Proposed Plan for
North Hollywood Central 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 Rinaldi-Toluca (RT) Well Field located in the vicinity of LADWP's RT and North Hollywood well fields (i.e., North Hollywood Central area), which are located in the eastern part of the San Fernando Basin (SFB) within the San Fernando Valley (SFV) of Southern California (**Figure 1**). The RT Well Field is one of several well fields in the SFB that have b.een 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 RT 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 PCE, TCE, and 1,4-dioxane contamination in the RT Study Area (area of aquifer from which the RT Well Field is expected to receive its future groundwater); and potential risks to human health and the environment posed by the PCE, TCE, and 1,4-dioxane contamination.

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

How You Can Comment

The LADWP encourages the public to comment on the proposed IRA at the RT Well Field. The comment period is August 2, 2018 through September 4, 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 September 4, 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

August 16, 2018
Public Meeting
6:00 pm

Valley Plaza Library
12311 Vanowen St.
North Hollywood, CA 91605

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 RT, 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 RT Well Field is a discrete, localized response action to address the contaminants of concern (COCs) that currently adversely impact beneficial use of water extracted from the RT production wells. LADWP has identified PCE, TCE, and 1,4-dioxane as the primary COCs. The proposed treatment system will be capable of treating 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 North Hollywood Central (NHC) Interim Remedial Investigation and Feasibility Study (RIFS) Report and other documents available in the Information Repository.

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 portfolio. Over the last five years, local groundwater has provided approximately 14 percent of the total water supply for the City, and since 1970 has provided up to 30 percent (%) of total supply during extended dry periods, when imported supplies became 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**).

The RT Well Field is located in the eastern part of the SFB within the LADWP Power System right-of-way corridor. It is a relatively new well field within the SFB, with production wells installed between 1985 and 1988. The RT Well Field comprises 15 production wells, numbered from RT-01 through RT-15. The production wells are arranged in a linear network, orientated northwest-southeast (**Figure 1**). The wells are bounded by the 170 Freeway to the west, Radford Avenue to the east, Cantara Street to the north, and Sherman Way to the south. The RT Well Field setting and production well locations are shown in **Figure 1**.

With the exception of one production well, RT-10 (680 feet [ft] deep), all RT production wells were drilled to approximately 800 ft below ground surface (bgs), and screened at various intervals between 360 ft and 780 ft. The flow capacities of RT production wells range between 5.1 cubic feet per second (cfs) and 8.6 cfs per well, with a combined total flow of 113.0 cfs (~82,000 AFY) for the 15 wells. Shortly after the well field began full operation, it produced nearly 60,000 AFY. However, production has decreased significantly due to contamination. In recent years, the well field produced less than 10,000 AFY as production wells were shut down due to contamination.

The RT Well Field is operated in accordance with the State of California Domestic Water Supply Permit issued by DDW to LADWP.

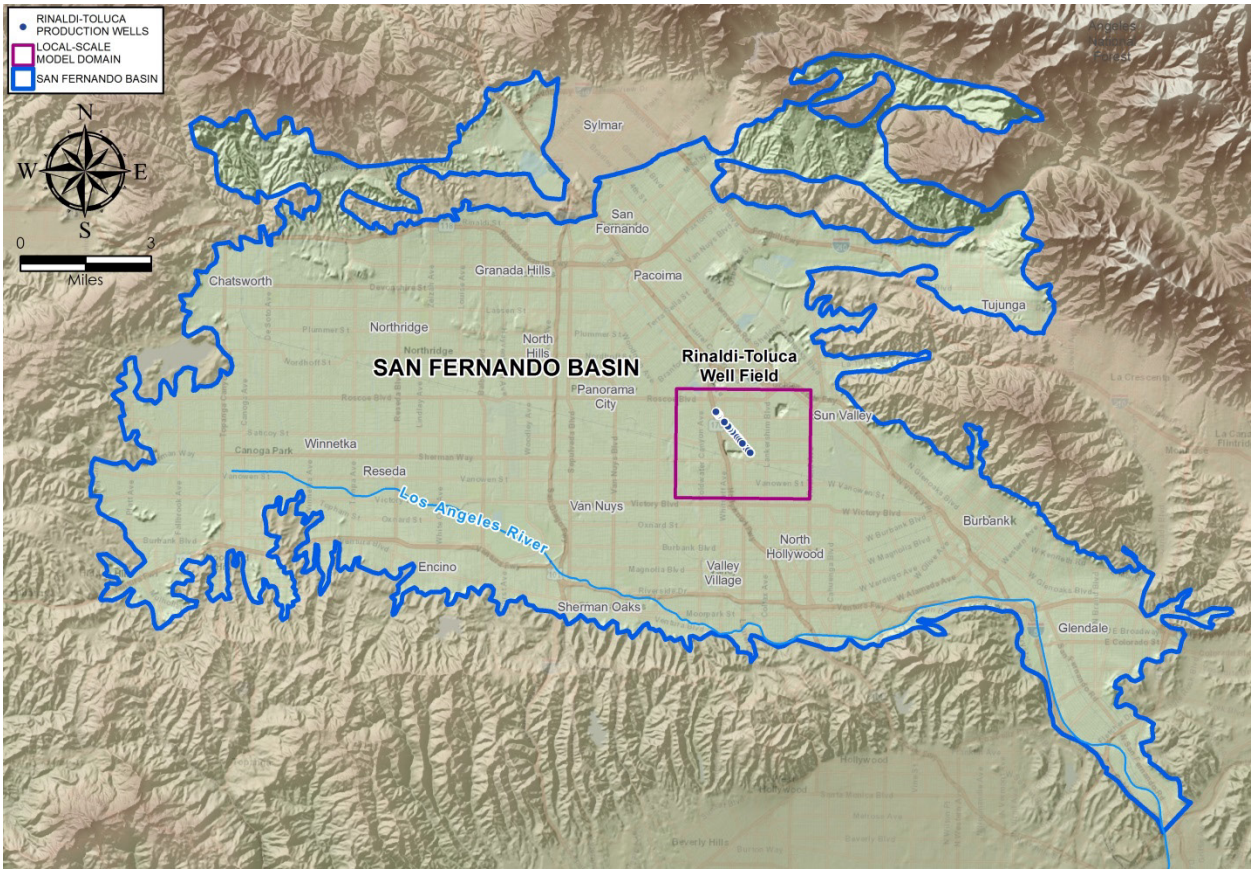

Figure 1 – The San Fernando Basin

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 RT Well Field. The

aforementioned blend point is an entry point to the LADWP distribution system that provides a mixture of well water and treated surface water. Because of the blending operations, LADWP currently provides (and provided in the past) safe clean water that meets all federal and state drinking water regulations.

DDW reviews this Well Blending Operations Plan each year. Under the plan, operational changes such as removing production wells from service are required under certain conditions.

LADWP has implemented a DDW-approved Interim Sampling Plan to collect contaminant concentration and other water quality data from the RT Well Field production wells to support the implementation of the Blending Plan. Substances detected in production wells at concentrations exceeding MCLs (PCE and TCE) and NL (1,4-dioxane) were identified as COCs in the Blending Plan. TCE and 1,4-dioxane have been detected at concentrations that cannot be managed by LADWP through its existing Permit and Blending Plan. Thus, additional measures are needed.

Furthermore, DDW intends for LADWP to reduce its reliance on blending over time, in particular for synthetic or emerging contaminants such as the identified COCs.

Groundwater

The groundwater basin (i.e., SFB) comprises predominantly permeable sands and gravels interbedded with laterally discontinuous lenses of less permeable finer grained silts and clays. The unconsolidated sediments in the eastern SFB, where the RT Well Field is located, are generally coarser grained and extend to at least 1,200 feet (ft) below ground surface (bgs). 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 from north or northwest to south or southeast, draining towards the LA River and the LA 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).

Several shallow and deeper groundwater zones have been used to describe the SFB aquifer system. 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 RT 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 Groundwater System Improvement Study Remedial Investigation Update Report; and the NHC Interim RIFS Report.

Site Characteristics

The RT Study Area is defined as the source area for groundwater entering the RT production wells under active pumping conditions. The source of the groundwater entering the RT Well Field is delineated by a capture zone(s) specific to the RT Well Field.

Within the RT Study Area, a number of contaminant sources have been identified. These sources are located west, east and south of the RT Well Field, which results in

multiple migration pathways between the sources and the receptors (i.e., RT production wells). The Preliminary Identified Source Areas (Figures 2, 3 and 4) were included in groundwater modeling work conducted as part of the study for the response action. These sources are described in the NHC Interim RIFS report.

Other unknown sources of contamination may exist that adversely impact groundwater quality within the RT Study Area; investigation into such potential sources is an ongoing activity.

The contaminant sources identified for the study were 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 and in offsite locations.

The EPA collects groundwater quality data from various stakeholders for sites in the RT Study Area to support its characterization of the SFB. The groundwater quality data collected in the RT 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 RT 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 RT Study Area, as shown in **Figures 2, 3, and 4**. The area of highest COC concentrations is located west and southwest of the RT production wells.

Contaminant migration in groundwater follows the primary direction of groundwater flow within the RT Study Area generally from north or northwest to south or 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 the RT Study Area, superimposed on natural groundwater flow directions.

Contaminant concentrations exceeding applicable MCLs or NLs are generally detected at higher concentrations in the shallower hydrostratigraphic zones and are generally highest closer to the Preliminary Identified Source Areas. Concentrations tend to decrease with depth. However, MCL or NL exceedances are also observed in the deeper hydrostratigraphic units.

The plume core areas have the highest concentrations of COCs and tend to be focused around and downgradient of Preliminary Identified Source Areas. Outside of the plume core areas, the plumes are dispersed throughout the RT Study Area as a result of contamination migrating from sources to production wells. For example, the plumes in the west of the RT Study Area have migrated both east toward the RT Well Field and south towards the NHW production wells; plumes in the northeast of the RT Study Area have migrated south towards the North Hollywood Well Field and southwest towards the RT Well Field.

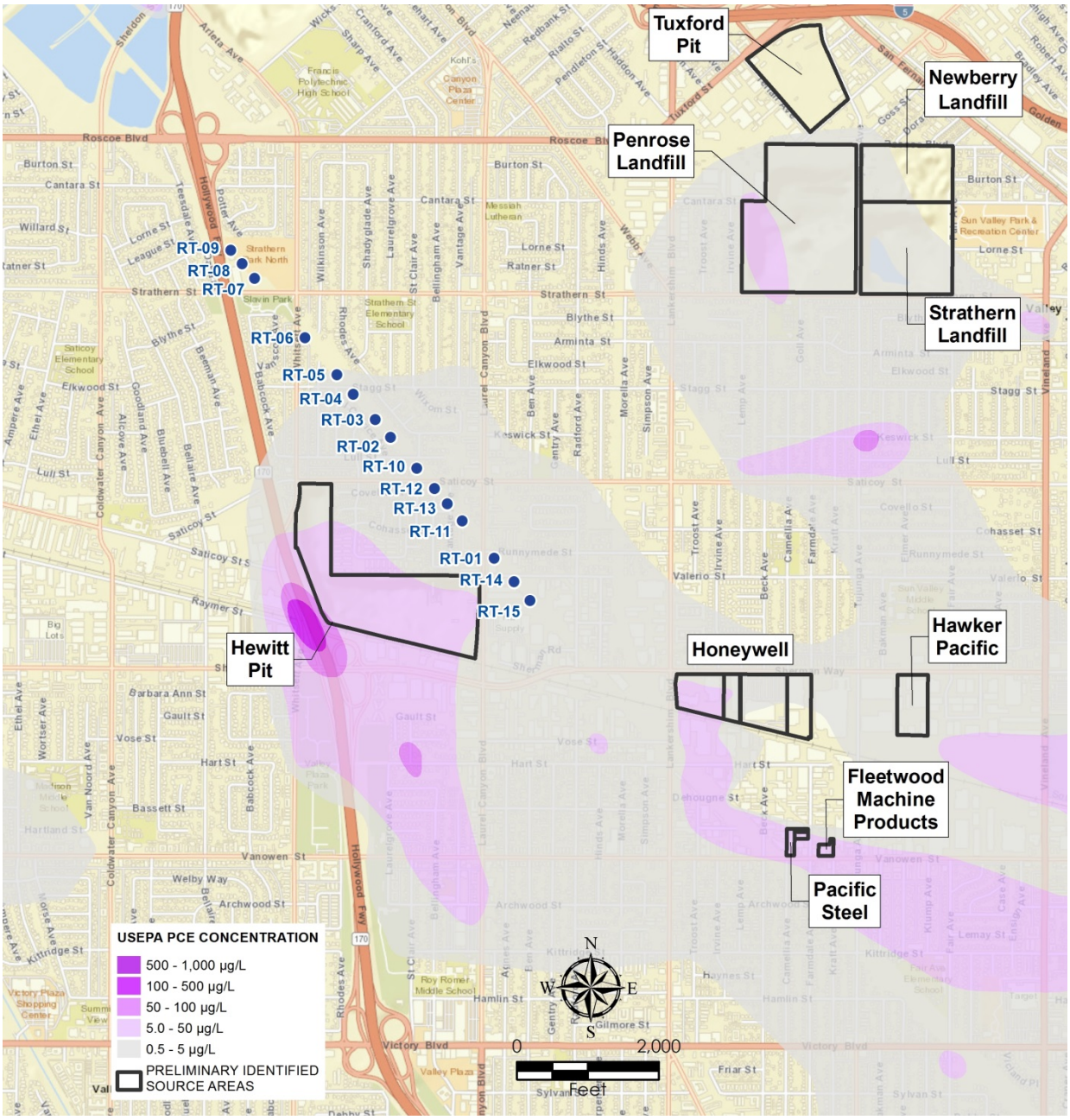

Figure 2 – EPA PCE Plume Map

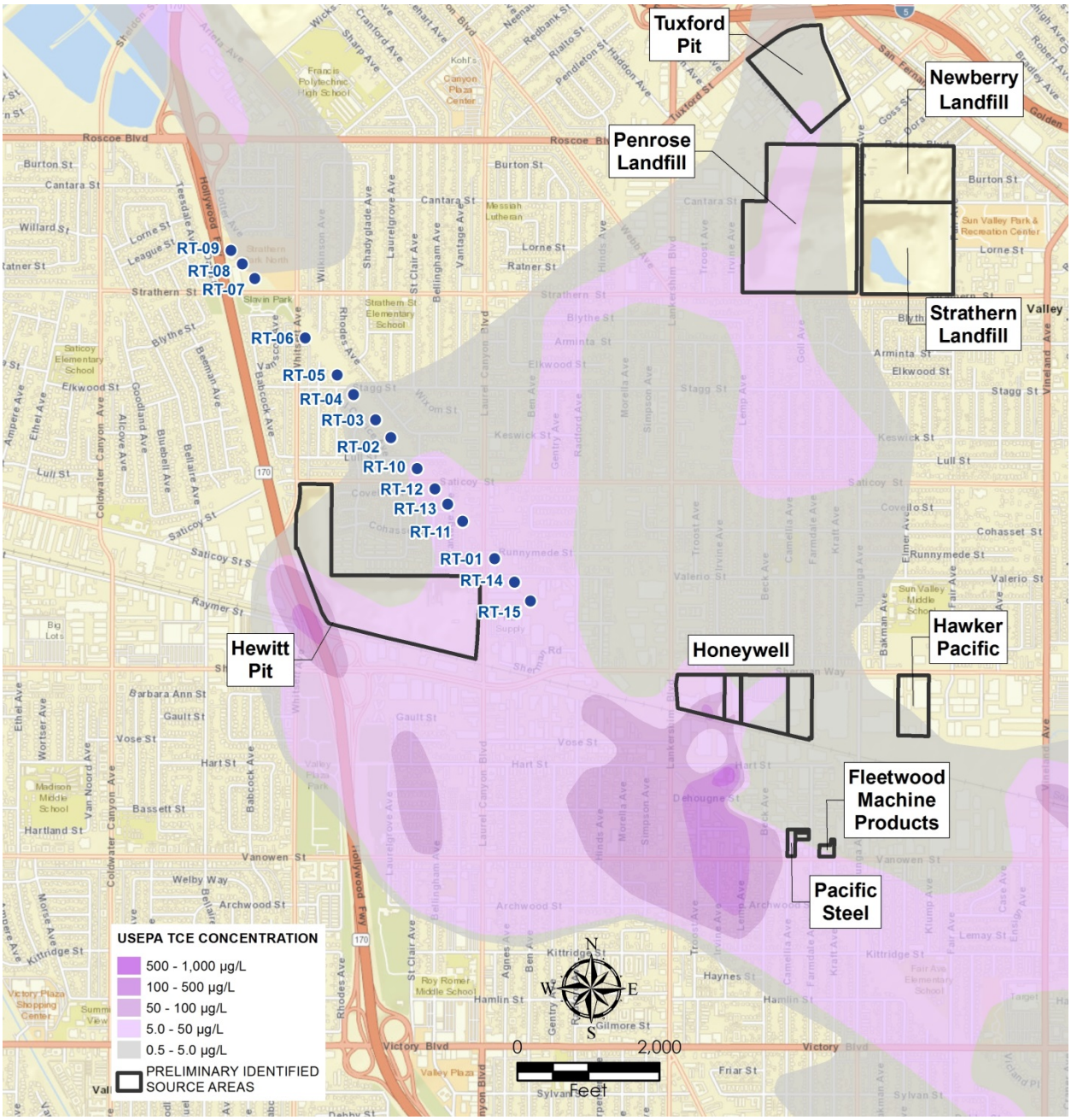

Figure 3 – EPA TCE Plume Map

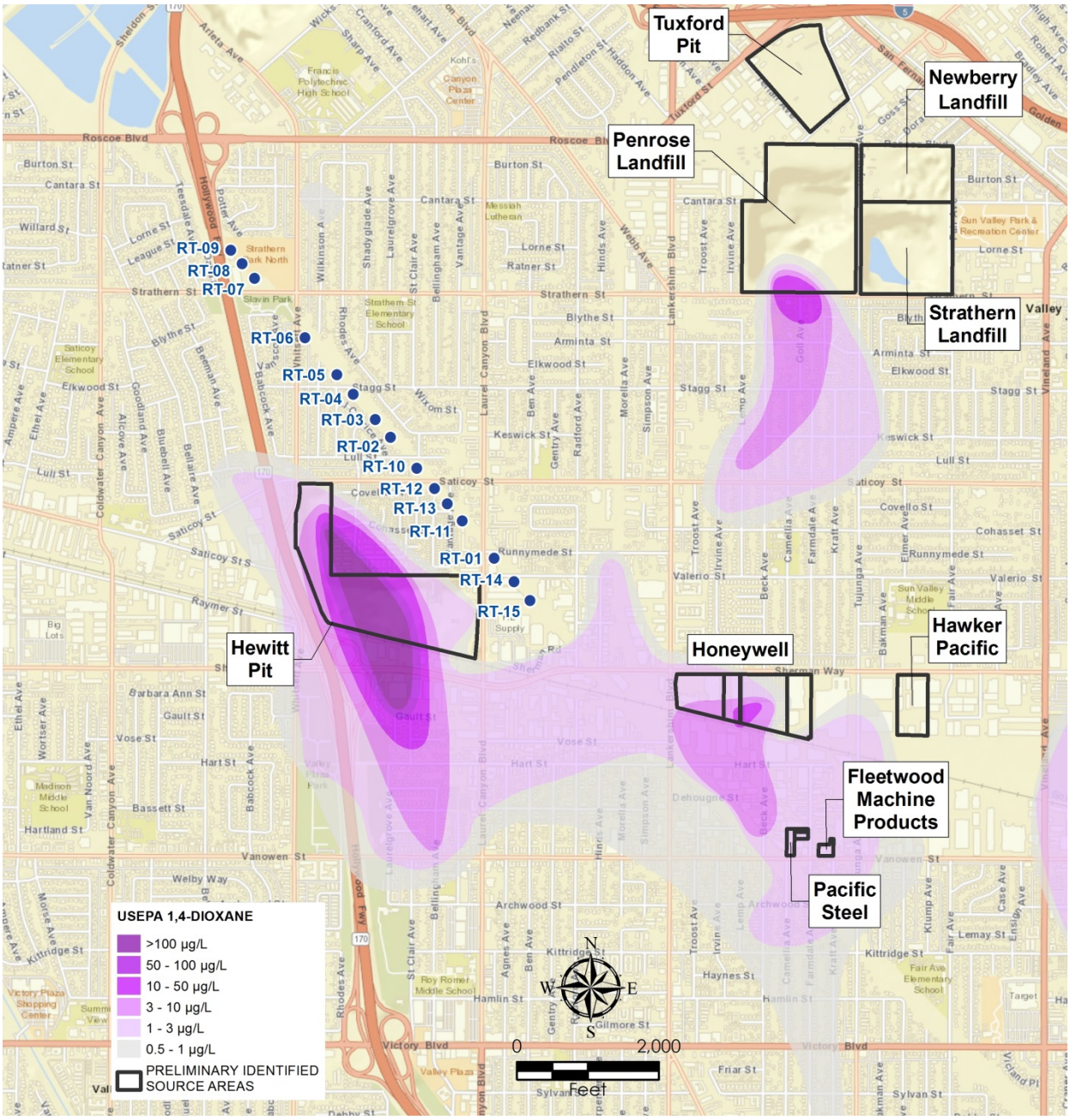

Figure 4 – EPA 1,4-Dioxane Plume Map

Operable Unit and Study Area

The RT Operable Unit (OU) was defined as the groundwater entering the RT production wells under active pumping conditions (i.e., the groundwater source area for the RT Well Field). The source of groundwater entering the RT Well Field production wells can be delineated by developing a pumping plan and using this pumping plan to delineate a potential capture zone(s). A potential capture zone can then be used to identify 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 the hydraulic characteristics of the geologic formation(s).

The RT Study Area represents the lateral extent of the RT OU based on the LADWP pumping plan. In this case, the 10-year capture zone was used for shorter term planning and remedial design while the 30-year capture zone was 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 EPA and CalEPA methodology, was performed to estimate current health risks and reasonably likely future risks from exposure to contaminants in RT OU groundwater. It should be noted that the current and future risks presented here are hypothetical, and that the LADWP currently distributes (and as distributed) water that meets all federal and state drinking water regulations.

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 (RAOs):

- Protect human health and the environment by reducing the potential for exposure to COCs in groundwater at concentrations exceeding MCLs or other 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 RT OU at

concentrations that prevent the beneficial use of the SFB;
- Remove COCs from groundwater in the RT 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 RT 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 RT Well Field and projections for future water withdrawals, LADWP developed a range of IRA alternatives for achieving the RAOs described herein. Five IRA alternatives (Alternatives 1, 2, 3A, 3B, 3C) that incorporate different combinations of actions (described in detail in the NHC 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 three remedial action alternatives involving groundwater pumping, treatment, and direct domestic use of treated water (Alternatives 3A, 3B and 3C).

Each of the alternatives was developed with the intent of being flexible, compatible with other nearby interim remedial actions, and consistent with an overall remedy for the SFB. Further, each of the alternatives was developed to be consistent with LADWP current and reasonably anticipated future water rights. Alternate pumping plans developed for the remedial action alternatives herein are not significantly different than LADWP's pumping plans developed prior to this interim RIFS. Therefore, groundwater levels are not anticipated to change in response to the action alternatives herein.

Sufficient RI work has been completed to develop, evaluate, and select a remedial alternative as part of an interim remedial action. Remaining data gaps do not limit or interfere with the evaluation of alternatives presented below.

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 North Hollywood Forebay 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 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 RT 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 RT OU.

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

Alternative 3A was developed to address the principal threats posed by COCs in the RT 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. Aboveground treatment would include technologies that are effective for treating TCE, PCE and 1,4-dioxane, which are 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 Production Wells

Alternative 3B was developed with the intent of potentially reducing treatment duration relative to Alternative 3A. Alternative 3B differs from Alternative 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 RT 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 RT 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 RT 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. Aboveground 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.

Alternative 3C – Groundwater Pump and Treat for Direct Domestic Use Using Extraction Wells and Production Wells

Alternative 3C was developed with the intent of using a lower annual extraction rate in the southern portion of the RT Well Field, and to evaluate whether such an approach could further reduce the potential for the interim response action to capture contaminated groundwater planned to be captured by other nearby remedies (such as the source control at the Hewitt Pit and remedies within the NHOU), and otherwise compare favorably under the NCP remedy selection criteria. Alternative 3C differs from Alternatives 3A and 3B in that the interim remedial action would include new lower capacity extraction wells which would enable reduced groundwater extraction rates during the anticipated low water demand period (e.g., winter). These new extraction wells would be sited adjacent to existing southern production wells, which have historically been the most contaminated in the RT Well Field. The extraction wells would be designed to focus extraction on groundwater bearing zones containing higher COC concentrations (i.e., model layers 1 and 2, 0-470 ft bgs) and would be operated at a lower production rate to capture the COC plumes primarily in model layers 1 and 2. In addition, three existing production wells would be used for remediation during high demand periods to capture the plume in layers 1-3 (0-770 ft bgs) and help prevent COCs migration to other non-remedy wells within the RT Well Field. Analysis summarized in Appendix A of the Interim RIFS Report indicates that Alternative 3C reduces the capture of contaminated groundwater planned to be captured by other nearby remedies which were simulated in nearby areas (such as the source control at the Hewitt Pit and remedies within the North Hollywood Operable Unit, and Alternative 3C has the potential to reduce pumping in the southern portion of the well field that is closer to these areas.

The contaminated groundwater would be captured by extraction wells and groundwater production wells for aboveground treatment. Aboveground treatment would include innovative treatment technology that offers the potential for comparable or superior performance and implementability, with fewer or lesser adverse impacts than other available technologies; and lower costs for similar levels of performance than other treatment technologies (40 CFR300.430 (e)(5)). After aboveground treatment, the treated water end use would be direct domestic use.

Evaluation of Remedial Alternatives

To determine which alternative to select, LADWP evaluated and compared the remedial alternatives using EPA's nine evaluation criteria (40 CFR 300.430(e)(9)). The nine criteria are summarized in **Figure 5**. EPA categorizes the nine criteria into three groups: (1) threshold criteria, (2) primary 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 NHC Interim RIFS report. LADWP will consider the modifying criteria (*i.e.*, State and Community Acceptance) after review of public comments received for this proposed plan. The alternatives are evaluated and assigned qualitative ratings of poor, fair, fair-to-good, and good for performance in relation to each other. **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. Alternative 1 does not include a response action to protect human health and the environment. The baseline HHRA is an evaluation of the no-action alternative. Based on the results of the baseline HHRA, Alternative 1 would result in unacceptable risks to the adult and child receptors for current and future use scenarios. Further, the RT 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. The Blending Plan minimizes the use of production wells that capture COC-impacted groundwater. Downgradient groundwater resources are expected to be impacted by COCs at levels exceeding Preliminary Cleanup Goals. 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.

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. Remedy wells would include the southern five production wells (RT-01, RT-11, RT-13, RT-14, and RT-15). The southern five production wells would be operated on a full-time basis at a flow rate of approximately 17,145 gpm or 27,656 AFY to limit the migration of COC-impacted groundwater in model layers 1-3 (0-770 ft bgs) within the RT OU. 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.

Figure 5 – EPA Nine Evaluation Criteria

Alternative 3B. 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. Remedy wells would include five interceptor wells operating on a full-time basis at approximately 3,680 gpm or 5,937 AFY to limit the migration of COC-impacted groundwater in model layers 1-2 (0-470 ft bgs), and the southern four production wells (RT-01, RT-11, RT-13, and RT-14) operating on as full-time basis at approximately 13,465 gpm or 21,719 AFY to limit the migration of COC-impacted groundwater in model layer 1-3 (0-770 ft bgs) in the RT OU. The analysis presented in Appendix A of the Interim RIFS 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 3B is assigned an Overall Protection of Human Health and Environment rating of 'good' relative to other alternatives.

Alternative 3C. Alternative 3C 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. Remedy wells would include five extraction wells operating on a full-time basis at approximately 6,732 gpm or 10,860 AFY to limit the migration of COC-impacted groundwater in model layers 1-2 (0-470 bgs), and three production wells operating six months of the year at approximately 10,323 gpm or 8,326 AFY to limit the migration of COC-impacted groundwater in model layers 1-3 (0-770 ft bgs). The analysis presented in Appendix A of the Interim RIFS 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. It is noted that with fewer (deeper) production wells operating as part of the remedy, there may be a greater potential for the COC-impacted groundwater to migrate to other non-remedy production wells and downgradient water resources in model layer 3 compared to Alternative 3A. The potential for non-remedy production wells to capture COC-impacted groundwater would then increase if only the extraction wells are operating at some point in the future. Alternative 3C is assigned an Overall Protection of Human Health and Environment rating of 'good' relative to other alternatives.

Compliance with ARARs

Alternative 1. For Alternative 1, under CERCLA Section 121, the requirement to meet ARARs applies only when a response action is selected and implemented. 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 groundwater produced by the production wells would contain COCs at levels that exceed the potential ARARs and TBCs. Alternative 1 is the no-action alternative, would not comply with ARARs and TBCs, and is not assigned a Compliance with ARARs rating as the criterion is not applicable to the alternative.

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 approximately 28,000 to 34,000 AFY from RT Well Field and production capacity of approximately 60,000 AFY is expected to remain unavailable for a period of more than 30 years and the Preliminary Cleanup Goals will not be achieved. Alternative 2 does not involve a remediation program to capture and remove COCs, so it is more likely that COCs will persist in the groundwater in the RT 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 shows the production wells could be operated to capture and remove COCs from groundwater in the RT 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 RT OU would be restored in accordance with the Basin Plan, which conforms to the State of California Antidegradation Policy (i.e., SWRCB Resolution 68-16) and SWRCB 92-49. The combination of technologies and process options included in Alternative 3A are demonstrated to be effective in treating the COCs to levels below the Preliminary Cleanup Goals. 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 shows the combination of the interceptor wells and the RT production wells could be operated to capture and remove COCs from groundwater in the RT 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 RT OU would be restored in accordance with the Basin Plan, which conforms to the State of California Antidegradation Policy (i.e., SWRCB Resolution 68-16) and SWRCB 92-49. The combination of technologies and process options included in Alternative 3B are demonstrated to be effective in treating the COCs to levels below the Preliminary Cleanup Goals, assuming the interceptor wells are adequately sited between source areas and production wells. 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.

Alternative 3C. Alternative 3C would comply with the ARARs and TBCs. The analysis presented in Appendix A of the Interim RIFS shows the combination of the extraction wells and the production wells could be operated to capture and remove COCs from groundwater in the RT 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 RT OU would be restored in accordance with the Los Angeles Regional Water Quality Control Board Basin Plan, which conforms to the State of California Antidegradation Policy (i.e., SWRCB Resolution 68-16) and SWRCB 92-49. The combination of technologies and process options included in Alternative 3C are demonstrated to be effective in treating the COCs to levels below the Preliminary Cleanup Goals presented in Section 2.3. However, as mentioned above, with fewer (deeper) production wells operating as part of the remedy, there may be a greater potential for the COC-impacted groundwater to migrate to other non-remedy production wells and downgradient water resources in model layer 3 (470-770 ft bgs). Alternative 3C 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. 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. Alternative 1 is assigned a Long-Term Effectiveness and Permanence rating of 'poor' relative to other alternatives.

Alternative 2. For Alternative 2, on the analysis conducted for the action alternatives presented in Appendix A of the Interim RIFS, COCs could continue to migrate uncontrolled from the well field capture zone to the 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. Contrarily, the requirements of the Blending Plan are to minimize the use of contaminated wells (i.e., Reserve Wells). As such, the Conceptual Site Model indicates COCs would continue to migrate downgradient of the RT Well Field. 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 shows Alternative 3A would provide adequate and reliable control of COCs migration in the RT 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.

LADWP has demonstrated that it is capable of managing the long-term operation of the production wells in accordance with a pumping strategy, which it has shown through the implementation of the Blending Plan. Operation of the production wells in accordance with the pumping strategy presented herein is important to the success of Alternative 3A. As shown in Appendix A of the Interim RIFS, the time series concentration profiles of COCs in the remediation production wells generally show initially high concentrations that are related to the distribution of COC concentrations as represented in the initial plume definition. These concentrations decline relatively quickly (i.e., less than ten years). However, over time, concentrations tend to again increase or stabilize, as the contribution of COC concentrations from the preliminary

identified source areas (as represented in the model as a continuous source flux term, i.e., constant concentration and recharge rate over time) eventually reach the production wells. Because the source term concentrations are constant for the full duration of the model simulation, they never decline and therefore the production well concentrations never decline. If source control measures or remediation at the identified source areas are implemented, these actions are likely to result in a reduction (or elimination) of source concentrations over time, and COC concentrations in production wells would decrease, thereby reducing the duration of treatment required. The duration of treatment is anticipated to be more than 30 years, and could be longer given the nearly 40-year history of groundwater contamination in the SFB, the potential for unknown sources of groundwater contaminants, and the current status of remedial action at the preliminary identified source areas. Other groundwater remediation activities in the SFB at North Hollywood, Burbank and Glendale have been operating for more than 20 years.

LADWP has demonstrated that it is capable of managing long-term monitoring requirements, which it has shown through the implementation of the DDW-approved Interim Sampling Plan. LADWP has demonstrated that it is capable of performing the operations and maintenance functions required for Alternative 3A, which it has shown through the implementation of the DDW 97-005 permitting process for the NHW treatment facility; which includes the same technologies used in Alternative 3A. Lastly, LADWP has the resources and expertise to manage change with a high degree of confidence. 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 limit the migration of 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 30 years, as presented in Appendix A of the Interim RIFS) 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 RT 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 RT Well Field, the interceptor wells may not be able to meet their purpose of preventing the migration of COC-impacted groundwater to the RT 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 cost estimate for this alternative presented in Appendix B of the Interim RIFS.

Further, the use of new interceptor wells would result in fewer production wells operating on a full-time basis to limit the migration of COCs in groundwater to other non-remedy production wells and downgradient water resources, particularly in model layer 3 (470-770 ft bgs) where other nearby remedies may be ineffective.

Other Long-Term Effectiveness and Permanence considerations are comparable

to Alternative 3A. The considerations include the potential to provide adequate and reliable control of COC migration in the RT OU, the potential to reduce COC concentrations in groundwater and treated water to levels below Preliminary Cleanup Goals, the potential to significantly reduce the risk to human health and the environment, the relative duration of remediation, and the capability of LADWP to manage long-term operations, maintenance and monitoring requirements and the changes that may occur over a period of more than 30 years.

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, and the use of interceptor wells would result in fewer production wells operating on a full-time basis to limit the migration of COCs in groundwater to other non-remedy production wells and downgradient water resources. Alternative 3B is assigned a Long-Term Effectiveness and Permanence rating of 'fair to good' relative to other alternatives.

Alternative 3C. The combination of pumping extraction wells and production wells to limit the migration of COC-impacted groundwater has the potential to be as or more effective than the use of only production wells. However, similar to Alternative 3B with fewer (deeper) production wells operating as part of the remedy, there may be a greater potential for the COC-impacted groundwater to migrate to other non-remedy production wells and downgradient water resources, particularly in model layer 3 (470-770 ft bgs) where other nearby remedies may be ineffective.

Alternative 3C was developed to present an alternative that uses a lower annual extraction rate in the southern portion of the RT Well Field, and to evaluate whether such an approach could further reduce the potential for the interim response action to capture contaminated groundwater planned to be captured by other nearby remedies (such as the source control at the Hewitt Pit and remedies within the NHOU), and otherwise compare favorably under the NCP remedy selection criteria. The analysis presented in Appendix A indicates that Alternative 3A is compatible with the other planned interim actions which were simulated in nearby areas (such as the source control at the Hewitt Pit and remedies within the NHOU), so that it is not necessary to implement a remedy designed to reduce that risk. Moreover, Appendix A shows that Alternative 3C is not more effective in this regard. In addition, LADWP would monitor Alternative 3A and could make adjustments as necessary.

Other Long-Term Effectiveness and Permanence considerations are comparable to Alternative 3A. The considerations include the potential to provide adequate and reliable control of COC migration in the RT OU, the potential to reduce COC concentration in groundwater and treated water to levels below Preliminary Cleanup Goals, the potential to significantly reduce the risk to human health and the environment, the relative duration of remediation, and the capability of LADWP to manage long-term operations, maintenance and monitoring requirements and the changes that may occur over a period of more than 30 years.

Therefore, Alternative 3C would provide overall long-term effectiveness and permanence; however, the use of extraction wells would result in fewer production wells operating on a full-time basis to limit the migration of COCs in groundwater to other non-remedy production wells and downgradient water resources. Alternative 3C is assigned a Long-Term Effectiveness and Permanence rating of 'fair to good' relative to other alternatives.

Table 2 – How do the Alternatives Compare to EPA's Evaluation Criteria?

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

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 RT 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. 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 RT OU as the alternative is being implemented as part of the Blending Plan. EPA finds 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 does not believe this approach is consistent with the intent of CERCLA (e.g., Section 121 (b)(1). Further, the implementation of the Blending Plan seeks to minimize the capture of COC-impacted groundwater, allowing the COC-impacted groundwater to migrate to downgradient water resources. In addition, the analysis presented in Appendix A of the Interim RIFS 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 RT OU. Alternative 2 does not include treatment and 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 RT OU, and conveys the water to a treatment facility at the North Hollywood Pump Station for effective treatment. The combination of treatment technologies and process options has been demonstrated in similar environmental settings to meet chemical-specific ARARs and TBCs, which are 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 RT OU, which is used for drinking water.

The analysis presented in Appendix A of the Interim RIFS indicates the use of the production wells will effectively and reliably limit the migration of the COCs in the RT OU, and remove the COCs from groundwater. The analysis indicates that the remedy will significantly reduce the volume of groundwater containing COC levels exceeding Preliminary Cleanup Goals. The analysis indicates more than 30 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 RT OU.

The Advanced Oxidation Process (AOP) treatment technology employed in Alternative 3A has been demonstrated to be capable of permanently and irreversibly destroying the primary COCs (i.e., 1,4 dioxane, TCE, and PCE), which is considered superior to using BATs to remove PCE and TCE, followed by AOP to remove 1,4-dioxane. The technology effectively transforms 1,4-dioxane, TCE, and PCE into harmless byproducts. The application of the AOP and Granular Activated Carbon (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 RT OU, and conveys the water to a treatment facility at the North Hollywood Pump Station for effective treatment. However, as explained above in the analysis of Long-Term Effectiveness and Permanence, the analysis shows the strategy of intercepting COC plumes and preventing further migration to the downgradient RT production wells has the potential to be less reliable than intercepting COC plumes at the RT Well Field itself. This is 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 RT Well Field, coupled with the reduction in groundwater extraction from production wells that would be employed to prevent increasing the size of the treatment plant for this alternative.

Further, the use of new interceptor wells would result in fewer production wells operating on a full-time basis to reduce the mobility and volume of COCs in groundwater, particularly in model layer 3 (470-770 ft bgs) where other nearby remedies may be ineffective. Other Reduction of Toxicity, Mobility, or Volume through Treatment considerations for Alternative 3B is comparable to Alternative 3A. The considerations include the capability of the AOP treatment technology to permanently and irreversibly destroy the COCs, and the

capability of the GAC treatment technology to separate the COCs (i.e., PCE, TCE but not 1,4-dioxane) from groundwater. 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 produced by the production wells, and the use of interceptor wells would result in fewer production wells operating on a full-time basis to reduce the mobility and volume of COCs. Alternative 3B is assigned a Reduction of Toxicity, Mobility, or Volume through Treatment rating of 'good' relative to other alternatives.

Alternative 3C. Alternative 3C uses extraction wells and production wells to extract COC-impacted groundwater from the RT OU, and conveys the water to a treatment facility at the North Hollywood Pump Station for effective treatment. However, as explained above in the analysis of Long-Term Effectiveness and Permanence, the use of new extraction wells would result in fewer production wells operating on a full-time basis to reduce the mobility and volume of COCs in groundwater, particularly in model layer 3 (470-770 ft bgs) where other nearby remedies may be ineffective.

Other Reduction of Toxicity, Mobility, or Volume Through Treatment considerations for Alternative 3C are comparable to Alternative 3A. The considerations include the capability of the AOP treatment technology to permanently and irreversibly destroy the COCs, and the capability of the GAC treatment technology to separate the COCs (i.e., PCE, TCE but not 1,4-dioxane) from groundwater. The application of the AOP and GAC treatment technologies addresses the statutory preference for treatment as a principal element.

Therefore, Alternative 3C would provide reduction of toxicity, mobility, or volume through treatment, however, the use of extraction wells would result in fewer production wells operating on a full-time basis to reduce the mobility and volume of COCs Alternative 3C 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 institutional actions described in Section 3 would continue to be implemented; however, the containment and treatment actions described in Section 3 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 remediation facilities at the North Hollywood Pump Station, 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 more than 30 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 North Hollywood Pump Station. Other groundwater remediation activities in the SFB at North Hollywood, Burbank and Glendale have been operating for approximately 20 years or more.

Alternative 3A does not pose unmitigable risks to the community during construction and operations, nor does the alternative pose unmitigable risks to workers beyond the typical risks associated with a construction project or operating water treatment facility. No unmitigable negative environmental impacts are anticipated in the area in which the treatment facility would be built, or in the groundwater aquifer. The alternative was developed to be consistent with LADWP current and anticipated future water rights, and the alternate pumping plan developed for the alternative is not significantly different than LADWP's pumping plans developed prior to this interim RIFS. Therefore, groundwater levels are not anticipated to change in response to the alternative.

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 this alternative would involve the construction of new interceptor wells within largely residential setting up-gradient of the RT production wells and a raw (untreated) water conveyance system from the interceptor wells to the remediation facilities. 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 remediation facilities at the North Hollywood Pump Station, which is an existing municipal water facility.

Other short-term effectiveness considerations for Alternative 3B are comparable to Alternative 3A. The considerations include risks to the community, workers, and environment during the construction and operations of the treatment facilities. 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. The potential to take homes from families and place production wells in residential areas imposes short term impacts that are absent for Alternative 3A and 3C. The delay in implementing Alternative 3B compared to 3A could also be considered a short-term impact. Alternative 3B is therefore assigned a Short-Term Effectiveness rating of 'fair' relative to other alternatives.

Alternative 3C. Alternative 3C includes many of the same technical components as

Alternative 3A. Implementation of Alternative3C would involve the construction of new extraction wells adjacent to the southern five production wells on land owned by LADWP. The activities have the potential to create short-term impacts typical of construction projects, including potential hazards to the community, workers, and the environment.

Other short-term effectiveness considerations for Alternative 3C are comparable to Alternative 3A. The considerations include risks to the community, workers, and environment during the construction and operations of the treatment facilities. Alternative 3C would provide short-term effectiveness; however, the construction of the extraction wells and associated conveyance system would be expected to present greater impacts to the community and the workers than the impacts associated with Alternative 3A. Alternative 3C is therefore assigned a Short-Term Effectiveness rating of 'good' 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. The administrative feasibility of implementing Alternative 2 is 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 RT 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 RT production wells 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. LADWP will conduct laboratory- and bench-scale testing of the AOP and GAC technologies to optimize the treatment processes, similar to testing conducted in support of the design of the NHW Remediation Facility. O&M of the facilities would require monitoring of operational performance for the duration of the interim remedial action (as provided in Appendix A of the Interim RIFS, currently estimated to be more than 30 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 NHW Remediation Facility.

An amendment to the State of California Domestic Water Supply Permit Issued to LADWP from the SWRCB DDW 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 RT OU are proven technologies and treated water would meet or exceed applicable water quality requirements with respect to the 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 implementation of the Blending Plan, in accordance with DDW requirements. Lastly, LADWP is the largest municipal utility in the nation, and has the resources to secure the services and materials required to implement Alternative 3A. Therefore, Alternative 3A would be implementable. Alternative 3A is assigned an implementability rating of 'good' relative to other alternatives.

Alternative 3B. New interceptor wells 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 multiple 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 multiple years to install the wells and associated electrical and water conveyance systems. The potential to take homes from families and place production wells in residential areas imposes implementability considerations that are absent for Alternative 3A.

Other implementability considerations for Alternative 3B are comparable to Alternative 3A. The considerations include the use of existing production wells and associated conveyance system, laboratory-scale testing of the AOP and GAC technologies, remedial design, DDW permitting, CEQA compliance, construction of a groundwater treatment facility, O&M of the facilities, and long-term DDW compliance requirements.

Alternative 3B would be implementable; however, the schedule required to implement the interceptor wells would likely be 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 Preliminary Cleanup Goal exceedances and the predominant contaminant migration pathway(s) between sources and receptors. Alternative 3B is assigned an implementability rating of 'fair' relative to other alternatives.

Alternative 3C. LADWP may need multiple years to install the extraction wells as they would be located on LADWP property, however, LADWP would not need to take property from residents or businesses through eminent domain proceedings, and the potential delays associated with these

activities are eliminated relative to Alternative 3B. LADWP would also not need to conduct time-consuming and costly well siting studies, as in Alternative 3B. Other implementability considerations for Alternative 3C are comparable to Alternative 3A. The considerations include the use of existing production wells and associated conveyance system, laboratory-scale testing of the AOP and GAC technologies, remedial design, DDW permitting, CEQA compliance, construction of a groundwater treatment facility, O&M of the facilities, and long-term DDW compliance requirements.

Alternative 3C would be implementable; however, the schedule required to implement the extraction wells is anticipated to be longer than the overall schedule to implement Alternative 3A, but shorter than the overall schedule to implement Alternative 3B. Therefore, Alternative 3C is assigned an implementability rating of 'fair to good' relative to other alternatives.

Cost

Alternative 1. Alternative 1 would not involve the implementation of a response action under CERCLA; therefore, no CERCLA response costs are associated with this alternative. Alternative 1 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 MWD of approximately 28,000 to 34,000 AFY for a period of decades (e.g., for the purpose of the comparative analysis of alternatives, longer than remedial action Alternatives 3A, 3B, 3C). The volume and duration of replacement water is estimated based on the analysis presented in Appendix A of the Interim RIFS.

The volume and duration of replacement water is based on the analysis presented in Appendix A of the Interim RIFS. To address the DDW position of lessening the reliance on blending over time, the analysis was based on deactivating RT production wells receiving COC concentrations exceeding MCLs/NLs, and also for the 10x MCL/NL thresholds specified in the Blending Plan (referred to as 2A-1 and 2A-2 in Appendix A of the Interim RIFS). The results of the analysis for both the MCL/NL threshold and 10x MCL/NL threshold were comparable, and did not significantly affect the comparative cost analysis.

A period of 30 years was selected to facilitate the comparison of Alternative 2 with Alternatives 3A, 3B, and 3C. The actual period for purchasing replacement water is expected to be significantly longer. Without groundwater containment and treatment action in the RT 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 30-year estimated cost for Alternative 2 is $1,256,000,000 based on the estimated annual volume of replacement water and the MWD annual rate for full-service, treated water. A detailed cost estimate is provided in Appendix B of the Interim RIFS. Due to various uncertainties in estimated costs over time, a sensitivity analysis was carried out to evaluate how changes in key parameters, including estimated duration, affect the outcome of cost analysis; this is also provided in Appendix B of the Interim RIFS. Alternative 2 is assigned a Cost rating of 'poor' relative to other alternatives.

Alternative 3A. The estimated cost of $543,000,000 for Alternative 3A represents the sum of the capital costs and the NPV of recurring costs over a span of 30 years of operations. The analysis presented in

Appendix A of the Interim RIFS shows the duration of the remedy could be longer however longer duration is not anticipated to affect remedy selection. The capital costs were estimated to be $224,200,000 to design and construct the following NHC Remediation Facility components: modifications to the conveyance and well system, pre-filtration system, ultraviolet (UV) AOP system, GAC systems and water storage, a UV building, and a new electrical system. A detailed cost estimate is provided in Appendix B of the Interim RIFS. Appendix B also presents a sensitivity analysis that shows the relative costs if the remedy has a different duration. Alternative 3A is assigned a Cost rating of 'good' relative to other alternatives.

Alternative 3B. The estimated cost of $601,000,000 for Alternative 3B represents the sum of the capital costs and the NPV of recurring costs over a span of 30 years of operations. The analysis presented in Appendix A of the Interim RIFS shows the duration of the remedy could be longer however longer duration is not anticipated to affect remedy selection. The capital costs were estimated to be $281,900,000 to procure land for interceptor well construction and design and construct the following NHC Remediation Facility components: construct conveyance from interceptor wells to the new groundwater treatment system, modifications to the conveyance and well system at RT Well Field, (pre-filtration system, UV AOP system, GAC systems, a UV building, and a new electrical system. A detailed cost estimate is provided in Appendix B of the Interim RIFS. As outlined for Alternative 3A above, Appendix B presents a sensitivity analysis to evaluate how changes in key parameters, including duration estimates, affect the outcome of cost analysis. Since Alternative 3B costs less than Alternative 2 but more than Alternative 3A (due to siting and installing interceptor wells), it is assigned a Cost rating of 'fair' relative to other alternatives.

Alternative 3C. The estimated cost of $548,000,000 for Alternative 3C represents the sum of the capital costs and the NPV of recurring costs over a span of 30 years of operations. The analysis presented in Appendix A of the Interim RIFS shows the duration of the remedy could be longer; however, longer duration is not anticipated to affect remedy selection. The capital costs were estimated to be $256,700,000 to design and construct the extraction wells and associated electrical and conveyance systems, as wells as the following NHC Remediation Facility components: construct conveyance from extraction wells to the new groundwater treatment system, modifications to the conveyance and well system at RT Well Field, Well Control Building, pre-filtration system, UV AOP system, GAC system, a UV building, and a new electrical system. A detailed cost estimate is provided in Appendix B of the Interim RIFS. As outlined above, Appendix B presents a sensitivity analysis to evaluate how changes in key parameters, including duration estimates, affect the outcome of cost analysis. Since Alternative 3C costs less than Alternative 2 and 3B but approximately the same as Alternative 3A, it is assigned a Cost rating of 'good' 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 has a duration of 15, 20, and 30 years. As shown in Appendix B of the Interim RIFS, Alternative 3A, 3B, and 3C 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, 3B, and 3C over Alternative 2. It is noted that even if Alternatives 2, 3A, 3B, and 3C are cost neutral, Alternative 3A, 3B, and 3C are superior with respect to the other criteria.

The relative cost benefit of Alternatives 3A, 3B, and 3C over Alternative 2 is likely greater than shown in the Table 5-B. This cost comparison assumes that Alternatives 2, 3A, 3B, and 3C 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 RT production wells without control for a longer period of time in Alternative 2 compared to Alternatives 3A, 3B, and 3C.

Alternative 3B has a higher capital cost than Alternative 3A, and a comparable Operations and Maintenance (O&M) cost. Given these findings, the comparative cost analysis for Alternatives 3A and 3B will not change with duration. Alternative 3A will have a lower NPV cost than Alternative 3B.

Alternative 3C has a higher capital cost than Alternative 3A, and a lower O&M cost. Given these findings, over periods of time longer than 30 years, the relative cost of Alternative 3C could become comparable to Alternative 3A; however, by that time other periodic cost factors (e.g., extraction well pump replacement) could affect the relative costs. Both 3A and 3C have a cost rating of "good."

Discount Rate Sensitivity Analysis. For projects to be implemented by the federal government, EPA guidance recommends the use of the discount rate issued by the federal Office of Management and Budget (OMB), which is currently 0.6% (net of inflation) for a 30-year project. For similar reasons, the updated OMB discount rate of 0.2% provides an appropriate discount rate for projects to be implemented by public agencies, which have lower costs of capital than private sector entities. As described in the LADWP 2015 Urban Water Management Plan, 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, 3B, and 3C as Alternative 2 is limited to recurring costs where Alternatives 3A, 3B, and 3C include capital costs. A lower real discount rate does not affect the relative costs of Alternatives 3A, 3B, and 3C. See Appendix B of the Interim RIFS for the results of a sensitivity analysis of discount rate on NPV.

Comparative Analysis. Comparing the cost of Alternative 2 to Alternatives 3A, 3B, and 3C indicates implementing containment and treatment actions to return usable groundwater in the RT OU to its beneficial use would have a lower cost than purchasing an alternate water supply from Metropolitan Water District (MWD). The cost of remedial action is on the order of $700/AFY, the cost of alternate water supply purchased from MWD is on the order of $1,200/AFY, and the net difference is on the order of $500/AFY.

One implication of this finding is that the opportunity cost from delaying the implementation of remedial action to return usable groundwater to its beneficial use is equal to the difference in cost between Alternative 2 and Alternatives 3A, 3B, and 3C. For example, if the beneficial use of 30,000 AFY of groundwater could be restored by implementing one of the remedial action alternatives (Alternatives 3A, 3B, 3C), then an opportunity cost of $15,000,000 a year would be incurred for each year the remedial action is delayed and an alternate water supply is purchased from MWD. By extension, a five-year delay would cause $75,000,000 in opportunity cost.

With respect to groundwater extraction, the capital cost of Alternative 3C is higher than Alternative 3A primarily due to the need to install additional groundwater extraction systems (e.g., extraction wells and associated electrical and water conveyance systems). The capital cost of Alternative 3B is higher than Alternative 3A and 3C primarily due to the need to buy land in areas anticipated to be developed for residential or commercial purposes, and the need to install

additional electrical and water conveyance systems.

The capital costs of Alternatives 3B and 3C are anticipated to be higher than Alternative 3A primarily due to the installation of additional groundwater extraction systems (e.g., extraction wells, interceptor wells, water conveyance systems); however, the overall cost could be even higher if the time required to install the additional groundwater extraction systems as part of Alternatives 3B and 3C delays the start of remedial action and results in additional purchase of an alternate water supply from MWD (as discussed above a five-year delay would lead to $75,000,000 in opportunity costs).

With respect to the groundwater treatment facility, the capital costs are anticipated to be comparable for Alternatives 3A, 3B, and 3C primarily due to the need to use production wells to contain the COC-impacted groundwater detected in model layer 3 (470-770 ft bgs) and to protect other production wells. While Alternatives 3B and 3C have the potential to improve the containment and restoration of COC-impacted groundwater in model layers 1-2 (0-470 ft bgs), the interceptor wells and extraction wells would not address the COC-impacted groundwater in model layer 3 (470-770 ft bgs). Further, the analysis presented in Appendix A of the Interim RIFS indicates the remedy production wells are effective and reliable in preventing the migration of COC plumes to other non-remedy production wells.

Table 3 – Cost Summary of Remedial Alternatives

Alt	Capital Cost	Recurring Cost	NPV
Alt 1	$0	$0	$0
Alt 2	$0	Variable	$1,256,000,000
Alt 3A	$224,200,000	$11,637,000	$543,000,000
Alt 3B	$281,900,000	$11,637,000	$601,000,000
Alt 3C	$256,700,000	$10,630,000	$548,000,000

Abbreviations: Alt - alternative; NPV = Net Present Value

Notes: NPV is calculated based on a 0.62% rate (net of inflation) and 30-year project life. For Alternative 2, the NPV includes cost for 2021 through 2050. For Alternative 3A, 3B, 3C, the NPV includes capital and O&M costs for 2021 through 2050. The cost estimate accuracy range is within the -30% to +50% order-of-magnitude guideline range.

Variable: $30,795,122 $30,784,756 in Year 2021 to $58,612,844$58,602,033 in Year 2050.

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 capture COC impacted groundwater within the RT OU, provide aboveground treatment and management of the COC contaminated groundwater, and provide the treated water to the LADWP distribution system for direct domestic use.

Key components of Alternative 3A depicted in **Figures 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.

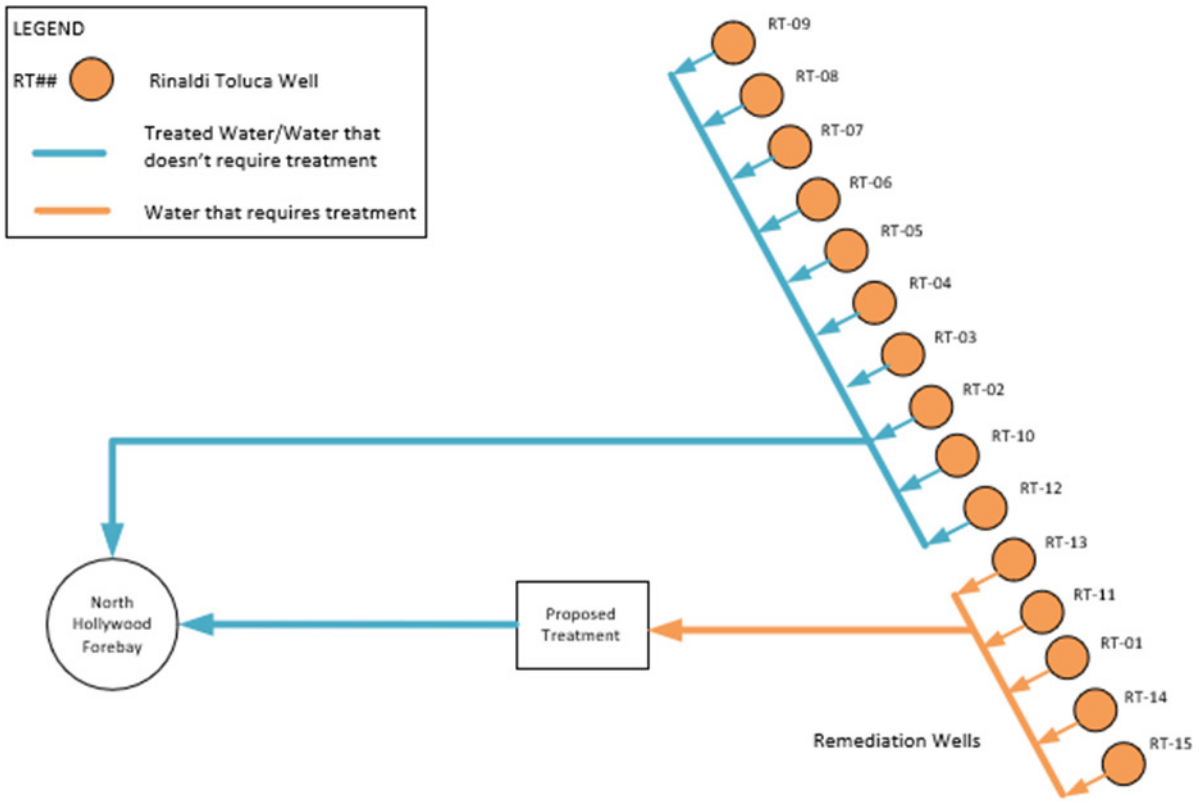

Figure 7 - Alternative 3A Wells, Pipelines, Treatment Facility, Distribution System

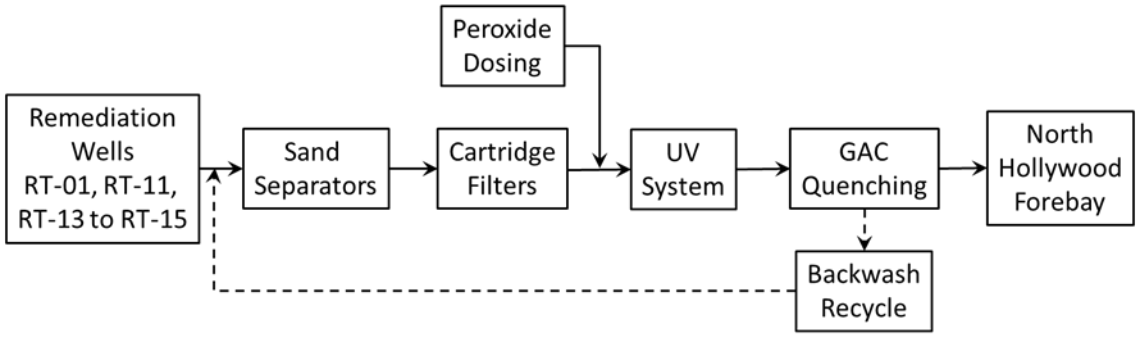

Figure 8 - Alternative 3A Simplified Process Flow Diagram

LADWP Contacts

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Information Repositories

LADWP maintains site information at the following repositories. These repositories contain the Administrative Record, 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 NHW Community Involvement Plan available at the repositories and LADWP website identified above.

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