

Biological Assessment of

Navarre Beach WWTP

Santa Rosa County

NPDES #FL0023981

Sampled January 1999

October 1999

Biology Section
Division of Administrative and Technical Services
Bureau of Laboratories

Comprehensive Quality Assurance Plan No. 870346G

Department of Environmental Protection

Results of Fifth Year Inspections

Discharger:	Navarre Beach WWTP
County:	Santa Rosa
NPDES Number:	FL0023981
Permit Expiration Date:	9/30/99

Toxics Sampling Inspection (**XSI**)

Date Sampled: 11 January 1999

Results: Copper was detected in the effluent sample (7.6 µg/L) at a level that exceeded Class III marine water quality standards (Rule 62-302.530(24) FAC). Zinc was detected in the effluent sample at a level that complied with Class III marine water quality standards. No organic pollutants were detected in the effluent sample.

Compliance Biomonitoring Inspection (**CBI**)

Date Sampled: 11 January 1999

Results: The effluent sample was not toxic to the fish, *Cyprinella leedsi,* or to the invertebrate, *Ceropdahnia dubia,* during the 48-hour bioassay.

Impact Bioassessment Inspection (**IBI**)

Date Sampled: 13 January 1999

Results: The macroinvertebrate taxa richness decreased 19% at test site 1 compared to the control site. Shannon-Weaver diversity decreased 44% at test site 2 compared to the control site, which violates the Class III water quality standard (Rule 62-302.530(11) FAC). Despite the violation of the biological integrity criterion, all three sites contain pollution-sensitive organisms such as the cumacean, *Oxyurostylis* sp., and the polychaete, *Prionospio heterobranchia.* The control site and test site 2 were dominated by haustorid amphipods, which made up 25% and 64% of each community, respectively. Algal communities did not appear to be affected by the discharge.

Water Quality Inspection (**WQI**)

Date Sampled: 11 January 1999

Results: All effluent nutrients complied with the facility's permit limits and were typical of other estuaries in Florida. The Algal Growth Potential (AGP) was below the 10 mg dry wt/L "problem threshold" at all three study sites. Effluent AGP was 12.5 mg dry wt/L. Chlorophyll *a* was undetected at all three study sites.

This biological assessment was prepared by DEP staff to provide information to be used in reviewing an NPDES permit renewal application for the subject facility. This assessment will be used in conjunction with other information concerning the facility and its receiving water body to determine appropriate final permit conditions.

Introduction

The Navarre Beach Wastewater Treatment Plant is located on Santa Rosa Island in Santa Rosa County, Florida (see map in the Appendix). This 0.9 MGD domestic waste facility has an oxidation ditch with flow equalization, tertiary filters, chlorination, and dechlorination (see Facility Summary in Appendix). The residuals, which are held in a holding tank, are dewatered on residual drying beds, dried, and taken along with static screen solids to the Holley-Navarre Landfill. The effluent is discharged into Santa Rosa Sound and 0.032 MGD of reclaimed water via spray irrigation is used, when needed, on 4.5 acres of plant grounds. The actual flow during this survey was 0.138 MGD.

State permit limits for the Navarre Beach Wastewater Treatment Plant are listed in Table 1. According to the facility's monthly operating reports, the facility exceeded the state's copper limit (with an average value of 30 µg/L for 31 separate tests) from September 1997, through September 1998 (see Facility Summary Sheets in Appendix). The facility is required to conduct 96-hour acute static renewal toxicity tests, using *Ceriodaphnia dubia* and *Cyprinella leedsi,* once every two months. For 1998, the facility passed 4 out of 5 tests, the sixth test, conducted in December, 1998, has not yet been received. The test performed in June, 1998, failed with 100% mortality in the *Ceriodaphnia* test, while two out of three resulting definitive tests passed. In 1997, the facility identified copper as the problem in the effluent. In order to alleviate the elevated levels of copper, the facility began a corrosion control treatment program in June of 1998. Subsequent toxicity tests have passed. No current enforcement actions are in effect.

Methods

The purpose of this investigation was to determine the discharger's effects on the receiving waters. A comparison of biological community health was made between a control site (located near Paradise Point within Santa Rosa Sound) and two test sites bracketing the discharge (see map in the Appendix). A habitat assessment was performed *in situ* to establish comparability between sites, and supplemental physical/chemical data were collected on the effluent and study sites on January 11, 1999, during an outgoing tide. The effluent and study sites were analyzed for nutrients, metals, and for organic constituents (base neutral and acid extractables, and pesticide extractables). Methods used for all chemical analyses are on file at the DEP Central Chemistry Laboratory in Tallahassee.

Acute screening toxicity bioassays, using the invertebrate, *Ceriodaphnia dubia,* and the fish, *Cyprinella leedsi*, as test organisms, were performed on an effluent sample. Sediments from control and test sites were analyzed for grain size and percent organic matter.

Phytoplankton were sampled at both control and test sites via subsurface grabs. Chlorophyll *a* was also determined for phytoplankton communities. Algal Growth Potential (AGP) tests were performed using *Selenastrum capricornutum* as the test organism for the freshwater effluent and *Dunaliella tertiolecta* for the marine receiving-water sites.

Benthic macroinvertebrate communities were evaluated at control and test sites using three replicate petite Ponar grabs. Several different measures of macroinvertebrate and algal community health have been employed to determine the effects of the discharge. These measurements include: taxa richness, Shannon-Weaver diversity index, community composition, functional feeding groups, and algal biomass. For discussion of each of these measures see the *Explanation of Measurements of Community Health* in the Appendix. All field and laboratory biological methods followed Biology Section Standard Operating Procedures (SOP's). The SOP's can be viewed on our web site at <www.dep.state.fl.us/labs/sops.htm>.

The following personnel were involved in this investigation: Glenn Butts, Laurence Donelan and Ken Ferguson (DEP Northwest District), and Julie Baughman, Ken Espy, Marshall Faircloth, Russel Frydenborg, Joy Jackson, Michael Heyn, Elizabeth Miller, Urania Quintana, Johnny Richardson, Lisa Homann, Amy Weaver, Steve Wolfe, David Whiting, and Vicki McGee (DEP Central Biology Laboratory in Tallahassee). The report was reviewed by the Point Source Studies Review Committee, consisting of Wayne Magley, Chuck Ziegmont, and Michael Tanski, as well as District representatives.

Results

The results for this report are in Tables 1 and 2.

Table 1. Effluent limits and summary of chemistry data.

City of Navarre Beach WWTP	Effluent Limits	Effluent Samples	Control Site	Test Site 1	Test Site 2
Organic Constituents (µg/L)					
	-	None Detected	-	-	-
Metals (µg/L)					
Aluminum	≤ 1500 **	50 U	-	-	-
Arsenic	≤ 50 **	20 U	-	-	-
Cadmium	≤ 9.3 **	0.05 U	-	-	-
Chromium	≤ 50 **	10 U	-	-	-
Copper	≤ 2.9 **	7.6	-	-	-
Iron	≤ 300 **	15 U	-	-	-
Lead	≤ 5.6 **	0.1 U	-	-	-
Mercury	≤ 0.025 **	0.1 U	-	-	-
Nickel	≤ 8.3 **	6 U	-	-	-
Selenium	≤ 71 **	40 U	-	-	-
Silver	≤ 2.3 **	0.04 U	-	-	-
Zinc	≤ 86 **	64	-	-	-
Nutrients (mg/L)					
Ortho-phosphate	-	1.9 J	0.08 UQ	0.08 U	0.08 U
Total phosphorus	5.0 * a	2.0	0.015 U	0.015 U	0.015 I
Ammonia	-	0.78	0.01 U	0.011 I	0.012 I
Nitrate+Nitrite	-	3.0	0.008 I	0.014	0.014
TKN	-	1.3	0.25 I	0.22 I	0.22 I
Organic Nitrogen	-	0.52	0.24	0.21	0.23
Total Nitrogen	-	4.3	0.26	0.23	0.23
General Phys-Chem Parameters					
Habitat Assessment	-	-	61	59	59
D.O. (mg/L)	5.0 d	9.4	11.1	11.2	11
pH (SU)	6.0-8.5	6.6	7.0	6.4	7.3
Conductivity (µmhos/cm)	-	1,198	25,433	25,122	25,072
Salinity (PPT)	-	0.8	15.5	15.2	15.2
Temperature (°C)	-	12.6	8.9	9.7	9.4
B.O.D., 5 day (mg/L)	5.0 a	5.6 Q	1.2 Q	1.6 Q	1.2 Q
Color (Pt-Co)	-	20	20	20	15
Flow (MGD)	0.9 b *	0.14	-	-	-
Turbidity (NTU)	-	0.5	0.6 A	0.5	0.5
AGP (mg dry wt/L)	-	12.5	0.1	1.1	2.0
Toxicity (48-hour static, screening bioassay)					
Bioassay - Fish	-	Not Toxic	-	-	-
Bioassay - Invertebrate	-	Not Toxic	-	-	-
Microbiology (# counts/100mL)					
Fecal Coliforms	14 c	20 U	20 U	20 U	20 U
Total Coliforms	-	20 U	20 B	20 U	20 B

* Permit Limit
** Class III water quality standard
A - Value reported is the mean of two or more determinations
B - Results based on colony counts outside the acceptable range
I - Value is < minimum quantitation limit, and ≥ minimum detection limit
J - Estimated value
Q - Sample held beyond normal holding time
U - Analyzed for but not detected; value is the minimum detection limit

a - Annual average
b - Monthly average
c - Weekly average
d - Daily average

Discussion

The study area can be described as a moderate salinity bay formed behind a barrier island. Land use in the area was predominantly residential and commercial. Habitat scores were in the "good" category at all three study sites, ranging from 59 points at test sites 1 and 2, to 61 points at the control site. Shorelines at all three study sites were mostly made up of natural shoreline, with occasional riprap (see Habitat Assessment Field Data Sheets in Appendix). The study sites were similar with respect to many of the physical/chemical parameters such as dissolved oxygen (all above 11.0 mg/L), salinity (near 15 ppt), temperature (near 9°C), and substrate composition (sand, shell, and detritus).

In spite of the corrosion control treatment program implemented by the facility, the effluent copper (7.6 µg/L) exceeded the Class III marine water quality standard (Rule 62-302.530(24) FAC). Zinc was detected in the effluent sample, yet complied with Class III marine water quality standards (Table 1). No organic pollutants were detected in the effluent sample.

The elevated copper was not toxic to the fish, *Cyprinella leedsi,* or to the invertebrate, *Ceriodaphnia dubia,* during the 48-hour bioassay (Appendix).

Coliform bacteria counts were very low in the effluent sample and at the Santa Rosa Sound study sites (Table 1).

All of the effluent nutrients complied with the facility's permit limits and levels at the study sites were typical of estuarine systems in Florida (Table 1). The effluent BOD (5.6 mg/L) complied with the facility's single sample limit (10.0 mg/L). The BOD sample was held beyond the normal holding time, which lowers the BOD because some of the organic material is already degraded by the microorganisms before the 5-day incubation period. The BOD value probably would have been greater if it had been analyzed within the holding time.

AGP, which measures bioavailable nutrients via algal response, was below the 10 mg dry wt/L "problem threshold" (Ron Raschke,

Table 2. Community structure of control and test sites.

Navarre Beach WWTP	Control Site	Test Site 1	Test Site 2
Macroinvertebrate Quantitative			
Number of Taxa	36	29	21
Shannon-Weaver diversity	4.1	4.1	2.3
Number of Polychaete Taxa	14	14	8
Community Composition			
% Amphipoda	31.1	11.1	66.0
% Cumacea	0.3	1.9	6.7
% Decapoda	4.3	0.9	1.0
% Gastropoda	3.7	3.7	1.0
% Pelecypoda	6.1	13.0	1.6
% Polychaeta	37.2	57.4	18.6
% Tanaidacea	6.0	5.0	0.0
% Thoracica	5.3	0.0	0.0
% Tubificidae	1.3	4.6	2.1
% Other	4.7	2.4	3.0
Functional Feeding Groups			
% Burrowing Deposit Feeders	6.1	16.7	4.1
% Predators/Carnivores	18.1	23.6	11.9
% Scavengers	5.1	1.4	1.3
% Surface Deposit Feeders	15.0	22.2	5.7
% Suspension Feeders	49.4	33.3	75.0
Other	6.3	2.8	2.0
Phytoplankton Algae			
Number of Taxa	11	15	12
Shannon-Weaver diversity	1.8	2.4	2.6
Chlorophyll *a* (µg/L)	1.12 U	1.0 U	1.0 U
Algal Density (#/mL)	1,321	865	969
% Blue-green	0.4	1.6	31.1
% Cryptophytes	44.3	33.1	40.8
% Diatoms	10.3	17.7	20.2
% Dinoflagellates	0.4	2.8	0.0
% Green	42.6	43.1	4.3
AGP (mg dry wt/L)	0.1	1.1	2

U - Analyzed for but not detected; value is the minimum detection limit

U.S. EPA, pers. comm.) at all three study sites. Effluent AGP was 12.5 mg dry wt/L.

Phytoplankton data were used to assess the algal community health (Figure 1). Algal densities were low for a marine system and overall the discharge did not seem to be having an adverse effect on the algal communities (Table 2). Chlorophyll *a* was undetected at all three study sites.

Quantitative measures of macroinvertebrate health indicated degradation at the test sites, especially test site 2 that may be associated with the discharge (Figure 2). Macroinvertebrate taxa richness at test site 1 and 2 was 19% and 42% lower than the control site, respectively (Figure 2). The Shannon-Weaver diversity was the same at test site 1 and the control site. The diversity at test site 2 was 44% less than the control site, and therefore does not meet the Class III marine water quality standard (Rule 62-302.530(11) FAC) (Table 2). The difference is due to an increase in haustorid amphipods from the control site (with 25% contribution) to test site 2 (64% contribution). Despite this difference, all three study sites contained the somewhat pollution-sensitive cumacean, *Oxyurostylis* sp., and the polychaete, *Prionospio heterobranchia* (see Macroinvertebrate Taxa Lists in the Appendix). Polychaete taxa richness was the same at the control site and test site 1, and decreased 43% at test site 2. Pelecypods, normally indicators of "good water quality", made up 6% of the control site, 13% of test site 1, and 2% of test site 2.

Literature Cited

EA Engineering, Science, and Technology and Tetra Tech, Inc. 1994. Bioassessment for the nonpoint source program (draft). Prepared for the Fla. Dept. Environ. Protection. Unpaginated.

Miller, W. E., T. E. Maloney, and J. C. Greene. 1978. The *Selenastrum capricornutum* Printz algal assay bottle test. U. S. Environ. Prot. Agency, EPA-600/9-78-018. 126 p.

Raschke, R. L. and D. A. Schultz. 1987. The use of the algal growth potential test for data assessment. J. Wat. Poll. Cont. Fed. 59(4): 222-227.

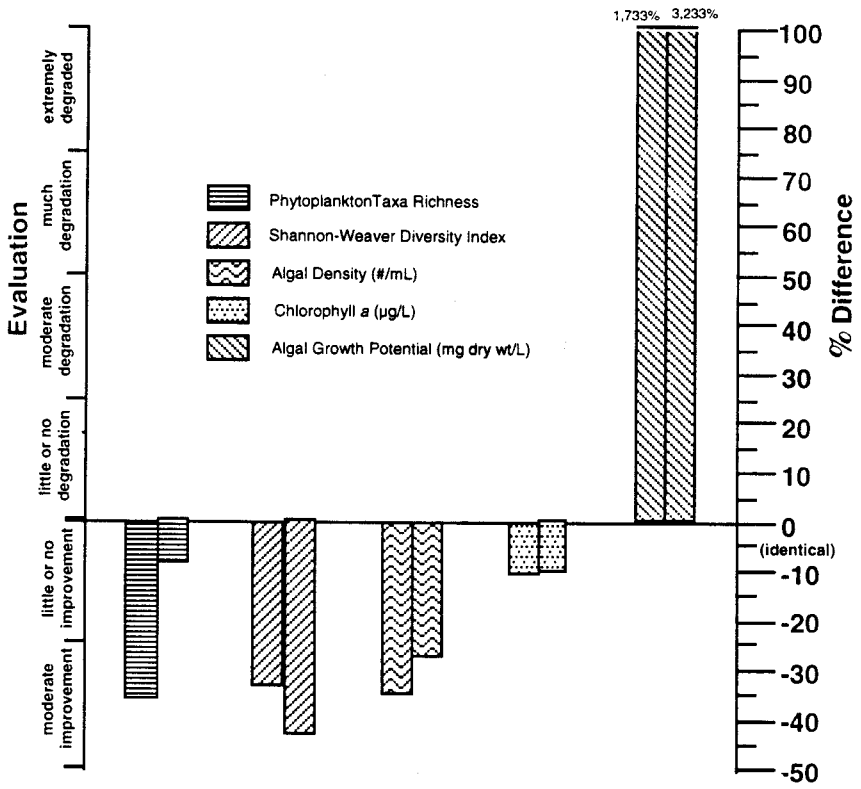


Figure 1. Effect of discharge on the phytoplankton community.

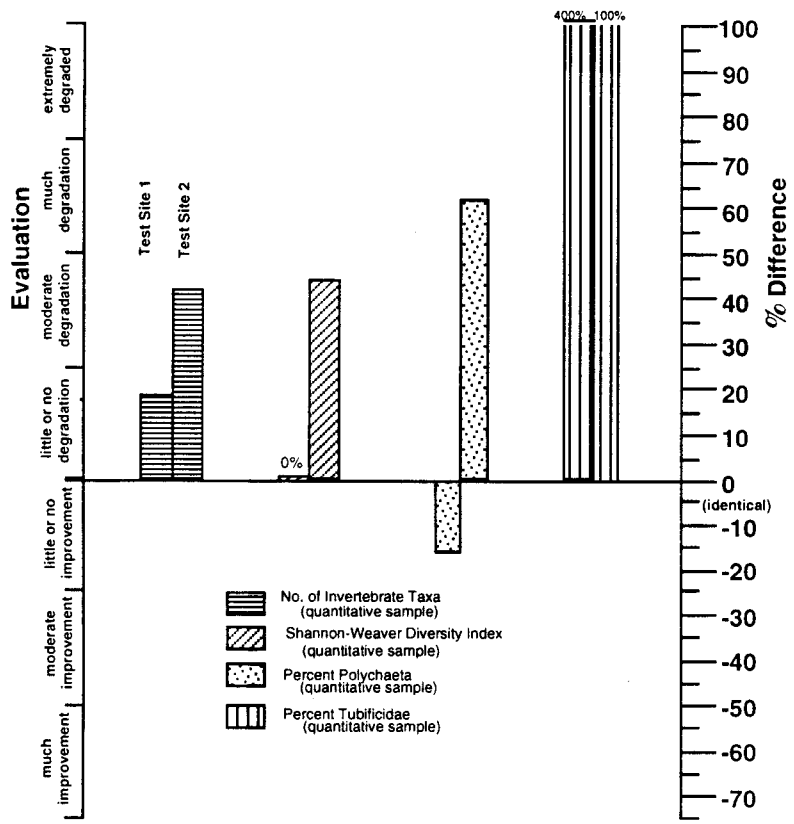
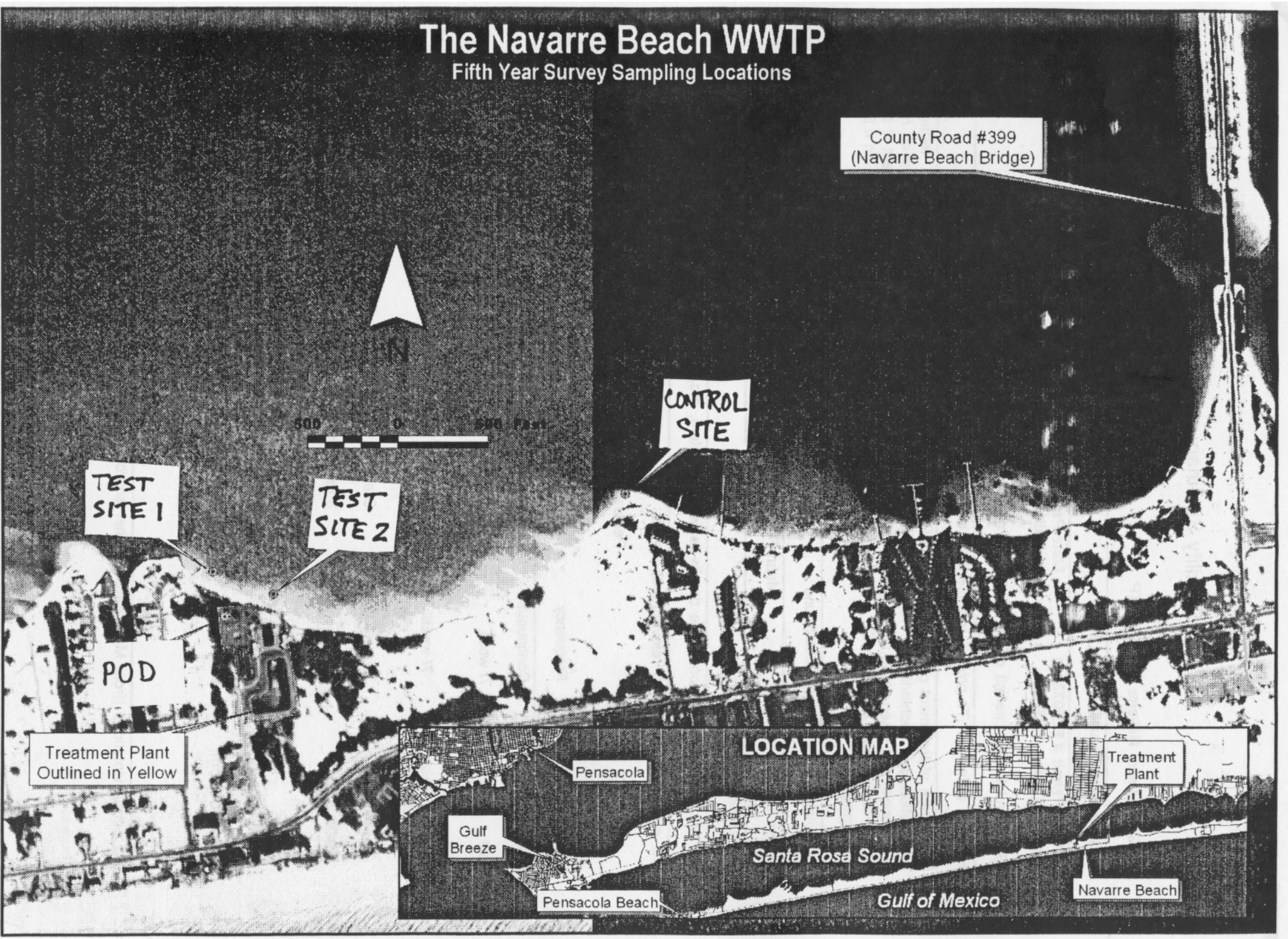


Figure 2. Effect of discharge on the benthic macroinvertebrate community.

Ross, L. T. 1990. Methods for aquatic biology. Fla. Dept. Environ. Reg. Tech. Ser. 10(1): 1-47.

Weber, C. I. 1993. Methods for measuring the acute toxicity of effluents to freshwater and marine organisms. 4th edition. EPA/600/4-90/027. U. S. EPA, Cincinnati, Ohio. 216 pp.


The Navarre Beach WWTP
Fifth Year Survey Sampling Locations
County Road #399
(Navarre Beach Bridge)
N
500
0
500 Feet
CONTROL SITE
TEST SITE 1
TEST SITE 2
POD
Treatment Plant
Outlined in Yellow
LOCATION MAP
Pensacola
Gulf Breeze
Pensacola Beach
Santa Rosa Sound
Gulf of Mexico
Treatment Plant
Navarre Beach

Facility Summary

Facility Name: Navarre Beach WWTP Date Summary Prepared: 12/30/98

Location map: County: Santa Rosa District: Northwest / 10

NPDES Permit # FL0023981 expiration date: 09/30/99 State Permit # DO17-175051 expiration date: 09/30/99 Facility Type: Dom.

State and Federal permit combined under Federal permit number

Function of facility: To provide treatment for domestic sewage on Santa Rosa Island

Description of treatment process: A 0.90 MGD oxidation ditch WWTP with flow equalization, tertiary filters, chlorination, and dechlorination. The residuals which are held in a holding tank are dewatered on residual drying beds, dried, and taken along with static screen solids to the Holley-Navarre Landfill. The effluent is discharged into Santa Rosa Sound. A 0.032 MGD of reclaimed water via spray irrigation is used when needed on 4.5 acres of plant ground.

Receiving waters: Santa Rosa Sound Classification III

Design Flow: 0.90 MGD Mean Flow: 0.172 MGD Flow during survey: 0.138 MGD

Discharge is: Continuous Best time to sample is: N/A

If facility has a mixing zone, give details (size, parameters, etc.) N/A

List effluent limits (attach relevant paperwork):

Federal/State Effluent Limits

Parameter	Frequency	Sample Type	Limit (units)
Flow	Continuous	Flow Meter	0.9 MGD (mx. mo. avg.)
pH	7/ week	Grab	6.0 (min) 8.5 (max)
Chlorine Residual (after disinfection)	7/ week	Grab	0.01 mg/L (mx. daily avg)
Dissolved O_2	5/ week	Grab	5.0 mg/L (min daily avg.)
CBOD-5 day	Weekly	8 Hr. Comp	5.0 mg/L (mx annl. avg.)
TSS	Weekly	8 Hr. Comp	5.0 mg/L (mx annl. avg.)
Total Phosphorus	Weekly	8 Hr. Comp	5.0 mg/L (mx annl. avg.)
Fecal Coliform	Weekly	Grab	14/100 ml (mx wkly avg.)

List permit violations (from MOR data or other source) and plant upsets within past year:

The facility exceeded the state's limit of <2.9 ug/L for Cu on the following dates...

Date	# ug/L	Date	#ug/L	Date	#ug/L
9/23/98	42.0	1/14/98	25.0	11/25/97	36.0
8/5/98	48.0	1/21/98	11.0	10/1/97	52.0
7/1/98	29.0	1/29/98	7.2	10/8/97	36.0
6/3/98	28.0	12/3/97	9.1	10/15/97	14.0
5/6/98	30.0	12/10/97	20.0	10/22/97	50.0
4/1/98	23.0	12/17/97	44.0	10/29/97	27.0
3/4/98	17.0	12/23/97	43.0	9/3/97	32.0
3/11/98	23.0	12/30/97	35.0	9/10/97	35.0
3/15/98	29.0	11/13/97	38.0	9/17/97	51.0
2/4/98	18.0	11/19/97	37.0	9/24/97	32.0
1/7/98	32.0				

-On June 21, 1998, a sludge drying bed overflowed approximately 300 to 400 gallons of digested sludge

Describe previous impact bioassessments, WQBEL's and previous or current enforcement actions: The Navarre Beach Wastewater Treatment Facility is required to conduct 96-hour acute static renewal toxicity tests using Ceriodaphnia dubia and Cyprinella leedsi once every 2 months. For 1998, the facility has passed 4 out of the 5 tests performed. The 6th test conducted in 12/98 has not yet been received. The 6/98 test failed with 100 mortality in the Ceriodaphnia dubia. 2 out of the 3 resulting definitive tests passed. Sometime in 1997, the facility identified copper as a problem in the effluent. As a result, in 7/98 a corrosion control treatment program was instituted to attack the situation. The program consists of adding Ortho Phosphate to the drinking water. Both tests performed since 7/98 passed. The facility will continue to be monitored to see if the Ortho Phosphate is helping. No current enforcement actions are in effect.

Discuss comparability of MOR results to past FDEP results and whether there are trends (improving, declining) in the data set: No definite trends can be identified within the data set.

Additional information: The corrosion control treatment program to alleviate the elevated levels of Cu were begun June 29, 1998. Ortho Phosphate and lime are being used to treat the problem.

Staff contributing to this review (signature)

Glenn Butts — Biologist
_____ — Inspector
_____ — Engineer
Kenny Ferguson — Other
Kim Allen — Other

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5/21/98)

SUBMITTING AGENCY CODE: 8010 SUBMITTING AGENCY NAME: FDEP	STORET STATION NUMBER: 33.03.0H41	DATE: 01-11-99	TIME: 1200	RECEIVING BODY OF WATER: SANTA ROSA SOUND

REMARKS: CONTROL SITE	COUNTY: SANTA ROSA	LOCATION: PARADISE POINT	FIELD NAME: # 4

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commericial	Industrial	Other (specify)
				100			

Local Watershed Erosion: None: ☐ Slight: ☒ Moderate: ☐ Heavy: ☐

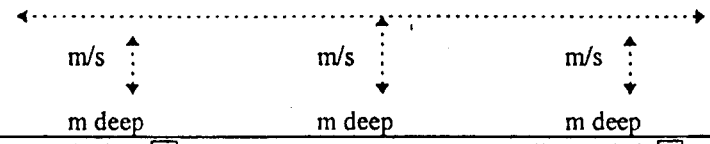
Local Watershed NPS Pollution: No evidence: ☐ Slight: ☒ Moderate potential: ☐ Obvious sources: ☐

Width of riparian vegetation (m) on least buffered side: **List & map dominant vegetation on back**

Artificially Channelized ☐ NO Artificially Impounded ☐ YES — none

High Water Mark: + = (m above present water level) (present depth in m) (m above bed)

Typical Width (m)/Depth (m)/Velocity (m/sec) Transect



Canopy Cover %: Open: ☒ Lightly Shaded: ☐ (11-45%) Moderately Shaded: ☐ (46-80%) Heavily Shaded: ☐

SEDIMENT SUBSTRATE

Sediment Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐

Sediment Oils: Absent: ☒ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none Silt smothering: none Other: ☐

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Sand	50		PONAR
Leaf Packs or Mats				Mud/Muck/Silt	10		
Aquatic Vegetation				Other: Beach debris	10		
Rock or Shell Rubble	20		PONAR	Other:			
Undercut banks/Roots	10			**Draw aerial view sketch of habitats found in 100 m section.**			

Water Quality	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm) or Salinity (ppt):	Time	SALINITY	Secchi (m):
Top	0.6	8.88	7.02	11.12	25,433	1200	15.5	
Mid-depth								
Bottom								

System Type: Stream: ☐ 1st - 2nd order Lake: ☐ Wetland: ☐ Estuary: ☒ Other: ☐

Water Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐

Water Surface Oils: None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity: Clear: ☐ Slightly Turbid: ☒ Turbid: ☐ Opaque: ☐

Color: Tannic: ☐ Green (algae): ☐ Clear: ☒ Other: ☐

Weather Conditions/Notes:

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☒	☐
Fish	☐	☐	☒	☐
Aquatic Macrophytes	☒	☐	☐	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

Sampling Team: G. BUTTS, L. DONELAN, K. FERGUSON

Signature: Glenn Butts

Date: 01-11-99

DEPARTMENT OF ENVIRONMENTAL REGULATION

MARINE BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: 9010 / SUBMITTING AGENCY NAME: FDEP	STORET STATION NUMBER: 33.03.0H41	DATE (M/D/Y): 01-11-99	RECEIVING BODY OF WATER: SANTA ROSA SOUND

REMARKS:	LOCATION:	FIELD ID/NAME:
CONTROL SITE	PARADISE POINT, EAST OF OUTFALL, WEST OF TOLL BRIDGE	# 4

Habitat Parameter / score	Excellent	Good	Fair	Poor
Littoral Alterations: 6	None—Unaltered shoreline. 9-10 points	Mostly natural shoreline, but with occasional riprap. 6-8 points	Shoreline consisting mostly of riprap and vertical seawalls. 3-5 points	Shoreline consisting almost entirely of vertical seawalls. 0-2 points
Community Types Observed: 26	At least four communities observed from the following list: mangrove swamp, marsh, oyster bar, grass bed, reef, saltern, natural beach, or tidal creek. 38-50 points	Two or three communities observed from those listed. 26-37 points	One community observed from those listed. 13-25 points	No communities observed from those listed. 0-12 points
Tidal Fluctuation: 3	>0.75 m. 4-5 points	0.5 - 0.75 m. 3 points	0.25 - 0.5 m. 2 points	<0.25 m. 0-1 point
Freshwater Discharges/ Alterations: 5	Only natural runoff.. 9-10 points	Mostly natural runoff, but with a few, small stormwater sources. 6-8 points	Considerable stormwater discharge from local roads, parking lots, etc. 3-5 points	Extensive manmade discharges, especially from canals draining large tracts of land. 0-2 points
Flow and Wave Action: 6	Light to moderate wave action present except under the harshest weather conditions. Flow unrestricted by manmade structures. 9-10 points	—	—	Heavy wave action sometimes present even during average weather conditions, or flow restricted by manmade structures so that velocities are very high. 0-2 points
Sediment Type: 15	Combination of sand, gravel, and shell. 12-15 points	Primarily sand, with small areas of mud. 8-11 points	Mixture of sand and mud, or well-aerated mud only. 4-7 points	Anaerobic mud. 0-3 points

TOTAL SCORE: 61

COMMENTS: GRASS BED FOUND IN OCT 1991 NOT OBSERVED IN 1995 OR PRESENT

ANALYSIS DATE:	ANALYST:	SIGNATURE:
01-11-99	G. BUTTS	Glenn Butts

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5/21/98)

SUBMITTING AGENCY CODE: 8010 SUBMITTING AGENCY NAME: FDEP	STORET STATION NUMBER: 33.03.0H31	DATE: 01-11-99	TIME: 1100	RECEIVING BODY OF WATER: SANTA ROSA SOUND

REMARKS: TEST SITE # ~~2~~ 1	COUNTY: SANTA ROSA	LOCATION: 20 M EAST OF NAVARRE WWTP	FIELD NAME: # 3

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commericial	Industrial	Other (specify)
				100			

Local Watershed Erosion: None: ☒ Slight: ☐ Moderate: ☐ Heavy: ☐

Local Watershed NPS Pollution: No evidence: ☐ Slight: ☐ Moderate potential: ☒ Obvious sources: ☐

Width of riparian vegetation (m) on least buffered side:

List & map dominant vegetation on back

Artificially Channelized ☐ NO
Artificially Impounded ☐ YES
none

High Water Mark: + =
(m above present water level) (present depth in m) (m above bed)

Typical Width (m)/Depth (m)/Velocity (m/sec) Transect
m wide

m/s m/s m/s
m deep m deep m deep

Canopy Cover %: Open: ☒ Lightly Shaded: ☐ (11-45%) Moderately Shaded: ☐ (46-80%) Heavily Shaded: ☐

SEDIMENT SUBSTRATE

Sediment Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐

Sediment Oils: Absent: ☒ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none Silt smothering: none Other: ☐

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Sand	40		PONAR
Leaf Packs or Mats				Mud/Muck/Silt	10		
Aquatic Vegetation				Other: Beach debris	10		
Rock or Shell Rubble	30		PONAR	Other:			
Undercut banks/Roots	10			**Draw aerial view sketch of habitats found in 100 m section.**			

Water Quality	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm) or Salinity (ppt):	Time	SALINITY	Secchi (m):
Top	0.6	9.65	6.44	11.16	25,122	1100	15.2	
Mid-depth								
Bottom								

System Type: Stream: ☐ 1st - 2nd order Lake: ☐ Wetland: ☐ Estuary: ☒ Other: ☐

Water Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐

Water Surface Oils: None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity: Clear: ☐ Slightly Turbid: ☒ Turbid: ☐ Opaque: ☐

Color: Tannic: ☐ Green (algae): ☐ Clear: ☒ Other: ☐

Weather Conditions/Notes:

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☒	☐
Fish	☐	☐	☒	☐
Aquatic Macrophytes	☒	☐	☐	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

Sampling Team: G. BUTTS, L. DONELAN, K. FERGUSON

Signature: Glenn Butts

Date: 01-11-99

DEPARTMENT OF ENVIRONMENTAL REGULATION

MARINE BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: 8010 / SUBMITTING AGENCY NAME: FDEP	STORET STATION NUMBER: 33.03.0H31	DATE (M/D/Y): 01-11-99	RECEIVING BODY OF WATER: SANTA ROSA SOUND

REMARKS: TEST SITE # ~~2~~ 1	LOCATION: 20 M EAST OF NAVARRE WWTP	FIELD ID/NAME: # 3

Habitat Parameter / score	Excellent	Good	Fair	Poor
Littoral Alterations: 6	None—Unaltered shoreline. 9-10 points	Mostly natural shoreline, but with occasional riprap. 6-8 points	Shoreline consisting mostly of riprap and vertical seawalls. 3-5 points	Shoreline consisting almost entirely of vertical seawalls. 0-2 points
Community Types Observed: 24	At least four communities observed from the following list: mangrove swamp, marsh, oyster bar, grass bed, reef, saltern, natural beach, or tidal creek. 38-50 points	Two or three communities observed from those listed. 26-37 points	One community observed from those listed. 13-25 points	No communities observed from those listed. 0-12 points
Tidal Fluctuation: 3	>0.75 m. 4-5 points	0.5 - 0.75 m. 3 points	0.25 - 0.5 m. 2 points	<0.25 m. 0-1 point
Freshwater Discharges/ Alterations: 5	Only natural runoff.. 9-10 points	Mostly natural runoff, but with a few, small stormwater sources. 6-8 points	Considerable stormwater discharge from local roads, parking lots, etc. 3-5 points	Extensive manmade discharges, especially from canals draining large tracts of land. 0-2 points
Flow and Wave Action: 6	Light to moderate wave action present except under the harshest weather conditions. Flow unrestricted by manmade structures. 9-10 points	—	—	Heavy wave action sometimes present even during average weather conditions, or flow restricted by manmade structures so that velocities are very high. 0-2 points
Sediment Type: 15	Combination of sand, gravel, and shell. 12-15 points	Primarily sand, with small areas of mud. 8-11 points	Mixture of sand and mud, or well-aerated mud only. 4-7 points	Anaerobic mud. 0-3 points

TOTAL SCORE: 59

COMMENTS: SAME HABITAT TYPE AS TEST SITE 1

ANALYSIS DATE: 01-11-99	ANALYST: G. BUTTS	SIGNATURE: Glenn Butts

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5/21/98)

SUBMITTING AGENCY CODE: 8010 SUBMITTING AGENCY NAME: FDEP	STORET STATION NUMBER: 33.03.0H50	DATE: 01-11-99	TIME: 1120	RECEIVING BODY OF WATER: SANTA ROSA SOUND

REMARKS: TEST SITE # X (2)	COUNTY: SANTA ROSA	LOCATION: 20 M WEST OF NAVARRE WWTP	FIELD NAME: # 2

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commericial	Industrial	Other (specify)
				100			

Local Watershed Erosion: None: ☐ Slight: ☒ Moderate: ☐ Heavy: ☐

Local Watershed NPS Pollution: No evidence: ☐ Slight: ☒ Moderate potential: ☐ Obvious sources: ☐

Width of riparian vegetation (m) on least buffered side:

List & map dominant vegetation on back

Artificially Channelized ☐ NO nonc
Artificially Impounded ☐ YES

High Water Mark: + =
(m above present water level) (present depth in m) (m above bed)

Typical Width (m)/Depth (m)/Velocity (m/sec) Transect
m wide

m/s	m/s	m/s
m deep	m deep	m deep

Canopy Cover %: Open: ☒ Lightly Shaded: ☐ (11-45%) Moderately Shaded: ☐ (46-80%) Heavily Shaded: ☐

SEDIMENT SUBSTRATE

Sediment Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐

Sediment Oils: Absent: ☒ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: (none) Silt smothering: (none) Other: ☐

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Sand	50		
Leaf Packs or Mats				Mud/Muck/Silt	10		
Aquatic Vegetation				Other:			
Rock or Shell Rubble	30			Other:			
Undercut banks/Roots	10			**Draw aerial view sketch of habitats found in 100 m section.**			

Water Quality	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm) or Salinity (ppt):	Time	SALINITY	Secchi (m):
Top	0.6	9.42	7.3	10.95	25,072	1120	15-2	
Mid-depth								
Bottom								

System Type: Stream: ☐ 1st - 2nd order Lake: ☐ Wetland: ☐ Estuary: ☒ Other: ☐

Water Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐

Water Surface Oils: None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity: Clear: ☐ Slightly Turbid: ☒ Turbid: ☐ Opaque: ☐

Color: Tannic: ☐ Green (algae): ☐ Clear: ☒ Other: ☐

Weather Conditions/Notes:

No Beach debris at this site

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☒	☐
Fish	☐	☐	☒	☐
Aquatic Macrophytes	☒	☐	☐	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

Sampling Team: G. Butts, L. Donelan, K. Ferguson

Signature: Glenn Butts

Date:

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
MARINE BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: 8010 SUBMITTING AGENCY NAME: FDEP	STORET STATION NUMBER: 33.03.OH50	DATE (M/D/Y): 01-11-99	RECEIVING BODY OF WATER: SANTA ROSA SOUND
REMARKS: TEST SITE #X(2)	LOCATION: 20 M WEST OF NAVARRE WWTP		FIELD ID/NAME: #2

Habitat Parameter score	Excellent	Good	Fair	Poor
Littoral Alterations 6	None—Unaltered shoreline. 9-10 points	Mostly natural shoreline, but with occasional riprap. 6-8 points	Shoreline consisting mostly of riprap and vertical seawalls. 3-5 points	Shoreline consisting almost entirely of vertical seawalls. 0-2 points
Community Types Observed 24	At least four communities observed from the following list: mangrove swamp, marsh, oyster bar, grass bed, reef, saltern, natural beach, or tidal creek. 38-50 points	Two or three communities observed from those listed. 26-37 points	One community observed from those listed. 13-25 points	No communities observed from those listed. 0-12 points
Tidal Fluctuation 3	>0.75 m. 4-5 points	0.5 - 0.75 m. 3 points	0.25 - 0.5 m. 2 points	<0.25 m. 0-1 point
Freshwater Discharges/ Alterations 5	Only natural runoff.. 9-10 points	Mostly natural runoff, but with a few, small stormwater sources. 6-8 points	Considerable stormwater discharge from local roads, parking lots, etc. 3-5 points	Extensive manmade discharges, especially from canals draining large tracts of land. 0-2 points
Flow and Wave Action 6	Light to moderate wave action present except under the harshest weather conditions. Flow unrestricted by manmade structures. 9-10 points	—	—	Heavy wave action sometimes present even during average weather conditions, or flow restricted by manmade structures so that velocities are very high. 0-2 points
Sediment Type 15	Combination of sand, gravel, and shell. 12-15 points	Primarily sand, with small areas of mud. 8-11 points	Mixture of sand and mud, or well-aerated mud only. 4-7 points	Anaerobic mud. 0-3 points

TOTAL SCORE 59

COMMENTS: HABITAT CONSISTS OF SAND/SHELL & ROCKS ALONG SHORE

ANALYSIS DATE:	ANALYST:	SIGNATURE:
01-11-99	G. BUTTS	Glenn Butts

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Navarre WWTP
County: Santa Rosa
Contact / District: Glenn Butts / Northwest
NPDES Permit #: FL0023981
LIMS Sample #: 364323 LIMS Job #: ELH-1999-01-12-11
sample log ____ ow
Test Type: Screening / Definitive
Static / Static Renewal / Flow-through
Test Number: 1 of 2
Room B246 Temp Range 23.5-25.0°C
Incubator # & Temperature range - 24.4-25.6°C

Sample Collection: Date 1/11/99 Time 10:05
Test Beginning: Date 1/12/99 Time 13:30
Test Ending: Date 1/14/99 Time 13:30
Organism Batch #: 2 Diluent Batch #: 3
Organism Age: <24 hrs SRT toxicant ____ batch #: ____
Remarks:
Test organism: Ceriodaphnia dubia

Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm) 0 hr	24 h	48 h
Ctl	A	5	5	5	8.2		8.1	24.0		23.6	7.6		7.9	170		180
	B	5	5	5			8.1			23.6			7.9			175
	C	5	5	5			8.1			23.5			8.0			175
	D	5	5	5			8.1			23.4			8.0			190
100%	A	5	5	5	7.1		8.5	23.8		23.6	8.5		8.1	990		1135
	B	5	5	5			8.5			23.6			8.0			1170
	C	5	5	5			8.5			23.6			8.0			1170
	D	5	5	5			8.5			23.5			8.0			1270
measured by:		FW	FW	MF	CH		MF	CH		MF	CH		MF	CH		MF
recorded by:		MF	FW	MF	FW		FW	FW		FW	FW		FW	FW		FW

Investigators' Signatures

Manfred Faircloth
Courtney Head

reviewer

form updated 5/22/98

Water Quality Parameters	Salt Water / Well Water	20% Min Water Batch #3	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):			Not measured			FW
Lab Total Residual Cl2 (mg/L):		<0.03	<0.03	DR-100	CH	MF
Alkalinity (mg/L as $CaCO_3$):		86	170	Hach	CH	MF
Hardness (mg/L as $CaCO_3$):		80	75	Hach	CH	MF
Total ammonia (mg/L as N):		<0.017	1.58	ORION	FW	FW
Salinity:		0	0	YCTmeter	CH FW	MF

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Navarre WWTP
County: Santa Rosa
Contact / District: Glenn Butts/Northwest
NPDES Permit #: FL0023981
LIMS Sample #: 364323 LIMS Job #: TLH-1999-01-12-11

Sample Collection: Date 1/11/99 Time 10:05
Test Beginning: Date 1/12/99 Time 14:00
Test Ending: Date 1/14/99 Time 13:30
Organism Batch #: 104 Diluent Batch #: Well
Organism Age: 11 days SRT toxicant batch #: —

sample log — DW ~~SW~~
Test Type: ~~Screening~~ (Definitive)
(Static) | Static Renewal | Flow-through
Test Number: 2 of 2

Remarks:

Test organism: Cyprinella leedsi

Room B246 Temperature Range 23.5-25.0°C
Incubator #3 Temperature Range 24.5-25.5°C

Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) ~~Cond. (µmhos/cm)~~ 0 hr	Cond. 24 h	Cond. 48 h
Ctl A	D1	5	5	5	7.7	8.2	8.3	24.0	23.8	24.2	7.5	7.3	7.9	220	235	255
Ctl B	D2	5	5	5	7.7	8.3	8.3	23.9	23.8	23.9	7.5	7.4	7.9	240	245	260
Ctl C	D3	5	5	5	7.7	8.3	8.3	23.9	23.7	23.9	7.5	7.4	7.9	240	250	260
Ctl D	D4	5	5	5	7.7	8.3	8.3	23.9	23.6	24.1	7.3	7.5	7.9	240	250	260
100% A	D5	5	5	5	7.0	8.0	8.3	23.9	23.5	24.1	8.7	7.4	7.9	1110	1010	1235
100% B	D6	5	5	5	7.0	8.0	8.3	23.9	23.4	24.0	8.7	7.3	7.9	1145	1150	1245
100% C	D7	5	5	5	7.0	8.0	8.3	23.9	23.4	24.0	8.8	7.4	7.8	1145	1160	1220
100% D	D8	5	5	5	7.0	8.0	8.3	23.9	23.4	23.9	8.8	7.4	7.8	1155	1190	1255
measured by:		FW	FW	FW	CH	CH	MF	CH	CH	MF	CH	CH	MF	CH	CH	MF
recorded by:		MF	FW	MF	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW

Investigators' Signatures

Susan Wenkel
Marshall Faircloth
Courtney Hee

Water Quality Parameters	Salt Water (Well Water)	20% Min Water	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):			Not measured			FW
Lab Total Residual Cl2 (mg/L):	<0.03		<0.03	DR-100	CH	MF
Alkalinity (mg/L as $CaCO_3$):	125		170	Hach	CH	MF
Hardness (mg/L as $CaCO_3$):	119		75	Hach	~~MF~~ ~~Hach~~ CH	MF
Total ammonia (mg/L as N):	<0.017		1.58	Orion	FW	FW
Salinity:	0	-	0	YCT meter	CH/FW	MF

reviewer form updated 5/22/98

Phytoplankton taxa list and densities (#/mL) for Navarre WWTP, collected via subsurface grabs in the Santa Rosa Sound on 1 January, 1999.

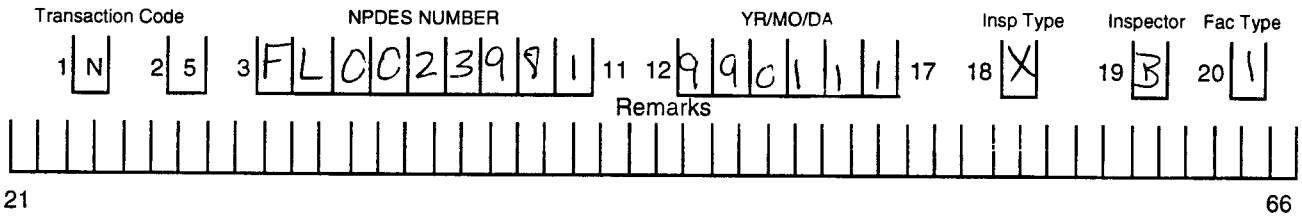
	Control Site	Test Site 1	Test Site 2
Bacillariophyceae			
Achnanthes sp.	–	14	–
Chaetoceros sp.	5	24	35
Cyclotella sp.	60	31	73
Cylindrotheca sp.	5	3	–
Gomphonema sp.	–	3	4
Navicula sp.	–	7	17
Nitzschia sp.	43	21	31
Pennales sp.	11	38	28
Rhizosolenia sp.	11	10	7
Chlorophyceae			
Chlamydomonas sp.	–	–	4
Chlorococcaceae	557	359	–
Chroococcaceae	–	–	297
Undetermined chlorophyceae	5	14	38
Chrysophyceae			
Dinobryon sp.	27	14	35
Cryptophyceae			
Chroomonas sp.	579	286	350
Cryptomonas sp.	5	–	45
Cyanophyceae			
Chroococcus sp.	5	–	–
Lyngbya contorta	–	–	4
Lyngbya sp.	–	7	–
Merismopedia sp.	–	3	–
Oscillatoria sp.	–	3	–
Dinophyceae			
Prorocentrum sp.	–	10	–
Undetermined dinophyceae	5	14	–

Benthic macroinvertebrate taxa list for Navarre WWTP, collected via Ponar grab samples in Santa Rosa Sound, on 1 January, 1999. Densities, in number/m^2, represent the mean of three replicates.

	Control Site	Test Site 1	Test Site 2
Amphipoda			
Ampelisca sp.	-	-	16
Amphilochidae	16	-	-
Ampithoe sp.	62	-	-
Aoridae	16	-	-
Corophium lacustre	16	-	-
Corophium simile	-	16	-
Corophium sp.	31	-	-
Gammarus mucronatus	233	31	-
Haustoriidae	1431	140	1929
Listriella barnardi	-	-	16
Monoculodes sp.	16	-	31
Cumacea			
Oxyurostylis sp.	16	31	202
Decapoda			
Pinnixa sp.	-	-	16
Xanthidae	249	16	16
Diptera			
Orthocladiinae	-	16	-
Gastropoda			
Acteocina sp.	16	-	-
Cerithium sp.	-	31	-
Crepidula sp.	109	-	-
Marginellidae	-	-	16
Mitrella lunata	31	-	-
Nassarius sp.	62	-	16
Odostomia sp.	-	31	-
Mysidacea			
Bowmaniella floridana	-	-	16
Nemertea			
Undetermined Nemertea	233	-	78
Pelecypoda			
Brachidontes exustus	-	47	-
Corbula sp.	-	16	-
Crassostrea virginica	78	-	-
Mactridae	62	-	-
Mytilidae	78	-	-
Tellina sp.	93	-	47
Tellinidae	-	156	-
Undetermined Pelecypoda	47	-	-
Polychaeta			
Amphinomidae	-	16	-

Aricidea sp.	171	93	31
Capitella sp.	47	-	-
Capitellidae	31	16	-
Eteone heteropoda	47	47	140
Glycera robusta	-	16	-
Gyptis sp.	-	16	31
Laeonereis culveri	451	109	156
Leitoscoloplos sp.	-	16	-
Maldanidae	31	-	31
Nereidae	-	47	-
Nereiphylla fragilis	47	-	-
Nereis sp.	-	16	-
Nereis succinea	700	358	47
Paraonidae	-	62	-
Phyllodoce mucosa	-	16	-
Polydora sp.	296	-	-
Prionospio heterobranchia	47	78	78
Prionospio sp.	16	-	-
Sabellidae	16	16	-
Scolelepis sp.	78	47	47
Serpulidae	16	-	-
Sigambra tentaculata	16	-	-
Spionidae	31	-	-
Streblospio benedicti	140	-	-
Sipuncula			
Undetermined Sipuncula	-	16	-
Tanaidacea			
Hargeria rapax	373	78	-
Thoracica			
Balanus sp.	311	-	-
Tubificidae			
Undetermined Tubificidae	78	78	62
Turbellaria			
Stylochidae	16	16	-

Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)



Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)

