Evaluation of Lake Tohopekaliga Habitat Enhancement Project

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Prepared for:

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Final Report December 2006

Executive Summary

In the summer of 2004 the Florida Fish and Wildlife Conservation Commission (FWC) initiated a project to remove accumulated organic matter in the littoral areas of Lake Tohopekaliga. The lake level was lowered and; because of the high costs required to transport this material long distances and lack of nearby disposal sites, the organic matter layer was scraped from the lake bottom and deposited in-lake, forming 29 islands (Figure 2 and Table 1). Because there were concerns about the impacts of in-lake disposal of organic matter on several aspects of the ecology of Lake Tohopekaliga, a contract was initiated between FWC and the University of Florida to address the various issues of concern. A time line for deliverables and group responsibilities was established (Appendix IV). This is the third and last annual report by the University of Florida for this study that summarizes the deliverables required by December 2006.

Task #1. Nutrients and their potential impact on whole lake trophic status and general water chemistry.

Summary of Deliverables for Task 1, Item 1 through Item 4.

Islands L, I, G and N (Figure 3) were selected for short (3 months of monthly sampling) and long-term (2 years of quarterly sampling) examination of water chemistry impacts because they were the islands located closest to the long-term water chemistry monitoring stations set up by the South Florida Water Management District. At each of the four islands, 3 water chemistry sampling stations were selected along a transect 25 m, 75 m and 150 m from the water-island interface toward the main lake. These stations were identified with the individual island's letter and a station number 1, 2, and 3 corresponding to 25 m, 75 m, and 150 m, respectively (e.g., L1, L2, and L3). Approximately 400 meters to one side of each transect, 3 additional water chemistry sampling stations were selected along a parallel transect approximately the same distance out into the main lake. These stations were spaced the same distance apart along the transect and this transect was considered a control. The control stations were identified with the individual island letter, the letter C for control and station number 1, 2, and 3 corresponding to 25 m, 75 m, and 150 m of the island transect, respectively (e.g., LC1, LC2, and LC3). The latitude and longitude for these stations were recorded with Global positioning (GPS) equipment and are recorded in Table 2. In the early 1980s the South Florida Water Management District set up four long-term water chemistry monitoring stations (BO2, BO4, BO6, and BO9) in Lake Tohopekaliga (Figure 3 and Table 2). At the beginning of our sampling, these four stations were also sampled to examine potential whole lake changes that may have occurred after the Lake Tohopekaliga enhancement project. Water sampling began in August 2004 when the water level in Lake Tohopekaliga reached low pool and water surrounded the islands.

The first three months of sampling showed that Island L and corresponding control transects are differentially impacted by water inputs from Shingle Creek. Therefore, Island L data were removed from additional analyses used to examine the potential impacts of in-lake islands on surrounding water chemistry. After removing Island L data from the analyses, there is no evidence over the short term (monthly samples for three months) suggesting that in-lake islands are impacting the following water chemistry variables in Lake Tohopekaliga: color, total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, specific conductance, pH, total alkalinity, total suspended solids, and organic suspended solids. Conducting the same analyses using ten sampling dates between August 2004 and June 2006 again showed no evidence that in-lake islands are impacting the following water chemistry variables in Lake Tohopekaliga: color, total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, specific conductance, pH, total alkalinity, total suspended solids, and organic suspended solids.

Examining both the short-term (August, September, and October 2004) and long-term (ten dates between August 2004 and June 2006) water chemistry data at four long-term stations (B02, B04, B06, and B09) showed that some water chemistry variables (color, total phosphorus, chlorophyll and dissolved oxygen concentration) are outside of the 95% confidence intervals calculated from data collected prior to the lake enhancement project. However, there is no doubt that after the three hurricanes passed over Lake Tohopekaliga large amounts of rain were inputting highly colored nutrient rich water. Figure 38 shows that immediately after muck scraping some color values exceeded 200 Pt-Co units as did water coming from Shingle creek on April 25, 2005 (Station SC5, Figure 5 and Table 4). However, examining the distribution of data before the muck scraping also shows several color values between 150 and 200 Pt-Co units. So even though analysis of variance suggests that whole lake color values were higher in Lake Tohopekaliga after muck scraping it was probably the result of tremendous rainfall associated with three hurricanes the passed over the lake in 2004 (Figure 1B and Figure 1C). This same observation can be made for total phosphorus, chlorophyll and dissolved oxygen concentrations. While the analyses of variance suggest that there is a significant difference in these three variables after muck scraping the majority of data collected after muck scraping falls within the distribution of recent historical data (Figures 39, 41 and 43). Therefore, it is unlikely that the muck scraping significantly impacted the whole lake water chemistry of Lake Tohopekaliga. It would be wise, however, to maintain these four long-term stations to continue looking for trends in water chemistry.

Task # 2. Longevity of created islands.

Summary of Deliverables for Task 2, Item 1 through Item 3.

Area and volume estimates were collected prior to the reflooding of areas surrounding the 29 islands created in Lake Tohopekaliga for future comparisons (Round 1). These data provide a baseline to determine the longevity of islands created by in-lake disposal of muck and we recommend that a subset of the islands be measured periodically (every 4 to 5 years) for this determination. The total footprint of the 29 islands was 65.85 acres with a total volume of approximately 1.2 million cubic yards. Six months after water surrounded all islands, area estimates on 14 islands (Round 2) indicate that the footprints of the islands remained relatively stable. Because the Kissimmee airport GPS base station was destroyed during one of the hurricanes, accurate volume estimates were not obtained six months after water surrounded all of the islands.

Approximately 18 months after the initial areas, average heights and volumes were measured, 15 islands were measured again using GPS equipment. Similar to Round 2 measurements, Round 3 areas were similar to the initial areas measured in Round 1. The average percent difference between Round 1 and Round 3 areas was about 1% with one island (Island V) actually gaining approximately 12% in area and one (Island R) losing approximately 11% of the original area. The areas of five islands appear to have increased and 10 appeared to have decreased slightly. Eighteen months after initial measurements, all 15 islands measured in Round 3 showed decreases in average height and volume. The decreases in average height ranged from 6.7% to 42.9%, averaging 20.3%. While the maximum height of the islands in places are as high as originally measured, wind and wave action have eroded and collapsed the edges of the islands making the overall average height significantly less. The decreases in volume ranged from 5% to 44%, averaging 21% loss of material. There is no apparent pattern for determining which islands were more susceptible to erosion. For example, Island A is relatively close to shore in a protected area and it lost 42.9% of its volume, while Island Y is one of the farthest offshore and it only lost 18.9% of its volume. This suggests that the wind and wave patterns throughout the three hurricanes were probably quite erratic (Figure 1C).

It is important to point out that while volume estimates for Round 2 measurements six months after the lake filled are not available, visual examination of the islands strongly suggests that most of the volume lost to the islands happened immediately after the lake filled and the hurricanes passed over. Thus, the calculations of lost material provided in this report, 18 months after the lake filled should be considered the product of an extremely unusual event and may not be representative of the losses to be expected for future management activities of this type.

Task # 3. Impacts of oxidation and mineralization of organics.

Summary Deliverables for Task 3, Item 1 and 2

In March 2004, Mark Hoyer (UF Investigator) and Marty Mann (FWC Project Manager) toured Lake Tohopekaliga examining the materials that were going to be incorporated into islands. At that time it was agreed that the materials that were going to be incorporated into the islands were quite diverse around the whole lake. Thus, it was agreed that instead of taking six muck samples from only four islands (total of 24 samples), 3 samples would be taken from each of the 29 islands (total of 87 samples). This sampling procedure allowed for a better examination of nutrient content and potential impacts of oxidation and mineralization on materials in the islands. Approximately 18 months later three cores from 15 islands (total of 45 samples) were again collected. All cores were collected with a post-hole digger and they averaged approximately 25 inches.

Sediment cores taken from the top of the islands after initial construction show the percent organics (volatile solids) and carbon content of the islands constructed in Lake Tohopekaliga averaged 11.4% and 46 (mg/g) ranging from 6.4% to 24.3 % and 19 (mg/g) to 134 (mg/g), respectively (Table 20). The total nitrogen and total phosphorus concentrations of the islands constructed in Lake Tohopekaliga averaged 3.0 (mg/g) and 0.10 (mg/g) ranging from 1.6 (mg/g) to 7.6 (mg/g) and 0.05 (mg/g) to 0.23 (mg/g), respectively. These cores showed that the percent organics, carbon and nutrient content of the islands constructed in Lake Tohopekaliga are within the range reported for deep-water sediments of 97 lakes by Brenner and Binford (1987). However, the total phosphorus concentration of the muck used to create the islands was approximately 5 times less then the deep sediments measured for Lake Tohopekaliga in 1982.

This is probably the result of management efforts conducted to remove treated wastewater effluent that was entering the lake.

There was no significant difference in percent volatile solids, carbon content and total phosphorus concentration of sediment cores collected in 2004 and data collected 18 month later in 2006 from 15 corresponding islands. However, an analysis of variance did show that total nitrogen content of cores collected in 2004 (2.6 mg dry wt/g) was less than data collected 18 month later in 2006 (4.6 mg dry wt/g) from 15 corresponding islands. These results are somewhat surprising considering the tremendous rainfall that occurred during the three hurricanes that happened immediately after the islands were constructed (Figure 1C). On average the islands lost approximately 21% of their volume 18 month after they were created (Table 19) and because of this it would be expected that organic contents and nutrients would have been less because of weathering and leeching, however they were not. One possible explanation for this is that there was tremendous growth of terrestrial plants on the tops of the islands after they were constructed. This growth could have increased the content of organics and nitrogen in the shallow cores due to the expansion of root systems in the surface soils of the islands.

Using bulk density, percent wet weight, island volumes, and nutrient concentrations of the sediments listed in Tables 15 and 20, the initial amount of nutrients incorporated in all of the islands can be estimated. Approximately 75 metric tons of phosphorus and 2081 metric tons of nitrogen were bound in island material, which are approximately 3.1 and 6.5 times the estimated annual loads (James et al 1994), respectively. While the amount of nutrients incorporated in the islands exceeds the annual nutrient loads to Lake Tohopekaliga and on average the islands lost approximately 21% of their volume 18 month after they were created, analyses of water chemistry conducted for the deliverables of Task 1 suggest that these nutrients are not leaching out to the water column and impacting the overall water chemistry of the lake.

Task # 4. Pluses and minuses to fish populations.

Summary for Deliverables for Task 4, Item 1 through Item 4

Six electrofishing transects (10 minutes) were collected in late winter of 2002 and 2003 before the lake enhancement project and in 2004 and 2005 after the lake enhancement project. The six transects were collected at fixed stations, spaced uniformly around the lake, along the shore with the pedal down constantly for 10 minutes. The latitude and longitude of these transects were marked with global positioning system equipment (GPS) to insure constant sampling locations though time. All fish collected were placed in an aerated tank, and at the end of each transect large sportfish were quickly measured for total length (TL mm) and released. Small fishes were placed in bags on ice for later workup. All largemouth bass and black crappie, which are two major sportfish in Lake Tohopekaliga, were measured to the nearest mm. All other fishes were grouped by species in 2-cm size groups (1-20 mm, 21-40, 41-60, etc.) and the total number for each size group of each species was recorded for each individual transect. Weights of fish were calculated using regression equations from Hoyer and Canfield (1994) and from Schaeffer (Personal communication, Florida Fish and Wildlife Conservation Commission).

Total electrofishing catch per unit effort averaged 303 (fish/hr), 66.9 (kg/hr) and 206 (fish/hr), 66.0 (kg/hr) in 2002 and 2003, respectively (Tables 23 and Table 24). Total electrofishing catch per unit effort averaged only 36 (fish/hr), 11.1 (kg/hr) and 75 (fish/hr), 34.6 (kg/hr) in 2004 and 2005, respectively (Tables 23 and Table 24). The lower catch per unit effort in 2004 and 2005 was expected after the extreme drawdown because all fish were concentrated during the drawdown and many forage fish were probably consumed. Additionally, after reflooding a smaller total number of fish were spread throughout newly flooded areas without much habitat to concentrate fish making it more difficult to capture fish. Plotting our Lake Tohopekaliga data with other similar Florida data shows that while catch per unit effort from 2004 and 2005 is down, it still falls within the range of other lakes of similar trophic status.

Fish community measurements in Lake Tohopekaliga show that fish species richness is lower after the lake enhancement project was completed. In 2002 and 2003, prior to the drawdown and lake enhancement project electrofishing transects collected 20 and 15 species of fish, respectively (Tables 25). In 2004 and 2005, immediately after the enhancement project only 9 and 12 species of fish were captured, respectively. However, species diversity and evenness calculated with numbers (Table 25) or weights (Table 26) are similar across time suggesting that the major fish species, which are the primary sportfish in Lake Tohopekaliga, are present in a consistent percentage. Many of the fish species not collected in 2004 and 2005 are species (bluefin killifish *Lucania goodei*, dollar sunfish *Lepomis marginatus*, eastern mosquitofish *Gambusia holbrooki*, golden topminnow *Fundulus chrysotus*, redfin pickerel *Esox americanus americanus*, sailfin molly *Poecilia latipinna*, and warmouth *Lepomis gulosus*) that associate with submersed aquatic vegetation that was not abundant in 2004 and 2005 because of the enhancement project and colored water caused by the hurricanes of 2004. It is doubtful that these fish are no longer present in Lake Tohopekaliga but that the limited sampling just missed them in 2004 and 2005. However, we recommend continued sampling to keep track of the whole fish community in Lake Tohopekaliga.

Task # 5. Cost of muck removal per year (rate of muck accumulation in cleared areas and how often will muck have to be cleared to maintain good habitat).

Summary of Deliverables for Task 5, Item 1 and 2.

In January of 2005 and 2006, sediment cores were taken once at each of five stations around each of the 29 wildlife islands in order to determine the depth (cm) of the organic material on the lake bottom immediately after water filled the lake and one year later. The latitude and longitude of all sediment core stations were recorded using GPS equipment for future reference. The stations were labeled with a SC (Sediment Core), followed by the island letter, and ending with the sediment core station number (e.g. SCA1, sediment core for Island A at station 1) (Figure 48, Table 27). The cores were taken with a clear plastic tube one and a half inch in diameter that was pushed into the sediment, sealed and removed. The thickness of organic sediment above the sand base in the core was measured using a meter stick (Figure 49). Two cores (1 and 2 for each island) were taken behind each island between the island and the shoreline water interface. The remaining three cores (1, 2, and 3 for each island) were taken along a transect set perpendicular to the shoreline approximately 300 meters (m) away from each island, and were separated by approximately 15 m (Figure 48). Taking cores from behind Island P was not possible because trees surrounded the island on three of the inland sides. Therefore, those two cores were taken from the open-water side of the island.

The average thickness of organic matter in scraped areas after completion of the lake enhancement project was 1.6 cm and 2.2 cm in 2005 and 2006, respectively. Taking the estimated 6.5 million cubic meters of material removed and dividing by the estimated 14.2 million square meters of area scraped (Mann et al. 2004) yields an average depth of approximately 46 cm of organic matter before the lake enhancement project. Thus, organic matter in the areas that were scraped during the lake enhancement project was significantly reduced and there is now a good base measurement for future determination of how fast organic matter accumulates in Lake Tohopekaliga. There was a significant ($p \leq 0.05$) 0.6 cm increase in average organic sediment depth from 2005 to 2006. This suggests that in 2006 there may be more sediment in scraped areas, possibly due to the loss of island volumes and redistribution of material. The average increase in sediment thickness, however, was only 0.6 cm and this may be the result of sampling error because even with GPS positioning equipment it is impossible to take cores in exactly the same locations from year to year. While taking sediment cores it was apparent that there are small local differences in sediment thickness due to low areas caused by heavy equipment ruts left during the lake enhancement activities. We recommend that these same core locations be sampled every few years (4 to 5) to determine the rate that organic sediment is accumulating in scraped areas of Lake Tohopekaliga.

Task # 6. Impact of in-lake disposal on the mobilization of heavy metals and other chemicals.

In the proposal to evaluate the Lake Tohopekaliga enhancement project, Task # 6 was designed to evaluate possible mobilization of heavy metals and other chemicals. This Task was the responsibility of the Florida Fish and Wildlife Conservation Commission (Appendix IV). This information can be found in a different report entitled “Evaluation of Lake Tohopekaliga Habitat Enhancement Project: Baseline Studies on Accumulation of Trace Metals and Organochlorine Pesticides in Fish Tissue” written by Ted Lange and others of the Florida Fish and Wildlife Conservation Commission, Freshwater Fisheries Division.

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Introduction

Lake succession is a natural process whereby lakes begin filling in with organic and mineralized material as soon as they are formed. Lake succession, in many Florida lakes, is occurring faster than natural processes would account for, thus impairing lake usage and changing lake ecology. Cultural eutrophication, lake water level stabilization and accelerated growth of invasive native and exotic aquatic macrophytes are three primary factors that can result in accelerated rates of lake succession by operating individually or in combination. Lake Tohopekaliga is experiencing accelerated lake succession as a result of all three of these factors.

The first municipal point-source discharges to reach Lake Tohopekaliga began in the late 1950s and significant deterioration in water quality and aquatic habitat was evident by 1969. Annual phosphorus loading peaked in 1980 at 112,000 kg/yr (Williams 2001). In 1982, it was estimated that 42% to 48% (60,000 kg) of the total phosphorus load and 41% to 49% of the total nitrogen load entering Lake Tohopekaliga came from wastewater treatment plants (Jones et al. 1983). Since that time, lake management activities caused a steady decline in wastewater effluent reaching the lake, thus decreasing the wastewater treatment plant phosphorus discharge to Lake Tohopekaliga from 87,000 kg in 1981 to 1,500 kg in 1988 (Dierberg et al. 1988; Williams 2001). Prior to the clean up, however, culturally increased phosphorus concentrations in the lake caused increases in algal production, organic sedimentation and therefore lake succession.

For the period of record from 1942 to 1964, Lake Tohopekaliga fluctuated between 59.40 ft MSL and 48.93 ft MSL; a range of 10.47 vertical feet (United States Geological Survey, unpublished data, Figure 1). Construction of the lock and spillway (S-61) was completed in January 1964 and a reduced fluctuation range was implemented in 1964. From 1964 to 1970, the elevation of Lake Toho was controlled between 56.09 ft MSL to 51.35 ft MSL: a difference of 4.74 feet (Wegener and Williams 1974). The regulation schedule was further revised, reducing fluctuation to 3.0 ft vertical, a fluctuation range of 55.0 ft MSL to 52 ft MSL, with a 1 in 3 year drop to 51.5 ft MSL. It is hypothesized that during high water events, floating plant material and nutrient rich sediment were deposited on the normally dry floodplain where they remained when the water receded. Conversely, nutrient rich sediments were exposed to drying and oxidation during drought conditions. Both mechanisms, which functioned to reduce the accumulation of organic matter and create a diverse, dynamic, aquatic plant community in the littoral zone, were lost when water level fluctuation was reduced from approximately 10 ft to 3 ft.

When the range in water level fluctuation in a lake is limited, conditions are created that allow expansive monocultures of emergent aquatic vegetation to develop in the littoral zone (Hoyer and Canfield 1997). These conditions are also favorable for some submersed and floating leaved aquatic vegetation. Large increases in aquatic vegetation cause increases in accumulation of organic matter, especially from exotic aquatic plants like hydrilla *Hydrilla verticillata* and water hyacinth *Echhornia crassipes*, which can form large mats of submersed or floating vegetation. Expansive monocultures of native emergent vegetation, such as pickerelweed *Pontederia cordata* and cattails *Typha* spp. also produce tremendous amounts of leaf litter. Excessive amounts of organic matter are trapped in stem and root structures of emergent and floating leaved plants such as spatterdock *Nuphar luteum*. This process can create tussocks (floating plant islands with an organic base) when anaerobic gasses build up in the organic layer that accumulates on the bottom, causing it to break loose and float to the surface. The obvious expansion of tussocks in the littoral zone and the historical record of aquatic plants in Lake Tohopekaliga (Hurkey 1957; Wegener 1969; Florida Department of Environmental Protection, Bureau of Invasive Plant Management 1982 to 1995) supports this contention with the following trends: increases in native and non-native grasses, increases in lily species and increases in native and non-native submersed species.

Cultural eutrophication, lake water level stabilization and accelerated growth of invasive native and exotic aquatic macrophytes individually and in combination have contributed to the rapid expansion of tussocks and accumulated organic matter along the shoreline in Lake Tohopekaliga. Aerial photographs of Lake Tohopekaliga from 1944 through 1996 (Appendix I) show the dramatic increase in tussocks and accumulated organic matter along the shoreline. This rapid accumulation of organic matter greatly accelerated lake succession, threatening to decrease the life span of Lake Tohopekaliga. Degraded fish and wildlife habitat have occurred because those areas are devoid of oxygen, and access for citizens who wish to use these areas of Lake Tohopekaliga was decreased. Therefore, the Florida Fish and Wildlife Conservation Commission (FWC) initiated a project in the summer of 2004 by lowering the water level in Lake Tohopekaliga and removing the accumulated organic matter. Due to high costs required to transport this material long distances and lack of nearby disposal sites, some of this material was deposited in-lake, forming 29 islands (Figure 2 and Table 1).

The lake enhancement project was designed to meet the following objectives:

1) Offset lake succession in Lake Tohopekaliga that resulted from cultural eutrophication, water level stabilization, expansion of invasive aquatic macrophytes, and especially the accumulation of organic material from aquatic plant monocultures in the littoral zone.

2) Restore fish and wildlife habitat in Lake Tohopekaliga toward historic plant community characteristics and improve sportfishing opportunities for the citizens of Florida.

3) Improve lake access and aesthetics of Lake Tohopekaliga for the citizens of Florida who wish to enjoy and preserve Florida’s lake systems.

4) Manage the aquatic plant communities in Lake Tohopekaliga following the project to maintain long-term, quality, fish and wildlife habitat.

There were concerns about the impacts of in-lake disposal of organic matter on several aspects of the ecology of Lake Tohopekaliga. For this reason, the Department of Fisheries and Aquatic Sciences, University of Florida brought together professionals from the US Environmental Protection Agency, Florida Department of Environmental Protection, US Army Corps of Engineers, US Fish and Wildlife Service, South Florida Water Management District, FWC and University of Florida to identify and discuss the issues of concern (Appendix II).

After this meeting a research proposal (Appendix III) was agreed to and contracted between FWC and the University of Florida to address all of these issues of concern and a time line for deliverables and group responsibilities was established (Appendix IV). This final report summarizes the deliverables required by December, 2006.

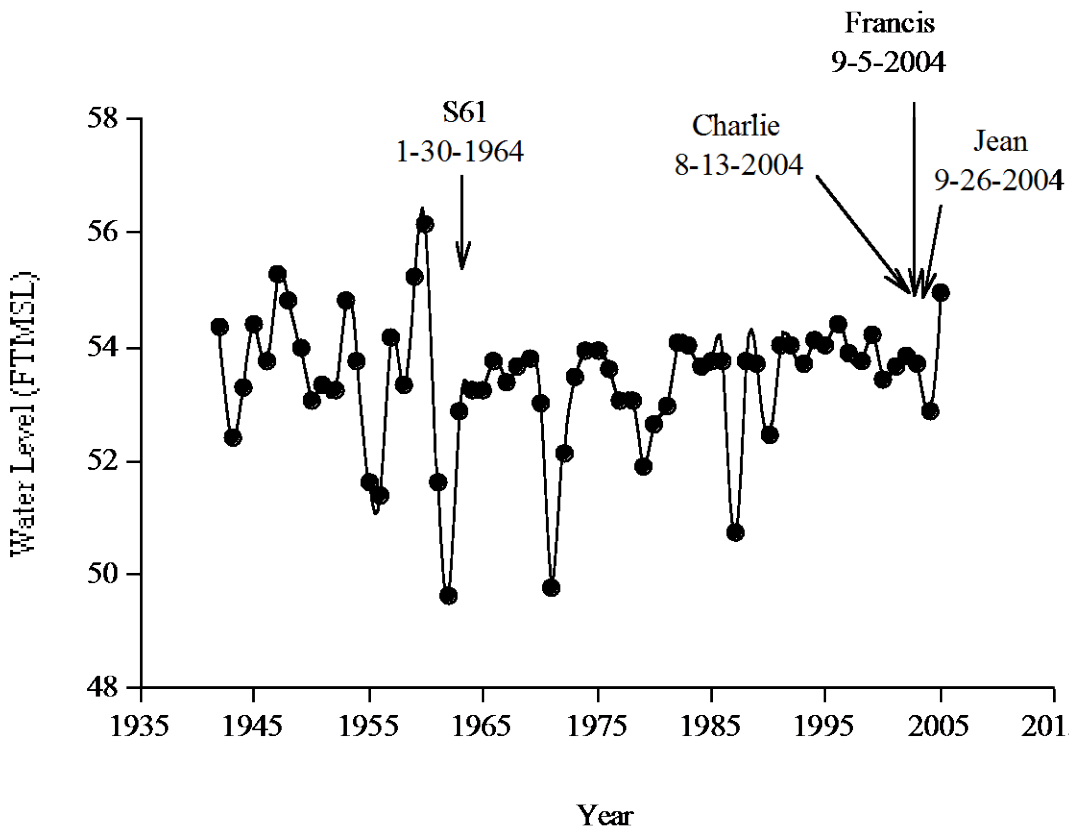


Figure 1A. Average annual water level for Lake Tohopekaliga from 1944 to present with the time of Hurricanes Charlie, Francis and Jean passing over the lake marked.

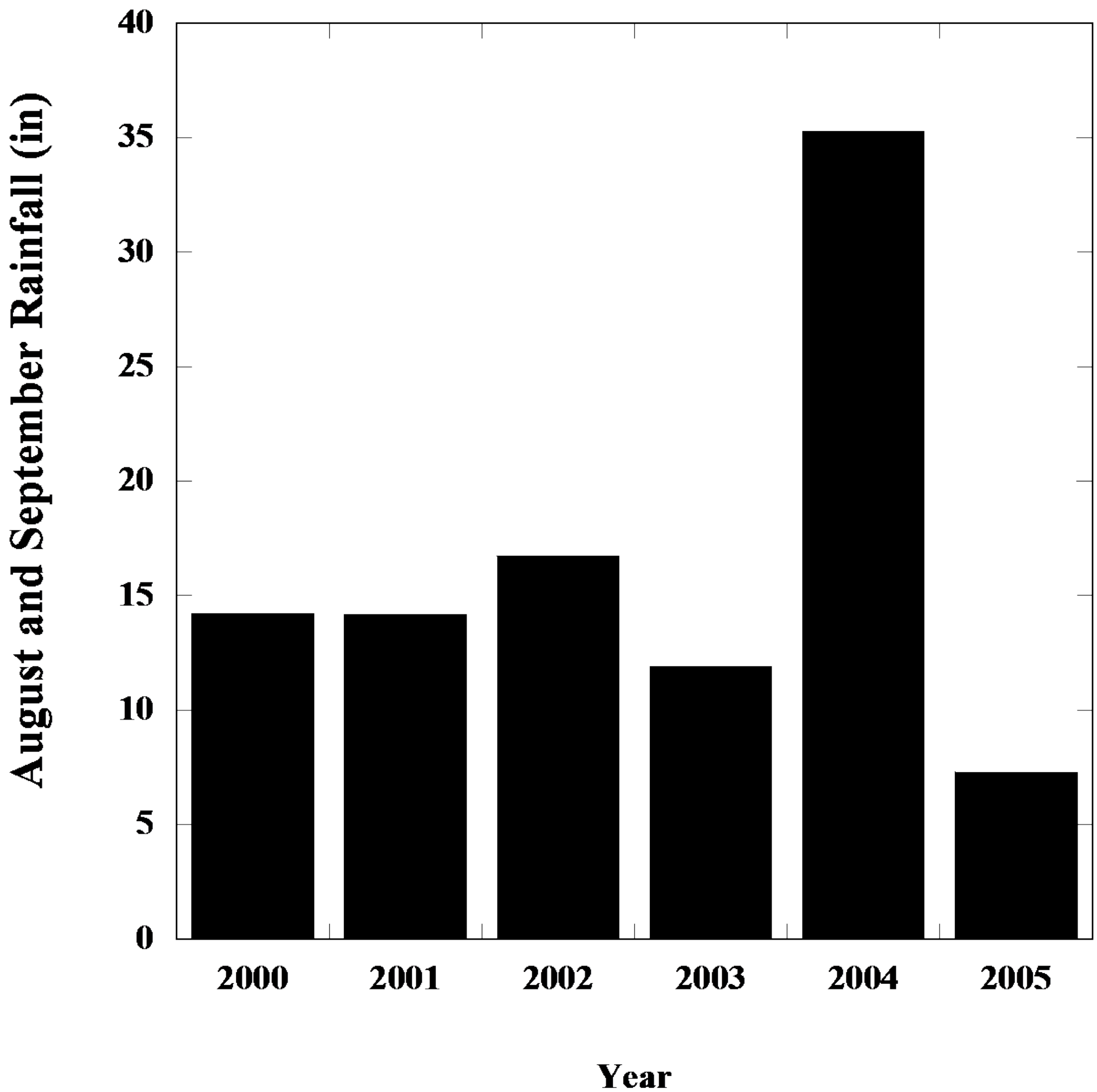


Figure 1B. The sum of all rainfall that fell in the months of August and September for years 2000 through 2005 at the South Florida Water management District's rain gauge located at the south side of Lake Tohopekaliga (S61-R).

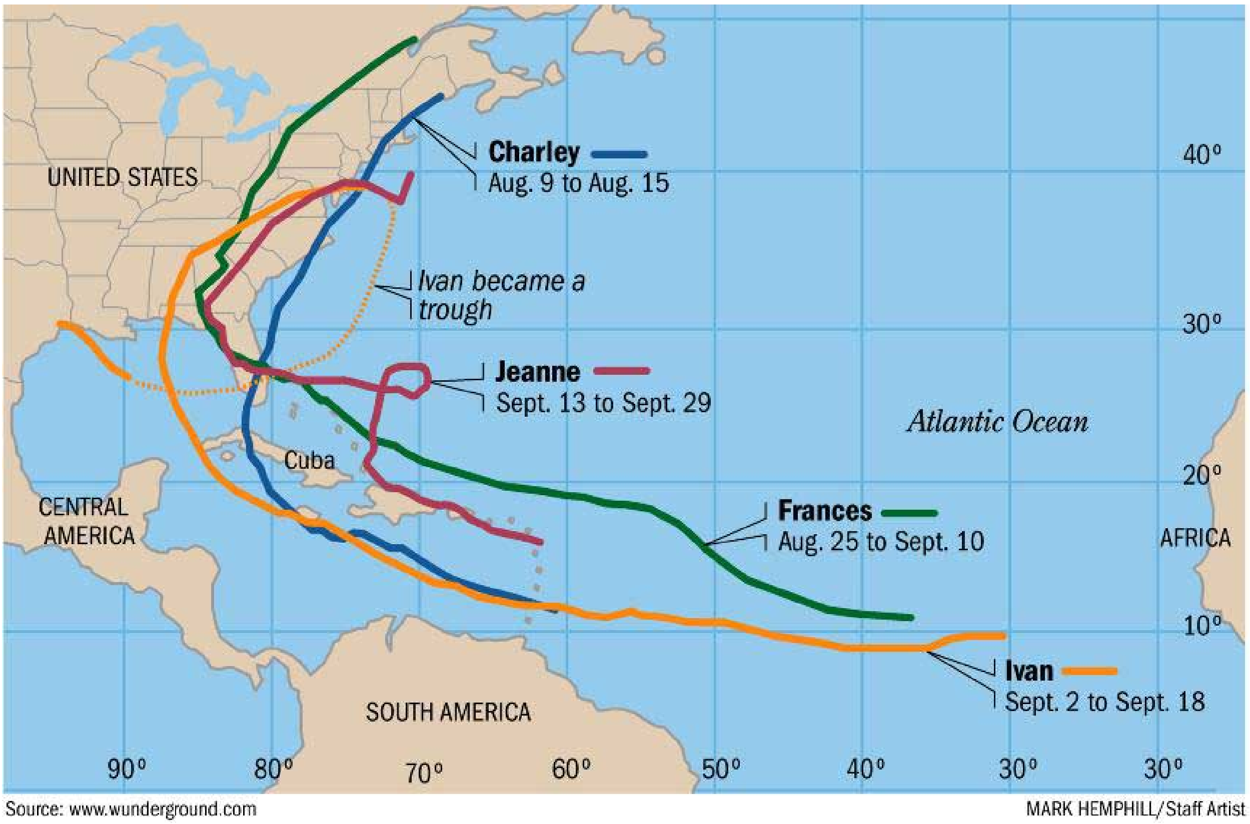


Figure 1C. Chart showing the times and paths of all major hurricanes that hit Florida in 2004.

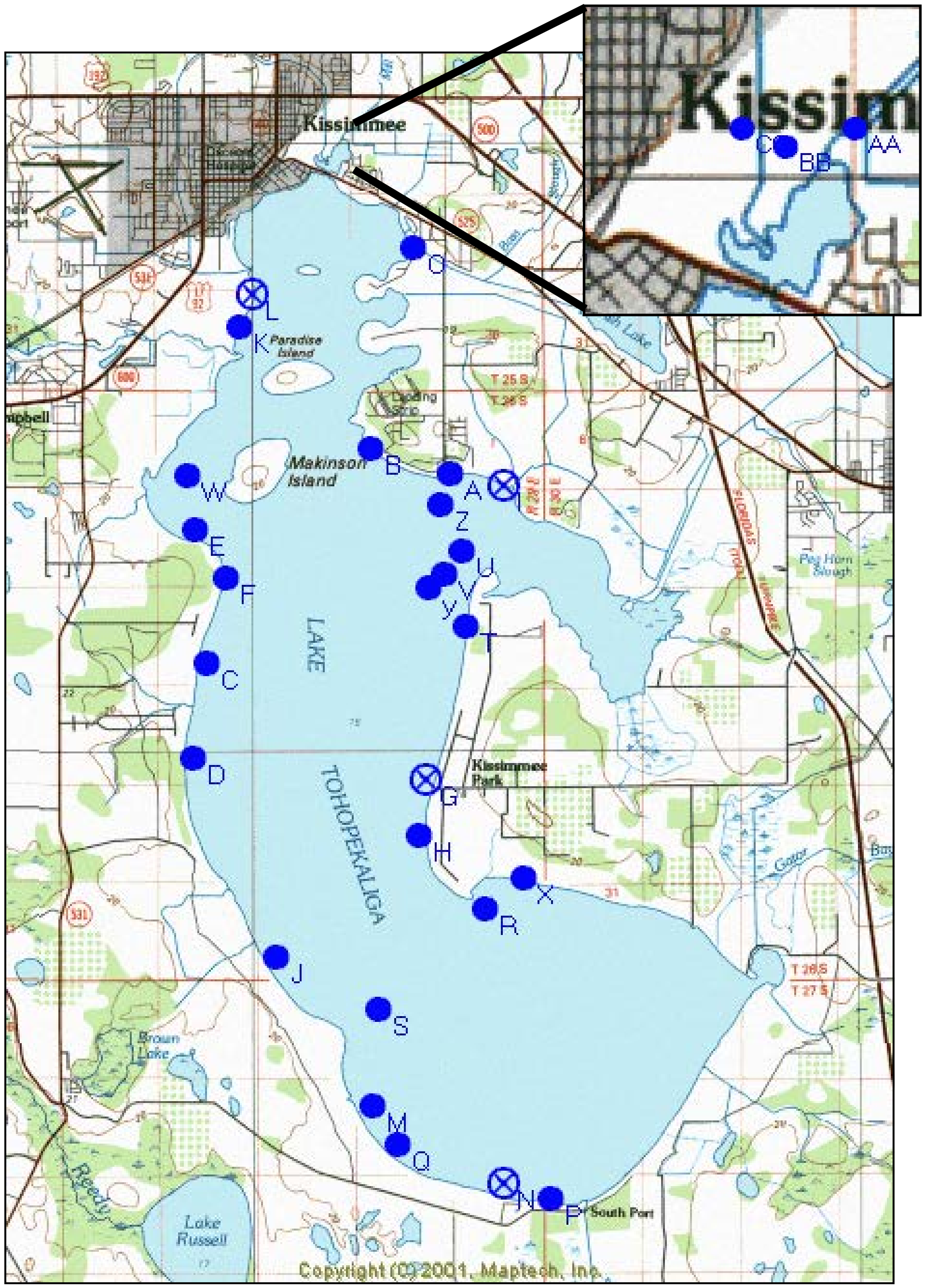


Figure 2. Location of 29 wildlife islands (●) created in Lake Tohopekaliga, Osceola County, Florida. The four wildlife islands with water sampling transects are designated with a circle encompassing an x (⊗).

Table 1. Location (Latitude and Longitude) of 29 wildlife islands constructed in the summer of 2004 in Lake Tohopekaliga, Osceola County, Florida.

Island	Latitude Degrees	Latitude Minutes	Latitude Seconds	Longitude Degrees	Longitude Minutes	Longitude Seconds
A	28	14	51.88	81	22	27.22
AA	28	17	55.45	81	23	28.56
B	28	15	5.44	81	23	15.88
BB	28	17	52.89	81	23	39.64
C	28	13	11.08	81	24	55.13
CC	28	17	55.65	81	23	46.72
D	28	12	19.36	81	25	3.29
E	28	14	22.84	81	25	1.85
F	28	13	56.38	81	24	43.31
G	28	12	8.56	81	22	42.82
H	28	11	38.14	81	22	46.31
I	28	14	45.88	81	21	55.03
J	28	10	33.29	81	24	13.19
K	28	16	10.85	81	24	35.27
L	28	16	28.05	81	24	27.71
M	28	9	12.48	81	23	15.80
N	28	8	32.10	81	21	56.40
O	28	16	53.31	81	22	49.66
P	28	8	23.52	81	21	26.40
Q	28	8	52.38	81	22	59.52
R	28	10	59.44	81	22	5.32
S	28	10	5.99	81	23	10.89
T	28	13	30.76	81	22	17.50
U	28	14	10.72	81	22	19.48
V	28	13	58.66	81	22	31.84
W	28	14	51.76	81	25	7.01
X	28	11	15.52	81	21	42.58
Y	28	13	51.58	81	22	41.14
Z	28	14	35.44	81	22	33.22

Deliverables

Deliverables for Task 1, Item 1 through Item 4 (Appendix IV):

Task #1. Nutrients and their potential impact on whole lake trophic status and general water chemistry.

1) January 1, 2003 to June 15, 2003. During this phase of Task #1 all historical data will be gathered and computerized for future analyses.
2) January 1, 2004 to June 30, 2004. UF shall hire a Senior Biological Scientist (Masters Level Biologist) to help coordinate the project. A graduate student will also be hired to help in all aspects of the project. Equipment and materials needed to accomplish the project will also be purchased during this phase of Task #1.
3) July 1, 2004 to June 30, 2005. UF shall begin sampling water chemistry monthly for three months when Lake Tohopekaliga refills to low pool stage (52 ft-msl). After initial 3 months of sampling, UF will continue to sample water chemistry quarterly.
4) July 1, 2005 to June 30, 2006. UF will continue quarterly sampling for water chemistry.

Task # 1, Item 1 through Item 4 have all been completed. There are two results sections for the analyses of water chemistry data. The first results section is for the analyses on data collected during the first three months of sampling and has already been provided in last year's annual report. The second results section is the analyses on all ten sampling events that occurred between August 2004 and June 2006. For potential future comparison all water chemistry data used in this report are listed in the last Appendix (Appendix VIII).

Methods

Islands L, I, G and N (Figure 3) were selected for short (3 months of monthly sampling) and long-term (2 years of quarterly sampling) examination of water chemistry impacts because they were the islands located closest to the long-term water chemistry monitoring stations set up by the South Florida Water Management District. At each of the four islands, 3 water chemistry sampling stations were selected along a transect 25 m, 75 m and 150 m from the water-island interface toward the main lake. These stations were identified with the individual island's letter and a station number 1, 2, and 3 corresponding to 25 m, 75 m, and 150 m, respectively (e.g., L1, L2, and L3). Approximately 400 meters to one side of each transect, 3 additional water chemistry sampling stations were selected along a parallel transect approximately the same distance out into the main lake. These stations were spaced the same distance apart along the transect and this transect was considered a control. The control stations were identified with the individual island letter, the letter C for control and station number 1, 2, and 3 corresponding to 25 m, 75 m, and 150 m of the island transect, respectively (e.g., LC1, LC2, and LC3). The latitude and longitude for these stations were recorded with Global positioning (GPS) equipment and are recorded in Table 2. In the early 1980s the South Florida Water Management District set up four long-term water chemistry monitoring stations (BO2, BO4, BO6, and BO9) in Lake Tohopekaliga (Figure 3 and Table 2). At the beginning of our sampling, these four stations were also sampled to examine potential whole lake changes that may have occurred after the Lake Tohopekaliga enhancement project.

Water sampling began in August 2004 when the water level in Lake Tohopekaliga reached low pool and water surrounded the islands. Surface water samples (approximately 0.5 m below surface) were collected at each station using 1-L acid-washed, triple rinsed Nalgene bottles. Water samples were placed on ice and transported within 24 hours to the Department of Fisheries and Aquatic Sciences water chemistry laboratory at the University of Florida for the analyses of total phosphorus (µg/L), total nitrogen (µg/L), chlorophyll (µg/L), pH, total alkalinity (mg/L as $CaCO_3$), color (Pt-Co units), and total, organic, and inorganic suspended solids (mg/L). At each station, Secchi depth (m) and water depth (m) was recorded and a Yellow Springs Instrument Model 35 conductance meter was used to measure dissolved oxygen (mg/L), temperature (C°), and specific conductance (µS/cm^2 @ 25 C°). The percent area covered (PAC %) with aquatic macrophytes was visually estimated in the immediate area around each station on the day sampling occurred.

Total phosphorus concentrations were determined using the procedures of Murphy and Riley (1962), with a persulfate digestion (Menzel and Corwin 1965). Total nitrogen concentrations were determined by oxidizing water samples with persulfate and determining nitrate-nitrogen with second derivative spectroscopy (D'Elia et al. 1977; Simal et al. 1985; Wollin 1987). Chlorophyll concentrations were determined spectrophotometrically (Method 10200 H; APHA 1998) following pigment extraction with ethanol (Sartory and Grobbelaar 1984). An Accument model 10 pH meter calibrated with buffers of pH 4.0 and 7.0 was used to measure pH. Total alkalinity concentrations were determined by titration with 0.02 N sulfuric acid (Method 2320 B; APHA 1998). Color was determined by spectroscopy (Bowling et al. 1986). Total suspended solids and organic and inorganic suspended solids were determined by filtration (Method 2540 D; Method 2540 E; APHA 1998) using Whatman 934-AH filters.

Figure 3. Location of experimental (O) and control (Δ) water quality transects and stations for the four selected wildlife islands (●), as well the four long-term water quality stations (⊗) (SFWMD) in Lake Tohopekaliga, Osceola County, Florida. The wildlife islands are designated by letters, experimental water quality stations are designated by an island letter plus the water quality station number, and the control water quality stations are designated by the island letter, followed by C (Control), and ending with the water quality station number.

Table 2. Latitude and Longitude for four wildlife islands selected for water quality sampling, and their associated water quality transects and stations in Lake Tohopekaliga, Osceola County, Florida. Islands are designated by letters, experimental water quality stations are designated by the island letter plus the water quality station number (1, 2, and 3) and control water quality stations are designated by the island letter, followed by C (Control), and ending with the water quality station number (1, 2, and 3). Also, latitude and longitude of the four long-term water quality monitoring stations set up by the South Florida Water Management District (BO2, BO4, BO6 and BO9)

Island/ Station	Latitude Degrees	Latitude Minutes	Latitude Seconds	Longitude Degrees	Longitude Minutes	Longitude Seconds
N	28	8	32.10	81	21	56.40
N1	28	8	35.78	81	21	56.02
N2	28	8	37.39	81	21	55.74
N3	28	8	39.76	81	21	55.47
NC1	28	8	38.12	81	22	6.46
NC2	28	8	39.69	81	22	6.18
NC3	28	8	42.10	81	22	5.63
L	28	16	28.05	81	24	27.71
L1	28	16	27.43	81	24	24.64
L2	28	16	27.40	81	24	22.82
L3	28	16	27.34	81	24	19.97
LC1	28	16	37.14	81	24	25.28
LC2	28	16	37.14	81	24	23.52
LC3	28	16	37.08	81	24	20.79
I	28	14	45.88	81	21	55.03
I1	28	14	44.42	81	21	56.12
I2	28	14	43.14	81	21	57.24
I3	28	14	41.15	81	21	58.85
IC1	28	14	47.96	81	22	8.88
IC2	28	14	46.61	81	22	10.04
IC3	28	14	44.62	81	22	11.77
G	28	12	8.56	81	22	42.82
G1	28	12	8.03	81	22	46.01
G2	28	12	7.99	81	22	47.75
G3	28	12	8.01	81	22	50.52
GC1	28	12	17.74	81	22	45.87
GC2	28	12	17.98	81	22	47.75
GC3	28	12	18.03	81	22	50.45
BO2	28	15	53.01	81	23	34.22
BO4	28	14	32.11	81	22	4.09
BO6	28	12	3.68	81	23	46.86
BO9	28	9	23.85	81	21	44.22

Statistical Procedures

For Results Section 1 (first three months of sampling) statistical computations were performed using various procedures in the JMP statistical package (SAS Institute Inc. 2000). Analysis of variance was used to determine if there were differences in water chemistry among islands, and between the water chemistry measured along the control transects and the island transects for the first three months of repeated sampling at fixed locations. The three months of water chemistry sampling we completed at the four SFWMD long-term monitoring stations were plotted with the last five years of data SFWMD collected prior to the enhancement project. This was done to determine if the water chemistry collected immediately after the enhancement project fell outside of the 95% confidence limits measured during the five years immediately prior to the enhancement project.

For Results Section 2 (all months of sampling) statistical computations were performed using various procedures in the JMP statistical package (SAS Institute Inc. 2000). Analysis of variance was used to determine if there were differences in water chemistry among islands, and between the water chemistry measured along the control transects and the island transects for all ten dates of repeated sampling at fixed locations. The ten dates of water chemistry sampling we completed at the four SFWMD long-term monitoring stations were also plotted with the last eight years of data SFWMD collected prior to the enhancement project. This was done to determine if the water chemistry collected after the enhancement project fell outside of the 95% confidence limits measured during the eight years prior to the enhancement project. Because analyses conducted in Results Section 1 indicated that Island L data were differentially impacted by water input from Shingle Creek, only data from Islands I, G, and N were used in Results Section 2.

Results Section 1 for Color (Pt-Co units)

Statistics for color measurements taken at each transect station are summarized in Table 3. Examining the following analysis of variance for color as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that area, treatment, area*treatment, and month all show significant effects ($p \leq 0.05$). However, examining the least squares mean table from a Tukey multiple comparison test shows that the only island transect that was significantly different from the control transect was island L. Figure 4 and Table 3 show that mean color measurements at the island transect ranged from 226 to 245 Pt-Co units, while color at the control transect ranged only from 123 to 154 Pt-Co units.

Analysis of Variance for Log 10 Color using data from all 4 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	3	3	0.74305916	19.6152	<.0001
Treatment	1	1	0.11288334	8.9396	0.0040
Treatment*Area	3	3	0.18278327	4.8251	0.0045
Month	2	2	0.35248001	13.9571	<.0001
Month*Treatment	2	2	0.02173945	0.8608	0.4280

LSMeans Differences Tukey HSD Alpha=0.050

Transect				Least Sq Mean
Island,Island L	A			2.3728578
Control,Island L		B		2.1457836
Island,Island N		B		2.1440036
Control,Island G		B	C	2.0570824
Control,Island N		B	C	2.0499570
Island,Island I		B	C	2.0191771
Island,Island G		B	C	2.0034914
Control,Island I			C	1.9699409

Levels not connected by same letter are significantly different.

Table 3. Color (Pt-Co Units) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	105	58	134	24
Island G	G2	110	58	136	26
Island G	G3	110	55	138	28
Control	GC1	141	112	180	20
Control	GC2	111	58	139	26
Control	GC3	112	58	145	27
	G Area Statistics	115	105	141	5
Island I	I1	123	108	141	10
Island I	I2	106	66	133	21
Island I	I3	97	58	120	19
Control	IC1	97	65	124	17
Control	IC2	99	66	123	17
Control	IC3	96	55	123	21
	I Area Statistics	103	96	123	4
Island L	L1	226	198	267	21
Island L	L2	245	223	260	11
Island L	L3	240	217	255	12
Control	LC1	123	102	151	15
Control	LC2	151	123	193	21
Control	LC3	154	134	176	12
	L Area Statistics	190	123	245	22
Island N	N1	168	142	219	25
Island N	N2	145	133	162	9
Island N	N3	117	81	140	18
Control	NC1	122	110	144	11
Control	NC2	117	86	141	16
Control	NC3	110	58	139	26
	N Area Statistics	130	110	168	9

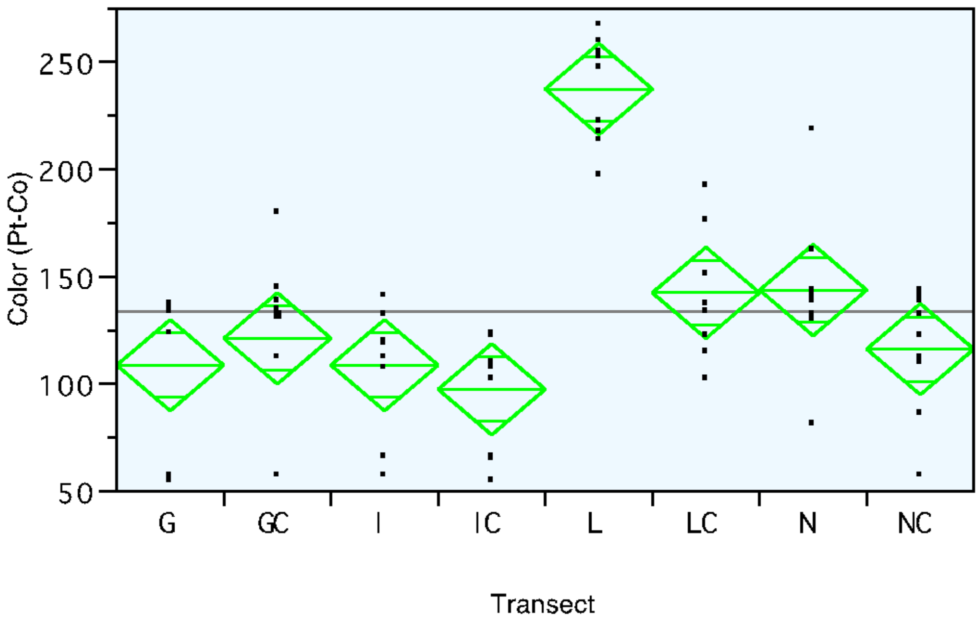


Figure 4. Plot of color values collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

The above analyses suggest that Island L may be impacting the water chemistry by leaching organic color to the surrounding water. However, extremely high colored water (>200 Pt-Co units) is also indicative of freshwater inputs from surrounding swampland. The difference between the L island transect and the control transect also appears with several other water chemistry variables including total phosphorus (Table 5) and chlorophyll (Table 7). Total phosphorus concentrations in the Island L transect averaged 141 µg/L and in the corresponding control transect total phosphorus averaged 204 µg/L. Chlorophyll concentrations in the Island L transect averaged 25 µg/L and in the corresponding control transect chlorophyll averaged 42 µg/L. In both cases the island transect has lower phosphorus and chlorophyll concentrations than the control transect which is the exact opposite of what would be expected if the islands were leaching nutrients to the surrounding waters. Looking at the location of Island L in Figure 2 and Figure 3 it is obvious that the Island L transect is much closer to potential water inputs from Shingle Creek in the northwest part of Lake Tohopekaliga than the control transect. Therefore, we suggest that the selection of Island L and the corresponding control transects was unfortunately inadequate to test for effects of island location on the water chemistry of surrounding waters due to the overshadowing effect from Shingle Creek water inputs. To confirm this hypothesis, seven stations were located perpendicular to shingle creek inputs and on April 25, 2005 temperature, specific conductance, and color were measured (Figure 5, and Table

4). Color was the highest in the mouth of Shingle creek (Station SC5, Figure 5 and Table 4) decreasing in both the north and south directions. Temperature and specific conductance were both lowest in the mouth of Shingle creek increasing in both the north and south directions. These data confirm that the L island transect and the control transect are being differentially impacted by Shingle Creek inputs and are not suited for testing the possible impacts of Island L on surrounding water chemistry. Thus, all further analysis of variance examining potential impacts of islands on surrounding water chemistry were conducted using only the combined data from Islands I, G, and N. It was also recommended that future sampling of Island L stations be discontinued because these data will not be useful in determining if the islands are impacting water chemistry of surrounding water.

Figure 5. Location of samples taken to examine potential effects Shingle Creek may have on water chemistry around Island L and the control transect north of Island L.

Table 4. Temperature, specific conductance and color measured at seven stations April 25, 2005 to examine potential effects Shingle Creek may have on water chemistry around Island L and the control transect north of Island L.

Station	Temperature (C)	Conductance (µS/cm @ 25 C)	Color (Pt-Co Units)
SC1	24.7	198	86
SC2	23.2	186	149
SC3	23.2	185	153
SC4	22.8	184	174
SC5	21.5	170	215
SC6	24.0	176	165
SC7	24.5	178	168

Removing Island L data and examining the following analysis of variance for color as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables indicate that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting the color in the surrounding waters of Lake Tohopekaliga.

Analysis of Variance for Log 10 Color using data from only 3 islands

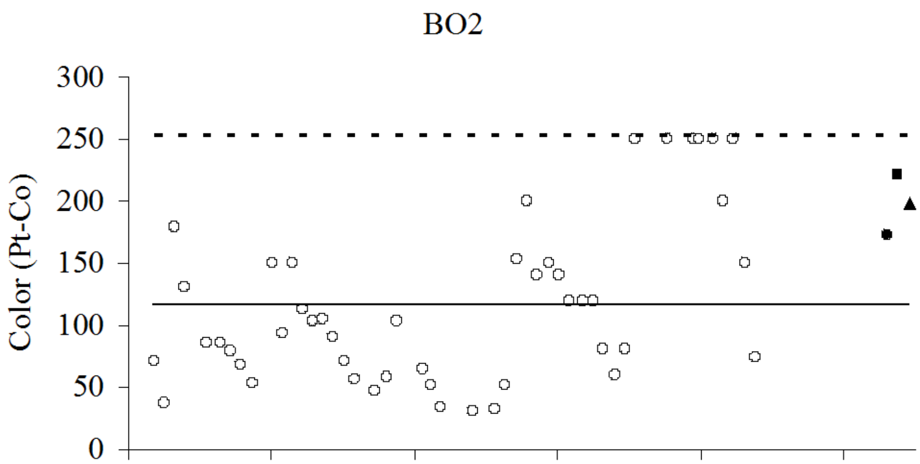
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	0.09728765	4.0637	0.0240
Treatment	1	1	0.01206694	1.0081	0.3209
Treatment*Area	2	2	0.05156746	2.1540	0.1281
Month	2	2	0.51980301	21.7124	<.0001
Month*Treatment	2	2	0.00746356	0.3118	0.7338

LSMeans Differences Tukey HSD Alpha=0.050

Transect			Least Sq Mean
Island,Island N	A		2.1440036
Control,Island G	A	B	2.0570824
Control,Island N	A	B	2.0499570
Island,Island I	A	B	2.0191771
Island,Island G	A	B	2.0034914
Control,Island I		B	1.9699409

Levels not connected by same letter are significantly different

The color values measured during the first three months of sampling at the four long-term water chemistry monitoring stations show that some of the measurements exceed the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 6). This is to be expected because of the rapid increase in water level caused by large amounts of rain (35 inches, Figure 1B) delivered by Hurricanes Charlie, Francis and Jeanne that crossed over Lake Tohopekaliga in August and September of 2004 (Figure 1C). This rainfall probably brought with it large amounts of color from surrounding areas. Continued monitoring of these stations will be needed to determine if this is a long-term change in the water chemistry of Lake Tohopekaliga.



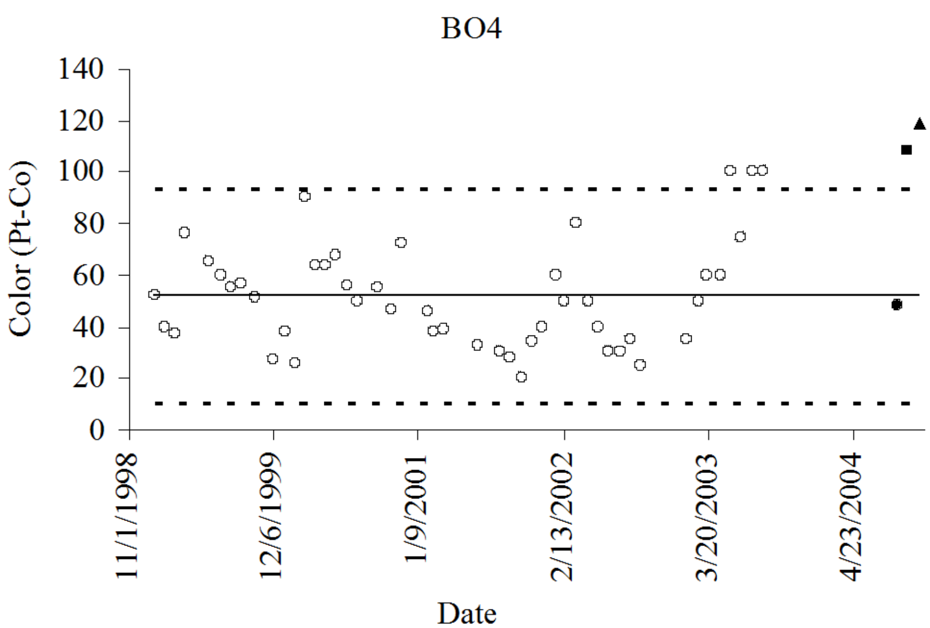


Figure 6. Relationship between date and color data collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

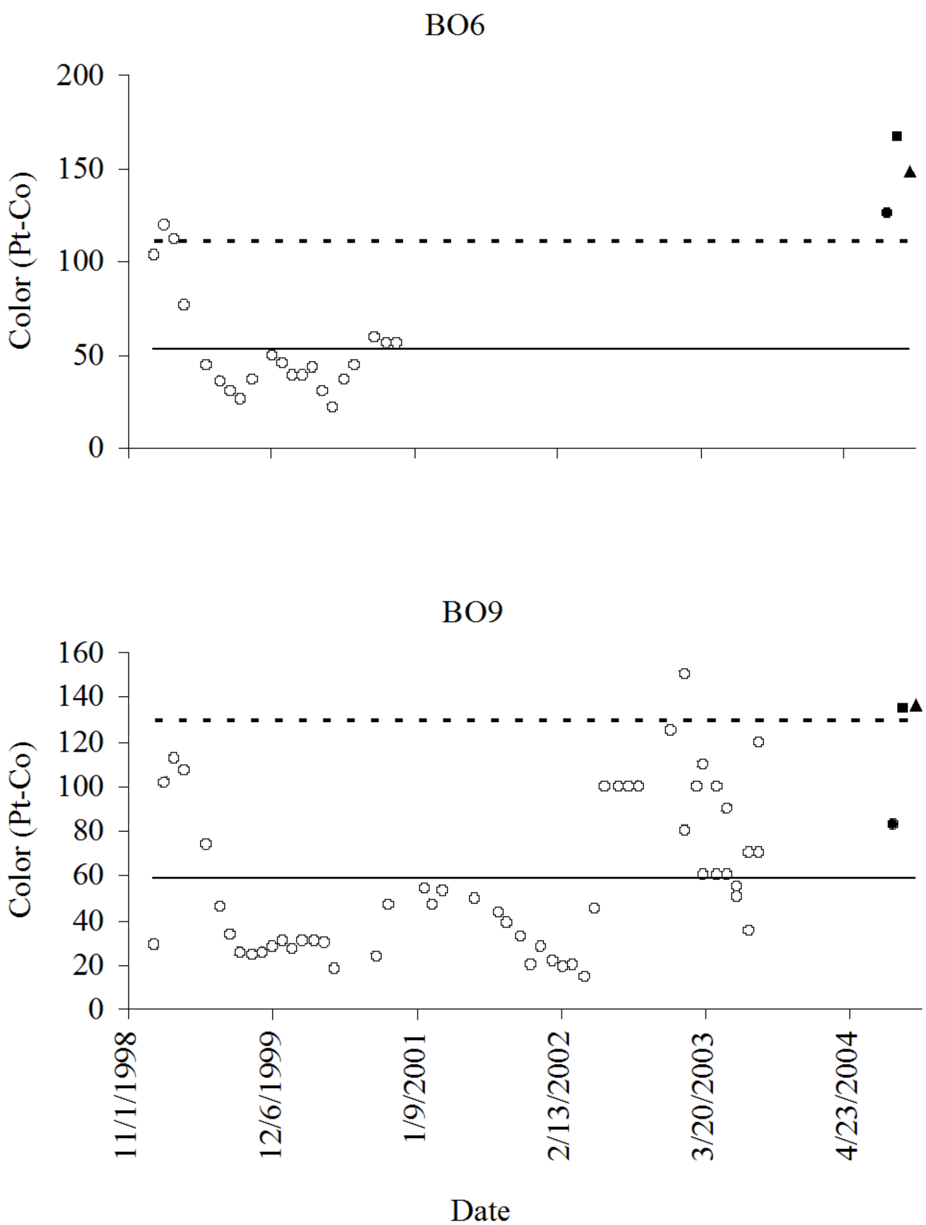


Figure 6 continued. Relationship between date and color data collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Total Phosphorus (µg/L)

Statistics for total phosphorus measurements taken at each transect and station are summarized in Table 5. Removing Island L data for reasons mentioned above and examining the following analysis of variance for total phosphorus as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting total phosphorus concentrations in the surrounding waters of Lake Tohopekaliga. Figure 7 and the least squares mean table from a Tukey multiple comparison test below show that total phosphorus concentrations in Lake Tohopekaliga vary within the lake but that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 Total Phosphorus using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	1.2738251	42.8385	<.0001
Treatment	1	1	0.0193908	1.3042	0.2596
Treatment*Area	2	2	0.0230423	0.7749	0.4669
Month	2	2	0.1042640	3.5064	0.0386
Month*Treatment	2	2	0.0975335	3.2800	0.0570

LSMeans Differences Tukey HSD Alpha=0.050

Level				Least Sq Mean
Island,Island N	A			2.0744102
Control,Island N	A	B		1.9862443
Control,Island G		B		1.8785275
Island,Island G		B		1.8655020
Island,Island I			C	1.6748911
Control,Island I			C	1.6363335

Levels not connected by same letter are significantly different

The total phosphorus concentrations measured during the first three months of sampling at the four long-term water chemistry monitoring stations show that some of the measurements exceed the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 8). This is to be expected because of the rapid increase in water level caused by large amounts of rain (35 inches, Figure 1B) delivered by Hurricanes Charlie, Francis and Jeanne. This rainfall probably brought with it large amounts of nutrients from surrounding areas. The newly scraped areas also had finely ground sediments that likely released their nutrients into the water as the lake filled. Continued monitoring of these stations will be needed to determine if this is a long-term change in the water chemistry of Lake Tohopekaliga.

Table 5. Total Phosphorus (µg/L) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	82	66	99	10
Island G	G2	74	58	90	9
Island G	G3	69	45	87	12
Control	GC1	95	72	133	19
Control	GC2	73	52	87	11
Control	GC3	68	47	86	11
	G Area Statistics	77	68	95	4
Island I	I1	61	40	72	11
Island I	I2	49	21	70	15
Island I	I3	41	35	50	4
Control	IC1	45	45	46	0
Control	IC2	44	42	48	2
Control	IC3	41	32	48	5
	I Area Statistics	47	41	61	3
Island L	L1	137	80	210	38
Island L	L2	141	82	221	41
Island L	L3	144	84	231	45
Control	LC1	192	87	369	89
Control	LC2	192	104	350	79
Control	LC3	227	81	338	76
	L Area Statistics	172	137	227	15
Island N	N1	152	105	217	34
Island N	N2	119	96	157	19
Island N	N3	100	90	119	10
Control	NC1	101	56	129	23
Control	NC2	117	104	130	8
Control	NC3	89	46	125	23
	N Area Statistics	113	89	152	9

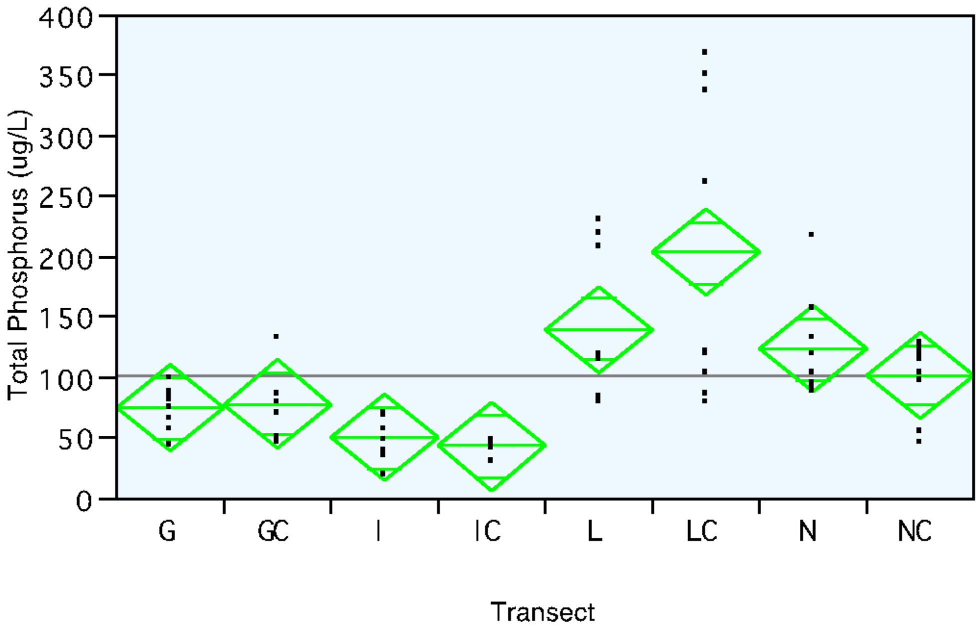


Figure 7. Plot of total phosphorus concentrations collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

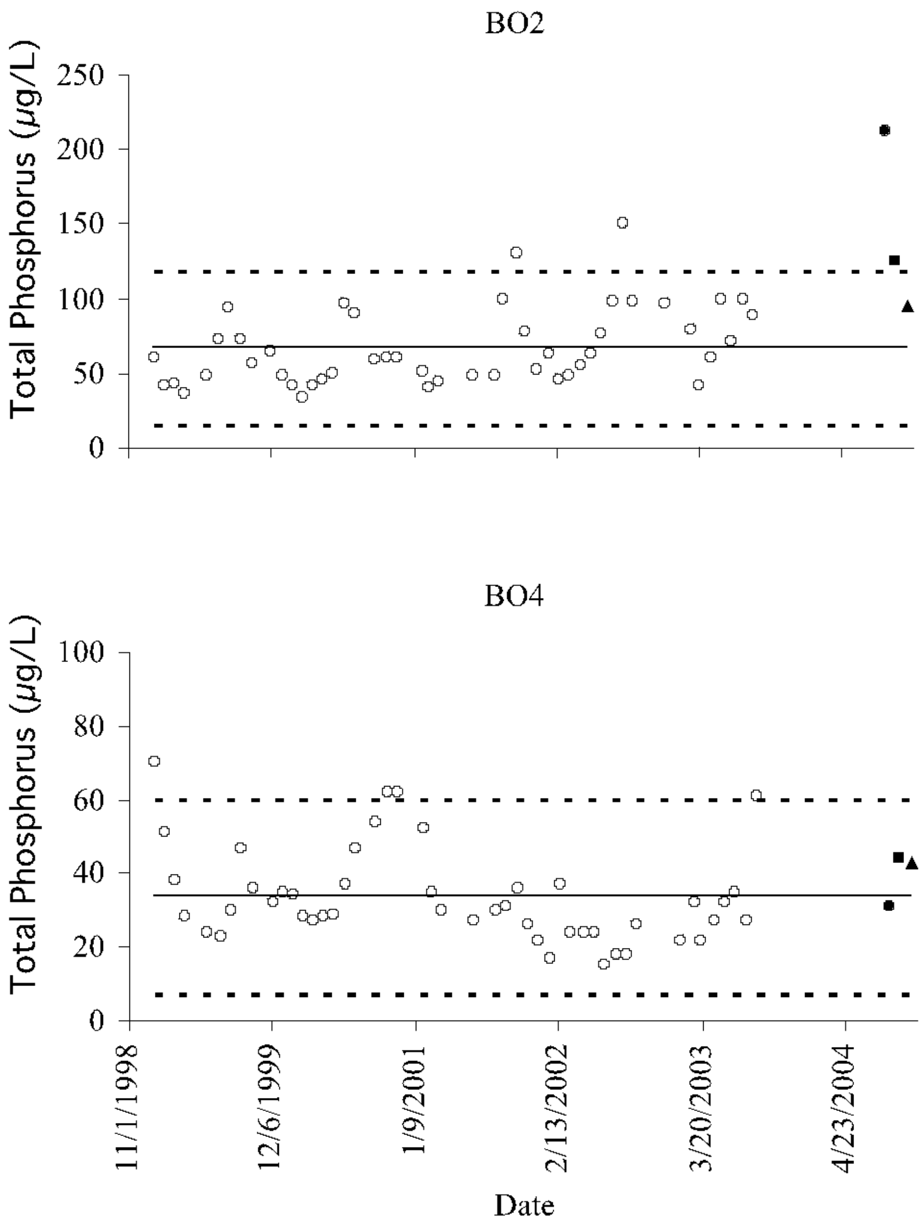
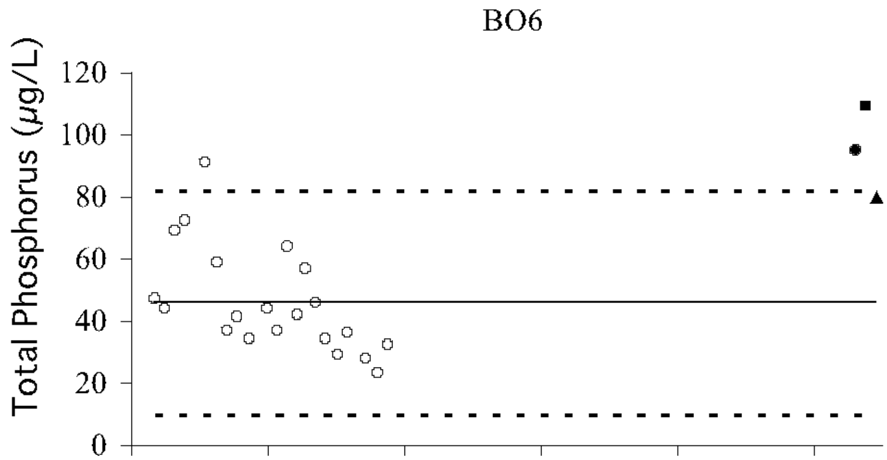


Figure 8. Relationship between date and total phosphorus concentration collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.



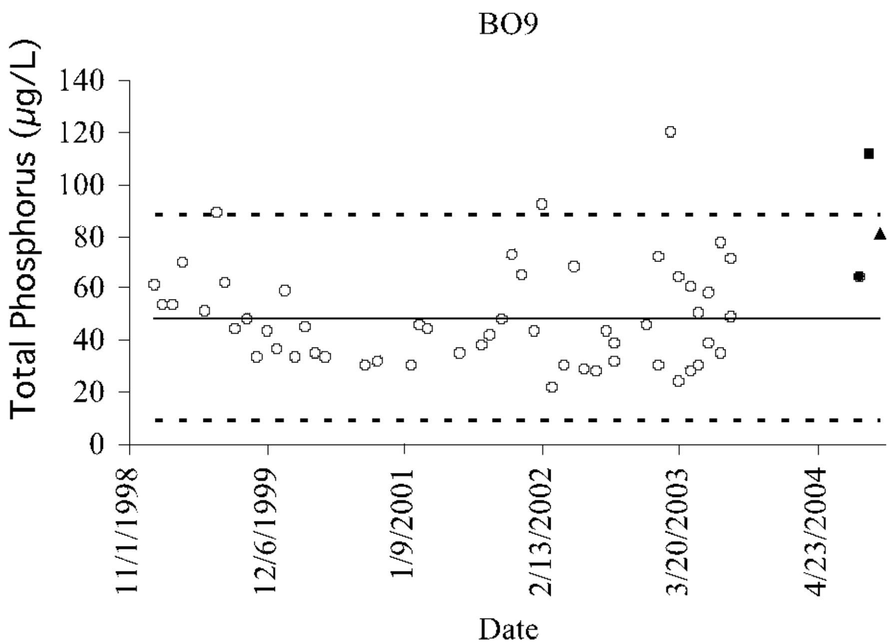


Figure 8 continued. Relationship between date and total phosphorus concentration collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Total Nitrogen (μg/L)

Statistics for total nitrogen measurements taken at each transect and station are summarized in Table 6. Removing Island L data for reasons mentioned above and examining the following analysis of variance for total nitrogen as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting the total nitrogen in the surrounding waters of Lake Tohopekaliga. Figure 9 and the least squares mean table from a Tukey multiple comparison test below show that total nitrogen concentrations in Lake Tohopekaliga vary within the lake but that the island transect and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 Total Nitrogen using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	0.56686421	81.4998	<.0001
Treatment	1	1	0.00766128	2.2030	0.1449
Treatment*Area	2	2	0.00462106	0.6644	0.5197
Month	2	2	0.04292491	6.1714	0.0043
Month*Treatment	2	2	0.03543526	5.0946	0.0602

LSMeans Differences Tukey HSD Alpha=0.050

Level				Least Sq Mean
Island,Island N	A			3.1867152
Control,Island N	A			3.1542143
Control,Island G		B		3.0395128
Island,Island G		B		3.0376191
Island,Island I			C	2.9400378
Control,Island I			C	2.8991782

Levels not connected by same letter are significantly different

The total nitrogen concentrations measured during the first three months of sampling at the four long-term water chemistry monitoring stations show that all of the measurements fall within the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 10). These data suggest that the lake enhancement project did not change the whole lake total nitrogen concentration significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if the lake enhancement activities will impact the future water chemistry of Lake Tohopekaliga.

Table 6. Total nitrogen (µg/L) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	1190	930	1330	130
Island G	G2	1077	880	1220	102
Island G	G3	1040	910	1150	70
Control	GC1	1093	950	1190	73
Control	GC2	1113	1030	1210	52
Control	GC3	1097	920	1280	104
	G Area Statistics	1102	1040	1190	20
Island I	I1	970	800	1150	101
Island I	I2	910	800	1130	110
Island I	I3	773	650	880	67
Control	IC1	827	790	870	23
Control	IC2	797	760	840	23
Control	IC3	763	650	870	64
	I Area Statistics	840	763	970	34
Island L	L1	1293	1000	1770	240
Island L	L2	1380	1060	1920	272
Island L	L3	1347	1050	1850	253
Control	LC1	1120	940	1310	107
Control	LC2	1143	1020	1340	99
Control	LC3	1263	940	1460	163
	L Area Statistics	1258	1120	1380	43
Island N	N1	1770	1330	2250	266
Island N	N2	1527	1180	2010	249
Island N	N3	1427	1140	1620	146
Control	NC1	1523	1300	1650	112
Control	NC2	1460	1300	1580	83
Control	NC3	1337	1120	1670	169
	N Area Statistics	1507	1337	1770	60

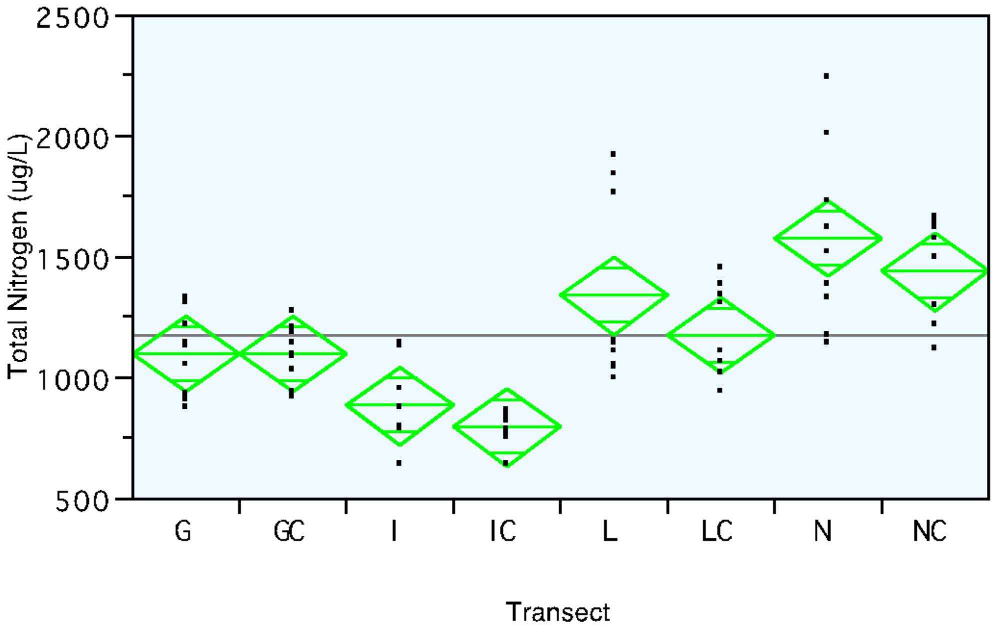


Figure 9. Plot of total nitrogen concentrations collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

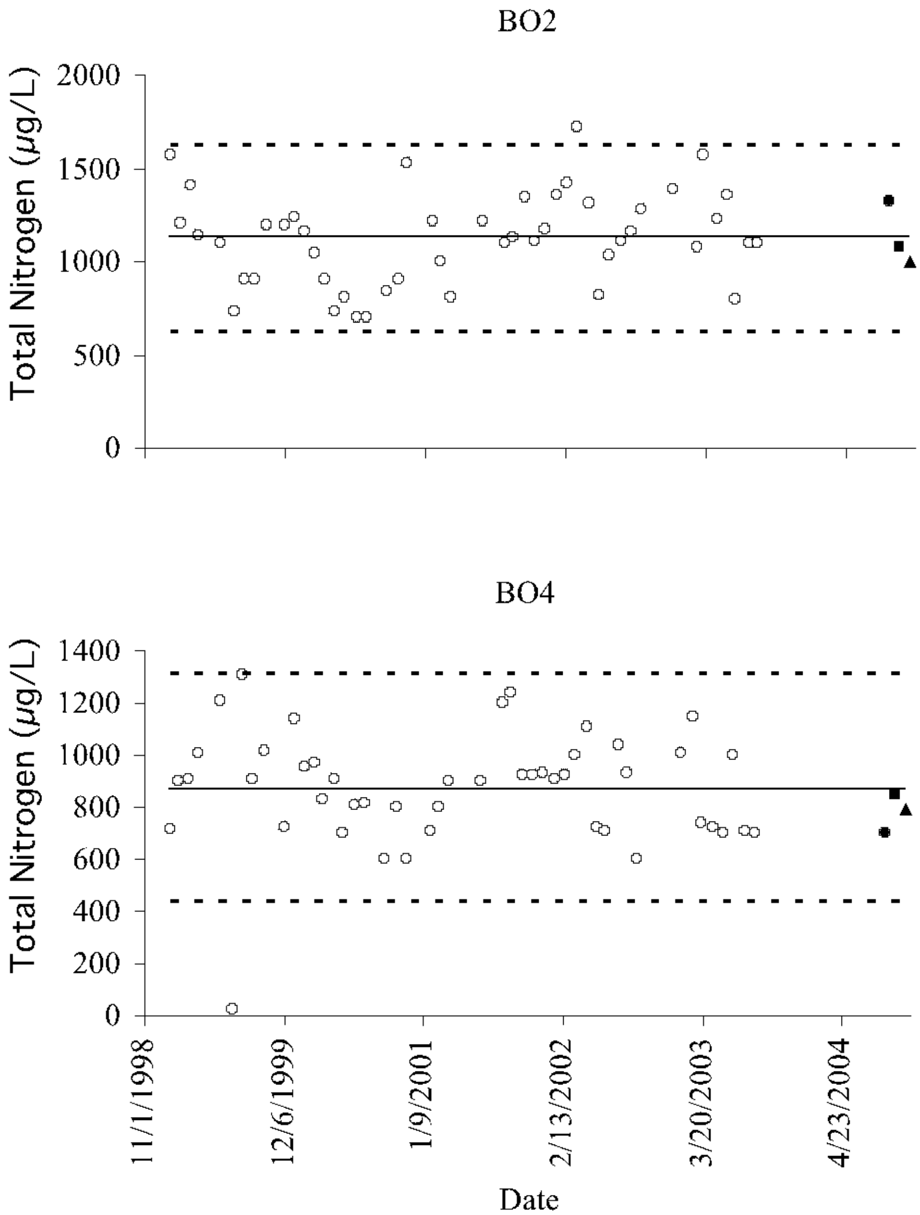


Figure 10. Relationship between date and total nitrogen concentration collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

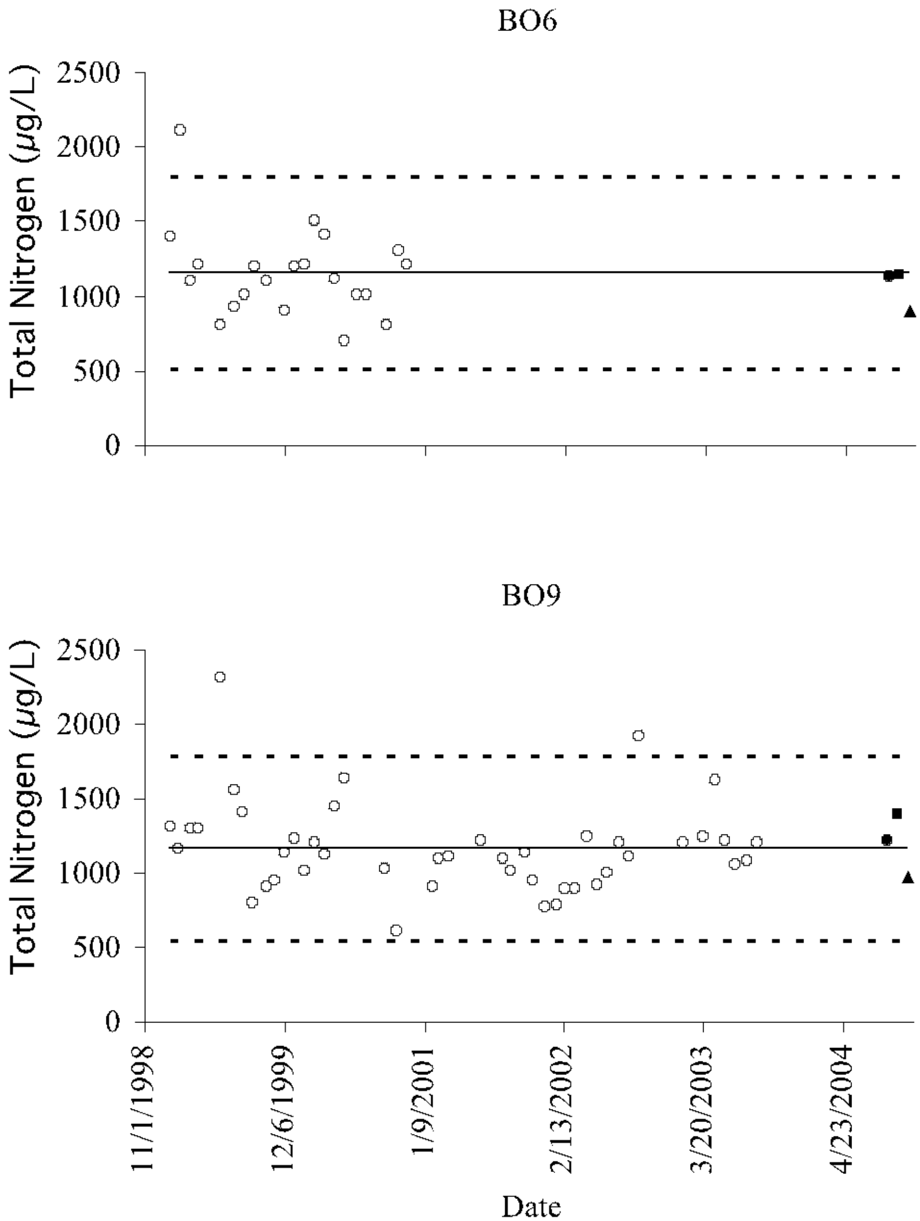


Figure 10 continued. Relationship between date and total nitrogen concentration collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Chlorophyll (µg/L)

Statistics for chlorophyll concentrations taken at each transect and station are summarized in Table 7. Removing Island L data for reasons mentioned above and examining the following analysis of variance for chlorophyll as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting chlorophyll concentrations in the surrounding waters of Lake Tohopekaliga. Figure 11 and the least squares mean table from a Tukey multiple comparison test below show that chlorophyll concentrations vary within Lake Tohopekaliga but that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 Chlorophyll using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	2.4080240	55.2059	<.0001
Treatment	1	1	0.0025670	0.1177	0.7332
Treatment*Area	2	2	0.0024950	0.0572	0.9445
Month	2	2	0.1427888	3.2735	0.0473
Month*Treatment	2	2	0.0159622	0.3659	0.6956

LSMeans Differences Tukey HSD Alpha=0.050

Transect				Least Sq Mean
Island,Island N	A			1.7541568
Control,Island N	A			1.7357975
Control,Island G		B		1.4924774
Island,Island G		B		1.4878093
Island,Island I			C	1.2415740
Control,Island I			C	1.2138966

Levels not connected by same letter are significantly different

The chlorophyll concentrations measured during the first three months of sampling at the four long-term water chemistry monitoring stations show that only two of the measurements exceed the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 12). These data suggest that the lake enhancement project did not change the whole lake chlorophyll concentrations significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if there is a long-term change in the water chemistry of Lake Tohopekaliga.

Table 7. Chlorophyll (µg/L) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	40	30	52	7
Island G	G2	33	23	51	9
Island G	G3	26	18	36	6
Control	GC1	44	31	58	8
Control	GC2	29	22	43	7
Control	GC3	27	19	40	7
	G Area Statistics	33	26	44	3
Island I	I1	20	17	23	2
Island I	I2	18	14	23	3
Island I	I3	16	13	22	3
Control	IC1	17	15	21	2
Control	IC2	19	14	23	3
Control	IC3	14	12	19	2
	I Area Statistics	17	14	20	1
Island L	L1	25	5	37	10
Island L	L2	22	5	34	9
Island L	L3	29	5	56	15
Control	LC1	40	11	65	16
Control	LC2	37	12	55	13
Control	LC3	50	10	72	20
	L Area Statistics	34	22	50	4
Island N	N1	83	61	113	16
Island N	N2	48	43	56	4
Island N	N3	50	39	70	10
Control	NC1	79	70	90	6
Control	NC2	60	53	64	3
Control	NC3	37	20	51	9
	N Area Statistics	59	37	83	7

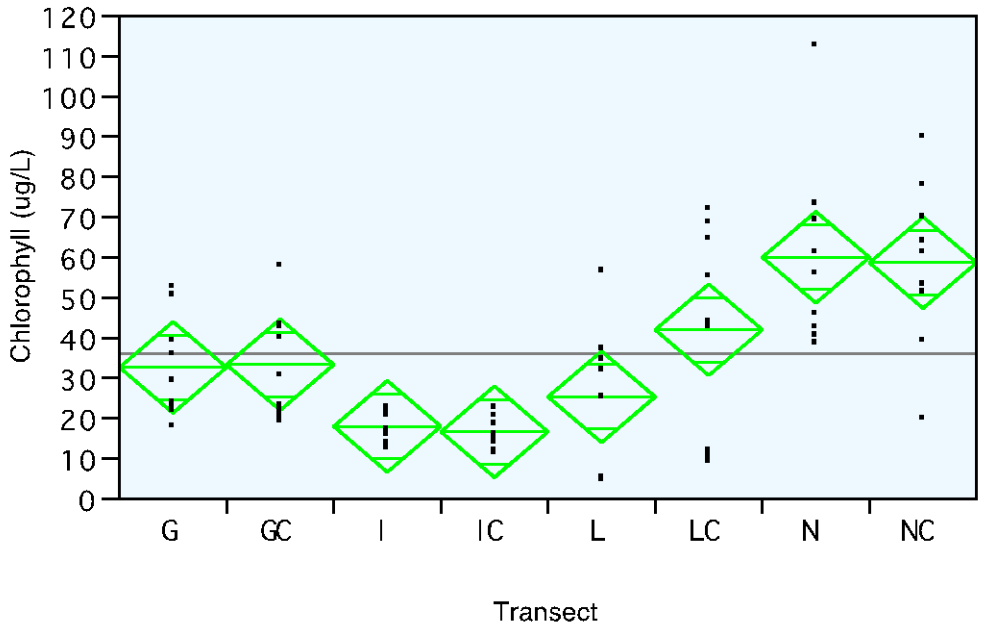


Figure 11. Plot of chlorophyll concentrations collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

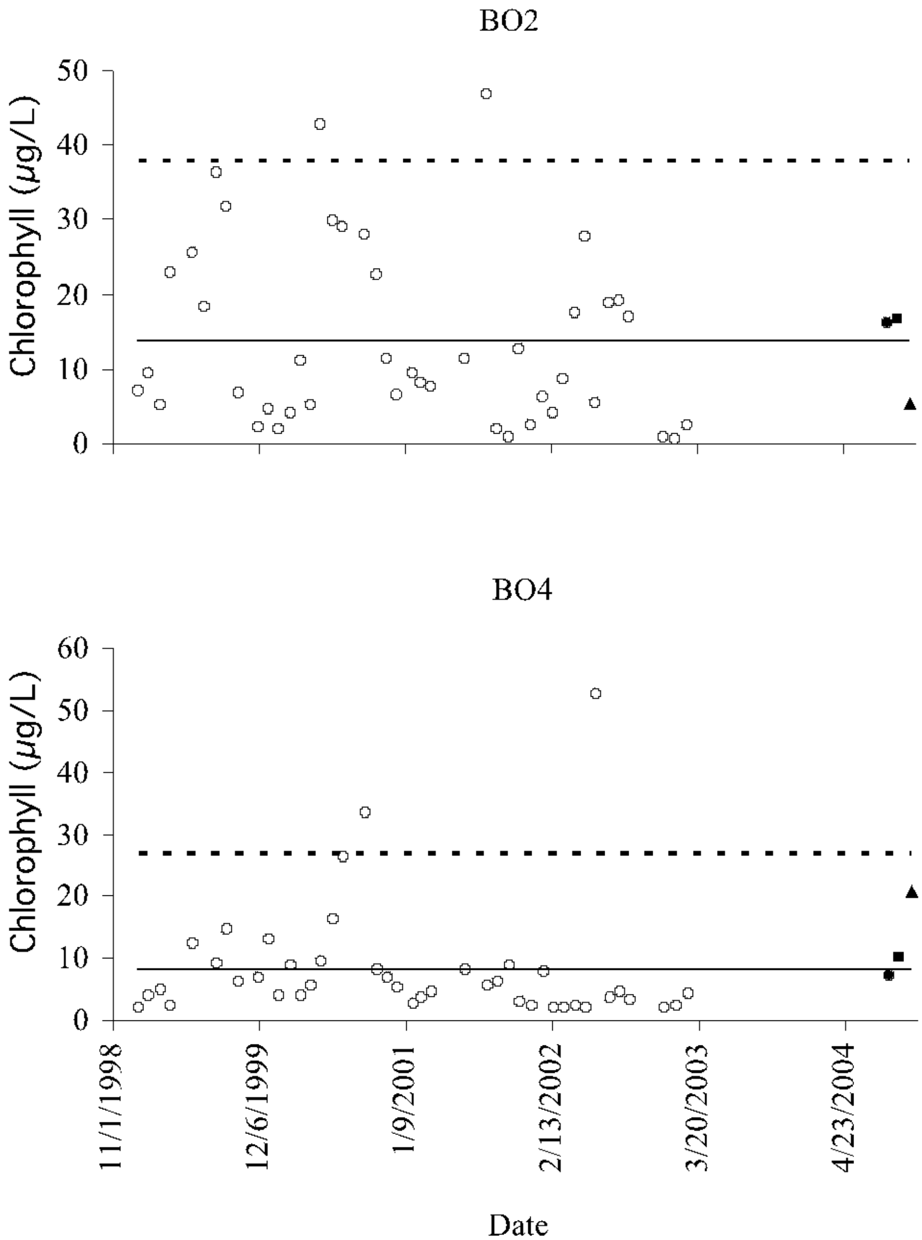


Figure 12. Relationship between date and chlorophyll concentrations collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

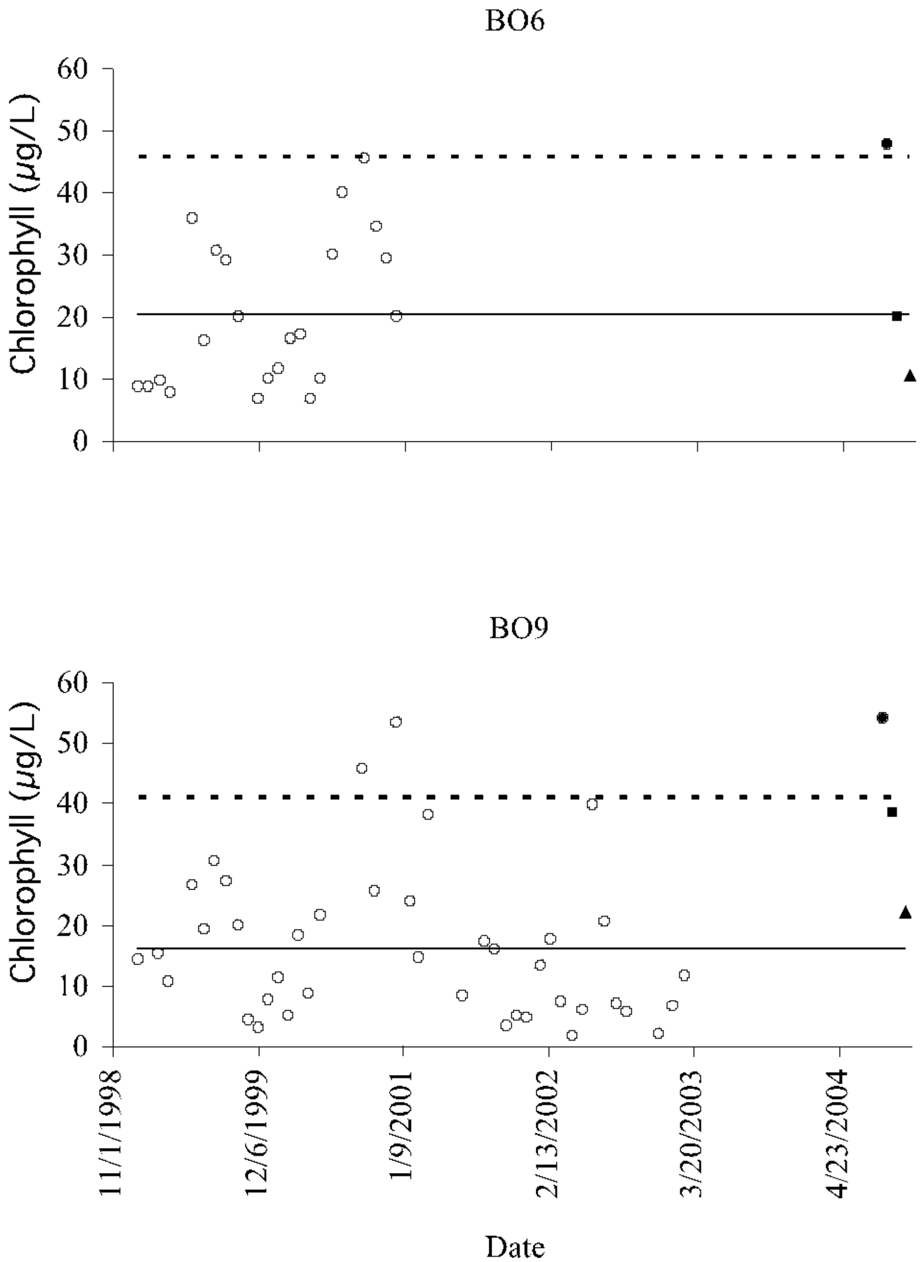


Figure 12 continued. Relationship between date and chlorophyll concentrations collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Secchi Depth (m)

Statistics for Secchi depth taken at each transect and station are summarized in Table 8. Removing Island L data for reasons mentioned above and examining the following analysis of variance for Secchi depth as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting Secchi depth in the surrounding waters of Lake Tohopekaliga. Figure 13 and the least squares mean table from a Tukey multiple comparison test below show that Secchi depth varied within Lake Tohopekaliga but that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 Secchi depth using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	0.80791561	107.6664	<.0001
Treatment	1	1	0.00503613	1.3423	0.2529
Treatment*Area	2	2	0.01572237	2.0952	0.1351
Month	2	2	0.06454106	8.6010	0.0007
Month*Treatment	2	2	0.01450969	1.9336	0.1567

LSMeans Differences Tukey HSD Alpha=0.050

Level				Least Sq Mean
Control,Island I	A			0.0218196
Island,Island I	A	B		-0.0345182
Island,Island G		B		-0.0684919
Control,Island G		B		-0.0945012
Control,Island N			C	-0.2812947
Island,Island N			C	-0.3089094

Levels not connected by same letter are significantly different

The Secchi depths measured during the first three months of sampling at the four long-term water chemistry monitoring stations show that none of the measurements exceeded the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 14). These data suggest that the lake enhancement project did not change the whole lake Secchi depth significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if the lake enhancement activities will impact the future water chemistry of Lake Tohopekaliga.

Table 8. Secchi depth (m) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	0.8	0.8	0.9	0.0
Island G	G2	0.9	0.8	0.9	0.0
Island G	G3	0.9	0.8	0.9	0.0
Control	GC1	0.8	0.6	0.9	0.1
Control	GC2	0.9	0.8	0.9	0.0
Control	GC3	0.8	0.7	0.9	0.1
	G Area Statistics	0.8	0.8	0.9	0.0
Island I	I1	0.9	0.8	0.9	0.0
Island I	I2	0.9	0.7	1.1	0.1
Island I	I3	1.0	0.9	1.1	0.1
Control	IC1	1.0	0.9	1.1	0.1
Control	IC2	1.1	0.9	1.4	0.2
Control	IC3	1.1	0.9	1.4	0.2
	I Area Statistics	1.0	0.9	1.1	0.0
Island L	L1	0.5	0.3	0.7	0.1
Island L	L2	0.5	0.4	0.6	0.1
Island L	L3	0.5	0.3	0.6	0.1
Control	LC1	0.6	0.4	0.7	0.1
Control	LC2	0.6	0.5	0.6	0.0
Control	LC3	0.6	0.5	0.6	0.0
	L Area Statistics	0.5	0.5	0.6	0.0
Island N	N1	0.5	0.4	0.6	0.1
Island N	N2	0.5	0.4	0.6	0.1
Island N	N3	0.5	0.4	0.6	0.1
Control	NC1	0.5	0.4	0.5	0.0
Control	NC2	0.5	0.5	0.6	0.0
Control	NC3	0.6	0.4	0.7	0.1
	N Area Statistics	0.5	0.5	0.6	0.0

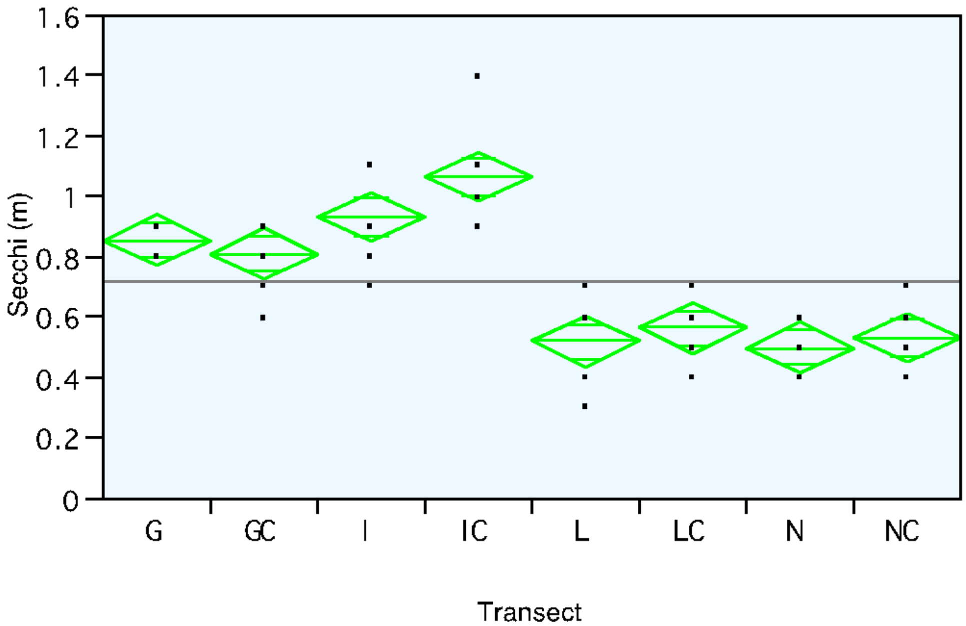


Figure 13. Plot of Secchi depth collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

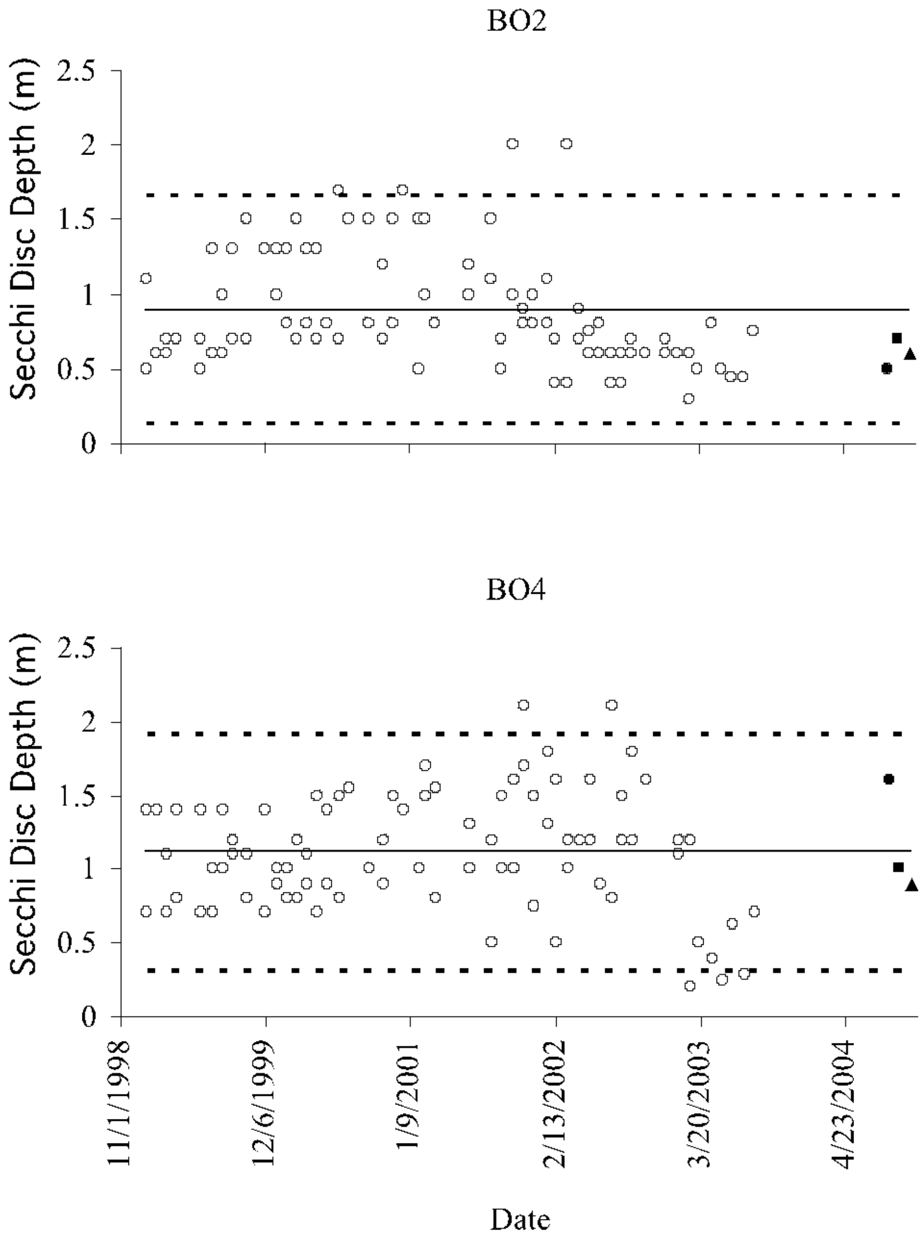


Figure 14. Relationship between date and Secchi depth values collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

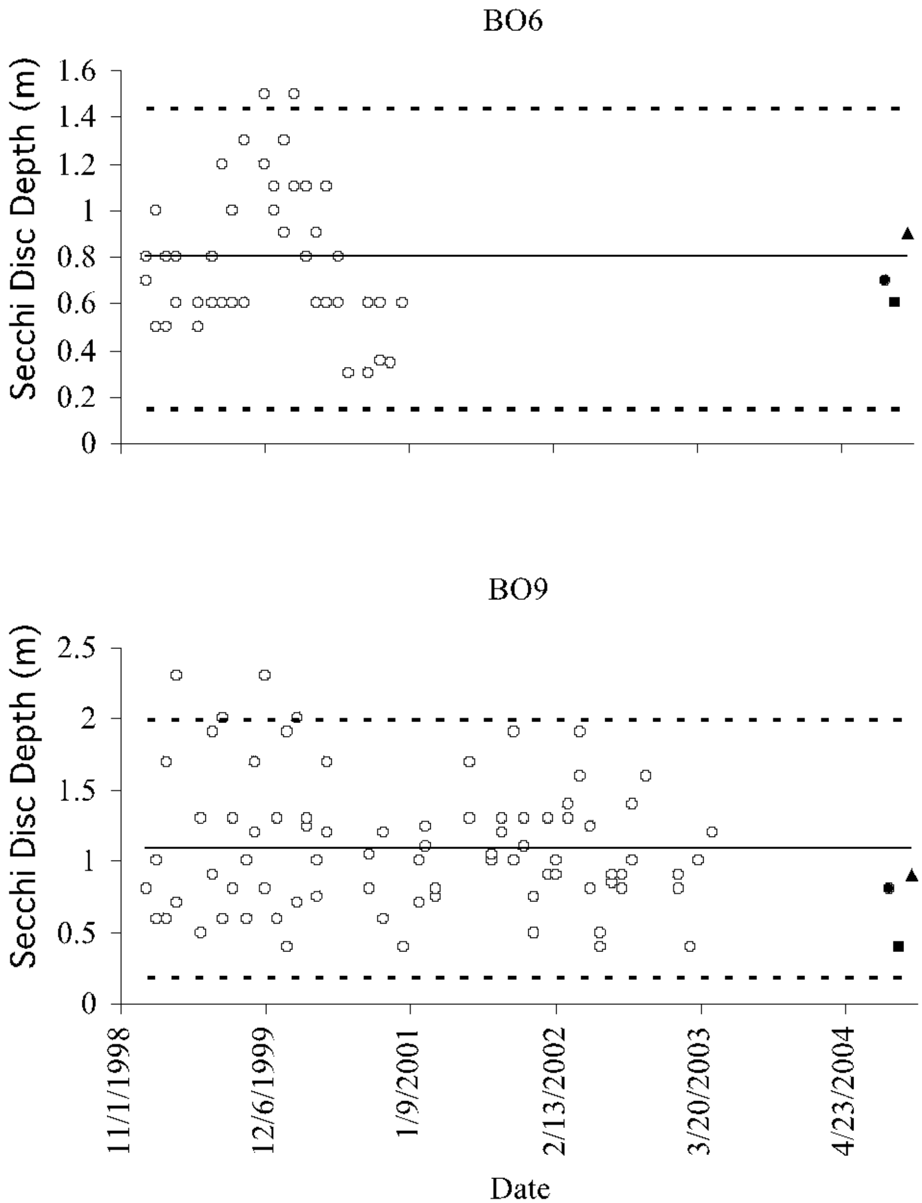


Figure 14 continued. Relationship between date and Secchi depth values collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Dissolved Oxygen (mg/L)

Statistics for dissolved oxygen concentrations taken at each transect and station are summarized in Table 9. Removing Island L data for reasons mentioned above and examining the following analysis of variance for dissolved oxygen as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting dissolved oxygen in the surrounding waters of Lake Tohopekaliga. Figure 15 and the least squares mean table from a Tukey multiple comparison test below show that dissolved oxygen in the general area around each island are not significantly different and that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 dissolved oxygen concentration using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	1.3708861	6.0701	0.0047
Treatment	1	1	0.0063435	0.0562	0.8137
Treatment*Area	2	2	0.0600969	0.2661	0.7676
Month	2	2	1.2055037	5.3378	0.0084
Month*Treatment	2	2	0.0120901	0.0535	0.9479

LSMeans Differences Tukey HSD Alpha=0.050

Level		Least Sq Mean
Control,Island G	A	0.75466982
Island,Island G	A	0.75362067
Control,Island I	A	0.72545020
Island,Island I	A	0.67918008
Island,Island N	A	0.44940406
Control,Island N	A	0.33705412

Levels not connected by same letter are significantly different

The dissolved oxygen measured during the first three months of sampling at the four long-term water chemistry monitoring stations show that only one of the measurements exceeded the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 16). These data suggest that the lake enhancement project did not change the whole lake dissolved oxygen concentration significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if the lake enhancement activities will impact the future water chemistry of Lake Tohopekaliga.

Table 9. Dissolved oxygen (mg/L) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	5.3	4.8	5.8	0.3
Island G	G2	5.8	5.4	6.0	0.2
Island G	G3	6.0	5.4	6.3	0.3
Control	GC1	5.1	4.3	5.6	0.4
Control	GC2	6.0	5.5	6.3	0.3
Control	GC3	6.0	5.4	6.4	0.3
	G Area Statistics	5.7	5.1	6.0	0.2
Island I	I1	4.1	2.9	6.1	1.0
Island I	I2	4.9	4.1	6.1	0.6
Island I	I3	5.7	5.3	6.2	0.3
Control	IC1	5.1	4.3	5.8	0.4
Control	IC2	5.4	5.0	5.6	0.2
Control	IC3	5.5	5.4	5.7	0.1
	I Area Statistics	5.1	4.1	5.7	0.2
Island L	L1	2.4	0.1	3.9	1.2
Island L	L2	1.8	0.2	3.5	1.0
Island L	L3	2.7	0.2	4.2	1.2
Control	LC1	2.7	0.6	4.7	1.2
Control	LC2	1.5	1.1	2.3	0.4
Control	LC3	1.5	0.7	2.1	0.4
	L Area Statistics	2.1	1.5	2.7	0.2
Island N	N1	3.2	0.2	5.0	1.5
Island N	N2	3.7	0.6	5.8	1.6
Island N	N3	5.4	4.1	6.2	0.6
Control	NC1	2.3	0.2	3.5	1.1
Control	NC2	3.1	0.1	5.2	1.5
Control	NC3	6.1	5.7	6.8	0.4
	N Area Statistics	4.0	2.3	6.1	0.6

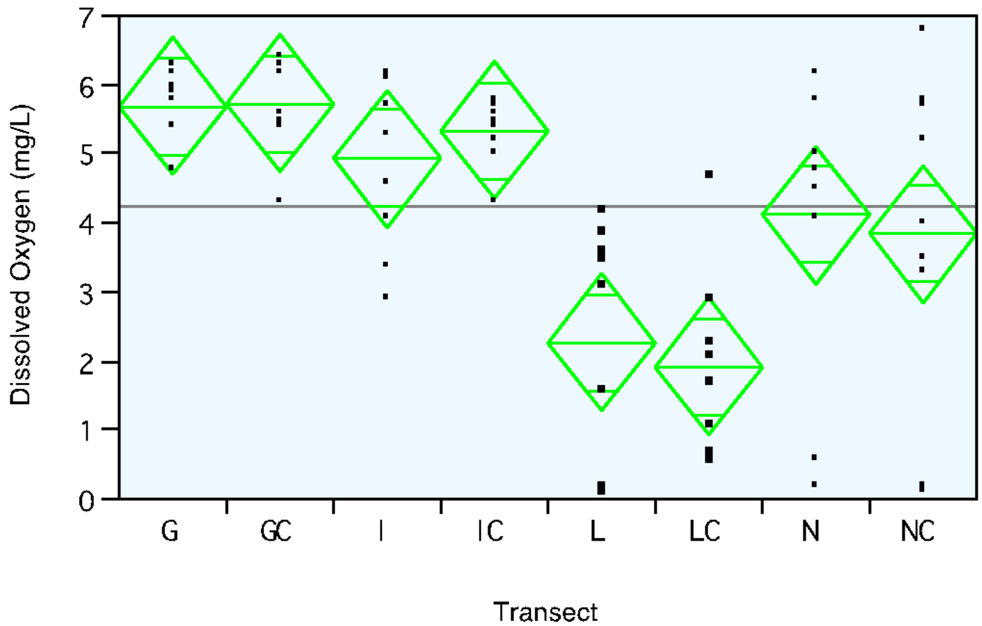


Figure 15. Plot of dissolved oxygen concentrations collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

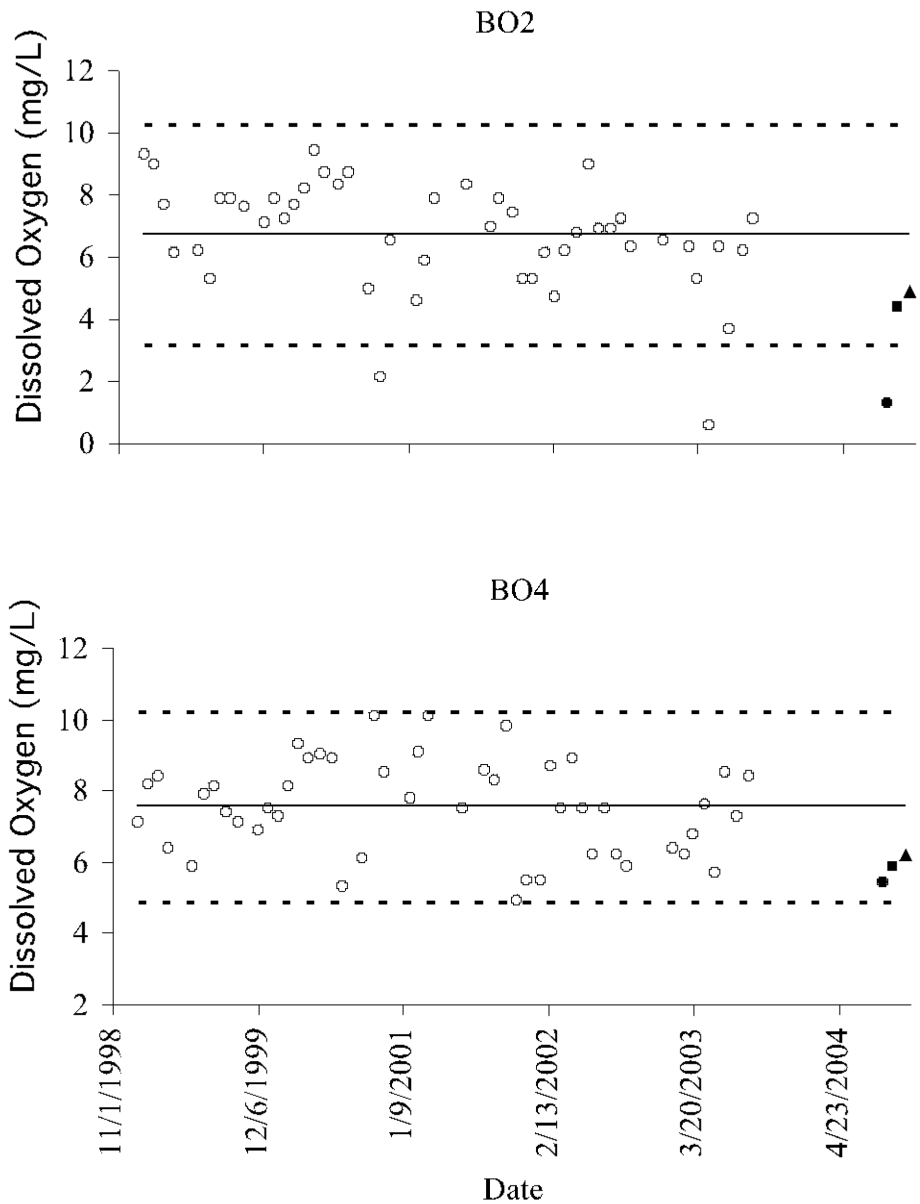


Figure 16. Relationship between date and dissolved oxygen concentration collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

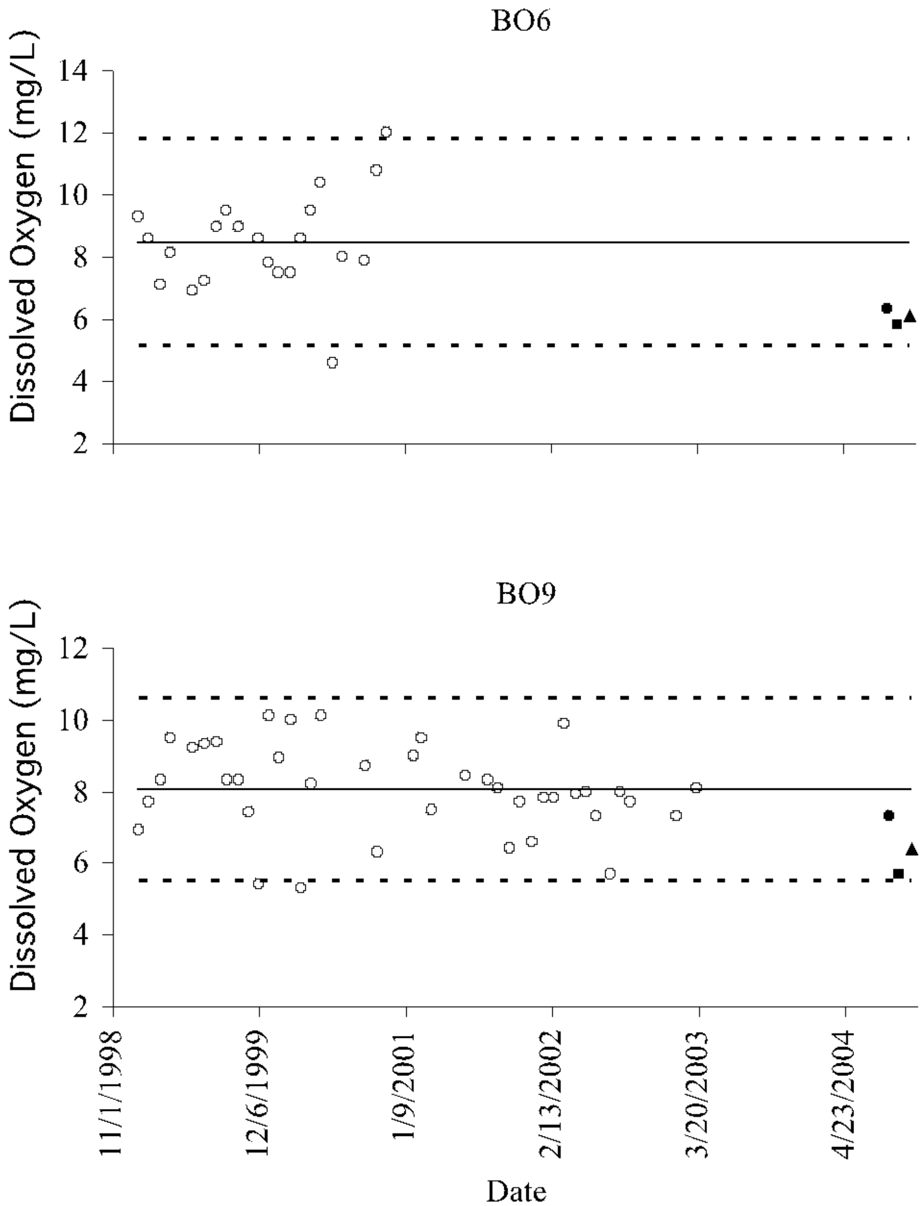


Figure 16 continued. Relationship between date and dissolved oxygen concentration collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

<u>Results Section 1 for Specific Conductance (µS/cm^2 @ 25 C°)</u>

Statistics for specific conductance measured at each transect and station are summarized in Table 10. Removing Island L data for reasons mentioned above and examining the following analysis of variance for specific conductance as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting specific conductance in the surrounding waters of Lake Tohopekaliga. Figure 17 and the least squares mean table from a Tukey multiple comparison test below show that specific conductance among the general areas around each island show some significant differences but that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 Specific Conductance using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	0.00310917	13.7279	<.0001
Treatment	1	1	0.00007423	0.6555	0.4225
Treatment*Area	2	2	0.00042744	1.8873	0.1635
Month	2	2	0.01377677	60.8286	<.0001
Month*Treatment	2	2	0.00008009	0.3536	0.7041

LSMeans Differences Tukey HSD Alpha=0.050

Level				Least Sq Mean
Control,Island N	A			2.0826784
Control,Island G	A	B		2.0755867
Island,Island G	A	B		2.0740675
Island,Island N	A	B	C	2.0730663
Island,Island I		B	C	2.0625190
Control,Island I			C	2.0584225

Levels not connected by same letter are significantly different

Specific conductance measured during the first three months of sampling at the four long-term water chemistry monitoring stations showed that only one of the measurements exceeded the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 18). These data suggest that the lake enhancement project did not change the whole lake specific conductance significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if the lake enhancement activities will impact the future water chemistry of Lake Tohopekaliga.

Table 10. Specific conductance (µS/cm @ 25 C°) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	119	114	122	3
Island G	G2	119	113	122	3
Island G	G3	118	112	121	3
Control	GC1	120	113	124	4
Control	GC2	119	112	122	3
Control	GC3	119	112	122	3
	G Area Statistics	119	118	120	0
Island I	I1	117	111	121	3
Island I	I2	115	111	120	3
Island I	I3	114	110	118	2
Control	IC1	115	111	120	3
Control	IC2	114	111	118	2
Control	IC3	114	111	118	2
	I Area Statistics	115	114	117	1
Island L	L1	138	126	145	6
Island L	L2	137	125	147	6
Island L	L3	137	130	145	4
Control	LC1	143	141	146	1
Control	LC2	143	140	146	2
Control	LC3	147	142	156	4
	L Area Statistics	141	137	147	2
Island N	N1	119	114	126	4
Island N	N2	119	114	127	4
Island N	N3	117	112	124	4
Control	NC1	123	113	136	7
Control	NC2	122	114	134	6
Control	NC3	119	114	122	3
	N Area Statistics	120	117	123	1

Figure 17. Plot of specific conductance collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

Figure 18. Relationship between date and specific conductance collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Figure 18 continued. Relationship between date and specific conductance collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for pH

Statistics for pH measured at each transect and station are summarized in Table 11. Removing Island L data for reasons mentioned above and examining the following analysis of variance for pH as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting pH in the surrounding waters of Lake Tohopekaliga. Figure 19 and the least squares mean table from a Tukey multiple comparison test below show that pH among the general area around each island show some significant differences but that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for pH using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	0.6177778	7.5012	0.0016
Treatment	1	1	0.0224074	0.5442	0.4646
Treatment*Area	2	2	0.0725926	0.8814	0.4214
Month	2	2	1.3744444	16.6889	<.0001
Month*Treatment	2	2	0.0959259	1.1648	0.3214

LSMeans Differences Tukey HSD Alpha=0.050

Level			Least Sq Mean
Island,Island G	A		6.9888889
Control,Island I	A	B	6.9444444
Control,Island G	A	B	6.9333333
Island,Island I	A	B	6.8222222
Control,Island N	A	B	6.7333333
Island,Island N		B	6.6777778

Levels not connected by same letter are significantly different

pH measured during the first three months of sampling at the four long-term water chemistry monitoring stations showed that none of the measurements exceed the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 20). These data suggest that the lake enhancement project did not change the whole lake pH significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if the lake enhancement activities will impact the future water chemistry of Lake Tohopekaliga.

Table 11. pH summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	6.9	6.7	7.2	0.1
Island G	G2	7.0	6.8	7.2	0.1
Island G	G3	7.1	6.9	7.2	0.1
Control	GC1	6.8	6.2	7.1	0.3
Control	GC2	7.0	6.8	7.2	0.1
Control	GC3	7.1	6.9	7.3	0.1
	G Area Statistics	7.0	6.8	7.1	0.0
Island I	I1	6.7	6.6	7.0	0.1
Island I	I2	6.8	6.7	7.0	0.1
Island I	I3	6.9	6.8	7.0	0.1
Control	IC1	6.9	6.8	7.0	0.1
Control	IC2	7.0	6.9	7.1	0.1
Control	IC3	7.0	6.8	7.1	0.1
	I Area Statistics	6.9	6.7	7.0	0.0
Island L	L1	6.9	6.8	7.0	0.1
Island L	L2	7.0	6.9	7.1	0.1
Island L	L3	7.0	6.8	7.1	0.1
Control	LC1	6.9	6.8	7.0	0.1
Control	LC2	6.9	6.7	7.0	0.1
Control	LC3	6.9	6.8	7.0	0.1
	L Area Statistics	6.9	6.9	7.0	0.0
Island N	N1	6.6	6.2	6.8	0.2
Island N	N2	6.7	6.2	7.2	0.3
Island N	N3	6.8	6.4	7.2	0.2
Control	NC1	6.6	6.5	6.8	0.1
Control	NC2	6.6	6.3	7.1	0.2
Control	NC3	6.9	6.7	7.2	0.1
	N Area Statistics	6.7	6.6	6.9	0.1

Figure 19. Plot of pH collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

Figure 20. Relationship between date and pH collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Figure 20 continued. Relationship between date and pH collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Total Alkalinity (mg/L as $CaCO_3$)

Statistics for total alkalinity measured at each transect and station are summarized in Table 12. Removing Island L data for reasons mentioned above and examining the following analysis of variance for total alkalinity as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only month show significant effects ($p \leq 0.05$). Area, treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting alkalinity in the surrounding waters of Lake Tohopekaliga. Figure 21 and the least squares mean table from a Tukey multiple comparison test below show that total alkalinity in the general area around each island show no significant differences and that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 total alkalinity using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	0.01409966	0.8190	0.4475
Treatment	1	1	0.00025105	0.0292	0.8652
Treatment*Area	2	2	0.00028497	0.0166	0.9836
Month	2	2	0.53749443	31.2223	<.0001
Month*Treatment	2	2	0.00309466	0.1798	0.8361

LSMeans Differences Tukey HSD Alpha=0.050

Level		Least Sq Mean
Control,Island I	A	1.2690896
Control,Island N	A	1.2640497
Island,Island I	A	1.2608843
Island,Island N	A	1.2571786
Island,Island G	A	1.2298022
Control,Island G	A	1.2276628

Levels not connected by same letter are significantly different

Total alkalinity measured during the first three months of sampling at the four long-term water chemistry monitoring stations showed that only one of the measurements exceeded the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 22). These data suggest that the lake enhancement project did not change the whole lake total alkalinity significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if the lake enhancement activities will impact the future water chemistry of Lake Tohopekaliga.

Table 12. Total alkalinity (mg/L as $CaCO_3$) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	18.2	9.6	23.0	4.3
Island G	G2	18.2	9.6	23.0	4.3
Island G	G3	18.3	9.8	23.0	4.2
Control	GC1	19.0	11.0	23.0	4.0
Control	GC2	18.7	10.0	24.0	4.4
Control	GC3	17.6	6.9	24.0	5.4
	G Area Statistics	18.3	17.6	19.0	0.2
Island I	I1	18.7	16.0	20.0	1.3
Island I	I2	18.7	16.0	20.0	1.3
Island I	I3	17.7	16.0	20.0	1.2
Control	IC1	18.7	16.0	20.0	1.3
Control	IC2	19.3	17.0	21.0	1.2
Control	IC3	18.0	17.0	20.0	1.0
	I Area Statistics	18.5	17.7	19.3	0.2
Island L	L1	36.3	34.0	38.0	1.2
Island L	L2	34.3	32.0	37.0	1.5
Island L	L3	35.7	33.0	39.0	1.8
Control	LC1	43.7	38.0	52.0	4.3
Control	LC2	42.7	36.0	52.0	4.8
Control	LC3	44.3	36.0	55.0	5.6
	L Area Statistics	39.5	34.3	44.3	1.8
Island N	N1	19.3	14.0	22.0	2.7
Island N	N2	18.3	13.0	22.0	2.7
Island N	N3	18.3	11.0	22.0	3.7
Control	NC1	18.3	10.0	23.0	4.2
Control	NC2	20.3	16.0	23.0	2.2
Control	NC3	18.7	12.0	22.0	3.3
	N Area Statistics	18.9	18.3	20.3	0.3

Figure 21. Plot of total alkalinity collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

Figure 22. Relationship between date and total alkalinity collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Figure 22 continued. Relationship between date and total alkalinity collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at four different stations (see Figure 2 and/or Table 2 for the locations of stations BO2, BO4, BO6, and BO9). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Total Suspended Solids (mg/L)

Statistics for total suspended solids measured at each transect and station are summarized in Table 13. Removing Island L data for reasons mentioned above and examining the following analysis of variance for total suspended solids as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting total suspended solids in the surrounding waters of Lake Tohopekaliga. Figure 23 and the least squares mean table from a Tukey multiple comparison test below show that total suspended solids vary within Lake Tohopekaliga but that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 total suspended solids using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	2.6017857	87.4902	<.0001
Treatment	1	1	0.0021122	0.1421	0.7081
Treatment*Area	2	2	0.0194954	0.6556	0.5241
Month	2	2	0.3360702	11.3010	0.0001
Month*Treatment	2	2	0.0595091	2.0011	0.1473

LSMeans Differences Tukey HSD Alpha=0.050

Level				Least Sq Mean
Control,Island N	A			1.0464802
Island,Island N	A			1.0274601
Control,Island G		B		0.7658198
Island,Island G		B		0.7564014
Island,Island I			C	0.5323453
Control,Island I			C	0.4663816

Levels not connected by same letter are significantly different

Long-term measurements of total suspended solids were only completed on stations BO2 and BO4. Total suspended solids measured during the first three months of sampling at BO2 and BO4 water chemistry monitoring stations showed that none of the measurements exceed the 95% confidence intervals estimated during the five year period immediately prior to the lake enhancement project (Figure 24). These data suggest that the lake enhancement project did not change the whole lake total suspended solids concentration significantly from the previous five years. However, continued monitoring of these stations will be needed to determine if the lake enhancement activities will impact the future water chemistry of Lake Tohopekaliga.

Table 13. Total suspended solids (mg/L) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	6.7	3.3	11.0	2.3
Island G	G2	6.4	3.9	8.6	1.4
Island G	G3	5.3	3.6	6.6	0.9
Control	GC1	5.1	4.1	7.0	0.9
Control	GC2	6.4	4.9	7.5	0.8
Control	GC3	7.0	3.9	11.1	2.2
	G Area Statistics	6.2	5.1	7.0	0.3
Island I	I1	4.4	2.8	5.5	0.8
Island I	I2	3.5	2.8	4.3	0.4
Island I	I3	2.8	2.2	3.4	0.3
Control	IC1	2.8	2.4	3.0	0.2
Control	IC2	3.0	2.5	3.6	0.3
Control	IC3	3.1	2.5	3.7	0.3
	I Area Statistics	3.3	2.8	4.4	0.3
Island L	L1	4.0	1.8	7.4	1.7
Island L	L2	4.0	1.9	7.8	1.9
Island L	L3	3.7	1.6	7.8	2.0
Control	LC1	6.5	3.1	12.4	3.0
Control	LC2	4.8	2.5	8.3	1.8
Control	LC3	6.1	1.6	8.6	2.3
	L Area Statistics	4.8	3.7	6.5	0.5
Island N	N1	10.8	7.4	13.0	1.7
Island N	N2	10.2	6.6	12.4	1.8
Island N	N3	13.3	7.3	22.9	4.8
Control	NC1	10.7	8.0	15.7	2.5
Control	NC2	12.1	7.5	14.8	2.3
Control	NC3	13.0	8.3	21.9	4.4
	N Area Statistics	11.7	10.2	13.3	0.5

Figure 23. Plot of total suspended solids collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

Figure 24. Relationship between date and total suspended solids concentration collected by the South Florida Water Management District and data collected for this study from Lake Tohopekaliga at two different stations (see Figure 2 and/or Table 2 for the locations of stations BO2 and BO4). Open circles represent long-term data collected during the five years immediately prior to the lake enhancement project. The solid circle, solid square and solid triangle represent data collected during this study in August, September, and October of 2004, respectively. The solid line represents the mean and the dashed line represents the 95% confidence interval for the data collected five years immediately prior to lake enhancement.

Results Section 1 for Organic Suspended Solids (mg/L)

Statistics for organic suspended solids measured at each transect and station are summarized in Table 14. Removing Island L data for reasons mentioned above and examining the following analysis of variance for organic suspended solids as the dependent variable and area (general island location in the lake), treatment (island transect and control transect), area*treatment interaction, month (August, September and October) and month*treatment interaction as independent variables suggests that only area and month show significant effects ($p \leq 0.05$). Treatment, treatment*area interaction, and treatment*month interactions showed no significant impact suggesting that the islands are not impacting organic in the surrounding waters of Lake Tohopekaliga. Figure 25 and the least squares mean table from a Tukey multiple comparison test below show that organic suspended solids vary within Lake Tohopekaliga but that the island transects and control transect within a general area are not significantly different.

Analysis of Variance for Log 10 organic suspended solids using data from only 3 islands

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Area	2	2	3.4779786	117.0801	<.0001
Treatment	1	1	0.0004244	0.0286	0.8665
Treatment*Area	2	2	0.0136252	0.4587	0.6351
Month	2	2	1.0008722	33.6926	<.0001
Month*Treatment	2	2	0.0569117	1.9158	0.1593

LSMeans Differences Tukey HSD Alpha=0.050

Level				Least Sq Mean
Control,Island N	A			0.85085437
Island,Island N	A			0.82892012
Control,Island G		B		0.55743189
Island,Island G		B		0.54606812
Island,Island I			C	0.24384101
Control,Island I			C	0.19372235

Levels not connected by same letter are significantly different

Table 14. Organic suspended solids (mg/L) summary statistics for individual water quality sampling stations and all stations combined around individual islands. Samples were taken in August, September and October 2004 immediately after water surrounded the islands.

Transect	Station	Mean	Minimum	Maximum	Std Error
Island G	G1	4.6	1.8	8.3	1.9
Island G	G2	4.1	1.9	6.9	1.5
Island G	G3	3.4	1.8	5.0	0.9
Control	GC1	3.7	2.0	6.5	1.4
Control	GC2	4.2	2.4	6.5	1.2
Control	GC3	4.5	2.1	8.0	1.8
	G Area Statistics	4.1	3.4	4.6	0.2
Island I	I1	2.4	1.4	3.0	0.5
Island I	I2	1.9	1.3	2.4	0.3
Island I	I3	1.3	1.1	1.5	0.1
Control	IC1	1.6	1.3	2.0	0.2
Control	IC2	1.6	1.2	1.9	0.2
Control	IC3	1.6	1.3	1.9	0.2
	I Area Statistics	1.7	1.3	2.4	0.2
Island L	L1	2.6	0.9	5.2	1.3
Island L	L2	3.0	1.3	5.8	1.4
Island L	L3	2.6	1.0	5.6	1.5
Control	LC1	3.9	1.7	8.0	2.1
Control	LC2	3.5	1.4	6.3	1.4
Control	LC3	4.2	1.1	6.0	1.6
	L Area Statistics	3.3	2.6	4.2	0.3
Island N	N1	8.1	4.4	12.0	2.2
Island N	N2	6.7	3.8	10.8	2.1
Island N	N3	7.4	3.6	10.3	2.0
Control	NC1	7.3	5.9	9.1	1.0
Control	NC2	8.1	4.5	12.4	2.3
Control	NC3	7.2	4.5	11.1	2.0
	N Area Statistics	7.5	6.7	8.1	0.2

Figure 25. Plot of organic suspended solids collected in August, September and October 2004 by transect. The first letter of the transect code represents the island code and if a C follows the island code it represents the control transect located approximately 400 meters from the island transect. The line across each diamond represents the transect mean and the vertical span of each diamond represents the 95% confidence interval for each transect. The solid line across the graph is the whole lake mean.

<u>Results Section 2</u>

Using data from all ten sampling dates, an analysis of variance was run using each water chemistry variable (color, total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, specific conductance, pH, total alkalinity, total suspended solids, organic suspended solids, and inorganic suspended solids) as a dependent variable and island (general island location in the lake), treatment (island transect and control transect), island*treatment interaction, month (seasonal variable) and month*treatment interaction as independent variables (see following analyses). All analyses showed that the whole model was significant. All analyses also showed exactly the same results that only island (general island location in the lake) and month showed significant effects. Treatment, treatment*island interaction, and month*treatment interaction showed no significant effects. This demonstrates that there are water chemistry differences in different areas around Lake Tohopekaliga and there are seasonal differences in water chemistry but there are no differences in water chemistry immediately surrounding the islands and control transects away from the islands. Plotting the actual water chemistry values by transect visually show the same results (Figures 26 through 37). Thus, the islands are not significantly impacting the water chemistry in water surrounding the islands.

Analysis of variance for Log 10 color (Pt-Co) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	0.1609257	5.0084	0.0078
Treatment	1	1	0.0036883	0.2296	0.6325
Treatment*Island	2	2	0.0196356	0.6111	0.5440
Month	7	7	3.2727692	29.1017	<.0001
Month*Treatment	7	7	0.0111353	0.0990	0.9983

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level		Least Sq Mean
Island,Island I	A	2.0006000
Control,Island I	A	1.9786167
Island,Island N	A	1.9391513
Control,Island G	A	1.9363856
Island,Island G	A	1.9164220
Control,Island N	A	1.9127663

Levels not connected by same letter are significantly different

Figure 26. Plot of color values collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 total phosphorus (µg/L) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	2.2752352	97.4974	<.0001
Treatment	1	1	0.0104666	0.8970	0.3450
Treatment*Island	2	2	0.0027134	0.1163	0.8903
Month	7	7	1.5656161	19.1683	<.0001
Month*Treatment	7	7	0.1045115	1.2796	0.2636

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Island,Island N	A			1.8927037
Control,Island N	A	B		1.8736071
Island,Island G		B		1.7984600
Control,Island G		B		1.7931951
Island,Island I			C	1.6250469
Control,Island I			C	1.6015589

Levels not connected by same letter are significantly different.

Figure 27. Plot of total phosphorus concentrations collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 total nitrogen (µg/L) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	1.2012439	144.1895	<.0001
Treatment	1	1	0.0024796	0.5953	0.4415
Treatment*Island	2	2	0.0041190	0.4944	0.6109
Month	7	7	0.2728354	9.3570	<.0001
Month*Treatment	7	7	0.0381867	1.3096	0.2489

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Island,Island N	A			3.1192685
Control,Island N	A			3.1129838
Control,Island G		B		3.0329131
Island,Island G		B		3.0297684
Island,Island I			C	2.9268381
Control,Island I			C	2.9066882

Levels not connected by same letter are significantly different.

Figure 28. Plot of total nitrogen concentrations collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 chlorophyll (µg/L) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	8.9402017	137.3353	<.0001
Treatment	1	1	0.0080499	0.2473	0.6197
Treatment*Island	2	2	0.0021195	0.0326	0.9680
Month	7	7	4.5056829	19.7755	<.0001
Month*Treatment	7	7	0.0174922	0.0768	0.9993

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Island,Island N	A			1.6210590
Control,Island N	A			1.6159762
Island,Island G		B		1.4631259
Control,Island G		B		1.4480287
Island,Island I			C	1.0967264
Control,Island I			C	1.0749432

Levels not connected by same letter are significantly different.

Figure 29. Plot of chlorophyll concentrations collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 Secchi depth (m) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	0.73498006	62.1109	<.0001
Treatment	1	1	0.01228230	2.0759	0.1517
Treatment*Island	2	2	0.01833937	1.5498	0.2156
Month	7	7	0.81103312	19.5823	<.0001
Month*Treatment	7	7	0.05275338	1.2737	0.2668

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Control,Island I	A			0.0064929
Island,Island I	A	B		-0.0375141
Island,Island G		B		-0.0668009
Control,Island G		B		-0.0737894
Control,Island N			C	-0.1657863
Island,Island N			C	-0.1810026

Levels not connected by same letter are significantly different.

Figure 30. Plot of Secchi depth collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 dissolved oxygen (mg/L) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	0.5461427	6.8609	0.0014
Treatment	1	1	0.0000153	0.0004	0.9844
Treatment*Island	2	2	0.0041474	0.0521	0.9492
Month	7	7	3.9240813	14.0845	<.0001
Month*Treatment	7	7	0.0311200	0.1117	0.9975

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level		Least Sq Mean
Island,Island G	A	0.84411211
Control,Island G	A	0.84187396
Control,Island I	A	0.81562232
Island,Island I	A	0.80374488
Island,Island N	A	0.71884085
Control,Island N	A	0.70737230

Levels not connected by same letter are significantly different.

Figure 31. Plot of dissolved oxygen concentrations collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 specific conductance (µS/cm @ 25 C°) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	0.05273127	30.9935	<.0001
Treatment	1	1	0.00019931	0.2343	0.6290
Treatment*Island	2	2	0.00017286	0.1016	0.9034
Month	7	7	0.30814561	51.7476	<.0001
Month*Treatment	7	7	0.00065114	0.1093	0.9977

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level			Least Sq Mean
Island,Island G	A		2.1239740
Control,Island G	A		2.1239612
Control,Island N	A		2.1206723
Island,Island N	A		2.1188089
Control,Island I		B	2.0881071
Island,Island I		B	2.0833548

Levels not connected by same letter are significantly different.

Figure 32. Plot of specific conductance collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for pH: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	0.547444	1.5783	0.2095
Treatment	1	1	0.000714	0.0041	0.9489
Treatment*Island	2	2	0.327444	0.9440	0.3912
Month	7	7	35.509111	29.2498	<.0001
Month*Treatment	7	7	0.149778	0.1234	0.9966

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level		Least Sq Mean
Island,Island G	A	7.3304167
Control,Island G	A	7.3168056
Control,Island I	A	7.2601389
Island,Island N	A	7.2570833
Control,Island N	A	7.1668056
Island,Island I	A	7.1437500

Levels not connected by same letter are significantly different.

Figure 33. Plot of pH collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of Variance for Log 10 total alkalinity (mg/L as $CaCo_3$) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	0.1147225	12.4712	<.0001
Treatment	1	1	0.0004655	0.1012	0.7508
Treatment*Island	2	2	0.0050429	0.5482	0.5791
Month	7	7	1.2710274	39.4773	<.0001
Month*Treatment	7	7	0.0062006	0.1926	0.9867

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Control,Island G	A			1.3538735
Island,Island G	A	B		1.3519783
Island,Island N	A	B		1.3398198
Control,Island N	A	B	C	1.3310149
Control,Island I		B	C	1.3013089
Island,Island I			C	1.2843084

Levels not connected by same letter are significantly different.

Figure 34. Plot of total alkalinity collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 total suspended solids (mg/L) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	6.2345623	66.1287	<.0001
Treatment	1	1	0.0328582	0.6970	0.4050
Treatment*Island	2	2	0.0235827	0.2501	0.7790
Month	7	7	4.5172966	13.6897	<.0001
Month*Treatment	7	7	0.1120010	0.3394	0.9348

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Island,Island N	A			0.90027917
Control,Island N	A			0.89727718
Island,Island G		B		0.72783905
Control,Island G		B		0.70448854
Island,Island I			C	0.47494884
Control,Island I			C	0.41652081

Levels not connected by same letter are significantly different.

Figure 35. Plot of total suspended solids concentrations collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 organic suspended solids (mg/L) data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	10.621643	98.9233	<.0001
Treatment	1	1	0.014747	0.2747	0.6009
Treatment*Island	2	2	0.003302	0.0308	0.9697
Month	7	7	9.469121	25.1970	<.0001
Month*Treatment	7	7	0.071232	0.1895	0.9873

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Island,Island N	A			0.70634825
Control,Island N	A			0.69352053
Island,Island G		B		0.50878967
Control,Island G		B		0.47774294
Island,Island I			C	0.11983574
Control,Island I			C	0.10691311

Levels not connected by same letter are significantly different.

Figure 36. Plot of organic suspended solids collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Analysis of variance for Log 10 inorganic suspended solids data: where island represents the area of the lake around an individual island, and treatment represents control transects off of the islands and transects next to the islands.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Island	2	2	1.5062189	15.6197	<.0001
Treatment	1	1	0.0356975	0.7404	0.3908
Treatment*Island	2	2	0.0860790	0.8927	0.4116
Month	7	7	3.1202899	9.2451	<.0001
Month*Treatment	7	7	0.2670813	0.7913	0.5956

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level				Least Sq Mean
Control,Island N	A			0.40302842
Island,Island N	A	B		0.37392696
Island,Island G	A	B	C	0.26011825
Control,Island G		B	C	0.21907171
Island,Island I			C	0.20640362
Control,Island I			C	0.12988617

Levels not connected by same letter are significantly different.

Figure 37. Plot of inorganic suspended solids collected on ten dates between August 2004 and June 2006 by transect. The first letter of the transect code represents the island and if a C follows it represents the control transect approximately 400 meters from the island transect. The line across each diamond is the transect mean and the vertical span of each diamond is 95% confidence interval for each transect. The solid line across the graph is the whole data mean.

Using data from all ten sampling dates, an analysis of variance was run using each water chemistry variable (color, total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, specific conductance, pH, and total alkalinity) from the four long-term sampling stations as a dependent variable and group (data collected before (1996 to 2004) and after (2004 to 2006) muck scraping occurred), station (B02, B04, B06, and B09), and station*group interaction as independent variables (see following analyses). All analyses showed that the whole model was significant. All analyses also showed that station had a significant effect suggestion that the water chemistry of lake Tohopekaliga varies spatially as did the analyses of transects from different islands. Only analyses on color, total phosphorus, chlorophyll and dissolved oxygen showed a significant group effect while all other variables showed no significant group effect. The least squares means difference tables suggest that color, total phosphorus, and chlorophyll values were higher after muck scraping and oxygen concentrations were lower after muck scraping. However, examining the plot of raw data versus date (Figures 38 through 46), each water chemistry variable collected after muck scraping falls well within the distribution of data collected between 1996 and 2004, which was before muck scraping.

There is no doubt that after the three hurricanes passed over Lake Tohopekaliga large amounts of rain were inputting highly colored nutrient rich water (Figure 1B and Figure 1C). Figure 38 shows that immediately after muck scraping some color values exceeded 200 Pt-Co units as did water coming from Shingle creek on April 25, 2005 (Station SC5, Figure 5 and Table 4). However, examining the distribution of data before the muck scraping also shows several color values between 150 and 200 Pt-Co units. So even though the analysis of variance suggests that whole lake color values were higher in Lake Tohopekaliga after muck scraping it was probably the result of tremendous rainfall associated with three hurricanes the passed over the lake in 2004 (Figure 1A and 1B). This same observation can be made for total phosphorus, chlorophyll and dissolved oxygen concentrations. While the analyses of variance suggest that there is a significant difference in these three variables after muck scraping the majority of data collected after muck scraping falls within the distribution of recent historical data (Figures 39, 41 and 43). Therefore, it is unlikely that the muck scraping significantly impacted the whole lake water chemistry of Lake Tohopekaliga. It would be wise, however, to maintain these four long-term stations to continue looking for trends in water chemistry.

Analysis of variance for long-term Log 10 color (Pt-Co) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	1.6264182	34.5322	<.0001
Station	3	3	1.5489411	10.9624	<.0001
Station*Group	3	3	0.0954801	0.6757	0.5675

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level			Least Sq Mean
After	A		1.9830515
Before		B	1.7715600

Level			Least Sq Mean
B02	A		2.0497778
B06		B	1.8386625
B04		B	1.8311580
B09		B	1.7896247

Levels not connected by same letter are significantly different.

Figure 38. Relation between date and color values for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term Log 10 total phosphorus (µg/L) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	0.6699758	28.3836	<.0001
Station	3	3	1.6630354	23.4849	<.0001
Station*Group	3	3	0.0526305	0.7432	0.5271

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level			Least Sq Mean
After	A		1.8007508
Before		B	1.6650113

Level				Least Sq Mean
B02	A			1.8536597
B09	A	B		1.7679110
B06		B		1.7439599
B04			C	1.5659936

Levels not connected by same letter are significantly different.

Figure 39. Relation between date and total phosphorus for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term Log 10 total nitrogen (µg/L) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	0.00000510	0.0003	0.9869
Station	3	3	0.44905066	7.9892	<.0001
Station*Group	3	3	0.01808543	0.3218	0.8096

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level		Least Sq Mean
Before	A	3.0109873
After	A	3.0106127

Level			Least Sq Mean
B09	A		3.0660734
B06	A		3.0310468
B02	A		3.0258744
B04		B	2.9202054

Levels not connected by same letter are significantly different

Figure 40. Relation between date and total nitrogen for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term Log 10 chlorophyll (µg/L) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	1.9772482	15.5764	<.0001
Station	3	3	5.3366625	14.0138	<.0001
Station*Group	3	3	0.3657950	0.9606	0.4117

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level			Least Sq Mean
After	A		1.3400228
Before		B	1.0975174

Level			Least Sq Mean
B09	A		1.4289764
B06	A		1.3749419
B02		B	1.1332662
B04		B	0.9378960

Levels not connected by same letter are significantly different.

Figure 41. Relation between date and chlorophyll for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term Log 10 Secchi depth (m) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	0.00591043	0.2360	0.6274
Station	3	3	0.39786456	5.2966	0.0014
Station*Group	3	3	0.16098869	2.1432	0.0948

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level		Least Sq Mean
Before	A	-0.0755322
After	A	-0.0883196

Level			Least Sq Mean
B04	A		0.0063182
B02		B	-0.1004991
B06		B	-0.1113974
B09		B	-0.1221255

Levels not connected by same letter are significantly different.

Figure 42. Relation between date and Secchi depth for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term Log 10 dissolved oxygen (mg/L) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	0.09169124	6.3115	0.0126
Station	3	3	0.28669311	6.5781	0.0003
Station*Group	3	3	0.01867005	0.4284	0.7328

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level			Least Sq Mean
Before	A		0.88908315
After		B	0.83825601

Level			Least Sq Mean
B06	A		0.90087112
B09	A		0.89729087
B04	A		0.86610561
B02		B	0.79041074

Levels not connected by same letter are significantly different

Figure 43. Relation between date and dissolved oxygen for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term Log 10 specific conductance (µS/cm @ 25 C°) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	0.06736640	2.3037	0.1302
Station	3	3	0.23521930	2.6812	0.0472
Station*Group	3	3	0.00482994	0.0551	0.9830

Least Squares Means Differences Tukey HSD Alpha=0.05

Level		Least Sq Mean
Before	A	2.1796146
After	A	2.1351689

Level			Least Sq Mean
B02	A		2.2166905
B06	A	B	2.1585874
B09	A	B	2.1538947
B04		B	2.1003944

Levels not connected by same letter are significantly different

Figure 44. Relation between date and specific conductance for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term pH data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	0.1599906	0.2857	0.5934
Station	3	3	8.6809438	5.1669	0.0017
Station*Group	3	3	2.3513736	1.3996	0.2433

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level		Least Sq Mean
Before	A	7.5959945
After	A	7.5275000

Level			Least Sq Mean
B06	A		7.8482558
B09	A		7.7783846
B02		B	7.3130000
B04		B	7.3073485

Levels not connected by same letter are significantly different.

Figure 45. Relation between date and pH for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Analysis of variance for long-term Log 10 total alkalinity (mg/l as CaCO3) data: where group is defined as data collected “Before” (1996 to 2004) and “After” (2004 to 2006) muck scraping occurred and station represents the four long-term water quality sampling stations (B02, B04, B06, and B09) examined in this study.

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Group	1	1	0.0254505	1.0885	0.2977
Station	3	3	1.2432577	17.7246	<.0001
Station*Group	3	3	0.0882766	1.2585	0.2889

Least Squares Means Differences Tukey HSD, alpha=0.05.

Level		Least Sq Mean
Before	A	1.4252925
After	A	1.3980439

Level				Least Sq Mean
B02	A			1.5574419
B06		B		1.4050972
B09		B		1.3904977
B04			C	1.2936360

Levels not connected by same letter are significantly different.

Figure 46. Relation between date and total alkalinity for data collected at four long-term monitoring stations (B02, B04, B06, and B09). Data were collected “Before” muck scraping (1996 to 2004) by the South Florida Water management District and “After” muck scraping (2004 to 2006) by University of Florida. The dashed lines represent the upper and lower boundary of the data collected before muck scraping that determines 95% of the data distribution.

Summary of Deliverables for Task 1, Item 1 through Item4

The first three months of sampling showed that Island L and corresponding control transects are differentially impacted by water inputs from Shingle Creek. Therefore, Island L data were removed from additional analyses used to examine the potential impacts of in-lake islands on surrounding water chemistry. After removing Island L data from the analyses, there is no evidence over the short term (monthly samples for three months) suggesting that in-lake islands are impacting the following water chemistry variables in Lake Tohopekaliga: color, total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, specific conductance, pH, total alkalinity, total suspended solids, and organic suspended solids. Conducting the same analyses using ten sampling dates between August 2004 and June 2006 again showed no evidence that in-lake islands are impacting the following water chemistry variables in Lake Tohopekaliga: color, total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, specific conductance, pH, total alkalinity, total suspended solids, and organic suspended solids.

Examining both the short-term (August, September, and October 2004) and long-term (ten dates between August 2004 and June 2006) water chemistry data at four long-term stations (B02, B04, B06, and B09) showed that some water chemistry variables (color, total phosphorus, chlorophyll and dissolved oxygen concentration) are outside of the 95% confidence intervals calculated from data collected prior to the lake enhancement project. However, there is no doubt that after the three hurricanes passed over Lake Tohopekaliga large amounts of rain were inputting highly colored nutrient rich water. Figure 38 shows that immediately after muck scraping some color values exceeded 200 Pt-Co units as did water coming from Shingle creek on April 25, 2005 (Station SC5, Figure 5 and Table 4). However, examining the distribution of data before the muck scraping also shows several color values between 150 and 200 Pt-Co units. So even though analysis of variance suggests that whole lake color values were higher in Lake Tohopekaliga after muck scraping it was probably the result of tremendous rainfall associated with three hurricanes the passed over the lake in 2004. This same observation can be made for total phosphorus, chlorophyll and dissolved oxygen concentrations. While the analyses of variance suggest that there is a significant difference in these three variables after muck scraping the majority of data collected after muck scraping falls within the distribution of recent historical data (Figures 39, 41 and 43). Therefore, it is unlikely that the muck scraping significantly impacted the whole lake water chemistry of Lake Tohopekaliga. It would be wise, however, to maintain these four long-term stations to continue looking for trends in water chemistry.

Deliverables for Task 2, Item 1 through Item 3 (Appendix IV):

Task # 2. Longevity of created islands.

1) January 1, 2004 to June 30, 2004. UF shall measure the volume of all created islands documenting initial basal areas and height with GPS equipment.

2) July 1, 2004 to June 30, 2005. UF shall measure volumes of 12 created islands documenting basal areas and heights with GPS equipment six months after the islands were flooded.

3) July 1, 2005 to June 30, 2006. UF shall measure volume of 12 created islands documenting basal areas and heights with GPS equipment 18 months after they were flooded.

Task #2, Item 1, Item 2, and Item 3 have been completed. Between April and July of 2004 (Round 1) the area, average height and volume of all 29 created islands were measured using GPS equipment. Between January and February 2005 (Round 2), the areas of 14 created islands were measured using GPS equipment. The areas measured on Round 2 compared well with the corresponding islands measured on the first round. Grids measuring altitude to calculate average island height and volumes were also taken. However, the Kissimmee base station at the airport that was used to post process altitude data to meter accuracy for calculating volumes on Round 1 was destroyed afterwards during one of the 2004 Florida hurricanes. Thus, the altitude data collected on Round 2 were not sufficiently accurate to yield acceptable volume estimates.

Above it was recommended that water quality stations around Island L be dropped because inputs from shingle creek differentially impact the water chemistry of the island and the control transects. To offset the cost of discontinuing Island L water sampling stations, it was recommended that two additional islands (total of 14 islands) be measured for Task 2, Item 3. Between January 1 and January 31, 2006 the area, average height and volume of 15 islands were measured using GPS equipment. A new base station (HULK) at the Kissimmee airport was operational and the data were made available by Scott Harris (Florida Department of transportation), yielding corrected data of sufficient quality for estimating average height and volumes for 15 islands.

Methods

The areas and volumes of all islands were measured using Trimble ProXR global positioning data logging system. The perimeter and contours were mapped separately for each island using approximately a 15 m logging interval around the island perimeter and a 15-m spaced grid across the island for the contours. Approximately every 15 meters, a coordinate point was recorded for 20 seconds and then averaged to create a data point containing latitude, longitude, and mean sea level. Before water surrounded the islands the perimeters of the islands were mapped at the scraped surface/piled muck interface. For the Round 2 and Round 3, after water surrounded the islands, a depth pole was used to find the estimated edge of the islands before GPS readings were taken.

The raw island map data were downloaded from the Trimble data logger using Pathfinder Office, version 2.51. The data were post corrected with base station data from the National Geodetic Survey Continually Operating Reference Stations website http://www.ngs.noaa.gov/CORS. Island data were corrected with the Kissimmee, Florida base station data collected at latitude 28° 30’ 42.16535” and longitude 080° 47’ 38.65917” in receiver independent exchange (RINEX) format. The latitude and longitude of the Kissimmee base station (28° 17’ 41.06960 and 81° 26’ 10.85023) were replaced in the RINEX header with the respective antenna reference point location coordinates in NAD 83 format. The antenna point locations were referenced from the data sheet for the base station on the CORS website (R. Scott Harris, Florida Department of Transportation, 2004).

Kissimmee US National Grid Spatial Address 17RMM5721429930(NAD 83)
Point of Contact: Florida Department of Transportation
1211 Governors Square Blvd.
Tallahassee, FL 32301
R. Scott Harris 805-414-7962
Richard.harris@dot.state.fl.us

The island coordinate data were converted from latitude and longitude to the Universal Transverse Mercator (UTM) projection system WGS 1984, zone 17 North in Pathfinder Office. The area of each island was calculated in Pathfinder Office by outlining the perimeter. All data were exported as a point file from Pathfinder Office to Microsoft Excel 2000 using an ASCII format. The average altitude of all perimeter points was subtracted from the average altitude of all contour points to calculate the average height of each island. The average heights for each island was then multiplied by the area of the island to determine volumes.

Results

One of the major objectives of this project was to document the initial location, area, average height and volume of each island so that the longevity of the islands can be determined in the distant future. Thus, all of the original (Round 1) GPS data, corrected GPS data are burned on a CD and placed in a sleeve on the inside of the back page of this document. Interested parties can use these data in the future as reference data for comparisons. The area maps with the contour points produced from Pathfinder Office for Round 1 are all printed in Appendix (V).

The area and volume of Island B were measured on three different dates to determine how variable the above methodology was during the project. This was done because the availability of satellites and the orientation of the satellites change from day to day, impacting the accuracy of measurements. The coefficient of variation for area (ha) estimates using Pathfinder Office was 1.5% and for volume (m^3) estimates was 13.5%. The coefficient of variation estimate for volumes was higher because it is more difficult to estimate altitude using this GPS technology.

Island	Date	Volume (m^3)	Area (ha)
B	4/15/04	7759	0.46
B	4/16/04	7834	0.47
B	4/21/04	9773	0.48
Mean		8455	0.47
Standard Deviation		1141	0.01
Coefficient of Variation (%)		13.5	1.51

The area of the individual islands measured in Round 1 ranged from 1.04 acres (0.42 ha) to 8.23 acres (3.33 ha) covering a total area of approximately 65.86 acres (26.65 ha) (Table 15). The volume of the individual islands ranged from 2157 yd^3 (1649 m^3) to 152706 yd^3 (116747 m^3) summing to a total volume of approximately 1.2 million cubic yards (916,000 m^3).

Approximately six months after the initial island area, average height and volume were measured and after three different hurricanes (Charlie, Francis and Jeanne) traveled over Lake Tohopekaliga, 14 islands were measured again. The areas of the 14 individual islands measured in Round 2 were very similar to the corresponding initial measured areas (Table 16) suggesting that the footprint of the islands changed little the first six months after water surrounded the islands. Maps plotting Round 1 and Round 2 measured areas are provided in Appendix VI. While the area of the islands remained relatively constant, visual inspection showed that some of the volume of most islands had been lost due to water and wind erosion. However, because the Kissimmee Airport base station was destroyed after the hurricanes accurate average height and volume measurements were not available for Round 2 to determine how much of the islands were lost.

Approximately 18 months after the initial areas, average heights and volumes were measured, 15 islands were measured again using GPS equipment. Similar to Round 2 measurements, Round 3 areas were similar to the initial areas measured in Round 1 (Table 17). The average percent difference between Round 1 and Round 3 areas was about 1% with one island (Island V) actually increased gaining approximately 12% in area and one (Island R) losing approximately 11% of the original area. The areas of five islands appear to have increased and 10 appeared to have decreased. However, the coefficient of variation for mapping the area of Island B on three different dates was 1.5% suggesting that some of the differences in the measured areas from Round 1 to Round 3 could be measurement error. Visually examining the maps plotting Round 1 and Round 3 measured areas in Appendix VII confirm that the areas did not change much in 18 months.

Eighteen months after initial measurements, 15 islands showed decreases in average height (Table 18) and volume (Table 19). The decreases in average height ranged from 6.7% to 42.9%, averaging 20.3%. While the maximum height of the islands in places are as high as originally measured, wind and wave action have eroded and collapsed the edges of the islands making the overall average height significantly less. The decreases in volume ranged from 5% to 44%, averaging 21% loss of material. There is no apparent pattern for determining which islands were more susceptible to erosion. For example, Island A (Figure 2) is relatively close to shore in a protected area and it lost 42.9% of its volume, while Island Y (Figure 2) is one of the farthest offshore and it only lost 18.9% of its volume. This suggests that the wind and wave patterns throughout the three hurricanes were probably quite erratic.

It is important to point out that while volume estimates for Round 2 measurements six months after the lake filled are not available, visual examination of the islands strongly suggests that most of the volume lost to the islands happened immediately after the lake filled and the hurricanes passed over. Thus, the calculations of lost material provided in Table 19, 18 months after the lake filled should be considered the product of an extremely unusual event and may not be representative for future management activities of this type.

Table 15. The surface area, volume and average height of each island were measured in Lake Tohopekaliga between May and July 2004. Island B was measured on three different dates (B, B2, and B3). B2 and B3 (highlighted) data were not used in the summary statistics.

Island	Average Island Height (m)	Average Island Height (ft)	Surface Area (ha)	Surface Area (acre)	Volume (m^3)	Volume (yd^3)
A	3.5	11.5	0.63	1.56	22070	28867
B	1.7	5.5	0.46	1.14	7759	10148
B2	1.7	5.5	0.47	1.16	7834	10247
B3	2.1	6.8	0.48	1.17	9773	12783
C	2.2	7.4	0.75	1.85	16797	21971
D	3.9	12.8	0.83	2.06	32380	42353
E	3.0	10.0	0.92	2.28	28092	36745
F	2.8	9.2	1.09	2.68	30520	39920
G	2.2	7.2	0.42	1.04	9303	12168
H	2.2	7.2	0.97	2.41	21502	28125
I	2.2	7.3	0.73	1.81	16346	21381
J	3.2	10.5	1.21	2.98	38808	50761
K	3.0	9.9	0.53	1.31	16021	20955
L	3.8	12.6	0.77	1.89	29435	38501
M	2.9	9.4	0.83	2.05	23849	31194
N	1.5	5.0	0.71	1.76	10759	14073
O	0.3	0.9	0.60	1.49	1649	2157
P	2.3	7.4	0.76	1.88	17255	22570
Q	2.6	8.5	0.83	2.06	21614	28271
R	3.7	12.1	1.02	2.53	37703	49316
S	3.5	11.5	3.33	8.23	116747	152706
T	5.6	18.4	0.91	2.24	50909	66589
U	6.2	20.2	1.11	2.73	68235	89252
V	6.5	21.3	0.95	2.35	61809	80846
W	2.5	8.3	0.89	2.20	22617	29582
X	3.9	12.9	1.02	2.51	39871	52151
Y	5.3	17.3	0.83	2.06	44015	57571
Z	2.8	9.1	0.97	2.40	26894	35177
AA	4.8	15.6	0.45	1.10	21231	27770
BB	4.6	15.2	1.18	2.90	54350	71090
CC	2.8	9.3	0.95	2.36	27132	35489
		Mean	0.92	2.27	31575	41300
		Minimum	0.42	1.04	1649	2157
		Maximum	3.33	8.23	116747	152706
		Sum	26.65	65.85	915671	1197697

Table 16. Comparison of island areas measured in Round 1 and Round 2, approximately six months after initial measurements.

	Round 1		Round 2			
Island	Area (ha)	Area (acres)	Area (ha)	Area (acres)	Difference (ha)	Difference (acre)
A	0.63	1.56	.	.		
B	0.46	1.14	0.44	1.08	0.02	0.06
B2	0.47	1.16	.	.		
B3	0.48	1.17	.	.		
C	0.75	1.85	0.74	1.82	0.01	0.03
D	0.83	2.06	.	.		
E	0.92	2.28	.	.		
F	1.09	2.68	1.10	2.71	-0.01	-0.03
G	0.42	1.04	0.35	0.85	0.08	0.19
H	0.97	2.41	0.92	2.26	0.06	0.14
I	0.73	1.81	0.65	1.60	0.08	0.21
J	1.21	2.98	1.22	3.02	-0.02	-0.04
K	0.53	1.31	.	.		
L	0.77	1.89	0.69	1.70	0.08	0.19
M	0.77	1.90	0.67	1.65	0.10	0.24
N	0.71	1.76	0.64	1.59	0.07	0.17
O	0.60	1.49	.	.		
P	0.76	1.88	.	.		
Q	0.83	2.06	.	.		
R	1.02	2.53	.	.		
S	3.33	8.23	.	.		
T	0.91	2.24	.	.		
U	1.11	2.73	.	.		
V	0.95	2.35	0.91	2.25	0.04	0.10
W	0.89	2.20	0.89	2.20	0.00	0.00
X	1.02	2.51	1.04	2.58	-0.03	-0.07
Y	0.83	2.06	.	.		
Z	0.97	2.40	.	.		
AA	0.45	1.10	.	.		
BB	1.18	2.90	1.13	2.78	0.05	0.12
CC	0.95	2.36	.	.		

Table 17. Comparison of island areas measured in Round 1 and Round 3 approximately 18 months from initial measurements.

Island	Round 1 Area (ha)	Round 3 Area (ha)	Round 1 Area (acre)	Round 3 Area (acre)	Round 1-3 Difference (%)
A	0.63	0.66	1.56	1.63	-4.8
B	0.46	0.43	1.14	1.06	6.7
F	1.09	1.08	2.69	2.67	0.9
G	0.42	0.4	1.04	0.99	5.2
H	0.97	0.97	2.41	2.4	0.4
I	0.73	0.69	1.81	1.7	5.7
J	1.21	1.14	2.98	2.82	5.6
L	0.77	0.79	1.89	1.95	-3.3
M	0.83	0.8	2.05	1.98	3.6
N	0.71	0.76	1.76	1.88	-6.6
R	1.02	0.91	2.53	2.25	11.0
U	1.11	1.12	2.73	2.77	-1.3
V	0.95	1.06	2.35	2.62	-11.5
X	1.02	1.01	2.51	2.5	0.6
Y	0.83	0.83	2.06	2.05	0.5
Mean	0.85	0.84	2.1	2.08	0.9
Minimum	0.42	0.4	1.04	0.99	-11.5
Maximum	1.21	1.14	2.98	2.82	11.1

Table 18. Comparison of island average height measured in Round 1 and Round 3 approximately 18 months from initial measurements.

Island	Round 1 Average Height (m)	Round 3 Average Height (m)	Round 1 Average Height (ft)	Round 3 Average Height (ft)	Round 1-3 Difference (%)
A	3.5	2.0	11.5	6.6	42.9
B	1.7	1.6	5.5	5.2	6.7
F	2.8	2.2	9.2	7.3	21.1
G	2.2	2.0	7.2	6.6	9.3
H	2.2	2.0	7.2	6.5	9.9
I	2.2	2.1	7.3	6.8	6.9
J	3.2	1.9	10.5	6.2	41.2
L	3.8	3.3	12.6	10.9	13.5
M	2.9	2.4	9.4	7.7	17.9
N	1.5	1.3	5.0	4.4	11.2
R	3.7	2.6	12.1	8.7	28.4
U	6.2	4.1	20.2	13.5	33.5
V	6.5	4.3	21.3	14.1	33.7
X	3.9	3.5	12.9	11.6	10.0
Y	5.3	4.3	17.3	14.0	18.9
Mean	3.4	2.6	11.3	8.7	20.3
Minimum	1.5	1.3	5.0	4.4	6.7
Maximum	6.5	4.3	21.3	14.1	42.9

Table 19. Comparison of island volumes measured in Round 1 and Round 3, approximately 18 months from initial measurements.

Island	Round 1 Volume (m3)	Round 3 Volume (m3)	Round 1Volume (yd3)	Round 3 Volume (yd3)	Round 1-3 Difference (%)
A	22070	13200	28867	17266	40
B	7759	6751	10148	8830	13
F	28092	23868	36745	31219	15
G	9303	8000	12168	10464	14
H	21502	19303	28125	25248	10
I	16346	14352	21381	18772	12
J	38808	21546	50761	28182	45
L	29435	26307	38501	34410	11
M	23849	18880	31194	24695	21
N	10759	10184	14073	13321	5
R	37703	24024	49316	31423	36
U	68235	45920	89252	60063	33
V	61809	45686	80846	59757	26
X	39871	35653	52151	46634	11
Y	44015	35524	57571	46465	19
Mean	30637	23280	40073.24	30450.07	21
Minimum	7759	6751	10148.41	8830.31	5
Maximum	68235	45920	89251.96	60063.36	44

Summary of Deliverables for Task 2, Item 1 through Item 3

Area and volume estimates were collected prior to the reflooding of areas surrounding the 29 islands created in Lake Tohopekaliga for future comparisons (Round 1). These data provide a baseline to determine the longevity of islands created by in-lake disposal of muck and we recommend that a subset of the islands be measured periodically (every 4 to 5 years) for this determination. The total footprint of the 29 islands was 65.85 acres with a total volume of approximately 1.2 million cubic yards. Six months after water surrounded all islands, area estimates on 14 islands (Round 2) indicate that the footprints of the islands remained relatively stable. Because the Kissimmee airport GPS base station was destroyed during one of the hurricanes, accurate volume estimates were not obtained six months after water surrounded all of the islands.

Approximately 18 months after the initial areas, average heights and volumes were measured, 15 islands were measured again using GPS equipment. Similar to Round 2 measurements, Round 3 areas were similar to the initial areas measured in Round 1. The average percent difference between Round 1 and Round 3 areas was about 1% with one island (Island V) actually gaining approximately 12% in area and one (Island R) losing approximately 11% of the original area. The areas of five islands appear to have increased and 10 appeared to have decreased slightly. Eighteen months after initial measurements, all 15 islands measured in Round 3 showed decreases in average height and volume. The decreases in average height ranged from 6.7% to 42.9%, averaging 20.3%. While the maximum height of the islands in places are as high as originally measured, wind and wave action have eroded and collapsed the edges of the islands making the overall average height significantly less. The decreases in volume ranged from 5% to 44%, averaging 21% loss of material. There is no apparent pattern for determining which islands were more susceptible to erosion. For example, Island A is relatively close to shore in a protected area and it lost 42.9% of its volume, while Island Y is one of the farthest offshore and it only lost 18.9% of its volume. This suggests that the wind and wave patterns throughout the three hurricanes were probably quite erratic.

It is important to point out that while volume estimates for Round 2 measurements six months after the lake filled are not available, visual examination of the islands strongly suggests that most of the volume lost to the islands happened immediately after the lake filled and the hurricanes passed over. Thus, the calculations of lost material provided in this report, 18 months after the lake filled should be considered the product of an extremely unusual event and may not be representative of the losses to be expected for future management activities of this type.

Deliverables for Task 3, Item 1 and Item 2 (Appendix IV):

Task # 3. Impacts of oxidation and mineralization of organics.

1) January 1, 2004 to June 30, 2004. UF shall collect six samples of island matter from four islands closest to the long-term water quality station set up by South Florida Water Management District. These samples will be analyzed for total phosphorus total nitrogen and organic content.
2) July 1, 2005 to June 30, 2006. UF shall collect six samples of island matter from four islands closest to the long-term water quality station set up by South Florida Water Management District. These samples will be analyzed for total phosphorus total nitrogen and organic content.

In March 2004, Mark Hoyer (UF Investigator) and Marty Mann (FWC Project Manager) toured Lake Tohopekaliga examining the materials that were going to be incorporated into islands. At that time it was agreed that the materials that were going to be incorporated into the islands were quite diverse around the whole lake. Thus, it was agreed that instead of taking six muck samples from only four islands (total of 24 samples), 3 samples would be taken from each of the 29 islands (total of 87 samples). This sampling procedure will allow for a better examination of nutrient content and potential impacts of oxidation and mineralization on materials in the islands. All 87 samples for Task 3 Item 1 have been collected, processed and the analyses of the data are reported on below.

Task # 3, Item 2 has been completed with the collection of three core samples from each of the 15 islands (total of 45 samples) that were measured for area and volume 18 months after water returned to Lake Tohopekaliga. All 45 samples for Task 3 Item 1 have been collected, processed and the analyses of the data are reported on below.

<u>Methods</u>

On the day initial area and volume of individual islands (29 islands) were measured, three separate cores were taken from the top of each island. Approximately 18 months after all island areas and volumes were initially measured 15 islands were measured again and three additional cores were taken using the same methods. The cores were taken using a post-hole digger and they were spaced uniformly around the islands depending on the shape of the island. The depth (approximately 24 in) and diameter (approximately 6 in) of the cores were measured to determine the volume of material that was removed. The material was weighed, shredded with garden clippers and a sub sample taken for later analysis. Bulk density of the island material was calculated by dividing the wet weight of the material by the volume of the core (kg wet wt/L).

At the laboratory, the sub sample of core material was dried at 100 C° and weighed to determine percent moisture content. A small sub sample (approximately 5 g) of the dried material was ground to a powder, weighed and burned at 550 C° and weighed again to estimate organic content. An additional small sub sample (approximately 5 g) of the dried material was ground to a powder for analysis of total phosphorus, total nitrogen and carbon concentrations. Total carbon and total nitrogen were measured on a Carlo-Erba 1500 CNS analyzer. Approximately 3-5 mg of untreated ground bulk sediment was loaded into tin capsules and placed in a 50-position automated sample carousel on the CNS analyzer. After flash combustion in a quartz column at 1040 ^{o}C in an oxygen-rich atmosphere, sample gas was transported in a He carrier stream and passed through a hot reduction column (650 ^{o}C), consisting of elemental copper, to remove oxygen. The effluent stream from the elemental analyzer then passed through a chemical (magnesium perchlorate) trap to remove water. It next passed into a GC column at 50°C where N_2 and CO_2 peaks were separated before being measured on a thermal conductivity detector. Total C and N were automatically calculated based on a regression created by measurement of a series of atropine standards (C = 70.56%, N = 4.84%). Total phosphorus (P) was measured using a Technicon Autoanalyzer II with a single-channel colorimeter, following digestion with H_2SO_4 and $K_2S_2O_8$ (Schelske et al. 1986). Nutrient concentrations in sediments are expressed as amount per unit dry mass.

Results

Data collected during Round 1 sampling show the percent organics (volatile solids) and carbon content of the islands constructed in Lake Tohopekaliga averaged 11.4% and 46 (mg/g) ranging from 6.4% to 24.3 % and 19 (mg/g) to 134 (mg/g), respectively (Table 20). The total nitrogen and total phosphorus concentrations of the islands constructed in Lake Tohopekaliga averaged 3.0 (mg/g) and 0.10 (mg/g) ranging from 1.6 (mg/g) to 7.6 (mg/g) and 0.05 (mg/g) to 0.23 (mg/g), respectively. In 1982 Brenner and Binford (1987) examined the organic, carbon and nutrient contents of deep-water sediments of 97 Florida lakes including Lake Tohopekaliga. In 1982 the organic, carbon and nitrogen content of deep-water sediments in Lake Tohopekaliga averaged 8.1 (%), 37 (mg/g), and 5.1 (mg/g), respectively, which fall into the ranges measured from the islands in this study. The total phosphorus content of the deep-water sediments in 1982 averaged 0.49 (mg/g), which is higher than the range of concentrations measured from the islands in this study (0.05 mg/g to 0.23 mg/g).

The lower phosphorus concentrations in the current sediment samples are probably due to the removal of municipal waster water inputs that peaked in 1980. The first municipal point-source discharges to reach Lake Tohopekaliga began in the late 1950s and significant deterioration in water quality and aquatic habitat was evident by 1969. Annual phosphorus loading peaked in 1980 at 112,000 kg/yr (Williams 2001). In 1982, it was estimated that 42% to 48% (60,000 kg) of the total phosphorus load and 41% to 49% of the total nitrogen load entering Lake Tohopekaliga came from wastewater treatment plants (Jones et al. 1983). Since that time, lake management activities caused a steady decline in wastewater effluent reaching the lake, thus decreasing the wastewater treatment plant phosphorus discharge to Lake Tohopekaliga from 87,000 kg in 1981 to 1,500 kg in 1988 (Dierberg et al. 1988; Williams 2001).

James et al. (1994) estimated nutrient loading to Lake Tohopekaliga by combining stream flow data with corresponding measurements of nutrients in the inflowing waters. They covered the years 1982 through 1992, which included years with wastewater inputs. By January 1988 all wastewater inputs had been diverted from the lake, so values for the period 1988-1992 provide our best estimate of the loadings during the current study. The following are the average annual phosphorus and nitrogen loads for the years 1988-1992 in metric tons, calculated by James et al. 1994:

Average annual Phosphorus load	24 t
Average annual Nitrogen load	319 t

(1 metric ton = 1000 kg).

Using bulk density, percent wet weight, island volumes, and nutrient concentrations of the sediments listed in Tables 15 and 20, the total amount of nutrients incorporated in all of the islands can be estimated. Approximately 75 metric tons of phosphorus and 2081 metric tons of nitrogen are bound in island material, which are approximately 3.1 and 6.5 times the estimated annual loads (James et al 1994), respectively. While the amount of nutrients incorporated in the islands exceeds the annual nutrient loads to Lake Tohopekaliga, analyses of water chemistry conducted for the deliverables of Task 1 above suggest that these nutrients are bound up in the islands and are not leaching out and impacting the overall water chemistry of the lake.

Approximately 18 months after initial core sampling, cores from 15 islands showed similar organic and nutrient contents. Data collected 18 months later show the percent organics (volatile solids) and carbon content of the 15 islands constructed in Lake Tohopekaliga averaged 10.6% and 53 (mg/g) ranging from 4.4% to 15.5% and 17.5 (mg/g) to 98.2 (mg/g), respectively (Table 21). An analysis of variance also showed no significant difference in percent volatile solids and carbon content between data collected in 2004 and data collected 18 month later in 2006 from 15 corresponding islands. Data collected 18 months later show total nitrogen and total phosphorus concentrations of the 15 islands constructed in Lake Tohopekaliga averaged 4.6 (mg dry wt/g) and 0.12 (mg dry wt/g), ranging from 2.0 (mg dry wt/g) to 7.8 (mg dry wt/g) and 0.08 (mg dry wt/g) to 0.18 (mg dry wt/g), respectively (Table 22). An analysis of variance also showed no significant difference in total phosphorus content between data collected in 2004 and data collected 18 month later in 2006 from 15 corresponding islands. However, an analysis of variance did show that total nitrogen content of cores collected in 2004 (2.6 mg dry wt/g) was less than data collected 18 month later in 2006 (4.6 mg dry wt/g) from 15 corresponding islands.

These results are somewhat surprising considering the tremendous rainfall that occurred during the three hurricanes that happened immediately after the islands were constructed (Figure 1B). On average the islands lost approximately 21% of their volume 18 month after they were created (Table 19) and because of this it would be expected that organic contents and nutrients would have been less because of weathering and leeching, however they were not. One possible explanation for this is that there was tremendous growth of terrestrial plants on the tops of the islands after they were constructed. This growth could have increased the content of organics and nitrogen in the shallow cores due to the expansion of root systems in the surface soils of the islands.

Table 20. Average bulk density, percent wet wt, percent organic content, carbon content and nutrient concentration of three sediment cores taken from all 29 islands created in Lake Tohopekaliga the summer of 2004.

Island	Bulk Density (kg wet wt/L)	Percent wet wt (%)	Organic Content (%)	Carbon (mg dry wt/g)	Total Nitrogen (mg dry wt/g)	Total Phosphorus (mg dry wt/g)
A	1.5	32	6.4	30	1.7	0.07
AA	1.2	35	15.2	50	2.9	0.22
B	1.4	34	8.1	41	2.3	0.10
BB	1.2	29	12.1	45	3	0.21
C	1.1	57	24.3	134	7.6	0.22
CC	1.4	35	14.8	42	3	0.23
D	1	38	15.9	87	6	0.08
E	1.1	34	10.3	35	2.3	0.07
F	1.3	45	15.7	80	4.6	0.13
G	1.4	33	9.8	49	3.1	0.09
H	1.8	38	7.7	31	2.1	0.10
I	1.5	38	10.5	37	2.5	0.10
J	1.3	42	14.7	83	4.6	0.15
K	1.3	35	10.3	37	2.6	0.08
L	1.2	41	14	62	4.1	0.11
M	1.3	46	16.6	50	3.7	0.08
N	1.5	24	7.5	22	1.6	0.07
O	1.5	24	7.4	28	2	0.08
P	1.3	24	10.3	46	3.4	0.10
Q	1.3	36	12.1	38	2.9	0.08
R	1.3	31	11.2	47	3.1	0.07
S	1.3	29	9.4	32	2.4	0.10
T	0.9	32	9.9	34	2.1	0.06
U	1.1	17	6.7	19	1.6	0.07
V	1	28	9.6	31	2.1	0.05
W	1.2	43	14.9	63	4.3	0.13
X	1.3	24	6.6	22	1.7	0.05
Y	1.1	24	7.9	25	2	0.05
Z	1.3	45	9.4	36	2.2	0.06
Mean	1.3	34	11.4	46	3.0	0.10
Minimum	0.9	17	6.4	19	1.6	0.05
Maximum	1.8	57	24.3	134	7.6	0.23
Standard Deviation	0.2	8.6	4	24	1.4	0.05

Table 21. Average percent volatile and carbon content of three sediment cores taken from 15 different islands created in lake Tohopekaliga in 2004 and 2006. Cores were taken from the surface to approximately 0.7 m deep.

Island	2004 Percent Volatile (%)	2006 Percent Volatile (%)	2004 Carbon (mg dry wt/g)	2006 Carbon (mg dry wt/g)
A	6.4	4.4	29.9	17.5
B	8.1	10.1	41.3	53.3
E	10.3	10.3	34.9	60.0
G	9.8	10.4	48.8	65.9
H	7.7	11.1	30.8	64.3
I	10.5	13.6	37.1	60.9
J	14.7	10.8	82.7	46.2
L	14.0	13.2	61.5	64.8
M	16.6	15.5	50.1	98.2
N	7.5	9.0	22.0	44.1
R	11.2	8.0	46.7	33.3
U	6.7	12.5	18.9	62.0
V	9.6	12.2	31.3	47.6
X	6.6	9.0	21.9	31.4
Y	7.9	9.5	24.7	50.4
Mean	9.8	10.6	38.8	53.3
Minimum	6.4	4.4	18.9	17.5
Maximum	16.6	15.5	82.7	98.2
Standard Deviation	3.1	2.6	17.2	18.8

Table 22. Average total phosphorus and total nitrogen content of three sediment cores taken from 15 different islands created in lake Tohopekaliga in 2004 and 2006. Cores were taken from the surface to approximately 0.7 m deep.

Island	2004 Total Phosphorus (mg/g)	2006 Total Phosphorus (mg/g)	2004 Total Nitrogen (mg dry wt/g)	2006 Total Nitrogen (mg dry wt/g)
A	0.07	0.08	1.7	2.0
B	0.45	0.12	2.3	4.5
E	0.07	0.14	2.3	4.9
G	0.09	0.10	3.1	5.4
H	0.10	0.11	2.1	5.4
I	0.10	0.14	2.5	4.8
J	0.15	0.18	4.6	4.1
L	0.11	0.14	4.1	5.4
M	0.08	0.16	3.7	7.8
N	0.07	0.09	1.6	4.3
R	0.07	0.08	3.1	3.4
U	0.07	0.17	1.6	5.4
V	0.05	0.11	2.1	3.8
X	0.05	0.08	1.7	3.0
Y	0.05	0.08	2.0	4.5
Mean	0.11	0.12	2.6	4.6
Minimum	0.05	0.08	1.6	2.0
Maximum	0.45	0.18	4.6	7.8
Standard Deviation	0.10	0.03	0.9	1.3

Summary Deliverables for Task 3, Item 1 and Item 2

Sediment cores taken from the top of the islands after initial construction show the percent organics (volatile solids) and carbon content of the islands constructed in Lake Tohopekaliga averaged 11.4% and 46 (mg/g) ranging from 6.4% to 24.3 % and 19 (mg/g) to 134 (mg/g), respectively (Table 20). The total nitrogen and total phosphorus concentrations of the islands constructed in Lake Tohopekaliga averaged 3.0 (mg/g) and 0.10 (mg/g) ranging from 1.6 (mg/g) to 7.6 (mg/g) and 0.05 (mg/g) to 0.23 (mg/g), respectively. These cores showed that the percent organics, carbon and nutrient content of the islands constructed in Lake Tohopekaliga are within the range reported for deep-water sediments of 97 lakes by Brenner and Binford (1987). However, the total phosphorus concentration of the muck used to create the islands was approximately 5 times less then the deep sediments measured for Lake Tohopekaliga in 1982. This is probably the result of management efforts conducted to remove treated wastewater effluent that was entering the lake.

There was no significant difference in percent volatile solids, carbon content and total phosphorus concentration of sediment cores collected in 2004 and data collected 18 month later in 2006 from 15 corresponding islands. However, an analysis of variance did show that total nitrogen content of cores collected in 2004 (2.6 mg dry wt/g) was less than data collected 18 month later in 2006 (4.6 mg dry wt/g) from 15 corresponding islands. These results are somewhat surprising considering the tremendous rainfall that occurred during the three hurricanes that happened immediately after the islands were constructed. On average the islands lost approximately 21% of their volume 18 month after they were created (Table 19) and because of this it would be expected that organic contents and nutrients would have been less because of weathering and leeching, however they were not. One possible explanation for this is that there was tremendous growth of terrestrial plants on the tops of the islands after they were constructed. This growth could have increased the content of organics and nitrogen in the shallow cores due to the expansion of root systems in the surface soils of the islands.

Using bulk density, percent wet weight, island volumes, and nutrient concentrations of the sediments listed in Tables 15 and 20, the initial amount of nutrients incorporated in all of the islands can be estimated. Approximately 75 metric tons of phosphorus and 2081 metric tons of nitrogen were bound in island material, which are approximately 3.1 and 6.5 times the estimated annual loads (James et al 1994), respectively. While the amount of nutrients incorporated in the islands exceeds the annual nutrient loads to Lake Tohopekaliga and on average the islands lost approximately 21% of their volume 18 month after they were created, analyses of water chemistry conducted for the deliverables of Task 1 suggest that these nutrients are not leaching out to the water column and impacting the overall water chemistry of the lake.

Deliverables for Task 4, Item 1 through Item 4 (Appendix IV):

Task # 4. Pluses and minuses to fish populations.

1) January 1, 2003 to June 30, 2003. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.
2) January 1, 2004 to June 30, 2004. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.
3) July 1, 2004 to June 30, 2005. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.
4) July 1, 2005 to June 30, 2006. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.

Data for Task # 4, Item 1 through Item 4 have been collected, analyzed and the results are reported below.

Methods

Electrofishing transects (10 minutes) were collected in late winter of 2002 and 2003 before the lake enhancement project and in 2004 and 2005 after the lake enhancement project. The rationale for this season is to assess age-1 sportfish abundance after their first winter and presumably after they have recruited to the stock. Also, this time period should provide a good sample of adults that are moving in to spawn. Six transects were collected at fixed stations, spaced uniformly around the lake, along the shore with the pedal down constantly for 10 minutes. The latitude and longitude of these transects were marked with global positioning system equipment (GPS) to insure constant sampling locations though time.

All fish collected were placed in an aerated tank, and at the end of each transect large sportfish were quickly measured for total length (TL mm) and released. Small fishes were placed in bags on ice for later workup. All largemouth bass and black crappie, which are two major sportfish in Lake Tohopekaliga, were measured to the nearest mm. All other fishes were grouped by species in 2-cm size groups (1-20 mm, 21-40, 41-60, etc.) and the total number for each size group of each species was recorded for each individual transect. Weights of fish were calculated using regression equations from Hoyer and Canfield (1994) and from Schaeffer (Personal communication, Florida Fish and Wildlife Conservation Commission).

Measures of community composition include species richness (the total number of species collected in an individual year), Shannon-Wieners diversity index (H) and evenness (E) (Pielou 1977; Ennos and Bailey 1995). The latter two indices were calculated from the following:

$$H = -\sum pi*\ln(pi)$$

$$E = H/\ln S$$

Where *pi* is the proportion of the whole community represented by species *i* and S is the number of species.

Results

In 2002 and 2003, prior to the drawdown and lake enhancement project electrofishing transects collected 20 and 15 species of fish, respectively (Table 23). Total electrofishing catch per unit effort averaged 303 (fish/hr), 66.9 (kg/hr) and 206 (fish/hr), 66.0 (kg/hr) in 2002 and 2003, respectively (Tables 23 and Table 24). In 2004 and 2005, immediately after the enhancement project only 9 and 12 species of fish were captured, respectively. Total electrofishing catch per unit effort averaged only 36 (fish/hr), 11.1 (kg/hr) and 75 (fish/hr), 34.6 (kg/hr) in 2004 and 2005, respectively (Tables 23 and Table 24). The decrease in number of species captured and lower catch per unit effort in 2004 and 2005 was expected after the extreme drawdown because all fish were concentrated during the drawdown and many forage fish were probably consumed. Additionally, after reflooding a smaller total number of fish were spread throughout newly flooded areas without much habitat to concentrate fish making it more difficult to capture fish.

Lake Tohopekaliga catch per unit effort data were compared to similar data collected from 60 Florida lakes ranging in lake size and trophic status (Canfield and Hoyer 1992). There was a significant positive relation between lake trophic status, estimated with chlorophyll concentrations, and catch per unit effort among Florida lakes (Figure 47). Plotting our Lake Tohopekaliga data with the other similar Florida data shows that while catch per unit effort from 2004 and 2005 is down, it still falls within the range of other lakes of similar trophic status.

As mentioned above, examining fish community measurements in Lake Tohopekaliga shows that fish species richness is lower after the lake enhancement project was completed. However, species diversity and evenness calculated with numbers (Table 25) or weights (Table 26) are similar across time suggesting that the major fish species, which are the primary sportfish in Lake Tohopekaliga, are present in a consistent percentage. Many of the fish species not collected in 2004 and 2005 are species (bluefin killifish, dollar sunfish, eastern mosquitofish, golden topminnow, redfin pickerel, sailfin molly, and warmouth) that associate with submersed aquatic vegetation that was not abundant in 2004 and 2005 because of the enhancement project and colored water caused by the hurricanes of 2004. It is doubtful that these fish are no longer present in Lake Tohopekaliga but that the limited sampling just missed them in 2004 and 2005. However, we recommend continued sampling to keep track of the whole fish community in Lake Tohopekaliga

Many studies have examined the impacts of low water, caused by drought, on fish populations (Magoulick and Kobza 2003). In a review of 50 such studies Matthews and Marsh-Mathews (2003) summarized short-term effects (drought from months to a few years) on fish populations or local assemblages. Similar to the results found for Lake Tohopekaliga, the most frequently demonstrated effects of short-term low water were population declines, some community changes and scattering movement within the study area. Mathews and Marsh Mathews (2003) point out, however, that these are short-lived effects as water comes back to the systems. Again, continued sampling is needed to determine if the total fish population of Lake Tohopekaliga will rebound to levels recorded prior to the lake enhancement project.

Table 23. Catch per unit effort (Fish/hr) values are total numbers by species captured in six ten-minute electrofishing transects conducted at Lake Tohopekaliga on four separate sampling events between December 2002 and December 2005.

	Catch per unit effort (fish/hr)			
Common Name	December, 2002	December, 2003	December, 2004	December, 2005
Black crappie	2	3	4	4
Blue tilapia	.	1	.	.
Bluefin killifish	8	.	.	.
Bluegill	76	70	8	23
Bluespotted sunfish	.	.	.	1
Bowfin	1	2	1	1
Brook silverside	9	1	.	.
Brown bullhead	2	1	.	1
Chain pickerel	20	15	.	2
Dollar sunfish	.	1	.	.
Eastern mosquitofish	10	.	.	.
Florida gar	14	15	6	14
Gizzard shad	24	.	.	.
Golden shiner	16	7	1	2
Golden topminnow	3	.	.	.
Lake chubsucker	43	26	2	4
Largemouth bass	34	40	1	20
Redear sunfish	21	17	8	2
Redfin pickerel	3	.	.	.
Sailfin molly	6	.	.	.
Seminole killifish	2	1	5	.
Taillight shiner	6	.	.	.
Threadfin shad	.	.	.	1
Warmouth	3	6	.	.
Total Number (Fish/hr)	303	206	36	75

Table 24. Catch per unit effort (Grams/hr) values are total weight captured by species in six ten-minute electrofishing transects conducted at Lake Tohopekaliga on four separate sampling events between December 2002 and December 2005.

	Catch per unit effort (gm/hr)			
Common Name	December, 2002	December, 2003	December, 2004	December, 2005
Black crappie	319	172	495	1631
Blue tilapia	.	2136	.	.
Bluefin killifish	3	.	.	.
Bluegill	4792	3810	708	2588
Bluespotted sunfish	.	.	.	3
Bowfin	2133	2263	1051	2111
Brook silverside	17	2	.	.
Brown bullhead	1371	333	.	1192
Chain pickerel	11271	4519	.	2018
Dollar sunfish	.	5	.	.
Eastern mosquitofish	6	.	.	.
Florida gar	8895	9611	5426	13124
Gizzard shad	173	.	.	.
Golden shiner	576	377	15	63
Golden topminnow	10	.	.	.
Lake chubsucker	22595	7545	916	2176
Largemouth bass	13137	33102	1749	9134
Redear sunfish	1153	1886	1404	596
Redfin pickerel	185	.	.	.
Sailfin molly	6	.	.	.
Seminole killifish	24	14	60	.
Taillight shiner	8	.	.	.
Threadfin shad	.	.	.	2
Warmouth	182	266	.	.
Total Weight (gm/hr)	66856	66041	11824	34635

Table 25. Individual species percent composition (100 times: number of individuals per species caught/total fish caught) in six ten-minute electrofishing transects conducted at Lake Tohopekaliga on four separate sampling events between December 2002 and December 2005.

	Percent of total catch (numbers)			
Common Name	December, 2002	December, 2003	December, 2004	December, 2005
Black crappie	0.7	1.5	11.1	5.3
Blue tilapia	0.0	0.5	0.0	0.0
Bluefin killifish	2.6	0.0	0.0	0.0
Bluegill	25.1	34.0	22.2	30.7
Bluespotted sunfish	0.0	0.0	0.0	1.3
Bowfin	0.3	1.0	2.8	1.3
Brook silverside	3.0	0.5	0.0	0.0
Brown bullhead	0.7	0.5	0.0	1.3
Chain pickerel	6.6	7.3	0.0	2.7
Dollar sunfish	0.0	0.5	0.0	0.0
Eastern mosquitofish	3.3	0.0	0.0	0.0
Florida gar	4.6	7.3	16.7	18.7
Gizzard shad	7.9	0.0	0.0	0.0
Golden shiner	5.3	3.4	2.8	2.7
Golden topminnow	1.0	0.0	0.0	0.0
Lake chubsucker	14.2	12.6	5.6	5.3
Largemouth bass	11.2	19.4	2.8	26.7
Redear sunfish	6.9	8.3	22.2	2.7
Redfin pickerel	1.0	0.0	0.0	0.0
Sailfin molly	2.0	0.0	0.0	0.0
Seminole killifish	0.7	0.5	13.9	0.0
Taillight shiner	2.0	0.0	0.0	0.0
Threadfin shad	0.0	0.0	0.0	1.3
Warmouth	1.0	2.9	0.0	0.0
Richness	20	15	9	12
Diversity	3.11	2.76	2.76	2.66
Evenness	0.98	0.87	0.87	0.84

Table 26. Individual species percent composition (100 times: weight of individuals per species caught/total weight caught) in six ten-minute electrofishing transects conducted at Lake Tohopekaliga on four separate sampling events between December 2002 and December 2005.

	Percent of total catch (weight)			
Common Name	December, 2002	December, 2003	December, 2004	December, 2005
Black crappie	0.5	0.3	4.2	4.7
Blue tilapia	0.0	3.2	0.0	0.0
Bluefin killifish	0.0	0.0	0.0	0.0
Bluegill	7.2	5.8	6.0	7.5
Bluespotted sunfish	0.0	0.0	0.0	0.0
Bowfin	3.2	3.4	8.9	6.1
Brook silverside	0.0	0.0	0.0	0.0
Brown bullhead	2.1	0.5	0.0	3.4
Chain pickerel	16.9	6.8	0.0	5.8
Dollar sunfish	0.0	0.0	0.0	0.0
Eastern mosquitofish	0.0	0.0	0.0	0.0
Florida gar	13.3	14.6	45.9	37.9
Gizzard shad	0.3	0.0	0.0	0.0
Golden shiner	0.9	0.6	0.1	0.2
Golden topminnow	0.0	0.0	0.0	0.0
Lake chubsucker	33.8	11.4	7.7	6.3
Largemouth bass	19.6	50.1	14.8	26.4
Redear sunfish	1.7	2.9	11.9	1.7
Redfin pickerel	0.3	0.0	0.0	0.0
Sailfin molly	0.0	0.0	0.0	0.0
Seminole killifish	0.0	0.0	0.5	0.0
Taillight shiner	0.0	0.0	0.0	0.0
Threadfin shad	0.0	0.0	0.0	0.0
Warmouth	0.3	0.4	0.0	0.0
Richness	20	15	9	12
Diversity	2.63	2.47	2.50	2.59
Evenness	0.83	0.78	0.79	0.82

Figure 47. Catch per unit effort (CPUE kg/hr) versus chlorophyll (µg/L) for 60 Florida lakes sampled by Canfield and Hoyer (1992) (open circle) and Lake Tohopekaliga (Osceola County, Florida) 2002, 2003, 2004, and 2005 (closed circle) electrofishing data. Linear regression is for log values of the 60 Florida lakes.

Summary for Deliverables for Task 4, Item 1 through Item 3

Total electrofishing catch per unit effort averaged 303 (fish/hr), 66.9 (kg/hr) and 206 (fish/hr), 66.0 (kg/hr) in 2002 and 2003, respectively (Tables 23 and Table 24). Total electrofishing catch per unit effort averaged only 36 (fish/hr), 11.1 (kg/hr) and 75 (fish/hr), 34.6 (kg/hr) in 2004 and 2005, respectively (Tables 23 and Table 24). The lower catch per unit effort in 2004 and 2005 was expected after the extreme drawdown because all fish were concentrated during the drawdown and many forage fish were probably consumed. Additionally, after reflooding a smaller total number of fish were spread throughout newly flooded areas without much habitat to concentrate fish making it more difficult to capture fish. Plotting our Lake Tohopekaliga data with the other similar Florida data shows that while catch per unit effort from 2004 and 2005 is down, it still falls within the range of other lakes of similar trophic status.

Fish community measurements in Lake Tohopekaliga show that fish species richness is lower after the lake enhancement project was completed. In 2002 and 2003, prior to the drawdown and lake enhancement project electrofishing transects collected 20 and 15 species of fish, respectively (Tables 25). In 2004 and 2005, immediately after the enhancement project only 9 and 12 species of fish were captured, respectively. However, species diversity and evenness calculated with numbers (Table 25) or weights (Table 26) are similar across time suggesting that the major fish species, which are the primary sportfish in Lake Tohopekaliga, are present in a consistent percentage. Many of the fish species not collected in 2004 and 2005 are species (bluefin killifish, dollar sunfish, eastern mosquitofish, golden topminnow, redfin pickerel, sailfin molly, and warmouth) that associate with submersed aquatic vegetation that was not abundant in 2004 and 2005 because of the enhancement project and colored water caused by the hurricanes of 2004. It is doubtful that these fish are no longer present in Lake Tohopekaliga but that the limited sampling just missed them in 2004 and 2005. However, we recommend continued sampling to keep track of the whole fish community in Lake Tohopekaliga.

Deliverables for Task 5, Item 1 and Item 2 (Appendix IV):

Task # 5. Cost of muck removal per year (rate of muck accumulation in cleared areas and how often will muck have to be cleared to maintain good habitat).

1) July 1, 2004 to June 30, 2005. Sediment cores will be taken six months after Lake Tohopekaliga reaches low pool. Replicate cores will be taken behind 24 islands between the island and land water interface. Three cores will also be taken along 24 transects set perpendicular to the shoreline in cleared areas away from created islands.

2) July 1, 2005 to June 30, 2006. Sediment cores will be taken 18 months after Lake Tohopekaliga reaches low pool. Replicate cores will be taken behind 24 islands between the island and land water interface. Three cores will also be taken along 24 transects set perpendicular to the shoreline in cleared areas away from created islands.

Task 5, Item 1 and Item 2 have been completed and analyzed. In January 2005 and January 2006 measurements of organic sediment thickness at 2 stations behind and three stations next to all 29 islands (total of 145 cores) have been completed.

Methods

Task #5 was designed to estimate thickness of organic sediment in scraped areas around all islands for future comparisons and the future determination of how fast organic sediment actually accumulates in Lake Tohopekaliga. Therefore, in January of 2005 and 2006, sediment cores were taken once at each of five stations around each of the 29 wildlife islands in order to determine the depth (cm) of the organic material on the lake bottom immediately after water filled the lake. The latitude and longitude of all sediment core stations were recorded using GPS equipment for future reference. The stations were labeled with a SC (Sediment Core), followed by the island letter, and ending with the sediment core station number (e.g. SCA1, sediment core for Island A at station 1) (Figure 48, Table 27). The cores were taken with a clear plastic tube one and a half inch in diameter that was pushed into the sediment, sealed and removed. The thickness of organic sediment above the sand base in the core was measured using a meter stick (Figure 49). Two cores (1 and 2 for each island) were taken behind each island between the island and the shoreline water interface. The remaining three cores (1, 2, and 3 for each island) were taken along a transect set perpendicular to the shoreline approximately 300 meters (m) away from each island, and were separated by approximately 15 m (Figure 48). Taking cores from behind Island P was not possible because trees surrounded the island on three of the inland sides. Therefore, those two cores were taken from the open-water side of the island.

Results

In 2005 the average thickness of organic matter in all 145 cores was 1.6 cm with a range of 0.0 to 16.5 cm (Table 27) and only 10% of the cores exceeded 5.3 cm. Taking the estimated 6.5 million cubic meters of material removed and dividing by the estimated 14.2 million square meters of area scraped (Mann et al. 2004) yields an average depth of approximately 46 cm of organic matter before the lake enhancement project. Thus, organic matter in the areas that were scraped during the lake enhancement project was significantly reduced.

In 2006 the average thickness of organic matter in all 145 cores was 2.2 cm with a range of 0.0 to 21.0 cm (Table 28) and only 10% of the core exceeded 6.8 cm. Paired T-tests show no significant differences ($p \leq 0.05$) between cores taken in 2005 and 2006 for cores taken behind islands or in scraped areas taken away from islands. However, Paired T-test did show that the sediment depth in all cores together taken in 2006 were greater than sediment depth in all cores taken in 2005. This suggests that in 2006 there may be more sediment in scraped areas, possibly due to the loss of island volumes and redistribution of material. The average increase in sediment thickness, however, was only 0.6 cm and this may be the result of sampling error because even with GPS positioning equipment it is impossible to take cores in exactly the same locations from year to year. While taking sediment cores it was apparent that there are small local differences in sediment thickness due to low areas caused by heavy equipment ruts left during the lake enhancement activities.

Figure 48. Examples of the location and distribution of the five lake bottom sediment core stations (○) taken from around each of the 29 wildlife islands (●) in Lake Tohopekaliga, Osceola County, Florida. The four wildlife islands with water quality stations are labeled with a circle encompassing an X (⊗). The sediment core stations were designated with the letters SC (Sediment Core), followed by the island letter, and ending with the sediment core station number. Inset shows specific locations for Island J.

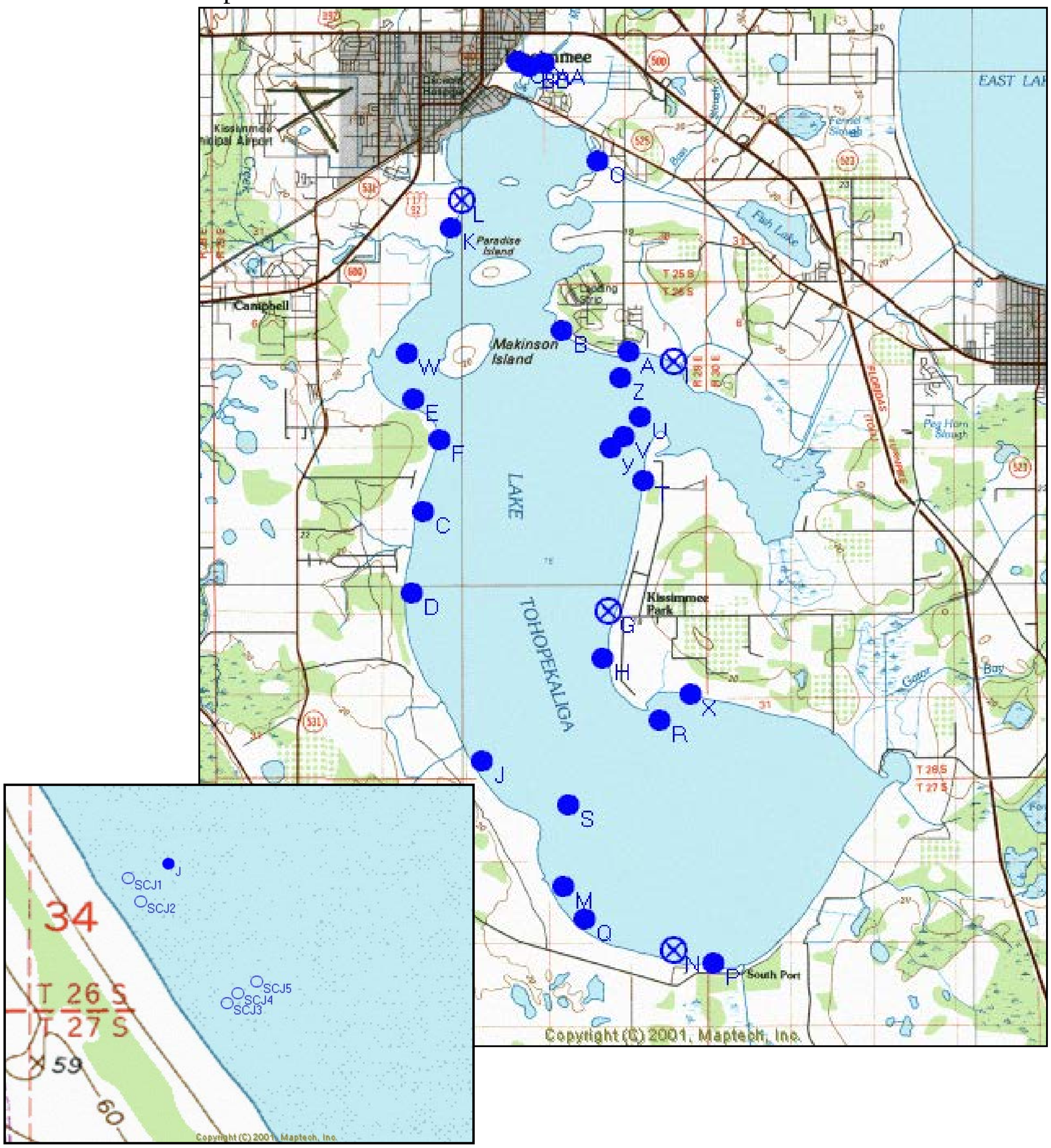


Figure 49. Picture of sediment core and how the organic sediment was measured.

Table 27. Depth of organic matter measured in 2005 and 2006 and location (Latitude and Longitude) of each sediment core taken from around and between the 29 wildlife islands constructed in Lake Tohopekaliga, Osceola County, Florida. The sediment core stations were designated with the letters SC (Sediment Core), followed by the island letter, and ending with the sediment core station number. Cores stations 1 and 2 are located behind the lettered island and stations 3, 4 and 5 are away from the island in scraped areas.

Station	Lat Degree	Lat Minute	Lat Second	Long Degree	Long Minute	Long Second	Organics 2005 (cm)	Organics 2006 (cm)
SCA1	28	14	52.2	81	22	25.5	1.7	1
SCA2	28	14	52.2	81	22	27.6	2.3	0.6
SCA3	28	14	51	81	22	38.8	0.7	0.2
SCA4	28	14	52.4	81	22	38.5	0	0.2
SCA5	28	14	53.1	81	22	38	0	0.3
SCAA1	28	17	51.9	81	23	30.2	0.6	0
SCAA2	28	17	52.1	81	23	29	0	0
SCAA3	28	17	41.2	81	23	35.1	1.8	0.6
SCAA4	28	17	42.5	81	23	35.7	0.7	0.2
SCAA5	28	17	42.2	81	23	39.5	1.7	0
SCB1	28	15	0.1	81	23	26.2	14.5	0
SCB2	28	15	5.4	81	23	15.3	9.5	11.4
SCB3	28	14	56.5	81	23	8.8	4.4	20.3
SCB4	28	14	58	81	23	6.6	16.5	19.1
SCB5	28	14	58	81	23	6.2	0.7	3.8
SCBB1	28	17	48.3	81	23	40.1	0.6	4.4
SCBB2	28	17	49.2	81	23	41.9	0.2	16.5
SCBB3	28	17	38.6	81	23	41.1	0.3	21
SCBB4	28	17	39.2	81	23	42.3	0.9	1.9
SCBB5	28	17	39.5	81	23	44.5	0.8	18.4
SCC1	28	13	11.3	81	24	59.1	0	0.2
SCC2	28	13	10.1	81	24	59.6	0.3	0.3
SCC3	28	13	2.6	81	25	0.6	0	0.2
SCC4	28	13	1.5	81	24	57.6	0.51	0.6
SCC5	28	13	2	81	24	56.4	0	0.6
SCCC1	28	17	52.7	81	23	51.1	0.3	1.3
SCCC2	28	17	52.9	81	23	50.5	0.2	0.6
SCCC3	28	17	41.4	81	23	48	0.3	0.6
SCCC4	28	17	42	81	23	50.2	0.3	0
SCCC5	28	17	43.2	81	23	51.6	0.1	0
SCD1	28	12	18.6	81	25	7.8	10.41	11.4
SCD2	28	12	17.4	81	25	8	0	1.3

Station	Lat Degree	Lat Minute	Lat Second	Long Degree	Long Minute	Long Second	Organics 2005 (cm)	Organics 2006 (cm)
SCD3	28	12	10.1	81	25	6.4	0	0.3
SCD4	28	12	9.8	81	25	4.1	0	0.3
SCD5	28	12	9.8	81	25	2	0.25	12.1
SCE1	28	14	19.8	81	25	4.7	1.27	0.6
SCE2	28	14	19.2	81	25	3.5	0	4.1
SCE3	28	14	18.3	81	25	0	0	1.3
SCE4	28	14	18.7	81	24	57	0	0.2
SCE5	28	14	19.3	81	24	56.1	0	0.2
SCF1	28	13	56.7	81	24	44.1	0	0.2
SCF2	28	13	55.7	81	24	44.2	0.25	1.9
SCF3	28	13	49.8	81	24	46.6	0	10.8
SCF4	28	13	48.8	81	24	45.4	0	0.2
SCF5	28	13	49.9	81	24	42.7	0	0.2
SCG1	28	12	7.5	81	22	41.8	1.11	0.2
SCG2	28	12	8.1	81	22	42.1	2.22	0.3
SCG3	28	12	16.4	81	22	41.3	0.64	3.2
SCG4	28	12	16.3	81	22	38.4	0.64	0
SCG5	28	12	15.5	81	22	35.9	0	0
SCH1	28	11	44.6	81	22	44.6	6.35	5.1
SCH2	28	11	37.3	81	22	44.8	0.76	0
SCH3	28	11	46.1	81	22	48.1	5.71	7.6
SCH4	28	11	48.1	81	22	45.9	3.81	6.3
SCH5	28	11	48	81	22	43.3	0	1.3
SCI1	28	14	45.3	81	21	54.3	7.4	0.2
SCI2	28	14	46.7	81	21	56.5	8.5	5.2
SCI3	28	14	47.6	81	22	6.6	1.1	0.6
SCI4	28	14	49.6	81	22	6.4	0	0
SCI5	28	14	50.6	81	22	5.4	0	0.2
SCJ1	28	10	31.3	81	24	17.1	3.81	0.2
SCJ2	28	10	29.7	81	24	16.1	0	1.3
SCJ3	28	10	22.7	81	24	9.4	0	3.2
SCJ4	28	10	23.4	81	24	8.6	0	0
SCJ5	28	10	24.2	81	24	7.1	0	0.2
SCK1	28	16	9.4	81	24	39	10.16	6.4
SCK2	28	16	8.5	81	24	38.8	2.54	4.4
SCK3	28	16	1.9	81	24	38.1	0.25	0
SCK4	28	16	1.3	81	24	37.1	1.91	0
SCK5	28	16	1.2	81	24	36.1	2.54	0
SCL1	28	16	27.6	81	24	31.3	0.25	0.6

Station	Lat Degree	Lat Minute	Lat Second	Long Degree	Long Minute	Long Second	Organics 2005 (cm)	Organics 2006 (cm)
SCL2	28	16	27	81	24	31.3	0	2.5
SCL3	28	16	18.7	81	24	31.6	0.25	0.6
SCL4	28	16	18	81	24	29.8	0.63	0.5
SCL5	28	16	17.7	81	24	28.8	0.25	0.5
SCM1	28	9	11.8	81	23	19.4	0	0.6
SCM2	28	9	10.2	81	23	19.1	0	3.2
SCM3	28	9	4.2	81	23	11.8	0	0.2
SCM4	28	9	5	81	23	9.8	0	0.6
SCM5	28	9	6.9	81	23	8.7	0	0.2
SCN1	28	8	28.2	81	21	56.9	5.71	6.4
SCN2	28	8	28.2	81	21	57.9	5.08	8.9
SCN3	28	8	27.5	81	21	49	0	0.2
SCN4	28	8	29.5	81	21	48.2	0	0.2
SCN5	28	8	31.5	81	21	48.9	0	0.2
SCO1	28	16	53.5	81	22	51.9	0.7	3.2
SCO2	28	16	53.9	81	22	51.4	0	1.9
SCO3	28	16	44.8	81	23	0.3	1.91	0
SCO4	28	16	45.5	81	23	0.7	1.27	0
SCO5	28	16	46.2	81	23	1.5	1.27	0
SCP1	28	8	25.7	81	21	27.3	0.63	0
SCP2	28	8	25.5	81	21	26.1	0	0
SCP3	28	8	24.8	81	21	20.9	0	0
SCP4	28	8	25.9	81	21	21.1	0	0
SCP5	28	8	28.2	81	21	20.9	0	3.2
SCQ1	28	8	49.6	81	23	2.9	0	0.6
SCQ2	28	8	48.5	81	23	1.6	0	4.4
SCQ3	28	8	45.3	81	22	52.8	13.33	11.4
SCQ4	28	8	46.8	81	22	51	10.16	9.5
SCQ5	28	8	48.6	81	22	50.7	3.56	2.9
SCR1	28	11	0.5	81	22	5	1.27	2.5
SCR2	28	11	1	81	22	7.1	1.91	0.3
SCR3	28	11	4.8	81	22	14	0	0
SCR4	28	11	2.6	81	22	14	0	0
SCR5	28	11	0.9	81	22	13.7	0	0.2
SCS1	28	10	3.4	81	23	15.6	0.25	0.3
SCS2	28	10	2	81	23	15	3.56	5.1
SCS3	28	9	53.9	81	23	12.4	0	0
SCS4	28	9	55	81	23	9.8	0.76	0.2
SCS5	28	9	56.2	81	23	8.5	0	0

Station	Lat Degree	Lat Minute	Lat Second	Long Degree	Long Minute	Long Second	Organics 2005 (cm)	Organics 2006 (cm)
SCT1	28	13	28.6	81	22	15.2	0.95	0.6
SCT2	28	13	30.5	81	22	15.3	0.48	0.6
SCT3	28	13	39.7	81	22	20	2.54	0.2
SCT4	28	13	40	81	22	17.5	0	0
SCT5	28	13	39.8	81	22	15.3	0	0.2
SCU1	28	14	6.1	81	22	17.9	0	0.2
SCU2	28	14	8.5	81	22	17.3	0.4	0.2
SCU3	28	14	11.6	81	22	8.7	0	0.6
SCU4	28	14	13.3	81	22	50.8	0.6	1.9
SCU5	28	14	15.3	81	22	9.8	0.3	12.1
SCV1	28	13	55.5	81	22	30.1	0.32	1.9
SCV2	28	13	57.4	81	22	30	0.07	0.2
SCV3	28	14	1.1	81	22	37.1	0.07	0.2
SCV4	28	14	2.8	81	22	28.6	0.63	0.2
SCV5	28	14	1.6	81	22	26.5	0.63	0.6
SCW1	28	14	50.9	81	25	11.3	0.63	0.3
SCW2	28	14	49.9	81	25	4.6	0.25	0.6
SCW3	28	14	42.4	81	25	12.3	3.81	0.2
SCW4	28	14	42.7	81	25	12.6	1.27	0.2
SCW5	28	14	44.2	81	25	16.5	2.54	0.3
SCX1	28	11	18.1	81	21	41.8	0	1.3
SCX2	28	11	18.5	81	21	44	0.63	1.3
SCX3	28	11	17	81	21	53.3	0	0
SCX4	28	11	18.1	81	21	54.1	0	0
SCX5	28	11	20.3	81	21	53.7	1.27	1.3
SCY1	28	13	51.5	81	22	39.8	0	0.2
SCY2	28	13	50.2	81	22	39.8	0	0.2
SCY3	28	13	41.6	81	22	45.3	0	0.2
SCY4	28	13	41.5	81	22	41.2	0	0.2
SCY5	28	13	42	81	22	38.6	0	0.6
SCZ1	28	14	36.8	81	22	34.4	9.5	2.5
SCZ2	28	14	35.8	81	22	32.7	2.7	0.6
SCZ3	28	14	33.4	81	22	22.9	0.9	3.5
SCZ4	28	14	31.8	81	22	23.3	0.6	0.2
SCZ5	28	14	28.9	81	22	24.4	13	3.2
					Mean		1.6	2.2
					Min		0.0	0.0
					Max		16.5	21.0

Table 28. Average depth of organic matter for cores taken behind islands, cores taken in scraped areas away from islands and all cores together. Medians and standard error estimates are also listed. Paired T-tests show no significant differences (p=0.05) between cores taken in 2005 and 2006 for cores taken behind islands or in scraped areas taken away from islands. Paired T-test did show that all cores together taken in 2006 were greater than all core taken in 2005.

Year	Location	Number of Cores	Mean	Median	Standard Error
2005	Behind Island 2005	58	2.1	0.5	0.4
2006	Behind Island 2006	58	2.2	0.6	0.4
2005	Scraped Area 2005	87	1.2	0.3	0.3
2006	Scraped Area 2006	87	2.2	0.2	0.5
2005	All Cores	145	1.6	0.3	0.3
2006	All Cores	145	2.2	0.3	0.4

Summary of Deliverables for Task 5, Item 1 and Item 2

In January 2005 and January 2006, measurement of organic sediment thickness at two stations behind and three stations next to all 29 islands (total of 145 cores) were completed. The average thickness of organic matter in scraped areas after completion of the lake enhancement project was 1.6 cm and 2.2 cm in 2005 and 2006, respectively. Taking the estimated 6.5 million cubic meters of material removed and dividing by the estimated 14.2 million square meters of area scraped (Mann et al. 2004) yields an average depth of approximately 46 cm of organic matter before the lake enhancement project. Thus, organic matter in the areas that were scraped during the lake enhancement project was significantly reduced and there is now a good base measurement for future determination of how fast organic matter accumulates in Lake Tohopekaliga. There was a significant ($p \leq 0.05$) 0.6 cm increase in average organic sediment depth from 2005 to 2006. The average increase in sediment thickness, however, was only 0.6 cm and this may be the result of sampling error because even with GPS positioning equipment it is impossible to take cores in exactly the same locations from year to year. While taking sediment cores it was apparent that there are small local differences in sediment thickness due to low areas caused by heavy equipment ruts left during the lake enhancement activities. We recommended that these same core locations be sampled every few years (4 to 5) to determine the rate that organic sediment is accumulating in scraped areas of Lake Tohopekaliga.

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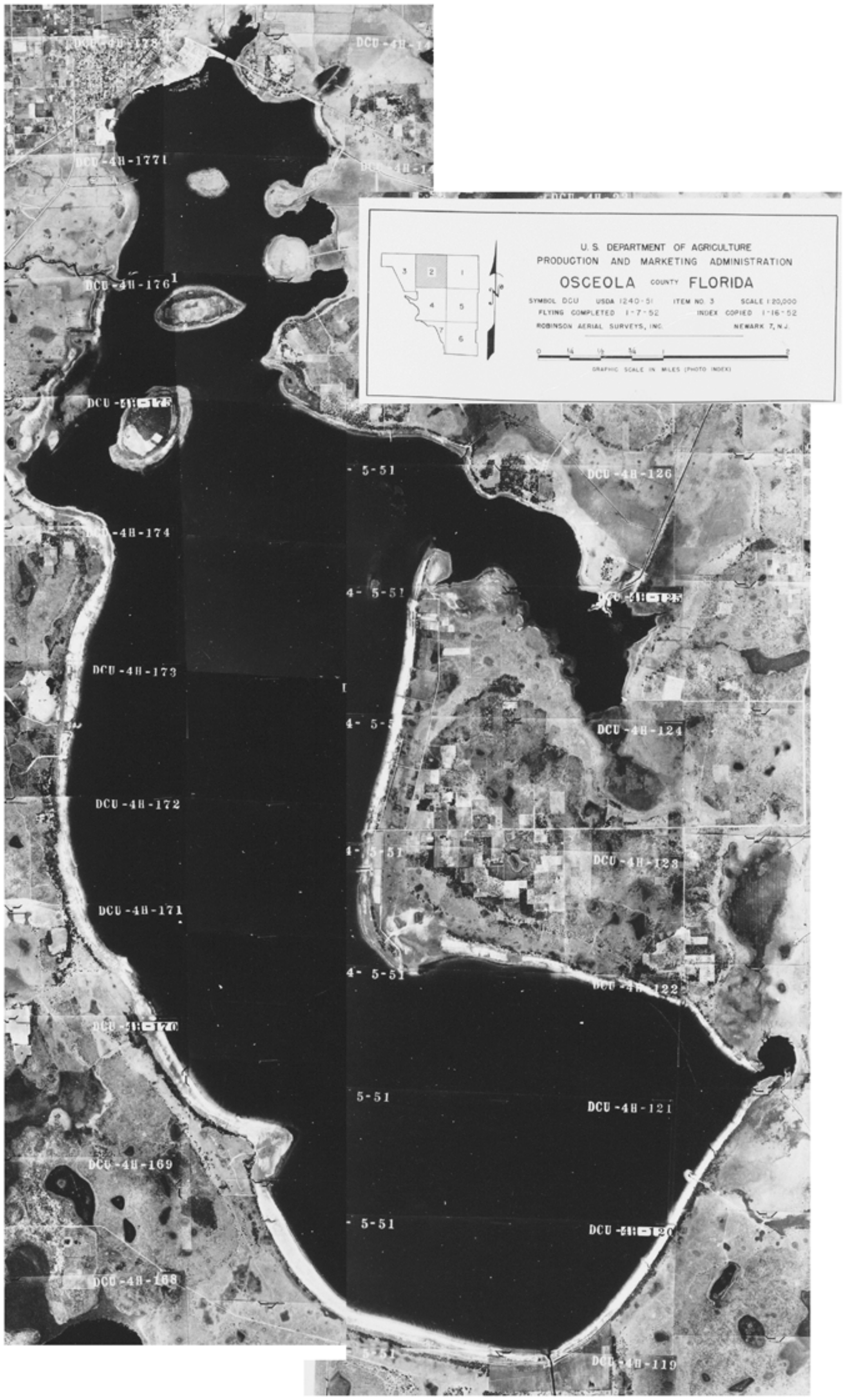
Appendix I

Historical aerial photographs of Lake Tohopekaliga taken from a collection of aerial photographs of Florida taken by the U. S. Department of Agriculture. The photographs are from 1944, 1953, 1959, 1979, and 1996.

1944


U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL ADJUSTMENT ADMINISTRATION
OSCEOLA COUNTY FLORIDA
FLYING COMPLETED 2-25-44
3-15-44
LAKE TOHOPEKALIGA
KISSIMMEE PARK
RESTRICTED DCU - 6C -127
RESTRICTED DCU - 6C -126
RESTRICTED DCU - 6C -125
RESTRICTED DCU - 6C -124
RESTRICTED DCU - 6C -122
RESTRICTED DCU - 6C -121
RESTRICTED DCU - 6C -120
RESTRICTED DCU - 6C -153
RESTRICTED DCU - 6C -154
DCU - 7C -13
DCU - 7C -12
DCU - 7C -9
DCU - 7C -8
DCU - 7C -5

1953


U. S. DEPARTMENT OF AGRICULTURE
PRODUCTION AND MARKETING ADMINISTRATION
OSCEOLA COUNTY FLORIDA
SYMBOL DCU USDA 1240-51 ITEM NO. 3 SCALE 1:20,000
FLYING COMPLETED 1-7-52 INDEX COPIED 1-16-52
ROBINSON AERIAL SURVEYS, INC. NEWARK 7, N.J.
GRAPHIC SCALE IN MILES (PHOTO INDEX)
DCU-4H-177
DCU-4H-174
DCU-4H-173
DCU-4H-172
DCU-4H-171
DCU-4H-169
DCU-4H-126
DCU-4H-124
DCU-4H-123
DCU-4H-121
DCU-4H-119

1959

U.S. DEPARTMENT OF AGRICULTURE
COMMODITY STABILIZATION SERVICE
OSCEOLA COUNTY FLORIDA
COUNTY SYMBOL DCU INVITATION NO. CSS-3-59 D.C. ITEM NO. 1
SCALE 1:20,000 FLYING COMPLETED 2-21-59 INDEX COPIED 3-4-59
THE AEROFLEX CORPORATION
ROBINSON AERIAL SURVEYS DIVISION NEWARK 7, N.J.
GRAPHIC SCALE IN MILES (PHOTO INDEX)

1979


GRAPHIC SCALE OF INDEX
0 ¼ ½ ¾ 1 2 3 4 5 MI
OSCEOLA COUNTY, FLORIDA
3-18-74 12097 374-256

1996


OSCEOLA COUNTY
0 0.5 1 2 3 4 MILES
0 0.5 1 2 3 4 5 6 KILOMETERS
SCALE OF INDEX
3-22-96
1:25000
PD-4406-9-10
PD-4406-9-09
PD-4406-9-08
PD-4406-9-05
PD-4406-9-04

Appendix II

There were concerns about the impacts of in-lake disposal of organic matter on several aspects of the ecology of Lake Tohopekaliga. For this reason, the Department of Fisheries and Aquatic Sciences, University of Florida brought together professionals from the US Environmental Protection Agency, Florida Department of Environmental Protection, US Army Corps of Engineers, US Fish and Wildlife Service, South Florida Water Management District, FWC and University of Florida to identify and discuss the issues of concern. This Appendix is the summary of that meeting.

Summary of Issues Related to In-Lake Disposal of Muck and/or Aquatic Vegetation

May 2, 2002

Sponsored and Prepared by:

Department of Fisheries and Aquatic Sciences, University of Florida/Institute of Food and Agricultural Sciences

Summary of Meeting

Personnel from the Department of Fisheries and Aquatic Sciences have recently been assisting with the development of Lake Management Plans for the Tsala Apopka Chain-of-Lakes in Citrus County, East Lake in Hillsborough County, and Lake Wailes in Polk County. These plans are being developed following a TEAM approach (Together for Environmental Assessment and Management), which uses citizen input to frame the issues of concern for each lake system (Canfield and Canfield 1994). It is obvious from these efforts that accumulation of muck and/or aquatic vegetation in lake systems is one of the major issues of concern for citizens around Florida. This is supported by the fact that the Florida Legislature has appropriated significant funds for the Florida Fish and Wildlife Conservation Commission (FWC) to remove muck from lake systems. FWC has now requested our Limnological group in the Department of Fisheries and Aquatic Sciences to write a proposal addressing issues of concern regarding in-lake disposal of muck and/or aquatic vegetation.

With this background, we felt is wise to assemble all of the agencies that have a vested interest regarding in-lake disposal to make sure all of their issues of concern are on the table. Thus, we assembled on May 2, 2002 professionals from the United States Army Corps of Engineers (USACE), the United States Environmental Protection Agency (USEPA), the Florida Department of Environmental Protection (DEP), the United States Fish and Wildlife Service (FWS), the South Florida Water Management District (SFWMD), FWC and the University of Florida to identify and discuss issues related to in-lake disposal of muck and or aquatic vegetation.

The professionals attending this meeting identified 18 individual issues of concern about in-lake disposal (See attached minutes). Several of these issues are related and may overlap considerably and other issues were discussed but not actually listed because of the dynamics of the meeting. The remainder of this summary, therefore, will be an attempt to group similar issues, identify issues that were discussed but not listed and put all of the issues and discussions into a framework that may be addressed with available data or data collected with new research. We hope that this effort will lead to a comprehensive management program that will provide the information needed to help us better manage all of Florida's lakes.

After reviewing the list of issues and the discussions of islands created with in-lake disposal of muck and/or aquatic vegetation we felt that all of the issues could be grouped under the following three major headings:

1) Short-term and long-term fate of the islands
   - a) Nutrients and potential impacts to whole lake trophic status
   - b) Impacts to general water chemistry
   - c) Impacts to oxidation and mineralization of organics
   - d) Habitat succession and wildlife utilization of islands

2) Cost versus benefits of in-lake disposal
   - a) Pluses and/or minuses to fish and wildlife habitats
   - b) Pluses and/or minuses to access and general aesthetics of lake systems

c) Cost of muck removal per year (rate of muck accumulation in cleared areas and how often will muck have to be cleared to maintain good habitat)
d) Cost of alternatives that may be "practicable"

3) Impact of in-lake disposal on mobilization of heavy metals and other chemicals

1) Short-term and long-term fate of the islands

a) Nutrients and potential impacts to whole lake trophic status
b) Impacts to general water chemistry

The management activity of in-lake disposal of muck and/or aquatic vegetation in Florida is relatively new (early 1990s). Short term impacts (< three years) of in-lake disposal of muck and/or aquatic vegetation to nutrient concentrations and general water chemistry in Orange Lake (Mallison and Hujik 1999) and Lake Jackson (Hulon et al 1997) have already been examined showing no significant deviation from whole lake background values. Representatives from SFWMD also added to our discussion the fact that whole lake nutrient concentrations in Lake Kissimmee before and after some in-lake disposal of muck remained constant. This information suggests that both short-term and probably long-term impact of in-lake disposal to nutrient and general water chemistry will be negligible. However, continued short-term and long-term monitoring of nutrients and general water chemistry before and after future management of muck would be prudent to verify the above results.

c) Impacts to oxidation and mineralization of organics

Long-term monitoring programs have not been set up to examine the oxidation and mineralization of materials in the islands that have already been created in some Florida lakes. Therefore, information on the life of the islands and what the composition of the island's material is over time is not available. So future management activities using in-lake disposal should consider long-term monitoring of created islands to determine their longevity. This form of information should also be obtained for materials placed on upland disposal sites for comparison with in-lake disposal. This type of information combined with the cost of each disposal type will aid in future management decisions regarding muck accumulation.

d) Habitat succession and wildlife utilization of islands

The short-term (< 3 years) colonization of terrestrial vegetation and wildlife utilization of islands created by in-lake disposal of muck and/or aquatic vegetation has also been examined in Lake Jackson (Hulon et al 1997). These data show as other colonization studies that new substrates are quickly colonized by invader species of plants followed by succession toward more woody species. The duration of this succession will be determined by the longevity of the substrates used to create the islands which is another reason to examine the long-term changes in the composition of the islands that was mentioned above. Hulon et al. (1997) also examined the wildlife utilization of the island and found abundant use by numerous species. The composition of these animal species will undoubtedly change through time as succession occurs and vegetation yields different types of habitat. Long-term monitoring of the terrestrial vegetation and wildlife utilization of islands may aid future management decision regarding in-lake disposal of muck and/or aquatic vegetation. Additionally some islands could be planted with native vegetation for future comparisons with islands that colonize naturally.

2) Cost versus benefits of in-lake disposal

a) Pluses and/or minuses to fish and wildlife habitats

FWC states that the major reason for removing muck from some lakes is to improve habitat for sportfish. Some studies have shown that the sportfish utilization of cleared areas was improved over areas impacted by muck (Tugend 2001; Allen and Tugend 2001). The question as to whether these improvements are needed for fish populations to reproduce and grow to the carrying capacity of the lake has not been addressed. However, the statement can be made that littoral areas dominated by muck that are devoid of oxygen decrease the carrying capacity of the lake for fish populations because they can no longer exploit those areas. Therefore, by default removing muck can increase the carrying capacity of the whole lake fish population regardless of whether the areas are needed for spawning and/or recruitment.

Any habitat manipulation changes fish and wildlife species composition because the species present before the manipulation are better suited for that type habitat then the habitat present after the manipulation. For example, the ring-necked duck thrives on lakes that are dominated by hydrilla but after that habitat is removed through some management activity ring-necked ducks are replace by more open water oriented aquatic birds (Hoyer and Canfield 1994). Similarly with fish populations, bream species are the dominant forage fish in hydrilla-dominated lakes but when hydrilla is managed shad populations become the dominant forage fish (Canfield and Hoyer 1992). Therefore, if a species is suited for littoral areas dominated by muck there is potential for decreases in that species after muck removal. Placing a value on a species and the decision to manage for a species over another one will always be a difficult task. Again monitoring these populations before and after managing muck in a lake will yield valuable information to help make future decisions regarding management of muck.

b) Pluses and/or minuses to access and general aesthetics of lake systems

Lake Succession or the filling in of a lake and moving it towards a wetland and eventually terrestrial habitat begin immediately after a lake is formed. The rate at which a lake fills in is determined by many morphological, hydrological and limnological factors. Many of man' s activities can accelerate the process of Lake Succession. However, whether the succession is natural or man induced, removing accumulated muck reverses Lake Succession keeping a lake a lake for a longer period of time. This is a large benefit to access, general lake aesthetics and fish habitat because without question (a statement that can be made only rarely) fish need water! This is also a consideration that most people understand and use when complaining about muck accumulation. They are afraid of losing their lake now or for their grandchildren. This is also where political pressure will come to actively manage muck in lake systems.

c) Cost of muck removal per year (rate of muck accumulation in cleared areas and how often will muck have to be cleared to maintain good habitat)

The rate of Lake Succession or long-term muck build up is not understood well. Setting up long-term monitoring station in areas cleared of muck to determine accumulation rates would be beneficial in determining how often this management activity needs to be performed. Determining the factors that influence sediment accumulation will also help extend the time between clearing of areas. This type of information could also be used to determine how many islands are needed in a lake to maintain a certain percent of a lake clear of muck.

c) Cost of alternatives that may be "practicable"

The USEPA states that the Clean Water Act Section 404 Program regulates the discharge of dredged or fill material into waters of the United States, including wetlands. The basic premise of the program is that no discharge of dredged or fill material can be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the Nation' s waters would be significantly degraded. The purpose of the program is to restore chemical, physical, and biological integrity, and to prohibit discharges that result in unacceptable adverse environmental effects. Fill material should not be discharged into the aquatic ecosystem unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact (either individually or in combination with other actions) on aquatic resources. For projects that involve fill into wetlands, there is a presumption that less environmentally damaging practicable alternatives exists, and the burden is on the applicant to demonstrate otherwise.

Section 404(b)(1) Guidelines (the implementing regulations for the Clean Water Act) require sequentially avoiding and minimizing of impacts (the dredge disposal) first. The law requires that avoidance be the first consideration in the permitting process.

Based on these laws the EPA would like significant consideration of practicable alternatives to in-lake disposal of muck and/or aquatic vegetation. The term "practicable" is a difficult one to define but it is generally defined in the terms of money and cost. There is no doubt that moving wet muck is expensive and the farther you have to move it the more expensive it is. Therefore, the cost of in-lake disposal of muck is much less then upland disposal allowing more muck to be managed per dollar. Even though upland disposal of muck and/or aquatic vegetation is more expensive than in-lake disposal, FWC considers upland disposal to be the favored option. However, upland disposal is a favored option only to a point and this point or cost needs to be clearly defined. FWC also states that many times it is not just a money issue but a consideration of having no place to dispose of the muck within a reasonable distance or no way to get the muck from the lake to an upland site. These issues are site specific and need to be addressed for each muck removal operation.

3) Impact of in-lake disposal on mobilization of heavy metals and other chemicals

The major concerns about toxicity of heavy metals and/or other chemicals is the fear that in-lake disposal of muck may mobilize these substances and cause mortality to the surrounding biota or accumulate in fish causing potential problems for human consumption. The following are some commonly measured constituents found in storm water runoff that potentially could occur in muck soils; surfactants (alkylbenzenesulfonate), toxic organic compounds (1,4-dichlorobenzene, toluene, xylenes, 1,1-dichloroethane, 1,1,1-trichloroethane, and acetone) and metals (antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc). The cost of analyzing these constituents varies considerably among laboratories. The costs of analyzing surfactants about $35 to $65 per sample, toxic organic compounds around $90 to $125 per compound, and metals about $15 to $25 per sample. These figures do not account for the time and personnel used to collect the samples.

A well designed study sampling multiple compounds and metals in the water column and sediments around the lake before and after in-lake disposal of muck would be very expensive, allowing much less actual management activities. A more economical approach would be to monitor fish populations before and after in-lake disposal. If the fish species composition is representative of local native populations and the sportfish tissue concentrations are under consumption advisories then there would be evidence that in-lake disposal of muck had not increased the mobilization of toxic materials.

Conclusions

We feel assembling all of the major players who have a vested interest regarding in-lake disposal of muck and/or aquatic vegetation for the purpose of identifying and defining issues was a good expenditure of time. The meeting was well attended and discussions revealed areas of common ground as well as areas that need more information for understanding.

This working draft of the meeting summary is not an attempt to exhaust the literature or data to justify individual lake management approaches. This summary is an attempt to define and organize the issues of major concern for the purpose of developing a research program to address the major issues regarding the management of accumulated muck and/or aquatic vegetation. We feel this is important because many citizens and political entities have identified muck as a problem and with that will come some type of management. We hope that our efforts here will yield the best approach available for all parties while realizing that there is a limited amount of funds to address this problem.

This summary will be sent to everyone that participated in the meeting for his or her review and comments. Knowing that everyone's schedule is busy, we still ask that you please expedite the review of this very important lake management issue. Thank you for you participation in these efforts.

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University of Florida
Limnology Group Strategic Planning Meeting
MINUTES
May 2, 2002

In Attendance:

Dr. Mike Allen (UF)
Dr. Roger Bachman (UF)
Mr. Peter Besrutschko (USACE)
Mr. Stephen Brooker (USACE)
Ms. Beth Burger (EPA)
Dr. Dan Canfield (UF)
Mr. Olice Carter (USACE)
Mr. Bill Caton (DEP)
Mr. David Hallac (FWS)
Ms. Christy Horsburgh (UF)
Mr. Mark Hoyer (UF)
Mr. Mike Hulon (FWC)
Mr. Brad Jones (SFWMD)
Mr. Ted Lange (FWC)
Mr. Marty Mann (FWC)
Ms. Liz Manners (USACE)
Ms. Nellie Morales (SFWMD)
Ms. Beth Sargent (FWC)
Mr. Lawson Snyder (FWC)
Ms. Susan Morgan (UF – Recorder)

Meeting was called to order at 10:15 a.m.
Meeting adjourned at 2:00 p.m.

Objective: To get feedback from pertinent agencies within the State addressing issues of concern regarding in-lake disposal of muck and/or aquatic vegetation.

Mike Hulon (FWC)

Discussed the purpose of the muck removal and how cost might be an issue if transporting the muck was the only option. His agency has commissioned UF's Department of Fisheries and Aquatic Sciences to write a proposal for in-lake disposal of muck and/or aquatic vegetation. His agency does not look upon this project as a "public oriented" one but as a necessary response to improve habitat.

Mr. Peter Besrutschko (USACE)

Suggested a researching a company that has developed a technique using an oxygen diffuser mixed with microbial action. Dr. Canfield gave history of a similar technique on an area lake that did not work. The concerns addressed by his agency are as follows:

1) Toxicity of soil
   - heavy metals
   - pesticides

The question was raised as to what is an "acceptable" level of toxicity. Mr. Besrutschko stated that a manual is used by his agency as a guideline.

Mr. Stephen Brooker (USACE)

Concerns shared by Mr. Brooker from his agency were as follows:

1) Alternative Analysis
2) Balance – Filling of wetlands, impact, leaving muck, cost of removing muck and the methodology were issues that needed to be addressed
3) Right amount of island and threshold of money
4) Problems: (a) nutrient amount and (b) fluctuation of lake level

The Definition of wetland was addressed at this point and Mr. Booker stated that the Corp's definition is from the shoreline down to 3 meters. Dr. Canfield suggested that any definition by any of the agencies could be somewhat ambiguous and this might be a problematic issue.

Mr. Brooker suggested getting rid of the muck by above land mounds rather than making islands.

The question was raised as to why the nutrient budget is so important. Mr. Brooker answered that if the Corp is going to write a permit for it, they want to know if it will pay off in the long term. Conditions such as (1) management of "x" number of islands only with (2) the potential to move them off will be considered by his agency.

Mr. David Hallac (FWS)

Mr. Hallac wanted to clarify that his agency's stance is not pro in-lake disposal. The concerns of his agency are as follows:

1) Not a permanent or stable habitat
2) Not being planted with native vegetation
3) Islands may be used for future disposals which would possibly in turn ruin the developing habitat already established from the previous disposal
4) Erosions on islands
5) Fate of transporting
6) Accelerated muck around the islands
7) Cattle excrement on island ending up in the lakes
8) Would like to keep as much littoral zone free
9) Methyl Mercury production concern

His suggestions were:

1) Do long-term studies
2) Have a control lake and monitor closely

Ms. Beth Burger (EPA)

Stressed that the EPA needed more written documentation on why muck could not be put on land. She requested an alternative analysis be submitted.

Mr. Bill Caton (DEP)

Concerns from DEP:

- Is it improving fish and wildlife habitat?
- Water quality?
- Is it going to create more shorelines?
- Homeowners view – should a poll be taken?
- Impact to recreation – boater safety
- Exotic plant habitat – who is going to manage it if it gets to be a problem?
- Converting sub-merged land into uplands

Ms. Liz Manners (USACE)

Concerns:

- What happens when you don't stabilize the island? (Longevity)
- What about a management plan for the islands?

Mr. Olice Carter (USACE)

Concerned with the nutrient situation (mass balance over long-term).

Mr. Brad Jones (SFWMD)

Concerns from SFWMD:

- Islands attracting wildlife – what kind of wildlife and would it have a negative impact?

- Amount of internal loading
- Phosphorus concentrations that contribute to internal loading – is it an effective sink for phosphorus?

Ms. Nellie Morales (SFWMD)

Concerned about public opinion.

Mr. Ted Lange (FWC)

Concerns:

- Nutrient budget
- State of the Lakes
- Impact of disposal islands to littoral zone

Questions brought up during discussion were:

1) What is the time frame for study?
Approximately 3 years but will be left up to the UF Limnology group.
2) How many islands should be tested?
This will also be determined by the UF Limnology group.

3) Testing of Toxicity – what toxins should be tested for and how?
Testing the fish is the logical answer.

It was suggested that a study should be done on the benthic community regarding the muck islands as well.

The agencies then requested the thoughts of the staff of UF. The following are the responses from the UF Limnology group.

Dr. Roger Bachman (UF)

Dr. Bachman, et al, has done studies which show there is no correlation between the biomass of macrophytes and nutrients in the water. There is much more emphasis on nutrients than it actually deserves. Eutrophic is not necessarily "bad" and in his opinion, islands are not an environmental problem.

Mr. Mark Hoyer (UF)

Mr. Hoyer is not concerned about nutrients. Systems are not natural and need to be managed which costs money. It is his desire to spend the funds as wisely as possible. Permits will need to be a "living document" in order to manage in the future.

Dr. Mike Allen (UF)

One of his Masters students have researched scraped areas of lakes and found that the oxygen is high and there is a diverse fish community. Some noticeable improvements where the caring capacity increases and the in-shore habitat is definitely better.

He trusts what Dr. Bachman says about nutrients. He believes the major issue might be aesthetics. He also agrees with FWC in that is certainly not cost effective to move sediments off-site. And from a fisheries standpoint, it will definitely have to be managed.

Ms. Christy Horsburgh (UF)

The goal is habitat. She would rather see a lake with islands than one that is over run with hydrylla.

Dr. Dan Canfield (UF)

Dr. Canfield's main objective is making reasonable management decisions. He feels that the terms need to be more well defined. He is a nutrient control advocate but also realizes the need to manage water levels and habitat and not so much the nutrients. It will be necessary to look at the internal processes. Basically what drives lakes is external.

<u>LIST OF CONCENS FROM THE AGENCIES:</u>

1) Toxicity of soil
    - heavy metals
    - pesticides
2) Are Islands a point source
3) Nutrient budget of lake and islands and how islands fit into the whole situation
4) Erosion – turbidity
5) Fate of organics in islands vs. uplands
6) Rate of muck re-accumulations
7) Island dynamics – over time – longevity
8) Alternatives for in-lake disposal
9) Nutrient/Macrophyte dynamics
10) Data for fisheries improvement
11) Exotics on islands – management
12) Future islands – re-use of island
13) Island Management Plan
14) [Nutrient] around islands to some endpoint?
15) Is the lake a sink? (Internally cycling)
16) Bioaccumulaton into top predators
17) Height of islands over time
18) Organic content over time

Appendix III

Proposal to Evaluation of Lake Tohopekaliga Habitat Enhancement Project

Section 1. Short-term and long-term fate of the islands

Task # 1. Nutrients and their potential impact on whole lake trophic status and general water chemistry.

There are concerns about the impact of in-lake disposal of muck and/or aquatic vegetation on localized and whole lake nutrient concentrations, chlorophyll levels, water clarity and general water chemistry. Nutrients, water clarity, chlorophyll and general water chemistry have been monitored in Lake Tohopekaliga for over 20 years by several agencies, and these efforts yielded very good historical baseline data. Particularly useful to this study, the South Florida Water Management District has four, long-term, in-lake stations strategically placed in Lake Tohopekaliga from north to south (Figure 1).

We are proposing to sample surface water along transects established at each of four islands located nearest to the four long-term monitoring stations maintained by the South Florida Water Management District in order to examine impacts to localized water quality. Each transect will have three sampling stations located at 25 m, 75 m and 150 m in a straight line from the island toward the open water long-term monitoring stations. Duplicate transects will be set up in adjacent areas where no islands exist and will serve as control sites. Water sampling will be initiated after the lake refills to low pool stage (52 ft msl) and will be collected for two years: monthly for the first three months and quarterly thereafter for the remainder of the project. Water samples will also be collected at each of the long-term monitoring stations on the same day transects are sampled. Standard methods will be used to analyze water samples for the following parameters:

1) Total phosphorus (µg/L)
2) Total nitrogen (µg/L)
3) Chlorophyll (µg/L)
4) Secchi depth (m)
5) Dissolved oxygen (mg/L)
6) Temperature (C°)
7) Specific conductance (µS/cm^2 @ 25 C°)
8) pH
9) Total alkalinity (mg/L as $CaCO_3$)
10) Color (Pt-Co units)
11) Total and organic suspended solids (mg/L)

These data will be used to examine local water chemistry gradients to evaluate whether or not the islands are affecting local conditions. The data can also be compared to historical data to evaluate whole lake water chemistry changes that may be occurring over time.

Task # 2. Longevity of created islands.

Currently, there are no long-term data available on longevity of islands created from in-lake disposal of muck and/or aquatic vegetation. To address this issue, we propose to measure the basal circumference of each island with global positioning system (GPS) equipment immediately after they are created. Several measurements of height will also be taken to determine the total volume of material in each island. This will establish baseline data for each island for future evaluations. The same measurements will be made on 12 of the islands at 6 months and 24 months after the lake fills. These data will provide an initial evaluation of island stability as well as provide baseline information for future comparison (5, 10 and 15 years).

Task # 3. Impacts of oxidation and mineralization of organics.

The South Florida Water Management District measures nutrient concentrations and water discharge values for the two major inputs and the major output of Lake Tohopekaliga. These data can be used to evaluate gross nutrient loading, nutrient retention and nutrient export rates for the lake. These data can also be compared to the volume of nutrients tied up in the islands and examined in relation to the rate of decay of the islands over time. Six samples of the materials used to create the four islands closest to the South Florida Water Management District long-term water chemistry monitoring stations will be collected at the time the islands are initially measured and again 24 months later. The material will be analyzed for the following parameters using standard methods:

1) Total phosphorus (µg/gm ash free dry weight)
2) Total nitrogen (µg/gm ash free dry weight)
3) Total weight per volume (gm/cm^3)
4) Dry weight per volume (gm/cm^3)
5) Ash free dry weight per volume (gm/cm^3)

These data will be used to compare total nutrient volumes present in all of the islands with gross annual nutrient loads for the lake. These data will also provide a measure of the organic matter initially present in the islands and an idea of how the islands are changing on a short-term basis (24 months). Finally these data will also yield baseline data on island composition for future comparisons with similar measurements (5, 10, 15 years).

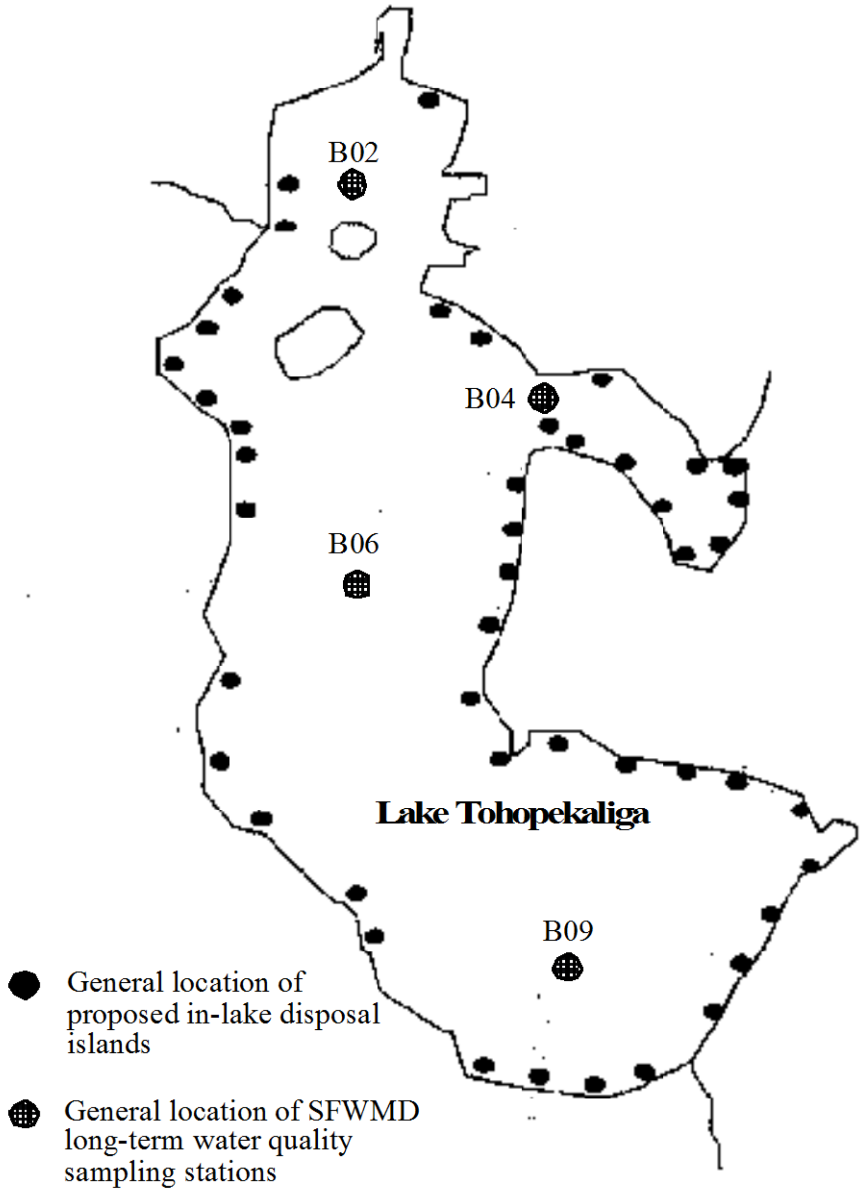


Figure 1. Map of proposed in-lake disposal islands and long-term water quality sampling stations in Lake Tohopekaliga.

Section 2. Cost versus benefit of in-lake disposal.

Task # 4. Pluses and minuses to fish populations.

Information on habitat succession and wildlife utilization of the islands was a concern expressed at our initial meeting, however, these issues have been and are continuing to be examined by other scientists. Therefore, this proposal will concentrate on impacts to fish populations.

The largemouth bass is a major sportfish in Lake Tohopekaliga. FWC has been collecting long-term electrofishing data on the largemouth bass population in Lake Tohopekaliga for more than 10 years. This data collection effort needs to continue in order to conduct a comprehensive, before and after in-lake disposal of muck and/or aquatic vegetation comparison of largemouth bass population characteristics.

Additional data will need to be collected in order to examine population characteristics of other fish species that inhabit Lake Tohopekaliga. Florida LAKEWATCH, the Department of Fisheries and Aquatic Sciences and FWC have been conducting long-term fish population evaluations on 32 major lakes in Florida for the last four years (Florida LAKEWATCH 2002B). The goals of this effort are three-fold: 1) examine the long-term variation in fish population characteristics from a wide range of lakes in relation to water chemistry, lake trophic status, aquatic macrophyte abundance and lake morphology, 2) educate citizens about Florida fish populations and how they function and 3) facilitate interaction and cooperation among Florida citizens, Florida LAKEWATCH, the Department of Fisheries and Aquatic Sciences and FWC. We propose to add Lake Tohopekaliga to the long-term fish sampling effort using the same electrofishing methodologies to examine impacts of in-lake disposal of muck and/or aquatic vegetation on other fish species in Lake Tohopekaliga. This will allow comparison of fish population characteristics in Lake Tohopekaliga with fish population characteristics found in other Florida lakes with similar limnological conditions. These comparisons will reveal whether or not management activities in Lake Tohopekaliga have altered the fish populations beyond what are found in other Florida lakes with similar limnological properties.

Task # 5. Cost of muck removal per year (rate of muck accumulation in cleared areas and how often will muck have to be cleared to maintain good habitat).

Cultural eutrophication, water level stabilization and extensive growth of invasive aquatic plants have all contributed to the accelerated rate of lake succession in Lake Tohopekaliga. Nutrient loading rates have been reduced over time in Lake Tohopekaliga, but water level stabilization and an abundance of invasive aquatic plants are likely to be part of the lake far into the future. Concerns have been expressed about the rate of muck accumulation that will occur behind islands, as well as rates of muck accumulation along the shoreline in general. The expansion of emergent vegetation like pickerelweed and cattail has been thought to dramatically increase organic sedimentation and muck accumulation. Since the extent of water level stabilization in Lake Tohopekaliga promotes the growth and expansion of these plants, it is difficult to separate the respective, causative factors. In addition, the FWC has become more active in habitat management in recent years, resulting in more balanced, diverse littoral zone aquatic plant communities in managed lakes. The FWC feels this will result in a reduced rate of muck accumulation. Control islands could be established where no aquatic plant management activities would occur in order to better understand leaf litter accumulation mechanisms, but studies of this type have been and are being conducted elsewhere. Therefore, FWC intends to aggressively manage aquatic plant communities in Lake Tohopekaliga according to policies set by FWC and Florida Department of Environmental Protection. Thus, the actual rate of muck accumulation following the project under the proposed management scenario needs to be measured for management decisions on Lake Tohopekaliga as well as future project lakes.

It will likely take several years to accurately measure the rate of muck accumulation. Baseline conditions need to be documented for future comparisons (5, 10, 15 years). We propose to take two sediment cores on the shoreline sides of 24 islands uniformly spaced around Lake Tohopekaliga, measuring the depth of organic material above the base sand. The coring sites will be located directly between the island and the land-water interface. Three cores will also be taken along 24 transects set perpendicular to the shoreline in cleared areas away from created islands. The location of all cores will be marked with GPS coordinates for future comparisons. The cores will be taken six months after the lake refills to low pool stage to document initial depths of soft organics, and again at 24 months. Information gathered in the future (5, 10, 15 years) under aquatic plant management that FWC proposes will allow for a good cost benefit analysis of the current in-lake disposal approach for managing muck in Lake Tohopekaliga. The information gathered in the future will also allow comparison between organic accumulation behind islands and where no island exists.

Section 3. Impact of In-lake Disposal on the Mobilization of Heavy Metals and Other Chemicals.

Task # 6. Impact of in-lake disposal on the mobilization of heavy metals and other chemicals.

There is a concern that the in-lake disposal of muck and/or aquatic vegetation in Lake Tohopekaliga may increase the mobilization of heavy metals and/or other chemicals. The concerns are three-fold, 1) increased mobilization may cause harm to organisms living in the lake, potentially decreasing relative abundance of individual species, or groups of species, and 2) increased mobilization may be potentially harmful to human consumers of fish that may have elevated levels of heavy metals and/or other chemicals, and 3) increased mobilization may be harmful to piscivorous wildlife through consumption of contaminated prey fish.

FWC sampled sediments in 1999 from six locations around the lake to determine concentrations of heavy metals, nutrients, and physical characteristics in the littoral sediments of Lake Tohopekaliga. Environmental Conservation Laboratories Inc (ENCO) analyzed these sediments for cadmium, copper, lead, zinc and 24 chlorinated pesticides. The laboratory did not detect any concentrations of chlorinated pesticides and only detected concentrations of lead that were no higher than what would be considered background level.

Largemouth bass from both Lakes Tohopekaliga and East Tohopekaliga are collected annually as part of the FWCC long-term mercury monitoring program. The age standardized mercury concentration has steadily decreased from 0.68 to 0.25 µg/g between 1990 and 2001 in Lake Tohopekaliga; however, the mean concentration of mercury in legal size largemouth bass has exceeded 0.5 ppm on several occasions, prompting Florida DOH to maintain its limited consumption advisory recommendation for largemouth bass. Also under a limited consumption advisory for largemouth bass in the Kissimmee Chain-of-Lakes are Lakes Alligator, Hatchineha, Kissimmee, East Lake Tohopekaliga, Brick, Hart, and Russell. Most of these lakes will be up for re-sampling of multiple species and review in the next couple of years.

Although all of the above data suggest there is no reason for concern about heavy metal or other chemical contamination in Lake Tohopekaliga, a multi-contaminant screening of muscle tissue from the primary sportfish that are often harvested for consumption (bluegill *Lepomis macrochirus*, redear sunfish *L. microlophus*, black crappie *Pomoxis nigromaculatus* and largemouth bass *Micropterus salmoides*), and from a bottom dwelling omnivorous species (brown bullhead *Ameiurus nebulosus*) will be conducted both prior to and post restoration. Multi contaminant screening will also be conducted on whole-body prey fish which have short generation times (e.g., composite sample of available prey fish with total length less than 40 mm). Analyses on large body fish will be conducted on a composite of 10 individual fillets for each species and on composites of many individual of each species of prey fish. All composites will be made proportionally to body weight of individual fish and archived individual fillets will be retained for further exploratory analyses if the need arises. In addition, FWC will continue its annual monitoring of mercury levels in largemouth bass muscle tissue from both Lake Tohopekaliga and East Lake Tohopekaliga. These data will be useful for determining possible affects of the proposed enhancement activities on contaminant accumulation in fish tissue.

Entering Lake Tohopekaliga into the Florida LAKEWATCH long-term fish-monitoring program (Task #4) will also allow an examination of possible changes in fish species composition or even species richness after in-lake disposal of muck and/or aquatic vegetation. If there are negative changes, this may point to increases in mobilization of heavy metal or other chemicals that may be interfering with some aspects of the fish community.

Appendix IV

Project Time Line and Group Responsibilities

Task #1. Nutrients and their potential impact on whole lake trophic status and general water chemistry.

The University of Florida (UF) shall be responsible for all aspects of Task #1.

1) January 1, 2003 to June 15, 2003. During this phase of Task #1 all historical data will be gathered and computerized for future analyses.
2) January 1, 2004 to June 30, 2004. UF shall hire a Senior Biological Scientist (Masters Level Biologist) to help coordinate the project. A graduate student will also be hired to help in all aspects of the project. Equipment and materials needed to accomplish the project will also be purchased during this phase of Task #1.
3) July 1, 2004 to June 30, 2005. UF shall begin sampling water chemistry monthly for three months when Lake Tohopekaliga refills to low pool stage (52 ft-msl). After initial 3 months of sampling, UF will continue to sample water chemistry quarterly.
4) July 1, 2005 to June 30, 2006. UF will continue quarterly sampling for water chemistry.
5) July 1, 2006 to December 31, 2006. A final report on all aspects of Task #1 will be completed.

Task # 2. Longevity of created islands.

UF shall be responsible for the majority of Task #2. When needed FWC will assist by providing airboat support for measuring islands after they are flooded.

1) January 1, 2004 to June 30, 2004. UF shall measure the volume of all created islands documenting initial basal areas and height with GPS equipment.
2) July 1, 2004 to June 30, 2005. UF shall measure volumes of 12 created islands documenting basal areas and heights with GPS equipment six months after the islands were flooded.
3) July 1, 2005 to June 30, 2006. UF shall measure volume of 12 created islands documenting basal areas and heights with GPS equipment 18 months after they were flooded.
4) July 1, 2006 to December 31, 2006. A final report will be completed describing all Task #2 accomplishments throughout the project.

Task # 3. Impacts of oxidation and mineralization of organics.

UF shall be responsible for all aspects of Task # 3.

1) January 1, 2004 to June 30, 2004. UF shall collect six samples of island matter from four islands closest to the long-term water quality station set up by South Florida Water Management District. These samples will be analyzed for total phosphorus total nitrogen and organic content.
2) July 1, 2005 to June 30, 2006. UF shall collect six samples of island matter from four islands closest to the long-term water quality station set up by South Florida Water Management

District. These samples will be analyzed for total phosphorus total nitrogen and organic content.

3) July 1, 2006 to December 31, 2006. A final report will be completed describing all Task #3 accomplishments throughout the project.

Task # 4. Pluses and minuses to fish populations.

FWC shall be responsible for collection of largemouth bass data and collecting all species fish data for the long term-term fish sampling program. FWC will be responsible for analyzing largemouth bass data and UF will be responsible for analyzing the all species data.

1) January 1, 2003 to June 30, 2003. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.
2) January 1, 2004 to June 30, 2004. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.
3) July 1, 2004 to June 30, 2005. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.
4) July 1, 2005 to June 30, 2006. FWC will collect all species electrofishing data for the long-term fish sampling program and deliver the data to UF.
5) July 1, 2006 to December 31, 2006. A final report will be completed describing all Task #4 accomplishments throughout the project.

Task # 5. Cost of muck removal per year (rate of muck accumulation in cleared areas and how often will muck have to be cleared to maintain good habitat).

UF shall be responsible for the majority of Task #5. When needed FWC will assist by providing airboat support for taking cores behind islands after reflooding.

1) July 1, 2004 to June 30, 2005. Sediment cores will be taken six months after Lake Tohopekaliga reaches low pool. Replicate cores will be taken behind 24 islands between the island and land water interface. Three cores will also be taken along 24 transects set perpendicular to the shoreline in cleared areas away from created islands.
2) July 1, 2005 to June 30, 2006. Sediment cores will be taken 18 months after Lake Tohopekaliga reaches low pool. Replicate cores will be taken behind 24 islands between the island and land water interface. Three cores will also be taken along 24 transects set perpendicular to the shoreline in cleared areas away from created islands.
3) July 1, 2006 to December 31, 2006. A final report will be completed describing all Task #5 accomplishments throughout the project.

Task # 6. Impact of in-lake disposal on the mobilization of heavy metals and other chemicals.

FWC will be responsible for all aspects of Task # 6.

1) December 1, 2002 to June 30, 2003. FWC will collect tissue samples from the primary sportfish that are harvested for consumption (bluegill *Lepomis macrochirus*, redear sunfish *L. microlophus*, black crappie *Pomoxis nigromaculatus* and largemouth bass

Micropterus salmoides) and from a bottom dwelling omnivorous species (brown bullhead *Ameiurus nebulosus*). Tissue samples will also be collected from the most common small species of fish with short generation times (e.g., eastern mosquitofish *Gambusia holbrooki*). Composite tissues samples by individual sportfish species and composite tissue samples of mixed small fish species will be analyzed for heavy metals and chlorinated pesticides.

2) December 1, 2003 to June 30, 2004. FWC will collect tissue samples from the primary sportfish that are harvested for consumption (bluegill *Lepomis macrochirus*, redear sunfish *L. microlophus*, black crappie *Pomoxis nigromaculatus* and largemouth bass *Micropterus salmoides*) and from a bottom dwelling omnivorous species (brown bullhead *Ameiurus nebulosus*). Tissue samples will also be collected from the most common small species of fish with short generation times (e.g., eastern mosquitofish *Gambusia holbrooki*). Composite tissues samples by individual sportfish species and composite tissue samples of mixed small fish species will be analyzed for heavy metals and chlorinated pesticides.

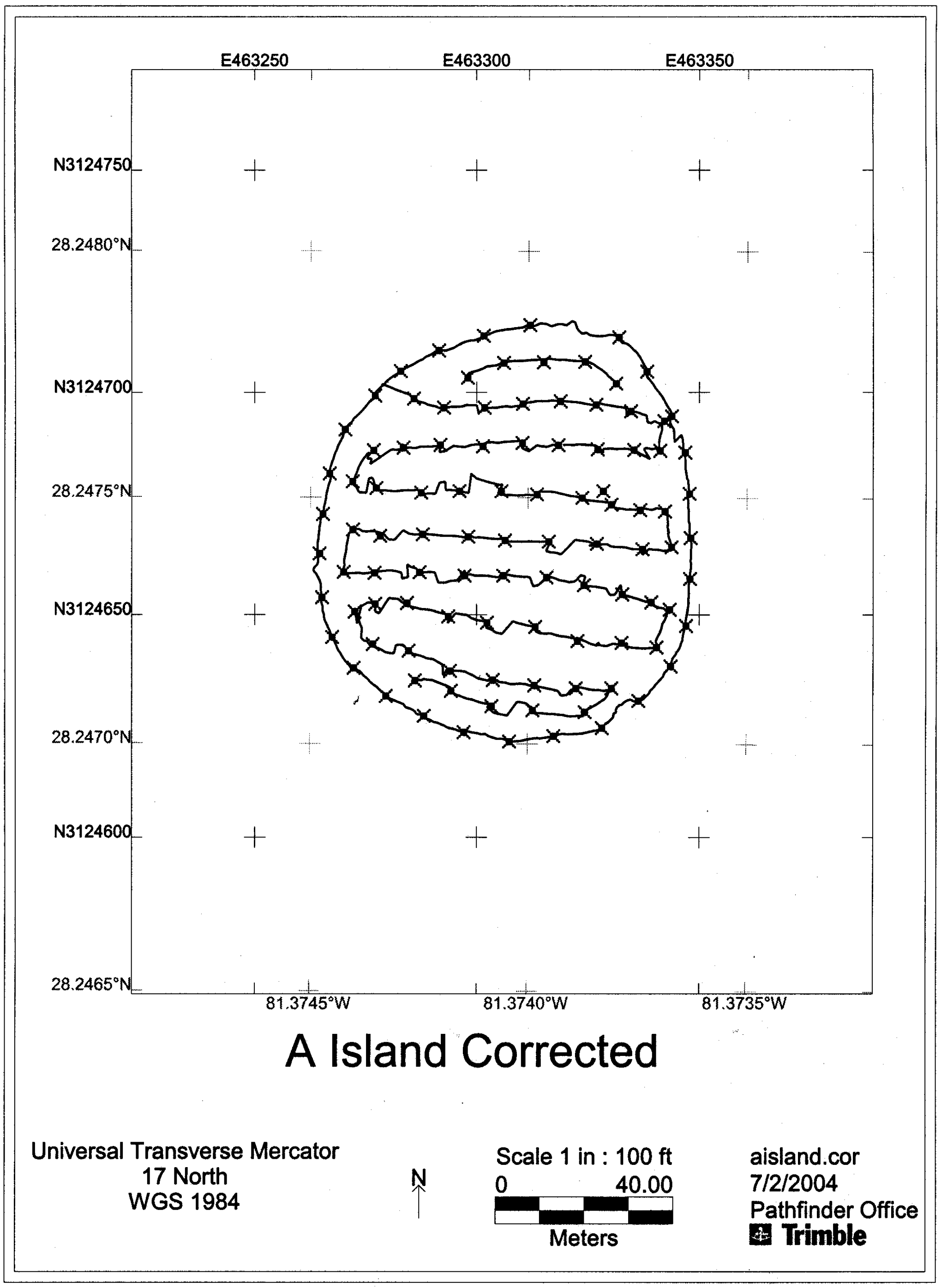
3) July 1, 2004 to June 30, 2005. FWC will collect tissue samples from the primary sportfish that are harvested for consumption (bluegill *Lepomis macrochirus*, redear sunfish *L. microlophus*, black crappie *Pomoxis nigromaculatus* and largemouth bass *Micropterus salmoides*) and from a bottom dwelling omnivorous species (brown bullhead *Ameiurus nebulosus*). Tissue samples will also be collected from the most common small species of fish with short generation times (e.g., eastern mosquitofish *Gambusia holbrooki*). Composite tissues samples by individual sportfish species and composite tissue samples of mixed small fish species will be analyzed for heavy metals and chlorinated pesticides.

4) July 1, 2005 to June 30, 2006. FWC will collect tissue samples from the primary sportfish that are harvested for consumption (bluegill *Lepomis macrochirus*, redear sunfish *L. microlophus*, black crappie *Pomoxis nigromaculatus* and largemouth bass *Micropterus salmoides*) and from a bottom dwelling omnivorous species (brown bullhead *Ameiurus nebulosus*). Tissue samples will also be collected from the most common small species of fish with short generation times (e.g., eastern mosquitofish *Gambusia holbrooki*). Composite tissues samples by individual sportfish species and composite tissue samples of mixed small fish species will be analyzed for heavy metals and chlorinated pesticides.

5) July 1, 2006 to December 31, 2006. A final report will be completed describing all Task #6 accomplishments throughout the project.

Appendix V

Map of perimeters and grid points used to calculate area and volume of the 29 wildlife islands constructed in Lake Tohopekaliga. Data for Appendix V maps were collected prior to refilling lake Tohopekaliga with water.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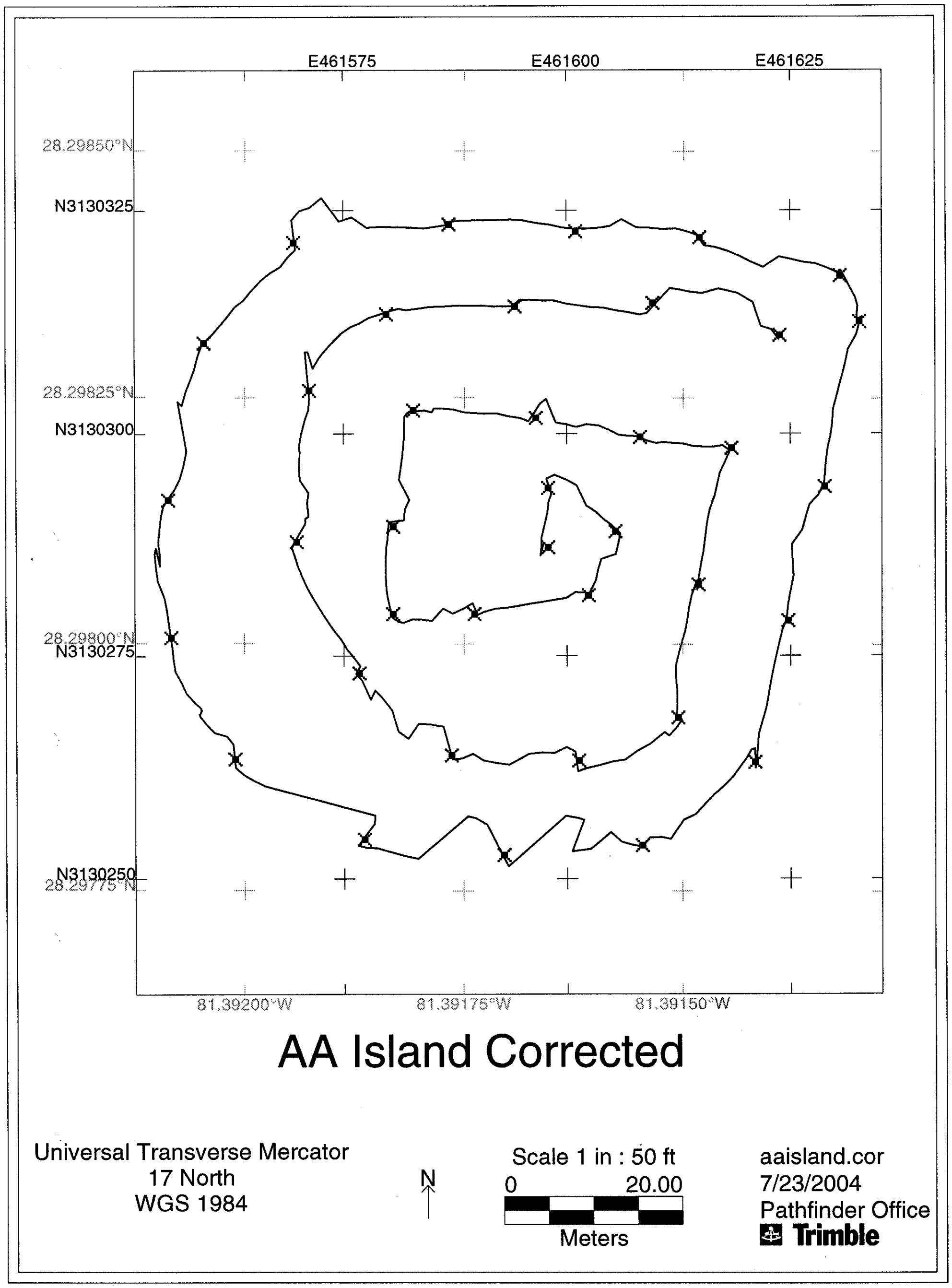
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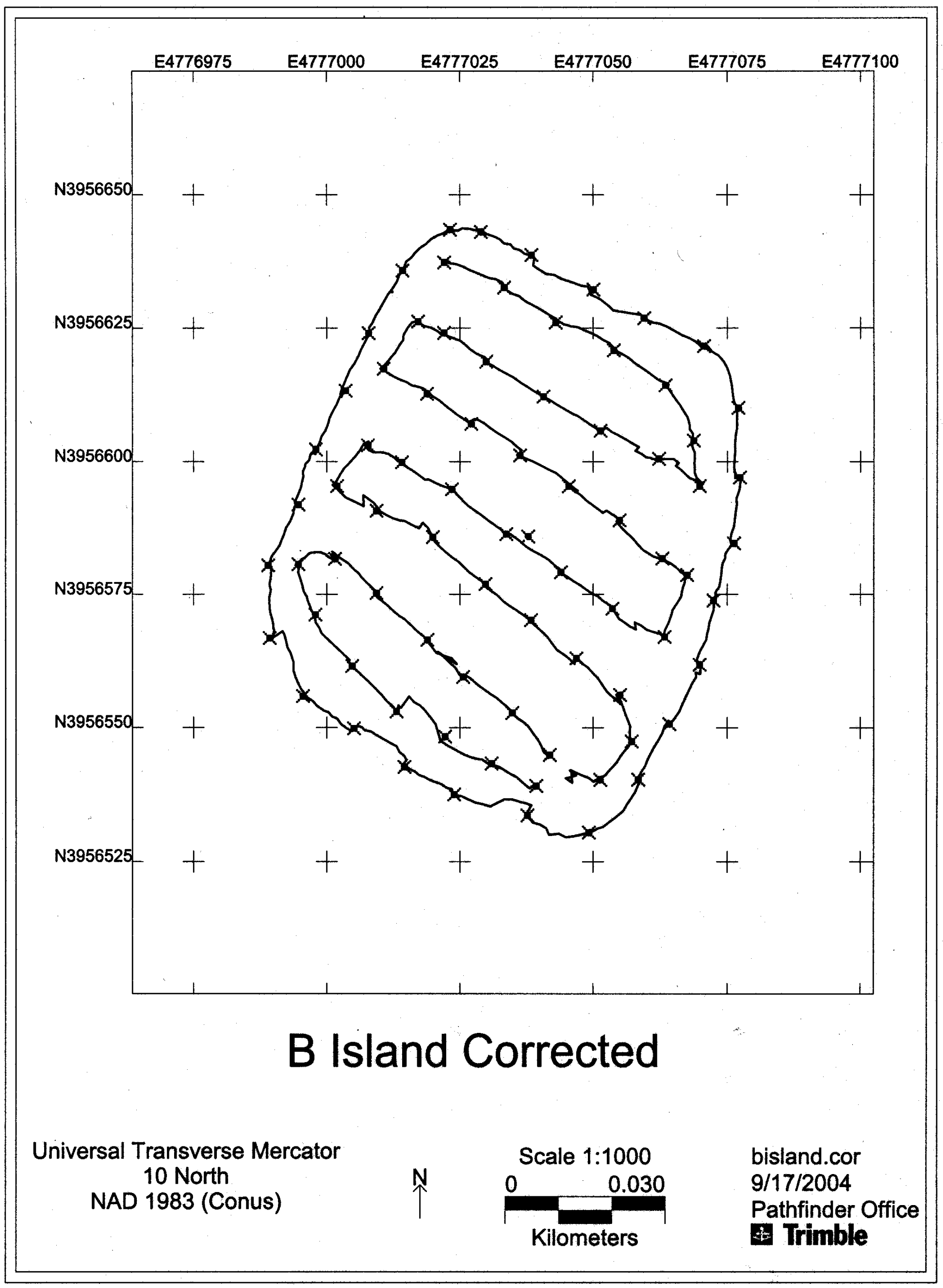

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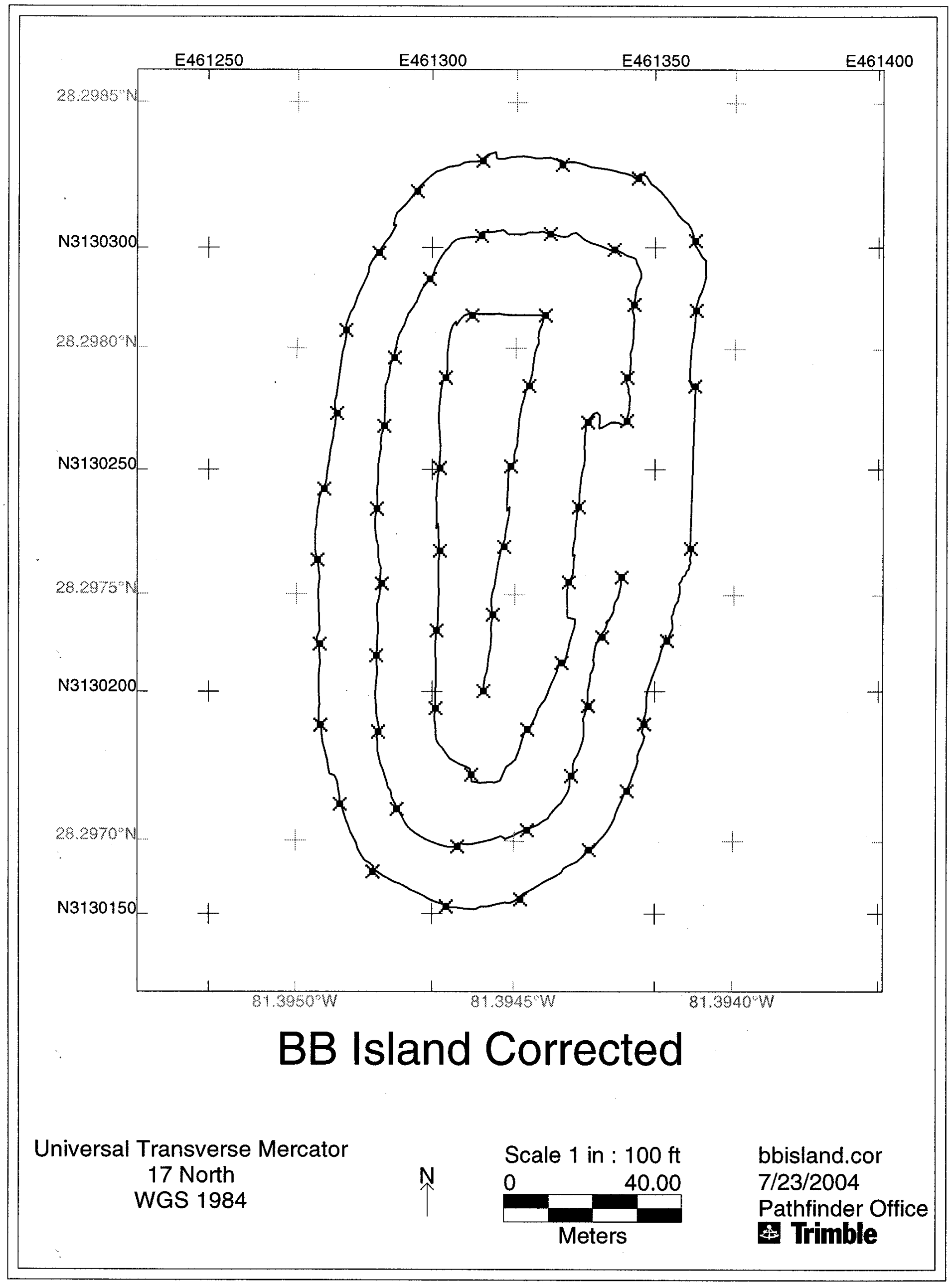
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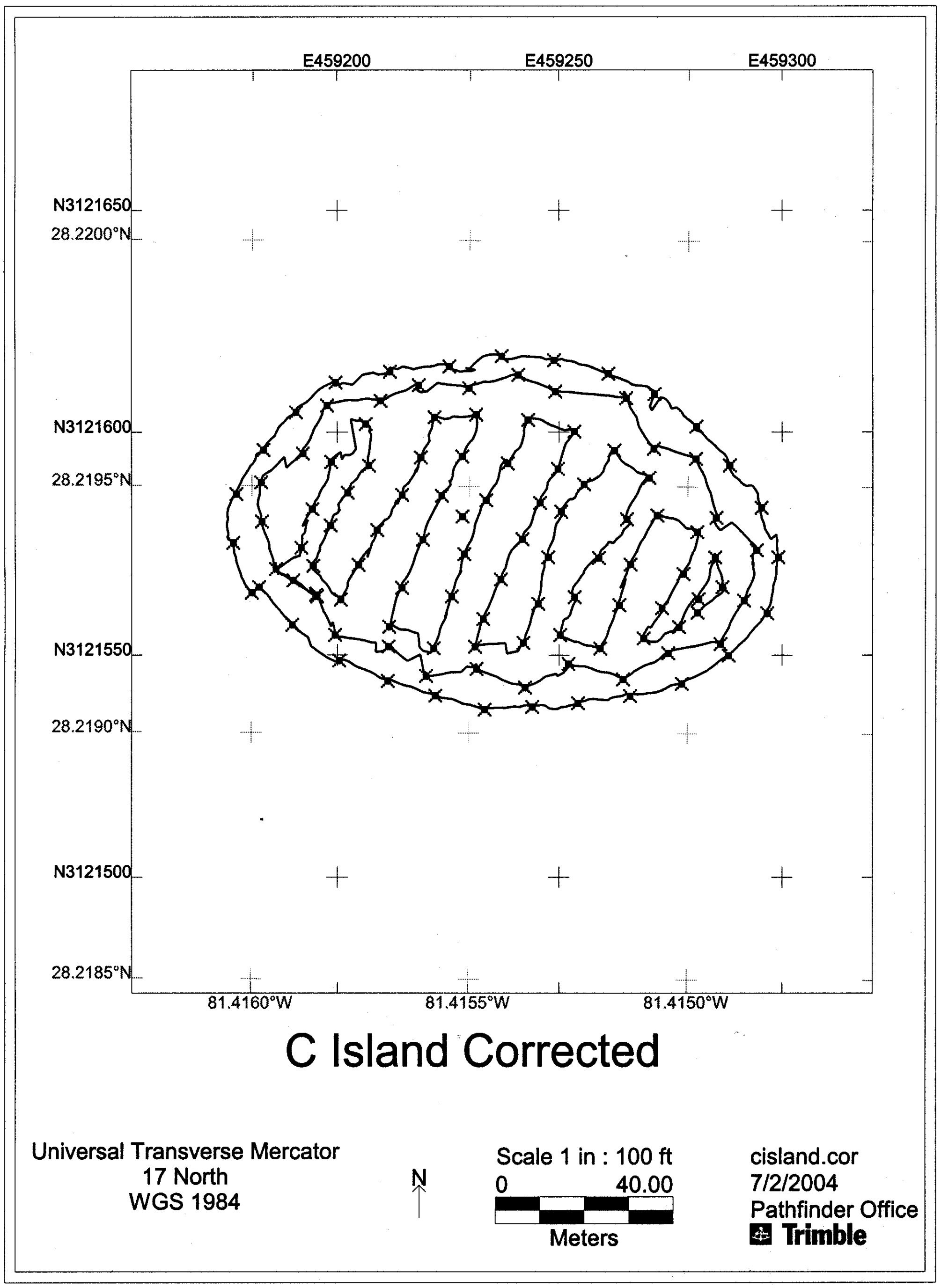

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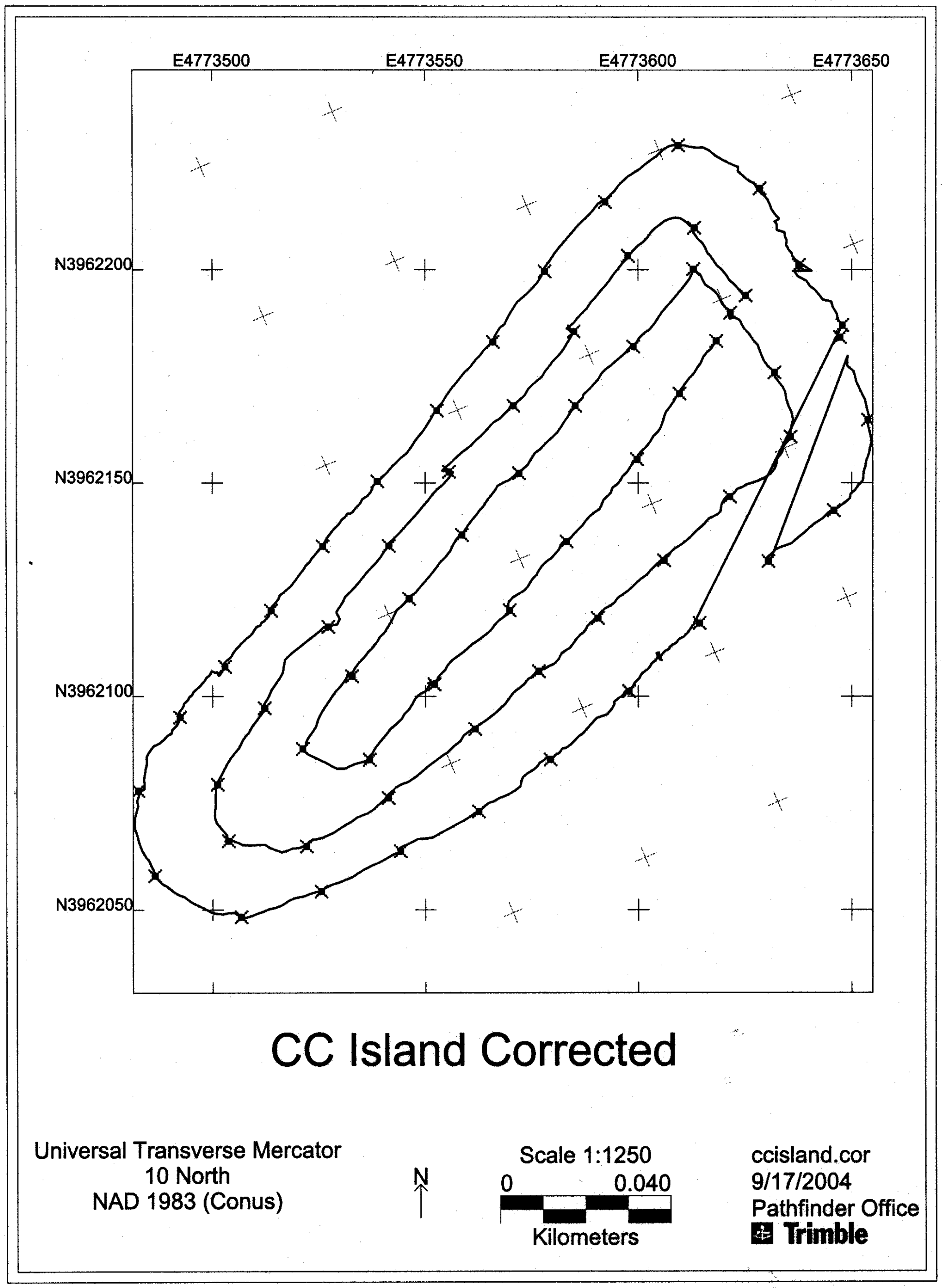

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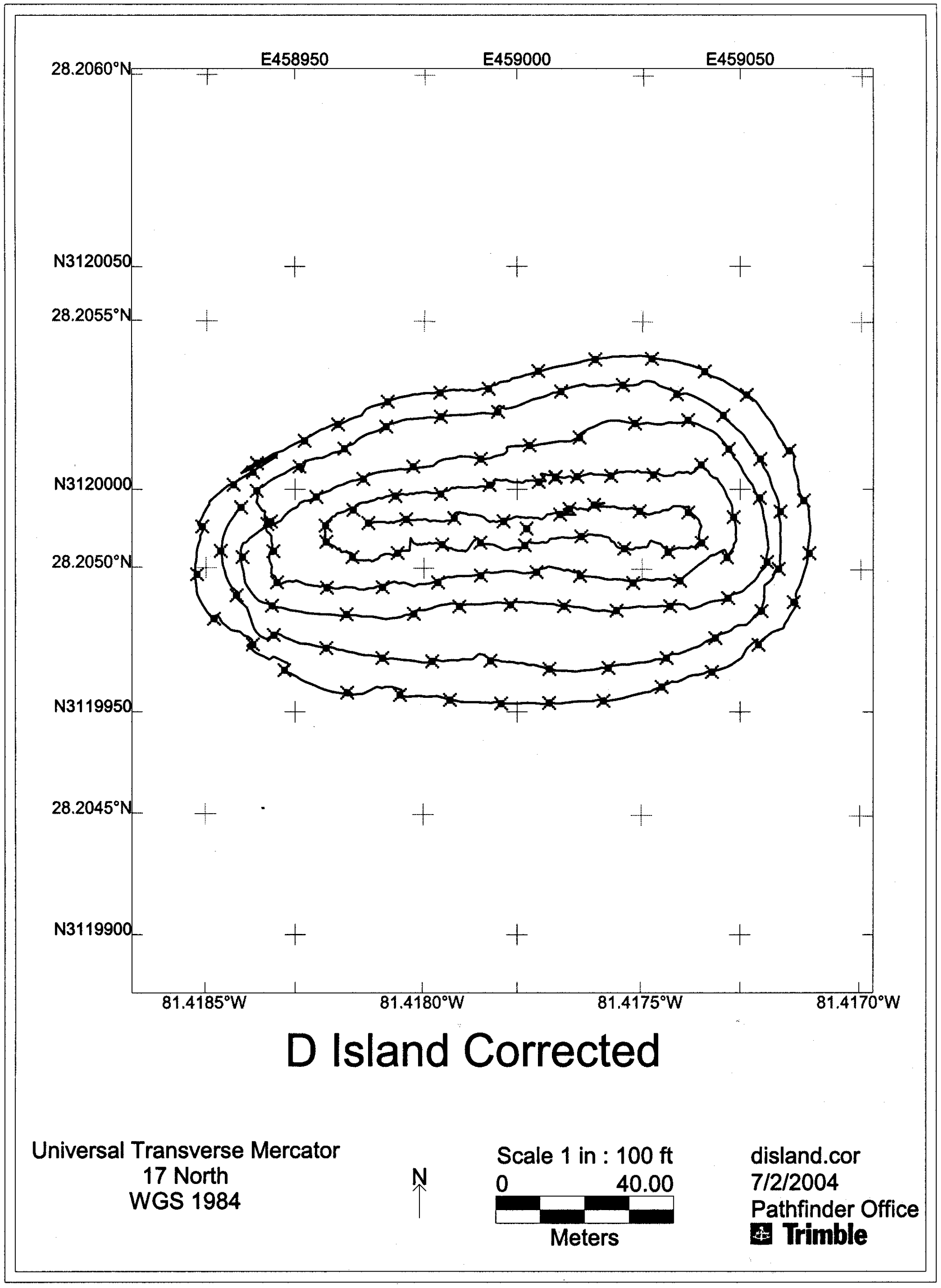

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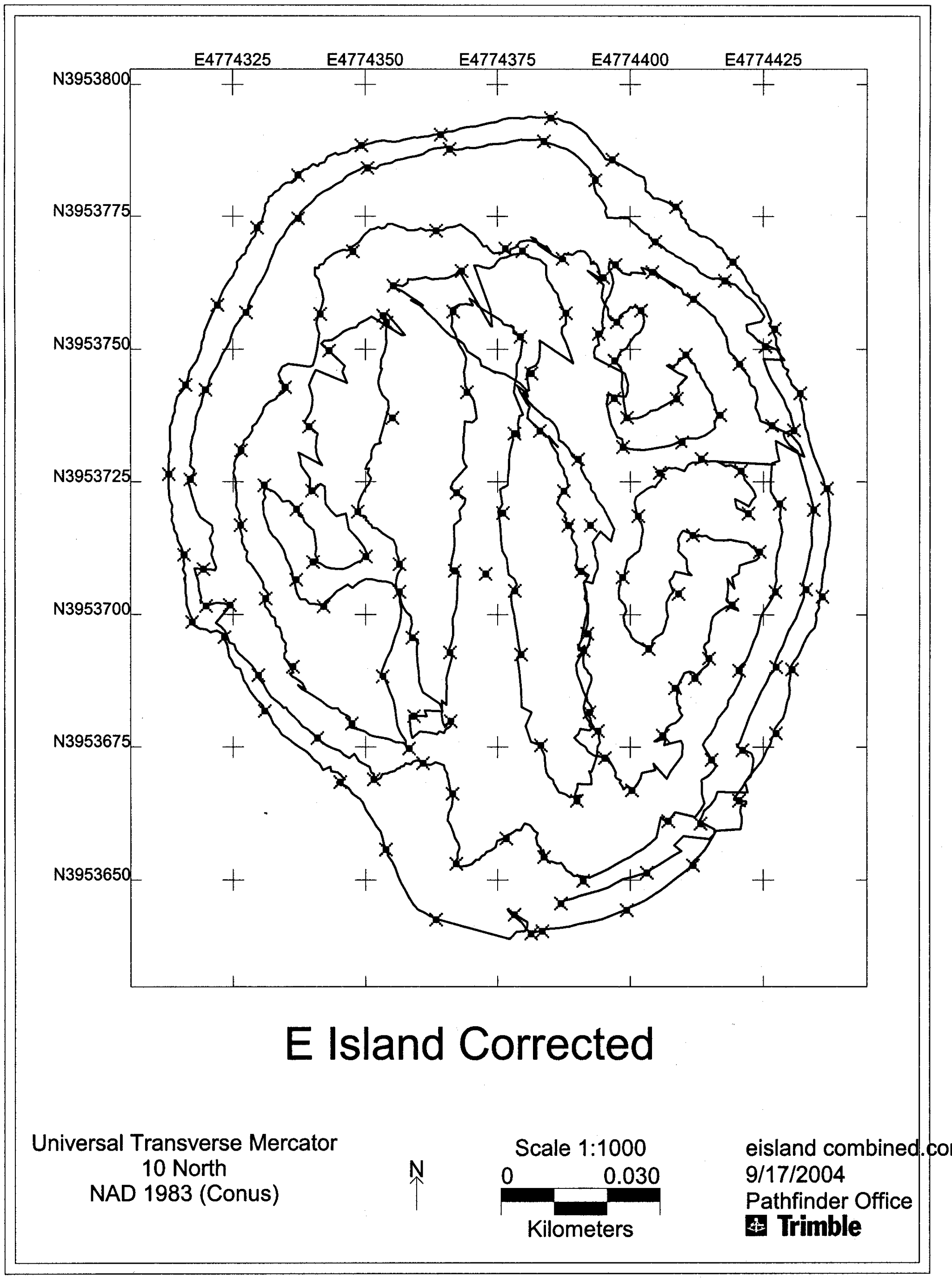
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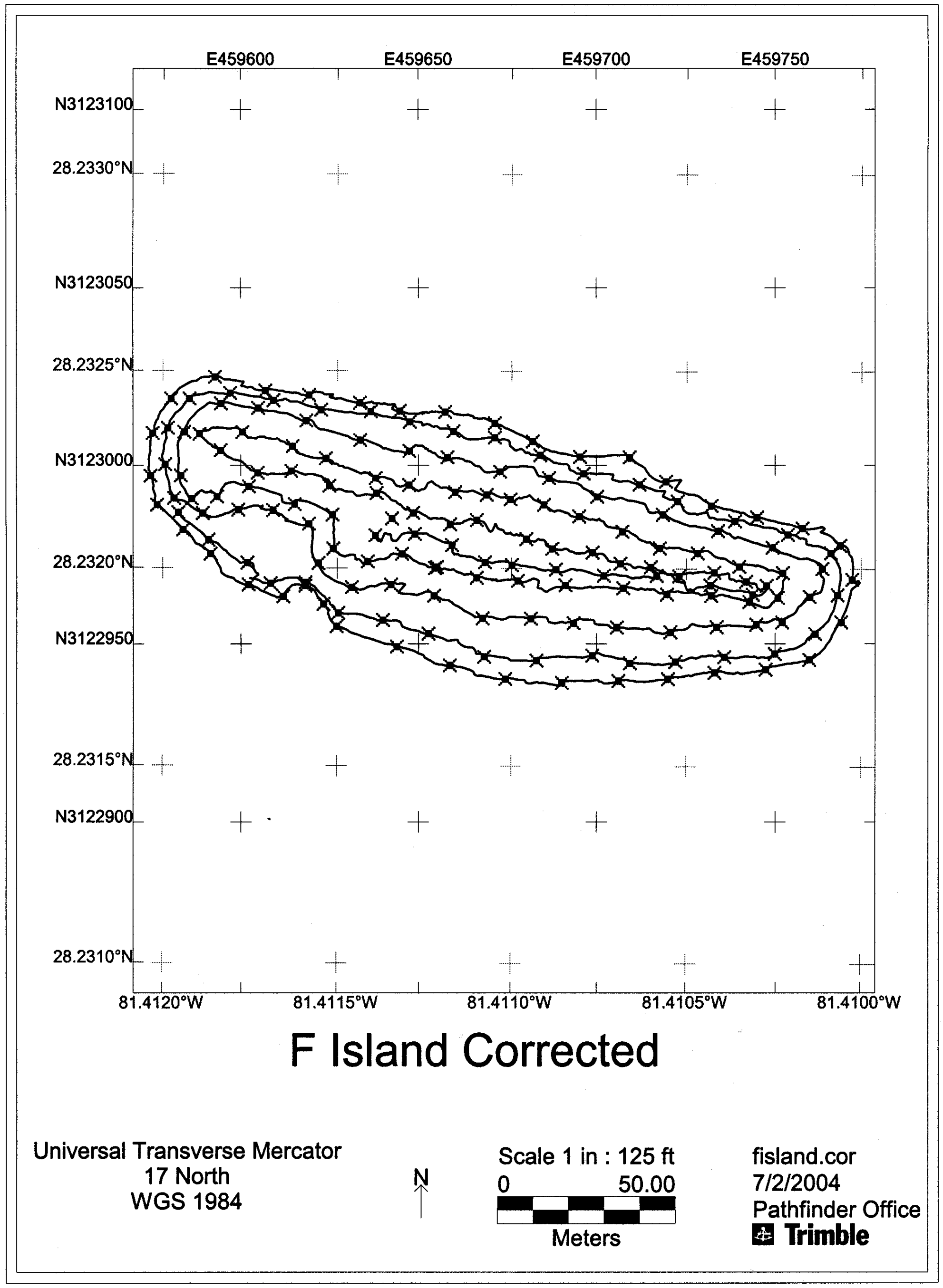
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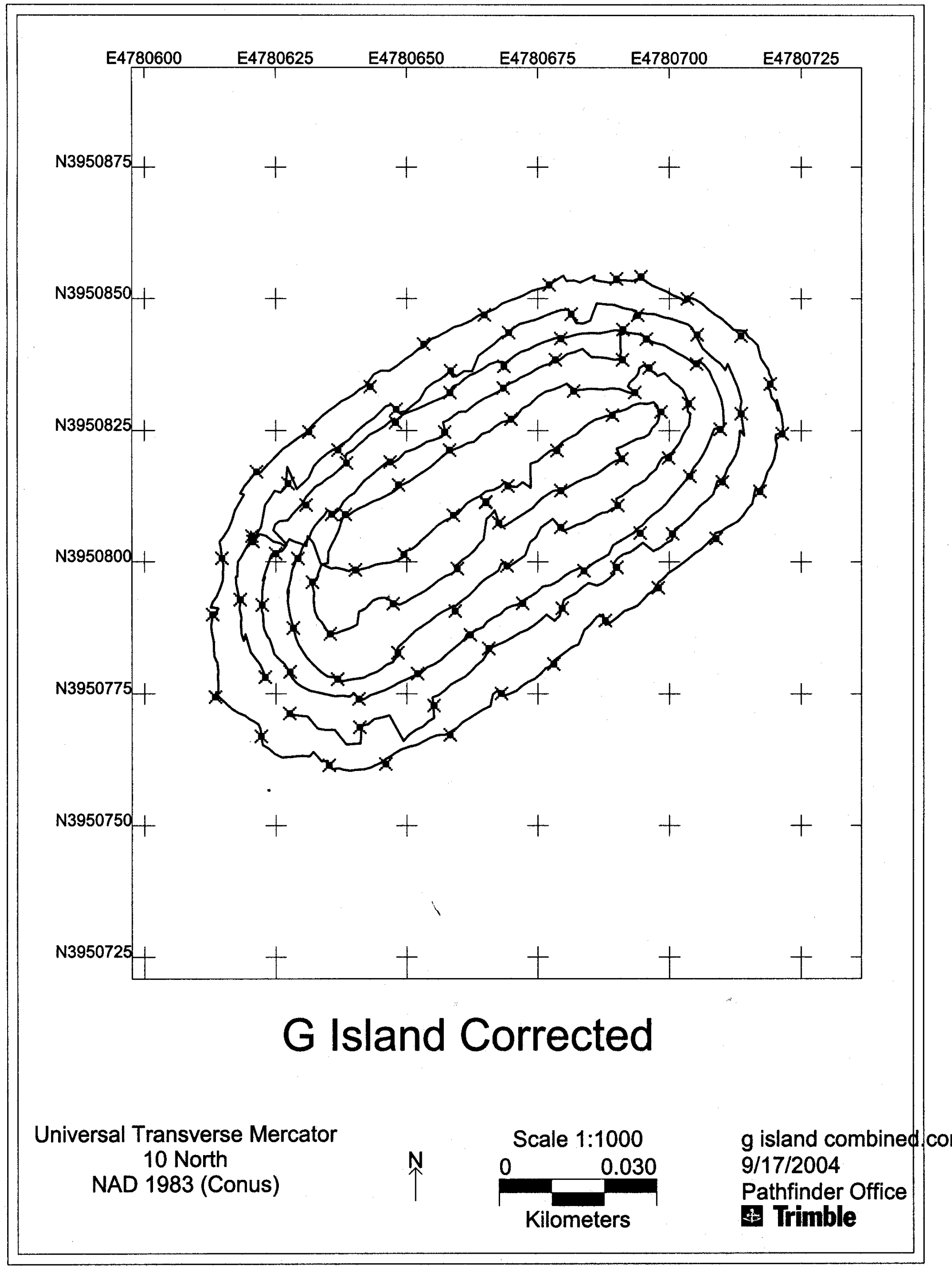

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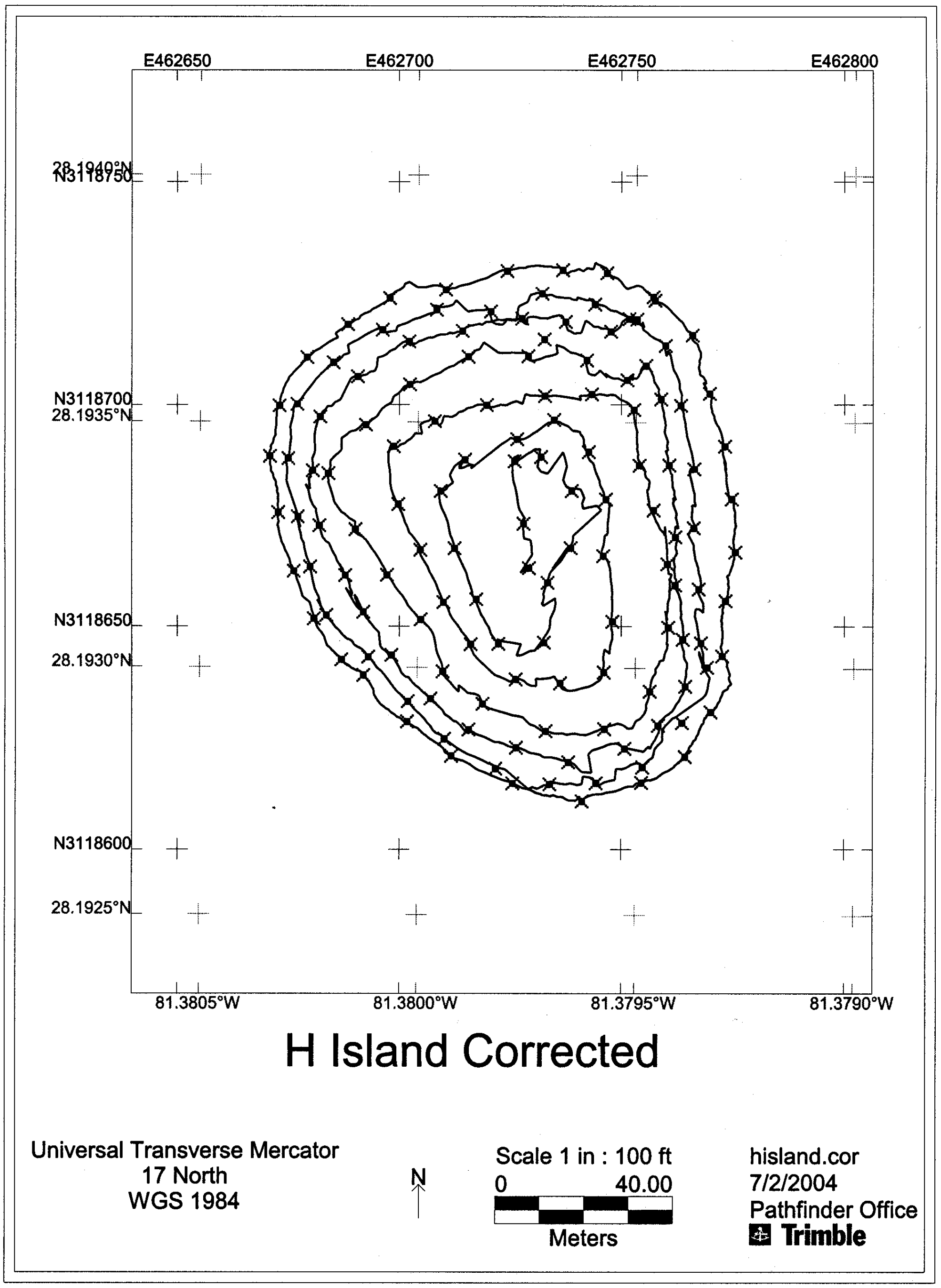

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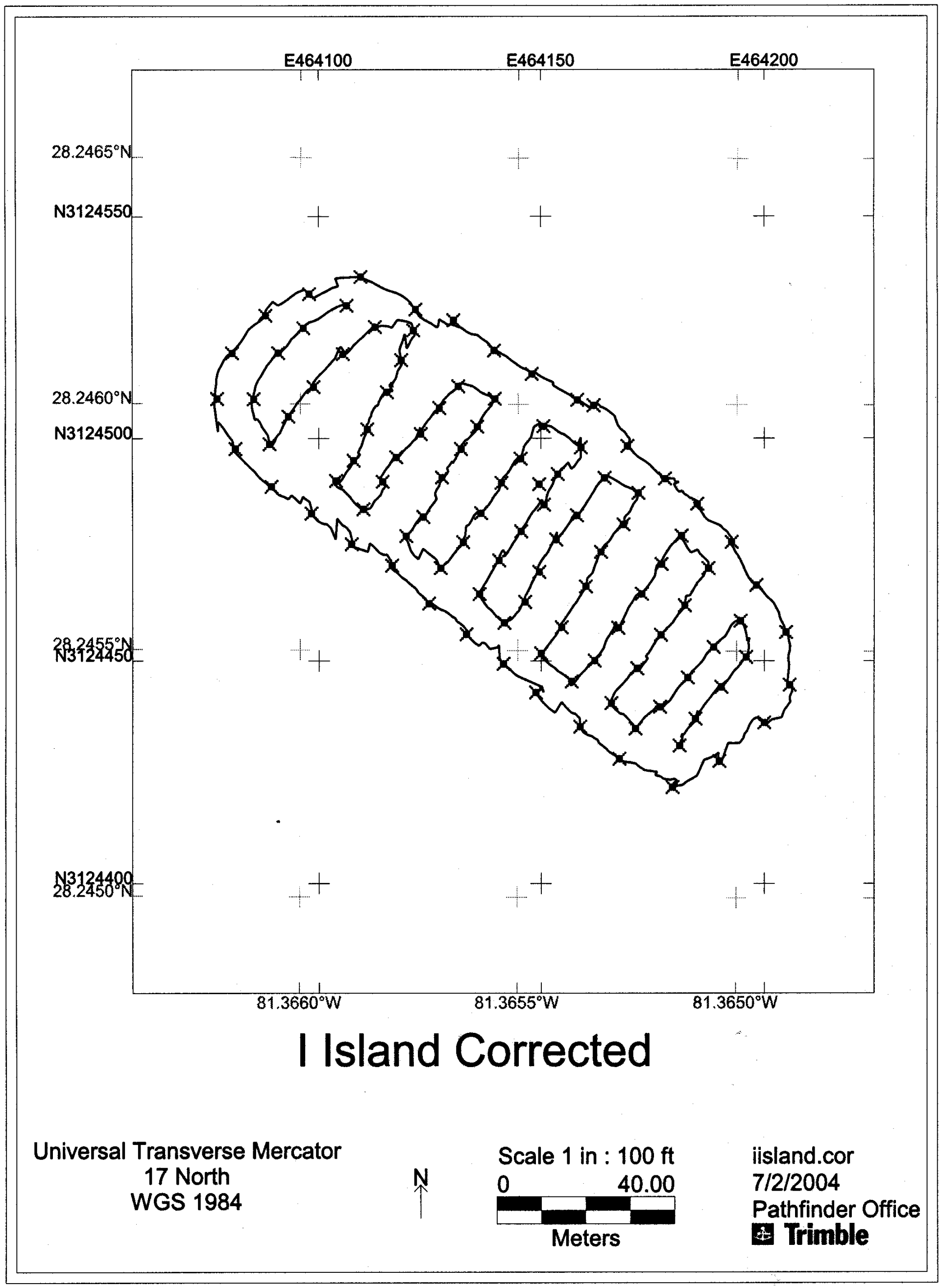
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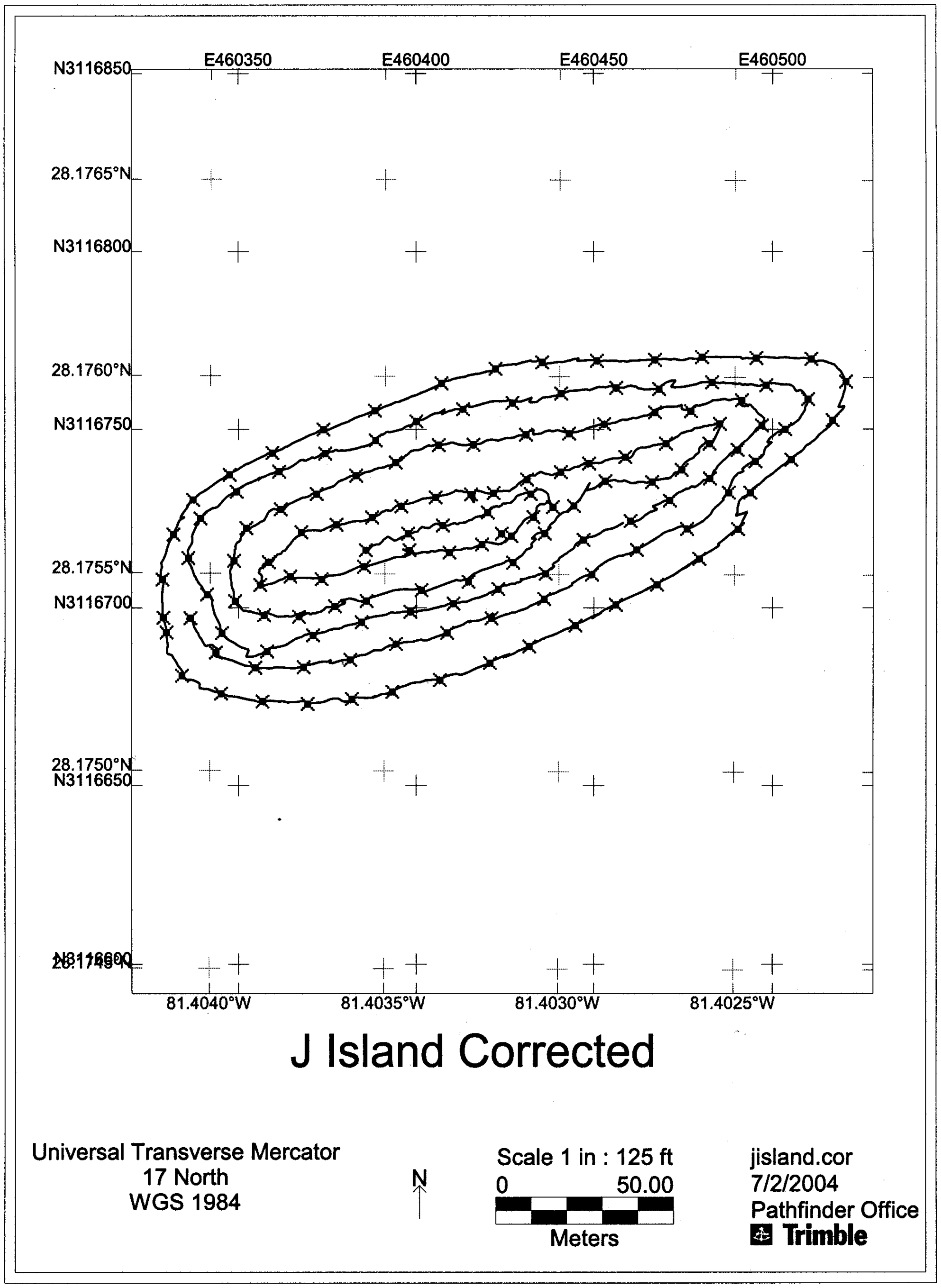

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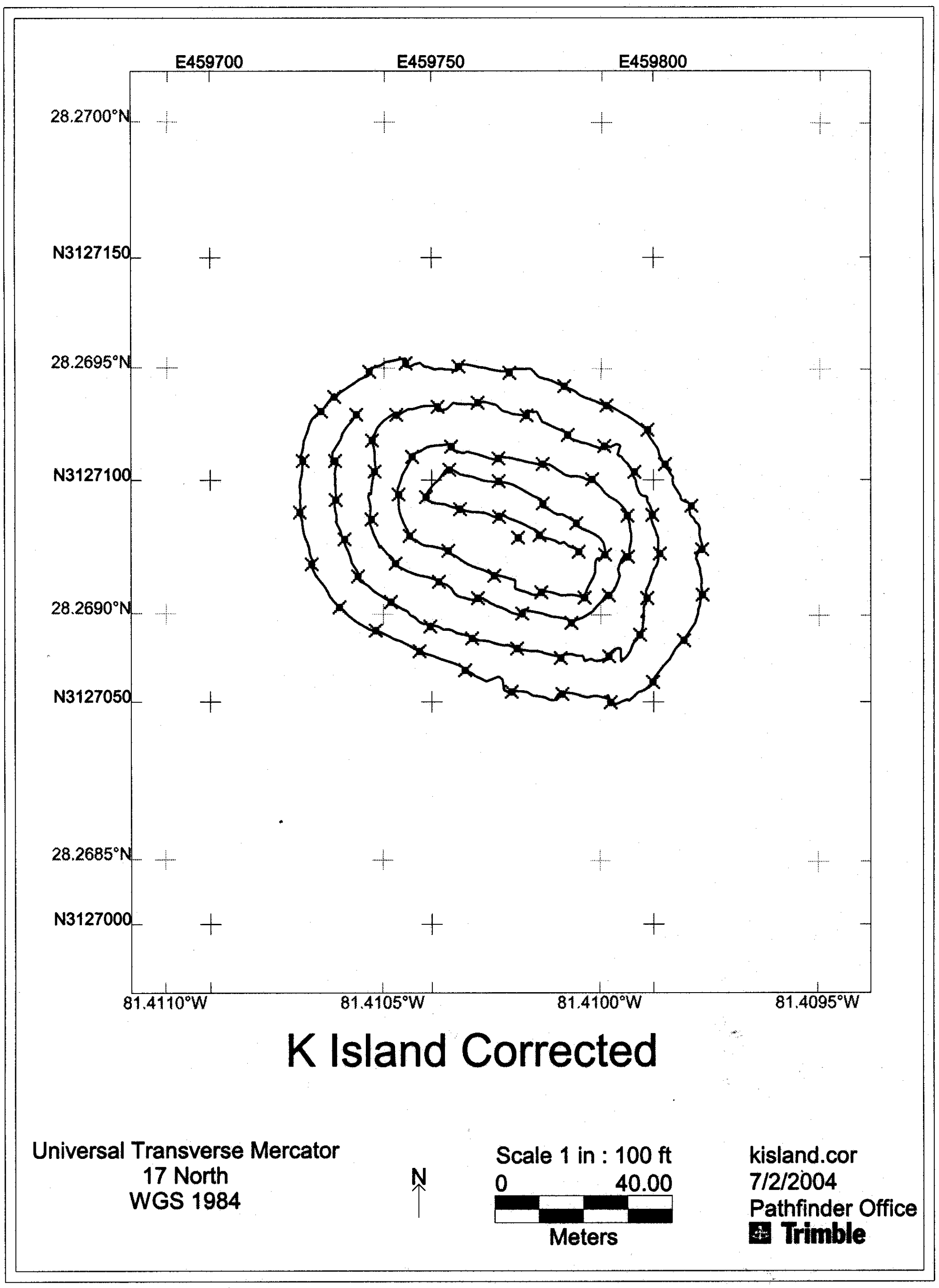
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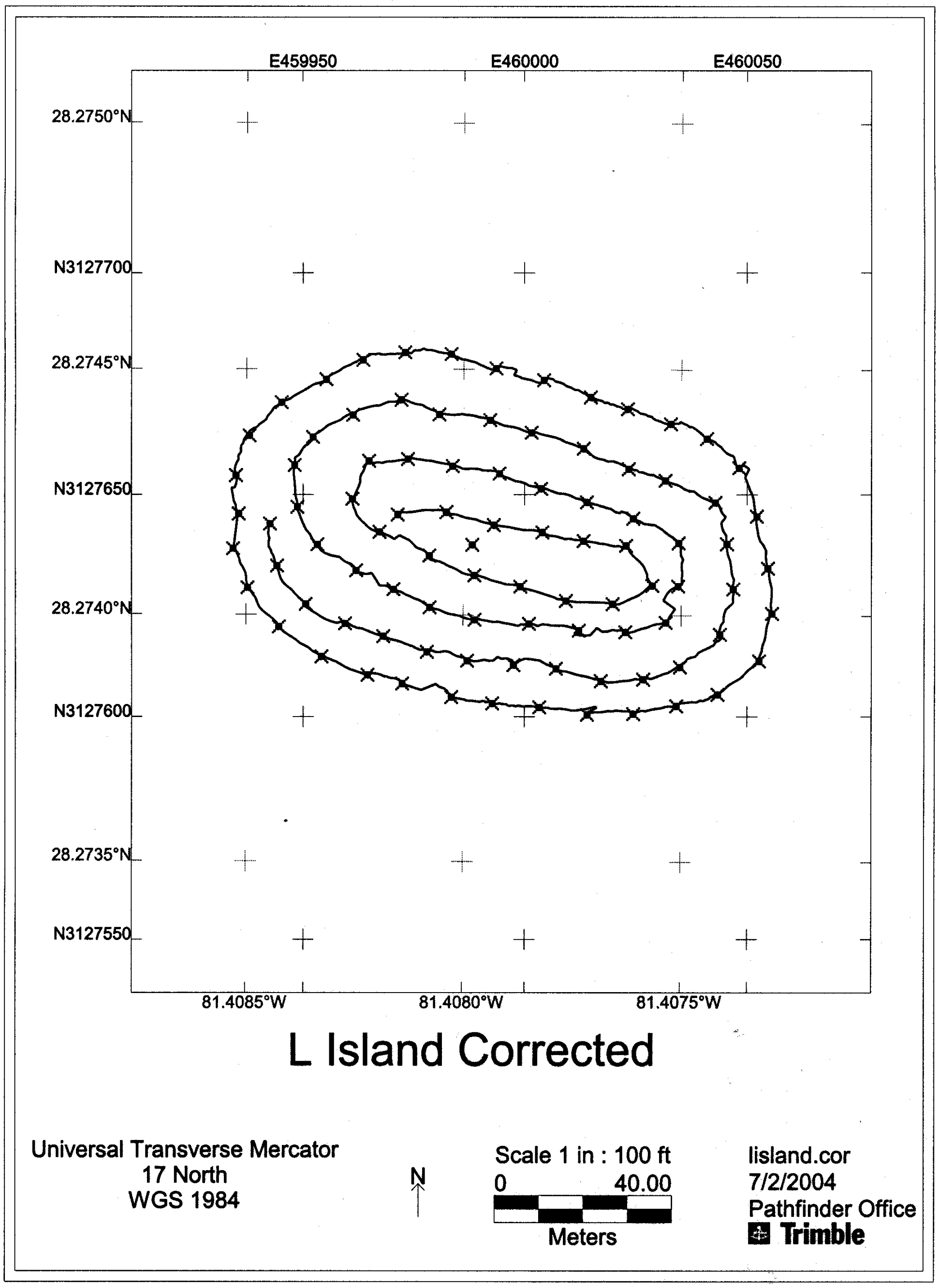
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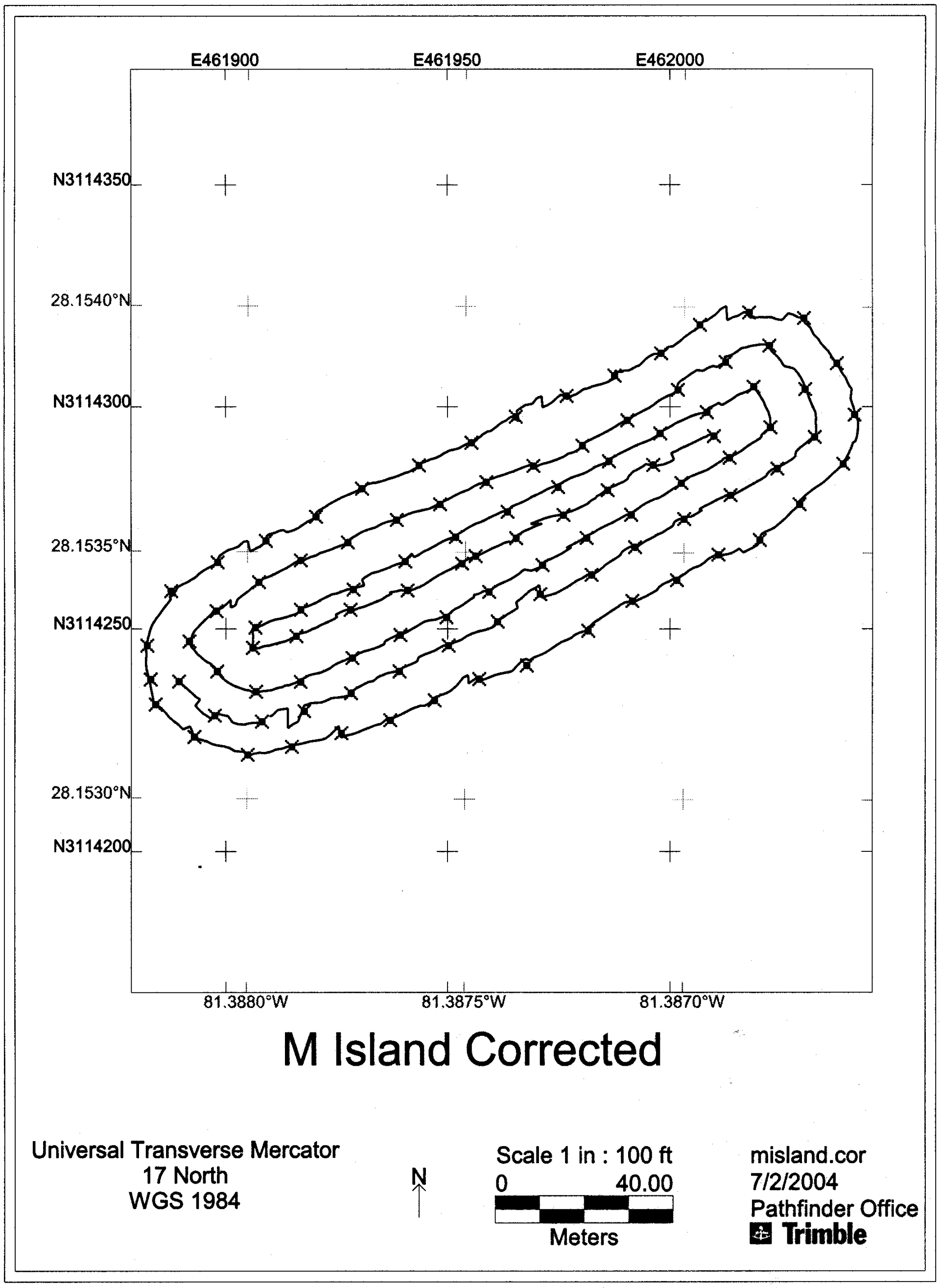
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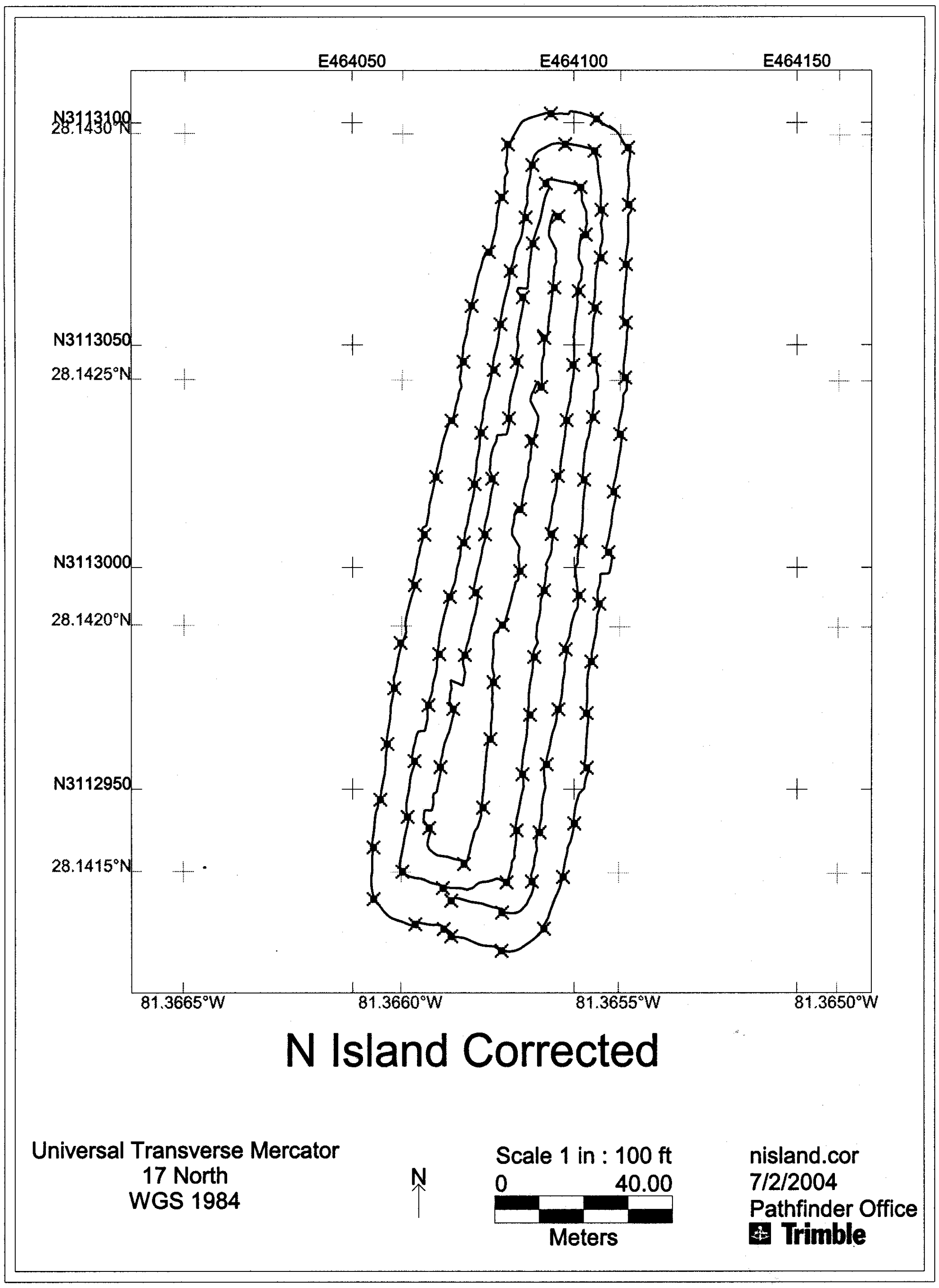
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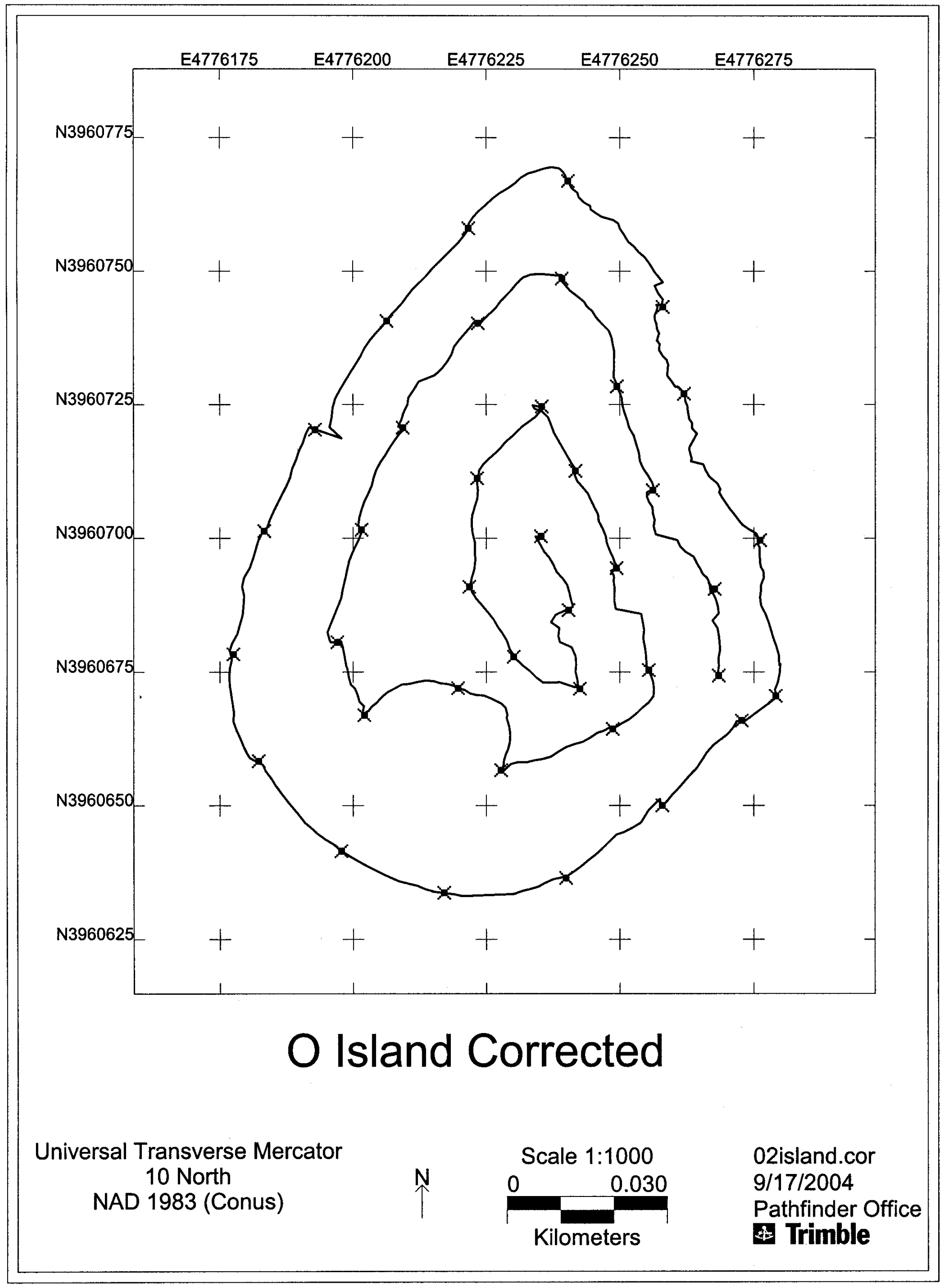
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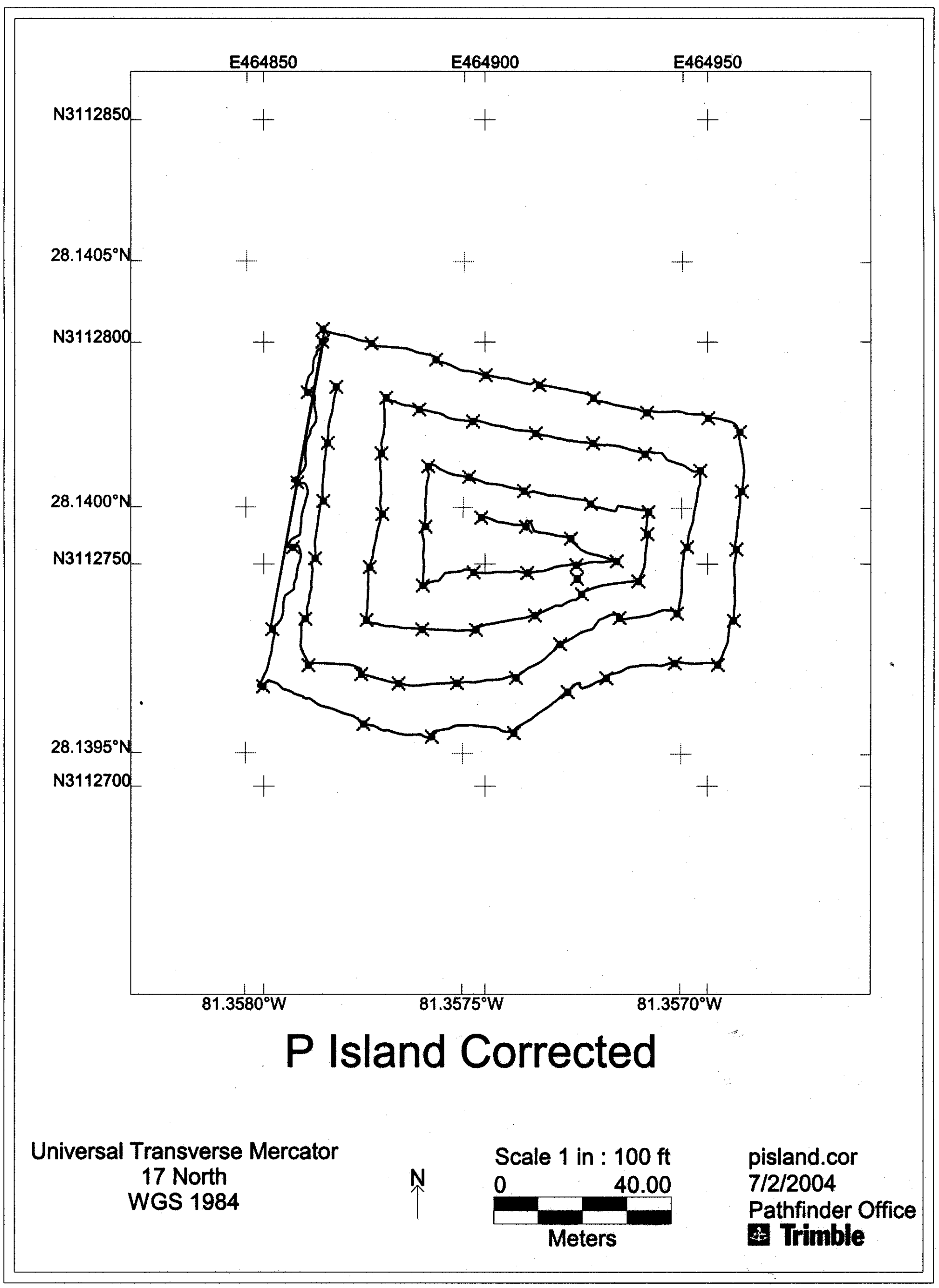
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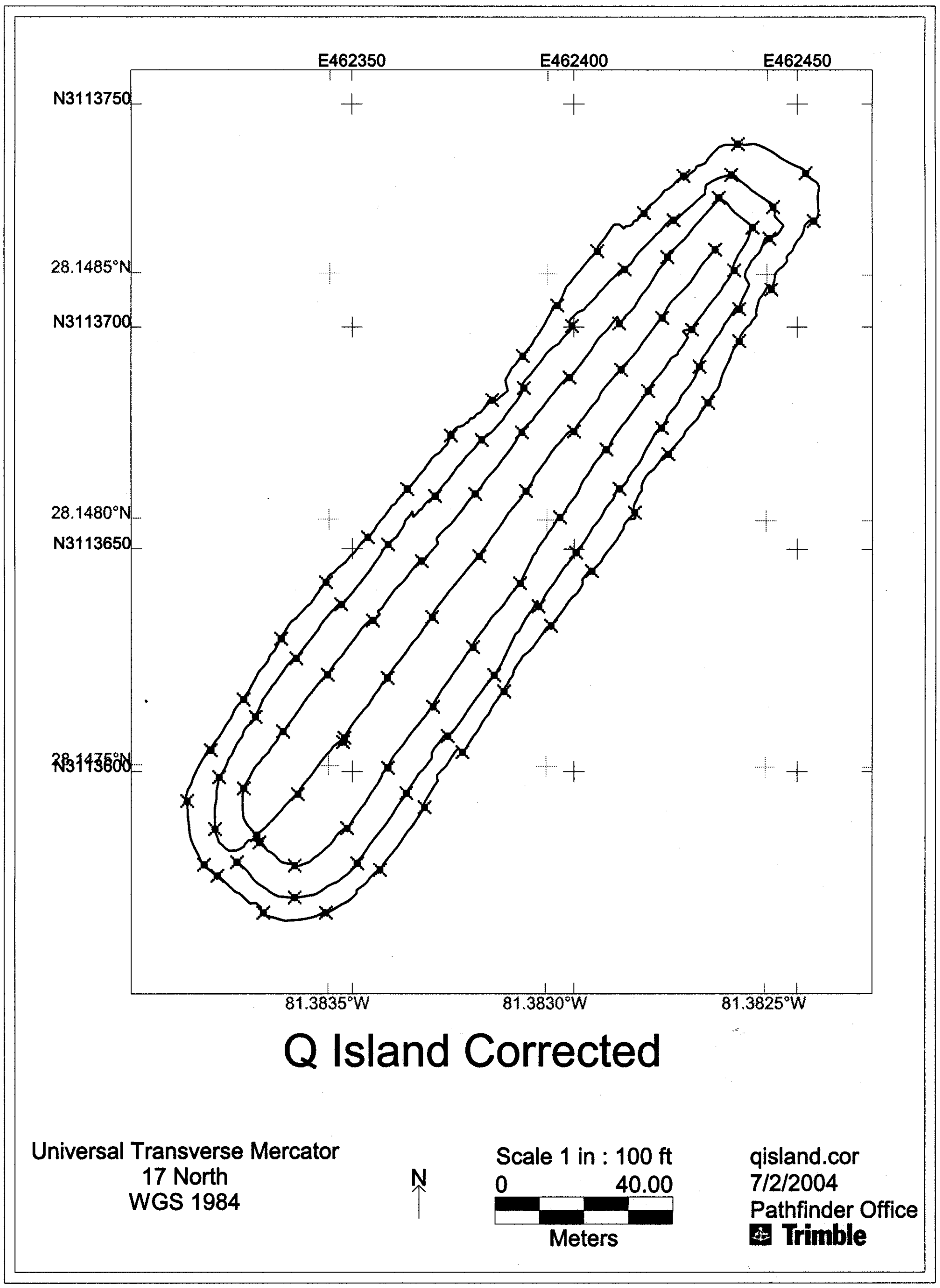

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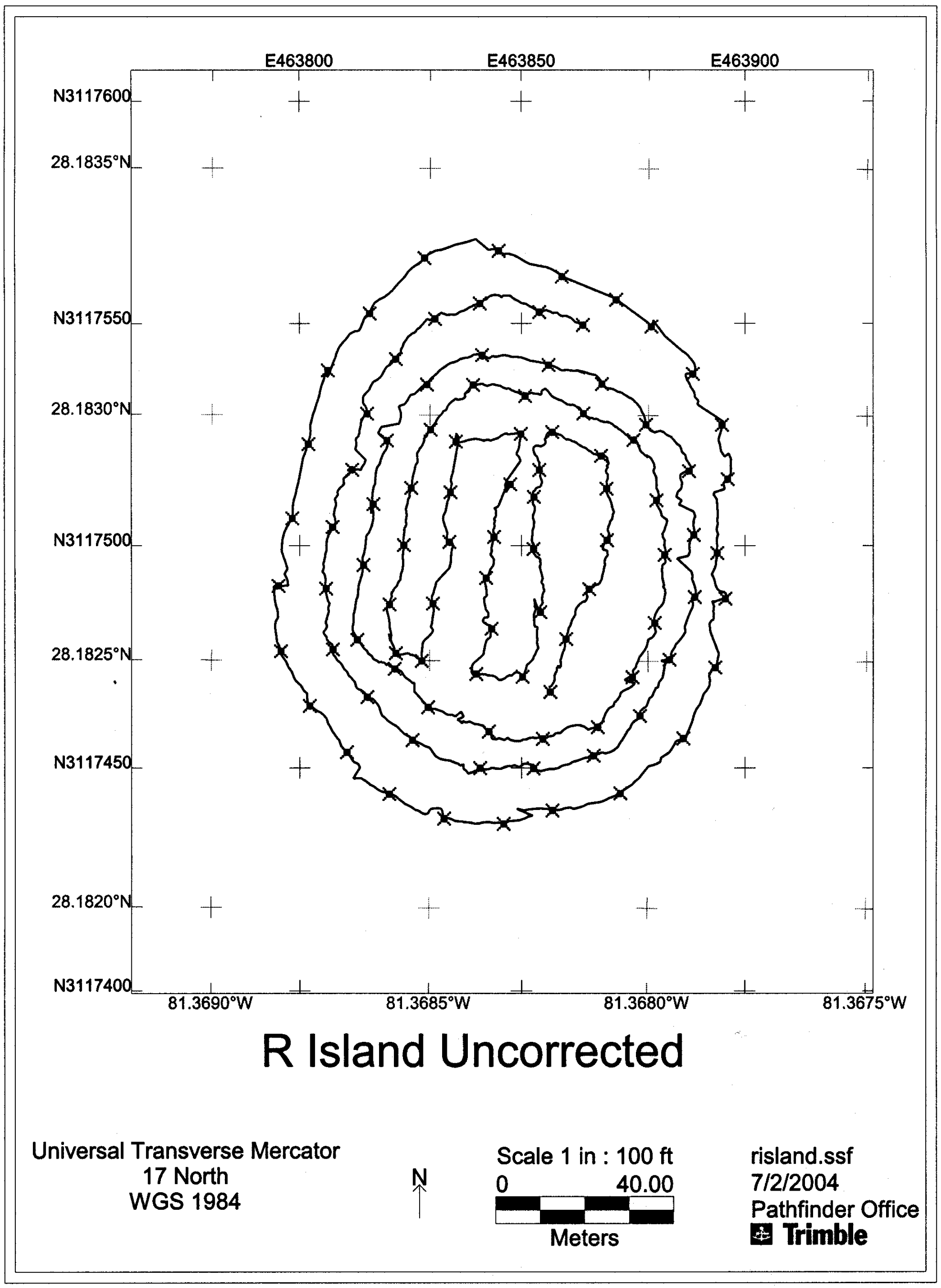
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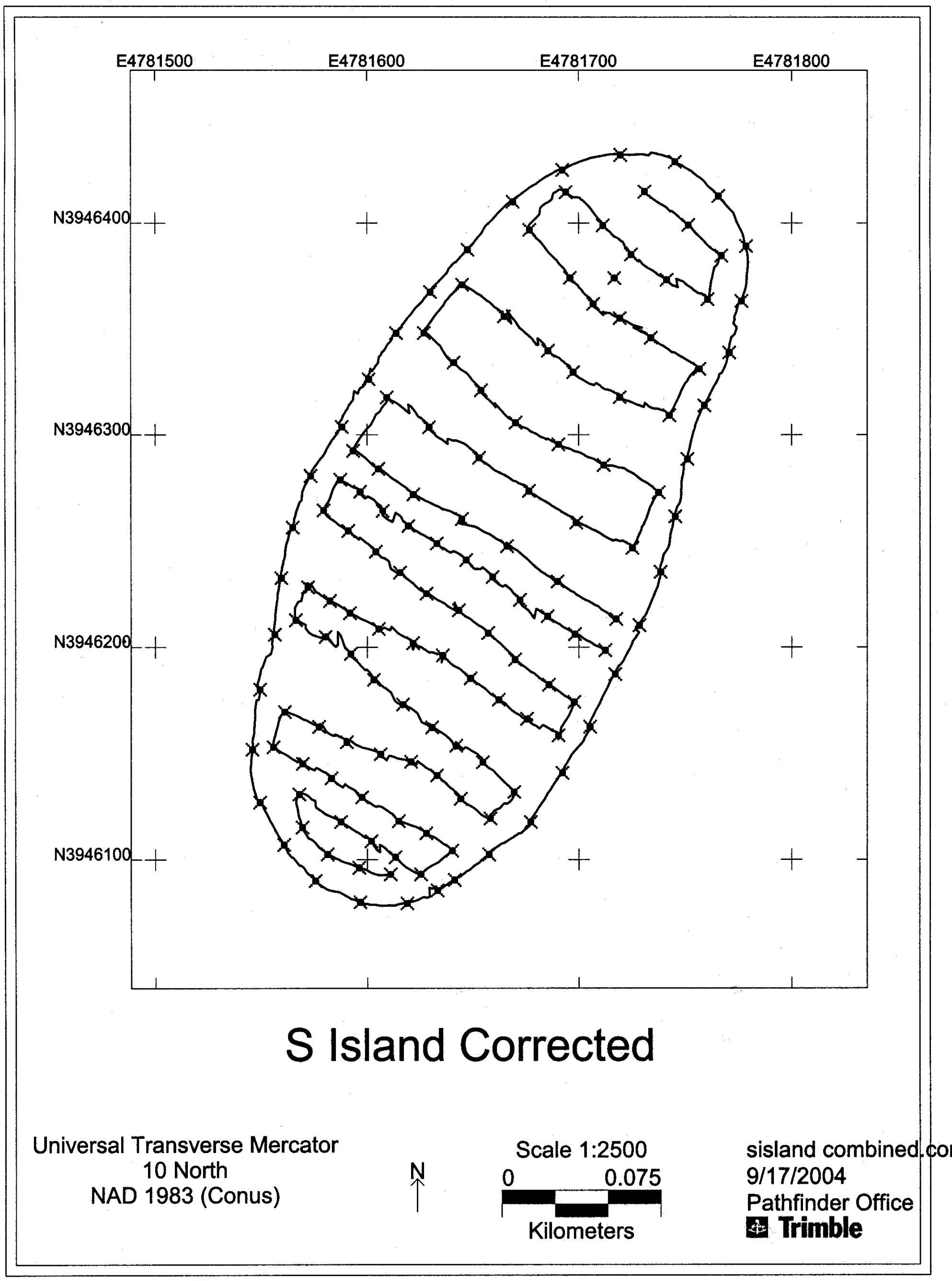
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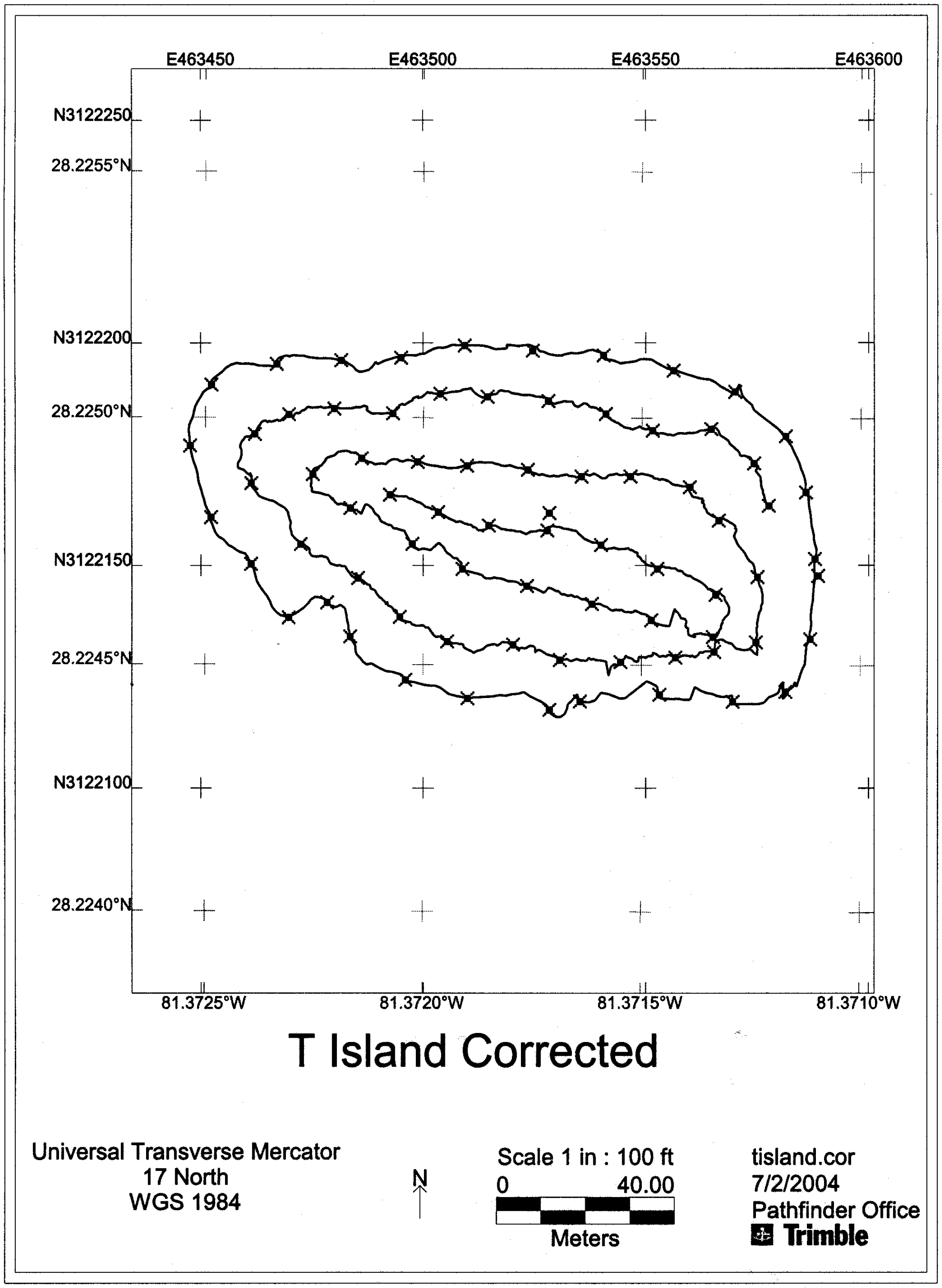

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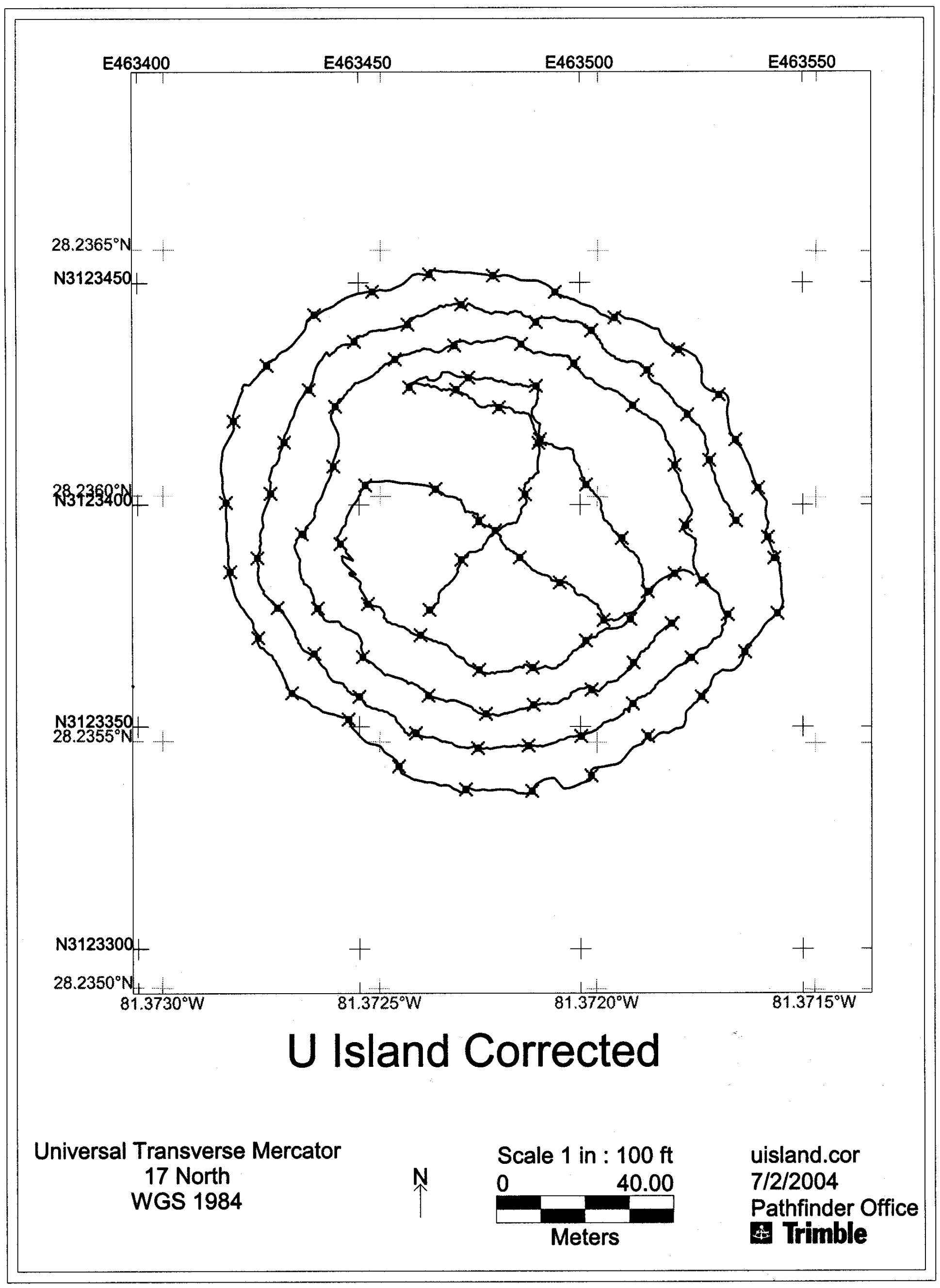
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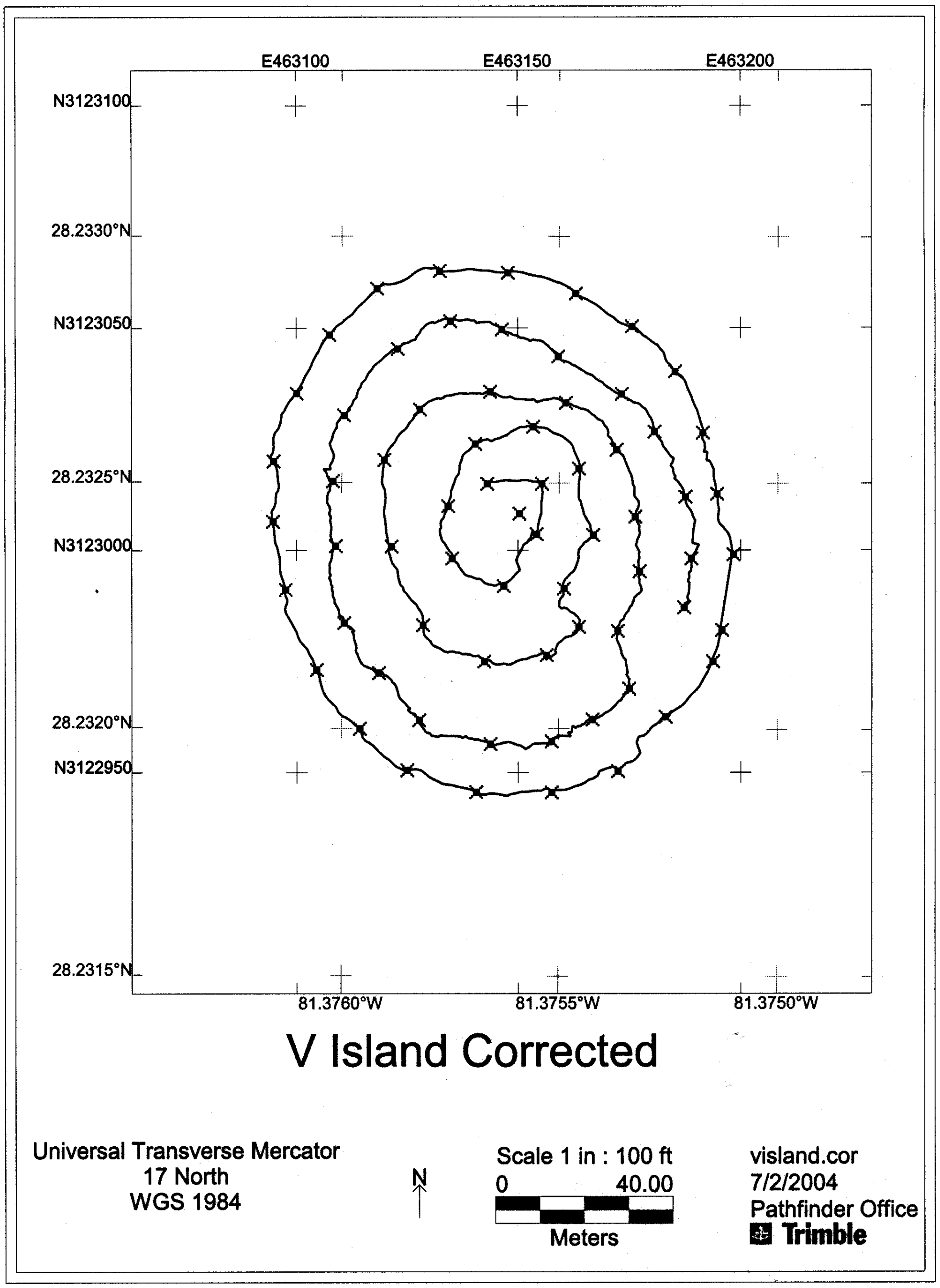

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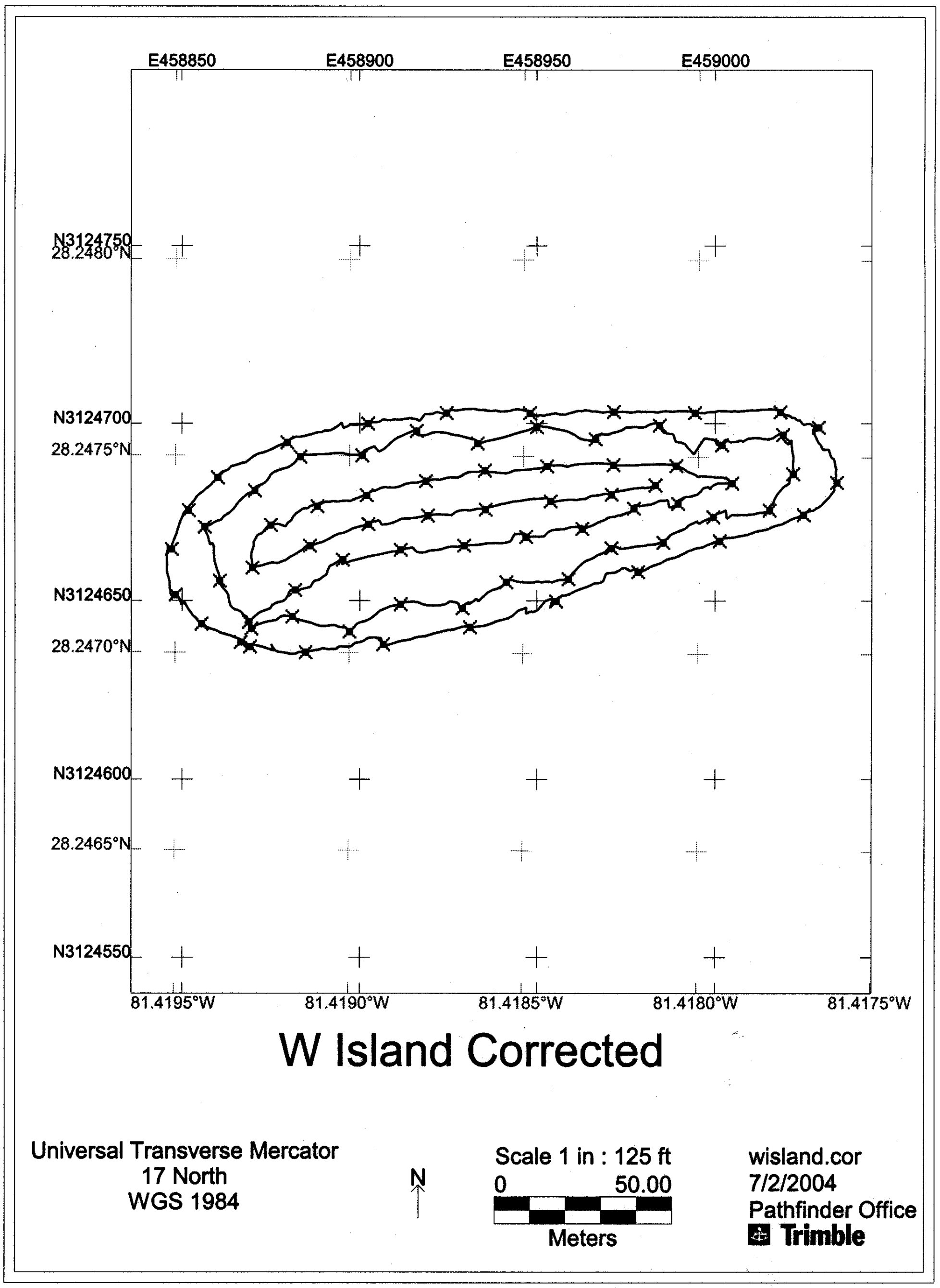

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Pathfinder Office
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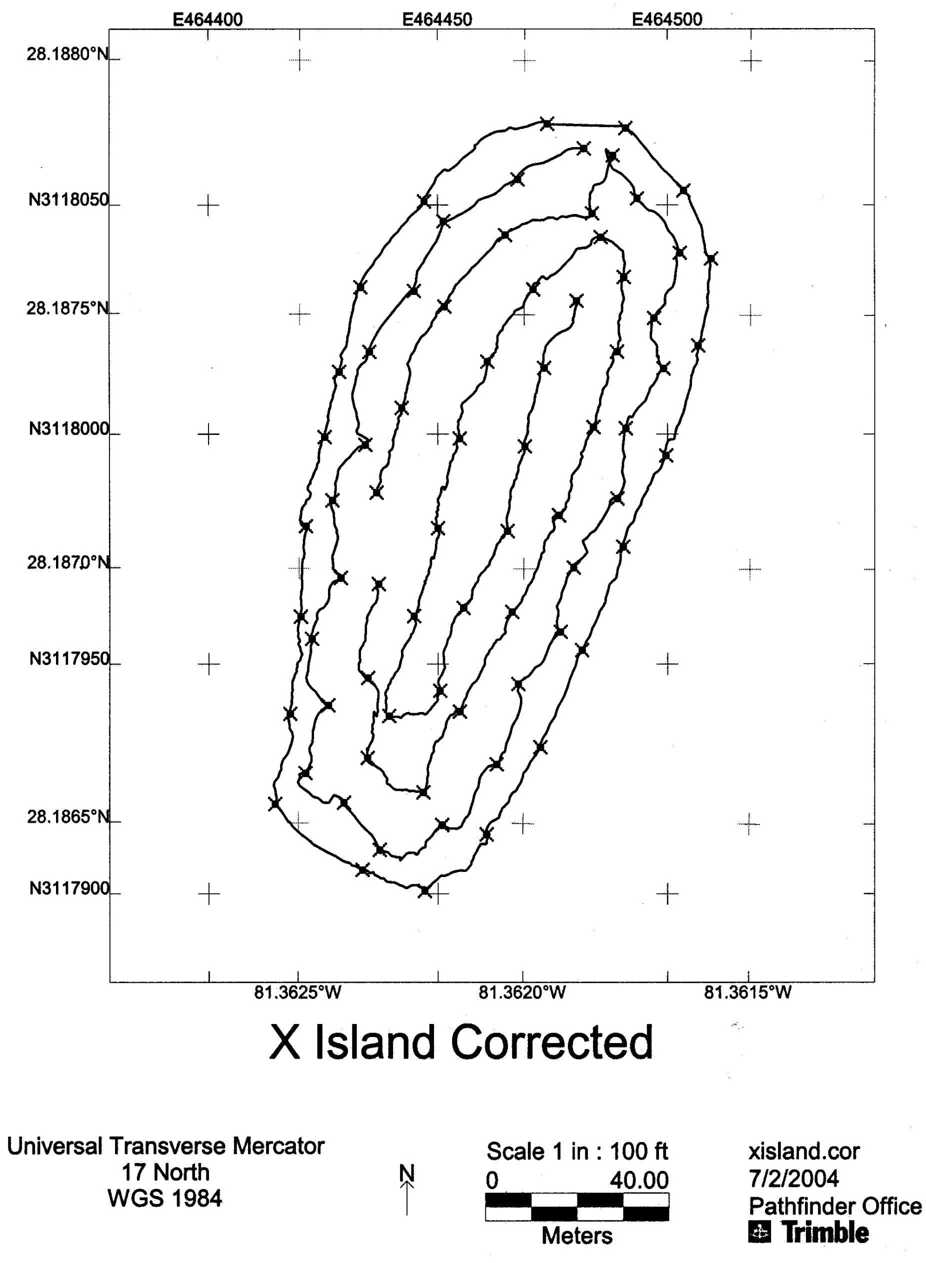
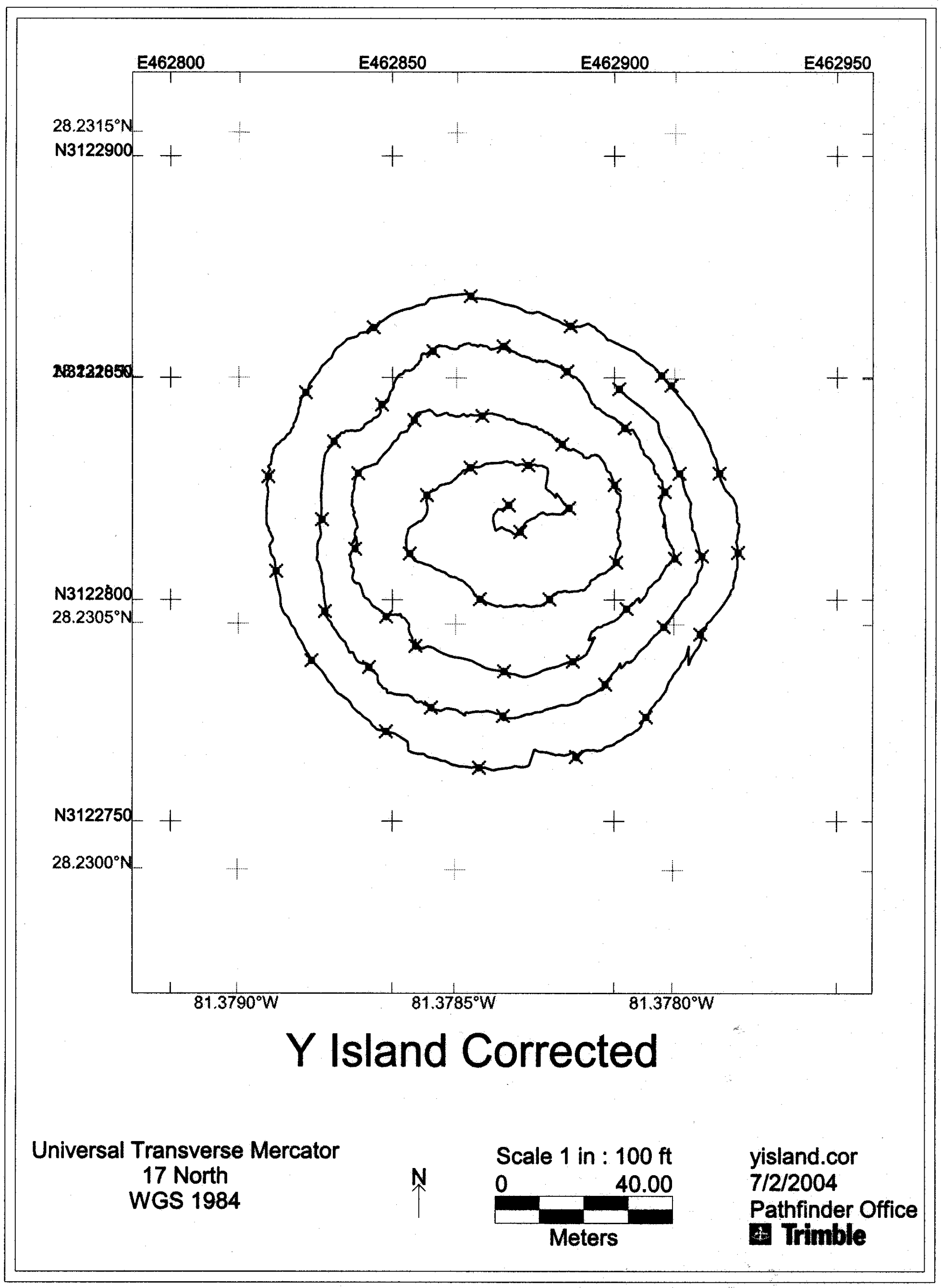


X Island Corrected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E462900
E462950
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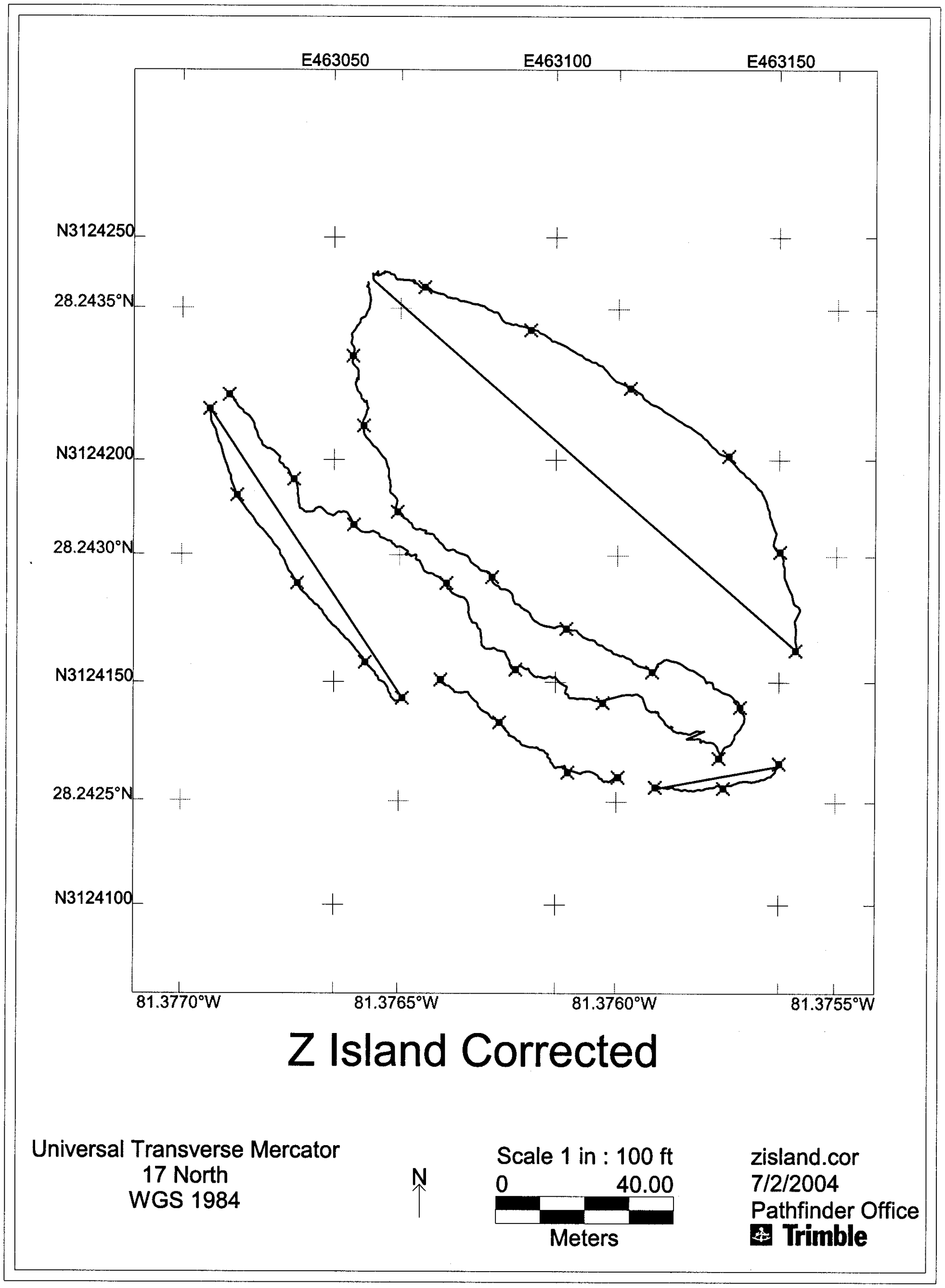
28.2300°N
81.3790°W
81.3785°W
81.3780°W
Y Island Corrected
Universal Transverse Mercator
17 North
WGS 1984
N
Scale 1 in : 100 ft
0
40.00
Meters
yisland.cor
7/2/2004
Pathfinder Office
Trimble



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E463150
N3124250
28.2435°N
N3124200
28.2430°N
N3124150
28.2425°N
N3124100
81.3770°W
81.3765°W
81.3760°W
81.3755°W
Z Island Corrected
Universal Transverse Mercator
17 North
WGS 1984
N
Scale 1 in : 100 ft
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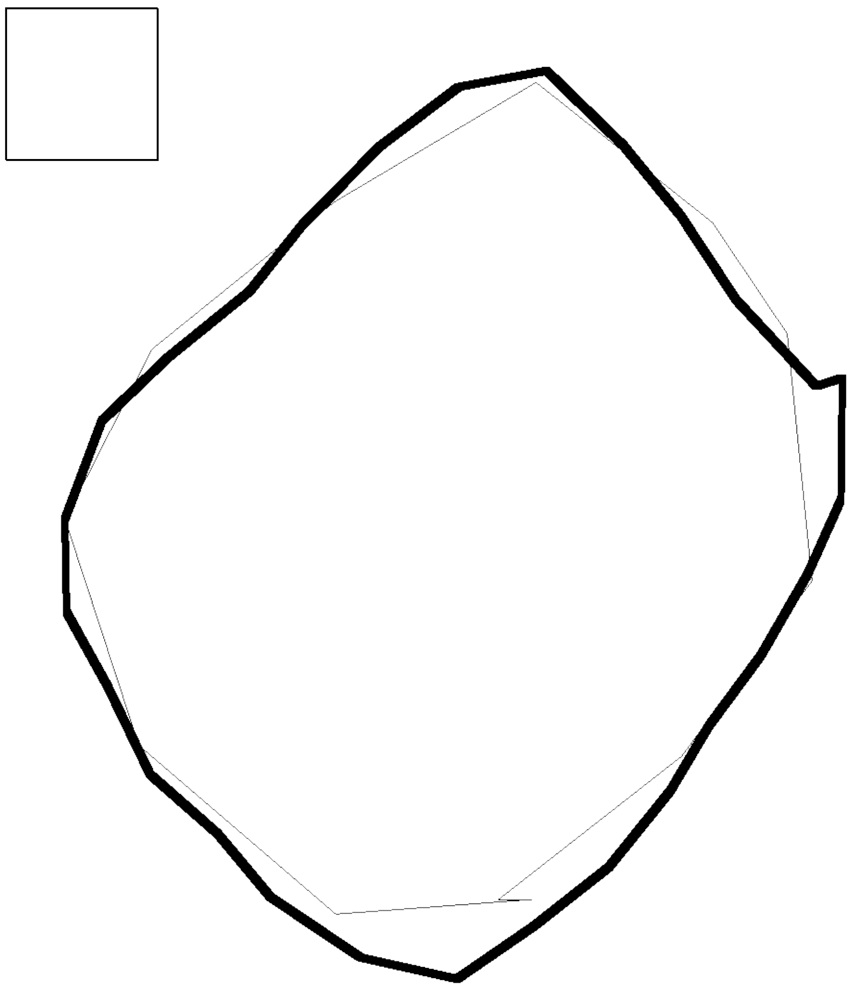
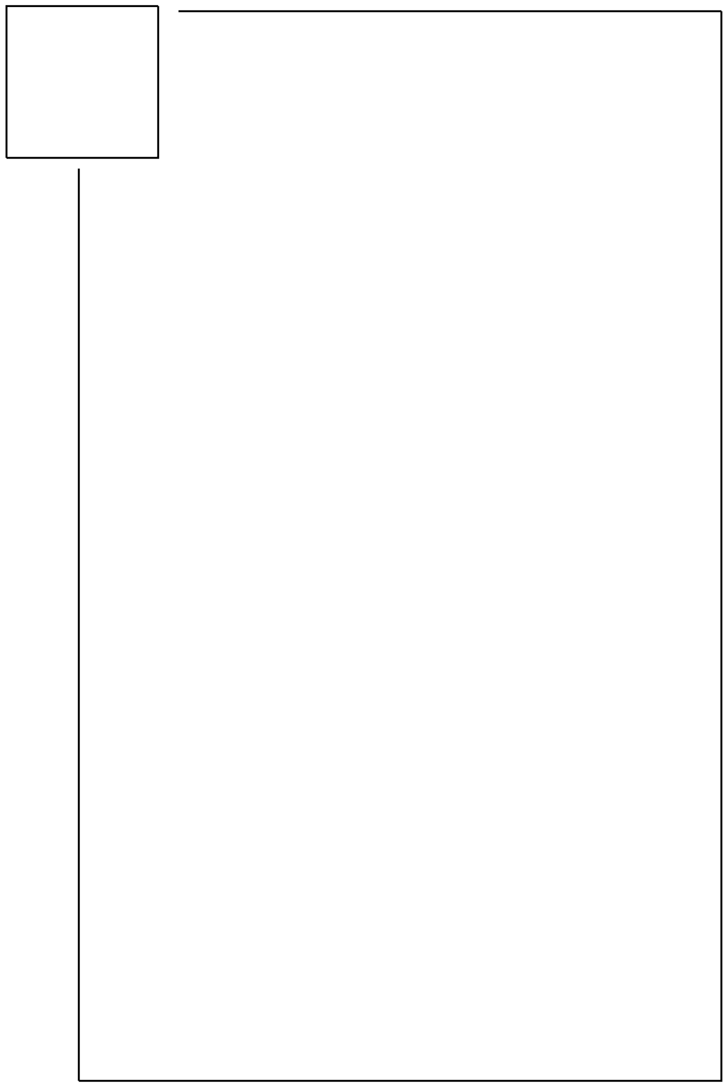
40.00
Meters
zisland.cor
7/2/2004
Pathfinder Office
Trimble

Appendix VI

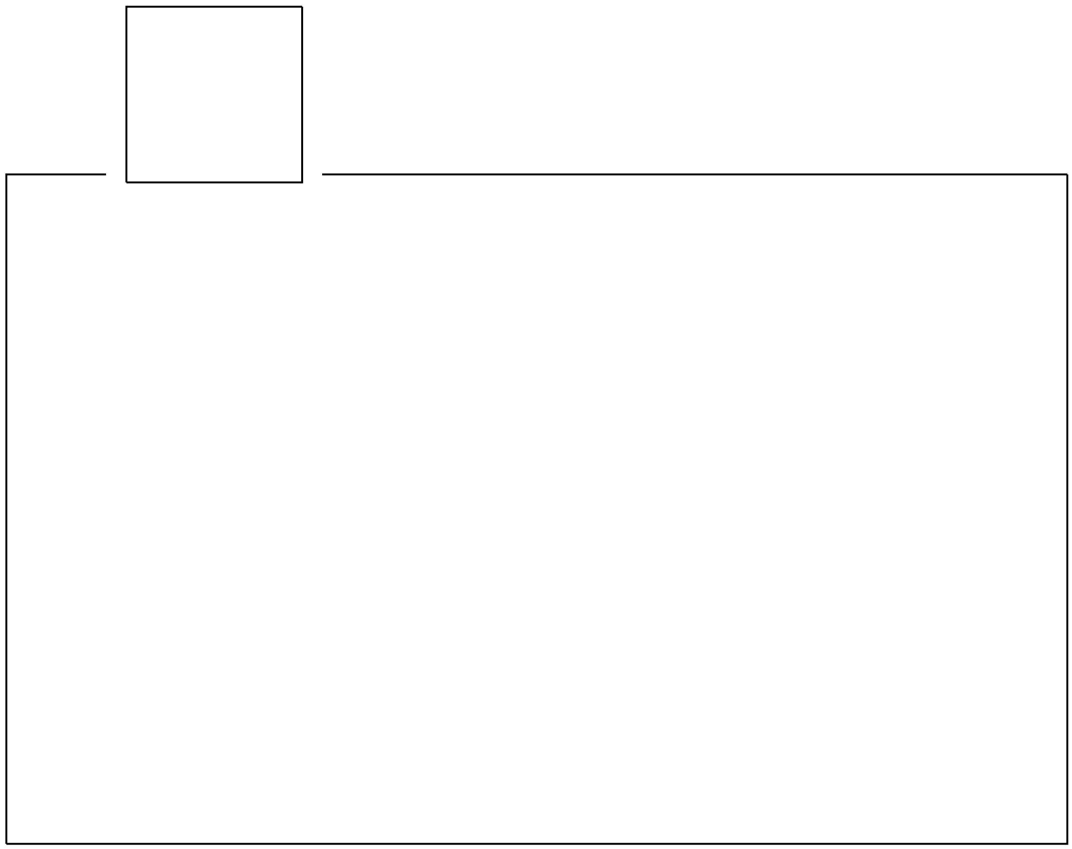
Overlay of the original wildlife island footprints (Round 1) and the footprints of 14 islands measured six months (Round 2) after water surrounded the islands.



Island B	**Round 1**	**0.46 ha (1.14 acres)**
	Round 2	0.44 ha (1.08 acres)



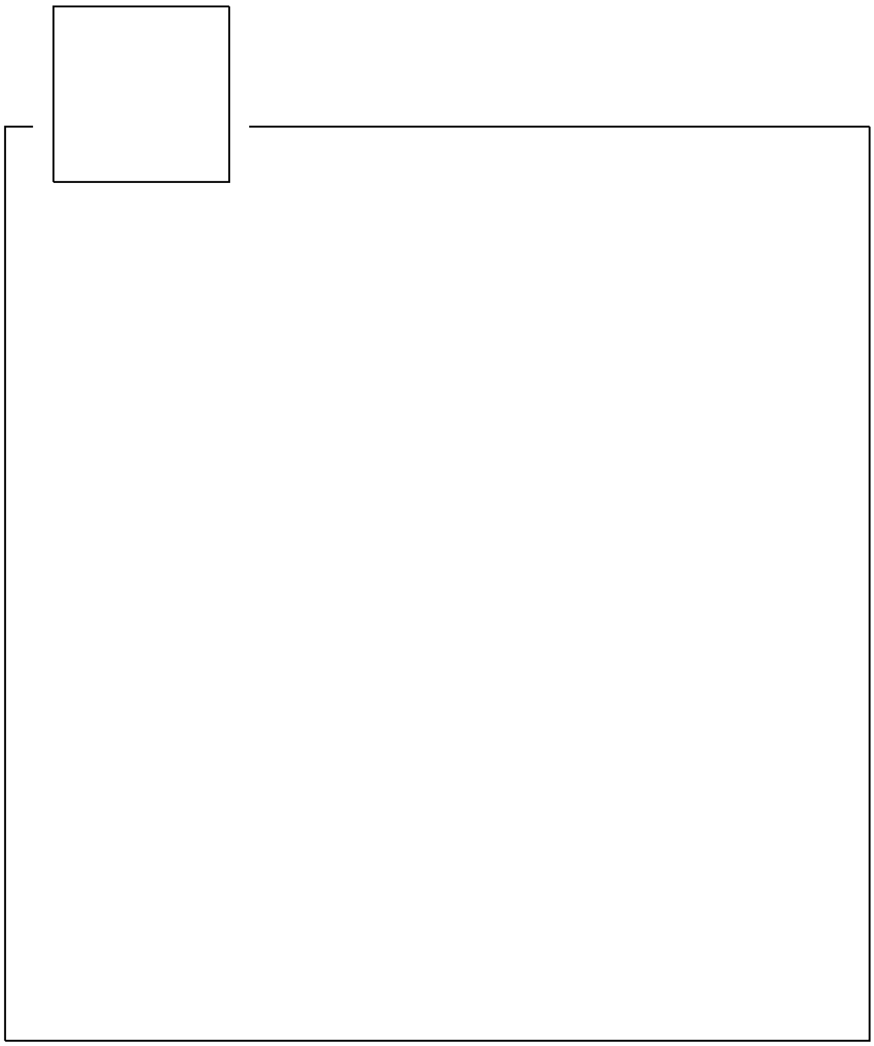
Island BB	**Round 1**	**1.18 ha (2.90 acres)**
	Round 2	1.28 ha (2.78 acres)



Island C	**Round 1**	**0.75 ha (1.85 acres)**
	Round 2	0.74 ha (1.82 acres)

Island F	**Round 1**	**1.09 ha (2.68 acres)**
	Round 2	1.10 ha (2.71 acres)

Island G	**Round 1**	**0.42 ha (1.04 acres)**
	Round 2	0.35 ha (0.85 acres)

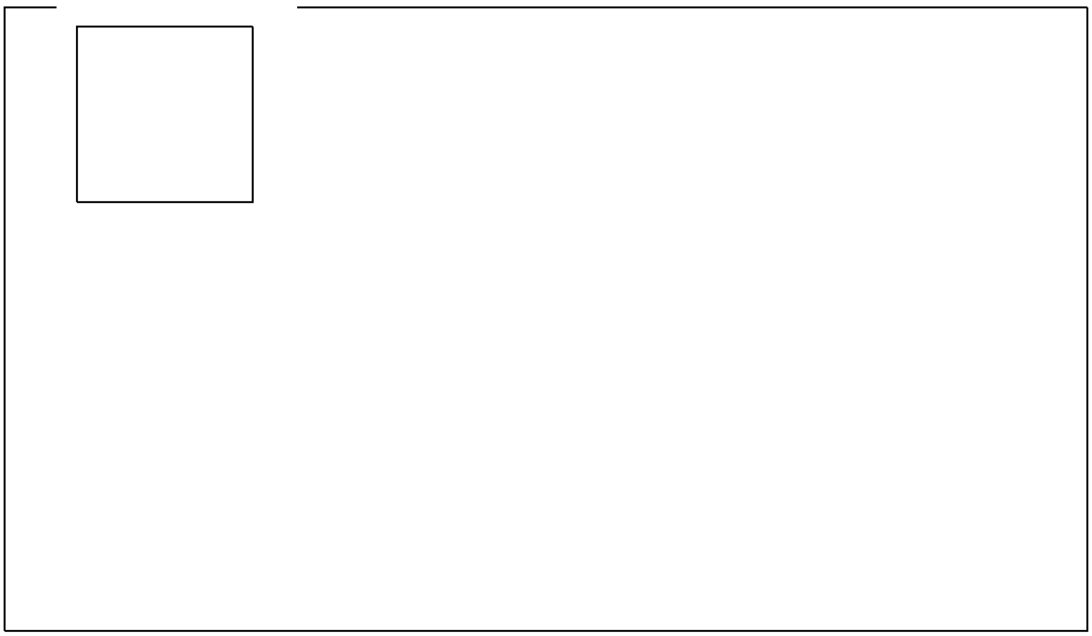


Island H	**Round 1**	**0.97 ha (2.41 acres)**
	Round 2	0.92 ha (2.26 acres)

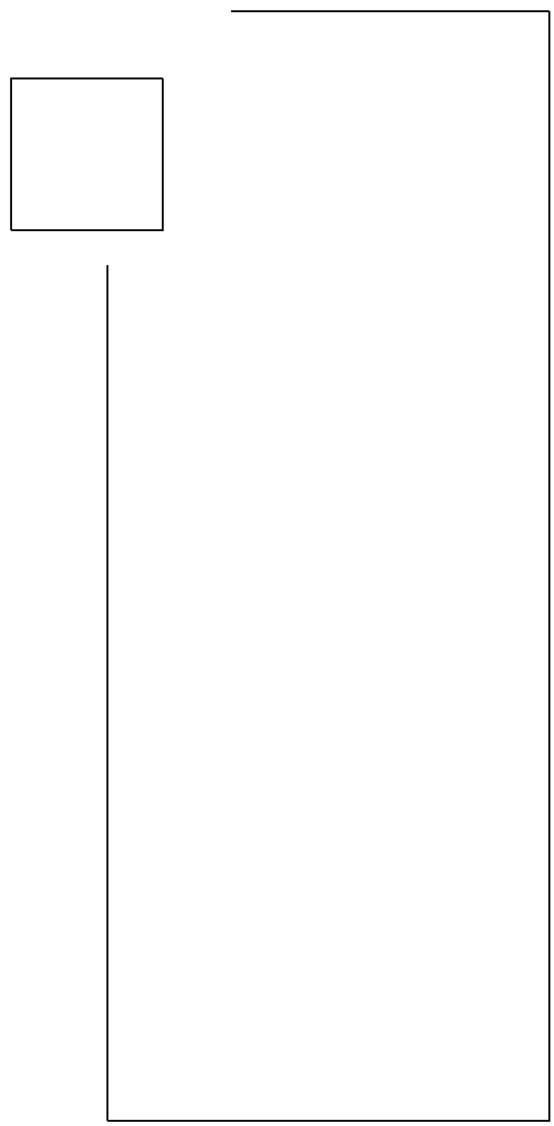
Island I	**Round 1**	**0.73 ha (1.81 acres)**
	Round 2	0.65 ha (1.60 acres)

Island J	**Round 1**	**1.21 ha (2.98 acres)**
	Round 2	1.22 ha (3.02 acres)

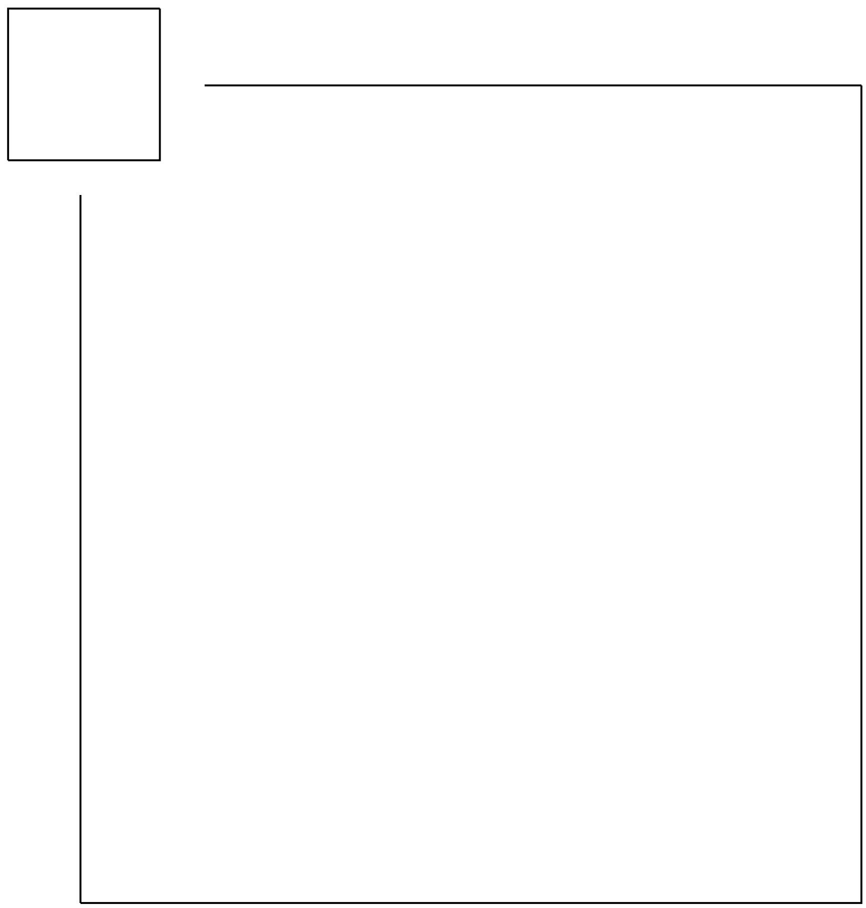
Island L	**Round 1**	**0.77 ha (1.89 acres)**
	Round 2	0.68 ha (1.70 acres)



Island M	Round 1	**0.77 ha (1.90 acres)**
	Round 2	0.67 ha (1.65 acres)

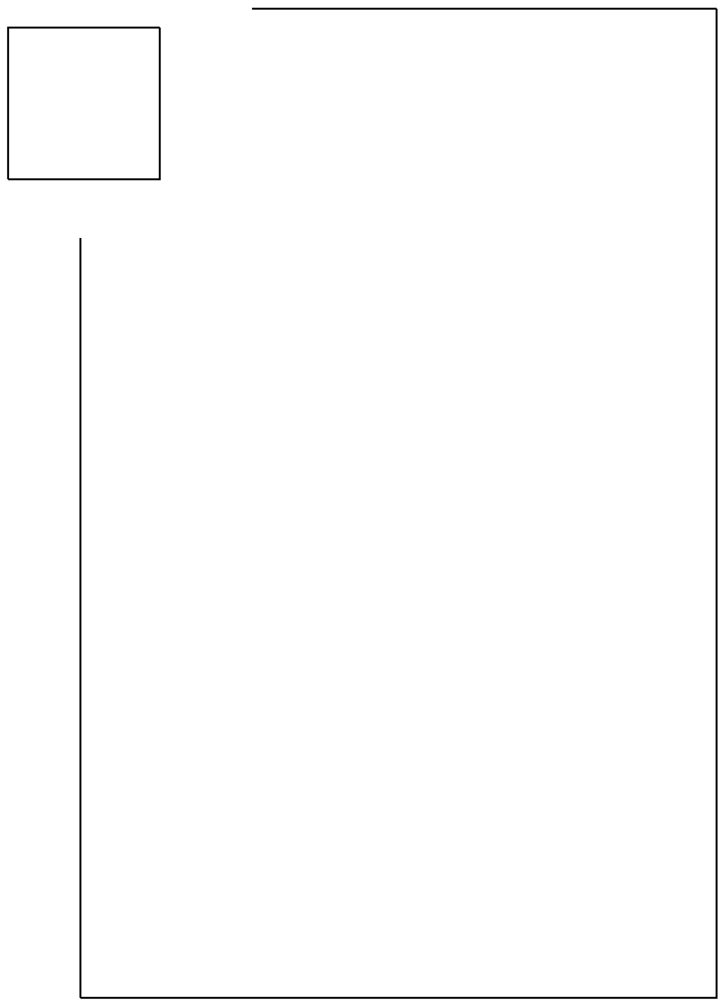


Island N	**Round 1**	**0.71 ha (1.76 acres)**
	Round 2	0.64 ha (1.59 acres)



Island V	**Round 1**	**0.95 ha (2.35 acres)**
	Round 2	0.91 ha (2.25 acres)

Island W	**Round 1**	**0.89 ha (2.20 acres)**
	Round 2	0.89 ha (2.20 acres)



Island X	**Round 1**	**1.02 ha (2.51 acres)**
	Round 2	1.04 ha (2.58 acres)

Appendix VII

Overlay of the original wildlife island footprints (Round 1) and the footprints of 14 islands measured eighteen months (Round 3) after water surrounded the islands.

Appendix VIII

Tables of all water chemistry data used in this report

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1981	8	26	B06	8.3	54.8	310	50
1981	8	27	B04	.	42.2	280	184
1981	8	27	B09	7.6	51.2	315	48.5
1981	9	16	B02	.	33.0	230	270
1981	9	16	B04	.	35.5	260	40
1981	9	16	B06	.	52.0	300	60
1981	9	16	B09	.	53.5	300	38
1981	10	14	B02	8.0	42.5	250	69
1981	10	14	B04	8.0	41.0	265	60
1981	10	14	B06	8.0	55.5	300	46
1981	10	14	B09	7.9	59.5	310	30
1981	11	10	B02	6.8	45.0	260	169
1981	11	10	B04	7.0	35.5	245	42
1981	11	10	B06	7.8	54.5	295	32
1981	11	10	B09	8.7	57.0	310	21
1981	12	8	B02	7.4	50.5	268	159
1981	12	8	B04	7.4	35.5	240	61
1981	12	8	B06	8.7	58.0	282	25
1981	12	8	B09	9.2	61.0	288	23
1982	1	14	B02	.	51.5	286	150
1982	1	14	B04	.	37.0	261	49
1982	2	3	B02	8.6	45.0	305	102
1982	2	3	B04	8.0	30.5	260	172
1982	2	3	B06	8.0	49.0	310	33
1982	2	3	B09	8.2	50.5	310	24
1982	3	11	B02	7.4	55.5	310	159
1982	3	11	B04	7.7	40.5	280	58
1982	3	11	B06	8.4	59.5	310	82
1982	3	11	B09	8.7	60.0	320	29
1982	4	7	B02	7.5	55.5	304	93
1982	4	7	B04	8.3	45.0	281	61
1982	4	7	B06	8.8	59.5	308	62
1982	4	7	B09	8.9	62.0	308	40
1982	5	12	B02	7.7	59.5	297	212
1982	5	12	B04	7.6	15.5	170	49
1982	5	12	B06	9.5	49.5	301	57
1982	5	12	B09	9.6	52.0	311	20
1982	6	16	B02	8.2	46.5	265	216
1982	6	16	B04	6.7	9.5	151	21
1982	6	16	B06	8.6	38.0	255	62
1982	6	16	B09	8.7	49.5	264	39
1982	7	15	B02	6.9	32.0	253	240
1982	7	15	B04	6.5	14.5	178	42
1982	7	15	B06	8.7	27.0	230	43
1982	7	15	B09	9.3	30.0	279	47
1982	8	11	B02	7.0	25.0	160	226
1982	8	11	B04	6.8	-5.0	121	67
1982	8	11	B06	8.0	17.0	125	49
1982	8	11	B09	7.4	26.5	176	59
1982	9	15	B02	.	29.0	155	219

| Year | Month | Day | Station | PH | Total | Specific | Color (Pt-Co) |

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1982	9	15	B04	.	12.0	116	70
1982	9	15	B06	.	20.0	138	91
1982	9	15	B09	.	24.0	148	29
1982	10	12	B02	6.5	23.0	180	141
1982	10	12	B04	5.9	11.5	115	51
1982	10	13	B06	7.0	20.5	127	90
1982	10	13	B09	7.8	23.0	140	43
1982	11	3	B02	6.0	30.0	180	129
1982	11	3	B04	6.0	14.0	120	86
1982	11	3	B06	6.1	23.0	150	126
1982	11	3	B09	6.1	21.5	155	48
1982	12	8	B02	6.8	33.5	205	162
1982	12	8	B04	6.7	17.0	137	55
1982	12	8	B06	8.1	24.0	162	98
1982	12	8	B09	7.1	23.5	158	75
1983	1	12	B02	7.7	36.0	225	172
1983	1	12	B04	6.9	16.0	145	95
1983	1	12	B06	7.8	25.0	165	114
1983	1	12	B09	7.5	23.0	155	69
1983	2	8	B02	7.0	34.0	217	188
1983	2	8	B04	6.6	15.0	140	66
1983	2	8	B06	7.4	32.5	193	101
1983	2	8	B09	8.3	26.0	160	73
1983	3	8	B02	7.1	25.5	184	161
1983	3	8	B04	6.4	10.5	120	94
1983	3	8	B06	7.1	22.5	161	143
1983	3	8	B09	7.2	25.0	165	71
1983	4	12	B02	6.7	24.0	181	119
1983	4	12	B04	6.7	13.0	127	97
1983	4	12	B06	7.2	21.0	161	120
1983	4	12	B09	8.9	20.5	170	88
1983	5	10	B02	7.6	29.0	194	205
1983	5	10	B04	6.3	5.5	118	71
1983	5	10	B06	9.0	15.0	153	139
1983	5	10	B09	9.2	13.5	159	99
1983	6	15	B02	7.6	33.0	227	222
1983	6	15	B04	8.0	8.0	137	51
1983	6	15	B06	8.5	16.0	174	98
1983	6	15	B09	8.7	13.5	166	106
1983	7	12	B02	.	29.5	160	166
1983	7	12	B04	.	17.5	100	74
1983	7	12	B06	.	21.5	155	101
1983	7	12	B09	.	18.5	150	101
1983	8	17	B02	6.8	29.5	165	160
1983	8	17	B04	5.5	-5.0	106	57
1983	8	17	B06	8.4	28.0	137	54
1983	8	17	B09	9.2	24.0	180	105
1983	9	14	B02	6.6	33.0	167	199
1983	9	14	B04	5.7	7.5	105	53
1983	9	14	B06	6.6	25.0	154	55
1983	9	14	B09	7.0	28.5	159	126
1983	10	12	B02	6.6	29.5	.	165

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1983	10	12	B04	5.9	-5.0	.	65
1983	10	12	B06	6.7	22.0	.	80
1983	10	12	B09	8.0	24.0	.	80
1983	11	9	B02	6.8	18.5	.	155
1983	11	9	B04	6.3	-5.0	.	71
1983	11	9	B06	6.9	-5.0	.	77
1983	11	9	B09	8.4	-5.0	.	84
1983	12	7	B02	7.2	35.5	183	139
1983	12	7	B04	6.8	14.5	128	78
1983	12	7	B06	7.0	28.5	153	62
1983	12	7	B09	7.2	26.5	147	56
1984	1	11	B02	7.0	30.5	192	121
1984	1	11	B04	6.6	7.5	113	59
1984	1	11	B06	7.0	22.5	156	66
1984	1	11	B09	7.2	25.0	155	44
1984	2	8	B02	8.1	28.8	199	179
1984	2	8	B04	7.3	-5.0	114	52
1984	2	8	B06	8.4	25.6	171	85
1984	2	8	B09	8.5	24.6	161	40
1984	3	7	B02	7.1	31.0	215	104
1984	3	7	B04	6.6	3.8	123	48
1984	3	7	B06	7.1	23.9	182	116
1984	3	7	B09	7.3	23.3	177	52
1984	4	11	B02	6.7	21.4	150	104
1984	4	11	B04	6.3	10.1	106	58
1984	4	11	B06	8.3	26.5	177	88
1984	4	11	B09	9.0	25.8	180	46
1984	5	9	B02	8.6	20.4	156	196
1984	5	9	B04	6.1	3.7	102	66
1984	5	9	B06	7.6	14.3	141	74
1984	5	9	B09	7.5	17.7	148	52
1984	6	5	B02	9.0	30.6	203	186
1984	6	5	B04	6.6	4.3	100	108
1984	6	5	B06	9.0	12.0	147	84
1984	6	5	B09	9.3	11.5	173	63
1984	7	18	B02	6.6	20.3	142	408
1984	7	18	B04	6.7	14.7	.	.
1984	7	18	B06	8.2	19.4	149	.
1984	7	18	B09	8.7	18.4	146	90
1984	8	16	B02	6.5	21.0	128	119
1984	8	16	B04	5.9	6.0	92	56
1984	8	16	B06	8.1	21.1	128	70
1984	8	16	B09	9.0	22.9	146	89
1984	9	12	B02	6.8	14.7	153	85
1984	9	12	B04	8.4	9.6	116	58
1984	9	12	B06	8.0	18.8	140	.
1984	9	12	B09	9.4	11.9	168	73
1984	10	10	B02	7.0	25.2	174	50
1984	10	10	B04	6.8	18.0	130	65
1984	10	10	B06	6.9	24.9	143	53
1984	10	10	B09	7.9	23.9	143	78
1984	11	8	B02	7.5	17.8	188	57

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1984	11	8	B04	6.9	16.8	141	58
1984	11	8	B06	7.3	14.5	149	57
1984	11	8	B09	7.4	11.7	147	65
1984	12	14	B02	7.3	28.1	210	47
1984	12	14	B04	7.8	15.1	155	28
1984	12	14	B06	8.8	18.9	158	92
1984	12	14	B09	9.1	21.1	143	48
1985	1	10	B02	8.2	38.8	193	57
1985	1	10	B04	7.6	28.0	170	52
1985	1	10	B06	7.3	28.2	166	85
1985	1	10	B09	8.6	25.1	157	43
1985	2	6	B02	8.4	33.2	222	55
1985	2	6	B04	7.6	25.2	185	34
1985	2	6	B06	7.1	25.0	174	60
1985	2	6	B09	8.4	23.5	167	58
1985	3	6	B02	9.0	37.0	237	53
1985	3	6	B04	9.0	25.9	204	56
1985	3	6	B06	9.0	23.0	188	50
1985	3	6	B09	9.1	20.2	182	51
1985	4	10	B02	8.8	40.1	227	49
1985	4	10	B04	8.6	42.5	208	45
1985	4	10	B06	8.3	31.3	195	23
1985	4	10	B09	8.9	29.5	187	47
1985	5	8	B02	9.2	41.2	263	150
1985	5	8	B04	9.0	27.9	216	44
1985	5	8	B06	9.0	31.0	219	38
1985	5	8	B09	9.6	29.9	236	37
1985	6	13	B02	7.4	53.5	274	171
1985	6	13	B04	7.2	12.9	152	33
1985	6	13	B06	6.7	45.1	224	30
1985	6	13	B09	7.0	40.1	217	27
1985	8	13	B02	6.8	42.5	200	215
1985	8	13	B04	6.7	16.5	155	20
1985	8	13	B06	7.4	44.7	216	46
1985	8	13	B09	7.7	43.6	220	41
1985	9	11	B02	7.1	32.9	192	159
1985	9	11	B04	6.5	-5.0	104	38
1985	9	11	B06	8.9	33.9	188	43
1985	9	11	B09	9.2	35.0	210	29
1985	10	16	B02	6.3	28.2	178	105
1985	10	16	B04	6.2	16.0	137	94
1985	10	16	B06	8.0	24.9	162	39
1985	10	16	B09	8.0	28.9	175	41
1985	11	6	B02	7.7	38.2	198	172
1985	11	6	B04	7.7	26.9	163	97
1985	11	6	B06	7.6	30.7	168	21
1985	11	6	B09	8.7	31.9	177	46
1985	12	3	B02	7.5	42.5	216	149
1985	12	3	B04	7.3	34.0	183	80
1985	12	3	B06	7.3	34.6	181	49
1985	12	3	B09	7.7	34.5	181	39
1986	1	15	B02	6.9	19.5	166	114

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1986	1	15	B04	6.9	-5.0	113	41
1986	1	15	B06	8.2	27.4	194	37
1986	1	15	B09	8.4	25.7	185	21
1986	2	11	B02	6.8	31.2	208	103
1986	2	11	B04	6.8	10.4	139	60
1986	2	11	B06	7.0	30.3	181	60
1986	2	11	B09	7.1	32.0	181	23
1986	3	12	B02	7.1	34.4	199	71
1986	3	12	B04	8.0	27.8	167	78
1986	3	12	B06	7.9	31.4	174	83
1986	3	12	B09	7.6	32.1	180	32
1986	4	10	B02	7.9	36.4	218	61
1986	4	10	B04	6.9	19.9	161	61
1986	4	10	B06	7.3	26.6	184	44
1986	4	10	B09	7.9	28.7	183	43
1986	5	8	B02	9.0	29.2	237	75
1986	5	8	B04	8.8	18.2	187	65
1986	5	8	B06	8.7	21.3	198	54
1986	5	8	B09	9.1	23.4	209	41
1986	6	10	B02	9.4	31.9	319	133
1986	6	10	B04	9.1	14.6	193	51
1986	6	10	B06	8.9	33.9	217	69
1986	6	10	B09	8.8	37.6	218	42
1986	7	16	B02	8.9	45.5	243	135
1986	7	16	B04	9.5	30.0	228	40
1986	7	16	B06	9.2	32.6	222	70
1986	7	16	B09	8.5	33.2	215	46
1986	8	14	B02	6.0	43.0	215	58
1986	8	14	B04	6.5	42.3	221	63
1986	8	14	B06	6.9	39.0	222	60
1986	8	14	B09	6.4	37.0	212	56
1986	9	17	B02	7.3	34.3	201	56
1986	9	17	B04	7.6	43.4	205	74
1986	9	17	B06	8.4	41.3	210	56
1986	9	17	B09	8.1	36.7	206	61
1986	10	15	B04	8.7	54.3	222	69
1986	10	15	B06	9.0	47.5	218	42
1986	10	15	B09	8.8	42.3	210	54
1986	11	18	B02	8.3	47.8	236	64
1986	11	18	B04	8.0	42.5	229	47
1986	11	18	B06	7.9	44.2	218	35
1986	11	18	B09	8.5	43.7	212	56
1986	12	16	B02	8.2	43.0	252	170
1986	12	16	B04	8.8	47.9	238	42
1986	12	16	B06	8.8	39.2	233	40
1986	12	16	B09	8.9	45.3	225	38
1987	1	20	B02	8.4	45.3	253	203
1987	1	20	B04	8.7	44.1	236	41
1987	1	20	B06	8.9	40.9	231	39
1987	1	20	B09	9.1	41.1	222	29
1987	2	25	B06	8.9	38.4	243	36
1987	2	25	B09	8.9	48.7	248	36

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1987	4	22	B06	7.4	6.4	132	38
1987	4	22	B09	8.6	16.1	140	33
1987	6	10	B06	9.1	17.2	164	37
1987	6	10	B09	9.5	10.0	179	138
1987	9	16	B04	6.1	19.2	158	103
1987	9	16	B06	7.6	28.7	161	40
1987	9	16	B09	6.8	19.3	159	38
1987	10	15	B02	7.1	22.2	168	233
1987	10	15	B04	7.3	16.5	154	79
1987	10	15	B06	7.3	24.3	163	41
1987	10	15	B09	7.9	19.4	157	40
1987	11	9	B02	6.7	19.5	130	208
1987	11	9	B04	7.4	7.1	166	67
1987	11	9	B06	8.4	25.6	154	92
1987	11	9	B09	8.3	24.1	153	36
1987	12	9	B02	6.9	24.3	156	182
1987	12	9	B04	6.7	6.6	112	55
1987	12	9	B06	7.0	21.8	124	54
1987	12	9	B09	7.7	22.7	128	40
1988	1	5	B02	7.1	22.1	155	155
1988	1	5	B04	6.6	8.9	117	80
1988	1	5	B06	7.0	18.3	141	44
1988	1	5	B09	7.0	19.3	144	117
1988	2	2	B02	7.4	25.8	166	197
1988	2	2	B04	7.0	6.1	118	63
1988	2	2	B06	8.6	21.2	149	46
1988	2	2	B09	8.5	21.4	150	54
1988	3	7	B02	7.4	25.3	171	120
1988	3	7	B04	7.1	-5.0	103	69
1988	3	7	B06	7.1	21.3	140	51
1988	3	7	B09	7.2	60.1	153	37
1988	4	5	B02	7.4	20.6	149	92
1988	4	5	B04	7.3	-5.0	115	65
1988	4	5	B06	7.4	20.6	145	92
1988	4	5	B09	7.2	16.5	141	38
1988	5	10	B02	7.2	19.8	142	73
1988	5	10	B04	7.0	-5.0	109	65
1988	5	10	B06	9.3	13.5	140	98
1988	5	10	B09	9.5	14.1	149	41
1988	6	8	B02	6.8	24.3	159	77
1988	6	8	B04	6.4	-5.0	122	57
1988	6	8	B06	6.8	16.5	146	90
1988	6	8	B09	8.8	17.0	155	70
1988	7	6	B02	7.3	27.6	157	247
1988	7	6	B04	6.3	-5.0	123	46
1988	7	6	B06	7.0	18.9	150	106
1988	7	6	B09	7.5	21.5	145	78
1988	8	4	B02	7.2	29.7	160	204
1988	8	4	B04	8.4	-5.0	132	57
1988	8	4	B06	8.5	19.4	150	94
1988	8	4	B09	8.6	22.3	153	91
1988	9	27	B02	6.8	24.3	137	150

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1988	9	27	B04	6.9	6.9	114	46
1988	9	27	B06	6.8	22.8	131	91
1988	9	27	B09	6.9	18.9	132	79
1988	10	13	B02	7.1	24.0	144	209
1988	10	13	B04	7.3	8.0	122	66
1988	10	13	B06	7.4	18.7	137	58
1988	10	13	B09	7.1	17.8	139	93
1988	11	9	B02	6.6	24.4	143	171
1988	11	9	B04	6.5	7.4	116	79
1988	11	9	B06	7.2	17.5	127	49
1988	11	9	B09	8.5	16.5	131	79
1988	12	6	B02	6.5	13.0	130	154
1988	12	6	B04	6.7	7.7	123	80
1988	12	6	B06	6.8	13.5	133	32
1988	12	6	B09	7.7	13.7	133	54
1989	1	3	B02	6.5	19.6	137	123
1989	1	3	B04	6.7	96.8	128	115
1989	1	3	B06	7.5	50.7	129	69
1989	1	3	B09	6.5	22.6	130	39
1989	2	14	B02	6.7	21.7	143	101
1989	2	14	B04	6.8	-5.0	112	42
1989	2	14	B06	8.0	37.4	134	71
1989	2	14	B09	8.2	41.0	135	31
1989	3	14	B02	7.3	24.4	151	83
1989	3	14	B04	7.1	23.1	132	70
1989	3	14	B06	8.6	24.9	143	59
1989	3	14	B09	8.8	22.7	147	63
1989	4	11	B02	8.4	22.3	150	70
1989	4	11	B04	8.2	16.7	139	65
1989	4	11	B06	8.2	24.0	147	76
1989	4	11	B09	8.1	23.5	147	57
1989	5	9	B02	.	27.2	167	60
1989	5	9	B04	6.8	5.9	120	37
1989	5	9	B06	8.2	21.3	148	85
1989	5	9	B09	8.6	23.6	153	50
1989	6	8	B02	7.3	25.3	173	45
1989	6	8	B04	7.1	-5.0	128	44
1989	6	8	B06	7.3	24.0	158	80
1989	6	8	B09	7.8	18.5	158	50
1989	7	11	B02	8.8	25.9	173	75
1989	7	11	B04	8.4	26.6	168	37
1989	7	11	B06	8.6	21.2	165	73
1989	7	11	B09	9.0	19.2	176	56
1989	8	15	B02	8.5	28.6	158	98
1989	8	15	B04	8.1	13.7	120	31
1989	8	15	B06	8.8	24.8	157	59
1989	8	15	B09	9.3	17.2	161	62
1989	9	12	B02	6.9	31.1	165	87
1989	9	12	B04	7.2	-5.0	116	36
1989	9	12	B06	8.4	25.7	155	50
1989	9	12	B09	8.3	26.6	150	64
1989	10	11	B02	7.0	30.8	159	72

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1989	10	11	B04	7.1	11.5	124	37
1989	10	11	B06	7.1	29.4	157	38
1989	10	11	B09	7.6	26.4	150	54
1989	11	7	B02	7.1	31.0	175	86
1989	11	7	B04	7.1	15.3	138	53
1989	11	7	B06	7.2	29.7	165	26
1989	11	7	B09	8.3	27.7	162	50
1989	12	5	B02	7.4	34.4	183	75
1989	12	5	B04	7.2	18.9	146	29
1989	12	5	B06	7.8	30.4	181	31
1989	12	5	B09	7.3	32.1	166	39
1990	1	16	B02	7.1	29.3	183	121
1990	1	16	B04	7.2	-5.0	119	36
1990	1	16	B06	7.2	19.9	150	28
1990	1	16	B09	7.8	25.7	155	52
1990	2	13	B02	6.9	30.6	184	83
1990	2	13	B04	6.9	9.6	120	40
1990	2	13	B06	7.2	18.6	146	31
1990	2	13	B09	7.3	22.5	150	23
1990	3	13	B02	6.6	25.1	187	81
1990	3	13	B04	6.1	-5.0	119	41
1990	3	13	B06	8.3	14.4	156	42
1990	3	13	B09	8.2	16.8	156	37
1990	4	10	B02	7.3	26.3	182	69
1990	4	10	B04	7.2	26.6	180	77
1990	4	10	B06	8.1	20.5	168	36
1990	4	10	B09	8.0	21.2	169	26
1990	5	1	B02	8.5	23.6	188	64
1990	5	1	B04	8.1	14.2	141	50
1990	5	1	B06	8.5	22.6	174	39
1990	5	1	B09	8.8	19.9	178	33
1990	6	5	B02	8.3	34.1	216	218
1990	6	5	B04	8.0	31.7	200	46
1990	6	5	B06	8.5	26.4	197	42
1990	6	5	B09	8.7	30.5	199	28
1990	7	2	B02	7.6	29.1	194	242
1990	7	2	B04	8.3	28.9	195	41
1990	7	2	B06	8.4	30.8	202	57
1990	7	2	B09	8.5	36.3	202	35
1990	8	8	B02	6.4	18.6	162	146
1990	8	8	B04	7.3	23.2	173	63
1990	8	8	B06	8.6	26.0	190	44
1990	8	8	B09	8.6	25.2	185	40
1990	9	4	B02	6.0	20.2	151	115
1990	9	4	B04	6.5	18.7	151	160
1990	9	4	B06	6.4	25.7	174	43
1990	9	4	B09	6.7	27.6	177	43
1990	10	23	B02	6.2	17.9	141	91
1990	10	23	B04	7.4	21.7	148	49
1990	10	23	B06	7.7	26.6	167	35
1990	10	23	B09	8.1	27.3	176	45
1990	11	7	B02	6.1	18.7	148	73

Year	Month	Day	Station	PH	Alkalinity (mg/L as $CaCO_3$) Total	Conductance (µS/cm @ 25°C) Specific	Color (Pt-Co)
1990	11	7	B04	6.3	19.3	146	44
1990	11	7	B06	6.2	20.5	164	30
1990	11	7	B09	6.8	25.2	171	47
1990	12	5	B02	5.0	34.8	148	83
1990	12	5	B04	4.6	37.3	151	68
1990	12	5	B06	4.5	39.3	159	28
1990	12	5	B09	4.5	40.3	164	32
1991	1	9	B02	6.3	25.5	168	108
1991	1	9	B04	6.4	25.2	166	57
1991	1	9	B06	6.4	28.3	171	198
1991	1	9	B09	6.3	26.4	173	32
1991	2	12	B02	6.6	8.0	168	156
1991	2	12	B04	6.8	13.5	153	40
1991	2	12	B06	6.9	14.6	166	47
1991	2	12	B09	6.9	22.5	165	26
1991	3	13	B09	7.4	25.5	185	198
1991	4	9	B02	7.0	26.7	173	255
1991	4	9	B04	7.2	23.5	169	51
1991	4	9	B06	8.5	28.0	175	41
1991	4	9	B09	7.6	27.3	174	27
1991	5	6	B02	7.5	26.2	154	246
1991	5	6	B04	7.5	10.8	133	28
1991	5	6	B06	8.7	26.4	173	43
1991	5	6	B09	9.0	25.5	176	31
1991	6	3	B02	6.3	23.0	134	196
1991	6	3	B04	8.0	14.0	129	35
1991	6	3	B06	7.9	28.4	162	35
1991	6	3	B09	8.9	27.7	170	32
1991	7	24	B02	6.7	13.2	113	214
1991	7	24	B04	6.6	6.2	110	92
1991	7	24	B06	8.1	9.7	120	31
1991	7	24	B09	8.4	13.4	133	31
1991	8	12	B02	.	20.8	.	164
1991	8	12	B04	.	6.6	.	66
1991	8	12	B06	.	13.5	.	33
1991	8	12	B09	.	17.0	.	55
1991	9	9	B02	5.8	19.8	114	140
1991	9	9	B04	6.2	8.1	98	81
1991	9	9	B06	6.2	13.7	105	51
1991	9	9	B09	6.0	14.3	109	30
1991	10	8	B02	.	22.8	.	98
1991	11	5	B02	7.0	15.5	163	105
1991	11	5	B04	6.6	5.9	131	74
1991	11	5	B06	6.9	11.9	142	63
1991	11	5	B09	7.2	12.9	142	30
1991	12	16	B02	7.0	-5.0	154	99
1991	12	16	B04	7.1	-5.0	130	56
1991	12	16	B06	7.1	-5.0	143	104
1991	12	16	B09	7.2	-5.0	140	46
1992	1	7	B02	7.3	15.5	167	100
1992	1	7	B04	6.6	8.1	144	68
1992	1	7	B06	8.2	-5.0	151	122

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1992	1	7	B09	8.5	17.2	149	48
1992	2	13	B02	7.8	-5.0	211	79
1992	2	13	B04	7.2	-5.0	180	47
1992	2	13	B06	8.7	-5.0	193	93
1992	2	13	B09	8.3	15.2	190	56
1992	3	31	B02	7.4	36.6	202	92
1992	3	31	B04	7.3	24.1	158	60
1992	3	31	B06	7.7	37.9	185	80
1992	3	31	B09	8.5	36.8	185	95
1992	4	22	B04	6.7	5.8	109	60
1992	4	22	B06	8.1	10.9	140	65
1992	4	22	B09	8.5	16.0	145	71
1992	6	4	B02	8.0	23.1	194	81
1992	6	4	B04	7.5	-5.0	135	55
1992	6	4	B06	8.2	13.0	167	52
1992	6	4	B09	8.0	16.9	176	60
1992	6	23	B09	9.0	18.1	152	155
1992	7	21	B02	7.9	19.6	173	173
1992	7	21	B04	7.2	13.7	135	52
1992	7	21	B06	8.0	20.3	169	55
1992	7	21	B09	8.1	18.6	163	62
1992	8	12	B02	7.4	33.6	130	199
1992	8	12	B04	7.1	19.3	104	38
1992	8	12	B06	8.9	29.5	130	50
1992	8	12	B09	8.9	28.3	130	51
1992	9	15	B02	7.1	19.2	129	178
1992	9	15	B04	7.4	16.1	106	50
1992	9	15	B06	8.3	21.9	121	64
1992	9	15	B09	8.6	23.4	125	46
1992	9	16	B04	7.1	13.4	97	64
1992	10	21	B02	7.2	27.4	124	165
1992	10	21	B04	8.8	18.0	99	72
1992	10	21	B06	7.6	19.5	111	56
1992	10	21	B09	7.7	23.0	120	50
1992	12	15	B02	6.6	20.3	151	171
1992	12	15	B04	7.6	19.8	104	58
1992	12	15	B06	7.2	5.0	125	43
1992	12	15	B09	7.6	25.1	123	47
1993	1	20	B02	6.4	27.8	162	144
1993	1	20	B04	6.2	-5.0	112	65
1993	1	20	B06	6.8	-5.0	128	32
1993	1	20	B09	7.1	-5.0	126	39
1993	2	23	B02	7.4	16.8	166	147
1993	2	23	B04	8.5	12.9	117	63
1993	2	23	B06	7.5	16.8	136	50
1993	2	23	B09	7.6	17.7	131	40
1993	3	22	B02	7.3	19.3	166	171
1993	3	22	B04	7.2	14.4	114	77
1993	3	22	B06	7.3	18.3	145	80
1993	3	22	B09	8.0	18.1	134	29
1993	4	27	B04	8.4	6.0	114	73
1993	4	27	B06	8.5	12.9	133	77

Year	Month	Day	Station	PH	Alkalinity (mg/L as $CaCO_3$) Total	Conductance (µS/cm @ 25°C) Specific	Color (Pt-Co)
1993	4	27	B09	8.6	9.4	134	47
1993	5	18	B02	9.3	14.3	165	123
1993	5	18	B04	9.1	10.6	132	58
1993	5	18	B06	8.7	15.0	146	76
1993	5	18	B09	9.1	9.2	150	65
1993	6	22	B04	9.4	21.1	151	43
1993	6	22	B06	8.9	25.4	157	84
1993	6	22	B09	8.9	22.9	156	68
1993	7	27	B02	7.5	31.0	201	145
1993	7	27	B04	8.7	33.3	216	37
1993	7	27	B06	9.0	27.4	210	99
1993	7	27	B09	8.9	25.3	216	67
1993	8	17	B02	7.2	31.7	155	136
1993	8	17	B04	7.2	37.4	150	40
1993	8	17	B06	8.0	28.6	136	98
1993	8	17	B09	9.3	27.0	139	82
1993	9	22	B02	6.8	33.3	146	81
1993	9	22	B04	7.2	41.0	175	40
1993	9	22	B06	8.7	31.2	166	65
1993	9	22	B09	8.7	29.6	163	82
1993	10	27	B02	6.2	30.8	155	82
1993	10	27	B04	6.7	43.1	183	31
1993	10	27	B06	6.9	32.9	168	45
1993	10	27	B09	7.0	32.1	170	92
1993	12	16	B02	7.3	38.4	176	98
1993	12	16	B04	7.1	36.2	168	50
1993	12	16	B06	7.8	36.3	171	49
1993	12	16	B09	7.6	35.1	171	65
1994	1	27	B02	7.5	37.0	169	83
1994	1	27	B04	7.5	39.6	171	36
1994	1	27	B06	7.8	36.3	161	38
1994	1	27	B09	8.6	35.7	160	43
1994	2	23	B02	6.8	36.7	176	15
1994	2	23	B04	6.7	26.6	147	35
1994	2	23	B06	7.3	35.4	170	49
1994	2	23	B09	7.9	35.0	167	35
1994	3	24	B02	7.9	36.7	182	68.5
1994	3	24	B04	6.9	23.1	143	31
1994	3	24	B06	7.3	35.2	173	39
1994	3	24	B09	7.7	34.8	173	33
1994	4	20	B09	8.9	35.5	179	29
1994	4	21	B02	7.2	35.7	179	118
1994	4	21	B04	7.1	19.1	134	38
1994	4	21	B06	8.4	34.2	174	50
1994	5	19	B02	.	36.9	.	106
1994	5	19	B04	.	17.6	.	30
1994	5	19	B06	.	28.9	.	31
1994	5	19	B09	.	32.8	.	27
1994	6	16	B02	9.0	33.5	149	173
1994	6	16	B04	7.9	23.2	141	64
1994	6	16	B06	8.9	29.7	159	41
1994	6	16	B09	9.3	31.2	169	35

Year	Month	Day	Station	PH	Alkalinity (mg/L as $CaCO_3$) Total	Conductance (µS/cm @ 25°C) Specific	Color (Pt-Co)
1994	7	28	B02	6.5	31.1	140	188
1994	7	28	B04	6.1	17.2	125	77
1994	7	28	B06	7.2	29.2	145	36
1994	7	28	B09	8.0	28.1	144	36
1994	8	25	B02	6.8	34.7	153	211
1994	8	25	B04	6.8	19.0	123	41
1994	8	25	B06	7.2	28.2	137	46
1994	8	25	B09	7.9	29.4	139	29
1994	9	21	B09	7.9	24.8	121	29
1994	9	22	B02	6.7	27.5	117	195
1994	9	22	B04	6.6	17.6	115	66
1994	9	22	B06	6.8	24.6	122	33
1994	10	20	B02	7.3	30.2	130	163
1994	10	20	B04	7.1	18.3	112	62
1994	10	20	B06	7.5	23.8	116	33
1994	10	20	B09	7.8	24.8	120	37
1994	11	8	B02	6.8	.	134	.
1994	11	8	B04	8.5	.	106	.
1994	11	8	B06	7.3	.	112	.
1994	11	8	B09	8.1	.	115	.
1994	12	6	B02	6.4	25.9	126	163
1994	12	6	B04	6.5	15.9	104	78
1994	12	6	B06	6.7	20.7	112	43
1994	12	6	B09	6.9	21.4	110	40
1995	1	5	B02	6.9	26.8	130	137
1995	1	5	B04	7.6	15.7	98	85
1995	1	5	B06	7.2	19.9	104	63
1995	1	5	B09	7.3	21.5	107	30
1995	2	2	B02	7.2	28.0	136	135
1995	2	2	B04	7.0	15.2	99	80
1995	2	2	B06	7.4	22.2	113	127
1995	2	2	B09	7.5	21.8	110	38
1995	3	2	B02	7.1	30.7	146	96
1995	3	2	B04	7.3	16.7	107	73
1995	3	2	B06	7.4	23.8	121	121
1995	3	2	B09	7.4	23.2	118	56
1995	3	22	B02	7.2	33.3	153	69
1995	3	22	B04	9.2	16.6	110	76
1995	3	22	B06	7.3	25.0	125	98
1995	3	22	B09	8.1	23.9	122	70
1995	4	27	B02	8.6	33.2	158	63
1995	4	27	B04	7.3	16.3	112	71
1995	4	27	B09	7.9	26.4	136	109
1995	5	24	B02	7.5	35.0	154	121
1995	5	24	B04	8.6	15.0	105	63
1995	5	24	B06	8.5	27.1	131	94
1995	5	24	B09	8.6	26.6	130	106
1995	6	27	B02	8.2	35.6	169	235
1995	6	27	B06	9.1	28.1	149	109
1995	6	27	B09	8.2	27.6	143	100
1995	7	24	B02	8.7	32.5	156	235
1995	7	24	B06	9.5	30.9	157	93

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1995	7	24	B09	9.3	28.6	143	102
1995	8	23	B09	7.2	25.3	125	82
1995	9	13	B02	6.8	28.3	125	210
1995	9	13	B04	7.0	12.7	100	70
1995	9	13	B06	8.0	23.9	116	95
1995	9	13	B09	7.1	20.6	107	100
1995	10	10	B02	7.0	27.6	124	204
1995	10	10	B04	6.7	15.8	106	80
1995	10	10	B06	7.2	23.2	115	52
1995	10	10	B09	7.3	21.9	109	65
1995	11	7	B02	7.0	28.6	133	.
1995	11	7	B04	6.8	11.7	99	.
1995	11	7	B06	7.2	23.3	119	.
1995	11	7	B09	7.3	23.6	118	.
1995	12	5	B02	6.9	27.9	140	163
1995	12	5	B04	6.7	14.6	107	84
1995	12	5	B06	7.5	23.4	119	38
1995	12	5	B09	7.9	23.9	120	48
1996	1	9	B02	7.2	29.4	1410	166
1996	1	9	B04	7.0	10.9	965	73
1996	1	9	B06	7.7	24.9	1217	31
1996	1	9	B09	7.7	23.1	1174	34
1996	2	12	B02	6.9	.	143	.
1996	2	12	B04	6.9	.	101	.
1996	2	12	B06	8.8	.	120	.
1996	2	12	B09	7.4	.	119	.
1996	4	9	B02	7.0	28.0	131	.
1996	4	9	B04	7.2	11.8	97	.
1996	4	9	B06	7.8	.	117	.
1996	4	9	B09	8.1	.	125	.
1996	5	6	B02	6.9	27.9	142	99
1996	5	6	B04	7.2	14.6	106	89
1996	5	6	B06	7.2	22.0	125	112
1996	5	6	B09	8.2	23.5	127	33
1996	6	12	B02	7.1	32.0	149	.
1996	6	12	B04	7.0	18.8	116	.
1996	6	12	B06	8.4	19.3	120	.
1996	6	12	B09	8.8	23.1	128	.
1996	8	6	B09	8.7	13.9	107	84
1996	8	7	B02	7.4	24.2	126	74
1996	8	7	B04	7.3	12.7	99	80
1996	8	7	B06	8.5	8.4	93	105
1996	9	24	B02	6.8	28.9	127	77
1996	9	24	B04	7.2	14.9	106	81
1996	9	24	B06	8.4	8.1	94	128
1996	9	24	B09	8.9	12.3	107	119
1996	10	29	B02	7.0	29.9	140	109
1996	11	21	B04	7.5	21.3	125	59
1996	11	21	B06	9.0	10.0	103	112
1996	11	21	B09	8.5	9.4	105	89
1996	12	18	B02	7.4	27.5	149	149
1996	12	18	B04	7.2	17.0	116	75

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1996	12	18	B06	7.6	10.9	102	124
1996	12	18	B09	7.7	11.4	103	122
1997	2	5	B02	7.0	29.6	158	114
1997	2	5	B04	6.9	19.3	123	54
1997	2	5	B06	8.3	22.4	113	102
1997	2	5	B09	7.8	13.3	111	102
1997	3	5	B02	7.3	25.0	155	86
1997	3	5	B04	7.1	21.2	131	77
1997	3	5	B06	8.3	12.7	118	71
1997	3	5	B09	7.7	24.0	118	97
1997	4	1	B02	7.6	29.6	164	71
1997	4	1	B04	7.3	19.2	123	46
1997	4	1	B06	8.2	15.6	127	55
1997	4	1	B09	8.0	15.6	121	95
1997	4	30	B02	7.2	25.3	145	67
1997	4	30	B04	6.9	12.2	107	42
1997	4	30	B06	8.9	14.9	129	73
1997	4	30	B09	9.1	14.9	128	70
1997	5	29	B02	.	25.6	.	.
1997	5	29	B04	.	13.4	.	.
1997	5	29	B06	.	19.9	.	.
1997	5	29	B09	.	17.0	.	.
1997	7	23	B02	8.0	32.3	152	60
1997	7	23	B04	8.9	15.5	1171	46
1997	7	23	B06	9.0	18.1	1330	.
1997	7	23	B09	8.9	17.9	1334	49
1997	8	19	B02	7.7	34.8	139	.
1997	8	19	B04	6.8	13.2	102	.
1997	8	19	B06	7.7	25.2	130	.
1997	8	19	B09	8.2	23.9	133	.
1997	9	25	B04	6.5	15.4	110	36
1997	10	15	B02	7.4	28.0	143	53
1997	10	15	B04	7.0	15.3	110	31
1997	10	15	B06	8.2	24.2	131	49
1997	10	15	B09	8.4	23.8	133	46
1998	1	7	B02	6.6	27.1	123	46
1998	1	7	B04	6.5	56.6	90	31
1998	1	7	B06	6.8	17.8	99	43
1998	1	7	B09	7.0	21.4	108	31
1998	3	12	B02	7.4	29.6	121	135
1998	3	12	B04	7.0	11.7	87	29
1998	3	12	B06	7.4	19.4	104	49
1998	3	12	B09	7.4	19.0	105	32
1998	4	29	B02	7.0	22.5	121	155
1998	4	29	B04	6.6	13.2	92	38
1998	4	29	B06	8.6	18.9	109	47
1998	4	29	B09	8.1	19.3	109	35
1998	5	20	B02	9.3	21.4	130	88
1998	5	20	B04	7.1	13.1	95	45
1998	5	20	B06	9.0	19.5	118	47
1998	5	20	B09	9.1	19.7	120	35
1998	6	17	B02	8.5	.	144	170

					Alkalinity (mg/L as $CaCO_3$)	Conductance (µS/cm @ 25°C)	
1998	6	17	B04	7.4	27.0	103	39
1998	6	17	B06	7.1	14.4	126	45
1998	6	17	B09	7.8	22.1	127	37
1998	7	15	B02	7.7	28.2	142	136
1998	7	15	B04	6.7	13.7	100	85
1998	7	15	B06	7.0	22.2	125	39
1998	7	15	B09	7.3	23.0	129	34
1998	8	12	B02	8.7	31.7	167	125
1998	8	12	B04	8.7	16.6	116	97
1998	8	12	B06	9.2	22.3	131	34
1998	8	12	B09	9.3	23.4	138	33
1998	9	10	B02	7.5	33.2	167	106
1998	9	10	B04	7.1	28.2	117	106
1998	9	10	B06	8.0	19.2	132	24
1998	9	10	B09	8.2	23.7	130	30
1998	10	14	B02	6.9	34.2	164	72
1998	10	14	B04	6.6	23.0	130	95
1998	10	14	B06	7.9	25.2	134	72
1998	10	14	B09	7.4	23.6	130	21
1998	11	19	B02	7.6	34.5	168	51
1998	11	19	B04	7.2	24.8	135	67
1998	11	19	B06	8.5	29.0	144	34
1998	11	19	B09	9.0	25.7	138	44
1999	1	13	B02	6.9	36.3	171	71
1999	1	13	B04	6.9	27.9	141	52
1999	1	13	B06	7.6	31.0	148	103
1999	1	13	B09	7.8	29.0	140	29
1999	2	9	B02	7.3	38.7	184	37
1999	2	9	B04	7.1	29.3	146	40
1999	2	9	B06	8.2	31.5	154	119
1999	2	9	B09	8.6	30.0	146	102
1999	3	10	B02	7.4	38.1	185	179
1999	3	10	B04	7.5	31.7	159	37
1999	3	10	B06	8.1	33.2	161	112
1999	3	10	B09	8.6	31.5	157	112
1999	4	7	B02	8.4	39.5	194	131
1999	4	7	B04	7.2	34.6	173	76
1999	4	7	B06	8.4	36.4	177	76
1999	4	7	B09	8.3	34.7	167	107
1999	6	8	B02	7.7	41.5	204	86
1999	6	8	B04	7.8	18.5	129	65
1999	6	8	B06	7.6	39.0	190	44
1999	6	8	B09	7.6	38.9	187	74
1999	7	14	B02	7.0	37.4	176	85
1999	7	14	B04	7.9	23.6	137	60
1999	7	14	B06	8.5	38.1	182	35
1999	7	14	B09	8.6	38.9	181	46
1999	8	11	B02	7.2	38.9	176	79
1999	8	11	B04	6.8	18.1	118	55
1999	8	11	B06	7.7	37.0	177	30
1999	8	11	B09	8.6	39.8	185	33
1999	9	9	B02	.	36.6	.	67
Year	Month	Day	Station	PH	Total	Specific	Color (Pt-Co)

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
1999	9	9	B04	.	18.2	.	57
1999	9	9	B06	.	33.8	.	26
1999	9	9	B09	.	38.1	.	25
1999	10	14	B02	7.0	35.9	171	53
1999	10	14	B04	6.8	30.4	110	51
1999	10	14	B06	7.4	32.0	151	37
1999	10	14	B09	7.7	30.0	155	24
1999	11	9	B09	7.8	30.7	148	25
1999	12	7	B02	7.2	40.8	181	150
1999	12	7	B04	6.8	16.4	109	27
1999	12	7	B06	7.3	26.2	136	49
1999	12	7	B09	8.7	29.7	147	28
2000	1	5	B02	7.2	40.3	183	93
2000	1	5	B04	6.9	15.5	106	38
2000	1	5	B06	7.5	27.4	139	45
2000	1	5	B09	7.6	27.7	138	31
2000	2	2	B02	7.3	38.5	180	150
2000	2	2	B04	6.9	15.7	113	26
2000	2	2	B06	7.7	28.4	143	39
2000	2	2	B09	8.8	29.6	145	27
2000	3	1	B02	7.4	42.6	195	113
2000	3	1	B04	7.0	18.4	122	90
2000	3	1	B06	7.8	30.6	152	39
2000	3	1	B09	9.4	31.0	154	31
2000	3	29	B02	8.0	45.3	200	103
2000	3	29	B04	7.5	20.9	131	64
2000	3	29	B06	7.9	32.4	159	43
2000	3	29	B09	8.5	32.1	155	31
2000	4	27	B02	7.9	46.7	215	105
2000	4	27	B04	7.9	12.3	112	64
2000	4	27	B06	8.1	33.5	170	30
2000	4	27	B09	8.9	33.7	170	30
2000	5	25	B02	8.7	32.8	210	90
2000	5	25	B04	7.1	14.7	126	68
2000	5	25	B06	8.2	35.8	179	22
2000	5	25	B09	9.0	38.1	181	18
2000	6	29	B02	.	54.5	.	71
2000	6	29	B04	.	16.6	.	56
2000	6	29	B06	.	36.7	.	37
2000	7	26	B02	.	51.0	.	57
2000	7	26	B04	.	18.9	.	50
2000	7	26	B06	.	37.6	.	44
2000	9	20	B02	.	47.1	.	46
2000	9	20	B04	.	30.1	.	55
2000	9	20	B06	.	44.6	.	59
2000	9	20	B09	.	46.3	.	23
2000	10	25	B02	7.3	51.7	225	58
2000	10	25	B04	7.5	33.8	166	47
2000	10	25	B06	7.5	47.5	213	56
2000	10	25	B09	7.7	46.8	204	47
2000	11	21	B02	8.3	55.4	196	104
2000	11	21	B04	8.1	35.9	142	72

					Alkalinity (mg/L as $CaCO_3$)	Conductance (µS/cm @ 25°C)	
2000	11	21	B06	8.3	52.7	187	56
2000	12	21	B02	.	.	.	.
2000	12	21	B04	.	.	.	.
2000	12	21	B06	.	.	.	.
2000	12	21	B09	.	.	.	.
2001	2	1	B02	7.7	59.6	252	64
2001	2	1	B04	7.6	39.0	185	46
2001	2	1	B09	8.2	51.4	223	54
2001	2	22	B02	7.8	62.6	251	52
2001	2	22	B04	7.7	42.7	187	38
2001	2	22	B09	7.8	55.6	224	47
2001	3	22	B02	8.0	65.9	259	34
2001	3	22	B04	7.8	47.0	200	39
2001	3	22	B09	8.0	57.7	233	53
2001	6	21	B02	7.9	58.3	266	31
2001	6	21	B04	7.9	55.3	157	33
2001	6	21	B09	8.8	23.0	260	49
2001	8	23	B02	7.0	39.1	179	32
2001	8	23	B04	7.1	21.1	135	30
2001	8	23	B09	8.4	.	176	43
2001	9	17	B02	6.2	27.3	130	52
2001	9	17	B04	7.0	21.4	128	28
2001	9	17	B09	6.9	40.2	137	39
2001	10	23	B02	6.3	35.3	187	154
2001	10	23	B04	7.8	27.3	136	20
2001	10	23	B09	7.4	32.1	147	32
2001	11	19	B02	6.7	43.6	172.5	200
2001	11	19	B04	6.7	27.8	117.8	34
2001	11	19	B09	6.7	34.1	138.9	20
2001	12	19	B02	6.7	46.2	183.5	140
2001	12	19	B04	7.5	34.1	131.1	40
2001	12	19	B09	7.2	38.3	148.2	28
2002	1	22	B02	6.5	45.7	216.8	150
2002	1	22	B04	9.1	30.5	141.2	60
2002	1	22	B09	6.7	38.3	161.6	22
2002	2	18	B02	6.2	50.5	216	140
2002	2	18	B04	8.0	34.9	142	50
2002	2	18	B09	6.8	38.5	163	19
2002	3	18	B02	6.8	44.9	213.1	120
2002	3	18	B04	8.0	22.2	124.6	80
2002	3	18	B09	7.9	41.3	171.6	20
2002	4	22	B02	7.7	52.0	209	120
2002	4	22	B04	9.2	22.5	134	50
2002	4	22	B09	7.8	38.5	165	14
2002	5	21	B02	7.4	63.5	236.2	120
2002	5	21	B04	8.7	20.0	139.4	40
2002	5	21	B09	8.8	40.5	176.6	45
2002	6	17	B02	6.1	46.5	197.3	80
2002	6	17	B04	8.9	28.0	147.9	30
2002	6	17	B09	8.8	42.5	185.3	100
2002	7	22	B02	6.0	34.6	164.9	60
2002	7	22	B04	5.9	20.9	130.2	30
Year	Month	Day	Station	PH	Total	Specific	Color (Pt-Co)

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
2002	7	22	B09	5.8	28.0	146.1	100
2002	8	19	B02	6.2	35.7	140	80
2002	8	19	B04	6.2	20.9	110	35
2002	8	19	B09	6.7	27.0	118	100
2002	9	16	B02	5.5	35.5	142.8	250
2002	9	16	B04	5.6	18.8	111.6	25
2002	9	16	B09	6.4	24.0	118.2	100
2002	10	21	B02	5.7	.	128	.
2002	10	21	B04	7.3	.	98	.
2002	10	21	B09	6.6	.	121	.
2002	12	16	B02	5.3	26.2	133	250
2002	12	16	B04	5.4	19.4	123	.
2002	12	16	B09	5.8	26.2	136	125
2003	1	21	B02	5.7	25.5	124	.
2003	1	21	B04	5.9	18.0	103	35
2003	1	21	B09	6.2	21.5	109	115
2003	2	24	B02	6.3	26.5	148	250
2003	2	24	B04	6.5	19.5	112	50
2003	2	24	B09	6.6	24.5	125	100
2003	3	17	B02	.	.	.	250
2003	3	17	B04	.	.	.	60
2003	3	17	B09	.	.	.	85
2003	4	21	B02	.	.	.	250
2003	4	21	B04	.	.	.	60
2003	4	21	B09	.	.	.	80
2003	5	19	B02	.	.	.	200
2003	5	19	B04	.	.	.	100
2003	5	19	B09	.	.	.	75
2003	6	16	B02	.	.	.	250
2003	6	16	B04	.	.	.	75
2003	6	16	B09	.	.	.	52.5
2003	7	21	B02	.	.	.	150
2003	7	21	B04	.	.	.	100
2003	7	21	B09	.	.	.	52.5
2003	8	18	B02	.	.	.	75
2003	8	18	B04	.	.	.	100
2003	8	18	B09	.	.	.	95
2004	8	24	B02	.	.	.	100
2004	8	24	B04	.	.	.	75
2004	8	24	B09	.	.	.	95.5
2004	8	25	B02	6.9	39.0	135	172
2004	8	25	B04	7.0	17.0	117	48
2004	8	25	B06	7.4	27.0	132	126
2004	8	25	B09	7.3	12.0	123	83
2004	8	25	G1	6.7	9.6	122	58
2004	8	25	G2	6.8	9.6	122	58
2004	8	25	G3	6.9	9.8	121	55
2004	8	25	GC1	6.2	11.0	123	180
2004	8	25	GC2	6.8	10.0	122	58
2004	8	25	GC3	6.9	9.8	122	58
2004	8	25	I1	6.6	20.0	121	108
2004	8	25	I2	6.7	20.0	120	66

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
2004	8	25	I3	7.0	16.0	118	58
2004	8	25	IC1	6.8	20.0	120	65
2004	8	25	IC2	7.0	17.0	118	66
2004	8	25	IC3	7.0	17.0	118	55
2004	8	25	L1	6.6	38.0	126	267
2004	8	25	L2	6.6	37.0	125	260
2004	8	25	L3	6.7	39.0	130	255
2004	8	25	LC1	6.9	52.0	146	151
2004	8	25	LC2	7.0	52.0	146	137
2004	8	25	LC3	7.0	55.0	156	134
2004	8	25	N1	6.2	14.0	126	219
2004	8	25	N2	6.2	13.0	127	162
2004	8	25	N3	6.4	11.0	124	81
2004	8	25	NC1	6.6	10.0	136	112
2004	8	25	NC2	6.3	16.0	134	86
2004	8	25	NC3	6.9	12.0	122	58
2004	9	22	B02	7.1	35.0	133	221
2004	9	22	B04	7.1	16.0	114	108
2004	9	22	B06	7.2	28.0	126	167
2004	9	22	B09	7.1	22.0	117	135
2004	9	22	G1	7.2	23.0	122	124
2004	9	22	G2	7.2	23.0	122	136
2004	9	22	G3	7.2	23.0	120	138
2004	9	22	GC1	7.1	23.0	124	112
2004	9	22	GC2	7.2	24.0	122	139
2004	9	22	GC3	7.3	24.0	122	145
2004	9	22	I1	6.6	16.0	120	141
2004	9	22	I2	6.7	16.0	115	133
2004	9	22	I3	7.0	17.0	114	112
2004	9	22	IC1	7.0	16.0	113	102
2004	9	22	IC2	7.1	21.0	114	108
2004	9	22	IC3	7.1	17.0	114	110
2004	9	22	L1	6.9	37.0	143	214
2004	9	22	L2	6.8	34.0	138	252
2004	9	22	L3	7.0	35.0	135	248
2004	9	22	LC1	7.0	41.0	141	102
2004	9	22	LC2	6.9	40.0	140	123
2004	9	22	LC3	6.8	42.0	144	151
2004	9	22	N1	6.8	22.0	118	144
2004	9	22	N2	7.2	22.0	117	133
2004	9	22	N3	7.2	22.0	112	130
2004	9	22	NC1	6.8	23.0	119	110
2004	9	22	NC2	7.1	23.0	118	123
2004	9	22	NC3	7.2	22.0	121	132
2004	10	21	B02	7.2	34.0	139	198
2004	10	21	B04	6.9	20.0	110	119
2004	10	21	B06	7.1	25.0	120	148
2004	10	21	B09	7.0	22.0	114	137
2004	10	21	G1	6.9	22.0	114	134
2004	10	21	G2	6.9	22.0	113	136
2004	10	21	G3	7.1	22.0	112	137
2004	10	21	GC1	7.0	23.0	113	132

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
2004	10	21	GC2	6.9	22.0	112	135
2004	10	21	GC3	7.0	22.0	112	134
2004	10	21	I1	7.0	20.0	111	119
2004	10	21	I2	7.0	20.0	111	120
2004	10	21	I3	6.8	20.0	110	120
2004	10	21	IC1	6.8	20.0	111	124
2004	10	21	IC2	6.9	20.0	111	123
2004	10	21	IC3	6.8	20.0	111	123
2004	10	21	L1	6.8	34.0	145	198
2004	10	21	L2	6.7	32.0	147	223
2004	10	21	L3	6.8	33.0	145	217
2004	10	21	LC1	6.8	38.0	143	115
2004	10	21	LC2	6.7	36.0	143	193
2004	10	21	LC3	6.8	36.0	142	176
2004	10	21	N1	6.8	22.0	114	142
2004	10	21	N2	6.6	20.0	114	139
2004	10	21	N3	6.7	22.0	114	140
2004	10	21	NC1	6.5	22.0	113	144
2004	10	21	NC2	6.5	22.0	114	141
2004	10	21	NC3	6.7	22.0	114	139
2005	2	15	B02	7.6	33.0	165	160
2005	2	15	B04	7.6	24.0	130	118
2005	2	15	B06	8.2	25.0	133	124
2005	2	15	B09	8.0	24.0	131	120
2005	2	15	G1	7.5	25.0	135	123
2005	2	15	G2	7.5	25.0	134	122
2005	2	15	G3	7.6	25.0	134	122
2005	2	15	GC1	7.7	25.0	134	124
2005	2	15	GC2	7.6	25.0	134	123
2005	2	15	GC3	7.7	25.0	134	121
2005	2	15	I1	7.2	24.0	130	116
2005	2	15	I2	7.3	24.0	130	115
2005	2	15	I3	7.3	23.0	130	118
2005	2	15	IC1	7.3	24.0	130	117
2005	2	15	IC2	7.3	24.0	130	117
2005	2	15	IC3	7.3	24.0	130	117
2005	2	15	L1	7.1	31.0	165	184
2005	2	15	L2	7.0	34.0	170	164
2005	2	15	L3	6.9	34.0	169	157
2005	2	15	LC1	7.2	35.0	171	164
2005	2	15	LC2	7.2	37.0	173	154
2005	2	15	LC3	7.0	38.0	175	139
2005	2	15	N1	7.3	24.0	132	117
2005	2	15	N2	7.3	24.0	132	116
2005	2	15	N3	7.3	24.0	131	118
2005	2	15	NC1	7.1	24.0	131	116
2005	2	15	NC2	7.2	24.0	131	116
2005	2	15	NC3	7.4	24.0	131	116
2005	4	21	B02	7.6	37.0	180	152
2005	4	21	B04	7.4	23.0	134	114
2005	4	21	B06	7.6	25.0	146	115
2005	4	21	B09	7.4	23.0	144	109

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
2005	4	21	G1	7.4	25.0	145	116
2005	4	21	G2	7.4	25.0	144	116
2005	4	21	G3	7.5	25.0	143	112
2005	4	21	GC1	7.2	24.0	143	109
2005	4	21	GC2	7.4	25.0	144	114
2005	4	21	GC3	7.6	25.0	145	113
2005	4	21	I1	7.4	23.0	136	112
2005	4	21	I2	7.2	23.0	134	113
2005	4	21	I3	7.4	23.0	134	112
2005	4	21	IC1	7.3	23.0	136	112
2005	4	21	IC2	7.3	23.0	134	113
2005	4	21	IC3	7.4	23.0	133	110
2005	4	21	L1	7.5	39.0	187	149
2005	4	21	L2	7.3	41.0	192	139
2005	4	21	L3	7.3	39.0	185	153
2005	4	21	LC1	7.5	47.0	200	119
2005	4	21	LC2	7.4	53.0	207	85
2005	4	21	LC3	.	.	.	.
2005	4	21	N1	7.1	24.0	143	106
2005	4	21	N2	7.1	23.0	149	107
2005	4	21	N3	7.2	24.0	147	106
2005	4	21	NC1	6.9	25.0	149	111
2005	4	21	NC2	7.0	24.0	148	107
2005	4	21	NC3	7.1	24.0	145	108
2005	6	21	B02	7.3	38.0	155	153
2005	6	21	B04	6.9	17.0	122	122
2005	6	21	B06	7.5	31.0	149	82
2005	6	21	B09	8.0	24.0	138	68
2005	6	21	G1	7.4	29.0	148	76
2005	6	21	G2	7.4	30.0	148	75
2005	6	21	G3	7.5	30.0	149	76
2005	6	21	GC1	7.4	30.0	148	76
2005	6	21	GC2	7.4	30.0	149	75
2005	6	21	GC3	7.4	30.0	149	76
2005	6	21	I1	7.1	21.0	122	95
2005	6	21	I2	7.1	21.0	122	102
2005	6	21	I3	6.9	20.0	121	129
2005	6	21	IC1	7.1	21.0	123	97
2005	6	21	IC2	7.0	21.0	122	97
2005	6	21	IC3	7.0	21.0	122	94
2005	6	21	N1	8.3	24.0	133	69
2005	6	21	N2	8.7	24.0	137	73
2005	6	21	N3	7.9	24.0	139	68
2005	6	21	NC1	7.2	23.0	136	77
2005	6	21	NC2	7.7	23.0	138	67
2005	6	21	NC3	8.1	24.0	139	65
2005	9	6	B02	7.4	34.0	144	118
2005	9	6	B04	7.1	16.0	118	121
2005	9	6	B06	7.5	25.0	136	72
2005	9	6	B09	7.5	22.0	131	65
2005	9	6	G1	7.7	24.0	132	68
2005	9	6	G2	7.5	21.0	123	75

Year	Month	Day	Station	PH	Total Alkalinity (mg/L as $CaCO_3$)	Specific Conductance (µS/cm @ 25°C)	Color (Pt-Co)
2005	9	6	G3	7.7	24.0	133	69
2005	9	6	GC1	7.7	24.0	134	69
2005	9	6	GC2	7.5	22.0	126	72
2005	9	6	GC3	7.5	24.0	132	66
2005	9	6	I1	7.0	22.0	120	167
2005	9	6	I2	7.0	20.0	118	151
2005	9	6	I3	7.0	17.0	118	140
2005	9	6	IC1	6.9	23.0	129	174
2005	9	6	IC2	6.9	23.0	126	173
2005	9	6	IC3	7.0	22.0	122	125
2005	9	6	N1	7.7	22.0	128	66
2005	9	6	N2	7.5	22.0	129	66
2005	9	6	N3	7.2	22.0	128	69
2005	9	6	NC1	7.4	21.0	128	66
2005	9	6	NC2	7.3	21.0	126	65
2005	9	6	NC3	7.3	21.0	129	69
2005	12	12	B02	7.4	36.0	160	118
2005	12	12	B04	7.2	20.0	117	84
2005	12	12	B06	7.3	22.0	121	71
2005	12	12	B09	7.4	20.0	118	61
2005	12	12	G1	7.2	21.0	118	77
2005	12	12	G2	7.1	21.0	117	79
2005	12	12	G3	7.2	22.0	120	76
2005	12	12	GC1	7.2	21.0	118	79
2005	12	12	GC2	7.1	21.0	117	82
2005	12	12	GC3	7.2	22.0	120	80
2005	12	12	I1	7.1	20.0	118	84
2005	12	12	I2	7.0	20.0	118	84
2005	12	12	I3	6.9	20.0	117	82
2005	12	12	IC1	7.1	20.0	118	84
2005	12	12	IC2	7.0	20.0	118	83
2005	12	12	IC3	7.2	20.0	117	82
2005	12	12	N1	7.0	20.0	118	64
2005	12	12	N2	7.2	20.0	118	64
2005	12	12	N3	7.1	20.0	119	64
2005	12	12	NC1	7.0	20.0	118	63
2005	12	12	NC2	7.4	17.0	118	63
2005	12	12	NC3	7.2	17.0	119	64
2006	3	22	B02	7.6	31.0	156	72
2006	3	22	B04	7.4	16.0	120	75
2006	3	22	B06	7.5	27.0	147	54
2006	3	22	B09	7.6	25.0	143	58
2006	3	22	G1	7.5	26.0	143	60
2006	3	22	G2	7.6	25.0	143	60
2006	3	22	G3	7.6	26.0	144	48
2006	3	22	GC1	7.3	25.0	143	58
2006	3	22	GC2	7.6	26.0	144	58
2006	3	22	GC3	7.6	26.0	144	62
2006	3	22	I1	7.3	17.0	122	78
2006	3	22	I2	7.3	17.0	119	77
2006	3	22	I3	7.3	16.0	119	78
2006	3	22	IC1	7.3	16.0	120	74

					Alkalinity (mg/L as $CaCO_3$)	Conductance (µS/cm @ 25°C)	
2006	3	22	IC2	7.4	16.0	120	75
2006	3	22	IC3	7.3	16.0	119	74
2006	3	22	N1	7.3	26.0	143	57
2006	3	22	N2	7.3	26.0	144	57
2006	3	22	N3	7.4	26.0	144	57
2006	3	22	NC1	7.2	26.0	143	57
2006	3	22	NC2	7.5	25.0	143	57
2006	3	22	NC3	7.5	26.0	143	55
2006	6	6	B02	8.3	42.0	207	61
2006	6	6	B04	9.1	17.0	134.5	56
2006	6	6	B06	9.4	35.0	183	36
2006	6	6	B09	9.0	34.0	178	33
2006	6	6	G1	8.2	35.0	181	34
2006	6	6	G2	8.3	36.0	181	33
2006	6	6	G3	8.7	36.0	181	33
2006	6	6	GC1	8.1	35.0	181	33
2006	6	6	GC2	8.5	36.0	181	33
2006	6	6	GC3	8.7	36.0	181	34
2006	6	6	I1	8.7	20.0	134	48
2006	6	6	I2	9.6	21.0	141	49
2006	6	6	I3	8.3	17.0	132	48
2006	6	6	IC1	9.5	29.0	161	44
2006	6	6	IC2	9.6	24.0	150	46
2006	6	6	IC3	9.4	23.0	141	47
2006	6	6	N1	9.1	33.0	179	33
2006	6	6	N2	8.5	34.0	177	32
2006	6	6	N3	8.6	33.0	177	32
2006	6	6	NC1	8.2	33.0	177	33
2006	6	6	NC2	8.3	33.0	177	34
2006	6	6	NC3	8.7	33.0	178	33

Year	Month	Day	Station	Total	Total	Chlorophyll	Secchi

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1981	8	26	B06	28	900	111	0.4
1981	8	27	B04	198	1610	42	0.7
1981	8	27	B09	32	1207	176	0.4
1981	9	16	B02	610	3000	31	0.8
1981	9	16	B04	384	1130	48	0.6
1981	9	16	B06	28	904	75	0.5
1981	9	16	B09	40	900	160	0.4
1981	10	14	B02	640	2271	7	0.5
1981	10	14	B04	423	1600	35	0.9
1981	10	14	B06	782	1000	102	0.5
1981	10	14	B09	46	700	150	0.3
1981	11	10	B02	599	1850	14	0.8
1981	11	10	B04	410	2207	23	0.8
1981	11	10	B06	547	1200	58	0.7
1981	11	10	B09	53	900	122	0.4
1981	12	8	B02	703	1920	4	0.7
1981	12	8	B04	316	2006	14	1.3
1981	12	8	B06	227	1104	43	0.7
1981	12	8	B09	50	712	62	0.5
1982	1	14	B02	566	1714	.	0.7
1982	1	14	B04	233	2405	.	1.1
1982	2	3	B02	424	2021	16	0.6
1982	2	3	B04	222	2020	15	1.0
1982	2	3	B06	431	915	87	0.5
1982	2	3	B09	94	700	107	0.4
1982	3	11	B02	362	1542	19	0.7
1982	3	11	B04	171	1700	24	1.0
1982	3	11	B06	297	770	43	0.7
1982	3	11	B09	840	1000	68	0.5
1982	4	7	B02	471	1815	17	0.6
1982	4	7	B04	132	1740	28	0.9
1982	4	7	B06	375	680	67	0.5
1982	4	7	B09	659	930	122	0.5
1982	5	12	B02	535	1450	16	0.6
1982	5	12	B04	144	1500	9	1.2
1982	5	12	B06	256	1936	37	0.6
1982	5	12	B09	256	1000	34	0.6
1982	6	16	B02	667	1905	67	0.6
1982	6	16	B04	182	1700	24	1.0
1982	6	16	B06	153	2200	107	0.4
1982	6	16	B09	393	1204	104	0.4
1982	7	15	B02	424	1400	26	0.8
1982	7	15	B04	143	1500	12	1.4
1982	7	15	B06	209	3500	59	0.4
1982	7	15	B09	272	1405	73	0.4
1982	8	11	B02	344	1619	23	0.6
1982	8	11	B04	288	2135	12	1.2
1982	8	11	B06	215	3210	41	0.5
1982	8	11	B09	199	1333	94	0.5
1982	9	15	B02	338	1217	35	0.5
1982	9	15	B04	68	1200	34	1.3
1982	9	15	B06	437	2400	54	0.5
1982	9	15	B09	243	3200	74	0.4

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1982	10	12	B02	314	1681	13	0.6
1982	10	12	B04	82	836	20	1.2
1982	10	13	B06	233	2700	60	0.6
1982	10	13	B09	129	4300	64	0.5
1982	11	3	B02	262	1880	9	0.5
1982	11	3	B04	79	829	11	1.1
1982	11	3	B06	257	3700	28	0.7
1982	11	3	B09	498	3600	43	0.5
1982	12	8	B02	336	1391	12	0.7
1982	12	8	B04	73	1187	20	1.0
1982	12	8	B06	233	2010	46	0.6
1982	12	8	B09	392	4100	64	0.6
1983	1	12	B02	357	1718	21	0.6
1983	1	12	B04	37	790	8	1.1
1983	1	12	B06	268	2888	38	0.7
1983	1	12	B09	343	3170	67	0.5
1983	2	8	B02	292	1191	8	0.5
1983	2	8	B04	54	1320	6	1.3
1983	2	8	B06	164	1870	27	0.8
1983	2	8	B09	381	2900	52	0.6
1983	3	8	B02	255	1177	14	0.6
1983	3	8	B04	60	820	4	1.1
1983	3	8	B06	216	3540	19	0.8
1983	3	8	B09	409	4100	12	0.5
1983	4	12	B02	194	1230	.	0.5
1983	4	12	B04	66	1020	.	1.9
1983	4	12	B06	254	1632	.	0.7
1983	4	12	B09	279	2310	.	0.6
1983	5	10	B02	361	2110	61	0.6
1983	5	10	B04	55	1010	10	1.3
1983	5	10	B06	237	1900	91	0.5
1983	5	10	B09	244	3910	102	0.5
1983	6	15	B02	388	1610	27	0.5
1983	6	15	B04	47	700	25	1.4
1983	6	15	B06	175	1200	85	0.3
1983	6	15	B09	186	2520	97	0.5
1983	7	12	B02	295	1800	62	0.6
1983	7	12	B04	51	836	44	1.1
1983	7	12	B06	172	1600	80	0.5
1983	7	12	B09	195	2900	84	0.4
1983	8	17	B02	267	1715	37	0.7
1983	8	17	B04	79	1023	25	1.5
1983	8	17	B06	221	1447	70	0.4
1983	8	17	B09	256	2210	97	0.4
1983	9	14	B02	247	1441	.	0.7
1983	9	14	B04	98	1020	.	1.4
1983	9	14	B06	233	2072	.	0.6
1983	9	14	B09	352	2710	.	0.5
1983	10	12	B02	255	1122	17	0.7
1983	10	12	B04	45	1043	7	0.9
1983	10	12	B06	209	1943	25	0.7
1983	10	12	B09	196	2220	35	0.4
1983	11	9	B02	264	1549	18	0.6

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1983	11	9	B04	53	1495	7	1.7
1983	11	9	B06	168	1253	38	0.5
1983	11	9	B09	191	2720	48	0.6
1983	12	7	B02	241	1161	18	0.6
1983	12	7	B04	43	848	10	0.8
1983	12	7	B06	161	1425	31	0.6
1983	12	7	B09	242	1630	65	0.5
1984	1	11	B02	216	1223	.	0.6
1984	1	11	B04	45	817	.	1.5
1984	1	11	B06	136	1432	.	0.7
1984	1	11	B09	242	1726	.	0.5
1984	2	8	B02	193	1122	.	0.7
1984	2	8	B04	46	1338	.	1.2
1984	2	8	B06	159	1725	.	0.7
1984	2	8	B09	185	1624	.	0.5
1984	3	7	B02	199	950	22	0.6
1984	3	7	B04	38	800	7	1.4
1984	3	7	B06	191	2027	23	0.6
1984	3	7	B09	186	1840	41	0.7
1984	4	11	B02	212	1490	14	0.6
1984	4	11	B04	43	800	7	1.2
1984	4	11	B06	128	2004	66	0.5
1984	4	11	B09	194	2745	120	0.4
1984	5	9	B02	290	2025	204	0.6
1984	5	9	B04	36	920	5	0.8
1984	5	9	B06	141	1814	126	0.3
1984	5	9	B09	139	1527	22	0.4
1984	6	5	B02	229	1504	80	0.5
1984	6	5	B04	40	500	7	0.8
1984	6	5	B06	155	1712	31	0.4
1984	6	5	B09	103	1400	64	0.4
1984	7	18	B02	293	1236	39	0.6
1984	7	18	B04	.	.	52	0.5
1984	7	18	B06	.	.	136	0.3
1984	7	18	B09	209	1614	167	0.3
1984	8	16	B02	333	1117	35	0.5
1984	8	16	B04	47	1010	11	0.8
1984	8	16	B06	174	1510	45	0.5
1984	8	16	B09	126	2410	97	0.4
1984	9	12	B02	281	1747	22	0.5
1984	9	12	B04	48	510	20	0.6
1984	9	12	B06	.	.	48	0.7
1984	9	12	B09	170	2210	63	0.3
1984	10	10	B02	317	1545	23	0.6
1984	10	10	B04	117	400	25	0.7
1984	10	10	B06	261	1300	68	0.5
1984	10	10	B09	140	2110	82	0.3
1984	11	8	B02	343	1800	60	0.4
1984	11	8	B04	102	800	28	0.6
1984	11	8	B06	135	1627	68	0.5
1984	11	8	B09	191	2210	116	0.4
1984	12	14	B02	121	900	48	0.4
1984	12	14	B04	82	1210	24	0.7

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1984	12	14	B06	174	1214	65	0.6
1984	12	14	B09	264	2100	37	0.5
1985	1	10	B02	138	1650	56	0.4
1985	1	10	B04	148	1120	28	0.5
1985	1	10	B06	196	1300	55	0.5
1985	1	10	B09	152	1725	74	0.5
1985	2	6	B02	139	1904	11	0.4
1985	2	6	B04	148	6	10	0.8
1985	2	6	B06	130	1000	8	0.6
1985	2	6	B09	194	1600	27	0.5
1985	3	6	B02	166	2328	98	0.4
1985	3	6	B04	70	1200	92	0.5
1985	3	6	B06	242	1720	120	0.6
1985	3	6	B09	194	2124	107	0.5
1985	4	10	B02	228	2705	96	0.4
1985	4	10	B04	89	1410	96	0.6
1985	4	10	B06	300	2505	101	0.4
1985	4	10	B09	135	1330	80	0.4
1985	5	8	B02	223	1605	142	0.4
1985	5	8	B04	94	900	64	0.8
1985	5	8	B06	100	1738	.	0.3
1985	5	8	B09	278	1400	.	0.3
1985	6	13	B02	300	2104	112	0.4
1985	6	13	B04	143	1410	93	0.8
1985	6	13	B06	115	2100	158	0.3
1985	6	13	B09	298	1214	220	0.3
1985	8	13	B02	175	1762	45	0.6
1985	8	13	B04	170	1625	62	0.6
1985	8	13	B06	135	1125	99	0.5
1985	8	13	B09	93	2224	111	0.3
1985	9	11	B02	183	1307	26	0.5
1985	9	11	B04	119	1931	9	0.8
1985	9	11	B06	151	1500	27	0.4
1985	9	11	B09	127	2305	67	0.3
1985	10	16	B02	298	3035	165	0.3
1985	10	16	B04	276	2510	56	0.4
1985	10	16	B06	270	2104	82	0.4
1985	10	16	B09	157	2200	118	0.4
1985	11	6	B02	159	1574	6	0.5
1985	11	6	B04	114	1687	35	0.5
1985	11	6	B06	219	2520	10	0.6
1985	11	6	B09	162	2660	48	0.5
1985	12	3	B02	129	1220	50	0.4
1985	12	3	B04	53	2252	28	0.5
1985	12	3	B06	400	1485	43	0.5
1985	12	3	B09	241	1400	82	0.5
1986	1	15	B02	137	1247	15	0.5
1986	1	15	B04	114	1424	4	0.9
1986	1	15	B06	143	1840	34	0.7
1986	1	15	B09	192	1260	50	0.6
1986	2	11	B02	113	1529	16	0.6
1986	2	11	B04	107	720	59	0.8
1986	2	11	B06	78	1830	15	0.7

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1986	2	11	B09	528	2106	9	0.6
1986	3	12	B02	106	1107	5	0.6
1986	3	12	B04	86	1510	10	0.6
1986	3	12	B06	96	2000	33	0.5
1986	3	12	B09	180	2600	7	0.5
1986	4	10	B02	197	2606	22	0.4
1986	4	10	B04	37	1200	7	0.5
1986	4	10	B06	94	3600	15	0.7
1986	4	10	B09	100	1305	13	0.6
1986	5	8	B02	215	3050	39	0.5
1986	5	8	B04	62	1110	11	0.5
1986	5	8	B06	70	920	6	0.6
1986	5	8	B09	100	3020	17	0.5
1986	6	10	B02	167	2600	92	0.4
1986	6	10	B04	69	0	94	0.5
1986	6	10	B06	44	3217	42	0.4
1986	6	10	B09	137	2314	44	0.3
1986	7	16	B02	162	2090	62	0.6
1986	7	16	B04	109	1220	105	0.5
1986	7	16	B06	77	2230	59	0.3
1986	7	16	B09	66	2725	82	0.3
1986	8	14	B02	160	1800	56	0.5
1986	8	14	B04	159	1100	73	0.7
1986	8	14	B06	88	1300	80	0.5
1986	8	14	B09	62	3204	96	0.4
1986	9	17	B02	139	1807	41	0.7
1986	9	17	B04	133	2137	38	2.0
1986	9	17	B06	129	2100	54	0.7
1986	9	17	B09	66	1600	60	0.5
1986	10	15	B04	165	2400	61	1.0
1986	10	15	B06	147	1400	41	0.6
1986	10	15	B09	73	4900	49	0.6
1986	11	18	B02	104	1807	44	0.8
1986	11	18	B04	136	2106	27	1.0
1986	11	18	B06	107	1600	37	0.6
1986	11	18	B09	141	2600	54	0.6
1986	12	16	B02	100	1906	52	0.9
1986	12	16	B04	104	2531	48	1.0
1986	12	16	B06	124	700	50	0.5
1986	12	16	B09	189	3807	69	0.5
1987	1	20	B02	132	1827	50	0.7
1987	1	20	B04	99	2208	37	1.1
1987	1	20	B06	141	1400	34	0.7
1987	1	20	B09	90	2500	62	0.7
1987	2	25	B06	112	1608	78	0.6
1987	2	25	B09	135	2320	66	0.5
1987	4	22	B06	88	2205	14	0.8
1987	4	22	B09	161	2200	41	0.7
1987	6	10	B06	90	2209	49	0.6
1987	6	10	B09	132	1117	96	0.5
1987	9	16	B04	96	1840	50	0.9
1987	9	16	B06	88	2000	135	0.4
1987	9	16	B09	97	1407	192	0.3

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1987	10	15	B02	187	4768	40	0.9
1987	10	15	B04	85	3914	40	0.7
1987	10	15	B06	114	2040	142	0.6
1987	10	15	B09	101	1246	192	0.6
1987	11	9	B02	158	1289	12	0.7
1987	11	9	B04	130	2082	52	0.8
1987	11	9	B06	208	2207	141	0.6
1987	11	9	B09	95	2525	185	0.5
1987	12	9	B02	163	1395	4	0.6
1987	12	9	B04	165	2162	5	1.6
1987	12	9	B06	85	2105	45	0.7
1987	12	9	B09	118	2900	40	0.6
1988	1	5	B02	163	1764	7	0.6
1988	1	5	B04	116	2197	10	1.1
1988	1	5	B06	110	2036	46	0.7
1988	1	5	B09	180	1727	88	0.5
1988	2	2	B02	134	1489	11	0.7
1988	2	2	B04	65	1552	12	1.2
1988	2	2	B06	161	2017	46	0.6
1988	2	2	B09	90	2338	39	0.6
1988	3	7	B02	122	1606	6	0.9
1988	3	7	B04	30	.	5	1.2
1988	3	7	B06	286	2065	22	0.7
1988	3	7	B09	210	2407	38	0.7
1988	4	5	B02	152	1288	3	0.8
1988	4	5	B04	52	1100	3	0.5
1988	4	5	B06	201	2304	20	0.9
1988	4	5	B09	281	2295	9	0.8
1988	5	10	B02	119	1363	22	0.9
1988	5	10	B04	39	910	8	1.6
1988	5	10	B06	95	2710	48	0.7
1988	5	10	B09	343	2223	61	0.6
1988	6	8	B02	158	800	57	0.6
1988	6	8	B04	50	800	18	1.2
1988	6	8	B06	96	2106	83	0.6
1988	6	8	B09	236	2265	127	0.6
1988	7	6	B02	163	1710	69	0.7
1988	7	6	B04	37	1012	21	0.7
1988	7	6	B06	79	2230	48	0.5
1988	7	6	B09	108	2330	90	0.5
1988	8	4	B02	118	1500	61	0.8
1988	8	4	B04	25	609	77	1.0
1988	8	4	B06	85	2900	66	0.5
1988	8	4	B09	121	2105	58	0.6
1988	9	27	B02	177	1486	43	0.5
1988	9	27	B04	69	800	19	1.0
1988	9	27	B06	98	1100	31	0.8
1988	9	27	B09	80	2612	35	0.8
1988	10	13	B02	124	1196	.	0.6
1988	10	13	B04	111	630	.	0.6
1988	10	13	B06	88	2614	.	0.6
1988	10	13	B09	83	1900	.	0.6
1988	11	9	B02	101	1053	20	0.6

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1988	11	9	B04	104	619	20	0.8
1988	11	9	B06	134	1411	52	0.7
1988	11	9	B09	93	3320	70	0.5
1988	12	6	B02	119	101	5	0.6
1988	12	6	B04	51	1100	17	1.0
1988	12	6	B06	140	1512	38	0.7
1988	12	6	B09	95	4024	52	0.5
1989	1	3	B02	91	1259	32	0.5
1989	1	3	B04	62	1622	15	0.7
1989	1	3	B06	99	1720	37	0.6
1989	1	3	B09	134	3428	26	0.6
1989	2	14	B02	118	961	6	0.7
1989	2	14	B04	39	710	6	1.1
1989	2	14	B06	65	4007	43	0.8
1989	2	14	B09	239	2100	45	0.7
1989	3	14	B02	84	744	25	0.8
1989	3	14	B04	46	900	8	1.1
1989	3	14	B06	67	1715	39	0.7
1989	3	14	B09	85	1900	64	0.6
1989	4	11	B02	160	2783	192	0.6
1989	4	11	B04	76	918	44	0.9
1989	4	11	B06	62	1600	65	0.5
1989	4	11	B09	71	1732	71	0.5
1989	5	9	B02	127	1705	60	0.8
1989	5	9	B04	24	700	10	1.5
1989	5	9	B06	73	1109	64	0.5
1989	5	9	B09	96	1400	76	0.4
1989	6	8	B02	130	1507	71	0.7
1989	6	8	B04	39	900	21	0.9
1989	6	8	B06	62	1910	71	0.5
1989	6	8	B09	82	1600	60	0.4
1989	7	11	B02	183	2430	89	0.6
1989	7	11	B04	78	800	26	0.6
1989	7	11	B06	53	1607	60	0.5
1989	7	11	B09	91	1615	28	0.5
1989	8	15	B02	87	1206	49	0.5
1989	8	15	B04	34	0	47	0.7
1989	8	15	B06	56	1200	76	0.5
1989	8	15	B09	62	1500	90	0.5
1989	9	12	B02	84	1529	42	0.6
1989	9	12	B04	65	1100	17	0.8
1989	9	12	B06	90	1200	53	3.2
1989	9	12	B09	51	2704	60	2.8
1989	10	11	B02	96	1138	33	0.6
1989	10	11	B04	81	1200	24	0.8
1989	10	11	B06	94	1115	53	0.6
1989	10	11	B09	64	1800	82	0.4
1989	11	7	B02	71	1310	46	0.5
1989	11	7	B04	88	742	18	3.4
1989	11	7	B06	126	944	25	0.6
1989	11	7	B09	116	1100	26	0.6
1989	12	5	B02	62	667	36	2.6
1989	12	5	B04	38	1432	16	0.8

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1989	12	5	B06	114	1206	37	0.6
1989	12	5	B09	109	1404	39	0.6
1990	1	16	B02	72	1020	26	0.8
1990	1	16	B04	44	1212	3	1.1
1990	1	16	B06	101	1100	34	0.6
1990	1	16	B09	122	1600	44	0.5
1990	2	13	B02	73	1108	29	0.8
1990	2	13	B04	33	900	4	1.3
1990	2	13	B06	75	1000	37	0.7
1990	2	13	B09	61	1404	40	0.8
1990	3	13	B02	92	807	17	0.8
1990	3	13	B04	30	975	1	0.9
1990	3	13	B06	84	1300	39	0.6
1990	3	13	B09	97	1200	41	0.7
1990	4	10	B02	115	1209	19	0.7
1990	4	10	B04	19	911	24	0.8
1990	4	10	B06	46	1907	51	0.5
1990	4	10	B09	71	1200	61	0.4
1990	5	1	B02	162	2432	81	0.7
1990	5	1	B04	25	0	28	1.1
1990	5	1	B06	55	1500	46	0.5
1990	5	1	B09	98	1100	67	0.5
1990	6	5	B02	138	1830	78	0.3
1990	6	5	B04	26	700	56	0.8
1990	6	5	B06	59	1609	68	0.5
1990	6	5	B09	49	1222	71	0.3
1990	7	2	B02	134	1805	72	0.6
1990	7	2	B04	110	800	54	0.9
1990	7	2	B06	65	1400	101	0.5
1990	7	2	B09	61	2005	111	0.3
1990	8	8	B02	99	1459	35	2.5
1990	8	8	B04	46	0	27	3.5
1990	8	8	B06	62	1715	30	3.3
1990	8	8	B09	83	1942	29	2.8
1990	9	4	B02	122	1303	22	0.6
1990	9	4	B04	144	1400	43	0.8
1990	9	4	B06	106	1450	68	0.6
1990	9	4	B09	76	1500	72	0.5
1990	10	23	B02	116	1074	16	0.7
1990	10	23	B04	135	1205	20	0.9
1990	10	23	B06	80	926	24	0.7
1990	10	23	B09	81	1820	13	0.7
1990	11	7	B02	83	1238	23	0.7
1990	11	7	B04	54	1736	11	1.0
1990	11	7	B06	117	835	29	0.6
1990	11	7	B09	119	1610	22	0.6
1990	12	5	B02	69	1024	.	0.7
1990	12	5	B04	65	2115	.	0.9
1990	12	5	B06	150	1208	.	0.6
1990	12	5	B09	94	1630	.	0.5
1991	1	9	B02	74	1021	32	0.8
1991	1	9	B04	40	1404	21	1.2
1991	1	9	B06	50	1304	34	0.8

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1991	1	9	B09	162	900	35	0.7
1991	2	12	B02	78	935	26	0.5
1991	2	12	B04	23	1400	12	1.1
1991	2	12	B06	71	1316	28	0.7
1991	2	12	B09	142	1007	30	0.9
1991	3	13	B09	44	1412	34	0.6
1991	4	9	B02	114	1357	23	0.8
1991	4	9	B04	43	1506	17	1.3
1991	4	9	B06	47	1924	36	0.7
1991	4	9	B09	92	1446	29	0.5
1991	5	6	B02	123	1045	66	0.6
1991	5	6	B04	57	1206	13	1.2
1991	5	6	B06	51	1700	64	0.5
1991	5	6	B09	33	1300	64	0.5
1991	6	3	B02	156	1508	.	0.6
1991	6	3	B04	32	800	.	1.2
1991	6	3	B06	83	1800	.	0.5
1991	6	3	B09	49	.	.	0.5
1991	7	24	B02	169	1307	31	0.7
1991	7	24	B04	51	948	10	1.1
1991	7	24	B06	60	2600	43	0.6
1991	7	24	B09	83	1909	29	0.8
1991	8	12	B02	87	1471	38	0.5
1991	8	12	B04	25	700	10	1.1
1991	8	12	B06	59	1405	35	0.7
1991	8	12	B09	57	2105	34	0.6
1991	9	9	B02	112	1413	9	0.6
1991	9	9	B04	19	1300	9	1.1
1991	9	9	B06	75	1700	20	0.6
1991	9	9	B09	46	2444	9	0.7
1991	10	8	B02	94	1424	7	0.8
1991	11	5	B02	61	1081	11	0.8
1991	11	5	B04	54	719	13	1.4
1991	11	5	B06	80	1119	12	0.8
1991	11	5	B09	77	1310	16	0.8
1991	12	16	B02	66	634	15	0.8
1991	12	16	B04	16	707	-1	1.3
1991	12	16	B06	85	1507	19	0.7
1991	12	16	B09	51	2006	24	0.6
1992	1	7	B02	54	904	17	0.8
1992	1	7	B04	31	0	2	1.1
1992	1	7	B06	54	1400	26	0.7
1992	1	7	B09	77	1112	22	0.4
1992	2	13	B02	54	800	6	0.9
1992	2	13	B04	7	1000	3	1.8
1992	2	13	B06	39	1213	33	1.0
1992	2	13	B09	101	1413	23	0.8
1992	3	31	B02	87	900	14	0.7
1992	3	31	B04	37	1200	6	1.3
1992	3	31	B06	59	900	39	0.7
1992	3	31	B09	46	1581	42	0.7
1992	4	22	B04	15	900	4	1.6
1992	4	22	B06	19	1605	25	0.8

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1992	4	22	B09	31	1216	29	0.6
1992	6	4	B02	117	1200	67	0.8
1992	6	4	B04	20	904	16	1.3
1992	6	4	B06	112	1704	81	0.6
1992	6	4	B09	43	1100	91	0.6
1992	6	23	B09	22	0	39	0.5
1992	7	21	B02	97	1504	57	0.6
1992	7	21	B04	23	800	10	1.5
1992	7	21	B06	25	1500	48	0.7
1992	7	21	B09	84	1500	50	0.6
1992	8	12	B02	92	1216	36	0.6
1992	8	12	B04	19	1100	12	1.5
1992	8	12	B06	37	1200	60	0.7
1992	8	12	B09	25	1600	70	0.6
1992	9	15	B02	63	1026	11	0.7
1992	9	15	B04	32	705	4	1.4
1992	9	15	B06	92	1304	21	0.7
1992	9	15	B09	38	1600	21	0.7
1992	9	16	B04	25	700	2	1.2
1992	10	21	B02	93	955	8	0.6
1992	10	21	B04	26	921	5	1.1
1992	10	21	B06	43	1400	25	0.5
1992	10	21	B09	78	900	30	0.8
1992	12	15	B02	62	998	4	1.1
1992	12	15	B04	18	1000	3	1.5
1992	12	15	B06	101	1200	37	0.7
1992	12	15	B09	57	1204	46	0.8
1993	1	20	B02	78	838	1	1.0
1993	1	20	B04	23	718	2	1.5
1993	1	20	B06	59	1100	8	0.9
1993	1	20	B09	113	1500	18	0.9
1993	2	23	B02	59	789	2	0.7
1993	2	23	B04	18	708	1	1.5
1993	2	23	B06	61	1110	18	0.9
1993	2	23	B09	51	1600	29	0.7
1993	3	22	B02	44	1106	3	1.2
1993	3	22	B04	14	807	6	1.4
1993	3	22	B06	38	807	10	1.0
1993	3	22	B09	62	1000	35	0.5
1993	4	27	B04	16	800	.	1.7
1993	4	27	B06	57	1138	.	0.7
1993	4	27	B09	88	1300	.	0.7
1993	5	18	B02	70	1800	.	1.0
1993	5	18	B04	15	700	.	1.6
1993	5	18	B06	36	804	.	0.6
1993	5	18	B09	28	800	.	0.7
1993	6	22	B04	20	36	.	1.4
1993	6	22	B06	39	1507	.	0.8
1993	6	22	B09	63	1200	.	0.6
1993	7	27	B02	114	1607	.	0.8
1993	7	27	B04	20	609	.	1.0
1993	7	27	B06	46	1400	.	0.8
1993	7	27	B09	42	1008	.	0.8

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1993	8	17	B02	78	1556	35	0.8
1993	8	17	B04	22	738	20	1.1
1993	8	17	B06	35	1810	42	0.8
1993	8	17	B09	40	1805	54	0.6
1993	9	22	B02	78	1460	.	0.6
1993	9	22	B04	18	705	.	1.3
1993	9	22	B06	76	1011	.	0.6
1993	9	22	B09	64	904	.	0.6
1993	10	27	B02	89	1005	.	0.6
1993	10	27	B04	36	600	.	1.0
1993	10	27	B06	36	1300	.	0.6
1993	10	27	B09	71	1500	.	0.7
1993	12	16	B02	41	1105	.	0.9
1993	12	16	B04	41	4	.	1.3
1993	12	16	B06	41	1100	.	0.7
1993	12	16	B09	67	1208	.	0.5
1994	1	27	B02	46	914	.	0.8
1994	1	27	B04	54	1512	.	1.6
1994	1	27	B06	55	0	.	0.9
1994	1	27	B09	19	1200	.	0.9
1994	2	23	B02	55	718	.	0.8
1994	2	23	B04	41	1404	.	1.1
1994	2	23	B06	91	1205	.	1.0
1994	2	23	B09	50	1500	.	0.7
1994	3	24	B02	42	865	.	0.9
1994	3	24	B04	18	1305	.	1.4
1994	3	24	B06	53	810	.	0.9
1994	3	24	B09	50	900	.	0.9
1994	4	20	B09	87	600	14	0.6
1994	4	21	B02	69	1031	10	0.9
1994	4	21	B04	25	904	3	1.5
1994	4	21	B06	66	1623	13	0.7
1994	5	19	B02	54	906	18	0.8
1994	5	19	B04	23	1000	.	2.0
1994	5	19	B06	63	1004	.	0.7
1994	5	19	B09	69	1205	.	0.6
1994	6	16	B02	102	1411	48	0.7
1994	6	16	B04	27	813	12	1.2
1994	6	16	B06	36	1206	20	0.8
1994	6	16	B09	56	1206	23	0.6
1994	7	28	B02	71	1421	21	0.8
1994	7	28	B04	29	730	5	1.1
1994	7	28	B06	37	1605	18	0.7
1994	7	28	B09	100	2105	15	0.7
1994	8	25	B02	92	1640	20	0.8
1994	8	25	B04	30	812	5	1.5
1994	8	25	B06	40	1313	16	0.7
1994	8	25	B09	26	1005	22	0.8
1994	9	21	B09	31	1000	18	0.8
1994	9	22	B02	105	62	7	0.6
1994	9	22	B04	43	748	4	1.1
1994	9	22	B06	45	1407	7	0.7
1994	10	20	B02	81	843	5	0.8

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1994	10	20	B04	48	1124	4	1.0
1994	10	20	B06	58	884	14	0.8
1994	10	20	B09	42	1547	20	0.8
1994	11	8	B02	.	.	6	0.6
1994	11	8	B04	.	.	6	1.8
1994	11	8	B06	.	.	15	0.8
1994	11	8	B09	.	.	30	0.7
1994	12	6	B02	94	906	12	0.6
1994	12	6	B04	19	1438	4	0.9
1994	12	6	B06	39	1307	16	0.8
1994	12	6	B09	37	1706	24	0.6
1995	1	5	B02	52	953	3	0.8
1995	1	5	B04	29	1427	4	1.0
1995	1	5	B06	44	620	9	1.1
1995	1	5	B09	59	1940	16	0.6
1995	2	2	B02	44	852	6	0.7
1995	2	2	B04	17	833	2	1.4
1995	2	2	B06	44	937	8	0.9
1995	2	2	B09	37	1305	18	0.6
1995	3	2	B02	52	844	12	0.7
1995	3	2	B04	23	610	4	1.9
1995	3	2	B06	54	811	34	0.7
1995	3	2	B09	44	2028	19	0.6
1995	3	22	B02	65	817	12	0.8
1995	3	22	B04	25	929	2	1.2
1995	3	22	B06	33	1221	11	0.8
1995	3	22	B09	48	938	22	0.6
1995	4	27	B02	84	1407	69	0.9
1995	4	27	B04	21	655	14	1.1
1995	4	27	B09	38	846	24	0.6
1995	5	24	B02	72	1116	2	0.9
1995	5	24	B04	17	711	13	1.1
1995	5	24	B06	46	1238	17	0.9
1995	5	24	B09	25	964	43	0.6
1995	6	27	B02	65	1009	27	0.8
1995	6	27	B06	28	1105	38	0.6
1995	6	27	B09	47	905	36	0.6
1995	7	24	B02	74	1110	19	0.9
1995	7	24	B06	36	1004	11	0.8
1995	7	24	B09	44	1507	22	0.6
1995	8	23	B09	42	1416	.	0.7
1995	9	13	B02	84	1587	16	1.0
1995	9	13	B04	24	847	10	1.2
1995	9	13	B06	40	1205	15	0.8
1995	9	13	B09	47	1620	20	0.9
1995	10	10	B02	66	995	-1	0.8
1995	10	10	B04	28	726	26	0.9
1995	10	10	B06	36	700	5	0.9
1995	10	10	B09	42	1408	22	0.9
1995	11	7	B02	.	.	20	0.6
1995	11	7	B04	.	.	5	1.0
1995	11	7	B06	.	.	5	0.8
1995	11	7	B09	.	.	14	0.7

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1995	12	5	B02	50	740	2	0.6
1995	12	5	B04	27	784	11	1.3
1995	12	5	B06	68	966	1	1.0
1995	12	5	B09	802	907	20	0.5
1996	1	9	B02	41	1410	2	1.1
1996	1	9	B04	30	936	10	1.2
1996	1	9	B06	65	871	22	1.0
1996	1	9	B09	100	1112	37	0.6
1996	2	12	B02	.	.	6	0.9
1996	2	12	B04	.	.	9	1.1
1996	2	12	B06	.	.	52	0.8
1996	2	12	B09	.	.	29	0.6
1996	4	9	B02	.	.	19	0.7
1996	4	9	B04	.	.	3	1.0
1996	4	9	B06	.	.	54	0.8
1996	4	9	B09	.	.	50	0.6
1996	5	6	B02	66	1017	19	1.2
1996	5	6	B04	39	820	13	1.3
1996	5	6	B06	55	822	22	1.0
1996	5	6	B09	66	1047	26	0.6
1996	6	12	B02	.	.	10	0.9
1996	6	12	B04	.	.	17	0.8
1996	6	12	B06	.	.	24	0.5
1996	6	12	B09	.	.	21	0.4
1996	8	6	B09	61	1046	38	0.6
1996	8	7	B02	81	1230	40	0.8
1996	8	7	B04	39	920	6	1.4
1996	8	7	B06	48	941	21	0.8
1996	9	24	B02	30	1230	6	1.4
1996	9	24	B04	28	825	8	1.2
1996	9	24	B06	34	1130	18	0.7
1996	9	24	B09	65	1046	38	0.6
1996	10	29	B02	53	812	16	1.1
1996	11	21	B04	48	605	20	2.0
1996	11	21	B06	49	1167	26	0.7
1996	11	21	B09	54	1221	26	0.6
1996	12	18	B02	74	1007	15	1.1
1996	12	18	B04	40	808	5	1.4
1996	12	18	B06	28	1300	14	0.7
1996	12	18	B09	41	1136	13	0.7
1997	2	5	B02	70	1015	10	1.2
1997	2	5	B04	25	700	5	1.4
1997	2	5	B06	44	1436	20	0.9
1997	2	5	B09	69	1100	14	0.8
1997	3	5	B02	53	1024	13	0.9
1997	3	5	B04	33	1000	6	1.6
1997	3	5	B06	65	1200	12	0.8
1997	3	5	B09	36	1433	26	0.8
1997	4	1	B02	42	700	18	1.4
1997	4	1	B04	36	1000	6	1.3
1997	4	1	B06	44	1105	27	0.7
1997	4	1	B09	75	1100	32	0.6
1997	4	30	B02	31	1020	14	1.0

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1997	4	30	B04	21	620	6	1.1
1997	4	30	B06	46	739	23	0.7
1997	4	30	B09	48	1214	30	0.8
1997	5	29	B02	.	.	22	0.7
1997	5	29	B04	.	.	4	2.0
1997	5	29	B06	.	.	.	0.5
1997	5	29	B09	.	.	29	0.4
1997	7	23	B02	121	1036	46	1.1
1997	7	23	B04	18	1020	39	1.1
1997	7	23	B06	.	.	27	0.5
1997	7	23	B09	72	1329	32	0.6
1997	8	19	B02	.	.	41	.
1997	8	19	B04	.	.	7	1.3
1997	8	19	B06	.	.	32	0.7
1997	8	19	B09	.	.	20	0.6
1997	9	25	B04	18	1200	8	1.2
1997	10	15	B02	101	1000	9	0.9
1997	10	15	B04	69	753	8	0.9
1997	10	15	B06	36	900	21	0.6
1997	10	15	B09	69	1200	62	0.6
1998	1	7	B02	46	1195	3	0.6
1998	1	7	B04	30	842	4	0.9
1998	1	7	B06	44	1420	7	0.6
1998	1	7	B09	51	820	14	0.6
1998	3	12	B02	72	1580	5	0.6
1998	3	12	B04	34	1028	5	0.7
1998	3	12	B06	39	711	17	0.9
1998	3	12	B09	45	904	32	0.5
1998	4	29	B02	79	1361	11	0.4
1998	4	29	B04	30	804	7	0.6
1998	4	29	B06	25	1110	38	0.5
1998	4	29	B09	39	1400	27	0.6
1998	5	20	B02	66	2213	44	0.6
1998	5	20	B04	37	1006	12	0.6
1998	5	20	B06	33	800	19	0.6
1998	5	20	B09	23	1100	17	0.8
1998	6	17	B02	97	605	41	0.4
1998	6	17	B04	31	1100	8	0.9
1998	6	17	B06	65	885	9	0.8
1998	6	17	B09	33	699	23	0.9
1998	7	15	B02	102	1000	56	0.5
1998	7	15	B04	51	1100	34	0.7
1998	7	15	B06	48	1014	34	0.5
1998	7	15	B09	69	1006	25	0.6
1998	8	12	B02	107	700	24	0.6
1998	8	12	B04	44	1906	21	1.0
1998	8	12	B06	54	1707	27	0.6
1998	8	12	B09	41	1408	27	0.6
1998	9	10	B02	76	825	52	0.8
1998	9	10	B04	47	909	42	0.6
1998	9	10	B06	63	616	40	0.5
1998	9	10	B09	61	1014	60	0.5
1998	10	14	B02	78	1607	15	0.6

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
1998	10	14	B04	80	604	18	1.1
1998	10	14	B06	67	1304	.	0.8
1998	10	14	B09	49	1800	36	0.7
1998	11	19	B02	86	1407	31	0.7
1998	11	19	B04	55	915	21	0.8
1998	11	19	B06	82	1404	22	0.6
1998	11	19	B09	88	600	25	0.6
1999	1	13	B02	61	1571	7	0.8
1999	1	13	B04	70	715	2	1.0
1999	1	13	B06	47	1400	9	0.8
1999	1	13	B09	61	1306	14	0.8
1999	2	9	B02	42	1204	9	0.6
1999	2	9	B04	51	900	4	1.4
1999	2	9	B06	44	2108	9	0.8
1999	2	9	B09	53	1159	.	0.8
1999	3	10	B02	43	1405	5	0.6
1999	3	10	B04	38	907	5	0.9
1999	3	10	B06	69	1100	10	0.7
1999	3	10	B09	53	1300	15	1.1
1999	4	7	B02	36	1135	23	0.7
1999	4	7	B04	28	1010	2	1.1
1999	4	7	B06	72	1210	8	0.7
1999	4	7	B09	70	1300	10	1.5
1999	6	8	B02	48	1100	26	0.6
1999	6	8	B04	24	1204	12	1.0
1999	6	8	B06	91	806	36	0.6
1999	6	8	B09	51	2305	26	0.9
1999	7	14	B02	72	732	18	0.9
1999	7	14	B04	23	23	.	0.8
1999	7	14	B06	59	925	16	0.7
1999	7	14	B09	89	1555	19	1.4
1999	8	11	B02	94	904	36	0.8
1999	8	11	B04	30	1308	9	1.2
1999	8	11	B06	37	1006	31	0.9
1999	8	11	B09	62	1404	31	1.3
1999	9	9	B02	72	905	32	1.0
1999	9	9	B04	47	905	15	1.1
1999	9	9	B06	41	1200	29	0.8
1999	9	9	B09	44	800	27	1.1
1999	10	14	B02	57	1196	7	1.1
1999	10	14	B04	36	1013	6	1.0
1999	10	14	B06	34	1100	20	0.9
1999	10	14	B09	48	900	20	0.8
1999	11	9	B09	33	951	4	1.4
1999	12	7	B02	64	1192	2	1.3
1999	12	7	B04	32	723	7	1.0
1999	12	7	B06	44	900	7	1.4
1999	12	7	B09	43	1134	3	1.5
2000	1	5	B02	48	1236	5	1.1
2000	1	5	B04	35	1137	13	0.9
2000	1	5	B06	37	1200	10	1.1
2000	1	5	B09	36	1236	8	0.9
2000	2	2	B02	42	1162	2	1.1

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
2000	2	2	B04	34	955	4	0.9
2000	2	2	B06	64	1204	12	1.1
2000	2	2	B09	59	1012	11	1.1
2000	3	1	B02	34	1045	4	1.1
2000	3	1	B04	28	970	9	1.0
2000	3	1	B06	42	1500	17	1.3
2000	3	1	B09	33	1209	5	1.4
2000	3	29	B02	42	908	11	1.1
2000	3	29	B04	27	828	4	1.0
2000	3	29	B06	57	1415	17	1.0
2000	3	29	B09	45	1119	18	1.3
2000	4	27	B02	46	726	5	1.0
2000	4	27	B04	28	910	6	1.1
2000	4	27	B06	46	1120	7	0.8
2000	4	27	B09	35	1440	8	0.9
2000	5	25	B02	50	809	43	0.8
2000	5	25	B04	29	700	10	1.1
2000	5	25	B06	34	704	10	0.9
2000	5	25	B09	33	1629	22	1.4
2000	6	29	B02	97	700	30	1.2
2000	6	29	B04	37	805	16	1.1
2000	6	29	B06	29	1004	30	0.7
2000	7	26	B02	90	704	29	1.5
2000	7	26	B04	47	812	26	1.6
2000	7	26	B06	36	1009	40	0.3
2000	9	20	B02	59	839	28	1.1
2000	9	20	B04	54	600	33	4.5
2000	9	20	B06	28	800	46	0.4
2000	9	20	B09	30	1023	46	0.9
2000	10	25	B02	61	900	23	0.9
2000	10	25	B04	62	800	8	1.1
2000	10	25	B06	23	1300	34	0.5
2000	10	25	B09	32	604	26	0.9
2000	11	21	B02	61	1529	11	1.1
2000	11	21	B04	62	600	7	1.5
2000	11	21	B06	32	1209	30	0.3
2000	12	21	B02	.	.	6	1.7
2000	12	21	B04	.	.	5	1.4
2000	12	21	B06	.	.	20	0.6
2000	12	21	B09	.	.	53	0.4
2001	2	1	B02	51	1214	9	1.0
2001	2	1	B04	52	706	2	1.0
2001	2	1	B09	30	910	24	0.8
2001	2	22	B02	40	1000	8	1.2
2001	2	22	B04	35	800	4	1.6
2001	2	22	B09	46	1100	15	1.2
2001	3	22	B02	45	809	7	0.8
2001	3	22	B04	30	900	4	1.2
2001	3	22	B09	44	1108	38	0.8
2001	6	21	B02	48	1213	11	1.1
2001	6	21	B04	27	900	8	1.1
2001	6	21	B09	35	1213	8	1.5
2001	8	23	B02	49	1100	47	1.3

Year	Month	Day	Station	Total Phosphorus (μg/L)	Total Nitrogen (μg/L)	Chlorophyll (μg/L)	Secchi Depth (m)
2001	8	23	B04	30	1200	5	0.8
2001	8	23	B09	38	1100	17	1.0
2001	9	17	B02	100	1130	2	0.6
2001	9	17	B04	31	1240	6	1.2
2001	9	17	B09	42	1020	16	1.2
2001	10	23	B02	130	1340	1	1.5
2001	10	23	B04	36	920	9	1.3
2001	10	23	B09	48	1130	3	1.4
2001	11	19	B02	78	1110	13	0.9
2001	11	19	B04	26	920	3	1.9
2001	11	19	B09	73	949	5	1.2
2001	12	19	B02	52	1170	2	0.9
2001	12	19	B04	22	930	2	1.1
2001	12	19	B09	65	770	5	0.6
2002	1	22	B02	63	1360	6	1.0
2002	1	22	B04	17	910	8	1.6
2002	1	22	B09	43	790	13	1.1
2002	2	18	B02	46	1420	4	0.6
2002	2	18	B04	37	920	2	1.1
2002	2	18	B09	92	890	18	0.9
2002	3	18	B02	48	1720	9	1.2
2002	3	18	B04	24	1000	2	1.1
2002	3	18	B09	22	890	7	1.4
2002	4	22	B02	55	1310	18	0.8
2002	4	22	B04	24	1110	2	1.2
2002	4	22	B09	30	1250	2	1.8
2002	5	21	B02	63	820	28	0.7
2002	5	21	B04	24	720	2	1.4
2002	5	21	B09	68	920	6	1.0
2002	6	17	B02	76	1030	5	0.7
2002	6	17	B04	15	710	52	0.9
2002	6	17	B09	29	1000	40	0.5
2002	7	22	B02	98	1110	19	0.5
2002	7	22	B04	18	1040	4	1.5
2002	7	22	B09	28	1200	20	0.9
2002	8	19	B02	150	1160	19	0.5
2002	8	19	B04	18	930	5	1.4
2002	8	19	B09	43	1110	7	0.9
2002	9	16	B02	98	1280	17	0.6
2002	9	16	B04	26	600	3	1.5
2002	9	16	B09	36	1920	6	1.2
2002	10	21	B02	.	.	.	0.6
2002	10	21	B04	.	.	.	1.6
2002	10	21	B09	.	.	.	1.6
2002	12	16	B02	97	1390	1	0.6
2002	12	16	B04	.	.	2	.
2002	12	16	B09	46	.	2	.
2003	1	21	B02	.	.	1	0.6
2003	1	21	B04	22	1010	2	1.1
2003	1	21	B09	51	1200	6	0.9
2003	2	24	B02	79	1080	2	0.4
2003	2	24	B04	32	1150	4	0.7
2003	2	24	B09	120	.	12	0.4

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
2003	3	17	B02	41	1569	.	0.5
2003	3	17	B04	22	740	.	0.5
2003	3	17	B09	44	1240	.	1.0
2003	4	21	B02	61	1230	.	0.8
2003	4	21	B04	27	720	.	0.4
2003	4	21	B09	44	1620	.	1.2
2003	5	19	B02	100	1360	.	0.5
2003	5	19	B04	32	700	.	0.2
2003	5	19	B09	40	1210	.	.
2003	6	16	B02	71	800	.	0.5
2003	6	16	B04	35	1000	.	0.6
2003	6	16	B09	48	1060	.	.
2003	7	21	B02	100	1100	.	0.5
2003	7	21	B04	27	710	.	0.3
2003	7	21	B09	56	1080	.	.
2003	8	18	B02	89	1100	.	0.8
2003	8	18	B04	61	700	.	0.7
2003	8	18	B09	60	1200	.	.
2004	8	24	B02	59	1100	.	0.9
2004	8	24	B04	43	800	.	0.3
2004	8	24	B09	33	1080	.	.
2004	8	25	B02	213	1320	16	0.5
2004	8	25	B04	31	700	7	1.6
2004	8	25	B06	95	1130	48	0.7
2004	8	25	B09	64	1210	54	0.8
2004	8	25	G1	66	1310	52	0.8
2004	8	25	G2	58	1220	51	0.9
2004	8	25	G3	45	1150	36	0.9
2004	8	25	GC1	133	1190	58	0.8
2004	8	25	GC2	52	1210	43	0.9
2004	8	25	GC3	47	1280	40	0.8
2004	8	25	I1	72	960	23	0.9
2004	8	25	I2	57	800	16	1.1
2004	8	25	I3	35	650	14	1.1
2004	8	25	IC1	46	820	15	1.1
2004	8	25	IC2	43	760	21	1.4
2004	8	25	IC3	32	650	12	1.4
2004	8	25	L1	210	1770	37	0.3
2004	8	25	L2	221	1920	34	0.4
2004	8	25	L3	231	1850	56	0.3
2004	8	25	LC1	369	1310	65	0.4
2004	8	25	LC2	350	1340	55	0.5
2004	8	25	LC3	338	1390	69	0.6
2004	8	25	N1	217	2250	73	0.4
2004	8	25	N2	157	2010	56	0.4
2004	8	25	N3	90	1520	70	0.6
2004	8	25	NC1	56	1300	70	0.5
2004	8	25	NC2	104	1300	62	0.6
2004	8	25	NC3	46	1120	51	0.7
2004	9	22	B02	125	1070	17	0.7
2004	9	22	B04	44	850	10	1.0
2004	9	22	B06	109	1140	20	0.6
2004	9	22	B09	111	1390	38	0.4

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
2004	9	22	G1	99	1330	39	0.8
2004	9	22	G2	90	1130	24	0.8
2004	9	22	G3	87	1060	22	0.8
2004	9	22	GC1	72	1140	43	0.6
2004	9	22	GC2	87	1100	23	0.8
2004	9	22	GC3	86	1090	19	0.7
2004	9	22	I1	72	1150	17	0.8
2004	9	22	I2	70	1130	14	0.7
2004	9	22	I3	50	880	13	1.1
2004	9	22	IC1	45	790	16	1.0
2004	9	22	IC2	48	790	14	1.0
2004	9	22	IC3	43	770	12	1.0
2004	9	22	L1	121	1110	32	0.7
2004	9	22	L2	121	1160	25	0.6
2004	9	22	L3	116	1140	25	0.6
2004	9	22	LC1	119	1110	44	0.7
2004	9	22	LC2	123	1070	43	0.6
2004	9	22	LC3	262	1460	72	0.5
2004	9	22	N1	133	1730	113	0.5
2004	9	22	N2	105	1390	46	0.4
2004	9	22	N3	119	1620	41	0.4
2004	9	22	NC1	119	1650	90	0.4
2004	9	22	NC2	116	1500	53	0.5
2004	9	22	NC3	125	1670	20	0.4
2004	10	21	B02	96	1000	5	0.6
2004	10	21	B04	43	790	21	0.9
2004	10	21	B06	80	900	10	0.9
2004	10	21	B09	81	970	22	0.9
2004	10	21	G1	82	930	30	0.9
2004	10	21	G2	75	880	23	0.9
2004	10	21	G3	75	910	18	0.9
2004	10	21	GC1	81	950	31	0.9
2004	10	21	GC2	79	1030	22	0.9
2004	10	21	GC3	72	920	21	0.9
2004	10	21	I1	40	800	20	0.9
2004	10	21	I2	21	800	23	0.9
2004	10	21	I3	39	790	22	0.9
2004	10	21	IC1	45	870	21	0.9
2004	10	21	IC2	42	840	23	0.9
2004	10	21	IC3	48	870	19	0.9
2004	10	21	L1	80	1000	5	0.6
2004	10	21	L2	82	1060	5	0.6
2004	10	21	L3	84	1050	5	0.6
2004	10	21	LC1	87	940	11	0.6
2004	10	21	LC2	104	1020	12	0.6
2004	10	21	LC3	81	940	10	0.6
2004	10	21	N1	105	1330	61	0.6
2004	10	21	N2	96	1180	43	0.6
2004	10	21	N3	91	1140	39	0.6
2004	10	21	NC1	129	1620	78	0.5
2004	10	21	NC2	130	1580	64	0.5
2004	10	21	NC3	97	1220	39	0.7
2005	2	15	B02	60	1010	.	0.9

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
2005	2	15	B04	39	860	14	1.2
2005	2	15	B06	56	930	32	1.0
2005	2	15	B09	56	950	29	0.8
2005	2	15	G1	53	920	24	1.0
2005	2	15	G2	54	910	27	0.9
2005	2	15	G3	54	940	29	0.9
2005	2	15	GC1	49	980	29	0.9
2005	2	15	GC2	56	930	28	0.7
2005	2	15	GC3	55	1030	26	0.9
2005	2	15	I1	44	900	16	0.9
2005	2	15	I2	40	850	16	0.9
2005	2	15	I3	43	860	16	0.9
2005	2	15	IC1	47	850	15	0.9
2005	2	15	IC2	39	840	11	0.9
2005	2	15	IC3	40	810	14	0.9
2005	2	15	L1	40	850	8	0.9
2005	2	15	L2	44	880	9	0.9
2005	2	15	L3	39	920	9	0.7
2005	2	15	LC1	44	900	6	0.9
2005	2	15	LC2	51	860	9	0.9
2005	2	15	LC3	49	900	10	0.9
2005	2	15	N1	53	990	17	0.9
2005	2	15	N2	54	920	16	0.9
2005	2	15	N3	63	1010	26	0.9
2005	2	15	NC1	58	950	17	0.9
2005	2	15	NC2	61	1000	15	0.9
2005	2	15	NC3	64	1050	29	0.9
2005	4	21	B02	53	1000	18	1.1
2005	4	21	B04	43	880	8	1.0
2005	4	21	B06	69	1060	20	0.9
2005	4	21	B09	63	1070	21	0.9
2005	4	21	G1	66	1090	32	0.9
2005	4	21	G2	69	1090	28	0.9
2005	4	21	G3	67	1060	24	0.9
2005	4	21	GC1	63	1000	16	0.9
2005	4	21	GC2	71	1200	30	0.9
2005	4	21	GC3	71	1210	32	0.9
2005	4	21	I1	42	910	9	0.9
2005	4	21	I2	45	890	9	0.9
2005	4	21	I3	48	900	10	0.9
2005	4	21	IC1	44	860	9	0.9
2005	4	21	IC2	36	810	8	0.9
2005	4	21	IC3	41	820	10	0.9
2005	4	21	L1	53	1020	22	.
2005	4	21	L2	45	870	8	.
2005	4	21	L3	53	980	12	2.0
2005	4	21	LC1	44	980	6	.
2005	4	21	LC2	50	920	11	.
2005	4	21	LC3	.	.	.	.
2005	4	21	N1	61	1200	27	0.9
2005	4	21	N2	58	1160	28	0.9
2005	4	21	N3	56	1070	22	1.0
2005	4	21	NC1	71	1150	26	0.9

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
2005	4	21	NC2	65	1300	35	0.9
2005	4	21	NC3	57	1130	26	1.0
2005	6	21	B02	113	850	21	0.8
2005	6	21	B04	53	920	16	0.9
2005	6	21	B06	89	960	38	0.9
2005	6	21	B09	108	1530	79	0.6
2005	6	21	G1	84	1020	34	0.7
2005	6	21	G2	91	1070	42	0.7
2005	6	21	G3	101	1060	41	0.7
2005	6	21	GC1	86	1120	42	0.7
2005	6	21	GC2	90	1010	41	0.8
2005	6	21	GC3	94	1010	42	0.7
2005	6	21	I1	46	790	19	0.9
2005	6	21	I2	49	840	18	0.9
2005	6	21	I3	61	1000	19	0.8
2005	6	21	IC1	52	770	18	1.0
2005	6	21	IC2	50	740	18	1.0
2005	6	21	IC3	47	710	17	1.0
2005	6	21	N1	103	1400	73	0.6
2005	6	21	N2	107	1380	74	0.6
2005	6	21	N3	108	1440	78	0.6
2005	6	21	NC1	99	1330	63	0.6
2005	6	21	NC2	87	1290	44	0.6
2005	6	21	NC3	113	1470	79	0.6
2005	9	6	B02	68	860	35	0.8
2005	9	6	B04	57	830	21	0.8
2005	9	6	B06	59	910	45	1.0
2005	9	6	B09	100	1250	74	0.6
2005	9	6	G1	63	990	44	0.8
2005	9	6	G2	50	860	33	0.7
2005	9	6	G3	62	960	42	0.7
2005	9	6	GC1	65	970	48	0.8
2005	9	6	GC2	54	910	39	0.7
2005	9	6	GC3	58	980	35	0.8
2005	9	6	I1	69	930	22	0.7
2005	9	6	I2	66	860	19	0.7
2005	9	6	I3	65	860	18	0.8
2005	9	6	IC1	72	900	24	0.7
2005	9	6	IC2	70	910	22	0.7
2005	9	6	IC3	60	810	20	0.8
2005	9	6	N1	104	1410	93	0.5
2005	9	6	N2	120	1530	85	0.5
2005	9	6	N3	106	1520	73	0.5
2005	9	6	NC1	107	1550	104	0.5
2005	9	6	NC2	117	1580	89	0.5
2005	9	6	NC3	106	1420	72	0.5
2005	12	12	B02	48	830	5	1.1
2005	12	12	B04	32	780	6	1.2
2005	12	12	B06	39	920	20	1.1
2005	12	12	B09	52	1080	42	0.7
2005	12	12	G1	34	790	7	1.6
2005	12	12	G2	37	810	6	1.4
2005	12	12	G3	29	820	7	1.5

Year	Month	Day	Station	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)	Secchi Depth (m)
2005	12	12	GC1	31	810	6	1.4
2005	12	12	GC2	29	780	5	1.3
2005	12	12	GC3	31	800	5	1.5
2005	12	12	I1	33	820	7	1.2
2005	12	12	I2	33	790	7	1.3
2005	12	12	I3	33	760	6	1.3
2005	12	12	IC1	32	840	6	1.2
2005	12	12	IC2	34	820	6	1.2
2005	12	12	IC3	34	880	6	1.3
2005	12	12	N1	54	1140	26	0.7
2005	12	12	N2	54	1150	36	0.8
2005	12	12	N3	52	1130	36	0.8
2005	12	12	NC1	59	1250	34	0.7
2005	12	12	NC2	56	1100	36	0.8
2005	12	12	NC3	51	1180	33	0.8
2006	3	22	B02	62	1150	32	0.6
2006	3	22	B04	38	810	12	1.2
2006	3	22	B06	47	1320	30	0.9
2006	3	22	B09	83	1460	56	0.7
2006	3	22	G1	79	1450	52	0.6
2006	3	22	G2	66	1360	50	0.6
2006	3	22	G3	61	1390	50	0.6
2006	3	22	GC1	62	1220	35	0.8
2006	3	22	GC2	60	1320	48	0.7
2006	3	22	GC3	61	1300	45	0.6
2006	3	22	I1	44	840	15	0.7
2006	3	22	I2	48	880	14	0.7
2006	3	22	I3	35	840	12	0.8
2006	3	22	IC1	33	820	10	1.1
2006	3	22	IC2	35	830	12	1.1
2006	3	22	IC3	36	830	11	1.0
2006	3	22	N1	48	1260	31	0.7
2006	3	22	N2	54	1350	31	0.9
2006	3	22	N3	50	1160	32	0.7
2006	3	22	NC1	54	1180	32	0.8
2006	3	22	NC2	53	1190	36	0.9
2006	3	22	NC3	45	1220	31	0.9
2006	6	6	B02	74	1270	42	0.7
2006	6	6	B04	39	890	6	1.3
2006	6	6	B06	69	1610	51	0.8
2006	6	6	B09	77	1530	64	0.6
2006	6	6	G1	83	1710	63	0.7
2006	6	6	G2	94	1720	76	0.6
2006	6	6	G3	92	1690	74	0.6
2006	6	6	GC1	82	1780	63	0.5
2006	6	6	GC2	93	1720	77	0.6
2006	6	6	GC3	90	1630	73	0.7
2006	6	6	I1	26	890	5	.
2006	6	6	I2	40	890	14	.
2006	6	6	I3	25	780	5	.
2006	6	6	IC1	33	920	15	.
2006	6	6	IC2	31	930	7	.
2006	6	6	IC3	30	820	5	.

				Phosphorus (µg/L)	Nitrogen (µg/L)	(µg/L)	Depth (m)
2006	6	6	N1	76	1650	50	0.7
2006	6	6	N2	79	1580	54	0.6
2006	6	6	N3	79	1550	60	0.6
2006	6	6	NC1	81	1690	50	0.6
2006	6	6	NC2	81	1590	50	0.7
2006	6	6	NC3	78	1510	54	0.6

Year	Month	Day	Station	Total	Inorganic	Organic	Temperature	Dissolved

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1981	8	26	B06	12.0	.	.	28.9	11.2
1981	8	27	B04	2.0	.	.	27.8	9.5
1981	8	27	B09	.	.	.	20.4	11.6
1981	9	16	B02	2.0	.	.	27.8	5.4
1981	9	16	B04	5.0	.	.	28.6	10.6
1981	9	16	B06	17.0	.	.	28.5	8.4
1981	9	16	B09	.	.	.	27.5	8.5
1981	10	14	B02	5.0	.	.	23.6	7.4
1981	10	14	B04	0.0	.	.	24.0	10.0
1981	10	14	B06	8.0	.	.	28.5	12.5
1981	10	14	B09	.	.	.	28.4	11.9
1981	11	10	B02	5.0	.	.	21.7	6.9
1981	11	10	B04	0.0	.	.	21.7	9.4
1981	11	10	B06	25.0	.	.	24.1	7.6
1981	11	10	B09	.	.	.	28.4	7.8
1981	12	8	B02	16.0	.	.	16.9	9.0
1981	12	8	B04	0.0	.	.	17.1	8.5
1981	12	8	B06	13.0	.	.	21.4	7.2
1981	12	8	B09	.	.	.	24.2	7.6
1982	1	14	B02	6.5	.	.	13.9	9.6
1982	1	14	B04	0.0	.	.	14.0	6.6
1982	2	3	B02	6.0	.	.	19.5	9.2
1982	2	3	B04	0.0	.	.	19.9	6.9
1982	2	3	B06	18.0	.	.	16.8	7.5
1982	2	3	B09	.	.	.	21.1	6.6
1982	3	11	B02	15.7	.	.	20.4	9.2
1982	3	11	B04	0.0	.	.	20.2	7.6
1982	3	11	B06	15.0	.	.	18.4	7.9
1982	3	11	B09	.	.	.	16.8	5.5
1982	4	7	B02	6.0	.	.	22.0	7.8
1982	4	7	B04	0.0	.	.	23.7	7.7
1982	4	7	B06	27.0	.	.	19.6	7.6
1982	4	7	B09	.	.	.	18.5	8.7
1982	5	12	B02	9.0	.	.	24.8	8.0
1982	5	12	B04	0.0	.	.	26.0	5.9
1982	5	12	B06	24.0	.	.	21.5	7.7
1982	5	12	B09	.	.	.	19.9	8.1
1982	6	16	B02	10.0	.	.	30.2	8.5
1982	6	16	B04	0.0	.	.	30.2	7.2
1982	6	16	B06	19.0	.	.	26.6	9.1
1982	6	16	B09	.	.	.	21.7	7.6
1982	7	15	B02	14.0	.	.	31.4	5.7
1982	7	15	B04	4.0	.	.	31.0	8.5
1982	7	15	B06	17.0	.	.	29.8	9.2
1982	7	15	B09	.	.	.	27.3	9.1
1982	8	11	B02	30.0	.	.	29.8	6.3
1982	8	11	B04	9.0	.	.	30.1	8.9
1982	8	11	B06	26.0	.	.	30.6	8.4
1982	8	11	B09	.	.	.	29.5	9.5
1982	9	15	B02	43.3	.	.	26.4	5.8
1982	9	15	B04	0.0	.	.	26.6	7.9
1982	9	15	B06	15.0	.	.	29.4	6.9

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1982	9	15	B09	.	.	.	28.3	9.4
1982	10	12	B02	30.0	.	.	20.6	4.8
1982	10	12	B04	0.0	.	.	20.8	7.0
1982	10	13	B06	15.0	.	.	26.8	8.6
1982	10	13	B09	.	.	.	26.5	8.0
1982	11	3	B02	26.0	.	.	16.6	5.7
1982	11	3	B04	0.0	.	.	16.7	7.3
1982	11	3	B06	8.0	.	.	22.7	8.4
1982	11	3	B09	.	.	.	21.4	11.2
1982	12	8	B02	1.0	.	.	14.7	8.4
1982	12	8	B04	0.0	.	.	15.6	7.7
1982	12	8	B06	14.0	.	.	16.5	8.2
1982	12	8	B09	.	.	.	16.8	10.3
1983	1	12	B02	8.0	.	.	20.0	8.8
1983	1	12	B04	0.0	.	.	20.9	9.8
1983	1	12	B06	10.0	.	.	15.1	8.8
1983	1	12	B09	.	.	.	15.0	6.6
1983	2	8	B02	3.0	.	.	22.1	8.2
1983	2	8	B04	3.0	.	.	23.9	6.6
1983	2	8	B06	19.0	.	.	19.7	4.9
1983	2	8	B09	.	.	.	19.7	7.9
1983	3	8	B02	22.0	.	.	25.7	6.4
1983	3	8	B04	0.0	.	.	26.0	6.1
1983	3	8	B06	7.0	.	.	23.1	5.9
1983	3	8	B09	.	.	.	23.9	9.3
1983	4	12	B02	11.0	.	.	27.2	8.1
1983	4	12	B04	3.0	.	.	28.9	6.6
1983	4	12	B06	12.0	.	.	25.0	7.7
1983	4	12	B09	.	.	.	25.6	7.9
1983	5	10	B02	11.0	.	.	29.1	6.9
1983	5	10	B04	12.0	.	.	30.3	6.9
1983	5	10	B06	6.0	.	.	27.4	7.5
1983	5	10	B09	.	.	.	27.8	10.5
1983	6	15	B02	2.0	.	.	28.3	8.7
1983	6	15	B04	5.0	.	.	31.3	7.5
1983	6	15	B06	3.0	.	.	28.7	9.5
1983	6	15	B09	.	.	.	30.1	10.2
1983	7	12	B02	0.0	.	.	27.4	6.6
1983	7	12	B04	13.0	.	.	28.0	10.5
1983	7	12	B06	18.0	.	.	29.2	10.1
1983	7	12	B09	.	.	.	29.9	8.7
1983	8	17	B02	7.0	.	.	26.4	6.6
1983	8	17	B04	0.0	.	.	27.1	9.3
1983	8	17	B06	17.0	.	.	27.9	8.1
1983	8	17	B09	.	.	.	27.9	10.5
1983	9	14	B02	3.0	.	.	21.7	5.8
1983	9	14	B04	5.0	.	.	22.8	8.3
1983	9	14	B06	19.0	.	.	26.9	9.5
1983	9	14	B09	.	.	.	26.9	6.2
1983	10	12	B02	1.0	.	.	20.8	7.2
1983	10	12	B04	0.0	.	.	20.8	8.6
1983	10	12	B06	10.0	.	.	22.1	6.3

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1983	10	12	B09	.	.	.	22.3	13.6
1983	11	9	B02	3.0	.	.	13.8	7.4
1983	11	9	B04	0.0	.	.	13.8	6.6
1983	11	9	B06	14.0	.	.	20.0	9.3
1983	11	9	B09	.	.	.	20.3	8.5
1983	12	7	B02	15.0	.	.	13.7	9.2
1983	12	7	B04	0.0	.	.	13.8	8.1
1983	12	7	B06	26.0	.	.	13.5	7.1
1983	12	7	B09	.	.	.	13.5	10.7
1984	1	11	B02	9.0	.	.	20.1	10.1
1984	1	11	B04	0.0	.	.	20.0	7.6
1984	1	11	B06	21.0	.	.	13.5	8.1
1984	1	11	B09	.	.	.	13.3	14.1
1984	2	8	B02	14.0	.	.	21.6	8.1
1984	2	8	B04	6.0	.	.	22.3	6.0
1984	2	8	B06	27.0	.	.	19.3	7.9
1984	2	8	B09	.	.	.	18.9	7.7
1984	3	7	B02	5.0	.	.	27.5	8.0
1984	3	7	B04	0.0	.	.	25.9	9.0
1984	3	7	B06	8.0	.	.	21.3	6.1
1984	3	7	B09	.	.	.	21.9	8.0
1984	4	11	B02	19.0	.	.	28.5	7.7
1984	4	11	B04	3.0	.	.	31.2	6.6
1984	4	11	B06	9.0	.	.	26.5	7.6
1984	4	11	B09	.	.	.	26.1	12.8
1984	5	9	B02	1.0	.	.	28.3	11.4
1984	5	9	B04	0.0	.	.	29.2	7.7
1984	5	9	B06	6.0	.	.	27.4	11.5
1984	5	9	B09	.	.	.	29.0	11.0
1984	6	5	B02	4.0	.	.	29.7	6.0
1984	6	5	B04	0.0	.	.	30.4	10.0
1984	6	5	B06	9.0	.	.	28.7	8.9
1984	6	5	B09	.	.	.	28.7	10.8
1984	7	18	B02	4.0	.	.	26.8	6.4
1984	7	18	B04	.	.	.	.	.
1984	7	18	B06	.	.	.	.	.
1984	7	18	B09	.	.	.	31.5	10.7
1984	8	16	B02	2.0	.	.	23.8	7.2
1984	8	16	B04	0.0	.	.	30.4	9.6
1984	8	16	B06	17.0	.	.	30.8	9.5
1984	8	16	B09	.	.	.	28.5	10.2
1984	9	12	B02	7.0	.	.	19.4	7.3
1984	9	12	B04	0.0	.	.	24.1	8.9
1984	9	12	B06	.	.	.	.	.
1984	9	12	B09	.	.	.	23.8	13.5
1984	10	10	B02	5.0	.	.	18.4	8.8
1984	10	10	B04	0.0	.	.	20.1	11.2
1984	10	10	B06	12.0	.	.	27.2	10.3
1984	10	10	B09	.	.	.	19.6	4.9
1984	11	8	B02	8.0	.	.	15.2	13.0
1984	11	8	B04	3.0	.	.	18.4	10.3
1984	11	8	B06	12.0	.	.	23.6	8.4

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1984	11	8	B09	.	.	.	18.6	5.8
1984	12	14	B02	1.0	.	.	20.3	10.7
1984	12	14	B04	3.0	.	.	15.6	9.1
1984	12	14	B06	10.0	.	.	18.9	8.3
1984	12	14	B09	.	.	.	15.7	10.4
1985	1	10	B02	7.0	.	.	22.5	10.5
1985	1	10	B04	7.0	.	.	20.4	7.3
1985	1	10	B06	8.0	.	.	17.8	3.1
1985	1	10	B09	.	.	.	19.2	8.1
1985	2	6	B02	3.0	.	.	20.2	10.4
1985	2	6	B04	4.0	.	.	23.1	6.2
1985	2	6	B06	5.0	.	.	15.5	5.5
1985	2	6	B09	.	.	.	22.4	11.7
1985	3	6	B02	0.0	.	.	25.4	9.1
1985	3	6	B04	6.0	.	.	20.9	6.1
1985	3	6	B06	5.0	.	.	19.3	8.4
1985	3	6	B09	.	.	.	20.9	9.3
1985	4	10	B02	4.0	.	.	28.0	11.1
1985	4	10	B04	5.0	.	.	25.1	7.3
1985	4	10	B06	5.0	.	.	22.5	8.2
1985	4	10	B09	.	.	.	26.3	11.5
1985	5	8	B02	5.0	.	.	28.4	4.7
1985	5	8	B04	7.0	.	.	27.9	9.7
1985	5	8	B06	0.0	.	.	21.0	9.4
1985	5	8	B09	.	.	.	27.2	9.9
1985	6	13	B02	5.0	.	.	29.7	4.9
1985	6	13	B04	5.0	.	.	28.7	8.4
1985	6	13	B06	8.0	.	.	25.0	8.5
1985	6	13	B09	.	.	.	28.7	10.6
1985	8	13	B02	7.0	.	.	27.6	7.0
1985	8	13	B04	3.0	.	.	31.5	9.3
1985	8	13	B06	7.0	.	.	27.5	10.6
1985	8	13	B09	.	.	.	30.7	8.6
1985	9	11	B02	0.0	.	.	21.1	8.3
1985	9	11	B04	2.0	.	.	27.7	9.7
1985	9	11	B06	7.0	.	.	28.7	9.8
1985	9	11	B09	.	.	.	27.3	9.9
1985	10	16	B02	5.0	.	.	22.7	8.8
1985	10	16	B04	0.0	.	.	20.3	10.5
1985	10	16	B06	17.0	.	.	31.3	10.9
1985	10	16	B09	.	.	.	20.7	13.8
1985	11	6	B02	4.0	.	.	15.1	9.0
1985	11	6	B04	4.0	.	.	22.9	8.1
1985	11	6	B06	9.0	.	.	27.4	7.7
1985	11	6	B09	.	.	.	22.3	4.8
1985	12	3	B02	0.0	.	.	21.0	8.8
1985	12	3	B04	3.0	.	.	15.7	9.3
1985	12	3	B06	9.0	.	.	20.9	10.5
1985	12	3	B09	.	.	.	15.5	8.3
1986	1	15	B02	0.0	.	.	21.3	9.8
1986	1	15	B04	2.0	.	.	21.1	14.7
1986	1	15	B06	0.0	.	.	22.0	12.4

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1986	1	15	B09	.	.	.	20.1	7.4
1986	2	11	B02	3.0	.	.	21.4	8.2
1986	2	11	B04	0.0	.	.	21.4	12.9
1986	2	11	B06	5.0	.	.	15.3	10.2
1986	2	11	B09	.	.	.	19.3	9.9
1986	3	12	B02	5.0	.	.	25.7	9.6
1986	3	12	B04	0.0	.	.	20.6	7.4
1986	3	12	B06	7.0	.	.	20.2	10.1
1986	3	12	B09	.	.	.	20.9	9.8
1986	4	10	B02	4.0	.	.	35.5	8.6
1986	4	10	B04	0.0	.	.	26.9	7.4
1986	4	10	B06	0.0	.	.	20.5	7.5
1986	4	10	B09	.	.	.	28.9	11.4
1986	5	8	B02	7.0	.	.	32.6	8.7
1986	5	8	B04	3.0	.	.	33.4	9.3
1986	5	8	B06	13.0	.	.	20.7	10.3
1986	5	8	B09	.	.	.	34.4	12.4
1986	6	10	B02	8.0	.	.	29.3	7.7
1986	6	10	B04	0.0	.	.	33.2	8.2
1986	6	10	B06	16.0	.	.	27.8	7.7
1986	6	10	B09	.	.	.	30.2	11.0
1986	7	16	B02	5.0	.	.	29.0	8.7
1986	7	16	B04	0.0	.	.	29.8	11.0
1986	7	16	B06	3.0	.	.	34.2	10.6
1986	7	16	B09	.	.	.	29.7	10.3
1986	8	14	B02	6.0	.	.	25.1	9.1
1986	8	14	B04	3.0	.	.	29.5	11.2
1986	8	14	B06	9.0	.	.	32.6	11.4
1986	8	14	B09	.	.	.	29.7	11.2
1986	9	17	B02	0.0	.	.	20.9	10.3
1986	9	17	B04	0.0	.	.	29.6	2.9
1986	9	17	B06	12.0	.	.	29.4	10.7
1986	9	17	B09	.	.	.	29.0	5.0
1986	10	15	B04	4.0	.	.	25.8	9.6
1986	10	15	B06	11.0	.	.	29.9	8.7
1986	10	15	B09	.	.	.	24.8	10.6
1986	11	18	B02	0.0	.	.	21.8	8.4
1986	11	18	B04	3.0	.	.	21.8	9.0
1986	11	18	B06	7.0	.	.	29.5	9.5
1986	11	18	B09	.	.	.	21.3	10.1
1986	12	16	B02	0.0	.	.	19.7	6.5
1986	12	16	B04	2.0	.	.	22.3	8.3
1986	12	16	B06	11.0	.	.	24.6	6.2
1986	12	16	B09	.	.	.	21.7	10.2
1987	1	20	B02	0.0	.	.	21.9	9.8
1987	1	20	B04	0.0	.	.	28.3	7.5
1987	1	20	B06	0.0	.	.	21.3	9.6
1987	1	20	B09	.	.	.	20.2	8.0
1987	2	25	B06	5.0	.	.	21.2	8.5
1987	2	25	B09	.	.	.	26.2	12.4
1987	4	22	B06	15.0	.	.	20.2	9.2
1987	4	22	B09	.	.	.	28.2	8.4

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1987	6	10	B06	9.0	.	.	25.7	7.9
1987	6	10	B09	.	.	.	29.5	7.3
1987	9	16	B04	14.0	.	.	20.8	10.4
1987	9	16	B06	18.0	.	.	29.1	12.2
1987	9	16	B09	.	.	.	20.3	12.2
1987	10	15	B02	0.0	.	.	17.1	8.1
1987	10	15	B04	0.0	.	.	22.5	8.1
1987	10	15	B06	16.0	.	.	30.0	7.6
1987	10	15	B09	.	.	.	21.7	8.3
1987	11	9	B02	3.0	.	.	16.3	9.5
1987	11	9	B04	0.0	.	.	17.6	8.7
1987	11	9	B06	10.0	.	.	18.2	8.5
1987	11	9	B09	.	.	.	17.5	7.7
1987	12	9	B02	4.0	.	.	19.2	8.3
1987	12	9	B04	2.0	.	.	16.6	7.6
1987	12	9	B06	18.0	.	.	22.2	10.9
1987	12	9	B09	.	.	.	16.4	7.5
1988	1	5	B02	7.0	.	.	19.7	8.1
1988	1	5	B04	0.0	.	.	18.0	6.3
1988	1	5	B06	3.0	.	.	17.6	5.2
1988	1	5	B09	.	.	.	17.2	5.6
1988	2	2	B02	0.0	.	.	23.8	7.0
1988	2	2	B04	7.0	.	.	19.8	7.0
1988	2	2	B06	12.0	.	.	16.2	6.6
1988	2	2	B09	.	.	.	19.5	6.7
1988	3	7	B02	0.0	.	.	26.2	5.9
1988	3	7	B04	3.0	.	.	23.5	8.8
1988	3	7	B06	6.0	.	.	16.9	8.0
1988	3	7	B09	.	.	.	23.1	10.1
1988	4	5	B02	0.0	.	.	27.0	6.6
1988	4	5	B04	0.0	.	.	24.9	6.5
1988	4	5	B06	4.0	.	.	19.0	4.7
1988	4	5	B09	.	.	.	26.2	10.1
1988	5	10	B02	0.0	.	.	27.6	5.8
1988	5	10	B04	0.0	.	.	27.1	6.6
1988	5	10	B06	8.0	.	.	23.1	7.3
1988	5	10	B09	.	.	.	26.7	8.2
1988	6	8	B02	0.0	.	.	29.5	5.1
1988	6	8	B04	0.0	.	.	27.9	8.6
1988	6	8	B06	11.0	.	.	26.3	8.2
1988	6	8	B09	.	.	.	27.3	10.2
1988	7	6	B02	0.0	.	.	28.8	7.5
1988	7	6	B04	0.0	.	.	30.0	9.3
1988	7	6	B06	7.0	.	.	26.2	8.7
1988	7	6	B09	.	.	.	29.4	12.0
1988	8	4	B02	3.0	.	.	22.8	7.3
1988	8	4	B04	36.0	.	.	29.5	9.0
1988	8	4	B06	23.0	.	.	27.7	10.6
1988	8	4	B09	.	.	.	29.2	8.8
1988	9	27	B02	3.0	.	.	22.1	8.3
1988	9	27	B04	7.0	.	.	22.5	8.7
1988	9	27	B06	14.0	.	.	29.8	10.1

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1988	9	27	B09	.	.	.	22.2	9.4
1988	10	13	B02	0.0	.	.	16.7	7.7
1988	10	13	B04	2.0	.	.	22.8	9.1
1988	10	13	B06	13.0	.	.	29.3	11.4
1988	10	13	B09	.	.	.	22.4	8.0
1988	11	9	B02	0.0	.	.	21.3	7.7
1988	11	9	B04	8.0	.	.	17.6	8.5
1988	11	9	B06	11.0	.	.	22.7	8.6
1988	11	9	B09	.	.	.	17.1	12.4
1988	12	6	B02	5.0	.	.	20.3	10.0
1988	12	6	B04	86.0	.	.	21.2	7.0
1988	12	6	B06	5.0	.	.	22.2	8.1
1988	12	6	B09	.	.	.	20.8	9.9
1989	1	3	B02	0.0	.	.	19.7	8.2
1989	1	3	B04	19.0	.	.	20.4	7.1
1989	1	3	B06	11.0	.	.	17.0	6.1
1989	1	3	B09	.	.	.	19.9	8.3
1989	2	14	B02	0.0	.	.	24.5	5.9
1989	2	14	B04	13.0	.	.	19.2	9.4
1989	2	14	B06	6.0	.	.	21.4	8.1
1989	2	14	B09	.	.	.	18.9	7.3
1989	3	14	B02	5.0	.	.	25.0	6.8
1989	3	14	B04	13.0	.	.	24.2	7.2
1989	3	14	B06	16.0	.	.	20.8	8.0
1989	3	14	B09	.	.	.	23.5	10.6
1989	4	11	B02	0.0	.	.	27.3	9.0
1989	4	11	B04	18.0	.	.	25.1	7.6
1989	4	11	B06	7.0	.	.	19.5	7.2
1989	4	11	B09	.	.	.	24.5	10.3
1989	5	9	B02	0.0	.	.	31.2	9.0
1989	5	9	B04	6.0	.	.	27.1	7.0
1989	5	9	B06	10.0	.	.	21.7	6.1
1989	5	9	B09	.	.	.	27.1	8.8
1989	6	8	B02	5.0	.	.	30.3	5.4
1989	6	8	B04	14.0	.	.	32.7	10.0
1989	6	8	B06	8.0	.	.	24.8	11.2
1989	6	8	B09	.	.	.	32.1	10.6
1989	7	11	B02	0.0	.	.	29.9	5.4
1989	7	11	B04	13.0	.	.	29.7	10.1
1989	7	11	B06	7.0	.	.	27.6	11.5
1989	7	11	B09	.	.	.	29.8	8.7
1989	8	15	B02	9.0	.	.	26.2	11.6
1989	8	15	B04	18.0	.	.	30.4	8.3
1989	8	15	B06	0.0	.	.	30.6	8.9
1989	8	15	B09	.	.	.	29.6	9.3
1989	9	12	B02	8.0	.	.	25.1	10.6
1989	9	12	B04	30.0	.	.	26.4	8.6
1989	9	12	B06	0.0	.	.	29.8	10.9
1989	9	12	B09	.	.	.	26.0	9.3
1989	10	11	B02	0.0	.	.	15.8	8.2
1989	10	11	B04	41.6	.	.	24.9	8.4
1989	10	11	B06	0.0	.	.	30.0	9.3

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1989	10	11	B09	.	.	.	23.7	8.0
1989	11	7	B02	0.0	.	.	16.3	8.8
1989	11	7	B04	40.0	.	.	15.9	9.2
1989	11	7	B06	3.0	.	.	25.3	8.2
1989	11	7	B09	.	.	.	15.7	6.7
1989	12	5	B02	0.0	.	.	20.1	8.6
1989	12	5	B04	46.0	.	.	16.5	7.8
1989	12	5	B06	4.0	.	.	24.1	9.7
1989	12	5	B09	.	.	.	15.8	9.6
1990	1	16	B02	0.0	.	.	23.7	9.0
1990	1	16	B04	6.0	.	.	19.8	9.1
1990	1	16	B06	3.0	.	.	14.2	8.0
1990	1	16	B09	.	.	.	19.8	9.4
1990	2	13	B02	3.0	.	.	21.5	9.9
1990	2	13	B04	98.0	.	.	24.0	7.0
1990	2	13	B06	5.0	.	.	15.7	6.4
1990	2	13	B09	.	.	.	23.5	8.7
1990	3	13	B02	3.0	.	.	28.0	6.8
1990	3	13	B04	8.0	.	.	21.4	8.6
1990	3	13	B06	3.0	.	.	19.6	8.8
1990	3	13	B09	.	.	.	21.8	7.5
1990	4	10	B02	13.0	.	.	30.2	4.7
1990	4	10	B04	18.0	.	.	28.6	8.6
1990	4	10	B06	6.0	.	.	24.3	7.3
1990	4	10	B09	.	.	.	26.7	9.1
1990	5	1	B02	14.0	.	.	29.3	6.5
1990	5	1	B04	17.0	.	.	29.3	7.4
1990	5	1	B06	14.0	.	.	21.6	8.6
1990	5	1	B09	.	.	.	30.4	9.5
1990	6	5	B02	7.0	.	.	29.7	7.3
1990	6	5	B04	15.0	.	.	29.4	7.1
1990	6	5	B06	11.0	.	.	26.4	7.3
1990	6	5	B09	.	.	.	29.4	10.8
1990	7	2	B02	11.0	.	.	29.7	8.8
1990	7	2	B04	13.0	.	.	33.2	9.8
1990	7	2	B06	6.0	.	.	30.6	9.4
1990	7	2	B09	.	.	.	32.6	9.5
1990	8	8	B02	3.0	.	.	27.6	7.3
1990	8	8	B04	33.0	.	.	30.1	9.2
1990	8	8	B06	16.0	.	.	29.6	10.9
1990	8	8	B09	.	.	.	29.7	9.8
1990	9	4	B02	4.0	.	.	24.0	10.7
1990	9	4	B04	11.0	.	.	27.5	7.6
1990	9	4	B06	2.0	.	.	32.3	7.7
1990	9	4	B09	.	.	.	28.1	7.9
1990	10	23	B02	0.0	.	.	18.1	8.1
1990	10	23	B04	2.0	.	.	24.1	9.3
1990	10	23	B06	4.0	.	.	29.5	7.9
1990	10	23	B09	.	.	.	24.5	6.2
1990	11	7	B02	3.0	.	.	22.4	6.3
1990	11	7	B04	15.0	.	.	17.7	6.0
1990	11	7	B06	3.0	.	.	28.0	9.3

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1990	11	7	B09	.	.	.	18.0	8.5
1990	12	5	B02	0.0	.	.	16.9	5.8
1990	12	5	B04	5.0	.	.	22.2	7.1
1990	12	5	B06	0.0	.	.	24.2	7.2
1990	12	5	B09	.	.	.	21.8	9.2
1991	1	9	B02	4.0	.	.	26.2	6.1
1991	1	9	B04	10.0	.	.	16.6	7.6
1991	1	9	B06	3.0	.	.	17.9	8.2
1991	1	9	B09	.	.	.	17.3	9.7
1991	2	12	B02	11.0	.	.	28.7	6.0
1991	2	12	B04	5.0	.	.	26.2	8.0
1991	2	12	B06	2.0	.	.	22.1	8.8
1991	2	12	B09	.	.	.	17.7	10.9
1991	3	13	B09	.	.	.	23.9	9.7
1991	4	9	B02	4.0	.	.	27.7	8.0
1991	4	9	B04	25.0	.	.	29.2	7.0
1991	4	9	B06	6.0	.	.	16.7	9.4
1991	4	9	B09	.	.	.	28.9	9.2
1991	5	6	B02	6.0	.	.	32.1	8.1
1991	5	6	B04	15.0	.	.	29.8	9.1
1991	5	6	B06	4.0	.	.	25.3	10.6
1991	5	6	B09	.	.	.	28.6	7.6
1991	6	3	B02	6.0	.	.	29.3	8.7
1991	6	3	B04	16.0	.	.	33.2	8.3
1991	6	3	B06	3.0	.	.	29.1	9.1
1991	6	3	B09	.	.	.	32.0	8.9
1991	7	24	B02	0.0	.	.	19.3	10.8
1991	7	24	B04	12.0	.	.	29.1	7.9
1991	7	24	B06	13.0	.	.	28.7	8.8
1991	7	24	B09	.	.	.	29.0	7.7
1991	8	12	B02	0.0	.	.	18.5	8.5
1991	8	12	B04	22.0	.	.	20.0	8.3
1991	8	12	B06	5.0	.	.	31.2	8.0
1991	8	12	B09	.	.	.	19.7	7.8
1991	9	9	B02	0.0	.	.	17.8	8.7
1991	9	9	B04	21.0	.	.	19.2	6.8
1991	9	9	B06	3.0	.	.	29.2	8.1
1991	9	9	B09	.	.	.	18.7	8.0
1991	10	8	B02	0.0	.	.	18.3	8.4
1991	11	5	B02	0.0	.	.	22.2	7.1
1991	11	5	B04	22.0	.	.	17.9	6.5
1991	11	5	B06	0.0	.	.	19.3	8.2
1991	11	5	B09	.	.	.	17.9	8.7
1991	12	16	B02	0.0	.	.	27.6	6.1
1991	12	16	B04	20.0	.	.	18.6	6.8
1991	12	16	B06	7.0	.	.	17.9	7.8
1991	12	16	B09	.	.	.	18.4	9.3
1992	1	7	B02	3.0	.	.	31.3	7.0
1992	1	7	B04	13.0	.	.	22.6	6.5
1992	1	7	B06	0.0	.	.	18.2	8.4
1992	1	7	B09	.	.	.	22.2	9.3
1992	2	13	B02	11.0	.	.	30.1	7.3

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1992	2	13	B04	15.0	.	.	25.9	10.1
1992	2	13	B06	1.0	.	.	18.7	8.8
1992	2	13	B09	.	.	.	26.1	9.7
1992	3	31	B02	13.0	.	.	29.7	8.9
1992	3	31	B04	7.0	.	.	27.4	9.6
1992	3	31	B06	5.0	.	.	21.9	8.9
1992	3	31	B09	.	.	.	27.0	10.3
1992	4	22	B04	10.0	.	.	31.6	8.0
1992	4	22	B06	3.0	.	.	26.2	9.3
1992	4	22	B09	.	.	.	32.2	9.5
1992	6	4	B02	9.0	.	.	22.8	8.8
1992	6	4	B04	13.0	.	.	30.2	10.4
1992	6	4	B06	2.0	.	.	27.4	8.8
1992	6	4	B09	.	.	.	31.7	12.0
1992	6	23	B09	.	.	.	30.4	9.1
1992	7	21	B02	4.0	.	.	15.7	14.6
1992	7	21	B04	1.0	.	.	31.9	9.0
1992	7	21	B06	5.0	.	.	32.5	9.3
1992	7	21	B09	.	.	.	32.6	9.8
1992	8	12	B02	8.0	.	.	18.4	6.8
1992	8	12	B04	11.0	.	.	28.2	9.5
1992	8	12	B06	5.0	.	.	30.4	10.9
1992	8	12	B09	.	.	.	21.8	10.0
1992	9	15	B02	8.0	.	.	17.6	6.3
1992	9	15	B04	4.0	.	.	22.6	10.7
1992	9	15	B06	0.0	.	.	31.7	9.4
1992	9	15	B09	.	.	.	16.3	8.4
1992	9	16	B04	2.0	.	.	16.7	9.8
1992	10	21	B02	2.0	.	.	18.6	5.2
1992	10	21	B04	7.0	.	.	19.5	9.3
1992	10	21	B06	8.0	.	.	22.8	8.5
1992	10	21	B09	.	.	.	19.3	6.4
1992	12	15	B02	0.0	.	.	30.4	5.7
1992	12	15	B04	4.0	.	.	18.6	6.2
1992	12	15	B06	.	.	.	16.2	7.9
1992	12	15	B09	.	.	.	17.6	9.6
1993	1	20	B02	4.0	.	.	31.2	8.9
1993	1	20	B04	11.0	.	.	18.7	5.9
1993	1	20	B06	.	.	.	19.2	8.3
1993	1	20	B09	.	.	.	18.3	10.1
1993	2	23	B02	3.0	.	.	29.6	8.7
1993	2	23	B04	6.0	.	.	24.8	5.5
1993	2	23	B06	.	.	.	17.4	5.8
1993	2	23	B09	.	.	.	23.8	9.1
1993	3	22	B02	5.0	.	.	29.2	7.1
1993	3	22	B04	15.0	.	.	29.6	9.3
1993	3	22	B06	.	.	.	18.4	9.9
1993	3	22	B09	.	.	.	29.0	8.0
1993	4	27	B04	28.0	.	.	33.8	8.1
1993	4	27	B06	.	.	.	24.2	9.3
1993	4	27	B09	.	.	.	31.9	10.0
1993	5	18	B02	11.0	.	.	24.1	5.8

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1993	5	18	B04	13.0	.	.	32.0	7.4
1993	5	18	B06	.	.	.	29.6	8.3
1993	5	18	B09	.	.	.	31.5	8.5
1993	6	22	B04	13.0	.	.	29.8	6.4
1993	6	22	B06	.	.	.	31.0	7.1
1993	6	22	B09	.	.	.	30.2	7.9
1993	7	27	B02	0.0	.	.	14.9	8.5
1993	7	27	B04	11.0	.	.	30.5	6.8
1993	7	27	B06	.	.	.	31.2	8.0
1993	7	27	B09	.	.	.	31.2	7.5
1993	8	17	B02	0.0	.	.	16.4	5.5
1993	8	17	B04	8.0	.	.	24.8	7.6
1993	8	17	B06	.	.	.	29.9	7.7
1993	8	17	B09	.	.	.	25.0	0.6
1993	9	22	B02	3.0	.	.	21.8	10.1
1993	9	22	B04	7.0	.	.	14.3	5.4
1993	9	22	B06	.	.	.	31.2	7.2
1993	9	22	B09	.	.	.	14.9	8.5
1993	10	27	B02	3.0	.	.	23.2	5.1
1993	10	27	B04	10.0	.	.	17.5	5.4
1993	10	27	B06	.	.	.	24.8	6.4
1993	10	27	B09	.	.	.	18.0	9.3
1993	12	16	B02	3.0	.	.	24.8	4.3
1993	12	16	B04	15.0	.	.	22.2	5.3
1993	12	16	B06	.	.	.	14.8	6.3
1993	12	16	B09	.	.	.	21.4	9.0
1994	1	27	B02	2.0	.	.	26.3	5.1
1994	1	27	B04	8.0	.	.	23.4	5.0
1994	1	27	B06	.	.	.	16.2	8.1
1994	1	27	B09	.	.	.	23.3	8.3
1994	2	23	B02	8.0	.	.	33.1	5.7
1994	2	23	B04	10.0	.	.	26.8	9.2
1994	2	23	B06	.	.	.	21.0	8.1
1994	2	23	B09	.	.	.	28.5	9.7
1994	3	24	B02	5.0	.	.	28.1	5.6
1994	3	24	B04	11.0	.	.	33.3	8.1
1994	3	24	B06	.	.	.	22.6	8.0
1994	3	24	B09	.	.	.	32.5	8.6
1994	4	20	B09	.	.	.	28.8	9.3
1994	4	21	B02	5.0	.	.	25.2	7.5
1994	4	21	B04	3.0	.	.	28.9	7.8
1994	4	21	B06	.	.	.	26.4	9.6
1994	5	19	B02	1.0	.	.	23.6	8.6
1994	5	19	B04	4.0	.	.	28.6	8.9
1994	5	19	B06	.	.	.	33.7	9.3
1994	5	19	B09	.	.	.	28.3	8.8
1994	6	16	B02	0.0	.	.	25.0	7.6
1994	6	16	B04	3.0	.	.	26.1	8.5
1994	6	16	B06	.	.	.	28.7	8.5
1994	6	16	B09	.	.	.	27.7	8.4
1994	7	28	B02	3.0	.	.	22.8	8.6
1994	7	28	B04	4.0	.	.	24.0	10.9

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1994	7	28	B06	.	.	.	28.9	8.4
1994	7	28	B09	.	.	.	24.8	8.6
1994	8	25	B02	3.0	.	.	15.4	9.3
1994	8	25	B04	0.0	.	.	27.1	8.4
1994	8	25	B06	.	.	.	26.5	8.1
1994	8	25	B09	.	.	.	25.3	10.5
1994	9	21	B09	.	.	.	24.1	5.7
1994	9	22	B02	3.0	.	.	14.5	7.6
1994	9	22	B04	5.0	.	.	23.8	9.1
1994	9	22	B06	.	.	.	24.4	10.5
1994	10	20	B02	5.0	.	.	19.8	9.0
1994	10	20	B04	4.0	.	.	15.6	4.9
1994	10	20	B06	.	.	.	24.8	12.0
1994	10	20	B09	.	.	.	16.3	6.7
1994	11	8	B02	.	.	.	.	.
1994	11	8	B04	.	.	.	.	.
1994	11	8	B06	.	.	.	.	.
1994	11	8	B09	.	.	.	.	.
1994	12	6	B02	0.0	.	.	22.6	10.8
1994	12	6	B04	14.0	.	.	13.6	6.3
1994	12	6	B06	.	.	.	23.8	7.6
1994	12	6	B09	.	.	.	14.5	7.3
1995	1	5	B02	0.0	.	.	24.3	4.9
1995	1	5	B04	10.0	.	.	19.9	8.0
1995	1	5	B06	.	.	.	15.4	6.6
1995	1	5	B09	.	.	.	20.1	7.8
1995	2	2	B02	8.0	.	.	28.9	6.2
1995	2	2	B04	0.0	.	.	25.2	7.0
1995	2	2	B06	.	.	.	15.5	7.6
1995	2	2	B09	.	.	.	21.7	9.3
1995	3	2	B02	0.0	.	.	26.9	6.7
1995	3	2	B04	0.0	.	.	23.7	10.2
1995	3	2	B06	.	.	.	19.9	8.1
1995	3	2	B09	.	.	.	24.3	10.4
1995	3	22	B02	4.0	.	.	33.3	7.0
1995	3	22	B04	0.0	.	.	29.1	8.5
1995	3	22	B06	.	.	.	21.9	10.5
1995	3	22	B09	.	.	.	28.2	9.8
1995	4	27	B02	8.0	.	.	29.5	10.0
1995	4	27	B04	0.0	.	.	29.4	8.1
1995	4	27	B09	.	.	.	26.6	10.1
1995	5	24	B02	8.0	.	.	28.2	8.6
1995	5	24	B04	3.0	.	.	28.2	7.4
1995	5	24	B06	.	.	.	28.1	10.8
1995	5	24	B09	.	.	.	31.3	8.6
1995	6	27	B02	4.0	.	.	23.9	8.2
1995	6	27	B06	.	.	.	27.0	9.2
1995	6	27	B09	.	.	.	29.9	9.2
1995	7	24	B02	6.7	.	.	21.5	3.4
1995	7	24	B06	.	.	.	33.1	7.1
1995	7	24	B09	.	.	.	29.0	8.5
1995	8	23	B09	.	.	.	27.5	9.1

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1995	9	13	B02	1.0	.	.	12.0	8.7
1995	9	13	B04	8.0	.	.	24.3	7.0
1995	9	13	B06	.	.	.	30.7	8.6
1995	9	13	B09	.	.	.	24.1	9.6
1995	10	10	B02	2.0	.	.	15.9	6.3
1995	10	10	B04	5.0	.	.	22.7	7.5
1995	10	10	B06	.	.	.	28.0	8.2
1995	10	10	B09	.	.	.	21.6	9.8
1995	11	7	B02	.	.	.	.	.
1995	11	7	B04	.	.	.	.	.
1995	11	7	B06	.	.	.	.	.
1995	11	7	B09	.	.	.	.	.
1995	12	5	B02	1.0	.	.	21.5	7.6
1995	12	5	B04	3.0	.	.	12.2	7.6
1995	12	5	B06	.	.	.	23.8	8.6
1995	12	5	B09	.	.	.	12.2	11.0
1996	1	9	B02	4.0	.	.	28.0	5.6
1996	1	9	B04	5.0	.	.	16.6	9.0
1996	1	9	B06	.	.	.	22.2	10.0
1996	1	9	B09	.	.	.	15.9	10.7
1996	2	12	B02	.	.	.	.	.
1996	2	12	B04	.	.	.	.	.
1996	2	12	B06	.	.	.	.	.
1996	2	12	B09	.	.	.	.	.
1996	4	9	B02	.	.	.	.	.
1996	4	9	B04	.	.	.	.	.
1996	4	9	B06	.	.	.	.	.
1996	4	9	B09	.	.	.	.	.
1996	5	6	B02	3.0	.	.	27.9	6.9
1996	5	6	B04	6.0	.	.	22.6	9.3
1996	5	6	B06	.	.	.	12.1	10.0
1996	5	6	B09	.	.	.	22.2	5.0
1996	6	12	B02	.	.	.	.	.
1996	6	12	B04	.	.	.	.	.
1996	6	12	B06	.	.	.	.	.
1996	6	12	B09	.	.	.	.	.
1996	8	6	B09	.	.	.	27.1	11.1
1996	8	7	B02	3.0	.	.	27.8	9.0
1996	8	7	B04	6.0	.	.	29.8	10.1
1996	8	7	B06	.	.	.	16.1	11.4
1996	9	24	B02	4.0	.	.	31.8	10.0
1996	9	24	B04	4.0	.	.	28.6	9.2
1996	9	24	B06	.	.	.	23.0	10.3
1996	9	24	B09	.	.	.	28.1	9.2
1996	10	29	B02	11.0	.	.	27.6	9.1
1996	11	21	B04	0.0	.	.	32.1	4.2
1996	11	21	B06	.	.	.	27.7	5.1
1996	11	21	B09	.	.	.	29.6	7.7
1996	12	18	B02	20.0	.	.	25.7	5.1
1996	12	18	B04	3.0	.	.	28.6	8.8
1996	12	18	B06	.	.	.	28.5	10.3
1996	12	18	B09	.	.	.	28.1	8.8

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1997	2	5	B02	26.0	.	.	18.1	8.8
1997	2	5	B04	8.0	.	.	22.3	10.0
1997	2	5	B06	.	.	.	30.6	9.2
1997	2	5	B09	.	.	.	21.8	9.1
1997	3	5	B02	16.0	.	.	18.7	9.9
1997	3	5	B04	8.0	.	.	19.1	6.8
1997	3	5	B06	.	.	.	28.0	7.4
1997	3	5	B09	.	.	.	18.5	9.4
1997	4	1	B02	24.0	.	.	25.2	8.6
1997	4	1	B04	17.0	.	.	20.3	7.5
1997	4	1	B06	.	.	.	22.1	8.5
1997	4	1	B09	.	.	.	18.2	9.1
1997	4	30	B02	0.0	.	.	23.9	7.6
1997	4	30	B04	14.0	.	.	25.0	7.7
1997	4	30	B06	.	.	.	18.4	9.1
1997	4	30	B09	.	.	.	24.5	9.9
1997	5	29	B02	.	.	.	.	.
1997	5	29	B04	.	.	.	.	.
1997	5	29	B06	.	.	.	.	.
1997	5	29	B09	.	.	.	.	.
1997	7	23	B02	4.0	.	.	24.2	7.1
1997	7	23	B04	7.0	.	.	24.8	7.6
1997	7	23	B06	.	.	.	.	.
1997	7	23	B09	.	.	.	23.5	8.4
1997	8	19	B02	.	.	.	.	.
1997	8	19	B04	.	.	.	.	.
1997	8	19	B06	.	.	.	.	.
1997	8	19	B09	.	.	.	.	.
1997	9	25	B04	9.0	.	.	24.7	8.3
1997	10	15	B02	4.0	.	.	31.2	9.0
1997	10	15	B04	6.0	.	.	31.8	7.2
1997	10	15	B06	.	.	.	19.3	9.9
1997	10	15	B09	.	.	.	23.7	6.9
1998	1	7	B02	18.0	.	.	32.7	8.0
1998	1	7	B04	8.0	.	.	33.1	6.9
1998	1	7	B06	.	.	.	24.5	9.5
1998	1	7	B09	.	.	.	30.1	10.9
1998	3	12	B02	13.0	.	.	26.3	10.1
1998	3	12	B04	13.0	.	.	29.7	8.3
1998	3	12	B06	.	.	.	23.5	10.7
1998	3	12	B09	.	.	.	31.9	8.0
1998	4	29	B02	12.0	.	.	19.9	9.7
1998	4	29	B04	3.0	.	.	26.0	6.7
1998	4	29	B06	.	.	.	26.7	7.3
1998	4	29	B09	.	.	.	25.5	6.1
1998	5	20	B02	5.0	.	.	16.3	6.9
1998	5	20	B04	0.0	.	.	20.2	9.5
1998	5	20	B06	.	.	.	31.7	6.4
1998	5	20	B09	.	.	.	19.1	9.6
1998	6	17	B02	1.0	.	.	25.7	11.6
1998	6	17	B04	9.0	.	.	17.1	7.5
1998	6	17	B06	.	.	.	32.2	10.0

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1998	6	17	B09	.	.	.	16.4	10.7
1998	7	15	B02	2.0	.	.	30.0	7.6
1998	7	15	B04	11.0	.	.	25.3	4.4
1998	7	15	B06	.	.	.	25.6	7.2
1998	7	15	B09	.	.	.	23.8	10.1
1998	8	12	B02	1.0	.	.	32.9	3.8
1998	8	12	B04	20.0	.	.	28.5	7.3
1998	8	12	B06	.	.	.	19.3	6.9
1998	8	12	B09	.	.	.	31.2	10.0
1998	9	10	B02	4.0	.	.	29.5	6.9
1998	9	10	B04	10.0	.	.	34.2	9.7
1998	9	10	B06	.	.	.	16.9	9.1
1998	9	10	B09	.	.	.	33.2	8.6
1998	10	14	B02	4.0	.	.	33.1	9.0
1998	10	14	B04	9.0	.	.	29.2	8.4
1998	10	14	B06	.	.	.	24.6	10.1
1998	10	14	B09	.	.	.	29.4	7.2
1998	11	19	B02	2.0	.	.	28.7	8.1
1998	11	19	B04	8.0	.	.	34.7	9.2
1998	11	19	B06	.	.	.	29.7	9.5
1998	11	19	B09	.	.	.	32.6	8.5
1999	1	13	B02	5.0	.	.	27.6	9.3
1999	1	13	B04	6.0	.	.	28.6	7.1
1999	1	13	B06	.	.	.	32.9	9.3
1999	1	13	B09	.	.	.	28.5	6.9
1999	2	9	B02	5.0	.	.	24.6	9.0
1999	2	9	B04	8.0	.	.	28.0	8.2
1999	2	9	B06	.	.	.	29.0	8.6
1999	2	9	B09	.	.	.	28.4	7.7
1999	3	10	B02	9.0	.	.	15.4	7.7
1999	3	10	B04	4.0	.	.	24.8	8.4
1999	3	10	B06	.	.	.	31.5	7.1
1999	3	10	B09	.	.	.	24.1	8.3
1999	4	7	B02	0.0	.	.	23.3	6.1
1999	4	7	B04	18.0	.	.	16.3	6.4
1999	4	7	B06	.	.	.	28.7	8.1
1999	4	7	B09	.	.	.	16.5	9.5
1999	6	8	B02	5.0	.	.	20.4	6.2
1999	6	8	B04	8.0	.	.	22.3	5.9
1999	6	8	B06	.	.	.	28.4	6.9
1999	6	8	B09	.	.	.	24.0	9.2
1999	7	14	B02	10.0	.	.	27.4	5.3
1999	7	14	B04	15.0	.	.	20.1	7.9
1999	7	14	B06	.	.	.	24.8	7.2
1999	7	14	B09	.	.	.	20.5	9.3
1999	8	11	B02	3.0	.	.	27.1	7.9
1999	8	11	B04	13.0	.	.	27.0	8.1
1999	8	11	B06	.	.	.	16.4	9.0
1999	8	11	B09	.	.	.	26.3	9.4
1999	9	9	B02	3.0	.	.	31.6	7.9
1999	9	9	B04	8.0	.	.	26.9	7.4
1999	9	9	B06	.	.	.	22.7	9.5

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
1999	9	9	B09	.	.	.	26.5	8.3
1999	10	14	B02	3.0	.	.	30.0	7.6
1999	10	14	B04	3.0	.	.	32.1	7.1
1999	10	14	B06	.	.	.	20.0	9.0
1999	10	14	B09	.	.	.	30.9	8.3
1999	11	9	B09	.	.	.	29.2	7.4
1999	12	7	B02	4.0	.	.	26.0	7.1
1999	12	7	B04	3.0	.	.	29.7	6.9
1999	12	7	B06	.	.	.	26.6	8.6
1999	12	7	B09	.	.	.	26.3	5.4
2000	1	5	B02	1.0	.	.	17.6	7.9
2000	1	5	B04	0.0	.	.	26.4	7.5
2000	1	5	B06	.	.	.	26.8	7.8
2000	1	5	B09	.	.	.	20.1	10.1
2000	2	2	B02	0.0	.	.	17.9	7.2
2000	2	2	B04	0.0	.	.	18.3	7.3
2000	2	2	B06	.	.	.	31.9	7.5
2000	2	2	B09	.	.	.	17.5	8.9
2000	3	1	B02	2.0	.	.	14.0	7.7
2000	3	1	B04	5.0	.	.	18.0	8.1
2000	3	1	B06	.	.	.	29.0	7.5
2000	3	1	B09	.	.	.	16.5	10.0
2000	3	29	B02	1.0	.	.	20.5	8.2
2000	3	29	B04	0.0	.	.	14.1	9.3
2000	3	29	B06	.	.	.	26.7	8.6
2000	3	29	B09	.	.	.	13.5	5.3
2000	4	27	B02	0.0	.	.	22.6	9.4
2000	4	27	B04	5.0	.	.	20.7	8.9
2000	4	27	B06	.	.	.	17.7	9.5
2000	4	27	B09	.	.	.	21.1	8.2
2000	5	25	B02	2.0	.	.	23.8	8.7
2000	5	25	B04	8.0	.	.	22.4	9.0
2000	5	25	B06	.	.	.	17.6	10.4
2000	5	25	B09	.	.	.	22.4	10.1
2000	6	29	B02	0.0	.	.	28.7	8.3
2000	6	29	B04	15.0	.	.	24.3	8.9
2000	6	29	B06	.	.	.	13.9	4.6
2000	7	26	B02	0.0	.	.	23.2	8.7
2000	7	26	B04	15.0	.	.	28.0	5.3
2000	7	26	B06	.	.	.	20.8	8.0
2000	9	20	B02	0.0	.	.	18.4	5.0
2000	9	20	B04	20.0	.	.	23.4	6.1
2000	9	20	B06	.	.	.	22.7	7.9
2000	9	20	B09	.	.	.	23.5	8.7
2000	10	25	B02	5.0	.	.	17.8	2.1
2000	10	25	B04	39.0	.	.	19.2	10.1
2000	10	25	B06	.	.	.	23.9	10.8
2000	10	25	B09	.	.	.	26.8	6.3
2000	11	21	B02	1.0	.	.	22.7	6.5
2000	11	21	B04	0.0	.	.	18.5	8.5
2000	11	21	B06	.	.	.	27.8	12.0
2000	12	21	B02	.	.	.	.	.

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
2000	12	21	B04	.	.	.	.	.
2000	12	21	B06	.	.	.	.	.
2000	12	21	B09	.	.	.	.	.
2001	2	1	B02	0.0	.	.	19.0	4.6
2001	2	1	B04	24.0	.	.	22.0	7.8
2001	2	1	B09	.	.	.	22.9	9.0
2001	2	22	B02	2.0	.	.	32.9	5.9
2001	2	22	B04	15.0	.	.	18.5	9.1
2001	2	22	B09	.	.	.	17.1	9.5
2001	3	22	B02	0.0	.	.	29.5	7.9
2001	3	22	B04	13.0	.	.	31.6	10.1
2001	3	22	B09	.	.	.	21.9	7.5
2001	6	21	B02	3.0	.	.	25.2	8.3
2001	6	21	B04	12.0	.	.	30.5	7.5
2001	6	21	B09	.	.	.	18.5	8.4
2001	8	23	B02	0.0	.	.	23.3	7.0
2001	8	23	B04	28.0	.	.	27.2	8.6
2001	8	23	B09	.	.	.	31.4	8.3
2001	9	17	B02	4.0	.	.	22.3	7.9
2001	9	17	B04	24.0	.	.	26.8	8.3
2001	9	17	B09	.	.	.	30.8	8.1
2001	10	23	B02	4.0	.	.	22.4	7.4
2001	10	23	B04	28.0	.	.	21.4	9.8
2001	10	23	B09	.	.	.	28.2	6.4
2001	11	19	B02	0.0	.	.	19.8	5.3
2001	11	19	B04	15.0	.	.	22.8	4.9
2001	11	19	B09	.	.	.	26.0	7.7
2001	12	19	B02	3.0	.	.	16.3	5.3
2001	12	19	B04	10.0	.	.	21.8	5.5
2001	12	19	B09	.	.	.	22.3	6.6
2002	1	22	B02	5.0	.	.	26.6	6.1
2002	1	22	B04	12.0	.	.	17.1	5.5
2002	1	22	B09	.	.	.	22.6	7.8
2002	2	18	B02	0.0	.	.	29.1	4.7
2002	2	18	B04	13.0	.	.	26.3	8.7
2002	2	18	B09	.	.	.	20.3	7.8
2002	3	18	B02	0.0	.	.	24.4	6.2
2002	3	18	B04	14.0	.	.	29.1	7.5
2002	3	18	B09	.	.	.	16.5	9.9
2002	4	22	B02	0.0	.	.	26.5	6.8
2002	4	22	B04	26.0	.	.	24.7	8.9
2002	4	22	B09	.	.	.	25.9	7.9
2002	5	21	B02	0.0	.	.	28.5	9.0
2002	5	21	B04	30.0	.	.	29.1	7.5
2002	5	21	B09	.	.	.	28.6	8.0
2002	6	17	B02	0.0	.	.	28.8	6.9
2002	6	17	B04	38.0	.	.	30.0	6.2
2002	6	17	B09	.	.	.	24.6	7.3
2002	7	22	B02	0.0	.	.	27.9	6.9
2002	7	22	B04	30.0	.	.	30.1	7.5
2002	7	22	B09	.	.	.	28.4	5.7
2002	8	19	B02	0.0	.	.	26.2	7.2

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
2002	8	19	B04	48.0	.	.	29.8	6.2
2002	8	19	B09	.	.	.	30.1	8.0
2002	9	16	B02	0.0	.	.	14.5	6.3
2002	9	16	B04	8.0	.	.	26.2	5.9
2002	9	16	B09	.	.	.	30.5	7.7
2002	10	21	B02	.	.	.	.	.
2002	10	21	B04	.	.	.	.	.
2002	10	21	B09	.	.	.	.	.
2002	12	16	B02	0.0	.	.	10.9	6.5
2002	12	16	B04	.	.	.	.	.
2002	12	16	B09	.	.	.	30.7	.
2003	1	21	B02	.	.	.	.	.
2003	1	21	B04	16.0	.	.	15.9	6.4
2003	1	21	B09	.	.	.	29.5	7.3
2003	2	24	B02	0.0	.	.	19.5	6.3
2003	2	24	B04	10.0	.	.	12.7	6.2
2003	2	24	B09	.	.	.	29.2	.
2003	3	17	B02	0.0	.	.	23.2	5.3
2003	3	17	B04	13.0	.	.	20.4	6.8
2003	3	17	B09	.	.	.	25.7	8.1
2003	4	21	B02	3.0	.	.	24.3	0.6
2003	4	21	B04	25.0	.	.	23.7	7.6
2003	4	21	B09	.	.	.	15.2	.
2003	5	19	B02	0.0	.	.	29.0	6.3
2003	5	19	B04	17.0	.	.	25.4	5.7
2003	5	19	B09	.	.	.	13.2	.
2003	6	16	B02	4.0	.	.	30.5	3.7
2003	6	16	B04	36.0	.	.	29.4	8.5
2003	6	16	B09	.	.	.	20.1	.
2003	7	21	B02	3.0	.	.	28.5	6.2
2003	7	21	B04	58.0	.	.	30.2	7.3
2003	7	21	B09	.	.	.	23.4	.
2003	8	18	B02	0.0	.	.	27.9	7.2
2003	8	18	B04	16.0	.	.	30.3	8.4
2003	8	18	B09	.	.	.	24.5	.
2004	8	24	B02	0.0	.	.	28.9	8.0
2004	8	24	B04	2.0	.	.	28.1	11.0
2004	8	24	B09	.	.	.	28.7	.
2004	8	25	B02	6.4	1.6	4.8	27.9	1.3
2004	8	25	B04	2.7	1.0	1.7	29.8	5.4
2004	8	25	B06	5.5	1.3	4.1	30.5	6.3
2004	8	25	B09	8.0	2.6	5.4	31.4	7.3
2004	8	25	G1	11.0	2.7	8.3	30.2	5.8
2004	8	25	G2	8.6	1.7	6.9	30.1	5.9
2004	8	25	G3	5.8	0.8	5.0	30.1	6.2
2004	8	25	GC1	7.0	0.5	6.5	30.3	4.3
2004	8	25	GC2	7.5	1.0	6.5	30.0	6.3
2004	8	25	GC3	11.1	3.1	8.0	29.9	6.2
2004	8	25	I1	5.5	2.5	3.0	29.7	3.4
2004	8	25	I2	3.4	1.0	2.4	29.6	4.1
2004	8	25	I3	2.2	1.0	1.2	29.8	5.3
2004	8	25	IC1	3.0	1.0	2.0	29.9	4.3

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
2004	8	25	IC2	2.8	0.9	1.9	30.0	5.0
2004	8	25	IC3	2.5	0.6	1.9	29.8	5.4
2004	8	25	L1	7.4	2.2	5.2	27.3	0.1
2004	8	25	L2	7.8	2.0	5.8	27.4	0.2
2004	8	25	L3	7.8	2.2	5.6	28.0	0.2
2004	8	25	LC1	12.4	4.4	8.0	27.1	0.6
2004	8	25	LC2	8.2	2.0	6.2	27.5	1.1
2004	8	25	LC3	8.6	2.6	6.0	27.9	1.7
2004	8	25	N1	13.0	1.0	12.0	31.5	0.2
2004	8	25	N2	12.4	1.6	10.8	29.5	0.6
2004	8	25	N3	9.7	1.3	8.3	30.9	4.1
2004	8	25	NC1	8.0	1.1	6.9	29.5	0.2
2004	8	25	NC2	14.8	2.4	12.4	30.0	0.1
2004	8	25	NC3	8.3	2.3	6.0	31.1	6.8
2004	9	22	B02	2.1	0.9	1.1	26.4	4.4
2004	9	22	B04	2.9	1.8	1.1	26.5	5.9
2004	9	22	B06	5.7	3.0	2.7	26.5	5.8
2004	9	22	B09	14.0	7.6	6.4	26.7	5.7
2004	9	22	G1	5.8	2.0	3.8	27.1	5.4
2004	9	22	G2	6.9	3.3	3.6	26.7	5.4
2004	9	22	G3	6.6	3.1	3.4	26.6	5.4
2004	9	22	GC1	4.1	1.6	2.5	27.5	5.6
2004	9	22	GC2	6.7	3.0	3.7	26.7	5.5
2004	9	22	GC3	6.0	2.7	3.3	26.6	5.4
2004	9	22	I1	4.8	2.0	2.8	26.6	2.9
2004	9	22	I2	4.3	2.3	2.0	26.6	4.6
2004	9	22	I3	3.4	1.9	1.5	26.5	5.7
2004	9	22	IC1	2.4	1.1	1.3	26.6	5.2
2004	9	22	IC2	2.5	1.3	1.2	26.6	5.6
2004	9	22	IC3	3.0	1.8	1.2	26.5	5.7
2004	9	22	L1	2.8	1.0	1.8	25.8	3.1
2004	9	22	L2	2.2	0.4	1.8	25.8	1.6
2004	9	22	L3	1.7	0.6	1.1	26.0	3.6
2004	9	22	LC1	3.1	1.1	2.0	25.8	4.7
2004	9	22	LC2	3.6	0.7	2.9	26.0	2.3
2004	9	22	LC3	8.2	2.6	5.6	25.8	0.7
2004	9	22	N1	12.0	4.0	8.0	27.1	4.5
2004	9	22	N2	11.6	6.2	5.4	27.0	5.8
2004	9	22	N3	22.9	12.6	10.3	26.9	5.8
2004	9	22	NC1	15.7	6.6	9.1	27.0	3.3
2004	9	22	NC2	14.0	6.7	7.3	27.1	5.2
2004	9	22	NC3	21.9	10.8	11.1	26.9	5.7
2004	10	21	B02	1.9	1.1	0.8	23.8	4.9
2004	10	21	B04	3.4	1.8	1.6	24.3	6.2
2004	10	21	B06	2.5	1.3	1.3	24.1	6.1
2004	10	21	B09	4.8	2.4	2.5	24.6	6.4
2004	10	21	G1	3.3	1.5	1.8	23.9	4.8
2004	10	21	G2	3.9	2.0	1.9	23.8	6.0
2004	10	21	G3	3.6	1.7	1.8	23.2	6.3
2004	10	21	GC1	4.2	2.2	2.0	23.9	5.5
2004	10	21	GC2	4.9	2.5	2.4	23.8	6.3
2004	10	21	GC3	3.9	1.8	2.1	23.9	6.4

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
2004	10	21	I1	2.8	1.4	1.4	24.2	6.1
2004	10	21	I2	2.8	1.5	1.3	24.3	6.1
2004	10	21	I3	2.6	1.5	1.1	24.3	6.2
2004	10	21	IC1	3.0	1.5	1.6	24.2	5.8
2004	10	21	IC2	3.6	2.0	1.6	24.2	5.5
2004	10	21	IC3	3.7	2.2	1.5	24.2	5.5
2004	10	21	L1	1.8	0.9	0.9	23.1	3.9
2004	10	21	L2	1.9	0.6	1.3	23.4	3.5
2004	10	21	L3	1.6	0.6	0.9	23.4	4.2
2004	10	21	LC1	4.0	2.3	1.7	23.2	2.9
2004	10	21	LC2	2.5	1.1	1.4	23.3	1.1
2004	10	21	LC3	1.6	0.5	1.1	23.2	2.1
2004	10	21	N1	7.4	3.0	4.4	24.6	5.0
2004	10	21	N2	6.6	2.8	3.8	24.5	4.8
2004	10	21	N3	7.3	3.7	3.6	24.7	6.2
2004	10	21	NC1	8.3	2.4	5.9	24.7	3.5
2004	10	21	NC2	7.5	3.0	4.5	24.8	4.0
2004	10	21	NC3	8.9	4.4	4.5	24.6	5.8
2005	2	15	B02	2.7	1.1	1.6	17.3	7.2
2005	2	15	B04	2.8	1.4	1.4	17.5	9.3
2005	2	15	B06	4.6	2.1	2.5	17.1	10.7
2005	2	15	B09	3.6	1.3	2.2	16.1	10.3
2005	2	15	G1	3.6	1.5	2.1	17.4	9.6
2005	2	15	G2	3.4	1.4	2.0	16.9	9.8
2005	2	15	G3	4.3	1.7	2.6	16.9	9.8
2005	2	15	GC1	2.7	1.4	1.3	16.9	10.1
2005	2	15	GC2	3.4	1.3	2.1	17.3	10.1
2005	2	15	GC3	4.3	2.1	2.2	16.8	9.8
2005	2	15	I1	3.6	2.2	1.4	17.7	8.5
2005	2	15	I2	3.9	2.1	1.8	17.6	8.9
2005	2	15	I3	3.3	1.7	1.6	17.5	9.0
2005	2	15	IC1	4.0	2.2	1.8	17.8	8.8
2005	2	15	IC2	3.3	1.6	1.7	17.9	9.0
2005	2	15	IC3	3.3	1.8	1.5	17.7	9.0
2005	2	15	L1	2.0	1.2	0.8	17.1	8.3
2005	2	15	L2	1.3	0.9	0.4	17.3	6.6
2005	2	15	L3	1.0	0.4	0.6	17.2	4.9
2005	2	15	LC1	1.3	0.7	0.6	17.4	7.9
2005	2	15	LC2	1.8	1.3	0.5	17.4	7.3
2005	2	15	LC3	0.9	0.6	0.3	17.5	4.3
2005	2	15	N1	3.0	1.3	1.7	17.4	9.4
2005	2	15	N2	2.2	0.6	1.6	15.7	8.3
2005	2	15	N3	5.7	3.1	2.6	16.0	9.2
2005	2	15	NC1	2.5	1.3	1.2	16.1	9.5
2005	2	15	NC2	3.3	1.6	1.7	16.3	9.4
2005	2	15	NC3	4.9	2.2	2.7	15.9	9.3
2005	4	21	B02	2.2	1.3	0.9	22.3	8.3
2005	4	21	B04	1.6	1.1	0.5	22.6	8.3
2005	4	21	B06	2.3	1.2	1.1	21.7	8.7
2005	4	21	B09	3.3	1.7	1.6	21.1	8.7
2005	4	21	G1	2.2	1.2	1.0	21.8	8.5
2005	4	21	G2	2.6	1.5	1.1	21.8	8.0

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
2005	4	21	G3	2.3	1.3	1.0	21.9	8.6
2005	4	21	GC1	1.3	0.7	0.6	21.7	7.0
2005	4	21	GC2	2.4	0.8	1.6	22.4	8.4
2005	4	21	GC3	2.1	1.1	1.0	22.3	8.9
2005	4	21	I1	2.1	1.3	0.8	23.0	7.7
2005	4	21	I2	5.2	3.3	1.9	22.9	7.9
2005	4	21	I3	2.6	1.6	1.0	23.2	8.2
2005	4	21	IC1	2.3	1.4	0.9	23.0	7.3
2005	4	21	IC2	2.3	1.3	1.0	23.2	7.9
2005	4	21	IC3	1.9	1.1	0.8	22.8	7.9
2005	4	21	L1	3.3	2.1	1.2	23.8	7.3
2005	4	21	L2	1.8	0.9	0.9	22.9	6.7
2005	4	21	L3	2.9	0.9	2.0	23.2	4.0
2005	4	21	LC1	3.8	2.3	1.5	23.4	5.9
2005	4	21	LC2	4.4	2.7	1.7	24.1	5.7
2005	4	21	LC3	.	.	.	.	.
2005	4	21	N1	2.5	1.0	1.5	21.7	4.1
2005	4	21	N2	2.7	1.2	1.5	21.6	5.5
2005	4	21	N3	2.5	1.3	1.2	21.5	7.7
2005	4	21	NC1	2.5	1.2	1.3	21.7	5.7
2005	4	21	NC2	2.4	1.1	1.3	21.6	6.6
2005	4	21	NC3	2.7	1.5	1.2	21.2	7.4
2005	6	21	B02	2.8	1.3	1.5	28.1	5.1
2005	6	21	B04	3.1	1.7	1.4	28.6	5.6
2005	6	21	B06	4.9	1.6	3.3	29.0	6.5
2005	6	21	B09	13.2	4.7	8.5	28.6	7.2
2005	6	21	G1	4.9	1.4	3.5	28.8	3.7
2005	6	21	G2	5.5	1.3	4.2	28.6	6.2
2005	6	21	G3	6.0	1.5	4.5	28.6	6.6
2005	6	21	GC1	4.3	1.3	3.0	28.9	4.6
2005	6	21	GC2	5.2	1.4	3.7	28.6	6.5
2005	6	21	GC3	5.8	1.6	4.2	28.7	6.7
2005	6	21	I1	3.0	1.5	1.5	28.7	6.3
2005	6	21	I2	3.2	1.6	1.6	29.0	6.1
2005	6	21	I3	3.4	1.6	1.8	28.5	5.7
2005	6	21	IC1	2.5	1.4	1.1	28.7	6.1
2005	6	21	IC2	2.3	1.0	1.3	28.6	6.0
2005	6	21	IC3	2.3	1.2	1.1	28.6	6.1
2005	6	21	N1	7.1	1.6	5.5	28.7	5.2
2005	6	21	N2	8.3	1.6	6.8	28.9	2.7
2005	6	21	N3	8.6	2.5	6.1	28.8	7.4
2005	6	21	NC1	7.0	2.2	4.8	28.7	7.6
2005	6	21	NC2	6.5	1.2	5.3	28.6	6.0
2005	6	21	NC3	10.7	2.6	8.1	28.7	7.0
2005	9	6	B02	7.5	2.9	4.6	27.4	6.1
2005	9	6	B04	5.9	2.6	3.3	28.5	6.1
2005	9	6	B06	7.7	2.8	4.9	28.1	6.7
2005	9	6	B09	15.3	5.0	10.3	28.3	6.7
2005	9	6	G1	9.7	3.2	6.4	28.2	7.0
2005	9	6	G2	6.9	2.5	4.4	28.0	6.7
2005	9	6	G3	8.5	2.3	6.2	28.0	7.0
2005	9	6	GC1	8.8	2.0	6.8	28.3	7.4

Year	Month	Day	Station	Total Suspended Solids (mg/L)	Inorganic Suspended Solids (mg/L)	Organic Suspended Solids (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
2005	9	6	GC2	8.7	3.0	5.7	28.0	6.5
2005	9	6	GC3	8.7	2.8	5.9	28.0	6.4
2005	9	6	I1	3.7	2.0	1.7	28.5	4.6
2005	9	6	I2	4.7	2.0	2.7	28.4	5.6
2005	9	6	I3	4.3	2.0	2.3	28.3	5.1
2005	9	6	IC1	4.5	1.8	2.6	28.5	5.1
2005	9	6	IC2	4.6	4.8	2.8	28.4	5.0
2005	9	6	IC3	4.2	1.7	2.5	28.5	6.1
2005	9	6	N1	15.8	3.0	12.8	28.2	6.6
2005	9	6	N2	21.8	7.3	14.5	28.1	6.5
2005	9	6	N3	20.4	6.5	13.9	28.0	6.4
2005	9	6	NC1	18.6	2.9	15.7	28.7	6.1
2005	9	6	NC2	18.1	5.3	12.8	28.4	6.6
2005	9	6	NC3	18.1	5.3	12.8	27.8	6.6
2005	12	12	B02	1.5	0.9	0.6	17.0	7.2
2005	12	12	B04	2.9	2.0	0.9	17.7	7.4
2005	12	12	B06	5.5	3.3	2.2	17.4	7.8
2005	12	12	B09	9.8	4.8	5.0	17.6	8.4
2005	12	12	G1	2.7	1.5	1.2	17.0	7.9
2005	12	12	G2	2.9	1.7	1.2	17.1	7.5
2005	12	12	G3	2.6	1.3	1.3	16.9	7.7
2005	12	12	GC1	2.5	1.5	1.0	17.1	7.3
2005	12	12	GC2	2.2	1.3	0.9	17.1	7.5
2005	12	12	GC3	2.7	2.0	0.7	16.9	7.7
2005	12	12	I1	2.1	1.6	0.5	17.3	7.4
2005	12	12	I2	2.5	1.8	0.7	17.4	7.3
2005	12	12	I3	2.4	1.8	0.6	17.5	7.3
2005	12	12	IC1	2.3	1.7	0.6	17.4	7.3
2005	12	12	IC2	2.9	2.0	0.9	17.6	7.2
2005	12	12	IC3	2.8	2.0	0.8	17.6	7.2
2005	12	12	N1	10.9	4.5	6.4	17.0	7.6
2005	12	12	N2	11.4	5.4	6.0	17.1	8.1
2005	12	12	N3	11.3	5.8	5.5	17.3	8.1
2005	12	12	NC1	13.1	6.1	7.0	17.6	7.7
2005	12	12	NC2	11.6	5.3	6.2	17.5	8.8
2005	12	12	NC3	11.3	5.6	5.8	17.4	8.2
2006	3	22	B02	4.9	1.9	3.0	22.9	8.3
2006	3	22	B04	4.1	2.1	2.0	23.1	8.6
2006	3	22	B06	4.7	1.7	3.0	23.1	8.6
2006	3	22	B09	7.9	2.2	5.8	23.4	9.5
2006	3	22	G1	10.1	2.7	7.4	23.1	8.5
2006	3	22	G2	9.0	2.0	7.0	22.9	8.9
2006	3	22	G3	8.6	2.5	6.1	22.9	8.8
2006	3	22	GC1	7.3	0.7	6.5	23.1	7.6
2006	3	22	GC2	9.4	3.4	6.1	22.9	8.9
2006	3	22	GC3	6.8	0.7	6.1	23.1	9.1
2006	3	22	I1	6.0	3.6	2.4	23.3	8.5
2006	3	22	I2	6.1	3.5	2.6	23.0	7.9
2006	3	22	I3	4.5	2.6	1.9	23.2	8.6
2006	3	22	IC1	3.6	1.5	2.1	23.1	8.5
2006	3	22	IC2	3.5	1.7	1.8	23.1	8.6
2006	3	22	IC3	3.0	1.6	1.4	22.9	8.6

				Suspended Solids (mg/L)	Suspended Solids (mg/L)	Suspended Solids (mg/L)	(°C)	Oxygen (mg/L)
2006	3	22	N1	6.4	1.4	5.0	23.1	8.1
2006	3	22	N2	6.8	1.9	4.9	23.0	7.7
2006	3	22	N3	4.8	0.5	4.3	23.4	8.6
2006	3	22	NC1	5.1	1.1	4.0	22.9	7.6
2006	3	22	NC2	6.8	1.6	5.1	23.5	8.8
2006	3	22	NC3	4.2	0.8	3.4	23.5	8.9
2006	6	6	B02	9.5	2.8	6.7	28.9	7.1
2006	6	6	B04	2.0	0.8	1.2	30.1	6.8
2006	6	6	B06	13.5	1.6	11.9	29.6	8.2
2006	6	6	B09	19.8	3.3	16.5	28.3	6.8
2006	6	6	G1	18.2	4.0	14.2	29.0	5.8
2006	6	6	G2	24.8	3.0	21.8	28.0	6.2
2006	6	6	G3	24.7	3.0	21.7	28.1	6.9
2006	6	6	GC1	23.1	5.0	18.1	28.9	5.9
2006	6	6	GC2	21.4	5.0	16.4	28.2	6.9
2006	6	6	GC3	23.1	5.0	18.1	28.3	7.0
2006	6	6	I1	1.6	0.7	0.8	29.3	5.6
2006	6	6	I2	2.5	0.8	1.6	30.2	7.4
2006	6	6	I3	1.1	0.5	0.6	29.7	6.3
2006	6	6	IC1	6.4	1.7	4.7	30.2	5.6
2006	6	6	IC2	0.8	0.0	0.8	30.5	7.3
2006	6	6	IC3	1.1	0.2	0.8	29.5	6.5
2006	6	6	N1	21.7	4.0	17.7	29.2	6.4
2006	6	6	N2	20.7	4.0	16.7	29.3	4.8
2006	6	6	N3	20.6	3.3	17.2	28.9	6.6
2006	6	6	NC1	19.7	5.0	14.7	29.7	5.4
2006	6	6	NC2	18.9	3.3	15.6	29.5	5.3
2006	6	6	NC3	18.9	4.2	14.8	29.0	6.8