

Putah Creek Aquatic Habitat Assessment October 2014



Prepared for

Hidden Valley Lake Community Services District

Prepared by

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Background

The Hidden Valley Lake Community Services District (District) provides domestic water and wastewater treatment services to the Hidden Valley Lake subdivision near Middletown, Lake County, California. Under License 13527A and Permit 20770B, the District diverts Putah Creek underflow via four wells for its municipal water supply. License 13527A includes the following condition:

For the period July 15 to October 31 of each year, licensee shall make up the difference between actual discharge, as measured at the site of the former Guenoc USGS gaging station on Putah Creek at Guenoc as shown on the 1958 USGS 7.5 minute series quadrangle map for Middletown, California, and the median daily discharge listed below:

Median Daily Discharge for Putah Creek at Guenoc, 1954-1975 (all amounts in cfs)

July	August	September	October
4.7	1.7	0.9	0.6

Licensee shall not be required to provide supplemental water at a rate greater than two cubic feet per second.

The District has been making supplemental water discharges to Putah Creek since 1995 (HVLCSD, 2000). However, a portion of the pipeline used to deliver water to Putah Creek was destroyed by flood flows during the 2005/2006 winter season. Following intensive efforts to secure funding and regulatory permits, the District was able to rebuild the pipeline, which became operational in October 2007. In 2006, flows in Putah Creek were above the minimum flow requirement for the majority of the discharge period (July 15 – October 31). Supplemental water was supplied via a neighbor's groundwater well on October 2 and 3, 2006 when flows fell below the minimum requirement. In 2007, the District did not receive permission from the neighbor to use the groundwater well, and no supplemental discharges were made until after the District's pipeline was repaired. While minimum flow requirements in Putah Creek at the USGS Putah Creek Near Guenoc gage (11453500) were met during most of summer 2006, and did not require supplemental discharges until late in the season, 2007 was a drought year and measurable flow at the gage ceased entirely in August 2007. After the pipeline was replaced, supplemental discharges to Putah Creek were reinitiated on October 8, 2007 and continued until November 5, 2007. At a discharge rate of approximately 520 gallons per minute (gpm), or 1.16 cubic feet per second (cfs), surface water flows physically reached the gage by October 27 but were not recorded by gage sensors until October 31, 2007.

Subsequent to the 2007 supplemental discharges, a reconnaissance aquatic habitat assessment was conducted on November 9, 2007 to provide a general overview of aquatic habitat conditions present downstream of the discharge locations after the channel had been dry for approximately two months and was subsequently re-wetted through the District's flow supplementation. The results of the November 2007 assessment are provided in Podlech (2007). In 2008, reconnaissance-level aquatic habitat assessments of Putah Creek were conducted in July (Podlech, 2008a) and November (Podlech, 2008b) to document aquatic habitat conditions within the supplemental discharge reach prior to and after the 2008 supplemental discharge season. In 2009, 2010, 2011, 2012, and 2013 the assessments were again conducted prior to the initiation of supplemental discharges, but the second surveys of each year were conducted in October *prior* to the cessation of supplemental discharges in order to better document aquatic habitat conditions as they are being maintained by the flow augmentation project (Podlech, 2009; 2010a; 2010b; 2010c; 2011; 2012a; 2012b; 2013a; 2013b; 2013c). Furthermore, the extent of the survey

reach was expanded in 2013 to include an approximately 2-mile reach of Putah Creek upstream of the supplemental discharge location (see *Assessment Methodology* below).

In April 2014, the District submitted Temporary Urgency Change Petitions to the State Water Board, requesting temporary relief from the supplemental discharge term in License 13527A (A030049A) and Permit 20770B (A030049B). In May 2014, the State Water Board issued a letter curtailing all post-1914 water rights in watersheds tributary to the Sacramento and San Joaquin river watersheds, including those of the District. On July 25, 2014, the State Water Board issued an order denying the Temporary Urgency Change Petitions, stating that “[s]ince diversion of water under the District’s permit and license has been curtailed, the Division is not able to approve the changes requested under the TUCPs.” In accordance with the curtailment order and order denying the Petitions, the District did not make supplemental discharges starting July 15, 2014 or thereafter during the time period that the permit and license were curtailed. The supplemental water period ended on October 31, 2014. The State Water Board temporarily lifted the curtailment for the District’s License and Permits on November 19, 2014.

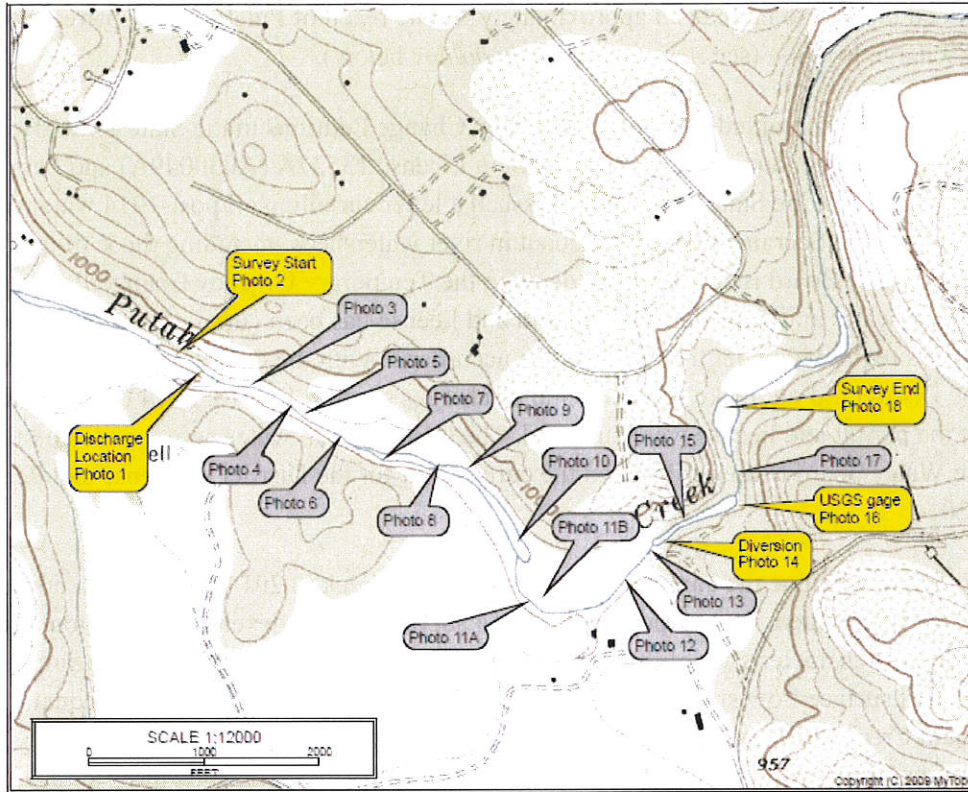
The District decided to continue the annual monitoring of Putah Creek in 2014 even though no supplemental discharges were being provided. The purpose of the 2014 surveys was to develop information regarding the physical and biological characteristics of the Putah Creek supplemental discharge reach during a severe drought and in the absence of surface flow supplementation. As such, the 2014 surveys document aquatic habitat conditions in Putah Creek under extremely dry hydrological conditions. To maintain consistency with prior assessments, the first of the two annual surveys occurred on July 14, 2014, one day prior to the date supplemental discharges would normally have been initiated. The results of the July 2014 assessment are summarized in Podlech (2014). The second survey was conducted on October 29, 2014, one day prior to the date supplemental discharges would normally have been terminated. This report summarizes the findings of the October 2014 assessment.

Assessment Methodology

The fifteenth reconnaissance-level aquatic habitat assessment of Putah Creek was conducted on October 29, 2014. The assessment site is located in Lake County approximately 5 miles northwest of Middletown and approximately 10 miles upstream of Lake Berryessa. The standard assessment reach, surveyed since 2011, extends from a location slightly upstream of the District’s flow supplementation discharge point, downstream to a point approximately 450’ below the USGS Putah Creek Near Guenoc gage (**Figure 1**). A total of approximately 1.2 miles of channel in this reach were assessed.

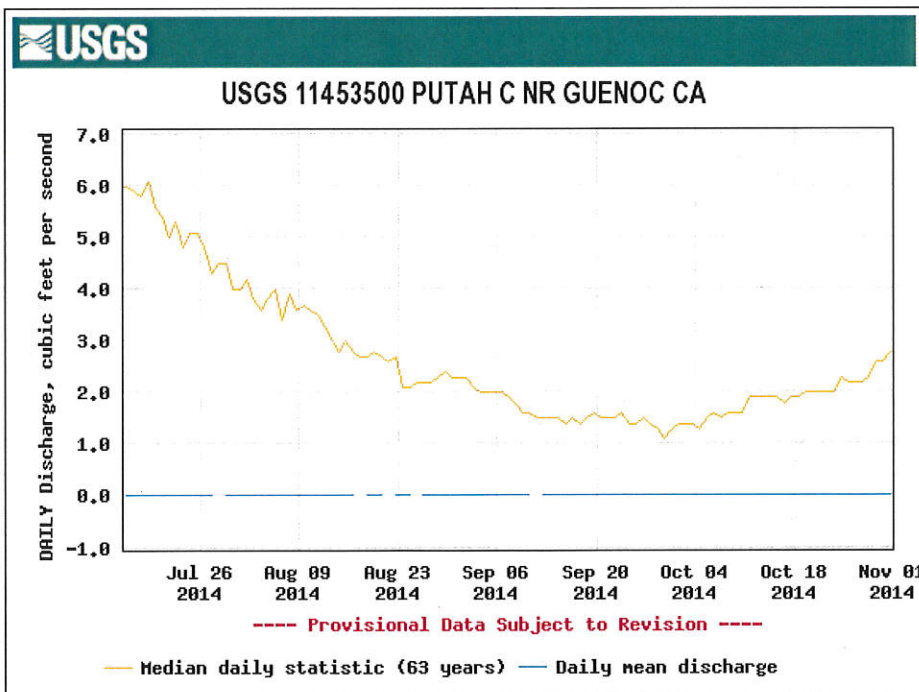
In addition to the standard assessment reach, an approximately 2-mile reach of Putah Creek upstream of the discharge location was surveyed. This reach extended from the U.S. Highway 29 bridge downstream to the discharge location.

Digital photographs of representative sites were taken. Approximate photo-point locations are depicted in **Figure 1** (supplemental discharge reach) and **Figure 3** (upstream of discharge location), and the photos are presented in **Appendix A** (supplemental discharge reach) and **Appendix B** (upstream of discharge location) of this report. An attempt was made to photograph the same sites as depicted in the July 2014 report (Podlech, 2014), where applicable, to allow for visual comparison of aquatic habitat conditions.



Source: Terrain Navigator Pro 10.1

Figure 1. Project Location and Vicinity



Source: <http://waterdata.usgs.gov/>

Figure 2. Provisional Mean Daily Streamflow at Putah Creek near Guenoc, USGS Gage 11453500, July 15, 2014 through October 31, 2014

Unlike prior surveys, water quality (water temperature and dissolved oxygen concentration) measurements were not collected on October 29, 2014 as all of the sites where these measurements have been collected in the past were dry on that day.

Assessment Results

Physical Habitat Characteristics Downstream of the Discharge Location

The average daily discharge is provisionally reported by USGS as having been 0.0 cfs at the gage on October 29, 2014. For comparison, USGS also provisionally reports streamflow on July 14, 2014 as 0.0 cfs at the gage. As depicted in **Figure 2**, average daily discharges at the Putah Creek Near Guenoc gage remained at 0.0 cfs, well below the 63-year median daily discharge at this location, during the entire summer 2014 season. While two minor precipitation events occurred prior to October 29, 2014, these events did not result in any measurable streamflow at the gage. It should be noted, however, that USGS staff have indicated that the accuracy of this gage at streamflows below 2 cfs is somewhat unreliable due to its location within a large pool (Whealen, pers. comm.), with 14 of 21 measurements collected by USGS staff at flows below 2 cfs rated as "poor". As described in the July 2014 report (Podlech, 2014), flowing water was present at the gage on July 14, 2014, even though the USGS gage reported 0.0 cfs flow, providing further indication of the inaccuracies of the gage for low flows. October 29, 2014, the gaging pool also contained water, though no surface flow was observed (see below).

In past years, the District installed a seasonal pipeline to discharge supplemental surface flows into a relatively deep (4') pool located toward the upstream end of the survey reach. For 2013, however, the pool had become entirely filled with coarse sediment, presumably as a result of geomorphic channel migration that likely occurred during two December 2012 storm events characterized by streamflows in excess of 10,000 cfs. For 2014, the District did not install the pipeline, and no supplemental discharges were provided. While this location still supported an isolated shallow (0.3' deep) pool on July 14, 2014, the entire stream segment was dry on October 29, 2014 (**Photo 1**).

Downstream of the usual discharge location, the Putah Creek assessment reach was almost entirely dry for approximately 1.0 mile on October 29, 2014 (see **Photos 2-13**), although a minor pool (15' length, 10' width, 3" depth) was present in the middle of the reach (**Photo 7**). Although some sections of this one-mile reach have been dry during some prior assessments, October 2014 marks the first time the entire reach contained practically no surface water. As discussed in prior reports, the upper one mile of the assessment reach consists of a broad alluvial fan with substrates dominated by large gravel and sand, and under natural conditions, low summer and fall baseflows are likely to only persist subsurface during dry (and possibly even average) water years.

Approximately one mile downstream of the usual supplemental discharge location, the head of a pool containing the USGS gage marks the beginning of a more confined channel within an increasingly narrow canyon. Bedrock outcrops dominate the majority of the channel between here and the end of the survey reach. Prior assessment reports speculated that surface flows, fed by subsurface accretion, would likely persist naturally in this reach throughout the year, even during dry years, in the absence of supplemental discharges provided by the District. The October 29, 2014 assessment provided evidence to support this assumption as surface water was present from the head of the gaging pool all the way downstream to the end of the assessment reach.

A neighbor's surface water diversion is located at the upstream end of the pool (**Photo 14**). However, on October 29, 2014, the diversion pump had been removed and no active diversions were occurring at the time of the assessment. During past assessments, wetted channel dimensions in this reach have been relatively stable, with no

significant visible differences in wetted widths or water surface elevations from summer to early fall, or from year to year, except during instances when the neighbor's pump is actively diverting, in which case significant surface water elevation changes have been noted (e.g., August 2011, July 2013, and October 2013). The pool is approximately 800' long and 40-80' wide. On October 29, 2014, water depths ranged from about 1.0' to 1.5', which is approximately 2' less than water depths observed on July 14, 2014 (**Photo 15**). Non-native juvenile bass were abundant in this pool in October 2014. The USGS gage is located at the downstream end of this pool (**Photo 16**) and stage measurements at the gage are therefore directly affected by upstream diversions.

Below the gage pool, a boulder-dominated reach extends for approximately 350' (**Photo 17**). On October 29, 2014, the wetted channel within this reach was approximately 20' wide with an average water depth of approximately 0.5-1.5', which is approximately 5' narrower and 6" shallower than conditions observed in July 2014.

Downstream of this reach, Putah Creek enters into the largest pool of the entire assessment reach. This pool is approximately 475' long and up to 200' wide. The maximum water depth has never been determined, but usually appears to be about 4-5'. In-channel boulders provide important cover and habitat complexity for fish and other aquatic organisms. Water surface elevations in October 2014 appeared to be approximately 1.0' lower than during the July 2014 assessment. This pool marks the downstream survey end point for the October 2014 assessment (**Figure 1**).

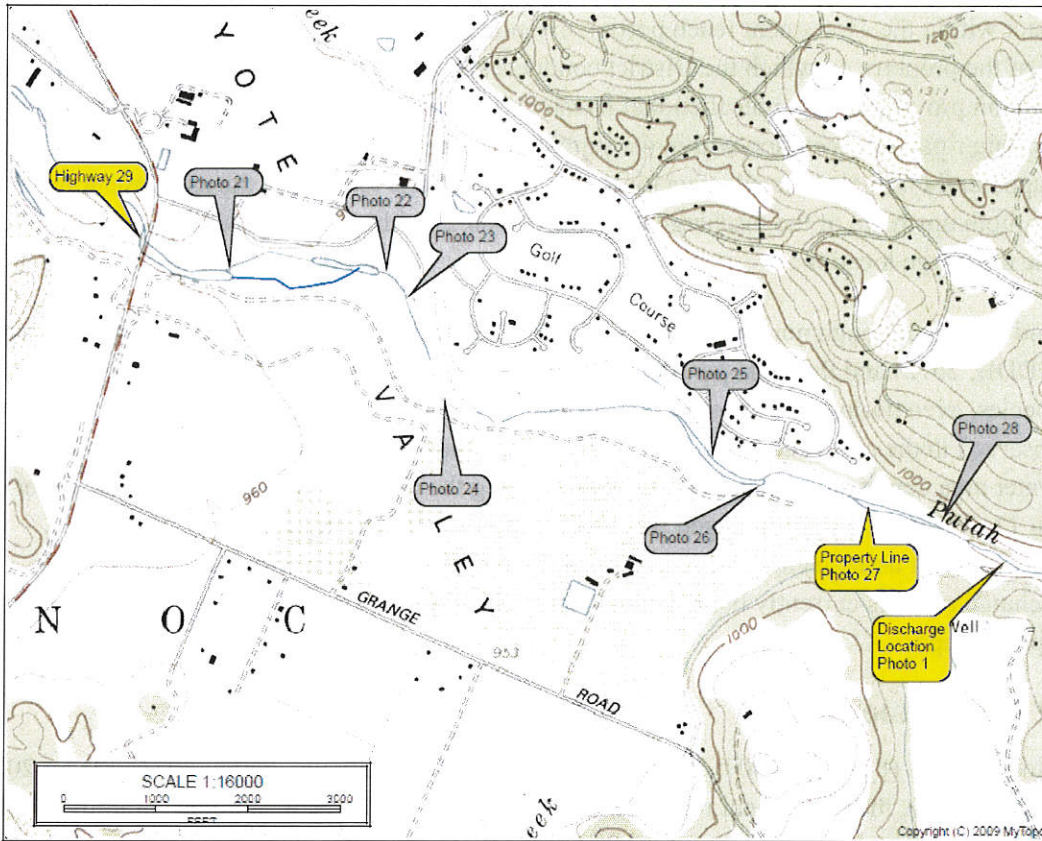
Physical Habitat Characteristics Upstream of the Discharge Location

2013 marked the first year that a substantial (2 mile) reach of Putah Creek upstream of the supplemental discharge location was included in the assessment to allow for a qualitative comparison between stream reaches supplemented with District discharges to reaches not receiving supplemental discharges. The 2-mile reach upstream of the usual discharge site was also assessed in 2014. During the July 2014 survey (Podlech, 2014), aquatic habitat conditions in this reach of Putah Creek consisted largely of shallow flows with only a few minor pools. Some areas had no surface flows or only isolated pools.

By the time of the October 29, 2014 assessment, almost the entire 2-mile reach between U.S. Highway 29 and the District's supplemental discharge site (**Figure 3**) was dry (see **Photos 21, 23, 24, 26 and 27**) and only three areas of isolated pools were observed (see **Photos 22, 25 and 28**). As such, no aquatic habitat assessment could be performed upstream of the discharge site in October 2014. Nevertheless, the dry channel conditions above the supplemental discharges provide valuable information regarding aquatic habitat conditions that would naturally occur in this reach of Putah Creek in the absence of supplemental discharges. Non-native juvenile bass were observed inhabiting the isolated pools.

Biological Resources

CNDDDB (2012) reports occurrences of two aquatic California Species of Special Concern within a 5-mile radius of the assessment site, northwestern pond turtle (*Emys marmorata*) and foothill yellow-legged frog. Northwestern pond turtles have been observed within the assessment site (HVLCS, 2000) and the large pools within this reach of Putah Creek provide the ponded water habitat and basking sites preferred by this species. Foothill yellow-legged frogs were observed in 2012 and 2013 within the backwater area depicted in **Photo 11A**, but not in any other portion of the assessment reach. No foothill yellow-legged frogs were observed in 2014. Fish species previously reported from this reach of Putah Creek include native rainbow trout (*Oncorhynchus mykiss*), as well



Source: Terrain Navigator Pro v9.2

Figure 3. Putah Creek Upstream of Supplemental Discharge Location

Note: The dark blue line depicts the approximate current location of the main channel

as non-native brown trout (*Salmo trutta*), smallmouth bass (*Micropterus dolomieu*), sunfish (*Lepomis* spp.), and catfish (*Ictalurus* spp.) (HVLCSO, 2000). Non-native inland silversides have been observed consistently since July 2008 (Podlech, 2008a), and river otters (*Lutra canadensis*) have occasionally been observed within the pool immediately upstream of the USGS gage (e.g., Podlech, 2008b). In October 2013, river otters were observed in an isolated pool located within the reach upstream of the supplemental discharge site (Podlech, 2013c).

Similar to previous reconnaissance surveys, few fish were observed within the assessment reach on October 29, 2014. No trout were observed, but non-native juvenile smallmouth bass were observed within the confined lower reach downstream of the supplemental discharge location, as well as within the isolated pools present upstream of the discharge location. The largely dry channel conditions both upstream and downstream of the discharge eliminated much of the habitat for these non-native warmwater species in 2014 and may have helped to control the population levels of these invasive species.

At the time of the first assessment of Putah Creek conducted for the District in November 2007, the majority of the assessment reach between the discharge location and the gage pool contained no significant riparian vegetation, presumably as a result of scouring flood flows during the 2005/2006 winter season. Since 2007, however, willows along the channel have become increasingly abundant and tall throughout much of the assessment reach, with the most substantial increases occurring toward the lower, more confined portions of the assessment reach. However, it should be noted that overall riparian corridor density, maturity, and spatial extent is

substantially greater within the assessment reach portion extending from Highway 29 to the fence line marking the upstream end of the property on which the District conducts supplemental discharges. The results of this qualitative comparison provide strong indication that livestock grazing within the Putah Creek channel is the primary factor limiting riparian vegetation within the supplemental discharge reach. It should be noted, however, that evidence of apparently drought-related vegetation die-offs was observed within the assessment reach in July and October 2014, both upstream of the discharge location as well as within the alluvial portion of the reach downstream of the discharge location.

Northwestern pond turtles, although not observed in October 2014, are known to occur in the assessed reaches of Putah Creek (CNDDDB, 2012) and the large perennial pools at the lower end of the reach provide ideal year-round habitat for this species, even during periods of absent surface flows in the upper reaches. Foothill yellow-legged frogs were not observed in the assessment reach until 2012, but appeared abundant in July 2012 and July 2013 within the backwater area depicted in **Photo 11A** as well as along the channel margins of the slack water reach depicted in **Photo 12**. No foothill yellow-legged frogs were observed during the July or October 2014 reconnaissance-level habitat assessments. A focused amphibian and reptile utilization assessment of the supplemental discharge reach is currently being conducted by Wildlife Research Associates, and its results will be presented in a separate report.

Assessment Conclusions

As noted in previous reports (Podlech, 2007; 2008a; 2008b; 2009; 2010a; 2010b; 2010c; 2011; 2012a; 2012b; 2013a; 2013b; 2013c; 2014), the assessment reach downstream of the discharge location is naturally divided into two distinct channel types. The upstream portion, between the discharge location and the pool containing the USGS gage, is situated in a broad alluvial channel containing large gravel and sand deposits. Prior reports had speculated that in the absence of supplemental water discharges, flows in this reach would likely become subsurface during the summer and fall of below-average water years, although isolated pools likely persist for some time. Support for this hypothesis was provided by the largely dry conditions observed in October 2014 during a critical drought period during which no supplemental discharges were provided.

Beginning with the pool containing the USGS gage and continuing downstream, the channel becomes more confined and contains larger stretches of impermeable bedrock outcroppings. For this lower portion of the assessment reach, prior reports speculated that surface flows, fed by subsurface accretion, would likely persist naturally in this reach throughout the year, even during dry years. In October 2014, despite the persistent drought and the absence of supplemental discharges, surface water and aquatic life in the form of non-native bass were observed throughout the confined reach, supporting the hypothesis. Riparian vegetation in this reach is relatively dense, providing further indication of perennial surface flows through much of the year.

The assessment reach upstream of the discharge location is characterized by more uniform geomorphology. This portion of Putah Creek is very broad with bankfull channel widths ranging between about 200' and 400'. Runs and low gradient riffles dominate this portion, and significant pools are essentially absent. Coarse sediment supply and transport appear extensive, and the alluvial geomorphology of the channel can result in flows being either partially subsurface, as was observed in July 2014, or completely dry, as was observed in October 2014. Overall riparian vegetation upstream of the fence line is noticeably more abundant and dense than below the fence line.

After three consecutive drought years in central California, precipitation during the 2009/2010 and 2010/2011 rainy seasons was relatively "normal" and extended well into the spring. During the 2011/2012 rainy season,

however, precipitation levels were again well below “normal”, and drought conditions have persisted and intensified into the 2014 water year. One runoff events exceeding 1,500 cfs occurred in February 2014, but only two additional minor events, with peak flows of less than 1,000 cfs, occurred subsequently in March and April 2014. For all three events, the hydrograph receded fairly rapidly after the storms, a sign of the exceedingly dry conditions in 2014. Aquatic habitat conditions observed in July 2014 were significantly affected by the lack of runoff, with several dry reaches observed at that time. Drought conditions intensified through the summer of 2014, and the majority of the assessment reach (both upstream and downstream of the discharge location) had dried out by October 2014, with the notable exception of the confined stream segment at the lower end of the assessment reach where pools retained surface water throughout the summer and early fall of 2014 even though no supplemental discharges were provided.

Qualitatively, fish abundance and distribution appeared significantly reduced in 2014, both upstream and downstream of the of the discharge location. Based on the fact that the vast majority of fish observed in this part of the Putah Creek over the past seven years were non-native predator species, the extensive channel drying observed in 2014 likely had a positive, albeit minor, effect on the aquatic ecology of the reach.

The two native special-status aquatic species known to occur in the standard assessment reach of Putah Creek (i.e., downstream of the usual supplemental discharge location), western pond turtles and foothill yellow-legged frogs, are unlikely to be dependent upon the District’s discharges. The turtles would be most likely to occupy the large pools in the lower reaches, which remain wetted even in the absence of supplemental discharges. Yellow-legged frogs are typically associated with flowing water, but are also known to occupy isolated pools. However, Putah Creek does not provide the preferred habitat of the species, which typically consist of higher gradient, relatively narrow channels dominated by boulders and cobbles. Within the general project vicinity, several tributary streams to Putah Creek provide such habitat. I have personally been conducting annual fish surveys in the Anderson Creek watershed, a tributary to Putah Creek located approximately 8 miles west of the assessment reach, for eighteen years. Foothill yellow-legged frogs are observed consistently during these surveys, indicating that regional yellow-legged frog populations appear to be healthy and stable within suitable habitat. It is doubtful that the species would naturally occur within the assessment reach without the artificial summer and fall flow supplementation. A focused amphibian and reptile utilization assessment of the supplemental discharge reach is currently being conducted by Wildlife Research Associates, and its results will be presented in a separate report.

Non-native bullfrogs, a voracious predator of foothill yellow-legged frogs and other native amphibians, have routinely been observed in the pool containing the USGS gage and other areas of the assessment reach. Periodic natural drying of the assessment reach may help suppress local bullfrog populations through elimination of some tadpoles.

Riparian vegetation along the assessment reach downstream of the fence line (located approximately 1,500’ upstream of the discharge location) tends to be relatively sparse within the broad, upper alluvial sections and becomes increasingly abundant within the more confined lower reaches. Evidence of livestock grazing is present throughout the reach. Periodic scour flows and concomitant channel realignments also may affect the abundance and distribution of riparian vegetation along the assessment reach. Riparian vegetation upstream of the fence line, where no evidence of grazing was noted, is more abundant, dense, and extensive than downstream of the fence. Supplemental water discharges appear to have limited effects on the condition of riparian vegetation within the discharge reach.

As discussed in prior reports, it is questionable whether the supplemental discharge program provides tangible ecological benefits or merely maintains a somewhat cool, wetted channel where very warm or dry conditions would exist naturally. Few fish have generally been observed in the shallow reaches before, during, and after supplemental discharges. Large pools within the lower, confined reaches of the assessment area likely support a greater abundance and diversity of fish. However, these pools remained wetted even during the summer of 2007 when the District was unable to provide supplemental discharges, and during the summer of 2014, a severe drought year during which supplemental discharges were also not made. It is also important to note that with the exception of rainbow trout, the assessment reach appears to support a largely non-native fishery and invasive bullfrogs. Artificially maintaining a non-native fishery is generally contrary to sound ecological principles and practices. Even if only native species were present in this section of Putah Creek, artificially maintaining summer streamflows at the historic median daily discharge level, as required under License 13527A, results in the elimination of all natural discharge levels below the median (i.e., it eliminates half of all natural summer discharge levels). The unnatural conditions created by the supplemental discharges were abundantly evident in October 2013 when Putah Creek upstream of the discharge location was almost entirely dry while aquatic habitat conditions observed downstream of the discharge location in October 2013 were almost identical to those observed in July 2013. Conversely, 2014 provided an opportunity to observe naturally dry conditions both upstream of the discharge location as well as within the alluvial channel portions downstream of the discharge location. Even under these conditions, the confined portions of the channel beginning at the gage pool remained wetted. Moreover, the abundance and distribution of riparian vegetation along the supplemental discharge reach appear to be a function of channel morphology, livestock grazing, and periodic high flow events, rather than supplemental discharges.

References

- California Natural Diversity Data Base (CNDDB). 2009. Query of 7.5 minute topographic quadrangles Middletown and Jericho Valley, Information dated April 4, 2009.
- Hidden Valley Lake Community Services District (HVLCS D). 2000. Delivery of Groundwater to Putah Creek for Summer Flow Enhancement for the Sustainability of Wildlife, Fish, and Other Aquatic Species in Southeastern Lake County. HVLCS D, Middletown, CA.
- Podlech, M. 2007. Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Ellison, Schneider & Harris, Sacramento, CA, November 21.
- Podlech, M. 2008a. July 2008 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Wagner & Bonsignore, Consulting Civil Engineers, Sacramento, CA, August 29.
- Podlech, M. 2008b. November 2008 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Wagner & Bonsignore, Consulting Civil Engineers, Sacramento, CA, December 11.
- Podlech, M. 2009. July 2009 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Wagner & Bonsignore, Consulting Civil Engineers, Sacramento, CA, October 13.
- Podlech, M. 2010a. October 2009 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Wagner & Bonsignore, Consulting Civil Engineers, Sacramento, CA, January 12.
- Podlech, M. 2010b. July 2010 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, October 4.
- Podlech, M. 2010c. October 2010 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, December 7.
- Podlech, M. 2011. August 2011 Putah Creek Reconnaissance Aquatic Habitat Assessment - Draft. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, December 20.
- Podlech, M. 2012a. October 2011 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, January 4.
- Podlech, M. 2012b. July 2012 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, September 11.
- Podlech, M. 2013a. October 2012 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, January 11.

Podlech, M. 2013b. July 2013 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, December 11.

Podlech, M. 2013c. October 2013 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, December 30.

Podlech, M. 2014. July 2014 Putah Creek Reconnaissance Aquatic Habitat Assessment. Technical Memorandum prepared for Hidden Valley Lake Community Services District, Hidden Valley Lake, CA, November 20.

Whealen, Paula, Wagner & Bonsignore, Consulting Civil Engineers, personal email communication, July 7, 2008, summarizing conversations with USGS staff.