STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

STAFF REPORT FOR REGULAR MEETING OF MARCH 22-23, 2018

Prepared on March 2, 2018

ITEM NUMBER: **4**

SUBJECT: **Surface Water Quality Conditions and Agricultural Discharges in the Central Coast Region**

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ACTION: **Informational**

SUMMARY

This staff report provides a brief overview of surface water quality conditions on the central coast relevant to nitrate, toxicity, turbidity, pesticides, and riparian and wetland habitat, as well as related agricultural discharges. The data from multiple monitoring programs continue to show a wide range of water quality conditions in surface waters; from areas where conditions meet water quality objectives and where beneficial uses are largely protected, to areas that are severely degraded in terms of water quality objectives and beneficial uses. Central coast Water Board staff as well as several external speakers will present water quality information as part of this informational item at the board meeting.

In this report, staff discusses ‘trends’ in the data. It is important to maintain objectivity when discussing trends and the notion that conditions are getting ‘better’ or ‘worse.’ A single parameter among many may show a positive trend in a particular area; however, this may not indicate an overall improvement in water quality conditions *relative to achieving water quality objectives and beneficial uses.* In addition, the cause of the trend is often unknown. Staff cannot assign causation to a trend when there is no solid basis for making the claim. This is challenging because human nature is to look for trends, assign a cause, and reach a conclusion about conditions improving or getting worse depending on one’s perspective.

As staff will discuss in this report, overall water quality data in agricultural areas do not indicate that surface water quality conditions are improving in terms of achieving water quality objectives and protecting beneficial uses. Furthermore, a significant amount of water quality degradation due to agricultural discharges continues to occur in these areas.

Staff continues to assess all available data and will propose options and recommendations for improving water quality in all upcoming permits, orders, and Basin Plan amendments. This includes development of future Total Maximum Daily Load (TMDLs), site-specific and general permits (i.e., wastewater), and the next agricultural order, Ag Order 4.0.

DISCUSSION

This staff report provides a brief overview of surface water quality conditions on the central coast relevant to nitrate, toxicity, turbidity, pesticides, and riparian and wetland habitat (groundwater conditions will be discussed in a future staff report). The information reviewed by staff includes data collected through implementation of the previous and current agricultural orders, and monitoring programs from multiple organizations. Following the water quality conditions discussion, staff also discusses particular water quality issues associated with agricultural areas. As discussed above, it is important to maintain objectivity when discussing trends and interpretations regarding conclusions that conditions are getting 'better' or 'worse.' A single parameter among many may show a positive trend in a particular area; however, this may not indicate an overall improvement in water quality conditions *relative to achieving water quality objectives and beneficial uses.* In addition, the cause of the trend is often unknown. Even trends that are considered to be 'statistically significant' have their limitations, including the ability to identify the cause of the trend, depending on what the study was designed to detect.

For overall water quality conditions to 'improve' in terms of achieving water quality objectives and beneficial uses, major changes are typically necessary (i.e., discharges must be treated, reduced, or abated, and spills must be cleaned up). In addition, determining causation for a trend in complex systems requires a specific monitoring program design, comprehensive sampling over time, proper control stations, and specific statistical analyses; criteria which are rarely met. This is particularly important when assessing monitoring data from complex scenarios and areas that are severely degraded with respect to many parameters. In some cases, the trends may have been influenced by weather, including the severe drought, or by discharger practices, and neither the Central Coast Ambient Monitoring Program (CCAMP) nor Preservation Inc.'s Cooperative Monitoring Program (CMP) study designs have the resolution to differentiate the cause(s). While the available data show trends in some areas for some water quality parameters, such as nitrate concentrations or turbidity, in most cases staff cannot assign a cause to these trends or conclude that overall water quality conditions are changing in such a way that water quality objectives will be achieved or beneficial uses will be protected. Where water quality problems are detected at CCAMP or CMP sites, a higher resolution network of monitoring sites would be needed to determine causality.

In some less complex systems, the cause of the trend may be obvious. For example, there are monitoring sites with 'positive' nitrate concentration trends downstream of wastewater treatment plants, where the treatment plant is the primary source of nitrate. After a treatment plant is upgraded specifically for the purpose of removing nitrate, nitrate concentrations might improve immediately downstream of the treatment plant, and the line between cause and effect can be reasonably drawn.

During staff's presentation for this item, staff will discuss the design and limitations of monitoring programs required through the existing and previous Ag Orders.

Additional Speakers

Staff has invited several external speakers to provide the board with additional information and context on the surface water quality conditions in the central coast. The following list includes each speaker's contact information, the title of their presentation, and a summary of the water quality-related topics they will present.

California Department of Pesticide Regulation (DPR), Yuzhou Luo (Yuzhou.Luo@cdpr.ca.gov), *Modeling Pesticide Application Data, Predicting Risk to Water Quality and Prioritizing Pesticides to Monitor at the Watershed Level*: The presentation will give a brief description of DPR's Surface Water Protection Program, which has been developing the Surface Water Monitoring Prioritization (SWMP) model to prioritize pesticides and geographic locations for pesticide monitoring in agricultural and urban areas of California. SWMP incorporates California's Pesticide Use Reporting (PUR) database for calculation of pesticide use amounts, and their accumulation and dissipation at watershed scale. SWMP incorporates pesticide use data, physicochemical properties, aquatic toxicity, and watershed morphology to identify specific pesticides and geographic locations where pesticide detections in surface water are expected. Monitoring studies based on the model-prioritized sampling sites and analytes are designed to detect higher levels of pesticide contamination, allowing for a conservative approach to pesticide risk assessment and mitigation.

California Department of Pesticide Regulation (DPR), Xin Deng (Xin.Deng@cdpr.ca.gov), *Current Pesticide Occurrences and Trends in Surface Water of the Central Coast Region*: The presentation will give a brief overview of DPR's long-term monitoring program in the central coast and share the findings on pesticide occurrences in surface water in recent years (2011-2016). It will focus on trends of commonly used insecticide groups, namely, organophosphates, pyrethroids and neonicotinoids.

Surface Water Ambient Monitoring Program (SWAMP)/Granite Canyon, Bryn Phillips (bmphillips@ucdavis.edu), *Toxicity and Pesticide Trends in Surface Waters of the Central Coast*: The presentation will provide a brief summary of toxicity and pesticide trends from the perspective of the state wide SWAMP Stream Pollution and Trends program monitoring. The presentation will also summarize findings related to test organism sensitivity to currently applied pesticides.

Central Coast Water Quality Preservation Inc., Sarah Lopez (sarah@ccwqp.org), *Cooperative Monitoring Program (CMP) Data Summary and Trends*: The presentation will present a summary of the most recent CMP results (including from 2017) to summarize current water quality status throughout agricultural watersheds of the central coast. The presentation will focus on nitrate, turbidity, and toxicity to invertebrates and will include a summary of the results of a trend analysis using results from 2005-2017

Background

The central coast region includes a diverse landscape of agricultural crops, orchards, and vineyards, rapidly expanding urban areas, and many miles of paved roadways. Chemicals applied to the land include synthetic and organic forms of fertilizers, pesticides, herbicides, petroleum products and others; the constituents of these applications are routinely discharged to surface waters, and ultimately the ocean. Pesticides and nutrients are causing widespread degradation of water quality and beneficial uses in our region. Research projects and monitoring programs have shown high concentration and mass loading of chemicals discharged from agricultural areas and entering the waterways of our region through irrigation, tile drain, and stormwater discharges. CCAMP data and the Agricultural Order-specified monitoring conducted by the CMP provide extensive documentation of these significant water quality impacts.

In 1998, CCAMP monitoring began collecting data from watersheds throughout the region. CMP monitoring began in 2005 and is focused on waterbodies currently on the Federal Clean Water Act section 303(d) List of polluted waters (303(d) List) in agricultural areas. Staff has summarized

CCAMP and CMP findings related to agricultural pollutants in this staff report. Interested parties can access more complete documentation of CCAMP and CMP information, including references and access to data, charts, and maps, through the CCAMP website (www.ccamp.org).

Surface Water Quality Conditions

Data show degradation of surface water quality in the lower reaches of waterbodies located in the major agricultural areas of the central coast region, particularly in the lower Pajaro River, Salinas River (including Gabilan Creek and Tembladero Slough) and Santa Maria River watersheds. This pollution severely impacts aquatic life and other beneficial uses (Figures 1 and 2). The following text provides a brief overview of the water quality status and trends in the central coast region, particularly for water quality problems commonly associated with agricultural runoff including nutrients, toxicity, pesticides, and turbidity.

Staff employs the CCAMP scoring approach to evaluate surface water conditions in the central coast. This approach evaluates data for each monitoring site and analyte combination in the context of thresholds protective of aquatic life and human health uses, and scores the site from 0 to 100 (very poor condition to excellent condition, respectively). Scores take into consideration both the frequency of threshold exceedance and the magnitude of those exceedances. In addition to evaluating scores for each individual pollutant, the CCAMP scoring approach utilizes multiple lines of evidence for each site, combining scores for individual analytes into indices, also scored from 0-100. For example, the CCAMP Index of Aquatic Health combines a site's scores for nutrients, water temperature, turbidity, dissolved oxygen, organic pollutants, toxicity, metals, and biology (Figure 1). Figure 2 shows Human Health Index scores for all sites in the central coast region. The CCAMP Human Health Index combines a site's scores for nutrients, indicator bacteria, organic chemicals, and metals when compared to drinking water quality objectives.

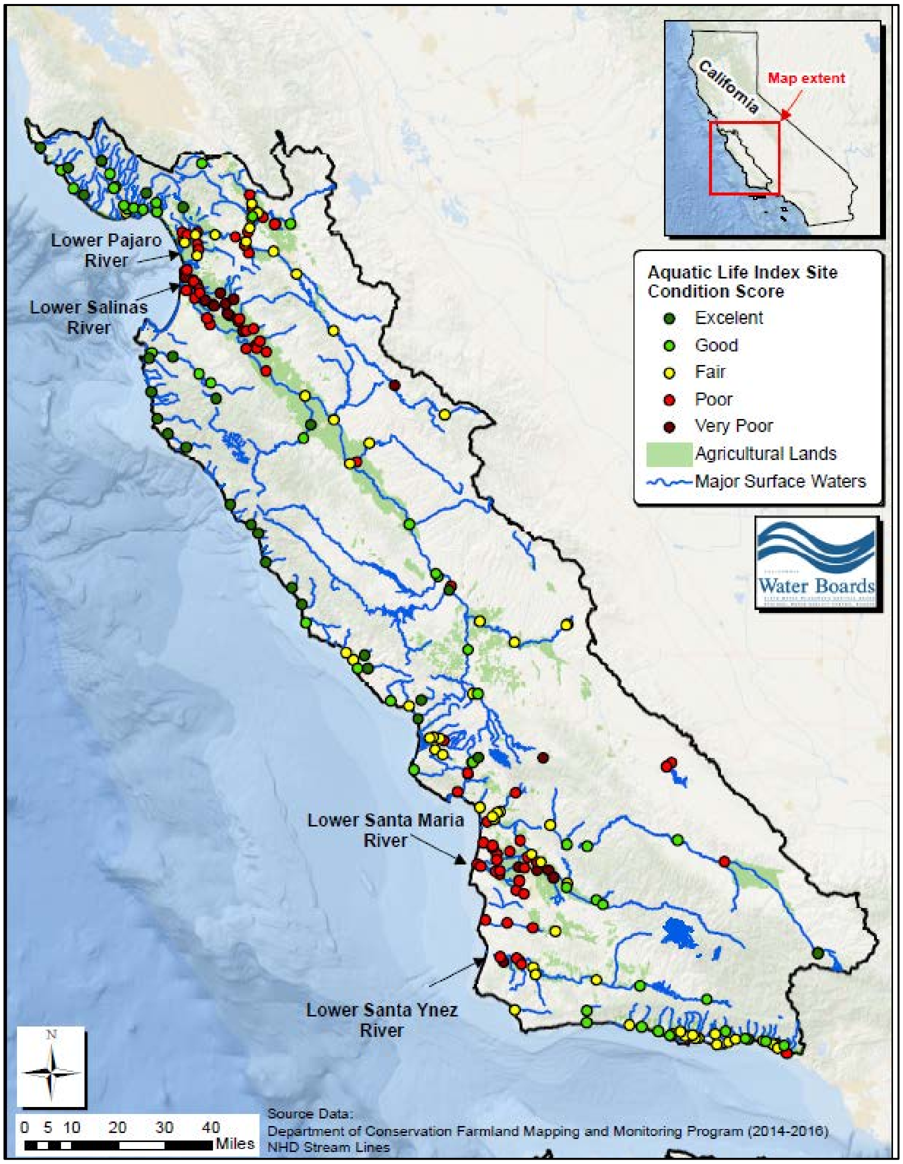

Figure 1. Central coast monitoring sites scored using the CCAMP Aquatic Life Index where dark green indicates sites in excellent condition (score 90 - 100), light green indicates good (80 – 89), yellow indicates fair (65 – 79), bright red indicates poor (45 to 64), and dark red indicates very poor condition (0 – 44). Green shading delineates agricultural areas identified by the 2014-2016 California Department of Conservation Farmland Mapping and Monitoring Program.

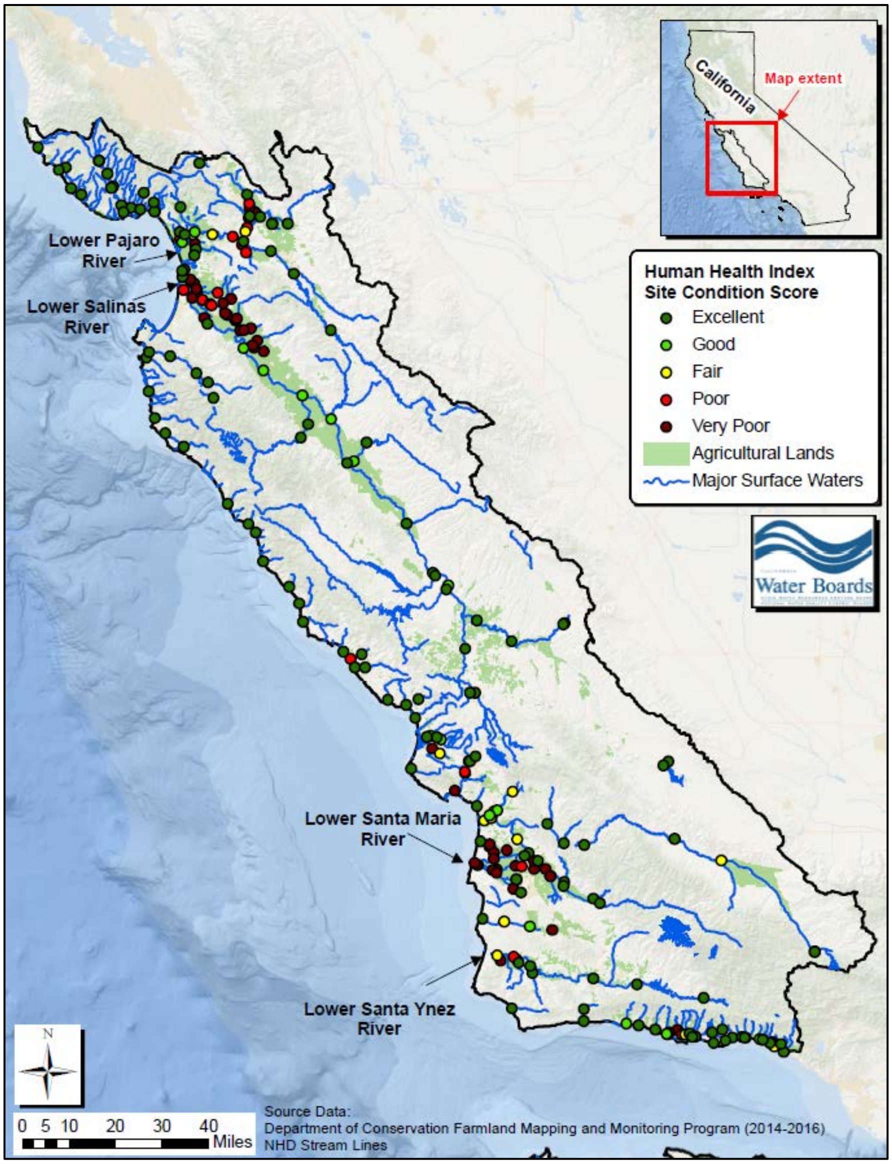

Figure 2. Central coast monitoring sites scored using the CCAMP Human Health Index where dark green indicates sites in excellent condition (score 90 - 100), light green indicates good (80 – 89), yellow indicates fair (65 – 79), bright red indicates poor (45 to 64), and dark red indicates very poor condition (0 – 44). Green shading delineates agricultural areas identified by the 2014-2016 California Department of Conservation Farmland Mapping and Monitoring Program.

Nitrate

Elevated levels of nitrate degrade water quality and impair beneficial uses for surface water, groundwater (drinking water), and aquatic habitat. Nitrate pollution is a widespread threat to human health in the central coast region. USEPA recently reported that nitrogen and phosphorus pollution, and the associated degradation of drinking and environmental water quality, has the potential to become one of the most costly and challenging environmental problems the nation faces (USEPA, 2011).

Sixty-five waterbodies in the central coast region are on the draft 2014-2016 303(d) List (draft 303(d) List) due to elevated nitrate concentrations (SWRCB, 2017, pending USEPA approval). Sixty percent of these waterbodies are located in the watersheds of the lower Pajaro River, Santa Maria River, and Salinas River (including Gabilan Creek/Tembladero Slough. Agricultural runoff heavily influences more than ninety percent of these waterbodies. Additionally, in four locations (lower Santa Ynez River, lower San Simeon, Chorro, and San Luis Obispo creeks) permitted discharges from municipal treatment facilities contribute significantly to nitrate loads and listings. Figure 3 illustrates the location waterbodies on the draft 303(d) List due to nitrate pollution. According to the CCAMP scoring approach for nitrate, the ten most impacted central coast sites all occur in agricultural areas of the lower Salinas River watershed including the Gabilan/Tembladero Slough, Santa Maria River and Pajaro River watersheds.

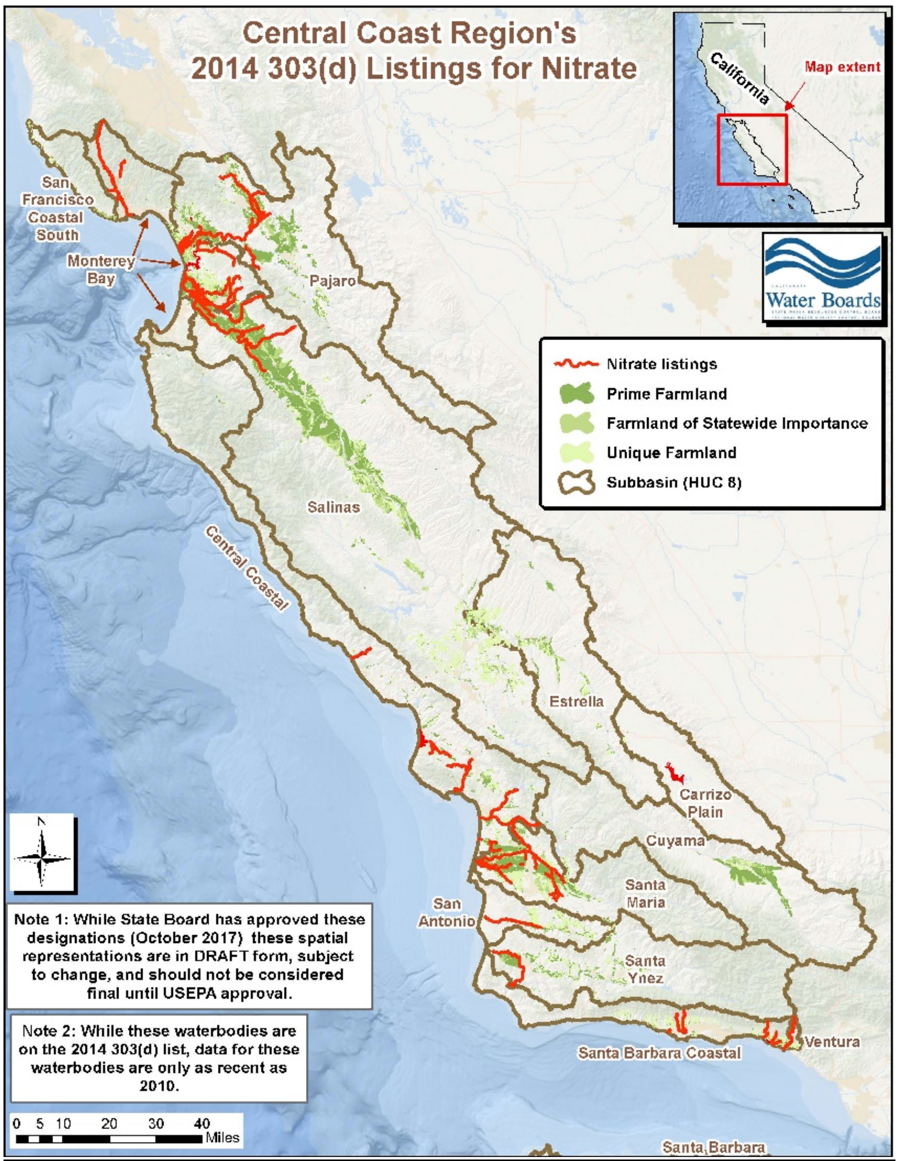

Figure 3. Map of the central coast region's waterbodies proposed for the draft 303(d) List due to nitrate pollution (SWRCB, 2017, pending USEPA approval).

Analysis of data from CCAMP and CMP sites show statistically significant trends in nitrate concentration and/or load. Data for some sites show a tendency for higher or lower concentrations than in the past. In most areas where data show trends in nitrate concentration and/or load, water quality still do not meet water quality thresholds supportive of aquatic life. One noteworthy trend from Tequisquita Slough, in the Pajaro River watershed, shows nitrate concentrations decreasing; average nitrate concentrations since 2013 are below the aquatic life threshold of 1.0 mg/L nitrate as N (meaning supportive of aquatic life uses). However, staff cannot determine if the trends in agricultural areas are due to weather, such as prolonged drought, or management practices.

Three locations in the central coast region show decreasing trends in nitrate concentration as a direct result of upgrades or changes in the operations of municipal wastewater treatment facilities resulting in improved quality of discharges to surface waters or land adjacent to surface waters. These include sites on lower Santa Ynez River, Chorro Creek, and San Simeon Creek. However, in San Luis Obispo Creek, downstream of the City of San Luis Obispo's wastewater treatment facility's discharge point, data show a significant increase in nitrate concentrations. This wasterwater treatment facility is under Time Schedule Order to upgrade nitrate treatment by November 30, 2019.

Toxicity

Toxicity testing determines the effects on living organisms when exposed to chemicals in sample water or sediment, and compares their response to test organisms exposed to clean sample water or sediment (a control group). Staff evaluated toxicity test results, in the form of test organism survival, growth and/or reproduction to determine if aquatic life beneficial uses are supported throughout the central coast region.

The draft 303(d) List identifies fifty-seven waterbodies in the central coast region that are not meeting water quality standards due to toxicity (SWRCB, 2017, awaiting USEPA adoption). Sixty-eight percent of these waterbodies are located in the Salinas River watershed, including the Gabilan/Tembladero Slough, Santa Maria River, and Pajaro River watersheds. Figure 4 illustrates the location of waterbodies on the draft 303(d) List due to toxicity. According to the CCAMP scoring approach for toxicity, ninety-four percent of sites scoring in poor or very poor condition occur in agricultural areas of lower Salinas River watershed including the Gabilan/Tembladero Slough, Santa Maria River, and Pajaro River watersheds.

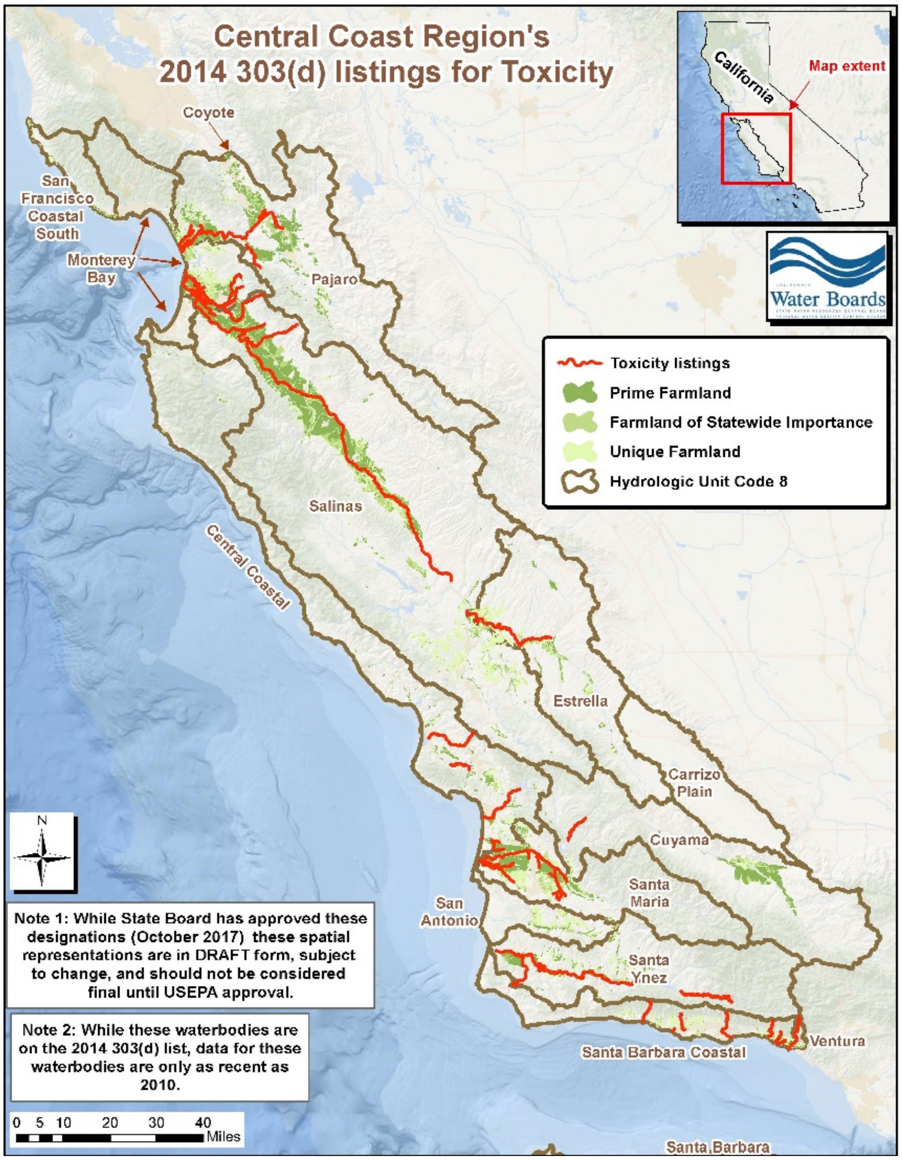

Figure 4. Map of the central coast region's waterbodies proposed for the draft 303(d) List due to toxicity (SWRCB, 2017, pending USEPA approval).

Water toxicity data show significant trends at five CMP monitoring sites, where toxicity to the invertebrate test organism *Ceriodaphnia dubia* occurred less frequently. For example, prior to 2011, ninety-four percent of the samples from the Salinas Reclamation Canal site (at La Guardia) were toxic, but since 2011, approximately fifty-five percent of samples resulted in toxic effects to survival of *C. dubia* (Figure 5). Many of the more recent water samples resulted in sub-lethal effects to *C. dubia*, rather than mortality. Sediment from this site continues to be toxic to *Hyalella azteca*, an amphipod sensitive to pyrethroid pesticides, which tend to adsorb to sediment.

Reduced frequency of toxicity to *C. dubia* at this and other sites is coincident with changes in pesticide application data, where many growers have discontinued or reduced the use of organophosphate pesticides such as chlorpyrifos, and diazinon; *C. dubia* is sensitive to this class of pesticides. In response to changes in pesticide application, the Monitoring and Reporting

Program for the current Agricultural Order (No. R3-2017-0002) requires the CMP to use multiple invertebrate test organisms for water samples, each sensitive to different classes of pesticides.

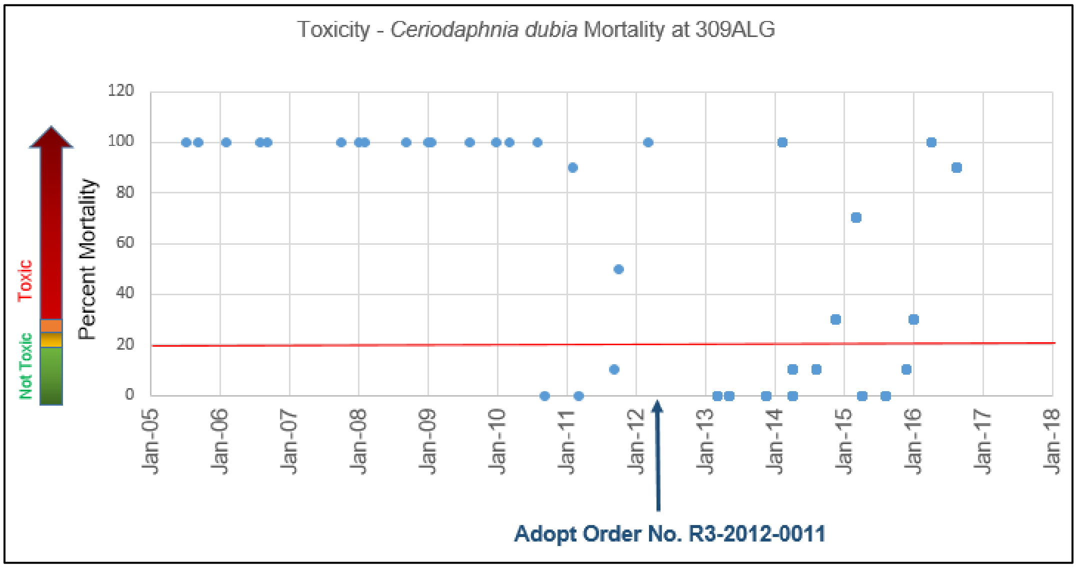

Figure 5. Water toxicity test data for *C. dubia* in the Salinas Reclamation Canal site at La Guardia (309ALG). The Y-axis ranges from zero organisms died (not toxic) to 100% mortality (toxic).

Pesticides

Pesticide pollution is widespread in agricultural and urban areas of the central coast region. Forty-five waterbodies in the central coast region are on the draft 303(d) List due to pesticide pollution (SWRCB, 2017, pending USEPA approval), (Figure 6). Seventy-one percent of those waterbodies are located in the watersheds of the lower Salinas River, Gabilan Creek/Tembladero Slough, Santa Maria River and Pajaro River. Several waterbodies are on the draft 303(d) List for multiple pesticides. Note that the draft 303(d) List does not include any neonicotinoid data and very limited pyrethroid data, and therefore does not reflect the shift in pesticide usage. Staff anticipate several additional listings when those data are included in the future assessment.

Outside of agricultural areas, pesticides impact aquatic life uses in the Santa Cruz area where four waterbodies are on the 303(d) List due to elevated concentrations of chlorpyrifos. The primary land uses in these areas are urban and rural residential.

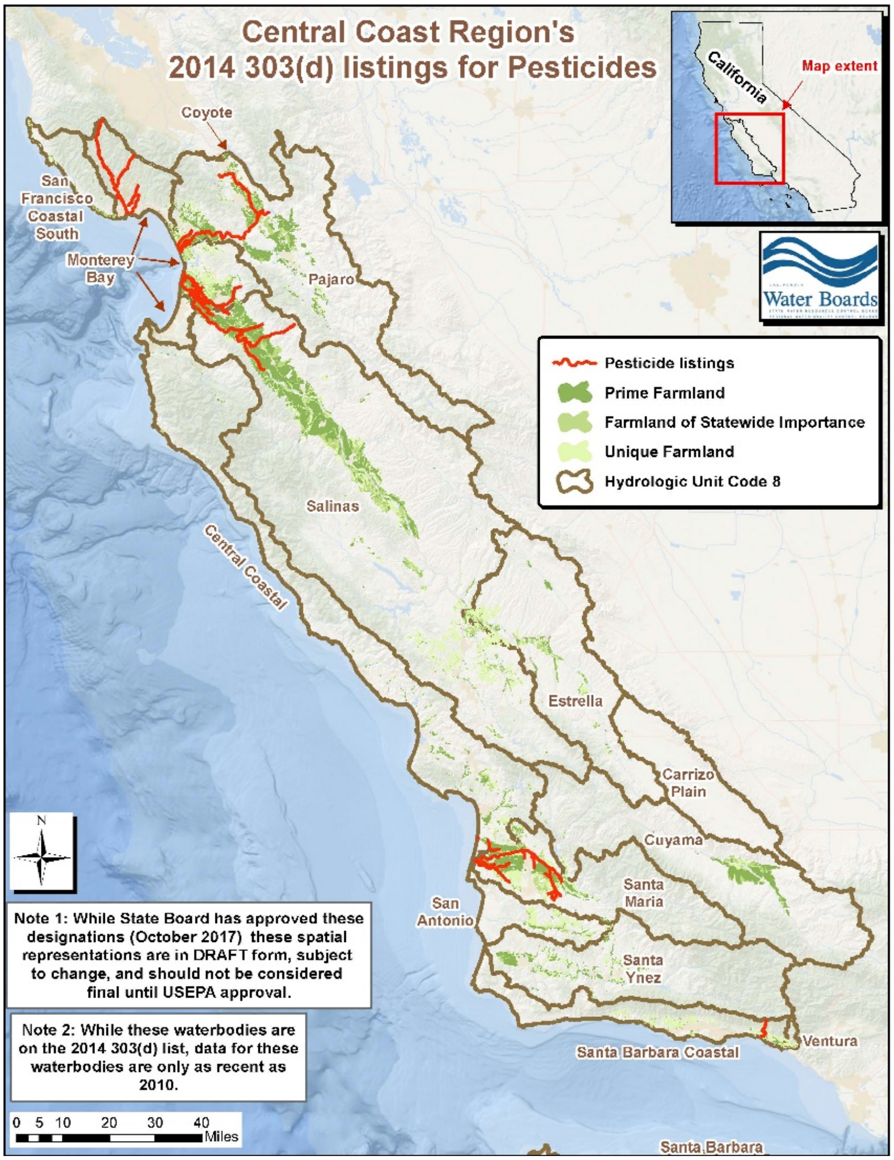

Figure 6. Map of the central coast region's waterbodies proposed for the draft 303(d) List due to pesticide contamination (red lines), (SWRCB, 2017, pending USEPA approval).

Central Coast Water Board staff assessed pesticide data for the central coast region, including a review of 2011-2016 DPR data focused on the watersheds of the lower Salinas River watershed, Gabilan Creek/Tembladero Slough, Oso Flaco Creek, and Santa Maria River. The following summary draws from that assessment. The pesticides discussed herein include active ingredients of chemicals used on crops.

DPR monitoring data from sites in the central coast region, collected between 2011 to 2016, show imidacloprid, a neonicotinoid pesticide, with the highest detection frequency of all pesticides analyzed (detected in eighty-four percent of samples). Imidacloprid exceeded the USEPA benchmarks in nineteen percent of the samples in which it was detected. Preliminary data from 2017 CMP monitoring (the first year the CMP monitored neonicotinoid pesticides) show imidacloprid detected in fourteen percent of the core program site samples.

Figure 7 illustrates the percent of DPR 2011-2016 samples with high priority pesticides detected and the percent of samples where concentrations exceed USEPA benchmark values. Pyrethroid pesticides, when detected, typically exceed USEPA benchmarks in the central coast region. Bifenthrin (a pyrethroid pesticide) exceeded the USEPA benchmark in forty-six percent of samples. Other pesticides of concern exceeded the USEPA benchmarks in over twenty percent of the samples, including malathion (an organophosphate) and methomyl (a carbamate). DPR monitoring also detected additional chemicals such as fungicides and herbicides in a high percentage of samples.

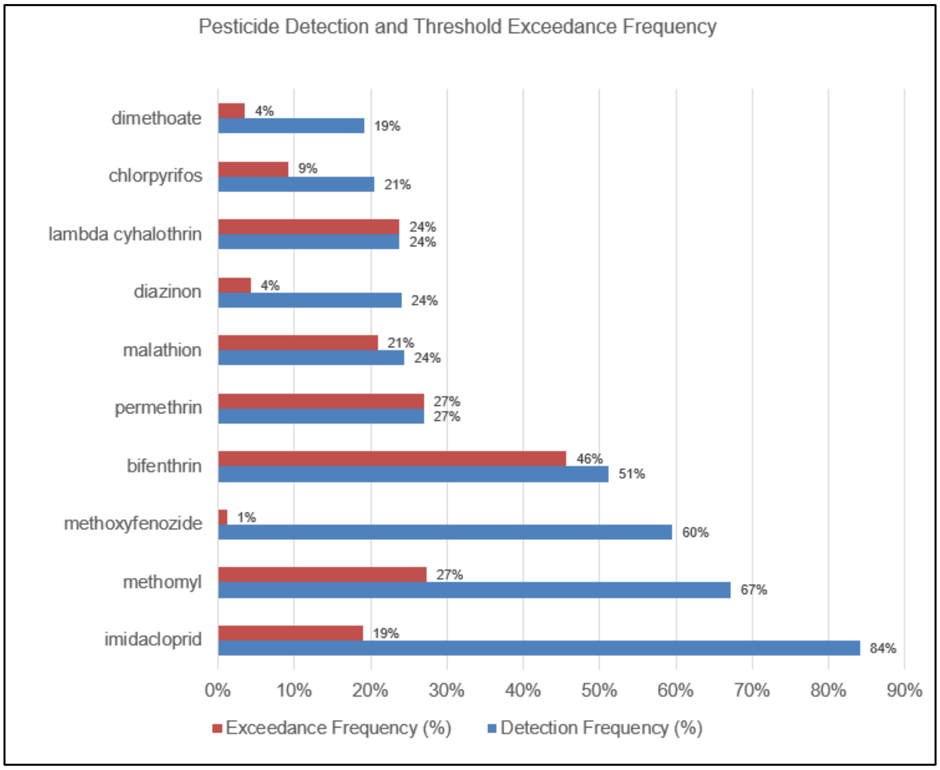

Figure 7. DPR pesticide data for the central coast (2011 to 2016). Percent of samples with pesticide detections and exceedances of lowest USEPA aquatic life benchmark.

Although the use of two organophosphate pesticides, chlorpyrifos and diazinon, has decreased in the central coast region (Figure 8), recent DPR monitoring detected chlorpyrifos in twenty-one percent of samples and diazinon in twenty-four percent of samples. Conversely, the use of neonicotinoid pesticides such as imidacloprid has increased in recent years (Figure 8) and DPR monitoring detected that pesticide in eighty-four percent of samples (Figure 7).

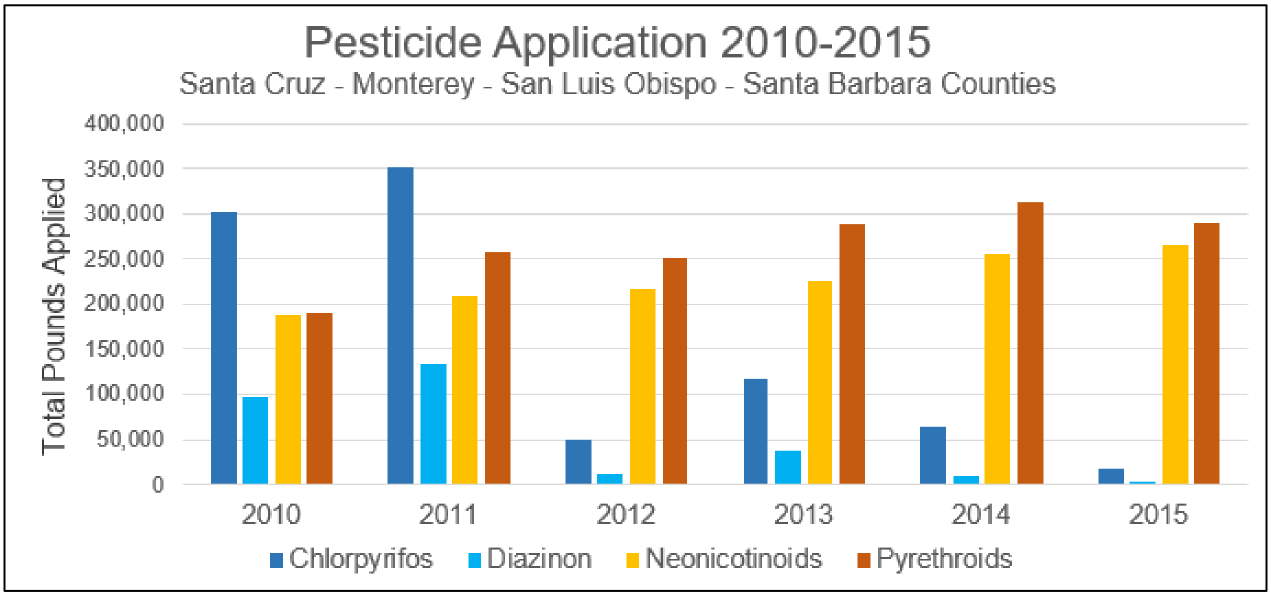

Figure 8. Total pounds of applied pesticides between 2010 and 2015 in four counties of the central coast region. Source: DPR pesticide Use Database

Based on the number of currently applied pesticides detected and exceeding USEPA benchmarks, the following watershed areas have the most pesticide pollution from agriculture: Gabilan Creek/Tembladero Slough watershed, Salinas River tributaries Chualar and Quail Creeks, and Orcutt Creek. Oso Flaco Creek is heavily impacted by malathion and imidacloprid. Pyrethroids detections in the Gabilan Creek/Tembladero Slough watershed far exceed those in the Santa Maria River watershed. In addition, pesticides impact some streams in urban and rural residential areas of region. Four streams in the Santa Cruz are on the 303(d) List due to elevated levels of chlorpyrifos. Recent data, not yet assessed for the 303(d) List, show that sediments in other urban watersheds including lower Carmel River and two Santa Barbara areas creeks (Arroyo Burro and Atascadero Creek) contain elevated levels of pyrethroid pesticides.

Turbidity

Turbidity is a measure of water clarity. Elevated turbidity during the dry season is an important indicator of sediment in agricultural tailwater discharges.

Many of the monitoring sites located in areas dominated by agricultural activities have sustained turbidity throughout the dry season, in some cases greatly exceeding 100 NTU as a median, compared to the 25 NTU criteria level necessary to protect steelhead trout (Figure 9). Waters that exceed 25 NTUs can reduce feeding ability in trout (Sigler et al., 1984). In the major agricultural areas of the central coast region, transport via irrigation runoff is the primary source of sustained turbidity during the dry season. In a well-functioning stream, elevated turbidity caused by sediment or eutrophication should be absent or short-lived in the dry season. This is true in many coastal streams and some streams located in agricultural areas such as upper Corralitos Creek, Arroyo Seco, lower Carmel River, Salinas River upstream of King City, and Lower San Luis Obispo Creek where there are no exceedances of the 25 NTU threshold in dry season (May – September).

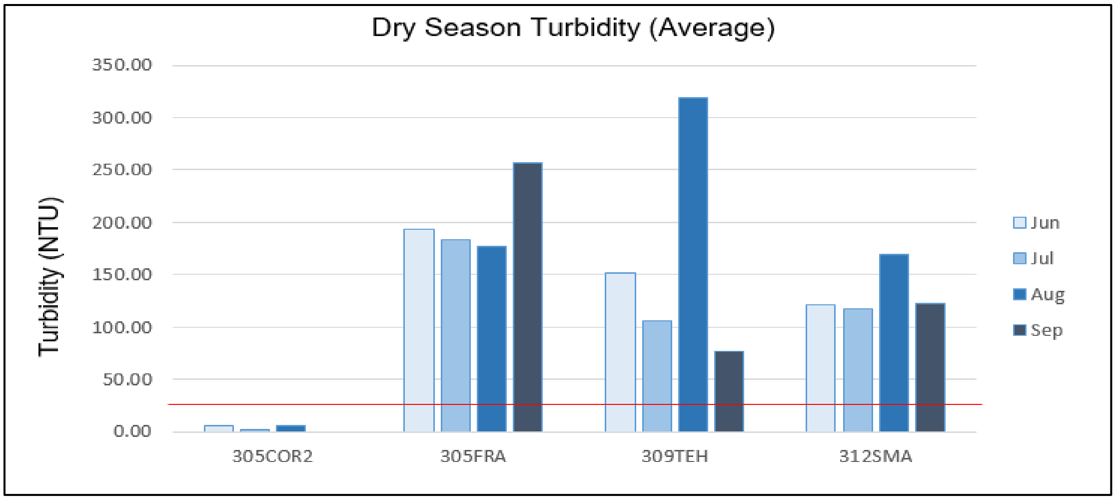

Figure 9. Average dry season turbidity levels, by month, at four sites in agricultural areas; Corralitos Creek above Watsonville (305COR2), Millers Canal (Pajaro River) at Frasier Lake Road (305FRA), Tembladero Slough at Haro (309TEH), and Santa Maria River above the estuary (312SMA). The red line delineates the aquatic life criteria protective of trout (25 NTUs).

In general, areas heavily influenced by agricultural discharges are in poor condition in terms of turbidity. These areas include the watersheds of the lower Salinas River, Gabilan Creek/Tembladero Slough, Santa Maria River, and Pajaro River. In the Salinas River and Gabilan Creek/Tembladero Slough watersheds, median turbidity values exceed 100 NTUs at sixty-one percent of the monitoring sites (median value of the entire data set for each site).

Fifty-five waterbodies in the central coast region are on the draft 303(d) List due to elevated turbidity (SWRCB, 2017, pending USEPA approval), (Figure 10). Seventy-eight percent of those waterbodies are located in the watersheds of the Salinas River, Gabilan Creek/Tembladero Slough, Santa Maria River, and Pajaro River. Figure 10 illustrates the location of waterbodies on the draft 303(d) List due to turbidity.

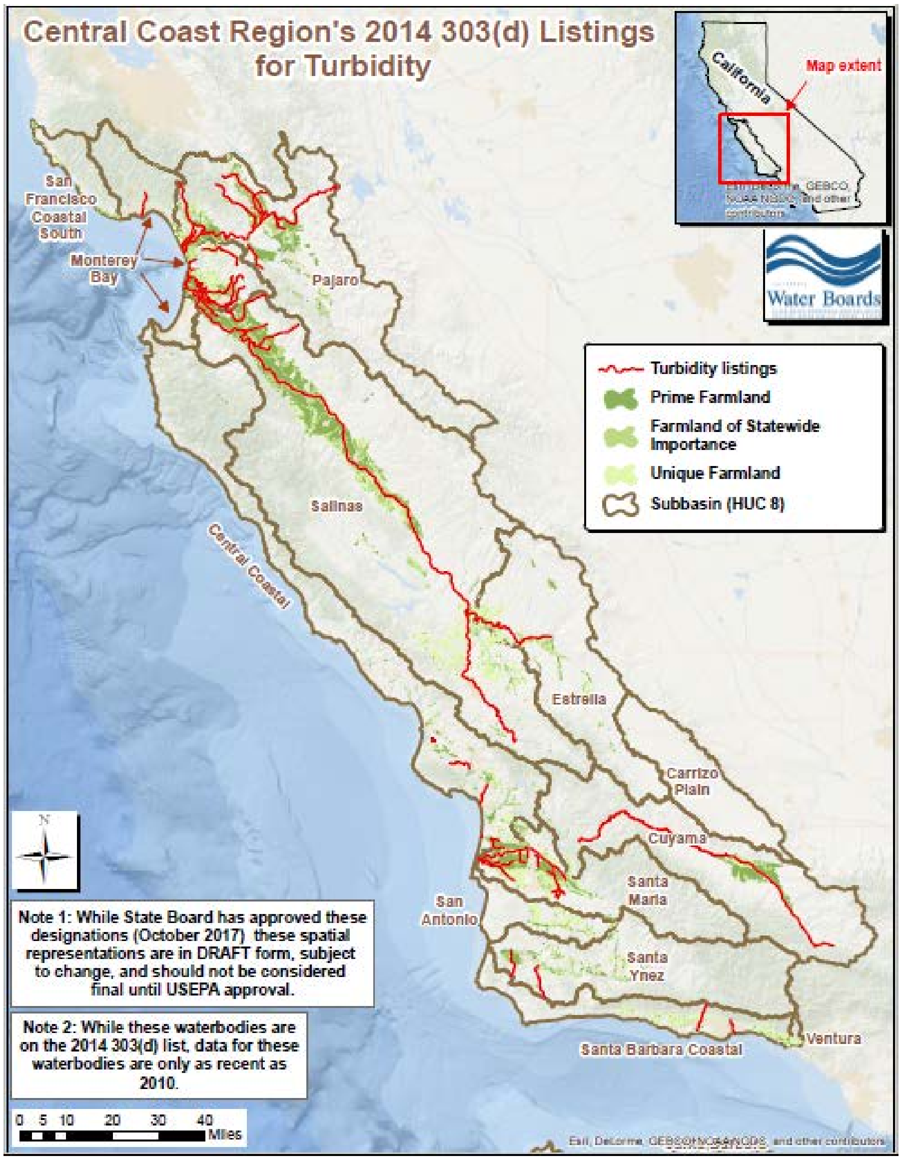

Figure 10. Map of the central coast region's waterbodies proposed for the draft 303(d) List due to elevated turbidity levels (red lines), (SWRCB, 2017, pending USEPA approval).

A number of the CCAMP and CMP sites score in poor or very poor condition for turbidity in the watersheds of the lower Salinas River, Gabilan Creek/Tembladero Slough, Santa Maria River and Pajaro River, where maximum values often exceed the limits of the field equipment (3000 NTU).

The turbidity data show a significant linear trend of decreasing turbidity at twenty-nine sites throughout the central coast region. Twenty of these are CCAMP or CMP sites in agricultural areas. However, in terms of improvement toward meeting water quality objectives, only three of those sites have improved from poor condition to fair condition while other sites still score poor or very poor for turbidity. Sites scoring in fair condition still exceed aquatic life turbidity standards on occasion. Nine of the sites showing decreasing turbidity trends are located in non-agricultural areas including lower Carmel River, three streams along the Big Sur Coast and urban streams along the Santa Barbara Coastline between Gaviota and Carpinteria. Overall, staff cannot determine if turbidity trends throughout the region are due to weather, such as drought, or management practices, and turbidity continues to be a major pollution problem in agricultural areas.

Resident Invertebrate Community Health

The community of organisms living in the stream such as benthic (bottom dwelling) macro-invertebrates (aquatic insects, snails and worms) respond to changes in habitat and water quality over their lifespans. Indices such as the California Stream Condition Index (CSCI) incorporate information about each organism's sensitivity to water quality and habitat and translate it into an overall measure of the stream's condition (Rehn, et. al., 2015). The CSCI score is a measure of how well the observed condition at a site matches the predicted condition.

Monitoring programs in the central coast region collect benthic macro-invertebrate data, and staff calculated CSCI scores. Figure 11 illustrates CSCI scores for CCAMP and CMP program sites. At many sites, this score reflects a single sample and additional data are needed to evaluate current biological conditions. This type of monitoring is conducted annually and therefore does not lend itself to trend detection, but biological condition is reflective of the recent health of the overall system. Therefore, a single sample provides a snapshot of current condition. Figure 11 illustrates that many monitoring sites ranked as "Very Likely Altered" or "Likely Altered" (as defined by Rehn, et. al., 2015) are located in areas with agricultural and/or urban uses. These poor ratings are likely a result of multiple factors, including habitat alteration as well as chemical and physical water quality degradation.

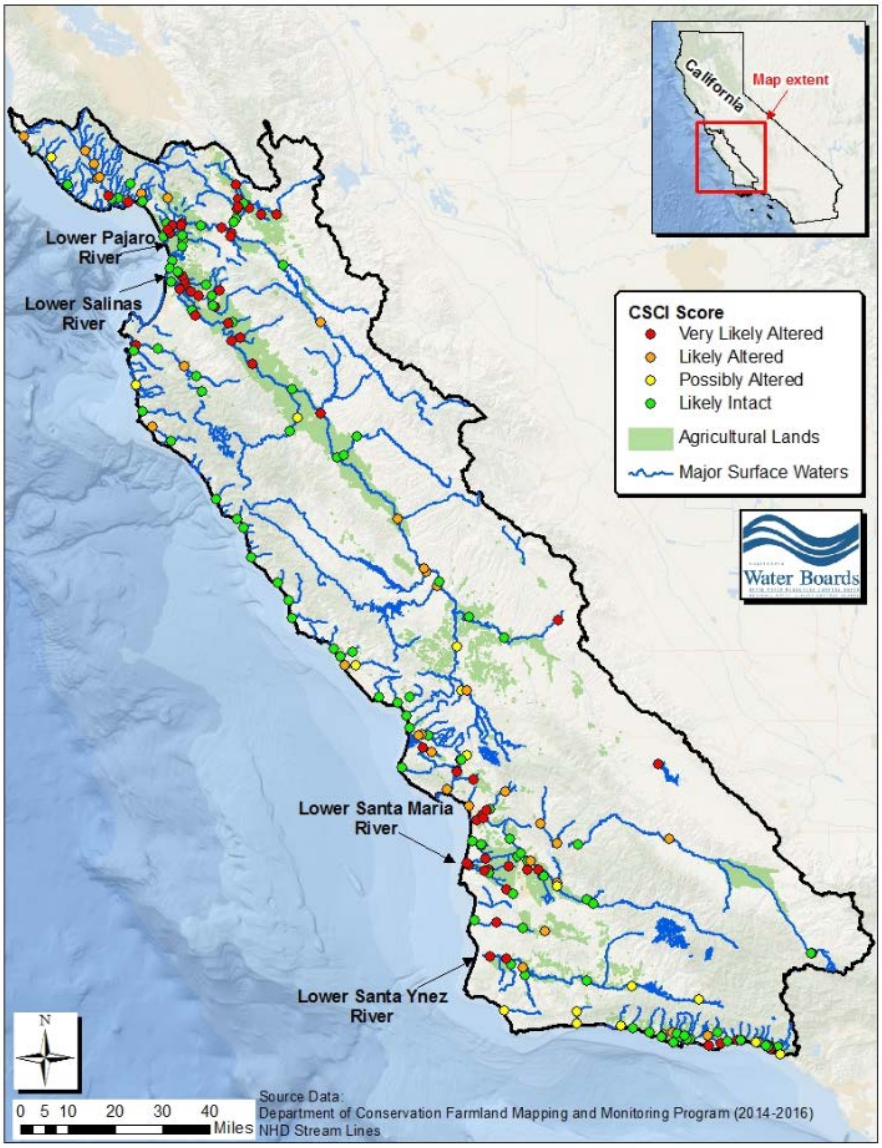

Figure 11. Map of CSCI scores at CCAMP and CMP sites in the central coast region.

Riparian and Wetland Habitat Conditions

There is limited data on riparian conditions along agricultural lands in the central coast region. However, there are indicators to help assess current conditions; sediment deposition is one indicator. The accumulation of fine sediment and sand deposited in the bottom of rivers and creeks helps indicate the presence or absence of riparian vegetation. Generally speaking, the greater the riparian vegetative buffer along creeks and rivers, the greater the protection of erosion and sedimentation into surface waters. Sediment laden stream bottoms can result from the immediate discharge of sediment from nearby fields, especially where stable and vegetated stream bank habitats are absent. In addition, the channelization of streams and consequent loss of floodplain contribute to degraded habitat condition.

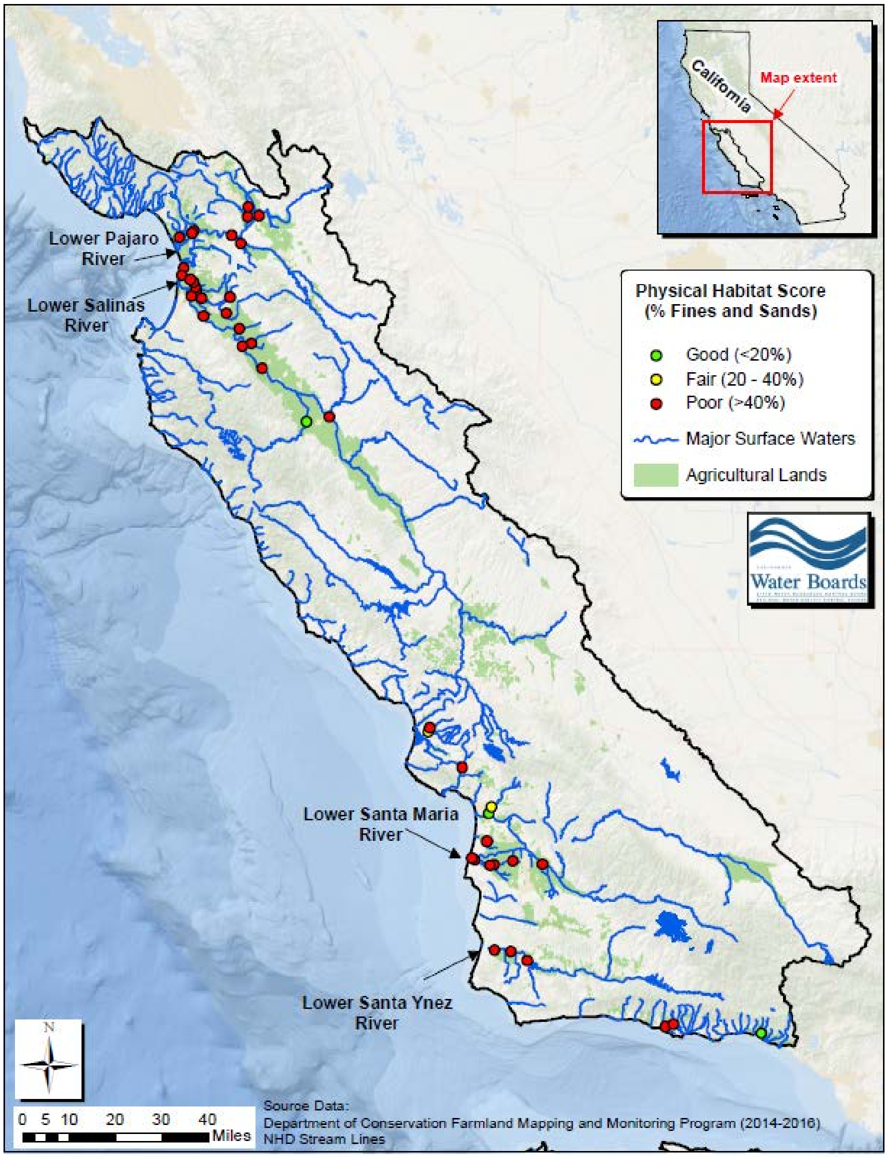

Figure 12. Map of sites with substrate size data, showing percent cover of fine and sand sized sediments at sites in agricultural areas.

Figure 12 illustrates the location of CCAMP and CMP sites in agricultural areas and the relative percent of fine and sand sized substrate particles at those sites. Instream substrate size is one of the physical habitat measurements collected with benthic invertebrate data assessments. Sites where the percent of fine sediment and sand exceeds 40% cover of the stream substrate score in poor physical habitat condition. This threshold is based on research in the San Lorenzo and Pajaro River watersheds that showed a strong correlation between percent of substrate that is fine and sand sized particles and low diversity of three benthic invertebrate taxa groups (mayfly, stonefly, and caddisfly), (Herbst, D. B. et. al., 2014). In general, sites in agricultural areas have a high percentage of fine and sand sized particles. Very few of the sites located in agricultural areas score in fair or good condition based on substrate size (these include Arroyo Seco, Arroyo Grande, and Arroyo Paredon). Additional data must be collected in order to evaluate the current conditions and future changes in riparian and wetland habitat conditions over time.

The current agricultural order, Ag Order 3.0 requires a small subset of Tier 3 farms to submit a Water Quality Buffer Plan (WQBP). Seven farms were required to submit the WQBP. The information collected from this limited reporting is insufficient to make broad inferences about the current ecological conditions of riparian and wetland habitats in and adjacent to agricultural areas in the central coast region.

Monitoring methodologies such as the Riparian Rapid Assessment Methodology (RipRAM), (Figure 13) are also useful to characterize riparian habitat condition and provide a range of condition scores. RipRAM evaluates the riparian vegetation condition as a factor to assess the functioning condition of a stream habitat. CCAMP employs the newly developed RipRAM methodology and to date has collected limited data in agricultural areas. However, as shown in Figure 13 RipRAM scores show poor riparian habitat condition in the lower Salinas and Pajaro River watershed areas, where agricultural land use is prevalent but many scores for sites outside agricultural areas indicate good riparian habitat condition. Additional data must be collected in order to evaluate the current conditions and future changes in riparian and wetland habitat conditions over time.

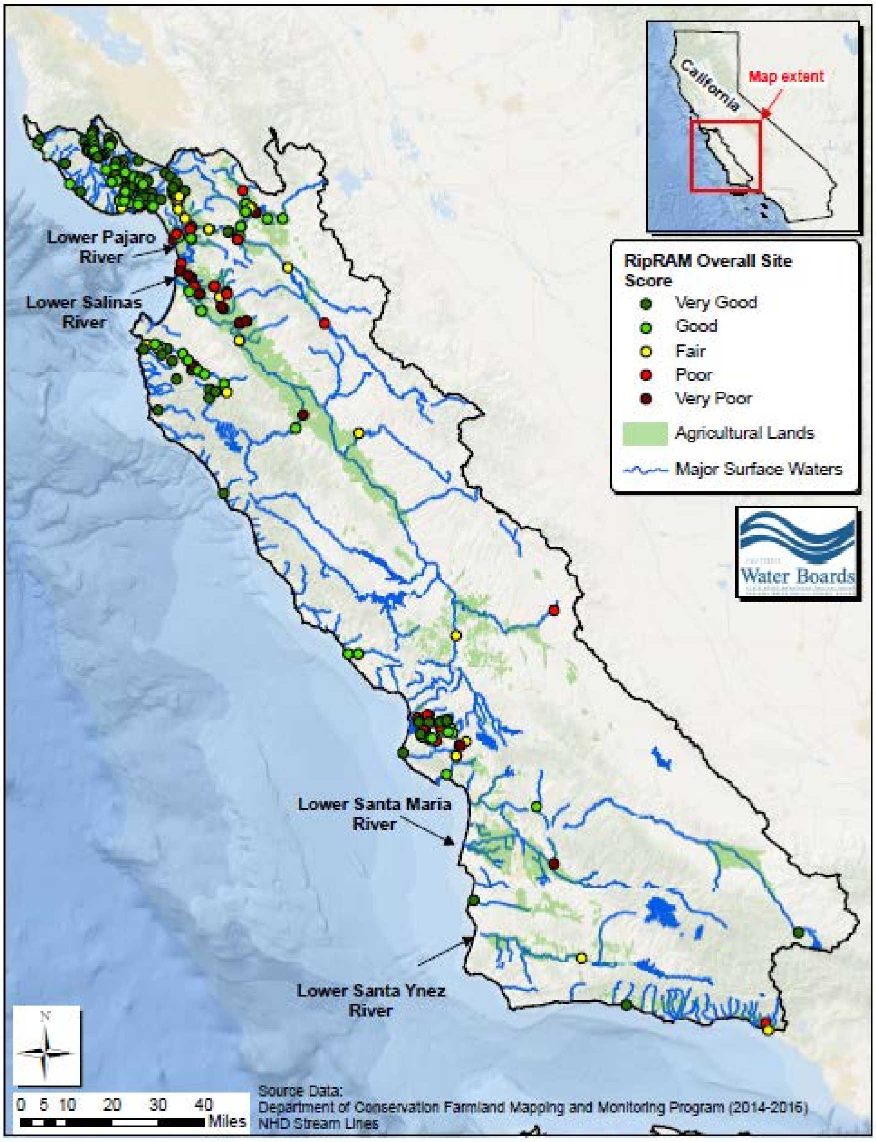

Figure 13. Map of sites with RipRAM Index scores for sites in the central coast region.

Riparian and Wetland Habitats

Riparian and wetland areas increase groundwater recharge, reduce erosion, and reduce the transport of sediment and agricultural pollutants. The pollutants include nutrients, pesticides, herbicides and fungicides. Many of the streams and rivers in the central coast are designated critical habitat for steelhead trout and other protected species. The restoration and protection of riparian and wetland areas are critically important to protect beneficial uses.

Wetlands and riparian areas play a significant role in protecting water quality and reducing adverse water quality impacts associated with nonpoint source (NPS) pollution (EPA, 2005). They are an important component of a combination of management practices that can be used to reduce NPS pollution in agricultural areas. In addition, in their natural condition they provide habitat for feeding, nesting, cover, and breeding to many species of birds, fishes, amphibians, reptiles, and mammals.

Wetlands

The spatial extent of wetlands in the state of California has been dramatically reduced by human activities since the 1850s. Human activities which have led to losses of coastal wetlands include urban and rural development, agriculture, and silviculture. These land use changes can also indirectly impact nearby wetlands by altering hydrology through increased runoff or water withdrawals in the watershed. Most of this loss occurs in freshwater wetlands. Riparian zones have likewise been reduced and impacted.

The scope and location of wetlands in the central coast region was assessed using the National Wetlands Inventory (NWI) database. The NWI was established by the US Fish and Wildlife Service (Service) in 1974 to conduct a nationwide inventory of U.S. wetlands to provide its biologists and others with information on the distribution of wetlands to aid in wetland conservation efforts. Staff used the NWI database to assess the wetland density by in the central coast region, and agricultural areas of the central coast region, at the landscape level (Figure 14).

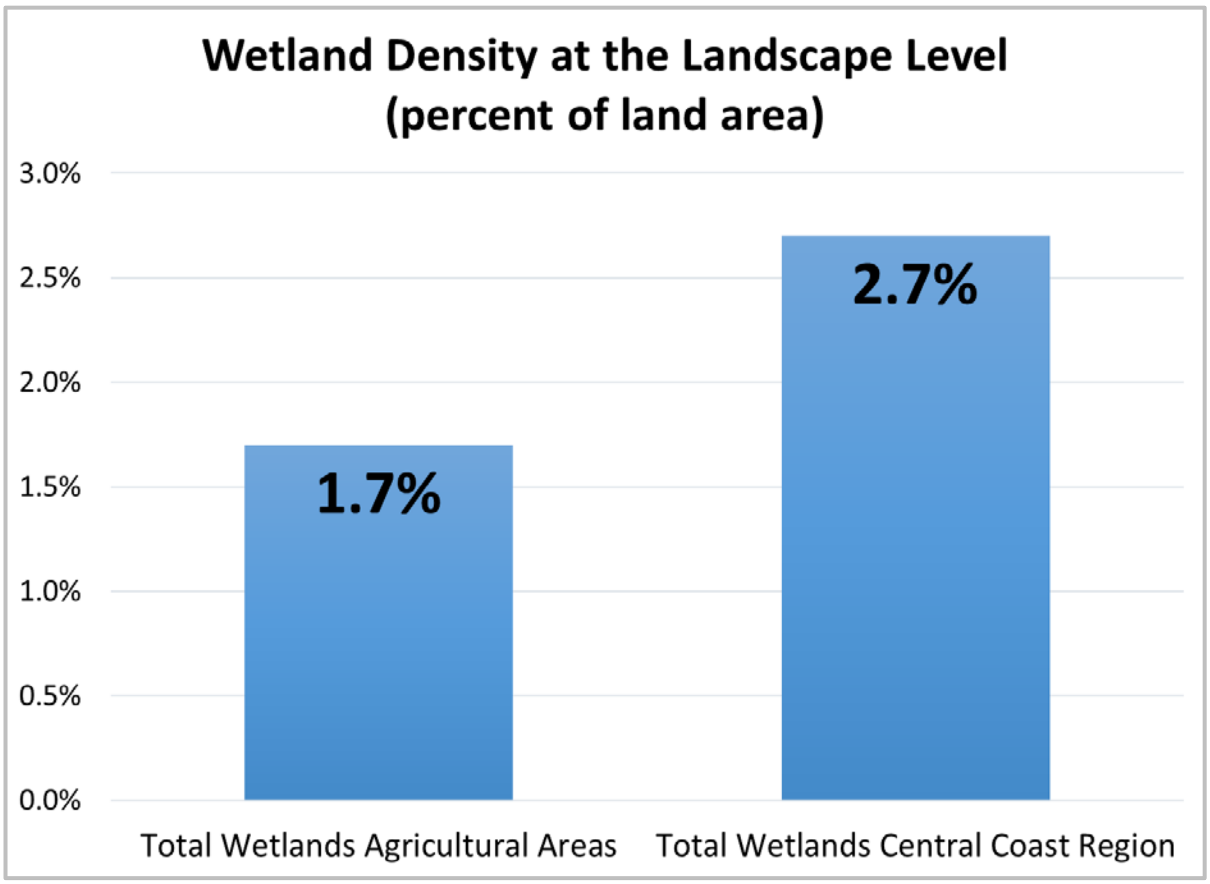

Figure 14. Wetland density, as a percent of total land cover, in the Central Coast Region and agricultural areas of the Central Coast region (NWI wetlands dataset).

Riparian Habitat

Intact riparian areas with tree cover support a variety of beneficial uses. Shade covering the streams moderates temperatures, creating better habitat for fish and insects. A healthy riparian area also contributes wood debris to streams, creating habitat for a variety of species.

Spatial datasets on riparian areas are available from the California Department of Forestry and Fire Protection's Fire and Resource Assessment Survey (FRAP, 2010). The FRAP dataset estimates riparian assets through a combination of the National Hydrography Dataset (NHD) and National Land Cover Dataset (NLCD). The NHD was used to locate streams and waterbodies. The buffered hydrology was then intersected with percent canopy cover from the NLCD. This provides a riparian area with percent cover for all perennial and intermittent streams and waterbodies in California. The percent cover was grouped into three classes for non-desert streams, indicating high, medium, and low canopy cover for non-desert area. Staff used the FRAP data to estimate the current state and extent of riparian assets in the central coast region and in agricultural areas of the region (Figures 15 and 16).

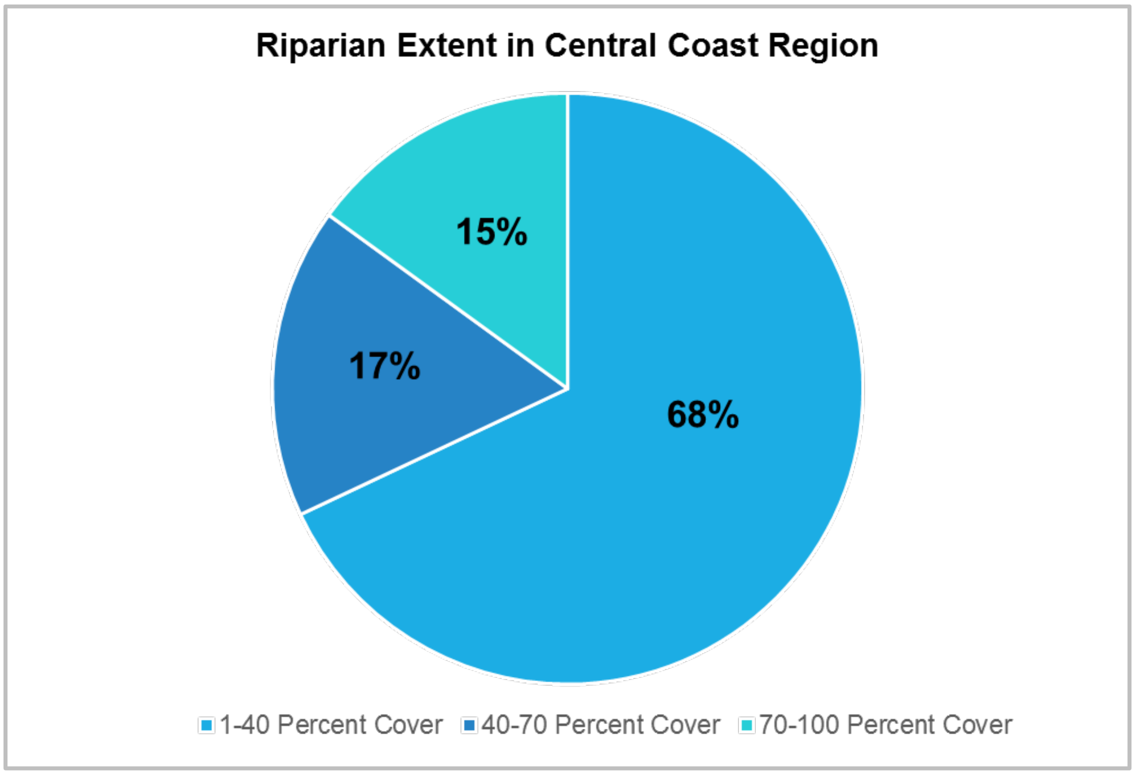

Figure 15. Riparian Extent in Central Coast Region (FRAP, 2010; NLCD, 2005)

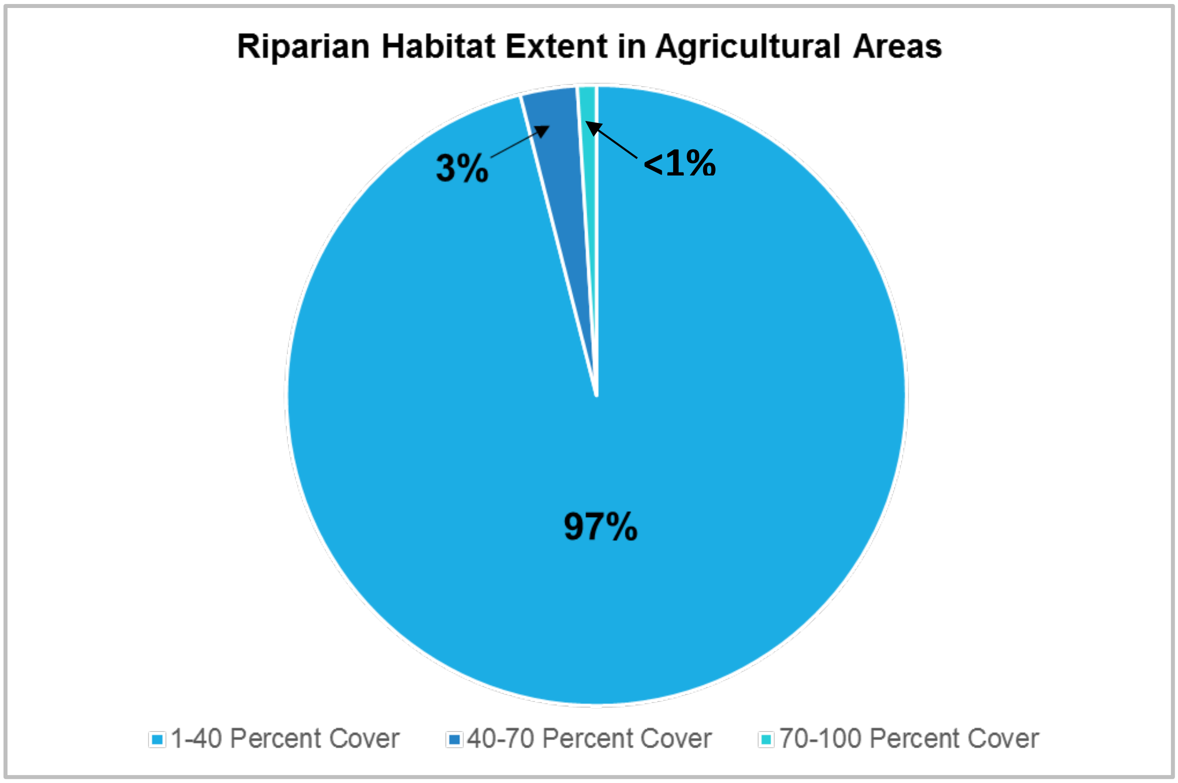

Figure 16. Riparian Extent in Agricultural Areas of the Central Coast Region (FRAP, 2010; NLCD, 2005)

Discharges from Irrigated Agriculture

Given the severe water quality degradation in irrigated agricultural areas, staff discusses certain issues associated with irrigated agricultural discharges below. Many of the statistics discussed have been compiled based on information gathered through implementation of the current and previous Ag Orders.

Irrigation Discharge

Excess irrigation water that leaves a farm field can discharge into irrigation ditches, wetlands, creeks, rivers, lakes, and the ocean. This irrigation discharge can be a source of sediment, nutrients, toxicity, and other pollutants that degrade water quality. Irrigation discharge can affect water resources designated for drinking water, irrigation, industrial use, and/or recreation activities, and for support of aquatic ecosystems.

Data from CCAMP and CMP indicate that surface waterbodies are severely impacted in the lower Salinas Valley, Pajaro Valley, and the lower Santa Maria Valley due to the intensive agricultural activity in these areas, and water quality in these areas are the most severely impaired in the central coast region.

There are approximately 1,198 farms (29% of all farms enrolled under Ag Order 3.0) that report irrigation discharge in their enrollment information. These farms also report that approximately 63,150 acres (15% of all acres enrolled under Ag Order 3.0) discharge irrigation water. Farms with irrigation discharge are located in all irrigated agricultural areas of the region. Figure 17 shows the general location of farms with irrigation discharge.

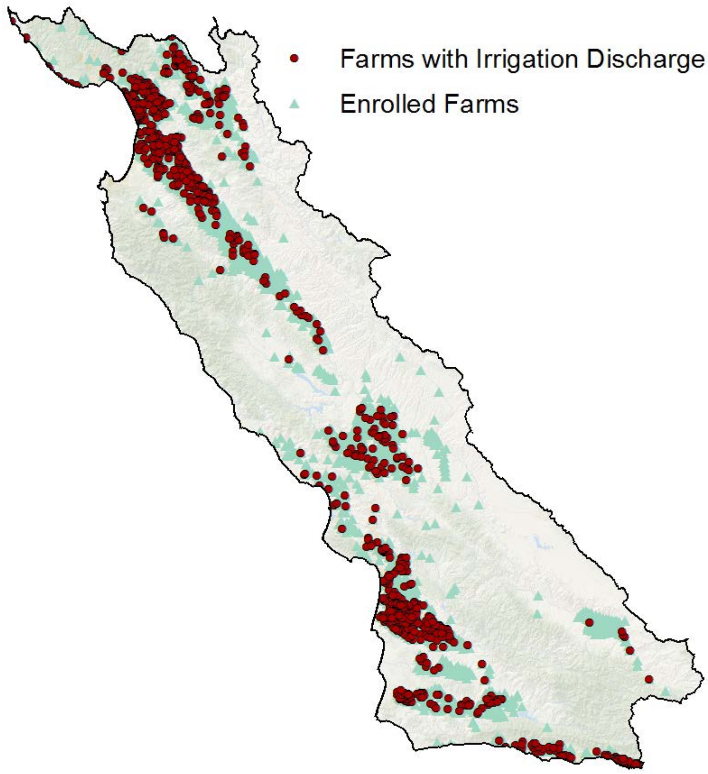

Figure 17. Location of ranches reporting irrigation discharge

Tile Drain Discharge

Tile drains, or subsurface drainage systems, remove excess water from the soil profile through a network of perforated tile tubes installed 2 to 4 feet below the soil surface. This lowers the water table to the depth of the tile drain over the course of several days. Once the water table has lowered to the elevation of the tiles, no more water flows through the tiles. The source of tile drain water is shallow groundwater which may include irrigation water, precipitation, or lateral movement of water due to regional groundwater flow (Vaughan, 1999).

Tile drain water typically enters irrigation ditches, wetlands, creeks, rivers, lakes, and the ocean. Tile drain water can be a source of nutrients, toxicity, and other pollutants that degrade water quality. Tile drain water can affect water resources designated for drinking water, irrigation, industrial use, and/or recreation activities, and for support of aquatic ecosystems. At this time, the overall scope and extent of water quality impacts to central coast water resources from tile drains is largely unknown and unquantified, as there is very little monitoring and reporting information from tile drains in the region.

There are approximately 230 farms (5% of all farms enrolled under Ag Order 3.0) that report the use of tile drains in their enrollment information. These farms also report approximately 15,500 acres (4% of all acres enrolled under Ag Order 3.0) as having tile drain discharges. Generally, areas with tile drains tend to be located in the lower Salinas Valley, Pajaro Valley, parts of southern Santa Clara valley, and the lower Santa Maria valley. Figure 18 shows the general location of farms with tile drains.

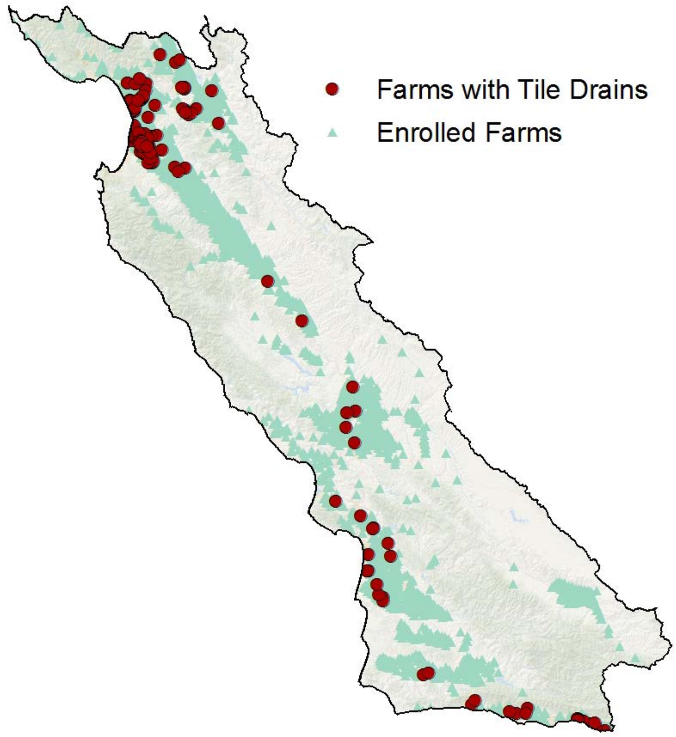

Figure 18. Location of ranches reporting tile drain discharge

<u>Pesticide Discharge</u>

Pesticides are widely used to protect agricultural crops from losses due to insects. Fungicides and herbicides are used to protect crops from fungal diseases and competition pressure from weeds and other unwanted plants. These chemicals have helped to increase agricultural production, but have led to human illness, wildlife losses, and water quality degradation. The ability to detect pesticides in the environment has greatly improved in recent years as laboratory methods can now detect very small concentrations of these chemicals in surface and groundwater, often at levels that degrade water quality and threaten aquatic life.

The Basin Plan general objective for <u>pesticides</u> states the following: "No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life."

The Basin Plan general objective for <u>toxicity</u> states the following: "All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal or aquatic life." Many pesticides have been detected at levels known to be toxic at a number of monitoring locations in agricultural areas of the central coast region in recent years.

Specifically, as previously discussed, forty-five waterbodies in the central coast region are on the draft 303(d) list due to pesticide pollution (SWRCB, 2017, pending USEPA approval). Several waterbodies are on the draft 303(d) list for multiple pesticides. The draft 303(d) list does not include any neonicotinoid data and very limited pyrethroid data. Staff anticipate several additional listings when those data are included in the assessment.

California Department of Pesticide Regulation data from 2010 to 2015 for Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara Counties show a general 68% increase of neonicotinoid pesticide active ingredient applied (thiamethoxam, imidacloprid, thiacloprid, dinotefuran, acetamiprid) from 50,817 pounds in 2010 to 85,247 pounds in 2015. Neonicotinoid pesticides have been detected at levels known to be toxic at a number of monitoring locations in agricultural areas.

Table 1. Neonicotinoid Pesticide Active Ingredient Applied *(pounds)*

County	2010	2015
Santa Cruz	723	1,413
Monterey	24,196	38,865
San Luis Obispo	9,422	17,142
Santa Barbara	16,476	27,827
TOTAL	50,817	85,247

California Department of Pesticide Regulation data from 2010 to 2015 for Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara Counties show a general 51% increase of pyrethroid pesticides active ingredient applied (gamma-cyhalothrin, lambda-cyhalothrin, bifenthrin, beta-cyfluthrin, cyfluthrin, esfenvalerate, permethrin, cypermethrin, fenvalerate) from 40,492 pounds applied in 2010 to 61,136 pounds applied in 2015. Pyrethroid pesticides have been detected at levels known to be toxic at a number of monitoring locations in agricultural areas.

Table 2. Pyrethroid Pesticide Active Ingredient Applied *(pounds)*

County	2010	2015
Santa Cruz	672	1,865
Monterey	28,599	45,794
San Luis Obispo	2,335	2,647
Santa Barbara	8,886	10,830
TOTAL	40,492	61,136

Water and sediment toxicity from pesticides continue to be parameters of concern in many water bodies and pesticide pollution is widespread in surface waters of the central coast’s agricultural areas.

CONCLUSION

The data from multiple monitoring programs continue to show a wide range of water quality conditions in surface waters on the central coast, from areas where conditions meet water quality objectives and where beneficial uses are largely protected, to areas that are severely degraded in terms of water quality objectives and beneficial uses. The majority of water quality degradation continues to occur in irrigated agricultural areas. Overall water quality data in these areas do not indicate that conditions are improving in terms of achieving water quality objectives and protecting beneficial uses. Staff is continuing to assess all available data and will propose options and recommendations for improving surface water quality in forthcoming site-specific and general orders, and Basin Plan amendments, including as part of Total Maximum Daily Load allocations (TMDLs) and Ag Order 4.0.

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