CRMC Guidelines - Non-regulatory Findings, References, and Figures from the Coastal Resources Management Program (Red Book): 650-RICR-20-00-1

This Red Book guidance document sets forth the findings made by the Coastal Resources Management Council and statements of basis and purpose of the regulations of 650-RICR-20-00-1. The guidance should be employed in interpreting R.I. Gen. Laws § 46-23-1, et seq.

Part 1.1.10 - Climate Change and Sea Level Rise (formerly § 145)

Findings

1. On very long (geologic) time scales, sea level naturally fluctuates in response to variations in astronomical configurations that cause changes in the Earth's climate system. Since the Last Glacial Maximum (approximately 26,000 years ago), global sea level has risen by over 390 feet (120 meters), as water that was previously trapped in continental ice sheets has made its way into the global ocean.

2. Sea level rise is a direct consequence of global climate change. Greenhouse gas emissions to the atmosphere increase surface warming, which in turn increases the volume of ocean waters due to thermal expansion, and accelerates the melting of glacial ice. Atmospheric greenhouse gas concentrations are already higher than levels at the last interglacial period, when sea levels were 13 to 19 feet (4 to 6 meters) higher than at present (Overpeck et al., 2006). Greenhouse gas concentrations are expected to continue to increase through 2100.

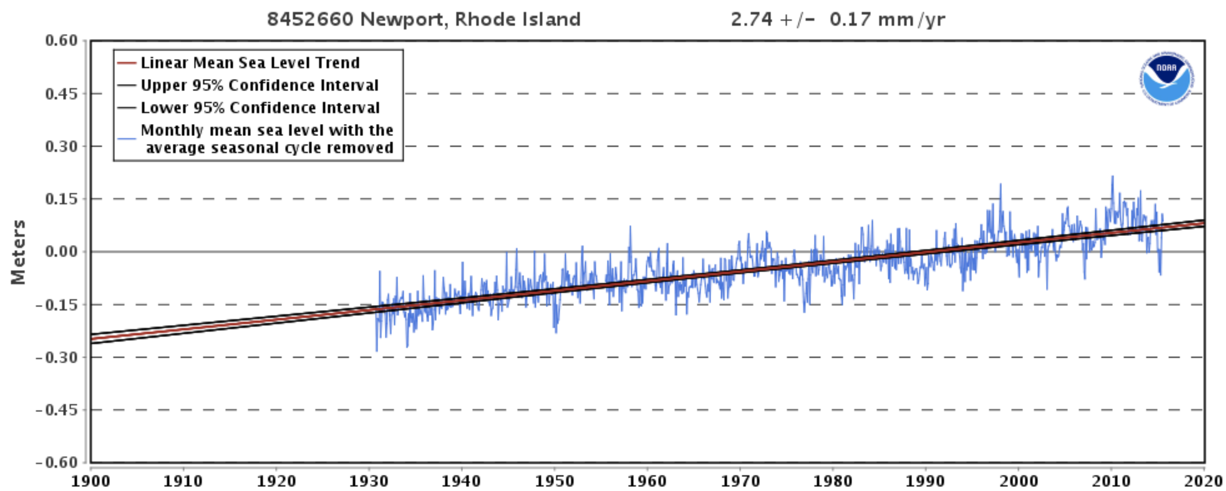
3. Human activities and increased concentrations of greenhouse gasses in the atmosphere have accelerated the historic rate of eustatic sea level rise. Over the last 100 years, sea levels have risen 0.56 feet (0.17 m) globally. The average rate of rise during the years between 1961 and 2003 was 0.071 inches per year (1.8 mm/yr), and between 1993 and 2003 the rate nearly doubled to 0.12 inches per year (3.1 mm/yr) (IPCC, 2007). The present rate of global sea level rise is 3.3 mm/yr as measured by satellite altimetry. See: http://sealevel.colorado.edu/.

4. In addition to rising global sea levels, the land surface in Rhode Island was believed to be subsiding at a rate of approximately 6 inches (15 cm) per century (Douglas, 1991). More recent studies indicate that many more factors, including changes in ocean circulation, contribute to Rhode Island's relative sea level rise than subsidence alone. The combination of these effects is evident from the long-term trend recorded by the Newport tide gauge (Figure 1), which indicates a rate of 10.8 inches (27.4 cm) of relative sea level rise per century or 2.74 mm per year.

5. The rate of sea level rise is accelerating. Future sea level rise, like the recent rise, is not expected to be globally uniform or linear. Some regions will become more substantially inundated than the global average, and others less. Of foremost concern is the trend in eustatic rise as observed from tide-gauge records over the past century. The rate of rise globally during the past 20 years is 25% faster than the rate of rise in any 20 year period that exists in the instrumental record (Church and White, 2006; Rahmstorf et al., 2007, Vermeer and Rahmstorf, 2009 and Rahmstorf et al., 2011).

6. Model-simulated projections of global sea level over the 21st century also clearly demonstrate accelerated progression. Predictions have ranged from 4 inches (10 cm) to several feet above current levels by the year 2100. As a rule, sea level estimates are increasing as the science of modeling becomes more developed.

Figure 1. Sea level has risen 9.1 inches since 1930 based on the long-term trend at Newport.



7. When compared with actual observations, modeling scenarios can be quite conservative, as recently observed rates of continental ice melt are greater than those used to generate estimates of sea level rise over the coming century. Since 1990, sea level has been rising faster than the rate predicted by models used to generate IPCC (2001) estimates (Rahmstorf et al., 2007).

8. Higher global temperatures indicate a greater risk of destabilizing the Greenland and West Antarctic ice sheets, yet a great amount of uncertainty remains as to the overall contribution from ice sheet melting The recent and much publicized Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2013) projects 11 to 39 in (28 to 98 cm) of eustatic sea level rise in the coming century. Sea levels are rising faster now than in the previous two millennia, and the rise is projected to accelerate – regardless of the emissions scenario, even with strong climate mitigation (IPCC, 2013).These estimates include limited contributions of ice flow dynamics and do not include local subsidence.

9. Rahmstorf (2007) and Rahmstorf et al. (2011) correlate global sea level rise to global mean surface temperature, which is a good approximation for observations of the 20th century. When this relationship is applied to 21st century warming scenarios, eustatic rise is projected between 1.6 to 4.6 feet (50 to 140 cm) above 1990 levels. Accounting for regional isostatic effects, this estimate suggests that by 2100 sea level in Rhode Island could rise approximately 2 to 5 feet (65 to 155 cm).

10. More recent scientific observations and refined climate models support previous projections and indicate that globally a range of sea level rise of between 2 to 6 feet (0.6 to 1.9 m) above 1990 levels is expected by the year 2100 (Jevrejeva et al., 2010; Vermeer and Rahmstorf, 2009 and Rahmstorf et al., 2011).

11. Regional rates of sea level rise will differ across the globe. The dynamic effects of ocean currents and the diminishing gravitational pull of dwindling ice sheets on ocean waters, have the potential to increase sea level rise rates at a particular location. Model projections indicate that a slowdown in the Atlantic Meridional Overturning Circulation (AMOC) may lead to a rapid rise in sea level on the northeast coast of the United States (Yin et al., 2009, Yin et al., 2011, Kuhlbrodt et al., 2009, Hu et al., 2009, Bingham and Hughes, 2009 and Kopp et al., 2010). Changes in static equilibrium of ocean and ice mass distribution will have an impact on relative sea levels depending on the rate of melt (Kopp et al., 2010).

12. U.S. Geological Survey scientists detail in their study (Sallenger et al., 2012) that recently accelerated sea level rise along the Atlantic Coast will result in sea levels 8 to 11 inches (20-29 cm) higher than the global average from Cape Hatteras, NC to Boston, MA by 2100. They present evidence that the rate of sea level rise increase in the study area was 3-4 times higher than the global average during the last two tidal epochs of 1950-1979 and 1980-2009. Sea level rise combined with storm surge, wave run-up and set-up will increase the vulnerability of near-shore areas to flooding, beach erosion and coastal wetland degradation.

13. A study by Strauss et al. (2012) examines topographic vulnerability of low-lying coastal land in the continental United States to sea level rise and flooding. The researchers found that there are presently 2705 housing units along the Rhode Island shoreline that are located less than 1 meter (39 inches) above local mean high water (MHW). These housing units are most at risk for increased flooding and eventual submersion as a result of sea level rise.

14. Tibaldi et al. (2012) investigated the historic patterns of extreme high tide events at 55 coastal locations of the contiguous United States using a detailed analysis of the NOAA tide gauge station data from 1979-2008 coupled with anticipated relative sea level rise. They calculate an increase of 5.1 inches (0.13m) by 2030 and 12.2 inches (0.31m) by 2050 above the 2008 mean high water level as measured at the Newport tide gauge. The study indicates that the frequency of extreme high tide levels will increase significantly in the coming years.

15. Climate change will result in wide scale systematic changes in the terrestrial and marine environments. These changes will result in ecosystem shifts that will challenge natural resource managers' efforts to cope and adapt to the new regime.

16. Future increases in relative sea level will displace coastal populations, threaten infrastructure, intensify coastal flooding and ultimately lead to the loss of recreation areas, public space, and coastal wetlands.

17. Coastal infrastructure will become increasingly susceptible to complications from rising sea levels, as the upward trend continues. Residential and commercial structures, roads, and bridges will be more prone to flooding. Sea level rise will also reduce the effectiveness and integrity of existing seawalls and revetments, designed for historically lower water levels.

18. Higher sea levels will result in changes in surface water and groundwater characteristics. Salt intrusion into aquifers will contaminate drinking water supplies and higher water tables will compromise wastewater treatment systems in the coastal zone.

19. Future increase in relative sea level will increase the extent of flood damage over time. Lower elevations will become increasingly susceptible to flooding as storm surge reaches further inland due to sea level rise in concert with a probable increase in the intensity of storms predicted from climate change. As a result, more coastal lands will be susceptible to erosion.

20. At historic rates of sea level rise, the relative surface elevation of a salt marsh may be maintained through the process of accretion (the build-up of live and decaying plant parts and inorganic sediments). Yet, at high rates of relative sea level rise as predicted by Rahmstorf (2007), accretive processes in coastal wetlands will not keep pace. These habitats can become submerged resulting in a loss of salt marsh vegetation and an alteration of habitat types. This has been demonstrated by the rapid salt marsh loss in coastal Louisiana. Observations by environmental researchers here in Rhode Island indicate that salt marshes are losing high marsh habitat as a result of more frequent inundation and possibly a consequence of accretion rates that are unable to keep pace with increased rates of sea level rise. As salt marshes and other coastal habitats become submerged, they migrate inland. However, coastal development has decreased the amount of upland open space adjacent to these habitats limiting their ability to migrate landward. Thus, an increase in the rate of relative sea level rise will likely result in significant losses of coastal saltmarsh habitats.

21. The average annual temperature of southern New England coastal waters, including Narragansett Bay, has risen approximately two (2) degrees Fahrenheit since the 1960's. This warming trend is implicated in the change of species composition and abundance in Narragansett Bay waters (Nixon, et al., 2003).

22. Increased water temperatures due to climate change will work synergistically with high nutrient levels to stress eelgrass beds. Eelgrass grows best in cool, clean waters. Even as nutrient levels in the Bay are reduced from wastewater treatment plants, if Bay and coastal waters continue to warm due to climate change, it will adversely impact eelgrass beds (Bintz, et al., 2003).

23. Barrier islands are forced landward with rising sea levels. Increased frontal erosion and retreat of the barriers will cause Rhode Island's south shore to migrate continuously landward with rising sea levels.

24. Due to the timescales associated with climate processes and feedbacks, anthropogenic warming and sea level rise will continue for centuries regardless of steps taken to curb greenhouse gas emissions (IPCC, 2007).

25. Flooding is a destructive natural hazard and results in economic loss to the citizens of Rhode Island. Approximately 154 square miles (14%) of the State's 1100 square miles of land area are mapped as Special Flood Hazard Areas by the National Flood Insurance Program (NFIP) where there is a 1% chance of flooding in any given year. (RIEMA, 2011). More than 16,000 buildings are located within these flood prone

areas with an additional 12,000 buildings located in areas mapped as 0.2% chance of flooding (based on CRMC GIS assessment of E911 data and flood zones).

26. All 39 communities within the State participate in the National Flood Insurance Program, yet only about half of Rhode Island property owners located within Special Flood Hazard Areas carry flood insurance (RIEMA and E911 data assessment).

27. Pursuant to R.I.G.L. § 46-23-6, the Council is authorized to develop and adopt policies and regulations necessary to manage the coastal resources of the state and protect life and property from coastal hazards resulting from projected sea level rise and probable increased frequency and intensity of coastal storms due to climate change. The Council is also authorized to collaborate with the State Building Commissioner and adopt freeboard calculations (a factor of added safety above the anticipated flood level), in accordance with R.I.G.L. § 23-27.3-100.1.5.5.

28. The U.S. Army Corps of Engineers (USACE) released a revised circular dated December 31, 2013 detailing its methodologies for assessing the impacts of sea level rise in the planning, design, engineering, construction, operation and maintenance of USACE civil works projects in coastal areas. The required project analyses determine how sea level rise scenarios may affect risk levels to the surrounding area and identify the design or operations and maintenance measures that will minimize adverse consequences while maximizing the beneficial effects of the project. See http://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1100-2-8162.pdf. In addition, the USACE in collaboration with the National Oceanic and Atmospheric Administration (NOAA) have released a sea level rise calculator available online at: http://corpsclimate.us/ccaceslcurves.cfm. The two NOAA tide gauges applicable to Rhode Island when using the sea level rise calculator are located in Providence and Newport.

29. NOAA has very high confidence that global mean sea level will rise at least 0.2m (8 inches) and no more than 2.0m (6.6 feet) by 2100 (Parris et al., 2012).

30. According to a USGS report (Titus et al., 2009), preparing in advance for expected sea level rise is justifiable for several types of impacts, as it may be less costly to react now than to react to an adverse condition in the future. Some examples:

· Coastal wetland protection. Preserving undeveloped lands abutting coastal wetlands allows wetland migration, but once developed, it is very difficult to make land available for wetland migration. Therefore, it is far more practicable to promote wetland migration by setting aside land before it is developed and preserving coastal buffer zones, than to require development to be removed as sea level rises.

· Some long-term infrastructure. Whether it is beneficial to design coastal infrastructure to anticipate rising sea level depends on economic analysis of the incremental cost of designing for a higher sea level now, and the retrofit cost of modifying the structure at some point in the future. Most long-lived infrastructure in the threatened areas is sufficiently sensitive to rising sea level to warrant at least an assessment of the costs and benefits of preparing for rising sea level.

· Floodplain management. Rising sea level increases the potential disparity between rates and risk. Even without considering the possibility of accelerated sea level rise, the National Academy of Sciences and a Federal Emergency Management Agency (FEMA)-supported study by the Heinz Center recommended to Congress that insurance rates should reflect the changing risks resulting from coastal erosion.

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Part 1.1.11 - Coastal Buffer Zones (formerly § 150)

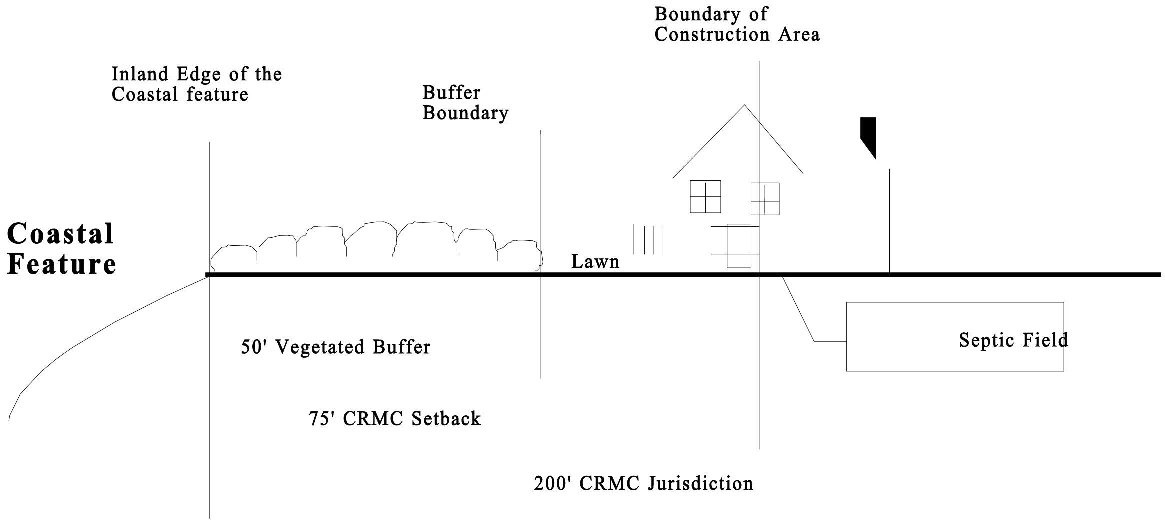
Findings

1. The establishment of Coastal Buffer Zones is based upon the CRMC's legislative mandate to preserve, protect and, where possible, restore ecological systems.

2. Vegetated buffer zones have been applied as best management practices within the fields of forestry and agriculture since the 1950s to protect in-stream habitats from degradation by the input of sediment and nutrients (Desbonnet et al 1993).

More recently, vegetated buffer zones have gained popularity as a best management practice for the control and abatement of nonpoint source pollutants (contaminated runoff) and are routinely applied in both engineered and natural settings (Desbonnet et al 1993; EPA 1993).

Figure 2. An Example of the Application of a Coastal Buffer Zone



Part 1.2.1 - Tidal and Coastal Pond Waters (formerly § 200)

Introductory Findings

1. Rhode Islanders have a deep commitment to their coastal environment. Their concern for Narragansett Bay and the South Shore coastal ponds has been voiced in numerous ways, including support of landmark legislation in 1971 that created the Coastal Resources Management Council, endorsement of many of the efforts of environmental organizations such as Save the Bay and the Audubon Society of Rhode Island, and passage of the largest bond issue in the state's history in order to relieve chronic pollution in upper Narragansett Bay caused by the antiquated Providence municipal sewage treatment plant. The concerns of the public have in large measure been responsible for decisions not to build oil refineries in Jamestown and Tiverton, and to halt the indiscriminate destruction of salt marshes and the improper disposal of dredged spoils. Narragansett Bay is widely accepted as the state's greatest resource, and our coastal waters and shoreline are the focus not only of tourism but of efforts to attract new businesses into the state. Rhode Island strives to maintain the image of a

desirable place to work and raise a family, and these attributes are inextricably bound to a varied and beautiful shoreline, where water quality and, no less important, visual quality are excellent and well protected. The qualities that make Rhode Island's coast beautiful and an unparalleled recreational resource are fully as important as the more readily quantifiable commercial and industrial water dependent activities. The designation of large stretches of waters or coastline for conservation and low intensity use by this Program recognizes these facts and will help maintain a high quality of coastal environment for future generations of Rhode Islanders.

2. More than 90 percent of Rhode Island's tidal waters are classified by the R.I. Department of Environmental Management as SA, the highest water quality rating. Water pollution, however, is a major concern, with eutrophication and bacterial contamination a growing concern in the salt ponds and with all major indicators of pollution showing strong gradients down the Bay from the Providence metropolitan area. Despite the pollutants and intense fishing pressure, Rhode Island's tidal waters support large seasonal populations of a variety of finfish. In the Bay, the quahog supports a large and important commercial fishery. Recreational fishing for flounder, bluefish, and striped bass is important nearshore.

3. Rhode Island has a rich history of maritime commerce and industry. In this century, however, the once booming urban waterfronts of the upper Bay have stagnated and declined despite major infusions of public funds to deepen the access channel to Providence to 40 feet and build new terminal facilities. During the postwar decades, oil imports have dominated waterborne commerce, but this sector has declined sharply since the mid-seventies. In 1973, the U.S. Navy announced a major pullout from its extensive facilities in the lower Bay, and by 1980 hundreds of acres of port facilities at Quonset, Davisville, Melville, and Coddington Cove had been turned over to the state. The State of Rhode Island now owns a large inventory of unutilized or underutilized port facilities. As commercial shipping has declined, recreational boating has increased. Facilities for the in water storage of boats are in short supply, but with very few exceptions expansion of marinas into new areas could only be accomplished if remaining salt marshes and other important natural features were sacrificed. Since this is considered unacceptable by the Council, the emphasis must be on the more efficient use of existing facilities, recycling of underutilized but already disturbed sites, and improvements to public launching facilities.

4. Activities that are dependent on Rhode Island's tidal waters generate substantial economic benefits to the state. Nearly one billion dollars are generated each year by such water related activities as marine industry, transportation and education, commercial fishing and marine recreation (Farrell and Rorholm, 1981). Substantial additional economic benefits are generated by water enhanced residential development, tourism, and the importance of an attractive marine environment in drawing high quality businesses to Rhode Island.

Part 1.2.1(A) - Type 1 Conservation Areas (formerly § 200.1)

Findings

1. The coastline that fronts directly on Long Island and Block Island Sounds includes some of the most dynamic and naturally scenic features in Rhode Island. These include but are not limited to the South Shore barriers and headlands, the erosion prone bluffs of Block Island, and Newport's rocky promontories. In order to adequately preserve these shorelines in these conservation areas, many activities proposed on shoreline features or in the tidal waters directly adjacent to these features must be severely restricted or prohibited.

2. Brigg's Marsh in Little Compton, Sachem Pond on Block Island, and Hundred Acre Cove in Barrington are examples of water areas which have exceptional value as waterfowl nesting and feeding habitat. Rare and unique assemblages of plants and animals and rich shellfish beds are found in these undisturbed waters. Many, but not all, water areas of well recognized significance to wildlife are within established sanctuaries or management areas.

3. Opportunities for scientific research and education have been enhanced by the designation of a National Estuarine Sanctuary in the upper Bay, one of some 15 similar designations nationwide. The sanctuary includes Bay waters extending to the 18 foot depth contour around Patience Island, the northern half of Prudence Island, and Hope Island.

4. Valuable conservation areas are not all in clean, rural environments. For example, Watchemoket Cove in the heart of the East Providence industrial waterfront is an important waterfowl resting area, particularly during the winter months when large numbers of canvasbacks, scaup, widgeon, and black ducks are present.

5. Several stretches of shoreline within Narragansett Bay have survived the rapid proliferation of residential development during recent decades in pristine condition. Examples include the Potowomut River, the Palmer River in Barrington and Warren, and the Mt. Hope Cliffs in Bristol. It is important that as much of this land as practicable be preserved from alteration to assure that Rhode Island's rich diversity of shoreline types and high scenic value are preserved.

Part 1.2.1(B) - Type 2 Low-Intensity Use (formerly § 200.2)

Findings

1. Type 2 waters are similar to Type 1 waters in their high scenic qualities, high value for fish and wildlife habitat, and, with some exceptions, good water quality. Densely developed residential areas abut much of the waters in this category, and here docks and the activities and small scale alterations associated with residential waterfronts may be suitable.

2. Major portions of the salt ponds along the South Shore between Watch Hill and Point Judith are assigned to Type 2 waters. Nearly all have retained their scenic and natural characteristics while accommodating residential docks, minor dredged channels, and small scale shoreline protection structures. Each coastal pond is an individually

distinct ecosystem and a unique feature of great scenic value. Continuing residential development within the watersheds of the salt ponds poses severe threats to future water quality in the form of both bacterial contamination and eutrophication. Permanent breachways built in the 1950s to provide easy access for boats to the ocean have radically altered the ecology of many of the larger ponds and are causing rapid siltation within the ponds.

3. Waters along open coasts which support low intensity uses associated with residential areas are found along stretches of the lower Bay. An example is the Sakonnet River, which separates Aquidneck Island from Tiverton and Little Compton. The Sakonnet waters are of high quality except for small areas adjacent to the few densely developed areas, and its shorelands are varied and picturesque, displaying large salt marshes, rocky cliffs, open agricultural fields, and wooded shoreline. The upper half of the Sakonnet River is a productive quahog ground and is fished commercially. Conchs are fished commercially throughout the river, and Almy Brook, which drains into the Sakonnet from Nonquit Pond, contains a sizable alewife run.

4. Several small riverine estuaries such as the Kickemuit River in Warren and the Pettaquamscutt (Narrow) River in Narragansett, South Kingstown, and North Kingstown are also assigned to Type 2 waters. These rivers contain extensive salt marshes and rich diversity of fish, shellfish, and waterfowl. Extensive residential development and restricted flushing combine to pose severe water quality concerns similar to those in the more developed salt ponds. Scenic values, however, remain high, and local residents are highly concerned that activities such as shellfishing and swimming are maintained and not preempted by poor water quality.

Part 1.2.1(C) - Type 3 High-Intensity Boating (formerly § 200.3)

Findings

1. Marinas are the principal means by which the boating public gains access to tidal waters, and therefore provide an important public service. Only beach going involves more Rhode Islanders in a recreation activity that makes direct use of tidal waters. In 1978, some 65 percent of all slips and moorings were within marinas and yacht clubs, and nearly all of these are within Type 3 waters.

2. Marinas face a number of difficulties. The boating season in Rhode Island is confined to six months, with most of the activity concentrated in June, July, and August. Many marina operations have difficulty in generating income during the remainder of the year and are economically marginal businesses. Nearly all the existing marinas were built when the value of waterfront property was far lower than it is today, and the pressure is mounting to convert marginal operations occupying high-value waterfront land to more profitable uses.

3. In many locations, marina operators are plagued with siltation problems and find it difficult to find acceptable sites for their dredged materials. Dredging problems can be best solved if the marina operators within a cove or harbor join together to finance the dredging and find a common local solution to the disposal problem. Options such as marsh building, beach nourishment, or the transport of materials to a more distant

location become technically and economically feasible when a sufficiently large volume of material is to be moved and a united effort to solve the problem is organized.

4. The growth in the size of the recreation fleet, limited berthing opportunities, and the increasing expense of in-water storage have contributed to rapid growth in the number of trailered boats. This has placed a heavy demand on public launching ramps, which are in short supply and many of which are in deteriorating condition or have limited parking capacity.

Part 1.2.1(D) - Type 4 Multipurpose Waters (formerly § 200.4)

Findings

1. The open waters of Narragansett Bay and the Sounds are used for a number of purposes including commercial and sport fishing, boating, commercial shipping, aquaculture, and scientific research. These areas are highly productive of fish and shellfish, and support substantial commercial fisheries including a small dragger fishery, seasonal lobstering, and shellfishing. The overwhelming majority of activity is in shellfishing, particularly quahogging. The quahog fishery has grown steadily over the past decade, and in 1980 the reported landings of quahog meats peaked at an all-time high of 3.5 million pounds, worth over $11 million. It is generally accepted that the reported catch is substantially less than the actual. In 1980, Rhode Island supplied more than one quarter of the nation's total harvest, and the fishery provided full time employment to some 1,300 fishermen and part time employment to an additional 2,300. The boundaries of principal grounds for the quahog trawler and lobster fisheries are shown in a general manner on maps in "An Aquaculture Management Plan for Rhode Island Coastal Waters," prepared in 1981 by W.J. Lapin of the Department of Environmental Management. A significant portion of the Bay's quahog beds is in upper Bay areas permanently closed to shellfishing, and many of the currently most productive grounds are closed for much of the year. Water pollution is thus a major threat to the Bay's shellfisheries.

2. In the early years of this century, the Bay supported a lucrative oyster culture industry. In 1910, some 20,000 acres of Bay bottom were leased to private growers. Conflicts between oyster growers and commercial shellfishermen were intense. The oyster industry began a rapid decline in the 1930s and ended in 1957. In the late 1970s, a new form of aquaculture using intensive off bottom culture methods was proposed for several locations. By mid-1982 three leases had been granted by the Council in the Bay and in the coastal ponds. Commercial fishermen oppose the reestablishment of aquaculture in the Bay fearing encroachment on their grounds and impacts on shellfish prices. Aquaculturists argue that their intensive methods need not compete with traditional fisheries for prime grounds and that aquaculture could provide the state with a new industry, providing jobs and revenues from a renewable native resource. Aquaculturists use floating structures such as rafts or lines suspended form buoys or may conduct their activities on the bottom. Most aquacultural activities involve fixed and relatively permanent structures. While the species potentially suitable for aquaculture are almost unlimited, the species of current interest for Narragansett Bay are mussels, oysters, and quahogs.

3. Boaters and sport fishermen are another major user group of Type 4 waters. The majority of the state's estimated 33,000 (1979) recreational boats are used on the Bay. Sport fishermen take large numbers of flounder, bluefish, and striped bass each year. The scenic qualities of the Bay, good water quality, and control over preemptive uses are essential to all recreational users.

4. A major concern to all users of Type 4 waters is good water quality. The major source of all principal pollutants to the Bay, including pathogenic bacteria, nutrients, petroleum hydrocarbons, metals, and exotic organic chemicals, are the urban and industrial centers that discharge into the Providence River. Strong down Bay gradients are seen in both the sediments and water column for all these pollutants. The long term combined impacts of pollutants on the Bay ecosystem are not well understood. There is evidence, however, that pollutants that enter the Providence River may be impacting the Bay as far south as Hope Island. The major sources of pollutants to the Bay are the rivers that drain some 2,000 square miles in Rhode Island and Massachusetts, the effluents from sewage treatment plants, and urban runoff.

Part 1.2.1(E) – Type 5 Commercial and Recreational Harbors (formerly § 200.5)

Findings

1. Type 5 waters all support a vibrant mix of commercial and recreational waterfront activities. All have important historic value that must be preserved. Competition for space is intense in all Type 5 waters, commercial fishing vessels, recreational boats, and ferries compete for limited water space, while waterfront businesses of many varieties vie for a position on the waterfront. The visual quality of these areas is highly important, since all are centers for tourism.

Part 1.2.1(F) - Type 6 Industrial Waterfronts and Commercial Navigation Channels (formerly § 200.6)

Findings

1. The Port of Providence extends some ten miles along the Providence and East Providence shores of the Providence River and is the state's principal general cargo and petroleum port. Import and export of products moving through the port have a major impact on the state's economy and generate jobs and economic activity in many other sectors. In fiscal 1981, 5.3 million tons of petroleum, steel, cement, automobiles, lumber, scrap metal, and other non-petroleum commodities were received or shipped. The Providence shipping channel is dredged to an authorized depth of 40 feet. Large segments of shoreline and water in the port area are in derelict condition and littered with abandoned piers and sunken barges. Efforts to expand and improve the port have been underway for many years. In East Providence, across the channel from the Providence municipal wharf, the Providence and Worcester Railroad Company has made large investments in a major new landing pier. On the Providence side, infusions of public funds have brought many improvements, but much remains to be done. Priority problems include the difficulty in finding acceptable sites for dredged materials produced by maintaining or improving existing channels and berths, and the need to

remove some 26,000 cubic yards of debris that forestalls the reuse of presently derelict areas. Coordinated planning and development efforts are essential to any initiative to improve the port and make it more competitive.

2. In the 1970s large scale port facilities and waterfront industrial sites at Quonset Davisville, Coddington Cove, and Melville were declared surplus by the Navy. These sites are available for redevelopment principally through the R.I. Port Authority. Some of the port facilities in these areas are in disrepair, and will require major infusions of capital if they are to be reused, while others are in good condition and are in active use for shipbuilding and other water dependent purposes. These facilities, when combined with the derelict waterfront in the Providence River, give the state a large inventory of unutilized or underutilized port facilities.

3. Rhode Island supports a thriving offshore commercial fishing industry based at the ports of Galilee and Newport. Galilee is home port to some 160 vessels, which landed 56 million pounds of fish and shellfish worth $11.7 million in 1982. The port facilities at Galilee are owned by the state and managed by the Department of Environmental Management. A large portion of the 21 million pounds of fish and shellfish worth $13 million (1979) landed at Newport is caught by vessels that have home ports out of state. Fishing vessels berthing at Newport utilize facilities managed under lease by the Department of Environmental Management. Rhode Island's commercial fishing fleets are growing but are severely hampered by limited berthing and unloading facilities. An expansion and improvement program of the state facilities at Galilee and Newport has been underway for a decade.

4. Nearly all Rhode Island's boating and shipping facilities require periodic dredging to maintain adequate water depths in channels and turning basins and at berths. Until the mid-sixties, dredge spoils were disposed with little concern for environmental impacts. Salt marshes were filled, new sandbars and spits created, and the largest project in recent history, the deepening of the Providence channel from 30 to 40 feet, left a large spoil mound off Brenton Reef in the Sound and a legacy of vehement opposition by fishing interests to any offshore disposal. For the past two decades, finding acceptable solutions to dredged materials disposal needs has proved difficult. Salt marsh building, bulk heading, and beach nourishment are frequently viable solutions where small volumes are concerned, but offshore dumping may be the only cost effective solution for large projects. All solutions raise concerns, and energetic opposition is frequently organized. Finding acceptable, environmentally sound solutions to dredged materials disposal remains an important challenge for the coastal program.

Part 1.2.2 – Shoreline Features (formerly § 210)

Introductory Findings

1. A great variety of geologic forms can be found where tidal waters meet the land. Where a coast is exposed to the forces of the open ocean, as along the South Shore, sea cliffs and wide sand or gravel beaches predominate. In sheltered waters, salt marshes and mud flats are common. The shoreline of Narragansett Bay is composed principally of narrow beaches of pebbles and cobbles that are backed by an often

unvegetated bluff of unconsolidated glacial sediment. Rhode Island's diversity of shoreline types provides a wealth of visually distinct areas, each of which supports different mixtures and intensities of use. This diversity must be recognized and maintained. The postwar decades have brought an explosion in the development of formerly rural coastal lands, and by the early 1980s most of the waterfront property that could be readily developed had been subdivided. Nearly all the remaining available parcels are within existing developments or they present natural constraints to the developer, such as poorly draining soils or steep slopes. Despite the recent surge of building along the lower Bay and South Shore, the coastline has retained much of its beauty. The appearance of long stretches of the coast from the water and vantage points along the shore provides a sense of natural beauty and open land; structures are not overly obtrusive. This quality, however, could be lost over the next few decades as the remaining farmland and estates, now worth great sums, come on the market and are sold off as house lots. Another major concern for the Council is the cumulative impact of individually minor alterations, particularly those brought about by residential development, on the qualities of the coastal environment.

2. All shoreline systems are dynamic, and change their shape and character in response to storms, tidal currents, human modifications, and the gradual rise in sea level. Twenty-five thousand years ago, at the time of maximum advance of the last glacial ice sheet, the ocean shoreline of Rhode Island was displaced over 15 miles seaward of Block Island. Sea level was lowered about 300 feet because ocean water was locked up in the glacial ice. Sea level began to rise as the ice melted, displacing the shoreline northward as the sea inundated Block Island Sound, and later, Narragansett Bay. Sea-level rise is also due to subsidence of the land and thermal expansion of ocean waters.

3. A principal concern of waterfront property owners is frontal erosion and storm-surge flooding. The susceptibility of any length of shoreline to erosion is determined by the type of shoreline (see Table 3) and its exposure to storm surge and waves during severe storms and hurricanes. Storm surge occurs when a combination of low atmospheric pressure and the force of high winds over a large expanse of open water causes sea level to rise dramatically along the coast, particularly at the head of funnel-shaped embayments like Narragansett Bay. During the 1938 hurricane, the storm surge forced water levels 12 feet above mean high water at Point Judith and over 13 feet at Providence. Waves 10 feet high and more were measured on top of the surge level. Such events are not rare; the state has been struck by 73 hurricanes in the past 350 years, 13 of which have caused severe flooding and erosion. In this century, the 1938 hurricane left 311 dead and nearly 2,000 houses destroyed, and Hurricane Carol killed 15 people and destroyed 3,800 houses in 1954.

4. In Rhode Island, most shoreline erosion takes place during moderate and severe storms, with recovery of sediment to beaches and foredunes in intervening periods. Many of today's shorefront residents acquired property in the middle 1980's during a period of relatively few storms and are unfamiliar with sustained periods of storminess or high category hurricanes. Most private shoreline protection structures which predate the RICRMP are under built or poorly designed with respect to major storms.

5. The federal flood insurance program guarantees subsidized insurance for buildings that meet defined construction standards in flood hazard areas. This program has encouraged building in some highly hazardous areas contrary to good coastal management practices.

Table 3. Shoreline Types and Their Susceptibility to Erosion (Adapted from Boothroyd and Al-Saud, 1978).

(A, most susceptible; E, least susceptible)

Type	***Characteristics***	***Example areas most susceptible to erosion due to their exposure***
Beaches (A)	Unconsolidated sand, gravel or cobbles, backed by a headland bluff.	Oakland Beach (Warwick) Matunuck Beach (S. Kingston) Scarboro Beach (Narragansett)
Barrier Spits (A)	Unconsolidated sediment that forms a spit parallel to the mainland and separated from it by a marsh or pond; Sand dunes are often present.	All South Shore barriers South side Conimicut Pt. (Warwick) Barrington Beach (Barrington) Jenny Pond spit (Prudence Island) Briggs Marsh barrier (Little Compton)
Headland Bluffs of Glacial Outwash (B)	Gravel, sand, silt, and clay deposited in glacial rivers and lakes as ice melted 15-18,000 years ago.	Buttonwoods (Warwick) Occupasstuxet Neck (Warwick) Coggeshall (Warren) Island Park (Portsmouth)
Headland Bluffs of Glacial Till (C)	Unsorted mixture of gravel to clay deposited in contact with glacier ice.	Northeast side of Pt. Judith (Narragansett) Briggs Pt. (Little Compton)
Soft Bedrock (D)	Sedimentary rock usually in the form of terraces or scalloped cliffs.	East shore of the Bonnet (Narragansett) East facing segment of the Newport Cliffs
Hard Bedrock (E) and	Least susceptible to erosion	Hard bedrock is composed of

Discontinuous Bedrock granite and metamorphic rocks;

Discontinuous bedrock, either hard or soft, often extends from the shore as a natural breakwater.

Part 1.2.2(A) - Coastal Beaches (formerly § 210.1)

Findings

1. Beaches are dynamic, flexible features. The character of a beach is determined primarily by the particle size of the sediment and by the amount of wave and current action. Beaches are formed by sediment that is carried by waves and longshore currents from eroding headlands, from up current beaches in the longshore system, and from the subtidal shoreface portion of the shoreline. It is often difficult to establish the source of sediment for an individual beach, but shoreline protection facilities such as bulkheads, seawalls, groins, or jetties can alter significantly the volume supplied by suppressing the source or altering the transport of sediment along the shore. Such structures can retard erosion at one site while increasing erosion rates on an adjoining property. Beaches alter their volume and shape in response to regional weather patterns. During stormy periods, large waves erode the beach and foredune zone and deposit sediment offshore on the subtidal shoreface as bars or platforms. These bars function to dissipate wave energy and thus retard erosion of the intertidal beach. Sediment is transported from the shoreface back to the beach during periods of fair-weather by small waves and a broad berm is deposited. There are usually fewer storms in the summer then the other three seasons, thus the beach (berm) has more volume at that time; however, the passage of hurricanes may interrupt this trend. Longshore currents generated in the surf zone by waves striking the beach at an angle transport sediment in the direction of the open angle. Coastal protection structures that protrude onto the berm may interrupt the transport of sediment along the beach, resulting in deposition on the up current side and increased erosion down current of the structure.

2. All beaches associated with barriers along the ocean shore and several isolated beaches within the Bay are important recreational resources that are used by some 100,000 residents and tens of thousands of out of state tourists on hot summer days.

Part 1.2.2(B) - Barrier Islands and Spits (formerly § 210.2)

Findings

1. Rhode Island's South Shore coastal ponds and a frequently low lying mainland are protected from the forces of the open ocean by a chain of low, narrow barriers. Their importance as buffers against storms, the continuing pressures to build upon them and a long history of disasters during hurricanes have made the regulation of activities on barrier a primary concern of the Coastal Resources Management Council. Several barriers that had all structures destroyed in 1938 and 1954 are again developed.

2. The flexibility of barriers permits them to withstand the severe forces of erosion to which they are exposed. All ocean-fronting barriers are migrating inland in response to

those natural erosion forces and to sea level rise. The migration process takes the form of “rolling over,” whereby sand eroded from the ocean beach is transported by storm-surge overwash water and deposited on the barrier and in the coastal lagoon landward of the barrier. The peat sometimes seen along the ocean shore of barriers is evidence of the past existence of a marsh that once flourished behind an older, more seaward barrier. This same flexibility makes barriers particularly ill-suited to human occupation. Not only do buildings interfere with foredune growth but during major hurricanes debris from shattered structures is swept inland, causing additional destruction on the barrier and on adjacent low-lying mainland areas, increasing property damage, and complicating cleanup efforts. Sixty-five percent of Rhode Island’s 27.3 miles of ocean-fronting barriers are undeveloped. The recreational opportunities and uniquely beautiful open space they provide are of growing importance in an increasingly developed region.

3. The damage that barrier islands and spits can sustain in major storm events is significant and as such they are considered high hazard areas. During actual storm events, high hazard areas can create dangerous situations even for emergency response personnel and as such all personnel, including emergency response personnel, should be kept out of these areas during major storm events.

4. Within Narragansett Bay there are several small barriers that are also highly susceptible to damage during major storms. With few exceptions, these barriers have not been developed and provide locally important natural areas of great beauty and often considerable recreational value.

5. In some cases barrier islands and spits do not have dunes associated with them. For the purposes of measuring setbacks, the feature shall be the coastal beach, dike, or revetment, whichever results in a greater setback.

6. The Council accepts climate change models that indicate that sea level rise rates will accelerate and it is likely that the frequency of intense storms will increase as global temperatures rise (IPCC 2007). The combination of more severe storms and higher sea levels will impact the barriers. Storm surge overwash is the mechanism that causes barriers to migrate landward and also increase in elevation (Otvos and Carter 2007; Riggs and Ames 2007). This increased elevation will become increasingly important as sea level rises. Studies of the underlying geology, sediment supply and coastal processes to barrier systems in the Outer Banks and the Gulf of Mexico point to a threshold, that once past, leads to barrier disintegration (Culver et. al. 2007; Sallenger et. al. 2007). Shoreline protection structures are particularly unsuitable for construction on the barriers because these structures interfere with the overwash processes that supply sediment to the back barrier, eventually leading to a situation where the barrier does not build in elevation and is much more likely to breach or drown in place.

Part 1.2.2(C) - Coastal Wetlands (formerly § 210.3)

Findings

1. Coastal wetlands are important for a variety of reasons. They provide food and shelter for large populations of juvenile fish and are nurseries for several species of fish. The mud flats and creeks associated with many coastal wetlands are rich in shellfish,

particularly soft-shelled clams. Coastal wetlands also provide important habitat for shore birds and waterfowl, and many are among the most scenic features of the Rhode Island shore. Coastal wetlands are effective in slowing erosion along protected shores.

2. Much of the original acreage of coastal wetlands in Rhode Island has been destroyed, and the pressures to fill coastal wetlands continue. Downtown Providence, much of Quonset, and many other low lying coastal communities are built on what was once coastal wetland. We do not know how much coastal wetland has been destroyed by development, but some 10 percent of our coastal wetlands of 40 acres or more is reported to have been filled between 1955 and 1964. Since coastal wetlands are found in sheltered waters, they frequently coincide with attractive sites for marinas and waterfront homes. The pressures to fill or otherwise alter coastal wetlands therefore remain. According to a 1975 survey, there are some 3,700 acres of salt marsh in the state, of which some 10 percent were fringe marshes less than five yards wide. Approximately 90 percent of the state's salt marshes abut Type 1 and 2 waters.

3. Many of Rhode Island's wetlands are small and, when viewed in isolation, may appear to be of insignificant value. However, these wetlands serve important ecological functions. The Council has sponsored research to investigate the feasibility of rating the relative value of individual coastal wetlands and two years of research revealed that it is not possible to rate coastal wetlands if all ecological considerations are given equal weight. The study also showed that there is little if any correlation between the perceived scenic value of a coastal wetland and its ecological characteristics.

4. Land uses and activities abutting coastal wetlands may have a strong impact upon the wetland itself and wildlife that use the wetland. Nearby drainage patterns which affect sedimentation processes and the salinity of waters may easily be altered, with detrimental effects. The construction of new shoreline protection structures and the bulkheading and filling along the inland perimeter of a marsh prevents inland migration of wetland vegetation as sea level rises, and will very likely result in the eventual permanent loss of coastal wetlands in these circumstances.

5. SLAMM has been used worldwide to model the response of coastal wetlands to sea level rise and refined since first developed in 1986.A new CRMC led study (2014) using SLAMM to assess all 21 Rhode Island coastal communities found that approximately 50% of the State’s current 4000 acres of saltmarsh would be inundated and lost under a 3-foot sea level rise and about 75% would be lost under 5-feet of sea level rise. Even considering potential marsh migration and transformation of abutting inland wetlands, there will be an overall net loss of saltmarsh as a result of sea level rise inundation throughout the State.

6. To ensure the long-term viability and ecological functions of salt marshes and other coastal wetlands, it is important to provide unobstructed pathways for these coastal wetlands to migrate landward as sea levels rise. Coastal Buffer Zones (Section 150) abutting coastal wetlands provide protected vegetated upland areas where coastal wetlands may migrate landward over time as sea levels rise.

7. In light of continuing pressures to alter coastal wetlands, and in accordance with the Council's policy of "no net loss", avoidance and minimization of impacts and

mitigation for unavoidable losses are necessary tools for retaining and restoring Rhode Island's coastal wetlands.

Part 1.2.2(D) - Coastal Headlands, Bluffs, and Cliffs (formerly § 210.4)

Findings

1. Coastal cliffs and bluffs include a wide variety of headland land forms ranging from low bluffs with scarps cut in easily erodible glacial river or lake sediment, or in glacial till, to the dramatic bedrock cliffs of Newport and Narragansett. They are among our most scenic coastal features and are the sites for popular scenic overlooks. More than 300,000 visit Newport's Cliff Walk each year.

Part 1.2.2(E) - Rocky Shores (formerly § 210.5)

Findings

1. Rocky shores play an important role in storm damage prevention and provide habitat to specially adapted assemblages of organisms. Gently sloping terraces of bedrock and boulders dissipate wave energy and are effective buffers that protect the mainland from storm damage. Rocky shores harbor a diversity of specially adapted plants and animals that can withstand both wave action and occasional desiccation. Tide pools are particularly beautiful features that should be protected.

2. Many rocky shores, especially in the lower Bay, are well recognized for their scenic value. Beavertail Point in Jamestown and sections of Ocean drive in Newport are notable examples. Rocky shores are often important tourist attractions, and are used for surf casting and skin diving by increasing numbers of people.

Part 1.2.2(F) - Manmade Shorelines (formerly § 210.6)

Findings

1. A 1978 survey of the Narragansett Bay shoreline revealed that along 25 percent of the shore natural features have been sheathed by manmade structures. Many of these have been built since the 1954 hurricane as attempts at "erosion prevention," undertaken at great cost by private property owners. Many will not survive a major hurricane that strikes the coast from the south. Many structures are overbuilt for the control of minor erosion between major storms.

Part 1.2.2(H) – Dunes (formerly § 210.7)

Findings

1. Human-altered foredunes constructed of sand-sized material able to be moved by the wind will move and grow similar to natural foredunes.

2. Human-altered forms constructed in the foredune area of gravel-sized material not moveable by the wind are not dunes, but are defined as dikes. Dikes are often

placed along the shoreline by property owners in the hope that they will function as foredunes. However, dikes should not be confused with a true foredune because their response to geologic processes is quite different.

Part 1.2.3 - Areas of Historic and Archaeological Significance (formerly § 220)

Findings

1. The Rhode Island coastal region has a rich and long history, and possesses many well preserved examples of prehistoric and historic sites. The coastal zone contains an abundant and diverse number of Native American Indian settlements, some dating back at least 3,000 years. The bulk of the information still to be obtained concerning Rhode Island's prehistory is associated with sites in the coastal zone. The Historical Preservation Commission has developed a predictive model that identifies those coastal sites where significant archaeological finds are most likely to be present.

2. Beginning with the first Europeans under Giovanni da Verrazano, who visited the site of Newport in the early 1500s, the coastal zone has been the location of important historic and architectural development. The Rhode Island coastal region is nationally recognized for its outstanding historic architecture, and the majority of all the sites and districts currently on the state and national registers of historic places are located in the coastal zone. Significant historic and archaeological sites are extremely valuable cultural, educational, economic, and recreational resources to the state's citizens and visitors alike, and they are part of the essential character of the coastal zone. Historic properties are a key element in defining the state's quality of life, and hence its attractiveness to a growing tourist industry and as a location for new investment. Historic sites and districts provide access to and enjoyment of scenic coastal areas, both in terms of the sites themselves and in the traditional land use patterns which define many scenic qualities in the coastal zone.

3. Historic and archaeological resources in the coastal zone are under great pressure from a variety of forces which threaten their outright destruction or the degradation of their historic qualities and setting. Unsympathetic new development, erosion, artifact collectors, and rising sea levels are major factors in reducing the number and quality of these irreplaceable resources.

Part 1.3.1(P) - Boat Lift and Float Lift Systems (formerly § 300.16)

Findings

1. Boat and float lifts can result in the elimination or reduction in the growth of marine organism by lifting either the boat or float out of water. However, because each are above the water, maintenance to the vessel or float is more readily accessible and increases the probability of paint, solvents and petroleum products entering the water.

2. Boat and float lifts can protect vessels and floats from low to moderate storms, tidal surges, wakes, wind and ice damage. In areas of high fetch, there is slight improvement to the safety of a vessel or float for damage from storm, wind and wave action. However, no practical amount of height above the water can ensure complete

safety to the boat or float as storm surge and high winds can engulf or throw a boat and/or a float off of its lift.

3. Some boat lifts aid in the boarding of a vessel.

4. The Council states in § 1.3.5 "...every effort should be made to safeguard from obstruction significant views to and across the water from highways, scenic overlooks, public parks, and other vantage points. The importance of the skyline as seen from tidal waters in determining the character of a view site must be recognized; it should, where possible, not be disrupted by visually intrusive structures." Superstructures associated with boat and float lift systems constitute a significant intrusive impact to the visual importance of Type 2 shorelines and also detracts from the character of Type 2 waters.

5. In accordance with § 1.3.1(D)(1), the Council assesses all proposed residential boating facilities for their appropriateness given geologic site conditions, potential impacts on public trust resources, potential navigation impacts, potential aesthetic and scenic impacts, and cumulative impacts associated with the increased density of existing recreational boating facilities in the vicinity of the proposed project. In considering these factors, the Council weighs the benefits of the proposed activity against its potential impacts and thus makes a determination on the merits of the structure given existing site conditions. Boat and/or float lifts may intensify low impact activities beyond that which is necessary to justify their use.

6. The Council's purpose in designating certain waterbodies as Type 2 is to minimize the potential for intensified use of the state's tidal waters and is in keeping with the Council's mandate to protect public trust resources. Boat and float lifts in coastal ponds and certain other low energy and low intensity use areas are considered excessive and can be expected to detract from high scenic values. In this regard, the Council has determined that in certain Type 2 waters, the construction of boat and float lifts is considered an unacceptable intensification of use which detracts from public use of tidal waters and associated natural resources held in the public trust.

Part 1.3.1(Q) - Wetland Walkover Structures (formerly § 300.17)

Findings

1. Physical passage to portions of property suitable for access is sometimes restricted due to the presence of wetland.

2. Certain types of wetlands are tolerant of minor amounts of foot-traffic without incurring significant environmental damage.

3. Wetlands which have high habitat values for fish and wildlife, high scenic value, or due to their relative size, vegetation types, and other characteristics are more susceptible to environ-mental damage, or have a higher probability of sustaining loss of habitat or scenic values, when altered.

4. Minor alterations of wetlands associated with wetland walkover structures may be considered appropriate for access upon property when proposed in accordance with this section.

Part 1.3.1(R) - Submerged Aquatic Vegetation and Aquatic Habitats of Particular Concern (formerly § 300.18)

Findings

1. Eelgrass roots and rhizomes inhabit sediments ranging from soft mud to coarse sand and exist in an aquatic environment subject to wave and tidal action and shifting sediment. Eelgrass has thin, green strap-like leaves ranging from up to 1m long and 10mm wide. Eelgrass coverage is variable ranging from a few individual plants in a small patch (less than one square meter) to submerged meadows covering many acres.

2. There is an annual and perennial form of eelgrass. The annual form grows from seed in June and July and the plants are not connected by rhizome. The perennial form grows laterally by means of rhizomes and a root system. Lateral expansion is fairly slow at about one meter per year. Both annual and perennial forms produce seeds. Widgeon grass has annual shoots which flower in the summer, along with a perennial base. Fruiting occurs from July to October. The plant grows in soft, muddy sediments and sandy substrates.

3. Deep water habitats include subtidal waters bordering the immediate shoreline where a depth of three (3) or more meters is typically achieved within 100 to 200 feet seaward of the MLW mark. In these areas, eelgrass is typically limited to the shoreline fringe. This environmental setting is typical of the open waters of Narragansett Bay, Block Island and Rhode Island Sounds. Examples of these areas include the shorelines of Prudence Island, Jamestown and Block Island.

4. Shallow water habitats include subtidal waters where a depth of 3 meters is not attained within 100 – 200 feet of the shoreline and where the average waterbody depth is generally less than 3 meters. This situation is typical of the salt ponds and other shallow coastal embayments. On the southern shore of the state are a series of coastal lagoons (“salt ponds”) connected to Block Island Sound and the Sakonnet River by tidal inlets. A total of 26 brackish or marine coastal lagoons have been identified within the state. Compared to the deep water habitats described above, the lagoons are generally shallow (more than half the area is only 1m deep). Sediment is primarily glacial outwash, sand and gravel. The water in these lagoons varies in its rate of exchange with oceanic water and consequently, its salinity. On the active lobes of the tidal delta, the annual form of Zostera occurs seasonally. On inactive lobes, Zostera is found in the submerged margins of the building salt marsh. Ruppia appears in coves with restricted water circulation. Coastal lagoons warm up earlier in the year, reach higher temperatures and cool off sooner than deep water habitats. Zostera is the overwhelmingly dominant species in lagoons with the greatest oceanic exchange and its biomass is most concentrated in beds nearest an opening between the pond and ocean. (See Sheath, R.G., and M.H. Harlin, ed. "Freshwater and Marine Plants of Rhode Island," Kendall/Hunt Publishing Company, 1988, 149pp.).

5. SAV benefits are defined to include, but are not limited to, the following: SAV provide support for large numbers of organisms, both plant and animal, and produce large quantities of organic material, which is important as a base to an active food cycle; the root structures bind sediments while the leaves baffle waves and currents, thereby trapping water column-borne material and retarding the resuspension of fine particles

while enhancing sediment stability; nutrient uptake occurs through both the leaves and the root system as well as by associated algae; SAV roots and leaves provide varied food resources and physical support for large numbers of fauna; SAV also provides nursery habitat for finfish and shellfish.

6. Many species of fish and wildlife are directly dependent upon SAV for refuge, attachment, spawning, and food. SAV provide a source of attachment and/or protection for the bay scallop (Argopectin irradians) and hard clam (Mercenaria mercenaria). Tautog (Tautoga onitis) and other fish lay their eggs on the surface of eelgrass leaves, and juvenile and larval stage starfish, snails, mussels, and other creatures attach themselves to eelgrass leaves. Scientific evidence also indicates that blue crabs (Callinectes sapidus) and lobster (Homarus americanus) have a strong reliance on SAV. Studies in New England have documented the occurrence of 40 species of fishes and 9 species of invertebrates in eelgrass beds. Waterfowl using submergent plant beds include American coot (Fulica americana), Mute swan (Cygnus olor), Gadwall (Anas strepera), American Wigeon (Anas americana), Canvasback (Aythya valisneria), and Redhead (Aythya americana). These birds feed on the foliage or tubers of the seagrasses. Blue-winged Teal (Anas discors) and Mallards (Anas platyrhynchos) may strain out floating seeds, strip seed from emerging heads, pluck off associated invertebrates, and bottom feed. Pied-billed Grebes (Podilymbus podiceps) also feed among the SAV, capturing small fish and large invertebrates taking cover there. Wading birds, such as egrets (Ardea sp., Egretta sp.) may use mats of SAV as stationary feeding perches or for traversing. (See Weller, M.W. "Wetland Birds: Habitat Resources and Conservation Implications," Cambridge University Press, 1999, 271pp.).

7. Historically, SAV existed in Rhode Island waters in shallow water embayments and areas that were poorly flushed by tidal currents. Review of historical information has shown that eelgrass beds were once widespread in Narragansett Bay, and that as late as the 1860s, extensive eelgrass beds were present even in the Providence River at the head of the bay. The eelgrass decline during the 1930s has been attributed to the advent of a disease (“wasting disease”), which caused a 90% destruction of all eelgrass beds in the Atlantic range. Healthy populations were generally re-established by the 1960s.

8. Today, eelgrass beds cover less than 100 of the 96,000 acres that comprise Narragansett Bay. Scientific evidence suggests that the most important factor contributing to the continuing decline of eelgrass has most likely been the introduction of increasing amounts of anthropogenic nitrogen to Narragansett Bay particularly since the 1950s, as the year-round human population near the water substantially increased both around Narragansett Bay and in the Salt Pond Region. In the salt ponds, nitrate-nitrogen loading from septic systems has contributed to a 41% decline in eelgrass beds over a 32-year period. (Short FT, Burdick DM, Granger S, Nixon SW. 1996. Long-term decline in eelgrass, Zostera marina, linked to increased housing development In: KUo J, Phillips RC, Walker DI, Krikman H (eds) Seagrass Biology: Proceedings of an International Workshop, Rottnest Island, Western Australia, 25-29 January 1996. University of Western Australia, Nedlands, Western Australia. Pp. 291-298). Historical trends of widgeon grass in Rhode Island waters have not been comprehensively studied.

9. Adverse impacts to SAV and SAV habitat include mechanical, chemical and physical damage of SAV, that may result from boat propellers, dredging and filling, bottom-disturbing fish harvesting techniques (i.e., scallop dredging, clam dredging and toothed rakes), shading caused by physical structures over beds (e.g. docks, piers) and/or excess nutrients, particularly nitrogen, causing excess algal bloom levels and high turbidity. Many activities under the Council's jurisdiction have the potential to adversely impact SAV and its habitat. These activities include but are not limited to Residential, Commercial, Industrial, and Public Recreational Structures (§ 1.3.1(C)), Recreational Boating Facilities (§ 1.3.1(D)), Sewage Treatment and Stormwater (§ 1.3.1(F)), Dredging and Dredged Materials Disposal (§ 1.3.1(I)), Filling in Tidal Waters (§ 1.3.1(J)), Aquaculture (§ 1.3.1(K)), and activities undertaken in accordance with municipal harbor regulations (§ 1.3.1(O)). Fishery harvesting techniques can also adversely impact eelgrass beds. Scallop dredging can significantly reduce biomass and surface area as well as shoot density of eelgrass. Toothed rakes used for shellfishing can also uproot eelgrass, while boat propellers and prop scarring of the marine bottom can destroy SAV by slicing and uprooting shoots.

10. Water quality and, in particular light intensity reaching the leaves is considered the most critical factor in the maintenance of healthy SAV habitats. Light availability controls the depth of SAV because SAV is dependent on photosynthesis. Factors that can act to reduce light levels include shading due to physical structures, water column clarity due to the excess of suspended solids, and nutrient enriched phytoplankton and macroalgal growth.

11. Research in Waquoit Bay, Massachusetts indicates that the height of a dock over the marine bottom is clearly the most important variable for predicting the relative light reaching eelgrass and for predicting eelgrass bed quality under docks. Docks with a north-south orientation admit more light and can better support eelgrass. Docks and their associated floats and boats placed over eelgrass beds can cause severe local impacts to eelgrass. Population-level impacts occur through shading from docks as well as boats, and prop dredging by boat motors, leading to the elimination of eelgrass under and around many docks. Research at Waquoit Bay indicates that impacts under floating docks generally resulted in complete loss of eelgrass. Research indicates that 30% is a minimum light level for support of eelgrass under docks (Short et al 1995). Based on a model developed by Burdick and Short (1995) to achieve a 30% minimum light level, docks need to be a maximum of 1 m (3.28 feet) wide and 3.0 meters (9.8 feet) above the marine bottom and situated in a north-south orientation. Recent reports have supported this preliminary finding (See Henry, K., "Jamestown Eelgrass Monitoring Review: A Summary of Existing Jamestown Eelgrass Monitoring Surveys." 2005). Even if such requirements are attained, above and below ground growth rates and vegetative reproduction are negatively affected. (See Bintz, Joanne C. and Scott W. Nixon, "Responses of eelgrass Zostera marina seedlings to reduced light." Mar Ecol Prog Ser 223: 133-141, 2001).

12. Several recent national and regional efforts support the need for protection and management of Rhode Island SAV resources. The Atlantic States Marine Fisheries Commission (ASMFC) developed a submerged aquatic vegetation policy in 1997 to communicate the need for conservation of coastal SAV resources for the protection of

ASMFC managed species, and to highlight state and ASMFC coastal SAV conservation and enhancement efforts. The New England Fishery Management Council has designated Essential Fish Habitat (EFH) as approved by the National Marine Fisheries Service (NMFS) under the requirements of the 1996 Magnuson-Stevens Fishery Conservation and Management Act. Because of its fisheries habitat value, SAV is a Habitat Area of Particular Concern protected under the EFH provisions of the Magnuson-Stevens Act.

13. SAV inventories conducted during the times of peak biomass provide the best indication of habitat or potential habitat (Fonseca et. al 1998). Peak biomass occurs in seagrass beds toward the end of the growing season and before plants have released their seeds. Plants that flower and develop seeds die shortly after releasing them. The growth and reproduction of eelgrass is affected by a number of environmental parameters such as light, water temperature, nutrient availability etc. When water temperatures exceed approximately 22 degrees Celsius (71.6 degrees Fahrenheit), seagrass growth can dramatically decrease and the development of seeds through sexual reproduction can be initiated in Rhode Island waters. As a result, the peak biomass period for eelgrass in Narragansett Bay typically occurs between July and August. Peak biomass in the south shore salt ponds and other shallow water embayments typically occurs during July.

Part 1.3.6 - Protection and Enhancement of Public Access to the Shore (formerly § 335)

Findings

1. In accordance with Article 1, Section 17 of the Constitution of the State of Rhode Island, the public has the legal right to use and enjoy Rhode Island's coastal resources.

2. Tourism and tourism-related industries, recreational boating and fishing, and commercial fishing contribute significantly to the economy of Rhode Island and are dependent upon adequate access to the shore throughout the State.

3. The scenic qualities of the Rhode Island coast are one of the State’s greatest natural assets and economic resources. The ability to view the coast and shoreline areas without obstruction by structures is an integral component of public access to the shore in Rhode Island.

4. A wide variety of opportunities for public access exist in Rhode Island. However, poor site conditions exist at many access sites and many sites are not accessible to individuals with disabilities.

5. Well-designed and maintained public access sites and improvements to existing public access sites can enhance the value of adjacent properties. In addition, properly designed, maintained and marked public access facilities, including adequate parking areas, can reduce the pressures for use of or infringement upon adjacent properties.

6. The Council recognizes that, due to public safety, security or environmental considerations, certain sites may not be appropriate for physical access.

7. The placement of structures, such as seawalls and rip rap, in or along the shore may alter shoreline processes and reduce the amount of public access available.

Part 1.4 – Federal Consistency (formerly § 400)

Findings

1. The federal consistency requirement, as provided for in section 307 of the Coastal Zone Management Act (CZMA) (16 USC §§ 1451-1464), is an important function of state coastal management programs. Under section 307, federal agencies conducting an activity which is reasonably likely to affect any land or water use or natural resource of the coastal zone, are required to do so in a manner consistent, to the maximum extent practicable, with the enforceable policies of the state's coastal management program developed and implemented under the CZMA. Federal permits and licenses, including those associated with outer continental shelf (OCS) plans, and grant-in-aid programs to local or state governments and related public entities, which are reasonably likely to affect any land or water use or natural resource of the coastal zone must also be consistent with the state's coastal management program.

2. As part of Rhode Island's coastal management program, both the geographical scope of the state's coastal zone and the enforceable policies applicable to the coastal zone have been defined and approved by the National Oceanic and Atmospheric Administration (NOAA). Rhode Island's approved coastal zone, for the purposes of exercising the federal consistency requirement of the CZMA, includes the area encompassed within the state's seaward boundary (three miles) to the inland boundaries of the state's 21 coastal communities. The Rhode Island Coastal Resources Management Program (RICRMP), which includes this "Redbook," the Council's Special Area Management Plans and Energy Amendments, and adopted State Guide Plan elements together make up Rhode Island's federally approved coastal program. The provisions of these programmatic documents and regulations which meet the definition of enforceable policies under the CZMA constitute the enforceable policies with which federal activities must be consistent in Rhode Island.

3. In order to assist federal agencies in determining whether a proposed activity is subject to the federal consistency requirement, and in accordance with the CZMA, the CRMC has listed activities, both direct and indirect, reasonably likely to affect any land or water use or natural resource of the coastal zone. It is important to note that these lists are not exhaustive and that any federal activity reasonably likely to affect any land or water use or natural resource of the coastal zone may be subject to the federal consistency requirement.

4. The Council's Federal Consistency Manual details the CRMC's federal consistency process and requirements and includes tables of listed activities subject to the federal consistency requirement. The Manual also provides background and an explanation of the federal consistency requirement as provided for in section 307 of the CZMA and its implementation in Rhode Island. The Council's federal consistency procedures and requirements have been derived directly from federal regulations

implementing the CZMA provided in the Code of Federal Regulations (15 CFR Part 930). Any changes to the federal regulations supersede those of Rhode Island.

Part 1.3.1(H) – Energy-Related Activities and Structures (Note: the findings below were part of the 1978 Energy Amendments (§ 600), which have been integrated within Part 1.3.1(H)

A Planning for energy facilities

1. Findings

a. Passage of the 1976 energy facility planning amendments in § 305 (b)(8) of the Federal Coastal Zone Management Act and subsequent promulgation of regulations under this section has placed substantial additional energy related planning burdens on states such as Rhode Island which are in the process of developing coastal management programs. More specifically, NOAA regulations now require the state to:

(1) Identify energy facilities which are likely to locate in or which may affect the coastal region.

(2) Develop a procedure for assessing the suitability of sites for such facilities.

(3) Develop policies and techniques for managing energy facilities and their impacts.

(4) Develop cooperative and coordinating arrangements between the Council and other agencies involved in energy facility planning and siting.

(5) Identify legal techniques to be used in managing energy facility siting and related impacts.

b. In order to implement NOAA requirements to identify energy facilities likely to be located in or affect the coastal region (15 CFR § 920.18(a)(1), the Council finds a need for the state to independently assess existing demand projections for electric power consumption.

(1) It is on the basis of such projections that power plants which may be located in or affect Rhode Island's coastal region will be proposed.

(2) Historic patterns of growth in electric power consumption, upon which existing facility development plans are

predicated, have declined dramatically in recent years (see Table 10).

(3) The Council does not find that this decline has been adequately reflected in existing demand assessments.

(4) The reasons for this decline remain unclear and until such reasons are better understood it will not be possible to project with confidence either future demand or related plant construction requirements.

Table 10: Rhode Island Electricity Consumption

Year	Consumption (Trillions of BTU'S) (3413 BTU'S per KWH)	Annual Rate of Growth (Percent)
1971	14.3	7.5
1972	15.3	6.9
1973	16.4	7.1
1974	15.5	-5.4
1975	15.1	-2.5
1976	16.5	9.2

Sources: 1971-1974, Electric Council, Statistical Bulletin, 1974. 1975, Annual reports submitted to Public Utilities Commission by each company. 1976, New England Power Company.

c. In enacting these new planning requirements the Congress expressly recognized and provided for the additional burdens, both temporary and financial, they placed on the states.

(1) Planning monies were made available for the specific purpose of undertaking energy facility planning efforts.

(2) The deadline for completing energy related planning and program development efforts under the Federal Coastal Zone Management Act, was extended to September 30th, 1978.

2. Planning policies

a. In order to effectively implement the various energy facility planning requirements of NOAA regulations promulgated on April 29th, 1977, the Council finds that the state should undertake assessments or establish procedures for assessing the following topics by September 30th, 1978:

(1) An assessment of OCS oil and gas related facility siting, including onshore support services, fuel transfer, storage and processing facilities, if any.

(2) An assessment of “native” energy sources including coal, wood, wind, water, solar, solid waste, geothermal and energy conservation.

(3) An evaluation of the regional context of energy production and distribution as it affects instate production and facility development requirements.

(4) An evaluation of long term petroleum related transportation and storage requirements and opportunities.

(5) An assessment of long term electrical power requirements and optional generating technologies with particular attention to such demand variables as changing life styles, income, rate base, intermediate, peak and reserve generating requirements, and such social considerations as the relative consequences of supply deficiencies and surpluses.

(6) An assessment of optional “mixes” of energy sources including OCS oil and gas, native sources and electrical generating techniques including total energy systems and co-generation with particular emphasis on the flexibility, reliability and environmental impacts of such sources and techniques.

(7) Development of detailed data on the siting requirements and related and/or operational impacts of specific facility types.

(8) Development of additional and/or refinement of existing Council Policies and Regulations relating to facility siting and operation pursuant to plan and program development responsibilities set forth under Title 46, Chapter 23, Section 6 of the General Laws.

(9) Development of specific coordinating and cooperative arrangements between the Council as the state’s principal

fact finder for nuclear power plant and oil refinery siting and the General Assembly as the final permitting body for such siting decisions.

(10) Development of additional arrangements to ensure consistent and cooperative planning and regulation by all units and levels of government.

(11) Assessment of techniques to reduce the demands for energy.

B. Siting of energy facilities

1. Findings

a. Facilities for the processing, transfer and storage of petroleum products and the production of electrical power provide services necessary to support and maintain the public welfare and the state's economy.

b. Such facilities, whether sited in the coastal region or elsewhere, have a high probability of affecting coastal resources and land uses because of their large size, environmental and aesthetic impacts, and impacts on surrounding land uses and broad development patterns.

c. In order therefore, to properly and effectively discharge legislatively delegated responsibilities related to the location, construction, alteration and/or operation of such facilities, the Council finds a need to require in all instances a permit for such location, construction, alteration and/or operation within the State of Rhode Island where there is a reasonable probability of conflict with a Council plan or program, or damage to the coastal environment.

C. Electric power production

1. Findings

a. The production of electrical energy whether by combustion of fossil fuels (oil, gas and coal) or nuclear fission involves a host of impacts on the coastal region, it's resources and uses of those resources. Impacts are caused by both construction and operation of generating plants. Impacts are extremely variable and dependent on a number of factors unique to specific sites and facility designs. General observations must consequently be weighted with this in mind. Impacts are of six principal types:

(1) Land use

(2) Water quality

(3) Air quality

(4) Waste disposal related

(5) Human health and safety

(6) Socio-economic

b. Siting of power generating plants has major impacts on coastal land use and development patterns.

(1) Power plants occupy large sites - up to 110 acres for a 1,000 MW oil fired plant and 350 acres for a nuclear plant.

(2) With their large buildings and tall stacks, power plants are major visual intrusions.

(3) Transmission rights-of-way may preempt other uses of lands located considerable distances from the plant itself.

(4) Exclusion and safety zones around nuclear power plants place constraints on surrounding uses and development patterns.

(5) Power plants require land with prime industrial development characteristics and preclude other industrial uses of such lands.

c. Siting of power plants is influenced by the availability of water for transportation and processing purposes, although neither fossil fuel nor nuclear facilities require a waterfront location. Construction and operation may have wide ranging impacts on water resources and marine life. Construction related impacts on nearby waters are comparable, although frequently of considerably longer duration than those for any major industrial facility. These may include increased runoff and siltation, dredging or filling and runoff of hydrocarbon contaminated liquid wastes. Construction of once-through cooling systems may have significant impacts on adjacent water bodies since extensive dredging may be required. Water consumption and related impacts during plant operation vary considerably with plant design, especially the design of the cooling system which accounts for most of the water used. Cooling and process water taken in and then released to the environment can have several impacts.

(1) Heated discharges affect critical biological functions of marine organisms.

(2) Chemical antifouling agents are used to prevent corrosion and marine growth in water systems; their cumulative impacts are unknown.

(3) Nuclear power stations release radioactive substances such as tritium and ruthenium.

(4) Fish may be trapped against water system intake screens and killed. Larvae and plankton are drawn through the entire system where most are killed by pressure changes, abrasion or temperature shock.

d. Plant construction and operation result in gaseous and particulate emissions which may affect air quality across a wide area.

(1) Construction related impacts are comparable to those associated with any large scale construction project. The considerable length of the construction period extends these impacts over a long time frame.

(2) Fossil fuel plant emissions include such pollutants such as sulphur dioxide, fly ash, nitrogen oxides, volatile hydrocarbons and carbon monoxide.

(3) Nuclear plant emissions are principally radioactive gases: Krypton, iodine and xenon.

e. Operation of fossil fuel powered plants, especially coal fired, generates large quantities of solid waste material. Its disposal may have major impacts on the coastal environment.

(1) Eighty to ninety-nine percent of the fly ash produced by fossil fuel combustion may be removed by stack “scrubbers” which produce a semi-liquid slurry or sludge. Up to 100,000 tons of this material may be produced annually by a 1,000 MW coal fired plant.

f. Generation of electrical power by nuclear fission produces considerably smaller but more toxic amounts of solid waste. Disposal of these highly radioactive wastes in an environmentally acceptable manner presents a number of very serious problems which remain to be resolved. In the absence of such resolution, the production of radioactive wastes represents a major long term environmental and human health hazard.

(1) Because nuclear wastes remain radioactive for long periods (most wastes have half- lives between 1 and 380,000 years) their safe disposal poses numerous problems. The technology for isolating them from the environment for such periods has not yet been developed.

(2) Radioactive wastes are shipped from the generating plant to temporary storage sites by unescorted trucks over public roads. Although protected by shielded casks designed to prevent their release in case of accident, the possibility of such release remains.

g. The production of electricity by either fossil fuel or nuclear fired plants pose threats to human health and safety. While these can be reduced by use of best available technology and careful management, they cannot be totally removed, and energy production will continue to involve some degree of public risk. Electrical power plants should therefore, only be built on the basis of a real and demonstrated need for their generating output.

D. Transfer of petroleum products

1. Findings for transportation by vessel

a. The Port of Providence is the major petroleum products distribution center for southern New England.

(1) 7.2 million tons of refined oil, kerosene and gasoline with an estimated value of $651 million were imported in 1975.

(2) Petroleum related vessel movements (including both tankers and barges) in and out of Narragansett Bay accounted for some 1,000 vessel movements in 1975.

b. Accidental groundings, collisions and resultant spills have not caused major environmental damages in Rhode Island. The recent Argo Merchant spill has demonstrated however, that oil spill clean-up technology is not presently capable of controlling major spills in weather conditions that are common offshore. The technology does, however, permit the control and clean-up of spills in sheltered waters under most conditions. The environmental impacts of spills can be significant and are of great concern.

(1) The Council finds that growing traffic in petroleum products poses an increased risk of spills and resultant environmental damage.

(2) Traffic in liquefied hydrocarbons also poses risks to life and property because of their highly flammable nature.

c. Regulation of marina commerce in navigable waters is the responsibility of the United States Coast Guard. The Coast Guard is also responsible for developing and enforcing vessel design standards and operational rules, and for enforcing federal laws regarding discharge of oily wastes, prevention, clean-up and mitigation of accidental spills of petroleum products. The Council has taken the following actions in cooperation with the Coast Guard.

(1) In April 1977 the Council contracted with the University of Rhode Island to implement a program for “finger printing” all petroleum shipments bound for or originating from Rhode Island ports.

(2) Chemical analysis of stored samples taken from all vessels landing in the state allows for speedy identification of the source of any oil spill in state water. The violator is responsible under existing State and Federal law, for damages resulting from a spill.

d. Regulations of the Rhode Island Department of Health prohibiting the discharge of oil or oily wastes into any waters of the state from any vessel are set forth under Title 46, Chapter 12 of the General Laws. Rhode Island’s water quality criteria under which all discharges are regulated through the Federal Water Pollution Control Act, also prohibit floating oil in any waters of the state.

3. Findings for transfer via pipeline

a. According to the Environmental Impact Statement prepared by the Bureau of Land Management on Georges Bank oil and gas lease sales, Rhode Island’s ocean shoreline, or that of nearby Massachusetts, provide the most likely landfalls for an OCS gas pipeline.

(1) Construction of one or two gas pipelines would begin between five and ten years after the first lease sale and each pipeline would take up to two seasons to complete.

(2) It appears unlikely that oil will be transported from OCS wells to shore through a pipeline and even less likely that OCS oil will be landed by tanker in southern New England. Crude oil, if it exists in exploitable quantities, will most probably be transported outside the region for processing.

(3) There is consequently adequate time to further evaluate issues relative to OCS pipeline construction, routing and landfalls prior to adopting final Council policy and regulations.

b. Pipeline corridor routing and construction in near shore waters and along the immediate shore front involve a number of environmental issues and may further conflict with other uses of coastal waters and resources.

(1) Much data must be assembled on the physical processes that take place on the ocean floor, especially in shallow near shore waters where bottom processes appear to be most active to ensure that a pipeline will withstand erosion, will be adequately supported and will not cause undesirable changes to the character of the bottom.

(2) Pipelines are of great concern to commercial fishermen since exposed pipe and valves can be snagged by towed fishing gear such as otter trawls and shellfish dredges. Pipelines may prompt the use of a corridor by fishermen. It is essential that fishermen play an active role in selecting the route for a pipeline and manner in which will be engineered.

(3) Pipelines may also have impacts upon navigation since anchors can snag the line and on-surface booster stations (if needed), may be an obstruction to navigation.

(4) The construction of a pipeline will cause short term impacts on the living environment. Route selection, construction timing and methods will require careful assessment to ensure minimal impacts.

(5) A marine pipeline landfall requires a right-of-way approximately 100 feet in width. A gently sloping shoreline is preferred, but not necessary. The pipeline must be buried to a sufficient depth to avoid seasonal changes in the nearby sea floor. Careful planning and engineering will be required to ensure that any impact on the shoreline will be temporary and/or sufficiently small to be acceptable.

(6) The construction of a pipeline landfall involves intensive short-term activity. Proper advanced planning involving wide participation will help to minimize environmental and social impacts.

5. Findings for vessel to vessel transfer

a. The transfer of petroleum and petroleum products poses a potentially severe threat to the state's coastal resources. Accidental spills of petroleum products may adversely impact the marine and coastal environments, may endanger public health and safety, and may damage other necessary and legitimate uses of the coastal region.

b. Minimum requirements and procedures to be followed during transfer of petroleum products from vessel to vessel must be set forth in order to insure that such transfers are carried out in a manner consistent with the Council's obligation to preserve and protect coastal resources.

c. Effective implementation of transfer regulations requires an ability to readily identify the source of any spilled petroleum. Technology exists to make such identifications through infrared spectroscopy ("fingerprinting").

7. Findings for vessel to shore transfer

a. Transfer of petroleum products from barges and tankers to shore front storage facilities located in upper Narragansett Bay has the potential to cause major environmental damage if not properly managed.

(1) As many as 10 million gallons of toxic material may be transferred in a single operation.

(2) Accidental spills due to human error or equipment failure could release massive amounts of petroleum into the marine environment.

(3) Petroleum may have persistent and wide ranging impacts on marine organisms and may accumulate in bottom sediments.

(4) If not contained, a spill could contaminate much of Narragansett Bay in a relatively short time, severely damaging its scenic and recreational values, its commercial shell fishery, and its natural environment.

b. Ship to shore transfers are not, however, a significant management problem in Rhode Island because of actions taken by the State Department of Health, the United States Coast Guard and the petroleum industry.

(1) The Department of Health promulgated rules and regulations to prevent the discharge or escape of petroleum products into state waters in 1957 under authority set forth in Title 46,

Chapter 12 of the General Laws. These regulations, upon which Council vessel to vessel transfer regulations were modeled, address ship to shore transfers directly and in comparable detail.

(2) Under Section 154.300, 33 CFR the Coast Guard enforces regulations pertaining to petroleum products handling. Under this section all terminals are required to prepare a spill prevention and mitigation plan which must be approved by the United States Coast Guard. All Rhode Island terminals have received such approval.

(3) The Rhode Island petroleum industry in itself has been a major innovator in the prevention and containment of spills. In cooperation with the State Department of Health, the Rhode Island Petroleum Association established the nation's first port petroleum cooperative in 1966. (There are now over 100). The cooperative purchased 3,000 feet of containment boom at that time and another 3,000 feet in 1973. Booms are stored at terminals in the port area and on two radio dispatched trucks donated by the industry to the Providence and East Providence Fire Departments.

c. The Council concludes that existing prevention and mitigation procedures and requirements are adequate to prevent damage to the coastal environment and are consistent with its legal obligation to preserve, protect and restore the coastal resources of the state.

d. The Council finds a need, however, to be able to more readily identify the source of any spilled petroleum product in the state's tidal waters.

(1) Recognizing that the technology exists to make such identifications, the Council has provided funding to support an oil "fingerprinting" laboratory at the University of Rhode Island.

9. Findings for shore transfer

a. Transfer of petroleum products from storage facilities in the coastal region to vehicles for transportation to retain and wholesale distributors, has limited potential for significantly damaging the coastal environment.

(1) The potential for major spills is small due to the limited size of single transfers (8,000 gallons for a large tank truck), and the utilization of automatic shut-offs on transfer equipment.

(2) The potential for chronic small spills or seepage is greater, but is controlled by the Department of Health regulations. These require that transfer areas be graded to channel runoff into oil/water separators which remove hydrocarbon residues.

(3) Compliance with health regulations has been excellent and seepage is consequently not a significant management issue.

b. The Council concludes that existing prevention and mitigation procedures and requirements for the on-shore transfer of petroleum are adequate to prevent damage to the coastal environment and are consistent with its legal obligation to preserve, protect and restore the coastal resources of the state. It finds no need to promulgate additional Policies and Regulations at this time.

10. Findings for petroleum bulk storage

a. Rhode Island is a major petroleum distribution center for the southern New England region. Nearly twice the state’s annual consumption of petroleum products passes through the Port of Providence each year. Considerable quantities of fuel are shipped by truck tanker to nearby Massachusetts and Connecticut.

b. Unlike other states in the region, Rhode Island has substantial excess bulk storage capacity. Existing facilities are capable of storing about 50% of the State’s annual (1 billion gallon) consumption of petroleum fuels. Existing facilities have surplus capacity both in present storage tanks and room for new tanks. Additional storage capacity exists in deactivated tanks at surplus Navy holdings at Melville in the Town of Portsmouth.

c. It appears unlikely that Rhode Island’s excess storage capacity will be taxed by increased demands in the foreseeable future. Present trends indicate a diffusion of oil distribution patterns. As a result Rhode Island’s significance as an import/export center is likely to diminish. Decreased export traffic will free up additional storage capacity in existing facilities. This will minimize or eliminate entirely the need for new tanks for domestic needs.

d. There appears to be no need to anticipate additional bulk petroleum storage facilities in the state’s coastal region for the foreseeable future.

12. Findings for the storage and processing of liquefied gases

a. The Rhode Island coastal region contains one liquefied natural gas (LNG) storage facility at Sassafras Point in Providence. Other facilities in the State of Rhode Island are located in Exeter and Cumberland. Existing facilities are supplied by truck. Gas stored in liquefied form is used to supplement piped supplies during peak winter consumption periods.

b. Increased demand for natural gas as a clean burning fuel for home heating may generate demands for additional LNG storage facilities. If local and regional demands continue to increase, it may become commercially attractive to import large volumes of LNG from foreign sources by tanker ship. Such imports would generate additional demands for storage facilities in the coastal region, especially in the existing port areas such as Providence.

c. As with other forms of highly concentrated energy, special scrutiny must be given to the location, design and operation of LNG/LPG facilities. Accidental releases of LNG could pose a public safety hazard. LNG is a cryogenic material, remaining in a liquid state at atmospheric pressure only when kept below -260° F. Containment and handling equipment must be specifically designed for service at these low temperatures. Should LNG accidently spill on land or water it vaporizes rapidly forming a cold plume of flammable natural gas. If ignited quickly, LNG pools burn as very intense fires in a manner similar to gasoline. If ignition does not occur quickly, a flammable (explosive if confined) vapor plume may be carried downwind until a source of ignition is encountered or until the gas vapor-to-total volume is less than 5%.

d. Technology and procedures exist to markedly reduce, but not totally eliminate the dangers associated with storage and handling of LNG. Stringent Federal regulations governing the design and operation of LNG facilities serve to minimize these dangers.

e. LNG storage may constitute a major coastal land use in terms of the acreage involved and potential impacts on surrounding land uses and development patterns. Site requirements for an LNG terminal are dependent upon the nature of its operations and the ambient site conditions. Such a facility may require substantial land area, perhaps up to 200 acres in a coastal location with access to channel depths of up to approximately 40 feet. Improper design and operation of such a facility could pose a safety hazard to surrounding land uses. Facilities may have visual impact on surrounding land uses and areas.

f. Little research has been completed on the long term environmental effects of an accidental release of LNG. Localized short term mortality of coastal and marine life forms exposed to the extremely cold gas can be anticipated. Re-gasification prior to release into distribution pipelines, may involve once through heating by seawater with consequent impacts on marine organisms through rapid cooling, release of toxic and anti-foulants, and mechanical damage. Due to such environmental constraints however, the preferred technique utilizes gas as the heating agent.

14. Findings for the processing of petroleum products

a. Oil and gas refining share essentially similar characteristics in terms of site requirements, construction activities and operational impacts. Gas facilities, however, are typically considerably smaller with a consequent reduction in siting and operational impacts.

(1) Construction: Comparable to any major industrial construction project, construction activities would include excavation, clearing, operation of heavy equipment, noise and emissions over an extended time frame.

(2) Water Use: Oil refineries in particular require considerable volumes of water for cooling and processing (between 5 and 12 million gallons per day for a 250,000 barrel per day facility). Cooling waters are discharged at elevated temperatures and may be contaminated with hydrocarbons, acids, and metallic compounds.

(3) Air Emissions: Refineries are potential major sources of air pollution including particulate, sulfur and nitrogen oxides; volatile hydrocarbons, hydrogen sulfide and carbon monoxide. Even with the best available technology, emissions cannot be totally eliminated.

(4)- Solid Wastes: Toxic absorbents, oxides, scale, catalysts and sludge in large quantities are by-products of the refining process and their disposal can have major environmental impacts.

(5) Aesthetics: Refineries can be major visual intrusions due to side and around-the-clock operations.

(6) Land Use: Refineries require large sites (between 1,000 and 1,500 acres for a 250,000 barrel a day oil refinery). Sites must be prime industrially serviced land. Siting may stimulate industrial growth in surrounding areas.

(7) Safety: The refining process involves the handling of highly toxic and flammable materials in large volumes. Appropriate safety precautions must be taken to contain these materials.

(8) Economic: Construction activity will have significant impacts on local employment opportunities for a limited period of time. Operational employment will vary with facility size, but will be much lower. Increased tax revenue will be generated. However, increased demands on public services, fire protection, water service, police, sewers, roads, schools and housing should also be anticipated.

b. Siting of oil refineries and/or gas processing facilities in the Rhode Island coastal region is a management issue. It is unlikely that an oil refinery will be sited in Rhode Island. A gas processing facility, while more likely would not be sited unless and until justified by production of OCS gas. These conclusions are based on the following factors:

(1) Environmental Impact Statements prepared on North Atlantic OCS lease sales indicate that oil will be refined at existing facilities in New Jersey.

(2) The Environmental Protection Agency has determined that siting of an oil refinery in Southeastern New England would have an unacceptable impact on air quality. It has publicly stated that it would not allow siting of major new emission sources including oil refineries in this area.

(3) Siting of gas processing facilities is dictated by pipeline routing. Since Rhode Island's ocean shoreline provides one likely landfall for an OCS gas pipeline, such facilities may be proposed. Construction should not be anticipated however, until eight or nine years after the first OCS lease sale.

Part 1.5 – Public and Government Participation (formerly § 700)

Findings

1. Public and governmental participation is an essential element of the Rhode Island Coastal Resources Management Program.

   a. Public participation is necessary in all phases of program development and implementation. The most effective vehicle for participation is often different for each facet of the program.

b. A variety of public participation programs ensures participation from the most diverse set of governmental bodies, interest groups and concerned individuals.

2. A traceable, open decision making process is critical if the public is to be a full partner in coastal management decisions.

   a. The Council has recognized the necessity for adopting formalized procedures which set forth the mechanism through which public and governmental input can occur.

   b. All records on which regulatory decisions are made must be open to public inspection.

3. It is essential that the many groups and individuals with an interest in or who will be affected by the adoption of Council policies and regulations have the opportunity to participate in the development of such policies.

   a. Numerous mechanisms in addition to testimony at formal hearings can be used to encourage such participation. Such mechanisms include technical input, review of preliminary drafts, meetings, workshops and advisory committees.

4. Solving many of the complex issues facing the coastal region requires the cooperation and coordination of numerous state and federal agencies, municipal governments, private groups, and individuals.

   a. Numerous state and municipal groups have adopted plans which are related to the use of the coastal region and its resources.

   b. Opportunities exist for facilitating cooperation among these groups including staff interactions and workshops, the State Planning Council, the Council permit review procedures and the A-95 review process.

   c. Because of the significance of federal activities within Rhode Island's coastal region and the lack of an existing mechanism for effective state/federal cooperation on coastal issues, the Council finds the special coordinating efforts must be made with federal agencies with an interest in the Rhode Island coastal region.

5. A critical element in the effective implementation of coastal management plans and policies will be public awareness of the coastal environment, and the management issues relating to the coastal region.

   a. An informed public and a workable management program are synonymous.

b. Numerous opportunities exist for increasing public consciousness of coastal issues including: media exposure, brochures and newsletters, exhibits, talks and audiovisual presentations, and public workshops.

c. The Council finds it has a special responsibility to prepare Rhode Island's youngest citizens to deal intelligently and knowledgeably with the many coastal issues and decisions they will face as adults. Coastal awareness must be fostered in the state's schools at all levels.