

Executive summary

History of the Region

Collier County encompasses over 2,300 sq miles and is located in southwestern Florida. Approximately 70 percent of Collier County (ca. 1,400 sq miles) has been altered by human modifications of the local hydrology (Atkins 2011). Prior to human alterations, rainfall either infiltrated into the surficial aquifer or flowed through extensive wetland features into the coastal waters of Collier County. Most of these hydrologic alterations were due to coastal development in Collier County since the early 1950s, as dredge-and-fill became the established method to meet the growing post-World War II demand for waterfront housing. The canals served to create waterfront property, increasing access for boating, and provided fill material needed for the creation of buildable lots (Antonini et al 2002).

In addition to shoreline modifications, extensive canal construction for urban and agricultural drainage has changed the timing and quantity of freshwater inflows to coastal waters. These changes have dramatically affected water quality and quantity of many of Collier County’s estuaries. For example, the construction of the Golden Gate Canal (GGC) network increased the size of the Naples Bay watershed and freshwater flows to Naples Bay, as lands that originally drained southward into the Rookery Bay watershed were redirected. Consequently, the Rookery Bay watershed is now much smaller and, combined with alterations in drainage pathways and changes in wet and dry season storage capacities, receives less freshwater inflow than it did historically. These altered freshwater inflow patterns have been identified as the most important threat to the natural biodiversity of Rookery Bay. **Figure ES-1** shows the current extents of these watersheds in Collier County.

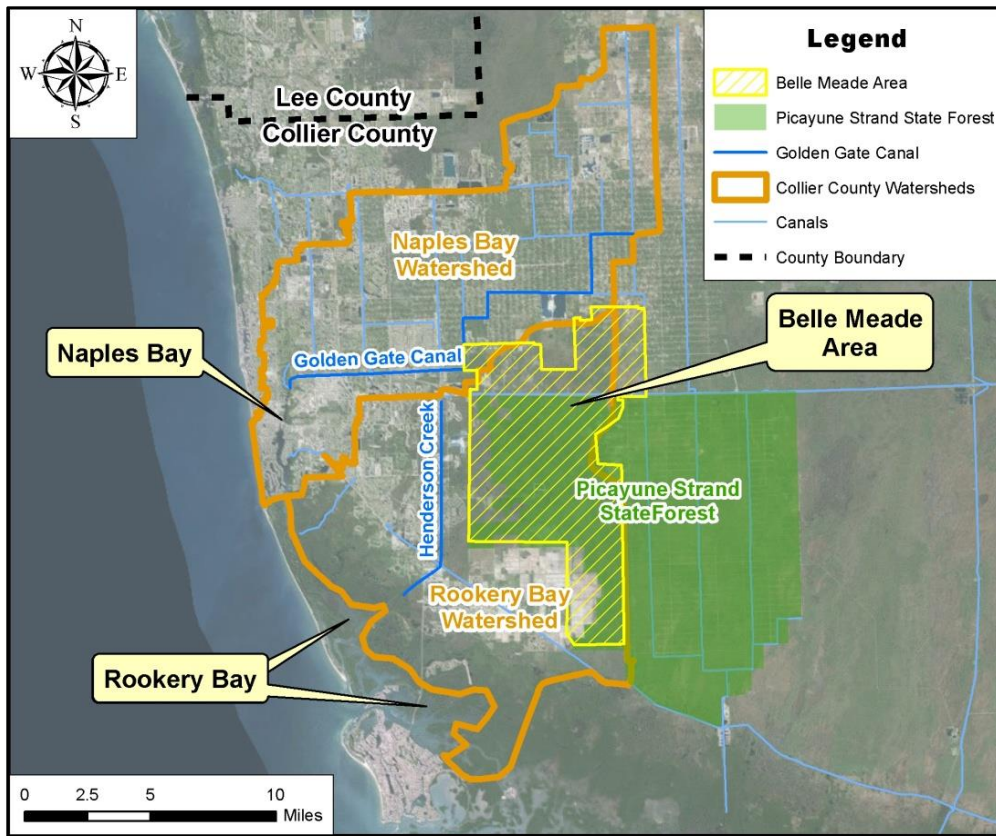


Figure ES-1 Watershed Location Map

Modifications to drainage patterns have resulted in significant impacts throughout the watersheds in Collier County. The historic areal extents of oyster bars and seagrass beds have been reduced by salinity alterations, reduced water clarity, and increased sediment loads. Tidal mangrove habitat has also been affected by coastal development and hydrologic alterations. Changes in the timing and amount of freshwater inflows into coastal waters, drainage alterations, and urbanization have also lowered groundwater levels, degraded or eliminated wetlands, altered wildlife distribution patterns or reduced populations, and increased the delivery of nutrients and other pollutants to coastal waters. This plan has been developed to address these conditions.

In addition to the altered hydrology of Naples Bay and Rookery Bay caused by the hydrologic alterations within Collier County, the natural systems of the Belle Meade area within the Picayune Strand State Forest (PSSF) have also been impacted by hydrologic alterations. In 1985, Conservation and Recreation Land (CARL) funds under the Save Our Everglades Project were used to start the purchase of properties which became the PSSF in 1996. These lands were purchased to help promote hydrologic and ecologic restoration and encourage passive recreation in this area.

While there is broad scientific consensus that Naples Bay is adversely impacted by excessive freshwater inflow, and that the Rookery Bay estuary is adversely impacted by too little freshwater inflow, the location of any proposed freshwater diversion (restoration) has not received as much attention. Existing management plans may have used the location of Henderson Creek as a default location for waters diverted out of the GGC system. However, more recent modeling work has suggested that areas farther east would benefit the most from flow diversions. As such, current information suggests that the benefit of a freshwater flow diversion out of the Naples Bay watershed from the Golden Gate Canal and into the Rookery Bay watershed would be greatest if freshwater was diverted through the Belle Meade region of the PSSF, rather than via Henderson Creek. Hydrologic restoration projects focusing on diversions in the Belle Meade region are included in both the Belle Meade Area Stormwater Management Master Plan (Parsons 2006) and the Collier County Watershed Management Plan (Atkins 2011). Such actions thus represent both project types and locations that are consistent with both the historical literature and the most recent modeling efforts.

Project Background

Recently, Collier County and the City of Naples developed the Golden Gate Watershed Improvement Program Initiative. The goal of this initiative is to foster the implementation of recommended projects based on environmentally sustainable management system strategies aimed at protecting, preserving, and restoring the resource in areas that have experienced the highest impact due to human activity, while encouraging efficient urban development in areas with the highest existing and potential urban development in the County.

To further implement the Golden Gate Watershed Improvement Program Initiative, the Collier County Comprehensive Watershed Improvement Plan (CCCWIP) was created. The purpose of this project, described herein, is to identify and develop a specific series of linked projects identified in the previous watershed management plans that will have the largest impacts to hydrologic and ecologic recovery within the County. The goals of this CCCWIP report are to:

- identify and address all of the critical issues related to each project;
- identify any issues that could possibly derail a project;
- utilize existing studies as the basis for the overall project concept;
- develop each project such that it is comprehensive, feasible, fundable and can be completed within the next 10 years ;
- validate that recommended projects can be accomplished ; and
- develop projects consistent with objectives of the RETORE Act

The CCCWIP is being co-sponsored by the Rookery Bay National Estuarine Research Reserve (RBNERR). RBNERR has been involved from the very beginning of project development and are represented on the Technical Advisory Committee for Collier County Watershed Management Plans. This project is, in part, based on the modeling that the Rookery Bay National Estuarine Research Reserve has recently completed. In addition, Collier County has worked diligently to gain the support and partnership of all other interested local groups/organizations. These groups/organizations include the following:

- Audubon of the Western Everglades/ Audubon Florida
- Big Cypress Basin/South Florida Water Management District
- City of Naples
- Conservancy of Southwest Florida
- Florida Fish and Wildlife Conservation Commission
- Fish and Wildlife Service
- Florida Wildlife Federation
- Florida Forest Service
- Collier County Watershed Technical Advisory Committee

Diverted Flow Capacity

This project included an evaluation of the availability of flows to be diverted from the GGC and the capacity of the downstream (Rookery Bay) watershed and estuary to receive additional flows (which includes the Belle Meade portion of the PSSF). Both the Collier County Watershed Management Plan and the Restoring the Rookery Bay Estuary (Henderson Creek Watershed Engineering Research Project) modeling results were used to evaluate existing flows to estuary systems in comparison to estimates of pre-development flow rates.

The flow analysis focused on defining the appropriate diversion flow rate for the project based on the ability of Rookery Bay to assimilate additional flows. The constraint in the system is, then, the receiving water body, the Rookery Bay. Previous studies considered various pumping rates to divert water from the GGC and reduce flows to Naples Bay. Although these studies indicated larger pumps would have a greater benefit on Naples Bay via great diversions, they would likely result in too much water to the receiving wetland systems and Rookery Bay. Review of the data indicated that a 100 cubic feet per second (cfs) pump station would divert enough water from the GGC to benefit both Naples Bay and Rookery Bay.

Project Conceptual Plan

Figure ES-2 presents an overview of the primary set of recommended projects for the CCCWIP. This set of projects has been carefully planned out with respect to potential effects to both Naples Bay and receiving wetlands (in the PSSF major road crossings (in Florida Department of Transportation right-of-ways), agricultural lands and Rookery Bay. These projects have also been developed in concert with the governmental, non-governmental and citizen groups (mentioned above) that will be directly impacted by the implementation of this plan, as to be consistent with the Golden Gate Watershed Improvement Program. A brief description of how the overall system would work is described below.

The projects start in the north where a 100 cfs pump station (Pump Station A) will be constructed on County-owned property along the GGC, approximately one mile east of Collier Blvd. and upstream of the GG-3 structure. The pump station would start pumping when the gate for the GG-3 structure is lowered to elevation 6.5 ft NAVD88, which roughly corresponds to elevation 8.0 ft NAVD88 in the Golden Gate Canal. The pump station would then pump to a one-mile long channel flow-way (linear pond) controlled by outfall structures. The linear pond flow-way would be designed with wetland plantings to improve water quality and have a multi-use recreational trail amenity. This would divert flows south, under White Lake Blvd. to the north I-75 cross canal. Once flows enter the I-75 north canal, flows would be conveyed through the existing box culverts under this section of I-75 to the south canal. Operational structures or ditch blocks would be designed to contain the flows within the west segment of the canals. The I-75 south canal is not contiguous, so portions between the ditch segments would need to be excavated to convey flows the entire to the next pump station intake.

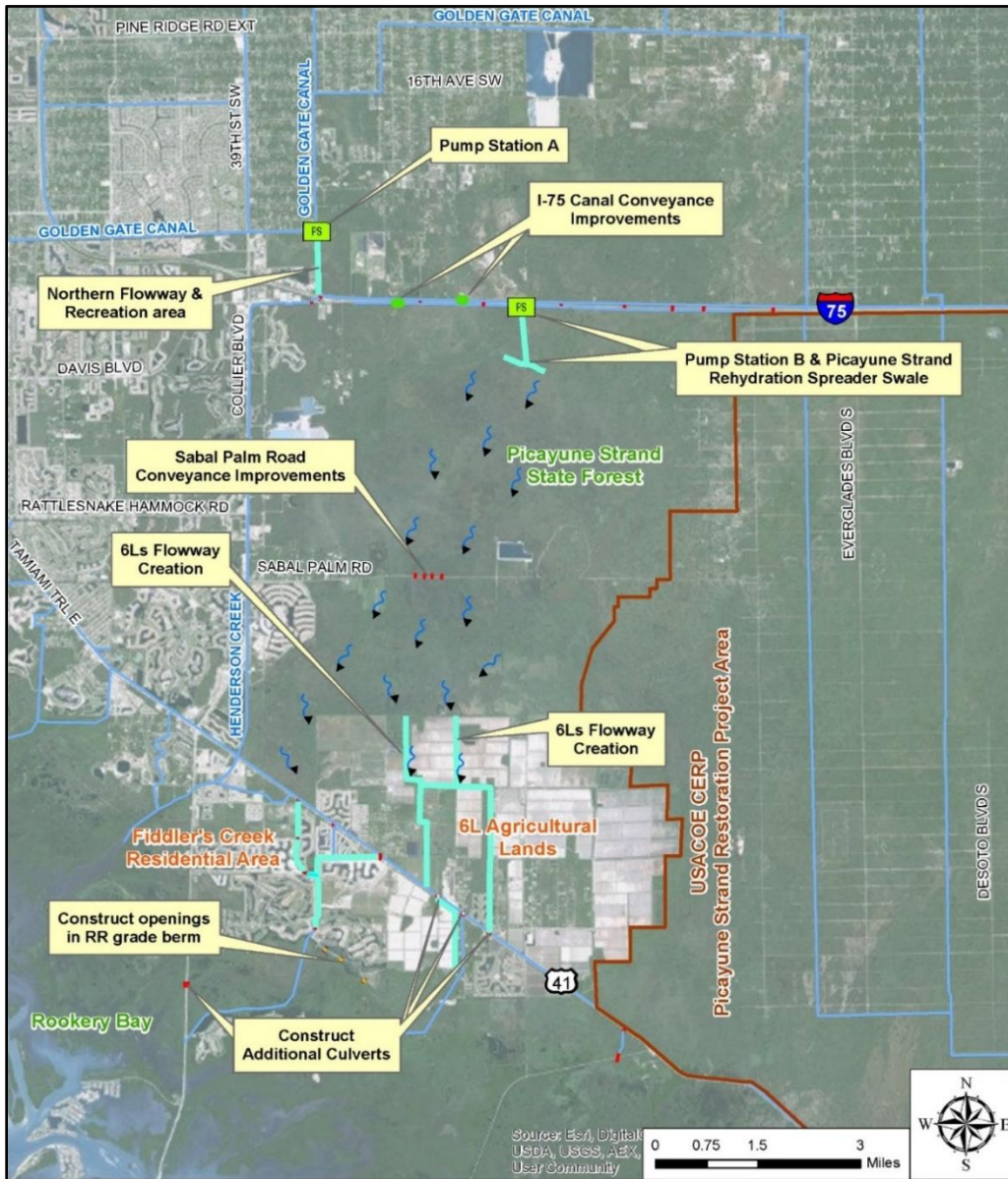


Figure ES-2 Overall Project Concept

A second pump station (Pump Station B) will be constructed on the south side of the I-75 south canal, also with a 100 cfs capacity, and would start pumping when water begins flowing into the north I-75 canal. The pump station would pump into a 4,000 foot (dry) channel flow-way which would convey flows south to a spreader swale that would discharge flows south through the Belle Meade wetland area flow-way. This flow would continue south to Sabal Palm Road where additional siphon culvert cross drains would be constructed to convey the additional flow under the road and south through the flowway.

As diverted flow continues south, it would flow in one of three directions. Some flow could circumvent the Six L's agricultural lands to the west, while the majority would flow into one of two control structures, each with a designed flow-way that would take flows through the Six L's lands. All flows would continue to the existing north US 41 drainage system, where additional culverts would be installed under US 41. From there the flows would continue south through the Fiddler's Creek residential area stormwater system and ultimately to Rookery Bay.

Critical Issues

One of the primary goals of this report was to determine the critical issues associated with implementing the CCCWIP, particularly the issues that could derail the project, and to identify and/or perform the preliminary analyses needed to resolve these issues. The following are the critical issues that were identified and evaluated as part of this study:

- Flow Capacity through the I-75 corridor
- Flows through the Picayune Strand State Forest (Particularly the effects on RCW habitat)
- Picayune Strand Restoration Project (PSRP) Coordination
- South Belle Meade Property Evaluation
- Six L's Agricultural Area Plan and Future Coordination
- Flow Capacities through US 41 to Rookery Bay

Project Benefits

The water quality in Naples Bay, specifically salinity, has been drastically impacted within the last 50 years, particularly from the construction of the canal system. The impacts of the magnitude of freshwater surplus and the extreme freshwater “shock loads” to the bay during the wet season, have been long documented. The benefit to Naples Bay by diverting flows south during the wet season is not necessarily as large as previous studies concluded, but the volume of freshwater that can be diverted represents a significant enhancement to the Naples Bay estuary.

On average, the proposed project would operate 42 days per year. On those days when operating, it would divert approximately 19 percent of flows to Naples Bay (18.78 percent). The amount diverted would equal about 9.5 percent of the wet season inflows to Naples Bay, and 8 percent of the total inflow each year. The amount of water diverted from Naples Bay would average 2,688 million gallons per year (2.7 billion gallons per year), which is equivalent to 8,250 acre-feet per year, or just over 10 billion liters per year.

The vegetation in the PSSF has shifted over the past 50 years due to hydrologic alterations and subsequent impacts to wetlands in general swamp forest in particular. Hydroperiods and water depths in this area have declined and there is general consensus that the Belle Meade area of the PSSF is in need of rehydration. This is validated by the forest's Ten-Year Resources Management Plan (dated 8/15/2008) under Goal 1, Objective 3, “*Evaluate and develop work plan for restoring hydrology*”. With the implementation of the CCCWIP, at least a portion of the historical flows would be restored within the region helping to re-establish historical wetland hydroperiods to at least some degree and assisting the Florida Forest Service with their goals for the PSSF. Although full restoration would likely include more than 100 cfs of additional wet season flow diversions, it has been shown that the limitations of the system that are now in place (Red-cockaded Woodpecker habitat, Picayune Strand Restoration Project and Rookery Bay), currently prevent more than the 100 cfs based on the conservative and preliminary analyses conducted as part of this project.

The CCCWIP also significantly benefits Rookery Bay. When comparing the areas within the Rookery Bay estuary that have flow deficits, to the location(s) of the diverted flows to the estuary from the CCCWIP project, it can be seen that these areas correspond, indicating the diverted flows are going to the areas that need water. Not only do diverted inflow locations correspond to the locations of inflow deficits, but diverted flow volumes (approximately 50 cfs from the preliminary modeling estimates) are also consistent with the documented inflow deficit volumes in corresponding areas of Rookery Bay.

Project Costs

The preliminary opinion of probable construction costs for the projects is presented below in **Table ES-1**. These estimates are based on best available information for quantities and unit prices for the year 2016, and are equivalent to a 15 percent design level. Sources for these estimates include the current Florida Department of Transportation tabulated costs for item average unit cost; and local bid tabs for similar projects in Collier County and throughout the South Florida Water Management District and the Southwest Florida Water Management District. Costs for any property acquisition (if needed) are not included. Construction costs include 2 percent for Maintenance of Traffic (MOT), 10% for Mobilization and a 30% contingency.

Additional costs are presented in the overall CCCWIP project cost estimate including a more detailed project development (5%), design/plans preparations (10%), permitting (5%) and mitigation (5%). An estimated cost is also included for monitoring and SCADA telemetry systems. Considering that this project has a ten-year planning horizon (approximate) for completion of construction, a cost escalation factor of 23% (3% per year compounded over 7 years) has also been included. Also included in the overall cost is funding for other minor projects that may be necessary or beneficial to enhance the system and for the future phase projects (North Belle Meade Flow-way and the Six L's Area Masterplan).

Table ES-1 Planning-Level Opinion of Probable Costs

| Project Element | Estimated Cost |
|--|-----------------------|
| Total Construction Cost | \$18,800,000 |
| Project Development | \$1,000,000 |
| Design/Engineering/Permitting/Mitigation (20%) | \$3,800,000 |
| Monitoring and SCADA Telemetry Systems | \$1,000,000 |
| Associated Projects, Engineering and Master Planning | \$3,000,000 |
| Cost Escalation over 7 years (3% per year) | \$4,400,000 |
| Total | \$32,000,000 |

System Operations Management

Additional planning and analysis will be required to accurately manage the flow diversions throughout the project area. Although preliminary analysis has been completed to determine how and where the diverted water will flow, including a modeling analysis using the MIKE SHE/MIKE-11 2D surface water/groundwater model, some level of uncertainty remains as to the flow direction. Collier County recognizes this uncertainty and the need for further analysis and plans additional in-depth analyses in future planning phases prior to project design. For this reason, this project includes an adaptive management approach to operating the diversion system.

Adaptive management is a structured and systematic process for continually improving decisions, management policies and practices by learning from the outcomes of decisions previously taken, and changing operations accordingly, as needed. In this manner, the operational protocol for the system will be continuously refined and optimized such that maximum benefit can be obtained while eliminating or minimizing any impacts. Monitoring sites will be set up throughout the project area that would encompass not just hydrologic monitoring, but wetland and habitat monitoring as well. The results and careful evaluation of these monitoring efforts will help drive the future operations and management of the system. These monitoring efforts will be defined as part of the future project development phase and will address system optimization and permitting needs.