CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
895 Aerovista Place, Suite 101
San Luis Obispo, California 93401- 7906
CLEANUP OR ABATEMENT ORDER NO. R3-2005-0014

Issued to

Olin Corporation and Standard Fusee Corporation
425 Tennant Avenue, Morgan Hill
Santa Clara County

The California Regional Water Quality Control Board, Central Coast Region (Regional Board) finds:

1. Olin Corporation and Standard Fusee Corporation (Dischargers), discharged or permitted the discharge of potassium perchlorate to waters of the state from a manufacturing facility located at 425 Tennant Avenue, Morgan Hill (Site), as shown on **Figure 1**. The Site is located approximately 30 miles southeast of San Jose and 0.5 miles west of Highway 101 in the City of Morgan Hill. The Site is in Santa Clara Valley, and is surrounded primarily by commercial property. Rural Residential, Agricultural and Urban land uses exist beyond and downgradient of the Site.

2. The Site is owned by Olin Corporation and consists of a 13-acre parcel located in southern Morgan Hill. The property is zoned light industrial with Assessor Parcel Number 817-029-028. Olin Corporation manufactured signal flares at the Site for about 32 years from 1956 to 1988. Standard Fusee Corporation leased the Site and manufactured signal flares for approximately seven years, from 1988 to 1995. Potassium perchlorate was used by the Dischargers to manufacture flares from 1956 to 1995. The Dischargers stored and used potassium perchlorate, strontium nitrate, chlorate, and other chemicals at the Site as ingredients of highway safety flares. Perchlorate contamination is suspected to originate from the Dischargers' use of an unlined evaporation pond to dispose of wastes from the cleaning of the ignition material mixing bowls, on-site burning of cardboard flare coatings, and accidental spills.

3. Olin Corporation was the sole property owner from at least 1956 to the present, had knowledge of the activities that resulted in the discharge and the legal ability to control the property and prevent the discharge. Both Olin Corporation and Standard Fusee Corporation, conducted activities that caused waste to be discharged or deposited where it was discharged into waters of the state and where it has created and threatens to create a condition of pollution or nuisance. If additional information is submitted that indicates other parties caused or permitted any perchlorate containing waste to be discharged into waters of the state in a manner that contributed to the perchlorate plume that resulted from the Dischargers' activities at the Site, the Regional Board will consider adding them to this Order. The results of investigations, described in **Findings 25 & 28** below, have confirmed the presence of chemicals used by the Dischargers in onsite soil and underlying groundwater.

4. This Order applies to the entire Site and to all known and unknown areas beyond the Site that have been impacted by Site activities. Perchlorate from the Site is known to occur in underlying soil and groundwater and downgradient groundwater. Wells that have tested positive for perchlorate pollution are shown on attached **Figure 2**. The results shown on **Figure 2** represent the most current result for each well south of the Site. Perchlorate has also been detected in wells northeast of the Site. The Dischargers and others are currently investigating perchlorate in this area to determine if the detected perchlorate originates from the Site.

5. The discharge of perchlorate described in this Order creates, or threatens to create, a condition of pollution or nuisance because, among other reasons, it has interfered with the use of hundreds of private domestic wells and has interfered with the use of water supplies for municipal and domestic beneficial uses. Perchlorate is a hazardous substance. The perchlorate detected at the Site is a waste as defined in California Water Code Section 13050(d). The Water Quality Control Plan, Central Coast Basin (Basin Plan), does not contain numeric water quality objectives for perchlorate in groundwater. The Basin Plan includes the following narrative objective: "Wherever the existing quality of water is better than the quality of water established herein as objectives, such existing quality shall be maintained unless otherwise provided by the provisions of the State Water Resources Control Board (State Board) Resolution No. 68-16, 'Statement of Policy with Respect to Maintaining High Quality of Waters in California,' including any revisions thereto." (Basin Plan, Chapter 3, Section II.A.) The perchlorate plume described in this Order degraded high quality waters of the state in violation of this objective.

6. The appropriate cleanup standard for perchlorate, as required by State Board Resolution No. 92-49, is background or the best water quality that is reasonable if background levels of water quality cannot be restored. Cleanup must consider all demands being made and to be made on impacted waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible. The current Notification Level and Public Health Goal for perchlorate is 6 parts per billion (ppb). The State Department of Health Services issued a draft Maximum Contaminant Level of 6 ppb.

7. Section 13304 of the Porter Cologne Water Quality Control Act (Porter Cologne) provides that: "Any person who... has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board, clean up the waste or abate the effects of the waste,..."

8. The Regional Board has been performing regulatory oversight of soil and groundwater investigation and cleanup at the Site since February 2001. The Site has been regulated previously by Regional Board orders including Water Code Section 13267 investigation orders, a cleanup or abatement order, and three waivers of waste discharge requirements, as described below. This Order does not rescind, supercede, or amend any previous action issued by the Regional Board, unless specifically stated in the ordering paragraphs (i.e., the paragraphs following "IT IS HEREBY ORDERED") below.

9. The Regional Board has directed onsite and offsite investigations via Water Code Section 13267 Orders (13267 Orders). These 13267 Orders require investigation of onsite and offsite impacts to soil and groundwater, and impose monitoring and reporting programs. Monitoring and Reporting Programs No. 01-161 (revised) and R3-2003-0168 were issued to the Dischargers using Water Code Section 13267 authority.

10. On July 7, 2004, the Regional Board issued Cleanup and Abatement Order No. R3-2004-0101 (Order R3-2004-0101). Order R3-2004-0101 directs the Dischargers to supply uninterrupted replacement water to well owners with perchlorate-contaminated wells and requires submittal of a replacement water plan for wells ranging from 4 to 10 ppb and implementation of water replacement plans for wells with concentrations above 10 ppb. The Dischargers are currently supplying interim replacement water to impacted offsite private well owners and completing plans and agreements to provide a long-term alternative water supply. The Dischargers have installed three ion exchange perchlorate removal systems on multiple user water supply wells in the San Martin community.

11. The Regional Board has enrolled the Dischargers in or issued the Dischargers three waivers of waste discharge requirements for the discharge of treated groundwater to land, the treatment of onsite soil, and the discharge of pump test groundwater to land. On December 8, 2003, the Regional Board enrolled Olin in General Waiver of Waste Discharge Requirements Resolution No. R3-2002-0115 (General Waiver) for discharge of treated groundwater to the Butterfield Retention Basin. The General Waiver allows and requires Olin to extract onsite groundwater and discharge it to the City of Morgan Hill's Butterfield Retention Pond. The Regional Board issued a Waiver of Waste Discharge Requirements Resolution No. R3-2004-0119 for onsite soil treatment on July 9, 2004. The soil treatment waiver requires the Dischargers to treat onsite soils to a level of 50 ppb, a level at which the Dischargers estimated groundwater would not be impacted above 4 ppb. A description of the treatment process is located in the Regional Board files. On December 6, 2004, the Regional Board enrolled the Dischargers in Waiver of Waste Discharge Requirements Order No. R3-2002-0115 for pump test water. The pump test groundwater discharge waiver allows the Dischargers to discharge limited quantities of groundwater to land. The Dischargers are conducting pump tests to determine well pump hydraulic characteristics for the design of wellhead perchlorate ion exchange treatment systems. The Dischargers also manage storm water runoff pursuant to State Board Order No. 99-08 DWQ, NPDES General Permit No. CAS000002 for Discharge of Storm Water Runoff Associated with Construction Activity.

12. **Hydrogeology**
The Site is located in the Llagas Subbasin of the Gilroy-Hollister Groundwater Basin in South Santa Clara County[1] (MACTEC, 2004)[2]. The Llagas Subbasin is a

[1] The geologic and hydrogeologic features of the South Santa Clara Valley, which include the Llagas Subbasin, are described in *Evaluation of Ground Water Resources, South San Francisco Bay, Volume IV, South Santa Clara County Area, Department of Water Resources Bulletin 118-1, May 1981 (DWR 118, 1981)*. In addition, the Site geologic/hydrogeologic features originate from the investigations conducted by Olin.

northwest to southeast trending alluvial-filled structural depression that is, in part, the southern extension of the north bounding Coyote Valley Groundwater Subbasin. The Llagas Subbasin is bounded on the west by the Santa Cruz Mountains/Gabilan Range and on the east by the Diablo Range, and merges to the south with the Gilroy-Hollister Groundwater Subbasin. The Tertiary- to Mesozoic-age bedrock forming these mountain ranges is relatively impermeable and limits the extent of groundwater movement to the east and west and at depth. The regional and local aquifer systems are composed of alluvial deposits over valley basin bedrock and include Pliocene to Holocene age continental deposits of unconsolidated to semi-consolidated gravel, sand, silt, and clay. These sedimentary deposits include older and younger alluvium from meandering stream systems, alluvial fans, flood plains, and lacustrine (lake bottom) and deltaic deposits from the ancestral Lake San Benito and Lake San Juan and the underlying Santa Clara Formation.

13. Based on the descriptions in the Department of Water Resources Bulletin 118 (DWR 118), the water-bearing deposits are predominantly older alluvium with an undefined amount of underlying Santa Clara Formation. The younger alluvium is typically located south of the City of Gilroy. The alluvial fan deposits are cited as occurring along the margins of the subbasin. Thicknesses of the alluvial deposits above bedrock in the central part of the subbasin are cited as at least 450 feet. The depositional history and paleodrainage system of the Llagas Subbasin was mostly composed of meandering stream channels that drained to the south-southeast and interchannel areas between active stream systems. The older alluvium stream channel deposits are described as Pliocene to Holocene age alluvial deposits of unconsolidated to semi-consolidated gravel, sand, silt, and clay. When present, the streams drained into the ancestral Lake San Benito in the Holocene period at least 5,000 years ago, and, more recently, into the ancestral Lake San Juan. The lacustrine deposits of the ancestral Lake San Benito and Lake San Juan are described as Holocene age clay and silt units that form a series of fairly continuous confining beds. The ancestral Lake San Benito deposits extend as far north as Middle Avenue and the ancestral Lake San Juan deposits extend as far north as Gilman Road and Dunlap Avenue. Lacustrine deltaic deposits are present where the meandering streams met the ancestral lakes. The lacustrine clays appear to be fairly continuous and form a series of confining beds south of Middle Avenue. North of Middle Avenue, the water bearing deposits have been characterized as unconfined and form a water table aquifer. Additional investigation and characterization of offsite hydrogeologic conditions are required in Ordering Paragraphs A, B, and C.

14. The Llagas Subbasin's northern boundary consists of a groundwater divide that is believed to coincide with the Coyote Creek alluvial fan topographic high as it emerges from the eastern foothills. The groundwater divide's approximate location is shown on the attached **Figure 3**[3]. The general regional direction of groundwater movement from the divide is toward the southeast, although the gradient near the Site appears relatively flat as shown on **Figure 3**. In addition to southeastern flow, **Figure 3** isocontours indicate a potential for groundwater flow to the north from the Site.

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[2] MACTEC Engineering and Consulting (MACTEC), 2004. *First Quarter 2004, Groundwater Monitoring Report, Monitoring and Reporting Program No. 2001-161, Olin/Standard Fusee Site, 425 Tennant Avenue, Morgan Hill, California*. January 31, 2004.

[3] Water District, 1999

The Dischargers are currently evaluating the possibility of a current or former northeast flow. Depth to water in the Llagas Subbasin is variable and typically ranges from 15 to 30 feet below ground surface (bgs) depending upon the season. Ordering Paragraphs A, B, and C require additional offsite hydrogeologic investigation and characterization to establish offsite groundwater flow patterns and characteristics.

15. Llagas Subbasin groundwater flow direction has been the subject of several investigations conducted by the U.S. Geological Survey (USGS), the California Department of Water Resources (DWR), and the Santa Clara Valley Water District (Water District). The USGS first investigated the Llagas Subbasin hydrogeology in 1917, and concluded that groundwater flow was generally south-southeast, parallel to the Santa Clara Valley's central axis. Water District groundwater contour maps and DWR investigations reflect findings similar to the USGS investigation.

16. Llagas Subbasin vertical and horizontal groundwater hydraulic gradients are not currently well defined, but are believed to increase during spring months as a result of recharge. Local groundwater gradients near municipal and agricultural production wells vary in response to production activities. Local gradients also change in response to the increase in groundwater extraction during dry summer months.

17. **Llagas Subbasin Stratigraphy**
Olin Corporation has evaluated Llagas Subbasin offsite stratigraphy and hydrogeology. The evaluation was based on lithologic logs and well construction details from over 500 available well logs, the distribution of perchlorate from the analytical results of sampling, and information from the Water District, water supply companies, well and pump maintenance companies, and private well owners. Subsurface stratigraphy is hypothesized to be composed of alternating permeable sand/gravel units and low permeability clay/silt units of variable thicknesses. The units split and merge but can be traced for considerable distances. The permeable sand/gravel units correspond with the alluvial deposits described above in the DWR 118 evaluation. The Dischargers' current hydrogeologic conceptual model hypothesizes that some clay units can also be traced for considerable distances.

18. The Dischargers' current hydrogeologic conceptual model hypothesizes that an intermediate aquifer zone sequence present beneath the Site can be continuously traced to near the Pacheco Pass Highway. The Pacheco Pass Highway is located approximately 9.5 miles South of the Site. The Dischargers' current hydrogeologic conceptual model hypothesizes that the stratigraphy and downgradient distribution of perchlorate demonstrate that the intermediate aquifer zone sequence is where perchlorate is located. The top of the intermediate aquifer zone sequence is approximately 80 feet below ground surface (bgs) beneath the Site and gradually deepens to 145 feet bgs at the Pacheco Pass Highway. The bottom of the intermediate aquifer zone sequence is considered to be 220 feet bgs beneath the Site because the lower intermediate aquifer zone sequence unit merges with the nearby upper intermediate aquifer zone sequence unit. The base of the intermediate aquifer zone sequence is approximately 200 feet bgs at Middle Avenue, and gradually deepens to 268 feet bgs at Rucker Avenue and approximately 325 feet bgs at Pacheco Pass Highway. There is sufficient uncertainty about localized Llagas Subbasin Stratigraphy to warrant additional focused investigation. Ordering Paragraphs A, B,

and C require additional focused Llagas Subbasin hydrogeologic investigation and characterization to establish offsite stratigraphy.

19. Apparently continuous clay silt aquitard units, both above and below the intermediate aquifer zone sequence, bound the intermediate aquifer zone sequence near the Site. The Dischargers' current hydrogeologic conceptual model hypothesizes that the clay silt aquitards tend to limit perchlorate within the permeable units within the intermediate aquifer zone. The clay silt aquitard that immediately underlies the intermediate aquifer zone sequence appears to correspond to one of the continuous lacustrine clays described in DWR 118 and would limit downward vertical perchlorate movement. However, offsite vertical gradients are not known and the Dischargers have not performed an investigation to determine direction or magnitude. The permeable sand/gravel units gradually become shallower and thin toward the edges of the subbasin as the units drape upward on the flanks of the Santa Cruz Mountains to the west and the Diablo Range to the east. The east and west margins of the subbasin are increasingly comprised of clay and silt because of alluvial deposition.

20. **Llagas Subbasin Hydrogeology**
Aquifer hydraulic conductivities are estimated to range from approximately 100 gallons per day per square foot (gpd/ft^2) near the basin margins to over 700 gpd/ft^2 near the basin's axial center, particularly to the south. The Dischargers' current hydrogeologic conceptual model hypothesizes that the increase in sands and gravels along the central axis of the valley also serves to limit the perchlorate to the more central portion of the subbasin because groundwater preferentially moves through high permeability materials found near the axial center of the subbasin. The Dischargers' current hydrogeologic conceptual model will be updated as a result of investigations required by Ordering Paragraphs A through D. Sufficient uncertainty exists about localized soil permeabilities and groundwater movement to warrant additional focused investigation.

21. **Underlying Site Stratigraphy**
Beneath the Site, the aquifer system is composed of heterogeneous layers of clay, silt, sand, and gravel, deposited on a bedrock surface more than 440 feet bgs. The Dischargers have characterized the Site subsurface into shallow (A), intermediate (B), and deep (C) aquifer zones based on data collected during well installation activities. Shallow A zone aquifer groundwater is predominately unconfined; however, local areas may be semi-confined by minor layers of silt and clay sediment within the aquifer, especially at greater depths within the shallow aquifer zone. Groundwater below the A zone aquifer is confined by fine-grained silts and clays that define the intermediate (B) and deep (C) aquifer zones aquitard units. The Dischargers have further defined these units into sub aquifers corresponding to the A1, A2 A3; B1, B2, B3; and C1, C2, C3.

22. **Underlying Site Hydrogeology**
Aquifer tests for the A zone yielded transmissivity test values ranging from 8,400 to 12,000 ft^2 per day (ft^2/day) and transmissivity values for the B1 zone range from 140 to 170 ft^2/day. The corresponding A zone bulk average hydraulic conductivity was

approximately 400 ft/day based on a 22 foot saturated thickness[4]. The corresponding B1 zone bulk average hydraulic conductivity, based on well EW-B1-001 25 foot screen length, was approximately 6 ft/day. Aquifer hydraulic properties have not been determined for the Deeper B2 and B3 and C1 through three sub aquifers. The Dischargers' current Site hydrogeologic conceptual model hypothesizes that the predominant direction of groundwater flow in each of the aquifer zones beneath the Site is toward the southeast, with localized and transient variability. The aquifer zone depth intervals are summarized below:

Aquifer Zone	Depth Interval (feet bgs)
Shallow or A	0 to 55
Intermediate or B	68 to 220
Deep or C	Greater than 243

23. Site vertical gradients are significant and imply a strong potential for downward flow within the intermediate and deep aquifer zones. Upward vertical gradients have also been observed at the Site, but to a lesser extent.

24. Residents, agricultural operations, businesses and cities surrounding and downgradient of the Site rely solely on groundwater for domestic, agricultural and industrial supply purposes. The known perchlorate plume area extends for approximately ten miles downgradient. Approximately 800 off site wells have had perchlorate detections offsite. Approximately 98% of those wells test below 10 ppb.

25. **On and Offsite Investigations and Remedial Measures**
The Dischargers caused or permitted perchlorate-containing wastes to be discharged to the soil at the Site and to groundwater underlying, downgradient to the south, and possibly to the north of the Site. Due to the naturally permeable and transmissive nature of underlying and downgradient hydrogeology, perchlorate-containing wastes have impacted onsite soil and on and offsite groundwater. Perchlorate was first detected at 21 and 55 ppb in underlying Site groundwater samples, in August 2000, during a due diligence investigation by a potential buyer. In response, the Dischargers installed three shallow monitoring wells (MW-1, MW-2, and MW-3) to verify the perchlorate detections. These wells were installed to approximately 35 feet below ground surface. Perchlorate was detected at 17 ppb in MW-1, 37 ppb in MW-2, and was not detected above 4 ppb in MW-3. Onsite, perchlorate has been detected in aquifers A, B and C, with the highest concentrations in the lower A and upper B1 zones. Concentrations in the A zone range from non detect (ND) to 770 ppb, B zone concentrations range from ND to 390 ppb, and C zone concentrations range from ND to 10 ppb.

26. The Dischargers believe that the offsite perchlorate plume exists mainly in the middle B zone aquifer and extends approximately ten miles to just past Highway 152 east of the City of Gilroy. However, the Dischargers' characterization of groundwater contamination to date has relied on existing supply wells and the lateral and vertical extent of the plume remains incomplete. The Dischargers proposed and the Regional

[4] GeoSyntec. 2003. 90% Design Report For On-Site Containment and Treatment of Perchlorate in Groundwater, Olin/Standard Fusee Site, Morgan Hill, California. October 23, 2003.

Board approved the use of 45 existing supply wells to continue to characterize and monitor the perchlorate plume's lateral and vertical extent on August 7, 2003. The Regional Board required, in a February 24, 2004 letter, the Dischargers to submit a technical justification for the proposed offsite-monitoring program. The February 24th letter, which constituted a Section 13267 Order, required the Dischargers to provide technical justification for utilizing offsite private supply wells for monitoring. The Dischargers submitted the technical report, but subsequently withdrew the proposed monitoring network in order to develop a revised Llagas Subbasin Monitoring Plan. A revised Llagas Subbasin Monitoring Plan is required to be submitted per Ordering Paragraph A.

27. Measurable perchlorate concentrations in the ten-mile long offsite groundwater plume range from a maximum of 100 ppb to a minimum of 2 ppb. The Dischargers have not installed downgradient-monitoring wells, but have relied upon perchlorate concentration data from existing private supply wells. It is unknown if any of the offsite private supply wells provide representative samples of perchlorate concentrations. Supply wells typically have screen lengths much longer than wells designed for monitoring. Longer screen and filter pack lengths and or intervals may tend to understate the maximum concentrations in groundwater. Uncertainties about well construction warrant a thorough evaluation of the offsite monitoring system. Ordering paragraphs A through D require additional evaluation of wells proposed for inclusion in the monitoring system and installation of monitoring wells to establish an appropriate monitoring well network.

28. **Other Investigations**
Perchlorate has been detected in some of the City of Morgan Hill's supply wells to the northeast of the Site. In response, the Regional Board ordered the Dischargers to investigate perchlorate northeast of the Site. On September 10, 2004, the Dischargers submitted the Groundwater Flow Assessment Report and subsequently submitted a Groundwater Flow Assessment White Paper and additional information requested by Regional Board staff. The Groundwater Flow Assessment Report concluded that northeast perchlorate impacted groundwater did not originate from the Site. Regional Board staff concluded that the groundwater model and the other data presented were inadequate to predict local groundwater flow or to understand current or historic flow conditions. Therefore, the Regional Board directed the Dischargers to proceed with phase II of the Groundwater Flow Assessment Work Plan and install northeasterly-located piezometers to collect additional sub aquifer data. In addition, the Regional Board directed the Dischargers to sample domestic supply wells in that northeast study area for perchlorate, and to submit a forensic investigation work plan (13267 Order dated December 8, 2004). The Dischargers continue to investigate whether these detections are related to the Site perchlorate discharge.

29. **Onsite Cleanup**
The Dischargers have implemented soil and groundwater cleanup at the Site. On August 3, 2004, the Executive Officer approved a combination of in situ and ex situ anaerobic bioremediation to treat perchlorate-contaminated soil. On November 18, 2003, Regional Board staff approved the installation and operation of the Onsite Groundwater Containment and Perchlorate Removal System (System). The System's purpose is to provide hydraulic containment and removal of perchlorate through

onsite groundwater extraction and treatment. The System began operation on February 23, 2004. By April 7, 2004, System startup was completed and has been operated continuously since that time.

30. **Offsite Cleanup**
The Dischargers have not yet proposed an offsite cleanup plan. This Order requires the Dischargers to propose an offsite cleanup level and evaluate offsite cleanup alternatives including basin characterization, monitoring, short and long-term plume migration and cleanup alternatives.

31. The following reports detail the presence of perchlorate in soil and or groundwater at, and beyond, the Site:
    - Environmental Engineering Consultants' *Perchlorate Investigation* dated December 7, 2000
    - Environmental Engineering Consultants' *Perchlorate Investigation* dated March 21, 2001
    - Law Engineering and Environmental Services' *Soil and Groundwater Investigation Report for the Olin/Standard Fusee Property* dated May 16, 2002
    - MACTEC Engineering Consultants' *Phase 3 Soil and Groundwater Investigation Report* dated December 2, 2002
    - MACTEC Engineering Consultants' *Phase 3 Soil and Groundwater Investigation and Remedial Action Conceptual Design Report* dated June 30, 2003
    - GeoSyntec Consultants' *90% Design Report For Onsite Containment and Treatment of Perchlorate in Groundwater,* October 24, 2003
    - GeoSyntec Consultants' *Soil Remediation Feasibility Study* dated November 21, 2003
    - GeoSyntec Consultants' *Remedial Action Work Plan & 90% Design Report For Soil Remediation*, April 8, 2004
    - MACTEC Engineering Consultants' Quarterly Groundwater Monitoring Reports dated October 30, 2003, January 30, 2004, April 30, 2004, July 30, 2004, and October 30, 2004

    Reports not specifically included above, but that have been submitted to the Regional Board by the Dischargers and others, are located in the Regional Board file.

32. **Basis for Groundwater Cleanup Standard**
State Board Resolution No. 68-16 (Resolution No. 68-16), "Statement of Policy with Respect to Maintaining High Quality of Waters in California," applies to this discharge. Resolution No. 68-16 requires:
    a. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.
    b. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which

will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

33. The groundwater impacted by the perchlorate plume is "high quality water" for purposes of Resolution No. 68-16.

34. State Board Resolution No. 92-49 requires Dischargers to "clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible." (Id., Section III.G.) Cleanup levels less stringent than background must comply with Section 20400, Title 27, California Code of Regulations (formerly Section 2550.4, Title 23, California Code of Regulations). The Dischargers have not yet analyzed whether background can be restored or what is the best water quality that is reasonable. This Order requires the Dischargers to determine background perchlorate levels (see Ordering Paragraph A and D) and provides a process for the Dischargers to propose an appropriate cleanup level. Should the Dischargers submit information that indicates background water quality cannot be restored, Regional Board staff will review that information to ensure consistency with Resolution No. 68-16 and No. 92-49, and with Section 20400, Title 27, California Code of Regulations or Section 2550.4, Title 23, California Code of Regulations.

35. **Beneficial Uses**
The Basin Plan incorporates statewide plans and policies by reference and contains a strategy for protecting beneficial uses of State Waters. This Order implements the water quality objectives and other requirements stated in that Plan. Pursuant to Chapter 2 of the Basin Plan, present and potential beneficial uses of groundwater underlying the Site, and in the area of the perchlorate plume, include:
    a. Domestic and municipal water supply.
    b. Agricultural water supply.
    c. Industrial water supply.

36. Groundwater throughout the affected area and Llagas groundwater subbasin is actively used as a source for domestic, municipal, agricultural and industrial supply waters. Section 13050(*l*) of the California Water Code defines "pollution" as an alteration of the water quality to a degree that unreasonably affects either beneficial uses or facilities that serve these beneficial uses. Section 13050(*l*)(2) provides that "pollution may include contamination." Section 13050(k) defines "contamination" as "an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease." Section 13050(m) defines "nuisance" as "anything which meets all of the following requirements: (1) Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property. (2) Affects at the same time an entire community or neighborhood, or any considerable number of persons ... (3) Occurs during, or as a result of, the treatment or disposal of wastes." The perchlorate plume

has interfered with the municipal and domestic use by thousands of people of the affected groundwater, who use both private and public supply wells and occurred during, or as a result of, the disposal of perchlorate-containing waste. The plume constitutes both pollution and nuisance.

37. **Notification**
The Regional Board has notified the Dischargers and all interested agencies and persons of its intent pursuant to California Water Code Section 13304 to prescribe this Cleanup and Abatement Order to the Dischargers. The Regional Board has made every reasonable attempt to notify these individuals and has provided them with an opportunity to submit their written views and recommendations.

38. **California Environmental Quality Act**
This enforcement action is being taken for the protection of the environment and as such is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) in accordance with Sections 15307 and 15308, Chapter 3, Title 14, California Code of Regulations. The issuance of this Order is also an enforcement action taken by a regulatory agency and is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.), pursuant to Section 15321(a)(2), Title 14, CCR.

39. **Cost Recovery**
Pursuant to Section 13304 of the California Water Code, the Regional Board is entitled to, and may seek, reimbursement for all reasonable costs actually incurred by the Regional Board to investigate unauthorized discharges of wastes or to oversee cleanup of such waste, abatement of the effect thereof, or other remedial action pursuant to this Order.

40. **Reporting**
Section 13267(b)(1) of the California Water Code provides that:

> "In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports."

As described in this Order, existing data and information about the Site indicates that waste has been discharged or is discharging from the facilities described above, which facilities are owned or operated, or formerly owned or operated by the Dischargers named in this Order. This Order requires monitoring, work plans and reports pursuant to Water Code Section 13267.

This finding is made in compliance with Section 13267. The work plans and monitoring required by this Order are necessary to design and implement a cleanup plan for the perchlorate-impacted groundwater and to determine compliance with this Order.

41. **State Board Review**
Any person affected by this Regional Board action may petition the State Board to review the action in accordance with Section 13320 of the California Water Code and Title 23, California Code of Regulations, Section 2050. The State Board, Office of Chief Counsel, must receive the petition within 30 days of the date of this Order. Copies of the law and regulations applicable to filing petitions will be provided upon request.

42. **Regional Board Review**
Any person affected by this Regional Board action may request the Regional Board to review this action. The hearing would be conducted by the Regional Board at a public meeting or by the Executive Officer, as determined by the Executive Officer after consultation with the Dischargers and (if not the Dischargers) the person(s) requesting review. A request for Regional Board review does not extend the 30-day period for filing a petition with the State Board, but the State Board may hold the petition in abeyance at the request or with the agreement of the petitioner. (See Title 23, California Code of Regulations, Section 2050.5(d). A Regional Board hearing request must be submitted in writing to Staff Counsel Lori T. Okun by facsimile to (916) 341-5199 within 30 days of the date of this Order. Failure to request Regional Board review may prevent a petitioner from submitting new evidence in support of a State Board petition.

IT IS HEREBY ORDERED, pursuant to Sections 13267 and 13304 of the California Water Code that the Dischargers shall clean up or abate the effects of the perchlorate discharge from the Site as follows:

The following Ordering Paragraphs do not currently apply to areas (aquifer zones) to the north or northeast of the Site (Northeast Groundwater Flow Study Area; see Finding 28). The Regional Board or Executive Officer will revise this Order or issue a separate order requiring the Dischargers to clean up and/or abate and/or further investigate perchlorate in aquifer zones serving the City of Morgan Hill's wells and other wells to the north or northeast of the Site, if the Regional Board or Executive Officer concludes that the Dischargers caused or permitted the discharge of waste, or threaten to cause or permit the discharge of waste, that has impacted or threatens those aquifer zones.

A. **LLAGAS SUBBASIN MONITORING PLAN Due Date: April 9, 2005**
Submit a monitoring plan acceptable to the Executive Officer that proposes to completely delineate and monitor the lateral and vertical extent of perchlorate in downgradient aquifer zones. The Llagas Subbasin Monitoring Plan shall be designed so that the following objectives are addressed:
1. Characterization of the lateral and vertical extent of perchlorate pollution in all identifiable aquifer zones.
2. Determination of plume migration status (shrinking, expanding, no change).

3. Provide accurate aquifer zone specific perchlorate concentration data.
4. Provide data to advance and improve the offsite hydrogeologic conceptual model.

The monitoring plan shall include locations of proposed and newly installed offsite monitoring wells. If the Dischargers propose to use supply wells as part of the offsite monitoring system, the Dischargers shall demonstrate, to the Executive Officer's satisfaction, that those supply wells will be effective at providing groundwater quality data comparable to properly constructed and sited monitoring wells or piezometers. The Dischargers may submit data from supply wells that are not properly constructed in order to supplement data from properly constructed and sited monitoring wells, but the Regional Board will only consider the supplemental data to the extent it provides valuable information. Ordering Paragraph B, below, requires submittal of a monitoring well installation and characterization work plan and schedule for implementation. The Llagas Subbasin Monitoring Plan shall include the following elements in addition to addressing the aforementioned objectives:

1. Recommendations for locations of new and existing offsite monitoring wells to determine the lateral and vertical extent of perchlorate pollution.
2. Recommendations for locations of new monitoring wells or existing supply wells to act as sentry wells for the City of Gilroy and other high volume water users. High volume water users do not include residences served by an individual private well. The Executive Officer shall determine what constitutes a "High Volume" well. Supply wells that are identified for use as sentry wells shall meet the requirements of subparagraph 3, below.
3. Recommendations for and identification of water supply wells that are proposed for inclusion in the Llagas Subbasin Monitoring Plan. If the Dischargers choose to include water supply wells, those wells shall be shown to be equivalent to properly sited and constructed monitoring wells. The Dischargers shall use the following criteria or propose alternative criteria, acceptable to the Executive Officer, to evaluate water supply wells:
    - Analysis of lithologic logs and well construction data.
    - Sampling and analysis for geochemical parameters.
    - Flow metering, packers to isolate zones, video logging, and chemical techniques for field-testing.
    - Comparison of supply well attributes and characteristics to properly sited and constructed monitoring wells.
    - Long-term well access.
4. Recommendations for a regional and local aquifer specific groundwater elevation-monitoring network to determine groundwater flow patterns.
5. Recommendations for a sampling and analysis plan that establishes standard sampling procedures.
6. Recommendations for a statistical method to determine if perchlorate concentrations are increasing, decreasing or static. The statistical method shall be applied to all monitoring wells.
7. Recommendations for prioritizing the investigation and characterization of plume areas to aid in the earliest possible determination of plume migration status.

After reviewing the Llagas Subbasin Monitoring Plan, the Executive Officer may revise the Monitoring and Reporting Program.

B. **MONITORING WELL INSTALLATION AND CHARACTERIZATION WORK PLAN Due Date: June 3, 2005**

The Monitoring Well Installation and Characterization Work Plan shall detail the Dischargers' plans to install offsite-monitoring wells in the Llagas Subbasin and to investigate existing supply wells for suitability as long-term monitoring wells. The work plan shall include the following:

1. Final locations of the proposed monitoring wells.
2. Typical well construction detail.
3. Drilling Method.
4. Target monitoring zones.
5. A schedule for implementing necessary monitoring well installations.
6. Determination of aquifer zone specific hydrogeologic parameters necessary for the development of the conceptual Llagas Subbasin hydrogeologic model.
7. Identification of existing supply wells proposed for long term monitoring.
8. Proposed methodologies to determine suitability for long term monitoring of proposed supply wells.

The Monitoring Well Installation and Characterization Work Plan shall include a proposed schedule for all proposed tasks. Following Executive Officer approval, the schedule shall become a part of this Order. The Dischargers shall perform all work in accordance with the approved schedule.

C. **IMPLEMENTATION OF MONITORING WELL INSTALLATION AND CHARACTERIZATION WORK PLAN**

Dischargers shall implement the Monitoring Well Installation and Characterization Work Plan within 30 days of the Executive Officer's concurrence with the Work Plan. The tasks and due dates in the schedule for implementation of the Work Plan shall, after approval by the Executive Officer, become enforceable terms of this Order. Within thirty days of completion of field activities, Dischargers shall submit a Monitoring Well Installation and Characterization Report.

D. **LLAGAS SUBBASIN CHARACTERIZATION REPORT Due Date: March 30, 2006 and January 31st Annually Thereafter.**

The Llagas Subbasin Characterization Report will describe the Dischargers' efforts to fully characterize the vertical and lateral extent of perchlorate offsite. Characterization will be an ongoing process. The initial report will report and evaluate the efforts, data, and results from Ordering Paragraphs A through C. The Report shall include the following elements:

1. Evaluation of background perchlorate concentrations for the Llagas Subbasin (i.e., whether any naturally-occurring perchlorate is present) and whether there are other anthropogenic sources of perchlorate.
2. A refined conceptual model of hydrogeologic conditions, groundwater flow patterns, and perchlorate distribution.
3. Description of activities undertaken to characterize the offsite plume.
4. Presentation and analysis of Llagas Subbasin and aquifer specific data including maps and figures showing perchlorate isoconcentration and groundwater elevation contours for each aquifer zone.
5. Aquifer specific information for remedial feasibility study development.
6. Results of the statistical evaluation to determine perchlorate concentration trends in each aquifer zone.

7. Proposed changes to the Monitoring and Reporting Program based on the updated Llagas Subbasin Hydrogeologic conceptual model.
8. An evaluation of other newly installed wells in the Llagas Subbasin (e.g., Water District wells, Gilroy test borings, etc.)

In future reports due annually on January 31st, the Dischargers shall evaluate additional hydrogeologic and perchlorate data collected, the monitoring systems performance in the past year, and shall evaluate and make recommendations based on the revised hydrogeologic conceptual model.

E. **PLUME MIGRATION CONTROL ASSESSMENT REPORT Due Date: March 3, 2006**

The Dischargers shall evaluate the need for plume migration control to stop or contain the migration of perchlorate that has originated from the Site and to protect groundwater beneficial uses. To complete this work, the Dischargers shall develop a Plume Migration Control Assessment Report, acceptable to the Executive Officer that evaluates whether plume cutoff is necessary. The assessment report should consider hydrogeologic information and analyses related to groundwater elevations, aquifer parameter data, field investigation, modeling, and or other pertinent data. The Dischargers may not rely on any groundwater modeling unless they provide the Regional Board with a legal copy of the modeling software, electronic input data files, assumptions used, model calibration information and all other data or information used in the model upon request. Any claims by the Dischargers of trade secret shall be subject to California Water Code section 13267(b)(2). If the Dischargers determine or the Executive Officer concludes that plume migration control is required, then the Dischargers shall submit a Plume Migration Control Feasibility Study, as outlined below.

F. **PLUME MIGRATION CONTROL FEASIBILITY STUDY**

If Plume cutoff is deemed necessary in Ordering Paragraph E above, a Plume Migration Control Feasibility Study shall be submitted no later than 60 days following Executive Officer concurrence. At a minimum, the Dischargers shall evaluate the following elements:

1. Alternatives for plume migration control to prevent perchlorate migration toward the City of Gilroy or other aquifer zones that are not impacted by perchlorate.
2. The Plume Migration Control Feasibility Study shall include a time estimate for establishing plume migration control for each alternative. The Plume Migration Control Feasibility Study shall include a time schedule for implementation of each alternative and shall select one or more alternatives as the preferred alternative(s).
3. An evaluation to determine potential adverse impacts to existing surface or groundwater beneficial uses that may be caused by the proposed migration control strategy.
4. The Dischargers shall submit a Plume Cutoff and Remediation Work Plan 60 days after approval by the Executive Officer.

G. **PLUME MIGRATION CONTROL WORK PLAN**

Due Date: 60 days after approval of Plume Migration Control Feasibility Study.

Within 60 days after the Executive Officer concurs with the Plume Migration Control Feasibility Study, the Dischargers shall prepare a Plume Migration Control Work

Plan that includes design and implementation plans for interim plume migration control alternative(s) selected in the Plume Migration Control Feasibility Study. The Plume Migration Control Work Plan shall be subject to concurrence by the Executive Officer, shall detail the Dischargers' plans and shall incorporate the time schedule(s) for implementation from the Feasibility Study.

H. **IMPLEMENTATION OF PLUME MIGRATION CONTROL WORK PLAN**
Due Date: 30 days after concurrence or 120 days after submittal.
Dischargers shall implement the Plume Migration Control Work Plan within 30 days of the Executive Officer's concurrence with the work plan, or if earlier, 120 days after submitting the Plume Migration Control Work Plan. The tasks and due dates in the schedule for implementation of the selected cutoff alternative (including the monitoring schedule) shall, after approval by the Executive Officer, become enforceable terms of this Order. Within 30 days of completion of field activities, Dischargers shall submit an Implementation Report documenting the implementation of the cutoff and remedial alternatives.

I. **LLAGAS SUBBASIN CLEANUP LEVEL REPORT Due Date: January 31, 2006**
The Dischargers shall submit a report that proposes a perchlorate cleanup level for the Llagas Groundwater Subbasin. The proposed cleanup level shall be developed in conformance with State Board Resolution No. 92-49. The report shall contain a basis for the proposed cleanup level.

J. **LLAGAS SUBBASIN CLEANUP FEASIBILITY STUDY Due Date: June 30, 2006**
The Dischargers shall prepare a Llagas Subbasin Cleanup Feasibility Study acceptable to the Executive Officer that addresses Llagas Subbasin cleanup alternatives. The report shall provide an analysis of alternatives for long-term, basin-wide groundwater cleanup to remediate perchlorate-impacted groundwater that has originated from the Site. The report shall address and or comply with the following elements:

1. The feasibility, effectiveness, and relative cost of cleanup alternatives in compliance with Resolution No. 92-49.
2. Consideration of present and potential beneficial uses at the Site, and offsite affected areas, including domestic and municipal water supply, agricultural water supply, and industrial water supply as defined by Chapter 2 of the Basin Plan.
3. A proposed schedule for implementation of each cleanup alternative shall be included in the alternatives analysis.
4. An estimate of the time it will take to reach the cleanup goal, considering all relevant factors such as remedial baseline or the Dischargers' proposed and Regional Board approved site-specific cleanup goal.
5. Include a cost estimate for each remedial alternative.
6. Selection of a remedial alternative(s).
7. An evaluation of alternatives for plume core remediation.
8. A proposed schedule to prepare a Llagas Subbasin Cleanup Work Plan

K. **LLAGAS SUBBASIN CLEANUP WORK PLAN**
Following the Executive Officer's concurrence with the Llagas Subbasin Cleanup Feasibility Study, the Dischargers shall prepare a Llagas Subbasin Cleanup Plan

acceptable to the Executive Officer that details implementation plans for the selected alternative(s). The Dischargers shall submit the Llagas Subbasin Cleanup Work Plan by the due dates established by the Executive Officer upon concurrence with the Llagas Subbasin Cleanup Feasibility Study in Ordering Paragraph J. The Llagas Subbasin Cleanup Work Plan shall, at a minimum, include the following elements:

1. A detailed implementation plan for the selected remedial alternative.
2. An updated time schedule for implementation.
3. A reasonable time estimate for the restoration of beneficial uses.
4. An adequate monitoring strategy and schedule to determine the lateral and vertical effectiveness of the selected cleanup alternative. Compliance monitoring wells shall be identified and or installed to ensure groundwater complies with clean up goals throughout the affected area. The monitoring schedule shall require progress reports on the implementation of the selected remedial alternative.
5. Other information deemed appropriate by the Dischargers, or specified by the Executive Officer in the concurrence with the Llagas Subbasin Cleanup Feasibility Study.

L. **IMPLEMENTATION OF OFFSITE CLEANUP WORK PLAN**
Due Date: 30 days after concurrence or 120 days after submittal.
Dischargers shall implement the Llagas Subbasin Cleanup Work Plan within 30 days of the Executive Officer's concurrence with the Workplan, or if earlier, 120 days after submitting the Workplan. The tasks and due dates in the schedule for implementation of the selected cleanup alternative (including the monitoring schedule) shall, after approval by the Executive Officer, become enforceable terms of this Order. Within thirty days of completion of field activities, the Dischargers shall submit an Implementation Report documenting implementation of the remedial alternatives. The Discharger shall install any necessary wells in accordance with the approved schedule. The monitoring schedule shall require progress reports on the implementation of the selected remedial alternative.

M. **EVALUATION OF NEW HEALTH CRITERIA**
The Dischargers may submit a technical report acceptable to the Executive Officer that contains an evaluation of whether or how the final cleanup plan and or cleanup standards would be affected, if the health goals or maximum contaminant levels (listed in Finding Paragraph 6) change as a result of promulgation of revised drinking water standards, maximum contaminant levels, notification levels, agricultural water quality goals, or other health based criteria. This technical report may be required by the Executive Officer in response to the aforementioned changes in standards or levels.

N. **EVALUATION OF NEW TECHNICAL INFORMATION**
The Dischargers may submit a technical report acceptable to the Executive Officer evaluating new technical and economic information that indicates that cleanup standards or cleanup technologies in some areas may be considered for revision. The technical report shall not be required unless the Executive Officer determines that such new information indicates a reasonable possibility that the Order may need to be changed.

O. **AMENDMENT OF DUE DATES**

If the Dischargers are unable to perform any activity or submit any document in compliance with the schedules in this Order, or in compliance with any work schedule submitted pursuant to this Order and approved by the Executive Officer, the Dischargers may request, in writing, an extension of the time specified. The extension request shall include justification for the delay. The Executive Officer may grant the request after considering the justifications merits.

P. **OVERSIGHT COSTS**

The Dischargers shall be liable, pursuant to California Water Code Section 13304, to the Regional Board for all reasonable costs incurred by the Regional Board to investigate unauthorized discharges of waste, or to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, pursuant to this Order. The Dischargers shall reimburse the Regional Board for all reasonable costs associated with investigation or oversight of the cleanup of this facility. Failure to pay any invoice for the Regional Board's investigation or oversight costs within the time stated in the invoice (or within thirty days after the date of invoice, if the invoice does not set forth a due date) shall be considered a violation of this Order.

All technical and monitoring plans and reports required in conjunction with this Order are required pursuant to Section 13267 of the California Water Code and shall include a statement by the Dischargers, or an authorized representative of the Dischargers, certifying (under penalty of perjury in conformance with the laws of the State of California) that the work plan and/or report is true, complete, and accurate. Hydrogeological and or technical reports and or plans shall be prepared or directly supervised by, and signed and stamped by a California Professional Geologist, Certified Engineering Geologist, or Civil Engineer.

This Order in no way limits the authority of this Regional Board to institute additional enforcement actions or to require additional investigation and cleanup at the Site consistent with California Water Code. This Order may be revised by the Executive Officer or the Regional Board as additional information becomes available.

FAILURE TO COMPLY WITH THE PROVISIONS OF THIS ORDER MAY SUBJECT YOU TO FURTHER ENFORCEMENT ACTION, INCLUDING BUT NOT LIMITED TO, ASSESSMENT OF CIVIL LIABILITY UNDER SECTIONS 13268 AND 13350 OF THE CALIFORNIA WATER CODE AND REFERRAL TO THE DISTRICT ATTORNEY OR ATTORNEY GENERAL FOR INJUNCTIVE RELIEF AND CIVIL OR CRIMINAL LIABILITY.

Roger W. Briggs
Executive Officer

3-10-05
Date

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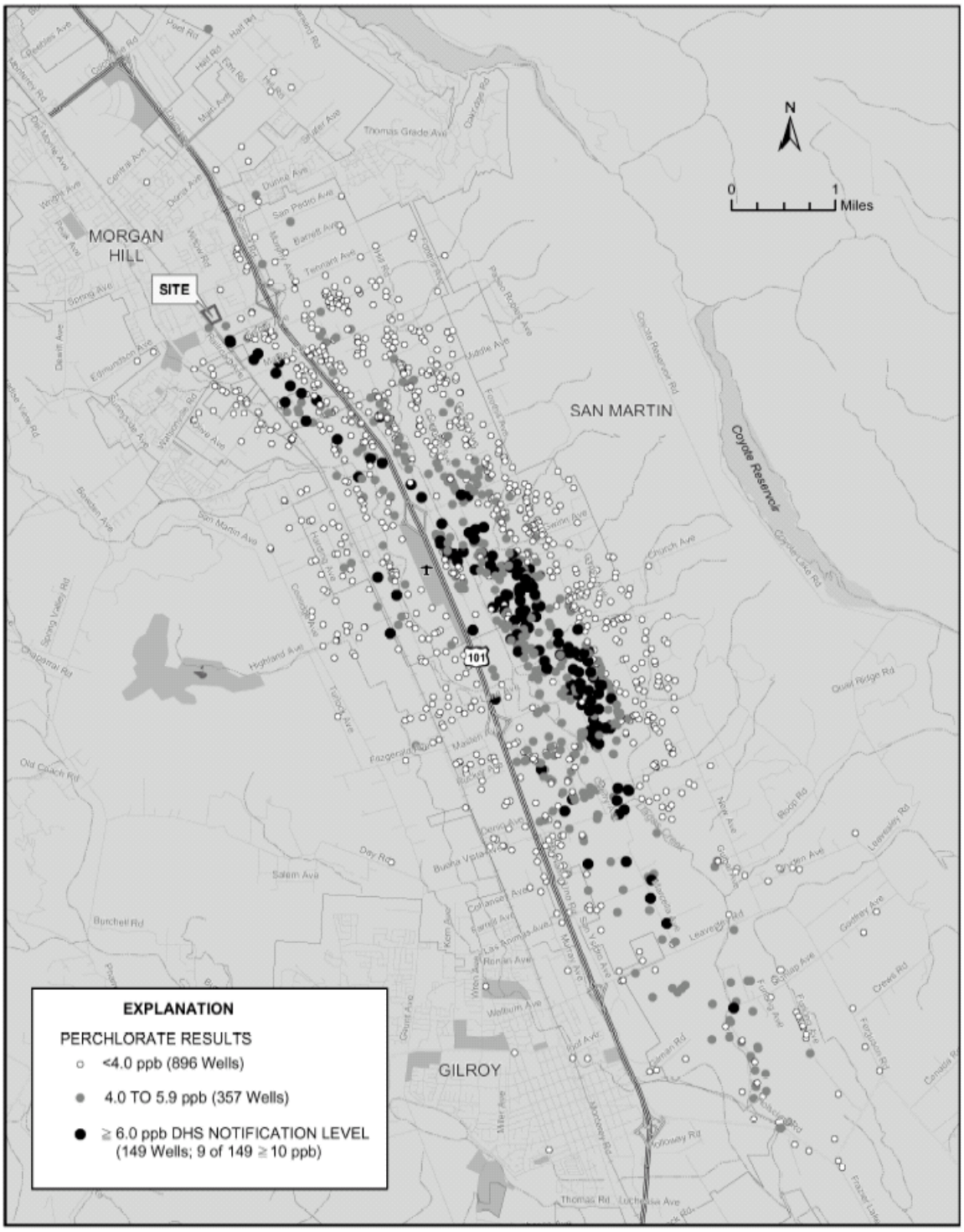
FIGURE 1.
425 TENNANT AVENUE SITE MAP



Perchlorate Results - Llagas Subbasin

FIGURE 2.

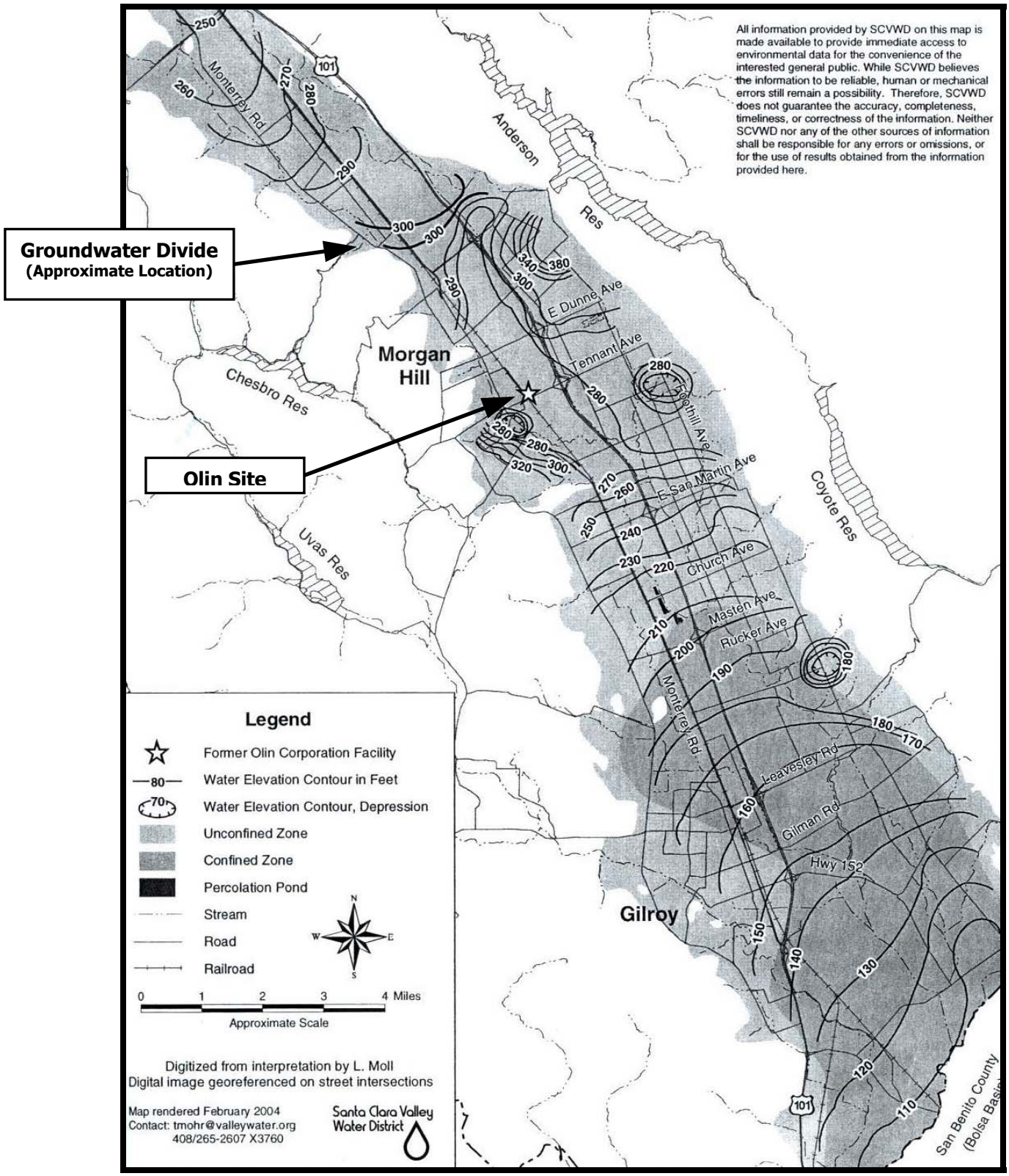


FIGURE 3.
GROUNDWATER DIVIDE