2017 CACHE CREEK ANNUAL STATUS REPORT

***** Public Review Draft – Not Yet Approved by Board of Supervisors *****

Photo Courtesy of Dr. Andrew Rayburn

For the period of:

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Prepared by:

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1.1 PURPOSE OF THE REPORT

Mining has occurred within the Cache Creek channel since before the beginning of the 20th century. Mining operations increased dramatically following World War II. Between the booming post-war economy and the construction of the national highway system the demand for high quality aggregate material, like the material naturally found in Cache Creek, increased exponentially. In the mid-1970's, in response to increased public interest in the environmental ramifications of in-channel mining, as well as the general degradation of the riparian environment along Cache Creek, Yolo County turned its attention towards the development of a comprehensive resource management plan for lower Cache Creek.

For over 20 years, and with the input of numerous stakeholder groups, advisory committees, and public participation, the County toiled to identify an appropriate balance between the mining of aggregate resources, encouragement and preservation of agricultural productivity, protection of water resources, and the enhancement and protection of the riparian environment. The result of this effort is the Cache Creek Area Plan (CCAP); a scientifically based management solution that balances a diverse range of concerns with the overriding vision of enhancing the variety of resource needs for the region. The Cache Creek Area Plan was formerly adopted by the Yolo County Board of Supervisors in 1996.

The CCAP program is administered by the Natural Resources Division of the Yolo County Administrator's Office. The program is funded by fees paid by participating mining operators for each ton of aggregate sold. More information regarding the Gravel Mining Fee Ordinance can be found in Title 8, Chapter 11 of the Yolo County Code, and also Section 7.3.1 of this report.

The CCAP is comprised of two separate, though complimentary, plans – the Off-Channel Mining Plan (OCMP) and the Cache Creek Resources Management Plan (CCRMP). The plan area is approximately 14.5 miles along both banks of lower Cache Creek, spanning from the Capay Dam to the town of Yolo, near Interstate 5 (Appendix A).

The OCMP is a mining plan that restricts location and extent of off-channel mining to approximately 2,123 acres through 2041. The current status of each mining operation along Cache Creek can be found in Appendix B. It governs the mining of aggregate resources (sand and gravel) outside of the channel banks of Cache Creek and the 100-year floodplain, and provides for a minimum 200-foot riparian corridor. The OCMP provides a policy framework and regulations to ensure balanced management of the off-channel corridor of lower Cache Creek. The regulations that accompany this plan generate the resources (including land dedications, funding, and adaptive management) necessary to implement the plan's vision.

The Cache Creek Resources Management Plan, adopted August 20, 1996 and amended August 15, 2002, eliminated in-channel commercial mining (mining inside of the boundaries of the CCRMP in-channel area, generally comprised of the active channel and banks) and established the Cache Creek Improvement Program

(CCIP) to implement on-the-ground projects to improve and/or maintain channel stability and restore riparian habitat. The CCRMP provides a policy and regulatory framework for restoration of 14.5 miles of lower Cache Creek and includes specific implementation standards. The CCIP is the implementation plan for the CCRMP and identifies categories of projects (bank stabilization, channel maintenance, revegetation, and habitat restoration) and general templates and standards for construction.

As a management plan that recognizes Cache Creek and its resources as a dynamic system, the CCRMP is not a static vision of management of the creek. The program is designed to evolve and adapt in response to new creek conditions and improved understanding of creek processes.

Information gathering and landowner participation are critical components in the implementation of the CCRMP and CCIP. The monitoring mandated by the program provides data on stream flow, water quality, erosion, and vegetation that guides creek management recommendations made by the three-member Technical Advisory Committee (TAC). The requirements for this annual monitoring report are contained in Chapter 6 of the CCIP.

The CCIP requires that the TAC complete a physical inspection of Cache Creek each year at the end of the runoff season. This annual inspection is frequently referred to as the "Creek Walk." The CCIP also provides the following description of the role of the TAC in the production of this annual report and clearly identifies the report's intended purpose.

> *"The TAC will produce an annual report in January of each year for the Board of Supervisors that describes the data collected and analysis conducted as part of the monitoring program. The annual report serves as a regular opportunity for the TAC to step back and take a larger perspective in looking at both the creek and at the CCRMP with a critical eye for improvement. Although this is a complex and ambitious project, it is designed to be adaptive, so that monitoring requirements and management techniques can appropriately address the ever-changing riparian environment. In order to be effective, the annual report should not be seen as a chronicle of success or a lackluster recitation of dry data, must reflect thoughtful self-evaluation. Is information being used? Are other forms of monitoring needed? Is there unnecessary or less-than-useful monitoring that can be eliminated or consolidated? Given the limited budget of the CCIP, are activities being carried out in a cost-effective manner and are the most important priorities being emphasized? Are objectives being met? Are the policy and technical assumptions still valid? Fundamental questions such as these should underlie the annual report, so that recommendations made by the TAC take into account the long-term benefit of both the creek and the community. Review of the report by the Board of Supervisors will provide the necessary policy direction, as well as provide an ongoing public forum for focusing the County's attention on the unique issues that concern Cache Creek."*

~ Cache Creek Improvement Program (page 41)

1.2 PROGRAM HIGHLIGHTS

Yolo County has implemented an annual monitoring program since 1997. For Water Year 2017, the highlights of these efforts include the following:

1) In November 2016, the second year of the required five years of **mercury sampling in off-channel mining wet pits** (Section 10-5.517, OCMP) was conducted, utilizing the services of Dr. Darrel Slotton. The Year #3 sampling event is scheduled to take place in November 2017. The report for the first year (2015) was published on the Natural Resources webpage in May 2017 and is attached to this report as Appendix C. County staff is currently reviewing the draft report for year two (2016) mercury monitoring.

2) There was **one surface water quality sampling** event this water year, which occurred on December 16, 2016. The samples from this event were analyzed for a suite of water quality constituents. A detailed discussion of these results is included in Chapter 3.

3) Three public **Cache Creek Technical Advisory Committee (TAC) meetings** were held during Water Year 2017: April 20, 2017, June 13, 2017, and August 22, 2017. These meetings were attended by TAC members, County staff, members of various partner agencies, program stakeholders, and the public.

4) On March 7, 2017, the Yolo County Board of Supervisors approved the **repeal of the sunset date of County's nighttime OHV ban ordinance**. In January 2016, the Board of Supervisors approved an ordinance banning the use of off-highway vehicles (OHVs) in Cache Creek between the hours of 7:00 p.m. and 6:00 a.m. This ordinance was set to expire on February 15, 2017 if the one-year sunset date was not repealed. More information on the ordinance and its related components can be found in Section 7.2.4.

5) On March 17, 2017, the Natural Resources Division released the **"2017 Technical Studies and 20-Year Retrospective for the Cache Creek Area Plan**." This report was prepared by the three TAC members and contains three individual reports, one specific to each of the three CCAP scientific disciplinary areas – fluvial geomorphology, hydrology and water quality and biological resources. This report was the result of an extensive technical analysis of collected data, other available information and analysis and conditions within the creek and is a key component of driving the proposed draft edits in the CCAP 20-Year Update. The 2017 Technical Studies provide an update to the 1995 Technical Studies. Appendix D includes a web link that takes you to the online version of the 2017 Technical Studies.

6) On May 8, 2017, the Natural Resources Division released draft proposed updates to the Cache Creek Area Plan as a part of the **CCAP 20-Year Update**. The purpose of this update is to analyze trends and adjust the program to avoid unexpected effects on resources management, particularly focusing on changes in creek conditions that have occurred over the prior 20 years;

analysis of collected data from monitoring programs, habitat restoration, channel stabilization, and reclamation efforts; and the existence of any new regulatory requirements. The CCAP 20-Year Update is anticipated to be completed by mid-2018.

7) The TAC conducted its **2017 Creek Walk on July 12-14, 2017.** The Creek Walk is the annual physical inspection of the creek with the main purpose of documenting channel conditions, as required by the CCIP. The entire length of the CCRMP boundary is covered over the three days. Joining the TAC on this year's Creek Walk was County staff, representatives from the gravel mining industry, program stakeholders, and members of the public. TAC observations from the 2017 Creek Walk are provided as Appendix E.

8) On July 31, 2017, the County released the **Draft Cache Creek Area Plan Parkway Plan** and **Draft Feasibility Study** for public review. The Parkway Plan provides a vision and integrated management plan for open space properties the County already owns, or will receive title to, as a result of the long-term partnership with the local aggregate mining industry. The Draft Parkway Plan, which was produced by Callander Associates and Tschudin Consulting Group, provides draft guidelines and specifications for development, access, use and management of each property, including the development of a trail system and public access. The accompanying Draft Feasibility Study, which was produced by BAE Urban Economics, analyzes the financial feasibility of various levels of parkway development, by identifying operations and maintenance and capital improvement costs of each property, along with potential revenues generated by public usage.

9) In September 2017, Towill Inc. conducted an **aerial survey** for the Lower Cache Creek area. This survey included the simultaneous capture of LiDAR and high-resolution aerial imagery. The data obtained from this survey was instrumental in the production of this annual report.

10) In October 2017, the Natural Resources Division released the **Cache Creek Area Plan Dashboard website**. This site provides real-time access to the primary data used by the Cache Creek TAC, the County, mining companies and other stakeholders. The data included on the site is important to the implementation of the Cache Creek Area Plan. Access to the data is organized in the form of a data "dashboard" that displays key information over time related to water resources, geomorphology, and vegetation and wildlife. New data will be uploaded to the site after the adoption of each Cache Creek Annual Status Report. The website was designed and created by the TAC Geomorphologist and TAC Hydraulic Engineer.

11) The County's Manager of Natural Resources continues to serve as the **Chair of the Water Resources Association (WRA) of Yolo County's Technical Committee** and was made Chair of the Westside Coordinating Committee for a two-year term, highlighting this program's value in providing watershed monitoring and protection.

1.3 SUMMARY OF SIGNIFICANT FINDINGS

Based on monitoring, analysis, regulatory requirements, and professional experience the TAC has made the following findings. This document makes reference to reaches and "river miles" to describe the physical location of observations and recommendations. A map of Cache Creek showing river mile markers is provided as Appendix A.

1.3.1 Hydrologic and Water Quality Findings

The 2017 Water Year was a very wet year for Cache Creek, the Sacramento River Valley, and the state of California. The Sacramento River Index classified 2017 as a "wet" year for the Sacramento River, which produced more than double the total runoff in 2017 as in 2016. The 2017 water year was wetter than has been observed for several years. Flows at Yolo exceeded 2,000 cubic feet per second (cfs) continuously between early January and mid-March 2017. During this period, there were multiple large runoff events, including nine above 10,000 cfs, four above 15,000 cfs, and two above 20,000 cfs. This hydrology in 2017 produced some dramatic changes in Cache Creek including significant sediment transport and channel change. Water quality sampling data remained within or below the ranges measured in previous years and did not exceed any recommended contaminant limits. Some contaminants continued to be not detected in water year 2017 as in the last several years.

1.3.2 Geomorphology Findings

As mentioned in Section 1.3.1, Water Year 2017 was extremely wet, which led to significant activity with respect to geomorphology. Flows exceeded 20,000 cfs (approximately a 5-year event) twice, and were above 10,000 cfs for extended periods of time. More sediment was transported in Water Year 2017 than in the entire period between 2007 and 2016. Water Year 2006 was the last year with a similar level of geomorphic activity as Water Year 2017. While the peak flow in Water Year 2006 exceeded the peak flow in Water Year 2017 (29,900 cfs in 2006 vs. 21,200 cfs in 2017), Cache Creek experienced more peak flow events and significantly longer periods of elevated flows in 2017 than in 2016. Widespread channel change including bank erosion, bed scour, and bed deposition occurred in 2017 and may have been even more extensive than in 2006 due to the multiple periods of increasing and decreasing flows and the extended periods of elevated flows. All locations with previously documented channel change experienced change in Water Year 2017, and some new locations changed significantly and have been added to the list of sites monitored by the Cache Creek TAC. In addition, Cache Creek appears to have shifted from a net-depositional condition between 1997 and 2011 to a net-erosional condition between 2011 and 2017. The net loss of sediment from the CCRMP area during this period was largely driven by the extensive bank erosion and lateral channel migration that occurred in Water Year 2017. Therefore, there were still large areas (primarily mid-channel bars) that were net-depositional during this most recent period where bar skimming and other in-channel maintenance actions could improve stability in Cache Creek.

1.3.3 Biological Resources Findings

The condition of biological resources in 2017 was markedly different than conditions observed in 2016, primarily due to the significant loss of vegetation caused by high flows (see Chapter 5). Herbaceous vegetation that had been observed increasing in the main channel in recent years was scoured away in many locations. Large patches of woody vegetation, including both willow scrub and riparian forest, were also removed along banks in several reaches due to channel meander and subsequent erosion. In addition, at least one past revegetation project was almost completely washed away. Native vegetation was again observed to be creating potentially adverse conditions in some locations; however, no actions are yet required other than continued annual monitoring.

Invasive species are still widespread in many locations along lower Cache Creek, although the intensive treatment of arundo, ravennagrass, and tamarisk that has occurred since 2006 with funding from the Wildlife Conservation Board has greatly reduced the extent of these three species. However, many additional invasive species (e.g., Himalayan blackberry, perennial pepperweed, and tree tobacco) are now common along lower Cache Creek, and should be prioritized for treatment and monitoring. After treatment, native species should be planted to enhance habitat and reduce the potential for reinvasion.

Many common and special-status species of wildlife, invertebrates, and fish were again observed by the TAC and others during the annual Creek Walk. Special-status species observed included Swainson’s hawk (State threatened), and Western pond turtle (State species of special concern). Additional species of note included mink, Mexican free-tailed bat, blue grosbeak, least sandpiper, lesser nighthawk, and red-shouldered hawk.

Significant opportunities for habitat enhancement and restoration were again noted in 2017, including the PG&E “Palisades” (River Mile [RM] 26.8), the Hayes “Bow-Tie” property (RM 20), the Millsap property (RM 18.5), the Wild Wings property (RM 17), and the Correll-Rodgers properties. Based on 2017 Creek Walk observations, the long-term resilience of revegetation and restoration projects within or adjacent to the active channel should be carefully considered prior to implementation, since such projects can be negatively impacted or completely removed by high flows.

1.4 SUMMARY OF 2017 RECOMMENDATIONS

There are a number of new recommendations identified below. Recommendations from the previous Annual Status Reports remain applicable and are listed in Chapter 6. If accepted by the Yolo County Board of Supervisors, the 2017 recommendations will be merged with previous year’s recommendations and the TAC will be tasked with prioritizing all the recommendations for review and/or implementation going forward. Chapter 6 of this report provides a listing of TAC recommendations from the most recent five years as well as the implementation status of each recommendation.

1.4.1 Hydrologic and Water Quality Recommendations

The TAC Hydraulic Engineer recommends the following:

- Capay Dam – Remedies to prevent future damage of the dam and movement of the dam's concrete pads into the channel should be undertaken.
- PG&E Palisades – The erosion control blanket and all associated infrastructure be removed and the palisades either be removed entirely or cut at or below ground level and revegetation/natural stabilization project be implemented.
- Erosion sites identified (Jensen Bend, Granite Esparto, Esparto Bridge, Woodland Reiff, south bank of RM 23.3, Teichert Esparto, and Payne Property) should continue to be monitored in the future.
- Longitudinal profiles of water surface elevations should be performed in the future, similar to the efforts on January 9, 2017 (more information is described in Section 3.3), to assist in calibrating the hydraulic model of Cache Creek developed in 2016. The TAC Hydraulic Engineer recommends mobilizing for survey for a predicted flow in excess of 30,000 cfs in the winter of 2017-2018.
- Work with water quality analytical lab to improve coliform testing.

1.4.2 Geomorphology Recommendations

As in previous years, geomorphology recommendations for Water Year 2017 are in three general categories: monitoring, evaluation, and implementation. Nearly all of the areas with previous documented channel change, as well as several new areas with significant channel change, have updated recommendations this year. The TAC Geomorphologist recommends the following:

- Accelerate voluntary implementation of previously recommended bar skimming projects at RM 25 and RM 20.
- Evaluate the potential for additional bar skimming at RM 21 and RM 22.
- The PG&E Palisades experienced significant damage in Water Year 2017 which elevated the importance of the TAC's previous recommendation to remove the Palisades infrastructure from Cache Creek.
- Some channel change was documented in the vicinity of all bridges in the CCAP area, therefore it is recommended that the County notify bridge owners and continue monitoring conditions at all bridges.
- Channel migration and erosion in several locations (RM 26, 25.5, 23.5, 22, 21.5, and 18) was in

close proximity to program boundaries (i.e. the Test 3 or its proposed replacement Channel Form Template). The TAC Geomorphologist recommends detailed monitoring and assessment of the need for treatment at each of these locations.

- Fine sediment deposition near Huff's Corner appeared to increase in Water Year 2017, prompting a new TAC recommendation for detailed monitoring in this location and an evaluation of the need to remove deposited fine sediment.

- Finally, as in Water Year 2016, the TAC geomorphologist recommends the TAC and County work together to develop a comprehensive invasive species removal, ecosystem restoration, flood management and water supply bundle of projects based on prior TAC recommendations and submit a Proposition 1 grant proposal to fund such projects in 2018.

1.4.3 Biological Resource Recommendations

Recommendations regarding biological resources are grouped into four general categories: native vegetation (Section 5.1.5), habitat restoration (Section 5.2.3), invasive species management (Section 5.3.2), and special-status species (Section 5.4.2).

- Recommendations regarding **native vegetation** focus on monitoring and management actions intended to understand changes in native vegetation and to accelerate recovery of native habitat.

- Recommendations regarding **habitat restoration** highlight high-priority potential projects, the importance of including native understory species, the need for post-implementation monitoring, and the importance of planting native species on invasive species treatment sites, and the potential for increased surface flows to accelerate native habitat recovery.

- Recommendations regarding **invasive species management** include expanding the list of priority species and the areas in which treatments are implemented, the importance of a formal monitoring program to track invasive species, the need to remove treated biomass from the CCRMP area, the importance of planting native species on invasive species treatment sites, and the need to leverage invasive species treatment within the CCRMP area to support additional mapping and treatment upstream of Capay Dam.

- Recommendations regarding **special-status species** focus on the need for additional monitoring and documentation of both rare and common species, documentation of observations, and the potential for increased surface flows to benefit Western pond turtle and other native species.

CHAPTER 2 - ANNUAL MONITORING REPORT

This section describes the data collected and analysis conducted as part of the annual monitoring program. The TAC provides recommendations below based on data, trend analysis, and field observations. The CCRMP and CCIP recommendations are designed to be adaptive, so that monitoring requirements and management techniques can appropriately address the ever-changing channel and riparian environment of Cache Creek.

Also included in this section are brief descriptions of annual monitoring activities, including results from previous years, review of in-channel Flood Hazard Development Permits (FHDPs), review of habitat restoration proposals, and changes from previous years.

2.1 TAC REVIEW OF PROJECTS AND PROPOSALS

2.1.1 Flood Hazard Development Permits

The TAC did not review any Flood Hazard Development Permits in 2017.

A Flood Hazard Development Permit was approved in 2015 for the Pacific Gas and Electric Company (PG&E) for the relocation of their 400 and 401 pipelines. This work involved the installation of new pipelines approximately 50 feet below the bed of Cache Creek and was completed in 2016. Since that time, the County and PG&E have engaged in conversations on how to deal with the remaining infrastructure. On March 14, 2017, the County submitted a letter to PG&E that contained comments from the TAC on the *2014 Final Report for the PG&E Project Line 400/401, Cache Creek Erosion Study*. On June 21, 2017, County staff and the TAC Hydraulic Engineer met with PG&E staff and their consultant team to discuss next steps. This group met again on August 31, 2017 in the field at the PG&E Palisades site, also in attendance was the landowner whose property the Palisades are located. After the field visit, the County sent a letter on September 19, 2017 following up on the County's preference on full removal of the Palisades infrastructure.

2.1.2 Granite Capay Bank Stabilization Project

In July 2017, the TAC Geomorphologist reviewed a proposal from Granite Construction for a bank stabilization project. Granite proposed to stabilize approximately 900 linear feet of the north bank of the Cache Creek channel at the eastern end of their Capay mining facility, just west of County Road 87, near river mile 24.5. This area experienced significant erosion from the sustained high-flow conditions and multiple extreme peak flows that occurred during the 2016-2017 winter. After reviewing the project, Dr. Tompkins submitted a Letter of Support to Granite Construction. Additionally, the Manager of Natural Resources submitted a Letter of Support for the project on behalf of the County.

2.2 RECOMMENDED CHANGES TO MONITORING PROGRAM

This section includes recommendations for changes in the monitoring program to ensure effectiveness and minimize cost, including recommendations for periodic updates and refinements of existing protocols, and recommended changes in the intensity and location of data collection activities as the channel adjusts over time.

2.2.1 Ambient Mercury Testing Protocols

In 2011, the County contracted with Dr. Darell Slotton (UC Davis) to study ambient mercury levels in fish and invertebrates in both Cache Creek and several off-channel mining pits. The results of this study were provided to the County in 2013 and are available on the Natural Resources webpage. The purpose of that study was to update baseline mercury bioaccumulation conditions in certain locations along Cache Creek. Mercury monitoring in wet pits is a requirement of the County's Surface Mining Reclamation Ordinance (Section 10-5.517).

In 2014, the County again contracted with Dr. Slotton to create a set of mercury monitoring protocols for the gravel producers to use when testing "wet pits" at mining operations where depth of mining has reached groundwater. The intent of these protocols is to ensure minimum performance standards for the collection and analysis of mercury data. A version of these protocols was attached to the 2015 Cache Creek Annual Status Report and were inappropriately listed as the final version. To correct this mistake, the finalized protocols will be adopted as a part of the Cache Creek Area Plan Update.

2.2.2 Aerial Survey Protocols

The TAC recommended, and the Board of Supervisors approved as part of the 2012 Annual Report, a change to the aerial surveys monitoring program described in the CCIP. The monitoring program could be as effectively implemented at significantly less cost if the aerial surveys were performed every five years, or after a "major event." A major event was defined by the TAC as "an event with peak flows of 25,000 cfs or more." Based on channel changes observed during Water Year 2015, the TAC recommends revising the definition of a major event as "an event with peak flows at the U.S. Geological Survey (USGS) Yolo streamflow gage of 20,000 cfs or more."

The program implemented a drone-based aerial survey data collection program in Water Year 2015 to realize significant cost savings (approximately 60-80%) estimated based on previously completed manned, fixed-wing surveys. While the drone surveys provided useful high-resolution aerial photography, the development of topographic data was challenged by issues related to survey control, vegetation, and other difficulties typical of working in and along river corridors. The TAC recommends continuing to explore drone-based aerial survey data collection both at the scale of the CCAP and for individual, smaller-scale projects, but further recommends that future contractors be required to demonstrate competence in both large-scale river survey data collection and drone-based data collection technology. In addition, the TAC recommends that LiDAR data be collected at the same time, and preferably by the same contractor, as high-resolution aerial photography.

The above recommendations were incorporated into the 2017 aerial survey performed by Towill, Inc.

2.2.3 Surface Water Testing

In 2012, the water quality sampling protocol was changed to sample three sites: CC10 – Capay Bridge, CC12 – Gordon Slough, and CC14 – I-5 Bridge. Sampling was also changed to one event per year unless additional events were warranted based on the recommendation of the TAC Hydraulic Engineer due to detections of contaminants in the first sampling event.

In 2015, due to elevated concentrations of several contaminants compared to the last several years, the TAC Hydraulic Engineer recommended sampling the two previously excluded sites (CC11 - Upstream of Gordon Slough and CC13 - Stephens Bridge) for the 2016 first flush event for the contaminants that were found at relatively high levels (TKN, TON, OP, Mercury, and TSS).

In 2017, the TAC Hydraulic Engineer recommends that appropriate measures to ensure reporting of the actual count of coliform (total and fecal) be performed. For several years, the analytical lab performing testing of the program’s water quality samples reports coliform concentrations as “>1,600” per mL. Because of this, the program cannot effectively assess coliform counts in Cache Creek.

CHAPTER 3 – HYDROLOGY

The 2017 Water Year was a very wet year for Cache Creek, the Sacramento River Valley, and the state of California. While 2016 represented a break from the 2012-2015 drought, the Sacramento River Index classified 2016 as a “below normal year.” By contrast, Water Year 2017 was classified as a “wet” year for the Sacramento River, which produced more than double the total runoff in 2017 as in 2016. This hydrology in 2017 produced some dramatic changes in Cache Creek including significant sediment transport and channel change.

This chapter describes the water quality, watershed hydrology, and flood monitoring prescribed by the Cache Creek Resources Management Plan and the Cache Creek Improvement Plan, all of which were likely influenced by the wet conditions and heavy runoff that occurred in Water Year 2017.

3.1 WATER QUALITY

3.1.1 Background

The CCRMP (3.4-3) requires water quality sampling at least once per year at the upstream and downstream ends of the CCRMP area during the “first flush” flow event. The CCRMP water quality monitoring program continues to use the services of the Yolo County Flood Control and Water Conservation District, under the supervision of the TAC Hydraulic Engineer, to conduct the surface water quality monitoring. The program’s water quality monitoring results are included in the Water Resources Information Database (WRID), a shared resource that is managed by the Yolo County Flood Control and Water Conservation District and available for public review by contacting the District.

3.1.2 Water Year 2017 Sampling Event

Water Year 2017 began with a large event between 12/15/16 and 12/16/17 that produced over 3,000 cfs at Yolo. The only water quality sampling event of Water Year 2017 occurred on December 16, 2016 at all five sites. Based on historical detections and trends in contaminants in Cache Creek, the sampling program has been streamlined so that not all contaminants are analyzed in the samples from Upstream of Gordon Slough (CC11) and Stephens Bridge (CC13). Table 1 summarizes the date and flow on Cache Creek during the sampling event.

Table 1: Water quality sampling dates and flows summary.

Sampling Date	Cache Creek Flow at Rumsey	Cache Creek Flow at Yolo	Notes
12/16/2016	~1,500 cfs	~3,000 cfs	Samples taken just after event had peaked at Rumsey and approximately at the peak of the event at Yolo.

Surface water data is coded and categorized in the WRID as shown in Table 2. The five monitoring locations shown on a map in Appendix F.

Table 2: Water quality sampling locations and codes.

Site Name	Site Code
Cache Creek at Capay Bridge	CC10
Cache Creek Upstream of Gordon Slough	CC11
Gordon Slough near Cache Creek	CC12
Cache Creek at Stephens Bridge	CC13
Cache Creek at I-5 Bridge	CC14

3.1.3 Water Quality Overview

This report describes trends and significant changes in water quality observed in the Water Year 2017 water quality monitoring data. At the five sites sampled on December 16, 2016, pH, temperature, total dissolved solids (TDS), ammonia nitrogen, nitrate nitrogen, and nitrite nitrogen remained within or below the ranges measured in previous years and did not exceed any recommended contaminant limits. Trace organic contaminants, such as total petroleum hydrocarbons as diesel and various pesticides continued to be not detected in Water Year 2017 as in the last several years. The dissolved oxygen probe malfunctioned in the field during the sampling are no values are reported for this year. Observations for other key contaminants are described in further detail on the following pages.

3.1.4 Water Quality Summary for Key Contaminants

Boron

Boron is a naturally occurring contaminant in the Cache Creek watershed and Yolo County is one of the counties in California with the highest levels of boron in groundwater wells. While boron is not a regulated contaminant, many agricultural crops are sensitive to boron concentrations and boron can cause toxicity in drinking water. California's drinking water standard for boron is 1,000 μg/l.

Boron was present in Water Year 2017 at similar concentrations to previous years, and generally lower than observed in 2016 and 2015. At the I-5 Bridge location, boron was detected slightly above the California drinking water standard (1). The TAC Hydraulic Engineer recommends no specific action other than continued attention to boron concentrations.

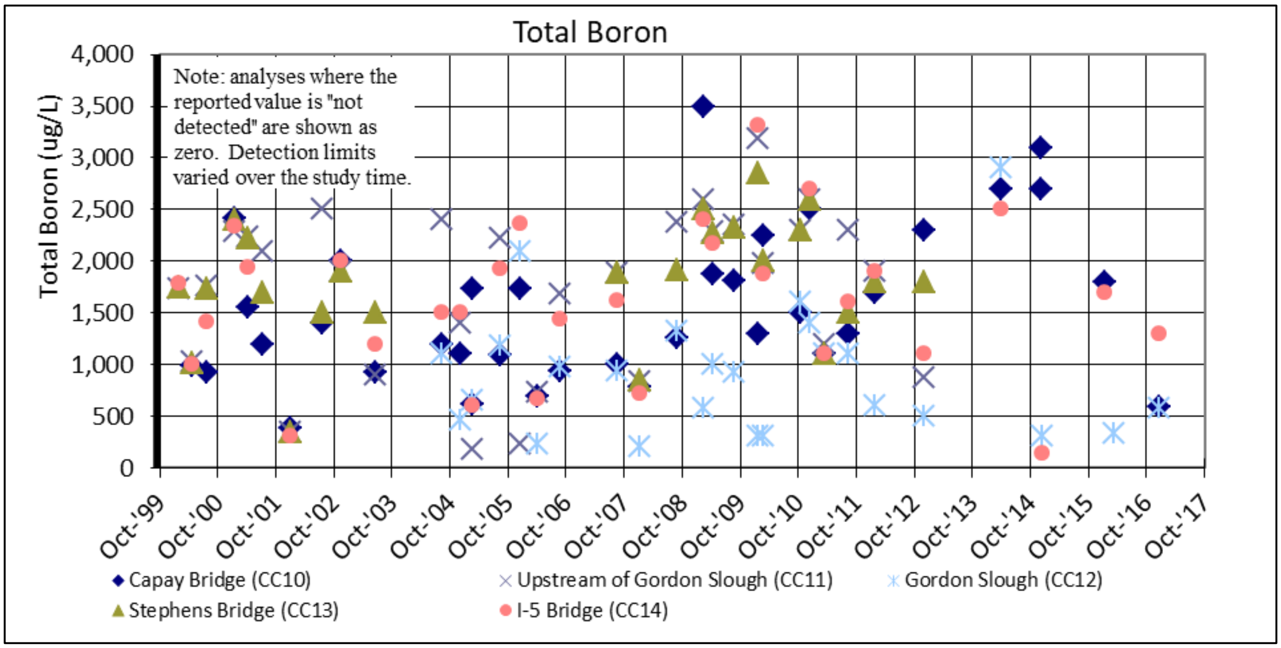

Figure 1: Boron concentrations in the CCRMP area from Water Year 1999 through Water Year 2017.

Dissolved Oxygen

Oxygen is required by invertebrates, fish, and many other kinds of wildlife found in Cache Creek. Oxygen dissolves in water from the atmosphere and from photosynthesis of algae and plants growing in the water. It is used up by respiring animals and microorganisms decomposing organic matter. Therefore, dissolved oxygen can fluctuate in Cache Creek based on many factors including sunlight (which increases photosynthesis and oxygen production), turbidity in the water (which shades the water, reducing light penetration and photosynthesis), and amount of organic material (which increases microbial activity and depletes oxygen.

As mentioned above, the dissolved oxygen probe malfunctioned during the December 16th sampling event. As a result, no values are reported for this year.

Fecal Coliforms

Fecal coliforms in water year 2017 continued to exceed the recommended range for swimming contact and total coliforms remain relatively high. The most likely source of total and fecal coliform bacteria in Cache Creek is fecal material from the intestinal tracts of wildlife, livestock, pets, or humans in the watershed. Fecal coliform bacteria multiply rapidly after introduction, especially during warm, low flow summer conditions.

The laboratory detection limits for coliforms in this year's analysis (1,600 /mL) are too low to actually resolve the concentrations. The TAC Hydraulic Engineer recommends notifying the analytical laboratory in future years to modify their procedures so that coliform concentrations can be resolved.

Total Suspended Solids

Total Suspended Solids (TSS) concentrations were more consistent throughout the study area than the previous two years, but at most sites were higher than historical averages (Figure 2). However, the samples were taken at a relatively high flow (3,000 cfs at Yolo) which may have been more likely to be carrying higher suspended sediments than typical storm events.

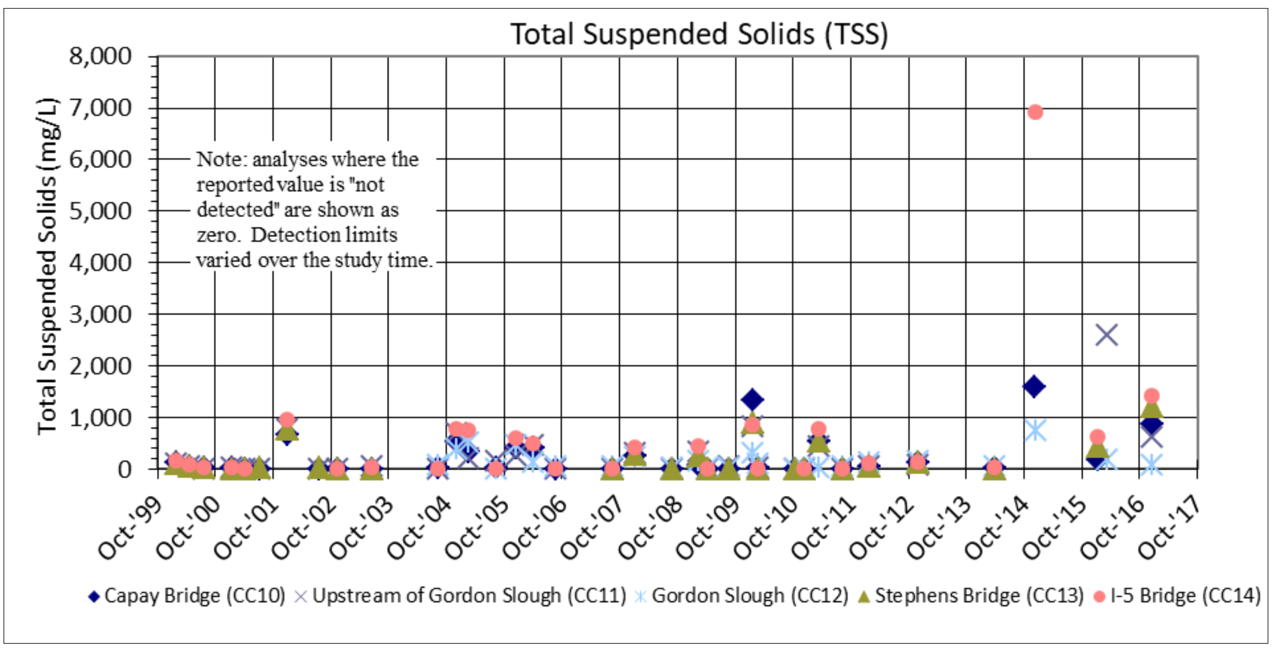

Figure 2: Total Suspended Solids concentrations in the CCRMP area from Water Year 1999 through Water Year 2017.

Mercury

Mercury concentrations – both total and dissolved – showed more consistent concentrations throughout the CCRMP area than in previous years (Figure 3 and Figure 4). After spikes in mercury at the Capay Bridge and I-5 Bridge in water year 2015, the samples analyzed in water year 2017 were lower but still a bit higher than levels typically seen in 2010-2014.

Total mercury concentrations exceeded the California Toxics Rule (CTR) threshold of 0.05 micrograms per liter at all sites. Dissolved mercury concentrations were lower than both 2015 and 2016. It is not clear why mercury levels continue to be elevated relative to 2010-2014. In a notable difference from recent years, most of the mercury was present as particulate-attached mercury, rather than as dissolved mercury. Because total suspended solids were higher than typical in this year's samples, and the flow during sampling was near the storm peak, higher levels of fine sediment particles in the samples may explain why more mercury was associated with particles rather than dissolved.

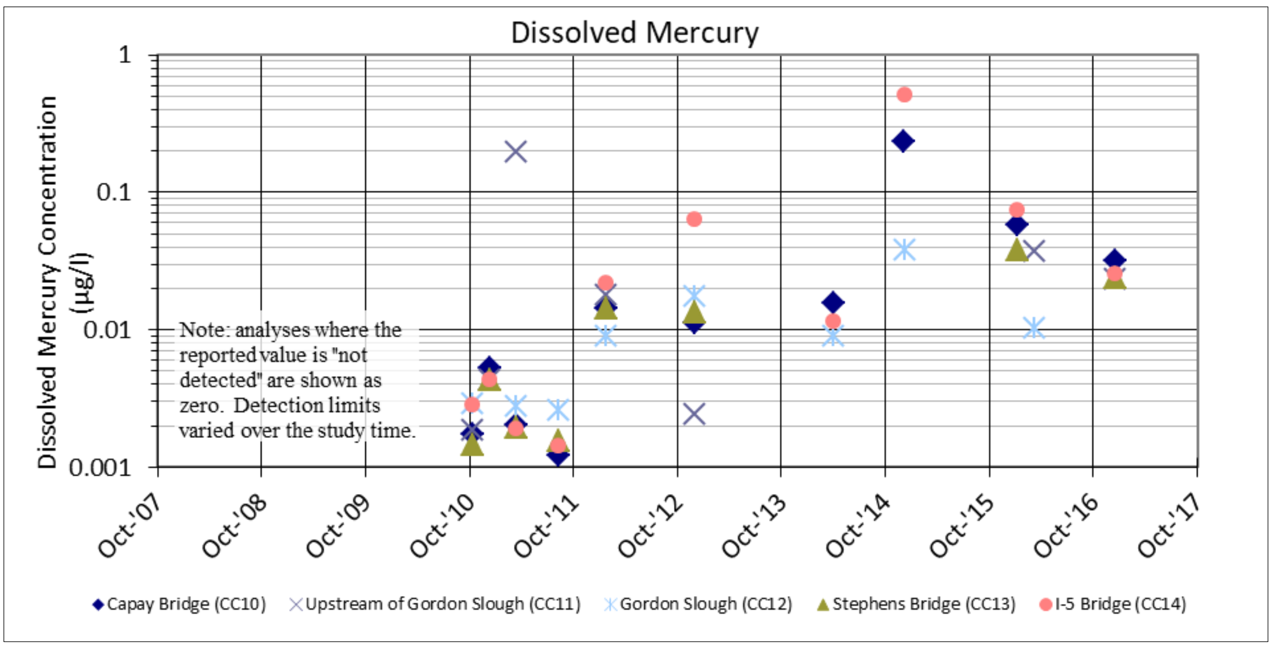

Figure 3: Dissolved mercury concentrations in the CCRMP area from Water Year 2008 through Water Year 2017.

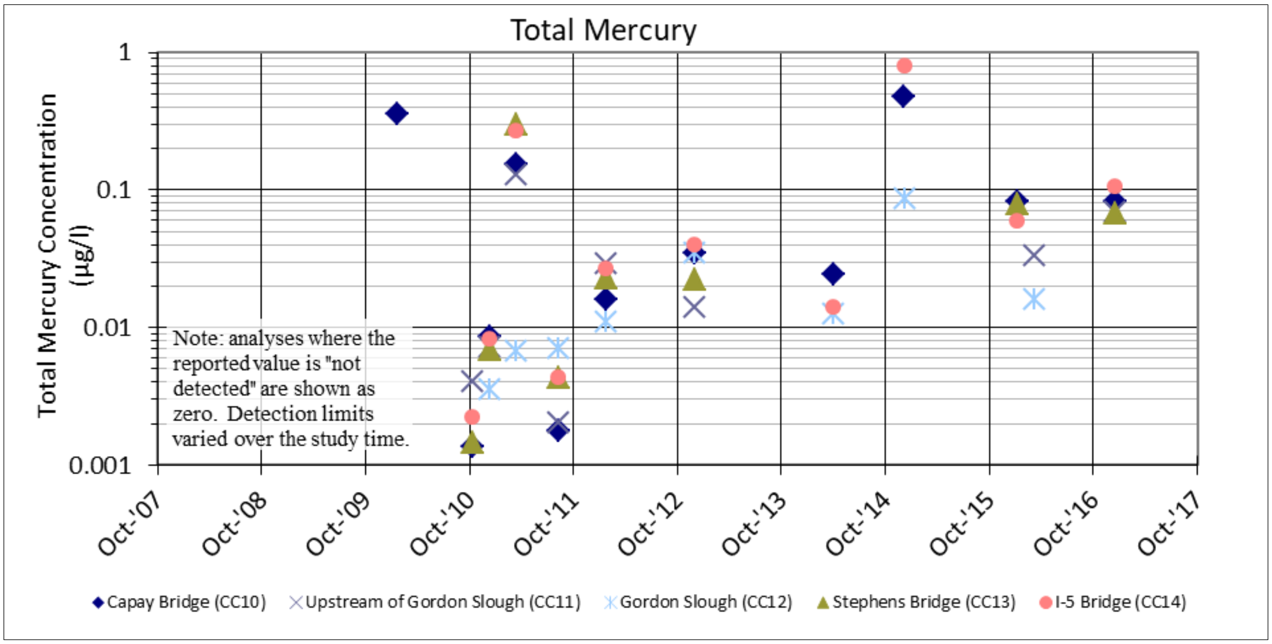

Figure 4: Total mercury concentrations in the CCRMP area from Water Year 2008 through Water Year 2017.

In addition, as previously recommended, the TAC Hydraulic Engineer continues to recommend continuation of coordination with other entities assessing broader mercury issues in the Cache Creek watershed, including the California Department of Water Resources (DWR), the Central Valley Regional Water Quality Control Board (RWQCB), the US Geological Survey (USGS) and the Bureau of Land Management (BLM) to ensure that relevant mercury information is shared with the broader on-going mercury studies.

Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen (TKN) concentrations were higher in Water Year 2017 than 2016 but were in line with historical levels (5). The TAC Hydraulic Engineer recommends no specific action other than continued attention to all nitrogen species concentrations in the future to determine if the spike in TKN 2015 was anomalous.

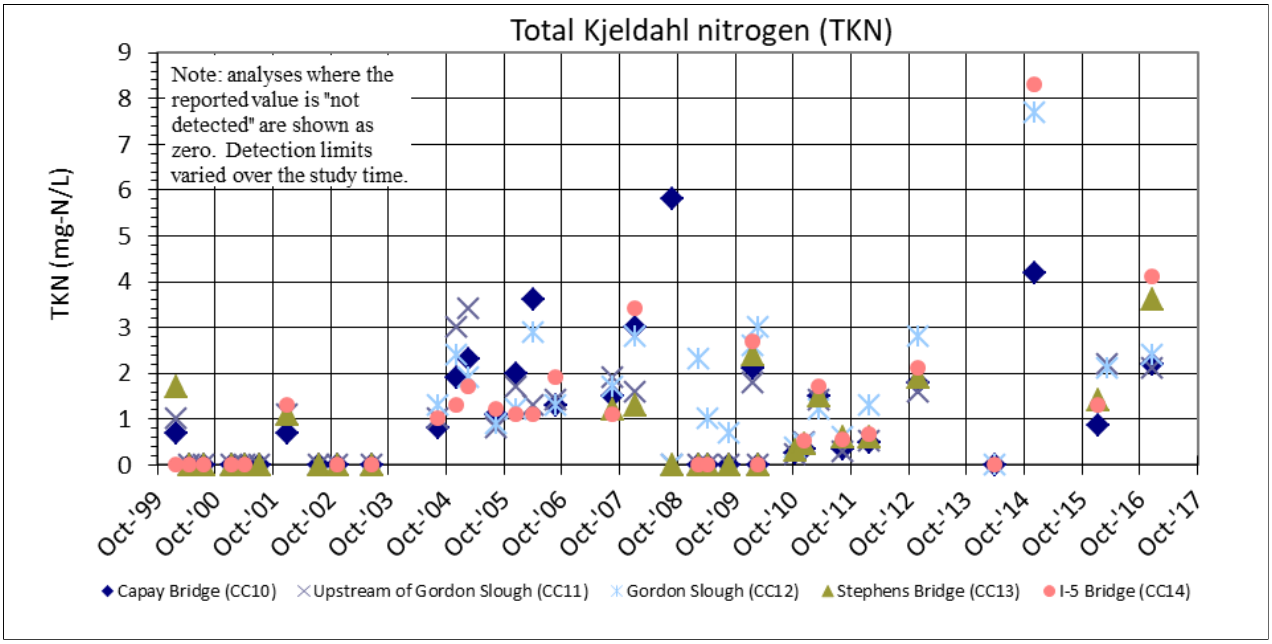

Figure 5: Total Kjeldahl Nitrogen concentrations in the CCRMP area from Water Year 1999 through Water Year 2017.

Orthophosphate

Orthophosphate concentrations in Water Year 2017 samples were typical of previous years and similar to 2016. The Gordon Slough site continued to exhibit the highest concentrations of all sites sampled as has typically been the case (Figure 6).

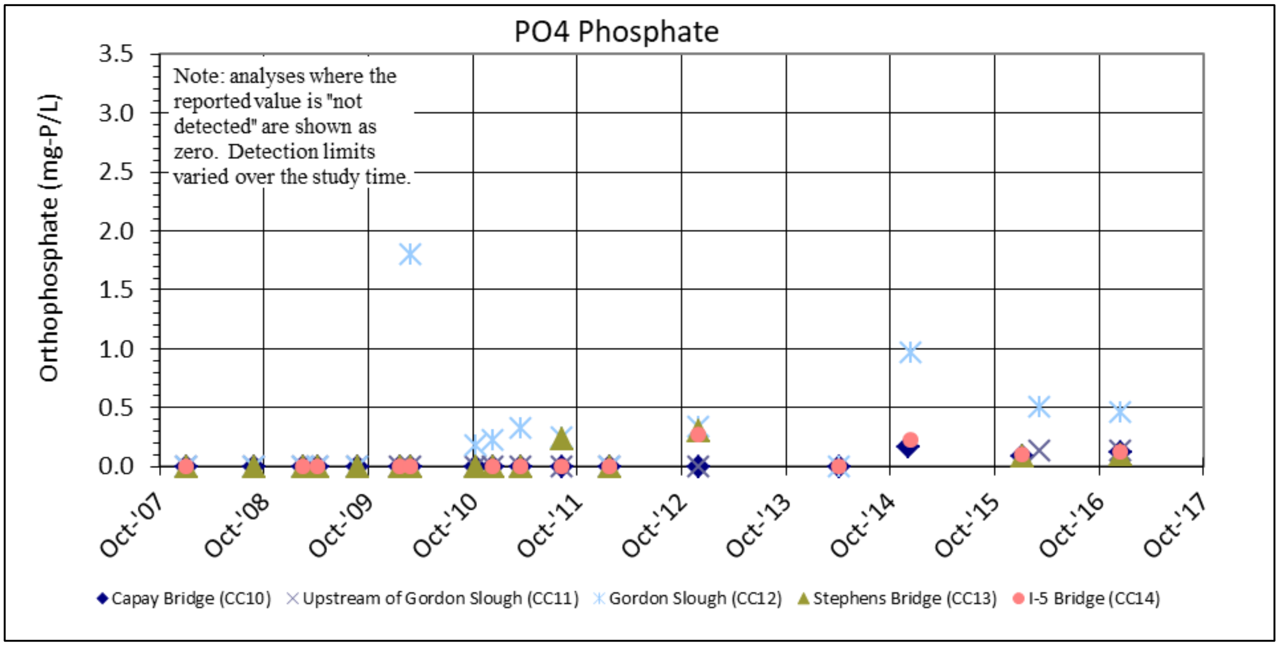

Figure 6: Total Orthophosphate concentrations in the CCRMP area from Water Year 2008 through Water Year 2017.

Vehicle Boneyard Water Quality Risk

The County has been engaged in code enforcement activities for many years at a private property on the south bank of Cache Creek approximately 1,500 feet upstream of the Capay Bridge (CR 85). The property is referred to as the "Vehicle Boneyard" because of the number of non-operative vehicles and vehicle parts located in the floodplain.

In previous years, the TAC determined that between 2002 and 2005, bank erosion adjacent to the Vehicle Boneyard had substantially reduced the distance between the channel and the junkyard. During the 2017 Creek Walk, the TAC Hydraulic Engineer did not notice substantive new erosion at the site, but continues to recommend continued monitoring of the distance between the creek and the boneyard, especially after high peak flows, until the subject vehicles have been removed.

3.2 SUMMARY OF ANNUAL WATER DISCHARGE DATA

Peak flows in Cache Creek are an important driver of sediment transport processes as well as water quality conditions in the CCRMP area. The CCIP requires that the TAC monitor hydrology at the upstream and downstream ends of the CCRMP area and this annual report summarizes this monitoring, with a focus on observations and conditions not already documented in previous annual reports. The 2017 Water Year was wetter than has been observed for several years. Flows at Yolo exceeded 2,000 cfs continuously between early January and mid-March 2017. During this period, there were multiple large runoff events, including nine above 10,000 cfs, four above 15,000 cfs, and two above 20,000 cfs.

The largest storm peaked at Rumsey on January 8, 2017 at 21,500 cfs and at Yolo on January 9, 2017 at 21,200 cfs (Figure 7). Another storm event on February 18, 2017 also exceeded 20,000 cfs. These events represent approximately 5-year return interval flow events for Cache Creek. Figure 8 below compares instantaneous flows at the Rumsey (upstream) and Yolo (downstream) gages during the period of recorded flows in Cache Creek (approximately 12/01/2016 through 4/30/2017). The 2-year return interval flow for Cache Creek is approximately 11,000 cfs, meaning that in addition to the two ~5-year events, five more events of a magnitude between the 2- and 5-year return interval occurred while two events in January reached 10,000 cfs.

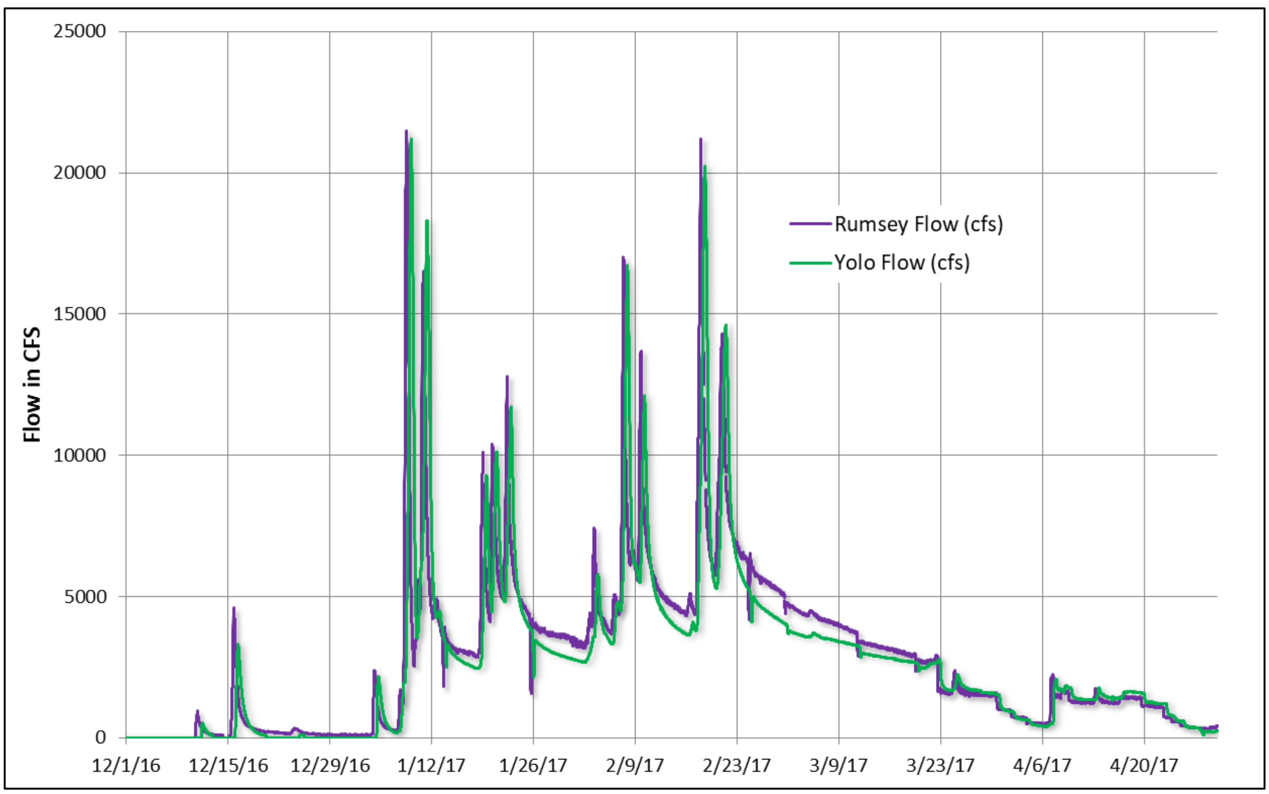

Figure 7: Instantaneous (i.e. hourly) flows between 12/01/2016 and 04/30/2017 at the Rumsey and Yolo gages.

3.3 SUMMARY FLOOD MONITORING

The CCIP (Section 6.3) specifies a trigger for flood monitoring during each day that a discharge of 20,000 cfs occurs at the Rumsey gage. This threshold was met twice during Water Year 2017. No flooding in the CCRMP area was reported during this event or the February 18, 2017 event that reached 20,200 cfs.

As part of an effort to calibrate a 2D hydraulic model of Cache Creek within the CCRMP area, a longitudinal water surface elevation profile was surveyed on January 7, 2016 (during which flows at Cache Creek at Yolo were approximately 18,000 – 19,000 cfs) throughout the CCRMP area. The survey included both water surface elevations at the time of survey and high water marks from the overnight January 8-9 peak event that reached 21,200 cfs at Yolo.

As shown in Figure 8, the hydraulic model predictions matched the surveyed water surface elevations very well.

Similar water surface elevation profiles are recommended to be surveyed in the future during larger events to further calibrate the hydraulic model, and any discrepancies between water surface elevation surveys and Yolo gage data should be noted.

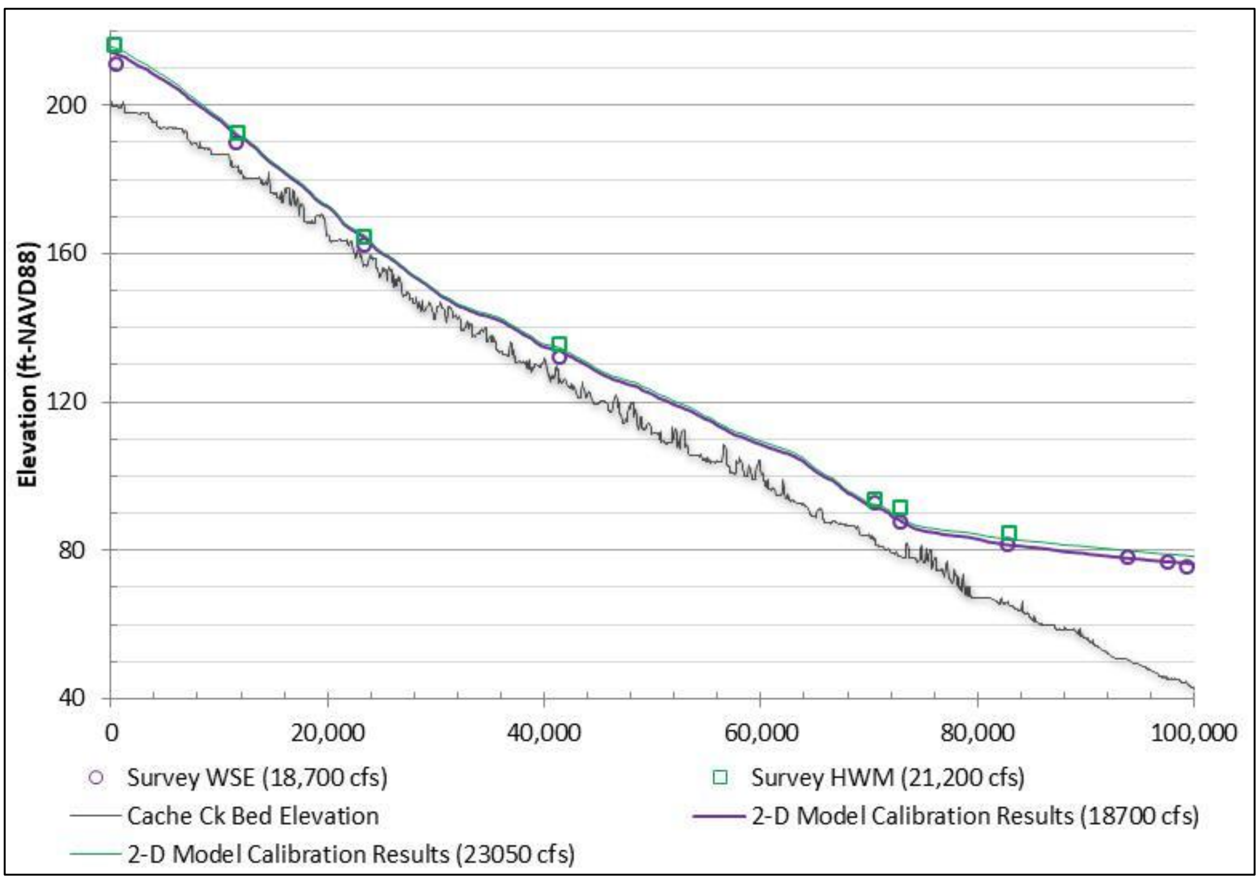

Figure 8: Longitudinal profile of water surface elevations measured on 01/09/2017 and predicted by calibrated 2D hydraulic model.

3.4 BRIDGE CROSSING AND OTHER INFRASTRUCTURE OBSERVATIONS

3.4.1 Capay Dam

Capay Dam continues to exhibit flow-related damage to the concrete "pads" that were installed on the apron. At present there are only three to four pads left and a comparison of 2016 and 2017 imagery shows that at least nine or ten new pads were moved off the apron during winter 2016-2017 (Figure 9 and Figure 10). These will break/decay over time and will eventually be a source of debris in Cache Creek downstream.

Figure 9: Photos showing Capay Dam in 2016 (left) and 2017 (right). 2017 photo shows several additional concrete pads were forced off the dam apron. Imagery courtesy of and copyright Google 2017.

Figure 10: Photo showing concrete pads that have slid off the Capay Dam apron.

3.4.2 PG&E Palisades

The PG&E Palisades and erosion control blanket exhibited signs of new damage from flows during winter 2016-2017. Two major scour holes were observed near a concrete pipe at the left (looking downstream) bank and in the blanket itself (Figure 11).

Figure 11: Photos showing scour holes in erosion control blanket at PG&E Palisades site.

3.4.3 Capay Bridge (County Road 85)

The Capay Bridge did not exhibit significant change such as the appearance of scour holes or other signs of significant sediment transport that removed vegetation during winter 2016-2017 (2).

Figure 1: Photos showing Capay Bridge. The channel bed was not significantly scoured and vegetation in the bed is clearly visible.

3.4.4 Esparto Bridge (County Road 87)

The winter of 2016-2017 resulted in significant channel bed change and sediment transport at the Esparto Bridge. We observed a scour hole around two piers (#5 and #6, numbered from left to right looking downstream) that had undercut the concrete foundations and exposed approximately 5-6 feet of steel piling (Figure 13).

Outside of this scour hole, significant deposition was observed, with piles of gravel and cobbles up to 20 feet vertically higher than the bottom of the scour holes.

Finally, immediately downstream of the bridge, on the right side, there were approximately twelve steel I-beams protruding from the channel bed that could pose a safety hazard (Figure 14).

Figure 13: Photos showing undercut Esparto Bridge piers with member of County staff for scale (right photo).

Figure 14: Photos showing un-scoured piers (left) and protruding steel piles immediately downstream of Esparto Bridge (right).

3.4.5 I-505 Bridge

There was significant debris accumulation at the I-505 Bridge, particularly on the upstream ends of piers (Figure 15). Much of the streambed was cleared of vegetation by flows during the winter and no undercutting of pier bottoms was observed.

Figure 15: Photos showing I-505 Bridge piers.

3.4.6 Stephens Bridge (County Road 94B)

The channel bed at the Stephens Bridge showed clear evidence that winter flows in 2016-2017 had uprooted most all vegetation and transported significant quantities of sediment. No undercutting or other issues at piers were noted (Figure 16).

Figure 16: Photos showing Stephens Bridge piers with channel bed mostly bare after scouring.

3.5 RECOMMENDATIONS

1. **Capay Dam Concrete Energy Dissipation Structures**

   Large, concrete slab pads were included in the construction of the Capay Dam apron expansion project. Unfortunately, these pads were not secured to the dam apron. The winter of 2016-2017 produced some of the highest and longest-duration elevated flows since the apron was constructed and at least nine to ten additional pads were moved off the apron. As recommended previously in both 2015 and 2016, the TAC Hydraulic Engineer recommends that remedies to prevent future damage and movement of these concrete pads into the channel be undertaken.

2. **PG&E Palisades and Erosion Control Blanket**

   The erosion control blanket and steel piles at the PG&E Palisades site continue to represent a barrier to natural function of Cache Creek. Ongoing negotiations between the County of Yolo and PG&E have been taking place during 2017 regarding their potential removal. It remains the TAC's recommendation that the erosion control blanket and all associated infrastructure be removed and the palisades either be removed entirely or cut at or below ground level and revegetation/natural stabilization project be implemented. During this year's Creek Walk, we observed a "pillow" from the erosion control blanket approximately 1,300 feet (1/4 mile) downstream of the Palisades, indicating the scale over which this decaying infrastructure can impact the Creek.

3. **Creek Monitoring of Erosion and Other Issues**

   Significant changes in channel form occurred due to the high flows experienced in Water Year 2017. The following sites were observed and should be actively monitored for impacts to adjacent infrastructure:

   a. **<u>Jensen Bend</u>**: The apex of the southward meander bend at the Jensen property migrated approximately 160 feet outwards during winter events 2016-2017.

   b. **<u>Granite Esparto</u>**: The north bank of the creek eroded up to 280 feet northward over this past winter. Granite Construction completed a stabilization project in the fall of 2017 to address this erosion.

   c. **<u>Esparto Bridge Pier Scour</u>**: Previous years' recommendations suggested monitoring of the Esparto Bridge piers, which were exhibiting undercutting scour. In 2017, two of the piers showed undercutting scour up to six feet below their concrete foundations, exposing steel piles. The County Public Works department was notified of this condition. In addition, several steel piles are protruding from the channel bed immediately downstream of the bridge and present a safety hazard.

d. **Reiff Site Levee Erosion**: This site was previously recommended for monitoring. The bank immediately upstream of the Reiff site levee breach has shown signs of new erosion in both 2016 and 2017. The new erosion in 2017 does not appear to threaten a new breach, but it should continue to be monitored to ensure that another breach does not occur.

e. **Bank Erosion at River Mile 23.3 across from Teichert Esparto Site**: This site eroded further in 2016-2017. This site should be monitored in the future to determine if bank stabilization is required.

f. **Teichert Esparto Aggregate Pile Site**: Bank erosion on the north side of the channel encroached into the Teichert Esparto site, where a large aggregate pile exists. Some of this aggregate has started to slough into the channel.

g. **Payne Property near River Mile 22**: In winter 2016-2017, the channel meandered northwards, eroding up to 140 feet of property.

4. Perform surveying to develop water surface elevation profiles for hydraulic model calibration.

This recommendation was successfully addressed in Water Year 2017. The current iteration of the program's hydraulic model has been calibrated for flows of approximately 4,000 cfs and 20,000 cfs. Similar surveying and calibration should be performed in the future at larger events (e.g., 30,000 cfs or higher) to ensure that model predictions are accurate across a wider range of flow regimes. The trigger for water surface elevation profile for 2017-2018 should be 30,000 cfs, rather than the previous recommendation of 15,000 cfs.

5. Work with the water quality analytical lab to improve coliform testing.

For several years, the analytical lab performing testing of the program's water quality samples reports coliform (total and fecal) concentrations as ">1,600" per mL. Because of this, the program cannot effectively assess coliform counts in Cache Creek. The lab should be instructed in the future that concentrations are likely to exceed 1,600 per mL and should take appropriate measures to ensure reporting of the actual count of coliforms.

CHAPTER 4 – GEOMORPHOLOGY

4.1 SUMMARY OF ANNUAL SEDIMENT DISCHARGE DATA

Sediment transport in creeks is correlated with flow. As flow increases, sediment transport increases. Sediment transport calculations for Water Year 2017 in the CCRMP area use sediment transport rating curves developed from pre-1996 measured suspended sediment data in Cache Creek. In general, the sediment component of most interest to the Cache Creek TAC is the material deposited in the channel (CCIP, p. 34). This is typically comprised of the sand and gravel component of the total sediment load, also called the "bedload." However, it is very important to note that prior in-channel mining (before 1996) created physical conditions in some reaches of Cache Creek conducive to deposition of fine sediments in addition to bedload. Figure 17 shows the bedload (Qb) and suspended load (Qs) volume calculated for Water Years 2005 through 2017.

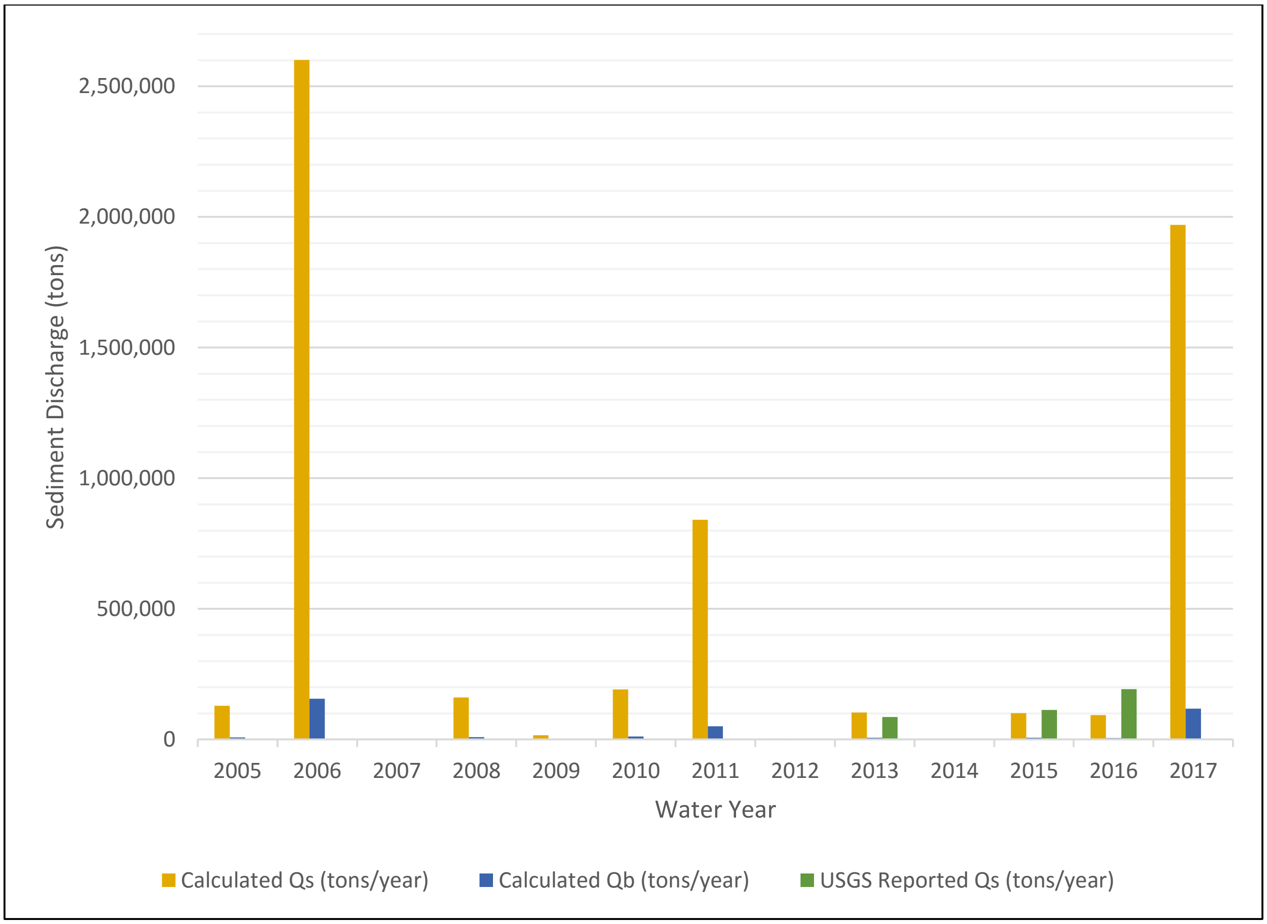

Figure 17: Cache Creek total sediment transport in tons/year. Includes Qs calculations made using provisional data.
**USGS suspended sediment transport data only available for Water Years 2013, 2014, 2015, and 2016.*

Table 3 is a ranked summary of suspended load and bed load transported to, and through, the CCRMP reach over the last thirteen Water Years. Total sediment transport in Water Year 2017 increased dramatically from the preceding drought periods, accounting for 31.7% of the total sediment load over the past thirteen years. Water Years 2006 and 2017 transported nearly three quarters of all the sediment over this time period. The extremely wet conditions in the Winter and Spring of 2017 (see Chapter 3), with extended periods of flows exceeding the mobilization threshold for sediment in Cache Creek, resulted in the high sediment transport in 2017.

Table 3: Calculated suspended (Qs) and bedload (Qb) sediment transport, percent of total sediment transported between 2006 and 2017 and USGS measured sediment discharge (where available).

Water Year	***Q_s (tons/year)***	***Q_b (tons/year)****	***Percent of Total***	***USGS Reported Sediment Discharge (tons/year)*****
2006	2,600,959	156,058	62.5%	0
2017	1,970,125	118,2017	31.7*	0
2011	841,136	50,468	20.2%	0
2010	192,179	11,531	4.6%	0
2008	161,006	9,660	3.9%	0
2005	128,903	7,734	3.1%	0
2013	103,913	6,235	2.5%	90,638
2015	108,024	6,481	2.6%	112,721
2016	93,179	5,591	2.2%	0
2009	16,968	1,018	0.4%	0
2012	3,934	236	0.1%	0
2007	1,999	120	0.0%	0
2014	86	5	0.0%	711

Note: The total sediment transported between 2005 and 2017 is approximately 6,215,897 tons.
* Assumes bedload is an average of six percent of the suspended sediment load.
**Includes provisional data.

4.2 EVIDENCE OF CHANGES IN CHANNEL DIMENSIONS OR BANK EROSION (BANK RETREAT)

Even though slightly less sediment appears to have been transported in 2017 than in 2006, channel changes in 2017 were some of the largest on record. Large-scale bank erosion, bed scour, active channel migration, and mid-channel bar deposition occurred throughout Cache Creek. Tables 4-A through 4-D summarize locations with current and recent past evidence of channel change and provide recommendations for each location. It is important to remember that some bank retreat is beneficial, allowing natural channel processes to occur and valuable habitat to form. Beneficial bank retreat can provide regeneration of riparian habitat, bank swallow habitat, and diversity of in-channel habitat (like pools and in-stream habitat) that might not exist otherwise. Therefore, bank retreat that does not threaten CCRMP boundaries does not necessarily require treatment. However, several areas of bank erosion and channel migration require either evaluation or treatment to address channel changes in Water Year 2017.

Nearly all areas of channel change in prior years, in addition to some new areas of significant new channel change, experienced change in Water Year 2017. In fact, large-scale channel change occurred throughout much of the upper eight miles of the CCAP area (RM 28 downstream to RM 18). Change was generally less extensive and more sporadic in the lower eight miles of Cache Creek. Large-scale change requiring evaluation and/or treatment occurred at the PG&E Palisades (RM 26.9), all along the Granite Capay region (RM 26 downstream to RM 25), in the Madison Reach near the Teichert facility (RM 23), adjacent to the Syar facility (RM 22), all along the property (RM 21 downstream to RM 20), adjacent to the Teichert Woodland facility (RM 15), and in the vicinity of all bridges. All large-scale channel migration sites should be evaluated with respect to the Test 3 and the proposed Channel Form Template (CFT) boundaries, and treatments should be designed and implemented at several of the sites (see Tables 4-A through 4-D for a summary).

4.3 EVIDENCE OF BED DEGRADATION OR AGGRADATION AND SIGNIFICANT CHANGES IN THE LOCATIONS OR SIZES OF BARS AND OTHER CHANNEL FEATURES

Sediment transport in Water Year 2017 generated multiple large-scale areas of both channel bed scour and deposition. Several locations experienced extensive bank erosion, and nearly all of the deposition occurred on mid-channel or point bars. Cache Creek appears to have shifted from net-depositional between 1996 and 2011 to net-erosional between 2011 and 2017 (see Section 4.6 for detailed quantities), meaning that more sediment was transported out of the CCAP area than transported into the area. The scale of erosion between 2011 and 2017 was much smaller than the deposition in the previous time period, and largely driven by extensive areas of bank erosion and lateral channel migration.

Despite the recent lack of net deposition, Water Year 2017 provided a reminder of the need and potential benefits of bar skimming to maintain desired conditions throughout the CCAP area. The high flows of 2017 clearly added to mid-channel bar elevations and extents, and almost certainly drove much of the bank erosion and lateral channel migration observed this year. Bar skimming has been identified as a possible management action for areas where significant channel bed aggradation has occurred (CCIP, p. 20). Bar skimming is the removal of channel bed sediment (generally gravel and coarser material) that has deposited and created significant mid-channel bars. Bar skimming can reduce erosion and scour potential and increase flow conveyance capacity. The CCIP authorizes bar skimming as a routine channel maintenance activity to maintain hydraulic capacity and reduce the probability of excessive and damaging bank erosion. All bar skimming proposals must be reviewed and approved by the TAC, and be designed to limit excavation volumes in balance with sediment supply volumes transported through Cache Creek and to protect and enhance creek ecosystem and geomorphic conditions, where possible.

Sediment deposition in bars or other channel forms reduces channel capacity and increases flow energy acting on the channel bed and banks. Depending on the location of the deposited bars, erosive pressure on one or both creek banks may increase as deposited sediment accumulates. In addition, gravel bars may become vegetated, further reducing flood capacity. The CCIP encourages bar skimming in areas where the gravel bar could potentially reduce flood capacity below the 100-year flood protection level or in areas where the bar may affect bank stability. Several such areas became readily apparent in 2017. In addition, because the high flows and sediment transport in Water Year 2017 removed extensive areas of in-channel riparian vegetation, bar skimming in the near future could be accomplished with very little impact on vegetation and associated habitats in Cache Creek.

Tables 4-A through 4-D identify several locations where bar skimming has been recommended in previous years and continues to be recommended this year. In response to the major channel changes in 2017, acceleration of previously initiated bar skimming efforts are recommended along Granite Capay and CEMEX. In addition, several new areas should be evaluated for potential bar skimming (RM 23.1, RM 22.0, and RM 21.4), as these areas experienced large-scale mid-channel bar deposition and channel migration. Finally, the mid-channel island / bar and associated left bank high flow channel near Huff's Corner (RM 11.3) experienced significant fine sediment deposition and should be considered as a potential sediment removal site as conditions here limit flow capacity in this highly confined creek reach at the downstream end of the CCAP area.

4.4 BRIDGE CONDITIONS

The CCIP directs the TAC to "monitor bridges, levees, and other infrastructure to detect and prevent damage" (CCIP, p. 33). Responsibility for the maintenance and repair of public bridges is held by other agencies (e.g. Caltrans or Yolo County Department of Community Services, for example). Current conditions at the bridges were observed and documented during the 2017 Creek Walk and compared to observations made over the last seven years. Table 5 summarizes bridge condition observations and recommendations for Water Year 2017.

Interestingly, similar conditions developed at all four bridges in 2017. In general, a combination of bank erosion, bed scour, and mid-channel and/or point bar deposition occurred in the vicinity of each bridge. Significant left bank erosion paired with in-channel deposition occurred immediately upstream of three bridges (87, 505, and 94b). The changes documented in Tables 4-A through 4-D should be integrated with the bridge observations and recommendations from Chapter 3 of this report and communicated to the maintaining agency immediately. In addition, it may be worth considering using the updated hydraulic model of Cache Creek created with the 2017 LiDAR topographic data to evaluate hydraulic and sediment transport conditions at the bridges and to help inform future monitoring and potential treatment

4.5 SUMMARY OF CHANGES IN CHANNEL TOPOGRAPHY AND FORM

The CCIP describes one of the objectives of the annual monitoring program as the observation and assessment of "changes in channel form and topography" (CCIP, p. 33). This information is used to locate areas of aggradation and degradation in the creek (CCIP, p. 39). A summary of changes in channel topography and form is provided in Tables 4-A through 4-D.

Table 4-A: Summary of channel change tracking (2010-2017).

River Mile	Location Description	2010	2011	2012	2013	2014	2015	2016	2017	Recommendation
RM 28.2-28.4	Near Capay Dam								**Channel bed scour and left bank erosion.**	**Notify dam owner and monitor left bank erosion repair site.**
RM 26.9	PG&E "Palisades" Pipe Crossing	Baseline observation	Movement	No change	No change	No change	Bed scour / bank erosion	Minor additional adjustment of concrete pillow blanket.	**Scour of concrete pillow blanket left bank; deposition downstream.**	**Accelerate coordination with PG&E on removal of concrete pillow bed armoring.**
RM 26.7	Upstream end of left bank bar								**Deposition, bar growth, left bank erosion**	**Monitor**
RM 26.4	Near Capay Bridge	Baseline observation	Movement	No change	No change	No change	Bed scour and deposition	No change	**Scour upstream of bridge and erosion and deposition downstream.**	**Notify bridge owner of channel change at bridge.**
RM 26.3	Mid-channel near Capay Bridge					Vegetated mid-channel bar	Bed scour and deposition	No change	**Scour upstream of bridge and erosion and deposition downstream.**	**Notify bridge owner of channel change at bridge.**
RM 26.0	Hungry Hollow	-	-	-	Exposed geotextile on RB	Possible bank swallow habitat	Right bank erosion	No change	**100+ feet of right bank erosion.**	**Reassess proposed CFT location and evaluate need for treatment.**
RM 25.4 - 25.5	Near Jensen Property	Baseline observation	Movement	No change	No change	Consider erosion / deposition in middle and bar skimming	Right bank erosion	Minor adjustment of bank protection remnants	**175+ feet of right bank erosion.**	**Reassess proposed CFT location and evaluate need for treatment.**

Orange boxes denote observations of channel change. Blue boxes denote areas recommended for evaluation and possible action. Green boxes denote areas recommended for project implementation. Observations from 2010 to 2016 are presented in grey to differentiate them from observations made during the current Water Year.

Table 4-B: Summary of channel change tracking (2010-2017).

River Mile	Location Description	2010	2011	2012	2013	2014	2015	2016	2017	Recommendation
RM 24.6 - 25.1	Near Granite Capay					Channel bed has degraded	Bed scour / bar scour and deposition	Minor adjustment of bank protection toe	**Extensive left bank erosion and mid-channel deposition.**	**Accelerate implementation of proposed gravel bar skimming project.**
RM 23.5	Madison Reach								**50+ feet of right bank erosion and mid channel deposition.**	**Reassess proposed CFT location and evaluate need for treatment.**
RM 23.1	Madison Reach						Right bank erosion	No change	**50+ feet of right bank erosion, capture of Teichert tailings pile, and mid channel deposition.**	**Repair bank at captured tailings pile, consider potential for gravel bar skimming project, and reassess proposed CFT location.**
RM 22.0	Near Syar	Baseline observation	Movement	No change	No change	Can use new channel as model for bar skimming in other areas	Bed scour and deposition	No change	**50+ feet of left bank erosion and mid channel bar deposition.**	**Reassess proposed CFT location, evaluate need for treatment, and consider potential for gravel bar skimming project.**
RM 21.8	Near Syar				Eroding bank	No change	Bed scour and deposition	No change	**Minor right bank erosion and mid channel bar deposition.**	**Reassess proposed CFT location, evaluate need for treatment, and consider potential for gravel bar skimming project.**
RM 21.6	Near the Old Madison Bridge	Baseline observation	Movement	No change	Continued vegetation establishment on LB; mid-channel bar deposition	The newly formed natural channel is a model of what could be constructed in other areas	Bed scour and deposition	No change	**Minor right bank erosion and mid channel bar deposition.**	**Reassess proposed CFT location, evaluate need for treatment, and consider potential for gravel bar skimming project.**
RM 21.4	Downstream from the Old Madison Bridge					Two spur dikes have toe erosion	Spur dike erosion	No change	**Minor right bank erosion and mid channel bar deposition.**	**Reassess proposed CFT location, evaluate need for treatment, and consider potential for gravel bar skimming project.**

Orange boxes denote observations of channel change. Blue boxes denote areas recommended for evaluation and possible action. Green boxes denote areas recommended for project implementation. Observations from 2010 to 2016 are presented in grey to differentiate them from observations made during the current Water Year.

Table 4-C: Summary of channel change tracking (2010-2017).

River Mile	Location Description	2010	2011	2012	2013	2014	2015	2016	2017	Recommendation
RM 21.1	Upstream of 505 Bridge								**100+ feet of left bank erosion.**	**Notify bridge owner of channel change at bridge, reassess proposed CFT location, and evaluate need for treatment.**
RM 20.8	Near CEMEX right bank protection								**Active channel migration toward right bank and mid channel bar deposition.**	**Monitor**
RM 20.1 - 20.5	Near CEMEX conveyor belt				Eroding toe of bank	No change	Bed scour / bank erosion / bar scour and deposition	Minor adjustment of bank protection and vegetation	**Major active channel migration toward left bank and mid channel bar deposition.**	**Accelerate implementation of proposed gravel bar skimming project.**
RM18.8-18.7	Dunnigan Hills Reach				Degraded nose of old dikes; exposed concrete ruble	No change	Right bank erosion	No change	**Vegetation clearing and minor channel adjustments.**	**Continue to monitor**
RM18.2-18.0	Upstream of Moore's Siphon	Baseline observation	Movement	No change	Beneficial in-stream habitat created by erosion	No change	Bed scour and deposition	No change	**Left bank erosion and mid channel bar deposition.**	**Reassess proposed CFT location and evaluate need for treatment.**
RM 17.8	Dunnigan Hills Reach				Beneficial erosion; vegetation established	No change	Bed scour and deposition	No change	**Minor vegetation clearing and mid-channel bar deposition.**	**Continue to monitor**
RM 15.9	Near CR 94B								**Left bank point bar deposition and growth.**	**Notify bridge owner of channel change at bridge and monitor.**

Orange boxes denote observations of channel change. Blue boxes denote areas recommended for evaluation and possible action. Green boxes denote areas recommended for project implementation. Observations from 2010 to 2016 are presented in grey to differentiate them from observations made during the current Water Year.

Table 4-D: Summary of channel change tracking (2010 – 2017).

River Mile	***Location Description***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***Recommendation***
RM 15.4	Near Teichert Woodland	Baseline observation	Minor movement	Minor movement	Beneficial erosion	No change	Minor bed scour and deposition	No change	**300+ feet of right bank erosion / channel migration and major mid-channel bar deposition.**	**Continue to monitor**
RM 15.0	Near Teichert Woodland	Baseline observation	Minor movement	Minor movement	Beneficial erosion	No change	Minor bed scour and deposition	No change	**Minor vegetation clearing and mid-channel bar deposition.**	**Continue to monitor**
RM 14.0	Near Woodland Reiff Breach				No change since 2012	No change	Levee breach channel scour / erosion	Minor deposition in breach channel	**Minor left bank erosion downstream of breach.**	**Implement levee breach channel enhancement / stabilization**
RM 12	Rio Jesus Maria Reach					Steep outer bend with structures and concrete rubble along edge of active channel	Minor bed scour and deposition	No change	**Minor vegetation clearing and mid-channel bar deposition.**	**Continue to monitor**
RM 11.3	Near Huff's Corner				Deposition at site of 2012 erosion	Beneficial deposition at site of 2012 erosion	Minor bed scour and deposition	No change	**Minor deposition on left bank point bar.**	**Assess need to remove fine sediment deposited along bar.**

Orange boxes denote observations of channel change. Blue boxes denote areas recommended for evaluation and possible action. Green boxes denote areas recommended for project implementation. Observations from 2010 to 2016 are presented in grey to differentiate them from observations made during the current Water Year.

Table 5: Summary of observations of bridge conditions (2010 – 2017).

Location	General Conditions	2010	2011	2012	2013	2014	2015	2016	2017	Recommendations
Capay Bridge at Road 85 (RM 26.35)	2007 CalTrans report: "no scour." Some erosion of the south bank upstream of the bridge in 2010, with no observable consequences to the bridge.	Observed Condition	Continued bank retreat	No change	No change	Mid channel bar has become more vegetated	Minor bed scour and deposition	No significant change since 2015	**Scour upstream of bridge and erosion and deposition downstream of bridge.**	Inform bridge owner and evaluate need for treatment.
Esparto Bridge at Road 87 (RM 24.35)	2006 CalTrans report: "signs of aggradation." Observed in 2010. Tendency for erosion on the north side, and the northern-most pier is slightly undercut.	Observed Condition	Continued bank retreat	No change	Possible aggradation	No change	Minor bed scour and deposition	No significant change since 2015	**Extensive left bank erosion upstream of bridge and mid-channel bar deposition upstream and downstream of bridge.**	Inform bridge owner and evaluate need for treatment.
Highway I-505 Bridge (RM 21.0)	2005 CalTrans report: "Scour holes at each pier." 2010: two-ten feet of sediment build up (aggradation) around the two southern bridge bays, with vegetation growing on the deposited material.	Observed Condition	Continued bank retreat	No change	Although there is undercutting, there is no change. Consider how vegetation on south side impedes flow	Monitor flow capacity changes on the right-hand side	Minor bed scour and deposition and continued right bay vegetation growth	No significant change since 2015	**Significant left bank erosion upstream of bridge and mid-channel bar deposition upstream and downstream of bridge.**	Inform bridge owner and evaluate need for treatment.
Road 94B Bridge (RM 15.9)	2007 CalTrans report: "Abutment 1 is undermined up to 18 inches." Relatively stable channel conditions in 2010.	Observed Condition	No change	No change	The vegetation filling the left-hand bay here looking downstream is dense and would impede the flow and reduce flow capacity. It is not clear whether this has changed since last year.	No change	Minor bed scour and deposition	No significant change since 2015	**Significant left bank point bar deposition immediately upstream of bridge.**	Inform bridge owner and evaluate need for treatment.

4.6 VOLUMETRIC CHANGE ANALYSES

Topographic data (i.e. LiDAR) was collected in 2017 for the first time since 2011. Volumetric change analysis quantifying the change in volume of stored bed material in Cache Creek between 1996 and 2011 was completed in the 2017 Technical Studies and 20-Year Retrospective for the CCAP (Attachment D). Cache Creek was net depositional between 1996 and 2011, with approximately ten million tons of net deposition throughout Cache Creek between the end of in-channel mining in 1996 and 2011.

The trend of net deposition appears to have changed between 2011 and 2017. New topography data sufficient for calculating volumetric change in the CCRMP area was collected in 2017 and shows approximately 400,000 tons of net erosion throughout Cache Creek. The net erosion is largely a result of large-scale bank erosion and lateral channel migration. However, there was still significant deposition on mid-channel bars throughout the creek. The Dunnigan Hills reach remained net-depositional during this time period. All of the other reaches were net-erosional, albeit with relatively small quantities of net erosion (except in the Madison Reach where net erosion was significantly higher). Figure 18 shows the influence of a large area of lateral bank erosion on net deposition in the Madison Reach, where significant areas of mid-channel bar deposition also exist. Figure 19 shows conditions in the one net-depositional reach during this period, where extensive mid-channel bar aggradation was significantly greater than erosion and lateral channel migration.

While the sediment transport trend between 2011 and 2017 appears to have shifted to net-deposition in most geomorphic reaches and the CCAP area as a whole, it is important to note that at smaller spatial scales, local deposition is causing significant channel migration and erosion that could be improved with targeted bar skimming projects. The topographic change data for the entire creek can be viewed on the Cache Creek web application (https://flowwest.shinyapps.io/cache-creek/ - see the topographic change tab) and should be used to guide bar skimming projects and other management actions in areas with major lateral channel migration and mid-channel bar deposition.

Table 6: Volumetric change analysis summary for periods between 1996-2011 and 2011-2017.

	1996 - 2011			**2011 - 2017**		
Reach	**Deposition (tons)**	**Erosion (tons)**	**Net (tons)**	**Deposition (tons)**	**Erosion (tons)**	**Net (tons)**
Capay	610,295	186,067	424,228	111,931	140,191	(28,260)
Hungry Hollow	2,841,177	400,354	2,440,822	622,712	711,504	(88,792)
Madison	2,272,808	361,648	1,911,159	567,799	781,188	(213,389)
Guesisosi	915,201	126,615	788,586	343,526	352,899	(9,373)
Dunnigan Hills	2,444,423	225,677	2,218,745	431,329	318,844	112,485
Hoppin	2,419,177	123,180	2,295,997	395,561	578,408	(182,847)
Rio Jesus Maria*	300,924	18,948	281,976	34,381	37,201	(2,820)
Total	11,804,004	1,442,490	10,361,514	2,507,237	2,920,234	(412,997)

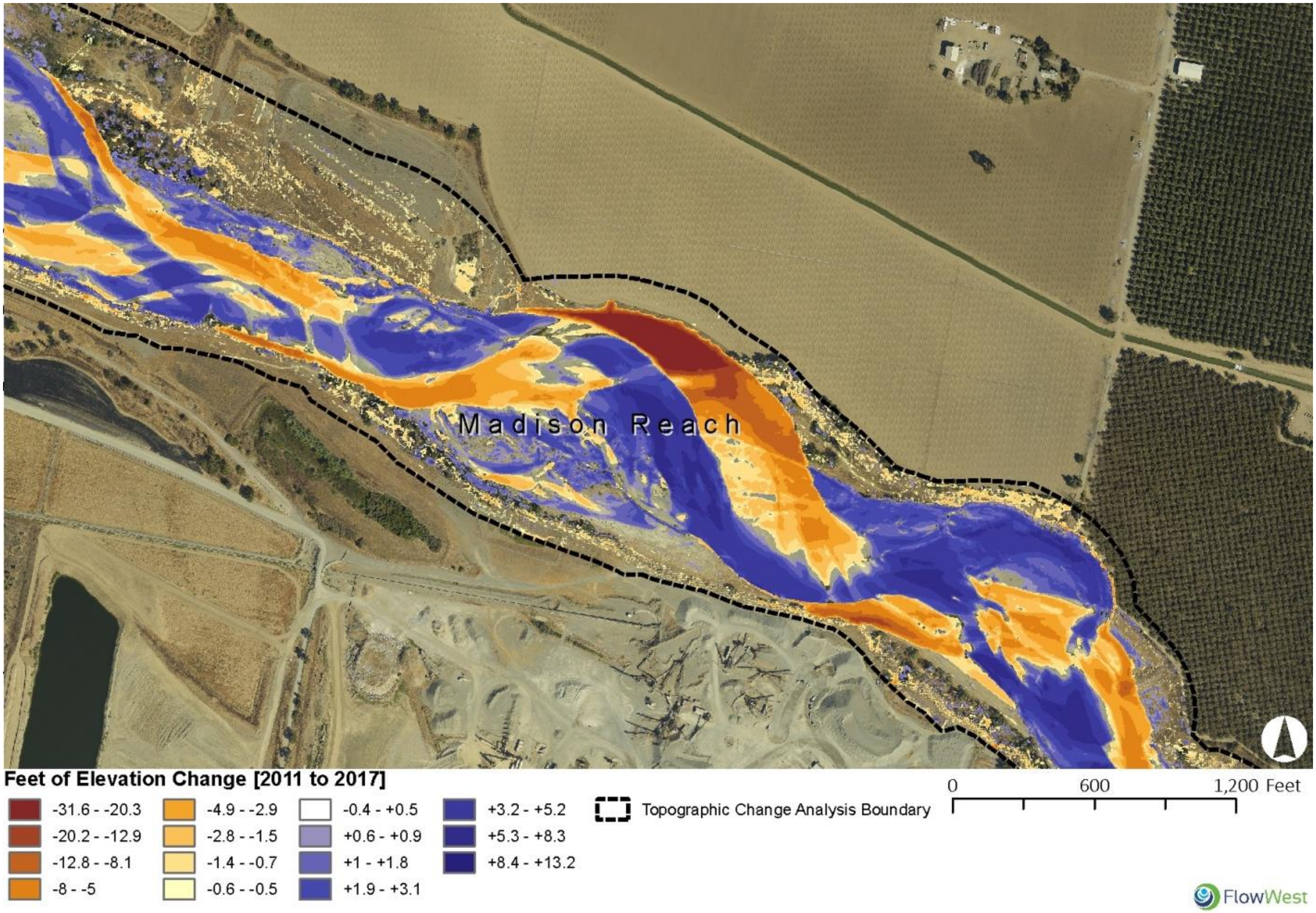

Figure 18: Topographic change in the Madison Reach showing large area of lateral bank erosion and channel migration as well as large areas of mid-channel bar deposition.

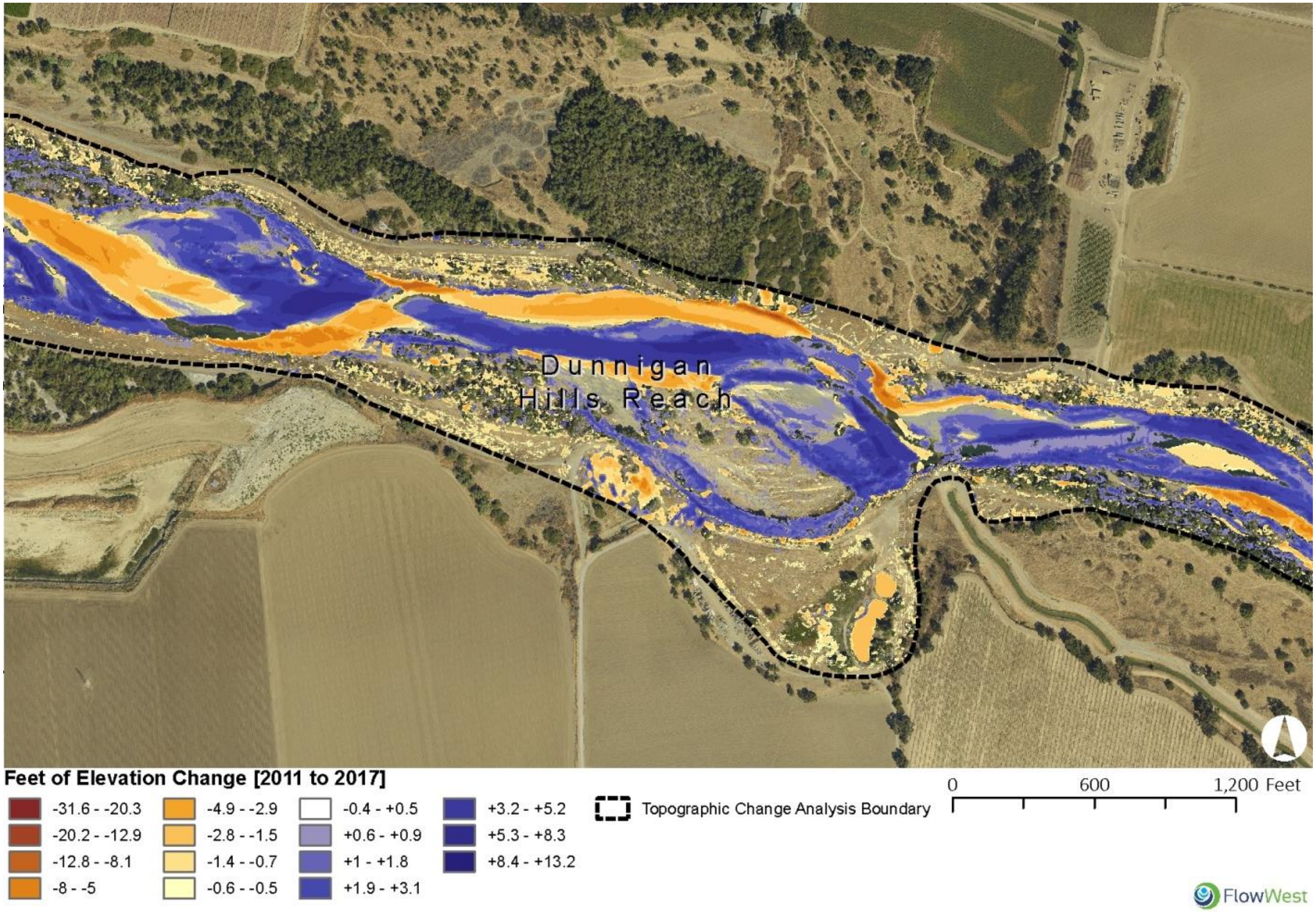

Figure 19: Topographic change in the Dunnigan Hills reach showing extensive mid-channel bar aggradation and relatively limited bank erosion or lateral channel migration.

4.7 CHANNEL MAINTENANCE ACTIVITIES

The CCIP (Section 4.2, starting on page 20) describes typical channel maintenance activities that can be implemented to achieve improved equilibrium in channel conditions and protect and enhance channel and riparian habitats. Examples of these maintenance activities include:

- Gravel bar skimming to maintain hydraulic capacity or reduce the probability of bank erosion
- Vegetation removal to maintain hydraulic capacity or reduce the probability of brank erosion, or to remove undesirable species
- Minor bank protection works
- Removal of debris at bridges or upstream of bridges susceptible to debris accumulation
- Maintenance of a defined low flow channel
- Internal levee repair

The TAC reviewed all of the recommended channel maintenance activities listed in the CCIP and identified sites where various maintenance activities could be implemented to achieve the objectives of the CCIP.

Some of the recommended channel maintenance activities in Tables 7-A and 7-B on the following pages are also described in the summary of channel changes in Tables 4-A through 4-D.

Table 7-A: Summary of recommended channel maintenance activities (2012-2017).

Site	Description	2012	2013	2014	2015	2016	2017	Recommendation
RM 28.3	Removal of concrete rubble in creek channel.	Not observed in 2012.	Low priority recommendation.	Low priority recommendation.	Not observed in 2015.	Low priority recommendation.	Additional concrete rubble immediately downstream of dam, but still low priority.	Monitor in conjunction with monitoring of repaired left bank.
RM 26.9	Removal of exposed webbing at the PG&E Palisades site.	Not observed in 2012.	Not observed in 2013.	Action required.	Much of webbing burned in riparian fire.	Limited additional adjustment of concrete pillow blanket	Significant new scour on left bank side of concrete pillow blanket.	Accelerate coordination of palisades removal with PG&E.
RM 25.0	Removal of mid-channel gravel bar to alleviate pressure on the north bank in this vicinity.	Recommended.	Recommended, but only monitoring required.	Recommended, but only monitoring required.	Limited additional north bank erosion highlights importance of near-term gravel bar skimming.	Very limited additional bank erosion.	Significant new channel erosion, migration, and mid-channel bar deposition.	Reevaluate and accelerate implementation of Granite Capay gravel bar skim plans initiated in 2015.
RM 23.0-22.8	Monitoring of levee erosion site.	Not observed in 2012.	Monitor only.	Monitor only.	Limited additional south bank erosion.	No significant change.	Left bank channel migration and erosion that captured Teichert tailings pile. Significant mid-channel bar deposition.	Evaluate and implement treatment for left bank erosion site and evaluate potential value of gravel bar skimming project.
RM 21.6 Active bank retreat near.	Mid-channel experimental bar skimming to relieve erosive pressure on the north bank.	Recommended.	Monitor only. Conditions have improved.	Not observed in 2014.	Limited bed additional scour and deposition.	Very limited additional bank erosion.	Significant left bank downstream channel migration and mid-channel bar deposition. Also new left bank erosion upstream at RM 22.	Evaluate the need to treat left bank erosion and migration sites.

Notes: *Observations from 2012 to 2016 are presented in grey to differentiate them from observations made during the current Water Year. Table entries with RMs and descriptions in red font are also described in Tables 4-A through 4-D.*

Table 7-B: Summary of recommended channel maintenance activities (2012-2017).

Site	Description	2012	2013	2014	2015	2016	2017	Recommendation
RM 20.3 - 20.8 mid-channel bar	Removal of mid-channel gravel bar to alleviate pressure on the south bank in this vicinity.	Recommended.	Action recommended.	Action recommended.	Limited additional bed scour, bank erosion, bar scour, and deposition.	Very limited additional bank erosion.	Significant new left bank migration and erosion and mid-channel bar deposition.	Evaluate the need to treat left bank erosion and re-activate CEMEX gravel bar skim plans initiated in 2014.
RM 20.4	Protection against further bank toe erosion on bank.	Not observed in 2012.	Consider bar skimming to alleviate hydraulic pressure.	Action required.	Limited additional bed scour, bank erosion, bar scour, and deposition.	Very limited additional bank erosion.	Significant new left bank migration and erosion and mid-channel bar deposition.	Incorporate into CEMEX gravel bar skim plans (if reactivated) initiated in 2014.
RM 19.8	Protection against further bank toe and slope erosion.	Not observed in 2012.	Action recommended.	Action required.	Limited additional erosion of bank immediately adjacent to conveyor belt.	Very limited additional bank erosion.	Deposition along formerly eroded left bank and migration of channel to right bank.	Monitor and consider as part of the CEMEX gravel bar skim plans, if reactivated.
RM 11.65	Removal of the bar near Huffs corner.	Not observed in 2012.	Not observed in 2013.	Action required.	South bank mostly unimpaired by 2015 high flows.	No significant change.	Some new fine sediment deposition on river left side of bar.	Continue to monitor bar and channel bank conditions and evaluate need for bar removal in CCAP update.

Notes: *Observations from 2012 to 2016 are presented in grey to differentiate them from observations made during the current Water Year. Table entries with RMs and descriptions in red font are also described in Table 4-A through 4-D.*

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CHAPTER 5 - BIOLOGICAL RESOURCES

Biological resources on lower Cache Creek include native vegetation, wildlife, invertebrates, and fish. Lower Cache Creek is a hotspot of biodiversity in a landscape mostly developed and converted to agricultural and urban land-uses. In addition to native trees, shrubs, and herbaceous plant species, over 200 common and special-status native species of wildlife, invertebrates, and fish have been observed within the CCRMP and broader-scale CCAP areas over the past two decades. Nonnative species are also considered within the biological resource framework because of the impacts they have on native species (e.g., displacement of native vegetation by invasive species such as arundo and tamarisk).

5.1 NATIVE VEGETATION

The distribution and extent of native riparian and upland vegetation within the CCRMP area reflect the dynamic geomorphologic and hydrologic processes of Cache Creek, regional climate, and both past and on-going human influences. Lower Cache Creek's position in the broad Central Valley Plain, low channel gradient, annual lateral channel movement, and channel braiding provide for a mosaic of riparian and upland habitat types. Depth to groundwater, scour of newly-planted or newly-recruited trees and shrubs by high flows, competition with invasive species, suitable soil substrates, and the presence of surface water in the low-flow channel are the major limiting factors in establishment and maintenance of native riparian vegetation including riparian forests, willow scrub, and herbaceous communities. In more upland areas on upper banks and higher terraces, factors such as depth to groundwater, available soil moisture, grazing, and competition with invasive species are the major limiting factors in establishment and maintenance of native upland vegetation including oak woodlands and grasslands.

5.1.1 Current Conditions

While observations on current conditions made during the 2017 Creek Walk are summarized in Section 5.1.2, additional analyses of current vegetation conditions were made in 2017 at the scale of the entire CCAP area. Vegetation classes (riparian forest, oak woodland, dense scrub, scattered scrub, and herbaceous) were mapped by the TAC Riparian Biologist across the CCAP area from high-resolution aerial photography, which was acquired by a County contractor in 2017. The standardized methodology developed in 2015/2016 by the TAC Riparian Biologist was used to ensure that vegetation data were compatible with, and comparable to, historical datasets.

<Insert results of 2017 aerial imagery analysis>

5.1.2 Changes in Native Vegetation

The condition of the existing vegetation observed during the 2017 Creek Walk was markedly different than conditions observed during the 2014–2016 Creek Walks, primarily due to the significant loss of in-channel and near-channel vegetation due to high flows. Herbaceous vegetation that had been observed increasing in the main channel from 2014–2016 was scoured away in many locations. Large patches of woody vegetation, including both willow scrub and riparian forest, was also removed along banks in several reaches due to channel meander and subsequent erosion. In addition, at least one past revegetation project was almost completely removed (see sec. 5.2.2). Reach-by-reach analyses of these and other changes in native vegetation are forthcoming once analysis of 2017 aerial imagery is complete.

As in 2016, native vegetation was observed to be creating potentially adverse conditions in some locations (e.g., woody vegetation on in-channel bars near RM 13.3 within the Hoppin reach). No actions are yet required other than continued annual monitoring of this site and of in-channel sites further downstream. Areas in which vegetative die-back was observed in 2015, likely due to the ongoing drought, were observed to have some dead vegetation although die-back did not worsen from 2015–2016.

<Insert quantitative analysis of changes in vegetation from 2015-2017 based on imagery analysis>

5.1.3 Notable Remnant Native Species

In addition to native vegetation described above, large patches of presumably remnant creeping wildrye (*Elymus triticoides*) are present along the upper terraces on the south bank of the creek between RM 13.7 and 13.6, RM 14.6 and 14.7, on upper north banks at RM 27.1 and 27.4 under trees. The patches would serve as excellent seed sources for future restoration projects. Large patches of native mugwort (*Artemisia douglasiana*) are also present in many locations along the creek, as are scattered patches of sedges (*Carex* spp.), wild rose (*Rosa californica*) and California wild grape (*Vitis californica*). A single buckbrush (*Ceanothus cuneatus*) shrub can be found on the south edge of the Millsap property, on the north bank uplands between RM 18.4 and 18.5. Buckbrush should be considered as a suitable species for future restoration projects. Blue elderberry (*Sambucus nigra* ssp. *caerulea*) are also abundant throughout the CCRMP area; see section 5.4 for a description of the 2016 elderberry mapping project.

5.1.4 Vegetation Monitoring

Vegetation monitoring is necessary to quantify vegetation trends (e.g., notable losses and gains in riparian habitat, shifts in habitat composition, and overall effects of the CCRMP and elimination of in-channel gravel mining). In terms of annual monitoring, the spatially-referenced field photo log updated by the TAC Biologist during the 2016 Creek Walk was again updated as part of the 2017 Creek Walk. The photo log is used as a basis during Creek Walks in combination with mobile mapping software to discern annual changes in vegetation and habitat conditions in the CCRMP area, with photo updates and new reference locations added to document current conditions.

Acquisition of aerial photography and other data (e.g., LiDAR) can occur annually if needed, but is generally acquired every five years and after major flow events. As described in Section 2.3.2, the County has been exploring new methods and tools over the past decade, including UAVs, high-resolution orthophotography, multi-band imagery, and LiDAR data. It is now possible to cost-effectively and reliably obtain sub-meter-resolution aerial photography and topographic data for the entire CCRMP area, and these data are important components of the biological resource monitoring program.

Long-term vegetation monitoring integrates annual observations and the results of other analyses. Assessments of long-term monitoring data, leading to updated recommendations and adaptive management strategies, occurs during CCRMP/CCAP updates and other similar efforts. As noted in previous Annual Reports, one of the major limitations to meaningful long-term monitoring of biological resources in the CCRMP area is that little baseline vegetation data were available. However, maps of existing vegetation along the Cache Creek corridor was prepared based on aerial photography in 1995 as part of the baseline Technical Studies. Another limitation to long-term monitoring of biological resources is that, from 1996–2015, vegetation monitoring was inconsistent over the past two decades, with no standardized methodology used. As a component of the 2016 CCAP update, a 20-year retrospective analysis of biological resources was performed to determine changes and trends in native and nonnative vegetation, wildlife, invertebrates, and fish. A standardized methodology for long-term vegetation monitoring was developed and presented in the final report. Additional aerial imagery was acquired in 2017, and this standardized methodology is being used to analyze changes in vegetation since 2015 (results forthcoming).

5.1.5 Recommendations Regarding Native Vegetation

Integrating across the preceding sections, the following recommendations are made regarding native vegetation management and monitoring within the CCAP area:

1. Opportunities to increase surface water flows in lower Cache Creek in the late spring and early summer should continue to be explored in collaboration with the Yolo County Flood Control and Water Conservation District to support native vegetation recovery.

2. Biomass from treated invasive species should be removed to reduce debris and to create space for native vegetation recruitment.

3. Monitoring of tree loss and damage due to beavers should continue during annual Creek Walks, and consideration of selective tree protection methods should be considered if necessary to protect mature native trees.

4. LiDAR data should be collected whenever high-resolution aerial photography is acquired (e.g, at the minimum five-year intervals and when flows exceed the annual threshold).

5. The standardized vegetation monitoring methods developed in 2015/2016 should continue to be

used for subsequent assessment of changes and trends in native vegetation within the CCAP, in addition to the annual Creek Walk. Additional monitoring methods (e.g., finer-scale permanent monitoring plots) should be considered, perhaps in collaboration with university researchers.

5.2 RESTORATION OPPORTUNITIES AND OBSERVATIONS ON PAST PROJECTS

5.2.1 Restoration Opportunities

In general, relatively few areas along lower Cache Creek remain available for riparian expansion as most of the channel is deeply entrenched, bound by levees, restricted by adjacent land uses, or characterized by shallow, gravelly soils underlain by relatively deep groundwater (e.g., Hungry Hollow and Madison reaches). A continued focus should be made on locations where habitat restoration and enhancement are possible, and sustainable as a natural condition with limited management. In 2016, a California Natural Resources Agency River Parkways grant application was successful for Capay Open Space Park, which included habitat restoration as a significant component (more on this grant can be found in Sections 7.5.3 and 7.5.4).. The Millsap property (north bank, RM 18.4) remains an excellent candidate for a combined restoration/public access project. Habitat restoration goals at the Millsap site would include oak woodland restoration, a native grassland understory, further control of invasive species, and the eventual establishment of public trails and interpretive features. Off-channel former mining pits in the Dunnigan Hills and Hoppin reaches are also excellent candidates for habitat enhancement (e.g., invasive species removal and planting of a native understory). Substantial native woody vegetation (primarily overstory trees) has established in these areas, although the understory is dominated by arundo, tamarisk, and other invasive species.

5.2.2 Status of Past Projects

At RM 20.7, native willows and grasses planted in 2010 on the south bank were almost completely removed by high flows in 2017. Detailed observations of other past revegetation projects were summarized in the 2016 annual report.

5.2.3 Recommendations Regarding Habitat Restoration

The following recommendations are made regarding habitat restoration within the CCAP area:

1. Priority restoration sites should be the focus of grant development and planning efforts; these priority sites include: Capay Open Space Park (RM 26.3), the PG&E palisades site (RM 26.8), the Hayes “Bow-Tie” property (RM 20), the Millsap property (RM 18.5), the Wild Wings property (RM 17), and Correll-Rodgers properties complex (RM 13.7).

2. Native understory species (forbs, grasses, and sedges) should be included in all subsequent revegetation and restoration projects, in addition to native trees and shrubs.

3. A minimum of 3-5 years of effectiveness monitoring, based on established performance criteria (e.g., at least 75% survival of woody species, at least 50% cover of herbaceous species) should be a mandatory component of any future revegetation or restoration project within the CCAP area. If performance criteria are not achieved, remedial action should be taken on the part of the project implementer.

4. Invasive species treatment projects should be considered as habitat enhancement projects, and bundled with habitat restoration projects whenever possible to increase project footprints and impacts for grant applications.

5. Revegetation or restoration using native woody and herbaceous species should be a standard practice following invasive species treatment.

6. Based on 2017 Creek Walk observations, the long-term resilience of revegetation and restoration projects within or adjacent to the active channel should be carefully considered prior to implementation, since such projects can be negatively impacted or completely removed by high flows.

7. As described in more detail in Section 5.1.5, opportunities to increase surface slows in spring and summer should be explored to accelerate native vegetation recovery (e.g., passive restoration), although active restoration (e.g., planting of native species) should remain the focus.

5.3 INVASIVE PLANT SPECIES MONITORING AND MANAGEMENT

5.3.1 Distribution and Extent of Invasive Plant Species

Echoing observations from the 2014–2016 Annual Reports, observations from the 2017 Creek Walk indicate that invasive arundo (*Arundo donax*), Ravennagrass (*Saccharum ravennae*), and tamarisk (*Tamarix* spp.) have been relatively well controlled within the CCRMP area due to on-going eradication efforts by the Cache Creek Conservancy (CCC) through its annual contract with this program. Chemical treatment under CCC's Invasive Weed Control Program has had a significant positive effect on biological resources along lower Cache Creek by reducing the negative impacts caused by these three species, including displacement of native vegetation, reductions in wildlife habitat, high rates of evapotranspiration that reduce available soil moisture, fine sediment accumulation, and flow redirection. However, prior to 2016, there was not a framework for quantitative assessment of the Program's effectiveness at reducing these three priority invasive species due to a lack of spatial data on the species' distribution and extent. In addition, it was unclear if additional invasive species should be prioritized for treatment, as has been recommended in recent Annual Reports.

In 2016, a detailed field survey of 25 priority invasive species (Table 8) within the CCRMP area and six adjacent County-owned parcels was conducted by the TAC Riparian Biologist (*Lower Cache Creek Invasive Species Mapping and Prioritization Project*; Rayburn 2016a). The goal of this project was to assess the distribution and extent of these species to inform adaptive management of the creek's biological resources. Specific objectives were to evaluate the effectiveness of the Invasive Weed Control Program, to produce a spatially-explicit baseline of invasive species extent and distribution, and to prioritize locations for invasive species treatment and habitat restoration. A similar field survey was also conducted in Fall 2016 along the five river miles immediately upstream of Capay Dam (*Capay Valley Invasive Species Mapping and Prioritization Project*; Rayburn 2016b). Downstream dispersal of invasive species from this area has been identified as a contributing factor to invasive species abundance in the CCRMP area. No large-scale invasive species control has been implemented in this area, so the focus of this second project was to map priority invasive species to inform planning and funding of control efforts. Only the results of the first survey within the CCRMP area will be summarized below.

Table 8. The invasive plant species selected for mapping as part of the 2016 Lower Cache Creek Invasive Species Mapping and Prioritization Project.

Common Name	Scientific Name	Growth Form
Arundo	*Arundo donax*	Herbaceous
Bamboo	Various	Herbaceous
Barbed goatgrass	*Aegilops triuncialis*	Herbaceous
Common teasel	*Dipsacus fullonum*	Herbaceous
Edible fig	*Ficus carica*	Shrub/tree
Eucalyptus	*Eucalyptus* spp.	Tree
Fan palm	*Washingtonia robusta*	Shrub/tree
Fennel	*Foeniculum vulgare*	Herbaceous
Himalayan blackberry	*Rubus armeniacus*	Herbaceous
Medusahead	*Elymus caput-medusae*	Herbaceous
Oleander	*Nerium oleander*	Shrub
Pampas grass	*Cortaderia selloana*	Herbaceous
Perennial pepperweed	*Lepidium latifolium*	Herbaceous
Poison hemlock	*Conium maculatum*	Herbaceous
Purple loosestrife	*Lythrum salicaria*	Herbaceous
Ravenna grass	*Saccharum ravennae*	Herbaceous
Stinkwort	*Dittrichia graveolens*	Herbaceous
Tamarisk	*Tamarix* spp.	Shrub
Thistles (Italian, bull, milk)	*Carduus pycnocephalus, Cirsium vulgare, Silybum marianum*	Herbaceous
Tree of heaven	*Ailanthus altissima*	Tree
Tree tobacco	*Nicotiana glauca*	Shrub/tree
Yellow flag iris	*Iris pseudacorus*	Herbaceous
Yellow starthistle	*Centaurea solstitialis*	Herbaceous

A total of 1,794 individual plants and 876 patches of the 25 invasive plant species were mapped within the CCRMP area. Invasive species were most common in the Capay, Dunnigan Hills, and Hoppin reaches, which are the same reaches in which native vegetation is most abundant. The most widespread species in terms of estimated area were nonnative thistles (113.2 acres), perennial pepperweed (54.5 acres), yellow starthistle (53.6 acres), Himalayan blackberry (16.8 acres), poison hemlock (14.6 acres), and tamarisk (10.9 acres), tree tobacco (4.5 acres), arundo (3.8 acres), tree of heaven (2.0 acres), and barbed goatgrass (1.3 acres). Lesser acreages were observed for the other target species. Only 0.2 acres of ravennagrass were observed during the survey, mostly along back-water channels, although there were dozens of individual plants.

The 2016 survey confirmed that arundo, Ravennagrass, and tamarisk were still found throughout the CCRMP area in the form of (1) resprouts from previously-treated plants and patches, (2) newly-established plants that likely resulted from propagules dispersed downstream from large patches above Capay Dam, (3) plants and patches in secluded locations away from the main channel, and (4) large stands on properties to which access has not been granted by landowners. For example, several large stands of tamarisk still occur immediately adjacent to the CCRMP area and act as a seed source for tamarisk establishment. These include the creek margins and adjacent uplands from RM 12.9 to 13.2, RM 13.5, RM 15.4 to 15.5, and RM 18.1 to 18.2. Conservancy and County staff continue to work with adjacent landowners to access these properties to treat tamarisk and other invasive species. Dense patches of tamarisk, arundo, and Ravennagrass also lie upstream of Capay Dam and are likely dispersed downstream into the CCRMP area. The survey also supported the expansion of the priority invasive species list for lower Cache Creek to include Himalayan blackberry, perennial pepperweed, poison hemlock, milk and Italian thistles, tree of heaven, tree tobacco, and yellow starthistle. The recommendation was also made to create a second tier of intermediate-priority species including barbed goatgrass, common teasel, edible fig, fennel, medusahead, purple loosestrife, and yellow flag iris, as well as a third tier of lower-priority species including eucalyptus, fan palm, oleander, pampas grass, and stinkwort.

During the 2017 Creek Walk, expanding patches of purple loosestrife were noted on the south bank between RM 27.9–28.0 and between RM 27.4–27.5. A patch of purple loosestrife was also observed in mature vegetation along the north bank at RM 20.5. Nonnative water primrose was observed along the margins of the in-stream concrete blanket at RM 26.9. New recruits of arundo and tamarisk were observed in dry stretches of the Hungry Hollow and Madison reaches, as well as potential resprouts from debris piles. Other priority species, such as perennial pepperweed, nonnative thistles, and tree tobacco were common along most reaches, and their distributions are best represented by maps included the 2016 *Lower Cache Creek Invasive Species Mapping and Prioritization Project* report, which can be found on the Natural Resources Division’s website.

5.3.2 Recommendations for Invasive Plant Species Management

Based on the results of this project, past TAC observations, the 2016 field survey, and the 2017 Creek Walk, the following recommendations are made to balance cost-effective invasive species management with the goals and objectives associated with implementation of the CCAP.

1. The list of priority invasive species within the CCRMP area, currently arundo, ravennagrass, and tamarisk, should be expanded to include multiple tiers of additional species that are widespread and spreading:

    a. **High priority**: arundo, Himalayan blackberry, perennial pepperweed, poison hemlock, milk and Italian thistles, Ravennagrass, tamarisk, tree of heaven, and tree tobacco;

    b. **Medium priority**: barbed goatgrass, common teasel, edible fig, fennel, medusahead, purple loosestrife, and yellow flag iris;

    c. **Low priority**: eucalyptus, fan palm, oleander, pampas grass, and stinkwort.

2. The annual "Creek Spray" and other invasive species control efforts should be expanded to include additional priority species and areas that are not immediately adjacent to the main channel. Spatially-explicit methods (e.g., GPS, mobile mapping technology) should be used to track the location and status (e.g., treated or not) of invasive species, and the database should be updated each year. Monitoring treated plants and patches to ensure that plants are completely killed by treatment is essential, since species such as arundo, Himalayan blackberry, and tamarisk, and tree of heaven tend to resprout after spraying, burning, and mechanical removal.

3. Dead invasive species biomass should be cut during or after treatment and either burned on site or transported out of the Program area. Arundo and tamarisk biomass does not readily degrade after treatment, and creates dense debris piles that have inhibited native vegetation establishment in some areas and that have also mobilized during high flows.

4. Invasive species treatment should be followed immediately by revegetation or restoration using local native species. Passive restoration – removing invasive species and assuming that native vegetation will replace it without the need for seeding or planting – is challenging along lower Cache Creek because of the abundance of invasive species that readily colonize disturbed areas (e.g., perennial pepperweed). Active planting of native species will reduce erosion and prevent re-invasion of invasive species on treated sites.

    a. Besides native trees (cottonwood, black willow, box elder, Valley oak, buckeye) and shrubs (e.g., wild rose, blue elderberry, quailbush), a cost-effective mix of competitive native herbaceous species should be developed for revegetation or restoration of treated areas. Such as mix would likely include creeping wildrye, mugwort, various sedges or rushes, pollinator-supporting species such as milkweeds, and other species.

b. The removal of invasive species that provide resources of native wildlife (e.g., tree tobacco, which native hummingbirds utilize as nectar resources) should be balanced with replacement by local native species that provide the same wildlife benefits (e.g., hummingbird sage).

c. Replanting treated areas with native species should be a component of any comprehensive CCRMP-area wide integrated revegetation and restoration plan.

5. In addition to annual monitoring that should become part of the Creek Spray program, comprehensive field-based monitoring of invasive species should be conducted at least every five years at the scale of the CCRMP area using methods summarized in Rayburn (2016a). This scale of monitoring would allow for a broader evaluation of the effectiveness of invasive species control efforts across the region, as well as identification of new priority species or areas in which rapid spread of invasive species is occurring.

6. Invasive species mapping and treatment efforts within the CCRMP area should be leveraged to support additional mapping and treatment efforts upstream of Capay Dam to target source populations that continue to disperse downstream to lower Cache Creek. Opportunities for collaboration with the Yolo County RCD, the Bureau of Land Management, and private landowners (e.g., the Yocha Dehe Wintun Nation) on invasive species mapping and treatment projects should continue to be explored.

5.4 SPECIAL-STATUS SPECIES

5.4.1 Observations of Special-Status Species and Additional Data

No active nesting colony of bank swallows (*Riparia riparia*; State threatened) were observed during the 2017 Creek Walk; however, a colony was observed by TAC members and County staff along the south bank at RM 21.4 in the Madison reach during a float trip approximately one month prior to the 2017 Creek Walk. This colony location was observed during the Creek Walk, although was no longer active as juveniles had likely fledged. Elsewhere in the Madison reach near RM 22.0, a historical bank swallow colony site was observed to have been scoured away by high flows, although the resulting bank was suitable for recolonization. Prior to 2014, bank swallow colonies were observed more frequently along lower Cache Creek; this apparent decline may be due to effects of the 2010–2015 drought (e.g., reduce surface flows with negative effects on prey species, lack of high flows that result in exposed, erodible banks in which bank swallows nest). Swainson's hawks (*Buteo swainsoni*; State threatened) were observed as flyovers at numerous locations along all seven reaches of lower Cache Creek, as in years past. Western pond turtles (*Actinemys marmorata*; State species of special concern) were again common, and were observed by Creek Walk participants in the Capay and Guesisosi reaches. Dead and stressed turtles were observed in previous years along dry stretches of the channel between wet pools. Neither dead nor stressed turtles were observed in 2017, likely due to higher surface flows and deeper pools that resulted from above-average precipitation.

As summarized in the 2016 Annual Report, the TAC Riparian Biologist mapped all blue elderberry shrubs throughout the CCRMP from 2015–2016. Elderberry shrubs are a special-status plant because they serve as the sole host for the federally-threatened Valley elderberry longhorn beetle (VELB; *Desmocerus californicus dimorphus*). The distribution of elderberry shrubs represents an important consideration to implementing habitat restoration, channel maintenance, and bank stabilization projects, given the typical limitations on disturbance within 100 feet of shrubs of a certain size occupied by VELB unless compensatory mitigation is provided. Over 10,000 elderberry shrubs were mapped within the CCRMP area and included seedlings, resprouts, mature shrubs, and older tree-like plants. Numerous seedlings, often found under the canopies of larger elderberry shrubs, strongly suggested that the elderberry population is increasing. Most elderberry shrubs were found on benches and upper terraces, with only a few scattered shrubs on the channel floor. This was hypothesized to have resulted primarily from periodic high flows that would tend to scour elderberry shrubs from the channel. Some evidence of this was observed during the 2017 Creek Walk, with at least two large elderberry shrubs observed to have been completely uprooted by high flows in the Hungry Hollow and Rio Jesus Maria reaches.

5.4.2 Recommendations Regarding Special-Status Species

Similar to 2016, the following recommendations are made regarding special-status species in the CCAP area:

1. Opportunities for expanded inventory and monitoring of common and special-status wildlife, invertebrate, and fish species should be explored to provide a more complete assessment of biological resources, potentially in collaboration with university researchers.

    a. Species of interest include birds (bank swallow, loggerhead shrike, Northern harrier, Swainson's hawk, various owls, white-tailed kite, and yellow warbler), mammals (American badger, bobcat, Columbian black-tailed deer, coyote, mountain lion, ringtail, river otter, and Sacramento Valley red fox), reptiles (Western pond turtle), invertebrates (VELB), and fish (California roach, hardhead, and Sacramento hitch).

    b. Potential monitoring methods include game camera networks, track plates, point count or transect surveys for nesting birds, native fish surveys, and telemetry (e.g., radio collars or GPS collars).

2. All observations of special-status species should be logged in the California Natural Diversity Data Bank (CNDDB; https://www.wildlife.ca.gov/Data/CNDDB).

3. Opportunities to increase surface flows in lower Cache Creek should be explored, since increased

flows should benefit Western pond turtle and other special-status species in addition to native vegetation.

5.5 ADDITIONAL BIOLOGICAL RESOURCE OBSERVATIONS

Additional avian species observed during the 2017 Creek Walk included acorn woodpecker, Anna's hummingbird, ash-throated flycatcher, barn swallow, belted kingfisher, Bewick's wren, black phoebe, black-crowned night-heron, black-headed grosbeak, blue grosbeak, Brewer's blackbird, brown-headed cowbird, Bullock's oriole, bushtit, California quail, California scrub-jay, California towhee, Canada geese, cliff swallow, common raven, common yellowthroat, double-crested cormorant, downy woodpecker, Eurasian collared-dove, European starling, great blue heron, great egret, green heron, house finch, killdeer, least sandpiper, lesser goldfinch, lesser nighthawk, marsh wren, mourning dove, northern flicker, northern mockingbird, Nuttall's woodpecker, osprey, red-shouldered hawk, red-tailed hawk, red-winged blackbird, snowy egret, song sparrow, tree swallow, turkey vulture, Western kingbird, white-breasted nuthatch, and wild turkey. Although they are not special-status species per say, these avian species are considered important wildlife resources by the California Department of Fish and Wildlife and are protected under the federal Migratory Bird Treaty Act, as are the nests of birds when in active use. Construction and other disturbance that would disturb nesting birds and lead to nest abandonment is prohibited under the Migratory Bird Treaty Act without specific authorization from the U.S. Fish and Wildlife Service.

Mammals observed during the Creek Walk included Columbian black-tailed deer (*Odocoileus hemionus columbianus*) at RM 27.0 and a mink (*Neovison vison*) along the north bank at RM 18.5. Minor beaver activity was observed along the north bank at RM 26.0. Mexican free-trail bats (*Tadarida brasiliensis*) were heard calling from under the bridge at RM 21.0. In addition, USGS staff encountered during the Creek Walk on the access road just downstream of RM 28.1 in the Capay Reach noted that a bobcat (*Lynx rufus*) had been seen at that location in Spring 2017. A mink was also observed at the Cache Creek Conservancy two days prior to the 2017 Creek Walk. Nonnative wild pigs (*Sus scrofa*) were observed by the TAC Riparian Biologist in both 2015 and 2016, but not in 2017.

Amphibians observed during the Creek Walk included California toad (*Anaxyrus boreas halophilus)* and nonnative bullfrog (*Lithobates catesbeianus*). Reptiles observed during the Creek Walk included Western pond turtles as described above, as well as Western fence lizards (*Sceloporus occidentalis*). Fishes included nonnative carp in the Capay reach, nonnative bullhead catfish in the Hungry Hollow reach, and likely observations of native pike minnow in the Madison reach. Insects observed included the American rubyspot dragonfly (*Hetaerina americana*) and the Western tiger swallowtail butterfly (*Papilio rutulus*).

CHAPTER 6 - STATUS OF PRIOR PROGRAM RECOMMENDATIONS

Beginning in 2011, the Cache Creek Annual Status Report has provided recommendations for channel improvement priorities. These recommendations are based on the physical, hydrologic, and biological assessments of Cache Creek and are pursuant to the goals, policies, and actions of the CCRMP. The prior recommendations, combined with the physical observations and data collected in the current year, formed the analytical basis for TAC recommendations regarding program priorities and projects in 2017. Prior recommendations are listed below and the current status – as of December 2017 – is provided for each. New recommendations developed as part of the 2017 Annual Report are included at the end of each table and are designated with a ☆ symbol. These recommendations will be officially incorporated into the list once they are reviewed and accepted by the Yolo County Board of Supervisors.

*Table 9-A: **High** Priority Programmatic and Channel Improvement Recommendations*

ID#	Description	Year Introduced	Status	Level of Effort
1	Channel maintenance project on upper bank at Huff's Corner (RM 11.6) to prevent downstream unraveling of existing bank protection. *[Geomorphologist]*	2012	Not Started	Low
2	Repair levee and bank erosion at RM 19.5. *[Geomorphologist]*	2012	Not Started	Medium
3	Total mercury concentrations have remained closer to the CTR threshold of 0.05 ug/L for two consecutive years, the CCIP should initiate more extensive coordination with other entities assessing broader mercury issues in the Cache Creek watershed, including DWR, the Regional Water Quality Control Board (RWQCB), and the Bureau of Land Management (BLM) to determine if the concentrations detected in the previous two years are pertinent to the broader on-going mercury studies. *[Hydraulic Engineer]*	2013	In Progress	Low-Medium
4	Update and maintain geo-spatially reference photo log for use on future Creek Walks and to document on-going changes and conditions on the Creek. *[Hydraulic Engineer]*	2012	On-Going *(Permanent Recommendation)*	Medium
5	Continue to monitor contaminants of concern in creek water based on water quality database review and prioritization describe above. *[Hydraulic Engineer]*	2011	In Progress	Medium
6	Determine whether CCRMP boundary should be updated. *[All]*	2011	In Progress (Working Study Area)	Low

7	Coordinate with full TAC, County staff, Cache Creek Conservancy staff, Yolo RCD staff, and landowners to identify areas and sites best suited for natural regeneration (passive restoration) and active restoration of riparian and upland habitat. *[Biologist]*	2011	In Progress	Medium
8	Continue to participate in the implementation of the Cache Creek Watershed Wide Invasive Management Plan. *[Biologist]*	2011	In Progress	Low
9	Remove large bar to reduce erosive pressure on bank at RM 11.7 (upstream from Huff's corner on north side). *[Geomorphologist]*	2014	Not Started	High
10	Plant native species on all invasive species treatment sites to prevent reinvasion and accelerate recovery of native vegetation. *[Biologist]*	2015	In Progress	Medium
11	Expand list of priority invasive plant species to include Himalayan blackberry, perennial pepperweed, tree of heaven, tree tobacco, nonnative thistles, and other species identified in 2015 annual report and 2016 invasive species mapping and prioritization project. *[Biologist]*	2015	In Progress	High
12	The County should survey water surface evaluation profiles of Cache Creek at high flows (15,000+ cfs) to assist in calibrating the 2D Hydraulic Model.	2016	Complete	Medium
☆1	Accelerate proposed bar skimming projects at RM 24.6 – 25 and RM 20.1 – 20.5 [?]	2017	In Progress	Medium
☆2	Consider potential for bar skimming projects at RM 23.1, RM 22, RM 21.8, RM 21.6, and RM 21.4 [?]	2017	In Progress	High
☆3	Evaluate need for treatment (channel management) at I-505 crossing where over 100 feet of north bank erosion occurred in 2017. [All?]	2017	In Progress	Medium
☆4	Reassess proposed Channel Form Template (CFT) location and evaluate need for treatment (instream maintenance) at RM 26.0, RM 25.4 – 25.5, RM 23.5, RM 22, RM 21.8, RM 21.6, RM 21.4, RM 21.1, and RM 18.0 – RM 18.2. *[Geomorphologist]*	2017	Not Started	High
☆5	Implement spatially-explicit monitoring to track location and status (e.g., treated or not) of invasive species patches. *[Biologist]*	2017	In Progress	Medium
☆6	The County should survey water surface elevation profiles of Cache Creek at high flows (30,000+ cfs) to assist in calibrating the 2D Hydraulic Model.	2017	Not Started	Medium

*Table 9-B: **Medium** Priority Programmatic and Channel Improvement Recommendations*

ID#	Description	Year Introduced	Status	Level of Effort
1	Compile Water Quality Impact Catalogue and associated source and contaminant potential assessment. *[Hydraulic Engineer]*	2012	In Progress	Low
2	Continue to pursue partnerships to install continuous turbidity monitoring. *[Hydraulic Engineer]*	2011	In Progress	Low
3	Channel maintenance project on lower bank at Huff's Corner (RM 11.6) to prevent downstream unraveling of existing bank protection. *[Geomorphologist]*	2012	Not Started	Low
4	Flood conveyance at the I-505 bridge: Coordinate with CALTRANS and stakeholders, and complete hydraulic modeling to determine before- and after-skimming water surface elevations if the bar were skimmed. *[Geomorphologist, Hydraulic Engineer]*	2011	Not Started	Low-Medium
5	Implement water temperature monitoring by placing water temperature data loggers in each reach. *[Hydraulic Engineer]*	2011	Not Started	Medium
6	In collaboration with university researches, non-profit scientists, and/or private consultations, implement statistically-valid monitoring of wildlife (birds, mammals, reptiles, and amphibians), insets (e.g., VELB) and fish to complement vegetation monitoring. *[Biologist]*	2011	In Progress	Medium
7	Explore opportunities to increase surface water flows in Cache Creek to improve conditions for native/riparian vegetation. *[Biologist]*	2013	In Progress	Medium
8	Remove remaining (some webbing burned in Water Year 2015) exposed webbing at the PG&E site (RM 26.9). *[Geomorphologist]*	2014	Not Started	Medium
9	Erosion sites from December 2014 event should be monitored in the future. *[Hydraulic Engineer]*	2015	In Progress	Low

10	Capay Dam damage due to flows in December 2014 be addressed and corrective actions implemented to prevent similar future damage. The December event was approximately a 2-3 year return event and this structure should not have sustained this damage for such a small magnitude flow event. *[Hydraulic Engineer]*	2015	Yolo County Flood Control and Water Conservation District has communicated that the issue will not be remedied. TAC will monitor site for any future problems that arise from the failure.	Low
11	Biomass from treated invasive species should be burned on site or otherwise removed from the CCAP area to reduce debris and to create space for native vegetation recruitment. *[Biologist]* -- Permanent Recommendation	2015	In Progress (Responsibility of Cache Creek Conservancy)	Medium
☆1	Monitor lateral channel migration throughout Cache Creek and add new programmatic recommendations for areas with extensive migration that threatens channel stability with respect to the proposed CFT. *[Geomorphologist]*	2017	In Progress	Low
☆2	Implement best management practices for planning, implementation, and evaluation of habitat enhancement and restoration projects (e.g., include native understory species, implement effectiveness monitoring). *[Biologist]*	2017	In Progress	Medium
☆3	Work with water quality analytical lab to improve coliform testing. *[Hydraulic Engineer]*	2017	In Progress	Low

*Table 9-C: **Low** Priority Programmatic and Channel Improvement Recommendations*

ID#	***Description***	***Year Introduced***	***Status***	***Level of Effort***
1	Remove berm/concrete barrier at Correll Rodgers. *[Geomorphologist]*	2012	Not Started	Low
2	Continue to monitor beaver activity in relation to potential impacts on native vegetation and wildlife, flows, and channel capacity. *[Biologist]*	2015	Monitoring Only	Low
3	Perform surveying to develop water surface elevation profiles for hydraulic model calibration. *[Hydraulic Engineer]*	2016	Completed in 2017	Low
☆1	Notify bridge owner and assess need for instream or channel bank maintenance immediately after Water Years with peak flows exceeding 20,000 cfs. *[Geomorphologist]*	2017	In Progress	Low

*Table 9-D: **Completed or Removed** Programmatic and Channel Improvement Recommendations (2015-2017)*

ID#	Description	Status
High Priority #1 (2016)	Assessment of bar skimming in the following locations: RM 26.1, 25.5, 21.6, and 20.3-20.5. Need to establish footprint, linear distance, and estimate of material to be removed (for ACE In-Channel Project list). *[Geomorphologist]*	Completed at 26.1 & 25.5 in 2016. Other locations updated in High Priority ☆2 (2017)
High Priority #2 (2015)	Estimate the annual rate of channel bed aggradation over time. *[Geomorphologist]*	Completed for CCAP Update in 2016
High Priority #4 (2015)	Amend Aerial survey contract and scope of work. *[Geomorphologist]*	Completed for 2015 Drone Survey
High Priority #4 (2016)	Create Creek Walk protocol. *[All]*	Completed in 2017
High Priority #7 (2015)	Continue to monitor actively migrating bends, and use a predictive model. *[Geomorphologist]*	Removed in 2016
High Priority #8 (2016)	Continue groundwater monitoring near Cache Creek. *[Hydraulic Engineer]*	Removed in 2017 – Completed by WRID
High Priority #12 (2015)	Continue to work with County staff and the aerial contractor to further refine and classify vegetation. *[Biologist]*	Completed in 2016
High Priority #12 (2016)	Active bank retreat near RM 21.6 (near the old Madison Bridge) should be monitored. *[Geomorphologist]*	Monitoring completed in 2016. Updated in High Priority ☆4 (2017)
High Priority #13 (2016)	Significant erosion at the I-505 crossing should be assessed and vegetation should be removed in order to protect the bridge piers. *[Geomorphologist]*	Erosion assessed in 2017 & recommendation updated in High Priority ☆3 (2017)
High Priority #14 (2016)	Replace dead arundo and tamarisk in the Capay Reach with native plantings. Coordinate with Cache Creek Conservancy. *[Biologist]*	Removed in 2017 – duplicate recommendation to 2017 High Priority #10 (2017)
High Priority #16 (2015)	Channel shifting patterns near RM 26.4 should be actively monitored. *[Geomorphologist]*	Completed for CCAP Update in 2016
High Priority #16 (2016)	Implement gravel bar skimming projects at RM 24.6–25.1 (Granite-Capay) and RM 20.1–20.5 (CEMEX). *[Geomorphologist]*	Removed in 2016 & updated in High Priority ☆1 (2017)
High Priority #17 (2015)	Bank erosion at RM 26.9 on the south bank continued engagement with PG&E. *[Geomorphologist]*	Completed in 2016
High Priority #17 (2016)	Evaluate proximity of on-going scour and erosion at RM 26, 25.4-25.5, and 23.1 to Test 3 Line to inform routine maintenance efforts. *[Geomorphologist]*	Completed in 2016 & updated in High Priority ☆4 (2017)

High Priority #18 (2015)	The bank retreat patterns near RM 25.4 -25.5, RM 22.0, and RM 20.6 for regeneration of riparian habitat. Site-specific small scale revegetation plantings explored. *[Geomorphologist]*	Removed in 2016
High Priority #18 (2016)	The TAC should develop a two dimensional (2D) hydraulic model for the study area to better evaluate key program components such as the Test 3 Line and in-channel stabilization projects. *[Hydraulic Engineer]*	Completed in 2016
High Priority #19 (2016)	Water quality sampling protocols should be amended for 2015/2016 to track contaminants that were elevated over historical norms in 2014/2015. *[Hydraulic Engineer]*	Completed 2016
Medium Priority #1 (2015)	Update reach descriptions using updated values for all channel characteristics. Standardize the reach endpoint descriptions. *[Geomorphologist]*	Completed for CCAP Update in 2016
Medium Priority #3 (2016)	Complete HEC-RAS modeling of the Huff's Corner area, and a comparison with the 1996 100-year flood capacity. *[Hydraulic Engineer]*	Completed in 2017
Medium Priority #4 (2015)	Mapping protocols should be developed to define the procedure and schedule for mapping vegetative cover within the CCRMP study area. *[Biologist]*	Completed in 2016
Medium Priority #6 (2015)	Channel maintenance project at south bank RM 12.35 to prevent the recruitment of foreign material into the Creek. *[Geomorphologist, Hydraulic Engineer]*	Completed in 2015
Medium Priority #9 (2016)	Monitor tree loss and damage by beavers to determine if/when intervention is appropriate. *[Biologist]*	Removed in 2017 – duplicate recommendation to Low Priority #2 (2017)
Medium Priority #10 (2016)	Monitor for bank retreat at the following locations: RM 26.9 (south [right] bank), RM 26.4 (south bank), RM 26.0 (south bank), RM 25.4-25.5 (south bank), RM 25.1 (bed degradation), RM 22.0 (north bank), RM 21.6 (north bank), RM 21.4 (spur dike toe erosion), RM 20.4 (south bank), RM 19.8 (south bank), RM 18.8-18.7 (south bank), RM18.2-18.0 (north bank), RM 15.4 (south bank), RM 15.0 (beneficial deposition on both banks), RM 14.3 (north bank), RM 12.3 (structures on south bank). *[Geomorphologist]*	Replaced in 2017 by Medium Priority ☆1 (2017)
Medium Priority #11 (2016)	Make observations at the following locations: RM 21.8 (south bank), RM 20.4 (potential for bar skimming; mid-channel), RM 17.8 (north bank), RM 11.6 (south bank). *[Geomorphologist]*	Replaced in 2017 by Medium Priority ☆1 (2017)
Medium Priority #13 (2016)	Evaluate potential for bar-skimming channel maintenance in the following locations: near RM 26.1, near RM 25.0-25.5, near RM 20.3-20.8 (high potential and benefits). *[Geomorphologist]*	Replaced in 2017 by High Priority ☆2 (2017)
Low Priority #1 (2016)	Channel bank retreat upstream from Moore's Siphon near RM 18.1 should be monitored. *[Geomorphologist]*	Replaced in 2017 by High Priority ☆4 (2017)
Low Priority #2 (2016)	Establish a high-flow triggered bank stability monitoring plan for the I-505 bridge. *[Geomorphologist]*	Incorporated into Low Priority ☆1 (2017)

Low Priority #3 (2016)	Establish a high-flow triggered bank stability monitoring plan for the south bank at the CEMEX Slope Protection Project. *[Geomorphologist]*	Removed in 2017
Low Priority #5 (2016)	Encourage property owner to remedy erosion at the toe of the embankment on south bank (RM 20.4, 19.8). *[Geomorphologist]*	Incorporated into High Priority ☆1 (2017)
Low Priority #6 (2016)	Focus habitat restoration efforts on priority sites, including Capay Open Space Park, the Millsap Property, the Hayes "Bow-Tie" property, and the Cache Creek Nature Preserve. *[Biologist]*	Replaced in 2017 by High Priority #7 (2017)

CHAPTER 7 - PROGRAM ADMINISTRATION

The Natural Resources Division continues to demonstrate its commitment to delivering a program that implements the CCAP in a responsible, balanced, and efficient manner. Staff has worked cooperatively and collaboratively with program stakeholders to refine the program and adaptively respond to evolving economic and environmental conditions. The Off-Channel Mining Plan (OCMP) continues to be administered by the County's Department of Community Services, which is also responsible for the processing of all new mining permit applications and Flood Hazard Development Permits. As in previous years, an outside consultant assisted with oversight, management, and audit services. Staff continues to strengthen relationships with core partners through open communication and demonstrated accountability. The production of this Annual Report is the direct result of the on-going commitment of all the CCAP partners in meeting the intended purpose and goals of the CCAP.

7.1 CACHE CREEK TECHNICAL ADVISORY COMMITTEE

The Cache Creek Technical Advisory Committee (TAC) was established to (1) provide scientific and technical review and oversight for all projects conducted under the CCIP, and (2) collect and evaluate scientific data on hydrologic, hydraulic, sediment transport, and biological conditions within the CCRMP area. The TAC is a three-person interdisciplinary group comprised of a hydraulic engineer, a fluvial geomorphologist and riparian biologist. The additional responsibilities of the TAC are outlined on pages 5 through 7 of the CCIP.

The 2017 Cache Creek Technical Advisory Committee is staffed by the following subject matter experts:

Andrew Rayburn, Ph.D., TAC Riparian Biologist

Dr. Rayburn obtained a B.A. in Biology from Austin College, a M.S. in Ecology and Evolutionary Biology from Iowa State University, and a Ph.D. in Ecology from Utah State University. He is a Certified Ecologist (Ecological Society of America) with over 16 years of experience in applied ecology with a focus on ecological restoration, invasive species control, landscape assessment, geospatial analysis, and both riparian and upland ecosystems.

Mark Tompkins, P.E., Ph.D., TAC Geomorphologist and TAC Chair

Dr. Tompkins completed his undergraduate and Master's degrees from the University of Illinois and earned his Ph.D. in Environmental Planning from University of California, Berkeley. He is a registered Civil Engineer and has over 18 years of consulting experience in river restoration, flood management, fluvial geomorphology, hydrology, hydraulics, sediment transport, fisheries biology, environmental planning, and water resources engineering.

Paul Frank, P.E., CED, TAC Hydraulic Engineer

Mr. Frank is an ecological engineer experienced in river corridor, wetland, and watershed management planning, analysis, and implementation. He has 15 years of engineering consulting experience practicing hydraulic, hydrologic, and flood analysis and modeling; fish passage design; sediment transport and fluvial geomorphology; and ecosystem conservation, restoration, and assessment planning. Mr. Frank has experience with designing and constructing multi-objective river and wetland design projects in North America, Europe, Asia, and the Middle East. He is a state-wide recognized expert in hydraulic and sediment transport analysis and modeling, having developed models for hundreds of miles of river systems throughout California.

7.2 PROGRAMMATIC RECOMMENDATIONS

Each year County staff, program partners, and the TAC review the programmatic requirements of the CCIP and the CCRMP and identified a number of appropriate program adaptations based on what is required by the program and what is feasible and achievable from an economic and operational stand point. The CCAP anticipates ongoing program adaptations, initiated at the staff level, to ensure continued efficient implementation based on funding and staffing realities, and conditions in and around the creek.

For 2016, the following recommendations were made by staff in consultation with interested parties and program partners and approved by the TAC (or other governing body, where appropriate). More detailed documentation supporting each of these, as well as a record of the public discussion of each item at the TAC meetings is available in the program files.

7.2.1 Partnership with the Yolo HCP/NCCP JPA

After significant discussion between Natural Resources staff and staff of the Yolo Habitat Conservation Plan and Natural Communities Conservation Plan Joint Powers Agency (HCP/NCCP JPA) the Board of Supervisors approved a partnership agreement between the two entities on December 2, 2014.

The Yolo County HCP/NCCP is a countywide plan to provide member agencies with a streamlined Endangered Species Act permitting process and protect habitat for 12 endangered and threatened species. JPA and Natural Resources staff developed a proposal to assist with the management of some of the lands Yolo County will receive over time as part of the Cache Creek Area Plan. The outline of this agreement, is as follows: The County of Yolo intends to donate easements on between 250 and 660 acres of "net gains" or other lands within the Cache Creek Area Plan area consistent with the Yolo HCP/NCCP, as long as the easements:

1. Are also consistent with the Cache Creek Area Plan and future Cache Creek Parkway Plan development

2. The Yolo HCP/NCCP pays for transaction costs associated with placement of the easements

3. The Yolo HCP/NCCP pays for habitat-related maintenance of these properties in perpetuity

The County may also contribute Cache Creek Area Plan funding towards acquisition of conservation easements, if funding is available and the acquisition is consistent with the policies and objectives described in the Cache Creek Area Plan program documents.

The County intends to continue to implement activities prescribed in the Cache Creek Improvement Program (e.g. monitoring and invasive species removal), funded with Cache Creek Area Plan revenue and consistent with the Yolo HCP/NCCP.

The County may at any time decline to partner with the Yolo HCP/NCCP Joint Powers Agency or decide not to donate easements or dedicate revenue to activities consistent with the Yolo HCP/NCCP. The JPA will work with the County to bring in revenue for Cache Creek Resources Management Plan and Cache Creek Improvement Program implementation that would not otherwise be available to the County.

This partnership will help the JPA meet the conservation obligations of the Yolo HCP/NCCP. The partnership also will bring additional state and federal funding into the County to implement the Cache Creek Resources Management Plan and Cache Creek Improvement Program that would not otherwise be available because it is designated only for HCP and NCCP implementation, as well as funding for ongoing habitat-related management and maintenance of the properties.

It is anticipated that the HCP/NCCP will be approved in 2018 and formal discussions regarding the dedication of easements and associated maintenance tasks will begin shortly after permit issuance.

7.2.2 Improved Coordination between OCMP and CCRMP Monitoring and Implementation

Staff has amended internal protocols to ensure coordination of monitoring activities among all program sectors. Department of Community Services staff are responsible for the physical inspection of each mining site on an annual basis. The TAC is responsible for an annual inspection of the Creek. The revised protocols ensure that the TAC is made aware of the results of the mining inspections and that Community Services staff is made aware of the results of the Creek Walk inspections. This will allow for early identification of potential problem areas within the program area.

7.2.3 Revised Off-Channel Pit Mercury Testing Protocols

In 2011, the County contracted with Dr. Darell Slotton to study ambient mercury levels in fish and invertebrates in both Cache Creek and several off-channel mining pits. The results of this study were provided to the County in 2013 and are available on the Natural Resources webpage. The purpose of this study was to update baseline mercury conditions in certain locations along Cache Creek. Mercury monitoring in wet pits is a requirement of the County's Surface Mining Reclamation Ordinance (Section 10-5.517). In 2014, the County again contracted with Dr. Slotton to create a set of mercury monitoring protocols for the gravel producers to use when testing the wet pits. The intent of these protocols is to ensure that the mercury data that the County receives is collected in the same manner to ensure that all of the data is compatible and comparable.

As mentioned above in Section 2.3.1, a version of these protocols was attached to the 2015 Cache Creek Annual Status Report and was inappropriately listed as a final version. However, it was discovered that version was simply a rough draft. The finalized protocols will be adopted with the Cache Creek Area Plan Update in 2018, and is to supersede the document attached in the 2015 Cache Creek Annual Report.

7.2.4 Trespass Enforcement on Cache Creek

In May 2014, the Natural Resources Division convened the first meeting of the Yolo County Trespass Task Force with the participation of representatives from the Sheriff's Department, District Attorney's Office, General Services, County Counsel and County Administrator's Office. The goal of the first meeting was to discuss roles and responsibilities, identify impediments and constraints to enforcement and prosecution and to ultimately reduce the number of trespass incidents and associated complaints.

As a direct result of the Trespass Task Force, the Sheriff's Department has changed their approach to dealing with simple trespass. Starting June 4, 2014 the Department began issuing tickets (infraction) for trespass under PC§ 602.8(a). Previously, the practice was to make an arrest (misdemeanor). This process is favored by the DA's office because infractions are treated in the same manner as traffic violations and shouldn't have an adverse effect on the DA's caseload. Arrests will still be made when warranted (i.e. the trespass was committed in conjunction with another crime such as theft, vandalism, etc.).

In an effort to further address the trespass issues experiences along the creek, Natural Resources staff brought an ordinance to the Board of Supervisors for their consideration in November 2015. After a series of board meetings and slight edits to the proposed ordinance, it was finally passed on January 26, 2016. This ordinance bans the use of OHVs in Cache Creek between the hours of 7:00 p.m. and 6:00 a.m. In addition to the passing of the ordinance, $100,000 in contingency funds were allocated to the Yolo County Sheriff's Office to support increased patrols. The Parks and Natural Resources Divisions were also directed to resume the search for suitable locations for an OHV park in Yolo County.

7.3 FUNDING

The implementation of the Cache Creek Area Plan is funded by fees collected through the Gravel Mining Fee Ordinance. This ordinance was adopted by the Board of Supervisors in 1996 when the program was developed and was most recently amended in December 2013. The purpose of this ordinance is to establish the fee amounts to be paid annually by the gravel operators for each ton of gravel sold, as well as identify how the fees will be spent. The current fee schedule is as follows:

Table 10. Gravel mining fee schedule.

Fee Effective	Fee per Ton	Fee Effective	Fee per Ton
Jan 1, 2013	$0.470	Jan 1, 2020	$0.619
Jan 1, 2014	$0.489	Jan 1, 2021	$0.644
Jan 1, 2015	$0.508	Jan 1, 2022	$0.669
Jan 1, 2016	$0.529	Jan 1, 2023	$0.696
Jan 1, 2017	**$0.550**	Jan 1, 2024	$0.724
Jan 1, 2018	$0.572	Jan 1, 2025	$0.753
Jan 1, 2019	$0.595	Jan 1, 2026	$0.783

7.3.1 Gravel Mining Fee Distribution

Pursuant to the Gravel Mining Fee Ordinance, the purpose and use of fees are to fund the implementation of the following:

- Cache Creek Resources Management Plan (CCRMP) and Cache Creek Improvement Program (CCIP)
- Off-Channel Mining Plan (OCMP)
- A long-term interest bearing account for future activities called the Maintenance and Remediation Fund (M&R)
- Habitat restoration and enhancement along Cache Creek (implemented by the Cache Creek Conservancy)

Each of the four fund receives a portion of the fee surcharge for each ton of gravel sold:

Table 11. Distribution of gravel mining fees.

CCRMP	OCMP	M&R	CCC
55.56%	17.78%	4.44%	22.22%

Pursuant to the Gravel Mining Fee Ordinance, Section 10-11.01(a) and (c), the calculated fee split is as follows:

Table 12: Calculated gravel mining fee split (2011-2019).

Year	Fee per Ton	CCRMP	OCMP	M & R	CCC
2011	$0.526	$0.293	$0.094	$0.024	$0.117
2012	$0.526	$0.293	$0.094	$0.024	$0.117
2013	$0.470	$0.261	$0.084	$0.021	$0.104
2014	$0.489	$0.272	$0.087	$0.022	$0.109
2015	$0.508	$0.282	$0.090	$0.023	$0.113
2016	$0.529	$0.294	$0.094	$0.023	$0.118
2017	**$0.550**	**$0.306**	**$0.100**	**$0.024**	**$0.112**
2018	$0.572	$0.318	$0.102	$0.025	$0.127
2019	$0.595	$0.331	$0.106	$0.026	$0.132

The Fee Ordinance identifies allowable expenditures as follows:

The **Cache Creek Resources Management Plan (CCRMP)** implementation fee is to be used to implement the CCRMP and CCIP. Specifically, it can be used for the design and construction of projects for channel stabilization and bridge protection; the design and construction of channel maintenance projects; monitoring, modeling, and flood watch activities per the CCIP; and compensation of the TAC.

It should be noted that, at the discretion of the County, up to 35 percent of the CCRMP fee paid by aggregate producers may be offset by costs incurred from participating in channel improvement projects. However, such offsets cannot be utilized for bank protection mitigation measures required under the off-channel mining permits. There were no fee offsets in 2017.

The **Off-Channel Mining Plan (OCMP)** administration fee is to be used for the implementation of the OCMP; administration of the long-term mining permits and Development Agreements; and inspection of mining and reclamation operations.

The **Maintenance and Remediation (M&R)** fee is to fund a long-tem, interest-bearing account for the following future activities: the correction of mercury bioaccumulation problems after reclamation has been completed, if necessary; clean-up hazardous materials contamination after reclamation is completed, if necessary; extended environmental monitoring of the off-channel mines, including data gathering and groundwater modeling, beyond that required in the mining permits; and maintenance of publicly held lakes within the plan area. No expenditures may be drawn from the Maintenance and Remediation fund until January 2027, at which time the fund shall be made available for the activities identified in the ordinance.

The **Cache Creek Conservancy (CCC)** contribution is to be used for habitat restoration and enhancement along Cache Creek, and revegetation projects consistent with CCRMP creek stabilization objectives. This portion of the gravel fees is paid directly to the Conservancy.

The **Twenty Percent Production Exception Surcharge** is collected for any amount of aggregate sold in excess of annual permitted production. These funds are to be divided evenly between the CCRMP Implementation fund and the Maintenance and Remediation fund.

Fee calculations for the current year are based on tons sold during the previous year. In 2016, the aggregate sales within the CCAP totaled 2,624,169 tons, resulting in fees due to the County of $1,187,658.97 for calendar year 2017. Tonnage sold in 2016 represents a 2.48% decrease in sales when compared to those from 2015 (2,690,800 tons).

Table 13: Total tons of gravel sold (2007-2016).

Year	***Total Tons Sold***
2007	3,455,996
2008	2,813,908
2009	2,190,454
2010	1,730,834
2011	1,869,151
2012	1,517,741
2013	2,090,247
2014	2,156,620
2015	2,690,800
2016	**2,624,169**

7.3.2 Program Audits and Review

Section 10-11.02(f) of the Gravel Mining Fee Ordinance requires the County to review fee revenue and expenditures on a biannual basis, to verify that program activities and expenditures fall within the scope of the program, and to verify deposits into appropriate program funds. To complete these reviews, that Natural Resources Division contracts with the County's Division of Internal Audit.

An audit of the gravel mining fees was scheduled to occur in FY 2014-2015, but unfortunately the Natural Resources Division received notice that the Division of Internal Audit had to defer the audit due to other audit priorities and the implementation of the County's new financial and human resources information systems. The Natural Resources Division has re-engaged in discussions to get this audit, and additional audits, scheduled and completed.

The County is also required by Section 10-11.05(b) of the Gravel Mining Fee Ordinance to biennially audit tonnage claims and revenue deposits. To fulfill this requirement, the Natural Resources Division conducts an annual analysis comparing the MRRC-2 document to the Assessor's report, and to the CCAP required tonnage report, along with the discrepancy explanations provided by the aggregate producers. The County's Auditor-Controller Office has determined that this analysis, conducted on an annual basis, satisfies the "tonnage claim" audit requirement.

7.4 CACHE CREEK AREA PLAN BUDGET

As mentioned in Section 7.3.1, the gravel fees paid to the CCAP are distributed between four distinct funds: CCRMP, OCMP, Maintenance and Remediation and Cache Creek Conservancy. Since the Conservancy receives its portion of the fees directly, it is not included in the County's overall budget for the CCAP.

An overview of major object items combined from the three County funds (CCRMP, OCMP, and M&R) is included in Table 14.

Table 14: Adopted final 2017-2018 Cache Creek Area Plan program budget.

Major Object	***Total***
Salaries and Employee Benefits	$ 167,584
Services and Supplies	$ 617,330
Other Charges	$ 0
Operating Transfers Out	$ 10,800
TOTAL EXPENSES	**$ 795,714**
Fees and Permits	$ 1,187,659
Investment Earnings	$ 10,500
TOTAL REVENUE	**$ 1,198,159**

7.5 GRANTS

7.5.1 Yolo County Natural Resources Division

This past year, the Natural Resources Division continued to serve as the lead agency for the "Restoring A Creek to Health: Capay Open Space Park From Gravel Mine to Parkway" project, which is being funded by a $499,000 grant obtained from the California Natural Resources Agency's California River Parkways Grant Program. This project focuses on three main components: habitat enhancement, installation of park and trail signage, and an educational component. A site plan overview of the project can be found in Appendix G.

The project site, Capay Open Space Park (COSP), is a 41-acre parcel that straddles Cache Creek. COSP, previously part of a gravel mining site, was donated to the County in 2004 by Granite Construction, and will serve as the gateway to the County-planned Cache Creek Parkway. This site is planned to be managed as a natural area and contains four major habitat types: bottomland floodplain, riparian woodland, riparian scrub, and oak savanna grassland. This project will occur over three years and will help to restore riparian diversity and function to this sub-reach of Cache Creek, fill a significant gap in the Cache Creek wildlife corridor, and serve as a model restoration site for the Cache Creek Parkway.

The Cache Creek Conservancy and Yolo County Resource Conversation District are assisting the County in the implementation of this project. Specific updates from both of these agencies can be found in Sections 7.5.3 (Cache Creek Conservancy) and 7.5.4 (Yolo County Resource Conservation District).

7.5.2 Yolo County Sheriff's Office

This is the eighth year, beginning with FY 2009-2010, that the Sheriff's Office has been the recipient of off-highway vehicle (OHV) grant funds from California State Parks Off-Highway Motor Vehicular Recreation Division. Over this time period, these allocations have been used to fund the Sheriff's OHV Enforcement Team, which monitors OHV recreation within the CCRMP area. To assist with fulfilling the matching fund requirement for State Parks' grant program, the Natural Resources Division contributes $10,000 to the Sheriff's Office.

Off-highway vehicular recreation is common in the formerly mined pits and stream banks of Cache Creek, subsequently creating erosion issues and destroying riparian vegetation. Trespassing is also frequently associated with this form of recreation, with people poaching, camping and loitering along the creek on private lands, leaving behind graffiti, property damage and trash. The OHV Enforcement Team's presence in Cache Creek is instrumental in addressing and properly enforcing these issues.

For FY 2016-2017, the Sheriff's Office was awarded a grant of $55,724 with an additional $18,575 contributed through matching funds, totaling $74,294 to be spent on OHV enforcement activities. A summary of how these grant and matching funds were utilized is included in Table 15. In addition to utilizing State Park's grant funding for enforcement and outreach, the Sherriff's Office continued to use funds from the $100,000 contingency fund contribution that occurred in 2015.

Table 15: Summary of 2016-2017 grant-funded OHV enforcement activities.

Enforcement	***Training/Equipment/Repairs/Fuel***	***Matching Fund***
No. of hours used: 332.5	**Equipment Use Expenses:** $915.32	**Applied to Personnel Costs:** $0
Cost: $26,321.00	**Materials/Supplies Expenses:** $1,751.50	**Applied to Materials/Supplies:** $0
No. of contacts: 3,316	**Equipment:** $26,454.38	**Applied to Equipment Use:** $18,574.66
No. of citations: 1	**Fuel:** $276.94	**Applied to Other:** $0
No. of warnings: 1		**Total Matching Funds Applied:** $18,574.66
No. of arrests: 0		

(Source: Yolo County Sheriff's Office; Reporting Period: 9/1/2016 through 8/31/2017)

The California State Parks Off-Highway Motor Vehicular Recreation Division awarded $68,216 to the Sheriff's Office for FY 2017-2018, which allows continued funding of their OHV Enforcement Team. The grant requires a local match of $22,739, which can be fulfilled by in-kind services. In total, expenditures for the upcoming fiscal year will be $90,955.

7.5.3 Cache Creek Conservancy

The Cache Creek Conservancy (CCC) continued its riparian restoration work on the three-year, $285,000 Environmental Enhancement and Mitigation Program (EEMP) grant from the California Natural Resources Agency. This grant funds a 40+ acre restoration, three-phase project on the Cache Creek Nature Preserve, utilizing the assistance of the Yolo County Resource Conversation District. In 2017, the CCC continued with Phase 2 of this project, focusing on removing additional invasive plants, such as star thistle and perennial pepperweed, disking of the soils, and planting native grasses, shrubs, and trees. Throughout the year, several community planting days were held resulting in more than three thousand forbs planted in the area.

The Cache Creek Conservancy also began working on its portion of the Capay Open Space Park project, led by the Yolo County Resource Conservation District; Yolo County is also a partner on this grant. This $499,000 three-year project is for creek and grassland habitat restoration and installation of new park signs and interpretive panels, which would highlight the history and natural landscape of the area. A public meeting was held in Esparto to solicit input regarding the interpretive panels; another is scheduled for January 2018.

The Cache Creek Conservancy completed a grant from the Water Resources Association fund an initial vegetation management project on the levees at Huff's Corner. This project's ultimate goal is to bring the levee up to California Department of Water Resources' standards, with hopes of transferring the operation and maintenance obligations from the County to a levee maintaining agency. The heavy rains in February 2017 delayed the projects somewhat.

As part of the Conservancy's adopted plan for the Cache Creek Nature Preserve, the following improvements to the Preserve were completed in 2017:

- The shade house has expanded and the resulting native plant propagation program has thrived. A demonstration native plant garden is being developed next to the metal barn to help teach proper seed cultivation techniques to students of varying ages.
- A new rope barrier has been installed at the parking lot edge.
- Repaired the harvester damage.
- Installed a new visitor's map of the Nature Preserve. The artwork was done by Yolo County artist Mark Demler and was funded through a grant by the Glide Foundation.
- Several trees succumbed to high winds, including one heritage oak. These trees have been trimmed or cut down to remove safety hazards to the public.
- Two iron rangers were installed to collect donations from Preserve visitors. The iron rangers were fabricated and donated to the Nature Preserve by Granite Construction.

7.5.4 Yolo County Resource Conservation District

The Yolo County Resource Conservation District (Yolo RCD) also played an instrumental role in the implementation of the Capay Open Space Park project. While their efforts began in January 2017, little ground work was completed due to a rainy winter. Throughout the spring and summer, the Yolo RCD controlled invasive thistles and other weeds on the property, as well as cleaned up old brush piles that were located on the south end of the creek. The Yolo RCD also worked with a soil scientist from the University of California Davis to create a strategy to grow healthy native trees in the compacted, gravelly soil at the park. This fall, the Yolo RCD used an excavator to dig deep holes of various shapes and sizes. Following digging, compost, wood chips and fine soils were added to the holes. In the upcoming months, Yolo RCD staff, local volunteers and students from the Student, Landowner and Watershed Stewardship (SLEWS) program will be planting native trees and shrubs in these holes. SLEWS students recently planted pollinator plants near the park entrance. Several volunteer workdays were also held to seed native grasses and flowers.

Additionally, the Yolo RCD requested $375,000 from the California Wildlife Conservation Board to support the extensive planning, outreach and permitting required to implement a large-scale invasive plant eradication program in the Putah-Cache Watershed. The main invasive species of interest is arundo *(Arundo donax)*, a bamboo-like perennial grass that grows up to 30 feet tall along waterways in dense stands. This species uses three times the amount of water used by native riparian vegetation. This project, if implemented, will save roughly 2,340 acre-feet of water per year through the elimination of 117 acres of arundo. The Yolo RCD will lead a project team to complete the required site analyses, develop appropriate treatment methods for arundo and associated weeds, create a monitoring and reporting plan, obtain necessary local, state and federal permits, including CEQA. Additionally, the RCD will collaborate with local partners to reach out to landowners with efforts to promote and achieve full participation in the program through completing long-term management agreements with the individual landowners. Once planning is completed, the Yolo RCD will apply for a multi-million dollar grant for the on-the-ground work.

7.5.5 Water Resources Association of Yolo County

The Water Resources Association of Yolo County (WRA) is a consortium of entities authorized to provide a regional forum to coordinate and facilitate solutions to water issues in Yolo County. Member agencies of the WRA include the Cities of Davis, Woodland, West Sacramento and Winters, the University of California Davis, Yolo County, the Yolo County Flood Control and Water Conservation District, Reclamation District 108, Reclamation District 2035 and the Dunnigan Water District.

Every fiscal year, the WRA allocates a percentage of membership dues to assist in the funding of water-related projects within Yolo County. The table on the following page summarizes the WRA’s project fund budget allocations for FY 2016-2017.

Table 16: 2016-2017 WRA project fund budget.

Project Name	Lead Agency	Funding Request	Local Match	Total Budget
City of Winters Storm Water Management Planning *(committed allocation)*	City of Winters	$15,000	$12,000	$27,000
Westside IRWMP Implementation	Westside Coordinating Committee	$20,000	$60,000	$80,000
Invasive Weed Removal & Management Huff's Corner (Year 1 of 3)	Cache Creek Conservancy	$15,500	$13,538	$29,038
Pilot Program Conduct Large Landscape Irrigation Audits	Cities of Woodland, Davis, and West Sacramento	$12,000	$18,000	$30,000
Cache Creek Invasive Weed Mapping & Prioritization	Yolo County RCD	$10,000	$32,000	$42,000
Salmon-in-the-Classroom/Salmon-in-the-Bypass	Putah Creek Council	$5,000	$34,000	$39,000
Yolo Bypass Integrated Project	Yolo Basin Foundation	$5,000	$10,000	$15,000
City of Winters Hexavalent Chromium (Cr6) Drinking Water Compliance Project	City of Winters	$20,000	$105,000	$125,000
SGMA Implementation	WRA/YCFB (YCFCWCD)	$16,127	$108,873	$125,000

(Source: Yolo County WRA)

7.6 STATUS OF PROGRAMMATIC PERMITS

The CCRMP relies on several federal and state programmatic permit and approvals that allow for annual implementation of in-channel activities and successful adaptive management. The County is in the process of seeking reauthorization of several of these permits, which streamline the process for channel improvement and habitat restoration projects in the CCRMP area. The status of each of these permits is summarized below.

7.6.1 U.S. Army Corps of Engineers (USACE)

Construction activities within wetland areas, as defined under the Federal Clean Water Act, require prior approval of a Section 404 permit from the USACE to allow for discharge into waters of the United States. The term of the original Regional General Permit No. 58 issued by the USACE was July 1997 through July 2002 for in-stream activities conducted within the CCRMP area. This permit was renewed in May 2004 for another five-year term, extending through May 2009. The County applied for a third reauthorization of this permit in 2011 and has been engaged in the reauthorization process since that time. A public notice concerning the reauthorization was issued in September 2012. Since the expiration of the public notice comment period in October, 2012, the USACE requested initiation of a Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS), as summarized below. The County commissioned an update to the 1996 Cultural Resources Study as required as part of the Section 106 consultation with the State

Office of Historic Preservation for compliance with the National Historic Preservation Act. The regional general permit is a valuable streamlined process for supporting habitat restoration and channel stabilization and maintenance activities on Lower Cache Creek, and is integral to achieving the goals and objectives of the CCAP and of multiple partner agencies. In 2016, the County contracted with ICF International, a professional consulting services firm that is working with the Yolo Habitat Conservancy on the issuance of the HCP/NCCP, to assist in obtaining reauthorization under Regional General Permit No. 58. At the time of publication of this report, the County still awaits a decision on their application.

7.6.2 U.S. Fish and Wildlife Service (USFWS)

As a part of the approval process for the Section 404 permit, the USACE is required to consult with the USFWS regarding a project's potential effects on federally listed threatened and endangered species. In October 1997, the USFWS issued a Biological Opinion for Valley Elderberry Longhorn Beetle (VELB), the only federally listed species to occur in the CCRMP/CCIP area. This opinion was relied upon by the USACE in the original and second reauthorization of the regional general permit. As part of the process to secure the third reissuance of the USACE Section 404 permit, the County submitted a new draft Biological Assessment to the USACE in August 2012 for use in the consultation process with the USFWS. In October 2012, the USACE requested initiation of a Section 7 consultation with the USFWS, and forwarded the draft Biological Assessment for their review and use in determining potential impacts on federally-listed species. The USFWS responded in January 2013 that they needed additional information before formal consultation could begin. Specifically, the USFWS requested that County staff review past project files to determine compliance with previous permits and mitigation requirements for impacts to federally protected species (such as the VELB). Staff researched 38 projects that were implemented on, or along, Cache Creek over the last 20 years and determined the following:

- 16 were constructed pre-CCAP (before 1997) and were not covered under the Regional General Permit
- 12 were constructed under the Regional General Permit and the County has provided evidence of notification
- Seven were outside of the channel and had no Army Corps jurisdiction
- Three were constructed under separate 404 authorization.

In September 2015, County staff from the Natural Resources Division and Community Services Department, Yolo Habitat Conservancy and associated consultants met with USFWS and USACE representatives to discuss the HCP/NCCP and CCRMP to discuss a mutually agreeable path forward. As a result, the County submitted a suite of projects to the Corps and Service for review in December 2015.

7.6.3 California Department of Fish and Wildlife (CDFW)

Construction activities within the defined bed and banks of stream channels require prior authorization from the CDFW through the Streambed Alteration Agreement process defined under Section 1600 of the State Fish and Wildlife Code. The term of the original general 1600 authorization issued by the CDFW was July 1997 through June 2002. This permit was renewed in August 2002 for another five-year term, extending through August 2007. An interim extension through December 2007 was subsequently granted. In August, 2008, the general 1600 authorization was replaced by a Section 1602 Memorandum of Understanding, which establishes an individual project permit template. County staff has initiated discussions with CDFW over the preferred method to secure authorizations for in-channel activities associated with the CCRMP/CCIP. A meeting was held on September 24, 2013 with representatives of CDFW to review the history of the program, conduct a reconnaissance of the CCRMP area, and identify options that best address current authorization requirements. It was determined that a Routine Maintenance Authorization (RMA) under the Streambed Alteration Agreement program was the appropriate mechanism to implement future projects on Cache Creek. The application for the RMA was submitted by the County in March 2014 and finally executed on November 12, 2015. The RMA is effective for 12 years and authorizes restoration and channel maintenance activities in Cache Creek. In November 2016, the Natural Resources Division formally applied to expand the County's RMA coverage through the submission of a sand/gravel/rock extraction permit. Once approved, this would provide authorization to perform in-channel bar skimming projects. At the time of publication of this report, the County's application is still pending.

7.6.4 Regional Water Quality Control Board (RWQCB)

Water Quality Certification, issued by the RWQCB pursuant to Section 401 of the Clean Water Act, is required in order to implement the Army Corps 404 Permit. The term of the original general 401 Certification issued by the Central Valley RWQCB was July 1999 through July 2002. This permit was reissued in August 2002 for a seven-year term, extending through May 2009. In September 2011, Yolo County submitted an application to the RWQCB requesting a third reauthorization of the 401 Water Quality Certification. The application was revised in December 2013 to address some concerns of the RWQCB. On April 29, 2016, the County received notice that the application for the 401 Certification was approved. The reauthorization of this certification will expire in April 2021.

7.6.5 California Department of Conservation Compliance with the Surface Mining and Reclamation Act (SMARA)

Pursuant to CCRMP Action 2.4-15, the County presented a request in 1997 to the State Mining and Geology Board to grant an exemption from the requirements of SMARA for all channel improvement projects approved under the CCIP. The Board rejected the request and determined that the CCRMP was subject to SMARA, so a legislative solution was sought.

In 1999, AB 297 (Thomson) was passed to amend SMARA to recognize the CCRMP as the functional equivalent of a Reclamation Plan for purposes of SMARA compliance. This legislation expired December 31, 2003. In 2004, AB 1984 (Wolk) reauthorized the legislation with an expiration of December 31, 2008. In 2007, AB 646 (Wolk) reauthorized the legislation a third time with an expiration of December 31, 2012. In 2011, SB 133 (Wolk) reauthorized the legislation a fourth time with an expiration of December 31, 2017. In 2016, SB 1133 (Wolk) was signed by Governor Jerry Brown, removing the sunset date on the CCRMP. This is a significant legislative milestone as it allows the program to operate in perpetuity and relieves staff of the work associated with sponsoring new legislation every five years to extend the prior provisions in the Public Resources Code.

7.7 PARTNER ORGANIZATIONS

The following entities are important partners to the County in implementing the CCRMP and CCIP:

7.7.1 California Construction and Industrial Materials Association – Yolo/Cache Creek Work Group

The California Construction and Industrial Materials Association (CalCIMA) is a trade association for the construction and industrial material industries in California, which includes aggregate, industrial mineral, and ready mixed concrete producers. In all, there are about 70 producer member companies that include 250 production sites in every county of California. Specifically, the members of the Yolo/Cache Creek work group of CalCIMA are Granite, Syar, Teichert, and CEMEX.

CalCIMA and the producers are active partners in the implementation of the CCAP. The original effort to develop the CCAP was initiated by the producers, who subsequently paid for the planning process. Both the industry and the County have benefited greatly from the resulting program which continues to be a model throughout the state. Currently, the County and CalCIMA meet quarterly in order to enable feedback and participation in program implementation. Producer representatives regularly attend CCAP TAC meetings, the annual Creek Walk and other program related activities.

7.7.2 Cache Creek Conservancy

The Cache Creek Conservancy (CCC) is a 501(c)(3) non-profit corporation that preserves, restores and enhances the Cache Creek watershed. The CCC, created in 1996, manages land for wildlife habitat, controls invasive plants, and provides environmental education within the lower Cache Creek. It receives fees generated by the Cache Creek Area Plan, as well as funding from state, federal, and foundation grants. The CCC operates with a staff of six employees (three full-time and three part-time) and is assisted by several dedicated volunteers and interns from University of California, Davis on a limited-time basis. All staff works under the direction of an independently elected 15-member Board of Directors.

The CCC and the County have collaborated on a number of joint ventures related to the creek, including management of County-owned lands such as the Correll-Rodgers property, the Millsap property, and the Cache Creek Nature Preserve. The County also contracts with the CCC to perform the annual invasive species Creek Spray.

A draft of the Conservancy's 2017 Annual Report is provided as Appendix H (*Note: The Conservancy's Annual Report will not be reviewed by the CCC Board until January 2018. The attached report is in draft form.)*.

7.7.3 Yolo County Resource Conservation District

The Yolo County Resource Conservation District (Yolo RCD) is a special district recognized under state law. The mission of the Yolo RCD is to protect, improve, and sustain the natural resources of Yolo County. The RCD Board of Directors and staff are dedicated to developing resource stewardship solutions for local landowners based on the best available science and local needs. RCD projects reflect a cooperative effort with the USDA Natural Resources Conservation Service, landowners, agencies, and agricultural and conservation groups.

The Yolo RCD is a lead agency in managing invasive plants throughout the Cache Creek watershed. In early 2016, the Yolo RCD was awarded a grant by the Water Resources Association of Yolo County to do detailed mapping of invasive plants in the first four miles of Cache Creek upstream of the Capay Dam, consistent with the recently completed Cache Creek Watershed-wide Weed Management Plan, and comparable to mapping efforts completed within the CCRMP area in 2016.

The Yolo RCD is currently working closely with the Cache Creek Conservancy on a CalTrans-funded Environmental Enhancement and Mitigation Program (EEMP) grant to remove invasive plants and plant native riparian vegetation on the east end of the Cache Creek Nature Preserve.

In 2017, the Yolo RCD worked with the Cache Creek Conservancy on habitat enhancements and interpretive improvements at Capay Open Space Park as part of the grant awarded to the County of Yolo by the California Natural Resources Agency's River Parkway Program.

A copy of the Yolo County RCD's 2016-2017 Annual Report is attached as Appendix I.

7.7.4 Yolo County Flood Control and Water Conservation District

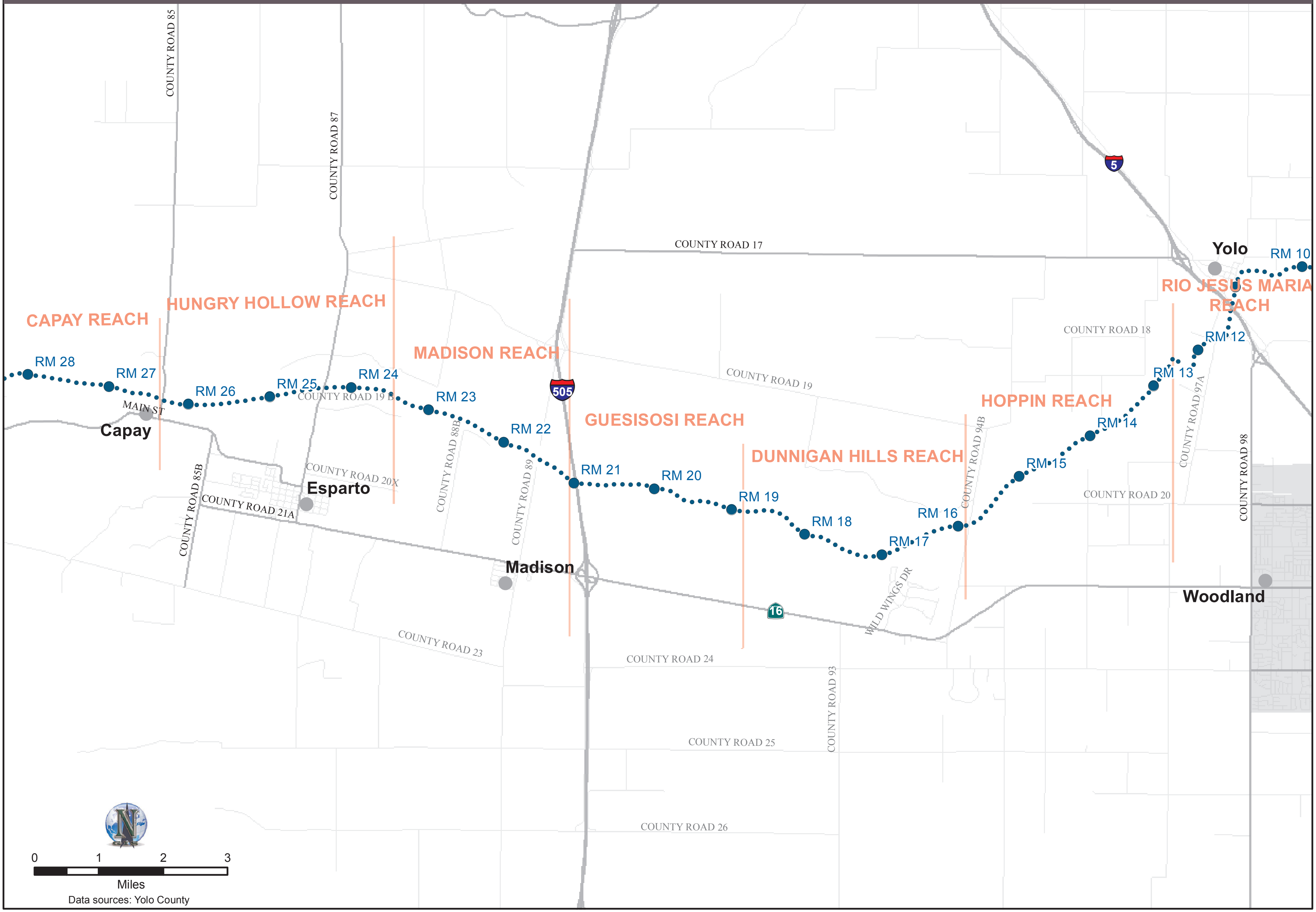
The mission of the Yolo County Flood Control and Water Conservation District (YCFCWCD) is to plan, develop, and manage the conjunctive use of the District's surface and groundwater resources to provide a safe and reliable water supply at a reasonable cost, and to sustain the socioeconomic and environmental well-being of Yolo County. YCFCWCD's boundaries cover 195,000 acres of Yolo County, including the entire CCRMP area. The District operates Clear Lake, Indian Valley Reservoir, and owns the majority of water rights for Cache Creek. As such, YCFCWCD plays a central role in determining the flow of surface water within the Cache Creek watershed. The Capay Diversion Dam, at the upstream end of the CCRMP area, provides some of the water that the District distributes through more than 150 miles of canals and laterals. YCFCWCD also acts as an important partner in stream restoration projects. YCFCWCD manages the WRA's groundwater monitoring program that provides valuable data that helps inform the CCRMP's impacts on groundwater.

APPENDICES

Appendix A:

Lower Cache Creek River Miles & Reaches Map

Lower Cache Creek - River Miles and Reaches



Appendix B:

Status of Mining Operations in Yolo County

Appendix B

Summary of Mining Operations

Approved Mining Operations (West to East along Cache Creek)

Key Information	Granite Capay	Granite Esparto	Teichert Esparto	Syar Industries	Cemex	Teichert Woodland	Teichert Schwarzgruber
Zone File Number	ZF#95-078, ZF#2001-096 (amend.)	ZF#2007-071	ZF#95-094	ZF#95-079, ZF#98-010 (amend.)	ZF#95-093	ZF#95-095	ZF#2011-0035
Approval Date End Date	11/25/1996; 12/03/2002 01/01/2028	11/08/2011 11/08/2041	11/25/1996 01/01/2028	11/25/1996; 02/16/1999 06/08/2029	11/25/1996 08/11/2027	11/25/1996 01/01/2028	11/13/2012 01/01/2028
Is Operation Active?	Yes	No (not permitted to commence operations until mining at Granite Capay is complete, and not prior to 2021)	Yes	Yes; however, site is currently idle—mining operations have been on hold since 2011	Yes	Yes (mining is complete—the site is being actively reclaimed)	Yes
Total Acres to be Mined	±312 acres	±302 acres	±148 acres	±248 acres	±586 acres	±252 acres	±41 acres
Reclamation Summary	127 acre permanent lake (including 51 acres of associated habitat); 121 acres returned to agriculture; 9 acres to habitat; 4 acres slopes. Plant site reclamation consists of 65 acres returned to agriculture and 3 acres slopes (included in summary above). To be reclaimed after completion of mining at Granite Esparto.	157 acre permanent lake; 44 acres of shoreline habitat; 112 acres returned to agriculture. Plant site reclamation is included under the summary for Granite Capay.	98 acre permanent lake; 31 acres of shoreline habitat (including emergent marsh, floodplain riparian, high terrace riparian); 19 acres of slopes. Plant site reclamation consists of 70 acres of habitat.	202 acre permanent lake (including 55 acres of vegetated shore and slopes, and 5 acre vegetated island); 46 acres returned to agriculture row crops. Plant site reclamation consists of approximately 70 acres returned to agriculture, and includes the raising of the site with excess soils.	153 acres of permanent lakes; 61 acres of associated habitat; 446 acres returned to agriculture (this includes 100 acres of a previously mined area permitted prior to ZF95-093); 26 acres of slopes. Plant site reclamation consists of 30 acres returned to agriculture.	23 acre permanent lake; 98 acres of seasonal pond habitat; 110 acres returned to agriculture; 4 acres miscellaneous habitat; 17 acres slopes. Plant site reclamation consists of 116 acres of grassland and oak woodland habitat and 5 acres of slopes. To be reclaimed after completion of mining at Teichert Schwarzgruber.	62 acres of habitat (including seasonal pond, riparian wetland, oak riparian wetland); 31 acres of open space (grassland). A total of 93 acres will be reclaimed by Teichert, which includes areas previously mined be Schwarzgruber and Sons, but will not be mined by Teichert. Plant site reclamation is included under the summary for Teichert Schwarzgruber.

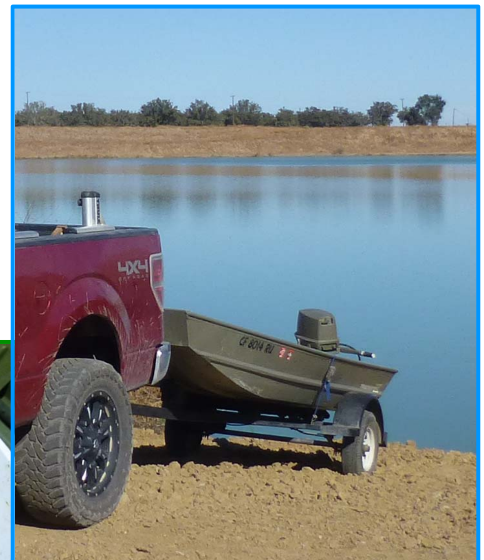
Rev. 9/29/17

Appendix C:

Cache Creek Off-Channel Aggregate Mining Ponds – 2015 Mercury Monitoring

CACHE CREEK OFF-CHANNEL AGGREGATE MINING PONDS – 2015 MERCURY MONITORING

Final Report
May 2017



Monitoring and Report by

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SUMMARY OF THE 2015 MONITORING AND ITS FINDINGS

- Pursuant to Section 10-5.517 of the Yolo County Code, this Fall 2015 monitoring was the first year of fish mercury testing for off-channel wet pit aggregate mining adjacent to lower Cache Creek between Capay and Woodland (Figure A in the Introduction). A variety of techniques were used to obtain samples of the fish present in each of these ponds. Large, angling-sized fish were tested individually for fillet muscle mercury, relevant to human consumption. Small, young-of-year, 'biosentinel' fish were analyzed whole-body, relevant to wildlife consumption, in multiple-individual composite samples.

- Useful samples of both large and small fish, of multiple species, were collected from 4 major ponds in the system: the Cemex–West Pond ('Phase 1'), Cemex–East Pond ('Phase 3-4'), Teichert–Reiff Pond, and Syar–B1 Pond. Two smaller ponds that had also been slated for monitoring could not be sampled this year because of inaccessibility issues that should be resolved in the future (Teichert–Mast and Storz Ponds).

- A total of 101 larger, angling-sized fish were sampled individually for fillet muscle mercury in this 2015 monitoring. A total of 360 small, young-of-year fish were split into 41 multi-individual composite samples by site, species and size. These were also analyzed for mercury.

- The new data from the 4 sampled off-channel, aggregate-mining ponds were compared between the ponds for corresponding samples, and between the ponds and corresponding 'baseline' fish collections conducted previously from adjacent Cache Creek.

- A set of 'baseline' fish samples were collected from Cache Creek, prior to this project, in Fall 2011 and Spring 2012 (Slotton et al. 2013). The baseline fish collections and analyses were made to provide new data for Yolo County and to satisfy requirements to test mercury concentrations in Cache Creek biota. They were also made to provide updated, more extensive comparison mercury data, from in-channel Cache Creek, for nearby off-channel aggregate mining pits and future reclaimed ponds. The 2011-2012 baseline samples had mercury levels similar to various earlier Cache Creek monitoring. All of these are summarized in this report.

- The 4 ponds sampled in Fall 2015 were found to show distinct, individual mercury signatures that were broadly consistent across the different fish types.

- The Cemex–West (Phase 1), was notably low in mercury across all of the samples available. It was statistically lower than the other tested ponds for nearly every corresponding sample type and was statistically lower than or similar to all of the comparable baseline creek samples.

- The Teichert–Reiff Pond had fish mercury levels similar to the baseline creek samples, with some samples lower, some statistically the same, and some higher.

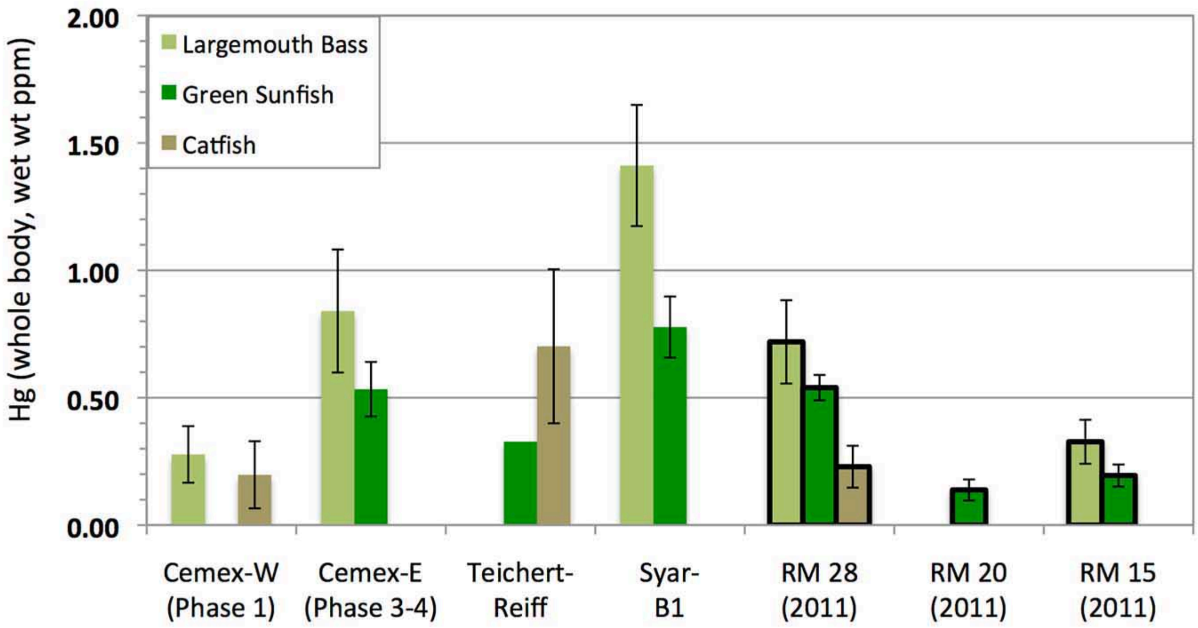
- The Cemex–East Pond (Phase 3-4) was higher in fish mercury than the Teichert–Reiff and Cemex–West ponds. Relative to the baseline creek samples, it was higher in most comparisons (8 of 11) and statistically similar in the other 3.

- Fish from the Syar–B1 Pond were higher in mercury than all of the comparable baseline creek samples. Fish from this pond also had statistically higher mercury than corresponding samples from the other ponds tested, except in juvenile Green Sunfish and Mosquitofish from the Cemex–East Pond (Phase 3-4) which were statistically similar.

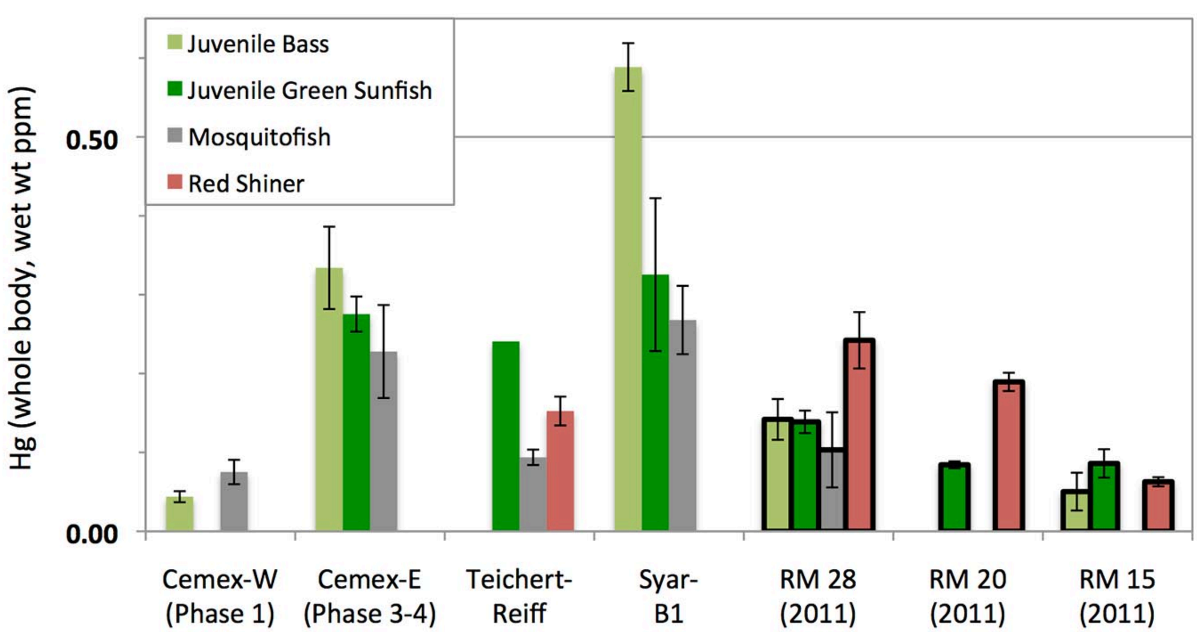
- So, of the four ponds monitored, two were found to be low or similar in fish mercury to the baseline Cache Creek samples (Cemex–West and Teichert–Reiff). Two appeared to be in an elevated range that may require attention (Syar–B1 and Cemex–East).

- This range of results may present an opportunity to help identify what is driving the high mercury levels at some locations and the low levels at others. Ultimately, if these factors can be identified, it may be possible to reduce levels at the elevated mercury sites through realistic and cost-effective modifications. The Yolo County Ordinance sets out requirements for investigating likely contributing factors which can guide potential mitigation approaches. Those protocols are in the process of being updated. The 2015 results are being tested for consistency with ongoing annual monitoring, as laid out in the ordinance. At the time of this report finalization (May 2017), those fall 2016 collections have been conducted. Laboratory work is in process and analytical results will be presented later in 2017.

- Summary figures (5a-b) and tables (1c-4c) from the body of the report are reproduced below, before the introduction. These provide a condensed presentation of the 2015 monitoring results, showing the fish mercury levels in each of the ponds, the pond results relative to each other, and relative to corresponding 2011-2012 baseline levels in adjacent Cache Creek.



(Figure 5a). Large Fish Mercury: Comparison of Ponds and 2011 Baseline Creek Samples
(All comparable species; average mercury and standard deviation for each site)
(RM refers to River Mile of baseline Cache Creek sites)



(Figure 5b). Small Fish Mercury: Comparison of Ponds and 2011 Baseline Creek Samples
(All comparable species; average mercury and standard deviation for each site)

Summary Comparisons With Comparable Samples From the Other Tested Ponds and Baseline Cache Creek Collections.
(statistically lower (<), higher (>), or indistinguishable (=) at the 95% confidence level)

(Table 1c). Cemex–West Pond (Phase 1)

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–E (Phase 3-4)**	**Teichert–Reiff**	**Syar–B1**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
Largemouth Bass	<		<	<		=
Channel Catfish		<		=		
Small fish whole body, composite mercury						
Largemouth Bass (juv)	<		<	<		=
Mosquitofish	<	=	<			=

(Table 2c). Cemex–East Pond (Phase 3-4)

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–W (Phase 1)**	**Teichert–Reiff**	**Syar–B1**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
Largemouth Bass	>		<	=		>
Green Sunfish			<	=	>	>
Small fish whole body, composite mercury						
Largemouth Bass (juv)	>		<	>		>
Green Sunfish (juv)			=	>	>	>
Mosquitofish	>	>	=			=

Summary Comparisons With Comparable Samples From the Other Monitored Ponds and Baseline Cache Creek Collections *(continued).*
(statistically lower (<), higher (>), or indistinguishable (=) at the 95% confidence level)

(Table 3c). Teichert–Reiff Pond.

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–W (Phase 1)**	**Cemex–E (Phase 3-4)**	**Syar–B1**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
White Catfish	>			>		
Carp						=
Small fish whole body, composite mercury						
Mosquitofish	=	<	<			=
Red Shiner				<		>

(Table 4c). Syar–B1 Pond.

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–W (Phase 1)**	**Cemex–E (Phase 3-4)**	**Teichert–Reiff**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
Largemouth Bass	>	>		>		>
Green Sunfish		>		>	>	>
Small fish whole body, composite mercury						
Largemouth Bass (juv)	>	>		>		>
Green Sunfish (juv)		=		>	>	>
Mosquitofish	>	=	>			>

INTRODUCTION

This monitoring was conducted for Yolo County in the fall of 2015, to provide new fish mercury information from a set of aggregate mining ponds located adjacent to lower Cache Creek. The monitoring was triggered by Section 10.5.517 of the Yolo County Reclamation Ordinance (Yolo County Code).

The ordinance (Section 10-5.517(b)) specifies that wet pits approved for eventual reclamation to permanent lakes must be evaluated annually for five years after creation and biennially for ten years after reclamation is completed, for "conditions that could result in significant methylmercury production". The "statistically verified average mercury concentrations" of comparable fish in the creek is the baseline for measurement of the "average mercury content" for fish in the wet pits/lakes. If the average mercury content of fish in a wet pit exceeds the ambient mercury content for fish in the creek over two consecutive years of measurement, the operator is required to take certain actions. Sections 10-5.517 (c) through (h) identify the methodology for the pit studies and the required actions dependent on the analysis results.

In May of 2015, the County identified six aggregate mining ponds for monitoring. The primary criteria for these ponds was that they were "wet" (had filled with groundwater), had active mining permits, and were approved for reclamation to permanent lakes/ponds. There are currently four aggregate mining operations (Cemex, Teichert Esparto, Teichert Woodland, and Syar) that require the initial five years of monitoring. The six identified ponds included two from Cemex (Phase 1 (West) and Phase 3-4 (East)), two from Teichert Esparto (Reiff and Mast), one from Teichert Woodland (Storz), and one from Syar (B1). Locations of these ponds, as well as the baseline Cache Creek sampling sites from 2011-2012, are shown in Figure A. Mast Pond was inaccessible because of mining operations. Storz Pond was made accessible too late for effective sampling (December). We made several attempts, but the fish were in winter hibernation mode. The 4 larger, more significant ponds were all sampled successfully for both large and small fish of multiple species.

Off-Channel Aggregate Mining Ponds Sampled in 2015 and Baseline 2011-2012 Sampling Locations in Cache Creek

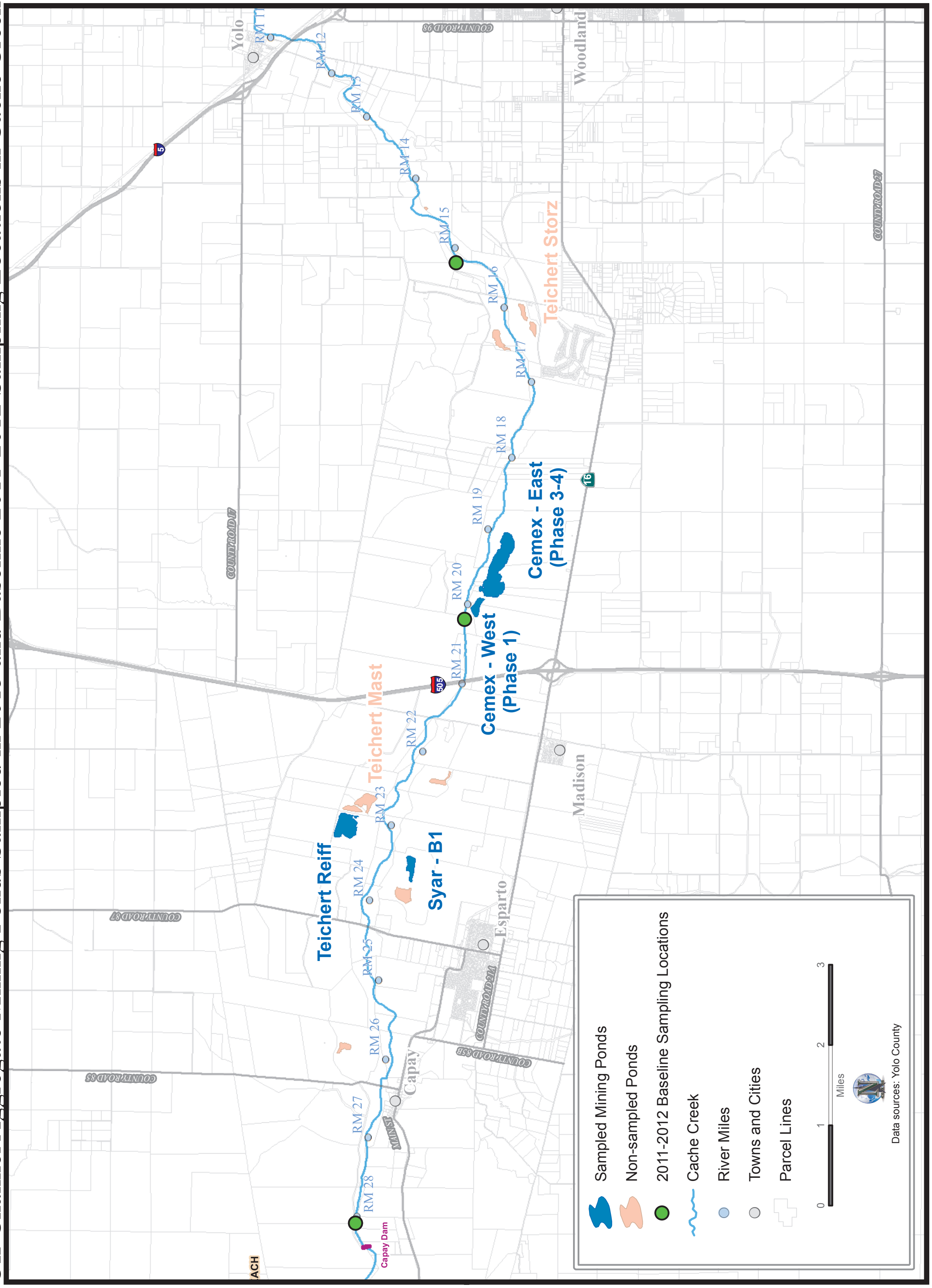


Figure A

The purpose of this report is to present the new fish mercury data from the tested aggregate mining ponds and to compare levels between the ponds and between the ponds and comparable 'baseline' samples taken from adjacent Cache Creek in 2011-2012. Following, below, are the methods we used and then a presentation of the new mercury data. The data are first presented for each specific pond site, for both large and small fish samples. The information is presented numerically in tables and graphically in plots. Discussions of the site data and comparisons are in these front sections, by site. Following the individual pond sections are a series of tables and graphs that compare mercury levels between the ponds and between the ponds and the 2011-2012 baseline creek data. Earlier comparison data from Cache Creek are also summarized.

Photos of the pond sites and many of the collected samples can be found in the Appendix at the end of the report.

METHODS

Field sampling was coordinated with staff of the three mining companies, Teichert, Cemex, and Syar. Access ramps for boat launching were constructed at some of the ponds, which was a big help. We used our sampling boat to get around each of the ponds and collect the fish.

The fish samples were taken with a variety of techniques. Adult fish were collected with experimental gill nets that have a variety of mesh sizes, also with baited set lines laid at the bottom of ponds (catfish), and by angling (bass). Gill nets and set lines, deployed in both daylight and nighttime conditions, were carefully monitored to quickly remove captured fish. Small fish were collected with a variety of seines and hand nets.

Large fish were field identified, weighed and measured, and sampled for mercury analysis using a non-destructive biopsy technique we developed that allows us to return the fish back to the water in good condition (Slotton et al. 2002). In this technique, laboratory digestion tubes, to be used in the analysis, are pre-weighed, empty, to ± 0.0001 g. In the field, several scales are removed from each fish on the left side above the lateral line and a small biopsy sample of app. 0.2000 g (about the size of a raisin) is taken from the left fillet. The sample is carefully placed into a pre-weighed digestion tube. Tubes are sealed with Parafilm™ and stored on ice in a sealed, freezer-weight bag. Later, at the laboratory, the tubes with sample pieces are again weighed and the exact weight of each sample is determined by subtracting the empty tube weight.

Small fish were field identified, cleaned and sorted by species, bagged in labeled freezer weight, zip-close bags with air removed, and transported on ice to the laboratory. Samples were then weighed, measured, and assembled into composite groupings of similar-sized fish. Each composite sample was frozen in doubled freezer weight bags with water surrounding and air removed, a technique our group has found to maintain natural moisture levels through the freezing process, something that can be a major problem for small fish samples (Slotton et al. 2015). Preanalytical processing included weighing each composite group and drying the sample to constant weight in a laboratory oven at 55 °C. Solids percentage was calculated during this process, through sequential weighings of empty weigh pans, pans with wet sample, and pans with dry sample. Dried samples were homogenized to fine powders using a laboratory grinder.

Large fish fillet muscle samples were analyzed for mercury directly, on a wet (fresh) weight basis. Small fish composite samples were analyzed whole body, homogenized into dry powders for consistency, as described above. Dry weight results were converted to original wet/fresh weight concentrations using the calculated % solids values. For all mercury analyses, samples were weighed into 20 ml digestion tubes and digested at 90 °C in a mixture of concentrated nitric and sulfuric acids with potassium permanganate, in a two stage process. Digested samples were then analyzed for total mercury by standard cold vapor atomic absorption (CVAA) spectrophotometry, using a dedicated Perkin Elmer Flow Injection Mercury System (FIMS) with an AS-90 autosampler. The method is a variant of EPA Method 245.6, with modifications developed by our laboratory (Slotton et al. 2015).

Extensive Quality Assurance / Quality Control (QAQC) samples were included in all analytical runs and tracked with control charts. Results for this project were all well within control limits.

RESULTS AND DISCUSSION

CEMEX–WEST POND ('Phase 1') *(Tables 1a-b, Figures 1a-b)*

This pond is the older of the 2 current Cemex ponds. It is located just south of Cache Creek and east of Highway 505. The Phase 1 Pond is an oval shaped, fairly deep bowl that is app. 400 m long and 150 m wide. Depths range to 12+ m (40+ feet). Photos of this and the other sites, and many of the samples taken, can be found in the Appendix at the end of this report.

We sampled the pond during daytime, twilight, and night conditions with a full range of techniques, and were able to obtain good samples of most of the fish species present (Tables 1a and 1b, Figures 1a and 1b). These included, for large, angling-sized fish, samples of 18 Largemouth Bass (*Micropterus salmoides*) and 2 large Channel Catfish (*Ictalurus punctatus*). The small fish present were juvenile Largemouth Bass (4-5") and Mosquitofish (1-2", *Gambusia*

Table 1a. Cemex–West Pond (Phase 1): Large fish sampled, Fall 2015

Fish Species	Fish Total Length (mm)	(inches)	Fish Weight (g)	(lbs)	Muscle Mercury (µg/g = ppm, wet wt)
Largemouth Bass	197	7.8	110	0.2	**0.124**
Largemouth Bass	200	7.9	120	0.3	**0.110**
Largemouth Bass	205	8.1	125	0.3	**0.105**
Largemouth Bass	309	12.2	420	0.9	**0.116**
Largemouth Bass	310	12.2	360	0.8	**0.295**
Largemouth Bass	312	12.3	360	0.8	**0.303**
Largemouth Bass	312	12.3	395	0.9	**0.309**
Largemouth Bass	319	12.6	405	0.9	**0.374**
Largemouth Bass	322	12.7	455	1.0	**0.233**
Largemouth Bass	325	12.8	465	1.0	**0.282**
Largemouth Bass	326	12.8	420	0.9	**0.429**
Largemouth Bass	328	12.9	445	1.0	**0.326**
Largemouth Bass	331	13.0	440	1.0	**0.473**
Largemouth Bass	332	13.1	490	1.1	**0.202**
Largemouth Bass	332	13.1	475	1.0	**0.312**
Largemouth Bass	332	13.1	505	1.1	**0.266**
Largemouth Bass	344	13.5	545	1.2	**0.341**
Largemouth Bass	354	13.9	540	1.2	**0.396**
Channel Catfish	530	20.9	1,410	3.1	**0.104**
Channel Catfish	660	26.0	2,850	6.3	**0.291**

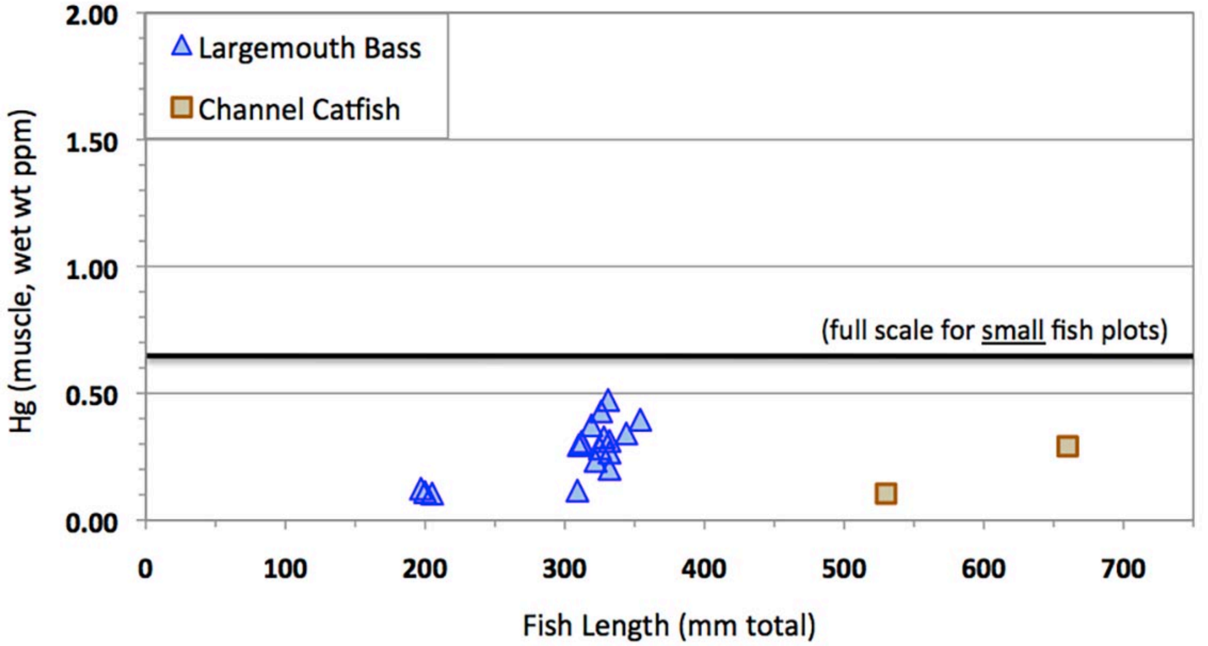


Figure 1a. Cemex–West Pond (Phase 1): Large Fish Sampled, Fall 2015
(fillet muscle mercury in individual fish)

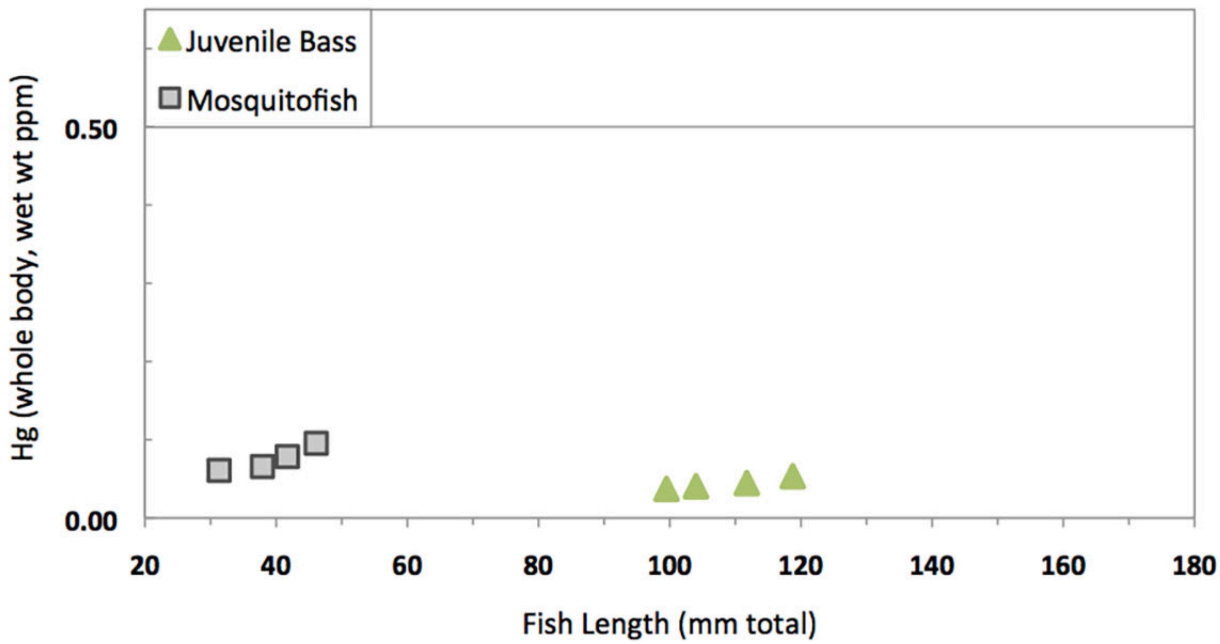


Figure 1b. Cemex–West Pond (Phase 1): Small Fish Sampled, Fall 2015
(whole-body, multi-individual composite samples)

Table 1b. Cemex–West Pond (Phase 1): Small Fish Sampled, Fall 2015
(multi-individual, whole body composite samples)

Fish Species	**n** (indivs. in comp)	**Av. Fish Length** (mm)	(inches)	**Av. Fish Weight** (g)	(oz)	**Whole-Body Mercury** (µg/g = ppm, wet wt)
Largemouth Bass (juv)	**8**	100	3.9	12.6	0.44	**0.037**
Largemouth Bass (juv)	**8**	104	4.1	15.1	0.53	**0.040**
Largemouth Bass (juv)	**8**	112	4.4	17.5	0.62	**0.045**
Largemouth Bass (juv)	**8**	119	4.7	20.8	0.73	**0.053**
Mosquitofish	**10**	31	1.2	0.31	0.01	**0.061**
Mosquitofish	**10**	38	1.5	0.55	0.02	**0.066**
Mosquitofish	**10**	42	1.6	0.71	0.03	**0.078**
Mosquitofish	**10**	46	1.8	0.95	0.03	**0.095**

affinis). We collected 32 small bass, which were divided into 4 composite samples of 8 fish each. The Mosquitofish collected were split into 4 composite samples of 10 fish each.

In total, this added up to 28 separate mercury samples analyzed from the Cemex-West Pond.

CEMEX–WEST POND (PHASE 1): FISH MERCURY LEVELS, AND COMPARISONS WITH OTHER 2015 POND SITES AND WITH 2011-2012 BASELINE SAMPLES

(Tables 1c, 5a-b, and Figures 5-12)

The Phase 1 Pond adult Bass samples had fillet muscle mercury ranging from 0.110-0.473 ppm, averaging 0.278 ppm. Adult Bass represent the top predator fish in this region and will typically have the highest mercury levels at any given site. These West Pond bass had the lowest levels found among the 3 bass-containing mining ponds sampled in 2015 (significantly lower at the 95% statistical confidence level). They were also lower than similar baseline samples from Cache Creek (statistically lower than the upstream, River Mile 28 site). The West Pond bass were in fact among the lowest mercury top predator fish samples we have collected in California across many studies.

The Cemex–West Pond (Phase 1) Channel Catfish had fillet muscle mercury of 0.104 and 0.291 ppm, averaging 0.198 ppm. With only 2 fish collected, this was not as strong a sample as we would like, but they were both large fish that had been exposed to the local pond conditions for years, making them strong indicators. We have ideas of how to increase our take in future collections. As with the Bass, despite their large size, these Catfish had statistically lower mercury, relative to the other pond with Catfish (Reiff). They were at a similar level as the baseline comparison Catfish taken at the River Mile 28 site, but note that the West Pond fish, averaging over 2 kg (4.7 pounds), were 20 times larger than the baseline catfish (0.1 kg, 0.2 lbs). Comparably-sized baseline creek fish could be expected to have much higher mercury levels.

The juvenile Bass multiple-fish composites had whole-body mercury ranging from 0.037-0.053 ppm, averaging 0.044 ppm. These levels were statistically well below those of similar samples taken from the Cemex–Phase 3-4 Pond (0.285-0.408 ppm) and the Syar–B1 Pond (0.545-0.613 ppm). They were significantly lower than baseline Creek juvenile bass samples from the upstream, River Mile 28 site (averaging 0.142 ppm) and lower, though not significantly, than the downstream, River Mile 15 sample (averaging 0.050 ppm).

The Mosquitofish Phase 1 Pond multiple-fish composites had whole-body mercury ranging from 0.061-0.095 ppm, averaging 0.075 ppm. Mosquitofish were taken in all 4 of the ponds monitored in 2015. Consistent with the other samples, the Phase 1 Pond Mosquitofish had the lowest mercury of the ponds sampled. They were significantly lower, at the 95% confidence level, than comparable fish from the Cemex–East (Phase 3-4) Pond (average = 0.228 ppm) and the Syar–B1 Pond (average = 0.268 ppm). They were lower, but not significantly, than the one comparison set of baseline creek samples we have, from River Mile 15 (average = 0.103 ppm).

Table 1c summarizes statistical comparisons of the Cemex–West (Phase 1) Pond fish data with corresponding data from the other tested aggregate mining ponds and from the 2011-2012 baseline Cache Creek samples. Detailed comparison tables (5a-b) and figures (5-12) can be found beginning on page 33. This pond had clearly the lowest fish mercury levels of the four tested mining sites. It was similar to the lowest mercury baseline creek site (River Mile 15) and was lower than the River Mile 28 baseline site. The Cemex–West (Phase 1) Pond may provide clues about the factors leading to lower, rather than higher, mercury exposure conditions.

Table 1c. Cemex–West Pond (Phase 1): Summary Comparisons With Comparable Samples From the Other Monitored Ponds and Baseline Cache Creek Collections
(statistically lower (<), higher (>), or indistinguishable (=) at the 95% confidence level)

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–E (Phase 3-4)**	**Teichert–Reiff**	**Syar–B1**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
Largemouth Bass	<		<	<		=
Channel Catfish		<		=		
Small fish whole body, composite mercury						
Largemouth Bass (juv)	<		<	<		=
Mosquitofish	<	=	<			=

CEMEX–EAST POND ('Phase 3-4') *(Tables 2a-b, Figures 2a-b)*

This pond is the more recent, and currently active, of the 2 Cemex ponds. It is also located just south of Cache Creek and east of Highway 505. It is immediately east of the Cemex-West (Phase 1) Pond. The Phase 3-4 Pond is a large, elongated water body that is app. 1,200 m long (1.2 km) and 300 m wide. Depths range from extensive areas of 0-2 m shallows to deep areas of 10+ m (40+ feet). Active mining was occurring in the northwest part of the pond when we sampled.

Table 2a. Cemex–East Pond (Phase 3-4): Large fish sampled, Fall 2015

Fish Species	Fish Total Length (mm)	(inches)	Fish Weight (g)	(lbs)	Muscle Mercury (µg/g = ppm, wet wt)
Largemouth Bass	302	11.9	340	0.7	**0.531**
Largemouth Bass	307	12.1	370	0.8	**0.388**
Largemouth Bass	317	12.5	370	0.8	**0.526**
Largemouth Bass	326	12.8	405	0.9	**0.481**
Largemouth Bass	332	13.1	515	1.1	**0.919**
Largemouth Bass	333	13.1	480	1.1	**1.255**
Largemouth Bass	335	13.2	450	1.0	**0.801**
Largemouth Bass	338	13.3	445	1.0	**0.997**
Largemouth Bass	339	13.3	495	1.1	**0.825**
Largemouth Bass	341	13.4	610	1.3	**0.876**
Largemouth Bass	342	13.5	455	1.0	**1.069**
Largemouth Bass	346	13.6	470	1.0	**0.677**
Largemouth Bass	346	13.6	545	1.2	**0.554**
Largemouth Bass	353	13.9	520	1.1	**0.895**
Largemouth Bass	357	14.1	620	1.4	**0.892**
Largemouth Bass	366	14.4	610	1.3	**0.962**
Largemouth Bass	368	14.5	605	1.3	**1.131**
Largemouth Bass	369	14.5	630	1.4	**0.983**
Largemouth Bass	379	14.9	715	1.6	**0.918**
Largemouth Bass	392	15.4	870	1.9	**1.123**
Green Sunfish	100	3.9	15	0.03	**0.588**
Green Sunfish	103	4.1	17	0.04	**0.648**
Green Sunfish	107	4.2	21	0.05	**0.612**
Green Sunfish	107	4.2	22	0.05	**0.479**
Green Sunfish	118	4.6	28	0.06	**0.461**
Green Sunfish	125	4.9	34	0.07	**0.314**
Green Sunfish	130	5.1	37	0.08	**0.481**
Green Sunfish	134	5.3	42	0.09	**0.655**
Green Sunfish	135	5.3	41	0.09	**0.492**
Green Sunfish	267	10.5	415	0.91	**0.605**

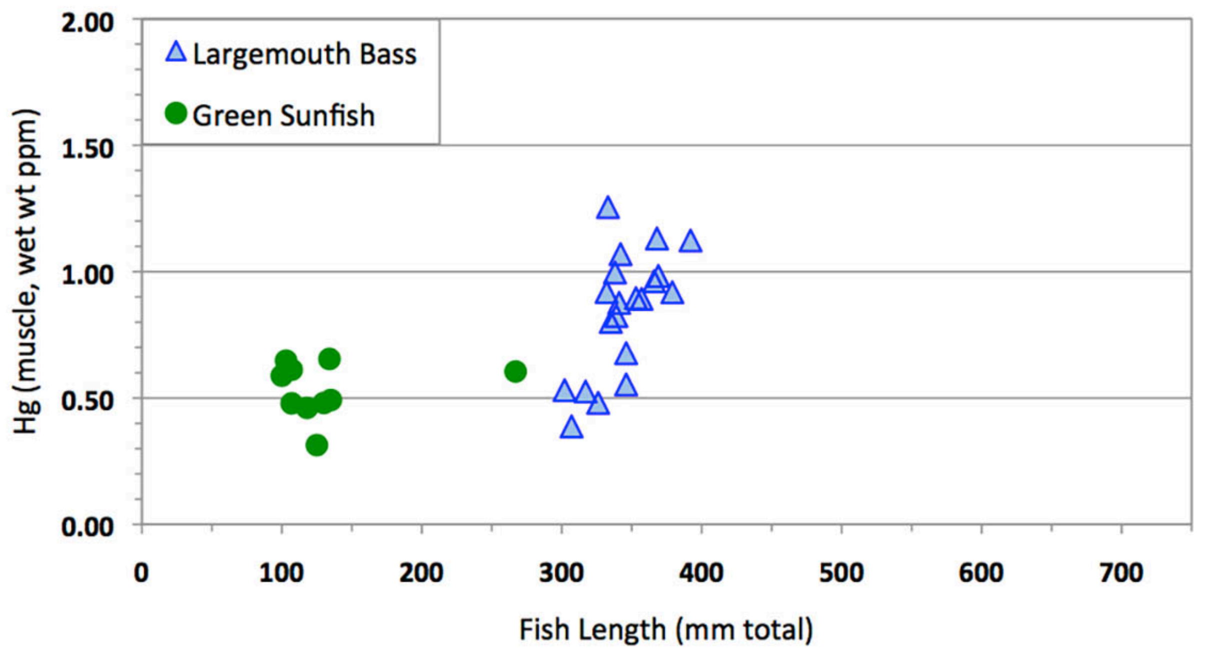


Figure 2a. Cemex–East Pond (Phase 3-4): Large Fish Sampled, Fall 2015
(fillet muscle mercury in individual fish)

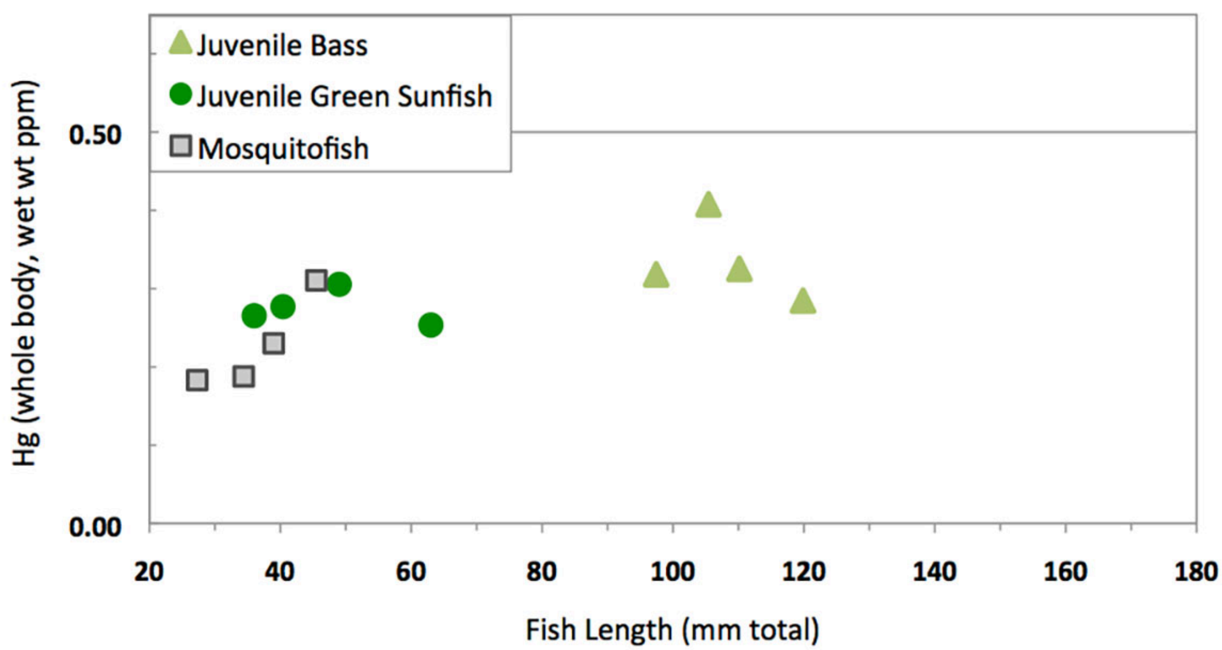


Figure 2b. Cemex–East Pond (Phase 3-4): Small Fish Sampled, Fall 2015
(whole-body, multi-individual composite samples)

Table 2b. Cemex–East Pond (Phase 3-4): Small Fish Sampled, Fall 2015
(multi-individual, whole body composite samples)

Fish Species	**n** (indivs. in comp)	Av. Fish Length (mm)	(inches)	Av. Fish Weight (g)	(oz)	Whole-Body Mercury (µg/g = ppm, wet wt)
Largemouth Bass (juv)	**7**	97	3.8	12.0	0.42	**0.318**
Largemouth Bass (juv)	**7**	105	4.2	14.1	0.50	**0.408**
Largemouth Bass (juv)	**7**	110	4.3	16.6	0.59	**0.325**
Largemouth Bass (juv)	**7**	120	4.7	20.7	0.73	**0.285**
Green Sunfish (juv)	**10**	36	1.4	0.80	0.03	**0.265**
Green Sunfish (juv)	**10**	40	1.6	1.15	0.04	**0.277**
Green Sunfish (juv)	**10**	49	1.9	1.81	0.06	**0.306**
Green Sunfish (juv)	**10**	63	2.5	3.43	0.12	**0.254**
Mosquitofish	**10**	27	1.1	0.21	0.01	**0.183**
Mosquitofish	**10**	34	1.4	0.40	0.01	**0.188**
Mosquitofish	**10**	39	1.5	0.60	0.02	**0.230**
Mosquitofish	**10**	46	1.8	0.99	0.03	**0.311**

We sampled the pond during daytime, twilight, and night conditions with a range of techniques, and were able to obtain good samples of the fish species present (Tables 2a and 2b). These included individual fillet muscle samples of 20 Largemouth Bass (*Micropterus salmoides*) and 10 Green Sunfish (*Lepomis cyanellus*). Catfish and other large species were not found. The small fish present were juvenile Largemouth Bass (4-5"), juvenile Green Sunfish (1-3") and Mosquitofish (1-2", *Gambusia affinis*). We collected 28 small bass, which were divided into 4 composite samples of 7 fish each. Forty juvenile Green Sunfish were placed into 4 composite samples of 10 fish each. The Mosquitofish collected were also split into 4 composite samples of 10 fish each.

In total, 42 separate mercury samples were analyzed from the Cemex-East Pond.

CEMEX–EAST POND (PHASE 3-4): FISH MERCURY LEVELS, AND COMPARISONS WITH OTHER 2015 POND SITES AND WITH 2011-2012 BASELINE SAMPLES
(Tables 2c, 5a-b, and Figures 5-12).

The adult Bass had fillet muscle mercury ranging from 0.388-1.255 ppm, averaging 0.840 ppm. This was significantly higher than the Bass from the adjacent West (Phase 1) Pond (average = 0.278 ppm) and significantly lower than Bass from the Syar–B1 Pond (average = 1.411 ppm). As compared to Cache Creek baseline samples, the Cemex–East (Phase 1) Bass were statistically indistinguishable from samples taken at River Mile 28 and statistically higher than similarly predatory Sacramento Pikeminnows taken at River Mile 15 (average = 0.327 ppm). However, the available RM 15 baseline creek samples were relatively small fish, less than half the weight of the Phase 3-4 Pond samples (see Table 5a). Creek samples of comparably sized predatory fish could be expected to contain higher mercury levels than those available in the baseline sampling.

The Cemex–East (Phase 3-4) Pond Green Sunfish had fillet muscle mercury between 0.314 and 0.655 ppm, averaging 0.534 ppm. This was statistically lower than in comparable fish from the Syar–B1 Pond (average = 0.777 ppm). In relation to the baseline Cache Creek samples, it was statistically the same as the River Mile 28 sample (average = 0.540) and statistically higher than the samples from River Mile 20 (average = 0.138 ppm) and River Mile 15 (average = 0.195 ppm).

The juvenile Bass multiple-fish composites had whole-body mercury ranging from 0.285-0.408 ppm, averaging 0.334 ppm. This was significantly lower than in comparable fish from the Syar–B1 Pond (average = 0.589 ppm) and significantly higher than the Cemex–West (Phase 1) samples (average = 0.044 ppm). In relation to the baseline Cache Creek samples, it was significantly higher than both samples, from River Mile 28 (0.142 ppm) and River Mile 15 (0.050 ppm).

The juvenile Green Sunfish multiple-fish composites had whole-body mercury ranging from 0.254-0.306 ppm, averaging 0.275 ppm. That was lower than fish from the Syar–B1 Pond (average = 0.325 ppm), though the difference was not statistically significant. Relative to comparable baseline Cache Creek samples, the Cemex–East Pond fish had significantly higher mercury than all three creek sites: River Mile 28 (average = 0.139 ppm), River Mile 20 (0.084 ppm), River Mile 15 (0.086 ppm).

The Mosquitofish multiple-fish composites had whole-body mercury ranging from 0.183-0.311 ppm, averaging 0.228 ppm. There were comparable samples from all three of the other pond sites. Levels were statistically indistinguishable from the Syar–B1 Pond (average = 0.268 ppm) and were statistically higher than at the Cemex–West (Phase 1) Pond (0.075 ppm) and the Teichert–Reiff Pond (0.094 ppm). They were higher than the single baseline creek sample set from River Mile 15 (0.103 ppm), though the difference was not significant.

Table 2c summarizes statistical comparisons of the Cemex–East (Phase 3-4) Pond fish data with corresponding data from the other tested aggregate mining ponds and from the 2011-2012 Baseline Cache Creek samples. Detailed comparison tables (5a-b) and figures (5-12) can be found beginning on page 33. This pond had significantly higher fish mercury than the other Cemex Pond (West, Phase 1) and the Teichert–Reiff Pond. Two sample sets were at levels similar to the highest mercury site, Syar–B1. Comparisons with creek baseline samples were mostly higher (8 of 11 comparisons).

Table 2c. Cemex–East Pond (Phase 3-4): Summary Comparisons With Comparable Samples From the Other Monitored Ponds and Baseline Cache Creek Collections
(statistically lower (<), higher (>), or indistinguishable (=) at the 95% confidence level)

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–W (Phase 1)**	**Teichert–Reiff**	**Syar–B1**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
Largemouth Bass	>		<	=		>
Green Sunfish			<	=	>	>
Small fish whole body, composite mercury						
Largemouth Bass (juv)	>		<	>		>
Green Sunfish (juv)			=	>	>	>
Mosquitofish	>	>	=			=

TEICHERT–REIFF POND *(Tables 3a-b, Figures 3a-b)*

This pond is the largest of the Teichert impoundments. It is located just north of Cache Creek, west of Highway 505 between 505 and County Road 87. The Reiff Pond is a fairly square-shaped pond that is app. 450 m on a side. Depths range from 0-2 m shallows along some of the margins to a deep central area to 9+ m (30 feet).

We sampled the pond during day, twilight, and night conditions with a full range of techniques. The fish collected are listed in Tables 3a and 3b. These included, for large, angling-sized fish,

Table 3a. Teichert–Reiff Pond: Large fish sampled, Fall 2015

Fish Species	Fish Total Length (mm)	(inches)	Fish Weight (g)	(lbs)	Muscle Mercury (µg/g = ppm, wet wt)
White Catfish	254	10.0	180	0.4	**0.783**
White Catfish	257	10.1	195	0.4	**0.556**
White Catfish	258	10.2	190	0.4	**0.461**
White Catfish	259	10.2	170	0.4	**0.542**
White Catfish	264	10.4	190	0.4	**0.303**
White Catfish	277	10.9	230	0.5	**0.496**
White Catfish	280	11.0	250	0.6	**0.760**
White Catfish	292	11.5	265	0.6	**0.439**
White Catfish	304	12.0	305	0.7	**0.456**
White Catfish	305	12.0	353	0.8	**1.403**
White Catfish	315	12.4	385	0.8	**0.504**
White Catfish	318	12.5	390	0.9	**0.525**
White Catfish	348	13.7	530	1.2	**0.651**
White Catfish	357	14.1	555	1.2	**0.586**
White Catfish	365	14.4	545	1.2	**0.879**
White Catfish	413	16.3	770	1.7	**0.796**
White Catfish	424	16.7	895	2.0	**0.721**
White Catfish	447	17.6	1,120	2.5	**1.284**
White Catfish	463	18.2	1,180	2.6	**1.191**
White Catfish	743	29.3	4,460	9.8	**1.396**
Green Sunfish	140	5.5	40	0.09	**0.328**
Carp	350	13.8	525	1.2	**0.212**
Carp	492	19.4	1,310	2.9	**0.490**

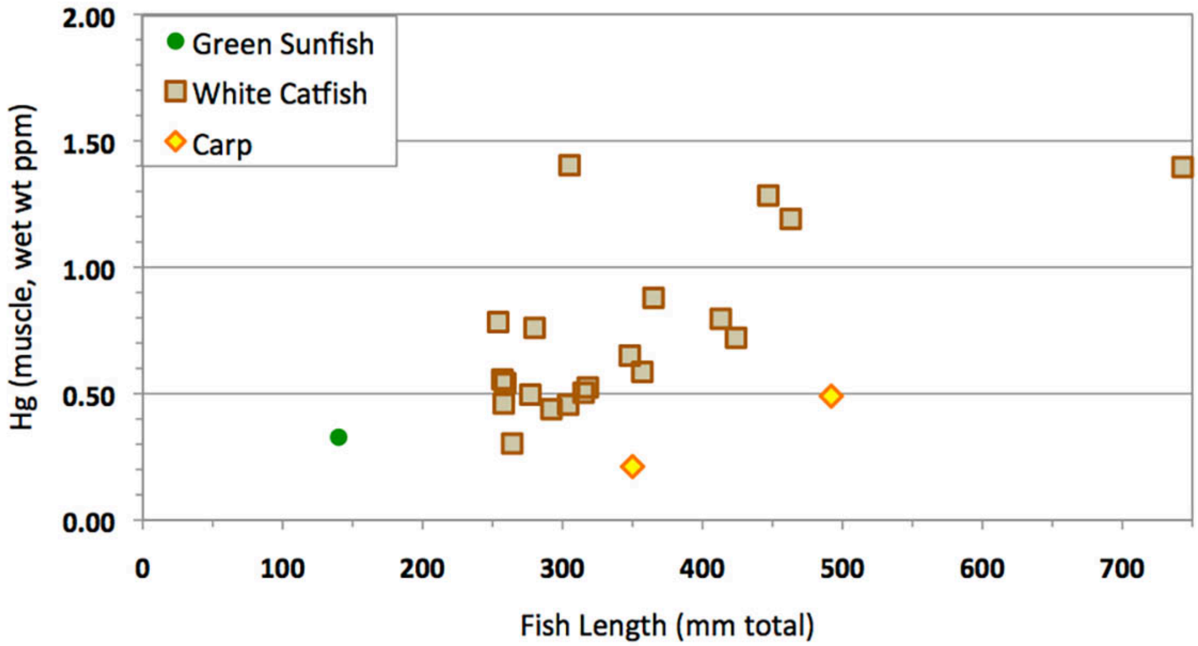


Figure 3a. Teichert–Reiff Pond: Large Fish Sampled, Fall 2015
(fillet muscle mercury in individual fish)

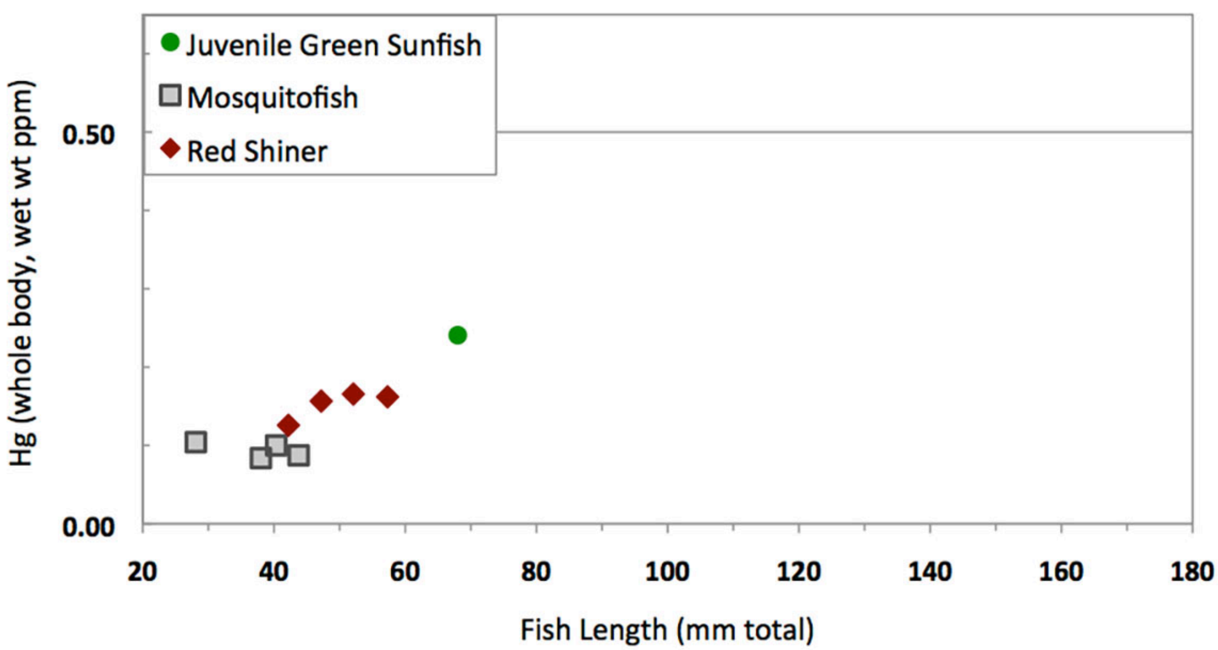


Figure 3b. Teichert–Reiff Pond: Small Fish Sampled, Fall 2015
(whole-body, multi-individual composite samples)

Table 3b. Teichert–Reiff Pond: Small Fish Sampled, Fall 2015
(multi-individual, whole body composite samples)

Fish Species	n (indivs. in comp)	Av. Fish Length (mm)	(inches)	Av. Fish Weight (g)	(oz)	Whole-Body Mercury (µg/g = ppm, wet wt)
Green Sunfish (juv)	**1**	68	2.7	5.10	0.18	**0.241**
Mosquitofish	**12**	28	1.1	0.29	0.01	**0.104**
Mosquitofish	**12**	38	1.5	0.51	0.02	**0.084**
Mosquitofish	**12**	40	1.6	0.60	0.02	**0.100**
Mosquitofish	**12**	44	1.7	0.86	0.03	**0.087**
Red Shiner	**10**	42	1.7	0.90	0.03	**0.126**
Red Shiner	**10**	47	1.9	1.23	0.04	**0.157**
Red Shiner	**10**	52	2.1	1.53	0.05	**0.166**
Red Shiner	**10**	57	2.3	1.67	0.06	**0.162**

samples of 20 White Catfish (*Ameiurus catus*). Nineteen of these ranged between 10 and 18 inches (250-470 mm) and 0.4-2.6 lbs (180-1,200 g). One was much larger, at 29" (743 mm) and nearly 10 lbs (4,460 g). White Catfish were by far the main large fish present. The only others taken in multiple days with multiple nets and set lines were 2 Carp (*Cyprinus carpio*) and a single Green Sunfish (*Lepomis cyanellus*). The small fish present were Red Shiners (*Cyprinella lutrensis* ~2") and Mosquitofish (*Gambusia affinis,* 1-2"). We collected 4 sets of 10 each Red Shiners and 4 sets of 12 each Mosquitofish. A single juvenile Green Sunfish was collected. In total, this added up to 32 separate mercury samples analyzed from the Reiff Pond.

TEICHERT–REIFF POND: FISH MERCURY LEVELS, AND COMPARISONS WITH OTHER 2015 POND SITES AND WITH 2011-2012 BASELINE SAMPLES
(Tables 3c, 5a-b, and Figures 5-12).

The White Catfish had fillet muscle mercury ranging from 0.303-1.396 ppm, averaging 0.737 ppm. Omitting the 10 pound fish that was much larger than the comparison samples, the average mercury was 0.702 ppm. Using either average, this was significantly higher than the catfish taken in the Cemex–West (Phase 1) Pond (average = 0.198 ppm) or in the baseline Cache Creek collection from River Mile 28 (0.143 ppm). However, note that the Teichert Reiff Pond fish, averaging 458 g (1.0 pound) excluding the much larger 10 lb fish, were more than 4 times larger than the baseline catfish (102 g, 0.2 lbs). Comparably-sized baseline creek fish could be expected to have higher mercury levels. The difference with the Cemex–West Pond catfish, though, which were larger, is indication of a significant difference between these two ponds.

The two Carp had fillet muscle mercury of 0.212 in a 14" (350 mm) fish and 0.490 ppm in a 19" (492 mm) fish, averaging 0.351 ppm. There were no Carp in the baseline creek collections, but we can compare with the set of Sacramento Suckers taken at River Mile 15, which are similar in their diets and bottom feeding habits. The Reiff Pond Carp were significantly higher in mercury than the creek Suckers (average = 0.143 ppm). As noted above for the catfish, this difference is mitigated somewhat by the relative size/age of the fish. The Reiff Pond Carp averaged 918 g (2.0 lbs), vs. the creek Sucker samples which averaged 231 g (0.5 lb). Comparably sized creek Suckers could be expected to have higher mercury levels than the baseline samples taken.

The single Green Sunfish had fillet mercury of 0.328 ppm. Statistical comparisons can't be made with a single individual, but this concentration was considerably lower than the Green Sunfish mercury from The Cemex–East Pond (average = 0.534 ppm) or the Syar–B1 Pond (0.777 ppm). Relative to the baseline Cache Creek samples, it was lower than at River Mile 28 (average = 0.540 ppm), and higher than the fish from River Mile 20 (0.138 ppm) and River Mile 15 (0.195 ppm).

The Red Shiner multiple-fish composites had whole-body mercury ranging from 0.126-0.166 ppm, averaging 0.152 ppm. We didn't find Red Shiners in any of the other ponds, but have good comparison baseline samples from the creek. The Reiff Pond Shiners were statistically lower in mercury than the River Mile 28 fish (av. = 0.242 ppm), lower but not significantly than fish from River Mile 20 (0.189 ppm), and higher than corresponding fish from River Mile 15 (0.063 ppm).

The Mosquitofish multiple-fish composites had whole-body mercury ranging from 0.087-0.104 ppm, averaging 0.094 ppm. This was statistically lower than fish from the Cemex–East Pond (average = 0.228 ppm) and the Syar–B1 Pond (0.268 ppm). It was statistically indistinguishable from the Cemex–West Pond sample (0.075 ppm) and the baseline Cache Creek sample from River Mile 15 (0.103 ppm).

The single juvenile Green Sunfish had whole-body mercury of 0.241 ppm. This was lower than the average mercury in this species from the Cemex–East Pond (average = 0.275 ppm) and the Syar–B1 Pond (0.325 ppm). It was higher than the average mercury in the baseline creek fish at River Mile 28 (0.139 ppm), River Mile 20 (0.084 ppm), and River Mile 15 (0.086 ppm).

Table 3c summarizes comparisons of the Teichert–Reiff Pond fish data with corresponding data from the other tested aggregate mining ponds and from the 2011-2012 Baseline Cache Creek samples. Detailed comparison tables (5a-b) and figures (5-12) can be found beginning on page 33. This pond was moderate relative to all the comparison samples, with some samples lower, some higher, and some the same. The pond's White Catfish definitely contained mercury at problem levels (to over 1.3 ppm), but it is not clear if this is higher than levels in Cache Creek catfish of comparable size, which were not available for the baseline sampling.

Table 3c. Teichert–Reiff Pond: Summary Comparisons With Comparable Samples From the Other Monitored Ponds and Baseline Cache Creek Collections
(statistically lower (<), higher (>), or indistinguishable (=) at the 95% confidence level)

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–W (Phase 1)**	**Cemex–E (Phase 3-4)**	**Syar–B1**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
White Catfish	>			>		
Carp						=
Small fish whole body, composite mercury						
Mosquitofish	=	<	<			=
Red Shiner				<		>

SYAR–B1 POND *(Tables 4a-b, Figures 4a-b)*

The Syar Cache Creek mining operation was not operating at the time of this sampling and had been idle since 2011. The B1 Pond is located south of Cache Creek and west of Highway 505, between 505 and County Road 87. After 4 years of drought conditions, it is a distinct, separate pond. With much higher water levels, the basin can link to the adjacent pond located to the west. The B1 Pond is an irregular rectangle shape app. 360 m long and 150 m wide. It is located in a steep-sided surrounding depression but, under conditions in 2015, depths were relatively shallow, ranging to about 6 m (20 feet).

Table 4a. Syar–B1 Pond: Large fish sampled, Fall 2015

Fish Species	Fish Total Length (mm)	(inches)	Fish Weight (g)	(lbs)	Muscle Mercury (µg/g = ppm, wet wt)
Largemouth Bass	210	8.3	105	0.2	**1.225**
Largemouth Bass	232	9.1	155	0.3	**1.021**
Largemouth Bass	246	9.7	205	0.5	**1.200**
Largemouth Bass	247	9.7	190	0.4	**1.172**
Largemouth Bass	249	9.8	200	0.4	**1.117**
Largemouth Bass	253	10.0	215	0.5	**1.369**
Largemouth Bass	256	10.1	225	0.5	**1.615**
Largemouth Bass	257	10.1	225	0.5	**1.686**
Largemouth Bass	259	10.2	250	0.6	**1.372**
Largemouth Bass	260	10.2	235	0.5	**1.302**
Largemouth Bass	263	10.4	240	0.5	**1.633**
Largemouth Bass	269	10.6	250	0.6	**1.538**
Largemouth Bass	274	10.8	260	0.6	**1.353**
Largemouth Bass	282	11.1	285	0.6	**1.593**
Largemouth Bass	296	11.7	355	0.8	**1.495**
Largemouth Bass	323	12.7	495	1.1	**1.893**
Largemouth Bass	425	16.7	1.160	2.6	**3.354**
Largemouth Bass	460	18.1	1.340	3.0	**3.363**
Green Sunfish	102	4.0	17	0.04	**0.783**
Green Sunfish	103	4.1	17	0.04	**0.935**
Green Sunfish	108	4.3	15	0.03	**0.856**
Green Sunfish	109	4.3	17	0.04	**0.750**
Green Sunfish	115	4.5	24	0.05	**0.779**
Green Sunfish	121	4.8	27	0.06	**0.640**
Green Sunfish	122	4.8	27	0.06	**0.617**
Green Sunfish	132	5.2	33	0.07	**0.863**
Green Sunfish	132	5.2	34	0.07	**0.625**
Green Sunfish	134	5.3	40	0.09	**0.927**

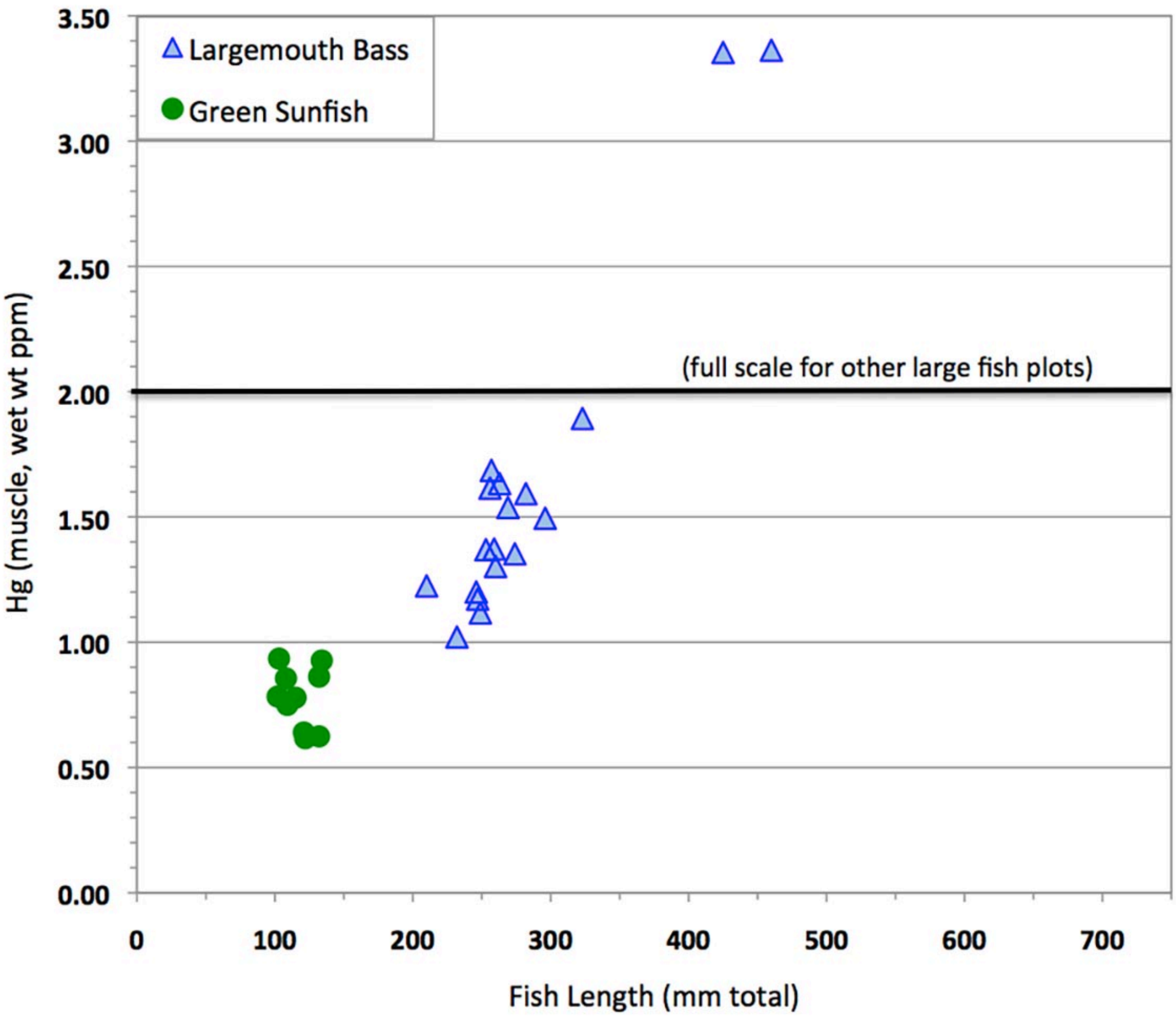


Figure 4a. Syar–B1 Pond: Large Fish Sampled, Fall 2015
(fillet muscle mercury in individual fish)

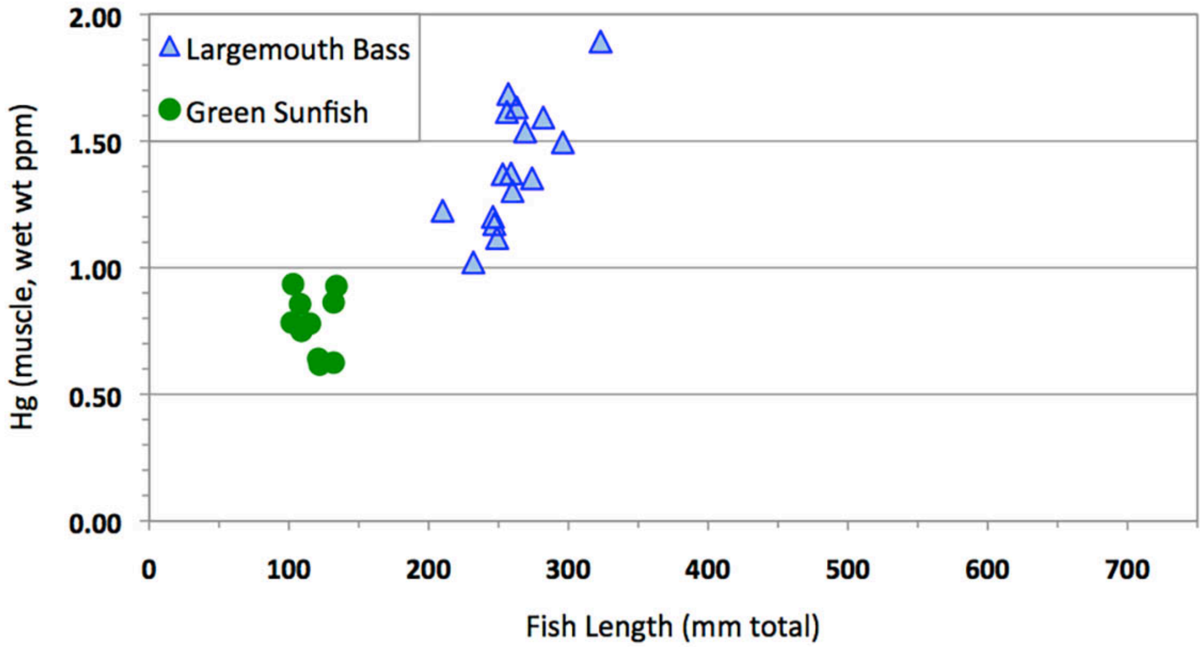


Figure 4b. Syar–B1 Pond: Large Fish Sampled, Fall 2015
(mercury scale matching other large fish plots; omitting 2 largest bass)

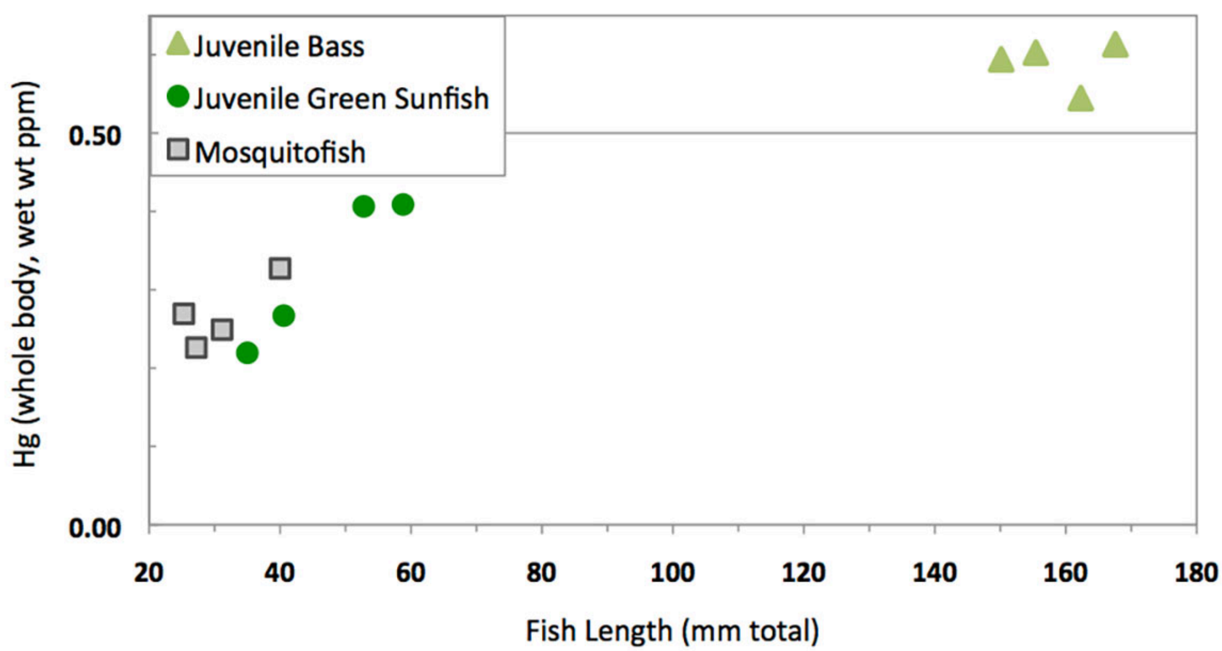


Figure 4c. Syar–B1 Pond: Small Fish Sampled, Fall 2015
(whole-body, multi-individual composite samples)

Table 4b. Syar–B1 Pond: Small Fish Sampled, Fall 2015
(multi-individual, whole body composite samples)

Fish Species	n (indivs. in comp)	Av. Fish Length (mm)	(inches)	Av. Fish Weight (g)	(oz)	Whole-Body Mercury (µg/g = ppm, wet wt)
Largemouth Bass (juv)	**7**	150	5.9	37.4	1.32	**0.594**
Largemouth Bass (juv)	**7**	155	6.1	39.9	1.41	**0.603**
Largemouth Bass (juv)	**7**	162	6.4	46.0	1.62	**0.545**
Largemouth Bass (juv)	**7**	168	6.6	50.6	1.79	**0.613**
Green Sunfish (juv)	**9**	35	1.4	0.69	0.02	**0.219**
Green Sunfish (juv)	**9**	41	1.6	1.06	0.04	**0.267**
Green Sunfish (juv)	**9**	53	2.1	2.25	0.08	**0.406**
Green Sunfish (juv)	**8**	59	2.3	2.91	0.10	**0.409**
Mosquitofish	**10**	25	1.0	0.14	0.01	**0.269**
Mosquitofish	**10**	27	1.1	0.18	0.01	**0.226**
Mosquitofish	**7**	31	1.2	0.29	0.01	**0.249**
Mosquitofish	**5**	40	1.6	0.62	0.02	**0.327**

As at the other sites, we sampled the B1 Pond during day, twilight, and night conditions on multiple days with a range of techniques. We were able to obtain good samples of the three fish species present (Tables 4a and 4b). These included fillet muscle samples of 18 Largemouth Bass (*Micropterus salmoides*) and 10 Green Sunfish (*Lepomis cyanellus*). The small fish present were juvenile Largemouth Bass (6-7" -- note, larger than the other small bass samples), juvenile Green Sunfish (1-2") and Mosquitofish (*Gambusia affinis*, 1-2"). We collected 28 small bass, which were divided into 4 composite samples of 7 fish each. The 35 juvenile Green Sunfish taken were put into 4 composite samples of 8-9 fish each. The 32 Mosquitofish collected were split into 4 composite samples of 5-10 fish each. In total, 40 separate mercury samples were analyzed from the Syar-B1 Pond.

SYAR–B1 POND: FISH MERCURY LEVELS, AND COMPARISONS WITH OTHER 2015 POND SITES AND WITH 2011-2012 BASELINE SAMPLES
(Tables 4c, 5a-b, and Figures 5-12).

The adult Bass had fillet muscle mercury in the very high range of 1.021-3.363 ppm, averaging 1.628 ppm. Two of the 18 bass were considerably larger (16-18") than the rest, and larger than the comparison samples. These two fish were much higher in mercury than the others (> 3.3 ppm). This is as high as we have found in any other comparable fish, including near mercury mine sites. The average, omitting these two, was somewhat lower at 1.411 ppm. Using either average, these bass were significantly higher in mercury than all the other comparison top predator fish samples, including those from the Cemex–West Pond (average = 0.278 ppm), Cemex–East Pond (0.840 ppm), baseline River Mile 28 (0.719 ppm), and baseline River Mile 15 (0.327 ppm).

Green Sunfish had fillet muscle mercury at 0.617-0.935 ppm, averaging 0.777 ppm. Consistent with the bass, the B1 pond Green Sunfish were statistically higher in mercury than all the other comparison samples, including those from Cemex–East (0.534 ppm) and the 3 baseline Cache Creek sites, River Mile 28 (0.540 ppm), RM 20 (0.138 ppm), and RM 15 (0.195 ppm).

The juvenile Bass multiple-fish composites had whole-body mercury ranging from 0.545-0.613 ppm, averaging 0.589 ppm. Consistent with the large fish samples, these were statistically higher in mercury than the comparison samples from the other ponds, Cemex–West (average = 0.044 ppm) and Cemex–East (0.334 ppm), and the baseline creek sites River Mile 28 (0.142 ppm) and River Mile 15 (0.050 ppm)

Juvenile Green Sunfish multiple-fish composites had whole-body mercury ranging from 0.219-0.409 ppm, averaging 0.325 ppm. This was statistically indistinguishable from corresponding Cemex–East fish (0.275 ppm) but was significantly higher than the three baseline Cache Creek sites, River Mile 28 (0.139 ppm), River Mile 20 (0.084 ppm), and River Mile 15 (0.086 ppm).

The Mosquitofish multiple-fish composites had whole-body mercury ranging from 0.226-0.327 ppm, averaging 0.268 ppm. Similar to the juvenile Green Sunfish data, this was statistically indistinguishable from the Cemex–East fish (average = 0.228 ppm) but significantly higher than the other comparison sets, including Cemex–West (0.075 ppm), Teichert–Reiff (0.094 ppm), and the baseline Cache Creek site with Mosquitofish, River Mile 15 (0.103 ppm).

Table 4c summarizes comparisons of the Syar–B1 Pond fish data with corresponding data from the other tested aggregate mining ponds and from the 2011-2012 baseline Cache Creek samples. Detailed comparison tables (5-6) and figures (5-12) can be found beginning on page 33. This pond was the highest mercury exposure environment of those tested, significantly higher in all 11 comparisons with corresponding baseline creek samples, and higher in 7 of 9 comparisons with other tested ponds. In 4 of these comparisons, though (juvenile bass), the higher levels may be partly due to the larger sizes of the B1 Pond juveniles (they may have been 2-year-olds).

Table 4c. Syar – B1 Pond: Summary Comparisons With Comparable Samples From the Other Monitored Ponds and Baseline Cache Creek Collections
(statistically lower (<), higher (>), or indistinguishable (=) at the 95% confidence level)

	– vs *Other 2015 Pond Sites* –			– vs *Baseline Cache Creek Sites* –		
Fish Species	**Cemex–W (Phase 1)**	**Cemex–E (Phase 3-4)**	**Teichert–Reiff**	**River Mile 28**	**River Mile 20**	**River Mile 15**
Large fish fillet muscle mercury						
Largemouth Bass	>	>		>		>
Green Sunfish		>		>	>	>
Small fish whole body, composite mercury						
Largemouth Bass (juv)	>	>		>		>
Green Sunfish (juv)		=		>	>	>
Mosquitofish	>	=	>			>

COMPARISON TABLES AND FIGURES: BETWEEN PONDS AND BETWEEN PONDS AND BASELINE 2011 CACHE CREEK SAMPLES

Table 5a. Large Fish Summary Comparison Data (averages and standard deviations)
(from multiple individual fillet muscle samples from each site)
Comparison 2011 baseline samples from Cache Creek in blue.
* *Omitting much larger bass (x2) and catfish (x1) for comparisons*

Site	Fish Species	n (indivs)	Av. Length (mm total)	Av. Weight (grams)	Av. Hg (µg/g = ppm, wet wt)	Std. Dev.
Cemex–W (Phase 1)	Largemouth Bass	**18**	305	393	**0.278**	± 0.111
Cemex–E (Phase 3-4)	Largemouth Bass	**20**	344	526	**0.840**	± 0.241
Teichert–Reiff	–					
Syar–B1	Largemouth Bass	**18**	281	355	**1.628**	± 0.668
*Syar–B1 **	*Largemouth Bass*	***16***	*261*	*243*	***1.411***	*± 0.238*
River Mile 28 (2011)	Bass + Sac. Pike.	**26**	260	236	**0.719**	± 0.163
River Mile 15 (2011)	Sac. Pikeminnow	**9**	264	145	**0.327**	± 0.086
Cemex–W (Phase 1)	–					
Cemex–E (Phase 3-4)	Green Sunfish	**10**	133	67	**0.534**	± 0.107
Teichert–Reiff	Green Sunfish	**1**	140	40	**0.328**	
Syar–B1	Green Sunfish	**10**	118	25	**0.777**	± 0.120
River Mile 28 (2011)	Green Sunfish	**3**	139	47	**0.540**	± 0.050
River Mile 20 (2011)	Green Sunfish	**10**	122	31	**0.138**	± 0.041
River Mile 15 (2011)	Green Sunfish	**10**	133	41	**0.195**	± 0.043
Cemex–W (Phase 1)	Channel Catfish	**2**	595	2,130	**0.198**	± 0.132
Cemex–E (Phase 3-4)	–					
Teichert–Reiff	White Catfish	**20**	347	658	**0.737**	± 0.333
*Teichert–Reiff **	*White Catfish*	***19***	*326*	*458*	***0.702***	*± 0.302*
Syar–B1	–					
River Mile 28 (2011)	Channel Catfish	**5**	239	102	**0.229**	± 0.082
Cemex–W (Phase 1)	–					
Cemex–E (Phase 3-4)	–					
Teichert–Reiff	Carp	**2**	421	918	**0.351**	± 0.197
Syar–B1	–					
River Mile 15 (2011)	Sac. Sucker	**8**	276	231	**0.143**	± 0.014

Table 5b. Supplemental historic baseline data – large fish, including the most closely comparable data from 1997 and 2000
(fillet muscle samples, ordered from upstream to downstream site)
2011 baseline creek samples in **bold**

Fish Species	Site	Year	n (individuals)	Av Length (mm total)	Av Weight (grams)	Hg (µg/g = ppm, wet wt)	Std. Dev.
Smallmouth Bass	Rumsey	2000	15	271	302	0.452	± 0.215
Smallmouth Bass	**RM 28**	**2011**	**7**	**265**	**326**	**0.782**	**± 0.204**
Smallmouth Bass	RM 20	2000	7	234	183	0.444	± 0.066
Smallmouth Bass	RM 15	1997	2	383	780	0.939	± 0.390
Smallmouth Bass	RM 08	2000	2	231	165	0.390	± 0.057
Largemouth Bass	**RM 28**	**2011**	**9**	**199**	**137**	**0.663**	**± 0.150**
Largemouth Bass	RM 03	1997	2	369	730	0.375	± 0.229
Sac. Pikeminnow	Rumsey	2000	8	327	304	0.622	± 0.341
Sac. Pikeminnow	**RM 28**	**2011**	**10**	**311**	**262**	**0.726**	**± 142**
Sac. Pikeminnow	RM 20	2000	8	269	147	0.509	± 0.244
Sac. Pikeminnow	**RM 15**	**2011**	**9**	**264**	**145**	**0.327**	**± 0.086**
Sac. Pikeminnow	RM 03	1997	1	241	110	0.499	
Channel Catfish	Rumsey	2000	1	411	565	0.225	
Channel Catfish	**RM 28**	**2011**	**5**	**239**	**102**	**0.229**	**± 0.082**
Channel Catfish	RM 20	2000	1	368	380	0.225	
Channel Catfish	RM 03	1997	10	336	304	0.174	± 0.026
Black Crappie	**RM 20**	**2011**	**1**	**176**	**59**	**0.138**	
White Crappie	RM 03	1997	6	208	95	0.300	± 0.141
Green Sunfish	**RM 28**	**2011**	**3**	**139**	**47**	**0.540**	**± 0.050**
Green Sunfish	RM 20	2000	4	132	41	0.271	± 0.223
Green Sunfish	**RM 20**	**2011**	**10**	**122**	**31**	**0.138**	**± 0.041**
Green Sunfish	**RM 15**	**2011**	**10**	**133**	**41**	**0.195**	**± 0.043**
Hybrid Sunfish	**RM 28**	**2011**	**6**	**134**	**42**	**0.375**	**± 0.055**
Bluegill	**RM 28**	**2011**	**5**	**130**	**45**	**0.308**	**± 0.102**
Bluegill	RM 20	2000	1	115	30	0.350	
Bluegill Sunfish	RM 03	1997	3	125	33	0.270	± 0.140
Sac. Sucker	Rumsey	2000	6	328	396	0.198	± 0.098
Sac. Sucker	RM 20	2000	5	253	174	0.154	± 0.027
Sac. Sucker	**RM 15**	**2011**	**8**	**276**	**231**	**0.143**	**± 0.014**
Sac. Sucker	RM 08	2000	4	319	336	0.339	± 0.164
Sac. Sucker	RM 03	1997	5	343	402	0.263	± 0.055

Table 6a. Small fish summary comparison data from multi-individual, whole body composites

(means of multiple composites, each consisting of multiple individual small fish)
Comparison fall 2011, spring 2012 baseline samples from Cache Creek in blue.

Fish Species	**Site**	**n** (comps)	**n** (inds/ comp)	**Av. Length** (mm total)	**Av. Wt.** (grams)	**Hg** (ng/g = ppb, wet wt)	**Std. Dev.**
Largemouth Bass (juv)	Cemex-W (Phase 1)	**4**	8	109	16.5	**0.044**	± 0.007
Largemouth Bass (juv)	Cemex-E (Phase 3-4)	**4**	7	108	15.9	**0.334**	± 0.052
–	Teichert-Reiff	–	–	–	–	–	–
Largemouth Bass (juv)	Syar-B1	**4**	7	159	43.5	**0.589**	± 0.030
Largemouth Bass (juv)	River Mile 28 (2011)	**4**	3-5	75	5.66	**0.142**	± 0.026
Largemouth Bass (juv)	River Mile 15 (2011)	**3**	1	93	10.2	**0.050**	± 0.024
–	Cemex-W (Phase 1)	–	–	–	–	–	–
Green Sunfish (juv)	Cemex-E (Phase 3-4)	**4**	10	47	1.80	**0.275**	± 0.022
Green Sunfish (juv)	Teichert-Reiff	–	1	68	2.70	**0.241**	
Green Sunfish (juv)	Syar-B1	**4**	8-9	47	1.73	**0.325**	± 0.097
Green Sunfish (juv)	River Mile 28 (2011)	**4**	4	53	2.81	**0.139**	± 0.014
Green Sunfish (juv)	River Mile 20 (2011)	4	4	58	3.37	**0.084**	± 0.004
Green Sunfish (juv)	River Mile 15 (2011)	**4**	4-5	56	3.15	**0.086**	± 0.018
Mosquitofish	Cemex-W (Phase 1)	**4**	10	39	0.63	**0.075**	± 0.015
Mosquitofish	Cemex-E (Phase 3-4)	**4**	10	37	0.55	**0.228**	± 0.059
Mosquitofish	Teichert-Reiff	**4**	12	38	0.56	**0.094**	± 0.010
Mosquitofish	Syar-B1	**4**	5-10	31	0.31	**0.268**	± 0.043
Mosquitofish	River Mile 15 (2011)	**4**	1-10	37	0.72	**0.103**	± 0.048
–	Cemex-W (Phase 1)	–	–	–	–	–	–
–	Cemex-E (Phase 3-4)	–	–	–	–	–	–
Red Shiner	Teichert-Reiff	**4**	10	50	1.33	**0.152**	± 0.018
–	Syar-B1	–	–	–	–	–	–
Red Shiner	River Mile 28 (2011)	**4**	10	48	1.00	**0.242**	± 0.036
Red Shiner	River Mile 28 (2012)	**6**	6	51	1.63	**0.189**	± 0.012
Red Shiner	River Mile 15 (2012)	**6**	6	52	1.79	**0.063**	± 0.006

Table 6b. Supplemental historic baseline data – small fish, fall collections, including the most closely comparable fall creek data from 1997-2002

Fall 2011 baseline creek samples in **bold**
(whole body composite samples)

Fish Species	**Site**	**Year**	**n** (comps)	**n** (inds/ (comp)	**Av Lgth** (mm total)	**Av Wt** (grams)	**Hg** (µg/g = ppm, wet wt)	**Std. Dev.**
Red Shiner	Rumsey	2000	1	3	38	0.5	0.091	
Red Shiner	**RM 28**	**2011**	**4**	**10**	**48**	**1.0**	**0.242**	**± 0.036**
Red Shiner	RM 20	2000	3	9	42	0.6	0.166	± 0.003
Red Shiner	RM 17	2000	3	10	39	0.5	0.162	± 0.020
Red Shiner	RM 17	2001	3	12	44	0.8	0.232	± 0.015
Red Shiner	RM 17	2002	6	1	44	0.7	0.164	± 0.064
Red Shiner	RM 15	1997	3	19	37	0.5	0.159	± 0.024
Red Shiner	RM 15	2000	3	10	40	0.5	0.118	± 0.005
Red Shiner	RM 15	2001	3	25	44	0.9	0.100	± 0.013
Red Shiner	RM 15	2002	6	1	46	0.8	0.106	± 0.026
Red Shiner	RM 08	2000	4	10	42	0.7	0.123	± 0.016
Green Sunfish	**RM 28**	**2011**	**4**	**4**	**53**	**2.8**	**0.139**	**± 0.014**
Green Sunfish	**RM 20**	**2011**	**4**	**4**	**58**	**3.4**	**0.084**	**± 0.004**
Green Sunfish	RM 17	2000	2	9	60	3.6	0.185	± 0.019
Green Sunfish	RM 17	2001	1	6	60	4.0	0.138	
Green Sunfish	RM 17	2002	6	1	70	6.0	0.217	± 0.060
Green Sunfish	RM 15	2000	2	6	63	4.3	0.110	± 0.000
Green Sunfish	RM 15	2001	1	8	67	6.2	0.126	
Green Sunfish	RM 15	2002	6	1	68	5.6	0.111	± 0.021
Green Sunfish	**RM 15**	**2011**	**4**	**4-5**	**56**	**3.1**	**0.086**	**± 0.018**
Bluegill Sunfish	**RM 28**	**2011**	**2**	**2**	**61**	**0.9**	**0.136**	**± 0.005**
Bluegill Sunfish	**RM 15**	**2011**	**4**	**4**	**67**	**6.0**	**0.052**	**± 0.004**
Bluegill Sunfish	RM 08	1997	3	7	52	2.5	0.079	± 0.006
Mosquitofish	RM 17	2000	1	5	32	0.3	0.146	
Mosquitofish	RM 17	2002	4	4	34	0.4	0.175	± 0.005
Mosquitofish	RM 15	2002	4	5	35	0.4	0.091	± 0.011
Mosquitofish	**RM 15**	**2011**	**4**	**1-10**	**37**	**0.7**	**0.103**	**± 0.048**

Table 6c. Supplemental historic baseline data – small fish, spring collections, including the most closely comparable spring creek data from 1997-2003

Spring 2012 baseline creek samples in **bold**
(whole body composite samples)

Fish Species	Site	Year	n (comps)	n (inds/ (comp)	Av Lgth (mm total)	Av Wt (grams)	Hg (µg/g = ppm, wet wt)	Std. Dev.
Red Shiner	Rumsey	2000	1	2	50	1.1	0.069	
Red Shiner	**RM 28**	**2012**	**6**	**6**	**51**	**1.6**	**0.189**	**± 0.012**
Red Shiner	RM 20	2000	3	9	43	0.7	0.070	± 0.011
Red Shiner	RM 17	2001	3	13	51	2.0	0.063	± 0.013
Red Shiner	RM 17	2002	4	13	58	2.2	0.067	± 0.010
Red Shiner	RM 17	2003	4	3	53	1.8	0.057	± 0.013
Red Shiner	RM 15	2001	3	12	58	2.2	0.046	± 0.003
Red Shiner	RM 15	2002	5	15	57	2.3	0.057	± 0.006
Red Shiner	RM 15	2003	4	5	53	1.9	0.061	± 0.006
Red Shiner	**RM 15**	**2012**	**6**	**6**	**52**	**1.8**	**0.063**	**± 0.006**
Red Shiner	RM 08	2000	3	10	46	1.1	0.081	± 0.011
Green Sunfish	**RM 28**	**2012**	**4**	**4-5**	**68**	**7.2**	**0.142**	**± 0.012**
Green Sunfish	**RM 20**	**2012**	**3**	**1**	**75**	**9.7**	**0.106**	**± 0.017**
Green Sunfish	RM 17	2001	1	17	75	6.4	0.079	
Green Sunfish	RM 17	2002	3	4	66	6.1	0.083	± 0.002
Green Sunfish	RM 17	2003	10	1	65	5.4	0.091	± 0.012
Green Sunfish	RM 15	2001	1	14	65	5.8	0.070	
Green Sunfish	RM 15	2002	3	2	68	6.2	0.070	± 0.010
Green Sunfish	RM 15	2003	8	1	58	3.8	0.075	± 0.016
Green Sunfish	**RM 15**	**2012**	**4**	**2-3**	**68**	**6.9**	**0.058**	**± 0.014**
Speckled Dace	Rumsey	2000	2	10	56	2.0	0.112	± 0.002
Speckled Dace	Rumsey	2001	3	12	59	2.2	0.106	± 0.010
Speckled Dace	**RM 20**	**2012**	**4**	**3-5**	**58**	**2.2**	**0.142**	**± 0.030**
Speckled Dace	RM 17	2001	3	8	61	2.5	0.113	± 0.011

Table 7. General comparison of the 2011-2012 baseline data with closely comparable historic data from 1997-2003.
(for matching sample types/sizes and closest sites)
(relative statistical differences of new data vs old, 95% confidence level)

Sample Type	River Mile 28	River Mile 20	River Mile 15
Large Fish			
Smallmouth Bass	same		
Largemouth Bass	same		
Sacramento Pikeminnow	same		same
Green Sunfish	same	same	same
Bluegill Sunfish	same		
Sacramento Sucker			same
Small Fish			
Red Shiner (Fall)	same		
Red Shiner (Spring)	**up**		same
Green Sunfish (Fall)	same	**down**	same
Green Sunfish (Spring)	**up**	same	same
Bluegill Sunfish (Fall)			**down**
Mosquitofish (Fall)			same
Speckled Dace (Spring)		same	
Aquatic Insects			
Dragonflies (Spring)		same	same
Damselflies (Fall)	same	same	**down**
Caddisflies (Spring)	**up**	same	
same			

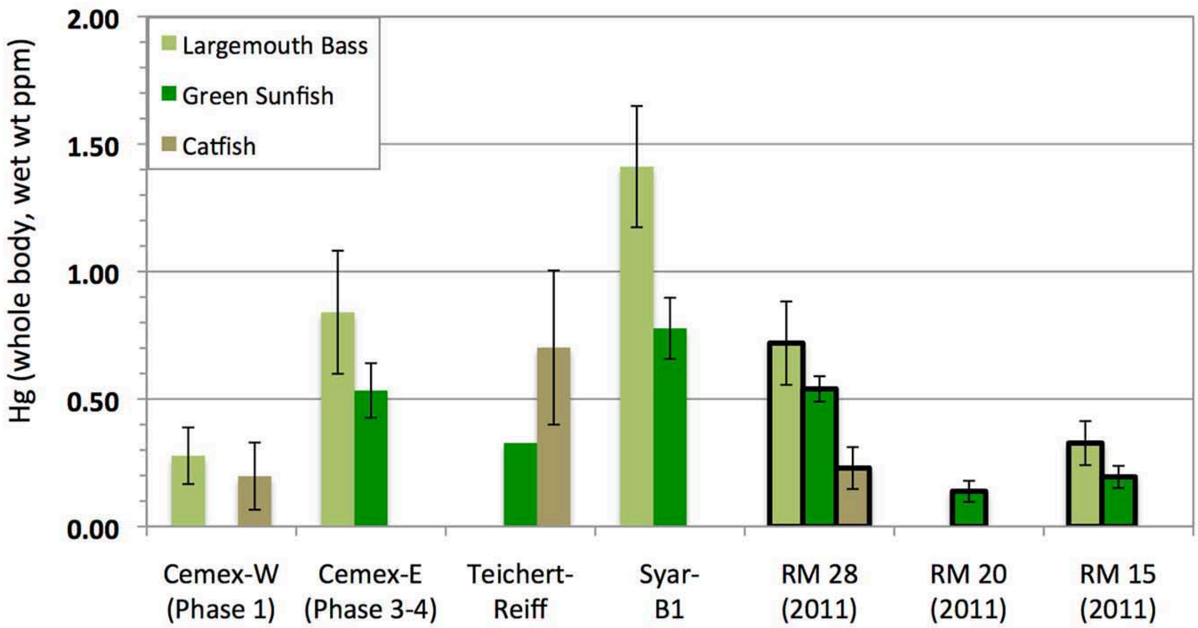


Figure 5a. Large Fish Mercury: Comparison of Ponds and 2011 Baseline Creek Samples
(All comparable species; average mercury and standard deviation for each site)
(RM refers to River Mile of baseline Cache Creek sites)

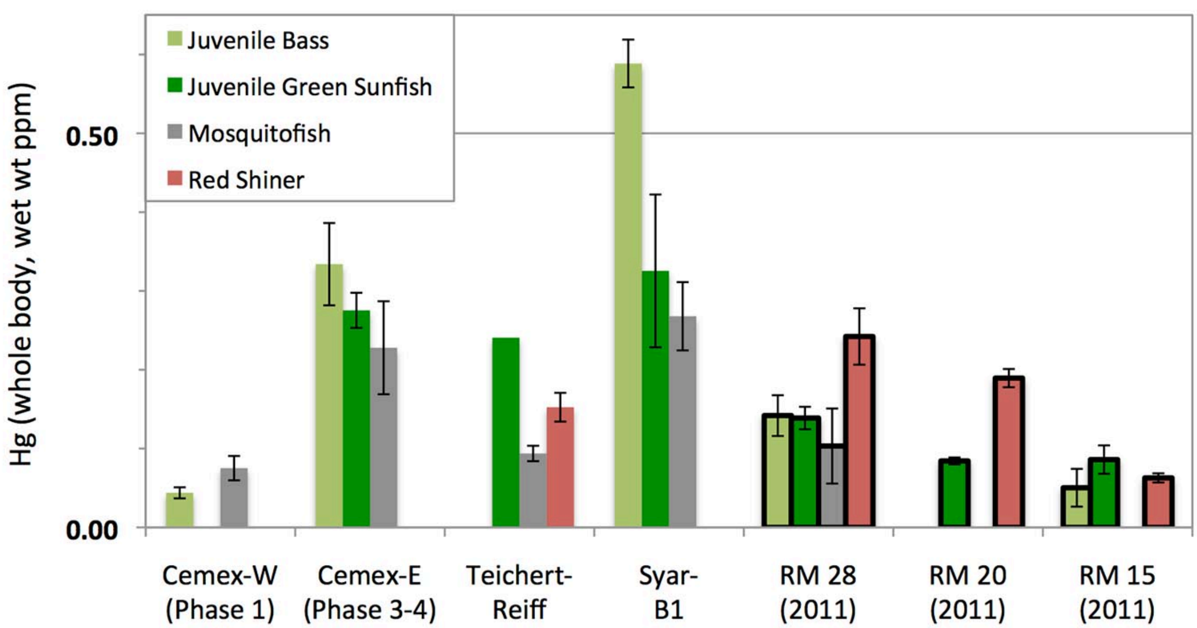


Figure 5b. Small Fish Mercury: Comparison of Ponds and 2011 Baseline Creek Samples
(All comparable species; average mercury and standard deviation for each site)

COMPARISON MERCURY PLOTS FOR INDIVIDUAL FISH SPECIES
(*large, angling-sized fish first, followed by small fish with reduced mercury scale*)

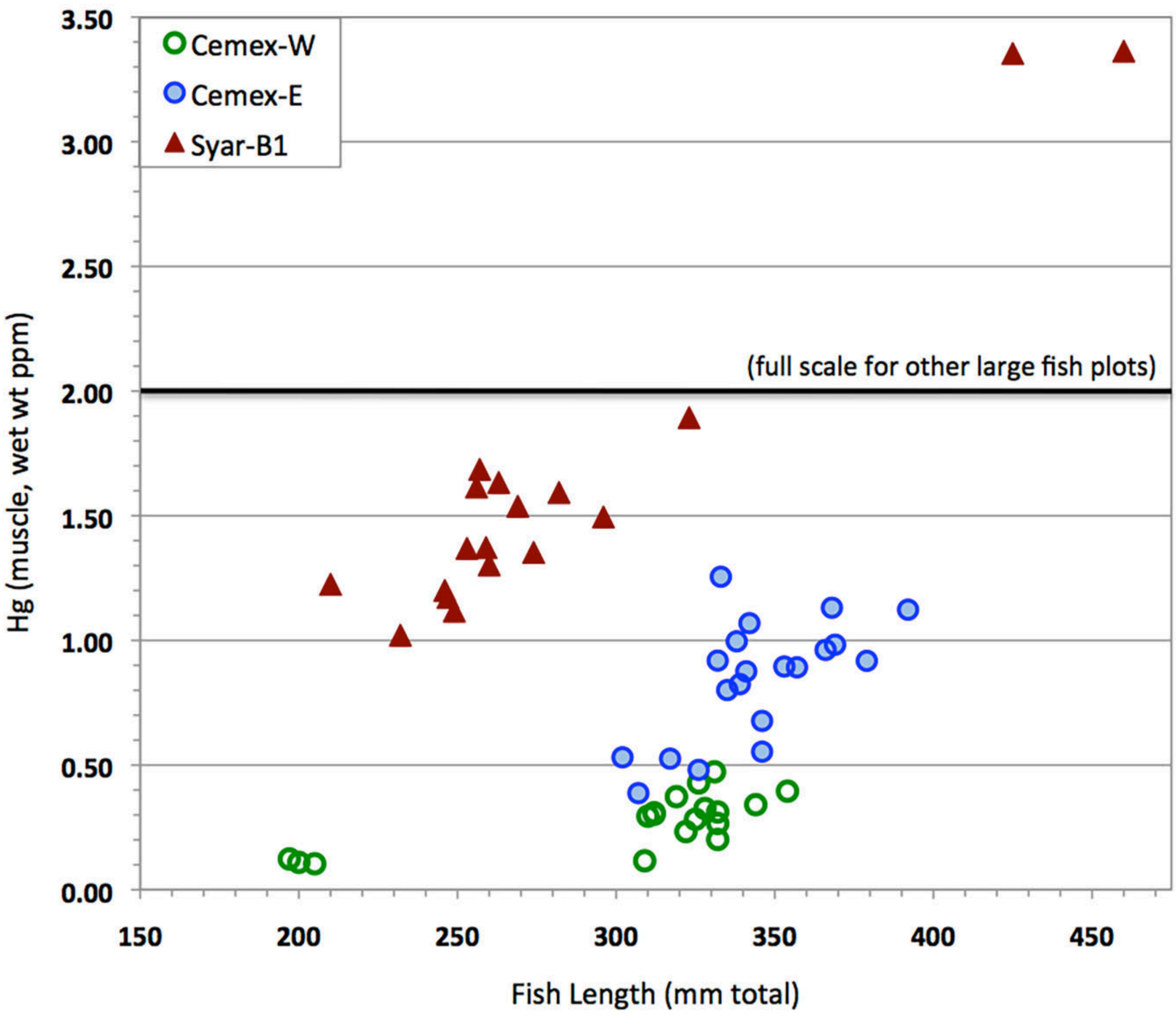


Figure 6a. Largemouth Bass Mercury: Site Comparison, Fall 2015
(fillet muscle mercury in individual fish; full scale, including all bass sampled)

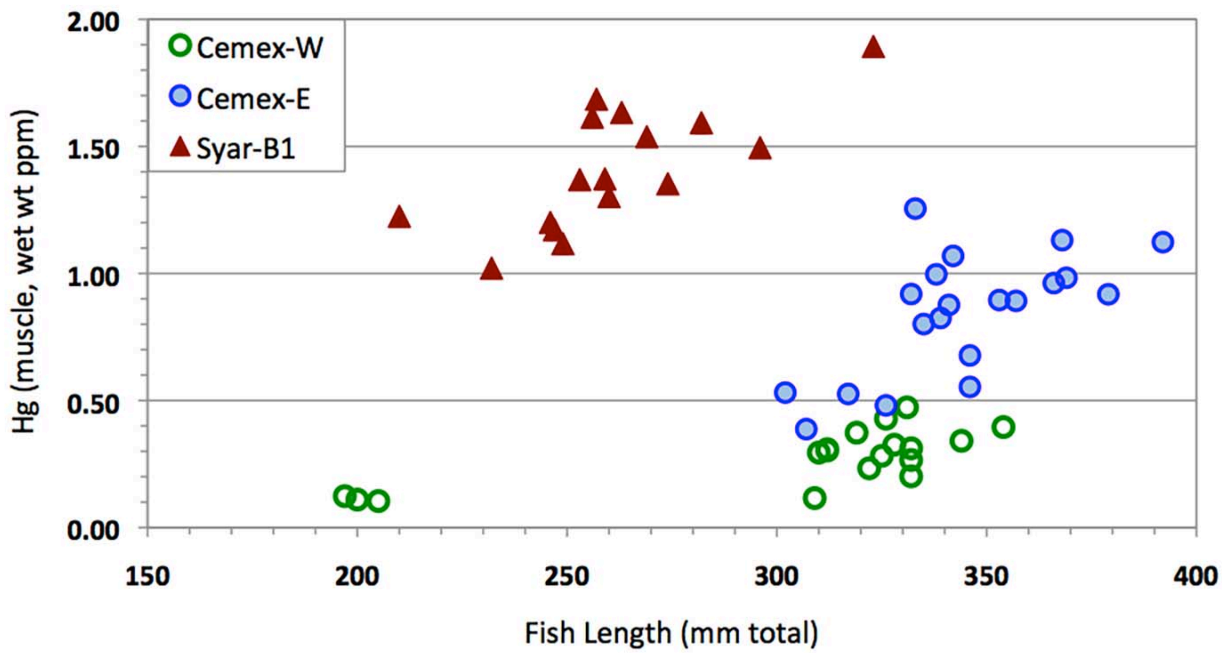


Figure 6b. Largemouth Bass Mercury: Site Comparison, Fall 2015
(Mercury scale matching other large fish plots; omitting 2 largest Syar-B1 fish)

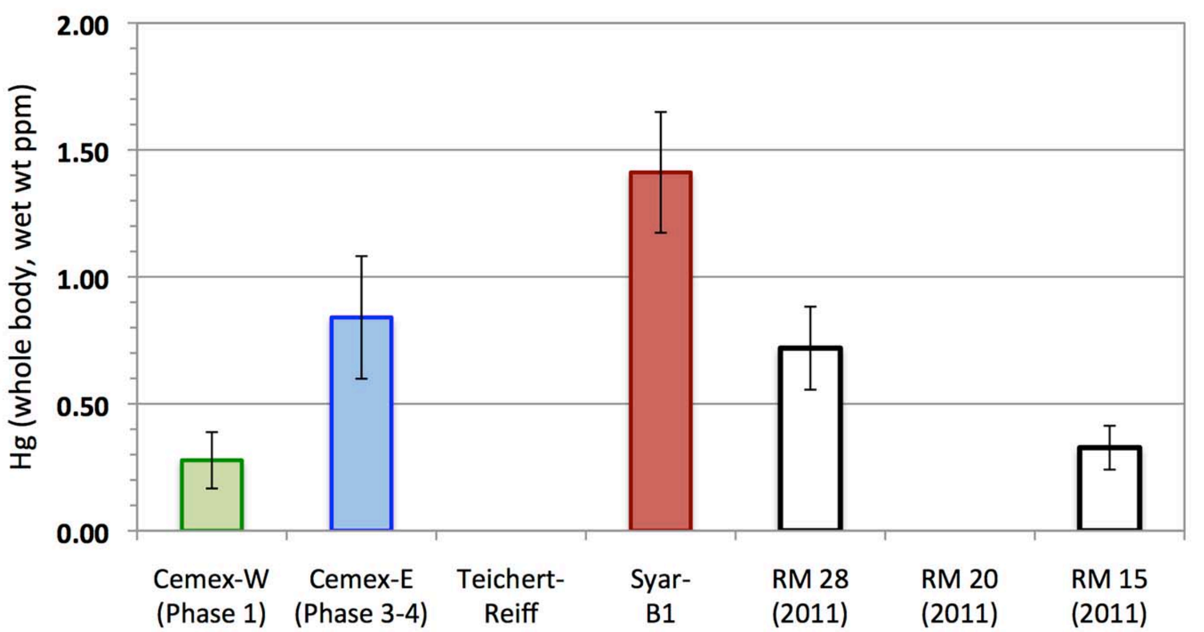


Figure 6c. Largemouth Bass: Comparison of Ponds and 2011 Baseline Creek Samples
(Average mercury and standard deviation for each site)

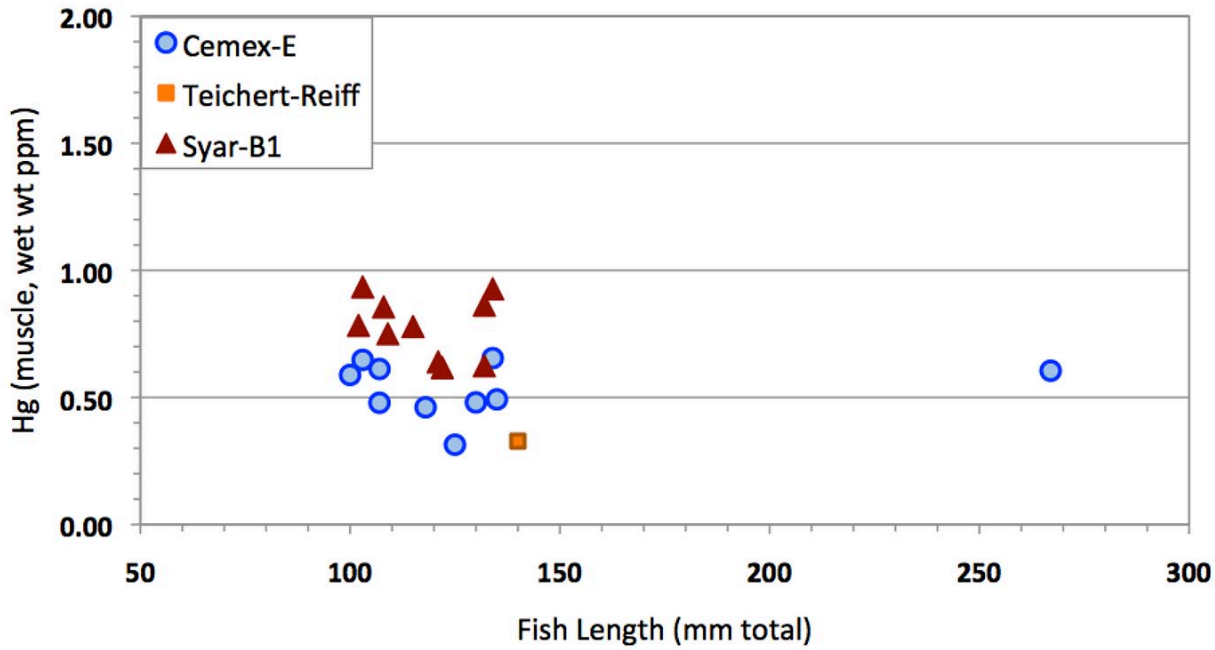


Figure 7a. Green Sunfish Mercury: Site Comparison, Fall 2015
(fillet muscle mercury in individual fish)

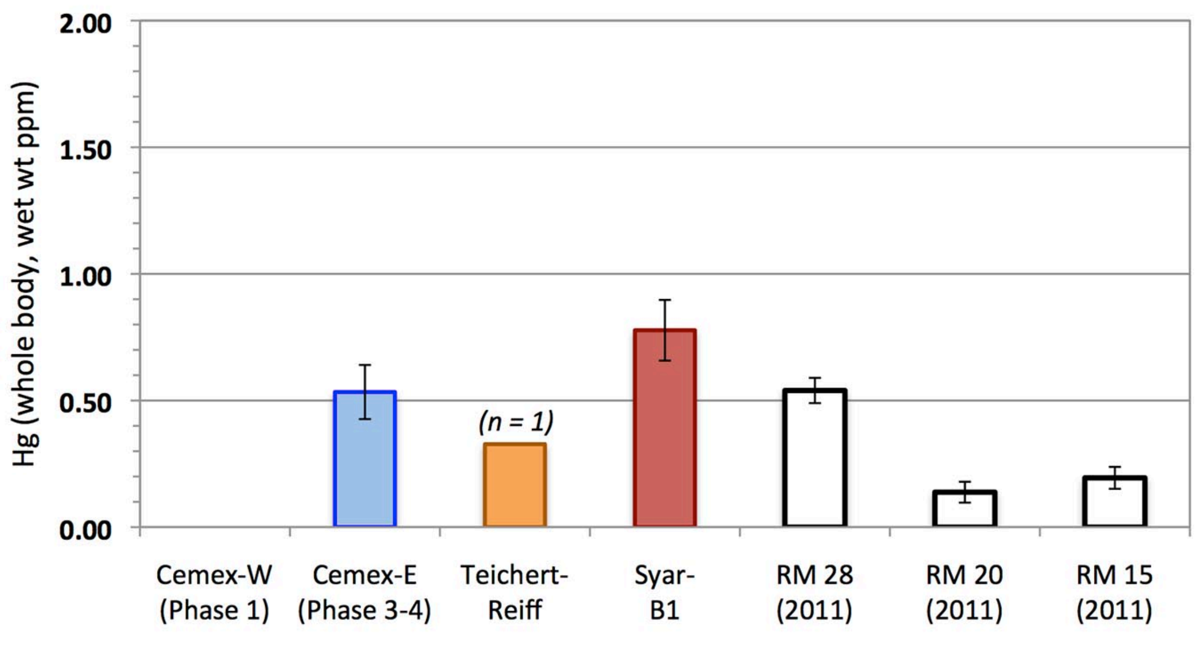


Figure 7b. Green Sunfish: Comparison of Ponds and 2011 Baseline Creek Samples
(Average mercury and standard deviation for each site)

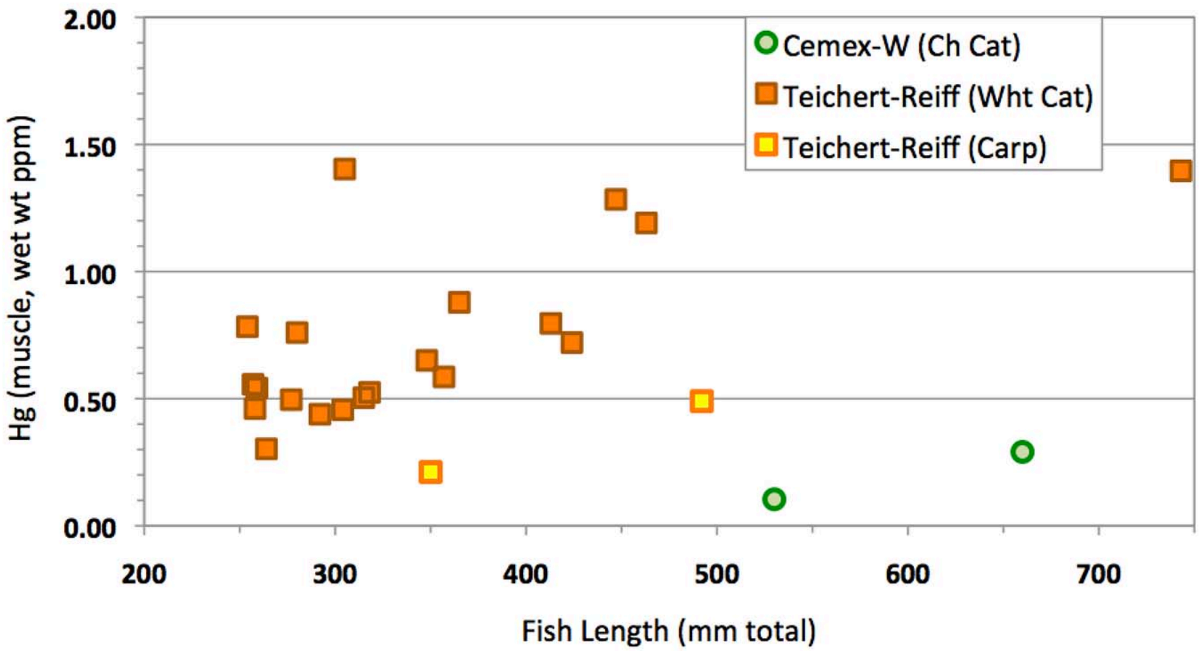


Figure 8a. Catfish and Carp Mercury: Site Comparison, Fall 2015
(fillet muscle mercury in individual fish)

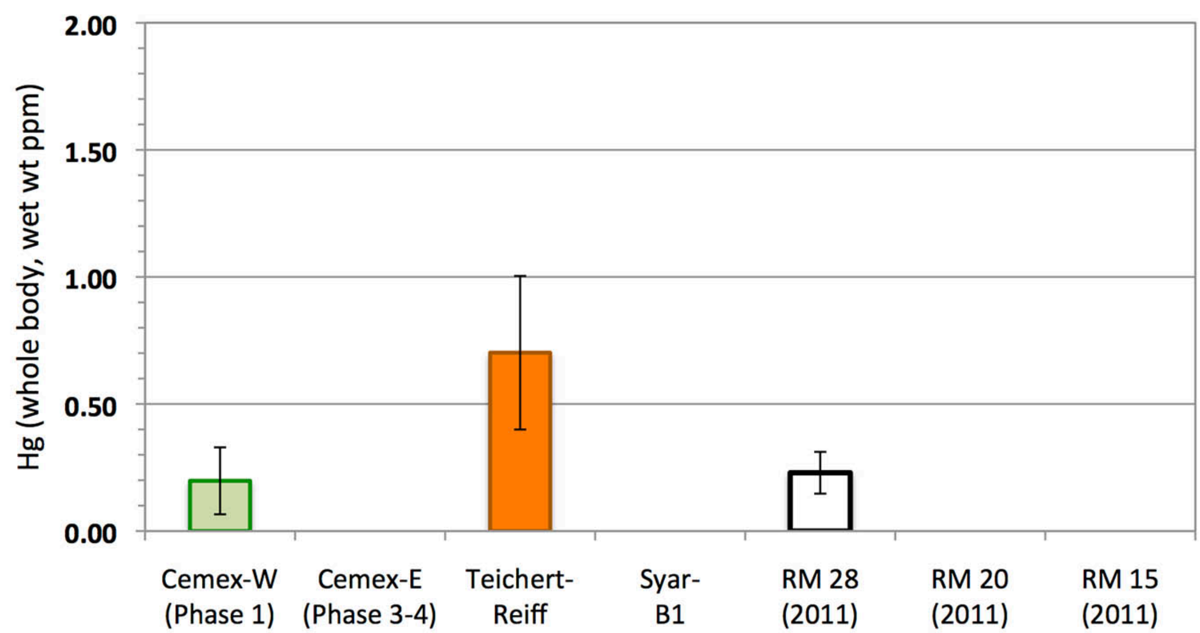


Figure 8b. Catfish: Comparison of Ponds and 2011 Baseline Creek Samples
(Average mercury and standard deviation for each site)

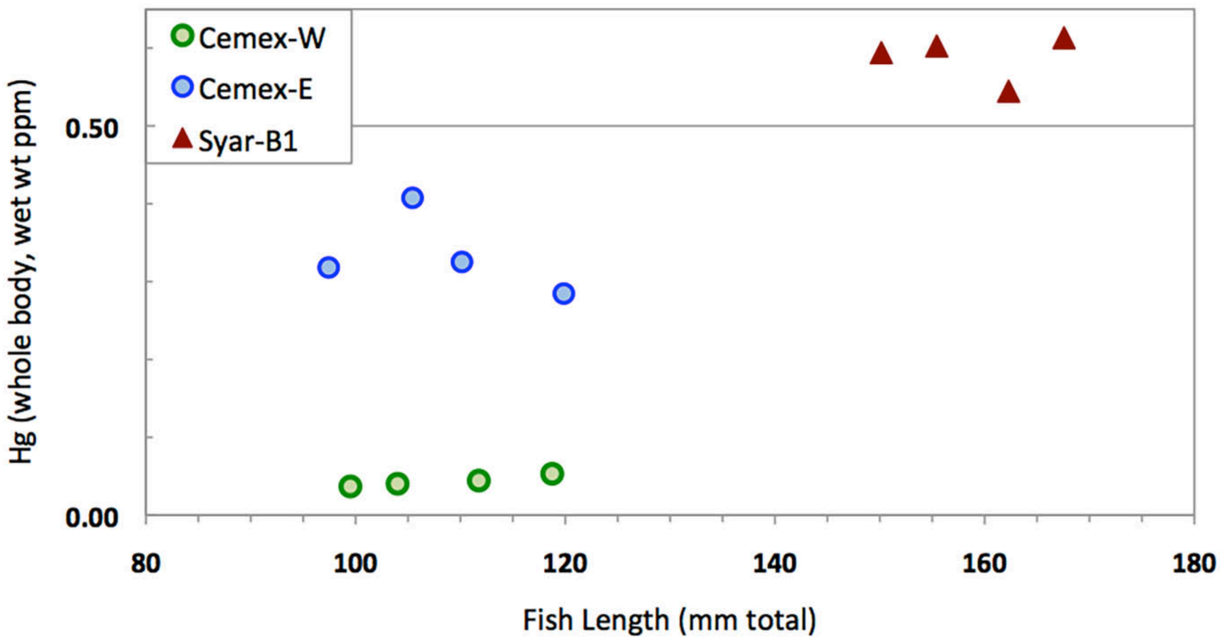


Figure 9a. Juvenile Largemouth Bass Mercury: Site Comparison, Fall 2015
(NOTE LOWER MERCURY SCALE FOR SMALL FISH PLOTS)
(whole body mercury in multi-individual composite samples)

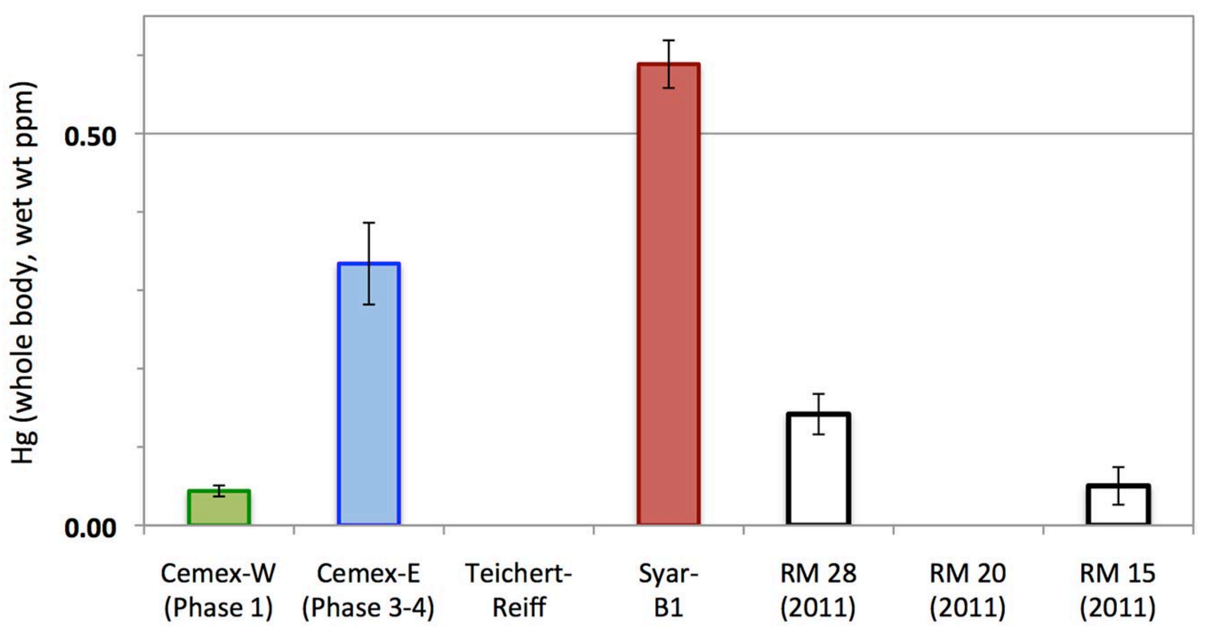


Figure 9b. Juvenile Bass: Comparison of Ponds and 2011 Baseline Creek Samples
(Average mercury and standard deviation for each site)

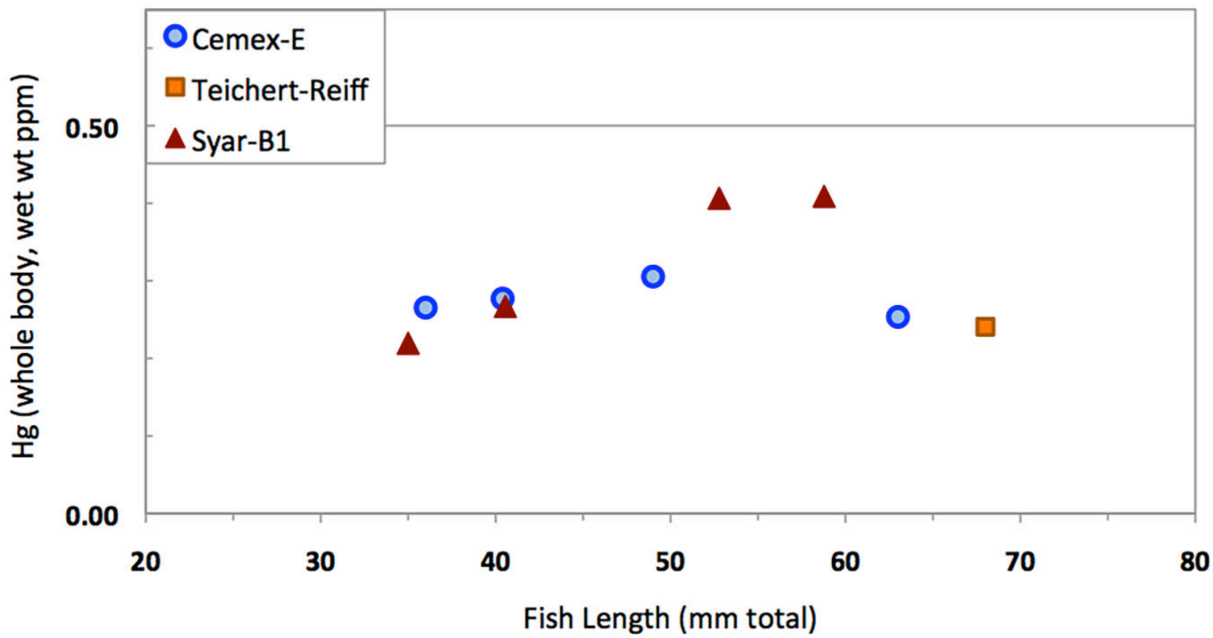


Figure 10a. Juvenile Green Sunfish Mercury: Site Comparison, Fall 2015
(whole body mercury in multi-individual composite samples)

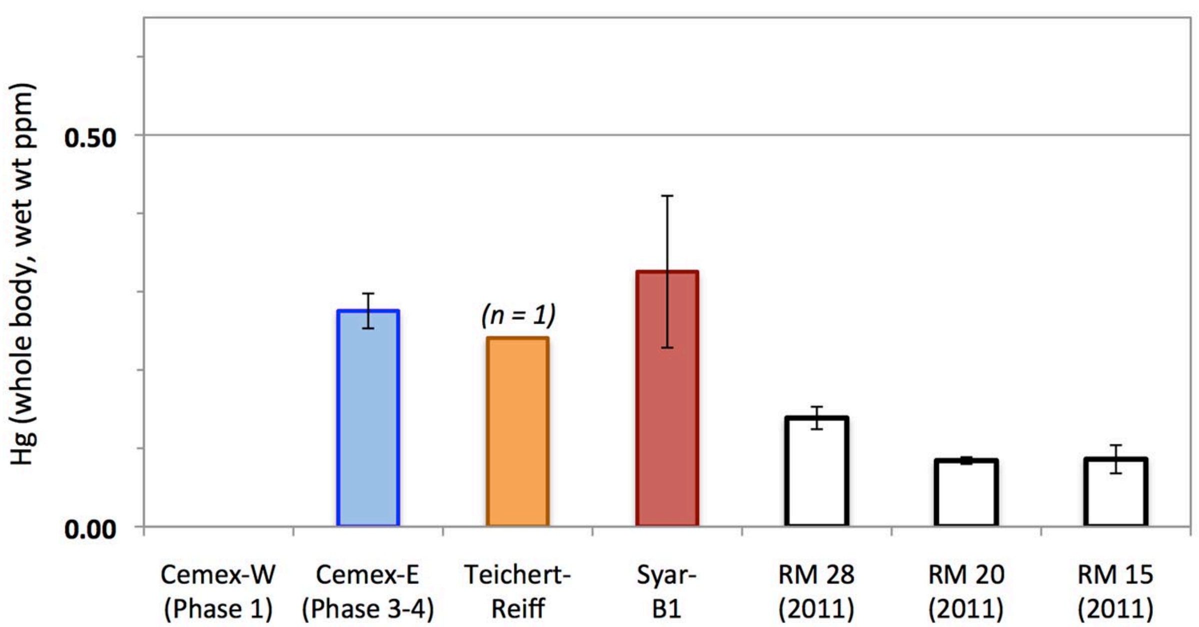


Figure 10b. Juvenile Green Sunfish: Comparison of Ponds and 2011 Baseline Creek Samples
(Average mercury and standard deviation for each site)

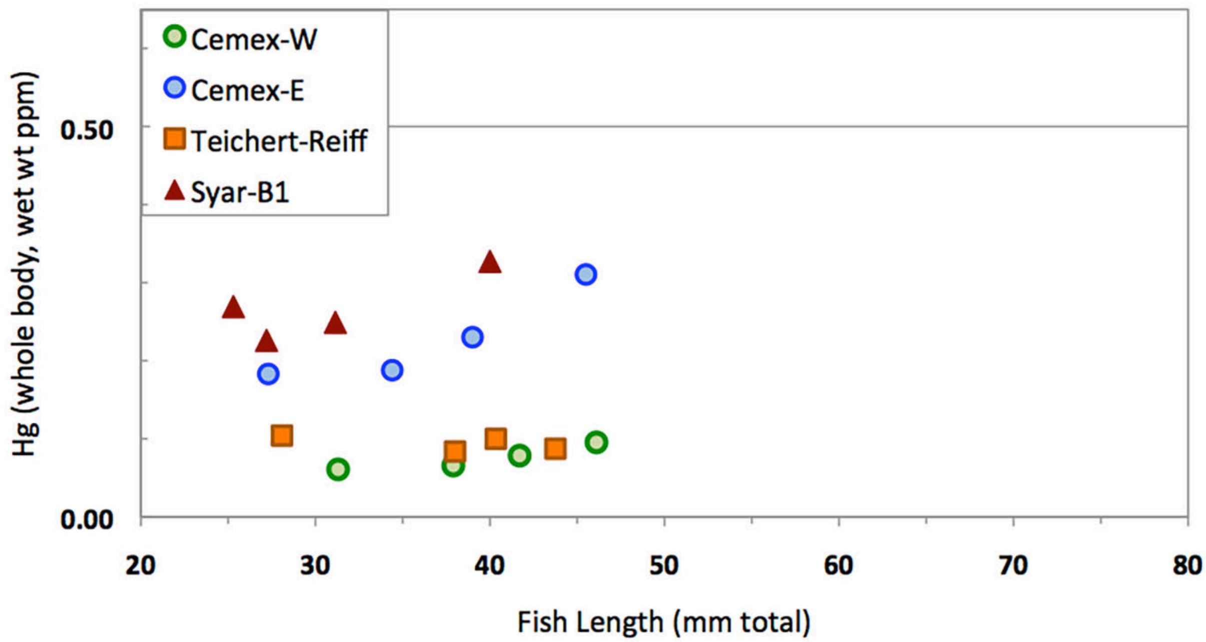


Figure 11a. Mosquitofish Mercury: Site Comparison, Fall 2015
(whole body mercury in multi-individual composite samples)

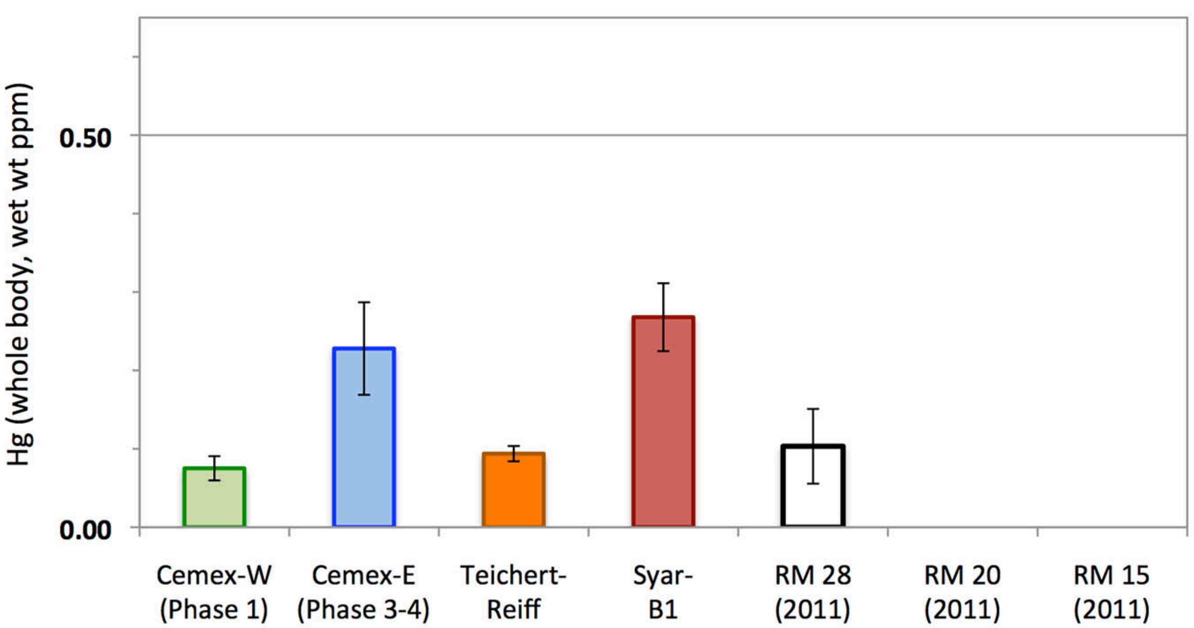


Figure 11b. Mosquitofish: Comparison of Ponds and 2011 Baseline Creek Samples
(Average mercury and standard deviation for each site)

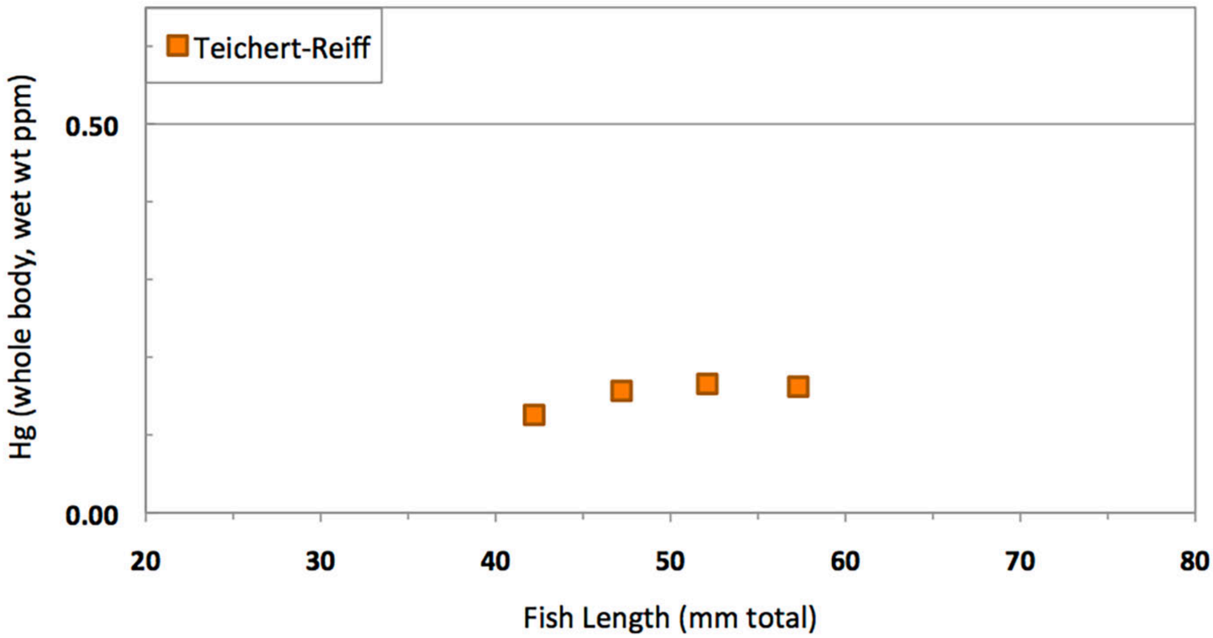


Figure 12a. Red Shiner Mercury: Fall 2015
(whole body mercury in multi-individual composite samples)

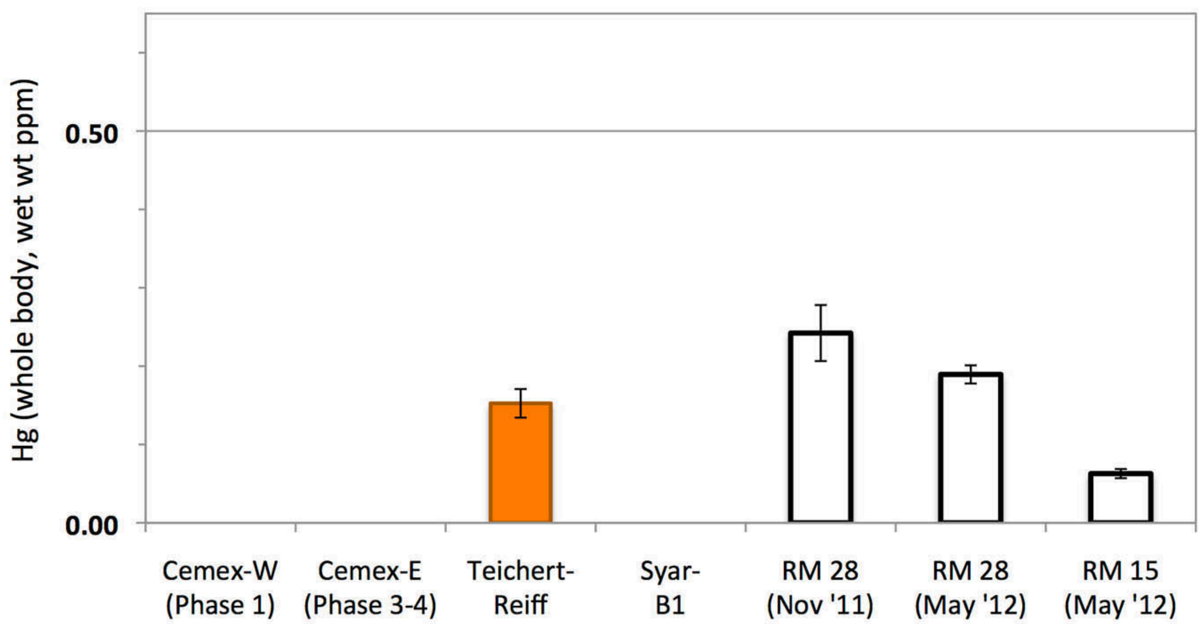


Figure 12b. Red Shiners: Comparison of Ponds and 2011 Baseline Creek Samples
(Average mercury and standard deviation for each site)

CONCLUSIONS

The four sampled ponds were found to show distinct, individual mercury signatures that were broadly consistent across the different fish species. There was a surprising range of fish mercury concentrations, with up to 5 or more times higher levels at the highest mercury sites relative to the lowest, in same sample types.

The Cemex–West Pond (Phase 1), was notably lowest in mercury across all of the samples available. It was statistically lower than all the other tested ponds for nearly every corresponding sample type and was statistically lower than or similar to all of the comparable baseline creek samples.

The Teichert–Reiff Pond had levels similar to the baseline creek samples, with some samples lower, some statistically the same, and some higher.

The Cemex–East Pond (Phase 3-4) was higher in fish mercury than the Teichert–Reiff and Cemex–West ponds. Relative to the baseline creek samples, it was higher in most comparisons (8 of 11) and statistically similar in the other 3.

The Syar–B1 Pond was higher in fish mercury than all of the comparable baseline creek samples. Fish from this pond also had statistically higher mercury than corresponding samples from the other ponds tested, except in juvenile Green Sunfish and Mosquitofish from the Cemex–East Pond (Phase 3-4) which were statistically similar.

So, of the four ponds monitored, two were found to be low or similar in fish mercury to the baseline Cache Creek samples (Cemex–West and Teichert–Reiff). Two appeared to be in an elevated range that may require future attention (Syar–B1 and Cemex–East).

This range of results may present an opportunity to help identify what is driving the high mercury levels at some locations and the low levels at others. Ultimately, if these factors can be identified, it may be possible to reduce levels at the elevated mercury sites through realistic and cost-effective modifications. The Yolo County Ordinance sets out requirements for investigating likely contributing factors which can guide potential mitigation approaches. Those protocols are in the process of being updated. The 2015 monitoring results are being tested for consistency with follow-up annual monitoring, as laid out in the ordinance. At the time of this report finalization (May 2017), those fall 2016 collections have been conducted. Laboratory work is in process and analytical results will be presented later in 2017.

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Slotton, D.G., S.M. Ayers, and R.D. Weyand. (2015 edition). Quality Assurance Project Plan (QAPP) for UC Davis Biosentinel Mercury Monitoring, including Standard Operating Procedures (SOPs). 31 pp.

Yolo County Code, Title 10. Chapter 5 (Surface Mining Reclamation), Section 10.5.517

APPENDIX

PHOTOGRAPHS OF SAMPLING SITES AND BIOLOGICAL SAMPLES ANALYZED FOR THIS REPORT

A1. Launching boat at the Teichert–Reiff Pond; one of several ramps built for this work

A2. Sampling boat and some of the gear

CEMEX – WEST POND ('PHASE 1')

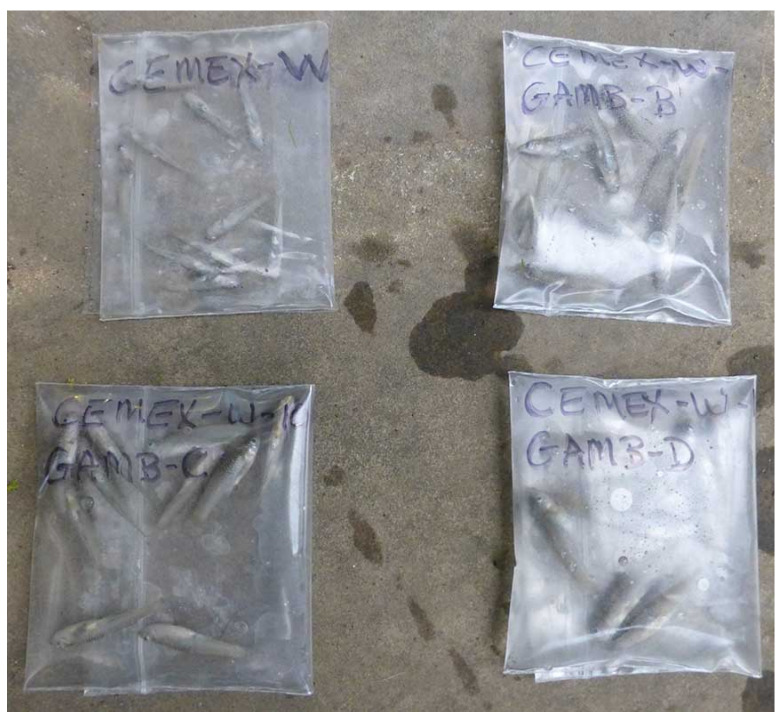
A3. View of the pond

A4. Adult Largemouth Bass

A5. One of the large Channel Catfish taken, with a bass

CEMEX – WEST (PHASE 1) POND *(continued)*

A6. Juvenile Largemouth Bass, divided into 4 composite samples



A7. Mosquitofish, divided into 4 composite samples

CEMEX – EAST POND (PHASE 3-4)

A8. View of the pond, from east side.

A9. Large Green Sunfish

A10. Some of the Largemouth Bass

CEMEX – EAST (PHASE 3-4) POND *(continued)*

A11. Juvenile Largemouth Bass, divided into 4 composite samples

A12. Juvenile Green Sunfish

A13. Mosquitofish samples

TEICHERT – REIFF POND

A14. View of the pond

A15. Carp and White Catfish

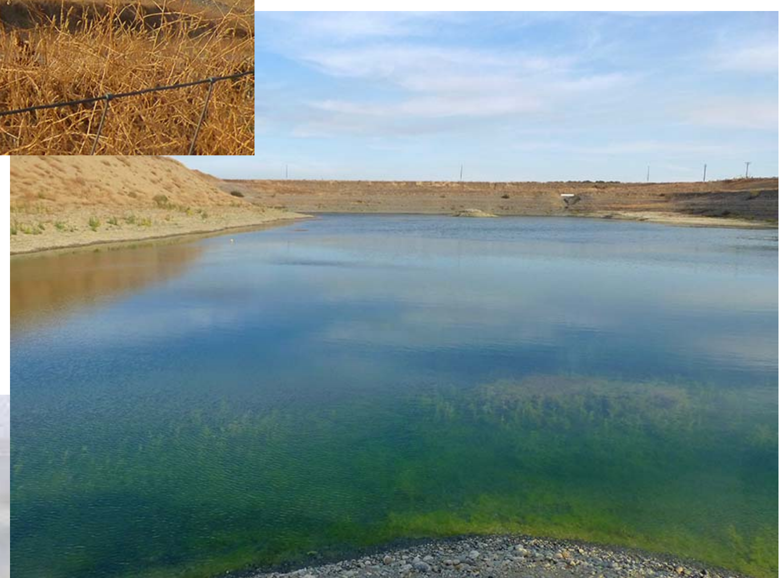
A16. More White Catfish, including the 10 pounder, and another Carp

TEICHERT – REIFF POND *(continued)*

A17. Red Shiners, divided into 4 composite samples

A18. Mosquitofish, divided into 4 composite samples

SYAR – B1 POND



A19, A20. Views of the pond

A21. Some of the Largemouth Bass samples

SYAR – B1 POND *(continued)*

A22. Juvenile Largemouth Bass, divided into 4 composite samples
Note the large size of these juveniles -- the clear tray on right held all the young bass in Figures A6 (Cemex–W) and A11 (Cemex–E)

A23. Some of the Green Sunfish samples

A24. Some of the Mosquitofish samples

Appendix D:

2017 Technical Studies and 20-Year Retrospective for the Cache Creek Area Plan

2017 TECHNICAL STUDIES AND 20-YEAR RETROSPECTIVE FOR THE CACHE CREEK AREA PLAN

Prepared for:

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March 17, 2017

Due to document size (200+ pages) the *2017 Technical Studies* can be found online at the following address:

http://www.yolocounty.org/home/showdocument?id=41164

Appendix E:

2017 Creek Walk Observations

Creek Walk 2017 - TAC Observations

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
28.4					
	Rayburn	Bio	Less veg than 2016 in channel proper due to high flows	Observation	Capay Reach
	Rayburn	Bio	Red tailed hawk, cliff swallow	Observation	Capay Reach
	Rayburn	Bio	Many large carp	Observation	Capay Reach
	Tompkins	Geo	Inflatable dam. Eroded hardpan looking downstream along the right bank.	Observation	Capay Reach
	Frank	Hydro	Concrete blocks falling off dam apron and new wall in background	Observation	Capay Reach
	Frank	Hydro	Falling blocks	Observation	Capay Reach
	Frank	Hydro	Apparent scour of bed with perched bedrock shelf. New flood wall in background	Observation	Capay Reach
	Frank	Hydro	Capay dam	Observation	Capay Reach
28.3					
	Rayburn	Bio	Possible western pond turtle, check photos	Observation	Capay Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Eroded hardpan and deposited sand bar from WY2017 high flows.	Monitoring Required	Capay Reach
28.1					
	Rayburn	Bio	USGS staff noted bobcat in Spring 2017 in this location	Observation	Capay Reach
	Tompkins	Geo	Usgs Acoustic Doppler Current Profiler (ADCP) setting up for canal flow measurements.	Observation	Capay Reach
28					
	Rayburn	Bio	Purple loosestrife patch	Monitoring Required	Capay Reach
27.9					
	Rayburn	Bio	Purple loosestrife patch	Monitoring Required	Capay Reach
27.8					
	Rayburn	Bio	Possible badger burrow, entrance approx. a foot across. Several entrances, and runways through grass.	Observation	Capay Reach
	Tompkins	Geo	Looking from left bank upstream, downstream, and across. Significant emergent and wetland vegetation in the channel. No major channel changes with WY2017 high flows.	Observation	Capay Reach
27.5					
	Rayburn	Bio	Large patch of purple loosestrife on South bank	Monitoring Required	Capay Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Rayburn	Bio	Purple loosestrife patch	Monitoring Required	Capay Reach
	Rayburn	Bio	Herbaceous veg in channel	Observation	Capay Reach
	Rayburn	Bio	Swainsons hawk calling	Observation	Capay Reach
	Tompkins	Geo	Looking upstream, across, and downstream from left bank. Significant new scour and incision potentially from WY2017 high flows. Still extensive emergent and herbaceous vegetation.	Observation	Capay Reach
27.4					
	Rayburn	Bio	Possible western pond turtles	Observation	Capay Reach
	Rayburn	Bio	Barn owl	Observation	Capay Reach
	Frank	Hydro	Site of previous fire and arundo re sprout	Observation	Capay Reach
27					
	Rayburn	Bio	Deer crossing	Observation	Capay Reach
	Rayburn	Bio	Some regrowth in burned area; understory still dominated by invasive species	Observation	Capay Reach
	Tompkins	Geo	Palisades. Large rafts of	Observation	Capay Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			debris on palisade posts upstream of the concrete sack blanket.		
	Frank	Hydro	Palisades from upstream	Observation	Capay Reach
26.9					
	Rayburn	Bio	State of blanket	Observation	Capay Reach
	Rayburn	Bio	Water primrose nonnative	Observation	Capay Reach
	Rayburn	Bio	Western pond turtle	Observation	Capay Reach
	Rayburn	Bio	Old reveg project; oaks and deergrass. Cages need to be removed from oaks.	Observation	Capay Reach
	Tompkins	Geo	PG&E Palisades. Major erosion on the left the bank at scoured blanket. Channel forming through the middle of the concrete sack blanket. Old pipeline exposed.	Observation	Capay Reach
	Tompkins	Geo	Minor right bank erosion at the Palisades. Right bank pool appears to be scoured deeper.	Monitoring Required	Capay Reach
	Tompkins	Geo	Palisades from left bank. Left edge of concrete sack blanket flanked and scoured by hydraulics over exposed old gas pipeline and debris on Palisades just upstream. Some action required to prevent further destruction	Action Required	Capay Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			and transport of blanket elements.		
	Frank	Hydro	Palisades from left the bank	Monitoring Required	Capay Reach
	Frank	Hydro	Channel and scour hole forming in the erosion control mat from exposed pipe line	Monitoring Required	Capay Reach
	Frank	Hydro	PG and a Palisades looking upstream to major scour holes have developed on the left Bank a sand and gravel bar is forming upstream on the right bank there are very few and that's all cables is left between the Palisades of themselves but the Palisades are hanging up lots of vegetation debris	Monitoring Required	Capay Reach
26.7					
	Rayburn	Bio	Osprey fly over	Observation	Capay Reach
26.6					
	Rayburn	Bio	Sandbar willows and other vegetation including young cottonwoods have persisted along the channel edge even with the high flows	Observation	Capay Reach
	Rayburn	Bio	Some new erosion on South Bank and roots exposed from Walnut, Buckeye, oak, etc.	Observation	Capay Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Rayburn	Bio	Minor beaver activity	Observation	Capay Reach
	Tompkins	Geo	Large bar upstream of Capay bridge looking upstream, across, and downstream. Significant movement of large cobble during WY2017 peak flows.	Monitoring Required	Capay Reach
	Tompkins	Geo	Looking down stream at Capay Bridge. Possibly some right bank scour and erosion from WY2017 peak flows.	Monitoring Required	Capay Reach
	Frank	Hydro	Pillow from PG&E blanket deposited	Observation	Capay Reach
	Frank	Hydro	Sediment particle size observation	Observation	Capay Reach
	Frank	Hydro	Sediment observation	Observation	Capay Reach
	Frank	Hydro	Previous scour channel not evident anymore	Observation	Capay Reach
26.5					
	Rayburn	Bio	Erosion and root exposure continues	Observation	Capay Reach
26.4					
	Rayburn	Bio	Some scour and loss of vegetation and bar material relative to previous year	Observation	Capay Reach
	Rayburn	Bio	Swainsons hawk calling	Observation	Capay Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	Sediment observation	Observation	Capay Reach
26.3					
	Rayburn	Bio	Active Cliffswallow colony under bridge as in years past	Observation	Hungry Hollow Reach
	Rayburn	Bio	State of veg on south portion of capay open space	Observation	Hungry Hollow Reach
	Tompkins	Geo	Looking upstream and downstream. Significant bed scour (to clay hardpan) and removal of vegetation upstream of bridge. Apparent deposition at, thunder, and downstream of bridge.	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Left side bridge abutment	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Number 1 pier	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Looking upstream	Observation	Hungry Hollow Reach
	Frank	Hydro	Number 2 pier	Observation	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
26.2					
	Rayburn	Bio	Vegetation persisting on	Observation	Hungry Hollow Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			mid channel bar		
	Rayburn	Bio	Juv bullhead catfish	Observation	Hungry Hollow Reach
	Tompkins	Geo	WY2017 high flows cleared some cobble off hardpan downstream of bridge.	Observation	Hungry Hollow Reach
26.1					
	Tompkins	Geo	Looking downstream. Newly exposed clay hardpan.	Observation	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
26					
	Frank	Hydro	Cut Bank on right side	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Cut Bank on right side	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
25.9					
	Tompkins	Geo	Looking downstream and upstream. Channel apparently eroded and deposited cobble during WY2017 high flows.	Observation	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	View of cut right bank	Observation	Hungry Hollow Reach
25.7					
	Tompkins	Geo	Looking downstream and then upstream. Active channel shifted right to left during WY2017 high flows.	Observation	Hungry Hollow Reach
	Frank	Hydro	<null>	Observation	Hungry Hollow Reach
25.5					
	Rayburn	Bio	Large elderberry	Observation	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
25.4					
	Tompkins	Geo	Looking upstream, across, and downstream. Channel flipped from right bank side to left bank side and eroded Granite bank protection measures on the left bank.	Observation	Hungry Hollow Reach
	Tompkins	Geo	Looking downstream, across, and upstream. New active channel along left bank at Granite Capay.	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	Upstream and Jensen bend	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Jensen Bend	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Jensen Bend	Monitoring Required	Hungry Hollow Reach
25.3					
	Rayburn	Bio	Swainsons fly over	Observation	Hungry Hollow Reach
	Rayburn	Bio	Arundo + tamarisk recruiting	Observation	Hungry Hollow Reach
	Frank	Hydro	Near end of Jensen bend it appears as though there was significant erosion this year, according to the GPS I am standing where the edge of bank used to be in 2015 but I am at least 200 feet away from the edge where the photo is being taken. The nose of the bend appears to have been blown away	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Photo of debris pile that was once part of the Jensen stabilization?	Observation	Hungry Hollow Reach
25.2					
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
24.8					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking downstream and upstream from left bank. Significant left bank channel deposition from WY2017 high flows.	Observation	Hungry Hollow Reach
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
24.6					
	Rayburn	Bio	Arundo resprout from large debris pile	Observation	Hungry Hollow Reach
	Tompkins	Geo	Looking upstream, across, and downstream from left bank. Erosion from migration of active channel in between training berms.	Monitoring Required	Hungry Hollow Reach
24.5					
	Tompkins	Geo	Looking downstream, across, and upstream. Major left bank erosion between training berms on left bank from migration of active channel.	Monitoring Required	Hungry Hollow Reach
	Frank	Hydro	Granite erosion site	Monitoring Required	Hungry Hollow Reach
24.4					
	Rayburn	Bio	Woody buckwheat shrubs, check if native and if so consider planting elsewhere in upland restoration projects	Observation	Hungry Hollow Reach
	Frank	Hydro	<null>	Action Required	Hungry Hollow Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	Pier not scoured	Observation	Hungry Hollow Reach
	Frank	Hydro	Pier not scoured	Observation	Hungry Hollow Reach
	Frank	Hydro	View of all piers	Observation	Hungry Hollow Reach
24.3					
	Rayburn	Bio	Swainsons calling	Observation	Hungry Hollow Reach
	Rayburn	Bio	Large Cliffswallow colony as in years before	Observation	Hungry Hollow Reach
	Rayburn	Bio	Looking west, view of vegetation and creek bed	Observation	Hungry Hollow Reach
	Tompkins	Geo	Looking upstream (first three photos) and downstream (last two photos) from bridge. Significant channel migration toward left bank upstream of the bridge during WY2017 high flows.	Observation	Hungry Hollow Reach
	Frank	Hydro	<null>	Observation	Hungry Hollow Reach
	Frank	Hydro	Pier	Observation	Hungry Hollow Reach
	Frank	Hydro	Severe undercutting scour at pier	Action Required	Hungry Hollow Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	Large pieces of steel debris in the channel	Monitoring Required	Hungry Hollow Reach
24.2					
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
24.1					
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
24					
	Rayburn	Bio	Some recruitment of Arundo and Tamarisk in vegetation patch	Observation	Hungry Hollow Reach
	Tompkins	Geo	Looking downstream and upstream. No major changes during WY2017.	Observation	Hungry Hollow Reach
23.9					
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
23.8					
	Rayburn	Bio	More Arundo sprouts coming up within the isolated strips of vegetation	Observation	Hungry Hollow Reach
23.7					
	Frank	Hydro	Sediment observation	Observation	Hungry Hollow Reach
23.6					
	Frank	Hydro	Sediment observatin	Observation	Hungry Hollow Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
23.5					
	Rayburn	Bio	Elderberry mapped in 2016 appears to no longer be present and removed by high flows	Observation	Hungry Hollow Reach
23.4					
	Tompkins	Geo	Looking downstream and upstream from channel bottom. No major changes	Observation	Madison Reach
	Frank	Hydro	Right side cut bank	Monitoring Required	Madison Reach
23.3					
	Rayburn	Bio	Lesser nighthawk	Observation	Madison Reach
	Rayburn	Bio	Pool with many species of fish, including carp, large dark catfish and many smaller fish of several different species. Possible pike minnows.	Observation	Madison Reach
	Frank	Hydro	Eroding bank	Monitoring Required	Madison Reach
	Frank	Hydro	Eroding bank	Monitoring Required	Madison Reach
23.2					
	Frank	Hydro	Eroding bank	Monitoring Required	Madison Reach
23.1					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	Sediment observation	Observation	Madison Reach
23					
	Tompkins	Geo	Looking downstream and upstream from channel bottom. Major left bank erosion and displacement of the large wood toe of slope stabilization.	Action Required	Madison Reach
	Frank	Hydro	Significant erosion on the left Bank at Teichert	Monitoring Required	Madison Reach
22.9					
	Rayburn	Bio	Swainsons calling	Observation	Madison Reach
	Tompkins	Geo	Looking downstream and upstream. Continued major erosion and removal of large wood toe protection along the left bank.	Action Required	Madison Reach
	Frank	Hydro	Exposed large woody debris and eroded left bank	Monitoring Required	Madison Reach
	Frank	Hydro	Erosion on the left Bank back to aggregate pile at Teichert	Monitoring Required	Madison Reach
22.3					
	Frank	Hydro	2017 right cut bank update. Does not look like significant erosion occurred this year.	Observation	Madison Reach
22.2					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking downstream and upstream. Relatively minor change from WY2017, but presence of extensive flat grading effect seen throughout the creek this year.	Observation	Madison Reach
22					
	Rayburn	Bio	No swallow colony in 2017 likely due to significant bank erosion in march from high flows	Observation	Madison Reach
	Frank	Hydro	Payne erosion site from channel	Monitoring Required	Madison Reach
21.9					
	Rayburn	Bio	Swainsons hawk	Observation	Madison Reach
21.5					
	Rayburn	Bio	Dark morph swainsons	Observation	Madison Reach
	Tompkins	Geo	Looking upstream, across, and downstream from channel bottom. Potentially some erosion of the left bank. Possible significant deposition on mid channel bar.	Observation	Madison Reach
	Frank	Hydro	Group is getting ready	Observation	Madison Reach
	Frank	Hydro	Bank erosion on the right bank right before training structures	Monitoring Required	Madison Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
21.4					
	Rayburn	Bio	Swallow colony, not occupied. Observed bank swallows during float approximately one month prior.	Monitoring Required	Madison Reach
	Frank	Hydro	Sediment observation	Observation	Madison Reach
21.3					
	Tompkins	Geo	Bed sediment / pebble count / gravel size photo.	Action Required	Madison Reach
	Frank	Hydro	View of eroding tips of weirs	Monitoring Required	Madison Reach
	Frank	Hydro	Sediment observation	Observation	Madison Reach
21.2					
	Rayburn	Bio	Persistent veg development in channel	Observation	Madison Reach
	Rayburn	Bio	Another view of persistent and increasing vegetation on north side of channel including gallery cottonwoods and large willows	Observation	Madison Reach
	Tompkins	Geo	Bed sediment / pebble count / gravel size photo.	Action Required	Madison Reach
21.1					
	Rayburn	Bio	Significant erosion and loss of vegetation; lateral	Monitoring Required	Madison Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			migration		
	Tompkins	Geo	Bed sediment / pebble count / gravel size photo.	Action Required	Madison Reach
	Frank	Hydro	Sediment observation	Observation	Madison Reach
	Frank	Hydro	Sediment observation	Observation	Madison Reach
	Frank	Hydro	Sediment observation	Observation	Madison Reach
	Frank	Hydro	Roadway drainage pipe collapsed into channel	Observation	Madison Reach
	Frank	Hydro	Significant lateral migration and eroding bank on approach to bridge abutment on the left Bank	Observation	Madison Reach
21					
	Rayburn	Bio	Site of some previous die back in 2015, likely due to drought. Vegetation is looking good with robust cottonwoods and mid story	Observation	Guesisosi Reach
	Rayburn	Bio	Cliff swallows under bridge	Observation	Guesisosi Reach
	Rayburn	Bio	Mexican free tailed bats calling from under bridge	Observation	Guesisosi Reach
	Tompkins	Geo	Looking upstream and downstream from bridge. Aggradation under 505 bridge in the middle of the area between peers.	Monitoring Required	Guesisosi Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			Significant bar growth upstream of bridge and possibly downstream of bridge. Photo 3 is bed sediment / pebble count / gravel size photo.		
	Frank	Hydro	Left bridge abutment, 505	Observation	Guesisosi Reach
	Frank	Hydro	Number one pier, 505	Observation	Guesisosi Reach
	Frank	Hydro	Downstream the left side bridge abutment, 505 bridge	Observation	Guesisosi Reach
	Frank	Hydro	Number one pier, 505 bridge	Observation	Guesisosi Reach
	Frank	Hydro	Number 2 pier, 505 bridge	Observation	Guesisosi Reach
	Frank	Hydro	Number 3 pier, 505 bridge	Observation	Guesisosi Reach
20.9					
	Frank	Hydro	Right abutments and number 4 pier, 505 bridge	Observation	Guesisosi Reach
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
	Frank	Hydro	Looking upstream at 505 bridge	Observation	Guesisosi Reach
20.8					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Rayburn	Bio	Former planting project completely removed by lateral migration	Monitoring Required	Guesisosi Reach
	Tompkins	Geo	Looking downstream and upstream. Major right bank erosion during WY2017 peak flows. Channel has shifted approximately 100 feet.	Action Required	Guesisosi Reach
	Tompkins	Geo	Looking at right bank from channel bottom. Significant erosion into right bank CEMEX bank protection during WY2017 peak flows.	Action Required	Guesisosi Reach
	Frank	Hydro	Cemex bank stabilization and restoration site, all the Cottonwood row has been scoured away this winter	Observation	Guesisosi Reach
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
20.7					
	Frank	Hydro	sediment observation and secondary channel that appears newly formed. sediment is coarser than is typical elsewere in this area	Observation	Guesisosi Reach
	Frank	Hydro	Sediment observation and bar that appears to have been freshly aggrading this winter	Observation	Guesisosi Reach
	Frank	Hydro	Looking north at left Bank erosion site, channel has shifted down stream and thalweg no longer goes up against that bank	Observation	Guesisosi Reach
20.6					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Rayburn	Bio	Potential swallow colony site, no holes but sort of suitable so check in future.	Monitoring Required	Guesisosi Reach
	Rayburn	Bio	Western pond turtle	Observation	Guesisosi Reach
	Frank	Hydro	sediment observation on elevated gravel bar with fresh aggradation	Observation	Guesisosi Reach
20.5					
	Rayburn	Bio	All veg lost due to channel migration	Observation	Guesisosi Reach
	Rayburn	Bio	Purple loosestrife patch	Monitoring Required	Guesisosi Reach
	Tompkins	Geo	Looking downstream and upstream. Migration of active channel during WY2017 peak flows. Old channel is blocked off by sediment and has formed into an Oxbow. Photo 3 is a bed sediment / pebble count / gravel size photo.	Monitoring Required	Guesisosi Reach
20.4					
	Rayburn	Bio	Planted vegetation, mostly willows, still hanging on along channel edge	Observation	Guesisosi Reach
	Rayburn	Bio	Looking upstream, continuation of the zone of vegetation loss due to high flows and channel migration	Observation	Guesisosi Reach
	Frank	Hydro	Cut Bank on right bank adjacent to Cemex conveyor belt. Channel has shifted down stream and	Observation	Guesisosi Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			thalweg is no longer up against most of this bank		
	Frank	Hydro	End of downstream end of eroding cut bank on South Bank at Cemex's conveyor belt.	Observation	Guesisosi Reach
20.3					
	Tompkins	Geo	Looking downstream and upstream from channel bottom. Continued downstream migration of meander has pushed the direct high flow energy away from the right bank where it was close to the conveyor belt.	Observation	Guesisosi Reach
20.2					
	Rayburn	Bio	Swainsons hawk	Observation	Guesisosi Reach
	Rayburn	Bio	Appears to be some loss of riparian forest patch due to channel migration and potential die back, check from aerial photos	Observation	Guesisosi Reach
	Frank	Hydro	Former bank erosion site, there is a relatively new aggraded fine sediment bar and the thalweg has moved away from this bank	Observation	Guesisosi Reach
20.1					
	Rayburn	Bio	Example of erosion of the bank and exposure of roots of mature vegetation	Observation	Guesisosi Reach
	Tompkins	Geo	Looking downstream and upstream from channel	Observation	Guesisosi Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			bottom. Continued downstream meander migration with aggradation of new point bar during WY2017 peak flows.		
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
	Frank	Hydro	New bank erosion site due to channel shift of this year	Monitoring Required	Guesisosi Reach
	Frank	Hydro	Eroding bank on left side	Observation	Guesisosi Reach
20					
	Rayburn	Bio	Western pond turtle	Observation	Guesisosi Reach
	Tompkins	Geo	Bed sediment / pebble count / gravel size photo.	Action Required	Guesisosi Reach
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
19.9					
	Tompkins	Geo	Looking downstream and upstream from channel bottom. Continued meander migration towards the left bank up against the Hayes "bow tie" property.	Observation	Guesisosi Reach
19.8					
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
19.7					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
19.6					
	Rayburn	Bio	Most planted vegetation along South Bank still alive	Observation	Guesisosi Reach
	Tompkins	Geo	Looking downstream and upstream from channel bottom. Continued meander migration and apparent bar aggradation. Flat graded appearance as seen in many other locations in the Creek after WY2017 peak flows.	Observation	Guesisosi Reach
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
	Frank	Hydro		Observation	Guesisosi Reach
19.5					
	Rayburn	Bio	Western pond turtles	Observation	Guesisosi Reach
	Rayburn	Bio	Red tailed hawk	Observation	Guesisosi Reach
19.4					
	Rayburn	Bio	Significant accumulation of large woody debris combined with loss of mature veg on site	Observation	Guesisosi Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking upstream, across, and downstream from channel bottom. Significant point bar growth and erosion into left bank mature riparian vegetation. Photo five is bed sediment / pebble count / gravel size photo.	Action Required	Guesisosi Reach
19.3					
	Rayburn	Bio	Large patch of Tamarisk that is now accessible for treatment sine channel has moved	Observation	Guesisosi Reach
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
	Frank	Hydro	Right bank erosion with hanging drainage pipe	Observation	Guesisosi Reach
19.2					
	Rayburn	Bio	Persistent in-channel vegetation	Observation	Guesisosi Reach
	Tompkins	Geo	Looking downstream and upstream from channel bottom. Gravel bar growth / aggradation during WY2017 high flows.	Observation	Guesisosi Reach
19.1					
	Frank	Hydro	Sediment observation	Observation	Guesisosi Reach
19					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Rayburn	Bio	Persistent strips of high-quality mature riparian vegetation, cottonwoods, black willows, etc. bracketing the large open space as in years past	Observation	Guesisosi Reach
	Tompkins	Geo	Looking downstream and upstream. Coordinates of point must be incorrect. No significant change in the active channel. Possible aggradation on the point bar from WY2017 peak flows.	Observation	Guesisosi Reach
18.9					
	Rayburn	Bio	Off channel pit, high-quality over story, with substantial tamarisk in mid story and little native understory. Great candidate for habitat enhancement and planting of sedges rushes and creeping wild rye, also consider options for reconnecting to active floodplain	Observation	Guesisosi Reach
18.8					
	Tompkins	Geo	Looking upstream, across, and downstream from right bank. Active channel location has not changed significantly during WY2017 peak flows.	Observation	Dunnigan Hills Reach
	Frank	Hydro	<null>	Observation	Dunnigan Hills Reach
18.7					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking downstream and upstream. Left bank gravel bar aggraded during WY2017 peak flows. Photo 1 is bed sediment / pebble count / gravel size photo.	Action Required	Dunnigan Hills Reach
	Frank	Hydro	Sediment observation	Observation	Dunnigan Hills Reach
18.5					
	Rayburn	Bio	Mink	Observation	Dunnigan Hills Reach
	Tompkins	Geo	Looking downstream and upstream from channel bottom. Gravel bar has prograded / advanced downstream and appears to have aggraded during WY2017 peak flows.	Observation	Dunnigan Hills Reach
18.4					
	Rayburn	Bio	Priority restoration site as noted in past years	Observation	Dunnigan Hills Reach
18.2					
	Rayburn	Bio	Large stand of Arundo and tamarisk that should be treated. Noted in years past.	Monitoring Required	Dunnigan Hills Reach
	Tompkins	Geo	Looking upstream and downstream from channel bottom. Approaching Moore's siphon. Active channel has migrated towards left the bank during	Observation	Dunnigan Hills Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			WY2017 high flows.		
	Frank	Hydro	Sediment observation	Observation	Dunnigan Hills Reach
18.1					
	Tompkins	Geo	Looking upstream, across, and downstream from left bank. Tight meander bend near Moore's siphon. The large pool that used to be at the apex of this bend has mostly filled in and the bank has eroded to the left.	Action Required	Dunnigan Hills Reach
18					
	Tompkins	Geo	Looking upstream, across, and downstream from point bar. Moore's siphon repair site showing significant left bank bar growth and erosion of right bank.	Observation	Dunnigan Hills Reach
	Frank	Hydro	Sediment observation	Observation	Dunnigan Hills Reach
17.8					
	Rayburn	Bio	Swainsons and red tailed hawk	Observation	Dunnigan Hills Reach
17.7					
	Rayburn	Bio	Downstream view of increasing herbaceous veg, some woody also	Observation	Dunnigan Hills Reach
17.5					
	Rayburn	Bio	The Farnum pit wetland area where historically	Observation	Dunnigan Hills Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			tri-colored black birds were seen		
17					
	Rayburn	Bio	Looking upstream, veg appears less than 2016	Observation	Dunnigan Hills Reach
	Tompkins	Geo	Looking upstream and downstream from channel bottom. No major channel change from WY2017 high flows.	Monitoring Required	Dunnigan Hills Reach
16.8					
	Rayburn	Bio	Persistent herbaceous vegetation in channel looking upstream	Observation	Dunnigan Hills Reach
	Tompkins	Geo	Looking downstream and upstream from channel bottom. Confined reach upstream of the Conservancy.	Observation	Dunnigan Hills Reach
16.6					
	Rayburn	Bio	Looking downstream, veg in channel	Observation	Dunnigan Hills Reach
	Tompkins	Geo	Looking downstream and upstream from channel bottom at conveyor bridge. No major channel change from WY2017 high flows. Photo 3 is bed sediment / pebble count / gravel size photo.	Action Required	Dunnigan Hills Reach
	Frank	Hydro	<null>	Observation	Dunnigan Hills Reach
16.5					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Rayburn	Bio	Cliff swallows under bridge	Observation	Dunnigan Hills Reach
	Tompkins	Geo	Bed surface / pebble count / gravel size photo. Downstream of conveyor bridge.	Observation	Dunnigan Hills Reach
16.3					
	Tompkins	Geo	Looking upstream and downstream from left bank. At Conservancy. On gravel bar. Note water quality sampling site in the creek here. Graded channel bed as seen elsewhere from WY2017 high flows. Photo 3 is bed surface / pebble count / gravel size photo.	Observation	Dunnigan Hills Reach
15.9					
	Rayburn	Bio	Looking downstream, min. Veg	Observation	Hoppin Reach
	Rayburn	Bio	Looking upstream, minimum veg	Observation	Hoppin Reach
	Rayburn	Bio	Cliff swallows under bridge, many	Observation	Hoppin Reach
	Rayburn	Bio	Some veg loss on bar relative to 2016?	Observation	Hoppin Reach
	Tompkins	Geo	Looking downstream and upstream from bridge. Left bank point bar growth upstream of bridge. Major meander migration	Observation	Hoppin Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			downstream of bridge from WY2017 peak flows.		
	Tompkins	Geo	Looking downstream and upstream from bridge. Left bank point bar growth upstream of bridge. Major meander migration downstream of bridge from WY2017 peak flows.	Observation	Hoppin Reach
	Frank	Hydro	Stevens bridge pier number one	Observation	Hoppin Reach
	Frank	Hydro	Stevens bridge pier Number 2	Observation	Hoppin Reach
	Frank	Hydro	Stevens bridge Pier Number 3	Observation	Hoppin Reach
	Frank	Hydro	Stephen fridge right side above me	Observation	Hoppin Reach
	Frank	Hydro	Sediment observation	Observation	Hoppin Reach
	Frank	Hydro	Looking down stream at Stevens bridge	Observation	Hoppin Reach
15.8					
	Frank	Hydro	Eroding right bank site does not look too bad	Observation	Hoppin Reach
15.7					
	Rayburn	Bio	Significant loss of bank and veg due to lateral migration. Forest loss.	Observation	Hoppin Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking downstream, across, and upstream from channel bottom. Major meander migration to river right and downstream that removed a large stand of mature riparian vegetation. Erosion of right bank. Monitor this site going forward as additional meander migration to the right bank could begin to cause problems.	Monitoring Required	Hoppin Reach
	Frank	Hydro	Sediment observation	Observation	Hoppin Reach
	Frank	Hydro	Sediment observation	Observation	Hoppin Reach
15.6					
	Tompkins	Geo	Looking upstream and downstream from channel bottom. Great example of large graded bar surface likely deposited during WY2017 peak flows.	Action Required	Hoppin Reach
15.5					
	Rayburn	Bio	Swainsons hawk	Observation	Hoppin Reach
	Tompkins	Geo	Looking upstream from channel bottom at downstream face of two major bar lobe deposits associated with WY2017 peak flows.	Observation	Hoppin Reach
15.4					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Frank	Hydro	Sediment observation	Observation	Hoppin Reach
15.3					
	Tompkins	Geo	Looking downstream and upstream at large graded bar from WY2017 peak flows.	Observation	Hoppin Reach
15.2					
	Rayburn	Bio	Dark morph swainsons hawk	Observation	Hoppin Reach
	Tompkins	Geo	Looking downstream, across, and upstream from left bank levee road. This is the area proposed by Teichert for an experimental floodplain / side channel reconnection project to improve native riparian vegetation and associated habitat.	Observation	Hoppin Reach
15.1					
	Rayburn	Bio	Barry's restoration site. Pitched to TAC in 2017.	Observation	Hoppin Reach
15					
	Rayburn	Bio	Cliff swallows under bridge	Observation	Hoppin Reach
	Tompkins	Geo	Looking upstream and downstream from conveyor bridge at proposed Teichert restoration site.	Observation	Hoppin Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking upstream and downstream from conveyor bridge at proposed Teichert restoration site. Note levee breach at downstream left bank of Cache Creek.	Observation	Hoppin Reach
	Frank	Hydro	Look at future restoration site	Observation	Hoppin Reach
	Frank	Hydro	looking upstream and downstream	Observation	Hoppin Reach
	Frank	Hydro	View of conveyor belt bridge pier. Very little change evident from previous years	Observation	Hoppin Reach
14.9					
	Rayburn	Bio	Open area and potential restoration site	Observation	Hoppin Reach
	Rayburn	Bio	Swainsons hawk	Observation	Hoppin Reach
	Rayburn	Bio	No swallow colony 2017	Observation	Hoppin Reach
14.8					
	Tompkins	Geo	Looking upstream and downstream from channel bottom. Continued presence of graded gravel bars from WY2017 high flows, but no major channel changes.	Observation	Hoppin Reach
	Frank	Hydro	Sediment observation	Observation	Hoppin Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
14.7					
	Rayburn	Bio	A hotspot of bird activity as in years past. Kingfisher, fly catchers, Swainsons hawk, and others	Observation	Hoppin Reach
	Rayburn	Bio	No swallow colony 2017	Observation	Hoppin Reach
14.6					
	Tompkins	Geo	Looking downstream and upstream from channel bottom. More graded gravel bars but no major channel change from WY2017 peak flows.	Observation	Hoppin Reach
14.5					
	Tompkins	Geo	Looking upstream, across, and downstream from right bank high levee. No major change from WY2017 high flows, but some limited graded gravel bar formation.	Observation	Hoppin Reach
14.4					
	Rayburn	Bio	Swainsons hawk	Observation	Hoppin Reach
	Tompkins	Geo	Photo is bed sediment / pebble count / gravel size photo.	Action Required	Hoppin Reach
	Frank	Hydro	Sediment observation	Observation	Hoppin Reach
14.3					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking upstream and downstream. Some left bank erosion along Woodland Reiff levee from WY2017 peak flows. Should continue to monitor this location closely.	Monitoring Required	Hoppin Reach
	Frank	Hydro	Left Bank at Woodland Reiff site with what looks like some fresh erosion	Observation	Hoppin Reach
14.2					
	Rayburn	Bio	Previous native grass planting looking OK, lots of established needlegrass although also lots of annual grass in the interspaces. Some blue wildrye also	Observation	Hoppin Reach
	Tompkins	Geo	Looking upstream, across, and downstream from channel bottom near Woodland Reif connection channel. The high flow channels appear to have silted in during WY2017 peak flows. The opening to Woodland Reif looks somewhat disconnected from the active channel.	Monitoring Required	Hoppin Reach
	Tompkins	Geo	Woodland reef connection channel showing some deposition from WY2017 peak flows. Mostly stable banks along the channel. No significant additional levee erosion from WY2017 high flows.	Monitoring Required	Hoppin Reach
	Frank	Hydro	Woodland Reiff breach site showing evidence of new	Observation	Hoppin Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			fine sediment deposition		
14.1					
	Rayburn	Bio	Example of debris	Observation	Hoppin Reach
	Tompkins	Geo	Looking upstream and downstream from channel bottom near the upstream end of highly laterally confined reach of Cache Creek. Continued graded gravel bars but no major channel migration from WY2017 high flows.	Observation	Hoppin Reach
	Frank	Hydro	Teichert stabilization project on right bank	Observation	Hoppin Reach
14					
	Rayburn	Bio	Rodgers pit 2017; could be an enhancement project	Observation	Hoppin Reach
	Tompkins	Geo	Looking downstream and upstream from high right bank. Continued graded gravel bars but no major channel migration from WY2017 high flows.	Observation	Hoppin Reach
	Frank	Hydro	Sediment observation	Observation	Hoppin Reach
	Frank	Hydro	<null>	Observation	Hoppin Reach
13.9					
	Rayburn	Bio	Corell pit 2017; could be an enhancement project	Observation	Hoppin Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
13.8					
	Tompkins	Geo	Eroded spillway between reclaimed basins.	Monitoring Required	Hoppin Reach
	Frank	Hydro	It does not seem like the water surface would overtop the levee road here as opposed to upstream and downstream double check elevation	Observation	Hoppin Reach
13.5					
	Rayburn	Bio	Red tailed hawk	Observation	Hoppin Reach
13.4					
	Tompkins	Geo	Looking downstream and upstream from right bank. No major change from WY2017 high flows.	Observation	Hoppin Reach
13.3					
	Rayburn	Bio	Persistent inchannel veg	Monitoring Required	Hoppin Reach
	Tompkins	Geo	No major channel change from Water Year 2017 peak flows.	Observation	Hoppin Reach
13.2					
	Tompkins	Geo	Photo 1 is bed sediment / pebble count / gravel size photo. Looking downstream and upstream. Continued graded gravel bars but no major channel	Action Required	Hoppin Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
			migration from WY2017 high flows.		
13.1					
	Tompkins	Geo	Photo 1 is bed sediment / pebble count / gravel size photo. Looking downstream and upstream. Continued graded gravel bars but no major channel migration from WY2017 high flows.	Action Required	Hoppin Reach
12.9					
	Rayburn	Bio	2 swainsons hawks	Observation	Hoppin Reach
	Tompkins	Geo	Looking downstream, across, and upstream from channel bottom. Active channel shifted to the left bank.	Observation	Hoppin Reach
12.6					
	Rayburn	Bio	Swainsons hawk	Observation	Rio Jesus Maria Reach
	Rayburn	Bio	Red shouldered hawk	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Looking downstream and upstream. Channel fully wetted. No major channel migration from WY2017 high flows.	Observation	Rio Jesus Maria Reach
12.5					
	Rayburn	Bio	Persistent in-channel vegetation	Observation	Rio Jesus Maria Reach

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking downstream and upstream. Continued graded gravel bars but no major channel migration from WY2017 high flows.	Observation	Rio Jesus Maria Reach
12.4					
	Rayburn	Bio	Elderberry completely removed by flows	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Looking upstream and downstream from channel bottom. Channel flowing full. No major change or channel migration from WY2017 peak flows	Observation	Rio Jesus Maria Reach
	Frank	Hydro	Sediment observation	Observation	Rio Jesus Maria Reach
12.3					
	Frank	Hydro	Bank scour on right side of tight S bend	Observation	Rio Jesus Maria Reach
12.2					
	Rayburn	Bio	Swainsons hawk	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Looking upstream and downstream from channel bottom. Channel flowing full. No major change or channel migration from WY2017 peak flows	Observation	Rio Jesus Maria Reach
	Frank	Hydro	View of threatened structures at tight S bend	Observation	Rio Jesus Maria Reach

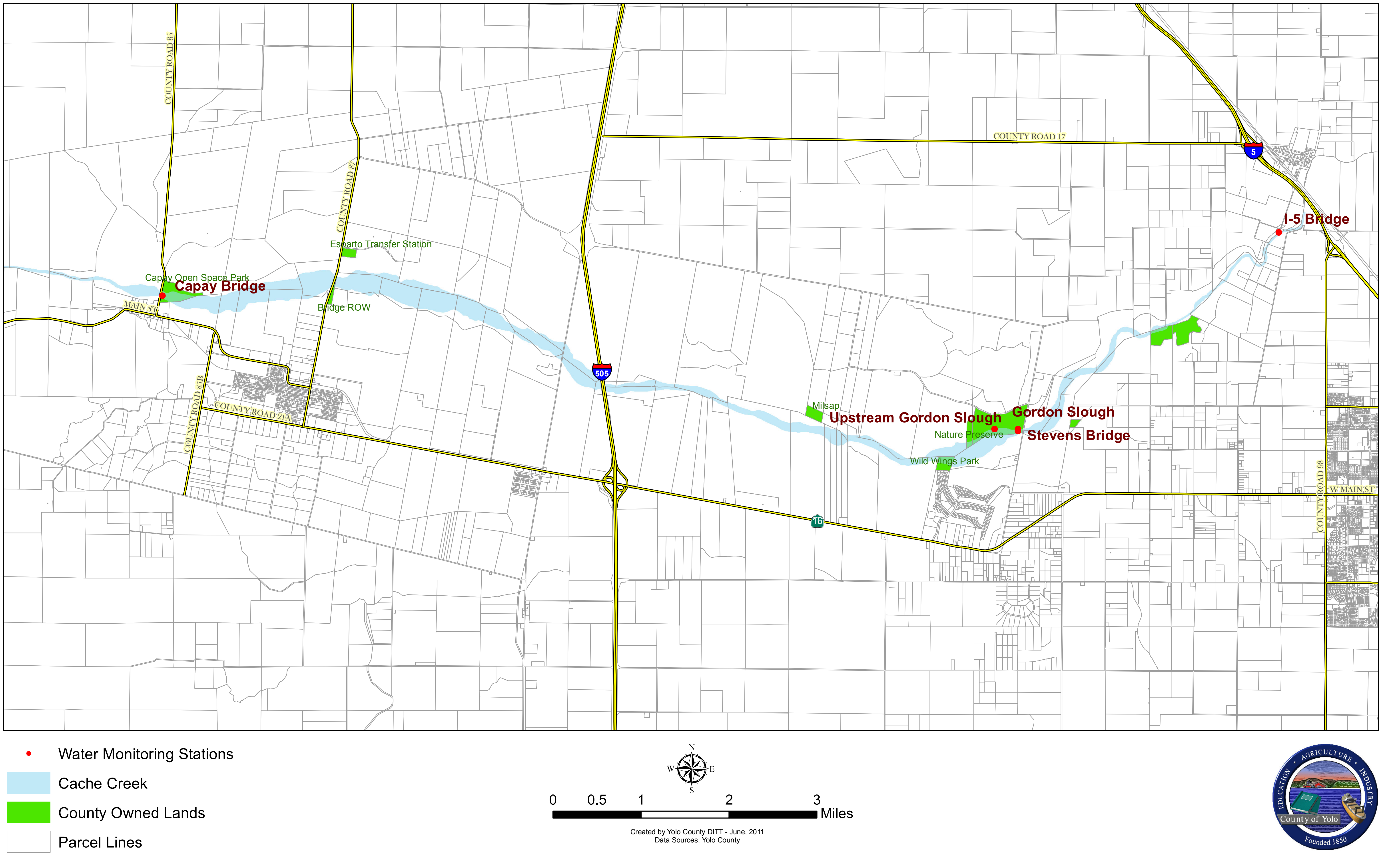
River Mile	Observer	Discipline	Comments	Observation Priority	Reach
12.1					
	Rayburn	Bio	Bank erosion exposing oak tree roots. Likely due to surface flows coming down from above; too high above channel floor to have been caused by flows	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Looking downstream and upstream. No major channel migration from WY2017 high flows.	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Looking downstream and upstream. No major channel change from WY2017 high flows. Photo 1 is bed sediment / pebble count / gravel size photo.	Action Required	Rio Jesus Maria Reach
	Frank	Hydro	View of approach to straight section	Observation	Rio Jesus Maria Reach
12					
	Rayburn	Bio	Mature riparian veg looking downstream	Observation	Rio Jesus Maria Reach
11.9					
	Rayburn	Bio	Mature riparian veg looking downstream	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Looking downstream and upstream. Fully wetted channel. No major channel migration or scour/erosion from WY2017 high flows.	Observation	Rio Jesus Maria Reach
11.7					

River Mile	Observer	Discipline	Comments	Observation Priority	Reach
	Tompkins	Geo	Looking upstream and downstream from fully wetted channel. No major channel migration from WY2017 high flows. Extremely long strand of algae just upstream of Huff's Corner.	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Photo 1 is bed sediment / pebble count / gravel size photo. Graded gravel bar but no major channel change from WY2017 high flows.	Action Required	Rio Jesus Maria Reach
11.6					
	Rayburn	Bio	Stand of oak trees seems to have recovered well after partial burn in 2015	Observation	Rio Jesus Maria Reach
	Tompkins	Geo	Looking downstream and upstream at Huff's Corner. Some deposition on footer boulders along outside bend. No major channel migration from WY2017 high flows.	Observation	Rio Jesus Maria Reach
	Frank	Hydro	Looking upstream from Huff's corner	Observation	Rio Jesus Maria Reach
	Frank	Hydro	Stabilization at Huff's corner	Observation	Rio Jesus Maria Reach

Appendix F:

Cache Creek Water Monitoring Stations

Cache Creek Water Monitoring Stations



Created by Yolo County DITT - June, 2011
Data Sources: Yolo County

Appendix G:

“Restoring A Creek to Health: Capay Open Space Park From Gravel Mine to Parkway”

Grant Site Plan

Restoring A Creek To Health: Capay Open Space Park From Gravel Mine To Parkway

PROPOSED PROJECT PLAN

Customer(s): COUNTY OF YOLO Natural Resource Division

District: YOLO COUNTY RESOURCE CONSERVATION DISTRICT

Approximate Acres: 40.2

Legal Description: USGS Quadrangle: Esparto, CA

Section: 14 & 13; T10N; R2W

Field Office: WOODLAND SERVICE CENTER

Agency: USDA Natural Resources Conservation Service

Assisted By: PHIL HOGAN

State and County: CA, Yolo County, California

Land Units: CAPAY OPEN SPACE PARK

Riparian Habitat Restoration/Enhancement

- Capay Open Space Park
- Grassland Habitat Enhancement (pollinator plantings) 0.5 acres
- Grassland Habitat Enhancement (improved management) 1.7 acres
- Grassland Habitat Restoration in existing swales 0.4 acres
- Riparian Habitat Restoration 1.1 acres
- Riparian Habitat Enhancement 3.2 acres
- Oak Savanna Restoration 4 acres

0 230 460 690 920 Feet

U.S. Department of Agriculture
Natural Resources Conservation Service

MAP:
2014 Aerial Photography
USDA Farm Service Agency
1:4,600

N

Appendix H:

Cache Creek Conservancy
2017 Annual Report
(Draft)

Currently in publication

Appendix I:

Yolo County Resource Conservation District 2016-2017 Annual Report

Currently in publication