Watershed Assessment Technical Report

Biological and Ecological Component

# Alder Creek Watershed Project

Prepared for:

City of Folsom
Department of Public Works
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February 2010

AECOM

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# 1 INTRODUCTION

## 1.1 BACKGROUND

The Alder Creek Watershed Project is funded by a CALFED grant (CALFED Watershed Program, Proposition 50, 2005 Grant Solicitation Program, project #994818BRO) administered by the California Department of Water Resources (DWR) and managed by the City of Folsom's Public Works Department (DWR/City of Folsom Grant Agreement No. 4600004717). The project is being implemented in accordance with the CALFED Watershed Program Plan, with its myriad goals and principles, which is incorporated by reference into the grant agreement. Since the grant was awarded in 2006, the original CALFED Watershed Program organization has transitioned into the Statewide California Watershed Program to promote and conduct effective stewardship of natural resources in a watershed context. The Program retains many of the important elements that made the CALFED Watershed Program successful, including public involvement and transparency. The goals of the previous CALFED Watershed Program Plan are still reflected in this project.

The City of Folsom's Public Works Department handles all stormwater management issues for the City, from design and construction of the storm drain system to operation and maintenance, and urban runoff pollution prevention through its stormwater quality program, designed to comply with the City's National Pollution Discharge Elimination System (NPDES) Municipal Stormwater Permit. The City secured the watershed grant funds in order to engage stakeholders in preparing a watershed management plan that would describe existing conditions and recommend projects to protect the health and integrity of the watershed in light of planned future development.

The goal of the Alder Creek Watershed Project is to gather stakeholders together to prepare a watershed management plan that will describe existing conditions and recommend projects to protect the health of the watershed and the creek in light of planned future development. Watershed protection and management goals developed with the stakeholders are:

- protect, preserve, enhance, and restore:
    - water quality,
    - fish and wildlife habitat and movement corridors,
    - sensitive natural communities (e.g., aquatic, riparian, woodland), and
    - hydrologic and geomorphic processes and functions (e.g., maintain drainage, infiltration, flood protection, sediment transport and deposition functions).
- provide passive recreational opportunities including a trail system that allows movement within the watershed and provides connectivity to trails outside of the watershed.
- provide watershed stewardship and educational opportunities.
- improve and/or maintain visual and aesthetic qualities.

The watershed-scale approach to the project will allow the stakeholders to develop integrated solutions that address the physical, chemical, and biological problems contributing to water quality and habitat degradation affecting the watershed. The project will provide an assessment of the current structure, function, and value of the watershed from the headwaters to Lake Natoma.

In spring 2007, the technical consulting team presented the proposed assessment approach to the Alder Creek Watershed Technical Advisory Committee (TAC) and other watershed stakeholders at the first (of several) stakeholder meeting(s). Assessment topics included review and synthesis of existing data and studies, maps, and aerial photography, and collection of new data in the field. During the meeting, questions were raised to solicit input from the TAC and other stakeholders regarding types of data to be collected, the methods of data collection, and if there were any data/studies that were not already being considered in the assessment. Prior to initiating data collection, a watershed assessment plan was prepared and submitted to the City of Folsom project manager and DWR grant manager.

## 1.2 PURPOSE

This technical report summarizes watershed assessments conducted as part of the Alder Creek Watershed Project. The primary goals of the watershed assessments were to characterize the current conditions of existing natural resources and to identify/verify opportunities and constraints, which in turn would lead to the identification of protection, preservation, restoration and enhancement opportunities. The characterization of current conditions provides a baseline against which future monitoring can be measured. Adequate, accurate characterization through review of existing data, monitoring, and assessment is the cornerstone to preserving, enhancing, and restoring watershed functions and values. The information gathered from monitoring activities is critical to the effort of protecting the beneficial uses of water; protecting sensitive resources; and determining the effects of watershed development and protection, restoration, and enhancement programs.

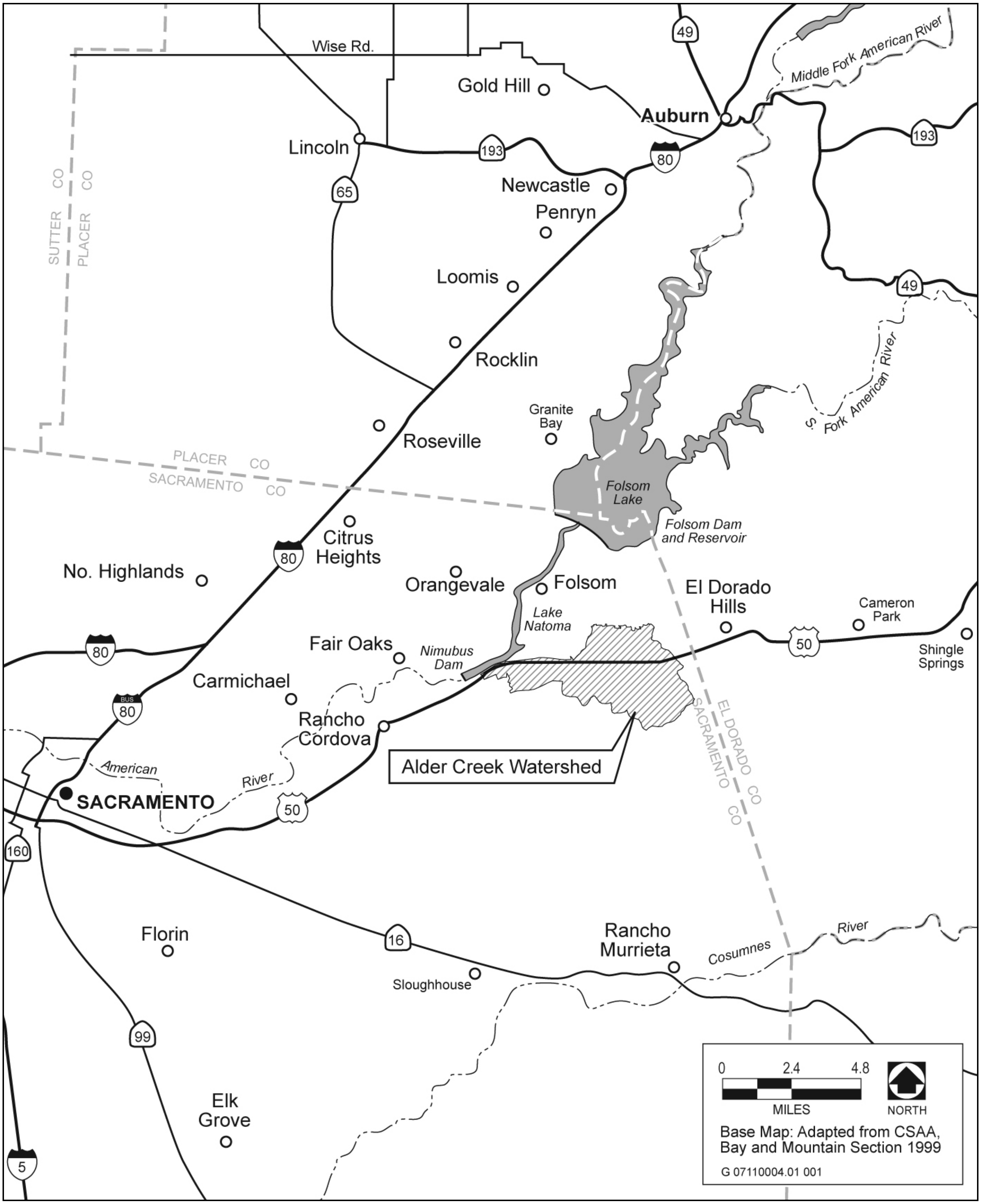
This report describes the biological and ecological components of the watershed assessment. Evaluation of hydrology, soils, geology, and geomorphology components are included in the *Alder Creek Watershed Assessment and Management Plan, River Geomorphology and Hydrology Report* prepared by Northwest Hydraulic Consultants (NHC) (2009). The primary goals of this component of the watershed assessment are to:

- Collect and compile existing data characterizing the current status of natural resources within the watershed;
- collect additional information, where necessary, to supplement existing datasets ;
- integrate existing and newly collected data to provide a watershed conditions baseline against which the effects of future land use changes and restoration projects within the watershed can be evaluated through ongoing monitoring; and
- identify opportunities and constraints that, in turn, could lead to the identification of restoration and enhancement opportunities to be pursued by the City of Folsom, land owners/developers, and/or other watershed stakeholders.

This report is divided into three main parts: an overview of the methodology used to prepare the report; presentation of results of the data collection exercises; and presentation of conclusions that can be drawn from the results of the watershed assessment, including opportunities and constraints relevant to the management and restoration of the watershed.

## 1.3 GEOGRAPHIC SETTING OF THE ALDER CREEK WATERSHED

Alder Creek originates in the western slopes of the Sierra Nevada foothills (maximum elevation 600 feet) in the northeastern corner of Sacramento County, southeast of the City of Folsom (Exhibit 1). From its headwaters, the creek flows southwest approximately 15 miles until it enters the American River at Lake Natoma (Exhibit 2). The entire watershed is roughly 11 square miles (7,000 acres) in size. Most of the watershed, located south of U.S. Highway 50 (U.S. 50), is undeveloped; the watershed also includes a 2.5-square-mile portion of the City of Folsom north of U.S. 50 that contains commercial, retail, and residential developments.




Source: Data compiled by AECOM 2009

**Alder Creek Watershed Project Vicinity Map** **Exhibit 1**

For the purposes of planning and assessment, Alder Creek can be divided into three distinctive reaches, shown on Exhibit 2:

- **Upper Watershed** – The upper watershed includes the ephemeral and perennial upper reaches of Alder Creek and its tributaries running from the headwaters to the creek's crossing of Prairie City Road. South of U.S. 50 in unincorporated Sacramento County but within the City of Folsom's sphere of influence, this portion of the watershed is characterized by open grassland and oak savanna used for livestock grazing. North of U.S. 50 within the City of Folsom boundary, residential housing, commercial office buildings, and extensive retail developments are the primary land uses, with natural habitat located primarily in areas where creek corridors have been preserved. Several detention facilities have been constructed on tributaries to Alder Creek within these developed areas. The detention facilities are intended to mitigate the adverse effects of stormwater and landscape irrigation runoff on Alder Creek.

- **Middle Watershed** – Creek reaches in the middle watershed in unincorporated Sacramento County flow perennially from Prairie City Road to the crossing under Folsom Boulevard. The GenCorp landholdings located south of U.S. 50 dominate the middle reach of Alder Creek. Most of the GenCorp property is undeveloped and contains oak woodlands, isolated industrial sites, and exposed legacy mining dredge tailings that dominate the topography of the site. This portion of Alder Creek bisects these deposits, allowing the flow to come into contact with sediments that may be contaminated with mercury and other metals. Preliminary development plans have been prepared for approximately 1,400 acres of land adjacent to the creek ("Easton Development") presently owned by GenCorp

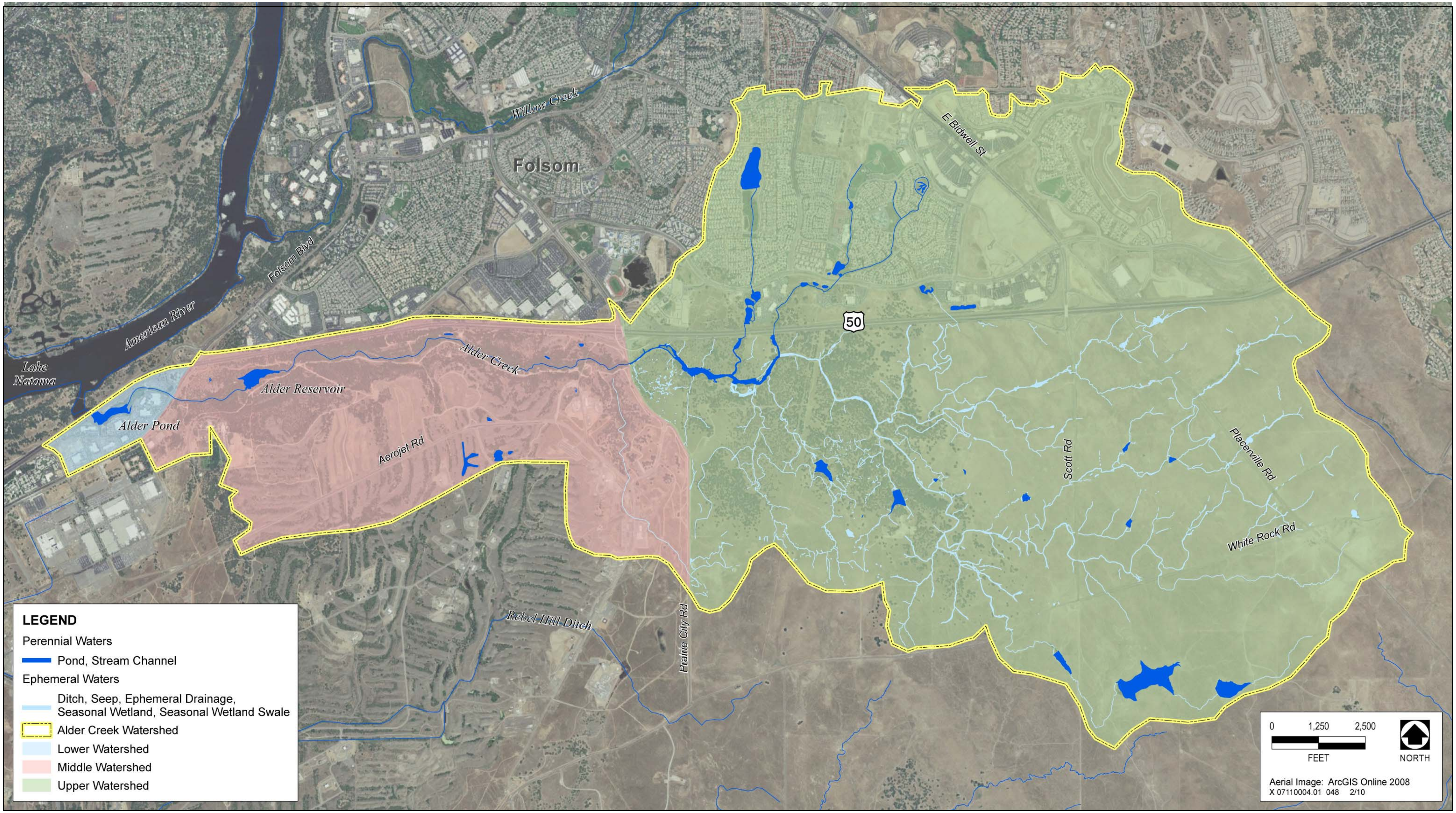
- **Lower Watershed** – Creek reaches in the lower watershed run from Folsom Boulevard to the confluence of Alder Creek with Lake Natoma. This area is within the Folsom city limits and the Folsom Automall is located to the south and U.S. 50 and the American River Parkway to the north. The backwater from Nimbus Dam affects this portion of the creek and forms Alder Pond. Stormwater runoff from both the automall and U.S. 50 is directed to the creek (and Alder Pond), and sediments from higher in the watershed (which may contain pollutants from past and current land uses) likely accumulate in this reach of the creek because of the backwater effect from Lake Natoma and reduced flow velocities in the creek / Alder Pond.

# 2 METHODS

As discussed previously, the Alder Creek watershed assessment relies on both preexisting data and new data collected specifically for the assessment. Much of the existing data came from previously completed environmental documents and biological studies for parcels within the watershed that may be developed in the future. New field data were collected to fill gaps in the existing data or to provide more specific data than were available in order to adequately document baseline watershed conditions. The methods used to collect these data are described in detail below.

## 2.1 REVIEW OF EXISTING DATA

To date, there have been no comprehensive efforts to study the watershed as a whole. Previous efforts by developers and local interest groups have focused on describing biological, ecological, and, to a lesser extent, physical resources within discrete portions of the watershed. These studies include Phase 1 environmental assessments, biological resource assessments, special-status species evaluations, wetland delineations, arborist reports, and mitigation and management plans for specific resources. A comprehensive review of these existing data was conducted as part of the watershed assessment. Other information on the existing watershed conditions, as well as concerns and interests regarding watershed protection, was generated through various interactions with watershed stakeholders, including meetings, field tours, and informal interviews. A list of the data sources and documents that were consulted is presented in Table 1. Additional data, such as soils surveys, geological maps,




Source: NHC 2007, Sacramento County 2007, AECOM 2007

**Alder Creek Watershed Map** **Exhibit 2**

drainage studies, development improvement plans, and similar existing data characterizing the physical environment, were reviewed by NHC for its component of the watershed assessment. Those results are presented in a separate report (NHC 2009).

**Table 1**
**Data Sources and Documents Consulted**

| Data Source or Document | Prepared for | Year |
|---|---|---|
| *Arborist Report on Trees on the White Rock Springs Golf Course Project* | Sacramento Valley View | 1993 |
| *Biological Resources Report, Sacramento Country Day School* | FHK Companies | 2003 |
| *Arborist Report for 14005 White Rock Road* | PDF Development Company | 2003 |
| *Biological Resources Assessment 130-Acre Folsom 138 Property* | Woodside Homes | 2004 |
| *Special-Status Plant and Wildlife Report, Sacramento Day School, White Rock Road* | Holloway Rassmusson Molondanof | 2005 |
| *Folsom South SOI Project Site Native Oak and Non Oak Tree Tabulation for Grid Areas 1-7* | MJM Properties LLC | 2005 |
| *Carpenter Ranch – Folsom SOI Project Site Initial Arborist Report and Inventory Summary* | Carpenter Ranch LP | 2006 |
| *Wetland Delineation for Folsom 560* | GenCorp Realty Investments | 2006a |
| *Wetland Delineation for Prairie City Road Business Park* | GenCorp Realty Investments | 2006b |
| *Draft Biological Resources Assessment Report, Centex - Folsom Heights Property* | Centex Homes | 2006a |
| *Tree Survey for the Centex - Folsom Heights Property* | Centex Homes | 2006b |
| *Results of a Focused Plant Survey on the Folsom South Site* | MJM Properties LLC | 2006a |
| *Biological Resources Assessment, Folsom South 1,400-acre Site* | MJM Properties LLC | 2006b |
| *Delineation of Waters of the United States, Folsom South 1,400-acre Site* | MJM Properties LLC | 2006c |
| *Arborist Report for Sacramento Country Day School* | Katz Kitpatrick Properties | 2007 |
| *90-Day Report, 2006–2007 Wet-Season Survey for Listed Vernal Pool Branchiopods, Folsom South Property, Sacramento County, California.* Prepared by Foothill Associates, Rocklin, CA. | MJM Properties LLC. | 2007a |
| *Results of Analyses of Soil Samples Collected from the Proposed Folsom South Project Site.* Prepared by Christopher Rogers of EcoAnalysts, Inc, Woodland, CA, for Foothill Associates, Rocklin, CA. | MJM Properties LLC | 2007b |
| *Listed Vernal Pool Branchiopod Wet Season Survey 90-Day Report, Carpenter Ranch* | Colliers International | 2007a |
| *Revised Jurisdictional Delineation and Special-Status Species Evaluation, Carpenter Ranch Property* | Colliers International | 2007b |
| *Folsom 560 Revised Wetland Delineation* | GenCorp Realty Investments | 2007a |
| *Prairie City Road Business Park – Revised Wetland Delineation* | GenCorp Realty Investments | 2007b |
| *Easton Resource Conservation Management Plan* | GenCorp Realty Investments | 2007c |
| *Draft Special-Status Species Assessment for Folsom South Area Group, Javanifard and Zhargami Parcel, Sacramento County* | The Hodgson Company | 2007a |
| *Wetland Delineation for Folsom South Owners Group Javanifard and Zhargami Parcel* | The Hodgson Company | 2007b |
| *Preliminary Delineation of Waters of the United States Folsom Heights Property* | Folsom Heights LLC | 2008 |
| *Comprehensive Clean Water Act Section 404 Application, Folsom Plan Area Specific Plan* | City of Folsom et al. | 2008 |

| Table 1<br>Data Sources and Documents Consulted | | |
|---|---|---|
| Data Source or Document | Prepared for | Year |
| *Carpenter Ranch Vernal Pool Branchiopod Survey Results and Summary*. Memorandum prepared by Ginger Fodge for Kent MacDiarmid, April 10, 2009. | Gibson and Skordal, LLC | 2009 |
| *Folsom SPA Bio Survey Status Report (Wet Season, Rare Plant, Elderberry, and other)*. Prepared by Richard O'Neal, April 13, 2009. | ECORP Consulting | 2009 |
| Source: Data compiled by AECOM 2009 | | |

## 2.2 NEW FIELD DATA COLLECTION

New data were collected to fill gaps in the preexisting data or to provide more specific data than were available in previously completed reports. This work included three main types of assessments: bioassessments (to characterize aquatic macroinvertebrate community composition, physical habitat, and water quality); riparian vegetation assessments (to characterize riparian habitat composition along the stream corridor), and hydrologic/hydrogeomorphic assessments (to characterize the hydrologic and hydrogeomorphic functions of the watershed and stream channels). Methods, results, and conclusions for the first two types are described in this report, whereas information on the third is presented in a separate report completed by NHC (2009).

Collecting detailed data related to the biological and physical attributes of Alder Creek will provide a baseline characterization of the creek that can be used to evaluate the effects of future land use changes and identify areas for preservation and protection. Background information on stream bioassessments and their role in measuring and monitoring streams and watersheds is provided below, to preface the discussion of specific methods used and results for the Alder Creek Watershed Project.

### 2.2.1 BACKGROUND ON BIOASSESSMENT

The federal Clean Water Act (CWA) gives states and territories the primary responsibility for implementing programs to protect and restore water quality. CWA Section 106(e)(1) requires the U.S. Environmental Protection Agency to determine that a state is monitoring the quality of navigable waters and compiling and analyzing data on water quality. To meet those CWA requirements and provide comprehensive information on the status of beneficial uses of California's surface waters, the State Water Resources Control Board and the Regional Water Quality Control Boards introduced the Surface Water Ambient Monitoring Program (SWAMP) in 2001. The SWAMP provides the impetus to implement a better organized, standardized program of biological assessment and monitoring throughout the state.

Biological assessments of aquatic communities also referred to as bioassessments, have become a useful tool for monitoring stream and watershed health. Bioassessments (i.e., examination of a stream's invertebrate fauna to gauge the stream's biological health) are gaining popularity among scientists, resource managers, and decision makers alike and have been adopted as a primary assessment method as part of the SWAMP. Standardized bioassessment procedures, combined with a rapid vegetation assessment developed by the California Native Plant Society (CNPS), were employed as primary new data collection assessment methods to characterize current conditions of existing riparian and aquatic resources in the Alder Creek watershed.

Aquatic invertebrates are common inhabitants of the stream bottom environment. Insects are the main types present and commonly include mayflies, stoneflies, caddisflies, and true flies. Non-insect invertebrates include snails, leeches, worms, and scuds. Aquatic insects and other invertebrates are central to the proper ecological functioning of streams and surrounding terrestrial environments. These invertebrates consume decomposing organic matter (e.g., detritus, wood, and leaf debris) and attached algae and in turn become an important food resource to fish and birds. In addition to their role in the food web, aquatic invertebrates have varying degrees of ability to withstand environmental degradation; thus, they may be used as indicators of water quality and habitat condition. For example, sediments from erosion and/or pollutants from runoff may decrease the variety of insects and other invertebrates that are able to survive, which may indicate a degradation of biological health.

When a bioassessment is conducted, bottom-dwelling (or benthic) organisms are collected to detect changes in stream health based on the number of different types present (diversity) and their level of tolerance of environmental impacts and pollution (sensitivity). Monitoring stream invertebrates in comparison to reference sites (areas having little or no impact but a similar physical setting) or over time at targeted sites provides a method to estimate the amount of degradation of aquatic systems or level of recovery in response to changing land uses. A bioassessment may be used with other, more traditional methods of stream assessment (e.g., testing for the presence of specific pollutants, dissolved oxygen levels, and other water quality parameters based on water chemistry) to measure the response of stream life to habitat changes. Frequently, however, a bioassessment may be a superior method of monitoring changes in aquatic habitats. For example, when pollution does not originate from a single point, it can be difficult to accurately characterize the source using chemical methods alone because this type of pollution usually does not occur continuously and therefore may not be detected in a given water sample. Because bioassessment monitors aquatic invertebrates that live in the stream, the technique is able to detect changes in water quality (via changes in invertebrate community composition) that occur in both local and upstream areas of the watershed and that may not be reflected in traditional assessment methods. Bioassessment techniques may also be superior to traditional water quality assessment procedures because after baseline conditions have been established (over a period of years and locations), repeated sampling can be done with less frequency and associated cost, relative to traditional techniques, to document future changes.

To fully understand the concept of bioassessments, it is important not only to know what they are, but also to understand the rationale for conducting them and how they can be used as a decision-making tool. The following text describes the rationale for conducting bioassessments, including the role of bioassessment in water quality determination and the utility of bioassessment as a decision-making tool.

### 2.2.2 Role of Bioassessment in Water Quality Determination

State and tribal water resource agencies in the United States have developed bioassessment protocols that have added an important dimension of ecological understanding to their overburdened and underfunded monitoring programs (Barbour 1997). The central purpose of assessing the biological condition of aquatic communities is to determine how well a water body supports aquatic life (Barbour et al. 1996). Biological communities integrate the effects of different pollutant stressors, such as excess nutrients, toxic chemicals, increased temperature, and excessive sediment loading; thus, they provide an efficient overall measure of the aggregate impact of the stressors. The use of information about ambient biological communities, assemblages, and populations to protect, manage, and exploit water resources has been progressing for the past 150 years (Davis 1995). Despite this long history, it has been only in the last decade that a widely accepted technical framework has evolved for using biological assemblage data for assessing water resources (Barbour et al. 1996).

### 2.2.3 Utility of Bioassessment as a Decision-Making Tool

A bioassessment provides important planning information for managing watersheds and serves four primary functions or uses for assessing watersheds and developing watershed management plans, all of which are relevant to the Alder Creek Watershed Project:

- initially assessing conditions,
- characterizing the magnitude of impairment,
- assisting in the diagnosis of causes to impairment (e.g., sedimentation, contaminants), and
- monitoring temporal trends to evaluate improvements or further degradation.

## 2.3 SITE SELECTION

Bioassessments and riparian vegetation assessments were conducted within representative portions of the watershed. The selection of sample sites was based on five primary criteria: (1) access is safe; (2) permission to access private property is granted; (3) sample site/area is representative of the part of the subwatershed and/or water body of interest, and, when taken together, all sites are representative of the watershed as a whole; (4) conditions are appropriate for sampling method (e.g., wadeable streams); and (5) location complements or supplements historical data (e.g., California Department of Fish and Game [DFG] reference sites, U.S. Geological Survey [USGS] monitoring). Based on these criteria, three stream sites were selected (see Exhibit 3):

- Lower Alder Creek (AC-1)—150-meter (m) reach along the mainstem of Alder Creek beginning immediately upstream of the Regional Transit Light Rail bridge (upstream of Folsom Boulevard). The watershed above this sample site is characterized by oak woodlands and dredger tailings and limited development.

- Middle Alder Creek (AC-2)—150-m reach along the mainstem of Alder Creek immediately upstream of the Prairie City Road bridge. The watershed above this sample site is characterized as semirural grassland and oak woodland on the creek's mainstem and residential, commercial, and retail development influencing three tributaries delivering water to the mainstem from the area north of U.S. 50.

- Upper Alder Creek Tributary (AC-3)—150-m reach along a tributary to Alder Creek upstream of U.S. 50 adjacent to (east of) a parking lot at the end of Iron Point Circle. The watershed condition above this sample site is characterized as urbanized/suburbanized with residential and commercial development.

Assessments were conducted on the following days and times for each site:

- AC-1: May 10, 2007—10 a.m.; May 30, 2008—9:30 a.m.
- AC-2: May 11, 2007—10:00 a.m.; May 30, 2008—11:00 a.m.
- AC-3: May 30, 2008—12:30 p.m.

Bioassessments, including full stream habitat characterization, and rapid vegetation assessments were performed during the first sampling for each site, and water quality data and benthic macroinvertebrate (BMI) samples only were collected during the second round of sampling. Sites AC-1 and AC-2 were sampled in spring 2007 and 2008; however, access permission to the AC-3 site limited sampling of this site to only spring 2008.

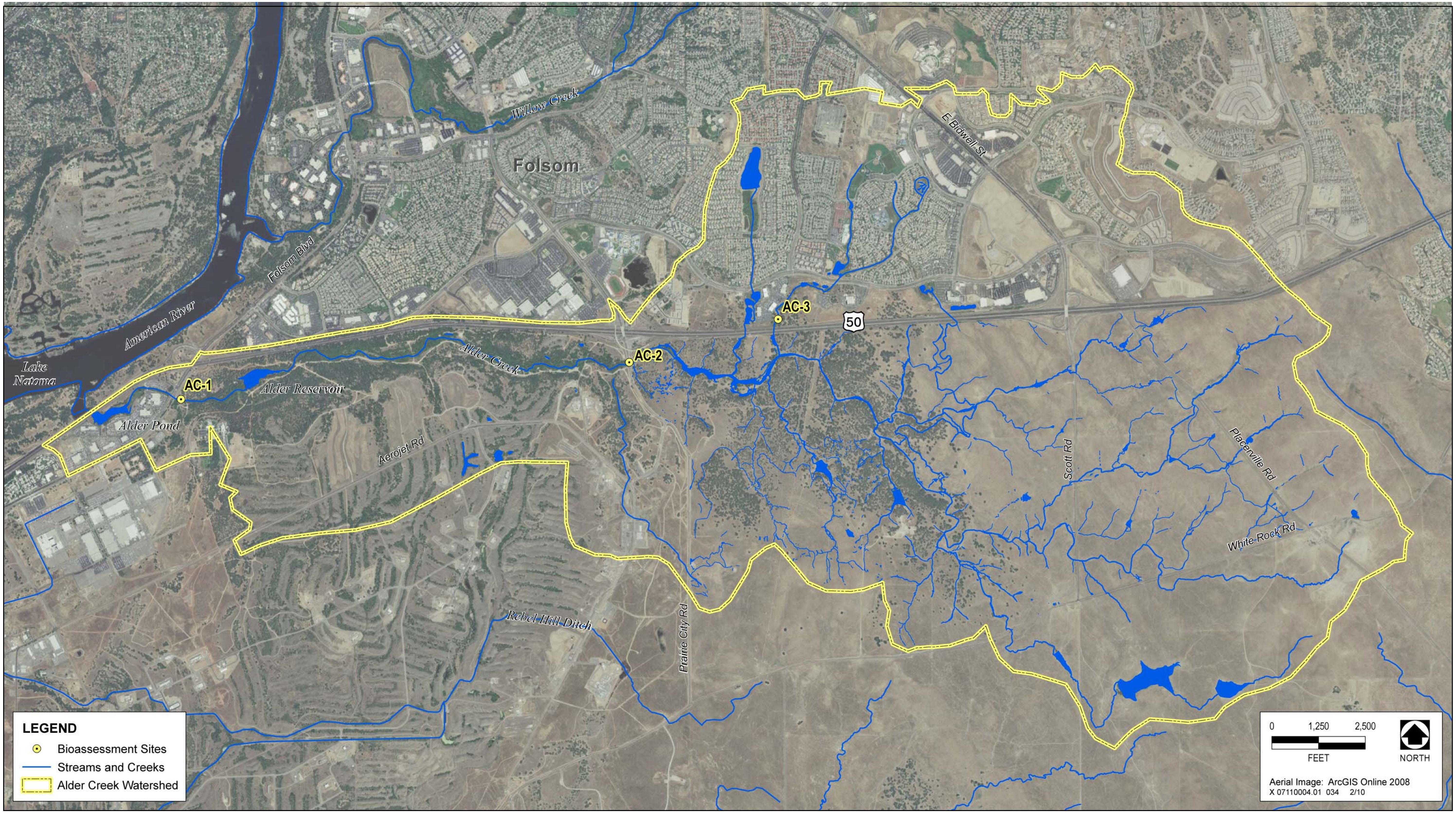
Although bioassessments conducted as part of this watershed assessment provide useful information on Alder Creek's ecological health, these data were developed from a small number of data points. Therefore, the descriptions below, while likely representative of the general ecological health of the creek, should be interpreted with some caution as these descriptions may not represent conditions found in all portions of the creek.

## 2.4 BIOASSESSMENTS

Trained biologists conducted the bioassessments, including the collection of BMIs, assessment of physical habitat characteristics, and general measurement of water quality. Additional rapid vegetation assessments were also performed to provide more detailed information on the adjacent plant communities (described separately below).

### 2.4.1 BENTHIC MACROINVERTEBRATE SAMPLING

Field sampling for the Alder Creek Watershed Project followed the standard operating procedure for collecting benthic macroinvertebrate and associated physical and chemical data developed by the SWAMP (Ode 2007) for ambient bioassessment in California.




Source: NHC 2007, Sacramento County 2007, AECOM 2007

**Alder Creek Watershed Bioassessment and Riparian Vegetation Assessment Survey Sites** **Exhibit 3**

The multihabitat method calls for the identification of a stream reach of 150 m. For each reach, 11 cross-stream transects along the reach are identified at 15-m intervals. Starting at the most downstream transect, benthic samples are collected from the left, center, or right end of the transect using a standard D-frame kick net with 0.5-millimeter (mm) mesh. Organisms were dislodged from the benthic substrate to a depth of 4–6 inches from within a 1-square-foot area of the benthic habitat (e.g., riffle, pool/glide, woody debris, vegetated banks, or submerged macrophytes) immediately upstream of the net. For each sample, the material retained in the net was immediately transferred into appropriately labeled 500-milliliter (mL) plastic wide-mouth jars containing 95% ethanol to preserve any organisms. A consistent amount of time was allocated to sampling each habitat type so as not to bias the BMI data generated during the study. Upon completion of the sample collection from a given transect, the next transect sample was collected in a similar fashion, and the collected material was placed into the same jar containing the material(s) from the previous transect(s). This sampling approach continued until all 11 transects were sampled.

The preserved samples were transported, under chain of custody, to DFG's Aquatic Bioassessment Laboratory (ABL), where they were stored at room temperature until sorting and organism identification was performed.

## BENTHIC MACROINVERTEBRATE LABORATORY PROCEDURES

The DFG ABL was contracted to perform all BMI laboratory procedures. A discussion of these procedures is provided below.

### Sample Sorting

All sample sorting was performed at the ABL. Following the removal of alcohol from the 500-mL plastic wide-mouth jars, each sample was placed into a 0.5-mm mesh sieve and rinsed using deionized water. Each item was examined carefully for the presence of BMIs. Then large debris (e.g., twigs, rocks) was removed from the sample. The remaining material was then evenly spread across a gridded tray. Following the random selection of a grid (using a random number generator), the materials from within the selected grid were transferred into a petri dish. Using a dissecting microscope, BMIs were removed from the dish during a systematic sorting of the sample. The BMIs were counted and then placed into 50-mL vials containing 70% ethanol/glycerin. This process was repeated grid by grid until 500 BMIs were collected.

After 500 BMIs were collected, the remaining materials in the last grid being sorted were placed into an additional 50-mL vial labeled with the appropriate sample code. The remaining materials from all the previously sorted grids were collected into a 500-mL plastic wide-mouth jar containing 70% ethanol/glycerin and labeled with the sample code and identified as "sorted." As a quality control measure, sorted materials from 20% of the samples were re-sorted by a different scientist, with the target of finding no more than 25 uncollected BMIs (5% of the overall number removed for identification). The remaining unsorted materials in the gridded tray were placed back into the original 500-mL plastic wide-mouth jar containing 70% ethanol/glycerin and the original sample label. This process was repeated for all the samples collected.

### Taxonomic Identification

A SWAMP bioassessment SOP Level II taxonomic effort, whereby most organisms were taxonomically identified to family, with Chironomidae being identified to genus, was approved for this study. This effort was achieved by removing the BMIs from the 50-mL vials, transferring them to a petri dish, and identifying each organism using standard taxonomic keys (Harrington and Born 2000, Merritt and Cummins 1996). A 10-mL vial with 70% ethanol/glycerin and a specimen label containing the sample identification number and family name was prepared for each taxonomic group, and each identified organism was transferred into the appropriate vial. After an organism was identified and before the scientist proceeded to another specimen, the petri dish was searched for additional organisms of the same family, which were added to the vial for that family. A push-button counter was used to maintain an accurate count of the various organisms; the data from the push-button counter were then transferred to a Level 2 Taxonomic Effort Worksheet. This process continued until all organisms were identified.

## BIOASSESSMENT DATA ANALYSIS/MANAGEMENT

### Data Analysis

The data from the identification of the sorted BMIs for each sample were used to generate biological metrics that allow for an assessment of the biological condition of the reach at each sampling location. These biological metrics define a characteristic of the BMI assemblage that may change in some predictable way with increased human disturbance and/or ecological restoration. The biological metrics are classified into four categories: richness measures, composition measures, tolerance/intolerance measures, and trophic measures. Those specified in the SWAMP Bioassessment standard operating procedures (SOP) (Ode 2007) are discussed below.

**Richness Measures**

Taxa Richness
Plecoptera Taxa
Trichoptera Taxa
Ephemeroptera Taxa

**Composition Measures**

EPT Index
Sensitive EPT Index
Percent Hydropsychidae
Percent Baetidae

**Tolerance/Intolerance Measures**

Tolerance Value
Percent Dominant Taxa
Percent Tolerant Organisms
Percent Intolerant Organisms

**Trophic Measures**

Percent Collectors
Percent Filterers
Percent Scrapers
Percent Predators
Percent Shredders

#### *Richness Measures*

Measures of richness reflect the diversity of the aquatic assemblage, where increasing diversity correlates with increasing health of the assemblage and decreasing richness correlates with increasing disturbance. The richness measures used in this study were taxa richness (the total number of individual taxa) and EPT taxa (number of families in the Ephemeroptera [mayfly], Plecoptera [stonefly], and Trichoptera [caddisfly] insect orders).

#### *Composition Measures*

Measures of composition reflect the relative contribution of the population of individual taxa to the total fauna and are based on the ecological patterns and environmental requirements of certain organism groups, such as those taxa considered to be environmentally sensitive or, alternatively, those considered to be a nuisance species. The composition measures used in this study were EPT index (percent composition of mayfly, stonefly, and caddisfly larvae), sensitive EPT index (percent composition of EPTs with low tolerance values), percent Hydropsychidae (percent of caddisflies in the more tolerant family Hydropsychidae), and percent Baetidae (a composition measure for a tolerant family of mayflies).

#### *Tolerance/Intolerance Measures*

Tolerance/intolerance measures are metrics that reflect the relative sensitivity of the community to aquatic disturbances. Although the taxa used are usually "pollutant tolerant" or "intolerant," they are not specific to the type of stressor. For example, these metric values typically also vary with increasing fine particulate organic matter and sedimentation. The tolerance/intolerance measures used in this study were tolerance value (values between 0 and 10 weighted for abundance of individuals that are pollutant tolerant [higher values] and intolerant [lower values]), percent intolerant organisms (percent of organisms that are considered highly intolerant to impairment as indicated by tolerance values of 0, 1, or 2), percent tolerant organisms (percent of organisms that are considered highly tolerant to impairment as indicated by tolerance values of 8, 9, or 10), and percent dominant taxa (percent composition of the single most abundant taxa).

### *Trophic Measures*

Trophic measures are metrics that provide information on the balance of feeding strategies in the aquatic assemblage. An imbalance of the functional feeding groups reflects unstable food dynamics and indicates stressed conditions. The trophic measures included in this assessment were percent collector-filterers (percent of BMIs that collect, gather, and filter fine particulate matter), percent scrapers (percent of BMIs that graze upon periphyton), percent predators (percent of BMIs that feed on other organisms), and percent shredders (percent of BMIs that shred coarse particulate organic matter).

### *Abundance*

Abundance is one additional metric that provides information on the total number of organisms in a given sampling area. Abundance is calculated by dividing the total number of organisms collected by the number of grids used for the subsampling and multiplied by the number of possible sampling grids. The abundance data represent the total number of organisms sampled per unit of measure.

These metrics were quantified for each site to characterize the parameter ranges for each portion of the watershed. General trends in biological metrics associated with disturbance are presented in Table 2. The data will be maintained for a future assessment of year-to-year trends. For the purposes of this technical memorandum, the BMI data and physical habitat data are presented and compared qualitatively, with overall watershed characteristics noted.

**Table 2**
**Trends in Biological Metrics Associated with Disturbance**

| Biological Metrics | Response to Disturbance |
|---|---|
| **Richness Measures** | |
| Taxa richness | Decrease |
| EPT taxa | Decrease |
| **Composition Measures** | |
| EPT index | Decrease |
| Sensitive EPT index | Decrease |
| Percent Hydropsychidae | Increase |
| Percent Baetidae | Increase |
| **Tolerance/Intolerance Measures** | |
| Tolerance value | Increase |
| Percent intolerant organisms | Decrease |
| Percent tolerant organisms | Increase |
| Percent dominant taxa | Increase |
| **Trophic Measures** | |
| Percent collectors | Increase |
| Percent filterers | Increase |
| Percent scrapers | Increase |
| Percent predators | Increase |
| Percent shredders | Decrease |

Source: Harrington and Born 2000

### *Index for Biological Integrity*

An index for biological integrity (IBI) is a scoring criterion that is used to integrate a number of metrics into a single value. Development and application of the single value provides a quantitative assessment tool for assessing the integrity of streams. Developing an IBI requires large data sets to be collected from a large regional area. In California, an IBI has recently been developed for Central Valley perennial streams (Rehn et al. 2008). The IBI includes a scoring range (0-100) divided into five equal condition (integrity) categories: 0–10 = ‘‘very poor’’, 11–20 = ‘‘poor’’, 21–30 = ‘‘fair’’, 31–40 = ‘‘good’’, and 41– 50 = ‘‘very good’’. Biological metrics used in the IBI include: collector richness (number of taxa that are collector-feeders), predator richness (number of taxa that are predators), percent EPT taxa (percent of taxa that are mayflies, stoneflies, or caddisflies), percent clinger taxa (percent of taxa that cling to vegetation) and Shannon diversity (a composite measure of taxonomic richness and evenness of abundance).

### Composite Metric Score

The composite metric score (CMS) approach to evaluating BMIs can be used to compare BMI metrics from one site to BMI metrics at other sites. Water quality and stream health as a function of BMI metrics can be identified by the distribution of CMS relative to each other and as they orient above, on, or below the normalized mean line. Because the quality of BMI metrics increase with improved water quality and stream health, CMS can be used to assess relative site water quality and stream health in the context of a biotic component.

In order to calculate a comparative CMS, the differences between sample metric values are normalized and summed in order to determine the grand mean of the metric values for multiple metrics. This value (or score) is then compared between the various sampling sites within a given watershed or to sites within a comparative watershed. The output of the CMS analysis is shown as a plot, which is composed of four parts: 1) sites are shown on the x-axis; 2) the range of normalized composite metric score values is shown on the y-axis, different datasets are depicted by different geometric symbols; 3) where multiple samples were collected from the same site intra-site scores are depicted by unique geometric symbols, where their vertical position on the plot corresponds to their individual composite metric score; and 4) a dashed, horizontal line crossing through “0” on the y-axis represents the grand mean of the normalized scores. For reference, if there was no variation in composite metric scores for samples collected from a group of sites, then the composite metric score plot would show points (samples) plotted on the mean line (sample metric values identical to grand mean metric value); as inter-site variation in composite metric scores increase, sites will score consistently above and below the mean line (sample metric values deviate from grand mean metric value). Sites with high intra-site variability will show samples ranging above and below the mean line.

The metric values are normalized (standardized) to the same measurement scale by dividing the difference between the sample mean metric value and the grand mean metric value by the standard error of the mean. The grand mean is the mean metric value calculated from all sample results being used in the comparative analysis. The formula for computing the CMS for these samples from the same ecological subregion is as follows:

$$\text{Composite Metric Score} = \sum \pm(\mathbf{x}_i - \text{x}_i)/\text{sem}_i$$

where:

- $\mathbf{x}_i$ = sample value for the i-th metric within an ecological subregion;
- $\text{x}_i$ = grand mean of the samples organized by collection season within an ecological subregion, for the i-th metric;
- $\text{sem}_i$ = standard error of the mean for the i-th metric;
- ± = a plus sign denotes a metric that decreases with response to impairment (e.g., Taxonomic Richness) while a minus sign denotes a metric that increases with response to impairment (e.g., Tolerance Value).

In order to apply the Alder Creek bioassessment results to a comparative CMS, existing BMI data collected by the DFG ABL for streams throughout the Sacramento Valley were utilized. This data includes BMI samples in 30 candidate reference streams (one being Alder Creek at the AC-1 location) in the Sacramento Valley below 250 feet elevation. From these 30 samples, the ABL identified 14 BMI metrics that are most able to discriminate between highly-stressed sites from less-stressed sites (see p. 10 of the Sac. Valley Reference Stream report [Ode et al. 2005] for more details on how these discriminators were determined).

### 2.4.2 PHYSICAL HABITAT ASSESSMENT

A physical habitat assessment was performed for each reach sampled (AC-1 and 2, spring 2007 and AC-3, spring 2008). The physical habitat assessment methods included a reachwide scoring evaluation and measurements and observations for transects and intertransect areas.

The reachwide evaluation included three physical habitat metrics: epifaunal substrate cover, sediment deposition, and channel alteration. Each metric was given a maximum score of 20, with greater values representing a better habitat for BMI; the combined habitat metric score for any site could not be greater than 60. Each metric was assigned to one of four categories of physical condition: optimal (20–16), suboptimal (15–11), marginal (10–6), and poor (5–0). Where possible, discharge was also measured for each reach.

Transect measurements and observations included the following attributes: wetted width, bankfull width, bankfull height, transect substrates (i.e., size class, depth, and embeddedness), bank stability, human influence, riparian vegetation, instream habitat complexity, and canopy cover. Intertransect attributes included wetted width, flow habitats, and substrates. Photographs were taken at the first transect (upstream [one photograph]), the middle transect (upstream and downstream [two photographs]), and the last transect (downstream [one photograph]).

A GARMIN Geko 201 global positioning system was used to record latitude and longitude coordinates for each sampling site. Reach and transect length were measured using a tape measure. Wetted and bankfull widths and substrate depths were measured using a stadia rod. Canopy was measured using a spherical densiometer. Flow rate was estimated (where possible) based on measuring the water velocity (with a flow meter) and wetted channel area at the sampling station. Copies of the field forms are presented in Appendix A.

### 2.4.3 WATER QUALITY SAMPLING

The following water quality parameters were measured in the field once upon arrival at each stream reach: temperature, pH, alkalinity, dissolved oxygen (DO), electrical conductivity (EC), and total dissolved solids (TDS). The following equipment was used to measure these water quality parameters:

- A YSI Model 55 multi-meter was used to measure temperature and DO.
- A Hanna Combo Model HI 98129 multi-meter was used to measure pH, EC, and TDS.
- A LaMotte Model WAT-DR field test kit was used to measure alkalinity.

## 2.5 RAPID VEGETATION ASSESSMENT

Vegetation community composition and dominance was sampled at each site (AC-1 and 2, spring 2007 and AC-3, spring 2008) using the CNPS Rapid Assessment protocol (CNPS Vegetation Committee 2005). Only those protocol components related to the assessment of plant community composition and structure were completed (the protocol also allows for the assessment of physical habitat parameters, much of which was redundant with data collected for other components of this study). The vegetation parameters collected at each site included: the size of the sample plot; the number and approximate diameter at breast height of any trees within the sample plot; the height and approximate ground cover of trees, shrubs, and forbs within each plot; and the 15–20 most common vascular plants, as well as the percent absolute ground cover for each plant within the sampled plot. In an effort to facilitate the repeatability of subsequent monitoring efforts, absolute ground cover for each plant was assigned one of seven standard cover classes rather than a specific ground cover value. A copy of the form used in the field is attached in Appendix B.

# 3 RESULTS AND DISCUSSION

This section provides a discussion on the results of existing data review, bioassessments, and rapid vegetation assessments conducted in the Alder Creek watershed.

## 3.1 EXISTING DATA REVIEW

### 3.1.1 GENERAL DESCRIPTION

As discussed previously, Alder Creek originates in the western slopes of the Sierra Nevada foothills in the northeastern corner of Sacramento County and flows in a southwest direction approximately 15 miles until it enters the American River at Lake Natoma (Exhibit 1). The creek drains an 11-square-mile watershed, with approximately one-quarter of the watershed lying north of U.S. 50 in the City of Folsom and the remaining three-quarters lying south of U.S. 50. Most of watershed south of U.S. 50 is being planned for development, and preliminary development plans have been prepared for GenCorp's 1,400-acre Easton development. The watershed is an important resource for the region, providing habitat for wildlife, avian, plant, and aquatic species. The mouth of Alder Creek at Lake Natoma is located on the lower American River, an important aquatic ecosystem for several plant, wildlife and fish species and source of drinking water for the region.

### 3.1.2 HISTORICAL WATERSHED CONDITIONS

The historic setting of the Alder Creek watershed can be generally divided into two distinct conditions: (1) conditions before human disturbance and (2) conditions and processes that have been affected by historic changes in the landscape due to Euro-American settlement and activities.

#### HISTORICAL NATURAL CONDITIONS

The Alder Creek watershed is found at the eastern edge of California's southern Sacramento Valley. As with other parts of California, the Sacramento Valley is characterized by a Mediterranean climate with hot, dry summers and cool, moist winters. Soils and geology found within the watershed reflect its location at the junction between the Great Valley and Sierra Nevada foothill geologic provinces at the eastern portion of the watershed and on ancient (i.e., Pleistocene-aged) river terraces in the western portion of the watershed. This unique combination of climate and geology is conducive to the formation of grassland habitats and associated seasonally inundated aquatic habitats, such as ephemeral streams (including Alder Creek) and vernal pools. Scattered oak woodlands and savanna similar to those in the upper watershed were also likely found historically, particularly in the upper watershed, where soils are more conducive to woodland formation. Plants and animals historically found in the watershed likely resemble those found here today, with the probable exceptions that these species were found in greater numbers and that native species were likely more common, particularly within grassland communities. These communities have been extensively modified by nonnative Euro-Asian species introduced to California beginning with Spanish colonial settlement in the 1700s (Schiffman 2007).

#### HUMAN OCCUPATION

Alder Creek meanders through what was originally Nisenan (Southern Maidu) territory. Nisenan settlement locations depended primarily on elevation, exposure, and proximity to water and other resources. Permanent villages usually were located on low rises along major watercourses. The largest group of Nisenan lived along the north side of the American River. Creeks and other smaller water sources also were used as part of their hunting and gathering lifestyle.

The Nisenan occupied permanent settlements from which specific task groups set out to harvest the seasonal bounty of flora and fauna that the rich valley environment provided. The Nisenan economy involved riparian resources, and many wild species were closely husbanded. The acorn crop from the blue oak (*Quercus douglasii*) and, in the Sierra Nevada, black oak (*Q. kelloggii*) was widely used and carefully managed; acorns often were stored in anticipation of winter shortfalls in resource abundance. Deer, rabbit, and salmon were the chief sources of animal protein in the native diet, but many insect and other animal species were taken when available (Wilson and Towne 1978). The historic ethnographic record does not indicate that Alder Creek or other nearby waterways underwent any significant changes during the time of Native American occupation.

With the depopulation and displacement of the native people during the late 19th and early 20th century, the use of the waterways changed from a hunting-and-gathering focus to a mining focus. Would-be miners came from all directions, and, by the late 19th century, mining was reported along Alder Creek (Thompson and West 1880) and extensive mining dredge tailings are prevalent to the south of the creek mainstem throughout the middle watershed (see Exhibits 3 and 4).

### LAND USE CHANGES AFFECTING NATURAL RESOURCES

Euro-American use of Alder Creek during the historic period was primarily in the form of mining operations, although agricultural and ranching uses also occurred. Mining commenced in the hills near Alder Creek, 2 miles south of Folsom, in 1853, a few years after the initial discovery of gold at Coloma. Water companies, such as the Natoma Water and Mining Company, used creeks, including Alder Creek, and other watercourses in their mining efforts (Thompson and West 1880).

During the late 19th century, the Euro-American presence steadily grew in the area surrounding Alder Creek. An1892 topographic map depicts railroad tracks crossing the creek, as well as buildings (within towns) in its vicinity (USGS 1892). This presence resulted in further changes in land uses adjacent to the creek. In 1896, for example, a bicycle cinder path was constructed from Alder Creek to Folsom (McGowan 1961). This wheel-way introduced a new land use to the watershed.

Other activities that affected the Alder Creek watershed included historic-era logging, livestock grazing, dam construction (e.g., Natomas Company Dam and Alder Reservoir and several stock ponds) and, more recently, urban development. These activities have resulted to multiple disturbances to the creeks morphology including channelization, incision, erosion, loss of floodplain, and the presence of non-native vegetation. Historic General Land Office maps (1855, 1858) depict fences and cultivated fields. Residential and commercial zoning have replaced most of the natural areas within the watershed north of U.S. 50, further modifying the creeks original form and functions. The creeks originating in the area north of U.S. 50 have also undergone a change in hydrology from ephemeral and intermittent to perennial as a result of urban runoff during the summer months (see Exhibit 2).

The rate and level of change to the surrounding areas of Alder Creek during the past century greatly exceeds that of the century preceding it. Increases in population and expansive land use impacts have resulted in modifications to its original flow, use, and appearance, as evidenced through historic maps and documents. A historical aerial photo taken in 1937 is provided in Exhibit 4.

## 3.1.3 CURRENT WATERSHED CONDITIONS

### BIOLOGICAL RESOURCES

This section describes the vegetation communities and plant and animal species of the Alder Creek watershed with an emphasis on those traits or characteristics that are relevant to watershed assessment and planning. In addition to the biological resources investigations prepared during the planning stages for potential development projects within the watershed (see Table 1), a number of standard references were consulted (Holland 1986, Sawyer and Keeler-Wolfe 1995, Hickman 1993, CNDDB 2007, CNPS 2001).

#### Habitats and Habitat Use

The Alder Creek watershed is characterized by a diversity of natural vegetation communities. The southern portion of the upper watershed (i.e., south of U.S. 50) is dominated by grasslands with scattered vernal pools and seasonal swales, as well as blue oak savanna. The southern portion of the middle reach contains more mixed oak and pine woodland, denser riparian forest/scrub along the creek, small areas of vernal pool grassland, and a few scattered locations of open water and seasonal marsh. Those portions of the upper and middle watershed north of U.S. 50 and within the city of Folsom contain a relatively narrow riparian habitat corridor along the primary tributaries with the remaining areas being characterized primarily by developed areas; small, landscaped parks; and stormwater detention basins that provide limited freshwater wetland and marsh habitat. The mixed oak-pine woodlands and riparian woodlands found in the middle reach continue into the lower reach. The lower watershed also contains some areas of grassland and freshwater marsh. Development in the lower watershed includes the Folsom Automall, which dominates the lower end of the watershed as it joins the American River and Lake Natoma.

As Alder Creek and its tributaries transverse the middle and lower watersheds, the fluvial geomorphology changes from narrow, relatively shallower channels to channels with a wider bed and steeper banks because of erosion and increased stormwater runoff from surrounding urban development. The hydrology of the creek and its tributaries also changes as urban runoff from the developed areas north of Hwy 50 and the commercial area around the automall contributes perennial flows. The vegetation communities associated with Alder Creek and its tributaries in the area north of U.S. 50 are therefore more reflective of modified watershed conditions relative to the area south of U.S. 50, which is primarily undeveloped.

The location of the main vegetation communities and other land cover types found within the Alder Creek watershed are shown in Exhibit 5a through 5c, and the approximate acreages of these habitats and land cover types are shown in Table 3. Each of these communities is described in more detail below. This information is drawn primarily from the background resource documents listed in Table 1, as well as information gathered during reconnaissance-level surveys conducted for the development of the watershed assessment and the knowledge and experience of individuals preparing the watershed assessment. Because exhaustive biological surveys for the entire watershed have not been conducted, some information presented below may be a generalization based on aerial photo interpretation, limited ground truthing, and prior experiences with similar plant communities and may not always accurately reflect watershed conditions. However, every attempt has been made to include the most updated, watershed-specific information wherever possible.

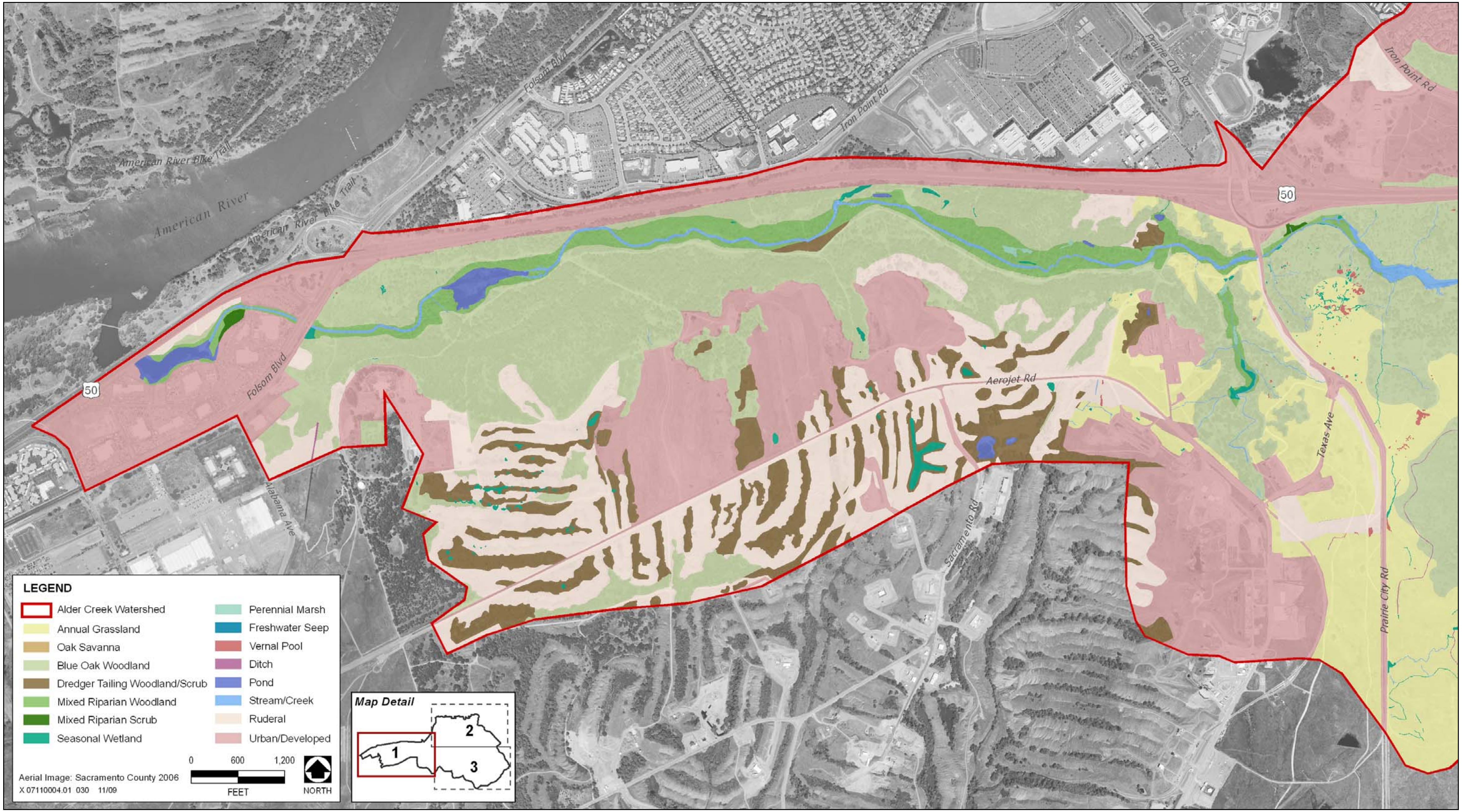
**Table 3**
**Alder Creek Watershed Habitat / Land Cover Type Acreages**

| Habitat / Land Cover Type | Acreage | Percent of Total |
|---|---|---|
| Annual grassland | 2,705 | 38 |
| Ruderal (i.e., disturbed areas dominated by weedy herbaceous species) | 501 | 7 |
| Oak savanna | 221 | 3 |
| Blue oak woodland | 1,152 | 16 |
| Dredger tailing woodland and scrub | 125 | 2 |
| Mixed riparian woodland | 78 | 1 |
| Mixed riparian scrub | 21 | 0 |
| Perennial marsh | 5 | 0 |
| Freshwater seeps | 8 | 0 |
| Seasonal wetland | 42 | 1 |
| Vernal pools | 4 | 0 |
| Ditches | 4 | 0 |
| Ponds | 67 | 1 |
| Streams and creeks | 44 | 1 |
| Urban/developed | 2,155 | 30 |
| **Total** | **7,132** | **100** |


Source: City of Folsom 2007, NHC 2007

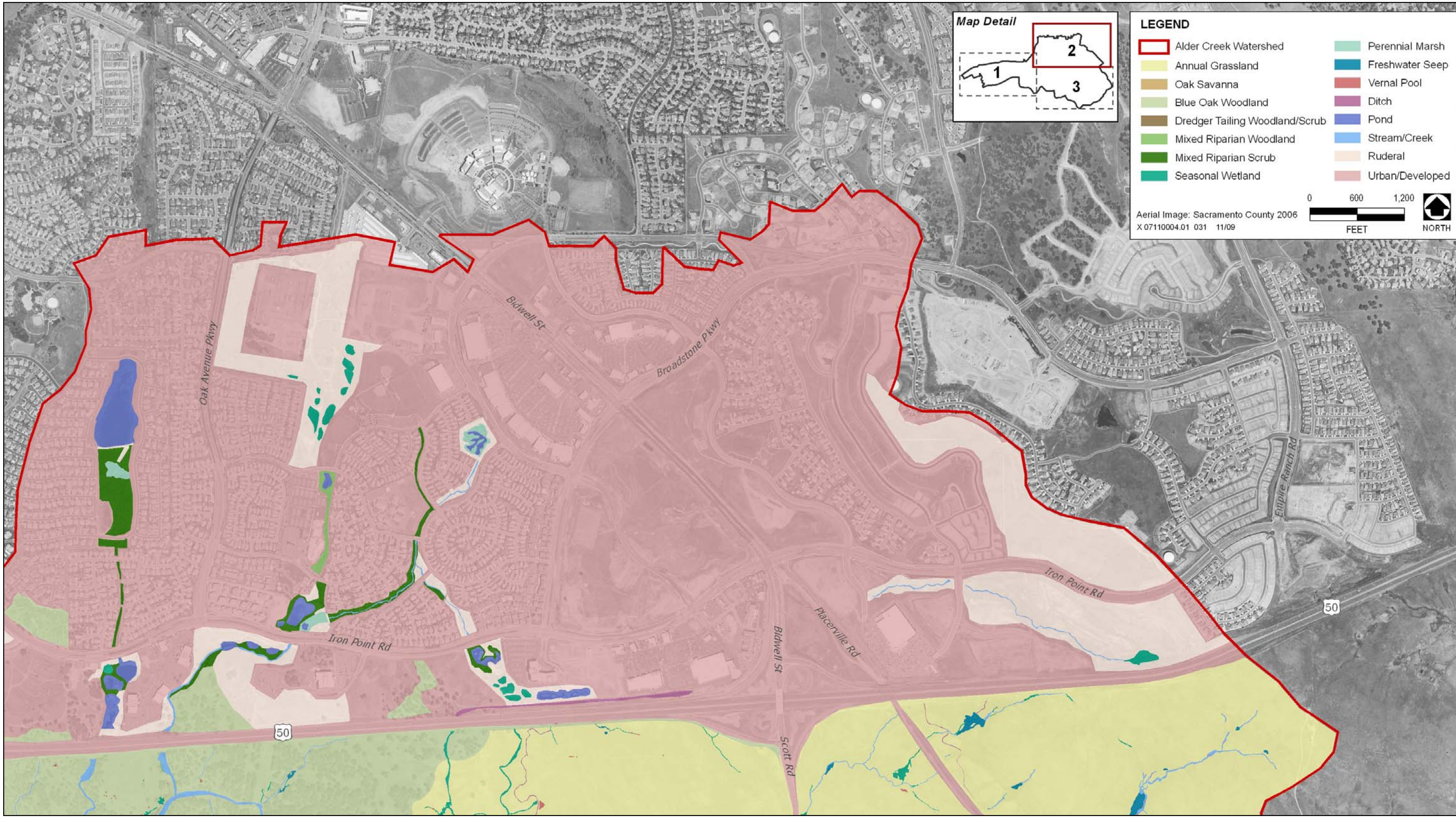
**Alder Creek Watershed – 1937 Aerial Photo**

**Exhibit 4**



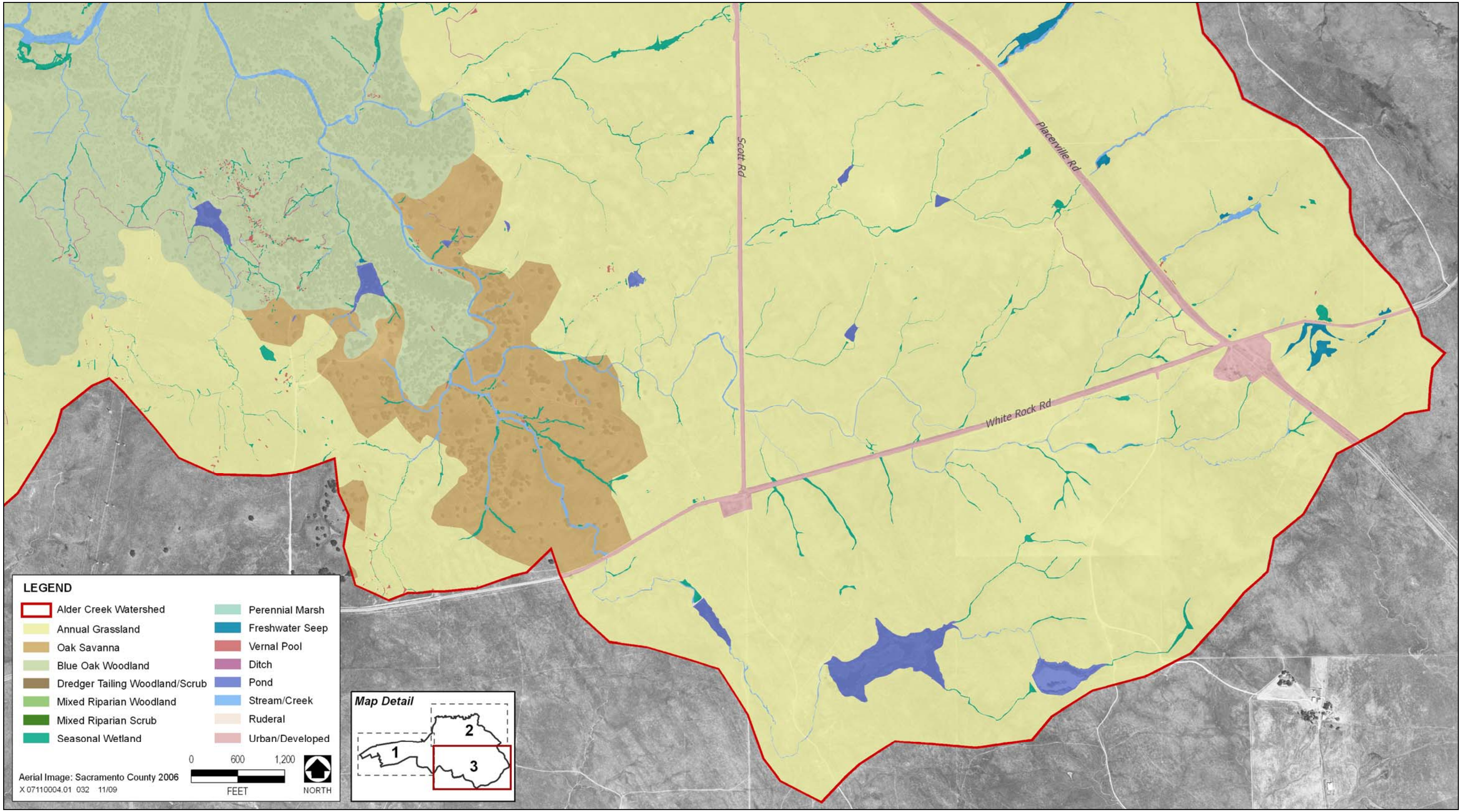

Source: AECOM 2009

**Alder Creek Watershed – Vegetation / Land Cover Type Map (1 of 3)** **Exhibit 5a**




Source: AECOM 2009

**Alder Creek Watershed – Vegetation / Land Cover Type Map (2 of 3)** **Exhibit 5b**




Source: AECOM 2009

**Alder Creek Watershed – Vegetation / Land Cover Type Map (3 of 3)** **Exhibit 5c**

### ***Grassland Habitats***

#### Annual Grassland

Annual grassland is composed primarily of nonnative annual grasses with little tree cover. It can also occur within riparian and savanna habitats and is sometimes associated with agricultural lands, such as pastures. It occurs throughout the watershed and is the dominant plant community within the upper watershed. Grasses typically found in this community include wild oats (*Avena barbata* and *A. fatua*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), Italian ryegrass (*Lolium multiflorum*), medusa head (*Taeniatherum caput-medusae*), annual fescues (*Vulpia* spp.), and Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*). Many exotic broadleaf species often intermix with the grasses. These include species such as filaree (*Erodium botrys*), bur clover (*Medicago polymorpha*), shamrock clover (*Trifolium dubium*), cut-leaf geranium (*Geranium dissectum*), dove-foot geranium (*Geranium molle*), annual hawkbit (*Leontodon taraxacoides*), smooth cat's ear (*Hypochaeris glabra*), yellow star-thistle (*Centaurea solstitialis*), and rose clover (*Trifolium hirtum*). Native species found in annual grasslands include tidy-tips (*Layia fremontii*), California goldfields (*Lasthenia californica*), miniature lupine (*Lupinus bicolor*), sky lupine (*Lupinus nanus*), brodiaea species (*Brodiaea* spp.), blue dicks (*Dichelostemma capitatum*), white Brodiaea, Ithuriel's spear (*Triteleia hyacinthina* and *T. laxa*), little-head clover (*Trifolium microcephalum*), various species of tarweed (*Hemizonia fitchii*, *Madia elegans*, *Holocarpha virgata*), and vinegar weed (*Trichostema lanceolatum*). Invasive species commonly found in annual grasslands include medusa head, barbed goat grass (*Aegilops triuncialis*), yellow star-thistle, Klamath weed (*Hypericum perforatum*), and Italian thistle (*Carduus pycnocephalus*).

#### Ruderal

Ruderal vegetation is similar to annual grassland with the exception that invasive species such as yellow starthistle, Italian thistle, medusa head, Klamath weed and similar species tend to be more common. Ruderal vegetation also tends to be frequently disturbed or affected by past disturbances. Within the watershed, ruderal vegetation is found on the tops of dredger piles, disturbed areas around areas of development, and locations within the City of Folsom that have been graded for future development.

#### Oak Savanna

Oak savannas are characterized by annual grassland with a sparse blue oak canopy; they are found primarily within the upper watershed.

#### Grassland-Associated Wildlife

Although annual grassland is dominated by nonnative plant species, this community has habitat value for a variety of native wildlife species. For example, burrowing wildlife species such as ground squirrels (*Spermophilus beecheyi*) and pocket gopher (*Thomomys bottae*) create dens or nest sites in this community. These burrows often constitute a crucial habitat element for other species that need them but are unable to dig them, such as the western burrowing owl (*Athene cunicularia*). Burrowing activity of rodents also attracts predators, such as coyote (*Canis latrans*), American kestrel (*Falco sparverius*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), and Swainson's hawk (*Buteo swainsonii*). Several common species of songbirds also nest or forage in annual grasslands. These include western meadowlark (*Sturnella neglecta*), western kingbird (*Tyrannus verticalis*), and savannah sparrow (*Passerculus sandwichensis)*.

Ruderal habitats potentially support many of the same wildlife species found in annual grassland; although, the habitat quality of ruderal areas tends to be lower than relatively undisturbed annual grasslands due to a greater presence of invasive plants or to past or frequent disturbances. Many patches of ruderal vegetation also tend to isolated or fragmented and located in close proximity to developed areas, further reducing their habitat value for most species of wildlife.

Wildlife species found in oak savannas are similar to those found in annual grasslands, but additional species may be present that forage or nest within the scattered oak trees, such as western gray squirrel (*Sciurus griseus)*, western scrub jay (*Aphelocoma californica*), ash-throated flycatcher (*Myiarchus cinerascens*), and acorn woodpecker (*Melanerpes formicivorus*).

### *Woodland, Scrub, and Riparian Habitats*

#### Blue Oak Woodland

Blue oak woodland is a broadleaved deciduous woodland plant community with a grassy or shrubby understory. It occurs throughout the watershed, but it is particularly common within the middle and lower portions of the watershed, where it is frequently the dominant plant community. Blue oak is the dominant oak species within the watershed, but interior live oak (*Quercus wislizeni*) and foothill pine (*Pinus sabiniana*) are also commonly found in this community. Understory shrubs include wedgeleaf ceanothus (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), coffeeberry (*Rhamnus californica*), coyote brush (*Baccharis pilularis*), and poison-oak (*Toxicodendron diversilobum*). Herbaceous species include many of the nonnative grasses previously discussed under annual grasslands, as well as dogtail grass (*Cynosurus echinatus*) and, occasionally, native perennial grasses, such as blue wildrye (*Elymus glaucus*) and purple needlegrass (*Nassella pulchra*). Many of the invasive species discussed above for annual grassland are also commonly found in blue oak woodland.

#### Dredger Tailing Woodland and Scrub

The middle and upper reaches of the watershed are characterized by dredger tailings associated with historic gold mining. As a byproduct of dredger operation, clays and other fine soil particles commonly aggregate along the sides and bases of dredger tailings (i.e., cobble-sized rock). These clay concentrations create areas of relatively higher soil moisture and lower water permeability that support a locally unique assemblage of riparian and woodland plants, such as Fremont cottonwood (*Populus fremontii*), which is frequently the dominant species; various species of oaks (*Quercus* spp.), willows (*Salix* spp.), coyote brush, poison-oak, coffeeberry, and blue elderberry (*Sambucus mexicana*). Scattered annual grasses and invasive plants, such as yellow star-thistle and Italian thistle, also may be found in this community. Canopy cover ranges from moderately dense (in which case, trees such as cottonwood and oak dominate with a shrub understory) to open (in which case, coyote brush and blue elderberry are the dominant plants along with associated annual grasses).

#### Mixed Riparian Woodland

Mixed riparian woodland is found in narrow banks along the middle and lower reaches of Alder Creek. This community type typically has one or more well-developed canopy layers. These canopy layers may be dense or more open and savannalike and are characterized by species such as Fremont cottonwood, valley oak (*Quercus lobata*), Oregon ash (*Fraxinus latifolia*), white alder (*Alnus rhombifolia*), red willow (*Salix laevigata*), Goodding’s willow (*Salix gooddingii*), and box elder (*Acer negundo*). Shrub layers are composed of Himalayan blackberry (*Rubus discolor*), California blackberry (*Rubus ursinus*), poison-oak, Arroyo willow (*Salix lasiolepis*), narrowleaf willow (*Salix exigua*), California wild grape (*Vitis californica*), blue elderberry, toyon, and coffeeberry. Invasive species found in this plant community include Himalayan blackberry, tree-of-heaven (*Ailanthus altissima*), and black locust (*Robinia pseudoacacia*).

#### Mixed Riparian Scrub

Riparian scrub is interspersed with mixed riparian woodland throughout the lower and middle reaches of Alder Creek as well as tributaries within the City of Folsom. It consists of an open to dense shrubby thicket dominated by a mixture of sandbar willow, arroyo willow, red willow, and immature stands of the mixed riparian woodland tree species discussed above. This plant community also forms a subcanopy in mixed riparian woodland. Dense stands of riparian scrub often lack an understory, but the more open stands support an understory of native species, such as wild rose (*Rosa californica*) and wild grape, and nonnative species, such as perennial pepperweed

(*Lepidium latifolium*), Himalayan blackberry, curly dock (*Rumex crispus*), and nonnative grasses. Common invasive species include Himalayan blackberry, perennial pepperweed, and giant reed (*Arundo donax*).

#### Woodland- and Scrub-Associated Wildlife

Woodland and scrub habitats provide important cover and foraging habitats for many species of wildlife. Reptiles and amphibians found in woodland habitats include California slender salamander (*Batrachoseps robustus*), western fence lizard *(Sceloporus occidentalis)*, and California kingsnake (*Lampropeltis getula californiae*). Common birds in oak woodland include acorn woodpecker (*Melanerpes formicivorus*), wild turkey (*Meleagris gallopavo*), great horned owl (*Bubo virginianus*), and oak titmouse (*Baeolophus inornatus*). In riparian habitats, red-shouldered hawk (*Buteo lineatus*), ash-throated flycatcher, blue grosbeak (*Guiracea caerulea*), and red-winged blackbird (*Agelaius phoeniceus*) are commonly found. Mammals that characterize woodland and scrub habitat include mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), and bobcat (*Lynx rufus).*

### *Aquatic Habitats*

#### Perennial Marsh

Perennial marsh is composed of emergent herbaceous vegetation in slow-moving water or ponded water. It also encompasses open water areas, such as ponds used for stormwater detention and livestock watering and other ponded areas along Alder Creek and its tributaries. The water is usually 1–3 feet deep for a significant portion of the year. The vegetation is typically between 4 and 8 feet tall and is well adapted to saturated soil conditions. Perennial marshes in this watershed are typically dominated by broadleaf cattail (*Typha latifolia*), tule (*Scirpus acutus*), and tall flatsedge (*Cyperus eragrostis*) and includes emergent perennial grasses and forbs, such as Sanford's arrowhead (*Sagittaria sanfordii*), smartweed (*Polygonum* spp.), and common bog rush (*Juncus effusus*). Common invasive plants include tall flatsedge and perennial pepperweed, as well as a variety of invasive grasses, such as dallis grass (*Paspalum dilatatum*).

#### Freshwater Seeps

A seep is a wetland plant community characterized by dense cover of perennial herb species usually dominated by rushes, sedges, and grasses. Freshwater seep communities occur at the eastern margins of the watershed on permanently moist or wet soils resulting from daylighting groundwater within the transition zone from the valley floor to the Sierra Nevada foothills. Characteristic plant species found in seeps within the watershed include Baltic rush (*Juncus balticus*), iris-leaved rush (*Juncus xiphioides*), common spikerush (*Eleocharis macrostachya*), white hedge-nettle (*Stachys albens*), rice cutgrass (*Leersia oryzoides*), and dense-flowered willowherb (*Epilobium densiflorum*).

#### Seasonal Wetlands

Seasonal wetlands are present throughout the watershed in both topographic depressions (e.g., areas in between dredger tailings) and swales. Hydrologically, seasonal wetlands are similar to vernal pools because they remain inundated or saturated for extended periods during winter and spring. Seasonal wetland swales do not pond water appreciably but are inundated by flowing water during rainfall and support a saturated upper soil horizon for an extended period during the growing season. Characteristic plant species in seasonal wetlands and seasonal wetland swales within the watershed include coyote thistle (*Eryngium castrense*), toad rush (*Juncus bufonius*), hyssop loosestrife (*Lythrum hyssopifolium*), foothill meadowfoam (*Limnanthes striata*), dallis grass (*Paspalum dilatatum*), rabbitsfoot grass (*Polypogon monspeliensis*), common spikerush, and Italian ryegrass.

#### Vernal Pools

Vernal pools are composed of both vernal pool complexes (i.e., interconnected networks of vernal pools and swales) and isolated vernal pools scattered within annual grasslands primarily located throughout the upper watershed. Vernal pools are shallow depressions in the landscape that pond seasonally during winter and then dry during spring and summer. These ponded areas are supported mainly by rainfall, localized watersheds, and sometimes shallowly perched groundwater within the immediate surroundings. Vernal pools are characterized by the presence of a diverse set of native, endemic plant species. Common vernal pool species include vernal pool goldfields (*Lasthenia fremontii*), blow-wives (*Achyrachaena mollis*), stipitate popcorn flower (*Plagiobothrys stipitatus*), white-headed navarretia (*Navarretia leucocephala* ssp. *leucocephala*), woolly marbles (*Psilocarphus brevissimus*), annual hairgrass (*Deschampsia danthonioides*), Sacramento mesamint (*Pogogyne zizyphoroides*), and various species of calicoflower (*Downingia* ssp.). Several species of rare, threatened, or endangered plants may be associated with vernal pools although, to date, none of these species has been documented within the watershed. Species that could potentially be found within the watershed include dwarf downingia (*Downingia pusilla*), Boggs Lake hedge-hyssop (*Gratiola heterosepala*), legenere (*Legenere limosa*), slender Orcutt grass (*Orcuttia tenuis*), pincushion navarretia (*Navarretia myersii* ssp. *myersii*), and Sacramento Orcutt grass (*Orcuttia viscida*).

### Ditches

Artificial ditches are present throughout the watershed. Many of these features follow topographic contours and may represent relics from historic hydraulic gold mining activities, whereas others may have been excavated to transport irrigation water. Some ditches on the project site support hydrophytic vegetation, such as rabbitsfoot grass, curly dock, and common yellow monkeyflower (*Mimulus guttatus*).

### Ponds

Artificial ponds (e.g., stock ponds or ponds associated with historic gold mining) are found in numerous locations within the watershed. These include ponds created through impoundment of stream channels (stock water ponds in the upper watershed and Alder Reservoir located in the middle watershed), stormwater detention ponds (located in the upper watershed north of U.S. 50), and excavated basins that are perennially inundated and support a sparse cover of emergent vegetation, many of which are discussed above under "Seasonal Wetlands" and "Perennial Marsh," along the shallow margins. Black willow and Fremont cottonwood may also be found on the pond banks.

### Streams and Creeks

Streams and creeks include the mainstem of Alder Creek and its tributaries. The upper reach of Alder Creek and tributaries within the upper watershed, with the exception of tributaries within the City of Folsom, are primarily ephemeral and contain flowing water only during the rainy season (see Exhibit 2). Consequently, this reach of the creek is largely unvegetated and does not support fish or aquatic wildlife. However, portions of the middle and, in particular, lower reaches of Alder Creek as well as tributaries within the City of Folsom flow perennially. In these areas, portions of the creek are vegetated with water primrose (*Ludwigia peploides*) and similar floating aquatic plants, most of which are considered to be invasive species. Other plant species present within and along streams and creeks include those described above for the freshwater marsh community and riparian forest and scrub communities.

### Aquatic-Associated Wildlife

Wildlife species that are commonly associated with aquatic habitats include western pond turtle (*Actinemys marmorata*), Pacific chorus frog (*Pseudacris regilla*), marsh wren (*Cistothorus palustris*), and mallard (*Anas platyrhynchos*). Additional species of waterfowl may be present seasonally in most aquatic habitats.

Vernal pools in the watershed provide specialized habitat for many special-status species, particularly vernal pool invertebrates, such as vernal pool fairy shrimp (*Branchinecta lynchi*) and vernal pool tadpole shrimp (*Lepidurus packardi*), both of which are likely to occur within the watershed. Western spadefoot (*Spea hammondii*), a California species of special concern, also may use vernal pool grasslands within the watershed for breeding and cover. More common species, such as some shorebirds and waterfowl, use vernal pools for foraging during winter and spring.

Wildlife using streams and creeks are similar to those using other aquatic habitats described above. The lower reaches of Alder Creek also support several species of common warm-water fish, such as bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), and smallmouth bass (*Micropterus dolomieui*).

### *Urban/Developed Areas*

Urbanized areas dominate the watershed north of U.S. 50. They include medium- to high-density residential and commercial (office) development, as well as extensive retail development (some under construction in the Palladio Mall). Urban areas in the watershed lack extensive native vegetation cover but may occasionally contain scattered areas of remnant valley oaks and blue oaks with a sparse annual grass understory and riparian communities along tributary corridors. Urban areas also contain landscaped areas with turfgrass and ornamental trees, such as Chinese pistache (*Pistacia chinensis*) and callery pear cultivars (*Pyrus calleryana*).

With the exception of the areas along the creek corridors, urban areas tend to have reduced habitat value for wildlife species because the natural habitat has been greatly modified. These areas support many nonnative species, such as house sparrow (*Passer domesticus*), European starling, and Norway rat (*Rattus norvegicus*). These and other wildlife in urban areas often easily adapt to disturbed environments. They may feed on trash or food left out by homeowners or find cover in ornamental trees. Other wildlife common in urban areas include raccoon, opossum, American crow, mourning dove (*Zenaida macroura*), western gray squirrel, and western fence lizard.

## Special-Status Species

Special-status species discussed include those that are afforded consideration or protection under the California Environmental Quality Act (CEQA), California Fish and Game Code, California Endangered Species Act (CESA), or federal Endangered Species Act (ESA). Specific classes of special-status species include the following:

- species officially listed by the State of California or the federal government as endangered, threatened, or rare;
- candidates for state or federal listing as endangered, threatened, or rare;
- species identified by DFG as species of special concern;
- species listed as fully protected under the California Fish and Game Code;
- species afforded protection under local or regional planning documents; and
- taxa considered by CNPS to be "rare, threatened, or endangered in California." CNPS includes five lists for categorizing plant species of concern:
  - List 1A—plants presumed to be extinct in California;
  - List 1B—plants that are rare, threatened, or endangered in California and elsewhere;
  - List 2—plants that are rare, threatened, or endangered in California but more common elsewhere;
  - List 3—plants about which more information is needed (a review list); and
  - List 4—plants of limited distribution (a watch list).

Tables 4 and 5 below provide lists of special-status species known to occur or with potential to occur within the Alder Creek watershed. These lists were developed through review of biological studies previously conducted within the watershed and in the vicinity, as listed in Table 1. The California Natural Diversity Database (CNDDB) (CNDDB 2008) and CNPS Inventory of Rare and Endangered Plants (CNPS 2008) also were reviewed for specific information on previously documented occurrences of special-status species in the Alder Creek watershed and surrounding areas. Exhibit 6 shows all the CNDDB occurrences within 2 mile of the Alder Creek watershed, as well as all occurrences within the watershed.

### *Special-Status Plant Species*

Eleven special-status plant species are known to occur within the Alder Creek watershed or have the potential to occur within the watershed: dwarf downingia, Bogg's Lake hedge-hyssop, legenere, slender Orcutt grass, Sacramento Orcutt grass, Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*), pincushion navarretia (*Navarretia myersii* ssp. *myersii*), big scale balsamroot (*Balsamorhiza macrolepis* var. *macrolepis*), Brandegee's clarkia (*Clarkia biloba* ssp. *brandegeeae*), Tuolumne button celery (*Eryngium pinnatisectum*), and Sanford's arrowhead (*Sagittaria sanfordii*). The potential for each species to occur in the watershed and habitat requirements for each species is described in Table 4.

### *Special-Status Wildlife Species*

Seventeen special-status wildlife species are known to breed or have the potential to breed within the Alder Creek watershed. Many of these species have a high potential to benefit from watershed management and restoration activities. Other special-status species, particularly several species of raptors, are known to or have the potential to use the watershed for nonbreeding winter habitat, during migration, or for foraging.

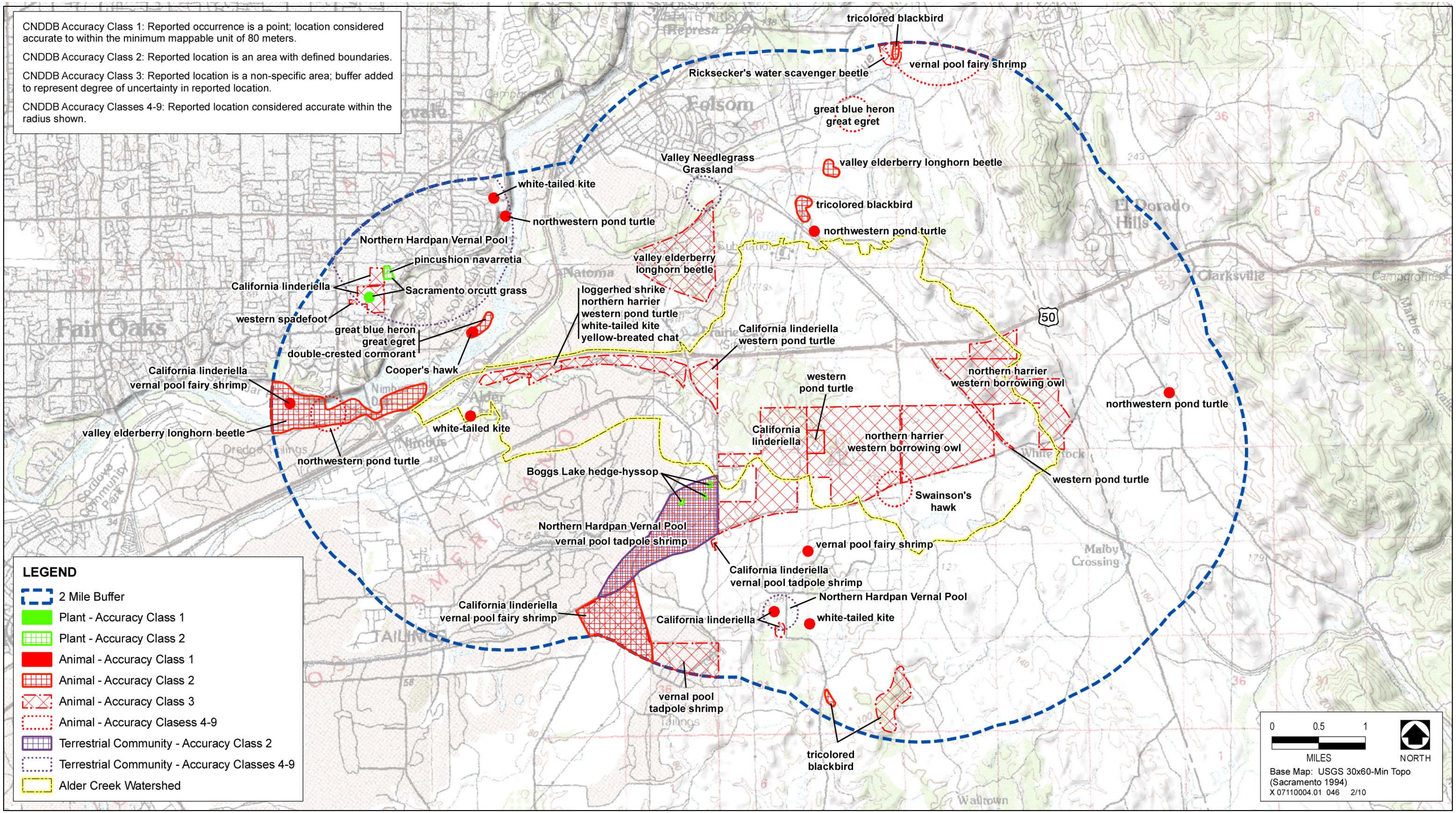
Special-status wildlife potentially breeding within the watershed include: valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, Conservancy fairy shrimp (*Branchinecta conservatio*), western pond turtle, western spadefoot, tricolored blackbird, grasshopper sparrow, golden eagle, burrowing owl, Swainson's hawk, northern harrier, white-tailed kite, yellow-breasted chat, loggerhead shrike, Modesto song sparrow, and American badger. Descriptions of special-status wildlife species in the watershed are provided below in Table 5.

### *Special-Status Fish*

No special-status fish species are known or have potential to occur within the Alder Creek watershed. Anadromous Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) utilize the lower American River below Nimbus Dam for spawning and rearing. Both of these species may have historically utilized Alder Creek prior to the construction of Nimbus Dam; however, the natural pre-development flow patterns that were more ephemeral and intermittent likely limited habitat values for these species.

### *Sensitive Habitats*

Sensitive habitats are those that are of special concern to resource agencies or are afforded specific consideration through CEQA, Section 1602 of the California Fish and Game Code, Section 404 of the CWA, and the state's Porter-Cologne Water Quality Control Act. Some plant communities in the Alder Creek watershed are considered sensitive or rare by the state and/or local counties because of limited distribution locally or regionally. Numerous sensitive habitats occur within the watershed. These include Alder Creek, vernal pools, seasonal wetlands, and most other aquatic habitats, as well as valley foothill riparian habitat along the middle and lower reaches of Alder Creek. Each of these habitats is described in more detail above.




Source: CNDDB 2008

**Alder Creek Watershed CNDDB and Special-Status Species Map** **Exhibit 6**

**Table 4**
**Special-Status Plant Species Known to Occur or with Potential to Occur in the Alder Creek Watershed**

| Species | Status[1] USFWS | DFG | CNPS | Habitat and Blooming Period | Potential for Occurrence[2] |
|---|---|---|---|---|---|
| Big scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis* | – | – | 1B.2 | Chaparral, cismontane woodland, and valley and foothill grassland, often on serpentinite soils; 295- to 4,600-foot elevation; blooms March through June | Could occur in grassland and oak woodland on the project site; however, the probability of occurrence is low because, although not restricted to serpentinite soils, this species is typically associated with serpentinite soils, which are not present on the project site |
| Brandegee's clarkia *Clarkia biloba* ssp. *brandegeae* | – | – | 1B.2 | Chaparral and cismontane woodland, often in roadcuts; 240- to 3,000-foot elevation; blooms May through July | Could occur in the blue oak woodland community |
| Dwarf downingia *Downingia pusilla* | – | – | 2.2 | Vernal pools or other seasonal wetlands in annual grasslands; below 1,500-foot elevation; blooms March through May | Could occur in seasonal wetlands, vernal pools, and swales on the project site |
| Tuolumne button-celery *Eryngium pinnatisectum* | – | – | 1B.2 | Vernal pools or other seasonal wetlands in cismontane woodland and lower montane coniferous forest; 200- to 3,000-foot elevation; blooms June through August | Could occur in on-site vernal pools and seasonal wetlands on the project site |
| Bogg's Lake hedge-hyssop *Gratiola heterosepala* | – | E | 1B.2 | Lake margin marshes and swamps, vernal pools, and other seasonal wetlands, primarily in clay soils; 30- to 8,000-foot elevation; blooms April through August | Likely to occur in vernal pools or other seasonal wetlands on the project site; known occurrences immediately adjacent to the project site on west side of Prairie City Road, near the proposed off-site detention basin location |
| Ahart's dwarf rush *Juncus leiospermus* var. *ahartii* | – | – | 1B.2 | Vernal pools and swales in areas of low cover of competing vegetation; most often on gopher turnings along margins of pools (Witham 2006:38); 95- to 750-foot elevation; blooms March through May | Could occur in vernal pools and swales on the project site |
| Greene's legenere *Legenere limosa* | – | – | 1B.1 | Relatively deep and wet vernal pools (Witham 2006:39); below 3,000-foot elevation; blooms April through June | Could occur in vernal pools on the project site |
| Pincushion navarretia *Navarretia myersii* ssp. *myersii* | – | – | 1B.1 | Vernal pools; 65- to 750-foot elevation; blooms in May | Could occur in vernal pools on the project site |

**Table 4**
**Special-Status Plant Species Known to Occur or with Potential to Occur in the Alder Creek Watershed**

| Species | Status[1] USFWS | DFG | CNPS | Habitat and Blooming Period | Potential for Occurrence[2] |
|---|---|---|---|---|---|
| Slender Orcutt grass *Orcuttia tenuis* | T | E | 1B.1 | Vernal pools; 100- to 5,800-foot elevation; blooms May through October | Could occur in vernal pools on the project site |
| Sacramento Orcutt grass *Orcuttia viscida* | E | E | 1B.1 | Vernal pools; 95- to 325-foot elevation; blooms April through July | Could occur in vernal pools on the project site |
| Sanford's arrowhead *Sagittaria sanfordii* | – | – | 1B.2 | Shallow freshwater marshes and swamps; below 2,200-foot elevation; blooms May through October | Likely to occur in ponds, drainages, or other wetlands on the project site that support freshwater marsh vegetation; documented CNDDB occurrence boundary overlaps project site boundary along Grant Line Road |

Notes: CEQA = California Environmental Quality Act; CESA = California Endangered Species Act; CNDDB = California Natural Diversity Database; CNPS = California Native Plant Society; DFG = California Department of Fish and Game; ESA = federal Endangered Species Act; USFWS = U.S. Fish and Wildlife Service.

[1] Legal Status Definitions

**USFWS:**
E = endangered (legally protected).
T = threatened (legally protected).
– = No legal status.

**DFG:**
E = endangered (legally protected).
– = No legal status.

**CNPS Categories:**
1B = plant species considered rare or endangered in California and elsewhere (protected under CEQA, but not legally protected under ESA or CESA).
2 = plant species considered rare or endangered in California but more common elsewhere (protected under CEQA, but not legally protected under ESA or CESA).

**CNPS Extensions:**
.1 = seriously endangered in California (>80% of occurrences are threatened and/or high degree and immediacy of threat).
.2 = fairly endangered in California (20–80% of occurrences are threatened).

[2] Potential for Occurrence Definitions
Unlikely to occur: Species is unlikely to be present on the project site because of poor habitat quality, lack of suitable habitat features, or restricted current distribution of the species.
Could occur: Suitable habitat is available at the project site; however, there are little to no other indicators that the species might be present.
Likely to occur: Habitat conditions, known occurrences in the project vicinity, or other factors indicate a relatively high likelihood that the species would occur at the project site.

Sources: CNDDB 2008, CNPS 2008, Holloway, Rassmusson, & Molondanof 2005; GenCorp Realty Investments 2007a, 2007b, 2007c, 2007d; Centex Homes 2006a; Foothill Associates 1998; Woodside Homes 2004; MJM Properties 2006b, 2006d, 2007a, 2007b; Colliers International 2006; Matus 1981 (cited in GenCorp 2007c); Shuford and Gardali 2008; USFWS 2008; data compiled by EDAW AECOM in 2009

**Table 5**
**Special-Status Wildlife Species Known to Occur or with Potential to Occur in Alder Creek Watershed**

| Species | Listing Status[1] USFWS | Listing Status[1] DFG | Habitat | Potential for Occurrence[2] |
|---|---|---|---|---|
| **Invertebrates** | | | | |
| Valley elderberry longhorn beetle *Desmocerus californicus dimorphus* | T/PD | – | Elderberry shrubs below 3,000-foot elevation; typically in riparian habitats | Known to occur; elderberry shrubs are present within the watershed, and significant numbers of elderberry shrubs with exit holes found in lower watershed |
| Vernal pool fairy shrimp *Branchinecta lynchi* | T | – | Vernal pools and other seasonal wetlands in valley and foothill grasslands | Likely to occur in vernal pools within watershed; documented CNDDB occurrences in immediate watershed vicinity (i.e., within 1 mile) |
| Vernal pool tadpole shrimp *Lepidurus packardi* | E | – | Vernal pools and other seasonal wetlands in valley and foothill grasslands | Likely to occur in vernal pools within watershed; documented CNDDB locations abutting watershed |
| Conservancy fairy shrimp *Branchinecta conservatio* | E | – | Vernal pools and other seasonal wetlands in valley and foothill grasslands | Could occur; suitable habitat is present in vernal pools within the watershed |
| **Amphibians and Reptiles** | | | | |
| Western pond turtle *Actinemys marmorata* | – | SC | Forages in ponds, marshes, slow-moving streams, sloughs, and irrigation/drainage ditches; nests in nearby uplands with low, sparse vegetation | Known to occur; documented in Alder Creek within the lower watershed |
| Western spadefoot *Spea hammondii* | – | SC | Vernal pools and other seasonal ponds with a minimum 3-week inundation period in valley and foothill grasslands | Could occur; suitable habitat present within the watershed; nearest documented occurrences are more than 5 miles away, in Roseville, Phoenix Park, and Mather Field areas |
| **Birds** | | | | |
| Tricolored blackbird *Agelaius tricolor* (nesting colony) | – | SC | Forages in agricultural lands and grasslands; nests in marshes, riparian scrub, and other areas that support cattails or dense thickets of shrubs or herbs | Could nest within watershed; suitable marsh and blackberry bramble habitats for nesting and grassland foraging habitat are present, and species has been documented at four locations within 5 miles of the watershed |
| Grasshopper sparrow *Ammodramus savannarum* (nesting) | – | SC | Nests and forages in dense grasslands; favors a mix of native grasses, forbs, and scattered shrubs | Could nest in grassland communities within the watershed |

**Table 5**
**Special-Status Wildlife Species Known to Occur or with Potential to Occur in Alder Creek Watershed**

| Species | Listing Status[1] USFWS | Listing Status[1] DFG | Habitat | Potential for Occurrence[2] |
|---|---|---|---|---|
| Golden eagle *Aquila chrysaetos* | – | FP | Forages in large open areas of foothill shrub and grassland habitats and occasionally croplands; does not nest in the Central Valley | Unlikely to nest within the watershed; migrating and nonbreeding individuals could forage in watershed grasslands |
| Burrowing owl *Athene cunicularia* (burrow sites) | – | SC | Nests and forages in grasslands, agricultural lands, open shrublands, and open woodlands with existing ground squirrel burrows or friable soils | Known to forage in the watershed and likely nests here |
| Swainson's hawk *Buteo swainsoni* (nesting) | – | T | Forages in grasslands and agricultural lands; nests in riparian and isolated trees | Known to occur; likely to nest within the watershed; suitable nesting and foraging habitat present |
| Northern harrier *Circus cyaneus* (nesting) | – | SC | Nests and forages in grasslands, agricultural fields, and marshes | Known to occur; likely to nest in the watershed; species has been observed foraging in the watershed |
| White-tailed kite *Elanus leucurus* (nesting) | – | FP | Forages in grasslands and agricultural fields; nests in riparian zones, oak woodlands, and isolated trees | Likely to nest in the watershed; suitable grassland foraging habitat and suitable nest trees present in blue oak woodland and riparian areas; several CNDDB-documented nest sites in the vicinity of the watershed |
| Yellow-breasted chat (*Icteria virens*) | – | SC | Nests and forages in riparian areas, particularly early successional riparian scrub; frequently associated with blackberry and other scrubby vegetation | Known to occur; observed nesting along Alder Creek in the lower watershed (Matus 1981); current status unknown but likely not significant numbers of birds nesting the watershed |
| Loggerhead shrike *Lanius ludovicianus* (nesting) | – | SC | Forages and nests in grasslands, shrublands, and open woodlands | Known to occur; foraging documented along middle reach of Alder Creek (Matus 1981) |
| Modesto song sparrow (*Melospiza melodia*) (year round) | | SC | Nests and forages primarily in emergent marsh, riparian scrub, and early successional riparian forest habitats in the north-central portion of the Central Valley; infrequently in mature riparian forest and sparsely vegetated ditches and levees | Could occur; potentially suitable nesting habitat present along Alder Creek and a few other wetlands within the watershed; however, the watershed is on the fringes of the species' geographic range, and there is scientific uncertainty as to whether song sparrows in eastern Sacramento County above 200 feet in elevation are of the Modesto form (Grinnell and Miller 1944, Shuford and Gardali 2008:400–402) |

**Table 5**
**Special-Status Wildlife Species Known to Occur or with Potential to Occur in Alder Creek Watershed**

| Species | Listing Status[1] | | Habitat | Potential for Occurrence[2] |
|---|---|---|---|---|
| | USFWS | DFG | | |
| **Mammals** | | | | |
| American badger *Taxidea taxus* | – | SC | Drier open shrub, forest, and herbaceous habitats with friable soils | Known to occur; suitable habitat present, particularly in upper watershed; documented in middle watershed by Matus (1981); nearest CNNDB occurrence (1990) is 10 miles to the southwest, in Rancho Cordova |

Notes: CEQA = California Environmental Quality Act; CNDDB = California Natural Diversity Database; ESA = federal Endangered Species Act; USFWS = U.S. Fish and Wildlife Service.

[1] Legal Status Definitions

**USFWS:**
D = delisted (no ESA protection).
E = endangered (legally protected).
PD = proposed for delisting.
T = threatened (legally protected).
– = no legal status.

**DFG:**
FP = fully protected (legally protected).
SC = species of special concern (no formal protection other than CEQA consideration).
T = threatened (legally protected).
– = no legal status.

[2] Potential for Occurrence Definitions
Unlikely to occur: Species is unlikely to be present on the project site because of poor habitat quality, lack of suitable habitat features, or restricted current distribution of the species.
Could occur: Suitable habitat is available at the project site; however, there are little to no other indicators that the species might be present.
Likely to occur: Habitat conditions, behavior of the species, known occurrences in the project vicinity, or other factors indicate a relatively high likelihood that the species would occur at the project site.
Known to occur: The species, or evidence of its presence, was observed at the project site during reconnaissance surveys or was reported by others.

Sources: CNDDB 2008; Holloway, Rassmusson, & Molondanof 2005; GenCorp Realty Investments 2007a, 2007b, 2007c, 2007d; Centex Homes 2006a; Foothill Associates 1998; Woodside Homes 2004; MJM Properties 2006b, 2006d, 2007a, 2007b; Colliers International 2006; Matus 1981 (cited in GenCorp 2007c); Shuford and Gardali 2008; USFWS 2008; data compiled by EDAW AECOM in 2009

## Water Quality

### *Beneficial Uses*

Alder Creek does not have any specific designated beneficial uses in the water quality control plan (Basin Plan) adopted by the Central Valley Regional Water Quality Control Board (RWQCB). Consequently, the Central Valley RWQCB applies the Basin Plan “tributary rule” and assigns to these creeks the beneficial uses designated for the nearest downstream location. The Central Valley RWQCB also regulates waste discharges in undesignated streams to ensure that downstream water quality conditions and beneficial uses are not degraded. Thus, these creeks are subject to regulation for the existing designated uses in their receiving water bodies. Designated beneficial uses for the American River and Lake Natoma and their tributaries as defined by the Basin Plan (Central Valley RWQCB 2007) are:

- municipal, industrial, and agricultural supply;
- irrigation;
- contact and noncontact recreation;

- coldwater fish habitat, migration, and spawning;
- warmwater fish habitat, migration, and spawning;
- wildlife habitat;
- power generation; and
- navigation.

The segment of the American River that is the receiving water for the Alder Creek watershed is included on the State's 303(d) list[1] as impaired for mercury from resource extraction (Lake Natoma and lower American River) and for unknown toxicity (lower American River).

There is no comprehensive water quality monitoring station in the watershed, and water quality data are limited, particularly in the upper and middle reaches. The following sections describe the limited data available.

### *Alder Creek Watershed Assessment Water Quality Data*

Limited water quality measurements were taken at three locations in the watershed as part of bioassessments (to characterize aquatic macroinvertebrate community composition, physical habitat, and water quality). Results for the water quality measurements are presented below below along with other bioassessment data and analysis.

### *U.S. Bureau of Reclamation Alder Creek Water Quality Sampling*

A water quality study was undertaken by Reclamation in 2002 in response to concerns from the U.S. Geological Survey (USGS) regarding mercury contamination in Lake Natoma and its tributaries. In the report, Alder Pond was characterized as a still-water portion of Alder Creek with a history of water quality problems that have resulted in excessive growths of water hyacinth and algae, accompanied by high levels of biochemical oxygen demand and depressed levels of dissolved oxygen. Nutrient enrichment from the local watershed (i.e., area that includes the developed automall) was suspected as a contributor to this problem (LSA Associates 2003). Two sites were sampled for water quality. Two samples of water hyacinth were also taken and measured for mercury accumulation in the whole plant and in the roots only, where mercury tends to bioaccumulate.

No mercury was detected in the hyacinth samples. Nutrient testing of the two water samples, collected in January 2002, found total phosphorus levels of 0.036 milligrams per liter or parts per million (mg/L) and 0.053 mg/L. Reclamation considers "fair" protection from nuisance aquatic plant growth to range from 0.030 mg/L to 0.049 mg/L and "poor" protection to range from 0.050 mg/L to 0.149 mg/L. These samples had total nitrogen levels of 0.71 mg/L and 1.01 mg/L, which are also sufficiently high to encourage nuisance plant growth. The study concluded that the large population of water hyacinth in Alder Pond is not a natural occurrence but is induced by high nutrient loading (Aiken2002).

Both sampling sites contained concentrations of salts two to five times higher than would be expected in the American River, the receiving water of Alder Creek. Total dissolved solids, typically at concentrations of 20–50 mg/L in the American River, were 130 and 120 mg/L at the two sample sites (Aiken2002). These values are below the Title 22 Secondary Water Quality Objective (established for drinking water) of 150 mg/L.

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[1] Under Section 303(d) of the CWA, states are required to develop lists of water bodies that would not attain water quality objectives after implementation of required levels of treatment by point-source dischargers (municipalities and industries). Alder Creek is not on the 303(d) list, but the receiving water bodies for Alder Creek—Lake Natoma and lower American River—are listed. Section 303(d) requires that the state develop a total maximum daily load (TMDL) for each of the listed pollutants. The TMDL is the amount of loading that the water body can receive and still be in compliance with water quality objectives. The TMDL can also act as a plan to reduce loading of a specific pollutant from various sources to achieve compliance with water quality objectives. The TMDL prepared by the state must include an allocation of allowable loadings to point and nonpoint sources, with consideration of background loadings and a margin of safety. The TMDL must also include an analysis that shows links between loading reductions and the attainment of water quality objectives. The EPA must either approve a TMDL prepared by the state or, if it disapproves the state's TMDL, issue its own. NPDES permit limits for listed pollutants must be consistent with the waste load allocation prescribed in the TMDL. After implementation of the TMDL, it is anticipated that the problems that led to placement of a given pollutant on the Section 303(d) list would be remediated.

One fecal coliform sample was taken at Alder Pond on September 16, 2002. Results showed 4 MPN/100 mL (most probable number of colonies per 100 milliliters of water) (LSA Associates 2003), which is below the minimum level of 20 MPN/100 mL as defined in the Sacramento MS4 Permit described below.

### *USGS and UC Davis Fish Tissue Study in Alder Pond and Lake Natoma*

Gold-dredging operations were widespread in the American River watershed, and the middle reach portion of Alder Creek watershed contains exposed dredge tailings that dominate the topography of the area. The middle reach portion of Alder Creek bisects these deposits, allowing the flow to come into contact with sediments that may be contaminated with mercury and other metals. Operators of floating dredgers coated the sluices with mercury to amalgamate the gold particles, occasionally spilling the mercury into the surrounding environment.

| **LAKE NATOMA (including nearby creeks and ponds) AND THE LOWER AMERICAN RIVER*** FISH CONSUMPTION GUIDELINES | |
|---|---|
| **WOMEN OF CHILDBEARING AGE AND CHILDREN AGED 17 YEARS AND YOUNGER EAT NO MORE THAN:** | |
| **DO NOT EAT** | **CHANNEL CATFISH** |
| **ONCE A MONTH** | **White catfish; all bass; pikeminnow*; or* sucker *OR*** |
| **ONCE A WEEK** | **Bluegill; sunfish; or other sport fish species** |
| **WOMEN BEYOND CHILDBEARING AGE AND MEN EAT NO MORE THAN:** | |
| **ONCE A MONTH** | **Channel Catfish or all bass *OR*** |
| **ONCE A WEEK** | **White catfish; pikeminnow; or sucker *OR*** |
| **3 TIMES A WEEK** | **Bluegill; sunfish; or other sport fish species** |
| ***MANY OTHER WATER BODIES ARE KNOWN OR SUSPECTED TO HAVE ELEVATED MERCURY LEVELS.** If guidelines are not already in place for the water body where you fish, women of childbearing age and children aged 17 and younger should eat no more than one sport fish meal per week and women beyond childbearing age and men should eat no more than three sport fish meals per week **from any location.** **EAT SMALLER FISH OF LEGAL SIZE.** Fish accumulate mercury as they grow. **DO NOT COMBINE FISH CONSUMPTION ADVICE.** If you eat multiple species or catch fish from other water bodies, the recommended guidelines for different species and locations should not be combined. For example, if you eat a meal of fish from the one meal per month category, you should not eat another fish species containing mercury for at least one month. **SERVE SMALLER MEALS TO CHILDREN. MEAL SIZE IS ASSUMED TO BE EIGHT OUNCES FOR A 160-POUND ADULT.** If you weigh more or less than 160 pounds, add or subtract 1 oz to your meal size, respectively, for each 20 pound difference in body weight. | |

Source: Office of Environmental Health Hazard Assessment

Although not a direct water quality measurement study, USGS and the University of California at Davis conducted a reconnaissance survey of mercury contamination in edible fish tissue taken from several sites in Lake Natoma, including the vicinity of the mouth of Alder Creek. These data were evaluated by the Office of Environmental Health Hazard Assessment, together with fish samples previously collected from the lower American River by the Toxic Substances Monitoring Program and the Sacramento River Watershed Program, in an effort to determine whether there may be potential adverse health effects associated with consuming sport fish from these water bodies. One largemouth bass out of 23 sampled from Alder Pond exceeded the Federal Drug Administration action level of 1.0 µg Hg/g (microgram of mercury per gram). In addition, 11 largemouth bass exceeded the U.S. Environmental Protection Agency (EPA) fish tissue residue criterion of 0.30 µg Hg/g. The one spotted bass sample collected in Alder Creek exceeded the EPA mercury action level. Study results showed that elevated concentrations of mercury were found in fish tissues samples at levels high enough to warrant the publishing of a health advisory and fish consumption guidelines for Lake Natoma (including nearby creeks and ponds) and the lower American River (Saiki et al. 2004).

### *Sacramento Stormwater Quality Partnership Water Quality Sampling in Downstream Lake Natoma*

Sacramento County and the Cities of Folsom, Rancho Cordova, Citrus Heights, Elk Grove, Galt, and Sacramento are copermittees to the Sacramento Areawide National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit that applies to the Alder Creek watershed. First issued in 1990, the latest permit was adopted on September 11, 2008 (NPDES Permit No. CAS082597, WDR Order No. R5-2008-0142). The permittees formed the Sacramento Stormwater Quality Partnership (SSQP) to coordinate and implement permit compliance activities. A Stormwater Quality Improvement Plan (SQIP) developed for compliance with the NPDES permit is the guiding document for the permittees (SSQP 2009) and describes the activities that will be implemented to reduce pollutant discharges in urban runoff.

Water quality monitoring in the American River at Nimbus Dam is performed by the SSQP to comply with monitoring requirements specified in the Sacramento Areawide NPDES MS4 Permit. Monitoring activities required by the permit and conducted to date included urban runoff (discharge) characterization; receiving water monitoring; urban tributary (creek); bioassessment; and additional pesticide monitoring, including monitoring for Diazinon and Chlorpyrifos.

For the 2006/2007 monitoring years, the American River at Nimbus Dam station (a location below the confluence of Alder Creek that is influenced by other upstream sources) showed a low level of dissolved oxygen in the December 10, 2006, sampling event (6.3 milligrams per liter [mg/L], below the water quality objective of 7 mg/L for coldwater spawning) and a pH of 6.2, below the Basin Plan range of 6.5 to 7.5. No other exceedances of water quality objectives were reported (SSQP 2007a). For the 2007/2008 monitoring year, the American River at Nimbus Dam station showed exceedances for E. coli (800 mpn/100 ml, above objective of 235 mpn/ 100 ml), fecal coliform (800 mpn/100 ml, above objective of 400 mpn/ 100 ml), total aluminum (951 and 528 mg/L, above objective of 200 mg/L), and dissolved lead (815 mg/L, above objective of 300 mg/L). No other exceedances of water quality objectives were reported (SSQP 2008). For the 2008/2009 monitoring year, the latest year available, the American River at Nimbus Dam station showed a single exceedance for fecal coliform (500 mpn/100 ml, above objective of 400 mpn/ 100 ml). No other exceedances of water quality objectives were reported (SSQP 2009).

Information on groundwater quality throughout the watershed is generally not available and therefore is not discussed.

### *NPDES Municipal Stormwater Permit Program*

Sacramento County and the Cities of Folsom, Rancho Cordova, Citrus Heights, Elk Grove, Galt, and Sacramento, are co-permittees to the Sacramento Areawide NPDES MS4 Permit that applies to the Alder Creek watershed. First issued in 1990, the latest permit was adopted on September 11, 2008 (NPDES Permit No. CAS082597, WDR Order No. R5-2008-0142).

The Sacramento MS4 Permit requires the permittees to develop and implement a Storm Water Management Plan/Program (known locally as the Stormwater Quality Improvement Plan or SQIP) with the goal of reducing the discharge of pollutants in urban runoff to the maximum extent practicable (MEP). MEP is the performance standard specified in Section 402(p) of the Clean Water Act (CWA). The SQIP specifies what Best Management Practices (BMPs) will be used to address certain program areas (SSQP 2009). The program areas include public education and outreach; illicit discharge detection and elimination; construction; post-construction (new development); and municipal operations. The Sacramento MS4 Permit also requires monitoring (as described above) and implementation of control programs for selected constituents identified as target pollutants of concern: pesticides, mercury, copper, lead, and coliform/pathogens.

To address the MS4 permit requirements, the permittees formed the Sacramento Stormwater Quality Partnership (SSQP), described below, to coordinate and implement permit compliance activities. A Stormwater Quality

Improvement Plan (SQIP) developed by Sacramento County for compliance with the NPDES permit is the guiding document for the permittees (SSQP 2007b). The City and County of Sacramento published the "Guidance Manual for On-Site Stormwater Quality Control Measures" in January 2000 which contained stormwater quality design standards designed to comply with the permit requirements and was widely referenced by the SSQP. It was replaced with the "Stormwater Quality Design Manual for the Sacramento and South Placer Regions" (SQDM), which is the guiding technical design guideline document for the SSQP (SSQP 2007c).

An important component of the latest permit requires each permittee to update and continue to implement the planning and new development element of its SQIP to minimize the short and long-term impacts on receiving water quality from new development and redevelopment. The permit requires the continued implementation of the permittees' development standards during the entitlement and CEQA process and the development plan review process. Specifically, the permit identifies the need to address changes in the hydrograph, defined as hydrograph modification or hydromodification, which could result from urbanization of a watershed. To address hydromodification, this permit requires the permittees revise their development standards and associated technical guidance (aka. Stormwater Quality Design Manual) and submit a Hydromodification Management Plan (HMP).

### *Sacramento Stormwater Quality Partnership*

The permittees of the NPDES Municipal Stormwater Permit described above, i.e. the Sacramento County and the Cities of Sacramento, Citrus Heights, Elk Grove, Folsom, Galt, and Rancho Cordova, have joined together to form SSQP (SSQP 2007a). The goals of the SSQP are to:

- improve the quality of urban runoff;
- increase public awareness about water quality and encourage pollution prevention behavior;
- strive for countywide consistency between permittee agency programs;
- improve internal communication and coordination to facilitate agencywide compliance;
- use public funds efficiently and effectively; and
- keep apprised of new and evolving regulations that may affect the Program in the future.

The permittees cooperatively participate in decision-making and goal-setting for the monitoring program, are involved in consultant selection and review, and comment on compliance reports and other work products. Annual Reports are produced that describe the activities conducted to comply with the NPDES permit.

The stormwater pollution prevention efforts needed to satisfy the NPDES permit requirements are implemented by the SSQP through its SQIP, either jointly or by the individual permittees. The major categories of SQIP activities, conducted jointly by the SSQP, are:

- program management – including legal authority and funding, inter- and intra-agency coordination, effectiveness assessment;
- target pollutant program;
- monitoring program to satisfy monitoring requirements specified in the monitoring and reporting program (MRP) portion of the NPDES permit;
- special studies; and
- regional public outreach.

Additionally, the permittees may share resources related to selected program element activities, such as commercial and/or industrial inspections. Program activities implemented by individual permittees (e.g., the City of Folsom) primarily involve activities related to program management (e.g., legal authority, funding, regulatory liaison, compliance reporting, training and coordination within and outside of the organization), construction, commercial/industrial inspections, municipal operations, illicit discharges, public outreach, and new development.

There are no proposed monitoring sites in the Alder Creek watershed through 2013 under the MPR portion of the NPDES permit. However, the receiving water monitoring component of the MRP includes urban tributary monitoring stations at three stations – Arcade Creek, Willow Creek, and Laguna Creek. The Laguna Creek monitoring location was chosen in part because of rapid development of the watershed, and the potential to characterize changes caused by development in the Sacramento urban area, similar to development planned under the Folsom South of Highway 50 Specific Plan Project that encompasses a large portion of the watershed.

## 3.2 NEW DATA COLLECTION

As described previously, new data were collected at three sites for stream aquatic invertebrates (i.e., bioassessments) and associated stream physical and habitat parameters. Riparian species composition and cover also were measured at each bioassessment site. These data are summarized below.

### 3.2.1 BIOASSESSMENT

#### PHYSICAL HABITAT ASSESSMENT

Photo documentation of the study sites is presented in Exhibits 7a through 9b. Several trends in the habitat conditions were recorded during the physical habitat assessment of the study sites (see Tables 6 and 7 and Exhibits 10-19). The Alder Creek sites ranked from optimal to suboptimal to marginal for physical habitat quality in the reachwide scoring component of the physical habitat assessment. Each of the physical habitat scores was highest for cover and lowest for channel alteration.

**Table 6**
**Physical Habitat Characteristics of the Alder Creek Watershed (Reachwide Scores)**

| Physical Habitat Parameters | Sampling Sites | | |
|---|---|---|---|
| | AC-1 | AC-2 | AC-3 |
| Epifaunal Substrate/Cover | 17 (optimal) | 15 (suboptimal) | 13 (suboptimal) |
| Sediment Deposition | 16 (optimal) | 17 (optimal) | 12 (suboptimal) |
| Channel Alteration | 15 (suboptimal) | 12 (suboptimal) | 10 (marginal) |
| **Total Habitat Score** | **48** | **44** | **35** |

**Table 7**
**Physical Habitat Characteristics of the Alder Creek Watershed**

| Physical Habitat Parameters | Sampling Sites | | |
|---|---|---|---|
| | AC-1 | AC-2 | AC-3 |
| **Channel Dimensions** | | | |
| Wetted Width (m) | 6.11 | 5.02 | 6.92 |
| Bankfull Width (m) | 8.28 | 11.46 | 8.77 |
| Depth (cm) | 10.8 | 7.7 | 53.4 |
| Mean for all 11 transects | | | |

**Table 7**
**Physical Habitat Characteristics of the Alder Creek Watershed**

| Physical Habitat Parameters | Sampling Sites | | |
|---|---|---|---|
| | AC-1 | AC-2 | AC-3 |
| **Substrate Size Class (% of reach)** | | | |
| Bedrock Smooth (>Car) | 0 | 0 | 0 |
| Bedrock Rough (> Car) | 0 | 0 | 0 |
| Concrete/Asphalt | 0 | 0 | 0 |
| Large Boulder (1–4 m) | 0 | 0 | 0 |
| Small Boulder (0.25 m–1 m) | 0 | 0 | 0 |
| Cobble (64–250 mm) | 0 | 16 | 0 |
| Coarse Gravel (16–64 mm) | 13 | 45 | 9 |
| Fine Gravel (2–16 mm) | 24 | 24 | 2 |
| Sand (0.25–2 mm) | 20 | 11 | 0 |
| Fines (<0.25 mm) | 44 | 4 | 89 |
| Hardpan (Consol. Fines) | 0 | 0 | 0 |
| Wood | 0 | 0 | 0 |
| Other | 0 | 0 | 0 |
| Bedrock Smooth (>Car) | 0 | 0 | 0 |
| Bedrock Rough (> Car) | 0 | 0 | 0 |
| Concrete/Asphalt | 0 | 0 | 0 |
| Mean for all 11 transects | | | |
| **Embeddedness (% substrate class ≥ gravel)** | 15.35 | 19.19 | 58.33 |
| Mean for all 11 transects | | | |
| **Bank Stability (percent of reach)** | | | |
| Eroded | 0 | 27 | 14 |
| Vulnerable | 23 | 32 | 45 |
| Stable | 77 | 41 | 41 |
| Average between transects for both banks (right and left) | | | |
| **Human Influence (% of reach)** | | | |
| Walls/Riprap/Dams | 18 | - | 9 |
| Buildings | - | - | 9 |
| Pavement/Cleared Lot | - | 18 | - |
| Road/Railroad | 36 | 18 | - |
| Mining Activity | -- | - | 9 |
| Average between transects | | | |

**Table 7**
**Physical Habitat Characteristics of the Alder Creek Watershed**

| Physical Habitat Parameters | Sampling Sites | | |
|---|---|---|---|
| | AC-1 | AC-2 | AC-3 |
| **Riparian Vegetation** | | | |
| Upper Canopy (>5 m high) | 3.23 | 1.43 | 2.23 |
| Lower Canopy (<5 m high) | 1.77 | 1.71 | 1.82 |
| Ground Cover—Shrubs, Grasses | 1.41 | 1.59 | 1.45 |
| Ground Cover—Bare Soil | 1.50 | 1.50 | 1.55 |
| Mean for all 11 transects<br>0 = Absent (0%), 1 = Sparse (<10%), 2 = Moderate (10-40%), 3 = Heavy (40-75%), 4 = Very Heavy (>75%) | | | |
| **Instream Habitat Complexity** | | | |
| Filamentous Algae | 0.91 | 1.73 | 1.36 |
| Aquatic Macrophytes | 0.18 | 1.18 | 2.73 |
| Boulders | 1.27 | 0.55 | 0.09 |
| Large Woody Debris | 0.73 | 0.09 | 0.00 |
| Small Woody Debris | 1.36 | 0.45 | 0.00 |
| Undercut Banks | 0.45 | 0.00 | 0.36 |
| Overhanging Vegetation | 1.27 | 2.36 | 0.91 |
| Live Tree Roots | 1.91 | 1.36 | 0.18 |
| Artificial Structures | 0.18 | 0.00 | 0.00 |
| Mean for all 11 transects<br>0 = Absent (0%), 1 = Sparse (<10%), 2 = Moderate (10-40%), 3 = Heavy (40-75%), 4 = Very Heavy (>75%) | | | |
| **Canopy Cover (% based on densitometer)** | 86% | 67% | 43% |
| Mean for all readings | | | |
| **Flow Habitats (% of reach)** | | | |
| Riffle | 22 | 19 | 1 |
| Rapid | 0 | 0 | 1 |
| Run | 9 | 24 | 29 |
| Glide | 53 | 54 | 28 |
| Pool | 16 | 1 | 40* |
| Cascade/ Fall | 0 | 2 | 1 |
| Dry | 0 | 0 | 0 |
| Note: Mean for all transects<br>*Majority of pool was a large wetland/marsh complex | | | |

Alder Creek: AC-1, Transect A (upstream)

Alder Creek: AC-1, Transect F (upstream)

**Photo Documentation of Alder Creek (Reach AC-1)** **Exhibit 7a**

Alder Creek: AC-1, Transect F (downstream)

Alder Creek: AC-1, Transect K (downstream)

**Photo Documentation of Alder Creek (Reach AC-1)** **Exhibit 7b**

Alder Creek: AC-2, Transect A (upstream)

Alder Creek: AC-2, Transect F (upstream)

**Photo Documentation of Alder Creek (Reach AC-2)** **Exhibit 8a**

Alder Creek: AC-2, Transect F (downstream)

Alder Creek: AC-2, Transect K (downstream)

**Photo Documentation of Alder Creek (Reach AC-2)** **Exhibit 8b**

Alder Creek: AC-3, Transect A (upstream)

Alder Creek: AC-3, Transect F (upstream)

**Photo Documentation of Alder Creek (Reach AC-3)** **Exhibit 9a**

Alder Creek: AC-3, Transect F (downstream)

Alder Creek: AC-3, Transect K (downstream)

**Photo Documentation of Alder Creek (Reach AC-3)** **Exhibit 9b**

Transect and intertransect measures of physical habitat parameters indicated that the three reaches surveyed in the watershed can be characterized by generally having riparian canopy cover and low to moderate gradient. Substrate class sizes recorded for each of the sites varied by specific location within the reach (see Exhibit 12), with smaller gravels and fines being dominant in pools and cobble and gravel being dominant in riffles and runs. Overall, the AC-3 site exhibited relatively more fines compared to sites AC-1 and AC-2. Embeddedness was recorded for all substrates in the fine gravel class or larger. Embeddedness was generally low for sites AC-1 and AC-2 and greater for site AC-3 (see Exhibit 13). This observation is consistent with AC-3 substrates having a larger portion of fines compared to the other two sites.

Human influence was consistently absent from the AC-1 and AC-2 sample sites, with the exception that roads and remnants of legacy mining activity were present (see Exhibit 14). Site AC-3 exhibited a variety of human influences with buildings, pavement/cleared lot, and walls all documented as being present. It is also very likely that human activities (small scale gold mining operation) resulted in both the creation of a side channel approximately eleven meters in length and a large wetland complex (mentioned above) that begins near the midway point of the reach and extends to the top-end of the reach. Banks were generally stable at all three of the sites; however, AC-3 was less stable than the other two sites (see Exhibit 15). This can likely be attributed to the human influences on this reach of stream.

The dominant form of instream habitat complexity at site AC-1 was live tree roots with some woody debris. AC-3 was dominated by overhanging vegetation, along with aquatic macrophytes dominating the wetland complex area on the upper half of the reach (see Exhibit 17).

AC-2 habitat complexity is dominated by overhanging vegetation, along with some documented filamentous algae. The overhanging vegetation can be attributed to the generally extensive growth of riparian species within the creek corridor.

Flow habitats at all of the sites consisted of a diverse complex of riffles, runs, glides, and pools (see Exhibit 19). The large wetland complex on AC-3 functions similar to a pool and has extensive cover in the form of cattails and bulrush growing within channel.

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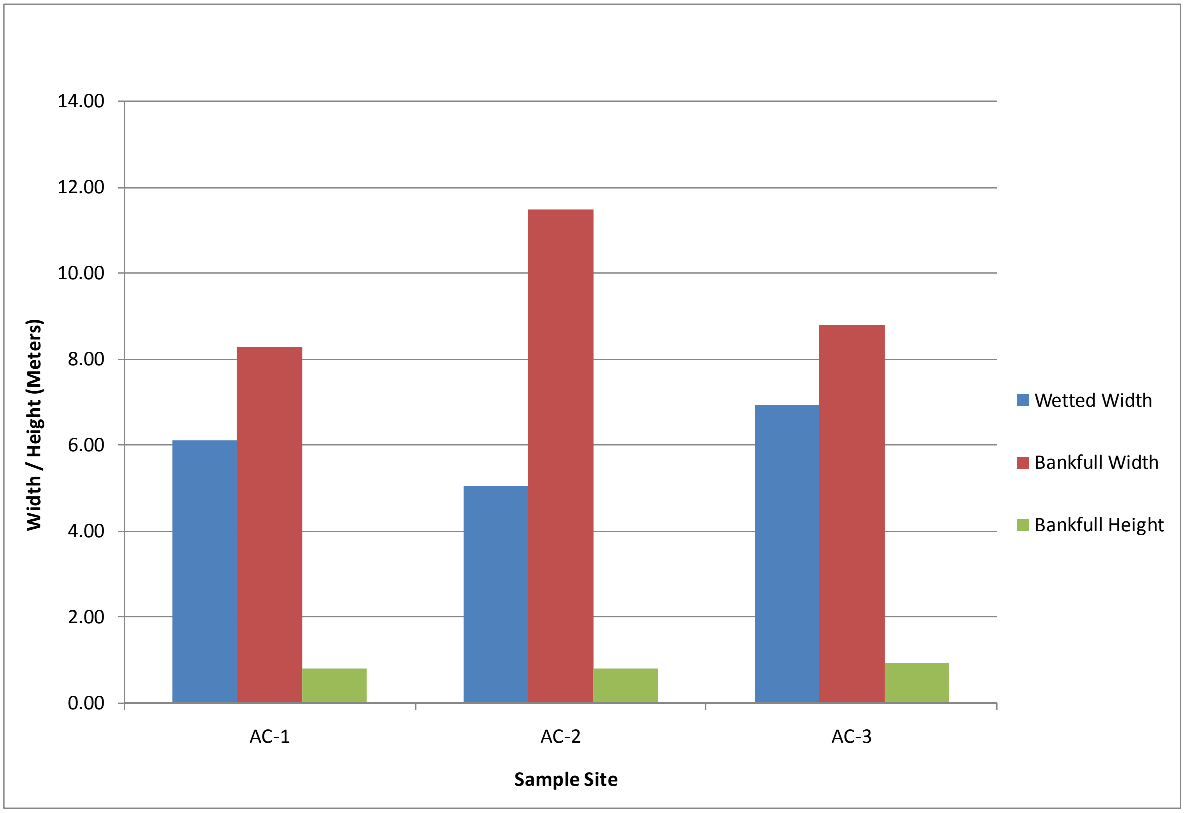
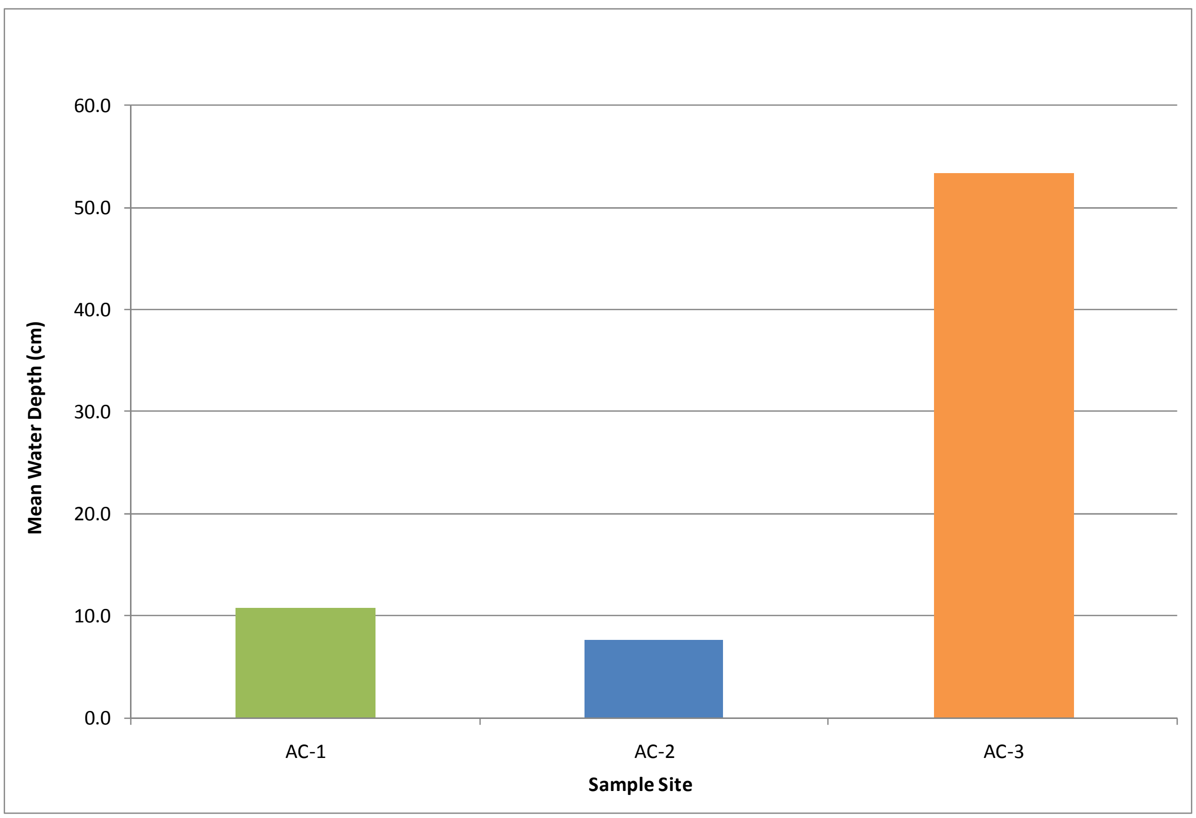
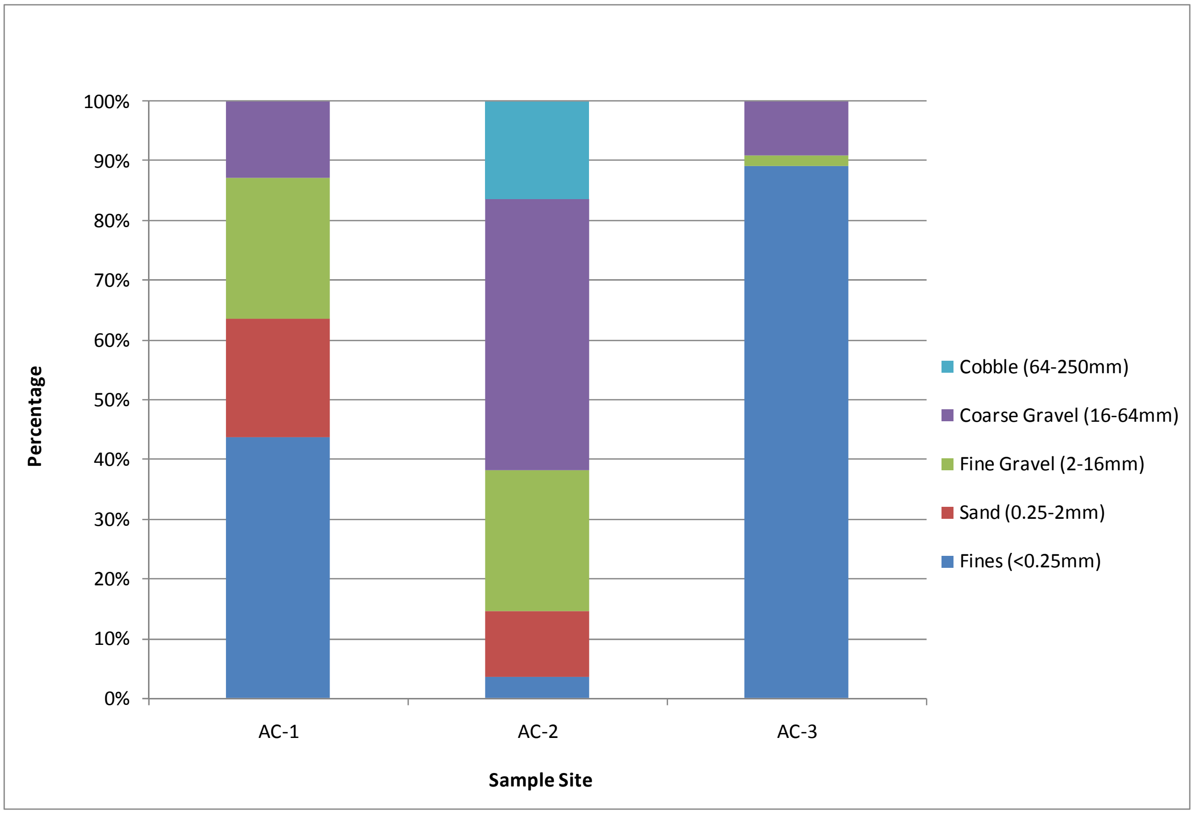


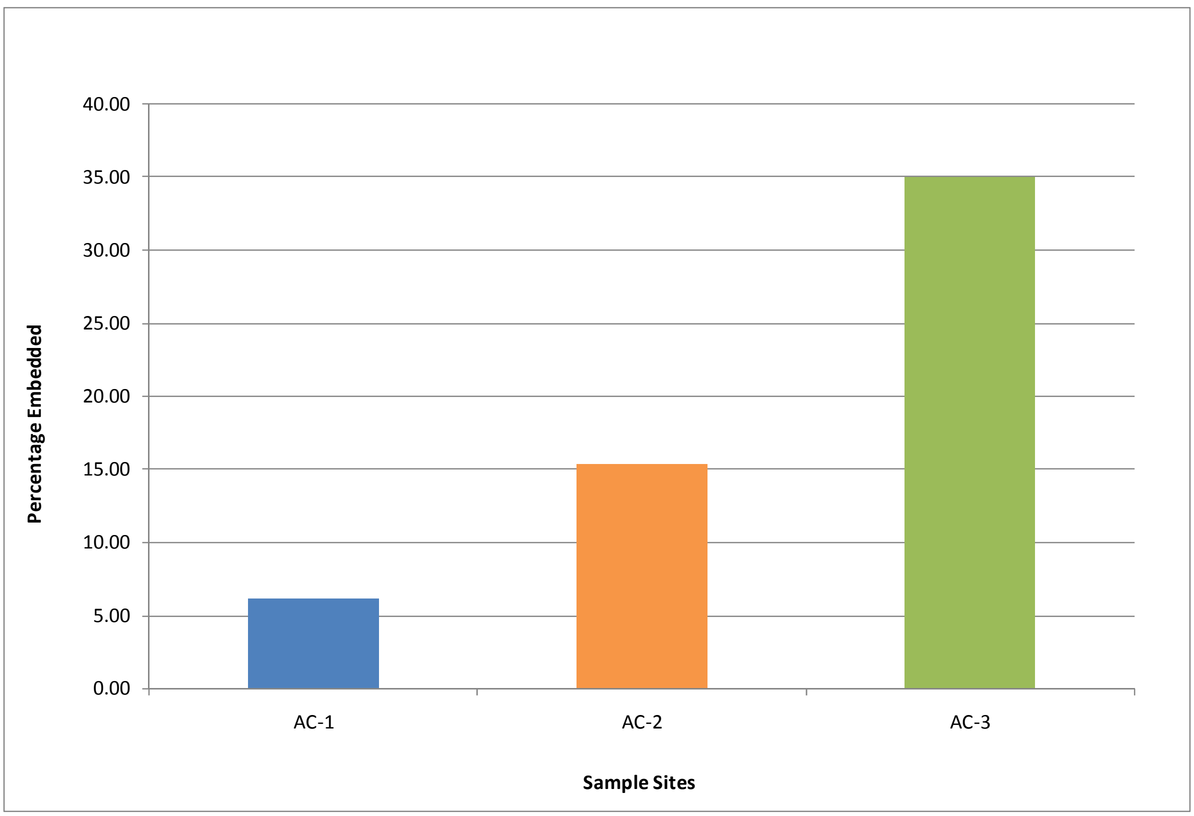

**Mean Channel Dimensions by Reach** **Exhibit 10**



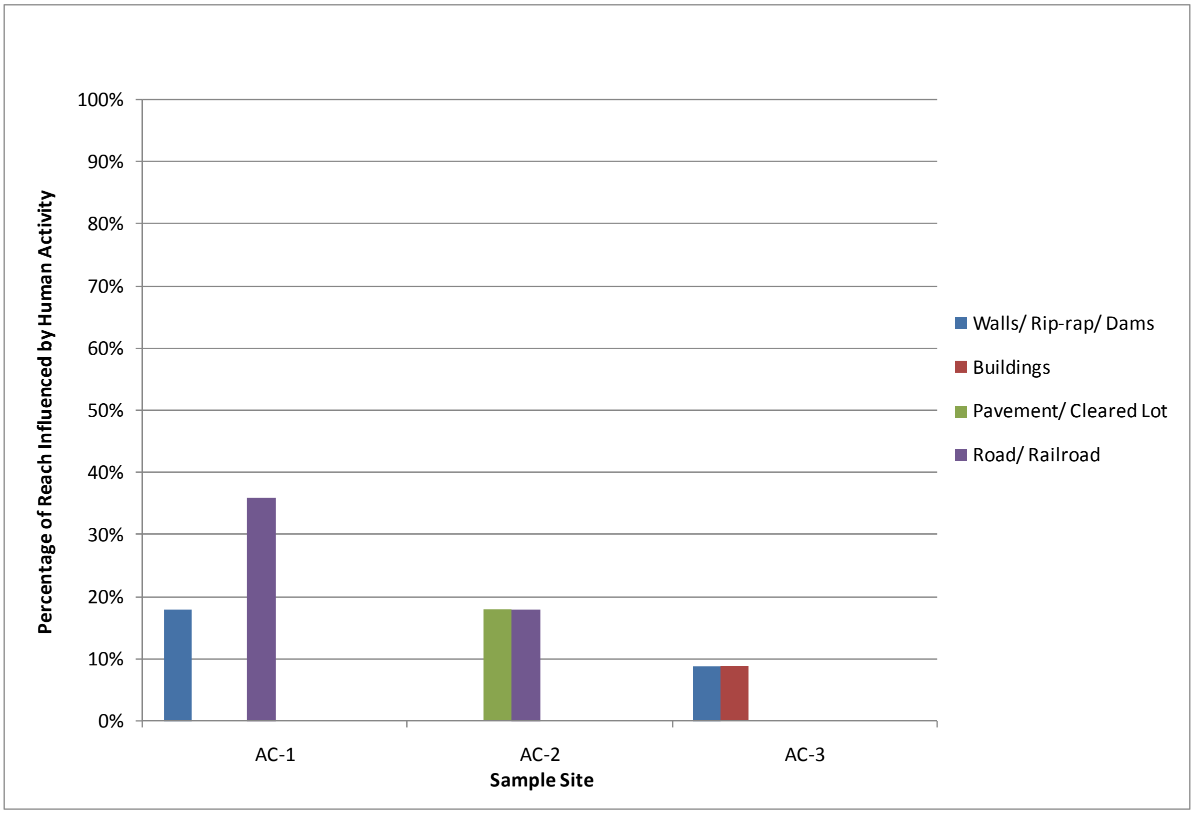

**Mean Water Depth by Reach** **Exhibit 11**



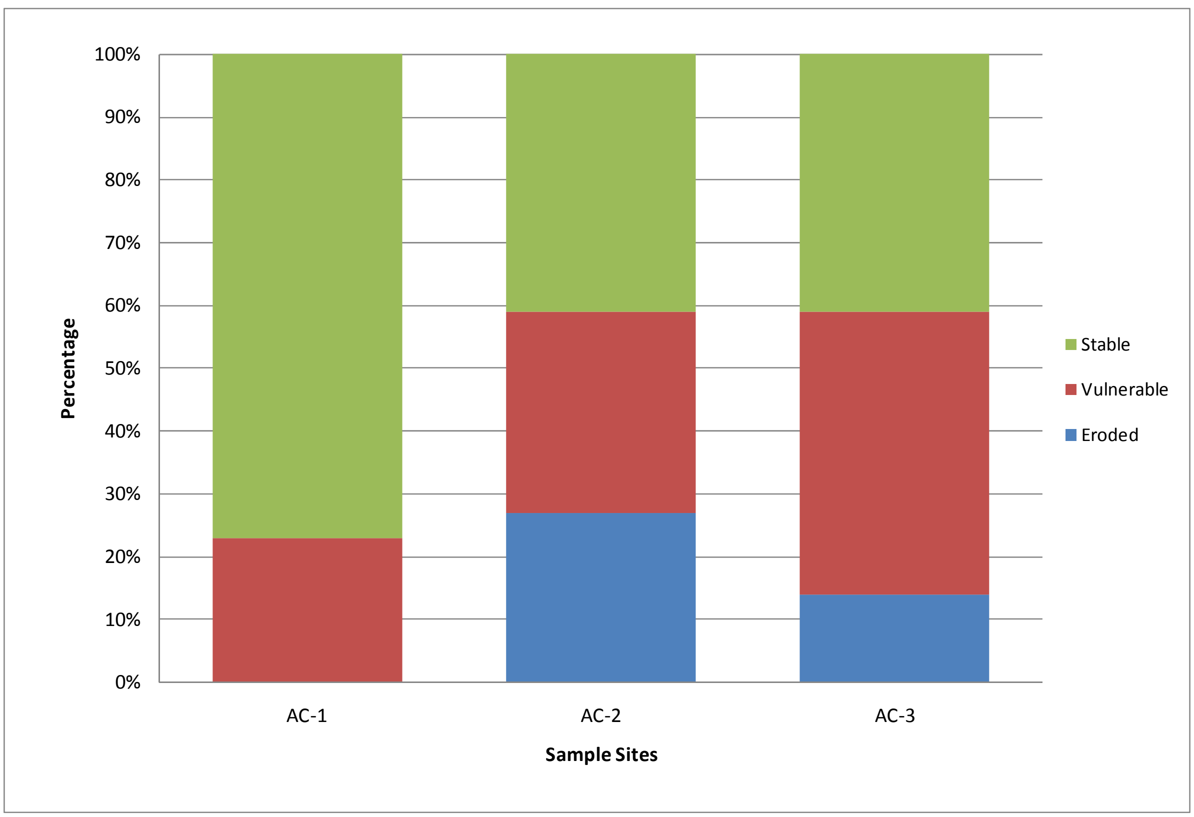

**Substrate Size Class Abundance by Reach** **Exhibit 12**



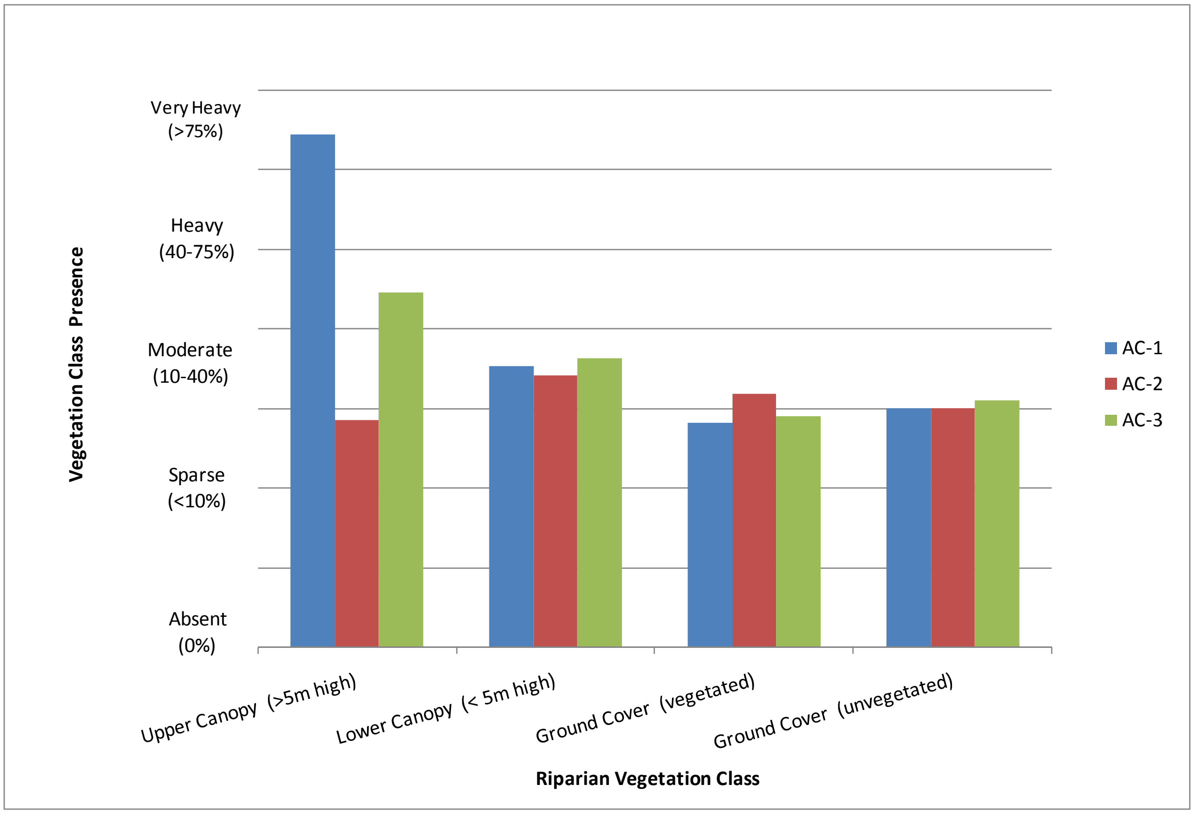

**Cobble Embeddedness by Reach** **Exhibit 13**



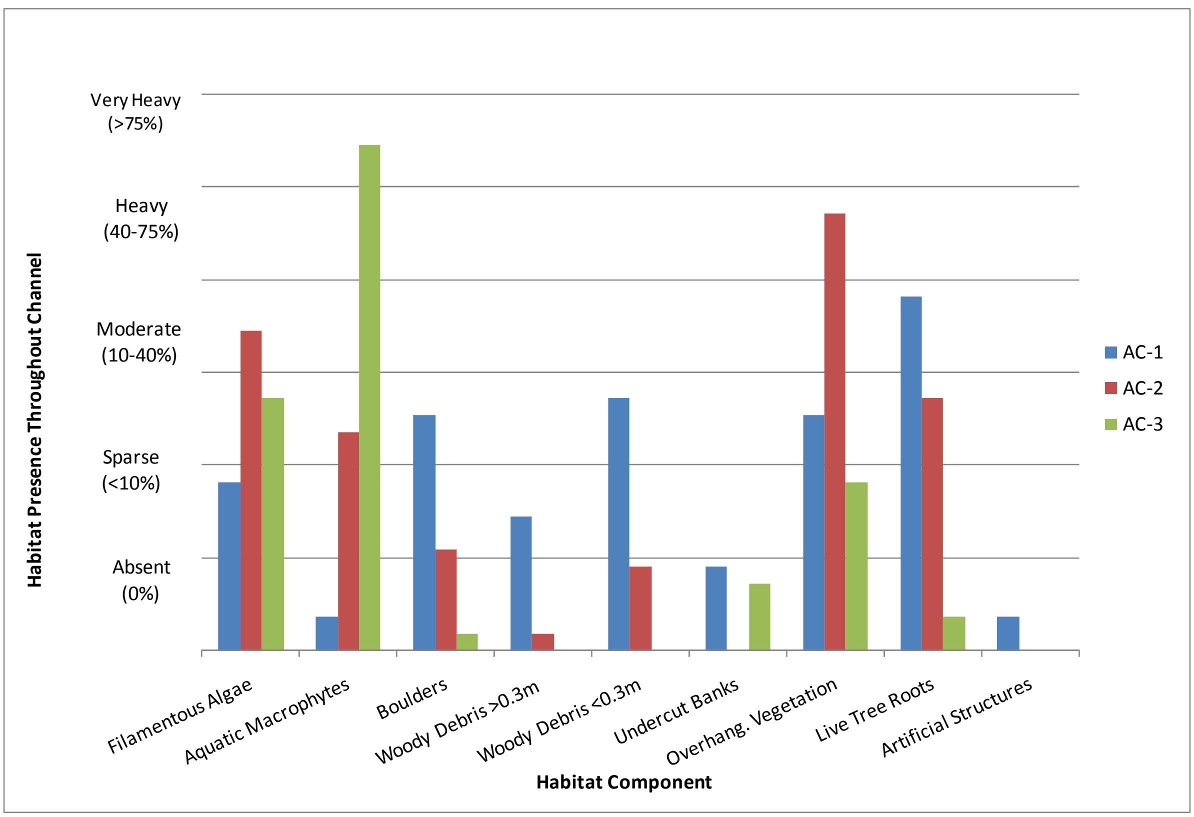

**Human Influence by Reach** **Exhibit 14**



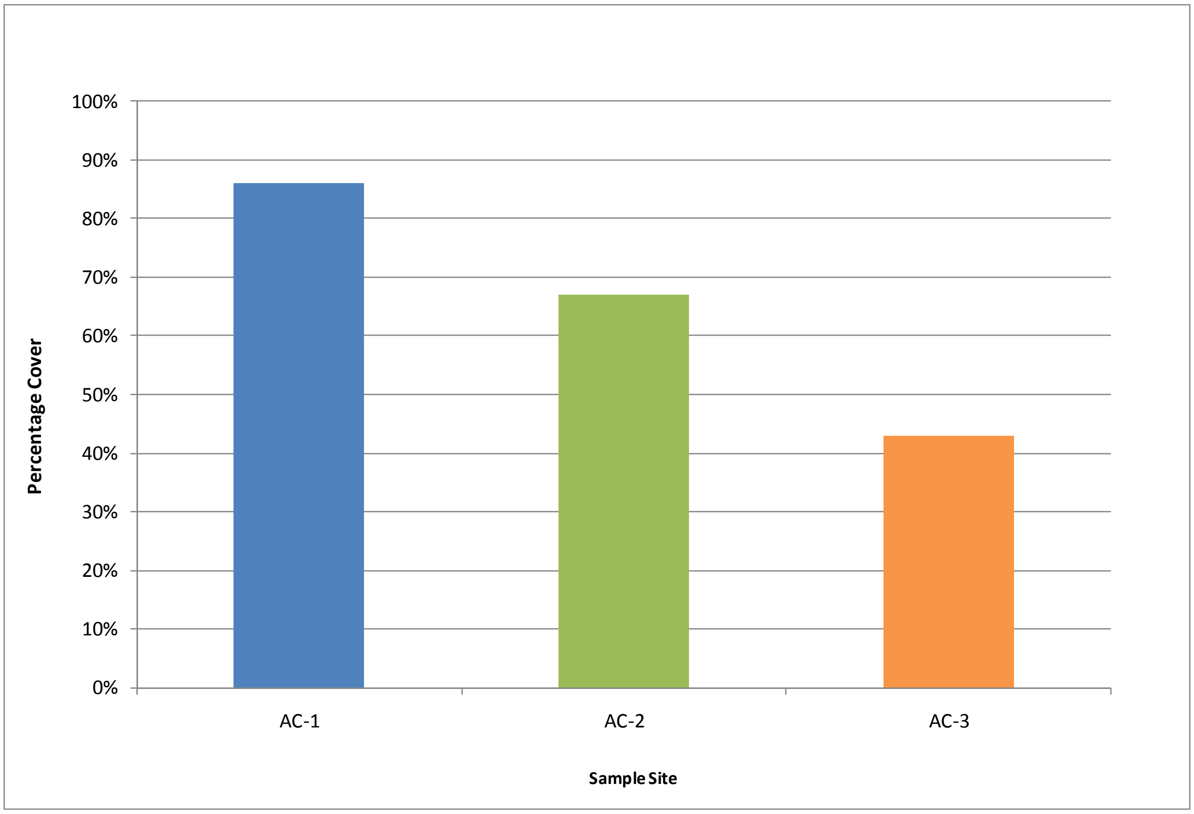

**Bank Stability by Reach** **Exhibit 15**



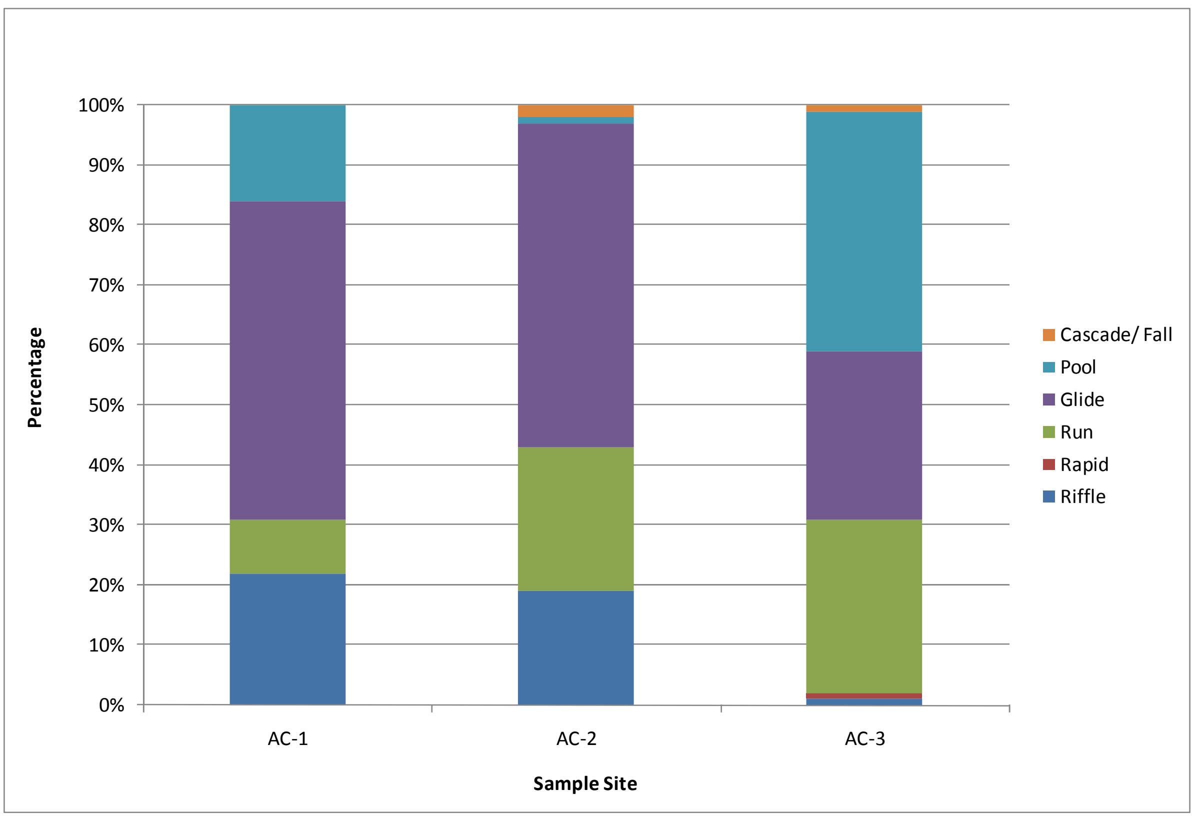

**Riparian Vegetation Class by Reach** **Exhibit 16**




**Instream Habitat Complexity by Reach** **Exhibit 17**




**Riparian Canopy Cover by Reach** **Exhibit 18**




**Flow Habitats by Reach** **Exhibit 19**

### Water Quality Assessment

Results of field water quality measurements are presented in Table 8. Temperatures were similar at all of the Alder Creek sites (range from 19.0 to 17.4 degrees Celsius [$^oC$]) and slightly cooler during the 2008 sampling (Table 8). DO was measured to be consistently relatively high at all of the sites and ranged for 7.07 to 7.55 milligrams per liter (mg/L). This component in water is critical to the survival of various aquatic life and the presence of relatively high levels of oxygen in water is a positive sign for the quality of water within Alder Creek.

**Table 8**
**Water Quality Characteristics for Alder Creek Watershed**

| Water Quality Parameters | Sample Sites | | | | |
|---|---|---|---|---|---|
| | AC-1 | | AC-2 | | AC-3 |
| | 5/10/07 | 5/30/08 | 5/11/07 | 5/30/08 | 5/30/08 |
| Temperature ($^oC$) | 19.0 | 17.4 | 19.0 | 18.8 | 18.3 |
| Dissolved oxygen (mg/l) | 7.07 | 7.24 | 7.55 | 7.27 | 7.5 |
| pH (standard pH units) | 7.81 | 8.1 | 7.64 | 7.92 | 7.97 |
| Electrical conductivity (µs) | 261 | 284 | 270 | 297 | 239 |
| Salinity (ppm) | 131 | 142 | 135 | 149 | 136 |
| Alkalinity (mg/l as $CaCO_3$) | 110 | 125 | 122 | 140 | 100 |

Notes: mg/l = milligrams per liter, mg/l as $CaCO_3$ = milligrams per liter as calcium carbonate. ppm = parts per million, $^oC$ = degrees Celsius, µs = microsiemens.
Source: Data collected by EDAW in 2008

The pH was measured to be near basic at all of the sites, ranging from 7.64 to 8.1 (standard pH units). This is a measure of the concentration of hydrogen ions in the water. This measurement indicates the acidity or alkalinity of the water. The acceptable range for pH is 6 to 9. A pH of 7 is neutral, and a pH of 7-8 is best for most fish. Fish cannot survive at a pH lower than 3.5 or higher than 9.5. Some fish, like trout are more sensitive than others.

Electrical conductivity, salinity, and alkalinity were also similar between the sites and sample years and were all within a normal range. Electrical conductivity is an indirect measure of the presence of inorganic dissolved solids, such as nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron. These substances conduct electricity because they are negatively or positively charged when dissolved in water. The concentration of dissolved solids, or the conductivity, is affected by the bedrock and soil in the watershed. It is also affected by human influences. Because Alder Creek is within a range that is considered normal for all chemical components of this assessment, it is likely that water quality is not impairing biological function of organisms within the creek.

### Benthic Macroinvertebrate Biological Metrics

Results of the biological metrics for BMIs collected in the Alder Creek watershed are provided in Table 9 and in Exhibits 20–26. A description of each of the metrics is provided above and is summarized again below along with a discussion of the results. The BMI taxa list is provided in Appendix C.

**Table 9**
**Biological Metrics for BMIs Collected in the Alder Creek Watershed**

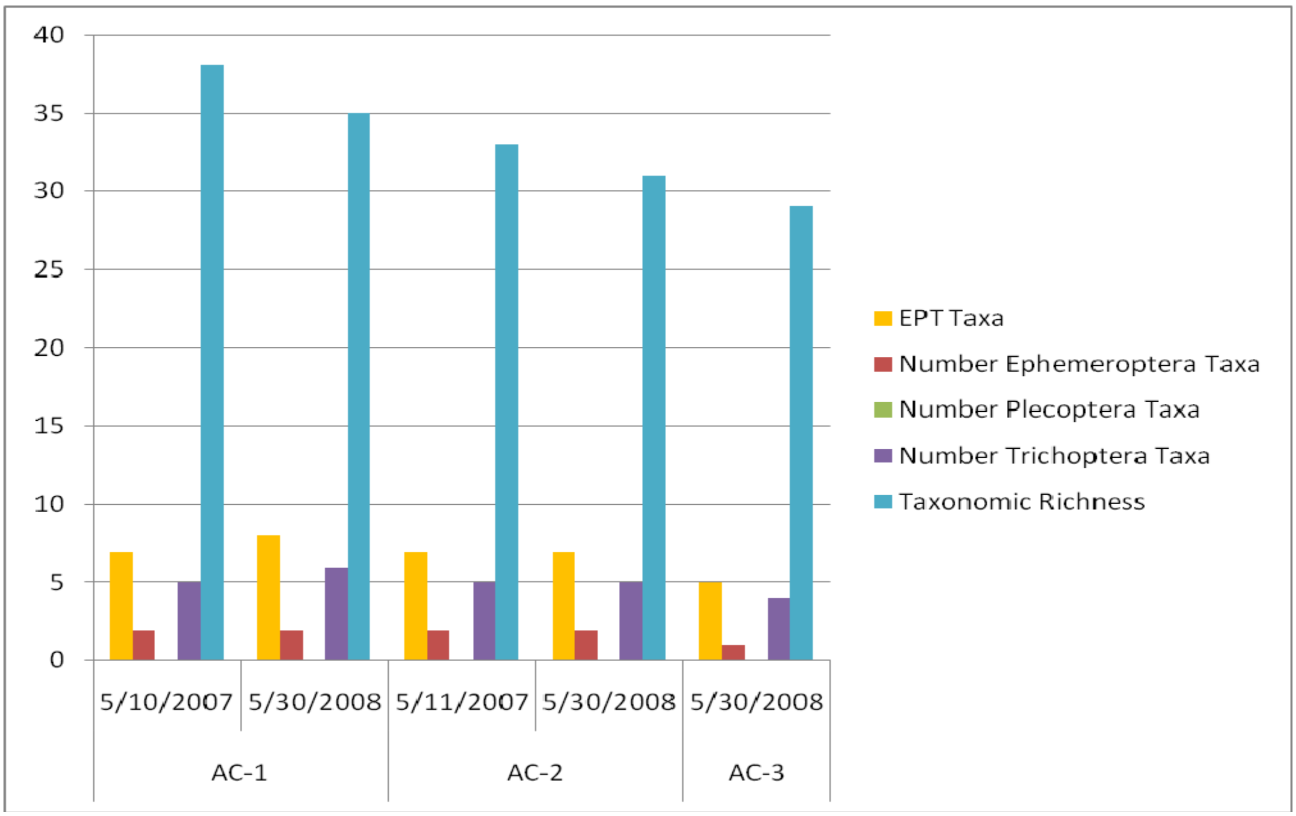
| Biological Metric | Sample Sites | | | | |
|---|---|---|---|---|---|
| | AC-1 | | AC-2 | | AC-3 |
| | 5/10/07 | 05/30/08 | 5/11/07 | 5/30/08 | 5/30/08 |
| **Richness Measures** | | | | | |
| Taxa richness | 38 | 35 | 33 | 31 | 29 |
| EPT taxa | 7 | 8 | 7 | 7 | 5 |
| **Composition Measures** | | | | | |
| EPT index | 31 | 19 | 41 | 20 | 9 |
| Sensitive EPT index | 1 | 7 | 1 | 1 | 0 |
| Percent Hydropsychidae | 10 | 4 | 10 | 11 | 1 |
| Percent Baetidae | 17 | 6 | 12 | 4 | 2 |
| **Tolerance/ Intolerance Measures** | | | | | |
| Tolerance value | 5.39 | 5.44 | 5.52 | 6.05 | 6.42 |
| Percent intolerant organisms | 4 | 1 | 0 | 1 | 0 |
| Percent tolerant organisms | 14 | 4 | 6 | 22 | 21 |
| Percent dominant taxa | 16.5 | 14.7 | 27.5 | 36.9 | 36 |
| **Trophic Measures** | | | | | |
| Percent collectors-filterers | 25 | 49 | 41 | 50 | 9 |
| Percent collector-gatherers | 62 | 39 | 32 | 31 | 68 |
| Percent scrapers | 4 | 2 | 2 | 7 | 9 |
| Percent predators | 4 | 4 | 4 | 3 | 4 |
| Percent shredders | 0 | 0 | 0 | 0 | 1 |

Source: Data collected by AECOM in 2007, 2008

### *Richness Measures*

Richness measures include taxa richness and EPT taxa. Taxa richness showed a general trend decreasing from the lower sample site (AC-1) to the upper sample site (AC-3) (see Exhibit 20).

As discussed above, richness measures reflect the diversity of the aquatic assemblage where increasing diversity correlates with increasing health of the assemblage and suggests that niche space, habitat, and food sources are adequate to support survival and propagation of particular species. The decrease in richness values (i.e., limited ability to support sensitive EPT species) between the lower segment of the creek and the upper segment of the creek could be a product of a smaller stream size and reduced complexity and/or increased influence/disturbance resulting from the urbanized northern upper watershed.

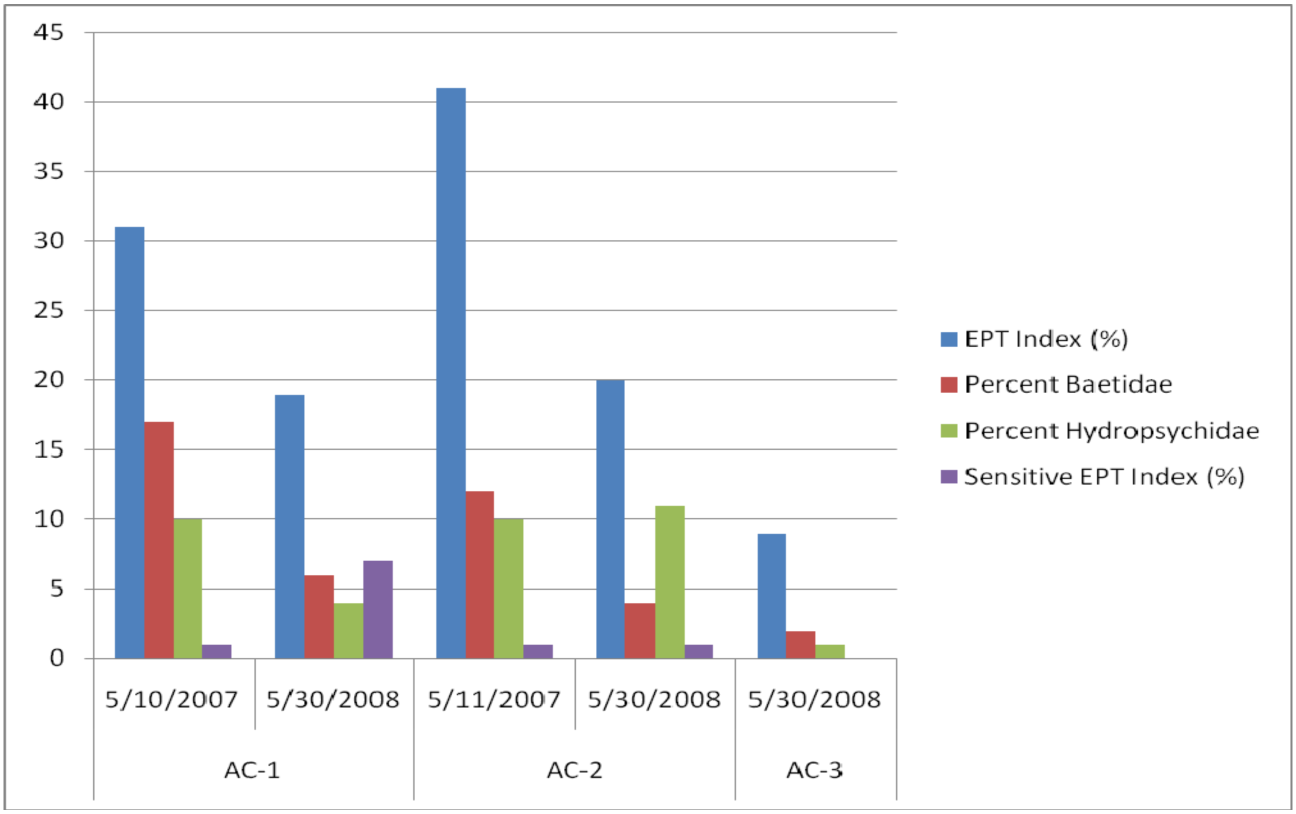



**BMI Richness Measures by Reach** **Exhibit 20**

### *Composition Measures*

Composition measures include EPT index, sensitive EPT index, percent Hydropsychidae, and percent Baetidae (see Exhibit 21). Sample site AC-1 had the highest sensitive EPT index value, and Site AC-2 had the highest EPT index value. The AC-3 site sample did not produce a value for sensitive EPT index because no sensitive EPT taxa were sampled.

Composition measures reflect the relative contribution of the population of individual taxa to the total fauna. Choice of a relevant taxon is based on knowledge of the individual taxa and their associated ecological patterns and environmental requirements, such as those that are environmentally sensitive or a nuisance species. Percent Hydropsychidae and Baetidae (two tolerant families) are regional metrics that have evolved to be particularly useful in California streams. The metric values usually increase as the effects of pollution in the form of fine particulate organic matter and sedimentation increase.

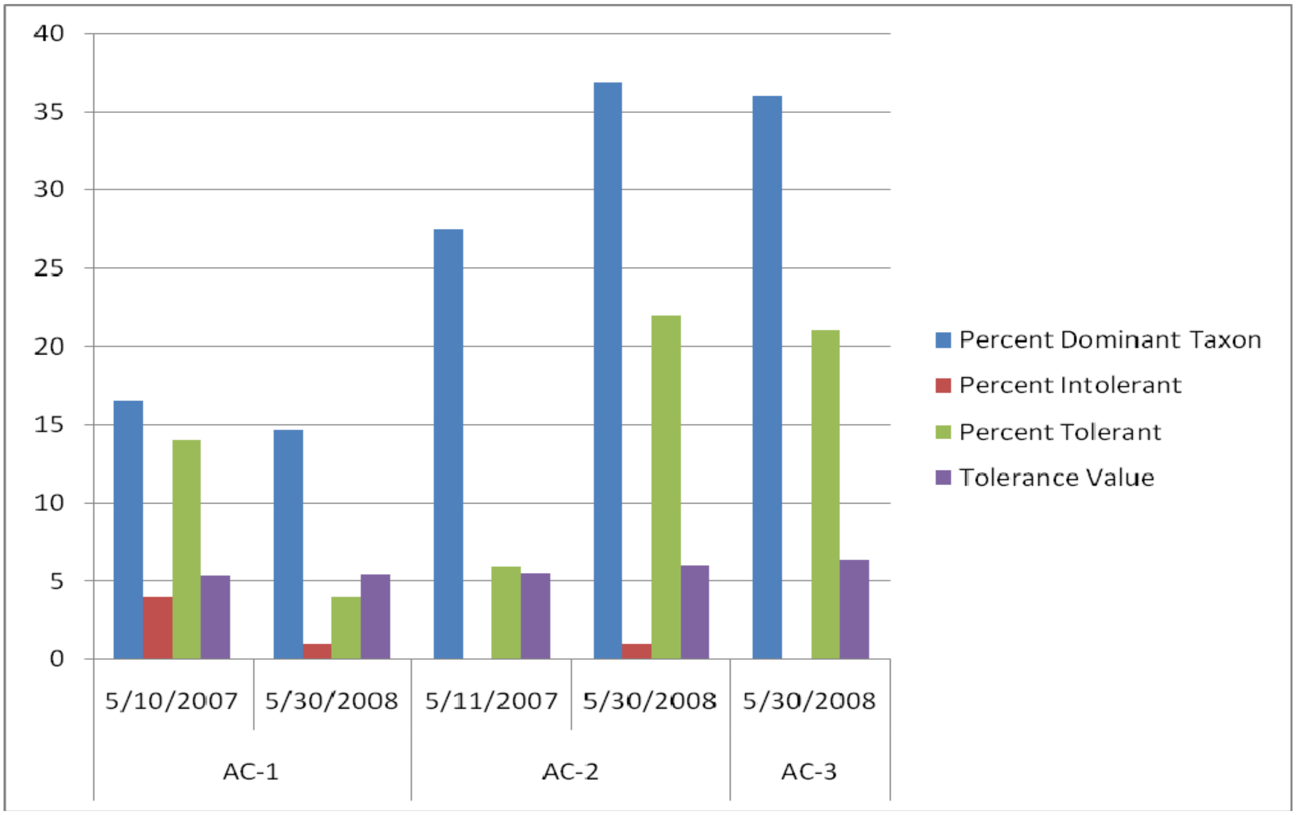



**BMI Composition Measures by Reach** **Exhibit 21**

### ***Tolerance/Intolerance Measures***

Tolerance/intolerance measures include tolerance value, percent intolerant organisms, percent tolerant organisms, and percent dominant taxa (see Exhibit 22). Only sample site AC-3 had no intolerant (i.e., sensitive) organisms combined with a relatively high percent of tolerant organisms. The site AC-1 sample recorded the highest number of intolerant organisms.

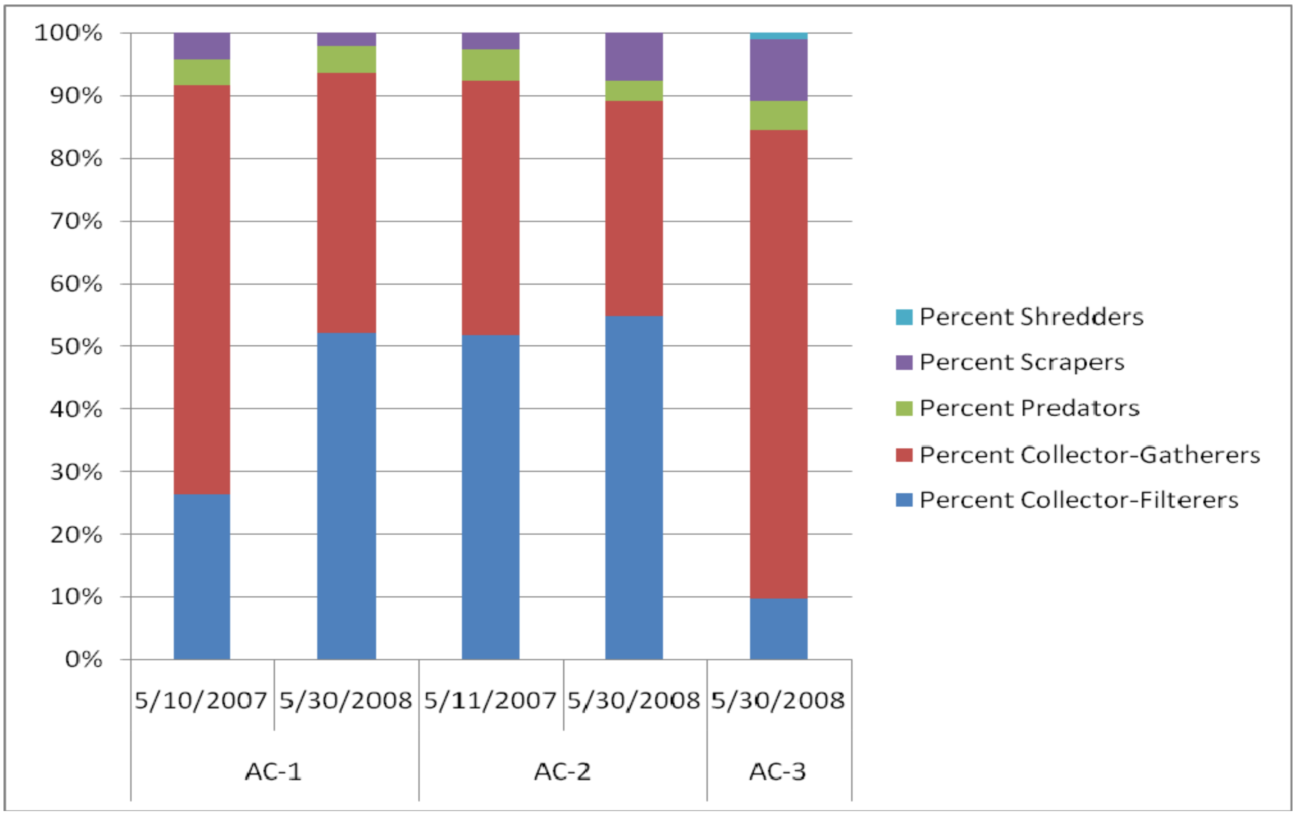
Tolerance/intolerance measures reflect the relative sensitivity of the community to aquatic disturbances. The taxa used are usually pollution tolerant and intolerant but are generally nonspecific to the type of pollution or stressors. The lack of sensitive taxa in the site AC-3 sample indicates disturbance to the streams to such a degree that sensitive taxa are not able to survive.




**BMI Tolerance/Intolerance Measures by Reach** **Exhibit 22**

### *Trophic Measures*

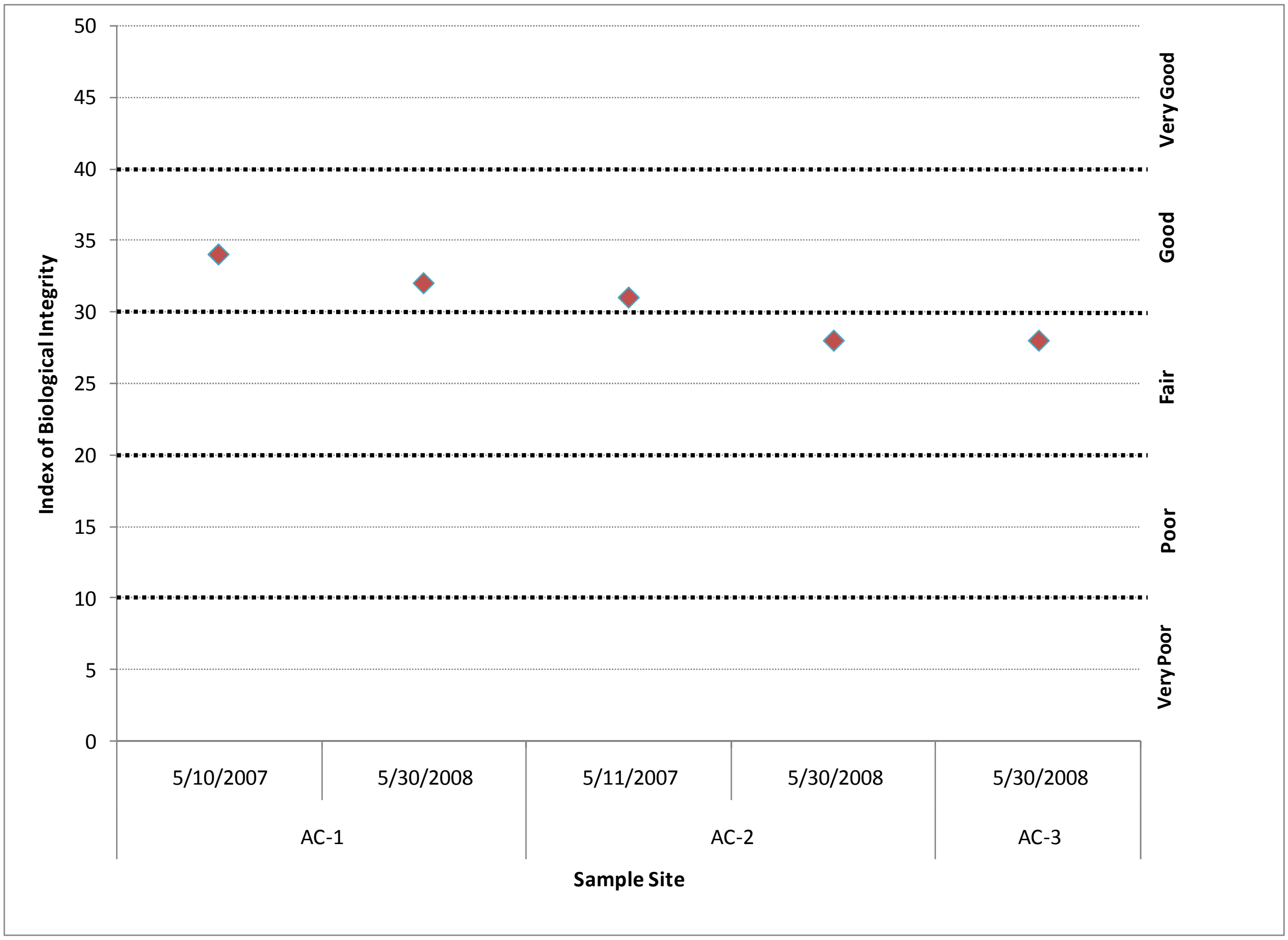
Trophic measures include percent collectors-filterers, percent collectors-gatherers, percent scrapers, percent predators, and percent shredders (see Exhibit 23). All the samples were dominated by relative numbers of collector-gatherers and collector-filterers, with small relative numbers of scrapers and predators. Only the site AC-3 sample included shredders. Trophic measures (i.e., functional feeding group measures) provide information on the balance of feeding strategies in the aquatic assemblage. The composition of the functional feeding group is a surrogate for complex processes of trophic interaction, production, and availability of food sources. An imbalance of the functional feeding groups can reflect unstable food dynamics and can indicate a stressed condition.




**BMI Trophic Measures by Reach** **Exhibit 23**

## Index for Biological Integrity

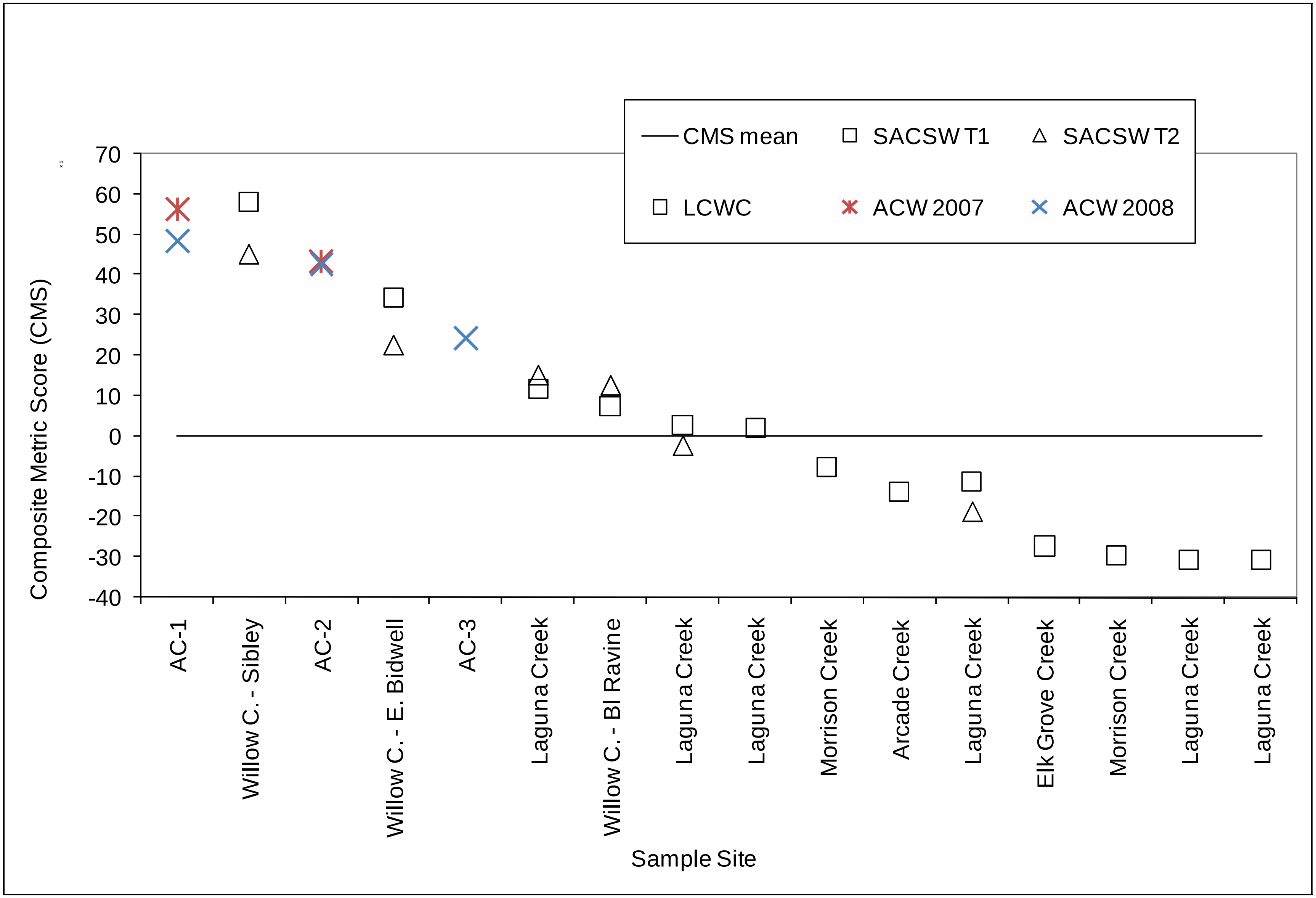
The IBI scores for each of the sites are illustrated in Exhibit 24. AC-1 scored in the “good” category for both samples, AC-2 scored in the “good” and “fair” categories for the 2007 and 2008 samples, respectively, and AC-3 scored in the “fair” category for both samples.




**IBI Scores by Reach** **Exhibit 24**

## Composite Metric Score

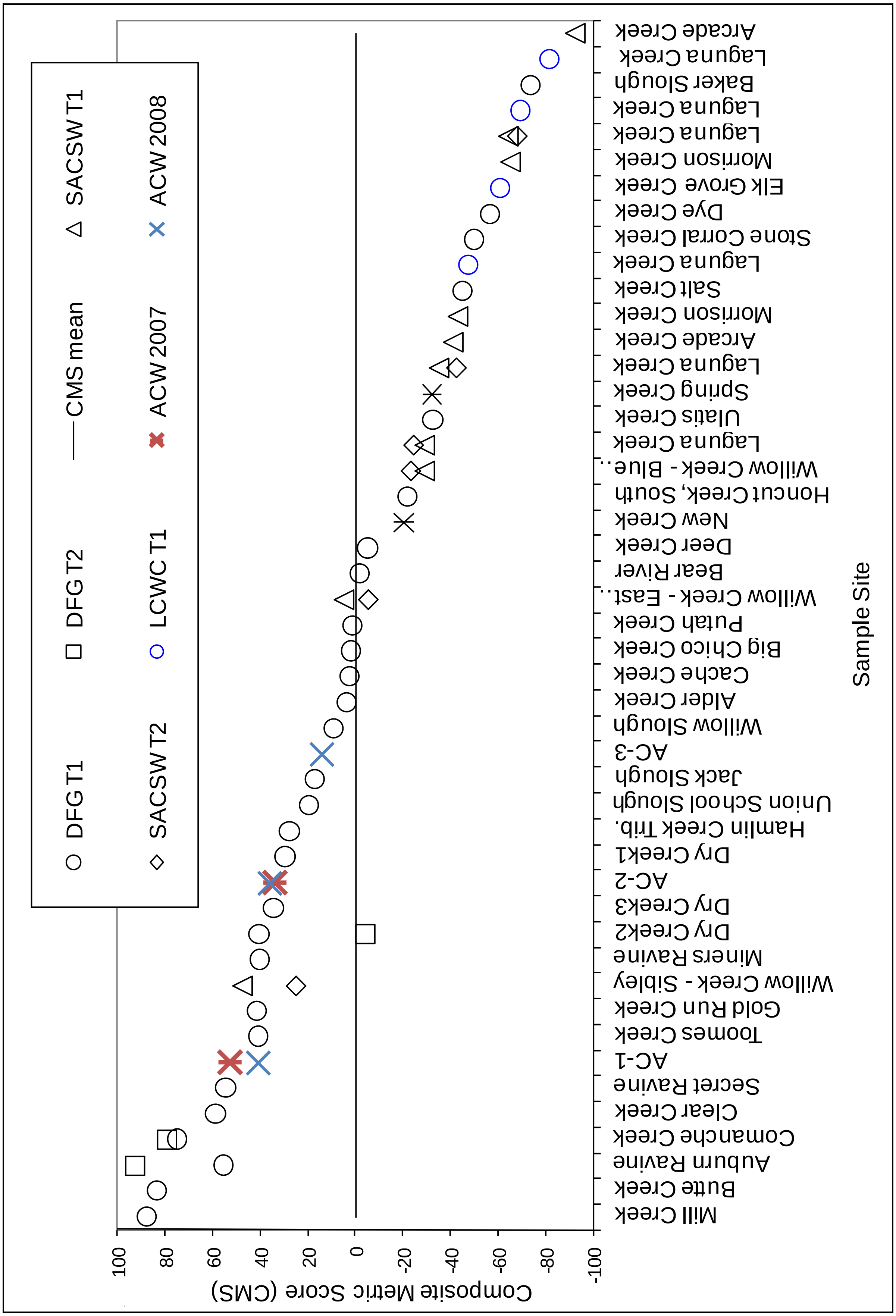
Exhibits 25 and 26 plot Alder Creek BMI CMSs relative to other Sacramento County and Sacramento Valley stream BMI scores, respectively (see Ode et al. 2005). Relative to other Sacramento County and Sacramento Valley streams, Alder Creek watershed streams exhibit relatively high quality conditions as measured using CMS analysis with the 14 metrics that were determined to be most discriminate. Relative to each other, CMS values decrease moving from downstream to upstream. This could be attributed to increased availability and diversity of food resources in the downstream areas (associated with increased riparian forest) as well as urban influences becoming more diluted or diminished in the lower portion of the watershed.




**Ranked CMS Plot for Sacramento County Stream BMI Bioassessment Sites**

**Exhibit 25**

**Exhibit 26**




**Ranked CMS Plot for Sacramento Valley Stream BMI Bioassessment Sites**

### 3.2.2 VEGETATION RAPID ASSESSMENT

Riparian vegetation community composition and structure was assessed in each of the three bioassessment sites. A brief narrative describing vegetation composition and structure within each site is presented below.

Site AC – 1 is heavily wooded with an overstory dominated almost entirely by white alder. In most cases canopy closure exceeds 50% and, in many cases, approaches 80% or higher. Due to ithe dense canopy, understory development is limited to scattered annual grasses along the creek channel and to patches of Himalayan blackberry, which can be very dense (approaching 100% cover) in canopy openings. Scattered willow, such as arroyo willow, are also found in this study site. Invasive woody plants observed in this study site include Himalayan blackberry, Cal-IPC rating High (Cal-IPC 2006), and scattered edible fig (*Ficas carica*), Cal-IPC rating Moderate (Cal-IPC 2006).

The AC - 2 site consists of two distinct segments in terms of species composition and structure. The lower half of the study site consists of moderately dense to dense riparian woodland dominated by white alder, sandbar willow, and arroyo willow. Overstory canopy closure in this part of the study site approaches 50% or more in some locations. Willows and dense patches of Himalayan blackberry as well as scattered patches of herbaceous vegetation provide understory structure. The upper half of the study site lacks a well-developed overstory. In this portion of the study site, herbaceous species, primarily narrow-leaved cattail (*Typha angustifolia*) are more common along the stream channel. A variety of other weedy herbaceous species, such as pennyroyal (*Mentha pelugium*), rice cutgrass, water smartweed (*Polygonum hydropiperoides*), and water primrose are also commonly found in this segment of the study site. Dense patches of Himalayan blackberry and scattered sandbar willow are also common along the edges of the stream channel. Aside from Himalayan blackberry, no invasive woody species were observed within the study site.

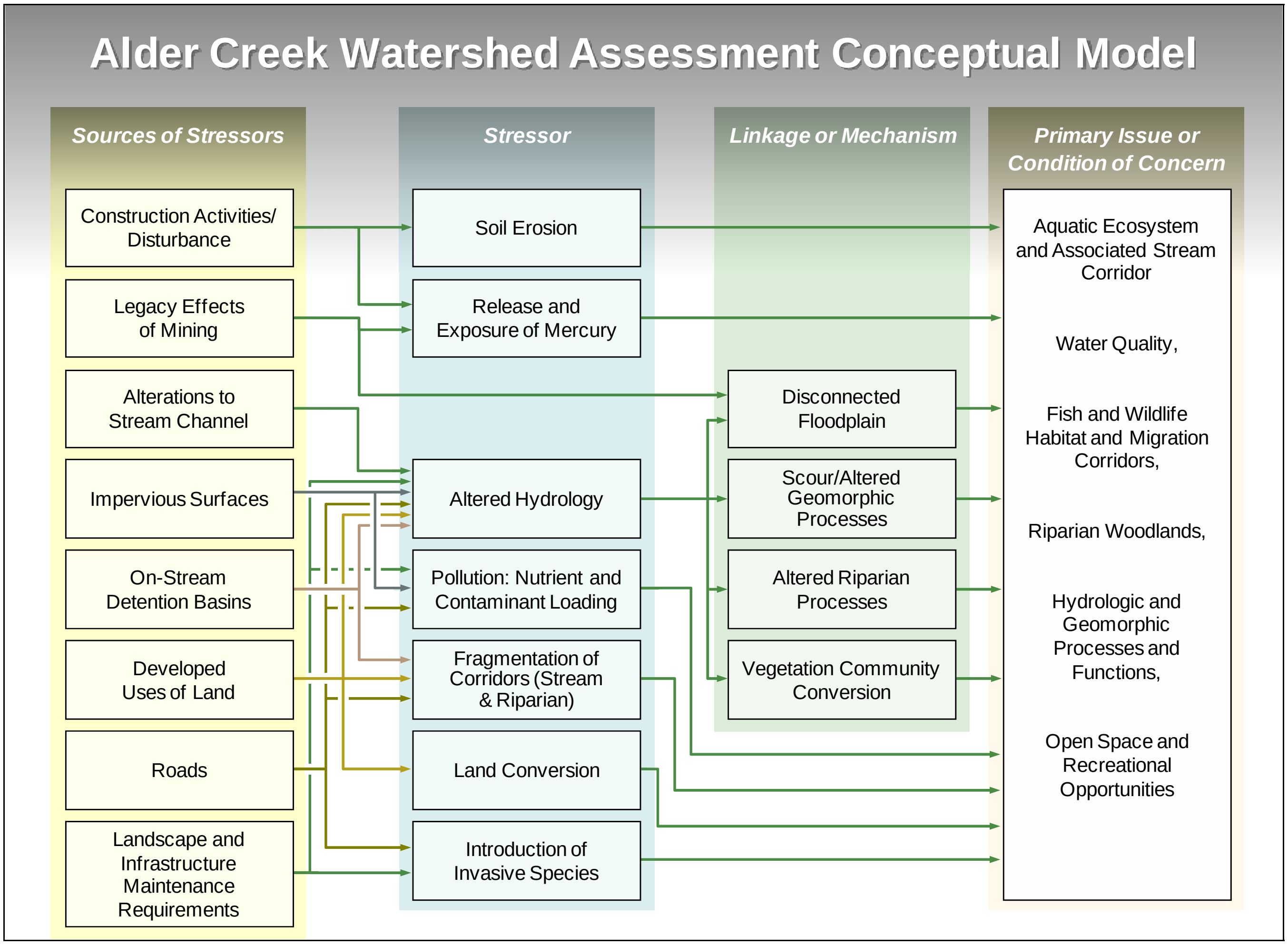
The AC - 3 site is dominated by two primary species, narrow-leaved cattail and tule. Tule is frequenlty the dominant species, but both species occur together in dense stands along the stream channel that approach 100% cover in many locations. The margins of the channel, within the active floodplain, are dominated by Baltic rush and a variety of weedy herbaceous species such as pennyroyal, tall willowherb (*Epilobium brachycarpum*), water smartweed, bristly ox-tongue (*Picris echioides*), and western vervain (*Verbena lasiostachys*). Shrubs, primarily scattered arroyo willow, Himalayan blackberry, and coyote brush, are found in small numbers throughout the study site. A variety of trees are found in the overstory, including: blue oak, valley oak, Fremont's cottonwood, white alder, and black willow. Canopy closure rarely exceeds 25%, which has allowed a diverse herbaceous understory to develop. Invasive woody species observed within the study site include Himalayan blackberry, which occupies less than 5% ground cover within the study site, and two small Chinese tallow trees (*Sapium sebiferum*), Cal-IPC rating Moderate.

# 4 KEY ISSUES AND CONSIDERATIONS

This chapter assesses the historic and present natural resource conditions in the Alder Creek watershed by identifying the key issues and considerations for preservation, conservation, restoration, and management. The key issues and considerations are framed by identifying the important beneficial natural resource functions and values followed by a description of primary concerns. A synthesis of the assessment results highlighting the interrelated and complex relationship between cause-and-effect linkages for the different resource areas is then provided. Finally, identification and analysis of opportunities and constraints is included to provide a logical method to identify, evaluate, and compare/contrast potential actions, facilitate consideration of a range of reasonable actions, and provide the basis for the selection of preferred actions to be incorporated into the watershed management plan.

## 4.1 ASSESSMENT OVERVIEW

Natural resources of the Alder Creek watershed were assessed to identify important beneficial functions and values and conditions of concern due to current and potential future degradation. Conditions of concern were further examined to determine the likely cause (i.e., stressors) of conditions and to identify past and on-going land use changes/activities that are the source of the cause or stressor. These relationships are illustrated in the conceptual model presented below.




Degradation of natural resource conditions in the watershed can be primarily attributed to changes in land use, including residential and commercial development and associated infrastructure, and agricultural activities. These changes have resulted in both direct and indirect impacts to natural resource and other watershed values. Direct impacts have resulted from the construction and initial conversion of natural vegetation communities and habitats to urban and agricultural land uses. Indirect impacts have and continue to result from the subsequent on-going activities associated with management / maintenance / operation of the urban and agricultural land uses. The past, ongoing, and predicted future effects of these direct and indirect influences natural resource conditions and values within the Alder Creek Watershed are examined in detail below.

### 4.1.1 FUNCTIONS AND VALUES

- Vegetation communities / habitats. Primary vegetation community / habitat types present in the Alder Creek watershed include: grasslands, oak savannah, oak woodlands, riparian woodlands and scrub, wetlands, and open water. These vegetation communities / habitat types support a diverse suite of native and nonnative species.

- Grassland vegetation communities present in the upper watershed supports many wildlife species including small mammals (e.g., squirrels and gophers), raptors (e.g., hawks and owls), and upland birds (e.g., quail and pheasant). Vernal pool grassland is composed primarily of annual grassland that supports vernal pool complexes and scattered vernal pools and provides habitat for vernal pool crustaceans and amphibians.

- Riparian communities within the watershed provide important habitat for many waterfowl, Neotropical migrant birds, resident birds, small mammals, and rodents. The lower watershed is connected to Lake Natoma and the American River, which provide important habitat for a wide diversity of species. The upper watershed is connected to large expanses of open space to south that ultimately connect to Deer Creek Hills preserve and the Cosumnes River.

- Wetlands and open water in the watershed including perennial and seasonal marsh, ponds and reservoirs, and other areas of open water. These areas are very productive habitats for wildlife. Many birds, both resident and migratory, breed within perennial marsh and forage in seasonal marsh and open water habitats.

► Special-status species. Alder Creek and its tributaries and the upland portions of its watershed are known to provide habitat for several special-status species, and have the potential to support others, underscoring the importance of watershed protection and stewardship. Efforts to improve the quality of aquatic, riparian, grassland, and vernal pool habitats throughout the watershed have the potential to benefit eleven special-status plant species and seventeen special-status wildlife species.

► Sensitive habitats. Three habitats in the Alder Creek watershed are currently considered sensitive or rare by the State and/or local counties because of limited distribution locally or regionally: vernal pools, valley foothill riparian, and aquatic.

► Aquatic ecosystems. Aquatic habitats within the watershed are primarily associated with Alder Creek and its tributaries; other features also include Alder Pond, Alder Reservoir, several stock ponds, seasonal wetlands, and vernal pools. Alder Creek can be generally characterized as intermittent in the upper watershed and perennial in the middle and lower watershed. The perennial condition in the middle and lower watershed is primarily the result of urban runoff originating from developed portions of the city of Folsom north of U.S. 50. Results of bioassessments at three locations throughout the watershed indicate that the creek ecosystem is currently in good health and compares favorably with other perennial creeks throughout Sacramento County and the larger Sacramento Valley. Alder Pond in the lower watershed and ponds in the upper watershed provide recreational enjoyment through nature/wildlife observation and fishing.

### CONDITIONS OF CONCERN

► Loss and/or conversion of sensitive vegetation communities / habitats. With much of the upper watershed to the north of U.S. 50 relatively built-out, concern regarding loss of sensitive habitats is focused on the upper and middle watershed areas south of U.S. 50. Widely distributed blue oak woodlands, oak savannah, and grasslands in the upper and middle watershed are especially at risk of loss due to large-scale developments that are currently in various stages of the planning process. Potential future loss / conversion of sensitive resources includes:

- oak / riparian woodland – direct loss and fragmentation;
- vernal pools and swales - water quality and hydrologic impairment;
- creeks – intermittent / ephemeral to perennial;

- riparian corridors – open oak woodland to willow / alder; and
- ponds – accelerated eutrophication, increased maintenance, loss of function, nuisance vegetation growth.

► Habitat fragmentation and loss of connectivity. Planned infrastructure construction in support of future development in the upper and middle watershed has the potential to result in habitat fragmentation and loss of connectivity in the watershed and throughout the larger region.

► Mercury release and exposure. Historic gold mining activities in the watershed have resulted in the presence of legacy mercury deposits in soils throughout the watershed. Land disturbance associated with construction activities has the potential to result in the release and exposure of mercury to the downstream aquatic ecosystems. Biochemical processes that occur in aquatic systems can result in the formation of methymercury, which is a form of mercury that bioaccumulates in aquatic organisms and is passed up the food web. Relatively high levels of methylmercury concentrations that have been documented in fish inhabiting Lake Natoma have resulted in fish consumption advisory for this resource.

► Urbanization-related changes stormwater runoff and erosion potential. Urbanization results in increased impervious surfaces, which, in turn has the potential to result in changes in stormwater runoff. These changes include:

- increased runoff volume and peak flow rates;
- reduced time lag to peak flow; and
- increased frequency of flow events.

These changes can result in downstream channel erosion and sedimentation, altered floodplain and riparian processes, and loss or shifts in riparian vegetation community characteristics.

► Urban/developed areas are typically lacking in native vegetation cover and associated habitat values. Urban areas tend to have diminished habitat value for wildlife species because the natural habitat has been greatly modified. These areas support many nonnative and common wildlife species.

## 4.2 OPPORTUNITIES AND CONSTRAINTS

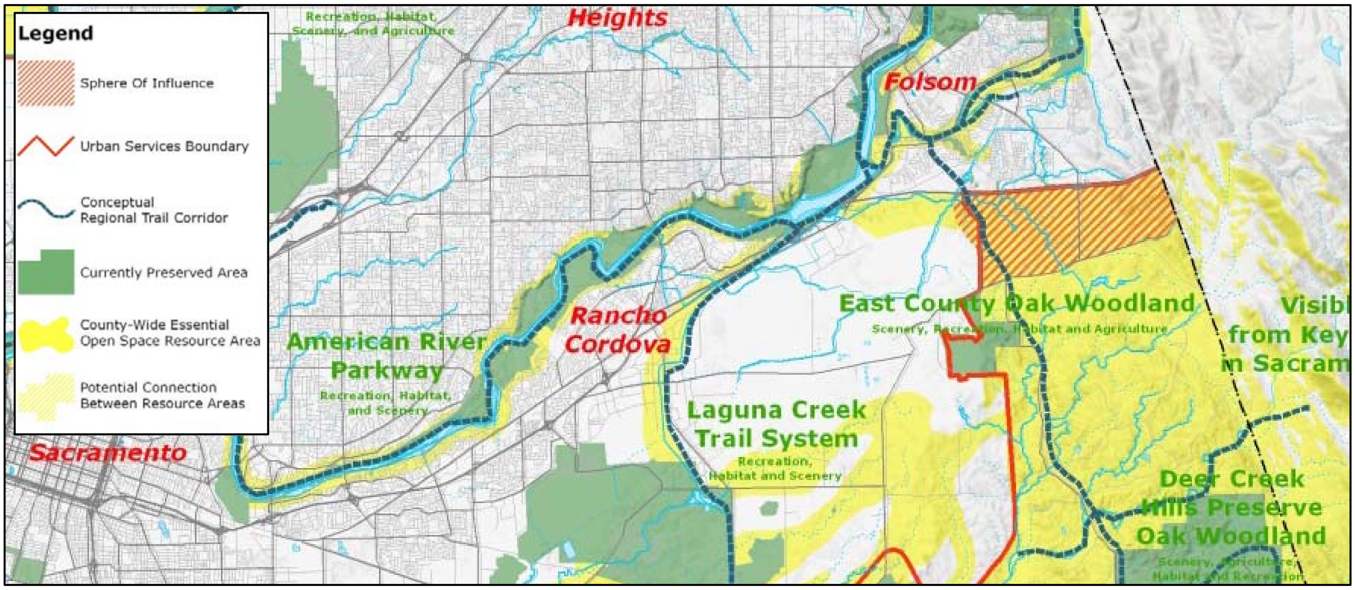
As discussed above, undeveloped portions of the watershed south of U.S. 50 are characterized by relatively undisturbed plant communities that provide habitat for a diversity of native plants and wildlife. Water quality and aquatic habitat functions of Alder Creek within this portion of the watershed are relatively intact. The location of the watershed, at the junction between the Sierra Nevada foothills and Central Valley, likely makes the southern portion of the watershed a movement corridor between Central Valley and Sierra Nevada habitats for many species of wildlife. However, this portion of the watershed will experience significant development pressure in the coming years. Therefore, this portion of the watershed presents both significant opportunities, in terms of terrestrial and aquatic habitat preservation as well as recreational uses and other uses that benefit from or are facilitated by habitat preservation, in addition to significant challenges to preserve these values in the face of urbanization. These opportunities and challenges are summarized below. As mentioned above, identification of opportunities and constraints is an important first step in developing preferred actions for the watershed management plan to address these opportunities and constraints. A map depicting opportunities and constraints in the Alder Creek watershed is provided in Exhibit 27.

### 4.2.1 OPPORTUNITIES

The following opportunities have been identified for the Alder Creek Watershed Project.

## CONNECTIVITY

Because the majority of the watershed is currently undeveloped, an opportunity exists to preserve connectivity. Connectivity is an all-encompassing term and includes habitat connectivity among preserved open space areas, primarily to benefit wildlife populations as described above. The concept of connectivity also includes hydrologic connectivity among stream channels, swales, and wetlands, and it includes multi-modal connectivity (e.g., pedestrian, bike) among existing regional trails networks and areas of future development. The preservation of Alder Creek through the dedication of a preserved creek corridor and the use of clear-span bridges or bottomless culverts along with the creation of a regional trails network within the creek corridor offers the most significant opportunity to maintain each of these aspects of connectivity within the watershed and throughout the larger region consistent with Sacramento Valley Conservancy's Twenty-First Century Vision for Open Space.

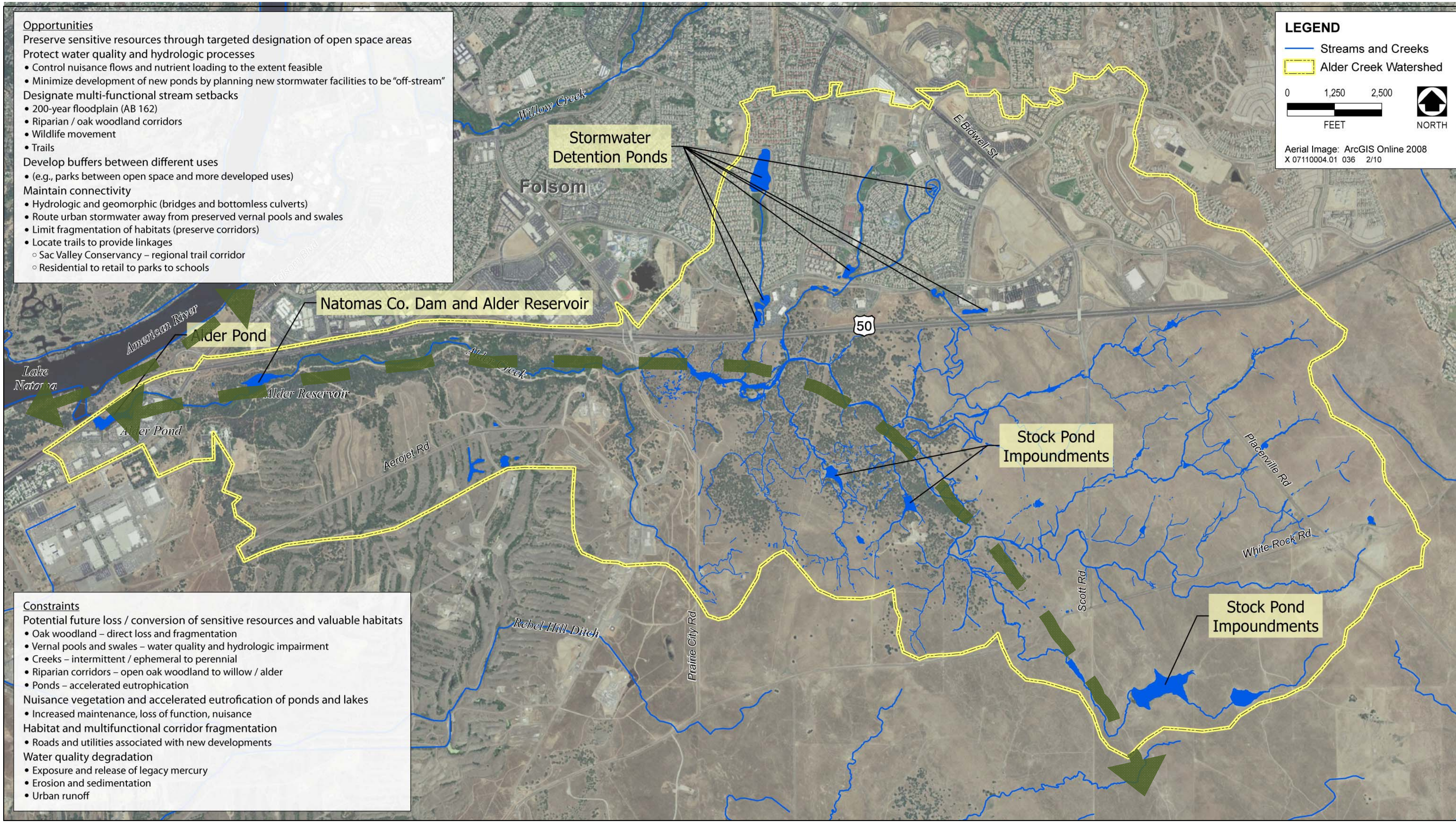



Source: Sacramento Valley Conservancy
Note: The extent of the map has been reduced to focus attention on the region surrounding the Alder Creek watershed

**Sacramento Valley Conservancy – Twenty-First Century Vision for Open Space**

## BIOLOGICAL RESOURCES

Significant biological resources are found throughout the southern portion of the watershed. The presence of these resources provides an opportunity to preserve native communities and species representative of the Central Valley and adjacent Sierra Nevada foothills through targeted designation of open space areas. These areas should encompass the greatest diversity of native communities and species, including rare, threatened, and endangered species. The areas should also be as large and interconnected as possible to facilitate movement of species among open space preserves (e.g., American River Parkway, Deer Creek Hills, Cosumnes River corridor) and persistence of species within those preserves. Open space preserves can be further enhanced by buffering preserves wherever possible from potentially incompatible surrounding land uses (e.g., by locating parks, rather than housing, adjacent to open space areas).




Source: NHC 2007, Sacramento County 2007, compiled by AECOM 2009

**Alder Creek Watershed Opportunities and Constraints Map** **Exhibit 27**

### WATER QUALITY AND HYDROLOGIC PROCESSES

Despite the developed nature of the northern watershed and modification of watershed hydrology, the mid and lower portions of Alder Creek still exhibit relatively good water quality and only slightly modified hydrologic processes. Therefore, an opportunity exists to preserve these functions to the maximum extent possible by maintaining a natural hydrograph; protecting the 200-year floodplain of Alder Creek; discouraging the direct diversion of urban run-off into stream channels, swales, and wetlands; detaining stormwater off-stream; and, reducing nutrient loading and protecting water quality.

## 4.2.2 CONSTRAINTS

The following constraints have been identified for the Alder Creek Watershed Project.

### BIOLOGICAL RESOURCES

The primary constraints posed to biological resources are habitat loss and fragmentation that are likely to result from future development within the watershed. This could result in the loss of rare, threatened, or endangered species, and, although this loss is likely to be mitigated, mitigation may occur outside the watershed resulting in a net loss of these resource values within the watershed. Habitat loss is likely to be most pronounced within grassland and oak woodland habitats, thus options for the preservation of habitat for species reliant upon these habitat types for breeding and foraging are likely to be most constrained.

### WATER QUALITY AND HYDROLOGIC PROCESSES

Water quality and hydrologic process are likely to be constrained by future development and increased nutrient loading, sediment delivery, and modified hydrology that may accompany development within the watershed. Increased nutrient loading is likely to pose significant constraints for the maintenance of many aquatic habitats through the increased potential for eutrophication and depletion of dissolved oxygen via aquatic vegetation growth. Sediment delivery, particularly legacy mercury-laden sediments that exist in dredge tailings that may be mobilized during development activities, are also likely to constrain opportunities for the maintenance of water quality as it pertains to the aquatic ecosystem. Future development within the headwaters of Alder Creek, where seeps, swales, ephemeral drainages, seasonal wetlands, and other aquatic habitats provide major contributions to the flow of Alder Creek and help regulate the hydrology of the creek, is likely to disrupt hydrologic processes. Additional analysis and evaluation should be conducted on the Natomas Company Dam and the Alder Reservoir impoundment behind the dam to address any potential safety issues and determine long term management strategies for the reservoir and dam. Additional analysis should also be conducted at Alder Pond, which is formed by Lake Natoma backwater and is the receiving water for the watershed.

### CONNECTIVITY

Roads, utilities, and other infrastructure are likely to constrain connectivity among open space areas, hydrologic connectivity, and connectivity along recreational trails and other trails to facilitate non-motorized mobility among adjacent areas of development by creating barriers to the free movement of wildlife, water, and people. Similar to water quality, opportunities to maintain connectivity, particularly hydrologic connectivity, are likely to be most constrained in the upper watershed where the hydrologic system consists of an interconnected network of seeps, wetlands, swales, and drainages rather than a single mainstem creek and major tributaries as is found in the middle and lower portions of the watershed.

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# Appendix A

Bioassessment Forms

| REACH DOCUMENTATION | Standard Reach Length (wetted width ≤ 10 m) = 150 m<br>Alternate Reach Length (wetted width >10 m) = 250 m | Distance between transects = 15 m<br>Distance between transects = 25 m |
|---|---|---|
| Project Name: | Date: | Time: |
| Stream Name: | Site Name/ Description: | |
| Site Code: | Crew Members: | |
| Latitude: °N | datum: NAD27 | |
| Longitude: °W | NAD83 | |

| AMBIENT WATER QUALITY MEASUREMENTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temperature (°C) | | pH | | Alkalinity (mg/L) | | Turbidity (optional) | |
| Dissolved $O_2$ (mg/L) | | Specific Cond. (µs) | | Salinity (ppt) | | Silica (optional) | |

| REACH LENGTH | | | |
|---|---|---|---|
| 150 m | | Other | |
| Actual Length (m) | | | |
| Explanation: | | | |

| PHOTOGRAPHS: | A (up): ☐ | F (up): ☐ | F (down): ☐ | K (down): ☐ |
|---|---|---|---|---|
| Additional Photographs (optional): | A (down): ☐ | K (up): ☐ | Others: | |

**DISCHARGE MEASUREMENTS** (first measurement = left bank) **check if measurement not possible** ☐

| VELOCITY AREA METHOD (preferred) | | | | Transect Width: | | | |
|---|---|---|---|---|---|---|---|
| | Distance from Bank (cm) | Depth (cm) | Velocity (m/sec) | | Distance from Bank (cm) | Depth (cm) | Velocity (m/sec) |
| 1 | | | | 11 | | | |
| 2 | | | | 12 | | | |
| 3 | | | | 13 | | | |
| 4 | | | | 14 | | | |
| 5 | | | | 15 | | | |
| 6 | | | | 16 | | | |
| 7 | | | | 17 | | | |
| 8 | | | | 18 | | | |
| 9 | | | | 19 | | | |
| 10 | | | | 20 | | | |

| BUOYANT OBJECT METHOD | Float 1 | Float 2 | Float 3 |
|---|---|---|---|
| Distance | | | |
| Float Time | | | |

| Float Reach Cross Section | | | |
|---|---|---|---|
| width (m)<br>depth (cm) | Upper Section | Middle Section | Lower Section |
| Width | | | |
| Depth 1 | | | |
| Depth 2 | | | |
| Depth 3 | | | |
| Depth 4 | | | |
| Depth 5 | | | |

| NOTABLE FIELD CONDITIONS (check one box per topic) | | | | | | |
|---|---|---|---|---|---|---|
| Evidence of recent rainfall (enough to increase surface runoff) | NO | | minimal | | >10% flow increase | |
| Evidence of fires in reach or immediately upstream (<500 m) | NO | | < 1 year | | < 5 years | |
| Dominant land use/ land cover in area surrounding reach | Agriculture | | Forest | | Rangeland | |
| | Urban/ Indus | | Suburb/Town | | Other | |

| Site Code: | Date: __ __ / __ __ / __ __ __ __ | [redacted] |
|---|---|---|

## SLOPE and BEARING FORM (transect based - for Full PHAB only)

| CL=clionometer OT=other TR=autolevel HL=handlevel | | MAIN SEGMENT | | | | | SUPPLEMENTAL SEGMENT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Transect** | **Method** | **Slope (%) or Elevation Difference (cm)** | | **Segment Length (m)** | **Bearing (0°-359°)** | **Propor-tion (%)** | **Slope (%) or Elevation Difference (cm)** | | **Segment Length (m)** | **Bearing (0°-359° C)** | **Propor-tion (%)** |
| **K-J** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **J-I** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **I-H** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **H-G** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **G-F** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **F-E** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **E-D** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **D-C** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **C-B** | CL TR HL OT | | % cm | | | | | % cm | | | |
| **B-A** | CL TR HL OT | | % cm | | | | | % cm | | | |

| **REACH SLOPE (BASIC version only, use as many segments as needed)** | | | | | | | METHOD | CL | | HL | | TR | HL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| SEGMENT 1 | | SEGMENT 2 | | SEGMENT 3 | | SEGMENT 4 | | SEGMENT 5 | | SEGMENT 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Slope (%) or Elevation Difference (cm) | | Slope (%) or Elevation Difference (cm) | | Slope (%) or Elevation Difference (cm) | | Slope (%) or Elevation Difference (cm) | | Slope (%) or Elevation Difference (cm) | | Slope (%) or Elevation Difference (cm) | |
| | % cm | | % cm | | % cm | | % cm | | % cm | | % cm |

## ADDITIONAL HABITAT CHARACTERIZATION

| **Parameter** | **Optimal** | **Suboptimal** | **Marginal** | **Poor** |
|---|---|---|---|---|
| **Epifaunal Substrate/ Cover** | Greater than 70% of substrate favorable for epifaunal colonization and fish cover (50% for low-gradient streams); mix of submerged logs, undercut banks, cobble or other stable habitat | 40-70% mix of stable habitat (30-50% for low-gradient streams); well-suited for full colonization potential | 20-40% mix of stable habitat (10-30% in low-gradient streams); substrate frequently disturbed or removed | Less than 20% stable habitat (10% in low-gradient streams); lack of habitat is obvious; substrate unstable or lacking |
| **Score:** | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **Sediment Deposition** | Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (>20% in low-gradient streams) | Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected (20-50% in low-gradient streams) | Moderate deposition of new gravel, sand, or fine sediment on bars; 30-50% of the bottom affected (50 - 80% in low-gradient streams) | Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently (>80% in low-gradient streams) |
| **Score:** | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, (e.g., bridge abutments); evidence of past channelization (> 20yrs) may be present but recent channelization not present | Channelization may be extensive: embankments or shoring structures present on both banks; 40 to 80% of stream reach disrupted | Banks shored with gabion or cement; Over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely |
| **Score:** | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

| | | |
|---|---|---|
| Site Code: | Site Name: | Date: __ __ / __ __ / __ __ __ __ |

| | | | |
|---|---|---|---|
| Wetted Width (m): | Bankfull Width (m): | Bankfull Height: | **Transect:** |

| TRANSECT SUBSTRATES | | | | Cobble Embed (%) |
|---|---|---|---|---|
| **Position** | mm or Size Class | Depth (cm) | CPOM | |
| L Bank | | | P A | |
| LeftCtr | | | P A | |
| Center | | | P A | |
| RightCtr | | | P A | |
| R Bank | | | P A | |

| BANK STABILITY 5m up and 5m downstream of transect and from bankfull to wetted width | | | |
|---|---|---|---|
| **Left Bank** | eroded | vulnerable | stable |
| **Right Bank** | eroded | vulnerable | stable |

| HUMAN INFLUENCE | 0 = Not Present CH - Within Channel B = On Bank C = Between Bank and 10 m from Channel P = >10 m and <50 m of Channel | | |
|---|---|---|---|
| | **Left Bank** | **Channel** | **Right Bank** |
| Walls/ Rip-rap/ Dams | 0 B C P | CH | 0 B C P |
| Buildings | 0 B C P | CH | 0 B C P |
| Pavement/ Cleared Lot | 0 B C P | | 0 B C P |
| Road/ Railroad | 0 B C P | CH | 0 B C P |
| Pipes (Inlet/ Outlet) | 0 B C P | CH | 0 B C P |
| Landfill/ Trash | 0 B C P | CH | 0 B C P |
| Park/ Lawn | 0 B C P | | 0 B C P |
| Row Crops | 0 B C P | | 0 B C P |
| Pasture/ Range | 0 B C P | | 0 B C P |
| Logging Operations | 0 B C P | | 0 B C P |
| Mining Activity | 0 B C P | CH | 0 B C P |
| Vegetation Management | 0 B C P | | 0 B C P |
| Bridges/Abutments | 0 B C P | CH | 0 B C P |
| Orchards/ Vineyards | 0 B C P | | 0 B C P |

| RIPARIAN VEGETATION (downstream) | 0 = Absent (0%) 3 = Heavy (40-75%) 1 = Sparse (<10%) 4 = Very Heavy>75%) 2 = Moderate (10-40%) circle one | |
|---|---|---|
| **Vegetation Class** | **Left Bank** | **Right Bank** |
| **Upper Canopy (>5 m high)** | | |
| Trees and saplings >5 m high | 0 1 2 3 4 | 0 1 2 3 4 |
| **Lower Canopy (0.5 m-5 m high)** | | |
| Woody shrubs and saplings 0.5 m to 5 m | 0 1 2 3 4 | 0 1 2 3 4 |
| **Ground Cover (<0.5 m high)** | | |
| Woody shrubs and saplings <0.5 m | 0 1 2 3 4 | 0 1 2 3 4 |
| Herbs/ grasses | 0 1 2 3 4 | 0 1 2 3 4 |
| Barren, bare soil/ duff | 0 1 2 3 4 | 0 1 2 3 4 |

| INSTREAM HABITAT COMPLEXITY | 0 = Absent (0%) 1 = Sparse (<10%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%) |
|---|---|
| Filamentous Algae | 0 1 2 3 4 |
| Aquatic Macrophytes/ Emergent Vegetation | 0 1 2 3 4 |
| Boulders | 0 1 2 3 4 |
| Woody Debris >0.3 m | 0 1 2 3 4 |
| Woody Debris <0.3 m | 0 1 2 3 4 |
| Undercut Banks | 0 1 2 3 4 |
| Overhang. Vegetation | 0 1 2 3 4 |
| Live Tree Roots | 0 1 2 3 4 |
| Artificial Structures | 0 1 2 3 4 |

| DENSIOMETER READINGS (0-17) *count covered dots* | |
|---|---|
| Center Left | |
| Center Upstream | |
| Center Downstream | |
| Center Right | |

| **Inter-transect:** not needed for last transect | indicate upper/ lower transects | | Wetted Width (m): |
|---|---|---|---|

| FLOW HABITATS (% between transects, T=100%) | |
|---|---|
| **Channel Type** | **%** |
| Cascade/ Fall | |
| Rapid | |
| Riffle | |
| Run | |
| Glide | |
| Pool | |
| Dry | |

| INTER-TRANSECT SUBSTRATES (measure in mm or use size classes) | | | |
|---|---|---|---|
| **Position (%)** | mm or Size Class | Depth (cm) | CPOM |
| L Bank | | | P A |
| LeftCtr | | | P A |
| Center | | | P A |
| RightCtr | | | P A |
| R Bank | | | P A |

**Note**: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size classes listed to right

**SUBSTRATE SIZE CLASS CODES**

**RS** = bedrock smooth (>car)
**RR** = bedrock rough (> car)
**RC** = concrete/asphalt
**XB** = large boulder (1-4 m)
**SB** = sml blder (.25 m-1 m)
**CB** = cobble (64-250 mm)
**GC** = coarse gravel (16-64 mm)
**GF** = fine gravel (2-16 mm)
**SA** = sand (0.06-2 mm)
**FN** = fines (<0.06 mm)
**HP** = hardpan (consol fines)
**WD** = wood
**OT** = other

**CPOM/ COBBLE EMBEDDEDNESS**

**CPOM:** Record presence (P)/ absence (A) of coarse particulate organic matter (>1.0 mm) within 1 cm of each particle.

**Cobble Embeddedness:** visually estimate % embedded by fine particles (record to nearest 5%)

| Site Code: | Date: __ __ / __ __ / __ __ __ __ | **FULL FORM** |
|---|---|---|

**Site Map:**

**Field Notes/ Comments:**

# APPENDIX B

Rapid Vegetation Assessment Field Forms

## CALIFORNIA NATIVE PLANT SOCIETY - VEGETATION RAPID ASSESSMENT FIELD FORM

(Revised Nov 21, 2005)

| For Office Use: | Final database #: | Final vegetation type name: | Alliance______ Association______ |
|---|---|---|---|

**I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION**

| Polygon/Stand #: | Air photo #: | Date: | Name(s) of surveyors: |
|---|---|---|---|
| ______ | ______ | ______ | ______ |

**GPS waypoint #:** ______ **GPS name:** ______ **GPS datum: (e.g. NAD 83)** ______ **Is GPS within stand?** Yes / No

**If No, cite from GPS point to stand, the distance** ______**(in meters) and bearing** ______**(in degrees) GPS Error: ±**______ **ft / m**

**UTM field reading: UTME** ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___ **UTM zone:** ______

**Elevation**: ______ **ft / m Photograph #'s**: ______

**Topography: convex**____ **flat**____ **concave**____ **undulating**____ | **top**____ **upper**____ **mid**____ **lower**____ **bottom**____

**Geology:** ______ **Soil Texture:** ______ **Rock: %Large**____ **%Small** ____ **%Bare/Fine:** ____ **%Litter:** ____ **%BA Stems:** ____

**Slope exposure** (circle one and/or enter actual °): **NE**______ **NW**______ **SE**______ **SW**______ **Flat**__ **Variable**__

**Slope steepness** (circle one and enter actual °): **0°**__ **1-5°** _____ **5-25°**_____ **> 25°**_____ **Upland** or **Wetland/Riparian** (circle one)

**Site history, stand age, and comments:** ______

______

______

**Type/ Level of disturbance** (*use codes*): ____/____ ____/____ ____/____ ____/____ ____/____ ____/____ ____/____ ____/____

**II. VEGETATION DESCRIPTION**

**Field-assessed vegetation alliance name:** ______

**Field-assessed association name** (optional): ______

**Size of stand: <1 acre**___ **1-5 acres**___ **>5 acres**___ **Plot:** Yes / No **If Yes, denote size: 100m²**__ **400 m²**__ **1000 m²**__ **Other** ____

**Adj alliances:**______ ______ / ______ ______

| Tree DBH (enter counts or denote ): | T1 (<1" dbh) | T2 (1-6" dbh) | T3 (6-11" dbh) | T4 (11-24" dbh) | T5 (24-48" dbh) | T6 (>48" dbh) |
|---|---|---|---|---|---|---|
| | | | | | | |

**If Tree, list 1-3 dominant overstory spp.:** ______

**Shrub** (mark one or enter %): **S1** (seedling <3 yr old) ___ **S2** (young <1% dead) ___ **S3** (mature 1-25% dead) ___ **S4** (decadent >25% dead) ___

**Herb** (mark one or enter %'s): **H1** (<4" height) ___ **H2** (4 -<8" ht) ___ **H3** (8 -<12" ht) ___ **H4** (≥12" ht.) ___ **% Total Veg Cover:** _____

**% Cover- Overstory Tree Conifer/Hardwood:** _____/_____ **Low Tree-Tall Shrub:** _____ **Lo-Mid Shrub:** _____ **Herbaceous:** _____

**Height Class - Overstory Conifer/Hardwood:** _____/_____ **Low Tree-Tall Shrub:** _____ **Lo-Mid Shrub:** _____ **Herbaceous:** _____

*Height classes*: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

**Species (List up to 20 major species), Stratum, and Approximate % cover:** (Jepson Manual nomenclature please)

*Stratum categories*: T=tall, M=medium, L=low; *% cover intervals for reference*: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%

| Strata | Species | % cover | | Strata | Species | % cover |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Unusual species:** ______

**III. PROBLEMS WITH INTERPRETATION**

**Confidence in alliance identification: (L, M, H)** ______ **Explain** ______

**Other identification problems** (describe): ______

**Polygon is more than one type: (Yes, No)** ______ (Note: type with greatest coverage in polygon should be entered in above section)

**Other types:** ______ ______ ______

**Has the vegetation changed since air photo taken?** Yes / No **If Yes, What has changed?** ______

## CALIFORNIA NATIVE PLANT SOCIETY - VEGETATION RAPID ASSESSMENT FIELD FORM

(Revised April 4, 2005)

| **For Office Use:** | **Final database #:** | **Final vegetation type name:** | **Alliance**______________ **Association**______________ |
|---|---|---|---|

**I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION**

| **Polygon/Stand #:** | **Air photo #:** | **Date:** | **Name(s) of surveyors:** |
|---|---|---|---|
| ________ | ________ | ________ | ________________ |

**GPS waypoint #:** __________ **GPS name:** ______________ **GPS datum: (e.g. NAD 83)** ________ **Is GPS within stand?** Yes / No

**If No, cite from GPS point to stand, the distance** _______**(in meters) and bearing** _______**(in degrees) GPS Error: ±**______ **ft / m**

**UTM field reading:** **UTME** ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___ **UTM zone:** ______________

**Elevation**: __________ **ft / m** **Photograph #'s**: ________________________________

**Topography: convex**____ **flat**____ **concave**____ **undulating**____ | **top**____ **upper**____ **mid**____ **lower**____ **bottom**____

**Geology:** _______ **Soil Texture:** _______ **Rock: %Large**____ **%Small** ____ **%Bare/Fine:** ____ **%Litter:** ____ **%BA Stems:** ____

**Slope exposure** (circle one and/or enter actual °): **NE**_______ **NW**_______ **SE**_______ **SW**_______ **Flat**__ **Variable**__

**Slope steepness** (circle one and enter actual °): **0°**__ **1-5°** _____ **5-25°**_____ **> 25°**_____ **Upland** or **Wetland/Riparian** (circle one)

**Site history, stand age, and comments:** ________________________________

________________________________________________________________

________________________________________________________________

**Type/ Level of disturbance** (*use codes*): ____/____ ____/____ ____/____ ____/____ ____/____ ____/____ ____/____ ____/____

**II. VEGETATION DESCRIPTION**

**Field-assessed vegetation alliance name:** ________________________________

**Field-assessed association name** (optional): ________________________________

**Size of stand: <1 acre**___ **1-5 acres**___ **>5 acres**___ **Plot:** Yes / No **If Yes, denote size: 100m²**__ **400 m²**__ **1000 m²**__ **Other** ____

**Adj alliances:**________________________ ________ / ________________________ ________

| **Tree DBH** (enter counts or denote ): | **T1** (<1" dbh) | **T2** (1-6" dbh) | **T3** (6-11" dbh) | **T4** (11-24" dbh) | **T5** (24-48" dbh) | **T6 (>48" dbh)** |
|---|---|---|---|---|---|---|
| | | | | | | |

**If Tree, list 1-3 dominant overstory spp.:** ________________________________

**Shrub** (mark one or enter %): **S1** (seedling <3 yr old) ___ **S2** (young <1% dead) ___ **S3** (mature 1-25% dead) ___ **S4** (decadent >25% dead) ___

**Herb** (mark one or enter %'s): **H1** (<4" height) ___ **H2** (4 -<8" ht) ___ **H3** (8 -<12" ht) ___ **H4** (≥12" ht.) ___ **% Total Veg Cover:** _____

**% Cover- Overstory Tree Conifer/Hardwood:** _____/_____ **Low Tree-Tall Shrub:** _____ **Lo-Mid Shrub:** _____ **Herbaceous:** _____

**Height Class - Overstory Conifer/Hardwood:** _____/_____ **Low Tree-Tall Shrub:** _____ **Lo-Mid Shrub:** _____ **Herbaceous:** _____

*Height classes*: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

**Species (List up to 12 major species), Stratum, and Approximate % cover:** (Jepson Manual nomenclature please)

*Stratum categories*: T=tall, M=medium, L=low; *% cover intervals for reference*: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%

| Strata | Species | % cover | | Strata | Species | % cover |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Unusual species:** ________________________________

**III. PROBLEMS WITH INTERPRETATION**

**Confidence in alliance identification: (L, M, H)** ______ **Explain** ________________________________

**Other identification problems** (describe): ________________________________

**Polygon is more than one type: (Yes, No)** ________ (Note: type with greatest coverage in polygon should be entered in above section)

**Other types:** ____________________ ____________________ ____________________

**Has the vegetation changed since air photo taken?** Yes / No **If Yes, What has changed?** ________________

# APPENDIX C

Benthic Macroinvertebrate Taxa List

# Appendix C – Benthic Macroinvertebrate Taxa List for Alder Creek Watershed

| BENTHIC MACROINVERTEBRATE TAXA LIST FOR ALDER CREEK WATERSHED | | | | | | | | AC-1 | | AC-2 | | AC-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 5/10/07 | 5/30/08 | 5/11/07 | 5/30/08 | 5/30/08 |
| Phylum | Subphylum | Class | Order | Family | Subfamily | Tribe | Taxon | | | | | |
| Arthropoda | | | | | | | | | | | | |
| | Hexapoda | | | | | | | | | | | |
| | | Insecta | | | | | | | | | | |
| | | | Coleoptera | | | | | | | | | |
| | | | | Elmidae | | | | | | | | |
| | | | | | | | Ordobrevia nubifera | 1 | -- | -- | -- | -- |
| | | | | Hydraenidae | | | | | | | | |
| | | | | | | | Hydraena sp. | -- | -- | 1 | -- | -- |
| | | | Diptera | | | | | | | | | |
| | | | | Ceratopogonidae | | | | | | | | |
| | | | | | | | Sphaeromias sp. | 1 | -- | -- | -- | -- |
| | | | | Chironomidae | | | | | | | | |
| | | | | | Chironominae | | | | | | | |
| | | | | | | Chironomini | | | | | | |
| | | | | | | | Chironomus sp. | -- | -- | -- | 1 | -- |
| | | | | | | | Cryptotendipes sp. | -- | -- | -- | -- | 2 |
| | | | | | | | Dicrotendipes sp. | -- | 1 | 5 | 4 | -- |
| | | | | | | | Glyptotendipes sp. | -- | -- | -- | -- | 6 |
| | | | | | | | Paratendipes sp. | -- | 2 | -- | 4 | 23 |
| | | | | | | | Polypedilum sp. | 4 | 1 | 2 | 3 | 4 |
| | | | | | | | Microtendipes rydalensis group | 5 | 53 | -- | 4 | -- |
| | | | | | | Tanytarsini | | | | | | |
| | | | | | | | Micropsectra sp. | 4 | 27 | -- | 26 | 192 |
| | | | | | | | Paratanytarsus sp. | 3 | 1 | 1 | -- | 4 |
| | | | | | | | Rheotanytarsus sp. | 42 | 70 | 134 | 186 | 25 |
| | | | | | | | Stempellinella sp. | 12 | 4 | 1 | -- | 7 |
| | | | | | | | Tanytarsus sp. | -- | -- | 6 | -- | -- |
| | | | | | Orthocladiinae | | | | | | | |
| | | | | | | | Orthocladius complex | 4 | -- | -- | -- | -- |
| | | | | | | | Cricotopus sp. | -- | -- | 3 | 1 | -- |
| | | | | | | | Eukiefferiella sp. | -- | -- | -- | 1 | -- |
| | | | | | | | Limnophyes sp. | -- | -- | -- | -- | 2 |
| | | | | | | | Parametriocnemus sp. | 33 | 41 | 4 | 4 | 13 |
| | | | | | | | Psectrocladius sp. | -- | -- | 2 | -- | -- |
| | | | | | | | Rheocricotopus sp. | 6 | 16 | 7 | 16 | 11 |

| BENTHIC MACROINVERTEBRATE TAXA LIST FOR ALDER CREEK WATERSHED | | | | | | | | AC-1 | | AC-2 | | AC-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 5/10/07 | 5/30/08 | 5/11/07 | 5/30/08 | 5/30/08 |
| Phylum | Subphylum | Class | Order | Family | Subfamily | Tribe | Taxon | | | | | |
| | | | | | | | Synorthocladius sp. | 20 | 1 | -- | -- | -- |
| | | | | | | | Cricotopus bicinctus group | 1 | -- | -- | -- | -- |
| | | | | | | Corynoneurini | | | | | | |
| | | | | | | | Corynoneura sp. | 1 | -- | -- | -- | -- |
| | | | | | | | Thienemanniella sp. | 8 | 35 | 2 | 5 | 5 |
| | | | | | Tanypodinae | | | | | | | |
| | | | | | | Pentaneurini | | | | | | |
| | | | | | | | Ablabesmyia sp. | 2 | -- | 1 | -- | -- |
| | | | | | | | Pentaneura sp. | 1 | -- | 3 | 6 | -- |
| | | | | Empididae | | | | | | | | |
| | | | | | | | Clinocera sp. | -- | 2 | -- | -- | -- |
| | | | | Muscidae | | | | -- | -- | 1 | -- | -- |
| | | | | Simuliidae | | | | | | | | |
| | | | | | | | Simulium sp. | 7 | 53 | 7 | 6 | 5 |
| | | | | | | | Simulium sp. | -- | -- | -- | 1 | 3 |
| | | | Ephemeroptera | | | | | | | | | |
| | | | | Baetidae | | | | | | | | |
| | | | | | | | Baetis tricaudatus | 79 | 28 | 53 | 21 | 13 |
| | | | | | | | Fallceon quilleri | 1 | -- | 6 | 1 | -- |
| | | | | Leptohyphidae | | | | | | | | |
| | | | | | | | Tricorythodes sp. | -- | 1 | -- | -- | -- |
| | | | Lepidoptera | | | | | | | | | |
| | | | | Pyralidae | | | | | | | | |
| | | | | | | | Petrophila sp. | -- | 1 | -- | -- | -- |
| | | | Odonata | | | | | | | | | |
| | | | | Coenagrionidae | | | | -- | -- | -- | -- | 6 |
| | | | | Coenagrionidae | | | | -- | 1 | 2 | -- | -- |
| | | | | | | | Argia sp. | 1 | 1 | 4 | -- | -- |
| | | | Trichoptera | | | | | | | | | |
| | | | | Brachycentridae | | | | | | | | |
| | | | | | | | Micrasema sp. | 1 | 3 | 1 | 5 | -- |
| | | | | Hydropsychidae | | | | 6 | 1 | 8 | 1 | 1 |
| | | | | | | | Hydropsyche sp. | 44 | 17 | 42 | 52 | 2 |
| | | | | Hydroptilidae | | | | 5 | -- | 11 | 1 | 4 |
| | | | | | | | Hydroptila sp. | 5 | 1 | 68 | -- | 5 |
| | | | | | | | Ochrotrichia sp. | -- | 1 | -- | 15 | -- |
| | | | | | | | Oxyethira sp. | 2 | -- | 4 | 2 | 1 |
| | | | | Hydroptilidae | | | | -- | 1 | 3 | 1 | 10 |
| | | | | | | | Oxyethira sp. | -- | -- | 1 | -- | -- |

| BENTHIC MACROINVERTEBRATE TAXA LIST FOR ALDER CREEK WATERSHED | | | | | | | | AC-1 | | AC-2 | | AC-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 5/10/07 | 5/30/08 | 5/11/07 | 5/30/08 | 5/30/08 |
| Phylum | Subphylum | Class | Order | Family | Subfamily | Tribe | Taxon | | | | | |
| | | | | Leptoceridae | | | | -- | -- | -- | -- | 2 |
| | | | | | | | Mystacides sp. | 5 | 5 | 5 | 2 | 10 |
| | | | | Philopotamidae | | | | | | | | |
| | | | | | | | Wormaldia sp. | -- | 31 | -- | -- | -- |
| | Crustacea | | | | | | | | | | | |
| | | Malacostraca | | | | | | | | | | |
| | | | Amphipoda | | | | | | | | | |
| | | | | Crangonyctidae | | | | | | | | |
| | | | | | | | Crangonyx sp. | 51 | 13 | 46 | 5 | 21 |
| | | | | Hyalellidae | | | | | | | | |
| | | | | | | | Hyalella sp. | 53 | 8 | 14 | 58 | 29 |
| | | Ostracoda | | | | | | -- | -- | -- | 4 | -- |
| | Chelicerata | | | | | | | | | | | |
| | | Arachnida | | | | | | | | | | |
| | | | Trombidiformes | | | | | | | | | |
| | | | | Lebertiidae | | | | | | | | |
| | | | | | | | Lebertia sp. | 1 | -- | -- | -- | -- |
| | | | | Sperchontidae | | | | | | | | |
| | | | | | | | Sperchon sp. | 1 | 1 | -- | 2 | -- |
| **Annelida** | | | | | | | | | | | | |
| | Clitellata | | | | | | | | | | | |
| | | Hirudinea | | | | | | | | | | |
| | | | Arhynchobdellida | | | | | | | | | |
| | | | | Erpobdellidae | | | | -- | -- | -- | -- | 7 |
| | | Oligochaeta | | | | | | 38 | 30 | 20 | 20 | 61 |
| | | | Lumbricina | | | | | 1 | -- | -- | -- | -- |
| **Coelenterata** | | | | | | | | | | | | |
| | | Hydrozoa | | | | | | | | | | |
| | | | Hydroida | | | | | | | | | |
| | | | | Hydridae | | | | | | | | |
| | | | | | | | Hydra sp. | 1 | 1 | 2 | -- | 4 |
| **Mollusca** | | | | | | | | | | | | |
| | | Bivalvia | | | | | | | | | | |
| | | | Veneroida | | | | | | | | | |
| | | | | Sphaeriidae | | | | -- | 1 | 1 | 1 | 1 |
| | | Gastropoda | | | | | | | | | | |
| | | | Basommatophora | | | | | | | | | |
| | | | | Ancylidae | | | | | | | | |
| | | | | | | | Ferrissia sp. | 6 | 5 | -- | -- | 2 |

| BENTHIC MACROINVERTEBRATE TAXA LIST FOR ALDER CREEK WATERSHED | | | | | | | | AC-1 | | AC-2 | | AC-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **5/10/07** | **5/30/08** | **5/11/07** | **5/30/08** | **5/30/08** |
| **Phylum** | **Subphylum** | **Class** | **Order** | **Family** | **Subfamily** | **Tribe** | **Taxon** | | | | | |
| | | | | Physidae | | | | | | | | |
| | | | | | | | Physa sp. | 3 | 2 | 6 | 34 | 41 |
| | | | | Planorbidae | | | | -- | 2 | -- | 3 | -- |
| | | | | Planorbidae | | | | 5 | -- | 3 | -- | 3 |
| | | | | | | | Helisoma sp. | 3 | -- | 1 | -- | 4 |
| **Nemertea** | | | | | | | | | | | | |
| | | Enopla | | | | | | | | | | |
| | | | Hoplonemertea | | | | | | | | | |
| | | | | Tetrastemmatidae | | | | | | | | |
| | | | | | | | Prostoma sp. | 4 | 1 | 1 | 1 | -- |
| **Platyhelminthes** | | | | | | | | | | | | |
| | | Turbellaria | | | | | | 9 | 13 | 5 | 7 | 4 |
| | | | | | | | | 480 | 476 | 487 | 504 | 533 |
| | | | | | | | | | | | | |
| | | | | | | | *Total Organisms Recovered* | 480 | 476 | 487 | 504 | 533 |
| | | | | | | | *Extra Organisms* | 87 | 57 | 143 | 0 | 0 |
| | | | | | | | *QC Organisms* | 1 | 0 | 3 | 6 | 0 |
| | | | | | | | *Total Picked (includes extras + QC)* | 568 | 533 | 633 | 510 | 533 |
| | | | | | | | *Grids Processed* | 0.75 | 0.375 | 0.5 | 2.125 | 0.75 |
| | | | | | | | *Total Grids Possible* | 3 | 3 | 2 | 6 | 4 |
| | | | | | | | *Abundance (#/ sample)* | 2272 | 4264 | 2532 | 1440 | 2843 |