

IX. STEELHEAD 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. 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 reporting period.

A. Capture and Transport Emigrating Smolts in Spring

Description and Purpose

During spring months, when steelhead smolts are actively emigrating from fresh water to the ocean, the diversion of surface and groundwater from the river often 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 District monitors streamflow, captures emigrating smolts, and transports them to the lagoon or ocean. The goal of this program is to reduce disruption of the steelhead life cycle due to streamflow diversions.

Implementation and Activities During 2006-2007

Between March and June 2007, mean daily streamflow in the Carmel River at the Highway 1 Bridge dropped from 164 to 0 cubic feet per second (cfs). Streamflow was less than 20 cfs by late March and less than 5 cfs by early May (**Figure IX-1**). As steelhead typically need a minimum flow of 20-30 cfs for successful passage, these low flows greatly shortened the normal smolt migration period, and provided generally poor conditions for the emigration of smolts from the lower Carmel River and the Lagoon into the ocean. The river mouth closed in early April due to low river inflow, but was manually reopened in late April to allow kelts and smolts access to the ocean.

- **2007 Downstream Migrant Trapping** - During the spring of 2007, as river conditions for smolt migration worsened, a downstream migrant trap was installed near the Narrows (RM 9.0) to catch out-migrating smolts and kelts, as well as young-of-the-year (YOY) fish, before they moved downstream into the drying river. Trapping was conducted from April 18 to May 31, 2007. Trapping results include: 264 smolts, 4,034 juvenile and YOY fish, seven kelts, two adult carcasses, and 21 mortalities (**Table IX-1**). Other species present, but not enumerated were stickleback, hitch, sunfish, sculpin, pacific lamprey, crayfish, toads, bullfrog tadpoles and western pond turtles. All smolts were released into the ocean at Stewarts Cove, and the small juveniles and YOY fish were released upstream into permanent habitat. WY 2007 was the first year smolts had been trapped in the lower river since 1994.

Between 1989 and 2007, 8,553 smolts have been rescued in the Carmel River Basin (**Figure IX-**

2). No smolts needed to be rescued in 2005-2006.

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 during the high-risk period from October through February, if needed. 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 2006-2007

District staff monitored river conditions during the fall and winter months of WY 2006-07. Mean daily streamflow below San Clemente Dam remained fairly constant between about 7 and 10 cfs from October to early December 2006 (see **Figure IX-4**) and did not exceed 20 cfs until early January. Continuous seasonal streamflow returned to the MPWMD gaging station at the Highway 1 Bridge gage on January 11, 2007, but remained below 10 cfs until February 11, 2007 (see **Figure IX-1**). The highest average daily discharge at the Highway 1 gage was only 213 cfs, reached in late February 2007. As a result of the low flows, there was some risk of fish stranding so conditions were carefully monitored throughout the fall and winter, but no rescues of juvenile fish were needed.

C. Rescue Juveniles Downstream of Robles del Rio in Summer

Description and Purpose

About 1.5 miles of habitat between Boronda Road and Robles del Rio and up to nine miles of habitat below the Narrows may dry up, depending on the magnitude of streamflow releases at San Clemente Dam, 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 (if it is available), and/or rearing juvenile steelhead at the SHSRF, located just downstream of San Clemente Dam, if habitat is not available.

Implementation and Activities during 2006-2007

- **MPWMD Annual Rescue Totals** – During the 2006 dry season, i.e., July through September 2006, a total of 16,375 steelhead were rescued from the mainstem Carmel River, including 14,935 young-of-the-year (YOY), 1,401 older juveniles, and 39 mortalities (**Table IX-**

2). Results for the 2007 dry season, which started in May and continued through September 2007, will be reported in the next annual report. In comparison to previous rescue seasons, rescues in the 2006 dry season (16,375 fish) were above the average number of steelhead rescued (13,905 fish) from 1989 through 2006 (**Figure IX-3**).

- **CRSA Annual Rescue Totals** – During the 2006 dry season, a total of 4,393 steelhead were rescued from the Carmel River mainstem by Carmel River Steelhead Association (CRSA) volunteers, including 4,113 YOY, 245 older juveniles, 2 adults and 33 mortalities (**Table IX-2**).

- **Mainstem Rescues, 2006 Dry Season** – Late spring storms combined with high water levels in the Carmel Valley Aquifer Subunits 3 and 4 resulted in an extended season of runoff, and the lower river did not begin drying up until July 2006. The surface flow of the Carmel River reached 10 cfs at the Highway 1 Bridge by July 16, 2006. In response to the decline in surface flow, District staff began rescues on July 17, 2006 and efforts continued to September 26, 2006. During these months, staff conducted 36 rescue operations, yielding a total of 16,375 fish.

- **2006 Dry Season, MPWMD Transplant Location** – During the 2006 dry season, all the juvenile steelhead rescued by MPWMD were transported and released into the District's SHSRF (16,375). The mortality of rescued and transported fish was 0.24% (39 fish), which is lower than the 1991-2006 average mortality of 0.61%. This reduction in mortality was probably due to the use of an experienced rescue crew, use of block nets to reduce electrofishing exposure, improved transport techniques, and more favorable environmental conditions during the rescue process.

- **2006 Dry Season, CRSA Transplant Location** – During the 2006 dry season, juvenile steelhead rescued by CRSA were transported and released in the Carmel River Lagoon. The mortality of rescued and transported fish was 0.75% (33 fish).

- **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 includes a diversion and pump station, two large circular tanks, an 800-foot long rearing channel, electrical, water, pressurized air and drainage systems, a office/shop/lab building and miscellaneous equipment.

Additional upgrades and modifications were made to the Facility between 2000 and 2003. These improvements included: 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 add an additional backup mechanism. If the river pumps were to fail, the channel would hold more water longer, giving staff more time correct the problem without fish loss.

Facility Modifications in Reporting Year 2006-2007 – Eight 250-gallon insulated rearing troughs

were installed in the spring of 2007. These rectangular, flow-through troughs replaced a defunct 22-foot diameter tank. These tanks can be used to rear small rescued fish, for additional quarantine treatments, or for growth and survival experiments.

Summary of 2006-2007 SHSRF Fish Stocking and Releases - Steelhead rescues began on July 17, 2006, and the first fish were brought to the Facility. Between July 17 and September 5, 2006, staff received approximately 16,418 rescued fish at the Facility. After being treated for parasites in quarantine, the fish were stocked in eight-foot rearing tanks, and the rearing channel at the Facility, including approximately 11,480 young-of-the-year (YOY) and 4,938 medium to large sized yearling fish (**Table IX-3**).

During the six and one-half month holding period, 36% of the Facility's fish died as a result of disease, stress, or generally poor health. There was only 20% unaccounted for mortalities (**Table IX-3**), due to the installation of new weirs that divided the channel into 17 separate sections, thus keeping the large, aggressive fish from preying on the small fish.

During January and February 2007, 7,192 fish were released from the Facility back into the Carmel River at five locations (**Table IX-4**). Largely due to the need for rapidly releasing fish from the rearing troughs affected by poor water quality (high turbidity from storm run-off), small, non-smolting fish were released above River Mile (RM) 10.5, primarily in the reach around the Facility and in Garland Park. Thirty percent of the fish were large or smolting, from both the tanks and rearing channel, and were released in the lagoon. Most fish were in excellent physical condition, and many had grown quite large.

The overall survival rate of fish held at the Facility in 2006 was 44%, equaling the Facility's 10-year average. While not as high as the 2005 survival rate, due to recurring bouts of bacterial infection in the rearing channel, the 2006 survival is still favorable when compared to the survival of wild fish in the lower Carmel River, and shows that the combination of the cooling tower, quarantine protocol, feeding regime, and naturalistic habitat in the rearing channel is successful in rearing wild-caught juvenile steelhead.

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 San Clemente Dam, (2) surveys of winter steelhead redds, and (3) surveys of the juvenile steelhead population in freshwater at the end of the dry season in October.

- **Winter Steelhead Adult Run** — The automatic fish counter and related equipment were reinstalled at San Clemente Dam on February 10, 2007, and operated continuously from that date until April 2, 2007. At that time, low flows did not allow a sufficient amount of water into the ladder to operate the counter properly. District staff removed the fish counter to allow migrating steelhead to pass unobstructed. Staff repositioned the video monitoring equipment in order to observe fish jumping the counter bay. These video data are still under review and an updated count will be reported as soon as possible.

As of April 2, 2007, a total of 222 fish passed over the counter, including 63 in February, 157 in March, and two in April (**Figure IX-4**). The Carmel River Lagoon did not breach until February 2007, resulting in zero adult fish passing the counter in January and early February. The 2007 run was less than half the 1994-2007 average of 471, and about 25 percent of the recent peak run of 804 fish in 2001 and 861 fish in 1998 (**Figure IX-5**). Of particular concern is the trend since 2001 as the run has declined in five of six consecutive years. This six-year decline raises serious questions about whether habitat conditions in the river and survival rates in the ocean are now less favorable for steelhead.

- **Winter Steelhead Redd Surveys** – Since 1994, the District has periodically conducted winter steelhead redd (nest) surveys downstream of Los Padres Dam. Originally, these surveys were part of the District’s spawning habitat restoration project to track how many adult fish actually 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 (RM 3.2) to Los Padres Dam (RM 24.8). Due to low numbers of adult fish in January and February 2005 and 2006, high river flows throughout most of the winter that precluded wading most river reaches, and large late storms that effectively “erased” existing redds, no redd surveys were conducted in the mainstem of the Carmel River in 2005-06.

Summary of 2006-2007 Redd Surveys: Runoff during WY 2007 was critically-dry, and the Carmel River Lagoon did not open until mid-February 2007. Due to time and river condition constraints, only one thorough survey pass was completed in mid-March 2007 between the Highway 1 Bridge (RM 1.1) and San Clemente Dam (RM 17.5). Overall, 210 redds, seven adult spawning pairs, 50 single adults, four kelts, and four carcasses were counted. Few smolts and juvenile fish were seen and no fry had emerged from the gravel yet. Of these overall totals, 39 redds and 30 adults were observed downstream of the Narrows (RM 9.0). This observation is significant due to the critically-low river flows in the spring and early summer months in 2007 that might have jeopardized the survival of eggs and fry in exposed redds and trapped those adults trying to migrate up or downstream. In addition, the fry that did survive had to be rescued at a very small size early in the season.

No redd surveys were completed above SCD or in the tributaries in 2007.

- **Juvenile Population Surveys** - Since Fall 1990, the District has surveyed the juvenile steelhead population in the Carmel River below Los Padres Dam. 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 October 2006, the population was surveyed at eleven stations in a 16.7-mile reach between the Red Rock area in mid-Carmel Valley and Los Padres Dam, including two sites in the San Clemente Reservoir (SCR) inundation zone. In this reach, the juvenile steelhead population density averaged 0.83 fish-per-foot of stream (fpf) and ranged from 0.28 fpf in the Upper SCR Inundation Zone (RM 19.6) to 1.65 fpf at the Lower SCR Inundation Zone Station (RM 19.0) above San Clemente Dam (**Table IX-5**). This surprising result of the highest and lowest fish densities being only a half-mile apart, demonstrates the variable and changing nature of the habitat in the inundation zone. In 2005, the Lower SCR Inundation Zone station had the lowest fish density. The overall average 2006 population density was about the same

as the long-term (1990 - 2006) average density of 0.85 fpf, but was well below the 2005 density level of 1.15 fpf (**Figure IX-6**). Perhaps the most surprising 2006 result was the 0.37 fpf density at the Stonepine Site, far below the site average of 1.02 fpf and the lowest since 1998. The reason for this finding is unclear since both river flow and food availability (BMI) appeared adequate for fish survival. The DeDampierre, Upper SCR Inundation Zone, and Cachagua sites also had much lower fish densities in 2006 compared to 2005 and their long-term averages. The Red Rock, Sleepy Hollow, and the Lower SCR Inundation Zone stations all had much greater densities of fish than their long term averages.

- **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 wells 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.

During the 2006 dry season, this mode of operation and flow releases from San Clemente Reservoir resulted in approximately 2.2 miles of additional viable aquatic habitat. Based on estimated population density at the Scarlett and Lower River sites (see **Table IX-5**), this habitat produced about 17,519 additional juveniles, representing 32% of the total juvenile population downstream of San Clemente Dam (**Figure IX-7**). This is the highest percentage since these statistics were first collected in 1993, and is 206.5% of the long term average of 15.5% for 1993 – 2006. It illustrates the great value of rewetting habitat below Robinson Canyon Road on a year-round basis.

F. Other Activities Related to the Steelhead Resource

The District carried out several activities in RY 2007 that were not required 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 rescue and transportation of kelts, spawning habitat monitoring, and assessment of the benthic macroinvertebrate communities.

"Kelts" are adult steelhead that spawn from January through March, 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 most years, especially when the upstream migration of adults is delayed due to late-season storms. District staff rescue and transport these fish to more stable waters, when needed.

In November 2000, the District began a bioassessment program using benthic macroinvertebrates (BMI) as an indicator of water and habitat quality at four locations between Los Padres Dam and the Red Rock steelhead population survey site. In 2004, a new site above Los Padres Reservoir was added. The above Los Padres location can be used as a reference site to compare "pristine" habitat to habitat below the dams, and that of the lower, developed valley. Results from the BMI analysis can be used as an indicator of water quality and food quantity and quality for juvenile steelhead, both amongst the sites and over time. Low BMI abundance may be attributable to

poor substrate quality (e.g., little available gravel or filled-in interstitial spaces [embeddedness]), high levels of suspended particulates/turbidity, poor oxygen concentrations or high water temperatures. Following CDFG's California Stream Bioassessment Procedure (CSBP), BMI samples are collected from each site in the fall and sent to a laboratory for analysis. A three-year summary report on the District's bioassessment program was completed in June 2005.

In addition to the bioassessment program, the District also began detailed monitoring of substrate conditions at its juvenile steelhead population survey sites in 2000. Substrate size distribution and embeddedness are analyzed and compared over time and space at each location. Substrate size and embeddedness affect both steelhead spawning and rearing success, as well as the presence and abundance of BMI that fish feed on.

Implementation and Activities in 2006-2007

- **Rescue and Transportation of Kelts** - Normally, steelhead kelts migrate downstream in late spring through June. Outflow to the ocean ceased in July 2006, therefore staff expected few, if any, adult fish in the lower river early in the 2006 rescue season. No kelts were found or rescued during the season.
- **California Stream Bioassessment Procedure** - During RY 2007, District staff collected benthic macroinvertebrate (BMI) samples in Fall 2006 from five locations between above Los Padres Dam and CAW's Begonia Treatment Plant at mid-Carmel Valley. The four sites below LPR coincide with District steelhead population survey stations. The above LPR site is near a CDFG steelhead population survey site.

Of the five composite site samples, 2,521 BMIs were processed comprising 61 taxa. Three species of mayflies comprised 29% of the taxa above Los Padres. *Baetis* mayflies were the most dominant species at the Los Padres, Cachagua, and Stonepine sites. *Simulium* (black fly larvae) dominated Sleepy Hollow, and Red Rock had a high percentage of caddisfly larvae (55%).

Results from 2006 showed lower abundance of BMI at all four sites below Los Padres Dam compared to 2005 (**Table IX-6**). The above Los Padres site had the greatest taxonomic richness, and a high percentage of intolerant organisms (those that are highly intolerant to water and/or habitat quality impairment), but very low abundance. The Red Rock site had the highest abundance and the greatest biovolume due to the presence of large hydropsychid caddisflies in the sample. Paradoxically, the Red Rock site had the highest percentage of intolerant organisms, and the second highest percentage of tolerant organisms (behind Cachagua). In 2006, the Sleepy Hollow site had higher diversity than in 2005, but the biovolume was 2.4 times lower than in 2005.

- **Carmel Lagoon Water Quality Monitoring** – The District continued to monitor lagoon water quality by taking depth profiles of the lagoon at five sites on a monthly basis in 2006-2007. In RY 2007, lagoon data were collected in all months except February and March, when the river was flowing and conditions were too dangerous to conduct the sampling. The raw data and associated graphs have been shared with the Carmel River Lagoon Technical Advisory Committee.

- **Development of a Rescue and Rearing Management Plan for the SHSRF** – The District has had a Section 10 Permit application on file with NOAA Fisheries for a number of years. In RY 2006-2007, the District continued to develop the “Rescue & Rearing Management Plan” (RRMP) for the SHSRF and the District’s rescue operations as required by NOAA for any fish rearing facility to receive a Section 10 Permit. District staff continued to meet with representatives of NOAA Fisheries, the California State Department of Fish and Game, aquaculturist Dave Streig of the Monterey Bay Salmon & Trout Project’s Big Creek Hatchery, and Mr. Bob Zampatti of the Carmel River Steelhead Association (CRSA) to develop initial drafts of the plan. The final draft of the RRMP is scheduled for completion by June 2008.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

Monitoring conducted by the District shows that the Carmel River steelhead population recovered from remnant levels that prevailed as a result of the last drought and past water supply practices. Since 1992, the spawning population has recovered from a handful of fish to levels approaching 900 adults per year as counted at San Clemente Dam. In the past six years, the spawning population has trended downward from 804 fish in 2001 to 222 fish in 2007. Monitoring of the juvenile population at several sites along the mainstem Carmel River below Los Padres Dam shows that the population is recovering from low densities during the 1989-91 drought period (ranging below 0.50 fish per foot [fpf] of stream) to levels frequently ranging above 1.00 fpf, values that are typical of well-stocked steelhead streams. In the 2006-2007 reporting period, the average population density was equal to the long-term average for the Carmel River. District staff believes the recovery and fluctuation of steelhead in the Carmel River Basin is directly related to the following factors:

- Improvements in streamflow patterns, due to favorable natural fluctuations, exemplified by relatively high base flow conditions since 1995;
- The District’s and the SWRCB rules to actively manage the rate and distribution of groundwater extractions and direct surface diversions within the basin;
- Changes to Cal-Am’s operations at San Clemente and Los Padres Dams, providing increased streamflow below San Clemente Dam;
- Improved conditions for fish passage at Los Padres and San Clemente Dams due to physical improvements;
- Recovery of riparian habitats, tree cover along the stream, and increases in woody debris, especially in the reaches upstream of Robinson Canyon and in the lower valley;
- Extensive rescues (and rearing) by MPWMD of juvenile steelhead over the last ten years, now totaling 250,297 fish through December 31, 2006; and by the transplantation of the younger juveniles to viable habitat upstream, and of older smolts to the lagoon or ocean; and
- Implementation of a captive broodstock program by Carmel River Steelhead Association and California Department of Fish and Game, and planting of 186,882 juvenile fish, including 73,786 fry, 84,679 fingerlings, and 28,417 smolts during the period from 1991

to 1994.

Though overall populations are improved since the inception of the Mitigation Program in 1990, District staff has noticed a period of decline in the adult run from 2001 to 2006, even though the juvenile population density has increased or fluctuated within a “normal” range. At present, the reasons for period of decline in adult returns are not obvious, but may be related to a combination of controlling and limiting factors including:

- Better spawning conditions in the lower Carmel River (i.e., fish spawn before they reach the counter at the dam);
- Chronic poor water quality in the lagoon that causes annual fish die-offs or high predation, especially in low-flow years, thus resulting in fewer returning adults;
- Low numbers of juvenile fish in 1999, 2001, and 2004 affecting subsequent adult populations;
- Migration barriers such as the Old Carmel River and San Clemente Dams;
- Chronic, and occasionally acute, fall temperature and hydrogen sulfide levels below LPD, and the increase in suspended sediment from the SCD summer draw-down;
- Potential for enhanced predation on smolts and YOY migrating through the sediment fields of LPD and SCD;
- Poor ocean conditions; and
- Ongoing but limited impacts of fishing (i.e., approximately 0.5-1.5% incidental mortality associated with catch-and-release fishing for adults in the winter season, and catch-and-release fishing for juvenile steelhead in the upper watershed above LPD during the Spring/Summer trout season may slightly reduce the number of fish that reach the ocean).

A recent challenge that may remain for some years is the potential effects of substantive physical and operational changes to San Clemente Dam required by DWR/DSOD, including possible removal of the dam. The most significant issue is the effect of released sediment from the reservoir on downstream river habitat, proper functioning of MPWMD’s SHSRF, and downstream property owners (flood elevations). Major changes include:

- Lowering of the reservoir water level to address seismic safety concerns;
- Significant changes in the sediment regime in the Carmel River downstream of San Clemente as the dam fills with sediment; and
- Loss of reservoir storage, which, in the past, has helped maintain adequate river flows and cooler water in the lower Carmel River.

Improvements in State and Federal permit conditions, however, have extended by two weeks, until at least May 1 of each year, the time that San Clemente Reservoir will remain full and that

the fish ladder can operate to pass adult steelhead upstream. This improvement over past standards may result in allowing up to a dozen or more adult steelhead each year to pass SCD under the new draw-down regimen.

District staff continues to provide technical expertise and scientific data to CAW engineers and environmental consultants, DWR/DSOD, CDFG, NMFS, U.S. Fish and Wildlife Service, and others involved in addressing the resource management issues associated with seismic retrofit of San Clemente Dam. District staff also continues to provide technical expertise and scientific data to CDPR, Monterey County Water Resources Agency, Monterey County Public Works Department, California Coastal Commission, U. S. Army Corps of Engineers, and Carmel Area Wastewater District, other regulatory agencies and stakeholders involved in the management of the Carmel River Lagoon and barrier beach.

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Prepared by Water resources Division
Finalized: August 16, 2009

Figure IX-1
Water Surface Elevation in the Carmel River Lagoon and
Highway One Bridge, January-July, 2007

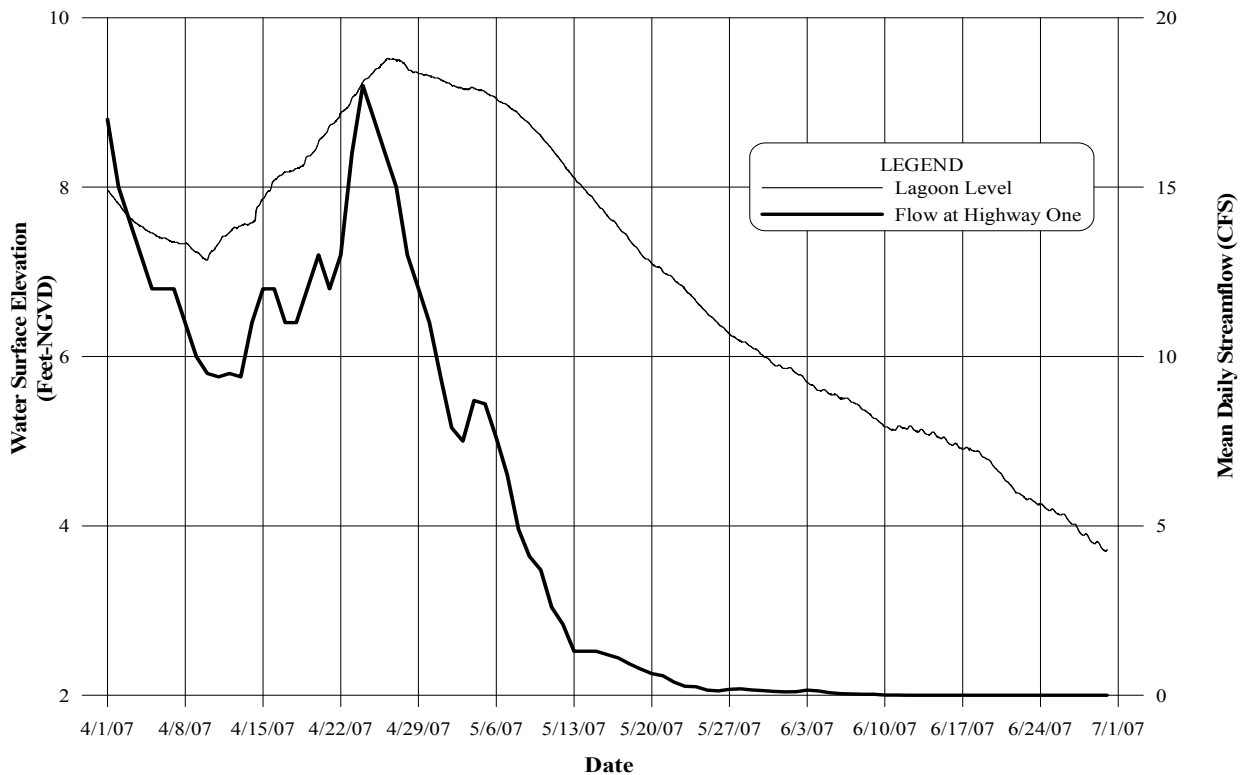
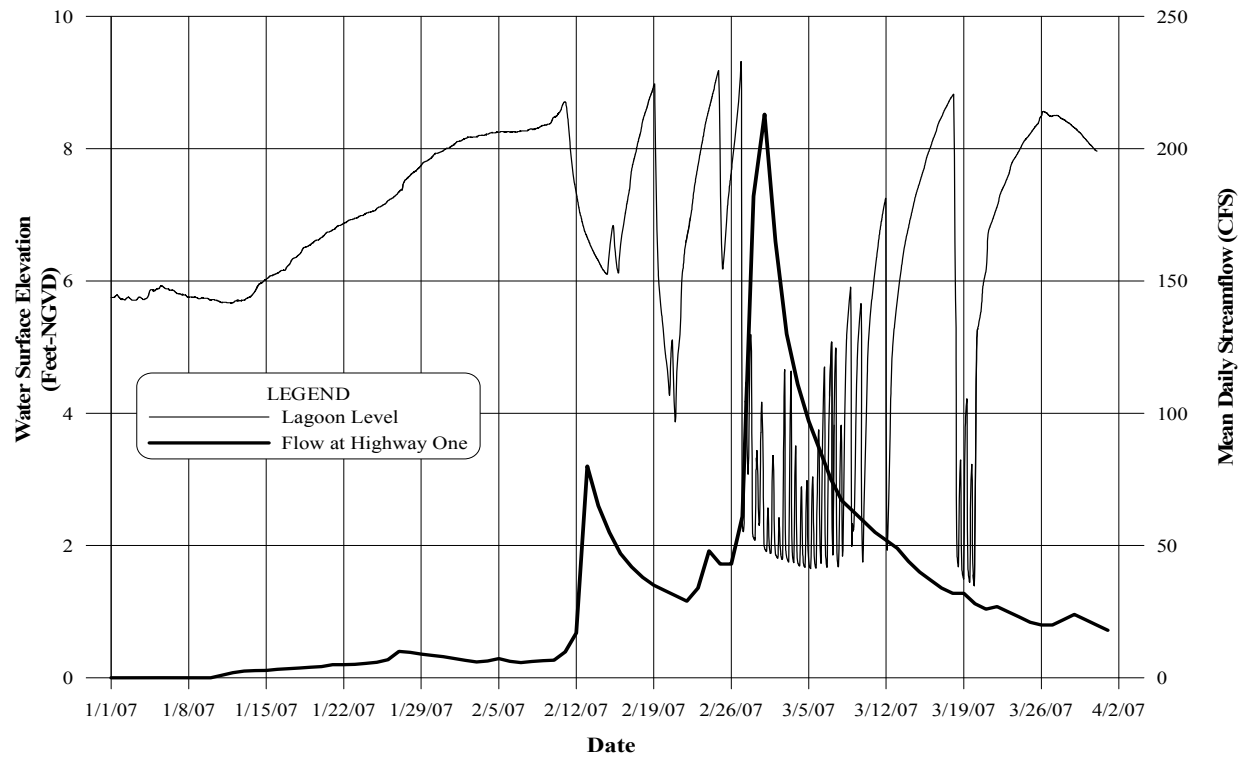


Table IX-1

MPWMD Scarlett Downstream Migrant Fyke Trap Results, Spring 2007.

Date	Juvenile/YOY	Smolts	Kelts	Adult Carcass	Morts	Juv/YOY Release Site	Adult/Kelt Release Site	Smolt Release Site
4/18/2007	7	4	0	0	0	Rosies Bridge		Pacific Ocean/Stewarts Cove
4/19/2007	96	7	0	0	0	Hitchcock Creek Confluence		Pacific Ocean/Stewarts Cove
4/20/2007	86	12	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/21/2007	146	20	1	0	0	Sleepy Hollow Area	Scarlett	Pacific Ocean/Stewarts Cove
4/22/2007	103	13	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/23/2007	140	15	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/24/2007	126	16	0	1	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/25/2007	99	10	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/26/2007	50	16	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/27/2007	55	11	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/28/2007	37	8	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
4/29/2007	30	3	1	0	0	Sleepy Hollow Area	Pacific Ocean/Stewarts Cove	Pacific Ocean/Stewarts Cove
4/30/2007	32	2	2	0	0	Sleepy Hollow Area	Pacific Ocean/Stewarts Cove	Pacific Ocean/Stewarts Cove
5/1/2007	40	10	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
5/2/2007	60	16	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
5/3/2007	80	10	0	0	0	Boronda		Pacific Ocean/Stewarts Cove
5/4/2007	83	2	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
5/5/2007	151	9	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
5/6/2007	147	10	0	0	0	Hitchcock Creek Confluence		Pacific Ocean/Stewarts Cove
5/7/2007	86	5	1	0	0	Boronda	Pacific Ocean/Stewarts Cove	Pacific Ocean/Stewarts Cove
5/8/2007	180	9	0	0	0	Garland Park		Pacific Ocean/Stewarts Cove
5/9/2007	95	10	1	0	0	Paso Hondo	Pacific Ocean/Stewarts Cove	Pacific Ocean/Stewarts Cove
5/10/2007	92	4	0	0	0	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
5/11/2007	138	11	0	0	0	Upstream SHW		Pacific Ocean/Stewarts Cove
5/12/2007	108	2	0	0	2	Sleepy Hollow Area		Pacific Ocean/Stewarts Cove
5/13/2007	184	12	0	0	0	Russell Wells		Pacific Ocean/Stewarts Cove
5/14/2007	277	0	0	0	12	Upstream SHW		
5/15/2007	135	2	1	0	0	Boronda	Pacific Ocean/Stewarts Cove	Pacific Ocean/Stewarts Cove
5/16/2007	80	2	0	0	3	W.Garza Well		Pacific Ocean/Stewarts Cove
5/17/2007	111	0	0	0	3	Upper Garland Park		
5/18/2007	106	0	0	0	0	Paso Hondo		
5/19/2007	79	4	0	0	0	W.Garza Well		Pacific Ocean/Stewarts Cove
5/20/2007	145	0	0	0	1	Sleepy Hollow Area		
5/21/2007	115	1	0	0	0	Boronda		Pacific Ocean/Stewarts Cove
5/22/2007	128	0	0	0	0	Garland Park		
5/23/2007	119	2	0	0	0	Old Carmel Dam		Pacific Ocean/Stewarts Cove
5/24/2007	53	0	0	0	0	Upper Garland Park		
5/25/2007	54	1	0	0	0	Upper Garland Park		Pacific Ocean/Stewarts Cove
5/26/2007	40	2	0	0	0	Boronda		Pacific Ocean/Stewarts Cove
5/27/2007	44	0	0	0	0	Hitchcock Creek Confluence		
5/28/2007	10	0	0	0	0	Sleepy Hollow Area		
5/29/2007	26	0	0	0	0	Garland Park		
5/30/2007	26	0	0	1	0	Garland Park		
5/31/2007	35	3	0	0	0	Garland Park		Pacific Ocean/Stewarts Cove
Totals	4034	264	7	2	21			

Figure IX-2

Number of Steelhead Smolts Rescued in the Carmel River Basin from 1989 to 2007

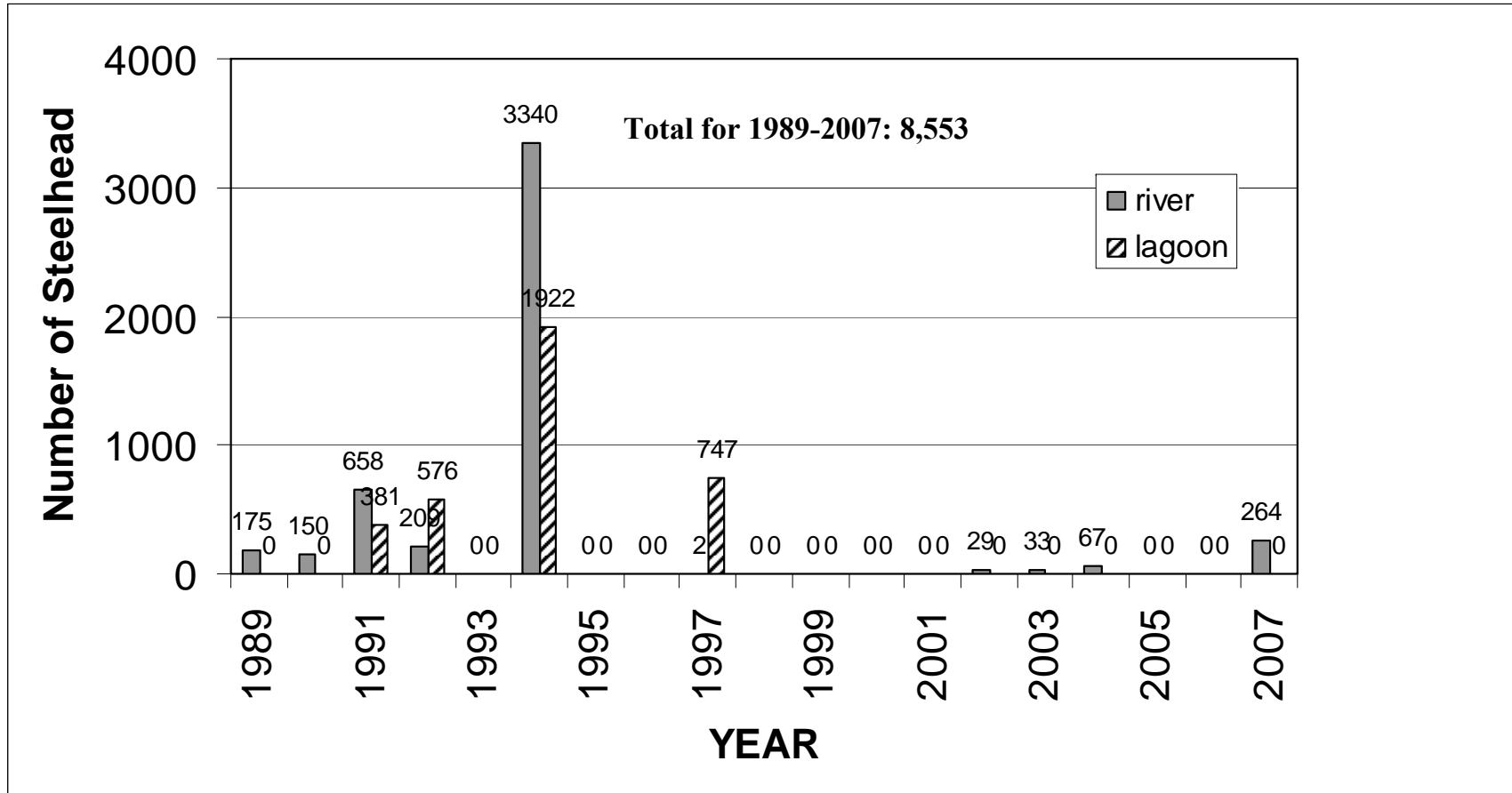


Table IX-2

Number of Juvenile Steelhead Rescued in Mainstem Carmel River, by Age Group and General Location, Rescue Year 2006.

Age Group	General Location	MPWMD July- Sept. 2006	CRSA July- Sept.2006
Young-of-the-year	Mainstem	14,935	4,113
Age 1+	Mainstem	1,401	245
Smolts	Lagoon and Lower River	0	0
Adults	Mainstem	0	2
Mortalities	Mainstem	39	33
Totals		16,375	4,393
Percentage Mortality		0.24%	0.75%

Figure IX-3

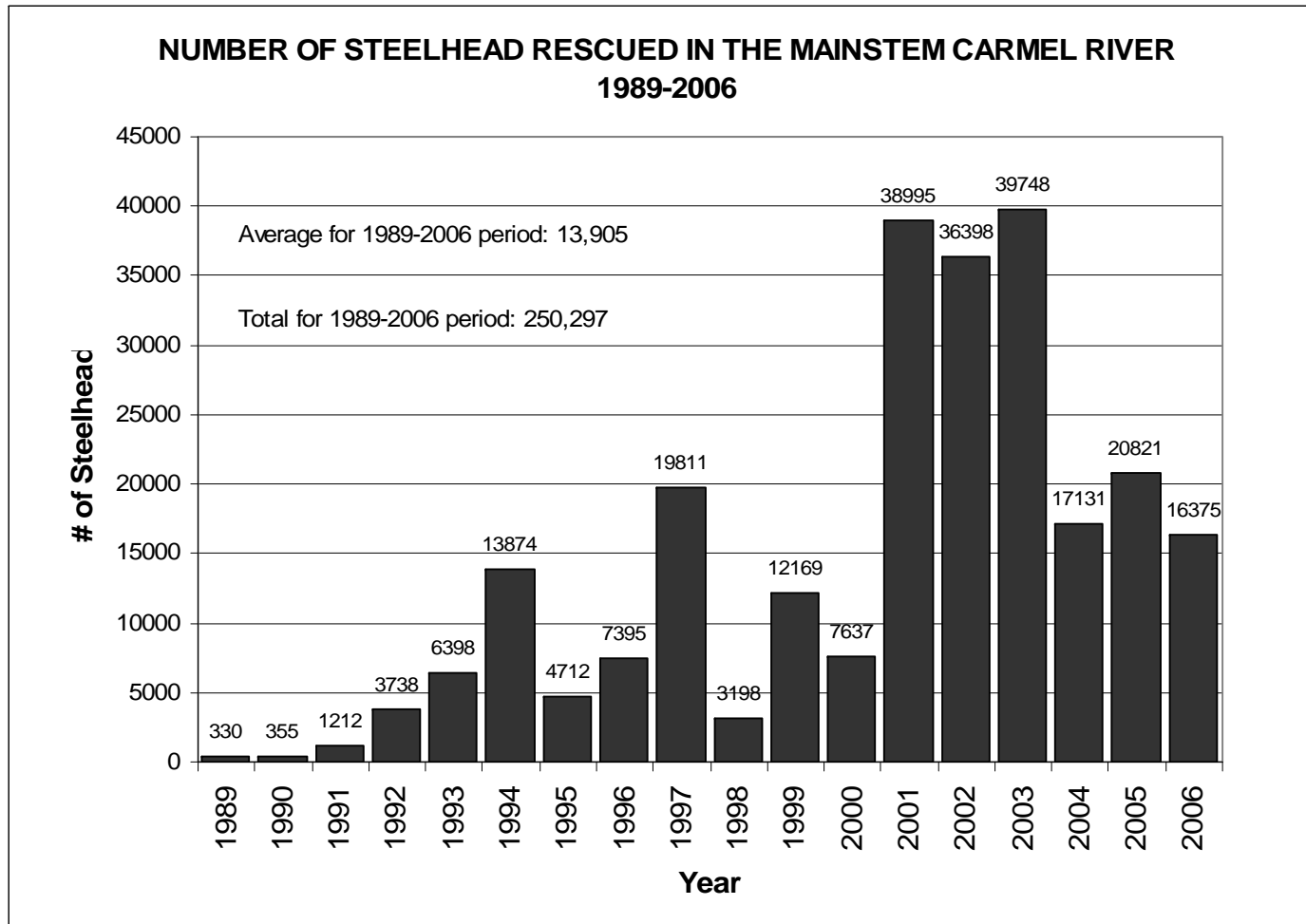


Table IX-3

SLEEPY HOLLOW STEELHEAD REARING FACILITY

Fish Rearing Summary: July 17, 2006 - February 7, 2007

Holding Location	# Fish Stocked ⁽¹⁾	# Morts (Disease) ⁽²⁾	# Morts (Unaccounted for) ⁽³⁾	Total # Released ⁽⁵⁾	% Survival	# by Release Location ⁽⁴⁾	Notes
Rearing Channel P1 - P4	1,929	213	2	1,757	91.1	1,052 -- Lagoon 705 -- River	P1 and P4 held large (1+ yr) fish, P2 and P3 held medium-sized fish at the beginning of the season.
Rearing Channel P12 - P16	11,480	5,282	2,163	4,035	35.1	777 -- Lagoon 3,258 -- River	YOY (4-11" FL at release)
Quarantine Holding Tanks	3,009	406	1,203	1,400	46.5	341 -- Lagoon 1,059 -- River	Fish were held in four 8' tanks between late August and mid-January due to a disease outbreak in the rearing channel.
Totals	16,418	5,901	3,368	7,192	44%	2,170 - Lagoon (30%) 5,022 -- River (70%)	
		36%	20%	44%			

Notes:

1. Fish were segregated in separate pools of the rearing channel by size/age at the start of the rearing season. Only three fish were found in pools where no fish were stocked (P5 - P11).
 2. Disease was primarily bacterial infection (*Flavobacterium columnare*).
 3. Unaccounted-for-fish [# fish stocked - (# of morts + # released)] are likely due to predation by larger fish, were not discovered as mortalities during the season due to turbid water, or are due to enumeration errors.
 4. Fish released into the Carmel River Lagoon were quite large and/or were smolting. ~Half released in the South Arm, half in the North Arm. Fish released into the Carmel River between Garland Park and the SHSRF were smaller and non-smolting.
 5. We counted 43 more fish in P1 at release than we thought we started with.
- "Morts" refer to mortalities. "FL" refers to fork length - the length of the fish from snout to the fork in its tail.

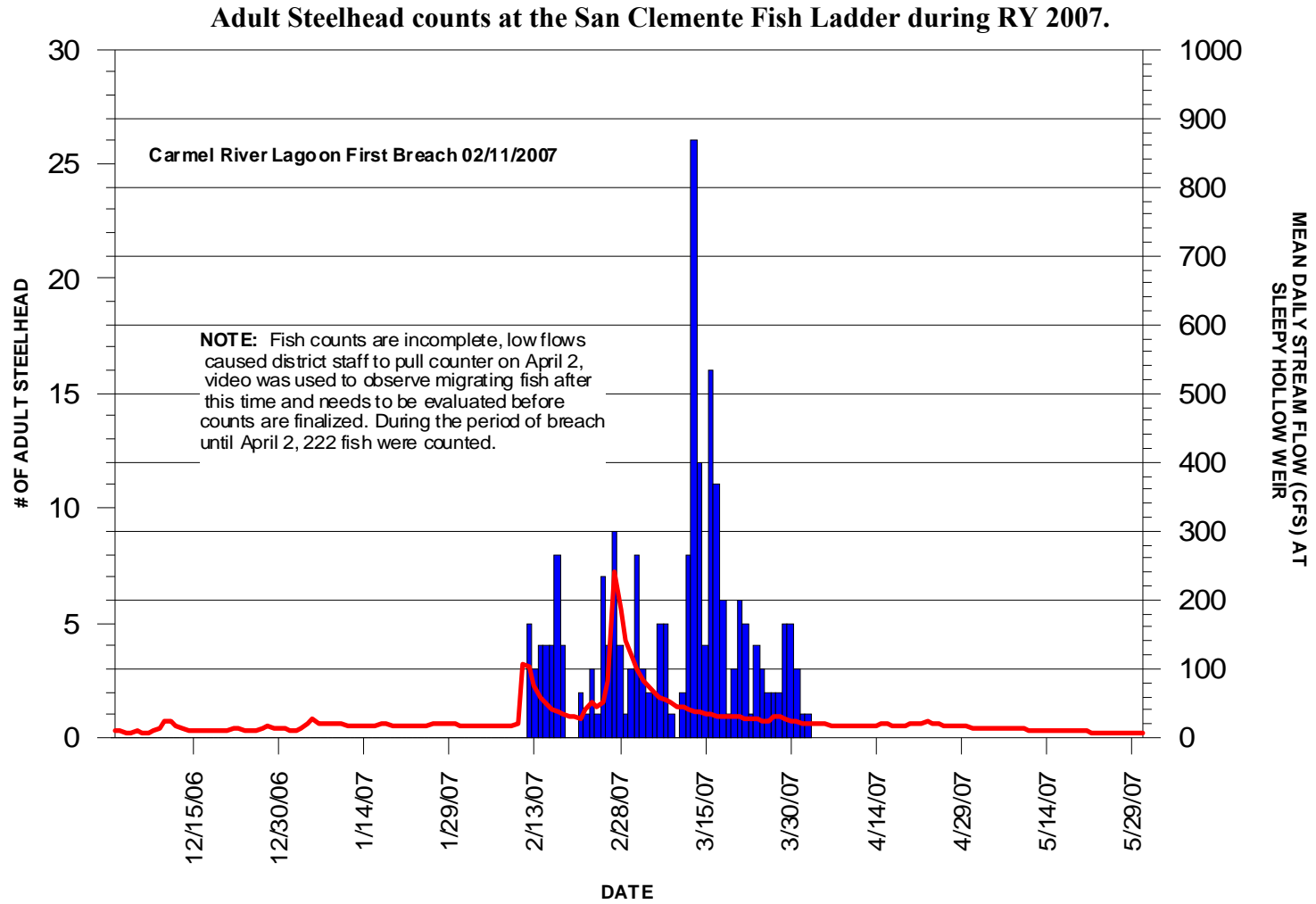
Table 1X-4

Sleepy Hollow Steelhead Rearing Facility
Fish Release Location Summary: January - February 2007

Release Location	Number of Fish	Percent of Total
SHSRF area	2,322	32%
Rosie's Bridge	136	2%
DeDampierre Park	837	12%
Garland Park	1,727	24%
Lagoon	2,170	30%
Total	7,192	100%

u/beverly/excel/shrf/2006/2006summary jan. 08 updated

Figure IX-4



** Streamflow measured at MPWMD gaging station at Sleepy Hollow Weir or San Clemente Spillway

Figure IX-5

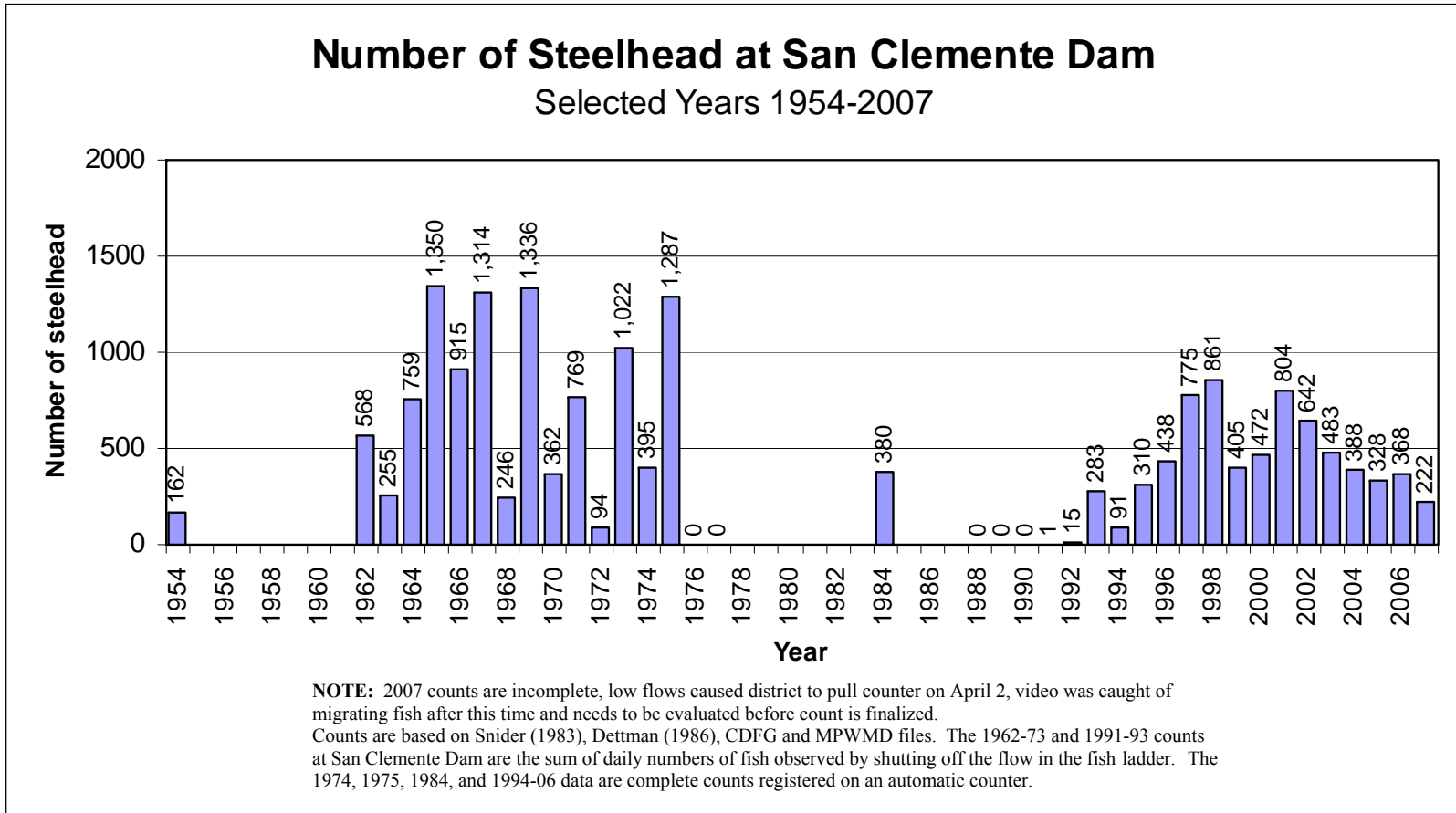


Table IX-5

Carmel River Juvenile Steelhead Annual Population Survey ¹

Lineal Population Density at Survey Stations (numbers per foot of stream) ^{2,3}															
	Lower River Sites	Scarlett Narrows	Garland Park	Boronda	DeDamp Park	Stonepine Resort	Sleepy Hollow	SCR Delta Lower Station	SCR Delta Upper Station	Los Compadres	Cachagua	Overall Annual Average	Average ⁴ 1993-on Comparison		
YEAR	RM 5.8	RM 8.7	RM 10.8	RM 12.7	RM 13.7	RM 15.8	RM 17.5	RM 19.0	RM 19.6	RM 20.7	RM 24.7	(nos./ft)	(nos./mi)	(nos./ft)	(nos./mi)
1990	0	0	0	0	0	0.50	0.27			0.26	0.22	0.14	733	--	--
1991	0	0	ND	0.12	0	0.74	0.39			0.09	0.62	0.25	1,294	--	--
1992	ND	ND	0.67	0.36	ND	0.96	0.30			0.40	0.83	0.59	3,098	--	--
1993	ND	0.62	0.91	0.92	0.82	0.84	0.52			1.22	1.84	0.96	5,075	0.96	5,075
1994	ND	0.44	0.23	0.43	0	0.50	0.29			1.51	0.71	0.51	2,713	0.51	2,713
1995	0.49	0.65	1.01	1.61	ND	1.42	0.69			0.50	1.63	1.00	5,281	1.07	5,666
1996	0.24	1.52	0.82	1.05	2.03	1.22	0.29			0.95	1.92	1.12	5,890	1.23	6,468
1997	0.02	0.22	1.02	1.74	1.15	0.5	0.22			1.15	1.41	0.83	4,359	0.93	4,891
1998	0.19	0.30	0.67	0.34	1.50	0.27	0.60			0.54	2.24	0.74	3,901	0.81	4,264
1999	0.17	0.26	0.50	0.32	0.62	1.67	0.45			0.46	1.35	0.64	3,403	0.70	3,716
2000	0.91	1.03	0.64	1.38	5.66	1.71	1.46			1.41	2.3	1.83	9,680	1.95	10,289
2001	ND	0.48	0.35	0.63	0.68	1.08	0.32			0.47	1.62	0.70	3,716	0.70	3,716
2002	ND	0.68	0.85	1.67	0.83	1.07	0.5	0.33	0.68	1.52	2.73	1.09	5,734	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	1.46	7,704
2004	0.25 ⁵	0.46	0.78	1.21	0.43	1.24	0.55	0.21	0.41	0.45	0.89	0.63	3,302	0.66	3,501
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	1.14	6,019
2006	1.13	0.64	0.86	0.87	0.47	0.37	0.95	1.65	0.28	0.87	1.00	0.83	4,363	0.80	4,203
Station Ave (no./ft)	0.51	0.55	0.80	0.92	1.10	1.02	0.63	0.60	0.66	0.85	1.50	0.85	4491	1.00	5283
Station Ave (no./mile)	2,710	2,878	4,227	4,867	5,826	5,361	3,311	3,147	3,495	4,494	7,942				
Overall Station Averages:												0.83	4,387		

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

² RM; indicates miles from rivermouth

³ Data listed as single digit 0; indicates stream was dry at sampling station

⁴ Average 1993-on comparison does not include data for lowest river sites at Meadows Road (1995); Schulte Area (1996), and Red Rock Area (1997- present).

⁵ Result for Lower River Site, 2004, (upper Red Rock) is estimated from one pass of rescues and data from Red Rock and Scarlett pop. surveys the past seven years.

Figure IX-6

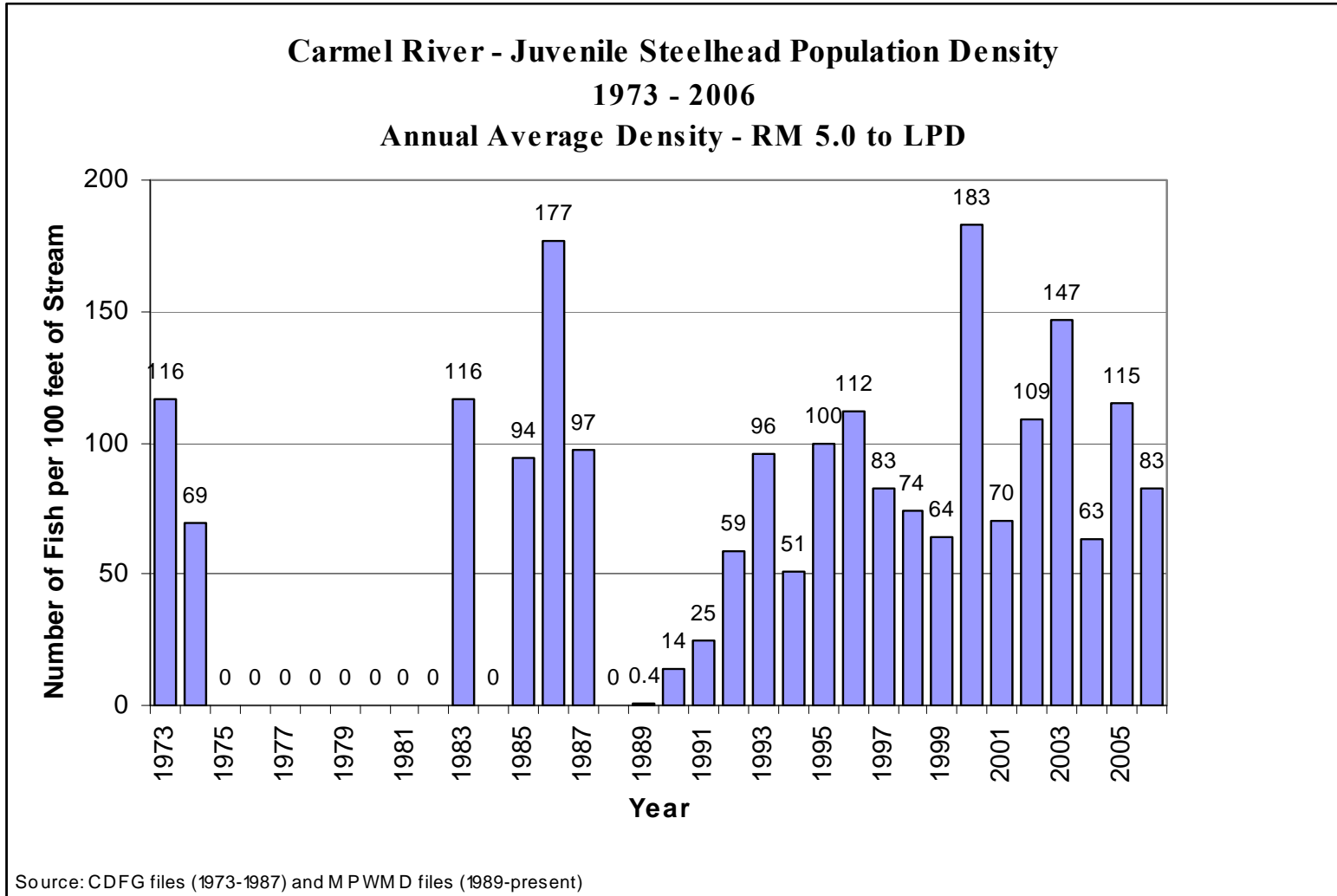


Figure IX-7

Estimated Number of Juvenile Steelhead Reared Below San Clemente Dam
1990 - 2006

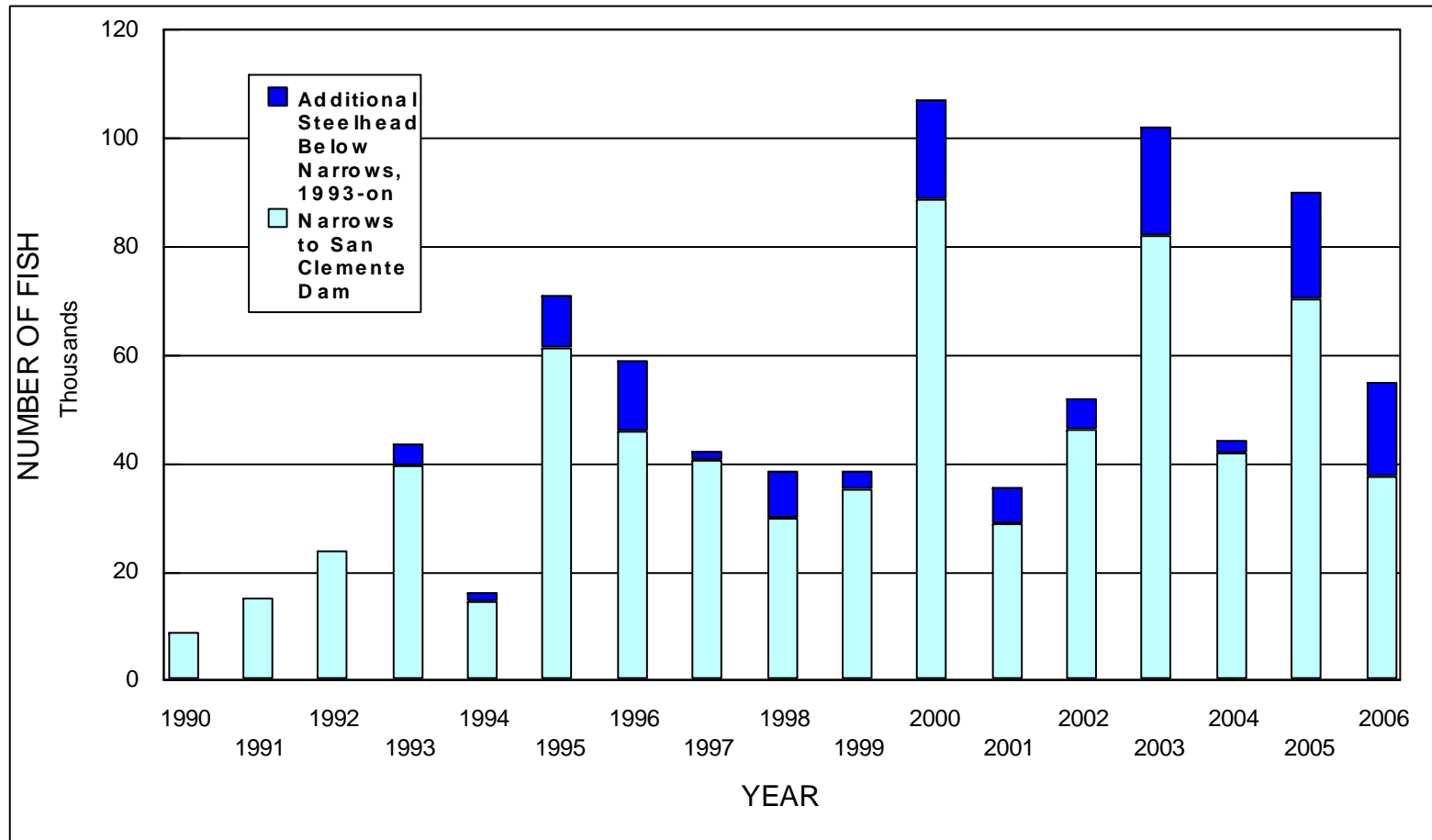


Table IX-6

Biological metric values for benthic macroinvertebrate (BMI) assemblages sampled from the Carmel River in October/November 2006, Monterey County.

Metrics	Carmel River Sites				
	CRLP	CRCA	CRSH	CRSP	CRRR
Taxonomic Richness	40	25	24	20	23
EPT Taxa	19	6	7	11	8
Ephemeroptera Taxa	7	2	2	2	2
Plecoptera Taxa	6	0	1	2	1
Trichoptera Taxa	6	4	4	7	5
EPT Index (%)	41	45	30	75	77
Sensitive EPT Index (%)	18	3.9	1.0	6.7	20
Shannon Diversity	2.7	2.3	2.2	1.8	2.3
Dominant Taxon (%)	21	27	35	46	25
Tolerance Value	4.4	5.7	5.7	4.9	3.9
Intolerant Organisms (%)	18	3.9	1.0	6.7	20
Tolerant Organisms (%)	4.3	15	6.0	3.9	8.0
Collector-Gatherers (%)	59	45	39	49	24
Collector-Filterers (%)	13	25	39	33	28
Scrapers (%)	13	10	7.7	6.3	3.9
Predators (%)	9.6	14	13	4.3	13
Shredders (%)	3.3	0.0	1.2	2.9	0.4
Other (%)	1.8	5.1	0.6	4.5	31
Estimated Abundance					
Composite sample (18 ft ²)	2300	4100	1600	3600	8900
Site (BMIs/ft ²)	128	228	89	200	494
Site (BMIs/m ²)	1376	2452	957	2153	5323
Estimated Biovolume					
ml/ft ²	0.23	0.58	0.16	0.34	1.0
ml/m ²	2.5	6.2	1.7	3.7	11
IBI Metrics					
Intolerant Individuals (%)	18	3.9	1.0	6.7	20
CG Taxa + CF Taxa (%)	35	44	54	50	35
Non-Insect Taxa (%)	10	36	29	25	39
Tolerant Taxa (%)	13	28	25	20	35
Coleoptera Richness	4	0	1	0	1
Predator Richness	13	10	7	5	7
EPT Richness	19	6	7	11	8

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