Proposed Plan for
Tujunga Well Field Interim Remedial Action

Introduction

This fact sheet presents the Los Angeles Department of Water and Power's (LADWP's) Proposed Plan to conduct an interim remedial action (IRA) to address hazardous substances dissolved in groundwater entering the Tujunga Well Field which is located in the eastern part of the San Fernando Basin (SFB), which in turn lies within the San Fernando Valley (SFV) of Southern California (**Figure 1**). The Tujunga Well Field is one of several well fields in the SFB that have been used or are currently being used to extract groundwater for the Cities of Los Angeles, Burbank, and Glendale.

LADWP seeks your feedback on this Proposed Plan. Your comments and suggestions may result in changes to the plan. After LADWP reviews all public comments received for the plan and related documents, it may adopt and implement the IRA.

LADWP's preferred IRA is to design and construct water treatment systems, pipelines, and other facilities needed to limit the migration of tetrachloroethene (PCE), trichloroethene (TCE), and 1,4-dioxane contaminated groundwater into uncontaminated and less contaminated areas of the Tujunga Well Field, remove and treat the contaminated groundwater, and provide the treated water for direct domestic use.

This plan describes the importance of groundwater as a source of drinking water to residents and businesses in Los Angeles, the nature and extent of contaminants of concern (COCs; e.g., PCE, TCE, and 1,4-dioxane) in the Tujunga Study Area (area of aquifer from which the Tujunga Well Field is expected to receive its groundwater, now and in the future), and risks to human health and the environment posed by the COCs.

How You Can Comment

The LADWP encourages the public to comment on the proposed IRA at the Tujunga Well Field. The comment period is July 12, 2018 through August 13, 2018. You can comment in person at a public meeting or in writing to the LADWP Community Involvement Coordinator. Please send comments, post-marked no later than August 13, 2018 by mail, fax or email to:

Los Angeles
Department of Water and Power
Attn: Antonio Medina
111 North Hope Street, Rm 1315
Los Angeles, CA 90012
Fax: (213) 367-0907
Email: remediation@ladwp.com

Public Meeting

July 26, 2018
Public Meeting
6:30 – 8:30 pm

Branford Recreation Center
Child Care Room
13306 Branford Street,
Arleta, CA 91331

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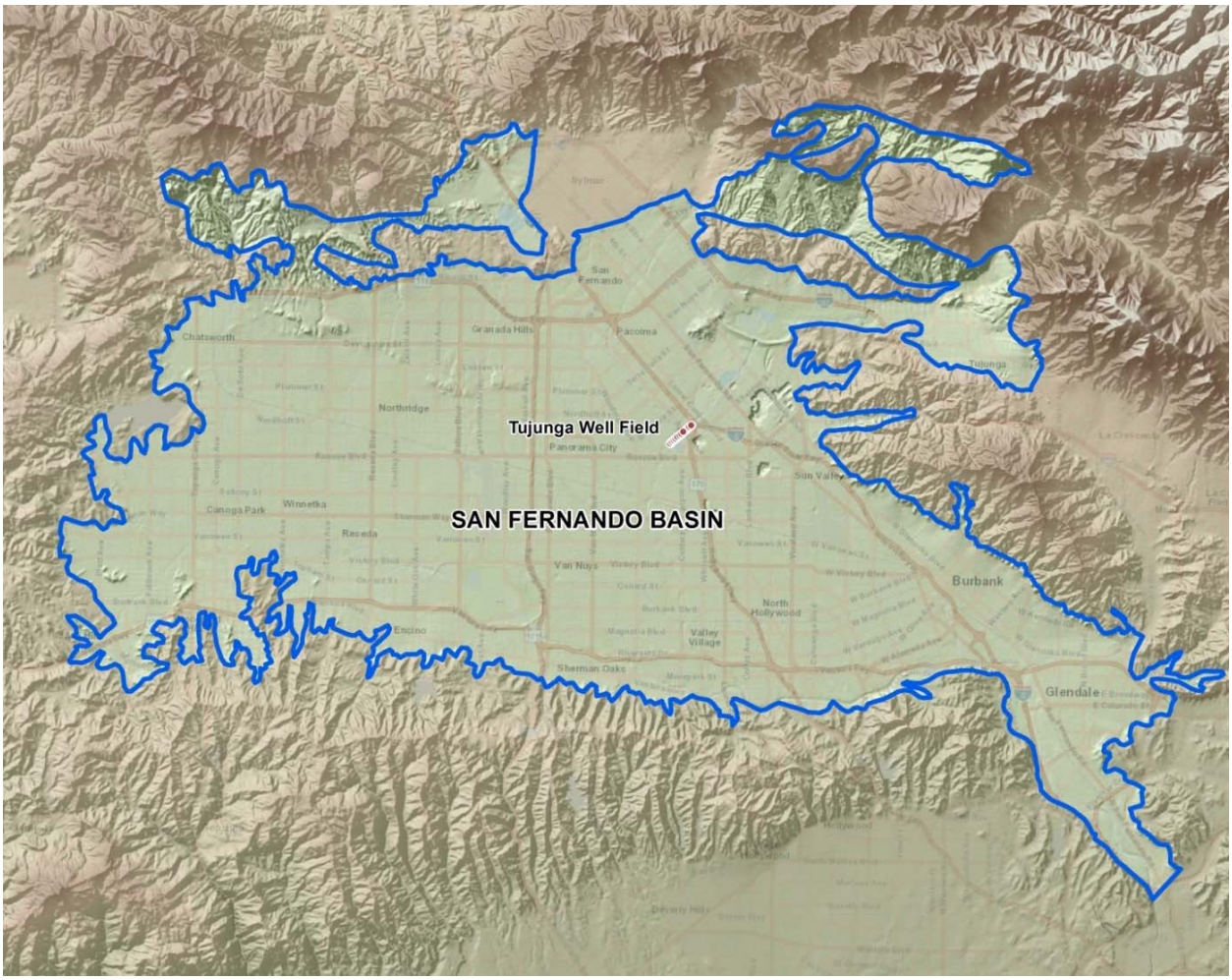

Figure 1 – The San Fernando Valley Groundwater Basin

This plan also identifies the preferred IRA and summarizes the preferred IRA's objectives, as well as its relative effectiveness, implementability, and cost, compared to other cleanup options considered by LADWP.

LADWP has been working jointly with state and federal agencies and local municipalities to investigate and clean up contamination within the SFB, including the United States Environmental Protection Agency (EPA), the Los Angeles Regional Water Quality Control Board (LARWQCB), the Cities of Glendale and Burbank, and other agencies, such as the State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW).

In 1986, the EPA placed four sites (or Areas of Concern [AOCs]) in the eastern SFB on the National Priorities List (NPL). Since that time, the EPA has selected several response actions to address the release of contaminants located in certain portions of the SFB. Primary AOCs within the SFB include the Rinaldi-Toluca, Tujunga, North Hollywood, and Pollock Well Fields. Due to the specific nature of the contamination in certain areas, LADWP decided on a discrete response action approach that

consists of analyzing and developing responses tailored for each localized AOC (e.g., individual wells and well fields). Thus, the treatment method or other response action will vary by individual wells and well fields across the SFB.

The IRA for the Tujunga Well Field is a localized response action to address the plume of COCs that currently adversely impact beneficial use of water extracted from the Tujunga production wells. LADWP has identified PCE, TCE and 1,4-dioxane as the primary COCs, and other COCs including 1,1-dichloroethene (1,1-DCE), 1,2,3-trichloropropane (1,2,3-TCP), and carbon tetrachloride (CTET) as secondary COCs, since these other contaminants are present at significantly lower concentrations and are more localized in occurrence. These secondary COCs occur in conjunction with the primary COCs and the proposed treatment system will be capable of treating each of these COCs to fully protect public health and the environment. LADWP is leading this IRA. For a detailed description of the information and analyses upon which this plan is based, see the Tujunga Interim Remedial Investigation and Feasibility Study (RIFS) Report and other documents available in the Information Repositories listed at the end of this document.

Background

The City of Los Angeles (the City) encompasses an area of 456 square miles with a population of nearly 4 million residents and a current water demand of more than 500,000 acre-feet per year (AFY). One acre-foot covers one acre of land, one foot deep. One acre-foot is equivalent to 325,821 gallons and is enough water to serve approximately two households per year. Local groundwater is a key resource that the City has relied upon as a major component of its local water supply. In a normal year, local groundwater could provide up to 14 percent (%) of the total water supply for the City, and up to 30% of total supply during extended dry periods when imported supplies have been less reliable. The City plans to obtain 50% of its water locally by 2035. The primary source of local water supply is groundwater, and the primary source of local groundwater is the SFB, providing more than 90% of the City's local groundwater supply.

The SFB underlies most of the SFV and is approximately 175 square miles (112,000 acres) in area (**Figure 1**). There are ten well fields in the SFB that have been used or are currently being used to produce groundwater for the Cities of Los Angeles, Burbank, and Glendale.

The Tujunga Well Field includes 12 sealed production wells that extract groundwater from 400 to 780 feet below ground surface (ft bgs) at flow rates ranging from ~4,900 to ~6,700 AFY (3,000 to 4,200 gallons per minute [gpm]). The combined maximum production capacity of the 12 production wells is approximately 71,100 AFY (44,000 gpm). The Tujunga Well Field is operated in accordance with the *State of California Domestic Water Supply Permit* issued by DDW to LADWP.

The DDW establishes Maximum Contaminant Levels (MCLs) and Notification Levels (NLs) for drinking water contaminants in California. NLs are established for chemicals that do not have MCLs. NLs are health based advisory levels. LADWP well field operations are carried out in accordance with the DDW approved Well Blending Operations Plan to prevent regulated drinking water contaminants from exceeding MCLs and NLs at the blend point downstream of the Tujunga Well Field. The aforementioned blend point is an entry point to the LADWP distribution system, which provides a mixture of water from multiple wells in the Tujunga Well Field. Because of the blending

operations, the LADWP currently provides safe clean water that meets all federal and state drinking water regulations.

DDW reviews this Well Blending Operations Plan each year and intends that LADWP reduce its reliance on blending over time, particularly for synthetic or emerging contaminants including Volatile Organic Compounds (VOCs). Under the Blending Plan, operational changes such as removing production wells from service are required when a production well significantly contributes to a contaminant concentration exceeding 80% of the MCL or NL at a blend point.

At present, the Tujunga Well Field includes the Tujunga Temporary Groundwater Treatment System (TGTS) which started operation in 2010, treating production wells TJ-06 and TJ-07 (**Figures 2, 3, and 4**). These wells were selected because they had the highest concentrations of PCE, TCE, 1,1-DCE, and CTET in the well field. Liquid phase granular activated carbon (GAC) is used for treatment, whereby each system consists of parallel sand removal units, followed by GAC equipment to treat an average design flow rate of 4,000 gpm from each well. The Tujunga TGTS removes VOCs but not 1,4-dioxane.

LADWP has implemented a DDW-approved Interim Sampling Plan to collect contaminant concentration and other water quality data from the Tujunga Well Field production and monitoring wells to support the implementation of the Blending Plan. Substances detected in production wells at concentrations exceeding MCLs (TCE, PCE, 1,1-DCE and CTET) and NLs (1,4-dioxane) were identified as primary COCs in production wells TJ-06 and TJ-07 in the Blending Plan. TCE, PCE, 1,1-DCE, and CTET have been detected at concentrations that can be managed by LADWP through its existing Permit and Blending Plan. However, 1,4-dioxane cannot be managed in this manner, as the Tujunga TGTS does not remove 1,4-dioxane and DDW does not allow blending for 1,4-dioxane.

Groundwater

The groundwater basin is comprised predominantly of permeable sands and gravels interbedded with laterally discontinuous lenses of less permeable finer grained silts and clays. The unconsolidated sediments in the eastern SFB, which is where the Tujunga Well Field is located, are generally coarser grained and extend to at least 1,200 ft bgs in the eastern portion of the SFB. Groundwater is generally encountered in the basin at approximately 250 to 350 ft bgs, although it may be deeper in areas where groundwater is actively pumped, or shallower in proximity to active recharge projects such as spreading grounds. Groundwater in the SFB generally flows south to southeast, draining towards the Los Angeles River and the Los Angeles River Narrows in the far southeast part of the SFB. Locally, groundwater hydraulic gradients can vary in magnitude and direction depending on various stresses (e.g. production well pumping for water supply, spreading ground recharge etc.).

Several shallow and deeper groundwater zones have been used to describe the SFB aquifer system, which collectively extend to over 1,000 ft bgs. These various zones are defined based on interpreted geologic and hydraulic characteristics. Further details relating to the geologic and hydrologic characteristics of the SFB and the Tujunga Well Field are provided in a range of sources including the Report of Referee - Los Angeles v. San Fernando; the 1992 San Fernando Valley Remedial Investigation; the 2009 Focused Feasibility Study, North Hollywood Operable Unit, San Fernando Valley Area 1 Superfund Site, Los Angeles County, California; and the Interim Action Record of Decision for the North

Hollywood Operable Unit; the 2015 Groundwater System Improvement Study Remedial Investigation Update Report; and the Tujunga Interim RIFS Report.

Site Characteristics

The Tujunga Study Area is defined as the source area for groundwater entering the Tujunga production wells under active pumping conditions. The source of the groundwater is delineated by a capture zone for the Tujunga Well Field.

Within the Tujunga Study Area, a number of preliminary contaminant source areas have been identified and included in groundwater modeling work conducted as part of the study for the response action. These source areas are generally located two to three miles north of the Tujunga Well Field, on the northern side of the Verdugo Fault (**Figures 2**, **3 and 4)**. Other potential unknown sources of contamination may exist that adversely impact groundwater quality within the Tujunga Study Area; investigation into potential sources is an ongoing activity.

The sources identified for the study have been in operation for many decades and most have had active remediation activities implemented to control onsite contamination. However, prior to identification of contamination in groundwater and implementation of onsite control measures, it is likely that contamination reached (via vertical migration) the groundwater table, dissolved in the groundwater and migrated offsite for decades. This is evidenced by high historical concentrations of COCs in the source areas.

The EPA collects groundwater quality data from various stakeholders for sites in the Tujunga Study Area to support its characterization of the Tujunga. Study Area to support its characterization of the SFB. The groundwater quality data collected in the Tujunga Study Area between January 1, 2010 and September 30, 2014 was used to produce plume maps of dissolved PCE, TCE, and 1,4-dioxane in groundwater. The PCE, TCE, and 1,4-dioxane plume maps produced by EPA, dated February 2015, are presented as **Figures 2, 3 and 4** respectively. The plume maps show the lateral extent of the primary COCs in groundwater within the Tujunga Study Area.

Extent of VOC Contamination

Based on previous investigations and analysis of the SFB, EPA plume mapping has provided evidence of widespread PCE, TCE, and 1,4-dioxane contamination within the Tujunga Study Area, as shown in **Figures 2**, **3 and 4**. The area of highest COC concentrations is located up-gradient with respect to groundwater flow; north of the Tujunga Well Field. Given the elevated concentrations of the primary COCs detected in monitoring wells located up-gradient of the production wells, the continued use of the production wells threatens to result in elevated concentrations of the primary COCs, of particular concern 1,4-dioxane, being detected in the groundwater pumped from these production wells.

Contaminant migration in groundwater follows the primary direction of groundwater flow within the Tujunga Study Area from northeast and northwest to southeast, and towards active groundwater production wells. The groundwater flow field, contaminant distribution, and stratigraphic framework suggest that active groundwater production wells strongly influence groundwater flow and contaminant transport within Tujunga Study Area, superimposed on natural groundwater flow directions. Within the Tujunga Study Area, contaminants exceeding applicable MCLs (or NL for 1,4-dioxane), are generally detected at shallow depths closer to the potential source areas, whereas in the Tujunga Well Field concentrations are

higher in deeper units of the aquifer, corresponding to the deeper pumping intervals of the Tujunga production wells. The plume core area has the highest concentrations of primary COCs, and tends to be relatively broad, with the shape of the plume narrowing and tailing off back toward to source areas north of the Verdugo Fault (**Figures 2, 3 and 4**). The MCL for PCE and TCE is 5 µg/L and the NL for 1,4-dioxane is 1 µg/L.

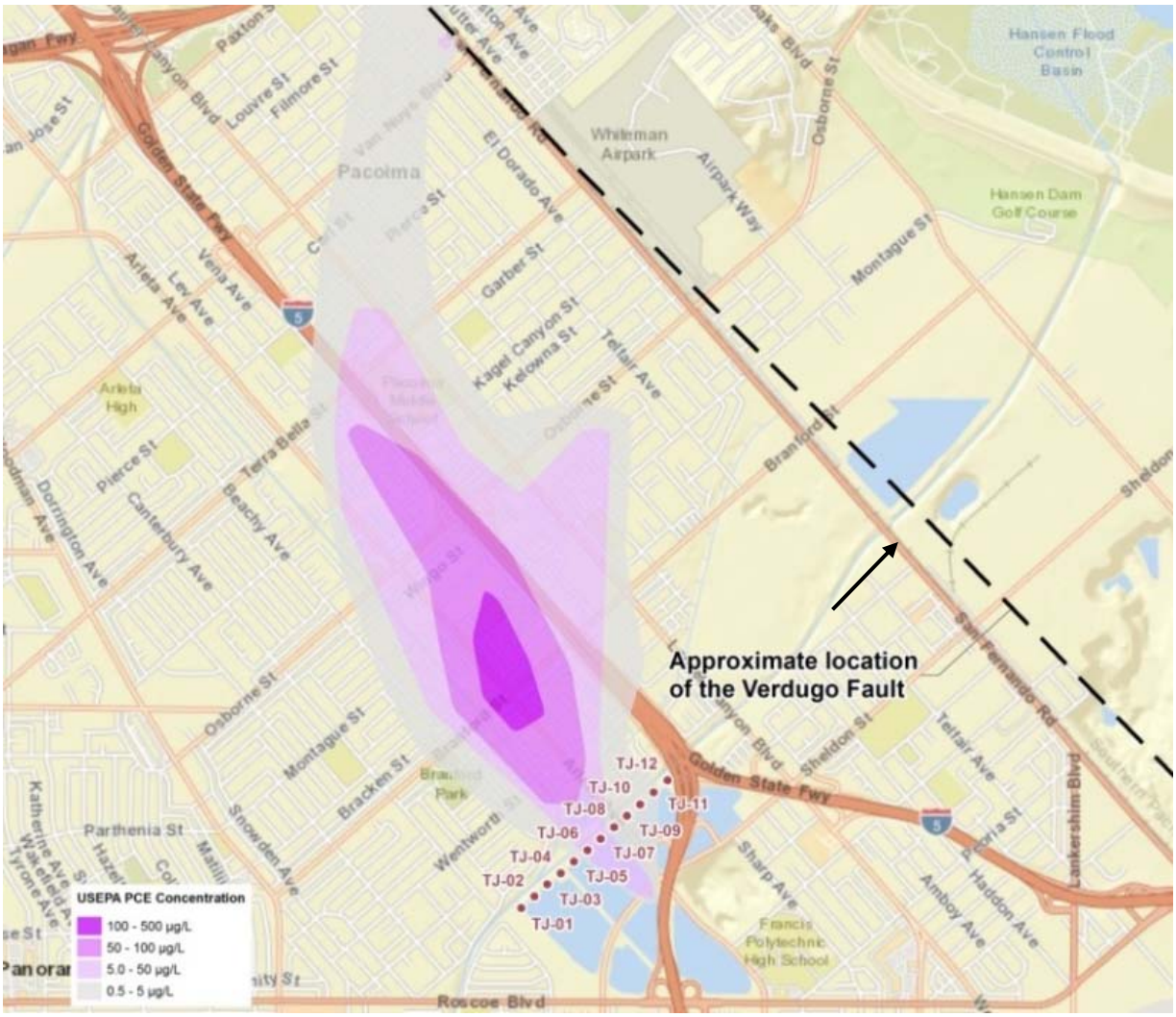

Figure 2 – EPA PCE Plume Map

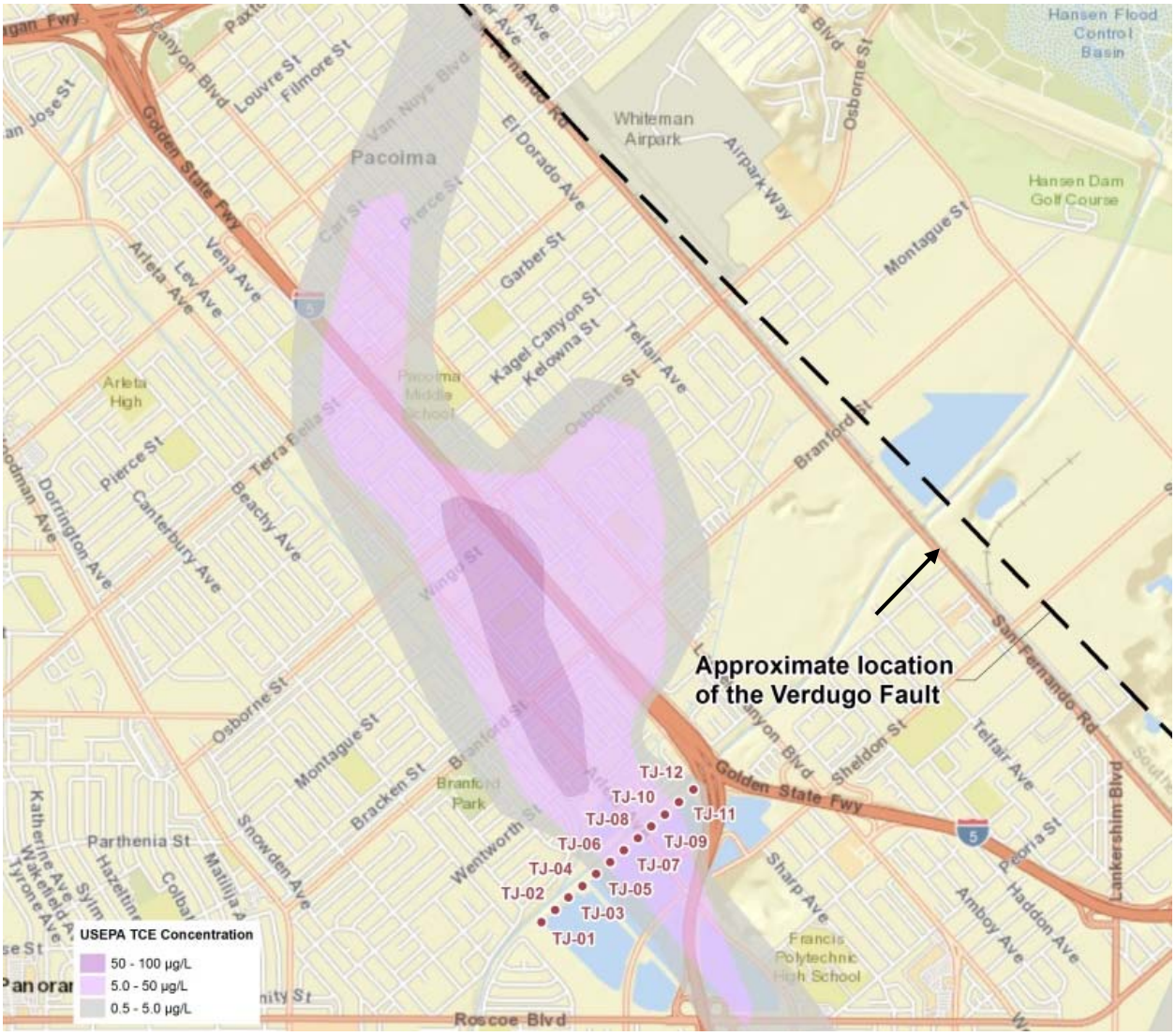

Figure 3 – EPA TCE Plume Map

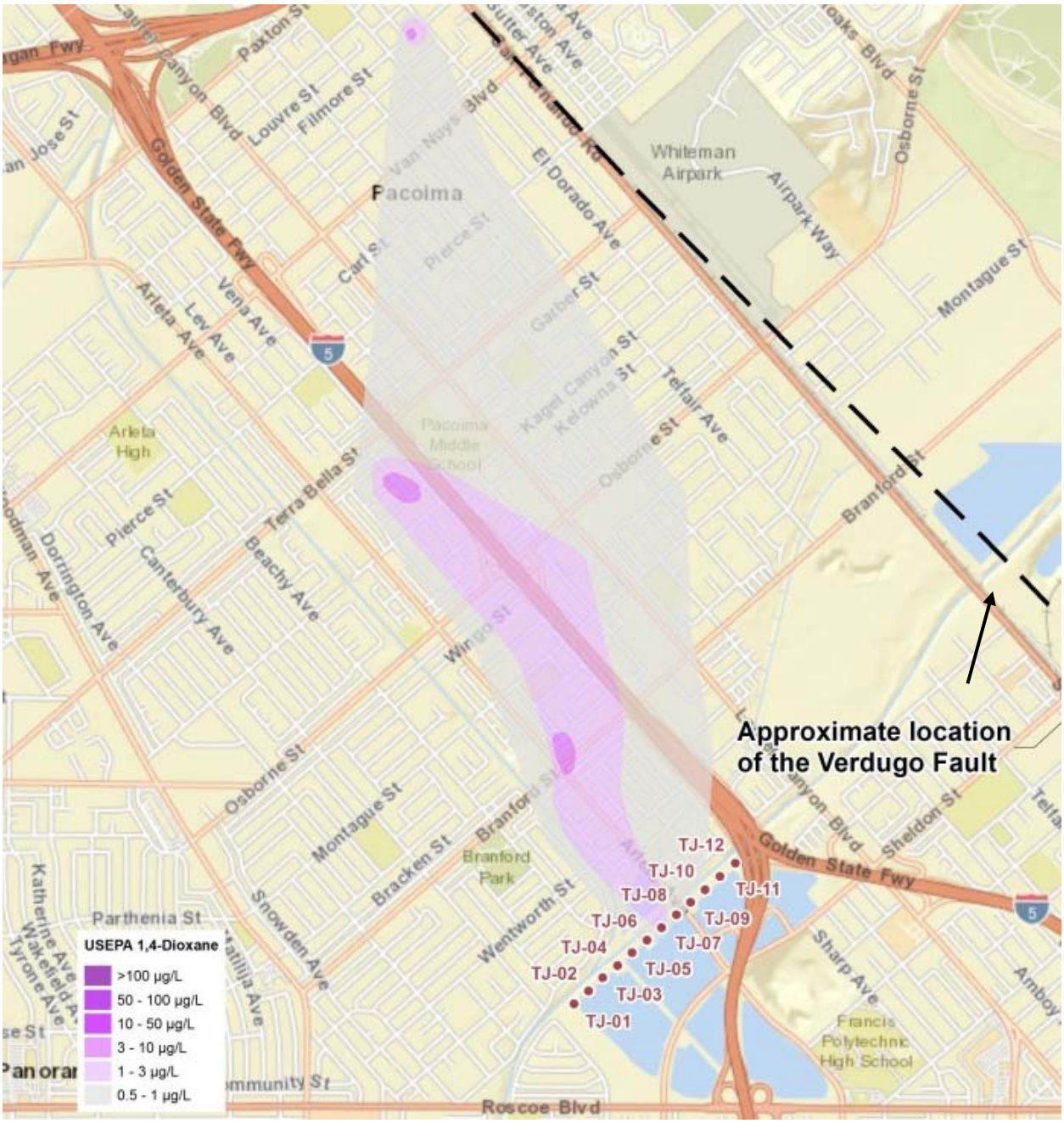

Figure 4 – EPA 1,4-Dioxane Plume Map

Operable Unit and Study Area

The Tujunga Operable Unit (OU) was defined as the groundwater entering the Tujunga production wells under active pumping conditions (i.e., groundwater source area for the Tujunga Well Field). The source of groundwater entering the Tujunga Well Field production wells can be delineated by developing a pumping plan and using this pumping plan to develop a potential capture zone. A potential capture zone can then be used to delineate the area of water captured by production wells within a given period of time (e.g., 10- or 30-year capture zones). The area of water captured by production wells within a given period of time is dependent on the volume of water extracted from the production wells during that period, and other factors such as the volume of water extracted from other nearby pumping wells, the volume of water recharged at various local spreading grounds and hydraulic characteristics of the geologic formations.

The Tujunga Study Area represents the lateral extent of the Tujunga OU based on the LADWP pumping plan. In this case, the 10-year capture zone can be used for shorter term planning and remedial design while the 30-year capture zone can be used for longer term planning including risk evaluation, fate and transport modeling, and groundwater recharge. The LADWP pumping plan is subject to change based on a number of factors such as supply and demand, climatic conditions, and maintenance activities. The goals of the pumping plan are described in the Sustainable City Plan and the 2015 Urban Water Management Plan.

Summary of Risks

A baseline human health risk assessment, based on both US EPA and Cal-EPA methodology, was performed to estimate current health risks and reasonably likely future risks from exposure to contaminants in Tujunga OU groundwater. Residents, indoor commercial workers, and farmers were determined to be the receptors of concern, and exposure via ingestion, inhalation, dermal contact and consumption of produce was examined. Constituents of potential concern were screened from a list of over 400 analytes using criteria that included detection frequency, exceedance of benchmarks, and other parameters. Statistical analysis was performed on the groundwater data to develop exposure point concentrations for use in the risk characterization.

Overall, both the carcinogenic and non-carcinogenic risk characterization results lie outside of EPA's risk management range (i.e., 10^{-6} to 10^{-4}; or greater than 1.0, respectively), indicative of a requirement for exposure control or remedial action.

Scope and Role of Response Action

This IRA is proposed to protect human health and the environment and to help to restore and maintain the beneficial uses of the SFB. The IRA is proposed to achieve the following Remedial Action Objectives

Protect human health and the environment by reducing the potential for exposure to COCs in groundwater at concentrations exceeding MCLs or risk-based cleanup goals in compliance with Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBCs);

- Limit the migration of COCs in groundwater in the Tujunga OU at concentrations that prevent the beneficial use of the SFB;
- Remove COCs from groundwater in the Tujunga OU to maintain the beneficial uses of the SFB and restore the aquifer to the extent practicable; and,

- Restore LADWP's capability to operate its existing Tujunga Well Field consistent with its historical and planned use in a flexible manner.

It is LADWP's current judgment that the IRA identified in this Proposed Plan is necessary to protect human health and the environment from actual or threatened releases of COCs into the environment, and to restore the beneficial use of the SFB.

Summary of Remedial Alternatives

Based on the available information about the current nature and extent of COC groundwater contamination in the vicinity of the Tujunga Well Field, and projections for future water withdrawals, LADWP developed a range of IRA alternatives for achieving the RAOs described above. Four IRA alternatives (Alternatives 1, 2, 3A, 3B) that incorporate different combinations of technologies and process options (described in detail in the Tujunga Interim RIFS) have been developed.

Based on the available information about the current nature and extent of COC groundwater contamination in the vicinity of the Tujunga Well Field, and projections for future water withdrawals, LADWP developed a range of IRA alternatives for achieving the Remedial Action Objectives (RAOs) described above. Four IRA alternatives (Alternatives 1, 2, 3A, 3B) that incorporate different combinations of technologies and process options (described in detail in the Tujunga Interim RIFS) have been developed.

The IRA alternatives developed include the No Action Alternative (Alternative 1), one response action alternative designated as Alternate Water Supply (Alternative 2), and two remedial action alternatives involving groundwater pumping, treatment, and direct domestic use of treated water (Alternatives 3A and 3B).

Alternative 1 – No Action

Alternative 1 was developed in accordance with the NCP (40 CFR 300.430(e)(6)) and EPA guidance for consideration and comparison to the action alternatives.

The No-Action Alternative would not provide overall protection of human health and the environment. The alternative does not include a response action to reduce the potential for exposure to hazardous substances; therefore, the Baseline Human Health Risk Assessment (HHRA) is an evaluation of the No-Action Alternative.

For the No-Action Alternative, groundwater containing COCs at concentrations exceeding Preliminary Cleanup Goals would be extracted from the existing production wells. The groundwater would not receive treatment to comply with ARARs and TBCs. The raw (untreated) water would be conveyed into the Tujunga Tank and Tujunga Pump Station for distribution into the LADWP water system for direct domestic use. Therefore, the No-Action Alternative would not meet the RAOs, comply with ARARs and TBCs, or achieve Preliminary Cleanup Goals.

Alternative 2 – Alternate Water Supply

Alternative 2 employs existing treatment and engineering controls to provide protection of human health by preventing or controlling exposure to COCs at concentrations exceeding ARARs and TBCs; however, would not limit the migration of COC in groundwater that prevent the beneficial use of the SFB, and would not be expected to restore LADWP's capability to operate its existing well fields consistent with its historical and planned use in a flexible manner. Alternative 2 is not anticipated to meet each of the RAOs, comply with each of the identified ARARs and TBCs, or achieve the Preliminary Cleanup Goals.

Alternative 2 assumes DDW would continue to allow blending in accordance with the existing Well Blending Operations Plan to prevent drinking water contaminants regulated by the DDW from exceeding Preliminary Cleanup Goals at the blend point down-stream of the Tujunga Well Field. However, DDW has stated that LADWP will not be able to rely upon blending for the long-term management of the COCs in areas subject to the DDW Process Memo 97-005, which would include the Tujunga OU.

Alternative 3A – Groundwater Pump and Treat for Direct Domestic Use Using Tujunga Production Wells

Alternative 3A was developed to address the principal threats posed by COCs in the Tujunga OU, meet each of the RAOs, comply with each of the identified ARARs and TBCs, and achieve the Preliminary Cleanup Goals within a reasonable timeframe. The contaminated groundwater would be captured by existing groundwater production wells for aboveground treatment. Groundwater modeling was used to evaluate options to minimize the number of groundwater production wells needed, as presented in Appendix A of the Interim RIFS Report. Above ground treatment would include technologies that are effective for treating TCE, PCE and 1,4-dioxane which is present in the remediation wells. Numerous technology options were considered, and the proposed plan selected those with fewer or lesser adverse impacts, lower costs for similar levels of performance, and with a combination of proven performance and innovation.

Alternative 3B – Groundwater Pump and Treat for Direct Domestic Use Using Interceptor Wells and Tujunga Production Wells

Alternative 3B was developed with the intent of potentially reducing treatment duration relative to Alternative 3A. Alternative 3B differs from Alternatives 3A in that the interim remedial action would include new interceptor wells. Interceptor wells are intended to be installed between the sources of groundwater contaminants and the Tujunga Well Field. The pumping of the interceptor wells could be implemented to form a hydraulic barrier to prevent the migration of groundwater contaminants to the Tujunga Well Field. As remediation progresses, the intent would be for the interceptor wells to capture a sufficient portion of the groundwater contaminant plumes migrating towards the Tujunga Well Field to prevent future Preliminary Cleanup Goals exceedances at the production wells, thereby reducing the volume of groundwater requiring treatment over the long-term.

The contaminated groundwater would be captured by interceptor wells and groundwater production wells for aboveground treatment. Above ground treatment would include technologies that are effective for treating TCE, PCE and 1,4-dioxane at the remediation wells. Numerous technology options were considered, and the proposed plan selected those with fewer or lesser adverse impacts, lower costs for similar levels of performance, and with a combination of proven performance and innovation.

Evaluation of Remedial Alternatives

To determine which alternative to select, LADWP evaluated and compared the remedial alternatives using EPA's nine

evaluation criteria. The nine criteria are summarized in **Figure 5**. EPA categorizes the nine criteria into three groups: (1) threshold criteria, (2) balancing criteria, and (3) modifying criteria. In the following discussion, the alternatives are evaluated in relation to the threshold criteria and the balancing criteria. A detailed description of this evaluation is provided in the Tujunga Interim RIFS report. LADWP will consider the modifying criteria (i.e., State and Community Acceptance) after review of public comments on this proposal. The alternatives are evaluated and assigned qualitative ratings of poor, fair, and good for performance in relation to each other and the criteria. **Table 2** summarizes LADWP's ranking of the alternatives in relation to EPA's threshold and balancing evaluation criteria.

Overall Protection of Human Health and the Environment

Alternative 1. The results of the Baseline HHRA show Alternative 1 would result in unacceptable risks to the adult and child receptors for current and future use scenarios. Further, the production wells would not be operated to control the migration of COCs to prevent their migration to downgradient groundwater resources. Alternative 1 is the No-Action Alternative and is not assigned an Overall Protection of Human Health and Environment rating as the criterion is not applicable to the alternative.

Alternative 2. Alternative 2 includes a response action to protect human health but does not protect the environment. Alternative 2 includes the implementation of the DDW-approved Blending Plan, which includes a plan to operate the production wells to reduce the potential for exposure to the COCs and thereby protect human health. However, the Blending Plan does not include actions to prevent COC migration to downgradient groundwater resources. Therefore, Alternative 2 does not protect the environment. Alternative 2 is assigned an Overall Protection of Human Health and Environment rating of 'poor' relative to other alternatives.

Figure 5 – EPA Nine Evaluation Criteria

Alternative 3A. Alternative 3A includes an interim remedial action that provides overall protection of human health and the environment. Institutional, containment and treatment actions would be implemented to draw COC plumes toward remedy wells and away from non-remedy wells and downgradient water resources. The analysis presented in Appendix A of the Interim RIFS Report shows the alternative would reduce the potential for exposure to COCs in groundwater at concentrations exceeding Preliminary Cleanup Goals, and reduce COC-impacted groundwater migration to other production wells and downgradient

water resources. Alternative 3A is assigned an Overall Protection of Human Health and Environment rating of 'good' relative to other alternatives.

Alternative 3B. Alternative 3B includes many of the same technical components as Alternative 3A. Alternative 3B includes an interim remedial action that provides overall protection of human health and the environment. Institutional, containment and treatment actions would be implemented to draw COC plumes toward remedy wells and away from non-remedy wells and downgradient water resources. The analysis presented in Appendix A of the Interim RIFS Report shows the alternative would reduce the potential for exposure to COCs in groundwater at concentrations exceeding Preliminary Cleanup Goals. Alternative 3B is assigned an Overall Protection of Human Health and Environment rating of 'good' relative to other alternatives.

Compliance with ARARs

Alternative 1. The No-Action Alternative does not include a response action to reduce the potential for exposure to hazardous substances. Based on the analysis of exposure to hazardous substances presented in the Baseline HHRA, the concentrations of COCs in the groundwater produced by the production wells would exceed the potential ARARs and TBCs. Therefore, Alternative 1 would not comply with ARARs and TBCs. Alternative 1 is the No-Action Alternative and is not assigned a Compliance with ARARs rating as the criterion is not applicable when no response action is selected and implemented, per Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) section 121.

Alternative 2. Alternative 2 would comply with the potential chemical-specific ARARs with the exception of SWRCB Resolution No. 92-49, since the alternative would not restore the beneficial use of groundwater and the SFB. In Alternative 2, without pumping to control COCs migration, a water right of up to 55,000 AFY from Tujunga Well Field and production capacity of approximately 71,100 AFY is anticipated to be unavailable for a period of more than 20 years, and the Preliminary Cleanup Goals would not be achieved. Alternative 2 does not include remedial action to capture and remove COCs, so it is more likely that COCs will persist in the groundwater in the Tujunga OU without control for a longer period of time. Alternative 2 is assigned a Compliance with ARARs rating of 'poor' relative to other alternatives.

Alternative 3A. Alternative 3A would comply with the ARARs and TBCs. The analysis presented in Appendix A of the Interim RIFS Report shows the production wells could be operated to capture and remove COCs from groundwater in the Tujunga OU in compliance with chemical-specific ARARs and TBCs to maintain the beneficial uses of the SFB and restore the aquifer to the extent practicable. The beneficial use of the Tujunga OU would be restored in accordance with the LARWQCB Basin Plan which conforms to the State of California Antidegradation Policy. Alternative 3A is assigned a Compliance with ARARs rating of 'good' relative to other alternatives.

Alternative 3B. Alternative 3B would comply with the ARARs and TBCs. The analysis presented in Appendix A of the Interim RIFS Report shows the combination of the interceptor wells and the production wells could be operated to capture and remove COCs from groundwater in the Tujunga OU in compliance with chemical-specific ARARs and TBCs to maintain the beneficial uses of the SFB and restore the aquifer to the extent practicable. The beneficial use of the Tujunga OU would be restored in accordance with the LARWQCB Basin Plan. Alternative 3B is anticipated to comply with the ARARs and TBCs and is therefore

assigned a Compliance with ARARs rating of 'good' relative to other alternatives.

Long-Term Effectiveness and Permanence

Alternative 1. For Alternative 1, based on the analysis conducted for the action alternatives, COCs would continue to migrate uncontrolled from the well field capture zone to the production wells for decades (e.g., longer than the alternatives that involve the capture of the COC-impacted groundwater). Further, the production wells would not be used to control the migration of COCs to prevent their migration to downgradient groundwater resources. Therefore, adequate and reliable controls would not be applied, and unacceptable risks to human health and the environment would remain. Therefore, Alternative 1 would not provide long-term effectiveness and permanence and is assigned a Long-Term Effectiveness and Permanence rating of 'poor' relative to other alternatives.

Alternative 2. For Alternative 2, based on the analysis conducted for the action alternatives presented in Appendix A of the Interim RIFS Report, COCs could continue to migrate uncontrolled from the well field capture zone to production wells for decades (e.g., longer than for the remedial action alternatives described herein). Further, the production wells would not be operated to control the migration of COCs to prevent their migration to downgradient groundwater resources. Adequate and reliable controls would not be applied, and unacceptable risks to human health and the environment would remain. Therefore, Alternative 2 would not provide long-term effectiveness and permanence. Alternative 2 is assigned a Long-Term Effectiveness and Permanence rating of 'poor' relative to other alternatives.

Alternative 3A. For Alternative 3A, the analysis presented in Appendix A of the Interim RIFS Report shows the alternative would provide adequate and reliable control of COC migration in the Tujunga OU, and is expected to reduce COC concentration in groundwater and treated water to levels below Preliminary Cleanup Goals; which would significantly reduce the residual risk to human health and the environment. Alternative 3A would also limit further migration of the COC plumes to other non-remedy production wells and downgradient water resources, which would also significantly reduce the risk to human health and the environment.

The use of the production wells to capture COC-impacted groundwater, and the use of demonstrated technologies increases the certainty that the alternative will prove to be successful. The combination of technologies and process options included in Alternative 3A has been demonstrated to meet the Preliminary Cleanup Goals for the COCs in similar environmental settings. Therefore, Alternative 3A would provide long-term effectiveness and permanence. Alternative 3A is assigned a Long-Term Effectiveness and Permanence rating of 'good' relative to other alternatives.

Alternative 3B. The use of the combination of interceptor wells and production wells to capture COC-impacted groundwater has the potential to be as or more effective than the use of only production wells; however, the use of the interceptor wells to prevent further migration to the downgradient production wells is uncertain over the long-term duration of the alternative (estimated to be more than 20 years, as presented in Appendix A of the Interim RIFS Report). The use of the interceptor wells to prevent further migration to the downgradient production wells is uncertain as the new interceptor wells would not be located to intercept contaminant plumes migrating from currently unidentified source areas that

are not located within the groundwater flow pathway between the preliminary identified source areas and the Tujunga Well Field. If the use of the combination of interceptor wells and production wells draws contamination away from currently unidentified source areas that are not located within the groundwater flow pathway between the preliminary identified source areas and the Tujunga Well Field, the interceptor wells may not be able to meet their purpose of preventing the migration of COC-impacted groundwater to the Tujunga Well Field. This outcome could lead to the requirement of additional interceptor wells and the associated time and cost of interceptor well siting activities. The potential time and cost for this outcome is not included in the costs presented herein (Appendix B of the Interim RIFS Report).

Further, the use of new interceptor wells would lead to fewer production wells operating to capture the COC-impacted groundwater migrating downgradient of the new interceptor wells as the groundwater extraction from the interceptor wells would be offset by a reduction in groundwater extraction from the production wells so that the treatment facility that is appropriately sized for the short-term period when the COC-impacted groundwater is migrating into both the interceptor wells and the production wells downgradient of the interceptor wells, but not oversized for the long-term period when the new interceptor wells could prevent the migration of COC-impacted groundwater to the production wells.

Therefore, Alternative 3B would provide overall long-term effectiveness and permanence; however, the effectiveness of intercepting COC-impacted groundwater, and preventing further migration to the downgradient production wells is uncertain. Alternative 3B is therefore assigned a Long-Term Effectiveness and Permanence rating of 'fair to good' relative to other alternatives. (**Table 1**).

Table 1 – How do the Alternatives Compare to EPA's Evaluation Criteria?

Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3A	Alternative 3B
Overall Protection of Human Health and the Environment	NA	Poor	Good	Good
Compliance with ARARs	NA	Poor	Good	Good
Long-Term Effectiveness and Permanence	Poor	Poor	Good	Fair to Good
Reduction of Toxicity, Mobility, or Volume through Treatment	NA	NA	Good	Good
Short-Term Effectiveness	NA	Fair	Good	Fair
Implementability	NA	Fair	Good	Fair
Cost	NA	Poor	Good	Fair

Note: NA = Not Applicable

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative 1. Alternative 1 would not include treatment of COCs in groundwater; therefore, the alternative would not reduce the toxicity, mobility, or volume of COC-impacted contaminated groundwater. As such, the principal threats posed by COCs in the Tujunga OU would not be reduced. Alternative 1 is the No-Action Alternative and is not assigned a Reduction of Toxicity, Mobility, or Volume through Treatment rating as the criterion is not applicable to the alternative.

Alternative 2. Alternative 2 would not include effective treatment of each of the COCs in groundwater at each of the production wells. The existing TGTS provides treatment is applied to only three of the twelve production wells. The TGTS uses GAC to remove VOCs; however, GAC is not effective in removing 1,4-dioxane. The analysis of Alternative 2 presented in Appendix A of the Interim RIFS Report shows that 1,4-dioxane could be expected to migrate into the twelve production wells at levels exceeding the Preliminary Cleanup Goal for 1,4-dioxane. Therefore, the existing TGTS would not be capable of achieving the Preliminary Cleanup Goal for 1,4-dioxane and this would result in the inactivation of the production wells.

Separately, while blending reduces the toxicity of COCs in groundwater served for domestic use through combining groundwater flowing from more impacted wells with groundwater flowing from less impacted wells or other sources, it does not reduce the toxicity of COCs in groundwater in the Tujunga OU as it's being implemented as part of the Blending Plan. EPA guidance is that blending (i.e., mixing, blending, and dilution of contaminated and uncontaminated groundwater in order to achieve remedial goals) would result in a larger volume of contaminated groundwater with lesser concentrations of contaminants, and that this approach is consistent with the intent of CERCLA. Further, the implementation of the Blending Plan seeks to reduce the capture of COC-impacted groundwater, allowing the COC-impacted groundwater to migrate to downgradient water resources. In addition, analysis presented in Appendix A of the Interim RIFS Report indicates that blending can only be implemented for a short time for select wells. Therefore, Alternative 2 would not reduce the toxicity, mobility, or volume of COC-impacted groundwater, and does not reduce the principal threats posed by COCs in the Tujunga OU. Alternative 2 is not assigned a Reduction of Toxicity, Mobility, or Volume through Treatment rating as the criterion is not applicable to the alternative.

Alternative 3A. Alternative 3A uses production wells to extract COC-impacted groundwater from the Tujunga OU, and conveys the water to a treatment facility at the Tujunga Spreading Grounds for effective treatment. The combination of treatment technologies and process options proposed for the Tujunga Remediation Facility has been demonstrated in similar environmental settings to meet ARARs and TBCs, which are the basis for the Preliminary Cleanup Goals for the COCs for the treated water; subject to additional requirements for permitting by state agencies. Therefore, Alternative 3A addresses the principal threats posed by the COCs in the Tujunga OU, which is used for drinking water.

The analysis presented in Appendix A of the Interim RIFS Report indicates the use of the production wells will effectively capture the mass of COCs in the Tujunga OU, and reliably reduce the mobility of the COCs. The analysis indicates that the remedy will significantly reduce the volume of groundwater containing COC levels exceeding Preliminary Cleanup Goals. The

analysis summarized in Appendix A of the Interim RIFS Report indicates more than 20 years will be required to achieve the Preliminary Cleanup Goals, which does not account for unknown sources that could be discharging contaminant mass to the Tujunga OU. Also, the application of Advanced Oxidation Process (AOP) and GAC treatment technologies addresses the statutory preference for treatment as a principal element. Therefore, Alternative 3A would provide reduction of toxicity, mobility, or volume through treatment. Alternative 3A is assigned a Reduction of Toxicity, Mobility, or Volume through Treatment rating of 'good' relative to other alternatives.

Alternative 3B. Alternative 3B uses interceptor wells and production wells to extract COC-impacted groundwater from the Tujunga OU, and conveys the water to a treatment facility at the Tujunga Spreading Grounds for effective treatment. However, as explained above in the analysis of Long-Term Effectiveness and Permanence, the analysis shows the strategy of intercepting COC-impacted groundwater, and preventing further migration to the downgradient production wells has the potential to be less reliable than reliance on intercepting COC-impacted groundwater at the Tujunga Well Field itself due to the uncertainties in the potential to locate the interceptor wells in the contaminant migration pathway between both known and currently unknown source areas and the Tujunga Well Field and the associated reduction in production rates at the Remediation Wells relative to Alternative 3A. The application of the AOP and GAC treatment technologies addresses the statutory preference for treatment as a principal element. Therefore, Alternative 3B would provide reduction of toxicity, mobility, or volume through treatment; however, the strategy of intercepting COC-impacted groundwater, and preventing further migration to the downgradient production wells is not expected to be sufficiently effective or reliable to eliminate treatment of groundwater production well water. Alternative 3B is assigned a Reduction of Toxicity, Mobility, or Volume through Treatment rating of 'good' relative to other alternatives.

Short-Term Effectiveness

Alternative 1. Alternative 1 would not involve the implementation of a response action to achieve RAOs; therefore, the alternative would not pose significant short-term risks to the public or the environment associated with implementation of a response action. Alternative 1 does not involve the implementation of a response action; therefore, the alternative was not assigned a Short-Term Effectiveness rating as the criterion is not applicable to the alternative.

Alternative 2. Alternative 2 includes a response action to protect human health; however, it does not include a remedial action to meet each of the RAOs. Existing treatment (the TGTS) (as possible) and institutional actions would continue to be implemented; however, the containment and treatment actions would not be implemented. Therefore, the alternative would not pose significant short-term risks to the public or the environment associated with implementation of a response action. Alternative 2 is assigned a Short-Term Effectiveness rating of 'fair' relative to other alternatives as the RAOs would not be met.

Alternative 3A. Implementation of Alternative 3A would involve the construction of a Tujunga Remediation Facility at the Tujunga Spreading Grounds, which has the potential to create short-term impacts typical of construction projects, including potential hazards to the community, workers, and the environment. However, impacts during construction of the remediation facilities can be mitigated.

Implementation of Alternative 3A would also involve the operation of facilities for a period

of at least 20 years, which has the potential create long-term impacts typical of operating water treatment facilities employing similar technologies, including potential hazards to the community, workers, and the environment. However, the impacts during operation of the facilities can also be mitigated, and it is not uncommon for water treatment facilities to be located in settings similar to the Tujunga Spreading Grounds.

Alternative 3A does not pose unmitigatable risks to the community during construction and operations, nor does the alternative pose unmitigatable risks to workers beyond the typical risks associated with a construction project or operating water treatment facility. No unmitigatable negative environmental impacts are anticipated in the area in which the treatment facility would be built. There may be some short-term risks during construction and operation of the treatment facility; however, these risks can be managed with proper planning, permitting, and administrative and engineering controls. Therefore, Alternative 3A would provide a high degree of short-term effectiveness. Alternative 3A is assigned a Short-Term Effectiveness rating of 'good' relative to other alternatives.

Alternative 3B. Implementation of Alternative 3B would involve the construction of new interceptor wells and a raw (untreated) water conveyance system from the interceptor wells to the remediation facilities within a largely residential setting upgradient of the production wells. The activities have the potential to create short-term impacts typical of construction projects, including potential hazards to the community, workers, and the environment. The impacts associated with the siting and installation of the interceptor wells and associated conveyance system would be expected to be more significant than the impacts associated with the construction of the Tujunga Remediation Facility at the Tujunga Spreading Grounds, which is an existing municipal water facility.

Alternative 3B would provide short-term effectiveness; however, the siting and construction of the interceptor wells and associated conveyance system would be expected to present more significant impacts to the community and the workers than the construction of the treatment facilities. Alternative 3B is therefore assigned a Short-Term Effectiveness rating of 'fair' relative to other alternatives.

Implementability

Alternative 1. Alternative 1 would not involve the implementation of a response action therefore, the analysis of technical feasibility, administrative feasibility, and availability of services and materials is not applicable. Alternative 1 was not assigned an implementability rating as the criterion is not applicable to the alternative.

Alternative 2. For Alternative 2, while the TGTS and conveyance infrastructure is already in-place to support the operation of the TGTS, the effectiveness of the TGTS is decreasingly reliable. The TGTS provides treatment for VOCs but not 1,4-dioxane, and is applied to only three of the twelve production wells. Analysis provided in Appendix A of the Interim RIFS Report indicates each of the twelve production wells will receive levels of COCs including 1,4-dioxane that will lead to the inactivation of the wells.

The administrative feasibility of implementing Alternative 2 is also becoming increasingly unreliable. As previously discussed in this section, DDW has stated that LADWP will not be able to rely upon blending for the long-term management of the COCs in areas subject to the DDW 97-005 policy, which would include the Tujunga OU. Permission to blend is subject to an annual review by DDW, which has indicated

a desire for LADPW to lessen its reliance on blending over time.

Lastly and similarly to administrative feasibility, the water the City imports to replace water from inactivated production wells is an increasingly unreliable source due to increasing uncertainties in seasonal availability, environmental conditions, and political influences. For example, imported water supplies from the State Water Project pumped from the Sacramento-San Joaquin Delta are uncertain due to changing hydrologic conditions related to climate change and declining environmental conditions for fish. The long-term implementability of the alternative water supply element of this alternative thus faces greater risks. Alternative 2 is assigned an implementability rating of 'fair' relative to other alternatives.

Alternative 3A. Alternative 3A is not expected to be difficult to implement on a technical basis. The production wells and conveyance system are already installed. LADWP owns the land necessary to construct the facilities, and LADWP employs the resources necessary to manage the construction and operation of the facilities. Remedial design, permitting and construction could take on the order of two to three years to complete, based on LADWP experience. Operations and Maintenance (O&M) of the facility would require monitoring of operational performance for the duration of the interim remedial action (as provided in Appendix A of the Interim RIFS Report, currently estimated to be at least 20 years). LADWP has the resources and expertise to manage normal technical difficulties associated with construction and operation of the facilities.

Similar to the technical feasibility of implementing Alternative 3A, the administrative feasibility of implementing Alternative 3A is not expected to be difficult. LADWP has demonstrated that it is capable of implementing the short-term permitting process required for Alternative 3A, which it has shown through the implementation of the DDW 97-005 permitting process and the California Environmental Quality Act (CEQA) compliance process for the North Hollywood West (NHW) Remediation Facility. An amendment to the State of California Domestic Water Supply Permit Issued to City of Los Angeles Department of Water and Power from the State Water Resources Control Board, Division of Drinking Water would be required for this alternative, which involves construction of a remediation system and distribution of treated water into a potable water supply system. The treatment process options evaluated for the Tujunga OU are proven technologies and treated water would meet or exceed applicable water quality requirements with respect to the DDW's MCLs and NLs.

LADWP has also demonstrated that it is capable of implementing the long-term DDW compliance process required for Alternative 3A, which has been shown through the operation of its water system, and particularly the TGTS, in accordance with DDW requirements. Lastly, LADWP has the resources to secure the services and materials required to implement Alternative 3A. Therefore, Alternative 3A would be implementable and is assigned an implementability rating of 'good' relative to other alternatives.

Alternative 3B. The new interceptor wells for Alternative 3B would require siting studies to locate the wells with a high degree of accuracy relative to the highest areas of contamination and the most significant pathway(s) between sources and receptors. This assumes such accuracy can be achieved practicably, and assumes the long-term pathway for contaminant transport remains unchanged in the future. The siting studies could require multiple years to provide an initial indication of where to

locate the interceptor wells and associated conveyance system. LADWP may need two to three years to acquire the land necessary to install the interceptor wells, which is anticipated to be developed for residential use. In this case, LADWP may need to acquire the land through eminent domain proceedings, the right of government to expropriate private property for public use, with payment of compensation, which would add multiple additional years. LADWP may then need one to two years to install the wells and associated electrical and water conveyance systems.

Alternative 3B would be implementable; however, the schedule required to implement the interceptor wells would be substantially longer than the overall schedule to implement Alternative 3A, and there could be significant uncertainty in whether the interceptor wells could be located with a high degree of accuracy relative to the highest areas of contamination and the most significant pathway(s) between sources and receptors.

Cost

Alternative 1. Alternative 1 would not involve the implementation of a response action under CERCLA therefore there are no CERCLA response costs associated with this alternative. Alternative 1 is the No-Action Alternative and is not assigned a cost rating as the criterion is not applicable to the alternative.

Alternative 2. Alternative 2 involves institutional actions including groundwater monitoring and the potential purchase of an alternate water supply from Metropolitan Water District of Southern California (MWD) of up to 55,000 AFY for a period of decades (e.g., for the purpose of the comparative analysis of alternatives in this section, longer than remedial action Alternatives 3A and 3B). The volume and duration of replacement water is estimated based on the analysis presented in Appendix A of the Interim RIFS Report.

The base period of at least 20 years was selected to facilitate the comparison of Alternative 2 with Alternatives 3A and 3B. The actual period for purchasing replacement water is expected to be significantly longer. Without groundwater containment and treatment action in the Tujunga OU, the COCs are anticipated to persist for a longer period than if containment and treatment actions were implemented.

The MWD rate in 2021 for full-service, treated water (i.e., replacement water) will be $1,107/AF based on the Updated Ten-Year Forecast Metropolitan Water District of Southern California May 7, 2018, which MWD projects to grow at a rate greater than inflation. The 20-year estimated cost for Alternative 2 is $1,313,000,000. A detailed cost estimate is provided in Appendix B of the Interim RIFS Report. Alternative 2 is assigned a Cost rating of ‘poor’ relative to other alternatives.

Alternative 3A. The estimated cost of $588,000,000 for Alternative 3A represents the sum of the capital costs and the Net Present Value (NPV) of recurring costs over a span of at least 20 years of operations. The analysis presented in Appendix A of the Interim RIFS Report shows the duration of the remedy could be longer. The capital costs were estimated to be $236,200,000 to design and construct the Tujunga Remediation Facility. Alternative 3A is assigned a Cost rating of ‘good’ relative to other alternatives.

Alternative 3B. The estimated cost of $615,000,000 for Alternative 3B represents the sum of the capital costs and the NPV of recurring costs over a span of at least 20 years of operations. The analysis presented in Appendix A of the Interim RIFS Report shows the duration of the remedy could be longer. The capital costs were estimated to

be $263,200,000 to procure land for interceptor well construction and design and construct the Tujunga Remediation Facility.

Since Alternative 3B costs less than Alternative 2 but more than Alternative 3A, it is assigned a Cost rating of 'fair' relative to other alternatives.

Duration Sensitivity Analysis. The exact duration of the response actions is estimated but the duration could change based on new information or changed conditions. Given this uncertainty as to the duration of the response action, a sensitivity analysis was completed to examine the costs if the response action had a duration of 15, 20, and 30 years. As shown in Appendix B of the Interim RIFS Report, Alternative 3A and 3B have a lower cost than Alternative 2 under each of these durations, and with longer durations leading to a greater cost advantage for Alternative 3A and 3B over Alternative 2. It is noted that even if Alternatives 2, 3A and 3B are cost neutral, Alternative 3A and 3B remain superior with respect to the other criteria.

The relative cost benefit of Alternatives 3A and 3B over Alternative 2 is likely greater than shown in the Table 2. This cost comparison assumes that Alternative 2, 3A and 3B have the same duration; however, Alternative 2 does not include containment and treatment actions, therefore it is more likely that COCs will persist in the groundwater in the vicinity of the production wells without control for a longer period of time in Alternative 2 compared to Alternatives 3A and 3B.

Discount Rate Sensitivity Analysis. The federal Office of Management and Budget (OMB) publishes discount rates appropriate for use by public agencies for long-term planning, which have lower costs of capital than private entities. The OMB rate is currently 0.2% (net of inflation) for a 20-year project. As described in the LADWP UWMP, given the many pressures on water in the area, it is likely that the costs of water will increase at a greater rate than inflation, such that a lower real discount rate could be appropriate. The effect of a lower real discount rate would be to increase the cost of Alternative 2 relative to Alternatives 3A and 3B as Alternative 2 is limited to recurring costs where Alternatives 3A and 3B include capital costs. A lower real discount rate does not affect the relative cost ranking of Alternatives 3A and 3B. See Appendix B of the Interim RIFS Report for the results of a sensitivity analysis of discount rate on NPV.

Table 2 – Cost Summary of Remedial Alternatives

Alt	Capital Cost	Recurring Cost	NPV
Alt 1	$0	$0	$0
Alt 2	$0	$Varies	$1,313,000,000
Alt 3A	$236,200,000	$18,000,000	$588,000,000
Alt 3B	$263,200,000	$18,000,000	$ 615,000,000

Abbreviations: Alt = alternative; NPV = Net Present Value.

Notes: NPV is calculated based on a 0.2% rate (net of inflation) and 20-year project life. For Alternative 2, the NPV includes cost for 2021 through 2040. For Alternative 3A and 3B, the NPV includes capital and O&M costs for 2021 through 2040. The cost estimate accuracy range is within the -30% to +50% order-of-magnitude guideline range.

Preferred IRA Alternative

LADWP's preferred IRA is Alternative 3A, which includes the implementation of institutional controls, containment and treatment actions. The preferred IRA would be designed to hydraulically capture COC impacted groundwater within the Tujunga Well Field area, provide above ground treatment and management of the primary and secondary COCs contaminated

groundwater, and then provide the treated water to the LADWP distribution system for direct domestic use.

Key components of Alternative 3A depicted in **Figures 6, 7, and 8** include groundwater production wells, conveyance piping, treatment facilities, distribution piping and monitoring wells.

Based on information currently available, LADWP believes the preferred IRA meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. LADWP expects the preferred IRA to satisfy the following statutory requirements of the CERCLA as amended: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; 5) satisfy the preference for treatment as a principal element, and 6) otherwise best satisfy the NCP remedy selection criteria. The preferred IRA can change, however, in response to public comment and/or new information.

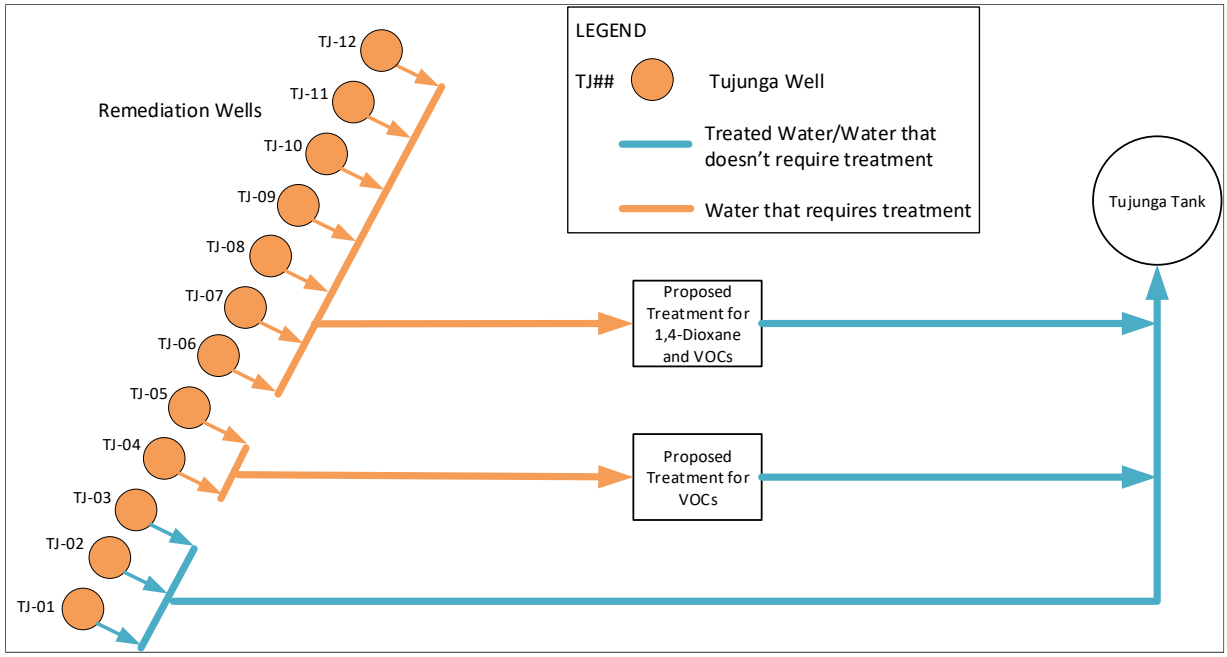

Figure 6 - Alternative 3A Wells, Pipelines, Treatment Facility, Distribution System

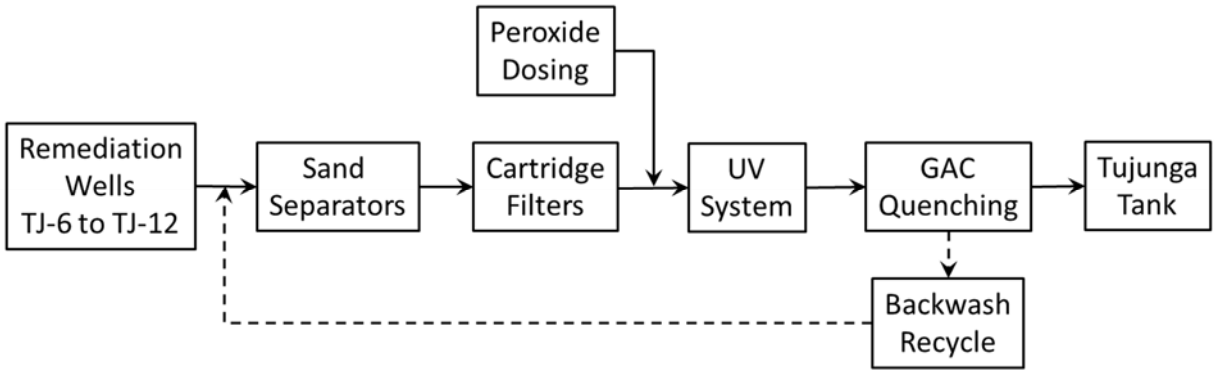

Figure 7 - Alternative 3A AOP Simplified Process Flow Diagram

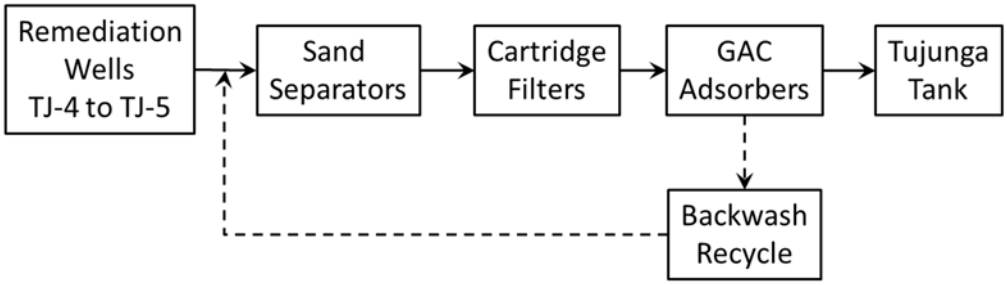

Figure 8 - Alternative 3A GAC Simplified Process Flow Diagram

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Information Repositories

LADWP maintains site information at the following repositories. These repositories contain the project documents, fact sheets, and reference materials. LADWP encourages you to review these documents to gain a more complete understanding of the site.

LADWP also has a site information web page at www.ladwp.com/remediation
For additional information about community involvement opportunities related to this response action, please see the Community Involvement Plan available at the repositories and LADWP website identified above.

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