

Biological Assessment of

Winter Garden Citrus Cooperative

Orange County

NPDES #FL0000833

Sampled December 1992

May 1993

Biology Section
Division of Technical Services

Department of Environmental Regulation
Results of Fifth Year Inspections

Discharger: Winter Garden Citrus Cooperative
County: Orange
NPDES Number: FL0000833
State Permit Expiration Date: 1 September 1993

Toxics Sampling Inspection (XSI)

Date Sampled: 1 December 1992

Results: Organic pollutants, including limonene (tentatively identified at an estimated 65 µg/L) and bromacil (less than 0.2 µg/L) were detected in the discharge. The chronically toxic value for limonene is 70 µg/L. Iron (78.7 µg/L) and zinc (16 µg/L) were measured in the effluent, but neither metal value was in excess of water quality standards.

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 1 December 1992

Results: The effluent sample was not toxic to the water flea, *Ceriodaphnia dubia*, but was lethal to 80% of the fish, *Notropis leedsi*, exposed to the full strength sample. This is a violation of Rule 17-302.510(5)(p) FAC, Rule 17-302.500(1)(d) FAC, and Rule 17-4.244(3)(a) FAC.

Impact Bioassessment Inspection (IBI)

Date Sampled: 1 December 1992 and 3 December 1992

Results: Many aspects of the reference site were apparently inadequate for valid comparisons with the test site. Measures of macroinvertebrate health indicated that both study sites were degraded. Similarly, neither the reference site nor the test site could be characterized as having normal, healthy algal communities. Low dissolved oxygen, poor habitat, nutrient enrichment, and oil contamination appeared responsible for the biological problems at the reference site. Effluent toxicity and thermal pollution were among the factors contributing to the poor biological health at the test site.

Water Quality Inspection (WQI)

Date Sampled: 1 December 1992

Results: Extremely high temperature (33.5° C or 92.3° F) prevailed at the downstream receiving water station due to the influence of the thermal discharge of the citrus cooperative. This is a violation of Rule 17-302.520(4)(a) FAC. The reference site was more nutrient enriched than was the test site. Ortho-phosphate, total phosphorus, ammonia, and TKN concentrations were all decreased downstream of the discharge. Consequently, only the reference site algal growth potential (at 8 mg algal dry wt/L) was above the eutrophication "problem threshold" (Raschke and Schultz 1987). Nitrate-nitrite was undetected at both receiving water stations.

These fifth year inspections provide the necessary information to evaluate the facility's impact on its receiving waters and to provide the basis for specific condition recommendations for permit renewal.

Introduction

The Winter Garden Citrus Cooperative, a processor of citrus products, is located in Winter Garden, Orange County, Florida (map in Appendix). During its seasonal operation (December through July), the facility produces citrus concentrate from approximately 10 million pounds of raw fruit per day. A wastewater discharge of 3.5 MGD is discharged into an unnamed Class III drainage which flows for approximately 1.5 miles to Lake Apopka. Treatment prior to discharge involves only aeration.

State permit limits for the effluent are as follows: BOD (average of 103 lbs/day), TSS (average of 127 lbs/day), total nitrogen as N (maximum of 11,257 lbs/year), total phosphorus as P (maximum of 565 lbs/year), pH (6 to 8.5), and dissolved oxygen (minimum of 5.0 mg/L). The total nitrogen and total phosphorus limits are based upon a 1979 wasteload allocation study.

There are no records of permit violations or previous water quality studies for this facility.

Methods

The focus of this investigation was to determine the discharger's effects on the receiving waters. A comparison of biological community health was made between a reference site (located in an ephemeral ditch beside a railroad, which was upstream of the citrus discharge) and a test site (the unnamed ditch downstream of the discharge). A habitat assessment was performed *in situ* to establish comparability between sites. Supplemental physical/chemical data were also collected on the effluent and study sites. Acute screening toxicity bioassays, using *Ceriodaphnia dubia* and *Notropis leedsi* as test organisms, were performed on an effluent sample (Weber 1991). The effluent was analyzed for metals and for organic constituents (base neutral and acid extractables, and pesticide extractables). Additionally, nutrient analyses were performed on effluent, reference, and test sites. Methods used for all chemical analyses are on file at the Tallahassee DER Chemistry Laboratory.

Benthic macroinvertebrate communities were evaluated at reference

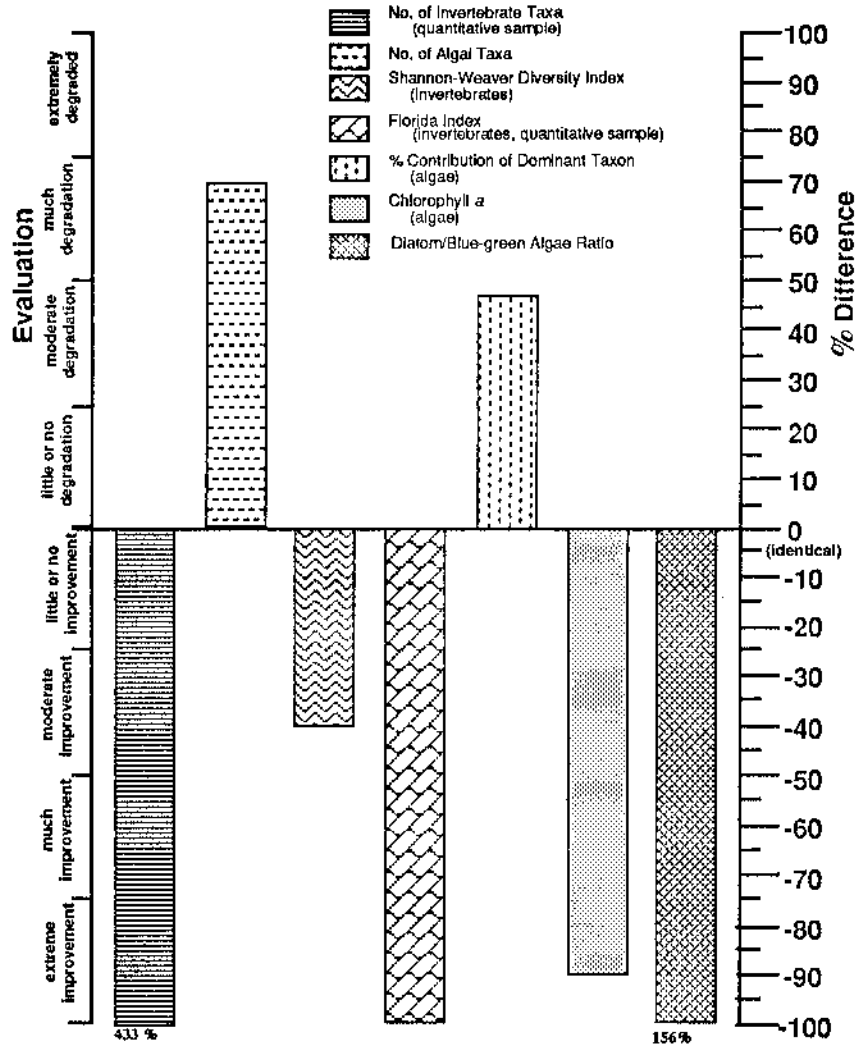
Major characteristics of community structure of control and test sites.

	Reference Site	Test Site
Macroinvertebrate Qualitative		
Number of Taxa	10	8
Florida Index	0	2
% Contribution of Dominant Taxon	82.9	47.5
% Oligochaeta	0	47.5
% Diptera	89.2	52.5
% Odonata	9.9	0
% Coleoptera	0.9	0
% Predators	12.2	17.2
% Collector-Gatherers	86.9	67.2
% Collector-Filterers	0.9	0
% Shredders	0	15.5
Macroinvertebrate Hester-Dendy		
Number of Taxa	3	16
Florida Index	0	1
Shannon-Weaver Diversity	1.5	2.1
% Oligochaeta	25	18.7
% Diptera	75	81
% Gastropoda	0	0.3
% Predators	0	26
% Collector-Gatherers	100	47.7
% Scrapers	0	0.4
% Shredders	0	25.9
Phytoplankton Algae		
Number of Taxa	13	4
% Contribution of Dominant Taxon	27.1	40.0
Chlorophyll a (mg/sq. m)	2.29	0.22
Diatom/Diatom + B-G Abundance Ratio	0.39	1.0
% Blue-greens	47.7	0
% Greens	11.2	50.0
% Diatoms	29.9	50.0
% Cryptophytes	8.4	0
% Euglenophytes	2.8	0
Algal Growth Potential (mg dry wt/L)	3.7	2.7

and test sites. Invertebrates were collected from multiple substrates (*e.g.*, snags, leaf packs, vegetation) using discrete dip net sweeps. Additional invertebrate collections were accomplished using Hester-Dendy multiplate samplers which were incubated for 28 days (Ross 1990). Phytoplankton populations were analyzed from samples taken via subsurface grabs. Chlorophyll *a* was also determined for phytoplankton communities (Ross 1990). Algal Growth Potential tests, using *Selenastrum capricornutum* as the test organism, followed Miller *et al.* (1978).

Explanation of Measurements of Community Health

Several different measurements of macroinvertebrate and algal community health have been employed in this report. Many of these, such as the number of taxa and chlorophyll *a* are well known. Others are briefly explained here. The Florida Index assigns points to stream-dwelling macroinvertebrates based on their sensitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy (*i.e.*, many clean-water organisms are present). Excessive numerical dominance of a single type of organism (a high % contribution of dominant taxon) is usually associated with disturbance. A decreased diatom to blue-green algae ratio (calculated by dividing the number of individuals in the Bacillariophyta by the number of individuals in the Bacillariophyta + Cyanophyta) is often indicative of nutrient enriched conditions. The determination of the Quantitative Stability Index (for taxonomic % composition) is a two step process. First, the relative proportions of major taxonomic groups are calculated for each site. Then, the lesser of the two percentages for each discrete taxonomic group is totaled. A QSI (for % composition) of 100% means that the two sites being compared are identical. This same type of procedure is used for calculating the QSI (for functional feeding groups).



Effect of discharge on receiving stream
(measured as difference between control and test sites).

For graphical purposes, the percent differences between the reference and test sites involving the number of taxa, Florida Index and the diatom to blue-green algae ratio are measured as the reference site minus test site divided by the reference site. The percent differences between sites involving the percent contribution of dominant taxon, chlorophyll *a*, and algal growth potential are measured as the test site minus reference site divided by the reference site.

The following personnel were involved in this investigation: Phil Kane and David Herbster (DER Central District) and Lyn Burton, Marshall Faircloth, Russel Frydenborg, Kathleen Lurding, Kimberly Pearce, Urania Quintana, Landon Ross, and Greg Wynn (Tallahassee Biology Laboratory).

Results

There was a substantial difference in habitat quality between the reference site (with 15 points) and the test site (with 52 points). The reference site was situated in a stagnant ditch (less than 0.025 m/sec) next to the railroad tracks, completely surrounded by industrial land uses. The test site was also in a channelized ditch, but had greater flow (velocity was 1 m/sec). Surrounding land uses there were industrial (50%), agricultural (25%), and residential (25%). Dissolved oxygen was very low at the reference site (0.6 mg/L), but adequate (6.0 mg/L) at the test site. Note that the low dissolved oxygen at the reference site made it inhospitable to most aquatic life. Extremely high temperature (33.5° C or 92.3° F) prevailed at the downstream receiving water station due to the influence of the thermal discharge of the citrus cooperative. This is a violation of Rule 17-302.520(4)(a) FAC, which prohibits raising the temperature of peninsular Florida fresh water streams more than 5° F above background (upstream temperature was 13.5° C or 56.3° F). The rule also states that at no times shall the temperature of a discharge in peninsular Florida be above 92° F.

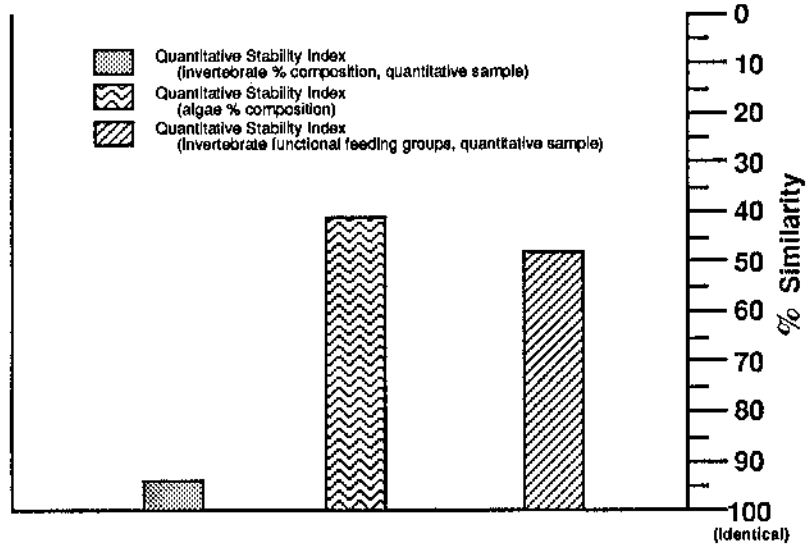
The presence of oily residue was noted in the sediments and water at the reference site, but not at the test site. The pH was 7.0 at the reference site, but not measured at the test site (although the effluent, which contributed substantially to the flow at the test site, had a pH of 7.8). Conductivity was similar at the two stations (350 µmhos/cm at the chosen reference site and 310 µmhos/cm at the test site). In summary, many aspects of the reference site were apparently inadequate (*e.g.*, poor habitat quality, very low dissolved oxygen, oil contamination, low flow, etc.) for valid comparisons with the test site. The test site, however, suffered from extreme thermal pollution.

The effluent sample was not toxic to the water flea, *Ceriodaphnia dubia*, but was lethal to 80% of the fish, *Notropis leedsi*, exposed to the full strength sample. This is a violation of Rule 17-302.510(5)(p) FAC, Rule 17-302.500(1)(d) FAC, and Rule 17-4.244(3)(a) FAC. After death, a filamentous bacteria growth associated with the effluent was observed on the fish. The cladocerans, which are considered more susceptable to entanglement, were not affected by the filamentous bacteria.

Organic pollutants, including limonene (tentatively identified at an estimated 65 µg/L) and bromacil (less than 0.2 µg/L) were detected in the discharge. The presence of limonene in the effluent is noteworthy, as this material is acutely toxic to fish at 702 µg/L (AQUIRE 1993) and to invertebrates at 577 µg/L (USEPA 1990). The chronically toxic value for limonene is 70 µg/L (USEPA 1990). While the fish mortality seen in the bioassay could not be attributed solely to the limonene present, this compound may have contributed to the toxicity of the sample. Other unidentified substances may also have been present in the sample which could have exerted a negative influence on the fish.

Iron (78.7 µg/L) and zinc (16 µg/L) were measured in the effluent, but neither metal value was in excess of water quality standards.

The reference site was more nutrient enriched than was the test site. Ortho-phosphate concentrations were undetected in the test site and effluent samples, but were measured at 0.2 mg/L at the reference site. Total phosphorus levels were about an order of magnitude lower at the test site (0.12 mg/L) and in the effluent (0.1 mg/L) than they were at the reference site (1.0 mg/L). Nitrate-nitrite was undetected at either receiving water location. Ammonia at the reference site (0.13 mg/L) was higher than that of the test site, where ammonia was below detection limits, despite the presence of 0.27



Effect of discharge on receiving stream
(measured as similarity between control and test sites).

mg/L of ammonia in the effluent. Similarly, TKN decreased from 0.86 mg/L upstream to 0.31 mg/L downstream of the discharge.

Exhibiting a trend analogous to the spatial distribution of nutrients, algal growth potential decreased from 8.0 mg algal dry wt/L at the upstream site to 3.7 mg algal dry wt/L) at the downstream site. AGP of the effluent was 2.7 mg algal dry wt/L. Only the reference site was above the 5 mg algal dry wt/L "problem threshold" (Raschke and Schultz 1987).

Measures of macroinvertebrate health indicated that both study sites were degraded. The reference site benthic community, however, appeared even more disturbed than the population found at the test site. The figure on p. 2 indicates the degree of difference between the reference and test sites. Larger differences (that is, higher percentages) correspond with greater degrees of degradation. Negative values mean that the test site is better than the reference site. The relative abundance of each individual taxon appears in the Appendix. The figure on p. 3 summarizes similarities between the sites. Smaller similarities (lower percentages) generally correspond with greater degradation.

Hester-Dendy sampling indicated that taxa richness was extremely poor at the reference site (with 3 taxa), increasing to 16 taxa at the test site (Species lists in Appendix). The taxa involved in this increase were predominately pollution tolerant forms, including 8 types of oligochaetes, and 6 kinds of tolerant chironomids, such as *Chironomus* sp. (see Hudson et al. 1990). Florida Index was zero at the reference site, indicating very stressed conditions. Florida Index increased to 1 point at the test site, indicating that polluted conditions still prevailed. The minimum expected Florida Index value for an unimpacted central Florida flowing stream is 15 points. Shannon-Weaver diversity was very low at both sites (1.5 at the reference, 2.1 at the test site). A diversity value of 2.1 is lower than 90% of other Florida streams (see Typical Water Quality Values in Appendix). These slight to moderate differences between the sites appear as improvements on the graph, but this is simply an artifact caused by the unusually low reference site values. Samples collected via dip net sweeps also suggested that both sites were degraded. Low dissolved oxygen, poor habitat, and oil contamination appeared responsible for the biological problems at the reference site. Effluent toxicity and thermal pollution were the factors contributing to the poor biological health at the test site.

Neither the reference site nor the test site could be characterized as having normal, healthy algal communities. For example, cyanophytes were the most abundant group at the reference site, although chlorophytes, diatoms, cryptophytes, and euglenophytes were also present. It was unusual that only two major groups of phytoplankters (chlorophytes and diatoms) were recovered from the test site. Phytoplankton taxa richness decreased by 69% (from 13 to 4) between the reference and test site. The percent contribution of the dominant taxon was 48% higher at the test site. Together, this fairly unequitable distribution of abundance, low species richness, and lack of representation of many algal groups at the test site is indicative of disturbance. The changes seen in algal populations between the reference site and test site are probably related to the increased flow and/or thermal pollution found at the test site. The dominance of blue-greens at the reference site was probably influenced by the elevated nutrients and AGP found there.

Conclusions

Many aspects of the reference site were apparently inadequate (*e.g.*, poor habitat quality, very low dissolved oxygen, oil contamination, low flow, etc.) for valid comparisons with the test site.

Extremely high temperature (33.5° C or 92.3° F) prevailed at the downstream receiving water station due to the influence of the thermal discharge of the citrus cooperative. This is a violation of Rule 17-302.520(4)(a) FAC.

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The reference site was more nutrient enriched than was the test site. Ortho-phosphate, total phosphorus, ammonia, and TKN concentrations were all decreased downstream of the discharge. Consequently, only the reference site algal growth potential

(at 8 mg algal dry wt/L) was above the eutrophication "problem threshold" (Raschke and Schultz 1987). Nitrate-nitrite levels were undetected at either receiving water station.

Measures of macroinvertebrate health indicated that both study sites were degraded. For example, Florida Index was zero at the reference site increasing to 1 point at the test site, indicating that polluted conditions still prevailed. Similarly, Shannon-Weaver diversity was very low at both sites (1.5 at the reference, 2.1 at the test site). A diversity value of 2.1 is lower than 90% of other Florida streams. Samples collected via dip net sweeps also suggested that both sites were degraded. Low dissolved oxygen, poor habitat, and oil contamination appeared responsible for the biological problems at the reference site. Effluent toxicity and thermal pollution were among the factors contributing to the poor biological health at the test site.

Neither the reference site nor the test site could be characterized as having normal, healthy algal communities. The test site suffered from an unequitable distribution of abundance, low species richness, and lack of representation of many algal groups. The reference site was dominated by cyanophytes. The problems observed at the test site were probably related to the hydrologic regime and/or thermal pollution, while the dominance of blue-greens at the reference site was probably influenced by the elevated nutrients and AGP found there.

Literature Cited

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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.

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

USEPA. 1990. Terpene hazard assessment. EPA Health and Environmental Review Division, Office of Toxic Substances. 53 p.

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Chemistry summary table for Winter Garden Citrus Cooperative .

	Effluent	Reference Site	Test Site
Organic Constituents (ug/L)			
Tentative ID of Limonene	65 J		
Bromacil	0.20 K		
Metals (ug/L)			
Aluminum	50 U		
Arsenic	20 U		
Cadmium	0.08 U		
Copper	5 U		
Chromium	10 U		
Iron	78.7 A		
Lead	15 U		
Mercury	0.1 U		
Nickel	5 U		
Silver	0.05 U		
Zinc	16 A		
Nutrients (mg/L)			
Ortho-phosphate	0.02 U	0.2	0.02 U
Total phosphorus	0.1	1.0	0.12
Ammonia	0.27	0.13	0.03 U
Nitrate+Nitrite	0.05 U	0.05 U	0.05 U
TKN	0.48	0.86	0.31
Other Parameters			
Habitat Assessment		15	52
D.O. (mg/L)		0.6	6.0
pH (SU's)	7.8	7.0	
Conductivity (µmhos/cm)	265	350	310
Temperature (°C)		13.5	33.5
AGP (mg dry wt/L)	2.7	8.0	3.7
Bioassay Fish	Toxic- 80% Mortality		
Bioassay Invertebrate	Not Toxic		

A - Value reported is the mean of two or more determinations
J - Estimated value
K - Actual value is known to be less than value given
L - Actual value is known to be greater than value given
N - Presumptive evidence of presence of material
O- Sampled, but analysis lost or not performed
Q - Sample held beyond normal holding time
U - Material analyzed for but not detected; value reported is the minimum detection limit
T- Value reported is less than the practical quantitation limit

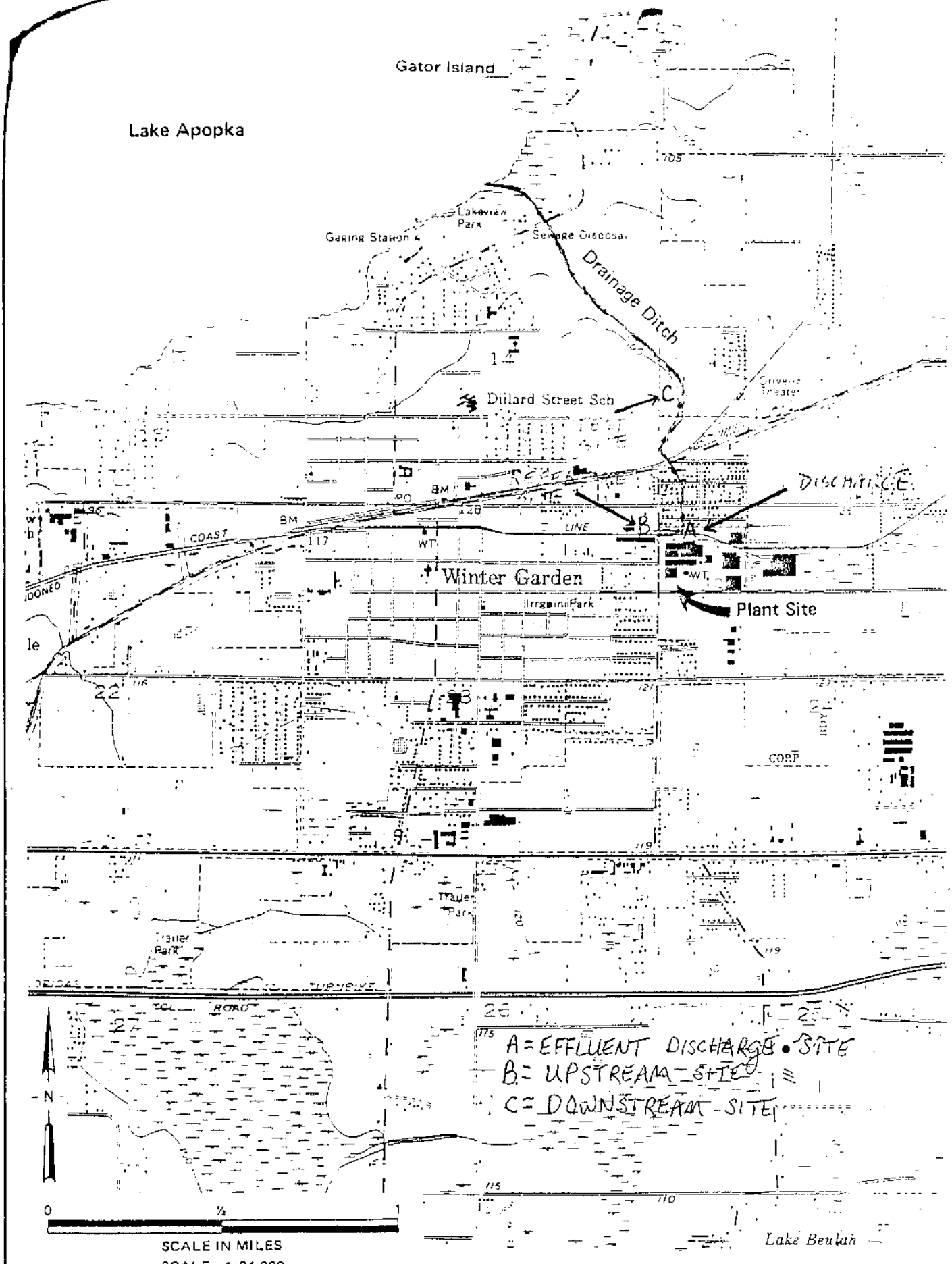
Typical Values for Selected Parameters in Florida Waters

Adapted from Joe Hand, FDER, personal communication, 1991
(data was collected between 1980 and 1989)

Percentile Distribution

Parameter	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
STREAMS (1617 stations)											
Phytoplankton Chlorophyll *a*	0.22	0.52	0.94	1.60	3.02	4.63	6.72	9.87	14.68	27.35	48.70
Periphyton Chlorophyll *a*	0.31	0.43	0.77	1.04	2.16	2.94	6.45	10.51	17.00	39.51	60.85
H-D Diversity	0.84	2.12	2.48	2.74	2.88	3.09	3.25	3.40	3.52	3.76	3.90
Qualitative Taxa Richness	9.00	12.00	17.00	20.00	22.00	24.50	26.00	28.00	31.00	37.00	53.00
H-D Taxa Richness	6.00	6.50	9.00	11.50	13.00	15.00	17.00	21.50	26.00	29.00	32.00
TKN	0.30	0.39	0.56	0.73	0.87	1.00	1.11	1.26	1.49	1.93	2.80
Ammonia	0.02	0.02	0.04	0.05	0.06	0.08	0.11	0.14	0.20	0.34	0.60
NO2-NO3	0.01	0.01	0.03	0.05	0.07	0.10	0.14	0.20	0.32	0.64	1.05
Total Phosphorus	0.02	0.03	0.05	0.06	0.10	0.13	0.18	0.25	0.39	0.74	1.51
Ortho Phosphorus	0.01	0.01	0.03	0.04	0.05	0.08	0.11	0.17	0.27	0.59	1.37
Turbidity	0.60	0.90	1.20	1.45	2.10	2.80	3.60	4.50	6.65	10.45	16.30
LAKES (477 stations)											
Phytoplankton Chlorophyll *a*	0.80	1.71	2.88	4.28	10.06	13.40	20.00	30.10	47.20	65.44	113.90
Dredge Diversity	0.71	0.97	1.43	1.74	1.98	2.12	2.21	2.59	2.85	3.15	3.17
Dredge Taxa Richness	3.00	5.00	6.50	7.00	9.00	10.00	11.00	13.00	15.00	17.00	21.00
TKN	0.36	0.49	0.67	0.83	1.08	1.26	1.40	1.51	1.68	2.11	3.46
NH3+NH4	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.12	0.15	0.21	0.28
NO2-NO3	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.05	0.10	0.14	0.23
Total Phosphorus	0.01	0.02	0.02	0.03	0.05	0.07	0.09	0.11	0.14	0.23	0.42
Ortho-Phosphorus	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.21	0.32
Turbidity	1.00	1.25	1.55	2.05	2.75	4.50	6.45	9.60	14.10	26.00	40.00
ESTUARIES (690 stations)											
Phytoplankton Chlorophyll *a*	2.14	3.28	4.49	5.13	6.00	6.93	7.94	9.60	12.40	17.60	22.20
Dredge Diversity	1.34	1.53	1.91	2.28	2.56	2.90	3.15	3.59	4.01	4.53	4.98
Dredge Taxa Richness	4.00	6.00	9.00	11.00	15.00	18.50	25.00	35.00	41.00	62.00	90.00
TKN	0.26	0.34	0.42	0.50	0.59	0.69	0.76	0.82	0.95	1.30	1.49
NH3+NH4	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.13	0.22	0.28
NO2-NO3	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.08	0.17	0.23
Total Phosphorus	0.01	0.02	0.06	0.07	0.10	0.11	0.14	0.17	0.23	0.43	0.59
Ortho-Phosphorus	0.01	0.02	0.03	0.04	0.04	0.05	0.07	0.09	0.12	0.21	0.44
Turbidity	3.50	4.00	4.50	5.05	5.40	5.60	6.30	6.80	8.00	11.40	11.75

Units:
Phytoplankton Chlorophyll *a* (ug/L), Periphyton Chlorophyll *a* (mg/m^2), Nutrients (mg/L), Turbidity (NTU), Taxa richness and diversity values are for macroinvertebrates



SOURCE: USGS 1956.

Jones Edmunds & Associates, Inc. JEA CONSULTING ENGINEERS AND SCIENTISTS
730 North Waldo Road / Gainesville, Florida 32601 / (904) 377-5821

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

Facility Name: Winter Garden Citrus Coop.		Date Summary Prepared: 3-19-93
Location (attach detailed map): 28°33'45" 81°34'30"	County: ORANGE	District: CENTRAL
Federal Permit # and expiration date: FL0000833 9-30-94.	State GMS # and State expiration date:	Facility Type: 2 (Industrial) Municipal Federal Agricultural Other (list):

Function of facility: A citrus processor which processes approx 10×10^6 lbs/day of raw fruit to make Citrus Concentrate.

Description of treatment process:
Effluent recives Aeration prior to discharge off-site. No other treatment is applied.

Receiving waters: Lake Apopka	Classification: I II (III)	
Design Flow: 3.5 MGD	Mean Flow: 3.5 MGD	Flow during survey:

Discharge is: Continuous Intermittent (Seasonal) Rainfall dependent
Other (describe)

therefore, the best time to sample is: December 1 through July 1 each year.

If facility has a mixing zone, give details (size, parameters affected, etc.):

none.

List effluent limits (if necessary, attach relevant paperwork):

Parameter	Limit (units)
BOD_5	103 lbs/day AVG
TSS	127 lbs/day AVG
Total N	11,257 lbs/YR MAX
TOTAL P	565 lbs/YR MAX
D.O	$\geq$ 5.0 mg/L
PH	6.0 - 8.5 S.U.

Describe special permit conditions and permit modifications:

Winter Garden Citrus Coop.
(Facility)

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FACILITY SUMMARY

Description of permitted outfall(s):
Disposal of non-Contact Cooling H_2O, from the existing barometric Condenser and refrigerant Compressors. Discharge is through Stormwater Ditch then to un-named Ditch to lake apopka.

List permit violations (from MOR data or other source) and plant upsets that occurred within past year:
none noted.

Describe previous impact bioassessments, WQBEL's, and previous or current enforcement actions:
RECORDS INDICATE NO OTHER PREVIOUS BIOASSESSMENTS OR WQBEL'S. NO PREVIOUS OR CURRENT ENFORCEMENT ACTIONS ARE INDICATED BY THE RECORDS

Discuss comparability of MOR results to past DER results and whether there are trends (improving, declining) in the data set:
no Change.

Additional information:

Staff contributing to this review (signature):

DR. Philip N. Fan	(Biologist)
Clayton L. Smith	(Inspector)
	(Engineer)
	( )
	( )
	( )

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 4)

SUBMITTING AGENCY CODE: 30 / SUBMITTING AGENCY NAME: FDER CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 12/01/92	TIME	RECEIVING BODY OF WATER: DITCH TO LAKE APOPKA

REMARKS:	LOCATION: WINTER GARDEN CITRUS COOP/cooling water 355 SOUTH 9TH STREET WINTER GARDEN, FLORIDA	FIELD ID/NAME: WGCC/CW [redacted]
UPSTREAM		

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
					100 %	

Local Watershed Erosion (check box): None ☐ Moderate ☑ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☐ Some potential sources ☑ Obvious sources ☐

Point-Source Pollution (list location and describe):

Estimated System Width (range, m): 1M	Estimated System Depth (range, m): 0.5M	yes
High Water Mark (m above bed): 1.0M	Velocity (range, m/s): <0.2M/S	Impounded ☐ Channelized ☑

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 Deposits: Sludge: ☐ Paper Fiber: ☐ Mud: ☑ Sand: ☐ Shell: ☐ Other: ☐

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Riffles			
Leaf Packs				Sand			
Aquatic Vegetation	80	14	NET	Mud/Muck/Silt	20	4	NET
Rock or Shell Rubble				Benthic leaf mats			
Undercut Banks/Roots				Other: DETRITUS	10	2	NET

WATER QUALITY

	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm):			Secchi (m):
Top								0.2M
Mid-depth		13.5	7.0	0.6	350			
Bottom	0.5M							

System Type : Stream: ☐ (Sand Bottomed ☐ Sand Bot w/ Spring ☐ Swamp & Bog ☐ Calcareous ☐ Alluvial ☐ Misc. ☐) Lake: ☐ Wetland: ☐ Estuary: ☐ Other: ☑ DITCH

Water Odors (check box): Normal: ☑ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐

Water Surface Oils (check box): None: ☐ Sheen: ☐ Globs: ☑ Slick: ☐

Clarity (check box): Clear: ☐ Slightly turbid: ☐ Turbid: ☑ Opaque: ☐

Color (check box): Tannic: ☑ Green (algae): ☑ Clear: ☐ Other: ☐ _____

Weather Conditions: CLOUDY/COLD

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

SAMPLING TEAM: KANE, HERBSTER	SIGNATURE: Philip N. Kane, Ed. D.	DATE: 12/01/92

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

SUBMITTING AGENCY CODE: 30 / SUBMITTING AGENCY NAME: FDER CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 12/01/92	RECEIVING BODY OF WATER: DITCH TO LAKE APOPKA

REMARKS:	LOCATION: WINTER GARDEN CITRUS COOP/COOLING WATER 355 SOUTH 9TH STREET WINTER GARDEN, FLORIDA	FIELD ID/NAME:
UPSTREAM		WGCC/CW

Habitat Parameter / score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover 2	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 1	Max. observed; >0.3 m/sec. **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec **0-7 points**
Artificial Channel/ Flow Alteration 1	No artificial channelization. Little activity (impervious surface) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability 8	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable.. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 3	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments 0	Add **5 points** if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.	**TOTAL SCORE** 15

COMMENTS:

ANALYSIS DATE: 12/01/92	ANALYST: PHIL KANE, Ed.D.	SIGNATURE: Philip N. Kane, Ed.D.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 4)

SUBMITTING AGENCY CODE: 30 / SUBMITTING AGENCY NAME: FDER CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 12/01/92	TIME	RECEIVING BODY OF WATER: DITCH TO LAKE APOPKA

REMARKS:	LOCATION: WINTER GARDEN CITRUS CO-OP/CONING WATER 355 SOUTH 9TH STREET WINTER GARDEN, FLORIDA	FIELD ID/NAME:
DOWNSTREAM		WG CC/CW

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
		25	25		50	

Local Watershed Erosion (check box): None ☐ Moderate ☐ Heavy ☑

Local Watershed NPS Pollution (check box): No evidence ☐ Some potential sources ☑ Obvious sources ☐

Point-Source Pollution (list location and describe):

Estimated System Width (range, m): 1.5M	Estimated System Depth (range, m): 0.5M	N/A	yes
High Water Mark (m above bed): 2.0M	Velocity (range, m/s): 1 M/S	Impounded ☐	
		Channelized ☐	

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 Deposits: Sludge: ☐ Paper Fiber: ☐ Mud: ☐ Sand: ☑ Shell: ☐ Other: ☑ CLAY

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Riffles	25	3	NET
Leaf Packs				Sand	50	3	NET
Aquatic Vegetation	5	5	NET	Mud/Muck/Silt			
Rock or Shell Rubble	10	10	NET	Benthic leaf mats			
Undercut Banks/Roots	5	2	NET	Other:			

WATER QUALITY

	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm):			Secchi (m):
Top								TO BOTTOM
Mid-depth		33.5		6.0	310			
Bottom	0.5M							

System Type : Stream: ☐ (Sand Bottomed, Sand Bot w/ Spring, Swamp & Bog, Calcareous, Alluvia, Misc.) Lake: ☐ Wetland: ☐ Estuary: ☐ Other: ☑ DITCH

Water Odors (check box): Normal: ☑ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☑ CITRUS

Water Surface Oils (check box): None: ☑ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity (check box): Clear: ☑ Slightly turbid: ☐ Turbid: ☐ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☐ Clear: ☑ Other: ☐

Weather Conditions: CLOUDY/COLD

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

SAMPLING TEAM:	SIGNATURE:	DATE:
KANE, HERBITER	Philip N. Kane, Ed. D.	12/01/92

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

SUBMITTING AGENCY CODE: 30 / SUBMITTING AGENCY NAME: FDER CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 12/01/92	RECEIVING BODY OF WATER: DITCH TO LAKE APOPKA

REMARKS:	LOCATION: WINTER GARDEN CITRUS CO-OP/COOLING WATER 355 SOUTH 9TH STREET WINTER GARDEN, FLORIDA	FIELD ID/NAME:
DOWNSTREAM		WGCC/CW

Habitat Parameter / score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover [illegible]	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 29	Max. observed; >0.3 m/sec. **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec **0-7 points**
Artificial Channel Flow Alteration [illegible]	No artificial channelization. Little activity (impervious surfaces) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability [illegible]	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 6	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments		TOTAL SCORE
0	Add 5 points if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.	52

COMMENTS:

ANALYSIS DATE:	ANALYST:	SIGNATURE:
12/01/92	DR. PHIL KANÉ	Philip N. Kane, Ed.D.

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: WINTER GARDEN CITRUS — Sample Collection: Date 12/1/92 Time 0850
Address/City: COOP CONDENSER/COOLING WATER — Test Beginning: Date 12/4/92 Time 1300
County: ORANGE — Test Ending: Date 12/4/92 Time 1400
Contact/District: P. KANE C — Test Organism: A. Undae
NPDES Permit #: FL00 00833 Outfall #: 001 — Life Stage/Age: 12 days

45667 92-DEC-02-09
verified 12/4/92 KP

Test Number: 2 of 2 — Test Type: Screening / Definitive
Static / Static Renewal / Flow-through

Remarks:
fish APPEAR TO HAVE BECOME ENTRAPPED IN CLUMPS OF WHITE FIBERS/FILAMENTS CONTAINED IN SAMPLE. EACH FISH ON BOTTOM OF JAR HAS A PILE OF WHITE FIBERS ON TOP OF IT.

Instrument Calibrations:

	pH	DO	Temp	Cond
0 hr	7.7, 10.10	8.7 @ 23°C	23.2 @ 23.3	950 / 9200 @ 22.9°C
24 hr	7.07, 10.10	8.5 @ 24°C	21.8 @ 21.7	940 / 9450 @ 22.6°C
48 hr	7.07, 10.10	8.8 @ 22°C	21.4 @ 21.4	950 / 9200 @ 23.5°C

Conc.	Chamber #	Number Live 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	DO (mg/L) 0	24	48	Cond. (µmhos/cm) 0	24	48
control	15	5	5	5	7.8	8.1	8.3	24.2	22.3	22.4	8.9	8.3	9.2	230	235	235
control	26	5	5	5	7.8	8.1	8.3				8.9	8.3	9.2	230	235	240
100%	8	5	8*	0	7.8	8.1	8.1	23.5	22.3	22.3	5.3	7.5	8.2	265	260	260
100%	28	5	5	2	7.8	8.1	8.1				5.4	7.5	8.1	265	260	260
		* 4 recorded wrong TM														
Measured/Loaded by:		MF	AF	KP	MF	MF	TM	MF	MF	TM	MF	MF	TM	MF	MF	TM
Recorded by:		TM	MF	KP	MF	TM	TR	MF	TM	TR	MF	TM	TR	MF	TM	TR

Investigators' Signatures
Marshall Faircloth
Tina M. Kubalik
Kim Pearce
Mary Rader
Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:				DR 100 Hach	KP 12/3/92
Lab Tot. Resid. Cl2:	<0.02	<0.02	<0.06	Hach	TM
Alkalinity:	115	65	100	Hach	TM
Hardness:	140	75	120	Hach	TM
Total Ammonia:	<0.02	<0.02	<0.02	Hach	TM

Ammonia Meter Slope: _____ Ammonia Blank: <0.02 Salinity Sample: _____ ppt

Sample Source: WINTER GARDEN CITRUS
Address/City: COOP ~~CONDENSOR~~/COOLING WATER
County: ORANGE
Contact/District: P. KANE C
NPDES Permit #: FL00 00833 Outfall #: 001

Sample Collection: Date 12/1/92 Time 0850
Test Beginning: Date 12/2/92 Time 1300
Test Ending: Date 12-4-92 Time 1400
Test Organism: Ceriodaphnia dubia
Life Stage/Age: < 24hr

45667 92-DEC-02-09
verified 12/4/92 KP

Test Number: 1 of 2 Test Type: (Screening) Definitive
(Static) Static Renewal | Flow-through

Remarks:

C. DUBIA HAVE AVOIDED ENTANGLEMENT IN FIBERS.

Instrument Calibrations:

	pH	DO	Temp	Cond
0 hr	7.7, 10.10	8.7 @ 22°C	23.2 @ 23.3	950 @ 22.9° / 9600
24 hr	7.7, 10.10	8.5 @ 24°C	21.8 @ 21.7	940 @ 22.6 / 9450
48 hr	7.7, 10.10	8.8 @ 20°C	21.5 @ 21.4	950 @ 23.5 / 9500

Conc.	Chamber #	Number Live 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	DO (mg/L) 0	24	48	Cond. (µmhos/cm) 0	24	48
Control	A	5	5	5	8.2		8.1	21.5		23.8	9.2		8.4	150		165
Control	B	5	5	5			8.2						8.5			170
Control	C	5	5	5			8.2						8.7			170
Control	D	5	5	5			8.2						8.7			180
100%	A	5	5	4	7.8		8.4	23.0		24.0	6.3		8.6	252		260
100%	B	5	5	5			8.4						8.6			270
100%	C	5	5	5			8.4						8.7			275
100%	D	5	5	5			8.4						8.7			280
Measured/Loaded by:		MF	MF	TM	MF		TM	MF		TM	MF		TM	MF		TM
Recorded by:		TM	MF	TR	MF		TR	MF		TR	MF		TR	MF		TR

Investigators' Signatures

Marbell Faircloth
Tina M. Kubsh
Kim Pearce
Tobin Rader
Reviewer

Water-quality Parameters

	Well Water	20% Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:				DR100	KP 12/3/92
Lab Tot. Resid. Cl2:	<0.02	<0.02	<0.06	Hach	TM
Alkalinity:	115	65	100	Hach	TM
Hardness:	140	75	120	Hach	TM
Total Ammonia	<0.02	<0.02	<0.02	Hach	TM

Ammonia Meter Slope: _____
Ammonia Blank: < 0.02
Salinity Sample: _____ ppt

Taxa list for Winter Garden Citrus Cooperative (individuals/m^2), collected via Hester-Dendy samplers (three replicates), upstream and downstream of the discharge, on 18 December 1992.

	Reference Site	Test Site
Diptera		
Chironomus sp.	–	9
Goeldichironomus holoprasinus	2	1
Larsia decolorata	–	2
Palpomyia grp. sp.	–	3
Polypedilum tritum	–	197
Paramerina sp.	–	1
Undetermined dipteran pupae	–	40
Tanypus carinatus	1	–
Gastropoda		
Hebetancyclus excentricus	–	1
Oligochaeta		
Dero lodeni	–	7
Dero sp.	–	14
Dero trifida	–	7
Eclipidrilus sp.	–	2
Undetermined Enchytraeidae	–	5
Limnodrilus hoffmeisteri	–	16
Pristina aequiseta	–	1
Pristinella jenkinae	–	6
Undetermined oligochaete sp.	1	–

Taxa list for Winter Garden Citrus Cooperative, collected via 20 discrete dip net sweeps of multiple substrates, upstream and downstream of the discharge, on 1 December 1992.

	Reference Site	Test Site
Coleoptera		
Suphis inflatus	24	–
Diptera		
Chironomus sp.	–	12
Undetermined culicid sp.	24	–
Goeldichironomus holoprasinus	2208	24
Larsia decolorata	–	24
Odontomyia sp.	48	–
Polypedilum illinoense grp.	–	120
Polypedilum tritum	–	168
Paramerina sp.	24	–
Undetermined dipteran pupae	–	12
Tabanus sp.	48	–
Tanytarsus sp. E Epler	–	12
Tanypus carinatus	24	–
Odonata		
Anax junius	144	–
Ischnura sp.	96	–
Libellula semifasciata	24	–
Oligochaeta		
Limnodrilus hoffmeisteri	–	336

Phytoplankton taxa list and densities for Winter Garden Citrus Cooperative, collected via subsurface grabs on 1 December, 1992.

	Reference Site	Test Site
Diatoms		
Achnanthes sp.	–	26
Gomphonema sp.	130	–
Navicula sp.	104	–
Nitzschia sp.	469	103
Pinnularia sp.	78	–
Unidentified pennate diatom	52	–
Chlorophyta		
Chlamydomonas sp.	–	26
Closterium sp.	52	–
Unknown chlorophyte flagellate	260	103
Cryptophyta		
Cryptomonas sp.	234	–
Cyanophyta		
Chroococcus sp.	755	–
Gomphosphaerium sp.	78	–
Oscillatoria sp.	208	–
Phormidium sp.	286	–
Euglenophyta		
Euglena sp.	26	–
Trachelomonas sp.	52	–

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

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0000833		931201		X	5	2

Remarks

21 66

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

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0000833		931201		B	5	2

Remarks

21 66