EXHIBIT 9

Draft Hydrogeologic Conceptual Site Model Report

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DRAFT
HYDROGEOLOGIC CONCEPTUAL SITE MODEL REPORT

Former Payless/Allstate, Avis and National Facilities
McCarran International Airport
Las Vegas, Nevada

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McCarran International Airport
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1.0 INTRODUCTION

Geo Blue Consulting, Inc. (Geo Blue) prepared this report describing the hydrogeologic portion of the Conceptual Site Model (CSM) common to the Payless/Allstate (8-000006), Avis (8-000217), and National (8-000416) facilities, formerly located at McCarran International Airport (McCarran Airport) on Rent-A-Car Road in Las Vegas, Nevada. The Nevada Division of Environmental Protection (NDEP) is directing cleanup of gasoline releases, including methyl tert-butyl ether (MTBE) and tert-butyl alcohol (TBA) in groundwater beneath and downgradient of the facilities. The downgradient MTBE and TBA plumes are regulated by the NDEP as a commingled plume. The NDEP required that the responsible parties for these three facilities prepare this report to summarize background information for the investigation and remediation of the former car rental facilities. Geo Blue prepared this report at the request of the Certified Environmental Managers (CEMs) for the responsible parties, including OGI Environmental LLC (OGI), Broadbent & Associates, Inc. (Broadbent), and Converse Consultants (Converse).

1.1 OBJECTIVE

This hydrogeologic portion of the CSM describes the geologic framework and groundwater conditions which are common to the former Payless, Avis, and National car rental facilities. The interpreted hydrogeology includes description of hydrostratigraphy, groundwater flow direction evaluation, and identification of potential MTBE and TBA migration pathways. This hydrogeologic framework provides the basis for interpretation of: (1) the extents of the residual groundwater impacts, (2) attenuation of MTBE and TBA in groundwater, and (3) impacts to groundwater quality downgradient of the facilities.

1.2 HYDROGEOLOGIC CSM DEVELOPMENT

This report summarizes background information and documents the interpretations and conceptual hydrogeologic framework developed between approximately 2007 and 2016 through quarterly technical meetings between the car rental facilities and the NDEP. Under NDEP oversight, the responsible parties have investigated, remediated source areas, and are continuing to monitor the extents of MTBE and TBA in groundwater downgradient of the former facility locations. Subsurface data collected by the CEMs are shared at the meetings and the data are used to update and refine or validate this CSM.

Starting in 2010, the data were compiled in a common database. On behalf of the environmental managers, CE2 Corporation maintains the database and prepares graphs, maps, and tables presenting the groundwater data. The data reports are available at http://www.ce2corporation.com/mccarran. In 2011, the CEMs retained AMEC Geomatrix, Inc. (Amec) to extract data from the common database and present it on large scale maps and a series of interpretive geologic cross-sections.

Initial draft interpretive geologic cross-sections, hydrostratigraphic interpretations, and delineation of the MTBE and TBA plumes were presented to the NDEP during the 9 May 2013 All Facilities meeting and updated for the 4 February 2014 meeting. Additional field investigation was subsequently performed and the hydrogeologic interpretations and interpretive geologic cross-sections were updated in 2015 and again in 2016. The most recent update is dated 28 September 2016 and was prepared by Langan Treadwell Rollo on behalf of the CEMs. The interpretive geologic cross-sections are included as Appendix A, and the presentation slides from the 9 May 2013 and 4 February 2014 meetings are included as Appendix B.

2.0 SITE DESCRIPTION

In this report, "the site area" is defined as the approximately 4,900 feet long and 700 feet wide area, trending west-southwest to east-northeast, that was investigated during the commingled plume project (Figure 1). The site area extends from McCarran Airport in the west to Maryland Parkway in the east and encompasses approximately 80 acres of land. The site area is overlain by McCarran Airport parking lots, public roadways, and commercial and residential developments. The locations of the facilities, the offsite investigation areas, the climate of the area, and land uses are described in this section.

2.1 LOCATION

The Payless, Avis, and National car rental and vehicle fueling operations were conducted at leaseholds in the northeastern portion of McCarran Airport. McCarran Airport and the site area are located in the south-central portion of the Las Vegas Valley (Figure 2).

The Payless and National facilities were on the west side of Rent-A-Car Road, and the Avis facility was on the east side. The car rental facilities addresses were 5175 (Payless), 5164 (Avis), and 5233 (National) Rent-A-Car Road. A number of other car rental facilities were historically located in this area as well and also were accessed from Rent-A-Car Road. The car rental facilities were demolished in 2007 and were replaced with the McCarran Airport Terminal 1 Economy Parking Lot (Figure 3).

East-northeast from the former Avis facility, the area between Paradise Road and Swenson Road was occupied by the Airport Inn (and subsequently a Howard Johnson's motel), several commercial properties, and the Palo Verde Circle residences. The Palo Verde Circle residences overlie the northernmost area investigated as part of the commingled plume investigations. The Howard Johnson's motel was demolished in 2012 and, as of 2017, is undeveloped.

Continuing in the east-northeastern direction from the former car rental facilities, the area between Swenson Boulevard and South Maryland Parkway is occupied by several residential neighborhoods. Commercial centers are located around the intersection of South Maryland Parkway and East Tropicana Avenue. Wilbur Street is within this area and is located approximately half-way between Swenson Road (Swenson Road is alternatively identified as the "McCarran Airport Connector") and South Maryland Parkway.

2.2 CLIMATE

The Las Vegas valley climate is arid and characterized by large temperature swings. Valley floor temperatures can exceed 120 degrees Fahrenheit, and there are typically more than 125 days per year where temperatures are 90 degrees Fahrenheit or warmer (Houghton et al, 1975). Conversely, in the Spring Mountains, west of the valley, winter temperatures are frequently below 32 degrees Fahrenheit. Average annual temperatures have increased from the mid-60s Fahrenheit in the 1980s, to approximately 70 degrees Fahrenheit in the 2000s (NOAA, 2016).

Annual average rainfall on the Las Vegas Valley floor is approximately 4 inches (NOAA, 2016). The Spring Mountains to the west receive more than 24 inches of precipitation each year. Rainfall patterns and the effects of these patterns on groundwater flow in the Las Vegas Valley groundwater basin are discussed in Section 5.

2.3 CURRENT AND FUTURE LAND USE

The land use in the locations of the former facilities is airport parking. Land uses over the downgradient portion of the commingled plume are residential and commercial. Development in the site area began in the 1960s, and the initial land uses remain relatively unchanged, despite the rapid population growth of the Las Vegas Valley. The population of Las Vegas increased from less than 500,000 in the 1980s to over 2 million in the 2010s (NOAA, 2016).

According to the City of Las Vegas Master Plan 2020, adopted 15 June 2000, while the overall population of Las Vegas is expected to continue to increase, land uses in the site area are expected to continue unchanged in the future. Future developments that could affect groundwater flow, such as subway systems or multi-story subterranean parking structures, although possible, are unlikely in this area, according to the Master Plan 2020.

3.0 HISTORICAL SITE INFORMATION

The Payless, Avis, and National facilities were formerly operated as car rental agencies with onsite vehicle fueling. A records review commissioned by the NDEP in 1996 identifies 13 sites with underground storage tanks (USTs), two additional sites with aboveground storage tanks (ASTs) and McCarran Airport's fuel farm in the vicinity of Rent-A-Car Road (HLA, 1996). Additional review of UST facilities in this area was performed by Broadbent in 2006 (Broadbent, 2006). The Payless (Allstate), Avis, and National car rental operations are listed in the 1996 review. By 2007, operations at these three car rental facilities had ceased and the USTs had been removed.

The history of the site area includes development of McCarran Airport and residential developments to the east-northeast, past Swenson Road by the mid-1960s; paving of Rent-A-Car Road and construction of car rental facilities in the 1980s; and operation of car rental agencies along Rent-A-Car Road through the 1990s and early 2000s (HLA, 1996). In 2006, 16 locations with registered USTs and 10 leaking underground storage tank (LUST) sites were located in the vicinity of Rent-A-Car Road (Broadbent, 2006). The detailed use history at the former Payless, Avis, and National car rental facilities, including UST systems, upgrades and removals, is provided in separate reports specific to each facility.

4.0 REGIONAL GEOLOGIC SETTING

The Las Vegas Valley is a structural depression formed by tectonic extension of the Basin and Range Province. The Spring Mountains west of the valley consist primarily of carbonate rocks in a series of thrust sheets. In addition, the southern part of the Spring Mountains includes red cliffs formed from the Aztec Sandstone. The valley is bounded to the east by Frenchman Mountain, consisting primarily of Cambrian age sandstone overlying crystalline basement rock. The Las Vegas Valley and surrounding mountain ranges are shown on Figure 4.

4.1 GEOMETRY OF THE ALLUVIAL GROUNDWATER BASIN

While bedrock is exposed on the mountain ranges surrounding the valley, unconsolidated sediments cover the valley floor with thicknesses of up to 1,500 feet or more. In most areas of the valley, the thickness of the alluvium is at least 1,000 feet. The axis of the alluvial basin trends northwest to southeast and is approximately 40 miles long and 12 to 20 miles wide. Ground surface elevation of the valley is approximately 3,000 feet above mean sea level (msl) in the northwest and approximately 1,500 feet above msl in the southeast. The surrounding mountain ranges reach elevations of almost 12,000 feet above msl (NGWA, 1998).

4.2 COMPOSITION OF ALLUVIUM AND PLAYA DEPOSITS

The alluvial sediments of the valley consist primarily of clastic rocks eroded from the surrounding mountains. In the site area, water resource investigations have divided the sedimentary units into playa and alluvial fan deposits (Leising, 2004; Figure 5). The alluvial fan deposits generally consist of interbedded sandy gravels and the playa deposits consist of silts and clays. Caliche within the alluvial fan deposits is extensive and on a regional scale has been hypothesized to impede vertical groundwater flow.

4.3 QUATERNARY FAULTS

A series of east-dipping normal faults surfaces on the west side of the Las Vegas Valley (Figure 6). These active faults are mapped to the north of the site and are oriented north-south. The three active faults mapped closest to the site area include the Cashman Fault which runs adjacent to Eastern Avenue and the southern end of which is near Spring Mountain Road; the Valley View Fault adjacent to Las Vegas Boulevard, north of Sands Avenue; and the Decatur Fault, paralleling Decatur Boulevard, northward from the intersection of Decatur Boulevard and Hacienda Avenue (Page, Lundstrom, Harris et al, 2005).

5.0 REGIONAL GROUNDWATER CONDITIONS

The Las Vegas Valley hydrographic area (Hydrographic Basin 13-212) includes: (1) the alluvial groundwater basin formed by unconsolidated valley-fill sediments and (2) bedrock aquifers in the surrounding mountain ranges and underlying the valley-fill (Guillory & Brantley, 2015).

Figure 4 shows the areal extent of the Las Vegas Hydrographic Basin. The unconsolidated sediments consist primarily of clastic deposits from the surrounding mountain ranges. Lithostratigraphic units within the valley-fill are generally identified as coarser alluvial fan deposits or finer grained playa deposits. The unconsolidated sediments form a groundwater reservoir beneath the Las Vegas Valley from the shallow water table to the underlying crystalline basement rocks.

5.1 OCCURRENCE AND DEPTHS

Groundwater levels in the Las Vegas Valley range from just below ground surface (bgs) near the Las Vegas Wash to several hundred feet bgs near the western border of the alluvial basin. The groundwater table generally occurs within the upper 50 feet of most of the Las Vegas Valley floor (Lopes et al, 2006). Excessive groundwater pumping for municipal supply resulted in decreases of several hundred feet in the potentiometric surface elevations of the deeper groundwater aquifers in the 1970s. In the early 1990s, the deeper aquifer potentiometric surface elevations recovered by up to 70 feet as a result of an artificial recharge program (Figure 7).

5.2 GROUNDWATER FLOW DIRECTIONS AND GRADIENTS

Groundwater is recharged to the Las Vegas Valley groundwater basin primarily from the Spring Mountains. Groundwater flow within the valley-fill basin generally trends (1) southward from between the toe of the Kyle Canyon alluvial fan and the western base of the Sheep Range, and (2) eastward toward the Las Vegas Wash from the Spring Mountains. Groundwater beneath the Redrock alluvial fan, and in the piedmont areas to the south, generally flows in the east-northeastward. Groundwater exits the Las Vegas Valley groundwater basin south of Frenchman Mountain and flows toward Lake Mead (Figure 4).

Precipitation in the Spring Mountains recharges the bedrock aquifers. From the bedrock aquifers, groundwater flows into the unconsolidated valley-fill sediments (Domenico, Stephenson, and Maxey, 1964; Figure 8). In general, most groundwater entering the Las Vegas Valley groundwater basin is believed to be transmitted to the valley-fill aquifers through the carbonate rock units of the Spring Mountains (Plume, 1989). Within the valley-fill deposits, current-day groundwater flow paths are generally assumed parallel to surface topography, except where faults provide conduits for vertical flow. This flow pattern is used to explain the artesian conditions in many early water wells drilled on the valley floor.

The sustainable yield for the groundwater basin (excluding artificially recharged import water) is conservatively estimated at 25,000 acre-feet per year (Maxey and Jameson, 1948). Natural recharge estimates range from approximately 30,000 acre-feet per year to approximately 60,000 acre-feet per year (Malmberg, 1965; Harrill, 1976; Donovan & Katzer, 2000). Net well pumpage (i.e., excluding pumpage of artificially recharged water) decreased from approximately 85,000 acre-feet per year in the late 1960s and early 1970s, to a low of approximately 41,000 acre-feet in 1999 (Guillory & Brantley, 2015). From 2000 through 2015, net pumpage increased from approximately 44,000 to 75,000 acre-feet (Guillory & Brantley, 2015).

5.3 LVVWD HYDROSTRATIGRAPHIC UNITS IN THE MWFA

In the Las Vegas Valley Water District's (LVVWD) Main Well Field Area (MWFA), located approximately 6 miles north of the site area, the valley-fill has been subdivided into three hydrostratigraphic units: (1) Las Vegas Wash Aquitard, (2) Las Vegas Springs Aquifer, and (3) Duck Creek Aquifer (Donovan, 1996). Lithologic properties vary within each unit, so classification of the units as "aquifers," or "aquitards," is generalized. The hydrostratigraphic units were developed based on correlation to allostratigraphic units. Allostratigraphic units are defined by interpreted ages of accumulation.

The Las Vegas Wash Aquitard forms the uppermost few hundred feet of valley-fill sediments in the MWFA. This hydrostratigraphic unit consists of interbedded fine and coarse-grained deposits. Underneath the Las Vegas Wash Aquitard, municipal wells are screened within the Las Vegas Springs Aquifer; the depth of the upper boundary of this aquifer varies from near 100 to over 400 feet bgs. The Duck Creek Aquifer underlies the Las Vegas Springs Aquifer, extending from approximately 400 to 950 feet below ground surface. In general, the Las Vegas Springs Aquifer is coarser on the west side of the valley and becomes finer grained as it nears the Las Vegas Wash. An idealized representation of the MWFA hydrostratigraphy is shown in Appendix B (Amec, 2013, page 6).

5.4 BASIN-WIDE HYDROGEOLOGIC FRAMEWORK

Based on a limited data set, using driller well logs to estimate lithology, Plume (1989) developed a hydrogeologic framework for the Las Vegas Valley. Plume's study estimated that the upper approximately 50 feet of sediments in the area near McCarran Airport consists of thinly bedded fine and coarse-grained sediments, and that this lithologic unit thins toward the Las Vegas Wash to the east. Underlying this unit, Plume estimated an approximately 50 to

100 feet thick fine-grained unit. At between approximately 100 and 150 feet below ground surface, the upper surface of a regional coarse-grained unit (i.e., a principal aquifer) was estimated. Plume's fence diagram of the Las Vegas Valley subsurface is included as Figure 9.

5.5 SHALLOW GROUNDWATER SEPARATION FROM DEEPER AQUIFERS

The Las Vegas shallow aquifer system overlies the Las Vegas Wash Aquitard, other low permeability units, or in some areas near-surface aquifers (LVVWD, 1991). The shallow aquifer system is generally defined as the upper 30 feet of saturated sediments where groundwater occurs within 20 feet of ground surface (i.e., groundwater from 20 to 50 feet bgs). The shallow aquifer system may consist of perched groundwater overlying lower permeability units or may consist of horizontally migrating shallow groundwater that overlies deeper groundwater (LVVWD, 1991).

5.6 SOURCES OF RECHARGE TO SHALLOW SYSTEM AND DEEPER AQUIFERS

Prior to urbanization of the Las Vegas Valley and overdraft of the deeper aquifers, groundwater migrated upward from the deeper aquifers (1) into the shallow aquifer system or springs and seeps along fault surfaces, and (2) into the shallow aquifer system through discontinuities in the Las Vegas Wash Aquitard. Overdraft of the deeper aquifers in the 1970s discontinued most upward groundwater flow; however, excess landscape irrigation, leaking sewer and water supply lines, and other anthropogenic sources provided replacement sources of recharge to the shallow aquifer system (LVVWD, 1991). Accordingly, water table levels dropped through the 1980s in some areas, while no changes or increases in the water table elevation were recorded in other areas.

During the 1990s, the LVVWD conducted an artificial recharge program that injected surface water imported from Lake Mead into the Las Vegas Springs Aquifer. Potentiometric surface elevations for wells screened in the Las Vegas Springs Aquifer increased by tens of feet near the injection sites within the MWFA, but did not recover to pre-development levels (Leising, 2004; Figure 7). The effects of the recharge program on water levels in the shallow aquifer system appear to vary regionally.

5.7 REGIONAL WATER QUALITY

Shallow groundwater within the Las Vegas shallow aquifer system is typically saline, exhibiting total dissolved solids (TDS) concentrations between 1,000 and 7,000 mg/L (Huntington, 2016). High TDS is associated with high rates of evapotranspiration on the valley floor and with dissolution of minerals within the shallow aquifer system (Leising, 2004). Deeper groundwater, generally below 100 feet bgs, typically exhibits much lower TDS concentrations.

Below the shallow aquifer, several groundwater facies have been identified, each with a different range of typical TDS concentrations. Groundwater from the Spring Mountain facies is generally documented as having TDS concentrations in the range of 350 to 500 mg/L.

6.0 SURFACE WATER BODIES

There are no perennial streams or rivers flowing from the Spring Mountains and onto the valley floor. The Las Vegas Wash, downstream of the waste water treatment plant, is the largest flowing surface water body in the Las Vegas Valley and is located approximately 6 miles east of the site area. Near the Las Vegas Wash, several smaller washes may exhibit occasional surface flows. Flows within the washes on the alluvial fans are generally the result of heavy rainfall and quickly infiltrate or evaporate. An unnamed wash intersects Gus Giuffre Road near Paradise Road. This unnamed wash has been culverted and routed through or around developments (Figure 10). A second unnamed wash was located near Lulu Avenue. This wash has also been culverted.

7.0 NEARBY WATER WELLS

For 2015, the Nevada Division of Water Resources (DWR) estimated gross groundwater pumpage from wells in the Las Vegas Valley at over 75,000 acre-feet. Most pumpage was from municipal wells, including those in the MWFA. The MWFA is approximately 6 miles north of the site area; however, historically, groundwater supply development included a municipal well center west of McCarran Airport which produced 5.0 million gallons per day (MGD) or 2,300 acre-feet per year. The DWR attributes approximately 6.5% of the total 2015 pumpage, or nearly 5,000 acre-feet, to domestic wells (Guillory & Brantley, 2015). DWR estimates 4,489 active domestic wells in the Las Vegas Valley basin (Guillory & Brantley, 2015).

Water supply well surveys were conducted for the site area in 1995, 2008 and 2016. The 1995 survey by Broadbent reviewed DWR records and identified wells #16691 and #15760 within ½ mile of the Avis facility. The 1995 report concluded that neither of the wells were downgradient and, therefore, were unlikely to be impacted. The 2008 survey was conducted using the LVVWD FacilityView program and field reconnaissance and found four wells approximately 5,000 feet east of the distal end of the plume. The 2016 survey included re-evaluation of the LVVWD database and confirmed the 2008 findings (Broadbent, 2016; Figure

11). In addition, Amec (2013) reviewed DWR records to obtain lithologic and historical water quality data for the site area. The results of that effort are described in Section 8.3.

8.0 SITE GEOLOGY

The geology of the site is assessed primarily on the recorded observations of geologists and engineers during subsurface activities related to the investigation and remediation of the commingled plume. The monitoring well database for the commingled plume includes 168 monitoring wells and associated boring logs. The geology of the site area was also investigated during drilling of temporary borings and remediation wells, and during excavations, and many of the reports of these activities include descriptions of the geology observed during the work.

8.1 SURFACE GEOLOGY

To augment the site-specific observations, Geo Blue reviewed a geologic map of the Las Vegas Valley (Figure 6). Surficial geology of the northeastern portion of McCarran Airport, including the three former car rental leaseholds, is mapped by the USGS as younger quaternary alluvium (Qay). Sediments within the wash intersecting Gus Giuffre Road, adjacent to the former Payless and Avis operations are mapped as youngest quaternary alluvium (Qayy). The quaternary alluvium is classified as gravelly fan deposits. East of Swenson Street, the USGS maps surficial geology as undivided fine-grained sediments of the Las Vegas Valley, of quaternary and potentially tertiary age (QTs) (Page, Lundstróm, Harris, et al., 2005). Presumably, based on depositional ages, Qayy overlies Qay, which in turn overlies QTs. The thicknesses of the units are not specified in this USGS geologic report.

8.2 LITHOLOGY OF LOGGED SEDIMENTS

Observed lithology documented in the project reports included clays, silts, sands, gravels, and caliche. The caliche is a secondary deposition, observed primarily within the sands and gravels. In general, sands, poorly graded sands (i.e., sand-silt or sand-clay mixtures), gravels, poorly graded gravels (i.e., gravel-silt or gravel-clay mixtures) predominate the upper 30 feet of many boring logs. Sediments below 30 feet bgs, to the maximum explored depth of the investigations or approximately 80 feet bgs, were predominated by clays and silts. Sand and gravel beds several feet thick were recorded between 30 and 80 feet bgs on many of the logs for deeper borings. Logs generated for the upper 25 to 30 feet in the site area west of Swenson Street frequently include thinly bedded silty sands and gravels. In the upper approximately 30 feet of borings drilled east of Swenson Street, relatively finer grained deposits were more frequently observed, including clayey sands, silty sands, clayey gravels, and silty gravels.

As part of the downgradient and deeper groundwater investigations conducted from 2009 through 2014 (OGI, 2009; Broadbent, 2010; Broadbent, 2012; OGI, 2014), deeper borings were drilled. Throughout the site area, clays and silts, including a red or reddish-brown clay, were frequently observed below 30 feet bgs. Although the predominant lithology is fine grained, gravel and sand beds up to several feet thick were reported in a number of logs.

8.3 DEEPER SITE GEOLOGY

The investigations performed in the site area extended to a maximum depth of approximately 80 feet bgs. There are approximately 25 wells with screens that are within the range of 60 to 80 feet bgs. To further evaluate the deeper site lithology, below 80 feet bgs, Amec (2013, 2014) obtained driller's well logs for former water supply wells in or adjacent to the site area. DWR records identified 12 inactive or destroyed wells installed between 1943 and 1962 in the NE quadrant, of the NW quadrant, of Section 27, Township 21 south, Range 61 east, Las Vegas Valley hydrographic area (i.e., wells with identification beginning with 212 S21 E62 27 BA). From these 12 wells, 9 drillers logs provided sufficient detail to estimate sediment lithology. Using a visual comparison of the logs, Amec concluded that the sediment type observations recorded on the logs confirmed the differentiation between the upper 30 feet bgs and deeper site lithology (Amec, 2014). The logs also suggest that the predominantly fine-grained lithology continues downward until at least approximately 100 to 120 feet bgs.

8.4 INTERPRETIVE GEOLOGIC CROSS SECTIONS

Cross-sections oriented parallel and perpendicular to the commingled plume axis were prepared to provide a three-dimensional representation of the site subsurface. To generate the cross-sections, Unified Soil Classification System (USCS) soil types, well construction, groundwater chemistry, former site boundaries, remedial systems, former excavations, major roadways, and key surface features were geocoded in ArcGIS, then plotted on maps and vertical profiles. A data entry format was developed and agreed to by OGI, Broadbent, Converse, and Amec. Prior to entry into the geodatabase, data was reviewed and validated.

Lithologic observations had been recorded over a period of years and by different field geologists, who were employed by different companies. Accordingly, professional judgement was required to distill the observations described on the boring logs into the USCS system. In addition, drilling methods and sample collection frequency appears likely to have influenced the geology interpreted in the investigation reports. Specifically, logs prepared for borings drilled using a hollow-stem auger (HSA) rig were typically based on collection of 1.5 feet of core per 5 feet of boring. This sampling rate was frequently reduced further by poor recovery when caliche was encountered. Conversely, where sonic drilling techniques were applied, continuous cores were retrieved, typically over 20-foot intervals. Many of the logs for borings drilled using HSA techniques do not record any thinly bedded gravel or sand deposits; whereas such potential groundwater migration pathways were generally observed when continuous cores were collected. Accordingly, interpretations in the cross-sections consider the relative data quality of the boring logs. The cross-sections are included in Appendix A.

West of Paradise Road

Interpretations of lithology west of Paradise Road are included on cross-sections A-A', B-B', and C-C'. Multiple borings and wells were drilled and excavations were performed in the upper 30 feet west of Paradise Road. Fewer deeper borings were drilled in this area. The upper 30 feet is coarse grained, and finer grained sediments predominate from 30 to approximately 60 feet bgs. Thinly bedded sand or gravel units were observed below 30 feet bgs. The upper 30 feet of cross-section B-B' is relatively finer-grained than the upper 30 feet of cross-section A-A'. Cross-section B-B' is south of cross-section A-A'.

Between Paradise Road and Swenson Street

Cross-sections A-A', B-B', D-D', E-E', and F-F' are within this area. This area includes the subsurface below the former Howard Johnson's motel property where remediation systems were installed. Shallow and deeper borings were drilled in this area. Coarser grained sediments predominate the upper 30 feet and finer grained sediments were reported between 30 and 60 feet bgs.

Between Swenson and Wilbur Streets

Cross-section A-A' is within this area. Shallow borings were typically drilled to approximately 30 feet bgs and the logs report coarse-grained sediments, predominated by sands. Few deeper borings were drilled in this area. OGI reported silts in OMW-48-45 from 22 feet bgs to 48 feet bgs, and silty sands deeper in OMW-48-65. These observations are consistent with the general trends reported elsewhere in the site area for sediments below 30 feet bgs.

Between Wilbur Street and Maryland Parkway

Cross-sections A-A', G-G', H-H', and I-I' are within this area. Three transects of multi-depth wells were drilled in between Wilbur Street and Maryland Parkway to investigate shallow and deeper groundwater. Well OMW-79-79, located between Lulu Avenue and University Plaza, was drilled to 80 feet bgs. Detailed logging was performed as part of the investigations; continuous cores were obtained for the borings, and some of the borings were advanced using sonic drilling methods. Sands and gravels predominate the upper 30 feet, and clays were observed from 30 to approximately 60 feet bgs. Thinly-bedded sands and gravels were observed below 30 feet in the deeper borings. Cross-section A-A' is data-driven in the area west of Paradise Road, whereas the cross-section is more interpretive in this area to present the additional information collected during the drilling programs in this portion of the site area.

9.0 SITE HYDROGEOLOGY

As detailed in Subsections 9.1 through 9.3, the shallow groundwater zone at the site is hydraulically and chemically differentiated from the underlying deeper zone. Because MTBE and TBA concentrations in the shallow zone have attenuated while MTBE and TBA concentrations persist in the deeper zone, these two hydrostratigraphic zones (i.e., the shallow zone and the deeper zone) need to be understood on the site-scale.

9.1 DEPTH TO GROUNDWATER

The depth to groundwater in the site area west of Paradise Road, beneath the locations of the former car rental operations, ranged from 13.10 to 19.00 feet bgs during the Fourth Quarter 2016 and from 13.71 to 18.56 feet bgs during the Fourth Quarter 2017. In general, the depth to water beneath the site area decreases from west to east.

Decreasing Depth Toward Maryland Parkway

The depth to groundwater near Maryland Parkway is approximately 5 feet less than the depth to groundwater near Paradise Road (Amec, 2014). Appendix B (Amec, 2014, page 16) compares ground surface elevations to groundwater surface elevations at various distances downgradient from the former facility locations.

Decreasing Depth Over Time

The depths to groundwater beneath the various portions of the site area have decreased over the monitoring period. Between 1995, when monitoring began, and 2017 the depth to groundwater decreased by approximately 5 feet.

9.2 GROUNDWATER FLOW DIRECTIONS AND GRADIENT

Groundwater elevation contours for Fourth Quarter 2015 are plotted on the map included with the interpretive geologic cross-sections. The groundwater table surface west of Paradise Road dips northeastwardly. East of Paradise Road, the inferred horizontal groundwater flow direction is to the east-northeast. Over the monitoring period, the interpreted aggregate direction of horizontal groundwater flow has been consistently to the east-northeast.

On average in the site area, the water table gradient is approximately 0.01 ft/ft to the east-northeast. Near Paradise Road, the gradient steepens to approximately 0.02 ft/ft, and from approximately Swensen Street to Maryland Parkway, the magnitude of the gradient is approximately 0.007 ft/ft.

The potential presence of vertical gradients was evaluated by Broadbent during the All Facilities NDEP meetings conducted in 2009 and 2010, and by OGI (2009). In some analyses, there appeared to be an upward gradient between groundwater at approximately 60 feet bgs and groundwater at approximately 45 bgs, and a downward gradient between groundwater at approximately 30 feet bgs and groundwater at 45 feet bgs. Conceptually, these trends could be explained by the conceptual model for idealized groundwater flow in the basin. In addition, the regional recharge project injected groundwater into the deeper producing aquifers, and excess irrigation water and leaking pipes infiltrate groundwater into the shallow aquifer, both of which might be expected to support such trends. OGI estimated vertical gradients, if present, to be relatively low.

9.3 AMBIENT WATER QUALITY

Groundwater samples collected between 2012 and 2017 were analyzed for TDS. TDS concentrations in site monitoring wells ranged from 184 to 8,042 mg/L. Many of the samples collected from shallow groundwater contained greater than 2,000 mg/L TDS. High salinity in shallow groundwater is a regional feature and was anticipated.

Groundwater samples were also analyzed to evaluate intrinsic biodegradation of petroleum compounds, including MTBE and TBA. Parameters monitored at the site included dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, conductivity, temperature, nitrate, sulfate, and ferrous iron. Investigation of metals in groundwater was performed as part of the remedial pilot testing performed by Broadbent in 2010 (Broadbent, 2010).

Ambient groundwater appears to be aerobic (>1.0 mg/L DO). Petroleum compounds and volatile organic compounds (VOCs) were generally not detected in ambient groundwater samples. Further review of ambient water quality, and comparison to groundwater conditions within the commingled plume area is outside the scope of this report and will be discussed in a report of MTBE fate and transport of the offsite MTBE plume.

9.4 HYDROSTRATIGRAPHY

The hydrostratigraphy of the site was interpreted based on the lithologic observations described in Section 8.0, overlain with groundwater chemical data. This approach is similar to the methodology used by Leising (2004) to develop hydrostratigraphic units for the MWFA; however, sequence stratigraphy to develop allostratigraphic interpretations was not attempted. The site hydrostratigraphy is divided into two units: a shallow zone and a deeper zone. The shallow zone is characterized by coarser-grained deposits, higher transmissivity, and high TDS concentrations. The shallow zone, which appears to correlate with the sandy aquifer referred to by the LVVWD as the Shallow Aquifer System, is hydraulically and chemically differentiated from the underlying deeper zone.

The deeper zone is characterized by finer-grained deposits, lower transmissivity, and the presence of laterally extensive beds of sands and gravels. The coarse-grained units, likely deposited as channel deposits during aggradation of the alluvial fan, appear to have the potential to sustain relatively high groundwater velocities.

The Interpretive Geologic Cross-Sections (Langan, 2016) depict the interpreted boundary between the Upper and Lower Hydrostratigraphic units (HSUs). The HSU boundary is at approximately 30 feet bgs, across the entire site area.

10.0 PREFERENTIAL PATHWAYS

Natural and anthropogenic preferential pathways for MTBE and TBA migration have been evaluated as part of the site investigation efforts. The Upper HSU generally consists of sandy deposits, so preferential pathways might include deeper buried utilities and improperly destroyed water supply wells. To date, such features have not been identified in the site area.

Within the Lower HSU, thinly bedded gravels and sands have acted as migration pathways for MTBE and TBA. Detailed borehole logging, including sonic drilling techniques to recover continuous soil cores, and depth-discrete groundwater sampling, found MTBE and TBA concentrations in offsite groundwater in thin sandy or gravelly units located within the Lower

HSU (OGI, 2009; Broadbent, 2012). These thin lithostratigraphic units occur at various depths. Based on the understanding of the regional depositional history, the sandy and gravelly lenses may be interconnected and are not likely to be laterally continuous.

The thin beds of gravel and sand were frequently described as loosely-compacted gravels with clay and sand (OGI, 2014: Log OMW-79-79) or as well graded gravel with silt and sand (Broadbent, 2013: Log OMW-75-76). On many logs, the field geologist recorded caliche deposits within or above the thinly bedded gravels and sands.

Fault planes have also been regionally identified as potential pathways for vertical groundwater flow, potentially including flow between the two HSUs in the investigation area (Leising, 2004). Leising (2004) hypothesized that the overdraft conditions, which followed development of Las Vegas Valley groundwater resources for water supply, may have resulted in fault planes becoming pathways for downward migration of shallow groundwater. Accordingly, there is the potential that MTBE and TBA may have migrated from shallow to deeper groundwater via the fault plane pathway. After the regional groundwater recharge program was implemented in the early 1990s, groundwater migration between deeper water resources and the shallow aquifer is anticipated to have been generally reduced and, in some areas, may have been restored to pre-development, upward flow conditions.

11.0 RELEASE SOURCE/UST SYSTEMS

One LUST gasoline release is reported on 21 December 1999 at the Payless (Allstate) facility in the NDEP Project Tracking database. At the Avis facility, three LUST gasoline releases are reported in the database: 1 January 1990, 14 November 2001, and 8 August 2007. And, at the National facility one LUST gasoline release is reported on 28 October 2002 in the database. Demolition of the three facilities in 2007 was completed after the UST systems were removed.

Broadbent (1995) reviewed Clark County Fire Department (CCFD) and Clark County Health Department (CCHD) files and identified UST operators in the site vicinity, including a UST at the Airport Inn, formerly located east of Paradise Road. Harding Lawson and Associates (1996) conducted aerial photograph reviews, regulatory agency record reviews, and a site reconnaissance to evaluate potential sources, receptors, and migration pathways for free product on the groundwater table near the facilities.

Broadbent (2006a, 2006b) conducted regulatory agency reviews, reconnaissance, and collected groundwater samples downgradient of potential additional contributors to the commingled plume. No additional contributors to the commingled plume were confirmed.

12.0 LNAPL

Historically, light non-aqueous phase liquid (LNAPL) was reported at the individual facilities and offsite in monitoring well MW-13 (since renamed HJMW-22) located east of Paradise Road (Broadbent, 1995). LNAPL from the Payless facility is believed to have migrated offsite onto the northern portion of the Avis leasehold, cross-gradient of the Avis UST system. Evaluation of historical LNAPL extent at each facility is not included in the scope of this hydrogeologic CSM for the three facilities.

In the offsite area, remediation was performed at the former Howard Johnson's motel location through the early 2000s. As of 2017, no mobile or migrating LNAPL was present in any of the site monitoring wells. Based on petroleum concentrations in groundwater, it is unlikely that residual LNAPL (i.e., non-migrating and non-mobile) remains in the offsite areas.

13.0 CONTAMINANTS OF CONCERN

The primary contaminant of concern common to the three facilities has been MTBE and TBA as a degradation product. The releases were identified as gasoline releases, and elevated benzene, toluene, ethylbenzene, and xylenes (BTEX) were historically detected in groundwater. In general, petroleum compounds other than MTBE and TBA did not migrate significantly beyond the areas affected by LNAPL.

14.0 SOIL IMPACTS

Soil near the groundwater table in the area of historical LNAPL extent was likely impacted when LNAPL was present; however, LNAPL was no longer present in any monitoring wells as of the Fourth Quarter 2017. MTBE and TBA do not readily adsorb to soil (i.e., have low organic carbon partition coefficients (Koc)) and are highly soluble. Accordingly, soil impacts would consist primarily of BTEX compounds and other petroleum hydrocarbons. Through the Fourth Quarter 2017, elevated groundwater levels have placed groundwater in contact with soil that would have been impacted when LNAPL was present. If the soil impacts had persisted, then shallow groundwater would be affected. No MTBE, TBA, or other gasoline compounds were reported during the Fourth Quarter 2017 in any of the shallow groundwater wells screened within the Upper HSU. Soil in the commingled plume area is not likely to be impacted by petroleum hydrocarbons, MTBE, or TBA.

Soil remediation was performed at the individual Payless, Avis, and National facilities, and residual onsite impacts will be summarized by the respective CEMs. Soil remediation activities at the facilities typically included over-excavation and offsite disposal of contaminated soil and soil vapor extraction.

15.0 SOIL GAS IMPACTS

MTBE and TBA are highly soluble and correspondingly have relatively lower Henry's Law constants, indicating that the potential for MTBE or TBA volatilization from liquid to vapor phase is limited. At the request of the NDEP, Broadbent (2009) conducted a soil gas survey within the site area. Six soil gas samples were collected and analyzed for total petroleum hydrocarbons (TPH) as gasoline (TPHg), BTEX and MTBE. MTBE was not detected in the soil gas samples. TPHg, benzene, toluene, and xylenes were detected, and the results were included in the 2009 Human Health Risk Assessment Update (Synergy, 2009). Synergy (2009) concluded that the relatively low petroleum compound concentrations reported in soil gas did not pose an unacceptable risk (i.e., calculated cancer risk less than the United States Environmental Protection Agency threshold of 1E-06 and hazard quotient less than 1.0). Because petroleum concentrations in shallow groundwater were below the NDEP action levels, soil gas in the commingled plume area as of Fourth Quarter 2017 was not likely impacted by petroleum hydrocarbons, MTBE or TBA.

16.0 GROUNDWATER IMPACTS

MTBE and TBA concentrations in groundwater are contoured utilizing the fourth quarter groundwater monitoring data each year. The most recent isoconcentration maps were prepared using the Fourth Quarter 2017 monitoring data, collected in November and December 2017. The Fourth Quarter 2017 isoconcentration maps prepared by CE2 Corporation, on behalf of the CEMs, are included in Appendix C. The subsections below describe the conceptual model of residual MTBE and TBA impacts in groundwater. The historical MTBE and TBA concentrations in groundwater in the site area are documented in the groundwater monitoring reports, initially prepared for each facility, and later prepared on behalf of the three CEMs. In the late 1990s, MTBE concentrations in groundwater monitoring wells were as high as 100,000 ug/L to 192,250 ug/L. Natural attenuation is reducing the extent and magnitude of MTBE and TBA groundwater impacts over time. MTBE and TBA concentrations measured during the Fourth Quarter 2015 (shown on the cross-sections in Appendix A), and during the Fourth Quarter 2017 (Appendix C) are summarized in the subsections below.

16.1 SOURCE AREAS AT THE FACILITIES

In or near the former facility locations, Fourth Quarter 2017 groundwater monitoring detected up to 2,000 ug/L MTBE in well MW-16-60 (National facility); 1,100 ug/L MTBE in well PMW-17-52 (Payless facility); and 210 ug/L MTBE in well AVMW-50-35 (Avis facility). The source area residual groundwater impacts did not appear to extend east of approximately Paradise Road. As of Fourth Quarter 2017 source area remediation was ongoing, and, consequently, MTBE and TBA concentrations at the former facility locations are expected to decrease. Each facility is addressing source area concentrations independently.

16.2 DOWNGRADIENT AREAS

The cross sections included in Appendix A depict contoured MTBE data collected during the Fourth Quarter 2015. MTBE concentrations in groundwater decreased from 2015 through 2017, and the extent of the MTBE and TBA plumes further receded. As of Fourth Quarter 2017, MTBE and TBA concentrations in the Upper HSU were below the NDEP action level of 200 ug/L. Also, as of Fourth Quarter 2017, in the downgradient area, near Wilbur, South Young, and South Turner Streets, MTBE persisted in groundwater between approximately 50 feet bgs and 70 feet bgs at concentrations above the action level, up to 1,400 ug/L. MTBE concentrations in deeper wells OMW-43-75, OMW-72-77, and OMW-79-79 delineated the vertical extent of the plume, to below the NDEP action level. At that time, groundwater in the zone with residual MTBE impacts was generally anaerobic (DO less than 1.0 mg/L).

Along Maryland Parkway, MTBE and TBA concentrations in monitoring wells OMW-68, OMW-70, and OMW-71, decreased and were below the NDEP action level in Fourth Quarter 2017. These results suggest that the plume is receding.

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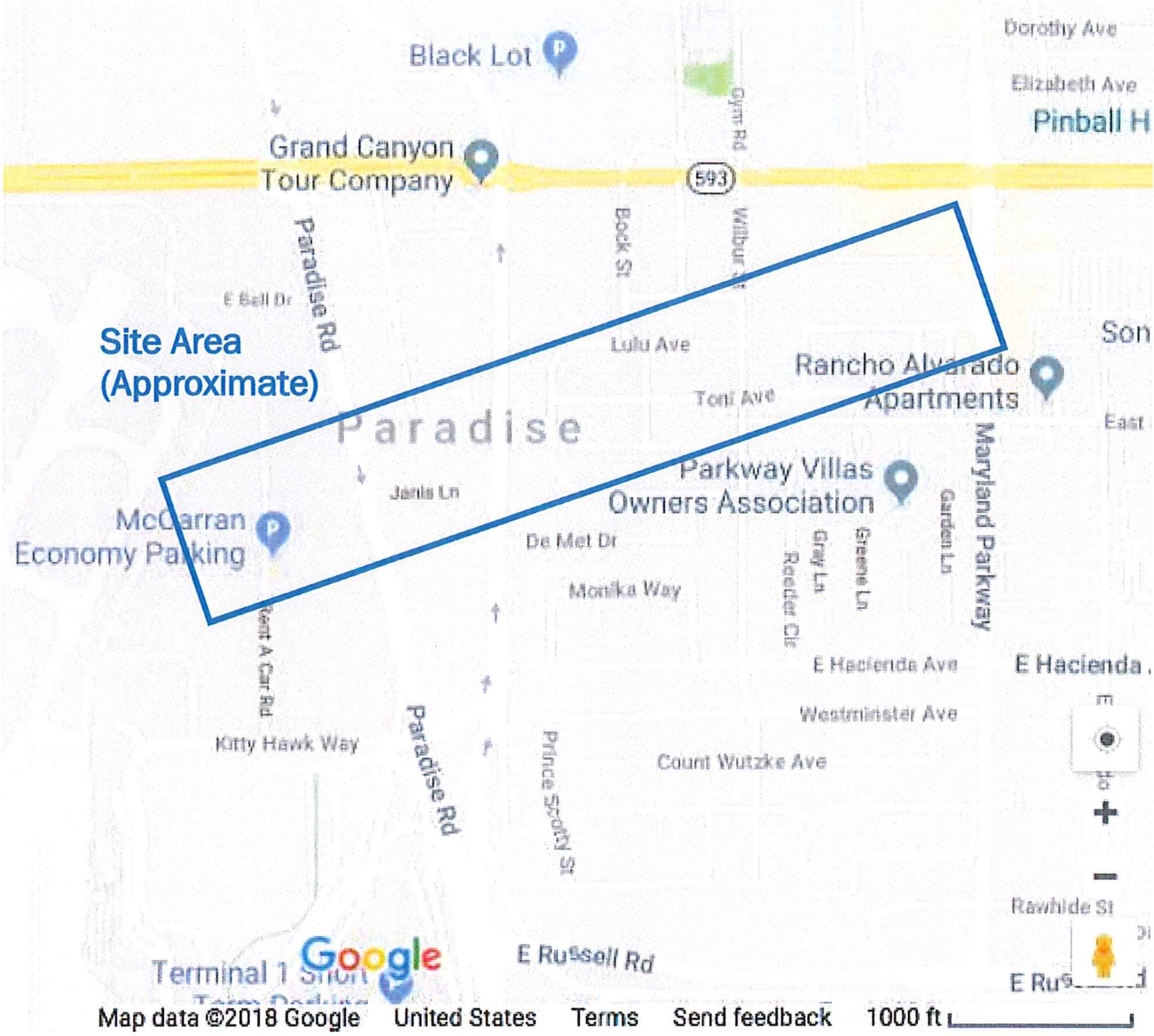
FIGURES



From Google Maps, 2018

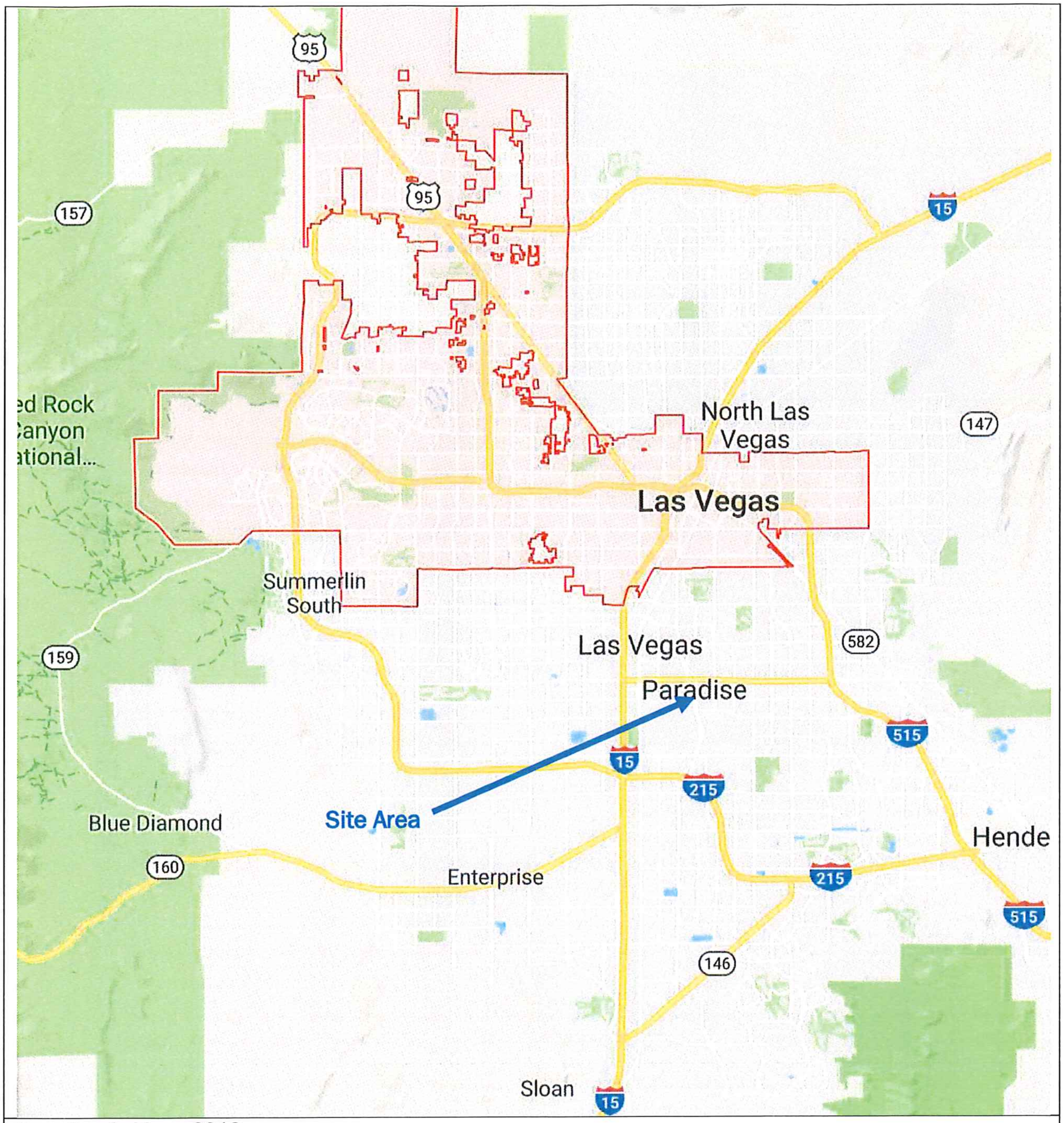
DRAFT Hydrogeologic Conceptual Site Model Report

Site Area

Geo Blue Consulting

Figure 1

28 August 2018



From Google Maps, 2018

DRAFT Hydrogeologic Conceptual Site Model Report	**Site Vicinity**
Geo Blue Consulting	**Figure 2** 28 August 2018

From Google Earth and Google Maps, Viewed on 28 August 2018

DRAFT Hydrogeologic Conceptual Site Model Report	**Current Site Uses – McCarran Economy Parking**
Geo Blue Consulting	**Figure 3** 28 August 2018

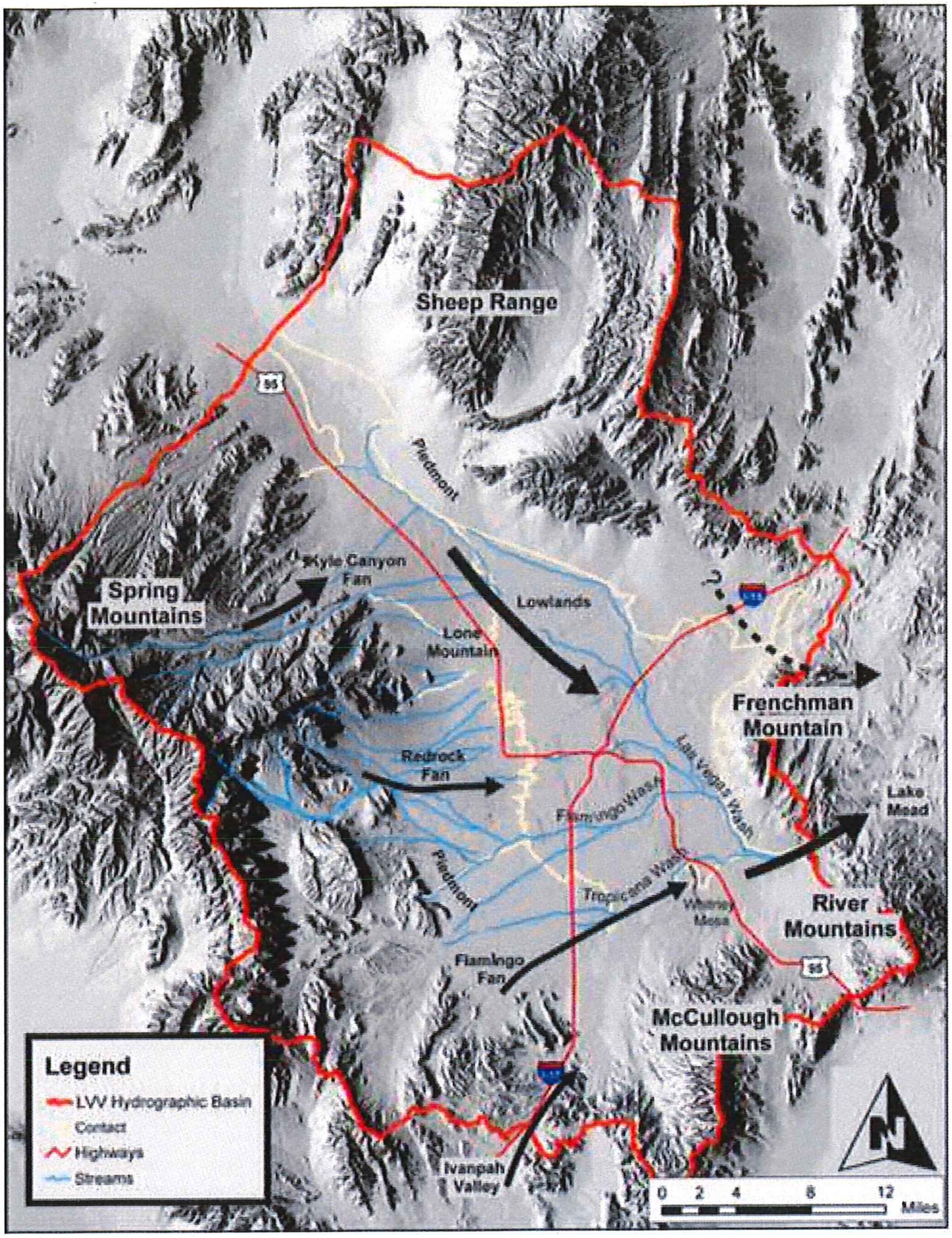


Figure 5. Las Vegas Valley Physiographic Features and Groundwater Flow Directions.

From Liesing, 2004

DRAFT Hydrogeologic Conceptual Site Model Report	**Las Vegas Valley Physiographic Features and Groundwater Flow**
Geo Blue Consulting	**Figure 4** 28 August 2018

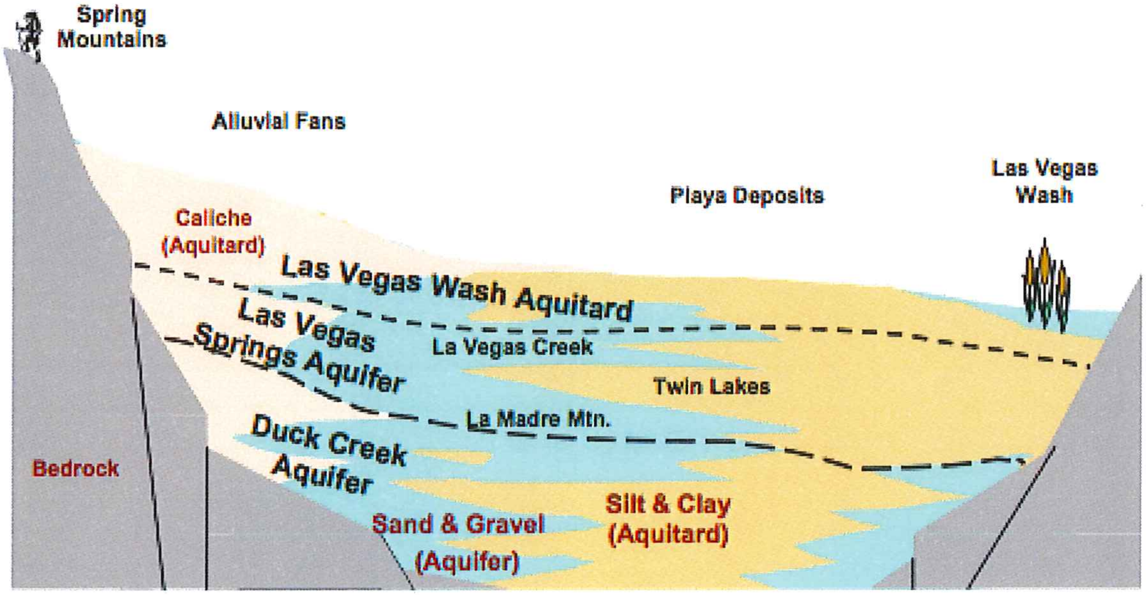
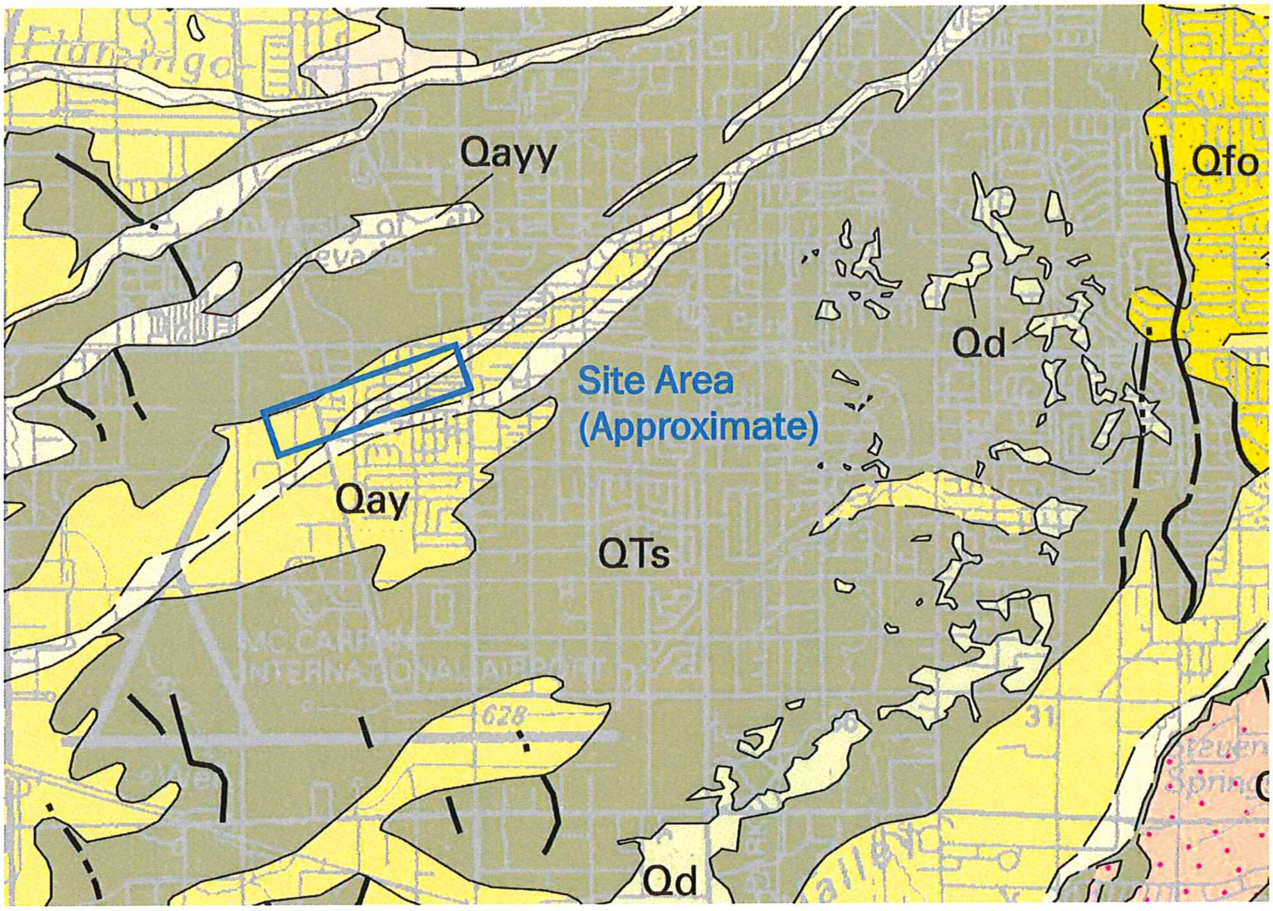


Figure 13. Hydrostratigraphic Units in the Las Vegas Valley (after Donovan, 1996).

From Liesing, 2004

DRAFT Hydrogeologic Conceptual Site Model Report	**Las Vegas Valley Hydrostratigraphic Units**
Geo Blue Consulting	**Figure 5** 28 August 2018



From USGS, National Geologic Map Database, 2018

DRAFT Hydrogeologic Conceptual Site Model Report

Surface Geology in the Site Vicinity

Geo Blue Consulting

Figure 6

28 August 2018

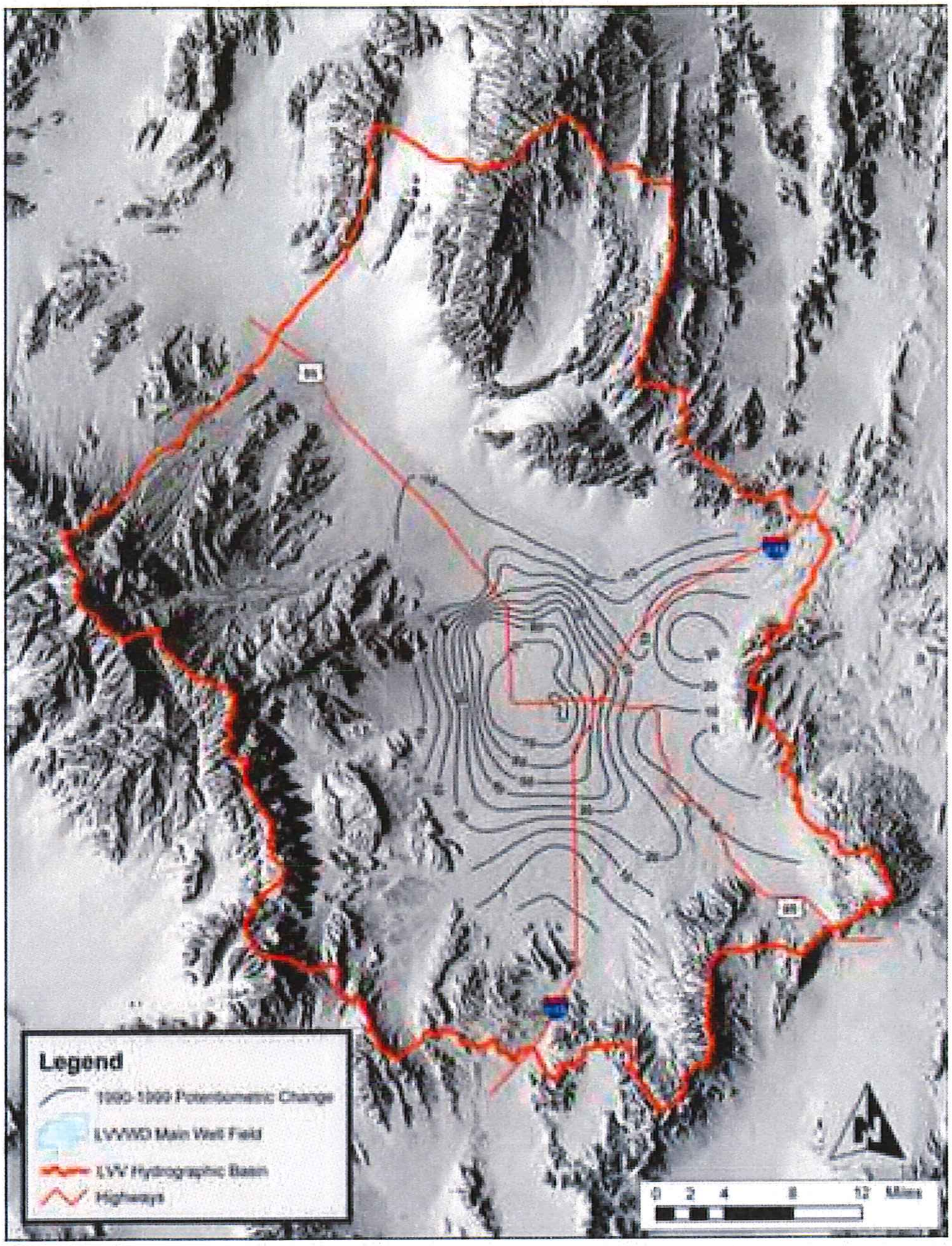


Figure 11. Change in the Potentiometric Surface of the Important Producing Aquifers, 1990 to 1999.

From Liesing, 2004

DRAFT Hydrogeologic Conceptual Site Model Report

Change in Potentiometric Surface, 1990 to 1999

Geo Blue Consulting

Figure 7

28 August 2018

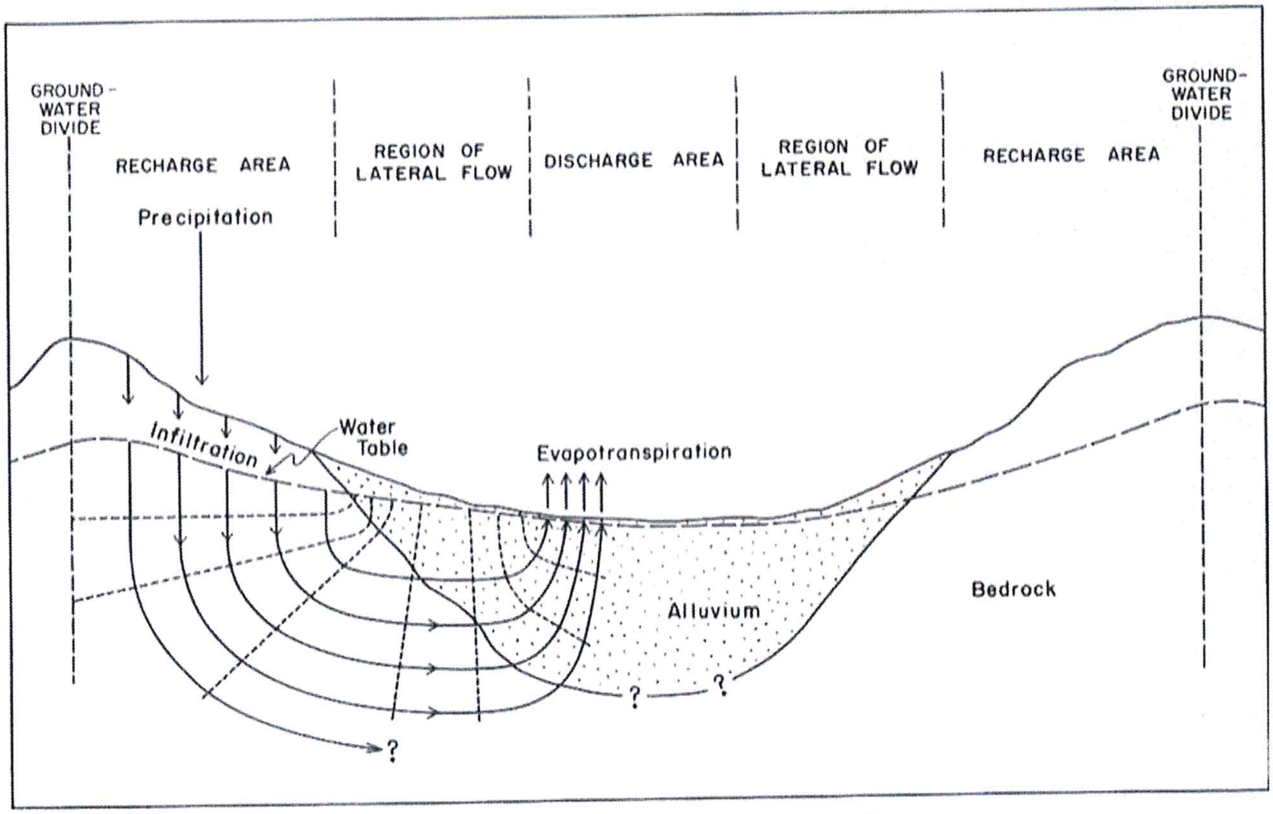
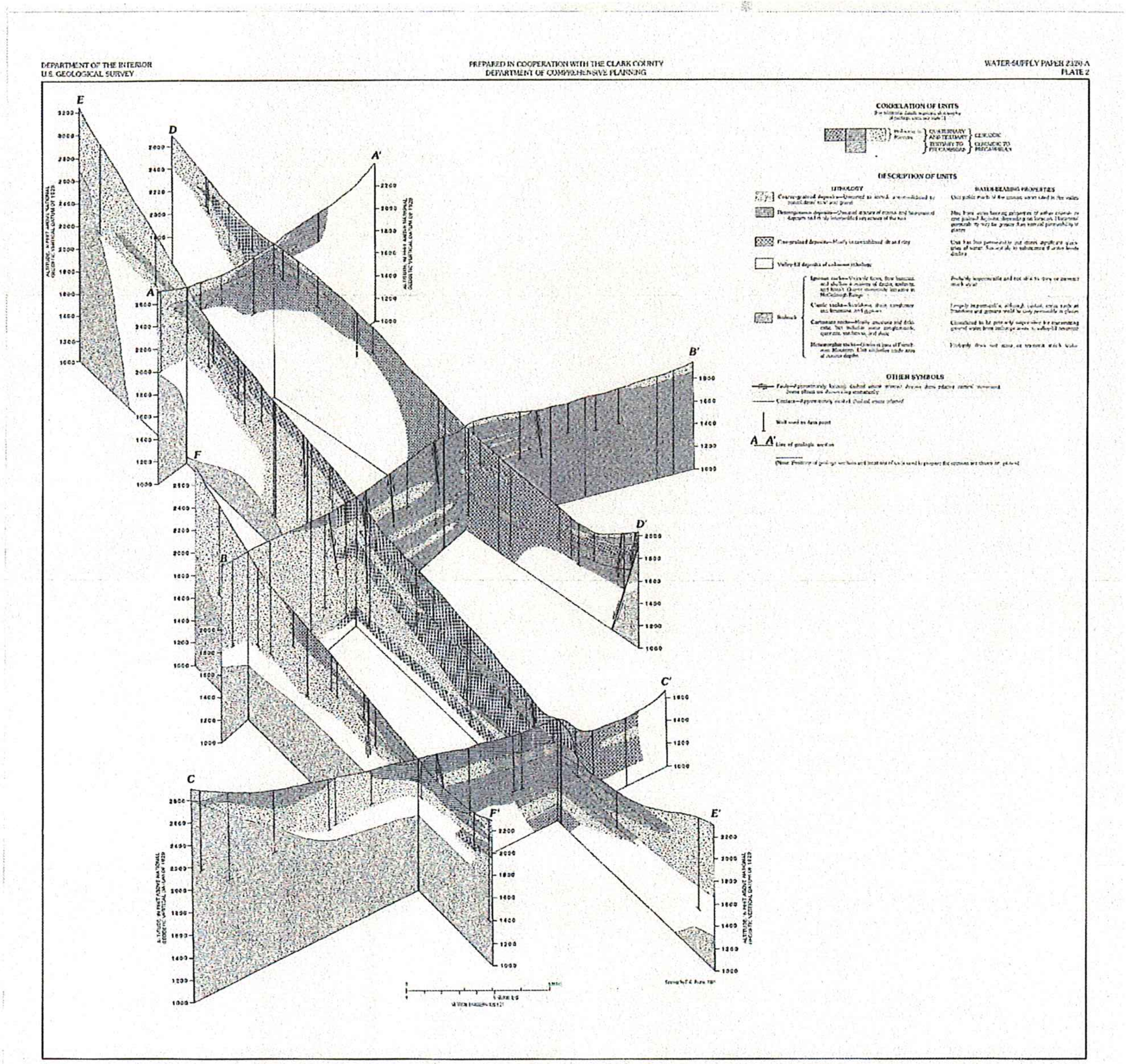


Figure 9. Idealized flow system, Las Vegas Valley.

From Domenico, 1964

DRAFT Hydrogeologic Conceptual Site Model Report	**Idealized Groundwater Flow System, Las Vegas Valley**
Geo Blue Consulting	**Figure 8** 28 August 2018



FENCE DIAGRAM SHOWING LITHOLOGY OF VALLEY-FILL DEPOSITS AND SUMMARY OF WATER-BEARING PROPERTIES FOR VALLEY-FILL AND BEDROCK UNITS, LAS VEGAS VALLEY, NEVADA

From Plume, 1989

DRAFT Hydrogeologic Conceptual Site Model Report

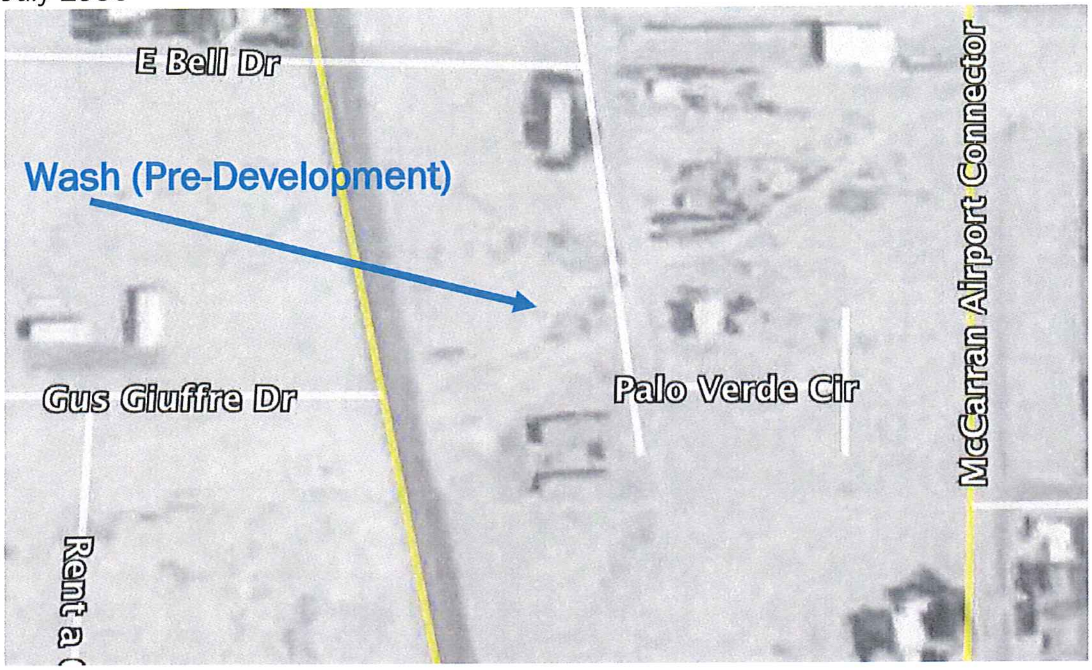
Fence Diagram Showing Lithology and Water-Bearing Properties

Geo Blue Consulting

Figure 9

28 August 2018

July 1950



November 2008

From Google Maps, 2018

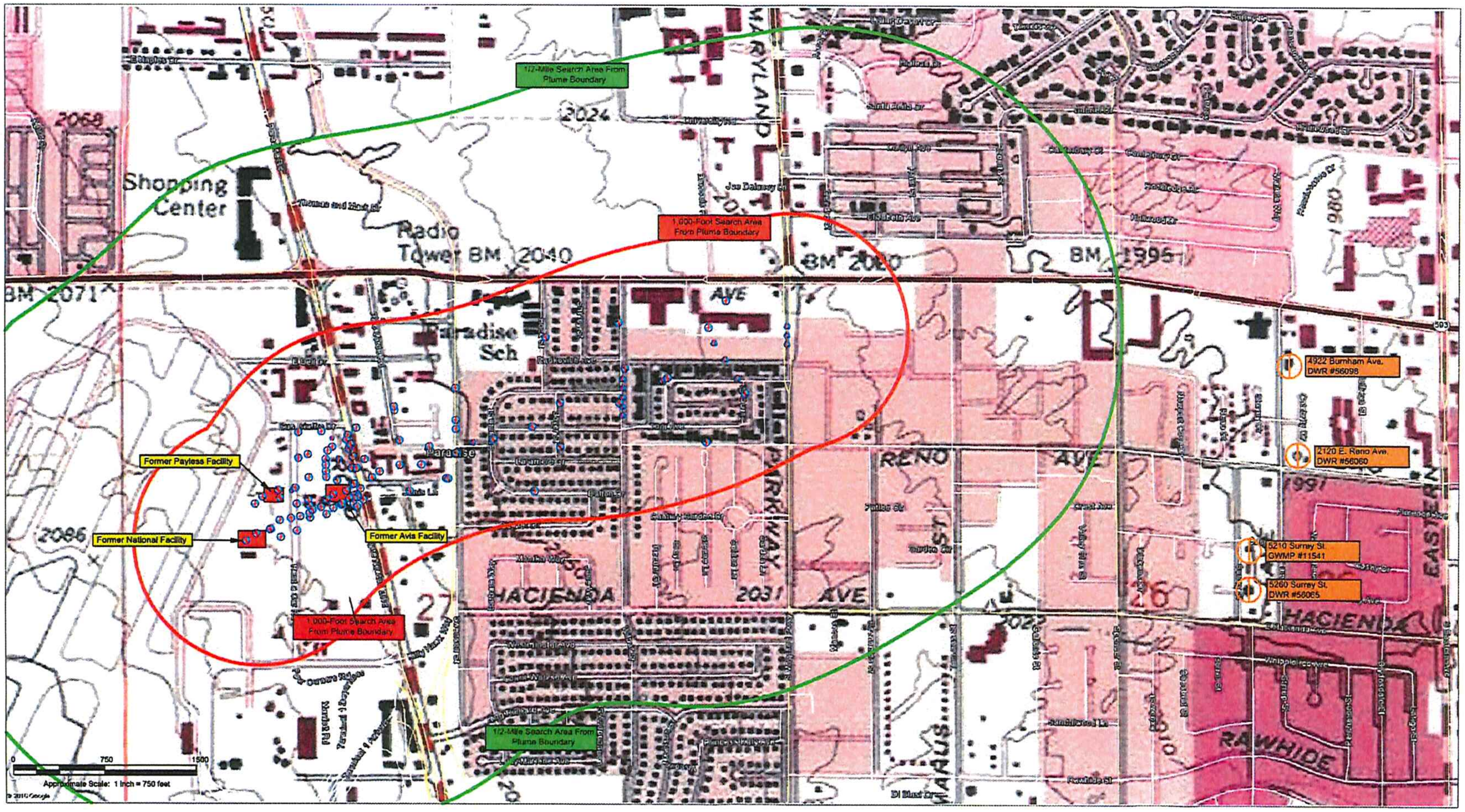
DRAFT Hydrogeologic Conceptual Site Model Report

Surface Water Bodies – Unnamed Wash

Geo Blue Consulting

Figure 10

28 August 2018



LEGEND

● Monitoring Wells Associated with Dissolved Petroleum Hydrocarbon Plume Evaluation

McCarran International Airport
Las Vegas, Nevada

BROADBENT & ASSOCIATES, INC.

CONVERSE CONSULTANTS

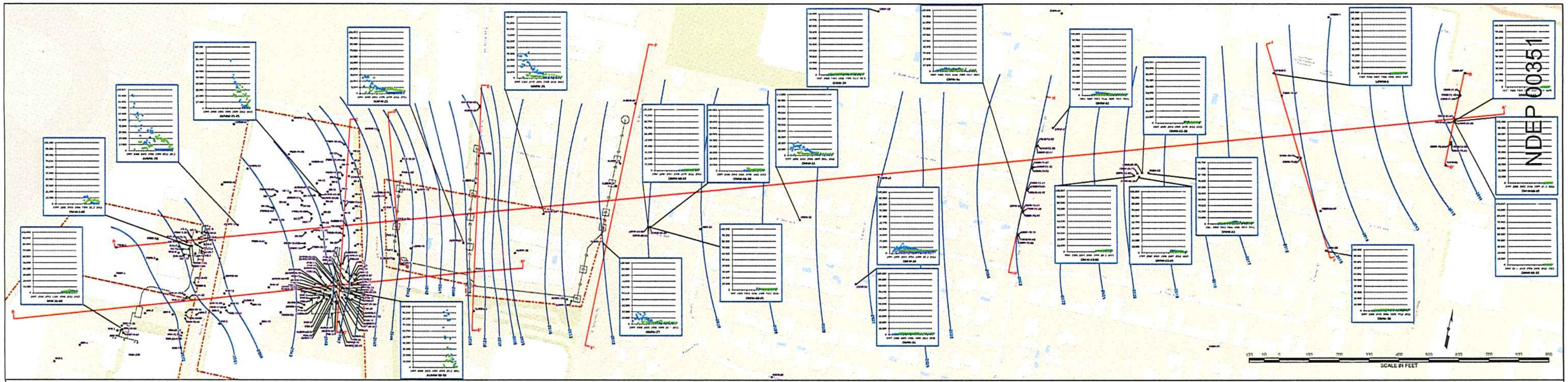
OGI ENVIRONMENTAL, LLC

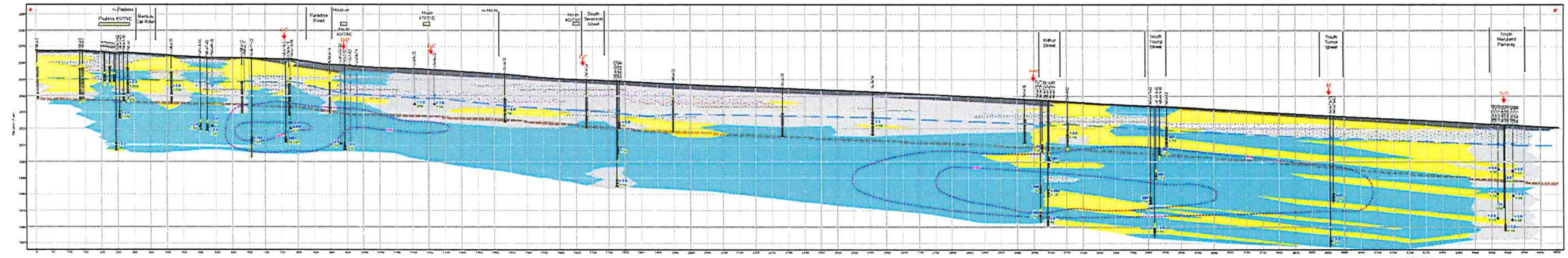
Drawing 1
Sensitive Receptor Survey
Search Boundary

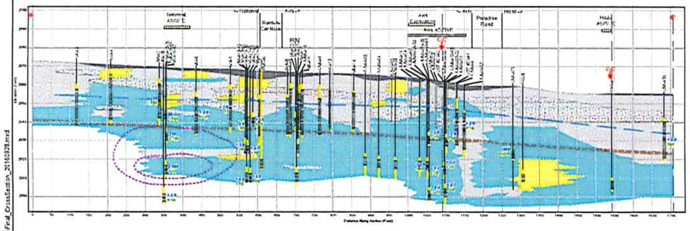
Figure 11

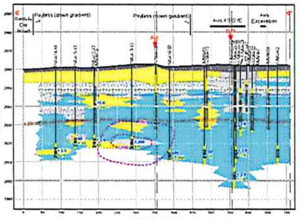
APPENDIX A

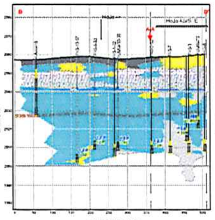
INTERPRETIVE GEOLOGIC CROSS-SECTIONS

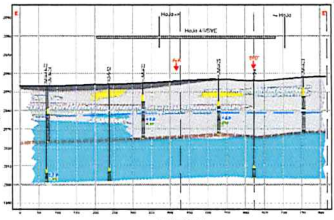












Legend

- ↓ Intersection of Other Cross Section
- • Well Location
- ▪ Sample from 4th Quarter 2015
- Water Levels 4th Quarter 2015 (dashed where approximate)
- Shallow Groundwater Contour 4th Quarter 2015 (Contour interval 1 foot)
- Water Table
- MTBE contour (approximate)
- Ground surface
- Approximate Upper and Lower HSU boundary
- Artifical fill
- Caliche
- USCS symbols: CL,ML, MH
- USCS symbols: SC, SM, GC, GM
- USCS symbols: SP-SC, SP-SM, SP, SW, GP-GC,GP,GW

Surface Geology

- Qa; Alluvium of active washes
- Qoa; Older alluvium of Blue Diamond and Red Rock fans
- QTs; Consolidated sediments

Map Definitions

CL – Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
ML – Inorganic silts, very fine sands, rock flour; silty or clayey fine sands with slight plasticity
MH – Inorganic silts and organic silt-clays of high plasticity
SC – Clayey sands, sand-clay mixtures
SM – Silty sands, sand-silt mixtures
GC – Clayey gravels, gravel-sand-clay mixtures
GM – Silty gravels, gravel-silt-silt mixtures
SP – Poorly-graded sands or gravelly sands, little or no fines
SW – Well-graded sands, gravelly sands, little or no fines
GP – Poorly-graded gravels or gravel-sand mixtures, little or no fines
GW – Well-graded gravels or gravel-sand mixtures, little or no fines
MTBE – Methyl Tertiary Butyl Ether
TBA – Tertiary Butyl Alcohol
HSU – Hydrostratigraphic Unit

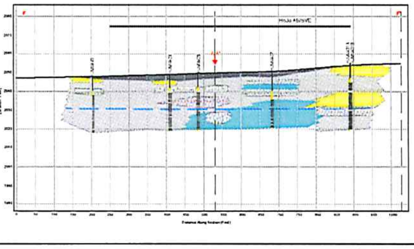
Notes:

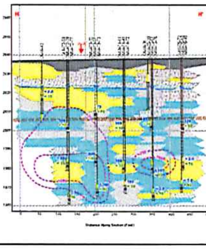
1. These interpretive geologic cross-sections represent a generalized understanding of the subsurface, and are based on widely spaced borings. The generalized study area geology and groundwater conditions presented on this figure are conceptual. Actual conditions are expected to vary between the points of exploration.
2. Surface geology and surface contours provided by Clark County Nevada GIS clearinghouse.
3. Well log data and analytical data provided from the project collaboration site.

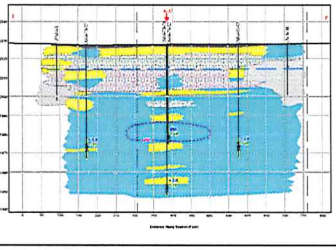
Well casing
Filter pack
Screen interval

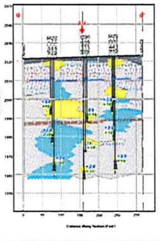
130 MTBE (µg/L)
75 TBA (µg/L)

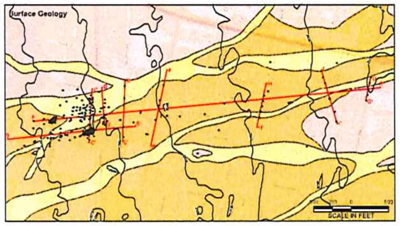
20
5 X Exaggeration
0
100
SCALE IN FEET

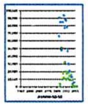












Trend plots show the concentration of MTBE and TBA through time for selected wells. MTBE is represented as blue dots; TBA is represented as green dots. Concentrations are in micrograms per liter (µg/L).

Interpretive Geologic Cross-Sections and MTBE & TBA Concentrations in Groundwater

Former Car Rental Facilities,
McCarran International Airport
Las Vegas, Nevada

By: BJS	Date: 9/28/2016	Project No. 731638203
LANGAN TREADWELL ROLLO		Figure 1

\\langan.com\data\SFO\data4\BSAYLOR\GIS_Projects\Avis_LV\Draft_CrossSections_20151013\Final_CrossSection_20160928.mxd

APPENDIX B

PRESENTATION SLIDES FROM THE 9 MAY 2013 AND 4 FEBRUARY 2014 MEETINGS

Regional Geologic Setting and Soil Boring Log Compilation

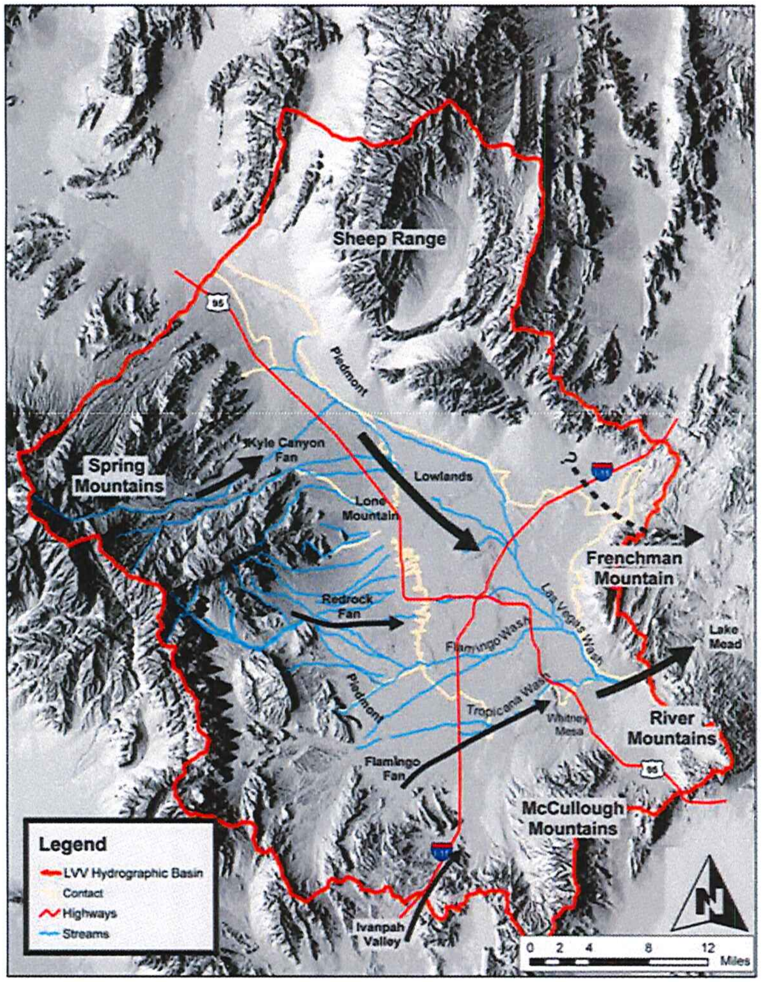
Prepared for the May 9, 2013 Former Rental Car Facilities Meeting

CSM Efforts Since February 2013 Meeting

amec

- Completed digitization of well logs
- Plotted log and chemistry data on cross-sections
- Compiled regional studies (SNWA, LVVWD, USGS, and others)
- Obtained limited data from NDWR well databases

Regional Groundwater Flow Directions and Hydrologic Features



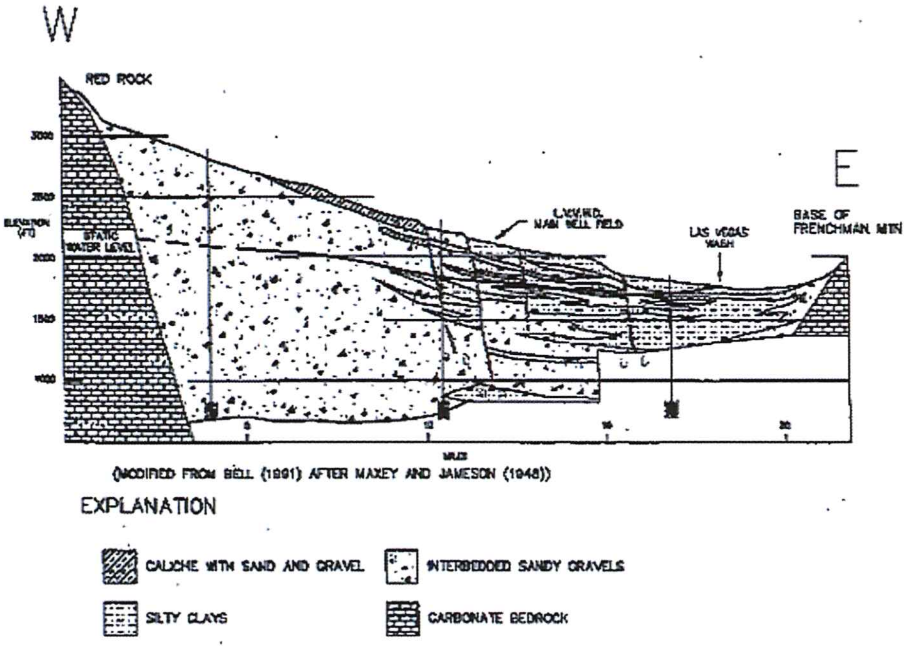
- The Rental Car Plume is adjacent to (or on top of?) the unnamed wash south of Flamingo Wash
- The LVVWD Main Well Field is approximately 6 miles north of the sites, adjacent to Hwy 95 and West of the I-15

Regional Geology

- Coarser alluvial fan deposits
- Finer playa deposits
- >1,500 ft of unconsolidated sediments

Las Vegas Valley Basin

NGWA, 1998

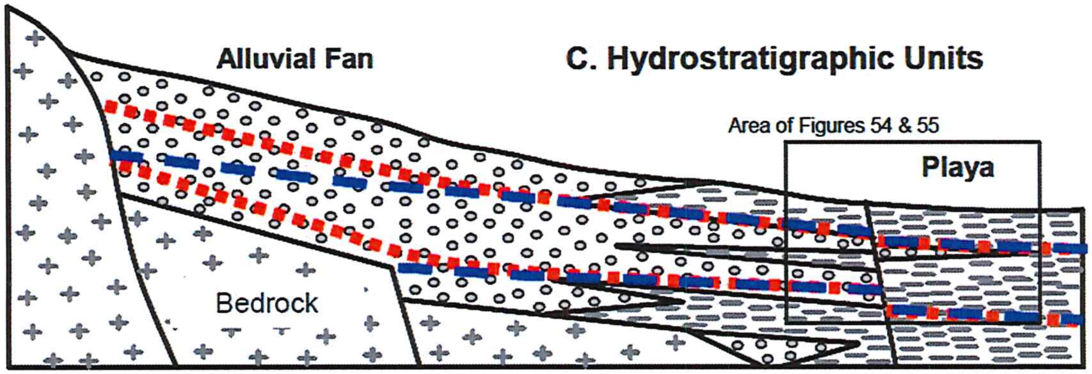


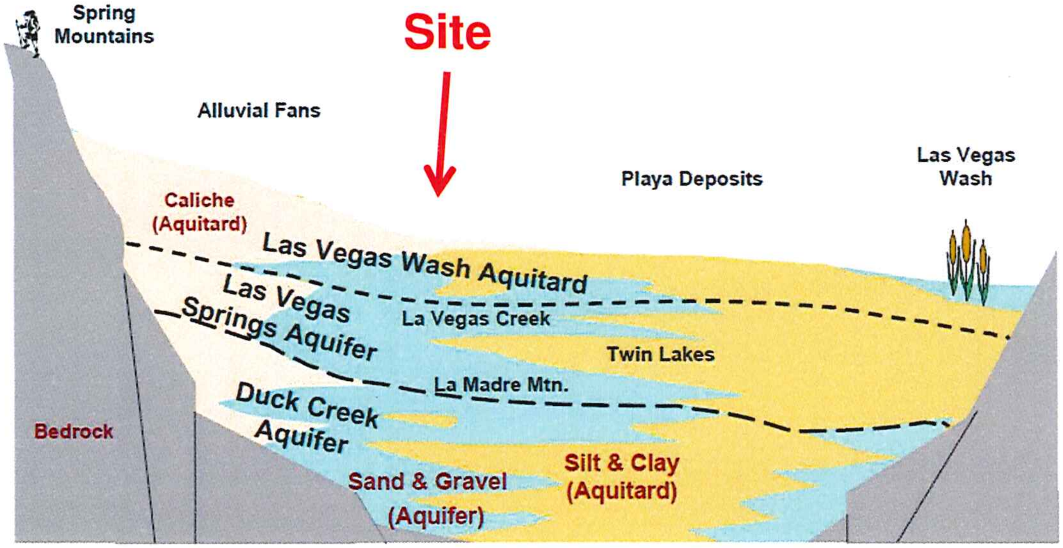
(MODIFIED FROM BELL (1991) AFTER MAXEY AND JAMESON (1948))

Figure 1-7. -- Generalized Geologic Cross Section of the Las Vegas Valley.

- > 1,500 ft of unconsolidated sediments
- Alluvial fan deposits interfingered with playa deposits
- Water table intersects surface at the Las Vegas Wash

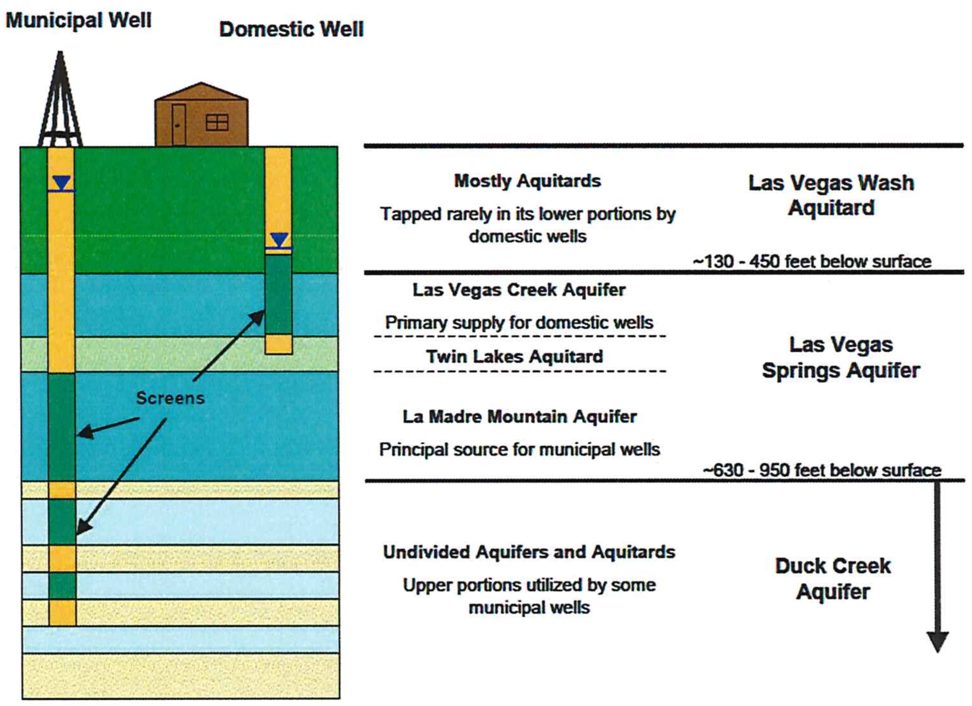
Major Stratigraphic Units (Leising, 2004)





- No distinct lithologic boundaries
- Hydrostratigraphic definitions include:
  - Age of sediments
  - Water quality (TDS)
- Site located near transition from alluvial fan to playa deposits

Generalized Water Uses by Depth



Mostly Aquitards

Tapped rarely in its lower portions by domestic wells

Las Vegas Wash Aquitard

~130 - 450 feet below surface

Las Vegas Creek Aquifer

Primary supply for domestic wells

Twin Lakes Aquitard

La Madre Mountain Aquifer

Principal source for municipal wells

Las Vegas Springs Aquifer

~630 - 950 feet below surface

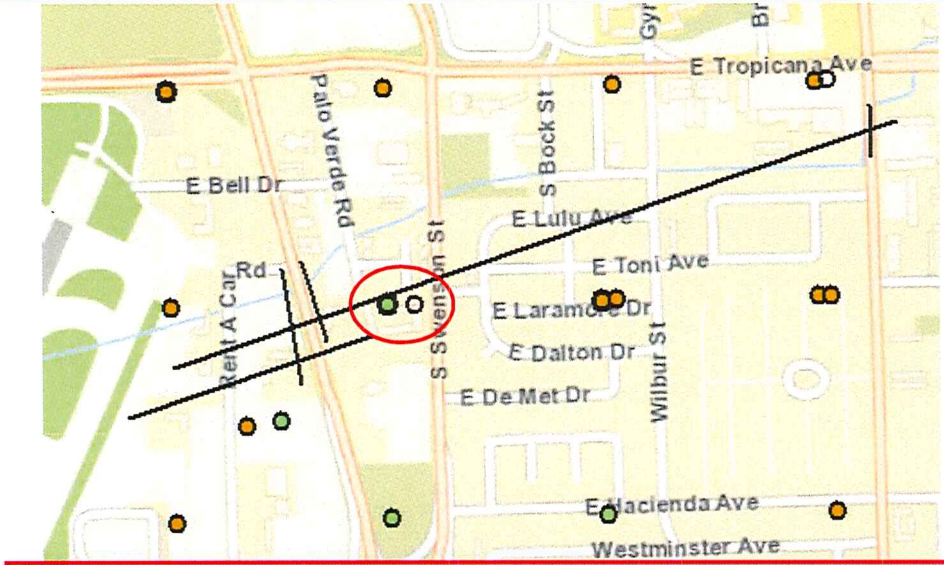
Undivided Aquifers and Aquitards

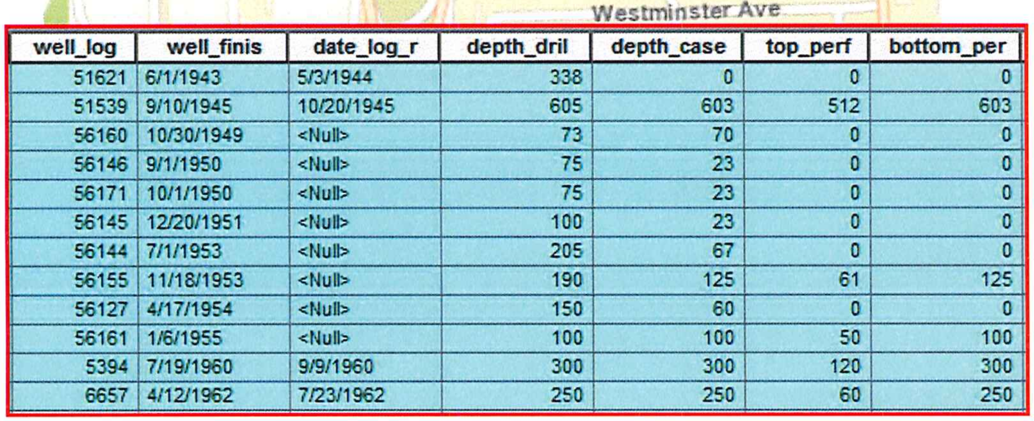
Upper portions utilized by some municipal wells

Duck Creek Aquifer

- Domestic and irrigation use of shallow groundwater
- Lower well yields and higher TDS in upper 100+ ft.
- Older wells screened in both shallow groundwater and Las Vegas Springs Aquifer

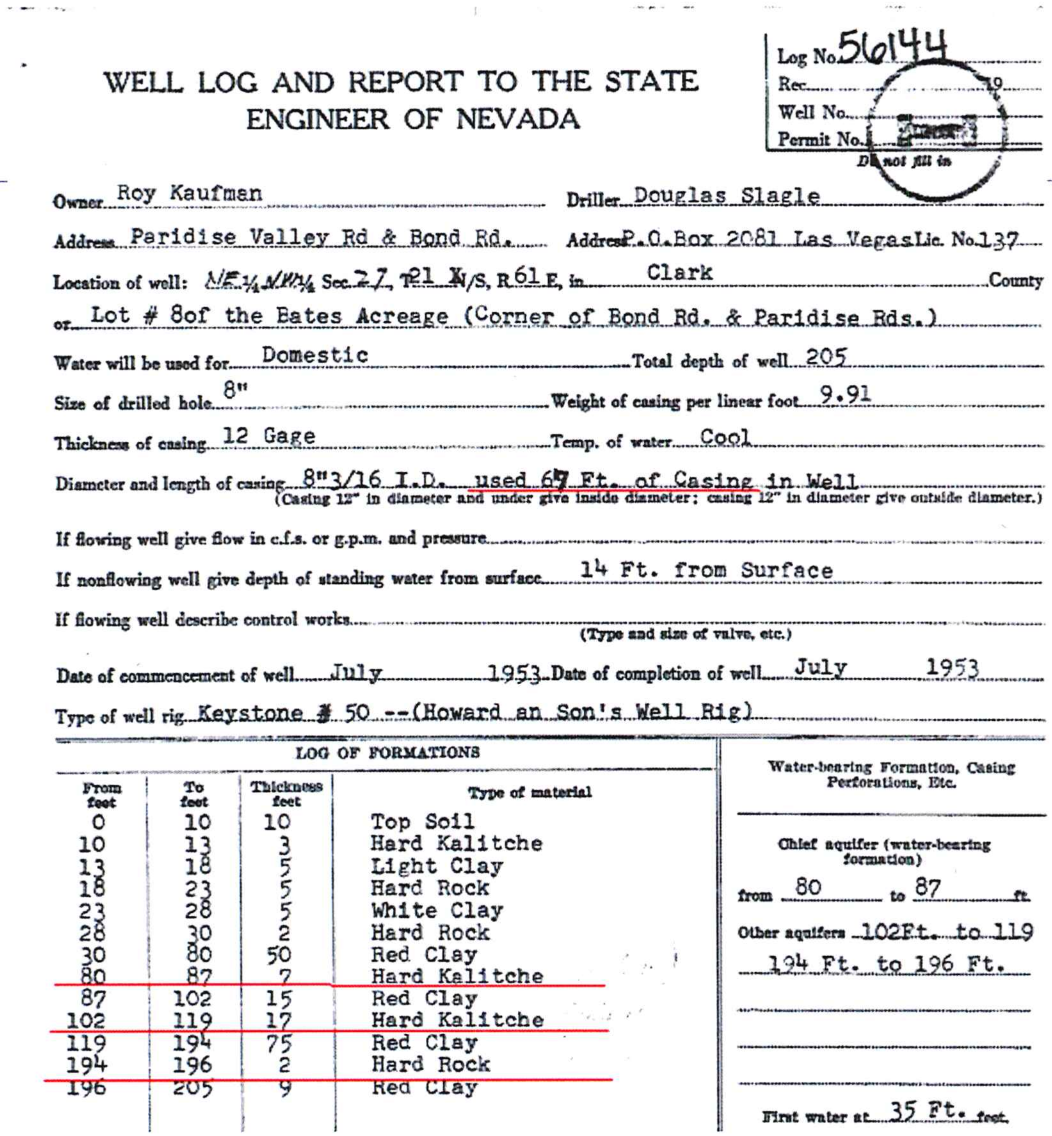
Deeper Lithologic Information For the Site





well_log	well_finis	date_log_r	depth_dril	depth_case	top_perf	bottom_per
51621	6/1/1943	5/3/1944	338	0	0	0
51539	9/10/1945	10/20/1945	605	603	512	603
56160	10/30/1949	<Null>	73	70	0	0
56146	9/1/1950	<Null>	75	23	0	0
56171	10/1/1950	<Null>	75	23	0	0
56145	12/20/1951	<Null>	100	23	0	0
56144	7/1/1953	<Null>	205	67	0	0
56155	11/18/1953	<Null>	190	125	61	125
56127	4/17/1954	<Null>	150	60	0	0
56161	1/6/1955	<Null>	100	100	50	100
5394	7/19/1960	9/9/1960	300	300	120	300
6657	4/12/1962	7/23/1962	250	250	60	250

- Boring logs generated for former water supply wells.
- Screened intervals of supply wells started at 40 ft bgs.
- 12 wells installed between 1943 to 1962 in NE1/4 of NW1/4 of Section 27 represented by locations circled in



WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No. 56144
Rec. 19
Well No.
Permit No. [illegible]
Do not fill in

Owner Roy Kaufman Driller Douglas Slagle
Address Paridise Valley Rd & Bond Rd. Address P.O.Box 2081 Las Vegas Lic. No. 137
Location of well: NE¼ NW¼ Sec. 27, T. 21 N/S, R 61 E, in Clark County
or Lot # 8of the Bates Acreage (Corner of Bond Rd. & Paridise Rds.)
Water will be used for Domestic Total depth of well 205
Size of drilled hole 8" Weight of casing per linear foot 9.91
Thickness of casing 12 Gage Temp. of water Cool
Diameter and length of casing 8"3/16 I.D. used 67 Ft. of Casing in Well
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)
If flowing well give flow in c.f.s. or g.p.m. and pressure
If nonflowing well give depth of standing water from surface 14 Ft. from Surface
If flowing well describe control works
(Type and size of valve, etc.)
Date of commencement of well July 1953 Date of completion of well July 1953
Type of well rig Keystone # 50 --(Howard an Son's Well Rig)

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	10	10	Top Soil
10	13	3	Hard Kalitche
13	18	5	Light Clay
18	23	5	Hard Rock
23	28	5	White Clay
28	30	2	Hard Rock
30	80	50	Red Clay
80	87	7	Hard Kalitche
87	102	15	Red Clay
102	119	17	Hard Kalitche
119	194	75	Red Clay
194	196	2	Hard Rock
196	205	9	Red Clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 80 to 87 ft.
Other aquifers 102Ft. to 119
194 Ft. to 196 Ft.

First water at 35 Ft. feet.

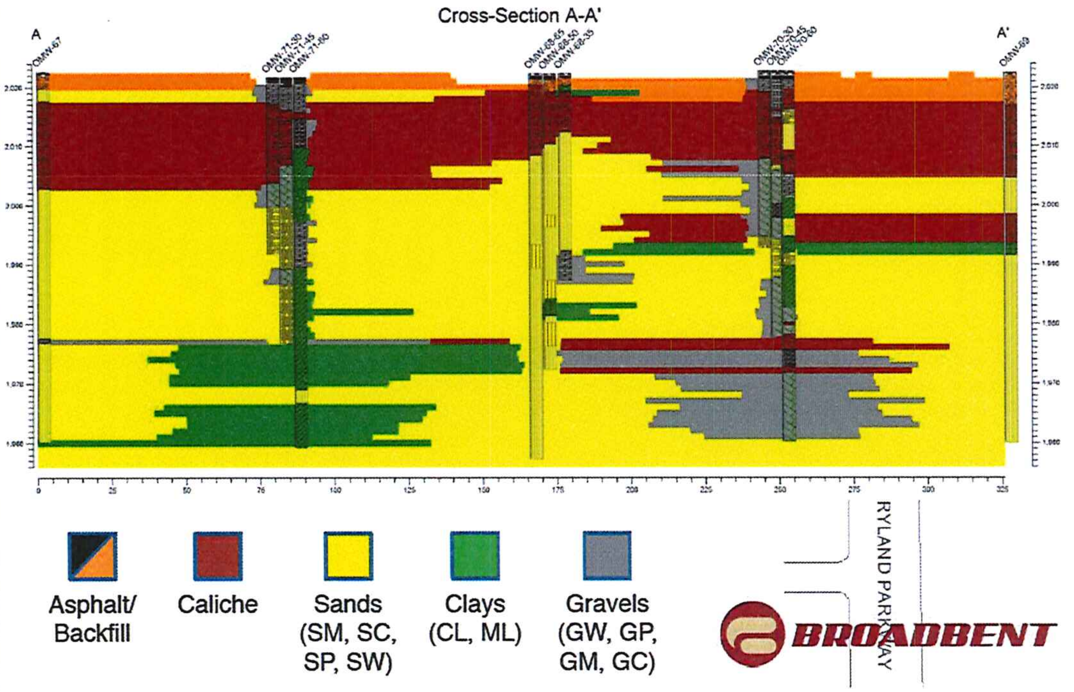
- "Red Clay" first encountered at 30 ft
- Red Clay interfingered with aquifer units
- Well "screened" (open borehole?) from 67 to 205 ft.

Recap of Site Stratigraphic Setting

- Near Toe of Alluvial Fan Deposits (i.e., highly variable and complex)
- Up-slope of Playa Deposits, but within the Las Vegas Wash Aquitard (Leising, 2004)
- LV Wash "Aquitard" is leaky, and includes high-K units
- Steep hydraulic gradient from Piedmont toward Las Vegas Wash

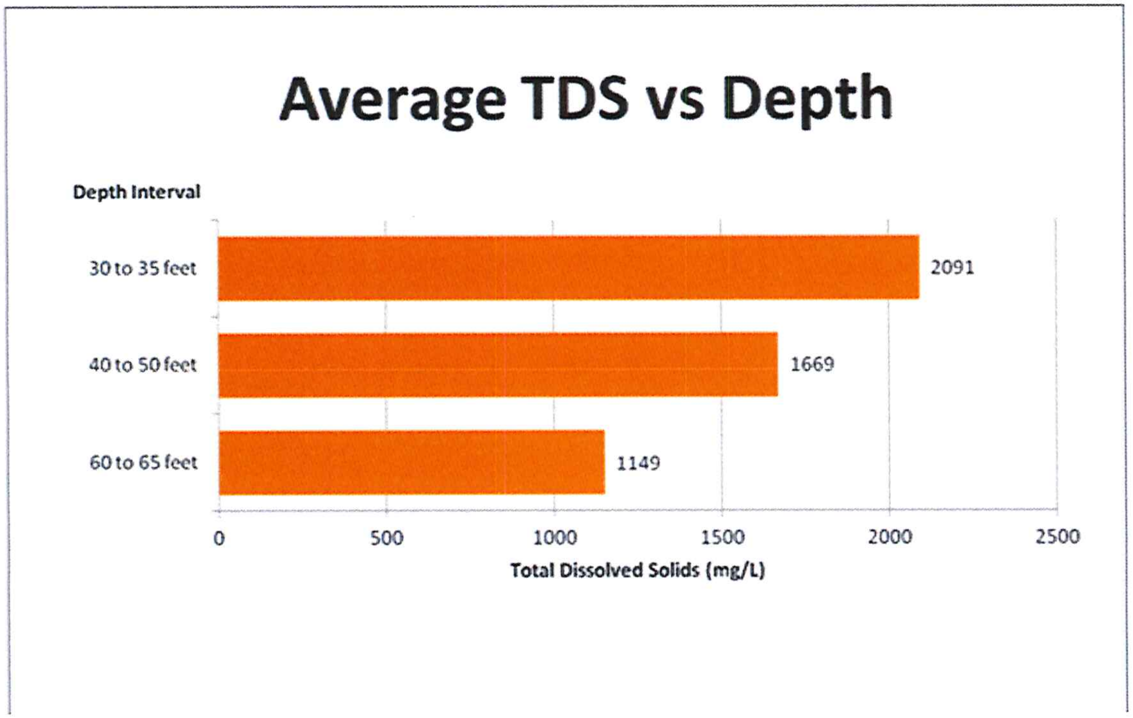
Site Lithology

Far Downgradient Investigation



- Many boring logs show silts and clays (some reddish brown) at about 30 ft
- Caliche is common but not at predictable depths
- Not all borings greater than 30 ft deep terminate in silt or clay

Site "Hydro-Chemi-Stratigraphy"



- Water quality improves with depth
- Two of the eleven deeper samples < 500 mg/L TDS
- Producing aquifer TDS in this area is between 400 and 800 mg/L