# Cooperative Groundwater Monitoring Plan
# for the
# Morro Valley Hyrogeologic Basin

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## Introduction

In the 2004 Agricultural Order, the Central Coast Water Board found that the discharge of waste from irrigated lands has impaired and polluted the waters of the State and of the United States within the Central Coast Region, has impaired the beneficial uses, and has caused nuisance. On March 15, 2012, the Central Coast Water Board adopted an updated Conditional Waiver of Waste Discharge Requirements (Agricultural Order No. RB3-2012-0011), henceforth referred to in this report as, "the Order". Studies indicate that fertilizer from irrigated agriculture is the largest primary source of nitrate pollution in drinking water wells. Therefore, the updated Order and Monitoring and Reporting Program requires implementation of ten measures to prevent further degradation and improve the quality of impaired waters. One of these measures The Order and MRP establishes a tiered approach, based upon those characteristics of individual farms/ranches at the operation that present the highest level of waste discharge or greatest risk to water quality.

There are more than 50 ranches, farms and orchards in the Morro Valley encompassing nearly 1000 acres of irrigated acreage. So far, thirty-two growers have enrolled by acknowledging that they irrigate crops for commercial sale thereby making them subject to the Order. Although the deadline to opt for cooperative groundwater monitoring has expired, Water Board staff has indicated that additional grower may still be allowed to participate. All but one of these growers produces avocados and has been designated as a Tier 1 operation. The only farmer growing row crops has received a Tier 2 designation. Each of these growers has opted to participate in a cooperative groundwater monitoring program as authorized by the order. The purpose of this plan is to outline the monitoring plan that will be used to comply with the requirement of the Order.

## Nature of Agricultural Operations in the Morro Valley

Agricultural activities in Morro Valley are comprised of a typical mix of irrigated crops, animal enclosures, stables, paddocks and grazing lands. A comparison of current irrigated agricultural acreage with prior crop surveys is shown in Table 1.

**Table 1. Irrigated Acreage 1977-2007 Morro/Little Morro Creek Valleys**

| Crop Type | Irrigated Acreage | | | | | |
|---|---|---|---|---|---|---|
| | 1977 | 1984 | 1992 | 1995 | 2001 | 2007 |
| Truck (except legumes) | 35 | 48 | 150 | 167 | 151 | 174 |
| Legumes | 11 | 89 | 228 | 371 | 193 | -- |
| Field | 70 | 69 | - | - | - | 6 |
| Pasture | 61 | 57 | 10 | 18 | 9 | 5 |
| Orchard | 59 | 187 | 258 | 361 | 562 | 798 |
| Total | 236 | 450 | 646 | 917 | 915 | 983 |

Notes: Orchard planting is not restricted to the valley floor. Survey by DWR in 1977, 1984 and 1995. Survey by Cleath & Associates in 1992, 2001, and 2007 with assistance from County records.

The short, mild winters of the central coast allow farming on a year-round basis. Therefore, the harvested acreage for row crops may be several times the farmed acreage, due to multiple cropping. As many as seven planting per year has been observed in some of the fields in the lower valley floor.

The most consistent trend in crops during the last 30 years is the steady increase in Avocado orchards. Avocado plantings have replaced many areas in the Morro Valley which were formerly in non-irrigated grains and field crops (1977 and 1985), and most recently peas (1995, 2001). Further expansion of the avocado growing areas to the hillsides above the valley floor represents the greatest portion of this increase. The California Farm Bureau, California Avocado Commission and the University of California Cooperative Extension in San Luis Obispo have been instrumental in providing proactive compliance since the earliest inception of the 2004 Order. In July of 2007, a three day seminar was conducted to provide growers with the requisite training in development and implementation of a Farm Water Quality Plan. Monthly grower workshops have provided informative session on how to employ best management practices to protect water quality. Valley avocado growers have routinely practiced water saving irrigation practices such as distribution uniformity monitoring and the use of micro sprinklers. Growers have already taken advantage of the Cooperative Surface Water monitoring program and most installed backflow prevention devices when they initially installed fustigation systems. Additionally, the California Avocado Commission is also actively working with growers, handlers, and packers to implement Good Agricultural Practices to ensure the safety of the crops they produce. The only Tier 2 grower in the Valley submits an Annual Compliance Form, so agricultural operations in the Morro Valley groundwater basin have moved forward aggressively to implement all corrective measures required by the Order. Figure 1 illustrates the location of various types of agricultures operations in the Morro Valley and Table 2 provides a list of those growers who have opted to participate in this Morro Valley Ground Water Monitoring Cooperative and share costs associated with this future cooperative monitoring program.

**Additional Land Uses Influencing Groundwater Quality**

Approximately 70 residential septic systems discharge to land overlying the ground water basin. Most of the residences are in Little Morro Creek Valley or upper Morro Creek Valley. There are less than 20 septic systems identified in the lower basin area, below the confluence of the two creek valleys. The largest volume of wastewater generated within the study area (outside of the City limits) is Rancho Colina, a residential development with approximately 68 permanent mobile homes, a recreational vehicle park with up to 57 spaces (with sewer hook-up), and clubhouse/office facilities. Raw wastewater effluent is collected, treated, and then discharged to a spray field located on adjacent property outside of the ground water basin. The spray field serves as irrigated pasture for grazing.

**Characterization of the Morro Valley Hydrogeographic Subregion**

The Morro Creek drainage area and the geology of the Morro Valley Groundwater Basin, are shown on Figure 2. The Morro Creek drainage area, comprising 17,272 acres, begins in the Santa Lucia Range and extends southwestward to Estero Bay. Rock formations within the Morro Creek drainage area include metavolcanic rocks, Mesozoic ultrabasic intrusive rocks, Upper Cretaceous marine sediments, Middle Miocene marine sediments, Quaternary alluvium and terrace deposits, and sand dune deposits of Pleistocene and Recent age. Annual precipitation

**Table 2. Morro Valley Groundwater Monitoring Cooperative Members**

| APN | Ranch | AW# |
|---|---|---|
| [redacted] | [redacted] | [redacted] |

falling on this drainage area varies from 16 inches at the coast to 35 inches at the northeastern drainage divide. Morro Creek and its main tributary, Little Morro Creek, drain the area. Downstream of this confluence, Morro Creek continues southwestward across the coastal area and empties into Estero Bay

The Department of Water Resources Bulletin 118 describes the Morro basin as encompassing 1,200 acres of alluvium, dune sand, and terrace deposits. The basin underlies the valley drained by Morro Creek and is bounded on the west by the Pacific Ocean and elsewhere by Cretaceous to Jurassic age Franciscan Formation rocks (DWR, 2004). There are three areas of groundwater storage in the Morro Creek Groundwater Basin. At the west end of the Morro Valley is a narrows formed by bedrock where the valley is less than 1,000 feet across. Downstream of the narrows, alluvial deposits from the valley are overlain in part by dune sands and also grade laterally into less permeable sediments associated with the near-shore depositional environment. The deepest portion of the valley sediments between the narrows and the coast follows an ancient stream channel alignment southwest toward the bay, while the active creek channel follows a more westerly alignment and drains directly into the ocean (Cleath & Associates, 1993a). Not all of the alluvial areas overlie significant saturated thickness of basin sediments. When shallow alluvial deposits nearest the valley edge, including smaller tributary channels and the uppermost portion of Little Morro Creek Valley are removed, the resulting basin area is approximately 1,200 acres. Most of the ground water in storage is contained in the basin area below the confluence of Morro Creek and Little Morro Creek valleys, which encompasses approximately 850 acres.

**Ground Water Occurrence and Movement**

Basin sediments consist predominantly of alluvial deposits in the Morro Valley, which extend approximately 60 to 80 feet beneath the valley floor. Groundwater is stored primarily in the alluvium, terrace deposits, and sand dune deposits. A number of faults cross the drainage area but there is insufficient subsurface geological information to determine if these affect the groundwater basin or its contained water.

The alluvium is comprised of sand and gravel stream channel deposits and finer-grained flood plain deposits of silt, clay and sand. Unconsolidated sedimentary deposits near the shore include beach and dune sands, and lagoonal fine grained sediments. Two aquifer zones have been identified within basin sediments (Brown and Caldwell, 1981 and Cleath & Associates, 1993a). The deeper aquifer zone is typically overlain by sandy clays, which had been interpreted as creating confining conditions in the lower basin area (Brown and Caldwell, 1981). However, more recent studies have concluded that the basin aquifer system is unconfined to leaky-confined (Cleath & Associates, 1993a and Aqui-Ver, 2003). Correlations between nitrate concentrations at the City well field and stream flow also support an unconfined aquifer system.

Ground water upstream of the narrows moves toward the coast. Equal-elevation ground water contour lines for fall 1954 (DWR, 1958) and spring 1970 (DWR 1972) and show southwesterly hydraulic gradients in the upper Morro Valley between 0.009 and 0.011 feet of decline in head per horizontal foot of distance (ft/ft), and 0.003 to 0.008 ft/ft in the lower valley, with up to 0.015 ft/ft through the narrows. Ground water elevation contour maps prepared for fall of 1977, 1980, 1982 (Cleath& Associates, 1993a) and 1991 (Cleath & Associates 1993b) also show ground water moving toward the coast, with up to 0.02 ft/ft of hydraulic gradient through the narrows.

Ground water movement below the narrows is controlled by the City well field. When the wells are in production, a pumping depression develops that draws water radially toward the wells, including sea water during drought. During non-pumping periods, ground water flow below the narrows is toward the coast at a nominal hydraulic gradient of 0.005 ft/ft（Aqui~Ver, 2005). Ground water in storage below the narrows extracted by City wells during non-drought periods is replenished primarily from Morro Creek stream seepage, percolation of precipitation, and subsurface inflow. During drought, sea water intrusion becomes a major component of recharge. Sea water is not a source of nitrate contamination, however, and the mechanics of intrusion are not pertinent to this investigation. Subsurface underflow through the narrows and stream seepage from Morro Creek are influenced by ground water levels, which are in turn influenced by ground water production from the well field. Production from City wells is an important factor in determining the contribution of recharge from each source. The relative proportion of basin recharge to the City well field from Morro Valley subsurface inflow has increased since State Water Project deliveries began, compared to recharge coming from Morro Creek stream seepage. The change in recharge dynamics at the City well field is due to reduced well field production following state water deliveries and dissolved MTBE plume detection in groundwater. Historical well field production during the 1980's averaged 540 acre-feet per year, but has averaged only 100 acre-feet per year since 2002.

**Existing Groundwater Quality**

Ground water from the City well field and other wells sampled is typically magnesium-calcium bicarbonate in character, which is consistent with the base flow from the surrounding watershed. There is a steady increase in ground water salinity between the upstream and downstream portions of the Morro Valley. The uppermost portion is close to 400 mg/l total dissolved solids (TDS). Upstream of the confluence with Little Morro Creek Valley, TDS concentrations are between 540 mg/l and 670 mg/l. In the lower valley area, TDS concentrations range from 690 mg/l to 1000 mg/l. TDS concentrations decrease slightly below the narrows. Ground water from the City well field contained between 640 mg/l and 760 mg/l TDS.

The state of California water quality standards are the controlling regulation for water quality in the Morro Creek area, since they incorporate the federal requirements in their entirety. Title 22 of the California Administrative Code. The Porter-Cologne Water Quality Control Act, as amended, forms the basis of state requirements for water quality control in the state of California. Under the act, regulation of water pollution control begins with the adoption of a water quality control plan, or basin plan, by the regional water quality control boards. Water quality objectives for Morro Basin are based on the policy of nondegradation of existing water quality as described in SWRCB Resolution 68-16. The basin plan requires that whenever the existing quality is better than the quality established as objectives, the existing quality shall usually be maintained. As no specific objectives for surface and groundwater were given for Morro Creek

Nitrate pollution of drinking water supplies is a critical problem throughout the Central Coast Region. Historical and existing conditions within this aquifer are already well established by several studies conducted over the past thirty-two years. The Morro Basin Nitrate Study

conducted by Cleath & Associates in December 2007, provides the most recent data regarding the quality of groundwater within the basin (See Figure 3). Nitrate concentrations in the lower Morro Valley have risen from an average of 34 mg/l in 1980 to an average of 160 mg/l in 2007. The study documents that fertilizer from irrigated agriculture has resulted in nitrate pollution of the drinking water wells of the City of Morro Bay located in within the Morro Valley groundwater hydrogeographic subregion. The timing of increasing nitrate concentrations at the City well field may be explained by the combined processes of increased nitrogen loading in the lower Morro Valley, which resulted in moderate increases in nitrates at the City well field through the 1990's, and by subsequent increases in the proportion of subsurface recharge to the City well field coming from the lower Morro Valley. The effect of decreased City well production on recharge dynamics has magnified the impact of increased nitrogen loading to the ground water basin on nitrate concentrations.

**Proposed Groundwater Water Monitoring Plan**

Two alternatives are available for growers with farm/ranches in Tiers 1 and 2 ONLY. The first option is to submit existing sample results for the constituents noted in Table 3 of the Monitoring and Reporting Program for Order No. R3-2012-0011-01. Growers in the Morro Valley choose to satisfy the sampling requirements by submitting a reference or citation of a local groundwater quality monitoring study that includes data collected within the last 5 years and documents local groundwater quality. The Morro Basin Nitrate Study thoroughly documents that Nitrate contamination in the uppermost aquifer has already impacted City drinking water wells at the mouth of the basin but the existing domestic wells throughout the remainder of the valley above the row crop operation do not exceed EPA primary drinking water standards.

The row crop operation on the lower valley floor is already under order by the Regional Board to control the use of nitrate fertilizers and conduct annual (more frequent??) groundwater monitoring. Five years after approval of this Cooperative Monitoring Plan, members of this Morro Valley Groundwater Monitoring Cooperative will conduct two rounds of groundwater sampling for the constituents noted in Table 3 of the MRP. Samples will be collected, analyzed and reported by Fruit Growers Laboratory of San Luis Obispo, a laboratory approved by the Board to perform work for the Order, who is a "Qualified Third Party", other than the owner, operator with the "knowledge and training in proper sampling methods, chain of custody, and QA/QC protocols." One sample will be collected during the spring (March/April) and the second sample will be collected during the fall (September/October). These samples will be collected from three wells located in the upper reach of Morro Creek [redacted] Each of these locations have been chosen because they currently have Nitrate levels that are below action levels but are adjacent to potential sources of future Nitrate contamination making them ideal bellwether sites. . The analytical results will then be uploading directly onto the GeoTracker database in the required Electronic Deliverable Format (EDF).***Growers must also provide specific information to the laboratory regarding the groundwater well (such as latitude and longitude, well use, well construction information).***

**Comment [S2]:** Confirm with RWQCB staff

**References**

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