

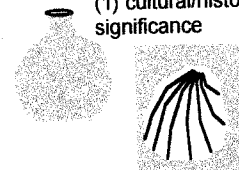
Turner River Management Plan

Big Cypress
National Preserve

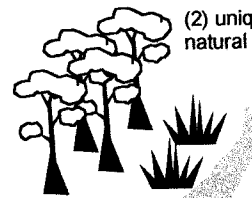
Bob Sobczak

Chief of Resource Management
Ron Clark

(1) cultural/historical
significance



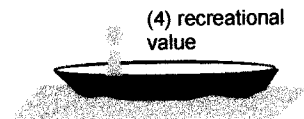
(2) unique
natural value



(3) hydrologic value



(4) recreational
value



(5) river restoration



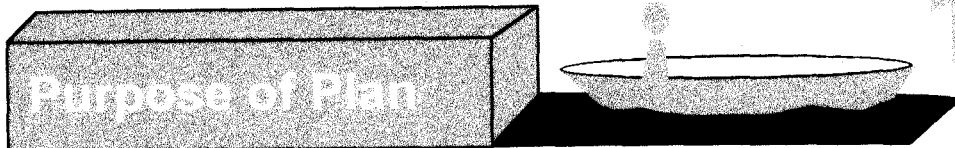
D R A F T
May 4, 2000

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— NOTE: Photos
not included

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Turner River lies in the southwestern portion of Big Cypress National Preserve. Its contributing watershed, headwater pools, and upstream portion of its channel lie within Big Cypress National Preserve. Its tailwaters and estuarine terminus lie in Everglades National Park (Figure 1.1).

Distinct river channels are uncommon in south Florida. A shallow wetland environment predominates the region, and where channels are present they are too short, discontinuous, densely vegetated, shallow, or too remote for navigation with canoe or kayak. Turner River is an exception to all of the above. Its channel twists and turns for 9 miles through mixed cypress swamp, open grassland prairie, mangrove tunnels, and estuarine tailwaters before emptying into Chokoloskee Bay.

Turner River is an important resource within Big Cypress National Preserve because it touches upon many of the reasons behind the establishment of the Preserve, as listed below and highlighted in Figure 1.2.

1. It is an important cultural and historic landmark.

Calusa and the later Seminole Indians used the river as passage in and out of the interior swamp land from the coast. Shell mounds of Calusa origins are located along the banks of the

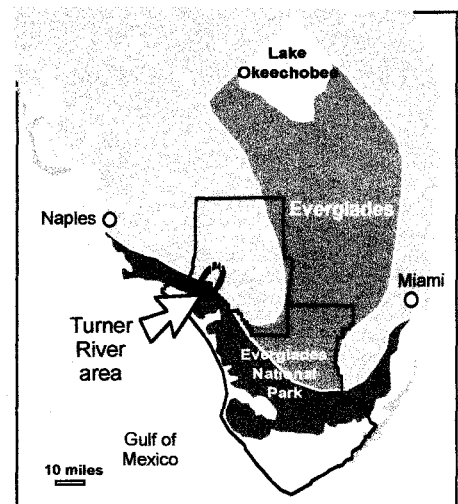


Figure 1.1 Map showing Turner River area.

river. The river is also closely linked to the early European settlement of southwest Florida (Chokoloskee Bay Country), during which the river functioned as a prominent transportation route and its banks were used for settlement and agriculture.

2. It is an important natural feature. Its corridor provides continuity between a range of freshwater and saltwater habitats of the region. Its headwaters form in forested swamp (cypress), its midwaters pass through grassland prairie, and its tailwaters move through mangroves, before finally easing out into Chokoloskee Bay. The channel and corridor provides a unique habitat for a variety of flora and fauna. The channel sustains surface water longer than the surrounding landscape during drydown periods, and so provides natural refuge for wildlife.

3. It is an important coastal discharge feature. The river is part of the upstream watershed that delivers freshwater discharge to the shallow coastal waters of Everglades National Park. This is important because a primary impetus behind Congressional establishment of Big Cypress National Preserve was to protect the quality, volume, and timing of water flowing into the shallow coastal waters of the Ten Thousand Islands which are part of Everglades National Park.

4. It is a popular channel to canoe. Because its channel is long, continuous, deep enough for canoeing, and easily accessible by two roadways, Turner River has become the most popular place to canoe in the Preserve. The New River, by contrast, also reaches into the freshwater marsh but it is not accessible by roadway and even if it were, the channel is blocked by heavy mangrove growth at the tailwaters.

5. It is an important resource because it has been restored. The same roadways that provide access to the river also severed the

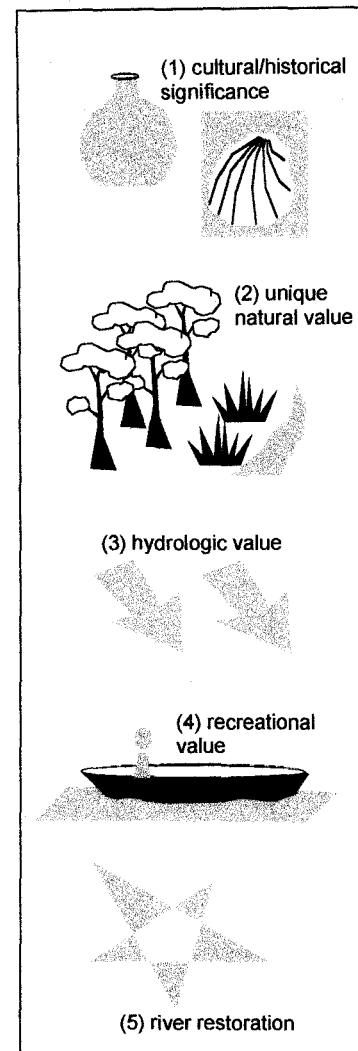
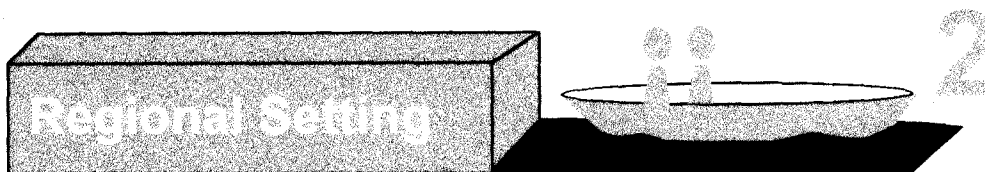


Figure 1.2. Sketch showing 5 reasons that Turner River is an important resource to Big Cypress National Preserve

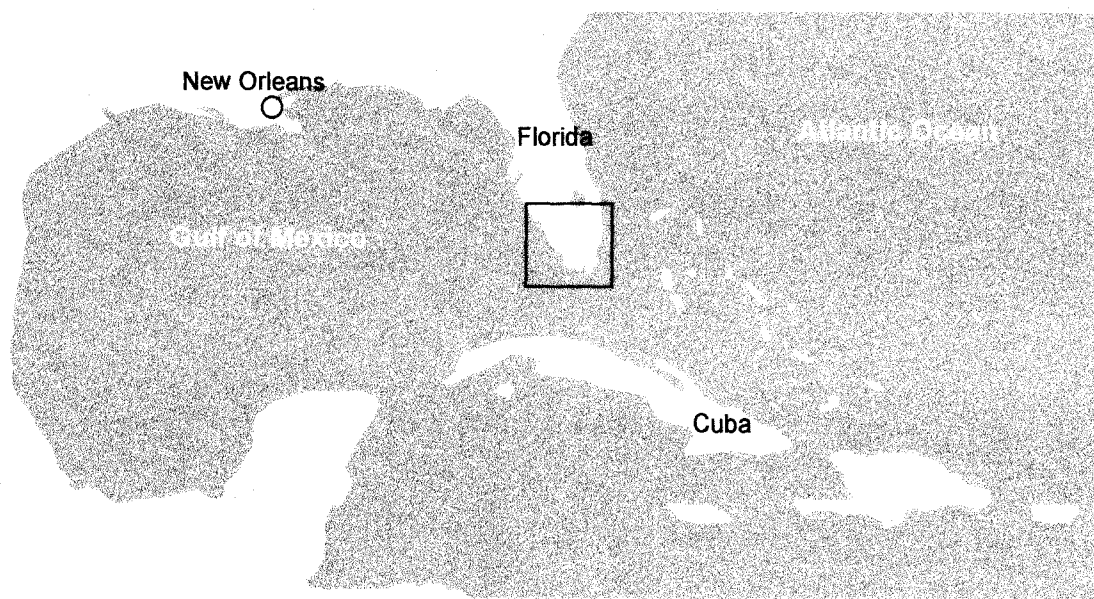
river from its upstream watershed, causing it to dry up and fill in with vegetation. Restoration actions have been taken over the past 2 decades by the National Park Service to return the river to a natural hydrologic regime and accommodate recreational use. These restoration actions resulted in degradation (infilling) of the canal that recreationalists were previously using to access the tailwaters of the Turner River (and also for fishing) – but these actions were needed to return the water that was escaping down the canal back into the river.

To date, river restoration has reintroduced both “flowing water” and canoeists back into the river. The return of water flow and increased recreational use to the river have created a need for the Turner River Management Plan. This plan looks at the history of the river and its restoration, what the restoration efforts have achieved, and what still needs to be done in order to enhance hydrologic restoration, to adequately provide for recreational opportunities on the river, and to ensure that the cultural character of the river will remain intact. The plan provides internal guidance to the National Park Service for managing the river in a “holistic” manner, as opposed to managing on a “piece by piece” basis or “ad hoc” emergency basis.



The area south of Lake Okechobee in Florida is predominated by an extensive subtropical wetland environment extending from the Atlantic to Gulf Coast and south to Florida Bay. This landscape is unique for many reasons, among which are its blending of temperate and tropical flora and fauna, the seasonal occurrence of widespread natural fire, and its incredible flat terrain which causes its shallow and extensive flooding regime.

Figure 2.1. Map showing the location of South Florida relative to the rest of the Gulf of Mexico and Caribbean Sea.



Wetlands are most commonly thought of as lying adjacent to and receiving waters from a lake or river overflowing its banks, but just the opposite is true in south Florida. The extensive wetland

is the river, only it moves very slowly and is almost always shallow enough to walk through. Within this wetland environment there are subtle flow channels and small streams which are fed water from the surrounding wetland.

South Florida has a heavy annual rainfall. Near Miami, an average of about 60 inches of rain falls each year, with slightly less falling in the interior and gulf coast. This is among the highest precipitation rates in the country, but its effect is even more dramatic because the majority of it falls during a single season. Regular afternoon showers in the rainy summer season (May to October) drop about three-quarters of the region's average rainfall. Prior to canal building*, these storms filled south Florida with a shallow sheet of surface water. Remarkably dry and cloudless conditions in the winter and spring slowly dried the landscape.

While it appears that surface water is simply rising and falling from wet to dry seasons, it is actually slowly flowing across the landscape and discharging to sea. Prior to canal building, a wide expanse of grasslands called the Everglades was the primary drainage path. It drained both rainfall that fell directly on it as well as water overflowing the southern bank of Lake Okeechobee.

The Kissimmee River flowed into the northern shore of the lake. The lake is only 10 to 20 feet deep and, prior to diking, had a very shallow bank and no well defined outlet channels. This meant that rising lake levels would spill out across the southern banks and enter the Everglades. From there water slowly flowed across the landscape in the form of a shallow and extensive sheet of water. The "pre-development" Everglades extended a hundred miles in length and forty miles in width. Flow was guided southward by slightly higher ridge of oolitic limestone

* An extensive network of canals, levees, pumps, and gates have been established in the 20th century (primarily between 1950-1970) to accommodate urban development, agricultural development, water supply, and flood control. Efforts are currently underway to modify this network to improve natural areas that have been negatively impacted by water management practices.

along the east coast (called the Atlantic Coastal Ridge) and the Big Cypress Swamp to the west. The freshwater intermingled with brackish waters of the coastal mangrove swamps before mixing into Florida Bay and the Gulf of Mexico.

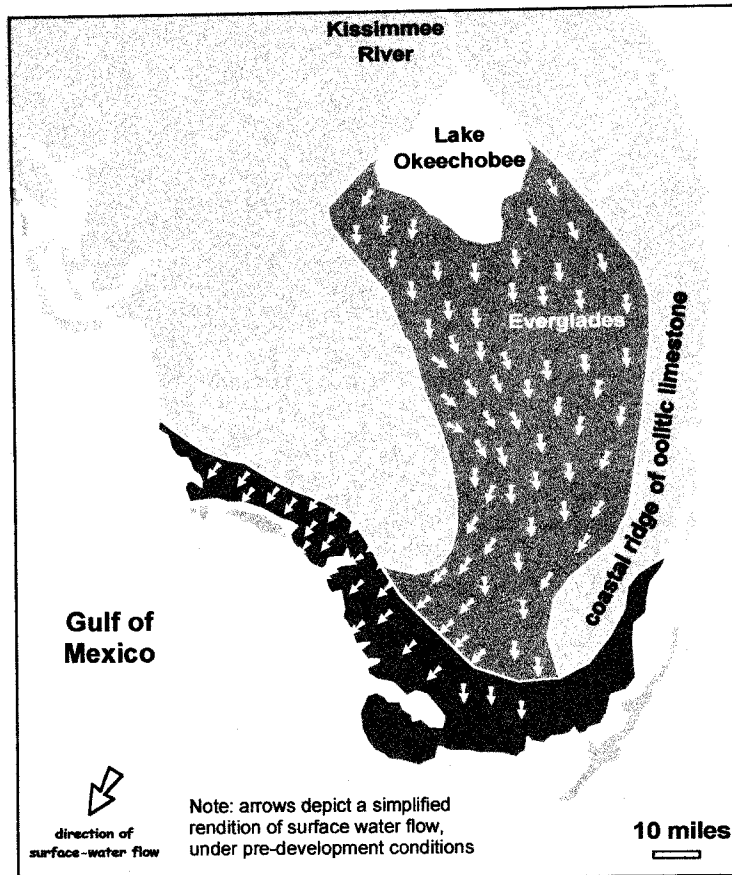


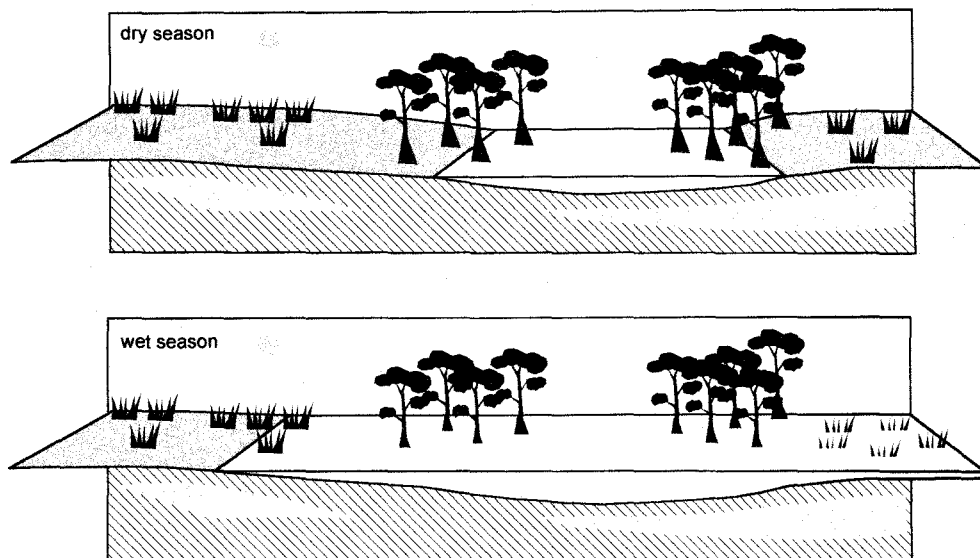
Figure 2.2. Map showing simplified rendition of the pre-development flow regime in the Big Cypress Swamp and greater Everglades.

Although the Big Cypress Swamp to the west is slightly higher than the Everglades, it is also characterized by a shallow, extensive, and slowly flowing wetland environment. The northeastern portion of the Big Cypress Swamp actually flows east into the Everglades. The rest of the Big Cypress Swamp flows in a slightly arcing southwesterly direction towards the coastal mangrove fringe of the Gulf of Mexico.

The flooding regime of both the Big Cypress Swamp and the greater Everglades is commonly referred to as "sheetflow"

because it spans as a shallow sheet across the entire landscape during high water. However, underneath this extensive sheet are subtle differences in depth which control the volume, distribution, and movement of this water. These subtle depressions are difficult to see with the naked eye, even during dry down conditions, but are easily recognizable by their distinct vegetation. Elongated stands of cypress trees, called strands, and meandering marshy areas called sloughs (pronounced "slew") are the two main flow features in the Big Cypress. They are only one to three feet lower than the adjacent wetland, and although they are usually discontinuous, they function as the primary water flow conduits.

Figure 2.3. Cross-section sketch of high and low sheetflow conditions, scaling is vertically exaggerated.



The transition from freshwater wetland to tidal mangrove swamp begins with a series of creeks that reach like fingers from the mangroves into the upstream marshes. These coastal rivers exist at the coastal fringe of both the Everglades and the Big Cypress Swamp. Geologically, these channels probably originated as tidal channels and shallow swales when all of South Florida was a shallow marine shelf. These features became hardened in the limestone when it became exposed to freshwater when the

marine shelf receded to the present day coast. Today, freshwater flow from the extensive inland wetland keeps these creeks fresh to slightly brackish most of the time, with saline conditions reaching into the creeks during drought and storm-driven tides. These creeks include Turner River, Chatham River, New River, and others.

Turner River is perhaps the best known of these coastal creeks because of its historical significance to settlers. The channelized river originates in headwater pools that are located nine meandering miles inland from the Ten Thousand Islands (which includes Chokoloskee Island). The headwater pools and the initial first few miles of its channel are overhung by swamp forest. There is a brief section of open prairie before it enters into a series of mangrove tunnels and pools as it collects into the widening estuarine channel and discharges into Chokoloskee Bay of the greater Ten Thousand Islands.

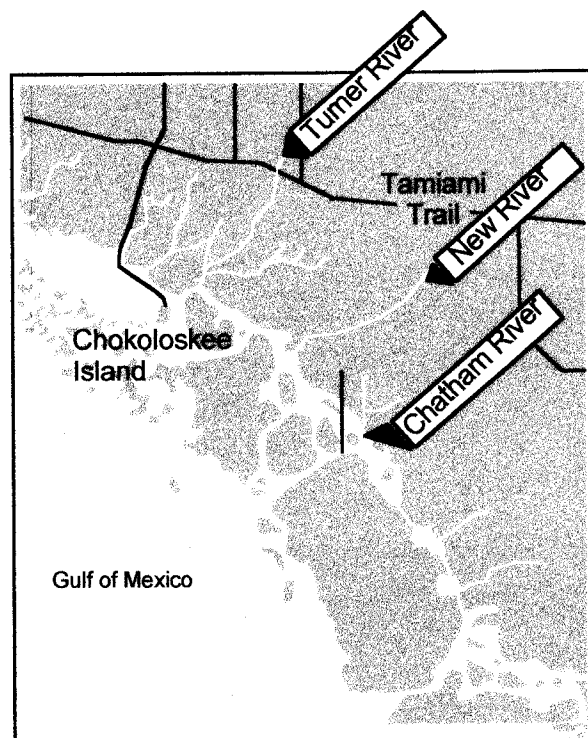
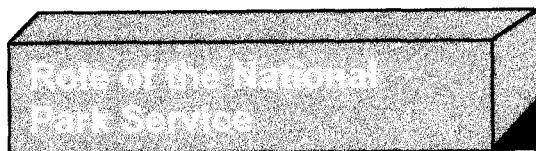


Figure 2.4. Map showing coastal creeks within the vicinity of Chokoloskee Island. Turner River is the only one of these creeks that reaches north of the Tamiami Trail.



This section describes the role of the National Park Service in the management of resources within its lands and also covers how Big Cypress National Preserve fits into the overall preservation of natural areas in south Florida.

Congressional Legislation:

In October 1974, the United States Congress established the Big Cypress National Preserve. Public Law 93-440 declared "That in order to assure the preservation, conservation, and protection of natural, scenic, hydrologic, floral and faunal, and recreational values of the Big Cypress Watershed in the State of Florida and to provide for the enhancement and public enjoyment thereof, the Big Cypress National Preserve is hereby established."

In accordance with the Preserve's enabling legislation and General Management Plan, the National Park Service envisions the Preserve as a nationally significant ecological resource – a primitive area where ecological processes are restored and maintained and where cultural sites are protected from unlawful disturbance. Visitors will have the opportunity to appreciate the natural setting, to explore the landscape and to learn more about the natural environment."

As a part of the National Park System, management of the Preserve is guided by the Organic Act of 1916, which states that the National Park Service's objective is "to conserve the scenery and the natural and historic objects therein and provide for the enjoyment of the same and by such means that will leave them unimpaired for the enjoyment of future generations."

History of Big Cypress National Preserve

The impetus behind the establishment of the Preserve also warrants a brief review in order to highlight the importance of hydrologic restoration within NPS management the Preserve.

Major urban centers originated along the coasts where navigation with watercraft was possible, but lack of interest, poor access, constant flooding condition, bug pests, and fear of hostile Indians prohibited development of the interior swamps. Knowledge of the interior swampland and interest in its development increased substantially in the wake of the Seminole wars in the middle and late 1800s, but actual development was to wait several more decades.

Completion of the Tamiami Trail in 1928 ushered in an initial wave of development in the Big Cypress Swamp. Logging operations along the Tamiami Trail and State Road 29 eliminated almost all of the virgin stands of old growth cypress by 1940. A second wave of development moved through the Big Cypress Swamp in the form of agricultural production. Farming communities sprung up along the Trail, Loop Road, and State Road 29. The natural plentitude of grasses and trees led to wide speculation of the area becoming productive farmland, but by the 1950s and 60s most of the large scale operations went out of business due to the unexpectedly low mineral content and high acidity of the soil. Unpredictable droughts and floods were probably factors as well.

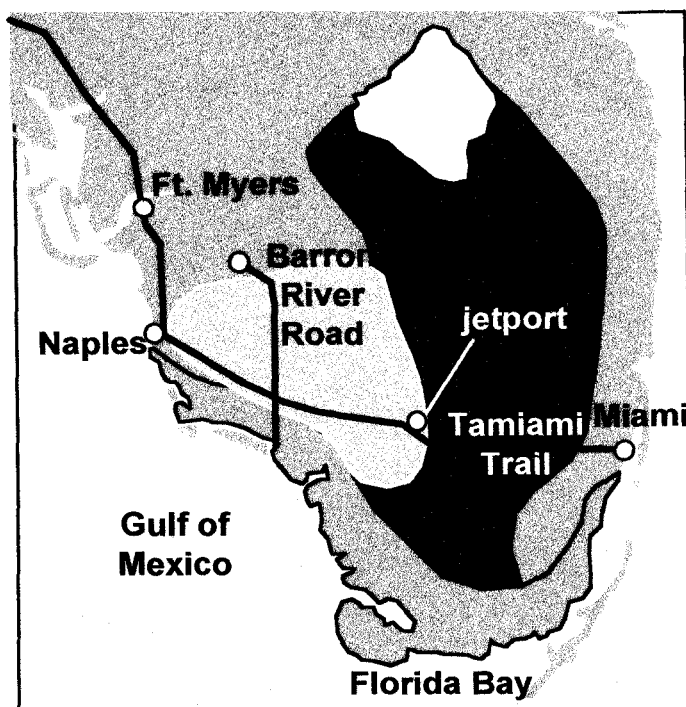


Figure 4.1. Map showing location of Tamiami Trail and State Road 29, both of which were completed in the late 1920s. The location of the jetport is also shown.

Despite clearcut logging and failed agricultural enterprises, the interior swampland remained relatively untouched by residential development. Some interior infrastructure (Turner River Road and Birdon Road) had been laid down towards this end, but the Big Cypress Swamp lay too remote from the east or west coasts to be seriously considered for rapid development.

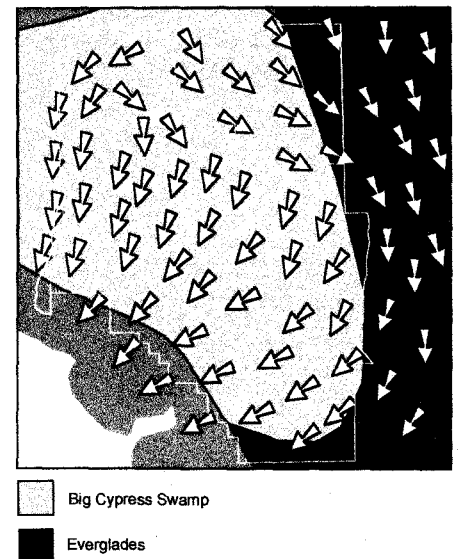
This all changed in the late 1960s as a result of efforts by Miami and Dade Counties to build a major municipal airport at the eastern edge of the Big Cypress Swamp. The primary airstrip of the facility was built before local, state, and federal entities were able to respond with adequate planning guidelines. If it had been completed, the airport would have been the biggest in the country, as its size and location intended to serve both the east and west coasts of South Florida. The natural flora, fauna, and hydrologic regime of the Big Cypress Swamp lay largely intact at that time, but completion of such a facility was expected to lead to the introduction of permanent residential and commercial development.

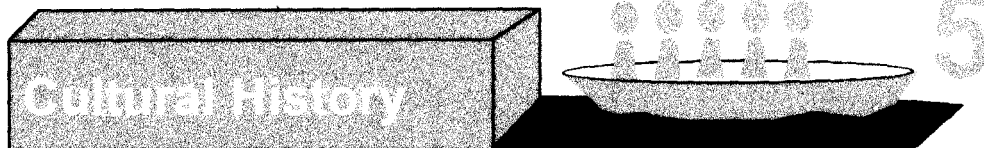
A major driving force behind establishment of Big Cypress National Preserve was that it comprised the eastern edge of the Big Cypress Swamp – the upstream source for over half of the freshwater discharge entering Everglades National Park. The freshwater and shallow coastal areas on the east side of the Park had already been dramatically altered by upstream drainage and water storage features which had been added for agricultural and residential development. Since it was established in 1947, there had been repeated attempts to develop operational and structural changes in the system to accommodate flows into the Park. However, difficulties in doing this supported the sentiment that the best option for sustaining flows to the west end of the park was to preserve its upstream watershed.

Congress exercised this option in 1974 by setting aside 547,000 acres of the Swamp as the Big Cypress National Preserve, under the management of the National Park Service. The exact size and shape of the Preserve essentially matched the upstream watershed that contributed freshwater flow to the western half of Everglades National Park. In 1988, additional lands were added to the northeast and west, for a total size of approximately 729,000 acres.

Big Cypress National Preserve was established as a “preserve” rather than as a “park” because the enabling legislation allowed for continuation of some activities within the area that would traditionally be excluded from a National park. In addition to preserving and protecting the natural hydrologic regime, its natural flora and fauna, and other landscape and cultural features, the Preserve allows hunting, cattle grazing, use of off-road vehicles, oil and gas exploration and development, and traditional Indian settlements and uses.

Figure 4.2. Map showing original boundary of Preserve as established in 1974 and the additional areas that were added in 1988. The original boundary was delineated along the approximate boundaries of a self-contained watershed.





Turner River empties into the northeast edge of Chokoloskee Bay. The term Chokoloskee now refers to the island at the southeast end of the bay, but originally the name was given to the entire inland bay and its feeding tributaries. The bay lies between the Florida mainland and the Ten Thousand Islands. It is 10 miles long, 2 miles wide and generally no more than 5 feet deep. During low tide and a strong north wind, water will almost completely empty out of the bay.

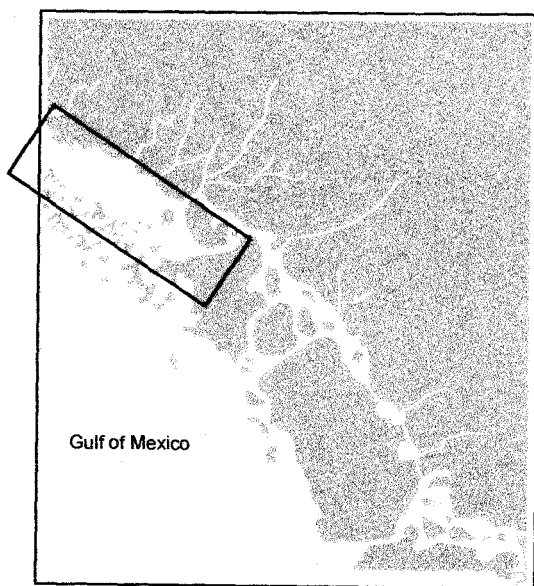


Figure 5.1. Map showing the location of Chokoloskee Bay Country. Chokoloskee Island is located at the tailwaters of the Turner River.

The area was originally settled approximately two thousand years ago by Calusa Indians. When the Spanish first arrived in the area in the 1500s, the population of the Calusa Indians was estimated at around 2,000 and was spread among 30 villages along the southwest coast. They probably relied on shellfish and fish to survive, with game and wild plants supplementing their diet, and lived in highest densities at the mouth of rivers.

Ancient shell mounds along the coasts and rivers that they inhabited remain somewhat of a mystery, yet a source of archeological knowledge regarding the culture. Remains of these mounds exist on Chokoloskee Island, Turner River, and other neighboring islands. A mound on Chokoloskee Island is 135 acres in size, and around 30 mounds are located on the east bank at the mouth of the Turner River and farther upstream as well. It is uncertain if the Calusa intentionally built the shell mounds to serve as dry places for permanent dwellings, or if they had some other function. It has been noted that the mounds remain dry while the surrounding landscape is flooded, thus making dry places to live, but it has also been suggested that dry ground was not as imperative for the Calusa as it would be for the settlers that followed (Tebeau, 1968).

Calusa occupation of the area ended by the 1800s. Tebeau reports that the last of the Calusas departed with the Spanish when Britain took control of Florida in 1763, but the population was probably reduced by this point from various factors, and a segment of the population and culture may have blended into the later Seminoles.

Seminole Indians moved into Florida in response to being forced out of Georgia and the Carolinas by English settlers in the 1700s and into the 1800s. Hunters found their way into the southern swampland of Florida for meat and for fur, hides, and feathers

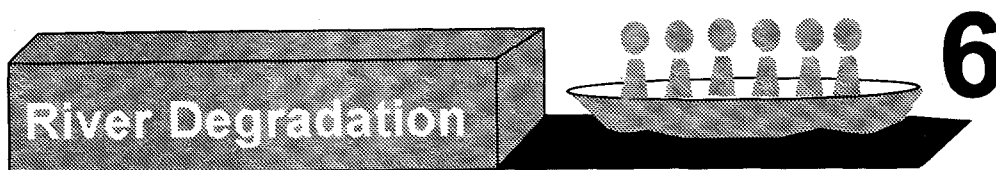
for trading, but did not set up permanent settlements there. By the middle 1800s, the Seminoles were forced into south Florida as the Seminole Wars ensued. The Seminoles were not coastal dwellers as were the Calusas, and this trait was probably fostered by the safe refuge that the impenetrable interior swampland provided from the United States military. Also differing from the Calusas, they relied on agriculture and also maintained some livestock (hogs and cattle).

The final phases of the Seminole War, generally called the Third Seminole War, occurred in and near the Chokoloskee Bay Country and Turner River. On November 18, 1957, Colonel S. St. George Rogers of the Florida Mounted Volunteers left Fort Myers with 110 men. They reached Chokoloskee Island on the 22nd, and two days later Captain John Parkhill led seventy-five of the men on an expedition up the Turner River. Available evidence suggested that the main band of remaining Seminoles were within the vicinity of the river's headwaters (Tebeau, 1968).

Nine miles up the river the party landed and marched three miles into the Deep Lake or Royal Hammock area. They were guided by Captain Richard Turner, who was an expert guide and whose name would later be given to the river. The party found a deserted settlement within a hammock and destroyed it. This expedition is given credit for officially ending the war, even though Parkhill was killed and 5 others were wounded when the Seminoles retaliated a few days later. The remaining Seminoles surrendered soon thereafter and agreed to deportation to Oklahoma. A group of Seminoles avoided or escaped the deportation and remained in South Florida. Many others have returned to South Florida in more recent times (Tebeau, 1968).

European settlement into Chokoloskee Bay Country began in earnest at the conclusion of the Seminole Wars. Settlers began to appear at about the same time on Chokoloskee Island, along Sand Fly pass, and along the banks of the three tributaries that feed into the Bay: Barron River, Halfway Creek, and Turner River. A unique culture developed among the residents and settlements of the loosely connected bay country. Boats provided the only transportation between these settlements and out of the Bay Country for sale of produce to the Florida Keys, instilling it with a remote and rugged character. Turner River provided the deepest and easiest transportation route into the interior swampland. The community of Everglades grew at the mouth of Barron River. Halfway Creek was given its name because it marked the halfway point for waterman between Chokoloskee Island and Everglades.

If the Bay Country was remote, so too was the rest of southwest Florida in beginning of the 1900s. When Collier County was established in 1923, Everglades was populated enough to be named the County Seat and it was renamed to Everglades City. Soon thereafter, an inland roadway was completed which connected Everglades City to the recently completed Tamiami Trail (a road that was 13 years in the making). It would take another 30 years before Chokoloskee Island would be connected to Everglades City by a 2-mile long causeway. Boating remains popular today for recreational and commercial fishing purposes, but the era of boat-only subsistence gradually passed into history with the completion of the roadways.



Roadways did more than just change the cultural behavior at the tailwaters of the Turner River, they also altered the hydrologic regime of the adjacent swamp. Prior to roadbuilding, access into the swampland of south Florida was limited to walking and canoe travel. South Florida's non-Indian population was small at this time. Growing coastal populations and a desire to open up the interiors of Florida to development led to efforts to build a roadway from coast to coast across south Florida. Roadbuilding was a daunting task because of the extensive and regular flooding of the environment, and difficulties caused by its remoteness.

Construction of the Tamiami Trail began in 1915. Due to funding problems and logistical difficulties of construction in a swamp, the portion of the road that runs through the interior swamplands of southwest Florida was not completed until 1928, two years after completion of State Road 29. Both roads served as transportation arteries for establishing commercial enterprises such as logging, agriculture, and general commerce between coastal population hubs.

Since the road couldn't be routed around the wetlands, the solution was to raise the roadbed above them. The material to raise the roadbed was provided by digging a continuous pit right next to the road. Digging this pit often required blasting to break

through the shallow limestone caprock. The material was extracted, crushed, and piled in a mound adjacent to the pit. The road was placed on top of this mound (Figure 6.1). The pit was retained to serve as a drainage canal, commonly called a borrow canal.

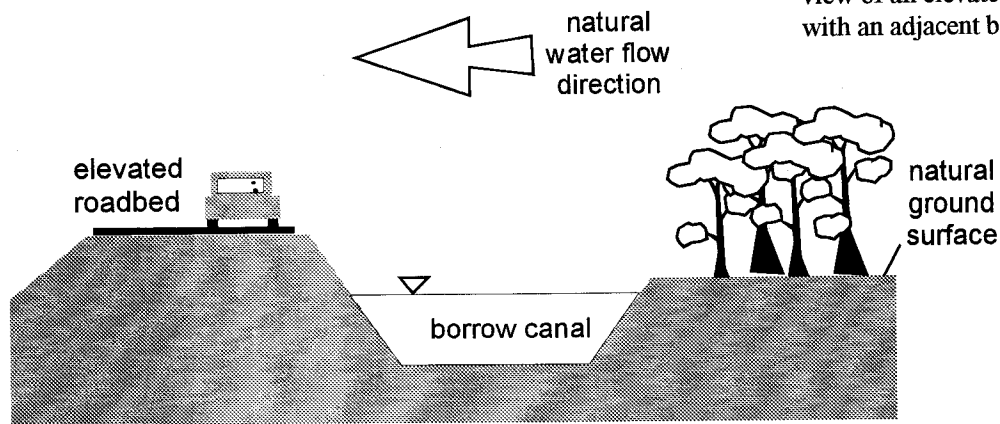


Figure 6.1. Cross-sectional view of an elevated roadbed with an adjacent borrow canal.

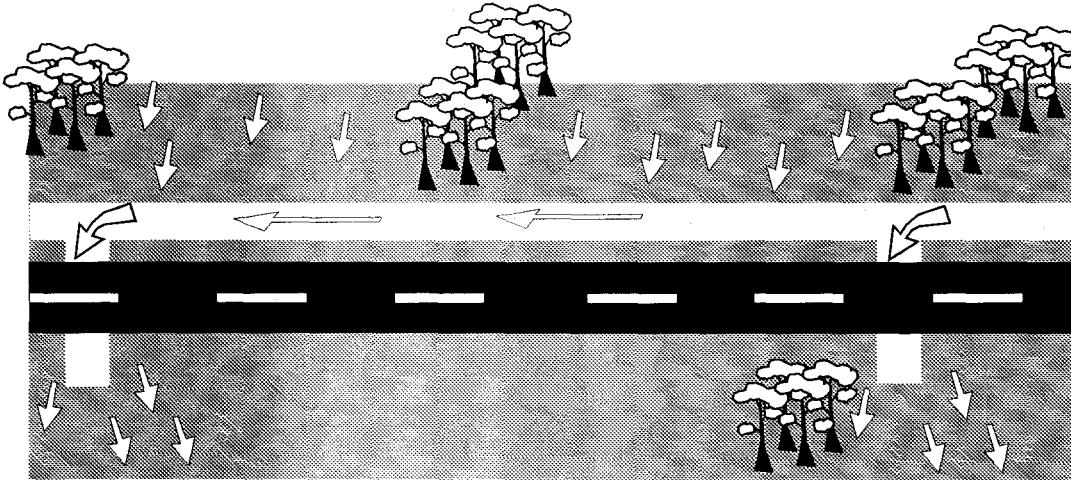
This simple design was effective from a road construction perspective because it was cheap and kept the road dry. The borrow canal was typically dug upstream of the roadbed for better drainage around the roadway. Upstream placement allowed it to intercept sheetflow and channel it alongside the road.

Bridged gaps were periodically left in the roadbed to allow water to pass under the road, rather than over the top of it. However, the vast majority of the road did not contain gaps, causing sheetflow to back up behind it or become channelized parallel to the road. Gaps were designed in the roadway to prevent the roadbed from overflowing, and may have been added on a trial and error basis as the road was flooded over. Gaps had to be more frequently placed in the Tamiami Trail (in comparison to State Road 29*) because it lay perpendicular to the major direction of flow. Gaps were typically chosen in places that could accommodate the most drainage (Figure 6.2). These

* The elevated roadbed under Barron River Road was not as extensively gapped because it was aligned in the same general direction as flow in the adjacent swamp.

places included strands, stream channels such as the Turner River, and also other canals.

Figure 6.2. Map showing how upstream sheetflow is channelized prior to being discharged downstream.



A large gap was left under the Tamiami Trail for the Turner River because of its drainage capacity. The borrow canal adjacent to the Trail was probably directly connected to the river when it was first built. This would have affected river flow by routing headwater flows directly in the canal, or vice versa. Lack of data prohibits a detailed inquiry, but the historic hydrologic alteration was probably small compared to the Turner River Road alterations which would come later.

Blocking Turner River with a Road

In the late 1950s, three roads were built in the northeast quadrant of the Tamiami Trail and State Road 29 intersection. They were probably constructed in expectation of future residential development. Turner River Road is the longest of these roads. Its southern terminus intersects the Tamiami Trail, from which it extends northward for fifteen miles. Birdon Road also intersects the Tamiami Trail on its southern end; it parallels Turner River Road for about six miles before turning due east and intersecting

Turner River Road. This top portion is commonly called Upper Wagon Wheel Road, with Lower Wagon Wheel referring to the road that connects Birdon Road to State Road 29 a mile and half to the south.

As shown in Figure 6.3, these roads form a continuous loop around the headwaters of the Turner River. The roads were constructed with elevated roadbeds and adjacent borrow canals in a similar fashion as the Trail. However, there were two important differences. First, these elevated roadbeds (especially Turner River Road) were barely culverted. Almost no roadbed culverts were needed because the adjacent borrow canals were in excellent hydraulic connection with each other and the State Road 29 and Tamiami Trail canals. The north-south orientation of the canals contributed to their drainage efficiency. Second, an extension was added to the downstream end of Turner River Canal. It extended two miles southward from the Tamiami Trail and converged with the natural Turner River channel at the approximate boundary between forested swamp and coastal mangroves.

The absence of roadbed culverts and the southern canal extension to the Turner River Canal significantly increased the drainage capacity of the canal, but those alterations virtually cut off natural flow to the headwaters pools and headwater channel of the Turner River. A sketch of the canal and river is shown in Figure 6.4.

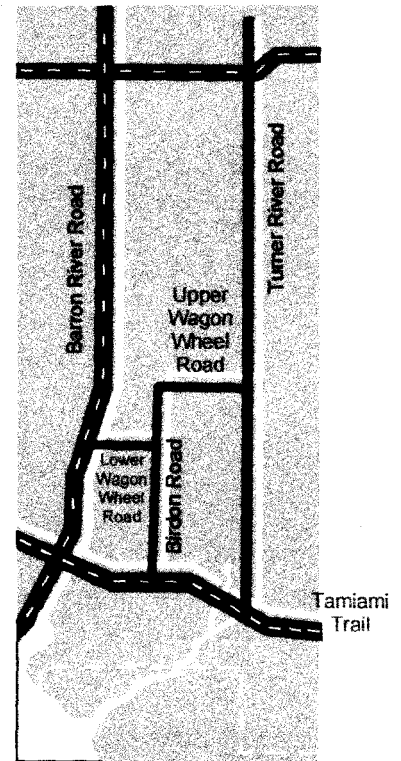


Figure 6.3. Roads built at the Turner River headwaters in late 1950s.

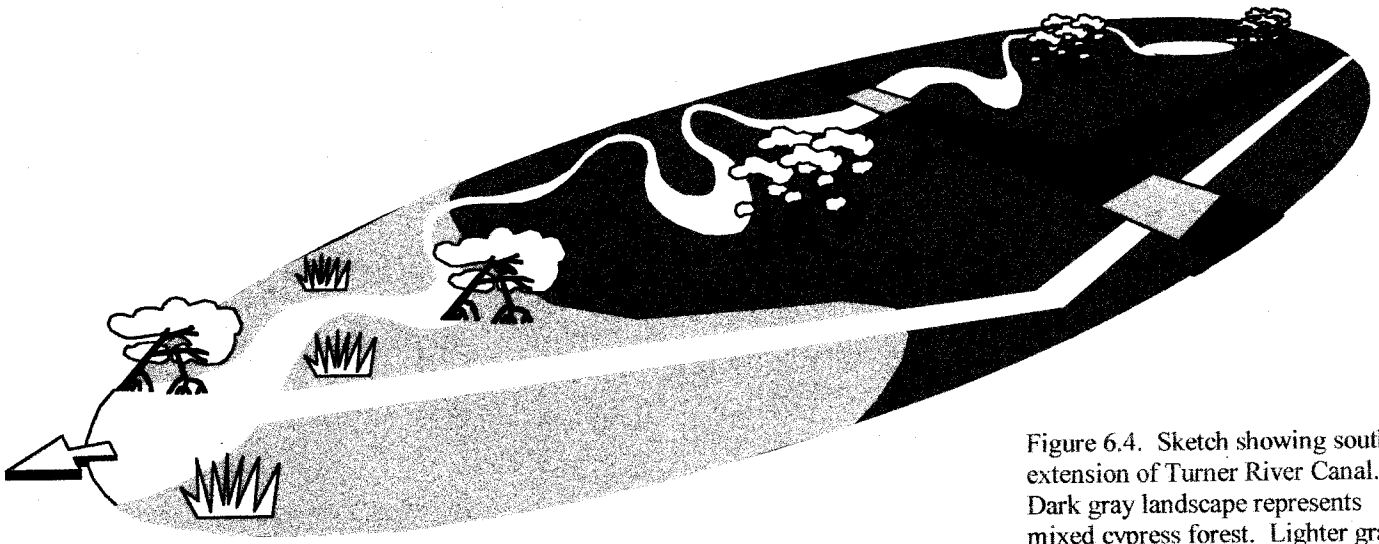
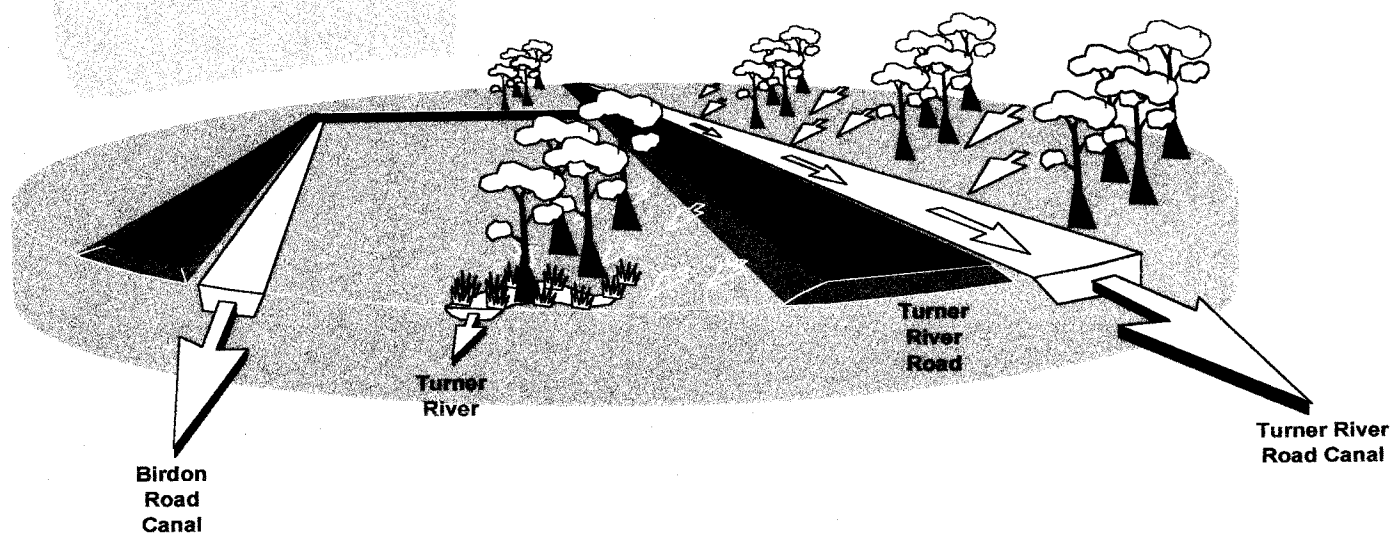


Figure 6.4. Sketch showing southern extension of Turner River Canal. Dark gray landscape represents mixed cypress forest. Lighter gray landscape represents prairie and mangrove area.

There is some evidence that local residents expressed disapproval with the location of Turner River road because they felt it would negatively impact the river. A possible concession to this may have been the addition of roadbed culverts under Turner River Road near the headwater pools of the river. These culverts were not large enough to convey adequate underflow and eventually filled in with sediment and vegetation.

Turner River Road and Turner River Canal had the most direct and profound effect on the river. As shown in Figure 6.5, the elevated roadbed acted as a dam that blocked sheetflow from reaching the river's headwaters, and the canal re-channeled this water away its natural course. A portion of this was routed into the Tamaimi Canal, but the majority was short-circuited around the cypress forest and directly into the river's tailwaters (prairie and mangroves).

Figure 6.5. Sketch showing how Turner River Road blocked sheetflow movement to the river and the canal carried the water away.



Replacing the River with a Canal

In many ways, Turner River Canal and its southern extension replaced the original headwater channel of the river. The basic dimensions of the canal – including its greater depth, width, and length – made it a more efficient drain than the river. Greater channel depth and width allowed it to drain and convey more water more efficiently than the river had previously done before the roadways and canals were built. Its geometric straightness also enhanced freshwater drainage as compared to the narrow, tortuous meanders of the natural river channel. And just as freshwater could flow faster downstream, saltwater tidal surges could reach further upstream when freshwater levels dropped in the dry season. Saltwater-tolerant fish and vegetation were commonly observed where the canal crosses under Tamaimi Trail.

Because the Turner River Canal extended 25 miles north of the Turner River headwater pools, the canal was carrying water from a drainage area much larger than the original watershed of the

natural river. The primary hydrologic feature affected by the northern reach of the canal was Deep Lake Strand (Figure 6.6). All aspects of the flooding regime in the strand (including depth, duration, and timing of sheetflow) were reduced, which lead to excessive drying of the area and catastrophic wildfires that resulted in a thinning of the peat in many areas (Duever et al, 1980).

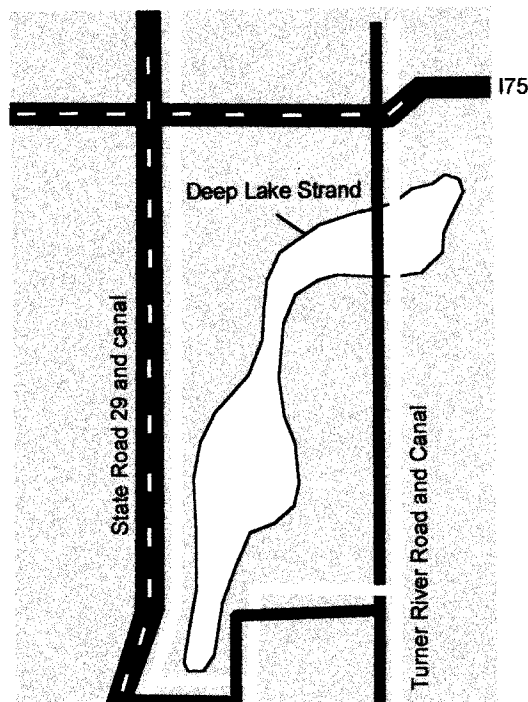


Figure 6.6. Map showing the location of Deep Lake Strand relative to Turner River Road, and how the canal intercepted water from the strand.

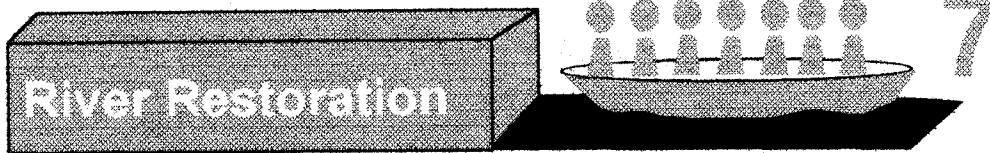
Recreational-use Shifted from the River to the Canal.

Prior to 1960, Turner River attracted tourists with "Turner River Jungle Gardens", a guided business which took visitors in small boats along the meandering course of the river and also through a canal circuit connected to the river. After roadway construction, small boating and recreational fishing activities shifted to the Turner River Canal.

The same features that made Turner River Canal a better conduit also allowed it to sustain water longer and deeper than the river. The depth of the canal allowed it to be canoeable well into the

dry season. H.P. Williams Wayside picnic area (which is located at the intersection of Tamami Trail and Turner River Road) provided an open and safe portage area, which was an improvement over the narrow roadside parking strip next to the river.

The bottom line was that the headwater channel of the Turner River had little to no flowing water and was clogged with vegetation. Over time the canal would be spoken of as "the river". This misnomer is partly attributable to the naming of Turner River Road immediately adjacent to it, but also because the river's headwaters were well hidden and probably went unnoticed to many casual visitors.



Devising a River Restoration Plan

Big Cypress National Preserve was established by an Act of Congress in 1974. This action brought the entire length of the Turner River and its contributing watershed under the single jurisdiction of the National Park Service.

Re-establishing flow into the Turner River was seen as a primary management goal. Hydrologists from Everglades National Park (Rosendahl and Sikkema) devised the original plan for restoring the river in 1980 as part of initial scoping activities that the Park scientists did for the nascent Preserve. Conceptually, the basic ideas were to plug the canals to prevent water from escaping down them, and to culvert the roadbeds to get water moving back towards the river. As shown in Figure 7.1, culverts and plugs were often added in pairs. This design backs water up and forces it directly through the culverts.

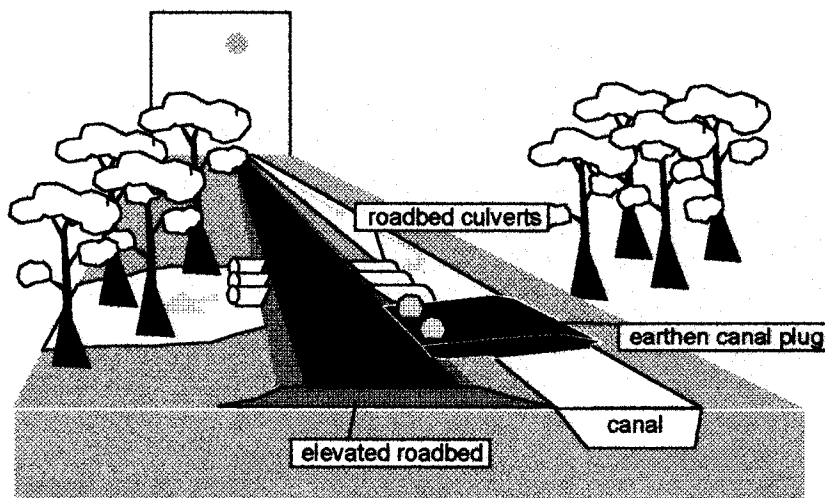


Figure 7.1. Sketch showing a culvert-plug pair. This is a common design for restoring sheetflow under a roadbed.

The original restoration plan consisted of 19 plugs and 8 culverts. Figure 7.2 shows the placement of the plugs and culverts, and also highlights the top priority area for restoration. This plan included adding a culvert-plug pair on Turner River road in the proximity of the river's headwater pools, and adding a plug at the at the downstream end of Turner River Canal where it converges with the river. These actions were expected to cause the greatest and most immediate improvement to the river, with the other "upper" watershed actions providing important, but less immediate, effects.

By the late 1980's, increases in staffing allowed the Preserve to physically implement the restoration. The restoration was implemented in full over a three year period, with some modifications to the original plan as follows. The "southern terminus" plug was installed a few hundred feet downstream of Tamiami Trail due to logistical difficulties in getting heavy equipment to the confluence of the canal and river. Two additional culverts were added under Upper Wagon Wheel Road to enhance flow to the downstream prairie. A plug was added in the canal adjacent to Lower Wagon Wheel Road to prevent drainage into the State Road 29 canal. A plug was added in the upstream portion of a southwest-running, diagonal canal that intersects the Birdon Road Canal.

Additional Restoration Actions

The restoration of the river rested on the assumption that hydrologic restoration would be the keystone to flushing out the sedimentation and vegetation that had built up in the channel over the past three decades. When this did not initially occur, the South Florida Water Management District donated an amphibious backhoe (called an Aquamog) and an operator to clear the channel, with hopes that this would open the way for

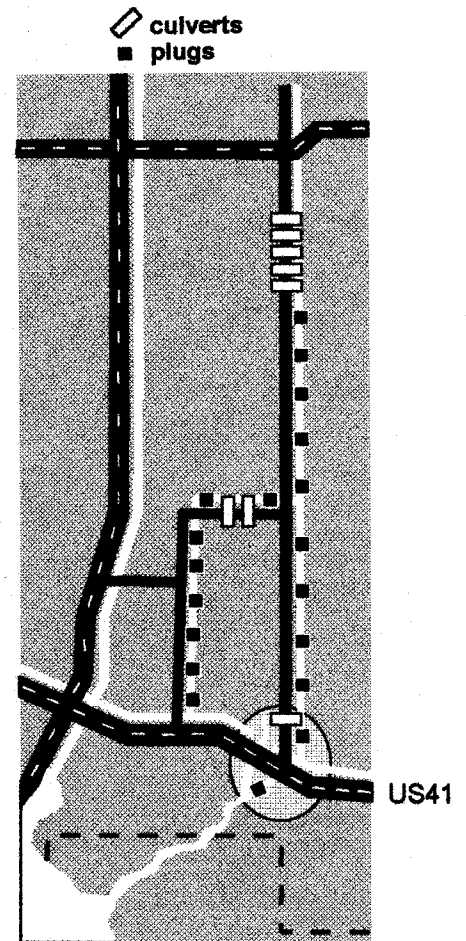


Figure 7.2. Sketch showing placement of culverts and plugs for the Turner River restoration as originally proposed. Black boxes are canal plugs and white rectangles are roadbed culverts. The circled area shows the priority area most needing flow improvements.

natural flushing. This action only achieved a temporary opening of the channel, as vegetation soon grew back.

The idea that flow volumes were still deficient in the canal was also supported by observations of water bypassing the culverts and flowing around the plugs. This was most frequently observed during times of high water at the plugs located on the downstream end of the Turner River Canal. Also, fish kills were occurring as a result of the plugging of the Turner River Canal. Prior to plugging the canal, saltwater surged up the canal as far as the Tamiami Trail. Freshwater fish could escape by swimming further upstream prior to plugging, but once the canal was plugged their freshwater escape route was blocked (Figure 7.3). Fishkills were also related to the occurrence of stagnant and shallow water conditions in the canals during the dry season, a condition that represses dissolved oxygen levels in the water column.

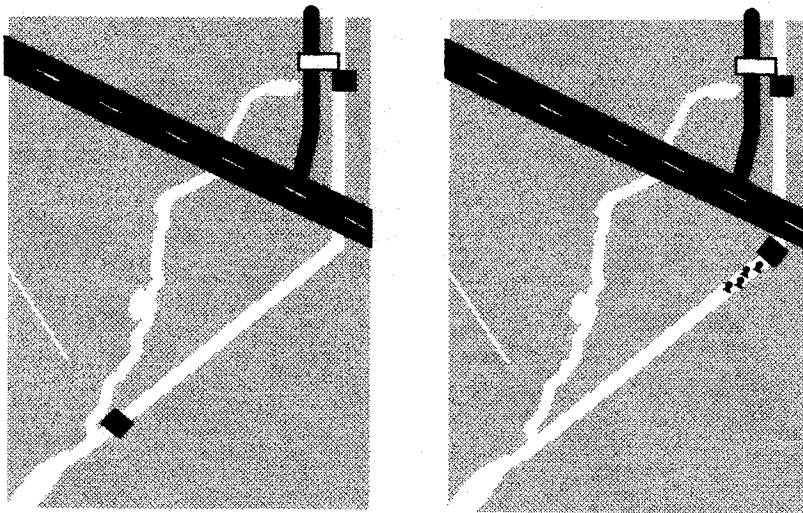


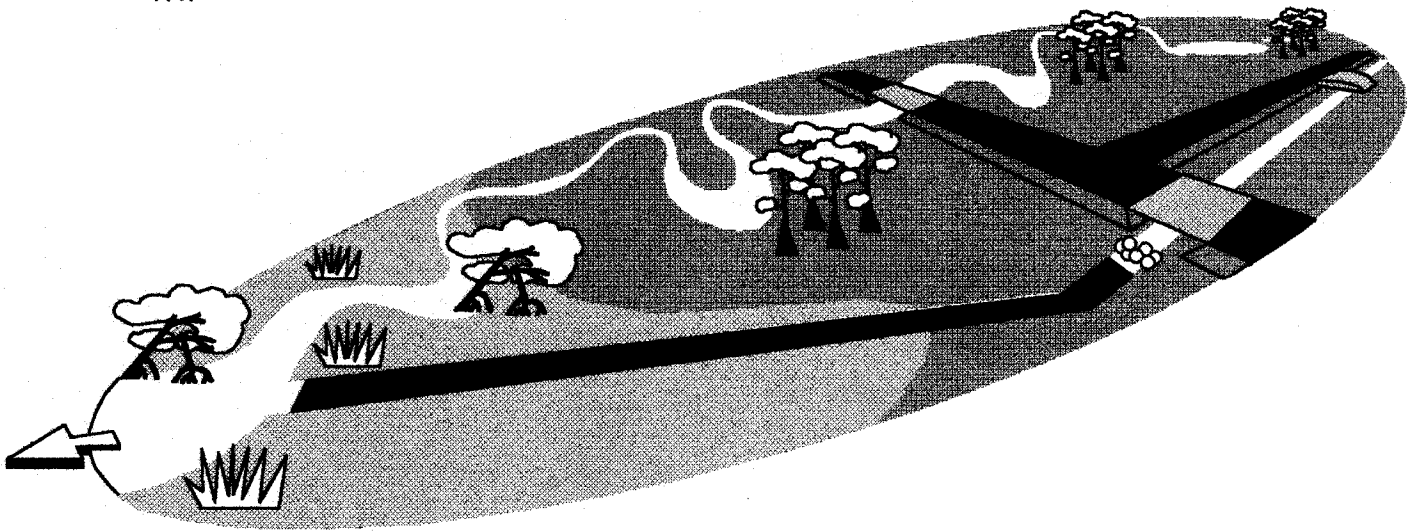
Figure 7.3. The original plug design is shown on the left, and the implemented placement to the right.

Despite these actions, Turner River Canal continued to serve as the primary canoe route. In part, this was because the downstream portion of the canal still provided continuous access to the tailwaters of Turner River, a route familiar to boaters from

past years. The other option – the headwaters channel of the Turner River – still remained heavily clogged with vegetation and continued to sustain shallower depths and a shorter flowing season than the canal.

In 1996, State wetland mitigation funds were used to fill in the downstream section of Turner River Canal. When the canal was originally dug, the extracted sediment was left in spoil mounds on both sides of the canal. Restoration simply involved use of heavy equipment to push the sediment back into the canal. The filled-in channel is recognizable at the site (H.P. Williams Wayside) by the large limestone boulders just south of Tamiami Trail. An overview sketch of the restoration is shown in Figure 7.4.

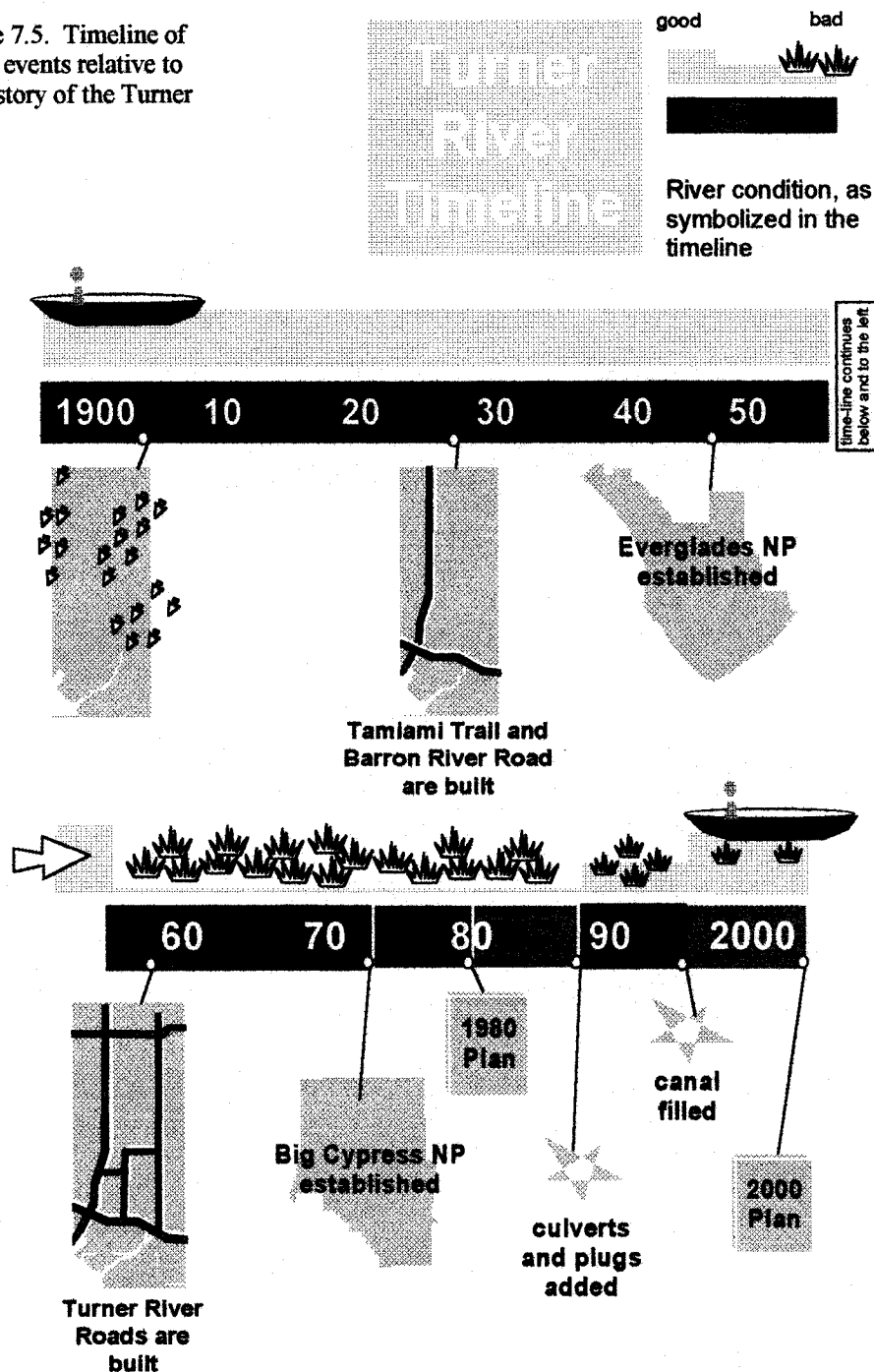
Figure 7.4. Sketch showing infilling of the southern extension to Turner River Canal. This shifted water and recreationalists back over to the river.



Besides just restoring wetland (by infilling the canal) and eliminating exotic vegetation (that had become established on the canal-side berm), this action further enhanced flow towards the river and also shifted canoeists and kayakers back into the river's headwaters. Turner River Canal no longer provides boat access to the natural channel of the Turner River, to the chagrin of some anglers, but the loss of recreational opportunity in the

canal has been replaced by restoration of a unique natural river corridor that teems with scenic, cultural, natural, and hydrologic significance. A time-line of the major events discussed relative to the history of the Turner River is shown in Figure 7.5. The final two sections discuss current management and management needs of the river corridor and watershed.

Figure 7.5. Timeline of major events relative to the history of the Turner River.





Recreational Use

Restoration actions have made the river canoeable again. Guided canoe tours are offered by Big Cypress National Preserve, Everglades National Park, and commercial enterprises based in Everglades City. Local and vacationing populations also embark on self-guided tours of the river. Canoeing on the river primarily occurs in the winter season (January to April), but may vary depending on river and weather conditions. Summer and Fall are low-use times due to lower water levels and flows, high heat and humidity, mosquito infestation, and lower visitation influx.

The focus of tours given by Big Cypress National Preserve staff is on the river's headwater pools and channel. Canoes are typically launched from the Tamiami Bridge where it spans across the river. Trips are also occasionally launched from the headwater culverts along Turner River Road when water levels are sufficiently high, and the group is prepared to nose through some southern wild rice to get to the headwater pools of the river. River reaches covered are primarily the headwater pools, the quarter mile of river north of the Tamiami Trail, and the mile or two of river south of Tamiami Trail. Everglades National Park (Gulf Coast District) runs canoe trips along the entire length



Figure 8.1. Photo of canoeists near the headwater pools of the Turner River.

of the river (9 mile trip from the Tamiami Trail to Chokoloskee Island). The frequency of canoe trips offered by the Preserve and the Park are one trip per weekend during the winter season; and these trips are scheduled to run on alternating days of the weekend to avoid overlap.

Preserve staff will periodically run the weekly canoe tour on Halfway Creek during a seasonal change of scenery, such as the return of migrating wading birds. Access to Halfway Creek is at the southern terminus of Seagrape Drive, located about 5 miles west of where Turner River passes under the Tamiami Trail. The initial part of the canoe trail on Halfway Creek is a canal and does not exhibit the natural meanders that Turner River offers, but holds more water longer (making it the better canoeing alternative when water levels recede). It is lined with dense stands of exotic vegetation and mangroves that have become established at the canal's fringe from inland intrusion of saltwater. An informal canoe path tacks across the prairie-mangrove fringe connecting Turner River to Halfway Creek, but this trail is poorly marked, requires a long day of paddling, and is easy to get lost on, and therefore not frequently used or recommended.

Current Vegetation Management

Turner River was choked with vegetation prior to its restoration, and remained almost non-navigable even after restoration actions returned water to it in the early 1990s. An Aquamog was brought in on occasion to physically extract vegetation and roots, but this only brought temporary success. Keeping the channel open requires application of a suite of 3 herbicides in 4 to 5 applications per year. A dry herbicide called Sonar is sprayed on the water column to control hydrilla. Diquat is used to control water lettuce, and a 2-percent formula of Rodeo is used to prevent southern wild rice from closing up the channel. The

latter is also sprayed on Brazilian Pepper along the river's banks. Applications are performed by Vegetation Management Staff within the Resource Management Division of the Preserve and are applied almost exclusively in the headwater pools and the segment of the river north of the Tamiami Trail. Treatments are made on an "as needed" basis south of the Trail. A portion of the herbicides probably flows into the area south of the Trail. Under current conditions, water lettuce has been almost entirely eliminated as a problem and only requires spot treatment. Hydrilla and southern wild rice require yearly maintenance to prevent the river from closing up.

Physical obstructions of vegetation are mechanically removed as is needed. Most recently this occurred at the area upstream from the headwater pools in order to open the way for canoests who launch at Turner River Road. This included clearing of branches and fallen trees.

Hydrologic Maintenance

Water levels are continuously recorded in the Turner River and Turner River Canal in the vicinity of the Tamiami Trail. The U.S. Geological Survey has collected water levels at the Turner River Canal since 1959 as part of its program to monitor flows under the Trail. Flows are measured on a biweekly interval along all the bridges and then correlated to daily water levels at the monitoring station to compute daily flows. The continuous water level station at Turner River was established by Big Cypress National Preserve in 1988 for monitoring river levels and making enlightened management decisions. Big Cypress National Preserve also maintains a hydrologic monitoring station in a cypress dome located in Deep Lake Strand. Hydrologic monitoring stations located proximate to the Turner River are shown in Figure 8.2.

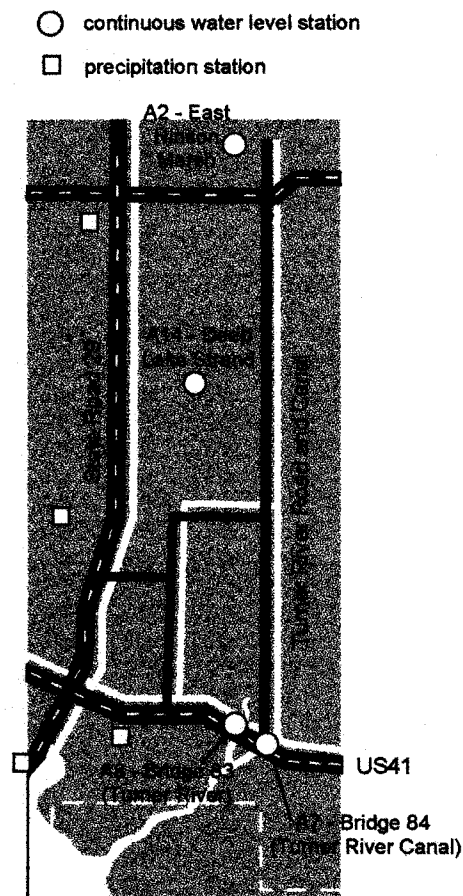
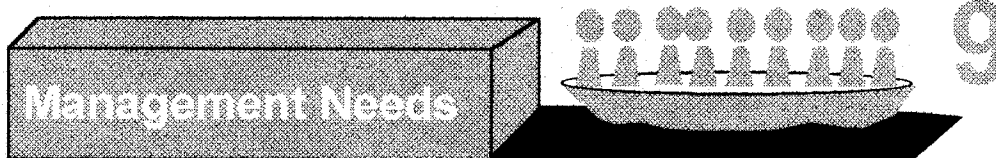


Figure 8.2. Map showing locations where water levels are monitored in and near the Turner River.



Figure 8.3. Photo of the A8 hydrologic monitoring station at Bridge 83 (Turner River)

The Maintenance Division of Big Cypress National Preserve
inspects and maintains the system of earthen plugs and roadbed
culverts which were added during the original restoration efforts
from 1988 to 1990.



The following science, restoration, and recreational needs have been identified for the Turner River. This plan identifies and briefly describes the need for these actions, but these actions are not implemented as part of the plan. The proposed actions have been incorporated into the comprehensive list of proposed projects for the Preserve and entered into the NPS project database called Project Management Inventory System (PMIS).

(1) Establish Hydrologic Monitoring in Upstream Watershed

Historically, the roadways and canals over-drained the wetland adjacent and upstream of Turner River. Currently, it is speculated that efforts to return flow to the river and prevent over-drainage of the adjacent wetland have, at times, resulted in retention of too much water upstream sides of Turner River Road and the Tamiami Trail. No water level information is being collected in the artificial contributing watershed of the Turner River. This makes it difficult to do more than speculate how the current configuration of canals, roadbeds, earthen canal plugs, and roadbed culverts are altering the timing, distribution, and volume of flow in the river.

This task will involve development of a monitoring program for collecting additional data within the watershed that then can then be used to provide a better measuring stick for the status of past

restoration efforts, and what future modifications may be necessary.

Establish Hydrologic Monitoring in Upstream Watershed	
Estimated Cost	\$25k for initial implementation of network, additional funds may be needed per analysis of data
Estimated FTE	1.0
Time Frame	1 year to implement, 1-3 wet seasons to collect data for analysis, long-term incorporation into monitoring program
Internal Capacity	High (BICY Hydrology)
Existing Funding	Yes 1999 SFWMD-BCB Cooperative agreement (up to \$25k)

(2) Develop model of Historic, Pre-Restoration, Current, and Target Hydrologic Conditions in the River. Despite increases in river flow that resulted from restoration actions completed in 1990 and 1996, the pre-development hydrologic regime of the river and its upstream watershed remain unknown. This data gap makes it difficult to determine the type and extent of restoration actions that are needed to re-establish pre-development timing, distribution, and volume of flow to the river.

The task of categorizing the natural hydrologic state involves interpretation of existing and newly collected hydrologic data to develop a hydrologic model of pre-development, pre-restoration, post-restoration, and desired (or target) conditions.

Develop Hydrologic Model of Historic, Pre-Restoration, Current, and Target Conditions of Turner River	
Estimated Cost	If internal - \$5k (for supplies, etc.) If external - \$20k
Estimated FTE	1.0
Time Frame	1 year, under assumption monitoring data has been collected and analyzed
Internal Capacity	High (BICY Hydrology)
Existing Funding	None

(3) Restoration of Disturbed Lands within Contributing Watershed of Turner River. Disturbed lands adjacent and upstream of Turner River are thought to be altering the timing, distribution, and volume of flow in the river. This project will involve identification and removal of elevated roadbeds that spur off Turner River Road and elevated roadbeds in the eastern edge of Bass Lakes Estates to prevent them from impeding sheetflow movement; and also infilling select canals to natural wetland grade to prevent them from preferentially draining sheetflow. Removal of the roadbeds along Turner River Road will open the door for adding additional culverts under Turner River Road in the future (see next project).

Restoration of Disturbed Lands within Contributing Watershed of Turner River	
Estimated Cost	If internal - \$100k If external – unknown
Estimated FTE	2.0
Time Frame	3 years – yr1=funding proposal and yr2-3=implementation
Internal Capacity	High (BICY Hydrology)
Existing Funding	\$100k NPS-Geologic Resources Division (GRD) Disturbed Lands funding, split between FY2000 and FY2001

(4) Addition of Conveyance Capacity under Turner River Road.

Currently, the majority of flow to Turner River occurs through nine 48" culverts located at 2 locations under Turner River Road. A total of 5-48" culverts just south of Interstate 75 accommodates water movement into Deep Lake Strand. There is a need to add more culverts based on hydrologic monitoring, analysis, and modeling considered in other projects as discussed.

Addition of Conveyance Capacity Under Turner River Road	
Estimated Cost	If internal - \$5k per culvert site If external -- unknown
Estimated FTE	Full scope unknown
Time Frame	Full scope unknown
Internal Capacity	Moderate, depending on scale (BICY Maintenance)
Existing Funding	None

(5) Develop log of Vegetative Management Actions and Periodic Documentation of Corridor Status.

A suite of herbicides is applied to the headwaters of the Turner River 4 to 5 times per year in order to keep the channel open for canoe navigation. Target plants include vegetation which floats on the surface (water lettuce), is shallowly submerged (hydrilla), and lines the channel (southern wild rice). Prior to restoration actions, it was speculated by Preserve Managers that re-introduction of flow would clean the river of vegetation by itself. An Aquamog was brought in on more that one occasion to try to "jump start" a clear vegetation channel, but this only achieved temporary success. Regular herbicide treatment has been a part of maintaining an open river channel in the headwaters for the past five years.

This task will involve keeping a log of vegetative management actions taken on the river, and making periodic inspections of

affected areas. This will become important as future actions are taken to increase flow to the river, thereby lessening the need to apply the types and quantities of herbicide currently done.

Develop Vegetation Management and River Status Log	
Estimated Cost	\$0.1k
Estimated FTE	0.1
Time Frame	Continual
Internal Capacity	High (BICY Vegetation Management, Ranger Division, Hydrology)
Existing Funding	None needed

(6) Develop Aquatic Inventory of River Flora and Fauna. River flow volume has been increased as a result of restoration actions completed in 1990 and 1996. This has been done by re-routing canal water into the river instead of by the re-establishment of natural overland flow which had historically replenished the river prior to roadbuilding. It remains uncertain how this alteration affects water quality and the types of aquatic flora and fauna.

This project will involve inventorying the water quality, flora and fauna of the river, and comparing this to nearby canals and a similar stream system that has not been influenced by a pervasive and directly-connected canal system.

Develop Aquatic Inventory of River Flora and Fauna	
Estimated Cost	If internal - \$10k If external - \$50k
Estimated FTE	1.0
Time Frame	1 year
Internal Capacity	Moderate (BICY Hydro. and Veg. Mgmt.)
Existing Funding	None

(7) Addition of River Launch Sites. Currently, access to the river occurs at “ad hoc” sites at the Tamiami Bridge and at the set of culverts on Turner River Road. There is a need to formalize canoe launch sites in both areas. An existing project is calling for the addition of a boat launch on the northwest corner of the Tamiami Trail and the river in the location of an existing (but primitive) launch area. A more formal canoe launch area should be also considered along Turner River Road at the headwater culverts. The primary concern is for visitor safety, so matters of footing, clear access, and vehicle parking will need to be addressed.

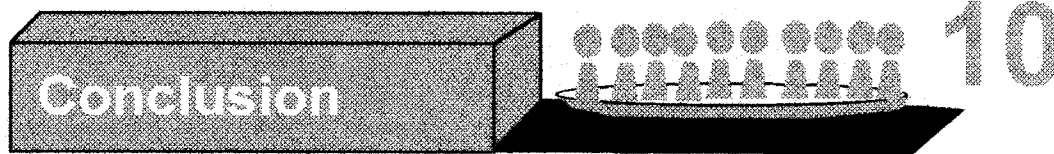
Addition of River Launch Sites	
Estimated Cost	\$200k for US41 \$10-50k for Turner River Road, depending on scale
Estimated FTE	Not applicable
Time Frame	Multi-year
Internal Capacity	Moderate (BICY Hydrology and Vegetation Management)
Existing Funding	US41 launch – included under BICY Internal Improvement Project

(8) Replacement of Tamiami Trail Bridge. Under current conditions, the Tamiami Trail spans across the Turner River about a quarter mile downstream from its headwater pools (at Bridge 83). The bridge was designed to be at the same traffic grade as the rest of the road, therefore the underside of the bridge allows only low overhead clearance for canoests and kayakers to pass under. The river corridor is also an area that experiences relatively concentrated levels of wildlife movement, yet the existing bridge does not allow terrestrial wildlife to pass along the corridor without also crossing the road. There is a need to build an arched bridge over the Turner River that can provide for improved recreational and wildlife passage.

Addition of River Launch Sites	
Estimated Cost	\$1-4M
Estimated FTE	Not applicable
Time Frame	Multi-year
Internal Capacity	None – FDOT
Existing Funding	None

(9) Develop Interpretive Brochure. An interpretive brochure is needed to keep the public informed on the recreational opportunities associated with the river, and work that the NPS is doing to improve recreational and hydrologic aspects of the river.

Develop an Interpretive Brochure	
Estimated Cost	\$2k
Estimated FTE	0.2
Time Frame	1 year
Internal Capacity	Yes
Existing Funding	None



Turner River is not an “untouched” resource. As such, management of the Turner River involves more than just “preserving” and existing natural resource – it involves proactive measures to restore it and preserve it for perpetuity. In 1988-1990 and 1996, major restoration efforts were implemented in order to re-route water back into the river. While these efforts have re-established flowing water (and canoeists) back the river, additional proactive measures are needed to fully complete restoration of the river and watershed.

The intent of this plan was to provide an overview of the multiple “pieces” of the Turner River. These “pieces” include the mosaic of natural ecotones the river meanders through, its cultural history, its hydrologic history, the relation between the river corridor and its watershed, and its recreational opportunities. The plan provides internal guidance to the National Park Service for managing the river in a “holistic” manner, as opposed to managing on a “piece by piece” basis or “ad hoc” emergency basis.

Turner River comprises only a small part of Big Cypress National Preserve’s total size (729,000 acres), yet the natural, scenic, cultural, hydrologic, and recreational values it provides

makes it a microcosm of the restoration challenges that face the National Park Service throughout the Preserve.

Unlike some of the larger scale restoration initiatives for south Florida scheduled for completion in the first part of the 21st century (and being coordinated through the U.S. Army Corps of Engineers and South Florida Water Management District), most of the measures described in this plan can be designed and implemented internally by Preserve staff. Some aspects of the restoration will involve coordination with other agencies, including the South Florida Water Management District, Florida Department of Transportation, Collier County, and regional and national offices of the National Park Service.

The overarching goal of the National Park Service for managing natural areas is "to conserve the scenery and the natural and historical objects and the wildlife therein and to provide the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (National Park Service Organic Act, 1916).