

Applicant Name: Eastern Municipal Water DistrictFAAST PIN: 42423Project Title: Perris North Basin Groundwater Contamination Prevention and Remediation Program**Project/Applicant Background**

1. Project Overview

The main objective of the Perris North Basin Groundwater Contamination Prevention and Remediation Program (Project) is to clean up a series of co-mingled volatile organic compounds (VOCs) (including PCE), perchlorate, and nitrate groundwater contamination areas (co-mingled VOC-Nitrate Plumes) in the Perris North Subbasin (Basin), also referred to as the Perris North Groundwater Management Zone (GMZ), which is within the San Jacinto Groundwater Basin, and prevent the further spread of contamination to the potable water aquifer down gradient of the current contamination areas. The specific source of what appears to be multiple contamination plumes in the area is unknown at this time and are considered to be co-mingled due to the large areal extent and varying constituents found in localized areas. While source locations are not known at this time some may be identified through a series of monitoring wells, analyses, and reporting that will be included within this Project over the long-term duration of project monitoring and reporting.

The Project objectives will be met by pumping contaminated groundwater from three well “clusters” that will allow for treatment of contaminants specific to each cluster and removal of the contaminants from the Basin. The Project will also reduce the spread of contaminated groundwater by reducing groundwater flows in order to limit the extent of the contaminants as well as avoiding potential co-mingling with the March Air Reserve Base (MARB) plumes and the potential spread to the potable aquifer near existing potable wells. By addressing these generalized objectives, the Project will facilitate groundwater contamination prevention and remediation through increased groundwater extractions and ultimately mitigate water quality concerns in the Basin. The Project will allow Eastern Municipal Water District (EMWD) to meet the primary and secondary objectives identified below:

Primary Objectives:

1. **Prevent the spread of contamination in an aquifer that has served as a source of drinking water:** The Project will remediate the aquifer system by extracting contaminated groundwater near the source of the contamination to prevent the spread of contaminated groundwater;
2. **Accelerate the cleanup of contamination in the aquifer that has served as a source of drinking water:** The Project will actively treat contaminated groundwater to accelerate (over natural attenuation rates) the cleanup of various contaminants using a combination of ion exchange, granular activated carbon (GAC) and blending to reduce contaminants of concern (COCs), including PCE (VOCs), nitrate, perchlorate, total dissolved solids (TDS), fluoride, and manganese (co-mingled VOC-Nitrate Plume) in the Basin to meet drinking water standards; and
3. **Protect an aquifer that serves as a source of drinking water:** The Project will intercept and remediate the co-mingled VOC-Nitrate Plume such that it prevents contaminated groundwater from migrating to the aquifer where potable wells are located.

Secondary Objectives:

1. **Reduce water imports to replace contaminated groundwater:** Increasing the use of local water supplies reduces the need for imported water and provides a more reliable supply for EMWD; and
2. **Better define contaminant plumes:** A series of up to 10 monitoring wells will be installed to better define and monitor contamination that may affect potable groundwater production wells in the region (see **Figure 10** for proposed monitoring well locations).

The State Water Resources Control Board (SWRCB) has invited Eastern Municipal Water District (EMWD) to provide a full proposal to apply for funding under Round 2 of the Groundwater Grant Funding Program. As part of the full proposal, the SWRCB asked that EMWD provide additional items along with the requirements of the final application. A table listing these requested items and where they can be found in this proposal is in **Attachment 2**. Since development of the Concept Proposal for the Project (provided in **Attachment 2**), EMWD performed GeoTracker and Envirostor database research that showed there are several contamination sources in the Basin that could potentially affect the proposed Project wells beyond just nitrate. This research identified VOCs as a COC in addition to the nitrate previously noted in the Concept Proposal. This data was used to create the comingled plume map provided as Figure 5.

a. Site Background/Site Description

Locate the site relative to major features within the surrounding area and describe major site features.

The Project site is located in the Perris North Subbasin (Basin), which is a subbasin of the San Jacinto Groundwater Basin and within the service area of EMWD. **Figure 1** and **Figure 2** present the Project area and nearby features. The Basin is bounded by the Box Mountains on the north, the San Timoteo Badlands on the northeast, the Bernasconi Hills on the east and south, and unnamed hills on the west. The Basin is a source of potable water for EMWD and the City of Perris. Active potable water wells within the Project boundaries, shown in **Figure 6**, include EMWD's Well 55, Well 56, Well 57 and Well 59, and McCanna Ranch Wells 01, 02, 03 and 04.

Three general areas or "clusters" have been identified for Project facilities:

1. **Moreno Valley Area:** Planned wells, treatment facilities and a pumping station would be located on a 1.84-acre parcel owned by EMWD. This is an empty parcel located on Ironwood Avenue east of Heacock Street in the City of Moreno Valley. Residential and commercial developments are located adjacent to the parcel.
2. **North and East Areas:** Planned wells, treatment facilities, a blending facility, and a pumping station would be located within two areas, the first immediately to the north of MARB and the second immediately to the east of MARB, both located outside the published extent of MARB plumes. In the north area, empty parcels will be identified in the vicinity of Alessandro Boulevard and Frederick Street in the City of Moreno Valley. In the east area, wells will be located at sites acquired by EMWD between Cactus Avenue and Iris Avenue in the City of Moreno Valley, potentially at the City of Moreno Valley Corporate Yard and/or nearby to the Vista del Lago High School. EMWD is working with the City of Moreno Valley to acquire a site for the Project.
3. **South Area:** Planned well and treatment facilities will be located on an empty parcel owned by EMWD in the vicinity of North Perris Boulevard and East Nance Street in the City of Perris.

Describe the various types of historical operations that have occurred at or near the site.

A number of historical operations at or near the contaminant plume may have contributed to the underlying contaminant plume, including agricultural use, junk/scrap/salvage yards, gas stations with underground storage tanks, residential developments with septic systems, and defunct businesses. Potential contamination sources have been identified by EMWD through implementation of the Drinking Water Source Assessment Program (DWSAP) that is required for source water assessment and protection administered by the State Water Resource Control Board (SWRCB) Division of Drinking Water (DDW). The assessment delineates an area around a drinking water source, such as a production well, and identifies existing or potential contaminants which may migrate to the drinking water source. The inventory of possible contaminating activities (PCAs) is determined and the drinking water source vulnerability is assessed. A vulnerability analysis is conducted based on the following factors: the presence of a PCA; the proximity of the PCA to the drinking water source; the risk associated with the PCA, such as the chemical identified and likelihood of the chemical being released; and the surrounding conditions and construction of the drinking water source.

Historic land use, specifically agriculture and associated machine maintenance (i.e., tractors) are considered primary potential sources of Pesticides (i.e., DBCP), VOCs (PCE and its daughter products), and fertilizers (nitrate and perchlorate). These activities occurred throughout the groundwater basin but appear to have been generally located in the areas defined for production wells.

Table 1 provides DWSAP vulnerability summary of the production wells within the Perris North Basin (map provided in **Attachment 2**). In this table, the column labelled Vulnerability – Detected Contaminants refers to “the source is considered most vulnerable to the following activities associated with contaminants detected in the water supply” as defined by DWSAP. The column Vulnerability – Others refers to “the source is considered most vulnerable to the following activities not associated with any detected contaminants.” The DWSAPs for the production wells can be found in **Attachment 2**.

In addition to the findings of the DWSAP, EMWD has performed an Envirostor search to determine whether any Responsible Parties contributed to the plume to be treated by the Project. Seven active cleanup sites were identified within the Perris North Basin boundaries; however, these site plumes are not the focus for this effort. The localized plumes are already being addressed by responsible parties and do not appear to be the source of the contaminant plume to be addressed by remediation components of the Project. There does not appear to be adequate information to assign responsibility of these disseminated plumes at this time so EMWD is moving forward with treatment of a plume that would not be otherwise addressed. The only active site that identified groundwater as a potential affected media is the MARB site.

TABLE 1. DWSAP VULNERABILITY SUMMARY

Well Source	Vulnerability – Detected Contaminants	Vulnerability – Others
Well 44 Heacock	Nitrate ¹	Automobile – Gas Station
Well 49 Fir Ave.	Known Contaminant Plumes (PCE, perchlorate & Nitrate)	Sewer Collection System
Well 55 Perris No. 2		Sewer Collection System
Well 56 New Perry		Agricultural Drainage
Well 57 (New) Follico		Underground Storage Tanks – Confirmed Leaking Tanks (Diesel & Fuels)
Well 59 Indian Ave.	Airports – Maintenance/ Fueling Areas at MARB ²	Agricultural Drainage, Junk/Scrap/Salvage Yards, Septic Systems – Low Density, Sewer Collection Systems

1. Nitrate identified by DDW

2. Well 59 Indian Ave. is currently inactive while treatment facilities are being designed/constructed. It should be noted the Well 59 Indian Ave. well was taken offline due to Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) exceeding EPA’s Health Advisory issuant. MARB is currently working with EMWD to mitigate the impacts of PFOS/PFOA to Well 59 Indian Ave

MARB is a Federal Superfund Site with potential contaminants of concern that include lead, petroleum, polychlorinated biphenyls (PCBs), polynuclear hydrocarbons (PAHs), and VOCs. This facility is an active U.S. Air Reserve Base part of the Air Mobility Command (AMC). Past activities that have resulted in contamination at the base include burning waste in firefighting training exercises and discharges to sanitary sewers and storm drains. Groundwater has been contaminated with petroleum hydrocarbons, chlorinated solvents, and non-chlorinated solvents. Soil has been impacted by solvents and PAHs. Note that the proximity of the Project to the MARB cleanup effort is discussed under “Describe other work to address the groundwater contamination” below. EMWD is actively working with MARB to ensure its groundwater system does not affect remedial efforts on the Base. A map and table detailing the locations identified through the Envirostor search is provided in **Attachment 2**.

Describe other work to address the groundwater contamination

In the case of the plume to be treated by components of the Project, no work to address the groundwater contamination has been completed as the contaminants are not attributed to a specific point source.

In the case of the contaminant plume underlying and near MARB, cleanup efforts are underway. A Federal Facilities Agreement (FFA) was signed between the Environmental Protection Agency (EPA), Department of Health Services (DHS), the Santa Ana Regional Water Quality Control Board (RWQCB), and the Air Force in September 1990, to provide for the remediation of the Base. The 2,500 acre site has been divided into five groups, or operable units (OUs), which are similar to the State's removal actions, for remediation. These groups are: OU1) groundwater and soil for areas along the east boundary and off base plume, OU2) groundwater and soil for areas not included in OU1 and OU3, and OU3) groundwater and soil in Site 33 (fuel tank field in the apron area); OU4) new areas of soil contamination discovered in the 1990's; OU5) combination of all groundwater plumes (other than Site 33), including off-base plumes.

Current cleanup efforts at MARB have been focused on the review of the Record of Decision (ROD) of OU 5 and the closure of soil contamination at Sites 31 (an aircraft weapons cleaning shop) and 34 (former fuel tank area with an oil/water separator) through a ROD Amendment. Contaminants in groundwater (OU5) are chlorinated solvents. Soils at Sites 31 and 34 are contaminated with PAHs. These tasks should be completed before 6/30/2019. A screenshot of actions completed to date is provided in **Attachment 2**. Sub-Area OU5 – Site 49 at MARB includes all groundwater contamination plumes and therefore relates to the proposed Project. This site is 10-acres in size and site characterization has been completed. MARB has existing groundwater extraction and treatment systems in place, but these do not provide complete hydraulic containment. A proposed plan was completed in January 2018 for clean-up operations, and is provided in **Attachment 2**. The plan proposes to implement an aggressive approach that includes active restoration, boundary plume control, plume monitoring and institutional controls. An enhanced groundwater extraction and treatment system is expected to provide boundary plume control. EMWD is actively working with MARB to ensure its groundwater system does not affect remedial efforts on the Base.

Describe the current site conditions and land use.

The current site conditions and land use overlying the North Perris Basin is primarily low to high density residential with some a mixture of light industrial (truck warehouses) and a small amount of manufacturing. EMWD is not currently treating contaminated groundwater in the Project area for the COC's identified in this application but has been developing plans to treat and/or mitigate the contaminated groundwater and prevent the flow of contaminated groundwater toward areas where the groundwater is not contaminated, though treatment facilities at Well 59 (as part of another project and not part of the proposed Project) are in the design phase. As described above, the contamination to be addressed by the Project is attributed to non-point sources from various land uses, including commercial, industrial and agricultural activities. Additionally, Well 57 is sometimes blended due to intermittent high TDS concentrations.

The Air Force/EPA have ongoing efforts to address point source plumes originating from MARB but their efforts are separate and distinct from the contamination cleanup and prevention Project proposed by EMWD. As discussed above, the cleanup efforts at MARB, which is a Superfund Site, have been ongoing for years. The point source groundwater contamination from MARB resulted from facility operations, including aircraft maintenance and repair, refueling operations, and training activities. EPA's efforts to clean up the plume are complicated by the flow of groundwater below MARB. In addition, groundwater levels beneath MARB are rising near the surface, further complicating the EPA cleanup effort. Up to eight wells southeast of MARB are in danger of being shut down should the contaminant plume from MARB continue migrating to the south, as shown in **Figure 6**.

The proposed Project will improve the EPA's ability to contain the point source contaminants by reducing the flow of groundwater under MARB, which will prevent further contamination of the groundwater near the potable wells located south of MARB, particularly EMWD Wells 55, 56, 57, and 59, and McCanna Ranch Wells 01, 02, 03, and 04 (**Figure 6**). Groundwater modeling, using the EMWD regional groundwater model described in *Eastern Municipal Water District March Air Reserve Base Groundwater Recovery Program Feasibility Study* (see **Attachment 2**), results support this statement, as seen in **Figure 15** and **Figure 16** that show modeled flow direction under baseline conditions and Proposed Project conditions (respectively). EMWD has been in contact with MARB to coordinate efforts to ensure that any influence of the Project on the EPA cleanup effort will be included in the next Record of Decision (ROD) update.

Feasibility Study

The following feasibility studies have been completed for the Project, and are provided in **Attachment 2**:

- *Potable Water Well Treatment Evaluation Final Report* (Kennedy/Jenks Consultants, 2013): This report profiled water quality, developed treatment alternatives, ranked alternatives, developed planning level costs, and calculated life cycle costs for groundwater treatment in the Moreno Valley Area.
- *Well 64 and 65 Equipping and Treatment Project – FINAL Feasibility Study Refinement Technical Memorandum* (Kennedy/Jenks Consultants, 2015): This technical memorandum updated treatment alternatives from the *Potable Water Well Treatment Evaluation Final Report*, evaluated the alternatives, updated planning level costs, evaluated options for disposal of process wastes, and updated life cycle costs.
- *Eastern Municipal Water District March Air Reserve Base Groundwater Recovery Program Feasibility Study* (Project Feasibility Study) (Kennedy/Jenks Consultants, 2019): This Project Feasibility Study evaluated costs for compliance with water quality standards for wells in Moreno Valley, north of MARB, east of MARB and south of MARB, and includes development and evaluation of treatment alternatives, development of planning level capital and O&M costs, development of life cycle costs, and results of groundwater flow modeling.

The following provides a discussion of how these studies assessed groundwater impacts, evaluated different project alternatives, and how the cost benefit analysis was calculated.

Groundwater impact assessment: Groundwater impacts were assessed in each of the above studies by evaluating water quality from nearby reference wells and through the use of EMWD’s groundwater model. Water quality characteristics were estimated for the proposed wells using water quality of the nearby reference wells. Contaminants of concern and treatment goals were developed for each of the areas based on primary maximum contaminant level (MCLs), Secondary Maximum Contaminant Limits (SMCL), Public Health Goals (PHG), and US EPA Provisional Health Advisories (PHA). Detailed discussion can be found in Section 2 – Groundwater Quality and Treatment Goals of the Project Feasibility Study. The following were identified as the COCs for the Project wells (and are depicted in **Figure 5**):

- Moreno Valley Area: Wells are expected to exceed the MCLs for tetrachloroethylene (PCE), nitrate, and perchlorate due to the presence of a co-mingled VOC-nitrate-perchlorate plume.
- North and East Areas: In the north and east areas, wells are expected to exceed the MCL for PCE and nitrate (note, while nitrate is found in numerous areas throughout this part of the Basin but a “Plume” was not drawn in this area because of the variability of the dataset) due to the presence of a co-mingled VOC-nitrate plume.
- South Area: Well is expected to exceed the MCLs for VOCs due to the presence of a VOC plume.

Project options and alternatives development and evaluation: Project options and alternatives were developed based on SWRCB DDW best available technologies for treatment of the COCs identified for each area. For this Project, “options” are used to describe treatment options for each of the three areas, while “alternatives” are the combinations of these options. The *Well 64 and 65 Equipping and Treatment Project – FINAL Feasibility Study Refinement Technical Memorandum* evaluated the treatment options and brine disposal alternatives using non-cost and cost factors for the Moreno Valley Area. Non-cost factors included: experience/installations, ease of operations & maintenance (O&M), expandability, water quality permitting/regulatory, footprint/constructability, and waste disposal. Cost factors included total annual cost in dollars per acre-foot of product water produced. Each of the treatment systems was scored and ranked according to these criteria. For the North and East Areas, options for blending and treatment were evaluated based on total annual cost in dollars per acre foot of water produced in the Project Feasibility Study.

Cost-benefit analysis: The alternatives evaluation incorporated a benefits analysis component by evaluating costs using life cycle unit costs, and by incorporating the non-cost factors discussed above. Options and alternatives to meet treatment goals were evaluated for each of the three areas in the listed feasibility studies, and are discussed here.

Moreno Valley Area Options

The following options are described in detail in the *Well 64 and 65 Equipping and Treatment Project – FINAL Feasibility Study Refinement Technical Memorandum*.

- Alternative 1: Reverse osmosis (RO) with new brine line to Inland Empire Brine Line (IEBL) for brine disposal + Granular Activated Carbon (GAC) for PCE
- Alternative 2: RO with hauling of brine to IEBL + GAC for PCE
- Alternative 3: Single Pass Ion Exchange (IX) for perchlorate + Stagger Fix Bed Regenerable IX for Nitrate + New Brine Line to IEBL+GAC for PCE
- Alternative 4: Single Pass IX for perchlorate + Stagger Fix Bed IX for Nitrate + Hauling of Brine to IEBL+ GAC for PCE (**preferred alternative**)
- Alternative 5: Regenerative IX for nitrate and perchlorate + New Brine Line to IEBL+ GAC for PCE
- Alternative 6: Regenerative IX for nitrate and perchlorate + Hauling of Brine to IEBL+GAC for PCE
- Alternative 7: Biological FBR for nitrate and perchlorate + GAC for PCE

Each of the above listed alternatives would address the nitrate, perchlorate and, PCE MCL exceedances. Blending was not considered as an alternative due to insufficient blend water availability. The analysis indicated that Alternative #4 (the single pass ion exchange for nitrate followed by regenerable ion exchange for nitrate and GAC for PCE) is the preferred option under the conditions assumed, and was carried forward into the analysis included in the Project Feasibility Study.

North and East Area Option:

As described in the Project Feasibility Study, the North Area wells are expected to exceed the MCLs for PCE and nitrate. In addition, blending is the EMWD’s preferred option to reduce nitrate concentrations, where blend water is available. GAC would be implemented to reduce PCE and ion exchange could be implemented to reduce nitrate concentrations, but neither treatment process would decrease the TDS. Ion exchange also produces a brine waste, which requires additional disposal infrastructure and associated costs. Therefore, given the proximity to a large MWD supply for blending, as well as the proximity to the MARB East Wells, which are anticipated to have lower nitrate, the compliance options evaluated were as follows:

- North Area Option 1: Treatment for VOCs and blending with MWD water to address nitrate
- North Area Option 2: Treatment for VOCs and blending with East Area wells to address nitrate

The East Wells exceed the PHG for fluoride as well as SMCLs for manganese, chloride and TDS. Activated alumina is a “best available technology” (BAT) for fluoride removal, but would not decrease the TDS, chloride, or manganese concentrations. Blending with MWD water is not feasible because the MWD blending water supply is fluorinated, and the fluoride concentrations are too high to reduce the concentration of fluoride in the groundwater below the PHG. The North Wells, however, have low fluoride, and could be blended with the groundwater from the East Wells. Therefore, the compliance options evaluated for this preliminary evaluation were:

- East Area Option 1: Reverse osmosis for fluoride, manganese, chloride and TDS removal
- East Area Option 2: Blending with North Area wells

One additional option was examined that would include blending the North Area wells with both MWD water and East Area well water, referred to as “enhanced blending”. The Project Feasibility Study was revised in 2019 to include VOC treatment due to the presence of PCE in exceedance of the MCL.

South Area Options:

Well 204 is expected to exceed the MCL for PCE. GAC is a common, effective method of treating PCE. Therefore, the compliance option evaluated for this preliminary evaluation was:

- South Area Option: GAC treatment

Project Alternatives:

Two sets of alternatives were developed that combine the above options to allow for a cost-benefit analysis of all proposed facilities:

- Alternative 1: **(preferred alternative)**
 - Moreno Valley Area: Single pass ion exchange for perchlorate, regenerable ion exchange for nitrate, GAC for PCE
 - North and East Areas: GAC for PCE and enhanced blending together (well water with MWD water) to lower concentrations of nitrate, manganese, fluoride and TDS.
 - South Area: Treat with GAC for PCE
- Alternative 2:
 - Moreno Valley Area: Single pass ion exchange for perchlorate, regenerable ion exchange for nitrate, GAC for PCE
 - North and East Areas: Blend North Area wells with MWD water for nitrate; treat water from East Area wells with reverse osmosis for manganese, fluoride and TDS; GAC for PCE
 - South Area: Treat with GAC for PCE

Based on unit cost, Alternative 1 was selected and is reflected in the scope of work for the proposed Project. Detailed information is provided in the Project Feasibility Study.

b. Regional Map/Project Location Map

The following maps are included at the end of this attachment:

- Figure 1: Regional map showing the groundwater basin location
- Figure 2: Project areas and well locations
- Figure 3: Proposed siting for wells and locations of exploratory wells in the Moreno Valley area
- Figure 4: Conceptual well siting and pipeline alignments of the North and East Areas.
- Figure 5: Approximate location of co-mingled plumes in the vicinity of the Project wells.
- Figure 6: Wells in danger of being shut down and wells shut down due to contamination
- Figure 7: Groundwater sampling results from the MARB Remediation Program
- Figure 8: MARB Superfund Site contaminant plumes
- Figure 9: Other projects in the groundwater Basin (described below)
- Figure 10: Proposed areas for planned monitoring wells

Figure 5 shows that most of the groundwater contamination plumes in the Basin consist of co-mingled plumes (defined by the SWRCB as the condition that exists when groundwater contaminated with petroleum from two or more discrete unauthorized releases have mixed or encroached upon one another to the extent that the corrective action performed on one plume will necessarily affect the other). The corrective actions and treatments performed at the Project wells will affect all of the contaminants in the vicinity of the Project wells.

Figure 9 shows that there are three major projects in the Basin consisting of two on-going implementation projects and one planning project. The first on-going implementation project is the MARB Remediation Program which is located in the Perris North GMZ. Significant remediation and corrective actions have been performed at the MARB in the past and some will continue into the near future. The second is the Perris II Reverse Osmosis Treatment Facility (Perris II ROTF), which is also located in the West San Jacinto Basin, but in the Perris South Basin which is separate from the Perris North Basin where the Project is located. The Perris II ROTF project pumps and treats significant volumes of high TDS groundwater from the Perris South Basin. The planning project shown in **Figure 9** is the California Department of Water Resources (DWR) Lake Perris Seepage Recovery Project. This project consists of installing several proposed groundwater extraction wells downstream of the Lake Perris Dam to recover several thousand acre-feet of seepage flowing underneath the dam into the Basin.

c. Groundwater Basin and Beneficial Uses

The Basin is a subbasin of the San Jacinto Groundwater Basin in western Riverside County. Contamination from historical land uses in the vicinity have limited the beneficial use and production of groundwater in the area. The current beneficial uses of the Perris North Basin identified in the Santa Ana Region Basin Plan include all of the following: municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply.

The groundwater aquifer in the Project area has been a source of potable water for nearly 100 years. However, over the last several decades, contaminants in the groundwater have resulted in numerous potable wells being shut down and unavailable for potable use. The Project area was primarily used for agricultural production, but over the last several decades it has transitioned to primarily urban uses.

Groundwater in the Basin is primarily used as a drinking water source by EMWD. The proposed Project will clean up the existing nonpoint source contaminants and protect the beneficial uses in the Project area by:

- Cleaning up the aquifer due to nonpoint source contamination in the groundwater. Remediation and treatment of contaminated groundwater will remove the contaminants from the aquifer. This will lead to future use of the Basin without the need for treatment of the water;
- Preventing the spread of contamination in the Basin to the aquifer that serves as a source of drinking water is critical to the success of the Project. Pumping groundwater near source of the contamination will reduce the spread of the contaminant. In addition, reducing the flow of groundwater near the contaminated groundwater underlying MARB will help reduce the spread of the contaminants from MARB to EMWD's potable wells Well 55, Well 56, and Well 59; and
- Once groundwater is treated to drinking water standards, the water will provide a source of drinking water that is not available today. Over the life of the Project, the nonpoint source contamination will be removed from the aquifer, and groundwater supply wells will no longer require treatment.

The Project focuses on preventing the spread of contamination and promoting aquifer clean-up of groundwater that was contaminated from nonpoint sources within the Basin. New wells pumping contaminated groundwater will be located in the following areas of the Basin: Western Moreno Valley, Northern Area (south of the Moreno Valley wells and north of MARB), East area (area east of MARB), and Southern area (as shown in **Figure 2**). The Project will address all of these issues through a combination of pumping, treatment and blending.

d. Source Area(s)

The groundwater contamination in the Basin is nonpoint source pollution associated with previous agricultural operations, equipment maintenance, and urban activities in the region. Potential chemicals of concern (COCs) in the Basin aquifer include volatile organic compounds (VOCs), perchlorate, nitrate, fluoride, manganese, and, tetrachloroethylene (PCE) (see Figure 5 for a plume map). Most of the groundwater contamination plumes in the Basin consist of co-mingled plumes. The corrective actions and treatments performed at the Project wells will affect all of the contaminants in the vicinity of the Project wells. EMWD performed GeoTracker database research that showed there are several contamination sources in the Basin. The data points, in map and table format, used to generate the plume map are provided in **Attachment 2**

MARB also has a number of point source contamination clean-up efforts underway. These efforts are not included in the scope of work for this proposal, and the Project will be managed to avoid impacting the clean-up efforts at MARB. The original source of potable water for MARB was groundwater wells located on site. Over time, the wells were shut down and the water supply was converted to municipal water due to contamination of the groundwater.

EMWD and adjacent water suppliers have had 10 potable water wells shut down over the last two decades due to groundwater contamination, while additional wells are in danger of being shut down should the contaminant plume from the MARB site travel south, as shown in **Figure 6**. When local groundwater cannot be used due to contamination, EMWD must replace this water supply with imported water from the Metropolitan Water District of Southern California (MWD).

e. Summary of Data available for chemicals of concern (COCs)

Water quality and COCs in the Basin were discussed above under Section 1a, Site Description. Since development of the Concept Proposal for the Project (provided in **Attachment 2**), EMWD performed GeoTracker and Envirostor database research that showed there are several contamination sources in the Basin that could potentially affect the proposed Project wells beyond just nitrate. This research identified VOCs as a COC in addition to the nitrate previously noted in the Concept Proposal. This data was used to create Figure 5, which shows the estimated location of comingled plumes in the vicinity of the Project. The estimated extents of the

contaminant plumes were developed based on review and analysis of published MARB plume maps to provide context and potential flow directions, numerous land use data and environmental work in the area along with discussions with EMWD staff, a long-term understanding of the Basin by EMWD staff and their consultants. The estimated extent of the affected (plume) areas is based available groundwater and well data, historic localized land use (site-specific), groundwater flow directions in the area, anecdotal reports of water quality in the area, and their best professional judgment. The two VOC plumes are separated by a bedrock high located between the VOC plumes. These are sources with no identified responsible parties.

Hydrogeologic cross sections are provided as **Figures 11 through 14**. In addition to these figures, charts of contaminant concentrations at several wells in the Basin are provided in **Attachment 2**. The groundwater elevation contours and major flow directions are shown in **Figure 15**. Groundwater flow directions indicate that the co-mingled plumes of the Basin could potentially move towards the Project wells and result in potentially additional remediation efforts. Note that particle trace data is not available, and groundwater flow directions are intended as a substitute. Figure 16 shows the results of a 20-year capture zone analysis for the Project wells. Capture zones of the Project wells show that if no action is taken, co-mingled plumes could potentially impact the Project wells. Flow directions and particle traces shown in **Figure 15** and **Figure 16**, respectively, do not suggest the co-mingled plumes will mix with the MARB flows. Groundwater flow modeling results are provided in **Attachment 2** as part of the Project Feasibility Study.

f. Consistency with Plans, Orders and Requirements

The Project has been included as part of regional planning activities as it is related to the Moreno Valley Groundwater Development project included in the Santa Ana Watershed Project Authority's Integrated Regional Water Management Plan, and will provide groundwater quality protection in an area noted in the AB3030 groundwater management plan for the West San Jacinto Groundwater Basin. The Project will also potentially be part of the Groundwater Sustainability Plan (GSP) that is currently being developed for the Western San Jacinto groundwater basin. While there isn't a Salt and Nutrient Management Plan in place in the West San Jacinto Basin, the Groundwater Management Plan for the basin provides TDS and NO₃-N goals of 570 mg/L and 5.2 mg/L, respectively. Given that a component of the Project will be to remove nitrate from the groundwater, the Project is considered to be in-line with these water quality objectives.

EMWD has had ongoing communication with the SWRCB DDW (and previously with CDPH) regarding water quality issues at Well 27. Per a letter from the SWRCB DDW, this well was placed on standby status due to elevated levels of manganese. Supporting documents regarding the Well 27 shutdown are provided in **Attachment 2**.

2. Responsible Party(ies)

As described under Section 1a – Site Background/Site Description, EMWD has performed searches for sources of contamination through both the Drinking Water Source Assessment Program (DWSAP) and Envirostor searches. Neither of these searches have found there to be a point source of contamination that would contribute to the comingled plume targeted for treatment by the proposed Project. A number of historical operations at or near the contaminant plume may have contributed to the underlying contaminant plume, including agricultural use, junk/scrap/salvage yards, gas stations with underground storage tanks, and residential developments with septic systems. A map and table detailing the locations identified through the Envirostor search is provided in **Attachment 2**. There is potential for the plume being treated through the MARB Remediation Program to travel south, and should that happen, wells could be affected by the contamination. An objective of the proposed Project is to reduce the flow of groundwater under MARB, and thus potentially help improve the efficiency of MARB groundwater treatment.

3. Experience and Knowledge

EMWD has already successfully implemented and operated two similar facilities – the Perris I and Menifee Desalters used for the treatment of groundwater. The two desalter projects were planned, designed and phased in over time. Each Desalter was constructed within approximately 2 years, which was within the planned schedules for these projects at the time. Given that EMWD already has two reverse osmosis facilities adjacent to the Perris II RO Treatment Facility (ROTF), its technical and managerial staff are already highly experienced and certified in the design and construction of such

plants. EMWD is currently developing a Monitoring and Reporting Plan (MRP) for the Perris II ROTF, which reinforces EMWD staff experience in assessment and monitoring of the effectiveness of the Project from a regulatory standpoint. The MRP development is closely coordinated with the SWRCB. Therefore, EMWD has staff with the technical knowledge to implement the Project. Additionally, an experienced contractor will be hired to provide construction services.

4. Coordination with Cooperating Agencies

EMWD has been in contact with representatives at the March Air Reserve Base, the Santa Ana Regional Water Quality Control Board (RWQCB), as well as State Water Resources Control Board (SWRCB) regarding the Project, and the RWQCB is aware of the Project as it will help meet the objectives of the Basin Plan. The Project is also supported by the following, who have provided the support letters provided in **Attachment 2**:

- | | |
|---|--|
| 1. Department of the Air Force, Air Force Reserve Command | 10. Monday Morning Group |
| 2. California State Senate, Thirty-First District | 11. Greater Riverside Chamber of Commerce |
| 3. California State Senate, Twenty-Third District | 12. City of Perris |
| 4. California State Senate, Twenty-Eighth District | 13. City of Moreno Valley |
| 5. California State Assembly, Forty-Second District | 14. Western Municipal Water District |
| 6. California State Assembly, Sixty-Seventh District | 15. Metropolitan Water District of Southern California |
| 7. California Department of Water Resource | 16. Moreno Valley Chamber of Commerce |
| 8. County of Riverside Board of Supervisors | 17. Perris Valley Chamber of Commerce |
| 9. County of Riverside Economic Development Agency | |

5. Long-Term Operation and Maintenance (O&M)

Eastern Municipal Water District is a large public water system with over 10,000 water service connection. The Alternative TMF Assessment Form is included under **Attachment 2**.

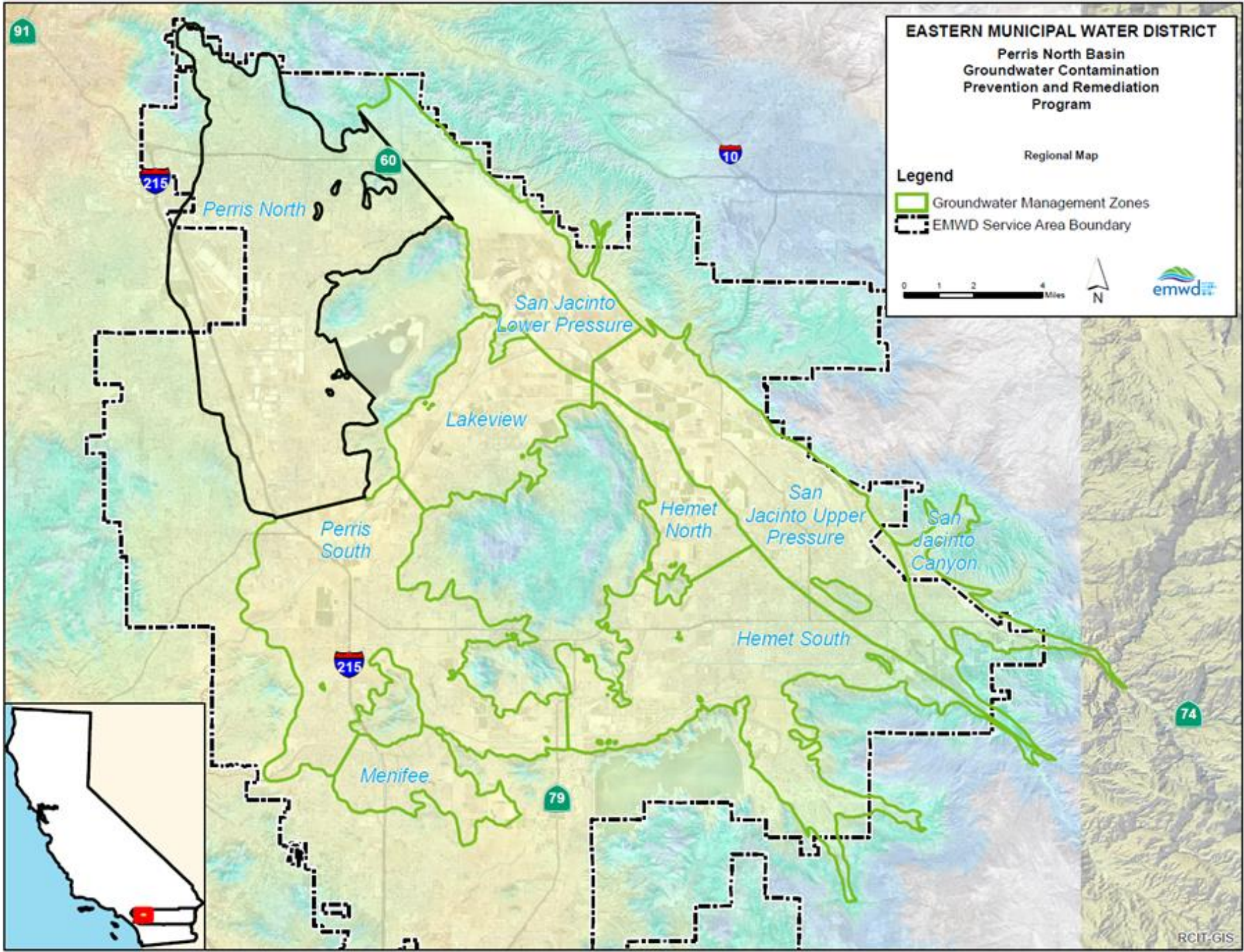
a. Technical and Managerial Capacity

EMWD operates a water system that consist of water treatment facilities, wells, boosters, tanks and distributions. There are 16 water distribution operators for the District with 5 assigned within the area of the Project. There are also 9 water treatment operators assigned to the three water treatment facilities. Facilities are monitored continually through a Supervisory Control and Data Acquisition (SCADA) system where Integrated Operation Center staff of 7 can dispatch the on-call operators. These highly experienced and certified staff maintain the operation of water system. The following EMWD staff supervisors will conduct operations for the Project and have summary resumes provided in **Attachment 2**: Khos Ghaderi – Director of Water Operations, Phil Lancaster- Operations Manager, John Dotinga – Operations Manager, and Joe Howell – Operations Manager.

b. Financial Capacity

Based on that experience, the current estimated O&M costs are approximately \$240 per acre foot of finish water generated. Based on an expected Project yield of 6,750 AFY for each year, O&M costs are estimated to be \$1.6 million per year on average over the 40-year life of the Project. EMWD has sufficient revenues available to cover these necessary O&M costs. The State Water Resources Control Board, Division of Financial Assistance does an annual credit review of Eastern Municipal Water District. Financial statements from the last three years are included in **Attachment 2**.

FIGURE 1: REGIONAL MAP



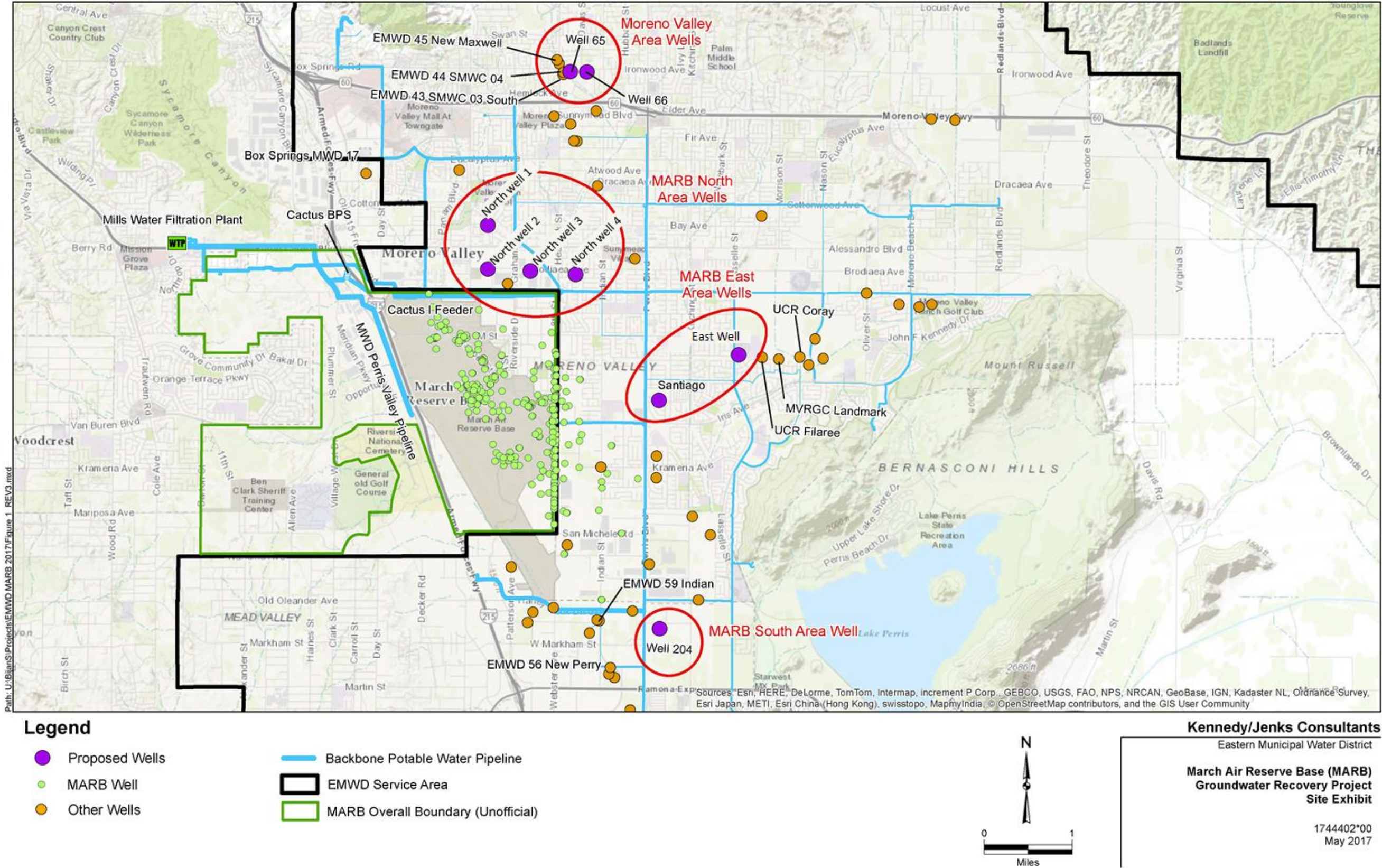
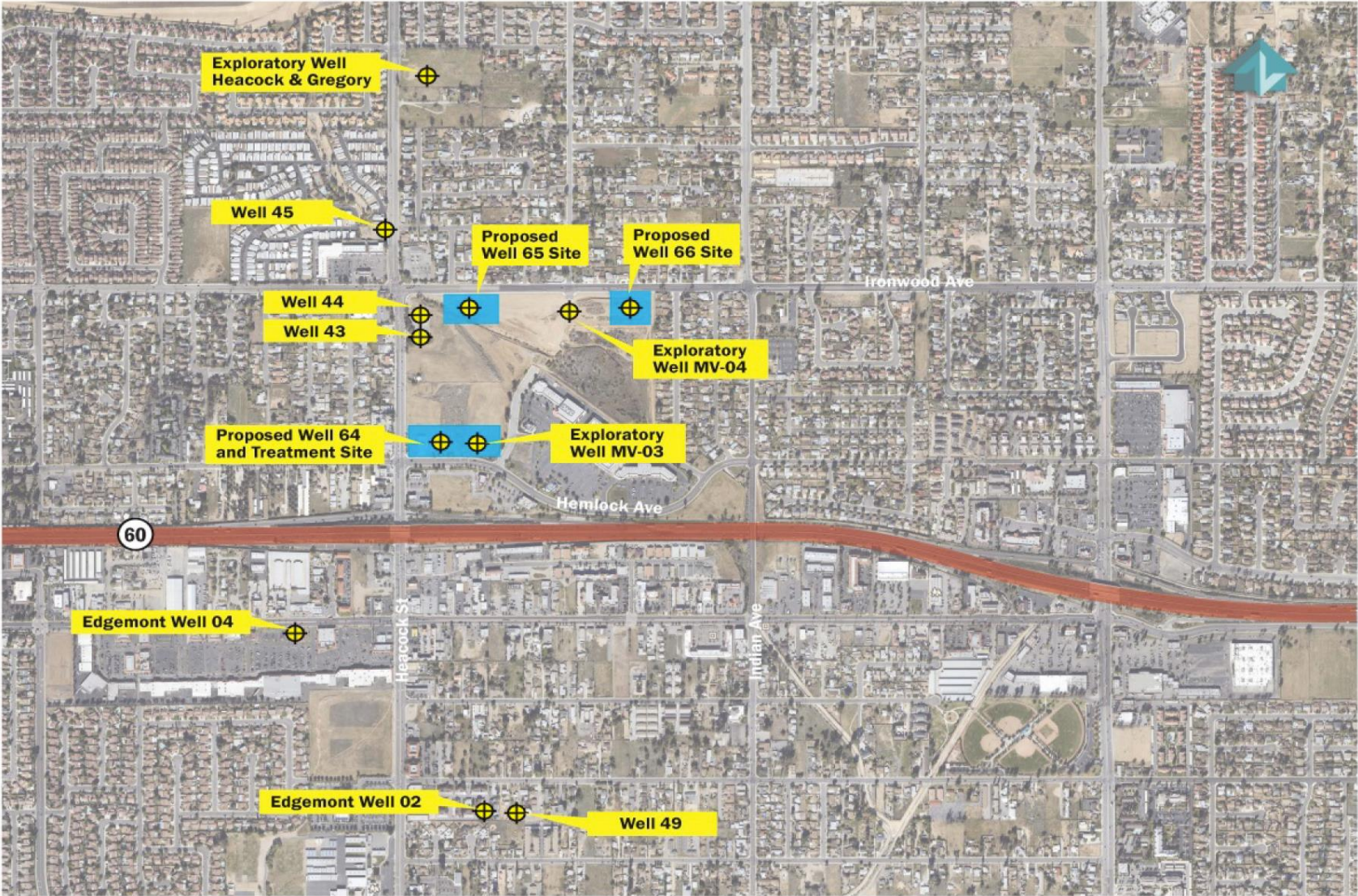


FIGURE 3: PROPOSED WELL AND EXPLORATORY WELL SITING IN THE MORENO VALLEY AREA (FIG 1-1 FROM THE 2015 WELL 64 AND 65 EQUIPPING AND TREATMENT PROJECT – FINAL FEASIBILITY STUDY REFINEMENT TECHNICAL MEMORANDUM)



Proposition 1 GWGP Implementation Full Proposal
FIGURE 4: CONCEPTUAL WELL SITING AND PIPELINE ALIGNMENT FOR NORTH AND EAST AREAS (FIG. 3 FROM THE PROJECT FEASIBILITY STUDY IN ATTACHMENT 2)

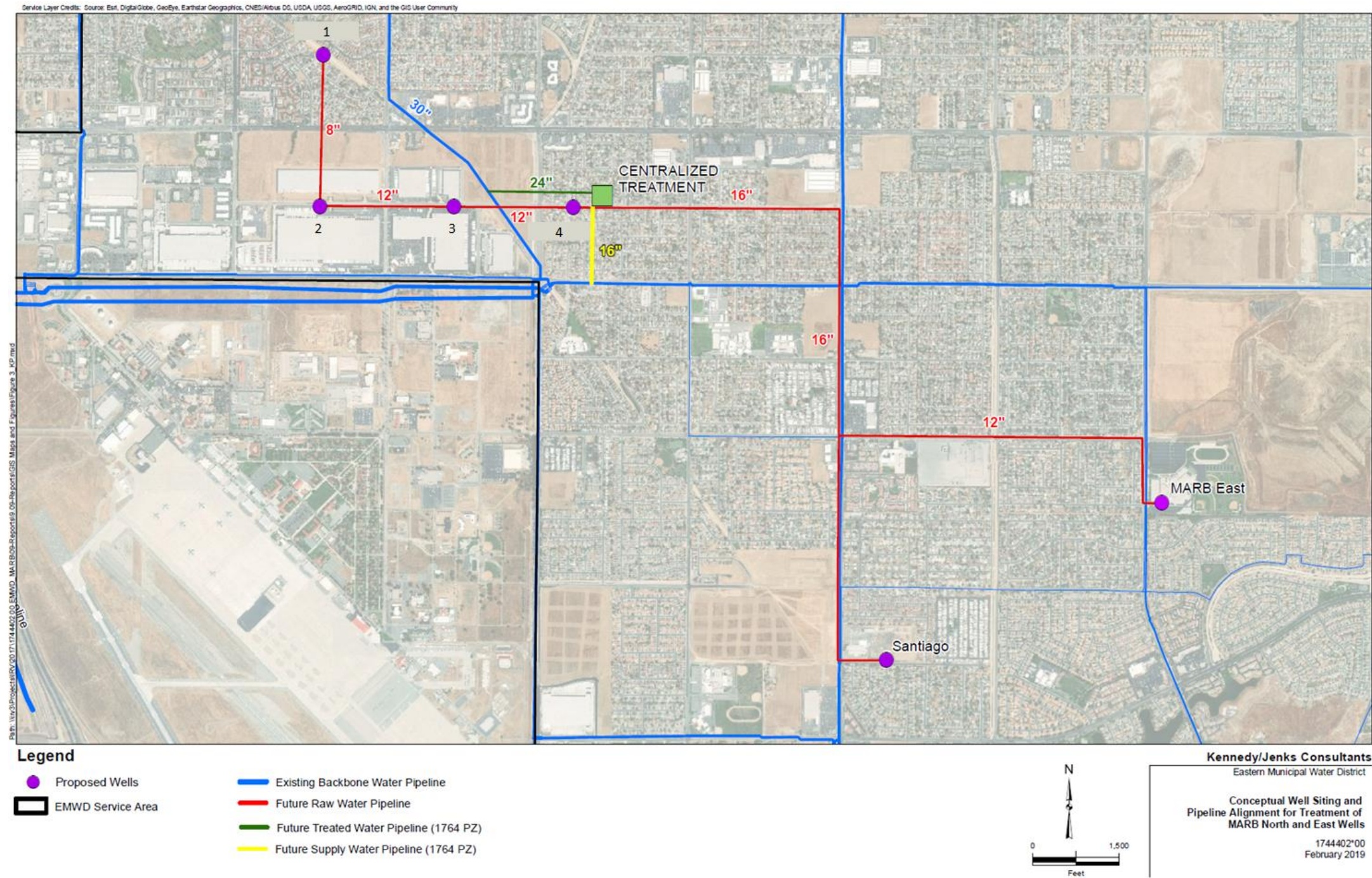
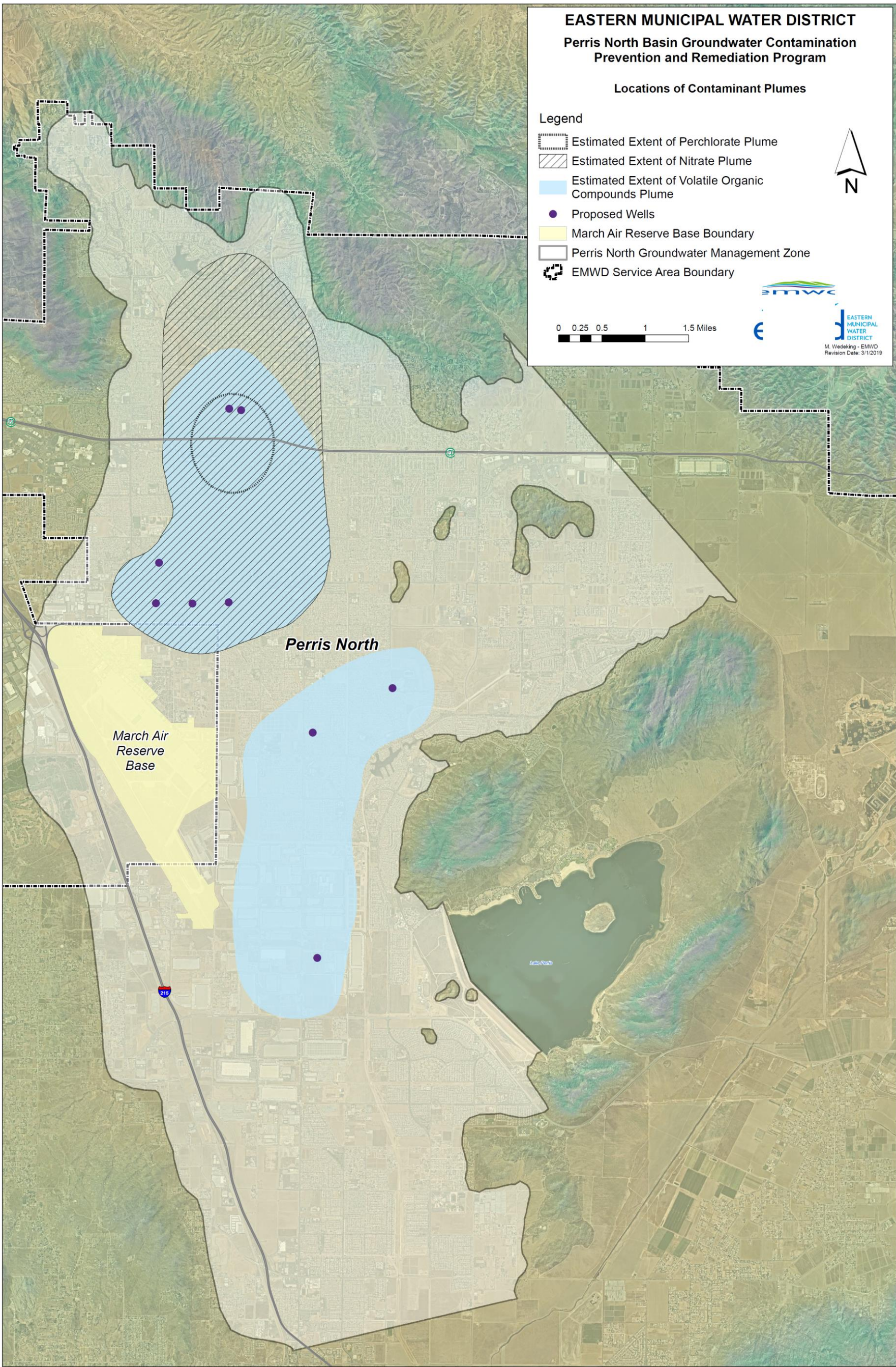


FIGURE 5: PLUME LOCATIONS



EASTERN MUNICIPAL WATER DISTRICT
Perris North Basin Groundwater Contamination Prevention and Remediation Program
Wells In Danger of Being Shut Down Due to Contamination

Legend

- Wells Previously Shut Down Due to Contamination
- Wells In Danger of Being Shut Down Due to Contamination
- Perris North Groundwater Management Zone
- EMWD Service Area Boundary

0 0.25 0.5 1 1.5 Miles

emwd EASTERN MUNICIPAL WATER DISTRICT

M. Wedeking - EMWD
Revision Date: 2/28/2019

Wells In Danger of Being Shut Down Due to Contamination

Well Name	Annual Yield (AFY)	Population Served ¹
EMWD 55 Perris II	1,060	7,530
EMWD 56 New Perry	1,510	10,730
EMWD 57 New Follico	1,075	7,640
EMWD 59 Indian	1,542	10,950
McCanna Ranch 01	88	630
McCanna Ranch 02	115	820
McCanna Ranch 03	201	1,430
McCanna Ranch 04	432	3,080
Total	6,023	42,810²

Notes:

- Assumed 440 gpd/EDU and 3.5 ppl/EDU
- Estimated number of connections: 12,200

Population Directly Benefiting From The Project

Wells	Annual Yield (AFY)	Population Served ¹
In Danger of Being Shut Down	6,023	42,810
Planned Production Wells	6,750	47,940
Total	12,773	90,750²

Notes:

- Assumed 440 gpd/EDU and 3.5 ppl/EDU
- Estimated number of connections: 26,000

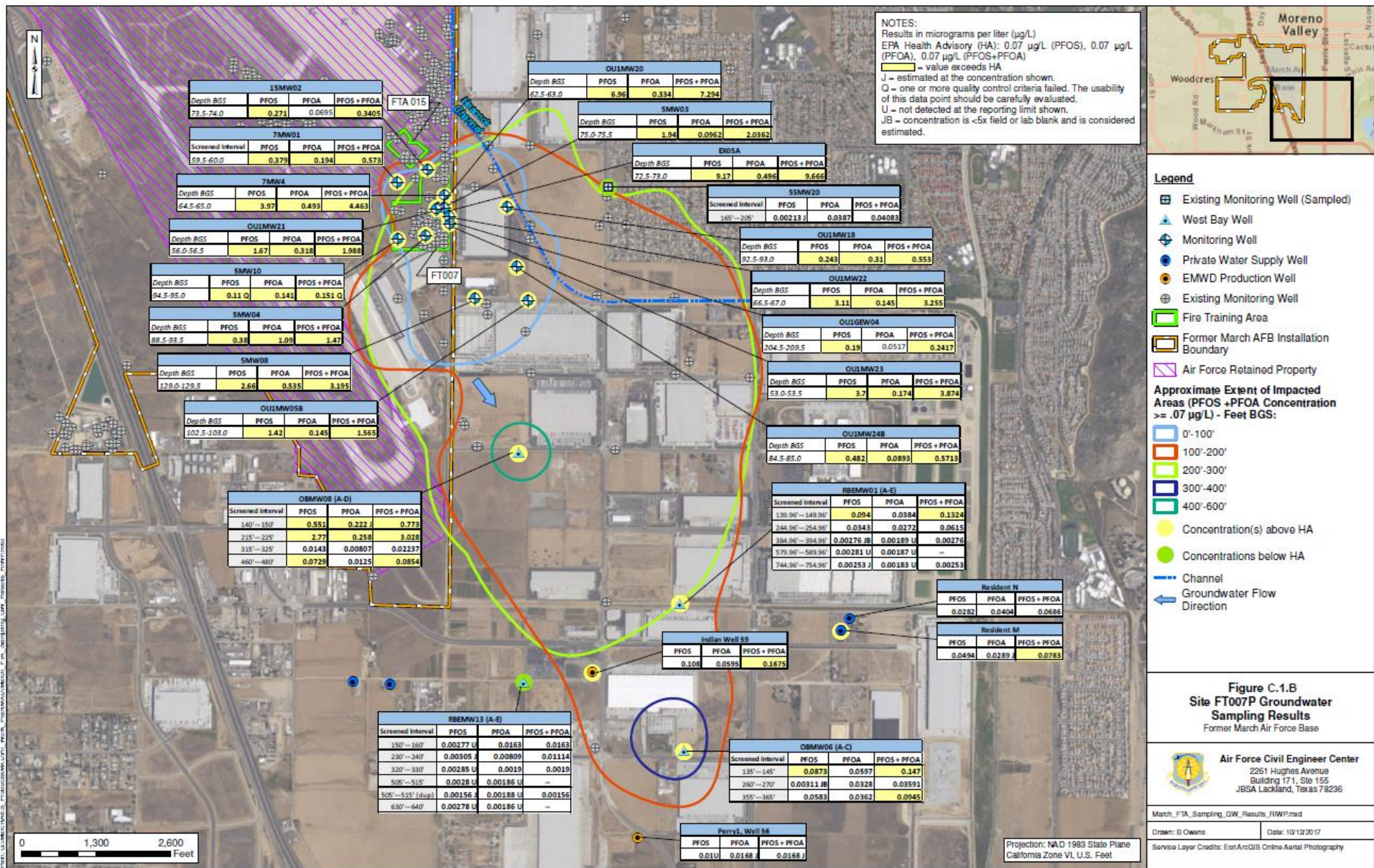


FIGURE 8: MARB SUPERFUND SITE CONTAMINANT PLUMES



FIGURE 9: OTHER PROJECTS IN THE GROUNDWATER BASIN

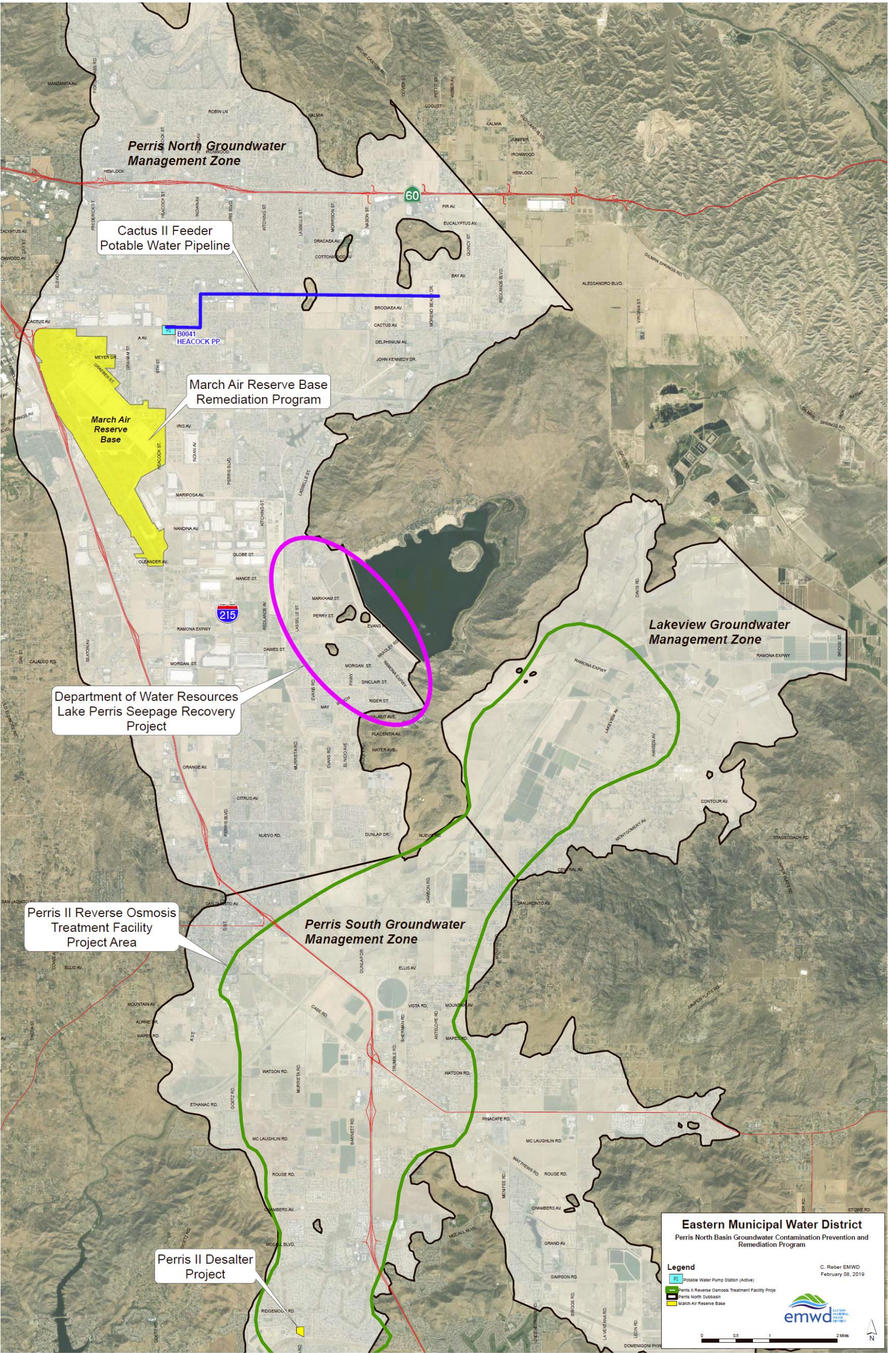


FIGURE 10: PROPOSED AREAS FOR PLANNED MONITORING WELLS

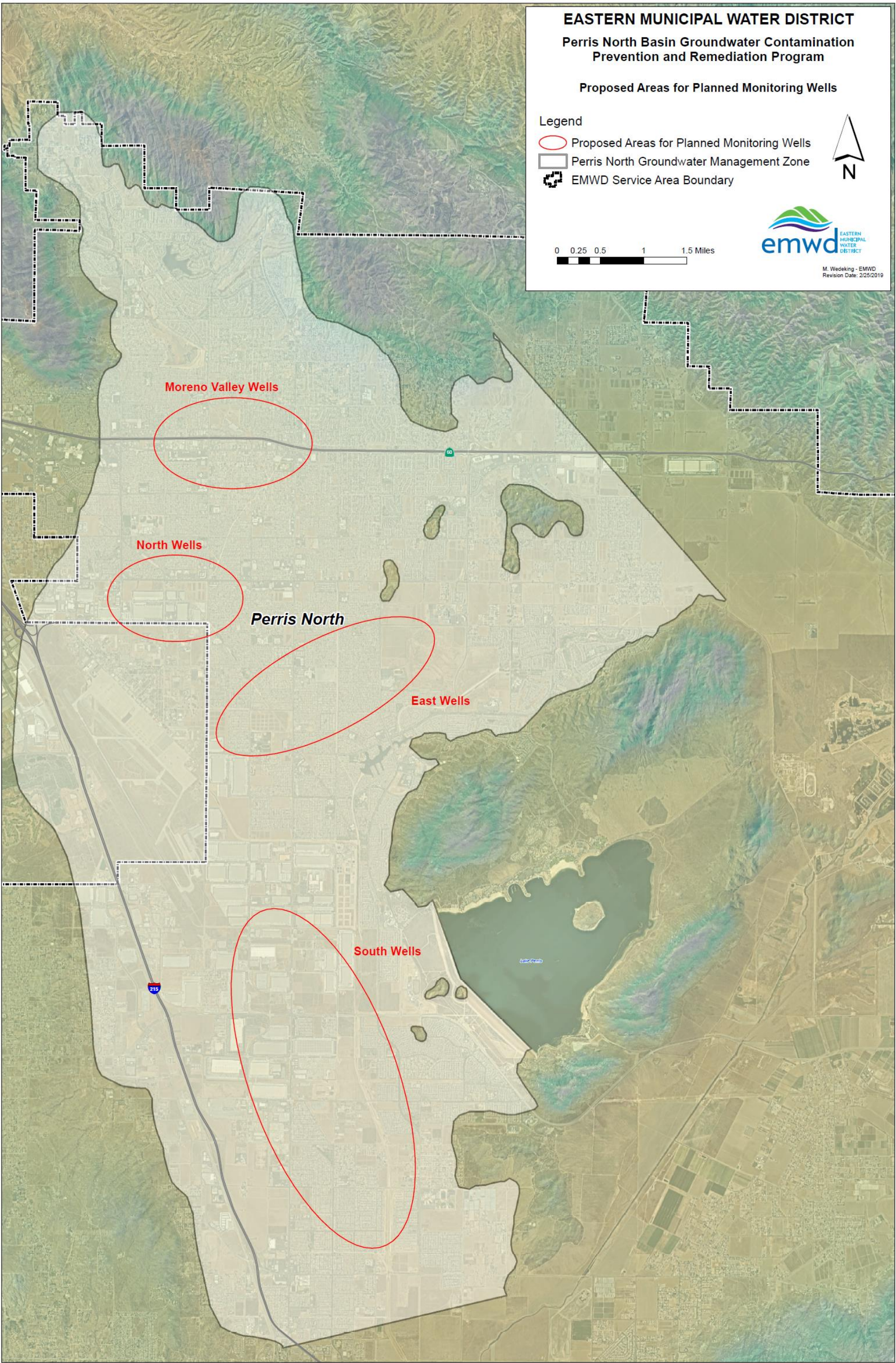


FIGURE 11: HYDROGEOLOGIC CROSS SECTION LINES

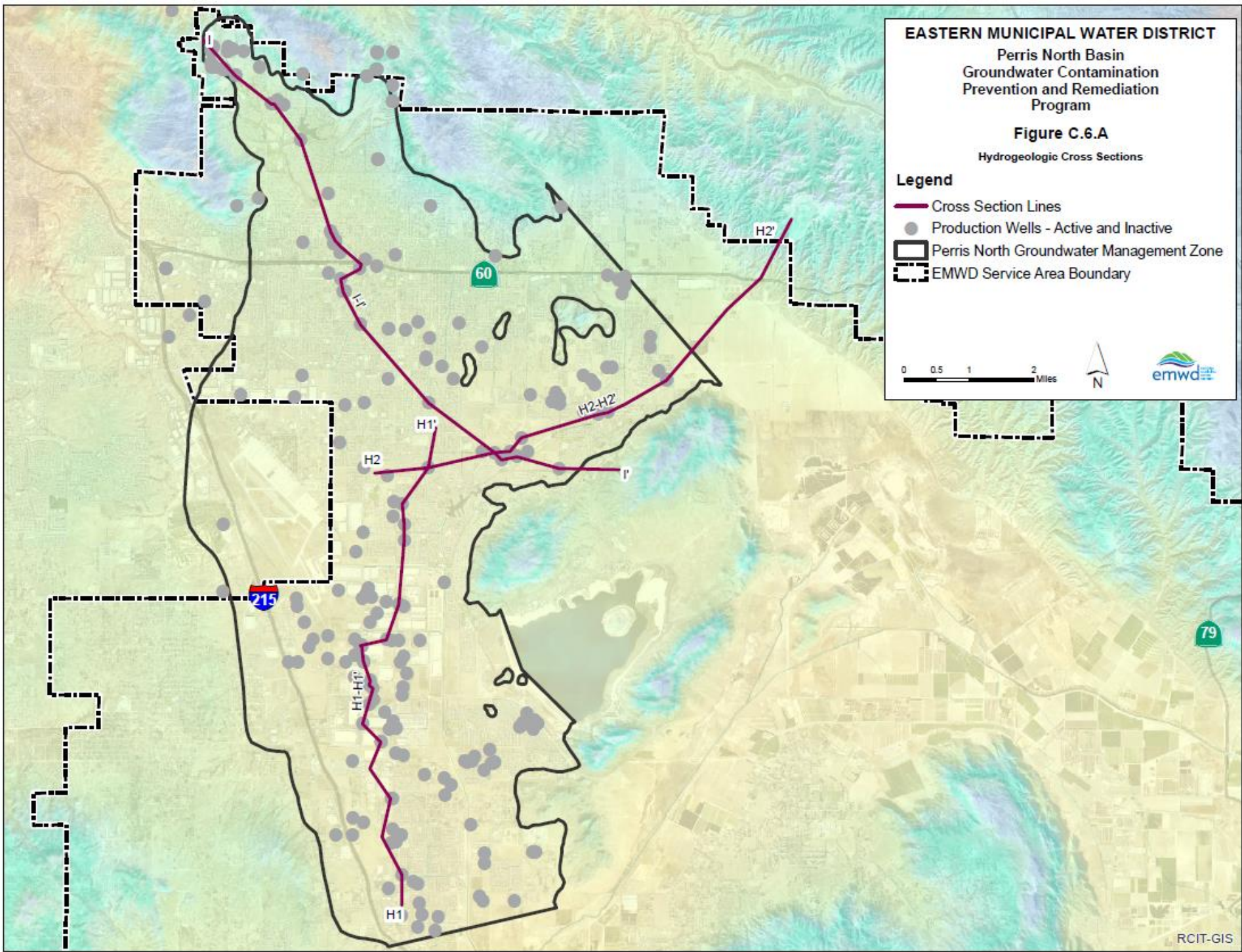








FIGURE 15: SIMULATED GROUNDWATER ELEVATION CONTOURS AND GROUNDWATER FLOW DIRECTIONS

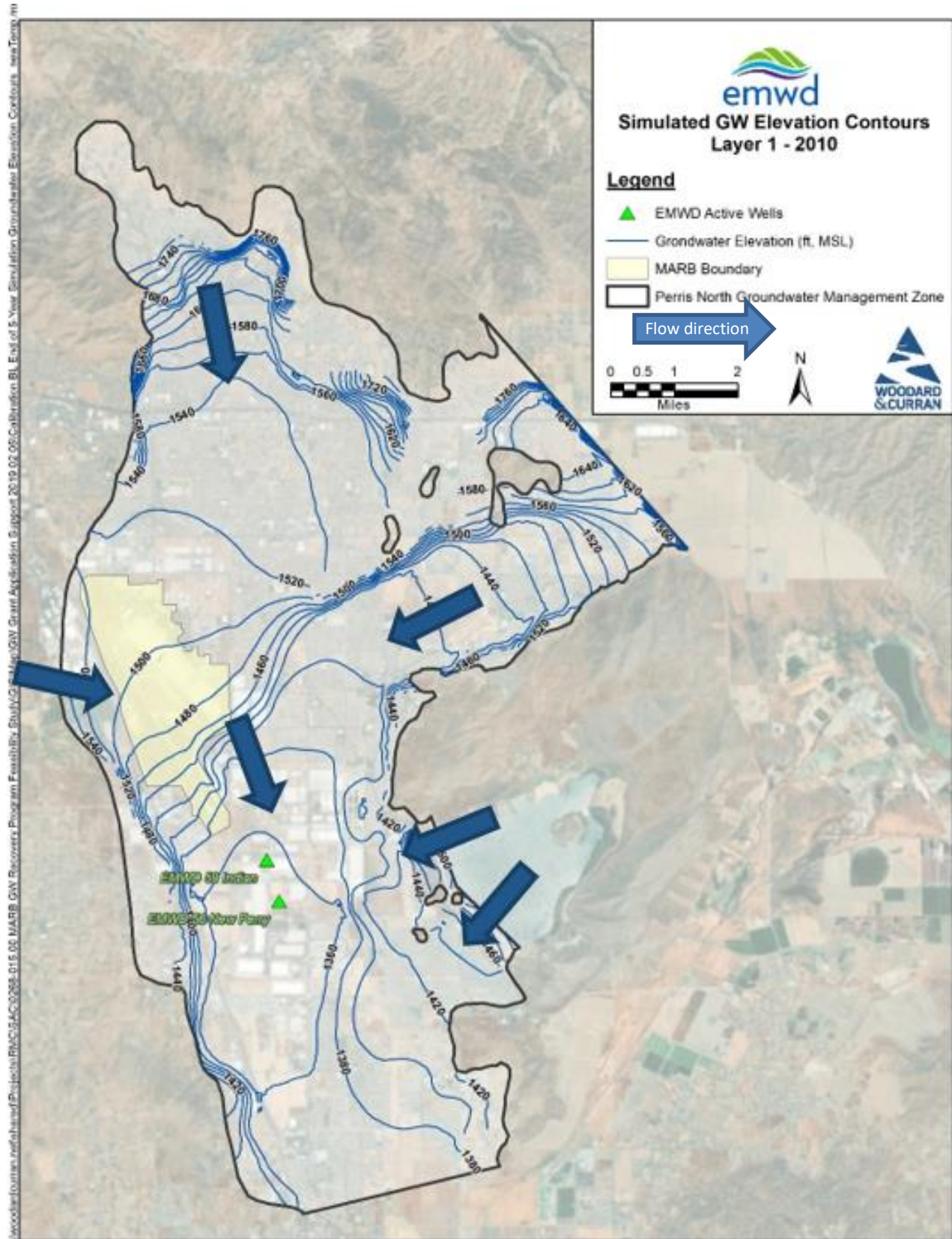


FIGURE 16: GROUNDWATER FLOW PATHLINES TO WELLS

