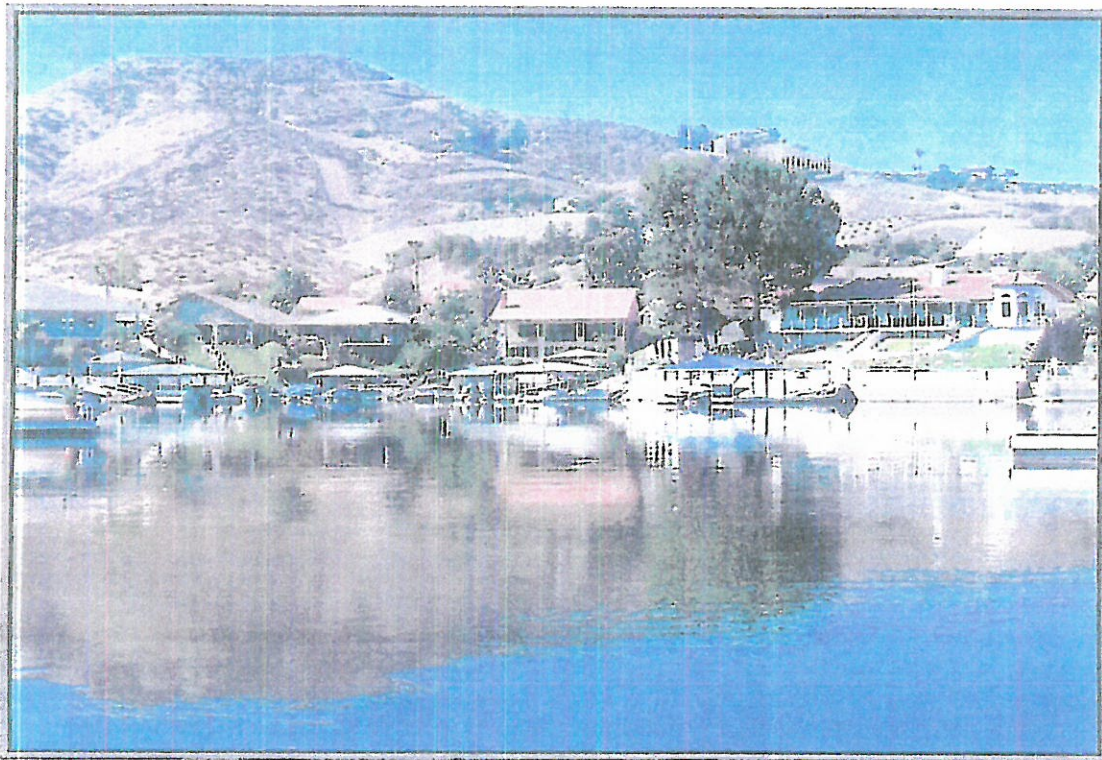


AQUATIC MACROINVERTEBRATE SURVEY OF CANYON LAKE, RIVERSIDE COUNTY

JULY 2004



Prepared For:

PBS&J
Canyon Lake Property Owners Association

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1.0 Project Overview

Weston Solutions, Inc. (Weston) was contracted to perform a benthic macroinvertebrate survey to describe existing conditions and biological resources in Canyon Lake, Riverside County, California. The survey was undertaken to provide compliance with Streambed Alteration Agreement 1600-2004-0028-R6, issued by the California Department of Fish and Game in anticipation of a proposed dredging project in Canyon Lake. The survey covered open water portions of the lake within the proposed dredge footprint, open water areas outside of the dredge footprint, and shallow water areas along the shoreline. This report includes the results of the pre-dredge survey conducted July 30, 2004.

2.0 Methods

Field Sampling

Field sampling occurred on July 30, 2004, between the hours of 0900 and 1330. Benthic macroinvertebrate samples were collected by Laurence Campagna, a biologist with Weston. Mark Iverson of PBS&J was present for site orientation. Samples were collected from the Canyon Lake Property Owners Association (POA) maintenance barge operated by POA personnel.

Four locations were sampled in open water areas within the proposed dredge footprint, and four open water locations outside of the dredge footprint were sampled for reference comparison. Two additional locations were sampled along the shoreline in vegetated areas adjacent to the areas to be dredged, and two shoreline locations outside of the areas to be dredged. A total of twelve benthic macroinvertebrate samples were collected. The locations of the sampling stations are shown on Figure 1.

The open water samples were taken in areas that best represented typical conditions in Canyon Lake. The shoreline samples were taken in "best available" habitats, i.e. areas with a natural shoreline with some submerged or emergent vegetation. The sample locations were not randomized. Sampling location information was recorded, including: time, water depth, water temperature, dissolved oxygen, turbidity, relative chlorophyll, and water visibility. Water quality measurements were taken with a YSI model 6600 at the surface of the open water sites. A general description of the sample (sediment color, consistency, presence of submerged vegetation) was also recorded.

Open water benthic invertebrate samples were collected using a standard .025-m² Ponar coring device. Sediment collected by Ponar grab was processed in the field by passing through a 0.5-mm sieve using site water. Material retained on the sieve was transferred to sample jars, labeled with the site information, and preserved with 95% ethanol. Shoreline samples were collected using a 1-ft wide, 0.5-mm mesh D-shaped kick-net. Each kick-net sample consisted of a composite of three 2-ft² areas of benthic habitat. Samples were returned to Weston's benthic laboratory in Carlsbad, CA for further processing.

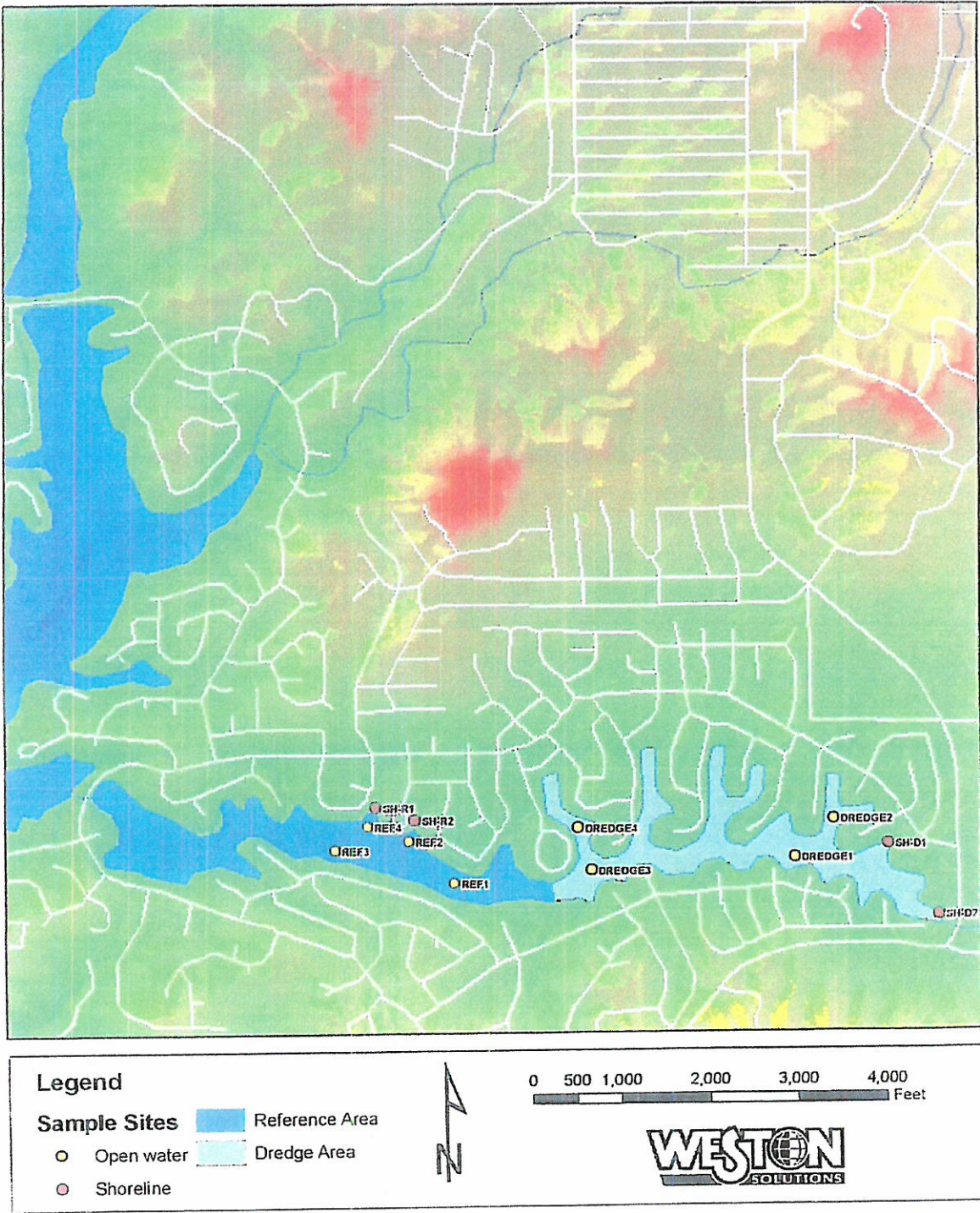


Figure 1. Canyon Lake Invertebrate Sampling Stations, July 2004.

Laboratory Analysis

In the laboratory, benthic macroinvertebrate samples were subsampled to yield up to 100 organisms, using the subsampling technique described in the California Stream Bioassessment Procedure (Harrington, 1999). Samples that contained less than 100 organisms were processed completely. Taxonomic identification of the organisms was performed using standard taxonomic keys, and generally followed the standard level of effort described in the CAMLnet List of Californian Macroinvertebrate Taxa and Standard Taxonomic Effort, revision date 27 January, 2003. Subsampling was performed by Thomas Gerlinger. Taxonomic identifications were made by Sheila Holt (Mollusca), Bill Isham (Insecta and miscellaneous phyla), and Alison Witheridge (Crustacea).

A taxonomic list of benthic macroinvertebrates identified from the samples was created using Microsoft Excel, and included the designated tolerance value (TV) and functional feeding group (FFG) of each taxon. Benthic macroinvertebrate community-based metric values were calculated from the database.

3.0 Results and Discussion

Water Quality

Physical water quality measurements are presented in Table 1. Values were fairly consistent throughout the study area, although Reference sites #3 and #4 had lower chlorophyll and turbidity than the other open water sites. Temperature values showed a steady increase from morning to afternoon. Water visibility was estimated to be one foot at all the open water sites, but was approximately three feet at the shoreline sites.

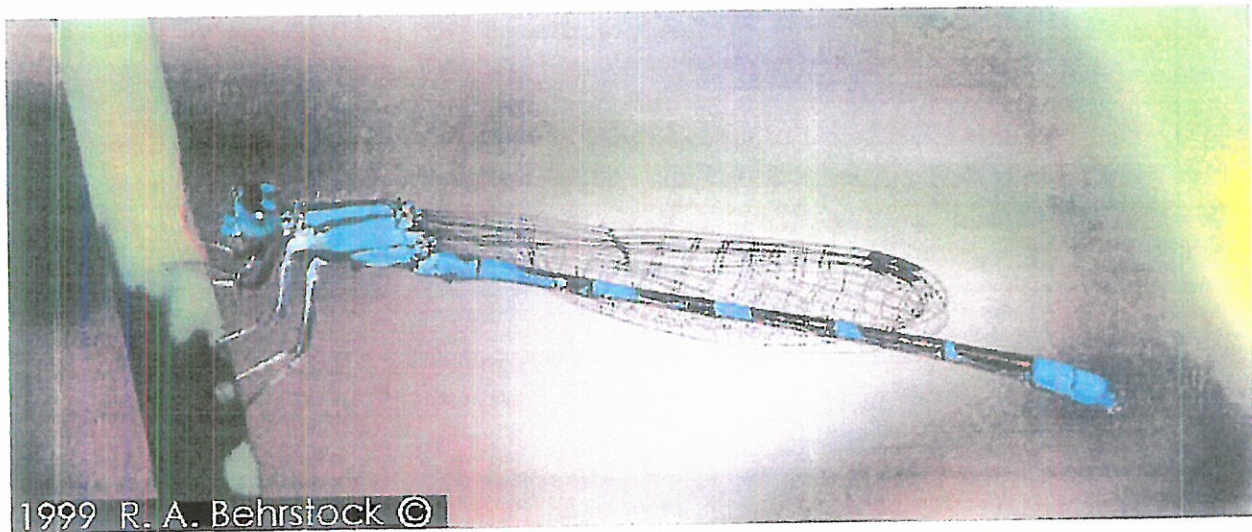
Benthic Community Composition

A complete taxonomic listing of all macroinvertebrates collected is presented in Table 2, and macroinvertebrate biological metrics are presented in Tables 3 and 4. A total of 819 organisms were collected at all of the sites, representing 24 unique taxa.

There was a considerable difference in community structure between the open water sites and the shoreline sites. This is not surprising considering the difference in depth and overall habitat conditions. The open water samples were collected in depths between 7.6 and 20 feet, lacked aquatic vegetation, and the sediment was fine black silt. The shoreline samples were collected in depths of 18 inches or less, with a substrate of coarse sand and some vegetation.

The open water sites were dominated by the phantom midge *Chaoborus*, which comprised nearly 100% of the benthic community. *Chaoborus* is an ambush predator that captures prey with a prehensile brush of antennae. It can be an important food source for fish. Specimens of *Chaoborus* collected were between 5 and 10 mm, and occurred in densities of up to 331 per ft². Oligochaetes (earthworms) were the only other organism in the open water sites collected in substantial numbers.

The shoreline sites had a much higher diversity (taxa richness) of organisms than the open water sites. The shoreline sites had from 8 to 18 different taxa per sample, compared to 1 to 3 taxa per sample at the open water sites. The amphipod *Hyaella* was the most abundant organism at the reference shoreline sites, and Chironomid midges were the most abundant organisms at the dredge shoreline sites. Other organisms of note that were collected included the Bluet damselfly *Enallagma*, the water scavenger beetle *Tropisternus*, the mayfly *Caenis*, the Caddisfly *Oxyethira*, and the water mite *Koenikea*. There were three genera of snails collected, *Fossaria*, *Gyraulus*, and *Physa*. Most of the organisms at the shoreline sites were either collector gatherers (detritivores) or predators. It may be noted that crayfish (O. Decapoda) were not collected or observed at any of the sites, and had not been observed recently in Canyon Lake by POA personnel.



Bluet Damselfly *Enallagma*, Adult

4.0 Conclusion

A survey to describe the existing conditions of the aquatic macroinvertebrate community of Canyon Lake was performed on July 30, 2004.

A total of 12 macroinvertebrate samples were collected: eight from deep, open water areas of the lake, and four from shallow sites along the shoreline of the lake.

A total of 819 individual organisms were identified from the samples, representing 24 unique taxa.

Open water areas were heavily dominated by the phantom midge *Chaoborus*. Shoreline areas were dominated by the Amphipod *Hyaella* and Chironomid midges, but also had a diversity of other organisms not seen in the open water areas.

5.0 References

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Table 2: Taxonomic Listing of Benthic Macroinvertebrates. Canyon Lake, July 2004.

TV=Tolerance Value: range is 0-10; 0 is intolerant to impairment, 10 is highly tolerant.

FFG=Functional Feeding Group: cg=collector gatherer, sc=scrapper, pa=parasite, ph=piercer herbivore, p=predator

NAME	TV	FFG	Shoreline				Open Water Dredge				Open Water Reference				Total	
			R1	R2	D1	D2	1	2	3	4	1	2	3	4		
PHYLUM ARTHROPODA																
Class Insecta																
Ephemeroptera																
Baetidae																
Callibaetis sp	9	cg		1		1										2
Ephemeroptera																
Caenidae																
Caenis sp	7	cg	6	15												21
Odonata																
Coenagrionidae																
Coenagrionidae	9	p	1													14
Enallagma sp	9	p														3
Libellulidae																
Libellulidae	9	p	2													2
Hemiptera																
Corixidae																
Corixidae	8	p														1
Trichoptera																
Hydroptilidae																
Oxyethira sp	3	ph	1													1
Coleoptera																
Hydrophilidae																
Tropisternus sp	5	p	1	1	1											3
Diptera																
Ceratopogonida																
Bezzia/Palpomysia complex	6	p	1	3												4
Atrichopogon sp	6	cg														1
Dasyhelea sp	6	cg														1
Chaoboridae																
Chaoborus sp	7	p						20	73	25	30	40	80	7	89	364
Chironomidae																
Chironomidae	6	cg	11	7	71	29										119
Class Malacostraca																
Amphipoda																
Hyaellidae																
Hyaella sp	8	cg	49	45	27	30										151
Isopoda																
Sphaeromatidae																
Gnorimosphaeroma sp						1										1
Class Ostracoda																
Ostracoda	8	cg	4	5	4	1										14
PHYLUM CHELICERATA																
Class Arachnida																
Acari																
Hydrachnidae																
Hydrachna sp	5	p	1	1												2
Unionicolidae																
Koenikea sp	5	p		11												11
PHYLUM CNIDARIA																
Class Hydrozoa																
Hydroida																
Hydridae																
Hydra sp	5	p	3													3
PHYLUM PLATYHELMINTHES																
Class Turbellaria																
Turbellaria	4	p	8	3		6										17
PHYLUM ANNELIDA																
Class Oligochaeta																
Oligochaeta	8	cg	6	2	1	12	3			9		1	4		13	51
Class Hirudinea																
Hirudinea	10	pa	5		2											7
PHYLUM MOLLUSCA																
Class Gastropoda																
Basommatophora																
Lymnaeidae																
Fossaria sp	6	sc	1	1	1	1										4
Physidae																
Physa/Physella sp	8	sc	3	4		5										12
Planorbidae																
Planorbidae	6	sc	6													6
Gyraulus sp	8	sc	2	2												4
															819	

Table 3: Summary Metrics for Macroinvertebrates in Canyon Lake. July 30, 2004.

Location	Open Water: Ponar Grab Samples Four Replicates per Site		Shoreline: Kick Net Samples Two Replicates per Site	
	Dredge	Reference	Dredge	Reference
Total Number Macroinvertebrates	160	235	212	212
Number Organisms per Square Foot	173	218	284	218
Taxa Richness	2	3	16	20
Number EPT Taxa (Ephemeroptera/Plecoptera/Trichoptera)	0	0	1	3
Percent EPT Taxa	0%	0%	0%	11%
Number Diptera (true flies) Taxa	1	2	3	2
Percent Chironomidae (midges)	0%	0%	47%	8%
Number Coleoptera (beetle) Taxa	0	0	1	1
Number Non-insect Taxa	1	1	8	12
Shannon Diversity Index	0.27	0.30	1.63	2.13
Margalef Diversity Index	0.20	0.37	2.80	3.55
Percent Non-insect Individuals	8%	8%	43%	76%
Percent Non-insect Taxa	50%	33%	50%	60%
Percent Dominant Taxon	93%	92%	47%	44%

Table 4: Individual Metrics for Macroinvertebrates in Canyon Lake. July 30, 2004

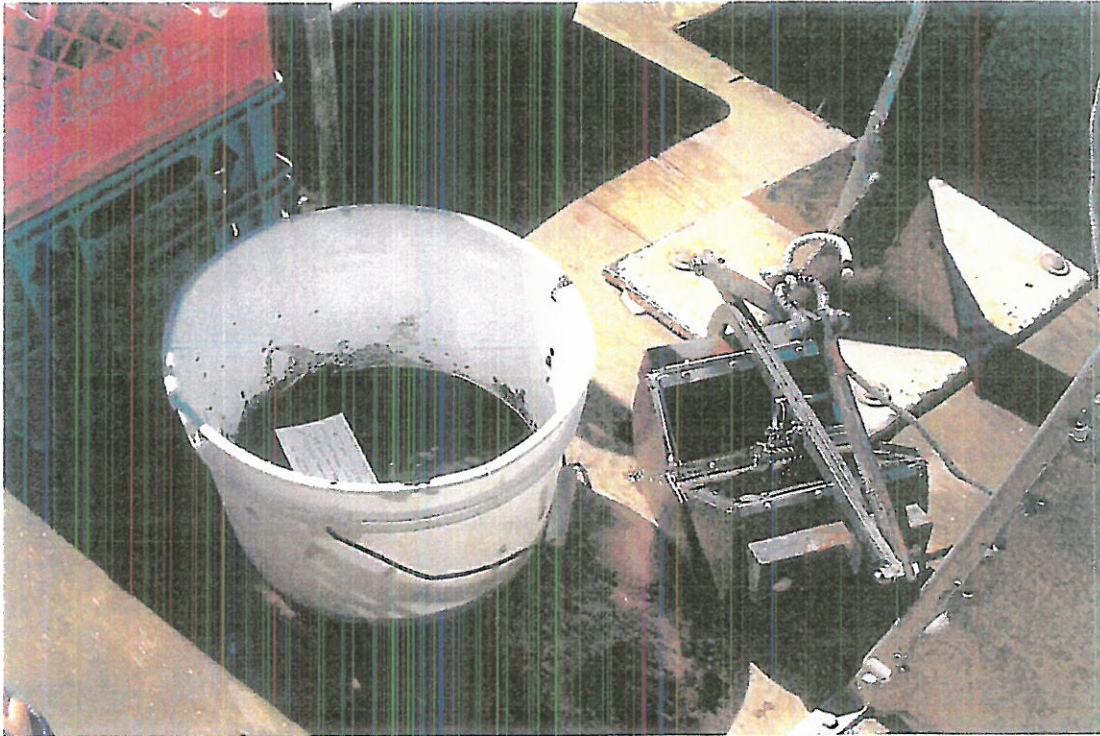
Location	Open Water: Ponar Grab Samples								Shoreline: Kick Net Samples			
	Dredge 1	Dredge 2	Dredge 3	Dredge 4	Ref 1	Ref 2	Ref 3	Ref 4	Dredge 1	Dredge 2	Ref 1	Ref 2
Total Number Macroinvertebrates	23	73	34	30	41	84	7	103	108	104	111	101
Number Organisms per Square Foot	85	271	126	111	152	312	26	382	288	280	283	154
Taxa Richness	2	1	2	1	2	2	1	3	8	13	18	14
Number EPT Taxa (Ephemeroptera/Plecoptera/Trichoptera)	0	0	0	0	0	0	0	0	0	1	2	2
Percent EPT Taxa	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	6%	16%
Number Diptera (true flies) Taxa	1	1	1	1	1	1	1	2	1	3	2	2
Percent Chironomidae (midges)	0%	0%	0%	0%	0%	0%	0%	1%	66%	28%	10%	7%
Number Coleoptera (beetle) Taxa	0	0	0	0	0	0	0	0	1	0	1	1
Number Non-insect Taxa	1	0	1	0	1	1	0	1	6	6	11	9
Shannon Diversity Index	0.39	0.00	0.58	0.00	0.11	0.19	0.00	0.43	0.99	1.90	2.11	1.89
Margalef Diversity Index	0.32	0.00	0.28	0.00	0.27	0.23	0.00	0.43	1.50	2.58	3.61	2.82
Percent Non-insect Individuals	13%	0%	26%	0%	2%	5%	0%	13%	33%	53%	79%	73%
Percent Non-insect Taxa	50%	0%	50%	0%	50%	50%	0%	33%	75%	46%	61%	64%
Percent Dominant Taxon	87%	100%	74%	100%	98%	95%	100%	86%	66%	29%	44%	45%



**Undeveloped shoreline adjacent to proposed dredging area,
site of collection of shoreline sample # 1.**



View from maintenance barge of open water site # 2, within the proposed dredging area.



Ponar grab sampler and a typical sample from the middle of Canyon Lake. Sediment consisted of fine silt that passed easily through a 0.5 mm sieve, was very dark in color, and had an organic odor.



A typical sample from the open water areas of Canyon Lake, after sieving. There was very little organic matter, no vegetation, and the benthic habitat was dominated by the phantom midge *Chaoborus*.