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BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

In the Matter of the Petition of: BLACKROCK REALTY ADVISORS, INC. FOR REVIEW OF THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LOS ANGELES REGION'S FAILURE TO ACT ON PETITIONER'S REQUEST FOR SITE CLOSURE	**PETITION FOR REVIEW AND MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT THEREOF**

Pursuant to Water Code section 13320, Health and Safety Code section 25269.40, and California Code of Regulations, title 23, sections 2050 *et seq.* and 2814.6, BlackRock Realty Advisors, Inc. ("Petitioner") hereby petitions the State Water Resources Control Board ("State Board") for review of the failure to act by the California Regional Water Quality Control Board for the Los Angeles Region ("Regional Board"). Petitioner submitted a request on March 18, 2014, to the Regional Board for closure of or no future action on the PortLA site under the Low-Threat Underground Storage Tank Case Closure Policy (the "Policy"). The Regional Board has not addressed the technical merits of Petitioner's request nor has the Regional Board provided a statement of reasons for its failure to grant that request.[1] Because clean-up efforts over the past 25 plus years have rendered the PortLA site a low threat to human health, safety, and the environment, the Regional Board's failure grant Petitioner's request contravenes the Policy as well as State Board Resolution No. 92-49. Accordingly, Petitioner submits this Petition for review of the Regional Board's improper failure to act.

1. CONTACT INFORMATION FOR PETITIONER, THE ADDRESS OF THE SITE, AND THE NAMES AND ADDRESSES OF THE OWNERS OF ADJACENT PROPERTIES:

Petitioner's address is 4400 MacArthur Boulevard, Suite 700, Newport Beach, California 92660. Petitioner may be contacted at the following mailing address, telephone number, and email address:

Leland Nakaoka
BlackRock Realty Advisors, Inc.
4400 MacArthur Boulevard, Suite 700
Newport Beach, CA 92660

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[1] As discussed in the Memorandum of Points and Authorities, Petitioner met with the Regional Board on May 15, 2014, to discuss the closure request. The Regional Board did not respond to the technical analysis that justifies Site closure, rather it insisted that Petitioner conduct investigations of previously closed portions of the PortLA site and install new wells that are unnecessary in light of all of the available information. The Regional Board reasoned that the Policy does not apply because the former refinery site has remaining free product and the Regional Board has never closed a refinery site with free product, notwithstanding that the site overlies brackish (very high TDS) water and is near the harbor area on the seaward side of where water is injected to protect regional groundwater from saltwater intrusion.

With a copy to:

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The site is located in an industrial area at 300 Westmont Drive, San Pedro, California (the "Site") and borders the Harbor Freeway to the Southwest of the Site. The adjacent property owners, and their addresses, are as follows:

Phillips 66 Refinery
1660 Anaheim Street, Wilmington, CA

Rancho LPG
2110 Gaffey Street, Los Angeles, CA

City Park
501 Westmont, San Pedro, CA

Defense Fuel Support Point
3171 North Gaffey Street, San Pedro, CA

2. SPECIFIC INACTION OF THE REGIONAL BOARD THAT THE STATE BOARD IS REQUESTED TO REVIEW:

Petitioner brings this Petition to request review of the Regional Board's failure to grant Petitioner's request for closure of and no further action on the PortLA Site at 300 Westmont Drive, San Pedro, California (Site ID 2040069) , including the Amended California Water Code section 13267 Order and Cleanup and Abatement Order 85-17 ("CAO 85-17"). The Regional Board has not issued an order or resolution in response to Petitioner's request. In fact, the Regional Board has not provided an explanation as to why Petitioner's closure request and its supporting Technical Report are insufficient. During the May 15, 2014 meeting between representatives of the Regional Board and Petitioner, the Regional Board failed to address the technical merits supporting Petitioner's request for closure. Instead, the Regional Board stated that it had insufficient information to evaluate the Site, asked that Petitioner reinvestigate parts of the Site that were closed long ago, investigate a release from a damaged (and since repaired) well, and conduct further delineation of the plume that Petitioner's consultants have established is stable and immobile. The Regional Board made these requests even though it has approved those plans to investigate, characterize, remediate, and monitor the Site and has overseen the implementation of the plans, including an estimated $40 million remediation program, over the past 25 plus years. Accordingly, Petitioner submits this Petition for review of the Regional Board's failure to act to the State Board.

3. DATE ON WHICH THE REGIONAL BOARD REFUSED TO ACT:

The Regional Board failed to act on March 18, 2014, by failing to respond to or grant Petitioner's letter of that same date within 60 days of the request. As discussed above, Petitioner's representatives met with the Regional Board to discuss the request for closure on May 15, 2014. However, during that meeting, the Regional Board did not address Petitioner's request for closure or the Technical Report.

4. A FULL AND COMPLETE STATEMENT OF THE REASONS THE FAILURE TO ACT WAS INAPPROPRIATE OR IMPROPER:

As more fully set forth in Petitioner's Memorandum of Points and Authorities below, in failing to respond to Petitioner's request for Site closure, the Regional Board's failure to act was improper and contrary to the Policy. The Site has been extensively studied and remediated for over 25 years, and an estimated $40 million has been spent to clean up the Site. Due to these concerted efforts, the Site now poses a low threat to human health, safety, and the environment. Specifically, the Site should be closed because it falls within the types of sites that are subject to the Policy, and the Site meets the criteria for closure set forth in the Policy.

The Regional Board has not pointed to any deficiencies in the Technical Report underlying Petitioner's request for closure. Instead, the Regional Board has failed to grant Petitioner's request based on the pretext that it lacks information. In particular, the Regional Board requests (1) further soil investigation on the southern portion of the former Western Fuel Oil site (the former "Hiuka" parcel, on what is now 301 and 401 Westmont Drive, a property advised by Petitioner and owned by the same pension fund as the 300 Westmont Drive property);

(2) further characterization to determine if detection of dissolved diesel range material originated from the free product plume; (3) additional wells to examine whether upgradient and cross-gradient control has been established and investigate whether the plume is moving down-gradient, off of the Site; and (4) further investigation as to the beneficial uses of the groundwater below the Site and further investigation and groundwater monitoring wells Site-wide. As more fully explained in the below Memorandum of Points and Authorities, the Regional Board's requests for additional information are unsubstantiated and the information sought is irrelevant to Petitioner's request for closure. The Site has been fully characterized and there is no evidence that additional data are needed to determine whether the Site poses a low threat to human health, safety, and the environment. Thus, the Regional Board's failure to grant Site closure is improper.

5. THE MANNER IN WHICH THE PETITIONER IS AGGRIEVED:

The Regional Board's refusal to grant Petitioner's request will result in ongoing environmental consultant expenses associated with the Regional Board's requirements as to product removal, upkeep, and installation of new wells, ongoing monthly well pumping expenses, and legal fees. If the Site is not closed, Petitioner's monthly expenses will be approximately $8,000 per month for environmental consultant fees, $4,000 per month for well pumping fees, and $8,000 per month for legal fees, for a total estimated monthly expense of approximately $20,000. Petitioner also typically pays an additional $3,000 to $4,000 per month for regulatory oversight of the Site. These estimates are based on Petitioner's monthly costs for the past several years, exclusive of any significant events that are unlikely to reoccur.

The Regional Board's refusal to grant Site closure will also cause Petitioner to incur other expenses. Because of the ongoing investigation and cleanup requirements, tenants have sought additional assurances and required further environmental investigation. Such requests delay occupancy of the buildings on the Site and increase the Petitioner's costs. Additionally, the open case impairs the Petitioner's ability to finance and/or sell the property should Petitioner wish to do so in the future.

6. THE SPECIFIC ACTION THE PETITIONER REQUESTS:

Petitioner requests that the State Board grant Petitioner's request for closure of and no further action determination for the Site, including CAO 85-17.

7. STATEMENT OF POINTS AND AUTHORITIES IN SUPPORT OF LEGAL ISSUES RAISED IN PETITION:

Please see Petitioner's Memorandum of Points and Authorities below and incorporated by reference as if fully set forth herein.

8. STATEMENT THAT THE PETITION HAS BEEN SENT TO THE APPROPRIATE REGIONAL BOARD AND TO THE DISCHARGERS, IF NOT THE PETITIONER:

A true and correct copy of this Petition and Memorandum of Points and Authorities with attached Exhibits was mailed to the Regional Board via FedEx Overnight mail on June 12, 2014. There are no dischargers other than Petitioner.

9. STATEMENT THAT THE ISSUES RAISED IN THE PETITION WERE PRESENTED TO THE REGIONAL BOARD, OR AN EXPLANATION OF WHY THE PETITIONER COULD NOT RAISE THOSE OBJECTIONS BEFORE THE REGIONAL BOARD:

The substantive issues and objections raised herein have been presented to the Regional Board. Specifically, Petitioner submitted a Technical Report in Support of Request for Closure ("Technical Report") to the Regional Board with its March 18, 2014 letter. A copy of the March 18, 2014 letter requesting Site closure is attached hereto as Exhibit 1 and is incorporated by reference as if fully set forth herein. The Technical Report was prepared by SCS Engineers (with certain analysis performed by Aqui-Ver) and contains detailed information supporting Petitioner's request for closure pursuant to the Policy. A copy of the Technical Report is attached hereto as Exhibit 2 and is incorporated by reference as if fully set forth herein.

Petitioner formalized its responses to the Regional Board's requests for information in a letter dated June 11, 2014. A copy of the June 11, 2014 letter is attached hereto as Exhibit 4 and is incorporated herein by reference as if fully set forth herein. Petitioner was not able to make formal arguments to the Regional Board in support of its request for closure because the

Regional Board did not hold a public hearing nor has the Regional Board provided a formal statement as to why it has not granted Petitioner's request.

10. REQUEST FOR A HEARING BEFORE THE STATE BOARD:

Petitioner respectfully requests that the State Board hold a hearing on this Petition as permitted by California Code of Regulation, title 23, sections 2050.6, subdivision (b), and 2814.7, subdivision (e). Petitioner's request for closure was not considered by the Regional Board at a public hearing. Thus, Petitioner requests that the State Board hold a public hearing so that Petitioner may present testimony to support this Petition, including (1) oral argument on the legal and policy issues raised by this Petition, and (2) factual and technical information through the testimony of Petitioner's consulting experts, including SCS Engineers.

DATED: June 12, 2014

Respectfully Submitted,

NOSSAMAN LLP

By: [signature]
BYRON P. GEE
Attorneys for Petitioner
BLACKROCK REALTY ADVISORS, INC.

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MEMORANDUM OF POINTS AND AUTHORITIES

1. INTRODUCTION

BlackRock Realty Advisors, Inc. ("Petitioner") petitions the State Water Resources Control Board ("State Board") pursuant to Water Code section 13320, Health and Safety Code section 25269.40, and California Code of Regulations, title 23, sections 2050 and 2814.6, for review of the failure to act by the California Regional Water Quality Control Board for the Los Angeles Region ("Regional Board"). Petitioner seeks review of the Regional Board's failure to grant Petitioner's request in its March 18, 2014 letter to the Regional Board for closure of or no further action on the PortLA Site at 300 Westmont Drive, San Pedro, California (Site ID 2040069) (the "Site"), under the Low-Threat Underground Storage Tank Case Closure Policy (the "Policy") and State Board Resolution No. 92-49. To date, the Regional Board has not addressed the technical merits of Petitioner's request nor has the Regional Board provided a statement of reasons for its failure to grant that request.

Instead, the Regional Board has failed to act under the guise that it requires more information even though the Regional Board has approved the plans to investigate, characterize, remediate, and monitor the Site and has overseen the implementation of those plans, including an estimated $40 million remediation program, over the past 25 plus years. Moreover, the Regional Board has granted soil closure for the Site, including the former Hiuka parcel, and concluded that no further action is required for the vast majority of the Site to the south and west of the small area of the northern tip of the Site that is the subject of this Petition. The Regional Board's information requests are unjustified and seek irrelevant information. Petitioner's request for closure demonstrates that clean-up efforts over the past 25 plus years have rendered the PortLA site a low threat to human health, safety, and the environment. Thus, the Regional Board's failure to grant Petitioner's request contravenes the Policy as well as State Board Resolution No. 92-49, and the State Board should grant closure.

2. FACTUAL BACKGROUND

A. The PortLA Site

Petitioner is the pension fund real estate advisor for the current owner of the Site, Port LA

Distribution Center, L.P., and the owner of the site of the former Hiuka Parcel, Port LA Distribution Center II, L.P. The Site is one of the most significant Brownfield developments in the Los Angeles region and is now used to store and distribute products brought in through the Port of Los Angeles. The Site is located at 300 Westmont Drive in San Pedro. The Site consists of most of the former Western Fuel Oil property, which was used as a petroleum refinery and then for terminal, storage, and transfer operations by the prior owners and operators from 1923 to 1995. (Exhibit 2, at p. 1.) However, the Site was remediated and redeveloped beginning in the 1990's. (*Ibid.*) Today, the property is part of the San Pedro Business Center, which is a distribution complex for goods transported through the Port of Los Angeles. (*Ibid.*) The Site currently houses two warehouses, a truck parking area, and access roads around the perimeter of the Site. (*Ibid.*) Most of the Site, except for a limited area of irrigated landscaping, is covered with concrete pavement, limiting water infiltration and groundwater recharge. (*Ibid.*) The remediation and development of the Site is now complete and the Site is an example of a successful brownfield project, perhaps the most significant and successful brownfield development in San Pedro.

The Site is on the edge of and upgradient from a non-beneficial use portion of the West Coast Groundwater Basin. (*Id.* at p. 2.) The portion of the Basin underlying the Site has brackish groundwater that contains a high concentration of total dissolved solids. (*Ibid.*) The groundwater is within or between the spheres of influence of the barrier injection wells of the Dominguez Gap Barrier Project that are used to prevent saltwater incursion into the coastal plain aquifers. (*Ibid.*) Development of this portion of the Basin is unlikely because it is located seaward of the Dominguez Gap, which portion of the Basin is defined as saline and is of poor quality due to salt-water intrusion. (*Ibid.*) In fact, the Regional Board's Table of Beneficial Uses of Inland Surface Waters[2] indicates that the portion of the Basin underlying the Ports of Los Angeles and Long Beach, where the Site is located, has been de-designated for all municipal

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[2] A copy of the Regional Board's Table of Beneficial Uses of Inland Surface Waters is attached hereto as Exhibit 6 and is incorporated by reference as if fully set forth herein.

uses. (Exhibit 6, at p. 2-30.) There are no plans to use the shallow groundwater beneath and down-gradient of the Site in the foreseeable future due to the high TDS levels in the groundwater. (Declaration of Daniel E. Johnson ("Johnson Decl."), ¶ 3.) In the unlikely event that groundwater beneath or down-gradient of the Site[3] is developed, the treatment required would resolve any low-level impacts remaining from the Site. (*Id.* at p. 2.)

B. Cleanup Efforts

The Regional Board issued CAO 85-17, which directed that the extent of contamination at the Site be examined and remediated consistent with plans approved by the Regional Board. Since the Regional Board issued CAO 85-17, approximately $40 million has been spent on Site-wide remediation over approximately 25 years.[4] (Exhibit 2, at p. 1.) As early as 1996, an environmental consultant submitted a report to the Regional Board that concluded that "[e]xisting groundwater contamination does not pose a risk to human health and the environment, based upon the future use of the Site and surrounding area for industrial purposes, the Site will not pose a risk in the future." (*Id.* at p. 17.) Due to these efforts, today only a <u>minor</u> fraction of the original hydrocarbon plume remains below the Site. (*Id.* at p. 1.)

The extensive remediation efforts have included air sparging and soil vapor extraction[5], soil treatment, and soil excavation. (*Ibid.*) These efforts removed approximately 12,000,000 pounds of petroleum hydrocarbons from the Site. (*Ibid.*) Approximately 40,000,000 additional pounds of contaminated soil were removed during the construction of the existing facilities. (*Ibid.*) In addition, the installation and monitoring of wells and the removal of free product from several wells has occurred. (*Id.* at p. 2.) Further assessments of the site have included evaluations of soil vapor and human health risk, cone penetration testing, rapid optical scanning,

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[3] The contamination beneath the Site is immobile and thus no down-gradient impacts would be expected.

[4] A summary of some of the investigations that have been conducted since the Regional Board issued CAO 85-17 are detailed on pages 15 to 17 of the Technical Report (Exhibit 2).

[5] The geology of the shallow water-bearing zone was characterized during the installation of the soil vapor extraction system. (*Id.* at p. 73.)

assessments of the possible migration of constituents of concern, and ongoing removal of free product from the wells. (*Id.* at pp. 1-2.)

Because the extensive remediation efforts were effective, the Regional Board also found, on July 30, 2001, that "'all provisions of the Cleanup and Abatement Order No. 85-17 have been met and the Order is no longer applicable to'" the Site. (*Id.* at p. 19.) The Regional Board noted that the Site would be subject to continued groundwater monitoring until cleanup goals were achieved. (*Ibid.*) Additionally, in 2008, the Office of Environmental Health Hazard Assessment ("OEHHA") accepted a soil vapor investigation and a vapor intrusion risk assessment for the Site. (*Id.* at pp. 5, 63.)

In the 13 years since the Regional Board found that provisions of the Cleanup and Abatement Order No. 85-17 have been met, extensive efforts have been made to further investigate and remediate the Site.[6] Efforts included the installation of additional and deeper wells and semi-annual well sampling events. (*Id.* at pp. 22, 24.) Based on the data, Petitioner's technical consultant, SCS Engineers, has concluded that no practicably recoverable free product remains at the Site and on-Site and off-Site groundwater contamination has been contained and stabilized. (*Id.* at pp. 5, 63.) These efforts meet and are consistent with prior investigation, remediation, and closure requirements. (*Id.* at p. 1) In light of these conclusions and years of study, Petitioner has determined that the requirements for closure as set forth in the Policy have been satisfied.

C. Overview of the Low-Threat Underground Storage Tank Case Closure Policy

The State Board adopted the Policy in Board Resolution No. 2012-0016, which became effective on August 17, 2012. The Policy establishes statewide criteria for the closure of certain low-threat petroleum underground storage tank ("UST") sites. (Policy, at p. 2.) The purpose of the Policy is to increase UST cleanup efficiency. (*Ibid.*) While the Policy specifically addresses USTs, its application is not limited solely to UST sites. Specifically, the Policy provides that:

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[6] A detailed summary of these efforts is located on pages 19 to 29 of the Technical Report (Exhibit 2).

> "While this policy does not specifically address other petroleum release scenarios such as pipelines or ***above ground storage tanks***, if a particular site with a different petroleum release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy."

(*Id.* at p. 2.)(emphasis added)

The Policy establishes general criteria to guide regional boards and local agencies regarding when site closure is warranted; but, the Policy recognizes that some sites may pose unique conditions and may be appropriately closed even if not all criteria in the Policy are met. (*Ibid.*) The Policy provides general criteria as well as media-specific criteria for groundwater, petroleum vapor intrusion to indoor air, and direct contact and outdoor air exposure. (*Id.* at p. 5.) The media-specific criteria for groundwater build upon Board Resolution No. 92-49, Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code section 13304, and direct that water subject to an unauthorized release:

> "[Must] attain either background water quality or the best water quality that is reasonable if background water quality cannot be restored. Any alternative level of water quality less stringent than background must be consistent with the maximum benefit to the people of the state, not unreasonably affect current and anticipated beneficial use of the affected water, and not result in water quality less than that prescribed in the water quality control plan for the basin within which the site is located."

(Policy, at p. 5.) Resolution No. 92-49 does not require that the requisite level of water quality be met at the time of site closure; rather, it specifies that compliance with cleanup goals must occur within a reasonable time.[7] (Res. No. 92-49, at p. 8.)

The Policy provides 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 and media-specific criteria described in this policy pose a low threat to human health, safety or the environment and ***are appropriate for closure*** . . . ." (Policy, at p. 2, emphasis added.) If the applicable regional board or regulatory agency determines that a site

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[7] The Environmental Protection Agency also has stated that reasonable restoration times may be as long as several decades. (55 FR 8732.)

meets the requirements in the Policy, then that agency or board ***shall*** notify responsible parties and specified interested persons that the site is eligible for closure.

In sum, the Policy is a clear statement by the State Board that the remediation of UST sites (or sites with similar petroleum contamination) should be conducted in a cost-effective manner with the focus being on ensuring that there is a low threat to human health, safety, and the environment. Whether there is a nexus between further cleanup efforts and reducing a site's threat to human health, safety, and the environment until that threat is low is the standard that regional boards are to use when determining whether closure of a site is warranted.

D. The Regional Board's Explanation for Its Failure to Grant Closure

Despite the fact that the Site has been extensively studied and remediated over the more than 25 years since the Regional Board issued CAO 85-17, the Regional Board asserts that it cannot grant closure because it has insufficient information about the Site. In particular, the Regional Board requests (1) further soil investigation on the southern portion of the former Western Fuel Oil site (the former "Hiuka" parcel, on what is now 301 and 401 Westmont Drive, a property advised by Petitioner and owned by the same pension fund as the 300 Westmont Drive property); (2) further characterization to determine if detection of dissolved diesel range material originated from the free product plume; (3) additional wells to examine whether upgradient and cross-gradient control has been established and investigate whether the plume is moving down-gradient, off of the Site; and (4) further investigation as to the beneficial uses of the groundwater below the Site and further investigation and groundwater monitoring wells Site-wide.

The Regional Board substantiated its requests for information during the May 15 meeting and in its meeting agenda. A copy of the May 15 meeting agenda and supporting documents are attached hereto as Exhibit 3 and are incorporated herein by reference as if fully set forth herein. First, the Regional board requests further assessment of metal contamination below the Hiuka parcel. Second, the Regional Board claims that it requires more information to characterize the Site because the groundwater plume is unstable as evidenced by increasing concentrations of total petroleum hydrocarbons ("TPH") in C10-C28 carbon range and in well MW-24. (Exhibit 3, at p. 3.) Third, the Regional Board explains that recent data and the shallow groundwater flow direction indicate that the plume remains mobile and continues to move off-Site, which indicates that additional monitoring is required. (*Id.* at p. 3.) Finally, the Regional Board asserts that because the 2011 laser-induced fluorescence rapid optical scanning tool investigation covered only limited areas of the Site and there is free produce present at the site, further Site-wide investigation is warranted. (*Id.* at p. 2.) However, as discussed below, none of the information requested by the Regional Board is necessary or relevant the Petitioner's request for Site closure.

3. ARGUMENT

A. Standard of Review

The State Board should review the Regional Board's failure to grant Petitioner's request for closure of the Site *de novo*. Water Code section 13320, subdivision (b), which generally governs petitions to the State Board, provides that "[t]he evidence before the state board shall consist of the record before the regional board, and ***any other relevant evidence*** which, in the judgment of the state board, should be considered to effectuate and implement the policies of this division." (Emphasis added.) Moreover:

> The state board may find that the action of the regional board, or the failure of the regional board to act, was appropriate and proper. Upon finding that the action of the regional board, or the failure of the regional board to act, was inappropriate or improper, the state board may direct that the appropriate action be taken by the regional board, refer the matter to any other state agency having jurisdiction, take the appropriate action itself, or take any combination of those actions. ***In taking any such action, the state board is vested with all the powers of the regional boards under this division.***

(*Id.*, subd. (c), emphasis added.)

Additionally, owners and operators of an UST may petition the State Board if closure has not been granted by the pertinent regional board or local agency, but they believe that the corrective action plan for the site was sufficiently implemented. (Health & Saf. Code, § 25296.40, subd. (a)(1); Cal. Code Regs., tit. 23, § 2814.8, subd. (a).) Health and Safety Code section 25296.40 similarly permits *de novo* review by the State Board and, in response to a petition, the State Board may either award closure or remand the case for action in compliance with the State Board's decision. (Cal. Code Regs., tit. 23, § 2814.7, subd. (d)(1).) The State Board may also take any other action that it deems appropriate. (*Id.*, subd. (d)(5).)

Thus, in reviewing Petitioner's Petition, the State Board is not required to defer to the findings of the Regional Board. Of course, here, the Regional Board made no formal findings to which the State Board could defer because the Regional Board issued no decision in response to Petitioner's request for closure. The Regional Board also did not address the merits of Petitioner's request. Thus, the State Board should review Petitioner's request for closure *de novo*.

B. Closure of the Site is Warranted Pursuant to the Low-Threat Underground Storage Tank Case Closure Policy

The Regional Board abused its discretion by failing to grant Petitioner's request for closure because (1) the Site qualifies for closure even though it is a non-UST site because the Policy applies to analogous petroleum release scenarios, (2) the Site satisfies the general criteria in the Policy, (3) the Site meets the Class 5 criteria for groundwater, (4) the Site satisfies the criteria for petroleum vapor intrusion to indoor air, and (5) the Site satisfies the criteria for direct contact and outdoor air exposure.[8] Even if the Site does not meet all criteria in the Policy, which it does, the Site should still be closed because it is a low threat to human health, safety, and the environment.

(i) The Site Qualifies for Closure Pursuant to the Policy

The Policy applies to petroleum release scenarios that involve non-USTs that implicate similar concerns as those associated with UST sites and, accordingly, applies to the Site. In particular, the Policy provides that while it does not specifically consider above ground storage tanks, "if a particular site with a different petroleum release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy." (Policy, at p. 2.) The petroleum release at the Site

[8] The sections below address the questions listed in the Checklist for the Policy in turn.

exhibits attributes consistent with petroleum UST releases and should be considered for closure under the Policy.

This conclusion is consistent with Resolution No. 92-49, which lists several policies that the Regional Board must apply when overseeing investigations and cleanup measures. One such policy is that the Regional Board shall "[p]rescribe cleanup levels which are consistent with appropriate levels set by the Regional Water Board for analogous discharges that involve similar wastes, site characterizes, and water quality considerations . . . ." (State Board Res. No. 92-49, at p. 8.) Since the Regional Board applies the Policy when reviewing UST sites, it should apply the Policy here because the Site has similar wastes, characteristics, and water quality considerations. (See also, *In the Matter of UST Case Closure Pursuant to Health & Saf. Code § 25296.10*, Order WQ 2014-0054, App. 1, at p. 1 [holding that closure was warranted even though there was some evidence indicating that "an above ground storage tank may have also existed on the" site].)

(ii) The Site Satisfies the General Criteria in the Policy

The Site satisfies all general criteria in the Policy, as specifically set forth below.

First, the unauthorized release is located within the service area of a public water system. (Exhibit 2, at p. 68.) The Site is in the Los Angeles Department of Water and Power's service area. (*Ibid.*)

Second, the unauthorized release consists only of petroleum. (*Ibid.*) The chemical composition of the release is consistent with the past uses of the Site as a petroleum refinery and for terminal, storage, and transfer operations. (*Ibid.*) The release consists of petroleum hydrocarbons and VOCs associated with refined petroleum products. (*Ibid.*)

Third, the unauthorized release from the storage tank system has been stopped. (*Ibid.*) The petroleum refinery ceased operations in 1948 and the petroleum storage operations ended in 1995. (*Ibid.*) All infrastructure on the Site related to the refinery and storage activities was removed in 1997 prior to the Site's redevelopment. (*Ibid.*) There is no ongoing source of an unauthorized release.

Fourth, the free product has been removed to the maximum extent practicable. The Site does contain limited free product LNAPL in wells in two areas at the Site. (*Ibid.*) However, the

LNAPL has a very low conductivity and velocity. (*Ibid.*) Additionally, the plume and LNAPL are stable and further recovery using conventional methods is unlikely to significantly recover the remaining free product. (*Ibid.*) Existing operations on the Site further constrain the ability to effectively conduct additional remediation. (*Ibid.*) Because the LNAPL is considered to be stable and additional recovery is not practicable, Petitioner concludes that free product has been removed to the maximum extent practicable from the Site. This conclusion is further substantiated based on the technical guidance documents that support the Policy and provide that free product recovery is to be interpreted in terms of whether the product or LNAPL is mobile or stable. (See, Technical Justification for Groundwater Media-Specific Criteria, April 24, 2012, at p. 6; see also, *In the Matter of the Petition of Kelly Gate Associates*, Order WQ 2011-0010-UST, at 8-9 [holding that closure was warranted where the petroleum hydrocarbons that existed at the site were susceptible to absorption and had low volatility and solubility]; *In the Matter of the Petition of James Salvatore*, Order WQ 2013-0109, at 8, 10 [holding that closure was warranted where the concentration of petroleum constituents in the groundwater were decreasing and the limited remaining hydrocarbons posed a low threat to human health and the environment].)

Fifth, a conceptual site model that assesses the nature, extent, and mobility of the release has been developed. (*Id.* at p. 69.) Petitioner previously submitted a Conceptual Site Model to the Regional Board. (*Ibid.*) The Technical Report, attached hereto as Exhibit 3, updates the elements of that model.

Sixth, secondary source has been removed to the extent practicable. (*Ibid.*) During the redevelopment of the Site, the Site was extensively remediated. (*Ibid.*) These efforts included air sparging and soil vapor extraction, which removed approximately 12,000,000 pounds of petroleum hydrocarbon. (*Ibid.*) In addition, an estimated 20,000 tons of contaminated soil were removed from the Site. (*Ibid.*) Site attributes prevent additional secondary source removal. (*Ibid.*) Therefore, natural attenuation is the most appropriate source removal strategy going forward. (*Ibid.*)

Seventh, groundwater has been tested for methyl tert-butyl ether (MTBE) and the results have been reported in accordance with Health and Safety Code section 25296.15. (*Ibid.*) Since

April 2002, MTBE has not been detected at levels above the laboratory reporting limit in groundwater samples from the dissolved phase plume. (*Ibid.*)

Eighth, a nuisance as defined by Water Code section 13050 does not exist at the Site. (*Ibid.*) A nuisance means anything that "(1) is injurious to health . . . so as to interfere with the comfortable enjoyment of life or property[;] (2) [a]ffects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal[; and] (3) [o]ccurs during, or as a result of, the treatment or disposal of wastes." (Water Code, § 13050, subd. (m).) The residual contamination beneath the Site does not constitute a nuisance because the vapor intrusion soil gas levels are below California Human Health Screening Levels and the groundwater contamination meets the requirements of Class 5 of the Groundwater Specific Criteria under the Policy such that it will pose a low threat, if any, to human health. Also, and as explained in detail below, the residual contamination beneath the Site does not impair the use of the groundwater, and the level of containments in the soil is low and will have no significant risk of adversely affecting human health. Therefore, the Site does not constitute a nuisance.

Ninth, there are no unique Site attributes or conditions that demonstrably increase the risk associated with the residual petroleum constituents. (*Ibid.*) The Site is located above relatively deep groundwater, there is a demonstrated absence of vapor intrusion issues, and thick concrete pavement covers more than 90% of the Site. Accordingly, there are no characteristics that increase risk and the Site satisfies the general criteria in the Policy.

(iii) The Site Satisfies the Media-Specific Criteria for Groundwater

The Site satisfies the groundwater media-specific criteria in the Policy because the contamination is stable and the Site meets all characteristics of a Class 5 site.

Significant evidence demonstrates that both the free product and the dissolved constituent plumes are stable, as more fully explained in the Technical Report. (Exhibit 2, at p. 70.) Also, the down-gradient extent of the plume is immediately adjacent to the de-designated portion of the groundwater basin. (*Ibid.*) Due to its de-designation, that portion of the basin has no beneficial uses or water quality objectives for the petroleum hydrocarbon in groundwater to exceed. (*Ibid.*)

While there are beneficial uses for portions of the basin directly beneath the Site, the shallow groundwater in that portion of the basin is not a current or planned source of drinking water. (See *id.* at p. 10; Johnson Decl., ¶ 3.) That is because the groundwater beneath the Site sits seaward of the Dominguez Gap Barrier Project injection wells; and, the intrinsic water quality at the Site is extremely poor. (Exhibit 2, at p. 70.)

Additionally, the Site meets all requirements of the Class 5 groundwater criteria because the contaminant plume poses a low threat to human health and safety, and the environmental and water quality objectives will be achieved within a reasonable time frame. The dissolved-phase contaminant plume below the Site is less than 500 feet long. (*Ibid.*) The lateral extent of the dissolved phase and accumulations in the wells are bounded or can be inferred and appear to be remarkably stable. (*Id.* at p. 3.) Modeling demonstrates that the down-gradient extent of the plume will not reach the nearest sensitive receptor, the Los Angeles Harbor, which is about 1,300 feet from the Site and 800 feet from the plume boundary. (*Id.* at pp. 3, 70.) The closest water supply well is not potable, but is an industrial service supply, and is located more than 1,000 feet from the Site and is screened several hundred feet below the impacted shallow aquifer. (*Id.* at p. 70.) And, the dissolved concentration of benzene is less than 1,000 µg/L. (*Id.* at p. 70.) Additionally, free product has been removed to the maximum extent practicable, as described in Section (3)(B)(ii) above. Finally, MTBE has not been reported at detectable concentrations in the dissolved plume. (*Ibid.*) All of these characteristics support the conclusion that the Site meets all Class 5 requirements.[9]

(iv) The Site Satisfies the Media-Specific Criteria for Petroleum Vapor Intrusion to Indoor Air and Direct Contact and Outdoor Air Exposure

The Site is a low threat for vapor intrusion to indoor air.[10] Petitioner's consultants, SCS Engineers, investigated soil vapors at the Site as recently as 2008. (*Id.* at p. 2) Although SCS

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[9] Additionally, as explained here and in the Technical Report, the clean up goals for the Site, set by the Regional Board in 1998, have also been satisfied. (See, *id.* at p. 4-5.)

[10] The Site is not an active commercial petroleum fueling facility; therefore, the Policy exception for this media-specific criteria is not applicable.

Engineers determined that soil vapor intrusion was theoretically possible, they concluded that even were such an intrusion to occur, an associated human health risk is highly unlikely. (*Ibid.*) OEHHA concurred and found that the investigation demonstrated that human health is protected. (*Id.* at p. 71.) Moreover, the Site buildings are protected by a methane protection system which, if necessary, provides an additional means of controlling exposure to soil vapor. (*Ibid.*) The Regional Board is aware of OEHHA's findings, although it has not issued a formal concurrence. Because the Regional Board has not made any indication that it disagrees with OEHHA's findings, Petitioner concludes that the Site falls within category (b) for petroleum vapor intrusion to indoor air because the Site-specific risk assessment demonstrates that human health is satisfactorily protected.

(v) The Site Satisfies the Media-Specific Criteria for Direct Contact and Outdoor Air Exposure

The Site is a low threat for direct contact and outdoor air exposure because the impacted soil has been removed from the Site, or treated and reused during the Site grading. (*Ibid.*) Reuse of treated soils was approved by the Regional Board. (*Ibid.*) Also, the health risk-based evaluation of the Site soil found that residual levels do not pose a health risk. (*Ibid.*) Based on past soil evaluations, there has been Site closure for soil as evidenced by a number of closure letters. (*Id.* at pp. 2, 8, 17-19.) As such, there is no significant risk that the soil on the Site will adversely affect human health through direct contact or outdoor air exposure.

(vi) The Site Poses a Low Threat, If Any, to Human Health, Safety, and the Environment

As discussed in detail above, the Site meets the criteria specified in the Policy. However, even if the State Board finds that the Site does not meet all of the criteria, closure is still warranted because the Site poses a low threat to human health, safety, and the environment. In fact, the Policy provides:

> It is important to emphasize that the criteria described in this policy do not attempt to describe the conditions at all low-threat petroleum UST sites in the State. ***The regulatory agency shall issue a closure letter for a case that does not meet these criteria if the regulatory agency determines the site to be low-threat based upon a site specific analysis.***

(Policy, at p. 2, emphasis added.)

As the Technical Report explains in great detail and as discussed above, the Site poses a low threat, if any, to human health, safety, and the environment. The remediation of the petroleum contamination at the Site is more than sufficient given the Site's future use for industrial purposes, that it is located above brackish water that is not used for municipal purposes, and that it is located upgradient from a de-designated portion of the underlying water basin. Moreover, Regional Board and/or OEHHA have granted soil closure and soil vapor closure. As such, full Site closure is ***required*** by the Policy.

C. The Regional Board's Requests for Further Investigation and Monitoring are Unjustified and Seek Irrelevant Information

The Regional Board failed to address the technical merits of Petitioner's request for closure. Instead, the Regional Board requests additional information from Petitioner. Specifically, the Regional Board requests (1) further soil investigation on the southern portion of the former Western Fuel Oil site (the former "Hiuka" parcel); (2) further characterization to determine if detection of dissolved diesel range material originated from the free product plume; (3) additional wells to examine whether upgradient and cross-gradient control has been established and investigate whether the plume is moving down-gradient, off of the Site; and (4) further investigation as to the beneficial uses of the groundwater below the Site and further investigation and groundwater monitoring wells Site-wide. The Regional Board has provided no justification for why additional information is needed to assess whether the Site should be closed pursuant to the Policy and Resolution 92-49—that is because there is none. Petitioner has substantiated its request for closure with extensive data and has fully characterized the Site. Because Petitioner has established that closure is warranted, the information the Regional Board seeks is simply irrelevant and would not assist with a determination of whether closure should be granted. Thus, the Regional Board's failure to grant closure is an abuse of discretion and contrary to the Policy.

(i) There is No Evidence to Warrant Any Further Investigation of the Former Hiuka Parcel.

First, the Regional Board claims that closure is not warranted because it seeks additional information about potential metal contamination at the former Hiuka parcel.[11] The Regional Board makes this request even though soil closure occurred in 2000 and there is no evidence of metal contamination occurring since that time. Thus, there is no reason why further characterization of the soil at the former Hiuka parcel is necessary to evaluate Site closure or is required to protect human health, safety, or the environment.

The Regional Board granted soil closure for the Hiuka site in 2000. A copy of the January 7, 2000 closure letter from the Regional Board is attached hereto as Exhibit 5 and is incorporated herein by reference as if fully set forth herein. The Regional Board noted that soil excavation and removal was conducted in accordance with the approved workplan and approximately 2,200 tons of contaminated soils were removed from the property. (Exhibit 5, at p. 1.) Based samples taken on the former Hiuka site, the Regional Board concluded that "an adequate number of samples were taken and analyzed for PAHs, PCBs, ***metals***, TRPH and VOCs and the soil contamination was adequately characterized." (*Ibid*., emphasis added.) The Regional Board concluded that following soil excavation all remaining contaminants except arsenic "met [the] Regional Board's soil screening criteria . . . ." (*Id.* at p. 2.) Further, because the Site was covered with asphalt and/or concrete, the Regional Board concluded that the health risks from arsenic exposure were "non-existent." (*Ibid.*) On these bases, the Regional Board granted soil closure in 2000.

The Regional Board has presented no evidence that the former Hiuka parcel has been impacted by any activities that would result in metal contamination since soil closure occurred in 2000.[12] There is no evidence of cutting, grinding, or other industrial or maintenance activities on

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[11] Note that while the site is located at 300 Westmont Drive, San Pedro, California, the address for the former Hiuka parcel is actually on the 301 and 401 Westmont Drive site called Port DC Phase I.

[12] The Regional Board did not express any concerns about metal contamination in its January 7, 2000 letter, nor has it raised any concerns about metal contamination on this parcel during the thirteen years since that date.

the parcel since 2000. Further, the Hiuka parcel is currently being used as part of a distribution center that consists of buildings with paved exterior parking areas – even if there were industrial activities occurring on Site (which there have been none), contamination would not have impacted the soil beneath the Hiuka parcel.

The Regional Board cannot simply reopen a closed Site without some basis to do so. For instance, Code of Regulation, title 23, section 2724 provides that corrective action is required for UST sites where there is <u>evidence</u> that the surface or ground water has been affected by an unauthorized release; free product is found at the site where the unauthorized release occurred; contaminated soils may be in contact with groundwater or surface water; or an actual or potential effect on nearby surface water or groundwater resources from contaminated soil or groundwater exists. The Regional Board has not provided evidence that any such grounds exists to justify further corrective action. (See, *In the Matter of the Petition of Kelly Gate Associates*, Order WQ 2011-0010-UST, at 7-8 [holding that soil and groundwater were sufficiently characterized notwithstanding the regional board's contentions that further sampling was needed for contamination unrelated to the former USTs].)

Because the Regional Board has presented no evidence of any activities since 2000 that would have produce metal contamination or any other basis to conclude that soil closure on the former Hiuka parcel should be reopened, this request for unnecessary data does not justify denying Site closure under the Policy.

(ii) The Plume Has Been Fully Characterized

Second, the Regional Board claims that the groundwater plume is unstable and points to increasing concentrations of TPH in the C10-28 carbon range in well MW 24 and detections of TPH C10-C28 in MW-20D as evidence that the plume is expanding. (Exhibit 3, at p. 3.) Based on this claim, the Regional Board states that further groundwater characterization is necessary. But, contrary to the Regional Board's contention, these detections are not connected to the free product at the Site and do not support the conclusion that the groundwater plume is unstable or expanding. (Exhibit 4, at pp. 5-7.)

The contamination in well MW-24 that was detected in May 2012, December 2012, June 2013, and January 2014, is not connected to the free product because the contamination detected is not commensurate with the weathering of the product that is found at the Site. (Declaration of Robert Q. Gutzler ("Gutzler Decl."), ¶ 4; Exhibit 4, at p. 9.) In fact, it is recommended that well MW-24 be destroyed because the detection there is likely an anomaly and the well may act as a conduit for future contamination. (*Ibid.*) Also, it is unlikely that detections since May 2012 at well MW-20D are from free product because of the upward hydraulic gradient and lack of mobility of the contaminants in question. (*Ibid.*)

Moreover, as the Technical Report explains in great detail, the dissolved free product on the Site is stable due to the slow groundwater migration rates and natural attenuation. (Exhibit 2, at pp. 70, 75; see also Exhibit 4, at pp. 5-7.) Therefore, even if additional dissolved hydrocarbons are detected near the free product plumes, that detection is irrelevant to determining whether Site closure is warranted because those detections do not indicate that the Site poses anything other than a low threat to human health, safety, and the environment. As discussed above, there is no requirement that a site be free of free product to obtain closure. The Policy recognizes that "[e]xperience has shown that residual contaminant mass usually remains after the investment of reasonable effort, and that this mass is difficult to completely remove ***regardless of the level of additional effort and resources invested.***" (Policy, at p. 1, emphasis added.) The Regional Board has presented no evidence that Site closure should not be granted due to the contaminant plume. (See, *In the Matter of the Petition of Kelly Gate Associates*, Order WQ 2011-0010-UST, at 8-9 [holding that closure was warranted where the petroleum hydrocarbons that existed at the site were susceptible to absorption and had low volatility and solubility]; *In the Matter of the Petition of James Salvatore*, Order WQ 2013-0109, at 8, 10 [holding that closure was warranted where the concentration of petroleum constituents in the groundwater were decreasing and the limited remaining hydrocarbons posed a low threat to human health and the environment].)

(iii) There is No Evidence that Additional Wells are Required to Assess the Plume

Third, the Regional Board asserts that additional onsite groundwater monitoring wells are warranted to delineate the Site upgradient and cross-gradient of well MW-19R. (Exhibit 3, at p. 3.) The Regional Board also asserts that additional wells are needed to assess the down-gradient flow of the plume. (*Ibid.*) The Regional Board makes this assertion even though it approved the well plan and has monitored the installation of the wells on the Site, dating back to the early 2000s. Yet, now, years later, the Regional Board requests that additional wells be installed. Additional wells are unnecessary and these requests do not provide a basis for the Regional Board's failure to grant closure.

Even if there are dissolved products upgradient of well MW-19R, the free product plume beneath the Site has been fully characterized and is stable, as discussed above.[13] The groundwater flow at the Site is to the northeast of well MW-19R for intermediate groundwater. (Exhibit 2, at p. 145.) Therefore, it is illogical to require additional monitoring wells upgradient of the plume because there is no evidence that the plume is spreading in that direction. Moreover, there is no need for any additional monitoring wells down-gradient of the existing plume because there is no evidence of off-site contamination in the northerly direction, down-gradient and cross-gradient from the plume, as evidenced by a review of data regarding wells on the Phillips 66 property. (Gutzler Decl., ¶ 3; see also, Exhibit 4, at p. 10 [free product is limited to the northeast portion of the Site].) Again, this assertion that additional delineation is required is not supported by evidence and is not in accordance with the requirements of the Policy.

(iv) The Regional Board's Requests for Additional Site-Wide Investigation and Information About the Groundwater Basin Do Not Justify Denying Closure

Fourth, the Regional Board has requested additional investigation of the Site-wide characteristics as well as the uses of the groundwater below the Site. Neither request warrants a denial of Site closure.

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[13] For a detailed analysis in response to this Regional Board request, please see Exhibit 4, which is the Response to Comments on Site Closure Status prepared by SCS Engineers.

As explained in the Technical Report, groundwater below the Site is of poor quality, and the groundwater just east of the Site has been de-designated from beneficial uses. (Exhibit 2, at p. 2.) The Site is also on the seaward side of the Dominguez Gap Barrier project, and is subject to salt-water intrusion. (*Ibid.*) Thus, although the water beneath the Site is subject to some beneficial uses, it has been de-designated from municipal use. (Exhibit 6, at p. 2-30.) Moreover, the Water Replenishment District that regulates the use of water in the basin does not plan to allow the use of shallow groundwater beneath or down-gradient of the Site for any purpose in the foreseeable future. (Johnson Decl., ¶ 3.) Additionally, the basin is an adjudicated bases and the water rights have been previously established meaning that in order to use groundwater below the Site, an entity or individual would have to have an existing right. (*Id.* at ¶ 4.) SCS Engineers is unaware of any groundwater pump installation or any such rights at the Site or down-gradient of the Site. (*Ibid.*) Thus, the decade or so time period for natural attenuation is a reasonable time to remediate the groundwater given that there is no anticipated use of this groundwater in the foreseeable future, if ever.

The Regional Board has not disputed the findings in the Technical Report and also has not indicated how additional information would be related to the premise that contamination at the Site may pose a threat to human health, safety, and the environment. The Regional Board cannot make requests without a purpose; for example, the State Board regulations governing USTs provide that a corrective action is "any activity **necessary** to . . . propose a cost-effective plan to adequately protect human health, safety, and the environment." (Cal. Code Regs., tit. 23, § 2720, emphasis added.) The Regional Board's additional data requests, at this juncture, are simply unwarranted and do not provide a sound basis for refusing to grant closure. (See, *In the Matter of the Petition of James Salvatore*, Order WQ 2013-0109, at 7-9 [holding that closure was appropriate where the regional board's requests for additional data were unnecessary and "would not change the conceptual site model for the Site, which in its current condition is unlikely to pose a risk to human health, safety or the environment"].)

4. CONCLUSION

For the foregoing reasons Petitioner respectfully requests that the State Board grant Petitioner's request for closure of and no further action on the Site, including CAO 85-17.

DATED: June 12, 2014

Respectfully Submitted,

NOSSAMAN LLP

By:
BYRON P. GEE
Attorneys for Petitioner
BLACKROCK REALTY ADVISORS, INC.

LIST OF EXHIBITS

Exhibit 1:	March 18, 2014 Letter to the Regional Board from BlackRock
Exhibit 2:	Technical Report in Support of Request for Closure
Exhibit 3:	May 15, 2014 Meeting Agenda and Supporting Documents
Exhibit 4:	June 11, 2014 Letter to the Regional Board from BlackRock
Exhibit 5:	January 7, 2000 Letter from the Regional Board Granting Soil Closure to the Hiuka Site
Exhibit 6:	Table of Beneficial Uses of Inland Surface Waters

PROOF OF SERVICE

The undersigned declares:

I am employed in the County of San Francisco, State of CA. I am over the age of 18 and am not a party to the within action; my business address is c/o Nossaman LLP, 50 California Street, 34th Floor, San Francisco, CA 94111.

On June 12, 2014, I served the foregoing PETITION FOR REVIEW AND MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT THEREOF on parties to the within action as follows:

☐ (By U.S. Mail) On the same date, at my said place of business, Copy enclosed in a sealed envelope, addressed as shown on the attached service list was placed for collection and mailing following the usual business practice of my said employer. I am readily familiar with my said employer's business practice for collection and processing of correspondence for mailing with the United States Postal Service, and, pursuant to that practice, the correspondence would be deposited with the United States Postal Service, with postage thereon fully prepaid, on the same date at San Francisco, State of CA.

☐ (By Facsimile) I served a true and correct copy by facsimile pursuant to C.C.P. 1013(e), to the number(s) listed on the attached sheet. Said transmission was reported complete and without error. A transmission report was properly issued by the transmitting facsimile machine, which report states the time and date of sending and the telephone number of the sending facsimile machine. A copy of that transmission report is attached hereto.

X (By Overnight Service) I served a true and correct copy by overnight delivery service for delivery on the next business day. Each copy was enclosed in an envelope or package designated by the express service carrier; deposited in a facility regularly maintained by the express service carrier or delivered to a courier or driver authorized to receive documents on its behalf; with delivery fees paid or provided for; addressed as shown on the accompanying service list.

☐ (By Electronic Service) By emailing true and correct copies to the persons at the electronic notification address(es) shown on the accompanying service list. The document(s) was/were served electronically and the transmission was reported as complete and without error.

Executed on June 12, 2014.

☐X (STATE) I declare under penalty of perjury under the laws of the State of CA that the foregoing is true and correct.

☐ (FEDERAL) I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Jeannie Wong

SERVICE LIST

State Water Resources Control Board
Underground Storage Tank Program
1001 "I" Street, 15th Floor
Sacramento, CA 95814
ATTN: George Lockwood

Mr. Sam Unger
Executive Officer
Regional Water Quality Control Board, Los Angeles Region
320 W. 4th Street
Los Angeles, CA 90013

Courtesy Copy via email to:

Jeannette L. Bashaw, Legal Analyst
State Water Resources Control Board
Office of Chief Counsel
1001 "I" Street, 22nd Floor
Sacramento, CA 95814
jbashaw@waterboards.ca.gov

EXHIBIT 1

NOSSAMAN LLP

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Byron P. Gee
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Refer to File #: 290888-0008

Via E-Mail and U.S. Mail

March 18, 2014

Mr. Sam Unger
Executive Officer
Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street
Los Angeles, CA 90013

Re: BlackRock's Request for PortLA Site Closure

Dear Mr. Unger:

BlackRock Realty Advisors, Inc. ("BlackRock"), as the pension fund real estate advisor for PortLA, requests that the Regional Water Quality Control Board - Los Angeles Region ("Regional Board") close the PortLA site at 300 Westmont Dr., San Pedro, California (Site ID 2040069)(the "Site") under the Low Threat Underground Storage Tank Case Closure Policy (the "Policy") standards adopted by the State Water Resources Control Board on May 1, 2012. The petroleum contamination at the Site is from prior elementary refining and petroleum terminal operations that ceased in 1995. Extensive site wide remediation was completed in 2000 and the only remaining contaminant of concern is contamination associated with petroleum product releases. To date, BlackRock and its predecessors have spent tens of millions of dollars remediating the Site. Only a minor fraction of the original hydrocarbon plume remains beneath the Site. Even though the contamination appears to have originated from above ground storage tanks, the Policy should apply because it states:

> "This policy is based in part upon the knowledge and experience gained from the last 25 years of investigating and remediating unauthorized releases of petroleum from USTs. While this policy does not specifically address other *petroleum release scenarios such as pipelines or above ground storage tanks, if a particular site with a different petroleum release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy*."

Site closure under the Policy is appropriate because the Site has the characteristics of a former UST Brownfields site and has the following characteristics:

A. The Site has been redeveloped into a Port Distribution Center;

B. The above ground storage tanks were removed nearly 17 years ago;

C. There are no other sources of new petroleum contamination releases on the Site (other than the fuel tanks of employee/visitor cars and trucks parked at the Site);

D. The remaining contamination beneath the Site is petroleum hydrocarbons that have the same natural attenuation characteristics as UST petroleum releases; and

E. The Site received closure for soil contamination, eliminating any potential differences between above ground and below ground storage tank contamination.

The Site has undergone a series of investigation and cleanup activities since the Regional Board issued Order 85-17, nearly 30 years ago. The Site should be closed because the requirements of the Policy (as well as the underlying SWRCB Resolution 92-49 and the Matthew Walker WQO that interprets 92-49 requirements) have been met, specifically:

(1) the local area is supplied potable water from the Los Angeles Department of Water and Power;

(2) the groundwater beneath the Site is of poor quality, has no beneficial use and is not near a source of public drinking water supply;

(3) the contaminants of concern consist only of petroleum products;

(4) the source of petroleum release stopped over 17 years ago when the storage tanks were removed and secondary sources (contaminated soils) were removed when the Site was graded during the Brownfield development and the Site received closure as to the soil contamination;

(5) free product from the groundwater has been removed to the maximum extent practicable because:

(i) prior remediation activities eliminated primary and all other secondary sources of contamination;

(ii) the age of the remaining contamination (particularly LNAPL and benzene) reduces its propensity to migrate;

(iii) the remaining LNAPL is immobile and non-recoverable using a variety of standard cleanup techniques;

(iv) the LNAPL free product, and dissolved phase plumes have demonstrated to be attenuating and will continue to naturally attenuate without further remedial activities within a reasonable timeframe; and

(v) removal of the remaining petroleum will have no benefit to human health or the environment and, the continued use of a vacuum truck to extract petroleum from the groundwater increases truck emissions that will add to air contamination in the local area.

(6) BlackRock and its consultants have generated a conceptual site model that was used to evaluate the petroleum contamination beneath the Site;

(7) Secondary sources of petroleum contamination have been removed to the extent practicable;

(8) MTBE is not present at the Site and other oxygenated compounds have been analyzed and do not exist in concentrations that is detrimental to human health and the environment; and

(9) The residual contamination beneath the Site does not constitute a "nuisance," as defined in California Water Code § 13050 because:

(i) the vapor intrusion soil gas levels are below screening CHHSL levels,

(ii) the groundwater contamination meets the requirements of Section 5 of the Groundwater Specific Criteria under the Policy and does not impair the use of groundwater, and

(iii) the level of contaminants in the soil is low and will have no significant risk of adversely affecting human health.

Based on the information summarized herein, and contained in the attached Technical Report in Support of Request for Closure by SCS Engineers and updated Dissolved and LNAPL Plume Stability Evaluation and Discussion of Cleanup Implications Report by Aqui-ver, Inc., the Site should be closed under the Policy.

We would like to set up a meeting with the Regional Board to discuss this Site. Please contact Dr. Robert Gutzler at (858) 571-5500, Ext. 246, regarding the Regional Board's availability for a meeting.

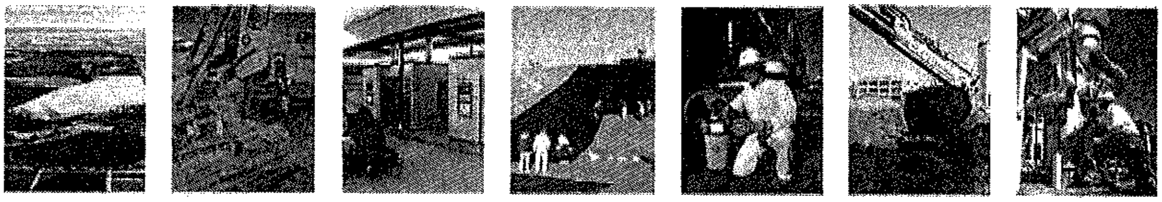
Sincerely,

Byron Gee

cc: Chuck McLaughlin (via U.S. mail)
Paul Cho (via U.S. mail)
Gary Beckett (via e-mail)
Dr. Robert Gutzler (via e-mail)
Leland Nakaoda (via e-mail)

EXHIBIT 2

SCS ENGINEERS



Technical Report in Support of Request for Closure

Port LA Distribution Center (CAO 85-17, SLIC No. 352, Site ID 2040069) 300 Westmont Drive San Pedro, California 90733

Presented to:
Mr. Paul K. Cho
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

Prepared for:
Mr. Leland Nakaoka
BlackRock
4400 MacArthur Boulevard, Suite 700
Newport Beach, California 92660

Presented by:
SCS Engineers
8799 Balboa Avenue, Suite 290
San Diego, California 92123
(858) 571-5500

March 18, 2014
Project Number: 01205525.08

March 18, 2014
Project Number: 01205525.02

Mr. Paul K. Cho
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

cc: Mr. Leland Nakaoka
BlackRock
4400 MacArthur Boulevard, Suite 700
Newport Beach, California 92660

Subject: **Technical Report in Support of Case Closure (Report)**

Site: **Port LA Distribution Center (San Pedro Business Center)**
300 Westmont Drive
San Pedro, California 90733
CAO No. 85-17; Site Cleanup Program No. 352 (Release Case)

Dear Mr. Cho:

SCS Engineers (SCS) is pleased to present this Report on behalf of BlackRock (Client).

This Report demonstrates that releases of petroleum hydrocarbons at the Site have been sufficiently mitigated to be protective of human health and the beneficial uses of water resources. The Site data not only meet and are consistent with prior investigation and remediation directives, but the Site data meet the criteria of the State Water Resource Control Board's Low Threat Closure Policy, as discussed in this Report. On the basis of meeting these criteria, SCS requests, on behalf of our Client, that the Regional Water Quality Control Board issue a "no further action letter" and close the Release Case associated with the above-referenced CAO.

If we can be of further assistance, or if you have any questions, please contact one of the undersigned at (858) 571-5500.

Sincerely,

Daniel E. Johnson
Vice President
SCS ENGINEERS

Robert Q. Gutzler, PhD, PG
Senior Project Professional
SCS ENGINEERS

PROFESSIONAL GEOLOGIST
Robert Q. Gutzler
No. 5571
STATE OF CALIFORNIA

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Figures

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Figures (continued)

Appendices

1.0 EXECUTIVE SUMMARY

SCS Engineers (SCS) is pleased to present this Report on behalf of BlackRock (Client). This Report provides technical support to establish that the petroleum hydrocarbons at the Site have been sufficiently mitigated to be protective of human health and the environment, including the beneficial uses of groundwater resources. The Site data not only meet and are consistent with prior investigation, remediation directives, and closure requirements, but the Site data meet the criteria of the State Water Resources Control Board's (SWRCB) Low Threat Closure Policy (Policy), as discussed in this Report. On the basis of meeting these criteria, SCS requests, on behalf of its Client, that the Los Angeles Regional Water Quality Control Board (RWQCB) issue a "no further action" letter for the Site and close all orders and directives associated with the Site including, but not limited to, Cleanup and Abatement Order 85-17 (CAO 85-17).

1.1 BACKGROUND

Port LA Distribution Center (Site) is located at 300 Westmont Drive in the northern portion of San Pedro, within the City of Los Angeles, California. The Site is part of the San Pedro Business Center, a 1.8-million-square-foot warehousing and distribution complex that services hundreds of millions of dollars of goods that flow through the Port of Los Angeles. The remediation and subsequent redevelopment of the Site is one of the most notable early success stories of brownfields redevelopment in Los Angeles.

The Site has been extensively studied and remediated over the nearly 30 years since the RWQCB issued CAO 85-17, and only a minor fraction of the original hydrocarbon plume remains beneath the Site. An estimated $40 million Site-wide remediation program was implemented from May 1998 to October 2000, via air sparging and soil vapor extraction (AS/SVE), soil treatment, and soil excavation for off-Site disposal. That program removed an estimated 12,000,000 pounds of petroleum hydrocarbons; additionally, an estimated 40,000,000 pounds (approximately 350,000 cubic feet) of contaminated soil were removed from the site during construction of the Distribution Center.

The Site occupies most of the former Western Fuel Oil (WFO) property where petroleum refinery, then terminal, storage, and transfer operations, were conducted from 1923 to 1995. In the late 1990s, the Site was purchased by a firm specializing in brownfields redevelopment, and as discussed above, the Site was extensively remediated and then successfully redeveloped as a commercial distribution facility. Current facilities at the Site include two large warehouse buildings, a central truck parking area, and access roads around the perimeter of the Site. With the exception of very limited areas of irrigated landscaping around the perimeter of the new development, the entire area surrounding the buildings at the Site has been covered with concrete pavement, limiting surface water infiltration, and on-Site sources of groundwater recharge.

During the long history of remediation efforts at the Site, a number of consultants have performed subsurface investigations and remedial actions. Documented work began in 1985 in response to CAO 85-17 and has continued since, including the Site-wide remediation work leading to a "no further action" letter for soil at the Site.

In addition to the groundwater remediation described above, groundwater assessment and remediation included installation and monitoring of wells before and after Site redevelopment, along with removal of free product from several wells since 2002. Recent assessments in response to RWQCB requirements have included evaluation of soil vapor and human health risk, possible intermediate and deeper water-bearing zone (WBZ) impacts, extensive investigations of the Site using cone penetration testing (CPT) and rapid optical scanning technique (ROST) technologies to better define the occurrence and extent of light non-aqueous phase liquid (LNAPL), ongoing assessment of the possible migration of constituents of concern (CoCs) in the shallow WBZ, and ongoing remediation comprising free product removal from wells.

1.2 WATER QUALITY

The native groundwater exhibits poor intrinsic quality, including a high total dissolved solids content (TDS) or brackish groundwater that is highly unlikely to ever be put to beneficial uses. The Site sits on the edge of, and directly upgradient from, the non-beneficial use portion of the West Coast Groundwater Basin. As stated, it is also within an area of known high TDS or brackish groundwater, between or within the spheres of influence of the barrier injection wells of the Dominguez Gap Barrier Project (DGBP) that are used to prevent saltwater incursion into the coastal plain aquifers. Based on prior conversations with officials of the Water Replenishment District, development of water resources south of the Dominguez Gap is very unlikely, since groundwater south of the DGBP is defined as saline and of poor quality. In the unlikely event of such use, the treatment required would resolve the low-level impacts (if any) remaining beneath the subject Site.

Monitoring well data collected at the Site confirm conclusions of regional studies that the groundwater beneath the Site is impacted by salt water intrusion. Elevated concentrations of chloride and other dissolved solids have been historically detected in Site wells, with evidence of saltwater intrusion dating to as early as 1955. Background or intrinsic water quality at the Site is extremely poor, and well in excess of the Water Quality Objectives of 800 milligrams per liter (mg/L) and 250 mg/L, respectively, as set out in the Basin Plan, and the 3,000 mg/L or less TDS criterion in RWQCB policy.

1.3 SITE SOIL, SOIL VAPOR, AND GROUNDWATER INVESTIGATION, DATA, AND CONTROL

Soil, soil vapor, and groundwater at the Site have been extensively investigated, as previously indicated.

Vadose soils that were impacted by petroleum hydrocarbons have been granted a "closed" status as has been evidenced by a number of closure letters. Soil vapor at the Site has been investigated on a number of occasions, including most recently by SCS in 2008. In particular, our investigation focused on the eastern-most portion of Building A. The intent of this investigation was to assess possible vapor intrusion into occupied portions of Site buildings, and if it occurred, whether there was an associated human health risk. We concluded that, although soil vapor intrusion was a theoretical possibility, an associated human health risk was highly unlikely.

Dissolved and phase-separated hydrocarbons have been detected in groundwater wells at the Site. However, the lateral extent of both the dissolved phase and areas where LNAPL accumulates in wells are bounded or can be inferred and appear to be remarkably stable, based on a comparison of historical and current groundwater quality data, as well as significant statistical analyses.

The vertical extent of CoCs at the Site has been assessed based on sampling data from monitoring wells installed in the intermediate and deeper WBZs. The lack of impacts to the deeper WBZ is consistent with an upward vertical hydraulic gradient that has been observed between the deep and shallow wells.

1.4 FATE AND TRANSPORT MODELING

"Fate and transport" modeling concluded that the downgradient extent of the plume will not extend to the nearest sensitive receptor, the Los Angeles Harbor.

Other modeling was completed to assess the contaminant migration (and specifically natural attenuation) at the Site. The modeling results indicate that the maximum lateral extent of dissolved benzene in groundwater above 1 microgram per liter (µg/L) is between 360 feet and 400 feet downgradient of the light non-aqueous phase liquid (LNAPL) area. Our modeling simulations indicate that this migration distance was achieved within 30 years after the release and remains steady thereafter (conservatively assuming a constant source, even though it is likely diminishing). No further migration is expected, regardless of any actions taken in the source area.

In addition, as discussed above, modeling was also conducted to estimate potential migration of the detected dissolved-phase benzene at the downgradient plume boundary and to assess the potential impacts to downgradient receptors (i.e., the waters of the Harbor). Under this scenario, this model predicted that the maximum lateral extent of dissolved benzene in groundwater above 1 µg/L is between 200 and 240 feet and 400 feet downgradient of MW-29.

While downgradient CoCs do not appear to be associated with releases at the Site, the most conservative modeling scenario (LNAPL at the downgradient plume boundary) resulted in a dissolved-phase benzene plume migrating no more than 400 feet, leaving approximately 400 feet of unimpacted shallow water bearing zone between the distal edge of the plume to the nearest point in the Harbor.

1.5 LNAPL EVALUATION

LNAPL mobility, stability and recovery were extensively evaluated in the Report. This evaluation confirmed that the LNAPL plume is stable and confined. A weight of evidence approach, wherein multiple lines of evidence are considered in their totality, was used to assess LNAPL plume stability. These lines of evidence are stated below:

- Confirmation that the LNAPL releases are finite and not ongoing at the Site
- Evaluation of the relative age of the LNAPL plumes; the older the plume, the more probable it has reached field static equilibrium

- Evaluation of LNAPL gradients
- Comparisons of estimated LNAPL to water conductivity values
- Evaluation of LNAPL flow
- Review of petrophysical properties, including expectations for an entry pressure threshold
- Inspection of LNAPL plume distribution to consider whether the morphology is consistent with the form of a stable plume.

In their 2011 report, Aqui-Ver, Inc. (AVI) concluded:

> "In summary, for this particular site, all the factors above point to LNAPL plume stability. While there may be small-scale movement in response to localized gradients, the plume is old enough and displays all the other features of a stable plume relative to site management objectives."

In 2014, AVI reviewed current information for the Site and concluded:

> "Site LNAPL transmissivity values (determined with site specific data) are much lower than the 0.1 to 0.8 ft2/day range that the Interstate Technology & Regulatory Council (ITRC) has recommended as a practical endpoint to effective hydraulic LNAPL recovery. Our detailed analysis, using site specific parameters collected by SCS, demonstrates that additional free product recovery will have no measurable beneficial effect. Other remedial options are not viable with the footprint of the Port LA Distribution Center business operations, and are not warranted given the negligible expected benefit, as detailed in our 2011 work. At this late plume stage, natural mass losses likely exceed the failingly small remaining recovery possible through hydraulic recovery."

1.6 CLEANUP STANDARDS AND WATER QUALITY OBJECTIVES

The following cleanup goals for the Site were previously established in 1998 by the RWQCB:

> "Closure will be conditioned upon a demonstrated achievement of performance criteria, including:
>
> - No practicably recoverable free product remains at the Site;
> - On-Site and off-Site groundwater contamination has been contained and stabilized."

1.7 CONSISTENCY WITH CLEANUP GOALS

SCS concludes that the Site has met the above-referenced cleanup goals. Soil remediation at the Site is complete, and the RWQCB has granted closure for Site soils. In addition, a soil vapor investigation and vapor intrusion risk assessment were completed and accepted by the Office of Environmental Health Hazard Assessment (OEHHA) and the RWQCB. Soil vapor does not pose a significant human health risk. This Report now concludes that the Site data demonstrate that all remaining objectives have also been met and that the Site meets the stated cleanup goals.

Based on the fate and transport modeling conducted by both AVI and SCS, and our review of historical as well as current groundwater monitoring data, SCS concludes that the dissolved-phase plume is stable or contained, both laterally and vertically and unlikely to migrate to or impact sensitive receptors.

Given the extremely poor intrinsic water quality at the Site and that the Site and dissolved phase plume are immediately adjacent to and upgradient of a groundwater basin without beneficial uses, the presence of CoCs in groundwater is highly unlikely to impair the beneficial uses of groundwater and the downgradient migration of CoCs will not result in exceedance of water quality objectives in the de-designated subarea. Multiple lines of evidence have indicated that it is highly unlikely that the CoCs in groundwater from the Site will migrate to or impact surface waters present in the Northwest Slip, some 800 feet from the Site.

In addition, free product recovery is, based on Policy technical guidance documents, to be interpreted in terms of whether the product or LNAPL is mobile or stable. Based on the analysis conducted by AVI, the LNAPL is stable and additional removal is not practicable.

1.8 LOW-THREAT CLOSURE POLICY

As noted in our Report, the Policy does consider non-underground storage tank (UST) sites and applies to the Port LA Distribution Center:

> "While this policy does not specifically address other petroleum release scenarios such as pipelines or above ground storage tanks, if a particular site with a different petroleum release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy."

Therefore, the Policy expressly acknowledges that release scenarios with similar attributes can be considered with the regulatory framework and criteria of the Policy. Based on SCS analysis, as described in detail in Section 6.0 of this Report, SCS believes the petroleum release at the Site does exhibit attributes consistent with petroleum UST releases and should be considered for closure under the Policy.

Furthermore, the Site data demonstrate that the Site meets both the general and media specific criteria of the Policy.

1.9 SUMMARY AND REQUEST

The Site conditions are consistent with both the Policy and Cleanup Goals. Given the demonstrated plume stability, the absence of risk presented by the immobile LNAPL, and demonstrated absence of health impacts or impacts to beneficial uses or sensitive receptors, SCS requests on behalf of our Client, that the Regional Board close the release case associated with the Site.

2.0 OBJECTIVE

The objective of this Report is to present technical data in support of a request for "closure" or no further action as well the recession of the various orders related to the Site, including the Amended California Water Code Section 13267 Order and Cleanup and Abatement Order 85-17 (CAO 85-17) (Orders). This Report has been prepared by SCS Engineers (SCS) for BlackRock Realty Advisers, Inc., which manages the Site for the current owners, Port LA Distribution Center, L.P, and Port LA Distribution Center II, L.P. Site assessment and remediation has been conducted under the direction of the Los Angeles Regional Water Quality Control Board (RWQCB) pursuant to the Orders.

This Report will demonstrate that the Site conditions meet the criteria for closure and that no further actions are necessary to protect the beneficial uses of the waters of the State.

3.0 BACKGROUND

3.1 SITE DESCRIPTION

The Port LA Distribution Center (Site) is located at 300 Westmont Drive in the San Pedro Business Center in the northern portion of San Pedro, within the City of Los Angeles, California (Figures 1 and 2). The Site occupies most of the former Western Fuel Oil (WFO) property where petroleum refinery, then terminal, storage, and transfer operations were conducted from 1923 to 1995. In the late 1990s, the Site was purchased by a firm specializing in brownfields redevelopment, and the Site was extensively remediated and then developed. Facilities at the Site include two large warehouse buildings, a central truck parking area, and access roads around the perimeter of the Site (Figure 2). With the exception of very limited areas of irrigated landscaping around the perimeter of the new development, the entire area surrounding the buildings at the Site has been covered with concrete pavement, limiting surface water infiltration and on-Site sources of groundwater recharge.

The 55-acre Site is bounded on the north by the Phillips 66 (formerly Tosco, Unocal, and ConocoPhillips) refinery and on the east by the Harbor Freeway (Interstate Highway 110). The shipping terminal facilities of the West Basin of the Los Angeles Harbor are located a short distance east of the Harbor Freeway. The Amerigas natural gas storage facility forms the western boundary of the Site, and the southern boundary consists of the former Hiuka parcel, now occupied by commercial buildings of the southern portion of the San Pedro Business Center, south of Westmont Drive. The former Gaffey Street Landfill, now in use as a City park, is located to the southwest of the Site. The Defense Fuel Support Point (DFSP) facility is located a short distance to the northwest of the Site, on the west side of Gaffey Street.

Prior to grading for redevelopment, the WFO property occupied a hill with elevations ranging from approximately 75 to 135 feet above mean sea level (MSL). This north-south trending hill is formed on the Gaffey Anticline, a geologic structure that strongly influences groundwater flow in the area (DWR, 1961). The Site is underlain by the generally fine-to-medium grained sandstones of the Lakewood and San Pedro Formations, which contain the shallow Gage and Lynwood aquifers that dip steeply to the northeast on the northeast flank of the Gaffey Anticline. Groundwater is found near MSL, possibly within perched zones of the Upper Lakewood Formation and within the San Pedro Formation. These shallow aquifers form part of the southeastern portion of the West Coast Groundwater Basin, which underlies the southwestern part of the Los Angeles Coastal Plain. The general geology and hydrogeology of the Site and vicinity have been well-characterized by previous investigations, as discussed below.

The Site sits on the edge of, and directly upgradient from, the non-beneficial use portion of the West Coast Groundwater Basin (Figure 2). It is also within an area of known high total dissolved solids (TDS) brackish groundwater, and between or within the spheres of influence of the barrier injection wells of the Dominguez Gap Barrier Project (DGBP) that are used to prevent saltwater incursion into the coastal plain aquifers.

The 55-acre Site was operated as an oil refinery from approximately 1923 to 1948, and during this period, property ownership changed several times. The Site was acquired by Westoil Terminal Company (Westoil) in the 1950s and operated as a petroleum terminal, storage, and transfer facility from 1950 to 1995. In 1974, Western Fuel Oil leased the Site from Westoil and continued to operate the Site as a terminal facility until 1995, when operations ceased. During Western Fuel Oil's tenancy, activities did not include refining operations (CET, 1997b). Facilities that served the WFO operations were demolished between 1997 and 1999 in preparation for redevelopment of the Site.

4.0 REGULATORY BACKGROUND

4.1 CLEANUP AND ABATEMENT ORDER 85-17

On February 25, 1985, the RWQCB issued CAO 85-17, which required investigation and remediation of pollution conditions at the Site.

Specifically, the RWQCB, under CAO 85-17, directed WFO and other refineries to:

1) Identify the nature and extent of the plume;
2) Identify the occurrence, if any, of petroleum free product and constituents;
3) Identify the nature and extent of soil, vapor, and groundwater contamination;
4) Characterize site hydrogeology; and
5) If a condition of pollution is determined, submit a plan which includes remedial measures and a timetable to correct that condition.

In 1985, Western Fuel Oil Company embarked on a cleanup effort to bring the WFO property into compliance with the directive. RWQCB opened case 85-21 (SLIC #352) for the WFO property and the adjacent former Hiuka property.

4.2 BROWNFIELDS SITE REDEVELOPMENT ACTIVITIES AND SITE CLOSURE CRITERIA

In November 1998, the RWQCB issued a letter to LandBank, as the representative for Gaffey Street Ventures, LLC, then owner of the Site and Hiuka properties, regarding the requirements for closure related to the redevelopment of the Site and development of the proposed San Pedro Business Park. In an attempt to clarify these requirements for the WFO property, the letter stated:

- "We concur, regarding soil closure at the subject Site, that once the vapor extraction system reaches asymptotic conditions and rebound tests indicate no rebound, the soil issues can be closed. Confirmation soil samples collected in locations approved by Regional Board staff shall be submitted to document the remaining soil contamination levels at the time of soil closure.

- "Regarding groundwater closure at the Site, we will consider such a request at the time that Gaffey Street Ventures demonstrates that asymptotic conditions have been reached and rebound tests indicate no rebound in Site vapor extraction wells. Closure will be conditioned upon a demonstrated achievement of performance criteria, including:

    1) No recoverable free product remains at the Site; and

    2) On-Site and off-Site groundwater contamination has been contained and stabilized.

- "Final closure of the Site will be approved when these conditions have been demonstrated by at least two additional years of groundwater monitoring after closure of the Site soil remediation. In addition, Gaffey Street Ventures requested a statement in the final closure letter indicating that the requirements of Order 85-17 have been satisfied and we concur with this request."

Demolition of the above- and below-ground structures at the Site began in June 1997 in anticipation of redevelopment. Demolition included cleaning and removing the aboveground tanks, above- and below-ground pipelines, and equipment. At the conclusion of the demolition activities in January 1998, remaining structures at the Site included tank berms, a concrete stormwater basin, and an office building. In July 1999, the office building was demolished.

The Site underwent combined soil and groundwater remediation from May 1998 to October 2000. The remediation system combined AS/SVE to address the impacted soil and groundwater. At various times during the period, three to four thermal treatment units, with a combined treatment capacity of 5,500 to 6,000 standard cubic feet per minute (scfm), were operated.

4.3 WATER BASIN POLICY

4.3.1 Saltwater Intrusion and Water Quality

Several comprehensive studies have been performed to characterize the hydrogeology and extent and control of salt water intrusion in the West Coast Basin, as reviewed in detail by Todd (1997). Saltwater intrusion into the West Coast Groundwater Basin, due to an inland hydraulic gradient resulting from groundwater withdrawal, has been recognized since the 1930s. Saltwater intrusion had extended beneath the Site by 1955.

The DGBP, which includes 41 injection wells and 232 observation wells, was constructed in 1971 to mitigate salt water intrusion north of San Pedro Bay and to protect the potable water supply in the basin. A detailed discussion of the saltwater intrusion in the area of the Site is presented in the *Revised Site Characterization Report* (Todd, 1997). Figure 4 shows the locations of some of the DGBP wells.

The DGBP injects imported water (average injection rate of 6,800 acre-feet per year) into the shallow aquifer system to create a hydraulic barrier. The Site is located southwest of the DGBP, on the seaward side of the injection barrier. The DGBP is reported to create a mound or flattening of the groundwater gradient in the shallow aquifers, which affect groundwater flow patterns (Todd, 1997).

According to Todd (1997):

> "According to the Los Angeles County Flood Control District (LACFCD), whenever chloride ion concentrations exceed 50 to 100 ppm [parts per million], salt water intrusion is suspected (LACFCD, March 1962). Figure 26 is a chloride concentration contour map based on 1993 data. The figure indicates the 200-Foot Sand Aquifer in the vicinity of the WFO property is impacted by salt water intrusion, with chloride levels exceeding 5,000 ppm. Figure 27 depicts chloride concentrations less than 125 ppm in the 400-Foot Gravel Aquifer in the vicinity of the WFO property.
>
> "The WRD [Water Replenishment District] is the agency responsible for managing the groundwater supplies of the West Coast Basin. Verbal discussions with WRD (May 1996) indicate that development of water resources south of the Dominguez Gap is very unlikely, since groundwater south of the DGBP is defined as saline. In addition, installation of new groundwater pumping wells would require approval of the Watermaster."

SCS confirmed the Todd (1997) statements regarding the development of water resources south of the Dominguez Gap in recent discussions with WRD staff (WRD, 2014).

Another indicator of salt water intrusion from the West Basin of San Pedro Bay is tidal fluctuations observed in monitoring wells. Monitoring of water levels over a 24-hour period was performed in early 1996, and water levels in wells on the Site showed a daily fluctuation that corresponds to fluctuations in the level of water in the bay; this direct relationship is consistent with saltwater intrusion and a hydraulic connection between groundwater in the 200-Foot Sand Aquifer beneath the Site and saltwater in the Bay (Todd, 1997).

4.3.2 Basin Plan and Beneficial Uses

The Site is located within the West Coast Basin portion of the Los Angeles Coastal Plain Hydrologic Area. While there are designated beneficial uses for groundwater within this Basin, the beneficial use designations and water quality objectives have been removed from the portion of the West Coast Basin in the Harbor District east of John S. Gibson Boulevard, which is immediately adjacent to and east of the Site (RWQCB, Resolution 98-018). In fact, former wells MW-12 and MW-13, which were part of the groundwater monitoring network for the Site, were on the west side of John S. Gibson Boulevard, directly adjacent to or within the non-beneficial use portion of the Basin.

In consideration of this area immediately adjacent to and downgradient from the Site, the RWQCB said:

> "The Regional Board also reconsidered the MUN [municipal and domestic supply] designation for ground waters in coastal areas that meet all of the following criteria: (1) they are not existing sources of drinking water; (2) they either lie seaward of well-established engineered barriers or have a gradient such that the coastal ground waters will not replenish sources of drinking water; and (3) they meet the exception criteria in State Board Resolution 88-63 based on either TDS levels or the ability to provide an average sustained yield of 200 gallons per day."

Based on our review of Site data, the Site meets the criteria set forth for the de-designated or non-beneficial portion of the Basin. In particular:

- The groundwater at the Site or in the Site vicinity is not a source of drinking water and there are no plans to make it a source of drinking water;
- The Site sits seaward of the Dominguez Gap injection wells; and
- Background or intrinsic water quality at the Site is extremely poor, with historical saltwater intrusion, and elevated concentrations of TDS (as high as 12,200 mg/L [milligrams per liter]) and chloride ions (as high as 6,390 mg/L) well in excess of the Water Quality Objectives of 800 mg/L and 250 mg/L, respectively, set out in the Basin Plan, and the 3,000 mg/L or less TDS criterion in State Board Policy.

4.3.3 Groundwater Production and Supply Wells

In 1994 and 1995, there were 84 active pumping wells in the West Coast Basin, with most of the pumping in the basin occurring north of the Pacific Coast Highway (Todd, 1997).
Figure 4 shows active and abandoned production wells within a 1-mile radius of the Site. Of the 14 production wells identified in the study area, three are active pumping wells, and 11 are abandoned. Additionally, there are 19 injection and observation wells operated by the Los Angeles County Department of Public Works (LACDPW) as part of the DGBP within a 1-mile radius of the Site. The three active production wells (WW-005, WW-006, and WW-007) used for

industrial water supply by Phillips 66 are located approximately 3,500 feet north of the Site. According to Phillips 66 reports, these wells are screened in the Silverado Aquifer.

The closest municipal water supply well is over 2 miles north-northeast of the Site. This well is screened in the Silverado Aquifer and operated by the Dominguez Water Corporation (Figure 4).

Boring logs for industrial water supply wells on the Phillips 66 refinery, north of the Site, indicate the following (Todd, 1997):

- A confining layer separates the Gage and Lynwood Aquifers.
- The Lynwood Aquifer is relatively thin (approximately 25 feet thick) and is of relatively low permeability.
- The Lynwood and Silverado Aquifers are separated by a relatively thick aquitard approximately 400 feet to 500 feet thick.

SCS contacted the California Department of Water Resources (DWR) to request a search of its files for water well records within a 1-mile radius of the Site, and SCS reviewed the September 2013 report of the Watermaster Service in the West Coast Basin (DWR, 2013). SCS also reviewed the on-line resources of the WRD of Southern California. The SCS research confirmed the information presented by previous reports (Todd, 1997).

4.4 LOW-THREAT CLOSURE

4.4.1 Development of Low-Threat Closure Approach and Policy

Substantial work was completed in the early to mid-1990s on low threat or risk leaking tank sites, including a significant effort by Lawrence Livermore Labs (LLNL)("*Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks*, 1995). Subsequently, the State Water Resources Control Board (SWRCB) and Regional Boards issued guidance in 1995 and 1996 on "Low Risk" sites, which forms the context or basis for more recent efforts, some 15 years later, described below.

More recently, the Low Threat Policy Task Force was presented its recommendations to the SWRCB on July 19, 2011. The task force and the recommendations reflected countless hours of staff and task force time. The SWRCB in turn encouraged public outreach and input on the Draft Low Threat Closure Policy (Policy), which occurred over the course of five public meetings. Subsequently, both peer and environmental review were conducted of the Policy, with peer review comments incorporated or addressed by staff. Final Technical Justification documents were developed in March and April of 2012. Subsequently, the Policy was finalized and presented to the SWRCB. On May 1, 2012, the SWRCB adopted a Low-Threat Underground Storage Tank Case Closure Policy (SWRCB Resolution No. 2012-0016). The Policy was approved by the Office of Administrative Law (OAL) on July 30, 2012. On August 17, 2012, the Notice of Decision was filed with the California Secretary for Natural Resources, and the Policy became effective.

On November 6, 2012, the SWRCB approved the *Plan for Implementation of Low-Threat Underground Storage Tank Case Closure Policy and Additional Program Improvements* (Plan) (SWRCB Resolution No. 2012-0062).

The approved Plan: (1) implements the Low-Threat Underground Storage Tank Case Closure Policy (Policy) adopted by the SWRCB under Resolution No. 2012-0016, and (2) summarizes other actions to improve the administration of the UST Program. The Plan is intended to provide consistent application of the Policy and consistent implementation of the UST Program in general, throughout the state. The Plan's major elements related to implementing the Policy are to specify the roles and responsibilities of the agencies in implementing the Policy.

The SWRCB administers the petroleum UST (Underground Storage Tank) Cleanup Program, which was enacted by the Legislature in 1984 to protect health, safety and the environment. The State Water Board also administers the petroleum UST Cleanup Fund (Fund), which was enacted by the Legislature in 1989 to assist UST owners and operators in meeting federal financial responsibility requirements and to provide reimbursement to those owners and operators for the high cost of cleaning up unauthorized releases caused by leaking USTs.

4.4.2 Policy Summary

The Policy states, in part:

> "The State Water Board believes it is in the best interest of the people of the State that unauthorized releases be prevented and cleaned up to the extent practicable in a manner that protects human health, safety and the environment. The State Water Board also recognizes that the technical and economic resources available for environmental restoration are limited, and that the highest priority for these resources must be the protection of human health and environmental receptors.
>
> "Program experience has demonstrated the ability of remedial technologies to mitigate a substantial fraction of a petroleum contaminant mass with the investment of a reasonable level of effort. Experience has also shown that residual contaminant mass usually remains after the investment of reasonable effort, and that this mass is difficult to completely remove regardless of the level of additional effort and resources invested.
>
> "It has been well-documented in the literature and through experience at individual UST release sites that petroleum fuels naturally attenuate in the environment through adsorption, dispersion, dilution, volatilization, and biological degradation. This natural attenuation slows and limits the migration of dissolved petroleum plumes in groundwater. The biodegradation of petroleum, in particular, distinguishes petroleum products from other hazardous substances commonly found at commercial and industrial sites.
>
> "The characteristics of UST releases and the California UST Program have been studied extensively, with individual works including:
>
> a. Lawrence Livermore National Laboratory report (1995)
> b. SB1764 Committee report (1996)
> c. UST Cleanup Program Task Force report (2010)

d. Cleanup Fund Task Force report (2010)
e. Cleanup Fund audit (2010)
f. State Water Resources Control Board site closure orders
g. State Water Resources Control Board Resolution 2009-0081

"In general, these efforts have recognized that many petroleum release cases pose a low threat to human health and the environment. Some of these studies also recommended establishing 'low-threat' closure criteria in order to maximize the benefits to the people of the State of California through judicious application of available resources.

"The purpose of this policy is to establish consistent statewide case closure criteria for low-threat petroleum UST sites. The policy is consistent with existing statutes, regulations, State Water Board precedential decisions, policies and resolutions, and is intended to provide clear direction to responsible parties, their service providers, and regulatory agencies. The policy seeks to increase UST cleanup process efficiency. A benefit of improved efficiency is the preservation of limited resources for mitigation of releases posing a greater threat to human and environmental health.

"This policy is based in part upon the knowledge and experience gained from the last 25 years of investigating and remediating unauthorized releases of petroleum from USTs. While this policy does not specifically address other petroleum release scenarios such as pipelines or above ground storage tanks, if a particular site with a different petroleum release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy."

The Policy goes on to articulate both general and media specific criteria:

"In the absence of unique attributes of a case or site-specific conditions that demonstrably increase the risk associated with residual petroleum constituents, cases that meet the general and media-specific criteria described in this policy pose a low threat to human health, safety or the environment and are appropriate for closure pursuant to Health and Safety Code section 25296.10. Cases that meet the criteria in this policy do not require further corrective action and shall be issued a uniform closure letter consistent with Health and Safety Code section 25296.10."

4.4.3 Application of the Low-Threat Closure Policy to Non-UST Sites

As noted above, the Policy does consider non-UST sites:

"While this policy does not specifically address other petroleum release scenarios such as pipelines or above ground storage tanks, if a particular site with a different petroleum release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy."

The Policy expressly acknowledges that release scenarios with similar attributes can be considered with the regulatory framework and criteria of the Policy. Based on SCS' analysis, as described in detail in Section 6.0 of this Report, SCS believes the petroleum release at the Site does exhibit attributes consistent with petroleum UST releases and should be considered for closure under the Policy.

5.0 CONCEPTUAL SITE MODEL

5.1 SITE INFORMATION

5.1.1 Site Description Summary

Site Name:	Port LA Distribution Center
Site Owner:	Port LA Distribution Center II, LLC
Responsible Party:	Port LA Distribution Center II, LLC
Site Address:	300 Westmont Drive, San Pedro, CA
SLIC Case No:	352
Site ID:	2040069

5.1.2 Description of Release and Identification of Constituents of Concern (CoCs)

During operations at the WFO property, a wide variety of liquids were stored at the Site. Petroleum hydrocarbons and a number of volatile organic compounds (VOCs), commonly associated with refined petroleum products, have been detected in groundwater at the Site.

Potential source areas have been identified in a number of ways, as summarized by Todd Engineers (Todd, 1997). Aerial photographs were reviewed, Site employees were interviewed, two soil vapor surveys were performed, and extensive soil sampling was conducted. These investigations indicated potential source areas at the facility, including numerous aboveground storage tanks and associated surface piping, sumps, loading docks, the pump house and valve pit, and a former drainage ditch.

Because soil impacts at the Site have received "closure or "no further action," we have focused the "Identification of CoCs" section of this Report on CoCs detected in groundwater and soil vapor.

As described in the Jones Environmental, Inc. (Jones) analytical report (Jones, 2002), the hydrocarbons present in the sample collected from monitoring well MW-6R appeared to consist of kerosene (Fuel Oil No. 1) with minor amounts of gasoline (less than 5 percent). Smaller amounts of a heavier-end hydrocarbon (C18 to C39) were also present. The hydrocarbons present in the free product sample from MW-14R appeared to consist of Jet Fuel A with approximately 10 to 15 percent gasoline.

Residual dissolved-phase CoCs detected at the Site are primarily comprised of petroleum hydrocarbons and related volatile organic compounds, including:

- Total petroleum hydrocarbons – gasoline range (TPH-GRO)
- Total petroleum hydrocarbons – diesel range (TPH-DRO)
- benzene
- toluene
- ethylbenzene
- xylenes
- 1,2-dichloroethane (DCA)
- 1,2-dichloropropane (DCP)
- methyl tertiary butyl ether (MTBE)
- tertiary amyl alcohol (TAA)
- tertiary butyl alcohol (TBA)
- 2-butanone

CoCs detected in groundwater samples collected in 2007 beneath the phase-separated hydrocarbons included TPH-GRO, benzene, ethylbenzene, toluene, MTBE, TBA, TAA, carbon disulfide, and 4-methyl-2-pentanone (CAPE, 2007b).

CoCs detected in the soil gas at the Site (SCS, 2008b) included benzene, trichloroethene, and chloroform. Of these CoCs, benzene was most frequently detected. Benzene was detected in 18 samples, with concentrations ranging from 0.1 to 3.3 micrograms per liter of vapor (μg/Lv), with the highest concentrations reported from sampling points located outside the building near the existing groundwater monitoring wells MW-6R and MW-14R.

5.2 SITE INVESTIGATIONS

5.2.1 Initial Investigation and Remediation Planning

During the long history of remediation efforts at the Site, a number of consultants have performed subsurface investigations and remedial actions. Documented work began in 1985 in response to CAO 85-17. As each successive phase of investigation and remediation was completed, the increased knowledge of the Site allowed the development of increasingly effective remediation programs that helped to meet the cleanup goals established by RWQCB. The following summary of previous work is not all-inclusive but attempts to delineate the general chronology of work at the Site and to highlight some of the most important results of the past investigation and remediation efforts. For greater detail, see discussion in Todd (1997).

From 1986 through 1987, The Earth Technology Corporation (ETC) installed six monitoring wells (MW-1 through MW-6), sampled soil and groundwater, and performed slug tests in an effort to define the hydrogeology of the Site (ETC, 1986a, b, c, and d; ETC, 1987a and b). Because petroleum hydrocarbons were found in two of the wells, ETC performed additional studies of historical spills and leaks to identify potential source areas. Free product was observed in monitoring well MW-6 located in the northeastern portion of the Site (near current well MW-6R).

In 1987, Radian Corporation (Radian) embarked on additional investigation and remediation activities, which continued until 1991 (Radian, 1988a and 1988b; Radian, 1990 a, b, and c; Radian, 1991). Radian presented the results of its extensive soil and groundwater sampling in its September 1988 report titled, *Western Fuel Oil Company San Pedro Facility Subsurface Investigation* (Radian, 1988). Areas of soil contamination with both TPH-GRO and TPH-DRO were defined. Petroleum hydrocarbons were also found in groundwater samples, but no free product was observed in any of the previously installed monitoring wells or in the five new wells installed by Radian (MW-7, MW-8, MW-9, MW-10, and MW-11).

Concurrent with part of the Radian work at the Site, EA Engineering, Science and Technology, Inc. (EA Engineering) conducted a soil vapor assessment that generally confirmed the presence of potential source areas identified in the previous soil investigation conducted by Radian. EA Engineering reported the results of its investigation in its October 1989 *Soil Vapor Contaminant Assessment, Western Fuel Oil Corporation* (EA Engineering, 1989).

Site assessment and remediation from 1992 through 1993 was conducted by Alton Geoscience (Alton). Alton continued the groundwater monitoring and sampling activities, installing two new off-Site wells (MW-12 and MW-13) in the shallow aquifer to the northeast, across the Harbor Freeway from the Site (Alton, 1993). Measurable free product or sheen was observed in monitoring well MW-6 and MW-10 (located near current well MW-10R) in all sampling events conducted by Alton. Gas chromatographs of the free product samples indicated that MW-6 contained degraded gasoline and MW-10 contained TPHd.

In 1993, the bulk of the environmental work at the Site was taken over by CET Environmental Services, Inc. (CET), which after 1999 changed its corporate name to Cape Environmental Management, Inc. (CAPE). CET/CAPE continued groundwater monitoring, presenting the results of sampling in a series of semiannual reports starting with the July 1993 monitoring event (CET, 1993-1998; CAPE, 2001-2009).

Concurrent with the early CET/CAPE work at the Site, Harding Lawson Associates (Harding Lawson) collected soil samples from 41 borings, with eight samples analyzed for an extensive list of parameters to allow forensic geochemical determination. The results of these analyses and an extensive evaluation of potential source areas were presented in the November 16, 1993, report titled *Preliminary Subsurface Soil Investigation for Forensic Geochemical Analyses, Westoil Terminals Company* (Harding Lawson, 1993).

The 1993 Harding Lawson report was the first to divide the Port Distribution Center portion of the WFO property into 14 "areas," later placed into groups: Western Areas (areas 1, 5, 6, 11, and part of area 12), South-Central Areas (portions of areas 7, 8, 12, 13, and 14), and Northeastern Areas (areas 2, 3, 4, 9, and 10, and portions of areas 7, 8, 13, and 14). These groups of areas were considered separate units for assessment and remediation purposes and for closure by RWQCB. In 1996, also concurrent with the CET work, Environmental Science and Engineering (ESE) drilled nine borings in the storm water collection basin. Petroleum hydrocarbons were not detected in the vadose zone beneath the basin, indicating that the basin was not a source of groundwater contamination.

In September 1996, Todd, on behalf of the Coastal Corporation of Houston, Texas, submitted to the RWQCB its *Site Characterization and Preliminary Remedial Strategy Report*, which contained extensive discussions of the Site's geologic setting and a very detailed historical survey of pre-grading investigations. The Todd (1996) report found that:

- The Site hydrogeology and the nature and extent of contamination are adequately characterized to the extent that remedial scenarios can be evaluated.
- The shallow aquifer beneath the Site is naturally impacted by salt water intrusion from San Pedro Bay and, therefore, is not potable and does not need to be remediated to maximum contaminant levels (MCLs).
- Existing groundwater contamination does not pose a risk to human health and the environment, and based upon the future use of the Site and surrounding area for industrial purposes, the Site will not pose a risk in the future.

Todd provided an update of the Site conditions and provided a conceptual model in its September 1997 *Revised Site Characterization and Risk-Based Corrective Action Analysis* (Todd, 1997) prepared for Pacific Refining Company of Houston, Texas.

In September 1997, the CET *Regional Groundwater Monitoring and Sampling Report* provided a synthesis of the regional groundwater analysis started in 1995 by Groundwater Technology, Inc. (GTI). The RWQCB requested these studies of the regional groundwater in the Gaffey Street Area (GSA) covered by the WFO, Phillips 66, and the DFSP facilities. CET concluded that the groundwater flow in the GSA is a complex pattern reflecting multiple influences including recharge from the Palos Verdes Hills, DGBP, and the Pacific Ocean. The local groundwater gradient trend was described by CET as "U"-shaped, with flow toward a low in the northeastern and northwestern portions of the DFSP and former Tosco properties, respectively. The groundwater gradient at the Site was observed to be toward the east-northeast, consistent with the earlier results of the GTI (1995) study. Groundwater samples collected from 125 monitoring wells in the GSA indicated the presence of widespread contamination, and light non-aqueous phase liquid (LNAPL) was observed in 14 of the 172 wells gauged in the GSA in thicknesses ranging from 0.02 feet in Site well MW-16 to 9.02 feet in Phillips 66 well MW-46. The large map of the GSA in the CET (1997) report indicates that Phillips 66 well MW-46 is located approximately 1,000 feet north of the Site.

In the July 1998 *Summary Report of the Installation of the AS/SVE Remediation System, Western Fuel Oil San Pedro Terminal*, CET provided details regarding the installation and operation of the air sparging/soil vapor extraction (AS/SVE) system at the Site from September 1997 through May 1998 (CET, 1998a). A total of 122 AS/SVE wells were installed at a spacing interval of approximately 100 feet across the Site, and eight AS/SVE wells were installed on the adjacent Phillips 66 refinery property.

5.2.2 RWQCB Approval of "No Further Action" for Soil

In 1999, following the operation of the AS/SVE system at the Site, the RWQCB issued letters approving LandBank's request to cease operation of the remediation systems in the five western areas and the south-central areas of the Site, with the condition that groundwater remediation shall continue for the Site. The approval letter for the five western areas was issued on September 1, 1999, and the approval letter for the south-central areas was issued on October 28, 1999. The two letters were superseded by a January 13, 2000 letter from the RWQCB that determined that no further action would be required for the soil at the western areas and south-central areas of the Site. The January 13, 2000, letter also noted that the "no further action" determination did not apply to the continued operation of the AS/SVE system in the remaining areas of the Site (i.e., the "northeastern areas").

Based on the reduction in the concentrations from the remaining vapor extraction wells, the RWQCB approved the termination and removal of the remainder of the system in October 2000 to allow mass grading of the property for development.
Approximately 20,000 cubic yards of shallow "hot spots" of impacted soil encountered during the grading operations were successfully excavated and treated.

In May 2001, CAPE submitted the *Soil and Groundwater Closure Report, Former Western Fuel Oil Site* to RWQCB (CAPE, 2001a). This document summarized the remediation efforts, the previous closures for specific portions of the Site, and the post-remediation grading, including the discovery and removal of one underground storage tank (UST). The report also discussed the groundwater conditions and presented a risk-based evaluation of the Site performed by Iris Environmental (Iris, 2001). CAPE concluded that:

- "From May 1998 to October 2000, the AS/VE [air-sparging/vapor extraction] remedial system removed approximately 12 million pounds of hydrocarbons from the soils and groundwater at the Site by either volatilization or *in situ* degradation of hydrocarbons. By September 2000, monitoring of the extracted vapor concentrations from the Site's vapor extraction wells (VEWs) indicated that almost all of the VEWs had reached asymptotic levels, which was the basis for termination of the remediation system. Therefore, the RWQCB approved the request to stop active remediation, and authorized removal of the AS/VE system to allow grading for development of the Site.

- "Approximately 20,000 cubic yards of shallow 'hot spots' of impacted soil encountered during the grading operations were successfully excavated, treated, confirmed with soil samples, and used as fill on the Site. An unknown 5,000-gallon UST encountered during the grading program was removed under a permit from the LAFD [Los Angeles Fire Department]. Soil samples from below the UST invert showed only minor impacts with TRPH [total recoverable petroleum hydrocarbons] in one soil sample at a concentration of 3,600 mg/kg [milligrams per kilogram]. VOCs were not detected in the two UST samples collected.

- "Concentrations of TPH [total petroleum hydrocarbons], BTEX [benzene, toluene, ethylbenzene, and xylenes], and 1,2-DCA [1,2-dichloroethane] in the Site groundwater monitoring wells were significantly reduced during the remediation program. While some elevated concentrations of benzene and 1,2-DCA remained in some of the monitoring wells, the Iris health risk-based evaluation indicates that the residual levels do not pose a health risk to future commercial populations of the Site. A separate groundwater monitoring and reporting program workplan is being prepared for approval by the RWQCB. This workplan will identify the number and locations of new monitoring wells to replace those abandoned during the grading operation. These new monitoring wells and the four remaining monitoring wells will provide for further monitoring of the groundwater quality at the Site.

- "A health risk-based evaluation of the Site performed by Iris concluded that the residual levels of chemicals present in the soil and groundwater at the Site would not adversely impact human health and would not threaten the underlying drinking water resource. Accordingly, further characterization or remediation at the Site is not warranted.
- "Based on the results of the remediation program and the Iris health risk-based evaluation, it is requested that the RWQCB grant a No Further Action Letter for the Site, and provide a determination that the requirements of the RWQCB Order 85-17 have been satisfied and no longer applied to this Site. These findings should be authorized with the understanding that groundwater monitoring will continue according to provisions of the Groundwater Monitoring and Reporting Plan (CAPE, 2001c [CAPE, 2001b]) to be submitted under separate cover."

On July 30, 2001, the RWQCB issued a determination that "no further action" for soil remediation would be required in the northeastern areas of the former WFO property and that "all provisions of the Cleanup and Abatement Order No. 85-17 have been met and the Order is no longer applicable to the Western Fuel Oil Company Site." However, the letter noted that groundwater remediation and monitoring would continue until the cleanup goal is achieved and that a workplan including locations of replacement wells must be submitted. This determination letter was superseded by an August 3, 2001, letter from the RWQCB in which it granted a "no further action" finding for the Site's soil but which included a statement that, at the end of an eight-quarter monitoring and reporting period, the RWQCB would make a determination as to whether further groundwater monitoring would be required.

In response to a request by SSR Realty Advisers (SSR) for clarification of the Site remediation requirements, the RWQCB issued a letter to LandBank on September 25, 2001, which stated that:

- "It was brought to our attention that the Western Fuel Oil property (WFO property) is comprised of 87.6 acres, not 76.4 acres. Therefore, our "no further action" letters for soil remediation are applicable to the entire 87.6 acres WFO property.
- "LandBank will continue their groundwater monitoring and reporting program at the WFO property for an additional two years. In addition, LandBank has submitted a groundwater monitoring and reporting program including the location of the replacement wells.
- "Based on the information provided for the WFO property, it is unlikely that the Regional Board will require a monitoring well to be installed at the Hiuka America Parcel of the WFO property. At the end of eight quarters of monitoring and reporting, we will evaluate the groundwater data and determine whether further monitoring is required for the site."

5.2.3 Post-Remediation Groundwater Monitoring and Sampling, Free Product Sampling, and Pump Test

In May 2001, CAPE submitted a *Groundwater Monitoring and Reporting Plan* to the RWQCB for approval (CAPE, 2001b). The plan proposed locations for new monitoring wells to replace those abandoned during development of the property. In a letter dated January 10, 2002, the RWQCB approved the *Groundwater Monitoring and Reporting Plan*. Between April 9 and April 12, 2002, after obtaining the appropriate well construction/destruction permits from the County of Los Angeles, Well MW-7 was abandoned, and six replacement wells (MW-5R, MW-6R, MW-9R, MW-10R, MW-14R, and MW-19R) were installed (CAPE, 2002).

Monitoring wells MW-6R and MW-14R were noted to have measurable product thicknesses, and on April 30, 2002, free product samples were collected from these two wells. As described in the Jones Environmental, Inc. (Jones) analytical report (Jones, 2002), the hydrocarbons present in the sample collected from monitoring well MW-6R appeared to consist of kerosene (Fuel Oil No. 1) with minor amounts of gasoline (less than 5 percent). Smaller amounts of a heavier-end hydrocarbon (C18 to C39) were also present. The hydrocarbons present in the free product sample collected from monitoring well MW-14R appeared to consist of Jet Fuel A with approximately 10 to 15 percent gasoline. The current property owners, Port LA Distribution Center, L.P. and Port LA Distribution Center II, L.P., have contracted with CAPE to perform interim remedial action consisting of removing free product from these two wells (and any other wells with measurable free product) on a biweekly basis.

Discussions and meetings with the RWQCB Project Manager for the Site, Mr. Paul Cho, resulted in additional investigation and assessment of environmental conditions at the Site.
In order to better characterize the free product at the Site, Mr. Cho required sampling of the groundwater beneath the free product, with special attention to the concentrations of benzene and fuel oxygenates, such as tertiary butyl alcohol (TBA) and methyl tertiary butyl ether (MTBE). On November 28, 2007, CAPE submitted a *Fuel Oxygenates and Benzene Evaluation* (CAPE, 2007b), which presented the results of its sampling and analysis of the groundwater from the three wells that have consistently contained free product. The samples from these wells showed relatively high concentrations of fuel oxygenates, including MTBE, TBA, and TAA, in the groundwater samples collected from beneath the free product in monitoring wells MW-6R, MW-14R, and MW-19R.

As part of the scope of the *Fuel Oxygenates and Benzene Evaluation*, CAPE also performed a pumping test at well MW-10, located north of Building A, near the Site boundary with Phillips 66. This pump test was intended to provide information on hydraulic conductivity and the behavior of groundwater during pumping, and to gain insight on the potential for contaminant migration. CAPE noted, however, that the pump testing resulted in insufficient drawdown to analyze the data for aquifer parameters (CAPE, 2007b). CAPE used the most recent water-level measurements to calculate a groundwater velocity of about 0.026 feet per day.

5.2.4 Vapor Intrusion Risk Assessment

In response to Mr. Cho's request for evaluation of potential human health risks, CAPE performed vapor intrusion modeling and air sampling (CAPE, 2007a). The use of generally accepted vapor risk modeling techniques indicated the potential for a significant (defined in terms of one excess cancer case in a population of one million [1E-06]) health risk due to the presence of benzene in groundwater beneath Building A. However, the results of the indoor air sampling were inconclusive due to the difficulty in interpreting the results in the absence of contemporaneous ambient air data at the Site.

Based on his review of the indoor air and groundwater data collected by CAPE, Mr. Cho recommended additional air and groundwater studies. On March 31, 2008, SCS submitted a *Workplan for Additional Assessment at the San Pedro Business Center, 300 Westmont Drive, San Pedro, California* (SCS, 2008a) to RWQCB. Mr. Cho approved the implementation of the soil vapor survey portion of this Workplan on April 9, 2008.

SCS conducted a soil vapor study of the Building A area (near areas of known and reported phase-separated hydrocarbons [PSH] in groundwater) in order to evaluate the potential human health risk from soil vapor intrusion originating from on-Site petroleum hydrocarbons associated with former Site use. Building A consists of a 760,000-square foot warehouse structure with office space at each end of the building. A sub-slab methane collection system was installed during construction of Building A.

Soil vapor sampling probes were installed inside and around the eastern end of Building A, and the soil vapor sampling was conducted. The results of the study indicated no significant risk to human health. The report (SCS, 2008b) concluded that:

"Based on the data obtained as part of this assessment, laboratory results, and current regulatory guidelines, it is our professional opinion that:

- The concentrations of VOCs (benzene) detected in the soil vapor samples collected within Building A at the Site are below their respective commercial CHHSL [California Human Health Screening Level] values.
- The concentrations of VOCs detected in some of the soil vapor samples collected within the parking areas outside Building A are above their respective commercial CHHSL values.
- The vapor intrusion modeling results using the totality of the soil vapor data result in an estimated total cancer risk of 9.1E-07. This value is less than 1E-06, the negligible risk threshold in California.
- Non-cancer health risks are also negligible, as indicated by a Hazard Index of less than 0.01, significantly below the California negligible risk threshold Hazard Index value of 1."

The SCS (2008b) report was evaluated by the California Office of Environmental Health Hazard Assessment (OEHHA) on behalf of the RWQCB. OEHHA issued a letter that concurred with the conclusions and recommendations in the SCS assessment.

5.2.5 Additional Groundwater Investigation

As part of the ongoing corrective action at the Site, the RWQCB, in a letter dated November 30, 2007, requested the installation of two monitoring wells into the deeper water-bearing unit to further evaluate hydrogeologic conditions at the Site. A *Work Plan for the Installation of Groundwater Wells Required for Corrective Action* was submitted in March 2008 (CAPE, 2008a), and a *Revised Work Plan for the Installation of Groundwater Wells Required for Corrective Action* (CAPE, 2008b) was submitted on June 30, 2008 (approved the by the RWQCB in a letter dated September 5, 2008).

Following submittal of a well permit application to the County of Los Angeles on September 22, 2008 (approved on September 30, 2008), two monitoring wells, MW-20D and MW-21D, were installed to a depth of approximately 200 feet below ground surface (bgs) in the deeper water-bearing zone (WBZ) on October 20 and October 26, 2008 (Figure 2).

Subsequently, in December 2008, the two new deeper wells and the other nine wells that comprise the groundwater monitoring network were monitored and sampled (CAPE, 2009). The groundwater in the two deeper wells was reported to have several CoCs, at generally low concentrations, and no detectable concentrations of MTBE, TBA or other fuel oxygenates. CoCs in shallow groundwater were generally reported at concentrations that were consistent with historical data. An upward vertical hydraulic gradient was estimated between the shallow and deeper WBZs.

5.2.6 Additional Groundwater Investigation and CPT/ROST Assessment of LNAPL

A document titled, *Revised Workplan for Installation of Additional Groundwater Monitoring Wells* (Revised Workplan) dated May 7, 2010 (SCS, 2010b), was prepared by SCS to provide the plan for installation of four new wells for future groundwater monitoring and assessment at the Site. The Revised Workplan was one of the "technical reports" requested by the RWQCB in its Amended California Water Code Section 13267 Order (Amended Order) issued on February 4, 2010. SCS mobilized to the Site to install the four new wells on July 12, 2010. The four new wells (MW-22, MW-23D, MW-24, and MW-25) were included in the December 2010 sampling event. Details of the well installation and the results of the initial sampling are presented in the *Report of Installation of Additional Groundwater Monitoring Wells, San Pedro Business Center, 300 Westmont Drive, San Pedro, California*, dated September 16, 2010 (SCS, 2010d).

The new wells were installed at three locations on July 12 through 22, 2010, as required by the Amended Order, as indicated on Figure 2. Well MW-24 was installed near the existing well MW-6R located in the parking/truck loading area south of Building A. Well MW-25 was installed near existing well MW-14R in the parking area east of Building A.

A pair of wells (MW-22 and MW-23D) was installed in the paved fire lane area north of Building A near existing well MW-10R. MW-23D is a deeper well designed to match the similar deep wells (MW-20D and MW-21D) previously installed south and east of Building A.

With the installation of the four new wells, each set of clustered wells includes one well screened in the water table interval, one well screened approximately 40 feet below the water table, and one well screened in the deeper WBZ about 100 feet below the water table. The new wells were installed, developed, and sampled as described in the table below.

Table 1. Well Installation Details

Well Cluster	Well Number	Water-Bearing Zone	Total Depth (in feet bgs)	Total Depth Below MSL (in feet)	Screened Interval (in feet bgs)
South of Building A	MW-6R	Shallow (water table)	114.70	12.43	89.7 to 114.7
	MW-24	Intermediate	145.30	42.71	135.0 to 145.0
	MW-20D	Deep	200.00	98.05	184.0 to 199.0
East of Building A	MW-14R	Shallow (water table)	105.00	12.09	80 to 105
	MW-25	Intermediate	145.00	51.89	135.0 to 145.0
	MW-21D	Deep	200.00	104.93	185.0 to 200.0
North of Building A	MW-10R	Shallow (water table)	114.85	16.53	89.9 to 114.85
	MW-22	Intermediate	145.00	46.22	135.3 to 145.3
	MW-23D	Deep	200.00	101.68	190.0 to 200.0

Notes:
bgs = below ground surface
MSL = Mean sea level (NAVD88 datum)

In September 2010, SCS mobilized to the Site to conduct a Cone Penetration Testing (CPT) investigation. The results were presented in the *Report of Cone Penetration Testing Investigation, San Pedro Business Center, 300 Westmont Drive, San Pedro, California*, dated June 2, 2011 (SCS, 2011b).

During a May 30, 2012, meeting to discuss Site progress, the RWQCB provided direction to install two new wells at off-Site locations near former wells located on Port of Los Angeles property along the west side of John S. Gibson Boulevard to provide data regarding the downgradient groundwater characteristics. On August 21, 2012, SCS submitted a *Workplan for Installation of Additional Groundwater Monitoring Wells* in compliance with the RWQCB directives. In a letter dated September 14, 2012, the RWQCB provided the following comments:

> "Off-Site groundwater monitoring wells within the intermediate water bearing zone should be installed based on the water quality data from the existing wells screened in the intermediate water bearing zone. Therefore, revise the Workplan to install additional groundwater monitoring wells screened in the intermediate water bearing zone.
>
> "A well construction diagram should be included to depict detailed well design for the proposed off-Site groundwater monitoring wells."

These additional requirements were incorporated into a *Revised Workplan for Installation of Additional Groundwater Monitoring Wells* (Revised Workplan) dated October 31, 2012. The revised scope of work included four new off-Site wells, two installed in the shallow water bearing zone WBZ, and two installed in the intermediate WBZ. The well installation activities are presented in the *Report of Installation of Additional Groundwater Monitoring Wells, San Pedro Business Center, 300 Westmont Drive, San Pedro, California*, dated December 24, 2013 (SCS, 2013c).

The new wells were installed on October 17 and 18, 2013, at two locations, as required by RWQCB (Figure 2). One pair of wells (MW-26 and MW-27) was installed near former well MW-12, which was located in the landscaped area along the west side of John S. Gibson Boulevard, and south of the above-ground portion of the Western Fuel Oil pipeline. A second pair of wells (MW-28 and MW-29) was installed north of former well MW-12, in the northern portion of the landscaped slope adjacent to the Interstate Highway 110 embankment retaining wall (Figure 2).

During the well development activities for the four new wells, depth-to-water measurements were made for the wells. The construction details for the wells are shown in the table below:

Table 2. Well Installation Details

Well Identifier	Water-Bearing Zone	Total Depth (in feet bgs)	Total Depth Above/Below MSL (in feet)	Screened Interval (in feet bgs)
MW-26	Shallow (water table)	19.0	+1.84	9 to 19
MW-27	Intermediate	58.5	-41.56	48 to 58
MW-28	Shallow (water table)	21.5	+6.18	10 to 20
MW-29	Intermediate	60.0	-44.08	50 to 60

Notes:
bgs = below ground surface
MSL = mean sea level (NAVD88 datum)

The first 2013 semiannual groundwater monitoring and sampling event was conducted in June 2013, and the results of event were presented in a report titled, *Groundwater Monitoring Report, First Semiannual 2013, San Pedro Business Center, 300 Westmont Drive, San Pedro, California,* dated August 15, 2013 (SCS, 2013b). More recently, in January 2014, SCS returned to the Site to conduct the second semiannual groundwater monitoring and sampling event for 2013 (SCS, 2014).

On February 12, 2014, SCS collected groundwater samples from on-Site well MW-10R and off-Site wells MW-26, MW-27, MW-28, and MW-29. These samples were used for forensic geochemical analysis, as discussed in section 7.7 of this Report.

The next semiannual groundwater monitoring and sampling event is scheduled for June 2014.

5.2.7 Groundwater Monitoring Well Sampling

The existing Site monitoring well network is currently monitored and sampled on a semiannual basis. A summary of results of recent groundwater sampling events is presented below.

May 2012

SCS conducted a semiannual sampling event in May 2012 and presented the following conclusions in a report submitted to the RWQCB in August 2012 (SCS, 2012b):

- "Groundwater flow in the shallow WBZ is northeasterly with a gradient averaging approximately 0.004 foot per foot (ft/ft). Groundwater flow in the intermediate WBZ is also northeasterly, with a gradient of 0.004 ft/ft. Groundwater flow in the deeper WBZ is easterly, with a gradient of 0.006 ft/ft. A generally upward vertical gradient is estimated between the deeper and shallow WBZs.

- "Free product thicknesses of 1.54 feet in well MW-6R, 0.19 foot in well MW-14R, and 0.06 foot in well MW-19R were recorded in May 2012. These values are generally similar to the measurements from previous sampling events.
- "TPH-GRO, TPH-DRO, and the VOCs benzene, ethylbenzene, isopropylbenzene, 1,2-DCA, 1,2-DCP, and TBA were detected in some shallow WBZ samples at concentrations generally similar to recent historical values.
- "Concentration plots for TPH-GRO, TPH-DRO, benzene, and TBA are generally consistent with historical trends. The oxygenate TBA was present at a concentration of 220 μg/L in MW-9R. TAA was not detected in the shallow WBZ wells.
- "COPCs [constituents of potential concern] in the shallow WBZ wells show generally decreasing concentration trends.
- "COPCs, including TPH-GRO, TPH-DRO, BTEX, isopropylbenzene, naphthalene, n-propylbenzene, and 1,2-DCA were detected in intermediate WBZ wells. This TPH concentration in well MW-24 is anomalous but may be explained by a surface release of hydrocarbons from a source, probably a truck, in the Building A parking lot.
- "TAA and TBA were not detected above the laboratory reporting limit in the intermediate WBZ wells.
- "While some COPCs have been detected in wells screened in the intermediate WBZ, we believe that the presence of these COPCs is likely attributable, at least in part, to the drilling and well installation process, as previously noted.
- "With respect to the deeper WBZ, COPCs are not, and have not ever been (with the sole exception of the 1,2-DCA detected during the current sampling event in well MW-20D), detected in MW-20D and MW-21D. While TPH-GRO and related COPCs were detected initially in MW-23D, the concentrations have decreased by several orders of magnitude since then, and no COPCs were detected in the May 2012 sampling of the well. We believe that the detected COPCs were principally the result of, or an artifact of, the drilling program. The May 2012 results indicate that TPH-GRO and related COPCs are not present at detectable concentrations in the deeper WBZ.
- "With respect to the vertical migration of oxygenates, neither TBA nor TAA were detected in any of the deeper WBZ wells. Given that these deeper WBZ wells are located in areas where phase-separated hydrocarbons (or elevated TPH-GRO concentrations) are present in the shallow WBZ, the continued absence of TBA/TAA in the deeper WBZ indicates that vertical migration of oxygenates is limited. This lack of migration is consistent with an upward vertical hydraulic gradient observed at the Site."

December 2012

SCS conducted a semiannual sampling event in December 2012 and presented the following conclusions in a report submitted to the RWQCB in February 2013 (SCS, 2013a):

- "Groundwater flow in the shallow WBZ is northeasterly with a gradient averaging approximately 0.004 foot per foot (ft/ft). Groundwater flow in the intermediate WBZ is also northeasterly, with a gradient of 0.004 ft/ft. Groundwater flow in the deeper WBZ is easterly, with a gradient of 0.006 ft/ft. A generally upward vertical gradient is estimated between the deeper and shallow WBZs.

- "Free product thicknesses of 0.19 foot in well MW-14R and 0.06 foot in well MW-19R were recorded in December 2012. These values are generally similar to the measurements from previous sampling events. Well MW-6R was blocked and groundwater and free product levels could not be measured.

- "TPH-GRO, TPH-DRO, and the VOCs benzene, ethylbenzene, isopropylbenzene, 1,2-DCA, 1,2-DCP, and TBA were detected in some shallow WBZ samples at concentrations generally similar to recent historical values.

- "Concentration plots for TPH-GRO, TPH-DRO, benzene, and TBA are generally consistent with historical trends. The oxygenate TBA was present at a concentration of 112 µg/L in MW-9R. TAA was not detected in the shallow WBZ wells.

- "COPCs in the shallow WBZ wells show generally decreasing concentration trends.

- "COPCs, including TPH-GRO, TPH-DRO, BTEX, isopropylbenzene, naphthalene, n-propylbenzene, and 1,2-DCA were detected in intermediate WBZ wells. The TPH-GRO and TPH-DRO concentrations in well MW-24 cannot be explained and is considered anomalous but may be explained by a surface release of hydrocarbons from a source, probably a truck, in the Building A parking lot. In the previous two sampling events TPH-GRO and TPH-DRO were not detected in the well.

- "TAA and TBA were not detected above the laboratory reporting limit in the intermediate WBZ wells.

- "While some COPCs have been detected in wells screened in the intermediate WBZ, we believe that the presence of these COPCs is likely attributable, at least in part, to the drilling and well installation process, as previously noted.

- "With respect to the deeper WBZ, COPCs are not, and have not ever been (with the sole exception of the 1,2-DCA detected during the May 2012 sampling event in well MW-20D), detected in MW-20D and MW-21D. While TPH-GRO and related COPCs were detected initially in MW-23D, the concentrations have decreased by several orders of magnitude since then, and no COPCs were detected in the December 2012 sampling of the well. We believe that the detected COPCs were principally the result of, or an artifact of, the drilling program. The December 2012 results indicate that TPH-GRO and related COPCs are not present at detectable concentrations in the deeper WBZ.

- "With respect to the vertical migration of oxygenates, neither TBA nor TAA were detected in any of the deeper WBZ wells. Given that these deeper WBZ wells are located in areas where phase-separated hydrocarbons (or elevated TPH-GRO concentrations) are present in the shallow WBZ, the continued absence of TBA/TAA in the deeper WBZ indicates that vertical migration of oxygenates is limited. This lack of migration is consistent with an upward vertical hydraulic gradient observed at the Site."

June 2013

SCS conducted a semiannual sampling event in June 2013 and presented the following conclusions in a report submitted to the RWQCB in August 2013 (SCS, 2013b):

- "Groundwater flow in the shallow WBZ is northeasterly with a gradient averaging approximately 0.004 foot per foot (ft/ft). Groundwater flow in the intermediate WBZ is also northeasterly, with a gradient of 0.003 ft/ft. Groundwater flow in the deeper WBZ is easterly, with a gradient of 0.006 ft/ft. A generally upward vertical gradient is estimated between the deeper and shallow WBZs.

- "No free product was recorded in wells MW-14R and MW-19R, for the first time in the history of these two wells. Well MW-6R was blocked, thus groundwater and free product levels could not be measured.

- "TPH-GRO, TPH-DRO, and the VOCs benzene, ethylbenzene, isopropylbenzene, 1,2-DCA, 1,2-DCP, TBA, and TAA were detected in some shallow WBZ samples at concentrations generally similar to recent historical values.

- "Concentration plots for TPH-GRO, TPH-DRO, benzene, and TBA are generally consistent with historical trends. The oxygenate TBA was present at a concentration of 330 μg/L in MW-9R. TAA was present at a concentration of 177 μg/L in MW-9R.

- "COPCs in the shallow WBZ wells show generally stable or decreasing concentration trends.

- "COPCs, including TPH-GRO, TPH-DRO, BTEX, isopropylbenzene, naphthalene, n-propylbenzene, and 1,2-DCA were detected in intermediate WBZ wells. The TPH-GRO and TPH-DRO concentrations in well MW-24 are considered anomalous, as discussed in prior reports, but may be explained by a surface release of hydrocarbons from a source, possibly a truck in the Building A parking lot, or by infiltration of surface drainage containing COPCs.

- "TAA and TBA were not detected above the laboratory reporting limit in the intermediate WBZ wells.

- "While some COPCs have been detected in wells screened in the intermediate WBZ, we believe that the presence of these COPCs is likely attributable, at least in part, to the drilling and well installation process, as previously noted, with the exception of TPH-DRO and TPH-ORO in MW-24.

- "With the exception of a THP-DRO concentration of 640 µg/L, no TPH or VOCs (including fuel oxygenates) were detected in samples collected from the deeper WBZ wells MW-20D, MW-21D, and MW-23D.

- "With respect to the vertical migration of oxygenates, neither TBA nor TAA were detected in any of the deeper WBZ wells. Given that these deeper WBZ wells are located in areas where phase-separated hydrocarbons (or elevated TPH-GRO concentrations) are present in the shallow WBZ, the continued absence of TBA/TAA in the deeper WBZ indicates that vertical migration of oxygenates is limited. This lack of migration is consistent with an upward vertical hydraulic gradient observed at the Site."

January 2014

SCS conducted a semiannual sampling event in January 2014, and presented the following conclusions in a report submitted to the RWQCB in February 2014 (SCS, 2014):

- "Groundwater flow in the shallow WBZ is easterly with a gradient averaging approximately 0.004 foot per foot (ft/ft). Groundwater flow in the intermediate WBZ is northeasterly, with a gradient of 0.004 ft/ft. Groundwater flow in the deeper WBZ is easterly, with a gradient of 0.006 ft/ft. A generally upward vertical gradient is estimated between the deeper and shallow WBZs. The initial measurements of groundwater elevations for the new off-Site wells may indicate a tidal influence.

- "Free product was recorded in wells MW-6R, MW-14R, and MW-19R.

- "TPH-GRO, TPH-DRO, and the VOCs benzene, ethylbenzene, xylenes, isopropylbenzene, 1,2-DCA, and 1,2-DCP were detected in some shallow WBZ samples at the Site at concentrations generally similar to recent historical values.

- "No COPCs were detected in off-Site shallow WBZ well MW-28. COPCs detected in off-Site well MW-26 included TPH-GRO, 1,2-DCP, isopropyl benzene, and n-propylbenzene.

- "Concentration plots for TPH-GRO, TPH-DRO, benzene, and TBA are generally consistent with historical trends.

- "COPCs in the on-Site shallow WBZ wells show generally stable or decreasing concentration trends.

- "COPCs, including TPH-GRO, TPH-DRO, benzene, ethylbenzene, 1,2-DCP, and 1,2-DCA were detected in intermediate WBZ wells at the Site.

- "COPCs detected in the off-Site intermediate WBZ wells include TPH-GRO, benzene, toluene, ethylbenzene, xylenes, chlorobenzene, 1,1-dichloroethane (1,1-DCA), 1,2-DCP, and 1,2,3-TCP.

- "The TPH-GRO and TPH-DRO concentrations in well MW-24 are considered anomalous, as discussed in prior reports.

- "TBA was not detected above the laboratory reporting limit in the intermediate WBZ wells. TAA was detected at a concentration of 234 µg/L in well MW-24.

- "While some COPCs have been detected in wells screened in the intermediate WBZ, we believe that the presence of these COPCs is likely attributable, at least in part, to the drilling and well installation process, as previously noted, with the exception of TPH-DRO and TPH-ORO in MW-24.

- "With the exception of a THP-DRO concentration of 2,710 µg/L, no TPH or VOCs (including fuel oxygenates) were detected in samples collected from the deeper WBZ wells MW-20D, MW-21D, and MW-23D.

- "With respect to the vertical migration of oxygenates, neither TBA nor TAA were detected in any of the deeper WBZ wells. Given that these deeper WBZ wells are located in areas where phase-separated hydrocarbons (or elevated TPH-GRO concentrations) are present in the shallow WBZ, the continued absence of TBA/TAA in the deeper WBZ indicates that vertical migration of oxygenates is limited. This lack of migration is consistent with an upward vertical hydraulic gradient observed at the Site.

- "Water quality in the intermediate and deep WBZs is characterized by elevated TDS levels characteristic of brackish or sea water, especially in the off-Site intermediate WBZ wells."

5.3 REGIONAL SETTING

5.3.1 Regional Geology

This discussion of the regional geology and hydrogeology is based on published information and the results of previous investigations on the Site and adjacent sites, in particular the *Revised Site Characterization and Risk-Based Corrective Action Analysis* prepared for the Site by Todd Engineers (Todd, 1997).

The Site is located near the northeastern margin of the Palos Verdes uplift. Surficial geological units in this area consist principally of Quaternary older alluvium/terrace deposits and slightly older Quaternary marine deposits, including the San Pedro Sand. Underlying the Quaternary units are Miocene sedimentary units of the Monterey Formation and its equivalents to a depth of approximately 1,500 to over 2,000 feet.

The Upper Pleistocene portion of the San Pedro Formation, referred to as the 200-Foot Sand interval, is underlain in the vicinity of the Site by a deltaic sequence of relatively fine-grained deposits, which are generally correlative with some of the coarse-grained sands and gravels of the upper portion of the Silverado aquifer (Ponti, 2008). This deltaic sequence is limited in extent to the area along the northeast flank of the Palos Verdes Hills, mainly between the Palos Verdes Fault and the Wilmington Anticline. The predominance of a deltaic depositional environment in the vicinity of the Site may help to explain the presence of the relatively fine-grained silty sands encountered in the lower portion of the shallow WBZ. The predominance of fine-grained deltaic deposits may also explain the origin of the thick aquitard separating the two water-bearing zones at the Site from the much deeper Silverado Aquifer.

Figure 4 shows some of the geologic features in the vicinity of the Site in relation to active and abandoned wells. Major geologic structures in the vicinity of the Site include the Gaffey Anticline, which crosses the southwest corner of the property and causes geologic beds beneath the Site to dip gently to the northeast, and the Palos Verdes Fault, which crosses the northeast corner of the Phillips 66 property, where it is reported to have caused displacement of older units but has not affected the younger formations associated with the Gage and Lynwood aquifers (Trihydro, 2008b).

5.3.2 Regional Hydrogeology

The Site is situated on an elevated marine terrace located near the southern edge of the West Coast Groundwater Basin, a relatively small groundwater basin underlying the southwestern part of the Los Angeles Coastal Plain (DWR, 1998). It is bounded on the north by the Ballona Escarpment, on the east by the Newport-Inglewood Uplift, on the southwest by the Palos Verdes Hills, and on the south and west by the Pacific Ocean. The Basin covers 160 square miles and includes 20 incorporated cities.

Five aquifers have been defined in the West Coast Basin. From the surface, they are the Gaspur, 200-Foot Sand (Gage), 400-Foot Gravel (Lynwood), Silverado, and Pico. The Pico Formation is composed of semi-consolidated materials of moderate permeability in some locations but is generally not used for water supply (Todd, 1997). The major aquifers are separated by aquitards in the general vicinity of the Site. These aquitards limit the downward migration of shallow groundwater contamination.

The Gage or 200-Foot Sand Aquifer was given that designation because it occurred approximately 200 feet bgs in the syncline extending from Inglewood southeasterly through Gardena (Todd, 1997). This unit is composed of fine- to medium-grained sand with variable amounts of gravel, sandy silt, and clay in the West Coast Basin (Todd, 1997). Its thickness varies from 25 feet to 200 feet in the vicinity of the Site.

In the West Coast Basin, the Lynwood Aquifer is called the 400-Foot Gravel Aquifer because its base is approximately 400 feet bgs along the axis of the syncline. It is composed of continental and marine deposits. The 400-Foot Gravel Aquifer is estimated to be approximately 25 feet thick in the vicinity of the Site (Todd, 1997).

The Silverado Aquifer consists of sand and gravel with localized, discontinuous beds of sandy silts, silt, and clay. A clayey zone divides this unit into an upper zone and a lower zone. Most of the groundwater extraction occurs from the coarser lower zone. The aquifer is about 350 to 700 feet thick in the southern portion of the West Coast Basin (Todd, 1997). Most of the freshwater production in the basin occurs in the Silverado Aquifer.

The Gaspur Aquifer occurs only within the ancestral channel of the Los Angeles River and does not extend to the vicinity of the Site.

Boring logs for deep industrial water supply wells drilled on the Phillips 66 property north of the Site, together with regional cross-sections confirm that, in the vicinity of the Site:

- A confining layer separates the 200-Foot Sand Aquifer from the 400-Foot Gravel Aquifer.
- The 400-Foot Gravel Aquifer is thin (approximately 25 feet thick) and composed of relatively low-permeability deposits.
- The 400-Foot Gravel Aquifer is separated from the Silverado Aquifer by a thick aquitard (approximately 400 feet thick).

As noted by Todd (1997):

> "CDM (August 1995) has developed a conceptual model to simulate the southern half of the West Coast Basin for a Dominguez Gap Barrier Project water quality study. The data gathering and modeling results indicated that lower hydraulic conductivities were present in the aquifers in the vicinity of the Site."
>
> " ...The hydraulic conductivities of the 200-Foot, 400-Foot, and Silverado aquifers decrease in the area of the Site. The horizontal and vertical conductivities of the 400-Foot Gravel Aquifer reduce to those of the aquitard above the 400-Foot Aquifer."

5.4 SITE SETTING

5.4.1 Topography

Prior to grading for redevelopment, the WFO property occupied a hill with elevations ranging from approximately 75 to 135 feet above MSL. Topography of the area around Building A originally sloped toward the east. Topography was changed by cut and fill operations during grading for the Site. Based on information on groundwater monitoring well elevations, the layer of fill beneath Building A thickens toward the east to around 15 feet thick.

5.4.2 Utilities

Based on our review of as-built plans for the Site, we identified the following utilities:

- Storm drain
- Sanitary sewer
- Fire water lines

Based on available information, these utilities are believed to be shallow. The storm drain system that drains the truck parking area empties into the retention basin at the east end of the Site. The sanitary sewer and fire water lines also appear generally to have shallow burial depths, but as-built details of the trench lines were not available to SCS. Based on the interpreted shallow depths of burial, we believe it unlikely that the utilities are acting as "preferential pathways" for CoC migration at the Site.

5.4.3 Geology

The geology of the shallow WBZ was characterized during the installation of the SVE system at the Site by CET (CET, 1998a). The lithologic composition of the shallow WBZ, from the ground surface to approximately 15 to 20 feet below MSL, is predominantly fine-grained silty sand, with occasional lenses of silt and clay. There appear to be no major lithologic barriers to lateral migration of groundwater within the shallow WBZ.

The geology of the deeper WBZ has been partially investigated by the drilling of several deep wells at the Site. Deep well MW-11 and its replacement well MW-18 encountered silts and silty fine-grained sands from the bottom of the shallow WBZ (at around 120 feet bgs or 20 feet below MSL) to a depth of approximately 180 to 200 feet bgs (roughly 90 to 100 feet below MSL), where cleaner sands that contained groundwater were encountered.

Cross-sections presented by CET (1998a) do not indicate the presence of faulting at the Site.

5.4.4 Hydrogeology

The Gage (200-Foot Sand Aquifer), the uppermost aquifer beneath the Site, is predominantly composed of fine- to very fine-grained sand with lenses of silt and clay. Both the shallow WBZ and the deeper WBZ are interpreted to be within the Gage Aquifer. The Gage Aquifer is in direct contact with salt water from the Los Angeles Harbor approximately 1,000 feet to the east of the Site. The hydrogeologic units at the Site beginning at the ground surface include the Gage Aquifer, an aquitard, the Lynwood (400-Foot Gravel Aquifer), an aquitard, and the Silverado Aquifer. The Lynwood Aquifer in the vicinity of the Site is more accurately described as an aquitard due to low hydraulic conductivity. It will be referred to as an aquifer in this Report for consistency with established nomenclature. Deep borings on the Phillips 66 refinery directly north of the Site and other regional studies confirm that the laterally continuous 25- to 50-foot-thick aquitard separates the Gage and Lynwood Aquifers in this area. The aquitard between the Lynwood and Silverado Aquifers is at least 400 feet thick in the vicinity of the Site.

At the Site, groundwater flow in the 200-Foot Sand Aquifer has been consistently toward the east-northeast. North of the Site, at the Phillips 66 refinery, groundwater flow patterns show an abrupt change with the flow direction changing from the east-northeast direction on the south side of the Phillips 66 property to a northwest direction on the north side of the refinery. This pattern has been consistent over the period of monitoring (since approximately 1986) and is reportedly due to recharge from the elevated Palos Verdes Hills west of the Site vicinity, the influence of areas of mergence, and the influence of the DGBP.

Groundwater in the Lynwood Aquifer flows to the northeast toward a pumping center and the area of mergence between the Lynwood and the Silverado Aquifers.

Groundwater flow in the Gage and Lynwood Aquifers, in the vicinity of the Site, is also affected by injection of water at the DGBP to control seawater intrusion. The DGBP provides a hydraulic barrier in the shallow aquifer, slowing contaminant migration from the Site toward pumping centers north of the DGBP.

Depth to first water at the Site varies from approximately 52 feet bgs on at the northeast corner of the property (MW-8) to approximately 96 feet bgs on the western side of the property (MW-5R).

East of the Site and east of the Interstate 110 Freeway (MW-12 and MW-13), the depth to water was historically measured approximately 15 to 16 feet below the surveyed measuring point since the ground surface elevation is much lower.

As reported in CAPE (2009):

> "An aquifer test was conducted in the shallow water-bearing zone at MW-10R, located near the northern boundary of the Site, in August 2007 (Cape, 2007[b]). Aquifer test data were analyzed by the modified Thiem equation method. The transmissivity was estimated by this method to be about 930 gallon/day per foot or 124 ft^2/day [squared feet per day]. Hydraulic conductivity (K) was calculated using the T= K x b formula; where Transmissivity (T) was computed from the Thiem equation and b is the saturated thickness of the aquifer, which is about 120 feet in and around MW-10R. Then, K= 124ft^2/per day /120ft or about 1 ft/day (CAPE, 2007[b]). Based on this, groundwater velocity was estimated using the Darcy equation (Velocity = KI/n; where I is the groundwater gradient and n is the porosity of the aquifer) at 0.026 ft/day assuming a porosity of about 0.25 and gradient of 0.00658 feet per foot."

Installation of additional monitoring wells at the Site has allowed the investigation of a deeper WBZ at approximately 200 feet bgs and an intermediate WBZ at approximately 140 feet bgs.

5.4.5 Recent Results / Hydrogeology

Groundwater Elevation and Gradient

A series of depth-to-water measurements for the Site wells indicated an apparent elevation increase in all of the on-Site wells compared to elevations measured during the previous monitoring events (SCS, 2014). The EPA *On-line Tools for Site Assessment Calculation - Gradient Calculator* website was employed to calculate gradients using measurements from the on-Site monitoring wells. The shallow groundwater gradient was estimated to be easterly, with a magnitude of 0.004 foot per foot (ft/ft), which is generally consistent with prior gradient estimates. The initial depth-to-water measurements from the new off-Site wells may indicate a tidal influence on groundwater elevations near the West Basin of the Los Angeles Harbor.

Gradient calculations based on the data collected during the August 2010 and subsequent sampling events indicate that there are apparent differences in flow direction between the shallow, intermediate, and deeper WBZs, as indicated in the table below and in Figure 3:

Table 3. Horizontal Gradient Calculations

Water Bearing Zone	Horizontal Gradient	
	Magnitude	Direction
Shallow Wells	0.004 ft/ft	east
Intermediate Wells	0.005 ft/ft	north-northeast
Deeper Wells	0.006 ft/ft	east-southeast

To evaluate possible vertical gradients between nested wells screened at different depths in the three areas investigated by the new wells, data from the recent monitoring event were input into the EPA *On-line Tools for Site Assessment Calculation - Vertical Gradient Calculator* website. The results for the three well clusters are shown in the table below.

Table 4. Vertical Gradient Calculations

Well Cluster	Well Pair	Water-Bearing Zone	Vertical Gradient	
			Magnitude	Direction
Location A (South of Building A)	MW-6R and MW-24	Shallow - Intermediate	2.72 ft/ft	up
	MW-6R and MW-20D	Shallow - Deep	0.017 ft/ft	up
	MW-24 and MW-20D	Intermediate - Deep	0.019 ft/ft	up
Location B (East of Building A)	MW-14R and MW-25	Shallow - Intermediate	1.99 ft/ft	up
	MW-14R and MW-21D	Shallow - Deep	0.002 ft/ft	up
	MW-25 and MW-21D	Intermediate - Deep	0.0004 ft/ft	down
Location C (North of Building A)	MW-10R and MW-22	Shallow - Intermediate	2.58 ft/ft	up
	MW-10R and MW-23D	Shallow - Deep	0.017 ft/ft	up
	MW-22 and MW-23D	Intermediate - Deep	0.029 ft/ft	up
Off-Site Wells – Southern Pair	MW-26 and MW-27	Shallow - Intermediate	0.029 ft/ft	down
Off-Site Wells – Northern Pair	MW-28 and MW-29	Shallow - Intermediate	0.012 ft/ft	down

Based on current and previous vertical gradient calculations for the well pairs in each cluster, a predominantly upward vertical gradient has been interpreted to be present in all three on-Site clusters. However, a slight downward gradient was noted using one well pair at Location B. The estimates of an upward hydraulic gradient are consistent with previous estimates of an upward vertical gradient between the shallow WBZ and the deeper WBZ in the on-Site wells. The initial results from the new off-Site wells indicate downward vertical gradients.

January 2014 Analytical Results

Shallow WBZ

TPH-GRO was detected in groundwater samples collected from shallow WBZ wells MW-9R, MW-10R, and MW-26 at concentrations of 127 µg/L, 14,900 µg/L, and 1,060 µg/L, respectively (Figure 5; Figure 6). TPH-DRO was detected in groundwater samples collected from well MW-10R at a concentration of 30,400 µg/L (Figure 6). 1,2-DCA, commonly used in the past as a lead scavenger in motor fuels, was detected in groundwater samples collected from well MW-9R at a concentration of 17.1 µg/L. Benzene was detected in groundwater samples collected from wells MW-9R and MW-10R at concentrations of 15.6 and 544 µg/L, respectively (Figure 5). Xylenes were detected in well MW-10R at a concentration of 70.1µg/L. The only other VOCs detected were ethylbenzene in MW-10R at a concentration of 603 µg/L; isopropylbenzene in MW-10R and MW-26 at concentrations of 35.9 µg/L and 18.3 µg/L, respectively; n-propylbenzene in MW-10R and MW-26 at concentrations of 20.4 µg/L and 21.2 µg/L, respectively; and 1,2-DCP in MW-8 and MW-26 at concentrations of 15.2 µg/L and 11.8 µg/L, respectively.

General minerals and natural attenuation parameters were also analyzed during the January 2014 sampling event. Dissolved methane was detected in most of the shallow WBZ wells. The results show that the samples with the highest concentrations of methane were from those wells that also had the highest concentrations of TPH, indicating that biological breakdown of hydrocarbons was occurring. Other natural attenuation indicators tested included nitrate, sulfate, and bicarbonate alkalinity. Non-detect concentrations of nitrate in samples from impacted wells suggest the occurrence of biochemical reactions that have reduced the concentrations of this substance, indicating the existence of oxidative bacterial breakdown of hydrocarbons. Relatively high concentrations of bicarbonate alkalinity in samples from TPH-impacted wells indicate the production of carbon dioxide, which is also likely associated with biological breakdown of hydrocarbons.

Based on the January 2014 inorganic analyses, water in the shallow WBZ continues to be generally sodium-calcium bicarbonate-chloride in nature. Water sample pH is near neutral. TDS concentrations range from 1,680 to 2,490 mg/L in the on-Site wells. TDS concentrations range from 724 to 793 mg/L in the off-Site wells. As indicated in the Stiff and Trilinear figures from the January 2014 sampling event, water chemistry in the shallow WBZ varies from well to well.

Groundwater information for the shallow WBZ from several monitoring wells in the southern portion of the Phillips 66 refinery was obtained from the most recent reports available on the GeoTracker database. The most recent sampling reported at the Phillips 66 property was conducted in April 2013 (Trihydro, 2013). Relevant data from this sampling event have been provided (Figure 7).

Intermediate WBZ

TPH-GRO was detected in samples collected from intermediate WBZ wells MW-24, MW-27, and MW-29 at concentrations of 102 µg/L, 4,590 µg/L, and 3,260 µg/L, respectively, in January 2014 (Figure 6). TPH-DRO was detected at a concentration of 26,900 µg/L in groundwater samples collected from well MW-24. TPH-ORO was detected at a concentration of 12,600 µg/L in groundwater samples collected from MW-24. These TPH-DRO and TPH-ORO concentrations are anomalous and inconsistent with historical data from MW-24. With the exception of monitoring well MW-24, TPH-ORO has not been detected in any previous groundwater samples from the Site well network. A workplan to evaluate the possible sources of this release and to conduct well repairs was submitted to the RWQCB on July 31, 2013.

Benzene was detected in samples collected from wells MW-24, MW-27, and MW-29 at concentrations of 33.4, 78.4, and 599 µg/L, respectively. Other VOCs detected were toluene in the sample collected from well MW-29 at a concentration of 29.4 µg/L; ethylbenzene in the sample collected from wells MW-25 and MW-29 at concentrations of 1.99 µg/L and 12.4 µg/L, respectively; xylenes in the sample collected from well MW-29 at a concentration of 20.8 µg/L. Additional VOCs present only in groundwater samples collected from well MW-24 include acetone at a concentration of 24.2 µg/L, 1,2-DCA at a concentration of 24.2 µg/L, and TAA at a concentration of 234 µg/L.

Some VOCs were reported only from the new off-Site wells. 1,2,3-trichloropropane and 1,2-DCP were found at concentrations of 233 µg/L and 4,000 µg/L, respectively, in groundwater samples collected from well MW-27. Additional VOCs present only in groundwater samples collected from well MW-29 include chlorobenzene at a concentration of 128 µg/L, 1,1-DCA at a concentration of 34.9 µg/L, 1,1-dichloropropene at a concentration of 11.4 µg/L, and TAA at a concentration of 234 µg/L.

Based on the results of groundwater sampling conducted since June 2009, chlorobenzene, 1,1-dichloroethane, and 1,1-dichloropropene have not been found in the on-Site wells. 1,2,3-Trichloropropane was detected in on-Site well MW-8 during the June 2009 sampling event, but has not been detected in any other on-Site groundwater samples since 2009. 1,2-DCP has been detected in MW-8 since June 2009, with generally decreasing concentrations ranging from 71.6 µg/L in June 2009 to 12.6 µg/L in June 2013.

As noted in the report of the initial sampling of the intermediate WBZ wells (SCS, 2010), it is likely that at least some of the COCs detected in samples in the intermediate WBZ are artifacts of the well installation process. This is supported by the fact that, during the second semiannual (June 2011) sampling event for the intermediate WBZ wells, concentrations of fuel-related CoCs were generally much lower (in some cases dramatically lower) than in the initial sampling event. Based on the results of the current sampling event, the trend of decreasing concentrations is generally continuing, with the exceptions of TPH-DRO and TPH-ORO in MW-24, which are considered anomalous.

TPH-GRO was detected in intermediate WBZ wells MW-22, MW-24, and MW-25 at concentrations from 208 µg/L to 11,400 µg/L in May 2012. TPH-DRO was detected at a concentration of 45,000 µg/L in well MW-24. TPH-ORO was detected at a concentration of 7,100 µg/L in well MW-24. These TPH concentrations are anomalous but may be explained by a surface release of hydrocarbons from a source, probably a truck, in the Building A parking lot. TPH-ORO has not been detected in any previous groundwater samples from the Site well network.

Aqui-Ver (2014) reviewed the MW-24 data and concluded:

> "MW-24 is an intermediate depth well, located in the truck loading area of the PDC (Figure 1, site plan). As seen by the chemical hydrograph for well MW-24 (Figure 2), benzene has been generally decreasing in concentration over time, while there has been a distinct more recent rise in diesel range organics (DRO) concentrations. Benzene is a compound of concern, DRO itself is not, so the key takeaway is the ongoing expected decline in benzene concentrations is consistent with the expectations of our 2011 work. It is noteworthy that these recent DRO concentrations are well above the solubility limits of diesel fuels (typically less than 6 - 15 mg/l solubility, API 2004), meaning that the results are emulsified and invalid as a quantitative dissolved-phase measure. Therefore the

> apparent dissolved-phase DRO increases may not in fact be present at levels reported by the lab. However, the increasing concentrations do indicate a change in conditions, and this is of potential concern given the location of MW-24 within the trucking operations area of the PDC. The most obvious source for a new occurrence of diesel at an intermediate groundwater depth at this location is the surface trucking operations. Given the historic nature of the subject plume beneath the PDC, and the absence of significantly changed hydraulics or other conditions, there is no expectation that this DRO increase is a result of natural fate and transport processes, but rather a new and presumably short-term pulse from surface runoff infiltrating the well box. It is always problematic to have direct conduits to the aquifer under conditions where there are surface sources that can add contaminants, which are fundamentally low mass artifacts imprinted on the broader historic plume.
>
> "Given the overarching recommendation of our work, which is for site closure, it is recommended that this well and others within the operations footprint of the PDC be destroyed, as chemical and gauging trends over the years are well controlled, and the risk of having these wells remain is greater than the value of maintaining these locations."

Prior to the December 2010 sampling event, fuel oxygenates had been absent from the Site monitoring wells during the previous two years, with the sole exceptions of two detections in samples collected from MW-9R. The presence of TBA in the initial samples at a concentration of 65.3 µg/L in MW-24 and a concentration of 139 µg/L in MW-25 are the possible result of the well drilling process, as discussed above, during which the oxygenates, along with other CoCs, may have been transported into deeper groundwater. In particular, this may be the case because drilling occurred through free product (or highly impacted zones) in the shallow WBZ in both of these wells. TBA was not detected above the laboratory reporting limit in the intermediate WBZ wells during the January 2014 sampling event.

Based on the results of the initial sampling of the new off-Site intermediate WBZ wells MW-27 and MW-29, the reported concentrations of total dissolved solids, chloride, sodium, and sulfate are much higher than those reported for the on-Site intermediate WBZ wells. The reported concentrations of these constituents indicate that the intermediate WBZ groundwater in the downgradient area of MW-27 and MW-29 would be described as brackish or saline.

Deeper WBZ

With the exception of a TPH-DRO concentration of 2,710 µg/L in the sample collected from monitoring well MW-20D, no TPH or VOCs (including fuel oxygenates) were detected in samples collected from the deeper WBZ wells MW-20D, MW-21D, and MW-23D (Figure 6).

During the January 2014 sampling, dissolved methane was not detected above the laboratory reporting limit in the deeper WBZ wells.

Based on the January 2014 samples collected from these three wells, water in the deeper WBZ is predominantly sodium-calcium chloride in character with a near-neutral pH. Concentrations of TDS in the samples collected from MW-20D, MW-21D, and MW-23D were 1,410 mg/L, 10,900 mg/L, and 1,390 mg/L, respectively. The TDS concentration of 10,900 mg/L in MW-21D would be described as brackish or saline.

Forensic Geochemistry

Due the unusual composition of chemicals detected during the recent monitoring of the newly installed downgradient monitoring wells, SCS retained Zymax Laboratories (Zymax) to conduct forensic analysis of groundwater samples collected in February 2014 to assess the chemical composition, or "fingerprint" of the chemicals in each of the wells. In particular, the analysis was intended to assess whether the results reported for off-Site wells are consistent with the on-Site source area or release, in addition to assessing whether the off-Site well data are consistent from well pair to well pair.

Therefore, the design of the sampling program included the collection of a groundwater sample from MW-10R, a well-known to have elevated concentrations of dissolved CoCs and near the downgradient Site boundary, and the southern off-Site well cluster MW-26/MW-27, and the more northern off-Site location MW-29. It should be noted that MW-28 was not included for analysis since there are very low or no detectable concentrations of CoCs in groundwater samples collected from this well.

After appropriate purging, four groundwater samples from monitoring wells MW-10R, MW-26, MW-27, and MW-29 were analyzed by Zymax for characterization and comparison of petroleum products in the sample. The following analyses were performed:

- C3-C10 gasoline range hydrocarbon concentration by gas chromatography/mass spectrometry (GC/MS)
- Fuel oxygenates by GC/MS
- C10-C40 alkane analysis by GC/MS

The complete Zymax report, including laboratory data, is presented as Appendix C to this Report and an excerpt is presented below, with emphasis added in ***bold italic*** face to highlight discussion points:

> "The C3-C10 gasoline range concentrations in the samples are shown in the Appendix, and are displayed as bar diagrams in the following pages. MW-10R, shown on p.7, contains a suite of hydrocarbons that is dominated by cycloalkanes, but contains small concentrations of trimethylpentanes, which are alkylate hydrocarbons that are blended into gasoline to increase octane levels. The BTEX components are dominated by benzene and ethylbenzene, which is characteristic of degradation in an anaerobic environment (Chapelle, 2001).
>
> **"MW-26 and MW-29**
>
> ***The bar diagram of MW-26 on p.7 shows a similar distribution to MW-10R*** up to C8. Benzene and ethylbenzene, however, are in much lower concentrations in MW-26, which would be consistent with the dissolved hydrocarbon plume migrating into a more aerobic environment, which would promote the degradation of the benzene and ethylbenzene.

The concentrations of the C3-benzenes and C4-benzenes are relatively higher in MW-26, and may reflect input from another source.

"The bar diagram of MW-29 on p.8 shows a very different hydrocarbon distribution, which is dominated by benzene and a methylpentene. In addition, in comparison with MW-26, the distribution of methylpentanes (identified as horizontal line 1) is different, and the concentrations of the dimethylcyclopentanes (horizontal line 2) are considerably lower. The relative concentrations of the BTEX compounds in MW-29 reflect their solubility in water and represent a relatively undegraded dissolved gasoline plume. MW-29 also contains DIPE (7 µg/L), a fuel oxygenate that was not detected in any other samples. ***These differences in the hydrocarbon and additive compositions indicate that the gasoline in MW-29 is not sourced from MW-10R.***"

"MW-27

In the bar diagram of MW-27 on p.9, benzene is dominant, with very small concentrations of other hydrocarbons. Ethylene dichloride (EDC) was also detected, which is probably associated with the other chlorinated solvents, dichloropropane and trichloropropane, that were detected in the sample, as shown in the Appendix. Dichloropropane is an intermediate in the production of tetrachloroethene and other chlorinated chemicals (Rossberg et al, 2006). Historically, trichloropropane has been used as a paint or varnish remover, a cleaning and degreasing agent, and in the production of pesticides. Currently, it is also being used as a chemical intermediate in the process of making chemicals such as hexafluoropropylene and polysulfides and as an industrial solvent (Cooke, 2009). Tetrahydrofuran, an industrial solvent, was also detected in MW-27. The minor hydrocarbon constituents in MW-27 are in such small concentrations that it is difficult to make any reliable correlation to the other samples. ***However, the BTEX distribution more closely resembles the distribution in MW-29 than MW-26, suggesting that in MW-27 the BTEX compounds in particular are probably derived from the same source as MW-29.***

"MW-10

The C3-C10 gasoline range concentrations in the samples are shown in the Appendix, and are displayed as bar diagrams in the following pages. MW-10R contains a suite of hydrocarbons that is dominated by cycloalkanes, but contains small concentrations of trimethylpentanes, which are alkylate hydrocarbons that are blended into gasoline to increase octane levels. The BTEX components are dominated by benzene and ethylbenzene, which is characteristic of degradation in an anaerobic environment (Chapelle, 2001). The bar diagram of MW-26 on the following page shows a similar distribution to MW-10R up to C8. Benzene and ethylbenzene, however, are in much lower concentrations in MW-26, which would be consistent with the dissolved hydrocarbon plume migrating into a more aerobic environment, which would promote the degradation of the benzene and ethylbenzene. The concentrations of the C3-benzenes and C4-benzenes are relatively higher in MW-26, and may reflect input from another source.

"The C10-C40 GC/MS alkane chromatograms are shown on pp.7-9. MW-10R contains a suite of hydrocarbons from 20 min to 55 min retention time in the carbon range C10-C24, which is the range of diesel and #2 fuel oil. Isoalkanes are dominant, with no evidence of n-alkanes, which are dominant in fresh diesel and #2 fuel oil, but are the most readily biodegraded hydrocarbons.

"The peaks up to 20 min retention time represent volatile hydrocarbons. There is no evidence of this diesel/#2 fuel oil in MW-26, MW-27, or MW-29. In MW-26, there is, in addition to the volatile hydrocarbons up to 30 min retention time, unidentified material from 45-50 min and a suite of n-alkanes from nC25 to nC35; this represents a small amount of petroleum wax from an unknown source. In MW-27, the only alkanes identified were from petroleum wax. MW-29 also contained a small amount of petroleum wax. A large peak, identified as $C_{10}H_{15}NO_2S$, probably represents n-butylbenzenesulfonamide, which is widely used as a plasticizer in polyacetals, polyamides, and polycarbonates, and has been found in ground water and effluent from wastewater treatment sites."

The Zymax report goes on to draw the following conclusions:

- "Water sample MW-10R contains dissolved hydrocarbons that most likely represent degraded gasoline.
- MW-26 contains a similar gasoline, and some heavier aromatic hydrocarbons, probably from another source.
- MW-29 contains a different gasoline with the fuel oxygenate DIPE. This gasoline is from a different source than MW-10R.
- The dissolved gasoline in MW-27 appears to be more similar to MW-29, and is probably from the same source as MW29.
- MW-10R also contains degraded diesel or #2 fuel oil that was not detected in MW-26, MW-27, or MW-29."

These data and conclusions suggest that while the gasoline range petroleum hydrocarbons in MW-26 are consistent with MW-10R and an on-Site source, the CoCs detected in other wells are, in general, not and are consistent with a distinct or separate source of release. Furthermore, the results from the intermediate zone wells, while consistent with one another, are not consistent with the detected CoCs in the shallow zone wells and suggests another source or sources of release, unrelated to the CoCs detected in on-Site wells.

5.4.6 Discussion

Based on piezometric mapping (Figure 5), groundwater flow in the shallow WBZ is generally towards the east and northeast. This is consistent with historical results. Water elevations in wells at the Site have generally fluctuated within a range of approximately 0.5 to 1 foot since 2002. However, an increase in groundwater elevations was observed in all of the on-Site wells during the January 2014 monitoring event.

Groundwater flow in the shallow WBZ was northeasterly, with a gradient ranging from 0.0020 to 0.0065 ft/ft during previous monitoring events, but the January 2014 gradient calculations indicate an easterly flow direction. The January 2014 flow directions for the intermediate and deep WBZs are generally similar to those of the previous monitoring events. Vertical gradients, calculated for the last 10 monitoring events, generally show an overall upward hydraulic gradient. Downward vertical gradients, between the shallow and intermediate WBZs, were observed in the initial monitoring of the new off-Site wells pairs.

In general, the laboratory results for the on-Site wells for the shallow WBZ are consistent with those from previous sampling events. However, the results from the new off-Site wells screened in the shallow and intermediate WBZs are not consistent with the results from the previous wells in the area, MW-12 and MW-13, which were destroyed in 2009. Detectable concentrations of TPH and other chemicals in the new wells may be related to residual impacts during well installation or may be related to upgradient sources, such as the nearby Phillips 66 refinery. Some CoCs reported from samples collected from the new off-Site wells have not been reported from the on-Site wells, such as chlorobenzene, 1,1-DCA, and 1,1-dichloropropene. The chemical 1,2-DCP was reported at a concentration of 4,000 µg/L in the sample from MW-27. This CoC has not been detected, with the exception of minor concentrations in well MW-24, in the samples collected from any on-Site intermediate WBZ wells since June 2009. The distribution of the CoCs in the off-Site wells may be suggestive of off-Site sources. It is likely that future groundwater sampling in the new wells will help to resolve the issues.

With the exception of the recent detection of TPH-DRO and TPH-ORO in MW-24, the CoCs that have been detected in wells screened in the intermediate WBZ, we believe, are at least partially attributable to the drilling and well installation process, as previously noted.

With respect to the deeper WBZ, CoCs were not, and have not ever been (with the exceptions of the 1,2-DCA detected during the May 2012 sampling event in the sample collected from well MW-20D, and the TPH-DRO detected during the June 2013 and January 2014 sampling events in the samples collected from well MW-20D), detected in MW-20D and MW-21D. While TPH-GRO and related CoCs were detected initially in MW-23D, the concentrations have decreased by several orders of magnitude since then, and no CoCs were detected in the last five sampling events. We believe that the detected CoCs were principally the result of, or an artifact of, the drilling activities. The January 2014 analytical results indicate that, with the exception of TPH-DRO in MW-20D, CoCs are not present at detectable concentrations in the deeper WBZ.

Neither TBA nor TAA was detected in any of the deeper WBZ wells. Given that these deeper WBZ wells are located in areas where free product (or elevated concentrations of TPH-GRO) is present in the shallow WBZ, the continued absence of TBA and TAA in the deeper WBZ indicates that vertical migration of fuel oxygenates to the deeper WBZ is not occurring. This lack of migration is consistent with the generally upward vertical hydraulic gradient present at the Site.

A concentration map is included for benzene in the shallow WBZ (Figure 7). The current concentration maps are similar to maps included in previous monitoring reports, indicating that the lateral extent of CoCs at the Site is generally stable. During the previous four monitoring events, the measured free product thickness has been generally similar in wells MW-14R and MW-19R.

In general, concentrations of CoCs detected in the January 2014 samples are similar to those in the recent past and discussed in the *Groundwater Monitoring Report, First Semiannual 2013* (SCS, 2013b); however, as would be expected, there is some fluctuation from one monitoring event to the next. In addition, the detection of TPH-DRO and TPH-ORO in MW-24 after two sampling events with no detected concentrations of these CoCs cannot be explained and is considered anomalous.

A series of concentration over time graphs for these wells was provided in the *Groundwater Monitoring Report, Second Semiannual 2013* (SCS, 2014) (Appendix D). The purpose of these graphs is to illustrate trends in analytical data, which can be useful in interpreting whether natural attenuation is taking place in the subsurface. The hydrograph for each well was also plotted on these graphs for reference purposes and to help evaluate whether groundwater elevation fluctuations are influencing COPC concentration trends. Based on a qualitative review of the current data, there are no apparent correlations between variations in COPC concentrations and variations in groundwater elevations.

Additionally, the linear-regression trendlines of the CoCs are depicted on each hydrograph, as appropriate, with the calculated square of the sample correlation coefficient (R^2). The R^2 value indicates the *goodness-of-fit* of the trendline to the dataset. In general, an R^2 value between 0.7 and 1 would be a *good to excellent* fit, between 0.4 and 0.7 a *moderate* fit, and below 0.4 would be a *poor* fit. For illustration purposes, samples with no detectable concentrations were plotted at half the reporting limit for the respective analyte. A summary of the R^2 values for TPH-GRO, TPH-DRO, and benzene are presented in the following table with R^2 values for the remaining detected analytes provided on the hydrographs. In general, decreasing or stable COPC concentration trends were noted in all wells. However, R^2 values for wells MW-8 and MW-9R indicate poor data fits for linear-regression methods. Different statistical methods may be necessary (e.g., Kendall-Thiel) to properly evaluate these trendlines.

Table 5. Trendline Statistical Values

Well	TPH-GRO R^2 (linear-regression trendline)	TPH-GRO R^2 Value	TPH-DRO R^2 (linear-regression trendline)	TPH-DRO R^2 Value	Benzene R^2 (linear-regression trendline)	Benzene R^2 Value
MW-5R	Decreasing*	0.89	Stable*	0.04	Decreasing*	0.31
MW-8	Decreasing*	0.32	Stable*	0.01	Not Detected	--
MW-9R	Decreasing	0.14	Stable*	0.04	Decreasing	0.14
MW-10R	Decreasing	0.41	Decreasing	0.005	Decreasing	0.79

Notes
* = CoCs not detected in current sampling
R^2 = square of the sample correlation coefficient
-- = not applicable

Wells monitored since at least the early 1990s (MW-8, MW-12, and MW-13) have shown overall increasing groundwater elevations of several feet, with an approximate 2-foot increase between 2001 and 2002, which appears to be the result of a change in vertical survey datum.

Water in the shallow WBZ is generally sodium-calcium bicarbonate-chloride in nature and, for on-Site wells, of relatively high TDS (1,930 mg/L mean TDS for on-Site shallow WBZ wells sampled). The mean TDS for the off-Site shallow WBZ wells is 759 mg/L.

Water quality in the intermediate WBZ is characterized by elevated TDS, and has TDS levels ranging from brackish to those consistent with sea water.

With the exception of TPH-DRO detected in MW-20D, neither TPH nor VOCs (including fuel oxygenates) was detected in samples from the deeper WBZ wells. Water in the deeper WBZ is different in chemical character with evidence of brackish (10,900 mg/L TDS in MW-21D) groundwater quality and an average TDS that is higher than in the shallow WBZ. A generally upward hydraulic gradient between the WBZs indicates that CoCs are unlikely to migrate downward from the shallow to the deeper WBZ.

5.5 LNAPL INVESTIGATION RESULTS

5.5.1 Interpretation of Subsurface Lithology and Lithologic Trends

The CPT investigation of LNAPL was conducted at the Site in response to RWQCB requirements. The goal of a CPT investigation is to identify *in situ* soil types and assess subsurface stratigraphy that can then be used in developing an overall understanding of the presence, fate, transport, and remediation potential of CoCs. Parameters measured by the piezocone are used to determine the soil behavior types (SBT), particularly cone resistance and friction ratio.

Diagrammatic cross-sections of the Site based on CPT data SBT logs indicate that the vadose zone is generally silty sand to coarse sand. As discussed in in the CPT report, the SBT logs may overestimate the amount of coarse-grained materials present (SCS, 2011b). The logs show a general increase in the amount of fines present at a depth of about 60 to 80 feet bgs, an interval in which CPT refusal was often encountered. It is likely that these fine-grained soils produced an increased friction load on the CPT probe, which eventually caused refusal.

The SBT logs for locations north of Building B (CPT-6 and CPT-7) and south of Building A (CPT-14, CPT-4, and CPT-13) all show predominantly fine-grained materials with a thin-bedded appearance. In the area south of Building A, only CPT-18 shows a predominance of sandy SBT classes. However, the lithologic log from MW-20D located close to CPT-18 suggests the presence of more silty lithologies than those indicated by the SBT log.

In summary, the CPT data indicated:

- Drilling conditions were generally difficult, with frequent refusal of the CPT borings prior to reaching their targeted depths below the water table, and coring attempts with the CPT method were unsuccessful in collecting soil samples from the saturated zone of the shallow WBZ.
- The upper portion of the vadose zone is generally sandy, while the lower part of the vadose zone and the strata beneath the water table are generally fine-grained silts and sandy silts.
- The amount of coarser-grained sand may be overestimated by the SBT lithologies interpreted from the CPT data.

SBT logs of the CPT borings show bedding features not generally recognized in core samples from the Site, particularly the presence of alternating thin beds of fine-grained deposits in the lower part of the stratigraphic section analyzed.

5.5.2 ROST Interpretation

General Methodology of CPT/ROST Borings and Interpretation of Logs and Trends

The second phase of the CPT investigation involved the use of a more powerful CPT rig to push a combination probe consisting of the CPT piezocone and a ROST sensor. The goal of the combination CPT/ROST borings was to evaluate the extent of LNAPL and to identify the distribution of the LNAPL relative to various lithologic types.

The CPT/ROST probe was advanced to refusal, with a goal of reaching 40 feet below the water table or about 140 feet bgs (the intermediate WBZ). This goal was achieved in only a few of the CPT/ROST borings due to refusal, but some of the borings did extend at least a short distance into the saturated zone.

The data from the borings that met refusal in the vadose zone are valuable in interpretation of the overall stratigraphy of the Site (SCS, 2011b). Some of the field-assigned boring labels of "ROST" were changed to "CPT" for their final designations on figures and tables.

The first series of combination CPT/ROST borings were placed around each of the three Site wells that have consistently contained LNAPL during groundwater monitoring events. The intention of these borings was to get a baseline indication of the ROST method's ability to recognize the distribution and composition of the hydrocarbons near a known area of LNAPL. Although the presence of LNAPL was known in the three wells, it was hoped that the ROST logs would help to identify the vertical distribution of hydrocarbons in enough detail to show relationships between the LNAPL and the subsurface stratigraphy and hydrogeologic conditions, and to allow the correlation of the hydrocarbon response with the soil categories identified by the CPT probe.

ROST reflectance values are generally less than 5 to 10 percent, suggesting the presence of LNAPL is relatively small quantities. However, there are some intervals of relatively high reflectance (greater than 20 percent) near the present water table and in the submerged portion of the shallow WBZ (Figures 11 and 12). In some ROST logs, there is an apparent "smear zone" of petroleum hydrocarbon-bearing soils from about the present water table to a depth of about 10 to 15 feet below the water table, likely due to past variations in groundwater levels and the generally higher water table elevations currently observed in the Site wells.

In summary, the ROST data indicated the following:

- The ROST reflectance values are generally low (from 0 to 3 percent) for the stratigraphic section investigated which means that LNAPL was generally not detected.
- Some spikes of relatively higher reflectance (greater than 20 percent) were noted in both the vadose zone and below the water table, characterized by thin layers of LNAPL associated with thin-bedded, fine-grained strata, as indicated by the SBT logs generated from the CPT response.

- The area north of Building B appears to contain limited potential for the presence of LNAPL based on the weak ROST response in the interval around the water table.

- The area south of Building A appears to have a two-layered distribution of hydrocarbons based on the ROST logs, with an upper layer starting at the water table and a deeper zone at about 10 to 15 feet below the water table.

A small area at the east side of Building A was found to have a very high reflectance response in a single ROST log ,CPT-21, with two layers located at a significant depth below the water table (Figure 12).

5.5.3 Laboratory Data

Sampling and Analysis Methodology

The ROST and CPT data alone do not allow for a direct field measurement of LNAPL saturation or hydrocarbon mobility. Therefore, additional soil and LNAPL data are required to evaluate the significance of the ROST reflectance and better understand actual LNAPL distribution and composition. Such data include LNAPL fluid physics data, LNAPL chemistry, *in situ* fluid saturation data, and soil-fluid interaction properties.

Soil borings were drilled with the CPT method and also by hollow-stem auger methods in an attempt to collect suitable soil core samples for laboratory analysis. The few core samples collected from the vadose zone by CPT methods in September 2010 represented the deepest strata that could be reached by the CPT coring, which was not successful in sampling at or below groundwater. A second attempt to collect core samples using a larger CPT truck in October 2010 was also unsuccessful. It was necessary to remobilize to the Site on December 13, 2010, with a CME75 hollow-stem auger rig, provided by Cascade Drilling, in order to collect core samples from the saturated zone.

The hollow-stem auger borings and soil samples were selected from specific depth intervals based on the information obtained from the CPT/ROST borings and logs. Core intervals were selected in intervals of uniform lithology and, when possible, strong ROST response. One core drilling location was placed at each of the three general areas of investigation.

LNAPL and Dissolved-Phase Chemistry

Free product chemistry was analyzed during a previous phase of work at the property (Jones, 2002). The carbon-range distribution of samples collected was interpreted to represent two different product types. The sample from MW-6R appeared to contain a distinct kerosene (Fuel Oil #1) pattern with hydrocarbons in the range of C4 through C17. The sample collected from well MW-14R resembled Jet A fuel, with most of the hydrocarbons in the C6 to C15 range. Some gasoline was noted to be present in both samples and was estimated to comprise 10 to 15 percent of the sample from MW-14R but was estimated at less than 5 percent of the sample from MW-6R. Due to the age of the releases, it is possible that much of the product represents "weathered" gasoline as a result of biodegradation/attenuation over many years. Such weathered gasoline may not be recognized by the ROST probe.

Soils chemical data collected during previous well installation activities are available for a wide range of samples (most recently, the samples from the four new monitoring wells and the core samples from the CPT investigation), and the dissolved-phase petroleum hydrocarbon chemistry is represented in numerous groundwater sampling events (Figure 6). The current series of groundwater sampling events began in 2002 with the "replacement" wells installed after completion of Site grading for redevelopment. Only a few of the previous groundwater wells were included in the well network, and two of these previous downgradient wells (MW-12 and MW-13) were destroyed under permit in 2009.

The groundwater monitoring results indicate that gasoline-range hydrocarbons dominate the dissolved-phase constituents, with diesel-range hydrocarbons present in two wells (MW-10R and MW-24). Oil-range hydrocarbons are not present in detectable concentrations.

Fluid Saturations

Understanding the characteristics of pore fluid behavior is critical in determining the potential for remediation. Core samples collected from the soil borings were analyzed for fluid saturation parameters and chemical composition. The fluid (LNAPL) type and soil physical properties determine whether the fluid is potentially recoverable using conventional groundwater remediation methods. While precautions were taken in the field to reduce loss of fluids during the coring and sample handling, some reductions are to be expected in any sampling procedure.

Residual saturation refers to the amount of immobile fluid, such as water or hydrocarbon, in a soil, i.e., the saturation level below which fluid drainage will not occur. The Modified American Society for Testing and Materials (ASTM) D425M/Dean-Stark analyses are used to bracket the expected residual saturation values, for possible use in modeling. The laboratory method applies centrifugal force of 1,000 times the force of gravity for 1 hour to reach an approximation of the field residual saturation of LNAPL. This test is essentially a simulation of the conditions created by an induced hydraulic gradient, such as might be created during hydraulic remediation efforts, and may also be used in calculating recoverable LNAPL.

The laboratory measured water and LNAPL saturations from the ASTM D425M/Dean-Stark pore fluid saturation tests were reported as a percentage of the total porosity of the soil (pore volume). The measured LANPL initial saturations for these tests ranged from 2.7 to 14.2 percent pore volume (Pv) for samples at or below the water table. The previously measured saturations for the two deep wells MW-20D and MW-21D do not appear to be representative. An initial NAPL saturation (by API RP 40) of around 3 percent was indicated in the capillary fringe sample CPT-1-85.0. The initial and final LNAPL saturation values for the core samples collected by SCS in December 2010 are shown in Table 6 below:

Table 6. Initial and Final LNAPL Saturation Values

Sample Number	Grain Size (mean)	NAPL Saturation ASTM D425/Dean-Stark: Initial	NAPL Saturation ASTM D425/Dean-Stark: Final (after centrifuge at 1,000xG)	Estimate of Percent Recoverable NAPL
SCS-B1-99.0'	very fine-grained sand	7.0	7.0	0

Sample Number	Grain Size (mean)	NAPL Saturation ASTM D425/Dean-Stark		Estimate of Percent Recoverable NAPL
		Initial	Final (after centrifuge at 1,000xG)	
SCS-B2-98.0'	very fine-grained sand	14.2	8.2	42
SCS-B2-112.0'	silt	7.5	6.2	17
SCS-B3-91.0'	Medium-grained sand	7.7	5.9	23
SCS-B3-107.0'	very fine-grained sand	2.7	2.7	0

The percentage of recoverable LNAPL based on the ratio of the initial to final NAPL saturations is 0 in two samples and reaches a maximum of 42 percent in SCS-B2-98.0'. The mean percent recoverable is 16 percent for these samples.

The residual saturation results from SCS-B2-98.0' suggest that a significant percentage of the LNAPL present in this sample could be removed by hydraulic methods. However, because the initial LNAPL saturation value of this sample was only 14.2 percent, even an optimistic estimate for hydrocarbon recovery would result in a relatively low mass of mobile LNAPL.

5.5.4 Lithology and Its Influence on LNAPL Distribution

Despite serious difficulties encountered during the implementation of the CPT investigation, important information was obtained about Site geology and the distribution of LNAPL. Some of this information about the LNAPL could not have been obtained without the application of ROST methods. Even though the data obtained from the saturated zone of the shallow WBZ was not as extensive as had been anticipated, there is sufficient new information that improves our understanding of the LNAPL distribution at the Site and the fate and transport of CoCs in the subsurface.

The CPT borings have revealed stratigraphic trends not previously identified in core sampling at the Site. The SBT logs show a generally sandy upper part of the vadose zone, underlain by a predominantly very fine-grained sand and silt interval starting at a depth of about 60 feet bgs and extending into the saturated zone. The SBT logs also suggest a great degree of variability in the generally fine-grained units. The thin-bedded aspect of the fine-grained units shown on the SBT logs indicates more small-scale lithologic heterogeneity than has been recognized from core sampling.

The CPT data indicate that the Site lithologies consist of interbedded silty sand, fine sand, and silts. As seen in core samples collected during the installation of groundwater monitoring wells, both coarse sands and clays are rare at the Site. The lithologic composition of the strata beneath the Site is generally consistent with deposition in a low energy coastal environment, possibly in a deltaic setting with associated tidal channels and strandlines. The very distinctive, heavily burrowed sand layer encountered at a depth of around 140 to 145 feet bgs in borings for the recently installed groundwater monitoring wells may represent the base of this fine-grained sequence. Such burrowed layers often represent a period of relatively low sedimentation rates, such as would be present in a shallow marine embayment prior to filling with the deltaic coarsening-upward "bayfill" deposits. Coarse-grained channel deposits would tend to be absent due to the lack of streams capable of carrying coarse materials. As a result of the depositional environment, the entire stratigraphic section investigated consists of predominantly fine-grained soils that will not be conducive to fluid migration.

5.5.5 LNAPL in Soil Samples and Its Relationship to Residual Saturation

Unfortunately, the Site raw ROST reflectance values are not easily translated into LNAPL field saturation quantities. At a nearby site (the Phillips 66 Carson refinery), statistical modeling of a large data set allowed a determination of the relationship between ROST total fluorescence values and the presence or absence of LNAPL impacts (Trihydro, 2008a).

The lower limit of 3 percent intensity was determined to indicate the presence of LNAPL in the pore spaces. The modeling also indicated that the ROST intensity values between 3 and 50 percent suggested the presence of LNAPL at or above residual saturation, depending on the lithology and type of product. The 2008 Trihydro report for the Phillips 66 Carson refinery concluded that ROST intensities greater than 50 percent indicate significant LNAPL impacts that could potentially be recovered by conventional methods.

5.5.6 ROST Indications of Vertical and Lateral Distribution of LNAPL

The ROST reflectance data show that little LNAPL is present in the vadose zone, with the possible exception of an area near well MW-20D south of Building A. Based on the ROST logs of the saturated zone, there is an interval of low to moderate ROST response extending downward from the current water table for a vertical distance of around 15 to 20 feet. In some logs, there are two distinct areas of LNAPL impact within this "smear zone" (Figures 11 and 12). The ROST data indicate that the capillary fringe associated with the current groundwater table does not appear to contain LNAPL, although core samples and field instrument readings indicate the presence of petroleum hydrocarbons in soil above the water table. A few of the ROST borings were able to reach below the interpreted LNAPL zone to strata with no measurable reflectance response.

Assessment of the lateral distribution of LNAPL was hampered by the lack of ROST data in some areas of the Site. The area between Buildings A and B appears to have a gasoline range or possibly kerosene range LNAPL zone beneath the water table in the area around monitoring well MW-6R (Figure 11). Although the ROST reflectance values are relatively high in this area, the reflectance decreases toward the south and east. The presence of Building A to the north of monitoring well MW-6R prevented the placement CPT/ROST borings to evaluate the northward extent of the submerged LNAPL zone.

On the east side of Building A, the CPT/ROST borings were hampered by shallow refusal at most locations. One ROST-only boring (CPT-21), located in the northern portion of the employee parking area, showed a very strong reflectance response suggesting the presence of diesel-range LNAPL (Figure 12). Unfortunately, assessment of this part of the Site was constrained by the limited space available for drilling due to the presence of steep-paved or landscaped slopes and several utilities (Figure 10).

5.5.7 Petrophysical and Chemical Data in Interpretation of ROST Results

The interpretation of the CPT and ROST data is aided by the physical and chemical laboratory analyses of soil core samples collected from locations selected primarily on the basis of ROST reflectance results.

At most locations, there are sharp ROST spikes associated with fine-grained strata indicated by the CPT logs. Although these fine-grained intervals appear to contain LNAPL, their small pore spaces (as confirmed by grain size analysis) would make LNAPL recovery difficult because it would tend to be held by the strong capillary forces in the fine soils. Also, there may be relatively little LNAPL impact, based on the low free product thickness currently measured in existing wells.

Although the ROST reflectance rarely exceeds 5 to 10 percent, most of the higher values appear to be in thin-bedded, fine-grained intervals in the saturated zone. Such lithologic heterogeneity, by itself, creates serious difficulties in recovering LNAPL because of problems regarding the prediction of LNAPL behavior and the potential effects on well capture zones. This geologic heterogeneity has a marked impact on the relative permeability and effective conductivity of LNAPL.

The predominantly fine-grained composition of the saturated zone also has a strong influence on the mobility of water and LNAPL. The capillary pressure data indicate that water is difficult to remove from the low porosity, fine-grained soils of the saturated zone. This relatively high water saturation prevents the LNAPL from moving through pores, so the LNAPL present within these fine soils will likely be impracticable to remove using conventional methods. Also, hydraulic recovery wells in the fine-grained soils are not likely to be very effective due to locally induced reductions in saturation near the wells.

This remaining water would be expected to interfere with the movement of LNAPL through the small pore throats of the fine-grained rock, leading to an "entrapment" of the LNAPL. As noted by Huntley and Beckett (2002):

> "For the same capillary pressure conditions, LNAPL saturations are substantially smaller in fine-grained soils than in coarse-grained soils, all other things being equal. This effect combines with the low intrinsic permeability of fine-grained soils to produce very low mobility and potential recovery in fine-grained materials. When the regional groundwater flow and volatilizations from the fine-grained materials is small, the lifespan of LNAPL in these materials can be long."

5.5.8 LNAPL Recovery

Residual LNAPL saturation measured for selected core samples at each of the three areas of investigation at the Site suggest that the mass of LNAPL present is not large and that much of it is not likely to be recoverable by conventional methods. As noted by Huntley and Beckett

(2002):

> "Residual saturation is the smallest saturation remaining in the formation against hydraulic recovery and is the theoretical endpoint of LNAPL hydraulic recovery. It is also a highly optimistic endpoint because real hydraulic variability, well efficiency, well interference, aquifer heterogeneity and other factors all combine to diminish actual recovery and leave more LNAPL in the formation."

Only a few core samples showed a significant decrease from initial to final LNAPL saturation. Combined with the likelihood of the entrapment of the remaining LNAPL in the fine-grained soils of the saturated zone, these factors will likely result in low recovery. Based on our experience and a review of published literature, the LNAPL present within these heterogeneous fine-grained soils of the saturated zone is not likely to be practicable to remove using conventional methods.

While the submerged LNAPL remains a source of dissolved CoCs, the LNAPL is likely stable due to the entrapment phenomena in the saturated zone. Moreover, groundwater data collected over the past 20 years and modeling results presented in the conceptual site model (CSM) (SCS, 2009b) indicate that the dissolved phase CoCs plume is generally stable with limited dissolved-phase CoC migration.

5.5.9 Extent of CoCs in Groundwater

Dissolved-Phase CoCs in Groundwater – Lateral Extent

Dissolved and phase-separated hydrocarbons have been detected in a number of intermediate WBZ wells at the Site. However, the lateral extent of both the dissolved phase CoCs and areas where LNAPL accumulates in wells are bounded or can be inferred by on-Site and Phillips 66 wells and appear to be remarkably stable, based on a comparison of historical and current groundwater quality data. This conclusion is further supported by other lines of evidence including "fate and transport modeling," as described in a subsequent section of this Report.

Dissolved-Phase CoCs in Groundwater – Vertical Extent

The vertical extent of CoCs at the Site has been assessed based on sampling data from monitoring wells installed in the deeper WBZ. These wells were installed in areas proximate to shallow wells with known and reported LNAPL accumulations and are likely representative of "high-risk" areas for vertical migration at the Site. The lack of impacts to the deeper WBZ is supported by an upward vertical hydraulic gradient that has been observed between the deep and shallow wells. In particular, fuel oxygenates including MTBE, TBA, and TAA have never been detected in the groundwater samples from the deeper WBZ.

Phase-Separated Hydrocarbons

Based on SCS' review of current and historical groundwater monitoring data, the areas where free product accumulates in monitoring wells appears stable and consistent and is limited to a few wells.

More recently, as previously described, modeling was conducted by Aqui-Ver, Inc. (AVI) to assess the LNAPL hydraulic conductivity and velocity (AVI, 2011). AVI concluded that the potential for LNAPL migration, as measured by velocity, is extremely limited (less than 1 foot per year (ft/year).

Off-Site Downgradient Wells

AVI (2014) reviewed the laboratory and forensic geochemical data for the new off-Site wells and concluded:

> "Recent work by SCS included installation of new off-Site and down gradient wells relative to the PDC site. An intermediate zone well furthest down gradient, MW-29, exhibited unexpected petroleum impacts (Figure 1, Site Plan; SCS 2014), based on the conceptual site model and expected transport conditions.
>
> "Advanced forensic evaluations by Zymax Laboratories, and a review by their Senior Geochemist Dr. Alan Jeffrey (attached hereto), show that the impacts at well MW-29 bear no resemblance to, and could not have come from, the PDC area plume. For instance, a diagram of the paraffins, isoparaffins, aromatics, naphthenes, and olefins (PIANO; Figure 3) of MW-29 as compared to onsite well MW-10R shows the highly distinct differences in these petroleum products. There is also a poor correlation in the gas chromatographic response between these locations (coefficient of correlation = 0.29; Figure 4). Given these observations, and those of Dr. Jeffrey, it is chemically definitive that MW-29 is unrelated to the PDC site plume.
>
> "In addition to that straightforward line of forensic chemistry evidence, there are other supporting observations for this conclusion. First, as shown in Figure 5, the groundwater geochemistry at MW-29 is significantly different from that within the PDC plume. That is, the groundwater at MW-29 is no longer the same as the PDC groundwater, but rather something much different (saltier). If transport was from the PDC to MW-29, groundwater geochemistry would tend to be similar. There is obviously the addition of non-site groundwater to this MW-29 area, and that means that a good portion of transport to this area is not from the PDC site.
>
> "Well-known plume transport principles, coupled with California's plume distribution studies, dictate that contaminant concentrations decrease with distance away from the "source" area. It is not reasonable to have higher concentrations of a degradable compound like benzene at a distal location like MW-29 than is present in near-source locations like MW-10R. This is physically implausible. Further, MW-29 does not contain detectable tert-butyl alcohol (TBA) or tert-amyl alcohol (TAA), the most transportable of contaminants present historically onsite, that will effectively move with the flow of groundwater and be muted by attenuation processes. It is not expected that a degradable compound like benzene would travel preferentially to lesser degradable compounds like TBA and TAA. Further, MW-29 contains diisopropyl ether (DIPE), whereas source area wells at the PDC do not. DIPE was used by some refiners as an anti-knock and oxygen additive from the late 1970s forward, peaking in the mid-1990s during the Reformulated Gasoline era (RFG). Again, the presence of DIPE and absence of TBA/TAA at MW-29 are distinguishing features, along with the other forensics, of a release attributable to a

source other than the PDC site. MW-29 also contains chlorobenzene, which has never been detected in PDC plume wells.

"In summary, petroleum impacts were discovered at MW-29 that are unrelated to the PDC site, and therefore do not influence past work regarding plume stability, transport, or risk."

5.5.10 Evaluation of the Fate and Transport of Groundwater Contaminants

Background and Objectives

In 2009, SCS conducted fate and transport modeling of the shallow WBZ at the Site to assess benzene migration. SCS revised the 2009 fate and transport modeling in the 2011 Corrective Action Plan and Feasibility Study to reflect two changed assumptions:

1) The thickness of the source area was 20 feet rather than the 10 feet that we previously assumed. This parameter was adjusted based on the data from the CPT/ROST investigation.

2) Interpreted the benzene concentration "end point" to 1 µg/L to assess the maximum benzene migration that is consistent with the MCL for benzene.

The model assumes a constant (infinite) source term, which is very conservative and likely does not reflect actual Site conditions, where source concentrations are expected to reduce over time. In addition to fate and transport modeling, AVI (2011) conducted similar modeling (with slightly different assumptions) for benzene transport as well as TBA transport in the shallow WBZ (Appendix A).

This evaluation of contaminant fate and transport was conducted to determine if there is a significant likelihood that petroleum hydrocarbons will migrate into deeper aquifers, or migrate significantly off-Site or impact sensitive receptors without source area intervention. The evaluation was conducted by evaluating vertical gradients (based on recent groundwater elevation data) to address the possibility of vertical migration, and mathematical modeling of horizontal transport of representative dissolved constituents using field-measured and assumed parameters. The modeling aimed to identify the maximum downgradient extent of contaminants that could be expected to extend beyond the existing monitoring network.

Technical Approach and Results

Vertical Gradients

Three monitoring wells (MW-20D, MW-21D, and MW-23D) have been installed in the deeper WBZ (i.e. at a total depth of approximately 200 feet bgs, whereas the "shallow" WBZ wells were installed to approximately 115 feet bgs). These wells present an opportunity to assess vertical movement of the groundwater.

The deeper WBZ wells are located close to shallow and intermediate WBZ wells so the gradient can be directly calculated between well pairs consisting of deep, shallow, and intermediate wells. The vertical gradients were calculated using the EPA Online Tools.

Water level differences between the corresponding well pairs reveal a predominantly upward gradient for the recent monitoring events. This suggests that there is no hydraulic driver for contaminants to move lower in the aquifer. These findings are consistent with the previously discussed hydrogeologic conceptual model that indicates recharge occurs in the elevated Palos Verdes Hills west of the Site and that the Site is located in or just east of a discharge area. This also suggests that further investigation of the deeper zones for contaminants that may have migrated from the free product is unnecessary and unjustified based on the physical conditions at the Site (i.e., the upward flow prevents the contaminants from migrating downward).

Horizontal Transport Modeling

Groundwater sampling has indicated that the plume is likely stable (i.e., not expanding). However, field assessment of the leading edge of the plume, necessary to confirm this, has not been possible to conduct as part of this program because the area is off-Site and not possible to access due to the Harbor Freeway. There is likely co-mingling of contaminants from other sources (e.g., Phillips 66) that would complicate the interpretation of very low levels of dissolved hydrocarbons. One monitoring well (Phillips 66 MW-8) is directly downgradient, and the data collected from this well do not indicate any impacts. However, to supplement these data, a mathematical modeling approach was implemented to predict the maximum downgradient extent of the dissolved plume leaving the contaminant source area at the Site.

To assess horizontal contaminant migration (and specifically natural attenuation), existing data collected from the Site and assumed parameter values (from published literature) were used in conjunction with an analytical modeling approach to predict concentrations of benzene (used as an indicator compound) at various linear distances downgradient (in terms of groundwater flow) from the contaminant source area. Benzene was selected as a "worst case" since it is the most mobile of the standard petroleum hydrocarbon constituents and it also carries the highest risk profile.

The potential for benzene transport was predicted for various times to evaluate the maximum downgradient extent that the contaminants would migrate before being attenuated. The modeling was implemented with the assistance of the computer program BIOSCREEN (Newell and McLeod, 1996). BIOSCREEN is specifically designed to simulate transport (and natural attenuation) of dissolved hydrocarbons at petroleum fuel release sites. The software has the ability to simulate advection, dispersion, adsorption, and aerobic decay as well as anaerobic reactions that have been shown to be the dominant biodegradation processes at many petroleum release sites. BIOSCREEN includes three different model types:

- Solute transport without decay;
- Solute transport with biodegradation modeled as a first-order decay process (simple, lumped-parameter approach); and
- Solute transport with biodegradation modeled as an "instantaneous" biodegradation reaction (approach used by BIOPLUME models).

For this effort, solute transport with biodegradation modeled as a first-order decay process was selected because of the limited amount of data available to support the instantaneous reaction model.

BIOSCREEN is based on the Domenico (1987) three-dimensional analytical solute transport model. The original model assumes a fully-penetrating vertical plane source oriented perpendicular to groundwater flow to simulate the release of organics moving into groundwater. In addition, the Domenico solution accounts for the effects of advective transport, three-dimensional dispersion, adsorption, and first-order decay. Because the first-order decay model was selected for this evaluation, the results the BIOSCREEN simulation is, in effect, the Domenico solution.

BIOSCREEN employs a simplified representation of the system; at this point, it is our opinion that this is justified by the available data.

Table 7 (on the following page) presents the baseline parameters used for model input. Assumed parameter values were selected (based on literature values) in order to provide conservative or worst-case results. For example, the longest reasonable biodegradation half-life for benzene that is reported in the literature was used in order to show the least amount of biodegradation that could be occurring, therefore resulting in the farthest possible downgradient migration of the plume.

The source area concentration was conservatively set at 40 mg/L, the maximum dissolved benzene concentration that can result from equilibrium between gasoline and water (Wilson et al, 1990). The size of the source area was defined as the current area of free product. The thickness of the source area was set at 20 feet based on results of CPT/ROST investigation. A conservative assumption employed was that the source area concentration remains constant at its existing concentration indefinitely. This combination of assumptions is likely, in our opinion, to produce the largest plume possible given the observed groundwater flow conditions, measured aquifer properties, and simplified assumptions.

The movement of the free product was not simulated. LNAPL has been observed in two, or sometimes three, monitoring wells. However, it is assumed that either the soil concentrations throughout the source area are below residual saturation (i.e., all the pore spaces are not completely occupied by hydrocarbon) and, therefore, under natural conditions (i.e., not in the presence of a monitoring well sink), the hydrocarbon is not mobile as LNAPL; or, if concentrations are at or above saturation, there is no driving gradient to mobilize the LNAPL. This explains why there has been no apparent migration of the free product area since groundwater monitoring was initiated at the Site. This also is a reasonable assumption given that there is no longer an ongoing source of LNAPL. Once the LNAPL dissipates or degrades to below residual saturation, or there is so little NAPL present that there is no gradient, actual free-phase migration of any significance is not possible.

To assess the potential dissolved-phase benzene migration at the Site, existing data collected from the Site and assumed parameter values (from published literature) were used in conjunction with BIOSCREEN to predict concentrations of benzene at various linear distances downgradient (in terms of groundwater flow) from the Site. Using these baseline parameters, the simulation was carried out for times of 5, 10, 15, 20, 25, 30, 50, 75, and 100 years. The results of these simulations are presented in Table 8. The fate and transport modeling results indicate that the maximum lateral extent of dissolved benzene in groundwater above 1 µg/L is between 360 feet and 400 feet downgradient of the NAPL source area. Our modeling simulations indicate that this migration distance was achieved within 30 years after the release and remains steady thereafter (conservatively assuming a constant source, even though it is likely diminishing). No further migration is expected, regardless of any actions taken in the source area.

Historical monitoring data from off-Site wells MW-8, MW-12, and MW-13 support this conclusion. In particular, Phillips 66 well MW-8 is located approximately 500 feet directly downgradient from the source area, and no contaminants have been detected in this well since April 2007.

It should be noted that the approach implemented is not an exact prediction of Site conditions. In addition to the field data limitations, the simulation itself incorporates several limiting assumptions. In our opinion, however, these limitations do not affect the overall project conclusions.

Table 7. Model Input Parameters

Parameter	Value	Units	Method	Source/Notes
Infinite Benzene Source Term Concentration	40.0	mg/L	Assumed	Wilson et al, 1990
Seepage Velocity (V_s)	10.2	ft/yr	Calculated	$v=ki/n_e$
Hydraulic Conductivity (k)	0.00035	cm/sec	Measured	Field Tests/CAPE (2007)
Hydraulic Gradient (i)	0.007	ft/ft	Measured	Field Water Level Measurements
Effective Porosity (n_e)	0.25	%	Assumed	Walton, 1988; Freeze & Cherry, 1979
Longitudinal Dispersivity (a_x)	13.3	ft	Assumed	Based on estimated plume length of 280 ft and Xu/Eckstein relationship
Transverse Dispersivity (a_y)	1.3	ft	Assumed	
Vertical Dispersivity (a_z)	0.0	ft	Assumed	
Retardation Factor (r)	1.3	unitless	Calculated	$R=1 + (K_d r_b/n_e)$ where $K_d=k_{oc} \times f_{oc}$
Aquifer Bulk Density (r_b)	1.7	kg/L	Assumed	General Literature
Organic Carbon Partition Coefficient (k_{oc}) (Benzene)	38	L/kg	Assumed	ASTM, 1995
Fraction Organic Carbon (f_{oc})	0.001	unitless	Assumed	LaGrega et al 1994
Solute Half Life (t-half) (benzene)	2.0	yr	Assumed	Maximum of Reported Range 0.02-2.0 yr (ASTM, 1995)

Table 8. Modeled Benzene Concentrations (mg/L) by Distance from Source (ft)

Time	Distance from Source (ft)										
(yrs)	0	40	80	120	160	200	240	280	320	360	400
5	40.000	10.047	1.489	0.083	0.001	0.000	0.000	0.000	0.000	0.000	0.000
10	39.999	11.751	3.263	0.754	0.121	0.012	0.001	0.000	0.000	0.000	0.000
15	39.999	11.870	3.504	1.007	0.266	0.059	0.010	0.001	0.000	0.000	0.000
20	39.998	11.878	3.526	1.043	0.305	0.085	0.022	0.005	0.001	0.000	0.000
25	39.998	11.878	3.527	1.047	0.310	0.091	0.026	0.007	0.002	0.000	0.000
30	39.998	11.878	3.528	1.048	0.311	0.092	0.027	0.008	0.002	0.001	0.000
50	39.996	11.878	3.527	1.048	0.311	0.092	0.027	0.008	0.002	0.001	0.000
75	39.994	11.877	3.527	1.048	0.311	0.092	0.027	0.008	0.002	0.001	0.000
100	39.992	11.877	3.527	1.047	0.311	0.092	0.027	0.008	0.002	0.001	0.000

The fate and transport modeling results indicate that the maximum lateral extent of dissolved benzene in groundwater above 1 µg/L is between 360 and 400 feet downgradient of the LNAPL area.

Our modeling simulations indicate that this migration distance was achieved within 30 years after the release and remains steady thereafter (conservatively assuming a constant source, even though it is likely diminishing). No further migration is expected, regardless of any actions taken in the source area.

Downgradient Source – MW-29

The forensic geochemistry and history of groundwater monitoring and concentration gradients provide lines of evidence that the detected concentrations of CoCs (e.g., benzene and 1,2-DCP) in the downgradient intermediate zone wells are not likely present as a result of release(s) at the Site. Nevertheless, fate and transport modeling was conducted, as a conservative approach, to assess whether the benzene, as an indicator compound, would migrate to and impact any sensitive receptors (i.e., the Northwest Slip of the Los Angeles Harbor).

Therefore, the BIOSCREEN analytical modeling completed for the Site was reinterpreted to estimate potential migration of dissolved-phase benzene at other locations with similar hydrogeologic conditions. As discussed, even though there are multiple lines of evidence that suggest that recently installed monitoring well to the northeast of the Site (MW29) is representative of another contaminant source the existing BIOSCREEN model can estimate potential benzene migration downgradient from this well. By changing the source term concentration to that reported for MW29 during the January 2014 sampling event (599 µg/L) a prediction of benzene concentrations at various distances downgradient for times of 5, 10, 15, 20, 25, 30, 50, 75, and 100 years. The results of these simulations are presented in Table 9.

Table 9. Modeled Benzene Concentrations (mg/L) by Distance from MW-29 (ft)

Time	Distance from Source (ft)										
(yrs)	0	40	80	120	160	200	240	280	320	360	400
5	0.599	0.143	0.019	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.599	0.168	0.044	0.010	0.001	0.000	0.000	0.000	0.000	0.000	0.000
15	0.599	0.170	0.048	0.013	0.003	0.001	0.000	0.000	0.000	0.000	0.000
20	0.599	0.170	0.048	0.014	0.004	0.001	0.000	0.000	0.000	0.000	0.000
25	0.599	0.170	0.048	0.014	0.004	0.001	0.000	0.000	0.000	0.000	0.000
30	0.599	0.170	0.048	0.014	0.004	0.001	0.000	0.000	0.000	0.000	0.000
50	0.599	0.170	0.048	0.014	0.004	0.001	0.000	0.000	0.000	0.000	0.000
75	0.599	0.170	0.048	0.014	0.004	0.001	0.000	0.000	0.000	0.000	0.000
100	0.599	0.170	0.048	0.014	0.004	0.001	0.000	0.000	0.000	0.000	0.000

The reinterpreted fate and transport modeling results indicate that:

- The maximum lateral extent of dissolved benzene in groundwater above 1 µg/L is between 200 and 240 feet downgradient of MW-29.
- Our modeling simulations indicate that this migration distance was achieved within 15 years and remains steady thereafter (conservatively assuming a constant source, even though it is likely diminishing). No further migration would be expected from this well with the reported benzene concentration.

The modeled benzene concentrations tabulated in Tables 8 and 9 are the product of a range of source term concentrations ranging from the highest expected from groundwater equilibria with free product gasoline (40 mg/L) to the dilute downgradient concentration observed in MW-29 (0.599 mg/L) migrating in the shallow WBZ.

Because the model assumes that hydraulic characteristics of the shallow WBZ throughout the Site are homogenous benzene migration distances can be applied to any location within the Site with benzene concentrations below the highest modeled (40 mg/L).

This concept can therefore be applied to estimate potential risks to the nearby surface water of Los Angeles Harbor which is approximately 800 feet from the eastern edge of the Site:

- The most conservative application of this concept would be for the hypothetical scenario where LNAPL was at the easternmost edge of the Site contributing the highest potential benzene concentration with the least distance to the Harbor.

While extremely unlikely, this conservative scenario would produce a dissolved-phase benzene plume migrating no more than 400 feet leaving approximately 400 feet of unimpacted shallow WBZ between the distal edge of the plume to the nearest point in the Harbor.

5.6 AVI DISSOLVED-PHASE AND LNAPL EVALUATION

5.6.1 Background

AVI conducted an evaluation of the dissolved and LNAPL plumes with respect to their stability, status, and threat to the waters of the State (AVI, 2011). AVI stated that the purposes of the work regarding the dissolved-phase plume were to:

- "Evaluate the stability, potential longevity, potential impacts to groundwater utilization, and the potential fate and transport of the TBA groundwater plume; and
- Evaluate the stability of the benzene groundwater plume at the Site to assist in evaluating the LNAPL plume stability."

AVI (2011) further indicated:

> "The evaluations conducted herein utilize historic groundwater concentration data, in context with other site characterization information, as a key indicator of the historical and future probable plume state. This focus was developed because groundwater is in contact with residual petroleum hydrocarbons, and understanding the stability, potential plum longevity, potential impacts to groundwater utilization, and potential fate and transport of the TBA plume and the stability of the benzene plume in relation to the LNAPL plume directly affect the long-term care requirements and closure."

5.6.2 Summary of Dissolved Plume Condition Evaluation

AVI (2011) provided a summary of key observations:

- The geospatial mass distributions illustrate plume stability for benzene.

- No wells were observed to exhibit increasing TBA trends, and the wells with sufficient data for a trend analysis exhibited a decreasing trend and reach the regulatory criteria by at the latest 2024 in the wells that are located along the leading edge of the plume. Thus the center of mass of the TBA plume is likely stable and is not moving downgradient.

- Worst-case scenario predictions using the mass flux from the Site to estimate maximum concentrations of TBA at a hypothetical drinking water well result in no impacts above regulatory criteria for TBA. Furthermore, utilization of groundwater from the Gage Aquifer would require treatment to remove naturally occurring dissolved phase constituents. During this treatment process TBA would most certainly be removed from the produced groundwater.\

- TBA has not been detected in off-site Phillips 66 well MW-8 and has not been detected above the NL [notification level] (12μg/L) in off-site well MW-12, both of which are located directly downgradient of the source area. MW-8 (Phillips 66) and MW-12 have generally been monitored for TBA since it was first detected at the site (2007); although MW-12 was abandoned in 2009.

- The plume trends and fate and transport analysis suggest that the TBA plume is stable laterally and is attenuating, which is further supported by the absence of detections in downgradient well MW-8 located on the Phillips 66 site.

- As discussed in the main body of the [CAP] report, the TBA plume is also contained vertically by predominantly upward vertical gradients in the Gage Aquifer beneath the site.

- In summary, these various layers of conservatism mirror USEPA risk assessment practices and those of ASTM to provide a direct analysis based on data, rather than models, to assess the safety of site closures under Resolution 92-49. It is estimated that the safety factors involved generate more than 3 orders of conservatism over actual expected conditions.

AVI concluded that:

> "Based on the summary of findings above, the TBA plume appears to be stable and contained by natural attenuation processes. This, coupled with the marginal quality groundwater beneath the site suggest that this plume meets State standards for presenting no risk, and no threat to future groundwater use."

AVI's analysis is consistent with SCS' modeling and previous interpretation of data and lines of evidence (SCS, 2009b).

5.6.3 Evaluation of LNAPL Plume and Cleanup Conditions

As indicated by AVI (2011), there are two key questions regarding the selection of appropriate plume management or cleanup actions for the Site:

- Is the LNAPL plume stable from a management perspective?
- Will additional active cleanup have any net benefit to the waters of the State?

AVI suggests that a weight of evidence approach, wherein multiple lines of evidence are considered in their totality, should be used to assess LNAPL plume stability. These lines of evidence are:

- Confirmation that the LNAPL releases are finite and not ongoing at the Site;
- Evaluation of the relative age of the LNAPL plumes; the older the plume, the more probable it has reached field static equilibrium;
- Evaluation of LNAPL gradients;
- Comparisons of estimated LNAPL to water conductivity values;
- Evaluation of LNAPL flow;
- Review of petrophysical properties, including expectations for an entry pressure threshold; and
- Inspection of LNAPL plume distribution to consider whether the morphology is consistent with the form of a stable plume.

5.6.4 Plume Age and Timing of Release

It is unlikely that any significant LNAPL releases occurred after the 1995 cessation of refinery and terminal operations at the Site. As noted by AVI, a finite LNAPL release will slow exponentially through time; therefore, the older a plume, the more probable it has reached field static equilibrium.

5.6.5 LNAPL Gradient

Although the LNAPL and groundwater gradients are not precisely the same, AVI notes that "the LNAPL gradients ... are generally of the same magnitude and direction as groundwater flow. This is typical of confined LNAPL, where the pressure regimes in the LNAPL simply reflect the surrounding hydrostatic pressure. LNAPL is confined in the same way groundwater is confined, by zones of porous materials having low effective hydraulic conductivity." Therefore, the small LNAPL gradients are unlikely to mobilize LNAPL beyond its present position.

5.6.6 Conductivity of LNAPL and Water and Resulting LNAPL Flow

The very low potential velocity of LNAPL (well below 1 foot per year) indicates plume stability. Because the LNAPL conductivity is about 100 to 20,000 times less than groundwater conductivity (and, in some of the core samples, LNAPL conductivity was zero), the potential for LNAPL flow is also approximately 100 to 20,000 times less than groundwater.

5.6.7 Review of Petrophysical Properties

The petrophysical laboratory data obtained from core samples collected within the relatively high LNAPL saturation area during the CPT/ROST investigation were further evaluated by AVI. AVI noted that:

"The combination of high capillarity, a distinct non-wetting entry pressure exhibited in the capillary data, and the relatively high percentage of fines in the majority of soil cores all indicate the LNAPL will not flow easily in this setting absent high pressure gradients."

5.6.8 Summary

AVI concluded:

"In summary, for this particular site, all the factors above point to LNAPL plume stability. While there may be small-scale movement in response to localized gradients, the plume is old enough and displays all the other features of a stable plume relative to site management objectives."

5.7 CLEANUP GOALS

5.7.1 Introduction and Background

In California, the Porter-Cologne Water Quality Control Act (Water Code Section 13000 et seq.) (Act) establishes the regulatory framework for water pollution control. The Act is implemented and enforced by the SWRCB, a division of the California Environmental Protection Agency, and the nine RWQCBs. The federal Clean Water Act and Porter-Cologne Act require that the RWQCBs adopt a water quality control plan (Basin Plan) to guide and coordinate the management of water quality in each region, including surface and groundwater resources. The purposes of the Basin Plan include to:

1) Designate beneficial uses of the region's surface and groundwater;

2) Designate the water quality objectives for the reasonable protection of those uses; and

3) Establish an implementation plan to achieve the objectives.

5.7.2 Site-Specific Closure Requirements and Integration with Basin Plan

A "no further action" letter has been issued for the soil in all parts of the Site. However, the groundwater portion of the case is still open. The closure conditions for groundwater at the Site were set by the RWQCB in November 1998.

> "Closure will be conditioned upon a demonstrated achievement of performance criteria, including:
>
> - No recoverable free product remains at the Site;
> - On-Site and off-Site groundwater contamination has been contained and stabilized."

These remediation goals are consistent with SCS' evaluation of the Basin Plan. As previously indicated, based on our review of Site data, the groundwater at the Site meets the de-designation criteria set forth for the de-designated or non-beneficial use portion of the West Coast Basin, immediately adjacent to the Site. In particular:

- The groundwater at the Site or in the Site vicinity is not a source of drinking water;

- The Site sits seaward of the DGBP injection wells;

- Background or intrinsic water quality at the Site is extremely poor, with historical saltwater intrusion, and elevated concentrations of TDS (as high as 12,200 mg/L) and chloride ions (as high as 6,390 mg/L) well in excess of the Water Quality Objectives of 800 mg/L and 250 mg/L, respectively, set out in the Basin Plan, and the 3,000 mg/L or less TDS criterion in SWRCB; and

- Interviews with water supply officials, including the Water Replenishment District, indicated that there are no current or future plans for water resource development in the vicinity of the Site.

Therefore, MCLs for drinking water and other common water quality objectives are not, in our judgment, applicable to the groundwater at the Site because there are no existing or potential beneficial uses to protect.

5.7.3 Title 23 Requirements and Recent State Water Resources Control Board Guidance

Phase-separated hydrocarbons or "free product" have been detected in groundwater in certain wells at the Site. California Code of Regulations, Title 23, Division 3, Chapter 16, Section 2655 mandates that free-phase product be removed "to the extent practicable," which, in our view, mirrors the RWQCB closure criteria described above.

More recent SWRCB guidance in the 2012 Low Threat UST Closure Policy provides additional clarification of "practicable" as follows:

> "(a) Free product shall be removed in a manner that minimizes the spread of the unauthorized release into previously uncontaminated zones by using recovery and disposal techniques appropriate to the hydrogeologic conditions at the site, and that properly treats, discharges or disposes of recovery byproducts in compliance with applicable laws; (b) Abatement of free product migration shall be used as a minimum design objective for the design of any free product removal system; (c) Flammable products shall be stored for disposal in a safe and competent manner to prevent fires or explosions."

Further interpretation and context is provided in the document titled *Technical Justification for Plume Lengths*, dated July 12, 2012, quoted in part below:

> **"Notes on Free Product Removal**
>
> State regulation (CCR Title 23, Division 3, Chapter 16, Section 2655) requires that 'responsible parties'.... remove free product to the maximum extent practicable, as determined by the local agency...' (Section 2655a) '.... in a manner that minimizes the spread of contamination into previously uncontaminated zones'... (Section 2655b), and that '[a]batement of free product migration shall be the predominant objective in the design of the free product removal system' (Section 2655c). Over the years there has been debate on the meaning of the terms 'free product' and 'maximum extent practicable.'
>
> "Product (light non-aqueous phase liquid [LNAPL]) can exist in three conditions in the subsurface: residual or immobile LNAPL (LNAPL that is trapped in the soil pore spaces by capillary forces and is not mobile), mobile LNAPL (enough LNAPL is present in the soil pore spaces to overcome capillary forces so that the LNAPL can move) and migrating LNAPL (mobile LNAPL that is migrating because of a driving head).
>
> " 'Residual LNAPL', 'mobile LNAPL' and 'migrating LNAPL' are described in detail in several peer-reviewed technical documents, including the 2009 Interstate Technology Regulatory Council (ITRC) Technical/Regulatory Guidance 'Evaluating LNAPL Remedial Technologies for Achieving Project Goals'. Given the predominant objective of abatement of migration, the term 'free product' in the State regulation is primarily equivalent to 'migrating LNAPL' (which is a subset of 'mobile LNAPL'), and secondarily equivalent to 'mobile LNAPL'.

> "Whether LNAPL is mobile (and therefore could potentially migrate) or not is usually tested by observing recharge of LNAPL after removing LNAPL from a monitoring well. Whether LNAPL is migrating or not is tested by monitoring the extent of the LNAPL body (usually using the apparent product thickness in monitoring wells) at a certain water level elevation over time. If the extent at that water level elevation does not expand, then the LNAPL is not migrating. Therefore, LNAPL must be removed to the point that its migration is stopped, and the LNAPL extent is stable.
>
> "Further removal of non-migrating but mobile LNAPL is required to the extent practicable at the discretion of the local agency. Removal of mobile LNAPL from the subsurface is technically complicated, and the definition of 'extent practicable' is based on site-specific factors and includes a combination of objectives for the LNAPL removal (such as whether the mobile LNAPL is a significant 'source' of dissolved constituents to groundwater or volatile constituents to soil vapor, or whether there is a high likelihood that hydrogeologic conditions would change significantly in the future which may allow the mobile LNAPL to migrate) and technical limitations.
>
> "The typical objectives for LNAPL removal, technologies for LNAPL removal and technical limitations of LNAPL removal are discussed in several peer-reviewed technical documents including the 2009 ITRC Guidance (see especially Section 4 'Considerations/Factors Affecting LNAPL Remedial Objectives and Remedial Technology Selection', Table 4.1 [Example Performance Metrics], Table 5-1 [Overview of LNAPL Remedial Technologies], and Table 6-1 [Preliminary Screening Matrix])."

This document provides important distinctions regarding the types of LNAPL and provides a conceptual framework to assess and evaluate the presence of LNAPL at the Site and whether it has been removed to the extent practicable. Previous and recent work by AVI is intended to address this framework and the distinctions it provides, and ultimately allows an assessment of whether this regulatory requirement has, in fact, been met.

5.7.4 Consistency with Cleanup Goals

Soil and Soil Vapor

Soil remediation at the Site is complete and the RWQCB has granted closure for Site soils.

In addition, a soil vapor investigation and vapor intrusion risk assessment were completed and accepted by OEHHA and the RWQCB. Soil vapor does not pose a significant human health risk.

Groundwater Contamination is Contained and Stabilized

Based on the fate and transport modeling conducted by both AVI and SCS, and our review of historical as well as current groundwater monitoring data, SCS concludes that the dissolved-phase plume is stable or contained, both laterally and vertically.

Recoverable Free Product

As has been previously indicated, extensive prior remediation efforts have been directed at LNAPL removal, including AS/SVE as well as vacuum truck purging and recovery. Millions of pounds of petroleum hydrocarbons have been removed from the subsurface of the Site as a result of remediation efforts. However, some LNAPL has been measured in Site wells subsequent to remediation and case closure of the soil at the Site.

Based on the work conducted by AVI, it is apparent that, while LNAPL is present in wells in two areas at the Site:

- LNAPL conductivity is very low, as is potential LNAPL velocity, and is estimated at less than 1 foot per year, and possibly less;
- Multiple other lines of evidence point to plume and LNAPL stability, including the age of plume and the plume morphology; and
- LNAPL recovery using conventional methods such as hydraulic recovery or even AS/SVE, which was, at one time, successful in removing mass, are unlikely to induce any significant recovery using conventional designs and well spacings.

Under SWRCB guidance, further LNAPL recovery and remediation is not necessary nor would it be "practicable." Indeed, considering the cost, cost per pound removed, or "net benefit" as put forward by AVI, then further remediation would be an imprudent use of scarce resources to protect what should, in reality, be classified as non-beneficial use groundwater.

AVI (2011) concluded:

> "Given that the site has all risk pathways contained and managed (low-risk), and given that additional cleanup would have no net benefit to the waters of the State, and a high impact to site operations that would need to cease to complete that effort, it is our opinion that no further action is warranted beyond monitoring plume stability and ongoing natural attenuation. There simply is no additional action that might be taken in the face of these beneficial site commercial operations that would have any benefit, and in a variety of scenarios would have negative net benefits."

Based on a review of their previous work at the Site, AVI (2014) concluded that:

"Site LNAPL transmissivity values (determined with site specific data) are much lower than the 0.1 to 0.8 ft2/day range that the Interstate Technology & Regulatory Council (ITRC, 2009) recommended as a practical endpoint to effective hydraulic LNAPL recovery. Our detailed analysis, using site specific parameters collected by SCS, demonstrates that additional free product recovery will have no measurable beneficial effect. Other remedial options are not viable with the footprint of the PDC business operations, and are not warranted given the negligible expected benefit, as detailed in our 2011 work [AVI, 2011]. At this late plume stage, natural mass losses likely exceed the failingly small remaining recovery possible through hydraulic recovery."

5.8 CONSTRAINTS ANALYSIS

5.8.1 Background

The dissolved plume already meets the closure requirements (since it is stable and contained). A number of constraints, as previously described, impact the potential viability of further remedial action for LNAPL at the Site. Some of the constraints include:

- The nature and extent of physical improvements at the Site, including buildings, their locations, and their ongoing operations;
- Site conditions, including geology, geochemistry, and hydrogeology;
- Plume location, depth, and morphology;
- Nature and age of the petroleum hydrocarbons;
- Required location and density of remedial operations to achieve significant recovery of mass; and
- The likely efficacy of conventional remedial alternatives.

Some of the most problematic constraints are the Site geology and the ongoing Site operations, improvements, and their location relative to the plume.

5.8.2 Site Buildings, Operations, Improvements, and Economic Considerations

As previously indicated, the Site is a successful brownfields redevelopment project, transitioning a bulk petroleum distribution facility into a 1.8-million-square-foot fully utilized and extremely busy goods transportation hub. The footprint of the Site buildings overlaps with the interpreted location of LNAPL.

In addition, due to the truck traffic, there are extremely thick concrete pavement sections and extensive underground utilities as well significant logistical issues that would need to be addressed before any remediation could be conducted. The impacts to the ongoing business operations in terms of disruptions and possible impediments to ongoing operations would likely be significant.

For example, if the remediation was conventional and involved a dense well field, piping runs, electrical utilities and a treatment system compound, this work would severely impact on-going business operations and would be constrained by existing physical improvements such as utilities and buildings.

5.8.3 Site Geology and Lithology

In addition to physical constraints associated with the built environment, the observed lithologies at the Site also constrain what is possible. As stated in the CPT investigation report (SCS, 2011b):

> "Although the ROST reflectance rarely exceeds 5 to 10 percent, most of the higher values appear to be to be in the thin-bedded, fine-grained intervals in the saturated zone. Such lithologic heterogeneity, by itself, creates serious difficulties in designing remediation

> systems because of problems regarding the prediction of LNAPL behavior and the potential effects on well capture zones. This geologic heterogeneity has a marked impact on the relative permeability and effective conductivity of LNAPL (SCS, 2011)."
>
> "The predominantly fine-grained composition of the saturated zone also has a strong influence on the mobility of water and LNAPL. The capillary pressure data indicate that water is difficult to remove from the low porosity, fine-grained soils of the saturated zone. This relatively high water saturation prevents the LNAPL from moving through pores, so the LNAPL present within these fine soils will likely be impracticable to remove using conventional methods. Also, hydraulic recovery wells in the fine-grained soils are not likely to be very effective due to locally induced reductions in saturation near the wells."

In addition, this remaining water would be expected to interfere with the movement of LNAPL through the small pore throats of the fine-grained rock, leading to an "entrapment" of the LNAPL. As noted by Huntley and Beckett (2002):

> "For the same capillary pressure conditions, LNAPL saturations are substantially smaller in fine-grained soils than in coarse-grained soils, all other things being equal. This effect combines with the low intrinsic permeability of fine-grained soils to produce very low mobility and potential recovery in fine-grained materials. When the regional groundwater flow and volatilizations from the fine-grained materials is small, the lifespan of LNAPL in these materials can be long."

5.8.4 Conventional Methods

As interpreted by AVI (2011):

> "Given that the LNAPL plume is stable, as discussed above, the plume management options range from managing it in-place to more active engineered cleanup approaches. In this section, the net benefit of various potential actions relative to the waters of the State will be considered."

AVI noted in its draft report to the RWQCB that the single-most applied remediation technique for Los Angeles area refineries to address LNAPL is hydraulic recovery (*Best Practices Study of Groundwater Remediation at Refineries in the Los Angeles Basin* [Beckett, Sale, Huntley, & Johnson, 2005]). AVI goes on to say that while LNAPL recovery can mitigate the potential for LNAPL transport and it does recover some mass, it does not typically result in any significant changes in the occurrence/recurrence of free product, and in fact, if not properly implemented, may result in spreading of the plume.

With respect to the presence of LNAPL at the Site, after consideration of Site-specific data, AVI states:

> "The expected change in saturation due to hydraulic recovery is quite negligible, as is the associated change in benzene concentration over time for each scenario…In effect, and consistent with an old, stable, and submerged plume with all the given properties, hydraulics will no longer have any effect on plume management over the long-term."

AVI also considered the possible efficacy and implementation of *in situ* air sparging (IAS) combined with soil vapor extraction, as well as IAS as a surrogate for any form of intensive cleanup.

Based on AVI's analysis, the efficacy of active IAS at the Site would be limited unless an extremely intensive spacing of wells (on the order of 10 to 15 feet on center) were designed and implemented. Even so, AVI goes on to state that, "IAS under these ideal conditions would be expected to reduce the overall concentrations of benzene and other compounds in the near-term, but would not have a significant effect on the long-term presence of the compounds or the management of the site."

AVI suggests, and SCS concurs, that IAS might be considered a good surrogate for any form of aggressive cleanup at the Site. Well densities to achieve any efficacy as well as the necessary hydraulic control to ensure that the "no harm" policy is adhered to would necessarily be intense. These well densities, the well locations, as well as very high costs, would likely result in very limited feasibility from a number of points of view. It is likely that operations at the Port Distribution Center could not continue, or would be significantly impacted, during the implementation and operation of such a system.

Even if implementation were feasible, there is no real benefit given the likely limitations on recovery and benefit to the environment and water quality, particularly in light of the very poor background water quality at the Site and limitations on beneficial uses.

Even if a beneficial use for the groundwater at or within the zone of influence of the Site could be identified, the groundwater would require extensive treatment or conditioning prior to use to remove salt and other objectionable compounds. Even if this use were necessary or required, which seems highly unlikely, such water treatment could also easily accommodate the treatment of petroleum hydrocarbons.

6.0 APPLICATION OF LOW-THREAT CLOSURE TO THE SITE

6.1 BACKGROUND

As previously discussed, the Policy does explicitly consider the possible applicability to other petroleum release scenarios:

> "While this policy does not specifically address other petroleum release scenarios such as pipelines or above ground storage tanks, if a particular site with a different petroleum release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy."

The Policy expressly acknowledges that release scenarios with similar attributes can be considered with the regulatory framework and criteria of the Policy. SCS believes and is of the opinion, as more fully described below, that the petroleum release at the Site does exhibit attributes consistent with petroleum UST releases and should be considered for closure under the Policy.

6.2 GENERAL CRITERIA

The Policy provides a series of general criteria that must be addressed to identify the specific conditions that make Site closure under the policy appropriate. The general criteria are set forth in the Policy, and a checklist has been developed by SWRCB staff as a screening tool to assist all parties in determining if a site meets the criteria in the Policy (Appendix E). The general criteria are listed below in **bold print**, followed by a discussion of their application to the Site:

The unauthorized release is located within the service area of a public water system.

The Site is in service area of the Los Angeles Department of Water and Power.

The unauthorized release consists only of petroleum.

The Site occupies most of the former WFO property where petroleum refinery, then terminal, storage, and transfer operations were conducted from 1923 to 1995. The chemical composition of the release is consistent with the past uses of the Site. Petroleum hydrocarbons and a number of VOCs commonly associated with refined petroleum products have been detected in groundwater at the Site.

The unauthorized ("primary") release from the UST system has been stopped.

Petroleum refining operations were conducted at Site from 1923 to 1948. The petroleum storage activities ceased in 1995. All remnants of the refinery and storage operations were removed during demolition conducted in 1997 in preparation for Site redevelopment. There is no ongoing source of release.

Free product has been removed to the maximum extent possible.

Free product LNAPL is present in wells in two areas at the Site with the following characteristics:

- LNAPL conductivity is very low, as is LNAPL velocity, which is estimated at less than 1 foot per year, and possibly less;
- Multiple other lines of evidence point to plume and LNAPL stability, including the age of plume and the plume morphology;
- LNAPL recovery using conventional methods such as hydraulic recovery or even AS/SVE, which were at one time successful in removing mass, are unlikely to induce any significant recovery using conventional designs and well spacings; and
- Existing buildings and current tenant operations constrain the effective implementation of additional remediation measures.

Additional information regarding whether additional product recovery is practicable has been presented in section 7.8 of this Report.

A conceptual site model that assesses the nature, extent, and mobility of the release has been developed.

A Conceptual Site Model (CSM) was previously submitted to the RWQCB (SCS, 2009b). Elements of the CSM have been updated in this Report.

Secondary source has been removed to the extent practicable.

Extensive remediation has been conducted at the Site as part of the redevelopment process. These efforts included air sparging and soil vapor extraction (AS/SVE) with estimates of mass removal on the order of 12,000,000 pounds of petroleum hydrocarbons. In addition, during the development and transformation of the former brownfield site into the current use, it is estimated that some 20,000 tons of contaminated soil were removed and disposed of off-Site.

Site attributes, including lithological, physical, and infrastructural constraints, prevent additional secondary source removal. Based on prior and current analysis, natural attenuation is the most appropriate source removal strategy.

Soil or groundwater has been tested for methyl tert-butyl ether (MTBE) and results reported in accordance with Health and Safety Code section 25296.15.

Prior to April 2002, MTBE was not included in the analytical program for the Site wells. Since that event, MTBE has not been detected above the laboratory reporting limit in groundwater samples from the dissolved-phase plume (MTBE was reported at J-flagged concentrations in groundwater samples collected beneath the free-product zone in wells MW-6R and MW-19R in the 2007-2008 sampling events). The results of the analysis for MTBE have been reported to the RWQCB in the series of Semiannual Groundwater Monitoring reports since April 2002.

Nuisance as defined by Water Code section 130050 does not exist at the site.

Nuisance related to the remaining impacts of former Site uses does not exist at the Site.

- Groundwater will not become a nuisance by direct contact or consumption at the property.
- The community and public health will not be affected by the remaining impacts.
- No treatment or disposal of wastes related to the petroleum release is conducted at the Site.

There are no unique site attributes or site-specific conditions that demonstrably increase the risk associated with residual petroleum constituents.

There are no unique Site attributes or Site-specific conditions that increase the risk, Site conditions which act to decrease the risk associated with residual petroleum constituents include:

- The relatively deep occurrence of groundwater,

- The removal and treatment of hydrocarbon-bearing soil and groundwater prior to re-use,
- The demonstrated absence of vapor intrusion issues,
- The presence of methane protection systems beneath Site buildings, and
- The thick concrete pavement which covers more than 90% of the Site.

6.3 MEDIA-SPECIFIC CRITERIA

6.3.1 Groundwater

The media-specific requirements are used to determine that threats to existing and anticipated beneficial used have been mitigated or are *de minimis.*

Is the contaminant plume that exceeds water quality objectives stable or decreasing in areal extent?

As described in the CSM, in the Report, and in the AVI report, there are multiple lines of evidence that both the free product and the dissolved constituent plumes are stable. Furthermore, the downgradient extent of the plume is immediately adjacent to the de-designated portion of the groundwater basin. Because the basin has been de-designated, there are no beneficial uses or water quality objectives for groundwater to exceed, even if there were additional plume migration.

Does the contaminant plume that exceeds water quality objectives meet all of the additional characteristics of one of the five classes of sites?

The Site meets the requirements of Class 5 of the Groundwater-Specific Criteria based on the following:

- The dissolved-phase contaminant plume that exceeds the water quality objective is less than 500 feet long.
- Free product has been removed to the maximum extent practicable and does not extend off-Site.
- The nearest existing water supply well (industrial service supply, not potable) is greater than 1,000 feet from the site (the Phillips 66 refinery industrial water supply wells are approximately 3,500 feet north of the Site boundary and are screened in the Silverado Aquifer).
- The nearest surface water body is the Northwest Slip of the West Basin of the Los Angeles Harbor, which is approximately 1,300 feet from the Site, and approximately 800 feet from the plume boundary.
- The dissolved concentration of benzene is less than 1,000 μg/L.
- MTBE has not been reported at detectable concentrations in the dissolved plume.

Based on these Site-specific conditions, the contaminant plume poses a low threat to human health and safety and to the environment and water quality objectives will be achieved within a reasonable time.

6.3.2 Petroleum Vapor Intrusion to Indoor Air

The Site is not an active commercial petroleum fueling facility.

A Site-specific risk assessment has been conducted that demonstrates that human health is protected (SCS, 2008), and the assessment has been concurred with by OEHHA.

The Site buildings are protected by a methane protection system which provides additional means of controlling exposure to soil vapor.

6.3.3 Direct Contact and Outdoor Air Exposure

The maximum concentrations on Table 1 of the Policy are not applicable because petroleum-impacted soils were removed from the Site during grading, or treated and reused during Site grading. Reuse of the treated soils was approved by the RWQCB. The health risk-based evaluation of the Site soil concluded that the residual levels do not pose a health risk to future commercial populations of the Site (Iris, 2001).

As a result of mitigation measures of controlling exposure to soils (e.g., pavement of Site, construction of buildings with methane protection systems) and excavation and on-Site treatment of soils prior to re-use approved by RWQCB with Site closure for soil, there is no significant risk of remaining petroleum hydrocarbon impacts adversely affecting human health.

6.3.4 Summary

The Policy contemplates applicability to non-UST petroleum releases, such as the Site, and the Site data demonstrate that the Site meets both the general and media-specific criteria of the Policy.

7.0 SUMMARY AND CONCLUSIONS

Based on SCS' research and review of the available data regarding Site and Site vicinity conditions, current regulations and regulatory guidance, and our experience, it is our opinion that:

7.1 BACKGROUND AND SITE HISTORY

- Port LA Distribution Center (Site) is located at 300 Westmont Drive in the San Pedro Business Center in the northern portion of San Pedro, within the City of Los Angeles, California. The Site occupies most of the former Western Fuel Oil (WFO) property where petroleum refinery, then terminal, storage, and transfer operations were conducted from 1923 to 1995. In the late 1990s, the Site was purchased by a firm specializing in brownfields redevelopment, and the Site was extensively remediated and then redeveloped. Facilities at the Site include two large warehouse buildings, a central truck parking area, and access roads around the perimeter of the Site. With the exception of very limited areas of irrigated landscaping around the perimeter of the new development, the entire area surrounding the buildings at the Site has been covered with concrete pavement, limiting surface water infiltration, and on-Site sources of groundwater recharge.

- During the long history of remediation efforts at the Site, a number of consultants have performed subsurface investigations and remedial actions. Documented work began in 1985 in response to CAO 85-17 and has continued through nearly 25 years of environmental investigation and remediation efforts including the work leading to a "no further action" letter for soil at the Site.

- Extensive remediation has been conducted at the Site. These efforts included AS/SVE with estimates of mass removal on the order of 12,000,000 pounds of petroleum hydrocarbons. In addition, during the development and transformation of the former brownfield site into the current use, it is estimated that some 20,000 tons of contaminated soil were removed and disposed of off-Site.

- Groundwater assessment and remediation included installation and monitoring of wells before and after Site redevelopment, along with removal of free product from several wells since 2002. Recent assessments in response to RWQCB requirements have included evaluation of soil vapor and human health risk, possible intermediate and deeper WBZ impacts, extensive investigations of the Site using CPT and ROST technologies to better define the occurrence and extent of LNAPL, ongoing assessment of the possible migration of CoCs in the shallow WBZ, and ongoing remediation comprising free product removal from wells.

7.2 REGIONAL AND SITE GEOLOGY

- The Site is located near the northeastern margin of the Palos Verdes uplift. Surficial geological units in this area consist principally of Quaternary older alluvium/terrace deposits and slightly older Quaternary marine deposits, including the San Pedro Sand. Major geologic structures in the vicinity of the Site include the Gaffey Anticline, which crosses the southwest corner of the property and causes geologic beds beneath the Site to dip gently to the northeast, and the Palos Verdes Fault, which crosses the northeast corner of the Phillips 66 property, where it is reported to have caused displacement of older units but has not affected the younger formations.

- Prior to grading for redevelopment, the WFO property occupied a hill with elevations ranging from approximately 75 to 135 feet above mean sea level (MSL). This north-south trending hill is formed on the Gaffey Anticline, a geologic structure that strongly influences groundwater flow in the area.

7.3 REGIONAL AND SITE HYDROGEOLOGY

- The Site and Site vicinity are underlain by the generally fine-to-medium grained sandstones of the Lakewood and San Pedro Formations, which contain the shallow Gage and Lynwood aquifers and which dip steeply to the northeast on the northeast flank of the Gaffey Anticline. Groundwater is found near MSL, possibly within perched zones of the Upper Lakewood Formation and within the San Pedro Formation. These shallow aquifers form part of the southeastern portion of the West Coast Groundwater Basin, which underlies the southwestern part of the Los Angeles Coastal Plain. The major aquifers in the West Coast Groundwater Basin include the Gaspur, Gage, Lynwood, and Silverado. The major aquifers are separated by aquitards in the general vicinity of the Site. These aquitards, as well as generally upward vertical hydraulic gradients, limit the downward migration of shallow groundwater contamination.

- Boring logs for deep industrial water supply wells drilled on the Phillips 66 property north of the Site, together with regional cross-sections, confirm that, in the vicinity of the Site:
  - A confining layer separates the Gage (200-Foot Sand) Aquifer from the Lynwood (400-Foot Gravel Aquifer);
  - The Lynwood Aquifer is thin (approximately 25 feet thick), composed of relatively low-permeability deposits;
  - The Lynwood Aquifer is separated from the Silverado Aquifer by a thick aquitard (approximately 400 feet thick).

- At the Site, groundwater flow in the Gage Aquifer has been consistently toward the east-northeast. North of the Site, at the Phillips 66 Refinery, groundwater flow patterns show an abrupt change with the flow direction changing from the east-northeast direction on the south side of the Phillips 66 property to a northwest direction on the north side of the refinery. This pattern has been consistent over the period of monitoring (since approximately 1986) and is reportedly due to recharge in the elevated Palos Verdes Hills west of the Site vicinity, the influence of areas of mergence, and the influence of the Dominguez Gap Barrier Project (DGBP).

- The Site sits on the edge of, and directly upgradient from, the non-beneficial use portion of the West Coast Groundwater Basin. It is also within an area of known high total dissolved solids (TDS) or brackish groundwater, between or within the spheres of influence of the barrier injection wells of the DGBP that are used to prevent saltwater incursion into the coastal plain aquifers. Based on prior conversations with officials of the Water Replenishment District, development of water resources south of the Dominguez Gap is very unlikely, since groundwater south of the DGBP is defined as saline and of poor quality.

- Of the 12 production wells identified in the study area, three are active pumping wells, and 11 are abandoned. Additionally, there are 19 injection and observation wells operated by the Los Angeles County Department of Public Works (LACDPW) as part of the DGBP within a one-mile radius of the Site. The three active production wells (WW-005, WW-006, and WW-007) used for industrial water supply by Phillips 66 are located approximately 3,500 feet north of the Site. According to Phillips 66 reports, these wells are screened in the Silverado Aquifer.

- The geology of the shallow water-bearing zone (WBZ) was characterized during the installation of the soil vapor extraction (SVE) system at the Site by CET (CET, 1998). The lithologic composition of the shallow WBZ from the ground surface to approximately 15 to 20 feet below MSL is predominantly fine-grained silty sand, with occasional lenses of silt and clay. There appear to be no major lithologic barriers to lateral migration of groundwater within the shallow WBZ.

- Groundwater flow in the shallow WBZ is northeasterly with a gradient averaging approximately 0.004 foot per foot.

- The geology of the deeper WBZ has been investigated by the drilling of several deep wells at the Site. The deep wells, MW-20D, MW-21D, and MW-23D, like the previous deep wells MW-11 and MW-18, encountered silts and silty fine-grained sands from the bottom of the shallow WBZ (at around 120 feet bgs or 20 feet below MSL) to a depth of approximately 180 to 200 feet bgs (roughly 90 to 100 feet below MSL), where clean sands that contained groundwater were encountered.

- Monitoring well data collected at the Site confirm conclusions of previously discussed regional studies that the Gage Aquifer beneath the Site is impacted by salt water intrusion. Chloride concentrations are commonly used to characterize the impact of salt water intrusion. Elevated concentrations of chloride and other dissolved solids have been historically detected in Site wells (Todd, 1997), with evidence of saltwater intrusion dating to as early as 1955. In the most recent sampling event (SCS, 2014), chloride concentrations ranged from 50.728 to 883 milligrams per liter (mg/L) in the shallow WBZ wells and from 488 to 11,220 mg/L in the intermediate WBZ and deeper WBZ wells. TDS concentrations range from 724 to 22,200 mg/L. Background or intrinsic water quality at the Site is extremely poor, and well in excess of the Water Quality Objectives of 800 mg/L and 250 mg/L, respectively, as set out in the Basin Plan, and the 3,000 mg/L or less TDS criterion in State Board Policy.

7.4 NATURE AND EXTENT OF COCS AT THE SITE

- Soil, soil vapor, and groundwater at the Site have been extensively investigated, as previously indicated.

- Vadose soils that were impacted by petroleum hydrocarbons have been granted a "closed" status as has been evidenced by a number of closure letters. More recent investigations have focused on the possible presence of petroleum hydrocarbons in the saturated zone, and these results are discussed below.

- Soil vapor at the Site has been investigated on a number of occasions, including most recently by SCS in 2008. In particular, our investigation focused on the eastern-most portion of Building A. The intent of this investigation was to assess possible vapor intrusion into occupied portions of Site buildings, and if it occurred, whether there was an associated human health risk. We concluded that, although soil vapor intrusion was a theoretical possibility, an associated human health risk was highly unlikely.

- Dissolved and phase-separated hydrocarbons have been detected in groundwater wells at the Site. However, the lateral extent of both the dissolved phase and areas where LNAPL accumulates in wells are bounded or can be inferred and appear to be remarkably stable, based on a comparison of historical and current groundwater quality data. This conclusion is further supported by "fate and transport modeling" and more recent work conducted by Aqui-Ver Inc. (AVI) as described below.

- The vertical extent of CoCs at the Site has been assessed based on sampling data from monitoring wells installed in the intermediate and deeper WBZs. These wells are installed in areas proximate to shallow wells with known and reported LNAPL and are likely representative of "high-risk" areas for vertical migration at the Site. The lack of impacts to the deeper WBZ is consistent with an upward vertical hydraulic gradient that has been observed between the deep and shallow wells.

- Due to the lack of CoCs in the deeper WBZ, and given the upward hydraulic gradient, SCS does not believe that additional investigation of the deeper WBZ is either warranted or supported.

- The TPH concentrations in well MW-24 are anomalous but may be explained by a surface release of hydrocarbons. The recent TPH-DRO concentrations in MW-24 are well above the solubility limits of diesel fuels, meaning that the results are emulsified and invalid as a quantitative dissolved-phase measure. It is recommended that MW-24 be destroyed.

7.5 SCS FATE AND TRANSPORT MODELING

- SCS updated previously conducted fate and transport modeling using more recent Site data. This was completed to assess the contaminant migration (and specifically natural attenuation) at the Site. Existing data collected from the Site and assumed parameter values (from published literature) were used in conjunction with an analytical modeling approach (BIOSCREEN) to predict concentrations of benzene at various linear distances downgradient (in terms of groundwater flow) from the Site. The fate and transport modeling results indicate:
  - The maximum lateral extent of dissolved benzene in groundwater above 1 µg/L is between 360 feet and 400 feet downgradient of the LNAPL area.
  - Our modeling simulations indicate that this migration distance was achieved within 30 years after the release and remains steady thereafter (conservatively assuming a constant source, even though it is likely diminishing). No further migration is expected, regardless of any actions taken in the source area.

- The forensic geochemistry and history of groundwater monitoring and concentration gradients provide lines of evidence that the detected concentrations of CoCs (e.g., benzene and 1,2 DCP) in the downgradient intermediate zone wells are not likely present as a result of release(s) at the Site. Nevertheless, fate and transport modeling was conducted, as a conservative approach, to assess whether the benzene, as an indicator compound, would migrate to and impact any sensitive receptors (i.e., in this case the Northwest Slip of the Harbor). Therefore, the BIOSCREEN analytical modeling completed for the Site was reinterpreted to estimate potential migration of dissolved-phase benzene at the downgradient plume boundary and to assess the potential impacts to downgradient receptors (i.e., the waters of the Harbor).

- The existing BIOSCREEN model can estimate potential benzene migration downgradient from the interpreted plume boundary. By using the reported concentration for MW-29 during the January 2014 sampling event (599 µg/L), or even more conservatively, assuming an infinite source of LNAPL is present at the downgradient plume boundary (see conclusion below), a prediction can be made of benzene concentrations at various distances downgradient for times of 5, 10, 15, 20, 25, 30, 50, 75, and 100 years:
    - The maximum lateral extent of dissolved benzene in groundwater above 1 µg/L is between 200 and 240 feet downgradient of MW29.
    - Our modeling simulations indicate that this migration distance was achieved within 15 years and remains steady thereafter (conservatively assuming a constant source, even though it is likely diminishing). No further migration would be expected from this well with the reported benzene concentration.
- This modeling can also be applied to estimate potential risks to the nearby surface water of Los Angeles Harbor which is approximately 800 feet from the eastern edge of the Site:
    - The most conservative application of this model would be for the hypothetical scenario where LNAPL was present at the easternmost edge of the Site contributing the highest potential benzene concentration with the least distance to the Harbor.
    - While extremely unlikely, this conservative scenario would produce a dissolved-phase benzene plume migrating no more than 400 feet leaving approximately 400 feet of unimpacted shallow water bearing zone between the distal edge of the plume to the nearest point in the Harbor.

7.6 DISSOLVED-PHASE EVALUATION

The following conclusions are based SCS's work and lines of evidence that have previously been developed or reported, as well as the work of AVI (2011, 2014).

- The geospatial mass distributions illustrate the plume stability for benzene.
- No wells were observed to exhibit increasing TBA trends, and the wells with sufficient data for a trend analysis exhibited a decreasing trend and reach the regulatory criteria by, at the latest, 2024 in the wells that are located along the leading edge of the plume. Thus, the center of mass of the TBA plume is likely stable and is not moving downgradient.
- Worst-case scenario predictions using the mass flux from the Site to estimate maximum concentrations of TBA at a hypothetical drinking water well result in no impacts above regulatory criteria for TBA. Furthermore, utilization of groundwater from the Gage

Aquifer would require treatment to remove naturally occurring dissolved-phase constituents. During this treatment process, TBA would most certainly be removed from the produced groundwater.

- TBA has not been detected in downgradient off-Site Phillips 66 well MW-8 and has not been detected above the NL (12µg/L) in off-Site well MW-12, both of which are located directly downgradient of the source area. Wells MW-8 (Phillips 66) and MW-12 have generally been monitored for TBA since it was first detected at the Site (2007), although well MW-12 was abandoned in 2009.

- The plume trends and fate and transport analysis suggests that the TBA plume is stable laterally and is attenuating, which is further supported by the absence of detections in downgradient well MW-8 located on the Phillips 66 site.

- As discussed in the main body of this Report, the TBA plume is also contained vertically by predominantly upward vertical gradients in the Gage Aquifer beneath the Site.

- In addition, AVI commented on the conservative aspect of the methods used in the plume evaluation: "In summary, these various layers of conservatism mirror USEPA risk assessment practices and those of ASTM to provide a direct analysis based on data, rather than models, to assess the safety of site closures under Resolution 92-49. It is estimated that the safety factors involved generate more than 3 orders of conservatism over actual expected conditions."

- AVI also stated that, "based on the summary of findings above, the TBA plume appears to be stable and contained by natural attenuation processes. This, coupled with the marginal quality groundwater beneath the site, suggest that this plume meets State standards for presenting no risk, and no threat to future groundwater use."

- AVI's analysis is consistent with SCS' modeling and previous interpretation of data and lines of evidence (see, e.g., SCS, 2009b, *Conceptual Site Model*).

7.7 FORENSIC GEOCHEMISTRY AND ASSESSMENT OF DOWNGRADIENT COCS

Forensic geochemistry was completed on targeted groundwater monitoring wells to assess possible on- and off-Site sources and impacts to groundwater downgradient of the Site. Zymax, a laboratory specializing in forensic geochemistry, was retained to perform the analysis and interpret the data. The Zymax (2014) report draws the following conclusions:

- "Water sample MW-10R contains dissolved hydrocarbons that most likely represent degraded gasoline.
- MW-26 contains a similar gasoline, and some heavier aromatic hydrocarbons, probably from another source.
- MW-29 contains a different gasoline with the fuel oxygenate DIPE. This gasoline is from a different source than MW-10R.

- The dissolved gasoline in MW-27 appears to be more similar to MW-29, and is probably from the same source as MW29.
- MW-10R also contains degraded diesel or #2 fuel oil that was not detected in MW-26, MW-27, or MW-29."

These data and conclusions suggest that while the TPH-GRO in MW-26 is consistent with MW-10R and an on-Site source, the CoCs detected in other wells are, in general, not, and are consistent with a distinct or separate source of release. Furthermore, the results from the intermediate WBZ wells, while consistent with one another, are not consistent with the detected CoCs in the shallow WBZ wells and suggests another source or sources of release, unrelated to the CoCs detected in on-Site wells.

7.8 LNAPL EVALUATION

As indicated by AVI (2011), there are two key questions regarding the selection of appropriate plume management or cleanup actions for the Site:

- Is the LNAPL plume stable from a management perspective?
- Will additional active cleanup have any net benefit to the waters of the State?

AVI (2011) indicates that a weight of evidence approach, wherein multiple lines of evidence are considered in their totality, should be used to assess LNAPL plume stability. These lines of evidence are:

- Confirmation that the LNAPL releases are finite and not ongoing at the Site
- Evaluation of the relative age of the LNAPL plumes; the older the plume, the more probable it has reached field static equilibrium
- Evaluation of LNAPL gradients
- Comparisons of estimated LNAPL to water conductivity values
- Evaluation of LNAPL flow
- Review of petrophysical properties, including expectations for an entry pressure threshold
- Inspection of LNAPL plume distribution to consider whether the morphology is consistent with the form of a stable plume.

AVI (2011) concluded:

> "In summary, for this particular site, all the factors above point to LNAPL plume stability. While there may be small-scale movement in response to localized gradients, the plume is old enough and displays all the other features of a stable plume relative to site management objectives."

7.9 CLEANUP STANDARDS AND WATER QUALITY OBJECTIVES

- Closure will be conditioned upon a demonstrated achievement of performance criteria, including:
    - No recoverable free product remains at the Site;
    - On-Site and off-Site groundwater contamination has been contained and stabilized (RWQCB, 1998).
- California Code of Regulations, Title 23, Division 3, Chapter 16, Section 2655 mandates that free-phase product be removed "to the extent practicable." This requirement is interpreted to be consistent with the "no recoverable" free product goal described above.
- More recent State Water Resources Control Board guidance (Low Threat UST Closure Policy) provides additional clarification of "practicable" as follows: "(a) Free product shall be removed in a manner that minimizes the spread of the unauthorized release into previously uncontaminated zones by using recovery and disposal techniques appropriate to the hydrogeologic conditions at the site, and that properly treats, discharges or disposes of recovery byproducts in compliance with applicable laws; (b) Abatement of free product migration shall be used as a minimum design objective for the design of any free product removal system; (c) Flammable products shall be stored for disposal in a safe and competent manner to prevent fires or explosions."
- In addition, free product recovery is, based on Policy technical guidance documents, to be interpreted in terms of whether the product or LNAPL is mobile or stable. Based on the analysis conducted by AVI, the LNAPL is stable and additional removal is not practicable.
- No demonstrated on-Site risk from vapor intrusion based on soil vapor investigation and vapor intrusion risk assessment.

7.10 CONSISTENCY WITH CLEANUP GOALS

- Soil remediation at the Site is complete, and the RWQCB has granted closure for Site soils. In addition, a soil vapor investigation and vapor intrusion risk assessment were completed and accepted by OEHHA and the RWQCB. Soil vapor does not pose a significant human health risk.
- Based on the fate and transport modeling conducted by both AVI and SCS, and our review of historical as well as current groundwater monitoring data, SCS concludes that the dissolved-phase plume is stable or contained, both laterally and vertically and unlikely to migrate to or impact sensitive receptors.
- Given the extremely poor intrinsic water quality at the Site, and that the Site and dissolved phase plume are immediately adjacent to and upgradient of a groundwater basin without beneficial uses, the presence of CoCs in groundwater is highly unlikely to

impair the beneficial uses of groundwater and the downgradient migration of CoCs will not result in exceedance of water quality objectives in the de-designated subarea. Multiple lines of evidence have indicated that is highly unlikely that the CoCs in groundwater from the Site will migrate to or impact surface waters present in the Northwest Slip, some 800 feet from the Site.

- As has been previously indicated, extensive prior remediation efforts have been directed at LNAPL removal, including AS/SVE as well as vacuum track purging and recovery. Literally millions of pounds of petroleum hydrocarbons have been removed from the subsurface of the Site as a result of remediation efforts. However, some LNAPL has been measured in Site wells subsequent to remediation and case closure of the soil at the Site.

- Based on the work conducted by AVI, it is apparent that, while LNAPL is present in wells in two areas at the Site:

  - LNAPL conductivity is very low, as is LNAPL velocity, which is estimated at less than 1 foot per year, and possibly less;

  - Multiple other lines of evidence point to plume and LNAPL stability, including the age of plume and the plume morphology; and

  - LNAPL recovery using conventional methods such as hydraulic recovery or even AS/SVE, which was at one time successful in removing mass, are unlikely to induce any significant recovery using conventional designs and well spacings.

- Under SWRCB guidance, further LNAPL recovery and remediation is not necessary nor would it be "practicable." Indeed, considering the cost, cost per pound removed, or "net benefit" as put forward by AVI, then further remediation would be an imprudent use of scarce resources to protect what should, in reality, be classified as non-beneficial use groundwater.

- AVI concluded: "Given that the site has all risk pathways contained and managed (low-risk), and given that additional cleanup would have no net benefit to the waters of the State, and a high impact to site operations that would need to cease to complete that effort, it is our opinion that no further action is warranted beyond monitoring plume stability and ongoing natural attenuation. There simply is no additional action that might be taken in the face of these beneficial site commercial operations that would have any benefit, and in a variety of scenarios would have negative net benefits."

7.11 LOW-THREAT CLOSURE POLICY

- The Low Threat Closure Policy contemplates applicability to non-UST petroleum releases, such as the Site, and the Site data demonstrate that the Site meets both the general and media specific criteria of the Policy.

7.12 CONSTRAINTS ANALYSIS

A number of constraints, as previously described, impact the potential viability of remedial alternatives at the Site. For the purposes of this analysis, SCS focused on the possible mitigation of LNAPL at the Site, as it is our opinion that the dissolved-phase plume meets the stated cleanup goal. Some of the constraints include:

- The nature and extent of physical improvements at the Site, including buildings and their locations and on-going operations;
- Site conditions, including geology, geochemistry and hydrogeology;
- Plume location, depth and morphology;
- Nature and age of the petroleum hydrocarbons;
- Required location and density of remedial operations to affect any significant recovery of mass; and
- The likely efficacy of convention remedial alternatives.

8.0 RECOMMENDATION

The Site conditions are consistent with both the Policy and Cleanup Goals. Given the demonstrated plume stability, the absence of risk presented by the immobile LNAPL, and demonstrated absence of health impacts or impacts to beneficial uses or sensitive receptors, SCS requests on behalf of our Client, that the RWQCB close the release case associated with the Site.

As was previously stated, even if implementation of active remediation were feasible, the net benefit to water quality and the environment is likely to be minimal given the likely limitations on recovery, the very poor water quality at the Site, and limitations on beneficial uses.

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