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November 22, 2006

Proj. No.: H0562C
File Loc.: Westminster

STATE OF CALIFORNIA
CENTRAL COAST WATER BOARD
Received
NOV 2 7 2006
895 Aerovista Place, Ste. 101
San Luis Obispo, CA 93401-7906

California Regional Water Quality Control Board
Central Coast Region
895 Aero Vista Drive, Suite 101
San Luis Obispo, CA 93401

Attention: Mr. Hector Hernandez

Dear Mr. Hernandez:

RE: REVIEW OF OLIN THIRD QUARTER 2006 GROUNDWATER MONITORING REPORT

On behalf of the City of Morgan Hill (the City), WorleyParsons Komex has reviewed the Olin Corporation (Olin) October 30, 2006 Report, "Third Quarter 2006, Groundwater Monitoring Report" (the Report) for the Olin property at 425 Tennant Avenue, Morgan Hill, California (the Site), submitted to the Central Coast Regional Water Quality Control Board (RWQCB). Our review focused primarily on Appendix E, Final Northeast Groundwater Flow Assessment. Below, please find a summary of major comments on the Report, followed by additional detailed technical comments.

a) Groundwater flow directions within the Middle and Lower Deep Aquifer zones in third quarter 2006 in the vicinity of the Site were dominantly northerly-directed. There are now five quarters of consecutive monitoring data (third quarter 2005 to third quarter 2006) that show a consistently northerly component of flow in the area northeast of the Site in the Deep Aquifer zone;

b) Pumping of the City's northeast wells effects the groundwater levels in the Deep Aquifer zone to the south extending beyond the Site. The observed drawdowns are far greater than the natural head differences that would produce groundwater flow to the south. Also, the drawdown response in various aquifer zones shows a lack of hydraulic connection between the Shallow Aquifer zone and the Deep Aquifer zone;

c) Hydraulic conductivity of the Deep Aquifer zone is adequate to produce extensive drawdown, on the order of tens of feet, over distances of several thousands of feet. Low hydraulic conductivity of the Deep Aquifer zone aquifer materials is inconsistent with the observed propagation of drawdown due to City pumping;

d) The groundwater velocity of 0.55 ft/day reported by Olin would allow a travel distance of over 10,000 feet in a 50-year period. In contrast, the Nordstrom well is only 6,700 feet from the Olin Site. Olin commenced disposal of its products almost immediately upon the opening of the facility in 1955. Therefore, the time available from the start-up of Olin operations to the detection

of perchlorate in the Nordstrom well is more than adequate to account for migration from the Site;

e) Data from the third quarter 2006 sampling confirm the presence of a significant perchlorate plume in the Deep Aquifer zone northeast of the Olin Site, and the mechanism of plume migration. In the third quarter 2006 an extensive and spatially continuous plume of perchlorate is observed from the Olin Site to the City's northeast wells, including Condit (3.4 ug/L), San Pedro (4.4 ug/L), Dunne #1 (3.9 ug/L), Dunne #2 (3.5 ug/L), Nordstrom (4.0 ug/L), and Diana #2 (3.0 ug/L). However, the City is greatly concerned that this perchlorate plume remains undelineated, and appears to be expanding northward given the recent (9/6/2006) detection of 3.0 ug/L perchlorate as far north as the Diana #2 well. Olin provides no course of action to either delineate and/or remediate these impacts in the Report.

Detailed Comments

1. Olin states that "The Water Board acknowledges that the SCVWD forensic investigation will likely provide data relevant to any further proceedings related to the source of perchlorate to the north of the Site" (Report, p. E-1). This is an overstatement of the Regional Water Quality Control Board (RWQCB) expectations for the forensic study by the Santa Clara Valley Water District (SVCWD). In the RWQCB June 29, 2006 letter to Olin (p. 3), providing their comments on the Llagas Basin Characterization Report, the RWQCB stated that "...the Water District does not provide any assurances concerning the study's effectiveness..." and "...the study may identify sources other than the Olin Site...". In the absence of any data on alternate sources of perchlorate other than the Olin Site, the RWQCB properly concluded in their June 29th letter that "...at this time, and until data are presented demonstrating that that another source(s) of perchlorate is a viable contributor to the detected groundwater impacts, we must consider Olin as solely responsible...".

2. With reference to Deep Aquifer Zone groundwater elevations, Figures E2.6e and E2.7e, Olin states that "Groundwater beneath the Site continues to flow to the southwest, toward the Tenant well." (Report p. E-5, second bullet). In fact, both figures show flow to the west and north in the Middle or Lower Deep Aquifer zone beneath the Olin Site. To clarify this flow pattern, we have added flow lines to Figure E2.6e (Figure 1), so as to clearly show that groundwater beneath all but the southern boundary of the Site flows to the northwest or west, with northerly and northeasterly flow directions in the area to the northeast of the Site. Figure E2.7e, which is based on data from four locations (MW-16, MW-52, PZ-02 and PZ-03) located to the southeast and northeast of the Site, clearly shows groundwater flow in the Lower Deep Aquifer is to the northeast in the area just east of the Olin Site. However, as drafted by MACTEC, Figure E2.7e includes ***unsupported extrapolation*** of contours well beyond the data points, producing a false impression of an easterly component of flow. In addition, none of the contours extend beneath the Olin Site to support Olin's statement above. To help clarify what the data in Figure E2-7e show, that figure has been modified by us to include only the contours bounded within the data points (Figure 2), along with groundwater flow arrows. The edited and corrected figure clearly shows northeasterly groundwater flow in the Lower Deep

Aquifer zone, immediately east of the Olin Site, and extending from at least MW-16, 1800 feet southeast of the Site, to at least PZ-03, 2600 feet northeast of the Site.

3. With respect to flow in the Middle Deep Aquifer zone, Olin states "Data from PZ-04-335 on August 31, 2006 indicates a southward direction of flow relative to the northern three deep-aquifer piezometers..." (Report p E-5, third bullet), with reference to data in Table E2.1. This is an overstatement of the groundwater flow pattern shown by the cited data, which indicates only the slightest southerly component of flow in the area east of the Site. First, groundwater level data for PZ-04-335 are not in Table E2.1, but are found in Table 3.3 of the main body of the Report. Second, this statement describing flow beneath the Site fails to consider the three on-Site wells completed in the Middle Deep Aquifer, MW-04C, MW-05C and MW-06C, data for which are included in Table 3.1 of the main body of the Report. To provide a complete picture of groundwater flow beneath the Olin Site on August 31, 2006, we have employed data from the relevant Middle Deep Aquifer piezometers and wells and have plotted and hand contoured these data (Figure 3). The appropriate contouring of the data shows Middle Deep Aquifer groundwater flow beneath the Site on August 31, 2006 was to the west-northwest; just to the east of the Site, groundwater flow shifted from west-southwesterly to north-northeasterly. The westerly to northwesterly direction of groundwater flow beneath the Olin Site in the Middle Deep Aquifer on August 31, 2006 is evident in Figure 3.

   Incorrect characterization of Deep Aquifer zone flow patterns is further continued in the same bullet point, with the statement "...groundwater flow beneath the Site migrates to the southwest toward the Tenant well and groundwater north of the Site migrates to the west/northwest." The dominance of west and northwesterly groundwater flow beneath the Site on August 31, 2006, has already been presented, above. Furthermore, groundwater elevation contours presented by Olin for July 5, 2006 (Figure 1, which is based on Report Figure E2.6e that is incorrectly described in the Report as contours for August 2006) clearly show a westerly to northwesterly flow direction across the vast majority of the Site, with the exception of the very southwestern corner nearest to the Tenant well. The dominant groundwater flow direction beneath the site and to the east of the site is to the northwest, shifting to northeasterly in the vicinity of PZ-02-315.

4. Olin claims that there is an upward-directed gradient between sub-alluvium and overlying fluvial aquifer material (Report, p E-6, first bullet). ***No*** data are presented to support this claim. Rather, all data presented in Appendix E of the report show only downward directed gradients within the Intermediate and Deep Aquifer zones, from third quarter 2005 to third quarter 2006. Groundwater elevation profiles in Figures E2.8 to E2.22, representing 20 monitoring events, all show downward hydraulic gradients in these zones. A similar statement on pages E-8 and E-9 of the Report is also unsupported.

   In this same bullet point (Report p E-6), Olin claims that "...the deep aquifer ...appears to be hydraulically communicative with the Subbasin to the east at this depth." This statement is completely unsupported by any data in the report, and must be viewed as nothing more than conjecture. In fact, there is no evidence presented by Olin anywhere in this Report of any hydraulic communication in the Deep Aquifer zone between the Site vicinity in the Llagas basin and the Subbasin to the east of the Diablo mountain range.

5. Referring to drawdown in the Deep Aquifer due to pumping of the City's northeast wells, Olin states that "The magnitude of drawdown observed, however, does not indicate capture of perchlorate beneath the Site..." (Report p E-10). However, long-term hydrographs for the multiport/piezometer installations MP-1/PZ-1 through MP-4/PZ-4 show substantial drawdown in the Deep Aquifer zone in response to pumping by the City's northeast wells. Report figures E2.31 through E2-31 show a general pattern of groundwater levels recovering through the winter of 2005/06, peaking in April 2006, followed by steady drawdown through July 2006, with stable drawdown through to mid-September, when water levels began to rise again. Maximum drawdowns observed in the various locations were:

   - PZ-1-333, 46 feet of drawdown
   - MP-2-235 and 255, 28 feet of drawdown
   - PZ-2-315, 41 feet of drawdown
   - PZ-2-415, 50 feet of drawdown
   - PZ-3-325, 39 feet of drawdown
   - PZ-3-427, 53 feet of drawdown
   - MP-4-251 and 273, 16 feet of drawdown

   These drawdowns are substantially larger than the historical head difference of 15 to 25 feet in regional groundwater elevations, representing mainly intermediate aquifer groundwater levels, across the area from about Nordstrom Park to the Olin Site. As noted by Olin in the Report page E-4, the regional hydraulic gradient in the Intermediate Aquifer Zone is 0.002 to 0.004, which over the distance of 6,700 feet from the Site to Nordstrom Park would correspond to a head difference of 13.4 to 26.8 feet. Consequently, the magnitude of drawdown observed in the Deep Aquifer zone, generally 28 to 53 feet, is more than adequate to overcome the natural gradient and reverse groundwater flow direction to the north. Moreover, groundwater elevation mapping in the Middle and Lower Deep Aquifer zones (previously discussed) clearly show a northerly-directed hydraulic gradient and groundwater flow. Since groundwater flow is in response to a hydraulic gradient, and in proportion to the hydraulic conductivity of the aquifer, the drawdown caused by City pumping creates a hydraulic gradient and, therefore, groundwater flow, from the Site to the City's wells. It is therefore reasonable to conclude that the drawdown is caused by the City's pumping and that groundwater beneath the Olin Site is being captured by, and is within the capture zone of the City's northeast wells.

6. Olin notes the rapid response in monitoring wells to City pumping, and observed that "The lag time (for)... groundwater elevation changes at PZ-03-325, located about 3,000 feet southwest of Dunne #1, is approximately 45 minutes." (Report p E-9). In contrast to this observation, Olin state that "The large magnitude of groundwater elevation fluctuations in rapid response to changes in pumping status of municipal wells observed at the deep aquifer piezometers corroborates the low hydraulic conductivity measures in this aquifer ..." (Report p E-19). Olin subsequently uses this inferred low hydraulic conductivity (K) of the Deep Aquifer zone to conclude that "Deep aquifer groundwater flow rates are among the lowest measured in the

Subbasin (0.01 to 0.55 feet/day) due to the low hydraulic conductivity of this unit." (Report p E-20). However, Olin's characterization of the hydraulic conductivity of the Deep Aquifer zone is based only on measurements from slug tests on a small number of piezometers. The K values from the slug tests are generally low, but are also inconsistent with the drawdown response observed by Olin, noted above, in the Deep Aquifer zone. Slug tests stress a very small volume of aquifer material, and measure local-scale properties only in the immediate vicinity of the piezometer screen. Municipal well pumping stresses a much larger volume of aquifer, and responds to the much larger-scale hydraulic properties of the aquifer.

To check the validity of Olin's inference of low hydraulic conductivity in the Deep Aquifer zone, calculations were done to assess the theoretical response to pumping using the Theis solution, for a three order-of-magnitude range in K values, from 1 ft/day to 100 ft/day. Other parameters used for the calculation were:

- Aquifer thickness, 50 feet
- Storage Coefficient (S) 1×10^{-4}
- Distance from the pumping well, 3000 feet
- Pumping rate 100 GPM

These conditions represent a generic aquifer and pumping condition, but are consistent with Deep Aquifer zone conditions. A relatively low pumping rate is used because at the low end of the K range unrealistic drawdown is produced in the pumping well. Also, it is recognized that pumping from the City's wells is drawing from both Intermediate and Deep aquifer zones, so only a portion of the pumping rate can be attributed to the Deep Aquifer. To allow easy comparison of the three cases, drawdown was expressed as percentage of the drawdown in the pumping well, and plotted as a function of time up to 7 days for the various K cases, in Figure 4. A single case was also calculated for the intermediate K value (10 ft/day) and a higher pumping rate (500 GPM), to illustrate the low sensitivity of drawdown response to pumping rate at that distance.

The drawdown curves in Figure 4 show that for K of 1 ft/day, virtually no response to pumping is observed until after several days. Even at K of 10 ft/day, no response to pumping is observable even after 4 hours. Only a hydraulic conductivity on the order of 10s to 100 ft/day can produce a response at a distance of 3000 feet in less than one hour. The drawdown plots in Figure 4 suggest that the large scale hydraulic conductivity of the Deep Aquifer zone must be substantially higher than the values measured by Olin in their slug tests. Therefore, groundwater flow rates, and corresponding perchlorate migration rates are likely to be at least near the high end of the range estimated by Olin, 0.01 to 0.55 ft/day, with the high value corresponding to a hydraulic conductivity of 6.8 ft/day (Report p E-16). A groundwater velocity of 0.55 ft/day would allow a travel distance of over 10,000 feet in a 50-year period, which is substantially greater than the distance of 6,700 feet from the Site to the Nordstrom well. Consequently, given the over 50-year time period available since the start of Olin operations, it is quite feasible for perchlorate from the Site to have migrated to the Nordstrom well.

7. Olin observes that pumping of the Diana #1 well produces drawdown in the Nordstrom well, but not at piezometer PZ-03-325 (completed in the Middle Deep Aquifer), and suggest that the lack of response at PZ-03-325 is because most of the flow in Diana #1 is from the Upper Deep and Intermediate aquifer zones. However, this conclusion is based on a factual ***error*** that "...the Diana #1 well is screened from 114 to 355 feet ...into the middle portion of the deep aquifer." (Report p E-10). Although drilled to 355 feet, the Diana #1 well is actually screened only from 116 to 193 feet, exclusively in the Intermediate Aquifer zone. The reason for the lack of response in the Middle Deep Aquifer at PZ-03-325 is because the piezometer is completed in an entirely different aquifer zone than the Diana #1 well. Therefore, absolutely ***nothing*** can be inferred about relative flow rates or hydraulic conductivity within the Deep Aquifer zone based on the lack of response to pumping in the Diana #1 well.

8. Olin note that piezometer PZ-03-325 shows greater drawdown in response to pumping at Dunne #1 and San Pedro wells, than to pumping at the Nordstrom well. Olin note that that pumping rate in the Nordstrom well is higher than in the Dunne #1 and San Pedro wells, which is correct, but Olin fail to note that the Nordstrom well is more than 1,000 feet farther from PZ-03-325 than are the other two wells. Of greater concern, however, is Olin's statement that "... if perchlorate migration from the Site were to be induced toward the northeast, the perchlorate would most likely be detected in the Dunne #1 or San Pedro wells prior to the Nordstrom well." (Report p E-10) This statement falsely gives the impression that the Dunne #1 and San Pedro wells have not been impacted by perchlorate, which is of course incorrect and contradicted by information presented by Olin itself in the Report, page E-15, which shows 2003 to 2005 average J-flag perchlorate concentrations in Dunne #1 well ranging from 0.99 to 2.42 ug/L, and in San Pedro well ranging from 2.07 to 2.88 ug/L. These average concentrations do not show the full impact of perchlorate in these wells, which have periodically detected much higher concentrations of perchlorate, up to 4.4 ug/L in the San Pedro well, and up to 3.28 ug/L in Dunne #1 well. Since the San Pedro and Dunne wells were not sampled for perchlorate unitl February 2003, there is no way of knowing whether these wells were impacted by perchlorate when the Nordstrom well was first sampled in 2000. Furthermore, the reported absence of perchlorate in the Dunne #1 and San Pedro wells from early samples reflected the reporting limit of 4 ug/L used at that time, rather than the j-flag reporting presently being used.

9. The Report includes groundwater level data and corresponding hydraulic gradient magnitude and direction for the northeast ternary of monitoring locations in the Middle Deep Aquifer at MP-1/PZ-1, MP-2/PZ-2, and MP-3/PZ-3. The data set now extends for five consecutive quarters, from third quarter 2005 to third quarter 2006, shown in Report figures E2-47 to E2-51. These data show a general pattern of a northwest hydraulic gradient direction during the third quarter and early fourth quarter with a more westerly-directed gradient fluctuating to northwesterly from the mid-fourth quarter through the second quarter. Periods of more northerly direction appear to correspond to periods of greater City pumping in the northeast, for example, during the third and early fourth quarters. Over the entire monitoring period, the groundwater flow direction, as indicated by the hydraulic gradient, is to the north or west. Any southerly component of flow is almost entirely absent, except for brief spikes lasting a few days or less during the fourth, first and second quarters, and even then the gradient direction is never more than 10 degrees south of west. These data confirm that flow direction in the

Middle Deep Aquifer deviates from the regional hydraulic gradient to the southeast, and that flow within the area bounded by these monitoring locations is directed to the west and north, with direction at any given time strongly influenced by pumping from the City's northeast wells.

10. Olin suggests that the Madrone Ponds somehow act as a hydraulic barrier to perchlorate migration in the Deep Aquifer zone in the statement "The consistent spatial distribution east of the Madrone Ponds in wells that are completed through the intermediate and deep aquifers suggests that a source exists east of Highway 101 and most likely north of the City of Morgan Hill." (Report p E-15). However, there is ***little or no*** hydraulic connection between the Shallow Aquifer, which is the recipient of Madrone Pond recharge, and the Deep Aquifer zone. In reference to groundwater level fluctuations in response to City pumping, Olin noted that "No such fluctuations have been observed in the shallow aquifer ... in contrast fluctuations are consistently observed in the intermediate and deep aquifers ..." (Report p E-8), which is an indication, not of what Olin asserts, but of the lack of hydraulic connection between the Shallow and the Deep aquifers, in particular. Moreover, there are substantial head differences between the Deep Aquifer and both the Intermediate and Shallow aquifers, which correspond to steep vertical hydraulic gradients. Olin notes that "...steep vertical gradients between the intermediate and deep aquifers indicate that these aquifers have limited hydraulic communication with one another." (Report p E-7). By extension, hydraulic communication between the Shallow and Deep Aquifers would be even more limited.

    The hydrographs shown in Report figures E2.23 to E2.42 consistently show no correlation between groundwater level variations in the Shallow and Deep aquifers, which is further evidence of the lack of hydraulic communication between these units. Groundwater level increases in the Shallow aquifer, due to precipitation or recharge, produce no response in the Deep Aquifer. Consequently, any recharge from the Madrone Ponds to the Shallow Aquifer will have no effect on groundwater levels, and hence groundwater flow, in the Deep Aquifer. That is, recharge from the Madrone Ponds does not form any type of hydraulic barrier to flow in the Deep Aquifer, and consequently, there is no reason why perchlorate from the Olin Site could not migrate in the Deep Aquifer to the east of the Madrone Ponds. No perchlorate source east of Highway 101 is required to explain the observed distribution of perchlorate in the Deep Aquifer zone. Furthermore, a source of perchlorate "north of the City of Morgan Hill" (as suggested by Olin) would likely be in the Coyote Subbasin, beyond any potential influence in the Llagas Subbasin.

11. Olin's mapping of perchlorate is the Deep Aquifer Zone, shown in Figure E3.3d, shows an isolated island of perchlorate around the City's San Pedro Well (4.40 to 4.4 ug/L), unconnected to other occurrences of perchlorate in the Deep Aquifer between this well and the Olin Site, including:

    - 5.2 and 6.0 ug/L at PZ-03-427;
    - 5.8 ug/L at MP-01-262;
    - 5.1 ug/L at PZ-02-415; and
    - 8.0 and 6.6 ug/L at PZ-04-335.

Despite the occasional Deep Aquifer monitoring interval without detectable perchlorate, two or more Deep Aquifer monitoring intervals at each location between the San Pedro well and the Olin Site have detectable perchlorate. In all likelihood, these Olin data represent a ***continuous plume*** of perchlorate from the site to the northeast, at least to the San Pedro well. In addition, J-Flag concentration data for several of the City's northeast wells is not included in the mapping on Figure E3.3d, providing an incomplete picture of the perchlorate distribution in the Deep Aquifer Zone. In spite of these widespread detections of perchlorate, including many of the City's northeast wells, Olin maintains that "The lack of a spatial pattern suggests that these estimated concentrations could be indicative of background concentrations" (Report p E-20).

The notion that the perchlorate levels observed in the northeast plume represent background concentrations is clearly preposterous and has already been addressed by RWQCB in the June 29, 2006 letter to Olin. Similarly, Olin's claim that that there is no spatial pattern to the distribution of perchlorate northeast of the site appears to reflect an absence of analysis and interpretation of the data, rather than the absence of a spatial pattern. To provide a more complete representation of perchlorate distribution northeast of the Olin Site, an isoconcentration contour map of the highest perchlorate concentration in the Deep Aquifer zone at each monitoring location, for third quarter 2006, was prepared by us for this response by hand contouring the data (Figure 5). Perchlorate analytical data from the City's wells for September 2006, plotted in Figure 5, is included in Appendix A. Figure 5 shows a plume of perchlorate at the 6 ug/L level migrating northeastward from the Olin Site to site PZ-3, with the plume at a 4 ug/L level extending northeastward to the Nordstrom well. The northeast plume appears to be a branch of the southern plume, which also originates at the Olin Site but consists of higher perchlorate concentrations, generally above 10 ug/L. The northeast plume is undelineated to the east and west, and also to the north, as indicated by detection of perchlorate at 3.0 ug/L at the Diana #2 well.

12. Once again, the Report discusses three potential alternative sources of perchlorate but as in the past, ***does not provide*** any data whatsoever to document that these are actual sources of groundwater contamination in the Llagas Subbasin. The RWQCB has already stated their position with respect to these undocumented potential sources, as cited previously in this comment letter. To reiterate the RWQCB's finding, "... until data are presented demonstrating that that another source(s) of perchlorate is a viable contributor to the detected groundwater impacts, we must consider Olin as solely responsible..." (RWQCB June 29, 2006 letter to Olin). To date, Olin continues not to provide said data.

13. Data from the third quarter 2006 confirm the presence of a significant perchlorate plume in the Deep Aquifer northeast of the Olin Site, and the mechanism of plume migration. However, the City is greatly concerned that this perchlorate plume remains undelineated, and appears to be expanding northward given the recent (9/6/2006) detection of 3.0 ug/L perchlorate as far north as the Diana #2 well. Olin's recommendations in the Report (p E-23) provide no acknowledgment of this plume, or any course of action to either delineate and/or remediate these impacts. Given the now conclusive evidence of a northeast plume from the Olin Site, we believe that it is incumbent on the RWQCB to take immediate action and require Olin to

complete delineation of the plume, and to develop an appropriate remedial action plan to deal with these impacts.

WorleyParsons Komex is pleased to provide these comments to the RWQCB and we are at your disposal to discuss any of the issues noted above. If you have any questions or need additional information please contact Mark Trudell at (714) 379-1157, extension 161, or by e-mail at mark.trudell@worleyparsons.com.

Sincerely,
WorleyParsons Komex

Mark Trudell, Ph.D., PG, CHG

Principal Hydrogeologist

Mark Ausburn, PG, CHG

Project Director

Encl.

cc: Mr. Steve Hoch, Hatch & Parent
Mr. Jim Ashcraft, City of Morgan Hill

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FIGURES

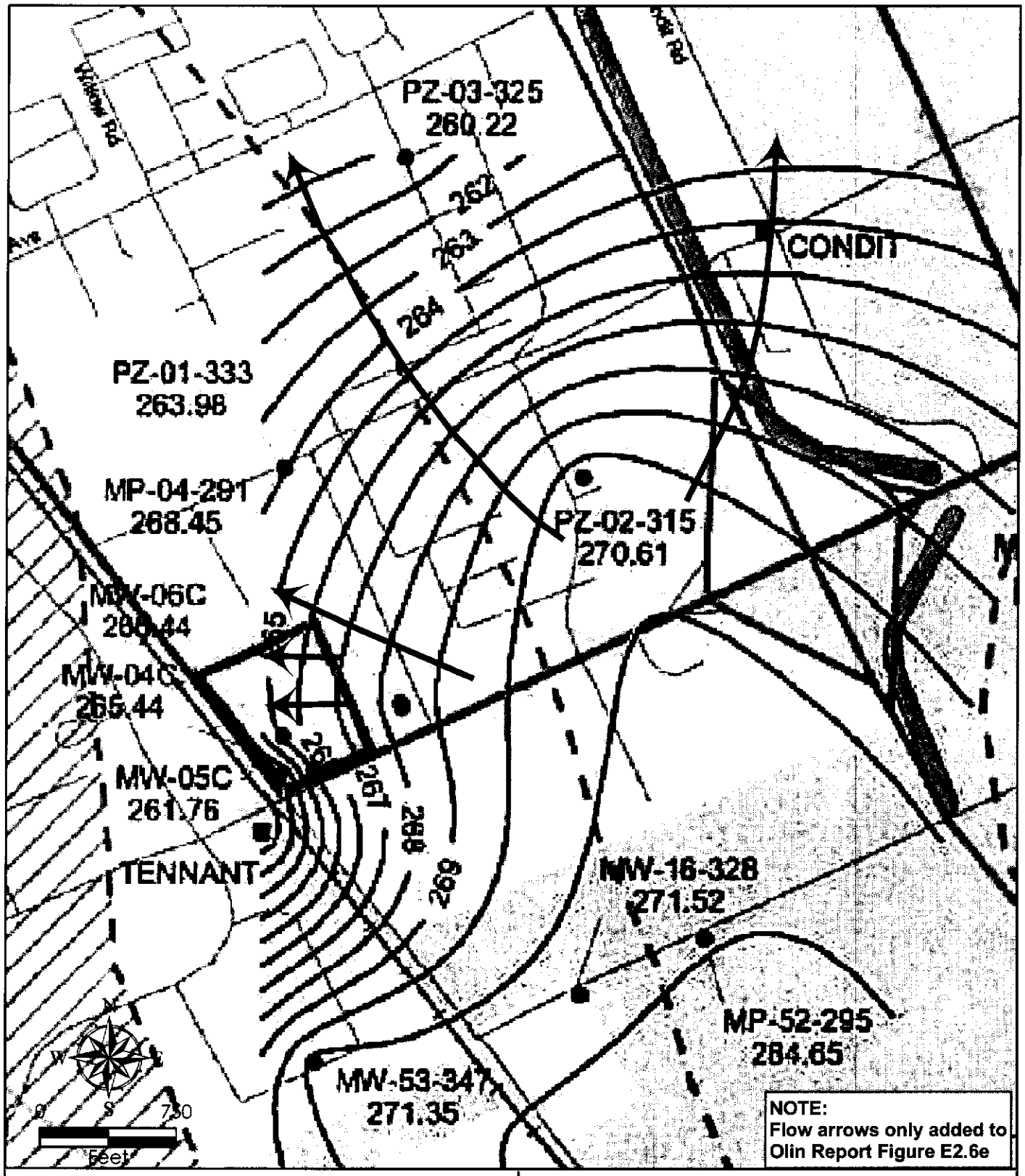

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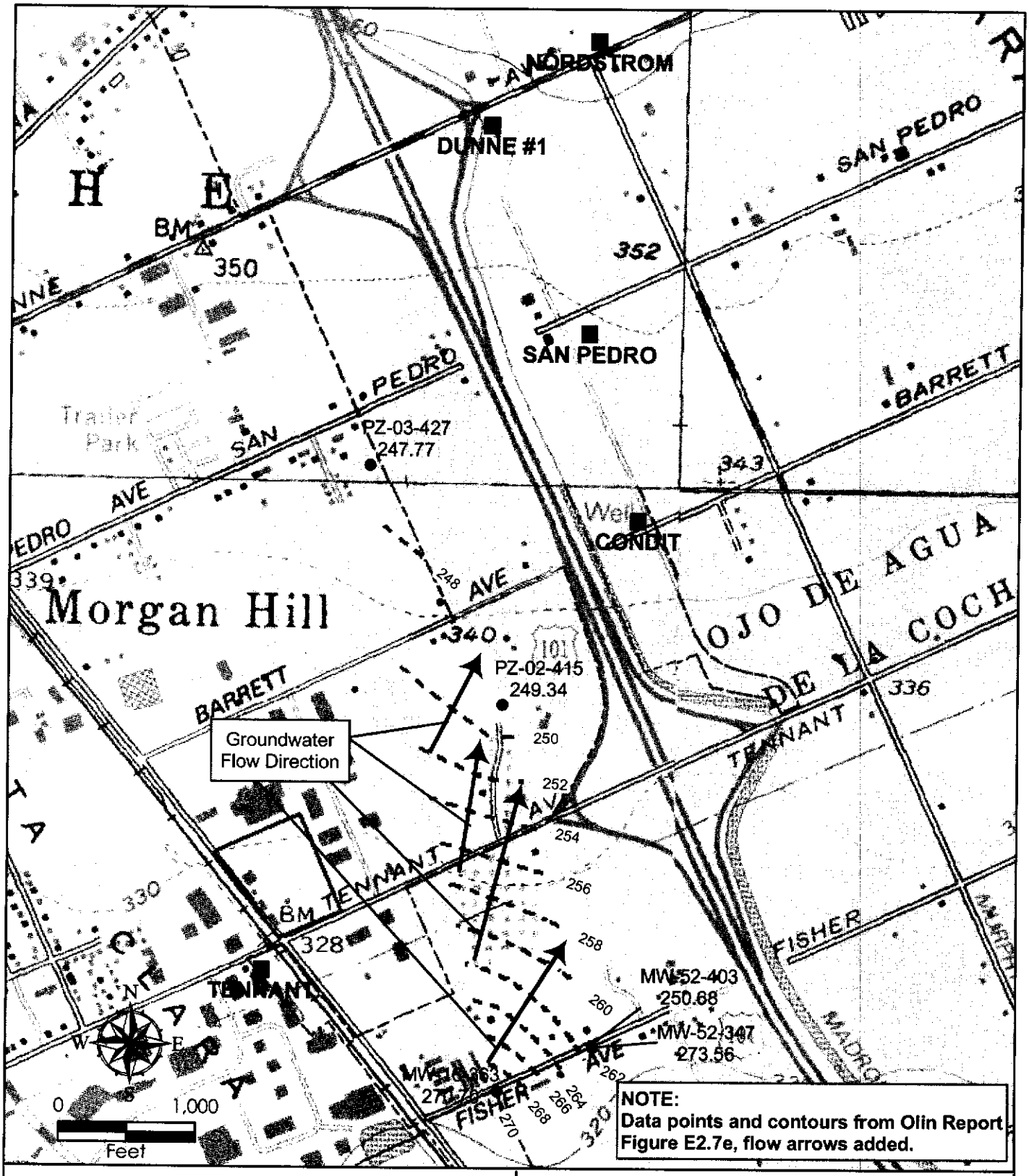
Figure 1. Groundwater Elevations - Deep Zone (Middle), Third Quarter 2006, modified from Report Figure E2.6e

SWL	MT	11/2006
H0562	1	



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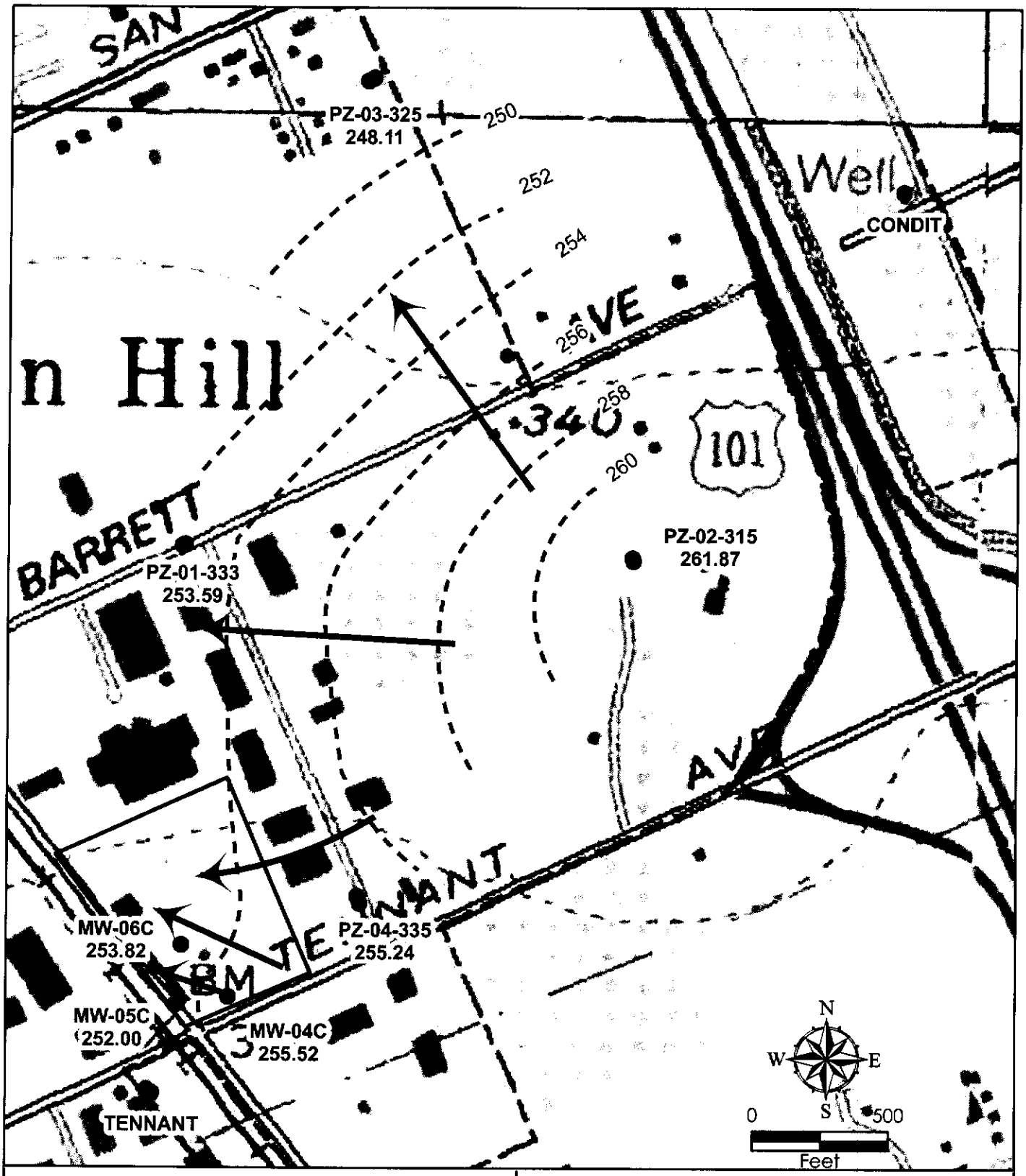
GROUNDWATER ELEVATIONS - DEEP ZONE (LOWER), THIRD QUARTER, 2006 MODIFIED FROM REPORT FIGURE E2.7e	SWL	MT	11/2006
	H0562	2	



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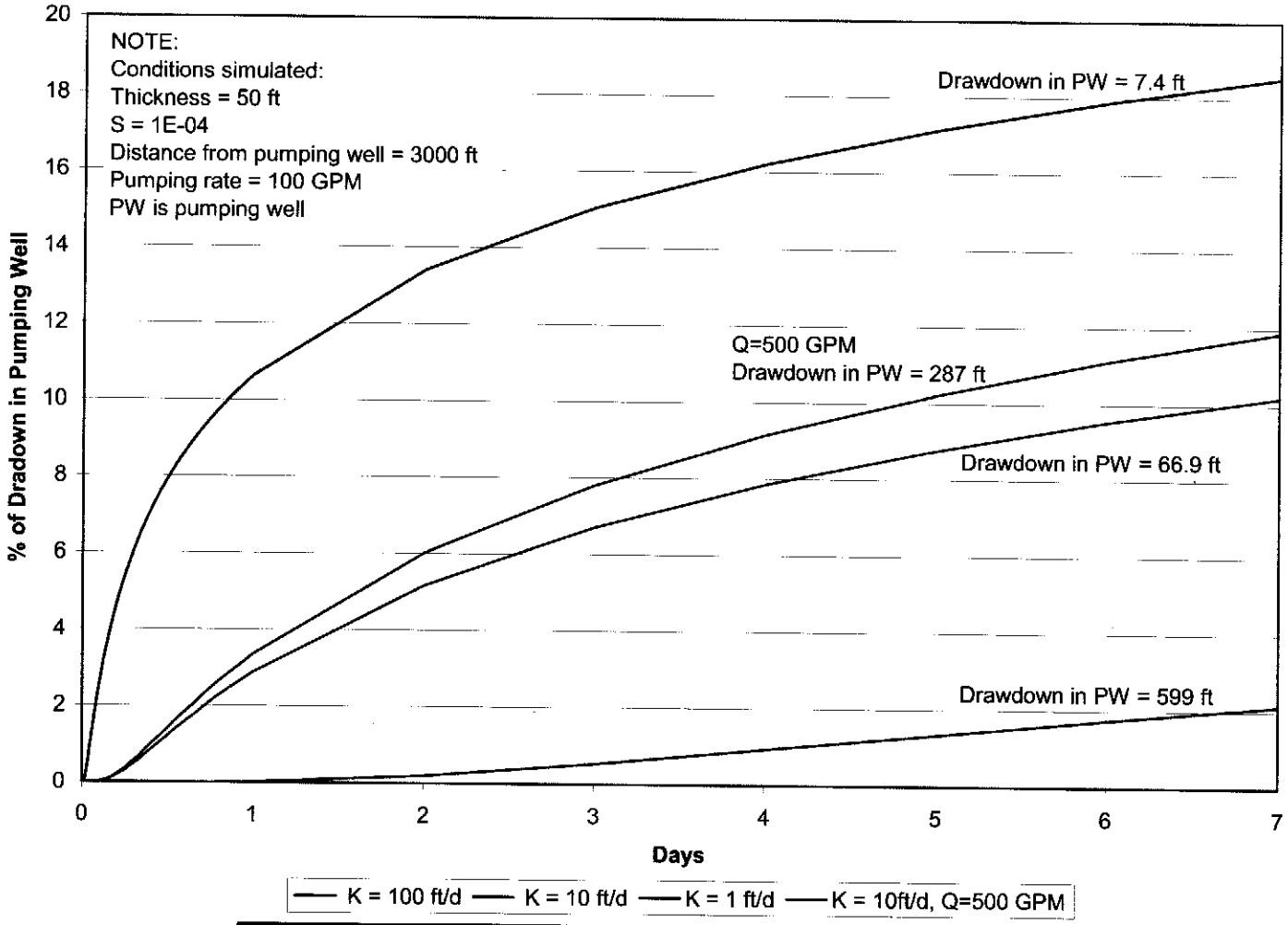
GROUNDWATER ELEVATIONS - DEEP ZONE (MIDDLE), AUGUST 31, 2006

SWL	MT	11/2006
H0562	3	

Drawdown Response as a Function of Hydraulic Conductivity



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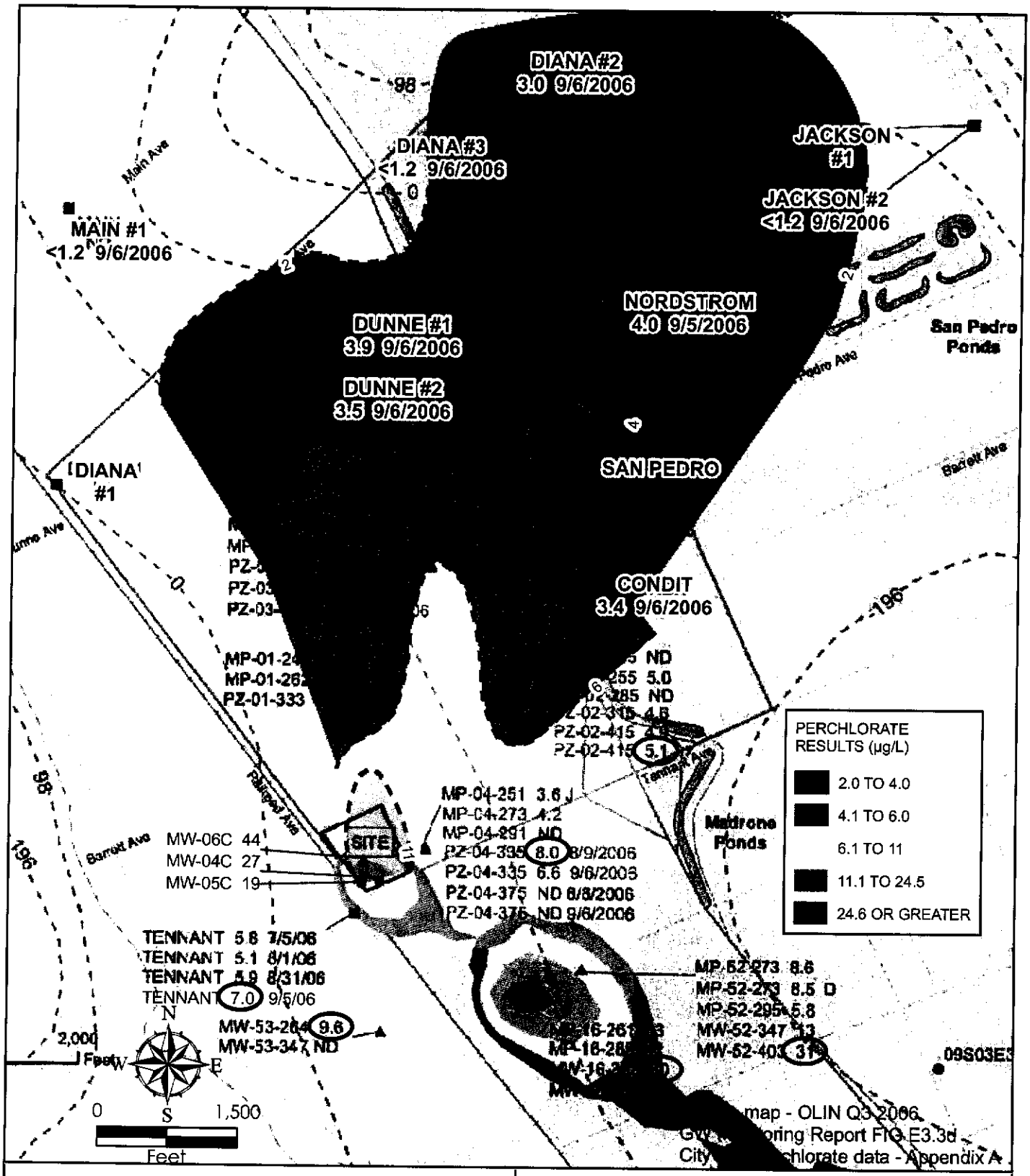
DRAWDOWN RESPONSE AS A FUNCTION OF HYDRAULIC CONDUCTIVITY	SWL	MT	11/2006
	H0562	4	



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PERCHLORATE ISOCONCENTRATION CONTOURS, DEEP AQUIFER ZONE, THIRD QUARTER 2006. HIGHEST VALUE AT EACH LOCATION MAPPED

SWL	MT	11/2006
H0562	5	

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APPENDIX A

LABORATORY ANALYTICAL REPORTS

CITY OF MORGAN HILL WELLS, SEPTEMBER 2006

TestAmerica
ANALYTICAL TESTING CORPORATION

885 Jarvis Drive
Morgan Hill, CA 95037
(408) 776-9600
FAX (408) 782-6308
www.testamericainc.com

R+M.

City of Morgan Hill 100 Edes Ct. Morgan Hill CA, 95037	Project: Tennant Well Perchlorate System Project Number: - Project Manager: Cory Fitch	MPI0082 Reported: 09/12/06 13:14

Perchlorate by EPA 314.0

TestAmerica - Morgan Hill, CA

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
~~Tennant Well-SV-99~~ Well Head (MPI0082-01) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	7	4	ug/l	1	6108004	09/07/06	09/07/06	EPA 314.0	
Tennant Well - SV-205 Treated Water (MPI0082-02) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	ND	4	ug/l	1	6108004	09/07/06	09/07/06	EPA 314.0	
Tennant Well - SV-100 T.P. Influent (MPI0082-03) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	6	2	ug/l	1	6108008	09/07/06	09/08/06	EPA 314.0	
Tennant Well - SV-101 (MPI0082-04) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	ND	2	ug/l	1	6108008	09/07/06	09/08/06	EPA 314.0	
Tennant Well - SV-102 (MPI0082-05) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	ND	2	ug/l	1	6108008	09/07/06	09/08/06	EPA 314.0	
Tennant Well - SV-103 (MPI0082-06) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	ND	2	ug/l	1	6108008	09/07/06	09/08/06	EPA 314.0	
Tennant Well - SV-200 Combined Effluent (MPI0082-07) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	ND	2	ug/l	1	6108008	09/07/06	09/08/06	EPA 314.0	
Tennant Well - SV-204 T.P Effluent (MPI0082-08) Water Sampled: 09/05/06 09:15 Received: 09/05/06 16:35									
Perchlorate	ND	2	ug/l	1	6108008	09/07/06	09/08/06	EPA 314.0	

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Rtn.

City of Morgan Hill	Project: Nordstrom Park Well	MPI0081
100 Edes Ct.	Project Number: -	Reported:
Morgan Hill CA, 95037	Project Manager: Cory Fitch	09/12/06 13:04

Perchlorate by EPA 314.0

TestAmerica - Morgan Hill, CA

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Nordstrom Well-SV-99 Raw water (MPI0081-01) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	4	4	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	
Nordstrom Well-SV-207 Treated water (MPI0081-02) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	ND	4	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	
Nordstrom Well-SV-100 T. P. Influent (MPI0081-03) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	3	2	ug/l	1	6I08008	09/07/06	09/07/06	EPA 314.0	
Nordstrom Well-SV-206 T. P. Influent (MPI0081-04) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	ND	2	ug/l	1	6I08008	09/07/06	09/07/06	EPA 314.0	
Nordstrom Well-SV-101 (MPI0081-05) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	2	2	ug/l	1	6I08008	09/07/06	09/07/06	EPA 314.0	
Nordstrom Well-SV-102 (MPI0081-06) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	2	2	ug/l	1	6I08008	09/07/06	09/07/06	EPA 314.0	
Nordstrom Well-SV-103 (MPI0081-07) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	3	2	ug/l	1	6I08008	09/07/06	09/08/06	EPA 314.0	
Nordstrom Well-SV-104 (MPI0081-08) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	2	2	ug/l	1	6I08008	09/07/06	09/08/06	EPA 314.0	
Nordstrom Well-SV-105 (MPI0081-09) Water Sampled: 09/05/06 09:45 Received: 09/05/06 15:35									
Perchlorate	2	2	ug/l	1	6I08008	09/07/06	09/08/06	EPA 314.0	

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14 September, 2006

Cory Fitch
City of Morgan Hill
100 Edes Ct.
Morgan Hill, CA 95037

RE: -
Work Order: MPI0128

Enclosed are the results of analyses for samples received by the laboratory on 09/06/06 15:30. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Douglas Clark
Project Manager

CA ELAP Certificate # 1210

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City of Morgan Hill 100 Edes Ct. Morgan Hill CA, 95037	Project: - Project Number: - Project Manager: Cory Fitch	MPI0128 **Reported:** 09/14/06 12:23

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Dunne I Well	MPI0128-01	Water	09/06/06 08:00	09/06/06 15:30
Dunne II Well	MPI0128-02	Water	09/06/06 08:05	09/06/06 15:30
Jackson I Well	MPI0128-03	Water	09/06/06 14:15	09/06/06 15:30
Diana I Well	MPI0128-04	Water	09/06/06 08:40	09/06/06 15:30
Diana II Well	MPI0128-05	Water	09/06/06 12:50	09/06/06 15:30
Diana III Well	MPI0128-06	Water	09/06/06 08:10	09/06/06 15:30
Boys Ranch I Well	MPI0128-07	Water	09/06/06 13:20	09/06/06 15:30
Boys Ranch II Well	MPI0128-08	Water	09/06/06 13:00	09/06/06 15:30
Boys Ranch III Well	MPI0128-09	Water	09/06/06 13:10	09/06/06 15:30
Main Well II (New)	MPI0128-10	Water	09/06/06 08:30	09/06/06 15:30
Condit Well	MPI0128-11	Water	09/06/06 13:55	09/06/06 15:30
San Pedro Well	MPI0128-12	Water	09/06/06 07:50	09/06/06 15:30
Main I Well	MPI0128-13	Water	09/06/06 14:45	09/06/06 15:30
Butterfield Well	MPI0128-14	Water	09/06/06 08:20	09/06/06 15:30

This report has been revised to include the re-analysis of three samples: Dunne I Well (MPI0128-01), Dunne II Well (MPI0128-02), and San Pedro Well (MPI0128-12).

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City of Morgan Hill 100 Edes Ct. Morgan Hill CA, 95037	Project: - Project Number: - Project Manager: Cory Fitch	MPI0128 **Reported:** 09/14/06 12:23

Perchlorate by EPA 314.0
TestAmerica - Morgan Hill, CA

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Dunne I Well (MPI0128-01) Water Sampled: 09/06/06 08:00 Received: 09/06/06 15:30										
Perchlorate	**3.9**	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	J
Dunne I Well (MPI0128-01RE1) Water Sampled: 09/06/06 08:00 Received: 09/06/06 15:30										
Perchlorate	**3.1**	1.2	4.0	ug/l	1	6I13012	09/12/06	09/13/06	EPA 314.0	J
Dunne II Well (MPI0128-02) Water Sampled: 09/06/06 08:05 Received: 09/06/06 15:30										
Perchlorate	**3.5**	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	J
Dunne II Well (MPI0128-02RE1) Water Sampled: 09/06/06 08:05 Received: 09/06/06 15:30										
Perchlorate	**3.0**	1.2	4.0	ug/l	1	6I13012	09/12/06	09/13/06	EPA 314.0	J
Jackson I Well (MPI0128-03) Water Sampled: 09/06/06 14:15 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	
Diana I Well (MPI0128-04) Water Sampled: 09/06/06 08:40 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	
Diana II Well (MPI0128-05) Water Sampled: 09/06/06 12:50 Received: 09/06/06 15:30										
Perchlorate	**3.0**	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	J
Diana III Well (MPI0128-06) Water Sampled: 09/06/06 08:10 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	
Boys Ranch I Well (MPI0128-07) Water Sampled: 09/06/06 13:20 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	

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City of Morgan Hill	Project: -	MPI0128
100 Edes Ct.	Project Number: -	**Reported:**
Morgan Hill CA, 95037	Project Manager: Cory Fitch	09/14/06 12:23

Perchlorate by EPA 314.0
TestAmerica - Morgan Hill, CA

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Boys Ranch II Well (MPI0128-08) Water Sampled: 09/06/06 13:00 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08004	09/07/06	09/07/06	EPA 314.0	
Boys Ranch III Well (MPI0128-09) Water Sampled: 09/06/06 13:10 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08007	09/07/06	09/07/06	EPA 314.0	
Main Well II (New) (MPI0128-10) Water Sampled: 09/06/06 08:30 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08007	09/07/06	09/07/06	EPA 314.0	
Condit Well (MPI0128-11) Water Sampled: 09/06/06 13:55 Received: 09/06/06 15:30										
Perchlorate	**3.4**	1.2	4.0	ug/l	1	6I08007	09/07/06	09/07/06	EPA 314.0	J
San Pedro Well (MPI0128-12) Water Sampled: 09/06/06 07:50 Received: 09/06/06 15:30										
Perchlorate	**4.4**	1.2	4.0	ug/l	1	6I08007	09/07/06	09/07/06	EPA 314.0	
San Pedro Well (MPI0128-12RE1) Water Sampled: 09/06/06 07:50 Received: 09/06/06 15:30										
Perchlorate	**4.2**	1.2	4.0	ug/l	1	6I13012	09/12/06	09/13/06	EPA 314.0	
Main I Well (MPI0128-13) Water Sampled: 09/06/06 14:45 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08007	09/07/06	09/07/06	EPA 314.0	
Butterfield Well (MPI0128-14) Water Sampled: 09/06/06 08:20 Received: 09/06/06 15:30										
Perchlorate	ND	1.2	4.0	ug/l	1	6I08007	09/07/06	09/07/06	EPA 314.0	

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City of Morgan Hill 100 Edes Ct. Morgan Hill CA, 95037	Project: - Project Number: - Project Manager: Cory Fitch	MPI0128 **Reported:** 09/14/06 12:23

Physical Parameters by APHA/ASTM/EPA Methods
TestAmerica - Morgan Hill, CA

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Dunne I Well (MPI0128-01) Water Sampled: 09/06/06 08:00 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**550**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Dunne II Well (MPI0128-02) Water Sampled: 09/06/06 08:05 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**590**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Jackson I Well (MPI0128-03) Water Sampled: 09/06/06 14:15 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**630**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Diana I Well (MPI0128-04) Water Sampled: 09/06/06 08:40 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**570**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Diana II Well (MPI0128-05) Water Sampled: 09/06/06 12:50 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**630**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Diana III Well (MPI0128-06) Water Sampled: 09/06/06 08:10 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**600**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Boys Ranch I Well (MPI0128-07) Water Sampled: 09/06/06 13:20 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**630**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Boys Ranch II Well (MPI0128-08) Water Sampled: 09/06/06 13:00 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**660**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Boys Ranch III Well (MPI0128-09) Water Sampled: 09/06/06 13:10 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**620**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	

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City of Morgan Hill 100 Edes Ct. Morgan Hill CA, 95037	Project: - Project Number: - Project Manager: Cory Fitch	MPI0128 **Reported:** 09/14/06 12:23

Physical Parameters by APHA/ASTM/EPA Methods
TestAmerica - Morgan Hill, CA

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Main Well II (New) (MPI0128-10) Water Sampled: 09/06/06 08:30 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**580**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Condit Well (MPI0128-11) Water Sampled: 09/06/06 13:55 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**660**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
San Pedro Well (MPI0128-12) Water Sampled: 09/06/06 07:50 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**540**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Main I Well (MPI0128-13) Water Sampled: 09/06/06 14:45 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**570**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	
Butterfield Well (MPI0128-14) Water Sampled: 09/06/06 08:20 Received: 09/06/06 15:30										
Specific Conductivity @ 25 C	**540**		1.0	umhos/cm	1	6I07023	09/07/06	09/08/06	SM 2510B	

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City of Morgan Hill 100 Edes Ct. Morgan Hill CA, 95037	Project: - Project Number: - Project Manager: Cory Fitch	MPI0128 **Reported:** 09/14/06 12:23

Perchlorate by EPA 314.0 - Quality Control
TestAmerica - Morgan Hill, CA

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6I08004 - General Preparation / EPA 314.0											
Blank (6I08004-BLK1)					Prepared & Analyzed: 09/07/06						
Perchlorate	ND	2.0	4.0	ug/l							
Laboratory Control Sample (6I08004-BS1)					Prepared & Analyzed: 09/07/06						
Perchlorate	25.1	2.0	4.0	ug/l	25.0		100	85-115			
Matrix Spike (6I08004-MS1)		**Source: MPI0118-01**			Prepared & Analyzed: 09/07/06						
Perchlorate	38.8	2.0	4.0	ug/l	25.0	12	107	80-120			
Matrix Spike Dup (6I08004-MSD1)		**Source: MPI0118-01**			Prepared & Analyzed: 09/07/06						
Perchlorate	37.7	2.0	4.0	ug/l	25.0	12	103	80-120	3	15	
Batch 6I08007 - General Preparation / EPA 314.0											
Blank (6I08007-BLK1)					Prepared & Analyzed: 09/07/06						
Perchlorate	ND	1.2	4.0	ug/l							
Laboratory Control Sample (6I08007-BS1)					Prepared & Analyzed: 09/07/06						
Perchlorate	26.2	1.2	4.0	ug/l	25.0		105	85-115			
Matrix Spike (6I08007-MS1)		**Source: MPI0128-10**			Prepared & Analyzed: 09/07/06						
Perchlorate	26.2	1.2	4.0	ug/l	25.0	ND	105	80-120			
Matrix Spike Dup (6I08007-MSD1)		**Source: MPI0128-10**			Prepared & Analyzed: 09/07/06						
Perchlorate	26.2	1.2	4.0	ug/l	25.0	ND	105	80-120	0	15	
Batch 6I13012 - General Preparation / EPA 314.0											
Blank (6I13012-BLK1)					Prepared & Analyzed: 09/12/06						
Perchlorate	ND	2.0	4.0	ug/l							

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City of Morgan Hill 100 Edes Ct. Morgan Hill CA, 95037	Project: - Project Number: - Project Manager: Cory Fitch	MPI0128 **Reported:** 09/14/06 12:23

Perchlorate by EPA 314.0 - Quality Control

TestAmerica - Morgan Hill, CA

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6I13012 - General Preparation / EPA 314.0											
Laboratory Control Sample (6I13012-BS1)					Prepared & Analyzed: 09/12/06						
Perchlorate	25.9	2.0	4.0	ug/l	25.0		104	85-115			
Matrix Spike (6I13012-MS1)		**Source: MPI0255-01**			Prepared & Analyzed: 09/12/06						
Perchlorate	30.0	2.0	4.0	ug/l	25.0	4.2	103	80-120			
Matrix Spike Dup (6I13012-MSD1)		**Source: MPI0255-01**			Prepared & Analyzed: 09/12/06						
Perchlorate	30.3	2.0	4.0	ug/l	25.0	4.2	104	80-120	1	15	

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City of Morgan Hill 100 Edes Ct. Morgan Hill CA. 95037	Project: - Project Number: - Project Manager: Cory Fitch	MPI0128 **Reported:** 09/14/06 12:23

Notes and Definitions

J	Estimated value. Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). The user of this data should be aware that this data is of limited reliability.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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