. ibid.

36. State of Rhode Island, Rules and Regulations Establishing Minimum Standards Relating to Location, Design, Construction and Maintenance of Individual Sewage Disposal Systems, Department of Environmental Management, Division of Land Resources (Providence, Rhode Island 1980).

37. Studies recognizing the problems of non-point pollution associated with individual sewage disposal systems that were constructed prior to modern engineering practices and state wide regulation are numerous; while the regulation of the design, operation and maintenance of these systems has improved and been modified since its advent in 1968, the problems of how to rectify existing

pollution contributions from older systems has been problematic, in great part because of the lack of state level or municipal efforts to address the problem head on. See, e.g. Olsen and Lee, supra note 6; State of Rhode Island, "Water Resources Issues in Land Use Policy", Rhode Island Office of State Planning, (Providence 1986) Technical Paper Number 122, pg 5; State of Rhode Island, Rhode Island's Nonpoint Source Management Plan:Preliminary Draft, Rhode Island Department of Environmental Management (Providence, Rhode Island 1988), 85 pp.; infra note 41; State of Rhode Island, Areawide Water Quality Management Plan, Statewide Planning Program (Providence, RI 1978), 130 pgs.

38. ibid.

39. State of Rhode Island, Areawide Water Quality Management Plan, supra note 37.

40. Olsen and Lee, supra note 6.

41. ISDS Task Force, Final Report of the ISDS Task Force to the Rhode Island Department of Environmental Management, Office of Environmental Coordination (Providence, Rhode Island 1987), 38 pgs.

42. "Residents Get Wet Reminder of Runoff Problem", Providence Journal, 3 December 1986; "Sewage Concerns to be Discussed Tonight" Narragansett Times, 20 March 1986.

43. ibid, Narragansett Times.

44. Rhode Island Projects for the Environment, "Pettaquamscutt River Individual Sewage Disposal System Study", (Wakefield, Rhode Island: Stedman Government Center 1980), 35 pp.

45. Rhode Island Department of Environmental Management, "Rhode Island's Nonpoint Source Management Plan: Preliminary Draft" (Providence, Rhode Island 1988), 85 pp.

46. ibid.

47. Olsen and Lee, supra note 6.

48. S.D. Hanisack, "An Ecological Survey of the Phytoplankton of the Pettaquamscutt River, Rhode Island" (Master's Thesis, University of Rhode Island, 1973); Hargraves, supra note 27.

49. United States Environmental Protection Agency, Chesapeake Bay: A Framework for Action, (Washington DC: Government Printing Office 1983). 186 pp.

50. Arthur W. Cooper, "Ecological Considerations", Coastal Zone Resource Management, James C. Hite and James M. Stepp, eds., (Praeger Publishers, 1971) pp 133-140 in Coastal Management: Readings and

Notes, Marc J Hershman and James H. Feldman, eds. (Seattle, Washington:Institute for Marine Studies 1979), pg 395.

51. Arild Underdahl, "Integrated Marine Policy:What, Why, How?", Marine Policy, 4(July 1980)3:159-168.

52. Ernie Englander, Jim Feldman, and Marc Hershman, "Coastal Zone Problems:A Basis for Evaluation", Coastal Zone Management Journal, 3(September 1977)3:219-226 in Coastal Management:Readings and Notes, Marc J. Hershman and James H. Feldman, eds. (Seattle, Washington:Institute for Marine Studies 1979), pg 20-21.

53. Lyle E. Craine, "Institutions for Managing Lakes and Bays", Natural Resources Journal, 11(July 1971)3:523-526, in Coastal Management:Readings and Notes, Marc J. Hershman and James H. Feldman, eds. (Seattle, Washington:Institute for Marine Studies 1979), pg 30-31.

54. supra note 51.

55. ibid.

56. supra note 1.

57. cite case law

58. Alexandra K. Dawson, Land Use Planning and the Law, (Hadley, Massachusetts, 1982), pg 73.

59. Title 45, Chapter 22-7 of the General Laws of Rhode Island, 1956, as amended.

60. Title 45, Chapter 22-6 of the General Laws of Rhode Island, 1956, as amended.

61. ibid.

62. ibid.

63. ibid.

64. See e.g. supra note 50; David L Strelchuk, "Managing the Shore Zone as A System" in Coastal Zone '80 (New York, New York: American Society of Civil Engineers 1980), pg 3072-3093; Jane L. Hegenbarth, "A Carrying Capacity Study of Hatteras Island", in Coastal Zone '85, (New York, New York: American Society of Civil Engineers 1985), pg 1848-1854.

65. supra note 60. Recent legislation in Rhode Island has moved to compensate for this ambiguity: the "Comprehensive Planning and Land Use Regulation Act" (Title 45, Chapter 22 of the General Laws of Rhode Island, 1956, as amended) was passed by the General Assembly

in 1988. The Act calls for the comprehensive revision and updating of municipal comprehensive plans by Rhode Island's communities and lists specific elements which must be addressed; additionally the legislation calls for the specific recognition and incorporation of state regulatory, management and development programs and provides for state-level review of the local plans to ensure conformity.

66. Jenny C. Meyers, "Governance of Nonpoint Source Inputs to Narragansett Bay: A Plan for Coordinated Action", Narragansett Bay Project (Cambridge, MA 1988), pg 14.

67. ibid.

68. ibid.

69 ibid.

70. Title 45, Chapter 24-1 of the General Laws of Rhode Island, 1956, as amended.

71. supra note 58, pg 37.

72. Title 45, Chapter 24-2 of the General Laws of Rhode Island, 1956, as amended.

73. Title 45, Chapter 24-3 of the General Laws of Rhode Island, 1956, as amended.

74. supra note 66, pg 14.

75. ibid.

76. The most prominant case was Anicelli vs. Town of South Kingstown, 463 A.2d 133 (RI 1983); The case involved the designation within a zoning ordinance as high flood danger zones the barrier beaches located within the Town of South Kingstown, and the prevention of Anicelli from constructing a house there. Despite recognition by the court of the exposure of barrier beaches to storm hazards, their fragility and the damage caused by construction and alteration of the barrier, the finding was that the regulation that prevented the construction of the house resulted in a taking of Annicelli's property for a public purpose without compensation. That the case turned on the fact that the barrier in question already supported significant levels of development, and therefore the zoning ordinance did not act to prevent a harmful use, the loss of the case by the town reinforced the conservatism of many municipalities in enacting aggressive environmental regulations, and is frequently quoted when the issue arises.

77. supra note 66, pg 14.

78. Title 45, Chapter 23 of the General Laws of Rhode Island, 1956, as amended.

79. Title 45, Chapter 23-3 of the General Laws of Rhode Island, 1956, as amended.

80. supra note 58, pg 45.

81. supra note 66, pg 219.

82. Riad G. Mahayani and Margurite Reich, Fiscal and Environmental Impacts of Subdivision Regulations in Rhode Island, (Kingston, Rhode Island:Rhode Island Agricultural Experiment Station, University of Rhode Island 1979) Agricultural Experiment Station Bulliten 430, pg. 3.

83. Town of North Kingstown, Zoning Ordinance: Article IV "Soil and Earth Removal", Article VIII "Overlay Districts", Adopted 1980; Subdivision and Development Regulations, Section V.A.4 "Limitation Districts", Adopted 1980.

84. Town of South Kingstown, Rhode Island, Zoning Ordinance, Section 306 "Waterbodies", Adopted 1976; Subdivision Regulations, Section II "Required Minimum Design and Improvement Standards," Adopted 1977.

85. Title 45, Chapter 34-1 of the General Laws of Rhode Island, 1956, as amended. This section of the General Laws primarily authorizes the municipalities to purchase land, enter into bond agreements and other financing arrangements; the siting of wastewater treatment facilities is regulated primarily through the regulations of the CRMC (in coastal areas) and the Division of Water Resources. The regulations act mainly through restrictions of wastewater discharges into various water quality classifications and through shoreline use designations under the Coastal Resources Management Program. The DEM and CRMC also conduct regulatory programs which require permits for the extension of sewer lines - in areas under the jurisdiction of the CRMC's Special Area Management Plan for the Salt Pond Region sewer lines are prohibited in certain areas of the ponds' watersheds; DEM's Water Resources Division requires an "Order of Approval", to insure conformance with municipal facilities development plans and to insure adequate capacity and treatment levels are available at the treatment plant. However, aside from these restrictions, municipal decisions guide the siting of plants and extension of sewer lines.

86. Title 45, Chapter 35; Title 45, Chapter 36 of the General Laws of Rhode Island, 1956, as amended.

87. State of Rhode Island, Report of the Governor's Committee on the Coastal Zone, Department of Natural Resources; Statewide Comprehensive Transportation and Land Use Program; University of Rhode Island, (Providence, Rhode Island 1970), pg 110.

88. Title 46, Chapter 23 of the General Laws of Rhode Island, 1956, as amended.

89. ibid, Section 6.

90. ibid, Section 6A.

91. supra note 33, page 258.

92. Robadue, Hennessy and Kaiser, supra note 2, page 13.

93. supra note 88.

94. Robadue, Hennessy and Kaiser, supra note 2, page 14.

95. ibid, page 16.

96. ibid, page 18.

97. ibid, page 19.

98. David W. Kaiser, "Environmental Decisions and the Courts:Legal Challenges to Decisions of the Rhode Island Coastal Resources Management Council and the San Francisco Bay Conservation and Development Commission", (Narragansett, Rhode Island:Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island 1986), pg 4.

99. Robadue, Hennessy and Kaiser, supra note 2, page 20.

100. supra note 33, page 262.

101. ibid.

102. supra note 89, Section 6.

103. ibid.

104. ibid.

105. supra note 89, Section 3.

106. supra note 89.

107. ibid.

108. ibid.

109. State of Rhode Island, "Coastal Community Land Use Review", Statewide Planning Program, (Providence, Rhode Island 1980) Technical Paper Number 82, pg 135.

110. Glenn Kumekawa, "Towards the Management of Narragansett Bay: An Institutional Analysis", (Kingston, Rhode Island: University of Rhode Island, Intergovernmental Policy Analysis Program 1987) Technical Report, pg 46.

111. Section 320 of the Coastal Resources Management Program establishes that the CRMC "shall review all activities inland of the area contiguous to shoreline features which may involve [any of the defined inland activities set forth at 46-23-6B], and make a determination of probability of conflict with the Council's programs" which triggers the regulatory review; the Council does however require regulatory review of all residential subdivisions of six units or more, any portion of which extends onto a shoreline feature or its contiguous area, or is within the watershed of specific coastal estuaries defined within the program.

112. State of Rhode Island, Coastal Resources Management Council Management Procedures, Coastal Resources Management Council (Providence, Rhode Island 1987), pg 4.

113. Olsen and Seavey, supra note 7, pg 74.

114. The Council utilizes an extremely broad definition of sewage and sewage treatment facilities which allows it to exert its jurisdiction inland, see supra note 7, Section 300.6, pg 74.

115. supra note 89.

116. Olsen and Seavey, supra note 7, page 88.

117. supra note 88.

118. supra note 33, page 266.

119. ibid, page 267.

120. supra note 88.

121. Regulatory responsibility for promulgating water quality standards was transferred to DEM in 1977 by 42-17 GLRI "An Act Enlarging and Reorganizing the State Department of Natural Resources and Changing its Name to the Department of Environmental Management"

122. supra note 33, page 268.

123. ibid.

124. ibid.

125. ibid.

126. ibid, page 171.

127. citation for bill State-local land use

128. supra note 33, pg 171.

129. ibid.

130. supra note 109, pg 154.

131. Title 2, Chapter 18 of the General Laws of Rhode Island, 1956, as amended; State of Rhode Island, Rules and Regulations Governing the Enforcement of the Freshwater Wetlands Act, Department of Environmental Management (Providence, Rhode Island 1981).

132. supra note 4; supra note 41.

133. ibid.

134. supra note 109, pg 140.

135. 33 U.S.C. 1251.

136. supra note 66, page 139.

137. supra note 131.

138. supra note 66, page 126

139. While the CRMC had not pursued an aggressive program aimed at developing consistency between local land use programs and the objectives of its programs on a statewide basis, the SAM Plan for the Salt Ponds region was primarily aimed at achieving this, supra note 6.

140. Robadue, Hennesy and Kaiser, supra note 2, pg 25.

141. ibid.

142. supra note 32.

143. Daniel S. Carol and David J. Brower, "Legal Considerations for Special Area Management" in Coastal Zone '83 (San Diego, California: American Shore and Beach Preservation Association and the California State Lands Commission, 1983), pg 2073.

144. Robadue, Hennesy and Kaiser, supra note 2, pg. 26.

145. ibid.

146. supra note 51.

147. ibid, pg 160.

148. ibid.

149. ibid.

150. ibid.

151. ibid.

152. ibid, pg 161.

153. ibid.

154. ibid.

155. ibid, pg 162.

156. ibid.

157. ibid.

158. ibid.

159. ibid.

160. Robadue, Hennesy and Kaiser, supra note 2, pg 26.

161. supra note 28.

162. Olsen and Lee, supra note 6.

163. Howard-Strobel et. al., supra note 5, Section 320.1.A.

164. ibid.

165. ibid.

166. Town of Narragansett, Chapter 246 "An Ordinance in Relation to Zoning", December 3, 1987, Section 2.1.

167. ibid, Section 3.1.

168. ibid, Section 3.4.

169. ibid, Section 3.4.3.h.

170. ibid, Sections 3.5; 3.6; 3.7.

171. ibid, Sections 6.1.4; 6.9.1; 6.9.2.

172. Personal communication from Brenda Dillman, Environmental Coordinator, Town of Narragansett, Rhode Island, 1988.

173. Personal communication from Clarkson Collins, Director of Community Development, Town of Narragansett, 1988.

174. Lombardo and Associates, "Middlebridge Wastewater Management Study, South Kingstown, Rhode Island, Final Report", (Boston, Massachuesetts, 1987), pg 8-1.

175. Written communication from Brenda Dillman, Environmental Coordinator, Town of Narragansett, Rhode Island, 1988.

176. Personal communication from Daniel Urish, University of Rhode Island, Department of Civil Engineering, 1987.

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