

Draft Environmental Assessment
of the
Proposed Designation of Sixteen Additional
Manatee Protection Areas in Florida

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I. Summary

The Fish and Wildlife Service (Service) proposes to establish sixteen (16) additional manatee protection areas in Florida. The Service is proposing this action under the Endangered Species Act as a means to reduce the level of take of Florida manatees (*Trichechus manatus latirostris*). Four (4) of the proposed areas would be manatee sanctuaries, in which all waterborne activities are prohibited from October 1 through March 31 while allowing for riparian use. The remaining twelve (12) areas would be designated manatee refuges, in which certain waterborne activities are prohibited or regulated, in particular, regulating boat speeds.

II. Introduction

A. SECTION ONE - PURPOSE AND NEED

1. Introduction:

The authority to establish protection areas for the Florida manatee is provided by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) and the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 U.S.C. 1361 et seq.), and published in Title 50 of the Code of Federal Regulations, Part 17, Subpart J. The Service may, by regulation, in accordance with 5 U.S.C. 553 and 43 CFR Part 14, establish manatee protection areas whenever there is substantial evidence showing such establishment is necessary to prevent the taking of one or more manatees. The Service may establish manatee protection areas on an emergency when we determine there is substantial evidence that there is imminent danger of a taking of one or more manatees, and that such establishment is necessary to prevent such taking. “Take” as defined by the ESA means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. “Harm” is further defined as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. “Harass” is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. [50 CFR 17.3]

We may establish two types of manatee protection areas—manatee refuges and manatee sanctuaries. A manatee refuge, as defined in 50 CFR 17.102, is an area in which we have determined that certain

waterborne activities would result in the taking of one or more manatees, or that certain waterborne activities must be restricted to prevent the taking of one or more manatees, including but not limited to a taking by harassment. A manatee sanctuary is an area in which we have determined that any waterborne activity would result in the taking of one or more manatees, including but not limited to a taking by harassment. A waterborne activity is defined as including, but not limited to, swimming, diving (including skin and SCUBA diving), snorkeling, water skiing, surfing, fishing, the use of water vehicles and dredging and filling activities.

The Florida manatee, a federally listed endangered species, resides in freshwater, brackish and marine habitats of coastal and inland waterways in the southeastern United States. The majority of this population resides in the waters of the State of Florida throughout the year and nearly all manatees use the waters of peninsular Florida during the winter months. The manatee is a cold intolerant species and requires warm waters (above 68° Fahrenheit) to survive during periods of cold weather. During the winter months many manatees rely on the warm water from natural springs, industrial and power plant outfalls for warmth. During the summer months they expand their range and are seen rarely as far north as Rhode Island on the Atlantic Coast and as far west as Texas on the Gulf Coast.

2. Purpose and Need of Action

Human activities, particularly waterborne activities, are resulting in the take of manatees. Recent information indicates that the overall manatee population has grown since the species was listed (32 FR 4001). However, in order for the Service to determine that an endangered species has recovered to a point that warrants the species' removal from the list of endangered and threatened wildlife and plants, the species must have improved in status to the point at which listing is no longer appropriate under the criteria set forth in section 4(a)(1) of the ESA. That is, threats to the species that caused it to be listed must be reduced or eliminated such that the species no longer fits the definition of threatened or endangered. While indications of increasing population size are very encouraging, it has not been demonstrated that human-related harm and harassment of manatees resulting from waterborne activities have been effectively reduced or eliminated.

Human use of the waters of the southeastern United States has increased dramatically as a function of residential growth and increased visitation. This phenomenon is particularly evident in the State of Florida. The

population of Florida has grown by 124% since 1970 (6.8 to 15.2 million, U.S. Census Bureau) and is expected to exceed 18 million by 2010 and 20 million by the year 2020. According to a recent report by the Florida Office of Economic and Demographic Research (2000), it is expected that by the year 2010, 13.7 million people will reside in the 35 coastal counties of Florida. In a parallel fashion to residential growth, visitation to Florida has increased dramatically. It is expected that Florida will have 83 million visitors annually by the year 2020, up from 48.7 million visitors in 1998. In concert with this increase of human population growth and visitation is the increase in the number of watercraft which ply Florida waters. In 1999, there were 829,971 boats registered in the State of Florida. This is an increase in registered vessels of almost 20% since 1993. During this same period the number of watercraft related manatee mortalities has increased by 144% from 35 to 82 deaths per year. In addition to boats belonging to Florida residents, the Florida Department of Community Affairs estimates that between 300,000 and 400,000 boats registered in other states use state waters each year.

The large increase in human use of waters inhabited by manatees has had direct and indirect impacts on this endangered species. Direct impacts include injuries and death from vessel impacts, water control structure operations, lethal and sub-lethal entanglements with commercial and recreational fishing gear and alterations of behavior due to harassment. Indirect impacts include habitat destruction and alteration, decreases in water quality within some aquatic habitats, decreases in quantity of warm water at natural sites, marine debris and general disturbance from human activities.

The vast majority of the reported human-related manatee mortality takes place in 18 Florida counties and 60 percent occurs in just four counties (Brevard, Collier, Duval and Lee) (U.S. Fish and Wildlife Service 1998). Manatee mortality has continued to climb steadily. Average annual mortality in the 1990's was twice that of the 1980's, and this trend continued in 2000 when 273 dead manatees were recorded. Totals over the past four years have averaged 45 percent higher than in the early 1990's. When the record high total of 1996 is included (the year in which the red tide die-off inflated total mortality to 416 animals), average annual mortality over the past five years has been nearly 60 percent greater than in the early 1990's (Marine Mammal Commission 2001).

The continuing increase in the number of recovered dead manatees throughout Florida has been interpreted as evidence of increasing mortality rates (Ackerman *et. al.* 1995). Due to their low reproductive rate, a decrease in adult survivorship due to watercraft collisions could

contribute to a long-term population decline (O'Shea *et. al.* 1985). It is believed that a one percent change in adult survival likely results in a corresponding change in the rate of population growth/decline (Marmontel *et. al.* 1997). Between 1976 and 1999, the number of carcasses collected in Florida has increased at a rate of 5.8 percent per year, and deaths caused by watercraft strikes increased by 7.2 percent per year (U.S. Fish and Wildlife Service, 2000a).

Collisions with watercraft are the largest source of human-related manatee deaths. Data collected during manatee carcass salvage operations in Florida indicate that a total of 979 manatees (from a total carcass count of 4021) were confirmed victims of collisions with watercraft since 1976. This number may not accurately represent the actual number of watercraft-related mortalities since many of the mortalities listed as "Undetermined Causes" show evidence of collisions with vessels. Collisions with watercraft comprise approximately 24 percent of all known manatee mortalities since 1976. Not only has the number of confirmed manatee watercraft-related mortalities increased, they have also increased as a percentage of total mortalities over that time. Since 1998, watercraft-related deaths have represented about 30 percent of all mortality, a five percent increase compared to the early 1990's. Although an increase in manatee deaths would be expected during periods of population growth, as apparently occurred in the 1980's and early 1990's, if population growth has leveled off and manatee mortality continues to increase, a decline in abundance is inevitable (Marine Mammal Commission 2001).

The second largest cause of human-related manatee mortality is entrapment in water control structures and navigation locks (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, 2000a). Manatees may be crushed in gates and locks or may be trapped in openings where flows prevent them from surfacing to breathe. Locks and gates were responsible for 159 manatee deaths between 1976 and 1999 (U.S. Fish and Wildlife Service 2000b). While there are no well-defined patterns characterizing these mortalities, it is believed that periods of low rainfall increase the likelihood of manatees being killed in these structures. These periods require more frequent, large-scale movements of water which require more frequent gate openings and closings in areas that attract manatees searching for freshwater. Increases in gate operation are thought to increase the likelihood of manatees being crushed in gates.

Manatees are also affected by other human-related impacts. These impacts include death caused by entrapment in pipes and culverts,

entanglement in ropes, lines, and nets, or ingestion of fishing gear or debris, vandalism, and poaching. The impact of these activities account for 106 manatee deaths since 1976. This is an average of four deaths per year. As with watercraft-related mortalities, other human-related deaths also appear to be increasing with 31 deaths, approximately 3 percent of the total mortalities recorded between 1997 and 2000, attributed to these impacts. This is an average of 7.75 deaths per year over the last four years attributable to other human-related activities.

Harassment of manatees is a concern, particularly when such actions impede the use of warm water areas critical to manatee survival during periods of cold weather. In particular, there is an increasing number of swimmers and divers visiting Florida's waters to view and swim with the manatees. On occasion, divers and swimmers have been observed attempting to pet, chase, ride, and even sit on manatees. This type of harassment may cause the manatee to leave warmer water to find relief from the harassment in colder areas where there are fewer people.

To help address the negative effects to manatees from human actions, the Service is proposing to establish twelve manatee refuges and four manatee sanctuaries in Florida. In evaluating the need for additional manatee protection areas we have considered the needs of the manatee at an ecosystem level with the goal of ensuring that adequate protected areas are available throughout peninsular Florida to satisfy the biological requirements of the species, with a view toward the manatee's recovery.

The Service acknowledges that there exists an extensive network of manatee speed zones and sanctuaries, which have been established throughout peninsular Florida by Federal, State and local governments. This existing structure substantially fulfills the above-stated goal. The purpose of our evaluation was to identify remaining gaps in the existing network and to propose appropriate measures for filling those gaps.

The Service also recognizes that the existing system of speed zones and sanctuaries has been established primarily by State and local governments. We recognize the important role of our State and local partners, and the Service continues to support and encourage State and local measures to improve manatee protection. We are proposing actions in areas in which State and local governments have been unable to implement what we consider to be adequate measures. The Service has also focused the currently proposed action on those sites in which we have determined that Federal action can effectively address the needs in the particular area, recognizing that we face certain resource limitations. We are eager to work with State or local agencies to develop and

implement measures in the areas discussed in the proposed rule that would be equally protective of manatees. If measures which offer the same or enhanced levels of protection are put in place before we make this rule final, we will consider excluding those areas from Federal protection.

Our authority to establish manatee protection areas is discretionary. During the development of this proposed rule many cited the increase in the overall size of the manatee population as evidence that the establishment of additional manatee protection areas is not needed. Recent data regarding the size of the manatee population are very encouraging, and indicate that local, State and Federal efforts to recover the manatee are working. However, increasing population levels do not change the fact waterborne activities are resulting in take of manatees, which is not allowed under the ESA and MMPA. Additionally, the continuing increase in the amount of human-related manatee mortality raises concerns that such take is impeding the recovery of the species. Therefore, we feel it is our obligation to use the tools we have available to reduce the level of human-related manatee mortality, so that we may someday achieve our goal of removing the manatee from the list of endangered and threatened wildlife and plants. The establishment of manatee protection areas is one such tool.

B. SECTION TWO - LONG-RANGE GOALS AND OBJECTIVES

1. Introduction:

The long-range goals and objectives of the proposed Service actions are to promote the protection and recovery of the federally listed Florida manatee, so that at a future date, it will eventually be downlisted and subsequently removed from the federal endangered species list.

The Draft Florida Manatee Recovery Plan, Third Revision, (U.S. Fish and Wildlife Service, 2000a) established four objectives necessary to establish a sustainable population of manatees within the state of Florida. These objectives are to:

- a. minimize causes of manatee disturbance, injury and mortality;
- b. determine and monitor the status of the manatee population
- c. protect, identify, evaluate, and monitor manatee habitat;
- d. facilitate manatee recovery through public awareness and education.

The proposed rule addresses one of these objectives; minimizing causes of manatee disturbance, injury and mortality. By establishing the proposed refuges and sanctuaries the Service intends to reduce the occurrence of take related to human activities within these areas.

2. Long-Range Objectives of Designating Refuges and Sanctuaries

Important solutions to the problems that manatees are facing include the acquisition of habitat, creation of reserves and enforcement of regulations to protect manatees and their habitat. Where sanctuaries have been previously established (i.e., Crystal River's King's Bay area) manatee use has increased substantially (Reynolds, 1995). The establishment of the proposed sanctuaries and refuges will help promote the protection of manatees by reducing the occurrence of take within these areas. As additional federal, state and local manatee protection zones are established, the manatees will have a network of safe havens for traveling between feeding, resting and wintering areas and experience less harassment and fewer incidences of take.

C. SECTION THREE - ISSUES, CONCERNS AND OPPORTUNITIES IDENTIFIED

1. Issue 1 - Manatee Protection and Recovery

The USFWS Technical/Agency Draft Florida Manatee Recovery Plan, Third Revision (2000a), substantially addresses the issues, concerns and opportunities associated with manatee protection and recovery and is hereby referenced and included as an attachment to this environmental assessment.

2. Issue 2 - Recreational Access and Uses

The sites proposed for listing under this rule serve a variety of recreational purposes. Many of the sites are used by boaters to travel from point to point. Other areas are used for recreational fishing, water skiing, snorkeling, diving and swimming. All sites are within a few miles of public access points and can be accessed from public and private boat ramps, docks or marinas. Designating proposed sites may alter recreational use in some areas. The Service realizes the potential impact of this rule on recreational use and is considering it during the review.

3. Issue 3 - Commercial Access and Uses

Several of these sites are used by commercial boat traffic and barges for the transportation of goods. Other sites are included in charter, dive and

tour boat service areas. Many sites are used for commercial fishing, particularly the crabbing industry. Additionally, water dependent facilities, such as bait and tackle shops, dive shops and marinas, may be affected by the proposed rule. Impacts to these industries will be addressed during the review of the proposed rule.

4. Issue 4 - Local Economy

Many of the economies of communities along Florida's waterways are dependent, at least partially, on water related activities. These activities may include commercial ports, marinas, tourism, fishing or any of a wide variety of other activities. The economic analysis of the proposed rule will be reviewed during the rule making process.

III. Alternatives

A. SECTION ONE - ALTERNATIVES CONSIDERED IN DETAIL

1. Alternative 1 - Baseline Management (No Action)

Under the "No Action" alternative the Service would not create any new refuges or sanctuaries for the Florida manatee. The existing network of speed zones and protection areas would remain. The Service would rely on state and local agencies to establish any new restricted areas which may be necessary through county or state-wide manatee protection plans.

2. Alternative 2 - Creation of a Limited Number (16) of Refuges and Sanctuaries

This alternative is the Service's preferred alternative. Adoption of this alternative would result in the designation of 12 new manatee refuges and 4 new manatee sanctuaries. Areas affected by the sanctuary designation would include the Blue Waters in Homosassa Springs, the Tampa Electric Company, FPC Bartow and TECO Gannon Power Plants in Tampa Bay all of which are winter warm water aggregation sites. Areas protected by refuge designation would include the Pansy Bayou, and Little Sarasota Bay portions of Sarasota County, Lemon Bay in Charlotte County, Shell Island in Lee County, and Haulover Canal, the Barge Canal, Sykes Creek, and the Cocoa Beach Municipal Park in Brevard County all of which are areas where manatees are at risk from watercraft.

B. SECTION TWO - ALTERNATIVES CONSIDERED BUT NOT ANALYZED

1. Alternative 3 - Establishment of All Suggested Refuges and Sanctuaries

This alternative would designate all areas recommended to the Service during the information gathering process as either refuges or sanctuaries and would include approximately 150 sites throughout the coastal waters of Florida and southeast Georgia.

2. Alternative 4 - Increase Enforcement of Existing Regulations Without Establishing New Refuges and Sanctuaries

This alternative would focus management on those areas already designated as either refuges or sanctuaries. The Service would not create any new refuges or sanctuaries for the Florida manatee. The Service would rely on increased efforts by federal, state and local agencies to increase law enforcement within the previously designated areas.

IV. Affected Environment

A. SECTION ONE - SANCTUARY/REFUGE ECOSYSTEM

1. Habitat

a. Location

The proposed refuges and sanctuaries are located within the inland waters of Florida in Citrus, Hillsborough, Pinellas, Sarasota, Desoto, Charlotte, Lee and Brevard Counties. All of these counties, except Brevard, are located along the central and west coast of the state adjacent to the Gulf of Mexico. Brevard County is on the Atlantic coast in the central portion of the state.

b. Climate

The Florida climate is generally characterized as transitional between temperate and subtropical conditions in the northern portions of the state and tropical conditions found in the Keys. Summers are generally long, warm and relatively humid while winters are mild with occasional periods of cold air. The climate is influenced by warm ocean currents in the Atlantic Ocean and the Gulf of Mexico. Average temperatures during the winter months range from the middle 40s to the middle 50s with occasional cold waves bringing the temperature to 15° to 20° Fahrenheit for short periods of time (Bradley 1972).

c. Floodplain, Wetlands, and Other Aquatic Resources

All of the sites being considered are aquatic habitats. The designation of a site as either a sanctuary or a refuge will result in restricted human activity in the area. These restrictions may include regulated use, such as slow, idle or no wake zones, or may completely prohibit human use within a proposed site for all or part of the year but will not eliminate waterway property owners access rights. Research has shown that boat traffic, especially at higher speeds, can cause considerable erosion to shorelines and emergent plants. Evidence of this has been shown where boat wash has removed the mud binder among shell substrate and loosens mangrove prop roots in Everglades National Park. Observations by officials indicate that many of the mangrove island along heavily traveled canals and the Intracoastal Waterway are disappearing (Snow 1989). The proposed management actions (i.e. slow speeds) may act to reduce shoreline erosion and therefore the need for shoreline protection, such as bulkheads, in some areas. The reduced erosion and turbidity will be beneficial to floodplains, wetlands, and other aquatic resources such as submerged aquatic vegetation within the restricted zones. Designation of a site would also reduce prop-cutting in submerged aquatic vegetation and benefit other aquatic resources by minimizing disturbances caused by faster moving watercraft. The designation and any restrictions associated with it, will not adversely impact the areas value as a floodplain, wetland or other aquatic resource.

d. Water Quality

The water quality in each of the proposed sites varies depending on the human use associated with the water body. The water quality in areas associated with the TECO and FPC Bartow power plants is currently affected by the warm water outfalls. These outfalls attract manatees and other aquatic species during the winter. The designation of these sites as sanctuaries will not affect the amount of warm water being released by these facilities. It will, however, increase the distance that motor boats will be required to stay away from them. The designation of a sanctuary at Blue Waters will restrict boat access near Homosassa Spring. This restriction may slightly improve water quality due to the reduction in motor fuels and oil being released into the surrounding water. The designation of speed zones in the remaining refuges may act to reduce some uses, such as water

skiing and jet skiing, that could contribute to degraded water quality. However these reductions are assumed to be small in the overall water quality of the areas. Overall, the resultant creation of speed zones and areas of restricted access will have limited impact on water quality due to the small size of each of the proposed refuges and/or sanctuaries.

e. Ground Water

None of the sites proposed for designation are important ground water recharge areas. One site, Blue Waters at Homosassa Springs is associated with a spring. The designation of these sites will not affect the ground water recharge or quality in those areas.

2. Wildlife

a. West Indian Manatee

The designation of the selected refuges and sanctuaries is expected to result in a decrease in the potential for “take” of manatees. Areas have been selected based on their importance to manatees as warm water refuges, migration and travel routes, and the potential of human/manatee conflicts. Additionally, harassment of manatees during the winter in warm water refuges has been shown to cause physiological stress and results in some manatees leaving the safety of the warm water to avoid human contact.

Results of studies in Brevard County indicate that watercraft-related manatee mortality is correlated with the presence of aquatic vegetation. This is evidenced by the number of dead manatees recovered with newly cropped undigested food remaining in their mouths. Additionally, it has been shown that there is a correlation between increased boat traffic in an area and an increase in number of manatee mortalities with Sykes Creek being one of the areas where a majority of watercraft-related manatee mortality is occurring.

b. Other Listed Species

There are several other species which also utilize the open water habitat which would be protected under the proposed rule these species include gulf sturgeon, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead

sea turtle, and bald eagle. Sea turtles are often seen in the coastal and inland waters of Florida. Evidence of boat strikes on sea turtles have been found on many of the carcasses recovered and recorded by the Sea Turtle Stranding and Salvage Network (STSSN). In 1997, 233 carcasses were recovered with evidence of boat strikes. This accounted for 24.8 percent of the carcasses recovered that year (Florida Department of Environmental Protection. 1998). In 1998, there were 301 carcasses recovered with evidence of boat strikes. This accounted for 30.6 percent of all carcasses recovered that year (Florida Department of Environmental Protection. 1999). In 1999, there were 217 carcasses with evidence of boat strikes. This accounted for 23.6 percent of all carcasses recovered. The running average between 1989 and 1998 indicates that 18.8 percent of all sea turtle carcasses recovered have evidence of boat-related injuries (Florida Department of Environmental Protection. 2000). The cause of death of the turtles recovered cannot be specifically identified but it can be assumed that many of the turtles that show evidence of boat strikes received the injury prior to death and may have died due to those injuries. The establishment of restricted areas through the proposed rule may decrease the potential for watercraft-related injuries to sea turtles just as it is expected to affect manatee mortality and injury.

B. SECTION TWO - SOCIO-ECONOMIC COMPONENTS

1. Public Use and Facilities

All of the sites proposed for designation as new refuges or sanctuaries have varying degrees of human use.

A small no-entry zone was created at TECO in 1986 and was expanded to include the entire discharge canal in 1989. Therefore no human activity is currently permitted within these boundaries. This no-entry zone probably has reduced disturbances to manatees from boats and appears to have resulted in an increase in manatee use of the site. The areas around the outfall structures for Tampa Electric Company (TECO) and the Bartow Electric Power Plants in Tampa Bay are used as winter fishing areas. The warm water outfall attracts a variety of fish that are generally not present in the area during the winter months. Fishermen in boats can travel up to the edge of the sanctuary and cast into the area where manatees are located. Such casting may disturb resting manatees and casting into manatee aggregations may result in snagging or hooking individual manatees. Hooks have been embedded in manatee eyes and

mouths where they have blinded individuals and affected their ability to feed. The use of monofilament line and other fishing gear has been shown to be detrimental to manatees. A database compiled by the Marine Mammal Pathology Laboratory in St. Petersburg, Florida contains records of manatee injuries, mortalities and rescues caused by fishery interactions. Between 1974 and September 1998, twenty-one manatees, 16 percent of all entanglement records, have either died or been rescued with flipper injuries caused by monofilament line. The extent of injuries varies from broken skin to complete amputation of the appendage (Nill 1998). The proposed expansion of this sanctuary will increase the area that is marked as off limits to humans and will therefore, reduce disturbance and reduce the potential for impacts of fishing gear on the manatees within the sanctuary area. However, the potential still remains that lost line and lures may adversely impact manatees outside of the proposed sanctuary area.

Blue Waters, a spring run associated with Homosassa Springs, is a popular location for boating, diving, swimming and snorkeling enthusiasts to visit and observe the manatees. The site has warm clear water which offers an excellent opportunity to interact with these animals. As with other spring systems, such as Kings Bay and Three Sisters in Crystal River, the manatees use this area for warmth during the winter and as a resting site. Observations at Three Sisters indicate that manatees occasionally enter the area when people are present but it is typical for manatee numbers to decline as the number of people increase (Wooding 1997). Similar activity has been observed to occur at Blue Waters as increasing numbers of visitors frequent the site. The Homosassa Springs State Wildlife Park has promoted the site for visitors by including observation decks, underwater viewing areas, a captive manatee facility and even a web cam for viewing manatee activities over the internet. Additionally, several companies offer guided tours and boat rentals for visitors to Blue Waters. The activities associated with dive boats and tourist use of the waterways in general has lead to harassment of manatees and temporary abandonment of the site to less suitable (i.e., colder water) areas while people are present. This action is adverse to manatees as it increases the amount of energy required to maintain body temperature and could potentially cause physiologic harm to the animals, particularly smaller manatees which are not as adept at maintaining body temperatures when compared to adult sized animals (U.S. Fish and Wildlife Service. 2000a). By implementing a sanctuary in the area most frequently used by manatees, the incidence of human harassment should decrease and the area that the manatee can use without being harassed will increase.

Pansy Bayou is a water ski area within a larger speed restricted zone. The area surrounding Pansy Bayou is marked as a “Slow Speed, Channel Included”. The ski area at Pansy Bayou has no speed restrictions.

The Barge Canal in Brevard County is used by both commercial and recreational vessels as a transit route between the Atlantic Ocean, Banana River and Indian River.

The remainder of the sites being considered under the proposed rule are used primarily by recreational and commercial boaters as travel corridors. Additional uses such as fishing, swimming, water skiing or jetskiing also occur within these areas.

2. Economic Conditions

This proposed rule will not have an annual economic impact of \$100 million or adversely affect an economic sector, productivity, jobs, the environment, or other units of government. A cost-benefit analysis is not required. We do not expect that any significant economic impacts would result from the establishment of 4 manatee sanctuaries (264.538 acres) and 12 manatee refuges (16,751.604 acres) in 7 Counties in the State of Florida. The public support for manatee protection is substantial in Florida. Using a contribution continuum method and reinforced by other empirical techniques, a study by Bendle and Bell in 1993 estimated that Floridians placed an asset value of \$3.2 billion (2001 dollars) on the protection of the manatee population. This amounts to a per-household value of \$18.12. The \$3.2 billion is an estimate of the benefit derived by Floridians from the existence of the manatee population.

The purpose of this proposed rule is to establish 16 additional manatee protection areas in Florida. We are proposing to reduce the level of take of manatees by controlling human activity in 4 areas proposed as sanctuaries and 12 areas proposed as refuges. Affected waterborne activities include swimming, diving, snorkeling, water skiing, surfing, fishing, the use of water vehicles, and dredging and filling activities. For the four areas designated as sanctuaries all waterborne activities would be prohibited from October 1 to March 31. For the 12 areas designated as refuges the areas would be slow-speed zones. The economic effect of these designations will be measured by the number of recreationists who use alternative sites for their activity or have a reduced quality of the waterborne activity experience at the designated sites. The State of Florida has 12,000 miles of rivers and 3 million acres of lakes so the designation of 17,000 acres (roughly 25 linear miles), most of which is for lower speed zones, is unlikely to prevent any waterborne activity because

of this rule, although some individuals may need to modify slightly when and where they pursue certain waterborne activities. Only one water craft company is known to use one of the proposed sites as a testing area for new hull designs. Alternative sites without speed zones are available nearby which would cost the manufacturer additional travel time and equipment re-calibration for the testing. No cost estimate for this adjustment is available at this time.

For boating recreationists, the inconvenience and extra time required to cross a slow-speed zone will reduce the quality of the waterborne activity for some participants. The extra time required for commercial charter boats to reach fishing grounds will reduce on-site fishing time and could result in lower consumer surplus for the trip. The number of recreationists and charter boats using the designated sites is not known. The State of Florida has nearly 800 thousand registered boats, but only those boats and recreationists using the designated sites will potentially be affected. However, since Florida has 12 thousand miles of rivers and streams and 3 million acres of lakes and ponds, it is likely that only a small percentage of boat users will be affected by this rule. The current designation of roughly 25 linear miles will cause some inconvenience in travel time over these areas, but alternative sites within the proximity of the manatee sanctuaries and refuges are available for all waterborne activities. Furthermore, none of the areas designated is the entire surface area of a water body. The undesignated parts of the water bodies are available for waterborne activities. Recreationists may be inconvenienced by having to travel to an undesignated area, but they are not prohibited from participating in any of the waterborne activities. Currently, no data sources estimate the amount of recreational activity in and around the 16 areas to be designated as either manatee sanctuaries or refuges. However, the majority (16,751.604 acres) of the areas proposed to be designated are for manatee refuges, which require only reduced speed. The 264.538 acres proposed as manatee sanctuaries are, for the most part, next to electric power generating plants and are part of larger water bodies where unrestricted waterborne recreational activity can take place. For these reasons, we believe some inconvenience to the public may occur because of reduced travel speeds but that the economic impact will not be significant.

To determine the potential effects of this proposed rule on small entities, we looked at economic data from the seven counties in Florida that would be affected. Table 1, below, depicts general economic characteristics of those counties, and table 2 gives employment data. As can be seen in table 1, the growth rate in per capita income is slower than the State average in Citrus, Brevard, and Charlotte Counties, but the rate of growth

Table 1

in total personal income exceeds the State average except in Brevard County, where it is slightly lower. Larger households account for the lower per capita income estimates in these counties. The proportion of total industry earnings coming from the amusements and recreation sector ranges from 0.5 percent in Brevard County to 2.7 percent in Sarasota County. All of these counties had the service sector as the largest economic contributor followed by retail trade and the real estate sectors. Overall, the affected counties had only a small proportion of earnings coming from the amusement and recreation sector. As a result, a small impact to the recreation sector would not result in a significant effect on county-level income.

Table 2 provides employment data using Standard Industrial Classification (SIC) codes. The latest available published data for the total number of establishments in the SIC codes for fishing, hunting, trapping (SIC code 9), water transportation (SIC code 44), miscellaneous retail and services (SIC code 59), amusement and recreation services (SIC code 79), and nonclassifiable establishments is 1997. These are the establishments most likely to be directly associated with recreationists pursuing waterborne activities where manatees may be involved. As can be seen on Table 2, of the total number of establishments in these SIC codes, a large proportion employ fewer than 9 employees with the largest number of establishments employing fewer than 4 employees. If any economic impacts are associated with this rule, they will affect some proportion of these small entities. Since the bulk of the acreage proposed (16,751.604 acres) by this rule is for manatee refuges, which would only require a reduction in speed, we do not believe the minor inconvenience caused by going slower in designated areas will cause more than an insignificant economic effect. The inconvenience may cause some recreationists to go to alternative sites, which may cause some loss of income to some small businesses. However, the inconvenience is small so we believe that this will not be a significant economic dislocation. For the four areas designated as sanctuaries (264.538 acres), the restriction on human activity from October 1 to March 31 may cause some recreationists to go to alternative sites. However, three of the areas designated are in front of power plants, and the fourth (Blue Waters) is only 4.145 acres. The designated areas are relatively small and part of large water bodies having large areas with no restrictions on human activity. Recreationists can pursue waterborne activities in close proximity to the manatee sanctuaries without entering the sanctuaries. For this reason, we believe that there will be an insignificant economic effect from the designation of the four areas as manatee sanctuaries. Without a significant change in recreationists' use patterns, there should be an equally insignificant change in business activity.

Table 2

The only known direct effect will be on a business using one of the areas to test hull designs. The economic cost of relocating the test site, which requires boats going at high speed, is not known. Substitute sites are available within a reasonable distance, but the quality of the substitutes for the required testing is not known. Information obtained during the public comment period on the proposed rule may allow further analysis of this and any other effects identified.

3. Cultural Resources

The aquatic areas of the state have been historically important to both the Native American and the colonial cultures. These areas may have been used for food collection, navigation and trade. Many of the springs have archeological sites associated with them. The proposed restriction resulting from the designation as a refuge or sanctuary will not adversely impact any archeological sites that may be present.

V. Environmental Consequences

A. Alternative 1 - Baseline Management (No Action)

1. Proposed Action

Under the “No Action” alternative the Service would not initiate any new management practices within the currently proposed areas. All current management practices, such as enforcing the existing sanctuaries, refuges and speed zones, will continue as before. Failing to adopt appropriate protective measures within our authority and resources for reducing the potential take of manatees is not acceptable to the Service.

2. Effects on Manatees

The “No Action” alternative would not give the Service any additional capability in reducing the amount of take on manatees in areas with identified problems. Over the last five years there have been 340 watercraft-related manatee deaths and 23 other human-related manatee mortalities. Human related deaths have contributed to 25 percent (363 out of 1429 deaths) of all reported manatee mortalities in the last five years. Without additional protective measures in areas with documented take of manatees that currently lack sufficient regulation, the number of human-related manatee deaths is expected to increase as public use of the waterways increases. The goal of the Endangered Species Act, including species specific recovery plans, is to recover listed species to sustainable

population levels and to eventually down or delist. Without the ability to reduce potential take by designating refuge and sanctuary areas for this species, the Service is limited in methods available to it to protect the manatee. The Service believes that increases in human-related manatee mortality will continue. The Service finds that the “No Action” alternative is not acceptable due to the expected increase in take that will result as the public use of Florida’s waterways continues to increase.

3. Effects on Public Use

The “No Action” alternative would allow current use of the waterways by humans to continue with no further regulation imposed by the Service. Public use of the currently proposed areas as well as all related manatee mortality numbers will continue to be monitored even if the areas are not designated as refuges or sanctuaries. Use of the waterways by the public will continue to grow as the state’s population and visitor numbers increase. The popularity of swimming with the manatees is also expected to grow and may become difficult to manage in some areas as this activity increases. Due to this expected increase in human use of areas that manatees frequent and the related increase in potential for take, the Service finds that the “No Action” alternative is not acceptable.

B. Alternative 2 - Creation of a Limited Number (16) of Refuges and Sanctuaries

1. Proposed Action

This alternative is the Service’s preferred alternative. Adoption of this alternative would result in the designation of 12 new manatee refuges and 4 new manatee sanctuaries. Areas affected by this designation are listed below.

- a. **Blue Waters:** The Service proposes to establish a seasonal manatee sanctuary at the headwaters of the Homosassa River, commonly referred to as the “Blue Waters”. This sanctuary would prohibit all waterborne activities from October 1 through March 31, inclusive.
- b. **Tampa Electric Company (TECO) Big Bend Electric Generating Plant::** The Service proposes to establish a seasonal manatee sanctuary at the warm water outflow of the TECO Electric Power plant in Tampa Bay, Hillsborough County, Florida. This seasonal closure will prohibit all waterborne activity at the site from October 1 through March 31, inclusive. Access to the lagoon and canals in the North Apollo Beach area will be allowed for ingress and egress at “Slow Speed” via the most direct route or one which will be established.

- c. FPL Bartow Electric Power Generating Plant: The Service proposes to establish a seasonal manatee sanctuary at the warm water outflow of the Bartow Electric Power generating plant in Tampa Bay, Pinellas County, Florida. This seasonal closure will prohibit all waterborne activity at the site from October 1 through March 31, inclusive. In addition, a manatee refuge will be established in the navigation channel north of the Bartow Plant, with the purpose of regulating watercraft operation to Slow Speed from October 1 through March 31 inclusive.
- d. Port Sutton: The Service proposes to establish a seasonal manatee sanctuary at the warm water outflows of the Gannon Electric Generating Station in Tampa Bay, Hillsborough County, Florida. This seasonal closure will prohibit all waterborne activity at the site from October 1 through March 31, inclusive. The remainder of the water within Port Sutton will be managed as a seasonal manatee refuge and vessels will be required to operate at Idle Speed.
- e. Pansy Bayou: The Service proposes to establish manatee refuges in the Pansy Bayou area of Sarasota County to regulate vessel traffic at Slow Speed-Year Around.
- f. Little Sarasota Bay: The Service intends to establish a manatee refuge to control vessel speeds in the little Sarasota Bay area, Sarasota County. The speed designation for this area will be “Slow Speed-Channel Exempt”.
- g. Lemon Bay: The Service intends to establish a manatee refuge in Lemon Bay, Charlotte County for the purpose of regulating vessel speed. Speed designation will be “Slow Speed-Channel Exempt”.
- h. Peace River: The Service intends to establish a manatee refuge in Peace River, Charlotte and DeSoto Counties. Waters within the marked navigation channel will be regulated to allow watercraft to travel up to a maximum of 25 mph. All waters outside of the marked channel will be regulated to provide for Slow Speed vessel operation. These regulations will be in effect throughout the year.
- i. Shell Island: The Service intends to establish a manatee refuge for the purpose of regulating vessel speed as “Slow Speed-Channel Included” in the navigation channel that is located just north of Shell Island at the mouth of the Caloosahatchee River.

- j. Haulover Canal: The Service proposes to establish a manatee refuge at the Haulover Canal site in Brevard County and extend the existing Slow Speed Zone eastward and westward from the ends of the canal.
- k. Barge Canal: The Service proposes the establishment of a manatee refuge for the purpose of regulating watercraft operation as “Slow Speed-Channel Included” for the entire length of the Barge Canal and extending eastward to the Canaveral Locks.
- l. Sykes Creek: The Service is proposing the establishment of a manatee refuge in Sykes Creek for the purposes of regulating watercraft operation to “Slow Speed-Channel Included”.
- m. Cocoa Beach Municipal Park: The Service proposes to establish a manatee refuge to regulate vessel operation to “Slow Speed” in the area adjacent to Municipal Park at Cocoa Beach, Brevard County, Florida.

2. Site Description

- a. Blue Waters: The site of this action includes a tract of submerged land, lying in Section 28, Township 19 South, Range 17 East, in Citrus County, more particularly described as the headwaters of the Homosassa River, adjacent to the Homosassa Springs State Wildlife Park, including the main spring, spring run and point where the run enters the northeast fork of the river along the southeastern shore.
- b. Tampa Electric Company (TECO) Big Bend Electric Generating Plant: The site includes a tract of submerged land, lying in Sections 10 and 15, Township 31 South, Range 19 East, in Hillsborough County, Florida, more particularly described as the waters in and around warm-water outflow of the TECO Big Bend electric generating station located west of Jackson Branch and including the Big Bend area of eastern Tampa Bay.
- c. FPL Bartow Electric Power Generating Plant: The site includes a tract of submerged land, lying in Sections 16 and 21, Township 30 South, Range 17 East, in Pinellas County, Florida, more particularly described as the warm-water outflow of the Bartow electric generating station located on the northern shore of Weedon Island, lying along a north-south axis line from the shoreline to the South Gandy Channel on the western shore of Old Tampa Bay.
- d. Port Sutton: The site includes a tract of submerged land, lying in Section 4, Township 30 South, Range 19 East, in Hillsborough County, Florida, more particularly described as the warm-water outflow of the TECO

Gannon electric generating station and harbor area of Port Sutton, lying along an east-west axis line south of Black Point in northern Hillsborough Bay.

- e. Pansy Bayou: That portion of Sarasota Bay lying northwesterly of a line 150 feet northwesterly of and parallel with a line perpendicular to the John Ringling Parkway Bridge connecting St. Armands Key to City Island from the northwesterly end of said bridge, southwesterly of a line 750 feet northeasterly of and parallel with the centerline of the John Ringling Parkway (running northwesterly from St. Armands Key), northwesterly of a line 1050 feet northwesterly of and parallel with a line perpendicular to the aforementioned John Ringling Parkway Bridge connecting St. Armands Key to City Island from the northwesterly end of said bridge, and southwesterly of a line 3250 feet northeasterly of and parallel with the centerline of the aforementioned John Ringling Parkway (running Northwesterly from St. Armands Key).
- f. Little Sarasota Bay: Those waters lying southerly of a line that bears North 90°00'00" East (True) and runs through the southerly tip of the first unnamed island south of Red Intracoastal Waterway Channel Marker 40 (latitude 27°10' 07" North, longitude 82°30' 05" West) and those waters lying northerly of the Blackburn Point Bridge.
- g. Lemon Bay: Those waters of Lemon Bay lying south of the Sarasota/Charlotte County boundary and north of a line North 60°14'00" East (True) parallel with a series of small islands approximately 1 mile south of the Bay Road Bridge. along the Private Aids Channel Markers just south of Green Intracoastal Waterways Channel Marker 9.
- h. Peace River: All waters of the Peace River and associated water bodies north and east of the Tamiami Trail.
- i. Shell Island: All waters within the marked Intracoastal Waterway channel between Green Marker 99 (approximate latitude 26°31'00" North, approximate longitude 82°00'52" West) and Green Marker 93 (approximate latitude 26°31'37" North, approximate longitude 81°59'46" West).
- j. Haulover Canal: All waters lying within 0.5 miles of each end of the Haulover Canal as well as the canal itself will be designated for "Slow Speed" operation.

- k. Barge Canal: All waters lying within the banks of the Barge Canal and including all waters lying within the marked channel in the Banana River which lie between the east entrance of the Barge Canal and the Canaveral Locks.
- l. Sykes Creek: All waters, including the marked channel in Sykes Creek. In particular, the portion of Sykes Creek southerly of the southern boundary of that portion of the creek commonly known as the “S” curve (said boundary being a line bearing East from a point on the western shoreline of Sykes Creek at approximate latitude 28°23'24" North, approximate longitude 80°41'27" West) and northerly of the Sykes Creek Parkway.
- m. Municipal Park: The waterbody west of Municipal Park within the City of Cocoa Beach commencing at a point 150 feet west of the southwest corner of the canal running between Willow Green and Country Club Roads, thence southerly (and parallel to the golf course shoreline) to a point 150 feet west of the southwest corner of the Municipal Golf Course shoreline, thence south to marker 502, thence westerly (inclusive of the area known as the “400 Channel”) to Red marker 500, thence northerly to Red marker 309, inclusive of the 400 Channel, thence southeasterly to the southwest corner of the canal referenced as the point of origin, all these waters being within the eastern half of Sections 8 and 17, Township 25 South, Range 37 East.

3. Reason for Determination

We intend for the actions proposed in this rule to represent the minimum amount of regulation necessary to achieve the goal of preventing the take of manatees. We made every effort to make our proposed designations consistent with the adjacent State or local designations. Therefore, in refuges proposed for designation as “Slow Speed” we adopted a definition that is consistent with that used by the State.

In documenting manatee use and historic manatee harm and harassment, we relied on the best available data including aerial survey data and manatee mortality data, information from the Florida Marine Research Institute, Pathobiology Laboratory, and other information from State and Federal sources. These data were supplemented with information from manatee experts, the public, and our best professional judgement. In determining the potential effectiveness of proposed Service actions, we considered the costs of managing sites versus the benefits to manatee conservation. Costs associated with site management include installation and maintenance of appropriate signage, public education, and enforcement. Because we will not deny access

for owners of waterfront property, designation of sanctuaries in the waters bordered by private property entails additional administrative burdens in terms of identifying and providing access to affected residents. We considered these administrative burdens in selecting sites. Finally, we evaluated the effectiveness of our proposed actions against the likely effectiveness of actions by State and/or local governments. We have not proposed areas for which we have determined that identified threats to manatees can be most effectively addressed by State or local action. We will continue to monitor sites which are not included in the currently proposed rule and may propose additional actions in the future, as appropriate.

We intend for the actions proposed in this rule to represent the minimum amount of regulation necessary to prevent the take of manatees. We made every effort to make our proposed designations consistent with the adjacent State or local designations.

- a. **Blue Waters:** The headwaters of the Homosassa River is an important wintering site for manatees (U.S. Fish and Wildlife Service. 2001). The site is in close proximity to the Homosassa Spring, a Class 1 magnitude spring, which provides relatively warm (72° F) water from the Florida aquifer. This warm water is essential to the survival and well-being of a significant number of manatees during cold weather periods, with as many as 123 manatees being observed at the site at one time (U.S. Fish and Wildlife Service. 2001). According to the Citrus County Manatee Protection Plan (1997), between 30 and 56 percent of the wintering manatees in the Homosassa River were seen in the Blue Waters area. Homosassa Springs State Wildlife Park, located directly upstream from the site and containing the Spring itself, is closed to entry for the wild manatees wintering here because the spring head is used as a care facility for captive manatees.

The presence of manatees, coupled with the shallow clear nature of the water, has attracted an increasingly large number of swimmers and divers to the site. The primary objective of these visitors is to interact in the water with the manatees. The waters of the Homosassa River are currently regulated as “Idle Speed”, and the State Park maintains a no entry zone from a line approximately 200 feet upstream of the confluence of the spring run and the northeast fork of the river. The number of visitors has grown to the point where manatees are observed leaving the site and swimming downstream, in spite of colder water temperatures available to them. This action is adverse to manatees as it increases the amount of energy required to maintain body temperature and could potentially cause physiologic harm to the animals, particularly smaller

manatees which are not as adept at maintaining body temperatures when compared to adult sized animals.

The reaction displayed by manatees to the large amount of human disturbance in the area has been documented and has it been demonstrated that the animals leave the Blue Waters site and move downstream in response to the disturbance.

The establishment of a manatee sanctuary at this location will provide manatees with an undisturbed area in which to rest, sleep and cavort, by extending the no entry zone currently maintained by the State Park approximately 200 feet downstream in the spring run. The waters in the existing no entry zone are for the most part too shallow to be accessible by manatees. There will still be opportunity for the public to engage in interaction with the manatees outside the proposed sanctuary, and interaction/viewing activities will probably increase as manatees will remain in the Blue Waters for extended periods of time due to decreased disturbance. This has proven to be the case with the establishment of manatee sanctuaries in Kings Bay/Crystal River, Florida.

- b. Tampa Electric Company (TECO) Big Bend Electric Generating Plant: large percentage of the manatees residing in the middle Gulf of Mexico area of Florida winter at the warm water outflows of two operating electrical power plants in Tampa Bay (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). We proposed this area based on observed manatee use patterns in response to cold weather/cooler ambient water temperatures. Currently, manatees use the TECO site for warmth during periods of cold weather. The undisturbed access to these sites is critical to the survival of these manatees during the winter. The maximum manatee count at this site was 316 on January 6, 2001 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b).

Warm water effluent from this plant attracts manatees during cold weather periods. Large numbers of fish are also attracted to this site, which, in turn, attracts large numbers of fishermen. The disturbance by boats causes manatees to move out of the area, thereby increasing metabolic rates and energy consumption of the animals in an attempt to maintain body temperatures. There have also been documented cases of manatees being hooked by and entangled with fishing gear (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). There is currently a seasonal no entry zone in the immediate vicinity of the TECO outflow; however, this zone is too small to prevent harassment of manatees by fishermen. Establishing a

sanctuary at this site will provide manatees with an expanded area during winter months. The area to be closed has been determined based on observed manatee use patterns in response to cold weather/cooler ambient water temperatures.

- c. FPL Bartow Electric Power Generating Plant: A large percentage of the manatees residing in the middle Gulf of Mexico area of Florida winter at the warm water outflows of two operating electrical power plants in Tampa Bay (Florida Marine Research Institute Aerial Survey Data). The undisturbed access to these sites is critical to the survival of these manatees during the winter. We have proposed this area based on observed manatee use patterns in response to cold weather/cooler ambient water temperatures. Currently, manatees use the Bartow site for warmth during periods of cold weather. The maximum manatee count at this site has been 66 manatees (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). This site is critical to the survival of these manatees during the winter.

Warm water effluent from this plant will attract manatees during cold weather periods. Large numbers of fish are also attracted to this site, which, in turn, attracts large numbers of fishermen. The disturbance by boats causes manatees to move out of the area, thereby increasing metabolic rates and energy consumption of the animals in an attempt to maintain body temperatures. There have also been cases of manatees being hooked by and entangled with fishing gear (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). Establishing a sanctuary at this site will provide manatees with undisturbed access to this warm water outflow. The area to be closed has been determined based on observed manatee use patterns in response to cold weather/cooler ambient water temperatures.

- d. Port Sutton: A large percentage of the manatees residing in the middle Gulf of Mexico area of Florida winter at the warm water outflows of the TECO and Bartow electrical power plants in Tampa Bay. The Gannon plant, also located in Tampa Bay, is currently being repowered and scheduled to go on-line in the near future. Once operating, the plant outflow is expected to attract wintering manatees. The undisturbed access to these sites is critical to the health and well-being of these manatees during the winter months. Currently, manatees use both the TECO and Bartow sites and shift from one to the other depending on which is producing the greatest amount of warm water discharge. We have proposed this area based on observed manatee use patterns in response to cold weather/cooler ambient water temperatures.

Warm water effluent from this plant will attract manatees during cold weather periods. Large numbers of fish also will be attracted to this site, which, in turn, will attract large numbers of fishermen. The disturbance by boats causes manatees to move out of the area, thereby increasing metabolic rates and energy consumption of the animals in an attempt to maintain body temperatures. There have also been cases of manatees being hooked by and entangled with fishing gear. The area currently lacks a no entry zone. Establishing a sanctuary at this site will provide manatees with undisturbed access to this warm water outflow. The area to be closed has been determined based on observed manatee use patterns in response to cold weather/cooler ambient water temperatures.

- e. Pansy Bayou: Manatees consistently use this site as both a travel corridor and feeding site (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). Pansy Bayou proper is currently closed to all vessel traffic except residents. The site of the proposed refuge is currently used as a waterski area, and the remaining waters around the proposed refuge are currently designated as “Slow Speed - Channel Included” (F.A.C. 62N-22.026(2)(a)(4)). Aerial survey data indicates significant manatee use in this area. There were 113 aerial surveys flown between 1985 and 1993 in the area of Pansy Bayou. These surveys were flown during all seasons. During each survey, manatees were detected in the vicinity of the high speed waterski area (within 0.75 mile), with a maximum number of twelve manatees observed during one survey. There have been two watercraft-related manatee mortalities within one mile of the proposed refuge. Establishment of a slow speed area within the proposed refuge will minimize the risk of taking manatees through watercraft collisions.

- f. Little Sarasota Bay: This area is consistently used by manatees for feeding and as a travel corridor. Aerial survey data indicates a significant level of use by manatees (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). From the period 1985 through 1993, there were 24 aerial surveys conducted in which manatees were detected in the proposed area. These flights were flown during all seasons of the year. The maximum number of manatees observed during one survey was seven. Concurrently, the areas of Sarasota Bay within a mile to the north and south of the proposed area were also flown. Manatees were also detected in these areas, with a maximum count of 12 manatees to the north of the site and 13 manatees to the south of the site. There have been four watercraft-related manatee mortalities within the confines of this site (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). There are currently no speed zones in this portion of Sarasota County.

The current unregulated nature of vessel operation has high potential for manatee take. Establishing a slow speed zone outside of the main navigation channel reduces the potential for take.

- g. Lemon Bay: Lemon Bay is used by manatees for feeding and as a travel corridor. Aerial survey data indicates that this area is used extensively by manatees (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). There are currently no speed zones for manatee protection in this portion of Charlotte County. The unregulated nature of this water body makes the taking of manatees very likely, due to the high speeds at which watercraft currently travel through areas frequented by manatees. There have been six watercraft-related manatee mortalities in Lemon Bay (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). Establishing a slow speed zone outside of the main navigation channel will reduce the likelihood of a take occurring.
- h. Peace River: Peace River is used by manatees for feeding and other activities throughout the year. There were 36 aerial surveys flown during the two year period 1987-88 during which manatees were observed in the Peace River area. The maximum number of manatees observed during one flight was 16 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). There have also been a significant number of manatee mortalities at this site, including 11 watercraft-related mortalities. Of this number, six of these deaths have occurred since 1995 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). There are currently no speed zones for manatee protection in the Peace River. As a result, watercraft may currently travel at high speeds through areas of the Peace River frequented by manatees. The establishment of the proposed refuge would slow vessel traffic in those portions of the Peace River where boats are most likely to encounter manatees; thereby minimizing the likelihood of take.
- i. Shell Island: The Caloosahatchee River is an important manatee habitat. This river system supports large numbers of manatees. The Florida Power & Light Ft. Myers Power Plant is a major wintering refuge for manatees. Aerial survey data indicate significant manatee use in the vicinity of the proposed site. On January 6, 2001, 434 manatees were observed at the power plant (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). Most manatees using the Caloosahatchee River must pass through or near the Intracoastal Waterway navigation channel north of Shell Island when entering or exiting the river. This funneling of manatee and boats traveling at high

speed through a narrow channel provides for a high probability of take. There have been nine watercraft-related manatee mortalities at this site as well as in close proximity to this site (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). By slowing watercraft to slow speed operations, safety will be enhanced for both manatees and humans using this waterway.

- j. Haulover Canal: All manatees and boats traveling between Mosquito Lagoon and the Indian River must travel through the Haulover Canal. The canal functions in a funnel-like fashion, concentrating manatees and boats. While vessels are currently required to proceed at Slow Speed within the confines of the canal, there is no speed regulation to the east and west beyond the canal. Hence, boats approaching at high rates of speed into an area which acts as a travel funnel for manatees represents a high potential for take. Aerial survey data indicates significant manatee use of the site and there have been ten watercraft-related mortalities in the vicinity (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). Regulating boats to operate at Slow Speed not only within the canal but at the entrances to both ends of the canal in “barbell” fashion, will minimize the potential for take.

- k. Barge Canal: The Barge Canal serves as a major travel corridor between the Indian and Banana Rivers for manatees and mariners alike. There have been 16 manatee carcasses recovered from the Barge Canal and vicinity (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). Portions of the Banana River north of the Barge Canal are possibly the most important summer feeding and resting areas on the Atlantic Coast. The Indian River is also an important feeding and resting area, however, it becomes more important during the winter months due to the number of warm water discharges including several electric generating plants, and various creeks and canals. The increasing number of manatees using the northern Banana River in spring during their northward migration must now cross into the Indian River through the Barge Canal and Sykes Creek to continue their northward route (Marine Mammal Commission 1988). There has been a high rate of manatee carcass recovery from the Barge Canal vicinity. Additionally, aerial survey data indicate significant use of the area by manatees (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). Currently there are four areas within the Barge Canal that are regulated as “25 miles-per-hour with 25-foot slow speed shoreline buffer, all year”, while the remainder of the Barge Canal is “slow speed - all year”. High speed vessel operation in a confined migration corridor, such as this, also has an enhanced likelihood of take. Regulating vessels to operate at “Slow Speed” will minimize the potential for take.

- l. Sykes Creek: Manatees consistently use Sykes Creek for feeding, resting and cavorting and as part of a major travel corridor between the Banana River and Indian River (Marine Mammal Commission 1988). Like the Barge Canal, it is a fairly narrow water body and is the site of 13 watercraft-related manatee mortalities (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). Aerial survey data indicates significant manatee use of the site (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). High speed vessel operation in this area will have a high likelihood of resulting in a manatee take. Regulating vessels to proceed at “Slow Speed” will minimize the likelihood of take.

- m. Cocoa Beach Municipal Park: There has been a high incidence of watercraft-related manatee carcass recovery in the vicinity of this site. The area contains a substantial amount of sea grasses and is used as a foraging area by manatees. Aerial survey data indicates significant manatee use of the site (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b). There have been four watercraft-related manatee mortalities in the vicinity of this site (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a). The site is currently a waterski area regulated as “35 miles-per-hour, all year” (F.A.C. 62N-22.006(1)(h)), whereas the surrounding waters are regulated as “slow speed, all year” (F.A.C. 62N-22.006(1)(d)). Given the use of the area by manatees, high speed vessel operation at this location has a high probability of resulting in take. Requiring vessels to proceed at “Slow Speed” will minimize potential manatee take.

4. Special Area Management

The refuges and sanctuaries proposed by this rule will be clearly marked as to the restrictions placed on the area and will be periodically patrolled by law enforcement officers. The Service has increased its efforts to reduce watercraft related manatee mortality over the last few years. These law enforcement operations focus on areas of high manatee mortality, large number of watercraft and low levels of compliance with protection regulations. During 1999 a total of 20 days were spent in Collier, Brevard and Volusia Counties resulting in 716 notices of violation being issued (U.S. Fish and Wildlife Service. 2000b). This is a 128 percent increase in issued notices from 1997 when 313 tickets were written during the 20 days the task force was operating. The number of federally sponsored enforcement initiatives will increase as funding for the task force increases. The Florida Fish and Wildlife Conservation Commission and local law

enforcement officers are also responsible for enforcing posted speed zones and restrictions which will be established under this proposed rule.

5. Effects on Public Use

Public use in areas proposed for designation as either sanctuaries or refuges will be affected by varying degrees depending on the proposed restrictions. Areas designated as sanctuaries, such as Blue Waters, TECO, Bartow and Gannon Power Plants will prohibit waterborne public uses within the established boundaries. A waterborne activity is defined as including, but not limited to, swimming, diving (including skin and SCUBA diving), snorkeling, water skiing, surfing, fishing, the use of water vehicles and dredging and filling activities. Areas designated as refuges will have restrictions placed on certain public uses. The majority of these restrictions would limit the speed at which watercraft travel while in the designated areas. Pansy Bayou, and Cocoa Beach Municipal Park are currently water ski areas. These areas will be established as “Slow Speed” zones therefore adversely effecting all water ski activities. The effect of establishing areas as reduced speed zones should be minimal in this case. All of the proposed areas are small in size and the resultant increase in travel time will be minimal.

6. Conclusion

In evaluating the need for additional manatee protection areas the Service has considered the needs of the manatee at an ecosystem level with the goal of ensuring that adequate protected areas are available throughout peninsular Florida to satisfy the biological requirements of the species, with a view toward the manatee’s recovery. We recognize that there exists an extensive network of manatee speed zones and sanctuaries, which have been established throughout peninsular Florida by Federal, State and local governments. This existing structure substantially fulfills the above-stated goal. The purpose of our evaluation has been to identified remaining gaps in the existing network and to propose appropriate measures for filling those gaps.

The Service also recognizes that the existing system of speed zones and sanctuaries has been established primarily by State and local governments. We recognize the important role of our State and local partners, and the Service continues to support and encourage State and local measures to improve manatee protection. The Service has focused the currently proposed action on those sites in which we have determined that Federal action can effectively address the needs in the particular area, recognizing that we face certain resource limitations. We are also proposing actions in areas in which State and local governments have been unable to implement what we consider to be adequate measures. The Service is eager to work with State or local agencies to develop and implement

measures in the areas discussed in the proposed rule that would be equally protective of manatees, thereby eliminating the need for Federal action.

This alternative, the designation, posting and enforcement of refuges and sanctuaries is expected to increase public awareness of the potential for take of Florida manatees in areas of high manatee use. Public use of these areas would be affected to varying degrees from complete prohibition of activities within the proposed sanctuaries to restricted activities such as “Slow Speed” zones in the refuges. These restrictions are expected to provide the manatee some protection from take in their heavily used travel corridors and their wintering areas. This alternative is the Service’s preferred alternative.

C. Alternative 3 - Establishment of All Suggested Refuges and Sanctuaries

1. Proposed Action

This alternative would designate all suggested areas as either refuges or sanctuaries. This would account for approximately 150 sites throughout the coastal waters of Florida and southeast Georgia.

2. Effects on Manatees

Under this alternative, the number of manatee sanctuaries and refuges would be increased substantially. This increase in protected areas would be beneficial to manatees due the expected decrease takings within the zones.

3. Effects on Public Use

Public use in each of the suggested sites would be restricted to varying degrees based on whether the area is designated as a refuge or a sanctuary.

4. Conclusion

Due to budgetary and staff allocation concerns, this alternative was not considered further during the review.

D. Alternative 4 - Increase Enforcement of Existing Regulations without Establishing New Refuges and Sanctuaries

1. Proposed Action

This alternative would focus management on those areas already designated as either refuges or sanctuaries. The Service would not create any new refuges or sanctuaries for the Florida manatee. The Service would rely on increased efforts by federal, state and local agencies to increase law enforcement within the previously designated areas.

2. Effects on Manatees

The continuation and increase in law enforcement actions within existing manatee refuges and sanctuaries would be expected to create an awareness in the public of the importance of these areas and the potential for injury or death to manatees related to human activities. By educating the public through increased law enforcement activities it would be expected that manatee mortality and injuries would decline. The Service will continue to make enforcement of existing manatee protection areas a priority. However, enforcement cannot reduce take of manatees in areas that lack regulations to enforce or in areas in which existing regulations are inadequate to minimize take of manatees. The Service has determined that such areas exist; therefore, relying entirely on increased enforcement of existing zones would not address identified problems and is unacceptable to the Service.

3. Effects on Public Use

Studies have shown that boater compliance with existing speed zones is less than what is required to significantly reduce manatee injuries and deaths. Under this alternative, increased patrols and enforcement of existing regulations would be initiated to cut down on violations. This alternative would not affect that portion of the public who are in compliance with existing regulations since no new regulated areas would be established. The only impact on public use would result from increased patrols and citations to those individuals who are violating the posted restrictions.

4. Conclusion

Due to the inability of increased law enforcement to minimize take of manatees in areas with lacking or inadequate protective measures, this alternative is not acceptable to the Service. The Service has made, and will continue to make, enforcement of existing regulations a high priority. Additionally, the Service will devote appropriate enforcement resources to any additional manatee protection areas designated.

E. Summary of Impacts of Alternatives

1. Biological Value of the Proposed Refuges and Sanctuaries

The biological value of each of the proposed sites was previously discussed in section IV.B.3 above. These sites are important for their use as warm water refuges, travel and migration corridors, feeding and resting areas. The selection of the 16 sites was based on their importance to manatees as individual sites and also as important links within the local ecosystem.

2. Adequacy of the Funding

The Service's decision to propose 16 new sanctuaries and refuges in this proposed rule is partially based on funding. In determining the potential effectiveness of proposed Service actions, we considered the cost of managing sites versus the benefits to manatee conservation. Costs associated with site management include installation and maintenance of appropriate signage, public education, and enforcement. It was determined that the budget allowance for this activity would allow for the designation, marking and enforcement of a limited number of small protected areas. There are many more areas that have been suggested as possible protected areas, however, the funding to manage those sites is not available at this time. As funding becomes available in the future, some of the suggested sites and possibly additional new sites, may be considered for designation as refuges or sanctuaries in the future. If additional funding is not available, the Service will not be able to propose new protected areas. At this time, there is sufficient funding available to manage the number and size of protected areas currently suggested.

3. Adequacy of the Amount Of Habitat Proposed for Designation

We selected sites for inclusion in the proposed rule from the list of sites developed through the preliminary meetings and the information gathered at the public workshops and in response to the advance notice. We based site selection on four factors-- 1) evidence that the site is used by manatees; 2) historic evidence of harm or harassment of manatees at the site due to waterborne human activities; 3) the potential for additional take based on manatee and human use of the site; and 4) a determination that we could implement effective measures at the site to address the identified problem, within our limits of staffing and funding.

In documenting manatee use and historic manatee harm and harassment, we relied on the best available data, including aerial survey data and manatee mortality data, information from the Florida Marine Research

Institute, Pathobiology Laboratory, and other information from State and Federal sources. These data were supplemented with information from manatee experts, the public, and our best professional judgement. In determining the potential effectiveness of proposed Service actions, we considered the costs of managing sites versus the benefits to manatee conservation. Costs associated with site management include installation and maintenance of appropriate signage, public education, and enforcement. Because we will not deny access for owners of waterfront property, designation of sanctuaries in the waters bordered by private property entails additional administrative burdens in terms of identifying and providing access to affected residents. We considered these administrative burdens in selecting sites. Finally, we have reviewed the effectiveness of our proposed actions against the likely effectiveness of actions by State and/or local governments. We have not proposed areas for which we have determined that identified threats to manatees can be most effectively addressed by State or local action. We will continue to monitor sites which are not included in the currently proposed rule, and may propose additional actions in the future, as appropriate.

4. Past Actions

Past actions by federal, state and local agencies have shown some encouraging results. The designation and enforcement of existing manatee protection zones and boating laws appears, and public education, while not eliminating the threat to manatees, appears to have allowed the manatee population in Florida to continue to increase over the last 25 years. The most recent statewide winter aerial survey (January 2001) reported an approximate population of 3200 manatees in Florida. However, problems still exist. Manatee mortality numbers from 1990 to 1999 indicate that 2512 manatees have died of various causes. Of these, 604 can be attributed to watercrafts and 55 to other human-related causes (U.S. Fish and Wildlife Service. 2000b). The continuation of management actions will be instrumental in the recovery of the Florida manatee.

5. Future Actions

Possible future actions associated with the preferred alternative include enhanced law enforcement in the areas designated as refuges and sanctuaries and the possible designation of additional areas as refuges and sanctuaries if the need becomes apparent. The goal of existing, proposed, and future refuges and sanctuaries is to protect the manatee, reduce levels of “take”, and result in a stable manatee population that may, in the future, warrant removal from the endangered species list.

6. Cumulative Effects

Observations by law enforcement officers and manatee researchers imply that “take” of manatees and human-related manatee mortalities are reduced in areas designated as refuges or sanctuaries. This indicates that, on a site-specific basis, previous actions to protect the manatee have been successful. However, areas outside of existing refuges and sanctuaries continue to experience human-related manatee injuries and mortalities. The designation of additional refuges and sanctuaries in areas heavily used by manatee and humans alike is expected to decrease the potential for “take” in these areas and also enhance the public awareness of the steps that can be taken to help protect the manatee. The cumulative impact of designating additional refuges and sanctuaries on the public has also been assessed. Impacts such as loss of recreational areas, increase in travel time, and general inconvenience that many boaters may experience due to these proposed refuges and sanctuaries will generally be limited to small areas within their overall travel area. It is expected that the addition of these proposed refuges and sanctuaries may add a maximum of 10 to 15 minutes to their travel time to most destinations in the areas reviewed. In most cases the additional travel time will be less than 5 minutes due to the limited scope of the currently proposed restrictions.

VI. Consultation and Coordination with Others

A. Public Involvement

In preparation for this proposed action the Service met with representatives from local, State and federal agencies and organizations involved in manatee research, management and law enforcement. These meetings helped the Service to develop a list of sites throughout Florida and southeast Georgia that manatee experts felt should be considered for possible designation as manatee protection areas.

The Service published an advance notice of proposed rule-making in the Federal Register on September 1, 2000 (65 CFR 53222). The purpose of the Advance Notice was to inform the public that the Service was initiating the process of investigating areas for possible designation as manatee protection areas, and to solicit initial public input. The Service received 1,752 responses to the advance notice. Of these, 1,737 supported Service efforts to establish additional manatee protection areas and 13 were opposed. The remaining 2 comments did not state a specific opinion.

The Service also conducted a series of six public workshops throughout peninsular Florida to present the list of potential sites and to solicit public input.

A total of 396 people attended the workshops, and 170 provided comments; either oral or written. Of these, 79 were general in nature either supporting Service efforts to establish additional manatee protection areas (40), or opposing them (39). An additional 36 comments were not specific to the topic or discussed other items. Fifteen commentors provided specific information or comments. These specific comments included increased enforcement (7), increased education (7), use of new technology including satellite tracking of manatees (2) and other rule related topics (3). Of the remaining comments, 28 were specifically opposed and 8 were specifically in favor of the establishing additional manatee protection areas.

B. List of Agencies and Individuals Receiving Copies of this EA

C. References

Ackerman, B.B., S.D. Wright, R.K. Bonde, D.K. Odell, and D.J. Banowetz. 1995. Trends and Patterns in Mortality of Manatees in Florida, 1974-1992. Pages 223-258 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival, editors. Population Biology of the Florida Manatee. National Biological Service Information and Technology Report I.

Bradley, J.T. 1972. Climates of the States; Florida. Pages 211-243 in Cartography of the United States No. 60-8.

Citrus County. 1997. Citrus County Manatee Protection Plan. In: Citrus County Comprehensive Management Plan, Chapter 13. Approved December 2, 1997. Pages 13 - 1 through 13 - 54.

Florida Department of Environmental Protection. 1998. Florida STSSN Update (January 1, 1997 - December 31, 1997). *Unpublished report.*

Florida Department of Environmental Protection. 1999. Florida STSSN Update (January 1, 1998 - December 31, 1998). *Unpublished report.*

Florida Department of Environmental Protection. 2000. Florida STSSN Update (January 1, 1999- December 31, 1999). *Unpublished report.*

Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000a. Manatee Salvage Database, Summary Report.

Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000b. Atlas of Marine Resources. R.O. Flamm, L.I. Ward, and M. White, eds. Version 1.3B

- Florida Office of Economic and Demographic Research. 2000. Source: Demographic Estimating Conference Database, updated June, 2000.
- Marine Mammal Commission. 1988. Preliminary Assessment of Habitat Protection Needs for West Indian Manatees on the East Coast of Florida and Georgia. Marine Mammal Commission. Washington, D.C. 107pp.
- Marine Mammal Commission. 2001. Draft Marine Mammal Commission Annual Report to Congress. Marine Mammal Commission. Bethesda, Maryland
- Marmontel, M., S.R. Humphrey, and T.J. O'Shae. 1997. Population Viability Analysis of the Florida Manatee (*Trichechus manatus latirostris*), 1976-1991. Conservation Biology. 11(2):467-481.
- Nill, E.K. 1998. The Florida Manatee (*Trichechus manatus latirostris*) Entanglement Report 1998. Florida Marine Research Institute.
- O'Shea, T.J., C.A. Beck, R.K. Bonde, H.I. Kochman, and D.K. Odell. 1985. An Analysis of Manatee Mortality Patterns in Florida 1976-81. Journal of Wildlife Management 49(1):1-11.
- Reynolds, J.E., III. 1995. Florida Manatee Population Biology: Research, Progress, Infrastructure, and Applications for Conservation and Management. Pages 6-12 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival, editors. Population Biology of the Florida Manatee. National Biological Service Information and Technology Report I.
- Snow, S. 1989. A Review of Personal Watercraft and Their Potential Impact on the Natural Resources of Everglades National Park. National Park Service Report.
- U.S. Fish and Wildlife Service. 1998. U.S. Fish and Wildlife Proposal To Reduce Boat-Related Manatee Mortality In Florida. *Internal memo*.
- U.S. Fish and Wildlife Service. 2000a. Technical/Agency Draft, Florida Manatee Recovery Plan, (*Trichechus manatus latirostris*), Third Revision. U.S. Fish and Wildlife Service. Atlanta, Georgia. 145pp.
- U.S. Fish and Wildlife Service. 2000b. Florida Manatee Recovery Accomplishments - 1999 Annual Report. U.S. Fish and Wildlife Service. Jacksonville, Florida. 34pp.
- U.S. Fish and Wildlife Service. 2001. Crystal NWR Manatee Aerial Survey Database. Crystal River NWR, Crystal River, Citrus County, Florida.

Wooding, J. 1997. An Assessment of Manatee Behavior Relative to Interactions with Humans at Three Sisters Springs, Crystal River, Florida. Florida Cooperative Fish and Wildlife Research Unit.

D. Appendices