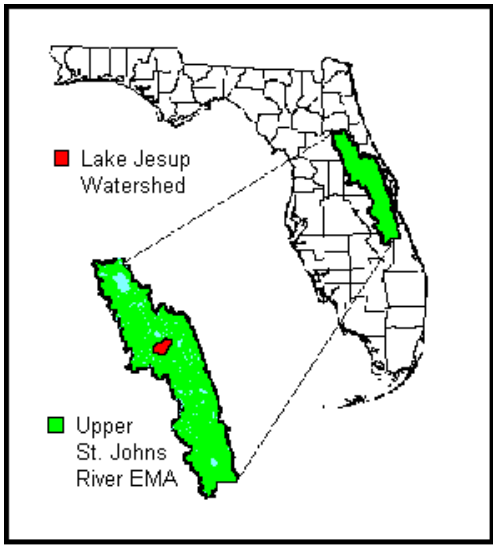
Biological and Chemical Assessment of Water Quality in Tributaries of Lake Jesup, Seminole County, Florida

Results of Sampling, July 1996 - September 1997



Surface Water Assessment and Monitoring Section
Division of Water Facilities

Florida Department of Environmental Protection
Central District, Orlando

Executive Summary

The water quality of eleven tributaries of Lake Jesup was examined from July 1996 through September 1997. Assessment tools included the following:

- biological assessment using the Stream Condition Index (SCI)
- water chemistry measurements of various nutrients
- determination of fecal coliform levels
- habitat assessment
- measurement of physicochemical parameters (DO, pH, temperature, and specific conductance)

The streams in the Winter Springs/Casselberry area (Soldier, Gee, Howell, and Bear Creeks) had fair to good water quality. Nutrient levels were higher than the average for Florida streams, though not excessive. Fecal coliform levels ranged from 170 to 620 colonies/100 mL, the highest being at Soldier Creek. All five sites (two sites at Howell Creek) rated good to very good on the Stream Condition Index (SCI). Results suggest that stormwater runoff and habitat alteration are the main sources of degradation in these streams. Improvement or establishment of stormwater retention systems and possible re-establishment of riparian buffer zones are suggestions for improvement of water quality.

Four streams were monitored in Black Hammock near Oviedo: Sweetwater Creek, Black Sweetwater Creek, Salt Creek, and Shortcut Canal. Water quality was generally poor in these streams. In most cases, nutrient levels were quite high. Fecal coliform readings ranged from 420 colonies/ 100mL at Shortcut Canal to 1,300 at Black Sweetwater Creek. Biological assessment ranked the streams from good to poor; most had low numbers of macroinvertebrate taxa with few good water quality indicator species present. Results suggest that the poor biological assessments are not due to the presence of saline groundwater in this area. Shortcut Canal rated better than the other three streams on most counts. Black Sweetwater Creek was severely degraded. All of these streams are highly modified to serve as conduits for agricultural
runoff. These box-cut ditches receive nutrient- and bacteria-enriched water from the numerous farms in the area. We suggest that the Black Hammock area is a good candidate for an Ecosystem Management effort.

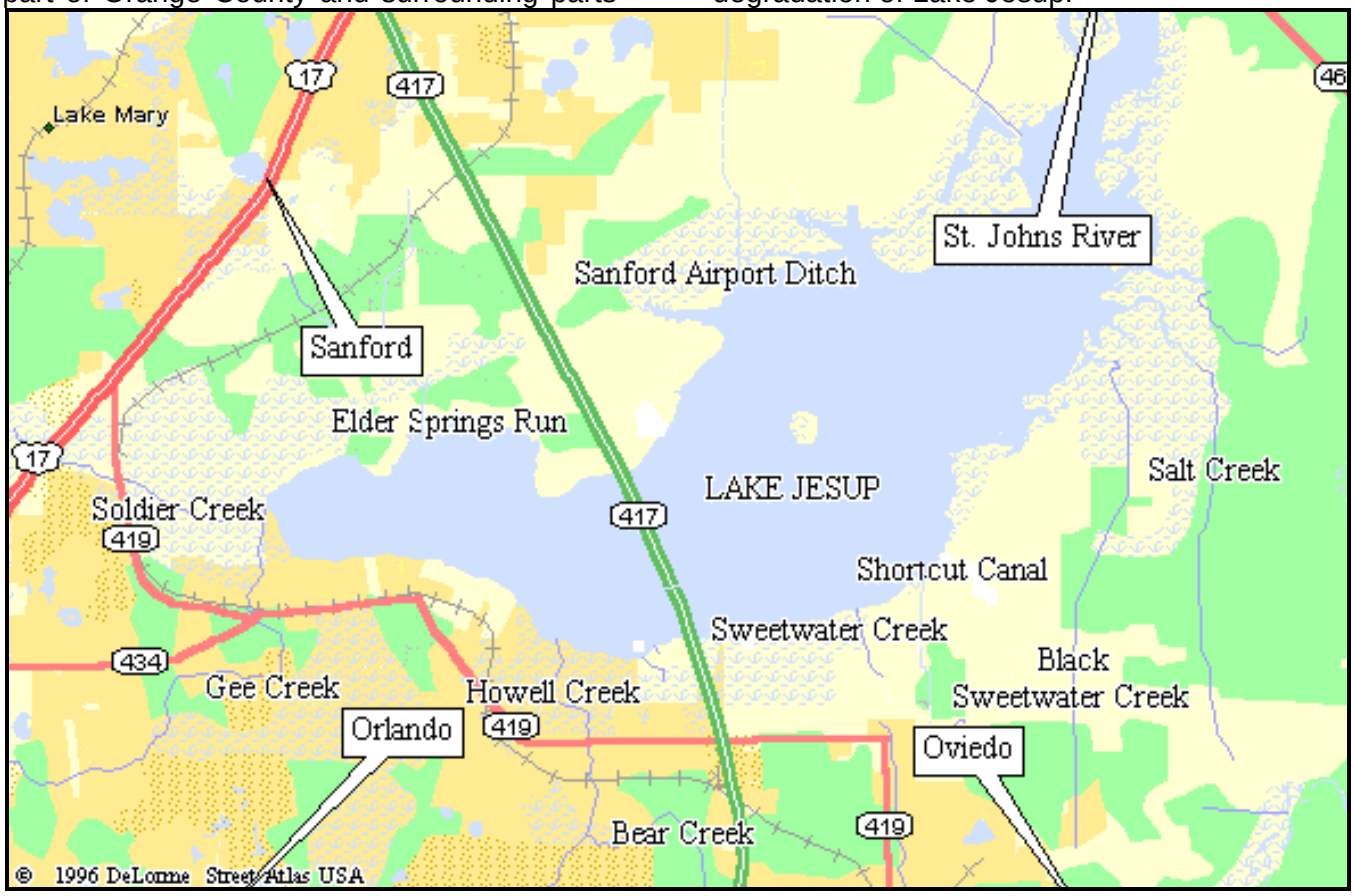
Elder Springs Run and the Airport Ditch were the two streams assessed in the Sanford area. Results from these two very different streams were fairly good. Nutrient levels were in the medium range. The Airport Ditch, which is made up almost completely of runoff from the Sanford Orlando Regional Airport, had lower nutrient levels than Elder Springs Run. Fecals, though somewhat high at both sites, did not exceed standards. Both sites received a good rating on the SCI, with macroinvertebrate taxa similar to those found in the Winter Springs area streams. Enhanced stormwater systems and agricultural best management practices would help to improve water quality in this area.

Overall, nutrients and fecal coliforms are fairly high in these streams. Most likely, these are results of nonpoint source runoff from urban areas in Winter Springs, Casselberry, and Sanford, and from agricultural activities in Oviedo. Without a doubt, the Black Hammock streams contain the highest concentrations of nutrients of all the Lake Jesup tributaries sampled.

PURPOSE

Lake Jesup has been identified as one of the most hypereutrophic lakes in central Florida. Its often pea-green color is due to the proliferation of unicellular algae resulting primarily from large amounts of nutrients. Fish kills, related to low oxygen conditions, are frequent. As recently as May 1983, effluents from several municipal wastewater treatment plants directly or indirectly entered the lake via its tributaries. Since then, all of these have diverted their effluent to the Iron Bridge regional wastewater treatment plant. More than 20 years of such inputs, however, along with the constriction of the lake's outlet to the St. Johns River and runoff from the intensive agricultural and cattle raising activities in the watershed, have resulted in deposits (up to 9.5 feet thick) of organic muck lining much of the lake bottom. Although the streams feeding the lake no longer receive WWTP effluents, they have the potential to carry substantial loads of nonpoint source pollution from the sprawling urban development of the northern part of Orange County and surrounding parts of Seminole County into the lake. Thus, it is important to monitor these tributaries to assess the quality of water entering Lake Jesup.

Lake Jesup restoration efforts were begun by the St. Johns River Water Management District in 1994. Initial diagnostic activities included lake water quality monitoring and circulation modeling to determine what effects the SR 46 constriction has had on the retention time of the lake. Since 1984, SJRWMD and other public agencies have purchased some 6,700 acres of surrounding marshlands for conservation, flood control, water quality improvement, and recreation. A draft report of SJRWMD's management plan thus far has been prepared (Marzolf 1997). It is hoped that the information contained in this report regarding water quality in Lake Jesup's tributaries will contribute to an understanding of the ecological health of the system as a whole, and help to identify land use patterns which continue to contribute to the degradation of Lake Jesup.



Map of Lake Jesup and vicinity, showing the eleven tributaries sampled.

METHODS

Eleven sites on the ten largest streams and canals flowing into Lake Jesup (see map) were monitored from July 9, 1996 through September 24, 1997. A number of smaller tributaries also flow into the lake, but they were not sampled in this study due to a lack of flow during the sampling period or limited access to the streams. Assessment of the ecological condition of the streams was based on four criteria:

- macroinvertebrate community structure
- water chemistry
- physicochemical measurements
- visual habitat assessments

The biological condition of the streams was determined using the Stream Condition Index (SCI), an assessment tool developed by FDEP biologists in cooperation with Tetra Tech, Inc. of Owings Mills, Md (Barbour *et al.* 1996). The SCI is an aggregation of seven different measures of macroinvert-ebrate community structure. Macroinverte-brates are small aquatic animals without a backbone that spend all or part of their lives in specific stream habitats. These include larval and adult insects, crustaceans, molluscs, worms, and several other groups. They are used as indicators of ecosystem health due to their relative immobility within the stream, their fairly long aquatic stages, and the sensitivity of many types to pollution, making them excellent integrators of water quality changes over time. Used as an indicator of ecosystem health, the SCI measures the degree of biological impairment of a stream compared with similar reference (least impacted) streams. SCI methodology involves sampling the aquatic habitats present by collecting twenty 0.5 m sweeps using a 0.3 m wide D-frame dipnet with 595 μm mesh. A random subsample of at least 100 macroinvertebrates is then taken.

Core Metrics of the SCI.

- *Total number of macroinvertebrate taxa*
- *Number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa*
- *Number of Chironomidae taxa*
- *Percent dominant taxon*
- *Percent Diptera*
- *Florida Index*
- *Percent filter feeders*

Twelve different water chemistry analyses were performed on samples taken at the sites. These included color, alkalinity, total NH_3, unionized NH_3, total Kjeldahl nitrogen, nitrate/nitrite, total phosphorus, chlorides, sulfates, turbidity, and fecal coliform concentration. Other physical parameters (dissolved oxygen, specific conductance, water temperature, and pH) were determined using Hydrolab multi-meters. A visual determination of habitat quality was made at each site. Samples were processed and analyzed by FDEP's Central Laboratory in Tallahassee according to standard operating procedures (FDEP 1994)

BASIN CHARACTERISTICS

Lake Jesup, a Surface Water Improvement and Management (SWIM) priority water body, has a surface area of some 10,000 acres (16,000 counting wetlands and floodplain). It is one of three large lakes associated with the St. Johns River which lie wholly or partially within Seminole County. The others, Lakes Harney and Monroe, lie on the border between Seminole and Volusia Counties. Although Lake Jesup proper is contained within Seminole County, its approximately 150 mi^2 watershed includes parts of Orange, Volusia, and Seminole Counties. It has a mean depth of just over one meter, with depths approaching seven meters in a few spots. It is fed by several natural streams, man-made canals, and broad wetland areas, plus discharge from Clifton Springs at the southern shore of the lake just east of Howell Creek. Urban development spreading in a northeasterly direction from the Orlando area and southeastward from Sanford has largely surrounded the western part of the lake. Rapid growth is also taking place in the vicinity of Oviedo near Lake Jesup's southeastern shore. The eastern part of the lake, where it meets the St. Johns River, is less intensely developed, with considerable amounts of agriculture and relatively undeveloped land in the vicinity. The SR 46 causeway constricts Lake Jesup's outlet to the St. Johns, and a canal (Government Cut) diverts the flow of the river past the lake outlet.

HISTORICAL BACKGROUND

To understand the anthropogenic impacts currently affecting Lake Jesup, it is useful to summarize the recent historical background of settlement and land use in the area. Agricultural activities and later extensive urban development have both left their mark on the ecological health of the system.

The earliest post-Native American colonization of the Lake Jesup vicinity took place near what is now the city of Oviedo. In the mid-1800s, a settlement then referred to as Solary's Wharf was established on the south shore of Lake Jesup. Initially, the few residents dealt in river traffic, transporting goods by boat on the St. Johns, through Lake Jesup, and then overland to and from Orlando and other inland areas. Soon, however, farmers began to clear the rich muck lands south of the lake to plant crops. Eventually, the settlement began to move south from Lake Jesup, and by 1875 a post office, two general stores, several houses, and a hotel had been built in the vicinity of Lake Charm. In 1879, the post office moved south from Lake Charm, and the new settlement was named Oviedo by the postmaster, after a university town in Spain. Farmers initially attempted to plant some of the crops that they were accustomed to growing in more northern climes, such as cotton and sugar cane, but these did not prove successful. They later found that citrus and vegetables were much more appropriate crops for the area, and an explosion of agriculture began, and continued for many years. By 1950, when Oviedo had a population of only 1,800, nearly one million crates of celery and one-third million crates of citrus were being shipped out annually.

Agriculture remains important in Oviedo to this day, but plays a much smaller role than it did in earlier years. Much of the growing in the area now takes place in Black Hammock, which is located north of the city of Oviedo near the southeast shore of Lake Jesup. This area was once important as a center for watercress production, but this form of agriculture has now been largely discontinued in Black Hammock because of the tremendous amount of groundwater needed to maintain the watercress fields. Currently, strawberries and other row crops, citrus, and many types of ornamental shrubs and trees are grown here. Farmland in the area is extensively canalized, with the ditches flowing north into the lake.

The story of Oviedo in the 1990s is one of population growth. Beginning with the establishment of the University of Central Florida several miles south of Oviedo, and the later development of several high-tech industries in the same vicinity, Oviedo soon became a "boom town," as residential developments sprang up rapidly in response to population growth in the Orlando area. Today, Oviedo has nearly 21,000 residents and is growing by leaps and bounds. Its 6,850 households have a median annual income of over $40,000. Population density is roughly 460 persons per square mile (Oviedo Chamber of Commerce 1997).

Fort Florida on the St. Johns River at Sanford
(Photo courtesy Florida State Archives.)

Across Lake Jesup to the northwest is the city of Sanford. The area was first settled in the 1830s as a U.S. Army outpost, and named Fort Mellon after Captain Charles Mellon, who was killed in an Indian attack. The name was later changed to Mellonville. The city was incorporated in 1877 and named Sanford after Henry S. Sanford, who bought 12,500 acres in the Mellonville vicinity and instituted the raising of citrus

and other crops in the area. Prior to the big freeze of 1895, Sanford was the largest shipper of citrus in the world. After the freeze, however, farmers in the Sanford area turned to vegetables (especially celery), and also to ferns. A number of cattle farms were also established. Population growth in Sanford has been more modest than that south of the lake in the Orlando metropolitan area. However, there are currently more than 35,000 residents living in Sanford, at a density of approximately 700 people per square mile. It is expected that population growth in Sanford will accelerate when SR 417 (the Greeneway) is extended northwest to I-4 in the near future, making the commute from Orlando to Sanford much more convenient.

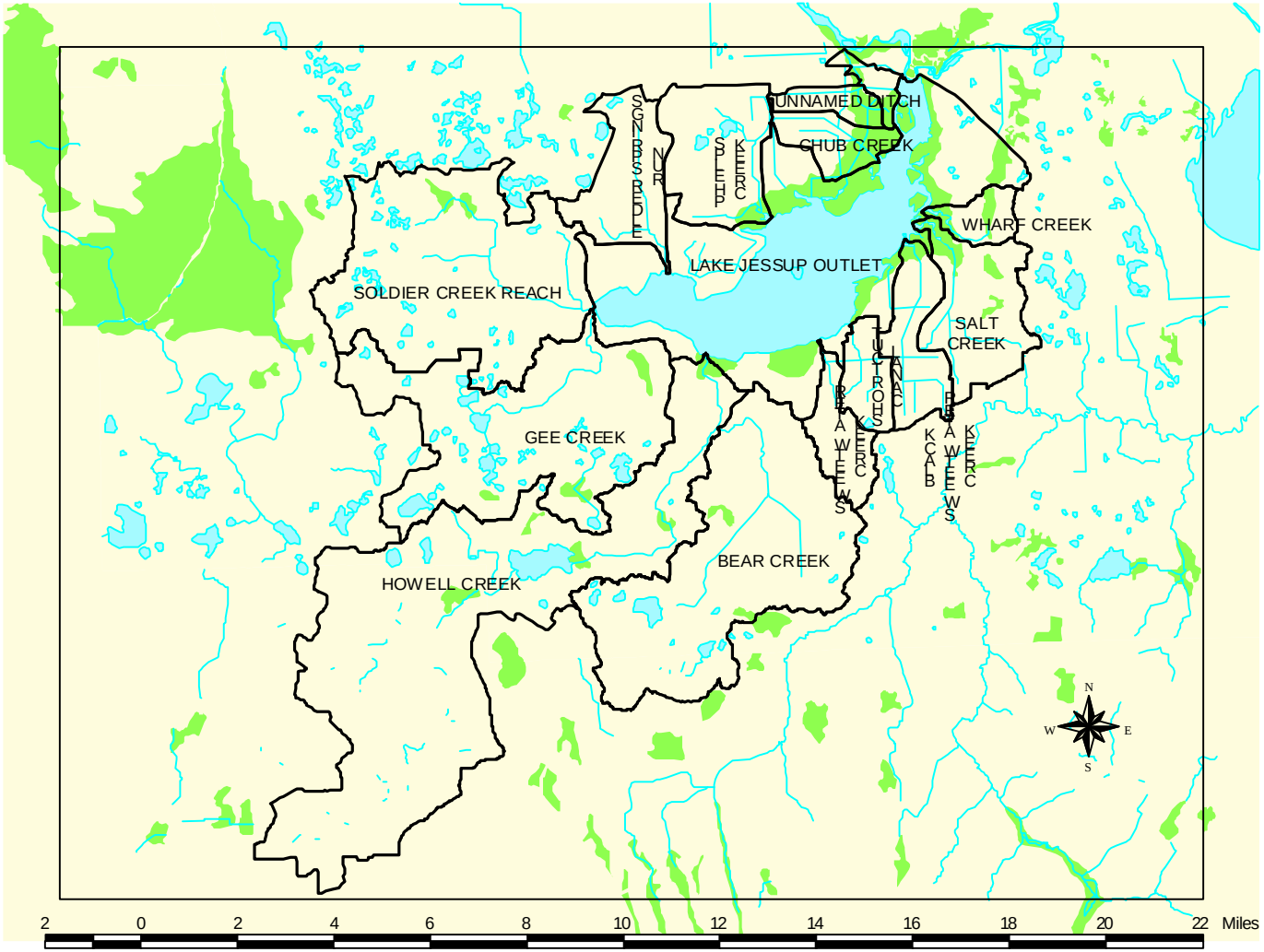
The youngest of the major urban centers located on the shores of Lake Jesup is the city of Winter Springs. Originally a part of Orlando, it went by the name "The Northern Village of Orlando." It was incorporated as a city in 1959. In 1972, its citizens voted to change the name of the town to Winter Springs. Although there is some agriculture in the area, the defining aspect of Winter Springs' story is urban growth. Since 1970, it has seen a population growth of more than 800%. Its current population exceeds 27,000, with some 10,000 households and a population density of 1,735 persons per square mile. Winter Springs is currently the largest municipality in Seminole County. Despite the fact that a considerable portion of the residential development in Winter Springs has taken place since the 1986 stormwater ruling came into effect, the potential for nonpoint source runoff from extensive areas of impervious surface is high.

Another important chapter in the saga of Lake Jesup's deterioration deals with the physical alteration of its connection with the St. Johns River. In the early part of the twentieth century, two canals were cut through the marshy peninsula formed at the confluence of the lake and the river to facilitate boat traffic. The Old Ferry Canal probably was cut through shortly before the turn of the century by steamboats repeatedly traversing the marsh during high water. Government Cut Canal, a more official endeavor, was probably constructed sometime in the late 1910s or early 1920s. By 1908, a causeway had been built across the area, with bridges spanning both channels (inflow and outflow) of the river. In the early 1950s, the inflow (south) channel of the river was filled in, and the current bridge over the other channel built. This effectively cut off the flow of the St. Johns from Lake Jesup, sending it through Government Cut, and leaving only the north channel connecting the lake to the river.

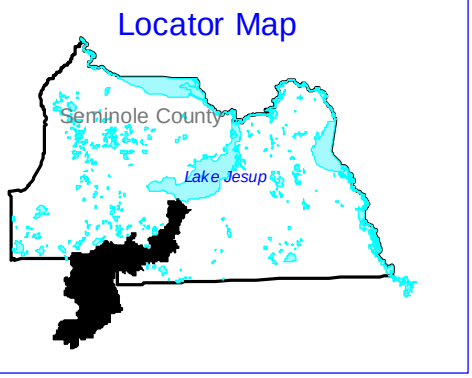
Thus, a long history of intense agriculture in the watershed, recent burgeoning population growth in surrounding cities, and severe restriction of the lake's outlet to the St. Johns River have undoubtedly contributed to the hypereutrophication of Lake Jesup.

Sanford steamboat launch, postcard, circa 1895. (Photograph courtesy of Florida State Archives.)

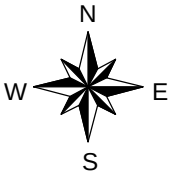
Lake Jesup Tributaries Drainage Basins

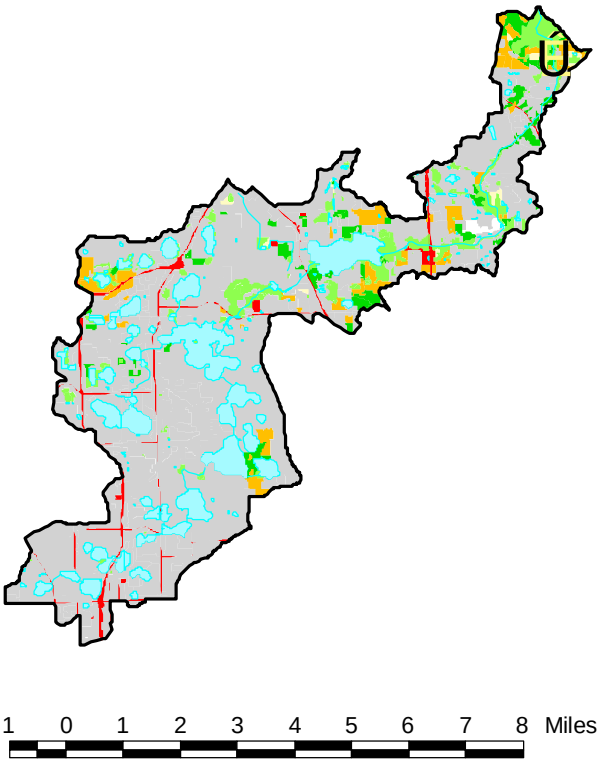


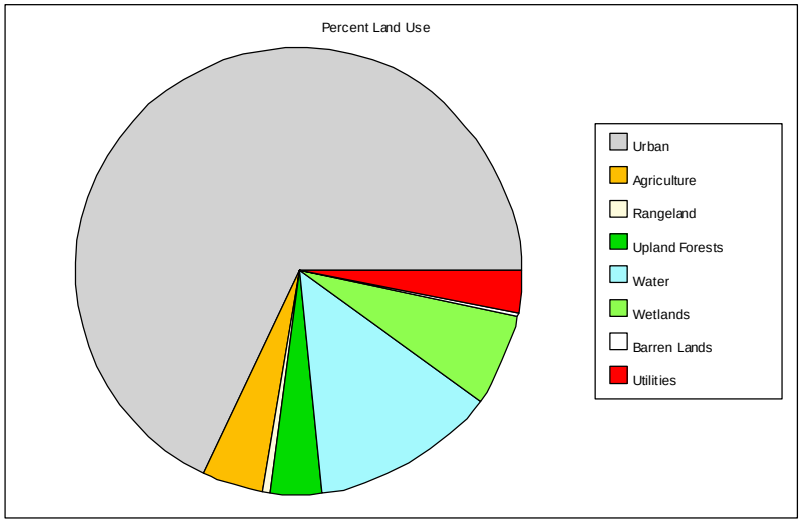
Howell Creek Basin



Basin Land Use
Area = 34.04 square miles
U = FDEP Sampling Site







RESULTS

Howell Creek

Howell Creek originates in a series of small lakes in the vicinity of downtown Orlando. The stream then passes through Lake Howell at the southern edge of the city of Casselberry, and afterwards through the Winter Springs/Tuskawilla area before flowing into Lake Jesup. Land use in the area is approximately two-thirds residential development, with most of the remainder being undeveloped land. Numerous nonpoint sources drain into Howell Creek, especially in the extensively urbanized upper reaches of the stream.

Howell Creek at SR 434

Despite this, biological and water chemistry sampling results suggest that water quality in Howell Creek is fairly good at this time. The SCI ranked the Howell Creek site at SR 419 as "good," with a total of 19 macroinvertebrate taxa collected in the subsample, including three from the EPT (larval mayflies, stoneflies, and caddisflies) group, and 14 points scored for Florida Index (good water quality) animals. At the time of sampling, there had been recent heavy rains, and the water level was high. This caused some habitat types to be largely inaccessible to sampling with dipnets, and might have caused the SCI scores to be somewhat lower than they might otherwise have been. The macroinvertebrate fauna was dominated at this site by fingernail clams (Pisidiidae), followed by the riffle beetle *Microcylloepus pusillus*.

All physical parameters measured were within normal ranges. Water chemistry analyses showed that nutrient levels were not especially high, most being roughly in the 50th percentile range compared with other Florida streams (see below and Appendix 1). Fecal coliform bacterial counts were fairly high (320 colonies/100mL), but did not exceed state standards for Class III waters. Habitat quality was good at the site.

Sampling was also carried out farther upstream in Howell Creek at Winter Springs Boulevard. The SCI assessment suggested a healthy macroinvertebrate community here, rating it as "very good." There were 21 different taxa collected, seven of which were EPT. The Florida Index yielded a score of 11 at this site. The most common macroinvertebrate species collected was *Microcylloepus pusillus*, the riffle beetle.

Water chemistry measurements were similar to those seen at the other Howell Creek site. Most were in about the 50th percentile range or less, except for turbidity, which was in the 77th percentile when compared with other Florida streams.

Dissolved oxygen, conductivity, pH, water clarity, and flow were all good. The habitat assessment, however, was suboptimal due to a minimal riparian buffer zone and areas of erosion, plus a lack of some instream habitat types.

Howell Creek at Winter Springs Blvd.

KEY ASSESSMENT PARAMETERS

Howell Creek at SR 434
7/9/96

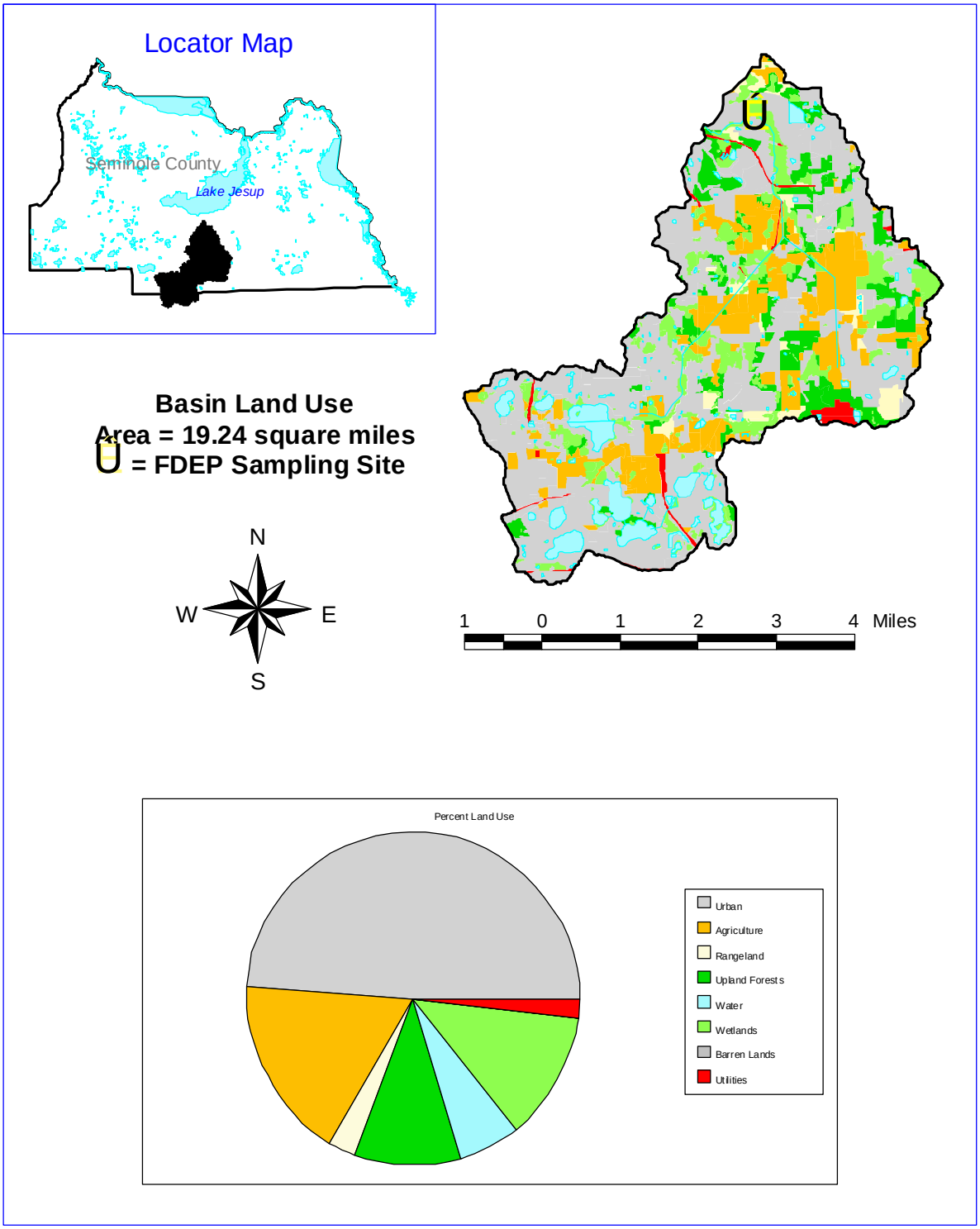
Biology		
SCI score	23 (good)	
Florida Index	10	
EPT	2	
number of taxa	19	
dominant taxon	Pisidiidae	
Chemistry	(value)	(percentile)*
dissolved oxygen	5.60 mg/L	50
conductivity	162 Tmhos/cm	30
pH	7.0 std. units	50
unionized NH_3	0.0003 mg/L	55
TKN	0.67 mg/L	30
nitrate/ nitrite	0.11 mg/L	60
total phosphorus	0.11 mg/L	60
fecal coliforms	320 colonies/100mL	85
Habitat		
assessment score	117 out of 145 points	

Howell Creek at Winter Springs Blvd.
8/18/97

Biology		
SCI score	27 (very good)	
Florida Index	11	
EPT	7	
number of taxa	21	
dominant taxon	*Microcylloepus pusillus*	
Chemistry	(value)	(percentile)*
dissolved oxygen	6.02 mg/L	60
conductivity	173 Tmhos/cm	30
pH	6.9 std. units	50
unionized NH_3	0.0002 mg/L	50
TKN	1.0 mg/L	50
nitrate/ nitrite	0.11 mg/L	60
total phosphorus	0.07 mg/L	50
fecal coliforms	320 colonies/100mL	85
Habitat		
assessment score	102 out of 145 points	

* Approximate percentile ranking compared with other Florida streams.

Bear Creek Basin



Bear Creek

This stream originates at Bear Gully Lake at the southern edge of Seminole County in the Goldenrod area. Its middle section, canalized about 50 years ago, is often called Bear Gully or Bear Gully Creek. Shortly beyond the point where it is joined by Lightwood Knox (also known as Lighter Knot) Canal just west of Oviedo, its course again becomes natural and remains so until it flows into Howell Creek in the Tuskawilla area of Winter Springs. The sampling site is a short distance upstream from this confluence. Residential and agricultural development account for two-thirds of land use in the Bear Creek watershed. Although surrounded by urban development in the upper and lower segments of its watershed, a natural wetland buffer has been preserved (especially in its lower reaches) where Bear Creek flows through these neighborhoods. For the most part, this is not true in the creek's canalized middle section, where the land use is primarily agriculture. A shopping mall with an eventual area of 1.2 million ft^2 is currently being built within the Bear Creek watershed near Oviedo.

Bear Creek at Northern Way

The results of biological sampling at Bear Creek suggest a healthy macroinvertebrate community in this stretch of the stream. The SCI rated Bear Creek as "very good." There were 27 macroinvertebrate taxa found in the subsample, five from the EPT group. The site received a Florida Index score of 11. The most common invertebrate collected was the riffle beetle *Microcylloepus pusillus.*

Habitat quality at the site was very good, with plentiful submerged roots and snags available for colonization by macroinvertebrates. The riparian zone is well preserved in this stretch of the creek, reducing the effects of nonpoint source runoff. The overall habitat rating was 131 out of a possible 145 points, the best seen in this survey.

Water chemistry data reveal that the levels of nutrients present here all exceed the 50th percentile ranking compared with other Florida streams. None, however, was extremely high, and none constituted a violation of water quality standards. This is true also for fecal coliform bacteria, which measured in the 91st percentile, but did not exceed Class III freshwater standards.

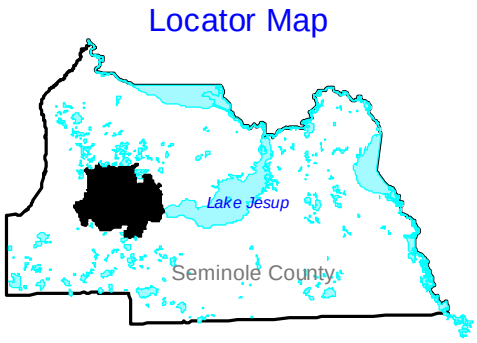
Physical water quality measurements were good at Bear Creek. Dissolved oxygen, pH, conductivity, and water temperature were all within normal ranges. Water velocity was among the highest recorded in this survey.

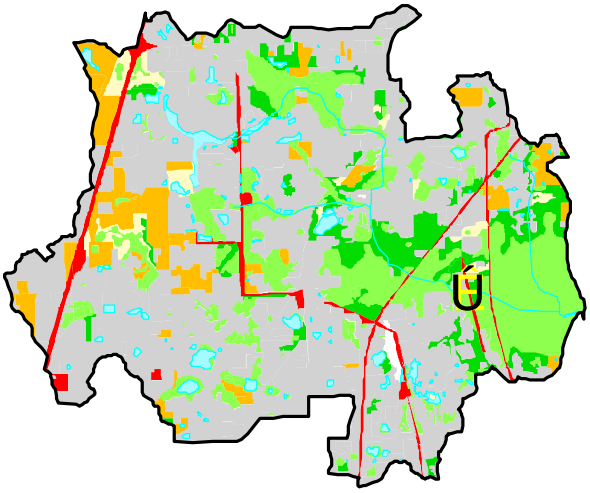
KEY ASSESSMENT PARAMETERS 9/24/97

Biology		
SCI score	29 (very good)	
Florida Index	11	
EPT	5	
number of taxa	27	
dominant taxon	*Microcylloepus pusillus*	
Chemistry	(value)	(%ile)*
dissolved oxygen	6.60 mg/L	67
conductivity	230 Tmhos/cm	38
pH	7.16 std. units	64
unionized NH_3	0.0005 mg/L	65
TKN	0.81 mg/L	40
nitrate/ nitrite	0.15 mg/L	63
total phosphorus	0.14 mg/L	71
fecal coliforms	540 colonies/100mL	92
Habitat		
assessment score	131 out of 145 points	

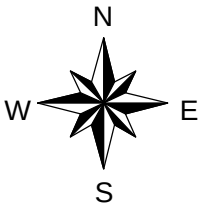
* Approximate percentile ranking compared with other Florida streams.

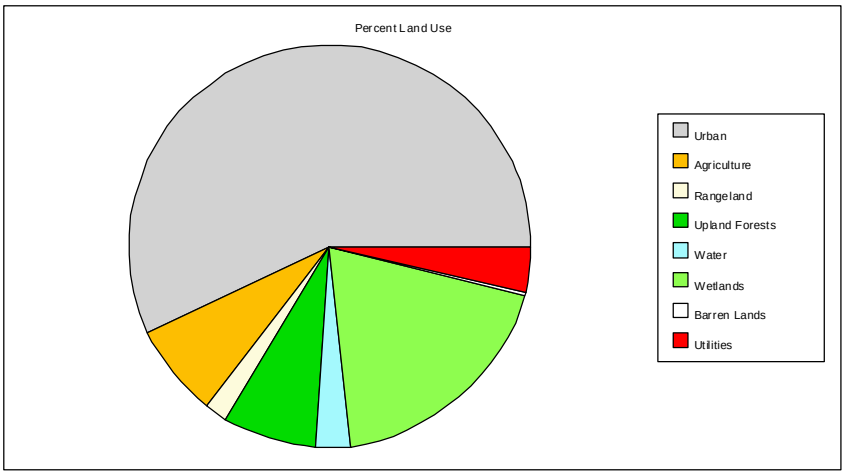
Soldier Creek Basin





Basin Land Use
Area = 18.54 square miles
U = FDEP Sampling Site





Soldier Creek

Also known as Soldier's Creek, this stream enters Lake Jesup at its far western edge, where it joins with its sister stream, Gee Creek. Residential development accounts for roughly 60% of land use in the Soldier Creek drainage basin. However, fairly extensive wetlands are also present, especially in the downstream section of the stream, a large portion of which is contained within Seminole County's Soldier's Creek Park.

Soldier Creek downstream of SR 419

Soldier Creek received a Stream Condition Index rating of 25, putting it in the "good" category. Of the 24 macroinvertebrate taxa collected at this site, three were members of the EPT group. A Florida Index score of 7 was determined for the stream. As seen in other streams in the area, the dominant species present was the riffle beetle *Microcylloepus pusillus*. The second most abundant was the larva of the blackfly, *Simulium*.

On the whole, nutrient values were slightly high in water samples taken from the creek. Total ammonia, unionized ammonia, and nitrate/nitrite were at the 50th percentile level or higher compared with other Florida streams. The total phosphorus reading was quite high at 0.21 mg/L, or in the 80th percentile. However, chlorides, sulfates, and total Kjeldahl nitrogen were comparatively lower in concentration. Fecal coliform counts were high (620 colonies/100 mL), but did not exceed state standards. All physicochemical parameters measured were within normal ranges.

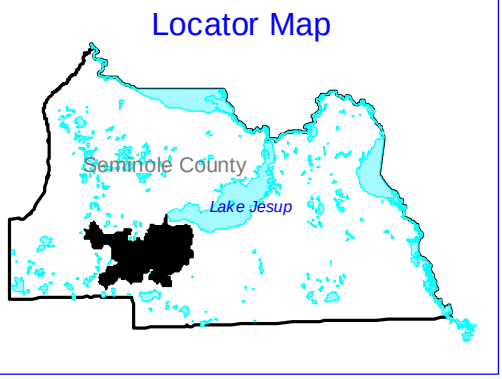
The habitat assessment yielded a score of 131 out of a possible 145 points. This was a tie with Bear Creek for the best habitat rating seen in this survey. Minor habitat smothering due to some bank instability prevented it from receiving a perfect score.

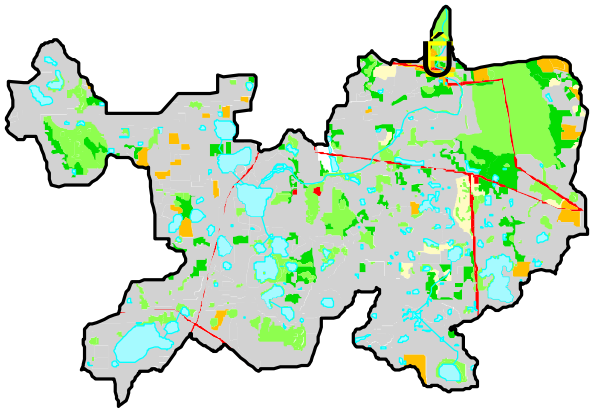
KEY ASSESSMENT PARAMETERS 7/9/96

Biology		
SCI score	25 (good)	
Florida Index	7	
EPT	3	
number of taxa	24	
dominant taxon	*Microcylloepus pusillus*	
Chemistry	(value)	(%ile)*
dissolved oxygen	6.10 mg/L	55
conductivity	163 ᴛmho/cm	68
pH	6.97 std. units	50
unionized NH_3	0.0003 mg/L	55
TKN	0.82 mg/L	40
nitrate/ nitrite	0.13 mg/L	60
total phosphorus	0.21 mg/L	80
fecal coliforms	620 colonies/100mL	95
Habitat		
assessment score	131 out of 145 points	

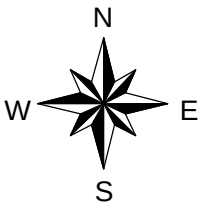
* Approximate percentile ranking compared with other Florida streams.

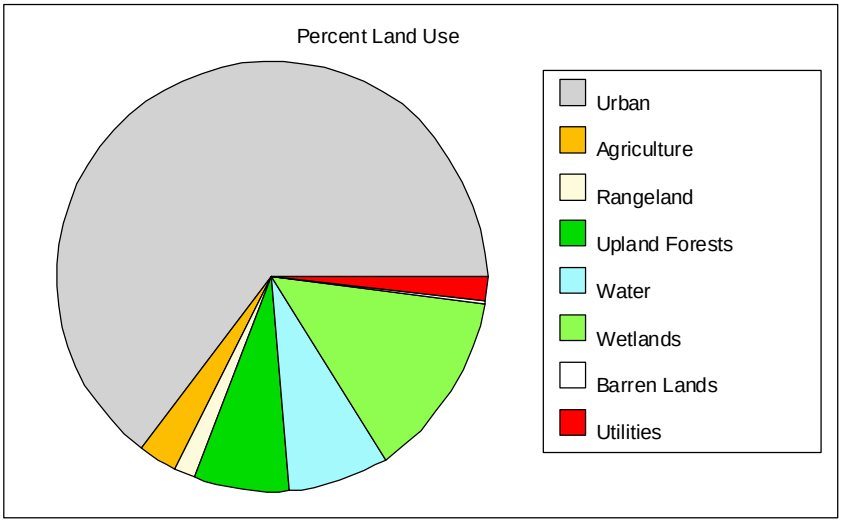
Gee Creek Basin





Basin Land Use
Area = 18.18 square miles
U = FDEP Sampling Site





Gee Creek

The eighteen-square-mile drainage area of Gee Creek includes virtually all of the city of Casselberry, plus portions of Longwood and Winter Springs. Approximately 65% of the basin is urban, with the remainder being mostly undeveloped wetlands, forests, and water. Gee Creek proper originates at Lake Kathryn in Casselberry. It flows northward out of the lake through the western part of Winter Springs to unite with Soldier Creek at the extreme western tip of Lake Jesup.

Gee Creek at SR 419/434

The largest number of macroinvertebrate taxa collected in this survey was encountered here. There were 28 different taxa collected in the subsample. Of these, three were members of the EPT group. Thirteen Florida Index points were scored, again the highest seen in this study. The Stream Condition Index score for this site was 27, placing it in the "very good" category. The dominant macroinvertebrate species was the midge *Polypedilum convictum* group, followed by the riffle beetle *Microcylloepus pusillus*.

At the time of sampling, nutrient values, especially the various forms of nitrogen, were fairly high. Most were in the 65th to 70th percentile range. Total Kjeldahl nitrogen, however, was relatively low, only in the 20th percentile range compared to other Florida streams. On the other hand, the calculated value for unionized ammonia was very high, in the 90th percentile range. This calculation is based on temperature, pH, and total ammonia concentration. The pH measured here was quite basic, 8.25, whereas the total ammonia value was 0.05 mg/L, in the 65th percentile. Unionized ammonia is considered toxic to aquatic life in high concentrations, but no evidence of degradation of the aquatic community was seen at this time. The high pH and nutrient values are probably due to algae blooms in upstream lakes. Fish kills due to algae blooms have occurred recently in Lake Kathryn.

Modest concentrations of chlorides and sulfates were found at Gee Creek. Turbidity was also quite low. Alkalinity was relatively high at this site, however, as were both fecal and total coliform concentrations. In none of these cases, though, was a violation of surface water quality standards detected.

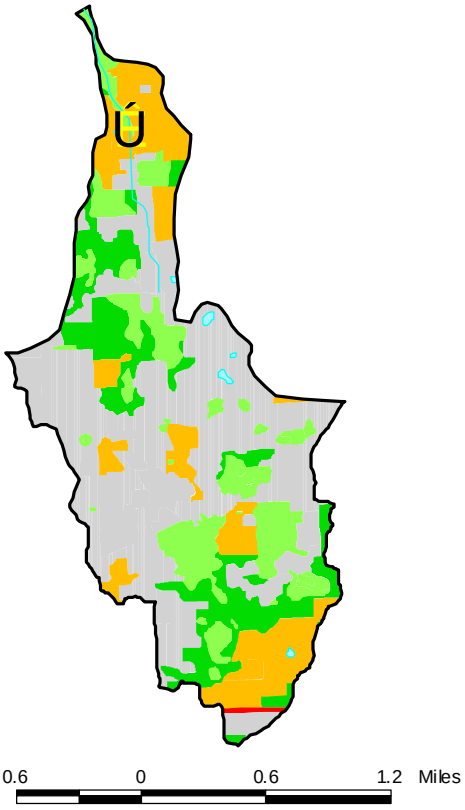
The habitat assessment for Gee Creek at SR 419/434 gave it a score of 111 out of a possible 145, or 77%. This placed it at the low end of the "optimal" habitat score range. Certain areas of erosion and the resulting siltation effect on habitats, along with a reduced riparian buffer zone, detracted somewhat from the overall habitat score for this site.

KEY ASSESSMENT PARAMETERS 3/3/97

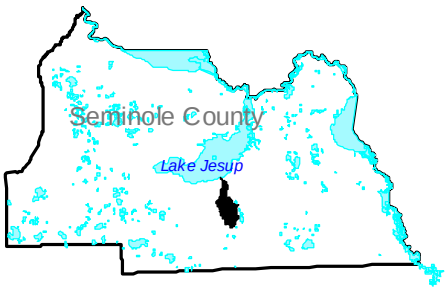
Biology		
SCI score	27 (very good)	
Florida Index	13	
EPT	3	
number of taxa	28	
dominant taxon	*Polypedilum convictum* gr.	
Chemistry	(value)	(%ile)*
dissolved oxygen	6.11 mg/L	60
conductivity	277 ᴛmhos/cm	42
pH	8.25 std. units	99
unionized NH_3	0.0045 mg/L	95
TKN	0.46 mg/L	20
nitrate/ nitrite	0.20 mg/L	70
total phosphorus	0.14 mg/L	70
fecal coliforms	170 colonies/100mL	70
Habitat		
assessment score	111 out of 145 points	

* Approximate percentile ranking compared with other Florida streams.

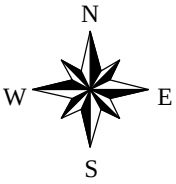
Sweetwater Creek Basin

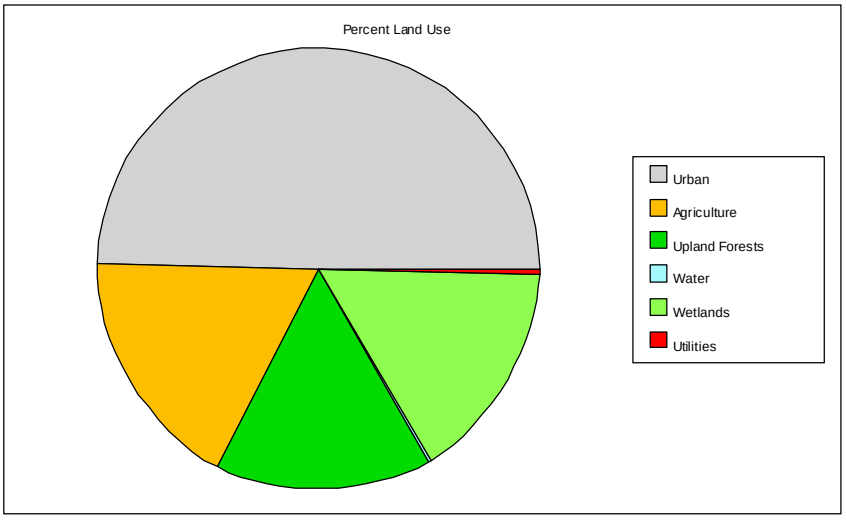


Locator Map



Basin Land Use
Area = 2.50 square miles
Ú = FDEP Sampling Site





Sweetwater Creek

The first of four streams or canals sampled in the Black Hammock area north of Oviedo, Sweetwater Creek originates in downtown Oviedo. It flows through residential and wetland areas before reaching Black Hammock, where it has been modified into a roadside ditch which drains north into Lake Jesup almost due south of Bird Island. The 2.5 square miles of land area that it drains is 50% urban development, with the remainder about evenly divided between agriculture, upland forests, and wetlands. Unlike the creeks in the Winter Springs area, Sweetwater Creek (as well as the other Black Hammock creeks) does not flow from or through any lakes, but apparently is fed by groundwater surfacing in wetlands and by runoff.

Sweetwater Creek at Deleon Street

Fifteen macroinvertebrate taxa were collected at Sweetwater Creek: nine dipterans, three oligochaetes, one mollusk, and two odonates. This is the lowest number of taxa seen at any of the eleven sites in this survey. In addition, this was the only site where there were no mayflies or caddisflies collected (*i.e.*, zero EPT). The Florida Index score was eight. The hydrobiid snail *Pyrgophorus platyrachis* was the dominant taxon, making up 52% of the individuals collected. SCI assessment ranked the site as suboptimal, placing it in the "good" category.

Nutrients were very high at this site. Concentrations of total ammonia, unionized ammonia, nitrate/nitrite, and total phosphorus were all in the 90th percentile range or higher. Alkalinity, total Kjeldahl nitrogen, chloride, and sulfate concentrations all ranged between the 75th and 80th percentiles. Fecal coliforms were also quite high, showing counts of 740 colonies per 100 mL. In none of these cases, however, was a current water quality standard violated.

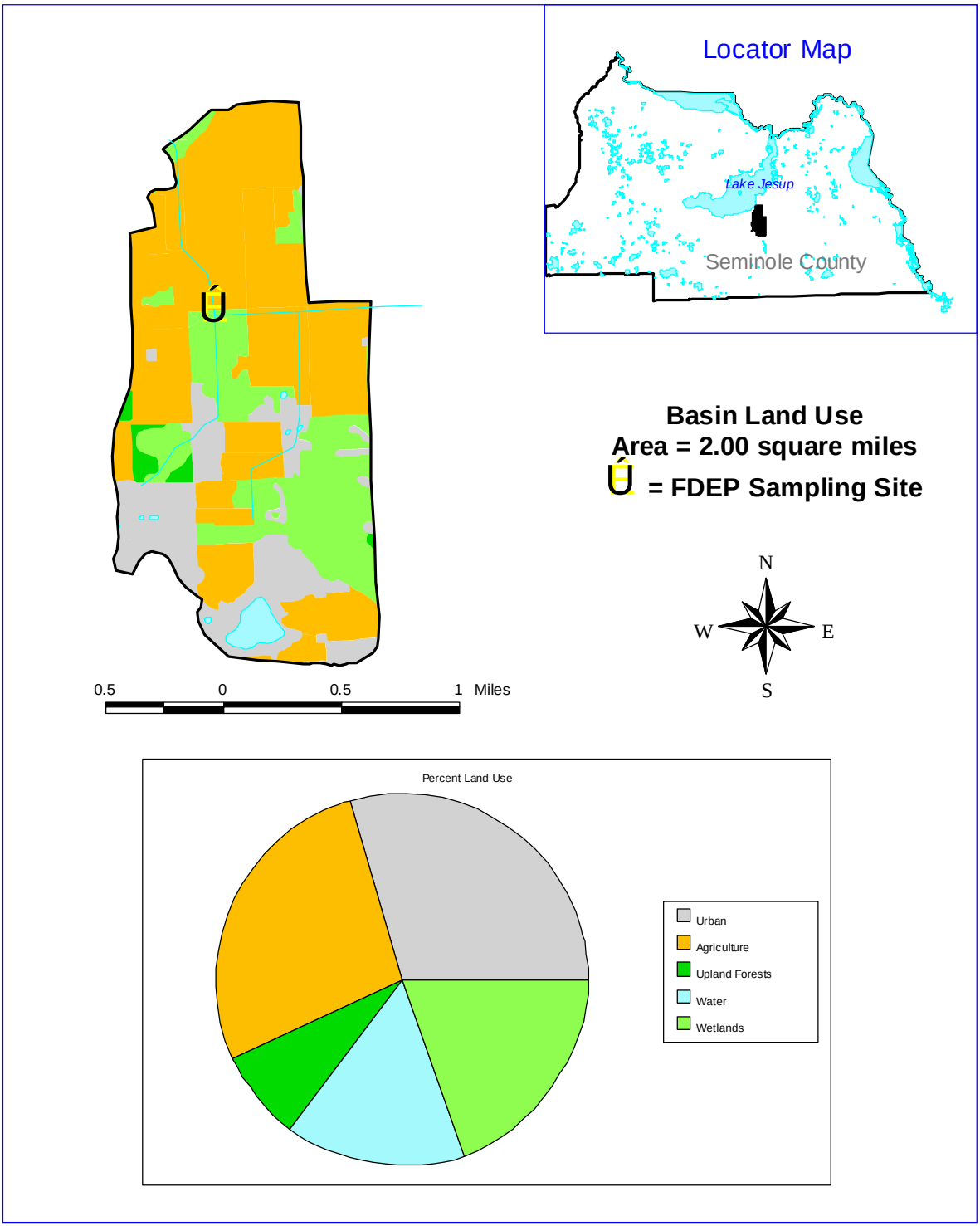
Habitat quality at Sweetwater Creek was suboptimal. A lack of riparian buffer zone on one side, substantial erosion and habitat smothering, and a poor quality streamside plant community contributed to a score of 76 out of a possible 145 points, or 52%.

KEY ASSESSMENT PARAMETERS 8/12/97

Biology		
SCI score	21 (good)	
Florida Index	8	
EPT	0	
number of taxa	15	
dominant taxon	*Pyrgophorus platyrachis*	
Chemistry	(value)	(%ile)*
dissolved oxygen	5.99 mg/L	55
conductivity	709 Tmhos/cm	68
pH	7.19 std. units	81
unionized NH_3	0.0019 mg/L	90
TKN	1.4 mg/L	75
nitrate/ nitrite	0.75 mg/L	92
total phosphorus	0.42 mg/L	90
fecal coliforms	740 colonies/100mL	95
Habitat		
assessment score	76 out of 145 points	

* Approximate percentile ranking compared with other Florida streams.

Shortcut Canal Basin



Shortcut Canal

As the name implies, this is not a natural waterbody, but a canal (or more accurately, a series of canals) which flows north into Lake Jesup. The two-square-mile drainage area is made up of 55% agricultural land drained by the canals, about 20% residential development centered at Lake Charm and the western part of Black Hammock, and roughly 25% undeveloped land, which is chiefly wetlands. With the exception of a half-mile stretch where it flows in an ill-defined course through a small wetland, it is made up of several interconnected box-cut roadside ditches which drain farmland.

Shortcut Canal at Howard Avenue

Biological sampling carried out at Shortcut Canal shows that the man-made water body is in fairly good ecological condition compared with other streams in the area. The SCI assessment gave a score of 25, placing it in the "good" category. Of the 21 macroinvertebrate taxa collected in the subsample, four were from the EPT group. The Florida Index score for Shortcut Canal was 11, equal to those from Bear and Howell Creeks. The dominant taxon was the amphipod *Gammarus* sp.

Chemical water quality sampling showed mixed results at this site. Total phosphorus and the calculated unionized ammonia values were quite high -- greater than the 80th percentile compared with other Florida streams. On the other hand, Kjeldahl nitrogen and nitrate/nitrite measurements were average, in the 54th and 57th percentiles, respectively. There were 420 colonies/100mL fecal coliforms, which is quite high (88th percentile), but not exceeding water quality standards.

Both chlorides and sulfates (and thus conductivity) were very high in this stream. In this area, saline water is present in the lower portions of the surficial aquifer beneath the freshwater layer. Excessive use of groundwater in the area for agriculture, plus extensive canalization of the land, have exacerbated saltwater intrusion into fresh groundwater sources. This has resulted in very high levels of sulfates and chlorides in this and other streams in the area (especially those to the east of Shortcut Canal), as well as the contamination of drinking water sources for residents in the eastern portion of Black Hammock. Thus, the chloride level in Shortcut Canal is in the 99th percentile compared with other Florida streams. Sulfates are in the 90th percentile.

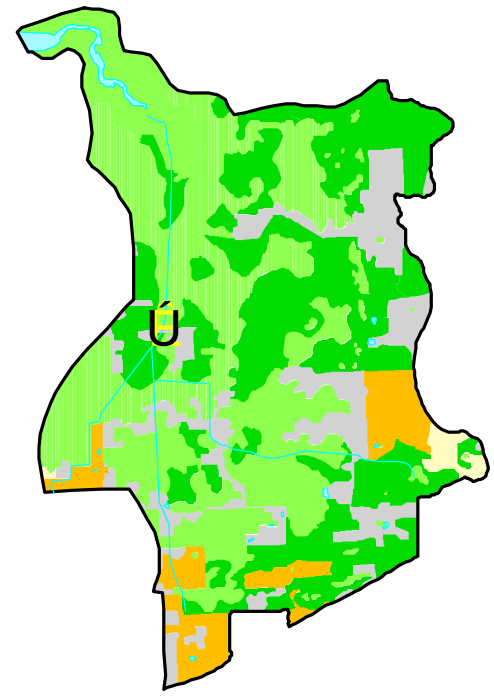
Shortcut Canal's habitat assessment score was fairly low. Being a man-made ditch, it scored relatively poorly on all portions of the habitat assessment. This was especially true regarding riparian buffer zone width, which was only three meters on one side, with citrus groves on both sides of the canal. The habitat assessment score was 87 out of a possible 145 points, or 60%.

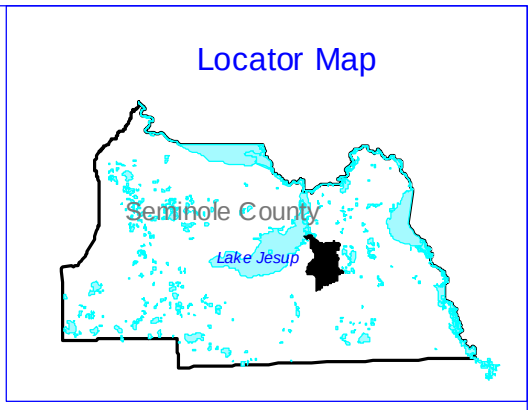
KEY ASSESSMENT PARAMETERS 9/8/97

Biology		
SCI score	25 (good)	
Florida Index	11	
EPT	4	
number of taxa	21	
dominant taxon	*Gammarus* sp.	
Chemistry	(value)	(%ile)*
dissolved oxygen	4.68 mg/L	35
conductivity	1910 ᴛmhos/cm	90
pH	7.24 std. units	90
unionized NH_3	0.0013 mg/L	82
TKN	0.52 mg/L	54
nitrate/ nitrite	0.11 mg/L	57
total phosphorus	0.30 mg/L	84
chlorides	580 mg/L	99
sulfates	87 mg/L	90
fecal coliforms	420 colonies/100mL	88
Habitat		
assessment score	87 out of 145 points	

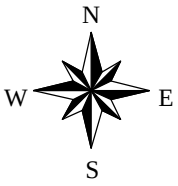
* Approximate percentile ranking compared with other Florida streams.

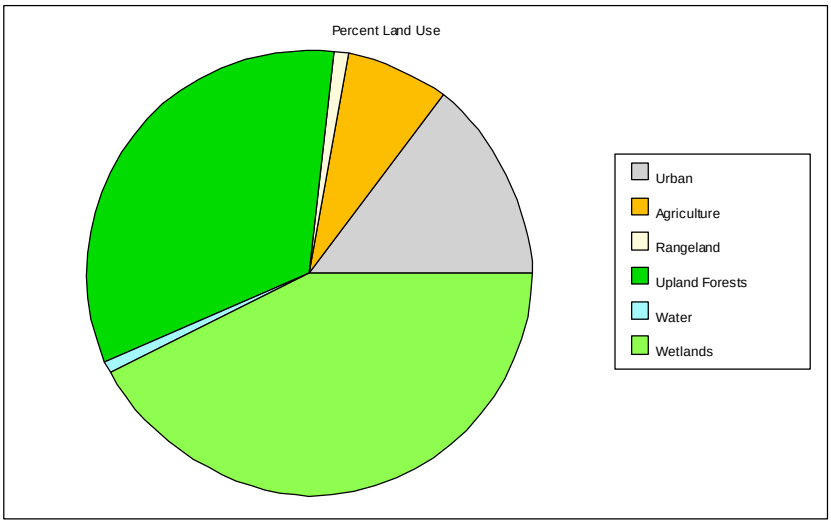
Salt Creek Basin





Basin Land Use
Area = 5.69 square miles
Ú = FDEP Sampling Site





Salt Creek

This stream is aptly named, since it is fed by base flow from partially saline groundwater, as mentioned earlier. It originates near SR 426 just east of Oviedo only about a mile from the Econlockhatchee River. A large portion of the stream has been canalized, where it functions as a roadside ditch and receives input from a number of other smaller ditches. Only where it enters the marshy area near the lake has it not been altered. The watershed of this stream is only sparsely developed. More than 75% of the land in the Salt Creek basin is upland forest and wetlands. About 15% is low-density urban development. The remaining land use is agricultural and rangeland.

Salt Creek downstream of Packard Ave.

Salt Creek received a poor Stream Condition Index rating. Nineteen macroinvertebrate taxa were collected in the sample, scoring only five Florida Index points (the lowest seen in this study). There were only two animals from the EPT group found here. Like Sweetwater Creek, the dominant macroinvertebrate species was the hydrobiid snail *Pyrgophorus platyrachis*.

Nitrogen levels were moderate to high at Salt Creek. Total Kjeldahl nitrogen was the highest (2.9 mg/L), whereas the nitrate/nitrite concentration was intermediate (0.16 mg/L). As would be expected from the saline groundwater influence, chloride and sulfate concentrations were very high (810 and 150 mg/L respectively). Both were in the 99th percentile range compared with other Florida streams. Total phosphorus was also very high in this creek, 0.35 mg/L, or the 87th percentile. Specific conductance was measured at 3000 Tmho/cm. The water was very darkly tannic in Salt Creek. The fecal coliform concentration, though fairly high, did not exceed state standards.

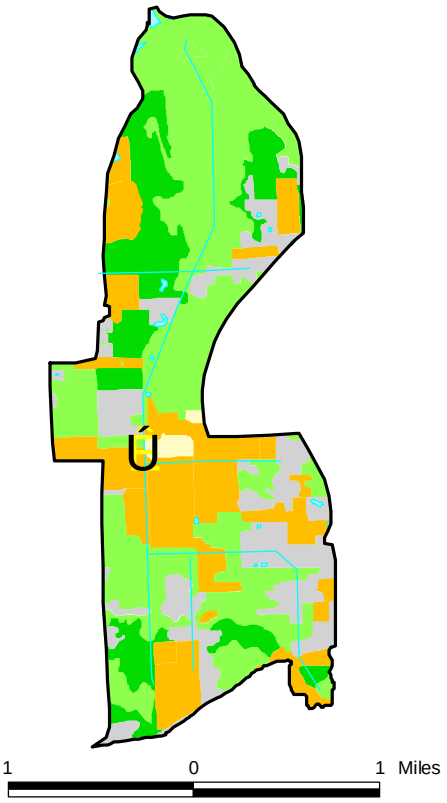
The habitat quality, though not excellent, did fall within the low part of the optimal range. Despite the fact that the stream's course has largely been altered, this was done many years ago, allowing for some recovery, and the surrounding area is largely undeveloped. Consequently, Salt Creek received a somewhat higher habitat score than other area streams and canals.

KEY ASSESSMENT PARAMETERS 8/12/97

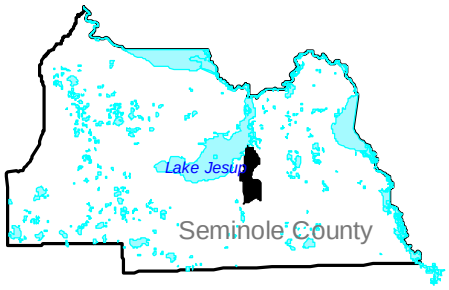
Biology		
SCI score	17 (poor)	
Florida Index	5	
EPT	2	
number of taxa	19	
dominant taxon	*Pyrgophorus platyrachis*	
Chemistry	(value)	(%ile)*
dissolved oxygen	5.31 mg/L	45
conductivity	3000 Tmho/cm	94
pH	6.88 std. units	45
unionized NH_3	0.0014 mg/L	82
TKN	2.9 mg/L	95
nitrate/ nitrite	0.16 mg/L	64
total phosphorus	0.35 mg/L	87
chlorides	810 mg/L	99
sulfates	150 mg/L	99
fecal coliforms	470 colonies/100mL	90
Habitat		
assessment score	114 out of 145 points	

* Approximate percentile ranking compared with other Florida streams.

Black Sweetwater Creek Basin



Locator Map



Basin Land Use
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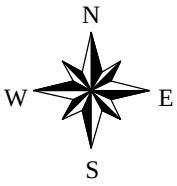
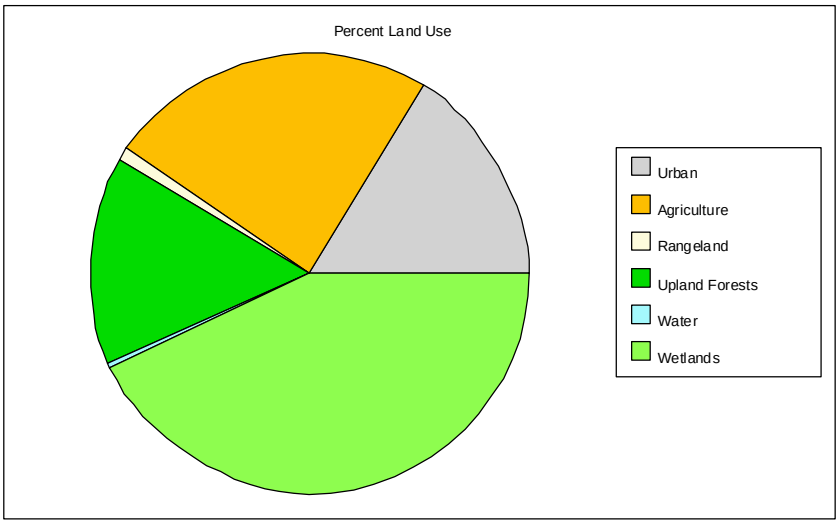
Ú = FDEP Sampling Site





Black Sweetwater Creek

Identified on some maps as Sweetwater Creek (though a separate stream entirely from the one of the same name discussed previously), Black Sweetwater Creek is basically a network of ditches which drain farmland in Black Hammock. Originating at the outskirts of Oviedo near SR 426, it drains 3.6 square miles of land, roughly 60% of which is undeveloped. Agriculture accounts for 23% of the land use, with most of the rest being devoted to urban development.

Black Sweetwater Cr. downstream of Howard Ave.

Black Sweetwater Creek scored very low on the biological assessment. It received an SCI score of 15, placing it in the "poor" category. Of the 19 macroinvertebrate taxa collected, there was only one EPT, the mayfly *Caenis diminuta*. Only six Florida Index points were scored. The hydrobiid snail *Pyrgophorus platyrachis* was dominant, making up 73% of the sample. The results suggest a poor and imbalanced macroinvertebrate community.

The results of water chemistry sampling were generally also poor. Levels of unionized ammonia (calculated) and total phosphorus were fairly high. As expected due to saline groundwater input, the chloride and sulfate measurements were also quite high.

Black Sweetwater Creek was the only site in this survey where the dissolved oxygen level was well below the state standard for Class III fresh waters (5.0 mg/L). The oxygen level found here was a very low 1.89 mg/L, a concentration at which many aquatic organisms cannot survive.

In addition, the fecal coliform concentration in the water taken at this site was 1300 colonies per 100mL. This is a definite exceedence of the allowable threshold under state standards, which is 800 colonies/100mL.

The habitat assessment at this site was equally abysmal. Because the channelized stream had extensive silt smothering, very low water velocity (0.06 m/s), and a riparian zone plant community that lacked diversity and contained a number of exotic species, the habitat assessment score was 65 out of 145 possible points. This gave it a rating of "marginal."

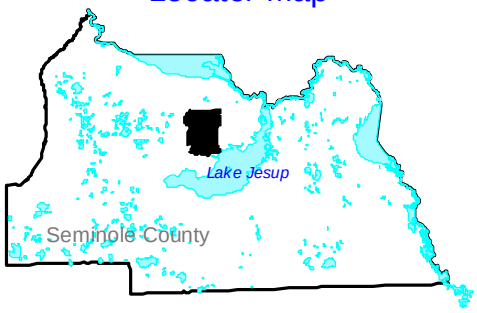
KEY ASSESSMENT PARAMETERS 9/24/97

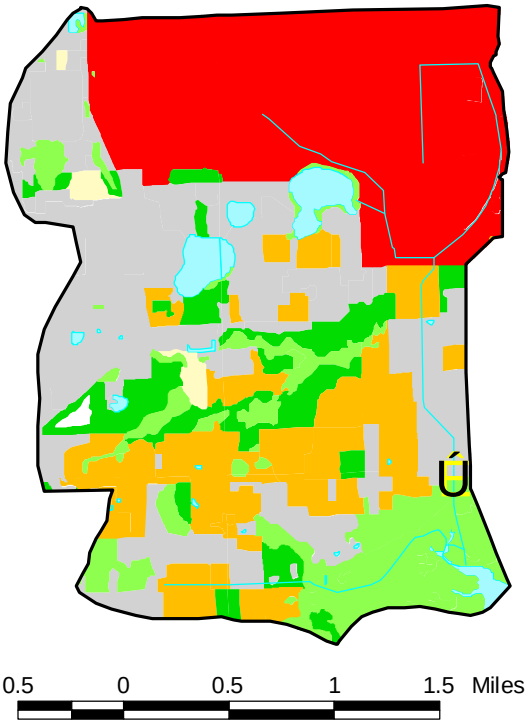
Biology		
SCI score	15 (poor)	
Florida Index	6	
EPT	1	
number of taxa	19	
dominant taxon	*Pyrgophorus platyrachis*	
Chemistry	(value)	(%ile)*
dissolved oxygen	1.89 mg/L	5
conductivity	1910 µmhos/cm	90
pH	6.99 std. units	50
unionized NH_3	0.0007 mg/L	71
TKN	0.47 mg/L	20
nitrate/ nitrite	0.06 mg/L	43
total phosphorus	0.35 mg/L	87
fecal coliforms	**1300 colonies/100mL**	99
Habitat		
assessment score	65 out of 145 points	

* Approximate percentile ranking compared with other Florida streams.

Black Sweetwater Creek upstream of Howard Ave.

Phelps Creek Basin





Basin Land Use
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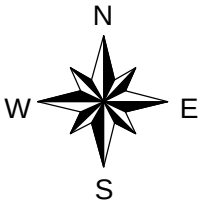
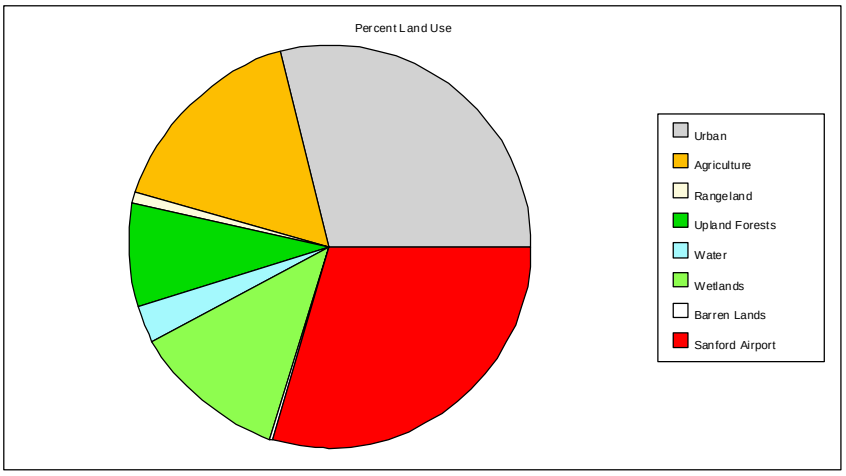
Ú = FDEP Sampling Site





Sanford Airport Ditch

A number of interconnected roadside ditches which flow through the Sanford Orlando Regional Airport culminate in this man-made ditch, which flows south from the airport to empty into Lake Jesup at the mouth of Phelps Creek. The watershed also includes Golden Lake south of the airport, which has an outlet into the ditch system. Approximately 30% of the land use in the Airport Ditch/Phelps Creek watershed is commercial (airport), with an equal amount being residential. The remaining land use is roughly 20% each of undeveloped land and field or pasture. The sample site is in a low-density urban area near the north shore of the lake.

Sanford Airport Ditch at Pineway Road

Twenty-two invertebrate taxa were collected in the sample taken here. Included in this number were four from the EPT group. A total of five Florida Index points was scored. The overall SCI assessment score was 21, giving Sanford Airport Ditch a "good" rating. The dominant species present in the sample was the riffle beetle *Microcylloepus pusillus*, which accounted for 38% of the individuals collected.

Despite the fact that its flow at this point is made up almost entirely of runoff from the vicinity of Sanford Orlando Regional Airport, water chemistry analyses suggested fairly good water quality in the Airport Ditch. Both nitrate/nitrite and total phosphorus values were the lowest measured in this study. All other water chemistry parameters showed low or average values compared with other Florida streams. However, the fecal coliform level in the stream (710 colonies/100mL) ranked in the 94th percentile. Although high, this was not in violation of current water quality standards.

Even though the water quality was reasonably good, the habitat quality was relatively poor. Due to low water velocity, a very reduced riparian zone buffer, and poor riparian vegetative community, the site received a score of 86 out of a possible 145 points, giving it a suboptimal rating.

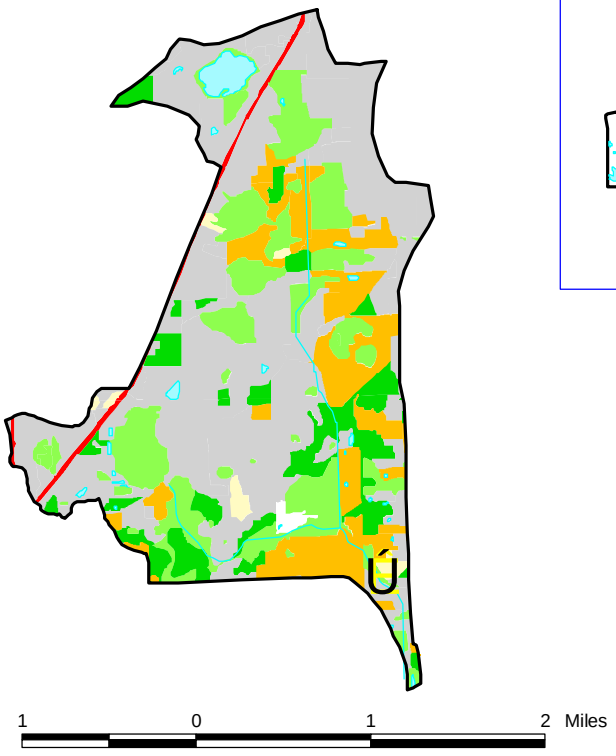
KEY ASSESSMENT PARAMETERS 8/25/97

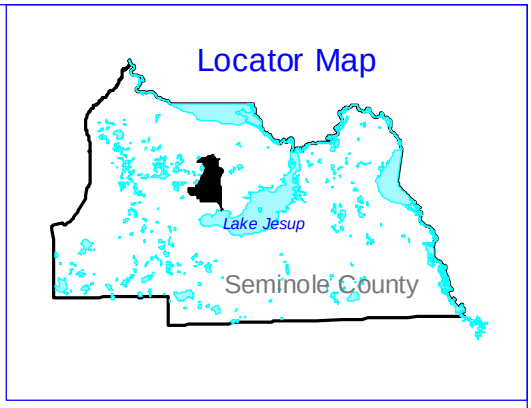
Biology		
SCI score	21 (good)	
Florida Index	5	
EPT	4	
number of taxa	22	
dominant taxon	*Microcylloepus pusillus*	
Chemistry	(value)	(%ile)*
dissolved oxygen	6.72 mg/L	69
conductivity	190 µmhos/cm	33
pH	6.97 std. units	50
unionized NH_3	0.0002 mg/L	50
TKN	0.49 mg/L	20
nitrate/ nitrite	0.03 mg/L	25
total phosphorus	0.03 mg/L	20
fecal coliforms	**710 colonies/100mL**	94
Habitat		
assessment score	86 out of 145 points	

* Approximate percentile ranking compared with other Florida streams.

Aerial view of Sanford Orlando Regional Airport showing ditch system (thin black lines). Golden Lake is at lower center.

Elder Springs Run Basin





Basin Land Use
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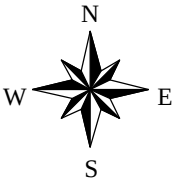
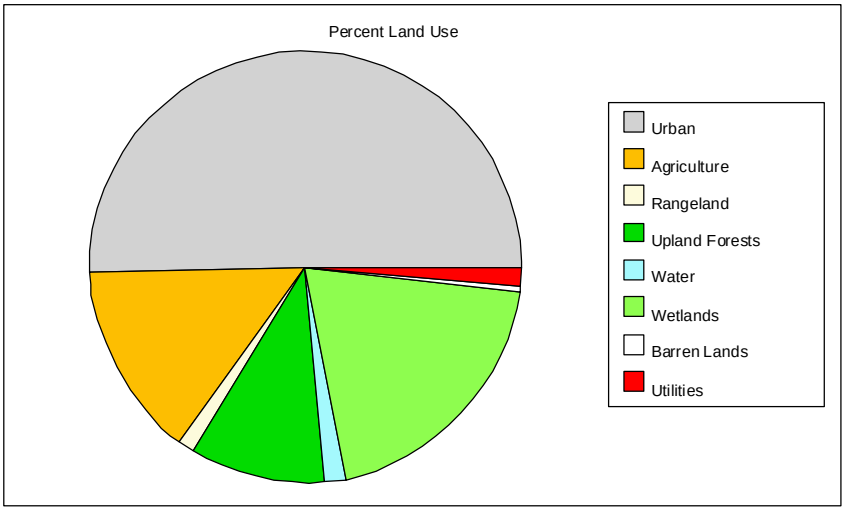
Ú = FDEP Sampling Site





Elder Springs Run

This watershed is made up of two forks. The western fork receives input from several small springs in the Elder Springs area south of Sanford. The eastern fork originates at Lake Ada just west of US Hwy 17/92 and flows south to where it joins Elder Springs Run proper about a mile above Lake Jesup. At several points in the eastern portion of the watershed, the stream is canalized, serving as a roadside drainage ditch. The combined stream flows into the lake at Seminole County's Lake Jesup Park. One-half of the land use in the Elder Springs Run watershed is urban. Roughly 15% is devoted to agriculture. Most of the remainder is undeveloped land.

Elder Springs Run
upstream of Myrtle Avenue

Elder Springs Run received a "good" rating on the SCI. There were 24 macroinvertebrate taxa collected, which included three from the EPT group. The Florida index score was nine. Once again, the dominant invertebrate taxon present was *Microcylloepus pusillus*, the riffle beetle.

Water chemistry results suggest fairly good water quality. Percentile rankings for these parameters ranged from the 46th to the 71st. As seen before, the concentration of fecal coliform bacteria in the water samples was very high (510 colonies/mL), but not above the level allowed by current Florida rules.

At the sampling site, the habitat evaluation produced good results. Out of a possible 145 points, the site scored 121, placing it in the mid-range of the "optimal" category. A narrow buffer zone and poor riparian plant community kept Elder Springs Run from receiving a very high habitat assessment.

KEY ASSESSMENT PARAMETERS 8/25/97

Biology		
SCI score	25 (good)	
Florida Index	9	
EPT	3	
number of taxa	24	
dominant taxon	*Microcylloepus pusillus*	
Chemistry	(value)	(%ile)*
dissolved oxygen	6.45 mg/L	65
conductivity	292 Tmhos/cm	43
pH	6.95 std. units	50
unionized NH_3	0.0003 mg/L	55
TKN	1.3 mg/L	70
nitrate/ nitrite	0.07 mg/L	46
total phosphorus	0.15 mg/L	71
fecal coliforms	**510 colonies/100mL**	90
Habitat		
assessment score	121 out of 145 points	

* Approximate percentile ranking compared with other Florida streams.

Elder Springs Run at Nolan Road,
upstream of sample site

Discussion

The sampling results show that Lake Jesup tributary streams located near to one another have similar water quality characteristics. With a few exceptions, the streams in the Black Hammock vicinity resemble one another in water quality, as do those in the Winter Springs/Casselberry area. Not surprisingly, the land uses within the watersheds of those streams which show similar water quality also tend to be similar. The two streams near Sanford, although very different in origin and hydrology, grouped closely together in water quality as well.

Winter Springs area streams

The streams in the Winter Springs area (Howell, Bear, Soldier, and Gee Creeks) are influenced most by residential development. The mean percentage of residential land use in the four watersheds is 59% (maxi-mum: Howell Creek, 68%; minimum: Bear Creek, 46%). Fortunately, most of the residential development in this area is fairly recent (at least in the lower reaches of these stream basins where they were sampled). Florida's stormwater rule went into effect in 1986. Consequently, modern stormwater retention methods were used in many of the developments in the area, leading to a reduction in the amount of nutrient- and bacteria-laden stormwater that would otherwise enter these streams during storm events. Despite this, nutrient levels as a whole were somewhat higher than the average for all Florida streams, particularly for total ammonia, nitrate/nitrite, and total phosphorus. Fecal coliforms were also fairly high in the area, with an average count of approximately 360 colonies/100mL, or the 85th percentile compared with other streams in the state. The highest of the four, Soldier Creek, had a level of 620 colonies/ 100mL. The Soldier Creek basin has the largest percentage of older homes of the four, and thus probably has more septic tanks in use within the watershed.

These somewhat elevated nutrient and coliform bacteria levels did not appear to have had substantial effects on the macro-invertebrate communities present in these streams. Results of the biological assessment were basically good. Particularly at Bear Creek, Gee Creek, and Howell Creek at Winter Springs Boulevard, there were high numbers of macroinvertebrate taxa, including quite a few which are sensitive to pollution, and are thus indicators of good water quality. Interestingly, a dominant macroinvertebrate at all of the sites was the riffle beetle *Microcylloepus pusillus*. This beetle is a member of the family Elmidae, the only truly aquatic beetles. The adults, tiny, hard-bodied, slow-moving beetles with long claw-bearing legs, respire by collecting air on patches of dense microscopic hairs termed "hydrofuges." The elongate larvae have gills in a cavity at the end of the abdomen which has a hinged door that can be opened or closed, or used as a fan to move water over the gills at times of low flow. Elmids are intolerant of many types of pollution, especially when it contains soaps or detergents (Brown 1972). Their respiratory physiology limits their distribution to habitats which are oxygen-rich (Gnilka & Gnilka 1982). At none of these sites was dissolved oxygen below the state standard of 5 mg/L.

Since there are no longer permitted point source discharges into any of these Winter Springs/Casselberry area streams, the biggest challenge to the ecological health of these systems is the intensity of urban development within the watershed. Habitat alteration and nonpoint source runoff problems due to extensive areas of impervious surface are characteristic of urban development, and are quite evident in the upper reaches of these streams.

Suggestions for the improvement of the environmental health of these tributaries of Lake Jesup include appropriate maintenance of stormwater retention systems where they are present, establishment of stormwater management improvements where they are not, active or passive rejuvenation of the riparian zone of lakes and streams within the drainages, agricultural BMPs, and the preservation of remaining wetland areas.

Circa 1972

Circa 1996

The aerial photographs above show part of the Winter Springs/Oviedo area at different periods. Notice the urbanization of areas that drain to Lake Jesup (at top left).

Oviedo area streams

In contrast to the relatively good quality of water flowing into Lake Jesup from the Winter Springs area, the water quality in streams in Black Hammock is generally poor. As a group, these four streams (Sweetwater, Black Sweetwater, and Salt Creeks and Shortcut Canal) were characterized by a poor biological community, low dissolved oxygen, high nutrients and fecal coliforms, and highly altered and degraded instream and riparian zone habitat.

The biological assessment showed that these streams supported comparatively small numbers of macroinvertebrate taxa, few to none of which were the sensitive EPT (mayfly, stonefly, and caddisfly larvae) species. Degradation was especially apparent at Salt, Sweetwater, and Black Sweetwater Creeks, where the macro-invertebrate community was dominated by the hydrobiid snail *Pyrgophorus platyrachis*. This snail is common in streams with low flow; soft, silty bottoms with large amounts of organic material; high chloride content in the water; and high turbidity (Thompson 1968). All three streams show these characteristics. Shortcut Canal, though certainly not pristine, rated better than the other three. All biological parameters were better, and the dominant macroinvertebrate was the amphipod (crustacean) *Gammarus* sp. The hydrobiid snail *Pyrgophorus platyrachis* accounted for only 2.4% of the macroinvertebrates collected at Shortcut Canal.

Because this area is characterized by partially saline groundwater, it was thought that the poor biological results from these streams might be tied in part to the difficulty freshwater organisms might have in dealing with the somewhat salty water present in these streams. This does not appear to be the case, however, since Shortcut Canal, which did substantially better than the others in terms of biology, fecal coliforms, and some nutrient levels, had a conductivity of 1910 ɪmhos/cm. This measurement is equal to that of Black Sweetwater Creek, the most degraded site of all those sampled in this survey.

Undoubtedly, the main ecological problem with these streams has to do with agriculture. All four streams have been altered, channelized to function as drainage ditches for the agricultural operations prevalent in this area. In most cases, environmentally beneficial land manage-ment practices are not utilized by those farming in Black Hammock. Water laden with nutrients and probably pesticides flows into these ditches, which in turn flow due north into Lake Jesup. In some places, animal pens are at the very edge of the steeply cut banks of these canals, no doubt contributing greatly to the fecal coliform concentrations. In Black Sweetwater Creek, where one of these pens apparently had a drainage pipe flowing into the stream, the fecal coliform level was 1,300 colonies 100mL, a definite violation of state water quality standards.

We believe that the Black Hammock area is an ideal candidate for an Ecosystem Management effort. Farmers in the area could be educated about current problems and offered suggestions for more environmentally sound and hopefully financially feasible alternative methods. The establishment of better land management practices in the area should help to improve the water quality in both these streams and Lake Jesup downstream.

Palm farm alongside Black Sweetwater Creek

Sanford area streams

Unlike the two groups already discussed, the streams in the Sanford area which were included in this study are very different from one another. Elder Springs Run is a natural stream fed by a number of small headwater springs and wetlands. Although canalized in some areas, its course is relatively natural. The majority of the land use in the basin is urban. The Sanford Airport ditch, on the other hand, is not a natural stream, but a drainage canal which conducts the collective flow of several ditches in the airport vicinity south, entering Lake Jesup at the mouth of Phelps Creek, which flows from west to east. Despite these differences, however, the two streams performed similarly in this study.

Both streams received a "good" rating on the Stream Condition Index. Macroinvertebrate species were numerous, with a fairly good number of pollution-sensitive taxa present. The dominant macroinvertebrate species present in both streams was the same seen in the Winter Springs area, *Microcylloepus pusillus*, the riffle beetle. Of the two streams, Elder Springs Run did somewhat better in terms of biology than the drainage ditch. This might have been a result of the available habitat, which was considerably better in the more natural Elder Springs Run than in the man-made Airport Ditch.

In terms of water chemistry, the Airport Ditch actually had somewhat better water quality than Elder Springs Run. Most nutrient measurements were roughly in the 50th to 70th percentile range in Elder Springs Run, compared with the 20th to 50th percentile range for Airport Ditch. The water was much more highly colored in Elder Springs Run than in the ditch. Elder Springs Run's water was the darkest of any seen in this survey (400 CUs; equal to measurements from Salt Creek near Oviedo). The water from Airport Ditch was among the least colored. Fecal coliforms were relatively high at both sites, though not in excess of standards.

Generalization of land use effects on water quality in these two side-by-side basins is difficult, since one is dominated by residential development and the other by commercial (airport) development. Roughly speaking, however, the remaining land use percentages (natural lands, rangeland, and agriculture) are basically equal between the two. Due to the similarity of the results, then, it can be observed that the dominating urban and commercial land uses *in these specific basins* have had approximately the same effect on water quality.

Suggestions for maintenance or improvement in water quality in this area include the establishment of adequate stormwater retention systems as development in the area increases and the use of best management practices by area growers and ranchers.

Airport Ditch at Marquette Road, looking upstream toward Sanford Airport

Summary

The quality of water entering Lake Jesup via the tributaries monitored in this study varied from area to area and, to a lesser degree, from stream to stream. However, a few overall observations can be made.

Fecal coliform bacteria levels were high in all of these streams. The lowest count seen, 170 colonies per 100mL, was recorded at Gee Creek. Measured coliform levels in 70% of Florida's streams were lower than this. The highest fecal count encountered in this study, at Black Sweetwater Creek, was 1,300 colonies/100mL, in the 99th+ percentile. Possible sources of such contamination include runoff from pasturelands or livestock holding areas, faulty or insufficiently spaced septic tanks, and runoff from urban areas.

Generally speaking, nutrient levels tended to be high in these streams. There were exceptions, however, particularly in regard to total Kjeldahl nitrogen. In the majority of these streams, TKN was in the 50th percentile or less. For most other nutrient parameters, however, measurements were fairly high. Nutrient enrichment might occur as a result of urban nonpoint source runoff, agricultural fertilizer runoff, and land management practices that do not place a priority on ecosystem health. It is not difficult to find examples of these situations throughout the study area.

Although nonpoint source pollution from urbanized areas is a contributing factor to water quality problems in the area, these results suggest that the most significant contributor to poor water quality in Lake Jesup's tributaries is agriculture. Reversing these poor water quality trends would require education, cooperation, and the implementation of land use practices that make both economic and ecological sense. Accomplishing these goals would not be simple, but, along with restoration efforts, would be an important step in helping to improve the water quality of Lake Jesup.

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Clifton Springs Run at Lake Jesup

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Appendix
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site name	STORET #	date	SCI	rating	# taxa	FL Ind.	EPT	dominant taxon	habitat *of possible 145*	color *CU*	alkalinity *mg/L CaCO3*
Airport Ditch	20010187	8/25/97	21	good	22	5	4	*Microcylloepus pusillus*	86	60	51.3
Bear Creek	20010049	9/24/97	29	v. good	27	11	5	*Microcylloepus pusillus*	131	100	56
Black Swtwtr	20010354	9/24/97	15	poor	19	6	1	*Pyrgophorus platyrachis*	65	40	132
Elder Springs	20010294	8/25/97	25	good	24	9	3	*Microcylloepus pusillus*	121	400	61.5
Gee Creek	20010185	3/3/97	27	v. good	28	13	3	*Polypedilum convictum*	111	40	93.5
Howell/434	20010186	7/9/96	23	good	19	10	2	Pisidiidae (then *M. pusillus*)	117	80	42
Howell/WSB	20010042	8/18/97	27	v. good	21	11	7	*Microcylloepus pusillus*	102	75	45
Salt Creek	20010051	8/12/97	17	poor	19	5	2	*Pyrgophorus platyrachis*	114	400	91.8
Shortcut Cnl	20010127	9/8/97	25	good	21	11	4	*Gammarus* sp.	87	40	127
Soldier Creek	20010184	7/9/96	25	good	24	7	3	*Microcylloepus pusillus*	131	200	53
Sweetwater	20010090	8/12/97	21	good	15	8	0	*Pyrgophorus platyrachis*	76	100	110

site name	stream width *m*	depth *m*	Secchi *m*	DO *mg/L*	conduct. *umhos/cm*	temp. *deg. C*	pH *SU*	canopy cover *light, moderate, or heavy*	riparian width *m **	velocity *m/s ***	turbidity *NTU*
Airport Ditch	3.0	0.4	>0.4	6.72	190	26.37	6.97	moderate	0.3	0.07	2.4
Bear Creek	5.5	1.0	0.5	6.60	230	25.40	7.16	moderate	12	0.50	9.6
Black Swtwtr	3.0	0.2	>0.2	1.89	1910	24.48	6.99	moderate	5	0.06	1.9
Elder Springs	3.0	1.5	1.0	6.45	292	25.27	6.95	moderate	8	0.33	4.2
Gee Creek	2.5	0.4	>0.4	6.11	277	21.93	8.25	light	10	0.15	2.1
Howell/434	4.0	1.5	1.0	5.60	162	27.60	7.00	moderate	>18	0.30	5.8
Howell/WSB	5.0	0.5	0.4	6.02	173	29.00	6.90	moderate	2	0.50	8.8
Salt Creek	4.0	0.8	0.5	5.31	3000	24.20	6.88	heavy	>18	0.17	10.0
Shortcut Cnl	3.5	0.2	>0.2	4.68	1910	22.30	7.24	light	3	0.33	5.7
Soldier Creek	3.0	1.0	>1.0	6.10	163	25.70	6.97	heavy	>18	0.30	3.8
Sweetwater	2.5	0.4	>0.4	5.99	709	24.55	7.19	moderate	0	0.50	2.1

* Because a riparian zone width of greater than 18 meters is considered ideal, no further estimation is made when widths exceed 18 m.

** Fastest velocity of three measurements made at representative cross-section.

Appendix
Assessment Data - Lake Jesup Tributaries Report
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site name	fecals		total P		chlorides		sulfates		NH3+NH4		unionized NH3	
	#/ 100 mL	*percentile*	*mg/L*	*percentile*	*mg/L*	*percentile*	*mg/L*	*percentile*	*mg/L*	*percentile*	*mg/L*	*percentile*
Airport Ditch	710	94	0.03	20	20	40	9.8	40	0.04	50	0.0002	50
Bear Creek	540	91	0.14	60	21	42	9.9	40	0.05	60	0.0005	70
Black Swtwtr	1300	99+	0.35	85	520	95+	78	87	0.11	5	0.0007	75
Elder Springs	510	90	0.15	80	49	62	15	50	0.05	60	0.0003	60
Gee Creek	170	70	0.14	70	23	44	9.8	40	0.05	60	0.0045	95
Howell/434	320	84	0.11	60	15	32	10	40	0.04	50	0.0003	60
Howell/WSB	320	84	0.07	50	18	37	12	45	0.03	40	0.0002	50
Salt Creek	470	90	0.35	85	810	95+	150	95+	0.29	40	0.0014	90
Shortcut Cnl	420	88	0.30	85	580	95+	87	90	0.13	10	0.0013	85
Soldier Creek	620	93	0.21	80	14	30	4	33	0.06	65	0.0003	60
Sweetwater	740	95	0.42	90	120	78	45	74	0.19	20	0.0019	90

site name	TKN		NO2+NO3		land use percentages ***							USGS gage
	mg/L	*percentile*	*mg/L*	*percentile*	*natural*	*silviculture*	*pasture*	*agriculture*	*residential*	*commercial*	*industrial*	
Airport Ditch	0.49	20	0.03	25	21	0	18	0	29	30	2	no
Bear Creek	0.81	40	0.15	60	29	0	4	21	46	0	0	no
Black Swtwtr	0.47	20	0.06	45	60	0	1	23	11	5	0	no
Elder Springs	1.30	70	0.07	45	32	0	1	15	50	2	0	no
Gee Creek	0.46	20	0.20	70	29	0	1	3	65	0	2	yes
Howell/434	0.67	30	0.11	60	25	0	1	4	68	0	2	yes
Howell/WSB	1.00	50	0.11	60	25	0	1	4	68	0	2	yes
Salt Creek	2.90	95	0.16	65	75	0	2	8	15	0	0	no
Shortcut Cnl	0.52	25	0.11	60	0	20	5	38	5	0	0	no
Soldier Creek	0.82	40	0.13	60	30	0	2	7	57	0	4	yes
Sweetwater	1.40	75	0.75	90	16	0	16	18	40	10	0	no

[Note: Percentile values given are rankings compared to other Florida streams, as shown in the draft document "Typical Water Quality Values for Florida Streams, Blackwater, Springs, Lakes, and Estuaries" being prepared by Joe Hand *et al.* of FDEP, Tallahassee.]

*** Land use percentages are for entire stream watershed, and are based on St. Johns River Water Management District GIS land use coverages.