



Edwards Aquifer
Research and Data Center

Monday, August 31, 1992

Mr. Gary Westmoreland
Asst. State Conservationist for Water
USDA - SCS
101 S. Main Street
Temple, Texas 76501

RE: August 31, 1992 Report of Seco Creek Bioassessment Study

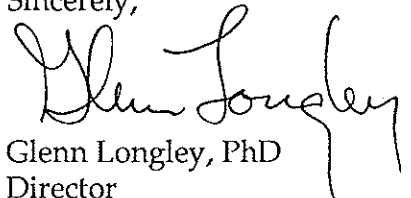
Dear Gary:

Enclosed is a copy of the required report. The water quality of Seco Creek is excellent, even though the EPA protocol requiring comparison with a regional Reference site on the Medina River would make it appear that there is moderate impairment. Since the analyses of the later samples in August have not been completed they will be included in the report for next year.

You will note in my recommendations that we should discuss some possible alternate collection sites as the stream gets drier. We should also try to have a joint meeting (informal) of all the investigators on the project for better coordination of work.

I will look forward to receiving your comments. Say hello to Allen for me.

Sincerely,



Glenn Longley, PhD
Director

Copy to:
Phillip Wright

Southwest Texas State University

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**SECO WATERSHED BIOASSESSMENT STUDY
BANDERA, MEDINA, AND UVALDE COUNTIES;
TEXAS**

**RESULTS FROM SEPTEMBER 18, 1991 TO
AUGUST 16, 1992**

by

**Glenn Longley
and
Calvin Phillips**

August 31, 1992

**EDWARDS AQUIFER RESEARCH & DATA
CENTER**

**SOUTHWEST TEXAS STATE UNIVERSITY
San Marcos, Texas**

INTRODUCTION

The U.S. Department of Agriculture and the State of Texas have cooperatively established the Seco Creek Water Quality Demonstration Project in portions of Bandera, Medina and Uvalde Counties. Leadership for this project is being provided by the USDA-Soil Conservation Service, the Texas Agricultural Extension Service, the Texas State Soil and Water Conservation Board and the USDA-Agricultural Stabilization and Conservation Service. The project is intended to demonstrate and transfer technology to producers that will protect the sensitive, rapidly recharged Edwards Aquifer from agrochemical, bacterial and sediment contaminants. The project will encourage voluntary adoption of demonstrated best management practices that will reduce nonpoint source water pollution from rangeland and cropland. In addition, technology will be demonstrated that has potential for enhancing aquifer recharge. The project has far reaching potential for adoption of best management practices on over 1 billion acres of range and croplands across the United States. In order to document the effects of these best management practices on the water quality of Seco Creek, U.S. EPA's Rapid Bioassessment Protocols (RBP) II and V for Streams and Rivers were used (Plafkin, et al, 1989). RBP's were specifically developed to obtain basic aquatic life data for planning and management purposes. In addition to the data collected by RBP's II and V, chemical and bacteriological analyses were taken concurrently. The chemical and bacteriological analyses included the following parameters: Fecal coliform/Fecal streptococcus, BOD₅, TOC, pH, temperature, conductivity, dissolved oxygen, nitrate, sulfate, ortho- and total phosphate, turbidity, and total suspended solids. Sampling was conducted twice each month at five locations on Seco Creek (Figure 1). Monthly pesticide scans were run at Site 5, below the recharge zone. The primary objective was to determine the water quality in the Seco Creek Watershed.

The Seco Creek watershed comprises 170,670 acres in Bandera, Medina, and Uvalde Counties and is composed of predominately rangeland (>85%) with the remaining area consisting of irrigated and dryland crop and pastureland. Predominate land uses are ranching with production of cattle, Angora goats, wildlife. Geographically the watershed is located within portions of the Central Edwards Plateau and Northern Rio Grande Plains Major Land Resource Areas of Texas.

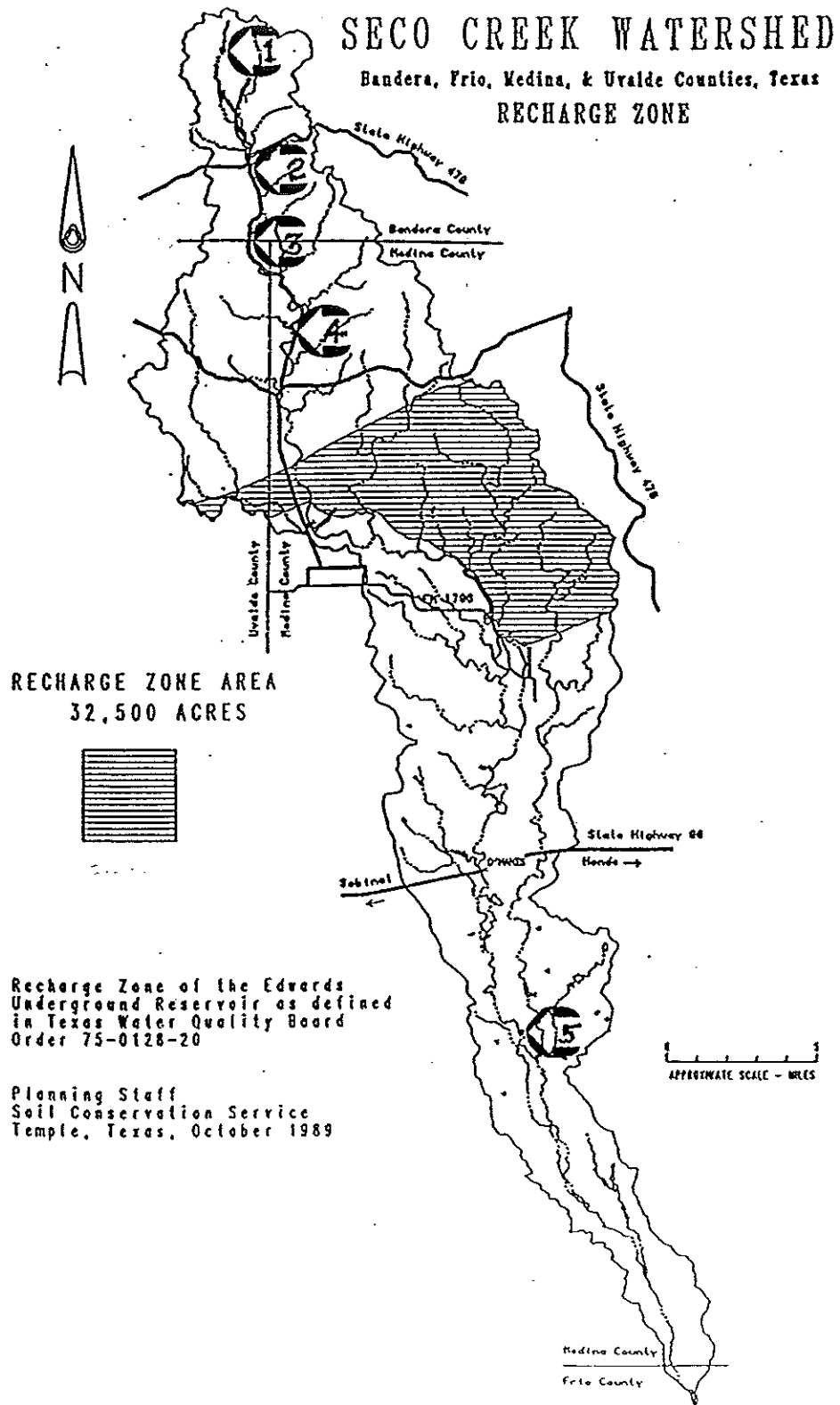


Figure 1. Sampling locations on Seco Creek.

The headwaters of Seco Creek are in southern Bandera County where it is a perennial stream. As the creek enters Medina County it crosses the recharge zone of the Edwards Aquifer. The stream becomes ephemeral since all base flow enters the aquifer at this point. The southern limit of the aquifer recharge zone is at the boundary of the two land resource areas. South of the recharge zone the creek is intermittent, Seco in Spanish means "dry".

METHODS

On each sampling date benthic macroinvertebrates were sampled using a kick screen made of two five foot shovel handles and 500 micron mesh netting. The cobble substrate just upstream from the kick screen was kicked and organisms which were dislodged from the substrate washed into the net. Two 45 second kicks were made, one in a fast moving riffle and one in a slow riffle. These two samples were composited on the screen and returned to shore for sorting to Order then stored in 80% Ethanol in 15 dram plastic vials. In the lab, organisms were sorted to family and the number from each family was recorded. The number and relative abundance of each family was used to calculate the metrics for Rapid Bioassessment Protocol II (RBP II) Plafkin, 1989.

Fish were collected using a ten foot seine and a backpack electroshocking unit working along the banks and under overhangs. Fish were preserved in 5% Formalin. In the lab, fish were identified to species and the number of each species was noted. The fish species and numbers were used to calculate RBP V metrics (Plafkin, 1989).

Chemical and bacteriological samples were collected using one gallon cubitainers, 120 ml sterile plastic containers and 50 ml amber, screw top bottles. Water samples were kept on ice during transportation and were refrigerated at 3 degrees Celsius upon returning to the lab. The following standard methods were used in order to test the water samples: 1. Fecal coliform - membrane filtration technique (Method 9222 D); 2. Fecal streptococcus - membrane filtration technique (Method 9230 C); 3. Biological Oxygen Demand - 5-Day BOD Test (Method 5210 B); 4. Total Organic Carbon - Combustion-Infrared (Method 5310 B); 5. pH - Orion Research ionalyzer 901; 6. Conductivity - Cole-Palmer Conductivity Meter 1481-60; 7. Dissolved Oxygen - YSI model 58 dissolved oxygen meter; 8. Nitrate - Automated Cadmium Reduction (Method 4500-

NO₃⁻ F); 9. Sulfate - Turbidimetric (Method 4500-SO₄²⁻ E); 10. Ortho-Phosphate - Ascorbic Acid (Method 4500-P); 11. Total-Phosphate - Ascorbic Acid (Method 4500-P); 12. Turbidity - HF Instruments Turbidimeter Model DRT 100 B; and 13. Total Suspended Solids - Total Suspended Solids (Method 2540 D) (APHA, 1989). Pesticide samples were run according to Gas Chromatographic Method 6630B (APHA,1989).

RESULTS

The primary objective of the Rapid Bioassessment study was to determine the effects of the various land management practices on the water quality in Seco Creek. This objective has been achieved by use of Rapid Bioassessment Protocols II and V combined with appropriate chemical analyses and pesticide scans. Bioassessment data was compared to the Ecoregion reference site for the area, which is the Medina river at State highway 16 west of Bandera, Texas. Chemical data was compared to EPA ranges for water quality.

At present, the only indication of decreased water quality occurred during the periodic flooding which occurred throughout the sampling year. During flooding water quality parameters such as the Fecal Coliform to Fecal Streptococcus Ratio and Total Suspended Solids were higher indicating lower water quality. These parameters returned to very low levels once the runoff from the flooding ceased. All other water quality parameters remained well within the good to excellent range for water quality.

The organisms which inhabit the creek were limited in numbers but not species richness (Appendices 1, 2, and 3). The benthic macroinvertebrate population fluctuated throughout the year. Numbers of organisms collected tended to be low during times of high flow. The fish population in Seco Creek was limited in numbers and size of fish (Appendix 4). This was expected due to the size of the watershed and the nature of the creek. No abnormalities such as lesions or growths were found on any of the specimens collected.

Physical/Chemical data are shown in Appendices 5 and 6.

- Fecal Coliform and Fecal Strep. Ratios ranged from (0.02) Site 2 on April 22, 1992 to 42.04 at Site 5 on August 2, 1992;
- Biochemical Oxygen Demand values were consistently below 2.00 milligrams per liter (mg/L) at all stations;

- Total Organic Carbon values fluctuated throughout the year with a range of <0.20 to 36.80 mg/L and the highest average of 7.88 at Site five.
- pH values were slightly basic as expected due to the limestone substrate with averages ranging from 7.33 at Site one to 7.96 at Site four.
- Conductivity values were higher below the recharge zone than above it. Below the recharge zone had an average of 1219.16 micromhos per centimeter. Above the recharge zone values ranged from an average of 385.41 micromhos per centimeter at Site One to an average of 403.67 micromhos per centimeter at Site Two.
- Dissolved Oxygen concentrations were high at all sites with a average range of 7.49 at Site One to an average of 9.58 mg/L at Site Three.
- Nitrate concentrations were much higher below the recharge zone than above it but were well below limits for primary drinking water standards. Below the recharge Zone Nitrate levels averaged 2.67 mg/L. Above the recharge zone Nitrate concentrations averaged <0.86 mg/L.
- Sulfate values were elevated and erratic below the recharge zone but mostly stable above it. The average below the recharge zone was 305.73 mg/L. The highest average above the recharge zone was 34.21 at Site Two.
- Ortho-Phosphate was stable at all sites with values consistently below 0.01 mg/L and a range of < 0.01 to 0.32 mg/L.
- Total-Phosphate values ranged from < 0.01 to 25 mg/L on February 26, 1992 at Site Five. The high reading may have been from organic material in sample.
- Turbidity values were higher below the recharge zone than above it. Values below the recharge zone had an average of 1.71 NTU. Above the recharge zone the highest average was 0.45 NTU at Site Four.
- Total Suspended Solids averages ranged from 4.03 mg/L at Site Two to 15.65 at Site Five.
- Pesticide levels were very low at all times (Appendix 6).

Rapid Bioassessment protocol II (invertebrates) has shown the stream to be moderately impaired from a biological perspective (Appendix 2). Sites tended to have few taxa and were dominated by one or two taxa. Family-level biotic index values below the recharge Zone averaged 5.58. Indices above the recharge Zone averaged 4.37. Rapid Bioassessment protocol V was compared to the reference site at the confluence of the Frio river and Hondo creek. The moderate impairment is an artifact of the protocol requiring comparison with a

reference site that is not actually similar. Appendix 4 lists the fish species present in Seco Creek.

Habitat assessment data indicated two different types of habitats. Above the recharge zone, sites were characterized by severely scoured bottoms, little or no instream cover and partially to completely embedded cobble substrates. Below the recharge zone, the site was characterized by partially embedded to not embedded cobble substrates, partial instream cover and some indication of erosion of upper and lower banks.

DISCUSSION

At present, the only indication of decreased water quality occurred during the periodic flash flooding which occurred throughout the sampling year. During this time water quality parameters such as Fecal Coliform to Fecal Strep ratio and Total Suspended Solids showed higher numbers indicating lower water quality. These parameters returned to very low levels once the runoff from the flooding ceased. Sulfate levels were high (average 316 mg/L) at site five due to an unknown reason. All other water quality parameters remained well within the good to excellent ranges.

The organisms which inhabit the creek were limited in total numbers and diversity when compared to the ecoregion reference site at the Medina river west of Bandera, Texas. Benthic organisms may have been limited due to the following factors: 1. solid rock substrates provided little habitat for invertebrates, 2. low nutrient availability due limited use of fertilizers in the upper watershed. The fish population in Seco Creek was also limited in numbers and size of fish. This limited population is most likely due to the same factors which limited the benthic population. No abnormalities such as lesions or growths were found on any of the specimens collected.

SUMMARY

The water quality of this stream is excellent for a stream of its type along the escarpment. The rapid bioassessment protocol requires comparison with a reference site in the same biotic region. The site on the Medina is the nearest established reference site and I

feel is not a good comparison with Seco Creek due to the larger size of the Medina River and difference in substrate type. From the water quality data gathered to date there does not appear to be any notable deterioration of water quality of management practices. The final report will have a more detailed discussion of the data gathered. Most of the data for late August is not included in this report and will be included in next year's report.

RECOMMENDATIONS

For the remainder of the study I feel that there should be sampling locations established on tributaries below where management practices are to be carried out and sampling should be done before and after a management practice is carried out. I also recommend that there should be a one day meeting of all the investigators working in the watershed for the various agencies. This would allow a better coordination of studies so that the best information possible might be obtained.

REFERENCES

- APHA, 1989. Standard Methods for the examination of Water and Wastewater. 17th Ed. Amer. Pub. Health Assn., Washington, DC.
- Bayer, Charles W. 1975. The Dragon Fly nymphs (Odonata: Anisoptera) of the Guadalupe River basin, Texas. M.S. Thesis, Southwest Texas State University, San Marcos, Texas, 161pp.
- Brown, Harley P. 1976. Aquatic Dryopoid Beetles (Coleoptera) Of The United States. Wat. Poll. Cont. Res. Series 18050 ELD04/72. U.S. E. P. A. Cincinnati, Ohio. 82pp.
- Burch, J. B. 1989. North American Freshwater Snails. Malacological Publications, Hamburg, Michigan. U.S.A. 365pp.
- Edmunds, George F., Steven L. Jensen, and Lewis Berner 1976. The Mayflies of North and Central America. University of Minnesota Press, Minneapolis. 330pp.

- Harris, T.L. and T.M. Lawrence. 1978. Environmental Requirements and Pollution Tolerance of Trichoptera. EPA-600/4-78-063. U.S.E.P.A., Cincinnati, Ohio. 309 pp.
- Hornig, C.E., and J.E. Pollard . 1978. Macroinvertebrate Sampling Techniques For Streams In Semi-Arid Regions. EPA-600/4-78-040. U.S. E. P. A. Las Vegas, Nevada. 21pp.
- Hubbs, C. 1970. Key to Fishes of Texas. Mimeograph, Zoology Dept., Univ. Texas. Austin.
- Johnson, Clifford. 1972. The Damselflies (Zygoptera) of Texas. Bull. of the Florida State Museum Biological Sciences 16(2): 55-128.
- Merritt, R.W. and K.W. Cummins. 1984. An Introduction to the Aquatic Insects of North America. Second Edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 722pp.
- Pennak, Robert W. 1989. Fresh-Water Invertebrates of the United States, 3rd Ed. John Wiley & Sons, Inc. New York. 628pp.
- Peters, Michael S. 1977. The Mayfly nymphs (Insecta: Ephemeroptera) of the Guadalupe River basin. M.S. Thesis, Southwest Texas State University, San Marcos, Texas. 84pp.
- Plafkin, J. L., M. T. Barbour, K. D. Porter, S. K. Gross and R. M. Hughes. 1989. Rapid Bioassessment Protocols for use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA/444/4-89-001.
- Thorp, James H. and Alan P. Covich. 1991. Ecology and Classification of North American Freshwater Invertebrates. 911pp.
- Wiggins, Glenn B. 1977. Larvae of the North American Caddisfly Genera (Tricoptera). University of Toronto Press. Toronto.
- Young, Willard C. and Charles W. Bayer. 1979. The dragonfly nymphs (Odonata: Anisoptera) of the Guadalupe river basin, Texas. The Texas Journal of Science 31(1):85-97.

APPENDICES

Appendix 1. Macroinvertebrates of Seco Creek

Taxa	SITE					Feeding Group
	1	2	3	4	5	
Ephemeroptera (Mayflies)						
Baetidae	X	X	X	X	X	scrapers
Caenidae	X	X				scrapers
Ephemeridae					X	gatherers
Heptageniidae	X	X	X	X	X	scraper
Leptophlebiidae			X		X	filterers
Siphonuridae	X	X	X		X	gatherers
Tricothyridae	X	X	X	X	X	gatherers
Odonata (Dragonflies & Damselflies)						
Calopterygidae			X			predator
Coenagrionidae	X	X	X	X	X	predator
Gomphidae	X		X	X		predator
Libellulidae		X	X		X	predator
Coleoptera (Beetles)						
Dryopidae		X				scrapers
Dytiscidae					X	predators
Elmidae	X		X	X	X	scrapers
Gyrinidae					X	predators
Hydrophilidae				X	X	predator
Lutrochidae		X	X	X		scrapers
Psephenidae		X				scraper
Trichoptera (Caddisflies)						
Calamoceratidae		X				shredder
Helicopsychidae		X				scrapers
Hydropsychidae	X	X	X	X	X	filterers
Hydroptilidae		X	X		X	piercer
Leptoceridae	X	X	X		X	filterers
Odontoceridae	X	X				shredders
Philopotamidae		X	X	X	X	filterers
Hemiptera (Water Bugs)						
Corixidae					X	predator
Gerridae	X				X	predator
Naucoridae		X	X	X	X	predator
Veliidae	X					predators
Diptera (True Flies)						
Athericidae		X				predator
Chironomidae	X					predator
Dixidae	X			X		collector
Simuliidae	X		X			filterers
Stratiomyidae	X	X				collector
Tabinidae				X		predator
Tipulidae			X		X	shredder
Megaloptera (Fishflies)						
Corydalidae		X	X	X	X	predator
Sialidae		X				predator
Plecoptera (Stoneflies)						
Leuctridae		X	X			shredder
Lepidoptera (Moths)						
Pyralidae		X	X			shredder
Gastropoda (Snails)						
Physidae	X					
Ancylidae					X	
Corbiculidae					X	

Appendix 2. Rapid Bioassessment Protocol Metrics, Indices, and Biological Condition Scores.

Raw Data

DATE	# individual	#TAXA	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	Bio. %	Impairment
Site 1									
18-Sep-91	27	5	3.69	1.00	1.00	48.1	2	50.00%	Moderately impaired
2-Oct-91	81	9	3.99	0.90	1.00	54.3	4	50.00%	Moderately impaired
16-Oct-91	99	6	4.17	0.59	0.00	34.3	2	33.33%	Moderately impaired
6-Nov-91	65	9	3.34	0.76	0.00	26.2	6	33.33%	Moderately impaired
20-Nov-91	114	13	3.47	0.59	1.00	27.2	6	58.33%	Moderately impaired
4-Dec-91	89	13	4.19	0.14	0.01	32.6	6	25.00%	Moderately impaired
17-Dec-91	105	11	3.61	0.69	1.00	42.9	5	50.00%	Moderately impaired
8-Jan-92	30	9	4.57	0.45	0.81	23.3	3	50.00%	Moderately impaired
22-Jan-92	97	9	3.98	0.04	1.00	27.8	5	33.33%	Moderately impaired
12-Feb-92	100	14	5.35	0.50	0.99	36.0	7	58.33%	Moderately impaired
26-Feb-92	88	10	4.65	0.53	0.96	38.6	5	50.00%	Moderately impaired
11-Mar-92	78	13	4.01	0.73	1.00	24.4	5	58.33%	Moderately impaired
25-Mar-92	117	9	4.88	0.80	1.00	38.5	4	50.00%	Moderately impaired
9-Apr-92	61	13	4.61	0.44	0.91	27.9	5	58.33%	Moderately impaired
22-Apr-92	116	6	5.52	0.57	1.00	35.3	2	41.67%	Moderately impaired
13-May-92	81	9	4.79	0.14	0.98	50.6	4	33.33%	Moderately impaired
27-May-92	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	#VALUE!	#VALUE!
14-Jun-92	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	#VALUE!	#VALUE!
5-Jul-92	123	10	5.05	0.21	1.00	55.0	5	33.33%	Moderately impaired
19-Jul-92	117	9	6.01	0.01	1.00	85.0	3	25.00%	Moderately impaired

Appendix 2. Continued.

DATE	# individual	#TAXA	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	Bio. %	Impairment
Site 2									
18-Sep-91	38	10	5.55	0.90	1.00	28.9	5	41.67%	Moderately impaired
2-Oct-91	10	6	3.70	0.67	1.00	40.0	2	50.00%	Moderately impaired
16-Oct-91	37	10	5.38	0.61	0.00	18.9	6	25.00%	Moderately impaired
6-Nov-91	55	12	4.78	0.89	0.00	23.6	6	41.67%	Moderately impaired
20-Nov-91	104	11	3.63	0.26	1.00	28.8	6	41.67%	Moderately impaired
4-Dec-91	71	7	5.28	0.00	1.00	49.3	1	25.00%	Moderately impaired
17-Dec-91	114	10	4.82	0.02	0.98	48.2	4	33.33%	Moderately impaired
8-Jan-92	76	10	5.71	0.38	1.00	28.9	5	41.67%	Moderately impaired
22-Jan-92	95	13	5.41	0.17	0.97	17.9	7	50.00%	Moderately impaired
12-Feb-92	96	12	5.69	0.25	1.00	32.3	5	41.67%	Moderately impaired
26-Feb-92	109	18	5.65	0.31	0.96	20.2	8	58.33%	Moderately impaired
11-Mar-92	53	10	6.06	0.41	1.00	22.6	3	41.67%	Moderately impaired
25-Mar-92	88	13	6.32	0.55	1.00	26.1	5	50.00%	Moderately impaired
9-Apr-92	73	6	3.80	0.50	1.00	79.5	3	50.00%	Moderately impaired
22-Apr-92	44	9	5.00	0.19	1.00	23.0	4	33.33%	Moderately impaired
13-May-92	75	12	5.00	0.24	0.97	22.7	4	41.67%	Moderately impaired
27-May-92	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	#VALUE!	#VALUE!
14-Jun-92	83	9	4.19	0.35	0.98	33.7	6	50.00%	Moderately impaired
5-Jul-92	129	8	3.99	0.05	0.99	45.0	3	33.33%	Moderately impaired
19-Jul-92	85	8	3.20	0.04	1.00	51.7	4	33.33%	Moderately impaired

Appendix 2. Continued.

DATE	# individual	#TAXA	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	Bio. %	Impairment
Site 3									
18-Sep-91	28	9	4.61	1.00	1.00	25.0	5	50.00%	Moderately impaired
2-Oct-91	30	7	5.43	1.00	1.00	26.7	3	41.67%	Moderately impaired
16-Oct-91	53	10	3.30	0.72	0.00	22.6	4	33.33%	Moderately impaired
6-Nov-91	72	8	4.81	0.21	0.00	37.5	4	25.00%	Moderately impaired
20-Nov-91	100	9	4.07	0.25	1.00	20.0	4	41.67%	Moderately impaired
4-Dec-91	84	5	3.32	0.14	1.00	59.5	4	33.33%	Moderately impaired
17-Dec-91	45	9	4.18	0.69	0.95	55.5	5	50.00%	Moderately impaired
8-Jan-92	47	11	4.40	0.47	0.95	53.2	6	50.00%	Moderately impaired
22-Jan-92	89	10	5.13	0.97	0.98	60.7	5	41.67%	Moderately impaired
12-Feb-92	98	8	3.38	1.00	1.00	51.0	3	50.00%	Moderately impaired
26-Feb-92	101	12	4.06	0.70	1.00	31.7	6	58.33%	Moderately impaired
11-Mar-92	102	7	3.84	0.75	1.00	76.5	4	50.00%	Moderately impaired
25-Mar-92	126	5	4.37	0.00	0.97	85.7	2	33.33%	Moderately impaired
9-Apr-92	22	3	4.77	0.86	1.00	86.4	1	50.00%	Moderately impaired
22-Apr-92	26	8	3.73	0.50	0.94	50.0	3	50.00%	Moderately impaired
13-May-92	33	8	5.70	0.17	0.69	39.0	5	33.33%	Moderately impaired
27-May-92	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	#VALUE!	#VALUE!
14-Jun-92	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	#VALUE!	#VALUE!
5-Jul-92	17	7	2.29	0.86	1.00	23.5	4	50.00%	Moderately impaired
19-Jul-92	14	4	4.90	0.14	1.00	42.8	2	33.33%	Moderately impaired

Appendix 2. Continued.

DATE	# individual	#TAXA	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	Bio. %	Impairment
Site 4									
18-Sep-92	49	5	4.63	0.98	1.00	79.6	3	50.00%	Moderately impaired
2-Oct-91	69	7	3.77	0.93	1.00	62.3	5	50.00%	Moderately impaired
16-Oct-91	64	10	3.81	0.63	0.00	37.5	6	33.33%	Moderately impaired
6-Nov-91	104	7	3.02	0.09	0.00	58.7	2	16.67%	Severely impaired
20-Nov-91	105	8	3.10	0.01	1.00	39.0	3	33.33%	Moderately impaired
4-Dec-91	114	8	2.90	0.01	1.00	47.4	4	33.33%	Moderately impaired
17-Dec-91	129	8	3.17	0.03	1.00	38.8	3	33.33%	Moderately impaired
8-Jan-92	52	12	3.77	0.44	1.00	17.3	7	66.67%	Moderately impaired
22-Jan-92	72	6	4.74	0.13	0.97	51.4	3	33.33%	Moderately impaired
12-Feb-92	25	5	5.04	0.30	1.00	40.0	5	41.67%	Moderately impaired
26-Feb-92	77	8	4.03	0.86	0.99	64.9	4	50.00%	Moderately impaired
11-Mar-92	13	4	2.54	0.17	1.00	38.0	3	41.67%	Moderately impaired
25-Mar-92	8	4	5.50	0.67	0.00	37.5	0	25.00%	Moderately impaired
9-Apr-92	55	10	6.71	0.00	1.00	41.8	2	25.00%	Moderately impaired
22-Apr-92	33	6	3.42	0.06	0.94	70.0	4	33.33%	Moderately impaired
13-May-92	98	8	3.46	0.14	0.17	41.8	5	16.67%	Severely impaired
27-May-92	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	#VALUE!	#VALUE!
14-Jun-92	37	7	3.51	0.10	1.00	29.7	5	33.33%	Moderately impaired
5-Jul-92	88	5	3.69	0.00	1.00	49.0	3	33.33%	Moderately impaired
19-Jul-92	87	8	3.21	0.07	1.00	93.6	4	33.33%	Moderately impaired

Appendix 2. Continued.

DATE	# individual	#TAXA	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	Bio. %	Impairment
Site 5									
18-Sep-92	60	5	6.72	0.96	0.97	90.0	2	58.33%	Moderately impaired
2-Oct-91	56	3	6.84	1.00	1.00	96.4	1	58.33%	Moderately impaired
16-Oct-91	70	7	6.17	1.00	0.90	62.9	2	75.00%	Non-impaired
6-Nov-91	32	6	5.94	1.00	0.65	28.1	2	83.33%	Non-impaired
20-Nov-91	151	8	4.09	0.36	0.83	40.4	4	66.67%	Moderately impaired
4-Dec-91	61	8	4.67	1.00	0.95	52.5	3	75.00%	Non-impaired
17-Dec-91	24	6	4.83	1.00	1.00	50.0	3	75.00%	Non-impaired
8-Jan-92	124	9	6.77	0.96	0.83	73.4	5	66.67%	Moderately impaired
22-Jan-92	108	6	6.71	0.98	0.97	85.2	4	66.67%	Moderately impaired
12-Feb-92	144	5	6.92	0.95	0.99	91.0	2	58.33%	Moderately impaired
26-Feb-92	104	7	6.78	0.90	0.97	83.7	2	66.67%	Moderately impaired
11-Mar-92	115	8	6.32	0.75	0.98	59.1	3	66.67%	Moderately impaired
25-Mar-92	122	8	6.62	0.92	0.95	59.0	4	66.67%	Moderately impaired
9-Apr-92	84	10	5.23	0.93	0.92	46.4	5	75.00%	Non-impaired
22-Apr-92	45	8	4.33	0.97	0.79	36.0	5	75.00%	Non-impaired
13-May-92	168	10	4.16	0.90	0.98	63.0	5	75.00%	Non-impaired
27-May-92	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	FLOOD	#VALUE!	#VALUE!
14-Jun-92	184	7	4.11	0.39	1.00	50.0	5	66.67%	Moderately impaired
5-Jul-92	119	7	4.66	1.00	1.00	26.0	4	83.33%	Non-impaired
19-Jul-92	122	8	4.20	0.00	1.00	54.0	3	58.33%	Moderately impaired

Appendix 3. The invertebrate taxa of Seco Creek.

Scientific Name	Common Name
EPHEMEROPTERA	MAYFLIES
CAENIDAE	Small squaregill mayflies
<i>Caenis sp.</i>	
TRICORYTHIDAE	Little stout crawler mayflies
<i>Tricorythodes sp.</i>	
HEPTAGENIIDAE	Flatheaded mayflies
<i>Stononema femoratum tripunctatum</i>	
<i>Cinygmula sp.</i>	
LEPTOPHLEBIIDAE	Pronggill mayflies
<i>Choroterpes sp.</i>	
OLIGONEURIDAE	Brushlegged mayflies
<i>Isonychia sp.</i>	
BAETIDAE	Small minnow mayflies
<i>Baetis sp.</i>	
<i>Dactylobaetis sp.</i>	
SIPHONURIDAE	Primitive minnow mayflies
<i>Ameleteus sp.</i>	
EPHEMERIDAE	Common burrowing mayflies
<i>Hexagenia sp.</i>	
PLECOPTERA	STONEFLIES
LEUCTRIDAE	Rolledwinged Stoneflies
<i>Zealeuctra sp.</i>	
TRICHOPTERA	CADDISFLIES
HYDROPSYCHIDAE	Common Netspinners
<i>Cheumatopsyche sp.</i>	
<i>Hydropsyche sp.</i>	
CALAMOCERATIDAE	Comblipped Case Makers
<i>Phylloicus sp.</i>	
LEPTOCERIDAE	Longhorned Case Makers
unid. taxa	
PHILOPOTAMIDAE	Fingernet Caddisflies
<i>Chimarra sp.</i>	
<i>Dolophilodes sp.</i>	
ODONTOCERIDAE	Strongcase Maker Caddisflies
<i>Marilia sp.</i>	
HYDROPTILIDAE	Micro Caddisflies
<i>Oxyethira sp.</i>	
HELICOPSYCHIDAE	Snailcase Maker Caddisflies
<i>Helicopsyche sp.</i>	
MEGALOPTERA	FISH, DOBSON, ALDERFLIES
CORYDALIDAE	Fishflies and Dobsonflies
<i>Corydalus sp.</i>	
SIALIDAE	Alderflies
<i>Sialis sp.</i>	

Appendix 3. Continued.

Scientific Name	Common Names
ODONATA	DRAGONFLIES
GOMPHIDAE	Clubtails
<i>Octogomphus sp.</i>	Eighttoothed Clubtails
<i>Erpetogomphus sp.</i>	Snake darners
<i>Progomphus sp.</i>	Clubtails
LIBELLULIDAE	Common skimmers
<i>Brechmorhoga sp.</i>	Mendacious skimmers
	DAMSELFLIES
COENAGRIONIDAE	Narrowwinged Damselflies
<i>Argia spp.</i>	Dancers
<i>Coenagrion sp.</i>	Damsels
CALOPTERYGIDAE	Broadwinged Damselflies
<i>Hetaerina sp.</i>	Rubyspot Damselflies
COLEOPTERA	WATER BEETLES
HYDROPHILIDAE	Water Scavenger Beetles
<i>Berosus sp.</i>	
DYTISCIDAE	Predaceous Diving Beetles
<i>Derovatellus sp.</i>	
PSEPHENIDAE	Water Pennies
<i>Psephenus sp.</i>	
ELMIDAE	Riffle Beetles
<i>Narpus sp.</i>	
<i>Rhizelmis sp.</i>	
LUTROCHIDAE	Minute Marshloving Beetles
<i>Lutrochus sp.</i>	
DRYOPIDAE	Longtoed Water Beetles
unid. taxa	
GYRINIDAE	Whirligig Beetles
<i>Dineutus sp.</i>	
LEPIDOPTERA	AQUATIC CATERPILLARS
PYRALIDAE	Aquatic Pyralid Moths
<i>Petrophila sp.</i>	

Appendix 3. Continued.

<u>Scientific Name</u>	<u>Common Names</u>
DIPTERA	MIDGES, MOSQUITOES, AQUATIC GNATS and FLIES
CHIRONOMIDAE	Midges
unid. taxa	
ATHERICIDAE	Athericidae
<i>Atherix sp.</i>	
TABANIDAE	Horse and Deer Flies
<i>Chrysops sp.</i>	
<i>Silvius sp.</i>	
SIMULIDAE	Black Flies
<i>Simulium sp.</i>	
STRATIOMYIDAE	Aquatic Soldier Flies
<i>Euparyphus sp.</i>	
<i>Oxycera sp.</i>	
TIPULIDAE	Crane Flies
<i>Brachypremna sp.</i>	
DIXIDAE	Dixid Midges
<i>Dixella sp.</i>	
HEMIPTERA	TRUE BUGS
NAUCORIDAE	Creeping Water Bugs
<i>Ambrysus sp.</i>	
GERRIDAE	Water Striders
<i>Gerris sp.</i>	
VELIIDAE	Shortlegged Striders
<i>Rhagovelia sp.</i>	
CORIXIDAE	Water Boatmen
unid. taxa	
PULMONATA	SNAILS
PHYSIDAE	
unid. taxa	
ANCYLIDAE	
unid. taxa	
BIVALVIA	
CORBICULIDAE	
<i>Corbicula sp.</i>	

Appendix 4 . The fish taxa of Seco Creek.

<u>Scientific name</u>	<u>Common name</u>
CYPRINIFORMES	
CYPRINIDAE	CARP AND MINNOWS
<i>Campostoma anomalum</i>	Central stoneroller
<i>Cyprinella lutrensis</i>	Red shiner
<i>Notropis stramineus</i>	Sand shiner
<i>Dionda episcopa</i>	Roundnose minnow
<i>Cyprinella venusta</i>	Blacktail shiner
CHARACIFORMES	
CHARACIDAE	CHARACINS
<i>Astyanax mexicanus</i>	Mexican tetra
SILURIFORMES	
ICTALURIDAE	BULLHEAD CATFISHES
<i>Ameiurus natalis</i>	Yellow bullhead
ATHERINIFORMES	
POECILIIDAE	LIVEBEARERS
<i>Gambusia geiseri</i>	Largespring gambusia
PERCIFORMES	
CENTRARCHIDAE	SUNFISHES
<i>Ambloplites rupestris</i>	Rock bass
<i>Lepomis auritus</i>	Red breasted sunfish
<i>Lepomis cyanellus</i>	Green sunfish
<i>Lepomis gulosus</i>	Warmouth
<i>Lepomis humilis</i>	Orangespotted sunfish
<i>Lepomis macrochirus</i>	Bluegill sunfish
<i>Lepomis megalotis</i>	Longear sunfish
<i>Lepomis microlophus</i>	Redear sunfish
<i>Micropterus salmoides</i>	Largemouth bass
CICHLIDAE	CICHLIDS
<i>Cichlasoma cyanoguttatum</i>	Rio Grande cichlid

Appendix 5. Physical-Chemical Data for Seco Creek.

Site One															
DATE	FECAL COLIFORM	FECAL STREP	FC/FS RATIO	BOD mg/L	TOC mg/L	pH	TEMP C	CONDUCTIVITY	DO g/mL	NITRATE mg/L	SULFATE mg/L	O-PHOS mg/L	T-PHOS mg/L	TURBIDITY NTU	TSS mg/L
9/18/91	114.00	242.00	0.47	<2.00		7.80	23.00	430.26	6.80	1.03	14.36	<0.01	0.02	0.15	0.57
10/2/91	10.00	16.00	0.63	<2.00	1.57	7.40	20.80	388.00	7.56	1.23	7.27	<0.01	<0.01	0.16	4.60
10/16/91	4.00	16.00	0.25	<2.00	1.64	7.50	20.00	272.63	7.52	0.76	8.40	<0.01	<0.01	0.50	6.94
11/6/91	2.00	14.00	0.14	2.80	1.11	7.50	18.10	347.07	7.80	0.88	9.13	<0.01	<0.01	0.21	<0.01
11/20/91	154.00	56.00	2.75	<2.00	0.67	7.20	17.30	403.86	7.10	1.03	9.20	<0.01	<0.01	0.32	1.01
12/4/91	8.00	10.00	0.80	<2.00	0.73	7.20	16.30	259.84	8.90	1.04	6.44	<0.01	0.02	0.32	0.44
12/17/91	4.00	16.00	0.25	<2.00	2.63	7.40	16.10	321.37	8.10	0.95	8.41	<0.01	0.02	0.50	0.55
1/8/92	16.00	30.00	0.53	<2.00	1.03	7.40	15.60	415.00	7.90	1.14	8.60	<0.01	<0.01	0.33	0.23
1/22/92	12.00	16.00	0.75	<2.00	1.75	7.20	13.90	391.00	9.40	1.21	8.39	<0.01	<0.01	0.24	29.60
2/12/92	32.00	38.00	0.84	<2.00	0.34	7.20	14.50	412.00	8.00	1.15	9.66	<0.01	<0.01	0.28	4.89
2/26/92	12.00	8.00	1.50	<2.00	3.95	7.20	14.80	368.00	8.00	1.03	7.97	<0.01	0.01	0.15	0.00
3/11/92	42.00	28.00	1.50	<2.00	1.94	7.40	15.20	341.00	7.60	0.95	9.35	<0.01	<0.01	0.26	0.14
3/25/92	34.00	16.00	2.13	<2.00	2.92	7.50	16.50	364.00	7.70	0.81	8.26	<0.01	0.01	0.18	7.93
4/8/92	134.00	54.00	2.48	<2.00	3.37	7.20	16.30	374.00	7.10	0.53	19.06	<0.01	<0.01	0.18	4.70
4/22/92	6.00	40.00	0.15	<2.00	19.61	7.20	17.00	412.00	7.30	0.75	13.57	<0.01	<0.01	0.15	0.25
5/13/92	58.00	118.00	0.49	<2.00	3.87	7.40	17.80	461.00	8.10	0.57	7.95	<0.01	<0.01	0.20	0.34
5/27/92	120.00	32.00	3.75	No Data	6.17	7.20	18.40	444.00	7.00	0.51	7.97	<0.01	<0.01	0.32	10.68
6/14/92	38.00	82.00	0.46	<2.00	12.75	7.50	21.60	479.00	7.10	0.40	22.35	<0.01	<0.01	0.25	0.33
7/5/92	96.00	160.00	0.60	<2.00	1.65		20.60	397.00	5.70	0.61	8.82	<0.01	0.01	0.20	3.97
7/19/92	276.00	128.00	2.16	<2.00	2.02	7.10	21.20	364.00	6.50	0.68		<0.01	<0.01	0.20	5.92
8/2/92	Bad	28.00		<2.00	1.52	7.20	20.90	430.00	6.70	0.74	6.50	<0.01	<0.01	0.15	1.02
8/16/92	16.00	22.00	0.73	<2.00	2.12	7.30	20.90	404.00	7.00	1.01	7.96	<0.01	<0.01	0.37	
AVERAGE	56.57	53.18	1.11		3.49	7.33	18.04	385.41	7.49	0.86	9.98			0.26	4.21

Appendix 5. Continued.

Site Two

DATE	FECAL COLIFORM	FECAL STREP	FC/FS RATIO	BOD mg/L	TOC mg/L	pH	TEMP C	CONDUCTIVITY	DO g/mL	NITRATE mg/L	SULFATE mg/L	O-PHOS mg/L	T-PHOS mg/L	TURBIDITY NTU	TSS mg/L
9/18/91	44.00	10.00	4.40	<2.00	1.81	8.10	29.00	416.70	7.22	0.37	46.32	<0.01	<0.10	0.10	0.77
10/2/91	6.00	26.00	0.23	<2.00	0.49	7.60	21.70	374.00	8.26	0.35	37.57	<0.01	<0.01	0.14	0.98
10/16/91	8.00	30.00	0.26	<2.00	0.56	8.00	22.30	329.42	8.83	0.16	61.02	<0.01	<0.01	0.36	2.38
11/6/91	64.00	40.00	1.60	2.53	0.76	7.60	19.90	378.62	9.20	0.26	63.83	<0.01	<0.01	0.20	1.47
11/20/91	38.00	34.00	1.12	2.38	0.63	7.50	16.60	462.76	9.60	0.30	50.44	<0.01	<0.01	0.26	<0.01
12/4/91	14.00	10.00	0.12	<2.00	0.45	7.70	14.70	316.61	10.60	0.26	50.82	<0.01	0.02	0.30	0.00
12/17/91	52.00	14.00	3.71	<2.00	1.03	7.50	14.40	325.66	8.70	0.31	54.52	<0.01	0.01	0.46	0.38
1/8/92	16.00	16.00	1.00	<2.00	1.07	7.80	14.00	430.00	9.30	0.63	33.08	<0.01	<0.01	0.39	0.00
1/22/92	4.00	2.00	2.00	<2.00	<2	7.80	14.70	442.00	9.50	0.66	35.62	<0.01	<0.01	0.19	0.00
2/12/92	60.00	30.00	2.00	<2.00	0.43	7.50	15.40	410.00	9.30	0.55	27.15	<0.01	<0.01	0.22	1.13
2/26/92	34.00	52.00	0.65	<2.00	2.27	7.70	12.50	437.00	10.00	0.56	27.36	<0.01	0.02	0.16	<0.01
3/11/92	34.00	16.00	2.13	<2.00	0.51	7.80	13.10	280.00	9.50	0.48	9.35	<0.01	0.01	0.35	1.94
3/25/92	14.00	20.00	0.70	<2.00	2.29	7.90	18.00	394.00	9.10	0.39	28.54	<0.01	0.01	0.13	0.30
4/8/92	46.00	40.00	1.15	<2.00	1.75	7.80	17.50	413.00	8.80	0.37	23.28	<0.01	0.02	0.22	0.41
4/22/92	10.00	432.00	0.02	<2.00	1.26	7.80	18.90	403.00	8.90	0.30	25.74	<0.01	<0.01	0.12	0.64
5/13/92	100.00	292.00	0.34	<2.00	1.12	7.60	21.20	508.00	9.90	0.23	30.82	<0.01	<0.01	0.14	0.76
5/27/92	TNTC	TNTC	NA	No Data	9.82	7.90	18.70	405.00	8.70	0.32	15.94	<0.01	<0.01	0.62	47.18
6/14/92	26.00	184.00	0.14	<2.00	2.91	7.70	21.80	452.00	7.80	0.19	19.41	<0.01	0.04	0.33	12.24
7/5/92	36.00	168.00	0.21	<2.00	2.26	7.30	22.90	460.00	7.60	0.29	28.70	<0.01	<0.01	0.17	0.89
7/19/92	68.00	90.00	0.76	<2.00	0.14	7.30	22.70	394.00	7.60	0.28		<0.01	<0.01		
8/2/92	Bad	78.00		<2.00	2.09	7.60	23.20	450.00	7.20	0.26	16.34	<0.01	<0.01	0.15	0.99
8/16/92	66.00	32.00	2.06	<2.00	1.93	7.50	21.90	399.00	7.90	0.35	32.50	<0.01	<0.01	0.25	
AVERAGE	37.00	76.95	1.23		1.69	7.70	18.87	403.67	8.80	0.36	34.21			0.25	4.03

Appendix 5. Continued.

Site Three

DATE	FECAL COLIFORM	FECAL STREP	FC/FS RATIO	BOD mg/L	TOC mg/L	pH	TEMP C	CONDUCTIVITY	DO g/mL	NITRATE mg/L	SULFATE mg/L	O-PHOS mg/L	T-PHOS mg/L	TURBIDITY NTU	TSS mg/L
9/18/91	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10/2/91	32.00	76.00	0.42	<2.00	1.35	8.10	20.00	363.00	9.85	0.41	33.83	0.01	<0.01	0.12	3.39
10/16/91	14.00	50.00	0.28	2.00	1.03	8.30	20.40	318.06	9.67	0.21	32.27	<0.01	<0.01	0.32	0.25
11/6/91	84.00	70.00	1.20	<2.00	0.47	8.20	15.70	340.76	10.70	0.41	57.94	<0.01	<0.01	0.21	2.12
11/20/91	212.00	94.00	2.25	<2.00	0.36	7.90	14.10	431.21	10.00	0.33	49.01	<0.01	<0.01	0.24	4.63
12/4/91	24.00	38.00	0.63	<2.00	0.52	8.10	9.30	305.70	10.10	0.38	46.51	<0.01	0.02	0.27	0.00
12/17/91	82.00	120.00	0.68	<2.00	0.82	7.90	11.60	355.92	10.10	0.40	48.40	<0.01	0.01	0.54	0.59
1/8/92	64.00	32.00	2.00	<2.00	1.26	7.90	10.10	410.00	10.30	0.89	32.02	<0.01	<0.01	0.36	4.74
1/22/92	12.00	22.00	0.54	<2.00	0.44	8.00	14.50	438.00	10.30	0.93	33.71	<0.01	<0.01	0.21	9.90
2/12/92	80.00	372.00	0.22	<2.00	0.66	8.10	15.90	381.00	9.40	0.73	24.61	<0.01	<0.01	0.25	1.92
2/26/92	154.00	82.00	1.88	<2.00	1.12	8.00	10.70	412.00	11.40	0.66	27.16	<0.01	0.01	0.15	1.02
3/11/92	82.00	64.00	1.13	<2.00	0.49	7.80	12.70	322.00	10.20	0.55	25.25	<0.01	<0.01	0.59	1.43
3/25/92	60.00	32.00	1.88	<2.00	1.56	8.10	19.70	396.00	9.80	0.50	27.66	<0.01	0.02	0.12	1.74
4/8/92	138.00	32.00	4.31	<2.00	2.82	7.70	17.60	405.00	9.60	0.37	23.28	<0.01	<0.01	0.25	1.88
4/22/92	20.00	6.00	3.30	<2.00	0.89	7.70	19.10	383.00	9.30	0.40	24.68	<0.01	<0.01	0.13	1.32
5/13/92	454.00	198.00	2.29	<2.00	0.97	7.90	23.50	473.00	8.20	0.29	26.96	<0.01	0.02	0.26	1.55
5/27/92	TNTC	TNTC	NA	No Data	10.52	8.00	18.30	406.00	9.00	0.30	16.57	<0.01	0.01	0.61	92.00
6/14/92	596.00	174.00	3.42	<2.00	0.08	7.90	21.70	430.00	8.50	0.22	19.94	<0.01	<0.01	0.25	1.18
7/5/92	104.00	82.00	1.27	<2.00	1.55	7.80	22.90	425.00	8.50	0.35	27.01	<0.01	<0.01	0.16	0.60
7/19/92	36.00	98.00	0.37	<2.00	2.25	7.80	23.00	385.00	8.40	0.31	15.40	<0.01	<0.01	0.36	1.70
8/2/92	Bad	26.00		<2.00	5.46	7.80	24.20	401.00	8.30	0.13	15.40	<0.01	<0.01	0.18	0.10
8/16/92	528.00	102.00	5.18	<2.00	5.28	8.10	22.10	402.00	9.50	0.33	30.80	<0.01	<0.01	0.79	
AVERAGE	187.91	88.50	1.75		1.90	7.97	17.48	389.70	9.58	0.43	31.15			0.30	6.60

Appendix 5. Continued.

Site Four

DATE	FECAL COLIFORM	FECAL STREP	FC/FS RATIO	BOD mg/L	TOC mg/L	pH	TEMP C	CONDUCTIVITY	DO g/mL	NITRATE mg/L	SULFATE mg/L	O-PHOS mg/L	T-PHOS mg/L	TURBIDITY NTU	TSS mg/L
9/18/91	72.00	22.00	3.27	<2.00	0.82	8.10	27.20	363.28	7.72	0.42	27.24	<0.01	0.01	0.11	1.72
10/2/91	154.00	64.00	2.41	<2.00	1.29	8.10	19.80	346.00	8.56	0.47	22.83	0.01	<0.01	0.11	1.32
10/16/91	44.00	20.00	2.20	<2.00	0.63	8.30	18.80	356.69	8.90	0.26	47.32	<0.01	<0.01	0.72	4.77
11/6/91	68.00	36.00	0.03	<2.00	0.38	8.20	12.00	336.55	10.20	0.42	44.38	<0.01	<0.01	0.72	0.37
11/20/91	326.00	92.00	3.54	<2.00	0.37	8.10	12.40	378.62	10.00	0.35	39.60	<0.01	0.01	0.20	3.78
12/4/91	54.00	20.00	2.70	<2.00	1.02	8.10	7.80	301.33	10.60	0.37	41.11	<0.01	0.03	0.38	0.05
12/17/91	100.00	34.00	2.94	<2.00	1.06	8.20	12.20	303.52	9.60	0.42	39.91	<0.01	<0.01	0.51	0.00
1/8/92	76.00	94.00	0.81	<2.00	0.71	7.90	15.40	363.00	9.40	0.91	23.98	<0.01	<0.01	0.35	1.71
1/22/92	36.00	38.00	0.95	<2.00	0.50	8.10	11.00	447.00	10.20	1.17	26.52	<0.01	<0.01	0.22	0.80
2/12/92	80.00	98.00	0.82	<2.00	3.49	8.00	16.30	388.00	9.10	0.72	20.80	<0.01	<0.01	0.19	1.34
2/26/92	168.00	154.00	1.09	<2.00	2.88	8.00	10.60	416.00	11.10	0.71	21.86	<0.01	0.01	0.15	0.68
3/11/92	118.00	320.00	0.37	<2.00	0.46	7.80	12.40	316.00	9.90	0.73	20.38	<0.01	0.01	0.90	3.20
3/25/92	74.00	34.00	2.18	<2.00	5.17	8.00	17.30	401.00	9.50	0.57	22.40	<0.01	<0.01	0.15	0.17
4/8/92	134.00	54.00	2.48	<2.00	36.80	7.90	17.60	396.00	8.70	0.75	8.65	<0.01	<0.01	0.23	1.55
4/22/92	82.00	100.00	0.82	<2.00	1.19	7.90	18.00	371.00	8.60	0.52	20.28	<0.01	0.01	0.15	0.90
5/13/92	222.00	270.00	0.82	<2.00	1.67	8.00	23.50	467.00	7.30	0.35	21.70	<0.01	<0.01	0.25	0.43
5/27/92	TNTC	TNTC	NA	No Data	13.63	7.80	17.90	398.00	8.70	0.31	21.02	0.01	0.02	1.81	297.70
6/14/92	68.00	122.00	0.56	<2.00	<0.20	7.70	21.90	432.00	8.20	0.28	16.96	<0.01	0.01	0.27	0.63
7/5/92	296.00	96.00	3.08	<2.00	4.80	7.50	22.70	425.00	7.70	0.45	23.60	<0.01	<0.01	0.19	3.70
7/19/92	634.00	84.00	7.50	<2.00	2.64	7.50	23.40	366.00	7.50	0.33		<0.01	<0.01	0.22	3.58
8/2/92	56.00	66.00	0.85	<2.00	2.70	7.60	24.40	385.00	6.90	0.41	12.08	<0.01	<0.01	0.18	0.24
8/16/92	332.00	222.00	1.50	<2.00	3.25	7.80	21.50	387.00	8.60	0.40	23.98	<0.01	0.01	1.80	
AVERAGE	80.91	97.14	1.95		4.07	7.96	17.46	379.27	8.95	0.51	26.03			0.45	15.65

Appendix 5. Continued.

Site Five

DATE	FECAL COLIFORM	FECAL STREP	FC/FS RATIO	BOD mg/L	TOC mg/L	pH	TEMP. C	CONDUCTIVITY	DO mg/L	NITRATE mg/L	SULFATE mg/L	O-PHOS mg/L	T-PHOS mg/L	TURBIDITY NTU	TSS mg/L
9/18/91	HEAVY/NFC	1140.00	NA	<2.00	10.26	7.70	26.00	470.13	7.96		54.70	0.09	0.03	7.41	80.61
10/2/91	HEAVY/NFC	366.00	NA	<2.00	6.13	8.00	20.40	538.00	6.40	0.53	55.69	<0.01	<0.01	2.17	8.31
10/16/91		92.00	0.46	2.46	6.38	8.20	18.80	711.10	6.60	0.15	126.59	0.02	0.03	5.76	5.96
11/6/91		94.00	0.94	5.09	5.83	8.00	11.10	1514.48	8.60	0.88	455.09	<0.01	<0.01	0.57	16.76
11/20/91		56.00	1.46	2.89	4.66	7.50	15.20	2061.38	6.00	1.92	535.42	<0.01	0.01	0.65	0.91
12/4/91		172.00	0.88	<2.00	5.31	7.60	8.00	43.67	9.30	3.37	756.77	<0.01	0.05	0.98	0.47
12/17/91		294.00	0.59	<2.00	5.38	7.80	11.80	42.85	8.40	2.91	855.15	0.01	0.07	2.11	17.44
1/8/92		390.00	0.59	<2.00	4.60	7.70	13.60	1306.00	9.40	2.61	219.34	<0.01	<0.01	0.41	3.29
1/22/92		120.00	0.20	<2.00	2.91	7.70	8.90	1666.00	12.70	4.73	335.72	<0.01	0.01	0.21	36.45
2/12/92		254.00	0.62	<2.00	6.40	7.70	14.60	899.00	8.90	1.63	183.36	0.01	0.03	1.90	4.38
2/26/92	TNTC	46.00	NA	<2.00	24.80	7.70	13.30	1506.00	8.10	3.84	280.80	<0.01	25.00	0.68	11.44
3/11/92		252.00	0.70	<2.00	5.89	7.50	15.70	909.00	7.30	1.37	196.08	<0.01	0.04	8.90	7.93
3/25/92		148.00	3.74	<2.00	4.56	7.90	17.50	1573.00	7.90	3.47	300.48	<0.01	0.03	0.15	3.08
4/8/92		290.00	2.04	<2.00	32.31	7.50	18.80	1153.00	7.30	2.05	223.24	<0.01	0.04	1.32	16.24
4/22/92		260.00	1.24	<2.00	4.97	7.50	20.40	1903.00	7.00	3.88	333.80	<0.01	0.04	0.24	11.89
5/13/92	NFC	468.00	NA	<2.00	6.57	7.60	24.60	1752.00	7.50	2.95	314.40	<0.01	0.03	0.30	13.94
5/27/92	TNTC	TNTC	NA	No Data	11.33	7.40	24.00	1478.00	6.90	3.10	280.68	<0.01	0.02	0.20	12.27
6/14/92		352.00	2.39	<2.00	5.38	7.40	26.70	726.00	6.10	0.85	181.08	0.01	0.04	1.53	15.08
7/5/92		154.00	0.68	<2.00	3.33		27.70	1690.00	6.00	3.59	339.44	0.01	0.02	0.22	10.36
7/19/92		202.00	2.31	2.38	5.27	7.60	27.30	1395.00	6.30	4.02		0.03	0.05	0.61	20.88
8/2/92		108.00	42.04	1.99	5.02	7.40	27.70	1819.00	6.30	4.00	11.52	0.32	0.06	0.34	1.40
8/16/92		108.00	2.87	<2.00	5.99	7.60	26.00	1665.00	6.50	4.20	381.00	0.02	0.01	1.09	
AVERAGE	504.94	253.43	3.75		7.88	7.67	19.00	1219.16	7.61	2.67	305.73			1.71	14.24

Appendix 6. Seco Creek Pesticide study results (All samples taken from Site 5 below the Recharge Zone).

Date	Time	Aldrin (µg/L)	α-BHC (µg/L)	β-BHC (µg/L)	γ-BHC (Lindane) (µg/L)	δ-BHC (µg/L)	α-chlordane (µg/L)	δ-chlordane (µg/L)	Dieldrin (µg/L)	Endosulfan I (µg/L)	Endosulfan II (µg/L)	Endosulfan Sulfate (µg/L)	Endrin (µg/L)	Endrin Aldehyde (µg/L)	Heptachlor (µg/L)	Heptachlor Epoxide (µg/L)	4,4'-DDD (µg/L)	4,4'-DDE (µg/L)	4,4'-DDT (µg/L)
10/02/91	0900	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	<0.08	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
11/06/91	0745	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	<0.08	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
12/04/91	0730	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	<0.08	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
01/08/92	0900	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	<0.08	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
02/12/92	0745	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	<0.08	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
03/11/92	0750	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	<0.08	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
04/08/92	0730	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	<0.08	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
06/14/92	0730	*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.02	<0.02	<0.02
07/05/92	0745	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.02	<0.02	<0.02

* Data not available due to readout problem.