

**MONTEREY PENINSULA
WATER MANAGEMENT DISTRICT**

**2015-2016 ANNUAL REPORT
(July 1, 2015 - June 30, 2016)**

for the

MPWMD MITIGATION PROGRAM

A report in compliance with the

**MPWMD WATER ALLOCATION PROGRAM
FINAL ENVIRONMENTAL IMPACT REPORT
(originally certified in November 1990)**

**Prepared by MPWMD Staff
October 2017**

**2015-2016 ANNUAL REPORT MPWMD
MITIGATION PROGRAM WATER
ALLOCATION PROGRAM EIR**

May 2017

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2015-2016 ANNUAL REPORT
(July 1, 2015 - June 30, 2016)

MPWMD MITIGATION PROGRAM
WATER ALLOCATION PROGRAM ENVIRONMENTAL IMPACT REPORT

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
Prepared May 2017

I. EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND:

In April 1990, the Water Allocation Program Final Environmental Impact Report (EIR) was prepared for the Monterey Peninsula Water Management District (MPWMD or District) by J.L. Mintier and Associates. The Final EIR analyzed the effects of five levels of annual California American Water (CAW or Cal-Am) production, ranging from 16,744 acre-feet per year (AFY) to 20,500 AFY. On November 5, 1990, the MPWMD Board certified the Final EIR, adopted findings, and passed a resolution that set Option V as the new water allocation limit. Option V resulted in an annual limit of 16,744 AFY for Cal-Am production, and 3,137 AFY for non-Cal-Am production, with a total allocation of 19,881 AFY for the Monterey Peninsula Water Resource System (MPWRS). The MPWRS is the integrated system of water resources from the Carmel River Alluvial Aquifer and Seaside Groundwater Basin that provide the Monterey Peninsula community's water supply via the Cal-Am water distribution network.

Even though Option V was the least damaging alternative of the five options analyzed in the Water Allocation Program EIR, production at this level still resulted in significant, adverse environmental impacts that must be mitigated. Thus, the findings adopted by the Board included a "Five-Year Mitigation Program for Option V" and associated mitigation measures.

In June 1993, Ordinance No. 70 was passed, which amended the annual Cal-Am production limit from 16,744 AF to 17,619 AF, and the non-Cal-Am limit from 3,137 AF to 3,054 AF; the total production limit was increased from 19,881 AF to 20,673 AF per year due to new supply from the Paralta Well in Seaside. In April 1996, Ordinance No. 83 slightly changed the Cal-Am and non-Cal-Am annual limits to 17,621 AF and 3,046 AF, respectively, resulting in a total limit of 20,667 AFY. In February 1997, Ordinance No. 87 was adopted to provide a special water allocation for the planned expansion of the Community Hospital of the Monterey Peninsula, resulting in a new Cal-Am production limit of 17,641 AFY; the non-Cal-Am limit of 3,046 AFY was not changed. These actions did not affect the implementation of mitigation measures adopted by the Board in 1990.

The Five-Year Mitigation Program formally began in July 1991 with the new fiscal year (FY) and was slated to run until June 30, 1996. Following public hearings in May 1996 and District Board review of draft reports through September 1996, the Five-Year Evaluation Report for the

1991-1996 comprehensive program, as well as an Implementation Plan for FY 1996-1997 through FY 2000-2001, were finalized in October 1996. In its July 1995 Order WR 95-10, the State Water Resources Control Board (SWRCB) directed Cal-Am to carry out any aspect of the Five-Year Mitigation Program that the District does not continue after June 1996. To date, as part of the annual budget approval process, the District Board has voted to continue the program. The Mitigation Program has accounted for a significant portion of the District's annual budgets in terms of revenue (derived primarily from a portion of the MPWMD user fee on the Cal-Am bill) and expenditures. It should be noted that this fee was removed from Cal-Am's bill in July 2009, resulting from actions subsequent to a California Public Utilities Commission ruling regarding a Cal-Am rate request. Cal-Am continued to pay the Carmel River Mitigation Program fee under a separate agreement with MPWMD through June 2010. The District and Cal-Am have negotiated an annual funding agreement that funded part of the 2016 mitigation program. The District's other revenue sources were used to fund the remainder of the program.

The California Environmental Quality Act (CEQA) (Pub. Res. Code 21081.6) requires that the MPWMD adopt a reporting or monitoring program to insure compliance with mitigation measures when implementing the Water Allocation Program. Findings Nos. 387 through 404 adopted by the Board on November 5, 1990 describe mitigation measures associated with the Water Allocation Program; many entail preparation of annual monitoring reports. This 2015-2016 Annual Report for the MPWMD Mitigation Program responds to these requirements. It covers the fiscal year period of July 1 through June 30. It should be noted that hydrologic data and well reporting data in this report are tabulated using the water year, defined as October 1 through September 30, in order to be consistent with the accounting period used by the SWRCB.

This 2015-2016 Annual Report first addresses general mitigation measures relating to water supply and demand (Sections II through XI), followed by monitoring related to compliance with production limits, drought reserve and supply augmentation (Sections XII through XV), followed by mitigations relating to specific environmental resources (Sections XVI through XIX). Section XX provides a summary of costs for the biological mitigation programs as well as related hydrologic monitoring, water augmentation and administrative costs. Section XXI presents selected references.

Table I-1 summarizes the mitigation measures described in this report. In subsequent chapters, for each topic, the mitigation measure adopted as part of the Final EIR is briefly described, followed by a summary of activities relating to the topic in FY 2015-2016 (July 1, 2015 through June 30, 2016, unless otherwise noted). Monitoring results, where applicable, are also presented. Tables and figures that support the text are found at the end of each section in the order they are introduced in the text.

ACCOMPLISHMENTS:

Many activities are carried out as part of the MPWMD Mitigation Program to address the environmental effects that community water use has upon the Carmel River and Seaside Groundwater Basins. Highlights of the accomplishments in FY 2015-2016 for each major category are shown in **Table I-2**.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

The following paragraphs describe observed trends (primarily qualitative), conclusions and/or recommendations for the mitigation program. General conclusions are followed by a summary of selected Mitigation Program categories.

General Overview

Overall, the Carmel River environment with respect to riparian vegetation, river flow, and aquifer levels is in better condition today than it was in 1990 when the Allocation Program EIR was prepared. This improvement is evidenced by increased riparian habitat and higher water tables in the Carmel Valley alluvial aquifer. However, the steelhead fishery was rebounding until the onset of the 2012-2015 drought. During and after the drought, steelhead numbers declined to levels similar to those seen in previous droughts, with 2016 being the fifth dry year with low numbers of both adult and juvenile steelhead.

The comprehensive MPWMD Mitigation Program is an important factor responsible for this improvement. Direct actions such as fish rescues and rearing, and riparian habitat restoration literally enable species to survive and reproduce. Indirect action such as conservation programs, water augmentation, ordinances/regulations and cooperative development of Cal-Am operation strategies result in less environmental impact from human water needs than would occur otherwise. The District's comprehensive monitoring program provides a solid scientific data baseline, and enables better understanding of the relationships between weather, hydrology, human activities and the environment. Better understanding of the MPWRS enables informed decision-making that achieves the District's mission of benefiting the community and the environment.

It is acknowledged that there are other important factors responsible for this improved situation. For example, since Water Year (WY) 1991, the Carmel River has received normal or better runoff in 16 out of 25 years. Actions by federal resource agencies under the Endangered Species Act (ESA) or the SWRCB under its Order WR 95-10 and follow-up orders have provided strong incentive for Cal-Am and other local water producers to examine and amend water production practices to the degree feasible, and for the community to reduce water use. Except for one year in 1997, the community has complied with the production limits imposed on Cal-Am by the SWRCB since Order 95-10 became effective in July 1995.

Despite these improvements, challenges still remain due to human influence on the river. The steelhead and red-legged frog remain listed as threatened species under the ESA. At least several miles of the river still dry up each year, harming habitat for listed fish and frog species. The presence of the two existing dams, flood-plain development and water diversions to meet community and local user needs continue to alter the natural dynamics of the river. Streambank restoration projects may be significantly damaged in large winter storm events, and some people continue to illegally dump refuse into the river or alter their property without the proper permits.

Thus, the Mitigation Program (or a comprehensive effort similar to it) will be needed as long as significant quantities of water are diverted from the Carmel River and people live in close proximity to it.

Water Resources Monitoring Program

Streamflow and precipitation data continue to provide a scientific basis for management of the water resources within the District. These data continue to be useful in Carmel River Basin planning studies, reservoir management operations, water supply forecast and budgeting, and defining the baseline hydrologic conditions of the Carmel River Basin. Also, the District's streamflow monitoring program continues to produce high quality and cost-effective data.

There is limited storage of surface water by dams on the Carmel River. Los Padres Reservoir, completed in 1948, holds 1,626 AF of usable storage (without flashboard), based on 2008 survey data. In addition, San Clemente Reservoir (SCR), completed in 1921, was removed in the fall of 2015 by order of the Department of Water Resources (DWR) due to seismic safety concerns.

Groundwater levels, and consequently groundwater storage conditions, in the Carmel Valley Alluvial Aquifer have maintained a relatively normal pattern in recent years, in contrast to the dramatic storage declines that were observed during the prolonged 1987-1991 drought period. The relatively stable storage in the Carmel Valley alluvial aquifer in recent years is attributable to a combination of periods of more favorable hydrologic conditions and the adoption of improved water management practices that have tended to preserve higher storage conditions in the aquifer. In WY 2016, Carmel Valley alluvial aquifer storage increased slightly compared with recent years as this year was classified as "below normal."

In contrast, storage conditions in the coastal portion of the Seaside Groundwater Basin have not been stable in recent years, in particular with respect to the deeper Santa Margarita aquifer, from which over 80 percent of the Cal-Am production in the Seaside Basin is derived. This downward trend in water levels reflects the changed production operations in the Seaside Basin stemming primarily from changed practices after SWRCB Order 95-10. The increased annual reliance on production from Cal-Am's major production wells in Seaside, along with significant increases in non-Cal-Am use, have dramatically lowered water levels in this aquifer, and seasonal recoveries have not been sufficient to reverse this trend.

To address this storage depletion trend, the District initiated efforts in the 2000-2001 timeframe to prepare a Seaside Basin Groundwater Management Plan in compliance with protocols set by the State of California (AB 3030, as amended by SB 1938). This process was superseded by litigation filed by Cal-Am in August 2003, requesting a court adjudication of water production and storage rights in the Seaside Basin. The District participated in all litigation proceedings as an intervening "interested party". The Superior Court held hearings in December 2005 and issued a final adjudication decision in March 2006, which was amended through an additional court filing in February 2007. The final decision established a new, lower "natural safe yield" for the Basin of 3,000 AFY, and an initial Basin "operating safe yield" of 5,600 AFY. Under the decision, the operating safe yield would be reduced by 10% every three years until the operating safe yield matches the natural safe yield of the Basin in 2021. The Court also created a nine-

member Watermaster Board (of which the District is a member) to implement the Court's decision. With the triennial reductions in operational yield required by the Seaside Basin Adjudication Decision, water levels have not been declining as fast as previously observed.

One of the means that could potentially mitigate this observed storage depletion trend is a program that the District has been actively pursuing since 1996 -- the Seaside Basin groundwater injection program (also known as aquifer storage and recovery, or ASR). ASR entails diverting excess water flows (typically in Winter/Spring) from the Carmel Valley Alluvial Aquifer through existing Cal-Am facilities and injecting the water into the Seaside Groundwater Basin for later recovery in dry periods.

The primary goal of the MPWMD ASR Project is better management of existing water resources and production facilities to help reduce impacts to the Carmel River, especially during the dry season. The projects are viewed as being complementary to other larger, long-term water augmentation projects that are currently being pursued for the Monterey Peninsula. These projects, also known as Phase 1 and 2 ASR projects, entail a maximum diversion of 2,426 AFY, and 2,900 AFY respectively from the Carmel River for injection. The combined average yield for both projects is estimated at about 2,000 AFY. The operation of the Phase 1 and 2 ASR Projects result in reduced unauthorized pumping of the Carmel River in Summer/Fall and increased storage in the Seaside Basin, which are both considered to be environmentally beneficial.

The ASR water supply efforts in 2015-2016 included: (1) continued work with regulatory and land use agencies on expansion of the Phase 1 Santa Margarita ASR site; (2) completion of the utility water system for the Phase 2 ASR Project at the Seaside Middle School site; (3) Completion of initial injection testing of the second ASR well at the Phase 2 ASR site; (4) coordination with Cal-Am and other parties to construct the necessary infrastructure for the ASR project expansion; and (5) continued implementation of a Memorandum of Understanding (MOU) with Cal-Am on operation and maintenance at the ASR facilities.

Groundwater quality conditions in both the Carmel Valley Alluvial Aquifer and Seaside Basin have remained acceptable in terms of potential indicators of contamination from shallow sources such as septic systems. There have been no identifiable trends indicative of seawater intrusion into the principal supply sources the coastal areas of these two aquifer systems to date.

Steelhead Fishery Program

Although the Carmel River steelhead population dramatically improved after the inception of the Mitigation Program in 1990, there was a period of general decline in the adult run from 2001 to 2011. Between 1992 and 2001, the spawning population recovered from a handful of fish to levels approaching 900 adults per year as counted at SCD. Then the run experienced a six-year downward trend from 804 adults in 2001 to 222 adults in 2007, rebounding somewhat in 2008 to 412 adults. However, in 2009 and 2010, the population underwent a dramatic reduction to 95 and 157 adults, respectively. Then in 2011 and 2012, the population rebounded again with 452 and 470 adults passing over SCD, while in 2013 the number dropped to 249, well below the 1994-2013 average of 421, likely due in part to the dry year. Drought conditions worsened in 2014 and

the river failed to connect to the lagoon for the first time since 1990. Despite a lack of sea-run adults in 2014, some resident adults did spawn in the upper valley as evidenced by the appearance of fry during summer rescues. Surpassing the four-year drought of the late 1980s to early 1990s, 2016 was the fifth dry year with low numbers of both adult and juvenile steelhead.

Previous redd surveys below SCD confirm that the spawning habitat in the lower river has improved considerably over the last 20 years and many adults now spawn there instead of the upper watershed. In addition, juvenile steelhead rescued by the District from the lower river that survive to adulthood are more likely to return to the lower river to spawn rather than migrate upstream past the SCD. In 2012, the District deployed the DIDSON counting station, acquired from CDFW grant funding, in the lower river to help determine whether more adults are in fact spawning downstream of the dam.

Variability of adult steelhead counts are likely the result of a combination of controlling and limiting factors including:

- the severe five-year drought affecting the entire west coast. The drought is the primary negative factor for all steelhead life stages including adult steelhead, as migration is limited or blocked and spawning reaches dry early;
- variable lagoon conditions, caused by artificial manipulation of the sandbar and/or naturally occurring periods of low winter flows;
- adverse ocean conditions in which ocean water temperatures off the coast of California were the highest ever recorded for much of 2014-2015, likely affecting the abundance of food resources and possibly even the survival of returning steelhead;
- low densities of juvenile fish in 2004, 2007, and 2009-2011 affecting subsequent adult populations; and
- the improved spawning conditions in the lower Carmel River, encouraging fish to spawn before they reach the counter at the dam, thus lowering the recorded count (but not the actual number of spawning adult fish).

- **Juvenile Steelhead**

Long-term monitoring of the juvenile steelhead population at eleven sites along the mainstem Carmel River below LPD shows that fish density continues to be quite variable both year to year and site to site from less than 0.10 fish-per-foot (fpf) of stream to levels frequently ranging above 1.00 fpf, values that are typical of well-stocked steelhead streams. In this 2015-2016 reporting period, the average population density was much less than the long-term average of 0.74 fpf for the Carmel River, likely due to the ongoing drought and poor habitat conditions in the lower river.

District staff believes the variability of the juvenile steelhead population in the Carmel River Basin is directly related to the following factors:

Positive Factors:

- improvements in streamflow patterns, due to favorable natural fluctuations, exemplified by relatively high base-flow conditions since 1995;
- District and SWRCB rules to actively manage the rate and distribution of groundwater extractions and direct surface diversions within the basin, coupled with changes to CAW's operations at SCD and LPD, providing increased streamflow below SCD;
- restoration and stabilization of the lower Carmel River's stream banks, providing improved riparian habitat (tree cover/shade along the stream and an increase in woody debris) while preventing erosion of silt/sand from filling gravel beds and pools;
- extensive juvenile steelhead rescues by the District over the last 26 years, now totaling 426,154 fish through 2015;
- rearing and releases of rescued fish from the SHSRF of nearly 97,300 juveniles and smolts back into the river and lagoon over the past 20 years (15 years of operation), at sizes generally larger than the river-reared fish, which in theory should enhance their ocean survival;

Negative Factors:

- As noted above, the severe five-year drought affecting the entire west coast is the primary negative factor for the juvenile steelhead population as rearing habitat dries early, or doesn't exist at all, along with low flows and higher water temperatures;
- variable lagoon conditions, including highly variable water surface elevation changes caused by mechanical breaching, chronic poor water quality (especially in the fall), and predation by birds and striped bass;
- barriers or seasonal impediments to juvenile and smolt emigration, such as intermittent periods of low flow below the Narrows during the normal spring emigration season;
- spring flow variability such as low-flow conditions that could dewater redds prematurely or high flows that could either deposit sediment over redds or completely wash them out;
- chronic, and occasionally acute, fall temperature and hydrogen sulfide levels below LPD, and the increase in suspended sediment from the SCD removal project;
- the potential for enhanced predation on smolts and YOY migrating through the sediment field above LPD.

A recent challenge that may remain for some years is the potential effects of substantive physical and operational changes that occur at SCD due to the Carmel River Re-route and Dam Removal project (CRRDR), especially the process of removal of the dam. The most significant issues are the effect of released or remobilized sediment from the CRRDR project on downstream river habitat, and the proper functioning of MPWMD's SHSRF. The three-year dam removal project began in 2013 with the removal of vegetation and rechanneling the river through the reservoir reach. The dam itself was removed in 2015 and the reconfigured channel was rewetted during the 2015-16 winter. Additional restoration and repairs are slated for late 2016. Major changes include:

- changes to the release flows and water quality;
- potentially significant changes in the sediment regime in the Carmel River downstream of San Clemente as the dam removal project progresses; and
- loss of reservoir storage, which, in the past, has helped maintain adequate river flows and cooler water in the lower Carmel River.

District staff continues to provide technical expertise and scientific data to CAW engineers and environmental consultants, DWR/DSOD, CDFW, NMFS, U.S. Fish and Wildlife Service, and others involved in addressing the resource management issues associated with both LPD and the area influenced by the SCD Removal and Carmel River Reroute Project. District staff also continues to provide technical expertise and scientific data to California Department Parks and Recreation, Monterey County Water Resources Agency, Monterey County Public Works Department, California Coastal Commission, U. S. Army Corps of Engineers, Carmel Area Wastewater District, and other regulatory agencies and stakeholders involved in the management of the Carmel River, the Carmel River Lagoon and the barrier beach.

Riparian Habitat Mitigation

With the exception of the Rancho Cañada to Rancho San Carlos Road Bridge reach, the Carmel River streamside corridor has stabilized in nearly all reaches that were affected by a combination of increased groundwater extraction, extreme drought and flood events that occurred during the 1970s, 1980s and 1990s. A complex channel has developed in the lower 16 miles of the river with improved steelhead spawning substrate, diverse habitat, and a richer riparian community. Areas with perennial or near perennial flow (upstream of Schulte Bridge) or a high groundwater table, such as downstream of Highway 1, have experienced vigorous natural recruitment in the channel bottom, which has helped to stabilize streambanks and diversify aquatic habitat. Areas that continue to be dewatered annually have somewhat less, but still significant growth.

The Soberanes fire in the summer of 2016 combined with the removal of San Clemente Dam and high flows in the winter of 2016-17 proved to be a combination of events that is changing the river downstream of the former dam site. Significant quantities of silt, sand, and debris were carried down from the fire-scarred upper watershed into the active channel in the alluvial reach.

In these areas, natural recruitment has led to vegetation encroachment that, in some areas, may constrict high flows and threaten bank stability. MPWMD continues to monitor these areas closely and to develop a management strategy to balance protection of native habitat with the need to reduce erosion potential. Environmental review of proposed projects and the process of securing permits is quite complex and requires an exhaustive review of potential impacts.

In contrast to areas with perennial flow, the recovery of streamside areas subjected to annual dewatering requires monitoring. Plant stress in the late summer and fall is evident in portions of the river that go dry. In these areas, streambanks can exhibit unstable characteristics during high flows, such as sudden bank collapse, because of the lack of healthy vegetation that would ordinarily provide stability. The drought that began with Water Year 2013 (beginning October 2012) and ended in Water Year 2016 is an ongoing concern because of the past history of channel erosion and bank instability after severe droughts in 1976-77 and 1987-1991. Impacts to streamside vegetation can manifest themselves for several years even after the end of a drought.

Although there are areas of deposition in the active channel, the long-term reduced sediment load delivery from the upper watershed has resulted in channel degradation (incision of the stream into the valley floor) in certain areas. Thus, pools become deeper and when combined with scour along the outside of streambanks this creates “cut” banks. Although this leads to a more complex and dynamic channel, which are desirable conditions, continued degradation can result in bank collapses and trigger an episode of erosion along the river. District staff continues to document degradation in the river bed including at the Carmel Area Wastewater District pipe across the river downstream of Highway 1 and at bridge infrastructure in the active channel. When river flows drop in late spring or early summer of 2017, District staff will investigate the overall scour and deposition of the streambed and report on this in next year’s mitigation report.

Restoration project areas sponsored by MPWMD since 1984 continue to mature and exhibit more features of relatively undisturbed reaches, such as plant diversity and vigor, complex floodplain topography, and a variety of in-channel features such as large wood, extensive vegetative cover, pools, riffles, and cut banks.

As cited in previous reports, the most significant trends continue to include the following:

- increased encroachment of vegetation into the active channel bottom that can induce debris blockage, bank erosion and increased risks during floods,
- effects to areas with groundwater extraction downstream of Schulte Road,
- channel changes and erosion due to new supply of sediment from upstream associated with high flows, San Clemente Dam removal, and the Soberanes Fire in Water Year 2017,
- healthy avian species diversity, and
- maturing of previous restoration projects.

Carmel River Erosion Protection and Restoration

With the exception of the channel area between the Via Mallorca Road bridge and the Rancho San Carlos Road bridge, streambanks in the main stem appear to be relatively stable during

average water years with “frequent flow” storm events (flows with a return magnitude of less than five years). The program begun by MPWMD in 1984 (and later subsumed into the Mitigation Program) to stabilize streambanks appears to be achieving the goals that were initially set out, i.e., to reduce bank erosion during high flow events up to a 10-year return flow, restore vegetation along the streamside, and improve fisheries habitat.

Consistent with previous reports, it is likely that the following trends will continue:

- Local, State and Federal agencies consider the Carmel River watershed to be a high priority area for restoration, as evidenced by the interest in addressing water supply issues, the removal of San Clemente Dam, proposed projects in the lower Carmel River, and continued oversight with the management of threatened species. Stringent avoidance and mitigation requirements will continue to be placed on activities that could have negative impacts on sensitive aquatic species or their habitats.
- Activities that interrupt or curtail natural stream functions, such as lining streambanks with riprap, have come under increasing scrutiny and now require significant mitigation offsets. Approximately 35% to 40% of the streambanks downstream of Carmel Valley Village have been altered or hardened since the late 1950s. Activities that increase the amount of habitat or restore natural stream functions are more likely to be approved or funded through State and Federal grant programs.
- Additional work to add instream features (such as large logs for steelhead refuge or backwater channel areas for frogs) can restore and diversify aquatic habitat.
- Major restoration projects completed between 1987 and 1999 have had extensive and successful work to diversify plantings. However, maintenance of irrigation systems is ongoing and requires extensive work in water years classified as below normal, dry and critically dry.
- The channel will change due to a new supply of sediment coming from upstream of the old San Clemente Dam and additional sources of sediment associated with the Soberanes Fire of 2016.

Between the mouth of the river and Robinson Canyon Road bridge, many areas of the river appear to be deeper than at any previous time since measurements have been recorded (i.e., beginning in 1978), with many reaches showing several feet of downcutting. This trend, which was identified as a concern in the 1984 Carmel River Management Program EIR, appears to have accelerated in the period from 1998 to 2015. This was a period of exceptional stability (for the Carmel River) as streambanks hardened with structural protection over the past several decades resisted erosion and the force of the river during high flows was directed into the channel bottom. This condition has resulted in the undermining of rip-rap protection and bridge infrastructure in some reaches. To assess the impact of scour and degradation in the bottom of the channel, the District budgeted funds in Fiscal Year 2014-15 and carried out a thalweg survey (survey along the bottom of the channel) along a portion of the lower river. The survey was completed in 2015 and 2016 and will be compared to similar periodic surveys dating back to 1984. However, this trend will have to be looked at carefully because as of Water Year 2017 recent high flows have transported large amounts of sediment into the mainstem of the Carmel River.

In the spring of 2010, the Carmel Area Wastewater District (CAWD) concrete-encased pipe across the bottom of the river was exposed for the first time since it was constructed in 1973. Information from CAWD about the depth of cover in 1973 indicates that the pipe was installed with six feet of cover; however, there is conflicting survey information that indicates the pipe encasement may have had only a few feet of cover. In 2012, District staff measured a maximum of 4.5 feet of scour from the top of the encasement, which is approximately five feet wide and five feet high (see **Figure XVII-3**). In September 2013, District staff measured between 4.0 and 4.25 feet of scour. Measurements from 2014 and 2015 indicated the scour hole remains at about four feet. In addition, the pipe encasement appears to be causing the river to create a large deep pool on the downstream side, while on the upstream side the encasement causes the river bottom to be flat and wide for an extended length. At certain low flow periods with the lagoon open, the encasement likely creates a temporary barrier to steelhead migration.

In the spring of 2011, the river migrated into the north streambank at the Rancho San Carlos Road Bridge (see **Figure XVII-4**). In the winter of 2017, during a series of high flows, erosion started taking place on the south side of the river. This reach has become unstable and the District will propose a restoration project that would stabilize the streambanks. If no work to stabilize the streambank is carried out, it is likely that the river will continue to erode property along the southern and northern streambanks and there will be additional loss of mature riparian forest.

Eventually, without corrective measures to balance the sediment load with the flow of water or to mitigate for the effect of the downcutting, streambanks will begin to collapse and the integrity of bridges and other infrastructure in the active channel of the river may be threatened.

Vegetation Restoration and Irrigation

To the maximum extent possible, MPWMD-sponsored river restoration projects incorporate a functional floodplain that is intended to be inundated in relatively frequent storm events (those expected every 1-2 years). For example, low benches at the Red Rock and All Saints Projects have served as natural recruitment areas and are currently being colonized by black cottonwoods, sycamores and willows. In addition, willow and cottonwood pole plantings in these areas were installed with a backhoe, which allows them to tap into the water table. These techniques have been successful and have reduced the need for supplemental irrigation.

Channel Vegetation Management

Another notable trend relating to the District's vegetation management program was the widening of the channel after floods in 1995 and 1998. With relatively normal years following these floods, the channel has narrowed as vegetation recruits on the channel bottom and gravel bars. Current Federal regulations such as the Endangered Species Act (ESA) "Section 4(d)" rules promulgated by NOAA Fisheries to protect steelhead significantly restrict vegetation management activities. Because of these restrictions, the District can carry out activities only on the most critical channel restrictions and erosion hazards in the lower 15 miles of the river. In the absence of high winter flows capable of scouring vegetation out of the channel bottom, encroaching vegetation may significantly restrict the channel. As vegetation in the river channel

matures in the channel bottom, more conflicts are likely to arise between preserving habitat and reducing the potential for property damage during high flows. MPWMD will continue to balance the need to treat erosion hazards in the river yet maintain features that contribute to aquatic habitat quality.

Permits for Channel Restoration and Vegetation Management

In 2012, MPWMD renewed its long-term permits with the U.S. Army Corps of Engineers and the California Regional Water Quality Control Board for routine maintenance and restoration work. In 2014, the District also renewed a long-term Routine Maintenance Agreement (RMA) with the California Department of Fish and Wildlife to conduct regular maintenance and restoration activities in the Carmel River.

Monitoring Program

Vegetative moisture stress fluctuates depending on the rainfall, proximate stream flow, depth to groundwater, and average daily temperatures, and tends to be much lower in above-normal rainfall years. Typical trends for a single season start with little to no vegetative moisture stress in the spring, when the soil is moist and the river is flowing. As the river begins to dry up in lower Carmel Valley (normally around June) and temperatures begin to increase, an overall increase in vegetative moisture stress occurs. For much of the riparian corridor in the lower seven miles of the Carmel River, this stress has been mitigated by supplemental irrigation, thereby preventing the die off of large areas of riparian habitat. However, many recruiting trees experience high levels of stress or mortality in areas difficult to irrigate. Riparian vegetation exposed to rapid or substantial lowering of groundwater levels (i.e., below the root zones of the plants) will continue to require monitoring and irrigation during the dry season.

With respect to riparian songbird diversity, populations dropped after major floods in 1995 and 1998 because of the loss of streamside habitat. Since 1998, species diversity recovered and now fluctuates depending on habitat conditions. Values indicate that the District mitigation program is preserving and improving riparian habitat.

Strategies for the future

A comprehensive long-term solution to overall environmental degradation requires a significant increase in dry-season water flows in the lower river, a reversal of the incision process, and reestablishment of a natural meander pattern. Of these, MPWMD has made progress on increasing summer low flows and groundwater levels by aggressively pursuing a water conservation program, implementing the first and second phases of the Seaside Groundwater Basin Aquifer Storage and Recovery Project, and recommending an increase in summer releases from Los Padres Reservoir.

Reversal, or at least a slowing, of channel incision may be possible if the supply of sediment is brought into better balance with the sediment transport forces. Additional sediment from the tributary watersheds between San Clemente Dam and Los Padres Dam will pass into the lower river in the foreseeable future now that San Clemente Dam has been removed. District staff are

already seeing signs of additional sediment in the Carmel River below Esquiline Road Bridge associated with high flows in Water Year 2017.

Over the long term, an increase in sediment supply could help reduce streambank instability and erosion threats to public and private infrastructure. However, reestablishing a natural supply of sediment and restoring the natural river meander pattern through the lower 15.5 miles of the Carmel Valley presents significant political, environmental, and fiscal challenges, and is not currently being considered as part of the Mitigation Program.

Integrated Regional Water Management (IRWM) Grant Program

The IRWM program promoted by the California DWR encourages planning and management of water resources on a regional scale and promotes projects that incorporate multiple objectives and strategies. In addition, the IRWM process brings stakeholders together and encourages cooperation among agencies in developing mutually beneficial solutions to resource problems.

MPWMD adopted the 2014 Update to the IRWM Plan for a region encompassing Monterey Peninsula areas within the District boundary, the area in the Carmel River watershed outside of the MPWMD boundary, Carmel Bay and the Southern Monterey Bay. The IRWM Plan combines strategies to improve and manage potable water supply, water conservation, stormwater runoff, floodwaters, wastewater, water recycling, habitat for wildlife, and public recreation. A final report on the grant to update the plan was completed in FY 2015-2016.

Funding from the IRWM grant program and other programs requiring an adopted IRWM Plan could provide the incentive to undertake a set of projects that would continue to improve the Carmel River environment and engage a larger number of organizations in helping to develop and implement a comprehensive solution to water resource problems in the planning region.

More information about the IRWM Plan and the group of stakeholders in the planning region can be found at the following web site:

<http://www.mpirwm.org>

Carmel River Lagoon Habitat

The District continues to support and encourage the ongoing habitat restoration efforts in the wetlands and riparian areas surrounding the Carmel River Lagoon. These efforts are consistent with goals that were identified in the Carmel River Lagoon Enhancement Plan, which was partially funded by the District. The District continues to work with various agencies and landowners to implement ongoing restoration of the Odello West property and future restoration of the Odello East property across the highway. Because of the restoration activities on the south side of the lagoon, the District has concentrated its monitoring efforts on the relatively undisturbed north side. Staff also continue to meet and discuss with other agencies the ongoing use of an existing CDPR agricultural well.

The District expanded its long-term monitoring around the lagoon in 1995 in an attempt to determine if the reduction in freshwater flows due to groundwater pumping upstream might change the size or ecological character of the wetlands. Demonstrable changes have not been identified. Because of the complexity of the estuarine system, a variety of parameters are monitored, including vegetative cover in transects and quadrats, water conductivity, and hydrology. It is notable that due to the number of factors affecting this system, it would be premature to attribute any observed changes solely to groundwater pumping. During the 22-year period to date, for example, there have been two **Extremely Wet** (1995 and 1998), two **Wet** (2005, 2006), five **Above Normal** (1996, 1997, 2000, 2010 and 2011), five **Normal** (1999, 2001, 2003, 2008 and 2009), two **Below Normal** (2004 and 2016), four **Dry** (2002, 2012, 2013 and 2015), and two **Critically Dry** (2007 and 2014) Water Year types in terms of total annual runoff. Thus, the hydrology of the watershed has been wetter than average 41% of the time, and at least normal or better 64% of the time during that 22 year period. However, monitoring in 2014 occurred during a Critically Dry Water Year that followed two consecutive Dry Water Years, and 2015 was the first time a fourth year of drought was ever monitored. Other natural factors that affect the wetlands include introduction of salt water into the system as waves overtop the sandbar in autumn and winter, tidal fluctuations, and long-term global climatic change. When the District initiated the long-term lagoon monitoring component of the Mitigation Program, it was with the understanding that it would be necessary to gather data for an extended period in order to draw conclusions about well production drawdown effects on wetland dynamics. It is recommended that the current vegetation, conductivity, topographical and wildlife monitoring be continued in order to provide a robust data set for continued analysis of potential changes around the lagoon. The District has also budgeted to reactivate the CDPR lagoon water-quality profiler that has been out of service for four years, under an interagency MOU. Continuous data at the CAWD pipe site should begin to be acquired again during the next RY.

Lagoon bathymetric cross sectional surveys, initially conducted in 1988, have been completed annually during the dry season since 1994. These data are useful in assessing changes in the sand supply within the main body of the lagoon and are necessary to answer to questions concerning whether or not the lagoon is filling up with sand, thus losing valuable habitat. As indicated in the survey plots, the sandy bed of the lagoon can vary significantly from year to year. In general, no major trends indicating sand accumulation or depletion at the lagoon cross sections have been identified based on available data, with the exception of the upstream-most cross section (XS) 4, which exhibits an overall loss in sand volume over the 1994-2013 period. The sand loss or down-cutting observed at XS 4 is consistent with the pervasive down-cutting that has occurred along the thalweg of the Lower Carmel River (LCR) upstream of the Highway 1 Bridge for several miles. The trend of LCR streambed scour appears to have begun in Water Year 2006. In addition, now that annual cross-sectional data have been collected in two Critically Dry years (WY 2007 and 2014) and two Dry years (WY 2012 and 2013), it is concluded that substrate elevations at the cross sections generally do not change in these low-flow years, despite the regular occurrence of major lagoon mouth breaches in all of these years, except WY 2014. Accordingly, the multi-year cross-sectional data set (22 years) indicates quantity of streamflow as the primary factor that controls substrate changes at the key cross sections.

Program Costs

Mitigation Program costs for FY 2015-2016 totaled approximately \$2.27 million including direct personnel expenses, operating costs, project expenditures, capital equipment, and fixed asset purchases. The annual cost of mitigation efforts varies because several mitigation measures are weather dependent. Expenditures in FY 2015-2016 were \$0.03 million less than the prior fiscal year due to decreases in Mitigation Program costs. However, the overall costs have remained constant (average of \$2.5 million per year) for last five years. In the past, expenditures had trended upward due to expenditures for the Aquifer Storage Recovery (ASR) Project. ASR Project costs are no longer captured under Mitigation Program Costs. FY 2013-2014 expenditures were \$2.41 million; and FY 2014-2015 expenditures were \$2.30 million.

During FY 2015-2016, revenues totaled \$2.88 million including mitigation program revenues, grant receipts, investment income and miscellaneous revenues. The Mitigation Program Fund Balance as of June 30, 2016 was \$1,065,968.

Table I-1

**SUMMARY OF COMPONENTS OF MPWMD MITIGATION PROGRAM
July 1, 2015 - June 30, 2016**

WATER MANAGEMENT

- Monitor Water Resources
- Manage Water Production
- Manage Water Demand
- Monitor Water Usage
- Augment Water Supply
- Allocation of New Supply
- Determine Drought Reserve

STEELHEAD FISHERY

- Capture/Transport Emigrating Smolts in Spring
 - Smolt rescues
 - Build acclimation facility/tagging study
- Prevent Stranding of Fall/Winter Juvenile Migrants
 - Juvenile rescues
 - Build mid-Valley holding facility
- Rescue Juveniles Downstream of Robles del Rio in Summer
- Operate Sleepy Hollow holding/rearing facility
- Modify Spillway/Transport Smolts Around Los Padres Dam
- Monitoring Activities for Mitigation Plan
 - Juvenile population surveys
- Other Activities not required by Mitigation Plan
 - Spawning habitat restoration
 - Fish planting (steelhead broodstock program)
 - Coastal Salmon Recovery Program grant (began mid-2001)
 - Modify critical riffles

RIPARIAN VEGETATION AND WILDLIFE

- Conservation and Water Distribution Management
- Prepare/Oversee Riparian Corridor Management Plan
- Implement Riparian Corridor Management Program
 - Cal-Am well irrigation (4 wells)
 - Channel clearing
 - Vegetation monitoring
 - Track and pursue violations
 - River Care Guide booklet
 - CRMP Erosion Protection Program

LAGOON VEGETATION AND WILDLIFE

- Assist with Lagoon Enhancement Plan Investigations (See Note 1)

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- Expand Long-Term Lagoon Monitoring Program
 - Water quality/quantity
 - Vegetation/soils
- Identify Alternatives to Maintain Lagoon Volume

AESTHETICS

- Restore Riparian Vegetation (see above)

Note 1: Mitigation measures are dependent on implementation of the Lagoon Enhancement Plan by the California Department of Parks and Recreation, the land owner and CEQA lead agency. Portions of the Enhancement Plan have been implemented by CalTrans as part of a “mitigation banking” project.

Table I-2
Summary of MPWMD Mitigation Program Accomplishments: 2015-2016 Report

MITIGATION ACTION	MAJOR ACCOMPLISHMENTS
Monitor Water Resources	Regularly tracked precipitation, streamflow, surface and groundwater levels and quality, and lagoon characteristics between Los Padres Dam and the Carmel River Lagoon, using real-time methods at numerous data collection stations. Maintained extensive monitoring network, and continuous streamflow recorders below San Clemente Dam and other sites.
Manage Water Production	Developed and implemented multi-agency Memorandum of Agreement and quarterly water supply strategies based on normal-year conditions; worked cooperatively with resource agencies implementing the federal Endangered Species Act. Implemented ordinances that regulate wells and water distribution systems.
Manage Water Demand	<p>A total of 1,842 conservation inspections were conducted in FY 2015-2016. An estimated 3.637 acre-feet (AF) of water were saved by new retrofits verified this year in these two categories. For FY 2015-2016, a total of 2,244 applications for rebates were received, 1,771 applications were approved with the use of the rebate refund, as described in Section VIII.</p> <p>As of June 30, 2016, a total of 91.775 AF of water remained available in the areas served by CAW, as described in Section IX. This includes water from pre- and post-Paralta Allocations and water added to a Jurisdiction's Allocation from Water Use Credit transfers and public retrofits.</p>
Monitor Water Usage	Complied with SWRCB Order 95-10 for Water Year 2016.
Augment Water Supply	Long-term efforts to augment supply included: (1) Continued participation in the CPUC rate hearing process to review elements of the Monterey Peninsula Water Supply Project (MPWSP); (2) Participated in meetings intended to resolve concerns about MPWSP construction, operations, financing, management and oversight; (3) Participated on Technical Advisory Committee to the Monterey Peninsula Regional Water Authority; (4) Operated Aquifer Storage and Recovery (ASR) Phase 1 and 2 projects in WY 2016; (5) performed preliminary injection test on second ASR Phase 2 injection well Seaside Middle School site; (6) Held regular coordination meetings with Cal-Am regarding planned infrastructure upgrades to deliver water supply to the ASR project wells at full capacity; (7)

MITIGATION ACTION	MAJOR ACCOMPLISHMENTS
	<p>Conducted additional work related to alternative desalination plant sites; (9) Provided technical support to the Monterey Regional Water Pollution Control Agency (MRWPCA) for the Groundwater Replenishment Project (GRP) and received presentations by MRWPCA; (10) Participated in CPUC hearing process on Cal-Am related rate requests.</p> <p>Other ongoing activities included: (1) Served as member of both the Seaside Basin Watermaster Board and as the Technical Advisory Committee; (2) Delivered several database products to the Watermaster and its consultants under the District’s contract for the required Seaside Basin Monitoring and Management Plan; (3) Continued participation in a technical role regarding removal of San Clemente Dam and associated sediment management.</p>
Allocate New Supply	Remained within Water Allocation Program limits.
Determine Drought Reserve	Rationing was not required due to maintenance of adequate storage reserve.
Steelhead Fishery Program	<p>The surface flow of the Carmel River dropped to below 10 cfs at the Highway 1 Bridge May 22, 2015 and District staff began full-scale rescues. Rescues were conducted over a four-month period (May 22 - September 28, 2015) between the Highway 1 Bridge (River Mile [RM] 1.0) and Robinson Canyon Bridge (RM 8.5) plus an additional 2.5 mile reach from Cal-Am’s West Garzas Well area to Rosies Bridge on Esquiline Road (RM 12 – 14.5). During this period staff conducted 67 rescue operations over 10 miles, yielding a total of 2,521 steelhead including: 2,231 young-of-the-year (YOY), 244 yearlings (1+), 30 resident adults (> 12” length), 1 kelt and 15 mortalities (0.59%). This total translates to 252 fish-per-mile (fpm) or 0.05 fish-per-lineal-foot (fpf). Since 1989, District staff has rescued 426,154 steelhead from drying reaches in the mainstem Carmel River. Compared to previous rescue seasons, rescue totals in the 2015 dry season was only 16% the 1989-2015 average of 15,783, as described in Section XVI.</p>
Riparian Habitat Program	<p>Continued revegetation efforts at exposed banks with little or no vegetation located between Via Mallorca and Esquiline Roads; Contracted to collect channel profile data and limited cross section data from the Carmel River for use in maintaining a long-term record and comparing to the past and future data; Made public presentations showing MPWMD-sponsored restoration work over the past 25 years; Continued long-term</p>

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MITIGATION ACTION	MAJOR ACCOMPLISHMENTS
	<p>monitoring of physical and biological processes along the river in order to evaluate the District’s river management activities; Continued the annual inspections of the Carmel River from the upstream end of the lagoon to Camp Steffani; Walked the entire river to observe and record erosion damage, conditions that could cause erosion, riparian ordinance infractions, and the overall condition of the riparian corridor; Continued enforcement actions to address serious violations of District riparian ordinances; Carried out vegetation management activities; Developed an Integrated Regional Water Management Plan; Operated under Routine Maintenance Agreement with CDFW for MPWMD vegetation maintenance activities.</p>
<p>Lagoon Habitat Program</p>	<p>The District continues to support and encourage the ongoing habitat restoration efforts in the wetlands and riparian areas surrounding the Carmel River Lagoon. These efforts are consistent with goals that were identified in the Carmel River Lagoon Enhancement Plan, which was partially funded by the District. The District continues to work with various agencies and landowners to implement ongoing restoration of the Odello West property and future restoration of the Odello East property across the highway. The District also surveyed and analyzed four bathymetric transects, participated in interagency meetings regarding management of lagoon in winter storm events (see also steelhead efforts that benefit lagoon) and monitored lagoon stage.</p>
<p>Aesthetic Measures</p>	<p>See Riparian Habitat Program measures in Section XVII.</p>

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II. HYDROLOGIC MONITORING

The Water Allocation Program EIR concluded that Water Supply Option V would have less-than-significant impacts on the water resources in the Monterey Peninsula area, and that no mitigation measures were required. This conclusion was based solely on changes to the hydrologic regime and not on changes to water-dependent resources. Impacts on water-dependent resources (e.g., riparian vegetation and wildlife and steelhead fishery) due to changes in the hydrologic regime were identified as significant in the EIR. Implementation of the mitigation measures proposed for the impacts on these water-dependent resources are described in subsequent sections. It was suggested in the EIR that the District continue and expand its current monitoring programs to establish baseline conditions for assessment of long-term changes (Finding No. 381). Accordingly, the District currently maintains ongoing precipitation, streamflow, storage, water-level and water-quality monitoring programs. These programs and the activities to implement them for Water Year 2016 (October 1, 2015 through September 30, 2016), are summarized below.

A. Precipitation Monitoring

Description and Purpose

During the period from October 1, 2015 through September 30, 2016, the District continued to process long-term precipitation records at Los Padres Dam (LPD) and at the former San Clemente Dam Site (SCDS) collected by California American Water (CAW). District staff also records precipitation at its Monterey office located at Ryan Ranch, and receives daily rainfall reports from the National Weather Service climate station at Monterey. In addition, real-time and historical rainfall data for the Monterey Peninsula area can be accessed via the Internet. These data support a variety of District programs, including erosion control, riparian vegetation management and identifying long-term precipitation trends and hydrologic-year conditions.

Implementation and Activities During 2015-2016

Work during this period involved continuing maintenance of the existing precipitation monitoring network. A summary of daily precipitation at SCDS during Water Year (WY) 2016 is shown in **Figure II-1**. The average annual recorded precipitation at this site for the period from 1922 through 2016 is 21.14 inches. In WY 2016, 22.25 inches of precipitation were recorded at SCDS, which is 105 percent of average.

Figure II-2 shows a comparison of WY 2016 rainfall at SCDS and the average monthly rainfall at this site. As indicated in **Figure II-2**, rainfall was above average in each month through January 2016. February 2016 was relatively dry at 39 percent of average, followed by a relatively wet March 2016 at 167 percent of average, before the rainy season abruptly ended. The highest daily rainfall total was 3.45 inches recorded on March 7, 2016 as clearly shown in **Figure II-1**.

B. Streamflow Monitoring

Description and Purpose

Since its inception, the District has historically collected streamflow measurements at approximately 15 mainstem sites on the Carmel River and on 16 tributaries to the Carmel River. The District's current principal streamflow measuring sites within the Carmel River Basin (CRB) are shown in **Figure II-3**. Prior to 1991, the streamflow measurements were instantaneous measurements made by the current-meter method. In 1991, a concerted effort was made to upgrade the streamflow monitoring network as staff installed continuous recorders¹ at six selected tributary sites. Since that time, the District has continued to expand its streamflow monitoring network, which currently consists of 18 continuous-recording gaging stations.

Data collected at the District streamflow monitoring sites are analyzed for use in water-supply planning, fishery, riparian and erosion control programs. More specific uses of streamflow data include, but are not limited, to the items listed below:

- Defining the general hydrologic conditions in the basin
- Setting flow requirements for meeting aquatic life goals
- Monitoring compliance with minimum-flow requirements
- Forecasting water-supply availability
- Assessing and scheduling fish rescue activities
- Assessing effectiveness of riparian mitigations
- Evaluating surface and groundwater interaction
- Developing and calibrating hydrologic models
- Delineating and managing flood plains
- Evaluating and designing water-supply projects
- Providing data for forecasting floods and defining flood-recurrence intervals
- Assessing hydrologic impacts from water-development projects
- Supporting Aquifer Storage and Recovery (ASR) operations

Implementation and Activities During 2015-2016

During the 2015-2016 period, the District operated and maintained (O&M) 16 streamflow gaging stations within the CRB / District Boundary, and collected continuous water-level data at both Los Padres Reservoir and at the Carmel River Lagoon. In addition, instantaneous measurements of discharge were collected at the Carmel River above Los Padres Reservoir and Danish Creek sites on a monthly basis during the “dry season” which runs approximately from June through November. The District continuous recording gaging stations are listed below:

Tributary/other

Finch Creek
Cachagua Creek
Pine Creek
San Clemente Creek
Tularcitos Creek
Hitchcock Creek
Garzas Creek near Lower Garzas Canyon
Garzas Creek at Garzas Road
Potrero Creek
Robinson Canyon Creek
San Jose Creek
Arroyo del Rey at Del Rey Oaks

Mainstem

Carmel River below Los Padres Reservoir
Carmel River at Sleepy Hollow Weir
Carmel River at Don Juan Bridge
Carmel River at Highway 1 Bridge
Carmel River above Los Padres Reservoir
(non-recording)

Continuous Water Level

Los Padres Reservoir
Carmel River Lagoon

Streamflow gaging station O&M at each of the above sites involves obtaining monthly discharge measurements, maintaining recording equipment, obtaining staff gage readings and occasional surveying. Subsequently, river/creek stage and discharge data are processed in-house utilizing Hydstra Time-Series Software (Kisters North America, Inc.), to produce continuous streamflow records for the sites. **Table II-1** summarizes the computed annual flows in acre-feet (AF) for the District sites for the WY 1992-2016 period. In addition, **Table II-1** includes annual flow values for the two mainstem sites operated by the U.S. Geological Survey (USGS) for the 1992-2016 period.

During the 2015-2016 period, District staff continued to maintain the existing streamflow monitoring network (network). Streamflow within the Carmel River Basin during WY 2016 was classified as “normal”, as further described below. Work within this period involved collecting numerous, routine streamflow measurements by the current meter method, in order to refine the stage/discharge relation at the gaging stations. In addition, several low-flow measurements were obtained at the sites utilizing a three-inch modified Parshall Flume.

Automation of Streamflow Data on District Website

During the 2015-2016 period, District staff continued to maintain automated daily posting of real-time steamflow data to the District website for the following locations:

CR below Los Padres Reservoir
CR at Sleepy Hollow Weir
CR at Don Juan Bridge
CR at Highway 1 Bridge
Finch Creek at Hastings Reservation
Carmel River Lagoon

This automated process facilitates data dissemination which reduces the volume of data inquiries.

- **Summary of Streamflow Conditions** -- Streamflow during WY 2016 within the CRB was classified as “normal”, which by definition ended the four-year hydrologic drought on the Monterey Peninsula that spanned WY 2012 through WY 2015. The highest peak streamflow event of the year occurred on March 6, 2016 at 2,280 cfs, and 1,690 cfs at the District’s Carmel River (CR) at Don Juan Bridge, and CR at Highway 1 Bridge gaging stations, respectively.

During WY 2016, 44,730 acre-feet (AF) of unimpaired runoff were estimated at the San Clemente Dam Site (SCDS). This total represents 66% of the average annual runoff (67,800 AF) expected at the SCDS.

C. Carmel River Lagoon Water-Level Monitoring

Description and Purpose

Since 1987, the District has monitored the level of surface water in the CR Lagoon. The water level is monitored with a continuous recorder located in the South Arm of the Lagoon that utilizes pressure transducer technology. The water-level data have been used, in part, to support technical studies for use by the Carmel River Steelhead Association, California Department of Parks and Recreation, California Coastal Conservancy, California Department of Fish and Wildlife, Monterey County Water Resources Agency (MCWRA), Monterey County Public Works Department (MCPWD) and MPWMD. In addition, the water-level data are monitored by the MCWRA via their ALERT system to enhance flood warning for residents located along the northern margin of the Lagoon and wetland.

Implementation and Activities During 2015-2016

During the 2015-2016 period, District staff continued to maintain the continuous water-level recorder located in the South Arm of the Lagoon, and a complete record of water-level readings (i.e., 15-minute intervals) was obtained. Staff continued to utilize the telecommunications capability established at the Lagoon gage in September 2007 to post Lagoon water-level data on to the District’s website. These continuous water-level data are automatically plotted and posted daily on the District website under the “Carmel River Lagoon Water Levels” as an 8-day plot that shows the past week’s levels. Staff continued to maintain the monthly lagoon level plots that are available on the District website from WY 2006 to the present. This allows interested parties to access the data to view historical and recent water-level trends.

The first Lagoon mouth opening of the WY 2016 season occurred on January 11, 2016 (**Figure II-4**) under relatively benign river inflow conditions of approximately 50 cfs. A storm series over the January 4-7, 2016 period produced 2.66 inches of rainfall at the San Clemente Dam Site which caused the “wetted front” of the Carmel River to reach the

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Lagoon on January 7, 2016. Over the January 7 through 10 period approximately 500 AF had flowed into the closed Lagoon before the water surface overtopped the beach berm at approximately 11 feet (NGVD29) causing the resultant breach. Subsequent lagoon water-level fluctuations seen in **Figure II-4** during the remainder of January 2016 indicate ocean tides and wave activity interacting with river inflow as the Lagoon mouth remained open except for several brief, intermittent mouth closures over the January 12 through 18 period

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Lagoon Water Level Monitoring\GJSection II hydrologic monitoring_GJ.docx

Figure II-1
San Clemente Reservoir Site Daily Rainfall: Water Year 2016

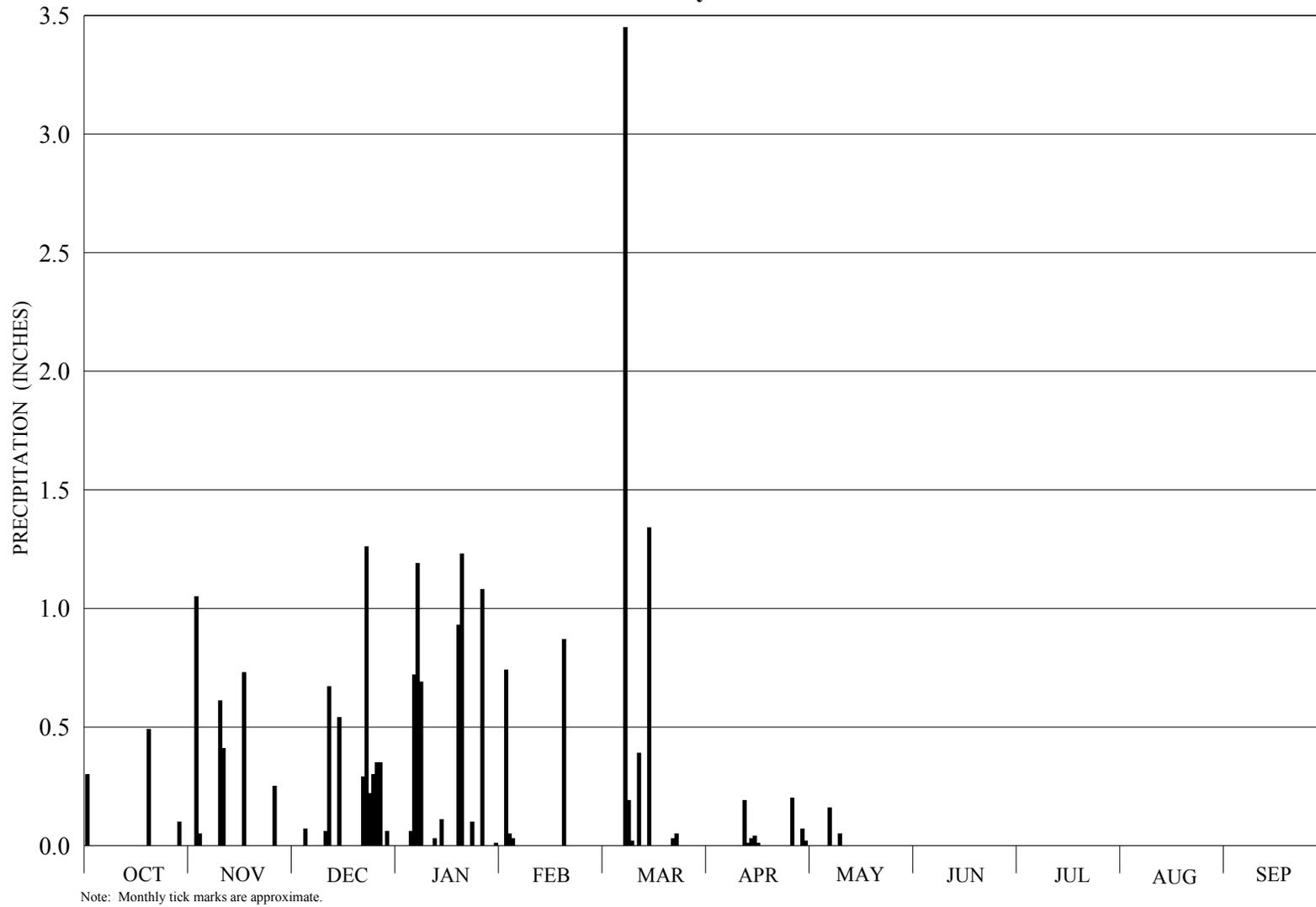
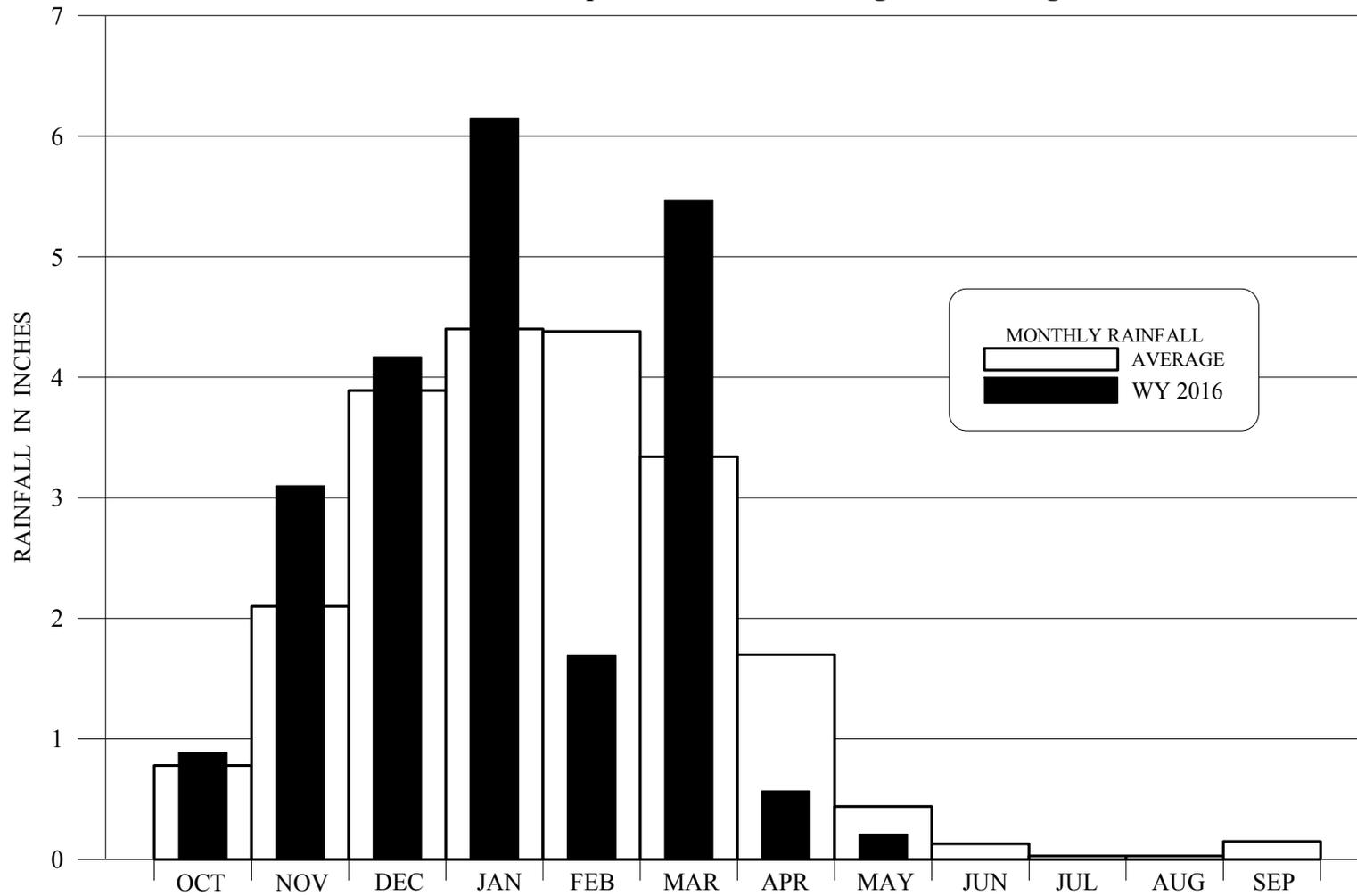
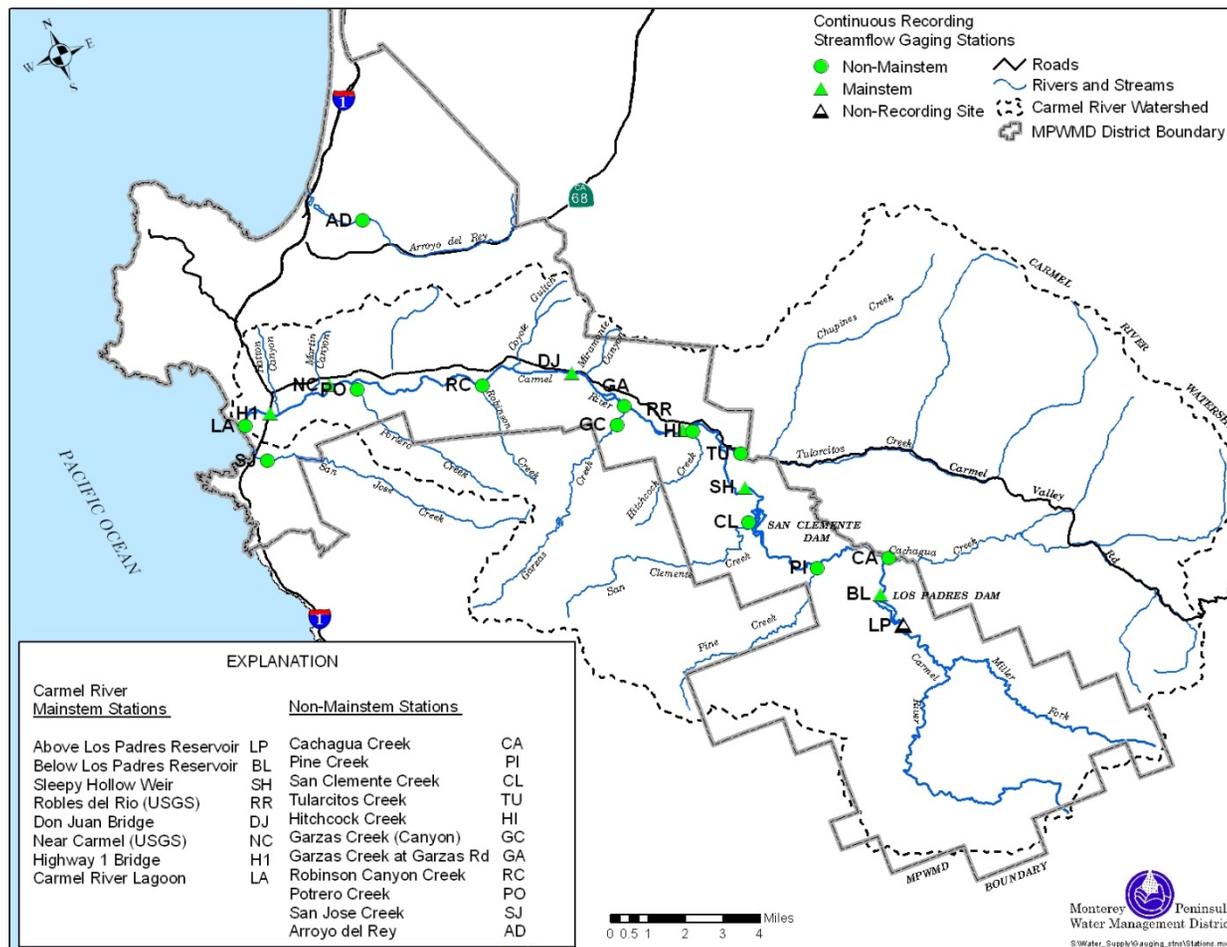


Figure II-2
Monthly Distribution of Rainfall at San Clemente Reservoir Site
Water Year 2016 Compared to 1922-2016 Long-Term Average

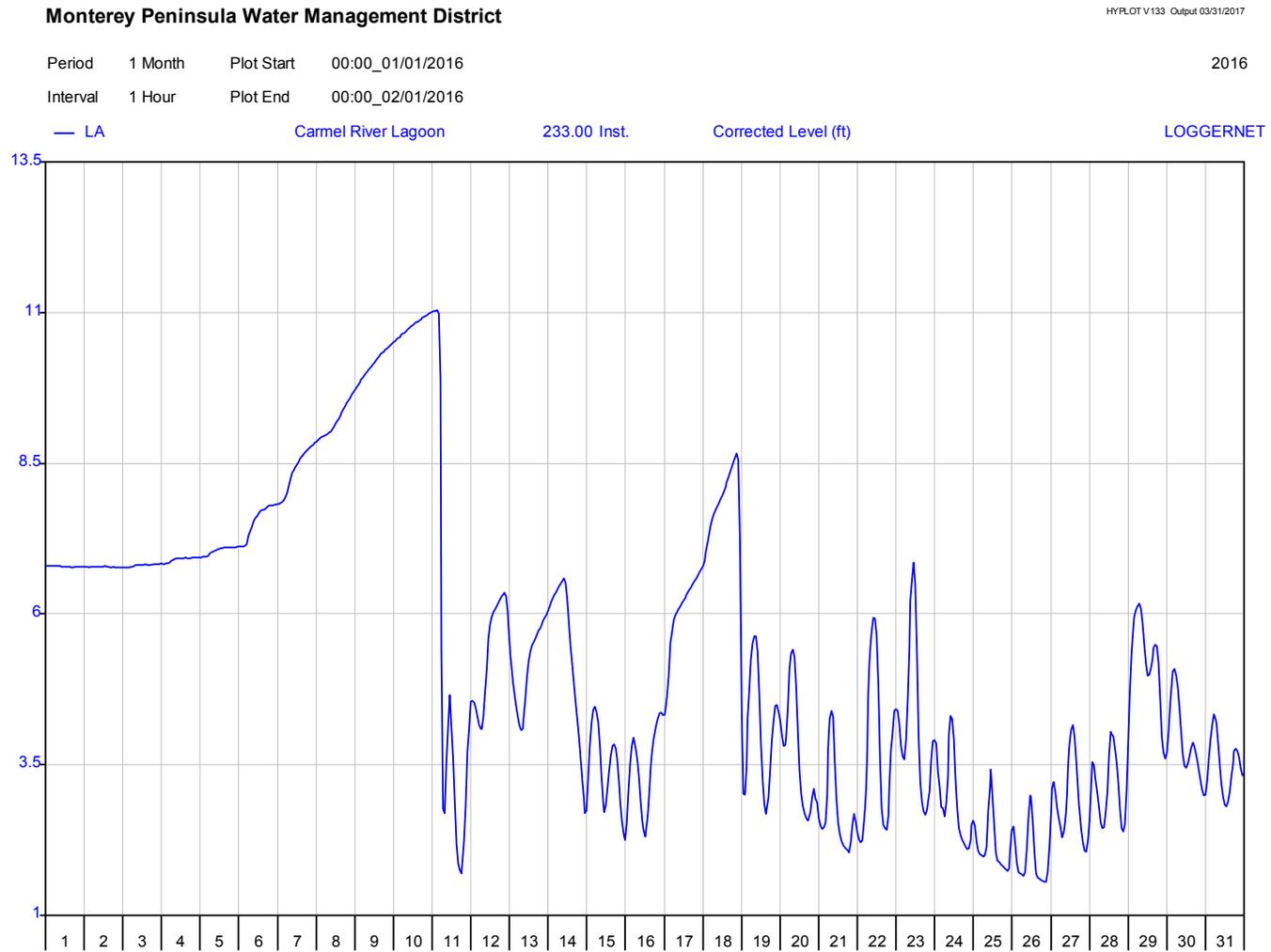


Note: Averages based on period of record 1922 - 2016

**Figure II-3
Carmel River Basin Principal Streamflow Gaging Stations**



**Figure II-4
Carmel River Lagoon Water Level**



**Table II-1
CARMEL RIVER BASIN - ANNUAL STREAMFLOW SUMMARY
WATER YEARS 1992 - 2016
(Values in Acre-Feet)**

TRIBUTARY SITES	Drainage Area (Sq.Mi.)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CACHAGUA CREEK	46.3	1,780	7,340	560	16,320	3,840	4,990	23,800	2,590	1,730	1,500	245	1,270	1,250	4,340	5,210	261	2,200	1,020	5,030	5,320	695	237	0	234	777
PINE CREEK	7.8	3,750	9,800	1,230	11,110	6,550	8,300	15,610	4,540	5,300	3,270	2,300	4,250	2,350	8,910	8,020	849	3,840	2,830	6,130	6,960	1,310	1,870	406	1,200	3,910
SAN CLEMENTE CREEK	15.6	5,450	17,070	1,820	20,580	9,310	14,100	33,380	7,130	9,830	5,340	3,270	5,850	3,720	16,330	13,720	1,360	5,520	4,270	9,950	12,950	1,960	2,570	469	1,670	7,300
TULARCITOS CREEK	56.3	635	3,220	444	5,100	1,650	2,450	22,610	3,810	2,450	1,490	630	552	503	1,000	2,480	503	917	405	1,140	1,430	452	327	94	n/a	n/a
HITCHCOCK CREEK	4.6	*	*	52	1,820	451	716	2,970	169	482	214	18	274	234	863	691	2	383	151	549	629	6	57	0	18	275
GARZAS CREEK	13.2	3,700	11,170	746	12,140	4,890	8,570	24,610	5,050	4,980	3,070	1,200	2,760	1,810	8,590	7,420	381	3,010	2,500	5,720	7,620	641	1,320	44	619	n/a
ROBINSON CANYON CR.	5.4	619	2,360	89	2,230	619	1,430	6,890	545	823	433	82	448	354	1,710	1,010	25	455	451	1,120	1,150	40	153	n/a	n/a	n/a
POTRERO CREEK	5.2	*	*	30	1,790	506	1,210	5,970	855	1,020	310	43	210	164	1,470	1,050	13	308	354	983	1,170	14	50	0	n/a	n/a
SAN JOSE CREEK	14.2	*	*	*	*	*	*	6,400	6,260	2,890	1,100	1,880	1,480	7,640	6,870	862	1,740	2,330	5,220	5,760	1,200	1,540	252	1,040	4,480	
MAINSTEM SITES																										
CR AT ROBLES DEL RIO	193	38,240	109,000	11,800	155,000	75,210	99,340	250,300	54,640	76,750	47,180	31,850	60,560	38,060	114,400	110,100	12,220	49,080	45,930	104,540	110,300	20,750	31,970	6,410	23,360	48,690
CR AT DON JUAN BRIDGE	216	*	122,000	12,760	173,600	83,090	111,800	252,200	53,570	73,960	49,360	31,330	60,420	38,330	121,800	118,300	12,150	52,510	47,410	106,300	116,500	20,820	28,340	5,600	21,550	49,060
CR NEAR CARMEL	246	35,570	123,400	8,200	177,400	74,500	104,100	261,100	55,000	76,190	47,790	28,340	55,400	35,220	119,200	119,200	7,440	43,960	43,960	105,840	115,800	17,120	24,390	517	14,970	45,740
CR AT HIGHWAY 1 BRIDGE	252	*	123,000	7,410	179,500	83,430	112,000	280,900	50,810	72,660	42,860	24,860	52,000	30,300	115,200	115,000	6,470	42,520	39,170	102,700	111,200	16,410	24,520	26	13,420	44,730

- Notes: 1. Carmel River (CR) at Robles del Rio and near Carmel sites are maintained by the USGS.
 2. (*) No continuous stage data collected.
 3. Streamflow sites listed in downstream order.
 4. San Jose Creek is outside the Carmel River Basin, but is shown for comparison.
 5. 2009-2016 values are subject to revision.

III. Carmel River Surface-Water Quality Monitoring

Description and Purpose

This monitoring is used to help assess whether or not water-quality criteria for aquatic life are being met in various reaches of the Carmel River, and whether habitats for resources such as Carmel River steelhead (*Oncorhynchus mykiss*) and red-legged frogs (*Rana aurora draytonii*) are being sustained or impaired. Monitoring also provides District staff with a way of measuring trends over extended time periods. These data are used for recommending appropriate reservoir release schedules, determining timing of fish rescues and as an indicator of habitat quality.

Since 1991, surface-water quality data have been collected at three sampling stations along the Carmel River on a semi-monthly basis. The locations of the sampling stations are as follows: (1) below Los Padres Reservoir (BLP) at River Mile (RM) 25.4, (2) below San Clemente Reservoir at the Sleepy Hollow Weir (SHW) at RM 17.1, and (3) at the Carmel River Lagoon (CRL) at RM 0.1. River miles are measured from the mouth of the Carmel River. Monitoring at these specific stations gives District staff information on the quality of water released from each reservoir and in the surface layer of the lagoon.

District staff also monitors river temperatures continuously at six locations within the Carmel River Basin (**Figure III-1**). The objective is to document the temperature regime in different stream reaches and to determine whether water-quality criteria for maximum stream temperatures are exceeded. In addition, these data allow District staff to monitor changes in the thermal regime of the river over time.

Implementation and Activities During 2015-2016

District staff carried out a semi-monthly surface water quality sampling program for the Reporting Year (RY) 2016 (July 1, 2015 to June 30, 2016); data were collected for the following chemical and physical parameters (units in parentheses): temperature (°F), dissolved oxygen (mg/L), carbon dioxide (mg/L), pH, specific conductance (uS/cm), salinity (ppt), and turbidity (NTU). The emphasis for this suite of parameters is on the suitability for rearing juvenile steelhead. In addition, continuous recording temperature data loggers (Optic StowAway temperature data loggers from the Onset Computer Corporation) were deployed at six locations on the Carmel River (**Figure III-1**), as follows:

- | | | |
|--------|------------------------------|-----------|
| 1. ALP | Above Los Padres Reservoir | (RM 27.0) |
| 2. BLP | Below Los Padres Reservoir | (RM 25.4) |
| 3. ASC | Above San Clemente Reservoir | (RM 18.5) |
| 4. SHW | Sleepy Hollow Weir | (RM 17.1) |
| 5. GAR | Garland Park | (RM 10.8) |
| 6. SAL | South Arm Lagoon | (RM 0.1) |

The District continued its vertical profiling program on the Carmel River Lagoon, on a monthly basis during RY 2016 (see plots in [Appendix III-1](#)). Vertical profiling helps better understand seasonal changes in the limnological cycles, such as stratification, internal mixing, community respiration, and how that relates to available habitat for steelhead.

The following paragraphs describe the results of the water quality monitoring efforts:

- **Carmel River Lagoon--** The water-temperature monitoring station for the Carmel River Lagoon is located in the south arm of the lagoon on the Carmel Area Wastewater District (CAWD) effluent discharge pipe. This site measures continuous surface water temperatures. This station had operational difficulties associated with it during RY 2016. Staff continues to apply adaptive strategies to correct these difficulties. During RY 2016, 77% of the time reliable data was collected at the water-temperature station and are shown in [Figure III-2](#). Loss of data occurred from February 10, 2016 to May 4, 2016. The maximum annual water temperature during sampling was 79.8°F, occurring on August 16, 2015. The overall average water temperature was 63.7°F and the maximum daily average temperature was 76.3°F. Constant water temperatures over 68°F are considered stressful for steelhead (Brungs and Jones, 1977). Average daily surface water temperatures over 68°F occurred 124 times. This represents 44% of the time during the sampling period. Surface water-quality data collected at the CRL station, which is located on the south side of the main body of the lagoon, are listed in [Table III-1](#). The minimum dissolved-oxygen measurement recorded during surface water quality sampling was 8.1 mg/L. The pH measurements ranged from 7.5 to 9.0. Carbon dioxide measurements ranged from 0 to 20 mg/L. The conductivity measurements ranged from 102 to 17,925 uS/cm. The surface salinity ranged from 0.1 to 13.8 ppt. The conductivity and salinity are highly variable at the lagoon due to tidal influences and river inflows. The turbidity measurements ranged from 0.5 to 15.0 NTU during the sampling period.
- **Carmel River Lagoon Vertical Profile -** Vertical profiling helps staff understand the seasonal changes in water quality that occurs in the lagoon throughout the water column over time. The beginning of the sampling period, July 2015, the lagoon was in a closed state with no surface inflow. Water temperatures in the lagoon were above 70°F throughout the water column. These water temperatures are stressful for all life stages of steelhead. In August and September the Odello channel was exhibiting supersaturated dissolved oxygen readings (above 15 mg/L) at the surface, due to the high rates of photosynthesis from the abundant aquatic vegetation that has established there. This supersaturation can redistribute steelhead that were inhabiting that area, reducing the available rearing habitat in the lagoon. Water temperatures continued to be in or close to stressful ranges from July through October, but by November had returned to an adequate range. Fall is also the time of year that tidal wave over-wash from large swells start to enter the lagoon, reducing water temperatures and increasing salinity. These over-wash events create a stratified layer of freshwater on top and salty water on the bottom. By November

the stratified layer was at about 1.5 meters depth. The top layer is adequate for steelhead rearing, but the bottom layer is inadequate habitat, because of the high salt concentration and the low dissolved oxygen. During the winter and early spring months the lagoons water level is dynamic, because of the openings and closures initiated by river inflow fluctuations. The lagoon tends to de-stratify in most locations, because of an increase from river inflow. This season experienced a late winter and adequate inflow to de-stratify the lagoon did not occur until March. In May, the lagoon started to stratify in the deepest locations and inflow was decreasing. By June, the lagoon had closed, inflow ceased, and the water began warming up again.

- **Garland Park--** Water temperature for the Garland Park (GAR) station is shown in **Figure III-3**. The sampling period for this station was July 1, 2015 to June 30, 2016. The maximum annual water temperature was 67.1°F, occurring on July 20, 2015. The overall average water temperature during the reporting year at this station was 57.5°F. Maximum daily average water temperature was 64.1°F, occurring on July 6, 2016. Daily average water temperatures were within adequate range for steelhead rearing during the entire sampling period.
- **Sleepy Hollow Weir--** Water temperature for the Sleepy Hollow Weir (SHW) station is shown in **Figure III-4**. The data recorders sampling period was July 1, 2015 to June 30, 2016. The maximum annual water temperature was 72.4°F, occurring on June 27, 2016. The overall average water temperature during the sampling period at this station was 57.0°F. The maximum daily average water temperature was 67.3°F, occurring on June 28, 2016. Daily average water temperatures were within adequate range for steelhead rearing during the entire sampling period. The Water-quality data collected at this station are listed in **Table III-2**. The dissolved-oxygen measurements recorded ranged from 9.6 to 13.2 mg/L. Carbon-dioxide measurements ranged from 0 to 10 mg/L. The pH measurements ranged from 7.5 to 8.0. The conductivity measurements ranged from 102 to 374 uS/cm and the turbidity measurements recorded were between 0.3 to 450 NTU. All parameters measured at this site were within adequate steelhead rearing ranges, except the turbidity that was observed during late December through January. The spike in turbidity was due to the sediment transport from the newly constructed San Clemente Dam reroute channel's first flushing events, this was a non-natural event.
- **Above San Clemente Reservoir--** Water temperature for the Above San Clemente (ASC) station is shown in **Figure III-5**. . The sampling period for this station was July 1, 2015 to June 30, 2016. The maximum annual water temperature was 69.6°F, occurring on August 16, 2015. The overall average water temperature during the reporting period at this station was 56.4°F. Maximum daily average water temperature at this station was 67.3°F, occurring on August 17, 2015. Daily average water temperatures were within adequate range for steelhead rearing during the entire sampling period.

- **Below Los Padres Reservoir--** Water temperature for the Below Los Padres (BLP) station is shown in **Figure III-6**. The data recorder's sampling period was July 1, 2015 to June 30, 2016. The maximum annual water temperature observed was 73.1°F, occurring on August 15, 2015. The overall average water temperature observed at this station during the sampling period was 59.3°F. The maximum daily average water temperature at this station was 72.3°F, occurring on August 16, 2015. Constant water temperatures over 68°F are considered stressful for steelhead (Brungs and Jones, 1977). Average daily water temperatures over 68°F occurred 79 times, all in August through October of 2015 and in June 2016. This represents 22% of the time during the sampling period and is directly related to reservoir water levels and releases. Water quality data collected at this station are listed in **Table III-3**. Water quality at this station is highly influenced by reservoir water quality and release location. The dissolved oxygen measurements recorded ranged from 7.6 to 13.2 mg/L. Carbon dioxide measurements ranged from 0 to 10 mg/L. The pH measurements ranged from 7.5 to 8.0. The conductivity measurements ranged from 105 to 346 uS/cm and the turbidity measured at this station ranged from 0.5 to 15.9 NTU.
- **Above Los Padres Reservoir--** Water temperature for the Above Los Padres (ALP) station is shown in **Figure III-7**. The sampling period for this station was July 1, 2015 to June 30, 2016. The maximum annual water temperature was 67.1°F, occurring on July 3, 2015. Average water temperature during the reporting period was 54.7°F. Maximum daily average water temperature at this station was 64.9°F, occurring on July 2, 2015. Daily average water temperatures were within the adequate range for steelhead rearing during the entire reporting year.

CONCLUSIONS AND/OR RECOMMENDATIONS:

Water temperatures above Los Padres Reservoir, were adequate for steelhead rearing during the entire sampling period. Water released from Los Padres Reservoir during late summer and fall period exhibited water quality conditions that were considered stressful to steelhead rearing. This potentially reduced growth rates or displaced fish to other sections of river that had more favorable conditions. Water quality conditions at the sampling sites around the former San Clemente Reservoir and down in the lower river were adequate for steelhead rearing during the entire sampling period.

Water quality conditions in the Carmel River Lagoon during the summer through fall were commonly within stressful ranges and likely decrease growth and survival rates of rearing steelhead. This is mainly caused by a lack of river inflow and variability in tidal influences. These factors can dramatically change the water quality dynamics in the lagoon depending on their outcomes. Stratification occurs when high tidal over wash enters the lagoon, creating a fresh and salt layer. Typically the salt layer has suboptimal water quality conditions for fish rearing. During the summer, aggressive growth of aquatic vegetation was observed in the Odello channel, which caused diurnal variability in dissolved oxygen. Suboptimal dissolved oxygen measurements were observed in summer season. Water temperatures were commonly at or near stressful levels for rearing

steelhead during the summer and fall period. Salinity readings were only in stressful ranges during the fall and winter, when wave over wash enters the lagoon and no freshwater input is occurring, causing stratification of the fresh and salt layers. Overall, the biggest threat to steelhead rearing in the lagoon continues to be the high water temperatures observed in the summer and early fall and the seasonal stratification, causing fish to be displaced and reducing the amount of habitat available for favorable rearing.

**Figure III-1
Temperature and Semi-Monthly Water Quality Monitoring Locations in the Carmel River Basin During RY 2015**

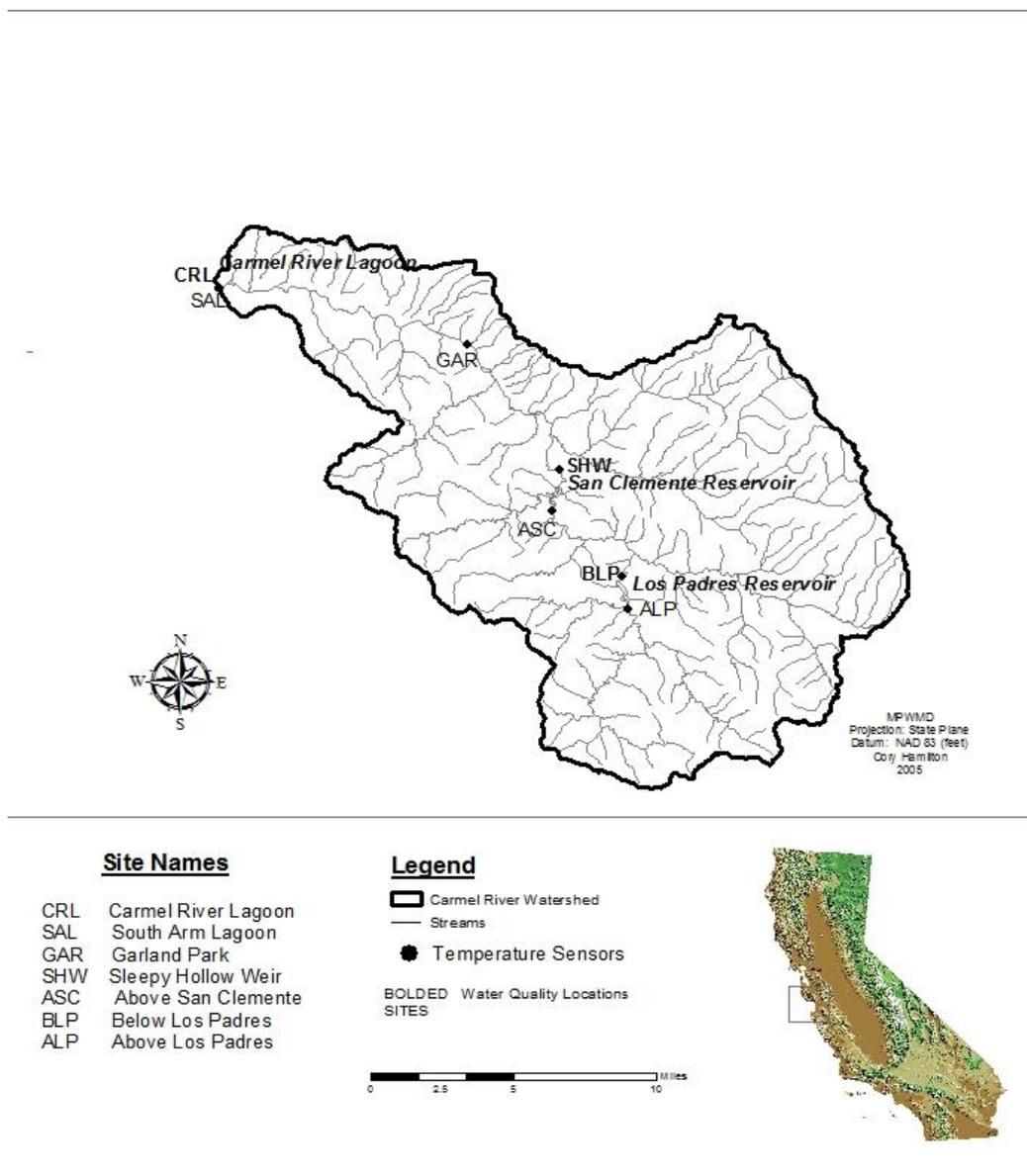


Figure III-2
Daily temperatures recorded from a continuous temperature data logger at the South Arm Lagoon (SAL) station during RY 2016

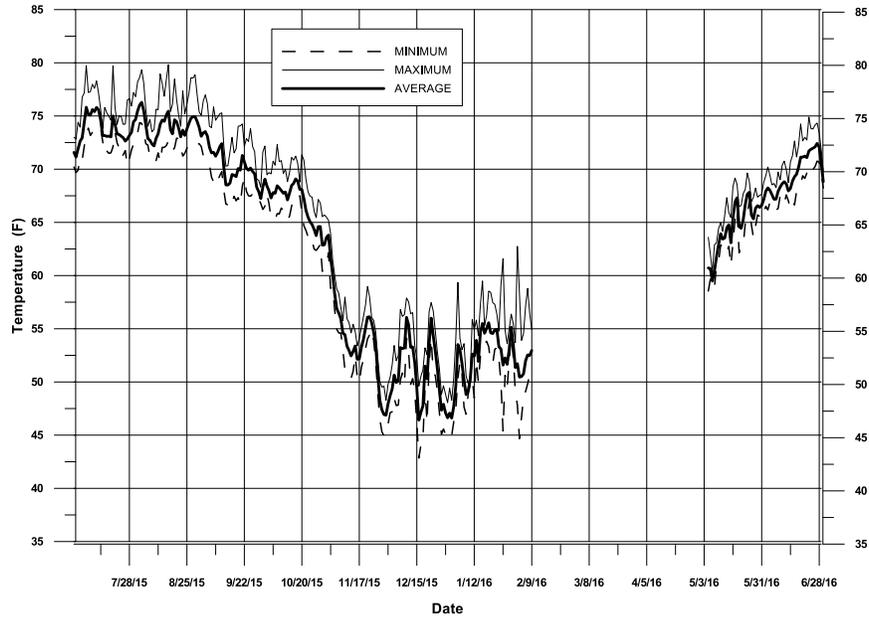


Figure III-3
Daily temperatures recorded from a continuous temperature data logger at the Garland Park (GAR) station during RY 2016

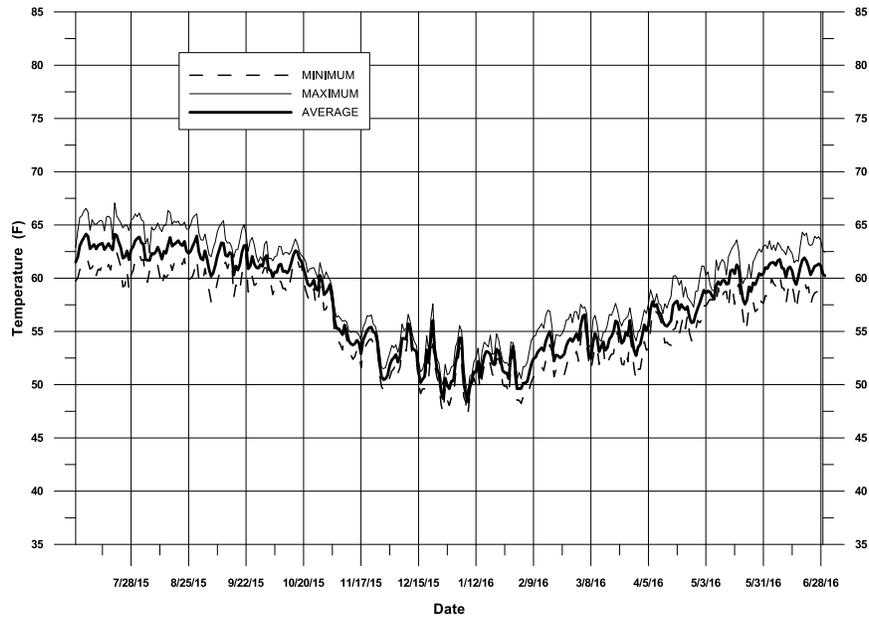


Figure III-4
Daily temperatures recorded from a continuous temperature data logger at the Sleepy Hollow Weir (SHW) station during RY 2016

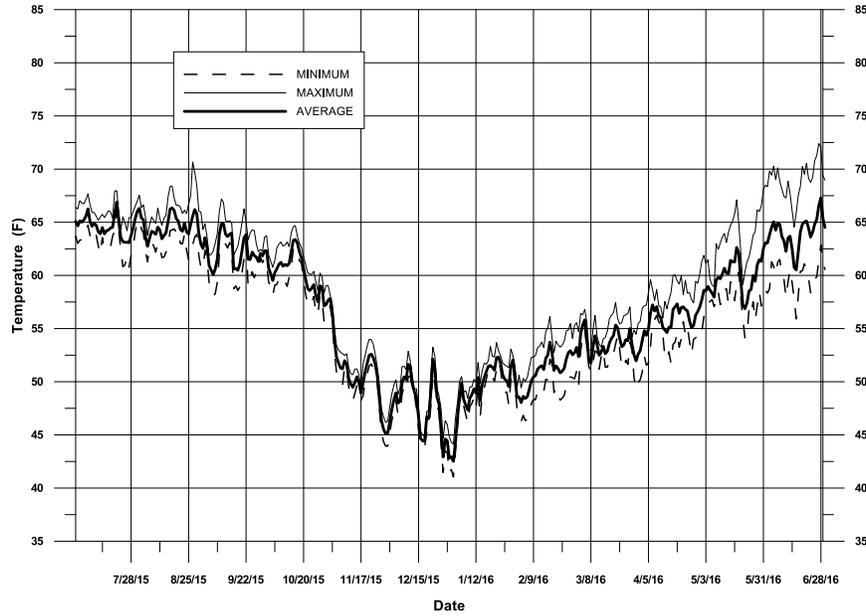


Figure III-5
Daily temperatures recorded from a continuous temperature data logger at the above San Clemente (ASC) station during RY 2016

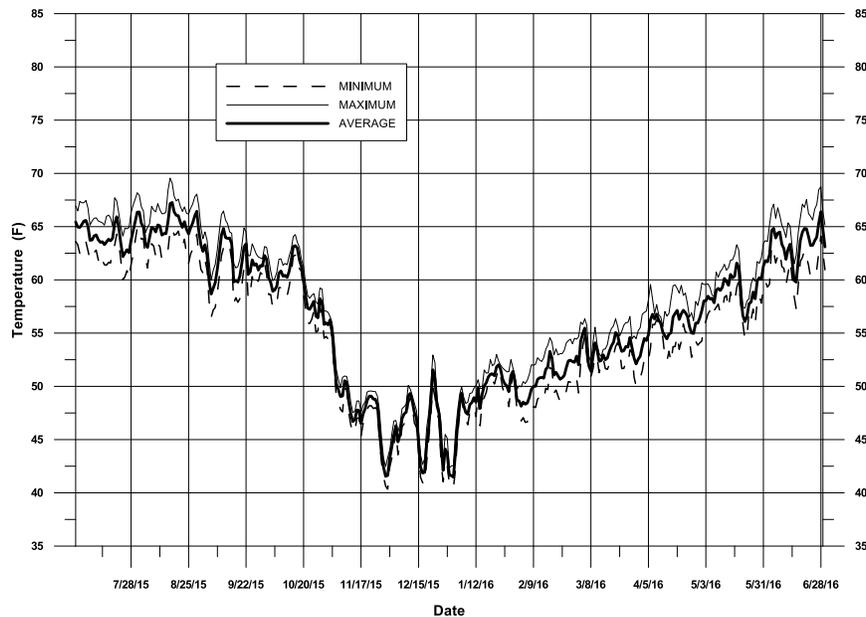


Figure III-6
Daily temperatures recorded from a continuous temperature data logger at the Below Los Padres (BLP) station during RY 2016

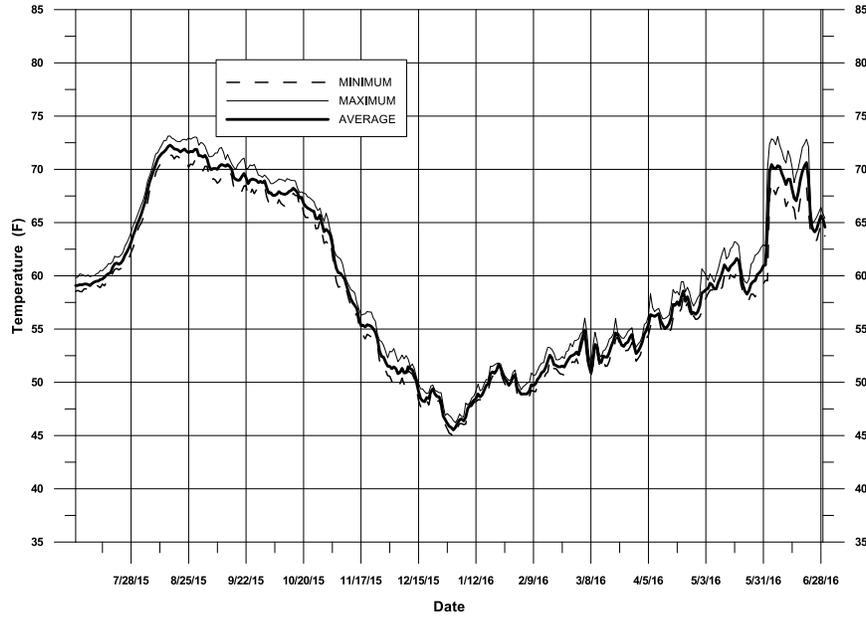


Figure III-7
Daily temperatures recorded from a continuous temperature data logger at the Above Los Padres (ALP) station during RY 2016

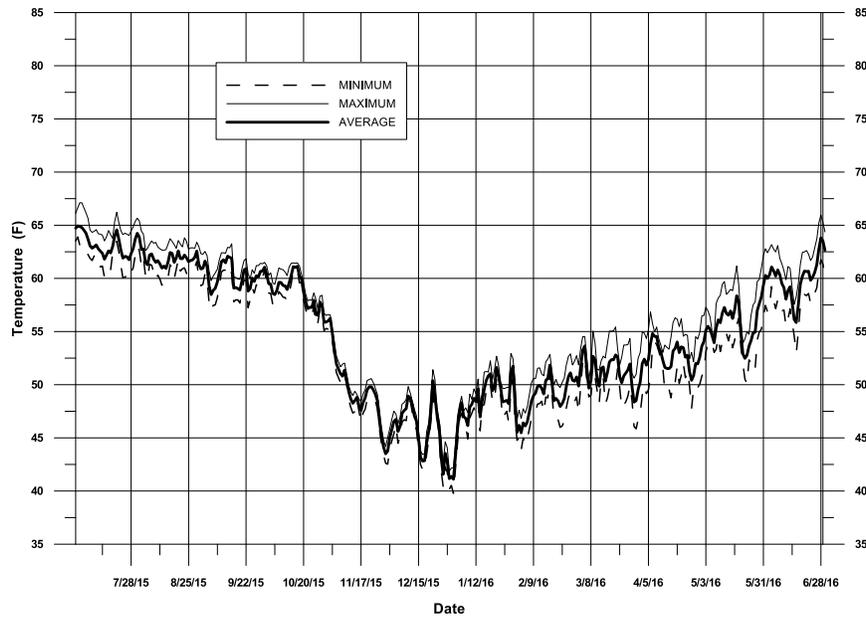


Table III-1
Water quality data collected by MPWMD during RY 2016 at Carmel River Lagoon (CRL) site.

Date	Time 24 Hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Nacl (ppt)	Turbidity (NTU)	WSE (ft)
7/9/15	1219	76.3	10.3	5	8.5	3405	1.8	1.42	4.17
7/28/15	1210	73.4	12.0	0	8.0	4452	2.5	1.2	3.55
8/10/15	1225	73.7	11.1	0	8.0	5231	2.9	1.22	2.9
8/27/15	1227	75.3	12.6	0	8.0	152	3.1	1.17	2.9
9/15/15	1434	71.7	14.4	0	9.0	4358	2.5	1.46	3.1
10/7/15	1335	69.5	14.4	0	8.5	164	2.2	1.57	3.2
10/21/15	1418	67.6	14.0	0	8.0	155	3.6	2.08	4.01
11/6/15	1315	58.3	13.3	10	8.0	4394	3.0	3.44	4.8
11/20/15	1345	59.1	12.5	15	8.0	6232	4.3	3.6	5.08
12/4/15	1325	55.2	9.2	20	8.0	7789	5.8	2.5	5.48
12/22/15	1415	57.3	9.0	10	7.5	17925	13.8	3.8	7.19
1/8/16	1300	51.2	10.8	0	7.5	2238	1.6	14	9.16
1/20/16	1350	52.7	11.5	0	8.0	105	0.5	15	2.6
2/3/16	1343	51.4	12.1	0	8.0	110	0.6	1.6	3.9
2/18/16	1300	57.3	10.5	5	8.0	102	0.4	3.4	6.94
3/9/16	1230	55.4	11.4	5	7.5	108	0.4	10	4.2
3/25/16	1330	57.7	11.5	5	8.0	233	0.1	1.5	4.22
4/5/16	1245	58.1	12.4	0	7.5	759	0.5	0.7	2.9
4/19/16	1345	61.2	11.6	5	8.0	584	0.3	0.5	4.63
5/10/16	1415	62.2	8.1	5	7.5	898	0.5	0.8	6.07
6/9/16	1615	68.8	9.6	5	7.5	952	0.5	0.55	5.95
Minimum		51.2	8.1	0.0	7.5	102	0.1	0.5	2.6
Maximum		76.3	14.4	20.0	9.0	17925	13.8	15.0	9.2
Average		62.5	11.5	4.3	8.0	2874	2.4	3.4	

Table III-2
Water quality data collected by MPWMD during RY 2016 at Sleepy Hollow Weir (SHW) station.

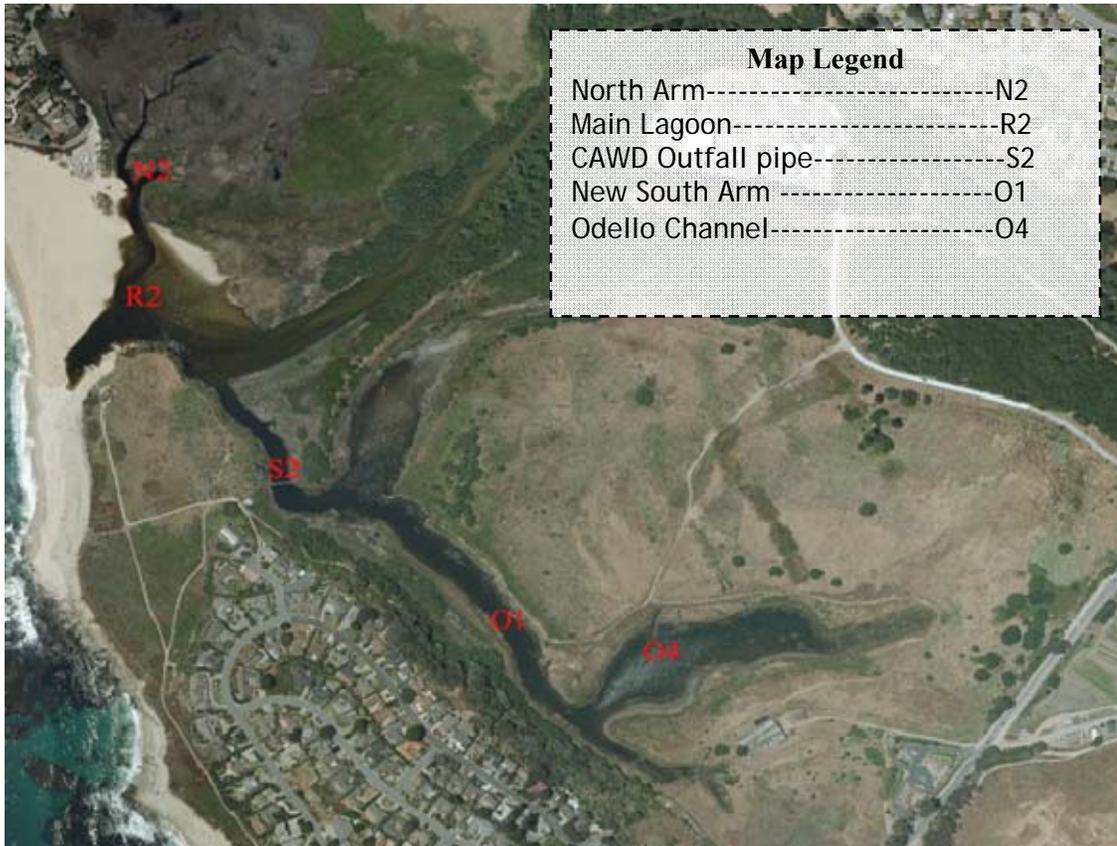
Date	Time 24 hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Turbidity (NTU)
7/9/2015	1116	64.0	9.7	0	8.0	309	1.28
7/28/2015	1108	62.3	10.3	0	8.0	248	0.56
8/10/2015	1055	63.5	10.0	0	8.0	269	1.24
8/27/2015	1106	63.9	9.6	5	8.0	318	1.27
9/15/2015	1317	63.9	9.8	5	8.0	103	0.3
10/7/2015	1224	60.1	10.3	5	8.0	374	1.07
10/21/2015	1322	59.6	10.4	5	7.5	105	1.21
11/6/2015	1200	51.7	11.9	5	8.0	107	0.79
11/20/2015	1225	52.7	11.2	10	8.0	365	3.7
12/4/2015	1210	49.8	11.6	10	8.0	102	3.8
12/22/2015	1300	52.9	11.5	10	7.5	266	450
1/8/2016	1145	47.1	13.1	0	8.0	111	19
1/20/2016	1205	51.3	12.8	0	8.0	115	13
2/3/2016	1200	47.9	13.2	0	8.0	113	0.55
2/18/2016	1130	52.8	12.4	0	8.0	160	1.5
3/9/2016	1115	53.7	12.2	0	8.0	114	5.3
3/25/2016	1210	53.8	12.0	5	7.5	152	0.8
4/5/2016	1145	54.1	12.1	0	7.5	168	0.65
4/19/2016	1230	58.1	11.4	0	8.0	188	0.4
5/10/2016	1230	60.8	10.9	5	7.5	204	0.75
6/9/2016	1143	61.8	10.4	5	7.5	242	0.75
MINIMUM		47.1	9.6	0.0	7.5	102	0.3
MAXIMUM		64.0	13.2	10.0	8.0	374	450.0
AVERAGE		56.5	11.3	3.3	7.9	197	

Table III-3
Water quality data collected by MPWMD during RY 2016 at Below Los Padres
(BLP) station.

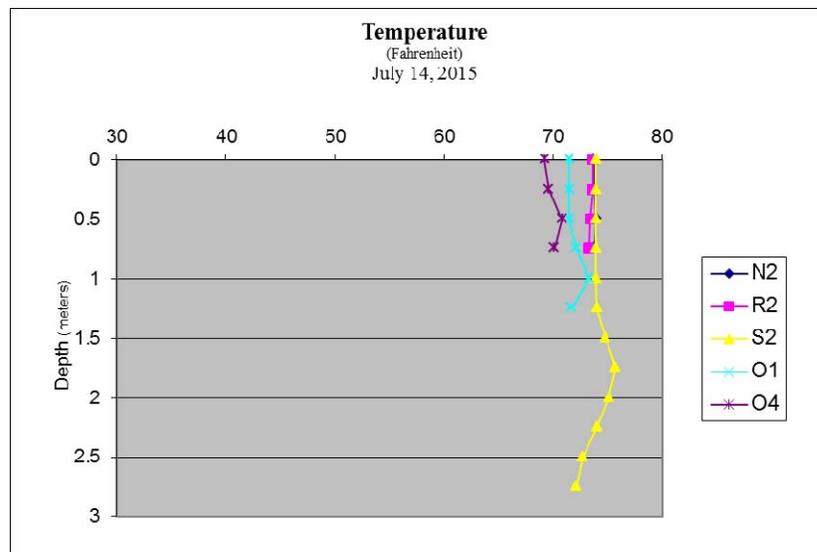
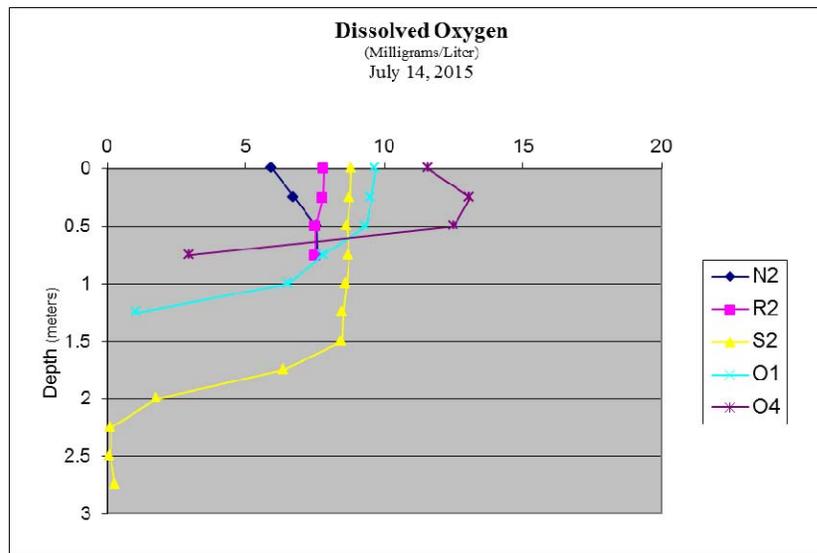
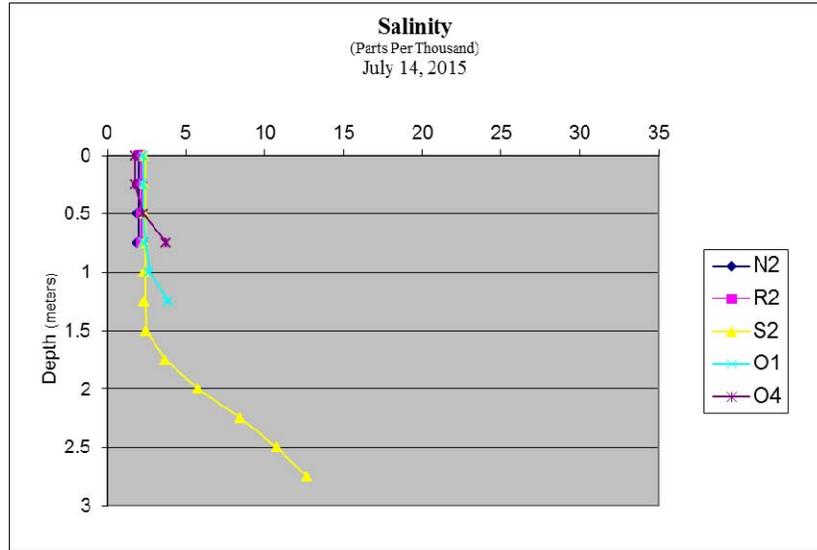
Date	Time 24 hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Turbidity (NTU)
7/9/2015	945	59.1	10.0	0	7.5	222	1.79
7/28/2015	1005	63.4	9.7	0	7.5	236	1.36
8/10/2015	933	71.1	8.6	0	7.5	278	3.85
8/27/2015	930	71.9	8.0	0	7.5	297	7.37
9/15/2015	1156	70.6	7.6	5	7.5	312	15.9
10/7/2015	1035	68.1	7.8	5	7.5	325	4.1
10/21/2015	1156	67.6	8.4	5	7.5	339	4.28
10/27/2015	1130	66.1	8.2	5	7.5	346	5.31
11/6/2015	930	61.1	8.7	5	7.5	336	3.62
11/20/2015	1030	56.0	9.9	5	7.5	313	6.5
11/23/2015	1212	55.9	10.5	10	7.5	314	9.4
12/4/2015	1030	52.1	10.8	10	7.5	295	8.4
12/22/2015	1055	49.5	11.9	10	8	203	5.1
1/8/2016	1005	47.4	13.2	0	8	137	1.4
1/20/2016	1030	51.1	12.8	0	8	105	4.3
2/3/2016	945	49.0	13.1	0	8	138	0.55
2/18/2016	1015	52.2	12.5	5	8	151	0.5
3/9/2016	945	51.9	12.9	0	8	117	2.3
3/25/2016	1100	53.7	12.1	5	7.5	140	0.5
4/16/2016	1030	58.0	10.9	5	8	171	0.45
5/10/2016	1030	59.7	10.5	5	8	184	2.1
6/9/2016	1000	68.8	8.8	0	7.5	230	0.7
MINIMUM		47.4	7.6	0.0	7.5	105	0.5
MAXIMUM		71.9	13.2	10.0	8.0	346	15.9
AVERAGE		59.3	10.3	3.6	7.7	236	

Appendix III-1

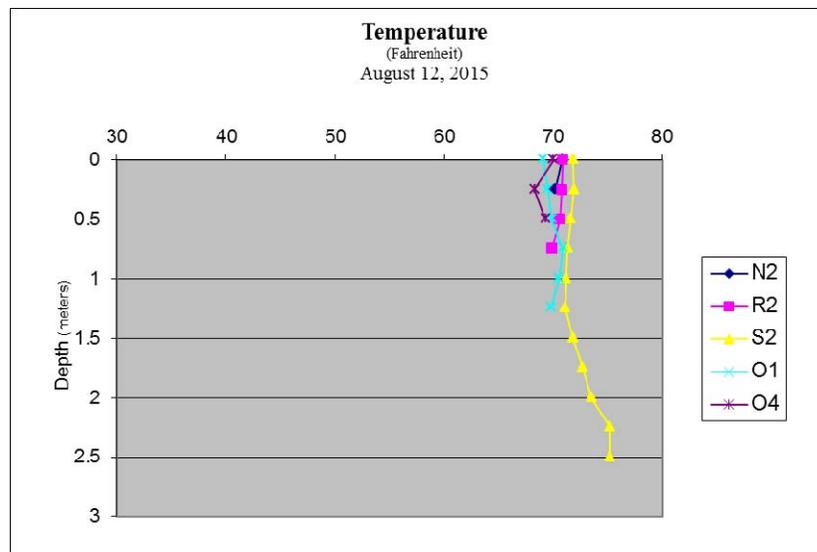
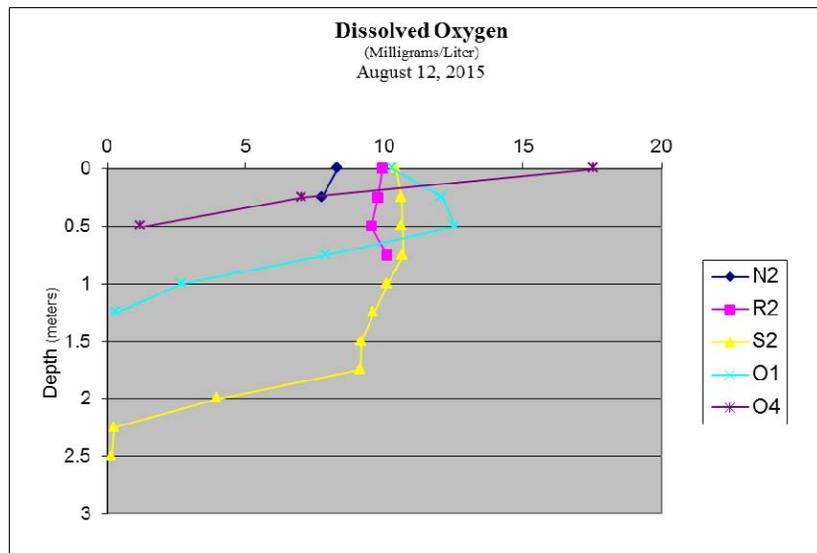
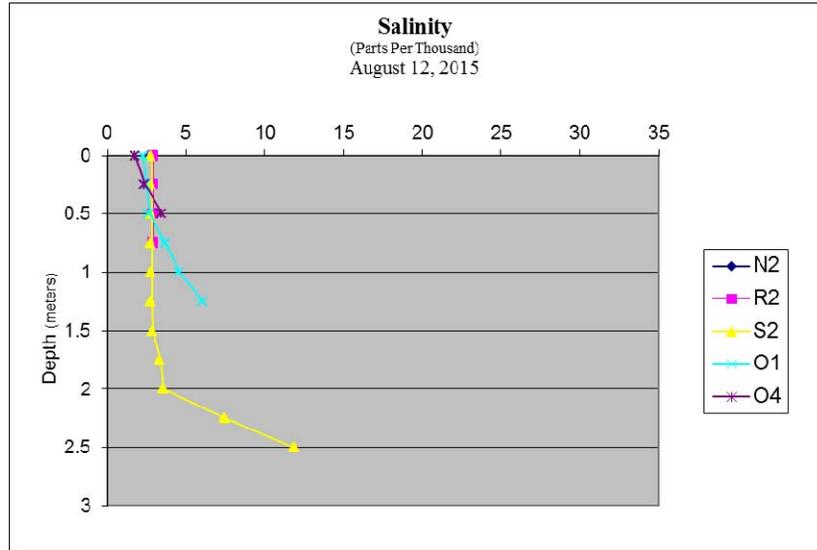
Carmel River Lagoon Profiles. Salinity (ppt), Dissolved Oxygen (DO), Temperature (degrees C). July 2015 – June 2016



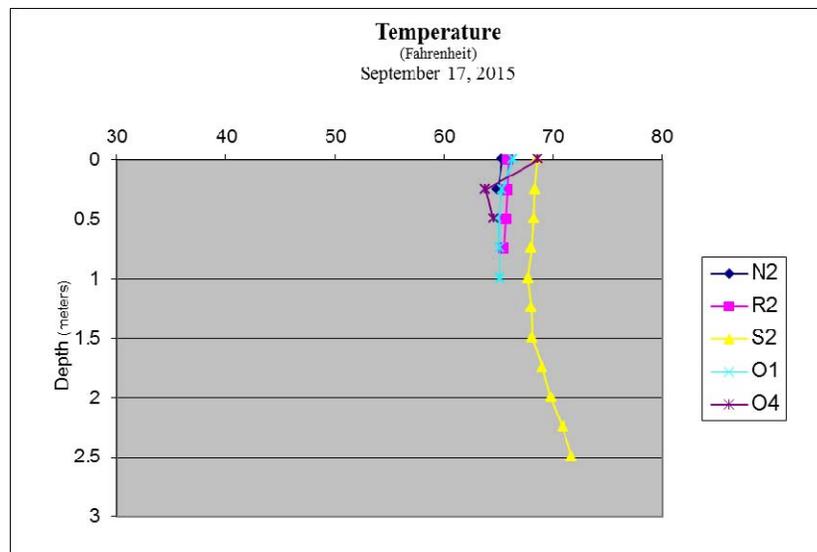
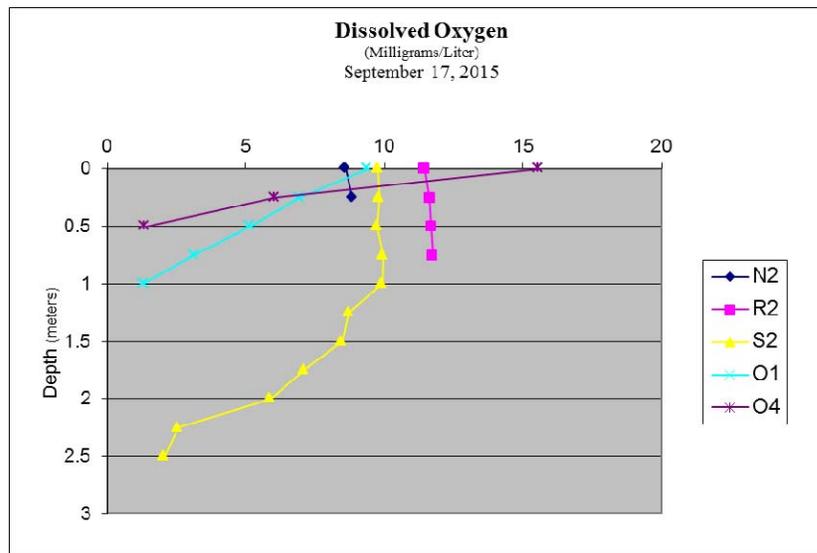
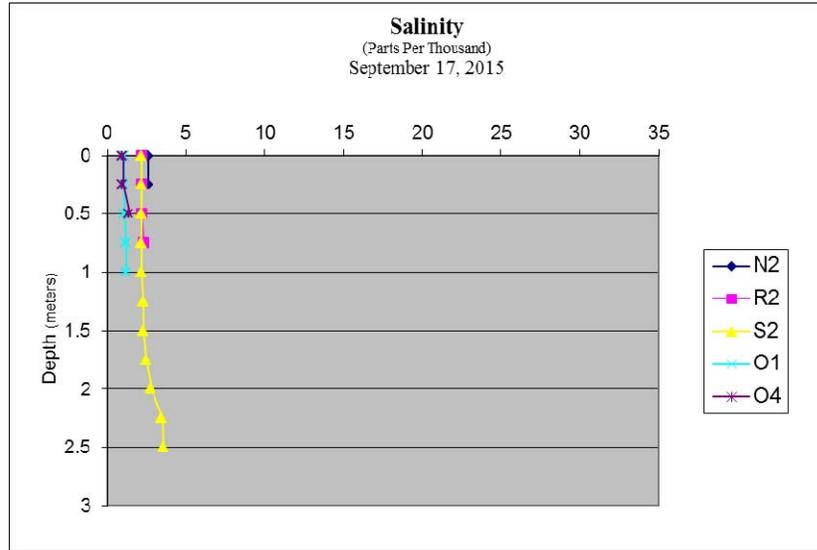
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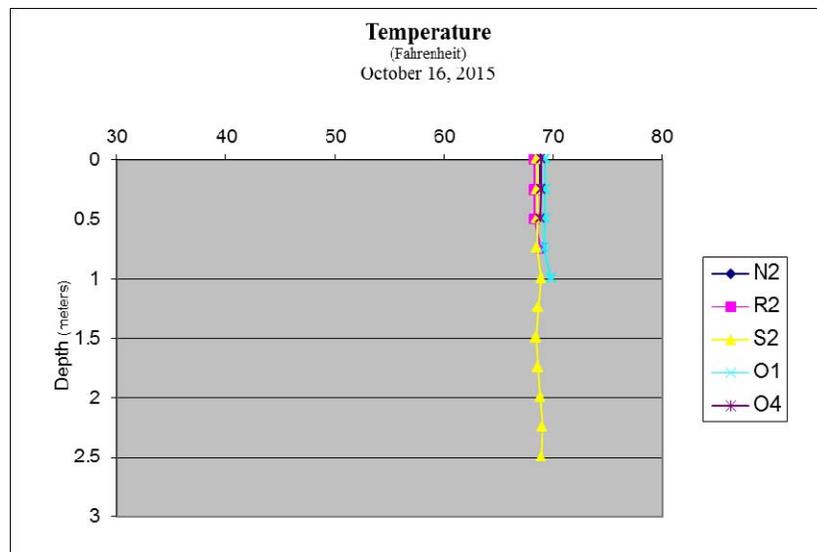
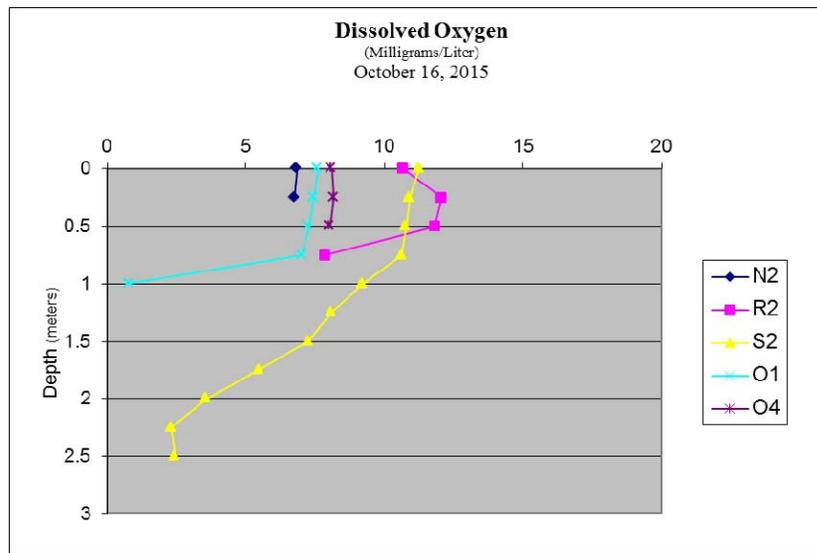
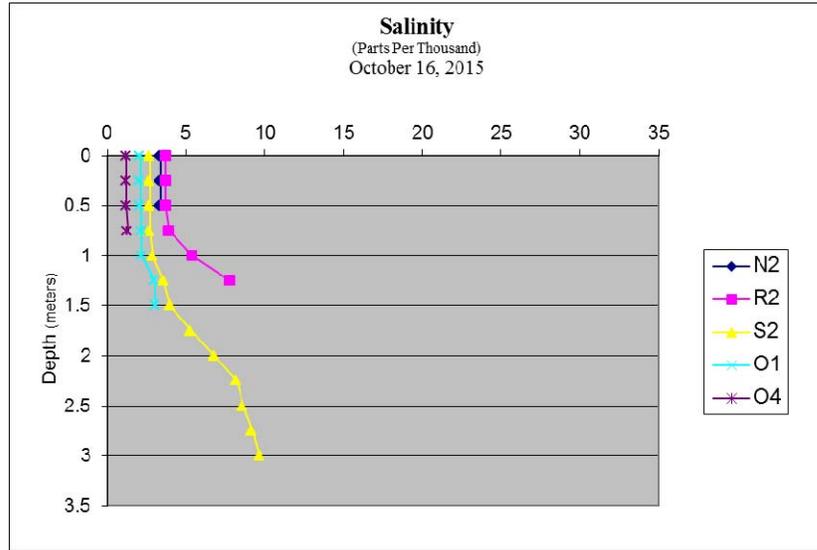
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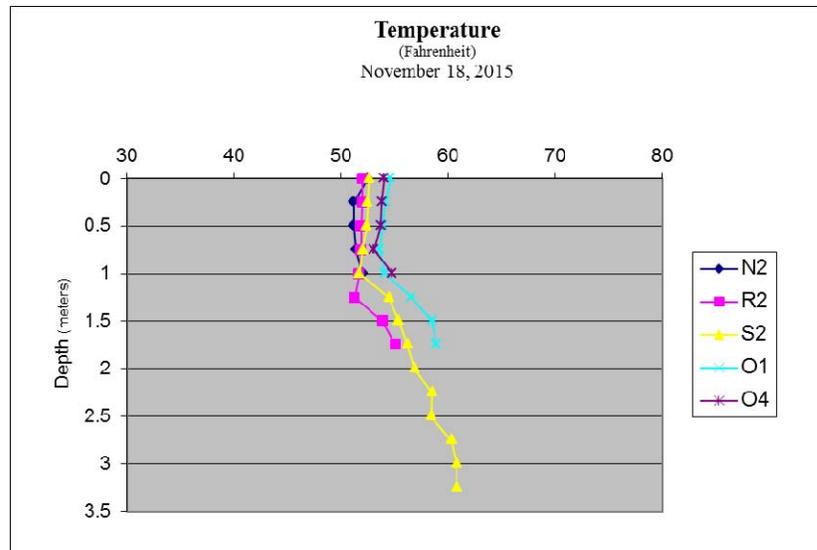
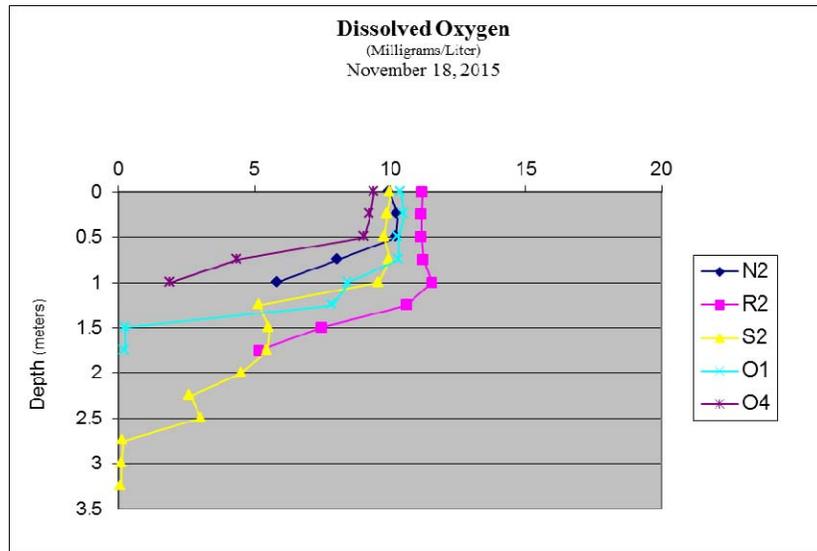
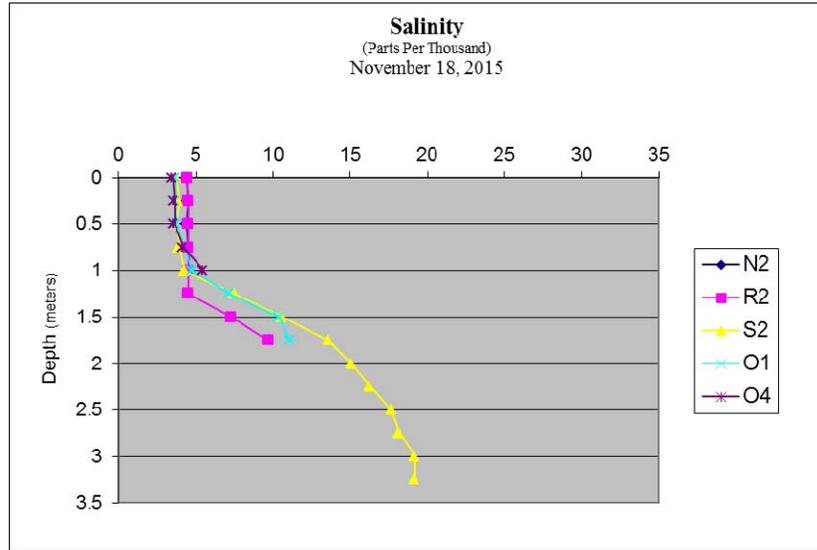
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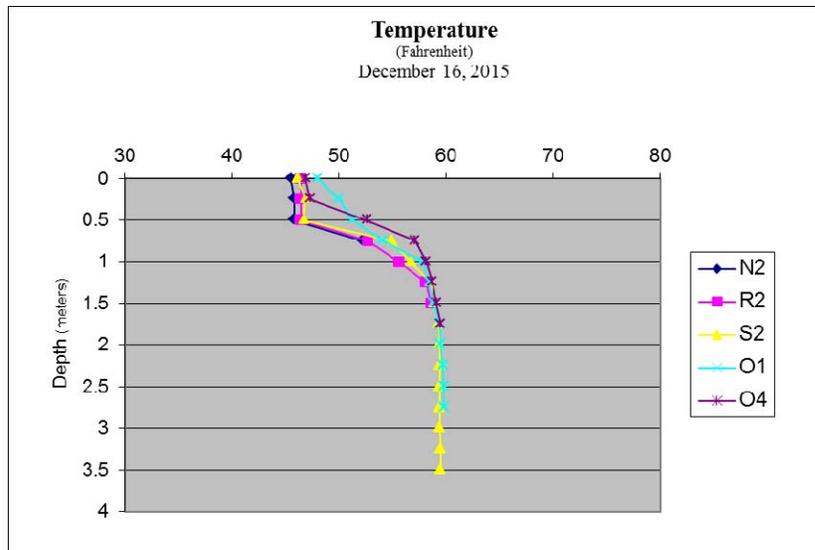
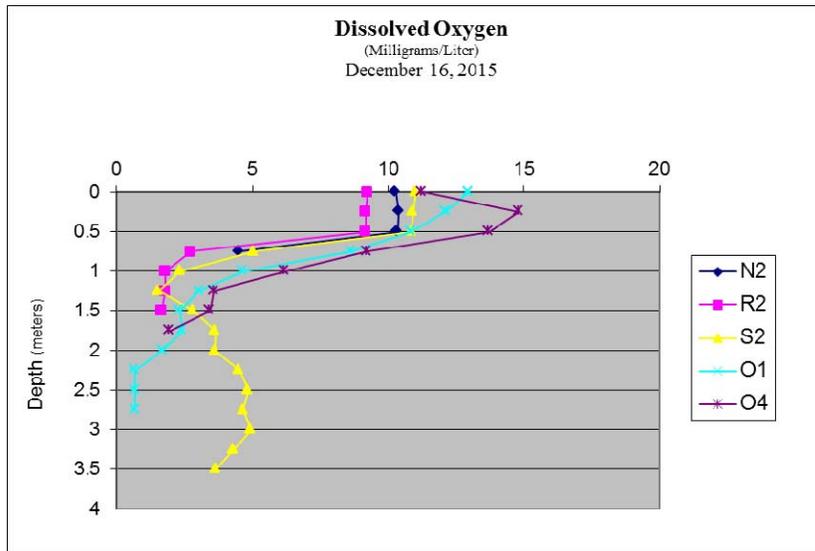
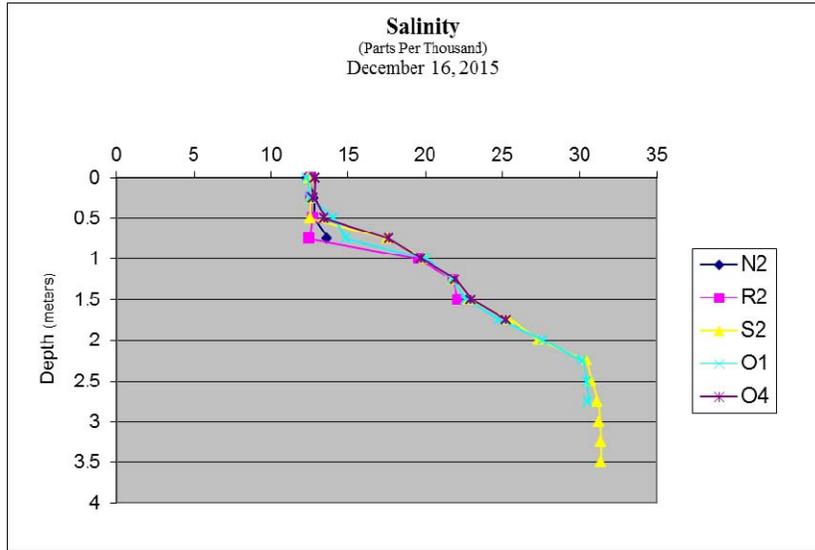
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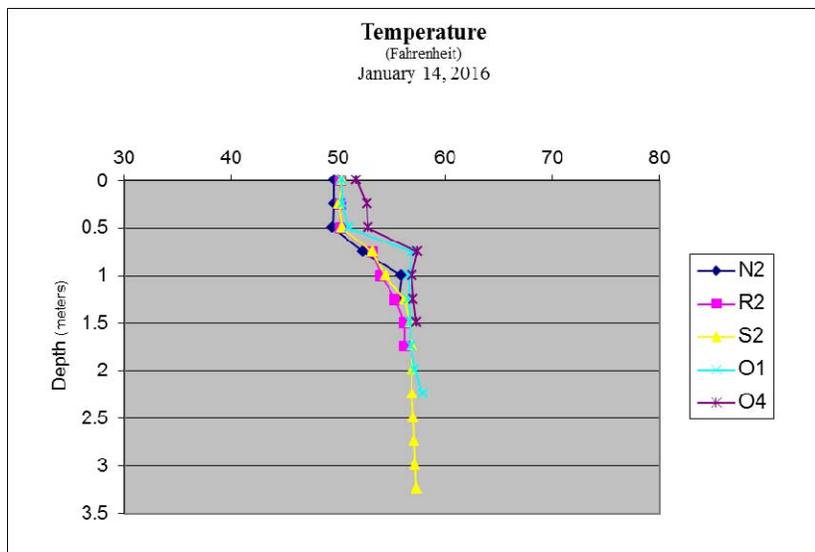
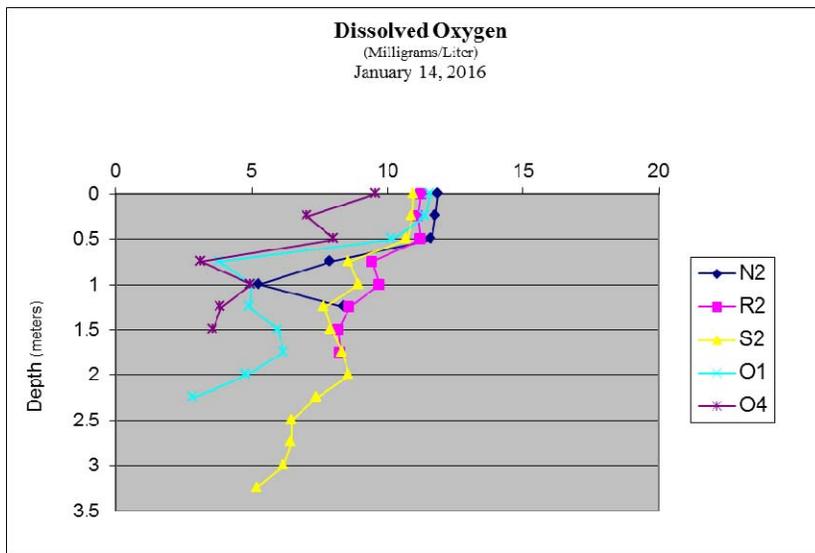
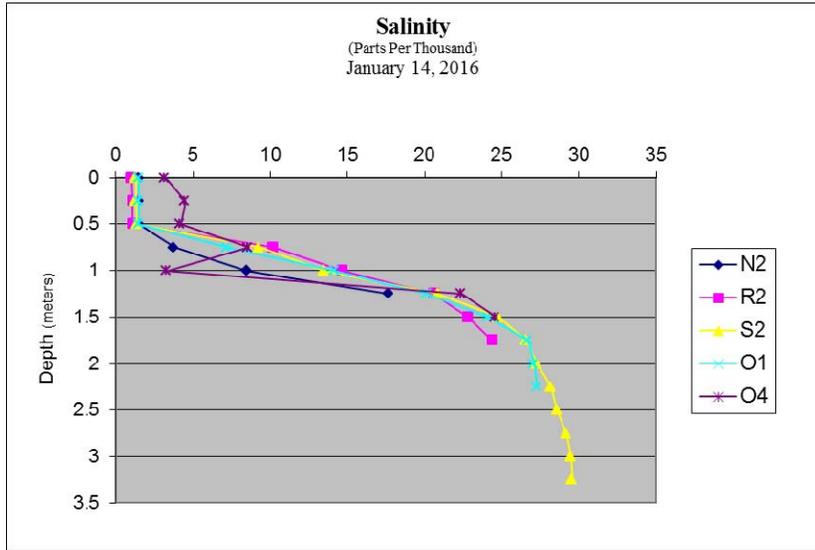
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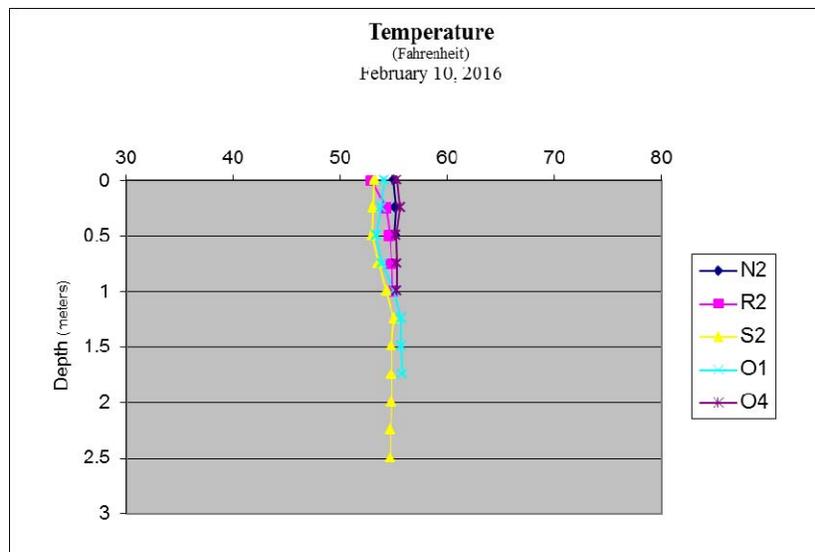
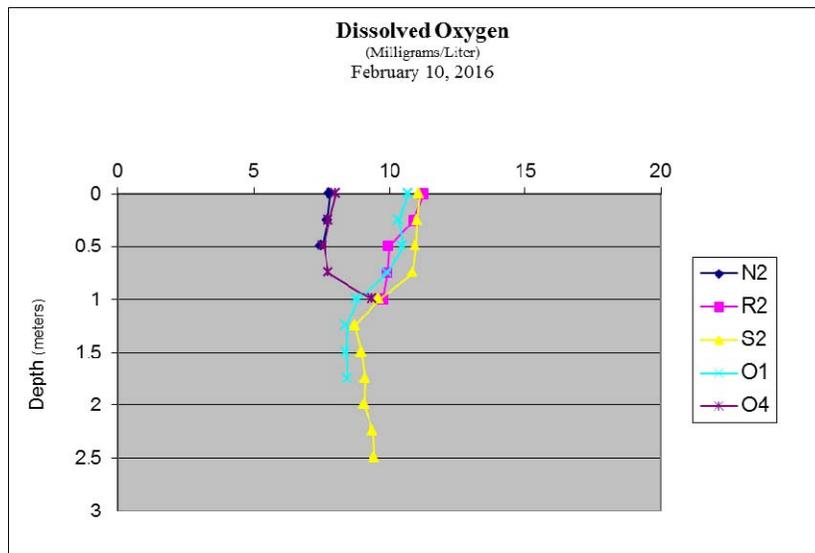
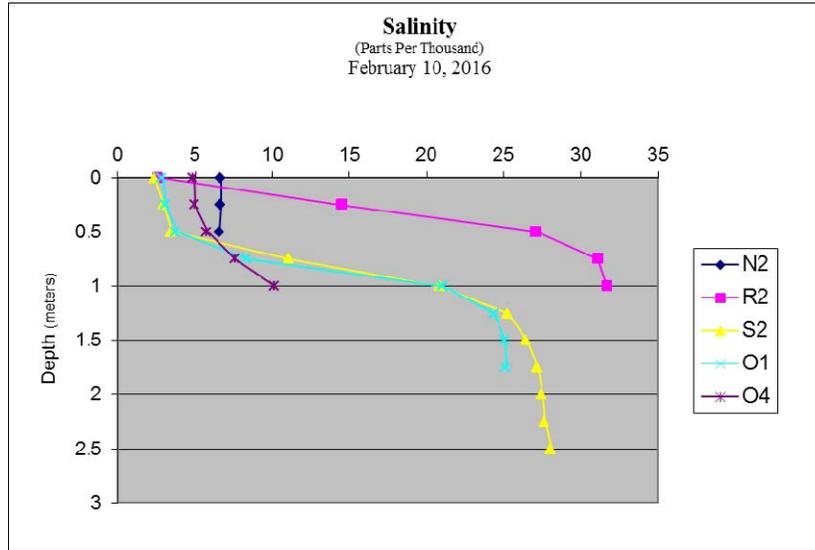
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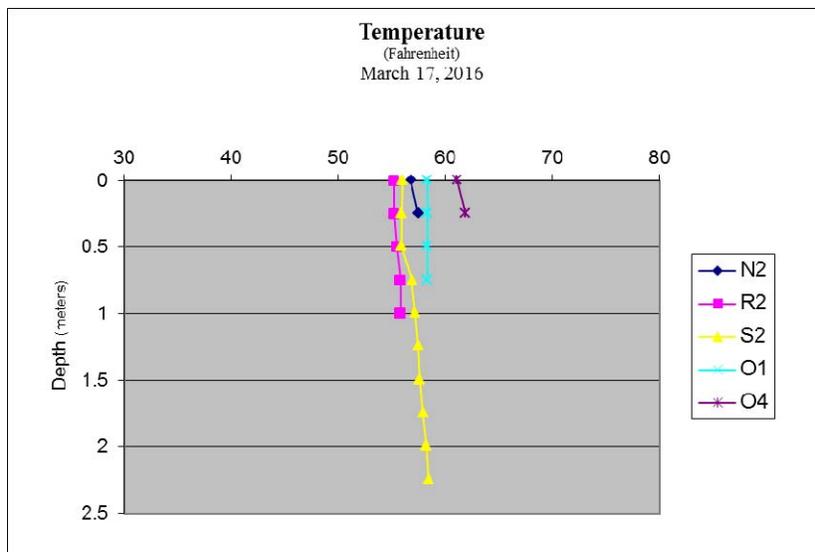
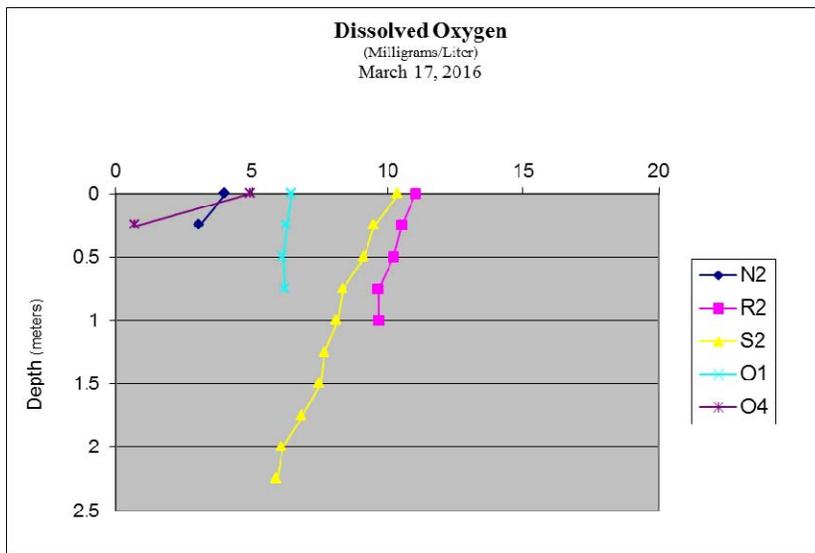
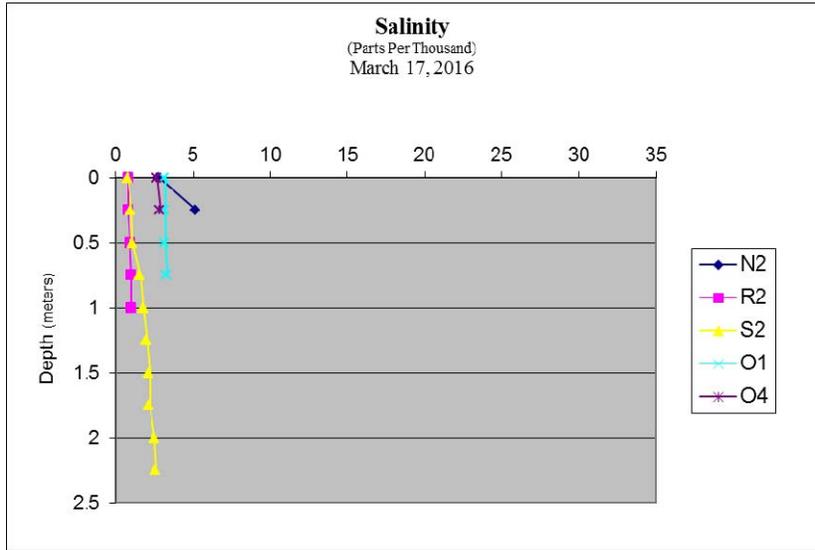
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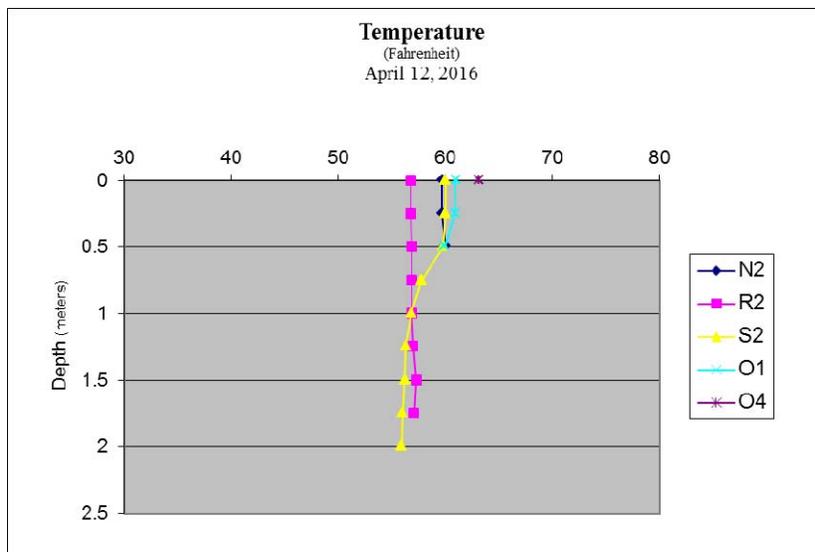
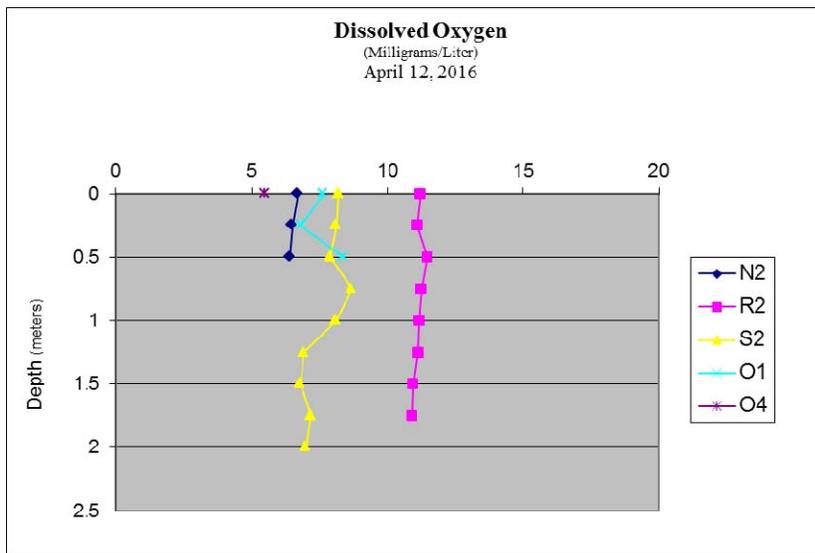
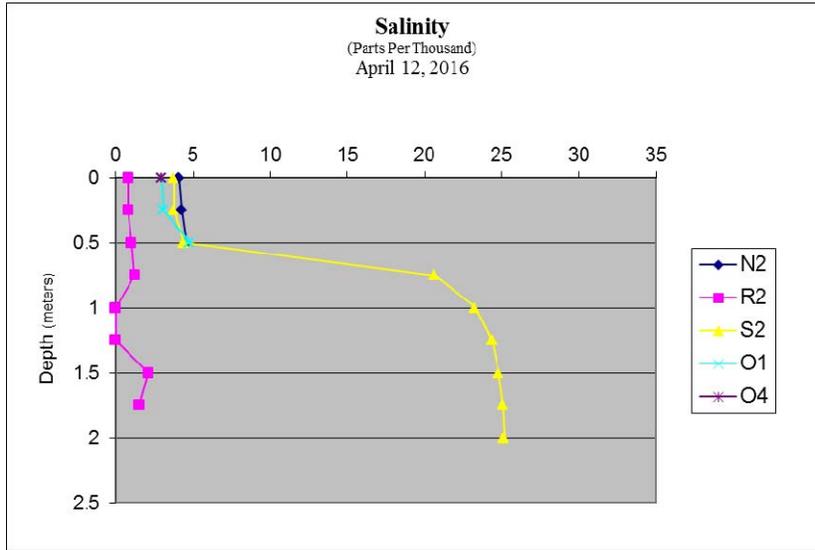
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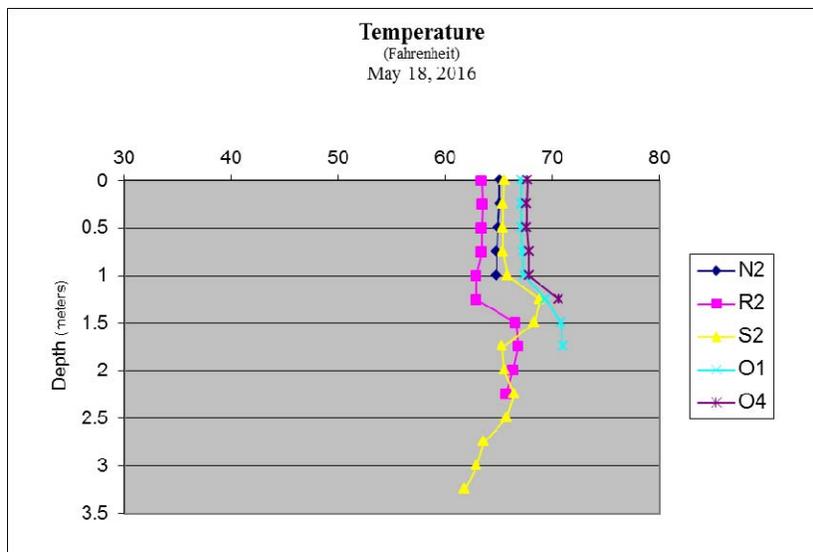
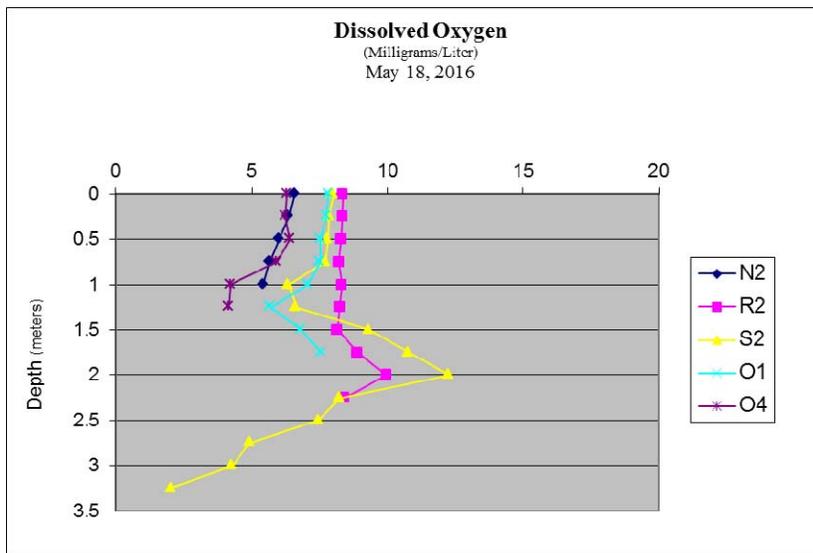
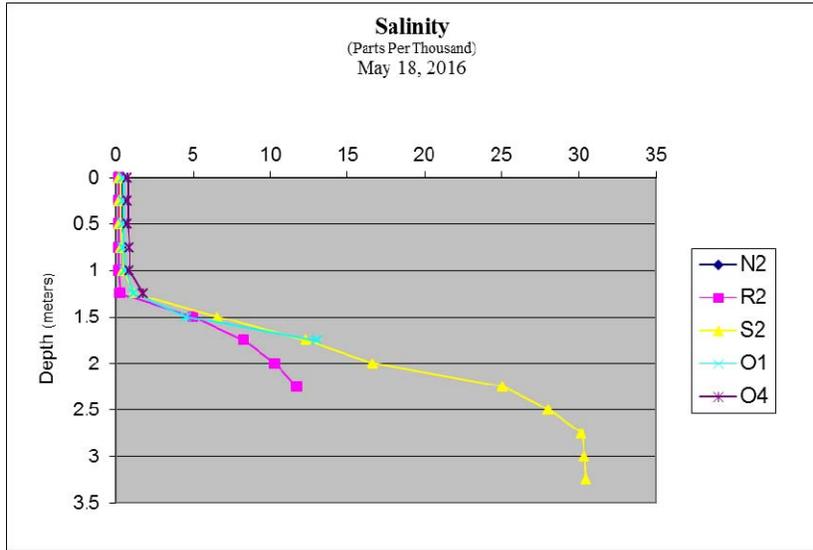
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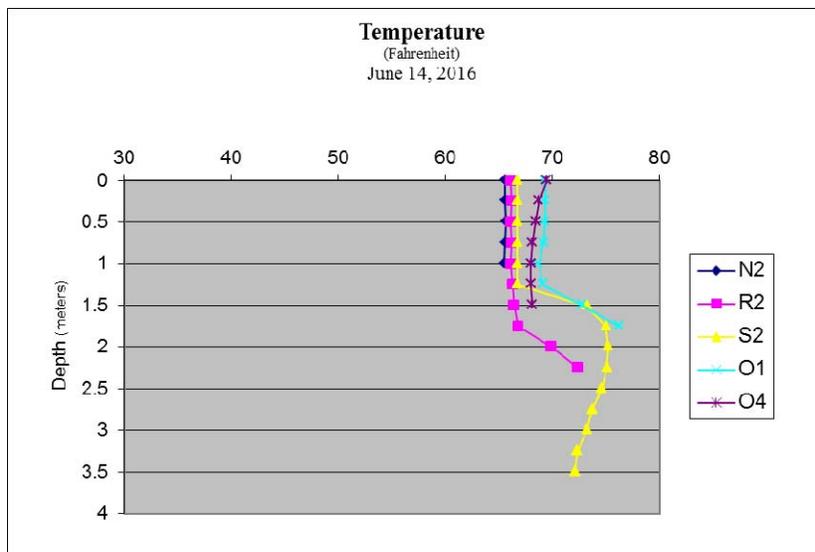
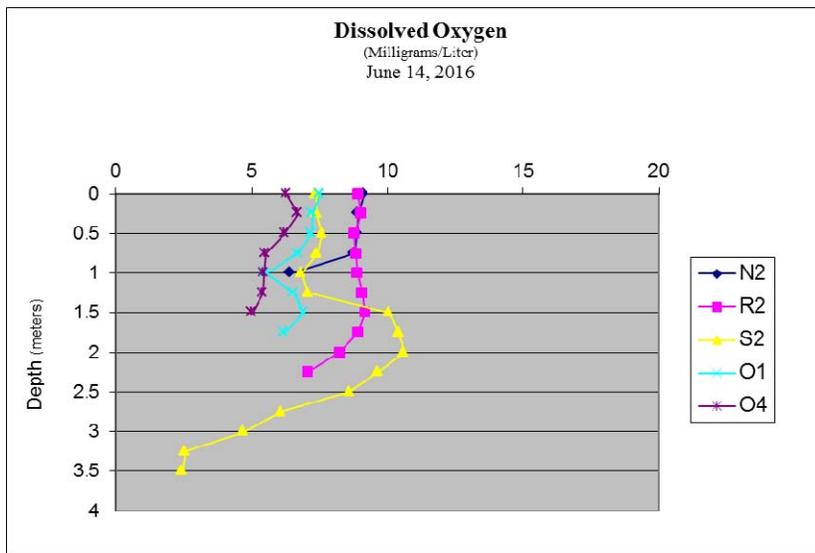
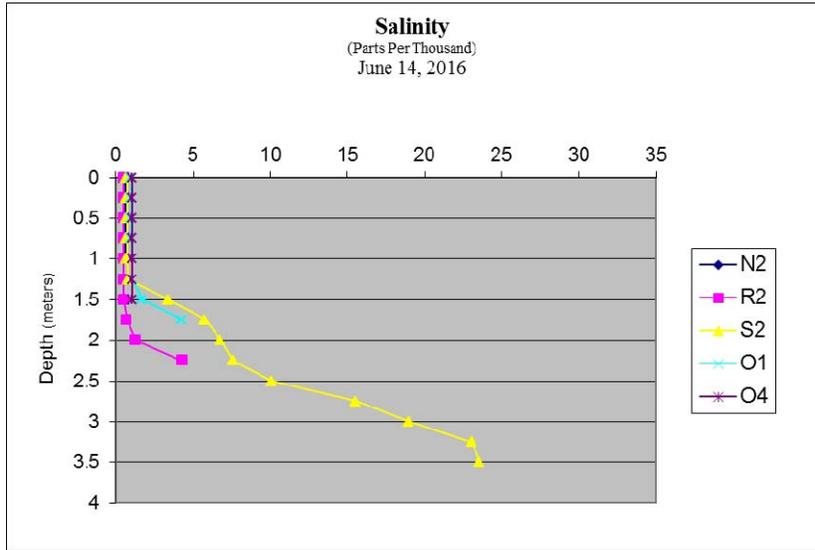
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May 2016



June 2016



IV. GROUNDWATER MONITORING

A. Groundwater-Level Monitoring

Description and Purpose

The District maintains a groundwater-level monitoring program in the Carmel Valley Aquifer and the Seaside Groundwater Basin. The data collected as part of this program are used to support a variety of programs including: (a) storage monitoring, (b) compilation of annual and long-term well hydrographs, (c) water-table contour mapping, (d) Carmel River Management Program, (e) Seaside Basin Watermaster Program, and (f) other special projects. The monitor-well measurements are stored in a database developed by the District to facilitate data entry, access and manipulation of the water-level data. In addition, groundwater-level measurements are collected on a regular basis by California American Water (Cal-Am) from each of their production wells, and these measurements are also utilized in the District's program. The District also participates in the cooperative California Statewide Groundwater Elevation Monitoring (CASGEM) program administered by the California Department of Water Resources (<http://www.water.ca.gov/groundwater/casgem/>).

Implementation and Activities During 2015-2016

- **Carmel Valley Aquifer** -- The District's monitor well network in the Carmel Valley Aquifer consists of dedicated monitor wells and producer production wells, and currently totals approximately 50 water-level monitoring wells. During this period, the wells were measured on a monthly basis, and these measurements were used to compute end-of-month storage volume estimates for the aquifer. In addition, more frequent monitoring of selected wells was conducted during winter storm events to more closely monitor aquifer recharge.

Figure IV-1 is a typical hydrograph from the lower Carmel Valley, showing groundwater-level fluctuations at the Rancho Cañada West monitor well (River Mile [RM] 2.13) and the Rio North monitoring well (RM 1.65) compared with mean daily streamflow in the Carmel River at Highway 1 (RM 1.09). The Rancho Cañada West monitor well is located about one mile downstream (i.e., westerly) of the farthest downstream Cal-Am production well in Carmel Valley, the Cañada well, and approximately 1,350 feet from the river channel. As shown on this figure, the groundwater elevation decreased approximately three feet between the beginning of October 2013 and the end of December 2013, due to the critically dry hydrologic regime and lack of runoff in the Carmel River. Three small runoff events between February 1 and April 2, 2014 did provide enough recharge to produce approximately one foot of recovery in the groundwater elevation in the Rancho Cañada West monitor well from February 1 through May 1, 2014. Groundwater levels remained fairly steady for the remainder of Water Year (WY) 2014. At the end of WY 2014 (i.e., September 30, 2014), the groundwater elevation in this well was about three feet lower than at the start of the WY.

The Rio North well is approximately 790 feet from the river channel. At this location, the magnitude of seasonal water-level fluctuation, approximately five and a half feet, is slightly greater than at the Rancho Cañada West monitor well, due to its location closer to the river. In WY 2014, when very little runoff occurred in the lower river, the Rio North well generally declined in elevation from October 1, 2013 right up until a very minor recovery in September 2014. This year, rather than observing a seasonal rise in winter, the water level in the Rio North well appeared as a slow attenuated decline. The peak groundwater elevations recorded in both wells were observed at the beginning of the WY. During the October 2013-September 2014 period, the monitoring data indicated that overall groundwater storage in the Carmel Valley Aquifer declined slightly in WY 2014. In the river reach between San Clemente Dam and the Narrows (i.e., aquifer subunits 1 and 2), the maximum storage estimate was 94% of capacity at the end of April, declining to the lowest storage estimate at 86% of capacity at the end of September 2014. Similarly, in the river reach from the Narrows to the Carmel River Lagoon (i.e., aquifer subunits 3 and 4), the maximum storage estimate was 85% of capacity at the end of April, declining to the lowest storage estimate at 75% of capacity at the end of September 2014. In spite of the critically dry hydrologic conditions and observed storage decline during WY 2014, the aquifer remained relatively full during the year due to a number of factors, including:

- Availability of some base flows during spring and early summer months,
 - Timing and magnitude of controlled river releases from the upstream reservoirs,
 - Maximized dry-season production from Cal-Am wells in the Seaside Basin,
 - Water-supply management practices implemented by the District, Cal-Am, the California Department of Fish & Wildlife and the National Marine Fisheries Service, as part of the Quarterly Water Supply Strategy and Budget process, and
 - State Water Resources Control Board (SWRCB) Order No. WR 95-10 (and subsequent amendments) and the Seaside Basin adjudication decision, which constrain Cal-Am production from the Carmel River and Seaside Groundwater Basins, respectively.
- **Seaside Groundwater Basin** -- In the Seaside Basin, monthly water-level measurements were collected from 20 monitor wells in the Seaside Coastal Subareas, and four were monitored in the Seaside Inland Subareas. An additional 29 wells in the Seaside Inland and Laguna Seca Subareas were monitored on a quarterly schedule during the year. These additional wells are a combination of active or inactive production wells, and dedicated monitor wells.

Figure IV-2 shows water-level data available from representative wells in the coastal portion of the Seaside Basin monitor well network. This graph shows the water-level elevations in the two principal aquifer zones, the shallower Paso Robles Formation and the deeper Santa Margarita Sandstone, at both upgradient (Site FO-07) and downgradient (Site PCA East) locations from the Paralta production well, the largest capacity Cal-Am well in the coastal area. The graph illustrates the more dominant effect that production from the coastal Seaside Basin wells has had on water levels in the Santa Margarita

Sandstone. The graph also illustrates the effect of changed water-supply practices resulting from SWRCB Order WR 95-10. Under the Order, Cal-Am was directed to maximize production from its Seaside Basin sources as a means to reduce production and associated impacts from the Carmel River system. This increased pumping resulted in a declining trend in Santa Margarita aquifer water levels, which are currently below sea level over a large area in the coastal portion of the basin. Seasonal recoveries associated with short-term reduced wintertime production and District aquifer storage and recovery (ASR) injection operations have not been sufficient to reverse the observed long-term downward water-level trend. However, the water-level responses in the Santa Margarita Aquifer at these locations indicate a lessening of the seasonal decline during WY 2014. Additional information on the ASR program is available at the District office. Discussion of the Seaside Basin ASR Projects is included in Section XV.

B. Groundwater-Quality Monitoring

Description and Purpose

The District maintains an ongoing groundwater-quality monitoring program for the two principal groundwater sources within the District: (a) the Carmel Valley alluvial aquifer, and (b) the coastal subareas of the Seaside Groundwater Basin. The purpose of the program is threefold:

- (1) to characterize the quality of water in the aquifers,
- (2) to detect groundwater contamination from septic systems or other sources in the shallow zones of the Carmel Valley aquifer, and
- (3) to monitor sea-water intrusion potential in the coastal portions of the Carmel Valley aquifer and Seaside Basin.

The District has maintained a groundwater-quality monitoring program for the Carmel Valley aquifer since 1981, and for the Seaside Basin since 1990. The District's program is in addition to the extensive water-quality monitoring that is conducted by Cal-Am at its production wells. The District manages all well construction, maintenance, and field-sampling activities associated with the program. Water samples are analyzed at Monterey Bay Analytical Services. The Monterey County Health Department, Cal-Am, and the Monterey County Water Resources Agency have also provided assistance with this program in the past. Collection of the water-quality data is intended to detect problems before they can affect the community's water supply.

Implementation and Activities During 2015-2016

The sampling schedule for Carmel Valley is normally staggered, with Upper Valley wells (i.e., upgradient of the Narrows) sampled in Spring and Lower Valley wells (i.e., downgradient of the Narrows) in Fall, to coincide with the historically higher nitrate concentrations in these respective areas. Collection of samples from the Seaside Basin monitor wells is conducted once per year in Fall, coinciding with the historically low water levels in the basin at that time of the year. Additionally, since 2014, samples were

collected quarterly from six wells closest to the coast in the Seaside Basin monitoring network by District staff in cooperation with the Seaside Groundwater Basin Watermaster.

- **Carmel Valley Aquifer** – Groundwater-quality data were collected from six of the network of seven monitor wells in the Carmel Valley aquifer in November 2016. One of the seven wells in lower Carmel Valley was not sampled earlier because it was submerged under high water in the Carmel River Lagoon during the sampling period. Another well that had historically been sampled during this period was destroyed by flooding in March 2011 when the river scoured away the south end of the Carmel River State Beach parking lot. The locations of these sampling points are shown in **Figure IV-3** and **Figure IV-4**. The results indicated that, in general, there were only minor changes in overall water quality compared to samples collected in 2015. Staff is particularly interested in tracking indicators of potential seawater intrusion in the coastal portion of Carmel Valley. Accordingly, three clustered sets of wells were established west of Highway 1, with each set being made up of three wells completed at different depths. Review of historical data indicated that the shallower and intermediate wells at the two well clusters closest to the coast are subject to the mixing of fresh water and saline water as high tides and surf overtop the sand berm between the lagoon and the ocean. This contributes to episodic mixing within the shallower and intermediate zones of the aquifer, but is not necessarily representative of larger-scale seawater intrusion into the aquifer. As described above, the three wells in the cluster closest to the ocean were destroyed by river erosion in March 2011, and the wells in the next closest cluster to the ocean were inaccessible due to high water during the sampling period, so during this Mitigation Report period, only the deeper well at the farthest well cluster from the coast (Well 16S/1W-13Lc) was sampled.

Well 16S/1W-13Lc is the deepest in the array of three wells located on State Parks property near the Carmel Area Wastewater District treatment plant at River Mile (RM) 0.65, currently the most proximate well to the ocean in Carmel Valley that was available for sampling. Although Specific Electrical Conductance (SEC) and Chloride concentration slightly fluctuate from year to year (**Figure IV-5**), overall increases in SEC and Chloride concentration are seen at this monitor well over the period of record. Additional background on historical water-quality at the coastal monitor well sites can be found in District Technical Memorandum 90-04, *Summary of Carmel Valley Groundwater-quality from Coastal Monitor Wells*, which is available at the District office. Staff will continue to track future results for trends that might indicate significant changes in concentrations of these or other constituents in the coastal area of the aquifer.

Water quality in well 16S/1E-23La, located 6.72 miles upstream from the river mouth, remained generally unchanged in 2016 relative to 2015, as shown on the graph of SEC and Chloride that is included to track long-term trends (**Figure IV-6**). Staff will continue to track changes in all of the monitor wells in the basin to determine if they are indicative of long-term trends, or anomalous short-term events.

- **Seaside Groundwater Basin** -- Eleven monitor wells in the coastal subareas of the Seaside Basin were sampled in August, October and December 2016. The locations of the Seaside monitor wells are shown in **Figure IV-7**. One function of the District's monitor-well network in the Seaside Basin is to serve as an early warning of potential sea-water intrusion into the two principal aquifer zones, the Paso Robles Formation and the Santa Margarita Sandstone. The water-quality results from the Seaside Basin indicate that very little water-quality changes have occurred over the period of record since monitoring began in 1990, and that there is no indication of sea-water intrusion in this area of the basin at this time. **Figure IV-8** shows SEC and Chloride concentrations in two coastal wells, one in the shallower Paso Robles Formation aquifer, and one in the deeper Santa Margarita Sandstone aquifer, for the historical period of record beginning in April 1991. Results from the District's monitoring program indicate that SEC averages approximately 350 and 825 microSiemens/centimeter ($\mu\text{S}/\text{cm}$), for the Paso Robles and Santa Margarita aquifer zones, respectively.

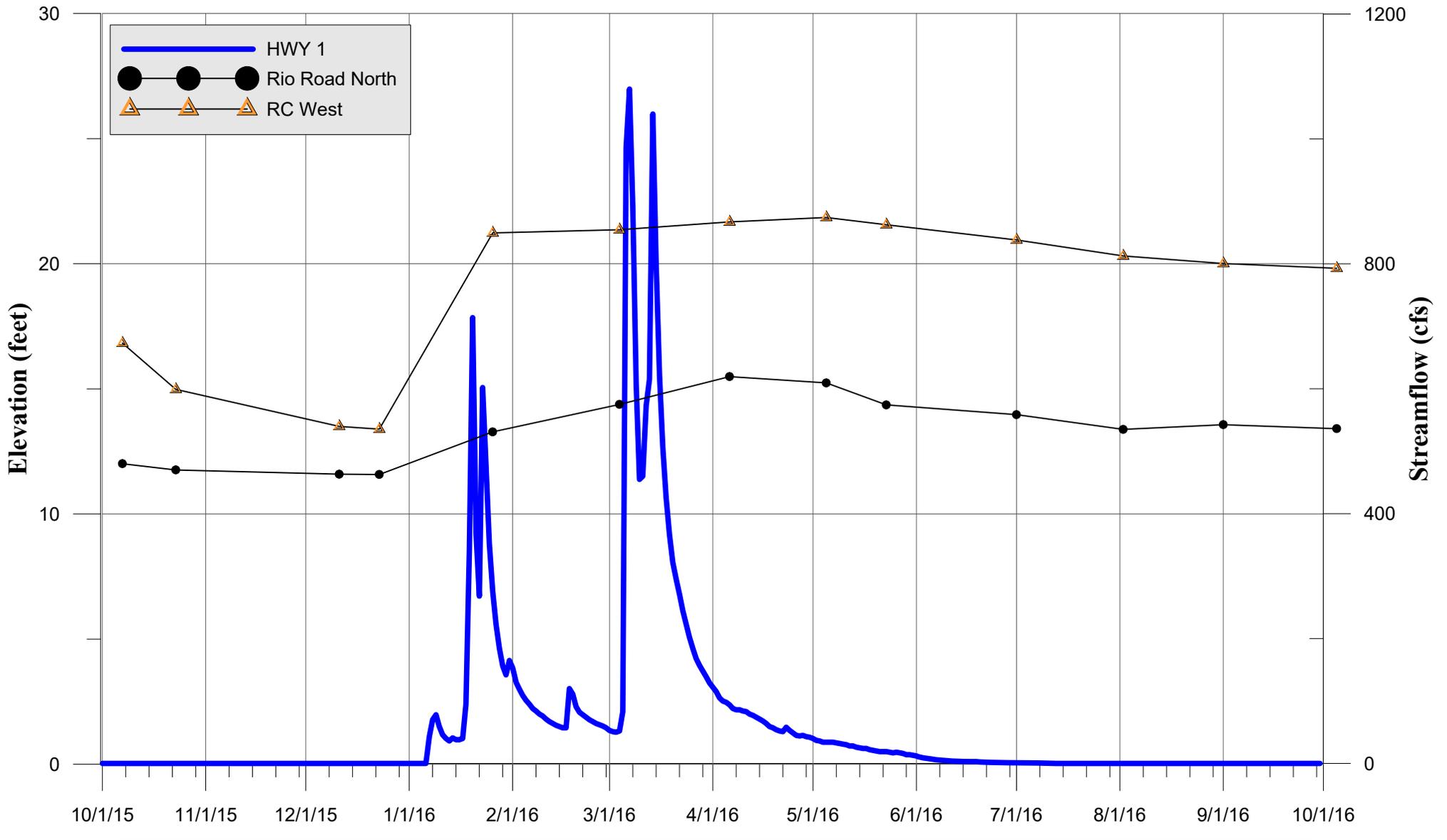


Figure IV-1 Hydrographs of Monitor Well Levels and Carmel River Streamflow

Well levels measured at Rancho Canada West and Rio Road North Monitor Wells.
Carmel River Streamflow measured at Highway 1 Bridge.

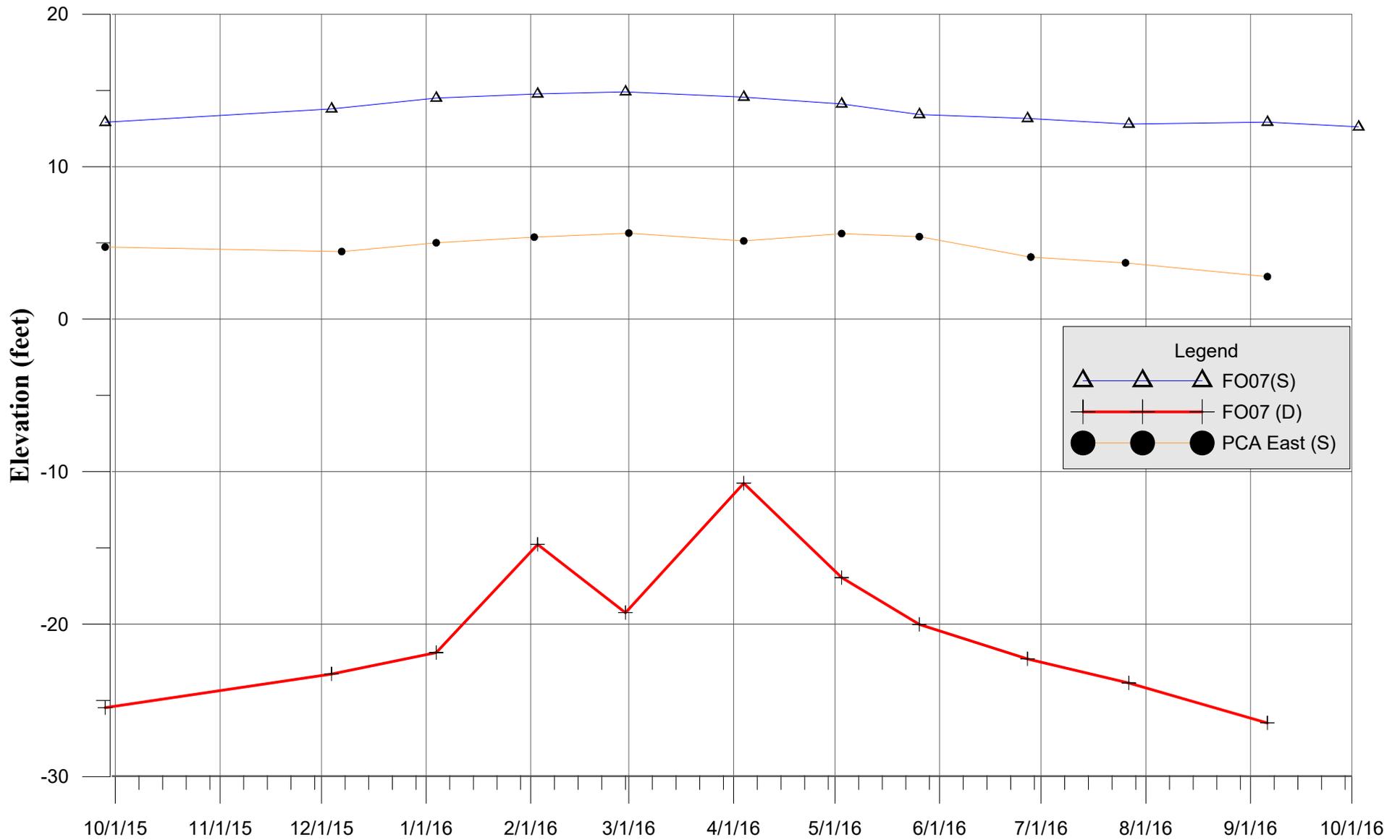
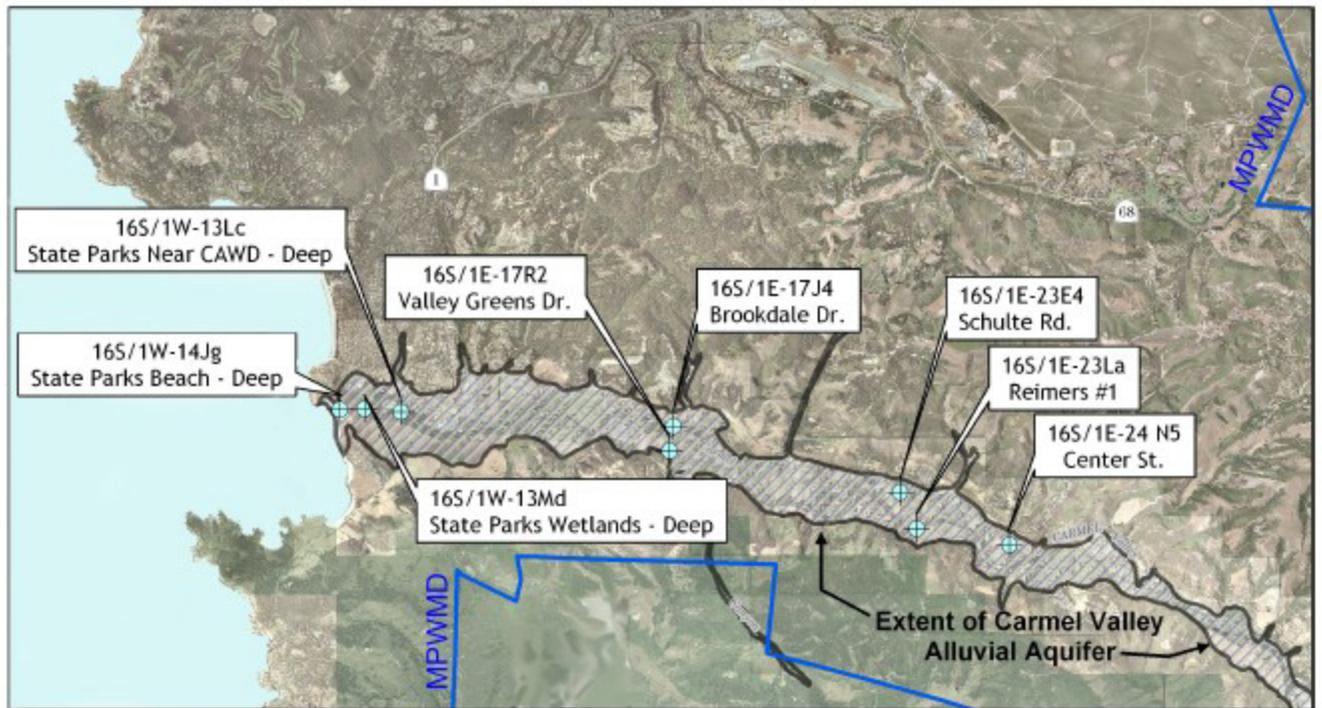


Figure IV-2 Hydrographs of PCA East and FO 07

Figure IV-3

LOCATION OF MPWMD LOWER CARMEL VALLEY
WATER QUALITY MONITORING WELLS
(River Mile 0.0 to 9.0)



0 6,250 12,500 25,000 37,500 50,000 Feet

Scale

Figure IV-4

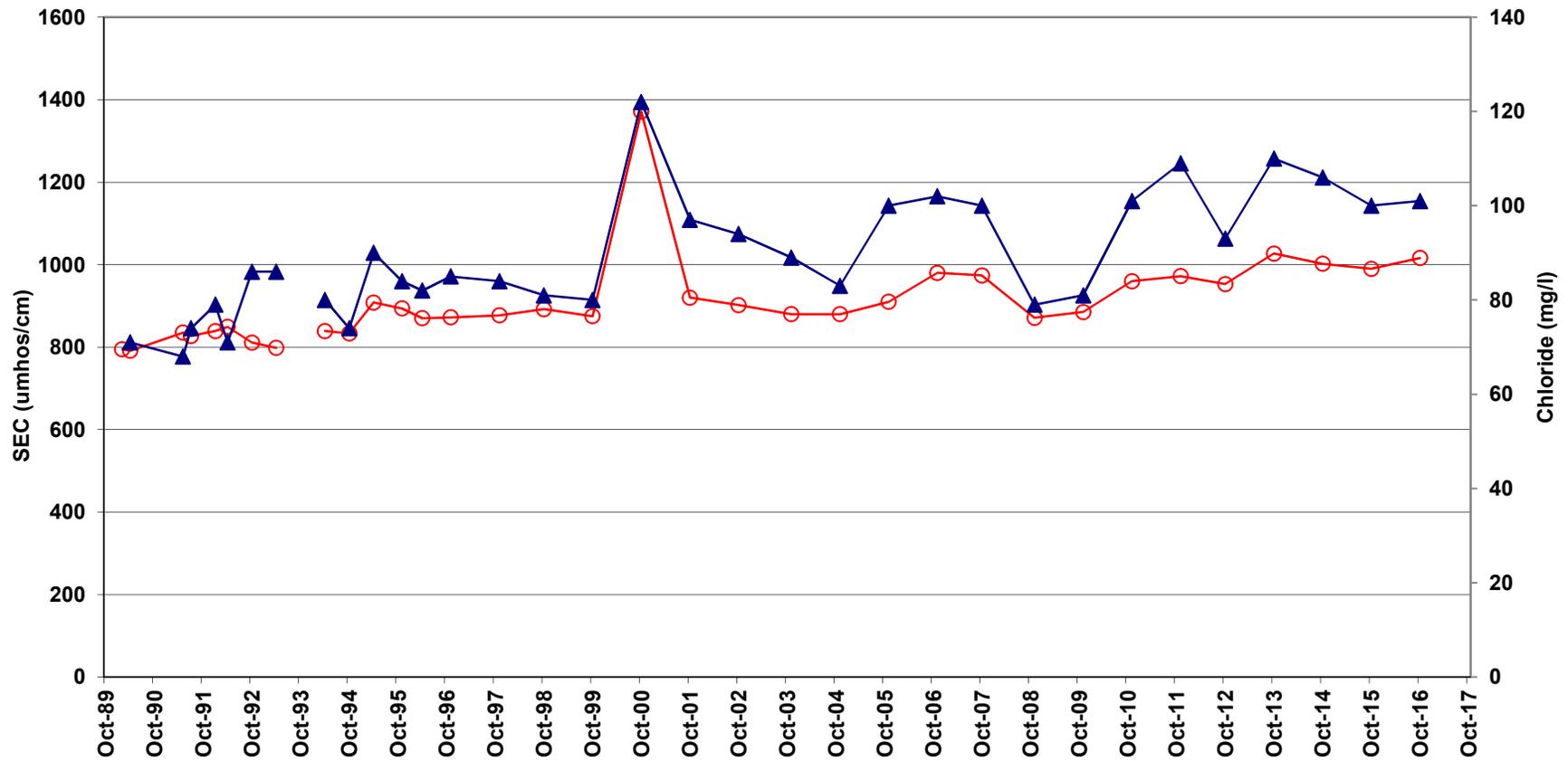
LOCATION OF MPWMD CARMEL VALLEY WATER QUALITY MONITORING WELLS
(River Mile 11.75 to 15.50)



River Mile (RM)	Well Common Name	State Well Number
12.52	Boronda Rd.	T16S/R2E-33Q1
13.65	Little League #1	T17S/R2E-03La
14.28	De Los Helechos	T17S/R2E-10B1

Figure IV - 5 WATER-QUALITY RESULTS
State Parks Near CAWD (deep) - 16S/1W-13Lc
River Mile 0.65

SEC 16S/1W-13Lc Chloride -16S/1W-13Lc



IV - 10

Figure IV - 6 WATER-QUALITY RESULTS
Reimers #1 - 16S/1E-23La
River Mile 6.72

▲ SEC -23La ○ Chloride -23La

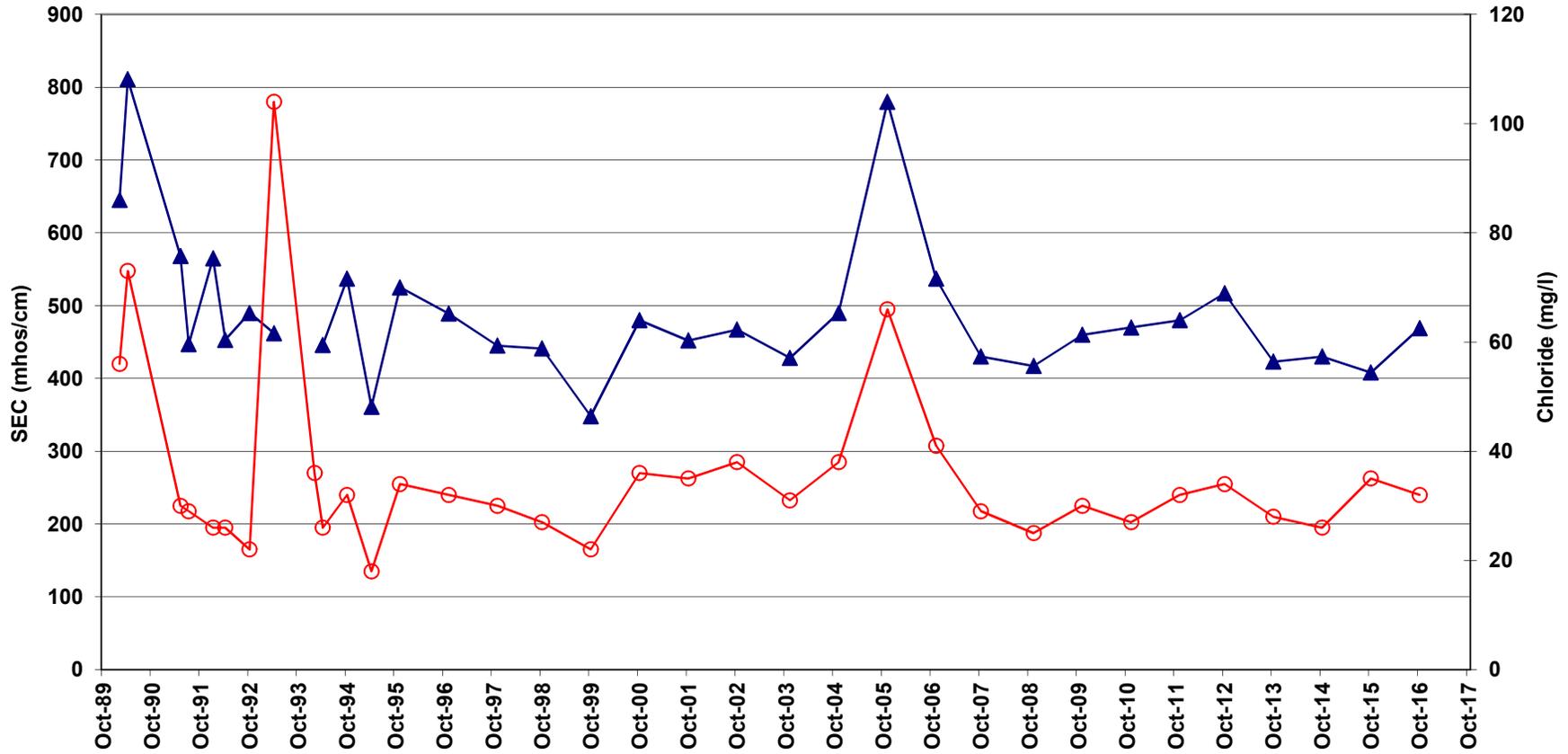


Figure IV-7

SEASIDE BASIN COASTAL GROUND WATER QUALITY MONITOR WELL LOCATIONS

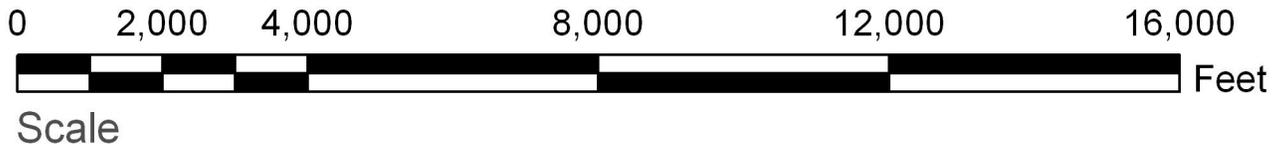
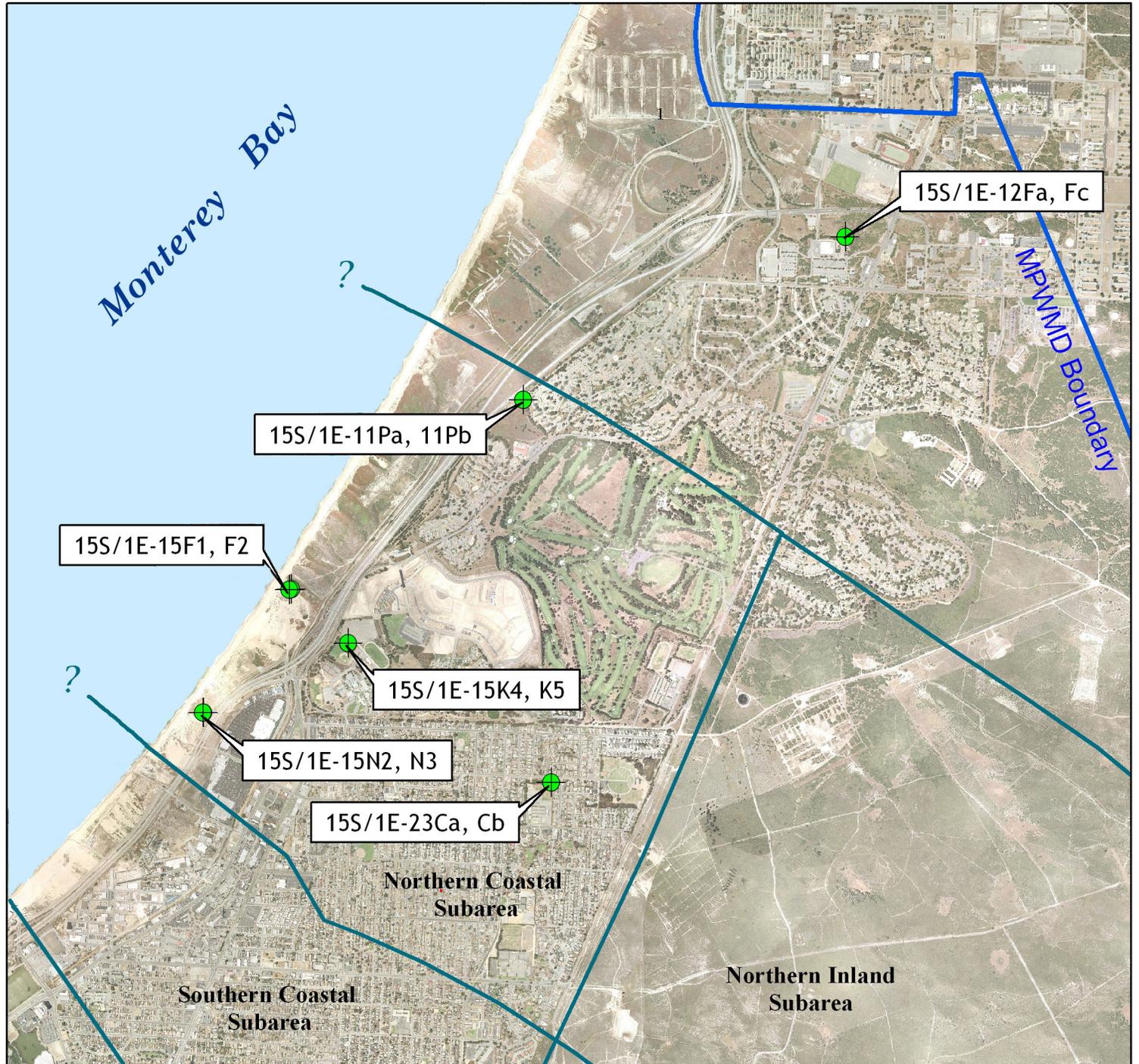
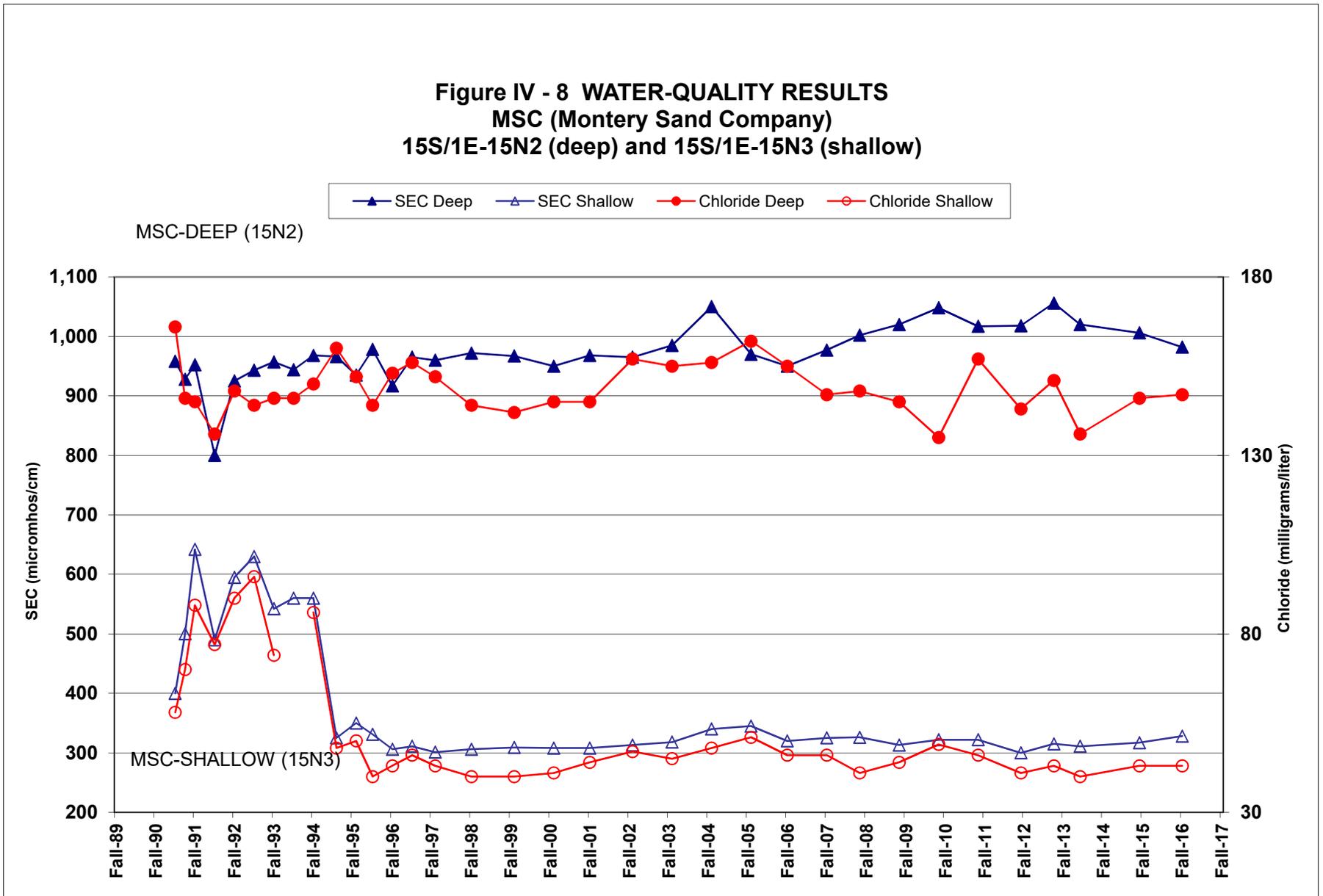


Figure IV-8



V. ANNUAL LOW-FLOW MEMORANDUM OF AGREEMENT

Description and Purpose

The original Memorandum of Agreement (MOA) between the California Department of Fish and Game (now California Department of Fish and Wildlife, CDFW), Cal-Am, and the District was developed in July 1983 to balance CDFW's requirement to conserve and protect the fish and wildlife resources of the state and Cal-Am's responsibility to supply water to the citizens of the communities of the Monterey Peninsula. This MOA is modified each year to reflect specific storage conditions and inflow projections at Los Padres and San Clemente Reservoirs in the Upper Carmel River watershed. Specifically, the MOA addresses the release of water into the Carmel River from San Clemente Dam and was originally designed to maximize surface flow to the Narrows during the low-flow season. In addition to specifying minimum flow releases from San Clemente Dam, the past MOAs limited Cal-Am diversions from San Clemente Dam to the Carmel Valley Filter Plant (CVFP) and directed how Cal-Am was to produce water from the Lower Valley Wells. Normally, the MOA is formulated in May and remains in force until the end of December. The agreement may be modified or extended by mutual consent of all the parties.

Implementation and Activities During 2015-2016

- **2016 MOA** – The 2016 MOA was developed on May 5, 2016 and approved by the District Board on May 16, 2016. The final document was signed by the District and forwarded to Cal-Am for their concurrence, but was not signed by CDFW due to the same unresolved language that was proposed in 2009 by CDFW. Based on storage conditions and expected reservoir inflows, it was agreed that Cal-Am would maintain minimum flows in the Carmel River below Los Padres at 6.4 cfs for June, 6.7 cfs for July, 6.5 cfs for August, and 3.0 for September and October. The 2016 MOA included terms to: (a) limit Cal-Am diversions at San Clemente Dam during low-flow periods, except during an emergency, as defined in SWRCB Order WRO 2002-0002; (b) allow production from Cal-Am's Russell Wells at a maximum rate of 0.5 cfs; (c) limit operation of Cal-Am wells in the Carmel Valley above Robinson Canyon Road Bridge during low-flow periods; and (d) require Cal-Am to make reasonable efforts to operate the lower Carmel Valley wells in sequence from the most downstream well, progressing upstream as wells are needed and available for production.

VI. QUARTERLY WATER SUPPLY STRATEGY AND BUDGET

Description and Purpose

Under Ordinance No. 19, which was adopted in December 1984, the District was required to develop an annual water-supply strategy. This strategy included estimates of projected demands and proposed production targets for the Cal-Am system. The strategy was designed to limit Cal-Am surface-water diversions from the Carmel River to no more than 35 percent of total Cal-Am production. Based on the District strategy, Cal-Am developed a water-supply budget specifying monthly production targets.

Under Ordinance No. 41, which was adopted in March 1989, development of the water-supply strategy and budget was changed from an annual to a quarterly process, and Cal-Am's annual surface-water diversions were reduced to a goal of no more than 29 percent of total production. Currently, the quarterly strategy and budget values are developed jointly by Cal-Am, the District, CDFW and NMFS, in conformance with the annual low-flow Memorandum of Agreement (MOA). The strategy is designed to maximize the long-term production potential and protect the environmental quality of the Carmel Valley and Seaside basins. The budget includes monthly production targets for each of Cal-Am's major production sources -- San Clemente Reservoir, Upper Carmel Valley (UCV) Aquifer, Lower Carmel Valley (LCV) Aquifer, and the Coastal Subareas of the Seaside Basin -- which reflect current and expected system conditions. The quarterly strategies and budgets are normally developed in December, March, June, and September of each year.

Starting in April 2002, the Quarterly Water Supply Strategy and Budgets were fundamentally changed by the State Water Resources Control Board (SWRCB), which adopted Order WRO 2002-0002 on March 21, 2002, and by NMFS and Cal-Am, who signed a Conservation Agreement on September 18, 2001. This order and agreement changed the way that Cal-Am operates its diversions and wells upstream of Robinson Canyon Road Bridge. Specifically, Cal-Am was ordered to:

1. Immediately upon issuance of SWRCB Order WRO 2002-0002, cease withdrawal of water from the San Clemente Dam during low-flow periods except during an emergency. For the purpose of the Order, "low-flow periods" are defined as times when stream flow in the Carmel River at the Don Juan Bridge gage (RM 10.8) is less than 20 cfs for five consecutive days.
2. Reduce diversions during low-flow periods from the Scarlett No. 8 Well, Los Laureles Wells Nos. 5 and 6, Panetta Wells, Garzas Wells Nos. 3 and 4, and the Robles Well. Current diversions are 1-7 days per month at each well. Diversions at these wells shall be reduced to a maximum of two eight-hour days per month, except that those wells that currently operate only one eight-hour day per month shall continue to operate at not more than one eight-hour day per month. To the maximum degree practicable, Cal-Am shall operate these wells at night. In consultation with NMFS, USFWS, CDFW and the District, Cal-Am can operate the Scarlett 8 well incrementally to meet maximum daily demand after using all other available downstream sources at

maximum capacity.

3. Install, not later than March 31, 2002, a pump that delivers water from the Begonia Zone to the Carmel Valley Village Zone. The “Begonia Zone” is defined to include water well production facilities in AQ3, AQ4 and the Seaside Groundwater Basin. The “Carmel Valley Village Zone” is defined to include all Cal-Am users upstream from the Del Monte Regulating Station.
4. The Russell Wells shall be limited to a combined total instantaneous diversion rate of not more than 0.5 cfs during low-flow periods.
5. During the low-flow periods, except for 0.5 cfs, all water diverted to Carmel Valley Village Zone shall be water that originates from the Begonia Zone (as defined in Paragraph 3 above).

In addition, the production goals for the quarterly budget process have changed over time. Beginning in 1998, the quarterly budgets were formulated with an annual production goal of 11,285 AF during each Water Year from the Carmel River Basin, in conformance with goals and requirements established by SWRCB Orders WR 95-10, WR 98-04, and subsequently in conformance with WRO 2002-0002, CDO 2009-0060, and WRO 2016-0016. Releases from San Clemente Reservoir were maximized throughout the year and groundwater production in the UCV was limited to periods when sufficient streamflow was available to recharge the aquifer.

Starting in March 2006, the annual limit for Cal-Am’s production from its wells in the Coastal Subareas of the Seaside Groundwater Basin for customers in its main system used in the quarterly budgets was reduced from 4,000 AF per year to 3,504 AF per year based on the final judgment in the basin adjudication. Accordingly, the total annual limit for Cal-Am from the Carmel River and Seaside Groundwater Basins for its main system was set at 14,789 AF. It should be noted that the March 2006 Seaside Basin adjudication decision was amended in February 2007. The decision was amended in part to allow Cal-Am to combine its production allocation from the Coastal Subareas with its production allocation from the Laguna Seca Subarea.

On January 15, 2008, the SWRCB issued a draft Cease and Desist Order (CDO) against Cal-Am. The Draft CDO refers to the 1995 SWRCB Order 95-10, and notes that compliance with Order 95-10 had not been achieved after 12 years. The CDO institutes a series of cutbacks to Cal-Am production from the Carmel River and prohibits new or intensified connections in the Cal-Am main system. MPWMD and several other parties participated in formal hearings before the SWRCB in the summer of 2008. After several draft versions, the final SWRCB determination on the CDO was issued on October 20, 2009. The District subsequently filed a suit to challenge this ruling, and the Monterey County Superior Court issued a stay on November 3, 2009. In response to a challenge by SWRCB, the court ruled on November 23, 2009 that the stay will remain in effect until the hearing that was held in Santa Clara in April 22, 2010. At that hearing, the Court lifted the stay and the CDO was reinstated. The CDO reduced the Cal-Am annual upper limit of diversion from the Carmel River previously set by Order 95-10 at 11,285 AF to 10,429 AF in WY 2010.

In WY 2015, the CDO (Order 2009-0060) set Cal-Am Carmel River production to 9,945 AF. In WY 2016, the CDO (Order 2016-0016) set the Cal-Am River production to 8,310 AF. The Seaside adjudication decision limited Cal-Am production in the Coastal and Laguna Seca Subareas of the Seaside Basin to 2,251 AF and 48 AF, respectively. This brought the WY 2016 total production limit from all sources to 10,609 AF (not including any adjustments for supplemental supplies or carryover storage).

Implementation and Activities During 2015-2016

During 2015 and 2016, the quarterly strategies and budgets were structured to optimize production from the Coastal Subareas of the Seaside Basin and minimize impacts from production in the Upper Carmel Valley (UCV). Activities in Water Year 2016 are described below.

- **Cal-Am Main System Production in Water Year 2016¹** – During WY 2016, Cal-Am produced 9,581 acre-feet (AF) of water for customer service from all sources in its Carmel River, Seaside Coastal and Laguna Seca Subarea systems. This production consisted of 6,869 AF from Carmel River source wells, 1,559 AF of native water from Seaside Coastal wells, 317 AF from Laguna Seca Subarea wells, and 160 AF from the Sand City desalination plant. Of the system total, no water was diverted at San Clemente Dam because it was removed in the summer of 2015.

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¹ Beginning with the 2002-2003 Mitigation Report, Cal-Am production is reported on a Water Year basis, from October 1 of one Calendar Year through September 30 of the following Calendar Year. This is a change from previous annual reports in which the reporting period was July of one year through June of the following year. This change makes the mitigation report consistent with reporting requirements under SWRCB Order No. WR 95-10.

VII. WELL REGISTRATION AND REPORTING PROGRAM

Description and Purpose

All owners of wells within the District are required to register and report their annual water production. The purpose of the program is to provide annual aggregate estimates of water production from both Cal-Am and non-Cal-Am wells in the various groundwater production zones in the District. The information provided is used to make decisions regarding management of the limited water resources of the Monterey Peninsula area.

The District began its Well Registration and Reporting Program in 1980. From 1981 through 1990, well owners were allowed to report water production by one of three methods: Water Meter, Land Use, or Power Consumption Correlation. In March 1990, the District adopted Ordinance No. 48 requiring installation of water meters on all large production wells (i.e., those producing 20 or more AFY). In November 1991, District rules were further amended with the adoption of Ordinance No. 56, which extended the metering requirement to all existing medium production wells, defined as those producing between 5 and 20 AFY, and all new wells within the District. Ordinance No. 56 also eliminated the Power Consumption Correlation reporting method.

Implementation and Activities During 2015-2016

Figure VII-1 shows summaries of reported production from Cal-Am and non-Cal-Am wells in WY 2016, and **Figure VII-2** shows the WY 2015 data (which has been revised since the 2015 Mitigation Program Report) for comparison.

With respect to the District's Water Allocation Program limits, Cal-Am production from the MPWRS in WY 2016 was 9,581 AF, or 8,060 AF (45.7%) less than the Cal-Am production limit of 17,641 AF that was established with the adoption of Ordinance No. 87 in 1997. Non Cal-Am production within the MPWRS in WY 2016 was 3,075 AF, or 29 AF (1.0%) greater than the non Cal-Am production limit of 3,046 AF established by Ordinance No. 87. Combined production from Cal-Am and non Cal-Am sources within the MPWRS was 12,656 AF in WY 2016, which is 8,031 acre-feet (38.8%) less than the 20,687 acre-feet production limit set for the MPWRS as part of the District's Water Allocation Program. Therefore, no action is necessary at this time, although staff will continue to monitor production trends within the MPWRS and District-wide. A comparison of reported water production from the MPWRS in Reporting Year 1997, WY 2007, and WY 2016 relative to the District's Water Allocation limits is presented in **Figure VII-3**. 1997 was the last time the production limits were adjusted. Prior to 2008, the LSS was not included in the MPWRS, but was added with the adoption of Ordinance 135 on September 22, 2008. However, the production limits in the District's Allocation Program did not change. Production from the MPWRS in RY 1997 and WY 2007 presented in **Figure VII-3** has been adjusted to include production from the LSS. Production from non-Cal-Am sources has not fluctuated a great deal, and since production from LSS is included, non-Cal-Am production has been over the production limit several years. Historical Cal-Am production presented in **Figure VII-3** was also adjusted to include production from the LSS. Cal-Am production from the MPWRS has greatly decreased, and since Cal-Am represents such a large portion

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of total production, combined production from Cal-Am and non-Cal-Am sources has also decreased over the last several years.

During WY 2016, District staff inspected 12 new water meter installations and three replacement meters to ensure compliance with the District's water meter installation standards and guidelines. In addition, staff reviewed copies of ten applications for permits for construction of new wells within the District from the Monterey County Health Department. Staff also advised recipients of County well construction permits that MPWMD Water Distribution System permits or written exemptions were also required.

Lastly, it should be noted that 99% of the groundwater production within the District was reported by the water meter method in WY 2016. In addition, 98% of registered well owners in the District reported annual production for their wells in WY 2016.

Figure VII-1

**MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
DRAFT WATER PRODUCTION SUMMARY FOR WATER YEAR 2016**

SOURCE AREAS ^{1, 2}	NON CAW (NON CAL-AM) WELLS						CAW (CAL-AM) WELLS		AQUIFER SUBUNIT TOTALS	
	WATER METER		LAND USE		SUB-TOTAL		WATER METER		NO. OF WELLS	PRODUCTION (AF)
	NO. OF WELLS	PRODUCTION (AF) ³	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)		
AS1	9	96.0	1	0.1	10	96.1	0	0.0	10	96.1
AS2	56	138.0	32	31.7	88	169.6	3	153.7	91	323.3
AS3	133	1,113.7	46	34.7	179	1,148.4	6	56,206.9	185	7,355.3
AS4	29	352.3	6	3.1	35	355.4	2	1,344.3	37	1,699.7
SCS	8	936.4	2	1.8	10	938.2	6	1,559.3	16	2,497.5
LSS	7	351.7	2	2.7	9	354.4	4	316.7	13	671.1
CAC	8	20.7	8	12.1	16	32.8	0	0.0	16	32.8
CVU	299	534.6	44	39.0	343	573.6	0	0.0	343	573.6
MIS	130	313.3	10	5.5	140	318.8	0	0.0	140	318.8
ACTIVE	679	3,856.7	151	130.7	830	3,987.4	21	9,580.9	851	13,568.3
INACTIVE	348		30		378		11		389	
NOT REPORTING	9		13		22		0		22	
SAND CITY DESAL							0	160.9		adjusted for SC desal
METHOD TOTALS:	1,036	3,856.7	194	130.7	1,230	3,987.4	32	9,741.9	1,262	13,729.2

DISTRICT-WIDE PRODUCTION	
SURFACE WATER DIVERSIONS:	
CAW Diversions (San Clemente Dam):	0.0
Non Cal-Am Diversions Within MPWRS:	13.3
CAW WELLS:	
SEASIDE:	1,876.0
CARMEL VALLEY:	7,704.9
Within the Water Resources System:	9,580.9
Outside the Water Resources System:	0.0
Sand City Desal	160.9
<i>CAW TOTAL, Wells and Diversion:</i>	9,741.9
NON CAW WELLS:	
Within the Water Resources System:	3,062.2
Outside the Water Resources System:	925.2
Non Cal-Am Diversions Outside the MPWRS:	50.7
<i>NON CAW TOTAL, Wells and Diversion:</i>	4,051.4
GRAND TOTAL:	13,793.3

NOTES:

- Shaded areas indicate production within the Monterey Peninsula Water Resources System. The LSS was added to the Monterey Peninsula Water Resources System in September 2008.
- CAW - California American Water
- Source areas are as follows:
 AS1 - UPPER CARMEL VALLEY - San Clemente Dam to Esquiline Bridge
 AS2 - MID CARMEL VALLEY - Esquiline Bridge to Narrows
 AS3 - LOWER CARMEL VALLEY - Narrows to Via Mallorca Bridge
 AS4 - LOWER CARMEL VALLEY - Via Mallorca Bridge to Lagoon
 SCS - SEASIDE COASTAL SUBAREAS
 LSS - LAGUNA SECA SUBAREA (Ryan Ranch Area is within LSS)
 CAC - CACHAGUA CREEK and UPPER WATERSHED AREAS
 CVU - CARMEL VALLEY UPLAND - Hillsides and Tularcitos Creek Area
 MIS - PENINSULA, CARMEL HIGHLANDS AND SAN JOSE CREEK AREAS
- Any minor numerical discrepancies in addition are due to rounding.
- 699.18 AF is included in CAW production from AS3 to account for water delivered to ASR in WY 2016.
- This total does not include 609.45 AF of ASR water that was recovered for Customer Service in WY 2016.
- Production includes 1.31 AF to Ryan Ranch from CAW Main System in WY 2016. No water was delivered to Seaside Municipal System in WY 2016.

Figure VII-2

**MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
DRAFT WATER PRODUCTION SUMMARY FOR WATER YEAR 2015**

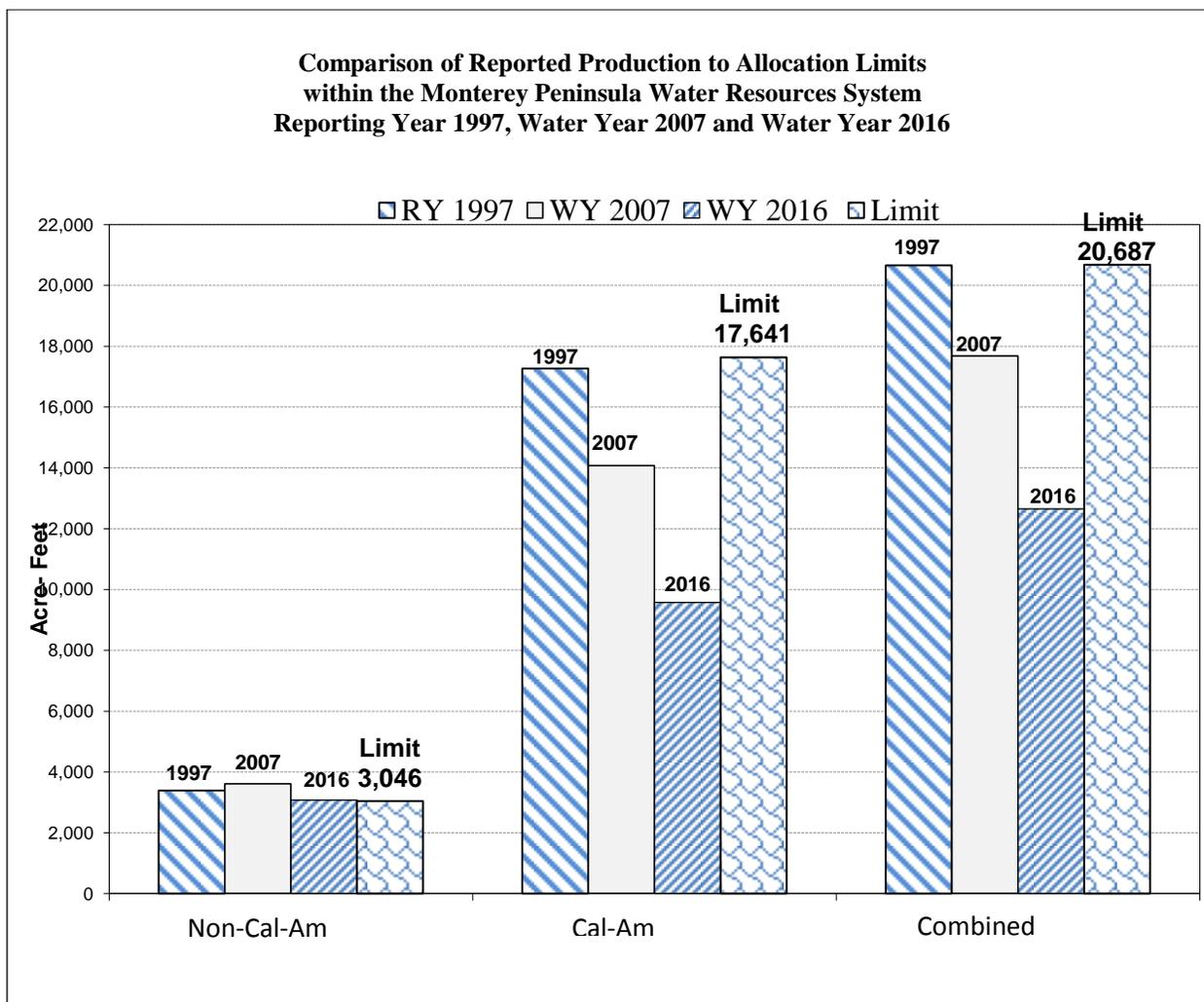
SOURCE AREAS ^{1, 2}	NON CAW (NON CAL-AM) WELLS						CAW (CAL-AM) WELLS		AQUIFER SUBUNIT TOTALS	
	WATER METER		LAND USE		SUB-TOTAL		WATER METER		NO. OF WELLS	PRODUCTION (AF)
	NO. OF WELLS	PRODUCTION (AF) ³	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)		
AS1	9	116.7	1	0.1	10	116.8	0	0.0	10	116.8
AS2	53	104.9	33	32.2	86	137.1	5	965.0	91	1,102.1
AS3	127	1,296.9	48	35.5	175	1,332.4	6	⁵ 4,526.9	181	5,859.4
AS4	31	582.4	6	3.1	37	585.5	1	1,521.1	38	2,106.6
SCS	9	520.6	1	0.7	10	521.3	6	2,436.8	16	2,958.2
LSS	5	467.0	0	0.0	5	467.0	5	327.9	10	794.9
CAC	8	33.8	8	12.1	16	45.8	0	0.0	16	45.8
CVU	285	536.3	44	37.6	329	573.8	0	0.0	329	573.8
MIS	120	419.6	0	0.0	120	419.6	0	0.0	120	419.6
ACTIVE	647	4,078.1	141	121.2	788	4,199.3	23	9,777.8	811	13,977.1
INACTIVE	345		0		345		9		354	
NOT REPORTING	24		9		33		0		33	
SAND CITY DESAL							0	245.4		adjusted
METHOD TOTALS:	1,016 ⁷	4,078.1	150	121.2	1,166	4,199.3	32 ⁷	10,023.2	1,198	14,222.5

DISTRICT-WIDE PRODUCTION	
SURFACE WATER DIVERSIONS:	
CAW Diversions (San Clemente Dam):	0.0
Non Cal-Am Diversions Within MPWRS:	12.6
CAW WELLS:	
⁶ SEASIDE:	2,764.7
CARMEL VALLEY:	7,013.0
Within the Water Resources System:	9,777.8
Outside the Water Resources System:	0.0
Sand City Desal	245.4
¹ CAW TOTAL, Wells and Diversion:	10,023.2
NON CAW WELLS:	
Within the Water Resources System:	3,160.1
Outside the Water Resources System:	1,039.3
Non Cal-Am Diversions Outside the MPWRS:	56.4
NON CAW TOTAL, Wells and Diversion:	4,268.3
GRAND TOTAL:	14,291.5

NOTES:

- Shaded areas indicate production within the Monterey Peninsula Water Resources System. The LSS was added to the Monterey Peninsula Water Resources System in September 2008.
- CAW - California American Water
- Source areas are as follows:
 AS1 - UPPER CARMEL VALLEY - San Clemente Dam to Esquiline Bridge
 AS2 - MID CARMEL VALLEY - Esquiline Bridge to Narrows
 AS3 - LOWER CARMEL VALLEY - Narrows to Via Mallorca Bridge
 AS4 - LOWER CARMEL VALLEY - Via Mallorca Bridge to Lagoon
 SCS - SEASIDE COASTAL SUBAREAS
 LSS - LAGUNA SECA SUBAREA (Ryan Ranch Area is within LSS)
 CAC - CACHAGUA CREEK and UPPER WATERSHED AREAS
 CVU - CARMEL VALLEY UPLAND - Hillsides and Tularcitos Creek Area
 MIS - PENINSULA, CARMEL HIGHLANDS AND SAN JOSE CREEK AREAS
- Any minor numerical discrepancies in addition are due to rounding.
- 215.19 AF was subtracted from CAW production in AS3 to account for water diverted to ASR wells in the Seaside Basin in WY 2015.
- This total includes 0.0 AF of ASR recovery, as no water was recovered for Customer Service in WY 2015.
- Production includes 7.50 AF to Seaside (Municipal) and 1.28 AF to Ryan Ranch from CAW Main System in WY 2015.

Figure VII-3



VIII. WATER EFFICIENCY AND CONSERVATION

Description and Purpose

As a legislated function of the Monterey Peninsula Water Management District (MPWMD or District), a comprehensive water Conservation Program was implemented in October 1979. The Conservation Program expanded in 1983 when the District facilitated development of *The Water Conservation Plan for Monterey County*. The Conservation Plan, adopted by the MPWMD Board in 1986, included a goal to reduce demand by 15 percent of the then-estimated year 2020 demand through implementation of a number of water saving measures including retrofits, use of recycled water, education and other means. At the time the plan was adopted, 2020 demand was expected to be 24,000 AFY for the Peninsula, making the conservation goal 3,600 AF.

Ordinance No. 30, adopted in 1987, was the cornerstone conservation ordinance for the Monterey Peninsula. This ordinance required retrofit to Ultra-Low Flush 1.6 gallons per flush toilets upon resale and in new construction, remodels/additions and changes in use. The ordinance was adopted in July 1987 and codified as MPWMD Regulation XIV, Water Conservation. Regulation XIV also implemented other mandatory water saving measures and a verification process. MPWMD's Regulation XIV has been regarded as a model for other agencies.

In 2009, MPWMD undertook an extensive overhaul of Regulation XIV. Revisions incorporated new technology and best management practices and made the regulation easier to understand. Substantial amendments to the program included significantly expanded indoor and outdoor water efficiency requirements for new construction, visitor-serving commercial uses and Non-Residential customers. For example, all Non-Residential Users that did not have 1.6 gallons-per-flush (gpf) toilets by January 1, 2010 were required to install High Efficiency Toilets (HET) by December 31, 2013. Another example is a requirement for Rain Sensors to be installed on all automatic Irrigation Systems upon Change of Ownership or Use and Expansion of Use (i.e., remodels).

Another legislated function of the MPWMD is the authority to implement and enforce water rationing. A water rationing plan developed by the Monterey Peninsula Water Management Agency (the predecessor to the MPWMD) was available when the MPWMD was established. Amendments to the plan were made in 1981 (Ordinance No. 7) and in 1988 (Ordinance Nos. 35 and 37) during drought-related rationing administered by MPWMD that continued through 1991. Water-use reductions of approximately 30 percent were achieved during the 1988-91 rationing.

In 1997, in response to SWRCB Order 95-10¹, the MPWMD Board of Directors tasked its staff with preparing a plan to address compliance with the Order (i.e., regulatory supply shortage) as well as with physical water shortages. MPWMD worked with a variety of community interests including California American Water (CAW), to conceive and develop the Expanded Water Conservation and Standby Rationing Plan (Plan), which was adopted as Ordinance No. 92 in 1998 (codified as Regulation XV). The Plan consists of seven stages. The first four stages

¹ SWRCB Order No. WR 95-10 concluded that CAW does not have a legal right for about 10,730 AFA (about 69% of the water supplied to CAW customers) which was being diverted from the Carmel River and that diversions were having an adverse effect on the public trust resources of the river.

provide CAW and the District with conservation “tools” to keep community water use within regulatory limits. Stages 5-7 of the Plan contain more stringent actions including per-capita rationing that would be triggered by a drought-induced water supply shortage and/or non-compliance with regulatory restrictions.

In February 2016, the MPWMD Board of Directors adopted Ordinance No. 169 which repealed the existing Regulation XV, The Expanded Water Conservation and Standby Rationing Plan of the Monterey Peninsula Water Management District and replaced it with a streamlined conservation and rationing plan known as “The 2016 Monterey Peninsula Water Conservation and Rationing Plan.”

A key element of the Conservation Program was also added in 1997 when the District began issuing rebates for voluntary toilet replacements with Ultra-Low Flush (ULFT) 1.6 gallons-per-flush toilets. Initially, the District shared funding with CAW. Today, the rebate funds for CAW’s customers are supported by the ratepayers through a conservation surcharge on the CAW bill, with the District administering the program.

The Rebate Program has been expanded over the years. At the end of WY 2016, the following items qualified for a rebate²:

Residential Indoor

- High Efficiency Toilet
- Ultra High Efficiency Toilet
- High Efficiency Residential Dishwasher
- High Efficiency Residential Clothes Washer
- Instant-Access Hot Water System
- On-demand pump or point-of source water heater as part of an Instant-Access Hot Water System

Non-Residential Indoor

- High Efficiency Toilet
- Ultra High Efficiency Toilet
- Pint Urinal
- Zero Water Consumption Urinal
- Water Broom
- Cooling Tower Conductivity Controller
- CEE Tier II Water Efficient Ice Machine
- X-ray film processor recirculation system
- Cooling Tower pH/Conductivity Controller
- Dry Vacuum Pumps
- High Efficiency Connectionless Steamer
- Water Efficient Commercial Dishwashers
- Medical equipment steam sterilizer retrofit with a water tempering device

² Rebates are issued when funding is available.

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- Water Efficient Commercial Steam or “Combi” Oven
- Commercial Ozone Laundry System
- Commercial Waterless Wok Stove

Outdoor Water Efficiency Rebates

- Smart (Weather-Based) Irrigation System Controller
- Soil Moisture Sensor
- Rainwater Harvesting (water storage capacity)
- Lawn removal and replacement with low water use plants or permeable surfaces
- Rotating Sprinkler Nozzles (minimum purchase and installation of ten)
- Graywater Irrigation System supplied by one Clothes Washer for irrigation and/or one or more Bathrooms that have a Bathtub/Shower connected to a Graywater Irrigation System
- Non-Residential Graywater Irrigation Systems considered on a case-by-case basis

Implementation and Activities During 2015-2016

- **Conservation Inspections** -- District staff continued an intensive inspection program to ensure compliance with the Conservation and Permit Regulations. Change of Ownership inspections make up the bulk of the District’s inspection program. Most of the **1,512** properties that changed ownership in FY 2015-2016 were inspected prior to the close of escrow. **Seventy-seven** percent (**77%**) of the inspected properties were found to be in compliance during the first inspection. An additional 1 percent (**1%**) passed during the second inspection, typically after replacing older toilets identified during the initial inspection. Subsequent enforcement is through non-compliance notice on the title of the property.

District staff inspected **835** properties for compliance with Water Permit conditions during FY 2015-2016.

A total of about **1,842** inspections were conducted in FY 2015-2016. An estimated **3.637** acre-feet (AF) of water were saved by new retrofits verified this year in these two categories.

- **Other Conservation Incentives** -- The District continued to offer incentives for property owners who agree to install water efficient appliances to offset new water fixtures as a condition of a Water Permit. Credit, in the form of water fixture units, remained available to offset new water fixtures in Remodels and Additions when an older model appliance is replaced with a High Efficiency Dishwasher (HEDW), High Efficiency Clothes Washer (HECW), High Efficiency Toilet (HET), and/or Instant-Access Hot Water (IAHW) System. This incentive program is one way to allow limited Remodeling and Additions without increasing water use.

- **Rebate Program** -- The Water Conservation Rebate Program is available on a first-come, first-served basis. District staff continues to meet with local community organizations to advertise the program.

From July 1, 2015, through June 30, 2016, a total of 2,244 applications for rebates were received, **1,771** applications were approved with the use of the rebate refund. **Table VIII-1** summarizes the Rebate Program for FY 2015-2016.

- **Conservation Education** -- District activities remained focused on public education and encouraging Peninsula residents and businesses to implement new water conservation and efficiency practices and to maintain existing equipment and behaviors. Individualized Water Waste education took place as necessary to remind water users not to wash sidewalks, leave hoses running or ignore leaks. Efforts again successfully kept community water use below regulatory limits. A comprehensive report on the conservation program is prepared annually and is available on the District's website.

- The District continued supporting water conservation education through the Water Awareness Committee of Monterey County (WAC). WAC is a nonprofit water-education organization serving Monterey County. The District, as a founding member, holds a seat on the WAC Board of Directors and contributes annual financial and staff support to its efforts. WAC provides books on water-efficient landscaping, Drip Irrigation, and other water related subjects to libraries in Monterey County, sponsors a school water education program and provides outreach opportunities for the public to learn about local water issues.
- District staff participated in several events during FY 2015-2016. Events included presentations at the Graniterock Contractor's Expo and at the Association of Environmental Planners Annual Conference. Outreach events included: Pebble Beach Community Services District Open House, Monterey Peninsula College Earth Day, Naval Postgraduate School Earth Day, City of Monterey's Cutting Day, City of Pacific Grove's Good Old Days, and Water Awareness Day at Del Monte Shopping Center. Staff also judged the annual Water Wise Garden Contest at the Monterey County Fair. The events provided the public with an opportunity to learn about the District's extensive activities and programs.
- District staff participated in the Monterey Business Council's Graywater Roundtable. The group was convened to establish guidelines and a process to permit and install Graywater Irrigation Systems in Monterey County. The group successfully completed the assignment and links to the County's process are provided on the District's websites.
- The District hosted two Laundry to Landscape classes. The classes were provided instruction on using graywater from the Clothes Washer to irrigate outdoors.
- The District participated in educating the Hospitality Industry at the Monterey County Hospitality Association Nick Lombardo Golf Tournament.

- The District participated in the Monterey Commercial Property Owners Association's annual golf tournament to discuss commercial customer rebates and retrofits.
- The District hosted Convert Thirsty lawn to a Drought Tolerant Garden class.
- The District co-sponsored two Green Gardener courses. One course was for advanced Green Gardeners and the other focused on Graywater Irrigation System design and installation.
- District staff partnered with CAW and the Water Awareness Committee to sponsor two classes exclusively for irrigation and landscape professionals on Irrigation Scheduling & Smart Controller Programming and Low Volume (Drip) Irrigation. Instruction was available in Spanish and English.
- District staff submitted comments on various development projects subject to CEQA. Projects subject to District water efficiency requirements include: Monterey Regional Airport – AMP, Monterey Salinas-Transit, and Rancho Canada Village.
- Water Demand staff attended the leading-edge WaterSmart Innovations Conference and Exposition. The conference offered four sessions with choices of eight different water efficiency tracks per session.
- District staff contributed to development of a water workbook with local water-supply information for school children. The book was printed and distributed to area schools.
- The school grant program awarded grants to schools in the Monterey Peninsula Unified School District to upgrade Irrigation System controllers and turf removal.
- In 2012, a third CIMIS station (#193) was installed in ET zone 2 at the Pacific Grove Municipal Golf Course. A second CIMIS station is located at Laguna Seca Golf Ranch. This CIMIS Station (#229) was activated on January 1, 2011, and is located in ET zone 3. The first CIMIS Station (#210) is located on the border of zones 3 and 6 and was activated on July 22, 2008.

- The District partnered with City of Pacific Grove and Cal-Am Water to save over 225,000 gallons of water per year with its turf removal project at Lovers Point, Pacific Grove.
- The District partnered with Niagara Conservation and Cal-Am to host a Stealth Toilet Event at the local Home Depot store, it promoted its Rebate program by providing cash back for the purchase of a new Ultra High-Efficiency Toilet.
- The District planted an organic garden at the main office, irrigation supplied by the Rainwater cistern on Site.
- The District partnered with the Monterey Peninsula Regional Park District on the installation of a Rainwater Harvesting system.
- Several ordinances were approved in recent years that affect water savings.
 - Ordinance No. 144, adopted August 16, 2010, added Rebates for Cooling Tower Conductivity/pH Controllers, Dry Vacuum Pumps, High Efficiency Connectionless Food Steamers, High Efficiency Commercial Dishwashers, Graywater Irrigation Systems, retrofits of medical steam sterilizers that utilize a continuous water flow with a water tempering device, and WaterSense labeled Ultra-High Efficiency Toilets.

The ordinance also amended the Rebate amounts for Pint Urinals (from \$250 to \$300), Rotating Sprinkler Nozzles (from \$0.50 to \$4.00 with a minimum purchase of ten), Water Efficient Ice Machines (from \$450 to \$500), and X-ray film processor recirculation systems (from \$2,000 to \$3,500), Cistern storage capacity was increased from 3,000 to 25,000 gallons with an added eligibility condition that the Site must have sufficient roof area to provide the runoff to fill the Cisterns during a normal Water Year. The ordinance also increases the maximum Lawn Rebate increases from 2,000 to 5,000 square-feet.

- Ordinance No. 145, adopted September 20, 2010, clarified and amended rules found in the permits, conservation, and enforcement regulations of the District.
- Ordinance No. 148, adopted April 18, 2011, amended Rule 141, Water Conservation Rebates, to implement new and additional policies related to Lawn removal Rebates adopted by the District's Board in Resolution 2011-04. The

ordinance also amended portions of the Rebate Program to strengthen conditions of approval, clarified that Sites must comply with applicable District rules before Rebates are issued, and disqualified from the Rebate Program Qualifying Devices mandated by local, State or Federal water conservation programs.

- Ordinance No. 149, adopted September 19, 2011, amended Rule 141, Water Conservation Rebates, to delete the Rebate for Rain Sensor in keeping with discussions between California American Water and the California Public Utilities Commission's Division of Ratepayer Advocates.

The ordinance also amended the Rebate amounts for Residential High Efficiency Clothes Washers from \$250 to \$500, Commercial High Efficiency Clothes Washers from \$450 to \$1,000, Lawn removal from \$1.25 per square-foot to \$1.00 per square-foot and reduces the maximum area of Lawn removal that qualifies for a Rebate from 5,000 square-feet to \$2,500 square-feet. The ordinance also eliminated the Rebate for Synthetic Turf.

- Ordinance No. 153, adopted June 19, 2012, increases the Cistern Rebate incentive by adding a higher rebate tier for the first 500 gallons of storage capacity. The Rebate increases to \$50 per 100 gallons for the first 500 gallons.
- Ordinance No. 156, adopted November 18, 2013, adds a Rebate for Ultra-Low Flush Toilet, High Efficiency Toilet and Ultra High Efficiency Toilet flappers. The ordinance adds a \$50 Rebate for replacement of Ultra-Low Flush Toilets with High Efficiency Toilets. The lower Rebate is justified due to implementation of amendments to the Health and Safety Code §17921.3 that mandates the sale and installation of High Efficiency Toilets in California after January 1, 2015.

The ordinance amends language related to mandatory inspection of Lawn removal and Cistern Rebate applications.

- Ordinance No. 159, adopted April 21, 2014, amends the Rebate Program to allow a limited time for Non-Residential Users to receive a Rebate for purchase and installation of High Efficiency Clothes Washers, allows Public and non-profit entities to receive a Rebate for installation of more than 20 High Efficiency Toilets, and gives the Board discretion to approve Rebates in excess of \$2,500 for Lawn removal at Public Sites.

- Ordinance No. 167, adopted December 15, 2015, amends the Rebate Program to allow a Rebate for High Efficiency Urinals purchased before January 1, 2016.

**Table VIII-1
Summary of Rebate Program**

<u>Type of Devices Rebated</u>	<u>Number of devices</u>	<u>Rebate Paid</u>	<u>Estimated AF</u>	<u>Gallons Saved</u>
High Efficiency Toilet (HET)	207	20,559.98	8.725332	2,843,158
Ultra-Low Flush to HET	488	42,637.77	4.850000	1,580,377
Ultra HET	215	29,648.39	2.120000	690,804
Toilet Flapper	0	0.00	0.000000	0
High Efficiency Dishwasher	237	29,375.00	0.717000	233,635
High Efficiency Clothes Washer	656	327,242.86	10.867500	3,541,186
Instant-Access Hot Water System	40	7,659.10	0.000000	0
On Demand Systems	12	1,200.00	0.000000	0
Zero Use Urinals	0	0.00	0.000000	0
High Efficiency Urinals	0	0.00	0.000000	0
Pint Urinals	0	0.00	0.000000	0
Cisterns	100	80,945.14	0.000000	0
Smart Controllers	17	2,430.00	0.000000	0
Rotating Sprinkler Nozzles	128	512.00	0.000000	0
Moisture Sensors	0	0.00	0.000000	0
Lawn Removal & Replacement	48	63,885.00	5.674878	1,849,165
Graywater	3	300.00	0.000000	0
Ice Machines	0	0.00	0.000000	0
<u>Totals: Month; AF; Gallons; YTD</u>	2151	606,395.24	32.954710	10,738,325

IX. ALLOCATION OF NEW WATER SUPPLY

The MPWMD Water Allocation Program requires that each new water Connection or Expansion of Use be accounted for so that System Limits are not exceeded. Ordinance No. 70, adopted by the District Board on June 21, 1993, ended the moratorium on the issuance of new water Connections that was imposed in January 1991 as a result of the Water Allocation Program EIR. The ordinance established a consumption Allocation of water that could be used by each Jurisdiction from a total of 358 Acre-Feet Annually (AFA). This amount was calculated from a formula based on the production capacity of the Paralta well, an interim water supply project development by the District in cooperation with California American Water (CAW) (see also **Section X**).

Of the 358 AFA available from the Paralta well, a 50 AFA District Reserve Allocation was established in 1993 for community benefit projects. In February 1995, Ordinance No. 73 rescinded the District Reserve and allocated the remaining water equally among the eight Jurisdictions. Of the original 50 AFA, 34.720 AFA remained and was distributed equally (4.34 AFA each) among the Jurisdictions.

As described in Section XI of this report, specific water “Entitlements” associated with funding of the Pebble Beach Reclamation Project are available for areas within the Del Monte Forest pursuant to Ordinance No. 109. These Entitlements are not water “Allocations”, and are therefore tracked separately. In addition, there are several other Entitlements of water available to specific areas of the CAW service area.

Implementation and Activities During 2015-2016

Between August 1993 and July 2016, a total of 316.890 AFA of the 342.720 AFA Paralta Well Allocation had been permitted for use by Jurisdictions, leaving 25.830 AFA remaining, or 7.5 percent of the Jurisdictions’ Paralta well Allocations. Credits from expired or canceled Water Permits (“Pre-Paralta Credits”) are tracked by Jurisdiction and may be used for Expansions of Use and New Connections similar to the Paralta Allocation. Finally, credits that were received for public retrofit projects from March 1995 to July 1998 (pursuant to Ordinance Nos. 75 and 91) and Water Use Credits that were transferred to a Jurisdiction are tracked as “Public Credits”. **Table IX-1** provides the status of water Allocations for each Jurisdiction as of June 30, 2016.

Table IX-2 summarizes the Entitlements of water available to specific areas of the CAW service area.

In April 2005, the first Water Use Permits were issued to property owners in the Del Monte Forest who purchased water from the Pebble Beach Company (PBC). Property owners taking advantage of this program pay PBC for the Entitlement and receive documentation of their

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purchase. The District processes and records a Water Use Permit on the title of the property that provides notice of the amount of Water Entitlement available. Regular Water Permits are required when the property owner desires to use the water available from a Water Use Permit. As of June 30, 2016, **43.573 AFA** of Water Use Permit water had been used to permit new and expanded uses.

Ordinance No. 132. In January 2008, the Board adopted Ordinance No. 132 (adding Rule 23.6) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within Sand City. This rule enables the issuance of Sand City Water Use Permits for new and expanded water uses on Sand City Sites, in a cumulative amount of no more than 206 AFA. As of June 30, 2016, fourteen Water Use Permits and Water Permits had been issued for a total of **3.616 AFA**.

Ordinance No. 165. In August 2015, the Board adopted Ordinance No. 165 (adding Rule 23.8) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within the Carmel River watershed and the City of Carmel-by-the-Sea. This rule enables the issuance of Malpasos Water Use Permits for new and expanded water uses on Carmel River watershed and the City of Carmel-by-the-Sea Sites, in a cumulative amount of no more than 80 AFA. As of June 30, 2016, thirty Water Use Permits and Water Permits had been issued for a total of **0.320 AFA**.

Table IX-1

**ALLOCATION REPORT
Reported in Acre-Feet
Water Year 2016**

Jurisdiction	Paralta	Pre-Paralta Credits	Public	Total Water Available
Airport District	8.100	0.000	0.000	5.197
Carmel-by-the-Sea	19.410	1.081	0.182	2.660
Del Rey Oaks	8.100	0.000	0.000	0.000
Monterey	76.320	0.030	3.661	3.894
Monterey County	87.710	0.000	1.891	12.175
Pacific Grove	25.770	0.012	0.133	0.145
Sand City	51.860	0.000	23.373	23.373
Seaside	65.450	34.438	1.144	44.331
TOTALS	342.720	35.561	30.384	91.775

Allocation Holder	Water Available	Total Demand from Water Permits Issued	Remaining Water Available
Quail Meadows	33.000	32.237	0.763
Water West	12.760	8.966	3.774

* Does not include 15.280 AFA from the District Reserve prior to adoption of Ordinance No. 73.

Table IX-2

**ENTITLEMENT REPORT
Reported in Acre-Feet
Water Year 2016**

Entitlement Holder	Entitlement	Total Demand from Water Permits Issued	Remaining Entitlement/and Water Use Permits Available
Pebble Beach Co. ¹	237.660	25.994	211.666
Del Monte Forest Benefited Properties ² (Pursuant to Ord No. 109)	127.340	43.573	83.767
Macomber Estates	10.000	9.595	0.405
Griffin Trust	5.000	4.809	0.191
CAWD/PBCSD Project Totals	380.000	83.971	296.029

Entitlement Holder	Entitlement	Total Demand from Water Permits Issued	Remaining Entitlement/and Water Use Permits Available
City of Sand City	165.000	3.616	161.384
Malpaso Water Company	80.000	0.320	79.680

Increases in the Del Monte Forest Benefited Properties Entitlement will result in reductions in the Pebble Beach Co. Entitlement.

X. WATER-USE TRENDS

Description and Purpose

Based on data provided by California American Water (Cal-Am), Monterey Peninsula Water Management District staff tracks water use (Cal-Am metered consumption) over time to assess community water-use trends. These data are used in water-supply planning (augmentation) as well as development of conservation programs (e.g., assess the degree of conservation savings needed and the effectiveness of conservation programs).

Implementation and Activities During 2015-2016

Water-use trends may be tracked by using production data at the well head, as described above, or by considering Cal-Am metered consumption information, as described below. **Figure X-1** provides water-use trends from 1980 through 2016, as represented by consumption in acre-feet per Cal-Am connection (AF/connection) for customers¹ in the Cal-Am's Monterey Co. District (i.e., the "Main System"). This is based on Cal-Am annual "Customers & Consumption by Political Jurisdiction & Classification" reports that provide water-use information for each political jurisdiction and Cal-Am system subunits, as well as several user classifications. For WY 2016, the use per connection is based on Cal-Am's total metered consumption² (8,987 AF) divided by Cal-Am's total customers (37,990) and equaled 0.237 AF/connection.

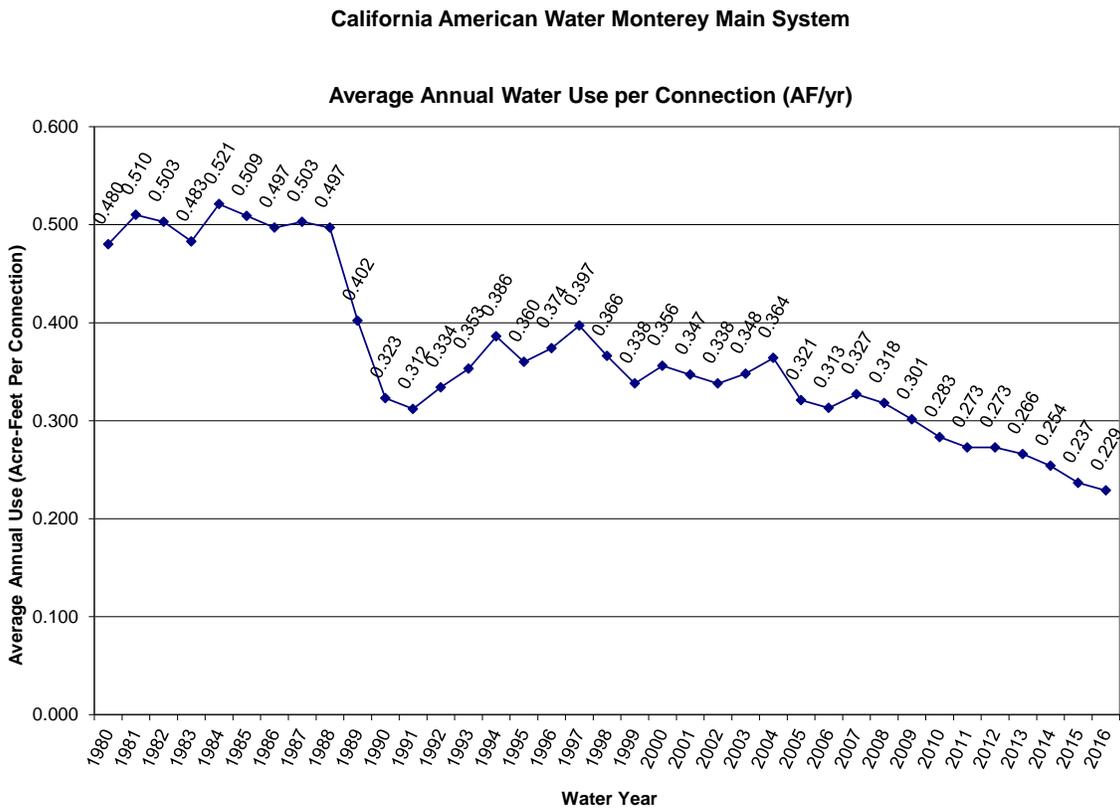
Water consumption per connection in WY 2016 was the lowest rate on record during the 1980-2016 period, likely due in part to increased awareness of the need for conservation and higher water charges, and possibly depressed economic conditions. Review of **Figure X-1** indicates that water use per connection for the last 26 years (1989-2016) is significantly less than in the preceding 9 years (1980-1988). The sharp decline in WYs 1989, 1990, and 1991 is attributable to mandatory water rationing in response to the 1987-1991 drought period. From 1992-2004, annual water consumption remained relatively stable, with a range from approximately 0.33 to 0.40 AF/connection, and average of 0.359 AF/connection, compared to the average of 0.500 AF/connection for the 1980-1988 period. Since WY 2004, a general annual declining trend has occurred. Notably, water consumption in WY 2016 (0.237 AF/connection) was 47% of the pre-drought consumption in RY 1987 (0.503 AF/connection).

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¹ Includes residential, multi-residential, commercial, industrial, golf course, public authority, other and non-revenue metered connections.

² Excludes Cal-Am satellite systems with separate well sources (i.e., Ryan Ranch, Hidden Hills, Bishop, Ralph Lane, Chualar and Ambler). Also excludes water supplied to MPWMD by Cal-Am wells to irrigate Carmel River riparian vegetation as part of the Allocation EIR Mitigation Program.

Figure X-1
California American Water Use Per Connection for Main System: 1980 – 2016



XI. WATER DISTRIBUTION SYSTEM MANAGEMENT (WATER PERMITS)

Description and Purpose

The Monterey Peninsula Water Management District (MPWMD or District) balances water supply and demand by carefully tracking the amount of allotted water used by the eight Jurisdictions within the MPWMD boundaries. The Monthly Water Allocation Program Report, found in the District's regular meeting Board packet, summarizes the amount of water available to each Jurisdiction. The current Allocation system, implemented after adoption of the Water Allocation Program EIR, replaced a system based on each Jurisdiction receiving a percentage of the total available production. The current process makes only newly developed water supplies available for new and expanding uses through an Allocation by Jurisdiction system, which is tracked every time a Water Permit is issued. In mid-1993, water from the Paralta Well project resulted in an Allocation of water to the Jurisdictions, ending a moratorium that was established in 1989.

In addition to Allocations for each of the Jurisdictions, there are several separate Water Entitlements: Water West, a water company purchased by California American Water (CAW) in the early 1990's, has an independent Entitlement of water for properties within the boundaries of the former system. Properties located in the Quail Meadows subdivision, Pebble Beach Company (PBC) properties, Hester Hyde, Griffin Trust, and J. Lohr properties also have an independent Entitlement of water. Water from the PBC's Entitlement can be assigned to other properties located within the Del Monte Forest (Pebble Beach).

Implementation and Activities During 2015-2016

- **Permit Activity** -- From July 1, 2015, through June 30, 2016, a total of **817** Water Permits were issued. As shown in **Table XI-1**, **17** new residences and **566** residential Remodels/additions were permitted in the CAW system. There were **98** Non-Residential Water Permits issued for Remodels/Additions and Changes of Use in the CAW system. As of June 30, 2016, a total of **91.775 AF** of water remained available in the areas served by CAW, as shown in **Section IX**. This includes water from pre- and post-Paralta Allocations and water added to a Jurisdiction's Allocation from Water Use Credit transfers and public retrofits.

- **Reclamation** – The Carmel Area Wastewater District/Pebble Beach Community Services District (CAWD/PBSCD) Recycled Water Project began operation in 1994, producing Reclaimed Water to replace Potable water previously used to irrigate golf courses and recreational open space in the Del Monte Forest (Pebble Beach area). At the start of operation, the District released Water Entitlements to the project sponsors for their fiscal participation. The PBC received 365 AF, Macomber Estates received 10 AF, and the Griffin Trust received 5 AF. The District retains 420 AF of the project's estimated savings of 800 AFA; none of the District share has been allocated.

Ordinance No. 109. In May 2004, the Board adopted Ordinance No. 109 (amending Rule 23.5) to enable financing of upgrades to the CAWD/ PBSCD Recycled Water Project. This ordinance

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enabled Water Entitlements held by the PBC to be made available to properties throughout the Del Monte Forest in order to finance the Project Expansion. Ordinance No. 109 also provided a framework for several ancillary agreements for financing, construction and operation, and sale of Recycled Water.

In April 2005, the first Water Use Permits were issued to property owners in the Del Monte Forest who purchased water from the PBC. Property owners taking advantage of this program pay PBC for the Entitlement and receive documentation of their purchase. The District processes and records a Water Use Permit on the title of the property that provides notice of the amount of Water Entitlement available. Regular Water Permits are required when the property owner desires to use the water available from a Water Use Permit. As of June 30, 2016, **43.573 AF** of Water Use Permit water had been used to permit new and expanded uses (see **Section IX**).

Ordinance No. 132. In January 2008, the Board adopted Ordinance No. 132 (adding Rule 23.6) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within Sand City. This rule enables the issuance of Sand City Water Use Permits for new and expanded water uses on Sand City sites, in a cumulative amount of no more than 206 AFA. As of June 30, 2016, fourteen Water Use Permits and Water Permits had been issued for a total of **3.616 AF**.

Ordinance No. 165. In August 2015, the Board adopted Ordinance No. 165 (adding Rule 23.8) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within the Carmel River watershed and the City of Carmel-by-the-Sea. This rule enables the issuance of Malpaso Water Use Permits for new and expanded water uses on Carmel River watershed and the City of Carmel-by-the-Sea Sites, in a cumulative amount of no more than 80 AFA. As of June 30, 2016, thirty Water Use Permits and Water Permits had been issued for a total of **0.320 AFA**.

- **Interagency Coordination** -- District staff continues extensive coordination with community development personnel from the local Jurisdictions to facilitate communication regarding the Water Permit process. Presentations on the local water-supply situation are given regularly, and meetings are held to discuss permit procedures and to answer questions about Allocation management. Through these meetings, rapport has been developed with the local agencies, making the management of water supplies more productive and accurate.

**Table XI-1
Summary of Water Permits Issued**

CALIFORNIA AMERICAN WATER Main System (July 2015-June 2016)			
Type of Water Permit	No. of Permits	Capacity (Acre-Feet)	Average Use Per Permit (Acre-Feet)
New Residential	17	0.000	0.000
• <i>Pebble Beach Entitlements*</i>	13	3.727	0.287
• <i>Sand City Entitlement*</i>	0	0.000	0.000
• <i>Malpasos Water Entitlement*</i>	0	0.000	0.000
Residential Remodels/Additions	566	0.515	0.001
• <i>Pebble Beach Entitlements*</i>	26	1.928	0.074
• <i>Sand City Entitlement*</i>	0	0.000	0.000
• <i>Malpasos Water Entitlement*</i>	8	0.320	0.040
New Non-Residential	0	0.000	0.000
• <i>Pebble Beach Entitlements*</i>	0	0.000	0.000
• <i>Sand City Entitlement*</i>	0	0.000	0.000
• <i>Malpasos Water Entitlement*</i>	0	0.000	0.000
Non-Residential Remodels/Additions	98	0.300	0.004
• <i>Pebble Beach Entitlements*</i>	1	7.129	7.129
• <i>Sand City Entitlement*</i>	1	0.044	0.044
• <i>Malpasos Water Entitlement*</i>	0	0.000	0.000

**Pebble Beach and Sand City Entitlements are tracked separately from Main California American Water System permits.*

XII. MONITOR PRODUCTION AND COMPLIANCE WITH SWRCB ORDER WR 2009-0060 AND WR 2016-0016

Implementation and Activities During 2015-2016

Regarding compliance with State Water Resources Control Board (SWRCB) Order WR 2016-0016 (i.e, the “Cease and Desist Order” or CDO), California American Water (Cal-Am) target production from the Carmel River Basin in Water Year (WY) 2016 for the SWRCB tally was based on the initial regulatory limit of 9,703 acre-feet (AF). This number was then reduced by Sand City Desalination Project production of 160 AF, resulting in an adjusted base amount of 9,543 AF. Actual Cal-Am Carmel River Basin diversions (after adjustments) for WY 2016 were 6,869 AF. Thus, Cal-Am reported diversions were 2,674 AF below the adjusted diversion limit from the Carmel River Basin imposed by the SWRCB. WY 2016 was the 19th straight year in which compliance with Order WR 95-10 was achieved and the 7th year for compliance with Order WR 2009-0060. A major purpose of the District’s *Expanded Conservation Plan and Standby Rationing Program* is to ensure continued compliance with the SWRCB Orders. The community was in Stage 1 of the conservation program throughout the 2015-2016 reporting period.

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XIII. MONITOR PRODUCTION AND COMPLIANCE WITH MPWMD ALLOCATION LIMITS

Description and Purpose

The adoption of Ordinance No. 70 in June 1993 revised the Monterey Peninsula Water Resource System (MPWRS) supply limit from an annual production limit of 19,881 acre-feet per year (AFY) to 20,673 AFY. The California American Water (Cal-Am) annual production limit of 16,744 AFY (Option V from Finding No. 403 of the Final Water Allocation Program EIR; Ordinance No. 53) was revised to 17,619 AFY, and the non-Cal-Am production limit of 3,137 AFY was revised to 3,054 AFY. This new water supply limit reflected the 385 AFY of new water production allocation from the Paralta Well project and minor adjustments to reflect the integration of the Water West system into the Cal-Am system, the annexation of Quail Meadows Subdivision into Cal-Am, and the refinement of the non-Cal-Am production estimate.

Ordinance No. 83, adopted in April 1996, set Cal-Am's annual production limit at 17,621 AFY and the non-Cal-Am annual production limit at 3,046 AFY, based on permanent reductions in water use by non-Cal-Am water users in exchange for water service from Cal-Am. As part of the agreement, 15% of the historical non-Cal-Am production was set aside to meet the Monterey Peninsula Water Management District (District) long-term water conservation goal. Based on these changes, a new limit for the MPWRS as a whole was set at 20,667 AFY.

The Cal-Am production limit was again amended in February 1997, when Ordinance No. 87 was adopted as an urgency ordinance to provide a special community benefit reserve allocation of 19.6 AFY of production to the Community Hospital of the Monterey Peninsula. Ordinance No. 87 increased the total annual Cal-Am production limit to 17,641 AFY, but did not change the non-Cal-Am limit. Thus, the new limit for the MPWRS as a whole is 20,687 AFY.

In addition to District-imposed production limits as part of its Water Allocation Program, Cal-Am must also comply with limits set by the State Water Resources Control Board (SWRCB) in 1995 as part of Order WR 95-10. The Order includes a provision that Cal-Am water diversions (surface and groundwater production) from the Carmel River basin should not exceed 11,990 AF in Water Year (WY) 1996, and not exceed 11,285 AF in WY 1997 and subsequent years. In 2009, the SWRCB issued Order 2009-0060 (i.e., the "Cease and Desist Order" or CDO), which further modified the Cal-Am production limits and imposed a production ramp-down schedule by water year (see **Section XII**). The water year begins on October 1 and ends on September 30 of the following year. The District program to monitor water use includes tracking Cal-Am compliance with the SWRCB goals.

Implementation and Activities During 2015-2016

District staff continued to manage the overall supply budget, sending periodic reports to the cities and/or county and providing updates and general information as needed. The monitoring programs initiated by Ordinance Nos. 52 and 53 continue to be implemented. Beginning with the 2001-2002 Annual Report, the District changed the reporting period for the Well Registration and Reporting Program from a Reporting Year (July 1-June 30) to a Water Year (October 1-

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September 30) to be consistent with the SWRCB Order reporting requirements, and other hydrological reporting programs. The 2000-2001 Annual Mitigation Report was the last report in which groundwater production within the District was presented in a Reporting Year format. Water production tables for the current year in this report use WY 2016 data (October 1, 2015 through September 30, 2016). Compliance with production limits imposed by MPWMD as part of the Water Allocation Program are shown in **Table XIII-1**.

Table XIII-1
MPWMD ALLOCATION LIMIT COMPARED TO WATER PRODUCTION¹ IN THE
MONTEREY PENINSULA WATER RESOURCE SYSTEM
 Data from Water Years 2015 and 2016

WATER USER	ALLOCATION LIMIT	WY 2015 PRODUCTION	% LIMIT	WY 2016 PRODUCTION	% LIMIT
Cal-Am	17,641 AF	10,024 AF	57%	9,581 AF	54%
Non-Cal-Am	3,046 AF	3,163 AF	104%	3,160 AF	104%
TOTAL	20,687 AF	13,187 AF	64%	12,741 AF	62%

Notes:

1. MPWRS includes production from the Carmel River and underlying Carmel Valley alluvial aquifer, Coastal Subareas and Laguna Seca Subarea of the Seaside Groundwater Basin. Does not include Sand City desal plant production.
2. The Water Year (WY) runs from October 1 to September 30.
3. The non Cal-Am Production figures include non Cal-Am surface-water diversions.

Source: MPWMD production reports

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¹ Production values (table above) are based on amounts of water diverted and pumped and are, therefore, higher than the metered sales figures for water delivered to customers.

XIV. DETERMINE DROUGHT RESERVE

Description and Purpose

In conceptual terms, drought reserve can be defined as the balance between water supply and water demand that is necessary to insure a specified level of drought protection. The question that remains is how much protection is "adequate". There is no universally accepted standard for quantifying "adequate" levels of drought protection for municipal water supply systems. Moreover, drought protection can be measured in a number of ways including safe or firm yield, annual shortfalls, frequency or severity of water rationing, carryover storage, or some indicator of environmental stress.

For the Monterey Peninsula Water Management District (MPWMD), the level of desired drought protection has been specified by the Board of Directors in terms of water rationing. Adequate drought protection exists as long as the frequency of mandatory water rationing is less than predetermined standards. The determination of whether or not mandatory water rationing would be imposed during a reoccurrence of particular drought periods is based on simulated system operations for the 1958-2002 period of record.

In more specific terms, drought reserve can be expressed as the total usable storage in the Monterey Peninsula Water Resources System that is required on May 1 to limit mandatory water rationing to the predetermined frequency. The total storage that is required includes carryover storage for use during the following water year and the storage necessary to satisfy the demand that is expected to occur during the remainder of the current water year. In August 1993, the Board adopted a drought protection goal that allows no more than 20 percent mandatory water rationing two percent of the time, or two out of 100 years, on average.

Implementation and Activities During 2015-2016

In 2016, District staff determined that approximately **23,091 acre-feet (AF)** of usable storage were required on May 1, 2016 to avoid requesting a District-wide voluntary 15 percent reduction in water demand. Similarly, approximately **18,221 AF** were required to avoid imposing mandatory 20 percent water rationing. Given that actual, usable storage on May 1 was estimated at **29,170 AF**, no demand reductions beyond existing Stage 1 restrictions were necessary for 2016 based on physical water availability. The 2016 trigger values are based on the maximum California American Water (CAW) production limit set by the State Water Resources Control Board in Order No. WR 2009-0060 (9,703 AF) for CAW's diversions from the Carmel River, the maximum production limit for CAW's diversions from the Coastal Subareas of the Seaside Groundwater Basin set by the Court as a result of the Seaside Groundwater Basin adjudication (2,251 AF), and the non CAW water production limit that was specified in the District's Water Allocation Program (3,046 AF).

XV. AUGMENT WATER SUPPLY

The Findings for Adoption of the Water Allocation Program EIR identified a set of general mitigation measures that relate to increasing the water supply. Finding No. 403-A states that the Monterey Peninsula Water Management District (MPWMD or District) shall pursue construction of a major, long-term water supply project to provide water for restoration of the environment and for public water supply. Finding No. 403-B states that the District should pursue a series of smaller "near-term" water supply projects to provide additional water for drought protection and some new growth until the long-term project is completed.

In 1996, District efforts related to both long-term and near-term projects were consolidated into the MPWMD Water Augmentation Plan (WAP). Specific goals and objectives were adopted in January 1997, and revised in January 1998, April 2000, and March 2001. Since 2001, the MPWMD Board has held Strategic Planning Workshops to set strategic planning initiatives, set goals and objectives to guide District activities, receive progress reports and provide policy guidance. Augmenting the water supply remains a major focus. Activities for the July 2014 through June 2015 reporting period were primarily guided by goals and objectives in the Strategic Plan adopted by the Board on April 15, 2013, as amended on April 20, 2015.

To maintain consistency with the Water Allocation Program EIR, the following sections describe MPWMD efforts for long-term and near-term projects separately. In practice, District water augmentation efforts are integrated. For aquifer storage and recovery (ASR), the long-term MPWMD ASR Phase 1 and Phase 2 Projects and associated water rights will be described under **Section XV-A**; the annual ASR operation activities will be discussed under **Section XV-B**.

A. Long-Term Water Supply Project

Description and Purpose

The mission of the District is to provide a long-term sustainable water supply to meet community needs while protecting the environmental quality of the Monterey Peninsula Water Resource System (Sand City desalination, Carmel River and Seaside Basins) for the benefit of the community and the environment. The following paragraphs provide background information followed by a review of actions in the July 2015 through June 2016 period. Additional information is provided by the General Manager at most monthly regular board meetings, available on the District website at: www.mpwmd.net.

Background: In the early 1990s, the electorate did not approve public funding for two major water supply projects – a small 3,000 acre-foot per year desalination project in 1993 and the proposed 24,000 acre-foot (AF) New Los Padres Dam and Reservoir (NLP) Project in 1995. Since then, the District has focused its efforts on non-dam alternatives, including a proposal for a large desal project. The District participated extensively in the 1999-2002 California Public Utilities Commission (CPUC) “Plan B” process to identify a non-dam alternative to the NLP, and continues to work with California American Water Company (CAW or Cal-Am) and other local agencies on water supply solutions.

The State Water Resources Control Board (SWRCB) decisions on Carmel River issues in July 1995 and subsequent orders continue to influence water augmentation efforts to the present. The SWRCB Order WR 95-10 identified an estimated 10,730 acre-feet per year (AFY) of historical unauthorized Cal-Am diversions from the Carmel River that must be replaced by another water project or projects. With few exceptions, SWRCB orders have a “one-for-one replacement” requirement, whereby any new water supply that is developed for Cal-Am use must offset the 10,730 AFY of unauthorized diversions from the Carmel River before new water supply can be used for new construction or remodels that intensify water use in the Cal-Am system. Thus, water for existing legal lots of record and other future needs will be available only when Order 95-10 and its subsequent requirements have been fully satisfied.

Because of a lack of progress toward completion of a replacement water supply and despite strong objections from the Monterey Peninsula, the SWRCB issued a Final Cease and Desist Order on October 20, 2009 (CDO 2009-0060). This Order set mandatory reductions in Carmel River diversions that were to culminate in reducing Cal-Am Carmel River diversions to an authorized amount of 3,376 AFY by December 31, 2016.

Cal-Am, in conjunction with the District, Monterey Peninsula Regional Water Authority, the City of Pacific Grove and the Pebble Beach Company, submitted an application to amend the Cal-Am CDO on November 20, 2015. On April 28, 2016, Cal-Am submitted a revised application to amend the CDO, in light of significant delays in the CPUC’s schedule for consideration of a proposed desalination facility, the Monterey Peninsula Water Supply Project (MPWSP) Desalination Project. These delays resulted from the CPUC’s desire to prepare a joint environmental impact statement and environmental impact report in conjunction with a federal partner, the Monterey Bay National Marine Sanctuary. In addition, the CPUC needed to evaluate a potential conflict of interest issue involving one of the contractors evaluating the project under the California Environmental Quality Act. There have also been repeated interruptions in operations of the test wells used to evaluate the impacts and viability of the proposed facility’s slant well technology.

On July 19, 2016, the SWRCB adopted Order 2016-0016 extending the CDO period to December 31, 2021. The effective diversion limit (EDL) for the Carmel River was lowered to no more than 8,310 AFY and additional mitigation measures to offset impacts to public trust resources were ordered by the SWRCB¹.

Seaside Basin Setting: Management of the Seaside Basin also has important ramifications for long-term community water supply. SWRCB Order 95-10 directs Cal-Am to maximize pumping in the Seaside Basin to the extent practicable in order to reduce diversions from the Carmel River. Thus, since 1995, the Seaside Basin has become an increasingly important source of water supply. Unfortunately, it has also exhibited signs of stress from over-pumping due to Order 95-10 as well as significant increases in non-Cal-Am use.

Superior Court Judge Robert Randall rendered a Final Decision on adjudication of basin water

¹ Additional detailed background information can be found in previous years Mitigation Program Annual reports and in SWRCB Orders 95-10 and 2009-0060.

rights on March 27, 2006 (as amended). The Decision determined that the Seaside Basin is in overdraft; quantified water rights for parties with overlying water rights (“Alternative Producers”); and set a reduced “natural safe yield” and a near-term “operating yield” allowed to be produced by certain parties with appropriate rights (“Standard Producers”) as they work toward a “physical solution” to eliminate the overdraft. The Decisions set a timetable that included triennial reductions in basin production. Thus, by 2021, Cal-Am’s legal share of water rights in the basin will be reduced to 1,474 AFY – down from production of nearly 4,000 AFY prior to adjudication. A nine-member Watermaster Board was created to implement the Decision with continued oversight by the Court. The MPWMD holds one seat on the Watermaster Board with two out of 13 votes; a MPWMD Board member serves as the MPWMD representative. The Watermaster has generally held monthly meetings since its formal commencement on April 5, 2006. The Watermaster website is at: <http://www.seasidebasinwatermaster.org/>.

District staff sits on the Watermaster Technical Advisory Committee and contributes data and analysis for several technical reports required by the Court. MPWMD staff and consultants, along with other partners, have been retained by the Watermaster to provide contract technical services, including project management, data collection, and preparation of documents required by the Court as part of the Seaside Basin Monitoring and Management Program.

Water Supply Needs: Community water-augmentation efforts have focused on compliance with SWRCB Orders and the Seaside Basin Adjudication. In addition, the proposed Monterey Peninsula Water Supply Project (MPWSP) includes water supply for existing lots of record. As presently envisioned, 9,752 AF of new supply will be added as a result of the MPWSP. Because of continuing water conservation outreach and incentives, the SWRCB CDO, and the enactment of a steeply-tiered rate structure, water use on the Monterey Peninsula has trended down and is currently hovering at levels not seen since 1960.

Participation in Regional Water Supply Project Planning and Selection: The District has adopted a leadership position in the community with respect to regional water supply planning related to the community’s compliance with SWRCB Orders and the Seaside Groundwater Basin adjudication. This reflects previous Board goals to have meaningful influence over the type, management and financing of the selected regional project, with emphasis on accountability to the community. Since 2004, Cal-Am has proposed a variety of regional water projects, and District participation in the CPUC approval process for a large Cal-Am project has accounted for significant staff and legal effort. Since 2011, District staff have met regularly with representatives throughout the Monterey Peninsula and Monterey County to formulate a regional approach to water supply.

In FY2015-16, this resulted in advancing the Monterey Peninsula Water Supply Project that includes two significant water supply components that, together, would provide all the water necessary to satisfy state mandates and provide water supply for lots of the record. The MPWSP website sponsored by Cal-Am is: www.watersupplyproject.org. The Groundwater Replenish Project – also known as Pure Water Monterey – sponsored jointly by MPWMD and by the Monterey Regional Water Pollution Control Agency (MRWPCA) is: [www.http://purewatermonterey.org/](http://purewatermonterey.org/)

In addition to the Cal-Am MPWSP project, two other regional desalination projects have been proposed:

1. “Deep Water Desal” -- A desalination project to be located in Moss Landing proposed by private investors that features a deep water intake to avoid harm to shallow marine organisms, and location near the power plant to serve a large computer “server farm” in association with the City of Salinas (www.deepwaterdesal.com); and
2. “The People’s Moss Landing Water Desalination Project (“PMLWDP”) is a proposed desalination plant in Moss Landing that will produce 13,404 acre feet per year of potable water. This desalination project would also be located in Moss Landing and is proposed by private investors that would partner with a public agency to deliver water to the Salinas Valley and Monterey Peninsula (<http://www.thepeopleswater.com/>).

Monterey Peninsula Regional Water Authority (MPRWA or Water Authority): In early 2012, the mayors of six Peninsula cities -- Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City and Seaside -- created a Joint Powers Authority (JPA) called the Monterey Peninsula Regional Water Authority. According to its website, the Water Authority’s goal is to find a solution to the pending Peninsula water shortage due to the SWRCB’s Cease and Desist Order and the Seaside Basin Adjudication. The Water Authority is concerned that the community has been unable to reach a consensus on a water supply solution, and if a project is not in place by the CDO deadlines, the community will face severe rationing and an economic crisis. The Water Authority believes in a portfolio approach to achieve an adequate and cost-effective water supply for the Peninsula while addressing public concerns about the transparency of the project development process, and about the projected increased cost of water. The Water Authority website is: www.mprwa.org.

In February 2012, the Water Authority invited the MPWMD General Manager to serve on its Technical Advisory Committee (TAC).

Monterey Peninsula Water Supply Project Governance Committee (Governance Committee): In order to enhance coordination between the public and private sector, provide oversight on behalf of the public, and help reduce the cost of future regional water supply projects, the Governance Committee was formed under an Agreement dated November 5, 2013 (revised April 30, 2014). The Governance Committee is comprised of the Water Authority, MPWMD, County of Monterey and Cal-Am.

Through mid-2016, the Governance Committee continued to monitor progress on the desalination component, Pure Water Monterey and construction of the Monterey pipeline. MPWMD facilitates meetings of the Governance Committee. Additional information including agenda packages and meeting minutes are at: <http://www.mprwa.org/>

MPWMD Water Supply Project Priorities: On April 20, 2015, the District Board adopted its Strategic Plan, which included One-Year and Three-Year goals and objectives related to water supply projects, as follows²:

² The staff note and proposed Strategic Plan are at Item 24 in the following link:

Desalination: Further develop the “Ratepayer Relief Bonds” proposal for a public contribution for the Cal-Am regional desalination project. (Note: Though not enumerated as a specific goal, the Board also supported evaluation of an alternative non-Cal-Am desalination project as a “back-up” measure, given the delays and uncertainties associated with the Cal-Am desalination project).

Groundwater Replenishment (GWR): Enter into a cost-sharing agreement for GWR and advance CEQA and feasibility work. This project is also known as “Pure Water Monterey” with the MRWPCA as the lead.

Aquifer Storage and Recovery: Complete Water Project 1 (ASR Phase 1), including an enhanced back-flush pond; redefine easement and enter into agreements with City of Seaside and Fort Ord Reuse Authority (FORA); complete construction.

Local Projects: Work with jurisdictions to advance planning and development of local supplies. Possible examples include: Pacific Grove golf course irrigation with recycled water, well development for Del Monte Golf Course irrigation, and other projects. The District has provided seed-level matching funding to advance local planning.

Odello Property: Regulate and provide oversight to owners’ proposal to de-link their water rights and transfer those rights to Cal-Am for community use, and transfer the agricultural property into open space public land. This is also referred to as the “Malpaso Water Company water entitlement.”

The Three-Year Strategic Goals included:

Develop Comprehensive Strategy for SWRCB Permit 20808-B: The District has successfully reassigned portions of the original New Los Padres Reservoir water rights Permit #20808 to Phases 1 and 2 of ASR (20808-A and 20808-C.) However, permit conditions for each are not consistent. The remainder Permit 20808-B could be revoked by the SWRCB if water is not put to an authorized use by the year 2020, unless an extension is approved. A strategy for the remainder will include:

- Identify two to three potential new injection and recovery sites, both in the Seaside Basin and the Carmel Valley;
- Evaluate possible source well rehabilitation and/or expansion in Carmel Valley, which could entail potential treatment capacity expansion.
- Develop strategy for direct diversion component of water right.
- Amend existing permits and conform all permits to same standards; Attempt to create greater operating flexibility such that any injection well can inject any water and wells can be used for both recovery and production.
- Consider completing a water availability analysis and an IFIM study to develop new permit conditions.

Prepare for Allocation of “New Water”: The District will need to develop fair and equitable mechanisms to allocate water from new water projects to the jurisdictions. Policies need to be considered for:

- Allocation of nearly 1,200 AF for legal lots of record;
- Local projects that may free-up potable supplies within jurisdictions;
- Additional water supplies that could be created by future ASR, Table 13 water rights, Odello East (Malpas) water rights, and changes in water right permit conditions;
- Use of any “excess” supplies in the early years of the MPWSP, before allocation to full build-out of Pebble Beach or legal lots of record;
- Update and evaluation of the jurisdictions’ general plan needs.

Establish a Long-Term Strategy for Los Padres Dam: In 2011, the District proposed increasing water supply capacity at Los Padres Dam through either a rubber dam on the existing spillway, or dredging. Cal-Am has expressed little or no interest in these projects in the past, due in part to the high cost and logistical challenges associated with replacing or enhancing fish transport through the dam, dredging the reservoir, and because the National Marine Fisheries Service (NMFS) has indicated that permanent removal of Los Padres Dam is a priority for restoration of the Central Coast Steelhead. However, many fisheries experts believe that a regulated river with the dam intact would be a better long-term solution for the steelhead as well as property owners along the river. The District will address:

- Dam ownership;
- Dam removal and steelhead recovery;
- Property owners and rights;
- Additional water supply;
- Fish passage;
- Extending District river work permit jurisdiction upriver to extend regulatory authority.

The One-Year Goals focused on continued progress on the projects identified above for the 2013 Strategic Plan, with the following refinements:

- Add a goal to pursue Proposition 1 and federal funding opportunities.
- For Local Projects, add Monterey Regional Airport, Monterey County Fairgrounds, and Pebble Beach Company Del Monte Golf Course as possible projects.
- Develop ordinance and allocation frameworks for locally developed water supplies. This includes regulation and oversight for water right transfers in the Carmel River Basin (e.g., Odello) and Seaside Groundwater Basin (e.g., Cypress, DBO) as well as reallocation of potable water saved by conversion to non-potable irrigation sources (Pacific Grove).

The Three-Year Goal to create long-term strategy for Los Padres Dam (described above) was

changed to be a One-Year Goal to establish a short-term action plan as well as a long-term strategy for the dam.

The Three-Year Goal to develop a comprehensive strategy for SWRCB Permit 20808-B (described above) remained the same. Similarly, the Three-Year Goal to prepare for allocation of “new water” was also continued, with the addition of the need to “clean up District rules regarding Water Credit transfers, sales and categories.”

In 2014, the State Legislature signed sweeping legislation (Sustainable Groundwater Management Act [SGMA]), which could potentially have a substantive effect on water supply planning and development of water projects. The District Board set goals to:

- Adopt a resolution designating the District as the Groundwater Sustainability Agency within its jurisdiction.
- Work with SWRCB and the Department of Water Resources to resolve issues regarding the categorization of the Carmel Valley Alluvial Aquifer.
- Work with the Watermaster to ensure reporting requirements for the adjudicated Seaside Groundwater Basin are met.
- Coordinate with Monterey County and/or MCWRA to address interaction between the Salinas Valley and Seaside Groundwater Basins.

The 2015 Adopted Strategic Goals document is also available on the District website at:

<http://www.mpwmd.net/who-we-are/mission-vision-goals/bod-goals/>

Implementation and Activities During 2015-2016

The following paragraphs describe action on the water augmentation goals identified above in the July 1, 2015 through June 30, 2016 period, unless only data for a Water Year (October 2015 through September 2016) are available. A brief summary of accomplishments is provided. Please refer to the 2014-2015 Annual Report for more detailed background information.

Monterey Peninsula Water Supply Project – The District worked jointly with Cal-Am, the Water Authority, and other parties to further the MPWSP. The District continued to actively participate in CPUC hearings and settlement agreements regarding Cal-Am’s Application A.12-04-019 for the MPWSP.

Groundwater Replenishment/Pure Water Monterey Project – The District provided the majority of funding and provided services for work on this innovative water recycling plant, working in partnership with the Monterey Regional Water Pollution Control Agency (MRWPCA) which will own and operate the system.

This past year, the project partners successfully obtained water rights for the project, secured State Revolving Fund loan monies from the State Water Resources Control Board (SWRCB) to build the project, and certified an Addendum to the Environmental Impact Report to add the Monterey Pipeline and Hilby Pump Station. Construction on

the Monterey Pipeline began in late 2016 with the District acting as Project Manager for environmental compliance assurance. When completed, the pipeline will allow Pure Water Monterey water to be supplied to Pebble Beach, Carmel and Carmel Valley and also allow excess Carmel River water to be delivered to the ASR wells in the winter.

Aquifer Storage and Recovery (ASR) - The District continued to refine facilities at the Santa Margarita site, and continued to work with FORA and the City of Seaside on securing property needed to install permanent pipelines connecting the Phase 1 and 2 sites and an expanded back-flush pit. The District completed all facilities at the Phase 2 Seaside Middle School site.

Local Water Projects– For a third year, the District approved grants to local public entities to help them pursue small water projects, including: (1) the City of Monterey for evaluating capture and reuse of urban stormwater, (2) The Pebble Beach Company for a non-potable supply well for irrigation of its Del Monte Golf Course, and (3) the City of Seaside for drilling a new well. Previously funded local projects are making progress: Pacific Grove released its Final Supplemental EIR in September 2015 and certified the Final EIR in October 2015. Subsequently, Pacific Grove was successful in securing Prop. 1 grant funding for the project. The Airport District produced a May 2015 draft report indicating that three existing wells have a combined reliable extraction rate of 66.2 gallons per minute. Additional work on identifying potential markets investment needed to maintain production reliability is needed. The Fairgrounds project did not move forward in FY 2016-16. Notably, the Fairgrounds completed the retrofit of all of its toilet facilities, which has altered the financial feasibility of re-plumbing the toilet facilities with well water, hence that project was dropped. The City of Monterey is partnering with MRWPCA to develop a stormwater resource plan for the Monterey Peninsula and Carmel Valley with additional grant funds from Prop. 1. The City of Seaside has not yet moved forward with a new well.

Odello Property/Water Rights Transfer – As part of issuance of a Water Distribution System Permit to the Malpaso Water Company (Odello East), the District reviewed a Carmel River water rights change permit issued by SWRCB that enables a limited amount of new connections to the Cal-Am system within the Carmel River watershed or City of Carmel-by-the-Sea. The District also passed Ordinance No. 165 to establish a Water Entitlement to Malpaso. This became the model for similar ordinances for other water right transfers. Several home remodels have been accomplished with water from the Malpaso entitlement.

Water Rights/SWRCB Permit 20808-B – The District continued work on an integrated ground water – surface water GSFLOW/MODFLOW model to update instream flow needs for steelhead in the Carmel River, with a focus on model calibration, data review and input. The model is expected to be operable in mid-2017, and allow the District to model different water supply scenarios and their impacts on the Carmel River. The model will be an important tool to assess water availability under a wide range of scenarios for water use under Permit 20808-B.

Proposition 1 Integrated Regional Water Management Program – The District took the lead for the Monterey Peninsula region in negotiating a final agreement for sharing Proposition 1 funds in the Central Coast funding area. The Monterey Peninsula region would receive \$4.2 million for implementation of projects. In related action, the District received grant funding from the federal Bureau of Reclamation to facilitate integrated management in light of future climate change.

Los Padres Dam Improvements – The District entered into an agreement with HDR to study alternatives for constructing upstream volitional passage at the dam and held an initial workshop meeting with technical staff from Cal-Am, MPWMD and regulatory agencies. The District also completed a draft scope of work to assess dam alternatives and sediment management. Future areas of study will include: sediment management, mitigating for downstream habitat impacts, and an evaluation of alternatives ranging from complete dam removal to increasing storage at the reservoir.

Sustainable Groundwater Management Act (SGMA) – The District continued to work with the Department of Water Resources in defining requirements under the SGMA for the Carmel Valley Alluvial Aquifer. MPWMD also coordinated with stakeholders in the Seaside Groundwater Basin regarding DWR recognition of the adjudicated Seaside Basin boundary for the latest version of DWR Bulletin 118, as well as general management issues in the vicinity of the Seaside and Salinas Basin boundaries.

B. Near-Term Water Supply Projects

Description and Purpose

Section XV-A above describes long-term water supply alternatives, including the MPWMD ASR Phase 1 and Phase 2 Projects. This section focuses on annual ASR operations. Since 1996, the District has evaluated the feasibility of ASR at greater levels of detail. As of June 2015, the District had constructed five ASR wells in the Seaside Basin: (1) a shallower ASR pilot test well into the Paso Robles Formation (located at Mission Memorial Park in Seaside) in 1998; (2) a 720-foot deep, full-scale test well into the Santa Margarita Formation in 2002 (now ASR-1); (3) another full-scale ASR well at the Santa Margarita site (ASR-2) in 2007; a full-scale ASR well at the Seaside Middle School site (ASR-3) in 2012; and a second full-scale well at the Middle School site (ASR-4) in 2014. To comply with the SWRCB water rights permit conditions, MPWMD submits detailed annual reports to the SWRCB after each operational season, which also confirm that diversions for the ASR projects have complied with regulatory requirements. A similar report is provided to the Central Coast Regional Water Quality Control Board as part of its ongoing oversight of the ASR program in the Seaside Basin.

Implementation and Activities During 2015-2016

The District operated the ASR facilities in coordination with Cal-Am while diverting 699 acre-feet (AF) of Carmel River Basin water for injection and storage in the Seaside Basin during the 2016 water year (WY). Since inception of the ASR program, a total of 5,685 AF has been

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diverted from the Carmel River for storage and subsequent recovery through the end of WY 2016. In Water Year 2016, 609 AF of ASR-stored water was extracted (recovered), for delivery to Cal-Am system customers.

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XVI. STEELHEAD FISHERY MITIGATION MEASURES

The Findings for Certification of the Water Allocation Program Final EIR (Findings Nos. 388-A through D) identified mitigation measures to reduce impacts to the Carmel River steelhead population, including: (a) expansion of the program to capture and transport smolts during spring, (b) prevent stranding of early fall and winter migrants, (c) rescue juveniles downstream of Robles del Rio during summer, and (d) implement an experimental smolt transport program at Los Padres Dam (LPD). Monitoring of adult returns and juvenile populations provides an indication of the overall success of the steelhead mitigation measures. The following sections briefly describe the purpose of each mitigation measure and activities during the current reporting period.

A. Capture and Transport Emigrating Smolts during Spring

Description and Purpose

The goal of this program is to reduce disruption of the steelhead life cycle due to streamflow diversions. During spring months, when steelhead smolts are actively emigrating from freshwater to the ocean, the diversion of surface and groundwater from the river and alluvial aquifer sometimes interferes, and in some cases, blocks migration into the ocean. This threatens individual fish, reduces the number of smolts that successfully reach the ocean, and indirectly affects the number of adults that eventually return to freshwater. When streamflow is too low for natural emigration, or when smolts are at risk of being stranded, the Monterey Peninsula Water Management District (MPWMD or District) monitors streamflow, captures emigrating smolts, and transports them to the lagoon or ocean.

Implementation and Activities During 2015-2016

The Carmel River continued to have low-flow conditions for the July 2015 through December 2015 period, but improved river conditions January through June 2016. During the primary three-month smolt migration period, March-May 2016, flows in the lower river at the Highway 1 Gage were generally good for smolt migration with flows ranging from 1,080 to 13 cubic feet per second (cfs) (**Figure XVI-1**). Due to the improved spring flows, no smolt trapping was needed in 2016 (**Figure XVI-2**).

B. Prevent Stranding of Fall/Winter Juvenile Migrants

Description and Purpose

As in other central California streams, juvenile steelhead in the Carmel River move downstream into lower reaches of the river well ahead of the peak emigration of smolts. Depending on river conditions and diversions during the previous dry season, there is some risk that pre-smolts and other juvenile steelhead will be stranded following early fall and winter storms, which increase flows and stimulate the fish to move downstream into habitats that are subsequently dewatered after the storm peak passes. This risk occurs primarily from October through February, although during severe droughts, the risk period may extend into March. The District mitigates this problem by capturing and transporting juveniles when necessary during the high-risk period. Currently, juveniles trapped during fall/winter months are transported upstream to viable habitats above the

Narrows or held at the District's Sleepy Hollow Steelhead Rearing Facility (SHSRF).

Implementation and Activities During 2015-2016

District staff monitored river conditions during the fall and winter months of 2015-2016. Flow at the District's Highway 1 Gage dropped to zero cfs in June 2015 and the lower river remained dry through early January 2016 (**Figure XVI-1**). Due to the dry conditions, there was a moderate risk of fish stranding and conditions were carefully monitored throughout the fall and winter but no additional rescues were needed.

C. Rescue Juveniles Downstream of Robles Del Rio during Summer

Description and Purpose

About 1.5 miles of habitat between Boronda Road and Robles del Rio Road, and up to nine miles of habitat below the Narrows, are seasonally subject to dewatering depending on the magnitude of streamflow releases at LPD, seasonal air temperatures, and water demand. Beginning as early as April or May of each dry season, the District rescues juvenile steelhead from the habitat in these reaches. The goal of this program is to help maintain a viable steelhead population by transplanting juveniles to permanent river habitats downstream of San Clemente Dam (SCD) (if it is available), and/or rearing juvenile steelhead at the SHSRF, located just downstream of SCD, if existing habitat is not available or is already fully saturated with juvenile steelhead.

Implementation and Activities During 2015 Rescue and Rearing Season

- **MPWMD Annual Mainstem Rescue Totals** – The surface flow of the Carmel River dropped to below 10 cfs at the Highway 1 Bridge May 22, 2015 and District staff began full-scale rescues. Rescues were conducted over a four-month period (May 22 - September 28, 2015) between the Highway 1 Bridge (River Mile [RM] 1.0) and Robinson Canyon Bridge (RM 8.5) plus an additional 2.5 mile reach from Cal-Am's West Garzas Well area to Rosies Bridge on Esquiline Road (RM 12 – 14.5). During this period staff conducted 67 rescue operations over 10 miles, yielding a total of 2,521 steelhead including: 2,231 young-of-the-year (YOY), 244 yearlings (1+), 30 resident adults (> 12" length), 1 kelt and 15 mortalities (0.59%) (**Table XVI-1a**). This total translates to 252 fish-per-mile (fpm) or 0.05 fish-per-lineal-foot (fpf). Since 1989, District staff has rescued 426,154 steelhead from drying reaches in the mainstem Carmel River. Compared to previous rescue seasons, rescue totals in the 2015 dry season was only 16% the 1989-2015 average of 15,783 (**Figure XVI-3**).
- **2015 MPWMD Tributary Rescues Totals** – In response to calls from the Santa Lucia Preserve that Potrero Creek was drying up, two rescue operations, over a two-mile reach, were conducted on June 26 and July 17. A total of 128 steelhead were captured including: 62 young-of-the-year (YOY), 19 yearlings (1+), 42 resident adults (5-9 inches length) and 5 mortalities (3.9%).
- **2015 Dry Season, MPWMD Transplant Location** – During the 2015 dry season 2,629 rescued steelhead were transported and released at two upstream locations with more reliable

flow: 1) the Cachagua Community Center area (2,595) and 2) the Cal-Am Scarlett Well area (34) (**Table XVI-1b**).

- **Sleepy Hollow Steelhead Rearing Facility (SHSRF)** - The District's Water Allocation Mitigation Program includes construction and operation of a facility for rearing juvenile steelhead through the dry season. In early 1997, the District completed construction of the SHSRF, which included: (1) a diversion and pump station, (2) two large circular tanks, (3) an 800-foot long rearing channel, (4) electrical, water, pressurized air and drainage systems, (5) an office/shop/lab building and (6) miscellaneous equipment.

As conditions changed, significant additional Facility upgrades and modifications were made between 2000 and 2003 including a cooling tower, large emergency generator, upgraded impellers on the existing pumps, purchases of an additional backup pump and a mobile emergency pump, and installation of a centrifugal separator to reduce the buildup of coarse sediment in the cooling tower and rearing channel. In 2005 and 2006, new wooden weir boards were installed and waterproofed in the rearing channel to prevent fish movement between bays and to serve as an additional water retention backup mechanism. In 2007, eight, 250-gallon, insulated rearing troughs replaced a defunct 22-foot diameter tank. These tanks are used to rear small rescued fish, for additional quarantine treatments, or for growth and survival experiments. In 2008, Tank 3, the remaining 22-foot diameter holding tank, was outfitted with a large re-circulating pump, filtration, and UV sterilization system to hold fish when the river's water quality is inadequate for fish survival or if the Facility's river pumps should fail.

Facility Modifications in Reporting Year 2016 – The District is in the process of completing a major intake system upgrade that will improve the reliability and ease of maintenance of the intake pumps during both high and low flow conditions. This project is funded by funds from the California American Water (Cal-Am) Settlement agreement with the National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (CDFW), administered through the State Coastal Conservancy (SCC), and is expected to be completed by 2018. During this reporting year, District staff and consultants completed the draft designs and initial permitting applications and the District Board approved the project and certified the environmental documents.

Summary of 2015 SHSRF Fish Stocking and Releases – No fish were held or reared at the Facility in 2015. Due to the on-going severe, state-wide drought and possible resultant river flows below the 4 cfs operational minimum, the intake pumps at the Facility could not reliably deliver fresh water to the tanks and rearing channel. Additionally, there was a high risk of poor river water quality from the removal project of San Clemente Dam only a mile upstream of the Facility. After consultation with the NMFS and CDFW, District staff determined the risk was too great to hold fish and decided to release all rescued steelhead back into the river at locations with reliable summer flows (See 2015 Dry Season Transplant Location Section).

D. Monitoring of Steelhead Population

Description and Purpose

The District uses three primary techniques to monitor the health of the steelhead population: (1) counts of adult steelhead passing SCD and LPD, and DIDSON (Dual-frequency IDentification SONar) results in the lower river, (2) surveys of winter steelhead redds, and (3) surveys of the juvenile steelhead population at the end of the dry season in October.

Implementation and Activities during 2015-2016

- **Winter Steelhead Adult Run** - The fish counter and video monitoring equipment at SCD was not operated after March 16, 2015. The dam and ladder were completely removed in the late summer of 2015 ending a 60⁺ year-old record. The average run size for the 1994-2015 period was 391 fish (**Figure XVI-4**).

The LPD Fish Trap is operated and monitored by Cal-Am. The trap was monitored from January 7 to May 31, 2016. The number of trapped adult steelhead reported during the 2016 migration season was zero for the third year in a row (**Figure XVI-5**). The average run size for the 1991-2016 period is 101 fish. This was the fourth zero count year since 1991. There were five resident trout counted in the trap this season.

- **Winter Redd Surveys** – Since 1994, the District has periodically conducted winter steelhead redd (nest) surveys downstream of LPD. Originally, these surveys were part of the District’s spawning habitat restoration project to track how many adult fish spawned in the injected gravel between the dams and to record the downstream movement of the gravel itself. In 2001, the survey area was enlarged to include the Stonepine Resort area and several tributaries. In 2003 and 2004, complete mainstem surveys were conducted from Via Mallorca Road Bridge to LPD. No redd surveys were conducted in the mainstem in 2005 and 2006 due to high river flows throughout much of the winter that precluded wading most river reaches and large late storms that effectively “erased” existing redds.

Due to time constraints and the existence of the adult fish counter at SCD, staff discontinued regular redd surveys above SCD in 2007 to focus on the lower Carmel River. During each spring of 2007, 2008 and 2009, one thorough survey pass was completed between the Highway 1 Bridge and SCD. The survey goals were to: a) quantify the number of spawning redds (nests) and adult fish (including spawning pairs, singles, kelts, and carcasses) in the mainstem river below SCD, and compare those numbers to the fish passage counts at SCD in order to make a better estimate of the river’s total steelhead run size; b) assess locations where adult steelhead may become stranded and need to be rescued as flows decrease; and c) assess the relative numbers of steelhead smolts still in the river. No redd surveys were done during 2010 and 2011 due to high river flows throughout the entire migration period that precluded wading the lower river. In 2012, 58 redds were observed between Boronda Road bridge. and the Rancho Cañada Golf Course (RCGC). In 2013, 54 redds were observed in three separate reaches. No redd surveys were conducted in 2014 due to the extremely dry conditions and lack of an adult steelhead run. In March 2015, one complete survey was conducted between Esquiline (Rosie’s) Bridge (RM 14.45) and the Highway 1 Bridge (RM 1.09). One redd was observed near Rosie’s

but no fish were seen. Of note is the first confirmed sightings of striped bass in the Carmel River when two groups of bass were observed in the Rancho Cañada reach.

In spring 2016, fisheries staff conducted two complete redd survey passes from LPD (RM 24.8) and Highway 1 (RM 1.09). Overall, 42 redds were observed between ~0.5 miles downstream of LPD and the upper end of Quail Golf Course (RM 5.25).

Pacific Lamprey - With the removal of SCD, Pacific Lamprey were able to spawn in the upper watershed for the first time since the 1920s. In 2016, 74 lamprey redds were counted between Syndicate Camp (RM ~22.5) and Robinson Canyon Bridge (RM 8.46). This was the greatest number of lamprey redds ever observed by District staff.

Striped Bass – Several groups of adult striped bass were observed upstream of Schulte Bridge (RM 6.7), extending their range an additional 4.3 miles upstream since 2015. To date, no juvenile bass have been found in the river.

Additionally, as part of the required monitoring for the 2014 spawning gravel enhancement project below LPD, three redd/gravel surveys were conducted in 2016 between LPD and the Cachagua Community Park. Despite excellent spawning conditions and gravel distribution, the lack of adult fish reaching the upper watershed led to only one steelhead redd in the newly placed gravel.

- **Juvenile Population Surveys** - Since Fall 1990, the District has surveyed the juvenile steelhead population in the Carmel River below LPD. This information is crucial to assess the success of adult reproduction and to determine whether or not freshwater habitats are adequately seeded with juveniles.

In 2015, due to the drought, 10 miles of river dried up and only six of the usual 11 survey sites were sampled throughout the 20-mile reach between Valley Greens Bridge and LPD. The juvenile steelhead population density at the six stations was low at 0.29 fish-per-lineal-foot (fpf) of stream, ranging from 0.10 at Garland Park to 0.46 at Cachagua (**Table XVI-2**).

The overall 2015 juvenile steelhead population density increased from the previous year's survey of 0.17 fpf, but was still well below the long-term (1990-2015) average density of 0.75 fpf (**Figure XVI-6**).

- **Constraints to Cal-Am Diversions from the Lower Aquifer** - During the 1992 SWRCB hearings on complaints against Cal-Am's diversions from the Carmel River, testimony was presented that outlined the potential benefits of a modified way of managing the sequence of pumping from Cal-Am well fields in the Carmel Valley Alluvial Aquifer. Pursuant to Condition No. 5 of SWRCB Order WR 95-10, Cal-Am is required to operate its Carmel Valley production wells beginning with the most downstream well, and moving upstream to other wells as needed to meet demand. The goal of this order is to maximize the length of viable stream and aquatic habitats in the lower Carmel Valley.

Due to the ongoing severe drought, this mode of operation and flow releases from Los Padres Reservoir did not result in any additional viable aquatic habitat in 2015. Rescues were needed up to the Narrows and also between Garzas Creek and Rosie's Bridge and no juvenile population estimates could be completed below Garland Park.

E. Other Activities Related to the Steelhead Resource

The District continues to carry out several activities that were not specifically identified as part of the original Allocation EIR Mitigation Program, but will improve habitat conditions, help restore the steelhead resource, or provide additional key data on the steelhead resource. These include: (a) rescue and transportation of kelts, (b) spawning habitat restoration and monitoring, (c) assessment of steelhead migration barriers, (d) operation of the DIDSON fish counter, (e) assessment of the benthic macro-invertebrate (BMI) communities, and (f) Carmel River habitat mapping.

Implementation and Activities in 2015-2016

- **Rescue and Transportation of Kelts** – "Kelts" are adult steelhead that have already spawned, typically from January through April, and begin to migrate back to the ocean in late spring and early summer. Under existing conditions, these fish are threatened by receding flows in many years, especially when the upstream migration of adults is delayed due to lack of early-season storms. District staff rescue and transport these fish to more stable waters, when needed.

In 2016, the lower river remained wet until June so no trapping was necessary and no kelts were captured during summer rescues.

- **DIDSON Fish Counts** – DIDSON (Dual-frequency IDentification SONar) produces high definition video images in all conditions, including low light and high turbidity. It is also a passive technique that does not require fish handling and does not impede migration. The DIDSON site is currently being evaluated for its applicability as a future long-term monitoring site for the estimation of adult escapement.

The 2016 migration season was characterized as a "Below Normal" Water Year Type (WYT). The Carmel River Lagoon first breached to the Pacific Ocean on January 11, 2016, marking the start of the steelhead migration period. The DIDSON was installed January 12, 2016 and operated until May 24, 2016.

Data collected from the DIDSON is still under review by District staff. The full report on DIDSON activity for the 2016 season will be documented in an MPWMD Technical memorandum titled: *The use of Dual-Frequency Identification Sonar (DIDSON) to estimate adult steelhead escapement in the Carmel River, 2016 Season.*

- **Bioassessment Program** – Using the California State Board's Reach Wide Benthic (RWB) protocol's Surface Water Ambient Monitoring Program (SWAMP) procedures, sampling was completed at four sites between Above Los Padres Dam (ALPD) and Stonepine Resort in November 2015. Results from the ALPD reference site showed an increase in index of biotic integrity (IBI) scores compared to the very low 2014 values, but remained far below the historic

(2004-2010) average score. The reductions in sensitive taxonomic groups along with the increase in the relative abundance of black flies (a non-preferred, tolerant species) led to the low scores. The recent lower scores suggest the prolonged drought may have affected the BMI assemblage, or at least the more sensitive BMI taxa.

Cachagua and Sleepy Hollow IBI scores were above the historic averages for these sites, but remain low in comparison to ALPD. Stonepine had an unusually low BMI abundance and a reliable IBI score could not be calculated.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

- **Adult Steelhead**

Two factors likely had the largest effect on adult steelhead this reporting year: the fifth year of the severe California drought and the removal of ninety-year-old San Clemente Dam. The removal of the dam will allow unrestricted access to many additional miles of mainstem and tributary habitat. Additional work scheduled for late 2016 to remove two other major barriers in the reach (Old Carmel Dam and Sleepy Hollow Ford) will allow fish unobstructed passage below LPD both upstream and downstream for the first time since the 1890's. One drawback to SCD's removal is the loss of the fish ladder with its associated fish counter, and the long-term data base on the number of returning adults. Without the SCD fish counter we will have to rely on adult counts from LPD, the DIDSON camera, and redd surveys.

Although the Carmel River steelhead population dramatically improved after the inception of the Mitigation Program in 1990, there was a period of general decline in the adult run from 2001 to 2011. Between 1992 and 2001, the spawning population recovered from a handful of fish to levels approaching 900 adults per year as counted at SCD. Then the run experienced a six-year downward trend from 804 adults in 2001 to 222 adults in 2007, rebounding somewhat in 2008 to 412 adults. However, in 2009 and 2010, the population underwent a dramatic reduction to 95 and 157 adults, respectively. Then in 2011 and 2012, the population rebounded again with 452 and 470 adults passing over SCD, while in 2013 the number dropped to 249, well below the 1994-2013 average of 421, likely due in part to the dry year. Drought conditions worsened in 2014 and the river failed to connect to the lagoon for the first time since 1990. Despite a lack of sea-run adults in 2014, some resident adults did spawn in the upper valley as evidenced by the appearance of fry during summer rescues. Surpassing the four-year drought of the late 1980s to early 1990s, 2016 was the fifth dry year with low numbers of both adult and juvenile steelhead.

Previous redd surveys below SCD confirm that the spawning habitat in the lower river has improved considerably over the last 20 years and many adults now spawn there instead of the upper watershed. In addition, juvenile steelhead rescued by the District from the lower river that survive to adulthood are more likely to return to the lower river to spawn rather than migrate upstream past the SCD. In 2012, the District deployed the DIDSON counting station, acquired from CDFW grant funding, in the lower river to help determine whether more adults are in fact spawning downstream of the dam.

Variability of adult steelhead counts are likely the result of a combination of controlling and

limiting factors including:

- the severe five-year drought affecting the entire west coast. The drought is the primary negative factor for all steelhead life stages including adult steelhead, as migration is limited or blocked and spawning reaches dry early;
- variable lagoon conditions, caused by artificial manipulation of the sandbar and/or naturally occurring periods of low winter flows;
- adverse ocean conditions in which ocean water temperatures off the coast of California were the highest ever recorded for much of 2014-2015, likely affecting the abundance of food resources and possibly even the survival of returning steelhead;
- low densities of juvenile fish in 2004, 2007, and 2009-2011 affecting subsequent adult populations; and
- the improved spawning conditions in the lower Carmel River, encouraging fish to spawn before they reach the counter at the dam, thus lowering the recorded count (but not the actual number of spawning adult fish).

- **Juvenile Steelhead**

Long-term monitoring of the juvenile steelhead population at eleven sites along the mainstem Carmel River below LPD shows that fish density continues to be quite variable both year to year and site to site from less than 0.10 fish-per-foot (fpf) of stream to levels frequently ranging above 1.00 fpf, values that are typical of well-stocked steelhead streams. In this 2015-2016 reporting period, the average population density was much less than the long-term average of 0.74 fpf for the Carmel River, likely due to the ongoing drought and poor habitat conditions in the lower river.

District staff believes the variability of the juvenile steelhead population in the Carmel River Basin is directly related to the following factors:

Positive Factors:

- improvements in streamflow patterns, due to favorable natural fluctuations, exemplified by relatively high base-flow conditions since 1995;
- District and SWRCB rules to actively manage the rate and distribution of groundwater extractions and direct surface diversions within the basin, coupled with changes to CAW's operations at SCD and LPD, providing increased streamflow below SCD;
- restoration and stabilization of the lower Carmel River's stream banks, providing improved riparian habitat (tree cover/shade along the stream and an increase in woody debris) while preventing erosion of silt/sand from filling gravel beds and pools;
- extensive juvenile steelhead rescues by the District over the last 26 years, now totaling 426,154 fish through 2015;

MPWMD 2016 Mitigation Program Report

- rearing and releases of rescued fish from the SHSRF of nearly 97,300 juveniles and smolts back into the river and lagoon over the past 20 years (15 years of operation), at sizes generally larger than the river-reared fish, which in theory should enhance their ocean survival;

Negative Factors:

- As noted above, the severe five-year drought affecting the entire west coast is the primary negative factor for the juvenile steelhead population as rearing habitat dries early, or doesn't exist at all, along with low flows and higher water temperatures;
- variable lagoon conditions, including highly variable water surface elevation changes caused by mechanical breaching, chronic poor water quality (especially in the fall), and predation by birds and striped bass;
- barriers or seasonal impediments to juvenile and smolt emigration, such as intermittent periods of low flow below the Narrows during the normal spring emigration season;
- spring flow variability such as low-flow conditions that could dewater redds prematurely or high flows that could either deposit sediment over redds or completely wash them out;
- chronic, and occasionally acute, fall temperature and hydrogen sulfide levels below LPD, and the increase in suspended sediment from the SCD removal project;
- the potential for enhanced predation on smolts and YOY migrating through the sediment field above LPD.

A recent challenge that may remain for some years is the potential effects of substantive physical and operational changes that occur at SCD due to the Carmel River Re-route and Dam Removal project (CRRDR), especially the process of removal of the dam. The most significant issues are the effect of released or remobilized sediment from the CRRDR project on downstream river habitat, and the proper functioning of MPWMD's SHSRF. The three-year dam removal project began in 2013 with the removal of vegetation and rechanneling the river through the reservoir reach. The dam itself was removed in 2015 and the reconfigured channel was rewetted during the 2015-16 winter. Additional restoration and repairs are slated for late 2016. Major changes include:

- changes to the release flows and water quality;
- potentially significant changes in the sediment regime in the Carmel River downstream of San Clemente as the dam removal project progresses; and
- loss of reservoir storage, which, in the past, has helped maintain adequate river flows and cooler water in the lower Carmel River.

District staff continues to provide technical expertise and scientific data to CAW engineers and

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environmental consultants, DWR/DSOD, CDFW, NMFS, U.S. Fish and Wildlife Service, and others involved in addressing the resource management issues associated with both LPD and the area influenced by the SCD Removal and Carmel River Reroute Project. District staff also continues to provide technical expertise and scientific data to California Department Parks and Recreation, Monterey County Water Resources Agency, Monterey County Public Works Department, California Coastal Commission, U. S. Army Corps of Engineers, Carmel Area Wastewater District, and other regulatory agencies and stakeholders involved in the management of the Carmel River, the Carmel River Lagoon and the barrier beach.

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Figure XVI-1

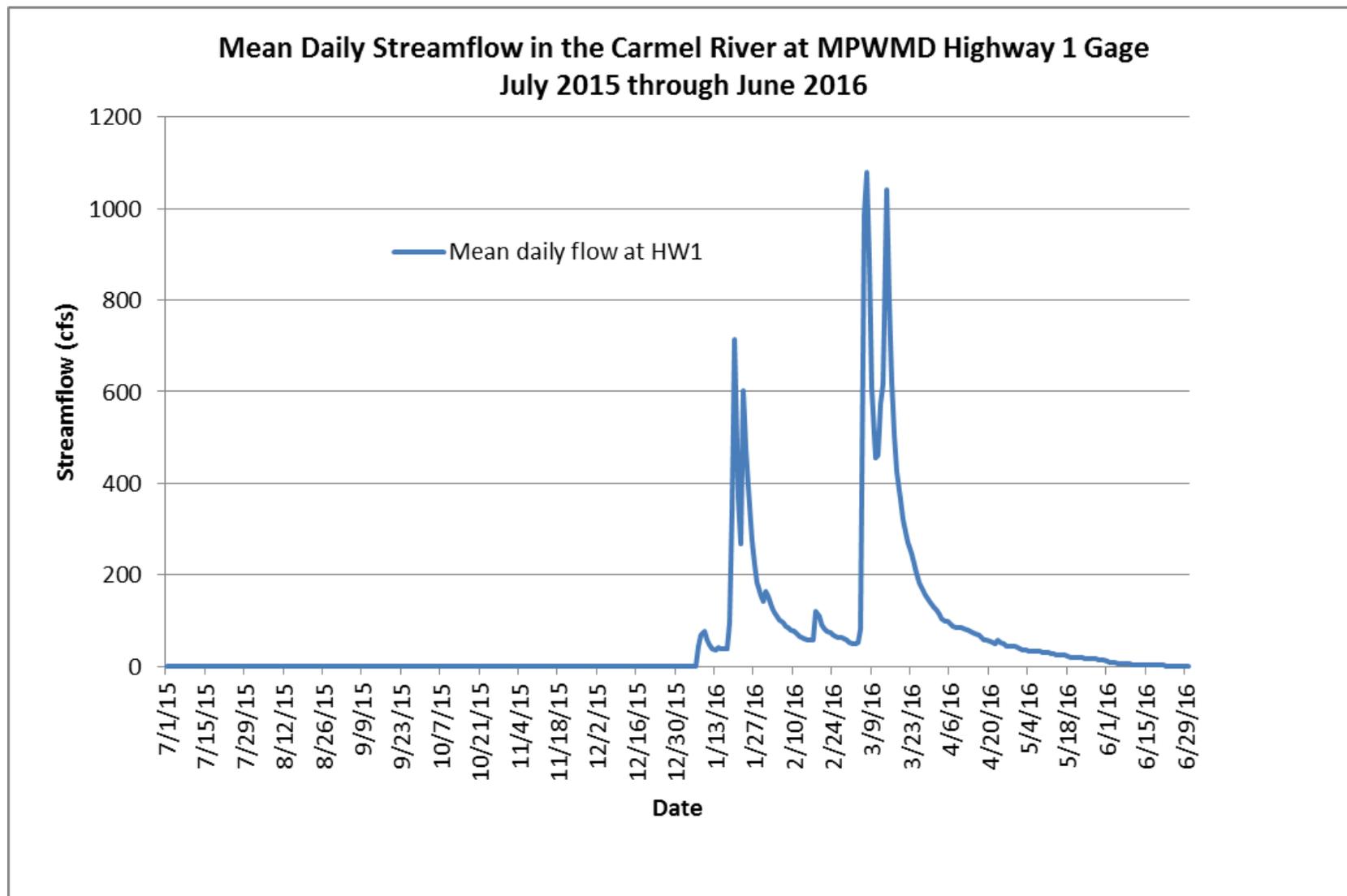


Figure XVI-2

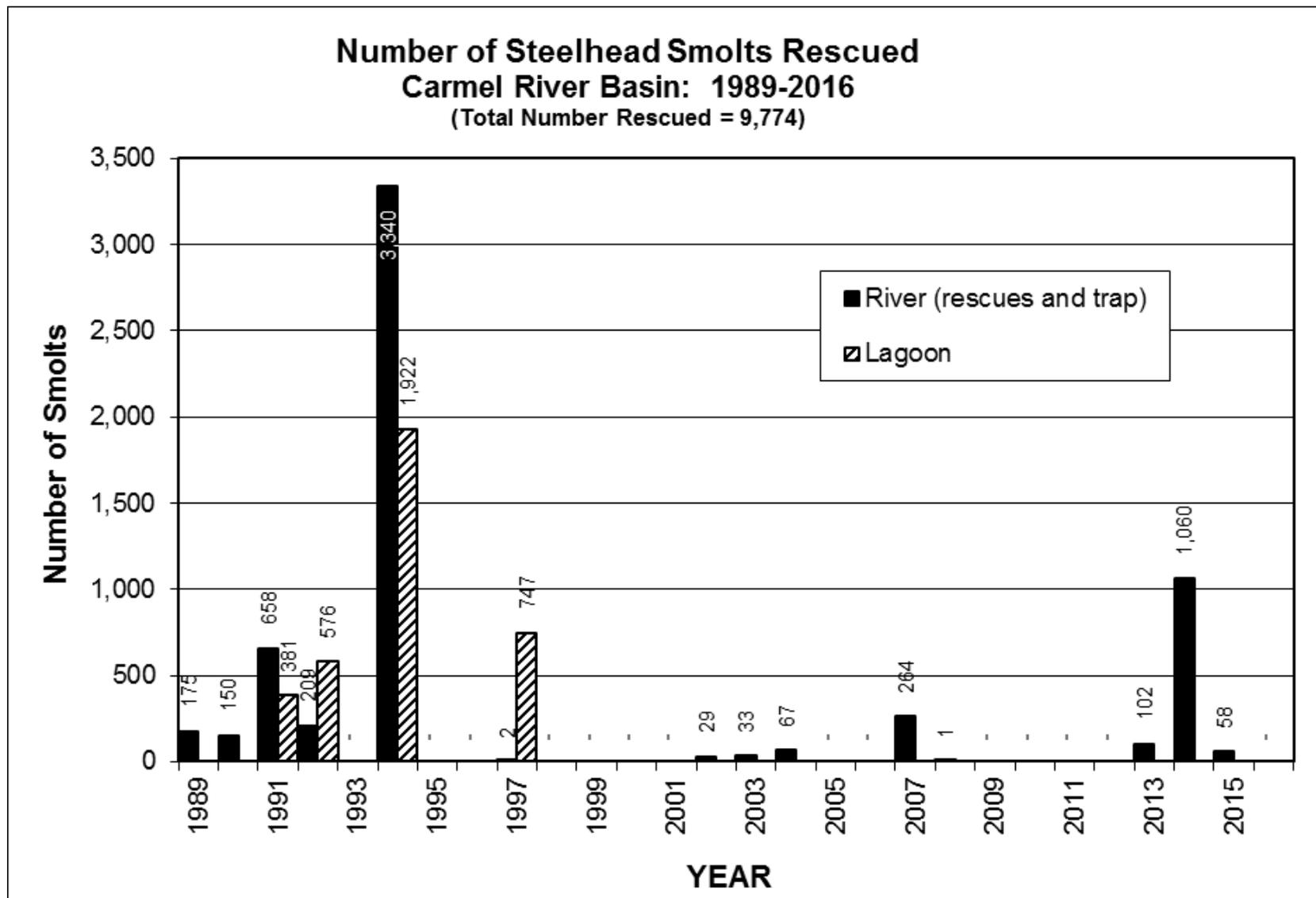


Figure XVI-3

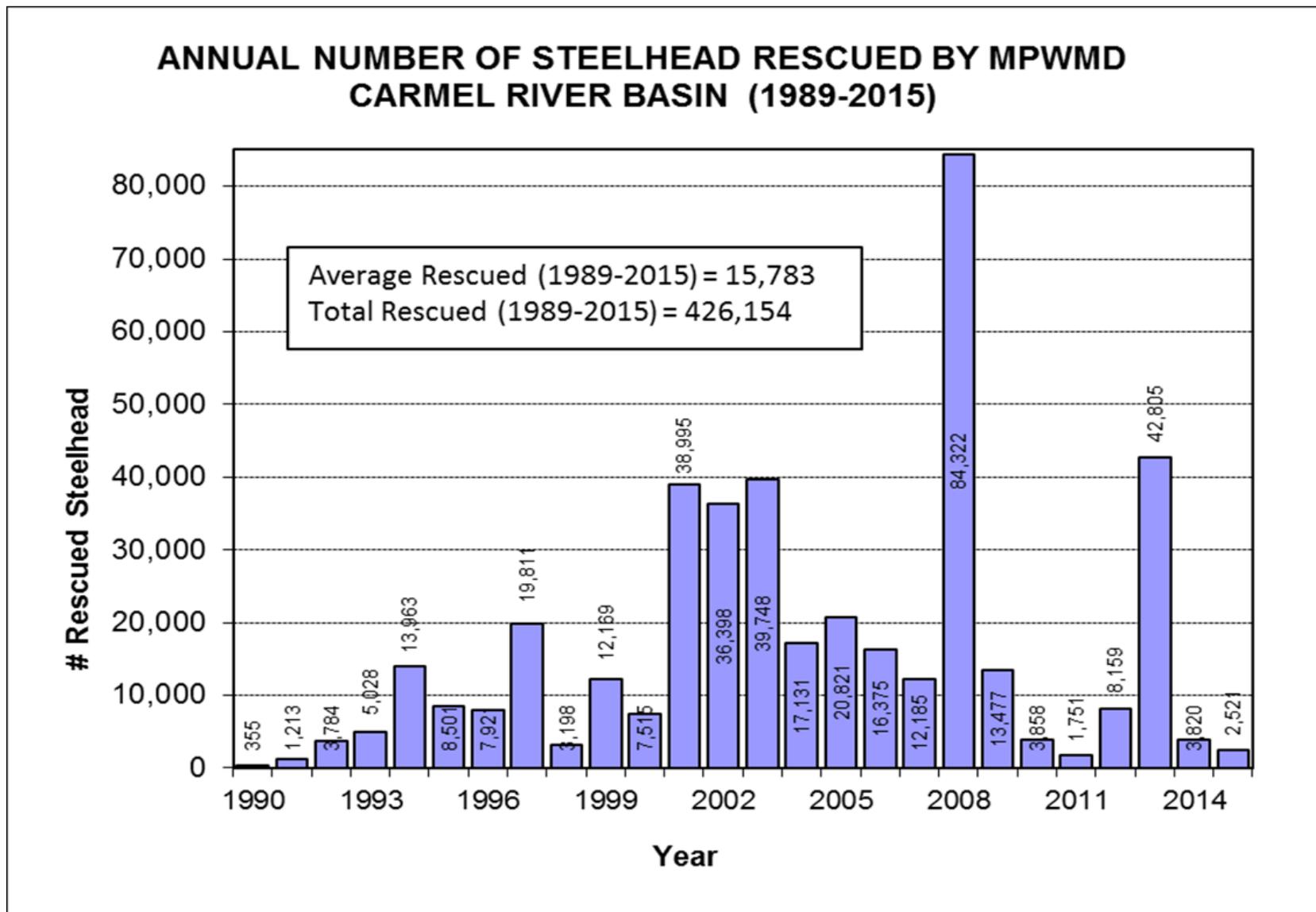
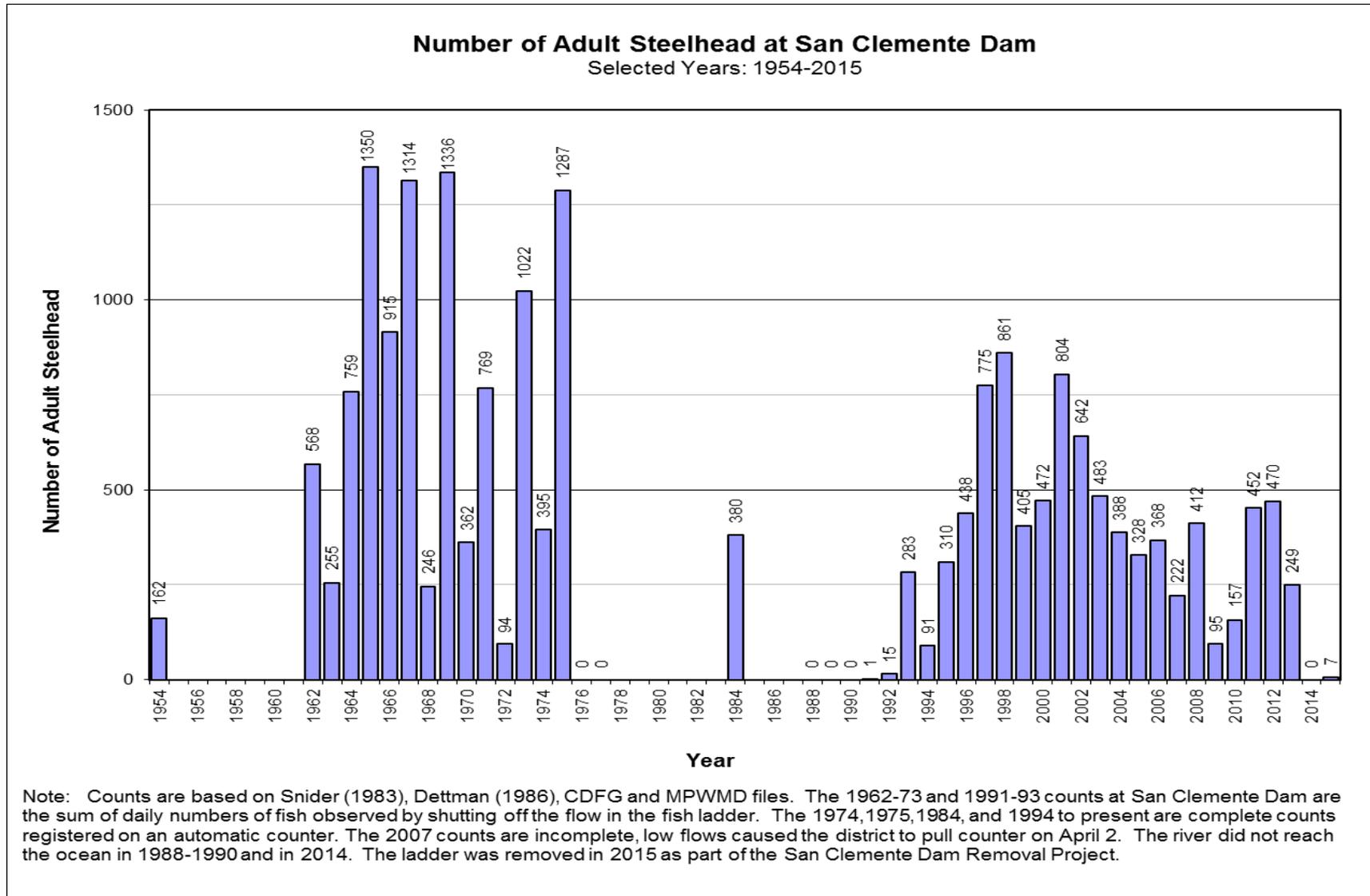


Figure XVI-4



*SCD was removed in 2015.

Figure XVI-5

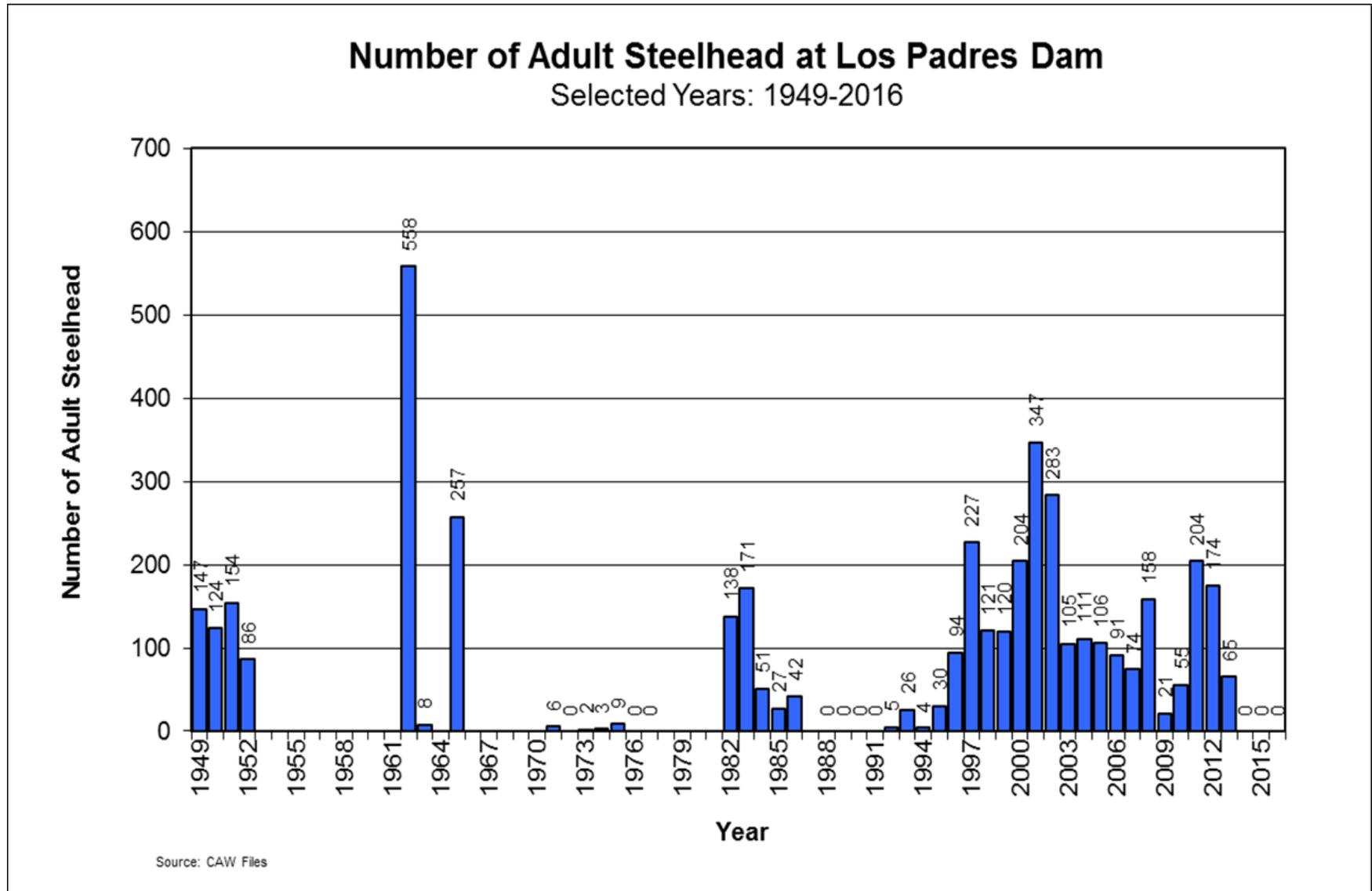


Figure XVI-6

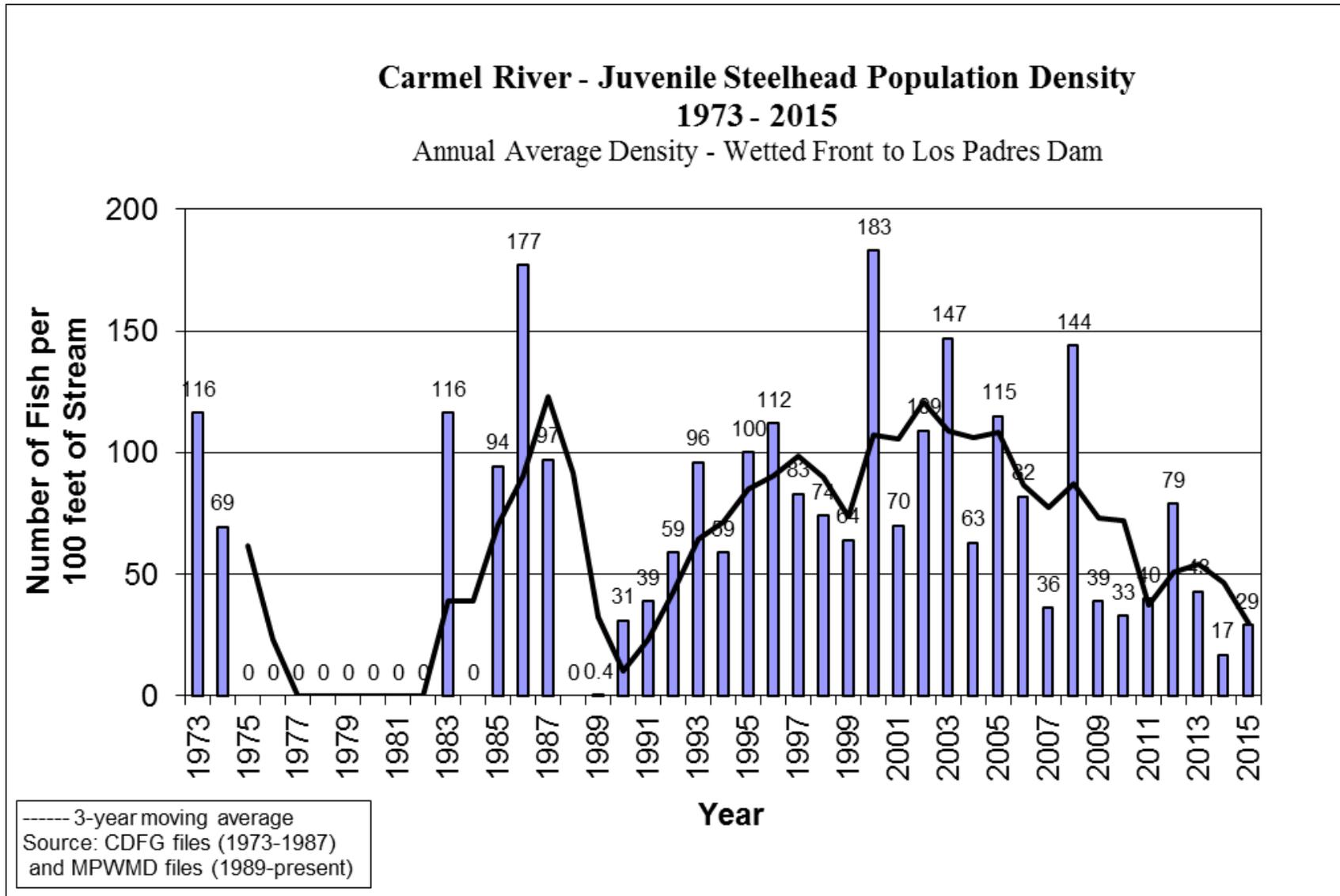


Table XVI-1a

**Number of Steelhead Rescued in the Carmel River Watershed
by Age Group and General Location, Rescue Year 2015.**

Age Group	MPWMD 2015 Mainstem	MPWMD 2015 Tributaries
YOY	2,231	62
1+	244	19
Smolts	0	0
Adult (resident)	30	42
Kelt	1	0
Mortality	15 (0.59%)	5 (3.9%)
Totals	2,521	128

Table XVI-1b

**Transplant Locations of (non-smolt) Steelhead Rescued in the
Carmel River Watershed, Rescue Year 2015.**

Rescue Location	Release Location	River Mile	Number Released
Mainstem	Scarlett Well Area	9.1	34
Mainstem	Cachagua Community Center	24	2,472
Tributaries	Cachagua Community Center	24	123
Total			2,629

NOTE: River miles are approximate.

Table XVI-2

Carmel River Juvenile Steelhead Annual Population Survey¹

Lineal Population Density at Survey Stations (numbers per foot of stream) ^{2,3}													
YEAR	Valley Greens Br. RM 4.8	Red Rock (Mid Valley) RM 7.7	Scarlett Narrows RM 8.7	Garland Park RM 10.8	Boronda RM 12.7	DeDamp Park RM 13.7	Stonepine Resort RM 15.8	Sleepy Hollow RM 17.5	SCR Lower Delta RM 19.0	SCR Upper Delta RM 19.6	Los Compadres RM 20.7	Cachagua RM 24.7	Overall Annual Average (nos./ft) (nos./mi)
1990					ND		0.50	0.27			0.26	0.22	0.31 1,650
1991					0.12		0.74	0.39			0.09	0.62	0.39 2,070
1992				0.67	0.36		0.96	0.30			0.40	0.83	0.59 3,098
1993			0.62	0.91	0.92	0.82	0.84	0.52			1.22	1.84	0.96 5,075
1994		ND	0.44	0.23	0.43	ND	0.50	0.29			1.51	0.71	0.59 3,100
1995		0.49	0.65	1.01	1.61	ND	1.42	0.69			0.50	1.63	1.00 5,281
1996		0.24	1.52	0.82	1.05	2.03	1.22	0.29			0.95	1.92	1.12 5,890
1997		0.02	0.22	1.02	1.74	1.15	0.50	0.22			1.15	1.41	0.83 4,359
1998		0.19	0.30	0.67	0.34	1.50	0.27	0.60			0.54	2.24	0.74 3,901
1999		0.17	0.26	0.50	0.32	0.62	1.67	0.45			0.46	1.35	0.64 3,403
2000		0.91	1.03	0.64	1.38	5.66	1.71	1.46			1.41	2.30	1.83 9,680
2001		ND	0.48	0.35	0.63	0.68	1.08	0.32			0.47	1.62	0.70 3,716
2002		ND	0.68	0.85	1.67	0.83	1.07	0.50	0.33	0.68	1.52	2.73	1.09 5,734
2003		1.53	0.82	2.16	1.86	1.45	1.55	1.23	0.58	1.09	1.69	2.16	1.47 7,738
2004		0.25	0.46	0.78	1.21	0.43	1.24	0.55	0.21	0.41	0.45	0.89	0.63 3,302
2005		1.23	0.60	1.34	1.16	0.91	1.62	1.63	0.21	0.85	0.98	2.10	1.15 6,062
2006		1.13	0.64	0.86	0.87	0.47	0.37	0.95	1.65	0.28	0.82	1.00	0.82 4,339
2007		ND	0.15	0.50	0.77	0.06	0.33	0.16	0.36	0.25	0.49	0.50	0.36 1,885
2008		ND	0.90	2.61	3.64	1.11	1.19	1.38	0.17	0.71	1.13	1.56	1.44 7,603
2009		0.24	ND	0.25	ND	0.27	ND	0.48	ND	ND	ND	0.72	0.39 2,070
2010	0.19	0.06	ND	0.30	0.38	0.17	0.31	0.32	0.26	0.11	0.60	0.78	0.33 1,737
2011	0.11	0.17	ND	0.36	ND	ND	ND	1.07	ND	ND	ND	0.27	0.40 2,091
2012	ND	0.67	0.47	1.01	1.58	0.35	0.59	0.37	1.31	0.74	0.82	0.83	0.79 4,195
2013	ND	ND	0.41	ND	ND	ND	ND	ND	ND	ND	0.40	0.48	0.43 2,270
2014	ND	ND	0.07	0.14	ND	ND	0.18	0.12		0.24	0.30	0.17	0.17 920
2015	ND	ND	ND	0.10	ND	ND	0.19	0.30		0.30	0.38	0.46	0.29 1,522
Station Ave (#/ft)	0.15	0.52	0.56	0.79	1.10	1.09	0.87	0.59	0.56	0.51	0.77	1.21	
Station Ave (#/mile)	792	2,753	2,980	4,151	5,819	5,749	4,603	3,138	2,980	2,717	4,079	6,364	
Overall Station Averages:													

¹ Surveys completed in October and results based on repetitive 3-pass removal method using an electrofisher.

² RM; indicates miles from rivermouth

³ ND indicates stream was dry at sampling station or that site was not sampled that year. Blanks = site not added yet. 2009 - huge storm mid-Oct and river got too high to sample. 2013 - much of r

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XVII. RIPARIAN HABITAT MITIGATION MEASURES

The Findings of Adoption of the 1990 Water Allocation Program Final EIR identified four mitigation measures to reduce impacts to the Carmel River riparian corridor, which includes wildlife that is dependent on streamside habitat (Finding Nos. 389-A through D, and 391). The measures are: (a) conservation and water-distribution management to retain water in the river; (b) prepare and oversee a Riparian Corridor Management Plan; (c) implement the Riparian Corridor Management Program; and (d) expand the existing monitoring program for soil moisture and vegetative stress.

Consistent with the goal of comprehensive resource management, the Monterey Peninsula Water Management District (MPWMD or District) continues to serve as the lead agency to implement an updated Integrated Regional Water Management Plan (IRWM Plan) for a region consisting of coastal watershed areas in Carmel Bay and south Monterey Bay between Pt. Lobos on the south and the Fort Ord Dunes State Park on the north – a 38.3-mile stretch of the Pacific coast. The area encompasses the six Monterey Peninsula cities of Carmel-by-the Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City, Seaside, and extends into portions of the unincorporated area of Monterey County in the Carmel Highlands, Pebble Beach and the inland areas of Carmel Valley and the Laguna Seca area. MPWMD adopted an IRWM Plan in 2007. Subsequently, MPWMD was successful in 2011 in obtaining a \$995,000 grant from the Department of Water Resources (DWR) to update the IRWM Plan to Proposition 84 standards. The plan combines strategies to improve and manage potable water supply, water conservation, stormwater runoff, floodwaters, wastewater, water recycling, habitat for wildlife, and public recreation. Ten planning projects and an update to the IRWM Plan were completed in FY 2014-2015. The total cost of the project, including local agency match, was about \$1.6 million. A final report on the grant was completed in August 2015. In 2016, MPWMD facilitated a funds-sharing agreement for the Central Coast funding area consisting of coastal watersheds from Santa Cruz County to Santa Barbara County. The agreement will allow the Monterey Peninsula region to plan for receiving \$4.6 million in IRWM grant funding over the next several years.

Additional information is contained at the end of this chapter.

A. Conservation and Water Distribution Management to Retain Water in the Carmel River

The purpose of this measure is to reduce pumping impacts on riparian vegetation, particularly in the region of Aquifer Subunit 2 (Scarlett Narrows to Carmel Valley Village). Activities to further this goal during 2015-2016 are summarized above in **Section II** (Hydrologic Monitoring), **Section V** (Annual Low Flow MOA), **Section VI** (Quarterly Budget), and **Section VIII** (Water Efficiency and Conservation).

B. Oversee Riparian Corridor Management Program

Riparian habitat mitigation measures proposed in the Water Allocation Program Final EIR have formed the basis for riparian corridor management activities undertaken since the Board of Directors certified the EIR in November 1990. The Riparian Corridor Management Program

(RCMP) integrates the District's many riparian mitigation and management activities into one program. Components of the RCMP include the Carmel River Erosion Protection and Restoration Program; continued irrigation around Cal-Am production wells in the lower Carmel Valley and around existing District restoration projects; in-channel vegetation management; public education; enforcement of District rules and regulations; and monitoring of wildlife, vegetation and soil.

C. Implement Riparian Corridor Management Program

The goal of the Riparian Corridor Management Program is the rehabilitation, restoration, enhancement and preservation of the streamside corridor along the Carmel River. As described below, several major sub-programs are carried out to achieve this goal.

Implementation and Activities During 2015-2016

During FY 2015-2016, MPWMD accomplished the following:

- continued revegetation efforts at exposed banks with little or no vegetation located in Aquifer Subunits 2 and 3 (Via Mallorca Rd. to Esquiline Rd.);
- operated under a Routine Maintenance Agreement with California Department of Fish and Wildlife and a Regional General Permit with the U.S. Army Corps of Engineers for maintenance activities associated with vegetation encroachment and restoration projects;
- made public presentations showing MPWMD-sponsored restoration work since 1984 and presented recent documentation of Carmel River State Beach, lagoon, and Scenic Road concerns;
- diversified restoration projects and experimented with planting techniques that allow trees to mature more quickly and depend less on irrigation;
- continued long-term monitoring of physical and biological processes along the river in order to evaluate the District's river management activities;
- continued the annual inspections of the Carmel River from the upstream end of the lagoon at River Mile (RM) 0.5 to Camp Steffani at RM 15.5 (staff members responsible for vegetation management and erosion prevention annually walk the entire river to observe and record erosion damage, conditions that could cause erosion [e.g., in-channel vegetation or debris], riparian ordinance infractions, presence of deleterious material, and the overall condition of the riparian corridor);
- carried out vegetation management activities at six sites (Via Mallorca Bridge, Koontz, Randazzo's Bridge, Boronda Bridge, Esquiline Bridge, and Ward Bridge);

The following sections describe MPWMD's work in more detail.

● Carmel River Erosion Protection and Restoration

Lower San Carlos Restoration Project: The two-mile reach between the lower end of the Rancho Cañada golf course and Rancho San Carlos Road Bridge has historically been unstable and has eroded at various locations during high flows in 1969, 1978-1983, 1995, 1998, 2006, 2007, and

2011. Floodplain development and frequent seasonal Carmel River dewatering are the primary causes of this periodic instability, with continued channel degradation also a factor.

During the spring of 2011, additional erosion of the north streambank occurred immediately downstream of the Rancho San Carlos Road Bridge. In FY 2015-2016, MPWMD staff inspected the site. During Water Year 2017, significant erosion of the south overbank area containing mature riparian forest occurred downstream of Rancho San Carlos Road Bridge. It is anticipated that an initial project design will be developed for this area to reduce future losses of riparian forest and to help stabilize this reach.

Riparian Ordinance Enforcement Action: MPWMD continues to work with private property owners on how to protect the riparian corridor. Typical actions included helping property owners plant native streamside vegetation on their property to prevent erosion.

Monitoring San Clemente Dam Removal and Carmel River Reroute: MPWMD engaged in efforts with state, local, and federal scientists interested in pre- and post-construction monitoring of the Carmel River. This included providing funding to the Scholl of Natural Sciences at California State University Monterey Bay to carry out topographic and sediment survey work.

- **Vegetation Restoration** -- Various techniques for vegetation installation were employed at District restoration projects in FY 2015-2016. Planting techniques involved either rooted seedlings or cuttings sustained by irrigation, or deeper plantings set to tap summer groundwater without supplemental water applications. The District continued to diversify streambanks by planting with willows, black cottonwoods, and sycamores.

The primary objectives of the District's restoration planting effort are to stabilize eroded stream banks with native vegetation and to enhance habitat values near the stream, on adjacent floodplains, and terrace areas. One of the goals of the habitat enhancement program is to diversify restoration plantings by identifying microhabitat areas and revegetating them with species typical of those riparian habitat sites. District staff provided riparian plants to several private property owners. Rooted seedlings are obtained from cuttings and seeds collected from along the Carmel River and propagated by a local nursery.

- **Irrigation Program** -- Established riparian vegetation has proven to be an effective deterrent to stream erosion; the mat-like roots of most riparian species bind together loose channel banks and foliage tends to slow the velocity of high river flows. The District selectively irrigates mature streamside vegetation and newly established restoration plantings in order to maintain a healthy, vigorous riparian corridor both for erosion protection and habitat enhancement.

Table XVII-1 and **Figure XVII-1** shows water use at various restoration and riparian mitigation sites for calendar year 2016. A total of 7.01 acre-feet (AF) of water were applied in 2016. In calendar year 2015, 7.04 AF were used to irrigate riparian vegetation. The irrigation season typically begins in April and continues through the end of November.

- **Vegetation Management** -- Since Fall 1990, the District has carried out annual vegetation management projects along portions of the Carmel River to reduce potential obstructions to river flow and to reduce the potential for bank erosion. In the past, the District has removed downed trees and vegetation that could deflect high water onto adjacent stream banks, thereby inducing erosion and degrading streamside habitat.

Carmel River Inspection - Annually, staff assesses the lower 15.5 miles from the lagoon to Camp Stephani in order to determine if and where clearing should occur. At sites where debris and/or live vegetation is judged to be a potential hazard, staff balances the goals of conserving aquatic and streamside habitat with reducing the potential for erosion of private and public property and infrastructure. Only woody plant material representing a bank erosion threat is treated by notching or partially cutting through the trunk and large limbs.

During the fall of 2015, six areas with vegetation encroachment, debris piles, and downed trees in the channel bottom were selected for vegetation management:

- 1. Via Mallorca Bridge Area (encroaching vegetation):** at approximately RM 3.2 several patches of willows were encroaching into the Carmel River. These willows had their branches trimmed back to allow debris to pass.
- 2. Koontz Area (debris piles):** approximately one mile downstream of Schulte Bridge at RM 6.0 debris piles have been forced up against vegetation. These debris piles were broken up with hand tools and removed from live vegetation. Some trees were trimmed to allow debris to pass through the constriction.
- 3. Randazzo's Bridge Area (encroaching vegetation):** beginning at a private bridge known as Randazzo's Bridge at RM 10.1 tree branches were trimmed and a downed tree was cut into several pieces to allow debris to pass through the reach.
- 4. Boronda Bridge Area (encroaching vegetation and downed trees):** at approximately RM 12.2 two areas had patches of encroaching vegetation along the Carmel River. These trees had their branches trimmed to allow debris to pass. Some willows blocking the active channel were removed. In addition, several large trees that had fallen into the main channel downstream of Boronda Bridge were cut into several pieces to allow debris to pass with the branches being removed.
- 5. Esquiline Bridge Area (encroaching vegetation):** upstream and downstream of Esquiline Bridge at RM 14.5 trees growing on mid-channel gravel bars were removed. Some branches were placed in the flowing stream to provide cover. The remaining branches and slash was removed from the channel.
- 6. Ward Bridge Area (downed trees):** upstream and downstream of Ward's private bridge at RM 15.0; several large trees had fallen in the main channel. These trunks were cut in several places to allow debris to pass. Large sections of the tree trunks were left in the flowing stream to provide large wood habitat.

A total of approximately 500 square feet of stream cover (standing trees) encompassing approximately 0.011 acres in the channel bottom was affected by vegetation management activities.

In addition to erosion hazard reduction, vegetation management objectives include removing trash and inorganic debris from the river channel. During FY 2015-2016, trash such as plastic, paper, cans, bottles and car parts were removed from the channel and disposed by the District.

In general, the health of the riparian corridor along the lower 15.5 miles of the river appeared to be good with continued development of naturally recruited species, such as black cottonwoods, willows, and sycamores, on some of the engineered floodplains as well as natural gravel bars. While most of the stream channel remained clear of major obstructions, District staff documented increases in vegetation encroachment into the channel bottom that will likely require continued monitoring and may require vegetation management activities in the future. District staff believes that continued selective removal of encroaching vegetation will be necessary during the summer of 2017. Without such a program, it is possible that unauthorized vegetation removal by property owners along the river may increase and lead to a decline in the health and stability of the riparian corridor.

- **Public Information and Partnerships**

MPWMD continued its outreach program with presentations to senior environmental science classes from Robert Louis Stevenson, 5th graders from the International School of Monterey, and graduate students at California State University Monterey Bay. Topics included information on the Monterey Peninsula Water Resource System, proposed water supply projects within the region, MPWMD's Environmental Protection Program, the Carmel River steelhead life cycle, specific issues related to the Carmel River watershed, and the history of politics and ownership of Monterey Peninsula water.

D. Expand Monitoring Programs for Soil Moisture and Vegetative Stress

This mitigation measure involves implementing a groundwater and vegetation monitoring program to better assess plant water stress and related irrigation needs in the riparian zone. Data from soil-moisture and plant water-stress tests facilitate the identification and location of impacts resulting from the prolonged depression or rapid drawdown of the water table. Soil and plant monitoring also documents the beneficial results of riparian mitigations, and provides a statistical foundation for determining trends in conditions over time.

In calendar year 2016, staff collected bi-monthly canopy ratings of individual trees at four study sites in mid and lower Carmel Valley (Rancho Cañada, San Carlos, Schulte Restoration Project, and the Valley Hills Restoration Project). Canopy ratings are used to determine the amount of defoliation that is occurring in riparian trees due to moisture stress associated with a falling water table. **Figure XVII-2** shows average canopy ratings for both willows and cottonwoods. Results showed that willows and cottonwoods were healthy and vigorous during the beginning of the monitoring season and then began exhibiting signs of moisture stress (defoliation) as the water table dropped. It should be noted that many trees are irrigated in the vicinity of large production

wells to offset impacts associated with water extraction. Monitoring results help District staff determine irrigation requirements for portions of the riparian corridor that are under the influence of groundwater extraction. Photo documentation and measurements of foliage volume occurs in other areas as well, depending on river flow conditions and depth to groundwater.

In addition to vegetation and groundwater monitoring, avian (bird) species diversity monitoring has been carried out annually from 1992 to the summer of 2010 and then on a periodic basis starting in 2015. Data collected by Dr. David Mullen and the BSOL since 1992 compares habitat values at permanent monitoring stations and provides an indication of changing patterns of avian use in District restoration projects. The information collected on avian species diversity has helped document the response of populations to habitat enhancements implemented by the District. Since 1992, the avian monitoring work has shown healthy avian species diversity along river reaches where the District has implemented restoration projects, while diversity-index readings in control sites with established riparian vegetation seem to fluctuate depending on the presence of flow in the river channel, the quality of the habitat, and off site conditions during migration. The avian monitoring program is carried out on a periodic basis because of budget constraints.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

With the exception of the Rancho Cañada to Rancho San Carlos Road Bridge reach, the Carmel River streamside corridor has stabilized in nearly all reaches that were affected by a combination of increased groundwater extraction, extreme drought and flood events that occurred during the 1970s, 1980s and 1990s. A complex channel has developed in the lower 16 miles of the river with improved steelhead spawning substrate, diverse habitat, and a richer riparian community. Areas with perennial or near perennial flow (upstream of Schulte Bridge) or a high groundwater table, such as downstream of Highway 1, have experienced vigorous natural recruitment in the channel bottom, which has helped to stabilize streambanks and diversify aquatic habitat. Areas that continue to be dewatered annually have somewhat less, but still significant growth.

The Soberanes fire in the summer of 2016 combined with the removal of San Clemente Dam and high flows in the winter of 2016-17 proved to be a combination of events that is changing the river downstream of the former dam site. Significant quantities of silt, sand, and debris were carried down from the fire-scarred upper watershed into the active channel in the alluvial reach.

In these areas, natural recruitment has led to vegetation encroachment that, in some areas, may constrict high flows and threaten bank stability. MPWMD continues to monitor these areas closely and to develop a management strategy to balance protection of native habitat with the need to reduce erosion potential. Environmental review of proposed projects and the process of securing permits is quite complex and requires an exhaustive review of potential impacts.

In contrast to areas with perennial flow, the recovery of streamside areas subjected to annual dewatering requires monitoring. Plant stress in the late summer and fall is evident in portions of the river that go dry. In these areas, streambanks can exhibit unstable characteristics during high flows, such as sudden bank collapse, because of the lack of healthy vegetation that would

ordinarily provide stability. The drought that began with Water Year 2013 (beginning October 2012) and ended in Water Year 2016 is an ongoing concern because of the past history of channel erosion and bank instability after severe droughts in 1976-77 and 1987-1991. Impacts to streamside vegetation can manifest themselves for several years even after the end of a drought.

Although there are areas of deposition in the active channel, the long-term reduced sediment load delivery from the upper watershed has resulted in channel degradation (incision of the stream into the valley floor) in certain areas. Thus, pools become deeper and when combined with scour along the outside of streambanks this creates “cut” banks. Although this leads to a more complex and dynamic channel, which are desirable conditions, continued degradation can result in bank collapses and trigger an episode of erosion along the river. District staff continues to document degradation in the river bed including at the Carmel Area Wastewater District pipe across the river downstream of Highway 1 and at bridge infrastructure in the active channel. When river flows drop in late spring or early summer of 2017, District staff will investigate the overall scour and deposition of the streambed and report on this in next year’s mitigation report.

Restoration project areas sponsored by MPWMD since 1984 continue to mature and exhibit more features of relatively undisturbed reaches, such as plant diversity and vigor, complex floodplain topography, and a variety of in-channel features such as large wood, extensive vegetative cover, pools, riffles, and cut banks.

As cited in previous reports, the most significant trends continue to include the following:

- increased encroachment of vegetation into the active channel bottom that can induce debris blockage, bank erosion and increased risks during floods,
- effects to areas with groundwater extraction downstream of Schulte Road,
- channel changes and erosion due to new supply of sediment from upstream associated with high flows, San Clemente Dam removal, and the Soberanes Fire in Water Year 2017,
- healthy avian species diversity, and
- maturing of previous restoration projects.

Carmel River Erosion Protection and Restoration

With the exception of the channel area between the Via Mallorca Road bridge and the Rancho San Carlos Road bridge, streambanks in the main stem appear to be relatively stable during average water years with “frequent flow” storm events (flows with a return magnitude of less than five years). The program begun by MPWMD in 1984 (and later subsumed into the Mitigation Program) to stabilize streambanks appears to be achieving the goals that were initially set out, i.e., to reduce bank erosion during high flow events up to a 10-year return flow, restore vegetation along the streamside, and improve fisheries habitat.

Consistent with previous reports, it is likely that the following trends will continue:

- Local, State and Federal agencies consider the Carmel River watershed to be a high priority area for restoration, as evidenced by the interest in addressing water supply

issues, the removal of San Clemente Dam, proposed projects in the lower Carmel River, and continued oversight with the management of threatened species. Stringent avoidance and mitigation requirements will continue to be placed on activities that could have negative impacts on sensitive aquatic species or their habitats.

- Activities that interrupt or curtail natural stream functions, such as lining streambanks with riprap, have come under increasing scrutiny and now require significant mitigation offsets. Approximately 35% to 40% of the streambanks downstream of Carmel Valley Village have been altered or hardened since the late 1950s. Activities that increase the amount of habitat or restore natural stream functions are more likely to be approved or funded through State and Federal grant programs.
- Additional work to add instream features (such as large logs for steelhead refuge or backwater channel areas for frogs) can restore and diversify aquatic habitat.
- Major restoration projects completed between 1987 and 1999 have had extensive and successful work to diversify plantings. However, maintenance of irrigation systems is ongoing and requires extensive work in water years classified as below normal, dry and critically dry.
- The channel will change due to a new supply of sediment coming from upstream of the old San Clemente Dam and additional sources of sediment associated with the Soberanes Fire of 2016.

Between the mouth of the river and Robinson Canyon Road bridge, many areas of the river appear to be deeper than at any previous time since measurements have been recorded (i.e., beginning in 1978), with many reaches showing several feet of downcutting. This trend, which was identified as a concern in the 1984 Carmel River Management Program EIR, appears to have accelerated in the period from 1998 to 2015. This was a period of exceptional stability (for the Carmel River) as streambanks hardened with structural protection over the past several decades resisted erosion and the force of the river during high flows was directed into the channel bottom. This condition has resulted in the undermining of rip-rap protection and bridge infrastructure in some reaches. To assess the impact of scour and degradation in the bottom of the channel, the District budgeted funds in Fiscal Year 2014-15 and carried out a thalweg survey (survey along the bottom of the channel) along a portion of the lower river. The survey was completed in 2015 and 2016 and will be compared to similar periodic surveys dating back to 1984. However, this trend will have to be looked at carefully because as of Water Year 2017 recent high flows have transported large amounts of sediment into the mainstem of the Carmel River.

In the spring of 2010, the Carmel Area Wastewater District (CAWD) concrete-encased pipe across the bottom of the river was exposed for the first time since it was constructed in 1973. Information from CAWD about the depth of cover in 1973 indicates that the pipe was installed with six feet of cover; however, there is conflicting survey information that indicates the pipe encasement may have had only a few feet of cover. In 2012, District staff measured a maximum of 4.5 feet of scour from the top of the encasement, which is approximately five feet wide and five feet high (see **Figure XVII-3**). In September 2013, District staff measured between 4.0 and 4.25 feet of scour. Measurements from 2014 and 2015 indicated the scour hole remains at about four feet. In addition, the pipe encasement appears to be causing the river to create a large deep pool on the downstream side, while on the upstream side the encasement causes the river bottom

to be flat and wide for an extended length. At certain low flow periods with the lagoon open, the encasement likely creates a temporary barrier to steelhead migration.

In the spring of 2011, the river migrated into the north streambank at the Rancho San Carlos Road Bridge (see **Figure XVII-4**). In the winter of 2017, during a series of high flows, erosion started taking place on the south side of the river. This reach has become unstable and the District will propose a restoration project that would stabilize the streambanks. If no work to stabilize the streambank is carried out, it is likely that the river will continue to erode property along the southern and northern streambanks and there will be additional loss of mature riparian forest.

Eventually, without corrective measures to balance the sediment load with the flow of water or to mitigate for the effect of the downcutting, streambanks will begin to collapse and the integrity of bridges and other infrastructure in the active channel of the river may be threatened.

Vegetation Restoration and Irrigation

To the maximum extent possible, MPWMD-sponsored river restoration projects incorporate a functional floodplain that is intended to be inundated in relatively frequent storm events (those expected every 1-2 years). For example, low benches at the Red Rock and All Saints Projects have served as natural recruitment areas and are currently being colonized by black cottonwoods, sycamores and willows. In addition, willow and cottonwood pole plantings in these areas were installed with a backhoe, which allows them to tap into the water table. These techniques have been successful and have reduced the need for supplemental irrigation.

Channel Vegetation Management

Another notable trend relating to the District's vegetation management program was the widening of the channel after floods in 1995 and 1998. With relatively normal years following these floods, the channel has narrowed as vegetation recruits on the channel bottom and gravel bars. Current Federal regulations such as the Endangered Species Act (ESA) "Section 4(d)" rules promulgated by NOAA Fisheries to protect steelhead significantly restrict vegetation management activities. Because of these restrictions, the District can carry out activities only on the most critical channel restrictions and erosion hazards in the lower 15 miles of the river. In the absence of high winter flows capable of scouring vegetation out of the channel bottom, encroaching vegetation may significantly restrict the channel. As vegetation in the river channel matures in the channel bottom, more conflicts are likely to arise between preserving habitat and reducing the potential for property damage during high flows. MPWMD will continue to balance the need to treat erosion hazards in the river yet maintain features that contribute to aquatic habitat quality.

Permits for Channel Restoration and Vegetation Management

In 2012, MPWMD renewed its long-term permits with the U.S. Army Corps of Engineers and the California Regional Water Quality Control Board for routine maintenance and restoration work. In 2014, the District also renewed a long-term Routine Maintenance Agreement (RMA)

with the California Department of Fish and Wildlife to conduct regular maintenance and restoration activities in the Carmel River.

Monitoring Program

Vegetative moisture stress fluctuates depending on the rainfall, proximate stream flow, depth to groundwater, and average daily temperatures, and tends to be much lower in above-normal rainfall years. Typical trends for a single season start with little to no vegetative moisture stress in the spring, when the soil is moist and the river is flowing. As the river begins to dry up in lower Carmel Valley (normally around June) and temperatures begin to increase, an overall increase in vegetative moisture stress occurs. For much of the riparian corridor in the lower seven miles of the Carmel River, this stress has been mitigated by supplemental irrigation, thereby preventing the die off of large areas of riparian habitat. However, many recruiting trees experience high levels of stress or mortality in areas difficult to irrigate. Riparian vegetation exposed to rapid or substantial lowering of groundwater levels (i.e., below the root zones of the plants) will continue to require monitoring and irrigation during the dry season.

With respect to riparian songbird diversity, populations dropped after major floods in 1995 and 1998 because of the loss of streamside habitat. Since 1998, species diversity recovered and now fluctuates depending on habitat conditions. Values indicate that the District mitigation program is preserving and improving riparian habitat.

Strategies for the future

A comprehensive long-term solution to overall environmental degradation requires a significant increase in dry-season water flows in the lower river, a reversal of the incision process, and reestablishment of a natural meander pattern. Of these, MPWMD has made progress on increasing summer low flows and groundwater levels by aggressively pursuing a water conservation program, implementing the first and second phases of the Seaside Groundwater Basin Aquifer Storage and Recovery Project, and recommending an increase in summer releases from Los Padres Reservoir.

Reversal, or at least a slowing, of channel incision may be possible if the supply of sediment is brought into better balance with the sediment transport forces. Additional sediment from the tributary watersheds between San Clemente Dam and Los Padres Dam will pass into the lower river in the foreseeable future now that San Clemente Dam has been removed. District staff are already seeing signs of additional sediment in the Carmel River below Esquiline Road Bridge associated with high flows in Water Year 2017.

Over the long term, an increase in sediment supply could help reduce streambank instability and erosion threats to public and private infrastructure. However, reestablishing a natural supply of sediment and restoring the natural river meander pattern through the lower 15.5 miles of the Carmel Valley presents significant political, environmental, and fiscal challenges, and is not currently being considered as part of the Mitigation Program.

Integrated Regional Water Management (IRWM) Grant Program

The IRWM program promoted by the California DWR encourages planning and management of water resources on a regional scale and promotes projects that incorporate multiple objectives and strategies. In addition, the IRWM process brings stakeholders together and encourages cooperation among agencies in developing mutually beneficial solutions to resource problems.

MPWMD adopted the 2014 Update to the IRWM Plan for a region encompassing Monterey Peninsula areas within the District boundary, the area in the Carmel River watershed outside of the MPWMD boundary, Carmel Bay and the Southern Monterey Bay. The IRWM Plan combines strategies to improve and manage potable water supply, water conservation, stormwater runoff, floodwaters, wastewater, water recycling, habitat for wildlife, and public recreation. A final report on the grant to update the plan was completed in FY 2015-2016.

Funding from the IRWM grant program and other programs requiring an adopted IRWM Plan could provide the incentive to undertake a set of projects that would continue to improve the Carmel River environment and engage a larger number of organizations in helping to develop and implement a comprehensive solution to water resource problems in the planning region.

More information about the IRWM Plan and the group of stakeholders in the planning region can be found at the following web site:

<http://www.mpirwm.org>

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Table XVII-1

Monthly Irrigation Water Use During 2016
(Values in Acre-Feet)

Project Site	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Total
DeDampierre	0.000	0.000	0.000	0.013	0.025	0.039	0.038	0.040	0.037	0.019	0.008	0.000	0.219
Trail and Saddle	0.000	0.000	0.000	0.200	0.354	0.379	0.425	0.592	0.429	0.321	0.000	0.000	2.700
Begonia	0.000	0.000	0.000	0.015	0.035	0.045	0.040	0.043	0.035	0.025	0.000	0.000	0.238
Reimers	0.000	0.000	0.000	0.038	0.133	0.266	0.239	0.400	0.207	0.256	0.000	0.000	1.539
Schulte Bridge	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.016	0.034	0.004	0.000	0.000	0.060
Cypress	0.000	0.000	0.000	0.000	0.033	0.000	0.285	0.711	0.647	0.343	0.000	0.000	2.019
San Carlos (Dow)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.095	0.045	0.000	0.000	0.236
TOTAL WATER USE IN ACRE-FEET FOR DISTRICT RESTORATION PROJECTS IN 2016 =												7.011	

Figure XVII-1
Riparian Irrigation Totals

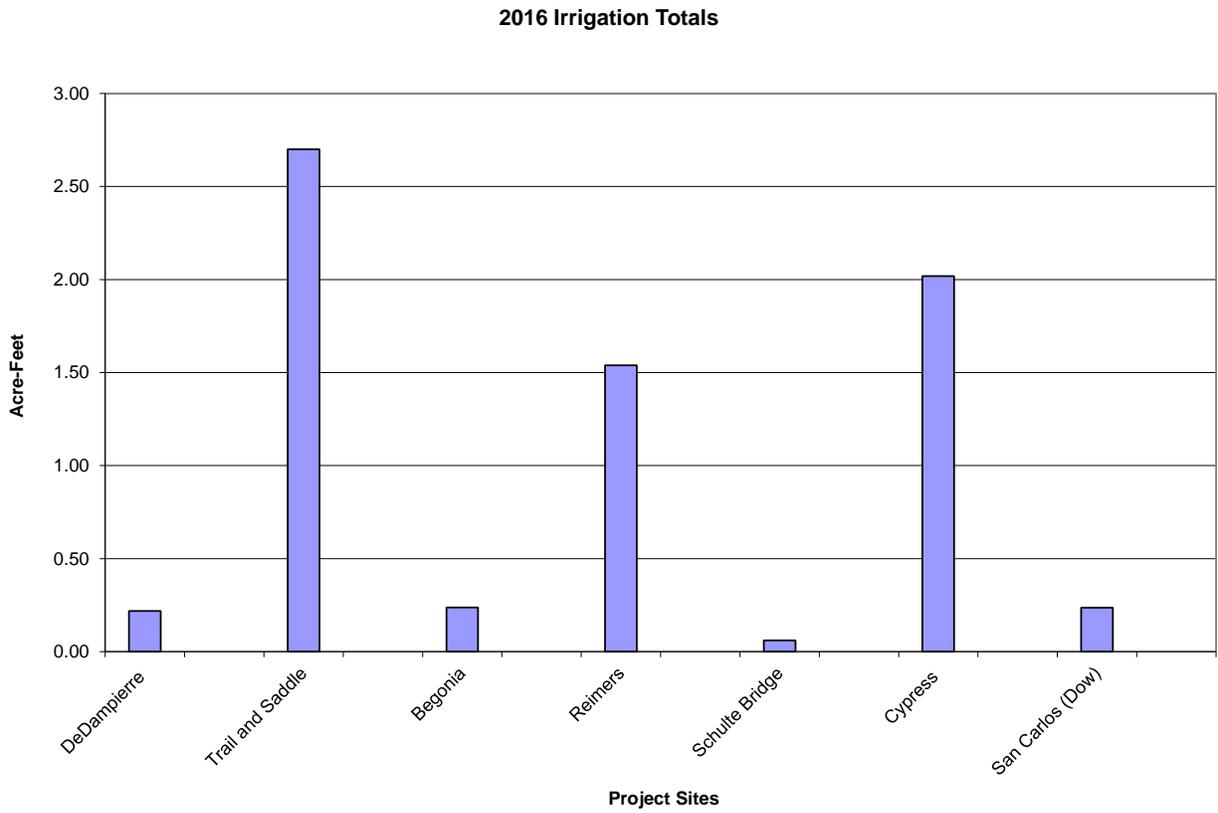
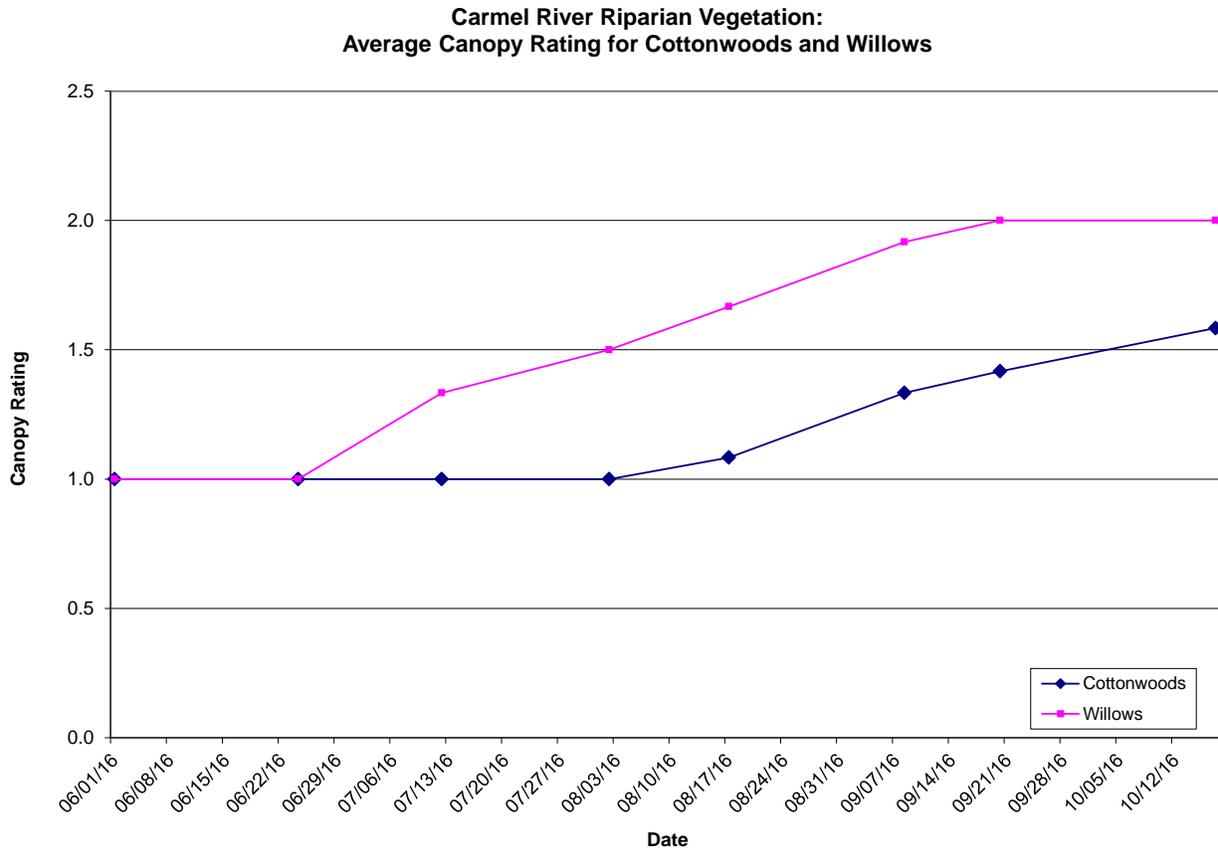


Figure XVII-2

2016 Average Canopy Rating for Cottonwoods and Willows



Canopy Rating Scale	Stress Level
1= Green, obviously vigorous	none, no irrigation required
2= Some visible yellowing	low, occasional irrigation required
3= Leaves mostly yellowing	moderate, regular irrigation required
4= < 10% Defoliated	moderate, regular irrigation required
5= Defoliated 10% to 30%	moderate, regular irrigation required
6= Defoliated 30% to 50%	moderate to high, additional measures required
7= Defoliated 50% to 70%	high stress, risk of mortality or canopy dieback
8= Defoliated 70% to 90%	high stress, risk of mortality or canopy dieback
9= > 90% Defoliated	high stress, risk of mortality or canopy dieback
10= Dead	consider replanting

Figure XVII-3
Carmel Area Wastewater District Pipe Encasement, Carmel River

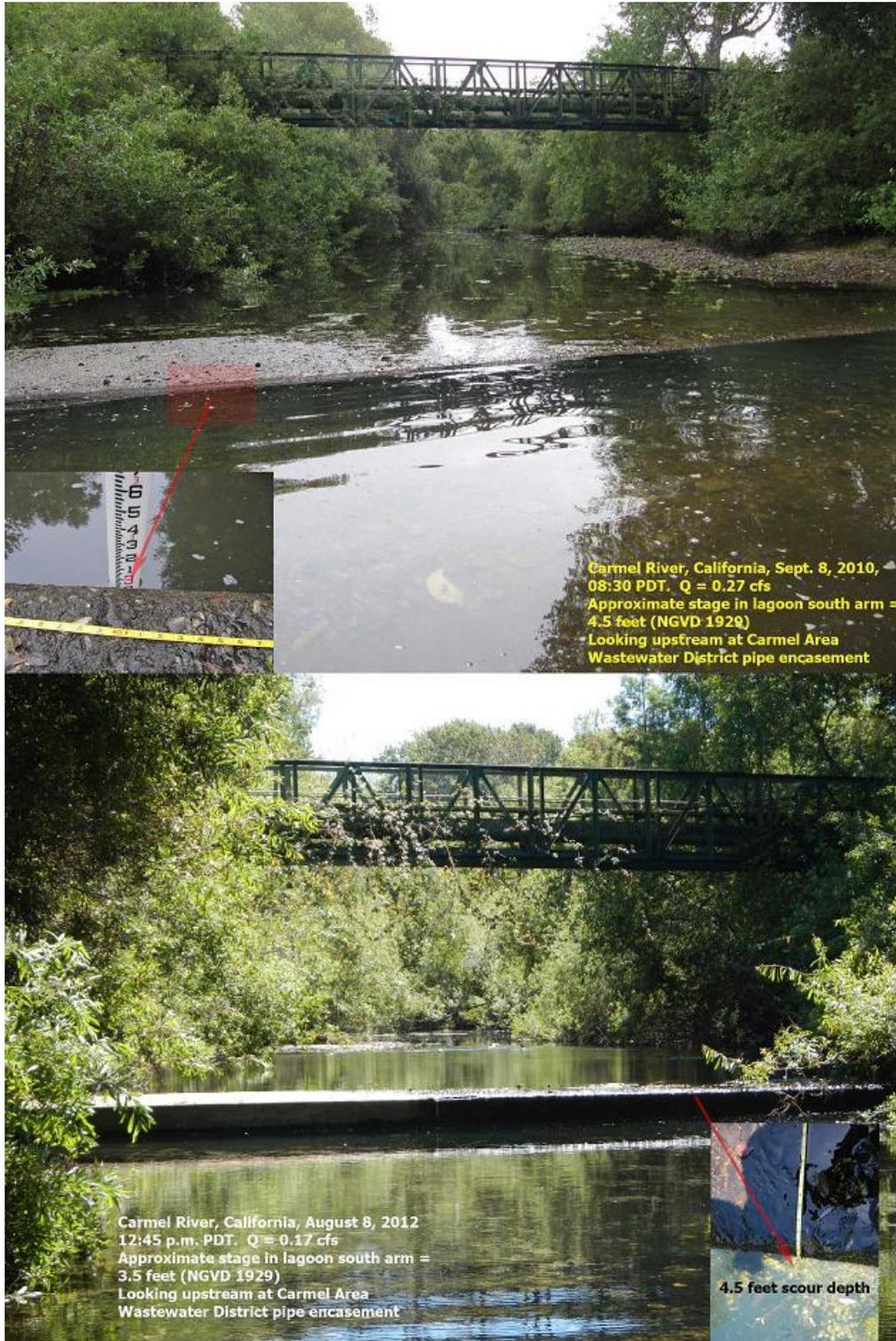


Figure XVII-4
Streambank Erosion at Rancho San Carlos Road Bridge, Carmel River
March 27, 2017



Right Bank Looking Downstream



Left Bank Looking Downstream

XVIII. LAGOON HABITAT MITIGATION MEASURES

The Findings for Adoption of the Water Allocation Program Final EIR identified three mitigation measures to reduce impacts to the Carmel River Lagoon, including wildlife that is dependent on it (Finding Nos. 390-A through C, and 392). They include: (a) assist with lagoon enhancement plan investigations, (b) expand long-term monitoring program, and (c) identify feasible alternatives to maintain adequate lagoon volume. This section briefly describes the purpose of these three programs and summarizes the mitigation activities from July 1, 2015 through June 30, 2016.

A. Assist with Lagoon Enhancement Plan Investigations

Description and Purpose

The Monterey Peninsula Water Management District (MPWMD or District), Monterey County Water Resources Agency (MCWRA), California Department of Parks and Recreation (CDPR), and the California Coastal Conservancy (Conservancy) co-funded the Carmel River Lagoon Enhancement Plan, which was prepared by Philip Williams & Associates. A key aspect of the Lagoon Enhancement Plan was to identify alternative means to restore and enhance the lagoon environment. District staff participated on a plan review committee, which met on an as-needed basis, and contributed staff expertise for enhancement plan investigations. District staff reviewed and provided comments on the Draft Lagoon Enhancement Plan document. These comments, as well as comments from other reviewing agencies, were incorporated into the Final Plan dated December 1992.

Implementation and Activities during 2015-2016

During this period, the CDPR continued their native riparian plant re-vegetation efforts at a reduced level within the 100-acre portion of the “Odello West” property that is now part of the Carmel River State Beach. The re-vegetation work is ongoing, though the formal monitoring program and its reporting ended after five years in 2009.

District staff monitored receiving water quality and continued to provide expertise to representatives from numerous state, federal and local agencies, as well as members of the public. The lagoon water-quality data for both surface and subsurface profiles are presented in Section III. During many months in the summer and fall, there is usually no natural surface flow to the lagoon, and the lagoon has historically experienced poor water quality and low water levels that could contribute to poor growth or fish mortality.

No water was applied to CDPR riparian restoration areas adjacent to the south arm of the lagoon during this period, and very little (0.06 acre-feet) was applied from the CDPR “Cal-Trans” well the previous year. Also, no water was pumped from the CDPR “Highway 1” well into the South arm of the Lagoon during this RY, and only 0.03 acre-feet of water was added to the lagoon from this well during the previous RY.

During April of last RY, the District began to report and graph lagoon levels in both NGVD

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1929 and the newer sea level topographic datum, NAVD 1988, that was adopted by the USGS in 1991. Most government agencies are shifting to the use of this newer datum. Lagoon elevation summaries starting this RY will be given in NAVD 1988. The difference between these older and newer sea level datums at this location along the California coast is +2.74 feet.

District staff did not provide any ongoing support to the Carmel River Lagoon Technical Advisory Committee (CRL-TAC) in this RY, regarding Monterey County Resource Management Agency (MC-RMA), Public Works (RMA-PW) management of the sandbar that forms each year between the lagoon and the ocean. The CRL-TAC remains operational in concept, but no further meetings were held during the last five RYs. Lagoon water levels can fall to less than five feet elevation (NAVD 1988, measured in the south arm) when the beach breaches in the middle. NMFS and CDFW have indicated that an elevation from four to ten feet at NGVD 1929 (equivalent to approximately seven to thirteen feet at NAVD 1988), depending on the time of year and life cycle needs of steelhead, would be an optimal management target to benefit steelhead rearing.

The lagoon was last connected to the ocean on a continuous basis last RY on March 31, 2015, when RMA-PW closed it mechanically. Lagoon elevations remained above the minimum target of 6.74 feet only through July 12, 2015. Lagoon levels never got lower than approximately 5.5 feet throughout the summer and fall of 2015. Wave over-wash events raised lagoon levels multiple times between October 3, 2015, and December 22, 2015 by up to two feet, each time. Lagoon elevation peaked at around 10.75 feet on December 11, 2015. RMA-PW took action to manage the lagoon on January 9, 2016, by sculpting a 60' by 60' outlet channel between the ocean and the lagoon at approximately 13.75 foot elevation. They let lagoon levels rise and water entered the outlet channel to initiate a breach on January 11, 2016. During the remainder of RY 2015-2016 until final mechanical lagoon closure by the county on June 13-14, 2016, the lagoon's water volume varied from approximately four to occasionally as high as nine to eleven feet. The lagoon closed at approximately 8.5 feet then declined to approximately 7.5 feet by the end of June 2016. The lagoon was open to the sea 80% of the time on 106 days of the 132-day period, between January 11, 2016 through May 22, 2016.

The lagoon was closed 71% of the time in this RY. Flow past the Highway 1 Gage to the lagoon ceased on July 8, 2015. The first rains of the year finally pushed flow back to Highway 1 Gage on January 7, and the lagoon opened on January 11, 2016. Winter rainstorms sufficient to sustain flow to the lagoon began on January 19, and sustained flow over 140 cfs through the end of the month. The first large winter storms of the RY reached a peak mean daily flow of 714 cfs on January 20, 2016. Flows declined through February, 2016, other than a two-day storm on the 19th-20th. The next major winter storms came twice in the first half of March, each with daily mean flows of over 1,000 cfs. River flows steadily declined from there on through the cessation of flow on July 13, 2016 (in the next RY). Thus flows during this current RY occurred for a total of only 189 consecutive days (52% of the time) past Highway 1 and into the lagoon.

The District continues to seek another participating agency to take over leadership of the CRL-TAC and chair the meetings, but the District will continue to provide the same level of staff support. The CRL-TAC meets as needed concerning management of the Carmel River lagoon

and beach. As described above, the CRL-TAC did not meet during the last five RYs. The District is no longer actively pursuing funding to implement *Final Study Plan for the Long-Term Adaptive Management of the Carmel River State Beach and Lagoon* (April 17, 2007), as no applicable source of funding was secured during this or the prior RY. The District is instead supporting analysis, permitting, and development of the Ecosystem Protective Barrier Project being advocated by the Carmel River Watershed Conservancy (CRWC) and pursued with grant funding acquired by the CRWC and provided to MC-RMA.

During the 2008-2009 RY, CDPR finalized its *Mitigated Negative Declaration for the Carmel River Lagoon Water Elevation Adaptive Management*, and acquired separate State and Federal permits for the closure of the lagoon in the spring to maximize habitat volume. However, due to State budgetary constraints, CDPR is no longer able to implement the permitted actions, and has not for the last six RYs. CDPR continues to recommend that another agency with appropriate jurisdiction and funding take over the lagoon closure process, and the MC-RMA/RMA-PW have in effect informally done so since 2011.

The MC-RMA is the parent county agency for RMA-PW. MC-RMA is now pursuing separate long-term State and Federal permit applications for lagoon breaching by RMA-PW. This is the fifth RY where MC-RMA and RMA-PW had most of the permits necessary for all their actions.

B. Expand Long-Term Monitoring Program

Description and Purpose

Long-term monitoring of the lagoon and its associated plant communities provides data that can be used to evaluate the wetlands' response to groundwater pumping. The purpose of the monitoring is to: (1) determine if changes in hydrology or plant species distribution and coverage are occurring due to the removal of groundwater upstream, and (2) implement additional mitigations if pumping-induced changes to hydrologic characteristics or vegetation are identified. The Mitigation Program calls for extensive studies such as vegetation mapping and soil surveys to occur every five years. In practice, lagoon vegetation has been monitored annually from 1995 through 2005, and nearly every other year thereafter, except 2011 when lagoon water levels were too high in summer to do so. This monitoring resumed in 2012. Saturation-paste conductivity of soils in the vicinity of the vegetation-monitoring stations was measured annually from 1995 through 2004. Wildlife surveys have not been conducted since 2010. Bathymetric surveys continue to be conducted each year.

Implementation and Activities during 2015-2016

The District has historically conducted three types of long-term lagoon monitoring activities, only two of which were completed this RY:

- Vegetation Surveys

- Topographic Surveys and hydrology
- Wildlife Surveys [last completed in 2010]
- **Vegetation Monitoring** – The same monitoring stations that were established in 1995 were sampled annually between 1995 and 2005, and then every other year until 2009, as the Allocation EIR only called for this monitoring to occur every two years. In July and August of 2011 the water level in the lagoon were too high to monitor the stations, except for very brief intermittent periods early in July. Therefore, vegetation monitoring did not occur in 2010 or 2011, but resumed in July 2012 and August 2014. In July and August of 2016, water levels were again too high to monitor the stations early in July, and the air quality was so bad the days that the monitoring was scheduled to occur due to the Sobranes wildfire in the Santa Lucia Mountains that staff made a decision to postpone the event till 2017.

The report, *Biologic Assessment of the Carmel River Lagoon Wetlands*, prepared for the District by the Habitat Restoration Group in 1995, provides a detailed description of the methodology employed. Ten pairs of quadrats were intentionally located along transects at lower elevations of the wetlands because it is anticipated that changes in the vegetative community would first become apparent in these habitat types. The north side was emphasized because of disturbances on the south side associated with the creation of the Cal-Trans Carmel River Mitigation Bank and subsequent restoration of the former Odello artichoke field.

No dramatic changes in vegetation were observed between the summers of 1995 and 2009, although the drier conditions experienced from Water Year 2012 through 2014 have produced a different gestalt in portions of the wetlands. Subtle differences in vegetative cover between years may be explained by slightly different sampling dates each year, made necessary by variations in the hydrologic regime from one year to the next, rendering some low-lying quadrats inaccessible until later in the season. The timing, magnitude and direction of wave action, runoff, and breaching of the sand bar at the mouth of the lagoon affect the duration of standing water in some of the lower-lying monitoring sites. The diversity and abundance of forbs in some lower lying quadrats and transects noticeably dropped from 2009 to 2014, while more salt-tolerant species such as salt-grass appear to becoming more dominant. However, there are exceptions, and it is too early to draw conclusions based on the limited data available. For example, some Obligate Wetland plants have declined along some transects, while increasing along other transects. Emergent species, such as pickleweed and silverweed take a while to appear following extended periods of inundation. They were missing from Transect #1 in 2012, which was monitored less a week after inundation, but showed up again during vegetation monitoring in 2014 at a time when the transects had not been inundated for nearly three months. Pale spikerush, an obligate wetland species categorized as a freshwater marsh plant, dropped out of four quadrats in 2014, but reappeared in one other quadrat where it was missing in 2012. Salt grass, a facultative wetland species characteristic of salt marshes, noticeably spread in three quadrats, decreased in abundance in two others, and completely dropped out of two other quadrats from 2012 to 2014.

A more detailed discussion of the results of past vegetation monitoring is presented in the 2005 Mitigation Program Report. Data gathered thus far suggest that factors favoring freshwater species over salt tolerant species may be occurring. Determining whether changes are

attributable to water management practices upstream as opposed to the timing of monitoring, beach breaching, variation in hydrologic regimes or global weather dynamics are more complex questions. Review of the available data has not identified significant changes from one monitoring event to the next. Nor have strong relationships between species composition or distribution and water management practices been identified. Staff anticipates continued monitoring of the wetlands every other year in the future to provide evaluation of long-term trends.

- **Topographic Surveys and Hydrologic Monitoring** -- During the period covered in this report, District staff surveyed four cross sections to track the movement of sediment in the lagoon, continued to maintain a water-level recorder and support an Automated Local Evaluation in Real Time (ALERT) station at the south arm, and measured groundwater elevations in three wetland piezometers that were installed in May 1996. There is a good correlation between surface-water elevation and water elevation in the piezometers. Staff also continues to track surface discharge into the lagoon at the Highway 1 gaging station, and water production upstream of the lagoon.

- **Wildlife Monitoring** – Birds are often used as indicators of the suitability of an area for wildlife because they tend to be easier to identify and count than other creatures. By tracking the species diversity index at a specific location over time, scientists are able to infer if changes have occurred that may affect the area’s dependent wildlife. In the past, District staff contracted with the Ventana Wilderness Society and Big Sur Ornithology Lab (BSOL) to conduct avian point count surveys in the riparian corridor of the Carmel River at sites from Carmel Valley Village to a point just upstream of the lagoon. The District carried out this program from 1992 through 2010 on a regular basis. However, due to budget constraints, the avian point counts are carried out less frequently, with the last one occurring in 2015.

Avian monitoring specific to the lagoon was last carried out by the District at sites near the lagoon at the mouth of the Carmel River in the summer of 2004. Sampling in the vicinity of the lagoon was subsequently carried out by the CDPR from 2005-2008, when monitoring ceased due to ongoing budget constraints.

Special Studies during 2015-2016

- **Steelhead Population Monitoring**

MPWMD applied for and acquired ESA Section 7 coverage starting in 2009 to conduct a mark-recapture study as part of its semi-annual renewal of staff Scientific Collecting Permits from CDFW. These have been replaced by the agency’s “entity” permit annually through 2017. No winter 2015-2016 population censuses were conducted this RY due to the drought conditions creating low lagoon levels, sometimes with poor water quality, where the sampling may have had an extremely detrimental effect on any steelhead remaining in the lagoon. Spring population surveys were not conducted due to high lagoon elevations and depths right after closure. By the time lagoon depths were shallow enough for sampling, water quality was marginal, so the effort was forgone for this RY.

C. Identify Feasible Alternatives to Maintain Adequate Lagoon Volume

Description and Purpose

The purpose of this mitigation measure is to determine the volume required to keep the lagoon in a stable condition that can adequately support plants and wildlife. It is envisioned that alternative means to achieve and maintain the desired volume will be compared, and the most cost-effective means selected. One alternative that may achieve these goals is the development of a water supply project that can reliably provide more water to the Monterey Peninsula and result in reduced diversions from the Carmel River; however, few other feasible alternatives have materialized in spite of extensive evaluation. MPWMD staff previously estimated that approximately 8 cfs, or about 16 acre feet per day (AFD), can percolate through the barrier beach when the outlet is closed and lagoon water levels are stable at relatively high elevations (8 – 9 feet). This seepage rate was determined utilizing continuous streamflow data from the Carmel River at Highway 1 Bridge gaging station and the 1997 lagoon stage volume relationship over the 1991-2005 period. However, in May and June 2009, following the manual lagoon mouth closure on May 18, 2009, streamflow and lagoon storage data showed that 12 cfs or 24 AFD percolated through the beach berm and into the surrounding wetlands (based on an updated 2007 lagoon storage table). It is postulated that increased infiltration capacity of the lagoon may be due to a combination of the excavation of an outlet channel to the south, the two South Arm excavations in 2004 and 2007, and that the manual lagoon mouth closure results in a higher water surface elevation than was typical of the 1991-2005 period. A higher water surface elevation likely results in flow through the outlet channel that then percolates into the beach. This volume of water passing through the beach is significant, and is equivalent to about two-thirds of the daily Carmel River diversions historically needed to meet a portion of the municipal demand of the Monterey Peninsula during the summer. No treated water from the CAWD was added to the lagoon in this RY. There were concerns about the effects the recycled CAWD water might have on water quality in the lagoon that might affect both juvenile steelhead and red-legged frog habitat values so the action has ceased until impact evaluations could be completed. Those studies have been suspended indefinitely (see **Section XVIII-A** above). No water from an existing agricultural well was added to the lagoon in this RY. Determination of desirable lagoon volume will be conducted in conjunction with the monitoring studies noted above and the findings of the Lagoon Enhancement Plan. Development of feasible alternative means to provide adequate volume to sustain healthy lagoon habitat throughout the dry season continues to be sought by the District.

Implementation and Activities During 2015-2016

District staff continued the annual survey of four key lagoon cross sections (**Figure XVIII-1**) to track changes in the volume of sand in the active portion of the lagoon over time. An initial survey of the four cross sections was conducted in January 1988. Subsequent annual surveys have been conducted beginning in September 1994 through the present. Sedimentation in the lagoon is a concern because the Carmel River as a whole has taken on an increased load of sand from Tularcitos Creek and other drainages following the El Niño winter of 1998. However, it appears at this time, the majority of the sediment deposited along the Carmel River in 1998 has washed through the Carmel River system and lagoon, and has subsequently reached the ocean.

These four key cross sections provide a quantitative means to evaluate whether or not lagoon volume is changing significantly over time. The dynamic nature of the lagoon substrate is evident in **Figure XVIII-2**, which shows the results of the annual surveys conducted since 1994.

In August 2016, staff completed the annual surveys of cross sections (XS) 1-4. In Water Year 2016, approximately 44,923 acre-feet (AF) of streamflow passed through the lagoon as measured at the District's Carmel River at Highway 1 Bridge (HWY 1) gage, and classified as a "Below Normal" year. The highest peak streamflow of WY 2016 was 1,690 cfs on March 6, 2016, recorded at the District's HWY 1 gage. With the exception of continued right bank scour at XS 4, and minor scour within mid-XS 1, lagoon substrate elevations at the cross sections remained essentially unchanged since the 2015 surveys (**Figure XVIII-3**).

Review of the entire cross sectional data set (**Figure XVIII-2**) shows that the August 2016 lagoon substrate elevations for XS 1-3 are well within the range of previous surveys, indicating no clear trend of either sand depletion or accumulation at the cross sections. However, XS 3 and XS 4 data indicate that the right bank substrate elevation is close to the lowest ever since 1994 (XS 3 station 200 feet, and XS 4 station 130 feet, respectively). This is consistent with the steady loss of streambed material at the Highway 1 Bridge gaging station (and along reaches for several miles upstream) that has been occurring since 2006, suggesting a limited sand supply in the Lower Carmel River at this time. In addition, it should be noted that at elevation 10-feet (NGVD 29 datum) the lagoon backwater zone now extends approximately one quarter mile upstream of the Highway 1 Bridge to the eastern margin of the Crossroads Shopping Center as a result of continued down-cutting of the stream channel.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

The District continues to support and encourage the ongoing habitat restoration efforts in the wetlands and riparian areas surrounding the Carmel River Lagoon. These efforts are consistent with goals that were identified in the Carmel River Lagoon Enhancement Plan, which was partially funded by the District. The District continues to work with various agencies and landowners to implement ongoing restoration of the Odello West property and future restoration of the Odello East property across the highway. Because of the restoration activities on the south side of the lagoon, the District has concentrated its monitoring efforts on the relatively undisturbed north side. Staff also continue to meet and discuss with other agencies the ongoing use of an existing CDPR agricultural well.

The District expanded its long-term monitoring around the lagoon in 1995 in an attempt to determine if the reduction in freshwater flows due to groundwater pumping upstream might change the size or ecological character of the wetlands. Demonstrable changes have not been identified. Because of the complexity of the estuarine system, a variety of parameters are monitored, including vegetative cover in transects and quadrats, water conductivity, and hydrology. It is notable that due to the number of factors affecting this system, it would be premature to attribute any observed changes solely to groundwater pumping. During the 22-year period to date, for example, there have been two *Extremely Wet* (1995 and 1998), two *Wet* (2005, 2006), five *Above Normal* (1996, 1997, 2000, 2010 and 2011), five *Normal* (1999, 2001, 2003, 2008 and 2009), two *Below Normal* (2004 and 2016), four *Dry* (2002, 2012, 2013 and 2015), and two *Critically Dry* (2007 and 2014) Water Year types in terms of total annual runoff.

Thus, the hydrology of the watershed has been wetter than average 41% of the time, and at least normal or better 64% of the time during that 22 year period. However, monitoring in 2014 occurred during a Critically Dry Water Year that followed two consecutive Dry Water Years, and 2015 was the first time a fourth year of drought was ever monitored. Other natural factors that affect the wetlands include introduction of salt water into the system as waves overtop the sandbar in autumn and winter, tidal fluctuations, and long-term global climatic change. When the District initiated the long-term lagoon monitoring component of the Mitigation Program, it was with the understanding that it would be necessary to gather data for an extended period in order to draw conclusions about well production drawdown effects on wetland dynamics. It is recommended that the current vegetation, conductivity, topographical and wildlife monitoring be continued in order to provide a robust data set for continued analysis of potential changes around the lagoon. The District has also budgeted to reactivate the CDPR lagoon water-quality profiler that has been out of service for four years, under an interagency MOU. Continuous data at the CAWD pipe site should begin to be acquired again during the next RY.

Lagoon bathymetric cross sectional surveys, initially conducted in 1988, have been completed annually during the dry season since 1994. These data are useful in assessing changes in the sand supply within the main body of the lagoon and are necessary to answer to questions concerning whether or not the lagoon is filling up with sand, thus losing valuable habitat. As indicated in the survey plots, the sandy bed of the lagoon can vary significantly from year to year. In general, no major trends indicating sand accumulation or depletion at the lagoon cross sections have been identified based on available data, with the exception of the upstream-most cross section (XS) 4, which exhibits an overall loss in sand volume over the 1994-2013 period. The sand loss or down-cutting observed at XS 4 is consistent with the pervasive down-cutting that has occurred along the thalweg of the Lower Carmel River (LCR) upstream of the Highway 1 Bridge for several miles. The trend of LCR streambed scour appears to have begun in Water Year 2006. In addition, now that annual cross-sectional data have been collected in two Critically Dry years (WY 2007 and 2014) and two Dry years (WY 2012 and 2013), it is concluded that substrate elevations at the cross sections generally do not change in these low-flow years, despite the regular occurrence of major lagoon mouth breaches in all of these years, except WY 2014. Accordingly, the multi-year cross-sectional data set (21 years) indicates quantity of streamflow as the primary factor that controls substrate changes at the key cross sections.

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Figure XVIII-1
Map of Monitoring Transects and Stations at Carmel River Lagoon.

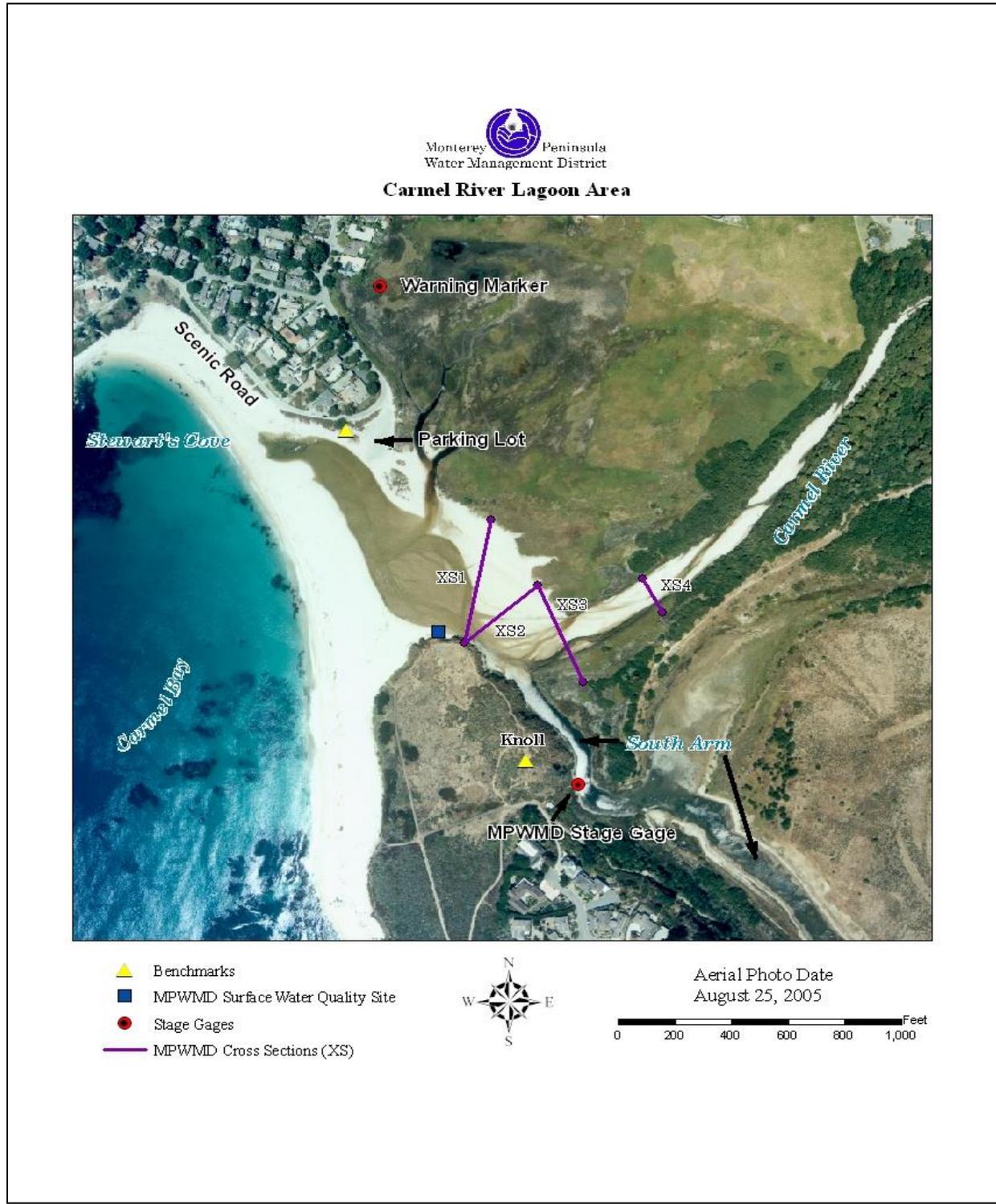


Figure XVIII-2
Carmel River Lagoon Cross Sections 1 through 4, based on Annual Surveys 1994-2016

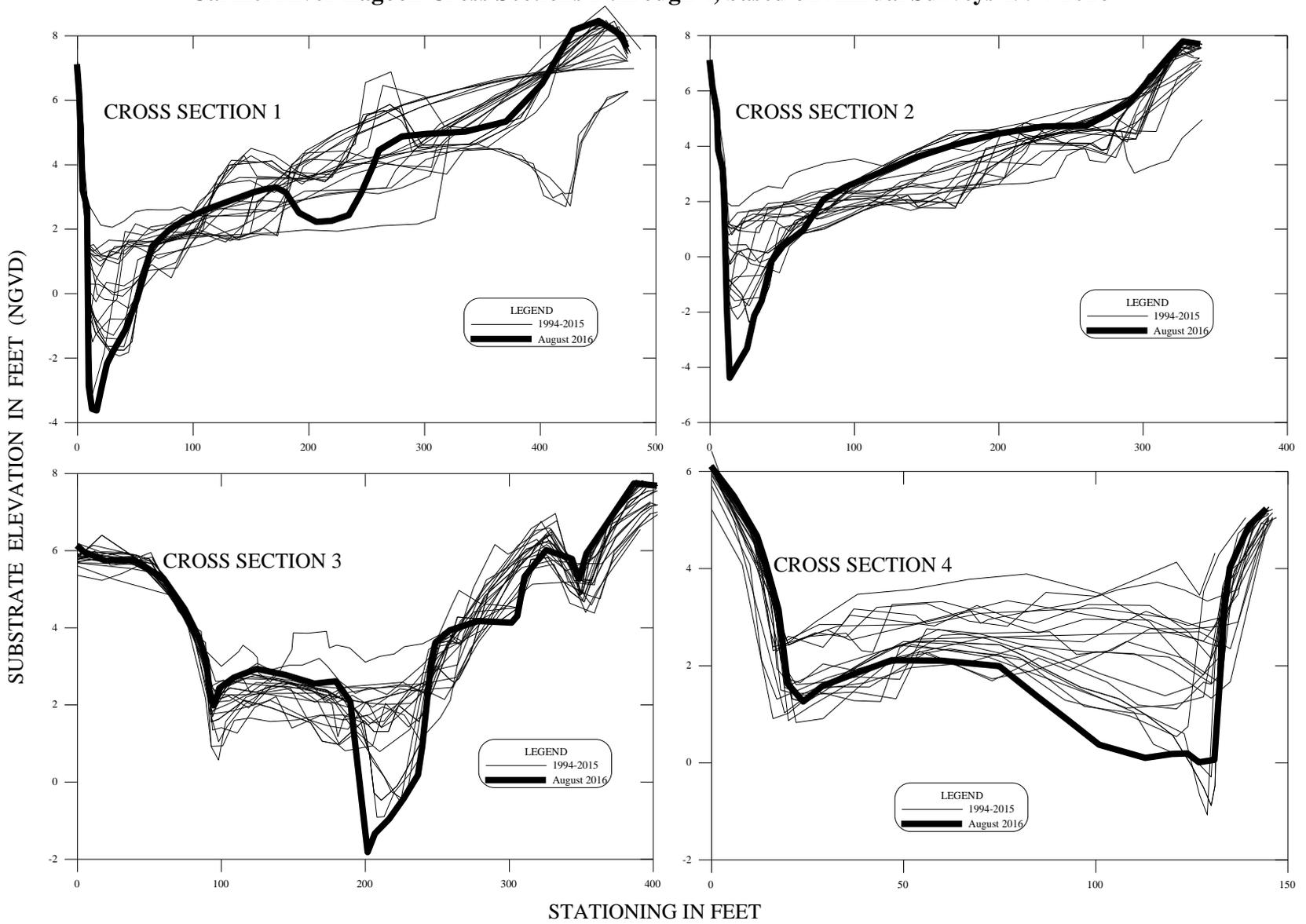
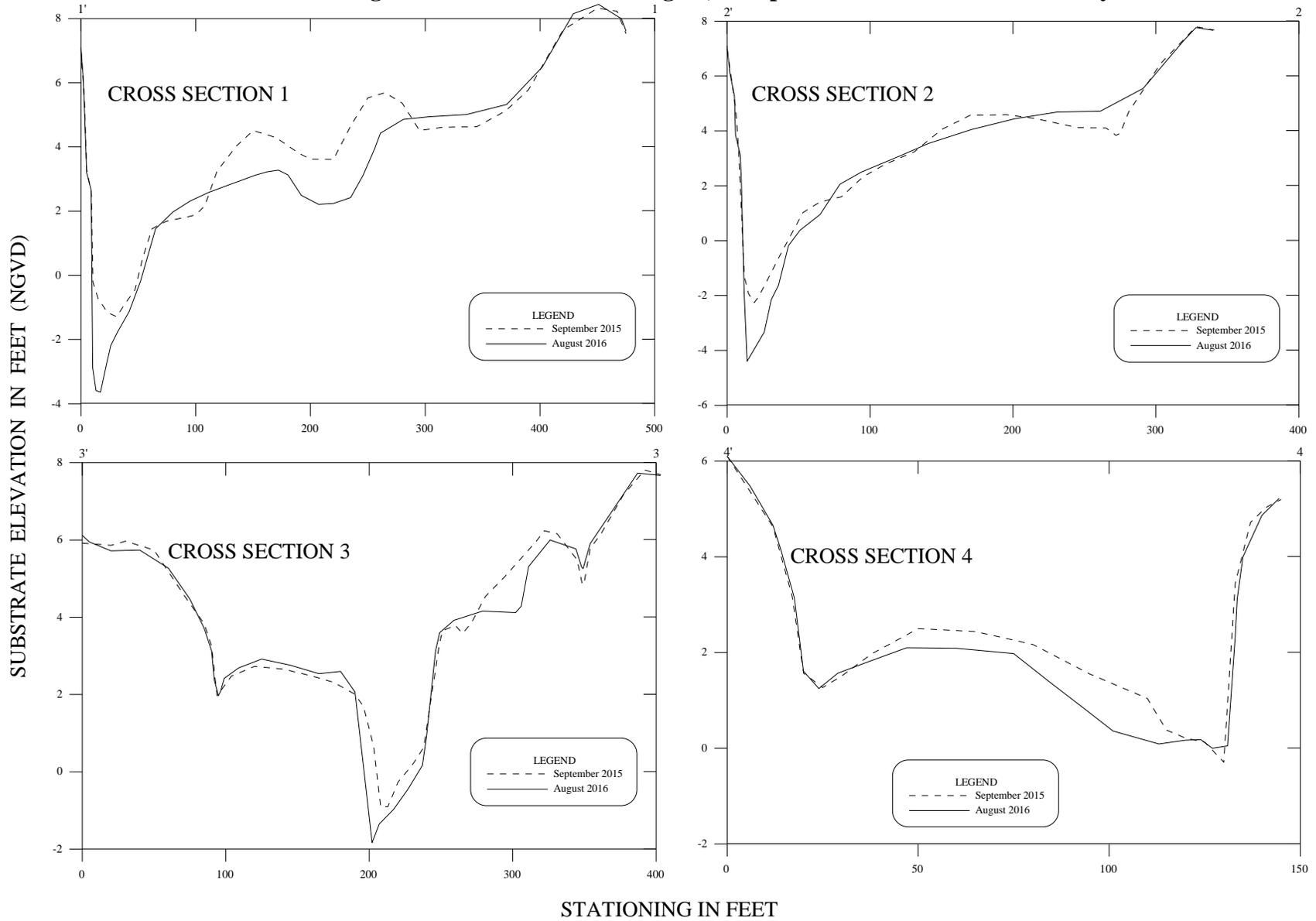


Figure XVIII-3
Carmel River Lagoon Cross Sections 1 through 4, Comparison of 2015 and 2016 Surveys



XIX. AESTHETIC MITIGATION MEASURES

The Findings for Adoption of the Water Allocation Program Final EIR identified one mitigation measure to reduce aesthetic impacts along the Carmel River associated with riparian vegetation – that is, to implement the riparian habitat mitigation measures described above in Finding No. 393. Accordingly, please refer to **Section XVII** for information on riparian mitigation activities during the period from July 2015 through June 2016.

XX. SUMMARY OF COSTS FOR MITIGATION PROGRAM, JULY 1, 2015 THROUGH JUNE 30, 2016

Mitigation Program costs for FY 2015-2016 totaled approximately \$2.27 million including direct personnel expenses, operating costs, project expenditures, capital equipment, and fixed asset purchases. The annual cost of mitigation efforts varies because several mitigation measures are weather dependent. Expenditures in FY 2015-2016 were \$0.03 million less than the prior fiscal year due to decreases in Mitigation Program costs. However, the overall costs have remained constant (average of \$2.5 million per year) for last five years. In the past, expenditures had trended upward due to expenditures for the Aquifer Storage Recovery (ASR) Project. ASR Project costs are no longer captured under Mitigation Program Costs. FY 2013-2014 expenditures were \$2.41 million; and FY 2014-2015 expenditures were \$2.30 million.

During FY 2015-2016, revenues totaled \$2.88 million including mitigation program revenues, grant receipts, investment income and miscellaneous revenues. The Mitigation Program Fund Balance as of June 30, 2016 was \$1,065,968.

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Table XX-1

Mitigation Program Cost Breakdown for the Period July 2015 through June 2016

<u>EXPENDITURES</u>	Data				Water			<u>Total</u>
	<u>Collection</u>	<u>Riparian</u>	<u>Fish</u>	<u>Lagoon</u>	<u>Supply</u>	<u>IRGWMP</u>	<u>Admin</u>	
Personnel Costs	\$172,502	\$217,085	\$374,840	\$73,922	\$204,175	\$14,706	\$343,231	\$1,400,461
Operating Expenses	54,693	68,829	118,846	23,438	64,736	4,663	108,824	444,029
Project Expenses	27,989	27,067	273,314	0	0	38,563	0	366,933
Fixed Asset Acquisitions	2,391	47,061	5,195	1,024	2,830	204	4,757	63,461
TOTAL EXPENDITURES	\$257,574	\$360,042	\$772,195	\$98,384	\$271,741	\$58,136	\$456,812	\$2,274,884
<u>REVENUES</u>								
Permit Fees								\$58,161
Mitigation Revenue								2,412,553
User Fees								71,805
Tax Revenues								0
Grant Receipts								334,864
Investment Income								1,594
Miscellaneous								443
TOTAL REVENUE								\$2,879,420
REVENUE OVER EXPENDITURES								\$604,536

XXI. REFERENCES

The following selected references provide additional information about the subjects described in this Annual Report. References are organized by section.

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Section XX. Summary of Costs

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