

# **GOTTFRIED CREEK RECONNAISSANCE REPORT**

**REGARDING  
SARASOTA COUNTY WATER RESOURCES CONTRACT 2004-139  
WORK ASSIGNMENT 04-02**

**JULY 12, 2005**



Submitted to:

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**MOTE MARINE LABORATORY TECHNICAL REPORT NO. 1032**

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## INTRODUCTION

Gottfried Creek heads in relatively undeveloped lands of Sarasota County and empties to Lemon Bay at Englewood, in Charlotte County. A trip was made to Gottfried Creek on May 27, 2005 in the company of Mike Jones and Jon Perry of Sarasota County Government (SCG), for the purpose of reconnoitering the creek for potential ecological indicators. A light rain and morning fog lifted and the day was clear and calm; the tide rose throughout the day and was at a slack high of 2.0 ft at 1526.

The trip began at a public ramp on Ainger Creek and sampling began at the creek's mouth, river kilometer (RK) 0.0 as determined by SCG (Attachment 1). Ecological observation proceeded upstream to the limit of navigation so as to conclude at slack high water, after which depth and meter profiles were made on the return trip. Depth was determined by lead line and salinity, temperature, pH and dissolved oxygen were measured at surface and bottom with a Hydrolab Surveyor 4 and Minisonde 4A. Position was recorded with a Garmin 12 XL GPS. Incidental surface salinity measurements were made with a refractometer.

## TRIP NARRATIVE

A transcript of field notes is given in Attachment 2. River kilometer positions are given in Attachment 3.

## DATA AND FINDINGS

**1. Logistical Assessment.** The nearest public boat ramp is on Ainger Creek, requiring a 15 minute trip around New Point Comfort to Gottfried Creek. Navigation aids leading from Ainger Creek into Lemon Bay are rudimentary. Boat speeds are regulated by signs. Daymarks in Gottfried Creek are reliable, and a channel at RK 1.0 makes it possible to cross a broad shoal. Gottfried Creek is passable by a small boat to about RK 5.0, at least on a summer high tide. Interviews with local boaters suggest that winter low tides would limit upstream passage.

**2. References.** A river kilometer system developed for this project by SCG was valuable. Benchmark and tidal data for Englewood are given in Attachment 4. Relative to mean lower low water (chart datum), mean tide level is 24.6 cm and mean higher high water is 47.8 cm higher. NAVD is located between mean high water and mean higher high water. There are, at present, no continuous *in-situ* sensing or measurement systems operating in the Creek, although SCG seeks to install same in the near future.

**3. Stream Geometry.** In its lowest five kilometers, the maximum width and depth of Gottfried Creek are 1000 m and 2.8 m (MLLW), respectively. From Lemon Bay, a uniform channel narrows at the McCall Road bridge crossing; is widest from RK 0.9 to 1.7, and then narrows to RK 2.8. Above this point, the channel meanders and narrows to RK 4.8 and then enters a closed canopy as a relatively straight stream. Attachment 5

provides stream dimensions as a function of RK.

**4. Bottom Types.** Attachment 6 enumerates bottom types of Gottfried Creek. At least twenty-one distinct bottom types were identified, of which sixteen (76%) are natural. In terms of areal coverage, no empirical data are available at present but field results indicate that there are substantial amounts of both natural and dredged bottoms in Gottfried Creek.

**5. Water Chemistry.** Surface and bottom values for conductivity, salinity, temperature, pH, and dissolved oxygen are given by river kilometer in Attachment 7. Measurements were made at slack high water. Salinity decreased uniformly with upstream distance, with small (<3 ppt) surface-to-bottom differences, except at RK 4.5 where surface salinity was significantly depressed (to 16.1 ppt) relative to 25 ppt at the bottom. Dissolved oxygen was low overall, less than 4.0 mg/l upstream, and higher downstream. Higher downstream concentrations are attributable to time of day, increased fetch, proximity to Lemon Bay, and the presence of SAV.

**6. Shorelines and Accessibility.** Mangroves and seawalls represent the majority of shorelines in Gottfried Creek. There is probably more mangrove shoreline if the edges of mangrove islands are considered. Mangroves extend upstream to near RK 4.5. Most mangrove shorelines are accessible. Many but not all seawalls are accessible owing to their proximity to homes and high-use or protected properties.

**7. Qualitative Seagrass Observations.** Two seagrass species, *Thalassia testudinum* and *Halodule wrightii*, were encountered in the Creek, with *Thalassia* restricted to RK 0.0 to 0.5 and *Halodule* restricted to RK 0.0 to 1.0. SAV beds at the creek's entry to Lemon Bay were patchy to continuous, mostly dense assemblages with 10-30 cm tall canopies; small amounts of drift algae, and abundant fauna. Although not vascular, filamentous algal periphyton covered extensive areas of the Creek from RK 2.0 to near 3.5 and should be identified and measured with respect to biomass and use by benthic fauna. No subtidal or stranded accumulations of drift macroalgae of any type were noticed and there were no nuisance accumulations of algae anywhere in the study area.

**8. Qualitative Macro-mollusk Observations.** Twenty species of gastropods and bivalves were collected in the tidal creek. None was freshwater although two, *Polymesoda* and *Tagelus*, are indicators of brackish-water conditions. A list of species and their distribution by RK is given in Attachment 8. The first two kilometers are species-rich, with 9, 10, and 10 species per RK. Between RK 2.0 and 3.0 a sharp drop in species richness occurs. At and upstream of RK 3.0 species richness is only 3 species per RK. The presence of live *Polymesoda*, and the size distributions of oysters and *Tagelus*, hold promise as creek metrics.

**9. Intertidal Index Candidates.** There is ample intertidal habitat in the creek, both natural and hardened, but continuity of conditions is broken at least twice, at the South McCall Road bridge (RK 0.65), and at the biotic transition described previously, near RK

2.5. As mentioned above, presence of the intertidal marsh clam, *Polymesoda*, offers some potential because its distribution relative to salinity in other rivers, especially the Myakka River, is well known. Oysters occur subtidally as well as intertidally in Gottfried Creek, and their abundance, size, morbidity and condition could be useful index metrics. Mangrove wood-borers may be useful intertidal indicators. They are strictly intertidal and affected by both salinity and total suspended solids (despite burrowing for habitat, they are filter-feeders.)

**10. Potential Ecological Homologs.** The stream is divisible into tidal and non-tidal reaches, although the head of tide is not presently known. The tidal reach is divisible into the upland-forested and mangrove-forested reaches, with a transition in the vicinity of RK 4.5 to 4.8. The mangrove-forested reach is divisible into several reaches based on stream morphology, aquatic vegetation, and fauna. In the case of fauna, for example, oysters occur as downstream reefs, midstream root epibionts and small clumps, and upstream relicts. Water chemistry during a dry season does not inform segmentation but the creek's wet season chemistry may.

## **INTERPRETATION AND RECOMMENDATIONS**

Gottfried Creek presents a substantial area of natural subtidal and intertidal habitat. Nowhere in the stream were bottom sediments found to be adverse to benthic fauna. The flora and fauna are clearly discernable as marine, estuarine, and brackish-water assemblages. True lotic conditions were not encountered in the first five river kilometers of the tidal stream, but the patterning of habitats and communities that were seen are indicative of a healthy system. Although the system is not pristine, Gottfried Creek presently is a valid reference stream for SCG's watershed management initiative, and should be used as a basis for comparing the condition of other county waterways. The next phase of this preliminary investigation will be to reconnoiter Whitaker Bayou, selected as an example of an extremely impaired tidal creek, by the same methods, to determine how it differs from Gottfried Creek.

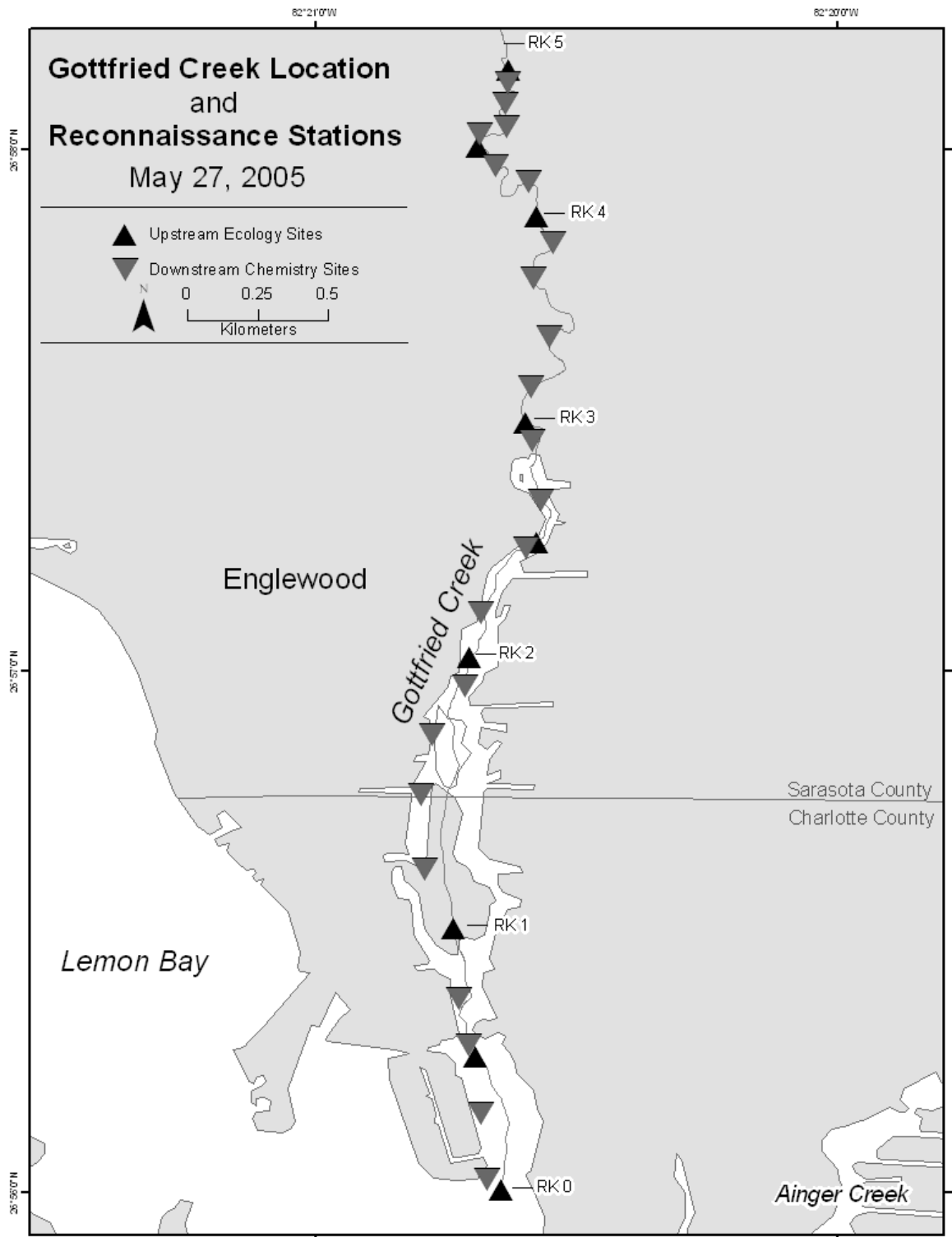
## **ACKNOWLEDGMENTS**

Mike Jones, Jon Perry, Greg Wahl, Jan Gannon, Jay Sprinkel, Trisa Wintringham, Jan Gannon, and Debi Ingrao made important contributions in planning, field work, taxonomy, data analysis, and report preparation.

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**ATTACHMENT 1.** Location of Gottfried Creek and ecological and chemistry sampling sites.



## ATTACHMENT 2. Narrative of a trip on Gottfried Creek, May 27, 2005

### RK 0.0 (0900 DST)

Center of creek: Water depth one meter, salinity 35 ppt. Firm bottom with thin layer of soft mud. Bottom looks and feels clean. *Thalassia* and *Halodule* present.

Percent cover in 4 haphazard throws of a 0.25 m<sup>2</sup> quadrat as follows:

| Species          | Repl. 1 | Repl. 2  | Repl. 3  | Repl. 4  |
|------------------|---------|----------|----------|----------|
| <i>Thalassia</i> | 50%     | 0        | 0        | 0        |
| <i>Halodule</i>  | 50      | 100      | 20       | 80       |
| Drift algae      | <5      | 0        | 0        | 0        |
| Epiphytes        | low     | moderate | moderate | moderate |

Live and dead mollusks were numerous and samples were collected.

East bank: Water depth 30 cm. Live and dead oysters present on a nice reef. In one 0.25 m<sup>2</sup> quadrat 113 live and 29 dead oysters were counted, and 24 spat were found. The largest live oyster was 7.0 cm in height. In the vicinity of the reef and on an old seawall marine life was abundant, including crown conchs, whelk egg cases, mangrove snapper, sheepshead, mullet, fiddler and mangrove tree crabs, and live and dead tulip snails. A recently live horse conch, pufferfish, needlefish, and blue crabs were seen, along with live barnacles on mangrove prop roots. No mangrove borers. The seawall had a line of dead barnacles with an upper zone of filamentous bluegreen algae.

En route to RK 0.5 a large oyster reef, dense *Thalassia* giving way to *Halodule*, bait fish, sting rays, and the alga *Gracilaria* were encountered.

### RK 0.5 (0948)

Center of creek: Water depth less than 20 cm; salinity 31 ppt. Large featureless shoal comprised of clean poorly sorted sediment, and a large oyster reef nearby. Sparse *Halodule*; *Gracilaria* the dominant alga. Conchs abundant on oysters, numerous juvenile mullet in area. Oyster reef partly exposed. In one quadrat there were 87 live and 37 dead oysters, and 101 oyster spat. The largest oyster was 6.0 cm in height.

East bank: Former Bass Biological Laboratory site. Old seawall with good oyster growth and a diverse oyster fauna. Extensive growth of *Caulerpa sertularioides* on the wall below mean low water. Red and black mangroves nearby with periwinkles, tree crabs, and wood borers. Also *Sphaeroma quadridentatum*. Comb jellies here.



## ATTACHMENT 2. Continued

### RK 1.0 (1036)

Center of creek: one meter deep; salinity 30 ppt. A group of daymarks define a dredged channel, the John C. Davison Pass, excavated through a shoal in midstream. Mangrove islands were sampled instead of shorelines owing to urbanization. The channel spoil is a featureless shoal of firm clean sand and the natural bottom around it is a firm level bottom with patches of short, sparse *Halodule* and some drift algae. Fishes include juvenile mullet, sheepshead and needle fish. Red mangrove roots on nearby overwash islands have heavy borer damage, some live barnacles, no periwinkles. A partly exposed oyster reef has large dead and medium live and dead oysters, and live spat are very abundant. Conchs present on reef. A quadrat yielded 107 live and 48 dead oysters, plus 68 spat. Comb jellies here.

### RK 1.5

Cursory examination of a seawall on the west bank found oysters and wood borers but no algae.

### RK 2.0 (1120)

The stream throats down here (when moving upstream). Depths variable, salinity 27 ppt. The bottom is a firm, clean mixture of fine sands mixed with mud, and is covered by a continuous growth of fine filamentous green algae. Numerous egg masses attached to the bottom. Nearby mangroves have large dead barnacles, heavy recent borer damage, tree crabs. No periwinkles or live nerites. A three by five meter patch of oysters is nearby but roots have no oysters. Occasional solitary clumps of large (to 80 cm) live oysters. Live *Tagelus* in abundance here.

Notes in transit: Compared to RK 2.0, RK 2.5 is similar in aspect and probably safer to occupy. Evidence of an old bridge (?) Crossing at RK 2.8B pilings occur across the stream and toward both banks.

### RK 2.5 (1403; sampled while waiting for slack tide)

Firm level bottom, salinity 27 ppt. Live and dead *Tagelus* of medium length are common. One large shoal was invested heavily in *Tagelus*, mainly live material. Some *Juncus* here, mangrove roots with moderate borer damage and no gastropods.

## ATTACHMENT 2. Continued

### RK 3.0 (1147)

Channel is five feet deep; salinity 24 ppt. The bottom is a firm, clean mixture of fine sands mixed with mud, and is covered by a continuous growth of fine filamentous green algae. Red mangroves nearby. No oysters on roots but borer damage is heavy and dead barnacles are present. No gastropods on roots but tree crabs abundant. On the bottom in front of the root zone clumps of large live oysters were found. Blue crabs and a large snook was seen here. There are a few recreational crab traps on the creek but no commercial set. Mussels and barnacles living here.

### RK 3.5 (in transit)

Undercut outside bank and shallow inside bank. Bottom is level firm sand. Mangroves with borer damage. Salinity 22 ppt. *Juncus* at RK 3.9.

### RK 4.0 (1228)

Depths varied; salinity 15 ppt on surface, 25 ppt on bottom. Firm level bottom comprised of mostly sand-sized sediment. In addition to vertical temperature differences there is a noticeable difference in temperature across the stream here; the water was noticeably colder on the east side. *Juncus* and white mangroves here, some red mangroves. Mangrove roots have borers but not gastropods or oysters. Live barnacles on a nearby seawall, also abundant *Ligia* (isopods). No SAV here but periphyton covers the bottom in places.

### RK 4.5 or 4.6? (1250)

Level, firm bottom, salinity 14 ppt. Large dead *Tagelus* and large live and dead *Polymesoda* are here. The bottom on the inside curve is soft and muddy compared to the rest of the transect. Mangroves contain borers. A manatee was spotted at RK 4.7 and *Acrostichum* was noticed in transit at RK 4.9.

### RK 5.0

Firm muddy bottom, salinity 13 ppt. Sediments contain organic debris (coarse material larger than detritus). Dead barnacles and *Tagelus* here, also numerous juvenile mullet. A lens of fossil marine shells is exposed on sloping bottom. Above this point the channel narrows considerably and overhanging and fallen trees prevent further upstream travel.

**ATTACHMENT 3.** Gottfried Creek station locations and depths in meters. RK, river kilometer.

| <u>RK</u> | <u>Latitude, deg. N.</u> | <u>Longitude, deg. W.</u> | <u>Depth* (DST)</u> |
|-----------|--------------------------|---------------------------|---------------------|
| 0.0       | 26.93372                 | 82.34456                  | 1.52 (1557)         |
| 0.25      | 26.93584                 | 82.34476                  | 1.79 (1554)         |
| 0.5       | 26.93801                 | 82.34516                  | 3.40 (1551)         |
| 0.75      | 26.93949                 | 82.34544                  | 2.67 (1549)         |
| 1.0       |                          |                           | 1.36 (1545)         |
| 1.25      | 26.94365                 | 82.34656                  | 1.88 (1543)         |
| 1.5       | 26.94602                 | 82.34666                  | 2.91 (1539)         |
| 1.7       | 26.94792                 | 82.34632                  | 1.39 (1536)         |
| 1.9       | 26.94948                 | 82.34526                  | 1.64 (1532)         |
| 2.2       | 26.95183                 | 82.34477                  | 1.70 (1529)         |
| 2.5       | 26.95392                 | 82.34329                  | 1.76 (1524)         |
| 2.7       | 26.95542                 | 82.34285                  | 1.00 (1520)         |
| 2.9       | 26.95736                 | 82.34310                  | 1.45 (1516)         |
| 3.1       | 26.95908                 | 82.34317                  | 1.27 (1512)         |
| 3.4       | 26.96068                 | 82.34257                  | 1.61 (1509)         |
| 3.7       | 26.96256                 | 82.34307                  | 2.06 (1506)         |
| 3.8       | 26.96366                 | 82.34245                  | 2.21 (1502)         |
| 4.1       | 26.96564                 | 82.34325                  | 2.15 (1459)         |
| 4.4       | 26.96614                 | 82.34429                  | 2.15 (1454)         |
| 4.5       | 26.96714                 | 82.34478                  | 1.52 (1452)         |
| 4.6       | 26.96737                 | 82.34395                  | 1.67 (1450)         |
| 4.7       | 26.96811                 | 82.34398                  | 1.27 (1447)         |
| 4.85      | 26.96879                 | 82.34390                  | 1.47 (1443)         |

\* Uncorrected for tide; slack high tide was 61 cm above chart datum.

**ATTACHMENT 4.** Tidal reference data for Englewood, Florida.

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

National Ocean Service

Station ID: 8725747

PUBLICATION DATE: 02/05/2004

Name: ENGLEWOOD, LEMON BAY, FLORIDA

NOAA Chart: 11425

Latitude: 26° 56.0' N

USGS Quad: ENGLEWOOD

Longitude: 82° 21.2' W

To reach the tidal bench marks from the junction of State Road 776 (South McCall Road) and State Road 775 (Placidia Road/Pine Street) in Englewood, proceed west on State Road 776 for 0.8 km (0.5 mi) to Beach Road, then turn left and proceed SW to the Tom Adams Bridge. The bench marks are in the vicinity of the bridge. The tide gage and staff were located west of the bridge tender's house.

PRIMARY BENCH MARK STAMPING NO 1 1973

DESIGNATION: 872 5747 TIDAL 1

MONUMENTATION: Tidal Station disk VM#: 6048

AGENCY: National Ocean Survey (NOS)

PID#: AG7835

SETTING CLASSIFICATION: Concrete culvert abutment

The primary bench mark is a disk set in the top of a concrete culvert head wall, 59 m (195 ft) south of the south corner of the bridge, 9 m (30 ft) SE of the center line of the highway, 5 m (18 ft) south of the SW end of the bridge bulkhead, 3 m (10 ft) SSE of the Tom Adams Bridge Monument, 3 m (10 ft) SE of a manhole cover, and 0.3 m (1 ft) below the level of the highway.

Tidal datums at ENGLEWOOD, LEMON BAY based on:

LENGTH OF SERIES: 1 YEAR

TIME PERIOD: March 1976 - February 1977

TIDAL EPOCH: 1983-2001

CONTROL TIDE STATION: 8725110 NAPLES, GULF OF MEXICO

#### ATTACHMENT 4. Continued

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

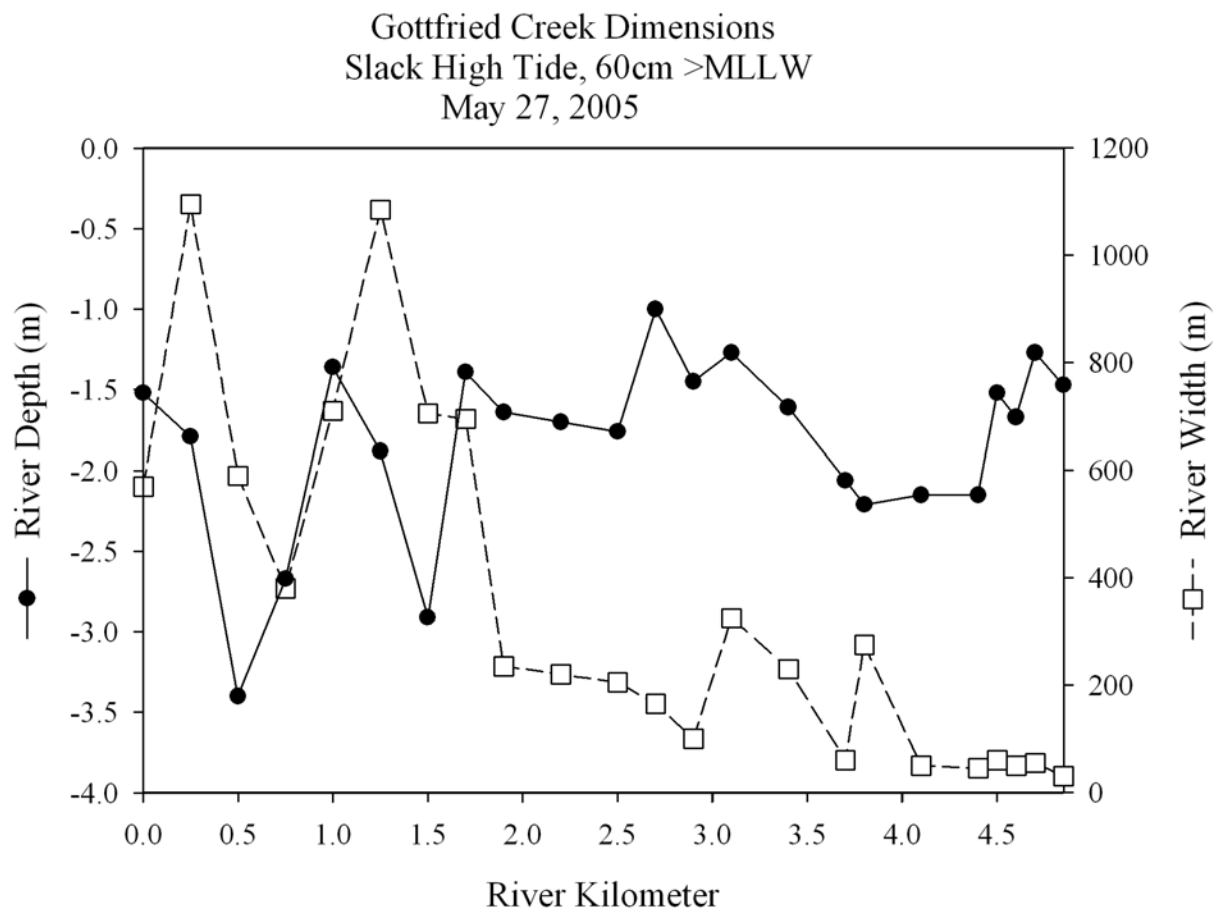
|   |          |
|---|----------|
| HIGHEST OBSERVED WATER LEVEL (05/15/1976) | = 0.918  |
| MEAN HIGHER HIGH WATER (MHHW)             | = 0.478  |
| NORTH AMERICAN VERTICAL DATUM-1988 (NAVD) | = 0.439  |
| MEAN HIGH WATER (MHW)                     | = 0.398  |
| MEAN TIDE LEVEL (MTL)                     | = 0.246  |
| MEAN SEA LEVEL (MSL)                      | = 0.244  |
| MEAN LOW WATER (MLW)                      | = 0.093  |
| MEAN LOWER LOW WATER (MLLW)               | = 0.000  |
| LOWEST OBSERVED WATER LEVEL (01/19/1977)  | = -0.377 |

#### Bench Mark Elevation Information

In METERS above:

| Stamping or Designation | MLLW  | MHW   |
|-------------------------|-------|-------|
| NO 1 1973               | 1.665 | 1.267 |
| IWCH 21 1965            | 7.047 | 6.649 |
| 5747 B                  | 1.341 | 0.943 |
| 5747 C                  | 4.012 | 3.614 |
| 5747 D                  | 3.932 | 3.534 |

**ATTACHMENT 5.** Creek width and depth relative to distance from Lemon Bay.



## ATTACHMENT 6. Bottom types of Gottfried Creek.

### I. INTERTIDAL

- A. *Unvegetated*
  - 1. Sandbar/shoal
  - 2. Oyster reef
  - 3. Natural upland shore
  - 4. Filled shore, unhardened
  - 5. Seawall
- B. *Vegetated*
  - 1. Forested bank
  - 2. Mangrove
  - 3. Marsh

### II. SUBTIDAL

- A. *Unvegetated*
  - 1. Sandbar/shoal
  - 2. Oyster reef
  - 3. Fossil shell exposure
  - 4. Seawall
  - 5. Undercut bank
  - 6. Level sands
  - 7. Level muds
  - 8. Thalweg\*
  - 9. Dredged holes and borrow areas
- B. *Vegetated*
  - 1. Thalassia dominant
  - 2. Halodule dominant
  - 3. Seawall (algae dominant)
  - 4. Level bottom with periphyton cover

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\* A line following the lowest part of a stream bottom.

**ATTACHMENT 7.** Surface (S) and bottom (B) water chemistry in relation to river kilometer (RK). Time is EST.

| RK   | Time<br>HMS | Sal<br>ppt | Temp<br>EC | pH<br>Units | Spec<br>Cond<br>mS/cm | DO<br>mg/l | DO%<br>Sat | Dep<br>m |
|------|-------------|------------|------------|-------------|-----------------------|------------|------------|----------|
| 4.8s | 1342        | 20.31      | 29.78      | 6.88        | 32.76                 | 2.77       | 41.3       | 0.27     |
| 4.8b | 1343        | 23.26      | 29.33      | 6.94        | 37.01                 | 2.66       | 40.1       | 1.70     |
| 4.7s | 1345        | 20.37      | 30.00      | 6.98        | 32.84                 | 3.33       | 49.9       | 0.29     |
| 4.7b | 1346        | 23.72      | 29.29      | 7.08        | 37.66                 | 3.10       | 46.9       | 1.38     |
| 4.5s | 1352        | 16.10      | 30.93      | 7.05        | 27.53                 | 2.61       | 38.9       | 0.23     |
| 4.5b | 1353        | 24.97      | 28.90      | 7.06        | 39.39                 | 2.60       | 39.3       | 1.97     |
| 3.8s | 1401        | 21.45      | 31.29      | 7.15        | 34.31                 | 3.83       | 59.1       | 0.35     |
| 3.8b | 1401        | 26.55      | 28.67      | 7.10        | 41.65                 | 2.77       | 42.1       | 1.95     |
| 3.4s | 1407        | 24.69      | 31.01      | 7.16        | 39.11                 | 3.63       | 56.8       | 0.25     |
| 3.4b | 1408        | 27.87      | 29.08      | 7.25        | 43.50                 | 4.01       | 61.9       | 1.67     |
| 2.9s | 1415        | 27.02      | 30.45      | 7.22        | 42.39                 | 4.14       | 64.7       | 0.28     |
| 2.9b | 1415        | 28.58      | 29.59      | 7.28        | 44.53                 | 4.14       | 64.8       | 1.40     |
| 2.5s | 1423        | 29.05      | 30.10      | 7.28        | 45.19                 | 4.62       | 73.0       | 0.24     |
| 2.5b | 1423        | 29.19      | 29.95      | 7.30        | 45.45                 | 4.36       | 68.8       | 0.92     |
| 1.9s | 1431        | 29.59      | 30.14      | 7.30        | 45.96                 | 4.17       | 66.1       | 0.22     |
| 1.9b | 1431        | 30.13      | 29.35      | 7.37        | 46.68                 | 4.76       | 75.3       | 1.21     |
| 1.9b | 1432        | 30.14      | 29.38      | 7.37        | 46.70                 | 4.67       | 73.4       | 1.19     |
| 1.5s | 1437        | 30.27      | 30.06      | 7.44        | 46.91                 | 4.86       | 77.4       | 0.28     |
| 1.5b | 1438        | 32.35      | 29.28      | 7.54        | 49.73                 | 4.76       | 75.6       | 2.72     |
| 1.0s | 1444        | 32.93      | 30.16      | 7.66        | 50.56                 | 5.66       | 91.6       | 0.29     |
| 1.0b | 1444        | 33.55      | 29.78      | 7.76        | 51.40                 | 6.47       | 104.4      | 1.74     |
| 0.5s | 1449        | 33.75      | 30.24      | 7.79        | 51.71                 | 6.81       | 110.9      | 0.25     |
| 0.5b | 1450        | 34.05      | 29.91      | 7.78        | 52.06                 | 7.02       | 113.9      | 2.38     |
| 0.0s | 1455        | 34.72      | 30.13      | 7.89        | 52.99                 | 8.46       | 138.4      | 0.28     |
| 0.0b | 1456        | 34.71      | 30.15      | 7.90        | 52.98                 | 8.85       | 144.8      | 1.13     |



**ATTACHMENT 8.** Diversity and dispersion of Gottfried Creek mollusks.

| Species                 | River Kilometer |     |     |     |     |     |     |     |     |     |     |     |
|-------------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                         | 0.0             | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 |
| Anomalocardia auberiana | X               |     | X   |     | X   |     |     |     | X   |     |     |     |
| Brachiodontes exustus   |                 | X   |     |     |     |     |     |     |     |     |     |     |
| Cerithium muscarum      | X               |     |     |     |     |     |     |     |     |     |     |     |
| Crassostrea virginica   | X               | X   | X   | X   | X   |     | X   |     | X   |     |     |     |
| Crepidula plana         |                 |     |     |     | X   |     |     |     |     |     |     |     |
| Fasciolaria tulipa      | X               |     |     |     |     |     |     |     |     |     |     |     |
| Littoraria angulifera   | X               | X   |     |     |     |     |     |     |     |     |     |     |
| Lucina pectinata        |                 |     |     |     | X   |     |     |     |     |     |     |     |
| Luciniscia nassula      | X               |     |     |     |     |     |     |     |     |     |     |     |
| Macoma constricta       |                 |     | X   |     | X   |     |     |     |     |     |     |     |
| Macrotoma fragilis      | X               |     |     |     |     |     |     |     |     |     |     |     |
| Melongena corona        |                 | X   | X   |     | X   |     |     |     |     |     |     |     |
| Modulus modulus         |                 |     | X   |     |     |     |     |     |     |     |     |     |
| Mytilopsis leucophaeata |                 |     |     |     | X   |     | X   |     |     |     |     |     |
| Nassarius vibex         |                 | X   |     |     |     |     |     |     |     |     |     |     |
| Neritina usnea          |                 |     |     |     | X   |     |     |     |     |     |     |     |
| Polymesoda caroliniana  |                 |     |     |     |     |     |     |     |     | X   |     |     |
| Pleuroploca gigantea    | X               |     |     |     |     |     |     |     |     |     |     |     |
| Tagelus plebius         | X               |     | X   |     | X   | X   | X   |     | X   | X   | X   |     |
| Tellina tampaensis      |                 |     | X   |     |     |     |     |     |     |     |     |     |
| Species Richness        | 9               | 5   | 7   | 1   | 9   | 1   | 3   | 0   | 3   | 2   | 1   |     |
| By Integer RK           | 9               |     | 10  |     | 10  |     | 3   |     | 3   |     | 2   |     |