ASSESSMENT OF STEELHEAD PASSAGE BARRIERS IN PORTIONS OF FOUR TRIBUTARIES TO THE CARMEL RIVER

Monterey Peninsula Water Management District
IRWM - PROJECT 3

Final Project Report - July 2014

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SECTION 1. INTRODUCTION

1.1 Background:

The decline of steelhead in the Carmel River Basin between the 1960s and 1990s prompted its listing as a threatened species under the protection of the federal Endangered Species Act (ESA) in 1997 (MPWMD, 2004). Despite significant habitat improvements in the Carmel River main stem and some improved practices concerning diversions in the basin over the past several decades, the run count at San Clemente Dam (18.6 miles upstream of the ocean [River Mile (RM) 18.6]), has not recovered to historic levels.

Under natural conditions, in normal and above water years, adult steelhead can potentially spawn in a total of 73.7 miles of stream, including 28.7 miles of the Carmel River main stem, 34.3 miles of primary tributaries, and 10.8 miles of secondary tributaries (**Table 1**). It is important to ensure that steelhead adults and juveniles have unimpeded access, in a timely manner without delays, to spawning and rearing habitats in tributary streams and the main stem below tributaries. A thorough, detailed survey needed to be completed of all potential barriers to steelhead migration as the first step to improving access to the upper reaches of those tributaries (CDFW, 1998; USFS, 2005).

1.2 Scope:

The scope of work for this project included an analysis of manmade barriers in tributary streams that were judged to be the most important in terms of potential steelhead habitat (**Figure 1**). The District selected four major tributaries for this assessment plus one potential main stem barrier known as Flavin's Ford. From downstream to upstream those four tributaries are: Potrero Creek, San Clemente Creek, Pine Creek, and Cachagua Creek.

1.3 Deliverables:

The priorities for this assessment were to: 1) provide a description of existing passage barriers; 2) document and confirm the amount of stream channel accessible to steelhead in selected tributaries under natural conditions; 3) locate, delineate, survey, and rank manmade barriers; 4) develop a prioritized list of actions/modifications at each barrier that will ultimately maximize production of juvenile steelhead from each tributary; and 5) recommend modifications to eliminate temporal migration delays and any partial blockages in selected tributaries.

SECTION 2. PROJECT SUMMARY

Although the general locations of many barriers were already known from existing documentation (MPWMD, 2004), we needed to identify their exact locations in order to generate an updated properties owners list. A Geographical Information System (GIS) was used to identify barrier locations utilizing high resolution orthoimagery, satellite images, and known watershed reaches. Once the barrier locations were determined, we used the Monterey County Assessor's parcel maps to identify the property owners and acquire their contact information.

The District hired a consultant to contact property owners with identified barriers about the project and to secure access agreements to their property for the assessments (**Appendix A**). Public meetings were held to answer property owner's questions and concerns.

Access was granted to all sites on Potrero, Pine, and San Clemente Creeks, as well as the main-stem site, Flavin's Ford. However, only one property owner, in addition to the public road bridges owned by Monterey County, gave us approval to survey barriers on their property in the Cachagua Creek Basin (Cachagua and Finch Creeks).

Visual and photographic reconnaissance surveys were completed on sites where access was granted by the property owners **(Appendix B)**. Additional photographic reconnaissance was done at some locations from the public roadway. Each identified site was given a "Green", "Yellow" or "Red" designation based on the likelihood of the site being an actual passage barrier to steelhead **(Table 2)**. Photos and a description of each site were presented in preliminary reports of each tributary water basin. Detailed assessments were later done at those sites designated as Yellow or Red in the reconnaissance survey.

The grant specified that the United States Forest Service (USFS) computer program FishXing (www.stream.fs.fed.us/fishxing/) would be used to analyze the surveyed barriers. However this program can only be used for culverts, not other types of manmade barriers. These culverts were analyzed using the FishXing program that calculates the percentage of time each culvert is passable to migrating adult fish at designated flows **(Appendix C)**. Other manmade potential barriers on the tributaries included low-flow crossings (fords), dams of various sizes, golf course features, and bridges. These barriers were mapped, photographed, surveyed (where possible), and described, but were outside the scope of this project since they could not be analyzed with the FishXing program.

2.1 Potrero Creek

Ten barriers were identified and surveyed on Potrero Creek **(Figure 2)**. Of the four tributaries in this project, only Potrero Creek had culverts. Five locations along the creek have single or double culverts that were surveyed and analyzed with FishXing. All five are barriers to migrating steelhead with three of them being complete or nearly complete barriers at most flows **(Table 2)**. The two sets of culverts under the Carmel Valley Athletic Club (CVAC) access roads are in very poor condition and are in dire need of removal or replacement to improve fish passage to the upper reaches of this tributary. The double culverts under Valley Greens Drive are under-sized and are frequently a velocity barrier.

Another serious passage issue is lower Potrero Creek between the confluence with the Carmel River and the first set of culverts under Valley Greens Drive. This approximately ¼ mile long reach crosses Quail Lodge Golf Course (Quail). Sections of it were reconstructed after flood damage in 1998, but this reach no longer appears to be functioning as a passable steelhead stream. This steep, narrow channel has little natural habitat or form and needs to be carefully evaluated and considered for significant future restoration. Further upstream, on the Santa Lucia Preserve property, we observed and modified a large log jam to improve steelhead passage that should be removed. There are also three modern bridges crossing the creek that are not barriers.

2.2 San Clemente Creek / Black Rock Creek

Although there are no culverts on San Clemente Creek, this tributary has a variety of potentially serious passage barriers. Near the confluence with San Clemente Reservoir (SCR) we noted several barriers including log jams and debris dams. However, since our reconnaissance survey, this entire lower reach has been impacted by the multi-year San Clemente Dam removal project. All vegetation has been removed and the channel is being reconfigured. No additional barriers are known to exist until Trout Lake on San Clemente Rancho (SCR) property.

The SCR reach has a number of potential barriers including the large summer dam and ladder at Trout Lake, several smaller summer dams, and a low-flow ford in very poor condition. Removal or modification of all these manmade structures should be discussed and remedied to allow better fish passage to upper San Clemente and Black Rock Creeks.

Additionally, several clear-span, modern bridges cross the upper reaches of this tributary that are not barriers.

Black Rock Creek, a tributary to San Clemente Creek, has no known passage barriers until the impassable, 15-foot high natural rock chute known as the "Big Dipper". In the unlikely event a fish did pass this site, an even larger natural barrier is slightly upstream, a ~70-foot high waterfall at the base of the White Rock Lake Dam at the White Rock Lake Gun Club.

2.3 Pine Creek

This tributary is the most pristine creek below Los Padres Dam. Although there is some land use upstream (light agriculture and hiking trails) this tributary has not been developed and has no known manmade barriers. The lower 200-foot reach of Pine Creek is a very steep, boulder cascade ending in a large bedrock pool at the confluence of the Carmel River. This natural feature is clearly a barrier at low flows but adult steelhead manage to migrate upstream in higher flows as verified by adult and juvenile fish sightings by District staff over the past 20 years. We were unable to reach the upper barrier described in the literature due to the inaccessible, steep, rough terrain and so cannot confirm its location or condition.

2.4 Cachagua/Finch Creeks

Although this tributary system frequently produces the greatest number of steelhead fry of any tributary, and several known passage barriers exist on this creek, we were only able to secure access agreements with one land owner to do detailed surveys. Cachagua Road crisscrosses the creek and we did look at all the bridges owned by Monterey County. In general these bridges are not migration barriers. Finch Creek, the major tributary to Cachagua Creek, is also crossed several times by county bridges on Carmel Valley Road. Several of these locations should be monitored regularly for debris jams. The Hasting's Reserve caretaker's house on upper Finch Cr. is accessed via a large concrete ford that causes downcutting and scour downstream and is blocking sediment upstream. This ford should be replaced with a bridge to improve fish access to the upper portion of the creek.

A long culvert located on James Creek at Jamesburg is in very poor condition and may need replacing. The lack of suitable steelhead spawning and rearing habitat upstream make this a low priority site for repair.

2.5 Main Stem Carmel River

Flavin's Ford (Flavin's Crossing) in Cachagua Valley is a concrete, low-flow road crossing built in the 1930's or 1940's. It is in disrepair but still passable in an emergency, such as the large forest fire (Basin Complex Fire) in 2008 when it was used by firefighters to get large equipment across the river. It acts like a dam, blocking sediment behind it and causing scour downstream. In moderate to high flows the ford is unlikely to block migrating fish. Removal of this unsightly manmade feature, in an otherwise relatively pristine reach, should be considered due to its effects on substrate, flow regime, benthic invertebrates, and for safety reasons due to exposed rebar.

SECTION 3. MAJOR PROBLEMS AND RESOLUTIONS

As mentioned above, the biggest issue was the District's inability to secure access agreements for any private property in the Cachagua Creek sub-basin. Before the project started, we had been assured by a local fisheries advocacy group that does work in the area that we would be allowed to survey private barrier sites. Despite several attempts by MPWMD's consultant to gain access, only one property, the Hastings Natural History Reservation (owned by the University of California), allowed staff to do a detailed survey of the three potential barriers on their property. We were also able to access all the Monterey County bridges on Cachagua Road. Several barrier sites on Cachagua properties were visible from the roadway and were given a ranking based on professional judgment. Two of them were fords classified as "Red" and should be thoroughly examined and remedied at a later date (Per. Com. with B. Leneve 7/2014: both property owners had expressed interest in the past of remedying the barriers at their properties).

Several other locations had significant barriers that were examined, photographed, and described, but were not surveyed. The most important of these was the dam and spillway at San Clemente Rancho (Trout Lake). Surveying this large barrier was outside the scope of this project. A complete, professional survey of this structure should be done and the results submitted to the California Department of Fish and Wildlife (CDFW) and the National Marine Fisheries Service (NMFS) for their action.

SECTION 4. PROJECT RESULTS AND BENEFITS

Steelhead migration barriers on four tributaries were identified and assessed. Existing maps were updated with the new information on barrier types and locations. Culverts were analyzed using the FishXing program while fords and summer dams were surveyed. Several barriers that were either too large (beyond project scope) to survey or were on properties where no permission was granted, were photographed and described. Barriers were ranked for each tributary according to the severity of the blockage verses the potential increase to access of upstream habitat with the highest ranking going to the worst barriers. An overall barrier ranking for the four tributaries was also determined. Recommendations for specific barrier site improvements as well as recommendations for additional sites to assess were completed.

Steelhead passage barrier locations, descriptions, and site photos are now available on the District's GIS mapping site.

To access IRWM GIS Mapping Site for user friendly fish migration barrier site maps, descriptions, and photos go to the following link:

http://arcgisirwm.mpirwm.org/SilverlightViewer_1_8/ (Select the dropdown menu, click on "Fish Barriers" then "Launch").

Or for "how to" videos for the new GIS site go to the following link:

http://www.mpirwm.org/Pages/Geographic-Information-Systems-(GIS).aspx

Based on new information gathered during this project, several maps and tables from the Carmel River Watershed Assessment (MPWMD, 2004) were updated. Three changes were made to "The extent of stream habitat accessible to adult steelhead" map **(Figure 1)**. The natural barrier on Blackrock Cr. was moved farther upstream, while the natural barrier on Garzas Creek was moved farther downstream. As habitat continues to improve on the lower Carmel River, adults are spawning further downstream. Fish are now regularly spawning in the Rancho Cañada reach. These data, along with barrier types and revised stream reach lengths, are also summarized in the updated **Table 1.**

The locations of all the barriers in each tributary are mapped in **Figures 2 – 6**. The sites are color coded based on the reconnaissance survey results **(Appendix B: 1-6)** and are classified as: "Green", "Yellow", or "Red" depending on the likelihood of the site being a passage barrier.

Barrier locations, type, site ratings, and recommended actions for each tributary and the main stem site are summarized in **Table 2**. Sites with serious barriers in need of priority action are highlighted in pink.

The project benefits include gaining a better understanding of existing tributary conditions and fish passage problems. Using the analysis results and site rankings as a guide it is hoped that the most severe passage barriers will be removed or modified in the near future using grants, government, or private funding to eventually provide unimpeded fish access to the uppermost natural barrier in each tributary.

SECTION 5. DISCUSSION OF RANKINGS

The dam, ladder, and spillway at Trout Lake (San Clemente Rancho - SCR) on San Clemente Creek were ranked as the number one barriers for modification or removal for several reasons (**Table 3**). Unlike most Carmel River tributaries, San Clemente Creek has continuous flow in most water years (MPWMD, 2009), and in general, is more pristine with less development than either Potrero or Cachagua Creeks. The dam and outlet works have been modified and improved over the years, but the fish ladder appears to be in disrepair and would be difficult for adult steelhead to migrate past. Juvenile trout were observed upstream of the lake in both San Clemente and Black Rock Creeks but it is not known if they were steelhead or rainbow trout. An additional 6.8 miles of productive habitat would be more accessible if this barrier were removed.

Three additional barriers were identified on San Clemente Cr. in SCR that should be removed: one low-flow ford and two boulder/concrete summer dams (Ranking #s 4, 5, and 12). These structures block upstream fish migration and downstream sediment transport. The lower summer dam blocks 6.3 miles of two creeks (San Clemente and Black Rock) while the other two structures block 3 miles of San Clemente Cr. The ford needs to be replaced with a small bridge and the summer dams should be removed.

Even though lower Cachagua Creek dries up most years, this tributary system is one of the most productive in the Carmel River watershed. Fish rescue efforts have captured over 6,000 young-of-the-year steelhead in some years. By removing a few serious passage barriers, adult steelhead would have unrestricted access of up to 10 miles of additional spawning and rearing habitat (**Table 3**). Four private low-flow fords (Ranking #s 2, 3, 6, and 10) should all be replaced with small bridges to allow for unobstructed adult fish passage and downstream sediment transport.

Potrero Creek has three very serious passage barriers that may block upstream fish passage in nearly all flows (**Appendix D1**). However, this lower Carmel River watershed tributary typically only has enough flow to attract adults and sustain juveniles on above-average water years (MPWMD, 2009) (**Appendices D2 and D3.**), making it less productive than either San Clemente or Cachagua Creeks, and thus lowering its barrier rankings (Ranking #s 7, 8, and 9) from where they might otherwise be (**Table 3**). Replacing the two culverts on the Carmel Valley Athletic Club (CVAC) property with small bridges and restoring the Quail Lodge golf course reach would allow access to an additional 3 miles of habitat during years with suitable flows.

Flavin's Crossing on the main stem is the final ranked barrier (#11) (**Table 3**). This large concrete ford serves little beneficial purpose but is likely a fish passage barrier at lower flows as well as being a large sediment transport barrier. It should be removed to allow this reach to return to a more natural condition.

The Pine Creek confluence was not ranked. Even though the boulder cascade is very steep, it is a natural feature (possibly made worse by Los Padres Dam retaining sediments) in a remote section of the watershed and does not need to be modified. District staff have observed both adult and juvenile steelhead upstream of the confluence on numerous occasions, so it not a complete passage barrier.

SECTION 6. RECOMMENDATIONS

Other Carmel River watershed barrier locations for future assessment and restoration:

1) CAWD pipe between the lagoon and HW1
2) Hitchcock Creek – much of it needs restoration
3) Robinson Canyon Creek – several fords and culverts

Sites in this study that need additional surveying:

1) Try to get access to the properties on Cachagua Cr. – 3 known fords that are likely barriers. Changing these fords, plus the one on Hasting's property, to small bridges would allow unrestricted fish passage at most flows to the upper reaches of this productive watershed.

2) Trout Lake dam is one of the major barriers on any Carmel River tributary and is found on one of the few tributaries that has suitable flow for adult fish passage in most years. In addition, with the removal of San Clemente Dam in the next two years and the rerouting of the Carmel River into the San Clemente Creek channel there may be greater numbers of adult steelhead migrating up San Clemente Creek since the clogged inundation zone will be gone and fish will have free passage. Although a detailed analysis of this structure, and its associated fish ladder, were beyond the scope of this project, this should be completed in the near term. Modifications have been made to the dam and outlet works in the past (MPWMD ~1998 field notes, and San Clemente Rancho Facebook photos, ~2010) and fish can likely get past the dam as they have done for 80 years at San Clemente Dam (juvenile fish were observed upstream of the dam and lake). However we were unable to observe this site in the winter with the lake drained so it is unclear how much of a barrier it is to adult migration.

3) The lower portion of Potrero Creek that flows through the Quail Golf Course needs to be restructured. It is too steep and has little to no natural habitat or structures. Lengthening and "naturalizing" this reach could improve both fish passage and golf course aesthetics.

Projects in progress that will improve Carmel River steelhead passage:

1) Removal of San Clemente Dam and Reservoir,
2) Removal of the Old Carmel Dam,
3) Removal of the Sleepy Hollow Ford, and
4) Installation of downstream migration facilities at Los Padres Dam.

The recommendations contained in this report should be considered part of a long-term effort to remove barriers in the watershed. Ideally, barriers would be removed in order of their priority for increasing passage to steelhead habitat. However, there may be other considerations that would push an individual project to a higher priority. These include funding and establishing partnerships between private property owners, stakeholders, and agencies. Past MWPMD experience with river restoration projects in the main stem has shown that property owners can be reluctant to support a new program that involves work on private property; however, carrying out pilot projects to remove barriers that may be lower in priority can have the effect of increasing local interest in completing additional projects. It is hoped that one or more projects carried out in each tributary would encourage local property owners to become knowledgeable about the potential to improve the steelhead run.

SECTION 7. REFERENCES CITED

CDFW. 1998. California Salmonid Stream Habitat Restoration Manual. Part IX: Fish Passage Evaluation at Stream Crossings.

MPWMD. James, G. 2009. Carmel River Basin Surface Water Resources Data Report Water Years 2004-2008.

MPWMD. 2004. Environmental and Biological Assessment of Portions of the Carmel River Watershed.

USFS. 2005. National Inventory and Assessment Procedure - For Identifying Barriers to Aquatic Organism Passage at Road Crossings.

Leneve, Brian. 2014. Personal Communication.

Table 1. Estimates of the linear extent of stream accessible to adult steelhead in the Carmel River Basin and barrier information. (Originally Table 5.5.1.1-A, Carmel River Watershed Assessment, MPWMD, 2004). Updated in 2014.

Estimates of the linear extent of stream accessible to adult steelhead in the Carmel River Basin

PORTION OF BASIN, Stream	Length Accessible (Miles)	Type of Permanent Barrier	Permanent Barrier Field Checked	Type of Temporary Barriers
DOWNSTREAM OF SAN CLEMENTE DAM				
- Carmel River mainstem[1]	16.48	none	yes	shallow riffles, flow barrier at Old Carmel Dam, reservoir drawdown at San Clemente Dam
-- Potrero Cr.	3.00	none	yes	culverts, shallow riffles
-- Robinson Canyon Cr.	1.11	unknown	no	concrete fords, boulder piles
-- Las Gazas Creek	2.00	bedrock chute	yes	bedrock chute, shallow riffles
-- Tularcitos Cr.	4.31	concrete ford	yes	Bedrock chutes, culverts
SAN CLEMENTE RESERVOIR TO LOS PADRES DAM				
- Carmel River mainstem	5.41	none	yes	Shallow riffles,bedrock chutes, concrete fords, & summer dams
-- San Clemente Creek	6.00	recreational dam	yes	recreation dams, boulder piles
--- Black Rock Cr.	2.99	bedrock chute and waterfall	yes	recreation dams, boulder piles, & bedrock chutes
-- Pine Creek	5.50	unknown	no	boulder piles, bedrock chutes
-- Cachagua Creek	4.78	none	yes	shallow riffles, concrete fords
--- Finch Cr.	6.00	none	yes	shallow riffles, boulder piles, concrete fords
--- James Cr.	1.80	none	yes	boulder pile, shallow riffles
UPSTREAM OF LOS PADRES RESERVOIR				
- Carmel River mainstem	6.78	waterfall	yes	shallow riffles, boulder piles
-- Miller Fork	5.87	unknown	no	shallow riffles, bedrock chutes
-- Danish Creek	1.70	bedrock chute & waterfall	yes	bedrock chute
Subtotals:				
- Carmel River mainstem	28.67			
-- Primary Tributaries	34.27			
--- Secondary Tribs.	10.79			
TOTAL IN CARMEL RIVER BASIN:	**73.73**			

[1] Downstream spawning habitat extent = Rancho Canada Golf Course, Br. #5 (RM= 2.1) (2013)

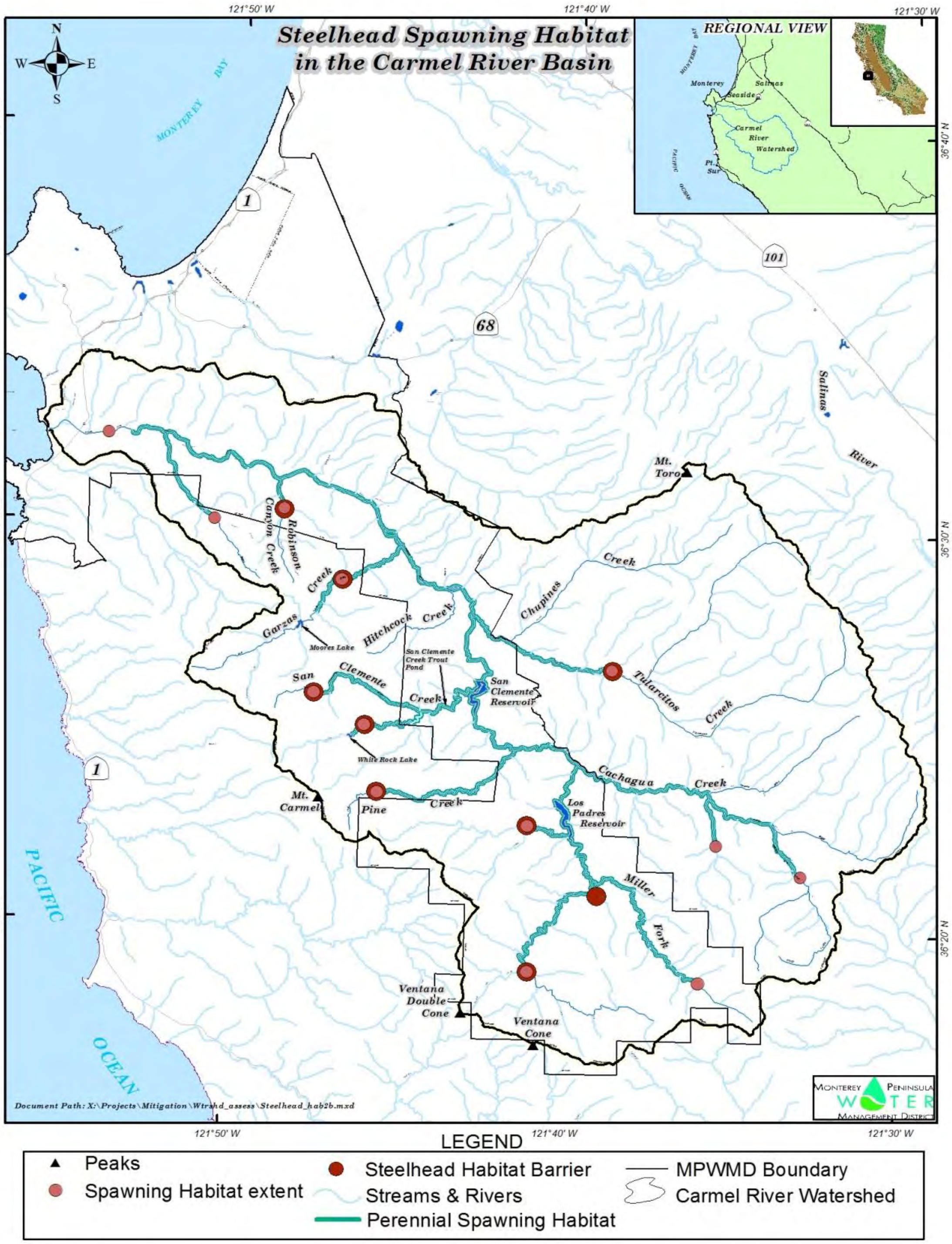

Figure 1. Carmel River Basin showing principle tributaries and extent of stream habitat accessible to adult steelhead. Location of uppermost barriers in tributaries based on historical surveys or on examination of topographic features on 7.5-minute USGS maps (MPWMD, 2004). Three barrier locations were updated in 2012 from MPWMD field observations: Black Rock Creek (moved farther upstream), Garzas Creek, and lower Carmel River (moved farther downstream).

Table 2. Summary of barrier locations, survey ratings, and action recommendations.

Summary of Barrier Locations, Ratings, and Site Recommendations									
Tributary	**Site #**	**Location**	**Barrier Type**	**Recon. Rating (Green) (Yellow) (Red)**	**Surveyed?**	**Analyzed with FishXing?**	***Distance from Upper Watershed Reach (miles)**	**Recommended Action**	**Notes:**
Potrero Creek	PCB-1	Confluence	Channel Constriction	Y	No	No	3.3	Minor channel clearing.	
(~3.3 miles)	PCB-2 (a,b,c,d)	Quail Golf Course	Channel Morph	Y	No	No	3.2	Detailed survey, channel reconfigurin, veg. replanting.	Severely degraded reach through golf course.
	PCB-3	Valley Greens Rd.	Double Culvert	Y	Yes	Yes	3.0	Keep inlet clear of obstructions.	
	PCB-4	Valley Knoll Rd.	Culvert	Y	Yes	Yes	2.9	Keep inlet clear of obstructions, improve outlet structures.	
	PCB-5	Rancho San Carlos Rd.	Culvert	R	Yes	Yes	2.8	Replace with bridge.	Very poor design.
	PCB-6	Rancho San Carlos Rd.	Double Culvert	Y/R	Yes	Yes	2.7	Replace with bridge.	Very poor condition.
	PCB-7	Chamisal Pass	Culvert	Y	Yes	Yes	2.5	Keep eye on outlet, add structure to prevent down cutting.	
	PCB-8	Wild Boar Run	Bridge	G	No	No	2.1		
	PCB-9	Potrero Trail	Bridge	G	No	No	1.5		
	PCB-10	Potrero Trail	Bridge	G	No	No	1.0		
San Clemente Creek	SCC-1 (a,b,c)	Confluence	Overgrown, log jams	Y	No	No	6.0	This reach is being redone with the SCD removal project.	
(~6.1 miles)	SCC-2	Rancho San Clemente	Dam/Ladder/Spillway	R	No	No	**4 + 2.8	Replace old ladder with modern standards/design.	Poor condition, does not meet modern standards.
	Scc-2a	SCR / Dormody Rd.	Divided Lake/pond	Y	No	No	**3.9 + 2.8	?	
	SCC-3	SCR / Dormody Rd.	Inlet Culvert	G	No	No	3.8	Replace screens, modernize design.	
	SCC-4	SCR / Dormody Rd.	Summer Dam	R	Partial	No	**3.5 + 2.8	Remove.	
	SCC-5	SCR / Dormody Rd.	Bridge	G	No	No	3.2		
	SCC-6	SCR / Dormody Rd.	Bridge	G	No	No	3.2		
	SCC-7	SCR / Dormody Rd.	Summer Dam	Y/R	Yes	No	3.2	Remove.	
	SCC-8	SCR / No Name Rd.	Ford	Y/R	Yes	No	3.0	Replace with bridge.	Very poor condition.
	SCC-9	Rancho San Carlos / San Clemente Trail	Bridge	G	No	No	1.3		
	SCC-10	Arroyo Sequoia	Bridge	G	No	No	0.4		
Black Rock Creek	SCC-11	Robinson Canyon Rd.	Natural Bedrock Chute	R	No	No	0.6		Complete natural fish barrier.
(~3.0 miles)	SCC-12	Robinson Canyon Rd.	Natural Waterfall	R	No	No	0.4		Complete natural fish barrier.
	SCC-13	White Rock Gun Club / Robinson Canyon Rd.	Dam	R	No	No	0.4		Above natural barriers.
Pine Creek	PC-1	Confluence	Boulder Cascade	Y	Yes	No	5.5	Very steep but fish make it past here under some flows.	Not feasible to modify this nature feature.
(~5.5 miles)	PC-2	Upper Barrier	Waterfall/Chute	?	No	No	3.0		Not observed. Reported to be natural bedrock chute.

Table 2 continued. Summary of barrier locations, survey ratings, and action recommendations.

Cachagua Creek	LCC-1	Confluence	None	G	No	No	10.8		
(4.8 miles)	LCC-2	Nason Rd. (Br #527)	Bridge	G	No	No	10.7		
	LCC-3	Jenson Camp/Cachagua Rd.	Ford/Culverts	Y	No	No	10.4	Needs larger culverts. Keep inlets clear of debris.	Not given property access permission.
	LCC-4	Comstat Rd. (Br. #528)	Bridge	G	No	No	10.0	Monitor gravel bar.	
	LCC-5	Cachagua Rd.	??	??					Not given property access permission.
	LCC-6	Cachagua Rd. (Br. #529)	Bridge	G	No	No			
	LCC-7	Cachagua Rd.	??	??					Not given property access permission.
	LCC-8	Trampa Canyon / Cachagua Rd. (Br. #530)	Bridge	G	No	No	8.4		
	LCC-9	Cachagua Rd./Boronda Cr. Confl. (MM 8.6)	Ford/Culverts	R	No	No	8.3	Replace with bridge. Severe barrier.	Not given property access permission.
	LCC-10	Cachagua Rd. / Ringers (MM 8.9)	Ford	R	No	No	8.1	Replace with bridge. Severe barrier.	Not given property access permission.
	LCC-11	Cachagua Rd. (MM 9.2)	Bridge	G	No	No			Not given property access permission.
	LCC-12	Cachagua Rd. (MM 9.2)	Bridge	G	No	No			Not given property access permission.
	LCC-13	Tassajara Rd. (Br. #532)	Bridge	G	No	No	6.0	Regularly remove rock dam that gets built here.	
James Creek	UCC-1	Tassajara Rd./Jamesburg	Culvert	R	No	No	0.2	Replace with new pipe arch. Culvert in poor condition.	Not given property access permission.
(~1.8 miles)	UCC-1a	Tassajara Rd.	Sm. Bridges	G	No	No	1.0		
Finch Creek	UCC-2	Carmel Valley Rd. (MM 25.4, Br. #533)	Bridge	G	No	No	4.3		
(~6.0 miles)	UCC-3	CV Rd. / Hastings Reserve (MM 25)	Ford	R/Y	Yes	No	3.8	Replace with bridge. Severe barrier.	
	UCC-4	Hastings Reserve (MM 25)	Foot Bridge	G	No	No	3.8		
	UCC-5	CV Rd./ Hastings/ Boekennoogen (MM 25.7)	Bridge	G	No	No	3.7		
	UCC-6	CV Rd. (Br. #537) (MM 26.5)	Bridge	G	No	No			
	UCC-7	CV Rd. (Br. #539) (MM 26.9)	Bridge	G	No	No		Monitor regularly.	Constricted channel at upper end.
	UCC-8	CV Rd. (Br. #542) (MM 27.7)	Bridge	G	No	No			
	UCC-9	CV Rd. (Br. #543) (MM 27.9)	Bridge	G	No	No		Monitor.	Concrete cross-weirs, possible problem at low flow.
	UCC-10	CV Rd. (Br. #545) (MM 28.1)	Bridge	G	No	No			Cattle fence hanging on d/s side
	UCC-11	CV Rd. (Br. #546) (MM 28.8)	Bridge	G	No	No			
	UCC-12	CV Rd. / Cahoon (MM 29.5)	Culverts	Y	No	No	0.1	Not much habitat u/s.	Not given property access permission.
Mainstem Carmel R.	CR-1	Flavin's Xing/Cachagua Rd.	Ford	Y	Yes	No	9.0	Remove.	

* Approximate distance

**Blocks both San Clemente and Black Rock Crks.

Pink highlighted Sites = priority action.

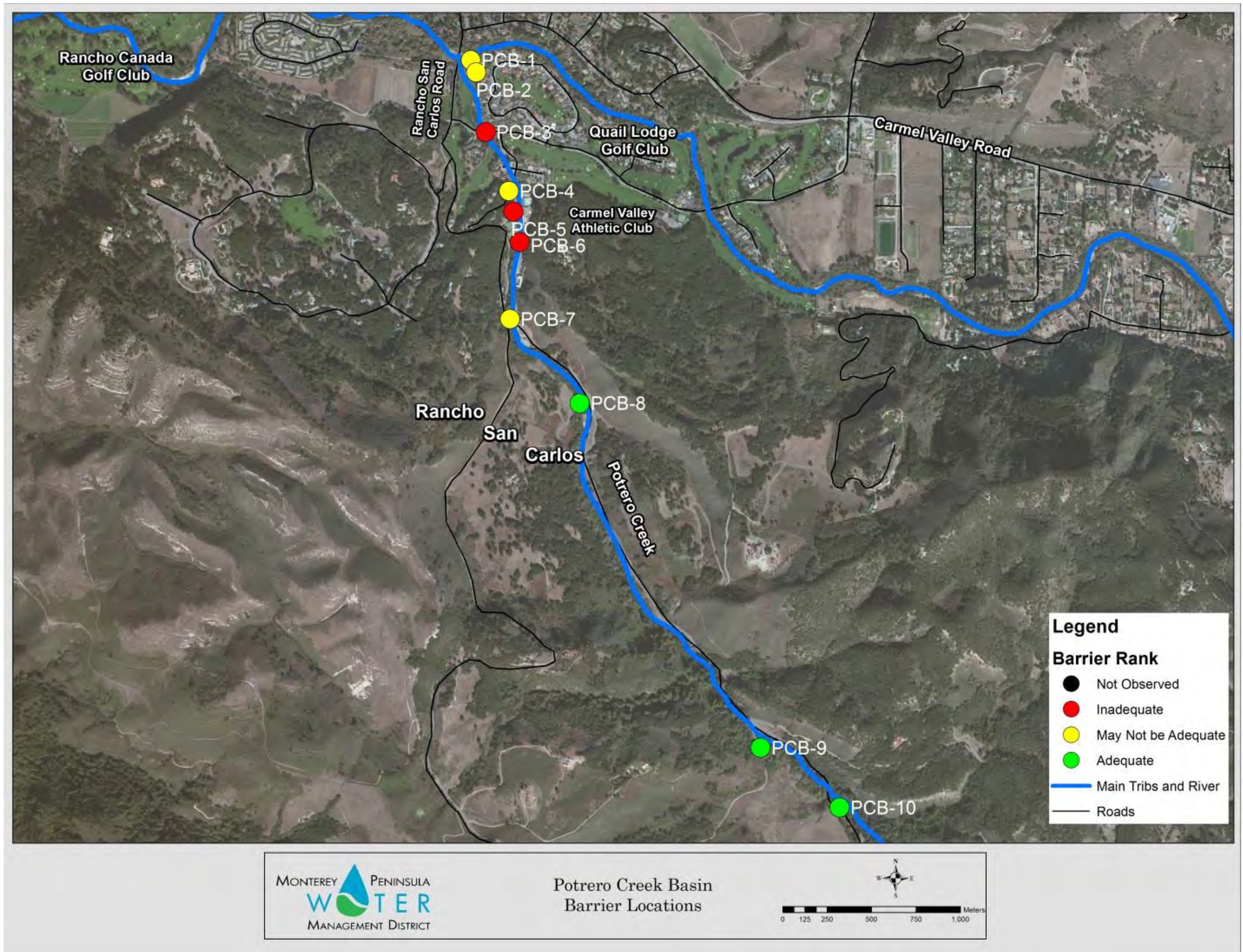

Figure 2. Location of steelhead passage barrier sites in Potrero Creek Basin (PCB). Site locations were updated and color classified after reconnaissance site visits. Classifications are the following: "Green" = Adequate Passage – likely not a barrier to any life stage of steelhead at any flow; "Yellow" = Inadequate Passage - potential barrier to some life stages or at some flows; and "Red" = Inadequate Passage - likely barrier to all life stages or at all flows.

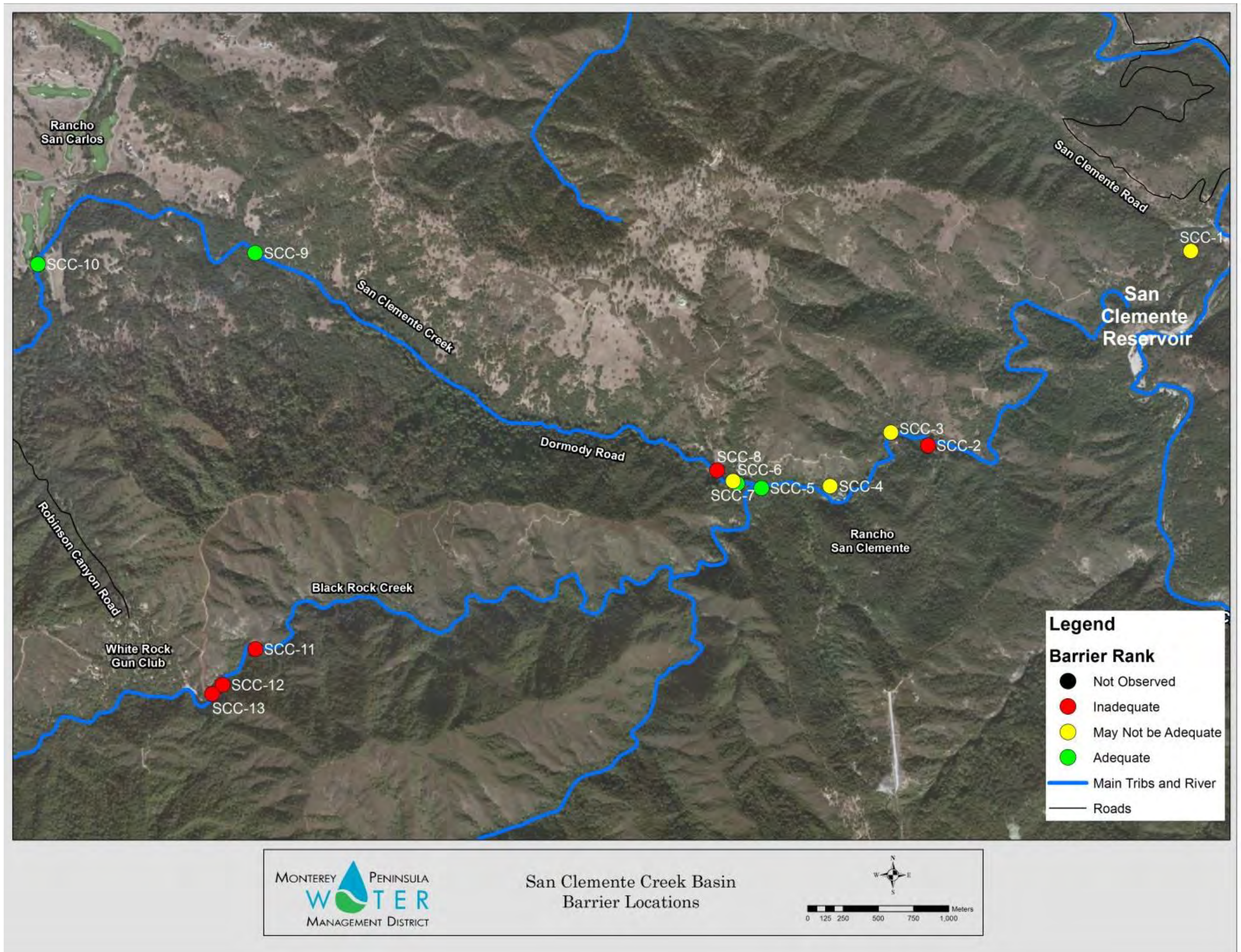

Figure 3. Location of steelhead passage barrier sites in San Clemente Creek Basin (SCC). Site locations were updated and color classified after reconnaissance site visits. Classifications are the following: "Green" = Adequate Passage – likely not a barrier to any life stage of steelhead at any flow; "Yellow" = Inadequate Passage - potential barrier to some life stages or at some flows; and "Red" = Inadequate Passage - likely barrier to all life stages or at all flows.

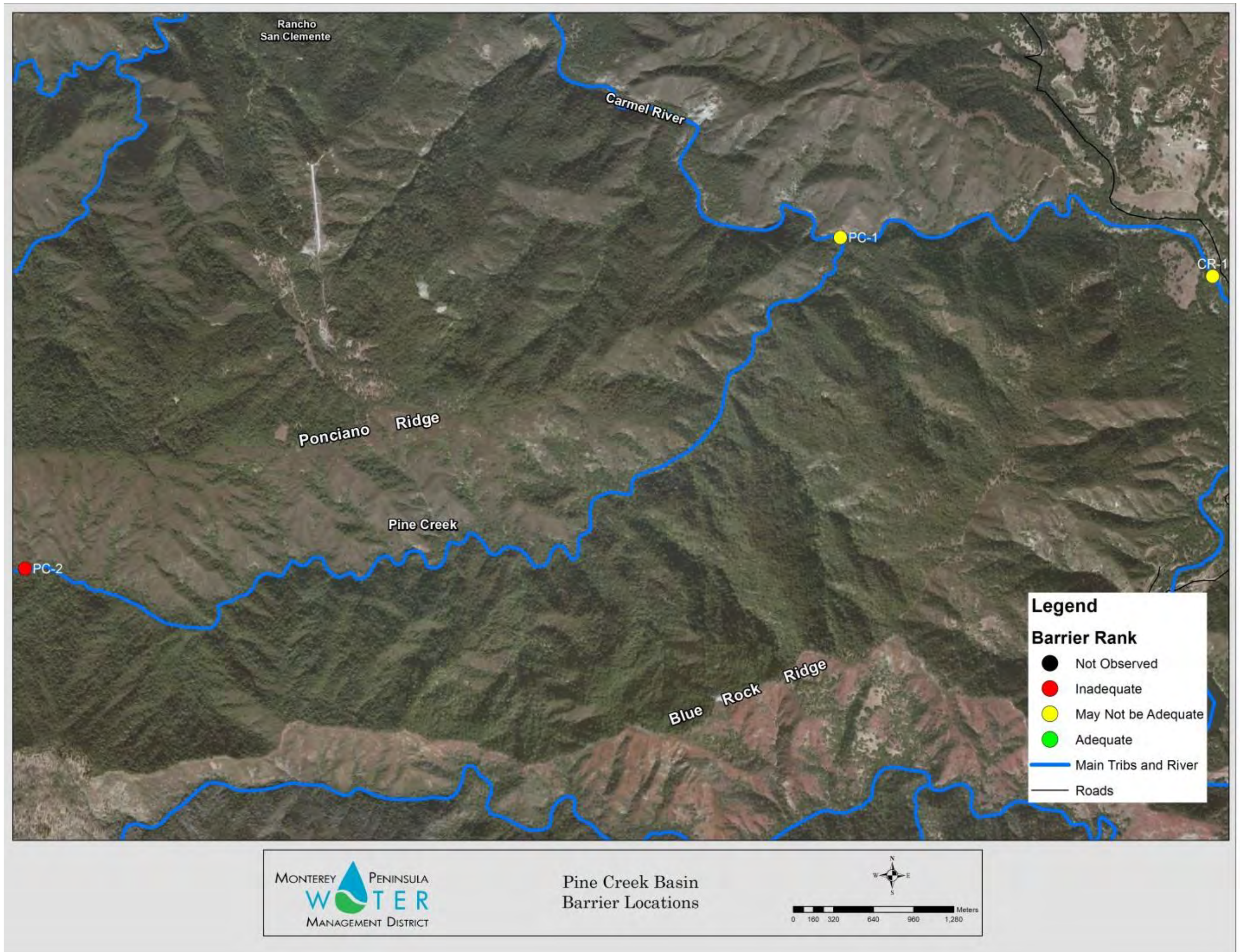

Figure 4. Location of steelhead passage barrier sites in Pine Creek Basin (PC) and the Carmel River main stem (CR). Site locations were updated and color classified after reconnaissance site visits. Classifications are the following: "Green" = Adequate Passage – likely not a barrier to any life stage of steelhead at any flow; "Yellow" = Inadequate Passage - potential barrier to some life stages or at some flows; and "Red" = Inadequate Passage - likely barrier to all life stages or at all flows.

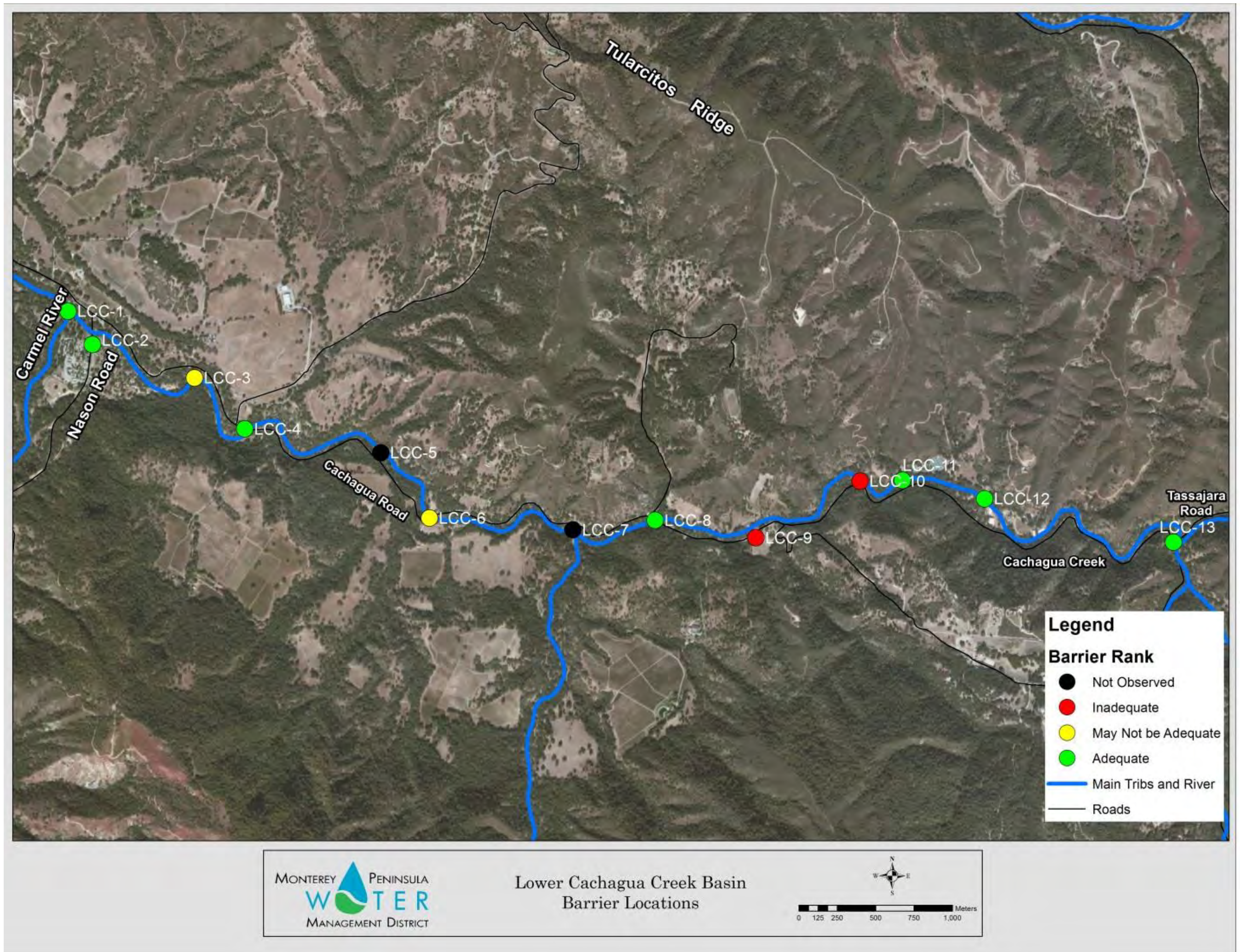

Figure 5. Location of steelhead passage barrier sites in Lower Cachagua Creek Basin (LCC). Site locations were updated and color classified after reconnaissance site visits. Classifications are the following: "Green" = Adequate Passage – likely not a barrier to any life stage of steelhead at any flow; "Yellow" = Inadequate Passage - potential barrier to some life stages or at some flows; and "Red" = Inadequate Passage - likely barrier to all life stages or at all flows.

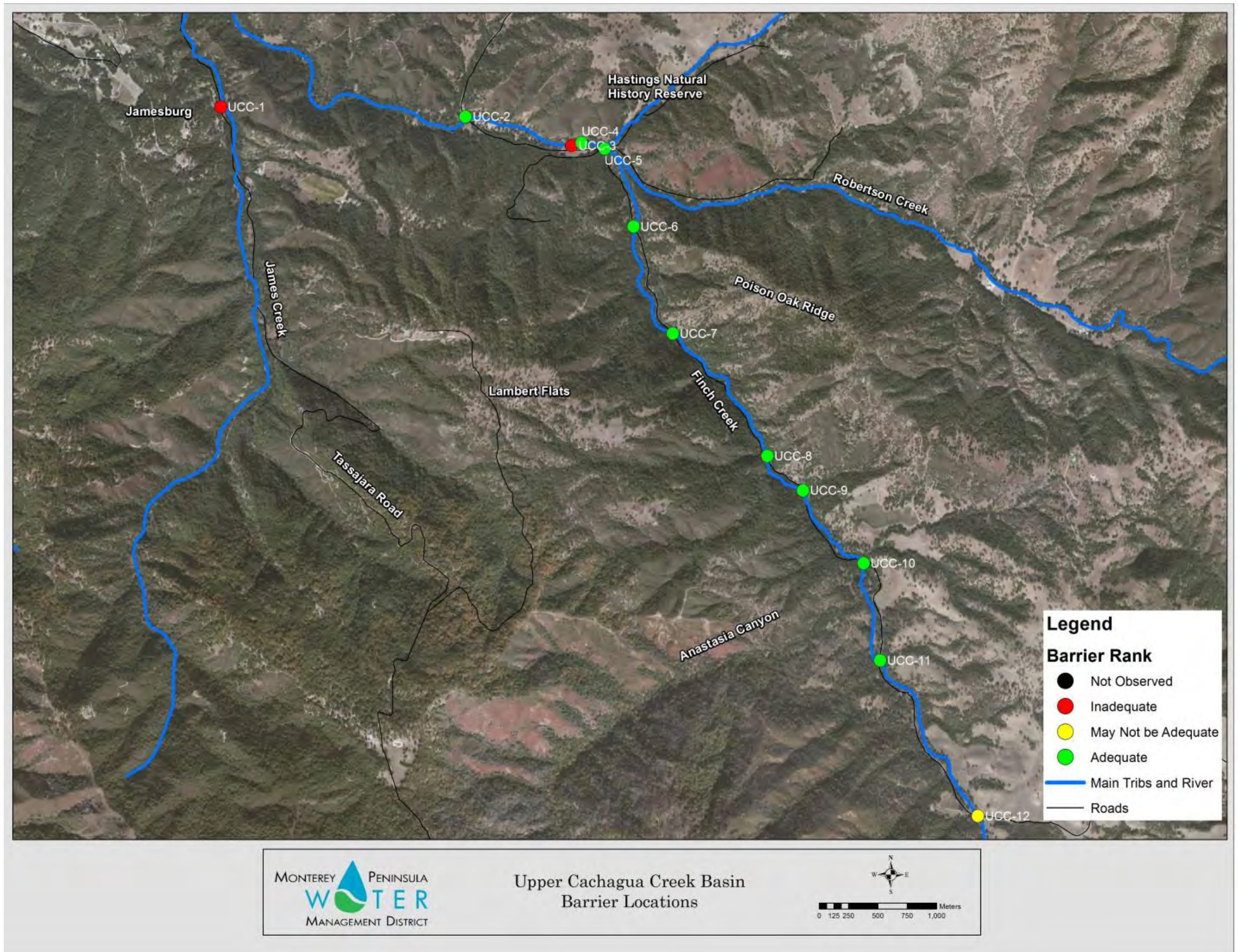

Figure 6. Location of steelhead passage barrier sites in Upper Cachagua Creek Basin (UCC). Site locations were updated and color classified after reconnaissance site visits. Classifications are the following: "Green" = Adequate Passage – likely not a barrier to any life stage of steelhead at any flow; "Yellow" = Inadequate Passage - potential barrier to some life stages or at some flows; and "Red" = Inadequate Passage - likely barrier to all life stages or at all flows.

Table 3. Rankings for barrier removal or improvement.

Fish Passage Barrier Removal/Improvement Rankings - Four Carmel River Tributaries					
Ranking #*	Location	Site	# Miles Additional Stream Access	Recommendation	Notes
1	San Clemente Cr.	Trout Lake Dam, Ladder, and Spillway	6.8	At minimum, ladder and spillway must be brought up to modern standards.	Largest manmade fish barrier on tribs. Blocks or delays access to two productive upper tributaries. Unclear how structure operates in the winter.
2	Cachagua Cr.	Ford near Boronda Cr.	8.3	Replace with small bridge	Depth and velocity barrier. Has caused a large scour hole d/s and sediment trap upstream
3	Cachagua Cr.	Ringer's Ford	8.1	Replace with small bridge	Depth and velocity barrier. Has caused a large scour hole d/s and sediment trap upstream
4	San Clemente Cr.	No Name Rd. Ford	3.0	Replace with small bridge	Ford is in very poor condition. Complete barrier at low flows.
5	San Clemente Cr.	Summer Dam near clubhouse	6.3	Remove	This structure is a total fish barier at low flows and a sediment trap.
6	Cachagua Cr. (Finch)	Hastings Reserve Ford	3.8	Replace with small bridge	Depth and velocity barrier. Has caused a large scour hole d/s and sediment trap upstream
7	Potrero Cr.	CVAC parking lot Culvert	2.8	Replace with small bridge	Complete velocity and depth barrier. Very poor design.
8	Potrero Cr.	CVAC access road Culverts	2.7	Replace with small bridge	Double culverts in poor condition. Velocity barriers.
9	Potrero Cr.	Quail Lodge Golf Course	3.2	Reconfigure reach between confluence and VG Rd.	Too steep for fish passage and no has habitat value.
10	Cachagua Cr.	Jensen's Camp Ford and Culverts	10.4	Replace with small bridge or larger culverts	Likely velocity barriers in high flows.
11	Mainstem C.R.	Flavin's Crossing (Ford)	9	Remove	Low flow fish passage barrier and sediment trap.
12	San Clemente Cr.	Summer Dam on Dormody Rd.	3.2	Remove	This illegal structure is a fish barier and sediment trap.

* Rankings are based on a combination of the severity of the barrier, the length of additional stream that would become assessable if the barrier were removed, and the general "value" of the creek for steelhead spawning and rearing.

Appendix A. Access Agreements

Task 1. Obtain Access Agreement.

Final Report from consultant, Scott Hennessy.

Scott Hennessy
294 Corral de Tierra, Salinas, CA 93908 phone: 831 601 1119
email: hennessyst@comcast.net website: shenvironmental.com

To: Larry Hampson, District Engineer
Monterey Peninsula Water Management District
5 Harris Court, Bldg. G
Monterey, CA 93940-0085

Date: September 17, 2012

Re: Steelhead Passage Barriers in Four Tributaries of the Carmel River, Access Acquisition and Permission for Work

Action Report

- Letter to landowner drafting 1-20-12 to 2-10-12
- Meeting with MPWMD staff 2-1-12
- Meet with Frank Emerson of Carmel River Steelhead Fishermen to discuss landowner contacts 2-8-12
- Mailing of landowner letter 2-20-12
- Public workshop on fish passage barriers-Carmel Valley 3-6-12 (3 attendees) and Cachagua 3-7-12 (1 attendee)
- Follow up calls to landowners 3-15-12 to 4-17-12 with 3 agreements signed.

Letter and Access Agreement from Scott Hennessy sent out to all property owners at the start of the project:

February 10, 2012

Dear People:

My name is Scott Hennessy and I am a former resident of Carmel Valley whose formative years in the early 1950s were spent learning to swim and fish in the Carmel River and some of its tributary creeks. I am writing to you to seek your help in restoring the Carmel River Steelhead population by improving fish passage up and down the watershed's streams. I am working with the Monterey Peninsula Water Management District (District) and I have attached some brief information and a Permission Agreement from the District.

I understand you may own property that includes stream channel which historical information indicates may have a potential barrier to fish passage. The District requests your permission to walk the stream channel this Spring to assess the potential fish passage barrier. The attached information explains that the District may be able to improve the fish passage without impacting your use of your land. If fish passage improvements are recommended and the District is able to secure funds for this work, there would be no cost to you and there would be an additional (separate) agreement between you and the District.

During this month I will be approaching the landowners along the Carmel River and some of the major tributaries to gain access for the District and will schedule meetings with the District and landowners in Carmel Valley to further discuss how the stream assessment will be accomplished and to provide information about potential stream channel barrier modification.

I thank you for your attention and hope you will help enhance the steelhead population by joining this effort to improve the watershed of the Carmel River.

Sincerely,

Scott Hennessy
294 Corral De Tierra
Salinas, CA 93908
831 601 1119
hennessyst@comcast.net

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

ACCESS PERMISSION FOR ASSESSMENT OF FISH PASSAGE BARRIERS IN THE CARMEL RIVER WATERSHED

DESCRIPTION OF PROGRAM

The Monterey Peninsula Water Management District (District) is the public agency charged with responsibility for integrated management of the water resources of the Monterey Peninsula. Protection and enhancement of the federally listed steelhead trout in the Carmel River and its tributary creeks is included in the District's responsibility. The population of steelhead in this watershed has declined from thousands to hundreds since the early 1960's. In an effort to improve Carmel River watershed steelhead habitat, the District would like to assess portions of the stream passing through your property where channel conditions could limit or block upstream and downstream migration of steelhead. The focus of an assessment is to gather enough photographic, topographic, and substrate (silt, sand, and rock) data in order to analyze the site for passage and determine whether modifications could be made to improve fish passage without impacting your use of your property. Assessment work would consist of one or two District staff or consultants spending several hours in the stream to gather data using photographic, survey, and other measuring devices.

The District has no funds at present to carry out stream channel modifications; however, the District would like to compile a list of potential sites for improving passage and obtain funds to carry projects that would improve fish passage. Granting access for obtaining data would not incur an obligation to the District for any future work. If the District proposes a fish passage improvement project on your property, the District would enter into a separate agreement with you for access, construction and maintenance of a project.

ACCESS ONTO PROPERTY

The Attached Access Agreement allows District staff to enter your property and to walk the stream section on your property. The sole purpose of the Agreement is to assess the stream. If you wish to discuss any concerns that you have regarding this access you may attend one of the meetings with District staff to be scheduled in Carmel Valley in the near future or address the issues to the District's representative. Access by District personnel will normally occur during business hours (8 a.m. to 5 p.m., Monday through Friday), unless other times are mutually agreed upon.

HOLD HARMLESS AGREEMENT

The District shall hold the property owner harmless for any injury to persons or property caused by District personnel while gathering assessment data.

NOTICE OF NON-RESPONSIBILITY

This agreement facilitates the assessment of current site conditions in the stream bottom, but it is not a promise by the District to make any changes to the stream.

ACCESS PERMISSION

Permission for access pursuant to this agreement shall start on_____________ and terminate on . Either party may terminate the permission by submitting written notice to the other party.

This agreement shall apply to the officers, employees, agents, successors, and/or heirs to either party to the agreement.

I/we, ____,own and control the land described by Assessor's Parcel Number ______________________________. I/we give my/our permission to the Monterey Peninsula Water Management District staff to enter this property for the purpose of the work described above subject to the conditions described above.

Signed: ___________________________________Date: ________________

Physical Address of Property: _______________________________

____

Mailing Address: __________________________

____

Phone Number: __________________________

Item 1: List of property owners contacted:

QUAIL LODGE INC
MC KAY PRODUCTIONS LLC
SANTA LUCIA COMMUNITY SERVICES DISTRICT
HILL AARON W & ELIZABETH
SANTA LUCIA CONSERVANCY
CALIFORNIA-AMERICAN WATER CO
LANG MARTHA COOPER TR
DORMODY MICHAEL H & DONNA D TRS
U S A
WHITE ROCK CLUB THE
HOFF ROBERT A & AN W CO-TRS
PRESERVE GOLF CLUB INC THE
CALIFORNIA-AMERICAN WATER CO
FLAVIN SEAN TR ET AL
SAN PAOLO MARIANO JOSEPH TR
HUBBARD STEVEN & SARAH
HUGO H & LINDA HUGO TRS
BONSPER D & PAM CO-TRS
GARDNER DOUGLAS J & SUSAN A TRS
NACHBAR LUKE S ET AL
JOULLIAN VINEYARDS
HAMBEY KATHLEEN A
RINGER DALE R & ANN
BERREY MARY TR
LEDOUX LAURENCE G TR
MOLLER RUTH ALICE & REESE WILLIAM ALBERT III
HARKINS SARA L & ELIZABETH H SUMIDA SUCCS-TRS
JOHNSON JAMES D & ANNIE-LIN TRS
REGENTS OF UNIVERSITY OF CALIF
BOEKENOOGEN PARTNERS
CAHOON KEITH ET AL

Item 2: Copies of agreements obtained:

Most agreements were verbal. Only four property owners submitted signed agreements.

Potrero Cr

ACCESS PERMISSION

Permission for access pursuant to this agreement shall start on 3/15/12 and terminate on 4/12. Either party may terminate the permission by submitting written notice to the other party.

This agreement shall apply to the officers, employees, agents, successors, and/or heirs to either party to the agreement.

I/we, Quail Lodge, Inc., own and control the land described by Assessor's Parcel Number ________________. I/we give my/our permission to the Monterey Peninsula Water Management District staff to enter this property for the purpose of the work described above subject to the conditions described above.

Signed: [signature] Date: 3/14/12

Physical Address of Property: Lawson Little @ Quail Lodge
8205 Valley Greens Dr

Mailing Address: Carmel, CA 93923

Phone Number: 831-620-8878

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5 Harris Court, Building G, Monterey, CA 93940 • P.O. Box 85, Monterey, CA 93942-0085
831-658-5600 • Fax 831-644-9560 • http://www.mpwmd.dst.ca.us

ACCESS PERMISSION

Permission for access pursuant to this agreement shall start on March 24, 2012 and terminate on Dec. 31, 2012. Either party may terminate the permission by submitting written notice to the other party.

This agreement shall apply to the officers, employees, agents, successors, and/or heirs to either party to the agreement.

I/we, the Santa Lucia Conservancy, own and control the land described by Assessor's Parcel Number 157-121-026, 239-102-004, 239-102-033. I/we give my/our permission to the Monterey Peninsula Water Management District staff to enter this property for the purpose of the work described above subject to the conditions described above.

Signed: Chris Hare Date: March 24, 2012

Physical Address of Property: 1 Chamisal Pass, 5 Chamisal Pass, 51 Chamisal Pass

Mailing Address: 26700 Rancho San Carlos Road
Carmel, CA 93923

Phone Number: 831-626-8595 x103

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ACCESS PERMISSION

Permission for access pursuant to this agreement shall start on 2/2012 and terminate on 2/2013. Either party may terminate the permission by submitting written notice to the other party.

This agreement shall apply to the officers, employees, agents, successors, and/or heirs to either party to the agreement.

I/we, Vincent Voegeli (Representing Berkeley Univ), own and control the land described by Assessor's Parcel Number 418 294 01900 / 418 293 02600. I/we give my/our permission to the Monterey Peninsula Water Management District staff to enter this property for the purpose of the work described above subject to the conditions described above.

Signed: [signature] Date: 2/23/12

Physical Address of Property: 38601 E. Carmel Valley Rd
Carmel Valley CA 93924

Mailing Address: – Same –

Phone Number: 831 659-2664

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5 Harris Court, Building G, Monterey, CA 93940 • P.O. Box 85, Monterey, CA 93942-0085
831-658-5600 • Fax 831-644-9560 • http://www.mpwmd.dst.ca.us

ACCESS PERMISSION

Permission for access pursuant to this agreement shall start on March 10 2012 and terminate on March 9, 2013 Either party may terminate the permission by submitting written notice to the other party.

This agreement shall apply to the officers, employees, agents, successors, and/or heirs to either party to the agreement.

I/we, Sam Flavin ,own and control the land described by Assessor's Parcel Number 417-101-032 . I/we give my/our permission to the Monterey Peninsula Water Management District staff to enter this property for the purpose of the work described above subject to the conditions described above.

Signed: [signature] Date: 3/13/12

Physical Address of Property: 17990 Cachagua Rd.
Carmel Valley CA

Mailing Address: 700 Grove St.
Monterey CA 93940

Phone Number: 831 373 3978

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Appendix B:

Reconnaissance Surveys and Barrier Assessment Reports, Including Photos:

1) Potrero Creek Basin (PCB 1 – 9). Pgs. 29–48
2) San Clemente Creek Basin (SCC 1 – 12). Pgs. 49-79
3) Pine Creek (PC 1-2). Pgs. 80-85
4) Lower Cachagua Creek (LCC 1-13). Pgs. 86-96
5) Upper Cachagua Creek (UCC 1-12). Pgs. 97-109
6) Main Stem Carmel River (CR-1). Pgs. 110-114

Potrero Canyon Basin (PCB 1-9)

Survey dates: 4/25/12 (flow = 0 cfs) (Beverly Chaney)
4/30 - 5/14/12 (BC and Casey Lanier)

Confluence: 10N 0601169.64 / 4044057.24
36° 53' 65.9" / 121° 86' 95.41" 44 ft. elevation
Top of watershed: 10N 06053319.57 / 4038638.75 1,210 ft. elevation
Potrero Creek drainage = 5.2 sq. miles

The lower ~ quarter mile of Potrero Creek flows across hole #6 of the Quail Lodge Golf Course adjacent to Rancho San Carlos Road **(Sites PCB-1 and PCB-2).** The reach was reconfigured in ~1996 after the banks failed in the large 1995 floods. To improve conditions for steelhead migration, rock weirs and V-log structures were installed. While these structures likely did improve access through the golf course, overtime they have started to fail as the pools have filled, scour holes have developed, and the banks have sloughed in. In addition, the streambed itself has become very narrow and is little more than a shallow ditch across the fairway. A sparse row of willow trees was planted along each bank but these are kept severely pruned to small shrub size and provide little if any habitat value to the creek.

This entire reach needs to be evaluated and re-engineered. The channel needs to be lengthened to decrease the channel slope and riparian vegetation needs to be replanted. Doing so would greatly improve both steelhead access to the upper watershed and make the area more aesthetically pleasing. The creek could be made to be natural feature of the course instead of a drainage ditch.

Upstream of the golf course, the creek flows through three culverts on Carmel Valley Athletic Club (CVAC) property. The middle culvert under the main parking area access road needs to be replaced with a bridge **(Site PCB-5)**. The outlet is perched and the culvert itself is a long, smooth, steep metal pipe that likely limits upstream fish passage to a few days per season. The upper barrier consists of twin culverts under a roadway between two parking area **(Site PCB-6)**. The bottoms of both culverts are corroded leaving large gaping holes onto the rocks beneath. This structure could easily be replaced with a small, clear-span bridge.

The majority of the Potrero Creek watershed is located in the Santa Lucia Preserve, a 22,000 acre parcel that contains the headwaters of four major Carmel River tributaries: Potrero Creek, Robinson Canyon Creek, Garzas Creek, and San Clemente Creek. The Preserve is crisscrossed with roads, both paved and dirt, large private estates, a golf course, stables and facilities, maintenance structures, and water supply lakes and ponds. Located just past the main gate on Rancho San Carlos Road, Potrero Creek passes through a large diameter culvert **(Site PCB-7).** Steelhead access through this barrier could be improved by installing additional gradient control boulders downstream of the culvert outlet and by widening the inlet with the removal of the T-posts and stacked concrete bags. Upstream of here, the creek passes under three large new wooden bridges **(Sites PCB-8-10)**. These modern, clear-span bridges are not barriers to steelhead passage.

Site PCB-1. **Confluence - Potrero Cr. and Carmel River.**
Yellow UTM: 10N 0601170/40444066

Confluence is overgrown with brush and is very shallow due to a built-up sand bar and eroding sand banks.

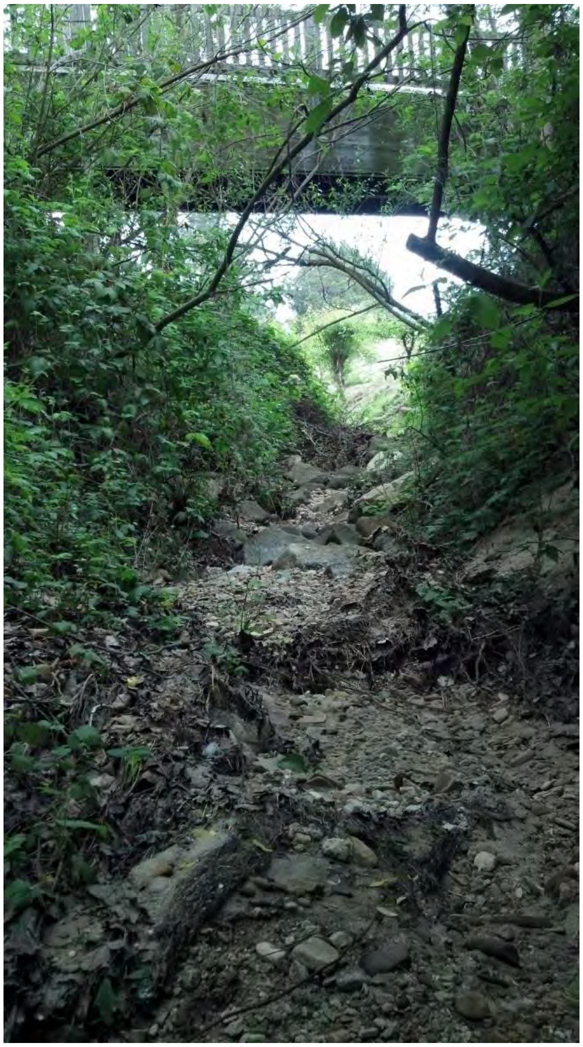
Site PCB-1. Potrero Cr/Carmel River confluence, looking upstream (u/s).

Site PCB-1. Potrero Cr/Carmel River confluence, looking downstream (d/s).

<u>Site PCB-2</u>. Confluence to Valley Greens Road - Multiple passage issues.
Red/Yellow

2a) **Steep Riffle Boulder-lined Channel** - Confluence to Foot Bridge (~150').
UTM: 10N 0601180/40444028

Creek bed is narrow and lined with 1-2' dia. boulders. Gravel and woody debris are lodged between boulders. Channel has ~1.5% grade.



Site PCB-2a. Steep Riffle Channel - looking u/s from confluence.

Steep Riffle Channel - looking d/s from Golf course Foot Bridge

2b) **Foot Br. to Rock Weirs** (~150')
UTM: 10N 0601192/40444590

No actual creek bed/channel, just a "V" notch through the grassy golf course fairway. A single row of willows has been planted along both banks but trees have been severely trimmed and offer no habitat or shade (bonsai). Grass and weed clippings have been thrown into channel.

Site PCB-2b. Lack of channel through golf course, from foot bridge looking u/s.

2c) Rock Weirs to Large Scour Hole (~100')

A steeper section with large boulder rock weirs every 20'. Scour hole (sink hole) is 4.5' deep, 6' diameter with a height difference of 2.5' between top and bottom lip of hole.

Site PCB-2c. Steep rock weirs

Site PCB-2c. Deep scour hole above rock weirs.

2d) **Scour hole to V-Notch Log Weir** (~60')
UTM: 10N 0601184/40443877

No channel, just a 12" shallow cut through grass and brush. Log weir consists of 6, 12" diameter logs set in a sharp "V" pointing upstream. Scour hole, 4' deep, 1' diff. between weir top and bottom hole lip. Woody debris has collected in scour hole, and substrate is coarse sand.

Site PCB-2d. V-notch log weir, looking u/s.

Site PCB-3. **Valley Greens Rd. Culverts** (~100 yds.)
Yellow UTM: 10N 0601229/4043731 d/s end

Channel improves through this reach even with some LWD obstructions. There is a narrow band of riparian vegetation; substrate is a mix of sand and gravel.

Culverts: 2 corrugated metal arches (?), ~ 7'dia, 4' high, 80' long. Natural substrate bottom (sand/small gravel) but little variability; very little grade change; no scour pools.

Site PCB-3. Valley Greens Rd. culverts - Looking upstream.

Site PCB-3. Valley Greens Rd. culverts - Looking downstream.

Site PCB-3. Valley Greens Rd. – L/B culvert entrance and streambed looking upstream

<u>Site PCB-4.</u> **Valley Knoll Road Culvert**
Yellow 36° 31' 52.9" / 121° 52' 04.4"

Upstream of Valley Greens Road, the riparian vegetation gets thicker, but much of it is weedy. Substrate is muddy-sand and small riprap. Channel is confined.

Site PCB-4.

Photo 1) Riprap weir cemented across channel and log jam just d/s of culvert. Culvert outlet covered in vines. 6" of mud in pipe. Cement apron for 25'.

Photo 2) Inlet to culvert. Granite riprap cemented on either side of inlet. 1' sand-mud.

<u>Site PCB-5</u>. Carmel Valley Athletic Club (CVAC) Culvert (between parking lots).
Red/Yellow **Rancho San Carlos Road**
36° 31' 49.8" / 121° 52' 03.7"

Pipe is smooth metal and is in two sections. There is a break in slope and angle at 75' where two pipes are riveted together. Upper end pipe is slightly smaller diameter. There is a 6-12" rust hole in bottom and pipe is being undercut. Smooth metal pipe, 100' long, 5' diameter. Outlet free-falls ~6" into a sand pool. Likely a velocity and depth barrier.

Site PCB-5. CVAC culvert outlet and plunge pool.

Site PCB-5. Plunge pool and d/s channel from culvert outlet.

Site PCB-5. Inlet and channel u/s of culvert.

<u>Site PCB-6</u>. Upper CVAC Culverts (access road to upper parking lot)
Red/Yellow **Rancho San Carlos Road**
36° 31' 44.8" / 121° 52' 02.6"

Double culverts under small access road to upper parking lot. Both are in poor condition with large rusted out holes in bottom and bent/warped metal. Water is flowing into the holes and under the pipes. There is a large concrete apron at outlet with a 2' drop onto creek bed.

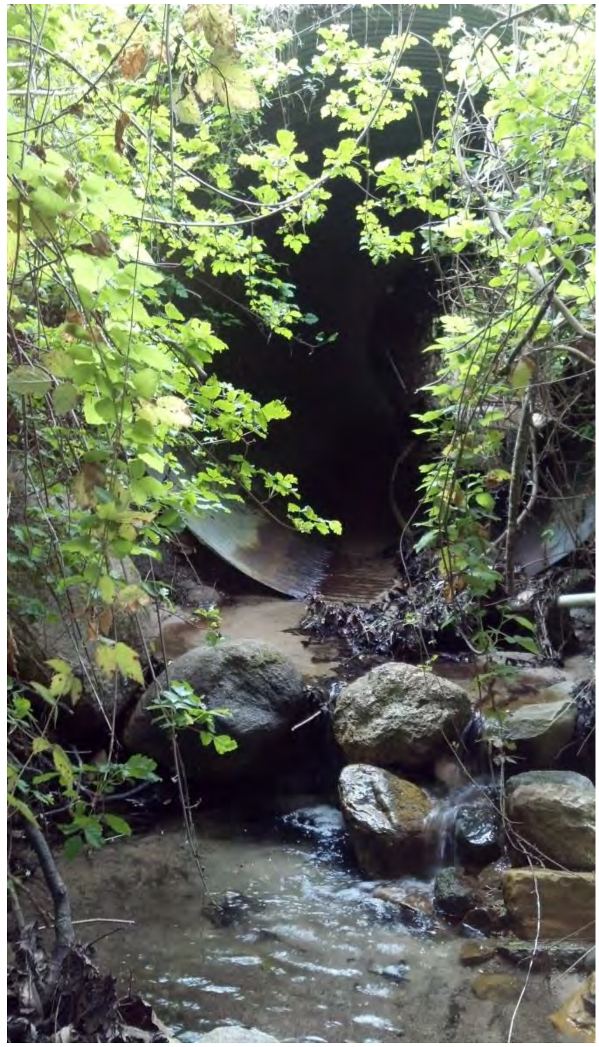
PCB-6. Outlet apron and drop off.

PCB-6. Inlets. Channel is more open here. Vegetation is vines/weedy/trees. Substrate is sand/small gravel and concrete rubble.

PCB-6. Interior of R/B culvert showing large section of rusted out pipe.

Site PCB-7. **Santa Lucia Preserve Culvert. Chamisal Pass Road** (just past main gate).
Yellow 36° 31' 33.3" / 121° 53' 04.7"
Continuous flow = <0.5 cfs, no fish.

Very large, 7.8' diameter, stream-grade culvert with a sand apron and 1'+ boulder rock-weir drop-off at outlet. Inlet is narrowed by a concrete bag wall and T-posts protruding into entrance. Substrate is sand and small gravel, riparian is thick vines and broken tree branches. Channel is incised.



Site PCB-7. Photo #1. Looking d/s at brush and sandy substrate below the culvert.
Photo #2. Culvert outlet showing the boulder weir and sand apron.

Site PCB-7. Photo #3. Looking d/s through culvert.
Photo #4. Culvert inlet showing the narrow concrete and T-post entrance and sandy substrate.

<u>Site PCB-8</u>. **Santa Lucia Preserve, Bridge**. Wild Boar Run Rd.

Green 36° 31' 34.44" / 121° 52' 03.4"

5/1/12 **-** Continuous flow = 0.5 cfs. Two 3-6" steelhead observed.

5/14/12 - Dry.

New, clear-span bridge. Not blocking any flow.

<u>Site PCB-9</u>. **Santa Lucia Preserve, Bridge**. Potrero Trail Rd.
Green 36° 31' 34.44" / 121° 52' 03.4"
5/1/12 **-** Continuous flow = 0.5 cfs.
5/14/12 – <0.25 cfs.
Four 3-6" fish observed at bridge and ~10 3-7" SH pool below logjam 100' d/s.

New, clear-span bridge, substrate is very sandy and there is a line of T-posts across channel d/s of bridge but it's not blocking any flow.
**See photo below for information on a log jam that needs to be removed.

Site PCB-9. Photo #1 looking u/s. Note T-posts. Photo #2 looking d/s, note sandy substrate.

Site PCB-9. Log jam located ~100' d/s of PCB-9 bridge. Complete barrier at low flow. Jam consists of a fallen alder tree with lumber and small woody debris stacked up against the tree. The water sieves though the branches, dropping 3 feet into a 2.5 foot deep pool where we observed 10 juvenile steelhead.

**We (BC/CL) broke up the jam making a clear, 2 foot dia. hole for fish passage. Fallen tree should be removed.

<u>Site PCB-10</u>. **Santa Lucia Preserve, Bridge**. Potrero Trail Rd.
Green 36° 30' 24.90" / 121° 51' 07.7"
5/14/12 **-** Continuous flow = 0.75 cfs.
Six 3-6" fish observed at bridge.

New, clear-span bridge. Not a barrier. Substrate is improving with more gravel/small rock and less sand. Also more pool and riffle habitat than further d/s.

Site PCB-10. Photo #1. Looking u/s. Photo #2. Looking d/s**.**

Potrero Creek watershed from the top of Santa Lucia Preserve (Rancho San Carlos).

Looking d/s towards the Carmel River and Carmel Valley.

Looking across the valley at the watershed divide with Robinson Canyon Creek.

San Clemente and Black Rock Creeks (SCC 1-12).

Survey dates: 5/8/12 -5/22/12, and 8/6/2012 (flow ~ 3 cfs)
(Beverly Chaney and Casey Lanier)

Confluence with SC Reservoir:	10N 0601169.64 / 4044057.24	
	36° 26' 04.3" / 121° 42' 36.1"	525 ft. elevation
Top of watershed:	10N 06093002.5 / 4033127.6	3,000 ft. elevation

San Clemente Creek drainage = 15.6 sq. miles

We entered San Clemente Creek from the District's gaging station, located approximately 300 meters upstream of the San Clemente Reservoir (SCR) influence zone at 36° 25' 55" / 121° 42' 41", (staff plate was reading 1.73' at the time of the survey) and walked downstream towards the confluence with the reservoir **(Site SCC-1)**. The reservoir end of the old inundation zone is thickly covered with small trees, brush, and weedy vegetation (stinging nettles). We were unable to walk to the confluence and were forced to located and explore it with the use of a small boat from the lake side. The creek enters the lake in the middle of the west arm, not from the narrow end (see photo). The channel is ~ 10 feet wide and 6 feet deep, posing no migration barriers. Brush had recently been cut near the mouth.

Slightly upstream from the confluence, but still in the SCR inundation zone, we located three log jams **(Sites SCC-1a,b,c).** The furthest upstream one was a significant barrier as it was comprised of a large fallen tree trunk, and multiple intertwined pieces of both smaller trees and large lumber beams. All three log jams should be removed as part of the SCD removal project in 2013-2015 (see updated photos from Dec. 2013 below).

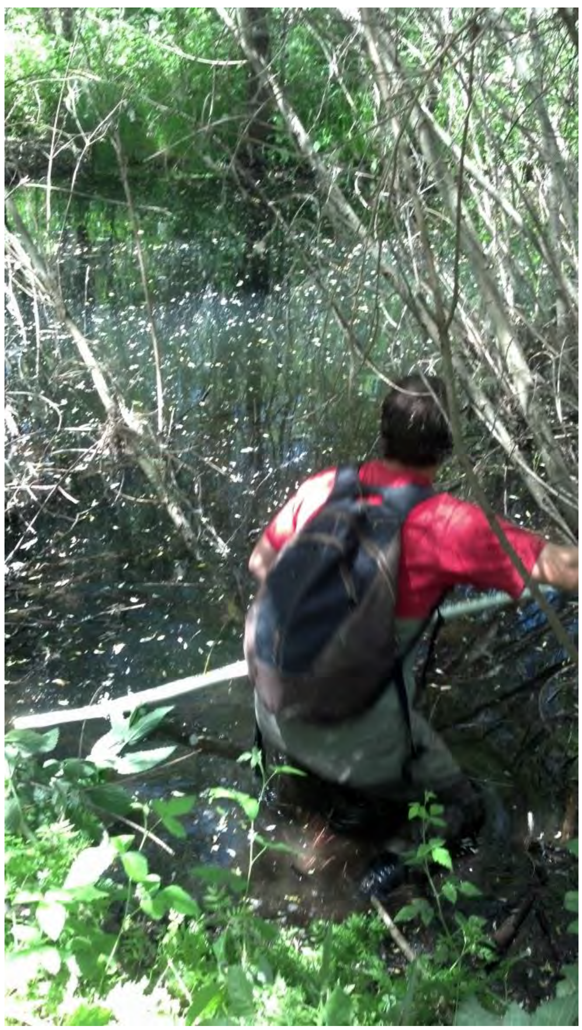
No known barriers exist between the log jam mentioned above and **(Site SCC-2)**, Trout Lake Dam.

San Clemente Rancho (SCR) is a private development of ~ 100 mostly summer cabins situated along San Clemente and Black Rock Creeks and a seasonally filled reservoir. Trout Lake Dam **(Site SCC-2)** is a large (~20' wide x 10' high) seasonal structure built in ~1963 that impounds a small-sized reservoir (~100 AF). Modifications made to the lake and the dam outlet in in the 1990's and early 2000's have improved native steelhead migration and downstream flow releases to San Clemente Creek. However, based on our observations, this dam, and its associated fish ladder, is a major barrier to both upstream and downstream juvenile migration and is likely a barrier to adult passage as well since the ladder appears to be inadequate. However, both NMFS and CDFW are aware of this structure, and apparently have okayed the continued summer impoundment and the stocking of rainbow trout. .

Black Rock Creek joins San Clemente Creek in SCR. No known barriers exist between the confluence and the natural barrier known as the "Big Dipper" **(SCC-11),** a 15-foot high bedrock chute that is impassable to upstream steelhead migration. Slightly upstream of this chute is a large (~70') waterfall **(SCC-12)** and the White Rock Lake Dam **(SCC-13)** located at the White Rock Gun Club.

<u>Site SCC-1</u>. **Confluence – San Clemente Cr. and San Clemente Reservoir.**
Yellow UTM: 10N 0601169.64 / 4044057.24
36° 26' 04.3" / 121° 42' 36.1"

Site SCC-1. In 2012 the confluence was very overgrown with thick vegetation (see photos below) and was difficult to examine. In 2013, this entire reach was stripped of vegetation and is being reconfigured as part of the San Clemente Dam Removal Project.



<u>SCC-1a</u> - SCR inundation zone log jams. These log jams will be removed as part of the SCD removal project.
Yellow 36° 25' 54.5" / 121° 42' 42.5"

Upstream of the inundation zone, approximately 100m downstream of the MPWMD SC Cr. gauging station the creek runs free and clear.

UPDATED 12/2013 - SCD Removal Project

SCC-1 and 1a,b,c - The entire SCC inundation zone is being completely modified. The Carmel River will be re-routed through this canyon (in 2015) and all existing vegetation has been removed. It is unclear whether the existing SCC channel will be passable in the 2013/14 winter.

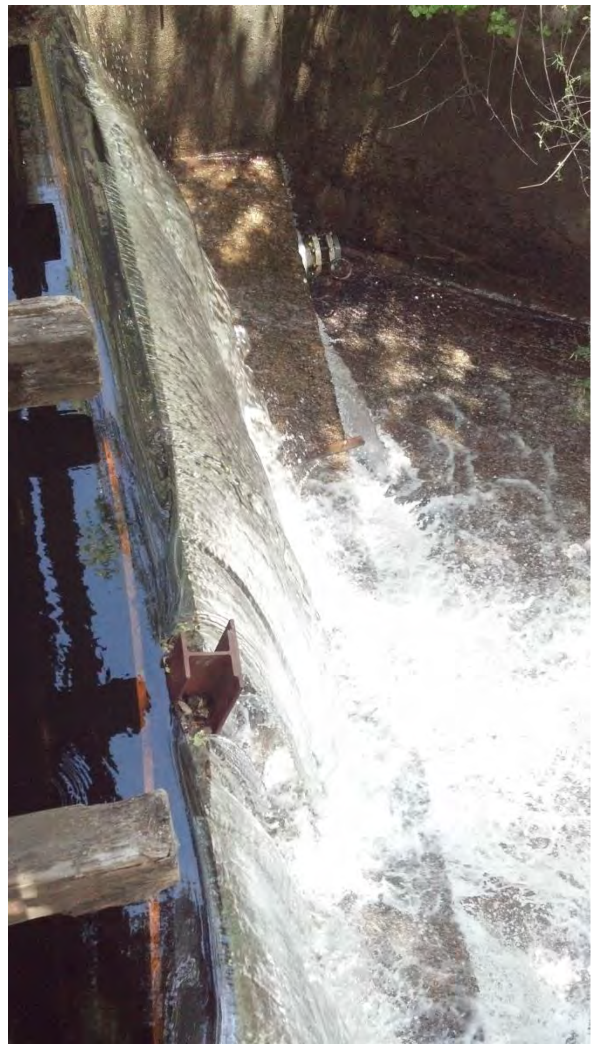
Site SCC-2. **San Clemente Rancho Dam fish ladder and spillway.**
RED 36° 25' 30.3" / 121° 43' 35.7"
5/21/2012 – ~3 cfs.

This long concrete spillway is completely impassable to upstream summer migrants and would likely cause significant harm to downstream migrants. The fish ladder looks to be of poor design and is in disrepair likely affecting upstream winter adult migration. Neither meets modern standards for fish passage and should be completely redesigned or removed.

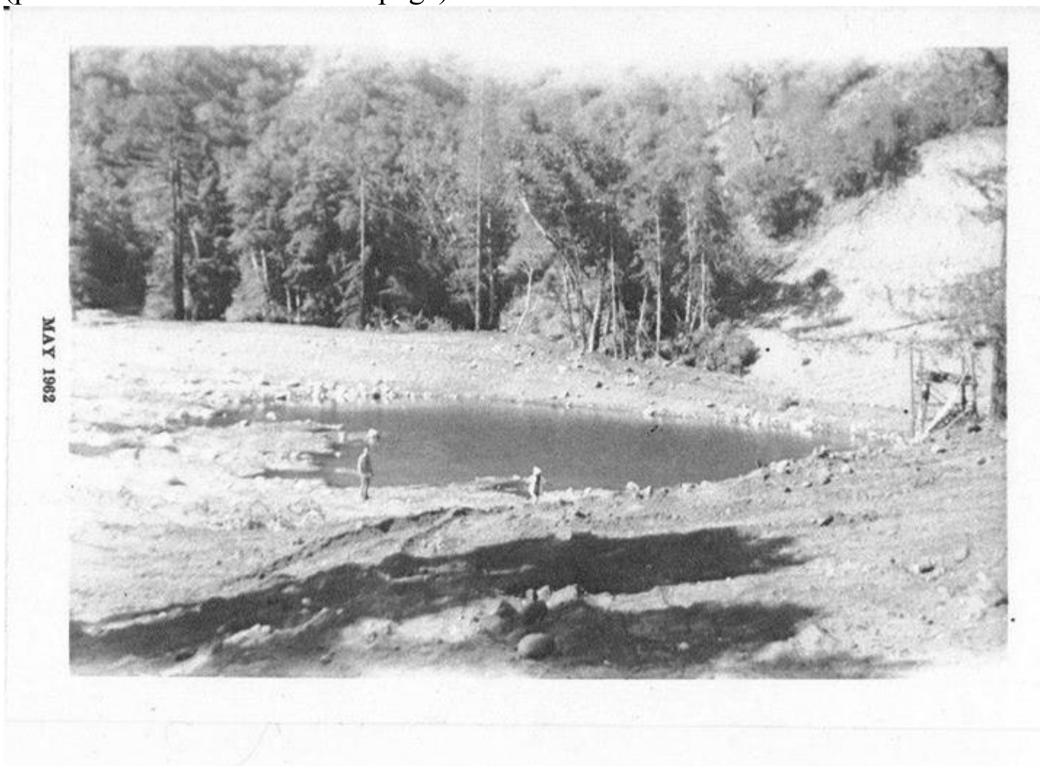
<u>SCC-2</u>. Ladder close-up from downstream (left photo) and from upstream (right photo).

<u>SCC-2</u>. **San Clemente Rancho Dam.**
RED 36° 25' 30.6" / 121° 43' 37.2"
5/21/2012, ~3 cfs.

The dam is constructed with steel I-beams, braced with 3" metal pipes, supporting a 10' high 4x10' beam wall covered with black plastic on top of a concrete base structure. The dam face was bowing significantly so I did not feel safe working below it. MPWMD modified the outlet valve works in 2002 to improve the bypass of water in the spring as the reservoir fills. Dormody Road crosses above the spillway at the dam.



Trout Dam and Reservoir during construction - 1962.
(photos from SCR Facebook page).



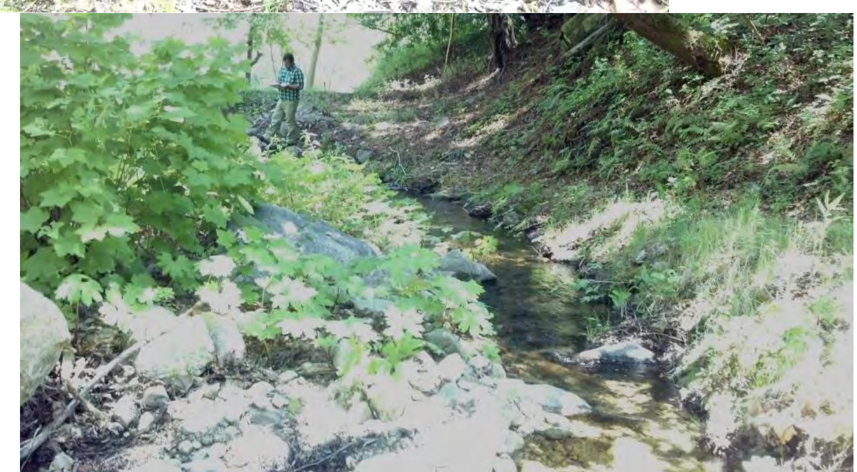
SCC-2. Trout Lake Dam's new main drain and gate valve installed in 2013 (photo from SCR Facebook page).

<u>SCC-2a</u>. **San Clemente Rancho Trout Lake.**
YELLOW? 36° 25' 30.6" / 121° 43' 37.2"
5/21/2012, ~3 cfs.

The lake is divided into two sections separated by a floating pontoon wall. On the right bank side (left side of photo), large (12+") hatchery reared, sterilized (?) rainbow trout are stocked each spring for home owners and guests to fish. On the left bank side of the pond (right side of photo), San Clemente Creek flows around the contained "lake side". Native steelhead are supposed to be able to migrate around the reservoir in the winter when the lake is drained. The floating wall appears to be held down along the bottom with rocks and there is a submerged concrete chute (lower photo) that is likely for draining the reservoir side.

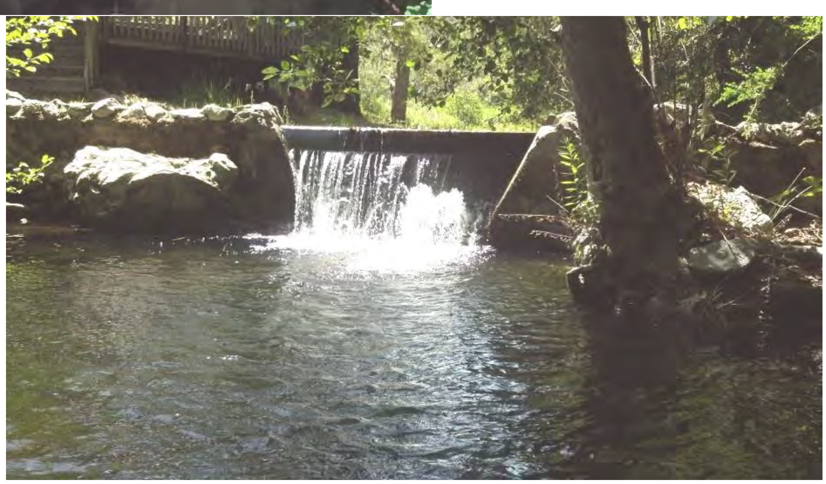
<u>SCC-3</u>. **San Clemente Rancho Trout Lake Inlet Culvert.**
GREEN 36° 25' 30.4" / 121° 43' 45.7"
5/21/2012, ~3 cfs.

The inlet diverts water from a San Clemente Creek side channel through a metal port (lower photo) into a screened pool then through a culvert into the stocked trout side of the pond. The screens are loosely placed and are in disrepair and would not keep fish from moving through the pipe in either direction.



SCC-4. **Summer Dam.**
RED 36° 25' 20.8" / 121° 43' 59.7"
5/21/2012, ~3 cfs.

Located across from the clubhouse, this dam is constructed from cemented large cobbles and a 2.8' deep, flat-bottomed, concrete V-notch holding four planks. The substrate below the dam consists of large cobble/boulders while above the dam its primarily sand. The slack water pool extends 84 feet upstream. While the boards are in place this dam is a complete migration barrier. Without the boards, the wall may still be a velocity barrier and could easily trap LWD.



SCC-4. These two photos show the summer dam from upstream and the large amount of sand deposits behind the dam.

SCC-5. **GREEN**

Black Rock Cr. Br. Dormody Rd. (at confluence with San Clemente Cr. in San Clemente Rancho)
36° 25' 20.2" / 121° 44' 17.4"
5/21/2012, ~1 cfs.

Clear-span modern bridge. No barrier.

SCC-6. **San Clemente Cr. Br. Dormody Rd. (at confluence with Black Rock Creek)**
GREEN **(New Site number)**
36° 25' 20.2" / 121° 44' 17.5"
5/21/2012, ~2 cfs.

Clear-span modern bridge. No barrier. No photos taken (similar to SCC-5).

SCC-7. **New Summer Dam, San Clemente Cr. Br., Dormody/Madrone Rd.**
YELLOW **(New Site and number)**
36° 25' 22.1" / 121° 44' 21.7"
5/21/2012, ~3 cfs

This new looking concrete structure, located almost under a new house deck, is a total barrier to both adults and juveniles if the metal weir boards (shown under the house) are in place and a partial barrier to juveniles if the boards are out. There is an 8” pvc pipe that runs through the base of the dam but the upstream end was buried under the substrate.

We found three of these concrete summer dams (one with the boards in), and several loose stacked rock dams located behind and around the RSC cabins on both creeks. These need to be addressed.

SCC-8. **No Name Rd. Ford.**
Red 36° 25' 24.5" / 121° 44' 25.7"
5/21/2012, ~3 cfs.

Located on San Clemente Creek, ~0.25 mile downstream from the entrance gate, this concrete ford is a major migration barrier that needs to be replaced with a small bridge. The old culvert is completely smashed and filled with debris. At this flow, 100% of the stream passes underneath the left bank side of the ford but no fish can pass due to failing concrete and a large amount of woody debris. At higher flows, water would go over the top of the ford but the downstream boulders are likely a barrier as well. Above the ford, the substrate is shallow sand.

Boulder substrate downstream of ford.

Sand substrate upstream of ford.

At low flow, the entire creek passes underneath the ford where passage is blocked by woody debris and rocks.

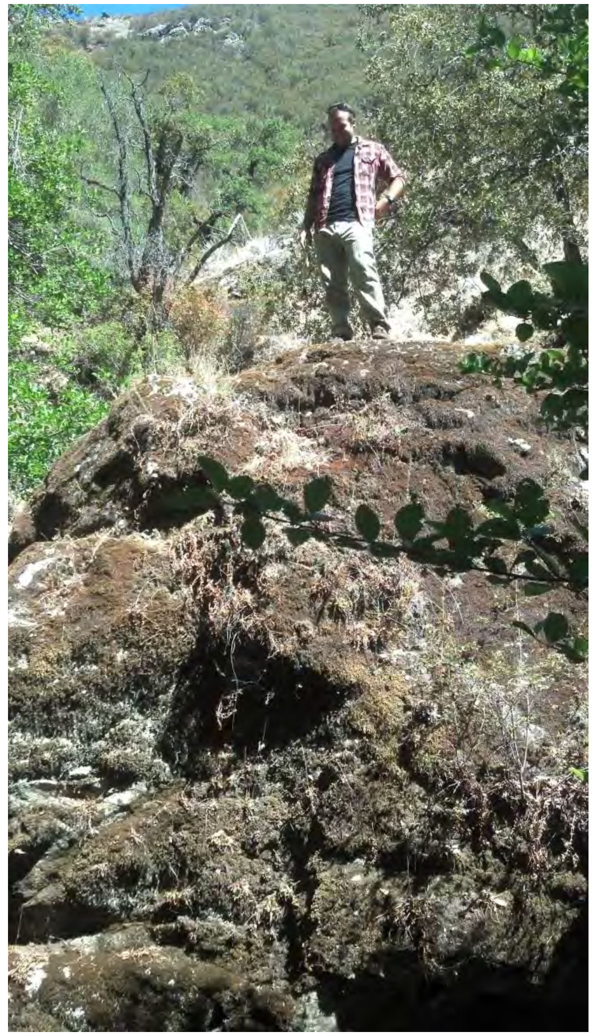
<u>SCC-9</u>. **San Clemente Trail / Dormody Rd, Santa Lucia Preserve, Bridge**
GREEN 36° 26' 4.37" / 121° 46' 11.27"
5/22/2012, ~3 cfs.
Clear-span, modern bridge. No barrier. No photos.

<u>SCC-10</u>. **Arroyo Sequoia Rd / San Clemente Trail, Santa Lucia Preserve, Bridge**
GREEN 36° 26' 1.9" / 121° 47' 2.2"
5/22/2012, ~3 cfs
Clear-span, modern bridge. No barrier. No photos.

SCC-11. **Black Rock Creek. Complete Natural Barrier, bedrock chute "Big Dipper".**
RED 36° 24' 42.1" / 121° 46' 19.1"
8/6/2012, ~0.25 cfs

The anadromous steelhead reach of Black Rock Creek (a tributary to San Clemente Cr.) is in a rugged canyon located between San Clemente Rancho and the White Rock Gun Club.

Located approximately 2.8 miles upstream of the confluence, this ~18-foot high, slick bedrock chute is a total/complete barrier for upstream fish migration. Small fish could pass downstream over the falls, but would likely be injured. We observed ~10 fish (3-8") in the chute's plunge pool and no fish upstream.



SCC-12. **Black Rock Creek. Complete, Natural Falls Barrier.**
RED 36° 24' 51.3" / 121° 46' 11.9"
8/6/2012, ~0.25 cfs

This ~70' high waterfall is a total/complete barrier for upstream fish migration. We observed one fish (~7") that looked sick in the outlet pool. The water quality appeared poor.

Photos below show: 1) the creek channel downstream of the dam; and 2) the dam's outlet pipe and plunge pool.

Photos below show: 1) poor WQ in the plunge pool; 2) looking up the waterfall/chute (dry); and 3) looking down the dam face towards the plunge pool.


<u>SCC-13</u>. **White Rock Lake Dam, Black Creek**

See Notes 36° 24' 43.1" / 121° 46' 21.2”

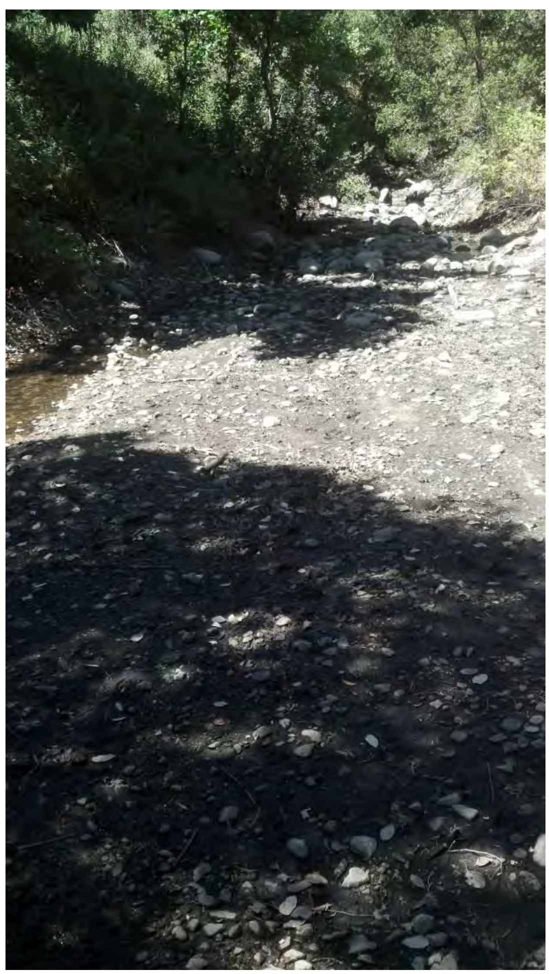
8/6/2012

Built in 1926, this dam is located on White Rock Gun Club property and is stocked with catchable-sized trout. While it would be a complete barrier to steelhead migration, it is located upstream of two natural barriers (<u>SCC-11</u> and <u>SCC-12</u>) so it should not be significantly impacting natural steelhead populations.

Photos below show: 1) the Black Rock Creek Dam and foot bridge; 2) and 3) close-up detail of the outlet works.

Photos below show 1) the Black Rock Creek Dam and foot bridge; and 2) Black Rock Creek Reservoir.

Photos below show 1) Black Rock Creek Reservoir, and 2) Black Rock Creek above the reservoir (dry).



Map of White Rock Gun Club

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Pine Creek Confluence (Site PC-1)

Survey dates: 8/14/12 (Dry) (B. Chaney and C. Lanier)

Site PC-1. **Pine Creek Confluence and Carmel River** – GRADE YELLOW/RED
Yellow/ Red UTM 10N 0617330.56 / 4029973.44
36° 24' 27.82" / 121° 41' 29.13" 675 ft. elevation
Pine Creek Drainage = 7.8 sq. miles

The lower 200-foot reach of Pine Creek was surveyed on August 14, 2012. Carmel River flow was 7 cfs and Pine Creek flow was 0 cfs through the survey site. The natural barrier that has been reported ~3 miles upstream was not observed due to the inaccessible steep, rugged terrain. Juvenile steelhead (< 3") were observed in the Carmel River both above and below the confluence.

Lower Pine Creek is primarily a steep boulder cascade, ending in a large, deep bedrock pool in an isolated section of the Carmel River midway between Syndicate Camp (Cachagua) and the Los Compadres Cabin (u/s SCR delta). Both adult and juvenile (fry) steelhead have been observed in Pine Creek in the past by MPWMD staff. MPWMD maintains a streamflow monitoring station 565 feet upstream of the confluence. Winter flows typically range from 10-100 cfs while summer flow is < 1 cfs.

Although not a total barrier to migrating steelhead, clearly this natural feature can block adult upstream migration to spawning glides during low flow years. The loss of juvenile fish in the spring is also possible if the tributary dries too early for fish to reach the main river. In addition, as the Carmel River channel continues to down cut from the lack of sediment recruitment, the lower Pine Creek cascade continues to steepen. Physically modifying this reach seems implausible due to the remote nature of the area and the naturally steep watershed of the creek. Additional sediment releases from upstream and good water management practices would seem to offer the best chance of maintaining adequate fish passage in this important tributary.

Site PC-1. Pine Creek Confluence with Carmel River.

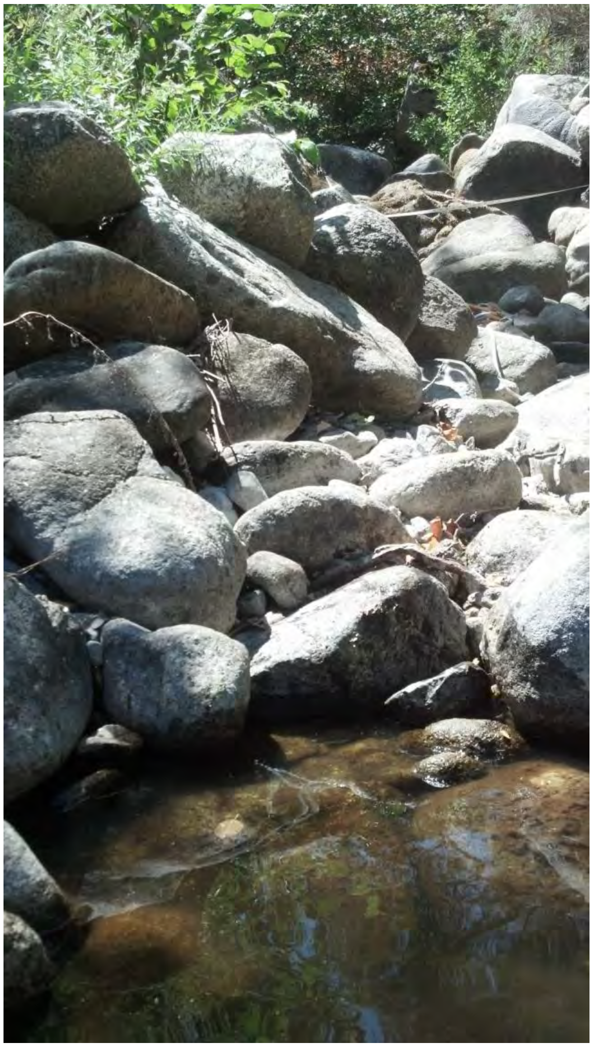

Photo 1 (left side): Looking up Pine Cr. cascade from Carmel River pool.
Photo 2 (right side): Looking down the cascade towards the Carmel River pool.

Photo 3) Large tree root mass growing across channel ~50' upstream of the confluence. Fish must jump this in most flow conditions.

Photo 4) Lower cross section site. Note the large boulders in the low flow channel.

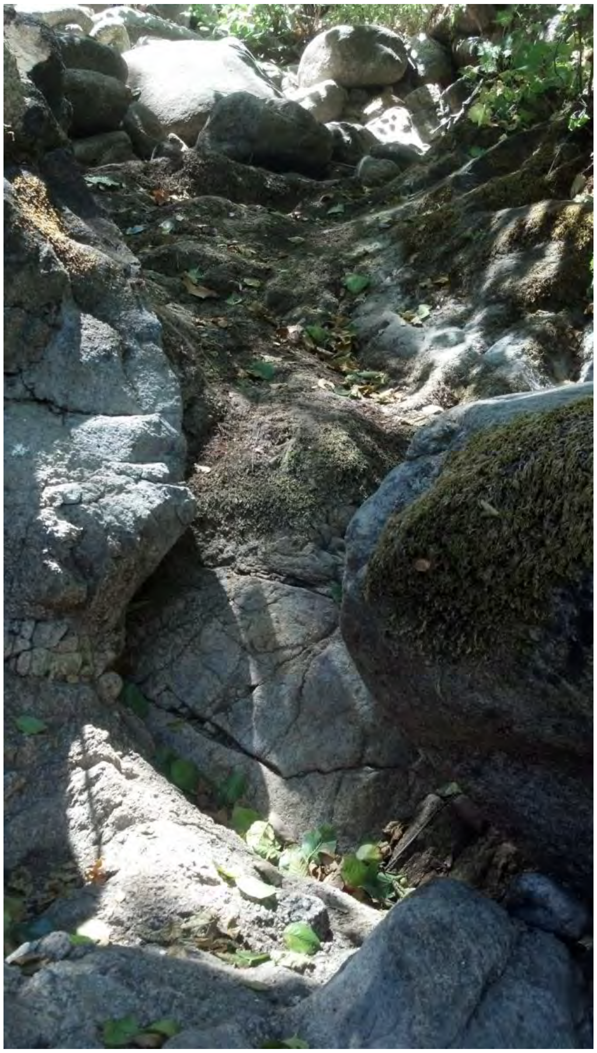 

Photo 5) (left side): Bedrock chute ~60 feet upstream of the confluence.
Photo 6) (right side): Steep boulders ~130 feet upstream of confluence.


Photo 7) Large boulders stacked near the top of the cascade reach.

Photo 8) Looking upstream, above the cascade reach (150 feet upstream of confluence). Substrate is still primarily boulders but there are also cobbles and some gravel. Slope is more gradual and there are several small resting pools.

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Lower Cachagua Creek Basin – Cachagua Creek (LCC Sites: 1-13)

Survey dates: 6/21/11 (~7cfs) (Beverly Chaney)
7/30/12 (Dry) (BC and Casey Lanier)
3/27/2013 (~1 cfs) (B. Chaney)

Confluence with CR:	10N 0620191 / 4029190	
	36° 24' 7.27" / 121° 39' 34.37"	830 ft. elevation
Top of watershed:	10N 0628462 / 4019439	5,000 ft. elevation

Cachagua Creek Drainage = 46.3 sq. miles

Despite repeated efforts, the District was not able to gain permission to survey most of the sites on private property in the Cachagua Creek Basin. Most of the sites photographed on 6/12/12 were visually observed from Cachagua Road. The confluence was observed on 3/27/13 from the Carmel River.

The basin was divided into two separate sub-basins: Lower Cachagua Creek (LCC) and Upper Cachagua Creek (UCC) which includes James and Finch Creeks. Of the barriers that we were able to physically survey, most were Monterey County (MoCo) bridges along Cachagua Road and Carmel Valley Road. There are six MoCo bridges in the LCC and ~10 in the UCC. Although they vary in design and age, none appear to be a significant barrier to steelhead migration at this time.

Conversely, there are four known separate sites where potentially serious migration barriers exist. One of them is the ford located at the Hastings Reserve caretaker's house in the UCC **(Site UCC-3)**. We were granted permission to survey this site in detail and believe the ford should be replaced with a clear-span bridge. The other three are located in the LCC on private property. The Jenson Camp ford **(Site LCC-3)** behind the Cachagua General Store was not surveyed but was carefully observed and photographed. This road crossing has four culverts that could clog with debris or be velocity barriers. Two other private fords **(Site LCC-9 and Site LCC-10)** were only observed from the road but appear to be likely migration barriers to both upstream and downstream migrants. Both fords look like they could be replaced with bridges. It is hoped that these sites can be surveyed in the future and then re-engineered to improve fish passage.

Site LCC-1. **Cachagua Creek Confluence and Carmel River**
Green UTM 10N 0620191 / 4029190
36° 24' 7.27" / 121° 39' 34.37"

The confluence was observed during the redd survey on March 27, 2013. Carmel River flow was ~20 cfs and Cachagua Creek flow was ~1 cfs. There does not appear to be any barriers to steelhead migration.

Site LCC-1. Cachagua Creek Confluence.

Site LCC-1. Cachagua Creek entering large CR pool from left side of photo.

Site LCC-2. **Nason Road Bridge**. **MoCo Bridge #527**
Green 36° 24' 1.2" / 121° 39' 30.3"
7/30/2012 – Dry.

Although there are bridge supports in the center of the channel, they are unlikely to cause a migration barrier. Channel is wide and shallow. Substrate is a boulder/cobble/gravel mix and the riparian vegetation is sparse.

Site LCC-2. Nason Road Bridge. Looking u/s.

Site LCC-2. Nason Road Bridge. Looking d/s.

Site LCC-3. **Jenson Camp Ford.** Not surveyed (no permission), but photos taken during bike recon.
Yellow
36° 23' 55.58" / 121° 39' 8.66"
6/21/2011 ~7 cfs.

Entire roadway and culvert system look to be recently repaired. Four culverts (2 square concrete, 2 corrugated metal pipes). Water was flowing in the two square L/B culverts at this flow; both were clear and fully passable. The two R/B ones have some rocks and debris at outlet and sand bars/willows at inlets).

Culverts could be easily clogged with debris or be a velocity barrier at high flows and a depth barrier at low flows.

Site LCC-3. Outlets.

Site LCC-3. Inlets.

<u>Site LCC-4.</u> **Comsat Road. Mo.Co. Br. #528 (MM 6.5).**
Green 36° 23' 47.1" / 121° 38' 58.9"
7/30/2012: Isolated pools (flow ~ 0.1 cfs), and six <3" fish observed.

Bridge clear spans creek but concrete abutments have altered the flow structure. Slow water with sand bottom u/s of bridge, sandbar deposit, bank erosion and riffle/chute underneath, and thick willows d/s. This bridge likely is not a passage barrier, but should be monitored on a regular basis.

Site LCC-4. Shown at ~7 cfs. Split channel and sandbar under bridge. Looking upstream at abutments.

Site LCC-6. **Mo.Co. Br. #529 (MM 7.9)**
Green 36° 23' 32.2" / 121° 38' 19.3"
7/30/2012: Dry.

We could not access river channel due to barbwire fence but bridge clear-spans the creek and is not a passage barrier, but should be monitored on a regular basis.

Site LCC-6. Downstream channel. Cobble substrate, brushy vegetation. No barrier.


Site LCC-6. Upstream channel.

<u>Site LCC-8.</u> **Trampa Canyon. Mo.Co. Br. #530 (MM 8.5)**
Green 36° 23' 31.9" / 121° 37' 32.2"
7/30/2012: Dry.

Bridge clear-spans creek and is not a passage barrier. Substrate is boulder/cobble with sand.

Site LCC-8. Photo #1. Looking upstream. Photo #2. Looking downstream.

Site LCC-9. **Ford at Boronda Cr. Confluence. (MM ~8.6). 19872 Cachagua Road.**
Red Not surveyed. Site was only observed from Cachagua Road during recon.
36° 23' 30.8" / 121° 37' 51.4"
3/22/2012: flow ~5 cfs
7/30/2012: Isolated pools.

There is a large notch covered by a metal plate cut through the center of the concrete ford river crossing. Nearly 100% of the flow at ~5 cfs goes through the notch, which is likely smooth and shallow. At the downstream side, the water falls ~2 feet, landing on a large boulder in a shallow pool. At higher flows, adult fish would have to jump 3-4 feet from the shallow pool up onto the smooth concrete ford and swim across the shallow depth. Downstream migrants would land on the boulder after passing through the notch.

This ford has a high probability of being an upstream adult migration barrier and moderate/high probability of causing damage to d/s migrants at both high and low flows. Addition surveys should be completed and the ford should be removed or modified.

<u>Site LCC-10.</u> **Ringer's Ford. (MM 8.9). 20775 Cachagua Road.**

Red Not surveyed. Site observed from Cachagua Road during recon tour.
~36° 23' 38.7" / 121° 36' 47.9"
3/22/2012: flow ~5 cfs
7/30/2012: Dry.

Smooth concrete ford with no apparent culverts. Water drops ~3' into pool of unknown depth. Classify as a likely "Red" due to high jump and shallow crossing.

This would be a prime location for a small, clear-span bridge crossing.

Site LCC-10.

<u>Sites LCC-11 and 12</u>. (MM ~9.2). CV Tennis Camp. 20803, 20805, 20808 Cachagua Road.

Green Not surveyed. Sites only observed from Cachagua Road during recon.
36° 23' 38.6" / 121° 36' 39.1"
3/22/2012: flow ~5 cfs
7/30/2012: Dry.

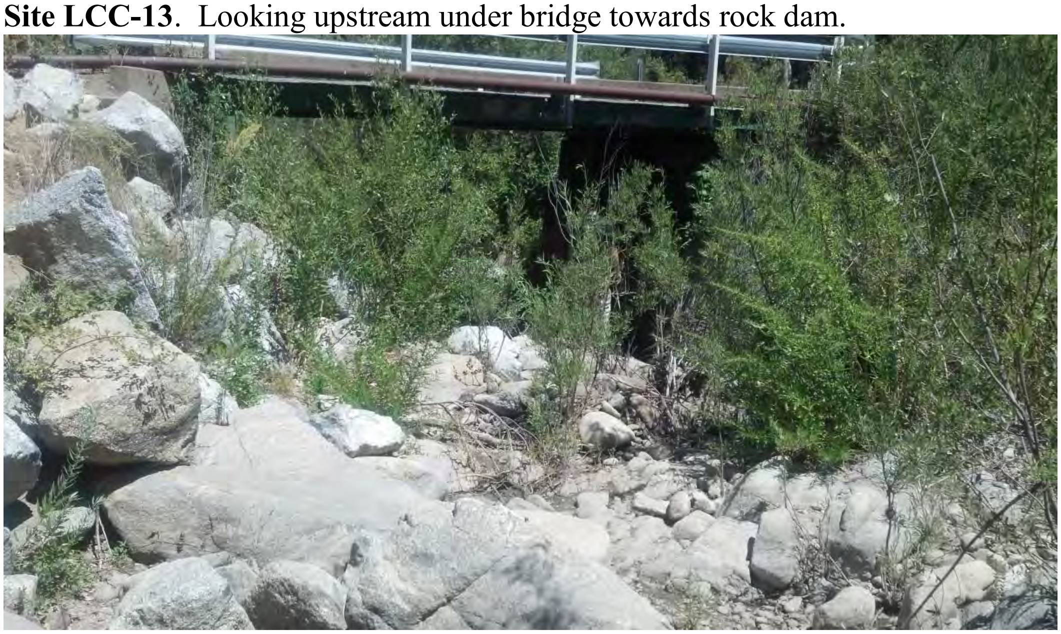
Both 20803 and 20805 have clear-span bridges over natural streambeds and no barrier issues.

The crossing at 20808 appears to be a natural-streambed road crossing - no structures were observed and there are no barrier issues.

Site LCC-13. **Tassajara Road Bridge at Cachagua Rd. MoCo Br. #532 (MM 1.5)**
Green 36° 23' 27.7" / 121° 35' 42.3"
3/22/2012: flow ~6 cfs
7/30/2012: Dry.

This clear-span bridge is located just downstream of the confluence of Cachagua, Finch, James Creeks and is not migration barrier. However, a large boulder dam has been constructed numerous times across creek on the upstream side of the bridge and it can be a migration barrier to both upstream and downstream migration. We removed it during this survey but this location should be monitored regularly.

Site LCC-13. Looking upstream under bridge towards rock dam.



Site LCC-13. Looking downstream. Substrate is boulder/cobble, riparian vegetation is brushy.

Upper Cachagua Creek Basin – James and Finch Creeks. (UCC Sites: 1-11)

Survey dates: 7/30/12 and 8/9/12. Flow = 0 – 0.2 cfs. (BC and CL)

UCC-1. **James Creek at Jamesburg Culvert. Tassajara Road.**
Red
36° 22' 06.90" / 121° 35' 23.9"
3/22/2012: flow ~0.25 cfs
7/30/2012: Dry.

In "Jamesburg" where Tassajara road turns to dirt there is a ~60' long metal culvert that runs diagonally under the road. It is severely degraded with much of the bottom rusted away. Water trickles across the jagged metal and then falls through several large holes at the d/s end. This culvert should be replaced soon although there appears to be little steelhead habitat upstream.

Other James Creek sites: There are several Mo. Co. bridges that are small and old but do not appear to be barriers – "Green". We did not have permission to see any private properties.

Jamesburg Culvert.

Site UCC-2. **Carmel Valley Road. MoCo Br. #533 (MM 25.4)**
Green 36° 22' 50.5" / 121° 34' 27.8"
7/30/2012: Dry.

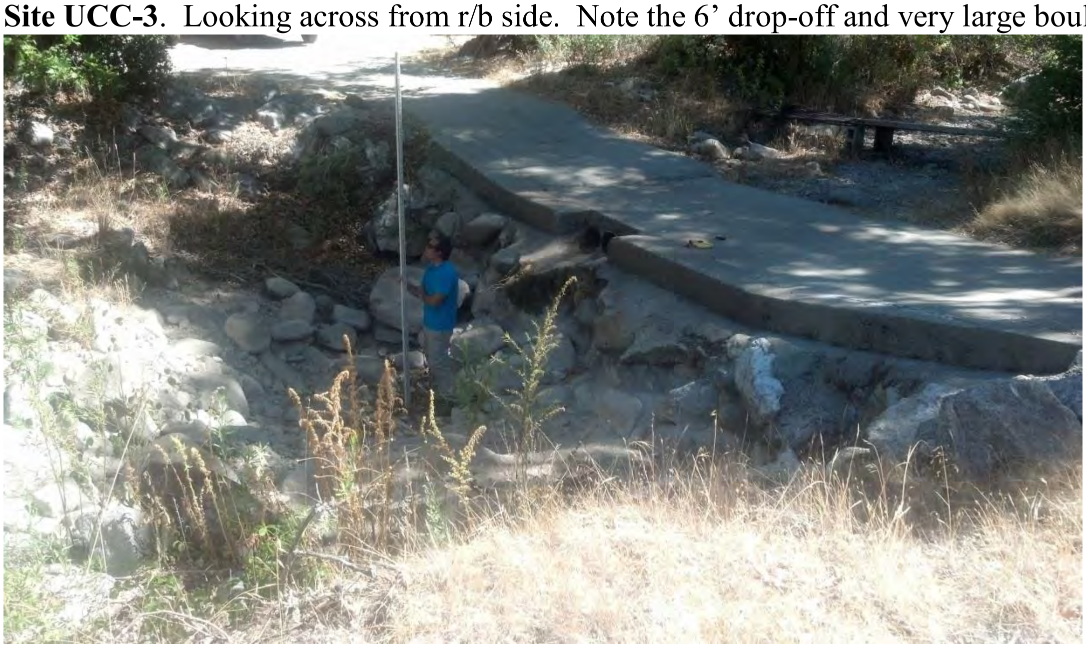
This is a very large, modern concrete bridge and is not a barrier. No photos were taken.

Site UCC-3. **Hastings Reserve Caretaker's House Ford. Carmel Valley Road (MM 25.6)**
Red/Yellow 36° 22' 44.8" / 121° 33' 59.2"
7/30/2012: Surveyed. Dry.

Site consists of a long concrete ford with four small culverts on the left bank side. Most of flow would pass over top of ford. Plunge pool has down cut ~6 feet below top of ford. The substrate upstream of the ford is primarily sand/small gravel, while downstream it is a boulder/cobble mix.

Personal observation from Vincent Voegel (Hastings caretaker): There were >20 large (7"+) steelhead in the pool d/s of the ford in 2012. CRSA did some fish rescues here that year.

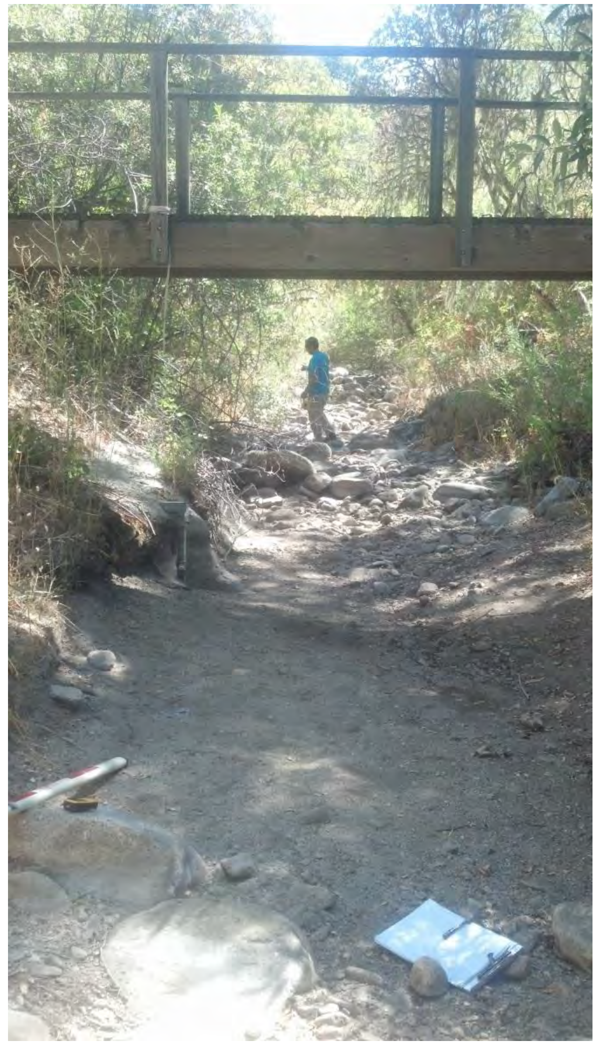
Site UCC-3. Looking across from r/b side. Note the 6' drop-off and very large boulders.



Site UCC-3. Looking across from l/b side.

Site UCC-3. Looking downstream at the culverts and plunge pool drop-off.

Site UCC-3. Close-up of the culvert inlets.



Site UCC-3. Left photo. Looking upstream at the culvert outlets and the ford drop-off. A seasonal plank walkway is shown in the background.

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Site UCC-4. **Hastings Reserve Caretaker's Footbridge. Carmel Valley Road (MM 25.6)**

Green 36° 22' 45.4" / 121° 33' 57.9"
7/30/2012: Dry.

Site UCC-4. Right Photo. The footbridge, shown here looking upstream from above the ford, is located 120' upstream of the ford. It is a clear-span structure and is not a barrier. The Hastings staff plate, gage, and camera are attached to the bridge footings.

Site UCC-5. **Hastings /Boekenoogen Bridge. Carmel Valley Road (MM 25.7)**
Green 36° 22' 44.0" / 121° 33' 50.0"
7/30/2012: Dry.

Clear-span bridge. Not a barrier. Boulder/cobble substrate and brushy vegetation.


Site UCC-5. Looking upstream.


Site UCC-5. Looking downstream.

Site UCC-6. **MoCo Bridge #537. Carmel Valley Road (MM 26.5)**
Green 36° 22' 25.8" / 121° 33' 41.20"
7/30/2012: Dry.

Clear-span bridge. Not a barrier. Boulder/cobble substrate and brushy vegetation.

Site UCC-6. Looking upstream.

Site UCC-6. Looking downstream.

<u>Site UCC-7</u>. **MoCo Bridge #539. Carmel Valley Road (MM 26.9)**
Green 36° 22' 00.3" / 121° 33' 31.5"
7/31/2012: Dry.

Clear-span bridge. The channel is constricted above the bridge by a large tree growing next the channel and a pile of large boulders, and below the bridge from a loose barbwire fence across the channel and the left bank bridge support. Boulder/cobble substrate. Vegetation is a mix of mature trees and shrubby plants. This site should be monitored regularly.

Site UCC-7. Looking upstream. Note the barbwire fence and the boulder wall on the right side of the photo.

Site UCC-7. Looking downstream. Note the large sycamore tree on left side and boulder pile across the channel.

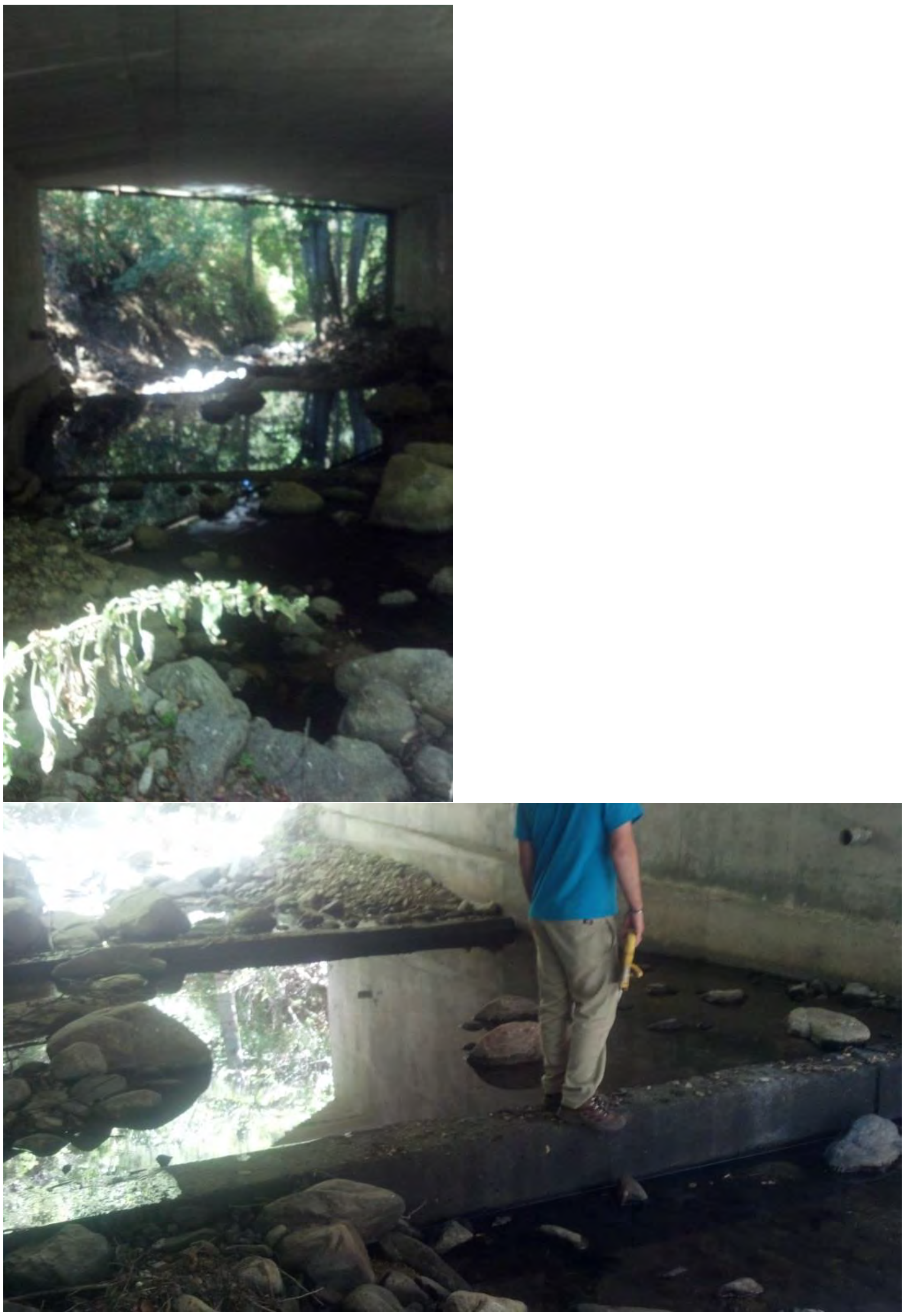
Site UCC-8. **MoCo Bridge #542. Carmel Valley Road (MM 27.7)**
Green 36° 21' 34.4" / 121° 33' 4.5"
7/31/2012: Dry.

Clear-span bridge is narrower than the others but is not a barrier. Boulder/cobble substrate. Vegetation is a mix of mature trees and shrubby plants.

Site UCC-8. Looking upstream.

Site UCC-9. **MoCo Bridge #543. Carmel Valley Road (MM 27.9)**
Green 36° 21' 28.3" / 121° 32' 55.0"
7/31/2012: ~0.1 cfs. ~40 steelhead observed (~35, <3" and 3, 3-6").

This is a newer concrete, clear-span bridge, but there are two ~1' high concrete weirs across the center under the bridge. Bridge is not likely a barrier, but in low flow the water would be wide and shallow as it passes over the weirs.



Site UCC-9. Looking upstream, and close-up of the concrete weirs.

Site UCC-10. **MoCo Bridge #545. Carmel Valley Road (MM 28.1)**
Green 36° 21' 12.9" / 121° 32' 40.1"
7/31/2012: ~0.25 cfs. ~3 steelhead observed (2, <3" and 1, 3-6").

Clear-span bridge is not a barrier but there is a cattle fence (?) hanging loosely from the d/s side of the bridge. Substrate is boulder and sand/mud. Vegetation is a mix of mature trees and shrubby plants.

Site UCC-10. Looking upstream. Note the wood slat fence.

<u>Site UCC-11</u>. **MoCo Bridge #546. Carmel Valley Road (MM 28.8)**
Green 36° 20' 51.6" / 121° 32' 34.2"
7/31/2012: Dry.

Very small, narrow, clear-span bridge is not a barrier. Substrate is boulder/cobble. Vegetation is a mix of mature trees and shrubby plants. No access to channel.

Site UCC-11. Small MoCo. Bridge.

Site UCC-12. **Cahoon Ranch Culverts. Carmel Valley Road (MM 29.5)**
Yellow 36° 20' 15.8" / 121° 32' 06.9"
Private property, didn't survey.
7/31/2012: Dry.

Near the top of the watershed, two 5'diameter SSP culverts with outlets dropping ~1.5' onto concrete rubble. Substrate is mud/cow manure. Looks like steelhead passage is possible, but habitat is poor.

Site UCC-12. Looking downstream. Note concrete rubble at outlets.

u\beverly\word\shpassagebarriergrant\irwm3\cachagua

Main Stem Carmel River - Flavin's Crossing (Site CR -1)

Survey date: 8/9/12 (7 cfs) (B. Chaney and C. Lanier)

Site CR-1. Main stem Carmel River – Flavin's Crossing – GRADE YELLOW
Yellow UTM 10N 0619719.563/ 4029764.7
36° 24' 19.7" / 121° 39' 53.9" 796 ft. elevation
River Mile ~ 22.5

Located off Cachagua Grade Road in Cachagua Valley, Flavin's Crossing, named after Mr. Sean Flavin (or his family) was likely built between the 1930's and 1940's to provide access across the river and to the Los Padres Dam construction site. Although badly eroded by the 70-plus years of continuous water flow, the concrete ford can still be used to cross the river. The ford was to provide access to the downstream fish facility of the proposed New Los Padres Dam. The dam was defeated in a 1995 vote and was never built. The ford was more recently used by fire fighters to get heavy equipment across the river during the large Basin Complex Fire in 2008 (Pers. communication with Billy Rager, Flavin property caretaker, 2012).

The ford was poured directly onto the riverbed substrate. There are no culverts (as far as I can tell). In some sections, the metal rebar has become badly exposed with long loose pieces of bars aiming downstream, potentially endangering upstream migrating steelhead, and other wildlife. During low flows, the water passing over the ford is very shallow, potentially restricting both upstream and downstream fish migration.

The ford acts like a low dam across the river and has caused both backwatering and down-cutting on its upstream and downstream sides. Upstream, there is a ~ 100 meters long, 1-2 meter deep, slack water pool with a fine silt and sand bottom. Downstream, the riverbed has down cut and steepened. The substrate is primarily boulders. The ford's plunge pool is ~2-4 feet deep depending on river flow.

This manmade structure is both unsightly and a partial barrier to fish migration. In addition, it is causing the degradation of the streambed and changes to the flow regime.

Site CR-1. Flavin's Crossing, Cachagua Valley – concrete ford.

Photo 1) Looking across the ford from right bank. Note the exposed rebar along upper/rightbank side of ford (white water area in foreground).

Photo 2) Looking across the ford from downstream left bank.

Photo 3) Looking across the ford from left bank. Note the shallow water depth across ford. Depth of plunge pool at this flow is ~1.5 feet.

Photo 4) Exposed rebar extending up from surface of eroded concrete ford.

Photo 5) Looking upstream towards the long backwatered pool.

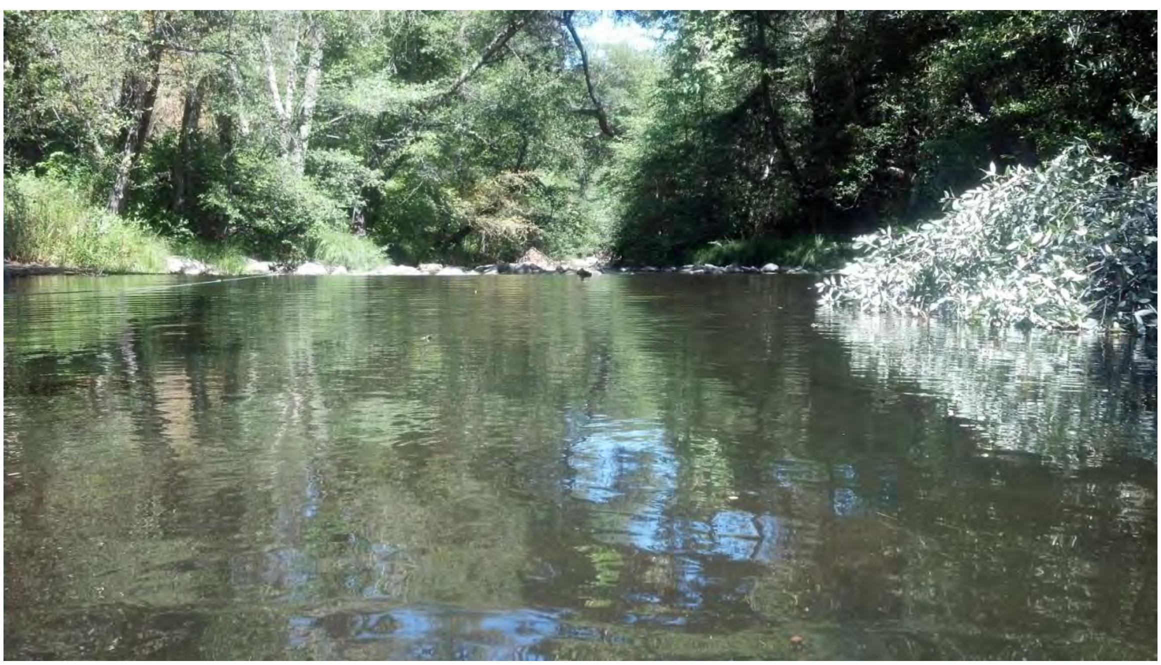


Photo 6) Large backwatered pool above the ford (~100 m long and 1 m deep). Pool substrate is ~3” of fine silt over sand.

Photo 7) Substrate downstream of ford is a boulders/cobble mix with a steep channel.

Photo 8) 2012 Google Earth photo of Flavin's Crossing in Cachagua Valley, CA. Note the slack water pool upstream and narrow riffle section downstream of crossing. Cachagua Road is at the top of the photo.

Appendix C. FishXing Site Reports – Potero Creek Basin (PCB).

Appendix C1: Site PCB-3.

Potrero Creek Fish Passage Barrier Assessment: Crossing Report for Site PCB-3 Valley Greens Rd Culverts (Quail Golf Course)

Crossing Location Information

Crossing Name: PCB-3.
Stream Name: Potrero Cr.
Road: Valley Greens Rd.
Mile Post: 0.1
36 Degrees 32" 0.48' Latitude, 121 Degrees 52" 8.74' Longitude

Comments:
2 side-by-side CMP culverts (pipe arches) embedded with natural substrate bottom consisting of sand and small gravel. No scour pools d/s or drops u/s. Outlet banks covered with thick weeds and trees. Stream gaging site immediately u/s of culverts.

Crossing Installation Data

Culvert Number 1
Culvert Type: 5.5 X 4.1 ft Pipe-Arch
Construction: Annular 2.67 x 1/2 inch
Installation: Embedded
Countersunk Depth: 0.4 ft
Natural Bottom Roughness Coefficient: 0.035
Culvert Length: 70 ft
Culvert Slope: 0.43%
Culvert Roughness Coefficient: 0.024
Natural Bottom Roughness Coefficient: 0.035
Inlet Invert Elevation: 89.1 ft
Outlet Invert Elevation: 88.8 ft
Inlet Headloss Coefficient (Ke): 0

Culvert Number 2

Culvert Type: 5.5 X 4.1 ft Pipe-Arch
Construction: Annular 2.67 x 1/2 inch
Installation: Embedded
Countersunk Depth: 0.4 ft
Natural Bottom Roughness Coefficient: 0.035
Culvert Length: 70 ft
Culvert Slope: 1.29%
Culvert Roughness Coefficient: 0.024
Natural Bottom Roughness Coefficient: 0.035
Inlet Invert Elevation: 89.7 ft
Outlet Invert Elevation: 88.8 ft
Inlet Headloss Coefficient (Ke): 0

<u>Design Flows</u>

Low Passage Flow: 2 cfs
High Passage Flow: 150 cfs

Table 1. Fish Passage Summary.

Fish Passage Summary	
Low Passage Design Flow	2.00 cfs
High Passage Design Flow	150.00 cfs
Percent of Flows Passable	0.6 %
Passable Flow Range	12.15 to 13.00 cfs
Depth Barrier	2.00 to 12.15 cfs
Leap Barriers	None
Velocity Barrier	13.00 cfs to 150.00 cfs
Pool Depth Barrier	None

<u>Tailwater Information</u>

Tailwater Option: Tailwater Channel Cross-Section
Channel Bottom Slope: 1%
Outlet-Pool Bottom Elevation: 88.4 ft

Table 2. Tailwater Cross Section Data.

Station (ft)	Elevation (ft)	Roughness Coefficient
1.00	91.15	0.100
2.00	88.75	0.070
5.00	88.42	0.040
8.00	88.50	
10.50	88.70	0.100
15.50	90.60	

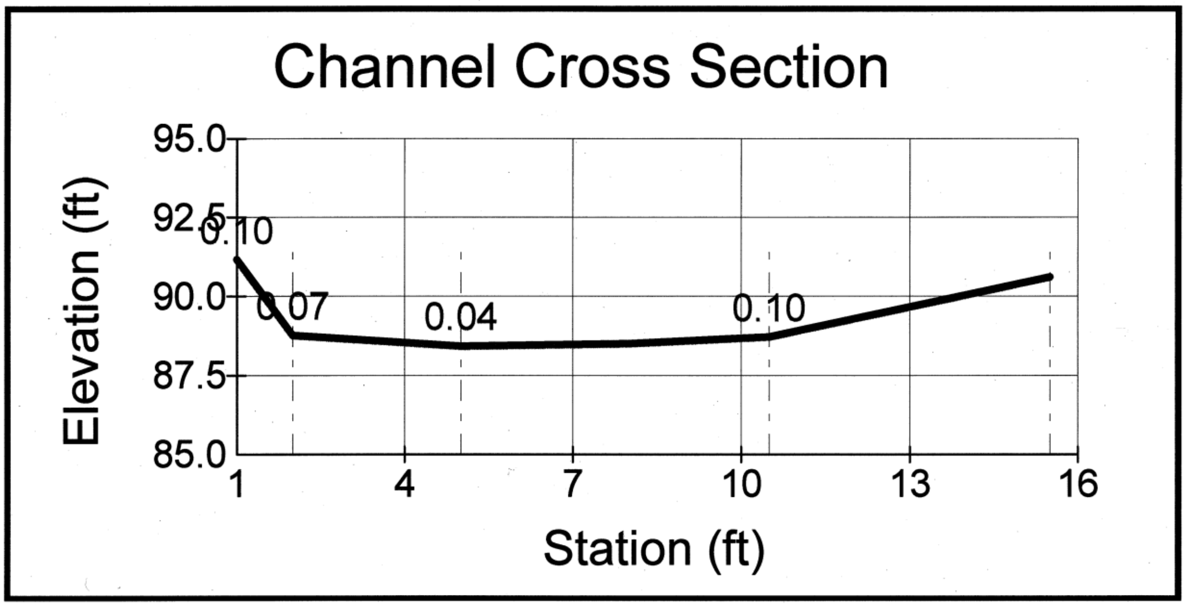


Figure 1. Channel Cross Section at Tailwater Crest.

Table 3. Tailwater Rating Table Information.

Discharge (cfs)	Tailwater Elevation (ft)	Wetted Perimeter (ft)	Cross-Sect. Area (sq. ft)	Composite Roughness Coefficient
0.0	88.4	0.00	0.00	0.040
0.1	88.5	3.73	0.15	0.047
0.4	88.6	5.90	0.63	0.049
1.2	88.7	8.07	1.33	0.050
2.4	88.8	8.86	2.18	0.054
3.9	88.9	9.25	3.07	0.056
5.7	89.0	9.64	4.00	0.058
7.7	89.1	10.03	4.95	0.060
9.8	89.2	10.42	5.94	0.062
12.2	89.3	10.81	6.95	0.063
14.7	89.4	11.20	8.00	0.065
17.3	89.5	11.59	9.07	0.066
20.2	89.6	11.98	10.18	0.067
23.2	89.7	12.37	11.32	0.068
26.3	89.8	12.76	12.49	0.070
29.6	89.9	13.15	13.69	0.071
33.1	90.0	13.54	14.91	0.071
36.7	90.1	13.93	16.17	0.072
40.5	90.2	14.32	17.46	0.073
44.5	90.3	14.71	18.78	0.074
48.6	90.4	15.10	20.13	0.075
52.8	90.5	15.49	21.52	0.075
57.3	90.6	15.88	22.93	0.076

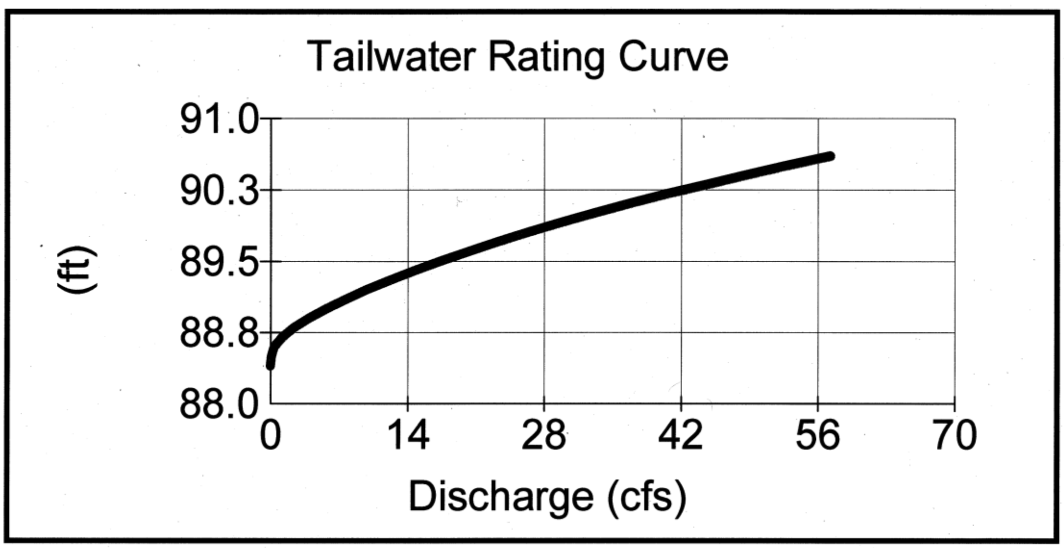


Figure 2. Tailwater Rating Curve

Table 4. Culvert Rating Table.

Q total (cfs)	Q (analysis) (cfs)	% Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0	0.00	0.00	0.00	0.00	-88.80	88.80	-88.40	Depth
2.00	1.99	100.00	0.13	3.29	-0.03	0.16	0.37	Depth
15	11.57	77.09	0.61	3.67	0.61	0.00	1.01	EB
22	15.59	70.87	0.86	3.70	0.86	0.00	1.26	EB
30	19.94	66.46	1.11	4.01	1.11	0.00	1.51	EB
38	24.10	63.42	1.33	4.24	1.33	0.00	1.73	EB
45	27.25	60.48	1.51	4.35	1.51	0.00	1.91	EB
52	32.08	59.69	1.68	4.61	1.68	0.00	2.08	EB
60	34.86	58.09	1.86	4.60	1.86	0.00	2.26	EB
68	38.85	57.12	2.03	4.75	2.04	0.00	2.44	EB
75	42.16	56.21	2.16	4.86	2.20	0.00	2.60	EB
82	45.88	55.83	2.31	4.98	2.36	0.00	2.76	EB
90	48.99	54.43	2.51	4.94	2.54	0.00	2.94	EB
98	52.78	53.92	2.69	5.02	2.72	0.00	3.12	EB
105	55.98	53.36	2.85	5.08	2.87	0.00	3.27	EB
112	58.15	52.42	3.00	5.08	3.03	0.00	3.43	EB
120	62.79	52.33	3.21	5.24	3.21	0.00	3.61	EB
128	66.35	51.82	3.39	5.35	3.39	0.00	3.79	EB
135	69.50	51.28	3.55	5.48	3.55	0.00	3.95	EB
142	71.22	50.16	3.70	5.58	3.71	0.00	4.11	EB
150.00	75.01	49.93	3.70	5.88	3.89	0.00	4.29	EB
158	79.02	50.01	3.70	6.20	4.07	0.00	4.47	EB
165	82.51	49.98	3.70	6.47	4.22	0.00	4.62	EB
172	86.01	49.98	3.70	6.74	4.38	0.00	4.78	EB
180	90.01	49.98	3.70	7.06	4.56	0.00	4.96	EB
188	94.01	49.98	3.70	7.37	4.74	0.00	5.14	EB
195	97.51	49.98	3.70	7.64	4.90	0.00	5.30	EB
202	101.01	49.99	3.70	7.92	5.06	0.00	5.46	EB
210	106.22	49.99	3.70	8.33	5.24	0.00	5.64	EB
218	110.14	49.99	3.70	8.63	5.42	0.00	5.82	EB
225	113.62	49.99	3.70	8.91	5.57	0.00	5.97	EB

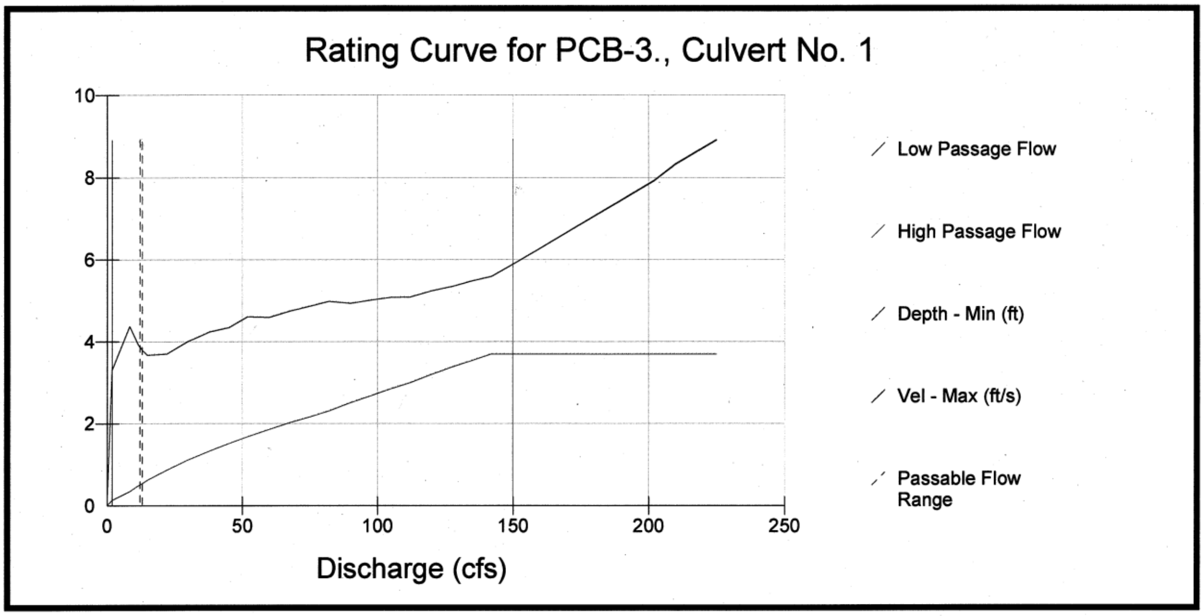


Figure 3. Culvert Rating Curve

Table 5. Culvert Summary for 12.5 cfs.

Summary for Q = 12.50 cfs	
Normal Depth (ft)	0.83
Critical Depth (ft)	0.50
Headwater Depth (ft)	0.96
HW/D	0.26
Inlet Velocity (ft/s)	3.13
Tailwater Depth (ft)	0.51
Outlet Water Surface Drop ...	0.00
Prolonged Swim Time (min)	10.68
Burst Swim Time (s)	4.20
Barrier Code	NONE

<u>Barrier Codes</u>

V = Strict Velocity Barrier
EB = Fish Exhausted at Burst Speed
Long = Fish Exhausted at Prolonged Speed
Leap = Excessive leap at outlet
Drop = Excessive drop at outlet
Depth = Too shallow for substantial distance
Pool = Leap Pool too shallow
NONE = Not a barrier

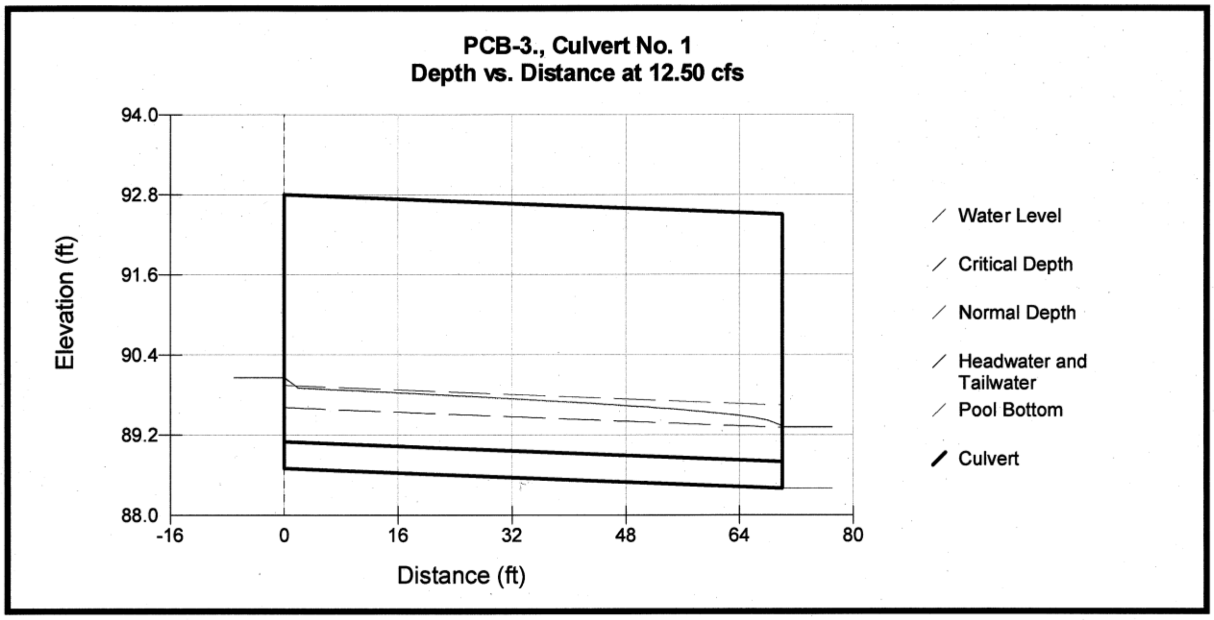


Figure 4. Water Surface Profile at 12.5 cfs

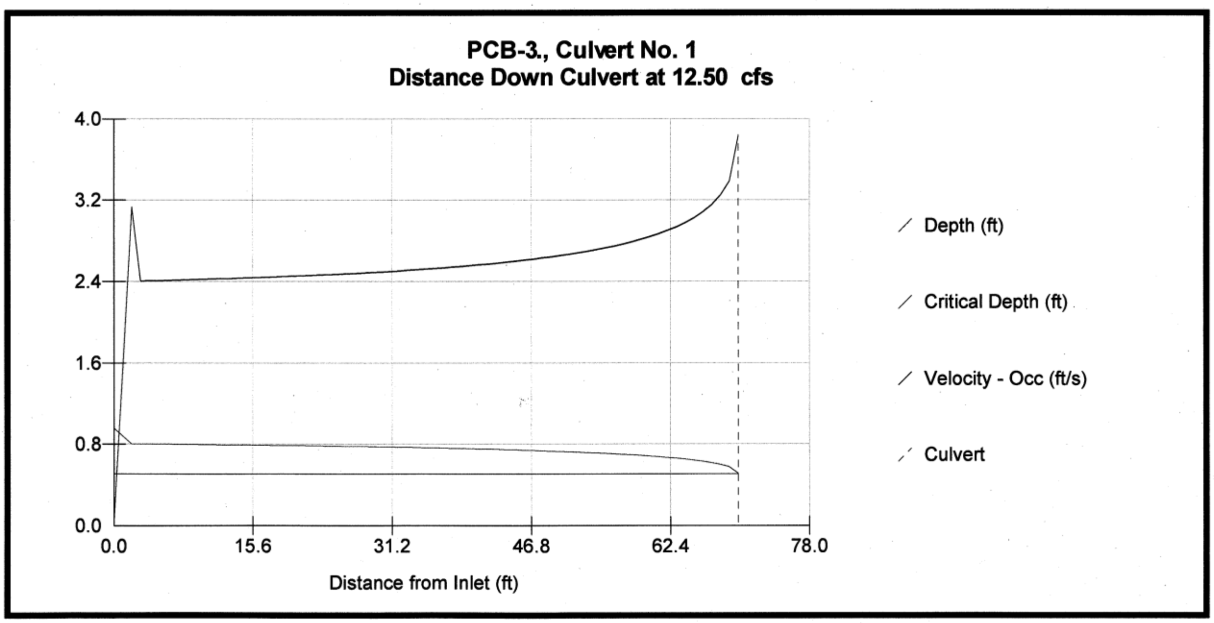


Figure 5. Culvert Profiles at 12.5 cfs

Appendix C2: Site PCB-5.

Potrero Creek Fish Passage Barrier Assessment: Crossing Report for Site PCB-5 Carmel Valley Athletic Club Lower Culvert

Crossing Location Information
Crossing Name: PCB-5
Stream Name: Potrero Cr.
Road: Rancho San Carlos, CVAC
36 Degrees 31" 49.8' Latitude, 121 Degrees 52" 3.7' Longitude

Crossing Installation Data
Culvert Type: 5 ft Circular
Material: smooth steel
Installation: Not Embedded
Culvert Length: 100 ft
Culvert Slope: 2.84%
Culvert Roughness Coefficient: 0.014
Inlet Invert Elevation: 100.05 ft
Outlet Invert Elevation: 97.21 ft
Inlet Headloss Coefficient (Ke): 0.9

Design Flows
Low Passage Flow: 2 cfs
High Passage Flow: 150 cfs

Table 1. Fish Passage Summary.

Fish Passage Summary	
Low Passage Design Flow	2.00 cfs
High Passage Design Flow	150.00 cfs
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	2.00 to 8.53 cfs
Leap Barriers	None
Velocity Barrier	2.00 cfs to 150.00 cfs
Pool Depth Barrier	None

FishXing V3.0 2006

Tailwater Information

Tailwater Option: Tailwater Channel Cross-Section
Channel Bottom Slope: 3%
Outlet-Pool Bottom Elevation: 96.28 ft

Table 2. Tailwater Cross Section Data.

Station (ft)	Elevation (ft)	Roughness Coefficient
0.00	99.48	0.080
5.00	97.60	
10.00	97.78	0.040
14.20	97.44	0.045
15.00	97.60	
22.00	99.48	0.100

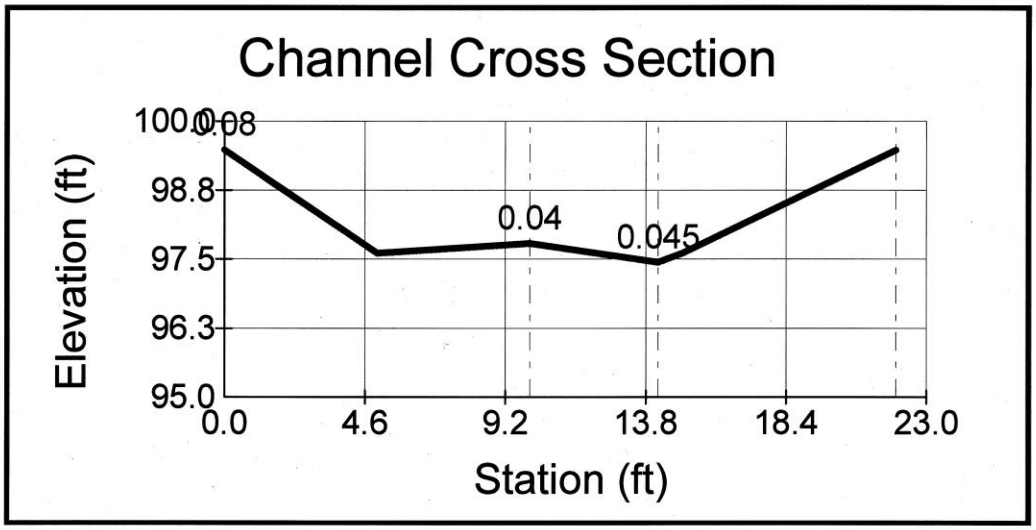


Figure 1. Channel Cross Section at Tailwater Crest.

FishXing V3.0 2006

Table 3. Tailwater Rating Table Information.

Discharge (cfs)	Tailwater Elevation (ft)	Wetted Perimeter (ft)	Cross-Sect. Area (sq. ft)	Composite Roughness Coefficient
0.0	97.4	0.00	0.00	0.000
0.0	97.5	0.70	0.01	0.041
0.2	97.6	2.45	0.17	0.041
0.5	97.7	6.55	0.59	0.057
1.6	97.8	11.24	1.48	0.062
4.0	97.9	11.91	2.62	0.062
7.2	98.0	12.58	3.83	0.062
11.3	98.1	13.25	5.11	0.062
16.1	98.2	13.92	6.45	0.062
21.7	98.3	14.59	7.85	0.062
28.0	98.4	15.26	9.31	0.062
35.0	98.5	15.93	10.84	0.062
42.9	98.6	16.60	12.44	0.062
51.5	98.7	17.27	14.09	0.062
60.8	98.8	17.94	15.82	0.062
70.9	98.9	18.60	17.60	0.062
81.8	99.0	19.27	19.45	0.062
93.6	99.1	19.94	21.36	0.062
106.1	99.2	20.61	23.34	0.062
119.5	99.3	21.28	25.38	0.061
133.7	99.4	21.95	27.48	0.061
148.7	99.5	22.62	29.65	0.061

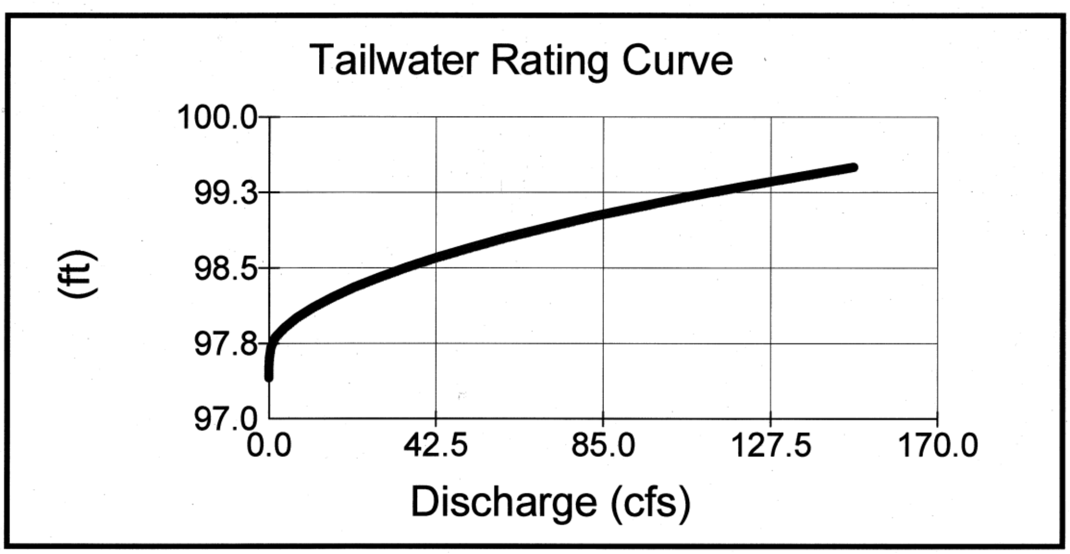


Figure 2. Tailwater Rating Curve

Table 4. Culvert Rating Table.

Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0	0.00	0.00	-97.21	97.21	-96.28	Depth
2.00	0.25	5.49	0.59	0.00	1.52	Depth; EB
15	0.65	9.89	0.95	0.00	1.88	EB
22	0.79	11.09	1.08	0.00	2.01	EB
30	0.94	11.67	1.20	0.00	2.13	EB
38	1.07	12.34	1.31	0.00	2.24	EB
45	1.17	12.82	1.39	0.00	2.32	V
52	1.27	13.23	1.48	0.00	2.41	V
60	1.38	13.65	1.56	0.00	2.49	V
68	1.48	14.02	1.64	0.00	2.57	V
75	1.56	14.31	1.71	0.00	2.64	V
82	1.64	14.57	1.77	0.00	2.70	V
90	1.74	14.85	1.84	0.00	2.77	V
98	1.82	15.12	1.91	0.00	2.84	V
105	1.90	15.33	1.96	0.00	2.89	V
112	1.97	15.54	2.01	0.00	2.94	V
120	2.06	15.76	2.07	0.00	3.00	V
128	2.14	15.97	2.13	0.01	3.06	V
135	2.21	16.15	2.18	0.03	3.11	V
142	2.28	16.32	2.23	0.05	3.16	V
150.00	2.35	16.52	2.28	0.07	3.21	V
158	2.43	16.70	2.33	0.10	3.26	V
165	2.49	16.86	2.38	0.12	3.31	V
172	2.56	17.02	2.42	0.13	3.35	V
180	2.63	17.19	2.48	0.15	3.41	V
188	2.70	17.36	2.53	0.17	3.46	V
195	2.76	17.51	2.58	0.19	3.51	V
202	2.83	17.72	2.62	0.20	3.55	V
210	2.89	18.08	2.68	0.22	3.61	V
218	2.96	18.44	2.73	0.23	3.66	V
225	3.02	18.76	2.78	0.24	3.71	V

Barrier Codes

V = Strict Velocity Barrier
EB = Fish Exhausted at Burst Speed
Long = Fish Exhausted at Prolonged Speed
Leap = Excessive leap at outlet
Drop = Excessive drop at outlet
Depth = Too shallow for substantial distance
Pool = Leap Pool too shallow
NONE = Not a barrier

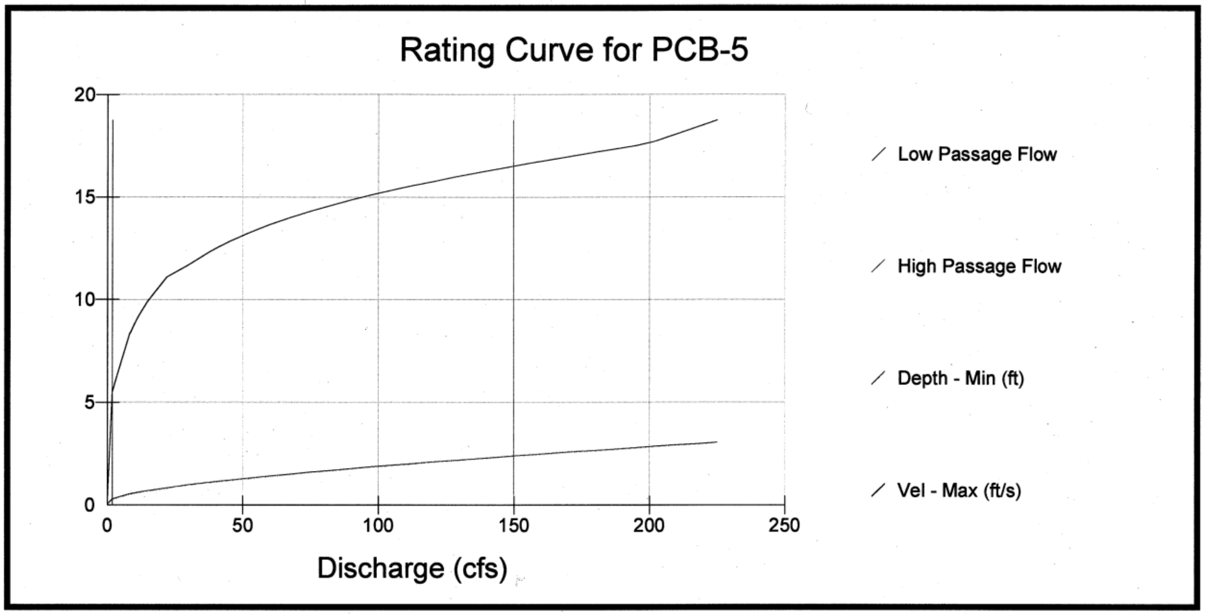


Figure 3. Culvert Rating Curve

Table 5. Culvert Summary for 10 cfs.

Summary for Q = 10.00 cfs	
Normal Depth (ft)	0.54
Critical Depth (ft)	0.87
Headwater Depth (ft)	1.11
HW/D	0.22
Inlet Velocity (ft/s)	7.65
Tailwater Depth (ft)	0.84
Outlet Water Surface Drop ...	0.00
Prolonged Swim Time (min)	0.00
Burst Swim Time (s)	5.00
Barrier Code	EB

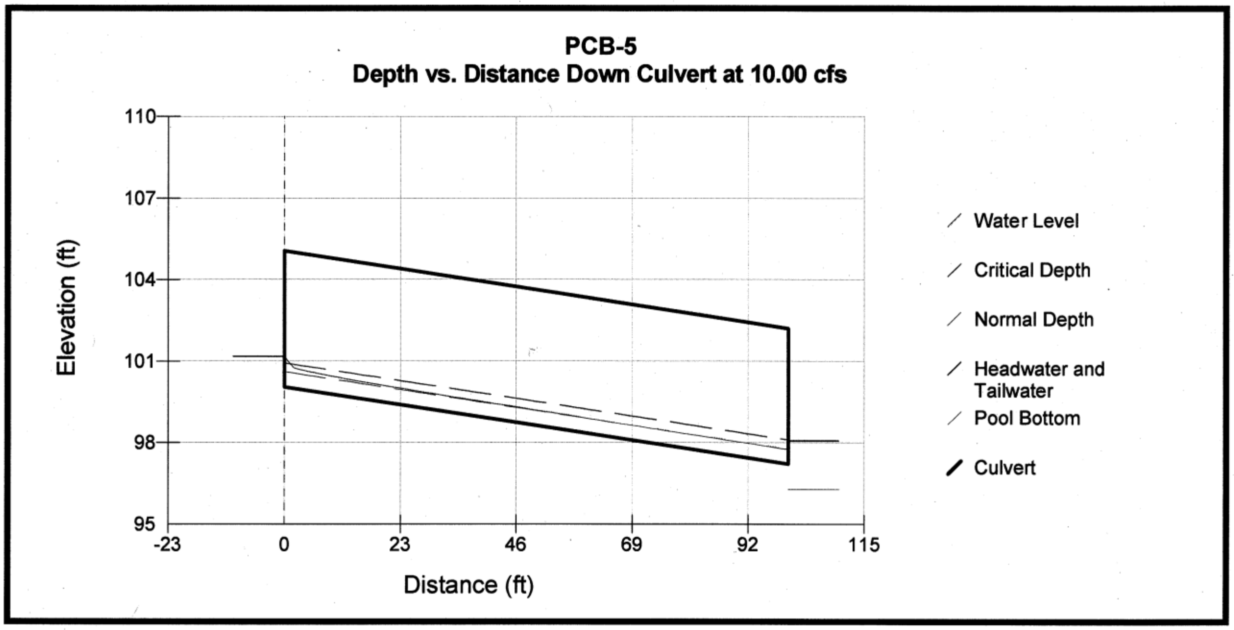


Figure 4. Water Surface Profile at 10 cfs

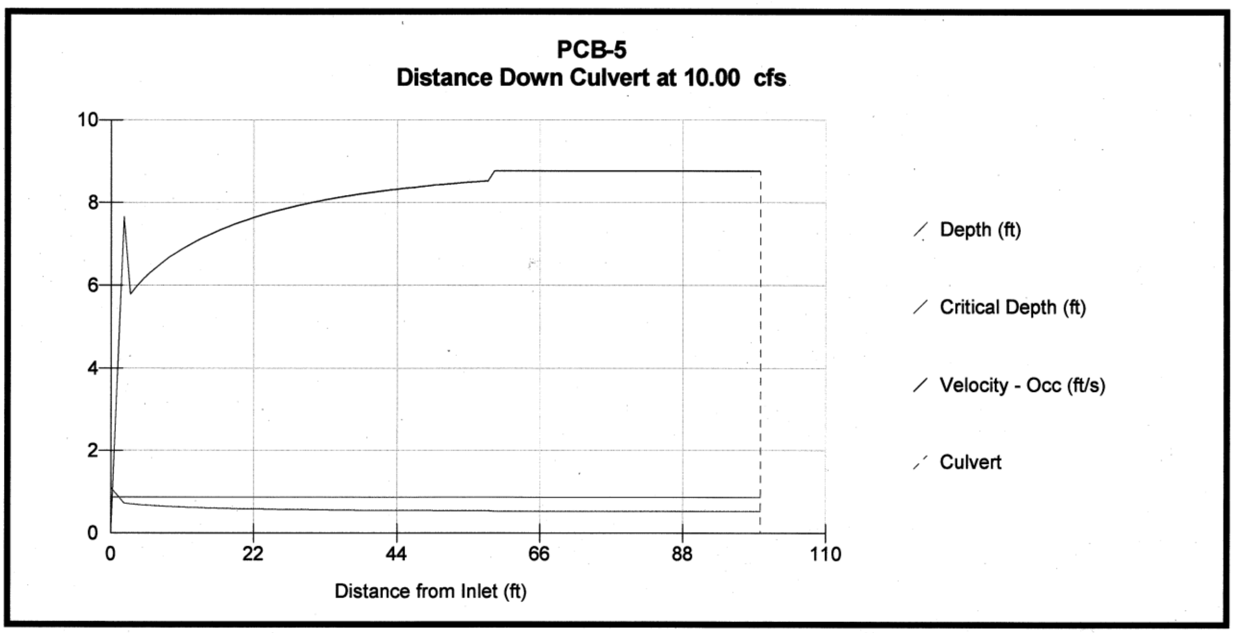


Figure 5. Culvert Profiles at 10 cfs

Apendix C3: Site PCB-6.

Potrero Creek Fish Passage Barrier Assessment: Crossing Report for Site PCB-6 Carmel Valley Athletic Club Upper Culverts

Crossing Location Information

Crossing Name: PCB-6
Stream Name: Potrero Cr.
Road: Rancho San Carlos, CVAC
36 Degrees 31" 44.9' Latitude, 121 Degrees 52" 2.6' Longitude

Comments:
Two identical culverts under the small bridge/access road at CVAC between the upper parking lot and the dirveway to the yoga center.
L/B culvert: sections of the bottom rusted out, substrate showing through.
R/B culvert: large hole in center of pipe, wter drops down under concrete pipe.
Has a concrete apron level with outlets but perched 2 feet above substrate (freefall). Tailwater control is a concrete rubble weir below apron.
Ave channel width u/s is 9'.
Both culverts need to be replaced asap with a small clear-span bridge and concrete rubble d/s removed.

Crossing Installation Data

Culvert Number 1
Culvert Type: 3.75 ft Circular
Construction: Helical 2.67 x 1/2 inch
Installation: Not Embedded
Culvert Length: 24 ft
Culvert Slope: 2.67%
Culvert Roughness Coefficient: 0.021
Inlet Invert Elevation: 99.99 ft
Outlet Invert Elevation: 99.35 ft
Inlet Headloss Coefficient (Ke): 0

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Culvert Number 2
Culvert Type: 3.75 ft Circular
Construction: Helical 2.67 x 1/2 inch
Installation: Not Embedded
Culvert Length: 20 ft
Culvert Slope: 3.20%
Culvert Roughness Coefficient: 0.021
Inlet Invert Elevation: 99.99 ft
Outlet Invert Elevation: 99.35 ft
Inlet Headloss Coefficient (Ke): 0

Design Flows
Low Passage Flow: 2 cfs
High Passage Flow: 150 cfs

Table 1. Fish Passage Summary.

Fish Passage Summary	
Low Passage Design Flow	2.00 cfs
High Passage Design Flow	150.00 cfs
Percent of Flows Passable	27.5 %
Passable Flow Range	9.45 to 50.16 cfs
Depth Barrier	2.00 to 9.45 cfs
Leap Barriers	None
Velocity Barrier	50.17 cfs to 150.00 cfs
Pool Depth Barrier	None

Tailwater Information
Tailwater Option: Tailwater Channel Cross-Section
Channel Bottom Slope: 5%
Outlet-Pool Bottom Elevation: 97.01 ft

Table 2. Tailwater Cross Section Data.

Station (ft)	Elevation (ft)	Roughness Coefficient
1.00	100.66	0.040
5.00	98.99	0.060
11.00	99.13	
19.00	99.03	
19.50	100.59	0.040

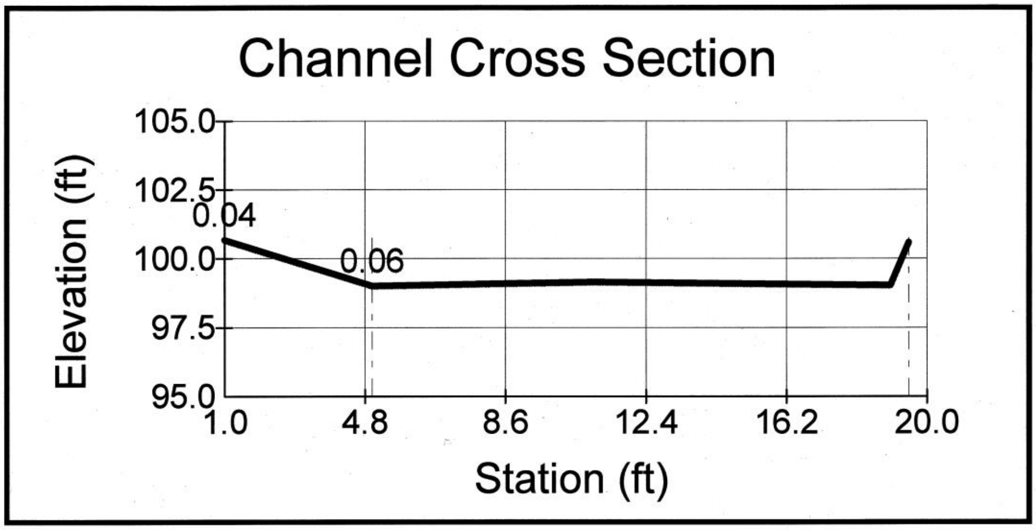

Figure 1. Channel Cross Section at Tailwater Crest.

Table 3. Tailwater Rating Table Information.

Discharge (cfs)	Tailwater Elevation (ft)	Wetted Perimeter (ft)	Cross-Sect. Area (sq. ft)	Composite Roughness Coefficient
0.0	99.0	0.00	0.00	0.040
0.0	99.0	0.00	0.00	0.059
0.2	99.1	9.41	0.37	0.059
2.3	99.2	14.69	1.71	0.059
6.3	99.3	15.05	3.18	0.059
11.9	99.4	15.42	4.67	0.059
18.9	99.5	15.78	6.19	0.058
27.1	99.6	16.15	7.74	0.058
36.5	99.7	16.51	9.32	0.058
47.0	99.8	16.88	10.92	0.058
58.7	99.9	17.24	12.55	0.058
71.4	100.0	17.61	14.21	0.057
85.2	100.1	17.97	15.89	0.057
100.1	100.2	18.34	17.60	0.057
116.0	100.3	18.70	19.34	0.057
132.9	100.4	19.06	21.10	0.056
150.8	100.5	19.43	22.90	0.056
169.7	100.6	19.79	24.72	0.056

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Table 4. Culvert Rating Table.

Q total (cfs)	Q (analysis) (cfs)	% Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0	0.00	0.00	0.00	0.00	-99.35	99.35	-97.01	Depth
2.00	0.97	48.74	0.24	3.91	-0.17	0.41	2.17	Depth
15	7.43	49.57	0.63	6.31	0.08	0.54	2.42	NONE
22	10.92	49.65	0.76	6.92	0.18	0.58	2.52	NONE
30	14.92	49.71	0.90	7.47	0.27	0.63	2.61	NONE
38	18.91	49.75	1.02	7.93	0.35	0.67	2.69	NONE
45	22.41	49.78	1.12	8.28	0.42	0.70	2.76	NONE
52	25.90	49.80	1.22	8.60	0.48	0.73	2.82	EB
60	29.89	49.82	1.32	8.94	0.55	0.77	2.89	EB
68	33.89	49.84	1.41	9.26	0.61	0.80	2.95	EB
75	37.39	49.85	1.49	9.52	0.67	0.83	3.01	EB
82	40.88	49.86	1.57	9.77	0.72	0.85	3.06	EB
90	44.89	49.87	1.66	10.05	0.77	0.88	3.11	EB
98	48.88	49.88	1.74	10.31	0.83	0.91	3.17	EB
105	52.38	49.89	1.81	10.54	0.87	0.94	3.21	EB
112	55.88	49.89	1.88	10.76	0.92	0.96	3.26	EB
120	59.88	49.90	1.96	11.01	0.96	0.99	3.30	EB
128	63.88	49.91	2.03	11.26	1.01	1.02	3.35	EB
135	67.38	49.91	2.10	11.48	1.05	1.05	3.39	EB
142	70.88	49.92	2.17	11.69	1.09	1.08	3.43	EB
150.00	74.91	49.94	2.24	11.94	1.14	1.10	3.48	EB
158	78.91	49.94	2.31	12.18	1.18	1.13	3.52	EB
165	82.41	49.95	2.38	12.40	1.22	1.16	3.56	EB
172	85.91	49.95	2.44	12.62	1.25	1.19	3.59	EB
180	89.92	49.95	2.51	12.87	1.29	1.21	3.63	EB
188	93.91	49.95	2.58	13.13	1.34	1.24	3.68	EB
195	97.42	49.96	2.64	13.36	1.37	1.27	3.71	EB
202	100.92	49.96	2.70	13.59	1.41	1.29	3.75	EB
210	104.92	49.96	2.77	13.86	1.45	1.32	3.79	EB
218	108.93	49.97	2.85	14.14	1.50	1.35	3.84	EB
225	112.43	49.97	2.91	14.39	1.53	1.38	3.87	EB

<u>Barrier Codes</u>

V = Strict Velocity Barrier
EB = Fish Exhausted at Burst Speed
Long = Fish Exhausted at Prolonged Speed
Leap = Excessive leap at outlet
Drop = Excessive drop at outlet
Depth = Too shallow for substantial distance
Pool = Leap Pool too shallow
NONE = Not a barrier

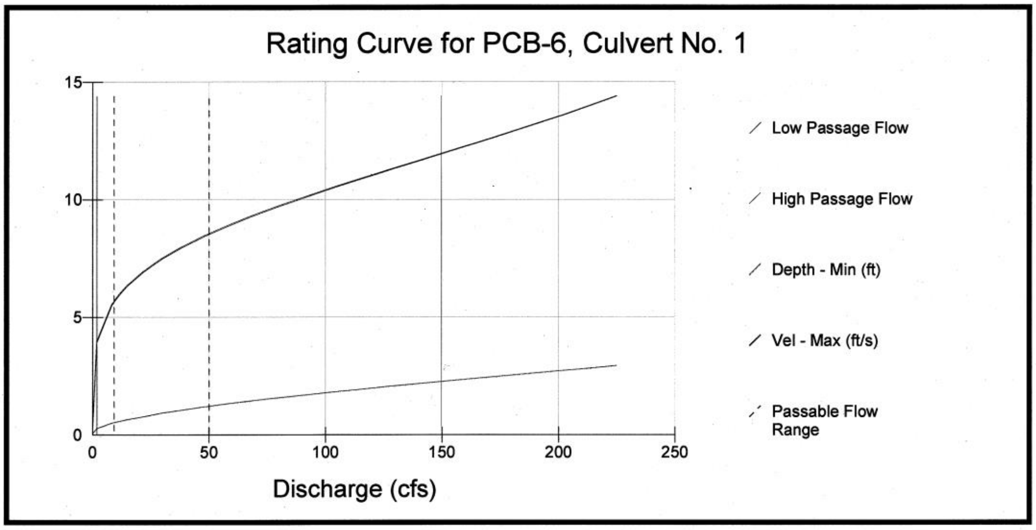

Figure 3. Culvert Rating Curve

Table 5. Culvert Summary for 10 cfs.

Summary for Q = 10.00 cfs	
Normal Depth (ft)	0.51
Critical Depth (ft)	0.65
Headwater Depth (ft)	0.83
HW/D	0.22
Inlet Velocity (ft/s)	5.73
Tailwater Depth (ft)	0.01
Outlet Water Surface Drop ...	0.51
Prolonged Swim Time (min)	0.00
Burst Swim Time (s)	3.26
Barrier Code	NONE

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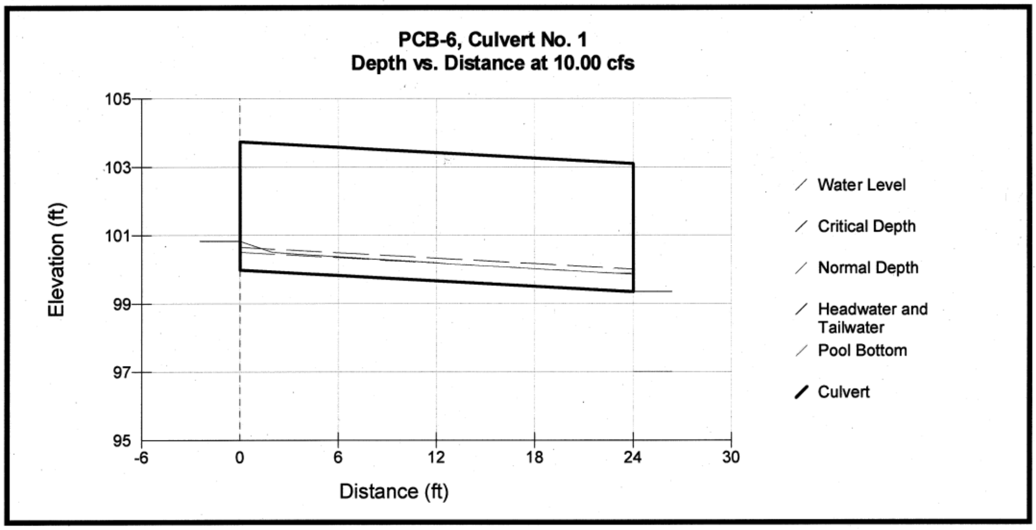

Figure 4. Water Surface Profile at 10 cfs

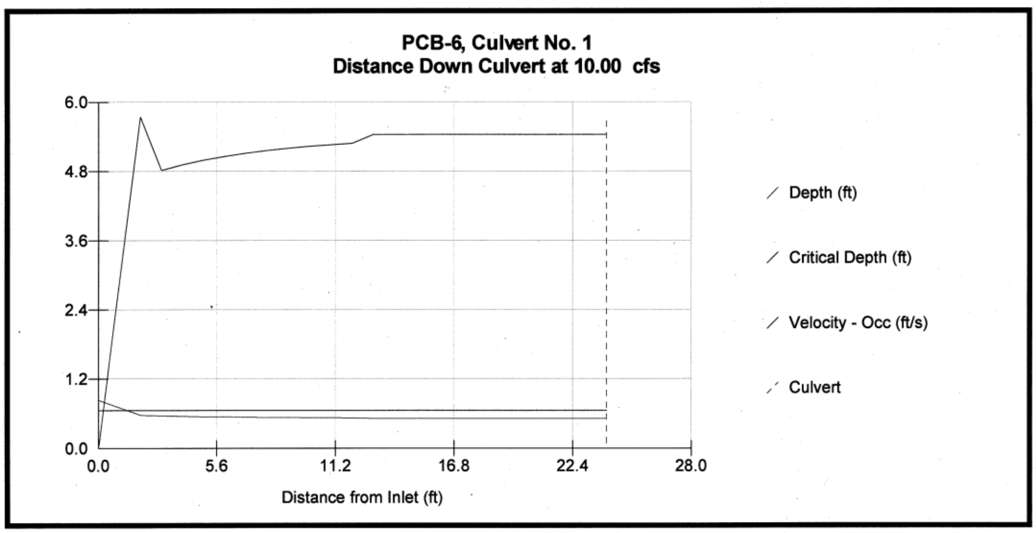

Figure 5. Culvert Profiles at 10 cfs

FishXing V3.0 2006

Appendix C4: Site PCB-7

Potrero Creek Fish Passage Barrier Assessment:
Crossing Report for Site PCB-7
Rancho San Carlos Culvert

Crossing Location Information

Crossing Name: PCB-7
Stream Name: Potrero Cr.
Road: Chamisal Pass
Mile Post: 0.0
36 Degrees 31" 33.3' Latitude, 121 Degrees 53" 4.7' Longitude

Comments:

Huge streamgrade culvert with 1+' rockweir apron dropoff . Lower end is corroding. Substrate is sand/sm gravel. ~0.5 cfs flowing through pipe at survey.

Inlet: a string of boulders form an apron, left side of pipe is deformed by concrete and fill.
Outlet: sand apron and boulder weir.

Crossing Installation Data

Culvert Type: 7.8 ft Circular
Material: Annular 3 x 1 inch
Installation: Embedded
Countersunk Depth: 0.2 ft
Natural Bottom Roughness Coefficient: 0.01
Culvert Length: 32 ft
Culvert Slope: 0.28%
Culvert Roughness Coefficient: 0.027
Natural Bottom Roughness Coefficient: 0.01
Inlet Invert Elevation: 96.45 ft
Outlet Invert Elevation: 96.36 ft
Inlet Headloss Coefficient (Ke): 0.5

Design Flows

Low Passage Flow: 2 cfs
High Passage Flow: 150 cfs

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Table 1. Fish Passage Summary.

Fish Passage Summary	
Low Passage Design Flow	2.00 cfs
High Passage Design Flow	150.00 cfs
Percent of Flows Passable	35.7 %
Passable Flow Range	4.92 to 57.70 cfs
Depth Barrier	2.00 to 4.92 cfs
Leap Barriers	None
Velocity Barrier	57.71 cfs to 150.00 cfs
Pool Depth Barrier	None

Tailwater Information

Tailwater Option: Tailwater Channel Cross-Section
Channel Bottom Slope: 7.7%
Outlet-Pool Bottom Elevation: 96.23 ft

Table 2. Tailwater Cross Section Data.

Station (ft)	Elevation (ft)	Roughness Coefficient
0.00	97.24	0.030
2.50	96.49	
3.50	96.89	0.040
5.00	96.44	
5.60	96.89	
7.00	96.30	
8.00	98.19	0.030

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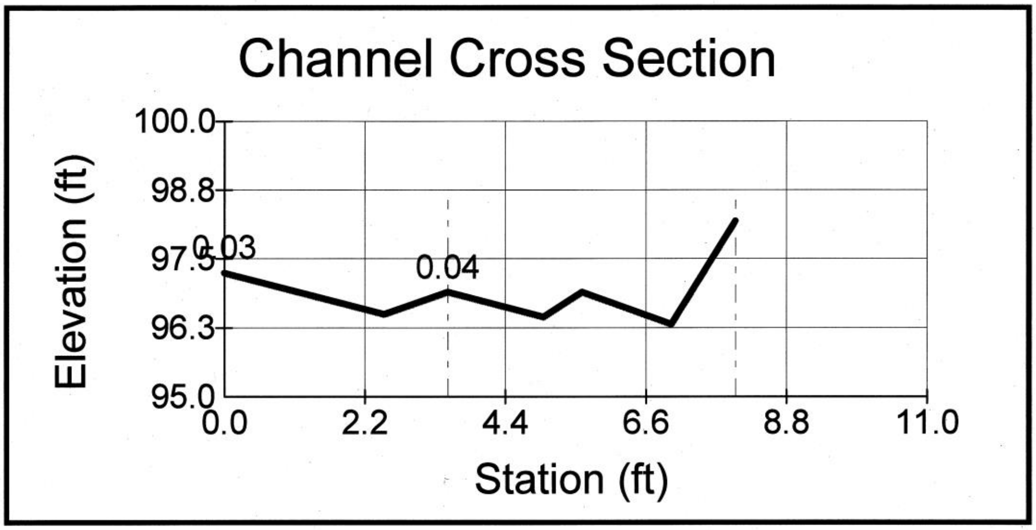


Figure 1. Channel Cross Section at Tailwater Crest.

Table 3. Tailwater Rating Table Information.

Discharge (cfs)	Tailwater Elevation (ft)	Wetted Perimeter (ft)	Cross-Sect. Area (sq. ft)	Composite Roughness Coefficient
0.0	96.3	0.00	0.00	0.045
0.0	96.3	0.15	0.00	0.040
0.0	96.4	0.52	0.03	0.040
0.2	96.5	1.71	0.11	0.038
0.8	96.6	3.22	0.33	0.037
2.1	96.7	4.72	0.67	0.037
4.2	96.8	6.22	1.15	0.037
7.7	96.9	7.20	1.76	0.036
12.7	97.0	7.66	2.41	0.036
18.7	97.1	8.12	3.10	0.036
25.7	97.2	8.59	3.83	0.036

FishXing V3.0 2006

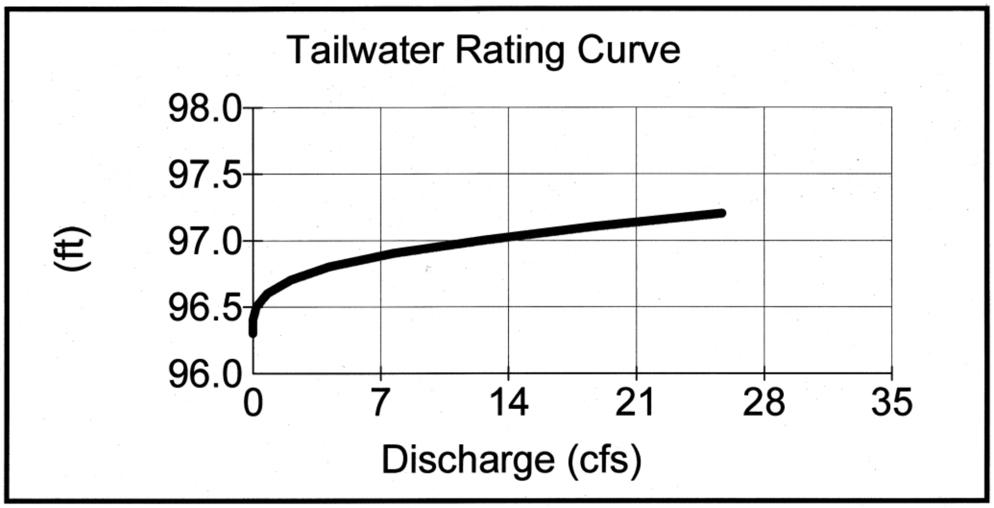


Figure 2. Tailwater Rating Curve

Table 4. Culvert Rating Table.

Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0	0.00	0.00	-96.36	96.36	-96.23	Depth
2.00	0.35	2.12	0.38	0.00	0.51	Depth
15	0.72	5.30	0.72	0.00	0.85	NONE
22	0.83	6.49	0.83	0.00	0.96	NONE
30	0.94	7.50	0.94	0.00	1.07	NONE
38	1.06	8.17	1.05	0.00	1.18	NONE
45	1.16	8.56	1.15	0.01	1.28	NONE
52	1.26	8.91	1.25	0.00	1.38	NONE
60	1.37	9.22	1.37	0.00	1.50	EB
68	1.48	9.41	1.48	0.00	1.61	EB
75	1.58	9.53	1.58	0.00	1.71	EB
82	1.68	9.62	1.68	0.00	1.81	EB
90	1.79	9.69	1.79	0.00	1.92	EB
98	1.90	9.74	1.90	0.00	2.03	EB
105	2.00	9.76	2.00	0.00	2.13	EB
112	2.10	9.77	2.10	0.00	2.23	EB
120	2.22	9.78	2.22	0.00	2.35	EB
128	2.33	9.77	2.33	0.00	2.46	EB
135	2.43	9.77	2.43	0.00	2.56	EB
142	2.53	9.75	2.53	0.00	2.66	EB
150.00	2.64	9.74	2.64	0.00	2.77	EB
158	2.75	9.72	2.75	0.00	2.88	EB
165	2.85	9.70	2.85	0.00	2.98	EB
172	2.95	9.68	2.95	0.00	3.08	V
180	3.07	9.66	3.07	0.00	3.20	V
188	3.18	9.66	3.18	0.00	3.31	V
195	3.28	9.78	3.28	0.00	3.41	V
202	3.38	9.90	3.38	0.00	3.51	V
210	3.49	10.07	3.49	0.00	3.62	V
218	3.60	9.80	3.60	0.00	3.73	EB
225	3.70	9.91	3.70	0.00	3.83	EB

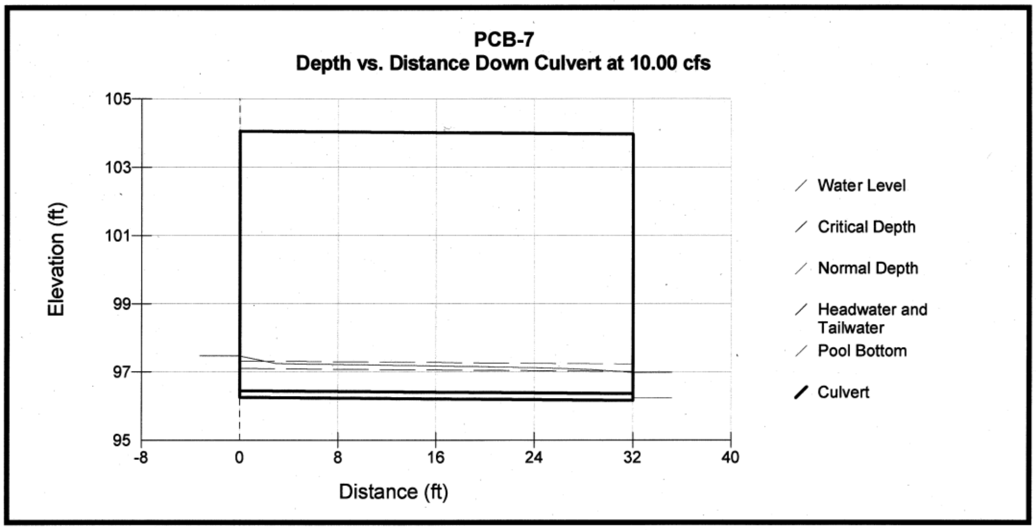


Figure 4. Water Surface Profile at 10 cfs

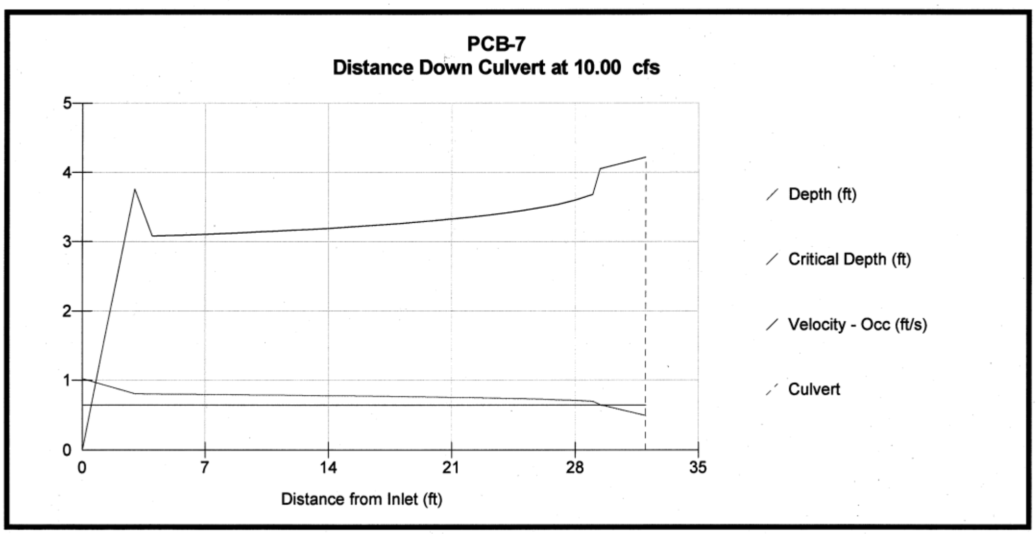


Figure 5. Culvert Profiles at 10 cfs

FishXing V3.0 2006

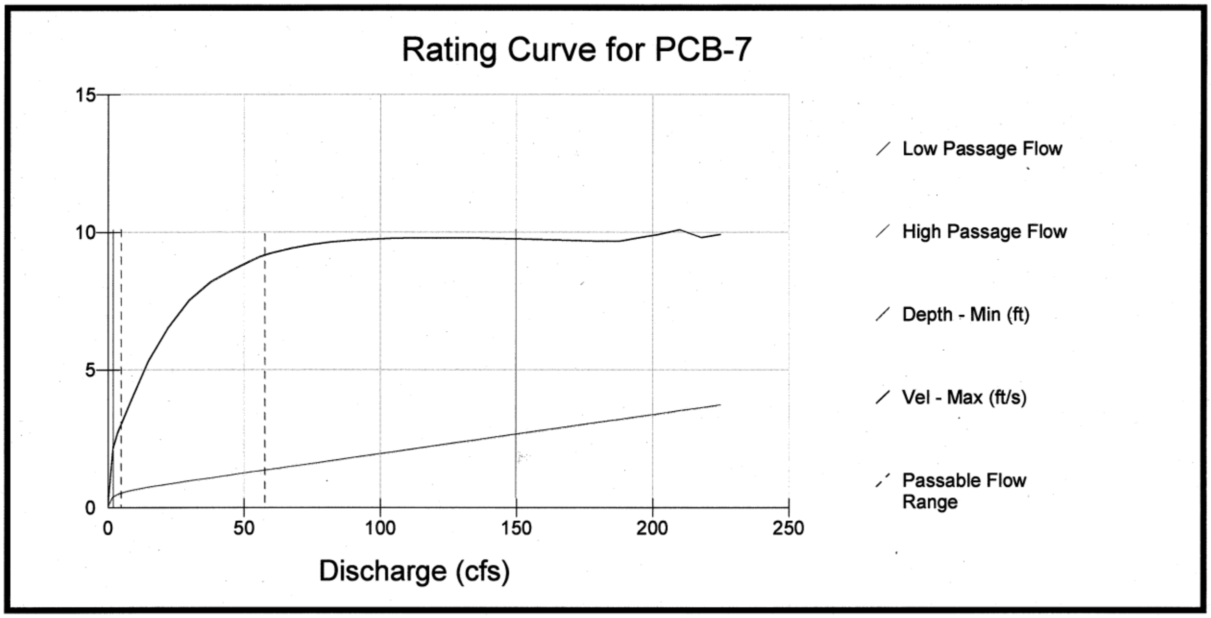


Figure 3. Culvert Rating Curve

Table 5. Culvert Summary for 10 cfs.

Summary for Q = 10.00 cfs	
Normal Depth (ft)	0.87
Critical Depth (ft)	0.65
Headwater Depth (ft)	1.02
HW/D	0.13
Inlet Velocity (ft/s)	3.76
Tailwater Depth (ft)	0.63
Outlet Water Surface Drop ...	0.00
Prolonged Swim Time (min)	0.08
Burst Swim Time (s)	3.18
Barrier Code	Depth

<u>Barrier Codes</u>

V = Strict Velocity Barrier
EB = Fish Exhausted at Burst Speed
Long = Fish Exhausted at Prolonged Speed
Leap = Excessive leap at outlet
Drop = Excessive drop at outlet
Depth = Too shallow for substantial distance
Pool = Leap Pool too shallow
NONE = Not a barrier

Appendix C5: Steelhead Biological Data used in FishXing analysis.

Biological Data

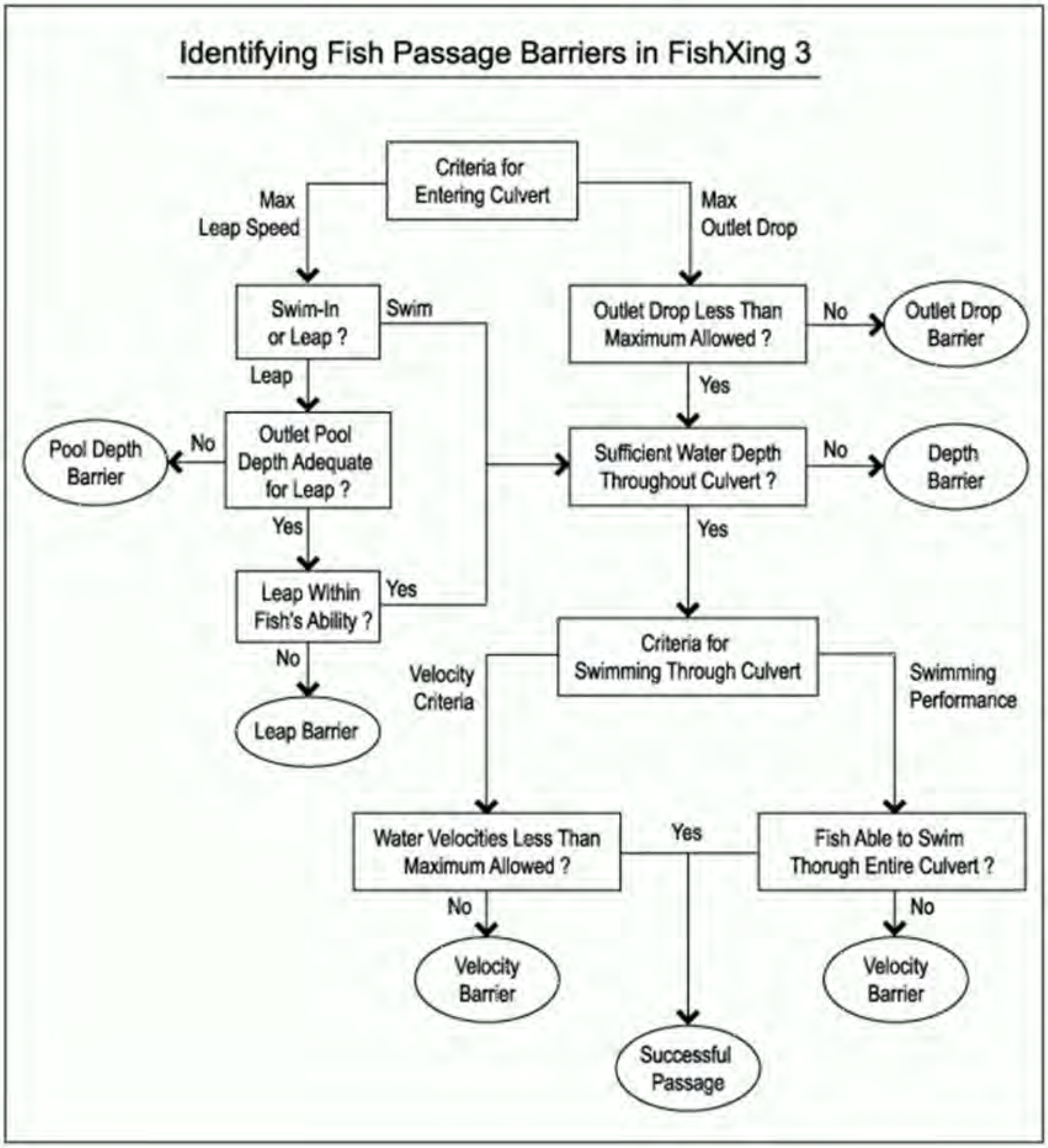
Title: steelhead
Fish Length: 26 in
Minimum Water Depth: 0.5 ft
Prolonged Swimming Speed: 2.5 ft/s
Prolonged Time to Exhaustion: 15 min
Prolonged Notes:
Oncorhynchus mykiss
Steelhead
Temp: 10 to 19 Deg C
Fish Body Depth: 0.48 ft

Burst Swimming Speed: 12.5 ft/s
Burst Time to Exhaustion: 5 s
Burst Notes:
Oncorhynchus mykiss
Steelhead
Length: 4.06 to 32.01 in
Temp: 7 to 19 Deg C
Swim Time: 1 - 20 s
Fish Body Depth: 0.48 ft
Fish Metrics Calculated

Leaping Speed: 27 ft/s
Velocity Reduction Factors:
Inlet: 1.00
Barrel: 1.00
Outlet: 1.00

FishXing V3.0 2006

Appendix C6. FishXing passage barrier flowchart.



Appendix D1. Summary of Potrero Creek Basin Culverts - Descriptions and passable flow ranges.

Site Number	Location (Road)	No. of Culverts	Culvert Shape and Size	Culvert Length	Culvert Slope	Low Passage Flow (QLP)	High Passage Flow (QHP)	Passable Flow Range*	% Passable*	Total # Days in Passable Range (WY 2008-2013)**
PCB-3.	Valley Greens Rd.	2	5.5 X 4 ft Pipe-Arch	70 ft	0.43%	2 cfs	150 cfs	12 - 13 cfs	0.6%	7
PCB-4	Valley Knolls Rd.	1	5 X 5.6 ft Arch	76 ft	0.37%	2 cfs	150 cfs	6 - 10 cfs	2.9%	19
PCB-5	RSC Rd. (CVAC)	1	5 ft Circular	100 ft	2.84%	2 cfs	150 cfs	none	0.0%	0
PCB-6	RSC Rd. (CVAC)	2	3.75 ft Circular	24 ft	2.67%	2 cfs	150 cfs	9 - 50 cfs	27.5%	26
PCB-7	Chamisal Pass	1	7.8 ft Circular	32 ft	0.28%	2 cfs	150 cfs	5 - 58 cfs	35.7%	59

*As calculated by the FishXing program.

** Mean Daily Discharge measured at MPWMD Gage near Site PCB-3 for Water Years (WY) 2008-2013.

Appendix D2. Potrero Creek – Exceedance Frequency Values.

	Potrero Creek: Exceedance Frequency Values: Water Years 1994-2013																			
	% of Time Exceeds Flow																			
Flow (cfs)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1.5	0.26	32.13	9.09	26.31	81.44	10.59	17.59	5.26	1.23	5.43	3.34	27.31	10.11	0.01	5.18	7.11	16.94	22.31	0.01	1.23
3.0	0.00	18.00	6.36	18.63	47.25	7.24	13.59	2.80	0.43	3.15	1.72	18.00	7.58	0.00	2.54	1.90	10.63	13.63	0.00	0.81
6.5	0.00	8.68	3.52	7.28	28.25	4.43	7.44	1.85	0.11	0.85	0.50	8.75	6.23	0.00	0.99	0.70	4.95	5.10	0.00	0.01
12.5	0.00	3.45	0.88	2.30	16.50	2.80	1.91	0.73	0.00	0.22	0.00	4.20	3.75	0.00	0.00	0.00	2.50	1.95	0.00	0.00
25.0	0.00	0.71	0.00	0.21	6.60	1.10	0.20	0.07	0.00	0.00	0.00	1.20	0.46	0.00	0.00	0.00	0.55	0.38	0.00	0.00
37.5	0.00	0.26	0.00	0.00	2.10	0.27	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
50.0	0.00	0.00	0.00	0.00	0.82	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62.5	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75.0	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pink = Dry Years - Low Potrero Flows

Blue = Wet Years - High Potrero Flows

Appendix D3. Potrero Creek Mean Daily Discharge – 1994-2013.

Potrero Creek, MPWMD Gage at Valley Greens Road - Mean Daily Discharge Data (cfs). Water Years (WY) 1994-2013.

WY 1994	WY 1995	WY 1996	WY 1997	WY 1998	WY 1999	WY 2000	WY 2001	WY 2002	WY 2003	WY 2004	WY 2005	WY 2006	WY 2007	WY 2008	WY 2009	WY 2010	WY 2011	WY 2012	WY 2013
OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT	OCT
0	0	0	0	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV	NOV
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.7	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	3.7	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01

Appendix D3 con't. Potrero Creek Mean Daily Discharge – 1994-2013.

DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC
0	0	0	0	0.84	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.02	0	0	0.42	0	0	0	0	0	0	0	0	0	0	1.6
0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
0	0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	7.1	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	3.9	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	11	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	9.9	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	5.1	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	8.6	2.7	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	3.6	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0.02	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.82	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	2	0.01	0	0	0	0.06	0	0	0	0	0	0.04	0	0	0	0
0	0	0	0	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1.5	0	0	0	0	7.7	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1.1	0	0	0	0	4.9	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.91	0	0	0	0	3.3	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.81	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.67	0	0	0	0.19	9.7	0	0	0	0	0	0	0	0	0	0
0	0	0	26	0.51	0	0	0	5.3	3.8	0	0	0	0.01	0	0	0	0	0	0
0	0	0	27	0.4	0	0	0	0.84	1.6	0	0	0	0	0	0	0	0	0	0
0	0	0	13	0.24	0	0	0	0.04	0.84	0	0	0	0	0	0	0	0	0	1.2
0	0	0	5.9	0.15	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	6.9
0	0	0	3.1	0.08	0	0	0	0	0.08	0	0	0	0	0	0	0	0.03	0	1.2
0	0	0	2.6	0.01	0	0	0	0	0	0	0	0.02	0.02	0	0	0	0	0	1.7
0	0	0	2.3	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	2.2
0	0	0	1.7	0	0	0	0	0.36	8.2	0	0	0	0	0	0	0	0	0	0.86
0	0	0	1.3	0	0	0	0	1.6	9.2	0.11	0	0	0	0	0	0	4.1	0	1.1
0	0	0	1.9	0	0	0	0	1.5	4	0.32	3	0	0	0	0	0	1	0	0.41
0	0	0	1.7	0	0	0	0	1.9	4.5	0	26	3.3	0	0	0	0	0.07	0	0.1
JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN
0	0	0	15	0	0	0	0	1.1	2.9	2.9	6.5	0.49	0	0	0	0	0.02	0	0.01
0	0	0	30	0.03	0	0	0	1.6	2	1.6	7.7	15	0	0	0	0	7.3	0	0
0	0	0	25	0.34	0	0	0	1.5	1.4	0.05	11	6.5	0	0	0	0	4	0	0
0	0	0	13	10	0	0	0	1	0.99	0	4.2	1.6	0	0.09	0	0	1.5	0	0
0	0	0	8.4	6.4	0	0	0	0.67	0.73	0	2.2	0.52	0	0.85	0	0	0.69	0	0
0	0	0	5.1	3.6	0	0	0	0.39	0.51	0	1.4	0.11	0	2.2	0	0	0.35	0	1.9
0	0.02	0	3.6	2.4	0	0	0	0.17	0.32	0	10	0.12	0	0	0	0	0.16	0	1.3
0	0	0	2.9	1.9	0	0	0	0.04	0.19	0	31	0	0	0	0	0	0.04	0	0.73
0	20	0	2.3	5.1	0	0	0	0.01	0.15	0	20	0	0	0	0	0	0	0	0.44
0	61	0	1.9	28	0	0	0.26	0	6.6	0	14	0	0	0	0	0	0	0	1.2
0	17	0	1.6	21	0	0	2.3	0	3.8	0	32	0	0	0	0	0	0	0	1
0	5.8	0	1.6	27	0	0	2.2	0	2.4	0	14	0	0	0	0	0	0	0	0.67
0	2.8	0	1.5	22	0	0	0.1	0	1.8	0	8.7	0	0	0	0	0	0	0	0.39
0	3	0	1.4	14	0	0	0	0	1.4	0	5.8	1.6	0	0	0	0	0	0	0.18
0	12	0	14	42	0	0	0	0	1.1	0	3.9	4.3	0	0	0	0	0	0	0.07
0	18	0	8.6	26	0	0	0	0	0.87	0	2.8	2.1	0	0	0	0	0	0	0.02
0	9.5	0	5.5	16	0	0	0	0	0.65	0	2.1	1.4	0	0	0	0	0	0	0
0	5	0	3.8	25	0	0	0	0	0.49	0	1.5	2	0	0	0	0.02	0	0	0
0	3.2	0	2.9	27	0.05	0	0	0	0.34	0	1.2	1.4	0	0	0	13	0	0	0
0	3.9	0	35	18	0.26	0	0	0	0.24	0	0.92	0.99	0	0	0	58	0	0	0
0	4.3	0	22	14	0.01	0	0	0	0.27	0	0.74	0.83	0	0	0	13	0	0	0
0	3.7	0	22	12	0	0	0	0	0.11	0	0.6	0.63	0	0	0	19	0	0	0
0	4.7	0	31	11	0.38	0.6	0	0	0.05	0	0.46	0.46	0	0	0	8.6	0	0	0
0	18	0	19	9	0.23	3.4	0	0	0.01	0	0.29	0.4	0	1.4	0	4.3	0	0	0
0	13	0	35	8.3	0.13	6.2	0.53	0	0	0	0.18	0.24	0	21	0	2.5	0	0	0
0	8.4	0	46	7.2	1.5	1.3	2.8	0	0	0	0.46	0.2	0	14	0	2.4	0	0	0
0	6.9	0	26	6.2	2.1	0.43	1.4	0	0	0	0.2	0.08	0	31	0	1.9	0	0	0
0	5.7	0	18	4.6	1.2	0.12	0.78	0.04	0	0	1.9	0.03	0	26	0	1.2	0	0	0
0	4.2	0	13	16	0.88	0	0.51	0	0	0	1	0.05	0	8.5	0	0.91	0	0	0
0	3.6	0	11	10	0.68	0.03	0.35	0	0	0	0.74	0.01	0	3.9	0	0.72	0	0	0
0	3.1	0.38	8.5	8.5	14	0	0.22	0	0	0	0.67	0	0	2.3	0	0.47	0	0	0

Appendix D3 con't. Potrero Creek Mean Daily Discharge – 1994-2013.

FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB	FEB
0	2.5	0.24	6.9	15	9.5	0	0.06	0	0	0	0.54	0	0	1.9	0	0.31	0	0	0
0	2.1	0	5.6	70	5.9	0	0	0	0	0	0.44	0	0	1.5	0	0.23	0	0	0
0	1.7	0	5.1	300	4.3	0.34	0	0	0	0.62	0.38	0	0	5.6	0	0.11	0	0	0
0	1.4	0.18	4.7	51	3.3	0.55	0	0	0	1.8	0.42	0	0	5	0	0.12	0	0	0
0	1.3	2.4	4.3	32	2.7	0.2	0	0	0	0.67	0.83	0	0	3	0	0.55	0	0	0
0	1.2	0.94	3.9	156	2.4	0.04	0	0	0	0.16	0.53	0	0	2.2	0	0.28	0	0	0
0	1.1	0.33	3.5	168	4	0	0	0	0	0	0.51	0	0	1.7	0	0.34	0	0	0
0	1	0.06	3.1	125	4.8	0	0	0	0	0	0.43	0	0	1.5	0	0.39	0	0	0
0	0.89	0	3.1	70	47	0	0.41	0	0	0	0.39	0	0	1.1	0	3.7	0	0	0
0	0.8	0	2.8	48	13	0.2	1.3	0	0	0	0.37	0	0	0.81	0	3	0	0	0
0	0.73	0	2.5	36	6.5	5.7	9.7	0	0	0	0.38	0	0	0.6	0	2	0	0	0
0	0.7	0	2.3	31	4.1	16	7.5	0	0	0	0.69	0	0	0.39	0	1.5	0	0	0
0	0.93	0	2.1	27	2.8	22	4	0	0	0	0.47	0	0	0.3	0.02	1.4	0	0	0
0	1.2	0	1.9	29	2	32	2.2	0	0	0	0.46	0	0	0.15	0	1.1	0	0	0
0	0.71	0	1.8	29	1.6	13	1.4	0	0	0	5.5	0	0	0.02	3.4	0.87	0	0	0
0	0.6	0	1.7	28	1.3	9	0.97	0	0.11	0	11	0	0	0	22	0.67	0.38	0	0
0	0.54	0	1.7	27	1.2	7.4	0.67	0.65	0	0	7	0	0	0	21	0.52	17	0	0
0.29	0.5	0	1.5	24	1.1	5.4	0.44	0.36	0	5	18	0	0	0	5.2	0.38	23	0	0
3.3	0.46	15	1.4	46	1.1	4.5	4.1	0.15	0	3.1	21	0	0	0	1.9	0.27	32	0	0
5.9	0.44	19	1.3	38	1.2	6	2.3	0.08	0	1.6	30	0	0	0.01	1.4	0.16	14	0	0
3	0.39	31	1.1	100	2.9	9.2	1.7	0.05	0	1	27	0	0	0	1	0.15	8.4	0	0
1.6	0.36	21	1.1	73	1.9	6.8	1.8	0.03	0	0.77	18	0	0	0.12	0.86	0.28	4.3	0	0
0.55	0.36	11	0.97	103	1.6	29	2.7	0	0	0.43	12	0	0	0.2	1.4	0.48	2.9	0	0
0.25	0.36	8.7	0.85	57	1.4	14	3.1	0	0	0.31	8.4	0	0	4	1.1	4.9	2.1	0	0
0.09	0.35	8.1	0.83	38	1.6	9.8	2.6	0	0	14	6	0	0	4.9	0.95	3	22	0	0
0.03	0.32	6.4	0.83	30	1.3	7.6	2.2	0	0	13	4.9	0	0	2.7	0.76	4	12	0	0
0	0.31	7.2	0.82	26	1.1	19	1.8	0	0.05	11	4.6	0	2.7	1.9	0.6	9.6	6.4	0	0
0	0.31	7	0.74	22	1	15	1.5	0	0	6.2	8.1	0.85	2.8	1.3	0.46	6.9	4.5	0	0
		6.3				11				3.9				0.97				0	
MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR	MAR
0	0.3	5.3	0.72	19	0.96	8.4	1.2	0	0	3	5.5	0.29	0.73	0.75	0.3	4.3	3.3	0	0
0	0.35	4.2	0.69	16	0.92	7	1.1	0	0	2.4	4.9	0.79	0.1	0.57	10	16	2.7	0	0
0	0.5	3.5	0.67	14	1.1	6.2	1	0	0	1.8	4.5	6.3	0	0.35	19	22	2	0	0
0	0.52	3.9	0.64	13	0.89	5.4	12	0	0	1.5	28	4	0	0.26	55	21	1.5	0	0
0	0.63	6.2	0.61	11	0.83	38	19	0	0	1.3	21	2.1	0	0.16	12	10	1.2	0	0
0	0.5	4.8	0.58	11	0.76	28	11	0	0	0.99	12	7.1	0	0.07	5.8	6.6	1	0	0.01
0	0.4	4.2	0.55	9.8	0.68	17	6.7	0.04	0	0.81	8.9	4.6	0	0.02	3.7	4.8	0.92	0	0
0	0.4	3.6	0.53	9.1	0.76	15	4.6	0.1	0	0.64	7.1	3.4	0	0	2.5	3.5	0.66	0	0
0	5.9	3.3	0.5	8.4	1.8	15	3.6	0	0	0.47	5.8	3	0	0	1.9	2.7	0.5	0	0
0	147	2.8	0.47	7.7	1.6	12	2.8	0	0	0.35	5	3.7	0	0	1.5	2.4	0.37	0	0
0	46	2.3	0.45	7	1.5	10	2.3	0	0	0.24	4.2	3.1	0	0	1.1	1.9	0.3	0	0
0	25	10	0.42	6.7	1.3	9	2	0	0	0.15	3.7	9.7	0	0	0.85	2.3	0.18	0	0
0	15	7.6	0.39	8	1.2	7.9	1.6	0	0	0.07	3.4	7.2	0	0	0.68	3.1	0.12	0	0
0	10	5.4	0.36	6.7	2.2	7.2	1.4	0	0	0.02	3	9	0	0	0.51	2.3	0.16	0	0
0	7.8	4.2	0.33	6	6.7	6.2	1.2	0	0.18	0	2.6	7.1	0	0	0.4	1.9	0.1	0	0
0	6	3.6	0.31	5.7	4.1	5.2	0.93	0	0.01	0	2.3	5.4	0	0	0.36	1.8	0.12	0	0
0	6	2.9	0.28	5.6	3.3	4.7	0.79	0.43	0	0	2.1	8	0	0	0.22	1.7	0.06	0.01	0
0	5	2.5	0.26	5.4	2.9	4.4	0.63	0.23	0	0	2	6.1	0	0	0.16	1.6	0.69	0	0
0	4.2	2.4	0.23	5.3	4	3.9	0.52	0.08	0	0	2.2	4.7	0	0	0.1	1.4	1.3	0	0
0	6	2.1	0.21	5.4	3.8	3.8	0.43	0.02	0	0	1.7	6.8	0	0	0.04	1.1	75	0	0
0	15	1.9	0.19	5.1	3.3	3.3	0.37	0	0	0	1.3	8.6	0	0	0	0.97	18	0	0
0	39	1.7	0.18	4.9	3.1	3	0.35	0	0	0	42	6.2	0	0	0.14	0.96	9.5	0	0
0	72	1.6	0.16	4.5	3.7	2.7	0.32	0.09	0	0	32	4.8	0	0	0.01	0.85	16	0	0
0	39	1.5	0.14	6	3.7	2.3	0.27	0.22	0	0	15	3.9	0	0	0	0.76	62	0	0
0	29	1.3	0.13	9	15	2.1	0.23	0.22	0	0.02	11	7	0	0	0	0.66	50	0.05	0
0	22	1.2	0.11	6	9.2	1.8	0.18	0.2	0	0	7.4	5.7	0	0	0	0.58	23	0	0
0	18	1	0.09	8	6.7	1.7	0.14	0.08	0	0	5.7	4.6	0	0	0	0.52	17	0	0
0	15	0.99	0.08	28	5.4	1.7	0.11	0.04	0	0	7.2	4.5	0	0	0	0.49	13	0	0
0	12	0.92	0.07	19	4.3	1.6	0.08	0	0	0	6.5	5.2	0	0	0	0.38	9.3	0	0
0	10	0.83	0.06	14	3.7	1.5	0.05	0	0	0	5.1	4.8	0	0	0	0.38	7.6	0	0
0	8.3	0.73	0.05	20	3.7	1.4	0	0	0	0	4.2	5.5	0	0	0	0.4	6.5	0	0

Appendix D3 con't. Potrero Creek Mean Daily Discharge – 1994-2013.

APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR	APR
0	7	1.1	0.04	31	3.3	1.2	0	0	0	0	3.6	7	0	0	0	0.38	5.4	0	0
0	5.9	1.3	0.03	20	2.6	1.1	0	0	0	0	3.2	5.5	0	0	0	0.26	4.6	0	0
0	4.8	1.1	0.03	22	2.1	0.99	0	0	0	0	3.1	6.5	0	0	0	0.24	4	0	0
0	4.1	0.97	0.02	21	1.8	0.94	0	0	0	0	3.8	61	0	0	0	0.69	3.4	0	0
0	3.3	0.85	0.02	17	2.7	0.86	0	0	0	0	2.9	85	0	0	0	39	3	0	0
0	2.9	0.73	0.02	15	5.5	0.83	0.03	0	0	0	2.7	23	0	0	0	12	2.7	0	0
0	2.9	0.63	0.01	18	5.8	0.84	0.8	0	0	0	2.8	14	0	0	0	7	2.7	0	0
0	2.4	0.59	0.01	15	9	0.81	0.36	0	0	0	2.7	11	0	0	0	5.1	2.4	0	0
0	2.2	0.56	0	13	8.9	0.71	0.31	0	0	0	3.2	8.8	0	0	0	4.2	2	0	0
0	2	0.49	0	11	6.8	0.68	0.2	0	0	0	2.6	7.8	0	0	0	3.2	1.9	0	0
0	1.8	0.41	0	13	19	0.64	0.24	0	0	0	2.4	7	0	0	0	11	1.8	0	0
0	1.7	0.37	0	11	13	0.59	0.19	0	0.08	0	2.3	6.5	0	0	0	20	1.6	0	0
0	1.9	0.34	0	13	9.3	0.58	0.18	0	0.95	0	2	5.9	0	0	0	13	1.5	4.2	0
0	1.5	0.27	0	13	7.5	0.62	0.2	0	0.71	0	2	5.5	0.01	0	0	8.6	1.3	2	0
0	1.6	0.22	0	11	6.2	0.55	0.15	0	0.38	0	1.9	5	0	0	0	6.2	1.2	0.64	0
0	1.5	0.23	0	9.6	5.1	0.55	0.1	0	0.26	0	1.7	5.4	0	0	0	4.7	1.4	0.17	0
0	1.3	0.26	0	8.7	4.3	1.2	0.07	0	0.19	0	1.6	4.8	0	0	0	3.7	1.5	0.02	0
0	1.3	0.17	0	8	3.8	0.63	0.06	0	0.05	0	1.5	4.2	0	0	0	3	1.4	0	0
0	1.3	0.13	0	7.4	3.4	0.48	0.16	0	0.01	0	1.4	3.8	0	0	0	2.5	1.3	0	0
0	1.4	0.1	0	6.6	3.1	0.42	0.71	0	0	0	1.4	3.5	0	0	0	4	1.3	0	0
0	1.3	0.07	0	5.7	2.8	0.41	2.3	0	0	0	1.3	3.2	0	0	0	9.5	1.4	0	0
0	1.2	0.05	0	5.3	2.3	0.37	1.5	0	0.15	0	1.2	2.8	0	0	0	6.1	1.3	0	0
0	1.1	0.03	0	5.1	2.1	0.35	1.2	0	0	0	1.4	2.5	0	0	0	4.5	1.2	0	0
0	1	0.01	0	4.9	2.1	0.35	1.1	0	0	0	1.2	2.4	0	0	0	3.7	1	0	0
0	1	0.01	0	4.6	2	0.32	0.89	0	0	0	1	2.3	0	0	0	3.1	0.99	0	0
0	1	0.01	0	4.2	1.8	0.32	0.74	0	0	0	1	2.2	0	0	0	2.7	0.67	0	0
0	1.1	0	0	4	1.7	0.35	0.65	0	0	0	0.94	1.9	0	0	0	2.5	0.6	0	0
0	1.1	0	0	3.7	1.7	0.34	0.55	0	0.2	0	1.2	1.8	0	0	0	2.2	0.49	0	0
0	1.3	0	0	3.5	1.5	0.35	0.46	0	0.09	0	0.85	1.7	0	0	0	1.9	0.42	0	0
0	1	0	0	3.4	1.4	0.32	0.38	0	0.06	0	0.82	1.6	0	0	0	1.7	0.3	0	0
MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY	MAY
0	0.84	0	0	3.1	1.4	0.3	0.39	0	0.04	0	0.71	1.5	0	0	0	1.6	0.33	0	0
0	0.78	0	0	3.1	1.3	0.29	0.34	0	0.04	0	0.71	1.3	0	0	0	1.4	0.37	0	0
0	0.69	0	0	3	1.3	0.27	0.27	0	0.44	0	0.64	1.2	0	0	0	1.2	0.32	0	0
0	0.64	0	0	2.9	1.2	0.23	0.22	0	0.83	0	0.68	1.1	0	0	0	1.1	0.35	0	0
0	0.6	0	0	2.8	1.1	0.19	0.19	0	0.71	0	0.98	0.93	0	0	0	1.1	0.33	0	0
0	0.5	0	0	2.6	1.1	0.19	0.16	0	0.57	0	0.68	0.85	0	0	0	0.93	0.33	0	0
0	0.44	0	0	2.7	1.1	0.19	0.14	0	0.75	0	0.57	0.66	0	0	0	0.83	0.38	0	0
0	0.44	0	0	2.6	0.96	0.17	0.12	0	0.59	0	0.52	0.63	0	0	0	0.75	0.41	0	0
0	0.45	0	0	2.6	0.96	0.15	0.1	0	0.57	0	0.62	0.64	0	0	0	0.74	0.46	0	0
0	0.45	0	0	2.6	0.96	0.14	0.06	0	0.46	0	0.42	0.64	0	0	0	0.71	0.54	0	0
0	0.42	0	0	2.5	0.86	0.13	0.04	0	0.34	0	0.38	0.57	0	0	0	0.66	0.68	0	0
0	0.43	0	0	2.3	0.86	0.12	0.01	0	0.25	0	0.33	0.52	0	0	0	0.6	1.1	0	0
0	0.57	0	0	2.3	0.77	0.12	0.01	0	0.17	0	0.29	0.49	0	0	0	0.57	2.6	0	0
0	0.46	0	0	2.2	0.77	0.1	0	0	0.12	0	0.24	0.46	0	0	0	0.5	4	0	0
0	0.4	0.11	0	2	0.77	0.1	0	0	0.07	0	0.24	0.46	0	0	0	0.42	4.9	0	0
0	0.36	0.37	0	2	0.77	0.11	0	0	0.04	0	0.23	0.41	0	0	0	0.41	5	0	0
0	0.32	0	0	1.9	0.77	0.07	0	0	0	0	0.18	0.38	0	0	0	0.35	5.6	0	0
0	0.3	0	0	1.9	0.68	0.04	0	0	0	0	0.15	0.36	0	0	0	0.33	3.1	0	0
0	0.29	0	0	1.8	0.68	0.02	0	0	0	0	0.12	0.36	0	0	0	0.24	3.1	0	0
0	0.27	0	0	1.7	0.6	0.01	0	0	0	0	0.14	0.36	0	0	0	0.19	1.1	0	0
0	0.26	0	0	1.6	0.6	0.01	0	0	0	0	0.14	0.55	0	0	0	0.15	1.1	0	0
0	0.26	0	0	1.6	0.6	0	0	0	0	0	0.11	0.43	0	0	0	0.13	0.86	0	0
0	0.26	0	0	1.6	0.52	0.01	0	0	0	0	0.12	0.25	0	0	0	0.11	1	0	0
0	0.26	0	0	1.5	0.52	0.01	0	0	0	0	0.09	0.24	0	0	0	0.11	1.6	0	0
0	0.26	0	0	1.6	0.53	0.01	0	0	0	0	0.05	0.24	0	0	0	0.11	1.9	0	0
0	0.24	0	0	1.5	0.49	0.01	0	0	0	0	0.02	0.24	0	0	0	0.1	1.2	0	0
0	0.22	0	0	1.5	0.47	0	0	0	0	0	0.01	0.19	0	0	0	0.21	0.17	0	0
0	0.2	0	0	1.8	0.47	0	0	0	0	0	0	0.18	0	0	0	0.12	0.21	0	0
0	0.18	0	0	1.5	0.46	0	0	0	0	0	0	0.16	0	0	0	0.08	0.18	0	0
0	0.15	0	0	1.4	0.4	0	0	0	0	0	0	0.14	0	0	0	0.06	0.03	0	0
0	0.12	0	0	1.4	0.36	0	0	0	0	0	0	0.09	0	0	0	0.05	0.06	0	0

Appendix D3 con't. Potrero Creek Mean Daily Discharge – 1994-2013.

JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN	JUN
0	0.1	0	0	1.3	0.34	0	0	0	0	0	0	0.06	0	0	0	0.04	0	0	0
0	0.07	0	0	1.3	0.35	0	0	0	0	0	0	0.03	0	0	0	0.03	0	0	0
0	0.07	0	0	1.2	0.4	0	0	0	0	0	0	0.02	0	0	0	0.02	0.03	0	0
0	0.05	0	0	1.2	0.34	0	0	0	0	0	0	0.01	0	0	0	0.01	0.91	0	0
0	0.03	0	0	1.2	0.3	0	0	0	0	0	0	0.02	0	0	0	0.01	0.19	0	0
0	0.01	0	0	1.2	0.3	0	0	0	0	0	0	0.03	0	0	0	0.01	0.07	0	0
0	0	0	0	1.1	0.28	0	0	0	0	0	0	0.02	0	0	0	0	0.02	0	0
0	0	0	0	1.2	0.24	0	0	0	0	0	0	0.03	0	0	0	0.01	0.01	0	0
0	0	0	0	1.2	0.22	0	0	0	0	0	0.01	0.03	0	0	0	0	0	0	0
0	0	0	0	1.2	0.21	0	0	0	0	0	0	0.04	0	0	0	0	0.01	0	0
0	0	0	0	1.2	0.16	0	0	0	0	0	0	0.02	0	0	0	0	0.01	0	0
0	0	0	0	1.1	0.12	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0
0	0	0	0	1	0.09	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0
0	0	0	0	1	0.06	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0
0	0	0	0	0.93	0.06	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0
0	0.5	0	0	0.92	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.84	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.84	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.83	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.79	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.76	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.75	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.77	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.75	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.74	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.69	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.74	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.71	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL
0	0	0	0	0.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix D3 con't. Potrero Creek Mean Daily Discharge – 1994-2013.

AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
0	0	0	0	0.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP
0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0