Part 5. Action Plans for the St. Andrew Bay Ecosystem

Introduction. *The Action Plans are organized by the general component of the ecosystem that they address such as biodiversity, chemical, and physical characteristics of the ecosystem. However, many Action Plans overlap general categories, as one would expect. All the Action Plans within a section are all inter-related and applicable to the overall goal of maintaining or restoring the biotic or abiotic components of the ecosystem.*

The first paragraph of each Action Plan provides the actions that have been taken pertaining to that Action Plan since the publication of the first edition of a "A Look to the Future". The original Action Plans contained paragraphs that addressed a number of aspects of each Action Plan. Review of these categories revealed that some are of little use, so they have been eliminated unless they were considered pertinent to achieving the Action Plan. Estimate of cost has been eliminated because the majority of these estimates were not based on a realistic assessment and costs have risen. Sources of funding, regulatory needs, and monitoring of environmental response have also been removed unless they were considered to be important in actually achieving the intent of the Action Plan.

Significant progress has been accomplished toward the completion of some of the Action Plans provided in the original plan, and others have been completed. The Action Plans in the original plan that have been significantly addressed are BD1, BD3, PS1, PS2, SG1, SG3, SG6, CC2, and G1. These Action Plans have been retained. The Action Plans that have been completed and are therefore, not included are BD7, BD10, SG3, SG5, AP2, PE1, PE2, PE3, PE4, PE5, and PH1. AP3 did not appear feasible because of the definition of Outstanding Florida Waters and Aquatic Preserves does not appear to lend credence to an attempt to achieve such status. It was not carried over to this plan. AQ1 and AQ2 have been deleted because there is little that can be done to encourage the state to accomplish these Action Plans through compliance with state regulations pertaining to aquatic preserves. The remaining AP Action Plans pertain to the internal organization of BEST and are not considered as part of this ecosystem management plan, because they are better completed internally. DPR1, DPR2, and DPR3 are covered in the SWIM plan for the Deer Point Reservoir subdrainage basin and the SWIM plan for the St. Andrew Bay drainage basin. As a result, they are not repeated here.

Action Plans for Maintenance and Restoration of the Living (Biotic) Components of the St. Andrew Bay Ecosystem

BD1. Species Diversity Assessment

Actions Completed: The activities that have been completed or are continuing that pertain directly to the inventory of species in the St. Andrew Bay ecosystem include the following.

Vascular plant species diversity in the St. Andrew Bay ecosystem.

1. Keppner & Keppner (1999) completed the first year of a survey of the vascular plants of Bay County with a grant from the Norcross Foundation. The herbarium of Bay County Vascular Plants is located at the U.S. Fish and Wildlife Service Field Office in Panama City, Florida. The herbarium contained over 900 specimens. An update was provided in December 1999, and the work continues.
2. *Keppner & Keppner (2000c) provided specimens of vascular plants and a list of plants from the NWFWMD, Econfina Creek Water Management Area to theNWFWMD.*
3. Keppner and Keppner (2001) provided a revised list of vascular plants from Bay County including the specimens in the NWFWMD collection.
4. *FNAI continually seeks and catalogues data regarding the biodiversity in Florida.*

Animal species diversity in the St. Andrew Bay ecosystem.

1. *Animal species diversity was not addressed directly in a number of reports but lists of animals were presented. Some of these are Koenig et al. (1999) and Payne (1997a & b, 1998), and DEP and NWFWD (1992).*
2. *Keppner and Keppner (in prep.) have collected a number of species of crayfish from the St. Andrew Bay ecosystem. This was accomplished in conjunction with a survey of an endemic species of crayfish in Bay County. A report of the species collected and their location will be provided to the U.S. Fish and Wildlife Service in July 2001.*

Action: Continue to determine the biodiversity of the ecosystem through the completion of surveys of the most visible flora and fauna that have not been surveyed in the past and continue the present surveys. Priority surveys should be directed at the freshwater fish, amphibians, reptiles, and freshwater invertebrates within the system.

Background: Compilation of the species present within the ecosystem revealed that the freshwater fish in the system have not been surveyed since 1954 and have never been surveyed ecosystem wide. The amphibians, reptiles, and freshwater invertebrates have also apparently not been surveyed recently. Mammals of the system appear to never have been systematically surveyed. Therefore, surveys are required to understand the diversity of these important groups of animals.

Strategy: The surveys of the freshwater fish, terrestrial mammals, amphibians, reptiles, and aquatic invertebrates should be designed by the appropriate biologists of the Florida Fish and Wildlife Conservation Commission (FFWCC) and others with knowledge of the particular groups. The surveys could be performed by FFWCC personnel or by volunteers under the supervision of FFWCC personnel or other knowledgeable organizations or individuals.

Expected Benefits: The benefits to the ecosystem would be to increase the knowledge of the occurrence and distribution of these groups that provide recreational activities, both direct and indirect, to the public. It would also provide information necessary to the management of the ecosystem to maintain species diversity and serve as a means of educating the public to the kinds and numbers of organisms that share the ecosystem with humans.

BD2. Comparison Survey of the Finfish of St. Andrew Bay

Actions Completed: Ogren and Brusher (1977) performed a study of the distribution and abundance of the fishes in St. Andrew Bay. The study was based on a specific set of conditions regarding fishing gear used, minimum depth of water sampled, and time of sampling. This information can serve as a base line against which future studies can be compared.

Action: Reproduce the survey conducted by Ogren and Brusher (1977) in order to obtain a comparison of existing finfish populations with those reported in the previous study.

Background: About 80-90% of the commercially and recreationally exploited finfish and shellfish in the Gulf of Mexico are considered to be estuarine dependent. The status of certain of those populations within the St. Andrew Bay system is currently unknown. Juvenile Red Snapper were common in the 1977 survey, but they appear to have declined over the years based on anecdotal information. A reproduction of the 1977 study would provide information as to the current status of these species in the bay system.

Strategy: Design a survey to closely reproduce the 1977 survey to provide comparative information as to the species present, their distribution, and numbers.

Expected Benefits: The trend in the populations of finfish subject to the sampling procedures would be better understood. This information would be available for use in the management plans for these species, and in the management of their habitats within the bay system.

BD3. Assessment of Lands and Sensitive Habitats

Actions Completed: FNAI has assessed the habitats of concern in the St. Andrew Bay ecosystem and in a number of publications, the Florida Fish and Wildlife Commission has addressed sensitive habitats from the point of view of sensitive species, mostly animals.

Action: Review the existing literature and synthesize it into a plan for the St. Andrew Bay ecosystem. Map the sensitive habitats remaining in the ecosystem and determine their priority for conservation or preservation as part of the overall goal of linking ecosystem fragments.

Background: *The location and areal extent of the remaining natural habitats within the ecosystem is unknown. The Fish and Wildlife Service has provided maps and a classification of the nation's wetlands including Bay County, but information regarding the other community types is not of general knowledge. Knowledge of the location and amount of natural communities in the ecosystem is valuable to planning to maintain ecosystem function and connectivity.*

Strategy: Request information from the Florida Natural Areas Inventory (FNAI) regarding any studies they may have performed that identifies the location and/or extent of the natural habitats in the ecosystem. Request species occurrence records for those protected and tracked species from FNAI and plot these records on a map to determine the locations of these species.

Expected Benefits: The benefits to the ecosystem would be the identification of the areas considered most valuable in maintaining biodiversity and ecosystem function. It would identify those areas necessary to complete the actions required to place, in conservation or preservation status, those areas essential to the enhancement of the existing public lands and would identify the corridors of natural vegetation needed to link the lands. The information could be prioritized to provide a plan for acquisition or conservation of these lands.

BD4. Identification and Mapping of Corridors Linking Public and Private Conservation and Preservation Lands in the Ecosystem

Actions Completed: The NWFWMD has mapped the public land within the ecosystem. The Bay County Conservancy, Inc. has purchased a tract of land in Panama City at State Avenue and 19th Street and is seeking to acquire other properties for preservation. The City of Panama City has mapped the remaining wetlands within the city limits. A group of citizens have begun the process of identifying corridors and land for possible acquisition or as mitigation to add to the ecosystem management areas. The scientific literature contains a number of articles that apply directly to corridors, their types, their functions, and the efficiency of their use.

Action: Summarize the available literature and apply it to the St. Andrew Bay ecosystem. Using the maps in existence and summary, identify corridors that will link the public lands to one another to reduce the fragmentation of the ecosystem and provide floral and faunal connections between the fragments. The Panama City wetland map should also be examined

to identify corridors to link wetlands in the ownership of the Bay County Conservancy and the City of Panama City.

Background: The largest purchaser of public land in the ecosystem is the NWFWMD in their goal to protect the surface and ground water quality of the Deer Point Reservoir subdrainage basin. The District is continuing to seek purchase of out parcels in the Econfina Creek Water Management Area (ECWMA) and along Econfina Creek itself. Pine Log State Forest is mostly out of the ecosystem, but should be connected with the ECWMA. The inner city wetlands should be connected as they are purchased, become conservation easements, or are otherwise placed in a conservation or preservation status.

Strategy: Use the maps and aerial photographs from The Nature Conservancy and the NWFWMD to locate corridors that will connect public and conservation lands together to reduce fragmentation of the ecosystem. Present these corridor visuals to the NWFWMD and Bay County Board of County Commissioners to be used as a basis for purchasing land and developing a land use plan that will assure the connection and protection of those lands.

Expected Benefits: Reduce the isolation of the public and conservation lands in the ecosystem by connecting them. This will establish functional relationships that are not present now.

BD5. Conservation of Primary Tributaries to St. Andrew Bay

Actions Completed: NWFWMD has developed and implemented a plan for the Econfina Creek-Deer Point Reservoir subdrainage basin. The District has identified and purchased lands identified as important in maintaining the water quality in the subdrainage basin.

Actions: Identify the lands along the major tributaries to the bay that would serve best to conserve the ecological functions and water quality of these tributaries following the example of the NWFWMD for the Econfina Creek-Deer Point Reservoir subdrainage basin.

Background: The major tributaries to the bay system, other than Econfina Creek, have not been examined from the point of view of conserving the water quality and ecological functions of these tributaries. The Burnt Mill Creek and Crooked Creek tributaries to West Bay and Sandy Creek and Wetappo Creek tributaries to East Bay should be examined with the view of obtaining public control over the management of these lands to conserve their ecosystem and water quality maintenance functions.

Strategy: Use aerial photography to examine the degree of development along the above referenced tributaries. Select those areas that will provide maximum diversity and water quality maintenance. Perform field investigations of the selected areas. Provide the county commission with the results.

Expected Benefits: This would provide the basic information necessary to take actions to acquire the lands. Acquiring the lands or a management interest in them would provide for the conservation of the diversity and water quality functions of these lands. Public lands and the habitats existing on those lands will provide the basis for the survival and recovery of many listed species of plants and animals in the ecosystem. The presence and abundance of

the populations of those species that are present on public lands should be investigated to provide information to the managing agency or agencies.

BD6. Assessment of Freshwater Inflow Needs for North Bay

Actions Completed: Flow over the dam has been and is being monitored. The NWFWMD has budgeted funds for this determination in the five year-plan described in the SWIM plan.

Action: Determine the minimum quantity of freshwater which must enter North Bay through the Deer Point Dam that is required to maintain the estuarine nursery area of North Bay and assure the maintenance of the harvestable oyster beds in the downstream, Class II waters of North Bay.

Background: Deer Point Dam was constructed in 1961 as a low level dam and spillway to provide a source of potable water for the growth of Bay County. The dam was constructed at the upper end of North Bay and impounds the high quality water entering from Econfina Creek and other tributaries. The Bay County Board of County Commissioners was authorized by special acts of the Florida Legislature to construct a saltwater barrier and convert a portion of North Bay and the surrounding lands into a freshwater reservoir. The area had experienced saltwater intrusion in a coastal well and a source of potable freshwater was needed to serve the residents of the County and its industries.

Prior to the construction of the dam the impounded area was estuarine in nature. Brusher and Ogren (1976) and Ogren and Brusher (1977) investigated the distribution and species of finfish and shrimp in the St. Andrew Bay system. They concluded that the area of North Bay below the Deer Point dam was a truly estuarine nursery area and important to the continued maintenance of the populations of certain finfish and shellfish in the system. Their conclusions were based on the quantity, quality, and timing of the freshwater inflows from the Deer Point Reservoir.

Deer Point Reservoir receives, on average, 619 mgd (millions of gallons per day) from its tributaries. The historic low flow was 285 mgd during a recent drought. Bay County currently has an intergovernmental agreement with the NWFWMD that permits the County to withdraw an average of 69.5 mgd with a maximum daily limit of 82 mgd. A modification of this agreement may occur in 2010 that would permit the County to withdraw a daily average of 98 mgd with a maximum daily withdrawal of 107 mgd. The NWFWMD has also reserved to the County an additional amount of water equal to the seven day/ten-year flow entering the reservoir for resource enhancement purposes. Therefore, the total amount of water that could be allocated to the County equals 285 mgd or the total flow at the historic low flow value.

Strategy: Obtain the information necessary to develop a study plan from the agencies with experience in determining freshwater inflow requirements to estuaries. With this information, develop a plan of study and identify the best path to completion of the study.

Expected Benefits: Maintain the estuarine nursery areas of North Bay for those estuarine dependent finfish and shellfish present in the St. Andrew Bay system.

Monitoring the Environmental Response: Monitor the salinity regime after the freshwater inflow determination is complete to assess the impact of the flows on the portion of North Bay below the Deer Point Dam. Monitor the harvestable oyster reefs for their productivity and their mortality due to natural predators.

Regulatory Needs: Regulations regarding the amount and timing of freshwater releases from the Deer Point Dam may be needed. This will be determined following completion of the study.

BD7. Restoration of Audubon Island

Actions Completed: The Port of Panama City has obtained the necessary permits to conduct dredging at the Port. A condition of those permits requires the Port to place suitable dredged material on Audubon Island to restore damage incurred during Hurricane Opal. The Port has placed riprap around the Island in preparation for the receipt of the dredged material.

Action: Support the efforts to restore Audubon Island, encourage the Port to place the material on the Island during the non-breeding season of the birds, and continue monitoring of the Island's breeding bird population.

Background: Audubon Island is a small artificial island located off the Port of Panama City. The Island serves as a breeding site for a wide variety of birds including the brown pelican. Significant numbers of pelicans and other birds are reared on this island each year. Hurricane Opal severely eroded the Island making it smaller and lowering the elevation. The Island should be restored to provided needed bird nesting and rearing habitat. The Island is monitored by the Florida Fish and Wildlife Conservation Commission regarding bird nesting activities.

Strategy: Continue the efforts to encourage the Port of Panama City to complete the work required as mitigation.

Expected Benefits: Restoration of previous nesting and rearing conditions for the large number of birds that use the island.

Monitoring of Environmental Response: Continue the state's annual monitoring of nesting success.

BD8. State Owned Submerged Land Assessment & Monitoring

Actions Completed: None

Action: Assessment and monitoring of state owned submerged lands.

Background: The State of Florida owns the lands within the state that are located at and below the mean high tide line in the St. Andrew Bay ecosystem. These submerged lands support the variety of habitats found within the system from seagrass beds to intertidal emergent marsh. These lands should be managed to maintain the integrity of the ecosystem. However, information as to the extent of these lands, particularly the emergent saltmarsh, is not generally known. In order to effectively manage the habitats located on these lands owned by the citizens of Florida, one must know where they are and what habitats they support. Knowledge of the lands below the mean high water mark is fairly well known. Emphasis should be directed at determining the habitat supported by the intertidal zone, particularly *Spartin*a and *Juncu*s emergent marshes.

Strategy: Request that the state agency responsible for holding these lands in trust for the citizens of Florida produce a series of maps that delineate the boundary of the state owned submerged lands in the St. Andrew Bay ecosystem and establish the type of emergent marsh habitats supported by these lands.

Expected Benefits: State owned water bottoms would be known and would, therefore, be capable of management to retain the ecological functions of those lands without adversely affecting private property.

Monitoring the Environmental Response: 1. Monitor the loss and alteration of these publicly owned lands through the permitting process by requiring that any loss or conversion of state owned lands from its existing condition be so recorded with the acreage and habitat lost or converted. 2. Examine the historical permitting information to determine the acres lost or converted and the habitats involved.

BD9. State Owned Submerged Lands Policy

Actions Completed: Many policies exist except a definitive one.

Action: Institute a policy whereby state owned, public, submerged lands located at or below the mean high tide line in the St. Andrew Bay ecosystem will not be converted from the natural or currently occurring condition for private or public use other than the maintenance of their ecosystem functions. The policy will be directed at the maintenance of ecosystem functions by retaining the public owned submerged habitats, particularly emergent and submergent, vegetated wetlands, as such.

Background: The State of Florida owns the lands that are located at and below the mean high tide line in the St. Andrew Bay ecosystem. These submerged lands support a variety of habitats found within the system from seagrass beds to intertidal emergent marsh. These lands should be managed to maintain the integrity of the ecosystem. The key to the management of these lands, in the interest of the maintenance of ecosystem function, is the prevention of their loss, destruction, or alteration for private or public uses that affect the ability of the existing submerged lands to so function. Case by case evaluation of permits does not prevent loss, destruction, or alteration for private or public uses of these lands. Many methods of encouragement to prevent the alteration or conversion of state owned submerged lands exist within the permitting process. However, they do not provide for the prevention of the loss or conversion of state owned submerged lands.

Strategy: Work with and encourage the responsible FDEP agencies to institute policies that: 1. prevent the conversion of state owned submerged lands to ownership by entities other than the State of Florida. 2. institute policies that prevent the conversion of state owned submerged lands to uplands or adversely alter the existing ecosystem functions of the land.

Expected Benefits: This would add further assurance that public lands remain in public ownership and that they remain a functioning part of the ecosystem. This would eliminate or reduce the incremental losses of public lands and their ecological functions resulting from the permitting of activities such as bulkheads waterward of the mean high tide line in areas not experiencing erosion.

Monitoring the Environmental Response: Annually review all permits issued in the ecosystem for compliance with the policy, establish number of acres of public lands converted to private ownership, and number of acres of habitat change on public lands.

Regulatory Needs: New laws or regulations are not needed, only a definitive policy statement that will be enforced.

BD10. Creation of an Ecosystem Mitigation Bank

Actions Completed: None

Action: Develop a mitigation bank for the ecosystem that would use some of the funds obtained from the existing local, state, and federal permitting programs to purchase lands identified as necessary to maintain the integrity of the ecosystem. The operation of the mitigation bank would be the responsibility of a local or state governmental agency or could be the responsibility of a nonprofit organization. Its purpose would be to obtain a mosaic of habitats characteristic of the ecosystem including aquatic, wetland, and terrestrial habitats and link them to existing public land in order to maintain the ecotones and connections between these habitats.

Background: State and federal permitting agencies such as the FDEP and the U.S. Army Corps of Engineers have developed procedures for the development of mitigation banks to serve the needs of the agencies and the public. Mitigation banks are supposed to speed the permitting process while better assuring that mitigation for unavoidable losses of the regulated habitats is performed and functions as a replacement for the habitat lost. A mitigation bank would be a method of obtaining funds for the directed expenditure to purchase and/or restore priority habitats in the ecosystem.

Strategy: Identify the agency or group to be responsible for the management of the mitigation bank. Obtain the guidelines for the development of a mitigation bank and begin the process of developing approval for the bank.

Expected Benefits: Provides a means of obtaining lands within the ecosystem that have been identified as necessary to the maintenance of the biodiversity and functions of the ecosystem.

Monitoring the Environmental Response: The effectiveness of the mitigation bank in adding priority lands and restoration of priority habitats would be tracked by assessing the acreage added each year and the amount of restorative work accomplished within the framework of the funds received.

Regulatory Needs: Existing state and federal laws and the mitigation bank guidelines developed by the state and federal permitting agencies are adequate for the accomplishment of this action.

BD11. Grand Lagoon Bridge Replacement

Actions Completed: None. Bridge replacement is in the planning process.

Action: Include in any future design for the bridge replacement and highway expansion a crossing structure spanning the Lagoon that is a modern, cement-supported bridge that spans the entire width of the Lagoon. The old earthen causeway currently in place could be completely removed. This action will restore the historic, cross-sectional hydrologic dimensions of the Lagoon as it passes under the new bridge.

Background: The causeway/bridge crossing created over Grand Lagoon in the 1950's has, ever since, severely restricted tidal flushing, water exchange, and marine fish and invertebrate larval transport. The structure has also severely reduced transport of pollutants and contaminants out of the Lagoon. As may be seen in aerial photographs of the areas east and west of the Lagoon, the structure has resulted in unusual tidal currents at the point of the small bridge that have resulted in sediment transport beyond the bridge on each side. This has, in turn, resulted in the burial of valuable sea grass beds.

Strategy: Comments should be provided to the Florida Department of Transportation and any other appropriate government agencies to clearly define the need for adequate bridge replacement and to accelerate such replacement. The recommendations should include complete removal of the old earthen causeway, removal of all sediments east and west of the old bridge that have buried sea grass beds, construction of a concrete-pile-supported bridge that spans the entire width of the Lagoon.

Expected Benefits: Increased water quality, water exchange, restoration of sea grass beds near the crossing, and increased biodiversity within the upper Lagoon resulting in enhanced larval transport of marine fishes and invertebrates.

Monitoring the Environmental Response: The effectiveness of this action to the environment will be measured as increased water clarity, water quality, tidal movement, biological diversity, and sea grass bed recovery. The monitoring will be accomplished through several of the other Action Plans identified within this document.

PS1. Assessment of the Protected, Rare and/or Endemic Species of Plants in the St. Andrew Bay Ecosystem

Actions Completed: The actions completed that pertain to the vascular plants that are protected, rare and/or endangered in the ecosystem include the following specific to the St. Andrew Bay ecosystem. Reports addressing all of Florida include, but is not limited to, Cox and Kautz (2000) and Cox et al. (1994).

1. The Bureau of Land Management has completed a preliminary survey of the listed plants on the Lathrop Tract in the St. Andrew Bay ecosystem. Included on the list are *Pinguicula ionantha, Verbesina chapmanii, Oxypolis greenmanii, Asclepias viridula, Scutellaria floridana, Coelorachis tuberculosa,* and *Aster spinulosus*. *Hypericum exile* was also found on the tract.

2. Keppner and Keppner (1999b) reported on a survey of 96 lakes, ponds, and basins on the Econfina Water Management Area for *Hypericum lissophloeus, Xyris longisepala, Xyris isoetifolia, Rhexia salicifolia,* and *Drosera filiformis*. The survey was supported with funds from the U.S. Fish and Wildlife Service.

3. The Florida Natural Areas Inventory (FNAI) is about to complete a survey of *Hypericum lissophloeus* on private land and to revisit the historic locations in their database. Work is scheduled for completion by June 1, 2001. FNAI obtains information and tracks species and biotic communities on a continual basis.

4. Keppner (2000) provided the NWFWMD with a report of observations of the response of *Hypericum lissophloeus* and *Rhexia salicifolia* to the drought.

5. Keppner, Keppner, and Blanchard (2000) developed a brochure that provides information regarding the conservation of protected species of vascular plants to property owners around the karst ponds in northern Bay and southern Washington Counties. The Nature Conservancy provided funds to print and distribute the brochures. The project was completed on March 1, 2001. The response has been sufficiently favorable for The Nature Conservancy to print additional copies.

6. Keppner and Keppner (pers. comm. 2000) located a new location for *Paronychia chartacea minima* on the Econfina Water Management Area. The location was forwarded to FNAI and specimens were placed in the Florida State University Herbarium and the NWFWMD collection.

7. Keppner and Keppner (2001) provided the NWFWMD with a list of specimens they placed in the NWFWMD herbarium. The list contained a number of protected and/or rare species. NWFWMD has used the Global Positioning Sysytem to place the locations of these species on their maps and aerial photographs.

Action: Continue to seek support and assist agencies in assessing the status and location of protected species within the ecosystem.

Background: Stein et al. (2000) identified the central Florida panhandle area including the St. Andrew Bay ecosystem as one of six areas of the United States noted for the diversity and endemism of its flora and fauna. The management and conservation of this biodiversity is based on knowing what species are present, where they are located, and their abundance.

Strategy: Continue to seek support to obtain information regarding the occurrence and distribution of the organisms present in the ecosystem with emphasis on those that are protected, rare, and/or endemic species.

Expected Benefits: Information regarding the occurrence and distribution of the protected, rare, and/or endemic species would provide knowledge to update the status of species with regard to their habitat status and the degree of protection, if any, that may be required to protect a species or the species diversity of the ecosystem as a whole.

Monitoring of the Environmental Response: Revisit critical sites to determine the status of the species or habitat based on FNAI element occurrence records.

Regulatory Needs: None unless information provided indicates that a species should receive additional protection or become protected under the existing federal and state statutes.

PS2. Participate in the Development of Guidelines for the Protection of Protected Species in the Ecosystem

Actions Completed or in Progress: The Bay County Board of County Commissioners voted unanimously to direct the Bay County Planning Board to develop guidelines to protect the listed and rare species in the Bay County portion of the ecosystem. FNAI is completing a survey of the rare, endemic, and protected species of plants in the karst pond area of the ecosystem. The Bay County Audubon Society adopted and provided funds for the printing of a manuscript describing the biology and conservation status of the smoothbark St. John's-wort and associated species in the karst area.

Background: Bay County contains habitat that supports a number of protected, rare and/or endemic species of plants. The karst pond area of Bay County is relatively well known as to the location of this habitat.

Strategy: Provide the Bay County Planning Board with all information available regarding the biology of the protected, rare and/or endemic species in the karst pond area and other areas of the Bay County. Provide recommendations for the protection of these species, and restoration of their habitats. Individuals or groups with knowledge of these species could serve as advisors if so requested by the Planning Board.

Expected Benefits: The unique species of plants in the Bay County portion of the ecosystem will be recognized and guidelines will be established to protect or conserve them for the future.

PS3. Assessment of the Protected, Rare and/or Endemic Species of Animals

Actions Completed or in Progress: The St. Andrew Bay ecosystem supports a number of protected, rare and/or endemic species of animals. The following items are actions that have been completed or are in progress that pertain to this Action Plan.

1. The St. Andrew Bay Resource Management Association has maintained a sea turtle nest monitoring program for the past 10 years. The monitoring involves the location, protection, relocation if necessary, and release of hatchlings at appropriate locations along the beach. Annual reports of the nesting activities, per cent hatching, and number of juvenile turtles released is provided each year (Watson, 1991-2000). The DEP, Division of Recreation and Parks surveys nesting activities along the beaches within the St. Andrews State Recreational Area. Tyndall Air Force Base conducts surveys along the beaches within this military installation.

2. The U.S. Fish and Wildlife Service is studying the Gulf Sturgeon. Reports of this anadromous fish in St. Andrew Bay ecosystem are sparse, but its occurrence should be considered in the overall management of the ecosystem.

3. Keppner and Keppner (2000b) performed a limited preliminary survey of the Panama City Crayfish designed to revisit the three previously known locations for this species. The volunteer report was provided to the U.S. Fish and Wildlife Service.

4. Keppner and Keppner (in prep.) are in the process of completing a survey of the presence of the Panama City Crayfish, Procambarus *(*Leconticambarus*)* econfinae *in the ecosystem. The final report is due June 30, 2001. The survey is supported by the U.S. Fish and Wildlife Service.*

5. The U.S. Fish and Wildlife Service maintains a program of monitoring the populations of endangered beach mice inhabiting the sand dunes of Bay County in conjunction with the Florida Fish and Wildlife Conservation Commission, and they have been involved with the Piping Plover Survey. The Service has prepared the Endangered Species component of the educational materials for the Kindergarten through Middle School curriculum.

Action: *Continue the monitoring programs and identify other species for study.*

Background: Stein et al. (2000) identified the central Florida panhandle area including the St. Andrew Bay ecosystem as one of six areas of the United States noted for the diversity and endemism of its flora and fauna. The management and conservation of this biodiversity is based on knowing what species are present, where they are located, and their abundance.

Strategy: Complete the projects in progress, add new projects as the need arises, and provide the information to the governmental agencies and elected officials for inclusion in their decision-making processes.

Expected Benefits: Information regarding the occurrence and distribution of the protected, rare and/or endemic species would provide knowledge to update the status of species with regard to their habitat status and the degree of protection, if any, that may be required to protect a species or the species diversity of the ecosystem as a whole.

PS4. Preservation of the Panama City Crayfish

Action: **Participate with state and federal agencies and the public to develop a plan to preserve the existence of the Panama City crayfish as a component of the ecosystem.**

Actions Completed: **A preliminary survey established the continued existence of the Panama City Crayfish, *Procambarus* (*L.*) *econfinae*, in the ecosystem. Additional survey work has added additional locations for this species and has added information regarding the range of this species in the ecosystem.**

Background: **The Panama City Crayfish is a true endemic to the St. Andrew Bay ecosystem. The range of this species is restricted to a small area of Panama City and Bay County. Although once thought to be extinct, it was rediscovered by the above surveys in 2000 and 2001. This species is listed by the Florida Fish and Wildlife Conservation Commission as a Species of Special Concern (See Appendix 2). The U.S. Fish and Wildlife Service will eventually decide the status of this species as a candidate for listing under the Endangered Species Act or work with private landowners to achieve a plan for preervation.**

Strategy: **Participate in and encourage the responsible state and federal agencies and Bay County to develop a plan that will assure the survival of this species in the ecosystem. Knowledgeable individuals and groups could offer to provide technical information, perform field surveys if necessary, and provide public participation in the process.**

Expected Benefits: **A plan to preserve the Panama City Crayfish would be developed that would be a result of a group effort and may preclude the lengthy and expensive process of listing the species under the Endangered Species Act and elevating it to a threatened or endangered level by the state.**

Action Plans for the Maintenance and Restoration of the Natural Communities of the St. Andrew Bay Ecosystem

Seagrass Management in the Ecosystem

Background: *The seagrass community occupies a unique place in the St. Andrew Bay estuarine system in that seagrass beds support highly diverse floral and faunal communities dependent on the presence of the dominant seagrass species. Seagrasses reflect the health of the bay system through their responses to alterations in various water quality and sediment quality parameters. Seagrass beds also provide spawning, feeding, nursery, and protective habitat for a wide diversity of aquatic organisms including many of recreational and commercial value. One example is the relationship between seagrass beds and the production of gag grouper (Koenig and Coleman, 1998).*

Decline in the acreage of seagrass in the system would indicate that water quality and/or sediment quality is changing in a manner that restricts their growth. For example, increased turbidity restricts the quality and quantity of light reaching the seagrass beds. Decline in the depth of penetration of light of adequate quality results in the decline in the quality of the seagrass beds, the depths at which they can grow and reproduce, and therefore, the number of acres covered by the seagrass. Seagrasses are used as an indicator of the health of the system, because of their responses to changes in various water quality and sediment quality parameters.

Wolfe et al. (1988) stated that in total acreage the St. Andrew Bay system contains the largest seagrass stock in the Panhandle of Florida. This statement was based upon data from McNulty et al. (1972). Hydroqual Inc. et al. (1993) summarized the information on the acreage of seagrass beds in St. Andrew Bay available at the time of their study, and Beck et al. (2000) stated that the St. Andrew Bay estuarine system contained 9838 acres of segrass beds. The U.S. Fish and Wildlife Service performed the most recent and thorough survey of the seagrass beds in St. Andrew Bay based on aerial photography from 1953, 1964, and 1992. The survey was prepared for the Fish and Wildlife Service's Panama City Field Office. Table 1 is the summary of that survey. The survey did not divide the seagrass beds by the species of seagrass that was dominant in each bed. Therefore, nothing can be said about the species composition of the beds or shift in species composition, if it occurred, during the times of the survey. The data is complex in that shifts in acreage of the components analyzed vary from year to year. However, some conclusions can be made based on the data in that survey regarding the overall acreage of seagrass beds in the bay.

The following table indicates that there has been a 17% decline in the total acreage of seagrass in the bay during the time of the study. This included a decline in the acreage of continuous beds in the system. Continuous beds indicate the presence of a healthy seagrass system and are considered to be the most valuable in terms of productivity, biodiversity, and habitat function. Fragmentation of continuous beds into patches of varying densities indicates a decline in the functioning of all aspects of the community. However, there are some natural areas in estuaries that are subject to water currents in which the seagrass beds become established as patches and remain patchy due to the flow of water through the bed.

Acres of Seagrass Beds in St. Andrew Bay, U.S. Fish and Wildlife Service Survey.

Type of Bed	**1953**	**1964**	**1992**
Continuous	3771.97	5479.37	4324.88
Dense Patch	799.94	1746.74	3056.62
Moderate Patch	5968.69	3475.71	1368.57
Sparse Patch	1145.63	841.10	933.94
Very Sparse Patch	156.99	176.26	144.57
Total Acres	11,843.22	11,719.18	9,828.58

The seagrass species present in St. Andrew Bay are shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), star grass (*Halophila engelmannii*), and widgeon grass (*Ruppia maritima*). The large continuous beds appear to be dominated by turtle grass and shoal grass. Manatee grass forms small continuous beds and is more restricted in areas of the bay. The distribution and extent of *Halophila engelmannii* in the system is unknown. Continuous turtle grass beds or turtle grass-shoal grass beds are considered to be the dominant climax seagrass community in the system. However, the turtle grass in St. Andrew Bay is at the northern extent of its range which may limit seed production and slow the progress of rhizomatous growth resulting in these beds being sensitive to environmental perturbation and are slow to recover from damage incurred. Turtle grass in the system experiences a shedding of leaves in the fall that results in massive amounts of seagrass wrack in the shallow water and shore of the bay. This material decomposes and provides a source of nutrients to the bay system.

Factors that can reduce the extent or quality of the seagrass beds include increased turbidity, dredging and filling, propeller damage and other mechanical damage, sediment contamination, nutrification of the water column, and local sustained decreases in salinity. This complex set of factors must be addressed in order to maintain and restore the seagrass habitats in the bay. Unlike other wetland communities, sea grass beds are difficult to restore when damaged and very difficult to create as mitigation for permitted losses. Loss of the climax vegetation from direct or indirect causes can be considered a permanent loss due to the slow regrowth of turtle grass and the inability to create new beds or restore damaged beds as mitigation for authorized losses in this system.

Direct destruction of sea grass beds in St. Andrew Bay by dredging or filling and mechanical damage should be avoided, because mitigation of losses by creation or restoration of these beds have not been successful in the past. An example is the mitigation for the Michigan Avenue outfall in St. Andrew Bay. Water quality should be maintained and preserved through actions regarding stormwater runoff and point source discharges. The status of the seagrass beds in the bay should be monitored for condition, distribution, and acres of coverage on a regular basis. Steps should be taken to restore conditions conducive to seagrass growth in the system.

SG1. Monitoring of Seagrass Beds in St. Andrew Bay

Actions Completed: The U.S. Fish and Wildlife Service survey of the seagrass beds of the St. Andrew Bay ecosystem was completed as referenced above. The St. Andrew Bay Resource Management Association (RMA), in partnership with Gulf Coast Community College and DEP, has begun a seagrass monitoring program at three locations in St. Andrew Bay estuarine system. Transects have been established at a site near Shell Island, Grand Lagoon, and in West Bay. Monitoring will be accomplished at each transect in the fall of each year. Data to be collected includes species composition, shoot density, per cent cover, and canopy height. In addition, water quality data will be collected monthly at each site including turbidity and photosynthetically active radiation (quality of light). The work was supported by a grant from the National Oceanic and Atmospheric Administration to the Florida Department of Community Affairs. For additional information, one can contact the RMA at P.O. Box 15028, Panama City, Florida 32406.

Action: Continue the monitoring of the areal extent of seagrass within the St. Andrew Bay estuarine system on a five year cycle by the U.S. Fish and Wildlife using aerial photography. Continue the St. Andrew Bay Resource Management Association seagrass monitoring program.

Strategy: Encourage and work with the U.S. Fish and Wildlife Service to provide an update of the current seagrass survey from aerial photography on a five year cycle.

Expected Benefits: Provide information as to the status of the seagrass community in the bay.

SG2. Protection of Seagrass Beds

Actions Completed: A Bay County seagrass ordinance was drafted and proposed in 1999 by Bay County and the Bay Environmental Study Team (BEST). BEST arranged for a community forum to discuss the ordinance. The Bay County Board of County Commissioners chose not to enact the ordinance at the time.

Action: Pursue additional state, federal and local legislation that would provide additional protection for seagrass beds in the St. Andrew Bay ecosystem.

Background: St. Andrew Bay is unique in the Panhandle for the acreage of seagrass beds within the ecosystem. The climax seagrass vegetation is *Thalassia testudinum* which is at the northern limit of its range in St. Andrew Bay. Therefore, recovery of damaged beds is unlikely or will take many years. Creation of seagrass beds as mitigation for losses in the ecosystem is essentially a permanent loss because attempts at creation of seagrass beds in the system have been unsuccessful. All seagrass beds grow on submerged lands that are owned by the State of Florida and are held by the state in the public interest. It is in the public interest to protect seagrass beds on public lands because of their value to the ecosystem.

Strategy: Obtain all data and information pertaining to the recovery of seagrass beds in the ecosystem and all data and information pertaining to mitigation projects involving seagrass beds in the ecosystem. Obtain available information on the reproductive status of the seagrass beds in the ecosystem and rates of rhizome growth, if available. Present the data and information in a report to the appropriate state, federal, and local government agencies as support for a request to prohibit the loss of seagrasses on public lands in the system.

Expected Benefits: Loss of seagrass beds to dredging and filling will cease or be significantly reduced.

Monitoring the Environmental Response: If accepted, monitoring should take two paths. The first should be directed at continuing the surveys recommended in SG1. The second is to monitor the appropriate agencies to assure that no loss of seagrass is permitted by the participating agencies.

Regulatory Needs: May require new legislation and/or changes to regulations and policies of the responsible agencies.

SG3. Restoration of Lost or Damaged Seagrass Beds

Actions Completed: BEST received a grant from the U.S. Fish and Wildlife Service in 2000 to perform a pilot restoration project involving the planting of *Spartina alterniflora* and possibly seagrass in West Bay. The pilot project is in the planning stage and will be completed in 2001 at which time monitoring will be initiated.

Action: Identify the areas of significant loss of seagrass. Investigate the cause of the loss. Initiate corrective measures to encourage regrowth. This is a long-term action due to the slow regrowth, but this action is essential.

Background: The U. S. Fish and Wildlife Service survey of seagrass beds and the attendant maps of the beds in the ecosystem referenced above indicate that some significant losses of continuous seagrass beds has occurred in various areas of the bay. These areas should be addressed for corrective actions.

Strategy: Examine the existing survey maps. Locate areas of significant losses. Follow the guidelines published by the National Marine Fisheries Service in determining the cause of the losses. Initiate corrective measures based on the information gathered as to the causation of the loss.

Monitoring Environmental Response: Those areas of loss that receive attention and corrective measures should be monitored for recovery rates on an annual basis.

SG4. Restoration of Seagrass Loss in West Bay

Actions Completed: The loss of about 350 acres of seagrass beds along the southern shore of West Bay has been documented by examination of the aerial photography mentioned in SG3. An idea for restoration is present, but a plan to achieve the restoration has yet to be developed.

Action: Develop a plan to restore the area in conjunction with all responsible and interested parties.

Background: The survey of the seagrass beds in the ecosystem performed by the Fish and Wildlife Service indicates that the shallow waters adjacent to Botheration Bayou along the south shore of West Bay has suffered a loss of approximately 350 acres of seagrass beds. This represents a 3% loss of the total acreage of seagrass present in the system in 1953 and a 3.6% loss of the seagrass beds present in 1992.

Strategy: Design a study based on the possible causes of the loss of seagrass in this area to attempt to identify the cause or causes. Begin the study with an examination of ambient salinity and freshwater inflow in the area in relationship to seagrass beds. Use adjacent beds as a comparison. Elimination of this possible cause will lead the investigation to the next hypothesis.

Expected Benefits: Identification of the cause for the loss will allow for the development of a possible restoration plan. Restoration, if possible, would bring 350 acres of currently unvegetated bay bottom back to a seagrass bed.

Monitoring the Environmental Response: Monitoring would not be required until restoration activities, if appropriate, were commenced. Monitoring would then consist of examining the rate of coverage of the expanding bed on an annual basis.

SG5. Education About the Significance of Seagrass Meadows in the Ecosystem

Action Completed**: This Action Plan has been completed as stated in the original plan.**

1. Mr. Doug Hough of the Museum of Man and the Sea, Panama City Beach, Florida completed a video depicting the importance of seagrass meadows to the ecosystem, and the effects of careless boating on the meadows. This video is available from the Museum.

2. "A Boater's Guide to St. Andrew Bay" was prepared by the Northwest Florida Aquatic Preserve Program (NWFAPP) and the Florida Marine Research Institute that was printed and distributed in 1996. The guide provides a map and information regarding the various habitats including the location the location of boat ramps and marinas in St. Andrew Bay. This is an excellent educational document of practical use by the public. It is directed at helping the boating public to avoid damaging seagrass beds and other estuarine habitats in St. Andrew Bay.

3. The International Paper Company Foundation and Arizona Chemical Company provided funds to the St. Andrew Bay Resource Management Association to produce and place signs at boat ramps to inform boaters of the effects of propeller damage to seagrass beds. The NWFAPP provided funds to place buoys in the water at the edge of selected seagrass beds to warn boaters of the shallow water.

4. The International Paper Company Foundation and Arizona Chemical Company provided a grant to BEST, Inc. to purchase materials for and develop a seagrass informational display for use at various conferences, festivals, etc.

5. The RMA, as part of the seagrass monitoring grant, will produce an educational video regarding the role of seagrass in the St. Andrew Bay estuarine system.

SG6. Innovative Pier and Dock Construction

Actions Completed: Shafer and Robinson (2001) reported on the results of a study that evaluated the use of grid platforms to minimize shading impacts of docks and piers on seagrasses. The study reached the following conclusions: 1) the use of fiberglass grating to increase light transmission should reduce the amount of seagrass loss due to shading by docks and terminal platforms. And 2) the method of piling installation used in this study minimizes the physical destruction and removal of seagrasses, and resulted in nearly complete regrowth of the bare area by the end of the second growing season.

Action: Work to have the conclusions of the report translated into regulatory action in the form of an addition to the regulatory guidelines for dock construction in the Florida Panhandle.

Background: Traditionally, permitting agencies have addressed the need for waterfront property owners to gain access to the water for navigational purposes by encouraging the construction of docks or piers to navigable depths rather than dredging access channels to the shoreline. A pile-supported structure has been considered the least environmentally damaging alternative to the dredging of access channels. This is true in nonvegetated water bottoms. However, information became available that the construction of pile supported structures over seagrass beds can result in the degradation or loss of the seagrasses under the structure. As the number of permits issued for piers and docks in seagrass beds increases, so does the possible adverse impacts of these structures on seagrass beds. Each new structure adds to the cumulative impact of existing structures. A less environmentally damaging construction alternative should be encouraged or required to reduce or eliminate seagrass loss due to docks and terminal platforms.

Strategy: Convene a meeting between the permitting agencies and the commenting agencies to assess the results and applicability of the study to the regulatory process in order to conserve seagrass habitat in the St. Andrew Bay estuarine system.

Expected Benefits: Will, if implemented, reduce the degradation and loss of seagrass beds due to pier and dock construction.

Regulatory Needs: Encourage the regulatory agencies to address methods of implementing the new techniques.

Management of Wetland Habitats in the St. Andrew Bay Ecosystem

State and federal agencies involved in the management of wetland habitats or the regulation of wetland habitats appear to agree with ecologists regarding the function of wetlands within ecosystems. In general, wetlands have a high rate of primary production, support a high diversity of organisms, retard and retain floodwaters, can serve as recharge areas for aquifers, remove excess nutrients in runoff, trap pollutants in runoff, and protect shorelines from erosion. Each type of wetland has its own set of characteristics and functional values to the ecosystem of which it is a part.

What is a wetland? The answer to that question is confusing, because a wetland is defined in a variety of ways depending on the governmental agency in question. The answers to that question can become quite confusing when one examines the various definitions of wetlands developed by regulatory agencies. The state definition and the method to determine the state's jurisdiction over wetlands is different from that of the federal government's definition and jurisdictional methodology under Section 404 of the Clean Water Act. The result of these varying definitions and methods for determining jurisdiction is that it is practically impossible to monitor the actual loss of wetlands destroyed through the state and federal permitting processes.

What is a jurisdictional wetland for the federal regulatory agency may not be a jurisdictional wetland for the state regulatory agency. Therefore, the two are not compatible regarding monitoring of losses. The problem of monitoring of wetland losses as a result of the permitting processes is further compounded by the individual agency's concept of which wetlands are "valuable" and the concept of mitigation. Wetlands of "lesser value" are considered as exemptions, subjects for general permits, or subjects for nationwide permits. Records of losses of wetlands resulting from the issuance of these permits is difficult, if not impossible, to obtain. If one selects a single regulatory agency definition of wetlands and attempts to monitor permitted wetland losses, one must also monitor the rate of compliance with mitigation requirements agreed to in order to obtain the permits. The success of mitigating actions and the ecological functional equivalency of the mitigating actions to the wetlands lost must also be considered. This complicated process provides many avenues for analysis of the success of a permitting program depending on the results one wishes to obtain. Therefore, any analysis of the success of a permitting process involving wetlands is questioned.

Ecosystem management must address wetlands from their ecological function without attempting to place a value on them to determine whether or not they will be permitted for destruction. In addition, ecosystem management must address the importance of ecotones between wetlands and uplands, because wetlands do not function independently of the surrounding habitats. Ecosystem management, to be effective, must go beyond the micromanagement and complications of the permitting systems. The FNAI definition of wetland types is not encumbered by regulatory processes and is used for the purposes of this plan (Appendix 1). The action elements developed for the management of wetlands in this plan are directed at obtaining this knowledge.

W1. Wetlands Inventory

Actions Completed: The U.S. Department of Interior, National Wetlands Inventory completed the maps for the St. Andrew Bay ecosystem in the late 1970's. These maps provide an acceptable baseline of the ecologically defined wetlands in the system. The City of Panama City has hired consultants to prepare a map of the wetlands remaining within the city and perform detailed studies of subdrainage basins.

Dahl (2000) provided some information regarding the alteration of various types of wetlands in the United States from 1986 t0 1997. The report states that freshwater, non-tidal wetlands experienced the greatest development pressure just inland from the coastlines of the United States. Citing other sources, the report states that wetlands located in coastal watersheds of many coastal counties are undergoing rapid growth, and they lead in many demographic indicators of development. The freshwater wetlands were most susceptible to development from rapid population growth, and the demand for housing, transportation infrastructure, and commercial and recreational facilities. The report shows the coastal counties where there were wetland losses between 1986 and 1997. Bay County is in the "high loss" category that is a loss in excess of 150 acres.

Beck et al. (2000) estimated that the St. Andrew Bay ecosystem has 9270 acres of saltmarsh, 607 acres of tidal flat, and 47 acres of intertidal shrub/forest. However, the distribution of these wetlands in the ecosystem was not provided at a scale usable to place on a map of the St. Andrew Bay ecosystem.

Action: Determine the type, quantity, and location of the various wetland types currently existing in the system based on the National Wetlands Inventory classification. Use the maps being prepared for Panama City to inventory the wetlands remaining in City limits.

Background: Reasonably accurate, current information regarding the types, quantity, quality, and location of wetlands within the St. Andrew Bay ecosystem do not appear to be available. The National Wetlands Inventory survey maps for the system are about 20 years old.

Strategy: Review the existing Wetland Inventory maps of the system to obtain baseline data on wetlands. These maps are available at the U.S. Fish and Wildlife Service, Panama City Field Office. Determine the status of the updating of these maps by the Wetland Inventory to determine when the new maps will be available. If the Wetland Inventory maps are not forthcoming in a reasonable period of time, obtain the most current Florida Department of Transportation aerial photographs and perform a comparison to determine the number of acres and location of the various types of wetlands remaining in the ecosystem. Also, determine the changes that have occurred by examination of old versus recent aerial photography.

Expected Benefits: The basic information necessary to manage the wetlands in the ecosystem would be obtained. This information in conjunction with the information obtained from other Action Plans would provide a basis for the determination of those areas necessary to maintain the function of the ecosystem.

Reliable Resources: Panama City Wetlands maps, The National Wetlands Inventory, U.S. Fish and Wildlife Service, NOAA (estuarine and marine wetlands), and Florida DOT aerial photographs.

W2. Identification of Areas for Wetland Restoration or Preservation

Actions Completed: The federal and state permitting agencies have established an area in Panama City Beach to receive adjacent land for mitigation of permits issued for the alteration of wetlands. Panama City has mapped the wetlands within the city limits.

Action: Determine the wetland areas in the watershed that can be improved through enhancement, restoration, and preservation activities. Develop a list of locations and acreage that qualify for the activities.

Background: The National Wetlands Inventory survey maps have identified the wetlands within the ecosystem, but areas that could benefit from enhancement and restoration activities have not been examined and identified.

Strategy: In conjunction with W1, BD3, and BD4, review National Wetland Inventory maps and contact wetland regulatory agencies to create a list of wetland sites that could be candidates for enhancement and/or restoration. Identify the wetlands in Panama City that could serve as preservation or conservation sites.

Expected Benefits: The candidate sites could be used as mitigation sites to offset wetland impacts resulting from the wetland permitting processes within the ecosystem, develop corridors between public land in the ecosystem, and be used as preservation areas.

W3. Vegetative Buffers for Wetlands and Water Bodies

Actions Completed: County and municipal Comprehensive Growth Management plans may have vegetative buffers stipulated in the plans. Bay County is in a state of indecision regarding vegetative buffers for water bodies in the county with the exception of the requirement for vegetative buffers around Deer Point Reservoir for those lands platted after adoption of the Comprehensive Plan by the County.

Action: Review all comprehensive growth management plans in the ecosystem for the presence of vegetative buffers for wetlands and water bodies. Encourage enforcement of existing buffer zones and encourage inclusion of buffer zones in those plans that lack them.

Background: The holistic view of ecosystem management recognizes that biotic communities within an ecosystem exist in a continuum. Humans place artificial boundaries on these habitats, and, at times, forget that they are interdependent. Ecotones are important in maintaining biodiversity and water quality when examining the relationship between wetlands, transitional zones, and uplands. These are interconnected habitats with animal movement between and dependent on the existence of the connections.

Strategy: Encourage the establishment of vegetative buffers and protect existing vegetative buffers around water bodies and wetlands at all levels of government, particularly the counties and municipalities in the ecosystem.

Expected Benefits: Improved water quality through protection and maintenance of wetland functions adjacent to water bodies and conservation of wetlands and the wetland-upland ecotones.

Monitoring the Environmental Response: Monitor the trend in increase or decrease of natural vegetation around water bodies. This could be accomplished through periodic examination of aerial photography.

Action Plans for Maintenance and Restoration of the Chemical and Physical (Abiotic) Components of the St. Andrew Bay Ecosystem

A1. Determine the Current Status of Air Quality in the Ecosystem

Actions Completed: The single air quality parameter measured in the ecosystem is particulate matter less than 10 microns in diameter (PM10). The ecosystem is considered an attainment area for the other six priority pollutants listed by the U.S. Environmental Protection Agency. However, growth may have altered the composition of the other six priority pollutants in the ecosystem.

Action: Request that DEP or the appropriate federal agency add a second air quality monitoring station in the ecosystem to obtain data on the amount of mercury possibly being emitted to the atmosphere and to assess the other five priority pollutants in the atmosphere.

Background: The single monitoring station for PM10 only has been in operation since 1992. The Deer Point Lake Reservoir was listed in1998 as an impaired water body based on an advisory directed at the human consumption of fish taken from the Reservoir. Mercury was listed as the parameter of concern (see air quality section of this plan). The possible ecological effects of mercury in the food chains of biotic communities are well established in the literature.

Strategy: Contact the appropriate state and federal agencies and request that an additional air quality monitoring station be placed in the ecosystem or the present station be modified to address mercury and the other priority pollutants.

Expected Benefits: Data on the current status of air quality in the ecosystem would be available. Air concentrations of the six priority pollutants would be documented, and information, positive or negative, would be obtained pertaining to the mercury advisory for the consumption of fish from Deer Point Reservoir.

Sediment Quality and Chemical Contamination in the Ecosystem

This section is taken from "A Look to the Future" as written by Mr. Michael Brim of the U.S. Fish and Wildlife Service. Alteration of the living resources of the St. Andrew Bay ecosystem can occur through the chemical contamination or pollution of air, water, soils, sediments, vegetation, and animals that result from commercial/industrial air emissions, vehicular emissions, point source discharges, urban stormwater runoff, discharges from vessels, and oil or hazardous material spills. It is the nature of chemical contaminants to cause subtle, insidious injuries to biological organisms and their habitats. Furthermore, because they are caused by chemicals, these injuries are usually the most difficult of all environmental impacts to observe and to evaluate. Chemical contamination of the ecosystem can severely degrade habitats, significantly reduce biological productivity and diversity, and even eliminate the presence of entire species. Water and/or sediment that becomes degraded by toxic chemicals can generate contaminated food chains that adversely affect numerous biological organisms. Top predators, such as eagles, dolphins and turtles, can often be the most severely injured.

There are many difficulties associated with evaluating and correcting chemical contamination problems. First, adverse effects are usually most significant during reproductive stages - developing eggs, larval or embryonic phases. Injury and/or mortality are not easily observed when they take place in invertebrates, fish, or bird eggs, or in the developing internal embryos of mammals. Second, injuries caused by several chemicals working together (synergism) are difficult to document and to understand. Third, chemical contaminants are usually generated not from one single, easily identifiable source, but from several sources, often remote and diverse. The environmental pathway from injured organisms back to a contaminant source or sources is therefore often difficult to describe.

Chemical contaminants not only adversely affect fish and wildlife resources, they can also be harmful to human beings. Concern is warranted when it comes to consumption of seafood and fish that contain undesirable quantities of mercury, PCBs, dioxin and other harmful chemicals. Public health agencies attempt to monitor concentration levels of undesirable chemicals that occur in food products and public natural resource land and recreational waters. However, probably the best way to protect the public health is to identify and control the sources from which harmful chemicals originate.

CC1. Chemical Contaminant Sediment Monitoring Within the St. Andrew Bay Ecosystem

Actions Completed: The U.S. Fish and Wildlife Service has conducted an extensive baseline evaluation of the chemical contaminants within sediments of the bay (Brim, 1998). The evaluation, completed primarily in the latter 1980s, includes 103 sediment stations located in the bayous and open waters of the bay. The U.S. Fish and Wildlife Service sediment database for St. Andrew Bay includes these 103 sampling locations and analyses for 61 individual chemicals. In addition, seven locations have been sampled for 17 dioxin and furan compounds.

Action: Chemically evaluate, once every ten years, approximately 200 sediment locations in the St. Andrew Bay ecosystem.

Background: The U.S. Fish and Wildlife Service began evaluating the chemical health of the sediments within the St. Andrew Bay ecosystem in 1985. This sampling established a valuable database for future comparison and monitoring of the health of ecosystem. This action is

necessary, in order to preserve and protect the vast, productive, and economically valuable sediment habitat within St. Andrew Bay. It is also necessary to measure the actual effectiveness of contaminant management programs in preventing the chemical degradation of the bay's vast sediment habitat areas. Already implemented and operational management programs within the bay include: 1) urban stormwater treatment facilities, 2) State-permitted, treated point source discharges, 3) oil and chemical spill prevention initiatives, 4) State permitted, pollution control for industrial and municipal air pollution emissions, and 5) regulation of port, marina, and vessel discharges.

The sediment chemical evaluation and monitoring program should include the following:

1) The already established 103 U.S. Fish and Wildlife Service sediment sampling locations.
2) The establishment of new sediment monitoring stations in the 37 (of 59) St. Andrew Bay bayous that have never been sampled for chemical contaminants.
3) The establishment of additional "open water" bay stations, as necessary, for adequate scientific sampling of the bay.
4) The establishment of 10 sediment sampling stations in Deer Point Reservoir, a major water body in the ecosystem which has never been sampled.
5) Chemical evaluation of sediment samples at least once every 10 years, at approximately 200 sediment locations (stations) within the 70,000 acres of St. Andrew Bay and Deer Point Reservoir.

Note: Two hundred sampling locations is a small, but adequate number, for this monitoring program. Two hundred stations amounts to an average of one station for every 350 acres of sediment habitat. This action will only require monitoring 20 stations per year on a rotational basis.

Strategy: Monitor routinely, 20 sediment stations each year. Evaluate the data base routinely to establish trends in chemicals, locate problem areas, identify contaminant sources, and initiate corrective actions.

Expected Benefits: The continued economic benefits of non-degraded habitat including valuable production of marine and freshwater organisms for commercial and recreational harvest, the preservation of harvestable organisms that are safe for human consumption, and the preservation of a clean ecosystem for human recreation.

Monitoring the Environmental Response: Monitoring will be through annual reports that update the data base, contain trend analysis, and define locations of concern. The U.S. Fish and Wildlife Service will manage the database.

Reliable Resources: The U.S. Fish and Wildlife Service can serve as custodian of the database.

CC2. Evaluation of Dioxin Compounds Within the Ecosystem

Actions Completed: The U.S. Fish and Wildlife Service has sampled marine sediments at seven locations within St. Andrew Bay, including one bayou and an adjacent lake, for 17 dioxin and furan compounds that are problematic to fish and wildlife resources. Dioxin and furan compounds were measured at every site and included most or all of the individual isomers for which analyses were run. The U.S. Army Corps of Engineers has sampled sediments at two other locations, and their data are comparable to the Service data for the area of the bay.

Action: At this time it is not known whether the dioxin and furan chemicals detected in the sediment samples from the nine locations (seven FWS and two Corps of Engineers) in the bay constitute an ecological risk to fish and wildlife resources within the bay. Therefore it seems prudent to evaluate the presence of these compounds more thoroughly to estimate the degree of any ecological impact, identify any local sources, eliminate further discharges as much as practicable, and to determine contributions from atmospheric deposition whether local, regional or remote.

Background: Dioxin and furan compounds are among the most toxic chemicals known. Their toxic effects can take place at incredibly low concentrations; as low as parts per billion and parts per trillion. The compounds vary in their toxic effects to different species, but they have been determined to be carcinogenic, teratogenic, and to mimic estrogenic compounds. The U.S. Environmental Protection Agency is scheduled to complete a very comprehensive reassessment of dioxin in the environment and its human health implications. Canada will produce its guidelines for acceptable amounts of dioxin compounds in surface waters, sediments, fresh water and marine organisms, and wildlife.

Strategy: Develop and implement a Dioxin Habitat and Biota Assessment Program for St. Andrew Bay to include additional sampling to estimate amount of bay habitat (sediments) affected and degree of contamination, and organisms most at risk from exposure to dioxin compounds.

Expected Benefits: The evaluation will result in a determination of the degree of ecological risk, if any, associated with the presence of dioxin compounds in the environment. If significant risk exists, steps can be taken to reduce or eliminate such risk, thereby protecting bay habitat, fish and wildlife resources, and the general public from unnecessary exposure.

Monitoring the Environmental Response: The first monitoring will be a final report of the findings of a dioxin evaluation program within St. Andrew Bay. If steps are taken to reduce dioxin concentrations within the bay habitat and biota, such can be measured via sampling implemented as part of CC1 above.

CC3. Chemical Monitoring of Biological Organisms

Actions Completed: Some sampling of fish has been conducted in the past by the National Marine Fisheries Service (1971) for metals. The U.S. Fish and Wildlife Service sampled various fish species, crabs and shrimp, for metals, organochlorine pesticides, PCBs, and

polycyclic aromatic hydrocarbons (PAH) in 1986. Both sampling efforts were random and very limited.

Action: Develop a Chemical Contaminant Monitoring Program for biological resources within the bay. The program should evaluate the resources consumed by the public (fish fillets, shrimp, and crabs). The program should also evaluate any chemical contaminants that could adversely effect species health and survivability, species reproductive capacity, biological diversity, and overall productivity by analyses of such tissues as eggs, fat, liver, etc. The program should also include opportunistic evaluation of aquatic birds, bird eggs, and incidental mortality of sea turtles and bottlenose dolphins. The program would include five separate annual components. One component would be completed each year, thus splitting the sampling into a five-year rotational system.

Background: Monitoring of the health of the bay's biological organisms has not been done on any systematic basis.

Strategy: Select and monitor indicator species representative of important groups and habitats. These indicator species should include ten fish species, four birds, and occasional, opportunistic evaluation of sea turtle and bottlenose dolphin mortalities. Chemical analyses should include organochlorine compounds, metals, and PAH compounds. Other chemical compounds may need to be included after review of the bay's habitat conditions, however dioxin and furan compounds are treated separately at this time (see action item CC5).

Expected Benefits: Benefits include: identification of contaminant problems within biota, correction of problems through identification of pathways of chemicals and sources, conservation of the bay's high species diversity, maintenance and possible increase of the bay's biological productivity (biomass), and protection of consumers of the bay's seafood.

Monitoring the Environmental Response: The environmental response would be monitored through the annual publication of monitoring reports, and a 5-year summary report. Trend analyses could begin after publication of the second 5-year report.

CC4. Restoration of Martin Lake Habitat

Actions Completed: The Fish and Wildlife Service has completed a preliminary evaluation of the chemical contaminants occurring in the sediments of the lake, and the Florida Game and Fish Commission has conducted fish surveys in the lake. Following a two year effort, the City of Springfield received a grant in 1998 to study Martin Lake and correct stormwater problems. A consulting firm was retained and a plan is being developed to assess the water quality, benthic communities, and sediment quality. The studies have begun or are about to commence.

Action: If warranted, restore the lake habitat to an uncontaminated condition that allows all public recreational uses without risk, and that reduces ecological risk to species that use the lake as habitat, including migratory birds, aquatic mammals, fishes and invertebrates.

Background: Prior to the 1950's, the lake was actually Martin Bayou with a free and open connection to St. Andrew Bay. Because industrial effluent from the bay was entering and polluting the Bayou, in the late 1950's a small dam was constructed at the entrance, and the saltwater bayou eventually evolved into a freshwater lake with one-way outflow of water into the bay. In the late 1980's the U.S. Fish and Wildlife Service collected a number of sediment samples from the lake and found the sediments to be contaminated with polycyclic aromatic hydrocarbon (PAH) compounds and some metals. Dioxin compounds were also present in the sediment and the presence of these chemicals is also a concern. Fish, including largemouth bass and redear sunfish, are present in the lake. To date, complete evaluation of all chemicals in the fish species of the lake has not been accomplished.

Strategy: Contamination within the lake may be historic (old contamination from a source that no longer exists) or contemporary. Attempt to identify the sources of contemporary contamination impacting the lake's sediments and biota. If any sources are currently present, eliminate further releases. Based on the results of the planned studies, determine the ecological and human health risks present in the lake and determine the areal extent and volume of sediment that may need to be removed to clean up contaminants within the lake.

A lake restoration/preservation plan could include: a) dredging and disposal of contaminated sediments, b) enlargement of the connections between the segments of the lake at Cherry Street and Highway 22 to increase water exchange and ingress and egress of aquatic species between the upper and lower portions of the lake, c) improvement of the management of stormwater runoff entering the lake through engineering design and a maintenance program, and d) evaluation and improvement of the management of the land in areas at the headwaters of the lake.

Expected Benefits: The lake is potentially an important urban recreational, educational, and biological resource. Consumable fish, trophy fish, and water-related recreational activities have a direct, positive economic benefit to the public. As a small, fresh water ecosystem, the lake will significantly benefit local educational facilities as a site for field trips, and individual student projects. Natural resource benefits include the establishment and maintenance of a diverse aquatic freshwater biological community including wading birds, water fowl, small mammals, fishes, and freshwater invertebrates. The lake will also serve as an important source of fresh water for wildlife, located next to a high salinity bay.

Monitoring the Environmental Response: Upon completion of any restoration actions that may be needed, sediments can be chemically evaluated on a routine basis, fish species can be chemically evaluated to assure that consumed fish are of no risk to the public, and fish and wildlife monitoring studies can be conducted to measure the biological productivity and diversity of the lake.