JANUARY 29, 2014

CORRECTIVE MEASURES STUDY WORK PLAN UPDATE

REVISION 1.0

RAYTHEON COMPANY

(FORMER HUGHES AIRCRAFT COMPANY)

1901 WEST MALVERN AVENUE

FULLERTON, CALIFORNIA

PREPARED FOR:
RAYTHEON COMPANY

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

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January 29, 2014

VIA FEDERAL EXPRESS - STANDARD

Mr. William F. Jeffers, PE
Hazardous Substances Engineer
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF TOXIC SUBSTANCES CONTROL
9211 Oakdale Avenue
Chatsworth, CA 91311-6520

Re: Transmittal of Revision 1.0 to Corrective Measures Study Work Plan Update, Former Raytheon Company (Formerly Hughes Aircraft Company) Site, 1901 West Malvern Avenue, Fullerton, California

Dear Mr. Jeffers:

This letter transmits Revision 1.0 to the Corrective Measures Study (CMS) Work Plan Update prepared by Hargis + Associates, Inc. (H+A) for the Former Raytheon Company (Formerly Hughes Aircraft Company) facility located at 1901 West Malvern Avenue in Fullerton, California (the Site). Enclosed is one hard copy with a compact disc that contains a copy of the above-referenced report.

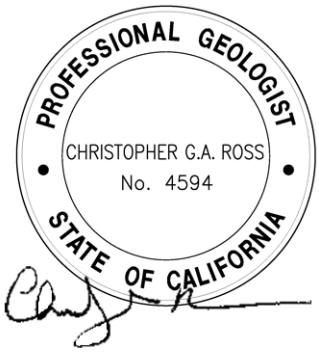
We received California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) December 6, 2013 comments to the original CMS Work Plan Update dated October 4, 2013. H+A transmitted responses and proposed actions to DTSC comments in a letter dated December 17, 2013. There was meeting at DTSC offices in Cypress California on January 16, 2014 to discuss the response to comments and associated proposed actions. The meeting was attended by representatives from DTSC, Orange County Water District, City of Fullerton, City of Buena Park, Orange County Public Works, Raytheon and H+A. During the meeting, there was general concurrence that the response to comments and respective proposed actions outlined in the H+A December 17, 2013 letter were acceptable with the exception of the response to DTSC comment 5, which was discussed further to refine and clarify the associated Remedial Action Objectives (RAOs). The revised RAOs were discussed during the meeting and were transmitted in e-mails from Chris Ross to DTSC (Bill Jeffers, Allan Plaza and Paul Pongetti) dated January 18 and 24, 2014. The revised RAOs and have been incorporated into the attached CMS Work Plan Update Revision 1.0.

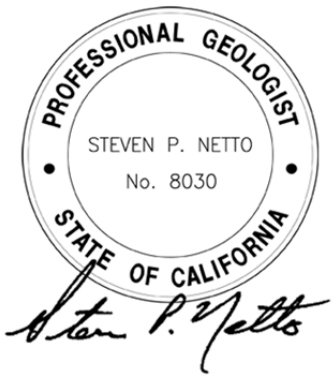
The attached document also includes an updated schedule, with the CMS Report being submitted to DTSC within 6 months of DTSC approval of the CMS Work Plan Update. We look forward to receiving

DTSC approval in the near future. If you have any questions or require further information, please contact us at 858-455-6500.

Sincerely,

HARGIS + ASSOCIATES, INC.





Christopher G.A. Ross, PG 4594, CHG 221
Principal Hydrogeologist

Steven P. Netto, PG 8030, CHG 872
Senior Hydrogeologist

CGAR/SPN/ama

Enclosure: 1 copy w-CD

cc w/encl: (via Email and 1 hard copy)
Mr. Paul Pongetti, Department of Toxic Substances Control, Cypress
Mr. Paul E. Brewer, Raytheon Company
Mr. Carl Bernhardt, California RWQCB, Santa Ana Region
Mr. Dave Mark, Orange County Water District
Mr. Eric Silvers, Regency Centers
Ms. Denise Gerstenberg, Cushman & Wakefield of California, Inc.

(via Email and 2 hard copies)
Mr. Dave Schickling, City of Fullerton

(via Email only) (*Hard Copies Provided Upon Request*)
Mr. Chad Blais, City of Fullerton
Mr. Robert Logan, RG, Kennedy/Jenks Consultants
Mr. Harris Sanders, Gateway Environmental Management LLC
Ms. Jennifer Schaefer, The Morgan Group, Inc.
Rosalind McLeroy, Esq., The Morgan Group, Inc.
Mr. Michael Payne, Prudential Real Estate Investors
Ms. Tizita Bekele, PE, Department of Toxic Substances Control, Cypress
Mr. Mike McGee, City of Buena Park
Ms. Carol Owens, The Morgan Group, Inc.
Mr. Duc Nguyen, Orange County Public Works

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ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-dichloroethylene
AOP	advanced oxidation process
CACA	Corrective Action Consent Agreement
CMS	Corrective Measures Study
COCs	compounds of concern
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
former property	293 acre portion of Site sold in 1998
gpm	gallons per minute
H+A	Hargis + Associates, Inc.
HHRAs	Human Health Risk Assessment
HiPOx™	peroxide and ozone
HAC	Hughes Aircraft Company
MCLs	Maximum Contaminant Levels
MNA	Monitored Natural Attenuation
RAOs	Remedial action objectives
Raytheon	Raytheon Company
the Site	1901 West Malvern Avenue, Fullerton, California
TCE	trichloroethylene
VOCs	Volatile organic compounds

HARGIS + ASSOCIATES, INC.

CORRECTIVE MEASURES STUDY WORK PLAN UPDATE
REVISION 1.0

RAYTHEON COMPANY
(FORMER HUGHES AIRCRAFT COMPANY)
1901 WEST MALVERN AVENUE
FULLERTON, CALIFORNIA

1.0 INTRODUCTION

This Corrective Measures Study (CMS) Work Plan Update has been prepared by Hargis + Associates, Inc. (H+A), on behalf of Raytheon Company (Raytheon) (formerly Hughes Aircraft Company [HAC]) for the site located at 1901 West Malvern Avenue which is northeast of the intersection of Malvern Avenue and Gilbert Street in Fullerton, California (the Site) (Figures 1 and 2). This CMS Work Plan updates the initial CMS Work Plan prepared in 2003 (H+A, 2003a) to provide current status and schedule for preparation of the CMS Report and associated tasks as discussed in a meeting with the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) on September 25, 2013 and includes revisions discussed in a meeting with DTSC on January 16, 2014.

1.1 PURPOSE AND SCOPE

A CMS is being conducted to determine appropriate groundwater corrective actions associated with operations at two former areas of the Site (former Building 609 area and former Building 601 area) in accordance with the Corrective Action Consent Agreement (CACA) with the DTSC (DTSC, 2003). The purpose of the CMS is to identify and evaluate a corrective measure alternative(s) that will address regional groundwater containing volatile organic compounds (VOCs) and 1,4-dioxane at and downgradient of the former property. For the purposes of this document the term “former property” refers to the approximate 293 acre portion of the former HAC Facility sold by Raytheon in 1998.

The purpose of this CMS Work Plan Update is to describe the current plan and schedule to evaluate corrective measures alternatives. In accordance with the CACA requirements for a CMS Work Plan, this CMS Work Plan Update includes the following elements:

- Section 1 provides an introduction, the overall purpose of the CMS Work Plan and the CMS, an outline of the scope of this document, and a brief background summary of activities completed since the initial 2003 CMS work plan;
- Section 2 presents remedial action objectives (RAOs) for groundwater;
- Section 3 identifies and describes corrective measures alternatives;
- Section 4 outlines the general approach and criteria for evaluating the corrective measures alternatives;
- Section 5 describes tasks being conducted to support the CMS;
- Section 6 summarizes the project organization;
- Section 7 presents a project schedule;
- Section 8 lists references cited; and
- Appendix A is a proposed outline for the CMS report.

1.2 BACKGROUND

This section presents an update to the background section presented in the initial CMS Work Plan prepared in 2003 (H+A, 2003a) and briefly summarizes results of tasks completed since the initial CMS Work Plan was prepared. A summary of previous investigations and Site conditions prior to 2003 are presented in more detail in Appendix A of the 2003 CMS Work Plan. The specific areas subject to the CACA have been identified based on the extensive Resource Conservation and Recovery Act Facility Investigation, subsequent groundwater assessment activities, and also takes into consideration voluntary remediation conducted by Raytheon.

1.2.1 Subject Areas of Corrective Action

As outlined in the initial 2003 CMS Work Plan, there are two specific areas that are being addressed in the CMS:

1. Groundwater within a portion of the regional aquifer system containing principally 1,1-dichloroethylene (1,1-DCE) and 1,4-dioxane, which, for the purposes of this document, will be collectively referred to as the former Building 609 area.

2. Groundwater within a portion of the regional aquifer system containing principally trichloroethylene (TCE) and 1,1-DCE, which, for the purposes of this document, will be referred to as the former Building 601 area.

1.2.1.1 Building 609 Overview

The Building 609 area included three subsurface features where impacts were observed: 1) soil from land surface to approximately 80 feet below former grade (the former source area); 2) a perched zone extending from under the former source area approximately 600 to 800 feet to the south; and 3) regional groundwater from the toe of the perched zone extending to the west of the former property boundary. The former source area, including soil in the vicinity of Solid Waste Management Unit 3, and the perched zone were the subject of voluntary remediation conducted by Raytheon.

As outlined in the initial 2003 CMS Work Plan, the former source area remediation was completed prior to 2001 and will not be part of the CMS based on the Human Health Risk Assessments (HHRAs), soil assessment, and data collected during operation of the voluntary source remediation program.

As outlined in the initial 2003 CMS Work Plan, prior remediation and results of HHRAs indicate that the potential exposure pathway associated with the perched zone is related to continued migration of post remediation residual VOCs and 1,4-dioxane near the toe of the perched zone

to the regional groundwater. This pathway will be addressed as part of the regional groundwater corrective action and further perched zone remediation will not be part of the CMS.

VOCs and 1,4-dioxane have been detected in groundwater samples collected from monitor wells near the toe of the perched zone and appear to extend in the regional groundwater system to west/southwest of monitor well MW-36, which is located approximately 8,000 feet west of the former property boundary along Malvern Avenue (Figure 3). The results of recently completed groundwater assessment are documented in a well construction report (H+A, 2013c). VOCs and 1,4-dioxane dissolved in regional groundwater from the toe of the perched zone to west/southwest of the former property will be considered in the CMS to protect the regional aquifer system and current or future potential production wells (potential receptors).

1.2.1.2 Building 601 Overview

The Building 601 area included two subsurface areas where impacts were observed: 1) soil from land surface to approximately 120 feet below former grade (the former source area); and 2) regional groundwater from the former source area extending to the west of the former property boundary. Perched groundwater was not encountered in this area of the Site.

As outlined in the initial 2003 CMS Work Plan, the former source area will not be part of the CMS based on the HHRAs, soil assessment, and prior assessments.

As outlined in the initial 2003 CMS, TCE and/or 1,1-DCE have been detected in groundwater samples collected from monitor wells MW-8 (adjacent to the former source area) and MW-15 (downgradient of the former source area). Subsequent samples collected from monitor well MW-8 also contained 1,4-dioxane; however, these detections were associated with a historical high water level and appear to be associated with the former Building 609 area. Subsequent assessment also indicated detection of relatively low concentrations of TCE in monitor wells near the southwest corner of the former property and in monitor wells to the west of the former property. In general, the TCE from the former Building 601 area appears to be commingled with the former Building 609 area 1,1-DCE and 1,4-dioxane to the west of the former property. As such, VOCs from the former Building 601 area will be considered in the CMS concurrent with

the former Building 609 area to protect the regional aquifer system at current or future hypothetical receptors.

1.2.2 Supporting CMS Activities

The following tasks have been conducted in accordance with CMS and Groundwater Assessment work plans and associated addenda since the initial 2003 CMS Work Plan was prepared:

- Groundwater monitoring and assessment from 2003 to present;
- Bench and pilot testing of groundwater treatment technologies from 2004 to present; and
- Groundwater modeling.

1.2.2.1 Groundwater Monitoring and Assessment

Routine groundwater monitoring has been conducted at the Site since 2003 and has been documented in periodic monitoring reports and data submittals. The following outlines groundwater assessment activities conducted to support the CMS since 2003.

- Between late 2003 and early 2004, deep exploratory boreholes and monitor wells were installed on the southern portion of the former property to assess regional groundwater conditions, refine the conceptual site model and improve the monitor well network (H+A, 2003b, 2003c, 2004a, 2004c, and 2004d). The results of these investigations were summarized in a report which presented two potential groundwater conceptual model alternatives (H+A, 2005c).

- In December 2007, there was a detection of 1,1-DCE and 1,4-dioxane in monitor well MW-26C (H+A, 2008a). Based on this detection and other data collected at the Site, one of the two conceptual models presented in the 2005 groundwater assessment report was determined to more accurately represent Site conditions (H+A, 2008b). This conceptual model indicated that there was a structural fold that provided a groundwater transport pathway (aka Unit B or target zone) within the regional groundwater system, which became the focus of subsequent investigations.

- Between 2008 and 2013, multiple phases of groundwater assessment have been conducted on and to the west/southwest of the former property as outlined in multiple groundwater work plan addenda (H+A, 2008b, 2008c, 2008d, 2009a, 2009c, 2010a, 2011a, 2011c, and 2013a). The results of the multiple groundwater assessment phases indicated that VOCs and 1,4-dioxane were detected primarily within Unit B on the southwestern portion of the former property and to the west/southwest of the property (Figure 3). The presence of a structural fold roughly parallel with Malvern Avenue creates a condition where Unit B slopes to the south from the toe of the perched zone, where the bottom of this zone is approximately 180 feet below land surface, to Malvern Avenue, where the bottom of this zone is approximately 1,000 feet below land surface (Figure 4).

The results of the most recent groundwater assessment have been summarized in a monitor well installation report and work plan addendum (HA, 2013c). As discussed during the September 25, 2013 meeting with DTSC, the groundwater assessment is substantially complete with the exception of a relatively small data gap in the vicinity of monitor wells MW-37 and MW-38. A work plan has been submitted to DTSC (H+A, 2013d) to address this data gap. The field work will be conducted after DTSC approves the work plan concurrently with CMS Report preparation.

1.2.2.2 Bench and Pilot Testing

Multiple groundwater pilot tests have been conducted at the Site starting in 2004. The pilot groundwater extraction and treatment system has reduced the mass of VOCs and 1,4-dioxane in the regional groundwater and has substantially reduced mass flux along the western portion of the former property. As of the end of August 2013, 79,141,034 gallons of groundwater has been extracted and approximately 121 pounds of VOCs and 22 pounds of 1,4-dioxane have been treated. The pilot system is being upgraded and will continue operations concurrent with CMS evaluations. The following outlines the pilot testing activities.

- In 2004, a pilot test of an advanced oxidation process (AOP) that uses peroxide and ozone (HiPOx™) to treat extracted groundwater was completed (H+A, 2004b and

2004e). Between 2005 and 2007, work plan preparation, and design and permitting of a pilot test involving extraction and treatment of groundwater from two wells screened within the regional groundwater system near the toe of the perched zone was completed (H+A, 2005a, 2005b, 2005d, and 2006). Construction of the pilot test treatment system was completed in 2008 and the treatment system was started in July 2008 (H+A, 2008e). From July 2008 through November 2009, the pilot system was operated with extraction wells EW-01 and MW-21 operating at a combined rate of approximately 20 gallons per minute (gpm) on a nearly continuous basis.

- In 2009, a work plan to expand the pilot treatment system to include a new extraction well, EW-02, located near the western portion of the former property was prepared (H+A, 2009b). Pilot system expansion took place between November 2009 and March 2010 to incorporate extraction well EW-02 into the extraction well network (H+A, 2010a and 2010b). During this time, the pilot test treatment equipment was also modified to increase the treatment system capacity from 20 gpm to 50 gpm, which is the maximum allowable flowrate in accordance with the sewer discharge permit. Beginning in March 2010, the pilot test system was operated near the maximum capacity of approximately 50 gpm on a nearly continuous basis from extraction well EW-02.

- In 2011 and 2012, a bench and pilot test work plan was prepared and implemented to test additional groundwater treatment technologies because the existing HiPOx™ AOP treatment system periodically resulted in formation of bromate above drinking water standards (H+A, 2011b and 2012). The results of the bench and pilot testing indicated that the three technologies evaluated were capable of treating VOCs and 1,4-dioxane without the formation of bromate above drinking water standards.

In 2013, a pilot test addendum was prepared to replace the existing AOP technology with one of the bench tested AOP technologies to monitor and confirm treatment system performance; and add an existing well (MW-29) to the extraction wellfield to enhance containment of higher concentration VOCs and 1,4-dioxane along the west side of the former property (H+A, 2013b). As discussed during the September 25, 2013 meeting with DTSC, the bench and pilot testing of groundwater treatment technologies is substantially complete with the exception of the construction and installation of the modified pilot treatment system and connection of the

existing monitor well (MW-29) to the treatment system. The construction and operation of the modified pilot groundwater extraction and treatment system will be implemented concurrently with CMS Report preparation and the results of operation and monitoring will be available in advance of preparation of the full-scale treatment system design which is part of Corrective Measures Implementation.

1.2.2.3 Groundwater Modeling

As outlined in the initial 2003 CMS Work Plan (H+A, 2003a), groundwater modeling was anticipated to be conducted to support evaluation of corrective measures alternatives. In 2003, the conceptual model of the groundwater system did not anticipate the complexities of the groundwater system which were subsequently defined and refined during groundwater assessment activities. Construction of the numerical flow model was initiated in 2011 and was not completed until late 2012 after the results of groundwater assessment had largely defined the general orientation and configuration of the fold along Malvern Avenue. Calibration of the groundwater flow model was largely completed in 2013. Based on the structural complexities and the highly transient groundwater conditions, solute transport modeling is not planned.

As discussed during the September 25, 2013 meeting with DTSC, the current groundwater flow model is adequate to support evaluation of groundwater corrective action alternatives using capture zone analysis. The model construction and results of calibration will be documented in a technical memorandum along with the current understanding of the Conceptual Site Model. It was agreed that this technical memorandum will be prepared concurrent with CMS Report preparation, but will be submitted prior to CMS Report submittal.

2.0 REMEDIAL ACTION OBJECTIVES

General RAOs for groundwater at the Site are to protect human health and the environment. In the initial 2003 CMS Work Plan it was thought that the extent of VOCs and 1,4-dioxane in regional groundwater was limited to the former property based on the then available data and conceptual model. For the purposes of this document, the compounds of concern (COCs) are compounds related to former HAC/Raytheon operations at the Site detected in the regional aquifer at concentrations exceeding their drinking water maximum contamination levels (MCLs) or in the case of 1,4-dioxane exceeding the California Notification Level. As described in Section 1.2.2.1 and discussed during the January 16, 2014 meeting with DTSC, subsequent groundwater assessment has indicated that VOCs and 1,4-dioxane were detected over a greater area of the regional groundwater; as such, the specific RAOs for groundwater are as follows:

- Prevent unacceptable exposure to groundwater containing COCs;
- Establish containment areas within the regional groundwater system to control future residual COC migration from former source areas; and
- Contain COCs in groundwater to protect current and future uses of groundwater with a short term goal of not exceeding drinking water MCLs at point(s) of compliance and a long-term goal of attaining drinking water MCLs in groundwater to the extent practical.

Corrective measures for groundwater will be evaluated in the CMS Report with respect to the RAOs for groundwater listed above and the following drinking water standards at existing and potential receptors: Federal and California State drinking water Maximum Contaminant Levels and California Notification Levels.

3.0 CORRECTIVE MEASURES ALTERNATIVES

Corrective measures alternatives will be evaluated for groundwater at the Site. Technologies demonstrated to be appropriate at sites with similar compounds of concern will be evaluated to select a preferred corrective measure alternative. As discussed during the September 25, 2013 meeting with DTSC, given the area and depth at which VOCs and 1,4-dioxane have been detected, permeable reactive barriers and in-situ technologies will be screened out early in the CMS Report and the following technologies will be retained: monitored natural attenuation (MNA); institutional controls; and pump and treat. In addition the No Action alternative will be evaluated for comparative purposes.

Monitored natural attenuation requires development of a monitoring program after natural attenuation has been selected as either a portion of or as the entire groundwater correction action. The monitoring program is intended to verify the performance of the corrective action and allow for modifications to the approach, as necessary.

Pump and treat will be evaluated to assess several containment alternatives and will include evaluation of various options for treated water use/disposal. More specifically, the treated water use and disposal options will include: non-potable reuse; reinjection, and/or sewer disposal. VOCs and 1,4-dioxane are the target compounds in groundwater. Based on the concentration of these compounds, the treatment technologies for pump and treat alternatives will be limited to advanced oxidation processes with liquid-phase carbon adsorption. These treatment technologies have been demonstrated to be appropriate at sites with similar compounds of concern and have been/will be subject to bench and/or pilot testing at the Site. The groundwater model developed for the CMS will be used to assess relative capture zones for different pump and treat corrective measures alternatives.

Each of the corrective action alternatives, with the exception of the no action alternative, will also include a description of one or more contingencies that could be implemented to improve the performance of the respective corrective action alternative based on key monitoring data

collected during the Corrective Measures Implementation phase (e.g., performance/point of compliance monitoring wells).

4.0 CORRECTIVE MEASURES ALTERNATIVE EVALUATION CRITERIA

Each corrective measure alternative will be evaluated based on:

- Overall protection of human health and the environment;
- Short- and long-term effectiveness and performance;
- Reduction of toxicity, mobility, and volume or mass through treatment;
- Implementability;
- Cost; and
- Green and Sustainable.

4.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Each corrective measure will be evaluated as to its overall protection of human health and the environment. The corrective measures alternatives will be evaluated to determine the degree to which potential human exposure is minimized or eliminated and the degree to which the groundwater resource is protected or improved.

4.2 EFFECTIVENESS

Each corrective measure alternative will be evaluated for long-term effectiveness by the ability to maintain reliable protection of human health. Likewise each corrective measure alternative will be evaluated for short-term effectiveness by the ability to protect community and workers during construction and implementation. Treated water use/disposal options will be evaluated to determine the ability of each to use/dispose of groundwater at the rate of groundwater extraction.

4.3 REDUCTION OF TOXICITY, MOBILITY, AND VOLUME/MASS

Each corrective measure alternative will be evaluated as to its reduction of toxicity, mobility, and volume or mass. Groundwater flow modeling will be used to project the relative percentage of contaminant mass contained by the various groundwater corrective measures alternatives.

4.4 IMPLEMENTABILITY

Each corrective measure alternative will be evaluated as to its implementability. The implementability evaluation will address the technical and administrative feasibility of implementing each corrective measure alternative. Technical feasibility will be evaluated based on the ability to implement the corrective measure alternative given the existing conditions at and downgradient of the former property. Administrative feasibility will be evaluated based on the ability to obtain permits, gain public acceptance, and receive any off-property access required for the corrective measure alternative.

4.5 COST

Each corrective measure alternative will be evaluated as to its expected cost. A preliminary cost estimate including both capital and operation and maintenance costs will be developed for each corrective measure alternative. The cost estimates will include calculations to determine the preliminary net present value of each corrective measure alternative using a seven percent discount rate.

4.6 GREEN AND SUSTAINABLE

As discussed during the September 25, 2013 meeting with DTSC, the evaluation criteria will focus on end use of treated groundwater, with preference provided to corrective measures alternatives that use treated groundwater for beneficial purposes or return treated water to the regional groundwater system.

5.0 CORRECTIVE MEASURES STUDY TASKS

Multiple tasks have been completed in support of the CMS Report. Generally the completed tasks fall within the following categories: groundwater assessment, bench/pilot testing; and construction of the groundwater flow model. Activities conducted for these tasks were described in Section 1.2.2. The following sections describe remaining CMS tasks that have been developed for evaluation of corrective measures alternatives for the Site. Each task has been designed to conform to the CACA. The additional CMS tasks are as follows:

- Complete groundwater assessment (concurrent with CMS Report preparation)
- Continue pilot testing (concurrent with CMS Report preparation)
- Document groundwater flow model construction (submittal in advance of CMS Report)
- Prepare CMS report (includes use of existing groundwater flow model)

5.1 COMPLETE GROUNDWATER ASSESSMENT

The results of the most recent groundwater assessment have been summarized in a monitor well installation report (H+A, 2013c). As discussed during the September 25, 2013 meeting with DTSC, the groundwater assessment is substantially complete with the exception of a relatively small data gap in the vicinity of monitor wells MW-37 and MW-38. This data gap will be resolved concurrently with CMS Report preparation. A new monitor well will be installed at the monitor wells MW-37 and MW-38 area. This monitor well will target Unit B, which appears to be between the screened intervals of monitor wells MW-37 and MW-38. The monitor well will be drilled and constructed by mud rotary techniques using methods and procedures documented in previous DTSC-approved work plans and as proposed in the groundwater assessment work plan addendum (H+A, 2014d). The estimated schedule for this task is summarized in Figure 5.

5.2 CONTINUE PILOT TESTING

As discussed during the September 25, 2013 meeting with DTSC, the bench and pilot testing of groundwater treatment technologies is substantially complete with the exception of the construction and installation of the new pilot treatment system and connection of the existing monitor well to the treatment system. The existing AOP technology will be replaced with an Ultraviolet Peroxide AOP technology in early 2014 to monitor and confirm treatment system performance and existing monitor well MW-29 will be connected to the extraction wellfield to enhance containment of higher concentration VOCs and 1,4-dioxane along the west side of the former property (H+A, 2013b). The construction and operation of the modified pilot groundwater extraction and treatment system will be implemented concurrently with CMS Report preparation and the results of operation and monitoring will be documented in quarterly data submittals/annual reports. The results will be available in advance of preparation of the full-scale treatment system design which is part of Corrective Measures Implementation (Figure 5).

5.3 GROUNDWATER MODEL AND CONCEPTUAL SITE MODEL DOCUMENTATION

As discussed during the September 25, 2013 meeting with DTSC, the current groundwater flow model is adequate to support evaluation of groundwater corrective action alternatives using capture zone analysis. The model construction and results of calibration will be documented in a technical memorandum along with the current understanding of the Conceptual Site Model. It was agreed that this technical memorandum will be prepared concurrent with CMS Report preparation, but will be submitted prior to CMS Report submittal (Figure 5).

5.4 PREPARE CORRECTIVE MEASURES STUDY REPORT

A draft CMS report will be prepared and submitted to the DTSC for review and comment. The draft CMS report will summarize the results of groundwater flow modeling and include a description of the corrective measures alternatives evaluated and the results of those evaluations. The corrective measure evaluation will be assessed based on the evaluation

criteria, and the preferred corrective measure(s) will be identified. A proposed outline for the CMS report has been prepared (Appendix A). As discussed during the September 25, 2013 meeting with DTSC, the groundwater flow modeling and draft CMS report preparation will be completed within 6 months of DTSC approval of this CMS Work Plan Update (Figure 5).

A final draft CMS report will be prepared to incorporate comments received from DTSC and other agencies, as appropriate.

6.0 PROJECT ORGANIZATION

The project organization outlined in the initial 2003 CMS Work Plan remains the same.

7.0 PROJECT SCHEDULE

The schedule for the CMS Report and associated tasks has been provided (Figure 5). The schedule outlines the proposed timeframe to perform and complete the CMS. The schedule may be modified in conjunction with the DTSC.

To the extent that this CMS Work Plan Update is approved by DTSC in February 2014, it is anticipated that the draft CMS report would be submitted to the DTSC in August 2014 (Figure 5). Within 45 days of receipt of comments from DTSC, a final draft CMS report that responds to DTSC comments will be submitted to DTSC. It is assumed the final draft CMS report will then be ready for public comment.

8.0 REFERENCES

California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), 2003. Corrective Action Consent Agreement, Raytheon Company, 1901 W. Malvern Ave., Fullerton, California 92634, EPA ID No. CAD063109243. Docket HWCA: P3-01/02-001. January 15, 2003.

Hargis + Associates, Inc. (H+A), 2003a. Corrective Measures Study Workplan, Raytheon Company, (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. April 25, 2003.

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_____, 2003c. Additional Groundwater Assessment Work Plan, *Revision 1.0*, Raytheon Company, (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. April 25, 2003.

_____, 2004a. Additional Groundwater Assessment Work Plan, Addendum No. 1, Raytheon Company (formerly Hughes Aircraft Company, 1901 West Malvern Avenue, Fullerton, California. March 23, 2004.

_____, 2004b. Groundwater Treatment Pilot Testing Corrective Measures Study Workplan (Revision 1.0), Addendum No. 2, Raytheon Company, (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. April 20, 2004.

_____, 2004c. Letter from C.G.A. Ross to W.F. Jeffers, DTSC, re Amendment A, Additional Groundwater Assessment Workplan Addendum 1, Former Raytheon Company Site, 1901 West Malvern Avenue, Fullerton, California. June 1, 2004.

_____, 2004d. Letter from C.G.A. Ross to W.F. Jeffers, DTSC, re Amendment B, Additional Groundwater Assessment Workplan Addendum 1, Former Raytheon Company Site, 1901 West Malvern Avenue, Fullerton, California. July 29, 2004.

_____, 2004e. Groundwater Treatment Pilot Test Summary Report, Raytheon Company, (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. October 26, 2004.

_____, 2005a. Letter from Mr. Christopher Ross to Mr. William Jeffers, California Environmental Protection Agency, Department of Toxic Substances Control, re. Addendum No. 3, Groundwater Treatment Pilot Testing, Corrective Measures Study Workplan, for Raytheon Company (Former Hughes Aircraft Company Site), 1901 West Malvern Avenue, Fullerton, California. January 18, 2005

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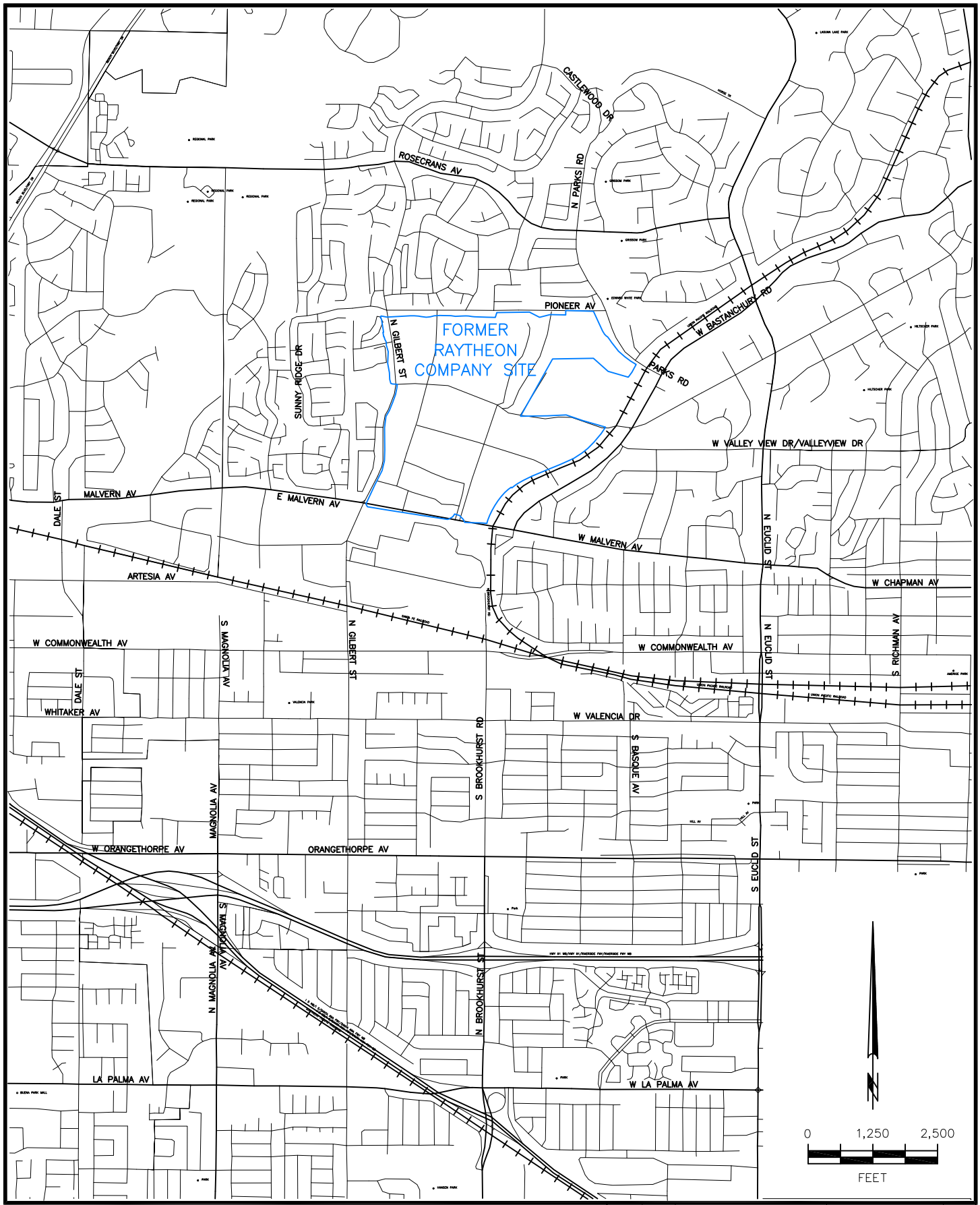

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5/11	RPT NO. 532.31	410-8281	A

FIGURE 1. SITE LOCATION

EXPLANATION

- MW-09 — GROUNDWATER MONITOR WELL
- MW-25 — GROUNDWATER PIEZOMETER
- P-09 — PERCHED ZONE PIEZOMETER
- EW-01 — GROUNDWATER EXTRACTION WELL
- MW-10 — FORMER GROUNDWATER MONITOR WELL (ABANDONED)
- P-04 — FORMER PERCHED ZONE PIEZOMETER (ABANDONED)
- DPE-05 — FORMER PERCHED ZONE DUAL-PHASE EXTRACTION WELL (ABANDONED)
- EB-01 — FORMER GROUNDWATER ASSESSMENT SOIL BORING (ABANDONED)
- PGETS — PILOT GROUNDWATER EXTRACTION AND TREATMENT SYSTEM FACILITY COMPOUND
- 609 — FORMER RAYTHEON BUILDING, DEMOLISHED MID-2000
- CURRENT RESIDENTIAL AND COMMERCIAL BUILDINGS
- DRIVEWAYS, PARKING LOTS AND OTHER HARDSCAPE OF SITE RE-DEVELOPMENT
- SITE BOUNDARY

MW-37 MW-38 MW-34 MW-39 MW-36 MW-32 MW-33 MW-35 MW-40 MW-31 MW-29 MW-30 MW-08 MW-15 MW-23 MW-28 MW-27 MW-22 MW-17 MW-19 MW-18 MW-13A MW-26/EB-04 MW-24 MW-21 MW-25/EB-03 EW-01 MW-16 MW-09 MW-20 MW-07 MW-06 MW-05 MW-11 MW-10 MW-12 MW-14 P-01 P-02 P-03 P-04 P-05 P-06 P-07 DPE-01 DPE-02 DPE-03 DPE-04 DPE-05 DPE-06 EB-01 EB-02

SEE DETAIL BELOW

ROCKLEDGE WAY, MEADOWBROOK WAY, VESTAVIA AVE, EMERYWOOD DRIVE, KENWOOD AVENUE, MONTICELLO AVENUE, LINKS ROAD, MALVERN AVENUE, BREA CREEK, LAKEKNOLL DRIVE, OAK STREET, NORTHAMPTON WAY, SHERIDAN RD, NEWCASTLE LN, WILLIAMSBURG RD, BAYBERRY WAY, BAYCREST PL, ROXBURY DR, BRIGHTON PL, ASHTON PL, FOXBOROUGH PL, BURNING TREE RD, N SEVILLE PL, FRANKLIN HILLS DR, CHATSWORTH PL, MONTEREY PL, CYPRESS POINT DR, RAMADA PLAZA, N CANDLEWOOD DR, N FAIR RD, SUNNY RIDGE DR, CARMEL CIR, CREEKSIDE DR, WINDSOR WAY, SANDBAR DR, W MILLSTREAM DR, BRIDGE WAY, MILLSTREAM DR, NORTH GILBERT STREET, STANBURY STREET, STERN-GOODMAN STREET, HUGHES DRIVE, COOLING TOWER, 601, 609, ROSES, OLD WAY, LINENS 'N THINGS, COMPUTER LITERACY, DEER HORNS, RETAIL, TARGET, ALBERTSONS, BARNES & NOBLE BOOKS, RESTAURANT AND RETAIL, BANK, A. T. & S. F. ARTESIA, RAILROAD BLVD, CITY OF FULLERTON WELL NO. 9, FULLERTON MUNICIPAL AIRPORT, OCWD AIRPORT TEST WELL 3S/11W-36A6, MOORE AVENUE, BURNING TREE ROAD, AIRPARK DRIVE, RAYMER AVENUE, GILBERT STREET, PRITCHARD AVENUE

0 250 500 FEET

DETAIL AREA

0 50 100 FEET

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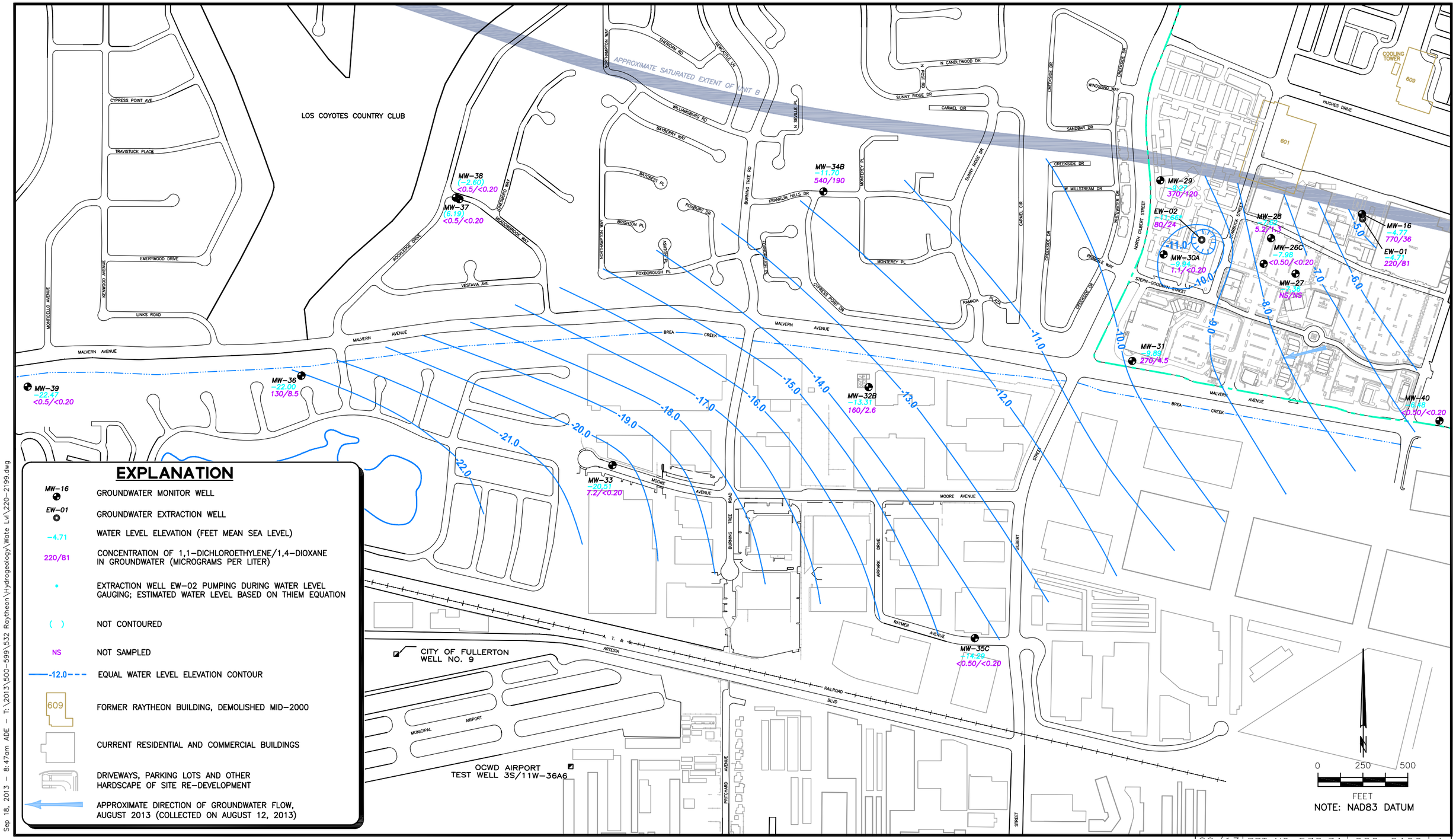
FIGURE 2.
WELL AND PIEZOMETER LOCATIONS



EXPLANATION

MW-16	GROUNDWATER MONITOR WELL
EW-01	GROUNDWATER EXTRACTION WELL
-4.71	WATER LEVEL ELEVATION (FEET MEAN SEA LEVEL)
220/81	CONCENTRATION OF 1,1-DICHLOROETHYLENE/1,4-DIOXANE IN GROUNDWATER (MICROGRAMS PER LITER)
*	EXTRACTION WELL EW-02 PUMPING DURING WATER LEVEL GAUGING; ESTIMATED WATER LEVEL BASED ON THIEM EQUATION
( )	NOT CONTOURED
NS	NOT SAMPLED
-12.0	EQUAL WATER LEVEL ELEVATION CONTOUR
609	FORMER RAYTHEON BUILDING, DEMOLISHED MID-2000
	CURRENT RESIDENTIAL AND COMMERCIAL BUILDINGS
	DRIVEWAYS, PARKING LOTS AND OTHER HARDSCAPE OF SITE RE-DEVELOPMENT
	APPROXIMATE DIRECTION OF GROUNDWATER FLOW, AUGUST 2013 (COLLECTED ON AUGUST 12, 2013)

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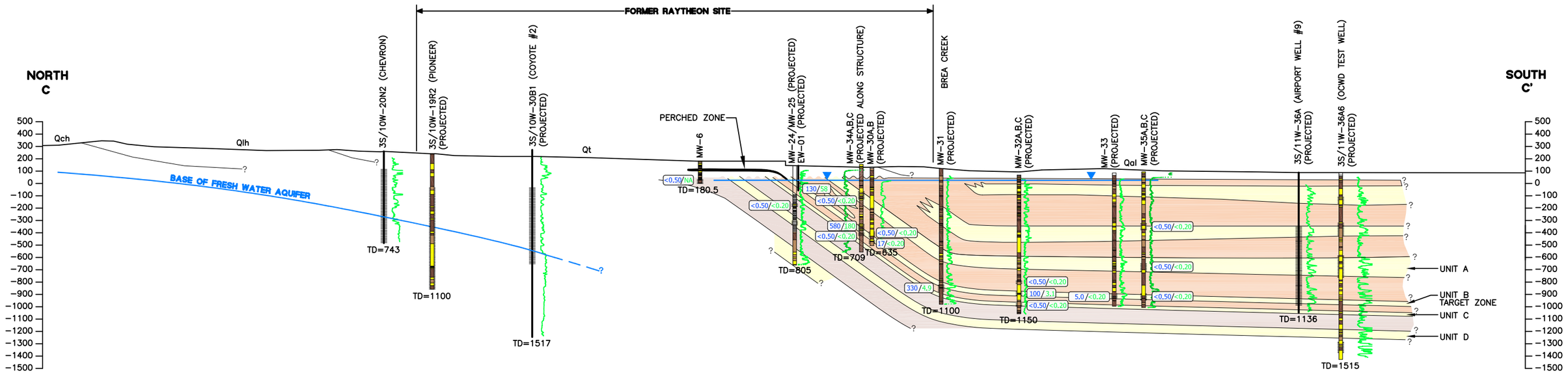
FIGURE 3.
WATER LEVEL AND WATER QUALITY UNIT B
AUGUST 2013

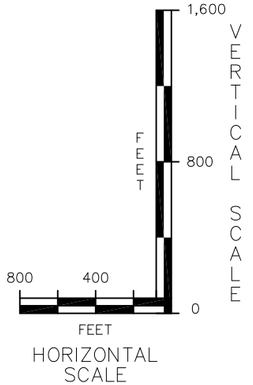


EXPLANATION

- RELATIVELY COARSE ZONE, PREDOMINANTLY SANDS WITH LITTLE TO NO SILT OR CLAY
- MIXED ZONE, MIXTURES OF SANDS, CLAYS, AND SILTS
- RELATIVELY FINE ZONE, PREDOMINANTLY SILTS OR CLAYS WITH LITTLE TO NO SAND
- PREDOMINANTLY COARSE ZONE
- MIXED ZONE
- RELATIVELY FINE ZONE
- SCREENED INTERVAL OF MONITOR WELL

LGRD
0 (OHM-M) 100 500

RESISTIVITY LOG (ohm-m) (LATERAL OR SHORT-NORMAL) OF WELL BOREHOLE. RIGHT EDGE OF THE LITHOLOGIC LOG COLUMN IS THE ZERO ohm-m LINE.



Qal	ALLUVIUM, HOLOCENE: UNCONSOLIDATED AND POORLY CONSOLIDATED GRAVEL, SAND AND SILT.
Qt/ Qoa	TERRACE DEPOSITS/OLDER ALLUVIUM, UPPER PLEISTOCENE TO HOLOCENE: POORLY CONSOLIDATED GRAVEL, SAND AND SILT, COMMONLY REDDISH-BROWN; LOCALLY RED-BROWN SILT.
Qlh	LA HABRA FORMATION, UPPER PLEISTOCENE: OLIVE-GRAY TO RED-BROWN SILTSTONE; PALE YELLOW-BROWN TO RED-BROWN THICK-BEDDED FRIABLE SANDSTONE; PALE-YELLOW-GRAY POORLY BEDDED PEBBLY SANDSTONE; AND PALE-YELLOW-BROWN UNSORTED PEBBLE-COBBLE CONGLOMERATE; BASAL PART FILLS IRREGULAR CHANNELS CUT INTO UNDERLYING STRATA.
Qch	COYOTE HILLS FORMATION, UPPER PLEISTOCENE: MODERATE YELLOW-BROWN TO MODERATE BROWN THICK-BEDDED TO MASSIVE FRIABLE PEBBLY SANDSTONE; OLIVE-GRAY TO GRAY-BROWN MASSIVE SILTSTONE; AND YELLOW-BROWN MASSIVE SANDSTONE AND PEBBLE CONGLOMERATE.
330	1,1-DICHLOROETHYLENE CONCENTRATION, MICROGRAMS PER LITER, FEBRUARY 2013 UNLESS OTHERWISE INDICATED
NS	NOT SAMPLED
4.9	1,4-DIOXANE CONCENTRATION, MICROGRAMS PER LITER, FEBRUARY 2013 UNLESS OTHERWISE INDICATED
	NOTE: SURFACE DISTRIBUTION OF STRATIGRAPHIC UNITS AND DESCRIPTIONS OF STRATIGRAPHIC UNITS EXCERPTED FROM YERKES, 1972.
▼	APPROXIMATE UNIT B GROUNDWATER LEVEL, FEBRUARY 2013
?	QUERIED WHERE INFERRED
NOTE:	NOT ALL ON-SITE WELLS ARE DEPICTED ON CROSS SECTION

CROSS SECTION LOCATION

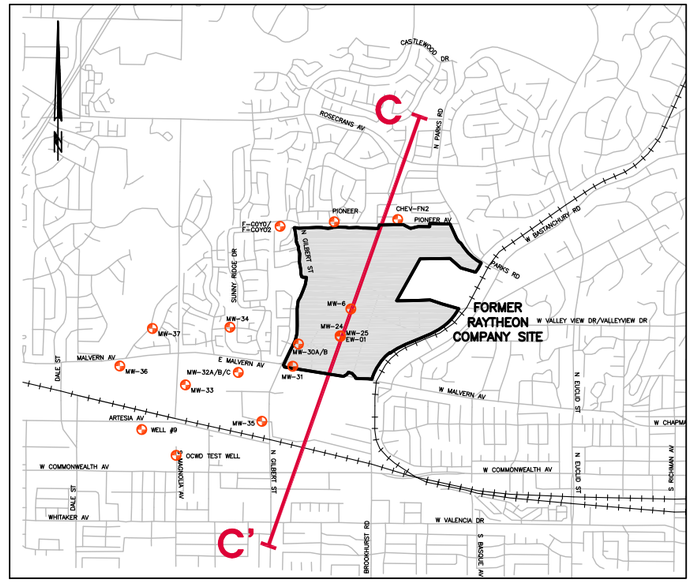


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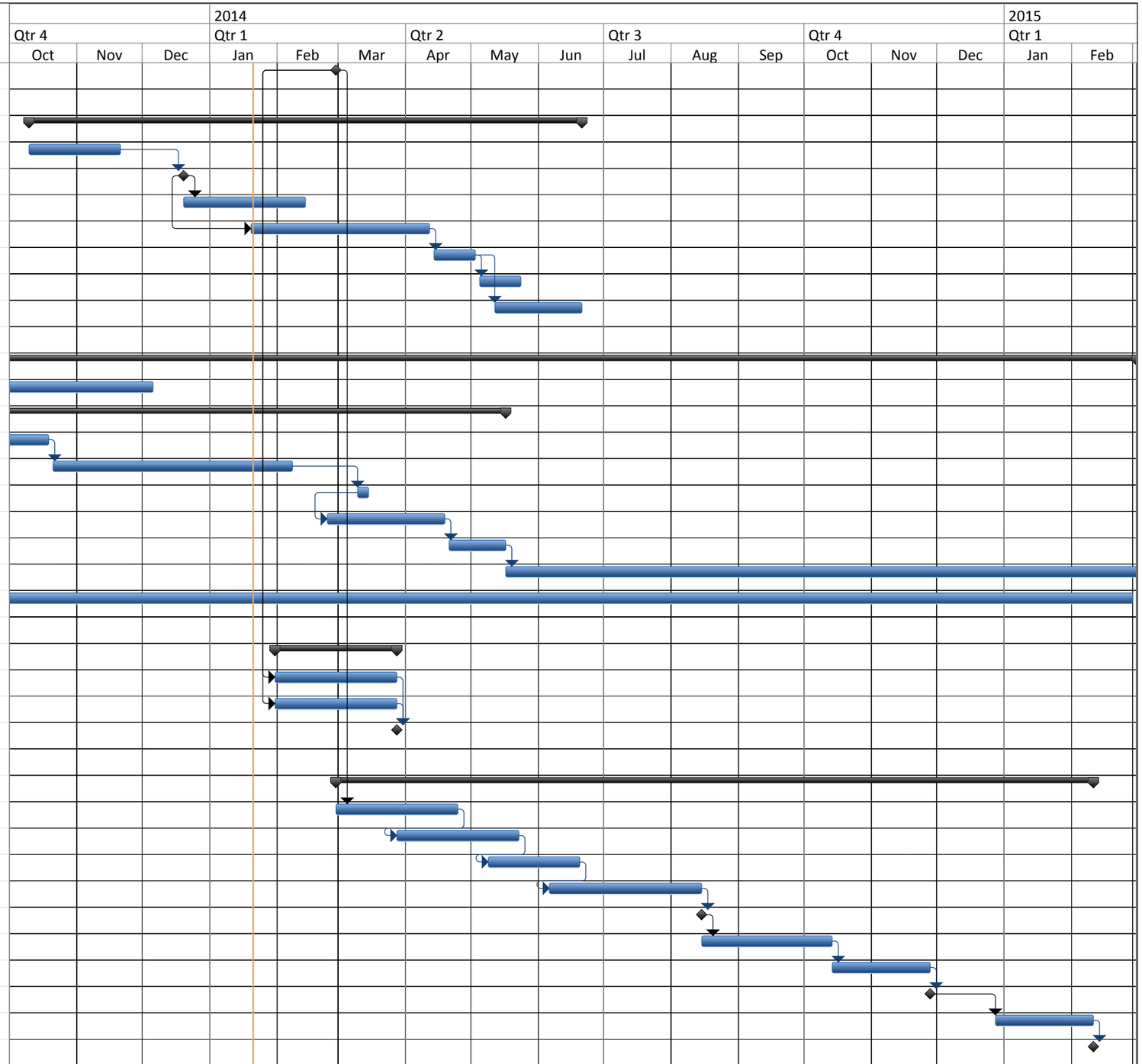
FIGURE 4.
REGIONAL CONCEPTUAL GROUNDWATER MODEL HYDROGEOLOGIC CROSS-SECTION C-C'

ID	Task Mode	Task Name
1		**DTSC APPROVAL OF CMS WORK PLAN UPDATE**
2		
3		**GROUNDWATER ASSESSMENT**
4		DTSC, OCWD and Raytheon finalization of well design
5		Submit Well Installation Report and Work Plan Addendum
6		DTSC review and approval
7		Obtain Access
8		Mobilize, drill and develop monitor well
9		Initial and confirmation samples
10		Prepare Data Submittal
11		
12		**PILOT TESTING**
13		**Operate, Maintain and Monitor EW-2 system**
14		**Upgrade system**
15		Finalize designs
16		Permitting and contracting
17		Ship treatment system to Site
18		Construction
19		Start-Up
20		**Operate, Maintain and Monitor upgraded system**
21		**Quarterly submittals and annual reports**
22		
23		**GROUNDWATER TECHNICAL MEMORANDUM**
24		Prepare Groundwater Model Documentation
25		Prepare Conceptual Site Model Documentation
26		Submit Technical Memorandum to DTSC
27		
28		**CORRECTIVE MEASURES STUDY**
29		Assemble Pump and Treat Alternatives
30		Conduct Groundwater Flow Modeling
31		Prepare Cost Estimates
32		Prepare draft Report
33		Submit Report to DTSC
34		DTSC Review and Comment
35		Revise CMS Report
36		Submit Final Draft to DTSC
37		Public Comment
38		Remedy Selection



Project: 532 2013-10 Figure 5
Date: Tue 1/21/14

Task Milestone Summary

FIGURE 5. TENTATIVE CORRECTIVE MEASURES STUDY SCHEDULE

APPENDIX A

CORRECTIVE MEASURES STUDY REPORT OUTLINE

APPENDIX A

CORRECTIVE MEASURES STUDY REPORT OUTLINE

1. INTRODUCTION
   - 1.1. PURPOSE AND SCOPE
   - 1.2. SITE BACKGROUND
     - 1.2.1. Location and History of Operations
     - 1.2.2. Regulatory History
     - 1.2.3. Geology
     - 1.2.4. Hydrogeology
     - 1.2.5. Summary of Impacts

2. CORRECTIVE MEASURES STUDY
   - 2.1. GROUNDWATER ASSESSMENT
   - 2.2. SITE CONCEPTUAL MODEL
   - 2.3. PILOT TESTS
   - 2.4. GROUNDWATER FLOW MODELING
   - 2.5. PRODUCTION WELL STATUS UPDATE

3. CORRECTIVE ACTION OBJECTIVES FOR GROUNDWATER

4. GROUNDWATER CORRECTIVE MEASURE TECHNOLOGIES
   - 4.1. IDENTIFICATION AND SCREENING OF POTENTIAL TECHNOLOGIES
   - 4.2. DESCRIPTION OF RETAINED TECHNOLOGIES
     - 4.2.1. No Action
     - 4.2.2. Institutional Controls
     - 4.2.3. Monitored Natural Attenuation
     - 4.2.4. Pump and Treat

5. GROUNDWATER CORRECTIVE MEASURES ALTERNATIVES
   - 5.1. CORRECTIVE MEASURE ALTERNATIVE EVALUATION CRITERIA
     - 5.1.1. Protection of Human Health and the Environment
     - 5.1.2. Short-Term and Long-Term Effectiveness
     - 5.1.3. Reduction of Toxicity, Mobility, and Volume/Mass
     - 5.1.4. Implementability
     - 5.1.5. Cost
     - 5.1.6. Green and Sustainable
   - 5.2. .CORRECTIVE MEASURE ALTERNATIVES
     - 5.2.1. Alternative GW1: No-Action
     - 5.2.2. Alternative GW2: Monitored Natural Attenuation
     - 5.2.3. Alternative GW3 to GWx Pump-and-Treat (combination of different extraction wellfields, and disposal/reuse of treated groundwater)

6. CONTINGENCIES FOR GROUNDWATER CORRECTIVE MEASURES ALTERNATIVES
   - 6.1. ALTERNATIVE GW2: MONITORED NATURAL ATTENUATION
   - 6.2. ALTERNATIVE GW3 TO GWX: PUMP AND TREAT

APPENDIX A
CORRECTIVE MEASURES STUDY
REPORT OUTLINE (continued)

7. RECOMMENDED GROUNDWATER CORRECTIVE MEASURE
   7.1. PROPOSED GROUNDWATER CORRECTIVE ACTION OBJECTIVES
   7.2. RECOMMENDED GROUNDWATER CORRECTIVE MEASURE

8. REFERENCES CITED

APPENDICES

Appendix

A GROUNDWATER FLOW MODELING

B CORRECTIVE MEASURES ALTERNATIVE COST ESTIMATES