

SECTION 5

PROBLEMS AND OPPORTUNITIES

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SECTION 5 PROBLEMS AND OPPORTUNITIES

Water resources projects are planned and implemented to solve problems, meet challenges, and seize opportunities. In the planning setting, a problem can be thought of as an undesirable condition, while an opportunity offers a chance for progress or improvement. The identification of problems and opportunities gives focus to the planning effort and aids in the development of planning objectives. Planning objectives are statements of what a plan is attempting to achieve; they communicate to others the intended purpose of the planning process. Problems and opportunities can also be viewed as local and regional resource conditions that could be modified in response to expressed public concerns (USACE, 1999). The Indian River Lagoon - South (IRLS) Project Implementation Report, which focuses on the specific issues and problems related to the southern Indian River Lagoon (IRL), its tributaries and watershed, allows for a more detailed analysis of the problems, and evaluation of the opportunities than was originally afforded under the 1999 Comprehensive Everglades Restoration Program (CERP). This section describes the problems and opportunities in the study area and the planning goals and objectives developed for the study.

5.1 PUBLIC CONCERNS

At the heart of the identification of problems and opportunities process, is an understanding of the public's concerns (USACE, 1999). As part of this study, public workshops were conducted early on in the planning process and then again during the last year of the study (for more details on public outreach refer to Section 9). Numerous presentations to public groups were conducted, including Martin and St. Lucie County Commissioners and staff, the Four County Coalition, St. Lucie River Initiative, Rivers Coalition, National Audubon, local rotary clubs, agency staff and management, business groups, agricultural organizations, and neighborhood and civic groups.

General public concerns are listed below:

- Health of the Estuary and Lagoon
- Wildlife Health and Abundance
- Water Quality
- Fish Health and Abundance
- Economic Impacts
- Tourism
- Water Supply
- Flood Protection

- Cost of the Project

In October 2000, two workshops/public meetings were held to provide a brief overview of the on-going IRLS plan formulation process; review existing IRLS alternative plans and provide an opportunity to comment on the IRLS Feasibility work. The public meeting on October 18th was held at the Blake Library in Stuart and the public meeting on October 19th was held in Fort Pierce at the University of Florida Institute of Food and Agricultural Services Auditorium. Approximately 140 people attended the meeting in Stuart and approximately 60 people attended the meeting in Fort Pierce. A questionnaire was developed and distributed during the workshops. Responses to that questionnaire as well as public comments recorded at meetings provided a good sense of the public's concerns and issues as well as the magnitude of each concern. This information was used to help guide the plan formulation process. Below are the concerns expressed by the public and local officials at the two town meetings.

STUART:

- There was concern expressed about the C-23 Canal / C-44 diversion canal. Individuals indicated their hesitation to support the proposed canal without additional scientific evidence favoring its construction.
- There was concern expressed about the cost of the proposed diversion canal.
- The IRLS team was urged to seek an outside peer review team of alternatives 4 and 5.
- Concern was voiced about the price of land acquisition.
- Concern for water quality in the C-23 canal was voiced.
- The most natural "fix" would be best.
- Overall, individuals complimented the IRLS team for their work to date.

FORT PIERCE:

- Individuals were very supportive of the proposed C-23/C-44 diversion canal and very supportive of the draft plan.
- Individuals expressed that the proposed diversion canal would provide management solutions to handling excess water from Lake Okeechobee.
- Individuals pointed out that the proposed diversion canal would give the South Florida Water Management District (SFWMD) and the U.S. Army Corps of Engineers (Corps) the flexibility to place water where it will do the least amount of harm.
- Individuals stated that the proposed diversion canal should be designed to help the estuary not the citrus industry.
- Individuals expressed a desire to work with all segments of the community to resolve any disagreements.

5.2 ECOLOGICAL PROBLEMS AND OPPORTUNITIES

Natural resource specialists agree that the remaining ecosystems in south Florida no longer maintain the functions and diversity that defined the pre-drainage system, and that these measures of ecological health will continue to decline without preventive actions. Not only is it certain that these natural systems will not recover their defining attributes under current conditions, it is unlikely that even the current, unacceptable ecological conditions can be sustained into the future (USACE, 1999).

The southern IRL watershed has some unique sub-regional problems as well as problems that can be found elsewhere in south Florida. The watershed has been modified by urban and agricultural development. The associated drainage and development practices have led to the severe deterioration of the St. Lucie River (SLR) and IRL. These modifications include

- Construction of major drainage canals (C-23.C-24, C-25 and C-44)
- Construction of numerous drainage conveyance systems connecting to the major drainage canals
- Discharge of stormwater runoff directed to the SLE and IRL that transverse the coastal ridges with little treatment or attenuation
- Diversion of water from Ft. Pierce Farms basins to the IRL through Taylor Creek
- Regulatory discharges from Lake Okeechobee through C-44 to SLE when Lake stages jeopardize the integrity of the Lake levee
- Discretionary Lake Okeechobee discharges to the SLE to reduce Lake levels prior to the wet season

The modification in the drainage runoff from both the watershed and the lake increases the contaminants to the SLE and IRL from urban and agricultural practices, including pesticides, suspended solids, and nutrients. In summary, the quality of water entering the estuary is degraded, and the quantity, timing and duration of inflows have been substantially altered (Hauert 2001).

The estuary shoreline and bottom sediments have been severely impacted. Shorelines and inter-tidal areas of the estuary that were once populated by mangroves and other detritus producing vegetation (important to the sustenance of a functional food chain) have been replaced by seawalls and docks. The natural shoreline vegetation once helped stabilize the substrate, filter stormwater runoff, and provide quality habitat. Unconsolidated sediments have accumulated in the estuary and are frequently re-suspended by wave energy

(Haunert, 1988; Taylor Engineering 1994). These unconsolidated sediments pose a severely degraded habitat for bottom dwelling organisms and have added to the overall water quality problems in the estuary by reducing both water clarity and dissolved oxygen (DO) levels. Overall, current conditions compromise the development of and reduce the potential to sustain healthy biological communities in the estuary, IRL, and near shore Atlantic Ocean reefs. (Haunert 2001)

5.3 WATER QUALITY PROBLEMS AND OPPORTUNITIES

The IRL is a state designated Surface Water Improvement and Management (SWIM) priority water body. Most of the Upper East Coast watershed consists of Class III waters; however, there are small areas of Class II waters (shellfish propagation or harvesting) within the watershed. Class II waters are generally afforded greater protection than Class III. Efforts are underway by the FDEP to develop Total Maximum Daily Loads for the SLE and IRL.

Eutrophication of Florida's estuaries has been associated with ulcerated fish, fish kills, declining fisheries resources, decline of submerged aquatic vegetation, and extensive and frequent algae blooms (Steidinger *et al.* 1999). Excess nitrogen (N) and phosphorus (P) are the primary causative agents in estuarine eutrophication (Kennish 1992). Nutrients in the SLE are excessive (Janicki 1999).

- Algae blooms in the SLE in excess of 30 ug/l chlorophyll-*a* are not uncommon (FDEP 1999)
- Median total phosphorus in the SLE for the period 1985-1998 was 0.149 mg/l, with a mean of 0.170 mg/l (Graves 1999)
- Median phosphorus concentration among Florida's estuaries in 1988-1998 was 0.081 mg/l (Hand, personal communication).

However, high P concentrations alone cannot account for the observed algae blooms; other nutrients are required, notably Nitrogen (N).

**FIGURE 5-1: ULCERATED FISH FROM ST LUCIE RIVER
FEBRUARY 26, 2000**



Nitrogen (N) is generally considered the chief limiting nutrient in estuaries and coastal waters (Boynton *et al.* 1982, Carpenter and Capone 1983, Valiela 1984, Kennish 1990). Median total nitrogen values for the SLE compare with the median value of other Florida estuaries. Two reasons for this are apparent:

- 1) total N concentrations within the estuary are not high because nearly all available N is rapidly converted to algal biomass, and
- 2) the form of N that is available is inorganic N not total N.

The inorganic N fraction is the sum of the nitrate, nitrite and ammonia N present in the water column. Doering (1996) attributed much of the seasonal variability in chlorophyll to ammonia concentrations in the freshwater discharges to the estuary.

In addition to eutrophication resulting from excess P and inorganic N entering the estuaries, many pollutants including pesticides and heavy metals are being transported in the water column. State water quality standards have been exceeded in the basin for copper, arsenic, ethion, diazinon, simazine, malathion, and endosulfan (FDEP 1999). Both N and P nutrient concentrations measured in local freshwater discharges have been found to increase during periods of increased flow (Chamberlain and Hayward, 1997); thus, high flow events not only transport more water to the estuary, but further impact conditions by delivering an even higher concentration of nutrients. It has been estimated (Herr 1999) that 60 percent of the pollutant load of P, N and

suspended solids is contained in the first one-quarter inch of runoff, and 95 percent contained in the first one inch. This “first flush” of stormwater runoff has the highest concentration of many of these pollutants that degrade the water quality in the SLE and IRL

5.4 ECONOMIC AND SOCIAL WELL-BEING PROBLEMS AND OPPORTUNITIES

The Central and Southern Florida Project (C&SF), by providing flood protection and water supply, has enabled the population of south Florida to grow from approximately 900,000 persons in 1950 to over 5.5 million in 1995. By 2050, the population in south Florida is projected to grow to 11.6 million. Increases in population growth intensify the competition for and stress upon regional water resources (USACE, 1999). In the IRL watershed there were 319,426 residents in 2000. This is projected to increase to 461,900 by 2020 (SFWMD, 1998).

With the current C&SF, the availability of water from regional surface and ground water sources remains relatively constant. The growing demand for inexpensive, high quality water for agriculture, industry and an increasing population will surpass the limits of readily available sources. When factoring in the needs of the natural system, upon which a good part of the region’s economy depends, conflicts among water users will become even more severe. In addition, the human community is fundamentally dependent on the project for public health, safety and welfare (USACE, 1999).

The Governor’s Commission for a Sustainable South Florida identified agriculture and tourism as “critical industries”. Agriculture depends upon the system for vital water supply and flood protection. The tourism industry is dependent upon the project in a myriad of ways. The ability to sustain the region’s economy and quality of life depend, to a great extent, on the success of the efforts to protect and better manage the region’s water resources.

In the IRL area, a summary of employment by county was compiled by Woodward-Clyde in their 1994 report to the IRL National Estuary Program. According to this report, the majority of the employment occurs in the services and trades categories. Government, construction, financial institutions, real estate, forestry, fisheries and agricultural services follow in that order. One of the best indicators of how the health of the IRL and its watershed affect the local economy is through an evaluation of the tourism and recreational industries. The numbers of businesses in the area often reflects the degree of tourism and recreational use. Businesses in the study area include:

- hotels and restaurants
- boating and water related businesses
- marinas, tackle shops, boat retailers and suppliers
- fishing guides, charter boats
- outdoor recreation supply businesses

To emphasize the impact to the economy, a series of meetings were held and a report was generated to evaluate the economic impacts of recreation and tourism to the local economy. These meetings were held after large regulatory releases from Lake Okeechobee occurred in the spring of 1998. The participants of these meetings included fishing guides, restaurant and motel owners, bait and tackle shop owners, charter boat captains and real estate salespersons. The large-scale releases, which devastated the health of the estuary, did affect the local residents who rely on the estuary in one form or another to make a living. There were reports of:

- charter boat cancellations
- declines in bait and tackle sales
- hotel cancellations
- a general downturn in spending during this time

One participant noted what he called the “trickle-down” effect in that people who depended directly on water-related businesses did not have the money to buy other products and services. Respondents reported hearing of serious losses, especially from those owning small businesses. Some fishing guides reported receiving cancellation calls from out-of-state clients who usually come to Florida to fish.

South Florida attracts people, both tourists and residents alike, with its beautiful weather and abundant water resources. A stable, healthy area ecology will directly benefit local economy through increases in tourism and dollars generated by the residents who enjoy outdoor activities.

5.5 PLANNING GOALS AND OBJECTIVES

The purpose of the IRLS Project Implementation Report is to evaluate and further refine the work performed under the 1999 C&SF Comprehensive Review process. The objective of the IRLS Project Implementation Report is to produce a plan on a sub-regional scale that would address not only the impacts on the SLE and Southern Indian River Lagoon from Lake Okeechobee via the St. Lucie Canal (C-44 Canal), but also that of the local watershed (i.e., from C-25, C-24, C-23 and C-44 Basins). The overarching goal of the study is to produce a

plan that, when implemented, will meet the restoration goals of the IRLS. Specific study goals and their associated objectives are shown in *Table 1-1*.

5.5.1 Restore Ecological Values

Healthy natural systems are an integral part of a sustainable south Florida. These systems provide numerous functions, including but not limited to:

- habitat for plant and animal species
- recreation and educational opportunities (photography, fishing, hunting, bird watching, etc.)
- water quality filtration including removal of nutrients and silt
- ground water recharge
- soil formation
- hydrologic linkages
- ground water quality protection
- interception of airborne pollutants
- shoreline stabilization
- protection against erosion

Each natural area is uniquely important. Wetlands, in particular, retard floodwater and provide surface water storage. Mangroves and estuaries provide important feeding areas and breeding habitat for numerous benthic invertebrates, finfish and shellfish, including several of commercial and recreational interest. Upland natural systems function as noise buffers, urban green space, habitat for plants and animals, and travel corridors for animals. Thus, plant and animal habitat, although perhaps the most obvious benefit or function, is just one of many functions that natural systems provide. Collectively, these systems benefit the natural ecology and support agricultural, urban, and other human interests as well. The ecological health and hydrologic characteristics of the IRL watershed freshwater wetlands directly affect the quality of the receiving water body.

FIGURE 5 – 2: FRESHWATER FLOWS

5.5.1.1 Freshwater Inflows

The IRL watershed has been modified by urban and agricultural development. The associated drainage and development practices have led to the severe deterioration of the SLR and IRL. These modifications include construction of numerous drainage conveyance systems connected to major canals (C-23, C-24, and C-44). Much of the watershed runoff from the North Fork drainage basins flows quickly into major canals that transverse the coastal ridge (C-23, C-24) instead of being detained, evaporated, cleansed and attenuated by natural systems. In addition to the SLE and IRL runoff, the C-44 Canal also provides a route for excessive Lake Okeechobee runoff to the South Fork of the SLE. These regulatory discharges are an outlet to tide during times of high lake levels that jeopardize the integrity of the levee surrounding the lake, or during discretionary releases when it is desirable for the health of the lake to bring the levels down prior to the wet season. Runoff from both the watershed and the lake contains substances from urban and agricultural practices including pesticides and excess suspended solids and nutrients. Therefore, the quality of water entering the estuary is degraded and the quantity, timing and duration of inflows are substantially altered (Haunert 2001).

5.5.1.2 Water Quality

Along with the unnatural quantity and timing of freshwater inflows to the waterbody are the associated water quality problems. Large volumes of water, which quickly drain from the land into receiving waterbodies, typically contain high levels of suspended solids, nutrients, pesticides, herbicides and heavy metals. All of these substances play a role in the overall deterioration of the health of the estuary and lagoon. Seagrasses are adversely affected by a decrease in light penetration through the water column. Increased color from dissolved organic material and suspended solids contribute to the lack of light reaching the seagrass beds. A secondary impact comes from increased epiphytic growth that covers the grass blades. This is caused by both increased nitrification and a decrease or change in the organisms (grazers) in the lagoon that feed on the epiphytes. Water quality problems also cause phytoplankton blooms, depressed levels of dissolved oxygen and lead to fish and shellfish health problems.

5.5.1.3 Habitat for Estuarine Biota

The IRL restoration will fall short of meeting all the goals of the study by looking only at improvements made to water quantity, timing, distribution and quality of the supply water. While these improvements will have a tremendous positive impact on the estuarine plants and animals, taking additional measures to improve habitat quality in the estuary are necessary. The destruction of the habitat during the past century from changes in the salinity levels, the instability of salinity levels, and the accumulation of muck sediments has decreased the diversity of the estuarine biota.

The loss of hard substrates has impacted the population of oysters, mussels and other sessile benthic species such as bryozoans, tunicates and barnacles. Several studies (Pearse and Wharton 1938; Wells 1961, Bahr and Lanier 1981) have found from 40 to over 300 faunal species associated with oyster beds. Oysters also have the ability to filter over 1500 times their body volume per hour (Loosanoff and Nomejko 1951). As living reefs grow, they attract other fish and shellfish by providing food and shelter.

The accumulation of muck sediments has choked out the submerged aquatic vegetation (SAV) and seagrass beds, once prevalent in the SLE. Seagrass and freshwater SAV provide habitat and nursery grounds for many fish and vertebrate communities (Gilmore 1977, Gilmore et al. 1981, 1983; Stoner 1983a). Other important roles of SAV include benthic-based primary productivity and sediment stabilization (Stoner 1983a, Virnstein et al. 1983, Gilmore 1987, Woodward-Clyde 1998). Sediment quality plays a very important role in the colonization of SAV and benthic invertebrates. These muck sediments

also reduce the water quality via increased turbidity and decreases in the dissolved oxygen levels.

5.5.1.4 Spatial Extent and Functional Quality of Watershed Wetlands

Scientists have identified the large spatial extent of south Florida wetlands as one of the defining physical characteristics of the pre-drainage ecosystem. The size of the south Florida wetlands, in combination with the complex mosaic of habitats, enabled multiple populations of plants and animals to thrive and persist over time. The size of the pre-drainage area in south Florida made it possible for the natural ecosystem to:

- support genetically viable numbers and sub-populations of species with large feeding ranges and/or narrow habitat requirements
- provide the aquatic production to support large numbers of higher vertebrate animals in a naturally nutrient-poor environment, and
- sustain habitat diversity despite natural disturbances. The ability of animal populations to recover from disturbances decreases as the available habitat area decreases since habitat diversity, the amount of seasonal refugia, and the number of dispersal options also decrease (USACE, 1999).

In south Florida roughly 50 percent of the pre-drainage wetland area and 90 percent of pinelands have been lost to development. Lake Okeechobee was much larger than it is at present with an extensive littoral/marsh system extending north, west, and south. The IRL watershed provides a unique opportunity for rehydration and habitat restoration due to the current availability of large tracts of land. This component of the IRLS Project Implementation Report will help meet that system-wide CERP goal that may be more difficult, if not impossible, to do in the more populated areas to the south.

5.5.1.5 Spatial Extent and Functional Quality of Upland/Wetland Mosaic

Adverse changes in natural habitats and the resultant impacts to native fish and wildlife species that depend on healthy habitats for survival have occurred in the south Florida ecosystems. The specific functions that wetlands or uplands perform are closely associated with their condition or quality. A reduction in the quality of these areas results in the loss of many or all of the functions that these areas historically performed. Improving the functional quality of the remaining natural areas is important to system-wide restoration given the loss of spatial extent and, thus, function of the historic wetlands and uplands (USACE, 1999).

Natural habitats in the IRL watershed have been physically and hydrologically altered and manipulated. Consequently, these ecosystems are now substantially less productive and diverse than the historic system. Aquatic productivity has been reduced or highly altered throughout the IRL. Reductions in aquatic productivity have affected the abundance of birds as well as fish. Ditching and draining of isolated depressional wetlands and sloughs degraded watershed habitat. The freshwater historically attenuated in wetlands now flows to secondary canals that drain to the primary C&SF canals that drain into the estuary. These unimpeded flows of untreated stormwater runoff have resulted in degradation of the estuary and lagoon.

Invasive plant and animal species have also impacted the quality of the landscape. Invasive species include both native (i.e., cattails) and non-native species (e.g., *Melaleuca*, Brazilian pepper, and Australian pine). Exotic species infestation ultimately reduces the habitat variability necessary to sustain a healthy community of both plants and animals. Water management has encouraged the spread of these invasive species by creating conditions under which they can out-compete the native habitat that existed under pre-drainage conditions. Eliminating the invasive and exotic species and the conditions that favor these species will contribute to restoration of native plants and animals and a more natural ecosystem hydrology and function.

5.5.1.6 Native Species Abundance and Diversity

The changes that have taken place in the natural system have led to decreases in native animal and plant populations. One of the most obvious indicators that the south Florida ecosystems have experienced ecologically significant reductions in productivity is the decline in wading bird populations. Several species are now so reduced in numbers that their long-term existence is jeopardized unless measures are taken to ensure their sustainability. Other species have a naturally restricted range; these species are also vulnerable to extinction if their specialized habitats are altered. In addition to considering these species, it is important to recognize that maintaining balanced communities of the more abundant species is essential to a sustainable ecosystem. It is also important to recognize that a balanced community is dynamic; population levels fluctuate widely from year to year as natural conditions vary. Unnaturally, small, isolated populations can be quickly extinguished by natural conditions (USACE, 1999).

Fragmented communities are more likely to lose species because the number of individuals in each fragment may be too small to persist. The smaller the fragment, the higher the likelihood is of losing species or favoring an imbalance in the species that do inhabit the areas. Therefore, improving the connectivity of

habitats will improve the range of many animals and their prey-base and provide for a more natural balance of species within the system.

The natural areas selected for restoration and enhancement in the IRLS plan were clustered around and include properties identified by several state programs such as Save Our Rivers (SOR), Conservation and Recreational Lands (CARL) and State Greenways and Trails. Restoration of these areas would provide for an almost continuous greenway from northern St. Lucie County down to the publicly owned lands of Jonathan Dickenson State Park, Dupuis Reserve and Corbett Wildlife Management Area. In the IRL watershed the opportunity exists to restore and reconnect greenways that, because of their size and upland/wetland mosaic, provide the potential to reestablish a portion of the historic south Florida ecosystem.

5.5.2 Enhance Economic Values and Social Well Being

The C&SF provides economic benefits through regional water supply, flood damage reduction, navigation, and recreation. While most people recognize the need for a healthy ecosystem to support the region's economy and jobs, many people are concerned that restoration projects will displace farms and other businesses, limit development, reduce available water supply, and reduce job opportunities. By contrast, continued degradation of the south Florida ecosystem will adversely affect the tourism and recreational industry that are important to the regional economy. It has been estimated that the IRL generates more than \$300 million in boat and marine sales annually and accounts for more than \$300 million in fisheries revenues. It also contains five state parks and recreation areas, four Federal wildlife refuges, and a national seashore (Natural Resources Conservation Service, (NRCS) 1997). In 2000 there were 319,426 residents in the IRL area. This is projected to increase to 461,900 in 2020 (SFWMD, 1998).

5.5.2.1 Water Supply

Drainage, water supply, and flood protection afforded by the C&SF have enabled the growth of south Florida's population, which by 1990 was 5.2 million. The drainage network formed by the project canals and the secondary canal system in Martin and St. Lucie counties has become an important source of irrigation water and freeze protection for agriculture. Rainfall, ground water inflow and withdrawals from the Floridan aquifer replenish surface water stored in the canals. Prior to large-scale citrus expansion in the 1960's, canal storage in St. Lucie County was adequate to meet irrigation demands. However, the drainage and development of the large wetland areas in western St. Lucie County have depleted much of the surface water storage. The lowering of water tables for flood protection has also reduced the amount of groundwater storage.

The reductions in water storage coupled with increasing acres of citrus production have resulted in inadequate supplies of surface water to meet demands during droughts (USACE, 1998 & SFWMD, 1998).

According to the Upper East Coast Water Supply Plan, the planning area faces many challenges in maintaining adequate water supply for a growing urban population while at the same time meeting the needs of the environment. Regional agricultural water demands are assumed to remain constant through 2050 with increases in agricultural acreages being offset by increases in irrigation efficiencies.

5.5.2.2 Flood Protection

The C&SF was conceived and authorized to provide regional flood protection for south Florida. The system of canals, levees, water control structures and pump stations conveys and confines flood waters to regional storage facilities such as Lake Okeechobee and the Water Conservation Areas, or to tidal receiving waters. Further, additional protection is afforded by the local systems operated by special taxing districts, private property owners, and local governments.

Structural flood protection in the IRL watershed includes the extensive canal systems that blanket the area. The primary canals include the C-23, C-24, C-25 and C-44 Canals. Other secondary and tertiary canals maintained by water control districts and landowners crisscross the landscape and afford protection from flooding. The existing infrastructure of drainage systems was never intended to totally eliminate flooding in developed areas. While flood protection is not the primary intent of this project, the evaluation of improvements and alternatives does include the analysis of those improvements and the effects on the current level of flood protections. The project will not compromise that existing level of protection, and although it was not a specific goal of the study to increase the level of protection, some ancillary benefits may be achieved.

5.5.2.3 Tourism, Recreation and Environmental Education

The expenditures of Florida's many tourists make tourism Florida's largest industry. Tourism directly employs more than 781,000 persons and generates more than \$37 billion in annual taxable spending. Outdoor recreation plays a significant role in this industry (USACE, 1999). Resource-based recreation is provided by the ecosystem. The restoration of the Everglades ecosystem as a whole and the SLE and IRLS in particular could have significant impacts on the value of outdoor recreation in south Florida. The project provides opportunities for improvements in a wide range of outdoor activities including:

fishing, boating, hunting, nature watching, hiking, camping, picnicking, horseback riding and nature photography. Environmental education can be greatly enhanced as the public and especially the area school children witness, learn about and become engaged in a major environmental restoration effort in their own community.

5.5.2.4 Fisheries and Associated Industries

The potential economic effects of alternative restoration plans on fishing in the SLE depend on how the changes brought about by the restoration affect the ecology of the estuary and how the improvements in the ecology then translate into changes in commercial and recreational fisheries. For recreational anglers, economic effects could result from changes in the quantity or quality of recreational fishing experiences. For professional fishing guides, the effects may include increases in income. There is little commercial fishing in the SLE. The use of gill nets was banned in 1994. Although there is little commercial fishing within the estuary proper, there are important ecological connections with offshore commercial fish stocks. Some commercial species of finfish and invertebrates inhabit estuaries year-round; however, a large number of species only use estuaries during portions of their life cycle. Approximately 66 percent of the fish in the estuary and lagoon are species that spawn on the continental shelf (Gilmore, 1988). The majority of them spend their adult life offshore and use the lagoon as a juvenile nursery (Gilmore, 1995).

5.6 WATERSHED ECOSYSTEM RESTORATION

The C&SF engineered system of canals, levees and developed areas has reduced and fragmented habitats, uncoupled uplands from wetlands and freshwater from marine habitats (Mazotti, Bioregional Assessments 1999). Loss of highly functional natural areas has negatively affected the rate, timing, volume, and quality of water flow to the SLE, the IRL and their tributaries. Drainage modifications (e.g., canals and ditches) which lower natural groundwater levels, and subsequent land use intensification in the SLE watershed have dramatically increased wet season flows to the estuary and reduced dry season inflows. Intensification of land use has dramatically increased nutrient loads to the estuary. The current state of development in the upper east coast region provides a unique opportunity to meet general and specific restoration objectives for the overall CERP as well as for the local area. Low intensity agriculture in the form of pasture/rangeland covers a large portion of the basin, ranging from high intensity, improved pasture to rangeland with wetland and upland natural areas containing suitable habitat for fish and wildlife resources. These areas provide an opportunity to restore habitat while

providing water storage and water quality improvements that will benefit the SLE and IRL.

FIGURE 5 – 3: DRY SEASON IMPACTS ON WETLANDS



Cox *et al* (1994) identified several natural land areas, termed “Strategic Habitat Conservation Areas”, within the Treasure Coast region that are important to ensure survival of focal species of wildlife, which are outside current conservation areas. These areas contain stands of prairie, pine flatwoods, and hardwood and cypress swamp that were once part of the more extensive vegetative communities such as St. John’s Marsh, Allapattah Flats, Cypress Creek, Cane Slough, Loxahatchee Slough, and their tributaries. Florida Natural Areas Inventory has identified areas adjacent to Allapattah that should be added to the Conservation and Recreation Lands (CARL)/Save Our Rivers (SOR) project.

The State of Florida Greenways and Trails program has also identified areas of conservation/ecological opportunities statewide to include “elements that protect ecosystems, landscapes and process native to Florida across their

natural range of distribution; protect the full range of Florida's biodiversity; conserve Florida's surficial and ground water resources for the benefit of the state's native ecosystems, landscapes, residents and visitors; incorporate ecologically compatible working landscapes; and incorporate degraded lands that, through restoration, will enhance the ecological function of the Statewide Greenways System" (University of Florida, 1997). The selected sites follow the major identified greenways in the region and fill in a significant portion of the State Greenways Plan.

In the St. Lucie watershed, there are three distinct ecological corridors. In the northwest portion of the region, conservation and working ranches link the northern extent of the Everglades with the southern reaches of the St. Johns River valley. The Orlando Ridge and adjacent cypress-dominated hydric forest form a corridor providing this link. This ecological corridor extends from the St. Johns Marsh/Fort Drum in Indian River County to the Dupuis Reserve in southern Martin County. Along the eastern edges of the hydric forest run the remnants of the Allapattah Flats. The Cypress Creek/Trail Ridge CARL/SOR and the Allapattah CARL/SOR projects are in this area.

A second significant corridor exists in the southeastern portion of the watershed, where the Loxahatchee River, Florida's only Wild and Scenic River, could be linked to the Atlantic Coastal Ridge via the South Fork of the SLR. The Loxahatchee is largely contained within Jonathan Dickenson Park while the Atlantic Ridge CARL/SOR project surrounds the South Fork of the SLR.

A vital east-west link between this north-south corridor in Martin County and several large conservation areas in Palm Beach County (over 100,000 acres in Corbett Wildlife Management Area and Dupuis Preserve) is provided by the Palmar CARL/SOR project. Natural areas north of Palmar provide a northern corridor up to the St. Lucie Canal, which connects to the westerly drainage basin of the South Fork.

Wetlands alone without upland edge effects cannot provide maximum function. While wetlands and short hydroperiod wetlands are uniquely valuable to the restoration effort, it is the original mosaic of upland and wetland habitat types that provided the spatial and temporal network for the production and survival of animals under a wide seasonal range of hydrological conditions (USACE, 1999). Providing restoration of upland and wetland habitat over large areas maximizes the value of the restoration.

The South Florida Ecosystem Restoration Task Force (Strategic Plan) lists the following criteria for restoring, protecting and preserving natural habitat and species and establishes this as an important goal of the CERP:

- The spatial extent of wetlands and other natural systems is sufficient to support the historic functions of the Greater Everglades ecosystem.
- Restored natural systems support productive agriculture, fisheries and tourist-based economies.
- Important wildlife corridors are identified, enhanced and preserved.
- Endangered and other Federal and state listed species are recovered to numerically sustainable levels, and sufficient habitats for maintaining healthy numbers are restored and protected.
- Invasive exotic plant and animal species are substantially eliminated or reduced to manageable levels.
- Diversity, abundance and behavior of native south Florida animals and plants in terrestrial and aquatic environments are characteristic of pre-drainage conditions.