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5. Contamination Migration in Area 3

This section describes the interpretation of the relationship between potential sources of ***groundwater contamination*** and the distribution and migration of ***Key contaminants of potential concern*** (COPCs) in the San Gabriel Valley Area 3 ***Superfund*** Site (Area 3). Key COPCs include ***contaminants*** detected multiple times at production wells in Area 3 at concentrations that exceed the ***evaluation criteria***. The ***remedial investigation*** (RI) report uses Key COPCs as a way of identifying regional contamination within Area 3.

Each section of this report provides a discussion of the subject, followed by any tables or figures cited in the text. In addition, exhibits and text boxes noted in the margins present key concepts, tables, and figures.

The glossary explains words presented in ***bold, italicized*** *text.*

The migration and ***persistence*** of Key COPCs influence the potential of Key COPCs to cause adverse effects to human health and the environment.

The contamination migration ***conceptual site model*** presented in this section incorporates the following four elements.

- ***Hydrogeology*** (discussed in Section 3 and Appendix D)
- Contaminant sources (discussed in Section 4)
- Contaminant distribution (discussed in Section 4)
- Contaminant migration (discussed in Technical Appendix 5)

As Section 2.2 describes, the United States Environmental Protection Agency (EPA) uses ***data quality objectives*** (DQOs) to guide data collection, analysis, and interpretation for each RI subtask. Table 2-1 (at the end of Section 2) presents the overall DQOs for the Area 3 RI; Table 5-1 (at the end of this section) presents the DQOs developed to guide data collection, analysis, and interpretation for the contamination migration conceptual site model (RI Subtask 3) for Area 3.

Table 5-1 identifies potential evaluation results and methods to avoid incorrect results. Table 5-1 defines evaluation boundaries for the groundwater investigation for Area 3, lists data needs to complete the subtask, and describes how the data will be used. Table 5-1 also includes an evaluation of the assessment conducted to determine the quality and usability of the data set.

Table 5-1 presents the DQOs for the contamination migration conceptual site model.

The contamination migration conceptual site model considers all Key COPCs in groundwater in Area 3, except nitrate. As discussed in Section 4.3.7, nitrate contamination is released by extensive ***non-point sources*** throughout the San Gabriel Valley Groundwater ***Basin*** (San Gabriel Basin), as opposed to contamination from the other Key COPCs, which likely is released by discrete sources within Area 3. Although nitrate contamination has been released by extensive non-point sources in the San Gabriel Basin, the ***human health risk assessment*** (HHRA) conducted for Area 3, as presented in Appendix D and summarized in Section 6, shows that nitrate contamination does contribute to the potential noncancer risks in Area 3. Therefore, the ***feasibility study*** for Area 3 will evaluate provisions to address nitrate contamination.

5.1 Contamination Migration Conceptual Site Model

Technical Appendix 5 discusses mechanisms that may control COPC migration in Area 3.

The contamination migration conceptual site model for Area 3 qualitatively describes the sources and potential migration pathways of Key COPCs in groundwater. Technical Appendix 5 discusses the mechanisms that may control COPC migration in Area 3. As discussed in Section 4, potential contaminant sources in Area 3 include manufacturing and chemical storage facilities concentrated in a large industrial area in southwestern (SW) Area 3, and dry cleaning facilities located throughout Area 3.

5.1.1 Hydrogeology of Area 3

The RI identifies a ***structural bedrock discontinuity*** within the geology of Area 3, possibly a ***fault*** zone associated with the Whittier Fault system, as shown in Figure 3-9. The structural bedrock discontinuity appears to differentiate the ***hydrostratigraphy*** and the groundwater conditions between the western and eastern portions of Area 3, and to affect groundwater flow, as discussed in Section 3 and Appendix D.

As discussed in Section 3.1.6 and Section D.1 in Appendix D, the western portion of Area 3 contains the bedrock ***aquifer*** and the western ***alluvial*** aquifer. Three distinct groundwater zones occur in the eastern alluvial aquifer in Area 3, designated in this report as the shallow, intermediate, and deep groundwater zones.

Historically, the western and eastern alluvial aquifers were in direct hydraulic communication, and groundwater elevations in the eastern alluvial aquifer were higher than the western bedrock elevation. Increased pumping in the San Gabriel Basin since the late 1940s caused a major decline in groundwater elevations in the eastern alluvial aquifer to below the western bedrock elevation. Groundwater underlying Area 3 historically flowed from west to east, with regional groundwater flow toward the San Gabriel Basin outlet, Whittier Narrows. Regional groundwater east of Area 3 flows southwestward.

In the western portion of Area 3, groundwater flows generally southeastward to eastward. Groundwater flow follows the bedrock structural features, in particular the southeastward-eastward ***plunging syncline*** where the saturated thickness of the ***alluvium*** is greatest. Properties that influence groundwater flow include limited recharge, hydraulic gradient and soil type, as the bedrock aquifer consists of finer-grained material than the western alluvial aquifer which acts to restrict groundwater flow. In the eastern portion of Area 3, within the shallow zone, groundwater generally flows to the southwest; while in the intermediate and deeps zones, groundwater flows toward the active production wells.

The Raymond Fault forms the northern boundary of Area 3 and separates the San Gabriel Basin from the Raymond Basin as illustrated in Figure 4-10. Groundwater north of the Raymond Fault in the Raymond Basin occurs at shallower depths than groundwater to the south in the San Gabriel Basin. Groundwater flows across sections of the fault from the Raymond Basin to the San Gabriel Basin in northeastern (NE) Area 3.

5.1.2 Contaminant Sources in Area 3

Evaluation of ***primary and secondary environmental data*** reveals the presence of seven Key COPCs in groundwater underlying Area 3 as discussed in Section 4.2.2 and Section 4.3. The seven Key COPCs include contaminants detected multiple times at production wells in Area 3 at concentrations that exceeded the evaluation criteria. The contamination migration conceptual site model excludes nitrate.

At least one or more Key COPCs occur beneath manufacturing and chemical storage facilities in each of the three aquifers underlying Area 3. Most facilities investigated have detected ***volatile organic compounds*** (VOCs) in the subsurface. Twelve facilities have reported chlorinated VOCs in groundwater at concentrations that exceed the evaluation criteria.

Potential non-point sources of contaminants include inflow of contamination from upgradient sources outside Area 3, such as the Raymond Basin, El Monte ***Operable Unit*** (OU), and South El Monte OU.

5.1.3 Contaminant Distribution in Area 3

Releases from facilities would cause contaminants to migrate downward, either as ***free-phase liquids*** or as solutes dissolved in water, through the ***vadose zone*** to groundwater. As the contaminants migrate vertically downward within the vadose zone, lateral migration from the source areas could occur along fine-grained units or potential ***perched groundwater zones***, if encountered.

The relative severity of contamination in the five geographic areas is ranked in the order indicated in Exhibit 5-1.

Exhibit 5-1 indicates the relative severity of contamination of the five geographic areas in Area 3.

EXHIBIT 5-1
Overall Ranking of Geographic Areas in Terms of Relative Severity of Contamination

	Geographic Area	Basis for Relative Ranking
1.	Southwestern (SW) Area 3 (tied with NE Area 3)	– Most identified point sources of contamination. – Occurrence of maximum ***trichloroethene*** (TCE) concentrations in groundwater and corresponding estimated risks to human health within Area 3.
1.	Northeastern (NE) Area 3 (tied with SW Area 3)	– Occurrence of maximum ***tetrachloroethene*** (PCE) concentrations in groundwater and corresponding highest estimated risks to human health within Area 3. – Presence of production wells.
3.	Central Area 3	– Most widespread occurrence of 1,2,3-trichloropropane (1,2,3-TCP) contamination within Area 3.
4.	Northwestern (NW) Area 3	– Limited number of potential sources of contamination identified.
5.	Southeastern (SE) Area 3	– Absence of identified potential point sources. – Potential impact of non-point sources.

Appendix E presents additional data in tables and figures to support the discussion in Section 4 and Section 5.

Figures E-7 through E-10 in Appendix E present concentration trends for Key COPCs observed at monitoring wells in Area 3.

Figures E-11 through E-23 in Appendix E present concentration trends for PCE and TCE observed in production wells in Area 3.

Figures 5-1, 5-2, and 5-3 present the maximum concentrations and migration pathways for PCE, TCE, and cis-1,2-DCE, respectively.

Figures 5-4 through 5-15 present the hydrogeologic cross-sections that illustrate the PCE and TCE contamination in Area 3.

Figure 3-4 shows the locations of the cross-sections in plan view.

5.1.4 Contaminant Transport in Area 3

Multiple sources contribute to the groundwater contamination in Area 3. Key COPC contamination likely originates from different sources. The cis-1,2-dichloroethene (cis-1,2-DCE) contamination may result from the degradation of TCE as discussed in Technical Appendix 5. ***Advection*** is the major component of migration of Key COPCs in Area 3 along the path of groundwater flow, which is determined by passive influences, such as subsurface geology, and active influences, such as pumping. Section 5.2 provides a detailed discussion of the distribution and migration of Key COPCs in the five geographic areas.

5.2 Contamination Distribution and Migration in Groundwater

This section assesses migration pathways of contaminants in groundwater in the five geographic areas within Area 3, designated in this report as SW, NW, central, NE, and SE Area 3. Appendix E presents additional data in tables and figures to support the discussion in Section 4 and Section 5. Figures E-7 through E-10 in Appendix E present concentration trends over time for Key COPCs observed at monitoring wells in Area 3. Figures E-11 through E-23 present concentration trends over time for PCE and TCE observed in production wells in Area 3. These concentration trends provide an indication of the persistence of groundwater contamination in Area 3. The evaluation considers the four elements of the contamination migration conceptual site model: hydrogeology, contaminant sources, contaminant distribution, and contamination migration.

Evaluations of the spatial extent and the concentrations of Key COPCs in groundwater are based on data collected from ***groundwater monitoring wells*** and production wells. Estimates of the vertical distribution of Key COPCs rely on data collected at discrete depth intervals from ***multiport monitoring wells***.

Figures 5-1, 5-2, and 5-3 present the maximum concentrations and migration pathways for PCE, TCE, and cis-1,2-DCE, respectively. Limited data for carbon tetrachloride, 1,2,3-TCP, and perchlorate preclude presenting migration pathways for these Key COPCs. Contaminant source identification and groundwater monitoring will continue during the feasibility study; the collected data will be evaluated and the contamination migration model will be refined. The conceptual hydrogeologic cross-sections in Figures 5-4 through 5-15 present the horizontal and vertical extent of PCE and TCE contamination in Area 3. Figure 3-4 shows the locations of the cross-sections in plan view.

Evaluation of potential sources of Key COPCs in groundwater is based on subsurface investigation data collected at the 33 facilities in Area 3 discussed in Section 4.4. Table 4-8 and Exhibits 5-2 through 5-6 that follow summarize Key COPCs detected in groundwater at 12 of the 33 facilities.

Table 4-8 and Exhibits 5-2 through 5-6 that follow summarize Key COPCs detected in groundwater at 12 of the 33 facilities.

The emphasis placed on contamination migration in SW, central, and NE Area 3 in the following discussion reflects the relative abundance of groundwater data collected in these three areas. Data collection in NW and SE Area 3 is limited because there are relatively few groundwater wells in these two areas.

As discussed above further evaluation of the extent and the migration of groundwater contamination in Area 3 will be considered during the feasibility study. Groundwater flow conditions in the three aquifers underlying Area 3 will be assessed during the evaluation of remedial alternatives in the feasibility study. Groundwater flow from the western alluvial aquifer to the eastern alluvial aquifer will also be evaluated.

5.2.1 Contamination Distribution and Migration in SW Area 3

The severity of groundwater contamination in SW Area 3 appears to rank highest within Area 3 (along with the severity of groundwater contamination in NE Area 3) as shown in Exhibit 5-1. PCE and TCE are the predominant Key COPCs. SW Area 3 contains the most industrial areas and the most facilities with Key COPCs reported in groundwater.

The investigation of contamination in SW Area 3 reveals several sources of Key COPCs observed in groundwater that have impacted both the bedrock aquifer and the western alluvial aquifer. EPA and the State of California continue efforts to identify sources of contamination. As shown in Table 4-9, subsurface investigations at 21 facilities in SW Area 3 reveal the presence of Key COPCs in ***soil vapor***, including PCE and TCE at all 21 facilities. The state has directed 10 facilities to investigate the groundwater. Other unidentified contaminant sources may exist in SW Area 3.

5.2.1.1 Groundwater Data Set for SW Area 3

Exhibit 5-2 summarizes the distribution of Key COPCs in groundwater in SW Area 3. All Key COPCs occur in groundwater in SW Area 3 at concentrations that exceed the evaluation criteria (***maximum contaminant levels*** [MCLs] or ***notification levels*** [NLs]).

Exhibit 5-2 summarizes the distribution of Key COPCs in groundwater in SW Area 3.

EXHIBIT 5-2
Key COPC Distribution In Groundwater In SW Area 3

Contaminant	MCL or NL (µg/L)	Maximum Concentration Detected and Associated Well (µg/L)	Number of Wells with Concentration Exceeding MCL/NL	Wells with Concentration Exceeding 10 Times MCL/NL	Aquifer(s) Impacted	Facilities[a] with Groundwater Concentration Exceeding MCL/NL
PCE	5	192 W12PMMW1	13 of 19	W12PMMW1 W12IWMW1 W12CPMW1 W12CVMW3 W12VCGM1	Western alluvial, bedrock	1, 3, 4, 5, 6, 8, 10, 22, 32
TCE	5	2,300 W12ASMW2	16 of 19	EPAMW11 W12ARMW1 W12ARMW3 W12ARMW4 W12ASMW1 W12ASMW2 W12ASMW3 W12CPMW1 W12CVMW3 W12CVMW4 W12CVMW5 W12IWMW1 W12PMMW1 W12USMW1	Western alluvial, bedrock	1, 3, 4, 5, 6, 8, 10, 32
cis-1,2-DCE	6	99 W12PMMW1	5 of 19	W12PMMW1	Western alluvial, bedrock	1, 8, 32
1,2,3-TCP	0.005	0.032 W12CPMW1	3 of 18	None	Western alluvial, bedrock	1, 4, 7
Carbon tetrachloride	0.5	3.2 W12ASMW2	6 of 19	None	Western alluvial	1, 3, 4, 6
Perchlorate	6	6.4 EPAMW11	1 of 5	None	Western alluvial	Unknown

Notes:

[a]Figure 4-9 shows the facilities with open subsurface investigations and the associated facility tracking numbers.

For information on the distribution of the Key COPC nitrate, refer to Section 4.3.7 and Exhibit 4-8. As explained in Section 4.3.7, the contamination migration conceptual site model for Area 3 excludes nitrate from consideration.

cis-1,2-DCE – cis-1,2-dichloroethene
MCL – maximum contaminant level
µg/L – micrograms per liter
NL – notification level
PCE – tetrachloroethene
TCE – trichloroethene
1,2,3-TCP – 1,2,3-trichloropropane

Table 4-8 summarizes Key COPC concentrations detected in Area 3.

The discussion of the distribution, concentrations, and migration of Key COPCs in groundwater in SW Area 3 is based on data collected from 19 monitoring wells. EPA installed two groundwater monitoring wells. Facilities 1, 3, and 32 have installed three, three, and four groundwater monitoring wells, respectively; and Facilities 4, 5, 6, 7, 8, and 10 have installed one well each. Table 4-8 summarizes Key COPC concentrations detected in Area 3. No production wells are installed in SW Area 3.

5.2.1.2 Tetrachloroethene Distribution and Migration in SW Area 3

The PCE contamination in groundwater in SW Area 3 noted in Exhibit 5-2 appears to originate from at least three sources that likely occur in the vicinities of Facilities 3, 8, and 22. Figure 5-1 presents maximum concentrations of PCE and the directions of horizontal groundwater flow. Figure 3-4 presents the location of the cross-sections within Area 3 in plan view. Figures 5-4 and 5-14 illustrate that PCE contamination in groundwater occurs in the western alluvial and bedrock aquifers. The observations described in the bullets below provide evidence of the migration of PCE in groundwater from the three sources.

Figure 5-1 presents maximum concentrations of PCE and the directions of horizontal groundwater flow.

Figure 3-4 presents the location of the cross-sections within Area 3 in plan view.

Figures 5-4 and 5-14 illustrate that PCE contamination in groundwater occurs in the western alluvial and bedrock aquifers.

- PCE observed in groundwater beneath Facility 8 appears to migrate to the southeast, as shown by the presence of PCE at lower concentrations in groundwater beneath Facility 5 located farther southeast. Facility 5 has used solvents; the presence of PCE detected may also be related to a site-specific release.
- PCE detected in groundwater beneath Facility 22 appears to migrate to the east-northeast, although the horizontal extent of PCE contamination originating from this facility is unknown. The groundwater flow beneath Facility 22 may be controlled by the geologic structure of the ***anticline***.
- PCE contamination also appears to have migrated from Facility 3, as evidenced by the occurrence of PCE at higher relative concentrations in groundwater at a downgradient monitoring well at Facility 3. Lower concentrations of PCE occur at monitoring wells located upgradient at Facilities 3, 4, and 6.

5.2.1.3 Trichloroethene Distribution and Migration in SW Area 3

TCE, the Key COPC that occurs most widely in groundwater in SW Area 3, appears to originate from at least four discrete sources in the vicinities of Facility 1; Facility 8; Facilities 3, 4 and 6; and Facility 32. TCE contamination generally occurs at locations with PCE contamination, but at higher concentrations and at more monitoring wells than PCE. This pattern of TCE detections, discussed in Technical Appendix 5, indicates that the occurrence of TCE from the degradation of PCE alone is unlikely. Figure 5-2 presents maximum concentrations of TCE and the directions of horizontal groundwater flow. Figure 3-4 presents the location of the cross-sections within Area 3 in plan view. Figures 5-5 and 5-15 illustrate that TCE contamination in groundwater occurs in the western alluvial and bedrock aquifers.

Figure 5-2 presents maximum concentrations of TCE and the directions of horizontal groundwater flow.

Figures 5-5 and 5-15 illustrate that TCE contamination in groundwater occurs in the western alluvial and bedrock aquifers.

The observations described in the bullets below provide evidence to suggest the presence of at least four sources of the TCE contamination in groundwater noted in Exhibit 5-2.

Exhibit 5-2 summarizes the distribution of TCE in groundwater in SW Area 3.

- Groundwater beneath Facility 1 shows the maximum concentration of TCE. The horizontal extent and the migration pathway of TCE contamination originating from Facility 1 remain unknown. The TCE contamination likely follows the groundwater flow direction to the southeast.

- TCE observed in groundwater beneath Facility 8 appears to migrate to the southeast, as shown by the presence of TCE at lower concentrations in groundwater beneath Facility 5 located farther southeast. Facility 5 has used solvents; the presence of TCE detected may also be related to a site-specific release.
- TCE occurs at similar concentrations in groundwater beneath Facilities 3, 4, and 6. The TCE contamination likely follows the groundwater flow direction to the southeast.
- TCE detected in groundwater beneath Facility 32 appears to migrate to the northeast; however, the horizontal extent of TCE contamination originating from this facility is unknown. The geologic structure of the fault, shown on Figure 5-2, may influence groundwater flow beneath Facility 32.

5.2.1.4 cis-1,2-Dichloroethene Distribution SW Area 3

Figure 5-3 presents the cis-1,2-DCE maximum concentrations and horizontal flow directions.

Figure 5-3 presents the cis-1,2-DCE maximum concentrations and horizontal flow direction. cis-1,2-DCE likely occurs as a ***biological degradation product*** of TCE, as evidenced by the occurrence of cis-1,2-DCE mainly at locations with TCE contamination.

A potential discrete source of cis-1,2-DCE contamination may occur in the vicinity of Facility 8. As shown in Exhibit 5-2, groundwater beneath Facility 8 shows the maximum reported concentration of cis-1,2-DCE in SW Area 3. If a discrete source of cis-1,2-DCE occurs beneath Facility 8, the contamination would likely follow the direction of groundwater flow to the southeast. Technical Appendix 5 evaluates the potential of biological degradation of TCE to cis-1,2-DCE.

Technical Appendix 5 evaluates the potential of biological degradation of TCE to cis-1,2-DCE.

5.2.1.5 1,2,3-Trichloropropane Distribution in SW Area 3

1,2,3-TCP contamination appears to occur in three locations in SW Area 3 based on very limited data. As shown in Exhibit 5-2, the data set includes results reported by only three facilities.

Absence of 1,2,3-TCP in groundwater downgradient of the facilities in SW Area 3 (at Monitoring Well EPAMW11) indicates that the occurrence of widespread 1,2,3-TCP contamination is unlikely. Evaluating the migration of 1,2,3-TCP contamination is not feasible without additional characterization data.

5.2.1.6 Carbon Tetrachloride Distribution and Migration in SW Area 3

The possibility of widespread carbon tetrachloride contamination in groundwater exists in SW Area 3. The detection of carbon tetrachloride in groundwater beneath several facilities, as shown in Exhibit 5-2, and downgradient of the facilities (at Monitoring Well EPAMW11) supports this observation. The potential source of the carbon tetrachloride remains unknown, but facilities may have used carbon tetrachloride as a cleaning fluid or in refrigerants.

5.2.1.7 Perchlorate Distribution in SW Area 3

The data set for perchlorate in groundwater is very limited. As shown in Exhibit 5-2, only five facilities in SW Area 3 have tested for perchlorate. Without additional characterization data, evaluating the horizontal extent and the migration of perchlorate contamination is not feasible.

5.2.1.8 General Contamination Migration in SW Area 3

Advection controls contamination migration in SW Area 3 in the bedrock aquifer and the western alluvial aquifer as described in Technical Appendix 5.

Figure 5-1 depicts the migration pathway, which follows the flow of groundwater in the southeastward-eastward direction through the western alluvial and bedrock aquifers. Because the structural features of bedrock control groundwater flow in western Area 3, contamination will migrate away from the higher bedrock elevations (Hellman Avenue and South Pasadena Anticlines) toward the lower bedrock elevations in the unnamed syncline.

Figure 5-1 depicts the migration pathway for SW Area 3.

Historically, eastward migration of contaminants in groundwater could have occurred from SW Area 3 into central Area 3. Before the 1950s, the occurrence of relatively similar groundwater levels placed the western alluvial and eastern alluvial aquifers in direct hydraulic communication and groundwater flowed from west to east.

Around the 1950s, the water level in the eastern alluvial aquifer dropped to an elevation below the elevation of the bedrock aquifer in western Area 3, which caused a separation of the aquifers. Groundwater flow from west to east decreased and any contamination migration eastward from SW Area 3 likely diminished.

Regional groundwater flow from the syncline to the structural bedrock discontinuity remains uncharacterized. The extent of VOC contamination in SW Area 3 warrants further evaluation as source investigations continue.

5.2.2 Contamination Distribution and Migration in NW Area 3

The severity of groundwater contamination in NW Area 3 appears to rank fourth within Area 3, as shown in Exhibit 5-1. Although sources of groundwater contamination in NW Area 3 remain undefined, groundwater in the intermediate and deep zones of the eastern alluvial aquifer at two production wells shows the presence of Key COPCs at concentrations that exceed the MCLs. Exhibit 5-3 summarizes the distribution of Key COPCs in groundwater in NW Area 3.

As shown in Table 4-9, subsurface investigations at two dry cleaning facilities in NW Area 3 revealed the presence of Key COPCs in soil vapor, including PCE and TCE at Facility 23, and PCE at Facility 29. The State of California has directed both facilities to investigate the groundwater. Other unidentified contaminant sources may exist in NW Area 3.

Exhibit 5-3 summarizes the distribution of Key COPCs in groundwater in NW Area 3.

EXHIBIT 5-3
Key COPC Distribution In Groundwater In NW Area 3

Contaminant	MCL or NL (µg/L)	Maximum Concentration Detected and Associated Well (µg/L)	Number of Wells with Concentration Exceeding MCL/NL	Wells with Concentration Exceeding 10 Times MCL/NL	Aquifer(s) Impacted	Facilities [a] with Groundwater Concentration Exceeding MCL/NL
PCE	5	8.9 01901679	1 of 2	None	Intermediate, deep	Unknown
TCE	5	12.2 01900934	1 of 2	None	Intermediate, deep	Unknown
cis-1,2-DCE	6	0.9 01900934	0 of 2	None	Intermediate, deep	Unknown
1,2,3-TCP	0.005	Not detected	0 of 2	None	None	Unknown
Carbon tetrachloride	0.5	1 01901679	1 of 2	None	Intermediate, deep	Unknown
Perchlorate	6	6.8 01901679	1 of 2	None	Intermediate, deep	Unknown

Notes:
[a]Figure 4-9 shows the facilities with open subsurface investigations and the associated facility tracking numbers. For information on the distribution of the Key COPC nitrate, refer to Section 4.3.7 and Exhibit 4-8. As explained in Section 4.3.7, the contamination migration conceptual site model for Area 3 excludes nitrate from consideration.

cis-1,2-DCE – cis-1,2-dichloroethene
MCL – maximum contaminant level
µg/L – micrograms per liter
NL – notification level
PCE – tetrachloroethene
TCE – trichloroethene
1,2,3-TCP – 1,2,3-trichloropropane

5.2.2.1 Groundwater Data Set for NW Area 3

Table 4-8 summarizes the Key COPC concentrations detected in Area 3.

PCE, TCE, carbon tetrachloride, and perchlorate occur in groundwater in NW Area 3 at concentrations that exceed the evaluation criteria (MCLs).

The following analysis is based on data from two production wells completed in the intermediate and deep groundwater zones in NW Area 3. Table 4-8 summarizes Key COPC concentrations detected in Area 3. No monitoring wells presently are installed in NW Area 3, although the state has directed the two dry cleaning facilities, discussed above, to install monitoring wells.

5.2.2.2 Tetrachloroethene and Trichloroethene Distribution in NW Area 3

Figures 5-1 and 5-2 presents maximum concentrations of PCE and TCE and the directions of horizontal groundwater flow.

Figure 3-4 presents the location of the cross-sections within Area 3 in plan view.

Figures 5-8 and 5-9 illustrate that PCE and TCE contamination in groundwater occurs in NW Area 3.

As shown in Exhibit 5-3, groundwater at production wells in NW Area 3 contains Key COPCs at concentrations that exceed the MCLs, including TCE at Production Well 01900934; and PCE, carbon tetrachloride, and perchlorate at Production Well 01901679. At least two sources of VOCs likely exist in NW Area 3. Figures 5-1 and 5-2 present maximum concentrations of PCE and TCE and the directions of horizontal groundwater flow. Figure 3-4 presents the location of the cross-sections within Area 3 in plan view. Figures 5-8 and 5-9 illustrate that PCE and TCE contamination in groundwater occurs in NW Area 3.

PCE concentrations at Production Well 01901679, the only active production well in NW Area 3, fluctuate with pumping cycles and have remained below the MCL since 2003, as shown in Figure E-12 in Appendix E.

The lateral and vertical extent and the occurrence of Key COPCs in NW Area 3 remain undefined. However, the contamination in NW Area 3 appears to mainly impact the intermediate groundwater zone, as opposed to the deep groundwater zone. An evaluation of hydrogeologic data and concentration trends for TCE at Production Well 01900934 shown in Figure E-11 reveals limited information about the relative depth of contamination in groundwater.

The following observations provide evidence that TCE contamination in NW Area 3 mainly impacts the intermediate groundwater zone.

- As shown in Figure E-12, a sharp increase in the concentration of TCE in groundwater occurred at Production Well 01900934 when pumping ceased in 2001. The TCE concentration more than doubled from 4.7 to 12.2 μg/L.
- Based on the evaluation presented in Section D.3.1.2 in Appendix D, a downward vertical gradient occurs between the intermediate and deep groundwater zones of the eastern alluvial aquifer. Production Well 01900934 is screened in both groundwater zones.
- The increase in the TCE concentration following the cessation of pumping, despite the downward vertical gradient, indicates the TCE contamination likely occurs mainly within the intermediate groundwater zone.

5.2.2.3 Other Key COPCs in NW Area 3

Potential sources of the carbon tetrachloride and perchlorate contamination, present at concentrations in groundwater that exceed the MCLs in Production Well 01901679, remain unidentified. As shown in Exhibit 5-3, 1,2,3-TCP and cis-1,2-DCE contamination appears absent or minimal in NW Area 3; however, additional data are needed to fully evaluate the occurrence and migration of groundwater contamination.

5.2.2.4 General Contamination Migration in NW Area 3

Contamination migration in NW Area 3 will follow groundwater flow toward Production Well 01901679 as the well is pumped. The characteristics of contamination migration in the western alluvial aquifer and bedrock aquifer in NW Area 3 are unknown and warrant further investigation, which will be considered during the feasibility study.

5.2.3 Contamination Distribution and Migration in Central Area 3

The severity of groundwater contamination in central Area 3 appears to rank third within Area 3, as summarized in Exhibit 5-1. TCE and 1,2,3-TCP are the predominant Key COPCs in groundwater in central Area 3; however, all Key COPCs occur in this area. Several potential sources of contamination appear to exist in central Area 3.

Table 4-8 summarizes Key COPC concentrations detected in Area 3.

Exhibit 5-4 summarizes the distribution of Key COPCs in groundwater in central Area 3.

As shown in Table 4-9, subsurface investigations performed at one manufacturing facility (Facility 9) and five dry cleaning facilities (Facilities 25, 26, 28, 30, and 31) in central Area 3 have revealed the presence of PCE and TCE in soil vapor. The state is directing the facilities to determine the lateral and vertical extent of the contamination.

5.2.3.1 Groundwater Data Set for Central Area 3

All Key COPCs occur in groundwater in central Area 3 at concentrations that exceed the evaluation criteria (MCLs or NLs). The discussion of the distribution, concentrations and migration of Key COPCs in groundwater in central Area 3 is based on data collected from five groundwater monitoring wells installed by EPA and 13 production wells. Table 4-8 summarizes Key COPC concentrations detected in Area 3. No facilities in central Area 3 have installed groundwater monitoring wells. Exhibit 5-4 summarizes the distribution of Key COPCs in groundwater in central Area 3.

EXHIBIT 5-4
Key COPC Distribution in Groundwater in Central Area 3

Contaminant	MCL or NL (µg/L)	Maximum Concentration Detected and Associated Well (µg/L)	Number of Wells with Concentration Exceeding MCL/NL	Wells with Concentration Exceeding 10 Times MCL/NL	Aquifer(s) Impacted	Facilities[a] with Groundwater Concentration Exceeding MCL/NL
PCE	5	23 01901681	4 of 18	None	Bedrock, intermediate, deep	Unknown
TCE	5	96 EPAMW12A	9 of 18	EPAMW14_03 EPAMW12A	Bedrock, intermediate, deep	Unknown
cis-1,2-DCE	6	14 EPAMW12A	4 of 18	None	Bedrock, intermediate, deep	Unknown
1,2,3-TCP	0.005	0.413 EPAMW15_06	5 of 18	01900010 01903014 EPAMW15_06	Bedrock, intermediate, deep	Unknown
Carbon tetrachloride	0.5	0.74J EPAMW14_04	2 of 18	None	Intermediate, deep	Unknown
Perchlorate	6	7.1 EPAMW15_02	2 of 15	None	Deep	Unknown

Notes:

[a]Figure 4-9 shows the facilities with open subsurface investigations and the associated facility tracking numbers.

J – Estimated Concentration

For information on the distribution of the Key COPC nitrate, refer to Section 4.3.7 and Exhibit 4-8. As explained in Section 4.3.7, the contamination migration conceptual site model for Area 3 excludes nitrate from consideration.

cis-1,2-DCE – cis-1,2-dichloroethene
MCL – maximum contaminant level
µg/L – micrograms per liter
NL – notification level
PCE – tetrachloroethene
TCE – trichloroethene
1,2,3-TCP – 1,2,3-trichloropropane

5.2.3.2 Tetrachloroethene Distribution and Migration in Central Area 3

Figure 5-1 presents maximum concentrations of PCE and the directions of horizontal groundwater flow. Figure 3-4 presents the location of the cross-sections within Area 3 in plan view. Figures 5-6, 5-8, 5-12, and 5-14 illustrate the distribution of PCE detections in the intermediate and deep groundwater zones of the eastern alluvial aquifer.

Groundwater production controls the migration of PCE in central Area 3. At least one discrete source most likely contributes to the PCE contamination in central Area 3 noted in Exhibit 5-4.

Figures E-9 and E-10 in Appendix E show the concentration trends for PCE in the intermediate and deep groundwater zones, respectively, measured at the EPA monitoring wells. Figures E-13 through E-21 illustrate the concentration trends for PCE in groundwater observed at production wells in central Area 3.

As shown in Figure E-9, the highest concentrations of PCE occur in groundwater sampled from the middle of the intermediate groundwater zone at multiport Monitoring Well EPAMW15. The concentration of PCE detected at EPAMW15 might originate at a source from which PCE has migrated to the production wells located in central Area 3 (01901681, 01901682, and 01903086).

5.2.3.3 Trichloroethene and cis-1,2-Dichloroethene Distribution and Migration in Central Area 3

Figures 5-2 and 5-3 present maximum concentrations of TCE and cis-1,2-DCE and the directions of horizontal groundwater flow. Figure 3-4 presents the location of the cross-sections within Area 3 in plan view. Figures 5-7, 5-9, 5-13, and 5-15 illustrate the distribution of TCE detections in the intermediate and deep groundwater zones of the eastern alluvial aquifer.

Figures E-9 and E-10 in Appendix E show the concentration trends for TCE in the intermediate and deep groundwater zones, respectively, measured at the EPA monitoring wells. Figures E-13 through E-21 depict the concentration trends for TCE in groundwater observed at production wells in central Area 3.

TCE contamination in groundwater in central Area 3 occurs in different locations than PCE contamination. This observation suggests that TCE originates from separate sources of contamination and not from PCE degradation. cis-1,2-DCE occurs exclusively at wells with detections of TCE in groundwater, which suggests that cis-1,2-DCE likely occurs due to biological degradation of TCE. No discrete source of cis-1,2-DCE has been identified. Technical Appendix 5 discusses biological degradation.

The bullets below summarize observations on the occurrence of TCE in central Area 3, and provide evidence to suggest that the TCE possibly originates from two potential sources.

Figure 5-1 presents maximum concentrations of PCE and the directions of horizontal groundwater flow.

Figure 3-4 presents the location of the cross-sections within Area 3 in plan view.

Figures 5-6, 5-8, 5-12, and 5-14 illustrate the distribution of PCE detections in the intermediate and deep groundwater zones of the eastern alluvial aquifer.

Figures E-9 and E-10 show the concentration trends for PCE and TCE in the intermediate and deep groundwater zones, respectively, measured at the EPA monitoring wells.

Figures E-13 through E-21 illustrate the concentration trends for PCE and TCE in groundwater observed at production wells in central Area 3.

Figure 5-2 and 5-3 present maximum concentrations of TCE and cis-1,2-DCE and the directions of horizontal groundwater flow.

Figures 5-7, 5-9, 5-13, and 5-15 illustrate the distribution of TCE detections in the intermediate and deep groundwater zones of the eastern alluvial aquifer.

Technical Appendix 5 evaluates the potential of biological degradation of TCE to cis-1,2-DCE.

- One source of TCE contamination in central Area 3 appears to originate west of and upgradient of the structural bedrock discontinuity. As shown in Exhibit 5-4 and Figure 5-15, the maximum concentrations of TCE in central Area 3 occur at Monitoring Well EPAMW12A, which is completed at the water table in the bedrock aquifer at the structural bedrock discontinuity. Contamination observed near EPAMW12A may be migrating to EPAMW13.
- Figure 5-13 illustrates that TCE occurs at elevated concentrations at depth in Monitoring Well EPAMW14 in the eastern alluvial aquifer, but not at shallow depths at the water table. This TCE contamination may originate from a discrete source, and be unrelated to the contamination observed at EPAMW13.

5.2.3.4 1,2,3-Trichloropropane Distribution in Central Area 3

Exhibit 5-4 summarizes the distribution of Key COPCs in groundwater in central Area 3.

As shown in Exhibit 5-4, 1,2,3-TCP occurs in groundwater at concentrations that exceed the NL at three wells in central Area 3. The source of 1,2,3-TCP contamination remains unknown, although the source appears to originate within central Area 3, east of and upgradient of Monitoring Well EPAMW15. This conclusion is based on the contamination observed at Monitoring Well EPAMW15, which shows that the maximum concentrations of 1,2,3-TCP occur in the upper portion of the intermediate groundwater zone.

The occurrence of 1,2,3-TCP contamination in groundwater at production wells in central Area 3 most likely resulted from pumping at the two wells (01903097 and 01900010). Continued pumping at Production Well 01903097 could cause further downgradient migration of the 1,2,3-TCP contamination.

5.2.3.5 Carbon Tetrachloride Distribution in Central Area 3

Figures E-9 and E-10, provided in Appendix E, show the presence of carbon tetrachloride in the intermediate groundwater zone.

As shown in Exhibit 5-4, carbon tetrachloride occurs in groundwater at concentrations that exceed the MCL at two wells in central Area 3. The contamination appears localized. Figures E-9 and E-10, provided in Appendix E, show the presence of carbon tetrachloride at concentrations that exceed the MCL in the intermediate groundwater zone, and the absence of carbon tetrachloride in the deep groundwater zone.

5.2.3.6 Perchlorate Distribution in Central Area 3

Exhibit 5-4 summarizes the distribution of Key COPCs in groundwater in central Area 3.

As indicated in Exhibit 5-4, perchlorate occurs in groundwater in central Area 3 at concentrations that exceed the MCL at two wells. The horizontal extent of perchlorate contamination is unknown, and evaluating the migration of perchlorate is infeasible without additional characterization data.

5.2.3.7 General Contamination Migration in Central Area 3

Contamination migration in central Area 3 follows the groundwater flow direction of the intermediate and deep groundwater zones toward localized pumping. However, determining the groundwater flow direction within central Area 3 is difficult due to the limited data set. Few monitoring wells exist in central Area 3 and the distance between wells is significant. The extent of VOC contamination in central Area 3 warrants further evaluation as source investigations continue.

5.2.4 Contamination Distribution and Migration in NE Area 3

The severity of groundwater contamination in NE Area 3 appears to rank highest within Area 3 (along with the severity of groundwater contamination in SW Area 3), as summarized in Exhibit 5-1. PCE, the predominant Key COPC in NE Area 3, occurs at the maximum concentrations reported within Area 3. At least three potential sources of contamination appear to exist in NE Area 3. Contamination impacts the shallow, intermediate, and deep zones of the eastern alluvial aquifer in NE Area 3.

As shown in Table 4-9, subsurface investigations at two dry cleaning facilities in NE Area 3 have revealed the presence of PCE, including detections in soil vapor and groundwater at Facility 21; and detections in soil vapor at Facility 24. The state has directed Facility 24 to investigate the groundwater. A third facility with a history of vehicle maintenance, Facility 19, also shows PCE in soil vapor and groundwater. Other unidentified contaminant sources may exist in NE Area 3.

5.2.4.1 Groundwater Data Set for NE Area 3

PCE, TCE, and 1,2,3-TCP occur in groundwater in NE Area 3 at concentrations that exceed the evaluation criteria (MCLs or NLs). The following analysis is based on data collected from one groundwater monitoring well installed by EPA, 16 groundwater monitoring wells installed at two facilities, and 12 production wells. Facilities 19 and 21 have 12 and four monitoring wells, respectively. Table 4-8 summarizes Key COPC concentrations detected in Area 3. Figure 5-1 presents maximum concentrations of PCE and the directions of horizontal groundwater flow. Figure 3-4 presents the location of the cross-sections within Area 3 in plan view. Figures 5-10 through 5-13 illustrate the distribution of PCE detections in the shallow, intermediate, and deep groundwater zones of the eastern alluvial aquifer.

The data set for 1,2,3-TCP, cis-1,2-DCE, carbon tetrachloride, and perchlorate in groundwater is limited for NE Area 3. 1,2,3-TCP is identified as a Key COPC based on one detection at two wells, as shown in Exhibit 5-5. Data demonstrate an absence of cis-1,2-DCE and carbon tetrachloride in groundwater, and the presence of perchlorate only at concentrations below the MCL.

Most of the data collected in NE Area 3 were obtained from Facility 19. Without additional characterization data, evaluating the migration of Key COPCs is not feasible; and eliminating cis-1,2-DCE, carbon tetrachloride, and perchlorate from further consideration as potential contaminants of concern in NE Area 3 remains premature.

Table 4-8 summarizes Key COPC concentrations detected in Area 3.

Figure 5-1 presents maximum concentrations of PCE and the directions of horizontal groundwater flow.

Figure 3-4 presents the location of the cross-sections within Area 3 in plan view.

Figures 5-10 through 5-13 illustrate the distribution of PCE detections in the shallow, intermediate, and deep groundwater zones of the eastern alluvial aquifer.

Exhibit 5-5 summarizes the distribution of Key COPCs in groundwater in NE Area 3.

EXHIBIT 5-5
Key COPC Distribution In Groundwater in NE Area 3

Contaminant	MCL or NL (µg/L)	Maximum Concentration Detected and Associated Well (µg/L)	Number of Wells with Concentration Exceeding MCL/NL	Wells with Concentration Exceeding 10 Times MCL/NL	Aquifer(s) Impacted	Facilities[a] with Groundwater Concentration Exceeding MCL/NL
PCE	5	950 W11TCSW1	12 of 28	W11TCSW1 W11TCSW2 W11TCSW3 W11TCSW6 W11TCSW7 W11TCW10	Shallow	19, 21
TCE	5	13.2 W11TCSW3	2 of 28	None	Shallow	19
cis-1,2-DCE	6	Not detected	0 of 28	None	None	Unknown
1,2,3-TCP	0.005	0.025 EPAMW16_01	2 of 20	01900935 EPAMW16_01	Intermediate, deep	Unknown
Carbon tetrachloride	0.5	Not detected	0 of 28	None	None	Unknown
Perchlorate	6	5.6 01900017	0 of 16	None	Intermediate, deep	Unknown

Notes:

[a]Figure 4-9 shows the facilities with open subsurface investigations and the associated facility tracking numbers. For information on the distribution of the Key COPC nitrate, refer to Section 4.3.7 and Exhibit 4-8. As explained in Section 4.3.7, the contamination migration conceptual site model for Area 3 excludes nitrate from consideration.

cis-1,2-DCE – cis-1,2-dichloroethene
MCL – maximum contaminant level
µg/L – micrograms per liter
NL – notification level
PCE – tetrachloroethene
TCE – trichloroethene
1,2,3-TCP – 1,2,3-trichloropropane

5.2.4.2 Tetrachloroethene Distribution and Migration in NE Area 3

The PCE contamination in groundwater in NE Area 3 noted in Exhibit 5-5 appears to originate from at least three sources. Two sources likely occur in the vicinities of Facility 19 and Facility 21; and a third source may originate near the Raymond Basin. The observations described in the bullets below provide evidence of the migration of PCE in groundwater from the three sources.

Figures E-8 and E-22 illustrate the occurrence of PCE in the intermediate groundwater zone.

Figure 3-4 presents the location of the cross-sections within Area 3 in plan view.

- PCE contamination occurs in the shallow groundwater zone beneath two monitoring wells located at Facility 19 and one monitoring well upgradient of Facility 19. The upgradient and downgradient extent of PCE contamination in groundwater near this facility is only partially defined.

  PCE also is present within the intermediate groundwater zone at Facility 19 at concentrations below the MCL. Farther downgradient of Facility 19, PCE occurs in the intermediate groundwater water zone at Production Well 01902786 (as shown in Figure E-22) and at Monitoring Well EPAMW16 (as illustrated in Figures E-8 and 5-12). The PCE concentration at the production well exceeds the MCL. The extent of PCE contamination in the intermediate and deep groundwater zones may be related to PCE contamination identified near Facility 19, but the horizontal and vertical extents are only partially defined.

- PCE contamination has occurred in groundwater underlying Facility 21 at concentrations that exceed the MCL, although recent data show an absence of PCE. The PCE in groundwater beneath Facility 21 most likely originates from a discrete source, unrelated to the source of PCE contamination in groundwater near Facility 19. Groundwater flows to the southwest and Facility 21 is located west of Facility 19.
- PCE and TCE occur at low levels in groundwater underlying a group of production wells, including 01900026, 01900935, 01901671, 01902789, 01902979, and 01903059. The occurrence of contamination in this group of wells is a potential concern even though the concentration levels are low. Potential sources remain unidentified.
- However, the Raymond Basin could be a potential source of contamination because groundwater flows across the Raymond Fault in this area as shown in Figure 3-6. The production wells are located cross-gradient from the source of contamination that originates and migrates in the shallow groundwater zone in the vicinity of Facility 19 (see Figure 3-19). Further investigation of contaminant sources in this area is warranted and will be considered during the feasibility study.

Figure 5-12 illustrates the distribution of PCE detections in the shallow and intermediate groundwater zones of the eastern alluvial aquifer.

5.2.4.3 Trichloroethene Occurrence in NE Area 3

TCE contamination occurs in groundwater underlying Facility 19, in addition to groundwater at the production wells discussed above. As indicated in Exhibit 5-5, TCE is present at Facility 19 at two monitoring wells completed in the shallow groundwater zone, which also show the maximum concentrations of PCE within NE Area 3. The presence of TCE could be related to the degradation of PCE, although an analysis of data to support this hypothesis is unavailable; no discrete source of TCE has been identified.

Exhibit 5-5 summarizes the distribution of Key COPCs in groundwater in NE Area 3.

5.2.4.4 General Groundwater Flow and Contamination Migration in NE Area 3

Figures 5-12 and 5-13 show that a fine-grained unit separates the shallow groundwater zone from the intermediate groundwater zone. The fine-grained unit appears to restrict vertical groundwater flow, as well as vertical contamination migration. However, pumping in the intermediate groundwater zone might influence contaminants to migrate downward from the shallow groundwater zone and across the fine-grained unit into the intermediate groundwater zone.

Figures 5-12 and 5-13 show that a fine-grained unit appears to restrict vertical groundwater flow from the shallow groundwater zone to the intermediate groundwater zone.

Contamination migration in the shallow groundwater zone in NE Area 3 will generally follow the direction of horizontal groundwater flow to the southwest. Contamination migration in the intermediate and deep groundwater zones follows the westward groundwater flow. Groundwater production within Area 3 influences groundwater flow and contamination migration.

Additional characterization is needed in NE Area 3 to determine whether PCE contamination, observed in the shallow groundwater zone beneath Facility 19, has migrated to Production Well 01902786. Further investigation also is warranted to determine the source of the PCE contamination beneath Facility 19, and will be considered during the feasibility study.

5.2.5 Contamination Distribution and Migration in SE Area 3

Groundwater contamination in SE Area 3 appears to rank lowest in terms of severity within Area 3, as summarized in Exhibit 5-1, although contamination data are limited. TCE and 1,2,3-TCP appear to occur as the predominant Key COPCs. Remedies are being designed to contain the VOC migration in the South El Monte and El Monte OUs. The feasibility study will evaluate the potential impact, if any, to groundwater in SE Area 3 from the non-point sources of the South El Monte and El Monte OUs.

Figures 5-1 through 5-3 present the maximum concentrations of PCE, TCE, and cis-1,2-DCE, and directions of horizontal groundwater flow.

Figures 5-8 through 5-11 show the distribution of PCE and TCE detections in the intermediate and deep groundwater zones of the eastern alluvial aquifer.

Table 4-8 summarizes Key COPC concentrations detected in Area 3.

Efforts to identify potential point sources of contamination observed in the production wells in SE Area 3 reveal no compelling leads. Of the potential source facilities identified, none have emerged as high priority targets for possible source investigations.

5.2.5.1 Groundwater Data Set for SE Area 3

TCE and 1,2,3-TCP occur in groundwater in SE Area 3 at concentrations that exceed the evaluation criteria (MCL or NL). The following analysis is based on data collected from 11 production wells completed in the intermediate and deep groundwater zones in SE Area 3. Table 4-8 summarizes the Key COPC concentrations detected in Area 3. No monitoring wells are installed in SE Area 3. Figures 5-1 through 5-3 present the maximum concentrations of PCE, TCE, and cis-1,2-DCE, and directions of horizontal groundwater flow. Figures 5-8 through 5-11 show the distribution of PCE and TCE detections in the intermediate and deep groundwater zones of the eastern alluvial aquifer.

The data set for cis-1,2-DCE, 1,2,3-TCP, carbon tetrachloride, and perchlorate in groundwater is limited for SE Area 3. Eliminating cis-1,2-DCE, 1,2,3-TCP, carbon tetrachloride, and perchlorate from further consideration as potential contaminants of concern in SE Area 3 remains premature despite the existence of some data that demonstrate an absence of these four Key COPCs in groundwater.

EXHIBIT 5-6
Key COPC Distribution In Groundwater In SE Area 3

Contaminant	MCL or NL (µg/L)	Maximum Concentration Detected and Associated Well (µg/L)	Number of Wells with Concentration Exceeding MCL/NL	Wells with Concentration Exceeding 10 Times MCL/NL	Aquifer(s) Impacted	Facilities[a] with Groundwater Concentration Exceeding MCL/NL
PCE	5	2.8 01900927	0 of 11	None	None	Unknown
TCE	5	5.9 01900926	1 of 11	None	Intermediate	Unknown
cis-1,2-DCE	6	Not detected	0 of 11	None	None	Unknown
1,2,3-TCP	0.005	0.0153 08000067	3 of 11	None	Intermediate, deep	Unknown
Carbon tetrachloride	0.5	Not detected	0 of 11	None	None	Unknown
Perchlorate	6	Not detected	0 of 11	None	None	Unknown

Notes:
[a]Figure 4-9 shows the facilities with open subsurface investigations and the associated facility tracking numbers.
For information on the distribution of the Key COPC nitrate, refer to Section 4.3.7 and Exhibit 4-8. As explained in Section 4.3.7, the contamination migration conceptual site model for Area 3 excludes nitrate from consideration.
cis-1,2-DCE – cis-1,2-dichloroethene
MCL – maximum contaminant level
µg/L – micrograms per liter
NL – notification level
PCE – tetrachloroethene
TCE – trichloroethene
1,2,3-TCP – 1,2,3-trichloropropane

5.2.5.2 Trichloroethene and 1,2,3-Trichloropropane Occurrence in SE Area 3

As indicated in Exhibit 5-6, only TCE and 1,2,3-TCP occur at concentrations that exceed the evaluation criteria (MCL or NL) in groundwater underlying SE Area 3. The following bullets summarize information on TCE and 1,2,3-TCP detections.

- As shown in Figure E-23 in Appendix E, the concentration of TCE in groundwater inexplicably exceeded the MCL at Production Well 01900926 once in 2001. All other data indicate that TCE concentrations consistently remain below the MCL.
- The concentrations of 1,2,3-TCP in groundwater exceeded the NL once at Production Wells 01900927, 08000067, and 08000133. Testing at Production Wells 01900927 and 08000133 last occurred in 2003.

Figure E-23, provided in Appendix E, shows the exceedance of the MCL that occurred in 2001.

5.2.5.3 Groundwater Flow and Contamination Migration in SE Area 3

As shown in Figure 5-1, groundwater in the intermediate and deep groundwater zones generally flows to the west in SE Area 3. The evaluation of groundwater flow and possible contamination migration from the El Monte OU and South El Monte OU into SE Area 3 remains incomplete. PCE, TCE, cis-1,2-DCE, 1,2,3-TCP, and perchlorate occur in these two OUs. Remedies are being designed to contain

Figure 5-1 depicts the migration pathway for SE Area 3.

the VOC migration in the South El Monte and El Monte OUs. The feasibility study will evaluate the potential impact, if any, to groundwater in SE Area 3 from the non-point sources of the South El Monte and El Monte OUs.

5.3 Conclusion

Contamination impacts groundwater in the bedrock aquifer; western alluvial aquifer; and the shallow, intermediate, and deep zones of the eastern alluvial aquifer. Advection, that is, the transport of dissolved contaminants by groundwater flow, controls the migration of Key COPCs in Area 3. Products of biological degradation also occur in Area 3, as discussed in Technical Appendix 5. However, biological degradation likely plays only a minor role in the migration of contaminants in Area 3.

The feasibility study will be conducted to evaluate remedial alternatives to address the potential risks estimated in the HHRA. Appendix D presents the HHRA, which is summarized in Section 6. The contamination migration conceptual site model will serve as the basis for the feasibility study presented in Section 8 as the next step for Area 3. Although evaluation of the data set has provided many details regarding hydrogeology, potential contamination sources, and migration, data needs have been identified. The data needs that will be considered during the feasibility study include determination of the impact of the structural bedrock discontinuity on groundwater flow, identification of additional potential sources, determination of vertical and horizontal groundwater flow patterns within the aquifers, and determination of the extent of biological degradation that may be occurring in Area 3.

Glossary

Glossary

advection: The process by which chemicals are transported by the bulk motion of the flowing groundwater.

alluvial: Relating to alluvium.

alluvium: Sediment deposited by flowing water, as in a riverbed, flood plain, or delta.

anticline: A convex upward series of folded geologic units that contains older rocks at its core.

aquifer: A saturated geologic unit, often of sand or gravel, which contains and transmits significant quantities of water under normal conditions.

basin: A large geologic depression in the bedrock that is filled with unconsolidated sediments.

bedrock: The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

biological degradation: The process by which organic substances are broken down by the enzymes produced by living organisms.

chlorinated volatile organic compound: Any volatile organic compound that contains a chlorine atom. Solvents commonly used in cleaning and degreasing applications often contain chlorinated volatile organic compounds.

conceptual site model: A planning tool that provides the framework from which the study design is structured. It is frequently created as a site map that organizes information that already is known about a site.

contaminant: A substance not naturally present in the environment or present in unnatural concentrations that can, in sufficient concentration, adversely alter an environment.

contaminants of potential concern: Contaminants that potentially pose a risk to human health or the environment.

contamination: The presence of hazardous substances in the environment.

data quality objectives: Performance and acceptance criteria that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

degradation products: Chemical compounds that are formed by natural degradation or decay of some other chemical compound.

environmental data: Any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology.

evaluation criterion: A standard or reference point on which a decision will be assessed.

fault: A fracture in the continuity of a rock formation, caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are displaced relative to one another and parallel to the plane of fracture.

feasibility study: The mechanism for the development, screening, and detailed evaluation of alternative remedial actions.

free-phase liquid: Liquids that do not mix easily with water or readily separate from water or both.

groundwater: Water occurring underground, in the zone of saturation in an aquifer.

groundwater monitoring well: A type of well specially designed and installed to sample groundwater at specific locations and depths to evaluate groundwater flow and contamination.

human health risk assessment: Qualitative and quantitative evaluation of the risk posed to human health by the actual or potential presence of specific contaminants.

hydrogeology: The study of the occurrence and movement of water beneath the surface of the earth.

hydrostratigraphy: The body of soil or rock having considerable lateral extent that also exhibits reasonably distinct groundwater conditions.

Key contaminants of potential concern: The contaminants detected multiple times in groundwater at production wells within Area 3 at concentrations that exceed evaluation criteria. Key COPCs identify regional contamination within Area 3.

maximum contaminant levels: The maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

multiport monitoring well: A type of monitoring well equipped with a sampling port for monitoring groundwater at multiple depth intervals of an aquifer.

non-point sources: Sources of contamination that originate from multiple areas or locations rather than from a discrete site.

notification level: Health-based advisory levels (formerly referred to as Action Levels) established by the California Department of Public Health for certain chemicals for which no established drinking water standards exist.

operable unit: A subunit of a Superfund site, defined based on a geographical area or on another parameter, where a number of separate activities are undertaken as part of site cleanup.

perched groundwater: Groundwater supported by a zone of material of low permeability located above an underlying main body of groundwater.

persistence of a contaminant: A term describing how long a contaminant will remain in the environment.

plunging: A term used to describe a folded geologic unit that is not horizontal. A fold will plunge in a particular direction.

primary data: Data generated or collected by the investigator during an investigative process.

remedial investigation: Actions undertaken to characterize the full nature and extent of contamination, including characterization of hazardous substances, identification of contaminant sources, and assessment of human health and ecological risk.

secondary data: Data collected or generated by a party other than the investigator during the investigative process.

soil vapor: Elements and compounds in a gaseous state in the small spaces between particles of soil. Such gases can be moved or driven out under pressure.

structural bedrock discontinuity: In structural geology, a subsurface bedrock zone or surface separating two unrelated groups of rocks across which an abrupt geologic change occurs, e.g., a fault.

Superfund: The program operated under the legislative authority of CERCLA and SARA that funds and carries out EPA solid waste emergency and long-term response actions, including conducting or supervising cleanup actions.

syncline: A concave upward series of folded geologic units that contains younger rocks at its core.

tetrachloroethene: A volatile organic compound primarily used for dry cleaning clothing and in manufacturing processes as a solvent and metal degreaser.

trichloroethene: A volatile organic compound that is a colorless or blue organic liquid with a chloroform-like odor. TCE is primarily used in manufacturing processes as a solvent, metal degreaser, and textile degreaser.

vadose zone: The soil or rock between the earth's surface and the water table.

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Tables

Figures

Technical Appendix 5