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6 February 2017

Proj. No.: 308038-03533
File Loc.: Costa Mesa

Santa Monica Water Resources Department
1212 5th Street, 3rd Floor
Santa Monica, CA 90405

Attention: Lisette A. Gold, D.Env.
Environmental Remediation Coordinator

Dear Dr. Gold:

RE: COMMENT LETTER, MOBIL SERVICE STATION 18FX5, 3800 SEPULVEDA BOULEVARD, CULVER CITY, CALIFORNIA, UST CASE CLOSURE SUMMARY

The State Water Resources Control Board (State Water Board) has proposed underground storage tank (UST) case closure for the above site, Los Angeles RWQCB, case number 1-07021, 3800 South Sepulveda Boulevard, Culver City, CA 90230 (“the Site”), Claim Number 5695. The City of Santa Monica (City), a key stakeholder in the Charnock Sub-basin of the Santa Monica Groundwater Basin in which the subject Site is located, has requested that WorleyParsons provide a hydrogeological review the proposed closure of the Site and advise the City if closure of this Site is warranted. The City operates five municipal water supply wells in the Charnock well field, (CH-13, 16, 18, 19 and 20) which are located approximately 2,800 feet northwest of the Site.

The Site closure proposed by the State Water Board is based on their interpretation that Site closure meets the criteria specified in the State Water Board's Low-Threat Underground Storage Tank Case Closure Policy (Low Threat Closure Policy) adopted by State Water Board Resolution No. 2012-0016. In their review of the case, the State Water Board concluded that “In the absence of unique attributes or site-specific conditions that demonstrably increase the risk associated with residual petroleum constituents, cases that meet the general had media-specific criteria in the Policy pose a low threat to human health, safety and the environment” (State Water Board Draft Order WQ -017-00:XX- UST, January 19, 2017, “the Order”).

In issuing the Draft Order the State Water Board may not have been aware of the unique attributes of the Site and the Site-specific conditions with the respect to the City's Charnock well field. The Charnock Well field was shut down from 1996 to December 2010 because of MTBE contamination from leaking underground storage tanks in the Charnock Sub-basin, including contamination from this Site. Municipal supply wells at the Charnock well field have recorded some of the highest MTBE concentrations ever measured in California drinking water, including 610 ug/L in CH-19 on March 15, 1996. Because of the high concentrations of MTBE in the Charnock subbasin, the California Division of Drinking Water (DDW; formerly Department of Public Health) required that the \$100 million Charnock Treatment Unit be permitted under Policy Memo 97-005 as an “Extremely Impaired Source”. At time of shutdown in 1996 the Charnock well field was supplying the City with approximately 50% of its demand, and today Charnock is key to meeting the City's water self-reliance goal.

ETIC Engineering on behalf of ExxonMobil Oil Corporation (ExxonMobil) applied to the Los Angeles Regional Water Quality Control Board (LARWQCB) for closure of the above site on September 15, 2015 (the “Closure Request”). Advisian-WorleyParsons on behalf of the City of Santa Monica subsequently provided a comment letter dated March 16, 2016 (March 2016 comment letter) to the LARWQCB expressing the City's concerns with the Site closure request. That comment letter is included as Attachment A. Key concerns raised in the March 16, 2016 comment letter included



persistent exceedances of the TBA notification level (NL, 12 ug/L) in both the Shallow Aquifer and Upper Silverado Aquifer, underestimated groundwater velocity and over-estimated travel time from the Site to the well field, and the artificially high reporting limit (RL) for TBA (10 ug/L) since June 2013 giving the false impression of widespread low TBA concentrations at the Site.

Detailed Comments

1. The Site is upgradient from the City of Santa Monica's Charnock well field, which draws water from the Shallow Aquifer (SA) and Upper Silverado Aquifer (USA), both of which are present beneath the Site. When groundwater production at the Charnock Well Field resumed in December 2010 following construction of the Charnock Treatment Unit for removal of MTBE and TBA from groundwater in the Charnock Subbasin, the resulting drawdown of groundwater levels propagated outward from the well field such that the cone of depression from Charnock pumping now extends a distance of at least 3200 feet from the well field, well beyond the 2800 ft distance from the Site to the well field. This is shown in figures 2a (Potentiometric Surface Map, Shallow Aquifer August 2016) and Figure 3a (Potentiometric Surface Map, Upper Silverado Aquifer August 2016) from Ramboll Environ (2017), included as Attachment B. These figures show that the Site is located within the capture zone of the Charnock Well Field. Comparison of recent groundwater elevations at the Site (from second quarter, 2016) to groundwater elevations from fourth quarter 2010 (prior to the re-start of pumping at the Charnock Well Field indicate a drawdown 49.1 feet in the Shallow Aquifer, and 52.6 feet in the Upper Silverado Aquifer. Clearly Charnock pumping is affecting groundwater levels at the Site in both major aquifers, and there is hydraulic communication between the two aquifers as indicated by the similarity in drawdown in the two aquifers.
2. Since the September 2015 closure request additional quarterly groundwater monitoring data has been collected, including four quarters of data from 2016. Reviewing the most recent four quarters of data from 2016 shows that there are still significant exceedances of the TBA NL in the Shallow Aquifer, including in: B-12: 22 (Q1), 68 (Q2), 45 (Q3), 32 ug/L (Q4); WC-1: 24 (Q1), 35 (Q2) ug/L; and WC-2: 220 (Q1); 120 (Q2); 11(Q3) ug/L. Location B-12 has historically had exceedances of the TBA NL (as noted in the March 2016 comment letter, Attachment A). Of particular concern are the recent TBA levels in location WC-2 (up to 220 ug/L in 2016), which is downgradient of B-12 (toward the Charnock Well Field), located near the northern property boundary. The high TBA concentrations in WC-2 represent a recent spike in TBA followed by a subsequent decline, suggesting migration of a TBA plume from a possible on-going TBA source in the vicinity of B-12. If so, this could be the source of the high TBA concentration (81 ug/L) about 900 feet downgradient of the Site at regional monitoring well RMW-52 (shown in Figure 3a, Attachment B), which is completed in the USA. Considering the evidence of hydraulic communication between the SA and the USA it is quite likely that a TBA plume in the SA from the site would migrate downward into the USA, particularly given the higher downward vertical gradients approaching the Charnock well field. Furthermore, the groundwater transport velocities of 681 ft/year for the Shallow Aquifer and 340 ft/year for the Upper Silverado Aquifer, and corresponding travel times to the well field of 4 to 8 years (March 2016 Comment Letter) mean that it is unlikely that the TBA plume from the Site will disperse to concentrations below the NL before reaching the well field, a fact borne out by the high TBA concentrations at RMW-52, 900 feet downgradient of the site, and migrating toward the well field.
3. Although TBA concentrations above the NL are clearly of concern for a public drinking water supply, the City is also very concerned with TBA concentrations below the NL. The treated water goal for TBA at the Charnock Treatment Unit mandated by the California Division of Drinking Water (formerly Department of Public Health) is < 2 ug/L (Detection Limit for Reporting, DLR). Consequently, influent TBA concentrations higher than 2 ug/L still require



treatment to meet the treated water goal. Therefore TBA concentrations in groundwater from the Site between 2 and 12 ug/L that could potentially reach the Charnock Well Field are still of concern to the City. This includes TBA concentrations in the range of <10 to 6.3j ug/L in the Upper Silverado Aquifer during 2016. In this case, please note that the detection limit of 10 ug/L currently applied at the Site (and since 2013) is not helpful in assessing the City's possible need to treat water from this site for TBA. Historic TBA reporting limits at the Site were as low as 0.63 ug/L, and certainly a reporting limit of 2 ug/L is readily achievable, and would allow the City to better assess the potential risk to the Charnock Well Field from this site.

Closing

We trust that these comments are helpful to the State Water Board in reconsidering the proposed Low Threat Closure for this UST case. It is the City's view that the TBA plume at the Site still poses a significant risk to the Charnock well field, and Site closure should not be granted until all TBA concentrations in groundwater are below the Notification Level for at least four consecutive quarters. Also, further assessment of TBA concentrations below the notification level in both the SA and USA should be conducted by applying a lower reporting limit for TBA (i.e., 2 ug/L or lower) in future monitoring events.

Please let me know if you have any questions or if I can be of assistance in any way. I can be reached by e-mail (mark.trudell@worleyparsons.com) or by phone (714 553-5520).

Sincerely,

A handwritten signature in blue ink that reads "Mark Trudell".

Mark Trudell, Ph.D., PG, CHG
Principal Hydrogeologist

REFERENCES

Environ International Corporation (Environ), 2017. Charnock Semiannual Groundwater Monitoring Report, (July 1 to December 31, 2016), Charnock Sub-Basin; Los Angeles, California. January 15, 2017.



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ATTACHMENT A – MARCH 2016 COMMENT LETTER



29 March 2016

Proj. No.: 308038-03533
File Loc.: Costa Mesa

Santa Monica Water
1212 5th Street, 3rd Floor
Santa Monica, CA 90405

Attention: Lisette A. Gold, D.Env.
Environmental Remediation Coordinator

Dear Ms. Gold:

**RE: CLOSURE REQUEST FOR PRP #8, FORMER MOBIL SERVICE STATION
18FX5, 3800 SEPULVEDA BOULEVARD, CULVER CITY, CALIFORNIA
("SITE")**

ETIC Engineering on behalf of ExxonMobil Oil Corporation (ExxonMobil) applied to the Los Angeles Regional Water Quality Control Board (LARWQCB) for closure of the above site on 15 September 2015 (the "Closure Request"). The City of Santa Monica (City) requested that WorleyParsons review the hydrogeological conditions at the Site and advise the City if closure of this Site is warranted.

The closure request is based on three lines of evidence that concentrations of contaminants in groundwater, principally MTBE and TBA, will decline over space and time in the future to levels below regulatory limits (Federal and State Maximum Contaminant Levels (MCLs) - 5 ug/L Secondary MCL for MTBE; 12 ug/L Action Level for TBA) which are the cleanup goals for the Site. The Site is upgradient from the City of Santa Monica's Charnock well field, which draws water from the Shallow Unnamed Aquifer (SUA) and Upper Silverado Aquifer (USA) which are present beneath the Site. The five production wells of the Charnock well field (CH- 13, 15, 16, 18, and 20) are located approximately 2,800 feet northwest of the Site.

The Closure Request utilizes spatial and temporal trend analysis and Bioscreen modeling to argue that the petroleum hydrocarbons plumes in groundwater are stable or shrinking, and therefore closure is justified under the Regional Board's Low Threat Closure Policy. However, the City has identified a number of concerns related to this closure request, based on our technical analysis of information presented in the Closure Request. These concerns are described in the detailed comments, below.

Detailed Comments

1. In describing the Temporal Evaluation for the Shallow Unnamed Aquifer the Closure Request states that "Dissolved-phase petroleum hydrocarbon and fuel oxygenate concentrations in onsite wells B-12, B13, WC-1, and WC-2 have decreased or remain below laboratory reporting limits since 2004. In the most recent sampling event in 2015, TPPH, benzene, MTBE and TBA were near or below laboratory reporting limits." (p.16). This statement is incorrect. TBA concentration in the most recent quarter (second quarter 2015 at the time of the Closure Request) in well B-12 was 20 ug/L, almost twice the Action Level. Moreover, as recently as first quarter 2015 TBA concentrations were above the Action Level in wells B-12 (15 ug/L), B-13 (21 ug/L) and WC-12 (18 ug/L). That is, exceedances were found in 50% of the SUA wells (3/6) monitoring as recently as first quarter 2015. One quarter's data showing TBA concentrations below the action level in most Shallow Unnamed Aquifer wells does not constitute and adequate case for site closure, without having those concentrations confirmed over multiple quarterly sampling events.



2. In describing the Temporal Evaluation for the Upper Silverado Aquifer the Closure Request states that “Dissolved-phase petroleum hydrocarbon and fuel oxygenate concentrations in onsite wells US-1 through US-6, US-7A/B, and US-8A/B have decreased or remain below laboratory reporting limits since 2008.” (p.17). This overstates the situation for TBA concentrations in the Upper Silverado Aquifer, for which there have very many detections in these wells since 2008, notably US-2 (11 detections), US-3 (18 detections), US-4 (8 detections), US-5 (25 detections), US-7A (9 detections), US-8A (15 detections), and US-8B (6 detections). While we acknowledge that TBA concentrations are down from their historic highs, there are still numerous wells with recent history of TBA detections at concentrations of great concern to the City. As recently as first quarter 2015, TBA concentrations exceeding the Action Level were detected at wells US-3 (15 ug/L), US-4 (14 ug/L), US-5 (15 ug/L) and US-7A (27 ug/L), representing 44% (i.e., 4/9) of the USA wells being monitored.
3. The spatial analysis of plume extents from 1997, 2004, 2009 and second quarter 2015 is biased by the selection of quarters that were mapped. If ETIC would have mapped first quarter 2015 instead of the second quarter, detection of TBA above the Action Level in three Shallow Unnamed Aquifer wells (B-12, B-13, and WC-2) and four Upper Silverado Aquifer wells (US-3, US-4, US-5, and US-7A) would give plume extents not dissimilar to historical mapping. With only one event mapped since the re-start of the Charnock well field in December 2010, ETIC has not documented the effect of well field pumping on plume migration or lateral extent. Note that there are no monitoring wells downgradient of the Site (between the Site and the well field) that are being sampled to monitor downgradient plume migration. The only well that is downgradient of the Site is RMC-7, which has not been sampled since October 2004 even though shift in groundwater flow direction to the north-northwest with the re-start of Charnock in 2010 has made this well an important downgradient monitoring point.
4. Laboratory reporting limits for TBA have historically been much lower than for sampling events since June, 2013. From October 2002 to February 2013 TBA reporting limits ranged from <0.24 to <6.5 ug/L. Starting in June 2013 the TBA reporting limit was raised to 10 ug/L, giving the false impression of a large number of non-detections, when in fact the artificially high reporting limit is largely responsible for the lack of TBA detections.
5. The Closure Request vastly underestimates the groundwater velocity beneath the Site used in the Bioscreen modelling (Section 6 of the Closure Request) to estimate plume transport time and distances for natural attenuation. The hydraulic parameters used in the Bioscreen modelling included a hydraulic conductivity (K) of 1E-03 cm/sec (2.8 ft/day); hydraulic gradient (i) of 0.004 and porosity (n) of 0.3. These parameters can be used to calculate groundwater velocity by Darcy’s Law, i.e., $v = Ki/n$; where v is groundwater velocity (linear pore water velocity; ft/day), K is hydraulic conductivity (ft/day), i is horizontal hydraulic gradient (unitless, or ft/ft) and n is effective porosity (decimal fraction). The calculation gives a groundwater velocity of 0.04 ft/day or 13.6 ft/year.

However, no basis is provided for the K value used in the Closure Request, and the value used appears to be far too low. “Reasonable” hydraulic conductivity (K) values for the Shallow Unnamed Aquifer and the Upper Silverado Aquifer are given in GeoTrans (2006, Table 4) as 80 ft/day for both aquifers (from a calibrated groundwater flow model). This is a factor of nearly 30 times higher than the K value used in the Bioscreen model. Horizontal hydraulic gradient (i) between the Site and the Charnock well field can be estimated from groundwater elevation maps developed by Environ (2015) from the regional groundwater monitoring program for July 2014. Typical horizontal hydraulic gradients estimated from these groundwater elevation maps for the Shallow Aquifer and Upper Silverado Aquifer are approximately 0.005 ft/ft and 0.035 ft/ft, respectively. Assuming a porosity (effective porosity) of 0.3 for the aquifer material (sand), the corresponding groundwater transport



velocities are 681 ft/year for the Shallow Aquifer and 340 ft/year for the Upper Silverado Aquifer. These values are a factor of 50 and 25 higher (Shallow Aquifer and Upper Silverado Aquifer, respectively) than the groundwater velocity used in the Bioscreen model. Consequently, the Closure Request conclusion that “The center of the modeled TBA plume would travel a maximum distance of 560 feet downgradient from US-5 and downgradient concentrations would be below the DHS action level of 12 µg/L in 44 years” (p. 27) is completely erroneous; Actual advective transport distance in 44 years using the groundwater velocities calculated above would be closer to 30,000 ft (Shallow Unnamed Aquifer) or 15,000 feet (Upper Silverado Aquifer). Notably, these distances are up to an order of magnitude further than the distance to the Charnock well field (2800 ft), and in fact the TBE plume from the Site would likely reach the well field within 4 to 8 years (Shallow Aquifer and Upper Silverado Aquifer, respectively) long before plume stabilization has occurred.

Closing

We trust that these comments are helpful to the Regional Board in reviewing the Closure Request by ExxonMobil for this Site. It is the City’s view that the TBA plume at the Site poses a significant risk to the Charnock well field, and Site closure should not be granted until all TBA concentrations in groundwater are below the Action Level for at least four consecutive quarters.

Please let me know if you have any questions or if I can be of assistance in any way. I can be reached by e-mail (mark.trudell@worleyparsons.com) or by phone (714 553-5520).

Sincerely,

Mark Trudell, Ph.D., PG, CHG
Principal Hydrogeologist

REFERENCES

Environ International Corporation (Environ), 2015. Charnock Semiannual Groundwater Monitoring Report, (July 1 to December 31, 2014), Charnock Sub-Basin; Los Angeles, California. January 15, 2015.

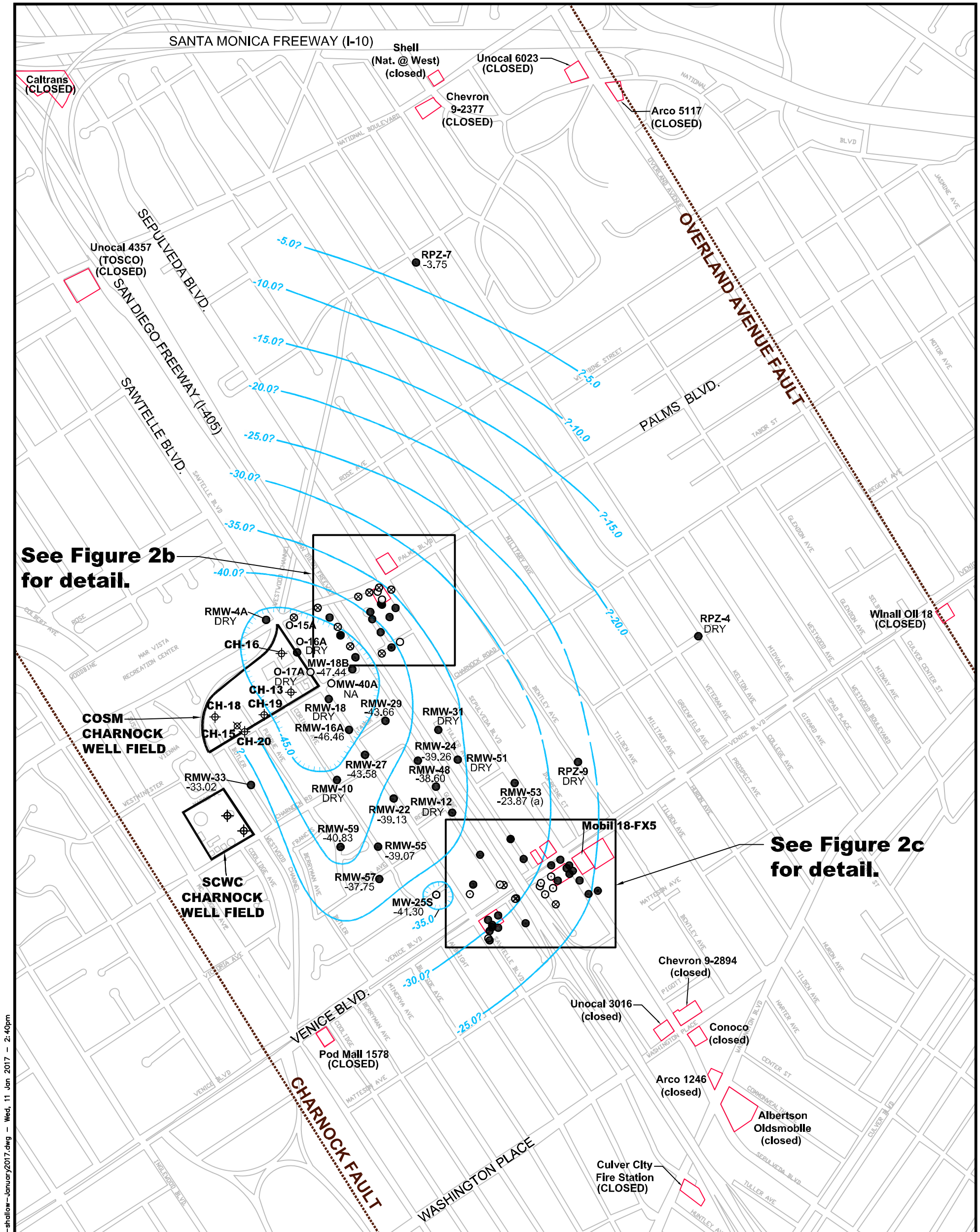
GeoTrans, Inc., 2006. Groundwater Flow Modeling Update (Groundwater Modeling Subtask 21.4), prepared for the Charnock Engineering Committee (CEC). April 4, 2006.



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ATTACHMENT B – FIGURES FROM RAMBOLL ENVIRON 2017



See Figure 2b for detail.

See Figure 2c for detail.

EXPLANATION

- -7.65 Shallow Aquifer Monitoring Well or Piezometer: Measured in August 2016 Groundwater elevation in feet, MSL Datum
- NA August 2016 water level data not available
- ⊕ Groundwater Extraction Well
- ⊕ Production Well
- ⊗ Destroyed Production Well
- ⊗ Destroyed Monitoring Well

--- Fault Zone

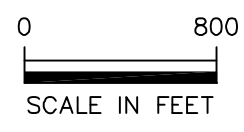
□ Site

-10.0 ? Groundwater elevation contour in feet, MSL Datum. Shown unbroken for presentation clarity, but does not imply certainty. Dashed and queried where inferred.

(a) Groundwater elevation appears anomalous; not considered for contouring.

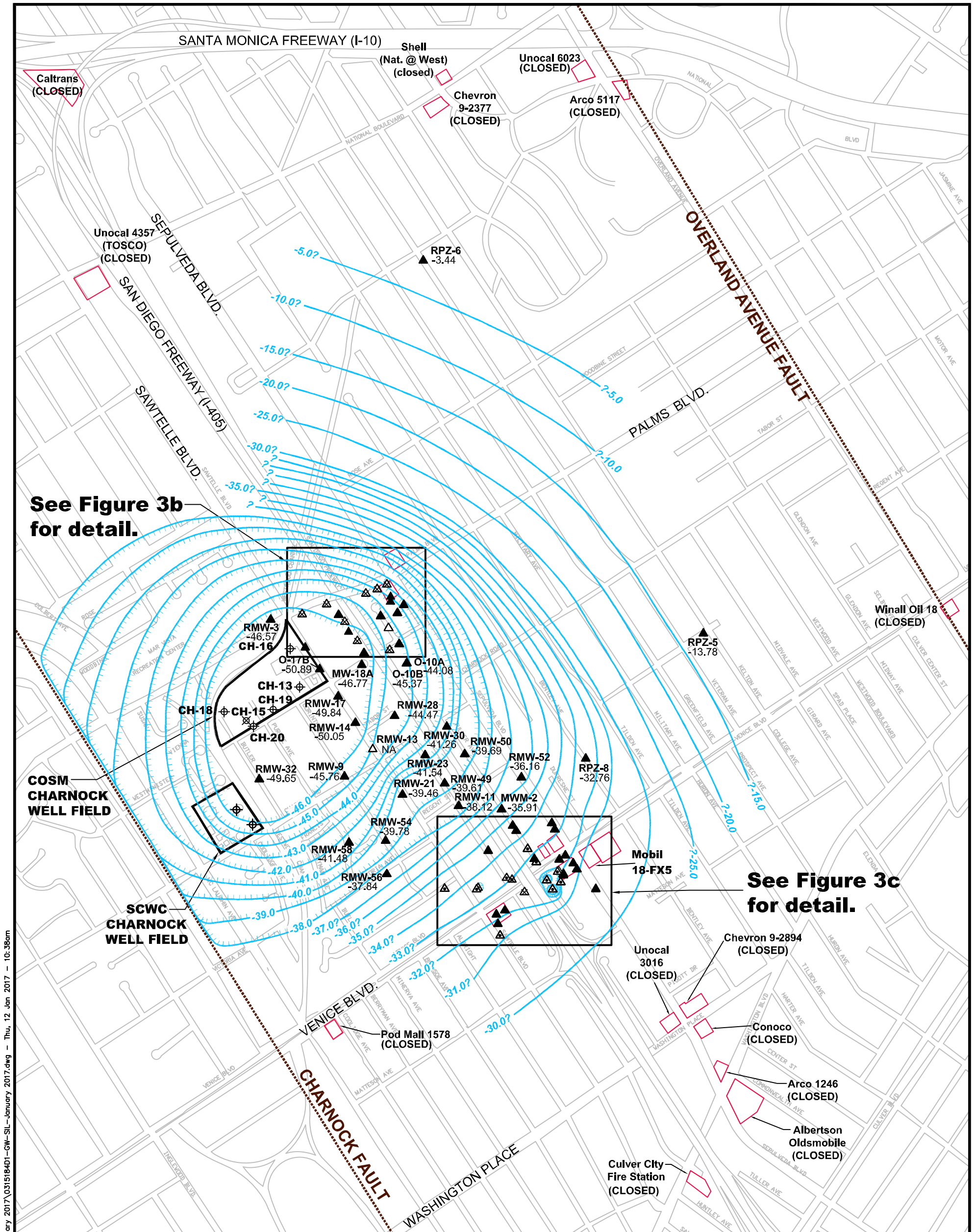
(b) Charnock Well Field began operating In December 2010.

NOTE: Groundwater elevations in Thrifty 247 site wells were measured in September 2016.



SOURCE: Charnock database, January 2017.

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See Figure 3b for detail.

See Figure 3c for detail.

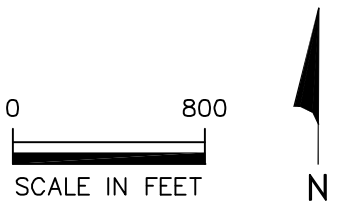
EXPLANATION

- ▲ Upper Silverado Aquifer Monitoring Well or Piezometer:
-7.77 Measured in August 2016, Groundwater elevation in feet, MSL Datum
- △ August 2016 water level data not available
- △ Groundwater extraction well
- ⊕ Production Well
- ⊗ Destroyed Production Well
- ▲ Destroyed Monitoring Well

- Fault Zone
- Site
- 10.0 → ? Groundwater elevation contour in feet, MSL Datum. Shown unbroken for presentation clarity, but does not imply certainty. Queried where inferred.
- (a) Groundwater elevation appears anomalous; not considered for contouring
- (b) Charnock Well Field began operating in December 2010.

NOTE: Groundwater elevations in Thrifty 247 site wells were measured in September 2016.

DRAFT



SOURCE: Charnock database, January 2017.



Potentiometric Surface Map - Upper Silverado Aquifer, August 2016
Charnock Sub-Basin; Los Angeles, California

Figure
3a

Drafter: RS

Date: 1/11/17

Contract Number: 03-15184D1

Approved:

Revised:

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ATTACHMENT A – MARCH 2016 COMMENT LETTER



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ATTACHMENT B – FIGURES FROM RAMBOLL ENVIRON 2017