

*FINAL*

**INTERIM YEAR 2 ANNUAL REPORT**

**ENVIRONMENTAL MONITORING SERVICES for COLORADO RIVER  
CORRIDOR PLAN**

TRAVIS COUNTY, TEXAS  
Contract No. PS110046JW

September 2014

Prepared for:  
Travis County, Texas

Prepared by:  
URS Corporation  
9400 Amberglen Boulevard  
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Independent Review by:  
John M. Sharp, Jr.

**PROFESSIONAL GEOSCIENTIST CERTIFICATION**

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**Interim Year 2 Annual Report Environmental Monitoring Services for  
Colorado River Corridor Plan**

Travis County, Texas

September 2014

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In accordance with the Texas Professional Geoscience Practice Act (Title 6, Texas Occupations Code, Chapter 1002; Senate Bill 405, 77th Legislature) and the Administrative Rules of the Texas Board of Professional Geoscientist (Title 22, Texas Administrative Code, Part 39, Chapter 850 and 851), the geoscientific information contained in the Interim Year 2 Annual Report Environmental Monitoring Services for Colorado River Corridor Plan dated September 2014 for Travis County, Texas has been reviewed by a registered professional geoscientist.

This is to certify that the findings, specifications, and/or professional opinions presented in this report have been prepared in accordance with generally accepted professional geologic and hydrogeologic practice. I hereby certify that I have prepared and/or reviewed the information presented in the Interim Year 2 Annual Report Environmental Monitoring Services for Colorado River Corridor Plan dated September 2014 and have found that the report is consistent with accepted geoscientific principles and practices.



Signature

*Kevin Pasternak*

Kevin Pasternak, P.G.  
Texas LPG No. 2469  
URS Corporation, a Nevada Corporation

Date

*9/18/2014*

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## List of Acronyms and Abbreviations

%	percent
µg/L	micrograms per liter
ABIA	Austin Bergstrom International Airport
ATF	Austin Tree Farm
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CRC	Colorado River Corridor
CRCP	Colorado River Corridor Plan
DTW	depth to water
FM	Farm-to-Market
ft	feet, foot
gpm	gallons per minute
ID	identification
LCRA	Lower Colorado River Authority
meq/L	milliequivalents per liter
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
MTBE	methyl tertiary butyl ether
MWS	Manville Water Supply Corporation
NA	not analyzed
NC	not calculated
NM	not measured
NTN	Native Texas Nursery
PAH	polycyclic aromatic hydrocarbon
PCL	protective concentration level
PM	particulate matter
PM <sub>10</sub>	particulate matter less than 10 microns in diameter
PM <sub>2.5</sub>	particulate matter less than 2.5 microns in diameter
SH	State Highway

## List of Acronyms and Abbreviations (Continued)

SM	Standard Method
SOP	Standard Operating Procedure
TCEQ	Texas Commission on Environmental Quality
TD	total depth
TDS	total dissolved solids
TDWR	Texas Department of Water Resources
TOC	top of casing
TPH	total petroleum hydrocarbons
TRRP	Texas Risk Reduction Program
TSS	total suspended solids
TWDB	Texas Water Development Board
TXI	Texas Industries, Inc.
URS	URS Corporation
VOC	volatile organic compound
WSC	Water Supply Company

## 1.0 INTRODUCTION

Travis County anticipates that Texas Industries, Inc. (TXI) will begin sand and gravel mining at their Hornsby Bend East and Hornsby Bend West mine locations. This Annual Report was prepared by URS Corporation (URS) to document the findings of the groundwater availability and groundwater quality monitoring during Interim Year 2 within the vicinity of the anticipated mining locations.

The Interim Year 2 groundwater availability and groundwater quality monitoring was a continuation of the Baseline and Interim Year 1 tasks. The Interim Year 2 data will be used to update and or adjust baseline values collected during 2011, 2012, and 2013 and previously presented in the *Final Baseline Report Environmental Monitoring Services for Colorado River Corridor Plan* (URS, August 2012) and the *Final Interim Year 1 Annual Report Environmental Monitoring Services for Colorado River Corridor Plan* (URS, November 2013). Groundwater availability was monitored by performing synoptic water level measurements across the site during four events and groundwater quality was monitored during May 2014 by collecting and analyzing water samples for basic water quality parameters. Additionally total petroleum hydrocarbon (TPH) and polycyclic aromatic hydrocarbon (PAH) groundwater samples were collected during Interim Year 2. Baseline and Interim Year groundwater elevation and water quality data will serve as a reference point for comparison to groundwater conditions during future mining activities.

The work described herein was performed in accordance with methods described in the *Final Sampling and Analysis Plan for Environmental Monitoring Services for Colorado River Corridor Plan* (URS, October 2011) (hereafter referred to as the *Sampling and Analysis Plan*). URS performed the work for Travis County under the Professional Services Agreement between Travis County and URS for Environmental Monitoring Services for Colorado River Corridor Plan (CRCP), contract number PS110046JW.

### *Limitations and Qualifications*

URS' work on this project shall not be intended as a warranty or guarantee of site conditions other than that it reflects professional judgment based on present standards and care of the profession.

## 1.1 Background

The CRCP study area covers over 30,000 acres in eastern Travis County (Figure 1-1). The CRCP study area is bounded by US 183 to the west, the Travis County/Bastrop County line to the east, by Farm-to-Market (FM) 969 to the north and State Highway (SH) 71 to the south. Approximately 3,000 acres within the Colorado River Corridor (CRC) are planned to be mined for sand and gravel by TXI at their Hornsby Bend East and Hornsby Bend West sand mining sites. The proposed TXI mining sites are located east of SH 130 and south of FM 969 along both sides of Dunlap Road (Figure 1-2).

### *Geology and Groundwater*

The surface strata over much of the CRCP study area consist of scattered remains of terrace deposits and stream or river alluvium, ranging in age from Pleistocene to Recent. The terrace

deposits consist of sand, gravel, and clay. They occur at higher elevations than the more recent floodplain deposits. The stream or river alluvium is composed of up to 60 feet (ft) of unconsolidated material, chiefly gravel, sand, and silt. Underlying the terrace and alluvial strata is the Cretaceous-aged Navarro and Taylor Groups, consisting of massive beds of shale, siltstone, marl, and chalk with clay (Brune, Gunnar and Duffin, June 1983). Based on a review of lithologic logs and well reports, the Navarro and Taylor Groups contact with the overlying alluvial deposits is at approximately 65 to 30 ft below ground surface (bgs).

The principal source of usable groundwater in the CRCP study area is from the Colorado River Alluvial Aquifer. This aquifer produces small to very large quantities of fresh to slightly saline groundwater. Based on a review of lithologic logs and well reports, the sand and gravel deposits within the Colorado River Alluvial Aquifer range from approximately 8 to 60-ft thick. Recharge to the aquifer in the CRCP study area is principally from rainfall on the outcrop and tributary streams. The Colorado River is in hydraulic contact with the aquifer and is suspected of influencing groundwater elevations and movement within the aquifer.

The Navarro and Taylor Groups can produce small quantities of groundwater, particularly in the weathered surface layers where fractures and shrink/swell cracking of the clay-rich surface occurs and conveys water into thin sand layers. Historically, many wells placed into this formation have been abandoned due to poor production (CRCP, September 2011).

## **1.2 Objectives**

The objectives of this Annual Report are to:

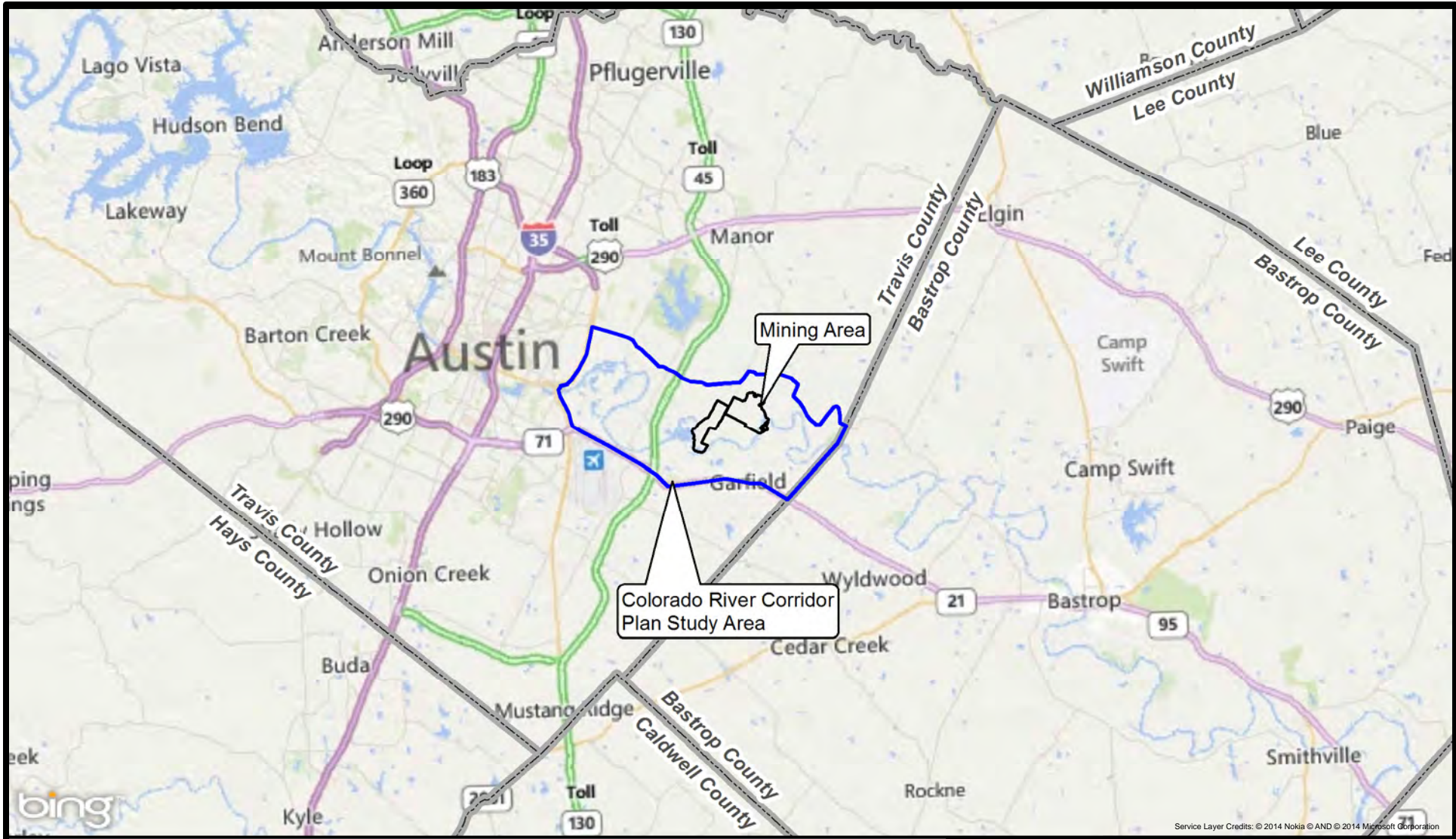
- Summarize all field activities and laboratory analyses performed during Interim Year 2 for environmental monitoring of groundwater;
- Present field data and analytical results;
- Provide an interpretation of the groundwater monitoring results;
- Update the groundwater baseline environmental conditions with Interim Year 2 results; and
- Present conclusions and recommendations.

## **1.3 Report Organization**

The Annual Report is organized as follows:

Section 1.0 – Introduction;  
Section 2.0 – Previous Environmental Monitoring;  
Section 3.0 – Interim Year 2 Field Activities;  
Section 4.0 – Environmental Monitoring Data Evaluation;  
Section 5.0 – Conclusions and Recommendations; and  
Section 6.0 – References.

Field forms are included in Appendix A, laboratory analytical reports are included in Appendix B, and historical precipitation data is included in Appendix C.



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<b>Legend</b>	
	County Boundary
	Mining Area
	Colorado River Corridor Plan Study Area

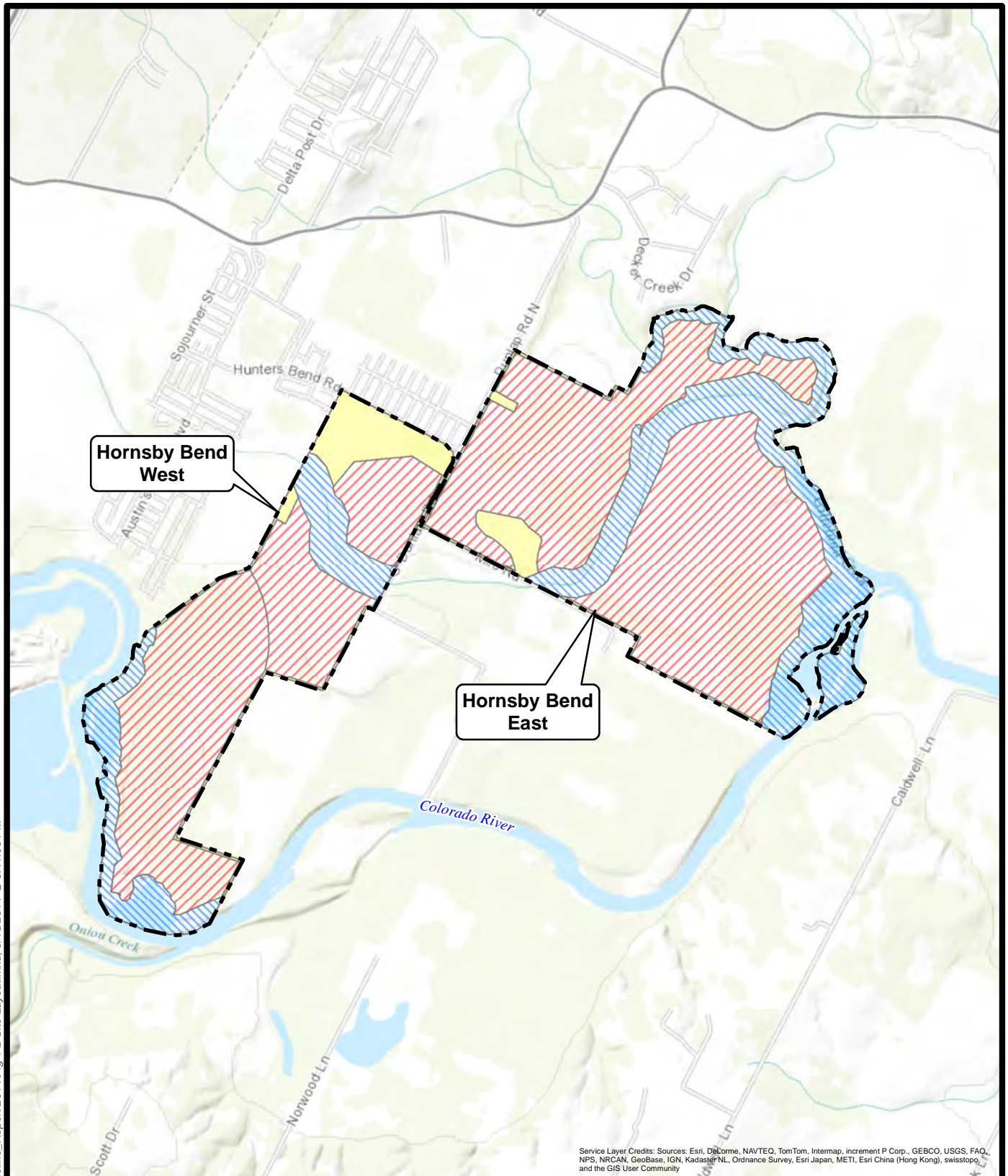
Miles

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Drawn by:  
gary\_callahan

Site: Travis County CRCP	
Title: <b>Figure 1-1 Regional Location Map</b>	
Date: 13 Sep 2014	Drawing File: Fig 1-1 Loc Map
Figure: 1-1	



K:\PROJECTS\Travis County CRCP\Baseline\_Report\2014\Fig 1-2 Site Layout.mxd, 9/13/2014 @ 8:41:03 PM

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

**Legend**

- TXI Mining Site
- City of Austin Buffer
- Mining Area
- Non-Mining Area

3,000 1,500 0 3,000  
Feet

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Drawn by:  
gary\_callahan

Site:	Travis County CRCP		
Title:	<p align="center"><b>Figure 1-2</b> <b>Anticipated Mining Area</b></p>		
Date:	13 Sep 2014	Drawing File:	Fig 1-2 Site Layout
Figure:	1-2		

## 2.0 PREVIOUS ENVIRONMENTAL MONITORING

Previous environmental monitoring was performed at the site to establish pre-mining environmental conditions for groundwater quality and availability, air quality, and noise levels.

Previous groundwater tasks completed during the Baseline and Interim Year 1 included:

- Conducting a well inventory review and a site reconnaissance;
- Obtaining well access permission from land owners;
- Surveying the coordinates and top of casing elevation of wells included in the monitoring network;
- Collecting groundwater quality and availability data from October 2011 to May 2012 during 6 sampling events;
- Collecting groundwater availability data from August 2012 to June 2013 during 4 quarterly events; and
- Collecting groundwater quality samples, including volatile organic compounds (VOCs), TPH, and PAHs, during the June 2013 sampling event.

The list of wells identified and used in the groundwater monitoring program is included in Table 2-1 and shown on Figure 2-1.

Previous air monitoring tasks completed during the Baseline Year included:

- Conducting site visits to determine locations for air sample collection;
- Obtaining site access permission from land owners for air sample collection; and
- Collecting baseline levels of suspended particulate matter (PM) in the 2.5 microns (PM<sub>2.5</sub>) and 10 microns (PM<sub>10</sub>) size fractions during four, multi-day periods from October 2011 to May 2012.

Previous noise level monitoring tasks completed during the Baseline Year included:

- Conducting site visits to determine noise sensitive land uses and terrain features;
- Obtaining site access permission from land owners for noise sample collection; and
- Collecting two rounds of short-term and long-term noise measurements from October 26 to November 3, 2011 and from March 20-30, 2012.

Baseline groundwater quality, air quality, and noise levels were evaluated and criteria for comparing groundwater, air and noise during mining to pre-mining, baseline conditions were established. The Baseline Year environmental monitoring tasks completed and the proposed evaluation criteria are presented in the *Final Baseline Report for Environmental Monitoring Services for Colorado River Corridor Plan* (URS, August 2012). The groundwater monitoring tasks completed during Interim Year 1 and the updated groundwater criteria based on these tasks are presented in the *Final Interim Year 1 Annual Report Environmental Monitoring Services for Colorado River Corridor Plan* (URS, November 2013).

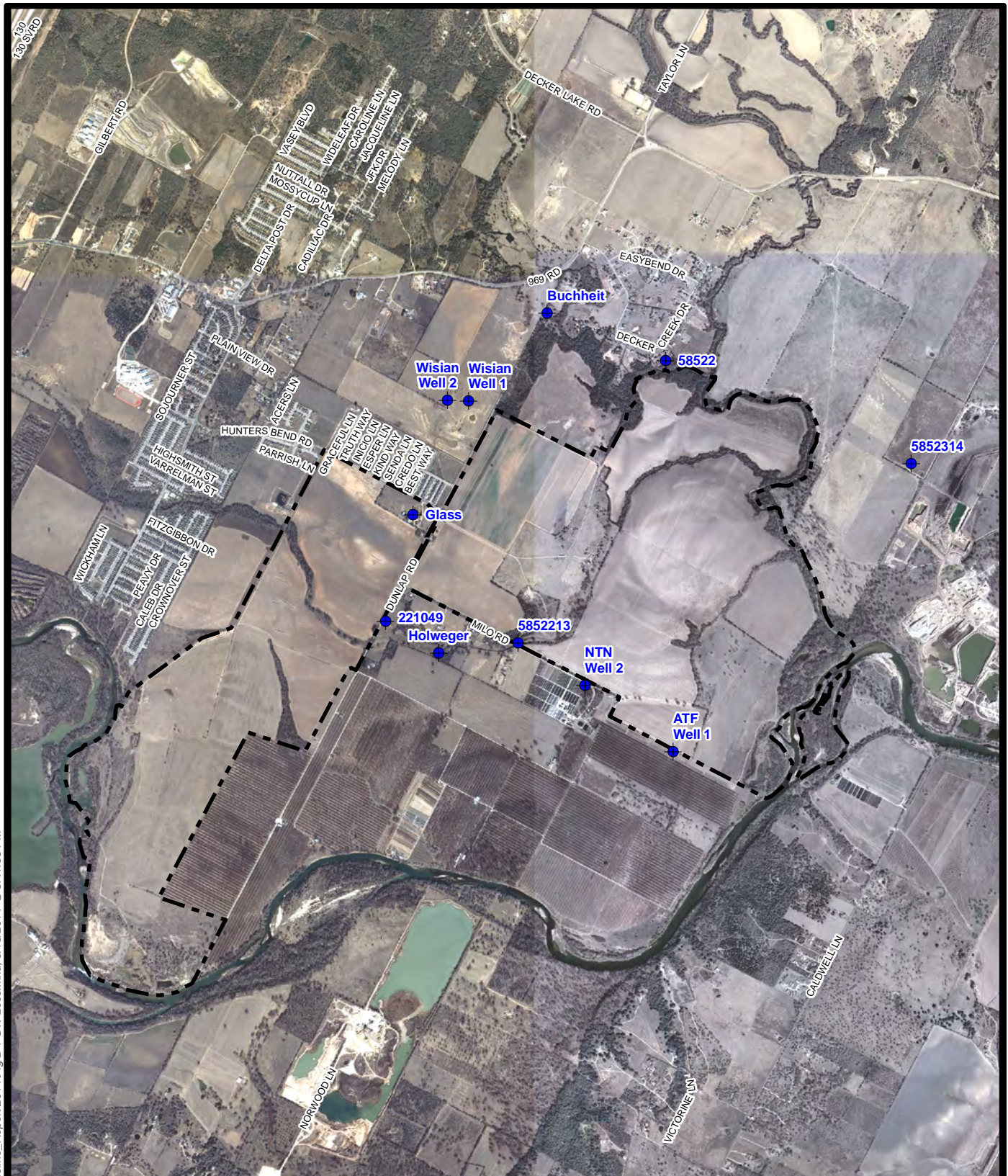
**Table 2-1. Groundwater Wells for Groundwater Monitoring Program**

Well ID	Well Owner	Northing	Easting	TOC Elevation (ft msl)	Diameter (inches)	TD (ft, TOC)	Active Pumping	Notes
58522	Douglas Edgar	10063222.73	3174211.78	414.637	4	56.36	Yes, occasional use for lawn care	Gauged depth to water and sampled
221049	Sarah King	10057588.37	3168216.16	420.800	5	43.98	Yes	Gauged depth to water and sampled
5852213	TXI	10057126.47	3171089.11	406.308	5	36.38	No	Gauged depth to water and sampled, next to Elm Creek; transducer location
5852314	Manville WSC	10060996.99	3179527.77	409.216	12	60.00	Yes, 668 gpm, cycles daily	Gauged depth to water and sampled; Water supply well
ATF Well 1	ATF	10054790.33	3174300.03	403.020	16	50.58	Yes, 450 gpm, occasional use	Gauged depth to water and sampled
Buchheit	Barb Buchheit	10064273.43	3171701.20	416.314	4	30.75	Yes, occasional use for lawn care	Gauged depth to water and sampled
Glass	TXI	NM <sup>1</sup>	NM <sup>1</sup>	NM <sup>1</sup>	30	46.99	No	Hand dug well, on west side of Hunters Mansion; Poor well production; only gauged and sampled in October 2011
NTN Well 2	Native Texas Nursery	10056198.58	3172482.94	406.565	18	40.77	Yes, 300 gpm, cycles daily	Gauged depth to water and sampled
Holweger	Dale Holweger	10056903.54	3169296.25	411.531	5	46.50	Yes, occasional use for stock tanks	Gauged depth to water and sampled
Wisian Well 1	Mary Wisian	10062371.14	3169965.66	440.240	8	65.10	No	Gauged depth to water and sampled
Wisian Well 2	Mary Wisian	10062375.18	3169484.23	435.521	6	62.18	No	Gauged depth to water and sampled

Notes:

<sup>1</sup> Due to poor well production, the Glass well was gauged and sampled only in October 2011. The well was replaced in the monitoring network with Wisian Well 2, and therefore was not included in the professional survey.

- ATF - Austin Tree Farm.
- ft - Feet.
- gpm - Gallons per minute.
- ID - Identification.
- msl - Mean sea level.
- NM - Not measured.
- NTN - Native Texas Nursery.
- TD - Total depth.
- TOC - Top of casing.
- TXI - Texas Industries, Inc.
- WSC - Water Supply Corporation.



K:\PROJECTS\Travis County CRCP\Baseline\_Report\2014\Fig 2-1 GW Locs.mxd, 9/13/2014 @ 8:41:58 PM

**Legend**

- TXI Mining Site
- Well Location

3,000 1,500 0 3,000

Feet

**URS**

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Drawn by:  
gary\_callahan

Site: Travis County CRCP

Title: **Figure 2-1  
Groundwater Assessment  
Locations**

Date: 13 Sep 2014	Drawing File: Fig 2-1 GW Locs	Figure: 2-1
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## 3.0 INTERIM YEAR 2 FIELD ACTIVITIES

Field activities performed during Interim Year 2 consisted of groundwater quality sampling and groundwater elevation surveys. Air quality sampling (Task 2) and noise level monitoring (Task 3) were not performed during Interim Year 2.

### 3.1 Task 1, Groundwater Evaluation

Groundwater gauging and sampling activities were performed during four events that took place on the following dates:

- September 10 to 11, 2013;
- November 18-19, 2013;
- February 18 to 19, 2014; and
- May 19 to 20, 2014.

Groundwater levels were measured and recorded, and groundwater samples were collected from the wells presented in Table 2-1 and shown on Figure 2-1, except for the Glass well, which was not included in the monitoring program. The depth to groundwater was gauged and TPH samples were collected from all wells during each Interim Year 2 event. Basic water quality chemistry samples were collected during the May 2014 event and PAH samples were collected during the November 2013 event.

#### 3.1.1 Groundwater Elevation

Groundwater levels were measured in accordance with the Texas Commission on Environmental Quality (TCEQ) Standard Operating Procedure (SOP) 7.1 (*Water Level/Sediment Measurement*) (See Appendix B of the *Sampling and Analysis Plan* [URS, October 2011]). All wells were measured within the same 48-hour period to ensure that a synoptic potentiometric surface was observed. The groundwater levels were recorded in a field log book or on monitoring well purge forms, which are included in Appendix A. In addition, hourly groundwater levels in Well 5852213 were monitored and recorded with an In-Situ Troll 500 submersible water level pressure transducer.

The groundwater gauging data from the Baseline Year (October 2011), Interim Year 1 (June 2013) and each Interim Year 2 groundwater gauging events are presented in Table 3-1. Potentiometric surface maps of the baseline study area for the September 2013, November 2013, February 2014, and May 2014 events are included in Figures 3-1 through 3-4, respectively. The groundwater elevation data recorded with the pressure transducer in Well 5852213 is presented in a well hydrograph with corresponding precipitation data from the Lower Colorado River Authority (LCRA) hydromet rain gauge located at the Gilleland Creek Station #5417 (Figure 3-5). The Gilleland Creek Station is located approximately 4 miles north of the study area near the intersection of FM 973 and SH 130. Groundwater elevations at Well 5852213 between January 27 and February 26, 2013 are extrapolated on Figure 3-5 because the transducer-recorded elevations for this period fluctuate greatly, i.e. +/- 0.5 ft within 24 hours. This degree of daily variation is not otherwise observed during the entire 2.5 years recorded by the transducer and cannot be readily explained by a known natural or anthropogenic cause.

### 3.1.2 Groundwater Sampling

Prior to groundwater sample collection, the groundwater was purged in accordance with the appropriate TCEQ SOPs, as included in Appendix B of the *Sampling and Analysis Plan* (URS, October 2011). Three wells (Well 5852213, Wisian Well 1, and Wisian Well 2) were purged using a submersible pump with dedicated tubing in accordance with TCEQ SOP 7.3 (*Purging a Monitoring Well with a Pump*) or TCEQ SOP 7.4 (*Micro Purging a Monitoring Well*). Seven wells were sampled using dedicated pumps and were purged in accordance with TCEQ SOP 7.9 (*Purging a Drinking Water Well*).

Groundwater field parameters were collected in accordance with TCEQ SOP 7.5 (*Measurements of Field Parameters*). The field parameters were measured using a Horiba U-52 water quality meter with flow-through cell. The meter was calibrated according to manufacturer's instructions at the start of each day of the Interim Year 2 sampling events. Field notes and monitoring well purge forms with recorded field parameters (temperature, specific conductivity, pH, turbidity, dissolved oxygen, and oxidation reduction potential) are included Appendix A.

After the wells were purged and field parameters stabilized, groundwater samples were collected in accordance with TCEQ SOP 7.7 (*Groundwater Sampling Using a Pump*), 7.8 (*Groundwater Sampling Using a Low-Flow Techniques*), or 7.10 (*Sampling a Drinking Water Well*). All groundwater samples were handled in accordance with TCEQ SOP 6.4 (*Sample Handling and Control*).

Groundwater samples, including quality control samples such as duplicate, equipment blank, and matrix spike (MS)/matrix spike duplicate (MSD) samples were collected and submitted to the laboratory for analysis. Samples from the September 2013, November 2013, and February 2014 events were submitted to LCRA Environmental Laboratory Services for analysis, and the May 2014 samples were submitted to DHL Analytical, Inc. The parameters analyzed and the analytical methods performed are shown below:

Parameter	Analytical Method
Ammonia	M4500-NH3
Anions (chloride, fluoride, nitrate, and sulfate)	E300.0
Bicarbonate (as HCO <sub>3</sub> ) and Carbonate (as CO <sub>3</sub> )	SM2320B
Cations (calcium, magnesium, potassium, and sodium)	SW6020A
TSS	SM2540D
PAHs (list of 15)	SW846 8270C
TPH	TX1005

PAHs - Polycyclic aromatic hydrocarbons.  
TPH - Total petroleum hydrocarbons.  
TSS - Total suspended solids.

The analytical results for basic water quality parameters from the Baseline Year and Interim Years 1 and 2 are presented in Table 3-2. Major-ion chemistry composition is depicted in Trilinear and Stiff diagrams presented in Figures 3-6 and 3-7, respectively. VOC and TPH analytical results are presented in Table 3-3, and PAH analytical results are presented in Table 3-4. The laboratory analytical report for the Interim Year 2 groundwater data is included in Appendix B.

All gauging and sample equipment, including the water level indicator and submersible pump (where applicable), were decontaminated between each well. The decontamination process consisted of two steps: 1) soapy water wash and 2) distilled water rinse.

**Table 3-1. Groundwater Elevation Data**

Well Owner	Well ID	TOC Elevation (ft msl)	Date	Depth to Water (ft TOC)	Groundwater Elevation (ft msl)	Ft of Water in Well
Douglas Edgar	58522	414.64	10/19/2011 <sup>(A)</sup>	38.92	375.72	17.44
			6/12/2013 <sup>(B)</sup>	DRY	NA	NA
			9/11/2013	DRY	NA	NA
			11/18/2013	DRY	NA	NA
			2/19/2014	39.40	375.24	16.96
5/19/2014	39.40	375.24	16.96			
Sarah King	221049	420.8	10/19/2011 <sup>(A)</sup>	32.63	388.17	11.35
			6/12/2013 <sup>(B)</sup>	32.19	388.61	11.79
			9/11/2013	32.74	388.06	11.24
			11/18/2013	32.18	388.62	11.8
			2/19/2014	32.25	388.55	11.73
			5/19/2014	32.27	388.53	11.71
TXI	5852213	406.31	10/18/2011 <sup>(A)</sup>	29.84	376.47	6.54
			6/11/2013 <sup>(B)</sup>	29.10	377.21	7.28
			9/10/2013	29.79	376.52	6.59
			11/18/2013	29.30	377.01	7.08
			2/18/2014	28.23	378.08	8.15
			5/20/2014	28.33	377.98	8.05
Mansville Water Supply Corporation	5852314	409.22	10/18/2011 <sup>(A)</sup>	41.10	368.12	18.90
			6/12/2013 <sup>(B)</sup>	42.35	366.87	17.65
			9/10/2013	40.12	369.10	19.88
			11/19/2013	34.32	374.90	25.68
			2/19/2014	34.15	375.07	25.85
			5/19/2014	34.76	374.46	25.24
Austin Tree Farm	ATF Well 1	403.02	10/19/2011 <sup>(A)</sup>	28.92	374.10	21.66
			6/11/2013 <sup>(B)</sup>	28.79	374.23	21.79
			9/10/2013	29.96	373.06	20.62
			11/19/2013	25.28	377.74	25.3
			2/18/2014	26.53	376.49	24.05
			5/20/2014	27.22	375.80	23.36
Barb Buchheit	Buchheit	416.31	10/19/2011 <sup>(A)</sup>	26.15	390.16	4.60
			6/12/2013 <sup>(B)</sup>	26.20	390.11	4.55
			9/11/2013	26.79	389.52	3.96
			11/19/2013	26.25	390.06	4.50
			2/19/2014	26.21	390.10	4.54
			5/19/2014	26.50	389.81	4.25
Dale Holweger	Holweger	411.53	10/19/2011 <sup>(A)</sup>	32.82	378.71	13.68
			6/11/2013 <sup>(B)</sup>	32.19	379.34	14.31
			9/11/2013	33.21	378.32	13.29
			11/18/2013	32.15	379.38	14.35
			2/19/2014	31.50	380.03	15
			5/19/2014	31.77	379.76	14.73

**Table 3-1. Groundwater Elevation Data (Continued)**

Well Owner	Well ID	TOC Elevation (ft msl)	Date	Depth to Water (ft TOC)	Groundwater Elevation (ft msl)	Ft of Water in Well
Native Texas Nursery	NTN Well 2	406.57	10/19/2011 <sup>(A)</sup>	33.82	372.75	6.95
			6/11/2013 <sup>(B)</sup>	31.65	374.92	9.12
			9/10/2013	32.47	374.10	8.3
			11/19/2013	30.45	376.12	10.32
			2/18/2014	30.00	376.57	10.77
			5/20/2014	31.27	375.3	9.5
Mary Wisian	Wisian Well 1	440.24	10/18/2011 <sup>(A)</sup>	50.39	389.85	14.83
			6/11/2013 <sup>(B)</sup>	50.14	390.10	14.96
			9/10/2013	50.80	389.44	14.3
			11/18/2013	50.05	390.19	15.05
			2/18/2014	50.23	390.01	14.87
			5/20/2014	50.25	389.99	14.85
Mary Wisian	Wisian Well 2	435.52	11/29/2011 <sup>(A)</sup>	45.50	390.02	16.68
			6/11/2013 <sup>(B)</sup>	45.20	390.32	16.98
			9/10/2013	45.40	390.12	16.78
			11/18/2013	45.00	390.52	17.18
			2/18/2014	45.21	390.31	16.97
			5/20/2014	45.41	390.11	16.77

<sup>(A)</sup> Groundwater Elevation Data from October 18, 19 or November 29, 2011, Baseline Year.

<sup>(B)</sup> Groundwater Elevation Data from June 11 or 12, 2013, Interim Year 1.

ATF - Austin Tree Farm.  
ft - Feet.  
ID - Identification.  
msl - Mean sea level.  
NA - Not available.  
NTN - Native Texas Nursery.  
TOC - Top of casing.  
TXI - Texas Industries, Inc.

Table 3-2. Groundwater Analytical Water Quality Data

Well ID	Sample ID	Well Owner	Sampling Event	Date	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Ammonia (mg/L)	TSS (mg/L)	TDS (mg/L) <sup>1</sup>	Note
ATF Well 1	CRCP-ATF1-010	ATF	1	10/19/2011	194	46.2	3.48	43.2	71.3	0.245	6.87	148	478	< 2.0	< 0.020	< 1.0	986	
	CRCP-ATF1-020	ATF	2	11/29/2011	203	45.0	3.57	46.3	79.4	0.230	6.46	170	490	< 2.0	< 0.020	< 1.0	1039	
	CRCP-ATF1-030	ATF	3	1/5/2012	220	47.3	4.01	53.2	81.3	0.200	6.76	171	544	< 2.0	< 0.020	< 1.1	1123	
	CRCP-ATF1-040	ATF	4	2/15/2012	210	46.0	4.42	54.1	83.0	0.224	6.68	184	515	< 2.0	< 0.020	< 1.1	1099	
	CRCP-ATF1-050	ATF	5	3/27/2012	222	46.8	4.49	57.4	83.6	0.140	4.86	175	496	< 2.0	< 0.020	1.70	1087	
	CRCP-ATF1-060	ATF	6	5/8/2012	201	41.2	3.58	50.2	65.2	0.360	8.91	143	461	< 2.0	0.073	2.30	967	
	CRCP-ATF1-070	ATF	7	6/11/2013	181	39.3	3.28	47.3	57.5	0.249	11.3	130	418	< 10.0	< 0.0200	< 1.06	878	
	CRCP-ATF1-110	ATF	11	5/20/2014	184	40.6	4.02	47.0	72.0	0.126 J	10.3	163	480	< 10.0	0.772	< 2.50	929	
	CRCP-ATF1-111	ATF	11	5/20/2014	187	41.6	3.98	48.1	71.4	0.110 J	11.2	162	472	< 10.0	< 0.100	< 2.50	926	Field Duplicate
5852314	CRCP-5852314-010	MWS	1	10/18/2011	137	39.9	2.22	81.2	61.0	0.235	10.8	188	364	< 2.0	< 0.020	< 1.10	875	
	CRCP-5852314-020	MWS	2	11/30/2011	140	40.7	2.16	86.1	60.9	0.241	11.2	190	356	< 2.0	< 0.020	< 1.10	878	
	CRCP-5852314-030	MWS	3	1/4/2012	138	36.8	2.21	88.4	52.2	0.300	11.1	187	364	< 2.0	< 0.020	1.70	871	
	CRCP-5852314-040	MWS	4	2/16/2012	134	38.9	2.12	94.5	63.8	0.259	11.0	207	349	< 2.0	< 0.020	2.10	891	
	CRCP-5852314-050	MWS	5	3/26/2012	139	40.7	1.98	85.8	53.3	0.170	10.7	192	368	< 2.0	< 0.020	2.30	883	
	CRCP-5852314-060	MWS	6	5/7/2012	154	42.5	2.53	79.4	61.3	0.245	10.3E	192	353	< 2.0	< 0.020	1.20	887	
	CRCP-5852314-070	MWS	7	6/12/2013	141	38.5	1.87	87.7	49.9	0.288	10.4	189	361	< 10.0	< 0.0200	1.96	871	
	CRCP-5852314-110	MWS	11	5/19/2014	77.6	23.0	1.72	56.2	43.4	0.288 J	1.03	111	231	< 10.0	< 0.100	< 2.50	544	
NTN Well 2	CRCP-NTNW2-010	NTN	1	10/19/2011	175	56.5	2.24	41.7	39.6	0.246	24.3	266	382	< 2.0	< 0.020	< 1.1	965	
	CRCP-NTNW2-011	NTN	1	10/19/2011	178	57.6	2.24	41.9	34.3	0.298	24.6	271	375	< 2.0	< 0.020	< 1.1	960	Field Duplicate
	CRCP-NTNW2-020	NTN	2	11/30/2011	192	62.2	2.31	46.2	41.3	0.264	17.9 E	302	340	< 2.0	< 0.020	< 1.0	988	
	CRCP-NTNW2-020	NTN	2	11/30/2011	NA	NA	NA	NA	NA	NA	27.0 H	NA	NA	NA	NA	NA	NC	Re-ran Nitrate Sample
	CRCP-NTNW2-021	NTN	2	11/30/2011	193	63.3	2.28	46.5	41.4	0.270	17.9 E	299	341	< 2.0	< 0.020	< 1.0	987	Field Duplicate
	CRCP-NTNW2-021	NTN	2	11/30/2011	NA	NA	NA	NA	NA	NA	26.7 H	NA	NA	NA	NA	NA	NC	Re-ran Nitrate Sample
	CRCP-NTNW2-030	NTN	3	1/5/2012	202	61.4	2.32	47.3	37.4	0.290	28.2	322	367	< 2.0	< 0.020	< 1.0	1041	
	CRCP-NTNW2-031	NTN	3	1/5/2012	204	62.5	2.35	46.7	37.9	0.280	27.9	326	358	< 2.0	< 0.020	< 1.0	1038	Field Duplicate
	CRCP-NTNW2-040	NTN	4	2/16/2012	202	63.8	2.42	52.6	44.9	0.348	34.7	364	337	< 2.0	0.027	< 1.0	1069	
	CRCP-NTNW2-041	NTN	4	2/16/2012	196	63.5	2.43	55.4	44.9	0.346	30.4	365	342	< 2.0	< 0.020	< 1.0	1069	Field Duplicate
	CRCP-NTNW2-050	NTN	5	3/27/2012	216	68.4	2.33	48.4	35.6	0.200	29.4	389	336	< 2.0	< 0.020	< 1.1	1098	
	CRCP-NTNW2-051	NTN	5	3/27/2012	221	69.4	2.43	48.8	35.2	0.190	29.4	385	356	< 2.0	< 0.020	< 1.0	1118	Field Duplicate
	CRCP-NTNW2-060	NTN	6	5/8/2012	233	76.7	2.51	44.2	37.5	0.420	31.1	406	347	< 2.0	0.020	< 1.0	1149	
	CRCP-NTNW2-061	NTN	6	5/8/2012	242	81.0	2.53	44.2	37.7	0.430	30.5	395	343	< 2.0	< 0.020	< 1.0	1145	Field Duplicate
CRCP-NTNW2-070	NTN	7	6/11/2013	228	76.9	1.99	52.5	41.2	0.312	32.7	456	326	< 10.0	< 0.0200	< 1.06	1185		
CRCP-NTNW2-071	NTN	7	6/11/2013	224	73.9	2.06	51.1	41.1	0.326	32.6	454	325	< 10.0	< 0.0200	< 1.02	1173	Field Duplicate	
	CRCP-NTNW2-113	NTN	11	5/20/2014	241	80.8	2.44 J	56.3	54.3	0.147 J	30.7	526	371	< 10.0	< 0.100	< 2.50	1332	MS/MSD
Holweger	CRCP-Holweger-013	Holweger	1	10/19/2011	117	19.7	2.03	41.3	32.2	0.301	21.6	31.4	310	< 2.0	< 0.020	< 1.1	556	MS/MSD
	CRCP-Holweger-023	Holweger	2	11/30/2011	114	18.3	1.88	45.2	32.6	0.286	20.7	34.1	300	< 2.0	< 0.020	< 1.1	548	MS/MSD
	CRCP-Holweger-033	Holweger	3	1/5/2012	112	16.8	2.00	40.2	20.6	0.296	17.8	27.0	311	< 2.0	< 0.020	< 1.1	532	MS/MSD
	CRCP-Holweger-043	Holweger	4	2/16/2012	105	15.5	1.99	44.0	17.7	0.296	16.5	26.1	289	< 2.0	< 0.020	< 1.0	501	MS/MSD
	CRCP-Holweger-053	Holweger	5	3/27/2012	105	15.3	1.98	37.5	11.8	0.430	15.2	23.8	314	< 2.0	< 0.020	< 1.0	511	MS/MSD
	CRCP-Holweger-063	Holweger	6	5/8/2012	113	16.5	1.94	31.9	11.9	0.390	16.1	21.1	287	< 2.0	< 0.020	< 1.0	485	MS/MSD
	CRCP-Holweger-073	Holweger	7	6/11/2013	102	15.8	1.49	35.1	11.8	0.334	15.3	19.5	290	< 10.0	0.0212	< 1.01	606	MS/MSD
	CRCP-Holweger-110	Holweger	11	5/19/2014	108	16.0	1.86	34.6	16.3	0.192 J	15.1	24.8	311	< 10.0	< 0.100	< 2.50	513	
5852213	CRCP-5852213-010	TXI	1	10/18/2011	130	24.8	4.68	31.9	27.8	0.293	0.070	7.11	460	< 2.0	6.35	60	688	
	CRCP-5852213-020	TXI	2	11/29/2011	133	21.2	4.70	28.9	19.8	0.360	< 0.050	9.84	420	< 2.0	3.57	18.2	639	
	CRCP-5852213-030	TXI	3	1/4/2012	128	20.2	4.35	30.0	16.5	0.390	< 0.050	28.4	404	< 2.0	1.90	25.4	633	
	CRCP-5852213-040	TXI	4	2/15/2012	129	20.1	6.01	25.5	15.6	0.239	< 0.010	34.1	527	< 2.0	1.52	73.7	759	
	CRCP-5852213-050	TXI	5	3/26/2012	150	23.2	4.41	25.5	15.2	0.230	< 0.100	37.4	425	< 2.0	0.909	5.9	683	
	CRCP-5852213-060	TXI	6	5/7/2012	150	23.6	4.62	22.6	18.5	0.332	0.025	14.6	455	< 2.0	1.22	7.0	691	
	CRCP-5852213-070	TXI	7	6/11/2013	154	22.9	4.86	23.5	12.6	0.365	< 0.100	21.1	409	< 10.0	1.38	274	648	
	CRCP-5852213-110	TXI	11	5/20/2014	145	36.0	5.29	33.0	17.6	0.334 J	< 0.100	4.08	569	< 10.0	1.04	10.1	810	

Table 3-2. Groundwater Analytical Water Quality Data (Continued)

Well ID	Sample ID	Well Owner	Sampling Event	Date	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Ammonia (mg/L)	TSS (mg/L)	TDS (mg/L) <sup>1</sup>	Note
221049	CRCP-221049-010	King	1	10/19/2011	99.0	12.3	1.83	29.0	13.3	0.267	13.6	17.9	286	< 2.00	< 0.020	4.80	461	
	CRCP-221049-020	King	2	11/30/2011	106	13.1	2.01	29.4	13.7	0.266	11.3 E	17.8	285	< 2.00	< 0.020	11.2	469	
	CRCP-221049-020	King	2	11/30/2011	NA	NA	NA	NA	NA	NA	14.2 H	NA	NA	NA	NA	NA	NC	Re-ran Nitrate Sample
	CRCP-221049-030	King	3	1/5/2012	104	11.9	1.90	30.3	11.1	0.265	13.1	16.4	320	< 2.00	< 0.020	17.9	498	
	CRCP-221049-040	King	4	2/15/2012	92.7	10.9	1.80	30.0	14.2	0.264	13.6	18.5	290	< 2.00	< 0.020	7.10	460	
	CRCP-221049-050	King	5	3/27/2012	102	11.5	1.88	30.5	10.2	0.180	12.9	14.9	268	< 2.00	< 0.020	3.80	441	
	CRCP-221049-060	King	6	5/8/2012	106	12.2	1.83	25.8	10.2	0.430	13.3	15.2	267	< 2.00	< 0.020	2.90	440	
	CRCP-221049-070	King	7	6/12/2013	104	12.2	2.12	30.6	11.1	0.290	14.5	17.6	266	< 10.0	< 0.0200	3.27	446	
CRCP-221049-110	King	11	5/19/2014	105	12.1	1.93	33.2	16.3	0.181 J	15.0	23.1	289	< 10.0	< 0.100	< 2.50	481		
Glass	CRCP-Glass-010	TXI	1	10/18/2011	3040	73.2	22.1	58.3	18.6	0.232	10.5	32.5	882	< 2.00	3.54	3120	4127	
58522	CRCP-58522-010	Edgar	1	10/19/2011	117	37.5	2.02	69.5	89.5	0.262	4.27	77.3	382	< 2.00	< 0.020	3.40	775	
	CRCP-58522-020	Edgar	2	11/29/2011	122	36.2	2.00	73.9	87.8	0.320	3.88	81.0	374	< 2.00	< 0.020	< 1.0	779	
	CRCP-58522-030	Edgar	3	1/5/2012	124	36.9	2.23	71.1	88.2	0.277	3.73	81.3	378	< 2.00	< 0.020	< 1.0	784	
	CRCP-58522-040	Edgar	4	2/15/2012	111	32.1	1.98	73.8	99.6	0.253	3.36	81.2	259	< 2.00	< 0.020	1.90	661	
	CRCP-58522-050	Edgar	5	3/27/2012	120	33.1	2.14	75.2	92.1	0.200	2.42	76.1	335	< 2.00	< 0.020	3.80	736	
	CRCP-58522-060	Edgar	6	5/7/2012	121	32.9	1.84	70.7	93.5	0.268	2.71	76.7	345	< 2.00	< 0.020	1.10	744	
	CRCP-58522-070	Edgar	7	6/12/2013	112	32.7	1.75	68.0	71.3	0.331	2.98	65.9	367	< 10.0	< 0.0200	26	721	
	CRCP-58522-110	Edgar	11	5/19/2014	118	35.5	2.10	75.6	90.0	0.203 J	2.42	80.8	374	< 10.0	0.160 J	< 2.50	776	
Wisian Well 1	CRCP-Wisian W1-010	Wisian	1	10/18/2011	87.0	11.00	2.64	56.8	18.5	0.238	8.62	27.2	308	< 2.00	< 0.020	2.30	513	
	CRCP-Wisian W1-015	Wisian	1	10/18/2011	< 0.200	< 0.200	< 0.200	< 0.600	< 1.00	< 0.010	< 0.010	< 1.00	2.00	< 2.00	< 0.020	NA	NC	Equipment Blank Sample
	CRCP-Wisian W1-020	Wisian	2	11/29/2011	91.4	10.8	2.65	62.8	14.5	0.300	8.80	24.2	305	< 2.00	< 0.020	< 1.0	511	
	CRCP-Wisian W1-025	Wisian	2	11/29/2011	3.72	< 0.200	< 0.200	< 0.600	< 5.00	< 0.050	0.225	< 5.00	2.00	< 2.00	< 0.020	2.90	NC	Equipment Blank Sample
	CRCP-Wisian W1-030	Wisian	3	1/4/2012	86.6	10.10	2.61	66.1	13.8	0.330	8.78	24.8	356	< 2.00	< 0.020	1.50	562	
	CRCP-Wisian W1-035	Wisian	3	1/4/2012	0.696	< 0.200	< 0.200	< 0.600	< 0.500	< 0.050	< 0.050	< 5.00	< 20	< 20.0	< 0.020	NA	NC	Equipment Blank Sample
	CRCP-Wisian W1-040	Wisian	4	2/15/2012	90.2	10.8	2.89	63.1	19.2	0.240	8.87	27.5	327	< 2.00	< 0.020	2.40	543	
	CRCP-Wisian W1-045	Wisian	4	2/15/2012	0.346	< 0.200	< 0.200	< 0.600	< 1.00	0.059	0.025	< 1.00	3.00	< 2.00	< 0.020	NA	NC	Equipment Blank Sample
	CRCP-Wisian W1-050	Wisian	5	3/26/2012	89.5	10.1	3.04	54.0	12.7	0.410	8.03	21.2	300	< 2.00	< 0.020	< 1.00	493	
	CRCP-Wisian W1-055	Wisian	5	3/26/2012	0.241	< 0.200	< 0.200	< 0.600	< 10.0	< 0.100	< 0.100	< 10.0	< 20.0	< 20.0	< 0.020	NA	NC	Equipment Blank Sample
	CRCP-Wisian W1-060	Wisian	6	5/7/2012	92.2	10.8	2.79	53.9	17.3	0.236	8.38 E	27.5	310	< 2.00	< 0.020	< 1.00	517	
	CRCP-Wisian W1-060	Wisian	6	5/7/2012	NA	NA	NA	NA	NA	NA	8.88 H	NA	NA	NA	NA	NA	NC	Re-ran Nitrate Sample
	CRCP-Wisian W1-065	Wisian	6	5/7/2012	0.665	< 0.200	0.545	< 0.600	< 1.00	< 0.010	0.080	< 1.00	3.00	< 2.00	< 0.020	NA	NC	Equipment Blank Sample
	CRCP-Wisian W1-070	Wisian	7	6/11/2013	90.1	11.1	2.30	62.8	14.4	0.269	9.94	24.8	309	< 10.0	< 0.0200	< 1.01	517	
CRCP-Wisian W1-075	Wisian	7	6/11/2013	< 0.200	< 0.200	< 0.200	< 0.600	< 10.0	< 0.100	< 0.100	< 10.0	< 10.0	< 10.0	< 0.0200	NA	NA	Equipment Blank Sample	
CRCP-Wisian W1-110	Wisian	11	5/20/2014	87.5	11.2	2.88	66.2	21.5	0.191 J	9.15	30.6	348	< 10.0	< 0.100	< 2.50	568		
Wisian Well 2	CRCP-Wisian W2-020	Wisian	2	11/29/2011	95.7	12.0	2.51	106	12.2	0.140	9.93	30.0	391	< 2.00	< 0.020	1.60	651	
	CRCP-Wisian W2-030	Wisian	3	1/4/2012	88.3	10.7	2.41	109	11.6	< 0.050	9.07	31.2	455	< 2.00	< 0.020	< 1.10	710	
	CRCP-Wisian W2-040	Wisian	4	2/15/2012	83.9	10.2	2.46	115	14.2	0.142	12.5	36.2	400	< 2.00	< 0.020	1.80	664	
	CRCP-Wisian W2-050	Wisian	5	3/26/2012	90.7	10.8	2.47	118	10.6	0.110	11.3	27.9	418	< 2.00	< 0.020	< 1.00	681	
	CRCP-Wisian W2-060	Wisian	6	5/7/2012	99.4	12.2	2.72	102	15.3	0.120	10.3 E	33.3	403	< 2.00	< 0.020	< 1.00	670	
	CRCP-Wisian W2-060	Wisian	6	5/7/2012	NA	NA	NA	NA	NA	NA	12.3 H	NA	NA	NA	NA	NA	NC	Re-ran Nitrate Sample
	CRCP-Wisian W2-070	Wisian	7	6/11/2013	94.4	12.2	1.97	96.4	11.4	0.189	10.1	26.8	388	< 10.0	< 0.0200	< 1.03	633	
	CRCP-Wisian W2-110	Wisian	11	5/20/2014	91.4	12.5	2.80	114	22.0	< 0.100	9.27	36.6	431	< 10.0	0.946	9.20	710	
CRCP-Wisian W2-115	Wisian	11	5/20/2014	18.3	0.516	0.101 J	0.160 J	< 0.300	< 0.100	< 0.100	< 1.00	< 10.0	< 10.0	< 0.100	3.90	NA	Equipment Blank Sample	
Buchheit	CRCP-Buchheit-010	Buchheit	1	10/19/2011	122	12.8	2.39	55.2	36.8	0.373	4.56	76.0	319	< 2.00	< 0.020	< 1.00	624	
	CRCP-Buchheit-020	Buchheit	2	11/30/2011	117	12.4	2.30	58.1	37.0	0.382	4.70	78.2	311	< 2.00	< 0.020	< 1.00	618	
	CRCP-Buchheit-030	Buchheit	3	1/5/2012	128	12.8	2.54	57.4	31.8	0.389	4.26	80.3	363	< 2.00	< 0.020	< 1.00	678	
	CRCP-Buchheit-040	Buchheit	4	2/16/2012	120	11.4	2.39	61.5	37.6	0.381	4.02	84.3	312	< 2.00	< 0.020	< 1.10	631	
	CRCP-Buchheit-050	Buchheit	5	3/26/2012	132	12.3	2.40	56.4	37.3	0.280	3.73	77.2	327	< 2.00	< 0.020	< 1.00	647	
	CRCP-Buchheit-060	Buchheit	6	5/7/2012	139	13.0	2.59	53.6	39.9	0.370	3.84	85.2	310	< 2.00	0.045	1.20	645	
	CRCP-Buccheit-070	Buchheit	7	6/12/2013	126	12.3	2.06	52.3	29.9	0.413	3.95	92.8	303	< 10.0	< 0.0200	< 1.02	620	
CRCP-Buccheit-110	Buchheit	11	5/19/2014	133	13.1	2.48	59.2	39.4	0.294 J	5.16	105	323	< 10.0	< 0.100	< 5.00	675		

**Table 3-2. Groundwater Analytical Water Quality Data (Continued)**

< Result is below the limits of detection, not detected.  
<sup>1</sup> TDS computed as sum of dissolved-ion concentration.

ATF - Austin Tree Farm.  
CRCP - Colorado River Corridor Plan.  
ID - Identification.  
mg/L - Milligrams per liter.  
MS/MSD - Matrix spike/matrix spike duplicate.  
MWS - Manville Water Supply Corporation  
NA - Not analyzed.  
NC - Not calculated.  
NTN - Native Texas Nursery.  
TDS - Total dissolved solids.  
TSS - Total suspended solids.  
TXI - Texas Industries, Inc.

Data Validation:

E - Value above quantitation range.  
H - Holding time exceeded.  
J - Analyte detected between method detection limit and reporting limit.

Table 3-3. Groundwater Analytical VOC and TPH Data

Well ID	Sample ID	Well Owner	Sample Date	Benzene (µg/L)	Ethylbenzene (µg/L)	Toluene (µg/L)	Xylene(total) (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)	MTBE (µg/L)	TPH >C12-C28 (mg/L)	TPH >C28-C35 (mg/L)	TPH C6-C12 (mg/L)	TPH C6-C35 (mg/L)	Note
TRRP Groundwater Ingestion Exposure Pathway PCL				5	700	1000	10000	10000	10000	240	0.98	0.98	0.98	NA	
ATF Well 1	CRCP-ATF1-070	ATF	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.84 UJL	<1.84 UJL	<1.84 UJL	<4.61 UJL	
	CRCP-ATF1-083	ATF	9/10/2013	NS	NS	NS	NS	NS	NS	NS	<1.86	<1.86	<1.86	<4.64	MS/MSD
	CRCP-ATF1-093	ATF	11/19/2013	NS	NS	NS	NS	NS	NS	NS	<1.90	<1.90	<1.90	<4.74	
	CRCP-ATF1-100	ATF	2/18/2014	NS	NS	NS	NS	NS	NS	NS	<1.82	<1.82	<1.82	<4.56	
	CRCP-ATF1-111	ATF	5/20/2014	NS	NS	NS	NS	NS	NS	NS	<0.689	<0.689	<0.689	<0.689	
5852314	CRCP-5852314-070	MWS	6/12/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.89 UJL	<1.89 UJL	<1.89 UJL	<4.72 UJL	
	CRCP-5852314-080	MWS	9/10/2013	NS	NS	NS	NS	NS	NS	NS	<1.87	<1.87	<1.87	<4.68	
	CRCP-5852314-090	MWS	11/19/2013	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.71	
	CRCP-5852314-100	MWS	2/19/2014	NS	NS	NS	NS	NS	NS	NS	<1.83	<1.83	<1.83	<4.58	
	CRCP-5852314-110	MWS	5/19/2014	NS	NS	NS	NS	NS	NS	NS	<0.671	<0.671	<0.671	<0.671	
NTN Well 2	CRCP-NTNW2-070	NTN	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.85 UJL	<1.85 UJL	<1.85 UJL	<4.62 UJL	
	CRCP-NTNW2-071	NTN	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.86 UJL	<1.86 UJL	<1.86 UJL	<4.65 UJL	Field Duplicate
	CRCP-NTNW2-080	NTN	9/10/2013	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.71	
	CRCP-NTNW2-090	NTN	11/19/2013	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.71	
	CRCP-NTNW2-100	NTN	2/18/2014	NS	NS	NS	NS	NS	NS	NS	<1.85	<1.85	<1.85	<4.63	
Holweger	CRCP-NTNW2-113	NTN	5/20/2014	NS	NS	NS	NS	NS	NS	NS	<0.678	<0.678	<0.678	<0.678	MS/MSD
	CRCP-Holweger-073	Holweger	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.87 UJL	<1.87 UJL	<1.87 UJL	<4.68 UJL	MS/MSD
	CRCP-Holweger-080	Holweger	9/11/2013	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.69	
	CRCP-Holweger-090	Holweger	11/18/2013	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.69	
	CRCP-Holweger-100	Holweger	2/19/2014	NS	NS	NS	NS	NS	NS	NS	<1.86	<1.86	<1.86	<4.64	
5852213	CRCP-Holweger-110	Holweger	5/19/2014	NS	NS	NS	NS	NS	NS	NS	<0.678	<0.678	<0.678	<0.678	
	CRCP-5852213-070	TXI	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.89 UJL	<1.89 UJL	<1.89 UJL	<4.73 UJL	
	CRCP-5852213-080	TXI	9/10/2013	NS	NS	NS	NS	NS	NS	NS	<1.86	<1.86	<1.86	<4.66	
	CRCP-5852213-090	TXI	11/18/2013	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.71	
	CRCP-5852213-100	TXI	2/18/2014	NS	NS	NS	NS	NS	NS	NS	<1.82	<1.82	<1.82	<4.55	
221049	CRCP-5852213-110	TXI	5/20/2014	NS	NS	NS	NS	NS	NS	NS	<0.693	<0.693	<0.693	<0.693	
	CRCP-221049-070	King	6/12/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.88 UJL	<1.88 UJL	<1.88 UJL	<4.69 UJL	
	CRCP-221049-080	King	9/11/2013	NS	NS	NS	NS	NS	NS	NS	<1.86	<1.86	<1.86	<4.66	
	CRCP-221049-090	King	11/18/2013	NS	NS	NS	NS	NS	NS	NS	<1.89	<1.89	<1.89	<4.71	
	CRCP-221049-100	King	2/19/2014	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.71	
58522	CRCP-221049-110	King	5/19/2014	NS	NS	NS	NS	NS	NS	NS	<0.690	<0.690	<0.690	<0.690	
	CRCP-58522-070	Edgar	6/12/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.88 UJL	<1.88 UJL	<1.88 UJL	<4.70 UJL	
	CRCP-58522-080	Edgar	9/11/2013	NS	NS	NS	NS	NS	NS	NS	<1.89	<1.89	<1.89	<4.73	
	CRCP-58522-081	Edgar	9/11/2013	NS	NS	NS	NS	NS	NS	NS	<1.87	<1.87	<1.87	<4.67	Field Duplicate
	CRCP-58522-090	Edgar	11/18/2013	NS	NS	NS	NS	NS	NS	NS	<1.90	<1.90	<1.90	<4.76	
	CRCP-58522-091	Edgar	11/18/2013	NS	NS	NS	NS	NS	NS	NS	<1.89	<1.89	<1.89	<4.73	Field Duplicate
Wisian Well 1	CRCP-58522-100	Edgar	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Not Sampled
	CRCP-58522-110	Edgar	5/19/2014	NS	NS	NS	NS	NS	NS	NS	<0.677	<0.677	<0.677	<0.677	
	CRCP-Wisian W1-070	Wisian	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.89 UJL	<1.89 UJL	<1.89 UJL	<4.73 UJL	
	CRCP-Wisian W1-075	Wisian	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.91 UJL	<1.91 UJL	<1.91 UJL	<4.78 UJL	Equipment Blank Sample
	CRCP-Wisian W1-080	Wisian	9/10/2013	NS	NS	NS	NS	NS	NS	NS	<1.88	<1.88	<1.88	<4.70	
	CRCP-Wisian W1-085	Wisian	9/10/2013	NS	NS	NS	NS	NS	NS	NS	<1.87	<1.87	<1.87	<4.67	Equipment Blank Sample
	CRCP-Wisian W1-090	Wisian	11/18/2013	NS	NS	NS	NS	NS	NS	NS	<1.96	<1.96	<1.96	<4.90	
CRCP-Wisian W1-105	Wisian	2/18/2014	NS	NS	NS	NS	NS	NS	NS	<1.85	<1.85	<1.85	<4.63	Equipment Blank Sample	
CRCP-Wisian W1-100	Wisian	2/18/2014	NS	NS	NS	NS	NS	NS	NS	<1.83	<1.83	<1.83	<4.58		
CRCP-Wisian W1-110	Wisian	5/20/2014	NS	NS	NS	NS	NS	NS	NS	0.703 J	<0.665	<0.665	0.703 J		

**Table 3-3. Groundwater Analytical VOC and TPH Data (Continued)**

Well ID	Sample ID	Well Owner	Sample Date	Benzene (µg/L)	Ethylbenzene (µg/L)	Toluene (µg/L)	Xylene(total) (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)	MTBE (µg/L)	TPH >C12-C28 (mg/L)	TPH >C28-C35 (mg/L)	TPH C6-C12 (mg/L)	TPH C6-C35 (mg/L)	Note
TRRP Groundwater Ingestion Exposure Pathway PCL				5	700	1000	10000	10000	10000	240	0.98	0.98	0.98	NA	
Wisian Well 2	CRCP-Wisian W2-070	Wisian	6/11/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.85 UJL	<1.85 UJL	<1.85 UJL	<4.61 UJL	
	CRCP-Wisian W2-080	Wisian	9/10/2013	NS	NS	NS	NS	NS	NS	NS	<1.87	<1.87	<1.87	<4.67	
	CRCP-Wisian W2-090	Wisian	11/18/2013	NS	NS	NS	NS	NS	NS	NS	<1.89	<1.89	<1.89	<4.72	
	CRCP-Wisian W2-095	Wisian	11/19/2013	NS	NS	NS	NS	NS	NS	NS	<1.90	<1.90	<1.90	<4.75	Equipment Blank Sample
	CRCP-Wisian W2-100	Wisian	2/18/2014	NS	NS	NS	NS	NS	NS	NS	<1.86	<1.86	<1.86	<4.65	
	CRCP-Wisian W2-110	Wisian	5/20/2014	NS	NS	NS	NS	NS	NS	NS	<0.692	<0.692	<0.692	<0.692	
	CRCP-Wisian W2-115	Wisian	5/20/2014	NS	NS	NS	NS	NS	NS	NS	<0.695	<0.695	<0.695	<0.695	Equipment Blank Sample
Buchheit	CRCP-Buchheit-070	Buchheit	6/12/2013	<2.00	<2.00	<2.00	<5.00	<4.00	<2.00	<2.00	<1.87 UJL	<1.87 UJL	<1.87 UJL	<4.69 UJL	
	CRCP-Buchheit-080	Buchheit	9/11/2013	NS	NS	NS	NS	NS	NS	NS	<1.87	<1.87	<1.87	<4.68	
	CRCP-Buchheit-090	Buchheit	11/19/2013	NS	NS	NS	NS	NS	NS	NS	<1.89	<1.89	<1.89	<4.73	
	CRCP-Buchheit-100	Buchheit	2/19/2014	NS	NS	NS	NS	NS	NS	NS	<1.89	<1.89	<1.89	<4.73	
	CRCP-Buchheit-110	Buchheit	5/19/2014	NS	NS	NS	NS	NS	NS	NS	<0.685	<0.685	<0.685	<0.685	

< Result is below the limits of detection, not detected.

µg/L – Micrograms per liter.

ATF - Austin Tree Farm.

CRCP - Colorado River Corridor Plan.

ID - Identification.

mg/L - Milligrams per liter.

MS/MSD - Matrix spike/matrix spike duplicate.

MTBE - Methyl Tertiary Butyl Ether.

MWS - Manville Water Supply Corporation

NA - Not available.

NTN - Native Texas Nursery.

PCL - Protective concentration level

TPH - Total petroleum hydrocarbons.

TRRP - Texas Risk Reduction Program.

TXI - Texas Industries, Inc.

VOC - Volatile organic compound.

Data Validation:

UJL - Not detected/estimated/biased low.

Table 3-4. Groundwater Analytical PAH Data

Well ID	Sample ID	Well Owner	Date	Acenaphthene (µg/L)	Acenaphthylene (µg/L)	Anthracene (µg/L)	Benzo(a)anthracene (µg/L)	Benzo(a)pyrene (µg/L)	Benzo(b)fluoranthene (µg/L)	Benzo(g,h,i)perylene (µg/L)	Benzo(k)fluoranthene (µg/L)	Chrysene (µg/L)	Dibenz(a,h)anthracene (µg/L)	Fluoranthene (µg/L)	Fluorene (µg/L)	Indeno(1,2,3-cd)pyrene	Naphthalene (µg/L)	Phenanthrene (µg/L)	Pyrene (µg/L)	Note
TRRP Groundwater Ingestion Exposure Pathway PCL				1500	1500	7300	1.3	0.2	1.3	730	13	130	0.2	980	980	1.3	490	730	730	
ATF Well 1	CRCP-ATF1-070	ATF	6/11/2013	<1.94	<1.94	<1.94	<1.94	<1.94 UJL	<1.94 UJL	<3.88	<1.94	<1.94	<3.88	<1.94 UJL	<1.94	<3.88	<1.94 UJL	<1.94	<3.88 UJL	
ATF Well 1	CRCP-ATF1-093	ATF	11/19/2013	<1.97	<1.97	<1.97	<1.97	<1.97	<1.97	<3.93	<1.97	<1.97	<3.93	<1.97	<1.97	<3.93	<1.97	<1.97	<3.93	MS/MSD
5852314	CRCP-5852314-070	MWS	6/12/2013	<1.92	<1.92	<1.92	<1.92	<1.92 UJL	<1.92 UJL	<3.85	<1.92	<1.92	<3.85	<1.92 UJL	<1.92	<3.85	<1.92 UJL	<1.92	<3.85 UJL	
5852314	CRCP-5852314-090	MWS	11/19/2013	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	
NTN Well 2	CRCP-NTNW2-070	NTN	6/11/2013	<1.94	<1.94	<1.94	<1.94	<1.94 UJL	<1.94 UJL	<3.88	<1.94	<1.94	<3.88	<1.94 UJL	<1.94	<3.88	<1.94 UJL	<1.94	<3.88 UJL	
NTN Well 2	CRCP-NTNW2-071	NTN	6/11/2013	<1.98	<1.98	<1.98	<1.98	<1.98 UJL	<1.98 UJL	<3.96	<1.98	<1.98	<3.96	<1.98 UJL	<1.98	<3.96	<1.98 UJL	<1.98	<3.96 UJL	Field Duplicate
NTN Well 2	CRCP-NTNW2-090	NTN	11/19/2013	<1.91	<1.91	<1.91	<1.91	<1.91	<1.91	<3.81	<1.91	<1.91	<3.81	<1.91	<1.91	<3.81	<1.91	<1.91	<3.81	
Holweger	CRCP-Holweger-073	Holweger	6/11/2013	<1.96	<1.96	<1.96	<1.96	<1.96 UJL	<1.96 UJL	<3.92	<1.96	<1.96	<3.92	<1.96 UJL	<1.96	<3.92	<1.96 UJL	<1.96	<3.92 UJL	MS/MSD
Holweger	CRCP-Holweger-090	Holweger	11/18/2014	<1.89	<1.89	<1.89	<1.89	<1.89	<1.89	<3.77	<1.89	<1.89	<3.77	<1.89	<1.89	<3.77	<1.89	<1.89	<3.77	
5852213	CRCP-5852213-070	TXI	6/11/2013	<1.92	<1.92	<1.92	<1.92	<1.92 UJL	<1.92 UJL	<3.85	<1.92	<1.92	<3.85	<1.92 UJL	<1.92	<3.85	<1.92 UJL	<1.92	<3.85 UJL	
5852213	CRCP-5852213-090	TXI	11/18/2013	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	
221049	CRCP-221049-070	King	6/12/2013	<2.11	<2.11	<2.11	<2.11	<2.11 UJL	<2.11 UJL	<4.21	<2.11	<2.11	<4.21	<2.11 UJL	<2.11	<4.21	<2.11 UJL	<2.11	<4.21 UJL	
221049	CRCP-221049-090	King	11/18/2013	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<3.80	<1.90	<1.90	<3.80	<1.90	<1.90	<3.80	<1.90	<1.90	<3.80	
58522	CRCP-58522-070	Edgar	6/12/2013	<2.06	<2.06	<2.06	<2.06	<2.06 UJL	<2.06 UJL	<4.12	<2.06	<2.06	<4.12	<2.06 UJL	<2.06	<4.12	<2.06 UJL	<2.06	<4.12 UJL	
58522	CRCP-58522-090	Edgar	11/18/2013	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<3.80	<1.90	<1.90	<3.80	<1.90	<1.90	<3.80	<1.90	<1.90	<3.80	
58522	CRCP-58522-091	Edgar	11/18/2013	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	<3.75	<1.87	<1.87	<3.75	<1.87	<1.87	<3.75	<1.87	<1.87	<3.75	Field Duplicate
Wisian Well 1	CRCP-Wisian W1-070	Wisian	6/11/2013	<1.96	<1.96	<1.96	<1.96	<1.96 UJL	<1.96 UJL	<3.92	<1.96	<1.96	<3.92	<1.96 UJL	<1.96	<3.92	<1.96 UJL	<1.96	<3.92 UJL	
Wisian Well 1	CRCP-Wisian W1-075	Wisian	6/11/2013	<2.44	<2.44	<2.44	<2.44	<2.44 UJL	<2.44 UJL	<4.88	<2.44	<2.44	<4.88	<2.44 UJL	<2.44	<4.88	<2.44 UJL	<2.44	<4.88 UJL	Equipment Blank Sample
Wisian Well 1	CRCP-Wisian W1-090	Wisian	11/18/2013	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	<1.90	<1.90	<3.81	
Wisian Well 2	CRCP-Wisian W2-070	Wisian	6/11/2013	<1.92	<1.92	<1.92	<1.92	<1.92 UJL	<1.92 UJL	<3.85	<1.92	<1.92	<3.85	<1.92 UJL	<1.92	<3.85	<1.92 UJL	<1.92	<3.85 UJL	
Wisian Well 2	CRCP-Wisian W2-090	Wisian	11/18/2013	<1.88	<1.88	<1.88	<1.88	<1.88	<1.88	<3.77	<1.88	<1.88	<3.77	<1.88	<1.88	<3.77	<1.88	<1.88	<3.77	
Wisian Well 2	CRCP-Wisian W2-095	Wisian	11/19/2013	<2.08	<2.08	<2.08	<2.08	<2.08	<2.08	<3.81	<2.08	<2.08	<3.81	<2.08	<2.08	<3.81	<2.08	<2.08	<3.81	Equipment Blank Sample
Buchheit	CRCP-Buchheit-070	Buchheit	6/12/2013	<1.94	<1.94	<1.94	<1.94	<1.94 UJL	<1.94 UJL	<3.88	<1.94	<1.94	<3.88	<1.94 UJL	<1.94	<3.88	<1.94 UJL	<1.94	<3.88 UJL	
Buchheit	CRCP-Buchheit-090	Buchheit	11/19/2013	<1.88	<1.88	<1.88	<1.88	<1.88	<1.88	<3.77	<1.88	<1.88	<3.77	<1.88	<1.88	<3.77	<1.88	<1.88	<3.77	

< Result is below the limits of detection, not detected.

µg/L - Micrograms per liter.

ATF - Austin Tree Farm.

CRCP - Colorado River Corridor Plan.

ID - Identification.

MS/MSD - Matrix spike/matrix spike duplicate.

MWS - Manville Water Supply Corporation

NTN - Native Texas Nursery.

PAH - Polycyclic aromatic hydrocarbon.

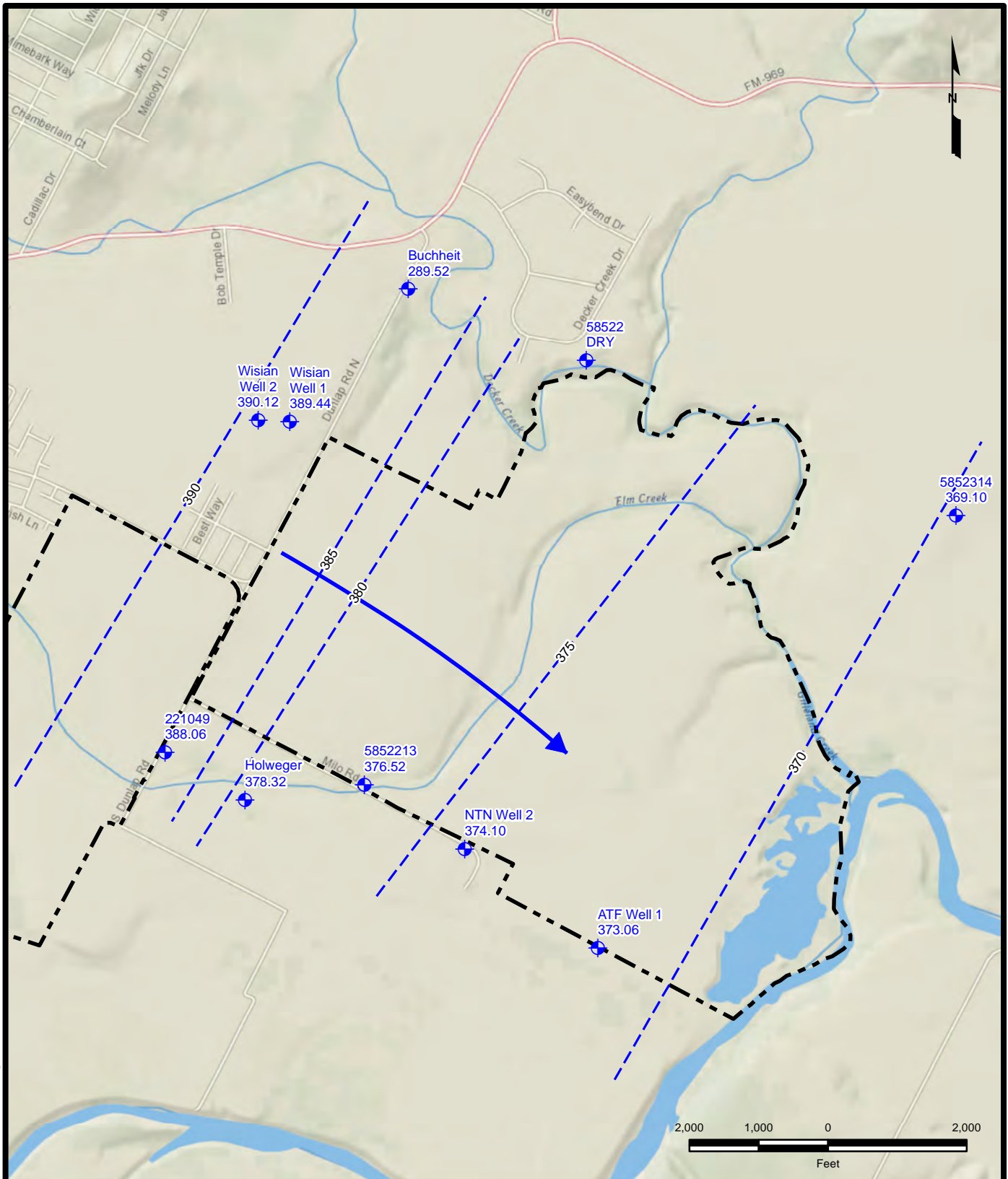
PCL - Protective concentration level.

TRRP - Texas Risk Reduction Program.

TXI - Texas Industries, Inc.

Data Validation:

UJL - Not detected/estimated/biased low.



K:\PROJECTS\Travis\_County\_CRCP\Baseline\_Report\2014\Fig 3-1 GWE0913.mxd, 9/13/2014 @ 8:42:53 PM

**Legend**

- TXI Mining Site
- Groundwater Well Location
- Potentiometric Surface Contour (ft msl) (Dashed Where Inferred)
- Groundwater Flow Direction

Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, IPC

**URS**

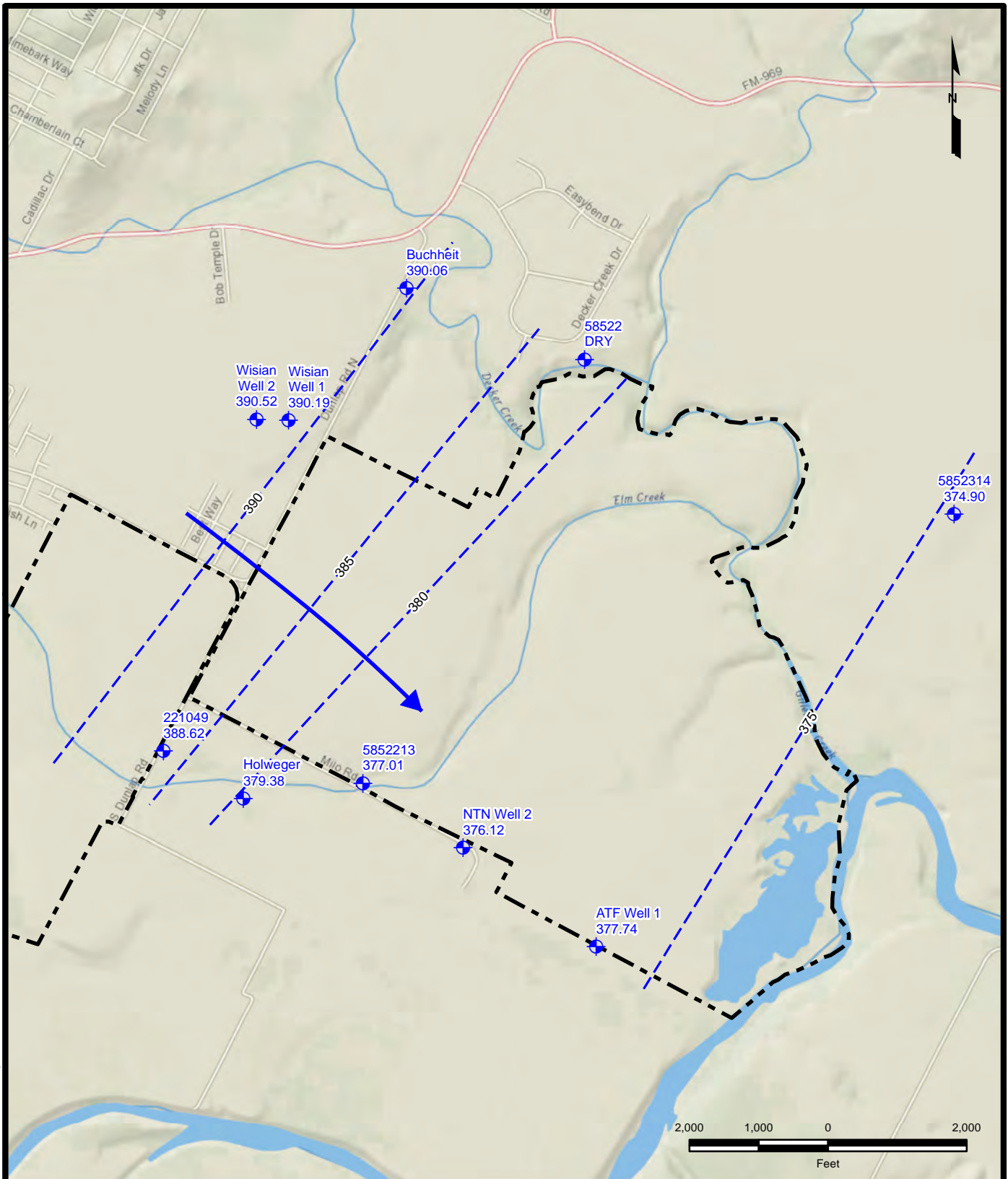
9400 Amberglenn Blvd.  
Austin, TX 78729  
Phone: (512) 454-4797  
Fax: (512) 419-5474

Drawn by:  
gary\_callahan

Site: Travis County CRCP

Title: **Figure 3-1  
Potentiometric Surface Map  
September 10-11, 2013**

Date: 13 Sep 2014	Drawing File: Fig 3-1 GWE0913	Figure: <b>3-1</b>
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K:\PROJECTS\Travis\_County\_CRCP\Baseline\_Report\2014\Fig 3-2 GWE1113.mxd, 9/13/2014 @ 8:44:27 PM

**Legend**

- TXI Mining Site
- Groundwater Well Location
- Potentiometric Surface Contour (ft msl) (Dashed Where Inferred)
- Groundwater Flow Direction

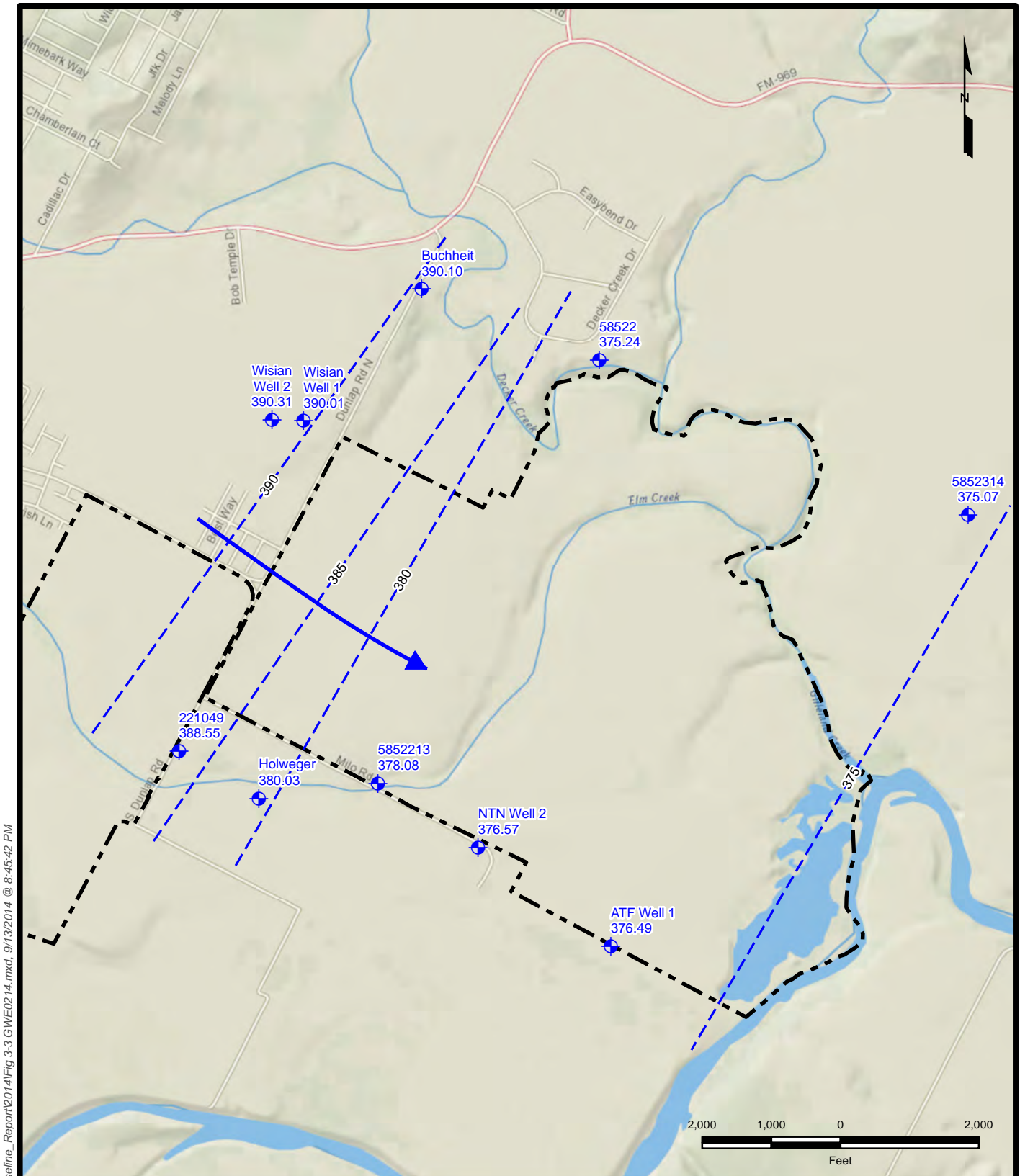
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, IPC

**URS**

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Drawn by:  
gary\_callahan

Site: Travis County CRCP			
Title: <b>Figure 3-2 Potentiometric Surface Map November 18-19, 2013</b>			
Date: 13 Sep 2014	Drawing File: Fig 3-2 GWE1113	Figure: 3-2	



K:\PROJECTS\Travis\_County\_CRCP\Baseline\_Report\2014\Fig 3-3 GWE0214.mxd, 9/13/2014 @ 8:45:42 PM

**Legend**

- TXI Mining Site
- Groundwater Well Location
- Potentiometric Surface Contour (ft msl) (Dashed Where Inferred)
- Groundwater Flow Direction

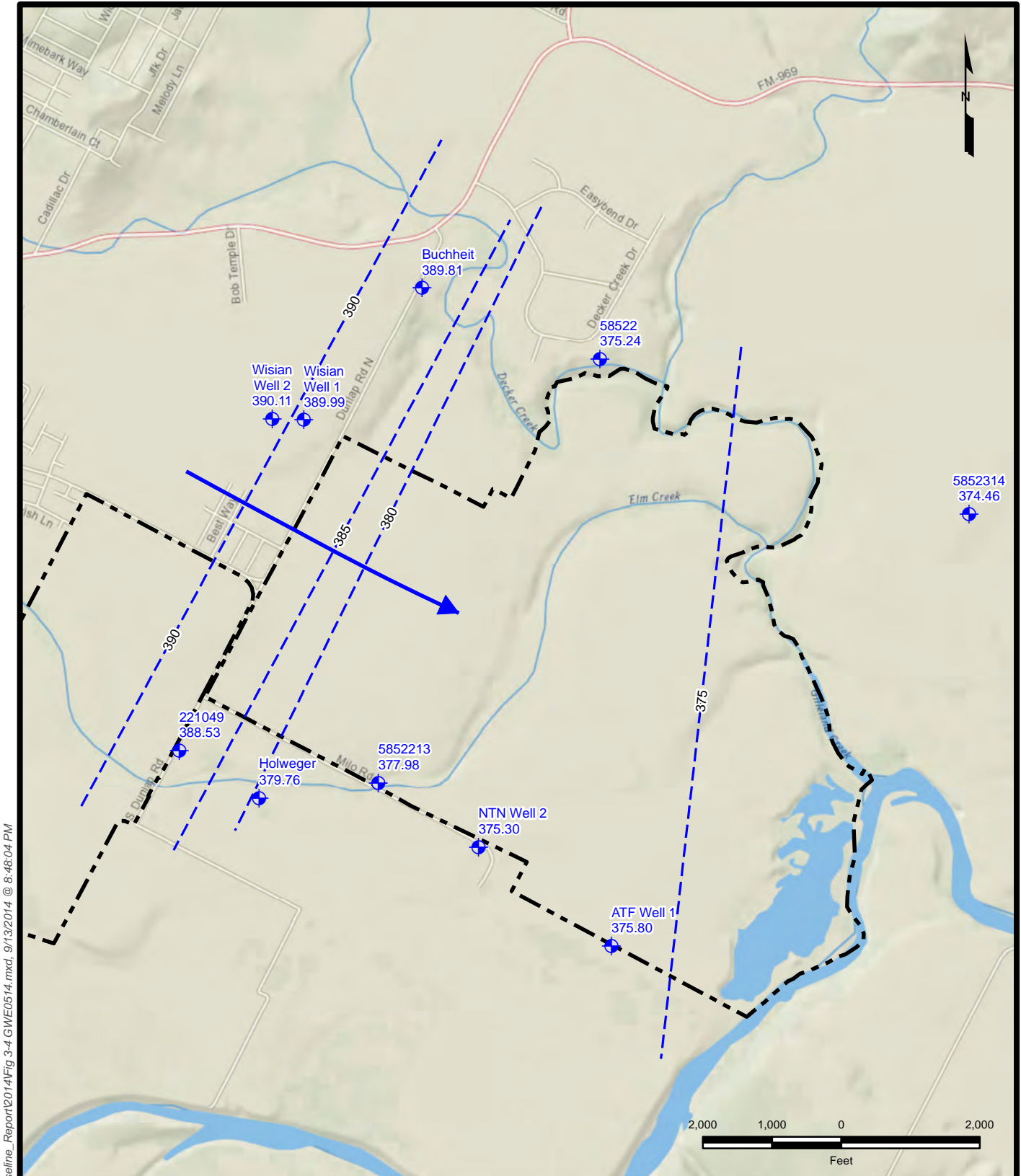
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, IPC

**URS**

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Drawn by:  
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Site: <b>Travis County CRCP</b>	
Title: <b>Figure 3-3 Potentiometric Surface Map February 18-19, 2014</b>	
Date: 13 Sep 2014	Figure: <b>3-3</b>
Drawing File: Fig 3-3 GWE0214	



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**Legend**

- TXI Mining Site
- Groundwater Well Location
- Potentiometric Surface Contour (ft msl) (Dashed Where Inferred)
- Groundwater Flow Direction

Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, IPC

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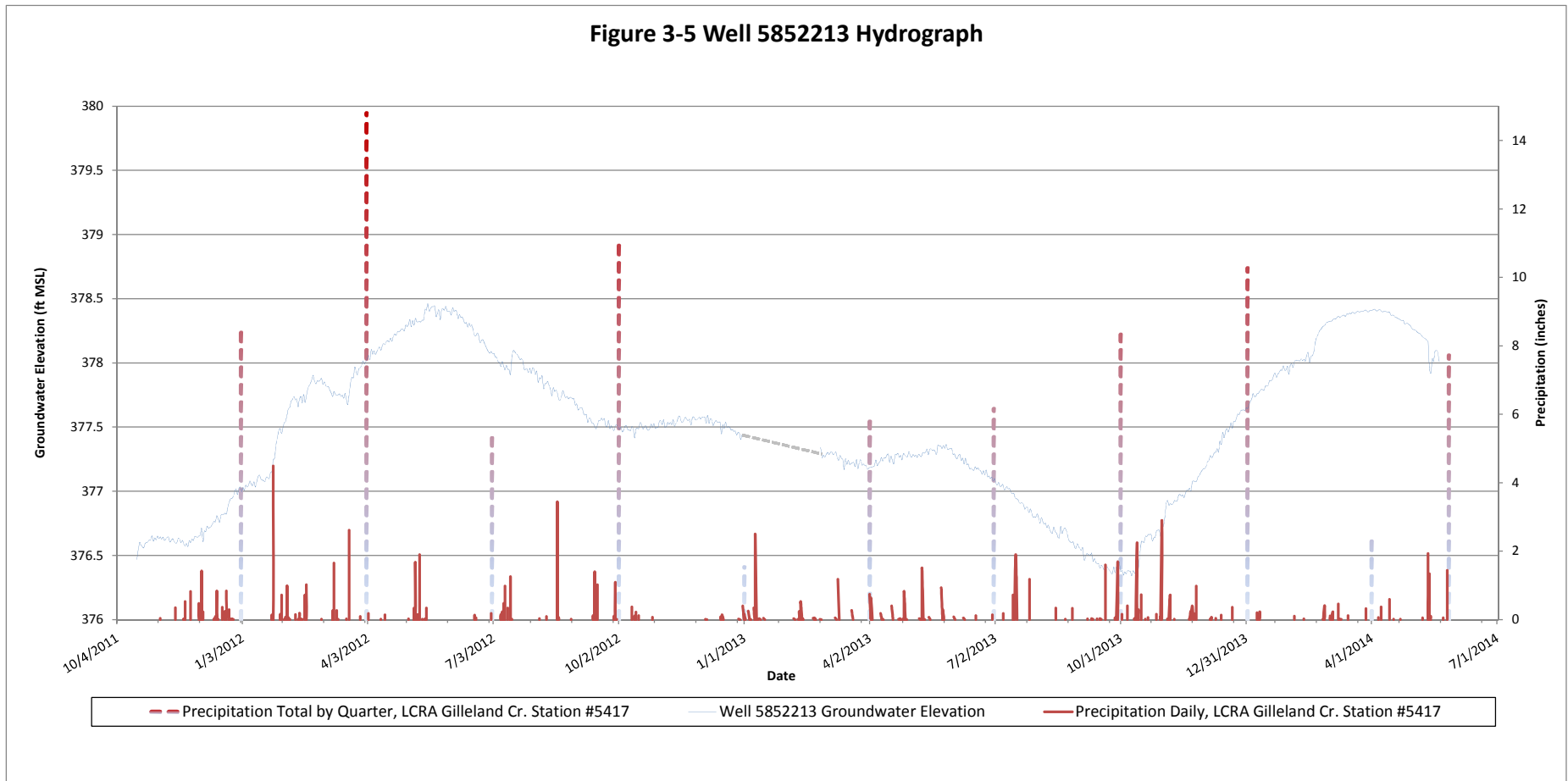
Drawn by:  
gary\_callahan

Site: Travis County CRCP

Title: **Figure 3-4  
Potentiometric Surface Map  
May 19-20, 2014**

Date: 13 Sep 2014	Drawing File: Fig 3-4 GWE0514	Figure: 3-4
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Figure 3-5 Well 5852213 Hydrograph



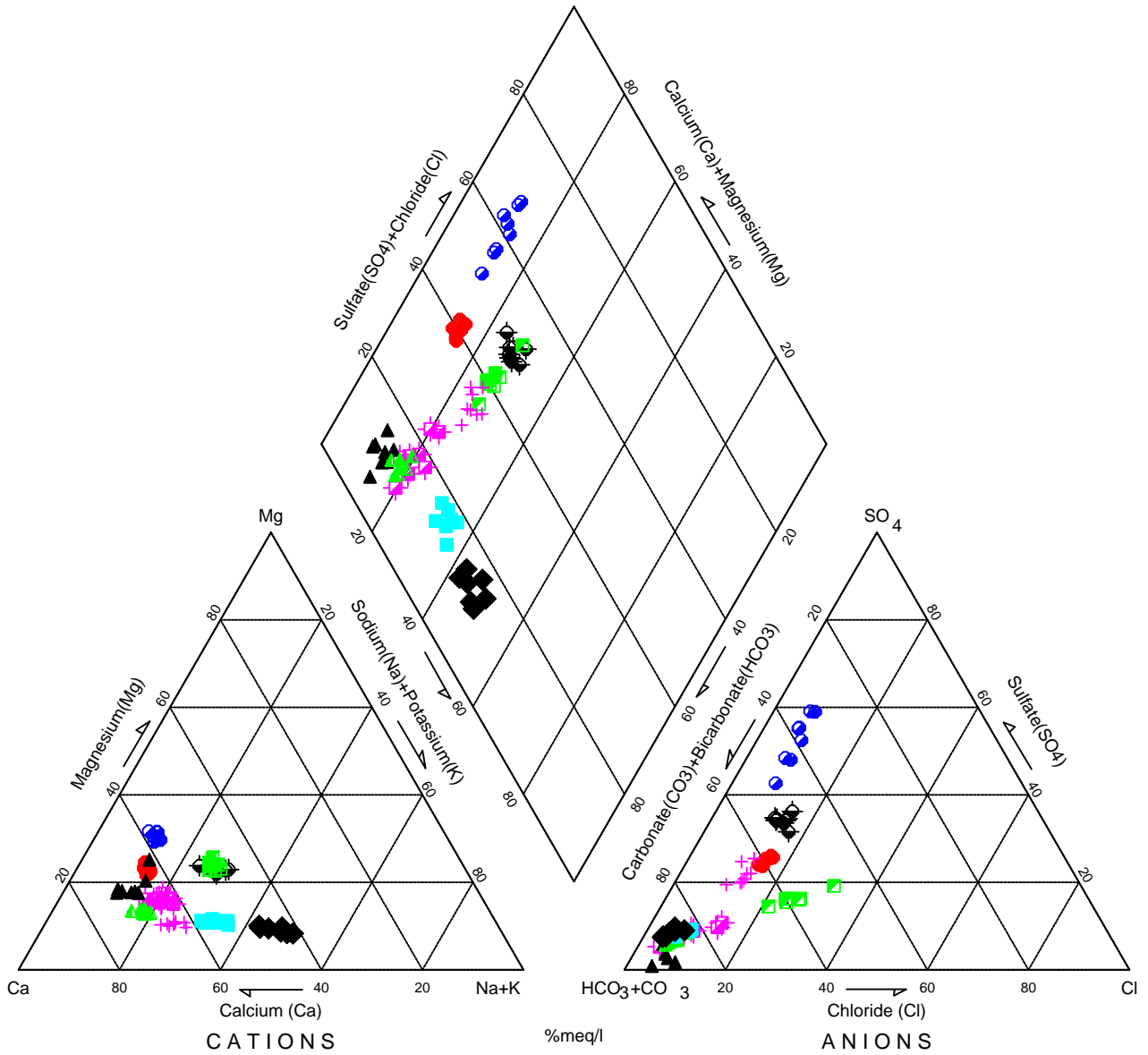
Note: Groundwater elevation extrapolated between January 27 and February 26, 2013 because of anomalous transducer-recorded data.

ft - Feet, foot.

MSL - Mean sea level.


LCRA - Lower Colorado River Authority.

File: K:\PROJECTS\Travis\_County\_CRCP\Baseline\_Report\2014\Diagrams2014.dwg Layout: Fig 3-6 Plotted: Sep 13, 2014 - 8:47pm

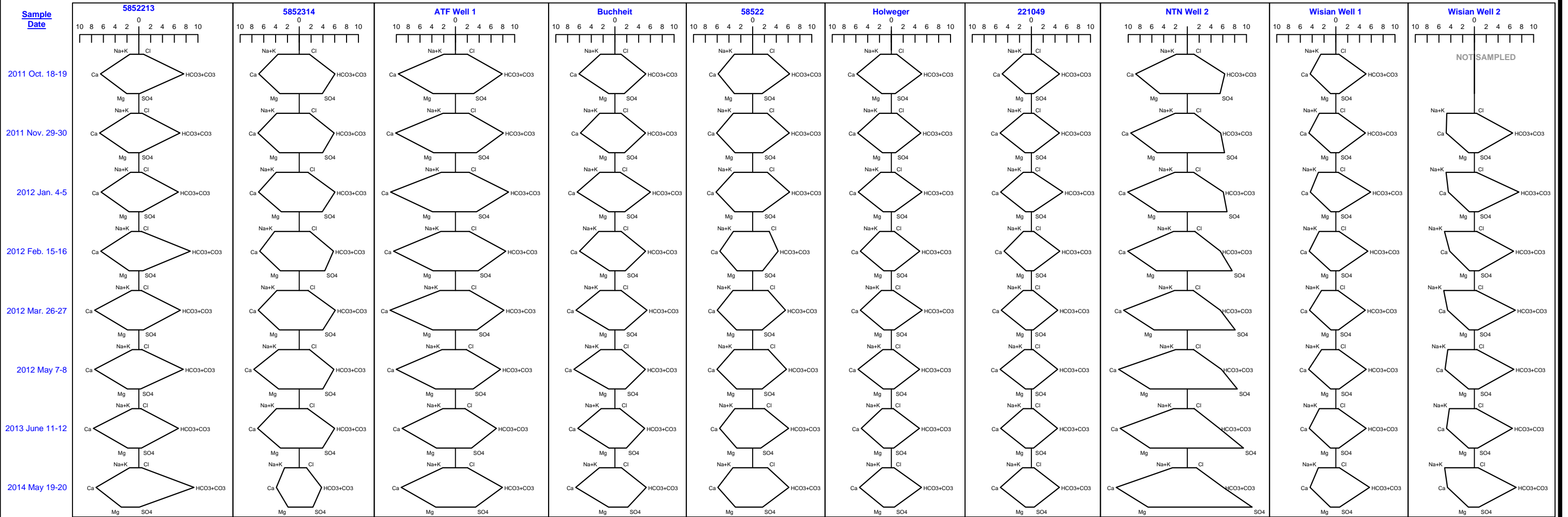


**Legend**

- ATF Well 1
  - ◆ 5852314 (MWS)
  - NTN Well 2
  - ✦ Holweger
  - ▲ 5852213 (TXI)
  - ▲ 221049 (King)
  - 58522 (Edgar)
  - Wisian Well 1
  - ◆ Wisian Well 2
  - ✦ Buchheit
- %meq/l Percent Milliequivalents per Liter

 9400 Amberglen Blvd. Austin, TX 78729 Phone: (512) 454-4797 Fax: (512) 419-5474	Client: <b>Travis County CRCP</b>	
	Title: <b>Figure 3-6 Trilinear Diagram</b>	
Drawn by:	Date: Sep 13, 2014	Figure: <b>3-6</b>

File: K:\PROJECTS\Travis\_County\_CRCP\Baseline\_Report\2014\Diagrams2014.dwg Layout: Fig 3-7 Plotted: Sep 13, 2014 - 8:47pm



Concentrations (milliequivalents per liter) of selected cations and anions from the 10 wells were used for the groundwater assessment.

<p>9400 Amberglenn Blvd. Austin, TX 78729 Phone: (512) 454-4797 Fax: (512) 419-5474</p>	Client: <b>Travis County CRCP</b>		
	Title: <b>Figure 3-7 Stiff Diagrams</b>		
Drawn by: gary_callahan	Date: Sep 13, 2014	Drawing File: Diagrams2014.dwg	Figure: 3-7

## 4.0 ENVIRONMENTAL MONITORING DATA EVALUATION

### 4.1 Task 1, Groundwater Evaluation

Groundwater availability and quality conditions based on Baseline and Interim Year 1 data were re-evaluated and updated using the Interim Year 2 groundwater data.

#### *Groundwater Availability*

The general groundwater flow direction of the Colorado River Alluvial Aquifer within the study area is towards the east and southeast with an average hydraulic gradient of 0.0021 (Figures 3-1 to 3-4). The groundwater flow direction is towards pumping wells Native Texas Nursery (NTN) Well 2, Austin Tree Farm (ATF) Well 1 and well 5852314. It is suspected that wells 5852314 and NTN Well 2 have the most significant influence on the potentiometric surface because of their daily cyclical pumping rates of approximately 670 gallons per minute (gpm) and 300 gpm, respectively. Well ATF Well 1 has an approximate pumping rate of 450 gpm, but it is not used on a regular basis. Localized buried gravel channels within the Colorado Alluvial Aquifer may provide preferential conduits for groundwater flow in directions not consistent with the general east-southeast groundwater flow direction.

From October 2011 to May 2014 the groundwater elevation in the area rose in eight of the 10 wells monitored. Table 4-1 shows the change in groundwater elevation at each well during the Baseline Year, Interim Year 1, Interim Year 2, and during the overall period covered by the Baseline and Interim Years. The overall rise in groundwater elevation is likely a recovery response to relatively average annual precipitation recharging the Colorado River Alluvial aquifer after the extreme dry conditions that persisted from February to October 2011 and relatively dry summer months in 2012 and 2013. The 2011 rainfall total recorded at Austin Bergstrom International Airport (ABIA) was only 16.90 inches and well below the average yearly rainfall of 32.56 inches. The 2012 rainfall totals recorded at ABIA and at the Gilleland Creek Station #5417 were 35.13 inches and 32.66 inches, respectively. In 2013 the Gilleland Creek Station recorded an annual rainfall total of 30.55 inches. Precipitation data from 1942 to 2013 at ABIA is included as Appendix C.

The observed groundwater elevation recorded with the transducer in well 5852213 shows marked increased water levels corresponding to precipitation events during the first quarter of 2012 and the fourth quarter of 2013. Water level trends are relatively flat or declining during periods of little or no precipitation (Figure 3-5). Although the area received average annual rainfall for 2012 and 2013, the rainfall was not distributed evenly by quarter. In 2012, approximately 46 percent (%) of the annual precipitation fell during the first quarter and in 2013, 34% fell during the fourth quarter. Cumulative precipitation by quarter is also presented on Figure 3-5.

Availability of groundwater for domestic, agricultural, and municipal use from the Colorado River Alluvial Aquifer is dependent upon the aquifer potentiometric surface remaining within or above the screened intervals of existing wells and is largely controlled by local precipitation recharge. During Interim Year 2, the observed water columns in wells included in the monitoring program ranged from 3.96 ft (Buchheit Well on September 11, 2013) to 25.85 ft (Mansville Water Supply Well, 5852314 on February 19, 2014) (Table 3-1). Overall

groundwater elevations ranged from approximately 390 ft above msl upgradient of the Hornsby Bend East mine location to approximately 370 ft above msl downgradient (Figures 3-1 to 3-4).

### ***Groundwater Quality***

Water quality of the Colorado River Alluvial Aquifer in the vicinity of the Hornsby Bend East mine location was assessed by analyzing the groundwater for benzene, toluene, ethylbenzene, xylene (BTEX), methyl tertiary butyl ether (MTBE), PAHs, and TPH, major-ions and total suspended solids (TSS).

Major-ions were graphically evaluated to identify the typical water types present prior to mining, and a statistical evaluation of major-ion concentrations in groundwater was performed to identify the typical range of values present during baseline conditions. No statistical evaluation was performed on the organic compounds (BTEX, MTBE, PAHs, and TPH) because all results were less than the detection or reporting limit of the laboratory analytical method used. However, it is noted that the detection limits for TPH, and five PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) are greater than their Texas Risk Reduction Program (TRRP) protective concentration level for groundwater ingestion.

Major-ion chemistry data was used to construct trilinear (Piper, 1944) and Stiff diagrams (Stiff, 1951). The trilinear diagram (Figure 3-6) depicts the water composition as percentage milliequivalents per liter (meq/L) and shows that the Colorado River Alluvial Aquifer groundwater is predominantly indicative of calcium-bicarbonate type water as observed in wells Wisian Well 1, 221049, Holweger, and 5852213. Wells 5852314, ATF Well 1, Buchheit, 58522, and NTN Well 2 have a calcium-bicarbonate/calcium-sulfate mixed type water. Wisian Well 2 is the furthest upgradient well in the study area and has calcium-bicarbonate/sodium-bicarbonate mixed type water.

Stiff diagrams (Figure 3-7) depict water composition as concentrations of meq/l for each of the eight samples collected from the 10 wells. The similarity of the eight stiff patterns from a single well indicates that no substantial temporal changes in major-ion chemistry occurred during baseline monitoring. This temporal consistency in major-ion chemistry at each well is also demonstrated by the tight pattern of plotted data for each well on the trilinear diagram (Figure 3-6). However, NTN Well 2 does show an increasing sulfate concentration trend from 266 milligrams per liter (mg/L) in October 2011 to 526 mg/L in May 2014 (Table 3-2). Calcium and magnesium also show an increasing trend at NTN Well 2 over the same time period albeit not as pronounced as the sulfate trend. A statistical evaluation of the water quality constituents for all wells is presented in Table 4-2 and the minimum, maximum and median for each well is presented in Table 4-3.

It is surmised that this increasing trend is related to the relatively high pumping rate of NTN Well 2 producing water with an increased contribution from the underlying Navarro and Taylor Groups. The abundant clay and shale mineralogy of the Navarro and Taylor Groups are a potential source for the increasing calcium, magnesium, and sulfate trend. This increasing trend is also evident in the trilinear and Stiff diagrams (Figures 3-6 and 3-7). Ideally water quality data from Navarro and Taylor Group wells located within the study area would be compared to the Colorado River Alluvial Aquifer data collected during the Baseline and Interim years to evaluate

if mixing of the waters could produce the water type observed at NTN Well 2. Unfortunately, no groundwater samples from Navarro and Taylor Group wells were collected and no Navarro and Taylor Group wells are known to be located within the CRCP study area boundaries. However, the Texas Water Development Board (TWDB) Groundwater database includes water quality data from 31 Navarro and Taylor Group wells located in eastern Travis County and a copy of the data download is included as Appendix D. From this data set, the median and maximum values of sulfate, calcium and magnesium from Navarro and Taylor Group wells is 190 mg/L and 2,230 mg/L (sulfate), 107 mg/L and 915 mg/L (calcium) and 21 mg/L and 211 mg/L (magnesium) respectively. The median calcium and magnesium values from the Navarro and Taylor Group wells are similar to median values from the Colorado River Alluvial Aquifer but the maximum values from the Navarro and Taylor Group are 2 to 3 times greater than the Colorado River Alluvial Aquifer maximum values shown on Table 4-2. The Navarro and Taylor Group median and maximum sulfate values are about 3 times and 4 times greater than the median and maximum sulfate values from the Colorado River Alluvial Aquifer.

These calcium, magnesium, and sulfate values from the Navarro and Taylor Group relative to the Colorado River Alluvial Aquifer values provide some anecdotal support that NTN Well 2 pumping may be drawing an increased contribution of water from the Navarro and Taylor Groups.

The statistics of the water quality constituents were used to estimate a range of values representative of pre-mining conditions. As expected, the median concentration for most constituents at the majority of the wells did not vary considerably from the overall median (Table 4-2). However, because of noticeable and consistent differences, primarily in sulfate concentrations, the well population may be split into two generalized groups: calcium-bicarbonate type water in western wells (Wisian Well 1, Wisian Well 2, 221049, Holweger, and 5852213) and calcium-bicarbonate/calcium-sulfate mixed type water in eastern wells (5852314, ATF Well 1, Buchheit, 58522, and NTN Well 2). Each population consists of five wells and divides the area from east to west.

### ***Water Quality Threshold Levels***

An indication that a change in baseline water quality has occurred could be gained by comparing newly observed water quality values to the range of baseline values shown on Table 4-2. However, just because a hypothetical future water quality parameter value may exceed its baseline maximum value does not necessarily indicate a change from baseline conditions. Natural variation in the baseline range exists and two distinct water types (east and west) have been identified at the site. Therefore, a two-tiered approach to identify values that exceed baseline conditions within each respective well population is proposed. The first tier is calculated as the median value plus two standard deviations, and the second tier is the maximum value plus two standard deviations. First and second tier values of the overall well population are presented in Table 4-2, and the minimum, maximum and median for each well is presented in Table 4-3. First and second tier values of the east and west well populations are presented in Table 4-4. This two-tiered approach is a revision to the threshold levels previously presented in the ***Final Baseline Report*** (URS, August 2012), which identified the maximum value plus one standard deviation for the overall well population as the threshold level.

**Table 4-1. Observed Groundwater Elevation  
Change from October 2011 to May 2014**

Well ID	Change in Groundwater Elevation (ft)			
	Baseline Year, October 2011 to May 2012	Interim Year 1, May 2012 to June 2013	Interim Year 2, June 2013 to May 2014	Baseline and Interim Years 1 and 2, October 2011 to May 2014
58522	+ 0.17	NM	NM	- 0.48
221049	+ 1.42	- 0.98	- 0.08	+ 0.36
5852213	+ 1.88	- 1.14	+ 0.77	+ 1.51
5852314	+ 4.85	- 6.10	+ 7.59	+ 6.34
ATF Well 1	+ 1.75	- 1.62	+ 1.57	+ 1.70
Buchheit	+ 0.82	- 0.87	- 0.30	- 0.35
Holweger	+ 1.44	- 0.81	+ 0.42	+ 1.05
NTN Well 2	+ 3.49	- 1.32	+ 0.38	+ 2.55
Wisian Well 1	+ 0.85	- 0.60	- 0.11	+ 0.14
Wisian Well 2	+ 0.67	- 0.37	- 0.21	+ 0.09

ATF - Austin Tree Farm.

ft - Feet, foot.

ID - Identification.

NM - Not measured, groundwater elevation below top of pump.

NTN - Native Texas Nursery.

**Table 4-2. Overall Water Quality Statistics**

Overall Statistic (all normal samples)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Ammonia (mg/L)	TSS (mg/L)	TDS (mg/L)
# of Samples	79	79	78	79	79	79	79	79	79	79	79	79	79
Median (50 <sup>th</sup> Percentile)	121	20.1	2.33	53.9	32.2	0.27	9.27	65.9	349	<2.00	0.02	1.20	675
Minimum	77.6	10.1	1.49	22.6	10.2	0.05	0.01	4.08	231	<2.00	0.02	1.00	440
Maximum	241	80.8	6.01	118	99.6	0.43	34.7	526	569	<10.0	6.35	274	1332
Standard Deviation	41.9	18.4	0.96	23.7	26.5	0.08	8.25	112	71.2	<3.48	0.87	32.1	210
Median + 2 Standard Deviations (First Tier)	205	56.8	4.25	101	85.2	0.43	25.8	291	491	<8.96	1.76	65.4	1095
Maximum + 2 Standard Deviations (Second Tier)	325	118	7.93	165	153	0.60	51.2	751	711	<17.0	8.09	338	1752

Data set from eight groundwater sampling events collected between October 2011 and May 2014.

< - Results is below the practical quantitation limit and is considered estimated.

mg/L - Milligrams per liter.

TDS - Total dissolved solids.

TSS - Total suspended solids.

**Table 4-3. Water Quality Statistics by Well**

Well ID	Minimum/Maximum	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Ammonia (mg/L)	TSS (mg/L)	TDS (mg/L)
ATF Well 1	Minimum	181	39.3	3.28	43.2	57.5	0.13	4.86	130	418	<2.00	0.02	1.00	878
	Median	202	45.5	3.795	48.75	75.7	0.23	6.815	166.5	485	<2.00	0.02	1.10	1012
	Maximum	222	47.3	4.49	57.4	83.6	0.36	11.3	184	544	<10.0	0.772	2.50	1123
5852314	Minimum	77.6	23	1.72	56.2	43.4	0.17	1.03	111	231	<2.00	0.02	1.10	544
	Median	138.5	39.4	2.14	85.95	57.1	0.245	10.8	189.5	358	<2.00	0.02	1.83	876
	Maximum	154	42.5	2.53	94.5	63.8	0.3	11.2	207	368	<10.0	0.1	2.50	891
NTN Well 2	Minimum	175	56.5	1.99	41.7	35.6	0.15	24.3	266	326	<2.00	0.02	1.00	965
	Median	209	66.1	2.32	47.85	40.4	0.28	30.5	376.5	343	<2.00	0.02	1.03	1083
	Maximum	241	80.8	2.51	56.3	54.3	0.42	34.7	526	382	<10.0	0.1	2.50	1332
Holweger	Minimum	102	15.3	1.49	31.9	11.8	0.19	15.1	19.5	287	<2.00	0.02	1.00	485
	Median	110	16.25	1.96	38.85	17	0.301	16.3	25.45	305	<2.00	0.02	1.10	522
	Maximum	117	19.7	2.03	45.2	32.6	0.43	21.6	34.1	314	<10.0	0.1	2.50	606
5852213	Minimum	128	20.1	4.35	22.6	12.6	0.23	0.01	4.08	404	<2.00	0.909	5.90	633
	Median	139	23.05	4.69	27.2	17.05	0.33	0.06	17.85	440	<2.00	1.45	21.8	685
	Maximum	154	36.0	6.01	33.0	27.8	0.39	0.10	37.4	569	<10.0	6.35	274	810
221049	Minimum	92.7	10.9	1.8	25.8	10.2	0.18	12.9	14.9	266	<2.00	0.02	2.50	440
	Median	104	12.1	1.89	30.1	12.2	0.27	13.6	17.7	285	<2.00	0.02	4.30	460
	Maximum	106	13.1	2.12	33.2	16.3	0.43	15	23.1	320	<10.0	0.1	17.9	498
58522	Minimum	111	32.1	1.75	68	71.3	0.2	2.42	65.9	259	<2.00	0.02	1.00	661
	Median	119	34.3	2.01	72.45	89.75	0.268	3.17	79.05	370	<2.00	0.02	2.20	759
	Maximum	124	37.5	2.23	75.6	99.6	0.331	4.27	81.3	382	<10.0	0.16	26.0	784
Wisian Well 1	Minimum	86.6	10.1	2.3	53.9	12.7	0.191	8.03	21.2	300	<2.00	0.02	1.00	493
	Median	89.8	10.8	2.72	62.8	15.9	0.254	8.84	26	309.5	<2.00	0.02	1.25	517
	Maximum	92.2	11.2	3.04	66.2	21.5	0.41	9.94	30.6	356	<10.0	0.1	2.50	568
Wisian Well 2	Minimum	83.9	10.2	1.97	96.4	10.6	0.05	9.07	26.8	388	<2.00	0.02	1.00	633
	Median	91.4	12.0	2.47	109	12.2	0.12	10.1	31.2	403	<2.00	0.02	1.10	670
	Maximum	99.4	12.5	2.8	118	22	0.189	12.5	36.6	455	<10.0	0.946	9.20	710
Buchheit	Minimum	117	11.4	2.06	52.3	29.9	0.28	3.73	76	303	<2.00	0.02	1.00	618
	Median	127	12.6	2.39	56.9	37.1	0.38	4.14	82.3	315	<2.00	0.02	1.01	638
	Maximum	139	13.1	2.59	61.5	39.9	0.413	5.16	105	363	<10.0	0.10	5.00	678

Data set from eight groundwater sampling events collected between October 2011 and May 2014.

- < - Result is below the limits of detection, not detected.
- ATF - Austin Tree Farm.
- ID - Identification.
- mg/L - Milligrams per liter.
- NTN - Native Texas Nursery.
- TDS - Total dissolved solids.
- TSS - Total suspended solids.

**Table 4-4. Water Quality Statistics by Well Population (East and West)**

Wells Statistic (normal samples)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Ammonia (mg/L)	TSS (mg/L)	TDS (mg/L)
<b>West Wells (Calcium-bicarbonate water type)</b>													
# of Samples	39	39	39	39	39	39	39	39	39	39	39	39	39
Median (50 <sup>th</sup> Percentile)	104	12.2	2.46	37.5	14.5	0.27	10.1	24.8	314	<2.00	0.02	2.40	548
Minimum	83.9	10.1	1.49	22.6	10.2	0.05	0.01	4.08	266	<2.00	0.02	1.00	440
Maximum	154	36.0	6.01	118	32.6	0.43	21.6	37.4	569	<10.0	6.35	274	810
Standard Deviation	19.2	5.51	1.14	29.5	5.34	0.09	6.00	7.9	74.5	<3.49	1.19	44.6	97.0
Median + 2 Standard Deviations	142	23.2	4.74	96.5	25.2	0.45	22.1	40.6	463	<8.99	2.40	91.7	742
Maximum + 2 Standard Deviations	192	47.0	8.29	177	43.3	0.62	33.6	53.2	718	<17.0	8.73	363	1004
<b>East Wells (calcium-bicarbonate/calcium-sulfate mixed water type)</b>													
# of Samples	40	40	40	40	40	40	40	40	40	40	40	40	40
Median (50 <sup>th</sup> Percentile)	139	39.1	2.31	56.9	55.9	0.27	6.72	155	362	<2.00	0.02	1.10	876
Minimum	77.6	11.4	1.72	41.7	29.9	0.13	1.03	65.9	231	<2.00	0.02	1.00	544
Maximum	241	80.8	4.49	94.5	99.6	0.42	34.7	526	544	<10.0	0.77	26.0	1332
Standard Deviation	42.7	18.6	0.7	14.5	20.9	0.10	9.9	115.7	66.7	<3.50	0.10	3.90	187
Median + 2 Standard Deviations	224	76.2	3.75	85.8	97.7	0.41	26.6	387	495	<8.93	0.26	8.92	1252
Maximum + 2 Standard Deviations	326	118	5.92	123	141	0.57	54.6	757	677	<16.9	1.01	33.8	1708

Data set from eight groundwater sampling events collected between October 2011 and May 2014.

< - Result is below the limits of detection, not detected.

mg/L - Milligrams per liter.

TDS - Total dissolved solids.

TSS - Total suspended solids.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

The following section presents the conclusions and recommendations of the Interim Year 2 environmental monitoring for groundwater.

### 5.1 Conclusions

#### *Groundwater*

Baseline groundwater availability conditions of the Colorado River Alluvial Aquifer in the vicinity of the Hornsby Bend East and Hornsby Bend West mine location indicate that groundwater flow is to the east and southeast, with a typical potentiometric surface of approximately 390 ft above msl on the west to approximately 370 ft above msl on the east. Groundwater elevations in the area were rising as winter and spring 2012 precipitation recharged the aquifer after an abnormally dry summer and fall of 2011. Declining or relatively flat water levels persisted from summer 2012 to fall 2013. Rising water levels in late fall 2013 and winter 2014 correspond to relatively increased precipitation (Table 3-1 and Figure 3-5).

The baseline groundwater quality values based on the Baseline and Interim Year 1 data were updated with data from Interim Year 2. It is appropriate to update the baseline water quality values with Interim Year 2 data because no mining was performed at the site during Interim Year 2, and no observable site conditions expected to affect baseline conditions were changed. The new data from Interim Year 2 had median values similar to the Baseline and Interim Year 1 median values and resulted in a 2% average change to the median values.

Groundwater at the site is split between two general water types. Calcium-bicarbonate type water on the west and calcium-bicarbonate/sodium-bicarbonate mixed type water to the east. The minimum to maximum ranges of water quality constituents on Table 4-2 are indicative of baseline water quality conditions. The second tier (maximum + 2 standard deviations) water quality values can be used as a threshold criteria to determine if baseline levels have been exceeded based on the overall well population and or by the east and west well populations as appropriate by location.

### 5.2 Recommendations

#### *Groundwater*

Prior to initiation of active mining operations at the Hornsby Bend East and Hornsby Bend West sites, it is recommended that groundwater levels and TPH sampling be conducted quarterly at the same 10 wells included in the baseline monitoring and that continuous water level monitoring at well 5852213 be continued. Groundwater sampling from the 10 wells for basic water quality constituents should be performed annually until active mining commences. The water quality and groundwater availability data collected during this interim mining period should be used to update baseline values. Once active mining starts, it is recommended that groundwater sampling and availability monitoring be conducted quarterly, and that quarterly air sampling and noise monitoring be resumed.

## 6.0 REFERENCES

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