2009
BIOASSESSMENT MONITORING PROGRAM IN LOS ANGELES COUNTY

Final Report

Prepared for:

Los Angeles County Flood Control District
Watershed Management Division
900 South Fremont Avenue
Alhambra, California 91803-1331

August 2010

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

WESTON SOLUTIONS

2009
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ACRONYMS AND ABBREVIATIONS

ABL	Aquatic Bioassessment Laboratory
bioassessment	biological assessment
Bioassessment Program	biological assessments of various freshwater streams in five Los Angeles County watersheds
BMI	benthic macroinvertebrate
CDFG	California Department of Fish and Game
County	Los Angeles County
CRAM	California Rapid Assessment Method
CSBP	California Stream Bioassessment Procedure
EPT	Ephemeroptera, Plecoptera, and Trichoptera
FFG	functional feeding group
IBI	Index of Biotic Integrity
LACFCD	Los Angeles County Flood Control District
LARWMP	Los Angeles River Watershed-wide Monitoring Program
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
Public Works	County of Los Angeles Department of Public Works
QA	quality assurance
QC	quality control
SAFIT	Southwest Association of Freshwater Invertebrate Taxonomists
SCCWRP	Southern California Coastal Water Research Project
SGRRMP	San Gabriel River Regional Monitoring Program
SMBW	Santa Monica Bay Watershed
SMC	Stormwater Monitoring Coalition
SMC Program	Stormwater Monitoring Coalition Southern California Regional Watershed Monitoring Program
SOW	scope of work
SWAMP	Surface Water Ambient Monitoring Program
TV	tolerance value
USEPA	United States Environmental Protection Agency
WESTON®	Weston Solutions, Inc.

EXECUTIVE SUMMARY

Background

Weston Solutions, Inc. (WESTON®) was contracted by the Los Angeles County Flood Control District (LACFCD) to perform biological assessments (bioassessments) of various freshwater streams in Los Angeles County (County) (Bioassessment Program). The Bioassessment Program is required for National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit compliance, under the enforcment of the Los Angeles Regional Water Quality Control Board (RWQCB). The goals of this program are to assess biological integrity and to detect biological trends and responses to pollution in receiving waters throughout the County. To achieve these goals, the program focuses on the sampling and analysis of freshwater stream benthic macroinvertebrates (BMIs). The program was initiated in October 2003, and monitoring surveys have been conducted once per year since that time, for a total of seven surveys to date. Surveys were conducted in October 2003, October 2004, October 2005, July (San Gabriel River Watershed only) and October 2006, June (San Gabriel River Watershed only) and October 2007, November 2008, and June 2009.

In 2009, the Bioassessment Program incorporated three collaborative monitoring programs in addition to the basic NPDES Program. These three programs included the San Gabriel River Regional Monitoring Program (SGRRMP), Los Angeles River Watershed-Wide Monitoring Program (LARWMP), and Stormwater Monitoring Coalition (SMC) Regional Watershed Monitoring Program (SMC Program).

Study Area and Monitoring Sites

The study area consisted of 22 stream monitoring sites within the five primary watersheds of the County. The watersheds and number of sites sampled in each were as follows:

- San Gabriel River Watershed: eight sites.
- Los Angeles River Watershed: six sites.
- Dominguez Channel Watershed: one site.
- Santa Monica Bay Watershed (SMBW), including Malibu Creek Watershed and Ballona Creek Watershed: five sites.
- Santa Clara River Watershed: two sites.

From June 15, 2009 to July 2, 2009, 22 sites were sampled. Three sites originally identified in the Scope of Work (SOW) were not sampled due to a lack of perennial flow. One site, SMC01364 (MAR1108-01364 in SOW), in the SMBW was rejected and replaced with SMC06926 for being non-perennial after a site visit. Two sites in the Santa Clara Watershed—SMC00204 (MAR1108-00204 in SOW) and SMC00604 (MAR1108-00604 in SOW)—were rejected and replaced with SMC04748 and SMC17056 for being non-perennial based on a preliminary assessment using Google Earth™ aerial imagery. These three replacement sites were randomly selected by the SMC and managed by the Southern California Coastal Water Research Project (SCCWRP). Three of the monitoring reaches (SGUT-501–San Gabriel River, SGUT-504–San Gabriel River, and 6–Arroyo Seco) were considered reference sites since they had minimal upstream urban development and runoff. Eight of the other sites were located in concrete-lined channels. These included sites SGLR01278–Coyote Creek (SMC01278), SGLR02656–Walnut Channel (SMC02656), SGLR09534–San Gabriel River, LALT500–Rio Hondo, LALT501–Arroyo Seco, LALT503–Tujunga Wash (SMC00756), 19–Dominguez

Channel, and SMC01640–Las Virgenes Creek. LALT503–Tujunga Wash was also coincident with SMC00756 (less than 300 m away) so it was also used for SMC data submission as an SMC site as well.

Methodology

Field sampling followed the standard protocols described in the Surface Water Ambient Monitoring Program (SWAMP) physical habitat assessment protocol (Ode, 2007). Organisms were identified to standard taxonomic Level II as specified in the *Southwest Association of Freshwater Invertebrate Taxonomists* (SAFIT) *List of Freshwater Invertebrate Taxa*. Data analysis included the calculation of standard community-based metric values and a Southern California Index of Biotic Integrity (IBI) (Ode et al., 2005). In addition to the SWAMP physical habitat assessment, the California Rapid Assessment Method (CRAM) for riverine wetlands was intiated in 2009. Additional analyses included a comparison of concrete-lined channels to unlined channels, comparison of IBI scores to site elevations, comparison of CRAM scores to IBI scores (2009 data only), and Bray–Curtis-based cluster analysis of taxa and monitoring sites. These analyses were performed for both the 2009 data and for the 2003 to 2009 data, separately.

Findings

Taxonomic evaluation of the 2009 samples yielded 146 different taxa from 14,073 individual organisms. Ostracods (seed shrimp) were present at every monitoring site and were the most abundant organisms collected throughout the County. The majority of organisms collected from the monitoring sites were moderately or highly tolerant to stream impairments. Twenty-one of the 22 sites were dominated by organisms in the collector–gatherer feeding group.

The IBI score of a monitoring reach is considered the strongest analytical tool for rating overall benthic community quality. The score is in points on a 0–70 scale, where higher scores indicate higher-quality BMI communities. Sites rated Poor or Very Poor have an IBI score of 26 or lower and are considered impaired (i.e., 26 is the impairment threshold). The IBI scores for the 2009 study ranged from 1 to 62, out of the possible 70 points (Table ES-1), and the ratings for quality of BMI communities ranged from Very Poor to Very Good. The monitoring reaches located in highly modified, concrete-lined channels had Very Poor IBI ratings. Analysis of individual metrics as well as total IBI scores showed that monitoring sites located in the lower-elevation, urban watershed areas had lower-quality benthic communities than sites located in the middle to upper and natural reaches of the watersheds. A correlation analysis of elevation and IBI scores indicated a positive and significant correlation countywide. When individual watersheds were considered, the San Gabriel Watershed and Los Angeles River Watershed had a positive correlation between elevation and IBI scores, whereas the SMBW had a negarive but insignificant correlation (i.e., IBI scores were somewhat lower in the upper watershed). Analysis of the IBI scores for the seven survey years through 2009 did not indicate any substantial trend through time toward degradation or improvement at any of the sites.

An analysis of the benthic community quality in concrete-lined sites versus unlined sites indicated a statistically significant difference in IBI scores between sites located in the lower watershed areas based on channel type. When reference sites were added to the analysis, the difference in IBI scores between concrete-lined sites and unlined sites was of much greater significance. When considering only 2009 data, the difference between concrete-lined sites and unlined sites was much greater than for the cumulative 2003–2009 data. Correlation analysis between CRAM scores and IBI scores had an R^2 of 0.577, indicating a significant correlation.

Conclusion

Stream bioassessment monitoring of the watersheds of the County has been conducted for seven consecutive years beginning October 2003, at a total of 42 different sites. Monitoring sites located in highly urbanized areas of the watersheds have consistently had BMI communities that were considered impaired based on the Southern California IBI. Reference monitoring site macroinvertebrate communities have been rated unimpaired for the duration of the study. Sampling and analysis methodology has been altered somewhat in the standard protocols, but overall results have been relatively consistent for all of the monitoring sites, and no results have shown any significant trend for increasing or decreasing biotic integrity. Correlations between IBI scores and channel type (i.e., concrete-lined versus unlined), elevation, and CRAM habitat scores indicated that all three factors are significantly related to IBI scores. These relationships were also confirmed by cluster analysis.

Table ES-1. Index of Biotic Integrity Scoring for 2009

Receiving Waterbody	Site Code	IBI Score (0–70 scale)	IBI Rating
San Gabriel River Watershed			
San Gabriel River	SGUT-501	62	Very Good
San Gabriel River	SGUT-504	34	Fair
San Gabriel River	SGUT-505	33	Fair
Emerald Wash	SGLR00288	15	Poor
Walnut Creek	SGLR02656 (SMC02656)	10	Very Poor
Walnut Channel	5, SGLT-506	5	Very Poor
Coyote Creek	SGLR01278 (SMC01278)	1	Very Poor
San Gabriel River	SGMR09534	1	Very Poor
Los Angeles River Watershed			
Arroyo Seco	6	50	Good
Arroyo Seco	7	16	Poor
Rio Hondo	LALT500	9	Very Poor
Arroyo Seco	LALT501	6	Very Poor
Compton Creek	8, LALT502	6	Very Poor
Tujunga Wash	LALT503 (SMC00756)	5	Very Poor
Dominguez Channel Watershed			
Dominguez Channel	19	1	Very Poor
Santa Monica Bay Watershed			
Trancas Canyon Creek	SMC01172 DUP	31	Fair
Trancas Canyon Creek	SMC01172	29	Fair
Malibu Creek	SMC01384	29	Fair
Rustic Canyon Creek	SMC06926	26	Poor
Trancas Canyon Creek	SMC01550	26	Poor
Las Virgenes Creek	SMC01640	7	Very Poor
Santa Clara River Watershed			
Santa Clara River	SMC17056	25	Poor
Santa Clara River	SMC04748	22	Poor

SGUT = San Gabriel River Upper watershed Targeted site
SGLT = San Gabriel River Lower watershed Targeted site
SGLR = San Gabriel River Lower watershed Random site
SGMR = San Gabriel River Mid-watershed Random site
LALT = Los Angeles River Lower watershed Tributary site
SMC = SMC random site

1.0 INTRODUCTION

Weston Solutions, Inc. (WESTON®) was contracted by the Los Angeles County Flood Control District (LACFCD) to perform biological assessments (bioassessments) of various freshwater streams in five Los Angeles County (County) watersheds (Bioassessment Program). The Bioassessment Program is required for National Pollutant Discharge Elimination System (NPDES) Permit compliance as enforced by the Los Angeles RWQCB (i.e., Region 4). The goals of the program are to assess biological integrity and to detect possible biological trends and responses to pollution in receiving waters throughout the County. Sampling and analysis followed the protocols described in the Surface Water Ambient Monitoring Program (SWAMP) physical habitat assessment protocol (Ode, 2007) and also incorporated the Stormwater Monitoring Coalition (SMC) Regional Monitoring of Southern California's Coastal Watersheds workplan (SCCWRP, 2007). This program was initiated in October 2003, and monitoring surveys have been conducted once per year since that time. In 2009, the Bioassessment Program incorporated three monitoring programs in addition to the NPDES Program. These included the San Gabriel River Regional Monitoring Program (SGRRMP), Los Angeles River Watershed-Wide Monitoring Program (LARWMP), and SMC Regional Watershed Monitoring Program (SMC Program).

The Bioassessment Program includes the collection and identification of stream benthic macroinvertebrates (BMI) and also assesses the quality and condition of the in-stream physical habitats and adjacent riparian zones. Using species-specific tolerance values (TVs) and community composition, numerical biometric indices are calculated that determine the ecological health of streams. Over time, this information may be used to identify ecological trends and aid analyses of the appropriateness of water quality management programs (Yoder and Rankin, 1998).

Invertebrates reside in streams for periods ranging from one month to several years and have varying sensitivities to physical, biological, and chemical disturbances in the stream. By assessing the invertebrate community structure of a stream, a realistic, long-term measure of stream habitat health and ecological response is obtained. This information may complement monitoring programs that test water quality parameters, which provide a measure of habitat conditions only at the moment sampling occurs. The addition of bioassessment to chemical, bacterial, and toxicological approaches to watershed monitoring programs gives a comprehensive indication of water quality and the effects of ecological impacts.

This report presents the results of stream bioassessment surveys from 22 monitoring sites in the Los Angeles Basin, conducted from June 15, 2009 to July 2, 2009. No significant rain events occurred during the sampling period or during the previous month. A taxonomic list of all identified BMIs, biological metric and Index of Biotic Integrity (IBI) calculations, and a discussion and analysis of the results are included in this report.

2.0 STUDY AREA OVERVIEW

The monitoring sites assessed in this study were located in five major watersheds throughout the County. These included the San Gabriel River Watershed, Los Angeles River Watershed, Santa Monica Bay Watershed (SMBW) (including the Ballona Creek Watershed and the Malibu Creek Watershed), Dominguez Channel Watershed, and Santa Clara River Watershed. The monitoring reaches are described in Table 1, along with the rationale for monitoring each site. Figure 1 is a map of the monitoring site locations.

Eight of the monitoring sites were located in concrete-lined channels: SGLR01278–Coyote Creek (SMC01278), SGLR02656–Walnut Channel (SMC02656), SGLR09534–San Gabriel River, LALT500–Rio Hondo, LALT501–Arroyo Seco, LALT503–Tujunga Wash (SMC00756), 19–Dominguez Channel, and SMC01640–Las Virgenes Creek. Three of the monitoring sites were unlined and were considered reference sites with minimal upstream urban development: SGUT-501–San Gabriel River, SGUT-504–San Gabriel River, and 6–Arroyo Seco.

Table 1. Los Angeles County Flood Control District Stream Bioassessment Monitoring Stations for 2009

Station	Targeted (T) or Random (R) Station	Receiving Waterbody	Location, Date Sampled	Coordinates	Justification	Elevation (ft above sea level)
San Gabriel River Watershed: Eight Sites						
SGUT-501	T	San Gabriel River unlined channel	San Gabriel River at the confluence of Bear Creek 06/16/2009	N 34.24067º W -117.88215º	Upstream reference site, targeted/fixed site for SGRRMP	1,620
SGUT-504	T	San Gabriel River unlined channel	Upper San Gabriel River near East Fork Road, 06/16/2009	N 34.23652º W -117.81664º	Upstream reference site, targeted/fixed site for SGRRMP	1,512
SGUT-505	T	San Gabriel River unlined channel	Upper San Gabriel River below Morris Reservoir, 06/30/2009	N 34.17133º W -117.88762º	Targeted/fixed site for SGRRMP	898
5, SGLT-506	T	Walnut Creek unlined channel	Walnut Channel upstream of San Gabriel River, 06/17/2009	N 34.06180º W -117.99314º	Targeted/fixed site for SGRRMP	298
SGLR 01278 (SMC01278)	R	Coyote Creek lined channel	Coyote Creek at Wardlow Road, 06/17/2009	N 33.82119º W -118.06651º	Random site for SGRRMP	20
SGLR 02656 (SMC02656)	R	Walnut Creek lined channel	Walnut Creek at Grand Avenue, 06/23/2009	N 34.07568º W -117.87160º	Random site for SGRRMP	500
SGLR 00288	R	Emerald Wash unlined channel	Emerald Wash below Live Oak Park, La Verne, 06/18/2009	N 34.130942º W -117.76835º	Random site for SGRRMP	1,440
SGMR 09534	R	San Gabriel River mainstem lined channel	San Gabriel River upstream of Carson Boulevard, 06/17/2009	N 33.82847º W -118.09478º	Random site for SGRRMP	30
Los Angeles River Watershed: Six Sites						
6	T	Arroyo Seco unlined channel	Upstream of Arroyo Seco Spreading Grounds, 06/15/2009	N 34.20327º W -118.16647º	Upstream reference site with minimal impact from residential land use	1,118
7	T	Arroyo Seco unlined channel	Arroyo Seco downstream from Interstate 134, 06/15/2009	N 34.144963º W -118.165102º	Assess impacts of residential land use	725
LALT500	T	Rio Hondo lined channel	Rio Hondo at Los Angeles River, 06/22/2009	N 33.93555º W -118.17200º	Offset site for the LARWMP	82
LALT501	T	Arroyo Seco lined channel	Arroyo Seco at Los Angeles River, 06/22/2009	N 34.08056º W -118.22491º	Offset site for the LARWMP	295
8, LALT502	T	Compton Creek unlined channel	Compton Creek upstream of the confluence with the Los Angeles River, 06/23/2009	N 33.84622º W -118.20922º	Offset site for the LARWMP	22
LALT503 (SMC00756)	T	Tujunga Wash lined channel	Tujunga Wash at Los Angeles River, 06/23/2009	N 34.14691º W -118.38932º	Offset site for the LARWMP	578

Table 1. Los Angeles County Flood Control District Stream Bioassessment Monitoring Stations for 2009

Station	Targeted (T) or Random (R) Station	Receiving Waterbody	Location, Date Sampled	Coordinates	Justification	Elevation (ft above sea level)
Dominguez Channel Watershed: One Site						
19	T	Dominguez Channel lined channel	Dominguez Channel and Vermont Avenue, 06/24/2009	N 33.87111º W -118.29683º	Assess impacts from upper Dominguez Channel Watershed	3
Santa Monica Bay Watershed: Five Sites						
SMC01172 (MAR1108-01172 in Scope of Work)	R	Trancas Canyon Creek unlined channel	Trancas Canyon Creek at Trancas Canyon Road, 06/24/2009	N 34.081667º W -118.858333º	Random site for the SMC Regional Monitoring Program	1,200
SMC06926 (Replaces MAR1108-01364 in SOW)	R	Rustic Canyon Creek unlined channel	Rustic Canyon Creek at Rustic Lane, 07/01/2009	N 34.04776º W -118.51117º	Random site for the SMC Regional Monitoring Program	210
SMC01384 (MAR1108-01384 in Scope of Work)	R	Malibu Creek unlined channel	Malibu Creek at Malibu Canyon Road, 06/29/2009	N 34.06417º W -118.70359º	Random site for the SMC Regional Monitoring Program	285
SMC01550 (MAR1108-01550 in Scope of Work)	R	Trancas Canyon Creek unlined channel	Trancas Canyon Creek at Edison Road, 06/25/2009	N 34.05490º W -118.84800º	Random site for the SMC Regional Monitoring Program	310
SMC01640 (MAR1108-01640 in Scope of Work)	R	Las Virgenes Creek lined channel	Las Virgenes Creek at Parkmoor Road, 06/29/2009	N 34.15302º W -118.69752º	Random site for the SMC Regional Monitoring Program	780
Santa Clara River Watershed: Two Sites						
SMC17056 (Replaces MAR1108-00204 in SOW)	R	Santa Clara River unlined channel	Santa Clara River upstream of Interstate 5, 07/02/2009	N 34.426392º W -118.577844º	Random site for the SMC Regional Monitoring Program	1,060
SMC04748 (Replaces MAR1108-00604 in SOW)	R	Santa Clara River unlined channel	Santa Clara River at Chiquito Canyon Road, 07/02/2009	N 34.413099º W -118.658774º	Random site for the SMC Regional Monitoring Program	885

SGUT = San Gabriel River Upper watershed Targeted site
SGLT = San Gabriel River Lower watershed Targeted site
SGLR = San Gabriel River Lower watershed Random site
SGMR = San Gabriel River Mid-watershed Random site
LALT = Los Angeles River Lower watershed Tributary site
SMC = SMC random site

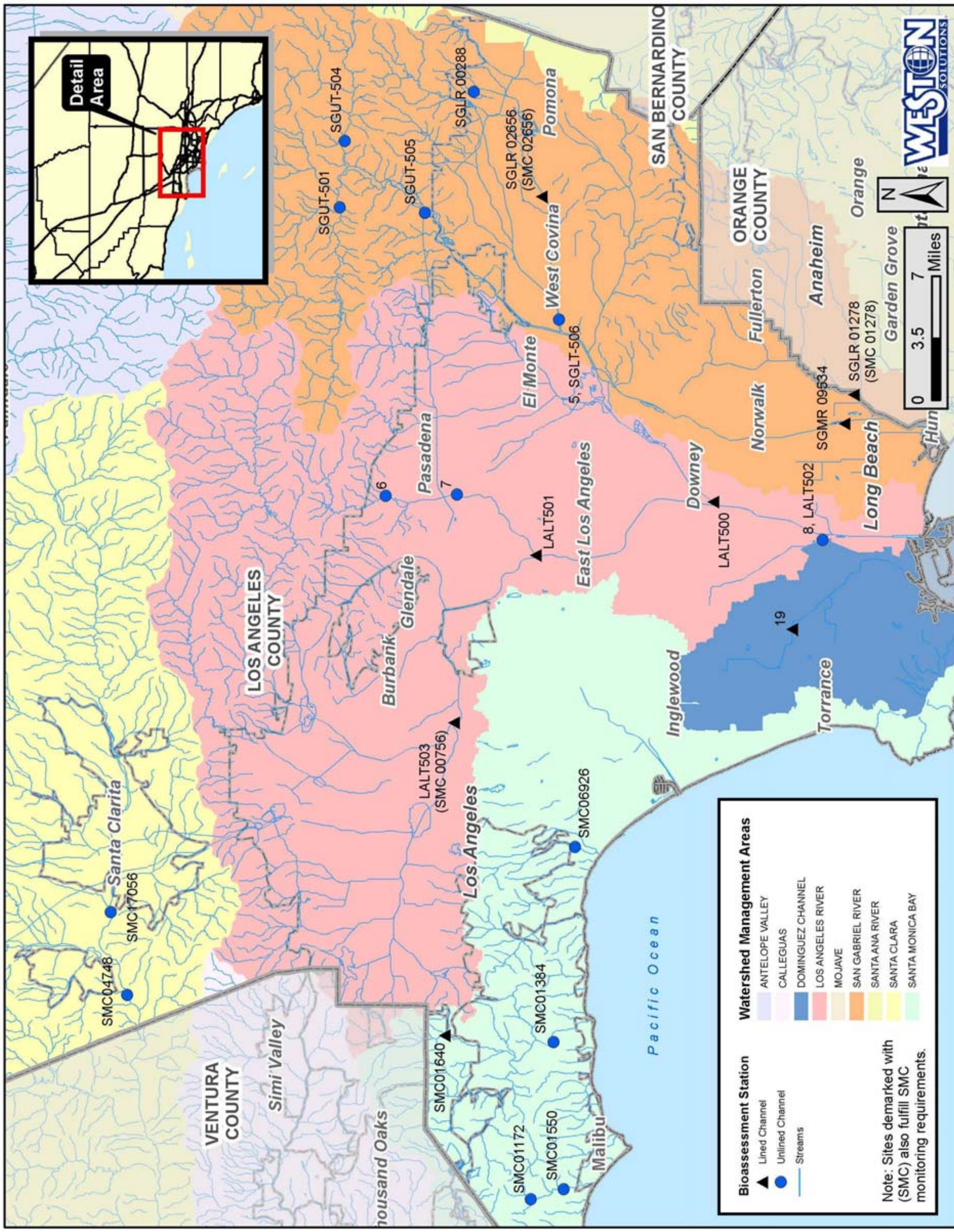


Figure 1. Stream Bioassessment Monitoring Locations for 2009

3.0 METHODS

A general description of the methods incorporated in the sampling program is presented below. WESTON personnel followed the protocols of the SWAMP physical habitat assessment procedure (Ode, 2007), the SMC regional bioassessment workplan (SCCWRP, 2007), and Quality Assurance Project Plan (QAPP) (SCCWRP, 2009). The California Rapid Assessment Method (CRAM) for riverine wetlands was also performed. These documents may be referenced for more detailed procedural information.

The sampling and analysis for the 2009 survey was performed using different protocols than in previous surveys, with the exception of the San Gabriel River sites in 2008. Throughout the history of the program, there have been varying levels of effort concerning the in-stream sampling area and the number of organisms processed for each site. These variances have been dictated by changes in the standard protocols and were not at the discretion of the LACFCD or its consultants. Sample area size has varied from 9 ft^2 to 18 ft^2 and was 11 ft^2 in 2009. The sampling strategy within the sites has changed from targeted riffle sampling to a reachwide sampling technique where collections were made at evenly spaced 15-m transects. In the laboratory, the number of organisms identified varied from 500 to 900 organisms and was 600 organisms in 2009.

3.1 Sampling Site Selection

Historically, the Bioassessment Program consisted of 20 targeted sites. In 2003, Los Angeles County Department of Public Works (LACDPW) staff performed a field reconnaissance of the monitoring reaches prior to program initiation to determine the suitability of the 20 original proposed sites. Over the years, various sites have been "offset" to contribute to other watershed-specific monitoring programs; For example, sites 11, 12, and 13 in the Los Angeles River Watershed were offset in 2008 with sites LALT500, LALT501, and LALT503 as a contribution to the LARWMP for the Los Angeles and San Gabriel River Watershed Council. Other programs that have been incorporated include the San Gabriel Rivers Regional Monitoring Program (SGRRMP) and the SMC Southern California Regional Watershed Monitoring Program (SMC Program).

In 2009, the 22 sites sampled included 11 targeted sites that have been sampled historically and 11 random sites that were sampled for the first time in 2009. Nine of the 11 random sites were selected for inclusion in the SMC Program; the other two were selected for inclusion in the SGRRMP. One historically targeted site, LALT503, was within 300 m of SMC site SMC00756 in 2009, so the data from LALT503 were used for that SMC site.

3.2 Monitoring Reach Delineation

Historically, monitoring sites were established in stream reaches with ample current flow and riffle habitat, where available. The sampling points specified in the California Stream Bioassessment Procedure (CSBP) target riffle habitat. An ideal riffle is an area of variable flow regimes with some surface disturbance and a relatively complex and stable substrate. These areas provide increased colonization potential for benthic invertebrates. Riffles typically support the greatest diversity of invertebrates in a stream, and by selecting the richest habitats available in each stream, comparability among streams is possible. For some of the monitoring sites in this study, optimal riffle habitat was not always available; therefore, best available habitat was sampled. The best available habitat was selected based on complexity of substrates in the streambed.

Under optimal conditions, five riffles constituted a monitoring site, and three of these were randomly selected for sampling per reach. The length of the monitoring reach was variable, depending upon the frequency of riffles. Given sufficient riffle width and length, a sampling transect perpendicular to stream flow was selected randomly in the upper one-third of the riffle. In situations where the only available riffles were very short and/or narrow, the samples were taken to best represent available substrate types. For monitoring reaches in uniform concrete channels, a 150-m reach of the stream was selected, and three separate 1-m-wide transects were randomly selected.

In 2009, the monitoring sites were delineated to encompass a 150-m stream reach regardless of site conditions. Historical targeted sites were established in the same locations as in past surveys. Randomly placed sites were established such that the downstream margin was as close to the nominal coordinates as possible and never more than 300 m away from the nominal coordinates. In three situations, the randomly selected sites proposed in the Scope of Work (SOW) were rejected due to lack of perennial water flow. One site in the SMBW—SMC01364 (MAR1108-01364 in SOW)—was rejected for non-perenniality after a site visit was performed. Two sites in the Santa Clara Watershed—SMC00204 (MAR1108-00204 in SOW) and SMC00604 (MAR1108-00604 in SOW)—were rejected for non-perenniality based on a preliminary assessment using Google Earth™ aerial imagery. These three sites were replaced with randomly selected sites provided by the SMC through Southern California Coastal Water Research Project (SCCWRP) coordination.

3.3 Sample Collection

Historically, once a sampling transect was established, BMIs were collected using a 1-ft-wide, 0.5-mm mesh D-frame kick-net. Depending on the protocol, a 1-ft^2 or 2-ft^2 area upstream of the net was sampled by disrupting the substrate and scrubbing the cobble and boulders so that organisms were dislodged and swept into the net by the current or by hand sweeping. In areas with little or no current, the substrate was disturbed, and the net was swept back and forth to capture the organisms. The duration of the sampling generally ranged from one to three minutes, depending on substrate complexity. Three areas along each transect were sampled and combined into one composite sample. The three sample points on the transect were usually taken near the right and left margins and in the middle of the stream, or the three sample points were selected to best represent the diversity of habitat types present. This procedure was repeated for the next two riffles. Sample material was transferred from the kick-net to 1-qt jars, preserved with 95% ethanol, and returned to WESTON's benthic laboratory for processing.

In 2009, BMI samples were collected at evenly spaced 15-m transects for a total of 11 transects in each 150-m reach. The physical conditions at all sites allowed for sampling over an uninterrupted 150-m reach. BMIs were collected using a standard 1-ft-wide kick-net, and each sample point consisted of a 1-ft^2 area. The samples were collected in a repeating alternating margin-center-margin pattern and were otherwise collected and preserved using similar methods as those previously used.

Every monitoring site was sampled from downstream to upstream. Every monitoring site was photographed. Representative photographs of the monitoring sites were taken (Appendix A).

3.4 Physical Habitat Quality Assessment

Historically, for each monitoring reach sampled, the physical habitat of the stream and its adjacent banks were assessed using United States Environmental Protection Agency (USEPA) Rapid Bioassessment Protocols (Barbour et al., 1999). Habitat quality parameters were assessed to provide a record of the overall condition of the reach. Parameters (e.g., channel alteration, frequency of riffles, width of riparian zones, and vegetative cover) help to provide a more comprehensive understanding of the condition of the stream. Additionally, specific characteristics of the sampled riffles were recorded, including riffle length, depth, gradient, velocity, substrate complexity, and substrate composition.

In 2009, the SWAMP physical habitat assessment protocol was used. This protocol is more comprehensive and quantitative than the USEPA protocol. Detailed measures (e.g, substrate size, bank vegetation, human influences, and in-stream features) were taken at the same 11 transects where BMI collections were taken. A subset of the physical habitat measures were also assessed at intertransects 7.5 m apart. Copies of the SWAMP field data sheets are presented in Appendix C (electronic version only). The CRAM for assessing riverine wetland quality was also performed at all locations, although this was only required at SMC sites. CRAM assesses a number of wetland attributes (e.g., in-stream habitat complexity, riparian vegetation, buffer zone width and quality, adjacent land uses, and hydrologic connectivity). CRAM incorporates a broader landscape scope than the SWAMP physical habitat assessment, and yields a single score for a site. The range of possible scores is 25 to 100 points, with higher scores representing higher-quality wetlands. The method is relatively new, and the scoring system has yet to be calibrated to give ratings such as ‘Poor’ or ‘Good’.

In situ physical water quality measurements were taken at each of the monitoring sites. Measurements included water temperature, specific conductance, pH, dissolved oxygen, and turbidity. Water samples were collected and analyzed for alkalinity and hardness in the laboratory to achieve greater accuracy than the standard field methods.

3.5 Laboratory Processing and Analysis

At the laboratory, samples were relinquished under chain of custody to the laboratory sample custodian. Prior to sample processing, technicians signed out each sample in a sample tracking logbook. The sample was poured over a No. 35 standard testing sieve (i.e., 0.5-mm stainless-steel mesh), and the ethanol was retained for reuse. The sample was gently rinsed with freshwater, and large debris (e.g., wood, leaves, and rocks) were removed. The sample was transferred to a tray marked with grids approximately 25 cm^2 and was spread homogenously to a thickness of approximately 0.25 inch. One grid was randomly selected, and the sample material contained within the grid was removed and processed. In cases where the animals appeared abundant, only a fraction of the sample in the grid may have been removed. The material from the grid was examined under a stereomicroscope, and the invertebrates were removed, sorted into major taxonomic groups, and placed in vials containing 70% ethanol. This process was repeated until the specified number of organisms was removed from the sample (i.e., 300, 500, or 600, depending on the protocol). Organisms from a grid in excess of the specified number were placed in a separate vial labeled “extra animals,” so that a total abundance for the sample could be estimated. All sample processing information was entered onto a Stream Bioassessment Sorting Sheet (Appendix C). Processed material from the sample was placed in a separate jar and was labeled “sorted,” and the unprocessed material was returned to the original sample container, checked in to the sample tracking logbook, and archived. Sorted material was retained for quality assurance (QA) purposes.

Historically, all organisms were identified to standard taxonomic Level I as specified in the *Southwest Association of Freshwater Invertebrate Taxonomists* (SAFIT) *List of Freshwater Invertebrate Taxa* (SAFIT, 2006), genus level for most insects, and order or class for non-insects. The taxonomic levels are fixed under this document to prevent inconsistencies in taxonomic effort between laboratories. The level of taxonomic effort was consistent from 2003 through 2008. In 2009, the taxonomic effort level was increased to SAFIT Level II, in which insects are identified to species level when possible, and chironomidae are identified to genus level to meet SMC requirements. With the exception of some beetles, nearly all of the insects identified in the program were in the larval and pupal stages of development, which metamorphose into an aerial adult form. Nearly all of the non-insect taxa are aquatic for their entire life history.

Quality Assurance / Quality Control—After sample processing is complete, all BMI samples were checked to ensure a 95% or better organism removal efficiency. Results of the sorting QA/ quality control (QC) were entered onto the Stream Bioassessment Sorting Sheet (Appendix C). To ensure accuracy of the taxonomic identifications, approximately 20% of the samples (i.e., four samples) were sent to the California Department of Fish and Game (CDFG) Aquatic Bioassessment Laboratory (ABL) for taxonomic verification. Any discrepancies between ABL identifications and the original identifications were reconciled in the taxonomic database. Taxonomic QA/QC results for one sample were also sent to the SMC to determine if minimum quality objectives (MQOs) were met. Results of the sorting and taxonomic QA/QC analyses are presented in Appendix C. There were four disputed identifications of four individual organisms, two sorting errors, and all counting discrepencies were considered minor. Additionally, the SMC QA sample (i.e., SMC06926) met all of the MQOs for the SMC Program.

3.6 Data Analysis

Taxonomic data were entered into an electronic file using Microsoft Word and were converted into a SAS® database for QA/QC and data reduction. BMI community-based metric values were calculated from the entire database. For calculation of the IBI (described below), the database was randomly reduced to a 500-organism count (Ode et al., 2005). A list of the standard CSBP metrics, a brief description of what they signify, and the predicted response to impairment is presented in Table 2. A taxonomic list of the macroinvertebrates present in each sample was created in Microsoft Excel, including the designated Tolerance Value (TV) and Functional Feeding Group (FFG) of each taxon. Macrophyte herbivores (mh), piercer herbivores (ph), omnivores (om), parasites (pa), and xylophages/wood-eaters (xy) were combined into a group designated “other.” Note that for some organisms identified at the Family level or above, a single TV or FFG was not assigned, because the taxa within the group have a broad range of tolerances or feeding strategies, and a single designation is not representative.

In addition to the individual metric values, a multi-metric IBI was calculated for each monitoring reach (Ode et al., 2005). The IBI is a quantitative scoring system for assessing the quality of BMI assemblages and is currently the most useful tool for reducing a complex macroinvertebrate dataset to a qualitative rating for each monitoring reach. The IBI score is derived from the cumulative value of seven biological metrics (Table 2). Percent collector–filterers and percent collecter–gatherers are combined into a single IBI metric. The total scores were categorized into ratings of the benthic community, ranging from Very Poor to Very Good. It has been noted that the Southern California IBI was developed with very few sites located at low elevations in the County. Future development of a refined IBI has been suggested by SWAMP.

Using data generated from the BMI samples, additional analyses included comparisons of IBI scores from concrete-lined and unlined channels, IBI scores and monitoring site elevations, and comparative analyses of mean biological metrics and IBI scores for all years of monitoring.

Table 2. Bioassessment Metrics Used to Characterize Benthic Invertebrate Communities

Metric	Description	Expected Response to Impairment
Richness Measures		
Taxa Richness	Total number of individual taxa	Decrease
Coleopteran Taxa*	Number of taxa in the insect order Coleoptera (beetles)	Decrease
EPT[1] Taxa*	Number of taxa in the Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) insect orders	Decrease
Dipteran Taxa	Number of taxa in the insect order Diptera (true flies)	Increase
Non-Insect Taxa	Number of non-insect taxa	Increase
Predator Taxa*	Number of taxa in the predator feeding group	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 TVs between 0 and 3	Decrease
Shannon Diversity Index	General measure of sample diversity that incorporates richness and evenness (Shannon and Weaver, 1963)	Decrease
Margalef Diversity	Measure of sample diversity weighted for richness	Decrease
Tolerance/Intolerance Measures		
TV	Value between 0 and 10 of individuals designated as pollution tolerant (higher values) or intolerant (lower values)	Increase
Dominant Taxon	Percent composition of the single most abundant taxon	Increase
Percent Chironomidae	Percent composition of the tolerant dipteran family Chironomidae	Increase
Percent Intolerant Organisms*	Percent of organisms in sample that are highly intolerant to impairment as indicated by a TV of 0, 1, or 2	Decrease
Percent Tolerant Organisms	Percent of organisms in sample that are highly tolerant to impairment as indicated by a TV of 8, 9, or 10	Increase
Percent Tolerant Taxa*	Percent of taxa in sample that are highly tolerant to impairment as indicated by a TV of 8, 9, or 10	Increase
Percent Non-Insect Organisms	Percent of organisms in sample that are not in the Class Insecta	Increase
Percent Non-Insect Taxa*	Percent of taxa in sample that are not in the Class Insecta	Increase
FFGs		
Percent Collector–Gatherers*	Percent of macrobenthos that collect or gather fine particulate matter	Increase
Percent Collector–Filterers*	Percent of macrobenthos that filter fine particulate matter	Increase
Percent Scrapers	Percent of macrobenthos that graze upon periphyton	Increase
Percent Predators	Percent of macrobenthos that feed on other organisms	Variable
Percent Shredders	Percent of macrobenthos that shreds coarse particulate matter	Decrease
Percent Other	Percent of macrobenthos that are pa, mh, ph, om, and xy	Variable
Abundance		
Estimated Abundance	Estimated number of organisms in entire sample	Variable

*Metrics used to calculate the IBI
[1]EPT = Ephemeroptera, Plecoptera, and Trichoptera
Source: SDRWQCB, 1999

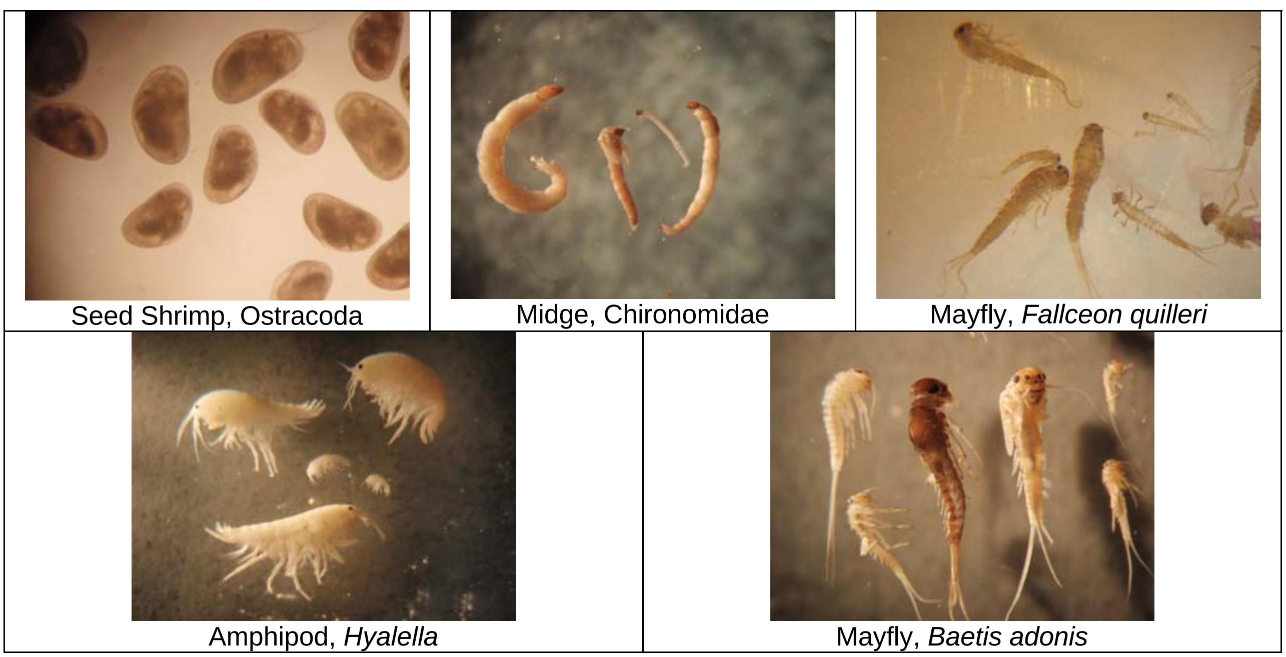
4.0 COUNTY-WIDE SURVEY RESULTS FROM 2009 AND 2003–2009

The 2009 Survey was conducted in June and July. A discussion of the 2009 survey results is presented below. A complete list of the benthic invertebrates identified at all sites and replicates is presented in Appendix B.1. Ranked total abundance for each species at all sampling sites combined is presented in Appendix B.2, and the calculated BMI metric values for each monitoring reach are presented in Appendix B.3.

The reader may notice seeming discrepancies between the number of unique taxa listed in the metrics tables and the apparent number of taxa in the taxa list. This is due to the presence of immature or damaged specimens identified at a higher systematic level than the standard effort but were not thought to be unique taxa. Also, the increased taxonomic effort for the 2009 survey substantially increased the apparent taxa richness, and comparisons with past surveys need to consider this difference.

4.1 Benthic Macroinvertebrate Community – 2009 Study Area Summary

When all sites in the County study area are combined, a total of 146 unique taxa were identified from 14,073 individual organisms (Appendix B.1 and Appendix B.2). The five most abundant taxa in descending order were Ostracods (seed shrimp) at 2,071 individuals; the chironomid midge, *Cricotopus* sp. at 1,141 individuals; the mayfly, *Fallceon quilleri*, at 1,082 individuals; the amphipod crustacean, *Hyalella* sp., at 963 individuals; and the mayfly, *Baetis adonis*, at 955 individuals (Appendix B.2) (Figure 2). All of these taxa are moderately to highly tolerant to habitat impairment and are in the collector–gatherer feeding group. Collector–gatherers feed on organic detritus, algae, and various microorganisms (Smith, 2001; Usinger, 1956), and high abundances of these organisms are often associated with high levels of urban runoff (Lenat and Crawford, 1994).



Seed Shrimp, Ostracoda | Midge, Chironomidae | Mayfly, *Fallceon quilleri*

Amphipod, *Hyalella* | Mayfly, *Baetis adonis*

Figure 2. The Five Most Abundant Organisms Collected in Los Angeles County for the 2009 Survey

The order Diptera (true flies) had the greatest number of unique taxa identified (55 taxa, including 30 chironomid genera), followed by Coleoptera (beetles) and Trichoptera (caddisflies) with 21 and 16 taxa, respectively (Appendix B.1). Ostracods and chironomid midges were present at all of the monitoring sites.

4.2 2009 Benthic Macroinvertebrate Community Metrics

Benthic invertebrate community metric values for each monitoring reach are presented in Appendix B.3. Table 2 above may be referenced for a brief definition of each metric and their response to impairment. Each metric is based on a different component of the BMI community, and the combination of metric scores gives an indication of overall biotic integrity for a given site.

Taxa Richness—Taxa richness is the total number of unique taxa in a sample, and it is presumed that higher richness indicates higher biotic integrity. This number does not account for damaged or immature specimens identified at a higher taxonomic level than specified in the SAFIT list (also referred to as indiscriminate taxa). In 2009, taxa richness per sample ranged from nine taxa at SMC01640–Las Virgenes Creek to 64 taxa at SGUT-501–San Gabriel River (Appendix B.3). By comparison, the highest taxa richness value in 2008 was 38 (WESTON, 2009), and the higher value in 2009 may be attributed to the increased taxonomic effort initiated by the SMC Program.

Diversity and Dominance—Two diversity indices were calculated for each site: Shannon diversity, which increases with evenness of distribution amongst present taxa and Margalef diversity, which increases with increasing numbers of taxa present. Shannon diversity values per site ranged from 0.6 at SGMR09534–San Gabriel River to 3.4 at 6–Arroyo Seco and SGUT-501–San Gabriel River (Appendix B.3). Margalef Diversity values per site ranged from 1.4 at SMC01640–Las Virgenes Creek to 10.5 at SGUT-501–San Gabriel River (Appendix B.3). Dominance is a metric that is presumed to decrease with increasing biotic integrity. Dominance by a single taxon was examined and found to range from 10.8% Ephemerellidae at SGUT-501–San Gabriel River to 89.0% *Fallceon quilleri* at SGMR09534–San Gabriel River (Appendix B.4).

Ephemeroptera, Plecoptera, and Trichoptera Taxa—This metric represents the number of taxa in the orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) that are collected at each site. These orders contain impairment-sensitive taxa, and greater diversity of these taxa indicates higher biotic integrity. Several of these taxa (e.g., mayflies in the family Baetidae and the caddisflies, *Cheumatopsyche* sp., *Hydropsyche* sp., and *Hydroptila* sp.) are tolerant to urban runoff that does not contain high levels of chemical pollutants. This means that percent-sensitive EPT is a much stronger metric than total-percent EPT when assessing ecological health at a site. All of the stonefly taxa are sensitive to urban runoff.

The greatest number of EPT taxa (24) was collected at SGUT-501–San Gabriel River, and the second greatest number of EPT taxa (13) was collected at 6–Arroyo Seco (Appendix B.3). There were no EPT taxa collected at three of the monitoring sites, including LALT502–Compton Creek, 19–Dominguez Channel, and SMC01640–Las Virgenes Creek. EPT individuals were most abundant at SGMR09534–San Gabriel River where the single taxon *Fallceon quilleri* comprised 89.0% of the benthic community (Appendix B.3). The most abundant of the EPT taxa across the survey region included the baetid mayflies, *Baetis adonis* and *Fallceon quilleri* (Appendix B.2). Sensitive EPT taxa (TV 0–3) were collected at eight of the sites and were collected in the greatest numbers at SGUT-501–San Gabriel River, where they comprised 39.2% of the benthic community.

***Tolerance Values*—**For most stream macroinvertebrates, a TV has been determined for each taxon through prior research on each type of animals' life history (Hilsenhoff, 1987). TVs range from 0 for organisms highly sensitive to impairments, to 10 for organisms that are highly tolerant to impairments. A low to moderate abundance of impairment-tolerant organisms does not necessarily imply impairment (SDRWQCB, 2001), but more importantly, the presence of sensitive organisms is unlikely when a stream is impaired. The presence of highly intolerant organisms (TV 0–2) is likely the strongest indicator of good water quality.

Average community TVs for all sites ranged from 3.7 at SGUT-501–San Gabriel River to 7.8 at SMC01640–Las Virgenes Creek (Appendix B.3). Highly tolerant organisms (TV 8–10) were most abundant at SMC01640–Las Virgenes Creek, where high numbers of ostracods contributed to a total of 86.0% tolerant organisms. Highly tolerant organisms were least abundant at SGMR09534–San Gabriel River, where they comprised 1.6% of the community. Highly intolerant (i.e., sensitive) organisms were collected from eight sites, which were the same sites where sensitive EPT were collected; sensitive EPT with a TV of 2 or less are also counted in the highly intolerant metric. These sites included SGUT-501, SGUT-504, SGUT-505, 6–Arroyo Seco, SMC01172, SMC06926, SMC01384, and SMC01550. SGUT-501 had the greatest number of intolerant organisms, where they comprised 37.2% of the community. Highly intolerant organisms collected in high numbers included the caddisflies, *Micrasema* sp. and *Tinodes* sp. (167 and 124 individuals, respectively), and the mayfly, *Serratella micheneri* (64 individuals).

***Functional Feeding Groups*—**As with TVs, FFG designations have been determined through prior life-history research or observations of each taxon. The percent composition of the FFGs provides useful information regarding benthic community function, and some feeding groups contain greater numbers of intolerant organisms (Table 2). In general, a more even distribution of the feeding groups indicates a higher-quality benthic community. The information from feeding group composition may be particularly useful in detecting physical habitat degradation and impacts from urbanization.

Twenty-one of the 22 monitoring reaches were dominated by taxa in the collector–gatherer feeding group (Appendix B.1 and Appendix B.3). The five most abundant taxa in the study region (i.e., ostracods, chironomid midges, *Fallceon quilleri*, *Hyalella*, and *Baetis adonis*) were in the collector–gatherer feeding group and generally increase in abundance in response to urban runoff in a watershed (SLSI, 2003). SMC01384–Malibu Creek was dominated by scrapers (i.e., snails). LALT503–Tujunga Wash (SMC00756) had the greatest dominance by a single feeding group, where collector–gatherers comprised 96.0% of the community.

***Estimated Abundance*—**The estimated total abundance is the total number of BMI predicted to be in the sample if the entire sample had been processed (e.g., if 50% of the sample had 600 BMI, the estimated total abundance would be 1200). This value is then divided by 11 to calculate the estimated number of animals living in 1 square foot of benthic habitat. Response to moderate habitat impairment is often indicated by an increase in total abundance by highly tolerant organisms, with a corresponding decrease in taxa richness and diversity; however, severe impairment can result in a catastrophic decrease in total abundance.

Estimated abundance ranged from 60 organisms per square foot of substrate at 01172–Trancas Canyon Creek to 4,049 organisms per square foot at SMC01640–Las Virgenes Creek (Appendix B.3). Abundance at the reference sites ranged from 209 to 392 organisms per square foot.

4.3 2009 Physical Habitat Quality Assessment

The SWAMP physical habitat procedure was performed at all sites. The procedure is much more comprehensive than the historical USEPA method in which ten parameters were assessed qualitatively on a 0 to 20 point scale to give a single habitat score. The SWAMP procedure retained three of these original USEPA parameters, including epifaunal substrate/cover, sediment deposition, and channel alteration. Additionally, many aspects of the reachwide habitat were quantitatively assessed (e.g., substrate size, algal cover, bank vegetation cover, canopy cover, in-stream habitat complexity, and human influences, flow volume, and reach gradient). Qualitative assessments were also made to characterize flow habitats and bank stability. As of the writing of this report, summary indices of the physical habitat data have not been developed. Table 3 lists the more relevant physical habitat parameters and briefly describes the conditions that are most beneficial to macroinvertebrate communities. Figure 3 presents photographs of good and poor quality physical habitats. Water quality data are presented in Appendix B.4, and physical habitat measures for each monitoring reach are presented in Appendix B.5.

Water quality measurements at most of the monitoring sites did not indicate severe impairment. Values for pH were between 7.44 and 9.66 (SMC01172–Trancas Canyon Creek and SMC01640–Las Virgenes Creek, respectively). Specific conductance, a general indicator of dissolved solids, was moderate to low at all sites except SMC01640–Las Virgenes Creek, which had a value of 3.049 mg/L. Alkalinity measures ranged from 68 mg/L $CaCO_3$ at SMC01640–Las Virgenes Creek to 480 mg/L $CaCO_3$ at SMC01172–Trancas Canyon Creek. Excessive salts, metallic cations (e.g., calcium, magnesium, and ferrous iron), and limestone formations can naturally elevate water hardness (Sawyer and McCarty, 1978). Dissolved oxygen levels ranged from 4.50 mg/L at SMC01172–Trancas Canyon Creek to 26.80 mg/L at 19–Dominguez Channel. Water temperatures were quite variable throughout the County, ranging from 14.42°C (i.e., 57.96°F) at SGUT-501–San Gabriel River to 31.60°C (i.e., 88.88°F) at SMC01640–Las Virgenes Creek. Turbidity, a measure of water clarity (clear waters have low nephelometric turbidity unit (NTU) values), was relatively low at most sites, although elevated turbidity was observed at LALT500–Rio Hondo and SMC04748–Santa Clara River.

Physical habitat measures of each monitoring reach are presented in Appendix B.5. Currently there are no standard metrics summarizing the overall habitat quality, and the more relevant measures are presented. For each site, the CRAM for riverine wetlands was applied. This assessment provides a single score relating to the physical habitat quality and incorporates in-stream quality, buffer zone vegetation, and surrounding landscape parameters. The range of scores is 25 to 100, and higher scores indicate a higher-quality physical habitat. The highest-quality physical habitats were at SGUT-501–San Gabriel River and 6–Arroyo Seco with CRAM scores of 85 each. The poorest quality physical habitat was at SMC01640–Las Virgenes Creek with a CRAM score of 27.

Table 3. Parameters Used to Characterize the Physical Habitat of a Stream Reach

Parameter	Conditions Assessed	Optimal Conditions
Epifaunal substrate/cover*	The percentage of substrate favorable for epifaunal colonization. Most favorable is a mix of snags, submerged logs, undercut banks, cobble, and other stable habitats.	Complex mix of stable substrates occupying a high percentage of the stream bottom.
Embeddedness	The percentage of fine sediment surrounding gravel, cobble, and boulder particles.	Very little embeddedness, with layered substrate.
Flow habitats	Flow habitats are classified as cascades, rapids, riffles, runs, glides, and pools.	A mix of all regimes, dominated by riffles.
Sediment deposition*	The percentage of bottom affected by the deposition of new gravel, sand, or fine sediment.	Little or no new deposition, less than 5% of the bottom affected.
Channel flow	The percentage of the stream channel filled by flowing water and the amount of substrate covered.	Water reaches base of both lower banks and minimal amount of substrate is exposed.
Channel alteration*	The amount of channelization, dredging, embankments, or shoring structures present.	Channelization or dredging absent or minimal; stream with normal pattern.
Riffle frequency	The frequency of occurrence of riffle habitat.	Occurrence of riffles frequent, with variety of habitat.
Bank stability	Evidence of erosion or bank failure.	Evidence of erosion and bank failure absent or minimal.
Vegetative protection	The percent cover by undisturbed, native vegetation on the streambank surfaces and immediate riparian zones.	More than 90% of the streambank surfaces covered by native vegetation.
Riparian vegetative zone width and canopy cover	The width of native riparian vegetation along both streambanks and the amount of overhanging vegetation above the streambed providing shade and coarse organic matter.	Width of riparian zone more than 18 m; human activities have not impacted zone. Canopy covers majority of streambed.

Source: CSBP, 1999
*Retained by SWAMP procedure

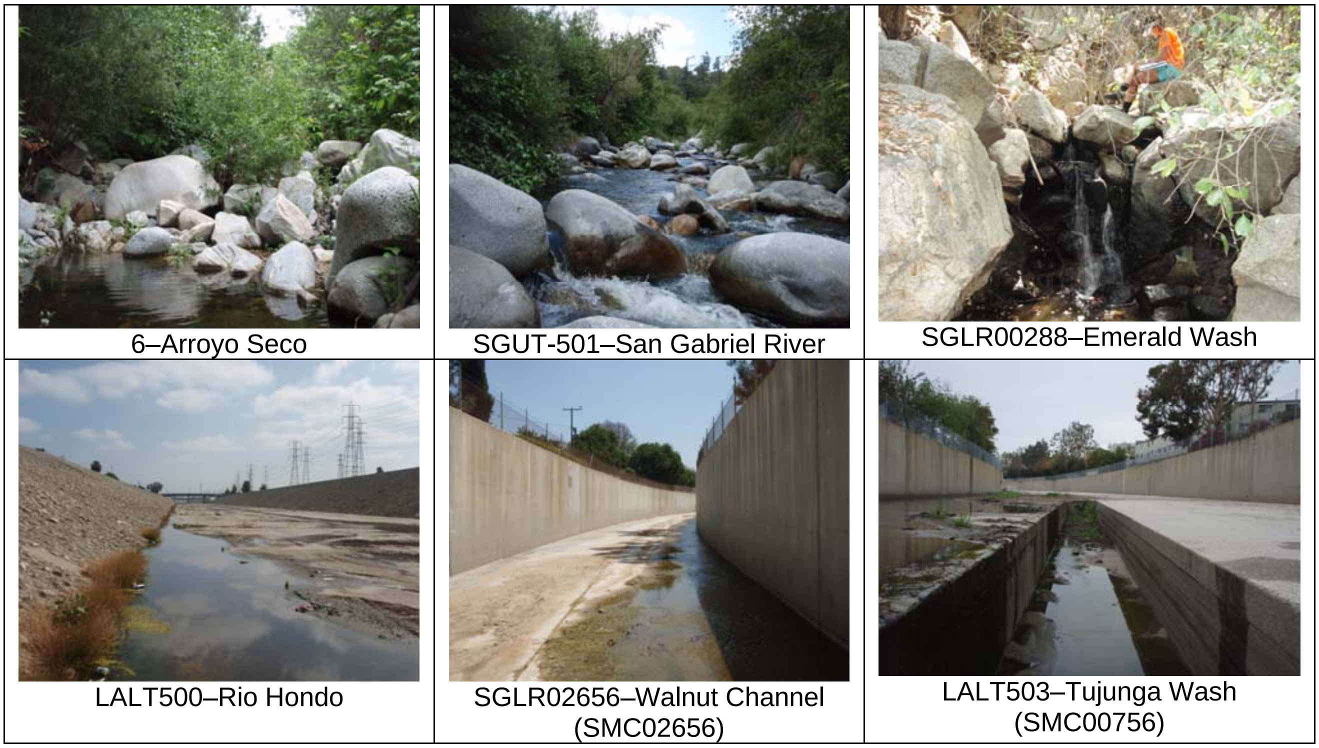


Figure 3. Examples of Good Physical Habitat Conditions (top row) and Poor Physical Habitat Conditions (bottom row)

4.4 2009 Index of Biotic Integrity

In 2004, a Southern California IBI was developed to cover the region extending from southern Monterey County to the Mexican border (Ode et al., 2005). The IBI gives a single quantified score to a site based on a multi-metric evaluation technique, and the scores may be compared across seasons and years of a monitoring program to give an indication of trends over time. The CDFG developed the IBI based on a multi-year, comprehensive assessment of reference and non-reference conditions in Southern California to establish an expected range of benthic invertebrate community structure in the region. This IBI may be refined in the future; it has been noted that this IBI may lack strength when assessing low-gradient or low-elevation sites (due to the rarity of reference streams in Southern California with these characteristics).

Ode et al. (2005) selected seven metrics that showed a strong and predictable response to ecological impacts and stressors to calculate the IBI (Table 4). The seven metrics include number coleoptera taxa, number EPT taxa, number predator taxa, percent collector–filterers plus collector–gatherers, percent intolerant individuals, percent non-insect taxa, and percent tolerant taxa. Each metric value was assigned a score from 0 to 10 (e.g., if there were four Coleoptera taxa in a sample, the metric score would be 7). The scores were added to provide a final IBI score; the highest possible total score was 70. This score may be normalized to a scale ranging from 0 to 100; the raw IBI scores are presented in this report. Each final score was then classified into rating categories ranging from Very Poor to Very Good. Table 4 shows the metric scoring ranges and rating categories for the Southern California IBI.

Table 4. Index of Biotic Integrity Scoring Ranges

Metric Score	Number Coleoptera Taxa	Number EPT Taxa	Number Predator Taxa	Percent CF and CG Individuals	Percent Intolerant Individuals	Percent Non-Insect Taxa	Percent Tolerant Taxa
10	>5	>17	>12	0–59	25–100	0–8	0–4
9		16–17	12	60–63	23–24	9–12	5–8
8	5	15	11	64–67	21–22	13–17	9–12
7	4	13–14	10	68–71	19–20	18–21	13–16
6		11–12	9	72–75	16–18	22–25	17–19
5	3	9–10	8	76–80	13–15	26–29	20–22
4	2	7–8	7	81–84	10–12	30–34	23–25
3		5–6	6	85–88	7–9	35–38	26–29
2	1	4	5	89–92	4–6	39–42	30–33
1		2–3	4	93–96	1–3	43–46	34–37
0	0	0–1	0–3	97–100	0	47–100	38–100
Cumulative Ratings: Very Poor: 0–13 Poor: 14–26 Fair: 27–40 Good: 41–55 Very Good: 56–70							

Source: Ode et al., 2005

The IBI is effective for broadly identifying impairment, and the boundary between Fair and Poor (i.e., an IBI score of 26) is considered the threshold for impairment. It must be noted that small differences in IBI scores are not significant and may be due to natural biological variability within a stream reach. Ode et al. (2005) determined that the minimum detectable difference between IBI scores is approximately 9 points (on the 0–70-point scale). This implies that at least a 9-point difference between two site scores is necessary to determine if one is of significantly higher quality than the other.

The total IBI scores for each monitoring reach are shown on Figure 4 and Figure 5. A complete list of the IBI metric values, individual IBI scores, and total IBI scores are presented in Appendix B.6.

The 22 monitoring sites in the County had IBI ratings ranging from Very Poor to Very Good with IBI scores ranging from 1 to 62, with a maximum possible IBI score of 70. Seven of the sites were rated above the level of impairment (i.e., Fair, Good, or Very Good), and three sites were within one or two points of the impairment threshold. SGUT-501–San Gabriel River was the highest-rated site and was the only one rated Very Good. Ten of the sites were rated Very Poor. Eight of these were in fully concrete-lined channels, and the other two were natural bottom streams within a concrete channel.

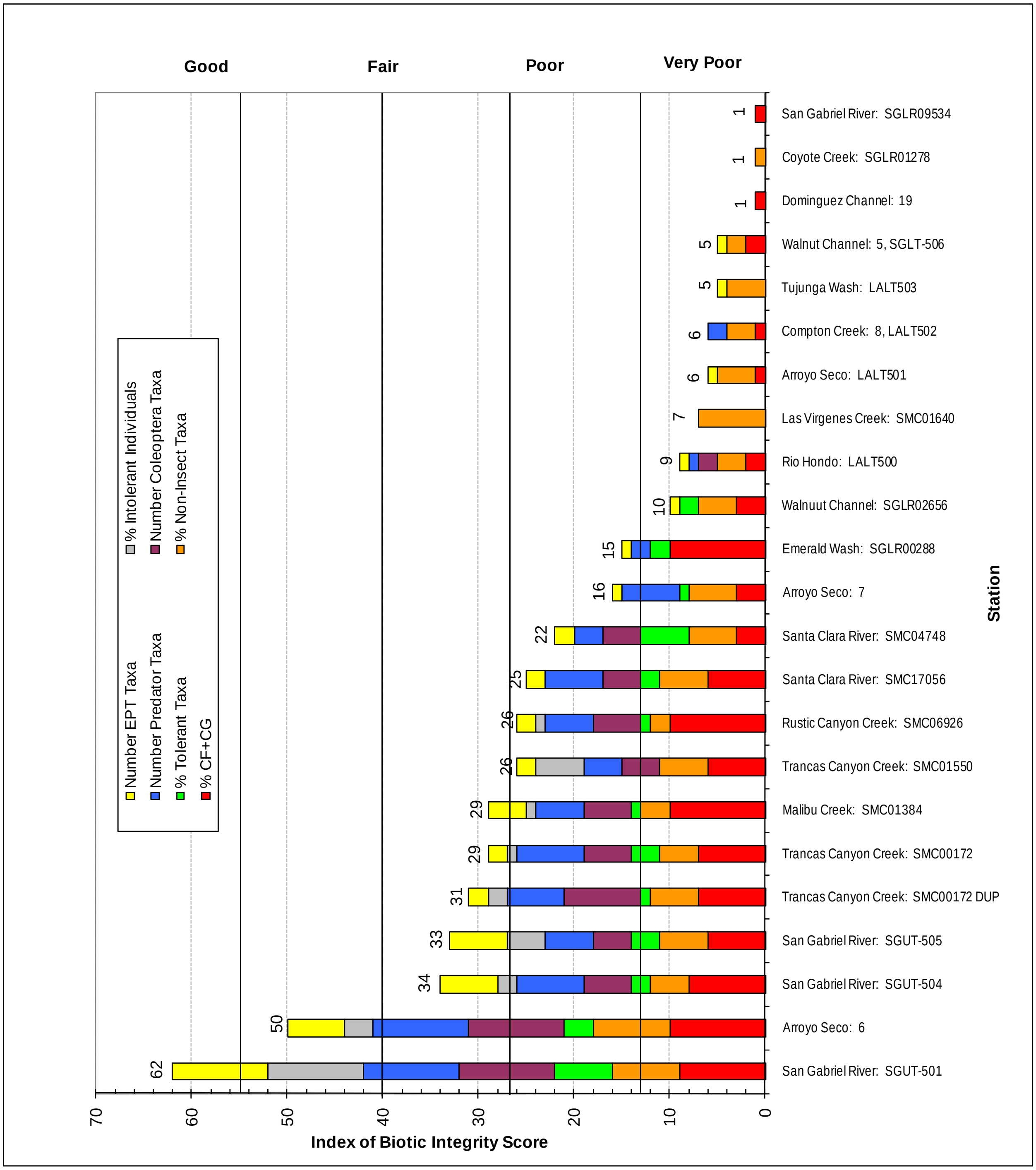


Figure 4. Index Biotic Integrity Scores for Los Angeles County Bioassessment Sites for 2009 (0–70 scale)

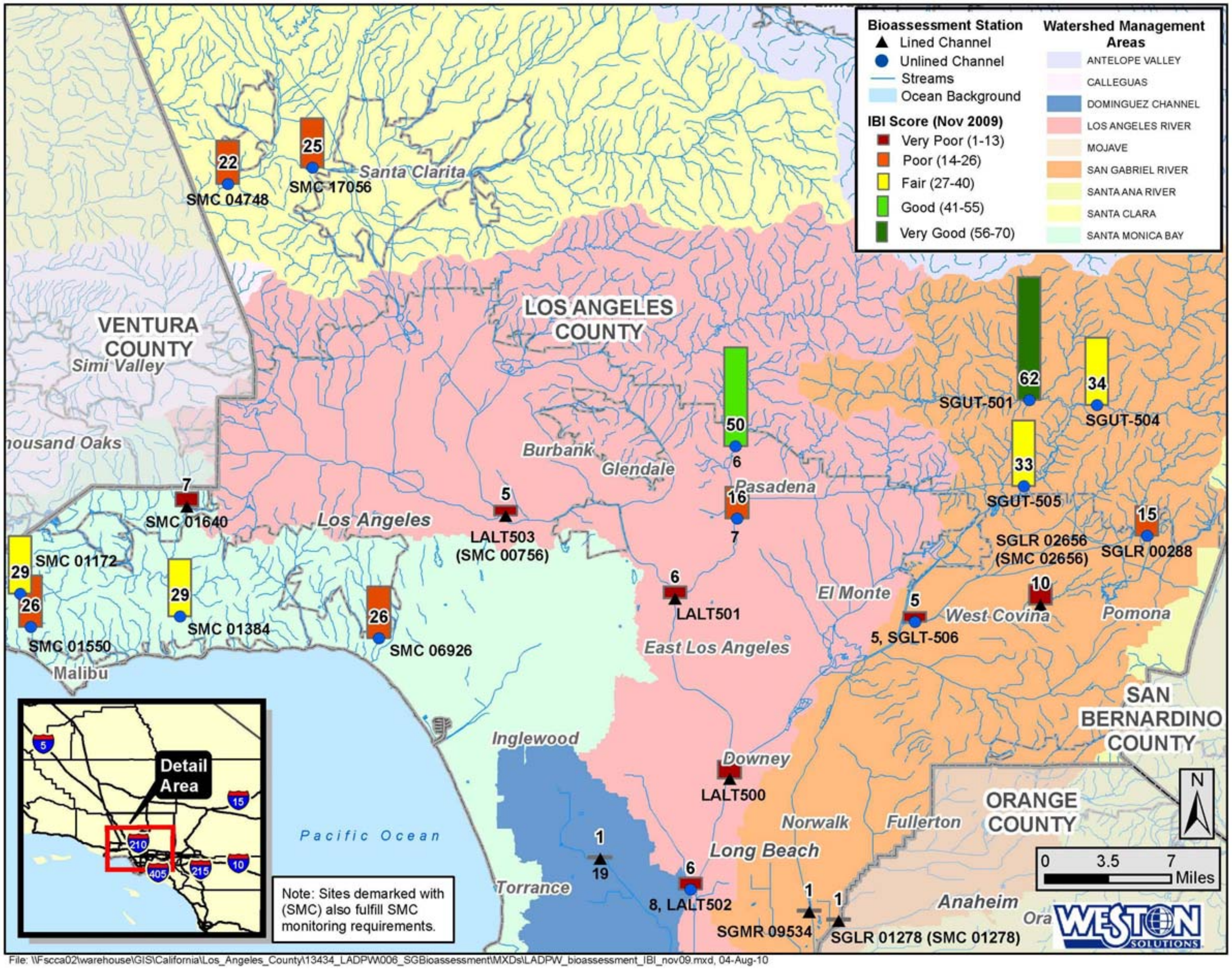


Figure 5. Stream Bioassessment Monitoring Locations with Index of Biotic Integrity Scores per Site for 2009

Comparison of Concrete-Lined Channels and Unlined Channels

In the 2009 survey, eight sites were located in concrete-lined channels, including three sites in the San Gabriel River Watershed: SGLR01278 (SMC01278), SGLR02656 (SMC02656), and SGMR09534, three sites in the Los Angeles River Watershed: LALT500, LALT501, and LALT503 (SMC00756), one site in Dominguez Channel Watershed: 19, and one site in the SMBW: SMC01640. A concrete substrate is considered inferior for macroinvertebrate colonization compared to a more complex natural substrate (e.g., substrates with layered cobblestone, plant stems, and wood). The concrete-lined channels generally had minimal coarse organic food sources, lacked riparian canopy, and had uniform water flow characteristics consisting of flat runs rather than true riffles. Concrete-lined channel sites typically have a relatively thick microalgae layer containing detritus and microorganisms, which provide the primary food resources for macroinvertebrates in this habitat type.

In 2009, the concrete-lined channel sites had IBI scores of 10 or less and benthic quality ratings of Very Poor (Figure 6). It is reasonable to infer that the poorer-quality physical habitats of the concrete-lined channel sites had a deleterious effect on benthic community quality and the IBI scores in the lower watershed stream reaches, but since these sites were dominated by urban runoff, water quality may have had an additional impact.

To determine if the IBI scores for unlined sites were statistically different from IBI scores at concrete-lined sites, the Wilcoxon Ranked Sum test was used and is presented graphically on Figure 7. This test is a non-parametric alternative to the two-sample t-test. Instead of using the actual values of the dataset, ranks of the data are used. More detailed methods are presented in *Biostatistical Analysis* (Zar, 1999). The results for the two groups were compared. The hypothesis was tested at an alpha of 0.05, as follows:

H_0: Unlined = Concrete-Lined
H_a: Unlined ≠ Concrete-Lined

The test was run using all sites, including the reference sites, and no exclusions were made based on location (i.e., upper or lower) in the watershed.

The results of the analysis indicated that in both scenarios the null hypothesis was rejected, and the alternate was accepted. This means that the IBI scores at unlined sites were statistically different, overall, than IBI scores at concrete-lined sites with a p-value of 0.005. When the p-value is less than 0.05 the difference is significant; in other words, the chance of having this result is less than 0.5%, and we can safely (or significantly) reject the null hypothesis. On Figure 7, a visual comparison of the two groups is presented. The minimum and maximum IBI scores are indicated by the upper and lower horizontal lines (whiskers), the 25th percentile is represented by the bottom of the shaded box, median is the line near the middle of the box, and the 75th percentile is the top side of the box. The two datasets are significantly different from one another if the mean of one set is higher or lower than the 25th or 75th percentile line of the other set. One version of the analysis does not include reference sites in the unlined group, whereas the other includes reference sites in the unlined group. Without considering reference sites, the mean IBI scores of the urban unlined sites were higher than the 75th percentile (top of the shaded box) of the concrete-lined sites and therefore were rated slightly superior. When reference sites were considered, this difference was increased, and the unlined sites were clearly statistically superior to the concrete-lined sites.

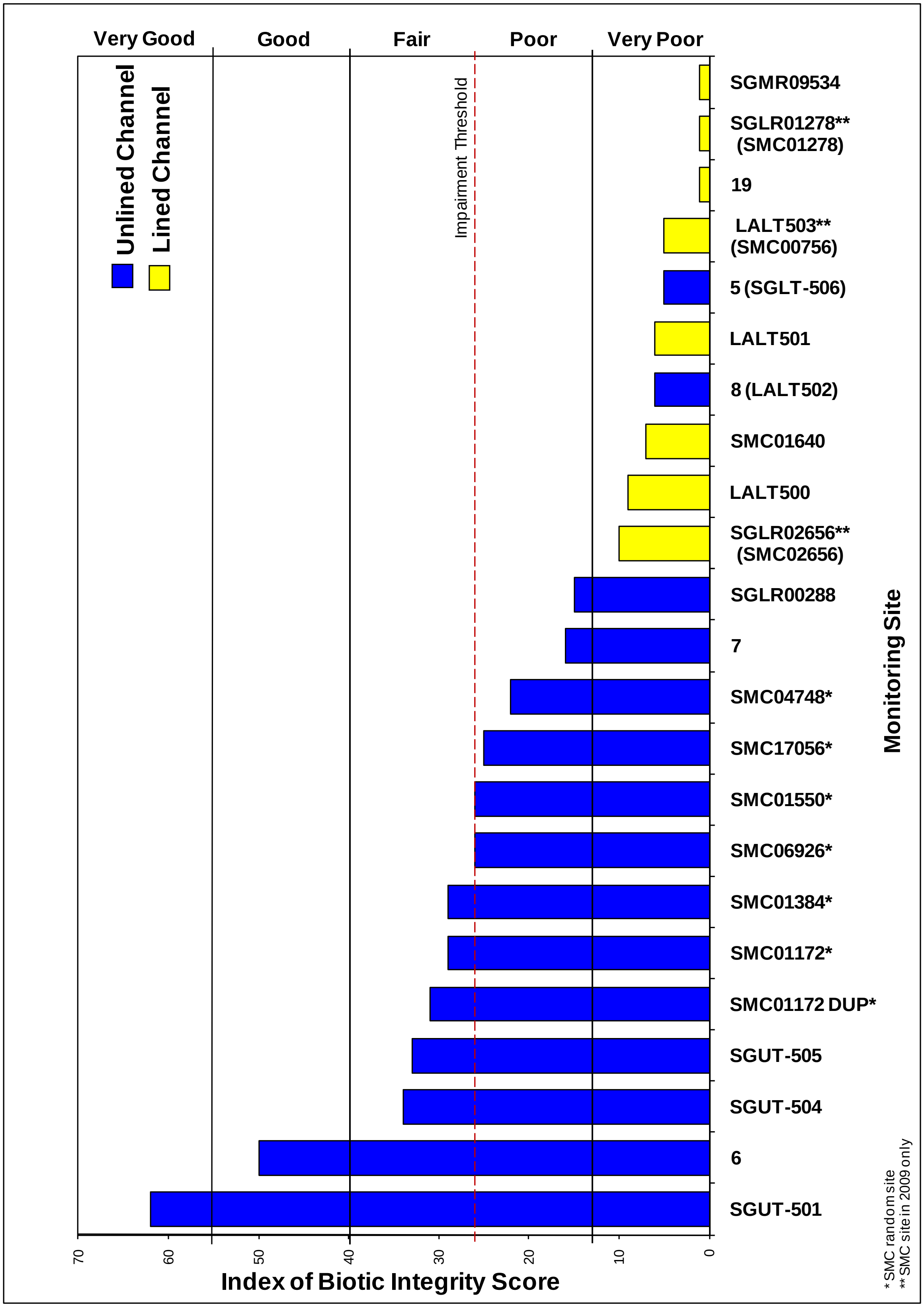


Figure 6. Index Biotic Integrity Scores for Concrete-Lined versus Unlined Channels for 2009 Survey

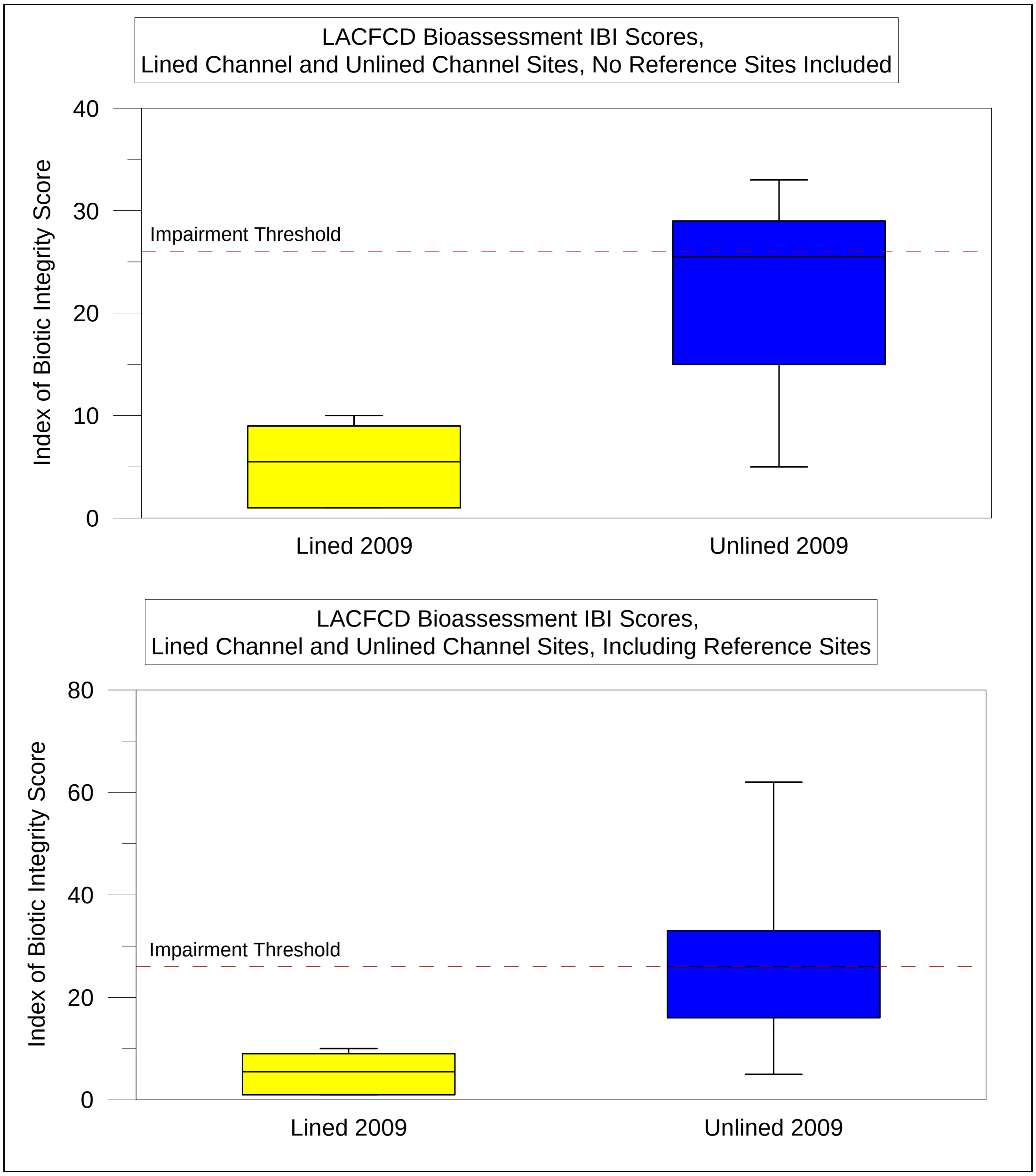


Figure 7. Comparison of Concrete-Lined and Unlined Channel Sites for 2009

Comparison of Index of Biotic Integrity Scores and California Rapid Assessment Method Scores for each Watershed for 2009

To test the relationship between IBI scores and physical habitat, a correlation between the IBI and the CRAM physical habitat scores was performed. Table 5 summarizes the site IBI scores, CRAM scores, and elevations. Figure 8 presents a scatterplot showing the results of the analysis. With an R^2 of 0.577, there was a statistically significant and positive relationship between the physical habitat quality of the sites and the IBI scores. 2009 was the first year CRAM was conducted, so there are no comparisons to be made with previous survey years for CRAM.

Table 5. Site Index of Biotic Integrity Scores, California Rapid Assessment Method Scores, and Elevation of Stream Bioassessment Monitoring Stations for 2009

Site	IBI Score (0–70)	CRAM Score (30–100)	Elevation (ft above sea level)
San Gabriel River Watershed			
SGUT-501*	62	83	1,620
SGUT-504*	50	74	1,512
SGUT-505	33	69	898
5, SGLT-506	5	58	298
SGLR 01278**	1	37	20
SGLR 02656**	10	37	500
SGLR 00288	15	69	1,440
SGMR 09534	1	39	30
Los Angeles River Watershed			
6*	34	85	1,118
7	16	69	725
LALT500	9	37	82
LALT501	6	39	295
8, LALT502	6	47	22
LALT503**	5	37	578
Dominguez Channel Watershed			
19	1	37	3
Santa Monica Bay Watershed			
SMC01172	30	79	1,200
SMC06926	26	42	210
SMC01384	29	83	285
SMC01550	26	85	310
SMC01640	7	27	780
Santa Clara River Watershed			
SMC04748	22	79	1,060
SMC17056	25	69	885

yellow highlight = lined channel site
blue highlight = unlined channel site
*reference site
**contribution to SMC

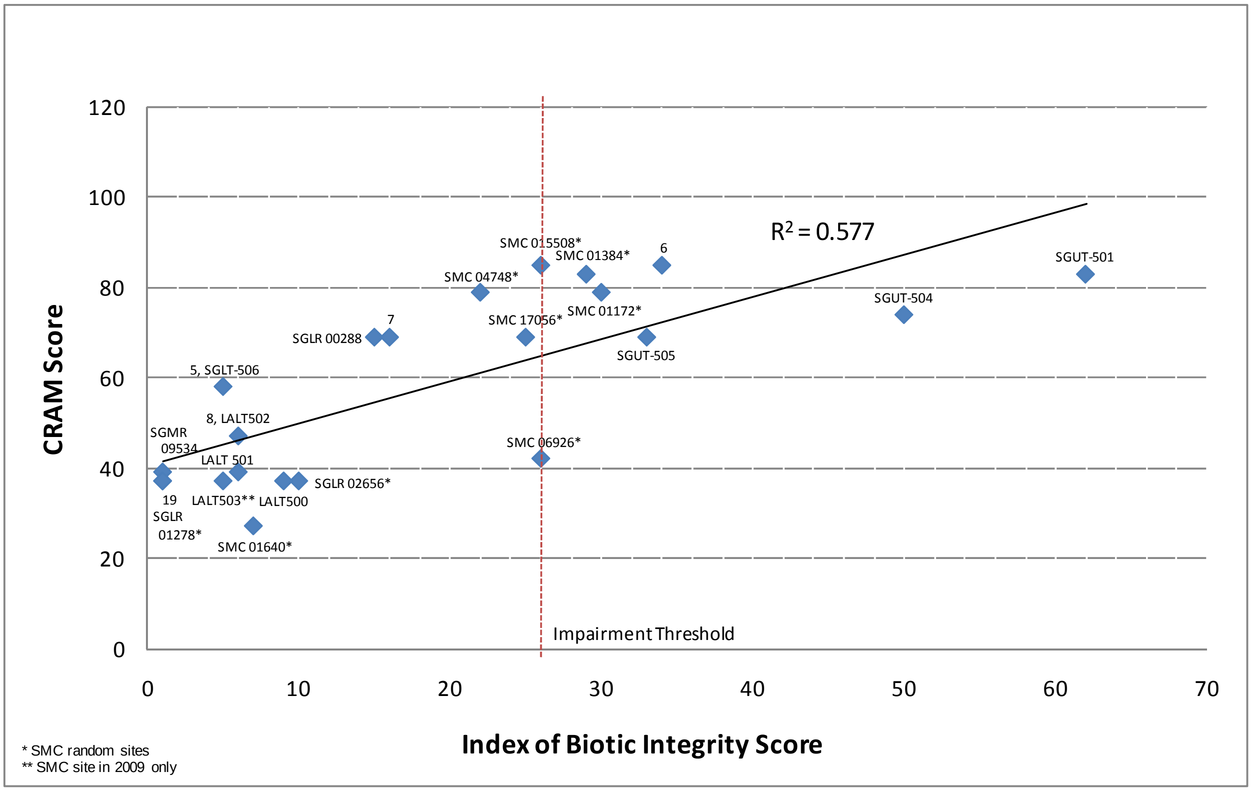


Figure 8. Correlation of California Rapid Assessment Method and Index of Biotic Integrity Scores for 2009

Comparison of Index of Biotic Integrity Scores and Elevation for 2009

To examine the relationship of IBI scores and elevation, a Spearman rank correlation was conducted for 2009 IBI scores versus elevation. The correlation coefficient for 2009 IBI versus elevation was 0.737. The correlation was significant since it was greater than the critical value of 0.415 (alpha of 0.05 (i.e., 95% confidence) and 23 samples). These results indicate that countywide, IBI scores are significantly and positively correlated to elevation per site. 2008 results also supported this correlation (WESTON, 2009).

Cluster Analysis

A cluster analysis was performed to test for similarities between site location and BMI community structure. The analysis is based on a two-way Bray–Curtis similarity matrix calculated on relative abundances of taxa by site. Sites with similar communities of taxa will cluster together; likewise, taxa that occur at the same sites will cluster together. The analysis only considers the taxa and sites and is independent of other factors such as channel type, elevation, or organism tolerance.

The 2009 results are portrayed in a two-way table that shows the relative abundance of each taxon by site (Appendix B.7). Results of the cluster analysis showed five major taxa clusters and four site clusters, labeled 1 through 5 and A through D, respectively, and bounded by bold red lines. The graphic also indicates concrete-lined sites (highlighted yellow), unlined sites (highlighted blue), reference sites (with astericked site names), and the organisms' TVs. The sites are also labeled with elevation codes indicating low (i.e., less than 500 ft above sea level), medium (i.e., 500–1,500 ft above sea level), and high (i.e., above 1,500 ft above sea level) elevations.

Overall site clustering showed that clusters A and B (i.e., reference site and Santa Monica Bay low-elevation site, respectively) had the greatest degree of separation from clusters C and D (i.e., low-elevation urban sites and mid-elevation sites, respectively). These clusters appear closely associated with IBI scores for the sites.

Site cluster A contained the two upper Trancas Canyon Creek samples SMC01772 and SMC01172 DUP, and was the most discreet cluster by taxa. Cluster A was highly associated with taxa cluster 5, which was best represented by the mayfly, *Paraleptophlebia* sp.; Coleoptera, *Agabus* sp., *Hydraena* sp., and *Sanfillipodytes* sp.); and dixid midges, *Dixella* sp. and *Meringodixa chalonensis*.

Site cluster B contained all three reference sites and two of the coastal Santa Monica Bay sites. Cluster B was most associated with taxa cluster 4, which contained most of the intolerant organisms but was also well represented in all taxa clusters.

Site cluster C contained all of the concrete-lined channel sites and other lower-elevation urban sites. Cluster C was most associated with taxa clusters 1 and 3, which contined many ubiquitous organisms (cluster 1) that were common to a wide range of sites and many of the higher tolerance organisms (cluster 3).

Site cluster D contained the two Santa Clara River sites, the Malibu Creek site and the upper San Gabriel River site below Morris Dam. Cluster D was most associated with taxa cluster 2, particularly the hydrophilid beetles, *Enochrus* sp., *Laccobius* sp., and *Tropisternus* sp. and the damselfly, *Hetaeriana americana*.

Comparison of the 2009 cluster analysis with previous years' cluster analysis (Appendix B.8) showed that there has been a consistent pattern of three cluster types (i.e., reference sites, urban unlined sites, and concrete-lined sites).

4.5 All Watersheds' Survey Results for 2003–2009

Study information from 2003 through 2008 (BonTerra, 2004; WESTON, 2005; WESTON, 2006; WESTON, 2007; WESTON, 2008; WESTON, 2009) was compared to the 2009 data to assess year-to-year variance and trends in biotic integrity of the streams. Regional macroinvertebrate community structure was relatively similar in the first six survey years (i.e., years prior to 2009), and the ten most abundant taxa remained fairly consistent. Additionally, sites with unique, high-quality communities (e.g., 6–Arroyo Seco and 17–Cold Creek) also showed year-to-year taxonomic consistency. Historically, the 2008 survey collected the greatest number of unique taxa studywide (i.e., 99) compared with 94 in 2007, 96 in 2006, 81 in 2005, 73 in 2004, and 88 in 2003. Countywide taxa richness in 2009 was 146, but, because of increased taxonomic effort to SAFIT Level II (per SMC protocols), this value is not comparable to the historical surveys. Because of this, the 2009 taxa richness values were re-calculated using the Level I taxonomic designations to allow comparison with historical surveys.

Since 2003, 42 sites have been monitored in the Bioassessment Program. Sixteen of these sites have been in concrete-lined channels. Figure 9 shows the IBI scores for all sites and all years of monitoring, with concrete-lined sites highlighted in yellow and unlined sites highlighted in blue. Each bar in Figure 9 represents one year's IBI results, in chronological order, from left to right for each site, with a maximum of seven bars per site.

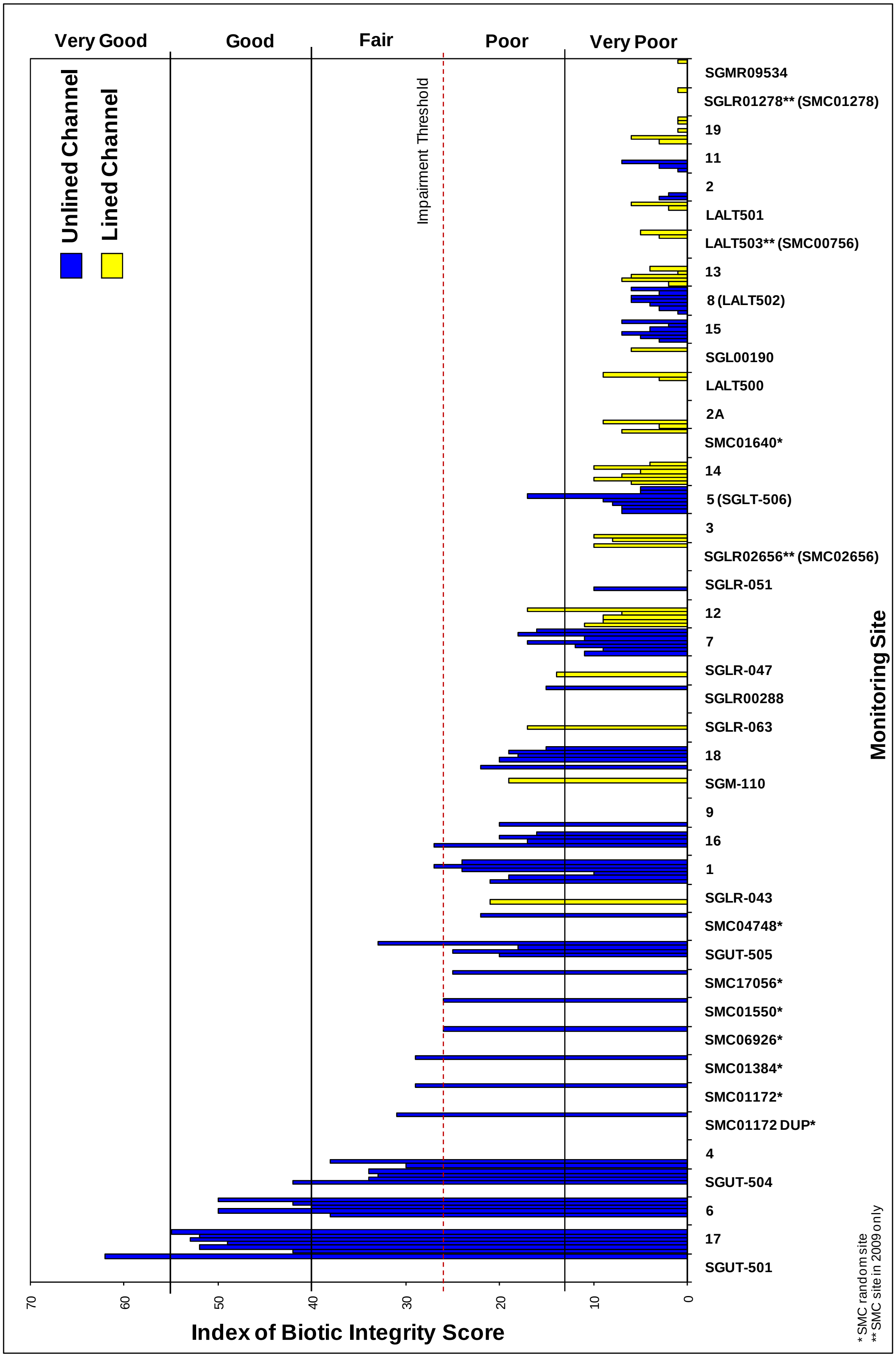


Figure 9. Index of Biotic Integrity Scores for Concrete-Lined versus Unlined Channels, All Watersheds for 2003–2009

The Wilcoxon Ranked Sum test was run with no exclusions based on location (i.e., upper or lower) in the watershed. The associated p-value was less than 0.000, indicating that the mean IBI scores of the concrete-lined sites were statistically lower than the unlined sites (p-value less than 0.05 is significant).

Using a whisker–box plot to compare the two channel types, the mean 2003–2009 IBI scores of the unlined sites were slightly superior to the concrete-lined sites in the lower watershed (Figure 10). When the reference sites were added to the analysis, a greater difference between site types resulted; mean IBI scores of unlined sites were significantly superior to those of the concrete-lined sites.

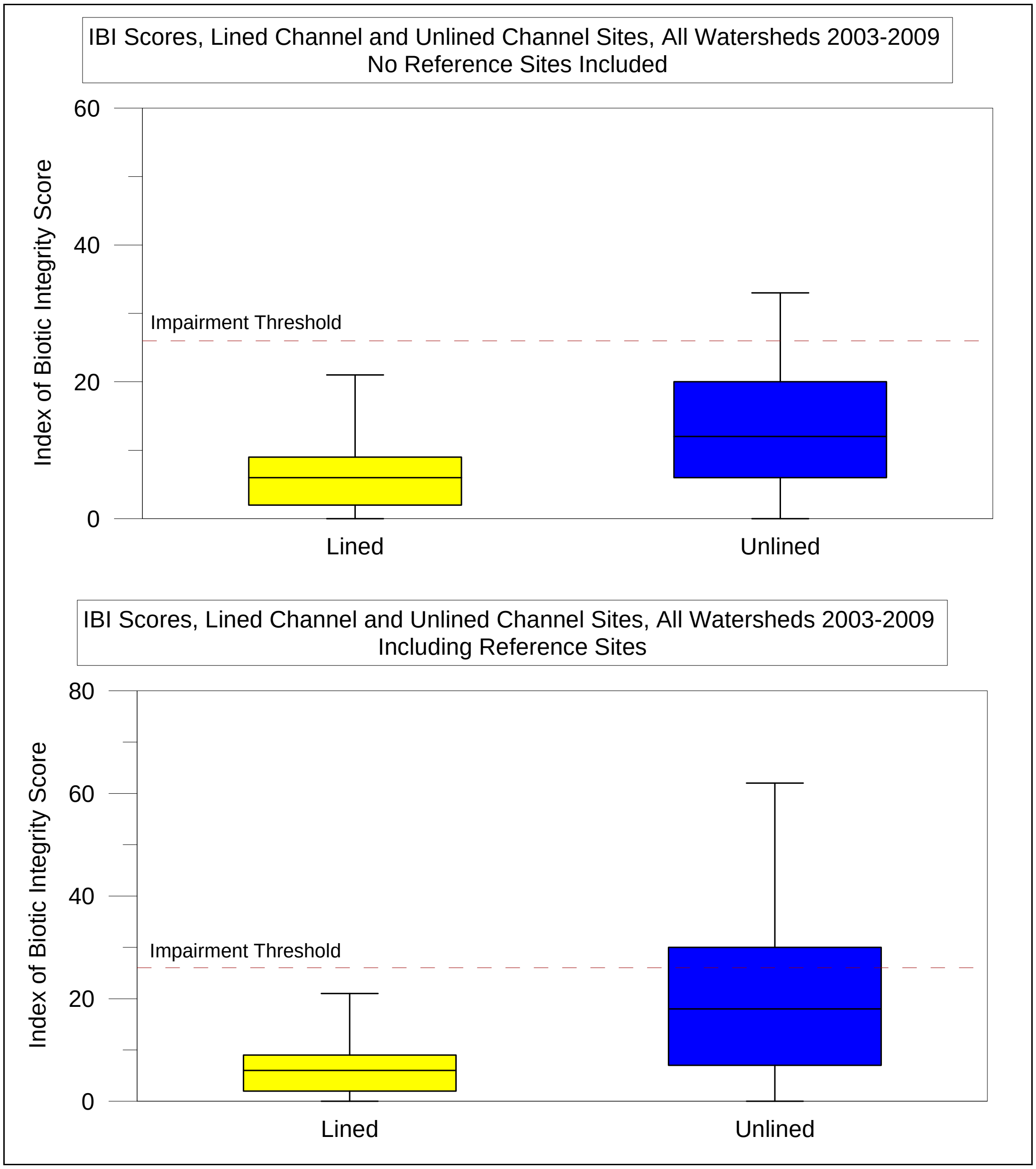


Figure 10. Comparison of Concrete-Lined and Unlined Channel Sites, All Watersheds for 2003–2009

Comparison of Index of Biotic Integrity Scores and Elevation for 2003–2009

To examine the relationship of IBI scores and elevation, a Spearman rank correlation was conducted for IBI score versus elevation. The correlation coefficient for IBI versus elevation was 0.536. The correlation was significant based on a critical value of 0.178 (119 samples and an alpha of 0.05). These results indicate that site IBI scores were significantly correlated to elevation on a countywide basis through time.

Cluster Analysis for 2003–2009

A cluster analysis was performed to test for similarities between site location and BMI community structure. The analysis was performed as described in Subsection 4.4 above. The similarity matrix is shown in Appendix B.8.

Overall results of the analysis of the whole time span were similar to the 2009 results with five major taxa clusters and four site clusters, labeled 1 through 5 and A through D, respectively. This analysis confirmed that the BMI communities are different based on their location in the watershed and their channel type. The site clusters fell into two general groups, with clusters A and B containing low to mid-elevation urban sites plus the concrete-lined channel sites, whereas clusters C and D contained the reference sites and less developed mid-elevation sites. The taxa clusters were also in two general groups, with clusters 1, 2, and 3 containing the ubiquitous and/or highly tolerant taxa, whereas clusters 4 and 5 contained nearly all of the intolerant (sensitive) taxa.

The BMI assemblages and IBI scores of the sites also confirmed that the less urbanized portions of the watersheds and the unlined sites (clusters C and D) were of superior quality. Site clusters C and D contained the intolerant taxa of taxa clusters 4 and 5, best characterized by the caddisflies, *Agapetus* sp., *Tinodes* sp., and *Wormaldia* sp.; mayflies, *Serratella* sp. and *Epeorus* sp.; and stoneflies, *Calineuria californica* and *Malenka* sp. 18–Triunfo Creek was the one site in cluster A that had a substantial number of taxa in taxa cluster 4, which was more characteristic of site clusters C and D. Additionally, the sites in clusters C and D had higher IBI scores than clusters A and B.

5.0 2003–2009 SURVEY RESULTS BY WATERSHED

Study information from 2003 through 2008 (BonTerra, 2004; WESTON, 2005; WESTON, 2006; WESTON, 2007; WESTON, 2008; WESTON, 2009) was compared to the 2009 data to assess the year-to-year variance and trends in biotic integrity of the streams. For these multi-year historical analyses, each watershed is considered separately. Targeted monitoring reaches were relocated very close to previous years' surveys and were historically sampled at the same time of year (mid-fall), except for the four San Gabriel River Watershed sites, sampled in June 2008, and all 2009 sites, sampled in June and July. Analyses for each watershed are presented in subsections 5.1 through 5.5.

One site, 19–Dominguez Channel, was moved approximately 0.5 mile upstream in 2006 due to high salinity (tidal influence) detected at the original site. Since the Bioassessment Program's inception in 2003, many of the original fixed monitoring sites have also been relocated to accommodate other watershed-specific monitoring programs, including the SMC Regional Bioassessment Program. Some of these sites have switched from a fixed or targeted location to a randomly (or stratified random) selected site. Random sites have typically been sampled for a single year and were then relocated the following year. Therefore, multi-year trends may not be assessed for a number of sites in some watersheds.

5.1 San Gabriel River Watershed Survey Results for 2003–2009

The San Gabriel River Watershed has been sampled in 18 different locations from 2003 through 2009 (Figure 11). One site, 5, SGLT-506–Walnut Channel, has been sampled in all seven surveys, but the remaining sites have been sampled a maximum of four times, and many sites have been sampled only once. Sites with "SG" in the site code prefix were offset sites for the SGRRMP study, and two of these sites, SGLR01278 (SMC01278) and SGLR02656 (SMC02656), were also designated SMC sites.

The watershed is somewhat unique in that it lacks full hydrologic connectivity between the upper and lower watershed areas, and these two areas are very different in terms of geography and land use. The upper watershed is largely in the Angeles National Forest, is sparsely populated, and has many high-gradient natural streams. The lower watershed is highly urbanized with low-gradient streams, many of which have been modified through channelization for flood control. Separating the upper and lower watershed areas are several "spreading grounds" that retain water for groundwater recharge. The bioassessment monitoring sites have signaled this difference with higher IBI scores (Figure 12) and better physical habitat rankings for the upper watershed sites: 4, SGUT-501, SGUT-504, and SGUT-505.

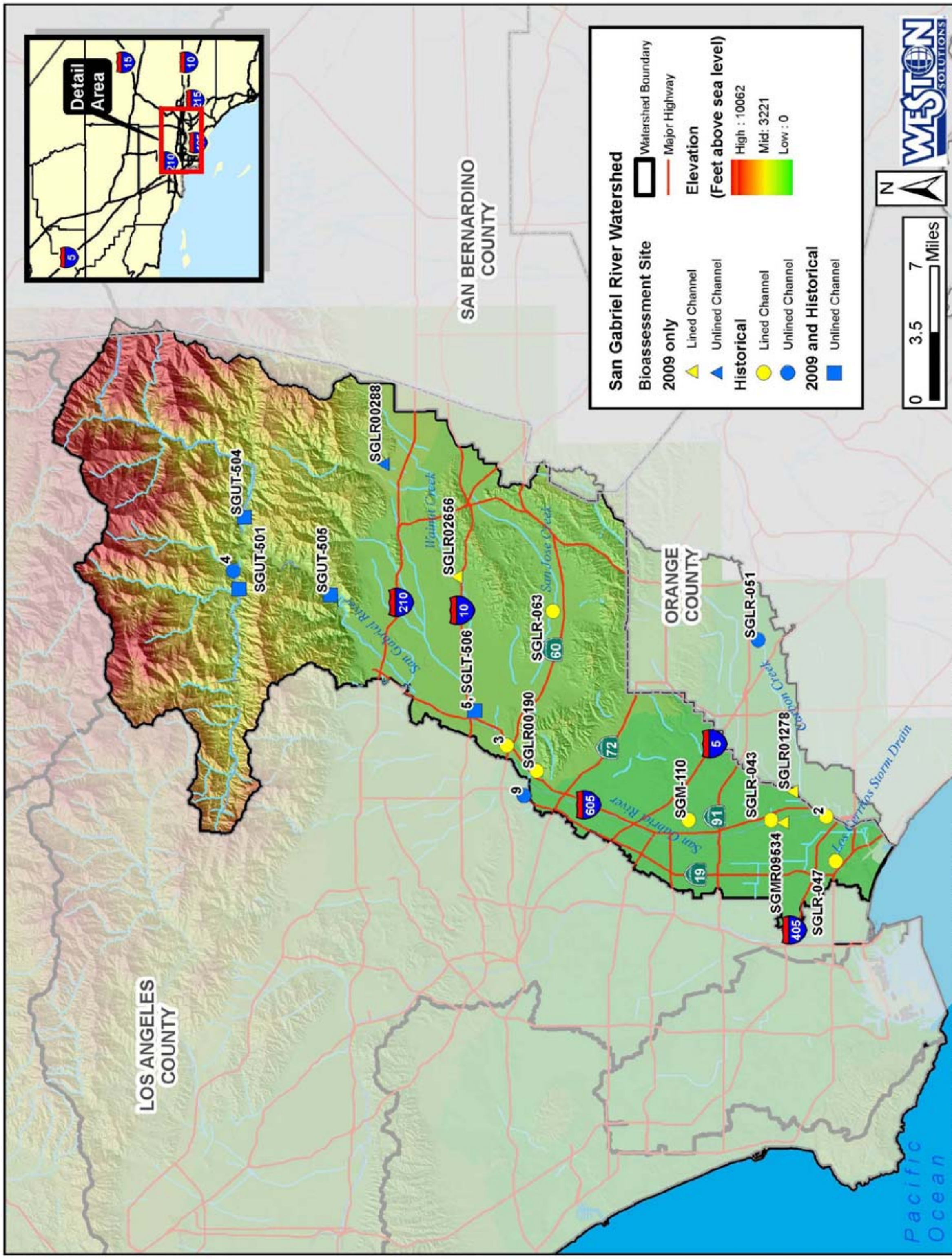


Figure 11. Bioassessment Monitoring Sites in the San Gabriel River Watershed for 2003–2009

Mean Metric Analysis for 2003–2009

Table 6 shows the mean biological metric values of four individual metrics that are considered strong indicators of ecological health. Concrete-lined channel sites are highlighted in yellow, and unlined channel sites are highlighted in blue. Reference sites are signified with an asterisk following their site names. For consistency with historical surveys, the 2009 taxa richness values were adjusted to taxonomic Level I from Level II, for their comparison with previous data.

SGUT-501–San Gabriel River biological metric values indicated a substantially higher-quality benthic community than at any other site. Values for mean taxa richness and EPT taxa were nearly double the next highest values at SGUT-504–San Gabriel River, and the percent intolerant taxa was over four times greater. There was a clear difference between the lower and upper watershed sites. The lower watershed sites had a maximum mean taxa richness of 15.0, whereas taxa richness in the upper watershed sites ranged from 24.0 to 50.0. The maximum mean number of EPT taxa in the lower watershed was 3, whereas in the upper watershed the mean number EPT taxa ranged from 9.8 to 24.0. Intolerant taxa were absent from all lower watershed sites and comprised from 3.1–36.8% of the benthic community in the upper watershed. The percent collector–filterers plus collector–gatherers (i.e., collector taxa) ranged from 50.6% at SGLR00288 to 100.0% at SGM-110. The ubiquity of these organisms means that the metric is not always an accurate indicator of impairment, and based on the IBI scoring ranges, a percentage of less than 80% collector taxa is indicative of Good biotic conditions. The reference sites in the watershed ranged from 59.2–85.0% collectors.

Table 6. San Gabriel River Watershed Selected Metric Values, Mean of Annual Surveys for 2003–2009

Monitoring Reach	Site Code	Number Samples	Taxa Richness**	EPT Taxa	Percent Intolerant Taxa	Percent Collector–Filterers plus Collector–Gatherers
Coyote Creek	2	2	11.0	2.3	0%	92.7%
San Jose Creek	3	2	10.5	2.0	0%	84.0%
San Gabriel River	4*	2	24.0	12.0	3.1%	85.0%
Zone 1 Ditch	9	1	21	5	0%	74.0%
San Gabriel River	SGUT-501*	1	50	24	36.8%	59.2%
San Gabriel River	SGUT-504*	4	26.7	12.0	8.2%	74.6%
San Gabriel River	SGUT-505	4	25.7	9.8	4.3%	72.1%
Walnut Channel	5, SGLT-506	7	13.6	2.0	0%	86.0%
San Gabriel River	SGL00190	1	7	0	0%	73.5%
San Gabriel River	SGLR-043	1	13	0	0%	74.0%
San Gabriel River	SGLR-047	1	11	0	0%	90.0%
Carbon Creek	SGLR-051	1	15	3	0%	72.0%
San Gabriel River	SGLR-063	1	14	3	0%	79.4%
San Gabriel River	SGM-110	1	4	1	0%	100.0%
San Gabriel River	SGLR01278 (SMC01278)	1	9	1	0%	97.2%
San Gabriel River	SGLR02656 (SMC02656)	1	11	3	0%	81.6%
San Gabriel River	SGLR00288	1	14	2	0%	50.6%
San Gabriel River	SGMR09534	1	10	1	0%	95.8%

Yellow highlight = concrete-lined channel site
Blue highlight = unlined channel site
*Reference site
**2009 taxa richness values adjusted from Level II to Level I taxonomy.

Comparison of Index of Biotic Integrity Scores for 2003–2009

SGUT-501–San Gabriel River was the highest ranking site (Table 7). It was also at the highest elevation and had the coldest water temperature and lowest specific conductivity out of all the San Gabriel River Watershed sites. Of all the sites monitored, the three designated reference sites (i.e., SGUT-501, SGUT-504, and 4–San Gabriel River) were rated unimpaired, whereas all others were rated impaired. SGUT-505 was the one site that had IBI scores on both sides of the impairment threshold of 26 points out of a possible 70, with an IBI score of 33 in 2009. None of the sites have shown any consistent upward or downward trends for the sites sampled four or more times (i.e., SGUT-504, SGUT-505, and 5, SGLT-506). The total scoring ranges for these sites was 12 to 13 points, with no consistency among sites for better or worse years (e.g., the highest IBI scores were in 2006, 2009, and 2007 for SGUT-504, SGUT-505, and 5, SGLT-506, respectively).

Table 7. San Gabriel River Watershed, Comparison of Index of Biotic Integrity Scores for 2003–2009

Monitoring Reach	Site Code	IBI Score 2003	IBI Score 2004	IBI Score 2005	IBI Score 2006	IBI Score 2007	IBI Score 2008	IBI Score 2009	Mean IBI Score	IBI Range
San Gabriel River	SGUT-501*							62	62.0	NA
San Gabriel River	SGUT-504*				42	34	33	34	35.8	8
San Gabriel River	4*	30	38						34.0	8
San Gabriel River	SGUT-505				20	25	18	33	24.0	15
San Gabriel River	SGLR-043			21					21.0	NA
Zone 1 Ditch	9	20							20.0	NA
San Gabriel River	SGM-110					19			19.0	NA
San Gabriel River	SGLR-063				17				17.0	NA
San Gabriel River	SGLR00288							15	15.0	NA
San Gabriel River	SGLR-047			14					14.0	NA
San Gabriel River	SGLR-051			10					10.0	NA
San Gabriel River	SGLR02656 (SMC02656)							10	10.0	NA
San Jose Creek	3	8	10						9.0	2
Walnut Channel	5, SGLT-506	7	7	8	9	17	5	5	8.3	12
Coyote Creek	2	3	9						6.0	6
San Gabriel River	SGL00190						6		6.0	NA
San Gabriel River	SGLR01278 (SMC01278)							1	1.0	NA
San Gabriel River	SGMR09534							1	1.0	NA

*Reference site
Yellow highlight = concrete-lined channel site
Blue highlight = unlined channel site

Comparison of Concrete-Lined Channels and Unlined Channels for 2003–2009

All of the concrete-lined channel sites monitored in the San Gabriel River Watershed were in the lower watershed. A majority of these were sampled one year only and all had IBI scores under 26, indicating impaired biotic integrity (Figure 12). The Wilcoxon Ranked Sum test was run with and without the reference sites, and no exclusions were made based on location (i.e., upper or lower) in the watershed. When reference sites were excluded, a p-value of 0.131 resulted, and the mean IBI scores of the concrete-lined sites were not statistically lower than the unlined sites in the lower watershed (p-value less than 0.05 is significant (i.e., the chance of having this result is less than 0.5%), and we can safely (or significantly) reject the null hypothesis). When reference sites from the upper watershed were considered, the p-value decreased to 0.013, which signifies that the unlined sites were statistically superior to the concrete-lined sites.

Using a whisker–box plot to compare the two channel types, the mean IBI scores of the concrete-lined sites were similar to the unlined sites in the lower watershed (Figure 13). When the reference sites were added to the analysis, a slightly significant difference between site types resulted (i.e., the median line of unlined sites was above the 75^{th} percentile line of the concrete-lined sites), and the unlined sites were superior to concrete-lined sites.

Comparison of Index of Biotic Integrity Scores and Elevation for 2003–2009

To examine the relationship of IBI scores and elevation, a Spearman rank correlation was conducted for IBI score versus elevation. The correlation coefficient for IBI versus elevation was 0.511. The correlation was significant, based on a critical value of 0.356 (31 samples and an alpha of 0.05). These results indicate that site IBI scores were significantly correlated to elevation.

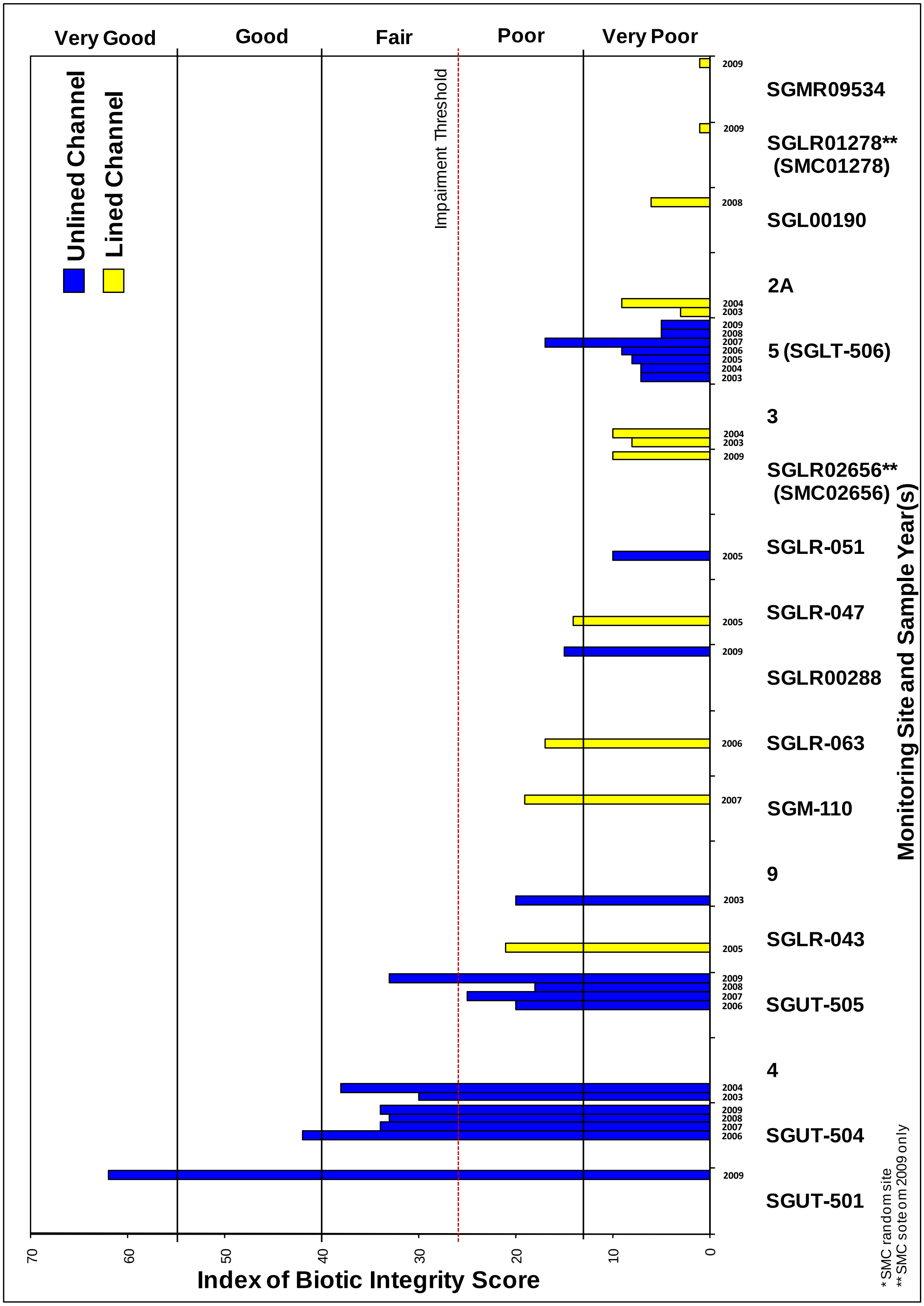


Figure 12. Index of Biotic Integrity Scores for Concrete-Lined and Unlined Channel Sites, San Gabriel River Watershed for 2003–2009

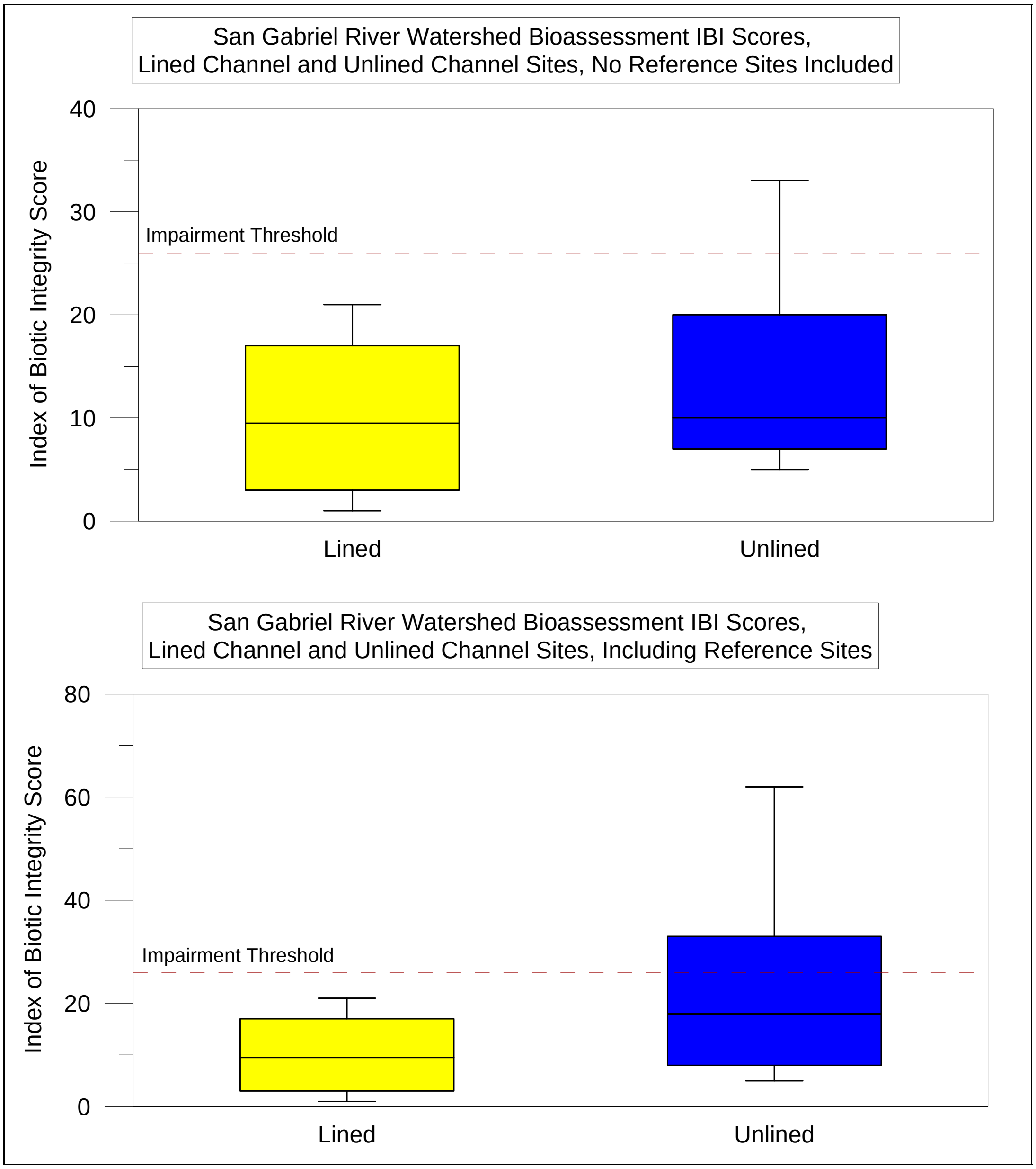


Figure 13. Comparison of Concrete-Lined and Unlined Channel Sites, San Gabriel River Watershed for 2003–2009

5.2 Los Angeles River Watershed Survey Results for 2003–2009

The Los Angeles River Watershed is similar to the San Gabriel River Watershed in that much of the upper watershed is in the Angeles National Forest, whereas the lower watershed is highly urbanized and has been modified with flood control channels, reservoirs, and spreading grounds. The bioassessment monitoring sites have mostly been in the lower watershed, except 6–Arroyo Seco (Figure 14). 6–Arroyo Seco is located near the base of Millard Canyon just above the Arroyo Seco Spreading Grounds and receives little or no urban runoff. The spreading grounds disrupt the hydrologic connectivity such that 7–Arroyo Seco, located approximately 4 miles downstream of 6–Arroyo Seco, is dominated by urban runoff. All other monitoring sites are in highly modified waterways in the lower watershed with either fully or partially concrete-lined channels with relatively intact hydrologic connectivity. Because large areas of wilderness in the upper watershed exist that have not been monitored in the Bioassessment Program, the full range of reference conditions are not represented in this report.

The watershed has been sampled in nine locations from 2003 through 2009. 8, LALT-502–Compton Creek and 7–Arroyo Seco have been sampled in every survey, and all other sites have been sampled at least twice. Sites with “LALT” in the site code prefix were offset sites for the LARWMP study and were sampled in tributaries to the Los Angeles River immediately above their confluence with the Los Angeles River.

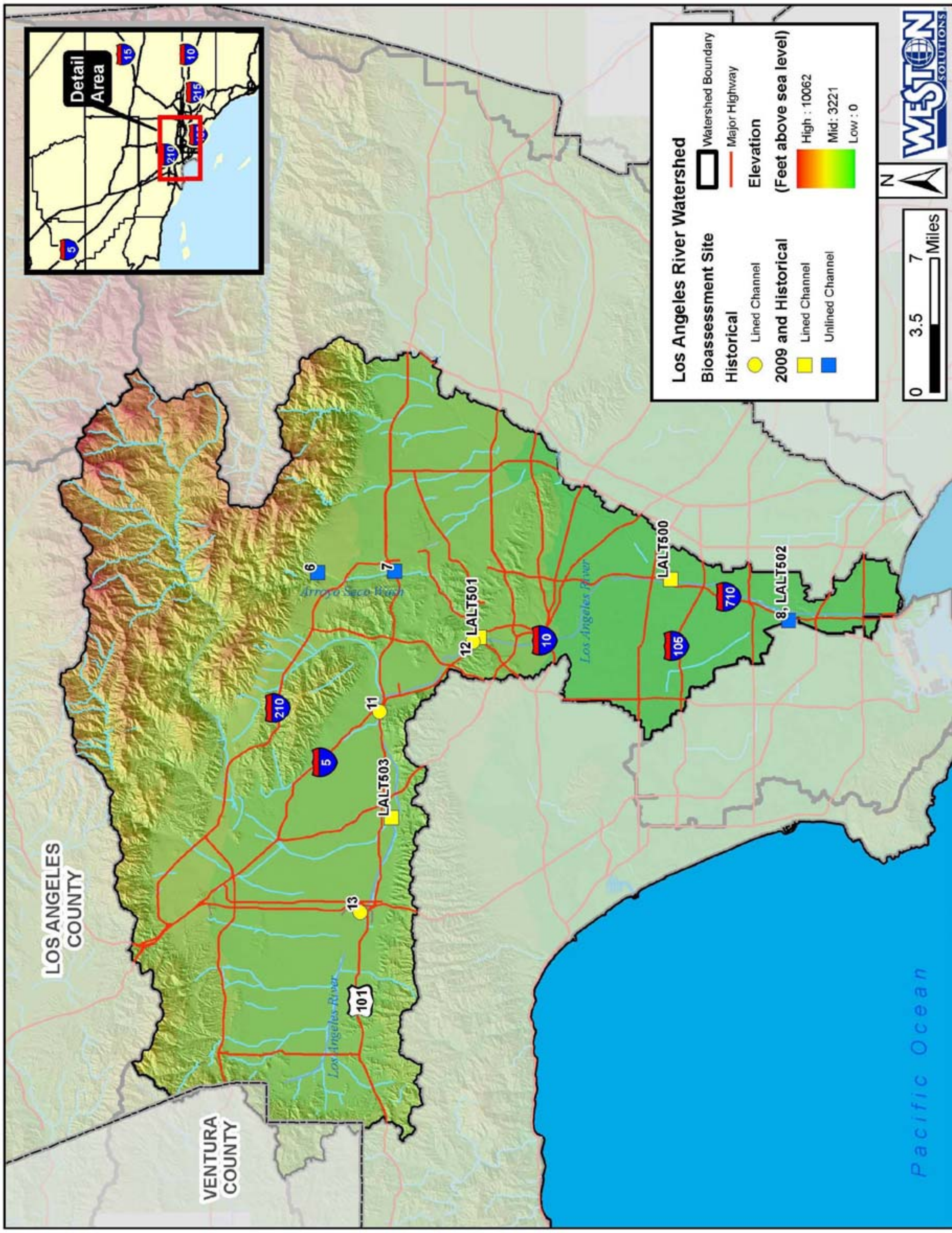


Figure 14. Bioassessment Monitoring Sites in the Los Angeles River Watershed for 2003–2009

Mean Metric Analysis for 2003–2009

Table 8 shows the mean biological metric values of four individual metrics that are considered strong indicators of ecological health. Concrete-lined channel sites are highlighted in yellow, and unlined channel sites are highlighted in blue. Reference sites are signified with an asterisk following their site names. 6–Arroyo Seco biological metric values indicated a higher-quality benthic community than any other site in the watershed. Values for taxa richnes and EPT taxa were substantially higher at 6–Arroyo Seco (35.6 and 11.1, respectively), and it was the only site where intolerant taxa were collected. The lower watershed sites had a maximum mean taxa richness of 15.8 and a maximum mean number of EPT taxa of 3. The mean percent collector–filterers plus collector–gatherers ranged from 84.5–98.4% in the lower watershed and was 49.2% at 6–Arroyo Seco. These metrics indicate Poor biotic conditions in the lower watershed, whereas 6–Arroyo Seco had Good biotic conditions.

Table 8. Los Angeles River Watershed Selected Metric Values, Mean of Annual Surveys for 2003–2009

Monitoring Reach	Site Code	Number Samples	Taxa Richness**	EPT Taxa	Percent Intolerant Taxa	Percent Collector–Filterers plus Collector–Gatherers
Arroyo Seco	6*	5	35.6	11.1	2.9%	49.2%
Arroyo Seco	7	7	15.8	2.8	0%	84.5%
Rio Hondo	LALT500	2	10.5	1.5	0%	93.4%
Arroyo Seco	LALT501	2	13.5	3.0	0%	97.3%
Compton Creek	8, LALT502	7	12.6	1.3	0%	92.1%
Tujunga Wash	LALT503 (SMC00756)	2	11.0	2.0	0%	98.4%
Los Angeles River	11	5	10.0	1.0	0%	98.2%
Los Angeles River	12	5	9.6	2.2	0%	90.3%
Los Angeles River	13	5	11.4	2.0	0%	94.7%

Yellow highlight = concrete-lined channel site
Blue highlight = unlined channel site
*Reference site
**2009 taxa richness values adjusted to Level I taxonomy

Comparison of Index of Biotic Index Scores for 2003–2009

6–Arroyo Seco was the highest-rated site in every survey since the beginning of the Bioassessment Program, with a mean IBI score of 44.0 out of 70 and a quality rating of Good (Table 9). This site also had the greatest range of IBI scores (12 points). All other sites had IBI scores in the Poor and Very Poor range and varied by 9 points or less. 7–Arroyo Seco was the second highest-rated site with a mean IBI score of 13.4 and a quality rating of Poor. 6–Arroyo Seco was the only site that varied greater than the minimum detectable difference of 9 points, and there was no consistent trend toward improvement or degradation at this site.

Table 9. Los Angeles River Watershed, Comparison of Index of Biotic Integrity Scores for 2003–2009

Monitoring Reach	Site Code	IBI Score 2003	IBI Score 2004	IBI Score 2005	IBI Score 2006	IBI Score 2007	IBI Score 2008	IBI Score 2009	Mean IBI Score	IBI Range
Arroyo Seco	6*			38	50	40	42	50	44.0	12
Arroyo Seco	7	11	9	12	17	11	18	16	13.4	9
Los Angeles River	12	11	9	9	7	17			10.6	8
Rio Hondo	LALT500						3	9	6.0	6
Arroyo Seco	LALT501						2	6	4.0	4
Compton Creek	8, LALT502	1	3	4	6	6	3	6	4.1	5
Los Angeles River	13	2	7	6	1	4			4.0	6
Tujunga Wash	LALT503 (SMC00756)						3	5	4.0	2
Los Angeles River	11	1	3	7	0	0			2.2	7

Yellow highlight = concrete-lined channel site
Blue highlight = unlined channel site
*Reference site

Comparison of Concrete-Lined Channels and Unlined Channels for 2003–2009

All of the concrete-lined channel sites monitored in the lower watershed had IBI scores indicating impaired biotic integrity (Figure 15). The Wilcoxon Ranked Sum test was run with and without the reference site. No exclusions were made based on location in the watershed. When reference sites were excluded, the p-value was 0.921, and the mean IBI scores of the concrete-lined sites were not statistically lower than the unlined sites in the lower watershed (p-value less than 0.05 is significant (therefore, the chance of having this result is less than 0.5%), and one can safely (or significantly) reject the null hypothesis). When the reference site from the upper watershed was considered, the p-value decreased to 0.241, but the unlined sites were still statistically similar to the concrete-lined sites; however, had more unlined upper watershed sites been sampled, there would likely have been a significant difference for IBI scores in concrete-lined sites.

Using a whisker–box plot to compare the two channel types, the mean IBI scores of the concrete-lined sites were very similar to the unlined sites in the lower watershed (Figure 16). When the reference site was added to the analysis, a slight difference between site types resulted but not to a level of statistical significance. As with the Wilcoxon Ranked Sum test, this result is skewed by an under-representation of unlined sites in the upper watershed, as the IBI scores of 6–Arroyo Seco are clearly superior to all other sites in the watershed (Figure 15).

Comparison of Index of Biotic Integrity Scores and Elevation for 2003–2009

To examine the relationship of IBI scores and elevation, a Spearman rank correlation was conducted for IBI score versus elevation. The correlation coefficient for IBI versus elevation was 0.585. The correlation was significant based on a critical value of 0.313 (40 samples and an alpha of 0.05). This result indicates that site IBI scores were significantly correlated to elevation.

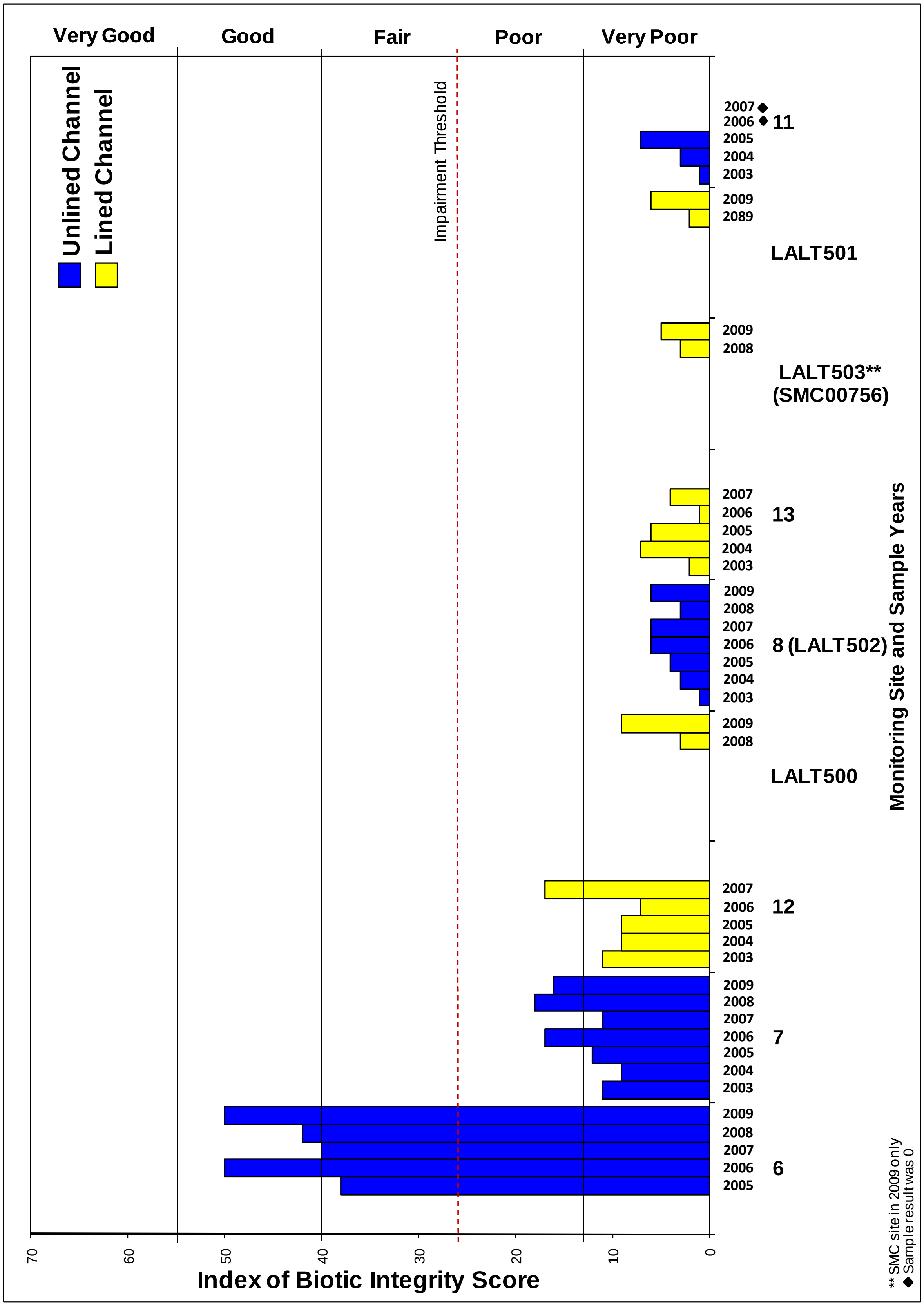


Figure 15. Index of Biotic Integrity Scores for Concrete-Lined and Unlined Channel Sites, Los Angeles River Watershed for 2003–2009

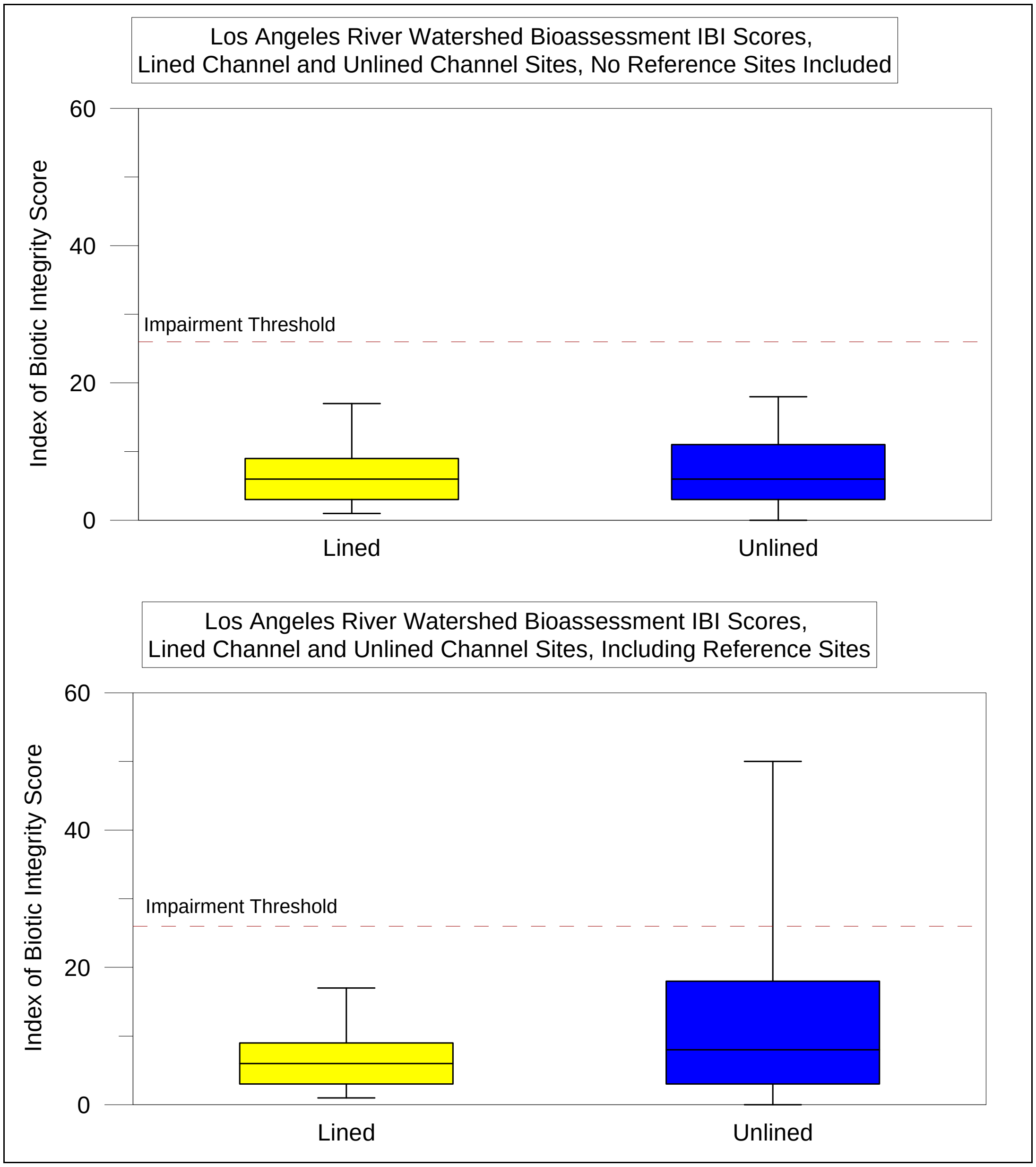


Figure 16. Comparison of Concrete-Lined and Unlined Channel Sites, Los Angeles River Watershed for 2003–2009

5.3 Dominguez Channel Watershed Survey Results for 2003–2009

The Dominguez Channel Watershed is located in the central portion of the Los Angeles Basin and is almost completely urbanized. The watershed boundary is defined not so much by topography but by a system of storm drains and flood control channels. The largest waterway is the Dominguez Channel, which discharges into the Los Angeles Harbor. A single bioassessment site, 19–Dominguez Channel, has been monitored in Dominguez Channel and has been sampled every year since 2003 (Figure 17). The site is within a fully concrete-lined channel and is just upstream of any tidal influence. Because only one site was monitored in this watershed, the comparative analyses performed for the other watersheds were not possible for this watershed.

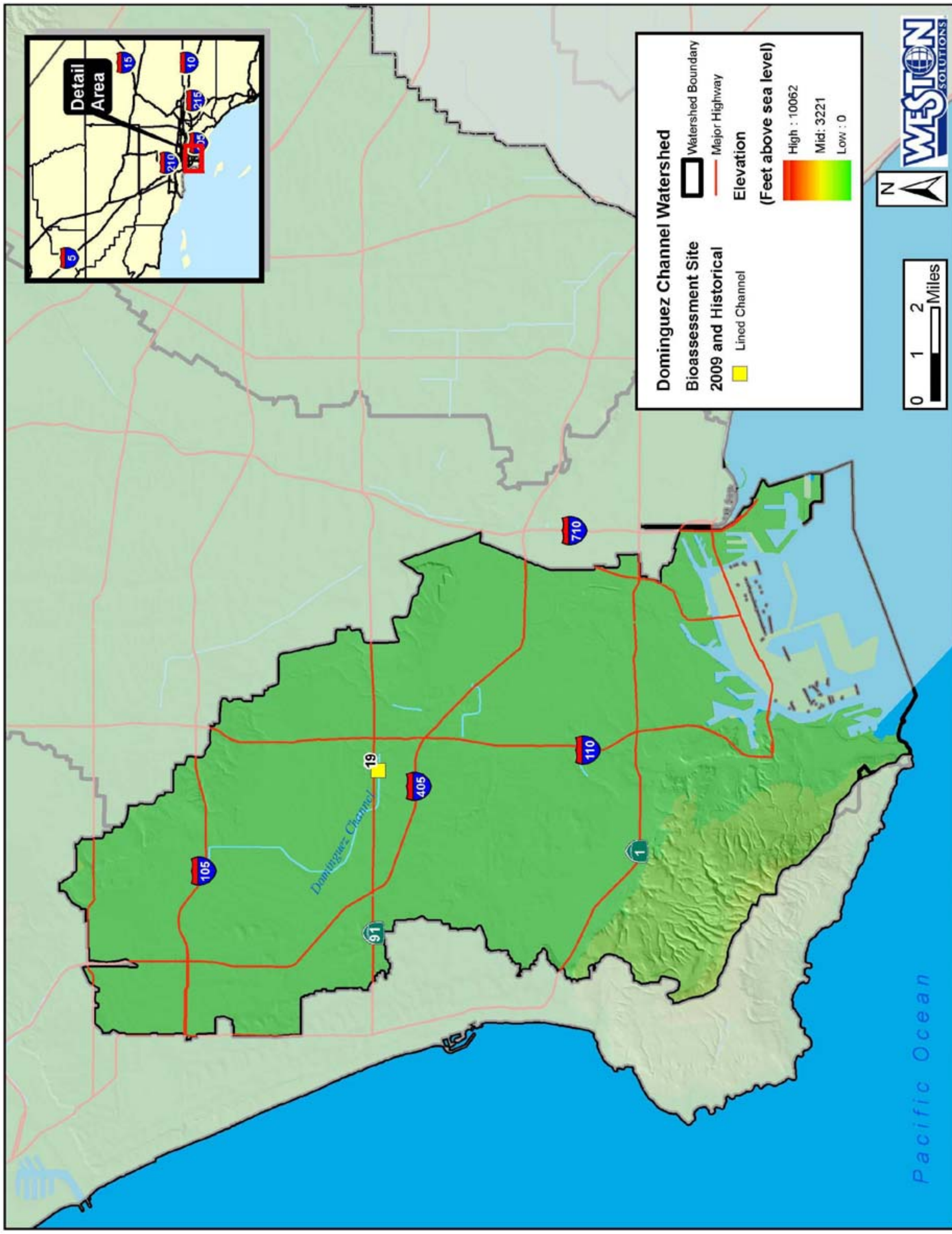


Figure 17. Bioassessment Monitoring Site in the Dominguez Channel Watershed for 2003–2009

Mean Metric Analysis for 2003–2008

Table 10 shows the mean biological metric values for 19–Dominguez Channel, which was sampled in a concrete-lined channel. All of the metrics indicated a low-quality benthic community at the site (i.e., taxa richness was low, EPT taxa and intolerant taxa were absent, and the percent collector taxa was high).

Table 10. Dominguez Channel Watershed Selected Metric Values, Mean of Annual Surveys for 2003–2009

Monitoring Reach	Site Code	Number Samples	Taxa Richness**	EPT Taxa	Percent Intolerant Taxa	Percent Collector–Filterers plus Collector–Gatherers
Dominguez Channel	19	7	9.3	0	0%	94.5%

Yellow highlight = concrete-lined channel site
**2009 taxa richness values adjusted from Level II to Level I taxonomy

The IBI scores for 19–Dominguez Channel have been consistently in the Very Poor range, with a mean IBI score of 1.8 (Table 11 and Figure 18). The scores have been consistent for the last five years of surveys, with scores of 0 or 1, and have been statistically similar for all seven surveys. Figure 19 also shows the IBI score ranges in a box plot.

Table 11. Dominguez Channel Watershed, Comparison of Index of Biotic Integrity Scores for 2003–2009

Monitoring Reach	Site Code	IBI Score 2003	IBI Score 2004	IBI Score 2005	IBI Score 2006	IBI Score 2007	IBI Score 2008	IBI Score 2009	Mean IBI Score	Range
Dominguez Channel	19	**3**	**6**	**0**	**1**	**0**	**1**	**1**	**1.8**	**6**

Yellow highlight = concrete-lined channel site

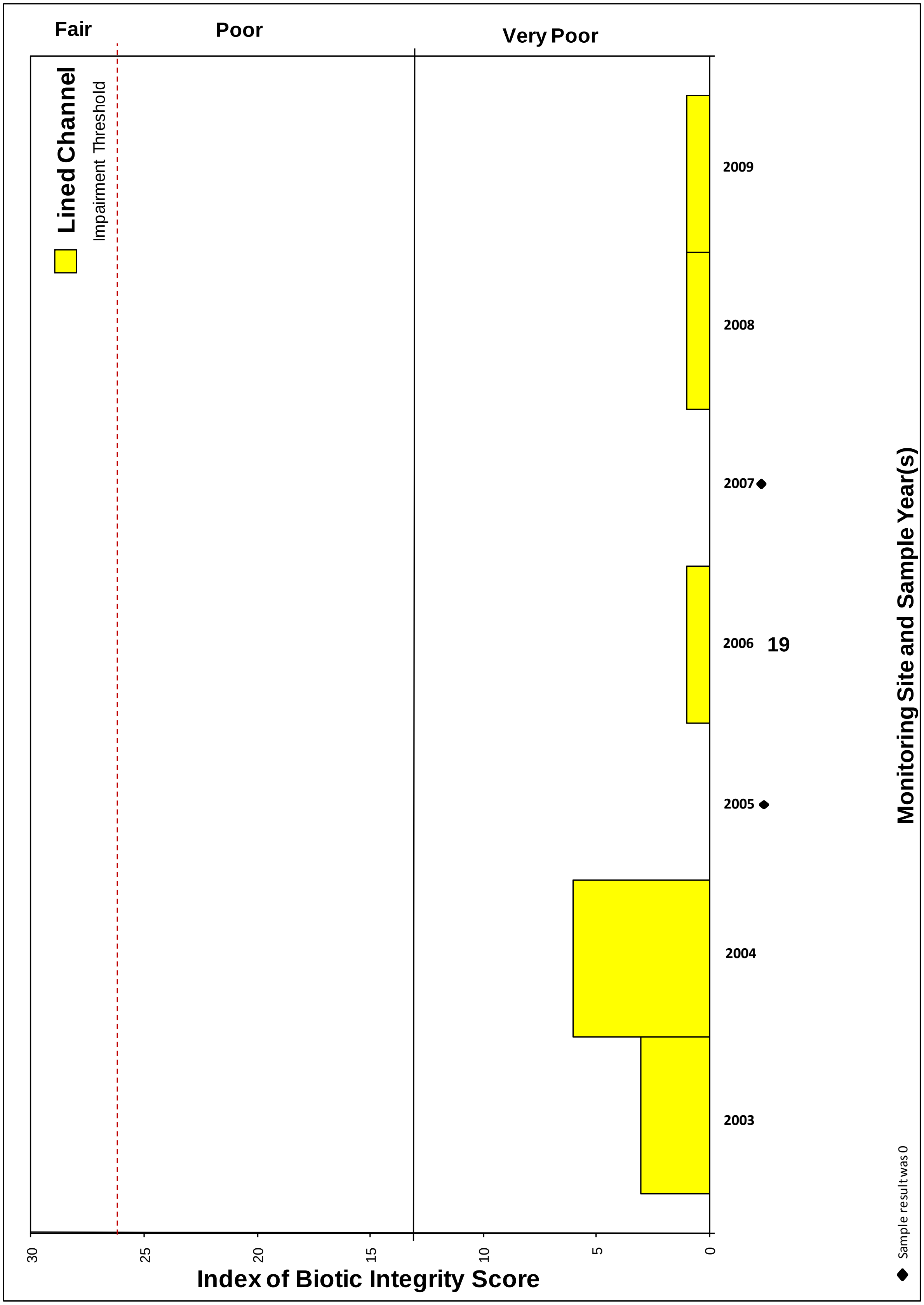


Figure 18. Index of Biotic Integrity Scores for Concrete-Lined Channel Sites, Dominguez Channel Watershed for 2003–2009

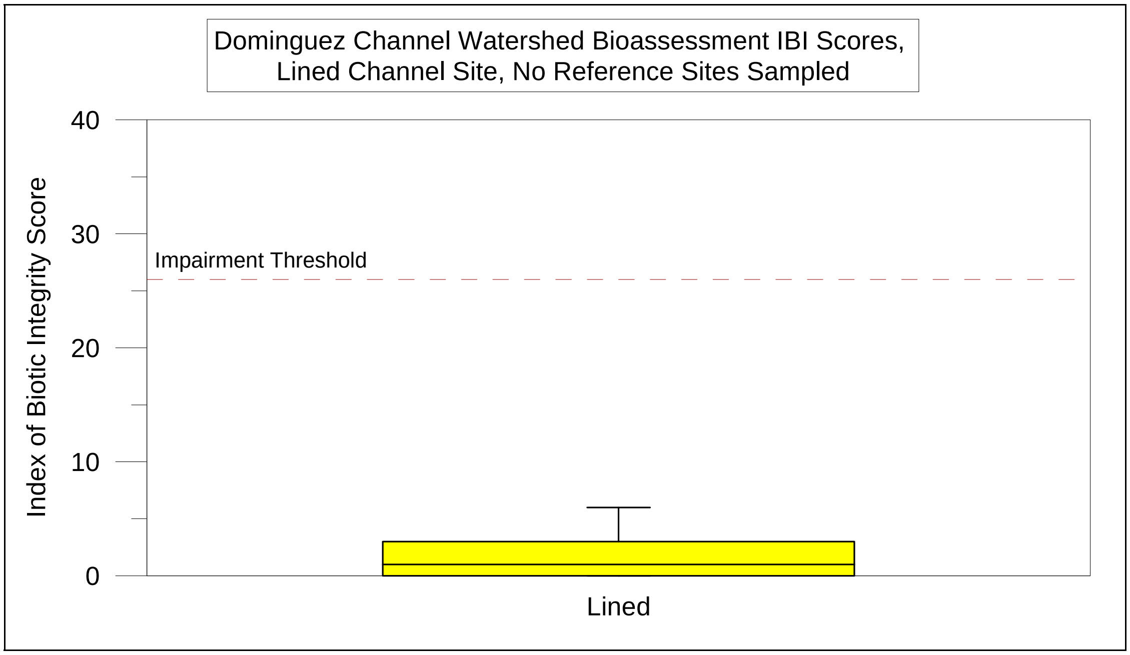


Figure 19. Comparison of Concrete-Lined and Unlined Channel Sites, Dominguez Channel Watershed for 2003–2009

5.4 Santa Monica Bay Watershed Survey Results for 2003–2009

The SMBW encompasses the Ballona Creek Watershed, the Malibu Creek Watershed, and several other small coastal drainages (e.g., Topanga Creek and Trancas Canyon Creek) (Figure 20). The Malibu Watershed and the adjacent watersheds contain large undisturbed areas of park land and natural preserves in the Santa Monica Mountains. In contrast to the other Los Angeles County watersheds, most of the urban runoff impacts occur in the upper reaches of the watersheds from urban centers along the Highway 101 corridor. The Ballona Creek Watershed is in a highly urbanized portion of the County.

The watershed has been sampled in ten different locations from 2003 through 2009. Historically, four targeted monitoring sites were located in the upper Malibu Creek Watershed area, including one reference site, 17–Cold Creek. All of these were in unlined channels. A historical Ballona Creek monitoring site, 14–Ballona Creek, was also sampled, within a fully concrete-lined channel. In 2009, all five historical sites were replaced with randomly placed SMC sites, four of which were located in lower watershed areas, and one site, SMC01640–Las Virgenes Creek, was in a fully concrete-lined channel.

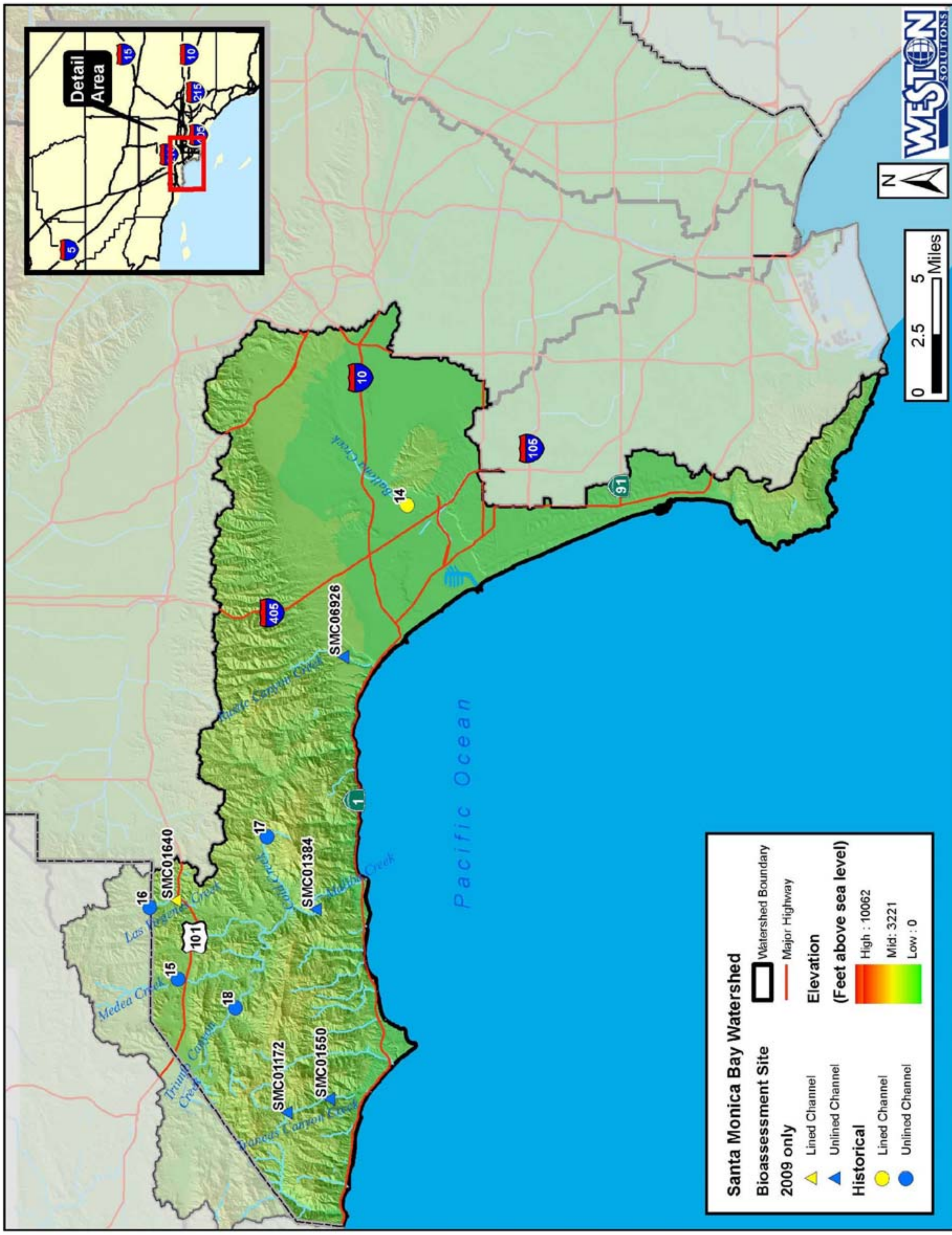


Figure 20. Bioassessment Monitoring Sites in the Santa Monica Bay Watershed for 2003–2009

Mean Metric Analysis for 2003–2009

Table 12 shows the mean biological metric values of four individual metrics that are considered strong indicators of ecological health. Concrete-lined channel sites are highlighted in yellow, and unlined channel sites are highlighted in blue. Reference sites are signified with an asterisk following their site names. Mean metric values for reference 17–Cold Creek indicated a higher-quality benthic community than all other sites in this watershed. Three of the sites were of substantially poorer quality than the majority, including 14–Ballona Creek, 15–Medea Creek, and SMC01640–Las Virgenes Creek. These three sites had mean taxa richness of less than 12, less than two EPT taxa, no intolerant taxa, and greater than 82% collector taxa. All other sites had moderate taxa richness, low to moderate EPT taxa, and most notably, had intolerant taxa present.

Table 12. Santa Monica Bay Watershed Selected Metric Values, Mean of Annual Surveys for 2003–2009

Monitoring Reach	Site Code	Number Samples	Taxa Richness**	EPT Taxa	Percent Intolerant Taxa	Percent Collector–Filterers plus Collector–Gatherers
Ballona Creek	14	6	10.5	1.8	0%	94.8%
Medea Creek	15	6	11.7	1.0	0%	82.4%
Las Virgenes	16	4	16.8	1.9	1.3%	89.8%
Cold Creek	17*	6	31.5	11	34.5%	22.3%
Triunfo Creek	18	5	26.8	2.8	0.4%	64.4%
Trancas Canyon Creek	SMC01172	2	24.5	4.0	3.5%	64.7%
Rustic Canyon Creek	SMC06926	1	21.0	5.0	1.0%	40.2%
Malibu Creek	SMC01384	1	22.0	7.0	3.0%	33.8%
Trancas Canyon Creek	SMC01550	1	21.0	4.0	13.8%	68.0%
Las Virgenes	SMC01640	1	4.0	0	0%	96.0%

Yellow highlight = concrete-lined channel site
Blue highlight = unlined channel site
*Reference site
**2009 taxa richness values adjusted from Level II to Level I taxonomy

Comparison of Index of Biotic Integrity Scores for 2003–2009

Except 17–Cold Creek, the IBI scores in the SMBW have historically shown impaired biotic conditions in the middle to upper watershed areas (Table 13). 17–Cold Creek was consistently the highest-rated site in the Bioassessment Program. Four of the SMC sites sampled in the SMBW in 2009 had IBI scores near the impairment threshold of 27 points, with three sites rated unimpaired and two rated impaired. SMC01640–Las Virgenes Creek was rated Very Poor. This site was located approximately 1.2 miles downstream of the historical Las Virgenes Creek site and had significantly poorer physical habitat quality.

Table 13. Santa Monica Bay Watershed, Comparison of Index of Biotic Integrity Scores for 2003–2009

Monitoring Reach	Site Code	IBI Score 2003	IBI Score 2004	IBI Score 2005	IBI Score 2006	IBI Score 2007	IBI Score 2008	IBI Score 2009	Mean IBI Score	Range
Cold Creek	17*	42	52	49	53	52	55		50.5	13
Trancas Canyon Creek	SMC01172 DUP							31	31.0	NA
Trancas Canyon Creek	SMC01172							29	29.0	NA
Malibu Creek	SMC01384							29	29.0	NA
Trancas Canyon Creek	SMC01550							26	26.0	NA
Rustic Canyon Creek	SMC06926							26	26.0	NA
Las Virgenes	16			27	17	20	16		20.0	11
Triunfo Creek	18	22		20	18	19	15		18.8	7
Ballona Creek	14	6	10	7	5	10	4		7.0	6
Las Virgenes	SMC01640							7	7.0	NA
Medea Creek	15	3	5	7	4	2	7		4.7	5

Yellow highlight = concrete-lined channel site
Blue highlight = unlined channel site
*Reference site

Comparison of Concrete-Lined Channels and Unlined Channels for 2003–2009

Two of the ten sites monitored in the SMBW were in fully concrete-lined channels (Figure 21). Both of these concrete-lined sites had mean IBI scores rated Very Poor in all surveys, and four of the unlined sites were rated Fair and Good. The Wilcoxon Ranked Sum test was run with and without the reference site. No exclusions were made based on location in the watershed. When reference sites were excluded, a p-value of 0.048 resulted, and the mean IBI scores of the concrete-lined sites were statistically slightly lower than the unlined sites in the lower watershed (p-value less than 0.05 is significant (therefore, the chance of having this result is less than 0.5%), and we can safely (or significantly) reject the null hypothesis). When the reference site from the upper watershed was considered, the p-value decreased to 0.015, and the statistical difference between the concrete-lined and unlined sites was much greater. Using a whisker–box plot to compare the two channel types, the mean IBI scores of the unlined sites were statistically superior to the concrete-lined sites (i.e., the mean line of the unlined sites is above the 75th percentile of the concrete-lined sites) regardless of whether the reference sites were included (Figure 22).

Comparison of Index of Biotic Integrity Scores and Elevation for 2003–2009

To examine the relationship of IBI scores and elevation, a Spearman rank correlation was conducted for IBI scores versus elevation. The correlation coefficient for IBI versus elevation was -0.121. The correlation was negative and not significant based on a critical value of 0.356 (33 samples and an alpha of 0.05). This result indicates that site IBI scores were not significantly related to elevation in this watershed, and the negative correlation indicated that IBI scores increased somewhat with decreasing elevation. This is likely due to a greater amount of urban development in the upper watershed and extensive forest land in the lower watershed.

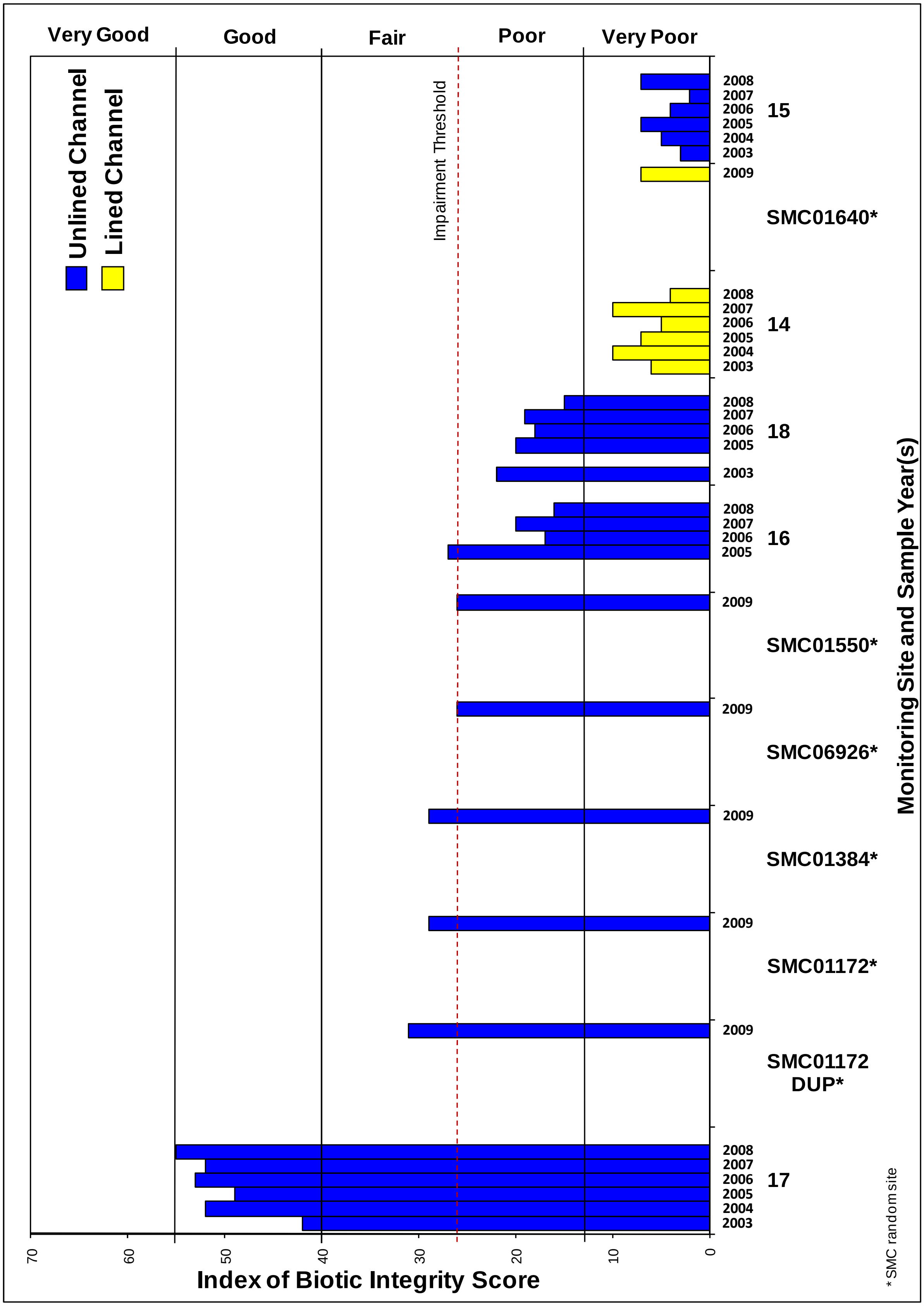


Figure 21. Index of Biotic Integrity Scores for Concrete-Lined and Unlined Channel Sites, Santa Monica Bay Watershed for 2003–2009

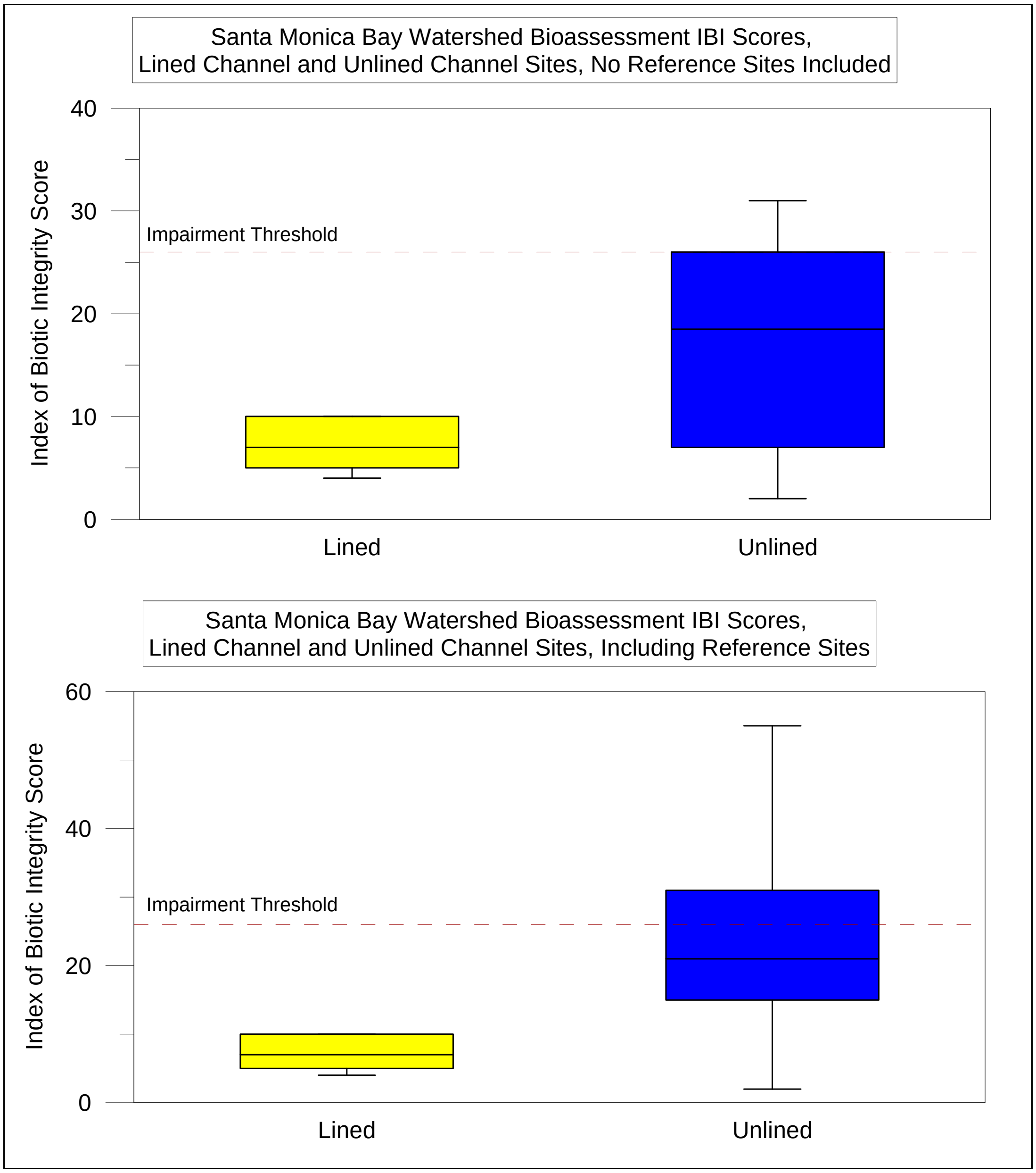


Figure 22. Comparison of Concrete-Lined and Unlined Channel Sites, Santa Monica Bay Watershed for 2003–2009

5.5 Santa Clara River Watershed Survey Results for 2003–2009

The upper portion of the Santa Clara River Watershed is in the County, with headwaters on the north slope of the San Gabriel Mountains (Figure 23). The lower watershed and outlet to the Pacific Ocean are in Ventura County. The mainstem of the Santa Clara River is unchannelized for its entire length, and a majority of the upper tributaries are non-perennial. Most of the urbanization in the upper watershed is associated with the City of Santa Clarita.

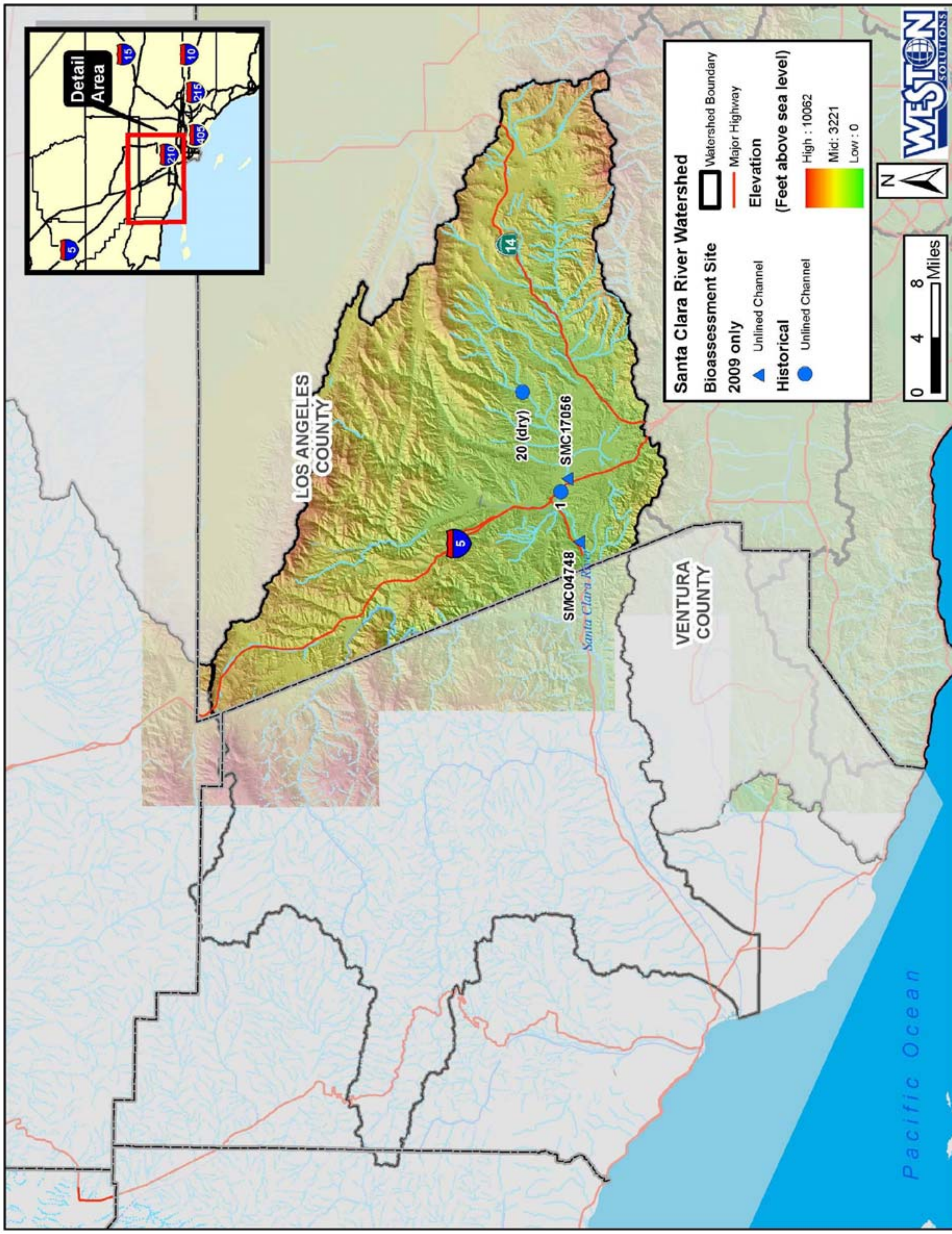


Figure 23. Bioassessment Monitoring Sites in the Santa Clara River Watershed for 2003–2009

Historically, one targeted site in the Santa Clara River mainstem, 1–Santa Clara River, was monitored every year from 2003 to 2008. An additional targeted site, 20–Bouquet Canyon, never had flowing water during the sampling period from 2003 through 2008. In 2009, these two targeted historical sites were replaced with two randomly placed SMC sites. All of the sites were in unlined channels of the mainstem, which have been perennialized by urban runoff. None of these were considered reference sites.

Mean Metric Analysis for 2003–2009

Table 14 shows the mean biological metric values of four individual metrics that are considered strong indicators of ecological health. The three sites monitored in the Santa Clara River had similar mean metric values. Mean taxa richness ranged from 19 to 21, there were four EPT taxa at each site, and no intolerant taxa were collected. Collector taxa were present in moderate percentages. The similarity of these results is not surprising as the sites were relatively close to one another, and the physical conditions of the riverbed were similar at each site.

Table 14. Santa Clara River Watershed Selected Metric Values, Mean of Annual Surveys for 2003–2009

Monitoring Reach	Site Code	Number Samples	Taxa Richness**	EPT Taxa	Percent Intolerant Taxa	Percent Collector–Filterers plus Collector–Gatherers
Santa Clara River	1	6	20.0	4.0	0%	69.4%
Bouquet Canyon (dry)	20	0	NA	NA	NA	NA
Santa Clara River	SMC04748	1	19	4	0%	81.4%
Santa Clara River	SMC17056	1	21	4	0%	69.6%

Blue highlight = unlined channel
**2009 taxa richness values adjusted to Level I taxonomy
NA = not applicable

Comparison of Index of Biotic Integrity Scores for 2003–2009

The three sites in the Santa Clara River Watershed had IBI scores in the Poor range, indicating slightly impaired conditions (Table 15, Figure 24 and Figure 25). 1–Santa Clara River has shown significant variability, with a total range of 17 points, and was the only site in the Bioassessment Program to vary across three IBI rating categories. This was likely due to the heavy rains of 2005 that substantially altered the streambed and flushed out most of the emergent vegetation, resulting in a low IBI score for that year. All other years had IBI scores within the minimum detectable difference of 9 points.

Table 15. Santa Clara River Watershed, Comparison of Index of Biotic Integrity Scores for 2003–2009

Monitoring Reach	Site Code	IBI Score								
		2003	2004	2005	2006	2007	2008	2009	Mean	Range
Santa Clara River	SMC17056							**25**	**25.0**	**NA**
Santa Clara River	SMC04748							**22**	**22.0**	**NA**
Santa Clara River	1	**21**	**19**	**10**	**24**	**27**	**24**		**20.8**	**17**
Bouquet Canyon (dry)	20	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**		**NA**	**NA**

Blue highlight = unlined channel
NA = not applicable
NS = not sampled

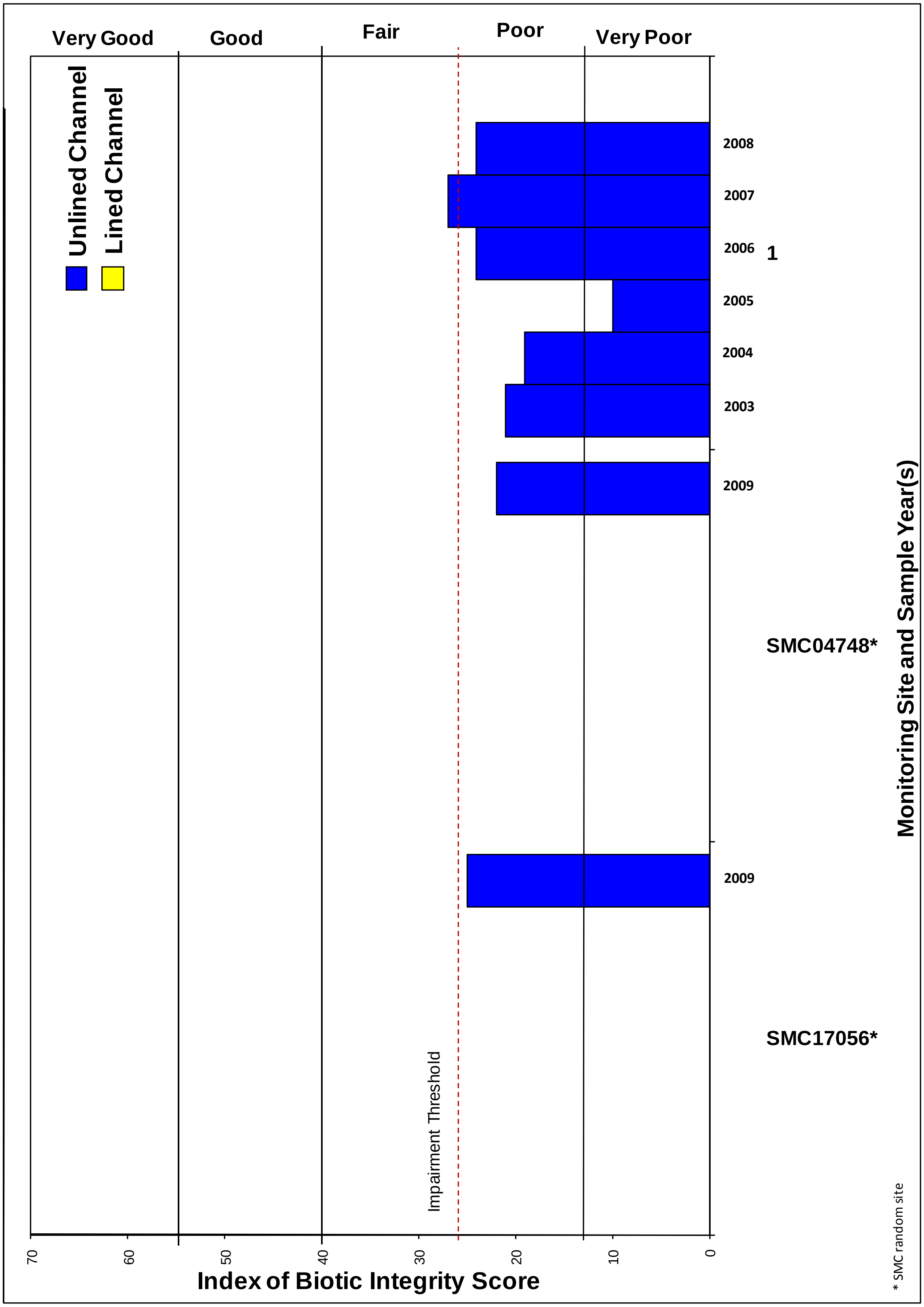


Figure 24. Index of Biotic Integrity Scores for Unlined Channel Sites, Santa Clara River Watershed for 2003–2009 (no concrete-lined sites)

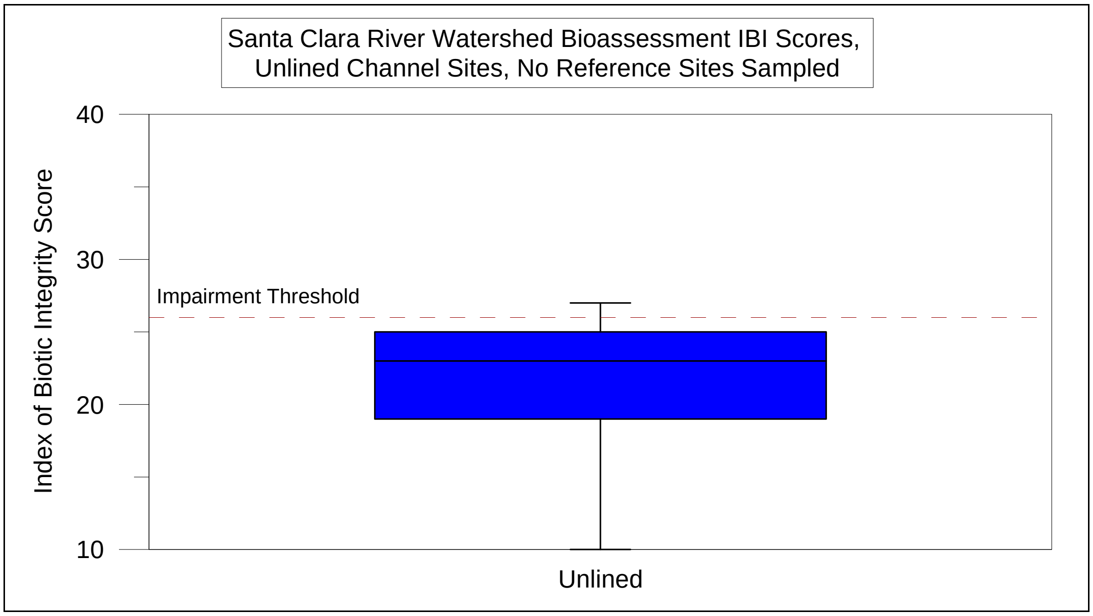


Figure 25. Unlined Channel Sites, Santa Clara River Watershed for 2003–2009 (no concrete-lined sites)

Comparison of Index of Biotic Integrity Scores and Elevation for 2003–2009

To examine the relationship of IBI scores and elevation, a Spearman rank correlation was conducted for IBI scores versus elevation. The correlation coefficient for IBI versus elevation was 0.329. The correlation was insignificant based on a critical value of 0.738 (eight samples and an alpha of 0.05). These results indicate that site IBI scores were not significantly correlated to elevation. This was not unexpected because the elevations of the three sites were within approximately 200 ft of one another, and the IBI scores were similar.

6.0 SUMMARY

Twenty-two receiving water monitoring reaches representing five watersheds in the County were sampled for BMIs and were assessed for physical habitat quality in June 2009 and July 2009. The monitoring reaches were located to provide an assessment of possible impacts associated with urban runoff and to evaluate the biological conditions for trend analysis of the BMI communities of the County. Since program inception in 2003, a total of 42 different sites have been sampled, and four of the sites were sampled in every survey.

Taxonomic evaluation of the 2009 samples yielded 146 different taxa from 14,073 individual organisms by SAFIT Level II taxonomic effort, which was at a higher level than in previous sampling years. The most abundant organisms collected throughout the County were Ostracods (seed shrimp), which were present at every monitoring site. The majority of organisms collected from the urban monitoring reaches were moderately or highly tolerant to stream impairments, and most of the sites were dominated by organisms in the collector–gatherer feeding group.

The IBI scores of the monitoring reaches ranged from 1 (poorest score) to 62 (best score) out of a maximum of 70 points, and the BMI communities were rated from Very Poor to Very Good. SGUT-501–San Gabriel River was the highest-rated site, and 6–Arroyo Seco was the second highest-rated site, with IBI scores of 62 and 50, respectively. Eight of the monitoring reaches were located in highly modified, concrete-lined urban water courses, and these sites had IBI ratings of Very Poor. Analysis of individual metrics as well as total IBI scores showed that in the San Gabriel and Los Angeles River watersheds, monitoring sites located in the lower watershed had lower-quality benthic communities than sites located in the middle to upper reaches of the watersheds. In these watersheds, there was a positive and significant correlation between site elevation and IBI scores. In the SMBW, this correlation was negative, and IBI scores decreased with increased elevation, although the correlation was not statistically significant.

Comparison of the IBI scores for seven survey years (i.e., 2003–2009) did not indicate any substantial trend toward degradation or improvement at any of the sites. Trend analysis was not possible for sites that have been sampled for less than four years, which included 26 of the 42 monitoring sites.

An analysis of the difference between concrete-lined sites and unlined sites often indicated a statistically significant difference in IBI scores at sites located in the lower watershed areas. When reference sites were added to the analysis, the difference in IBI scores between concrete-lined sites and unlined sites was generally of greater significance. The difference between concrete-lined and unlined sites was greater for the 2008 and 2009 data than for data from 2003 to 2007. This was due to the replacement of several lower Los Angeles River sites that were in concrete-lined channels yet had IBI scores similar to other unlined lower watershed sites. When this analysis was performed by watershed, the lower Los Angeles River Watershed sites did not show a difference between concrete-lined and unlined sites, whereas in the San Gabriel River Watershed and SMBW, the difference between concrete-lined and unlined sites was much greater. Correlation analysis between CRAM physical habitat scores and IBI scores indicated a significant relationship between physical habitat and biotic integrity.

The two-way cluster analysis of 2009 taxa and sites indicated some clustering by taxa, but the sites appeared to cluster more readily according to site physical conditions and total IBI score.

Upper watershed sites with natural channels had the strongest clustering, lower to mid-watershed channelized sites with soft bottoms clustered together and fully concrete-lined sites clustered together. The lower watershed sites were populated primarily with abundant, ubiquitous, and opportunistic organisms common to most sites, whereas the upper watershed sites had fairly distinctive benthic communities, with a number of unique taxa present at each site. Cluster analysis of all data from 2003 to 2009 had results similar to the 2009 data, with an overall strong association between site IBI scores and site clustering.

7.0 FUTURE PROJECTIONS FOR BIOASSESSMENT

As the science of bioassessment monitoring continues to evolve, further changes in monitoring protocols and methods and in the regulatory climate are likely. Regulatory issues are likely to emerge as well, including the implementation of biological objectives or "biocriteria". This may require NPDES MS4 Permit holders to evaluate and implement ways to increase the biotic integrity of receiving waters (e.g., elevate a stream site's IBI score or another prescribed metric). Preliminary meetings regarding these potential requirements have indicated that not all waterbodies will be considered equally and that biological objectives will consider existing limitations on BMI colonization. These limitations may include attributes such as physical habitat constraints, natural perturbations, and cost-prohibitive mitigations, although these have yet to be defined.

Currently, the methodology for stream physical habitat assessment incorporates two separate protocols (i.e., SWAMP and CRAM). CRAM was performed at all sites, although it was only required to be performed at SMC sites. Both protocols assess unique attributes of the physical habitat, but there is also some redundancy between them. Streamlining of protocols by a state agency (e.g., SWAMP or CDFG) would increase efficiency of the assessment and would require approval by the State Water Resources Control Boards (SWRCBs) and RWQCBs and would then be incorporated into the NPDES MS4 Permit. The application of the IBI in low-gradient, depositional stream reaches is another potential improvement of current stream physical habitat assessment methodologies. Reference conditions for this habitat type were not adequately incorporated in the development of the IBI, and these types of sites may be designated as impaired when water quality is good and sensitive organisms are present but in very low numbers.

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APPENDICES A–C

APPENDIX A

Photos of Monitoring Reaches

Appendix A: Site Photos

SGUT-501–San Gabriel River

SGUT-504–San Gabriel River

SGUT-505–San Gabriel River

5, SGLT-506–Walnut Creek

Appendix A: Site Photos

SGLR01278–Coyote Creek (SMC01278)

SGLR02656–Walnut Creek

SGLR00288–Emerald Wash

SGLR09534–San Gabriel River (SMC09534)

Appendix A: Site Photos

6–Arroyo Seco

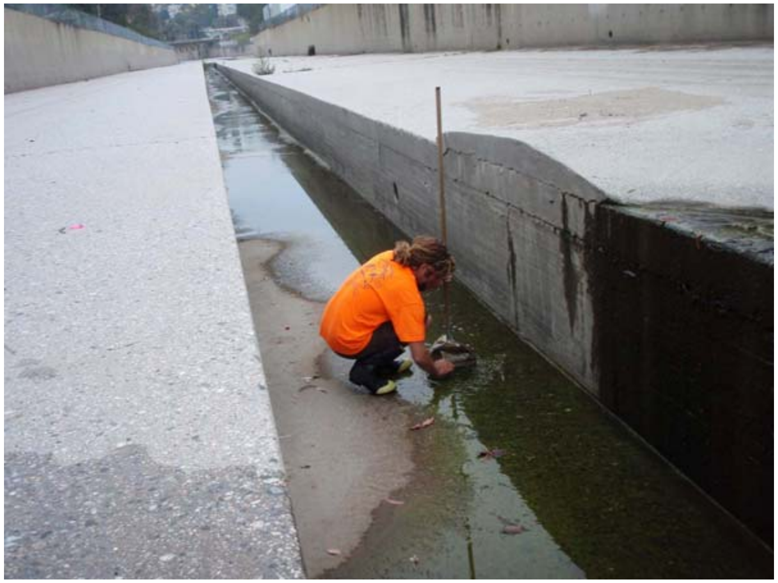
7–Arroyo Seco

LALT500–Rio Hondo

LALT501–Arroyo Seco

Appendix A: Site Photos

8, LALT502–Compton Creek



LALT503–Tunjunga Wash

19–Dominguez Channel

SMC01172–Trancas Canyon Creek

Appendix A: Site Photos

SMC01384–Malibu Creek

SMC01550–Trancas Canyon Creek

SMC01640–Las Virgenes Creek

SMC04748–Santa Clara River

Appendix A: Site Photos

SMC06926–Rustic Canyon Creek

SMC17056–Santa Clara River

APPENDIX B

Survey Results Data

Appendix B.1: Taxonomic Listing of Benthic Macroinvertebrates Collected from LACFCD Mointoring Sites for 2009

TV=Tolerance Value: range is 0-10; 0 is intolerant to impairment. FFG=Functional Feeding Group; cg=collector gatherer, cf=collector filterer, sc=scraper, p=predator, pa=parasite, mh=macrophyte herbivore, ph=piercer herbivore, om=omnivore. sp denotes taxa identified at genus level.

			San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed						Santa Clara River Watershed	
	TV	FFG	SGUT-501*	SGUT-504*	SGUT-505	5, SGLT-506	SGLR01278** (SMC01278)	SGLR02656** (SMC02656)	SGLR00288	SGMR09534	6*	7	LALT500	LALT501	8, LALT502	LALT503** (SMC00756)	19	SMC01172	SMC01172 DUP	SMC06926	SMC01384	SMC01550	SMC01640	SMC04748	SMC17056
PHYLUM ARTHROPODA																									
Insecta																									
Ephemeroptera (mayflies)																									
Baetidae																									
Baetis adonis	5	cg	56	44	5			10	155		41	43		490		12				12	29			23	35
Baetis sp	5	cg	2									3		11						1					
Callibaetis sp	9	cg		3	2		2				7		1						1	8		42			
Centroptilum/Procleon sp	3	cg	1																						
Diphetor hageni	5	cg	28																						
Fallceon quilleri	4	cg		7	60	25		1		544	12	47		25		23					13			161	164
Caenidae																									
Caenis sp	7	cg	6								9														
Ephemerellidae	1	cg	74	17																					
Serratella micheneri	1	cg	55	9																					
Heptageniidae																									
Epeorus sp	0	sc	16																						
Leucrocuta/Nixe sp	3	sc	8																						
Leptohyphidae																									
Tricorythodes sp	4	cg	16	32	55						1										25			221	51
Leptophlebidae																									
Paraleptophlebia sp	4	cg																137	194						
Odonata (dragonflies, damselflies)																									
Aeshindae																									
Anax junius	8	p																		1		2			
Anax sp	8	p							2						2				1						
Anisoptera																									
Anisoptera		p							1			3													
Calopterygidae																									
Hetaerina americana	6	p																			1			4	1
Coenagrionidae	9	p		1	3						3	6	2		7			1			3	1			1
Argia sp	7	p	15	20	5				109		71	35						1	36	23	7	18		2	2
Ischnura sp	9	p										6			4										
Gomphidae	4	p																							1
Progomphus borealis	4	p																						2	
Lestidate																									
Archilestes grandis	9	p																				9			
Archilestes sp	9	p									24	3										5			
Libellulidae	9	p	2	4							3											4			
Paltothemis lineatipes	9	p												1							1				
Plecoptera (stoneflies)																									
Nemouridae																									
Malenka sp	2	sh	4																						
Perlidae																									
Calineuria californica	2	p	4																						
Hemiptera (true bugs)																									
Belostomatidae	8	p	1								1														
Corixidae	8	p					1						25		6	1									
Corisella edullis	8	p											1												
Trichocorixa reticulata	8	p					1																		
Megaloptera (alderflies, dobsonflies)																									
Sialidae																									
Sialis sp	4	p																				2			
Trichoptera (caddisflies)																									
Brachycentridae																									
Micrasema sp	1	mh	57	4							15							3	14			74			
Glossosomatidae																									
Agapetus sp	0	sc	3																						
Helicopsychidae																									
Helicopsyche borealis	3	sc		4																					
Hydropsychidae	4	cf			1																				
Cheumatopsyche sp	5	cf	8	7							7										1				
Hydropsyche sp	4	cf	30	22	41						22									2	28				
Hydroptilidae	4	ph		2	6			4					3					18		4	10			8	8
Hydroptila sp	6	ph	8	14	1	4		85	7		9		4	17		1			9	10	43	8		35	132
Ochrotrichia sp	4	ph	3		1																				
Oxyethira sp	3	ph			1																				
Lepidostomatidae																									
Lepidostoma sp	1	sh	2								5							1							
Limnephilidae																									
Psychoglypha sp	2	sh	1																						
Philopotamidae																									
Wormaldia sp	3	cf	2								1							5							
Polycentropodidae																									
Polycentropus sp	6	p			27						1														
Psychomyiidae	2	sc			1																				
Tinodes sp	2	sc	2	7	69						20									4	16	6			
Rhyacophilidae																									
Rhyacophila sp	0	p	2																						
Sericostomatidae																									
Gumaga sp	3	sh	1																						
Uenoidae																									
Neophylax sp	3	g	1																						
Lepidoptera (moths)																									
Pyralidae																									
Petrophila sp	5	sc			5																				
Coleoptera (beetles)																									
Dryopidae																									
Helichus sp	5	sh									12														
Postelichus sp	5	sh		1	1						1														

Yellow highlight = lined channel site
Blue highlight = unlined channel site
*Reference site
**Contribution to SMC

Appendix B.1: Taxonomic Listing of Benthic Macroinvertebrates Collected from LACFCD Mointoring Sites for 2009

TV=Tolerance Value: range is 0-10; 0 is intolerant to impairment. FFG=Functional Feeding Group; cg=collector gatherer, cf=collector filterer, sc=scraper, p=predator, pa=parasite, mh=macrophyte herbivore, ph=piercer herbivore, om=omnivore. sp denotes taxa identified at genus level.

			San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed						Santa Clara River Watershed	
	TV	FFG	SGUT-501*	SGUT-504*	SGUT-505	5, SGLT-506	SGLR01278** (SMC01278)	SGLR02656** (SMC02656)	SGLR00288	SGMR09534	6*	7	LALT500	LALT501	8, LALT502	LALT503** (SMC00756)	19	SMC01172	SMC01172 DUP	SMC06926	SMC01384	SMC01550	SMC01640	SMC04748	SMC17056
Dytiscidae	5	p																		1					
Agabus sp	8	p																2	2	1					
Hydroporinae	5	p																	4						
Sanfillipodytes sp	5	p											3					2	1						
Stictotarsus striatellus	5	p									1														
Elmidae																									
Heterelmis sp	4	cg																			1				
Microcylloepus sp	2	cg	1																		4				
Optioservus sp	4	sc	22							1															
Ordobrevia nubifera	4	sc	6	2							3														
Zaitzevia sp	4	sc	12								17														
Gyrinidae																									
Gyrinus sp	5	p																				1			
Haliplidae																									
Peltodytes sp	5	mh	1	1							5									6		1			
Hydraenidae																									
Hydraena sp	5	p																2	1						
Hydrophilidae																									
Berosus sp	5	p									2														
Cymbiodyta sp	5	p																	1						
Enochrus carinatus	5	cg																						1	
Enochrus sp	5	cg			1																1				1
Laccobius sp	5	mh			1																				1
Tropisternus sp	5	p																						1	2
Psephenidae											4														
Eubrianax edwardsi	4	sc	1																						
Psephenus falli	4	sc	1								2														
Diptera (true flies)																									
Ceratopogonidae	6	p					1					1										3	2		
Atrichopogon	6	cg																7	1						
Bezzia/Palpomyia	6	p			2						1													1	1
Ceratopogon sp	6	p			2																				
Dasyhelea sp	6	cg			3			24				1		14	3	6		1				1	3		
Chironomidae	6	cg	3	3			5																		
Ablabesmyia sp	8	cg			2						7										2				
Alotanypus sp	7	p				7						4										4			
Apedilum sp	6	cg	1		3			16			6		11				1		4			5			
Brillia sp	5	sh	2															3	1	4		3			
Chironomus sp	10	cg				29	28	1		1	1		14		6	14	10		2			31			
Corynoneura sp	7	cg							2									2	2			2			1
Cricotopus sp	7	cg	1	20	3		39	177	8	16		6	146	6	7	440	154	31	32			6	49		
Cricotopus/Bicinctus group	7	cg					5			8						10									
Cricotopus/Trifascia group	7	cg	3																						2
Cryptochironomus sp	8	p					2					1													
Dicrotendipes sp	8	cg	3	1	15	98	48	74			5	19	67		5	70	103			1		2	44		4
Eukiefferiella sp	8	om	5	1	1			3	6		2			1	3			6	3		1				
Labrundinea	6	p		22				3										1	13	14		17		1	5
Limnophyes sp	8	cg							4					1	1			7	1						
Micropsectra sp	7	cg	19			35	1	1			3	15					2	5	2						
Microtendipes	6	cf	5	52	1						6	3								7		8			
Orthocladius complex	6	cg																					2		
Parametriocnemus sp	5	cg	1						2									7	4	6					
Paraphaenocladius sp	4	cg			1													5							
Paratanytarsus sp	6																				1				
Pentaneura sp	6	p	4	3	16		2		12		11	15		2						2	2			8	5
Phaenopsectra sp	7	sc		1																					
Polypedilum sp	6	om	1	7	2						9							2	1	6			22		3
Procladius sp	9	p			1	2	2		1						12		1				1				
Psectrocladius sp	8	cg									5											1			
Pseudochironomus sp	5	cg		5	1	4	1	26				3	1	1	2				1		1	6	1		11
Rheocricotopus sp	6	om	1		18				15		4									15	8			7	
Rheotanytarsus	6	om	7	61	33	3					46	1						10	5	24	4	6			3
Stenochironomus sp	5	cg							1		1														
Synorthocladius sp	2	cg			1																				
Tanytarsus sp	6	cf		5	15	7	12	18	1		5							5	7	6		49			1
Thienemanniella sp	6	cg	2																						
Thienemannimyia group	6	p	4	9	20	30		24			4	1		1		7		9	6	2		4			3
Tribelos sp	5	cg																				1			
Culicidae																									
Anopheles sp	8	cg																				1			2
Culex sp	8	cg													3	2	1	5	38			4			
Dixidae																									
Dixella sp	2	cg																11	10						
Meringodixa chalonensis	2	cg																1	2	4		1			
Dolichopodidae	4	p				2									2										
Empididae	6	p		3				2			1					1									
Chelifera/Metachela sp	6	p									1														
Hemerodromia sp	6	p	5	12							2	1													4
Neoplasta sp	6	p	1																						
Wiedemannia sp	6	p	1																						
Ephydridae	6						3	1		5		1			1				1			1		7	3
Muscidae	6	p						1			1							1							
Psychodidae		cg						7					1	6							1				
Maruina lanceolata	2	sc									3														
Pericoma/Telmatoscopus	4	cg	2								1	1													
Psychoda sp	10	cg										1													
Sciomyzidae	6	p																1	1						
Simuliidae																									
Simulium sp	6	cf	7	21				15	67		7	5		5		10		1					3	10	54

Yellow highlight = lined channel site
Blue highlight = unlined channel site
*Reference site
**Contribution to SMC

Appendix B.1: Taxonomic Listing of Benthic Macroinvertebrates Collected from LACFCD Mointoring Sites for 2009

TV=Tolerance Value: range is 0-10; 0 is intolerant to impairment. FFG=Functional Feeding Group; cg=collector gatherer, cf=collector filterer, sc=scraper, p=predator, pa=parasite, mh=macrophyte herbivore, ph=piercer herbivore, om=omnivore. sp denotes taxa identified at genus level.

			San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed						Santa Clara River Watershed	
	TV	FFG	SGUT-501*	SGUT-504*	SGUT-505	5, SGLT-506	SGLR01278** (SMC01278)	SGLR02656** (SMC02656)	SGLR00288	SGMR09534	6*	7	LALT500	LALT501	8, LALT502	LALT503** (SMC00756)	19	SMC01172	SMC01172 DUP	SMC06926	SMC01384	SMC01550	SMC01640	SMC04748	SMC17056
Stratiomyidae																									
Caloparyphus/Euparyphus	8	cg	2	3	38	4		13			31	289								1	2		1		51
Euparyphus sp	8	cg	1		11	2		3			1	72		3										1	
Nemotelus sp	8	cg											1												
Stratiomys sp	8	cg																						1	
Tipulidae																									
Dicranota sp	3	p	1																						
Limonia sp	6	sh			1										1										
Tipula sp	4	om							2		2	3						2		7					3
PHYLUM CHELICERATA																									
Arachnida																									
Acari (mites)																									
Eylaidae																									
Eylais sp		p																1							
Hydryphantidae																									
Protzia sp	8	p		2																					
Hygrobatidae																									
Atractides sp	8	p	5															4	3						
Hygrobates sp	8	p	1																						
Lebertiidae																									
Lebertia sp	8	p	2	3	1																				
Limnesiidae																									
Limnesia sp	5	p									4							2		1					
Mideopsidae																									
Mideopsis sp	5	p																			1				
Sperchontidae																									
Sperchon sp	8	p	3	13	2						1	4				1				12	11				5
Torrenticolidae																									
Torrenticola sp	5	p	3	2																1					
PHYLUM ARTHROPODA																									
Malacostraca																									
Amphipoda (scuds)																									
Hyalellidae																									
Hyalella sp	8	cg				1	41	1				1	63	1	322	1	9	113	97		103	208			2
Decapoda (crayfish)																									
Cambaridae	8	sh													9						2				
Ostracoda (seed shrimp)	8	cg	7	28	57	185	313	118	17	2	64	3	289	2	10	5	190	27	16	154	1	3	478	67	29
PHYLUM PLATYHELMINTHES																									
Turbelleria (flatworms)	4	p	6	28	34	21	4	5	95	11	20	5								45	12			32	1
PHYLUM NEMERTEA																									
Enopla (tongueworms)																									
Hoplonemertea																									
Tetrastemmatidae																									
Prostoma sp	8	p		1		1			12		1										1			1	5
PHYLUM ANNELIDA																									
Hirudinea (leeches)																									
Arynchobdellida																									
Erpobdellidae																									
Erpobdellidae	8	p								1					1										
Mooreobdella sp	8	p				1				2					2		3								
Rhyncobdellida																									
Glossiphoniidae																									
Helobdella sp	6	pa													1										
Oligochaeta (earthworms)	5	cg	20	18	1	129	99		55	11	9	7	10	3	194	7	103	11	3	27	2	17		2	
PHYLUM MOLLUSCA																									
Gastropoda (snails)																									
Pulmonata																									
Ancylidae																									
Ferrissia sp	6	sc							1						1										
Hypsogastropoda																									
Hydrobiidae	8	sc																			283	12			
Pulmonata																									
Lymnaeidae																									
Lymnea sp	6	sc	11									1	1					1	2						
Radix auricularia	6	sc			1																				
Physidae																									
Physa sp	8	sc	5	82	4	42	2		46	2	23	7	34	4		2	39	138	114	166		5		6	3
Planorbidae																									
Gyraulus sp	8	sc									8														
Helisoma sp	6	sc																		9		3			
Prosobranchia																									
Thiaridae																									
Melanoides tuberculata		sc								5															
Bivalvia (clams)																									
Veneroida																									
Corbiculidae																									
Corbicula sp	10	cf			29																			5	
Pelecypoda																									
Sphaeriidae																									
Pisidium sp	8	cf							3	1										12					

Yellow highlight = lined channel site
Blue highlight = unlined channel site
*Reference site
**Contribution to SMC

Appendix B.2: Ranked Abundance of Benthic Macroinvertebrates Collected from LACFCD Monitoring Sites for 2009

Taxon	San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed						Santa Clara River Watershed		Grand Total
	SGUT-501*	SGUT-504*	SGUT-505	5, SGLT-506	SGLR01278** (SMC01278)	SGLR02656** (SMC02656)	SGLR00288	SGMR09534	6*	7	LALT500	LALT501	8, LALT502	LALT503** (SMC00756)	19	SMC01172	SMC01172 DUP	SMC06926	SMC01384	SMC01550	SMC01640	SMC04748	SMC17056	
Ostracoda	7	28	57	185	313	118	17	2	64	3	289	2	10	5	190	27	16	154	1	3	478	67	29	2065
Cricotopus sp	1	20	3		39	177	8	16		6	146	6	7	440	154	31	32			6	49			1141
Fallceon quilleri		7	60	25		1		544	12	47		25		23					13			161	164	1082
Hyalella sp				1	41	1				1	63	1	322	1	9	113	97		103	208			2	963
Baetis adonis	56	44	5			10	155		41	43		490		12				12	29			23	35	955
Oligochaeta	20	18	1	129	99		55	11	9	7	10	3	194	7	103	11	3	27	2	17		2		728
Physa sp	5	82	4	42	2		46	2	23	7	34	4		2	39	138	114	166		5		6	3	724
Dicrotendipes sp	3	1	15	98	48	74			5	19	67		5	70	103			1		2	44		4	559
Caloparyphus/Euparyphus spp	2	3	38	4		13			31	289								1	2		1		51	435
Tricorythodes sp	16	32	55						1										25			221	51	401
Hydroptila sp	8	14	1	4		85	7		9		4	17		1			9	10	43	8		35	132	387
Argia sp	15	20	5				109		71	35						1	36	23	7	18		2	2	344
Paraleptophlebia sp																137	194							331
Turbellaria	6	28	34	21	4	5	95	11	20	5								45	12			32	1	319
Hydrobiidae																			283	12				295
Simulium sp	7	21				15	67		7	5		5		10		1					3	10	54	205
Rheotanytarsus	7	61	33	3					46	1						10	5	24	4	6			3	203
Micrasema sp	57	4							15							3	14			74				167
Hydropsyche sp	30	22	41						22									2	28					145
Chironomus sp				29	28	1		1	1		14		6	14	10		2			31				137
Tanytarsus sp		5	15	7	12	18	1		5							5	7	6		49			1	131
Thienemannimyia group	4	9	20	30		24			4	1		1		7		9	6	2		4			3	124
Tinodes sp	2	7	69						20									4	16	6				124
Euparyphus sp	1		11	2		3			1	72		3										1		94
Ephemerellidae	74	17																						91
Micropsectra sp	19			35	1	1			3	15					2	5	2			8				91
Microtendipes	5	52	1						6	3								7		8				82
Pentaneura sp	4	3	16		2		12		11	15		2						2	2			8	5	82
Labrundinea		22				3										1	13	14		17		1	5	76
Rheocricotopus sp	1		18				15		4									15	8			7		68
Callibaetis sp		3	2		2				7		1						1	8		42				66
Serratella micheneri	55	9																						64
Hydroptilidae		2	6			4					3					18		4	10			8	8	63
Pseudochironomus sp		5	1	4	1	26				3	1	1	2						1	6	1		11	63
Dasyhelea sp			3			24				1		14	2	6		1				1	3			55
Culex sp													3	2	1	5	38			4				53
Polypedilum sp	1	7	2						9							2	1	6			22		3	53
Sperchon sp	3	13	2						1	4				1				12	11				5	52
Apedilum sp	1		3			16			6		11				1		4			5				47
Corbicula sp			29																			5		34
Corixidae					1						25		6	1										33
Archilestes sp									24	3										5				32
Eukiefferiella sp	5	1	1			3	6		2			1	3			6	3		1					32
Zaitzevia sp	12								17															29
Coenagrionidae		1	3						3	6	2		7			1			3	1			1	28
Diphetor hageni	28																							28
Polycentropus sp			27						1															28
Hemerodromia sp	5	12							2	1													4	24
Cheumatopsyche sp	8	7							7										1					23
Cricotopus/Bicinctus					5			8						10										23
Ephydridae					3	1		5		1			1				1			1		7	3	23
Optioservus sp	22							1																23
Prostoma sp		1		1			12		1										1			1	5	22
Dixella sp																11	10							21
Parametriocnemus sp	1						2									7	4	6						20
Procladius sp			1	2	2		1						12		1				1					20
Tipula sp							2		2	3						2		7					3	19
Baetis sp	2									3		11						1						17
Epeorus sp	16																							16
Lymnea sp	11									1	1					1	2							16
Pisidium sp							3	1										12						16
Alotanypus sp				7						4										4				15
Caenis sp	6								9															15
Psychodidae						7					1	6							1					15
Limnophyes sp							4					1	1			7	1							14

Yellow highlight = lined channel site
Bue highlight = unlined channel site
*Reference site
**Contribution to SMC
"sp" denotes taxa identified to genus level

Appendix B.2: Ranked Abundance of Benthic Macroinvertebrates Collected from LACFCD Monitoring Sites for 2009

Taxon	San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed						Santa Clara River Watershed		Grand Total
	SGUT-501*	SGUT-504*	SGUT-505	5, SGLT-506	SGLR01278** (SMC01278)	SGLR02656** (SMC02656)	SGLR00288	SGMR09534	6*	7	LALT500	LALT501	8, LALT502	LALT503** (SMC00756)	19	SMC01172	SMC01172 DUP	SMC06926	SMC01384	SMC01550	SMC01640	SMC04748	SMC17056	
Peltodytes sp	1	1							5									6		1				14
Brillia sp	2															3	1	4		3				13
Libellulidae	2	4							3											4				13
Atractides sp	5															4	3							12
Helichus sp									12															12
Helisoma sp																		9		3				12
Ablabesmyia sp			2						7										2					11
Cambaridae													9						2					11
Chironomidae	3	3			5																			11
Ordobrevia nubifera	6	2							3															11
Ischnura sp										6			4											10
Archilestes grandis																				9				9
Corynoneura sp							2									2	2			2			1	9
Atrichopogon																7	1							8
Gyraulus sp									8															8
Lepidostoma sp	2								5							1								8
Leucrocuta/Nixe sp	8																							8
Meringodixa chalonensis																1	2	4		1				8
Mooreobdella sp				1				2					2		3									8
Wormaldia sp	2								1							5								8
Ceratopogonidae					1					1										3	2			7
Empididae		3				2			1					1										7
Limnesia sp									4							2		1						7
Psectrocladius sp									5								1			1				7
Hetaerina americana																			1			4	1	6
Lebertia sp	2	3	1																					6
Paraphaenocladius sp			1													5								6
Sanfillipodytes sp											3					2	1							6
Torrenticola sp	3	2																1						6
Agabus sp																2	2	1						5
Anax sp							2						2				1							5
Bezzia/Palpomyia			2						1													1	1	5
Cricotopus/Trifascia	3																						2	5
Melanoides tuberculata								5																5
Microcylloepus sp	1																		4					5
Petrophila sp			5																					5
Anisoptera							1			3														4
Calineurua californica	4																							4
Dolichopodidae				2									2											4
Helicopsyche borealis		4																						4
Hydroporinae																	4							4
Malenka sp	4																							4
Ochrotrichia sp	3		1																					4
Pericoma/Telmatoscopus	2								1	1														4
Psephenidae									4															4
Agapetus sp	3																							3
Anopheles sp																				1			2	3
Cryptochironomus sp					2					1														3
Enochrus sp			1																1				1	3
Hydraena sp																2	1							3
Maruina lanceolata									3															3
Muscidae						1			1							1								3
Postelichus sp		1	1						1															3
Psephenus falli	1								2															3
Tropisternus sp																						1	2	3
Anax junius																				2				2
Belostomatidae	1								1															2
Berosus sp									2															2
Ceratopogon sp			2																					2
Erpobdellidae								1					1											2
Ferrissia sp							1						1											2
Laccobius sp			1																				1	2
Limonia sp			1										1											2
Orthocladius complex																					2			2
Paltothemis lineatipes												1							1					2

Yellow highlight = lined channel site
Bue highlight = unlined channel site
*Reference site
**Contribution to SMC
"sp" denotes taxa identified to genus level

Appendix B.2: Ranked Abundance of Benthic Macroinvertebrates Collected from LACFCD Monitoring Sites for 2009

Taxon	San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed						Santa Clara River Watershed		Grand Total
	SGUT-501*	SGUT-504*	SGUT-505	5, SGLT-506	SGLR01278** (SMC01278)	SGLR02656** (SMC02656)	SGLR00288	SGMR09534	6*	7	LALT500	LALT501	8, LALT502	LALT503** (SMC00756)	19	SMC01172	SMC01172 DUP	SMC06926	SMC01384	SMC01550	SMC01640	SMC04748	SMC17056	
Progomphus borealis																						2		2
Protzia sp		2																						2
Rhyacophila sp	2																							2
Sciomyzidae																1	1							2
Sialis sp																				2				2
Stenochironomus sp							1		1															2
Thienemanniella sp	2																							2
Aeshna sp																		1						1
Centroptilum/Procleon spp	1																							1
Chelifera/Metachela sp									1															1
Corisella edullis											1													1
Cymbiodyta sp																	1							1
Dicranota sp	1																							1
Dytiscidae																		1						1
Enochrus carinatus																						1		1
Eubrianax edwardsi	1																							1
Eylais sp																1								1
Gomphidae																							1	1
Gumaga sp	1																							1
Gyrinus sp																				1				1
Helobdella sp													1											1
Heterelmis sp																			1					1
Hydropsychidae			1																					1
Hygrobates sp	1																							1
Mideopsis sp																			1					1
Nemotelus sp											1													1
Neophylax sp	1																							1
Neoplasta sp	1																							1
Oxyethira sp			1																					1
Paratanytarus sp																			1					1
Phaenopsectra sp		1																						1
Psychoda sp										1														
Psychoglypha sp	1																							1
Psychomyiidae			1																					1
Radix auricularia			1																					1
Stictotarsus striatellus									1															1
Stratiomys sp																						1		1
Synorthocladius sp			1																					1
Tribelos sp																				1				1
Trichocorixa reticulata					1																			1
Wiedemannia sp	1																							1
Grand Total	597	607	605	632	610	633	624	610	595	616	677	594	598	613	616	592	636	599	622	585	605	607	600	14073

Yellow highlight = lined channel site
Bue highlight = unlined channel site
*Reference site
**Contribution to SMC
"sp" denotes taxa identified to genus level

Appendix B.3: Metric Values for Benthic Macroinvertebrates Collected from LACFCD Monitoring Sites for 2009

	San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed						Santa Clara River Watershed		
Metric	**SGUT-501***	**SGUT-504***	**SGUT-505**	**5, SGLT-506**	**SGLR01278****	**SGLR02656****	**SGLR00288**	**SGMR09534**	**6***	**7**	**LALT500**	**LALT501**	**8, LALT502**	**LALT503****	**19**	**SMC01172**	**SMC01172 DUP**	**SMC06926**	**SMC01384**	**SMC01550**	**SMC01640**	**SMC04748**	**SMC17056**	**Range**
Taxa Richness	63	40	41	19	20	22	23	11	57	31	17	18	21	17	11	39	35	31	31	39	8	22	32	8-63
Ephemeropteran Taxa	9	5	4	1	1	2	1	1	5	2	1	3	0	2	0	1	2	2	3	1	0	3	3	0-9
Plecopteran Taxa	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-2
Trichopteran Taxa	12	6	8	1	0	1	1	0	8	0	2	1	0	1	0	4	2	3	3	3	0	1	1	0-12
EPT Taxa	23	11	12	2	1	3	2	1	13	2	3	4	0	3	0	5	4	5	6	4	0	4	4	0-23
Dipteran Taxa	22	17	19	11	12	16	12	4	23	18	6	10	10	8	6	21	18	12	10	21	7	7	15	4-23
Non Insect Taxa	10	9	6	6	5	3	7	6	8	7	5	4	8	5	5	8	6	9	9	6	1	6	6	1-10
% EPT Taxa	65.4%	24.6%	42.6%	4.8%	0.2%	15.6%	25.6%	90.6%	24.6%	15.0%	1.2%	91.0%	0.0%	6.2%	0.0%	28.4%	34.2%	5.8%	25.4%	22.6%	0.0%	72.4%	63.6%	0.0%-91.0%
% Sensitive EPT organisms	39.6%	6.8%	10.8%	0.0%	0.0%	0.0%	0.0%	0.0%	5.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	2.6%	0.8%	2.6%	13.8%	0.0%	0.0%	0.0%	0.0%-39.6%
% Chironomidae organisms	10.0%	32.4%	22.2%	35.4%	24.4%	55.2%	8.6%	4.2%	19.8%	11.2%	36.0%	2.4%	5.2%	88.4%	44.4%	15.4%	12.4%	14.8%	3.6%	28.0%	20.0%	2.8%	6.4%	2.4%-88.4%
Shannon Diversity	3.4	3.2	3.0	2.2	1.7	2.2	2.3	0.5	3.4	2.1	1.8	0.9	1.4	1.2	1.7	2.5	2.3	2.5	2.1	2.6	0.8	1.9	2.4	0.5%-3.4%
Margalef Diversity	10.3	6.8	6.8	2.9	3.1	3.9	3.5	1.6	9.0	5.1	2.6	2.7	3.4	2.6	1.6	6.1	5.5	5.0	5.0	6.4	1.3	3.5	5.1	1.3-10.3
Average Tolerance Value	3.7	5.8	5.5	6.9	7.4	6.8	5.8	4.2	6.1	7.2	7.7	5.1	7.0	7.0	7.3	6.3	6.2	6.9	6.9	6.6	7.8	4.9	5.5	3.7-7.8
% Dominant Taxon	12.8%	14.2%	10.4%	27.4%	52.2%	29.0%	24.6%	90.6%	11.6%	49.0%	41.8%	81.8%	53.0%	72.4%	29.8%	23.6%	30.2%	26.6%	44.6%	33.6%	78.4%	36.8%	26.6%	11.6%-90.6%
% Intolerant organisms	37.2%	6.2%	10.8%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	4.8%	1.6%	2.6%	14.0%	0.0%	0.0%	0.0%	0.0%-37.2%
% Tolerant organisms	5.8%	24.8%	27.2%	56.2%	72.4%	32.4%	14.8%	1.2%	32.0%	67.6%	72.8%	2.0%	64.8%	15.4%	56.8%	49.6%	45.0%	58.8%	65.0%	55.2%	86.0%	13.6%	17.0%	1.2%-86.0%
% Collector-gatherer	50.0%	30.4%	42.4%	79.8%	95.0%	75.0%	38.6%	97.0%	33.6%	83.0%	88.6%	95.0%	91.0%	96.4%	92.6%	62.6%	64.6%	36.0%	29.6%	57.0%	95.8%	78.0%	58.8%	29.6%-97.0%
% Collector-filterer	8.8%	16.6%	14.4%	1.2%	2.0%	4.8%	11.4%	0.0%	8.8%	1.4%	0.0%	1.0%	0.0%	1.6%	0.0%	1.8%	1.4%	5.2%	4.6%	10.6%	0.6%	2.2%	9.0%	0.0%-16.6%
% Predator	10.4%	20.8%	18.8%	10.8%	2.0%	5.2%	37.8%	1.8%	25.6%	13.2%	4.6%	0.6%	6.6%	1.4%	0.8%	4.8%	9.2%	16.6%	6.4%	11.4%	0.4%	8.6%	5.8%	0.4%-37.8%
% Shredder	1.4%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.8%	0.2%	0.8%	0.4%	0.6%	0.0%	0.0%	0.0%	0.0%-2.8%
% Scraper	15.6%	16.6%	12.2%	6.8%	0.4%	0.0%	7.6%	0.8%	13.4%	1.4%	5.8%	0.6%	0.2%	0.4%	6.6%	22.6%	19.4%	29.0%	47.2%	4.6%	0.0%	1.2%	0.6%	0.0%-47.2%
% Others	13.6%	15.6%	11.8%	1.4%	0.0%	14.8%	4.6%	0.0%	15.8%	0.8%	1.0%	2.8%	0.6%	0.2%	0.0%	7.4%	5.0%	12.4%	11.6%	15.6%	3.2%	9.0%	25.4%	0.0%-25.4%
Estimated abundance of BMI/ft^2	392	265	206	557	514	1,602	101	242	209	280	196	503	195	79	905	107	60	423	802	802	4,049	1,505	447	60-4,049

Yellow highlight = lined channel site
Blue highlight = unlined channel site
*Reference site
**Contribution to SMC

Appendix B.4: Physical Water Quality Data for LACFCD Bioassessment Sites for 2009

Watershed	Receiving Water Body	Site Code	pH	Specific Conductance (mS/cm)	Water Tempurature (°C)	Dissolved Oxygen (mg/l)	Turbidity (ntu)	Alkalinity (mg/L $CaCO_3$)
San Gabriel River Watershed	San Gabriel River	SGUT-501*	8.32	0.279	14.42	9.56	11.1	154
	San Gabriel River	SGUT-504*	8.50	0.285	21.63	9.53	-1.3	140
	San Gabriel River	SGUT-505	8.26	0.301	23.00	7.98	5.2	136
	Walnut Channel	5, SGLT-506	8.04	1.221	22.54	8.97	8.7	200
	Coyote Creek	SGLR01278**	9.23	1.279	28.52	15.35	1.7	76
	Walnut Channel	SGLR02656**	8.86	1.246	25.74	16.82	2.1	132
	Emerald Wash	SGLR00288	7.63	0.924	16.77	7.32	6.7	244
	San Gabriel	SGMR09534	8.68	1.119	29.04	15.89	0.1	196
Los Angeles River Watershed	Arroyo Seco	6*	7.81	0.361	17.14	9.33	-0.9	250
	Arroyo Seco	7	8.09	0.868	16.44	8.43	1.7	224
	Rio Hondo	LALT500	9.38	0.774	25.15	14.39	78.7	84
	Arroyo Seco	LALT501	9.08	0.827	27.64	12.85	-1.9	86
	Compton Creek	8, LALT502	7.49	0.716	25.20	5.14	8.2	200
	Tujunga Wash	LALT503**	8.15	1.601	16.60	7.57	12.8	246
Dominguez Channel	Dominguez Channel	19	9.42	1.136	30.18	26.80	0.5	152
Santa Monica Bay Watershed	Trancas Canyon Creek	SMC01172	7.44	0.540	13.93	4.50	-0.1	480
	Rustic Canyon	SMC06926	8.25	0.956	19.58	9.03	-0.1	316
	Malibu Creek	SMC01384	8.01	2.068	26.50	7.52	-0.8	280
	Trancas Canyon Creek	SMC01550	8.00	0.891	21.78	9.20	1.2	368
	Las Virgenes	SMC01640	9.66	3.049	31.60	9.44	1.3	68
Santa Clara River Watershed	Santa Clara River	SMC04748	8.16	1.086	21.59	8.61	37.5	232
	Santa Clara River	SMC17056	7.75	0.661	23.67	7.64	-2.2	328

Yellow highlight = lined channel site
Blue highlight = unlined channel site
*Reference site
**Contribution to SMC

Appendix B.5: Physical Habitat Measures of LACFCD Bioassessment Monitoring Reaches for 2009.

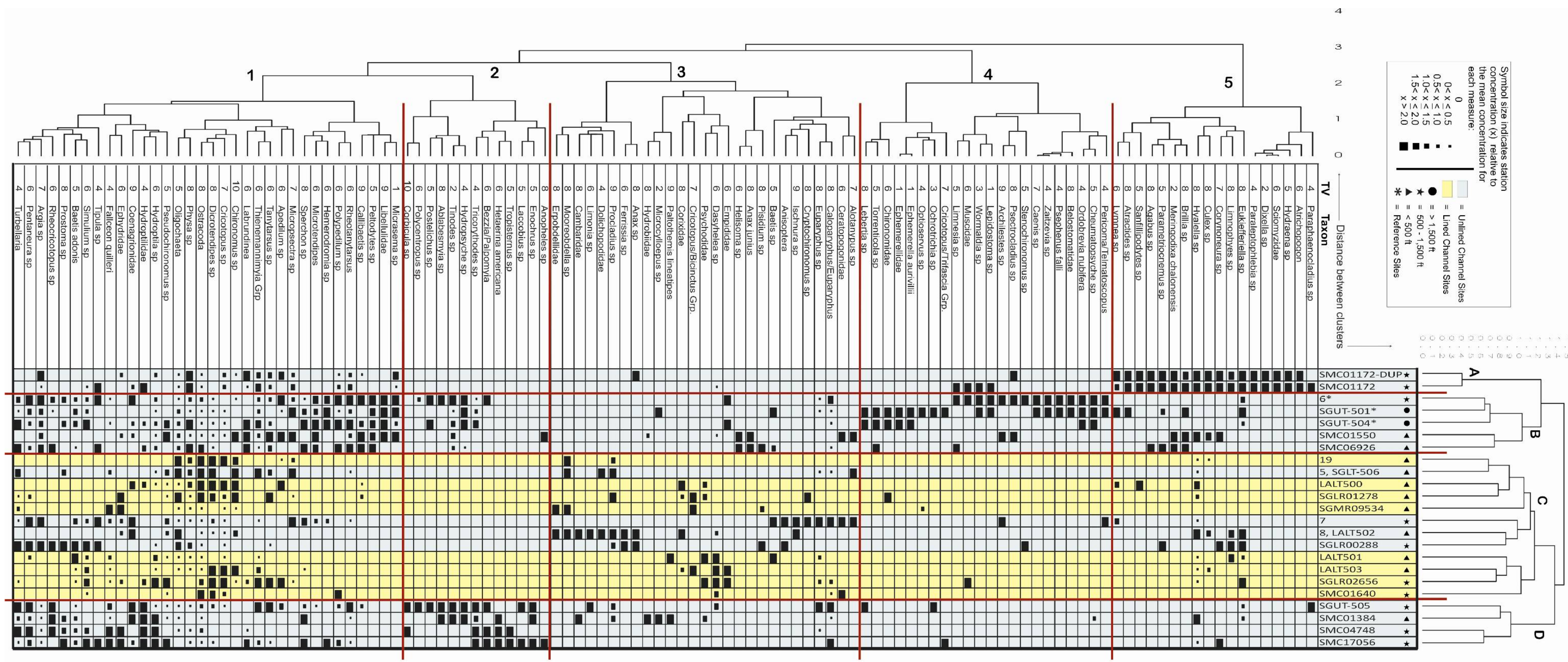
	San Gabriel River Watershed								Los Angeles River Watershed						Dominguez Channel	Santa Monica Bay Watershed					Santa Clara River Watershed	
Physical Habitat Measure	**SGUT-501***	**SGUT-504***	**SGUT-505**	**5, SGLT-506**	**SGLR 01278****	**SGLR 02656****	**SGLR 00288**	**SGMR 09534**	**6***	**7**	**LALT500**	**LALT501**	**8, LALT502**	**LALT503****	**19**	**SMC 01172**	**SMC 06926**	**SMC 01384**	**SMC 01550**	**SMC 01640**	**SMC 04748**	**SMC 17056**
CRAM physical habitat score (25-100 point scale)	83	74	69	58	37	37	69	39	85	69	37	39	47	37	37	79	42	83	85	27	79	69
Elevation (feet above sea level)	1,620	1,512	898	298	20	500	1,440	30	1,118	725	82	295	22	578	3	1,200	210	385	310	780	1,060	885
SWAMP physical habitat attributes																						
Substrate complexity (0-20 scale)	19	14	16	5	1	1	16	2	18	14	2	3	5	1	2	18	10	16	16	1	11	8
Sediment deposition (0-20 scale)	16	14	18	6	20	16	13	19	13	9	15	16	2	19	15	16	14	14	15	18	8	6
Channel alteration (0-20 scale)	19	15	19	4	1	1	14	1	19	11		2	8	1	1	20	5	18	20	1	18	15
Attached macroalgae (% of reach)	21%	17%	27%	5%	50%	4%	6%	97%	19%	0%	7%	62%	3%	0%	35%	15%	10%	30%	18%	14%	44%	40%
Bank stability-left bank	stable	stable	stable	stable	stable	stable	vulnerable	stable	stable	stable	stable	stable	stable	stable	stable	stable	stable	stable	stable	stable	stable	vulnerable
Bank stability-right bank	stable	stable	stable	stable	stable	stable	vulnerable	stable	stable	stable	stable	stable	stable	stable	stable	stabe	stabe	stabe	stabe	stabe	stabe	vulnerable
Gradient (% of slope)	2.77%	2.49%	1.57%	0.38%	0.08%	0.65%	11.30%	0.06%	4.18%	2.40%	0.16%	1.24%	0.89%	0.02%	0.07%	2.35%	2.34%	2.00%	3.83%	0.97%	0.43%	0.73%
Flow Volume (cfs, ft^3/second)	7.63	20.95	0.15	0.03	2.54	0.72	0.005	22.56	0.02	0.31	0.00	0.67	0.15	0.05	1.37	0.01	0.06	0.44	0.01	0.07	16.24	2.14
Average canopy cover (% of reach)	21%	2%	17%	8%	0%	29%	94%	3%	56%	69%	0%	3%	28%	0%	0%	90%	75%	75%	71%	38%	7%	9%
Riffle habitat (% of reach)	34%	25%	35%	17%	0%	0%	52%	0%	37%	44%	0%	40%	4%	0%	0%	17%	24%	33%	19%	0%	31%	43%
Run/glide habitat (% of reach)	48%	70%	36%	83%	100%	100%	28%	100%	16%	42%	100%	60%	9%	100%	100%	19%	71%	33%	35%	100%	69%	57%
Pool habitat (% of reach)	18%	5%	29%	0%	0%	0%	20%	0%	47%	14%	0%	0%	87%	0%	0%	64%	5%	34%	46%	0%	0%	0%
Substrate composition																						
Fines (% of reach)	0%	20%	3%	35%	0%	0%	4%	0%	3%	10%	1%	0%	50%	0%	0%	2%	7%	1%	5%	0%	10%	1%
Sand (% of reach)	21%	9%	3%	16%	0%	0%	29%	0%	22%	28%	2%	0%	16%	0%	2%	13%	17%	23%	11%	0%	55%	80%
Gravel (% of reach)	2%	1%	0%	8%	0%	0%	0%	0%	3%	1%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%
Cobble (% of reach)	60%	65%	76%	41%	0%	0%	48%	0%	43%	46%	0%	0%	22%	0%	0%	36%	56%	55%	50%	0%	29%	19%
Boulder (% of reach)	8%	2%	11%	0%	0%	0%	6%	0%	8%	0%	0%	0%	0%	0%	0%	3%	0%	1%	11%	0%	0%	0%
Roots (% of reach)	1%	3%	7%	0%	0%	0%	3%	0%	1%	6%	0%	0%	0%	0%	0%	24%	0%	20%	10%	1%	6%	0%
Consolidated Sediment (% of reach)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	12%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bedrock (% of reach)	8%	0%	0%	0%	0%	0%	10%	0%	19%	0%	0%	0%	0%	0%	0%	20%	0%	0%	11%	0%	0%	0%
Concrete (% of reach)	0%	0%	0%	0%	100%	100%	0%	100%	1%	9%	97%	100%	0%	100%	98%	0%	20%	0%	2%	99%	0%	0%

Yellow highlight = lined channel site
Blue highlight = unlined channel site
*Reference site
**Contribution to SMC

Appendix B.6: Index of Biotic Integrity Scores for LACFCD Bioassessment Sites, June 2009.

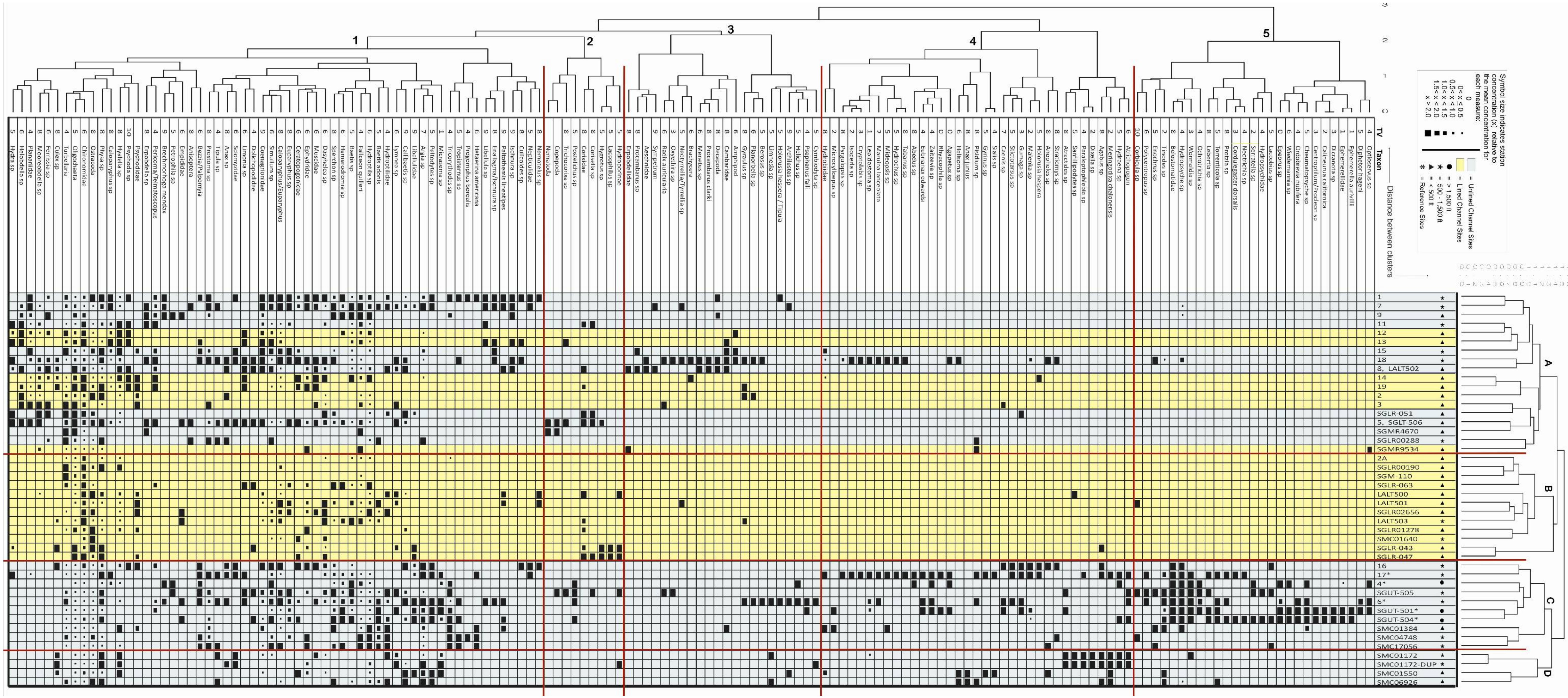
Watershed	Receiving Water Body	Site Code	Total IBI Score	IBI Rating	% CF+CG		% Non-Insect Taxa		% Tolerant Taxa		Number Coleoptera Taxa		Number Predator Taxa		% Intolerant Individuals		Number EPT Taxa	
					Metric Value	IBI score	Metric Value	IBI score	Metric Value	IBI score	Metric Value	IBI score	Metric Value	IBI score	Metric Value	IBI score	Metric Value	IBI score
San Gabriel River	San Gabriel River	SGUT-501*	62	Very Good	63%	9	20%	7	18%	6	7	10	15	10	38%	10	23	10
Los Angeles River	Arroyo Seco	6*	50	Good	56%	10	17%	8	26%	3	9	10	16	10	8%	3	12	6
San Gabriel River	San Gabriel River	SGUT-504*	34	Fair	66%	8	30%	4	30%	2	3	5	10	7	6%	2	11	6
San Gabriel River	San Gabriel River	SGUT-505	33	Fair	73%	6	26%	5	26%	3	2	4	8	5	11%	4	12	6
Santa Monica Bay	Trancas Canyon Creek	SMC01172 DUP	31	Fair	70%	7	26%	5	35%	1	5	8	9	6	4%	2	4	2
Santa Monica Bay	Trancas Canyon Creek	SMC01172	29	Fair	70%	7	31%	4	27%	3	3	5	10	7	3%	1	4	2
Santa Monica Bay	Malibu Creek	SMC01384	29	Fair	37%	10	35%	3	35%	1	3	5	8	5	3%	1	7	4
Santa Monica Bay	Trancas Canyon Creek	SMC01550	26	Poor	73%	6	26%	5	48%	0	2	4	7	4	14%	5	4	2
Santa Monica Bay	Rustic Canyon	SMC06926	26	Poor	50%	10	41%	2	36%	1	3	5	8	5	1%	1	4	2
Santa Clara River	Santa Clara River	SMC17056	25	Poor	73%	6	26%	5	30%	2	2	4	9	6	0%	0	4	2
Santa Clara River	Santa Clara River	SMC04748	22	Poor	85%	3	26%	5	21%	5	2	4	6	3	0%	0	4	2
Los Angeles River	Arroyo Seco	7	16	Poor	88%	3	27%	5	36%	1	0	0	9	6	0%	0	3	1
San Gabriel River	Emerald Wash	SGLR00288	15	Poor	56%	10	47%	0	33%	2	0	0	5	2	0%	0	2	1
San Gabriel River	Walnut Channel	SGLR02656** (SMC02656)	10	Very Poor	85%	3	30%	4	30%	2	0	0	1	0	0%	0	2	1
Los Angeles River	Rio Hondo	LALT500	9	Very Poor	89%	2	38%	3	54%	0	1	2	4	1	0%	0	3	1
Santa Monica Bay	Las Virgenes Creek	SMC01640	7	Very Poor	100%	0	20%	7	40%	0	0	0	0	0	0%	0	0	0
Los Angeles River	Arroyo Seco	LALT501	6	Very Poor	96%	1	31%	4	38%	0	0	0	1	0	0%	0	3	1
Los Angeles River	Compton Creek	8, LALT502	6	Very Poor	95%	1	38%	3	62%	0	0	0	5	2	0%	0	0	0
Los Angeles River	Tujunga Wash	LALT503** (SMC00756)	5	Very Poor	99%	0	31%	4	38%	0	0	0	2	0	0%	0	3	1
San Gabriel River	Walnut Channel	5, SGLT-506	5	Very Poor	89%	2	40%	2	40%	0	0	0	2	0	0%	0	2	1
Dominguez Channel	Dominguez Channel	19	1	Very Poor	93%	1	71%	0	71%	0	0	0	1	0	0%	0	0	0
San Gabriel River	Coyote Creek	SGLR01278** (SMC01278)	1	Very Poor	98%	0	45%	1	55%	0	0	0	3	0	0%	0	1	0
San Gabriel River	San Gabriel River	SGMR09534	1	Very Poor	96%	1	70%	0	40%	0	0	0	3	0	0%	0	1	0

Yellow highlight = lined channel site
Blue highlight = unlined channel site
*Reference site
**Contribution to SMC



Appendix B.7: Cluster Analysis of Stations and Taxa for Los Angeles County Bioassessment Monitoring Sites for 2009

(TV values are not applied to some family or order level taxa due to high variability within those levels)



Appendix B.8: Cluster Analysis of Stations and Taxa for Los Angeles County Bioassessment Monitoring Sites for 2003–2009

(TV values are not applied to some family or order level taxa due to high variability within those levels)

APPENDIX C

Field Data Sheets

(ON CD ONLY)

(Chain of Custodies and Field Data Sheets are available upon request.)

WESTON SOLUTIONS.

Approved by: BL
Date: 2 Oct 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey **Jul-09**
Station Site 6 Replicate 1
Date Collected 15 Jun 09
Sample Sed. Vol. (mL) 250 No./Type Contr. 1/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 3/8 Sorted By YLP Date(s) Sorted 7/6/09 - 7/7/09
Total Sort Time 5.5hr # Animals Sorted 600 Animals Remaining 262
Animals/Grid (optional) A-1 - 430, ~~D3~~ C2 - 157, D2-275
Comments

Distribution of Sorted Material Est. total abundance 2299 ÷11 = 209

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG Pass/Fail Pass Date 12 Sep 09
QA/QC Time 1/3 hr Re-Sort Time Re-Sort Date
No. of Animals QA/QC 5 Removal rate 99.4%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes (Wood) (Algae) Seeds Animals
   Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS.

Approved by: BT
Date: 2OCT09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey **Jul-09**
Station Site 7 Replicate 1
Date Collected 15 Jun 09
Sample Sed. Vol. (mL) 200 mL No./Type Contr. 1/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 2/8 Sorted By YLP Date(s) Sorted 7/7/09
Total Sort Time 4hr # Animals Sorted 600 Animals Remaining 143
Animals/Grid (optional) A2-391, B-1-352
Comments

Distribution of Sorted Material Est. total abundance 3080 ÷ 11 = 280/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG Pass/Fail Pass Date 13 Sep09
QA/QC Time 1/3 hr Re-Sort Time Re-Sort Date
No. of Animals QA/QC 11 Removal rate 98.5%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD circled) FAIR POOR
2. Single Major Component:
   Shellhash, ~~Tubes~~, Wood (circled), Algae (circled), Seeds (circled), Animals
   Fibers, Coarse Sand (circled), Fine Sand, Pea Gravel, Organic Material (circled)
   Sewage Debris, Macrodetritus, Other:

WESTON SOLUTIONS

Approved by: BI
Date: 20 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title: **LACFCD Bioassessment**
Survey: **Jul-09**
Station: Site 19
Replicate:
Date Collected: 24 Jun 09
Sample Sed. Vol. (mL): 150
No./Type Contr.: 1/1L
Sampler: **Kick Net**

II. Sorting (600 animals)

Sort Fraction: 0.25/4
Sorted By: YLP
Date(s) Sorted: 7/7/09 - 7/8/09
Total Sort Time: 4 hr
Animals Sorted: 600
Animals Remaining: —
Animals/Grid (optional): D1 - 600 (25%)
Comments:

Distribution of Sorted Material

Est. total abundance: 9952 ÷ 11 = 905

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	—		
Trichoptera	—		
Chironomidae	1		
Diptera	—		
Other Insects	—		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	—		

III. Sorting QA/QC

Sort Criteria: 100 %
QA/QC By: TVG
Pass/Fail: Pass
Date: 12 Sep 09
QA/QC Time: 1/3 hr
Re-Sort Time:
Re-Sort Date:
No. of Animals QA/QC: 6
Removal rate: 99.0%
No. of Animals Re-Sort:

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD, circled) FAIR POOR

2. Single Major Component:

Shellhash ~~Tubes~~ (Wood, circled) (Algae, circled) Seeds Animals
Fibers (Coarse Sand, circled) Fine Sand Pea Gravel Organic Material
Sewage Debris ~~Macrodetritus~~ Other:

WESTON SOLUTIONS.

Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title LACFCD Bioassessment
Survey Jul-09
Station SGUT-501
Replicate 1
Date Collected 16 Jun 09
Sample Sed. Vol. (mL) 300
No./Type Contr. 1/1L
Sampler Kick Net

II. Sorting (600 animals)

Sort Fraction 1.15/8
Sorted By YLP
Date(s) Sorted 7/8/09
Total Sort Time 5hr
Animals Sorted 600
Animals Remaining —
Animals/Grid (optional) AZ-568, D1-32 (15%)
Comments

Distribution of Sorted Material
Est. total abundance 4306 ÷ 11 = 392

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	—		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG
Pass/Fail Pass
Date 12 Sep 09
QA/QC Time 1/2 hr
Re-Sort Time
Re-Sort Date
No. of Animals QA/QC 22
Removal rate 96.3%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes (Wood) (Algae) Seeds Animals
   Fibers (Coarse Sand) Fine Sand Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS

Approved by: BI
Date: 2OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey **Jul-09**
Station SGUT 504 Replicate 1
Date Collected 16 JUNE 09
Sample Sed. Vol. (mL) 200ml No./Type Contr. 1 Lt Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 3/14 Sorted By OEJ Date(s) Sorted 8,9,13-15 JULY09
Total Sort Time 6 # Animals Sorted 600 Animals Remaining ~~6~~ 14
Animals/Grid (optional) 2B, DF; 3D
Comments 1D

Distribution of Sorted Material Est. total abundance 2912÷11=265

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	2		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG Pass/Fail Pass Date 13Sep09
QA/QC Time ¼ hr Re-Sort Time Re-Sort Date
No. of Animals QA/QC 3 Removal rate 99.5%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood (Algae) Seeds Animals
   Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS.

Approved by: BI
Date: 2OCT09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-05~~ Jun 2009
Station SGUT 505 Replicate
Date Collected 30 Jun 09
Sample Sed. Vol. (mL) No./Type Contr. 2/L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 7.5/25 Sorted By TVT Date(s) Sorted 7-18-09
Total Sort Time 5 # Animals Sorted 600 Animals Remaining 32
Animals/Grid (optional) 2.5/25 - 194, 2.5/25 - 218, 2.5/25 - 188
Comments

Distribution of Sorted Material Est. total abundance 2260÷11=206/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca		1	
Crustacea	1		
Other phyla	1		
~~Extra~~ Remaining Animals			

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By YLP Pass/Fail Fail Date 18Sep09
QA/QC Time 40 min Re-Sort Time Re-Sort Date
No. of Animals QA/QC 41 Removal rate 93.5%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood (Algae) Seeds Animals
   Fibers Coarse Sand (Fine Sand) Pea Gravel (Organic Material)
   Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS.

Approved by: BZ
Date: 2 Oct 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-05~~ 2009

Station S6LR-002BB Replicate ______

Date Collected 18 Jun 09

Sample Sed. Vol. (mL) ______ No./Type Contr. 1/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 15/25 Sorted By TG Date(s) Sorted 7-11-09

Total Sort Time ~~3.5~~ 4.5 (TG) # Animals Sorted 600 Animals Remaining 22

Animals/Grid (optional) 1/5 - 213, 1/5 - 227, 1/5 - 160

Comments ______

Distribution of Sorted Material Est. total abundance 1115 ÷ 11 = 101/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
~~Extra~~ Remaining Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %

QA/QC By BTshan Pass/Fail Pass Date 13Sep09

QA/QC Time 1/2 hr Re-Sort Time ______ Re-Sort Date ______

No. of Animals QA/QC 23 Removal rate 96.4%

No. of Animals Re-Sort ______

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR

2. Single Major Component:

Shellhash Tubes Wood Algae Seeds Animals
Fibers Coarse Sand (Fine Sand) Pea Gravel (Organic Material)
Sewage Debris Macrodetritus Other: ______

WESTON SOLUTIONS.

Approved by: BI
Date: 2OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey **Jul-~~08~~ 09**
Station 56LR 01278 Replicate ______
Date Collected 17 Jun 09
Sample Sed. Vol. (mL) ______ No./Type Contr. 2/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 3/25 Sorted By TVT Date(s) Sorted 7-16-09
Total Sort Time 4.5 # Animals Sorted 600 Animals Remaining 54
Animals/Grid (optional) 1/25 - 236, 1/25 - 198, 1/25 - 166
Comments ______

Distribution of Sorted Material Est. total abundance 5658 ÷ 11 = 514/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera			
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
~~Extra~~ Rem. Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By YLP Pass/Fail Pass Date 18Sep09
QA/QC Time 1/2 hr Re-Sort Time ______ Re-Sort Date ______
No. of Animals QA/QC 15 Removal rate 97.7%
No. of Animals Re-Sort ______

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood (Algae) Seeds Animals
   Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other: ______

WESTON SOLUTIONS.

Approved by: BT
Date: 2OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-05~~ Jun 2009
Station SGLR 2656 Replicate ____
Date Collected 23 Jun 09
Sample Sed. Vol. (mL) ____ No./Type Contr. 1 / 1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 1/25 Sorted By TVG Date(s) Sorted 7-19-09
Total Sort Time 3.5 # Animals Sorted 600 Animals Remaining 45
Animals/Grid (optional) 1/3 of 1/25 - 241, 1/3 of 1/25 - 196, 1/3 of 1/25 - 163
Comments ____

Distribution of Sorted Material Est. total abundance 17,625 ÷ 11 = 1602/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects			
Mollusca			
Crustacea	1		
Other phyla	1		
~~Extra~~ Remaining Animals			

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By YLP Pass/Fail Pass Date 18 Sep 09
QA/QC Time 1/2 hr Re-Sort Time ____ Re-Sort Date ____
No. of Animals QA/QC 27 Removal rate 95.8%
No. of Animals Re-Sort ____

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR

2. Single Major Component:
Shellhash Tubes Wood (Algae) Seeds Animals
Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
Sewage Debris Macrodetritus Other: ____

O:\BLANK FORMS\Benthic\Bioassessment\bioassessment sort sheet.xls

WESTON SOLUTIONS.

Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment**
Survey ~~Jul-05~~ 2009
Station SGMR 09534
Replicate 1
Date Collected 14 Jun 09
Sample Sed. Vol. (mL) 300
No./Type Contr. 1/1L
Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 2/8
Sorted By YLP
Date(s) Sorted 7/9/09
Total Sort Time 7.5 hr
Animals Sorted 600
Animals Remaining 45
Animals/Grid (optional) D1-470, C2-175
Comments Only 2 Grids - BI

Distribution of Sorted Material

Est. total abundance 2656 ÷ 11 = 242

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	—		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG
Pass/Fail Pass
Date 14 Sep 09
QA/QC Time 1/3 hr
Re-Sort Time
Re-Sort Date
No. of Animals QA/QC 9
Removal rate 98.6%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR

2. Single Major Component:

Shellhash Tubes Wood (Algae) Seeds Animals
Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS.

Approved by: BI
Date: 2 Oct 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title LACFCD Bioassessment
Survey Jul-~~08~~ 09
Station SGLT 506
Replicate 1
Date Collected 17 Jun 09
Sample Sed. Vol. (mL) 600
No./Type Contr. 2/1L
Sampler Kick Net

II. Sorting (600 animals)

Sort Fraction ~~2.13~~ 2.5 YLP /24
Sorted By YLP
Date(s) Sorted 7/10/09
Total Sort Time 8hr
Animals Sorted 600
Animals Remaining –
Animals/Grid (optional) C5-238, B3-200, D1-162 (50%)
Comments

Distribution of Sorted Material

Est. total abundance 6125 ÷ 11 = 557/ft2

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	—		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	—		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG
Pass/Fail Pass
Date 13 Sep 09
QA/QC Time 1/3 hr
Re-Sort Time
Re-Sort Date
No. of Animals QA/QC 6
Removal rate 99%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood (Algae) Seeds Animals
   Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS.

Approved by: RI
Date: 20 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey **Jul-~~05~~** 09
Station LALT 500 Replicate
Date Collected 22 Jun 09
Sample Sed. Vol. (mL) 50 No./Type Contr. 1/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction ~~1/8~~ 5/12 YLP Sorted By YLP Date(s) Sorted 7/13/09
Total Sort Time 3.5hr # Animals Sorted 600 Animals Remaining 215
Animals/Grid (optional)
Comments

Distribution of Sorted Material Est. total abundance 2150 ÷ 11 = 196/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG Pass/Fail Pass Date 12 Sep 09
QA/QC Time 1/4 hr Re-Sort Time Re-Sort Date
No. of Animals QA/QC 4 Removal rate 99.5%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR

2. Single Major Component:
Shellhash Tubes Wood Algae Seeds (Animals)
Fibers Coarse Sand Fine Sand Pea Gravel (Organic Material)
Sewage Debris Macrodetritus Other:

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Approved by: [signature]
Date: 2OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title LACFCD Bioassessment
Survey ~~Jul 05~~ 2009
Station LALT-501
Replicate
Date Collected 22 Jun 09
Sample Sed. Vol. (mL)
No./Type Contr. 1/1L
Sampler Kick Net

II. Sorting (600 animals)

Sort Fraction 3/25
Sorted By TVG
Date(s) Sorted 7-12-09
Total Sort Time 2.5
Animals Sorted 600
Animals Remaining 58
Animals/Grid (optional) 1/25 - 158, 1/25 - 202, 1/25 - 240
Comments

Distribution of Sorted Material

Est. total abundance 5533 ÷ 11 ≐ 503/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
~~Extra~~ Remaining Animals			

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By YLP
Pass/Fail Pass
Date 16 Sep 09
QA/QC Time 1/2 hr
Re-Sort Time
Re-Sort Date
No. of Animals QA/QC 12
Removal rate 98.2%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD — circled) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood (Algae — circled) Seeds Animals
   Fibers Coarse Sand Fine Sand Pea Gravel (Organic Material — circled)
   Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS.

Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-05~~ 2009
Station LALT 502 (8) Replicate
Date Collected 22 Jan 09
Sample Sed. Vol. (mL) No./Type Contr. 1/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 7.5/25 Sorted By TVG Date(s) Sorted 7-16-09
Total Sort Time 3.5 # Animals Sorted 600 Animals Remaining 27
Animals/Grid (optional) 2.5/25 - 207, 2.5/25 - 200, 2.5/25 - 193
Comments

Distribution of Sorted Material Est. total abundance 2140 ÷ 11 = 195/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera			
Trichoptera			
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
~~Extra~~ Remaining Animals			

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By YLP Pass/Fail Pass Date 16 Sep 09
QA/QC Time 1/3 hr Re-Sort Time Re-Sort Date
No. of Animals QA/QC 17 Removal rate 97.3%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood Algae Seeds Animals
   Fibers Coarse Sand (Fine Sand) Pea Gravel (Organic Material)
   Sewage Debris Macrodetritus Other:

WESTON SOLUTIONS.

Approved by: B-I
Date: 2 Oct 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment**
Survey **Jul-~~05~~** 09
Station LALT 503
Replicate
Date Collected 23 Jun 09
Sample Sed. Vol. (mL) < 50mL
No./Type Contr. 1 / 1L
Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 6/8
Sorted By YLP
Date(s) Sorted 7/13/09 - 7/15/09
Total Sort Time 5.5 hr
Animals Sorted 600
Animals Remaining 24
Animals/Grid (optional)
Comments

Distribution of Sorted Material
Est. total abundance 867 ÷ 11 = 79/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG
Pass/Fail Pass
Date 13 Sep 09
QA/QC Time 1/3 hr
Re-Sort Time
Re-Sort Date
No. of Animals QA/QC 13
Removal rate 97.9%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood Algae Seeds (Animals)
   Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other:

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Approved by: BI
Date: 20CT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment**
Survey ~~Jul-05~~ 2009
Station SMC 01172
Replicate ______
Date Collected 24 Jun 09
Sample Sed. Vol. (mL) ______
No./Type Contr. 1/1L
Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 14/25
Sorted By TYG
Date(s) Sorted 7-13-09
Total Sort Time 5.5h
Animals Sorted 600
Animals Remaining 57
Animals/Grid (optional) 1/3 - 250 1/3 - 214, 1/3 - 136 (~~[struck out]~~) (61)
Comments 2/25 - 104, 2/25 - 96, 2/25 - 99, 2/25 - 85, 2/25 - 80, 2/25 - 102, 2/25 - 34 extra 57

Distribution of Sorted Material
Est. total abundance 1173 ÷ 11 = 107/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
~~Extra~~ Remaining Animals			

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By OEW
Pass/Fail Pass
Date 16Sep09
QA/QC Time 1/2 hr
Re-Sort Time ______
Re-Sort Date ______
No. of Animals QA/QC 8
Removal rate 98.7%
No. of Animals Re-Sort ______

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:

Shellhash Tubes Wood (Algae) Seeds Animals
Fibers Coarse Sand Fine Sand Pea Gravel (Organic Material)
Sewage Debris Macrodetritus Other: ______

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Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title: LACFCD Bioassessment
Survey: ~~Jul-05~~ 2009
Station: SMC 01172 Dup
Replicate:
Date Collected: 24 Jun 09
Sample Sed. Vol. (mL): 300
No./Type Contr.: 1/1L
Sampler: Kick Net

II. Sorting (600 animals)

Sort Fraction: ~~28.5/24~~ 23.5/24 YLP
Sorted By: YLP
Date(s) Sorted: 7/15/09 - 7/17/09
Total Sort Time: 10 hr
Animals Sorted: 600
Animals Remaining: —
Animals/Grid (optional):
Comments: # Grids? - BI

Distribution of Sorted Material

Est. total abundance: 661 ÷ 11 = 60/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	—		

III. Sorting QA/QC

Sort Criteria: 100 %
QA/QC By: TVG
Pass/Fail: Pass
Date: 13 Sep 09
QA/QC Time: 20 min
Re-Sort Time:
Re-Sort Date:
No. of Animals QA/QC: 11
Removal rate: 98.2%
No. of Animals Re-Sort:

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash, Tubes, (Wood), (Algae), Seeds, Animals, Fibers, Coarse Sand, Fine Sand, Pea Gravel, Organic Material, Sewage Debris, Macrodetritus, Other:

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Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-06~~ 2009
Station SMC 01384 Replicate
Date Collected 29 JUN 09
Sample Sed. Vol. (mL) 600 No./Type Contr. 2/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 3/24 Sorted By YLP Date(s) Sorted 7/17/09 - 7/20/09
Total Sort Time 6 hr # Animals Sorted 600 Animals Remaining 445
Animals/Grid (optional) B3-244, C5-149, D1-652
Comments

Distribution of Sorted Material Est. total abundance 8816 ÷ 11 = 802/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By OEW Pass/Fail Pass Date 16Sep09
QA/QC Time 1hr Re-Sort Time Re-Sort Date
No. of Animals QA/QC 35 Removal rate 96.6%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes Wood (Algae) Seeds Animals
   Fibers Coarse Sand ~~Fine Sand~~ Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other:

O:\BLANK FORMS\Benthic\Bioassessment\bioassessment sort sheet.xls

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Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment**
Survey ~~Jul-05~~ 2009
Station SMC01640
Replicate
Date Collected 29 Jun 2009
Sample Sed. Vol. (mL)
No./Type Contr. 1 / 1L
Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 3/8 of 25 (3/ = .375)
Sorted By TLT
Date(s) Sorted 7-10-09
Total Sort Time 3.5
Animals Sorted 600
Animals Remaining 47
Animals/Grid (optional) 1/8 of 1grid = 223, 1/8 of 1grid = 210, 1/8 of 1grid = 167
Comments

Distribution of Sorted Material

Est. total abundance 44533 ÷ 11 = 4049/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera			
Trichoptera			
Chironomidae	1		
Diptera	1		
Other Insects			
Mollusca			
Crustacea	1		
Other phyla			
~~Extra~~ Remaining Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By YLP
Pass/Fail Fail
Date 18 Sep 09
QA/QC Time 1/2 hr
Re-Sort Time
Re-Sort Date
No. of Animals QA/QC 36
Removal rate 94.4%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR

2. Single Major Component:
   Shellhash Tubes Wood (Algae) Seeds Animals
   Fibers Coarse Sand Fine Sand Pea Gravel Organic Material
   Sewage Debris Macrodetritus Other:

668

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Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-05~~ 2009
Station SMC 04748 Replicate ____
Date Collected 2 July 09
Sample Sed. Vol. (mL) 600 mL No./Type Contr. 2/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 1/24 Sorted By YLP Date(s) Sorted 7/20/09 - 7/21/09
Total Sort Time 7 hr # Animals Sorted 600 Animals Remaining 47
Animals/Grid (optional) A2 - 647
Comments ____

Distribution of Sorted Material Est. total abundance 16,560 ÷ 11 = 1505

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1	1	
Crustacea	1		
Other phyla	1		
Extra Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By TVG Pass/Fail Fail? Date 13 Sep 09
QA/QC Time 1/2 hr Re-Sort Time ____ Re-Sort Date ____
No. of Animals QA/QC 36 Removal rate 94.4%
No. of Animals Re-Sort —

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash ~~Tubes~~ Wood (Algae) Seeds Animals
   Fibers (Coarse Sand) Fine Sand Pea Gravel (Organic Material)
   Sewage Debris Macrodetritus Other: ____

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Approved by: BI
Date: 2OCT09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-05~~ 2009
Station SMC 06926 Replicate ______
Date Collected 1 July 09
Sample Sed. Vol. (mL) 300 No./Type Contr. 2/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 3.13/24 Sorted By YLP Date(s) Sorted 7/21/09 - 7/22/09
Total Sort Time ______ # Animals Sorted ______ Animals Remaining ______
Animals/Grid (optional) D6-375, B3-137, C5-75, A1-13 (13%)
Comments ______

Distribution of Sorted Material Est. total abundance 4654 ÷ 11 = 423/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	—		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By BIsham Pass/Fail Pass Date 10Aug08
QA/QC Time 1/2 hr Re-Sort Time ______ Re-Sort Date ______
No. of Animals QA/QC 8 Removal rate 98.7%
No. of Animals Re-Sort ______

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR

2. Single Major Component:

Shellhash Tubes (Wood) Algae (Seeds) Animals
Fibers Coarse Sand Fine Sand Pea Gravel (Organic Material)
Sewage Debris Macrodetritus Other: ______

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Approved by: BI
Date: 2 OCT 09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment** Survey ~~Jul-05~~ 2009
Station SMC 01550 Replicate
Date Collected 25 Jun 09
Sample Sed. Vol. (mL) 300 No./Type Contr. 1/1L Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 3/24 Sorted By YLP Date(s) Sorted 7/23/09
Total Sort Time ______ # Animals Sorted 600 Animals Remaining —
Animals/Grid (optional) C4-173, A1-348, B2-79
Comments

Distribution of Sorted Material Est. total abundance 4912 ÷ 11 = 447/ft²

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
Extra Animals	—		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By BIchan Pass/Fail Pass Date 15Sep09
QA/QC Time Re-Sort Time Re-Sort Date
No. of Animals QA/QC 14 Removal rate 97.6%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:
   Shellhash Tubes (Wood) (Algae) Seeds Animals
   Fibers Coarse Sand Fine Sand Pea Gravel (Organic Material)
   Sewage Debris Macrodetritus Other:

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Approved by: BI
Date: 2OCT09

Stream Bioassessment Sorting Sheet

I. Sample Identification

Project Title **LACFCD Bioassessment**
Survey ~~Jul-05~~ 2009
Station SMC17056
Replicate
Date Collected 2 July 09
Sample Sed. Vol. (mL)
No./Type Contr. 1/1L
Sampler **Kick Net**

II. Sorting (600 animals)

Sort Fraction 4.5/25
Sorted By TVG
Date(s) Sorted 7-25-09
Total Sort Time 4hr.
Animals Sorted 600
Animals Remaining 43
Animals/Grid (optional) 1/3 - 217, 1/3 - 229, 1/3 - 154
Comments

Distribution of Sorted Material

Est. total abundance

	# of Vials	# of Jars	Contents of Jars
Ephemeroptera	1		
Trichoptera	1		
Chironomidae	1		
Diptera	1		
Other Insects	1		
Mollusca	1		
Crustacea	1		
Other phyla	1		
~~Extra~~ Remaining Animals	1		

III. Sorting QA/QC

Sort Criteria 100 %
QA/QC By OEW
Pass/Fail Fail
Date 15Sep09
QA/QC Time 1hr
Re-Sort Time
Re-Sort Date
No. of Animals QA/QC 67 nothing unique
Removal rate 89.6%
No. of Animals Re-Sort

IV. Sample Qualification Comments (Circle One)

1. Preservation: (GOOD) FAIR POOR
2. Single Major Component:

Shellhash Tubes Wood (Algae) Seeds Animals
Fibers Coarse Sand (Fine Sand) Pea Gravel Organic Material
Sewage Debris Macrodetritus Other:

DEPARTMENT OF FISH AND GAME
AQUATIC BIOASSESSMENT LABORATORY-CHICO
CALIFORNIA STATE UNIVERSITY, CHICO
CHICO, CA 95929-0555
530-898-4792

November 18, 2009

Bill Isham
Weston Solutions
2433 Impala Drive
Carlsbad, CA 92008

Dear Bill,

Attached are the results of my QC analysis of 3 samples submitted from the LACFCD LA County 2009 project. The results are presented in five summary tables. This QC analysis was performed in accordance to the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT)'s Standard Taxonomic Effort Document (STE) 28 November 2006 version (Richards and Rogers, 2006).

There were two instances of "tagalong" organisms. These are defined as specimens accidentally included in a vial of organisms of another taxon and are marked as "Probable sorting error" in the attached Listing of Taxonomic Discrepancies file.

A damselfly nymph originally identified as *Enallagma* is in my opinion an *Ischnura* instead. It is similar to the other, earlier instar specimens identified as *Ischnura* in the same sample. The banded eye character is not discernable, but the antennae have 7 distinct segments rather than 6 and the spines along the lateral carinae of the abdomen are in distinct multiple rather than a single row (Westfall and May, 1996).

The *Trichocorixa* originally identified as *T. calva* is actually a *T. reticulata* instead. *Trichocorixa* specimens can be difficult to identify to species, but in this case, the strigil is shorter and straight and not obviously elongated and curved as in *T. calva* (Lauck, 1979).

A Ceratopogonidae pupa was misidentified as Psychodidae. The leg sheaths were not superimposed and the abdominal apex had simple spines but no other setation sending this specimen past Psychodidae in the key (Courtney and Merritt, 2008). Also, larvae of *Psychoda* were misidentified as *Pericoma/Telmatoscopus*. The lack of a preanal plate precludes the possibility of these being *Pericoma/Telmatoscopus* even though there are 26 tergal plates present (Courtney and Merritt, 2008). One thing I've noticed for these multi-plated *Psychoda* is that the plates tend to be relatively smaller than those in *Pericoma/Telmatoscopus*. For that taxon, the 3 plates for each segment tend to cover most of the dorsal surface of the segment.

I have a couple curation notes for this project. Several vials and one slide-mounted specimen were correctly identified, but not included in the submitted data. These include an Oligochaeta vial for LALT-502, an Anisoptera and a *Sperchon* vial for Station 7. The Ceratopogonidae larva (*Dasyhelea*) slide in SGLR 01278 was included on the midge subcontractor data sheet, but not in the submitted data file. Additionally, I noticed that several counts differed from the vial labels and the submitted data sheets. I defaulted to the datasheets in all cases for the analysis.

I welcome any questions or comments you may have concerning this report.

Sincerely,

Austin Brady Richards
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California State University, Chico
Chico, CA 95929-0555
arichards@csuchico.edu
(530) 898-4792

Literature Cited

Courtney, G.W., and R. W. Merritt. 2008. Chapter 22: Aquatic Diptera. Part One. Larvae of Aquatic Diptera. In *An introduction to the aquatic insects of North America, fourth edition, xvi + 1158 pp. + 39 color plates*, edited by R. W. Merritt, K. W. Cummins and M. B. Berg. Dubuque, Iowa: Kendall/Hunt Publishing Company.

Lauck, David R. 1979. Family Corixidae/water boatmen. In *The semiaquatic and aquatic Hemiptera of California (Heteroptera: Hemiptera)*, edited by A. S. Menke.

Richards, A. B. and D. C. Rogers. (2006). "Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) List of Freshwater Macroinvertebrate Taxa from California and Adjacent States including Standard Taxonomic Effort Levels. Version: 28 November 2006." Retrieved 11 May 2007, from http://www.waterboards.ca.gov/swamp/safit.html

Westfall, M. J. and M. L. May (1996). Damselflies of North America. Gainesville, FL, Scientific Publishers.

Comparative Taxonomic Listing of all Submitted Samples

Samples submitted by Weston Solutions for Project: LACFCD LA County

Report prepared by Brady Richards, CDFG ABL-Chico, 11/13/2009

Taxonomist	Sample no.	Vial no.	Original ID	Original Count	Stage	ABL Count	ABL ID
	LALT-502						
		1	Culex	3	L	3	Culex
		2	Dolichopodidae	2	L	2	Dolichopodidae
		3	Limonia	1	L	1	Limonia
		4	Ephydridae	1	L	1	Ephydridae
		5	Dasyhelea	2		1	Ostracoda
		5	Dasyhelea	2	L	2	Dasyhelea
		6	Coenagrionidae	7		7	Coenagrionidae
		7	Ischnura	4		4	Ischnura
		8	Anax	2		2	Anax
		9	Corixidae	6		6	Corixidae
		10	Helobdella	1		1	Helobdella
		11	Mooreobdella	2		2	Mooreobdella
		12	Erpobdellidae	1		1	Erpobdellidae
		13	Ostracoda	12		10	Ostracoda
		14	Hyalella	322		322	Hyalella
		15	Cambaridae	8		9	Cambaridae
		16	Chironomus	6	L	6	Chironomus
		17	Cricotopus	7	L	7	Cricotopus
		18	Dicrotendipes	5	L	5	Dicrotendipes
		19	Eukiefferiella	3	L	3	Eukiefferiella
		20	Limnophyes	1	L	1	Limnophyes
		21	Procladius	12	L	12	Procladius
		22	Pseudochironomus	2	L	2	Pseudochironomus
		23	Oligochaeta	187		188	Oligochaeta

Taxonomist	Sample no.	Vial no.	Original ID	Original Count	Stage	ABL Count	ABL ID
	SGLR 01278						
				0	x	0	
		1	Callibaetis	2		2	Callibaetis
		2	Ephydridae	3	L	3	Ephydridae
		3	Psychodidae	1	P	1	Ceratopogonidae
		4	Trichocorixa calva	1	A	1	Trichocorixa reticulata
		5	Corixidae	1	L	1	Corixidae
		6	Ostracoda	319		313	Ostracoda
		7	Hyalella	41		41	Hyalella
		8	Turbellaria	4		4	Turbellaria
		9	Oligochaeta	94		99	Oligochaeta
		10	Physa	2		2	Physa
		11	Chironomidae	4	P	5	Chironomidae
		12	Chironomus	28	L	28	Chironomus
		13	Cricotopus	19	L	19	Cricotopus
		14	Cricotopus	20	P	20	Cricotopus
		15	Cricotopus bicinctus group	5	L	5	Cricotopus bicinctus group
		16	Cryptochironomus	2	L	2	Cryptochironomus
		17	Dicrotendipes	43	L	43	Dicrotendipes
		18	Dicrotendipes	5	P	5	Dicrotendipes
		19	Micropsectra	1	L	1	Micropsectra
		20	Pentaneura	2	L	2	Pentaneura
		21	Procladius	2	L	2	Procladius
		22	Pseudochironomus	1	L	1	Pseudochironomus
		23	Tanytarsus	12	L	12	Tanytarsus
		24	Ceratopogonidae	1	L	1	Dasyhelea

Taxonomist	Sample no.	Vial no.	Original ID	Original Count	Stage	ABL Count	ABL ID
	Station 7						
		1	Baetis adonis	40		43	Baetis adonis
		2	Baetis	6		3	Baetis
		3	Fallceon quilleri	47		1	Psocoptera
		3	Fallceon quilleri	47		46	Fallceon quilleri
		4	Archilestes	3		3	Archilestes
		5	Argia	35		35	Argia
		6	Enallagma	1		1	Ischnura
		7	Ischnura	5		5	Ischnura
		8	Coenagrionidae	6		6	Coenagrionidae
		9	Caloparyphus/Euparyphus	289	L	289	Caloparyphus/Euparyphus
		10	Euparyphus	72	L	72	Euparyphus
		11	Ceratopogonidae	1	P	1	Ceratopogonidae
		12	Ephydridae	1	L	1	Ephydridae
		13	Hemerodromia	1	L	1	Hemerodromia
		14	Pericoma/Telmatoscopus	2	L	1	Psychoda
		15	Simulium	5	L	5	Simulium
		16	Tipula	3	L	3	Tipula
		17	Hydroptila	1	L	1	Hydroptila
		18	Hyalella	1		1	Hyalella
		19	Ostracoda	3		3	Ostracoda
		20	Oligochaeta	7		7	Oligochaeta
		21	Alotanypus	4	L	4	Alotanypus
		22	Cricotopus	6	L	6	Cricotopus
		23	Cryptochironomus	1	L	1	Cryptochironomus
		24	Dicrotendipes	19	L	19	Dicrotendipes
		25	Micropsectra	15	L	15	Micropsectra
		26	Microtendipes	3	L	3	Microtendipes
		27	Pentaneura	15	L	15	Pentaneura
		28	Pseudochironomus	3	L	3	Pseudochironomus
		29	Rheotanytarsus	1	L	1	Rheotanytarsus

Taxonomist	Sample no.	Vial no.	Original ID	Original Count	Stage	ABL Count	ABL ID
	Station 7						
		30	Thienemannimyia group	1	L	1	Thienemannimyia group
		31	Anisoptera	3		3	Anisoptera
		32	Sperchon	4		4	Sperchon

Listing of Enumeration Discrepancies

Samples submitted by Weston Solutions for Project: LACFCD LA County

Report prepared by Brady Richards, CDFG ABL-Chico, 11/13/2009

	Sample #	Vial #	Original ID	# Counted Original	# Counted QC	Difference (Original - QC)
Minor Counting Discrepancies						
	LALT-502	5	Dasyhelea	2	3	-1
		13	Ostracoda	12	10	2
		15	Cambaridae	8	9	-1
		23	Oligochaeta	187	188	-1
	SGLR 01278	6	Ostracoda	319	313	6
		9	Oligochaeta	94	99	-5
		11	Chironomidae	4	5	-1
	Station 7	1	Baetis adonis	40	43	-3
		2	Baetis	6	3	3
		14	Pericoma/Telmatoscopus	2	1	1

Listing of Taxonomic Discrepancies

Samples submitted by Weston Solutions for Project: LACFCD LA County

Report prepared by Brady Richards, CDFG ABL-Chico, 11/13/2009

		Final ID				
Sample #	**Vial #**	**Original ID**	**QC Final ID**	**Taxonomic level of dispute**	**# Organisms**	**Comments**
LALT-502						
Probable sorting error						
	5	Dasyhelea	Ostracoda	Subphylum	1	This disputed ID also represents a difference in taxonomic precision.
SGLR 01278						
Disputed ID						
	3	Psychodidae	Ceratopogonidae	Family	1	
	4	Trichocorixa calva	Trichocorixa reticulata		Species	1
Original ID less precise						
	24	Ceratopogonidae	Dasyhelea		1	
Station 7						
Disputed ID						
	6	Enallagma	Ischnura	Genus	1	
Original ID not in Master Taxa List						
	14	Pericoma/Telmatoscopus	Psychoda		1	
Probable sorting error						
	3	Fallceon quilleri	Psocoptera		1	

Page 1 of 1

Summary of Taxonomic and Enumeration Discrepancies

Samples submitted by Weston Solutions for Project: LACFCD LA County

Report prepared by Brady Richards, CDFG ABL-Chico, 11/13/2009

		Taxonomic Discrepancies						Counting Discrepancies			
				Taxonomic Precision Relative to QC							
Sample #	**Total Taxa**	**Disputed ID**		**More precise**		**Less**		Major		Minor	
		*f**	*n***	*f*	*n*	*f*	*n*	*f*	*d****	*f*	*d*
LALT-502	23	-	-	-	-	-	-	-	-	4	5
SGLR 01278	22	2	2	-	-	1	1	-	-	3	12
Station 7	32	1	1	-	-	-	-	-	-	3	7

* = the frequency of occurence of the discrepancy, in number of samples *f*
** = the number of organisms affected (by QC Lab counts) *n*
*** = the sum total of (absolute value of) differences in counts *d*

QC Report - Disputed ID's only

Samples submitted by Weston Solutions for Project: LACFCD LA County
Report prepared by Brady Richards, CDFG ABL-Chico, 11/13/2009

Sample #	***Vial***	***Original ID***	***QC ID***	***comments***
SGLR	3	Psychodidae	Ceratopogonidae	
	4	Trichocorixa calva	Trichocorixa reticulata	
Station 7	6	Enallagma	Ischnura	

STATE OF CALIFORNIA - THE RESOURCES AGENCY Arnold Schwarzenegger

DEPARTMENT OF FISH AND GAME
AQUATIC BIOASSESSMENT LABORATORY-CHICO
CALIFORNIA STATE UNIVERSITY, CHICO
CHICO, CA 95929-0555
530-898-4792

November 18, 2009

Bill Isham
Weston Solutions
2433 Impala Drive
Carlsbad, CA 92008

Dear Bill,

Attached are the results of my QC analysis of 2 samples submitted from the SMC SoCal 2009 project. The results are presented in five summary tables. This QC analysis was performed in accordance to the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT)'s Standard Taxonomic Effort Document (STE) 28 November 2006 version (Richards and Rogers, 2006).

The odonate nymph originally identified as *Anax junius* is most likely *Aeshna* instead. *Anax* nymphs have lateral spines on segments 7-9 only, but these have spines on segments 6-9 (Needham et al., 2000). A recent revision has split out many *Aeshna* species into the new genus *Rhionaeshna* (von Ellenrieder, 2002). For *Aeshna/Rhionaeshna* nymphs this size, the most accurate identification will likely be family. This information will be included in the next revision of the SAFIT STE and I include it here for your information only.

A dipteran pupa originally identified as Muscidae is actually an Ephydridae, and most likely a member of the genus *Hydrellia*. The specimen can be identified through either the larval key or pupal key as the puparium is the larval exuviae. The posterior spiracles are on stalks and as indicative for *Hydrellia*, the spiracles are spinelike (Courtney and Merritt, 2008). There is another genus with the same configuration which is found in California, so it's probably best to leave the identification at family. The larva originally identified as Brachycera (Ephydridae?) belongs to the same taxon as the pupa.

San Diego County Site

I welcome any questions or comments you may have concerning this report.

Sincerely,

Austin Brady Richards
Aquatic Bioassessment Laboratory–Chico
California State University, Chico
Chico, CA 95929-0555
arichards@csuchico.edu
(530) 898-4792

Literature Cited

Courtney, G.W., and R. W. Merritt. 2008. Chapter 22: Aquatic Diptera. Part One. Larvae of Aquatic Diptera. In *An introduction to the aquatic insects of North America, fourth edition, xvi + 1158 pp. + 39 color plates*, edited by R. W. Merritt, K. W. Cummins and M. B. Berg. Dubuque, Iowa: Kendall/Hunt Publishing Company.

Needham, James G., Minter J. Westfall, Jr., and Michael L. May. 2000. *Dragonflies of North America*. Gainesville: Scientific Publishers.

Richards, A. B. and D. C. Rogers. (2006). "Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) List of Freshwater Macroinvertebrate Taxa from California and Adjacent States including Standard Taxonomic Effort Levels. Version: 28 November 2006." Retrieved 11 May 2007, from http://www.waterboards.ca.gov/swamp/safit.html

von Ellenrieder, Natalia. 2002. A synopsis of the Neotropical species of *'Aeshna'* Fabricius: the genus *Rhionaeshna* Forster (Odonata: Aeshnidae). *Tijdschrift voor Entomologie* 146:67-207.

Taxonomist	Sample no.	Vial no.	Original ID	Original Count	Stage	ABL Count	ABL ID
	SMC06926						
		1	Baetis adonis	12		12	Baetis adonis
		2	Baetis	1		1	Baetis
		3	Callibaetis	8		8	Callibaetis
		4	Hydropsyche	2	L	2	Hydropsyche
		5	Tinodes	4	L	4	Tinodes
		6	Hydroptila	10	L	10	Hydroptila
		7	Hydroptilidae	4	P	4	Hydroptilidae
		8	Argia	23		23	Argia
		9	Anax junius	1		1	Aeshna
		10	Peltodytes	6	L	6	Peltodytes
		11	Meringodixa chalonensis	4	L	4	Meringodixa chalonensis
		12	Simulium	1	L	1	Simulium
		13	Caloparyphus/Euparyphus	1	L	1	Caloparyphus/Euparyphus
		14	Tipula	1	L	7	Tipula
		15	Agabus	1	A	1	Agabus
		16	Dytiscinae	1	L	1	Dytiscinae
		17	Limnesia	1		1	Limnesia
		18	Sperchon	12		12	Sperchon
		19	Torrenticola	1		1	Torrenticola
		20	Oligochaeta	27		27	Oligochaeta
		21	Ostracoda	154		154	Ostracoda
		22	Turbellaria	45		45	Turbellaria
		23	Brillia	4	L	4	Brillia
		24	Dicrotendipes	1	L	1	Dicrotendipes
		25	Labrundinea	12	L	12	Labrundinea
		26	Labrundinea	2	P	2	Labrundinea
		27	Microtendipes	7	L	7	Microtendipes
		28	Parametriocnemus	6	L	6	Parametriocnemus
		29	Pentaneura	2	L	2	Pentaneura
		30	Polypedilum	6	L	6	Polypedilum
		31	Rheocricotopus	14	L	14	Rheocricotopus

Taxonomist	Sample no.	Vial no.	Original ID	Original Count	Stage	ABL Count	ABL ID
	SMC06926						
		32	Rheocricotopus	1	P	1	Rheocricotopus
		33	Rheotanytarsus	24	L	24	Rheotanytarsus
		34	Tanytarsus	6	L	6	Tanytarsus
		35	Thienemannimyia group	2	L	2	Thienemannimyia group

Listing of Enumeration Discrepancies

Samples submitted by Weston Solutions for Project: SMC So Cal 2009

Report prepared by Brady Richards, CDFG ABL-Chico, 11/18/2009

Minor Counting Discrepancies

Sample #	Vial #	Original ID	# Counted Original	# Counted QC	Difference (Original - QC)
~~SMC00473~~	~~1~~	~~Simulium~~	~~210~~	~~212~~	~~-2~~
	~~5~~	~~Baetis~~	~~2~~	~~3~~	~~-1~~
	~~12~~	~~Hyalella~~	~~162~~	~~160~~	~~2~~
SMC06926	14	Tipula	1	7	-6

Listing of Taxonomic Discrepancies

Samples submitted by Weston Solutions for Project: SMC So Cal 2009

Report prepared by Brady Richards, CDFG ABL-Chico, 11/18/2009

Sample #	Vial #	Final ID Original ID	Final ID QC Final ID	Taxonomic level of dispute	# Organisms	Comments
SMC00473						
Disputed ID						
	4	Muscidae	Ephydridae	Family	1	
SMC06926						
Disputed ID						
	9	Anax junius	Aeshna	Genus	1	This disputed ID also represents a difference in taxonomic precision.

Summary of Taxonomic and Enumeration Discrepancies

Samples submitted by Weston Solutions for Project: SMC So Cal 2009

Report prepared by Brady Richards, CDFG ABL-Chico, 11/18/2009

Sample #	Total Taxa	Taxonomic Discrepancies						Counting Discrepancies			
		Disputed ID		Taxonomic Precision Relative to QC							
				More precise		Less		Major		Minor	
		*f**	*n***	*f*	*n*	*f*	*n*	*f*	*d****	*f*	*d*
~~SMC00473~~	~~28~~	~~1~~	~~1~~	-	-	-	-	-	-	3	5
SMC06926	33	1	1	-	-	-	-	-	-	1	6

* = the frequency of occurence of the discrepancy, in number of samples *f*
** = the number of organisms affected (by QC Lab counts) *n*
*** = the sum total of (absolute value of) differences in counts *d*

QC Report - Disputed ID's only

Samples submitted by Weston Solutions for Project: SMC So Cal 2009
Report prepared by Brady Richards, CDFG ABL-Chico, 11/18/2009

Sample #	*Vial*	*Original ID*	*QC ID*	*comments*
~~SMC00473~~	~~4~~	~~Muscidae~~	~~Ephydridae~~	
SMC06926	9	Anax junius	Aeshna	This disputed ID also represents a difference in taxonomic precision.

2257

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DATE 3Nov09 PAGE 1 OF 1

PROJECT NAME / SURVEY / PROJECT NUMBER: ~~SMC~~ LACFCD 2009

PROJECT MANAGER / CONTACT: Bill Isham

COMPANY / CLIENT: Weston

ADDRESS:

PHONE / FAX / EMAIL:

SITE ID (Location)	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE / VOLUME	TOTAL NUMBER OF CONTAINER	ANALYSIS/TEST REQUESTED: Taxonomic verification							PRESERVED HOW	SAMPLE TEMP. (°C) UPON RECEIPT	WESTON LAB ID
LALT502	LALT502	6/09	-	Bio	G/8ml	16	X							70% ETOH	NA	Same
7	→	↓	-	Bio	↓	20	↓							↓		↓
SGLR01278	→	↓	-	Bio	↓	10	↓							↓		↓
LALT502	→	6/09		↓	Slides	1 box	↓							Slide Mount		↓
7	→	↓		↓	↓	1	↓							↓		↓
SGLR01278	→	↓		↓	↓	1	↓							↓		↓

Sample Matrix Codes: FW= fresh water GW=ground water SLT=salt water SW=storm water WW=waste water
SED=sediment A=air BIO=biologic SS=soil T=tissue O=other (specify) ________

Container Code: G=glass P=plastic B=bags ☐ O=other ________

Shipped By: ☐ Courier ☐ UPS ☐ FedEx ☐ USPS ☐ Client drop off ☐ Other ________

Turnaround Time: ☐ 2-day ☐ 5-day ☐ 7-day ☐ 10-day ☐ 14-day ☐ Standard ☐ Other ________

Reporting Requirements: ☐ PDF ☐ EDD ☐ Hard Copy ☐ Email ☐ Other ________

SAMPLED BY: PRINT Damon Owen SIGNATURE

COMMENTS / SPECIAL INSTRUCTIONS:

	RELINQUISHED BY: Print Name	Signature	Firm	Date/Time	RECEIVED BY: Print Name	Signature	Firm	Date/Time
1.	Bill Isham	[signature]	Weston	3Nov09/0955	Austin Brady Richards	[signature]	ABL-Chico	11/4/2009/1500
2.	Austin Brady Richards	[signature]	ABL Chico	18Nov2009/1500	Bill Isham	[signature]	Weston	19Nov09/1600
3.								
4.								
5.								
6.								

WHITE – return to originator • YELLOW – lab • PINK – retained by originator

2256

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DATE 3 Nov 09 PAGE 1 OF 1

PROJECT NAME / SURVEY / PROJECT NUMBER: SMC Regional Monitoring

PROJECT MANAGER / CONTACT: Bill Isham

COMPANY / CLIENT: Weston

ADDRESS:

PHONE / FAX / EMAIL:

SITE ID (Location)	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE / VOLUME	TOTAL NUMBER OF CONTAINER	ANALYSIS/TEST REQUESTED: Taxonomic verification	PRESERVED HOW	SAMPLE TEMP. (°C) UPON RECEIPT	WESTON LAB ID (FOR WESTON USE ONLY)
SMC00473 →		5/09	-	BIO	G/8ml	17	X	70% EtOH	NA	Same
SMC06926 →		6/09	-	BIO	G/8ml	22	↓	↓		↓
SMC00473	Midge Slides	5/09		BIO	G slide	1		Slide Mount		
SMC06926	"	6/09		BIO	G slide	1	↓	↓		↓

Sample Matrix Codes: FW= fresh water GW=ground water SLT=salt water SW=storm water WW=waste water SED=sediment A=air BIO=biologic SS=soil T=tissue O=other (specify) ______

Container Code: G=glass P=plastic B=bags ☐ O=other ______

Shipped By: ☐ Courier ☐ UPS ☐ FedEx ☐ USPS ☐ Client drop off ☐ Other ______

Turnaround Time: ☐ 2-day ☐ 5-day ☐ 7-day ☐ 10-day ☐ 14-day ☐ Standard ☐ Other ______

Reporting Requirements: ☐ PDF ☐ EDD ☐ Hard Copy ☐ Email ☐ Other ______

SAMPLED BY: PRINT Damon Owen SIGNATURE

COMMENTS / SPECIAL INSTRUCTIONS

	RELINQUISHED BY: Print Name	Signature	Firm	Date/Time	RECEIVED BY: Print Name	Signature	Firm	Date/Time
1.	Bill Isham	[signature]	Weston	3Nov09/0949	Austin Brady Richards	[signature]	ABL-Chico	11/4/2009 1500
2.	Austin Brady Richards	[signature]	ABL-Chico	18Nov2009/1500	Bill Isham	[signature]	Weston	19Nov09/1100
3.								
4.								
5.								
6.								

From: Raphael Mazor [raphaelm@sccwrp.org]
Sent: Monday, July 12, 2010 4:44 PM
To: Isham, William
Subject: Re: taxonomic QA from 2009

Bill,

I did not do a formal write-up of your QA, but you passed all of our MQOs.

Here is a summary:

Sample SMC06926:
Recount accuracy: 98.5%
Taxa count error rate: 0%
Taxa ID error rate: 3.3% [Vial 9: Aeshna misidentified as Anax junius]
Individual ID error rate: 0.2%
High taxonomic resolution error rate: 0%
Low taxonomic resolution error rate: 0%
Overall taxonomic resolution error rate: 0%

Batch-level MQOs:
Random error rate: 4.8%
Systemic error rate: 0%

Raphael D. Mazor
Freshwater Biologist
Southern California Coastal Water Research Project
3535 Harbor Blv Suite 110
Costa Mesa, CA 92626