

NATURAL AND CULTURAL RESOURCES

Introduction

The ~~existing~~ Comprehensive Planning and Land Use Regulation Act requires a Natural and Cultural Resources Element that is intended to provide an inventory of the significant natural resource areas in the Town such as water, soils, prime agricultural lands, natural vegetation systems, wildlife, watersheds, wetlands, aquifers, coastal features, flood plains, and other natural resources, and the policies for the protection and management of these areas. The element also includes policies for the protection of the historic and cultural resources in the Town.

~~Under a proposed amendment to the Act, the required contents of the Comprehensive Plan split natural resource identification and conservation from historical and cultural resources identification and protection. The Act still requires an inventory of significant natural resource areas such as, but not limited to, water, soils, prime agricultural lands, forests, wildlife, wetlands, aquifers, coastal features, and flood plains. The plan must include goals, policies, and implementation techniques for the protection and management of these areas.~~ The historical and cultural resources identification and protection section likewise requires an inventory of significant historical and cultural resources such as historical buildings, sites, landmarks, and scenic views.

This Element will identify both natural ~~resource/conservation~~ and ~~historical/cultural~~ resources. This element includes goals, policies, and implementation techniques for the protection of these resources, and the policies and implementa-

tion techniques are identified at the end of this chapter.

The overarching goals of this element are:

1. To offer residents of Warren a high quality of life through the preservation and best use of natural, historic and cultural resources.
2. To maintain and reinforce Warren's small town character, emphasizing its natural setting and maritime, agricultural and industrial history as manifested in the continuing presence of wharves and harbors; extensive farmland; concentrations of historic houses; historic street patterns; and historic mills and mill-related buildings.

These policies are based on an understanding that growth will continue and that growth management and resource protection are necessary to ensure both the economic and environmental health of Warren. A healthy economy requires a healthy ecology. These goals and policies also lead to awareness of how the water has shaped the land, which likewise set limits and boundaries for the Town's growth in the past and will do so in the future. The settlement pattern initially set urban uses well apart from rural or agrarian ones. Over the decades, this distinct separateness blurred as differing land uses merged or were overlaid by new development patterns. While Warren is likely to change, its future must include land and resource protection as well as economic development strategies that retain a working waterfront, working farms, open space and historic resources.

Natural Resource Identification and Conservation

~~Warren is a small town with a heritage tied to its water related history and harbor and its rural ambiance, represented by the remaining farms and related open spaces.~~ Physically, the character of Warren can be defined into two main areas that are hinged together where Belcher Cove nearly connects with the Kickemuit River. To the south is the built-up sector that straddles a central spine that includes the village, Main Street and Metacom Avenue. This area's western edge is the waterfront backed up by the historic area and Main Street. To the east is

Touisset, a rural area that includes active farms and open spaces, along with housing and commercial uses. This rural area is remarkable for the remaining farms and the largely undeveloped character of Touisset. Warren has magnificent waterfront edges and scenic views, which becomes central to preserving its natural resources.

Warren's development history has resulted in residential uses interspersed with commercial/service uses and industries. A layering of predominant uses moves inland from the Warren River: waterfront, historic district, Main Street, mills, and related housing. From the Kickemuit River side, the land ranges from residential uses to commercial.

Warren residents know their proud heritage. The Town reads as a seaside town, but it also has a vibrant village and its assets lie in its historic fabric and the rural areas to the east. Efforts need to be made to aggressively retain the Town's history as manifested in prominent historic structures and outlying farmlands so integral to the history and quality of life in Warren. In addition, small scale infill development should be carefully designed so that it helps knit together the varied patterns of land use throughout the commercial areas of Warren.

In addition to benefiting local quality of life, capitalizing on town image can reap rewards by attracting businesses and tourism. In promoting itself, Warren must be careful to retain its true character; attracting regional visitors is most likely to be successful if the Town highlights its own unique coastal character.

Appendix A, Natural Resource Identification and Conservation provides details on the following:

1. Natural Conditions
2. Geography
3. Bedrock and Surficial Geology
4. Soils
5. Agricultural Soils
6. Freshwater and Coastal Wetlands
7. Water Quality and TMDL Plans³⁴
 - a. Palmer River TMDL
 - b. Kickemuit TMDL
 - c. Implementing TMDLs
8. Water Supply
 - a. Surface Water (Kickemuit Reservoir)
 - b. Groundwater
9. Flood Zones
10. Vegetation and Forest Resources
11. Rare, Threatened and Endangered Species
12. Air Quality
13. Hazardous Materials

³⁴ Section on TMDL's adapted from RIDEM's TMDL website www.state.ri.us/dem/programs/benviron/water/quality/rest/index.htm

Policies and Actions Natural Resource Identification and Conservation

Policy 1: Preserve, protect and acquire open space for the purpose of preserving and enhancing the natural and visual resources of the Town.

Actions to Implement Policy 1:

NCR	Action	Action Agents
1.1	Develop a more formalized Warren open space protection plan that prioritizes key parcels, and details protection measures.	Warren Land Conservation Trust, Planning Board, Conservation Commission Town Council, and Open Space Committee.
1.2	Support the Warren Land Conservation Trust in its effort to preserve environmentally and culturally significant properties through donated land.	Town Council, Planning Board, and Conservation Commission
1.3	Extend the conservation protection area around Belcher Cove and establish wildlife areas on the Palmer and Kickemuit rivers.	Town Council, Conservation Commission, Warren Land Conservation Trust, and Planning Board.
1.4	Establish a system of pedestrian trails to increase awareness of conservation lands and improve movement.	Town Council, Conservation Commission, and Warren Land Conservation Trust.
1.5	Erect platforms to attract nesting ospreys and further promote awareness of Belcher Cove and other conservation areas.	Town Council, Conservation Commission, and Warren Land Conservation Trust
1.6	Make use of the RI Natural Heritage Program’s comprehensive statewide inventory of the rarest and most vulnerable natural features to identify and protect wildlife habitat and rare, threatened or endangered flora and fauna. Incorporate this procedure into development review.	Conservation Commission, Warren Land Conservation Trust, Town Council, and Town Council.
1.7	Protect farmland and other valuable rural and natural resources by adopting protection measures such as conservation development guidelines.	Planning Board and Town Council.

NCR	Action	Action Agents
1.8	Work with farmland owners to establish a Farmland Protection Overlay District in the Zoning Ordinance, similar to the Kickemuit Reservoir Watershed Overlay District and the Waterfront Overlay District Development Plan Review.	Planning Board and Town Council.

Policy 2: Preserve, protect and open up scenic views and overlooks including those to and from the waterfront, of and across farmland, to the Kickemuit River, and of historic resources.

Actions to Implement Policy 2:

NCR	Action	Action Agents
2.1	Establish "scenic" zones and viewsheds and landscaping requirements are more defined and eliminate billboards on a town-wide basis.	Town Council, Warren Land Conservation Trust, and Planning Board.

Policy 3: Promote the siting of industrial and commercial uses so as to have minimal impact on natural resources. Consider vacant areas that are not naturally insignificant.

Actions to Implement Policy 3:

NCR	Action	Action Agents
3.1	Support potential use of the area bounded by Child and Franklin streets on the north and south and Arlington and Railroad avenues on the east and west as an industrial/service commercial park, emphasizing preservation of more naturally and scenically significant land.	Planning Board, Conservation Commission, and Warren Land Conservation Trust.

Policy 4: Maintain and improve public access to shorelines and investigate linking such amenities, such as the waterfront, to the Town center and to residential neighborhoods

Actions to Implement Policy 4:

NCR	Action	Action Agents
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NCR	Action	Action Agents
4.1	Identify, mark, enforce, and maintain established right-of-ways for pedestrian, bicycle and other access to the water. Explore new rights-of-ways to connect to existing ones.	Conservation Commission, Warren Land Conservation Trust, Town Council, and Harbor Commission.

Policy 5: Maintain, restore and protect groundwater quality and the water quality in Warren's rivers and reservoir for fish and wildlife habitat and for recreation and water supply purposes.

Actions to Implement Policy 5:

NCR	Action	Action Agents
5.1	Though amended in 2004, the Town should regularly update the Harbor Management Plan.	Planning Board, Warren Harbor Management Commission.
5.2	Monitor pollution of the Warren, Kickemuit and Palmer rivers.	Town Council, Conservation Commission and Kickemuit River Council.
5.3	Examine the zoning and subdivision regulations and investigate other means such as public education and onsite wastewater management to help meet the standards of the Total Maximum Daily Load (TMDL) Program for the Kickemuit and Palmer Rivers.	Town Council, Conservation Commission and Kickemuit River Council.

Policy 6: Preserve and protect the Kickemuit Reservoir and its watershed and tributaries for continuing use as a public drinking water supply and as a natural and scenic resource.

Actions to Implement Policy 6:

NCR	Action	Action Agents
6.1	Maintain input to the BCWA to retain and preserve the Kickemuit Reservoir and the rest of system as the primary or back-up water supply.	Town Council and Conservation Commission.
6.2	Protect the watershed through zoning, performance and development standards, purchase of development rights, and/or	Warren Land Conservation Trust, Conservation Commission, Plan-

NCR	Action	Action Agents
	outright purchase.	ning Board, and Town Council.
6.3	Work with neighboring Towns in protecting the watershed and monitor impacts of development actions in neighboring towns on Warren.	Warren Land Conservation Trust, Conservation Commission, Planning Board, Town Council, and Bristol County Water Authority (BCWA) state delegation.:
6.4	Join statewide and regional attempts to block Liquefied Natural Gas (LNG) tankers at every opportunity.	Warren Land Conservation Trust, Conservation Commission, Planning Board, Town Council, and state delegation.

Policy 7: Plan and implement roadside improvements that incorporate comprehensive street tree-planting and retention and building of stone walls.

Actions to Implement Policy 7:

NCR	Action	Action Agents
7.1	Develop a street tree-planting program for the downtown commercial area and subsequently for each residential neighborhood.	Conservation Commission, Wa ren DPW, and Town Council, and Tree Commission.
7.2	Enact an ordinance for the protection of historic stone walls, hedgerows and other rural remnants to help retain town character in more rural areas.	Warren Preservation Society, Warren Land Conservation Trust, Planning Board Town Council.

Policy 8: Oversee vigilant enforcement of environmental laws, codes and regulations and create public awareness of such laws.

Actions to Implement Policy 8:

NCR	Action	Action Agents
8.1	Encourage the Conservation Commission with a "watchdog" function regarding environmental violations; such a monitoring role should be carried out in close cooperation with the	Conservation Commission, Build ing Official, and Town Council.

NCR	Action	Action Agents
	Town Building Official.	
8.2	Incorporate Conservation Commission comments and recommendations into Planning Board decisions on development plan review.	Conservation Commission, Planning Board.

Policy 9: Promote environmentally sensitive site planning through the principles of smart growth and conservation development throughout Warren.

Actions to Implement Policy 9:

NCR	Action	Action Agents
9.1	Modify zoning and subdivision regulations to enact conservation development for the purpose of protecting environmentally and historically important sites.	Planning Board and Town Council.
9.2	Adopt creative land development techniques such as flexible zoning and conservation development that enable development, while preserving a site's salient features and the rural and working farm landscapes of Warren.	Planning Board and Town Council.
9.3	Mitigate environmental impacts from commercial development adjacent to residential areas by requiring innovative green technology wherever possible.	Planning Board, Chamber of Commerce, and Town Council.

Policy 10: Protect groundwater resources and public and private wells for current and future use.

Actions to Implement Policy 10:

NCR	Action	Action Agents
10.1	Conduct an inventory of threats to groundwater quality town wide and in particular within wellhead protection areas (WHPA). Prepare a local wellhead protection plan in accordance with the RI Wellhead Protection Program (WHP) Program. Refer to RIDEM's summary of the WHP Program.	Conservation Commission, Kickemuit River Council and Town Council.

Policy 11: Within unsewered rural areas of the Town, ~~establish a policy alternatives such as innovative and alternative (I&A) onsite wastewater treatment systems (OWTS).~~³⁵

Actions to Implement Policy 11:

NCR	Action	Action Agents
11.1	Establish an innovative and alternative (I&A) onsite wastewater management plan and ordinance to ensure the inspection and proper maintenance of OWTS.	Conservation Commission and Town Council.
11.2	Complete an onsite wastewater management plan that will enable the residents of the Town to qualify for low interest loans for the repair and replacement of failed and sub-standard OWTS and to phase out cesspools.	Conservation Commission and Town Council.
11.3	Support the implementation of the Touisset Point and Highlands Wastewater Management & Water Supply Impact Study By Fuss & O'Neill.	Town Council, Conservation Commission and Kickemuit River Council.

Policy 12: Establish and maintain measures to control sediment and erosion

Actions to Implement Policy 12:

NCR	Action	Action Agents
12.1	Monitor the Soil Erosion and Sediment Control Ordinance.	Planning Board, Conservation Commission, Town Council.
12.2	Include maintenance requirements as a condition of permit approvals and establish routine inspection and enforcement procedures.	Planning Board, Conservation Commission, Town Council.
12.3	Consider participation in Regional Compliance Inspection Programs; Staff of Conservation District will assist towns in im-	Planning Board, Conservation Commission, Town Council.

³⁵ The Department of Environmental Management's new Rules for septic systems took effect on January 1, 2008. Under the new Rules, the term "individual sewage disposal system" (ISDS) has been replaced with the term "onsite wastewater treatment system" (OWTS) to better emphasize the importance of treatment in system function and environmental protection.

NCR	Action	Action Agents
	<p>plementing the above requirements by reviewing site plans and performing site inspections. Town officials would maintain enforcement authority. It is proposed that a portion of building permit fees could be passed to the Conservation Districts to finance site review and inspection services.</p>	

Appendix A Natural Resource Identification and Conservation

Natural Conditions

This section summarizes Warren's natural environment including its geography, geology, ground and surface waters, water quality, soils, agricultural land, wetlands and coastal resources. The benefits and constraints of these resources as they relate to community development are also discussed.

Geography

The geography and natural systems of Warren are well defined and have strongly influenced settlement patterns. Though small in area, Warren has approximately 16 miles of coastline along the Palmer, Warren and Kickemuit rivers, and Narragansett and Mount Hope bays. The Kickemuit River has had a major influence on settlement and land use and separates several sections of the Town from each other. Like many communities on Narragansett Bay, Warren is made up of landforms that extend southward into the Bay.

Warren's topography ranges from sea level to approximately 90 feet. This is typical of the characteristics of the Narragansett Bay region. The bay and rivers have sculpted a land area of low ridges generally running north to south, separated by open water or lowlands that are characterized by high water tables and wetlands, generally unsuitable for development. Although erosion control is always an important consideration, steep slopes do not present a major development constraint. Slopes greater than eight percent characterize approximately 135 acres, 3.7 percent of Warren's soils. Substantial acreage however is constrained by the lack of slope. This together with overall low elevation leaves them vulnerable to periodic flooding and persistently poor drainage.

Bedrock and Surficial Geology

Bedrock and surficial geology describes the skeletal framework of the land and affects the distribution of soil types, surface hydrology and the location and amount of groundwater. Warren is part of the 102 square mile Narragansett Basin, composed of coal age (Pennsylvania Period) sedimentary rocks including conglomerate, sandstone, shale, and coal. Warren has a few bedrock outcrops mostly located to the east of Metacom Avenue and between Metacom Avenue and Main Street. Visible bedrock is evidence of the powerful scouring effect of the glaciers. Bedrock types include Scituate granite gneiss (sgf) Hope Valley alaskite (hva) and mafic dikes and sills. Mafic is a dark color igneous rock rich in magnesium and iron. Dikes and sills are rocks, which when in the molten condition, filled in either fissures (dike) or between layers (sill) of older rocks.

Surficial deposits are sandwiched between the bedrock and the soils and consist either of till or outwash. Till is an unsorted mixture of boulders cobble, gravel and sand deposited directly by glacial ice and is often characterized by an impermeable or restrictive layer. Outwash is a well sorted deposit carried by glacial melt water. Groundwater is generally more abundant in outwash than in till. Other deposits not of glacial origin include those deposits by waves, rivers or wind.

Warren is in the Narragansett Till Plains, which make up the area immediately around Narragansett Bay. This area is covered by glacial till composed of sedimentary rock, shale, sandstone, conglomerate, and, in a few places, coal. The till is generally compacted to a color ranging from dark gray to olive and is finer in texture than till derived from granite. Most of the landforms have been smoothed by glacial action. Till deposits in Warren (1,666 acres) are primarily located, to the west of Market Street north of School House Road, in a band along Birchswamp Road and Metacom Avenue and throughout much of the eastern portion of the town. Outwash deposits (2,279 acres) are located in the vicinity of Touisset Point and throughout much of the western portion of the Town.

Soils

The RI Soil Survey provides comprehensive soil mapping and classification. It describes the physical and chemical characteristics of particular soils and assigns soils to a hydrological group. It also discusses the constraints and benefits of each soil type relative to such things as construction, septic system functioning, natural resource and agricultural management.

The majority of Warren's soils (66%) present severe constraints for onsite sewage treatment systems. These soils are either slowly permeable or have high watertables or both and generally run in bands from the north to the south. In addition another 620 acres (17%) are characterized by excessive permeability. Excessively permeable soils include those soils with percolation rates of 5 minutes per inch or faster. These outwash soils have sandy or gravelly sub soils and due to the rapid percolation may inadequately treat septic system effluent. This is particularly true of nitrates, which in excess cause eutrophication of estuarine waters and presents a health threat to drinking water. Septic systems in these soils may require special design in order to prevent groundwater contamination and reduce nitrates.

Warren would benefit from an onsite wastewater (septic system) management plan and ordinance. This Wastewater management ordinance would require regular inspection and maintenance of onsite wastewater treatment system (OWTS) and cesspool phase out. Sewers have been necessary west of the Kickemuit, south of Belcher Cove and out along developed roads to the north. The remaining land continues in agricultural use. Extension of sewers into the western portion of Warren would facilitate suburban sprawl and is contrary to the comprehensive plan objectives of preserving Warren's environment and its agricultural and rural components.

Seventeen percent (630 acres) of soils are classified as urban. These soils vary in character and are located in the more built-up sections of Town. In addition to the urban soils ten acres have been classified as "du" (dump) and another 70 acres as beach.

Agricultural Soils

Much of Warren consists of prime and secondary farmland soils. Some of this productive land has been built upon, especially in the more urban western portion of the Town. These lands are primarily in the Touisset Point area, but a band down the center of the western area and extending into Bristol and out to the Kickemuit River is also designated as important farmland. Developed intensively, this area is effectively non-productive. Most of the agricultural land is located in the western portion of Warren and along the reservoir. Farms and nurseries in the Touisset area correspond with the soil designations.

As of 2003/2004 the land area of Warren is approximately 3,965 acres of which 17% is used for farmland. In terms of land cover/land use there are 521 acres of tillable cropland, 9 acres of orchards and nurseries and 143 acres of pasture for total of 673 acres.³⁶

In addition to purchasing development rights, farming should be encouraged through tax incentives and farm-friendly zoning regulations. Residential development that occurs in agricultural areas should be designed to protect as much agricultural land as possible. As an alternative to conventional subdivisions small-scale developments

³⁶ RIGIS Land Cover Land Use data 2003/2004. Note that the data collection method is different from previous Land Use Land Cover datasets for the State, so comparison, in terms of how much a certain land use has been gained or lost cannot be stated or calculated.

or family compounds with reduced road standards, flexible zoning and a decrease in allowable density should be required.

In addition to this element, the land use and economic development elements of the comprehensive plan emphasize the importance of preserving Warren's working farms.

Freshwater and Coastal Wetlands

Nature has set very definite limits to the types of development that can occur in Warren. In addition to flooding, the proximity of water presents coastal constraints governed by law and monitored by the CRMC, the Army Corps of Engineers and other regulatory agencies. Extensive inland water bodies and wetlands have related constraints and are protected to some degree by the RI Wetlands Act. The Town, however, should consider the cumulative impact of small changes on wetlands in the review of development proposals.

The principal drainage areas are the Kickemuit River, Mount Hope Bay, Narragansett Bay, Palmer River and Warren River. When developing water quality protection strategies, the characteristics of the basin and the receiving waters should be taken into account.

According to the RIGIS database Warren has 701 acres of wetlands. Of these 588 acres are freshwater and under the jurisdiction of RIDEM and the remaining 113 are coastal and under the jurisdiction of CRMC. Forested swamp and salt marsh are the two most prevalent wetland types.

The town has many freshwater resources including wetlands, ponds, streams and the Kickemuit reservoir. RIGIS Ponds data indicate approximately 47 acres of ponds and open water and 273.77 acres of Estuarine Emergent Wetland (salt marsh). Much of the remaining acres are deciduous forested or shrub wetlands that often follow streams running north to south. Some of these stream systems, particularly in agricultural areas support emergent wetlands (marshes).

There are three large wetland systems of statewide importance: the wetlands north of the reservoir, preserved as Green Acres; east of Long Lane along the Massachusetts border; and behind the Hugh Cole Recreation Park. These wetlands provide important habitats for flora and fauna, erosion and flood controls, pollution buffers and scenic resources. The location of wetlands within the more built-up sections of Town helps to explain why so many sub-neighborhoods are separated from adjacent development and why certain lands are not built upon. In some cases, wetlands have been so encroached upon that their natural condition is severely compromised. In extreme cases, such as in the center of Town between Child Street and the Bristol line, encroachment has all but obliterated original wetland conditions.

Warren is blessed with a good harbor and many saltwater wetlands. Hundreds of acres of salt marshes lie along the Warren, Palmer and Kickemuit rivers; they are among the state's most valuable coastal features. In addition to their scenic value, they are productive nursery areas for fish and shellfish, provide habitat for important flora and fauna, and serve as nutrient traps and buffers against storms and floods.

The Warren River has approximately 2.5 miles of saltwater coastline featuring a half-mile stretch of natural and manmade beaches and almost a mile of wetlands around Hanley's Point and Little Island. It abuts the downtown Waterfront Historic District, where stone wharves dating from the eighteenth and nineteenth century are still used today. Besides its obvious historic and scenic significance, the waterfront concentrates pollution from commercial and industrial sources, potentially making it easier to monitor and control. Little Island serves as a permanent wild-life refuge, pollution buffer and scenic resource in this busy harbor.

The Palmer River has roughly four miles of coastline, made up entirely of saltwater wetlands. RIDEM has designated 760 acres of these wetlands as top priority for protection and has classified the area SA, the highest environmental quality rating. CRMC has similarly categorized the area Type 1 (conservation area). In addition to providing scenic beauty, both the Palmer and the Kickemuit Rivers provide valuable fish, plant and wildlife habitats; offer year-round active and passive recreation; help control flooding, erosion and pollution; and accommodate fin and shell fishing.

Along the Kickemuit River there are approximately five miles of saltwater coastline, of which about 80% is wetland and 20% natural beach. The most outstanding feature is Chace Cove, which was the summer camp of Massasoit and the Wampanoags. Over 60 acres around the cove have been donated to the Rhode Island Audubon Society for permanent protection. This river is rated SA by the DEM and Type 2 (low intensity use) by the CRMC. The upper Kickemuit River and the Kickemuit Reservoir have approximately 3 miles of freshwater shoreline, along which 50% is pasture, 30% forest and 20% residential. The reservoir's watershed extends well inland, particularly on the eastern/southeastern side. Features along the banks of the upper river and the reservoir include five working farms, Warren's oldest cemetery, several historic homes, numerous archaeological sites, and Green Acres Heritage Park.

About one and a half miles of the Warren coastline along Touisset Point is natural beach abutting Mount Hope Bay. The area offers good swimming and fishing opportunities. Behind the beach are bluffs 30 feet high with spectacular views. Unfortunately, the bluffs are eroding at the rate of 2 to 5 feet per decade, posing a threat to the homes built here. Along Hanley's Point there is a stretch of natural beach about a half-mile long that faces Narragansett Bay. On the inland side of the beach is a 60-acre wetland of state importance. A DEM right-of-way extending from the bike path to the shore provides scenic views of the historic harbor, wetlands and the bay.

Warren's coastal water quality standards, developed by DEM in accordance with the federal Clean Water Act and state laws, "provide water quality for the protection and propagation of fish, shellfish and wildlife, and for recreation in and on the water; take into consideration their use and value as public water supplies; and take into consideration their use for aquaculture, industrial and other purposes including navigation."³⁷

Water Quality and TMDL Plans³⁸

Rhode Island's water quality restoration planning efforts are centered on the federally mandated requirement that states develop Total Maximum Daily Load (TMDL) plans for waters not meeting one or more water quality criteria. Consistent with federal Clean Water Act requirements, the Rhode Island Department of Environmental Management's Office of Water Resources identifies those waters not meeting water quality standards based upon the most recent assessment of water quality conditions completed as part of the state's new *Integrated Water Quality Monitoring and Assessment Report*. The resulting 303(d) List of Impaired Waters identifies these waterbody impairments (waterbody segment and water quality parameter specific) and prioritizes them for TMDL development.

Warren should work in concert with all other towns fronting the Bay to improve overall water quality. This can be accomplished by eliminating remaining point sources of pollution and the installing adequate storm sewers to eliminate periodic discharges into the Bay. The Town must monitor pollution and recreational activity in accordance with state water quality classifications. Local benefits include improved fin and shell fishing, increased swimming opportunities, and greater attractiveness to potential tourists and business opportunities.

³⁷ Harbor Management Plan

³⁸ Section on TMDL's adapted from RIDEM's TMDL website www.state.ri.us/dem/programs/benviron/water/quality/rest/index.htm

More insidious perhaps are sources of nonpoint pollution. These include such things as septic system effluent and stormwater runoff, which can contain everything from pet wastes and fertilizers to petroleum products. The implementation of an onsite wastewater management district and the use of structural and non-structural best management practices (BMP's) for buffer enhancement and runoff improvement should be implemented.

A total maximum daily load (TMDL) is a term that refers to a detailed plan to restore water quality to a waterbody that does not meet State water quality standards and is listed as impaired water on the State's 303(d) list of impaired waters. States must take into account seasonal variations and must include a margin of safety to account for uncertainty in the modeling and monitoring process. A TMDL reflects the total pollutant loading of the impairing substance a waterbody can receive and still meet water quality standards. TMDL Plans are currently being developed for the Palmer River for pathogens and nutrients and for the Kickemuit Reservoir for nutrients and bacteria.

Palmer River TMDL

The estuarine waters of the Palmer River lie in Rhode Island, but 90% of its watershed lies in Massachusetts. The Palmer River fecal coliform sources are from areas in Massachusetts and from two streams that flow into Belcher Cove. The sources in Massachusetts have been linked to agricultural operations, which are improving their management practices with the help of the Massachusetts Division of Food and Agriculture. The sources in the streams flowing into Belcher Cove are varied and include dog waste, storm water runoff, wildlife and agricultural operations. Measures are being put in place to reduce the fecal coliform sources in Belcher Cove. More detail can be found in the Palmer River fecal coliform TMDL.

The Palmer River also has high levels of nutrients loads, which affect reduce water quality by increasing algal growth and reducing dissolved oxygen levels, a condition referred to as hypoxia. The Palmer River is listed on the state's 303d List of Impaired Waters for nutrients and hypoxia. Nutrients increase the growth of phytoplankton and macroalgae which shade beneficial submerged aquatic vegetation. The excess growth of these organisms causes an increased use of oxygen during the night and early morning hours when the plants respire. Oxygen in the water column is also depleted when these organisms decay and the nutrients are then released back into the water column. This kind of decreased water quality condition is called eutrophication, and results in a decrease in the population size and diversity of animals and plants including eelgrass in the area. Eelgrass, a submerged aquatic plant, provides an excellent nursery ground for fish and shellfish. The Palmer River was once filled with eelgrass, but over the past century, the eelgrass in the Palmer River has disappeared completely.

Kickemuit TMDL

RIDEM is currently in the process of preparing a Total Maximum Daily Load (TMDL) plan for the Kickemuit, which serves as a drinking water supply for the Bristol County Water Authority.

EPA has provided extensive staff resources as well as \$50,000 in consultant services to monitor and model water quality in the watershed. Since most of the watershed lies in Massachusetts, RIDEM, is also involving state and local officials in Massachusetts in this restoration effort.

Implementing TMDLs

After EPA and the State have approved a TMDL, the town should examine its zoning and subdivision regulations and investigate other means such as public education and onsite wastewater management to help meet the standards of the plans. Non-point source controls may be established by implementing Best Management Practices (BMPs) through voluntary or mandatory programs for enforcement, technical and financial assistance, training and education, and demonstration projects. RIDEM evaluates the effectiveness of TMDLs using the following strate-

gies; monitoring pollutant loadings, tracking implementation and effectiveness of controls, Assess water quality trends in the waterbody, and reevaluate TMDL for attainment of water quality standards.

Water Supply

Surface Water (Kickemuit Reservoir)

In addition to water from the Scituate Reservoir transported through the cross bay pipeline, water is supplied by the Bristol County Water Authority (BCWA), which acquired the utility from the Bristol County Water Company in 1986. Locally, water is drawn from four reservoirs, the Kickemuit in Warren and three others in Swansea and Rehoboth. The Kickemuit Reservoir and nearby land is also an important local wildlife area.

The watershed of the Kickemuit Reservoir, including its acreage in adjacent communities, totals 3,310 acres. The Town adopted a watershed protection overlay district as part of its 1997 zoning amendments. The overlay district prohibits certain harmful uses within the watershed, establishes development standards for new subdivisions and requires site plan review for most uses within the watershed.

Even with the construction of the cross bay pipeline, the Kickemuit Reservoir must continue to meet current and future water supply needs. Furthermore, and more specific to this Element, the scenic natural habitat, open space, and recreational potential of the reservoir and its watershed should be protected and retained as a major inland facility for passive uses including fishing, picnicking, hiking and nature study. However, top priority use of the reservoir should be as a water supply.

Groundwater

Groundwater is water that lies beneath the surface of the ground and saturates the soil. This flowing water is usually located a predictable distance below the surface but has seasonal highs and lows. Although there are no significant aquifers in Warren, groundwater will continue to be an important water supply source outside of the water service area. In addition to the surface water reservoirs, water supply also comes from two wells in Barrington.

Most of the town's groundwater is classified as GA. The recharge area for the well at Touisset Point is classified as GAA. In addition there is a large area of degraded water quality (GB) in the center of Town and several smaller areas of GA non-attainment. In order to preserve Warren's groundwater for future use protection measures such as the adoption of an onsite wastewater management plan should be implemented.

Flood Zones

The Federal Insurance Rate Map (FIRM) is the legal document for determining flood zone location and may be viewed at town hall. Flooding is primarily limited to tidal surges caused by hurricanes. As a hurricane travels in its usual north to northeast direction, the counterclockwise wind circulation around the low-pressure center results in strong winds from all directions. Thus a hurricane passing near the Narragansett Bay area can create tidal surges along any shoreline where there is sufficient "fetch" length.

Located in the upper part of Narragansett Bay, Warren experiences high surge elevations due to the funneling effect the Bay has on severe cyclone storms passing by the area. Flooding from such surges occurred during the 1938 hurricane and again during Hurricane Carol in 1954. The 1938 hurricane, which was comparable to a 100-year flood, generated flood elevations of approximately 14 feet in Warren. Elevations from Hurricane Carol were about

13 feet. Locally, the effects of both storms were extensive, damaging properties along the Warren and Kickemuit rivers, Mount Hope Bay and Belcher Cove, as well as contaminating the Kickemuit Reservoir when water from the Kickemuit River poured over the Child Street Dam.

Zoning regulations and building codes for special flood hazard areas (A, V and V-30 Zones) conform to Federal Emergency Management Agency (FEMA) development standards. Many communities have developed hazard mitigation plans to address the impact of natural disasters such as flooding.

Vegetation and Forest Resources

Most of the remaining undeveloped land in Warren is wetland (900+- acres), farmland (795 acres), forested areas (406 acres) and brushland 30 acres. Eighty percent of the upland forests are deciduous, 2 percent are coniferous and 18 percent are mixed. (A forest with greater than 80% deciduous trees is considered deciduous, greater than 80 percent coniferous is classified as coniferous. Fifty to eighty percent deciduous or coniferous is classified as mixed). A greenway corridor extends from Palmer River to Touisset Point.

Rare, Threatened and Endangered Species

Warren has a number of ecologically significant natural communities and is home to several rare species. The Palmer River in particular provides critical habitat for rare species. The salt marsh along its shores is recognized as a high quality wetland, providing habitat for several rare species. Wetlands along northern parts of the river support the Northern Diamond Back Terrapin, osprey and several uncommon plants. A small area of critical habitat is also located in Touisset Point in the vicinity of Chase Cove. Other significant habitats in Warren include the power line/pipeline right-of-way, where species depend on open habitat and regular mowing and the wooded upland to the west of the right-of-way. Threats to these habitats include improper maintenance of right-of-ways, the spread of phragmites along the pipeline, dumping of household waste in the adjacent woodland, and potential development of the upland border of the marsh.

Air Quality

Warren's air quality is affected by the quality of air throughout the region. Clean, dry, high quality air arrives with fronts from Canada but must compete with moist air from the south and west that is often polluted by the New York/Washington D.C. urban corridor and the industrial Midwest. It is this air that has been recognized as the primary cause of acid rain affecting lakes and trees in the northeast, as well as posing a threat to pregnant women and persons with respiratory problems.

Sources of high-level air pollution in Warren are few but nonetheless threaten residents' health. One source is the buildup of carbon monoxide fumes from dense automobile traffic statewide that can create unhealthy conditions. In addition, local industries are known to emit noxious fumes.

In accordance with guidelines provided by the RIDEM Division of Forest Environment, the Town should consider implementation of development requirements pertaining to vegetation and lot coverage. In addition to improving the appearance and traffic circulation of development, these guidelines can help cleanse the air and mitigate the "heat island effect. While Warren and its residents can have little effect on regional air quality, local industry can be monitored for emissions violations.

Hazardous Materials

The Town should maintain specific plans for addressing the issue of hazardous materials in the workplace and on its roads. Ideally this should be embodied in a local Hazardous Materials Plan. The Town's emergency management operations include provisions for hazardous materials mitigation.

Historic and Cultural Resources

History of Warren

Located on the east bank of the Warren River, the town was named after a British naval hero, Admiral Sir Peter Warren, who was victorious at the battle of Louisburg, Nova Scotia, in 1745. The town originally developed as a port town, an important whaling center, and a farming community. In the 19th century, the town became home to several large industrial concerns, including the Warren Manufacturing Company cotton mill. Warren was the original site of the native village of Sowams and the home of Wampanoag Sachem Massasoit, friend and ally of the Pilgrims. As early as 1632, a trading post was established at Sowams by the Plymouth settlers. In 1636, Roger Williams, banished from Salem, fled to Sowams where he was sheltered by Massasoit until he settled in Providence. After the death of Massasoit, relations between the natives and the settlers became strained, leading to King Philip's War in 1638.

At a very early date, the inhabitants of Warren began to engage in maritime pursuits. By 1760 the town was well known as a whaling port and shipbuilding became an important industry. The Revolutionary War seriously affected Warren's commercial prosperity, and the town suffered British raids in 1778 along with the rest of the region. Within the decade after the Revolution commerce revived, and until the middle of the 19th century, Warren was famous for the fine vessels launched from its yards. These vessels, largely commanded by Warren men and operated by Warren crews, engaged in whaling, merchant service, and the West India trade. With the decline of the whaling industry and related seafaring commerce toward the middle of the 19th century, business attention turned to textile manufacturing. Warren's first cotton mill was erected by the Warren Manufacturing Company in 1847. Further mills and factories developed during and after the Civil War, attracting an immigrant work force.³⁹

As in many small towns, residents of Warren tend to maintain an affinity for the past. This section identifies scenic areas, candidates for National Register Historic Places, historic district zoning, historic sites and archeological sites. The historic resources of Warren are documented in the Rhode Island Historical Preservation and Heritage Commission's (RIHPHC) survey Warren, RI. Statewide Preservation Survey B-W-1 which was prepared in 1975 and has not been corrected or updated. Nonetheless, the survey is useful as an inventory and many of its historical photographs are still relevant. Although many of the structures no longer stand, it is important to note the overall history of the Town. According to the RIHPHC, the following areas are National Register Districts in Warren:

1. Warren Waterfront Historic District established in 1974 and expanded in 2003.
2. Warren United Methodist Church/First Methodist Church (and Parsonage amendment), 27 Church Street established in 1971.

Like most towns, Warren has grown in definable periods including Native American settlements along the coast and rivers; early European settlement of farms and the initial village; mercantile development and prosperity based on foreign sea trade; industrial-based growth and construction of worker housing; and, lastly, the post-industrial growth and suburban expansion.

Each period established a pattern that reflected the dominant uses and conventions of development common to that time. The Native American settlements were destroyed by European settlers and evidence persists only as archaeological sites. Early European settlers were motivated by fishing, boat building and mercantile trade opportunities and they established the street pattern within the Water Street/Main Street area from the Palmer River south. This period also contributed the small houses

³⁹ *Preserve America* Community Warren, Rhode Island.

and lots common to the seventeenth century and early eighteenth century. The outlying area was developed as farms, a pattern that is still evident today.

With the introduction of the mill and other forms of industry, the economic order changed with the nineteenth century Industrial Revolution. The need for an extensive work force resulted in a different scale and form of development that was no longer exclusively oriented towards the water. This type of development was still concentrated primarily in the southwestern part of Town but expanded towards the east. Large industrial and civic buildings and worker housing characterize this period.

Industry dominated Warren's identity through the early twentieth century until the gradual reduction of industrial activity in the latter part of the century introduced economic diversification, with a shift from manufacturing to service industries. This shift was primarily manifested along Market Street and Metacom Avenue. Suburban housing has expanded into the southwestern sector of Town.

Remnants of earlier periods, however, still have a positive influence on Town character. The old railroad tracks have become a well-designed and popular bike path. The street pattern in the historic areas of Town persists, as do many of the farms and some of their buildings. This rich fabric of its past provides a historical context that must be respected and should serve as a major determinant in the future development of Warren.

Appendix B, Historic and Cultural Resources provides detail on the following:


1. Historical Resources
2. Warren Waterfront Historic District
3. Kickemuit River Crossing/Windmill Hill Historic District
4. Touisset Neck Historic District
5. Historic Buildings
6. Archeological Resources

Policies and Actions Historic and Cultural Resources

Policy 3: Promote the preservation of historic and culturally significant buildings and sites.


Actions to Implement Policy 1:

NCR	Action	Action Agents
1.1	Enact a mandatory historic district zoning.	Massasoit Historic Association, Planning Board, Town Council Warren Preservation Society, and Warren Voluntary Historic District Commission (WVHDC).
1.2	Set up a revolving fund to be used in the rehabilitation of historic buildings, particularly those in the downtown area.	Massasoit Historic Association, Planning Board, Town Council Warren Preservation Society, and Warren Voluntary Historic District Commission (WVHDC).
1.3	Extend the existing downtown historic district to include additional historic structures and street patterns, extending the northern and southeastern boundaries.	Massasoit Historic Association, Planning Board, Town Council Warren Preservation Society, and Warren Voluntary Historic District Commission (WVHDC).
1.4	Consider the establishment of additional historic districts (per Inventory descriptions).	Massasoit Historic Association, Planning Board, Town Council Warren Preservation Society, and Warren Voluntary Historic District Commission (WVHDC).
1.5	Add to the State and National Registers future eligible properties including historic districts as well as individual properties.	Massasoit Historic Association, Planning Board, Town Council Warren Preservation Society, Warren Voluntary Historic District Commission (WVHDC) and RIHPHC,
1.6	Recognizing the significance of archeological sites such as Burr's Hill; conduct a town wide assessment of such sites and plan for their protection.	Massasoit Historic Association, Planning Board, Town Council Warren Preservation Society, and Warren Voluntary Historic

NCR	Action	Action Agents
		District Commission (WVHDC)
1.7	 Add historic district zoning protection to noncontiguous archeological sites.	Planning Board, Town Council, RIHPHC, and Warren Preservation Society.


Policy 2: Provide historic, environmental and cultural education opportunities to the public.

Actions to Implement Policy 2:

NCR	Action	Action Agents
2.1	Work with groups such as the Massasoit Historical Association, Warren Preservation Society, George Haile Library and Audubon Society to establish education programs on natural and environmental resources in Warren.	 Conservation Commission, Warren Land Conservation Trust, Warren Preservation Society, Massasoit Historical Association and Town Council.

Policy 3: Foster the Town's maritime identity by promoting water-related uses in the Water Street area.

Actions to Implement Policy 2: 

NCR	Action	Action Agents
3.1	<p>Plan and establish a waterfront park system, including walking paths.</p>	 Planning Board, Warren Preservation Society and Massasoit Historic Association.

Appendix B Historic and Cultural Resources

Historical Resources

Besides many significant historic buildings covering a wide range of periods and styles, Warren has a National Register District, two other historic districts, historic and archaeological sites, and a rich historic context. Of the three districts described below, only the waterfront historic area is currently an official historic district. In 1975, the Rhode Island Historic Preservation Commission recommended the other two areas as well.

Warren Waterfront Historic District

This district is bounded, approximately, by the Warren River on the west and north; Main Street and the railroad right-of-way on the east; and sections of Franklin, Campbell, and Wheaton Streets on the south (2/28/74; expanded 10/2/03).

First designated in 1974 and expanded in 2003, almost half a square mile of this area is in the District. Over 300 documented historic buildings dating as far back as the mid-eighteenth century are located within this district. Books, studies and documents show that this area has been recognized as historically important for over 150 years. Besides the large number and variety of individual historic buildings, the eighteenth century layout of the streets and wharves and the ongoing vitality of the waterfront add to the cohesiveness and importance of this district.

Kickemuit River Crossing/Windmill Hill Historic District

This historic area is noteworthy more for historic events and sites than for historic structures. The area is bounded on the north and east by the Massachusetts border, on the south by the old Fall River Railroad and on the west by Birch Swamp Road. Along the Massachusetts border are Margaret's Cave and King's Rock, site of the Wampanoag Nation's grinding mill. The oldest house in Warren, built by Levi Haile in 1682, still stands nearby. To the south along the Kickemuit River was the location of a "sweat," a hut where Wampanoags came to cleanse body and soul. Many significant events involving early white settlers and the Wampanoags took place in this area--including Massachusetts's 1653 sale to Hugh Cole and others of the first tract of the land later incorporated as the town of Sowams. Warren's first houses were built here but were destroyed during the war in 1675. Warren's oldest cemetery, dating from 1690, lies along the Kickemuit. The district also contains Windmill Hill and the Ice Pond, just north of the reservoir. With the exception of Green Acres Heritage Park and the cemetery, this important historic area has no protection or programs for preservation.

Touisset Neck Historic District


This rural area extends from the old Fall River Railroad south to Mount Hope Bay, bounded on the east by the Massachusetts border and on the west by the Kickemuit River. With the exception of two summer colonies started in the early 1900s, and recent suburban growth, Touisset has remains rural in character. The area contains several large historic farms and houses dating from the 1700s. The largest farm still in operation is Manchester's Farm, once known as "Gardener's Ideal Farm," comprising over 330 acres. The railroad that extended through the area in the 1860s increased the prosperity of the farming community, enabling farmers to sell produce and dairy products directly to Providence and Fall River markets. Today, development pressures and the lack of protective measures threaten the district's preservation.

Historic Buildings

A complete list of documented historic buildings can be found in the Warren, Rhode Island Statewide Preservation Report. The RIHPHC survey of Warren identifies several individual properties as possibly eligible for listing on the National Register. In addition, the Town has conducted an inventory of its housing stock by date of construction.

Archeological Resources

Warren has significant archeological resources, including Burr's Hill (between Main and Water Streets) which was a major Wampanoag burial ground from the 1500s to the 1700s. Although long thought to have been removed, parts of the cemetery may remain in the Town Park. The presence of the cemetery indicates that a sizable Wampanoag village may have existed nearby. The RIHPHC survey includes an overview of local archeology. Using this information, the Town should give special attention to known and potential archeological sites.

~~A large part of the town is listed in the National Register of Historic Places as the Warren Waterfront Historic District, covering more than half of a square mile and more than 300 buildings; an area of farms and early 20th-century summer residences centered on Touisset Neck outside of the town center has slowly been replaced with year-round homes.~~ 

~~With Community Development Block Grant funds, the town is supporting rehabilitation work for the 2nd Story Theater, a professional theater company housed downtown in the historic French Canadian benevolent and fraternal society building, Cercle Jacques Cartier Hall.~~ 