THE WISHTOYO FOUNDATION, VENTURA COASTKEEPER

Bioassessment Monitoring of Conejo and Calleguas Creeks

Wishtoyo Foundation, Ventura Coastkeeper

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Presented by:

Aquatic Bioassay & Consulting Laboratories, Inc.
29 N. Olive St.
Ventura, CA
805 643 5621

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INTRODUCTION

This report is submitted to the Wishtoyo Foundation in response to their request for bioassessment sampling at three locations on Conejo and Calleguas Creeks in Ventura County. In response to this request, Aquatic Bioassay and Consulting Laboratory was contracted to conduct sampling on October 6th, 2006. This report includes all of the physical, chemical and biological data collected during the survey, photographic documentation of each site, QA/QC procedures and documentation followed by the metrics specified in the CSBP (2003), including the Southern California Index of Biological Integrity (IBI), along with interpretation of these results.

BACKGROUND

Major issues facing streams and rivers in California include modification of in-stream and riparian structure, contaminated water and increases in impervious surfaces which has led to the increased frequency of flooding. There have been many studies and reports showing the deleterious effects of land-use activities to macroinvertebrate and fish communities (Jones and Clark 1987; Lenat and Crawford 1994; Weaver and Garman 1994; and Karr 1998). A major focus of freshwater scientists has been the prevention of further degradation and restoration of streams to their more pristine conditions (Karr et al. 2000).

During the past 150 years direct measurements of biological communities including plants, invertebrates, fish, and microbial life have been used as indicators of degraded water quality. In addition, biological assessments (bioassessments) can be used as a watershed management tool for surveillance and compliance of land-use best management practices. Combined with measurements of watershed characteristics, land-use practices, in-stream habitat, and water chemistry, bioassessment can be a cost-effective tool for long-term trend monitoring of watershed conditions (Davis and Simons 1996).

Biological communities act to integrate the effects of water quality conditions in a stream by responding with changes in their population abundances and species composition over time. These populations are sensitive to multiple aspects of water and habitat quality and provide the public with more familiar expressions of ecological health than the results of chemical and toxicity tests (Gibson 1996). Furthermore, biological assessments when integrated with physical and chemical assessments, better define the effects of point-source discharges of contaminates and provide a more appropriate means for evaluating discharges of non-chemical substances (e.g. nutrients and sediment).

Water resource monitoring using benthic macroinvertebrates (BMI) is by far the most popular method used throughout the world. BMIs are ubiquitous, relatively stationary and their large species diversity provides a spectrum of responses to environmental stresses (Rosenberg and Resh 1993). Individual species of BMIs reside in the aquatic environment for a period of months to several years and are sensitive, in varying degrees, to temperature, dissolved oxygen, sedimentation, scouring, nutrient enrichment and chemical and organic pollution (Resh and Jackson 1993). Finally, BMIs represent a significant food source for aquatic and terrestrial animals and provide a wealth of ecological and bio-geographical information (Erman 1996).

In the United States the evaluation of biotic conditions from community data uses a combination of multimetric and multivariate techniques. In multimetric techniques, a set of biological measurements ("metrics"), each representing a different aspect of the community data, is calculated for each site. An overall site score is calculated as the sum of individual metric scores. Sites are then ranked according to their scores and classified into groups with "good", "fair" and "poor" water quality. This system of scoring and ranking sites is referred to as an Index of Biotic Integrity (IBI) and is the end point of a multi-metric analytical approach recommended by the EPA for development of biocriteria (Davis and Simon 1995). The original IBI was created for assessment of fish communities (Karr 1981), but was subsequently adapted for BMI communities (Kerans and Karr 1994).

The first demonstration of a California regional IBI was applied to the Russian River watershed in 1999 (DFG 1998). As the Russian River IBI was being developed, the Department of Fish and Game (DFG) began a much larger project for the San Diego Regional Board. After a pilot project conducted on the San Diego River in 1995 and 1996, the San Diego Regional Board contracted DFG to help them incorporate bioassessment into their ambient water quality monitoring program. During 1997 through 2000, data was collected from 93 locations distributed throughout the San Diego region. Finally, between 2000 and 2003, bioassessment data were collected from the Mexican border to the south, Monterey County to the north and to the eastern extent of the coastal mountain range. These data were used to create an IBI that is applicable to southern California and is applied to the data in this report (Ode 2004).

MATERIALS AND METHODS

Sampling Site Descriptions

Two sampling locations were visited on Conejo Creek and one on Calleguas Creek on October 6th, 2006 (Table 1, Figure 1). Photographs of each site are displayed in Figure 2.

Table 1. Sampling locations and descriptions for 3 locations on the Conejo and Calleguas Creeks.

Sta.ID	Description and Comments	Latitude	Longitude	Elev. (ft)
CJ2	Conejo Creek at Hill Canyon Road	34° 13.604	118° 55.867	230
CJ1	Conejo Creek at Howard Road	34° 11.562	119° 00.217	114
CL2	Calleguas Creek at University Drive	34° 10.763	119° 02.369	72

Figure 1. BMI sampling locations for the three sites on the Conejo and Calleguas Creeks.

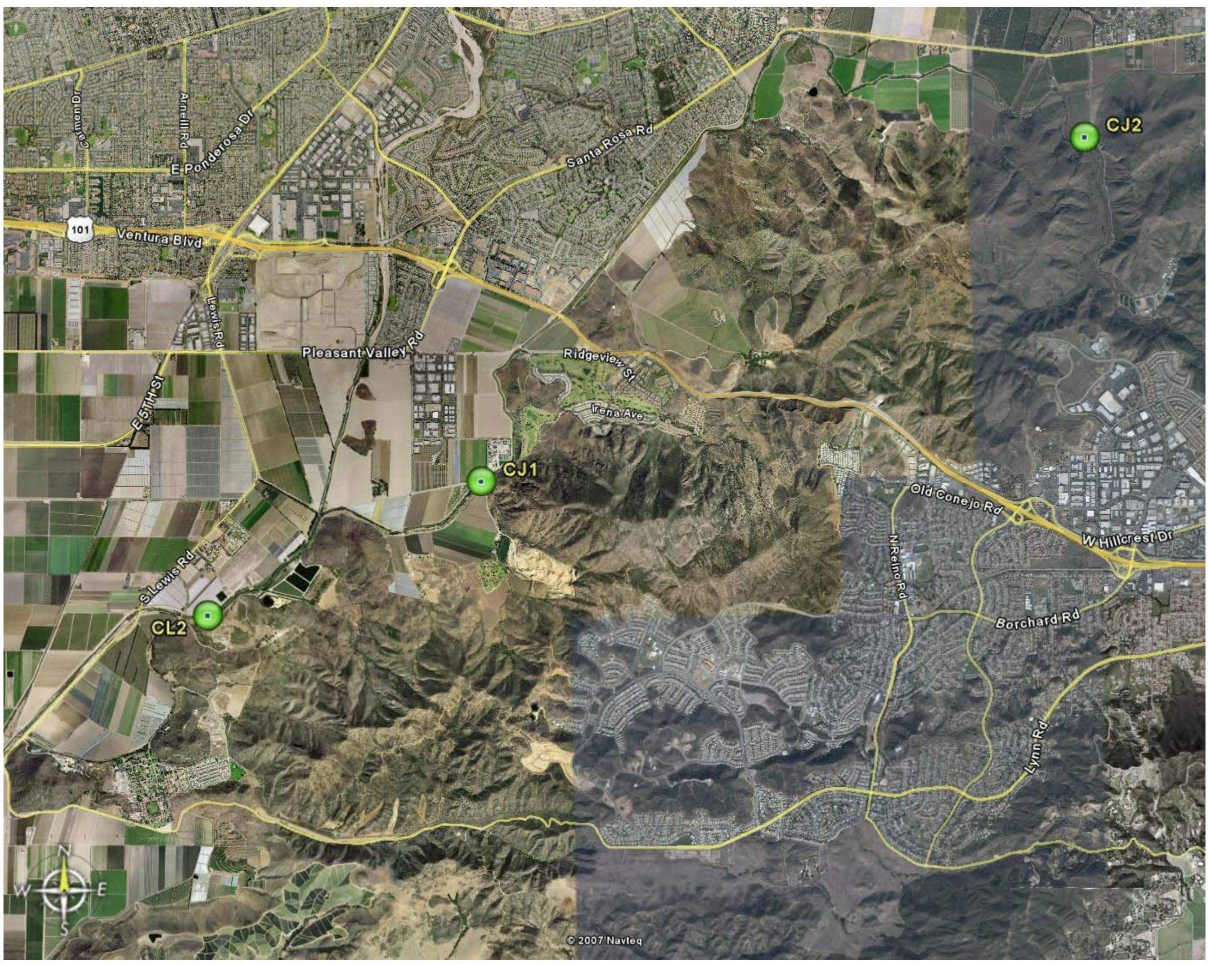

Figure 2: Sampling location photos of the three sampling sites in Conejo Creek (CJ2 & CJ1) and Calleguas Creek.


CJ2


CJ2


CJ1


CJ1


CL2


CL2

Collection of Benthic Macroinvertebrates

Sampling and laboratory procedures for this survey followed the California Stream Bioassessment Procedure (CSBP 2003). The CSBP is a regional adaptation of the U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocols (Barbour et al. 1999) and has been used in various parts of the world to measure biological integrity of aquatic systems (Davis et al. 1996).

Benthic macroinvertebrate (BMIs) samples were collected in strict adherence to the CSBP in terms of both sampling methodology and QC procedures. Our sampling approach is described below:

1. At each sample location we collected samples for BMIs so that the stream habitat was not disrupted. Therefore, sampling began at the most downstream riffle and proceeded upstream. Riffles were defined as areas in the reach where the velocity of flow was greatest due to shallow water coupled with a high relief bottom. At each site the California Bioassessment Worksheet (CBW) was used to collect all of the necessary station information.
2. This portion of the Arroyo Simi is a low gradient stream (<2% grade). Therefore, a 100 m reach was measured with the station coordinates as it's midpoint, and then a random number table was used to randomly establish three transects perpendicular to stream flow.
3. The benthos within a 2 ft^2 area was sampled upstream of a 1 ft wide, 0.5 mm mesh D-frame kick-net. Sampling of the benthos was performed manually by rubbing cobble and boulder substrates in front of the net, followed by "kicking" the upper layers of substrate to dislodge any remaining invertebrates. The duration of sampling ranged from 60-120 seconds, depending on the amount of boulder and cobble-sized substrate that required rubbing by hand; more and larger substrates required more time to process.
4. Three locations along each transect that were representative of habitat diversity were sampled and combined into a single composite sample. The composite sample was transferred into a 1 gallon wide-mouth plastic jar containing approximately 300 ml of 95% ethanol. Thus, a single composite sample was collected for each site.
5. Chain of Custody (COC) sheets were completed for samples as each station was completed.
6. QC Procedures for collection of BMIs included:
    - At the beginning of the sampling day the project manager reviewed the CSBP protocols with the field crew.
    - The project manager ensured that the bioassessment worksheet was completely and accurately filled in at each station, chains of custody were created, and sample labels (internal and external) were included and were corrected for each sample.
    - Once samples were returned to the laboratory the CBW and COC worksheets were checked for accuracy. All samples were logged in, and then stored along with the COC in a secure location.

Physical/Habitat Quality Assessment and Chemical Measurements

Physical habitat quality was assessed for the monitoring reaches using U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocols (RBPs) (Barbour et al. 1999). The team collected the physical/habitat measurements at each station and recorded the information on the CBW. These measurements are summarized as follows:

1. Water temperature, specific conductance, pH and dissolved oxygen were measured using a hand held YSI 85 water quality meter that was pre-calibrated in the laboratory.
2. Riffle length, width and depth in meters were recorded. Width measures are averages taken at each transect and depth measures are averages taken along each transect.
3. A hand held flow meter was used to measure current velocity. Three measures were collected along each transect, and then averaged together.
4. A densitometer was used to measure % canopy cover.
5. Substrate complexity, embeddedness, consolidation and categories (fines, gravel, cobble, boulder, and bedrock) were estimated using CSBP Physical/Habitat Quality Form.
6. Stream gradient was estimated visually.
7. QC procedures for the physical/habitat measurements included:
   - The Project Manager has received training from the California Department of Fish and Game.
   - Application of our experience performing physical/habitat measurements at other locations in southern California. The Project Manager ensured that the measurements were consistent with the CSBP.
   - The water quality meter was calibrated before use and laboratory records were kept in accord with the California Environmental Laboratory Accreditation Program (ELAP) standards.

Sample Analysis/Taxonomic Identification of Benthic Macroinvertebrates (BMIs)

Professional level identification of fresh water organisms was conducted in adherence with Taxonomic Effort Level 1 specified in the CSBP (2003). Each member of our taxonomic team has extensive experience in the identification of freshwater organisms. Samples entering our lab are processed as follows:

1. A maximum number of 500 organisms were sub-sampled from the composite sample using a divided tray, and then sorted into major taxonomic groups. All remnants were stored for future reference.
2. The 500 organisms were identified to the genus species level. Our taxonomists have access to the most current taxonomic references and communicate with members of the Southwest Association of Freshwater Invertebrate Taxonomists and the Department of Fish and Game regarding new or difficult species.
3. As species were identified they were included in an electronic data sheet that, once complete, rolls the information up into each of the bioassessment metrics specified in the CSBP.

4. A voucher collection was created for the program that includes at least one individual of each species collected.
5. Taxonomic QC procedures are as follows:
   - Sorting efficiencies are checked on 10% of the samples. Remnants from sorted grids are placed in a jar and inspected by the laboratory supervisor. There should be no more than 10% of the total number of organisms sorted from the grids left in the remnants. This is documented on the sample tracking sheet. If a problem occurs, the supervisor discusses it with the sorting team. Other samples were inspected to ensure that the 10% sampling efficiency was achieved.
   - Once identification work was complete, 10% of all samples were sent to the Department of Fish and Game (DF&G) offices in Rancho Cordova for a QC check. The samples sent to DF&G were sorted by species into individual vials that included an internal label. Any discrepancies in counts or identification found by the DF&G taxonomists were discussed, and then resolved. All data sheets were corrected and where necessary bioassessment metrics were updated.
   - It is a requisite of our QC program that all staff members involved in taxonomy belong to CAMLnet, an organization dedicated to the standardization of freshwater organism naming conventions.

Data Development and Analysis

Multi-metric

All BMI data were used to calculate the CSBP bioassessment metrics specified in the manual. The following metrics were calculated and their responses to impaired conditions are listed in Table 3:

1. Richness measures: taxa richness, cumulative taxa, EPT taxa, cumulative EPT taxa Coleoptera taxa.
2. Composition measures: EPT index, sensitive EPT index, Shannon diversity.
3. Tolerance/intolerance measures: tolerance value, intolerant organisms (%), tolerant organisms (%), dominant taxa (%), Chironomidae (%), Tubificida (%), Non-insect taxa (%).
4. Functional feeding group: collectors (%), filterers (%), grazers (%), predators (%), shredders (%).
5. Abundance estimates.
6. The above metric values were used to compute a relative BMI Ranking Score for each station based on the Southern California Index of Biological Integrity. The scoring values derived from Ode et al. (2004, in press) are listed in Table 2. This information was used to make an assessment comparing sites from this survey.

Table 2. Scoring ranges for the seven metrics included in the Southern California IBI and the IBI values.

Metric Scoring Ranges for the Southern California IBI										
Metric Score	Coleoptera Taxa	EPT Taxa		Predator Taxa	% Collector Individuals		% Intolerant Individuals		% Non-Insect Taxa	% Tolerant Taxa
	All Sites	6	8	All Sites	6	8	6	8	All Sites	All Sites
10	>5	>17	>18	>12	0-59	0-39	25-100	42-100	0-8	0-4
9		16-17	17-18	12	60-63	40-46	23-24	37-41	9-12	5-8
8	5	15	16	11	64-67	47-52	21-22	32-36	13-17	9-12
7	4	13-14	14-15	10	68-71	53-58	19-20	27-31	18-21	13-16
6		11-12	13	9	72-75	59-64	16-18	23-26	22-25	17-19
5	3	9-10	11-12	8	76-80	65-70	13-15	19-22	26-29	20-22
4	2	7-8	10	7	81-84	71-76	10-12	14-18	30-34	23-25
3		5-6	8-9	6	85-88	77-82	7-9	10-13	35-38	26-29
2	1	4	7	5	89-92	83-88	4-6	6-9	39-42	30-33
1		2-3	5-6	4	93-96	89-94	1-3	2-5	43-46	34-37
0	0	0-1	0-4	0-3	97-100	95-100	0	0-1	47-100	38-100

Cumulative IBI Scores

Very Poor	Poor	Fair	Good	Very Good
0-19	20-39	40-59	60-79	80-100

Table 3. Bioassessment metrics used to describe characteristics of the BMI community.

BMI Metric	Description	Response to Impairment
Richness Measures		
Taxa Richness	Total number of individual taxa	decrease
EPT Taxa	Number of taxa in the Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) insect orders	decrease
Ephemeroptera Taxa	Number of taxa in the insect order Ephemeroptera (mayflies)	decrease
Plecoptera Taxa	Number of taxa in the insect order Plecoptera (stoneflies)	decrease
Trichoptera Taxa	Number of taxa in the insect order Trichoptera (caddisflies)	decrease
Composition Measures		
EPT Index	Percent composition of mayfly, stonefly and caddisfly larvae	decrease
Sensitive EPT Index	Percent composition of mayfly, stonefly and caddisfly larvae with tolerance values between 0 and 3	decrease
Shannon Diversity	General measure of sample diversity that incorporates richness and evenness (Shannon and Weaver 1963)	decrease
Tolerance / Intolerance Measures		
Tolerance Value	Value between 0 and 10 weighted for abundance of individuals designated as pollution tolerant (higher values) or intolerant (lower values)	increase
Percent Intolerant Organisms	Percent of organisms in sample that are highly intolerant to impairment as indicated by a tolerance value of 0, 1 or 2	decrease
Percent Tolerant Organisms	Percent of organisms in sample that are highly tolerant to impairment as indicated by a tolerance value of 8, 9 or 10	increase
Percent Dominant Taxa	Percent composition of the single most abundant taxon	increase
Percent Hydropsychidae	Percent of organisms in the caddisfly family Hydropsychidae	increase
Percent Baetidae	Percent of organisms in the mayfly family Baetidae	increase
Functional Feeding Groups (FFG)		
Percent Collectors	Percent of macrobenthos that collect or gather fine particulate matter	increase
Percent Filterers	Percent of macrobenthos that filter fine particulate matter	increase
Percent Grazers	Percent of macrobenthos that graze upon periphyton	variable
Percent Predators	Percent of macrobenthos that feed on other organisms	variable
Percent Shredders	Percent of macrobenthos that shreds coarse particulate matter	decrease
Estimated Abundance	Estimated number of BMIs in sample calculated by extrapolating from the proportion of organisms counted in the subsample	variable

RESULTS

Physical Habitat Characteristics and Water Quality

The physical characteristics of the riffles sampled in the survey area are presented in Table 4. The depth of each sampling location ranged from 0.9 to 1.2 ft. Each sampling reach was characterized as low gradient (1%). Percent canopy cover ranged from 0 at CL2 to 63% at CJ2. Stream bed complexity was greater and embeddedness was lower, at CJ2 when compared to Stations CJ1 and CL2. Sediment substrates were characterized by over 90% fine sediments at Station CL2 and as a mixture of fines, gravel and cobble at CJ1 and CJ2. Water quality measurements were typical for the sampling region and season. Each parameter was within normal ranges for pH, dissolved oxygen and temperature. Conductance was similar between sites and typical for a low gradient stream in a southern California agricultural area.

***Physical/Habitat Scores*:** Assessment of the physical/habitat conditions of a stream reach is necessary for two reasons: one is to assess the overall quality of a stream reach and another is to assess the physical/habitat of the bioassessment site. In many cases organisms may not be exposed to chemical contaminants, yet their populations indicate that impairment has occurred. These population shifts are most times the result of degraded stream bed and bank habitat. Excess sediment, caused by bank erosion due to human activities, is the leading pollutant in streams and rivers of the United States (Harrington and Born 2000). Sediments fill pools and interstitial areas of the stream substrate where fish spawn and invertebrates live, causing their populations to decline or to be altered. Physical/habitat characterization of the site is also important to help ensure that habitats are uniform between riffles so that population differences can be accurately assessed.

Out of a total possible score of 200, physical/habitat scores for the 3 sites ranged from 58 at downstream Station CL2 to 101 Station CJ2 (Table 5, Figure 3). This indicates that the habitat conditions at each site were in the marginal range. These low scores were the result of the near absence of bank vegetation, bank erosion and sediment deposition, high substrate embeddedness which have all led to the absence of the in stream cover that is necessary for a natural BMI community to thrive. Each of these indicates that these reaches have been altered by human disturbances.

Table 4. Physical habitat measurements for 3 reaches in Conejo Creek (CJ1 & CJ2) and Calleguas Creek. Measurements are specified in the California Stream Bioassessment Procedures (CADFG 2003).

Parameter	CJ1	CJ2	CL2
Reach Length (ft)	300	300	300
Average Riffle Length (ft) [1]	6	6	6
Average Riffle Depth (ft)	1.08	0.89	1.21
Average Riffle Velocity (ft/sec)	0.34	0.83	0.53
Vegetative Canopy Cover (%)	35	63	0
Average Substrate Complexity	9	12	6
Average Embeddedness	4	13	3
Substrate Composition (%)			
Fines (<0.1 in.)	57	18	95
Gravel ((0.1 -2 in.)	13	18	5
Cobble (2-10 in)	25	60	-
Boulder (>10 in.)	5	3	-
Bedrock (solid)	-	-	-
Substrate Consolidation	Low	Low	Low
Percent Gradient (%)	1	1	1
pH	7.61	7.92	7.92
D.O (mg/L)	9.11	9.28	8.15
Water Temperature (C°)	23.44	21.2	21.16
Specific Conductance (S/cm at 25EC)	1473	1192	1467

1. There are no riffles in low gradient streams, therefore a 6 ft length was sampled.

Table 5. Physical habitat assessment for the three sampling sites in Conejo Creek (CJ1 & CJ2) and Calleguas Creek.

Habitat Parameter	CJ1	CJ2	CL2
1. Instream Cover	8	13	5
2. Embeddedness	6	6	3
3. Velocity / Depth Regime	10	15	5
4. Sediment Deposition	11	15	5
5. Channel Flow	7	10	11
6. Channel Alteration	2	11	4
7. Riffle Frequency	6	6	4
8. Bank Stability	6	7	13
9. Vegetative Protection	8	8	4
10. Riparian Vegetative Zone Width	7	10	4
Reach Total	**71**	**101**	**58**
Condition Category	**Marginal**	**Marginal**	**Marginal**

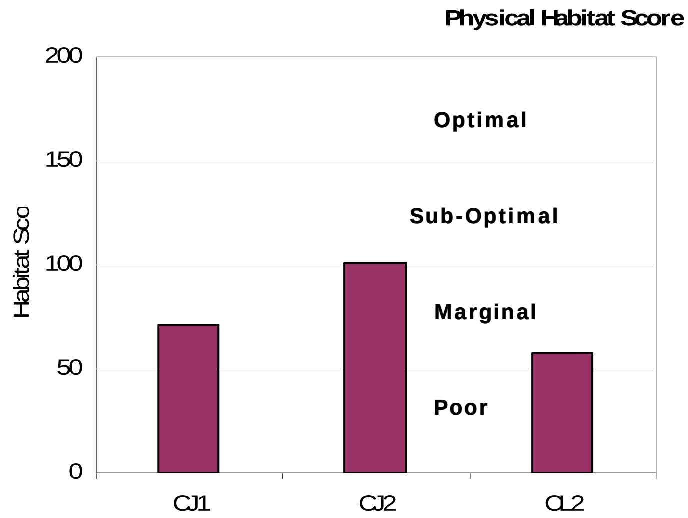

Figure 3. Physical/Habitat quality scores.

BMI Community Structure

The BMIs identified from the samples collected from the 3 sites are listed in order of decreasing abundance in Table 6. The biological metrics calculated from BMI samples are listed in Table 7. The entire taxa list and abundances are presented in Appendix A, Table A-1. Forms containing chemical and physical/habitat characteristic scores and field notes are on file at Aquatic Bioassay and Consulting Laboratories in Ventura.

A total of 1,529 BMIs were identified from the 3 samples collected at the three sampling sites. The most abundant species collected at the three sites were similar and included midge larvae (Chironomidae), mayflies (*Fallceon quilleri* and *Baetis sp*), black flies (*Simulium sp*.), an amphipod crustacean (*Hyalella sp*.), Oligochaete worms and, at Station CJ1, the bivalve *Corbicula fluminea*, which is an invasive species common to the region.

Biological Metrics

Each of the biological metrics listed in Table 3, above, were calculated for this survey and are presented in Table 7.

***Richness Measures*:** Cumulative taxa richness is a measure of the total number of species found at a site. This relatively simple index can provide much information about the integrity of the community. Few taxa at a site indicate that some species are being excluded, while a large number of species indicates a more healthy community. EPT taxa are the combined number of individual species of mayflies (Ephemeroptera), caddisflies (Trihoptera), and stoneflies (Plecoptera) present at a location. These families are generally sensitive to impairment and, when present, are usually indicative of the healthy community.

Taxonomic richness was similar across sites ranging from 15 at CL2 to 18 at CJ1 (Table 7). Representation of EPT taxa at all three sites was low and similar across sites.

***Composition Measures*:** The Shannon Diversity index, the percent Sensitive EPT and percent dominance are all measures of community composition. Since no Sensitive EPT taxa were collected at any of the sites sampled during this survey, only diversity and dominance are presented here. Species diversity indices are similar to numbers of species; however they contain an evenness component as well. For example, two samples may have the same numbers of species and the same numbers of individuals. However, one station may have most of its numbers concentrated into only a few species while a second station may have its numbers evenly distributed among its species. The diversity index would be higher for the latter station. Sensitive EPT taxa are mayflies, stoneflies and caddisflies whose tolerance values range from 0 to 3. These taxa are very sensitive to impairment and, when present, can be indicative of more natural conditions. Percent dominance reflects the proportion of the total abundance at a site represented by the most abundant species. For example, if 100 organisms are collected at a site and species A is the most abundant with 30 individuals, the percent dominance index score for this site is 30%. The benthic environment tends to be healthier when the dominance index is low, which indicates that more species compose the total abundance at the site.

During this survey, Shannon Diversity was lower at Station CL2 (1.68) and greatest at Station CJ1 (2.09) (Table 7). The percentage of dominant taxa was higher at both CL2 (39.6%) and CJ2 (36.6%) and lowest at CJ1 (25.6%).

***Tolerance Measures*:** The Southern California IBI uses both the % Intolerance and % Tolerant organisms to evaluate the overall sensitivity of organisms to pollution and habitat impairment. Each taxa is assigned a tolerance value from 0 (highly intolerant) to 10 (highly tolerant). The % Intolerance Value for a site is calculated by multiplying the tolerance value of each species with a tolerance value ranging from 0 to 2, by its abundance, then dividing by the total abundance for the site. Since, during this survey, no intolerant species were collected at any site, only the % Tolerance Value is graphically depicted. A site with many tolerant organisms present is considered to be less pristine or more impacted by human disturbance than one that has few tolerant species. The tolerance values for each species were developed in different parts of the United States and can therefore be region specific. Also, different organisms can be tolerant to one type of disturbance, but highly sensitive to another. For example, an organism that is highly sensitive to sediment disturbance may be very insensitive to organic pollution. With these drawbacks in mind, the Tolerance Values generally depict disturbances in a stream that when coupled with other metrics can provide good information regarding a stream reach.

The average tolerance values were similar (6.2 to 6.6) at all stations, indicating that moderately pollution tolerant organisms were prevalent across all sites. The percentage of tolerant taxa was highest at Station CJ2 (41%) and lowest at Station CJ1 (21%) (Table 7).

***Functional Feeding Groups*:** These indices provide information regarding the balance of feeding strategies represented in an aquatic assemblage. The combined feeding strategies of the organisms in a reach provide information regarding the form and transfer of energy in the habitat. When the feeding strategy of a stream system is out of balance it can be inferred that the habitat is stressed. For the purposes of this study, species were grouped by feeding strategy as predators, collector-gatherers, collector-filterers, scrapers, and shredders. The Southern California IBI uses the numbers of predators and percent collectors at a site to calculate the index.

The average number of predator taxa was similar across sites, ranging from 4 to 5 (Table 7). The predominant feeding type was collection, which ranged from greatest at Station CL2 (87%) to lowest at CJ1 (69%).

***IBI Scores*:** Work conducted in the 1990's by the San Diego Regional Board and the California Department of Fish and Game, established an Index of Biotic Integrity (IBI) for the San Diego region and its watersheds (Ode and Harrington 2000). The index has recently been expanded to include all of southern California (Ode 2004). The IBI is a multi-metric technique whereby biological metrics are calculated which represent a different aspect of the community structure. The IBI scores are calculated as the sum of the individual metric scores at each site. The sites are then ranked according to their scores based on good, fair and poor water quality. The IBI scores calculated for this survey and their corresponding condition rating are listed in Table 8 and Figure 4. The metric scoring ranges established for the Southern California IBI survey are listed in Table 2 and were used to classify the scores generated from this study.

The IBI scores for sites in this study ranged from lowest at Stations CJ2 and CL2 (6 and 13 = very poor, respectively) to greatest at CJ1 (21 = poor) (Table 8, Figure 4). These scores indicate that conditions at each of the three sites in this survey were impaired.

Table 6. Most abundant species by site.

CJ-1				CJ-2				CL-2			
Species	**Avg Abund**	**% of Total Abund**	**Cumulative % Abund**	**Species**	**Avg Abund**	**% of Total Abund**	**Cumulative % Abund**	**Species**	**Avg Abund**	**% of Total Abund**	**Cumulative % Abund**
Chironomidae	129.0	25.6	25.6	Hyalella sp.	195.0	36.6	36.6	Fallceon quilleri	195.0	39.6	39.6
Fallceon quilleri	110.0	21.8	47.4	Oligochaeta	92.0	17.3	53.8	Hyalella sp.	141.0	28.7	68.3
Simulium sp. (L)	79.0	15.7	63.1	Chironomidae	92.0	17.3	71.1	Chironomidae	57.0	11.6	79.9
Hyalella sp.	54.0	10.7	73.8	Simulium sp. (L)	81.0	15.2	86.3	Simulium sp. (L)	45.0	9.1	89.0
Corbicula fluminea	39.0	7.7	81.5	Baetis sp.	17.0	3.2	89.5	Ostracoda	9.0	1.8	90.9
Oligochaeta	25.0	5.0	86.5	Fallceon quilleri	15.0	2.8	92.3	Oligochaeta	8.0	1.6	92.5
Baetis sp.	22.0	4.4	90.9	Ostracoda	7.0	1.3	93.6	Pericoma/Telmatoscopus sp. (L)	7.0	1.4	93.9
Planariidae	17.0	3.4	94.2	Argia sp.	7.0	1.3	94.9	Physa/Physella sp.	6.0	1.2	95.1
Tricorythodes sp.	8.0	1.6	95.8	Cheumatopsyche sp.	5.0	0.9	95.9	Tricorythodes sp.	6.0	1.2	96.3
Prostoma sp.	4.0	0.8	96.6	Physa/Physella sp.	4.0	0.8	96.6	Coenagrion/Enallagma sp.	5.0	1.0	97.4
Physa/Physella sp.	4.0	0.8	97.4	Tricorythodes sp.	4.0	0.8	97.4	Ephydra sp.	5.0	1.0	98.4
Hydroptila sp.	4.0	0.8	98.2	Coenagrion/Enallagma sp.	4.0	0.8	98.1	Baetis sp.	4.0	0.8	99.2
Coenagrion/Enallagma sp.	3.0	0.6	98.8	Prostoma sp.	3.0	0.6	98.7	Dolichopodidae (L)	2.0	0.4	99.6
Ostracoda	2.0	0.4	99.2	Petrophila sp.	3.0	0.6	99.2	Erpobdella punctata	1.0	0.2	99.8
Lymnaeidae	1.0	0.2	99.4	Gyraulus sp.	2.0	0.4	99.6	Sperchon sp.	1.0	0.2	100.0
Ferrissia sp.	1.0	0.2	99.6	Sperchon sp.	2.0	0.4	100.0				
Erpobdella punctata	1.0	0.2	99.8								
Argia sp.	1.0	0.2	100.0								
TOTAL	**504**	**100**			**533**	**100**			**492**	**100**	

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Table 7. Biological metric calculations.

Biological Metric	CJ-1	CJ-2	CL-2
Taxonomic Richness	18	16	15
% dominant taxa	25.6	36.6	39.6
EPT taxa	4	4	3
EPT Index (%)	28.6	7.7	41.7
Sensitive EPT Index (%)	0.0	0.0	0.0
Predator Taxa	5	4	4
Coleoptera Taxa	0	0	0
Percent Chironomidae	25.6	17.3	11.6
Percent Non-Insect	29.4	57.2	33.7
Shannon Diversity	2.09	1.84	1.68
Tolerance Value	6.2	6.6	6.2
Percent Intolerance Value (0-2)	0.0	0.0	0.0
Percent Tolerance Value (8-10)	21.4	40.7	33.1
Percent Collectors	69.4	79.2	86.8
Percent Filterers	23.4	16.1	9.1
Percent Grazers	2.0	1.7	1.2
Percent Predators	5.2	3.0	1.8
Percent Shredders	0.0	0.0	1.0
Percent Hydropsychidae	0.0	0.0	0.0
Percent Baetidae	26.2	6.0	40.4
Estimated Abundance	4592	4092	5510

Table 8. Southern California IBI scores and ratings for three sites sampled in Conejo and Calleguas Creek.

Station / Metric	CJ-1	CJ-2	CL-2
Coleoptera Taxa	**0**	**0**	**0**
EPT Taxa	**2**	**2**	**1**
Predator Taxa	**2**	**1**	**1**
% Collector Taxa	**1**	**1**	**1**
% Intolerant Taxa	**0**	**0**	**0**
% Non-Insect	**5**	**0**	**4**
% Tolerant	**5**	**0**	**2**
Total	**15**	**4**	**9**
Adjusted Score (1.43)	**21**	**6**	**13**
So. Cal. IBI Rating	**Poor**	**Very Poor**	**Very Poor**

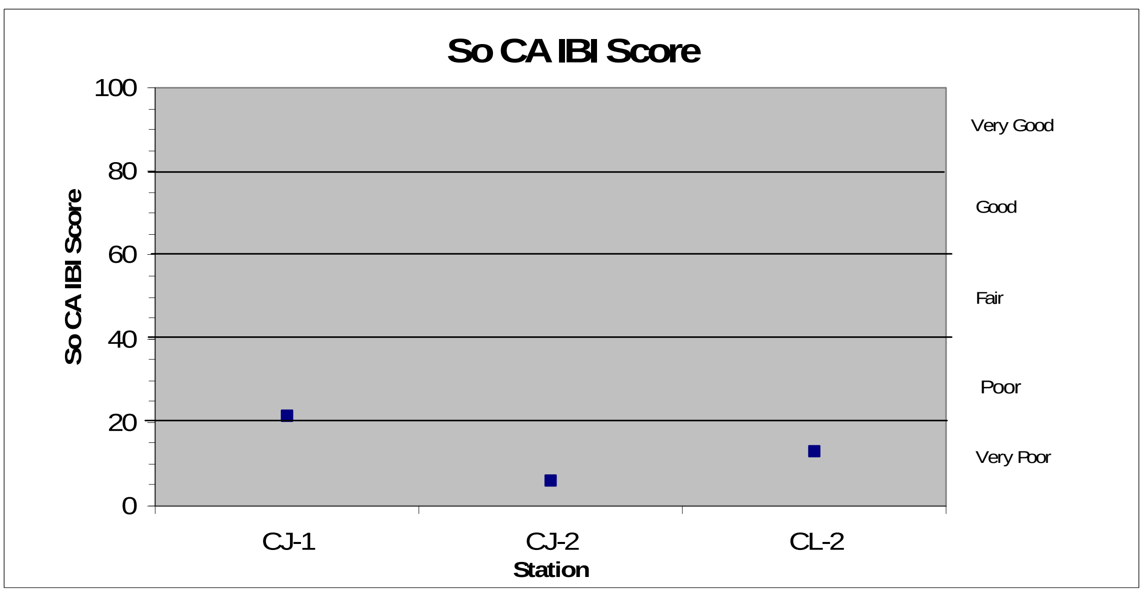

Figure 4. Southern California IBI Scores for sites that were sampled in the Conejo and Calleguas Creek.

DISCUSSION

The bioassessment monitoring for the Wishtoyo Foundation was conducted by Aquatic Bioassay and Consulting Laboratories on October 6th, 2006 at two locations in Conejo Creek and one site on the Calleguas Creek. Bioassessment samples and physical/habitat observations were collected at each of the three locations. Station CJ2, the most upstream site, was located in Conejo Creek at Hill Road approximately 1.3 miles downstream of the Hill Canyon Wastewater Treatment Plant. Station CJ1 was located just downstream of the Camarillo Wastewater Treatment plant at Howard Rd on Conejo Creek. Station CL2 was located on Calleguas Creek just above University Dr.

Physical habitat conditions at each of the three stream reaches provided marginal habitat conditions for benthic macroinvertebrates (BMIs) due to the lack of instream cover, high embeddedness and substantial historic channel alteration. The banks of the stream reaches at Stations CJ1 and CJ2 were eroded. At each site vegetative protection was sparse and the width of the riparian zones was small.

The BMI assemblages residing in these reaches were low in taxa richness and diversity. Additionally, the taxa that dominated these populations were moderately tolerant organisms which are capable of living under stressed conditions. The absence of all sensitive EPT taxa and pollution insensitive species at all three sites supports this finding. When the BMI populations found at these sites were compared against reference sites in southern California using the Southern California IBI each scored in either the very poor (Stations CJ2 and CL2) or poor range (CJ1). This indicates that these sites are impaired compared to the best conditions found at other locations in southern California. Also, these IBI scores are comparable to other low gradient streams in agricultural areas of this region.

There is no evidence that the effluent from the wastewater treatment facilities have caused these impaired conditions. It is more likely that the physical habitat conditions at these sites have played a major role in the degradation of the BMI populations found there.

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Appendix A. Taxa List

Table A-1. Taxa abundances, tolerance values and functional feeding groups.

Identified Taxa	Tol Value	Func Feeding Group	CJ-1	CJ-2	CL-2
Insecta Taxa					
Ephemeroptera					
Baetis sp.	5	cg	22	17	4
Fallceon quilleri	5	cg	110	15	195
Tricorythodes sp.	5	cg	8	4	6
Odonata					
Coenagrion/Enallagma sp.	9	p	3	4	5
Argia sp.	7	p	1	7	
Trichoptera					
Cheumatopsyche sp.	4	cf		5	
Hydroptila sp.	6	sc	4		
Lepidoptera					
Petrophila sp.	5	sc		3	
Diptera					
Dolchipodidae	4	p			2
Chironomidae	6	cg	129	92	57
Ephydra sp.	6	sh			5
Pericoma/Telmatoscopus sp.	4	cg			7
Simulium sp.	6	cf	79	81	45
Non-Insecta Taxa					
Arachnoidea					
Sperchon sp.	8	p		2	1
Ostracoda					
Ostracoda	8	cg	2	7	9
Malacostraca					
Hyalella sp.	8	cg	54	195	141
Gastropoda					
Physa/Physella sp.	8	sc	4	4	6
Lymnaeidae	8	sc	1		
Gyraulus sp.	8	sc		2	
Ferrissia sp.	6	sc	1		
Bivalva					
Corbicula fluminea	10	cf	39		
Turbellaria					
Planariidae	4	p	17		
Hirudinea					
Erpobdella punctata	8	p	1		1
Oligochaeta	5	cg	25	92	8
Enopla					
Prostoma sp.	8	p	4	3	
TOTAL			**504**	**533**	**492**