Appendix D: 97-005 Step Reports (Steps 1 through 5)

Olympic Well Field

Drinking Water Source Assessment and Contamination Assessment Report

City of Santa Monica, California

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Acronyms and Abbreviations

μg/L	micrograms per liter
AMSL	above mean sea level
AST	aboveground storage tank
basins	groundwater basins
bgs	below ground surface
Boeing	The Boeing Company
CAO	Clean-up and Abatement Order
CCY	City Corporation Yard
City	City of Santa Monica
ft/day	feet per day
ft^2/day	square feet per day
Gillette	The Gillette Company
gpm	gallons per minute
groundwater model	numerical groundwater flow and solute transport model
I	Interstate
ICF	ICF International
MTBE	methyl tert-butyl ether
PCE	perchloroethene
R	retardation factors
RWQCB	Regional Water Quality Control Board
SCM	Site Conceptual Model
SRA	settlement and release agreement
SVE	soil vapor extraction
TCE	trichloroethene
UST	underground storage tank
VOC	volatile organic compound

Executive Summary

This drinking water source assessment and contamination assessment report has been prepared to address step one of the California State Water Resources Control Board, Division of Drinking Water updated 97-005 permitting process. Planned modifications to the City of Santa Monica's (the City) Arcadia Water Treatment Plant and the installation of new groundwater production wells in the Olympic Well Field has triggered the need for the 97-005 permit.

Step 1 of the permitting process requires the applicant to prepare a drinking water source assessment report to identify the source and characterize the distribution of all known contaminants that are present in the groundwater within the producing well field. Source assessment is foundational to, and forms the basis of, the subsequent steps in the 97-005 permitting process. As is summarized in this executive summary and described in detail in this report, available data gleaned from several decades of investigation, site cleanup, monitoring, and modeling provides an abundance of relevant information to demonstrate a clear understanding of the occurrence and distribution of contaminants in the Olympic Well Field.

The City has been producing water from the Olympic Well Field since the mid-1970s. Volatile organic compounds (VOCs) were first observed in drinking water wells in the late 1970s. At that time very little was understood regarding the occurrence and distribution of VOCs in the Olympic Well Field. The City, through the Los Angeles-Regional Water Quality Control Board's (LA-RWQCB) certified unified program agency (CUPA), regulated the permitting, inspection, and compliance of underground storage tank (USTs) in the City. Through this program the City began the process of identifying likely contaminant sources in the Olympic Well Field. By the mid-1980s it became apparent to the City that The Gillette Company (Gillette) had conducted activities since the 1950s that likely led to the release of VOCs, including perchloroethene (PCE), trichloroethene (TCE), and 1,4-dioxane to the groundwater. Later, a facility formerly operated by The Boeing Company (Boeing) was also identified as a VOC source. The City directed both Gillette and Boeing to conduct site investigations to define the occurrence and distribution of dissolved-phase VOCs in groundwater at and adjacent to their respective sites.

Between the mid-1980s and early-2000s exhaustive work was conducted at the Gillette and Boeing sites, much of it reluctantly. The Gillette and Boeing cases were transferred to LA-RWQCB for oversight once it was apparent that Gillette and Boeing had conducted activities that were responsible for the degradation of groundwater quality in the Olympic Well Field. In 2008, LA-RWQCB issued a cleanup and abatement order (CAO) to Gillette. In late 2012, LA-RWQCB issued a CAO to Boeing. Both CAOs required ongoing site cleanup, additional site investigation and monitoring. In 2011 and 2012, the City entered into Settlement and Release Agreements (SRAs), with Gillette and Boeing, respectively. As part of the SRAs the City assumed responsibility for the restoration of groundwater quality in the Olympic Well Field. Restoration activities included as-needed plume delineation, demonstration of plume control, and on-going quarterly monitoring. In addition to these requirements, the City volunteered to prepare a numerical groundwater flow and transport model to confirm previously conducted analytical flow modeling and to assist in the long-term management of Olympic Well Field.

Groundwater in the Olympic Well Field occurs principally in four zones: B-, C-, and D-Zones (local designations) and the Sunnyside Aquifer (regional designation). The two existing and operational production wells in the Olympic Well Field, SM-4 and SM-3, produce from all 4 zones. VOC contamination has been observed in B- and C-Zones from the extensive groundwater monitoring well network. Monitor wells in the Olympic Well Field have been subject to quarterly sampling and monitoring for nearly two decades. Analytical and aquifer parameter data collected from the monitoring wells have enabled the City to develop a comprehensive understanding of the occurrence and distribution of well field contamination.

In summary, four VOCs have been detected in monitoring wells and production wells at or above maximum contaminant levels (MCLs) or notifications levels (NLs): PCE, TCE, 1,4-dioxane, and 1,2,3-TCP. The City is required to provide quarterly monitoring reports to LA-RWQCB to demonstrate that the PCE and TCE contaminant plumes, which are subject to the SRAs, are within the pumping radius of influence (i.e., capture zone) of the production wells. This requirement has been met since 2011 via monitoring results, which include, groundwater flow maps and contaminant iso-concentration maps, and by numerical groundwater modeling.

It is also notable that the City has established an informal Olympic Basin Surveillance Program. Under this program, the City conducts an active surveillance program of all tank/release sites in the Olympic subbasin and works diligently with the LA RWQCB to ensure all potential releases to groundwater are remediated to the fullest extent to ensure that drinking water resources are not impacted. The City has the full assurance from the LA RWQCB that no contaminated property will be closed without the full review and approval of the City.

Collectively, decade's worth of study, investigation, and analysis provide the City with ample data to prepare the drinking water source assessment discussed in this report. Additionally, this assessment will provide a strong foundation for subsequent steps of the 97-005 permit process.

Section 1
Introduction

The planned expansion and reconfiguration of the City of Santa Monica's (the City) Arcadia Water Treatment Plant (Arcadia WTP) has triggered the need to amend an existing 97-005 permit for the Charnock Well Field and Arcadia WTP. This drinking water source assessment and contamination assessment report (DWSACAR) has been prepared on behalf of the City to address Step 1 of the California State Water Resources Control Board, Division of Drinking Water, Updated 97-005 Permitting Process.

The City currently produces groundwater for public consumption from three well fields: Charnock, Arcadia, and Olympic. Water produced from Charnock and Olympic well fields have historically been contaminated with fuel hydrocarbons/additives and volatile organic compounds (VOCs), respectively. The City met the full 97-005 requirements for these two adversely impacted well fields. Under the current configuration groundwater produced from the Olympic Well Field is blended with water produced from the Charnock Well Field (three of the five Charnock wells are treated at the Charnock Treatment Facility for MTBE removal) and then pumped to the Arcadia WTP for further treatment. The Arcadia WTP treatment processes consists of greensand filtration, reverse osmosis, decarbonation, disinfection, and mechanical aeration in the treated water reservoir (Arcadia Reservoir).

Under its updated Sustainable Water Master Plan (SWMP) the City is taking initiatives to maximize local water resources and reduce its reliance on costly imported water supplies. Part of the SWMP includes restoring the Olympic Well Field production, including the installation of two new production wells to replace aging wells, and the expansion and reconfiguration of the Arcadia WTP. The expansion and reconfiguration the Arcadia WTP is necessary to accommodate a new well head Olympic Advanced Water Treatment Facility (Olympic AWTF), meet future increased groundwater production, and treat VOCs, 1,4-dixoane and 1,2,3-trichloropropane (1,2,3-TCP) which have been detected in the Olympic Well Field.

The expanded and reconfigured Arcadia WTP will be co-located with the new Olympic AWTF. The Olympic AWTF will be for water produced and delivered via separate pipeline from the Olympic Well Field; no blending with Charnock produced groundwater will occur. The proposed treatment for water from the Olympic Well Field will consist of ultraviolet light advanced oxidation and granular activated carbon.

This DWSACAR report is organized as follows:

- Section 2: Site Setting
- Section 3: Olympic Well Field Hydrogeology
- Section 4: Groundwater Well Pumping and Recharge
- Section 5: Contaminant Sources, Distribution, and Trends
- Section 6: Numerical Modeling

Section 2
Site Setting

The Olympic Well Field lies within the Olympic Subbasin, which is part of the larger Santa Monica Groundwater Subbasin of the Los Angeles Basin (Figure 1). For the purposes of this report, the Santa Monica Subbasin will be referred to as simply the Santa Monica Groundwater Basin or Santa Monica Basin. The Santa Monica Groundwater Basin covers an area of approximately 47 square miles and lies in the northwestern section of the Coastal Plain of Los Angeles County. The Los Angeles Coastal Plain covers an area of approximately 860 square miles and is subdivided into five groundwater basins (basins): Orange County Coastal Plain, Central, West Coast, Hollywood, and Santa Monica basins.

The Santa Monica Basin is bounded by the Santa Monica Mountains to the northwest, the Pacific Ocean to the west and southwest, the Newport-Inglewood Fault to the northeast, and the Ballona escarpment and Baldwin Hills to the south and southeast. The Santa Monica Basin is separated from the West Coast Basin by the Ballona Gap. In general, faults subdivide the Santa Monica Basin into five subbasins: Arcadia, Olympic, Coastal, Charnock, and Crestal.

The Hollywood, Central, and West Coast basins are far enough from the Olympic Well Field that hydrogeologic features and aquifer stresses are not considered relevant to this study. The Olympic Subbasin is one of five subbasins within the Santa Monica Basin and is bounded by the Arcadia Subbasin to the northwest, the Charnock Subbasin to the northeast, and the Coastal Subbasin to the southeast. The Crestal Subbasin lies beyond the Charnock Subbasin between the Charnock Subbasin and the Hollywood and Central basins (MWD 2014).

The Santa Monica Basin is characterized by a Mediterranean climate, with highly seasonal rainfall, warm summers, and cool, mild winters. The majority of the rainfall occurs from November to March with an average of 2 to 3 inches of precipitation falling monthly during this period. Between April and October, monthly rainfall seldom exceeds a few tenths of an inch. Annual precipitation from 1937 through 2013 is shown on Figure 2.

The Olympic Well Field is at the western end of the Sawtelle Plain and lies at an elevation of approximately 150 feet above sea level. The well field vicinity, along Olympic Boulevard, is relatively flat, with gentle slopes to the north rising toward uplands of the Santa Monica Mountain foothills and descending more steeply beyond the Interstate (I) 10 Freeway toward Pico Boulevard.

The Olympic Well Field is located along Olympic Boulevard between 26th Street and Centinela Avenue (Figure 3). Land use in the Olympic Well Field vicinity is a mixture of residential, commercial, and light industrial. Historic land uses have included clay mining and subsequent landfilling in former clay pits, aerospace manufacturing and other machining and fabrication supporting the aerospace industry, consumer goods manufacturing, and vehicle fueling and maintenance. Historic activities have resulted in the releases of VOCs, primarily tetrachloroethene (PCE), trichloroethene (TCE), and petroleum-based fuel products to groundwater tapped by production wells in the Olympic Well Field.

Section 3
Olympic Well Field Hydrogeology

3.1 Regional Overview

The regional groundwater basins are separated by geologic features such as non-water-bearing bedrock, faults, and other features that prevent or inhibit groundwater flow. The Santa Monica Basin is divided into five separate subbasins loosely defined by fault alignments (Figure 4). The origin of the delineations for the five subbasins within the Santa Monica Basin is not documented (RCS 2013). Faults in the Santa Monica Basin and structural geology are discussed in greater detail in Section 3.5. The Olympic Well Field pumping radius of influence extends south into the adjacent Coastal subbasin, terminating near the northern edge of the Santa Monica Airport. While hydrogeologic and analytical data from the Coastal subbasin is sparser than that available for the Olympic subbasin, available data does not suggest the presence of any deleterious effects from pumping in the Olympic Well Field. For example, the City installed a relatively shallow production well near City Hall in the Coastal subbasin. The borehole for that well extended to depths exceeding 600 feet. Electric logs from the borehole indicated that base of fresh water to be at a depth of approximately 540 feet. Likewise, the City drilled a test production well near the airport called Airport Well No. 1. The well extends to a depth of approximately 610 feet. Ongoing groundwater quality investigation is being conducted by Boeing near the Airport Well No. 1 location to determine if prior industrial activity may have impacted the groundwater aquifer

The aquifers of the Santa Monica Basin consist of unconsolidated and semi consolidated fluvial and marine deposits (Reichard et al. 2003; Poland et al. 1959). During the mid-Pliocene to Holocene, sea level fluctuations resulted in beach and bay deposits that were subsequently dissected by alluvial deposits derived from erosion in the surrounding mountains, which filled the basin with heterogeneous beds of clays, silts, sands, and gravels of various thicknesses (Poland et al. 1959). Poland et al.'s position on the depositional environment in this region has been supported by the results of deeper lithologic assessment. AMEC Geomatrix, Inc. (2009a) states: "The lateral continuity of these units is consistent with a marine depositional environment such as described in published literature (e.g., Poland et al. 1959) for the Pleistocene-age San Pedro Formation in this part of the Los Angeles Basin. Shells and shell fragments observed in sediment cores from various locations and depths in the study area further support a marine origin for the deeper units."

The regional hydrogeology and physiography are described by Poland et al. (1959) and RCS (2013). Groundwater occurrence in the Olympic Subbasin is generally confined, with some areas of unconfined or perched groundwater in the uppermost strata. Recent alluvium is limited within the Olympic Subbasin and includes the clays Ballona aquifer, also referred to as the "50-foot gravel." Perched and semi-confined groundwater may occur in this unit. Underlying the Ballona aquifer, the primary economic groundwater-producing zones in the Olympic Subbasin include aquifers within the Lakewood Formation and the underlying San Pedro Formation. The Olympic Well Field produces water from these confined aquifers.

3.2 Olympic Well Field Geologic Overview and Correlation to Regional Stratigraphy

Localized groundwater investigations in the Olympic Well Field vicinity have characterized the shallower strata (<500 feet below ground surface [bgs]) as the A-, B-, C-, and D-Zone aquifers, with intervening aquitards. Understanding the geological context of these aquifer zones requires correlation to the regional aquifer designations and general geologic framework. Hydrostratigraphic correlation of the Santa Monica Basin geologic units presented by RCS (2013) to unit designations used in local hydrogeologic assessments in and near the Olympic Well Field was conducted using a combination of borehole data from environmental drilling programs performed within approximately one half mile of the Olympic Well Field (Gillette, City Corporate Yard, Boeing, and other investigations in the vicinity) with that available from recent City of Santa Monica investigations (ICF 2013a, 2014a) and regional hydrogeologic studies (RCS 2013). These correlations are based on well logs from Santa Monica production well SM-4 and the lithologic units observed at continuously cored borings at adjacent monitoring well OB-9 (ICF 2014a, 2014b) and nearby Gillette site borehole EB30 (AMEC 2009b). Borehole EB30 was advanced to 555 feet bgs and provides a geologist's log of a continuously cored borehole and a geophysical log. Additionally, observations from soil borings were compared with stratigraphic descriptions from RCS (2013). Figure 5 shows the correlation of primary hydrogeologic units and an idealized north to south cross section across the Santa Monica Basin showing the regional setting in which the local geologic units and structure occur.

The uppermost water-bearing geologic unit is the Ballona aquifer, or "50-foot gravel." This unit is correlated to the A-Zone aquifer. The underlying Lakewood aquifer is correlated with the A/B Aquitard, the B-Zone aquifer, and the upper 40 to 50 feet of the upper B/C aquitard. Below the Lakewood aquifer, the Upper San Pedro aquifer consists of two main units, the Silverado (upper) and Sunnyside (lower) aquifers. The Silverado aquifer consists of the lower 20 to 30 feet of the B/C aquitard, the C-Zone aquifer, the C/D aquitard, and the D-Zone aquifer. Below the Silverado aquifer are the Sunnyside aquifer and an unnamed unit immediately above the Pico Formation. The Sunnyside aquifer and an unnamed underlying unit are combined for the work documented in this report. The San Pedro aquifer is considered the lowermost economic aquifer in the Santa Monica Basin. The underlying Pico formation consists of consolidated, interbedded clay, silt, sand, and gravel and is generally not considered to be a significant source of fresh water (RCS 2013). The Pico and lower formations are considered saline and are used for oil production locally throughout the Los Angeles Basin (RCS 2013).

3.3 Detailed Olympic Well Field Geology

Detailed lithology for the different aquifer zones is presented below. Lithologic descriptions are from core samples collected in the vicinity of the Olympic Well Field. A borehole data inventory map, providing the locations and deepest intervals encountered in boreholes advanced in the Olympic Well Field vicinity, is shown on Figure 6. Lithology and aquifer composition are provided in this section; preferential pathways and aquifer heterogeneity are discussed in Section 3.4, and geologic structures are discussed in Section 3.5. Correlation of local aquifer units to regional hydrogeologic units is discussed in Section 3.2 and summarized on Figure 5. Figures 7, 8, and 9, provide cross sections through the Olympic Well Field vicinity.

3.3.1 Ballona Aquifer (A-Zone Aquifer)

The Holocene-Age Ballona aquifer, or "50-foot gravel," reported by RCS (2013) in the shallow (<150 feet bgs) part of the Olympic Well Field is correlated with the A-Zone aquifer. This unit consists of brown to dark brown sandy and gravelly clays and silts interspersed with beds of silty and clayey sands and gravels (ICF 2013b, 2014a). The Ballona or A-Zone aquifer is not the focus of this study and will receive only limited discussion.

3.3.2 Lakewood Aquifer (A/B Aquitard, B-Zone Aquifer, Upper B/C Aquitard)

The late Pleistocene-Age Lakewood aquifer underlies the Ballona or A-Zone aquifer. The Lakewood aquifer is subdivided in the Olympic Well Field vicinity into the A/B aquitard, B-Zone aquifer, and the upper portion of the B/C aquitard.

The A/B aquitard forms a confining unit separating the A- and B-Zone aquifers. This unit is poorly defined, but where present consists of 10 to 100 feet of dark brown clay and silt with occasional sandy or gravelly beds (ICF 2013b, 2014a), and may include at least one unconformity between the A-Zone aquifer and underlying sediments (AMEC 2009a). This geologic unit consists of brown, stiff to very stiff silts and clays, with low to medium plasticity, and is often finely bedded. Thin sandy and gravelly intervals are also present within the A/B aquitard.

The underlying B-Zone aquifer is only present generally north of an east-west line crossing from the north to the south side of Olympic Boulevard near the intersection with 26th Street. The B-Zone aquifer generally consists of 20 to 50 feet of yellowish-brown fine- to medium-grained silty sands with occasional gravelly, silty, and clayey beds. The shallowest B-Zone aquifer occurrence is approximately 60 to 70 feet bgs to the south side of Olympic Boulevard east of 26th Street. The B-Zone aquifer dips to approximately 200 feet bgs north of Olympic Boulevard. Below the B-Zone aquifer is the B/C aquitard.

At production well SM-4 the contact between the Lakewood and underlying San Pedro Formation is shown by RCS (2013) as approximately 20 feet above the bottom of the B/C aquitard. For the purposes of this report, the B/C aquitard will be treated as one unit and is described below.

3.3.3 San Pedro Formation

Regionally, the San Pedro formation hosts five sub-units considered economic water bearing strata: the Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside aquifers (Reichard et al. 2003). In the Olympic Subbasin and vicinity, the upper portion of the San Pedro formation, consisting of the Hollydale, Jefferson, and Lynwood aquifers, is absent. Only the Silverado and Sunnyside aquifers are present and will be discussed here.

3.3.4 San Pedro Formation, Silverado Aquifer (Lower B/C Aquitard C-Zone Aquifer, C/D Aquitard, and D-Zone Aquifer)

The upper portion of the early Pleistocene-Age Silverado aquifer consists of the B/C aquitard and the C-Zone aquifer. The B/C aquitard generally consists of 20 to 60 feet of grayish-brown clays and silts with discontinuous sandy and gravelly intervals ranging from a few inches to over 10 feet thick. The B/C aquitard clays and silts are generally stiff to very stiff and of low to medium plasticity with occasional fine bedding.

The top of the C-Zone aquifer occurs as shallow as approximately 45 feet bgs at monitoring well MW-12, south of Olympic Boulevard and east of 26th Street, and dips to over 330 feet bgs at well OB-3 near the intersection of Stewart Street and Pennsylvania Avenue. The C-Zone aquifer is locally composed of 50 to 80 feet of fine to medium yellowish-brown silty sands with occasional coarse sand and gravelly intervals. Discontinuous clayey and silty beds are present throughout the C-Zone aquifer. Below the C-Zone aquifer, the C/D aquitard consists of 3 to 15 feet of dark gray, stiff clayey silt to clay with low to medium plasticity.

The top of the D-Zone aquifer is approximately 105 feet bgs at monitoring well KMW-6, approximately 650 feet southeast of the intersection of Olympic Boulevard and 26th Street. The top of the D-Zone aquifer dips to approximately 390 feet bgs at borehole EB30, approximately 200 feet southwest of the intersection of Stewart Street and Pennsylvania Avenue. The D-Zone aquifer consists of approximately 100 to 130 feet of predominantly fine to medium sand with varying amounts of clay and silt. The D-Zone aquifer sands are interbedded with silts and clays ranging from 1 to 5 feet thick. Detailed lithologic data are not available to determine the continuity of these silt and clay beds. Sands in the D-Zone aquifer are yellowish-brown in the upper 20 to 30 feet of the D-Zone aquifer and dark greenish-gray and brown throughout most of the lower portion of the aquifer. The D-Zone aquifer is the lowest sub-unit of the Silverado aquifer.

3.3.5 San Pedro Formation, Sunnyside Aquifer

The early Pleistocene-Age Sunnyside aquifer underlies the D-Zone aquifer and is indicated in the SM-4 geophysical log by a distinct signature correlating with a similar signature at borehole EB30 (AMEC 2009b). The EB30 well log extends into the upper 40 feet of the Sunnyside aquifer and core descriptions indicate that beneath the Gillette Site, immediately below the contact between the D-Zone (Silverado) aquifer, the underlying Sunnyside aquifer consists of approximately 5 feet of brown clayey gravel. This gravel is, in turn, underlain by predominantly dark greenish-gray sand with intervals of clayey and silty sand with occasional gravelly intervals. Below this interval, aquifer characterizations are based on geophysical logs and regional literature.

The Sunnyside aquifer and another unnamed, poorly characterized unit are interpreted to extend to the base of the San Pedro formation. The upper part of this system tends to be characterized by alternating fine-grained and coarse-grained zones. The coarsest part of the aquifer system generally is at the base and is as much as 100 feet thick (Reichard et al. 2003). At the base of the San Pedro formation, a disconformable contact with the upper Pico formation is considered to be the base of the economic fresh water aquifers (Poland et al. 1959; Reichard et al. 2003; RCS 2013).

3.3.6 Pico Formation

The Pliocene-Age Pico formation consists of consolidated interbedded marine clay, silt, sand, and gravel. Individual sand and gravel beds within the Pico formation are 20 to 100 feet thick and separated by clay and micaceous siltstones. The Pico formation is of sufficiently low permeability to be considered a no-flow boundary for the purposes of groundwater modeling (GeoTrans 2005; Reichard et al. 2003).

The Pico formation hosts localized oil and natural gas reservoirs at depths below the base of the freshwater aquifers in the region (RCS 2013). The top of the Pico formation is generally considered to be the base of the groundwater flow system and also the lower extent of the freshwater within the Los Angeles Basin (Poland et al. 1959; Reichard et al. 2003; GeoTrans 2005; RCS 2013).

3.4 Preferential Pathways and Aquifer Heterogeneity

3.4.1 Preferential Pathways

The presence of preferential pathways and confining units significantly influences groundwater flow. The main large-scale preferential pathways in the vicinity of the Olympic Well Field consist of the well-defined coarser grained beds that compose the aquifers described above. Within these aquifers, preferential pathways in the form of gravel beds appear to occur as isolated lenses in the B-Zone and C-Zone aquifers. However, these gravel beds do not appear to be of significant thickness, nor can they be consistently correlated between boreholes. Cross sections showing the coarse-grained aquifer units and intervening fine-grained aquitards are provided in Figures 7, 8, and 9.

Confining units consist of the silty and clayey beds described above as the aquitards present between the main aquifers. Within the aquitards, localized gravelly and sandy units have been observed with significantly different thickness in adjacent boreholes. These irregular zones of coarse-grained materials provide lateral and vertical preferential pathways and may facilitate localized groundwater flow within the aquitards. Lenses with higher fractions of gravel were observed in the aquifers and aquitards during the drilling of monitor well borings (ICF 2013b, 2014a). Based on field observations, these lenses appear to be laterally discontinuous and are seldom correlated between boreholes; however, groundwater can be expected to flow preferentially through these layers where present. Direct conduits through the aquitards have not been directly observed or reported during drilling programs conducted in the Olympic Well Field vicinity.

3.4.2 Lateral and Vertical Heterogeneity

Lateral and vertical heterogeneity can strongly influence groundwater movement by facilitating or impeding groundwater flow. Lateral and vertical heterogeneities are observed at widely varying scales in the Olympic Well Field geologic strata. The presence of very low-permeability silt and clay aquitards between the A-, B-, C-, and D-Zone aquifers represent large-scale vertical heterogeneity. Impedance of groundwater flow across these aquitards is demonstrated by significantly different hydraulic heads indicating a downward hydraulic gradient of 25 to 45 feet between adjacent aquifers (AMEC 2009b).

Within the aquifers, relatively clayey and silty layers have been observed in core samples; however, these zones appear to be laterally discontinuous and are seldom correlated between boreholes. These layers can be expected to inhibit vertical groundwater flow within an individual aquifer. Downward hydraulic gradients of 2 to 10 feet within the C-Zone aquifer indicate the influence of clayey and silty lenses within this aquifer (AMEC 2009b). Hydraulic gradients between the aquifers and within individual aquifer units will be discussed in Section 2.7, Groundwater Levels and Flow.

3.5 Santa Monica Basin Structural Geology

In general, strata within the Santa Monica Basin dip from the Santa Monica Mountains in the north to the Pacific Ocean toward the south. Regionally these strata generally thicken to the south, are gently folded, and are cut by faults throughout the Santa Monica Basin (Figure 5). Figure 4 shows two alignments of major faults mapped by various investigators in the Santa Monica Basin: a generally west to east-northeast trending structure and a northwest to southeast trending structure (Geomatrix 2007a; RCS 2013).

Near-surface faults throughout the Santa Monica Basin influence groundwater flow and often act as barriers to groundwater movement throughout the basin (GeoTrans 2005; Geomatrix 2007a; RCS 2013); mapped faults and relevant geologic structures in the Santa Monica Basin include the features discussed in the following sections.

3.5.1 Olympic Well Field Geologic Structures

In the context of the Santa Monica Basin hydrogeologic system, the Santa Monica Fault is mapped as extending generally from west to east from the vicinity of the Lincoln Boulevard and Montana Avenue intersection approximately to the intersection of the I-10 and I-405 freeways (Figure 4), where it intersects the Charnock Fault (RCS 2013). The Santa Monica Fault is mapped as passing adjacent to the Olympic Well Field, crossing under the vicinity near the intersection of Stewart Street and Olympic Boulevard. At the Charnock Fault, the Santa Monica Fault is offset several hundred feet to the northwest and changes direction, continuing to the northeast. The Santa Monica Fault is downthrown on the north side with a vertical offset of approximately 200 feet in the vicinity of the Olympic Well Field (RCS 2013). For the purpose of the work presented here, the Santa Monica Fault is presumed to exist at depth; however, a surface expression is not interpreted to be present near the Olympic Well Field (Geomatrix 2007a).

The possible influence of faulting on groundwater movement in the Olympic Well Field has been considered an important element in understanding the local hydrogeology (RCS 2013). The Santa Monica Fault has been mapped by previous investigators who have inferred the presence of at least 10 different fault trace locations in the Olympic Well Field vicinity (Geomatrix 2007a); however, surface expressions for the Santa Monica Fault have not been identified. In evaluation of these fault traces, and the work used to delineate them, most investigations determined the presence of faults from groundwater level differences or "groundwater anomalies" in wells presumed to be on different sides of a fault (Geomatrix 2007a). Investigations conducted subsequent to Geomatrix's 2007 study have found that "subsurface investigation[s]…indicate the absence of faults that offset hydrostratigraphy or influence groundwater levels and groundwater flow within the depth of investigation in the study area" (AMEC 2009a). ICF observed significant groundwater level differences between the A-Zone, B-Zone, and C-Zone aquifers, and that groundwater levels are consistently higher in the shallow aquifers and lower in the deeper aquifers. However, due to the dipping geologic structure (Figures 7 and 9), wells can be screened at the same depths but monitor different aquifer zones, resulting in the appearance of significant groundwater level differences and thus the appearance of a hydraulic barrier, such as a fault, between nearby wells.

Using borehole data from multiple investigations in the Olympic Well Field vicinity (AMEC various; KOMEX 2002a, 2002b, 2003; ICF 2013b, 2014a, 2015) interpretation of a potential Santa Monica Fault has been evaluated. Data from multiple boreholes indicate that while the Santa Monica Fault may be present at depth in the consolidated Pico formation and lower strata, upper unconsolidated sediments appear to have been folded into an asymmetrical anticline within approximately 500 feet of the surface. This anticline dips northward toward the interior of the Olympic Subbasin and exhibits at least 200 feet of relief, indicated by the difference in the top of the C-Zone aquifer elevations between monitoring well locations KMW-6 and OB-2 as illustrated on Cross Section A-A' (Figure 7).

The deep faulting and accompanying anticlinal formation in the overlying unconsolidated deposits can be expected to result in uplift and erosion along the crest of the anticline relative to the downward dipping flanks to the north and south. The B-Zone aquifer sands are absent south of Olympic Boulevard between 26th Street and Stewart Street, and in the vicinity of monitoring well OB-13C, near Olympic Boulevard and South Centinela Avenue. The presence of B-Zone aquifer sands at monitoring well OB-14 and preliminary groundwater levels similar to those observed at other B-Zone aquifer wells (ICF 2015a) indicates the B-Zone aquifer is locally continuous northward from monitoring well OB-14 to Olympic Boulevard between production wells SM-3 and SM-4 (Figure 3). The discontinuous nature of the B-Zone aquifer sands along (and to the south) of the alignment of Olympic Boulevard suggests the B-Zone sands were eroded locally along the crest of the anticline. Based on this interpretation, after erosion of the B-Zone aquifer sands, deposition of Holocene sediments composing the A/B aquitard and the A-Zone aquifer occurred.

The lithology and structure subparallel to strike from the intersection of Colorado Avenue and Cloverfield Boulevard to monitoring well OB-13C, approximately 100 feet west of the intersection of South Centinela Avenue and Olympic Boulevard is illustrated on Cross Section B-B' (Figure 8). The lithology and structure along a transect from monitoring well MW-12, northeast of the intersection of Michigan Avenue and 24th Street, to monitoring well OB-3, near the intersection of Stewart Street and Pennsylvania Avenue, is illustrated on Cross Section C-C' (Figure 9).

Structural contour maps of the top of the B-Zone aquifer, top of the B/C aquitard, top of the C-Zone aquifer, and the top of the C/D aquitard are presented on Figures 10 through 13, respectively. The top of base of the San Pedro formation, comprising the lower groundwater flow system boundary, is shown on Figure 14.

3.5.2 Newport-Inglewood Fault

The Newport-Inglewood Fault system is generally aligned with the northeastern boundary of Santa Monica Basin (Figure 4); it extends from the northwest to southeast across the Los Angeles Plain from Beverly Hills to Orange County. This fault system is a regional structural feature consisting of a series of predominantly en-echelon right-lateral strike slip faults that include the Overland Avenue Fault. Movement on the Newport-Inglewood Fault has resulted in the southern side moving to the northwest relative to the northern side. Sediments in the Santa Monica Basin, on the southern side of the Newport-Inglewood Fault, are upthrown relative to those located northeast in the Central and Hollywood basins (RCS 2013).

3.5.3 Hollywood-Brentwood Fault System

The Hollywood-Brentwood Fault system, also referred to as the Potrero Canyon Fault (Kennedy Jenks 2011), trends in a general east-west direction along the northern boundary of the Olympic Subbasin (Figure 4). This fault system consists of the Hollywood South Branch Fault and the Brentwood Fault. The Malibu Coast Fault is aligned with, and slightly offset from, the Brentwood

Fault and extends about 1 mile inland from the Pacific Ocean. For the purpose of this study, the Malibu Coast Fault is considered part of the Hollywood-Brentwood Fault system.

The Brentwood Fault is generally aligned with the northern Olympic Subbasin boundary and extends from the Charnock Subbasin western boundary near the Pacific coast to near the intersection of the I-405 Freeway and Santa Monica Boulevard. The Hollywood South Branch Fault extends sub parallel to Santa Monica Boulevard from near the intersection of Ohio Avenue and Granville Avenue to near the intersection of Crescent Heights Boulevard and Santa Monica Boulevard in Hollywood (RCS 2013). The Brentwood Fault comprises the northwestern boundary of the Olympic Subbasin and acts as a barrier to groundwater flow, as indicated by a 176-foot groundwater elevation difference observed in the vicinity of the Arcadia Well Field, between wells on the hydraulically upgradient and downgradient sides of the Brentwood Fault (Montgomery 1974). The Brentwood Fault is interpreted to have approximately 650 feet of displacement. On the north side of the Brentwood Fault, the base of the San Pedro formation is interpreted as being only about 100 feet bgs. The Brentwood Fault juxtaposes the Pico formation, north of the fault, against the Lakewood, Silverado, and Sunnyside aquifers on the south side (RCS 2013).

3.5.4 Charnock Fault

The Charnock Fault extends from northwest to southeast from along an alignment sub parallel to the I-405 Freeway from the vicinity of Perdue Avenue and Olympic Boulevard to just beyond the southeastern Santa Monica Basin boundary at Ballona Creek (Figure 4). The Charnock Fault is generally aligned with the northeastern boundary of the Santa Monica and Coastal Subbasins with the Charnock Subbasin and is interpreted to have approximately 40 feet of vertical displacement near the Charnock Well Field (RCS 2013). Water levels on either side of the fault differ by greater than 20 feet, indicating the fault acts as a barrier to groundwater flow (GeoTrans 2005).

3.6 Aquifer Properties

To develop an understanding of the aquifer properties, ICF reviewed literature and consultants' reports from groundwater investigations and groundwater modeling performed in the Olympic Well Field vicinity and elsewhere in the Santa Monica Basin. Aquifer properties considered here consider the aquifer's physical characteristics related to groundwater flow and contaminant fate and transport. Aquifer properties relevant to groundwater flow and contaminant fate and transport include:

- hydraulic conductivity
- transmissivity
- specific yield/storativity[1]
- fraction organic carbon
- retardation factor[1]

Published and other aquifer property data from aquifer tests performed at high-capacity water supply wells are limited in the Santa Monica Basin or elsewhere in the Los Angeles Basin. Generally,

[1] Expressed values listed in the text are dimensionless.

these data are assigned to the regional aquifers such as the Lakewood and Silverado aquifers. Aquifer tests performed locally at the former Gillette site and the City Corporation Yard (CCY) are available and can be assigned to the local aquifer designations used here; however, it should be noted that these two groups of tests have yielded significantly different hydraulic conductivity results for similar lithologies. Aquifer testing at the former Gillette site was performed by constant-rate aquifer pumping, whereas the CCY tests were performed using slug testing methods. Because constant-rate aquifer testing stresses a larger portion of the aquifer than slug testing, resulting in a more representative portion of the aquifer being tested, it produces results more representative of the aquifer.

Core sample hydraulic conductivity, porosity, and density test results are also available from aquifers and aquitards at the Olympic Well Field. Data from core samples represent a discrete portion of the formation tested and may be highly variable due to lateral and vertical heterogeneities within the aquifer. roundwater modeling in the Charnock Subbasin provides reasonable minimum (minimum), reasonable maximum (maximum), and model-calibrated values, and may be the only aquifer property values available for some aquifer strata described here (GeoTrans 2006).

3.6.1 A-Zone Aquifer and A/B Aquitard Properties

Aquifer tests conducted in the A-Zone aquifer indicate hydraulic conductivities ranging from 2.3 to 47 feet per day (ft/day) and transmissivities ranging from 25 to 920 square feet per day (ft^2/day) (Geomatrix 2007b). Groundwater modeling in the Charnock Subbasin by GeoTrans (2006) provides hydraulic conductivity minimum, maximum, and calibrated values of 50, 240, and 60 ft/day, respectively, for the corresponding stratigraphic unit ("Ballona aquifer"). Specific yield values or storativity were not calculated for the A-Zone aquifer for the project area. GeoTrans (2006) provides minimum, maximum, and model-calibrated specific yield values of 0.05, 0.25, and 0.14, respectively, for all stratigraphic units modeled, but do not provide storativity values for the "A-Zone," or Ballona aquifer. These values are appropriate for unconfined clayey or silty aquifer materials. Published aquifer property values were not available for the Ballona aquifer.

Aquifer core sample permeameter test analysis values for hydraulic conductivity are presented in Table 2. Calculated retardation factors (R) for PCE and TCE are presented in Table 3.

For the A-Zone aquifer, two core sample permeameter tests indicate hydraulic conductivity values of 0.002 and 0.005 ft/day. Thirty-two core samples yielded average R values for PCE and TCE of 6.4 and 2.9, respectively.

For the A/B aquitard, 20 core sample analysis values for hydraulic conductivity indicate an average value of 0.006 ft/day. Forty-seven calculated retardation factors for PCE and TCE yielded R values averages of 7.2 and 3.2 (consistent units), respectively. GeoTrans (2006) provides minimum, maximum, and model-calibrated values for A/B aquitard hydraulic conductivity as 0.005, 1, and 0.05 ft/day, respectively, for the corresponding stratigraphic unit ("Ballona aquitard"). GeoTrans (2006) also provides minimum, maximum, and model-calibrated storativity values for A/B aquitard of 0.00004, 0.05, and 0.05, respectively, for this stratigraphic unit.

3.6.2 B-Zone Aquifer and B/C Aquitard Properties

Aquifer tests conducted in the B-Zone aquifer are summarized in Table 1 and indicate hydraulic conductivities ranging from 3 to 120 ft/day and transmissivities ranging from 90 to 6,100 ft^2/day (AMEC 2009b). AMEC (2009b) did not calculate specific yield or storativity for the B-Zone aquifer. Groundwater modeling in the Charnock Subbasin by GeoTrans (2006) provides hydraulic conductivity minimum, maximum, and model-calibrated values of 20, 250, and 80 ft/day, respectively, for the corresponding stratigraphic unit ("Shallow Aquifer"). Modeling in the Charnock Subbasin by GeoTrans (2006) provides minimum, maximum, and model-calibrated storativity values of $4x10^{-5}$, 0.05, and 0.03, and specific yield values of 0.05, 0.25, and 0.14, respectively, for this stratigraphic unit. These storativity values appear to be reasonable for leaky confined to semi-confined conditions and the specific yield values appear to be reasonable for unconfined silty sand aquifers, respectively. Published hydraulic conductivity values are available only for the Lakewood aquifer in general and indicate a range of 1 to 140 ft/day (Reichard et al. 2003).

For the B-Zone aquifer, data from 13 core samples indicate an average hydraulic conductivity value of 2.018 ft/day. Thirty-three calculated R values for PCE and TCE yielded averages of 3.9 and 2.0, respectively.

Aquifer test data are not available from the B/C aquitard. GeoTrans (2006) provides minimum, maximum, and model-calibrated values for B/C aquitard hydraulic conductivity as $5.4x10^{-4}$, 1, and 0.11 ft/day, respectively, for the corresponding stratigraphic unit ("Shallow Aquitard"). GeoTrans (2006) provides minimum, maximum, and model-calibrated values for B/C aquitard storativity as $5.4x10^{-5}$, 0.05, and 0.05, respectively.

For the B/C aquitard, data from 20 core samples indicate an average hydraulic conductivity value of 0.051 ft/day. Twenty-five calculated retardation factors for PCE and TCE yielded averages of 3.9 and 2.0 (consistent units), respectively.

Silverado Aquifer (Undifferentiated)

Published aquifer property values are only available for the Silverado aquifer as a whole, and indicate hydraulic conductivities ranging from 18 to 170 ft/day with a geometric mean value of 101 ft/day; transmissivities range from 1,845 to 108,700 ft^2/day and have a geometric mean of 11,600 ft^2/day (RCS 2013; Poland et al. 1959).

3.6.3 C-Zone Aquifer and C/D Aquitard Properties

Slug tests were conducted in the C-Zone aquifer near the Olympic Well Field and are summarized in Table 1. Data from these slug tests indicate hydraulic conductivities ranging from 0.001 to 8.7 ft/day with a geometric mean of 0.26 ft/day; transmissivities were not determined (Arthur D. Little, Inc. 2000). These data are low for what would be expected for a sandy aquifer and should be used with caution. Storativity values were not available from site-specific tests of the C-Zone aquifer in the Olympic Well Field. Groundwater modeling in the Charnock Subbasin by GeoTrans (2006) provides hydraulic conductivity minimum, maximum, and model-calibrated values of 10, 250, and 80 ft/day, respectively, for the corresponding stratigraphic unit ("Upper Silverado Aquifer"). GeoTrans (2006) also provides minimum, maximum, and model-calibrated storativity values of $4x10^{-5}$, 0.05, and 0.03 and specific yield values of 0.05, 0.25, and 0.14, respectively, for this stratigraphic unit. These storativity values appear to be reasonable for leaky confined to semi-confined conditions and the specific yield values appear to be reasonable for unconfined silty sand aquifers.

For the C-Zone aquifer, data from eight core samples indicate an average hydraulic conductivity value of 0.393 ft/day. Twenty-seven calculated R values for PCE and TCE yielded averages of 3.9 and 2.0, respectively.

For the C/D aquitard, data from four core samples indicate an average hydraulic conductivity value of 0.003 ft/day. Eleven calculated R values for PCE and TCE yielded averages of 36.5 and 13.3, respectively.

Aquifer test data are not available from the C/D aquitard. GeoTrans (2006) provides minimum, maximum, and model-calibrated values for C/D aquitard hydraulic conductivity as $5.4x10^{-4}$, 1, and 1 ft/day, respectively.

D-Zone Aquifer Properties

Site-specific D-Zone aquifer transmissivity, hydraulic conductivity, and storativity values obtained from aquifer pumping or slug tests are not available in the Olympic Well Field. Groundwater modeling in the Charnock Subbasin by GeoTrans (2006) provides hydraulic conductivity minimum, maximum, and model-calibrated values of 10, 250, and 105 ft/day, respectively, for the corresponding stratigraphic unit ("Lower Silverado Aquifer top zone"). GeoTrans (2006) also provides minimum, maximum, and model-calibrated storativity values of $4x10^{-5}$, 0.05, and 1x10-4, respectively, for the corresponding stratigraphic unit. These storativity values indicate leaky confined to semi-confined conditions.

For the D-Zone aquifer, core sample analysis values for hydraulic conductivity have an average value of 0.006 ft/day. Fifteen calculated R values for PCE and TCE yielded averages of 18.9 and 7.2, respectively.

Sunnyside Aquifer Properties

Site-specific Sunnyside aquifer transmissivity, hydraulic conductivity, and storativity values have not been obtained from the Olympic Well Field, nor are these data available in published literature. Groundwater modeling in the Charnock Subbasin by GeoTrans (2006) provides hydraulic conductivity minimum, maximum, and model-calibrated values of 10, 250, and 18.2 ft/day, respectively, for the corresponding stratigraphic unit ("Lower Silverado Aquifer bottom zone"). GeoTrans (2006) also provides minimum, maximum, and model-calibrated storativity values of $4x10^{-5}$, 0.05, and 1x10-4, respectively, for the corresponding stratigraphic unit. These storativity values indicate leaky confined to semi-confined conditions.

3.7 Groundwater Levels and Flow

Historic regional groundwater level data are sparse, and ambient (pre-pumping) water levels are unavailable (Poland et al. 1959). More recent regional characterization (Reichard et al. 2003) has lacked sufficient resolution in the area of interest to evaluate detailed groundwater flow patterns in the major aquifers of the Santa Monica Basin at the subbasin scale.

Groundwater flow in the vicinity of the Olympic Well Field is heavily influenced by pumping at production wells SM-3 and SM-4. Different aquifer zones exhibit different lateral groundwater flow regimes as well as differing groundwater elevations between the A-, B-, and C-Zone aquifers. Groundwater level data at the Olympic Well Field are not available to determine the flow regimes in the D-Zone aquifer and the underlying formations.

As discussed above, groundwater flow in the Olympic Well Field mainly occurs within coarser-grained stratigraphic units. Lenses of silt and clay impede vertical groundwater flow Within the coarser-grained units, resulting in preferential lateral flow within the aquifer zones. Likewise, within the finer-grained aquitard units, localized zones of sand and gravel occur that can act as conduits within these units. Direct vertical conduits through the aquitards have not been directly observed during drilling and soil boring programs conducted in the Olympic Well Field vicinity.

3.7.1 A-Zone Aquifer Groundwater Occurrence and Flow

The A-Zone aquifer is not the focus of this report and therefore will receive limited discussion. The A-Zone aquifer is unconfined in the Olympic Well Field and does not appear to be significantly affected, if at all, by pumping at nearby production wells. It is separated from strata in which the production wells are completed by the A/B aquitard. Groundwater elevations and flow direction in the A-Zone aquifer during July 2010 are documented by AMEC (2010) and multiple previous monitoring reports for the former Gillette facility. Groundwater level measurements indicate groundwater levels approximately 30 to 55 feet bgs, or approximately 105 to 125 feet above mean sea level (AMSL). Groundwater data in the A-Zone aquifer are limited to the vicinity of the former Gillette facility, bounded by Olympic Boulevard, 26th Street, Steward Street, and Pennsylvania Avenue. Water level surface elevation mapping indicates groundwater in the A-Zone aquifer flows in multiple directions, from south to northeast in the southern portion of the former Gillette facility, and from north to south in the northern portion of the former Gillette facility. Groundwater flow converges in the middle and appears to move to the west.

3.7.2 B-Zone Aquifer Groundwater Occurrence and Flow

The B-Zone aquifer underlies the A/B aquitard and dips northward, becoming generally flat-lying to the north of the Olympic Well Field (Figures 8 and 10). Groundwater in the B-Zone aquifer occurs under unconfined conditions in the southern portion of the aquifer. As the B-Zone aquifer dips to the north, confined conditions occur; the recent potentiometric surface ranges between approximately 101 and 120 feet bgs (ICF 2020).

Current groundwater level data in the B-Zone aquifer extends from Broadway Boulevard to the north and northwest, 26th Street to the west, Olympic Boulevard to the south, and Stanford Street to the east (Figure 3). Pumping at the Olympic Well Field significantly affects groundwater and flow in the B-Zone aquifer. Ambient (non-pumping) water level data sufficient to determine groundwater flow direction are unavailable, but the presumed ambient groundwater flow is interpreted to be west-northwest as indicated by the third quarter 2011 potentiometric surface when production wells SM-3 and SM-4 were off-line (Figure 15). During extended shutdown periods at production well SM-4, groundwater levels rose to approximately 75 feet AMSL as indicated by measurements during 2007 and 2008 (ICF, 2015b).

Since fall 2009, when generally continuous groundwater pumping resumed at production well SM-4, B-Zone aquifer groundwater flow directions have shifted from the northwest to a more nuanced flow configuration that varies somewhat across the site as observed in late 2019 due to the effects of ongoing pumping (Figure 16). The potentiometric surface contours indicate that the lateral hydraulic gradient is to the north-east with an approximate magnitude of 0.005 feet/foot (ft/ft) in the southwestern part of the site, and generally towards the City's production wells in the eastern part of the site. The interpreted flow direction in the northern part of the site is primarily towards the southwest with an approximated magnitude of 0.007 ft/ft. Convergent flow is noted in the west of the site which part of the extended cone of depression that extends in that direction from the well field pumping regime.

The long-terms effects of pumping in the Olympic Well Field are described in Section 5.

3.7.3 C-Zone Aquifer Groundwater Occurrence and Flow

The C-Zone aquifer underlies the B/C aquitard; this aquifer, like the B-Zone, also dips northward before it is presumed to become generally flat-lying to the north of the Olympic Well Field (Figures 8 and 12). Groundwater level data from the monitoring well network for the C-Zone are available in an area bounded by Cloverfield Boulevard, Broadway Street, Centinela Avenue, and Exposition Boulevard. from the area between Broadway Street and 24th Street to the northwest and as far northeast as the intersection of Franklin Street and Nebraska Avenue (Figure 3).

Groundwater in the C-Zone aquifer occurs under unconfined conditions in the southern portion of the Olympic Well Field. As the C-Zone aquifer dips to the north, confined conditions occur in the northern portion of the aquifer. Pre-pumping groundwater level data from the Olympic Well Field are insufficient to evaluate ambient C-Zone groundwater flow directions, but it is expected to be west-northwest similar to the B-Zone. During the fourth quarter 2019, the C-Zone aquifer potentiometric surface ranged between approximately 137 to 169 feet bgs, with the deepest groundwater levels observed in GW-30, which is located southwest of production well SM-4 (ICF 2020).

Groundwater flow in the C-Zone is less nuanced and more predictable than flow in the B-Zone. For comparison purposes C-Zone groundwater flow patterns for 2011 are illustrated on Figure 17. More recent groundwater flow patterns from late 2019 are shown on Figure 18. Between 2011 and late 2019 C-Zone groundwater flow has shifted markedly to the east and has established a predictable cone of depression created by the pumping of SM-4 and SM-3.

3.7.4 D-Zone Aquifer Groundwater Occurrence and Flow

Groundwater level data for the D-Zone aquifer are not available. Groundwater monitoring well OB-6D was initially thought to be screened in the D-Zone, but after several quarters of monitoring and analyses of water levels it was found to be screened in the lower portion of the C-Zone. Based on the numerical modeling conducted and described in later sections of this report, groundwater flow in the D-Zone is presumed to converge on pumping wells SM-3 and SM-4.

3.7.5 Sunnyside Aquifer Groundwater Occurrence and Flow

Discrete groundwater level data are not available for the Sunnyside aquifer. This upper portion of the Sunnyside aquifer is screened by production wells in the Olympic Well Field; groundwater flow is presumed to converge on pumping wells SM-3 and SM-4.

Section 4
Groundwater Well Pumping and Recharge

4.1 Groundwater Pumping

Groundwater pumping at Santa Monica production wells SM-3 and SM-4 plays a significant role with respect to groundwater flow in the Olympic Well Field. Production wells SM-3 and SM-4 were constructed in 1969 and 1981, respectively, and production data are available from early 1985. Other historic production wells in the Olympic Well Field include SM-2/2B and SM-7. Production well SM-2/2B was abandoned in the 1980s. SM-7 was never put into service due to production issues related to sanding and was destroyed in 2018. A replacement well for SM-7 (denoted SM-8) was completed in 2018; it will be brought into service once DDW permits are approved. A replacement well for SM-3 is currently in construction; its replacement SM-9 will be brought into service once DDW permits are approved.

Since coming online, production wells SM-3 and SM-4 have collectively produced 8.3 and 6.5 billion gallons of water, respectively, based on monthly totals for each well. Figure 19 illustrates annual pumping totals for the period from 1985 to 2019. As can be seen on Figure 19, the wells were pumped significantly in the first 2 years after coming online; however, between 1987 and 1993, they were not used for substantial production. Between 1993 and mid-2002, the Olympic Well Field wells each produced approximately 400 million gallons yearly before being shut down in 2002, when the aforementioned release of MTBE was discovered in the Charnock Well Field. Well SM-3 was returned to service in 2005, generally producing 400 million gallons per year through 2013, when this well was taken out of service for relining due to casing failure. Well SM-4 experienced limited use until returning to service in late 2009, when pumping resumed in full.

Pumping rates at production wells SM-3 and SM-4 initially exceeded 1,000 gallons per minute (gpm); however, since the 1990s the wells have generally produced 750 to 800 gpm (ICF 2015b). Since being relined and brought back into production in 2014, the pumping rate at well SM-3 has generally ranged from 500 gpm to 200 gpm due to a reduction in casing diameter (Figure 19). Initial flow testing conducted indicate that SM-3's replacement, SM-9, is capable of producing approximately 600 gpm, with a maximum potential flow rate of 800 gpm (RCS, 2020). Going forward, the anticipated total Olympic Well Field production will be approximately 2,000 gpm. This estimate is based on historic production rates from SM-4 and flow testing conducted at SM-8 and SM-3/9. Individual anticipated flow rates for SM-4, SM-8, and SM-3/9 are 700 gpm, 600 gpm, and 700 gpm, respectively.

The effects of groundwater pumping and contaminant plume capture are discussed in Section 5.

4.2 Aquifer Recharge

Aquifer recharge in the Santa Monica Basin occurs mainly along the base of the Santa Monica Mountains where streams from the mountains enter the alluvial plain, as areal recharge from precipitation and from lawn, park, and golf course irrigation percolation, and as underflow from adjacent groundwater basins (RCS 2013). Precipitation in the Santa Monica Basin can vary widely from year to year, resulting in inconsistent natural areal recharge. While precipitation in Santa Monica has averaged 11.1 inches per year since 1937, in recent years recorded annual rainfall totals have ranged from over 25 inches in 1998 to only 0.5 inch in 2006 (Figure 2). Since 2006, annual rainfall in Santa Monica has not exceeded 5.75 inches. Aquifer recharge data are not available; however, areal recharge data estimates are available from calibrated groundwater models in the Los Angeles Basin or the nearby Charnock Subbasin (Reichard et al. 2003; GeoTrans 2005). An areal recharge estimate of 1.5 inches per year was reported by Reichard et al. (2003) and values of 2 to 8 inches per year are reported by GeoTrans Inc., who reviewed hydrogeologic data and performed groundwater modeling in the Charnock Subbasin and stated that "no data conclusively define areal recharge for the basin" (GeoTrans 2005). Due to the proximity and similar hydrology of the Olympic Well Field to the Charnock Well Field, this statement is presumed to apply to the Olympic Well Field.

There are currently no known active injection wells or artificial recharge spreading basins in the Olympic Subbasin (RCS 2013). It should be noted, however, that the City is implementing a sustainable water infrastructure project (SWIP). This project, which currently is in the construction phase, will consist of the injection of advanced treated recycled water into the D-Zone and Sunnyside aquifer units in the western portion Olympic Well Field near the intersection of Olympic Boulevard and 26th Street. The source water to produce the advanced treated recycled water includes brackish/saline groundwater, wastewater, and stormwater.

Section 5
Groundwater Contaminant Sources, Distribution, and Trends

5.1 Groundwater Contaminants and Sources

The Olympic Well Field lies in an area of Santa Monica having a long history of manufacturing and light industrial operations. Releases from these industrial operations led to the presence of the principal contaminants detected in the productions wells, including PCE and TCE and other industrial contaminants such as 1,4-dioxane and 1,2,3-trichloropropane (TCP) in produced groundwater.

As a prelude to the detailed discussion of contaminant sources discussed below, it is notable and worth discussing that over the past three decades the City has incurred significant costs and conducted exhaustive research and effort to ensure that groundwater from the Olympic Well Field meets all requirements for distribution and public consumption. In the period between the late 1970s and early 2000s underground storage tanks (USTs) were permitted, inspected, and regulated by the City's Environmental Program Division (EPD) and later the City's Fire Division. Since, the City was the permitting and compliance agency they were acutely aware of non-compliance issues that could lead to the release of contaminants. Furthermore, since many of the regulated facilities were in an industrial area of Santa Monica that co-existed with the Olympic Well Field, the City proactively and consistently took actions to minimize the potential degradation of groundwater quality in the Olympic Well Field. The City engaged consultants and involved the City's Attorney Office, and its own EPD staff to identify and pursue legal actions against polluters in the Olympic Well Field. The cost of identifying polluters and the cost of restoring Olympic Well Field water quality was substantial.

To recover costs associated with the degradation of water quality in the Olympic Well Field, the City identified those entities thought to be the major contributors to groundwater contamination and subsequently negotiated settlement and release agreements (SRAs) with two entities: The Gillette Company (Gillette) and The Boeing Company (Boeing). Under conditions set forth in the SRAs and through individual Clean-up and Abatement Order (CAO) issued to Gillette and Boeing by the Los Angeles Regional Water Quality Control Board (LA-RWQCB), the City agreed to perform certain activities to demonstrate that dissolved-phase VOCs in the B- and C-water-bearing zones (B- and C-Zones) in the Olympic Well Field are captured by pumping at production wells SM-3 and SM-4 (LA-RWQCB 2010). It is notable that all the chemicals detected in the production wells requiring treatment due to their concentrations being in exceedance of MCLs or Notification Levels (PCE, TCE, 1,4-dioxane and 1,2,3-TCP) were listed as Chemicals of Concern in the Boeing CAO. Boeing neither admitted nor denied those chemicals directly or indirectly the underlying groundwater, but nonetheless compensated the City for damages.

Per the aforementioned CAOs, the City is responsible for the delineation of VOC contamination in the B-Zone aquifer, long-term groundwater monitoring, and demonstrating that the groundwater contaminant plume in the B-Zone is controlled by the pumping of City production wells SM-3 and SM-4 or their replacements. As a method of demonstrating plume control, the City is developed a numerical groundwater flow and solute transport model, a summary of which is provided later in this report. The groundwater model was based on the hydrogeologic framework detailed in Olympic Well Field Site Conceptual Model (SCM)(ICF 2015b).

As part of the SRA with Boeing and in accordance with Boeing's CAO, the City is responsible for monitoring groundwater conditions in the Olympic Well Field and demonstrate capture of VOC contamination in the B-Zone. The City has been conducting this work quarterly since the third quarter 2011 and thus has gained a thorough understanding of the occurrence and distribution of contamination within the well field.

The City has established an informal Olympic Basin Surveillance Program. Under this program, the City conducts an active surveillance program of all tank/release sites in the Olympic subbasin and works diligently with the LA RWQCB to ensure all potential releases to groundwater are remediated to the fullest extent to ensure that drinking water resources are not impacted. The City has the full assurance from the LA RWQCB that no contaminated property will be closed without the full review and approval of the City.

The principle Olympic Well Field contaminant sources are described below.

5.1.1 Former Gillette (Paper Mate) Facility

The former Gillette facility comprised four buildings denoted as Buildings 1, 2, 3, and 4. Buildings 1, 3, and 4 (from west to east) were located on the north side of Olympic Boulevard between 26th Street and Stewart Street (for regulatory purposes this is referred to as the "southern portion" of the former Gillette site). Building 2 was located north of Buildings 3 and 4 toward Pennsylvania Avenue on property on which Red Bull currently operates (for regulatory purposes this is referred to as the "northern portion" of the former Gillette site). Buildings 1, 3, and 4 still exist and the property on which the buildings are located was, until recently, owned by the Hines Company. The location of the former Gillette facility and current Red Bull facility are shown on Figure 3. Gillette manufactured ballpoint pens under the Paper Mate brand from 1957 until 2006, when operations ceased at this facility. Operations that used potentially hazardous materials, or generated materials designated as hazardous wastes, included degreasing, metal plating, molding, nickel plating, ink manufacturing, product assembly, and tooling and maintenance. Over the facility's history, virgin and spent solvents containing PCE and TCE and other wastes were stored in drums at various locations at the facility and later in up to 35 USTs and 45 ASTs. USTs and ASTs were generally located in two separate locations, along the northern property line and along the southern property line adjacent to Olympic Boulevard. During investigations and closure activities, leaking USTs and associated underground piping were discovered, as well as the presence of contaminated soils in multiple locations at the former facility (AMEC 2008). As of the late 2000s, all known USTs and ASTs had been removed and numerous investigations and extensive source area remediation had been performed.

Releases to the soil and groundwater from the Gillette site have been well characterized and those releases have affected the City's groundwater production wells (LA-RWQCB 2010). The hydrostratigraphy and groundwater movement beneath and in the vicinity of the Gillette site is well defined. Releases of VOCs in the A-, B-, and C-Zones beneath the former Gillette site are well documented. Dissolved contaminants in the B- and C-Zones beneath the Gillette site are contained within the pumping radius of influence of SM-3 and SM-4 when they are pumping at full capacity.

In October 2016 the southern portion of the former Gillette site received no further action status for soils only from LA-RWQCB. LA-RWQCB concluded that results from soil vapor, soil matrix, and shallow groundwater samples (A-Zone) had demonstrated that wastes originating from the southern portion of the site had been adequately assessed. It is estimated that approximately 2,100 lbs of VOCs were removed from the subsurface by soil vapor extraction (SVE) and in situ thermal treatment (ISTT). LA-RWQCB's closure letter for the southern portion of the site is provided in Appendix A.

In May 2019 the northern portion of the former Gillette site received no further action status for soils only from LA-RWQCB. From about 1983 to 2013 a number of source areas were remediated by SVE and excavation. Post-SVE confirmation sampling indicated that approximately 90% of VOCs in excess of residential soil and soil vapor screening levels had been removed by SVE and excavation. LA-RWQCB's closure letter for the southern portion of the site is provided in Appendix A.

5.1.2 Boeing Facility

Boeing is the successor to the Douglas Aircraft Company, which conducted aircraft parts assembly and manufacturing activities from 1942 to 1971 at the Boeing-Exposition site, which was located south of SM-4 on Exposition Boulevard at the location currently occupied by the MTA Maintenance Facility (Figure 3). VOCs have been detected in the soil, vapor, and groundwater beneath the Boeing-Exposition site. VOC releases to the A-Zone at the Boeing site have been characterized by over 150 soil borings and groundwater monitoring wells.

Deeper groundwater assessment work in the B- and C-Zone has not been conducted at the Boeing Exposition site; however, the distribution of VOCs in A-Zone monitoring wells, coupled with the knowledge of contaminant migration gained from the Gillette assessment and hydrogeologic studies, suggests that VOC releases from the Boeing site have likely affected, or have the potential to affect, the City's Olympic Well Field groundwater production wells. Any releases of VOCs from the A-Zone at the Boeing site will migrate to the B-Zone and be captured by the pumping of production wells SM-3 and SM-4 (Worley Parsons 2011).

In February 2020 LA-RWQCB provided comments on Boeing's Five-Year Groundwater Monitoring Report for the site. LA-RWQCB concluded that Boeing has not fully characterized the extent of shallow groundwater (A-Zone) contamination in the vicinity of Olympic Boulevard, west of SM-4. Boeing has been directed by LA-RWQCB to submit a workplan for this additional assessment work. Boeing has conducted monitored natural attenuation of the A-Zone VOC plume at the site since 2013.

5.1.3 City of Santa Monica Corporation Yard

The City Corporation Yard (CCY) is located at 2500 Michigan Avenue (Figure 3) and is an active vehicle fueling, maintenance, and storage facility for solid waste handling, street maintenance, and other public works operations. The CCY has been used by the City for public works operations since approximately the late-1940s. Multiple USTs ranging from 3,000 to 10,000 gallons have been present at the site since before the mid-1980s storing varying petroleum products including diesel, gasoline, and virgin and waste oil. Petroleum product releases have occurred at the site, including the fuel additive MTBE, a release of which was discovered in 2001. Remedial activities commenced in 2004 and included soil excavation, soil vapor extraction (SVE), and ozone sparging. SVE was performed for 20 months and removed an estimated 8,500 pounds of hydrocarbons from unsaturated soils at the site. From August 2009 until December 2012, ozone sparging was performed at 28 ozone sparge wells to mitigate fuels and MTBE in groundwater (ICF 2013c), which ultimately led to CCY site closure in May 2013 (LA-RWQCB 2013). Shortly after the MTBE release was observed, production wells SM-3 and SM-4 were proactively shut down and remained off-line through late 2004 when SM-3 returned to service. Production well SM-4, which is the closest of the two production wells to CCY, was not returned to full service until early 2008. Due to the pro-active remedial activities conducted at the CCY, coupled with the temporary cessation of groundwater pumping in the Olympic Well Field, MTBE was never detected in the groundwater extracted from SM-4 and SM-3. Notably VOCs were not released to the groundwater.

5.1.4 Bergamot Arts Center

The Bergamot site is currently occupied by commercial art galleries of the Bergamot Station Arts Center. Historically, the Bergamot site was generally defined as having a western portion and an eastern portion. Currently, Bergamot Station Arts occupies the western portion and Agensys occupies the former eastern portion (prior to Agensys, 20th Century Fox occupied the eastern portion). These two areas are identified as “Bergamot” and “Agensys” on Figure 3. The Bergamot site was previously used primarily for light to heavy industrial activities since being purchased from the Southern Pacific Railroad in 1894. Industrial occupants of the Bergamot site have reportedly included: Douglas Aircraft and an unidentified roofing materials manufacturer (eastern portion); and Mor-Flo Industries and American Appliance Manufacturing Corporation, a subsidiary of Mor-Flo Industries (western portion). Materials and processes used at the site between World War II and 1970 are not well documented; however, storage drums with unknown contents were observed in a 1948 aerial photograph. Mor-Flo Industries used the facility to insulate hot water heaters with an isocyanate resin material using components piped from two 33,000-gallon ASTs. Fuel storage USTs were also reportedly present at the site from at least 1985 until the late 1990s and are known to have leaked. Petroleum fuel compounds and chlorinated solvents including TCE and breakdown products have been observed in soil and groundwater samples collected from multiple locations at the site (Arthur D. Little, Inc. 2000). After substantial study, testing, and analysis, no direct or significant link of releases from the Bergamot site to Olympic Well Field groundwater contamination was established.

5.2 Groundwater Contaminant Distribution

Dissolved-phase groundwater contaminants are present in the A-, B-, and C-Zone aquifers in the Olympic Well Field vicinity, primarily beneath the historic source areas described above. PCE and TCE in A-Zone groundwater has been observed at concentrations over 21,000 micrograms per liter (μg/L) and 1,400 μg/L, respectively. Gillette has made significant progress addressing vadose zone and A-Zone aquifer soil and groundwater contamination, respectively, and has submitted a closure request to LA-RWQCB. The contaminant distribution in the A-Zone aquifer will not be discussed in greater detail here.

Groundwater VOC contamination in the deeper aquifers in the Olympic Well Field vicinity has been documented since approximately 1980, although details from early detections are limited (RCS 2013). In 1982, TCE concentrations of 146 μg/L were observed in a sample taken from the discharge line during test pumping at production well SM-7. Subsequent depth discrete sampling performed in 1985 at production well SM-7 indicated TCE concentrations between 150 and 278 μg/L in the screened interval between 215 and 391 feet bgs (RCS 1985); these depths correlate to intervals in hydraulic communication with the B-, C-, and D-Zone aquifers. Since the late 1980s, multiple investigations throughout the Olympic Well Field vicinity have determined the magnitude and extent of PCE, TCE, and other VOCs.

North of Olympic Boulevard, PCE concentrations in the B-Zone aquifer tend to be significantly higher than TCE concentrations. In the C-Zone aquifer an inverse relationship is generally observed, i.e., PCE concentrations tend to be significantly lower than TCE concentrations.

The sections below provide a discussion of PCE and TCE concentrations at wells that are currently monitored. For the B- and C-Zone aquifers, the wells at which the highest PCE and TCE concentrations have been observed will be discussed, along with corresponding trends.

5.2.1 B-Zone Aquifer Groundwater Contaminant Distribution and Trends

Recent Contaminant Distribution

The distribution of PCE, TCE, 1,4-dioxane, and 1,2,3-TCP in the B-Zone aquifer during the fourth quarter of 2019 are presented on Figures 20, 21, 22, and 23, respectively. PCE and TCE concentration data from B-Zone monitoring wells indicate the presence of a PCE and TCE plume moving to the west-northwest, with the highest concentrations of 240 and 190 μg/L, respectively, at monitoring well MW-11, which is in the median of Olympic Boulevard east of 26th Street, and close to source of these compounds. Analytical data from the farthest downgradient monitoring wells indicate PCE and TCE concentrations of 1.6 and 15 μg/L in OB-5 and OB-10Bm respectively, which are located on Broadway. The general plume geometry and concentration trends of PCE and TCE between 2014 and 2019 are similar, the primary differences being due to the presence on additional data points in 2019.

Figures 22 and 23 illustrate the distribution of 1,4-dioxane and 1,2,3-TCP, respectively in the B-Zone. The data set is not as complete for these compounds as it is for PCE and TCE, but the general distribution of 1,4-dioxane is widespread in the area monitored and seems to generally mimic the distribution of PCE and TCE. It is notable that 1,4-dioxane was used historically in the formulation of inks and as stabilizer for chlorinates solvents. Monitoring for 1,2, 3-TCP began in the Olympic Well Field during the second quarter 2019 Olympic Well Field sampling event. Figure 23 demonstrates that 1,2,3-TCP was not detected in groundwater monitoring wells above the method detection limit of 0.005 ug/L. However, 1,2,3-TCP was detected in production well SM-4 in June 2019 slightly above the method detection limit at a concentration of 0.0051 ug/L. It should be noted that SM-4 is screened in both the B- and C-Zones.

Groundwater Contaminant Trends

Due to various legal provisions and with the approval of LA-RWQCB, many monitoring wells “older” monitoring wells have been destroyed. New monitoring wells were installed for the purpose of plume delineation. Data from some of the older wells are useful for observing “historical” contaminant trends, while representative data from “newer” wells are useful for observing more recent trends.

Groundwater VOC concentrations for “historic” wells in the B-Zone aquifer over time are shown graphically on Figures 24/1 and 24/2. Historic groundwater concentration data indicate that the highest B-Zone aquifer PCE and TCE concentrations, 11,500 and 2,220 μg/L, respectively, were observed during October 2008 at monitoring well GW-19-2 (Figure 24/1), which was located approximately 200 feet north of the intersection of Olympic Boulevard and 26th Street. PCE and TCE concentrations at monitoring well GW-19-2 followed a generally declining trend, with concentrations in September 2014 being 620 and 130 μg/L, respectively, after which the well was abandoned.

Well GW-106, which was located approximately 600 feet east-northeast of monitoring well GW-19, was monitored beginning in 2006. Groundwater PCE and TCE concentrations at this location followed a generally declining trend, ranging from 30 and 52 μg/L, respectively, in spring 2006 to <1 and 1.5 μg/L, respectively, in September 2014 (Figure 24/1). PCE and TCE concentrations at this well include several sampling events with results near or below laboratory detection limits. This well was abandoned in late 2014.

Well GW-20-1, which is near the intersection of Nebraska Avenue and Stewart Street, was monitored beginning in 2008. Groundwater VOC data at this location indicate significantly varying concentrations of PCE, ranging from 1.9 to 51 μg/L, with generally stable TCE concentrations ranging from <1 to 2.6 μg/L. PCE concentrations at monitoring well GW-20-1 have followed a somewhat erratic trend, generally increasing from 12 μg/L when first sampled in June 2008 to 51 μg/L in July 2013, and declining to 11 μg/L in September 2013 (Figure 24/2). This well was abandoned in 2014.

More recent B-Zone VOC data trends are presented for monitoring wells MW-11 and OB-5 in Figure 25. MW-11 is located closer to the source of VOCs near the former Gillette site. The maximum PCE concentration of 470 μg/L was detected in MW-11 in May 2017. Since then PCE concentrations have steadily fallen and were reported at a concentration of 240 μg/L in late 2019. TCE concentrations in MW-11 peaked at a concentration of 270 μg/L in August 2018 and have ranged between 150 and 200 μg/L through 2019.

OB-5 is located downgradient from the Gillette source and reported a maximum PCE concentration of 40 μg/L in January 2014. Since then the concentrations have steadily fallen and were reported at a concentration of 1.6 μg/L in late 2019. TCE concentrations in OB-5 peaked at 24 μg/L in January 2014 and have steadily fallen to single digit concentrations, with the most recent concentration reported at 4.9 μg/L in late 2019.

1.4-dioxane trends are illustrated for selected B-Zone wells in Figure 26. The data set is relatively limited, but it appears that concentrations are stable or slightly decreasing. The highest 1,4-dioxane concentrations are in OB-5 and OB-14. The distribution of 1,2,3-TCP was discussed above; no inferences on trends can be made at this time due to the limited data set.

5.2.2 C-Zone Aquifer Groundwater Contaminant Distribution and Trends

Recent Contaminant Distribution

The C-Zone aquifer groundwater PCE, TCE, 1,4-dioxane, and 1,2,3-TCP distribution during the fourth quarter of 2019 are presented on Figures 27, 28, 29, and 30, respectively. Recent groundwater PCE and TCE concentration data from wells monitoring the C-Zone aquifer indicate the presence of a somewhat localized VOC plume, with the highest PCE and TCE concentrations in the vicinity north of the former Boeing facility (now the MTA Maintenance facility). OB-11C reported the maximum PCE and TCE concentrations of 240 μg/L and 190 μg/L, respectively. The C-Zone distribution of 1,4-dioxane has a markedly different signature than PCE and TCE. The distribution of 1,4-dioxane is ubiquitous throughout the well field, although the maximum concentration of 74 μg/L was detected in OB-11C. The distribution of 1,2,3-TCP is more isolated; only three wells, OB-2, OB-15C, and OB-12C, reported concentrations above the MDL of 0.005 μg/L.

Groundwater Contaminant Trends

Groundwater VOC concentrations in the C-Zone aquifer over time are shown graphically for selected wells on Figure 31. Some of these wells are "historical" that provide a decade worth of analytical data and some of these wells are "newer" and thus provide a snapshot of more recent trends. Groundwater concentration data indicate that the highest C-Zone aquifer PCE and TCE concentrations occur at two different wells, KMW-12 and GW-18-2, respectively.

Well KMW-12, located south of Olympic Boulevard about 550 feet east of 26th Street, has been monitored since January 2003, but has become dewatered recently due to on-going pumping in production wells. PCE concentrations at KMW-12 have historically been as high as 440 μg/L (observed in February 2009); however, PCE concentrations in KMW-12 have fluctuated erratically, ranging from 1 to 2 μg/L when the first groundwater samples were collected in 2003, then periodically increased to concentrations of 200 to 400 μg/L, separated by intervals of significantly lower concentrations. Following the peak PCE detection of 440 μg/L in 2009, the concentration spikes have decreased and become less frequent. The most recent sampling in January 2017 (prior to the well going dry) indicates PCE concentrations of less than 1.0 μg/L. Groundwater TCE concentrations at monitoring well KMW-12 were generally below 30 μg/L until late 2008, when concentrations generally increased to between 50 and 100 μg/L. In January 2017, the TCE concentration at KMW-12 was 18 μg/L.

Of the C-Zone wells ever monitored, TCE concentrations were the highest at monitoring well GW-18-2, reaching a maximum concentration of 522 μg/L in July 2007. TCE concentrations at this well demonstrated a generally declining trend since mid-2007 and maintained approximately 200 μg/L or lower since between mid-2007 and 2012. Groundwater PCE concentrations at GW-18-2 were less than 5 μg/L from May 2008 until July 2012, and generally ranged from 10 and 17 μg/L between October 2012 and September 2014 prior to the well being abandoned.

1.4-dioxane trends are illustrated for selected number of C-Zone wells in Figure 32. Although the data set is relatively limited, it appears that concentrations are generally stable for some wells and somewhat erratic for other wells. The highest 1,4-dioxane concentration has been reported in OB-11C, whereas OB-15C has the highest average concentrations. The distribution of 1,2,3-TCP was discussed above; no inferences on trends can be made at this time due to the limited data set.

Section 6
Numerical Modeling

A numerical groundwater flow and solute transport model was developed for the Olympic Well Field the City's Water Resources Division to support implementation of the Olympic Well Field Management Plan (ICF, 2017). The primary purpose of the model was to assess and confirm capture of VOCs present in groundwater in the vicinity of the Olympic Well Field, evaluate the threats posed by other hazardous waste releases near the City's wells, help guide the siting of future monitoring and production wells, for adaptive management of existing wells, and as a tool for estimating the sustainable yield of the groundwater subbasin. In the context of this DWSA report, the numerical flow and solute transport is useful for demonstrating that groundwater flow characteristics and contaminant movement in the Olympic Well Field are understood, well-established, and predictable.

A summary of the model is described below; details can found be found in the model report (ICF, 2017).

6.1 Model Code

The USGS MODFLOW code, a modular, finite-difference computer code developed to simulate three-dimensional groundwater flow was used to develop the groundwater flow and solute transport model for the Olympic Well Field. Several different versions of the MODFLOW code were used during model development and calibration to address issues that arose with respect to re-wetting of cells, large head differences across faults and groundwater extraction from the various aquifer units. These versions included MODFLOW-2005, and MODFLOW-NWT. Ultimately the MODFLOW-SUFACT™ code was selected for flow and transport modeling. Built around the MODFLOW code, MODFLOW-SURFACT™ is a proprietary flow and solute transport code that includes advanced computational modules based on robust, efficient, mass-conserving algorithms. To assess groundwater capture, the USGS MODPATH code was utilized. MODPATH is a particle-tracking post-processing program designed to work with MODFLOW. To facilitate the preparation and evaluation of model input and output, the graphics pre-/post-processor Groundwater Vistas™ (GV)was utilized. GV is a Windows® program that utilizes a graphic user interface (GUI) to build and modify a database of model parameters.

6.2 Groundwater Flow: Boundaries, Faults, and Calibration

The model report (ICF, 2017) is well-documented a provides abundant detail on the technical aspects of the set-up and work elements conducted to ensure the model reasonably replicates actual conditions.

The model boundaries are shown on Figure 33. All or portions of three of the Santa Monica Basin subbasins are included within the model boundaries: Olympic, Arcadia, and Coastal. Boundary conditions are discussed in the model report. A representative cross-section through the model domain is shown on Figure 34. Within the model domain the only fault that has off-set model hydrogeologic layers is the widely studied Brentwood Fault, which more or less defines the boundary between the Olympic and Arcadia subbasins. No faults are expressed in the Olympic subbasins, although some folding has occurred in upper geologic units, which has affected groundwater flow.

Calibration is the process of refining the numerical model representation of the conceptual hydrogeologic model framework, hydraulic properties, and boundary conditions to achieve a pre-determined degree of correspondence between the model simulation and observations of groundwater flow. A numerical model is considered calibrated when the model can, with reasonable accuracy, reproduce the real-world observations the model was designed to simulate. A scattergram of simulated vs. observed heads in the calibrated model is presented on Figure 35. This figure demonstrates that most of the targets fall along and are equally spaced about a 45-degree linear trend line that represents a perfect fit between the two sets of data. The closer the data points are to the line, the better the calibration. In this case, the results exceeded (where better than) the pre-established calibration criteria.

Hydrographs for measured and model-predicted water levels were also compared as part of a qualitative calibration process (i.e., history matching). Figures 36 and 37 present a series of hydrographs comparing observed and simulated water levels in select observation wells in the B and C zones. As illustrated, the simulated water levels (red lines) are generally very similar to the measured water levels (blue lines).

6.3 Contaminant Transport

Following completion of the groundwater flow model, transport models were developed and calibrated for TCE and PCE in the Olympic Well Field area. To develop each transport model, the distribution and concentration of TCE and PCE spatially and in individual monitoring wells were evaluated over the transient calibration period (2008 – 2015). For each compound, a “composite” plume was established for the B- and C-Zones for the 2008 timeframe (the starting point for the transient time period). The composite TCE and PCE plumes represent roughly average concentrations for the start of the transport simulations. These plumes were then digitized onto the transient groundwater flow model (as initial concentrations).

After the TCE and PCE data were input, the model was run forward through the end of the transient flow period (December 2015). The simulated TCE and PCE concentrations in B-Zone and C-Zone monitoring wells were then compared to measured concentrations in each well, and initial concentrations were adjusted as necessary to obtain a reasonable match. Chemical hydrographs for TCE and PCE in select B- and C-Zone monitoring wells are shown on Figure 38. A good overall match to TCE and PCE trends over time is observed in most wells, although the individual TCE and PCE peaks and valleys measured in each well are not matched. This variance is expected due to the variations in field sampling techniques over time, laboratory analytical methods and natural variability, e.g., fluctuating water levels, encountered when water quality samples are obtained

In addition to matching the concentrations in individual wells, the simulated spatial extent of the TCE and PCE plumes at the end of the transient flow period was compared to the observed plume extent. The simulated TCE and PCE plumes at the end of the transient period in the B-Zone are shown on Figures 39 and 40. As with the chemical hydrographs, a reasonable match was obtained to the overall spatial distribution of TCE and PCE in each zone.

6.4 Model Results

After the calibration process described above, the groundwater flow model was used to evaluate capture of dissolved-phase VOCs in the B-Zone and C-Zone in the Olympic Well Field area. Prior to the development of the numerical flow model pumping from City wells SM-3 and SM-4 was anticipated to provide capture based on measured water level data and previously conducted analytical modeling (ICF, 2010). To assess VOC capture from SM-3 and SM-4 in the model, reverse particle tracking was employed. A circle of particles (generally ranging from 6 to 12) was placed around wells SM-3 and SM-4 in the B- and C-Zones in the calibrated flow model. The particle tracks were run in reverse (backward tracking) to determine the zone of capture from each well over the transient calibration period.

As illustrated on Figures 41 and 42, capture, as depicted through 2015, extended west of the Santa Monica Water Garden and beyond well OB-10B, the western-most groundwater monitoring well in the Olympic Well Field. A capture zone analysis was recently conducted on the revised transient model, which was run over a 11-year period terminating in December 2018. The results are shown on Figures 43 and 44. A comparison of the B-Zone and C-Zone 2015 and 2018 capture zones indicate very stable conditions under actual monthly well production volumes.

Section 7
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Tables

Table 1
Hydraulic Conductivity and Transmissivity Data Summary
Olympic Well Field
Site Conceptual Model

Well ID	Aquifer Zone	Transmissivity Estimate (feet^2/day)	Hydraulic Conductivity Estimate (feet/day)	Test Type	Data Source
B-Zone Aquifer					
GW-14	B	90	3.1	Constant-rate aquifer pumping test	AMEC, 2009
GW-106	B	2660	55	Constant-rate aquifer pumping test	AMEC, 2009
GW-106	B	2580	54	Constant-rate aquifer pumping test	AMEC, 2009
GW-112	B	160	8	Constant-rate aquifer pumping test	AMEC, 2009
GW-107	B	6100	120	Constant-rate aquifer pumping test	AMEC, 2007
GW-108	B	230	7.7	Constant-rate aquifer pumping test	AMEC, 2007
GW-109	B	1000	25	Constant-rate aquifer pumping test	AMEC, 2007
B Zone Average		1,831.4	39.0		
B Zone Geometric Mean		754.1	20.8		
B Zone Maximum		6100	120		
B Zone Minimum		90	3.1		
C-Zone Aquifer					
MW-10	C	N/A	0.11	Falling head slug test	Arthur D. Little, 2000
MW-12	C	N/A	0.29	Falling head slug test	Arthur D. Little, 2000
MW-12	C	N/A	0.58	Rising head slug test	Arthur D. Little, 2000
MW-13	C	N/A	0.14	Falling head slug test	Arthur D. Little, 2000
MW-13	C	N/A	0.19	Rising head slug test	Arthur D. Little, 2000
MW-14	C	N/A	0.15	Falling head slug test	Arthur D. Little, 2000
MW-14	C	N/A	0.001	Rising head slug test	Arthur D. Little, 2000
MW-15	C	N/A	6.29	Falling head slug test	Arthur D. Little, 2000
MW-15	C	N/A	8.70	Rising head slug test	ADL 19##? App H.
C Zone Average			1.83		
C Zone Geometric Mean			0.26		
C Zone Maximum			8.70		
C Zone Minimum			0.001		
Silverado Aquifer Undifferentiated					
N/A	N/A	1,845	18.5	Specific capacity estimates from pumping*	Richard C. Slade & Associates, 2013
N/A	N/A	12,139	121.4	Specific capacity estimates from pumping*	Richard C. Slade & Associates, 2013

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Table 2
Aquifer Core Sample Hydraulic Conductivity Summary
Olympic Well Field
Santa Monica, California

Sample I.D.	Sample Depth (feet)	Hydraulic Conductivity[8] cm/s[9]	Hydraulic Conductivity[8] ft/d
A-Zone Aquifer			
EB18-5	71.5 - 72.5	5.49E-07	0.002
EB23-1	50.5 - 51.5	1.86E-06	0.005
		Minimum	**0.002**
		Maximum	**0.005**
		Average	**0.003**
		Geometric Mean	**0.003**
A/B Aquitard			
EB18-10	122 - 122.5	8.56E-07	0.002
EB18-13	152.5 - 153.5	4.17E-07	0.001
EB19-9	122.5 - 123.5	4.17E-07	0.001
EB19-13	140.5 - 141.5	1.13E-07	0.000
EB19-15	171.5 - 172.5	5.72E-08	0.000
EB22-1	62.5 - 63.5	1.85E-06	0.005
EB22-2	72.5 - 73.5	8.23E-07	0.002
EB22-3	87.5 - 88.5	1.70E-06	0.005
EB22-4	102.5 - 103.5	9.64E-07	0.003
EB23-2	62.5 - 63.5	7.44E-08	0.000
EB23-3	72.5 - 73.5	1.27E-07	0.000
EB23-4	82.5 - 83.5	1.34E-06	0.004
EB24-1	52.5 - 53.5	2.96E-05	0.084
EB24-2	62.5 - 63.5	8.62E-07	0.002
EB24-3	77.5 - 78.5	2.21E-07	0.001
EB26-1	62.5 - 63.5	3.54E-07	0.001
EB27-1	50.5 - 51.5	1.36E-06	0.004
EB27-2	67.5 - 68.5	7.05E-07	0.002
OB-2-125-125.5-AB	125-125.5	6.51E-07	0.002
OB-4-149-149.5-AB	149-149.5	1.85E-06	0.005
		Minimum	**0.0002**
		Maximum	**0.084**
		Average	**0.006**
		Geometric Mean	**0.002**
B-Zone Aquifer			
EB17-8	120.5 - 121.5	1.45E-06	0.004
EB22-5	109.5 - 110.5	7.09E-06	0.020
EB22-12	137.5 - 138.5	4.18E-04	1.185
EB23-6	97.5 - 98.5	5.06E-04	1.434
EB24-4	97.5 - 98.5	1.76E-06	0.005
EB24-6	102.5 - 103.5	3.51E-03	9.950
EB24-12	129 - 129.5	1.44E-03	4.082
EB27-3	87.5 - 88.5	1.07E-06	0.003
EB27-8	112.5 - 113.5	8.60E-04	2.438

Sample I.D.	Sample Depth (feet)	Hydraulic Conductivity[8] cm/s[9]	Hydraulic Conductivity[8] ft/d
EB28-4	150 - 151	5.54E-04	1.570
EB30-4	212.5 - 213.5	1.67E-03	4.734
EB30-7	232.5 - 233.5	2.83E-04	0.802
OB-2-176-176.5-AB	176-176.5	6.83E-07	0.002
		Minimum	**0.002**
		Maximum	**9.950**
		Average	**2.018**
		Geometric Mean	**0.217**
B/C Aquitard			
EB15-2	90.5 - 91.5	3.34E-07	0.001
EB16-5	104 - 105	2.39E-06	0.007
EB17-10	142.5 - 143.5	2.20E-06	0.006
EB20-10	142.5 - 143.5	4.18E-07	0.001
EB20-12	157.5 - 158.5	6.81E-07	0.002
EB22-14	151.5 - 152.5	3.18E-06	0.009
EB22-16	162.5 - 163.5	1.72E-06	0.005
EB23-11	122.5 - 123.5	3.39E-04	0.961
EB23-13	139.5 - 140.5	3.97E-07	0.001
EB24-14	149.5 - 150.5	1.11E-06	0.003
EB26-8	122.5 - 123.5	1.46E-06	0.004
EB27-12	137 - 138	7.53E-07	0.002
EB28-6	156.5 - 157.5	1.69E-06	0.005
EB28-7	175 - 176	2.46E-06	0.007
EB30-9	250.5 - 251.5	4.53E-07	0.001
EB30-10	268.5 - 269.5	4.27E-07	0.001
EB30-11	290.5 - 291.5	8.15E-08	0.0002
OB-2-194-194.5-BC	194-194.5	1.63E-06	0.005
OB-3-293.5-294-BC	293.5-294	1.43E-06	0.004
OB-3-316-316.5-BC	316-316.5	4.84E-07	0.001
		Minimum	**0.0002**
		Maximum	**0.961**
		Average	**0.051**
		Geometric Mean	**0.003**
C-Zone Aquifer			
EB16-8	127 - 128	6.29E-07	0.002
EB22-18	187.5 - 188.5	1.70E-05	0.048
EB22-21	197.5 - 198.5	2.66E-06	0.008
EB24-16	172.5 - 173.5	2.91E-06	0.008
EB27-14	157.5 - 158.5	4.35E-06	0.012
EB28-8	198 - 199	8.02E-07	0.002
EB28-13	235 - 235.5	1.08E-03	3.061
EB30-15	360.5 - 361	3.53E-07	0.001
		Minimum	**0.001**
		Maximum	**3.061**
		Average	**0.393**
		Geometric Mean	**0.012**

Sample I.D.	Sample Depth (feet)	Hydraulic Conductivity[8] cm/s[9]	Hydraulic Conductivity[8] ft/d
C/D Aquitard			
EB14-8	162.5 - 163.5	6.50E-07	0.002
EB15-13	181.5 - 182	4.67E-07	0.001
EB16-17	210 - 210.5	1.65E-06	0.005
EB21-8	158.5 - 159.5	1.45E-06	0.004
		Minimum	**0.0013**
		Maximum	**0.005**
		Average	**0.003**
		Geometric Mean	**0.003**
D-Zone Aquifer			
EB22-31	282.5 - 283.5	1.58E-06	0.004
EB24-27	262.5 - 263.5	8.64E-07	0.002
EB26-20	222.5 - 223.5	2.30E-06	0.007
EB27-23	240.5 - 241.5	1.12E-06	0.003
EB28-18	284.5 - 285.5	2.29E-07	0.001
EB28-19	295.5 - 296	2.02E-06	0.006
EB28-21	297 - 298	1.44E-06	0.004
EB28-22	316.5 - 317.5	6.18E-06	0.018
		Minimum	**0.0006**
		Maximum	**0.018**
		Average	**0.006**
		Geometric Mean	**0.004**

Notes:

Analysis performed using American Petroleum Institute (API) Method RP40 and/or ASTM D2216 Method.

cm/s = centimeters per second.

ft/d = feet per day

"EB" Sample data from AMEC Geomatrix 2008, 2009b

"OB" Sample data obtained during 2012 well installation program, not previously reported.

Table 3
Aquifer Material Retardation Factor Summary
Olympic Well Field
Santa Monica, California

Sample I.D.	Boring I.D.	Sample Depth (feet)	PCE Retardation Factor	TCE Retardation Factor
A-Zone Aquifer				
EB1-12.0	EB1	12.0	7.4	3.2
EB1-27.0	EB1	27.0	19.5	7.4
EB1-55.5	EB1	55.5	3.1	1.7
EB1-60.0	EB1	60.0	7.8	3.4
EB2-27.0	EB2	27.0	5.0	2.4
EB3-14.0	EB3	14.0	1.5	1.2
EB3-29.0	EB3	29.0	4.3	2.2
EB3-39.5	EB3	39.5	1.3	1.1
EB4-16.0	EB4	16.0	1.5	1.2
EB4-26.0	EB4	26.0	8.8	3.7
EB4-38.0	EB4	38.0	2.9	1.7
EB5-14.0	EB5	14.0	4.4	2.2
EB5-24.0	EB5	24.0	10.7	4.4
EB5-39.0	EB5	39.0	7.0	3.1
EB5-51.0	EB5	51.0	4.3	2.1
EB6-14.0	EB6	14.0	6.9	3.0
EB6-32.0	EB6	32.0	4.6	2.2
EB6-49.0	EB6	49.0	3.8	2.0
EB6-61.0	EB6	61.0	6.1	2.8
EB7-15.0	EB7	15.0	8.9	3.7
EB7-18.0	EB7	18.0	4.6	2.2
EB7-35.0	EB7	35.0	12.3	4.9
EB7-55.5	EB7	55.5	4.3	2.1
EB8-13.0	EB8	13.0	11.5	4.6
EB8-25.0	EB8	25.0	4.7	2.3
EB8-37.0	EB8	37.0	11.2	4.5
EB18-4	EB18	72.5	5.1	2.4
EB18-7	EB18	94	7.9	3.4
EB18-5	EB18	71.5 - 72.5	5.8	2.7
EB23-1	EB23	50.5 - 51.5	7.3	3.2
IRM-HP-19-49 -53	IRM-HP-19	49.2	7.1	3.1
IRM-HP-20-49 -53	IRM-HP-20	49-53	4.7	2.3
		Minimum	**1.3**	**1.1**
		Maximum	**19.5**	**7.4**
		Average	**6.4**	**2.9**
		Geometric Mean	**5.5**	**2.6**
A/B Aquitard				
EB1-99.0	EB1	99.0	4.7	2.3
EB1-100.0	EB1	100.0	2.8	1.6
EB2-47.5	EB2	47.5	1.8	1.3
EB2-55.0	EB2	55.0	5.0	2.4
EB2-74.0	EB2	74.0	2.5	1.5
EB3-50.0	EB3	50.0	2.2	1.4
EB3-58.0	EB3	58.0	3.2	1.8
EB3-72.5	EB3	72.5	5.3	2.5

Sample I.D.	Boring I.D.	Sample Depth (feet)	PCE Retardation Factor	TCE Retardation Factor
EB3-96.0	EB3	96.0	5.2	2.5
EB4-75.0	EB4	75.0	3.2	1.8
EB4-77.5	EB4	77.5	6.9	3.0
EB4-85.0	EB4	85.0	3.4	1.8
EB5-68.5	EB5	68.5	7.5	3.2
EB5-84.5	EB5	84.5	5.2	2.5
EB6-66.5	EB6	66.5	3.7	1.9
EB6-77.5	EB6	77.5	4.2	2.1
EB7-78.0	EB7	78.0	11.0	4.5
EB7-85.5	EB7	85.5	4.8	2.3
EB8-52.0	EB8	52.0	5.0	2.4
EB8-59.5	EB8	59.5	4.0	2.0
EB8-68.5	EB8	68.5	2.4	1.5
EB8-80.5	EB8	80.5	16.0	6.2
EB8-86.0	EB8	86.0	5.9	2.7
EB8-103.5	EB8	103.5	3.9	2.0
EB18-9	EB18	114	3.6	1.9
EB18-11	EB18	132	22.1	8.3
EB18-12	EB18	152.5	10.3	4.2
EB18-14	EB18	172	11.6	4.7
EB18-10	EB18	122 - 122.5	14.0	5.5
EB18-13	EB18	152.5 - 153.5	12.5	5.0
EB19-8	EB19	120	6.9	3.0
EB19-9	EB19	123.5	1.4	1.1
EB19-12	EB19	140.5	12.9	5.1
EB19-14	EB19	160	8.2	3.5
EB19-16	EB19	180	9.8	4.1
EB19-13	EB19	140.5 - 141.5	8.0	3.4
EB19-15	EB19	171.5 - 172.5	2.8	1.6
EB22-4	EB22	102.5-103.5	12.8	5.1
EB22-1	EB22	62.5-63.5	10.2	4.2
EB22-2	EB22	72.5-73.5	27.5	10.2
EB22-3	EB22	87.5-88.5	16.3	6.3
EB23-2	EB23	62.5 - 63.5	7.5	3.2
EB23-3	EB23	72.5 - 73.5	4.1	2.1
EB23-4	EB23	82.5 - 83.5	4.7	2.3
IRM-HP-21-49 -53	IRM-HP-21	49.2	3.5	1.9
IRM-HP-23-45 -49	IRM-HP-23	47	6.3	2.8
OB-4-149-149.5-AB	OB-4	149-149.5	3.8	2.0
		Minimum	**1.4**	**1.1**
		Maximum	**27.5**	**10.2**
		Average	**7.2**	**3.2**
		Geometric Mean	**5.8**	**2.8**
B-Zone Aquifer				
EB1-104.0	EB1	104.0	3.1	1.7
EB1-109.0	EB1	109.0	2.3	1.5
EB1-129.0	EB1	129.0	3.1	1.7
EB2-85.0	EB2	85.0	1.5	1.2
EB2-95.0	EB2	95.0	1.4	1.2
EB2-108.0	EB2	108.0	2.2	1.4

Sample I.D.	Boring I.D.	Sample Depth (feet)	PCE Retardation Factor	TCE Retardation Factor
EB3-113.0	EB3	113.0	2.2	1.4
EB3-125.0	EB3	125.0	1.2	1.1
EB30-4	EB30	212.5 - 213.5	1.4	1.1
EB30-7	EB30	232.5 - 233.5	6.8	3.0
EB4-95.0	EB4	95.0	1.3	1.1
EB4-115.0	EB4	115.0	1.5	1.2
EB5-107.0	EB5	107.0	2.3	1.4
EB6-90.5	EB6	90.5	3.7	1.9
EB6-102.0	EB6	102.0	2.1	1.4
EB7-105.0	EB7	105.0	30.8	11.3
EB7-115.0	EB7	115.0	10.6	4.3
EB7-125.0	EB7	125.0	2.7	1.6
EB8-124.0	EB8	124.0	3.5	1.9
EB17-5	EB17	115	1.9	1.3
EB17-6	EB17	120	8.5	3.6
EB18-15	EB18	192	1.6	1.2
EB18-18	EB18	212	1.4	1.1
EB20-4	EB20	100	1.6	1.2
EB20-5	EB20	104.5	1.2	1.1
EB20-8	EB20	125	1.4	1.1
EB22-5	EB22	109.5-110.5	3.7	1.9
EB22-12	EB22	137.5-138.5	5.8	2.7
EB23-6	EB23	97.5 - 98.5	8.0	3.4
EB28-4	EB28	150 - 151	4.9	2.4
OB-3-230-231-BZ	OB-3	230-231	1.3	1.1
OB-3-247-248-BZ	OB-3	247-248	1.6	1.2
OB-4-185-185.5-BZ	OB-4	185-185.5	1.9	1.3
		Minimum	**1.2**	**1.1**
		Maximum	**30.8**	**11.3**
		Average	**3.9**	**2.0**
		Geometric Mean	**2.6**	**1.7**
B/C Aquitard				
EB2-117.0	EB2	117.0	4.9	2.4
EB2-127.0	EB2	127.0	7.5	3.3
EB5-127.5	EB5	127.5	7.4	3.2
EB5-128.0	EB5	128.0	4.5	2.2
EB6-120.0	EB6	120.0	3.4	1.8
EB15-3	EB15	91.75	16.6	6.4
EB15-4	EB15	110	15.4	6.0
EB16-6	EB16	105.5	16.0	6.2
EB16-5	EB16	104-105	10.6	4.3
EB17-9	EB17	140	10.7	4.4
EB20-11	EB20	145	9.9	4.1
EB20-10	EB20	142.5 - 143.5	4.4	2.2
EB20-12	EB20	157.5 - 158.5	13.5	5.3
EB22-14	EB22	151.5 - 152.5	5.2	2.4
EB22-16	EB22	162.5-163.5	19.2	7.3
EB23-11	EB23	122.5 - 123.5	5.3	2.5
EB23-13	EB23	139.5 - 140.5	13.1	5.2
EB28-6	EB28	156.5 - 157.5	8.9	3.7

Sample I.D.	Boring I.D.	Sample Depth (feet)	PCE Retardation Factor	TCE Retardation Factor
EB28-7	EB28	175 - 176	9.1	3.8
EB30-9	EB30	250.5 - 251.5	1.6	1.2
EB30-10	EB30	268.5 - 269.5	5.5	2.6
EB30-11	EB30	290.5 - 291.5	8.1	3.4
OB-2-194-194.5-BC	OB-2	194-194.5	3.5	1.9
OB-3-293.5-294-BC	OB-3	293.5-294	4.3	2.1
OB-3-316-316.5-BC	OB-3	316-316.5	5.2	2.5
		Minimum	**1.6**	**1.2**
		Maximum	**19.2**	**7.3**
		Average	**8.6**	**3.6**
		Geometric Mean	**7.3**	**3.3**
C-Zone Aquifer				
EB14-4	EB14	130.5	1.9	1.3
EB15-6	EB15	130	1.2	1.1
EB15-9	EB15	150	1.4	1.1
EB16-15	EB16	192	8.9	3.7
EB16-7	EB16	126.5	14.7	5.7
EB16-8	EB16	127-128	5.8	2.7
EB16-10	EB16	150	1.7	1.2
EB16-13	EB16	172	1.7	1.2
EB17-12	EB17	162	5.1	2.4
EB17-13	EB17	176	1.8	1.3
EB17-16	EB17	199	1.9	1.3
EB17-19	EB17	219	2.3	1.5
EB20-13	EB20	165	19.9	7.5
EB20-16	EB20	197	1.2	1.1
EB20-18	EB20	205	1.4	1.1
EB20-20	EB20	225	1.4	1.1
EB21-2	EB21	120	1.4	1.1
EB21-4	EB21	139	4.1	2.1
EB22-18	EB22	187.5-188.5	5.9	2.7
EB22-21	EB22	197.5-198.5	4.9	2.4
EB28-8	EB28	198 - 199	4.1	2.1
EB28-13	EB28	235 - 235.5	1.7	1.2
EB30-15	EB30	360.5 - 361	2.2	1.4
OB-2-258-259-CZ	OB-2	258-259	1.5	1.2
OB-2-275-275.5-CZ	OB-2	275-275.5	1.3	1.1
OB-3-355-356-CZ	OB-3	355-356	1.6	1.2
OB-3-368-369-CZ	OB-3	368-369	1.3	1.1
		Minimum	**1.2**	**1.1**
		Maximum	**19.9**	**7.5**
		Average	**3.9**	**2.0**
		Geometric Mean	**2.6**	**1.7**
C/D Aquitard				
EB14-7	EB14	150	48.6	17.5
EB14-9	EB14	166	57.0	20.4
EB14-8	EB14	162.5-163.5	33.4	12.2
EB15-11	EB15	169	6.1	2.8
EB15-13	EB15	181.5-182	35.2	12.8
EB16-18	EB16	211	26.9	10.0

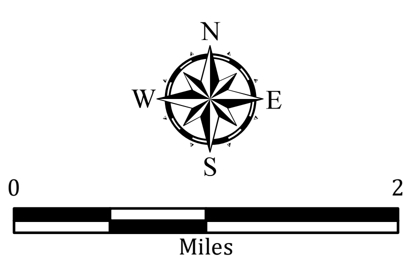
Sample I.D.	Boring I.D.	Sample Depth (feet)	PCE Retardation Factor	TCE Retardation Factor
EB16-17	EB16	210-210.5	19.0	7.2
EB17-21	EB17	229.5	41.6	15.1
EB20-22	EB20	245	90.4	32.0
EB21-7	EB21	158	25.6	9.5
EB21-8	EB21	158.5 - 159.5	18.0	6.9
		Minimum	**6.1**	**2.8**
		Maximum	**90.4**	**32.0**
		Average	**36.5**	**13.3**
		Geometric Mean	**30.0**	**11.2**
D-Zone Aquifer				
EB14-12	EB14	186	1.4	1.1
EB14-13	EB14	195	121.7	42.8
EB14-15	EB14	215	4.0	2.0
EB14-17	EB14	229	23.2	8.7
EB15-14	EB15	190	15.4	6.0
EB15-16	EB15	210	4.4	2.2
EB15-19	EB15	230	2.5	1.5
EB15-21	EB15	250	58.5	20.9
EB17-23	EB17	239	5.3	2.5
EB21-10	EB21	179	9.3	3.9
EB21-12	EB21	199	4.4	2.2
EB22-31	EB22	282.5-283.5	18.1	6.9
EB28-18	EB28	284.5 - 285.5	9.3	3.9
EB28-19	EB28	295.5 - 296	2.8	1.6
EB28-21	EB28	297 - 298	2.5	1.5
		Minimum	**1.4**	**1.1**
		Maximum	**121.7**	**42.8**
		Average	**18.9**	**7.2**
		Geometric Mean	**8.1**	**3.8**

Notes:

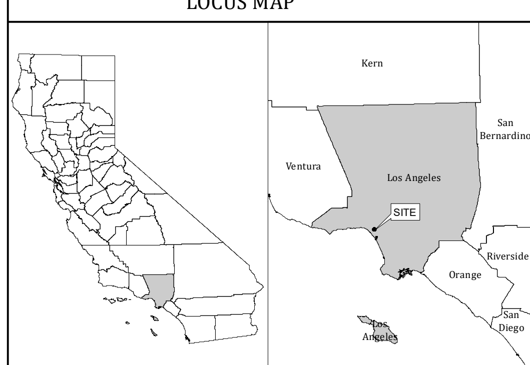
"EB" Sample data from AMEC Geomatrix 2008, 2009b

"OB" Sample data obtained during 2012 well installation program conducted by ICF (not previously reported).

Figures



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

OLYMPIC SUBBASIN LOCATION MAP

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

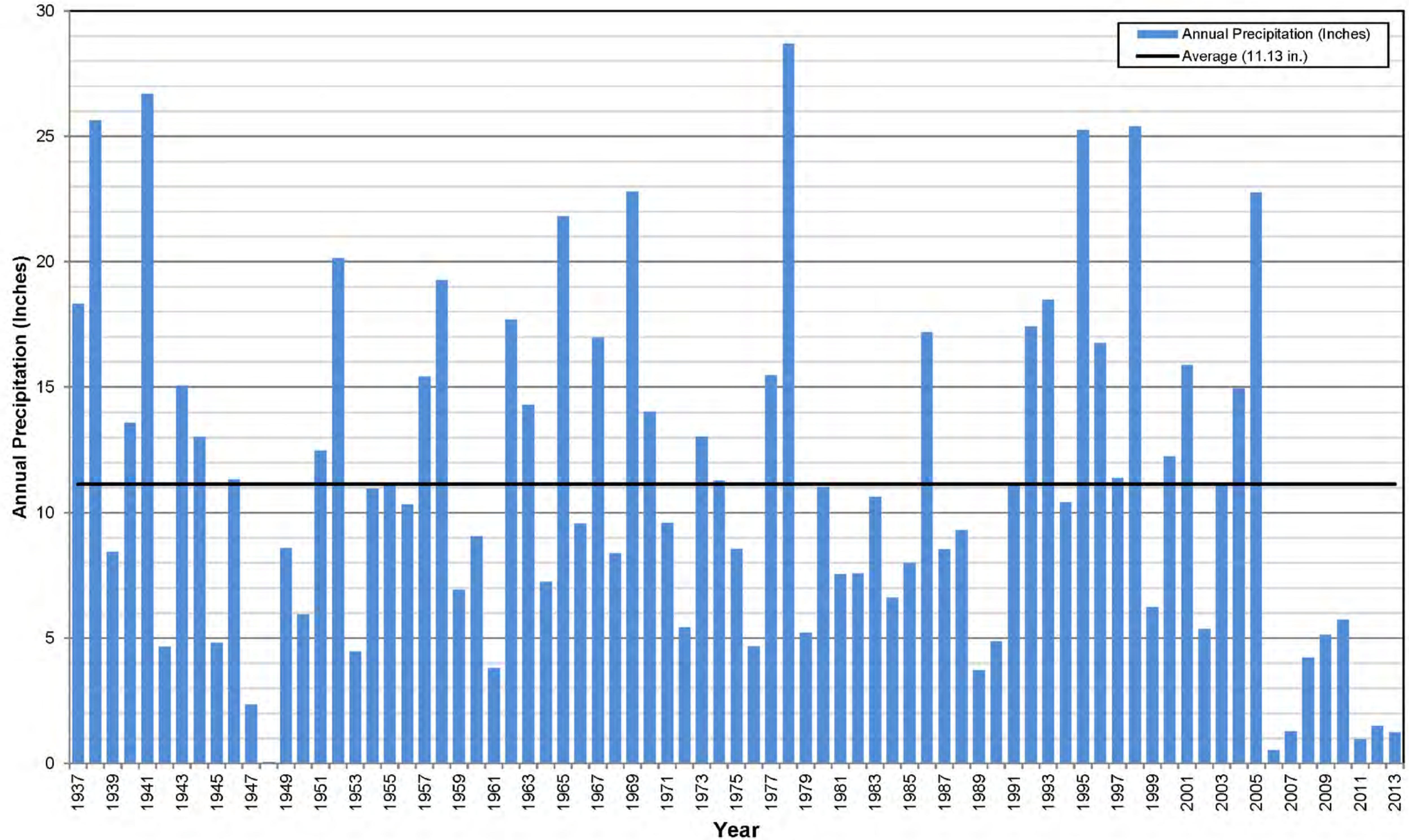
SCALE

DATE
05/2020

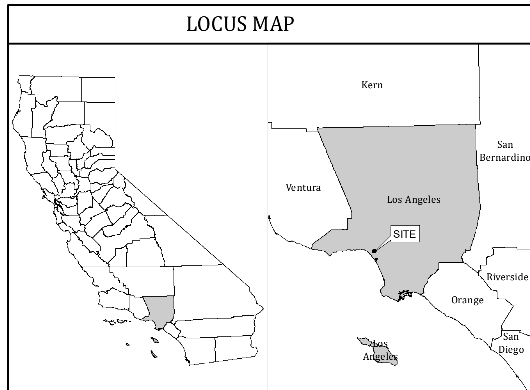
PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 1 OF 44



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

YEARLY PRECIPITATION TOTALS AT SANTA MONICA PIER

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

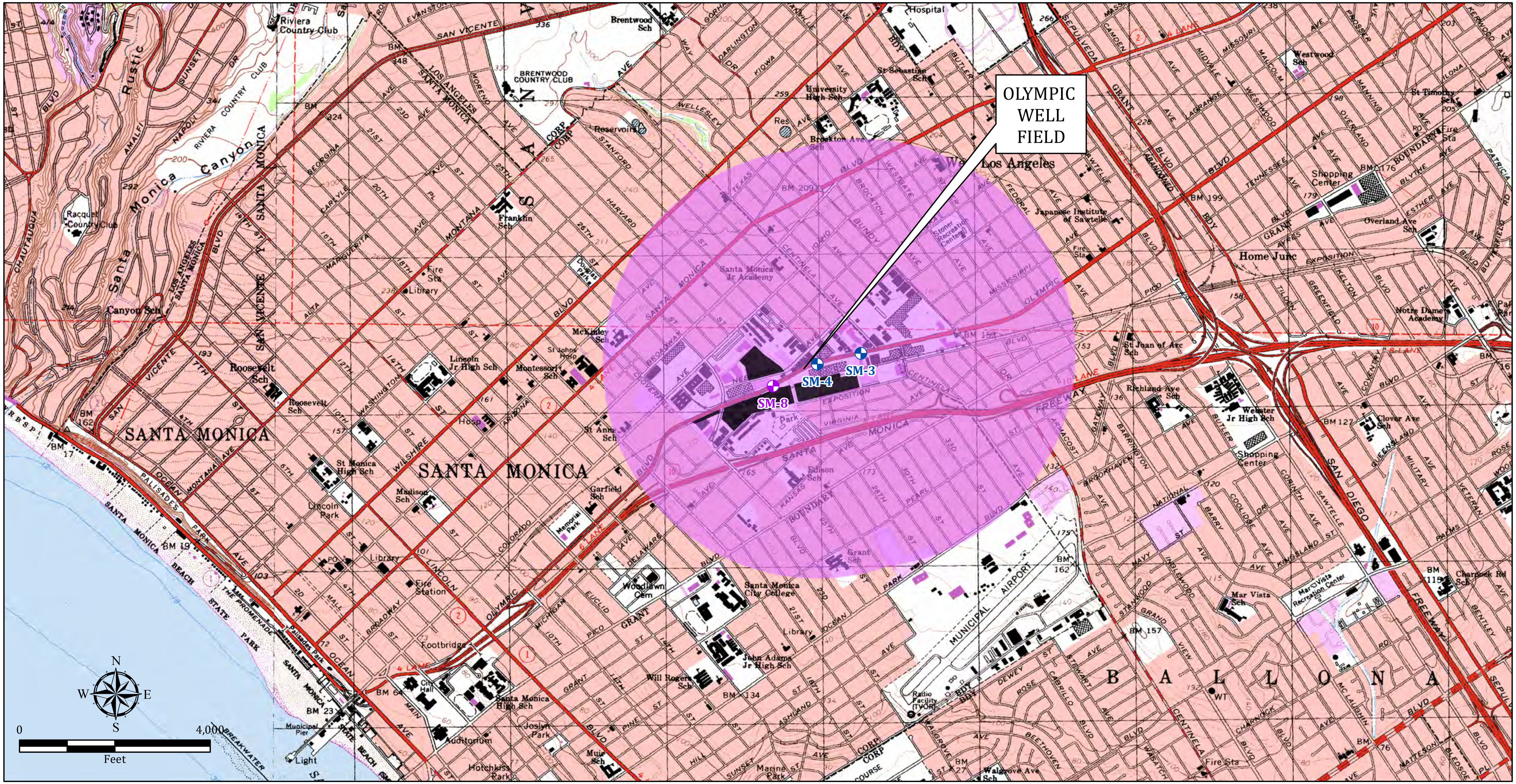
SCALE

DATE
05/2020

PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

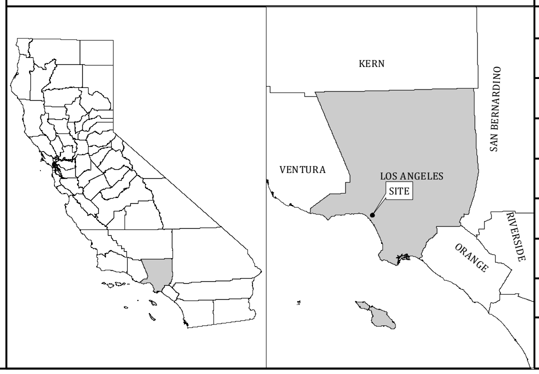
FIGURE 2 OF 44



LEGEND

- CITY OF SANTA MONICA PRODUCTION WELL (ACTIVE)
- CITY OF SANTA MONICA PRODUCTION WELL (INACTIVE)
- PROPERTIES WHERE LONG-TERM MONITORING WELLS ARE LOCATED
- ESTIMATED RADIUS OF DRAWDOWN (4,500 ft radius around SM-3 and SM-4)

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	11/12/2019

TITLE

SITE VICINITY MAP

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

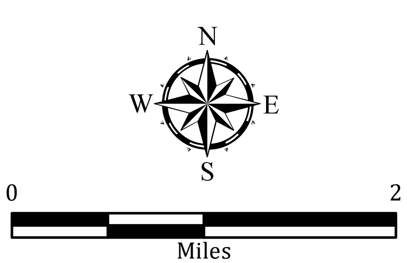
SCALE: 1 inch = 2,000 feet

DATE: 05/2020

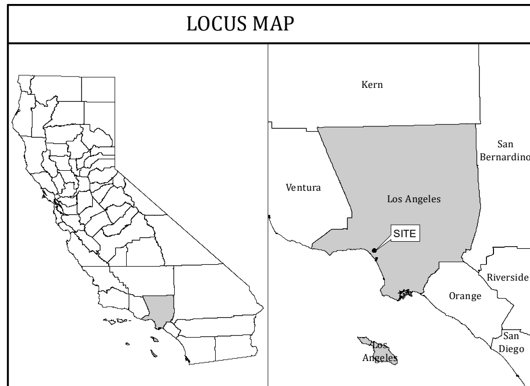
PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. USGS 7.5" Quad sheets; Beverly Hills and Topanga. All locations approximate.

FIGURE 3 OF 44



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

SANTA MONICA BASIN SUB-BASINS AND FAULTS

PREPARED FOR

CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

SCALE

DATE

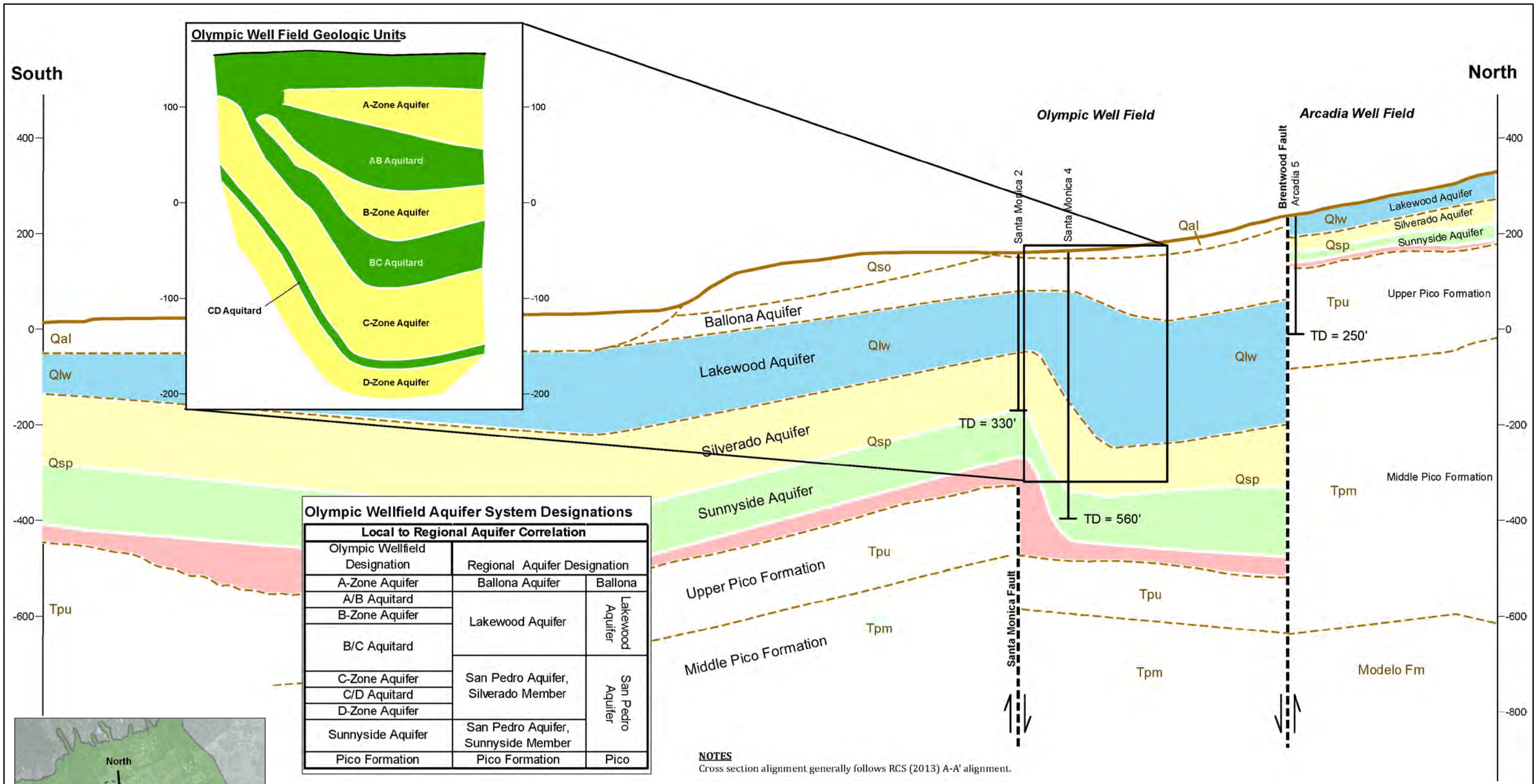
05/2020

PRJ. NO.

308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 4 OF 44

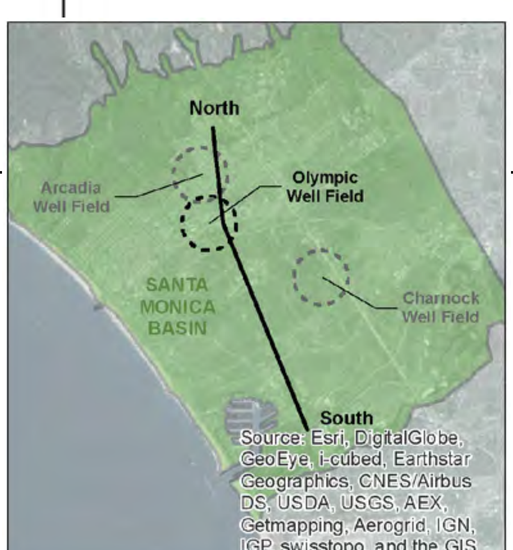


Olympic Wellfield Aquifer System Designations

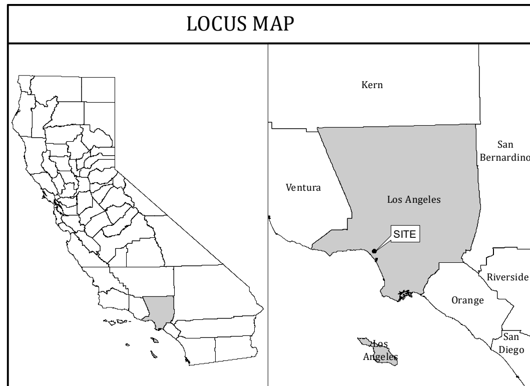
Local to Regional Aquifer Correlation		
Olympic Wellfield Designation	Regional Aquifer Designation	
A-Zone Aquifer	Ballona Aquifer	Ballona
A/B Aquitard	Lakewood Aquifer	Lakewood Aquifer
B-Zone Aquifer		
B/C Aquitard		
C-Zone Aquifer	San Pedro Aquifer, Silverado Member	San Pedro Aquifer
C/D Aquitard		
D-Zone Aquifer		
Sunnyside Aquifer	San Pedro Aquifer, Sunnyside Member	
Pico Formation	Pico Formation	Pico

NOTES

Cross section alignment generally follows RCS (2013) A-A' alignment.



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

IDEALIZED CROSS SECTION WITH LOCAL TO REGIONAL AQUIFER CORRELATION

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

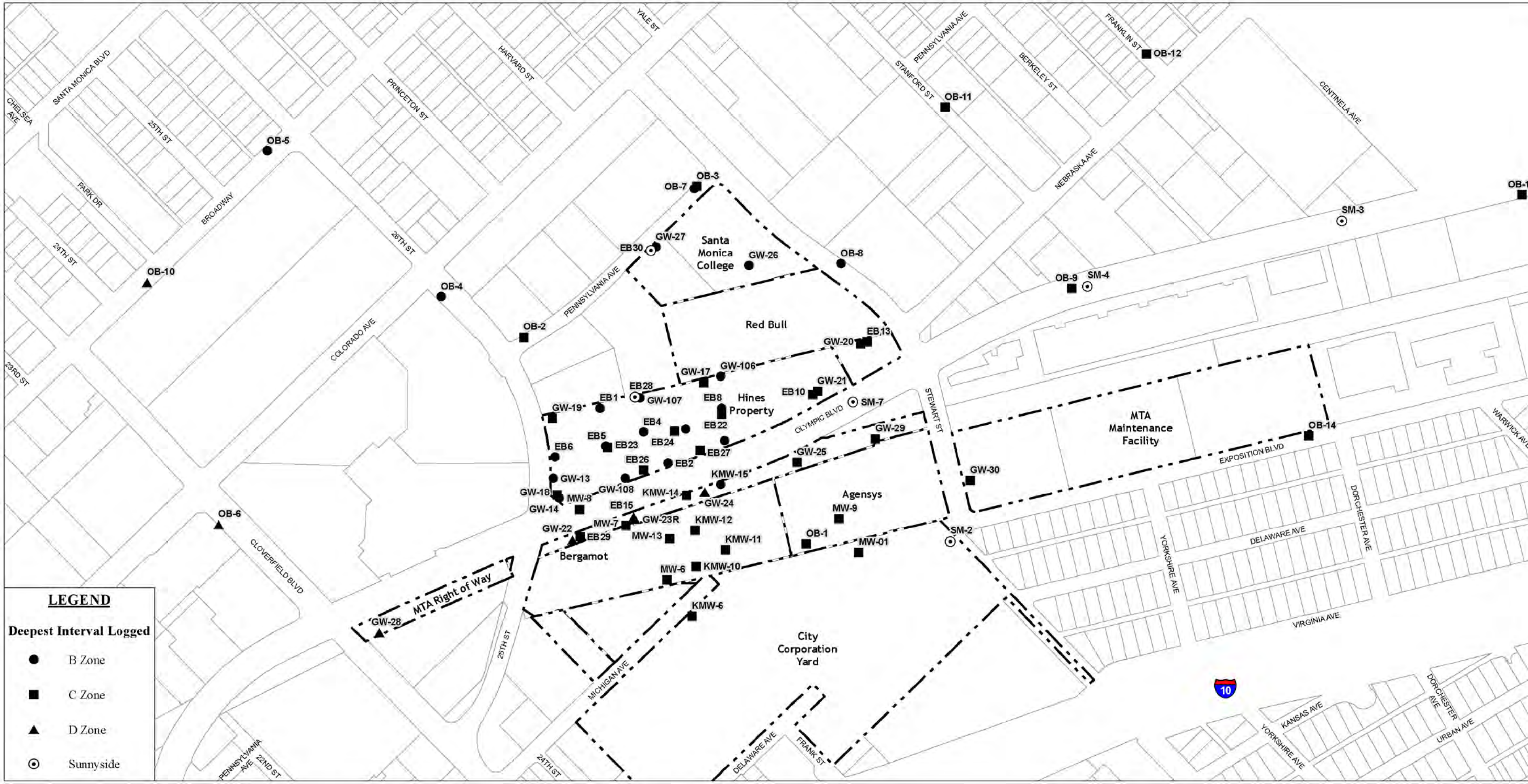
SCALE

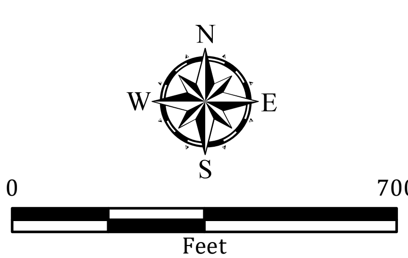
DATE 05/2020

PRJ. NO. 308038-07119

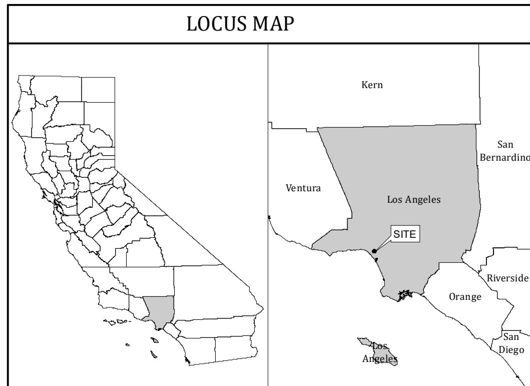
SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 5 OF 44





LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

BOREHOLE DATA INVENTORY MAP

PREPARED FOR

CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

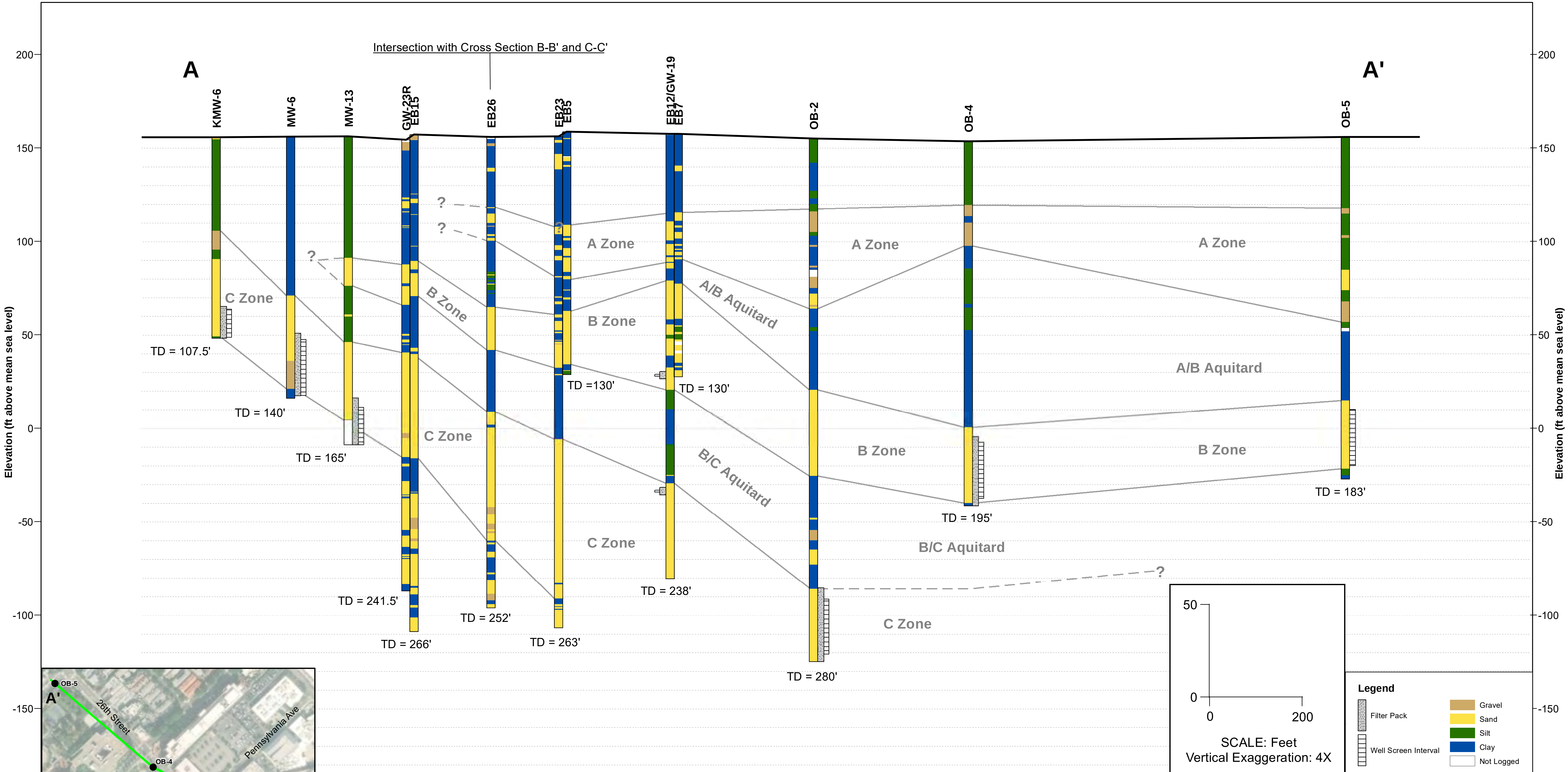
SCALE

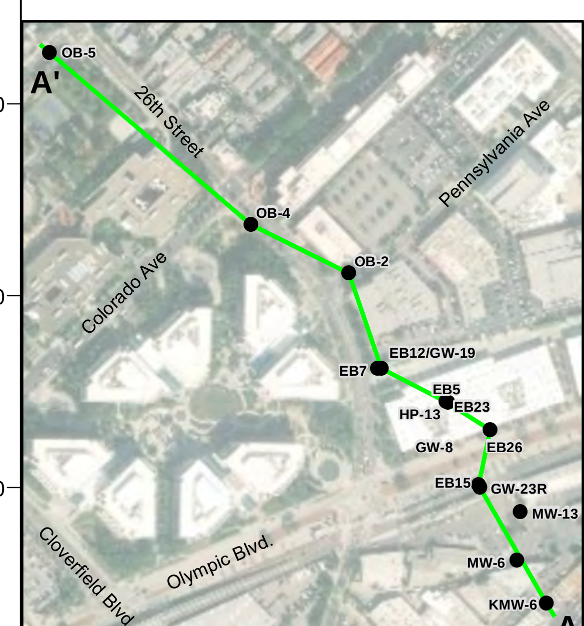
DATE 05/2020

PRJ. NO. 308038-07119

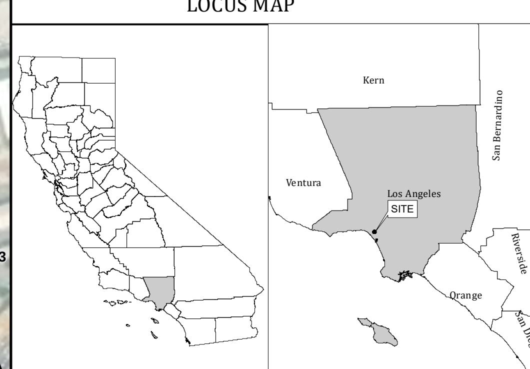
SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 6 OF 44





LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

OLYMPIC WELL FIELD CROSS SECTION A-A'

PREPARED FOR: CITY OF SANTA MONICA, OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

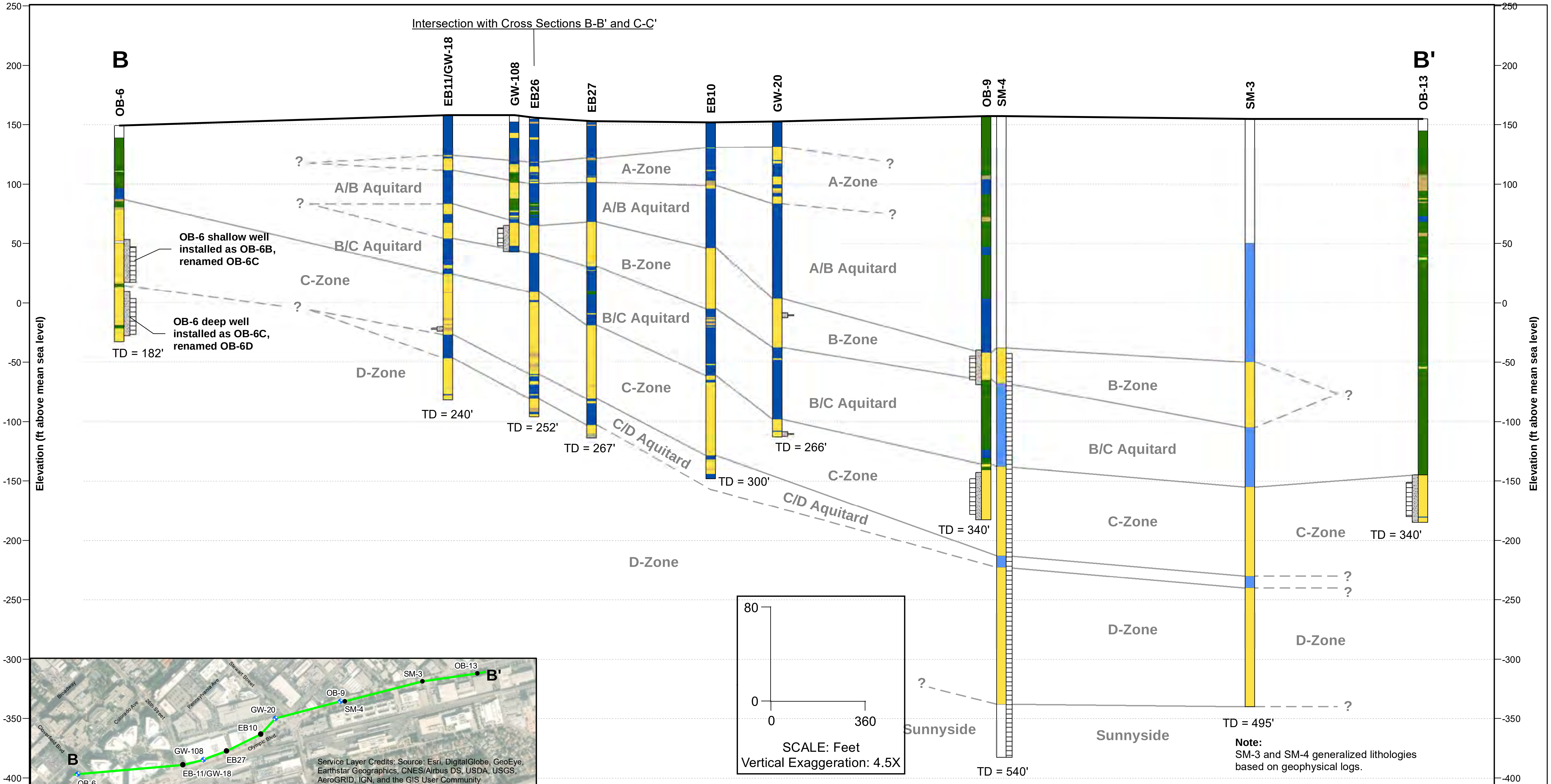
SCALE:

DATE: 5/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Portion of base map provided by AMEC. All locations approximate.

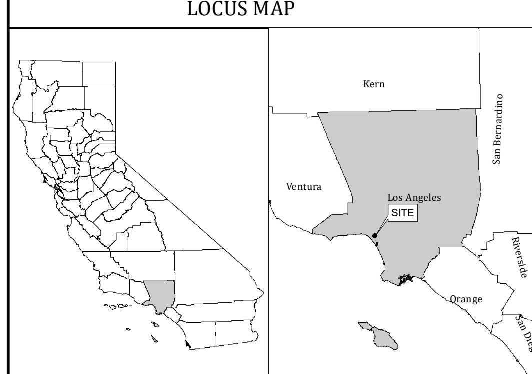
FIGURE 7 OF 44



Legend

- Approximate Ground Surface
- Filter Pack
- Well Screen Interval
- Gravel
- Sand
- Silt
- Clay
- Aquitard
- Not Logged

LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

ICF

TITLE
OLYMPIC WELL FIELD CROSS SECTION B-B'

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

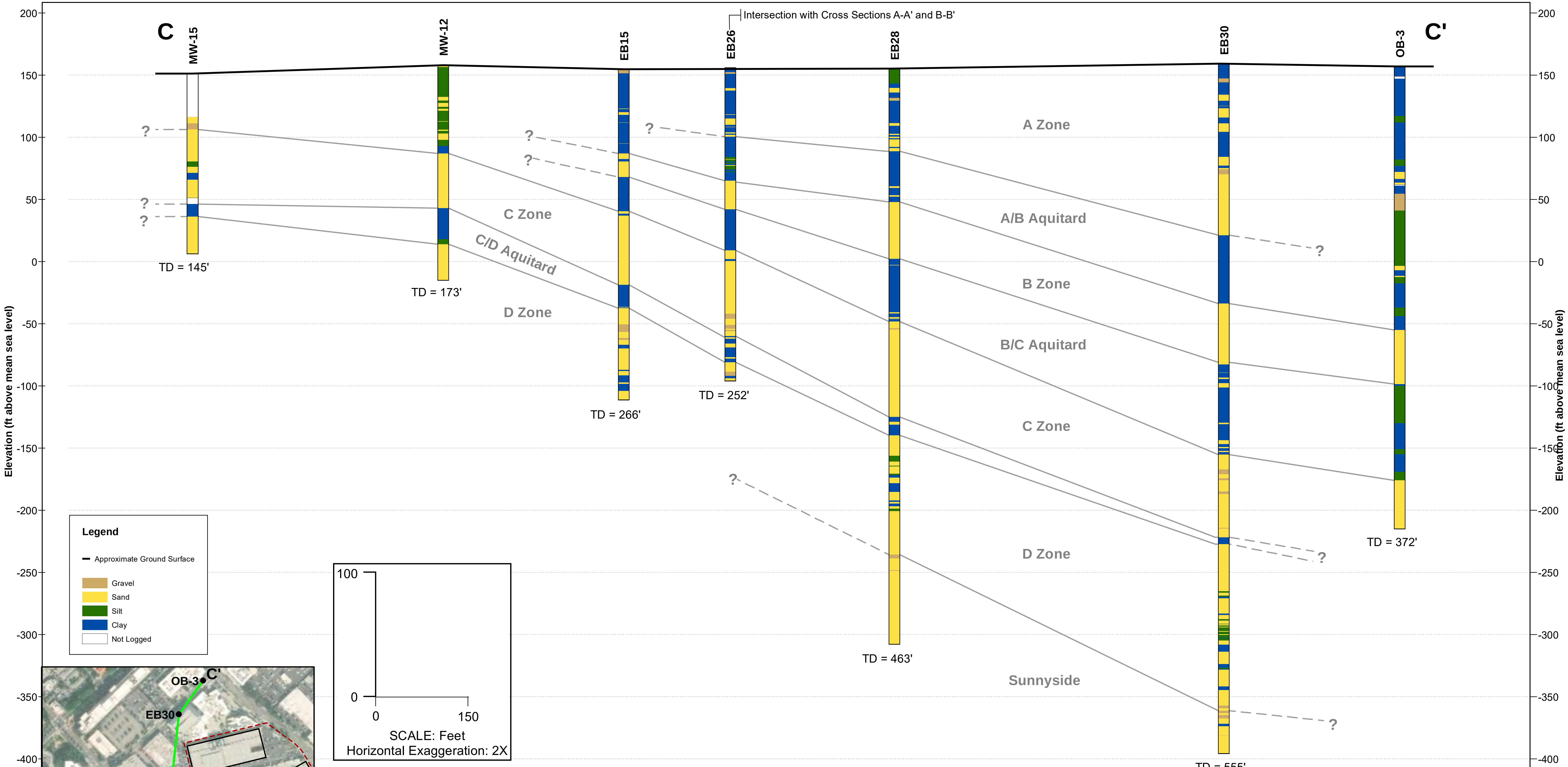
SCALE:

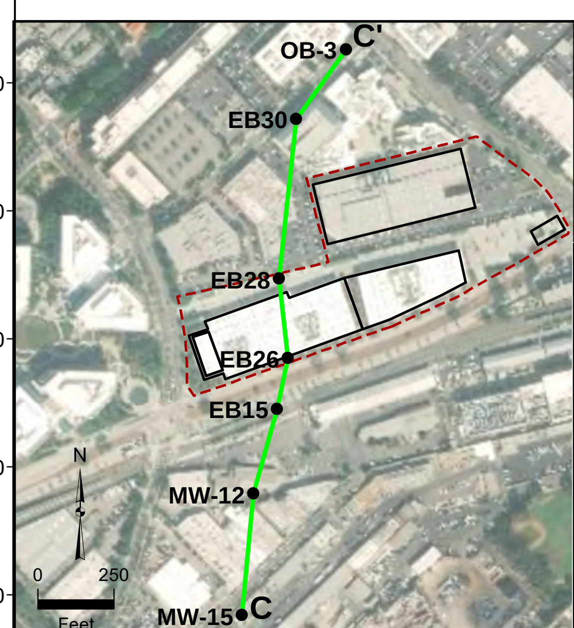
DATE: 5/2020

PRJ. NO. 308038-07119

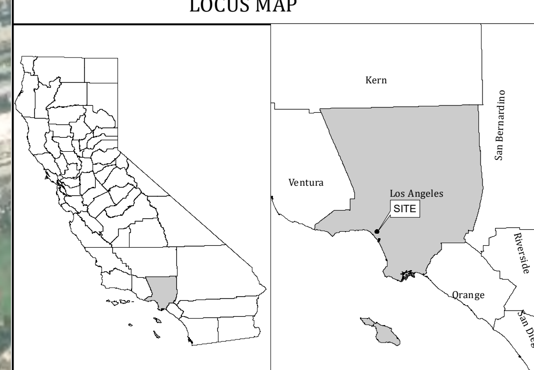
SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Portion of base map provided by AMEC. All locations approximate.

FIGURE 8 OF 44





LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
SWL	
MT	

TITLE

OLYMPIC WELL FIELD CROSS SECTION C-C'

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

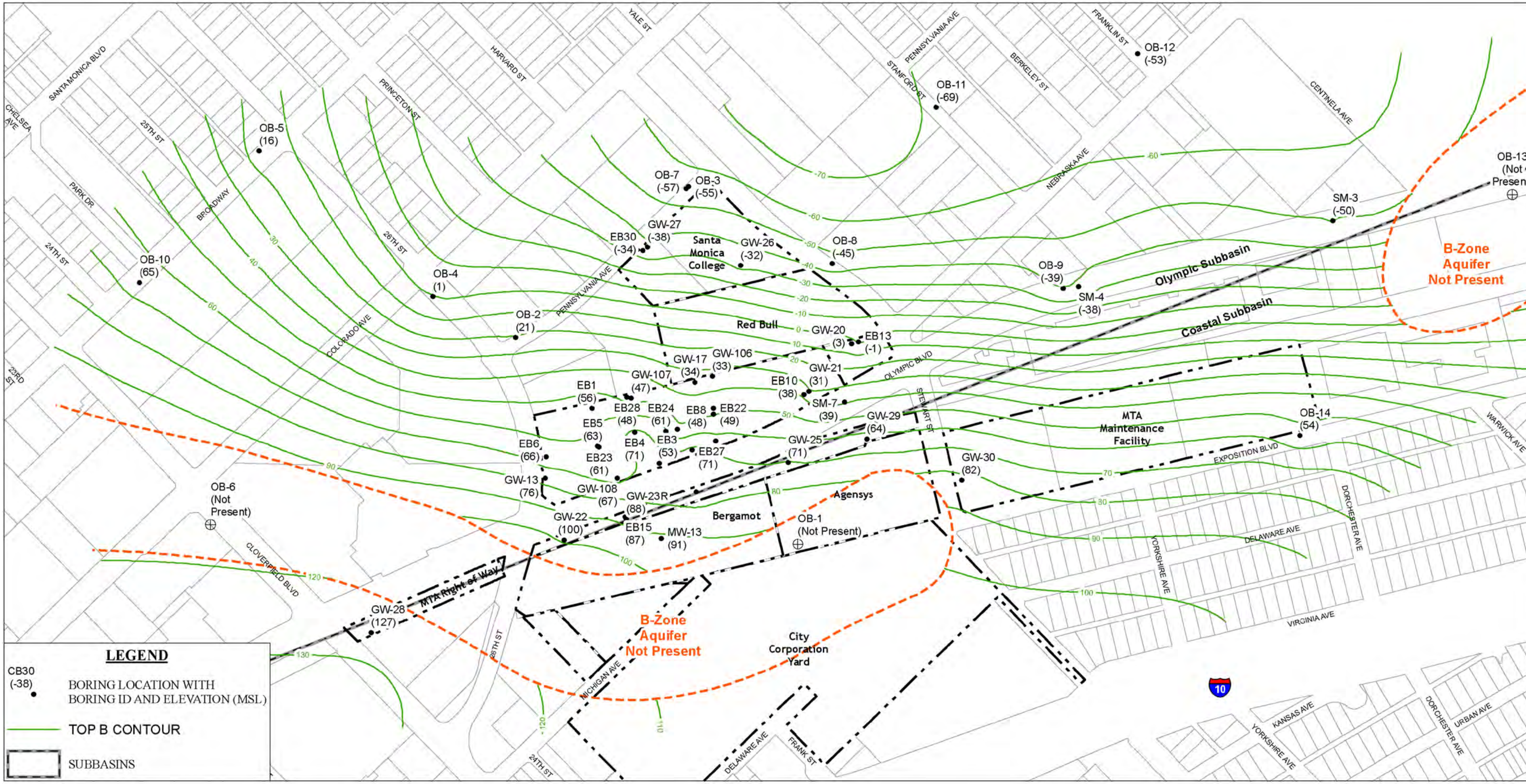
SCALE

DATE
5/2020

PRJ. NO.
308038-07119

SOURCE
Los Angeles County GIS web server. City of Santa Monica GIS. Portion of base map provided by AMEC. All locations approximate.

FIGURE 9 OF 44

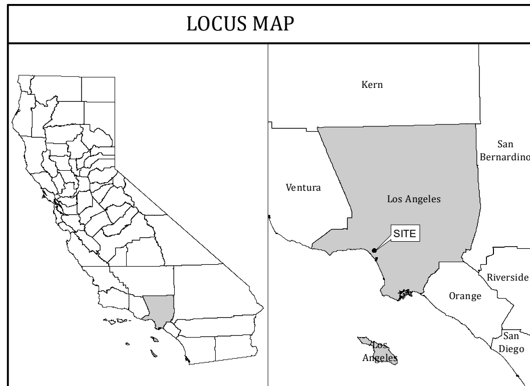


NOTES:
1) Elevations above mean sea level (AMSL)

N W E S

0 700
Feet

LOCUS MAP



REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

ICF

TITLE

STRUCTURE CONTOURS FOR TOP OF B-ZONE AQUIFER

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

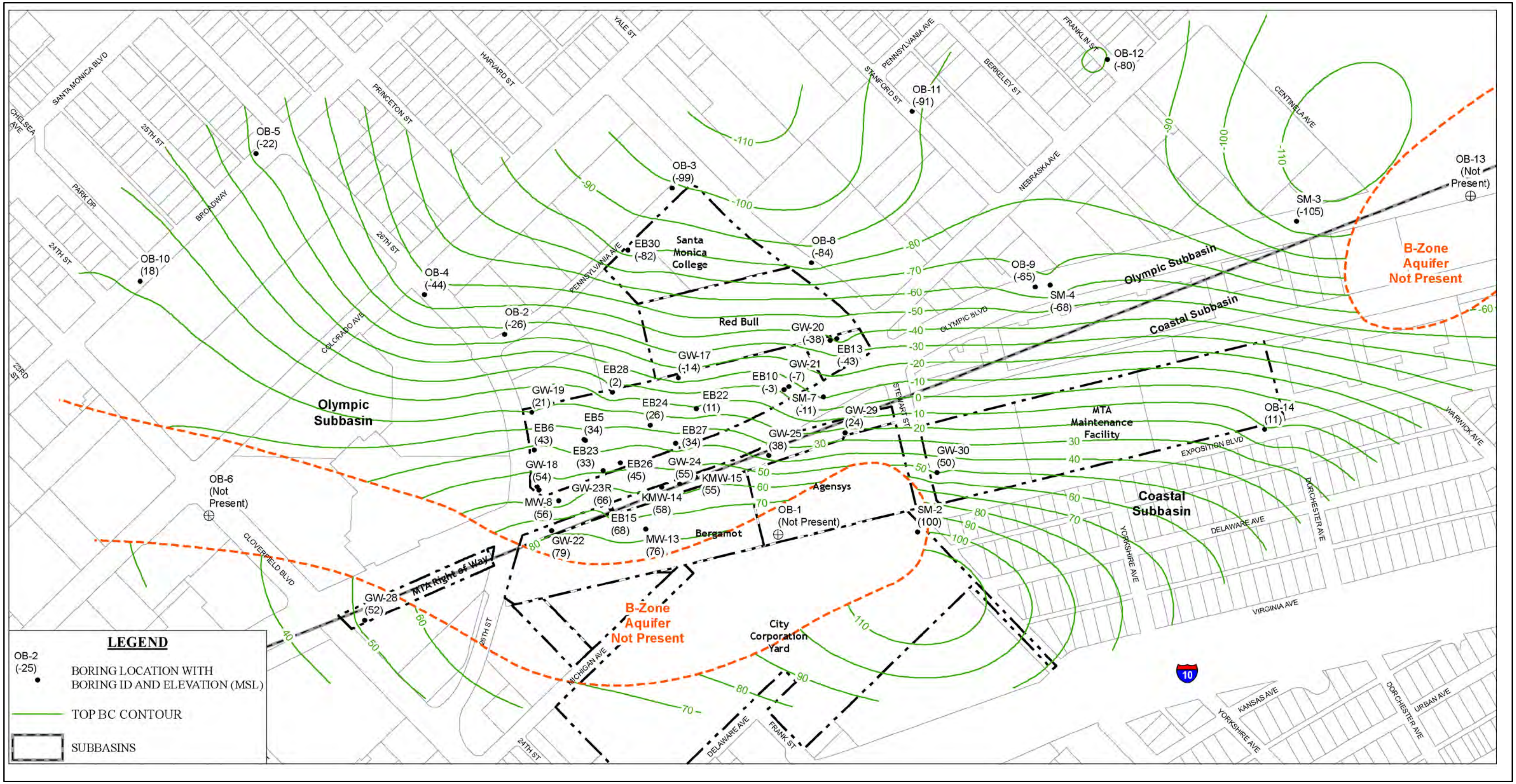
SCALE

DATE
05/2020

PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 10 OF 44

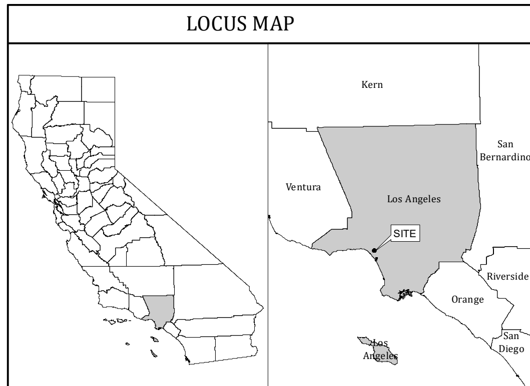


NOTES:
1) Elevations above mean sea level (AMSL)

N W E S

0 700
Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

STRUCTURE CONTOURS FOR TOP OF B/C AQUITARD

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

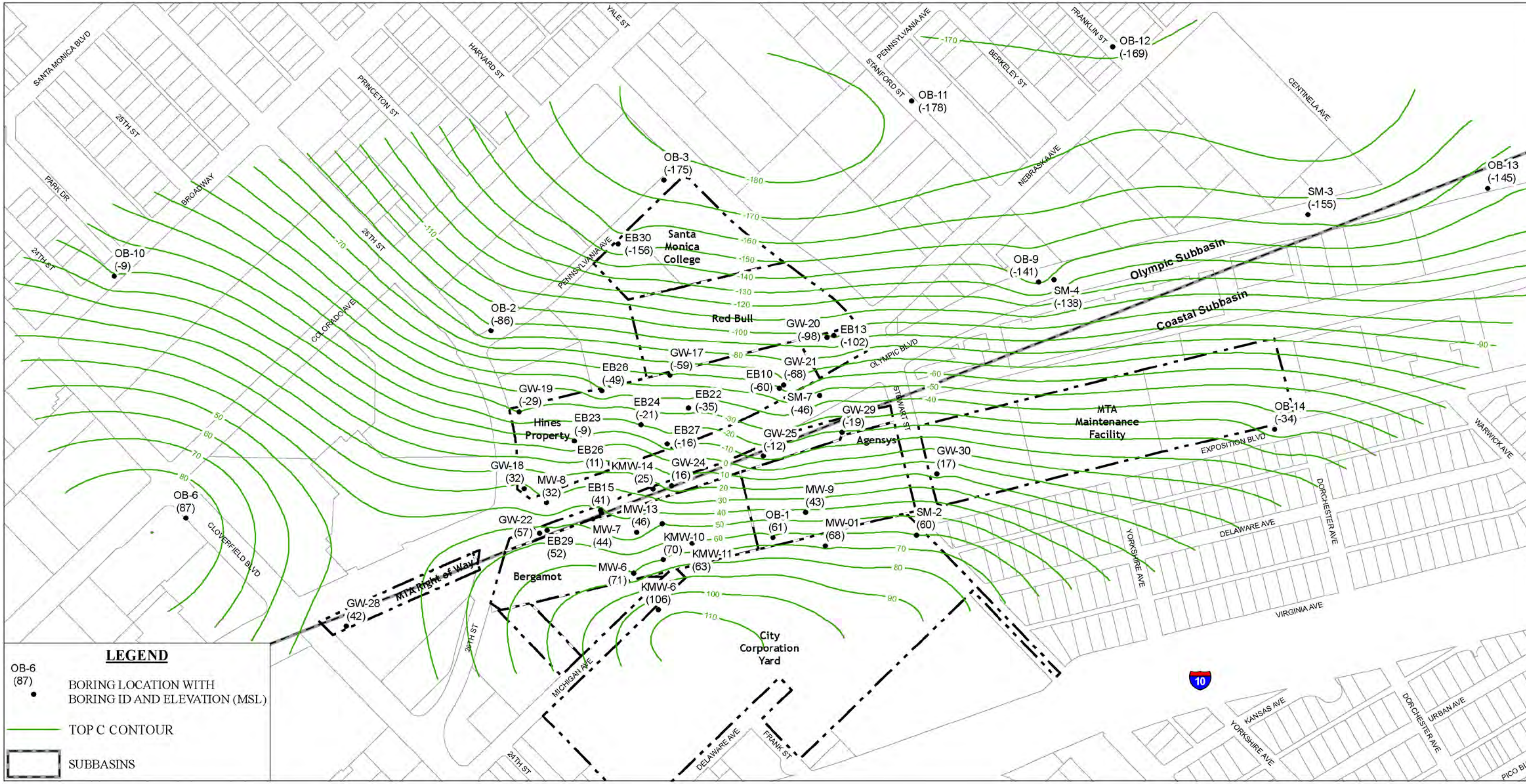
SCALE

DATE 05/2020

PRJ. NO. 308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 11 OF 44

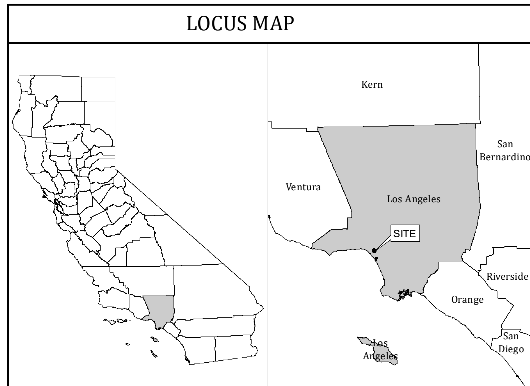


NOTES:
1) Elevations above mean sea level (AMSL)

N
W E
S

0 700
Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

STRUCTURE CONTOURS FOR TOP OF C-ZONE AQUIFER

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

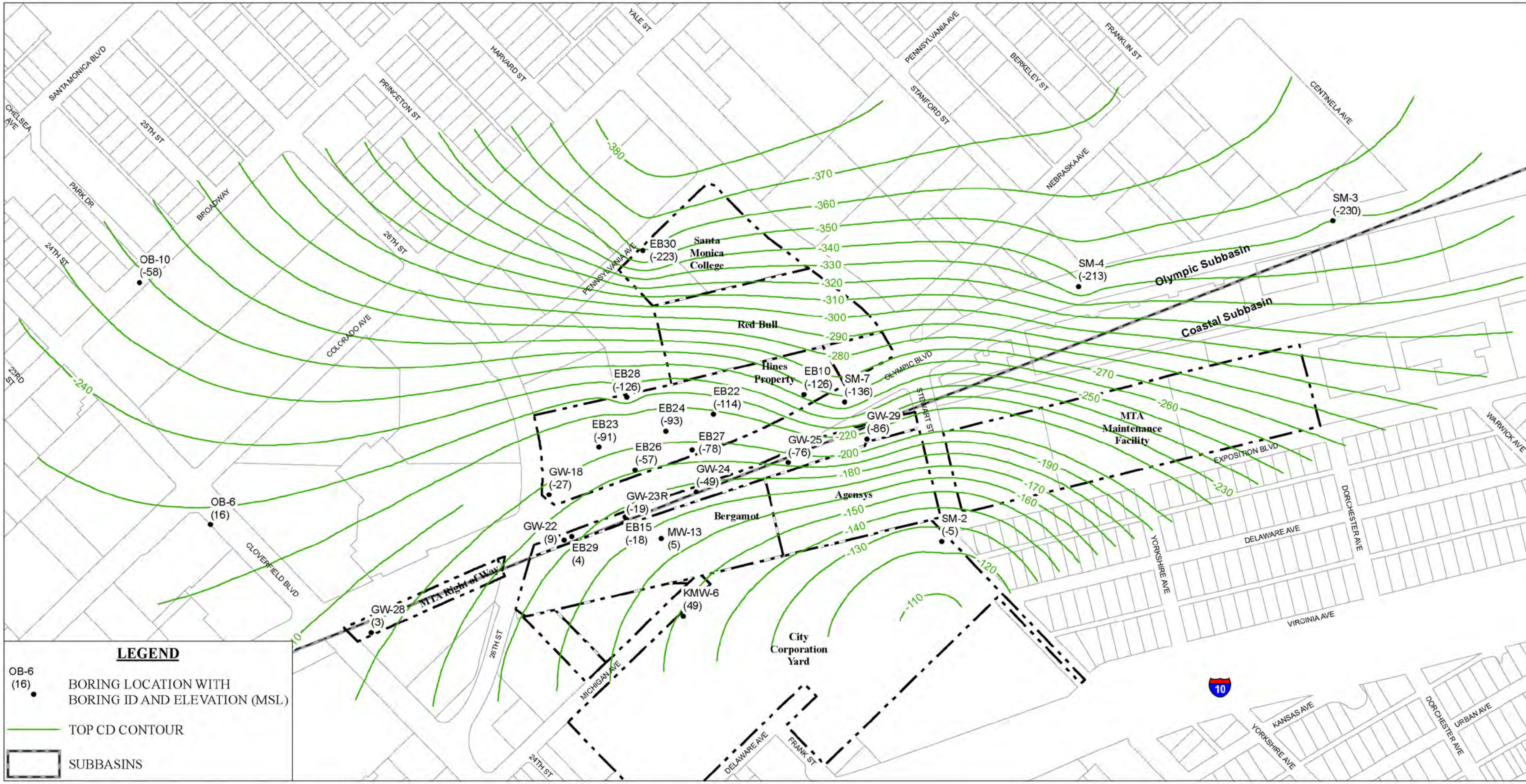
SCALE

DATE
05/2020

PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 12 OF 44



NOTES:

1) Elevations above mean sea level (AMSL)

N W E S

0 700

Feet

LOCUS MAP

REVISIONS			
REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

STRUCTURE CONTOURS FOR TOP OF C/D AQUITARD

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD SANTA MONICA, CALIFORNIA

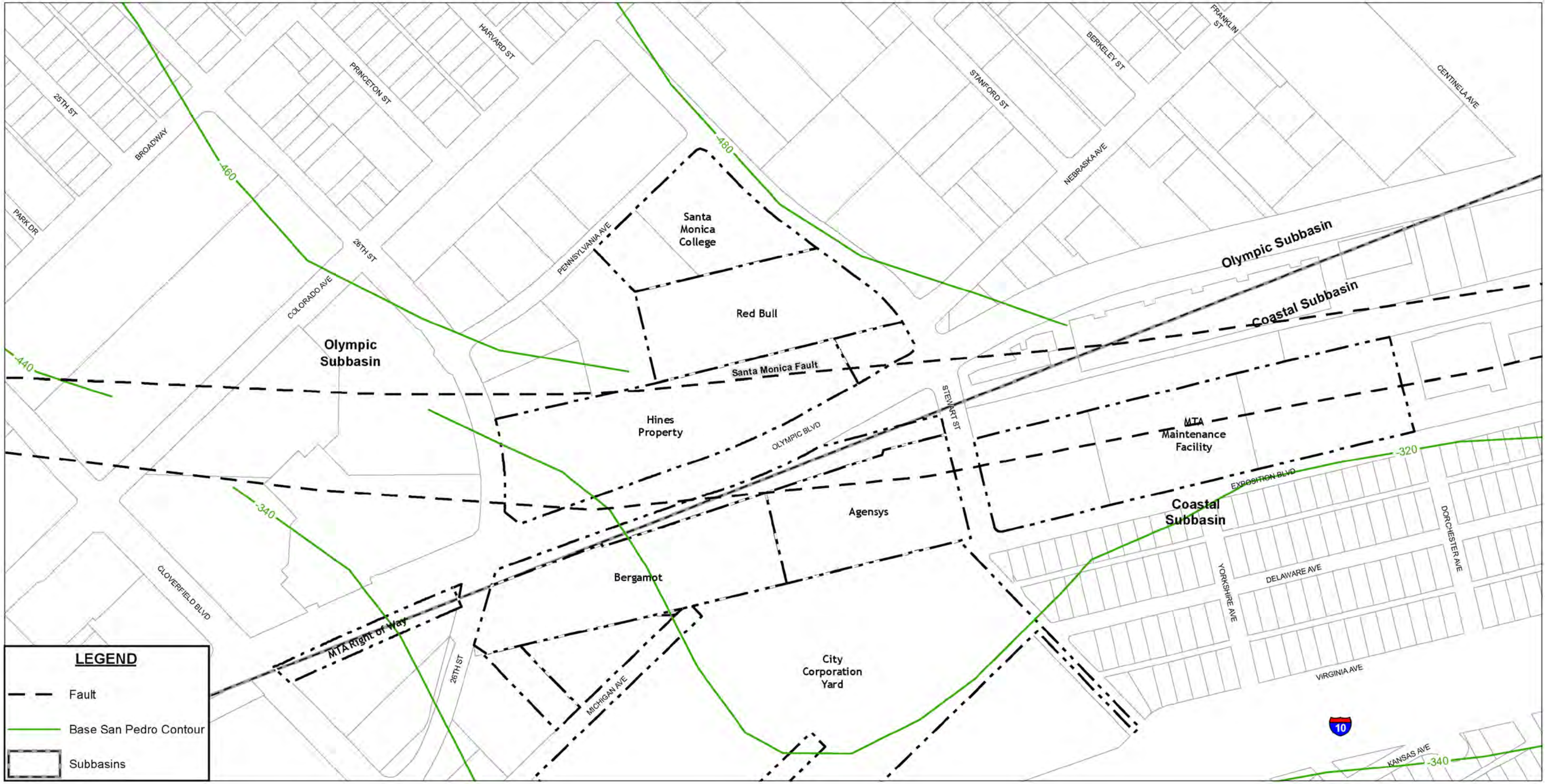
SCALE

DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 13 OF 44

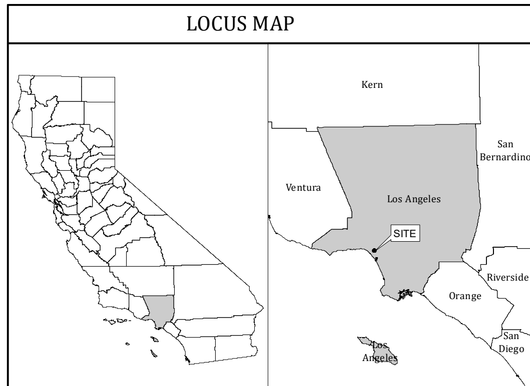


NOTES:
1) Elevations above mean sea level (AMSL)
2) Structural contours and fault locations from RCS (2013)

N W E S

0 600
Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE
STRUCTURE CONTOURS FOR BASE OF SAN PEDRO FORMATION

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

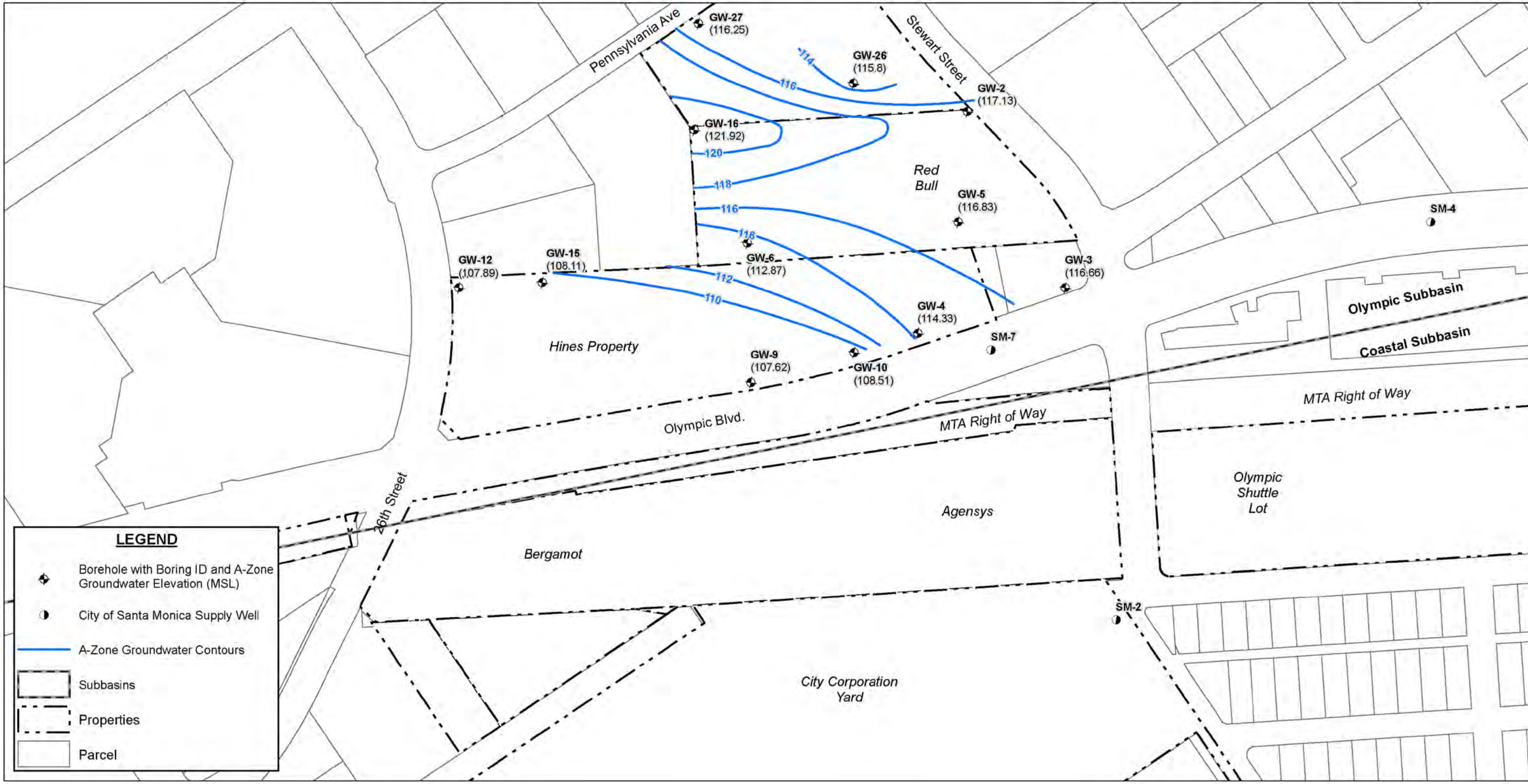
SCALE

DATE
05/2020

PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 14 OF 44

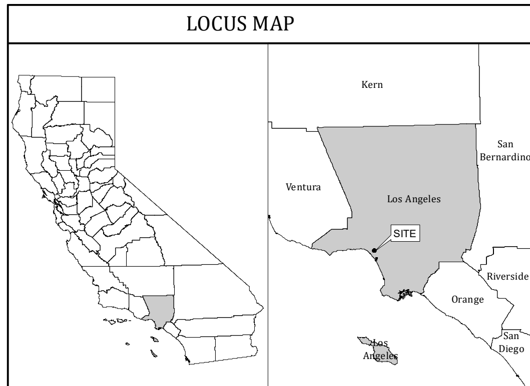


NOTES:
1) Elevations above mean sea level (AMSL)

N W E S

0 400
Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

B-ZONE AQUIFER GROUNDWATER LEVEL CONTOUR MAP, 4TH QUARTER 2011

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

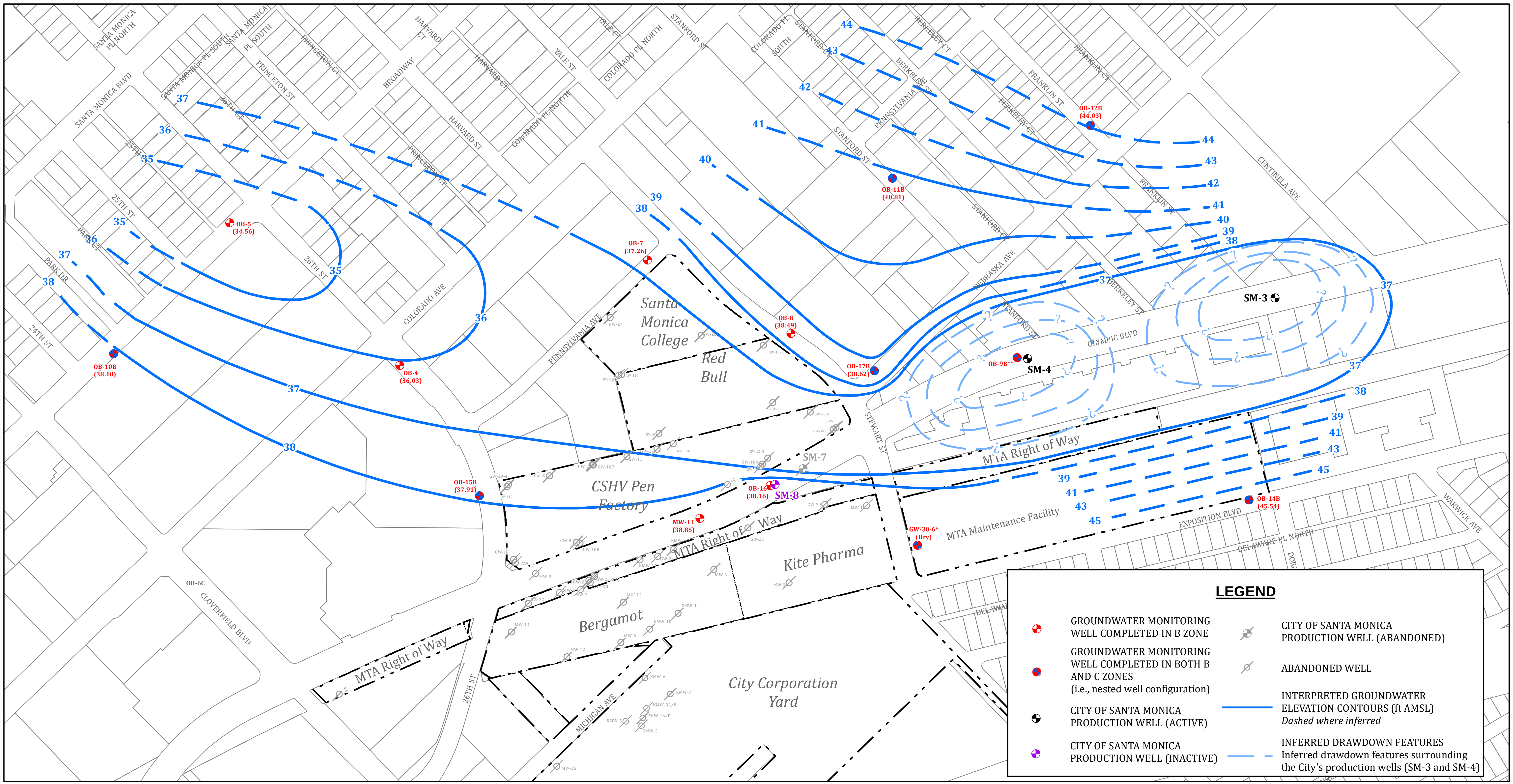
SCALE

DATE
05/2020

PRJ. NO.
308038-07119

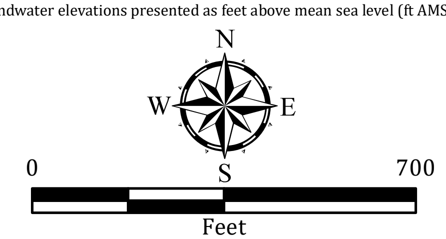
SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 15 OF 44

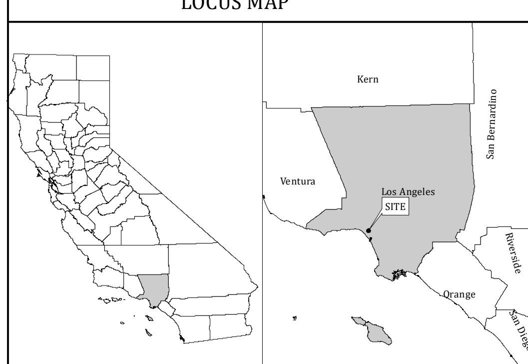


NOTES

1) All B-Zone groundwater monitoring wells gauged on November 12, 2019.
2) *Groundwater monitoring well GW-30-6 was found to be"dry" *(<1 ft. of water at base of well)* during Q4 2019 monitoring event.
3) ** Groundwater elevation data for monitoring well OB-9B excluded from assessment. Minor temporal groundwater elevation variability indicates that the well has a limited hydraulic connection with B-Zone aquifer.
4) Groundwater elevations presented as feet above mean sea level (ft AMSL).



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

B-ZONE WELL POTENTIOMETRIC SURFACE CONTOURS

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

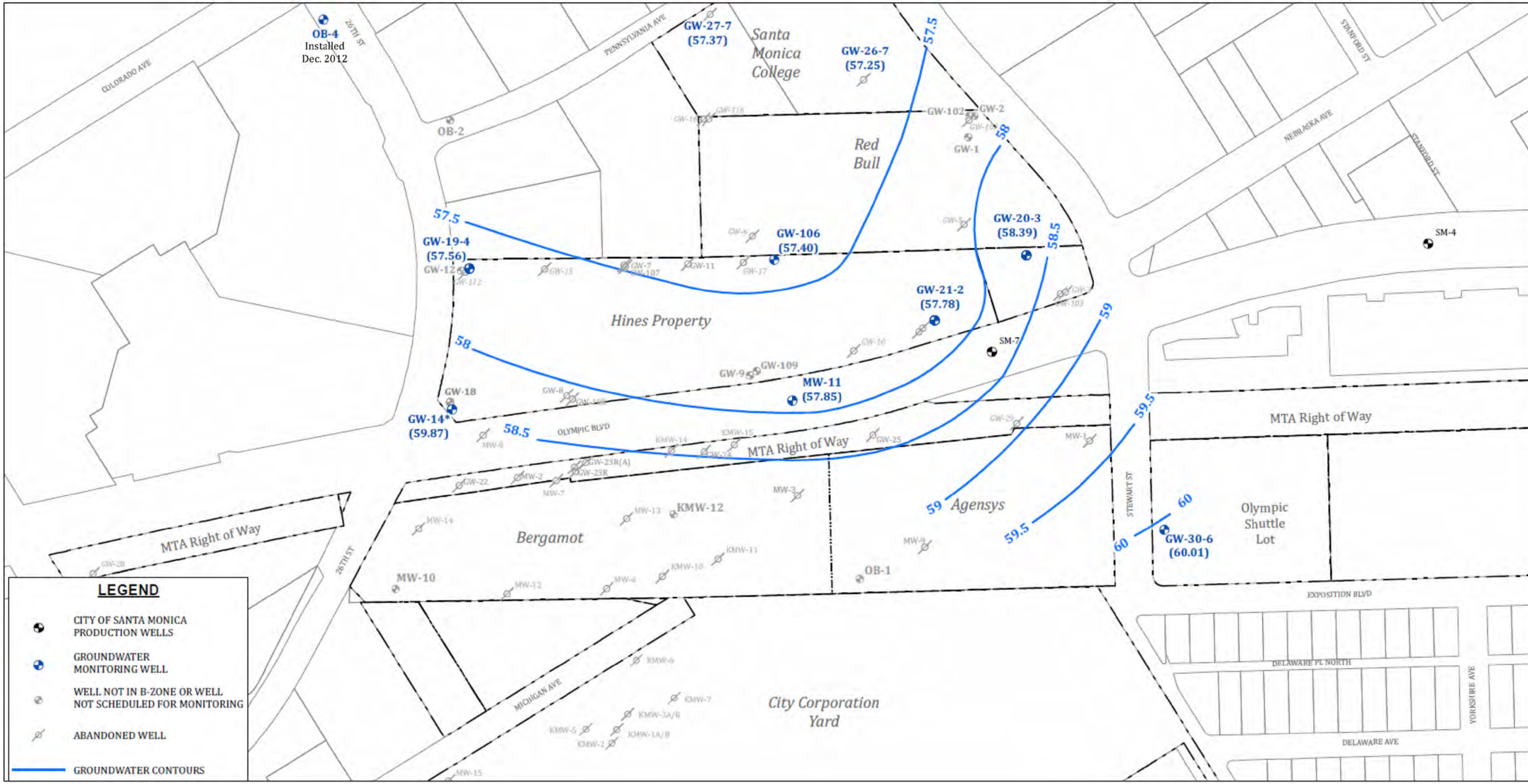
SCALE: 1 inch = 350 feet

DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 16 OF 44



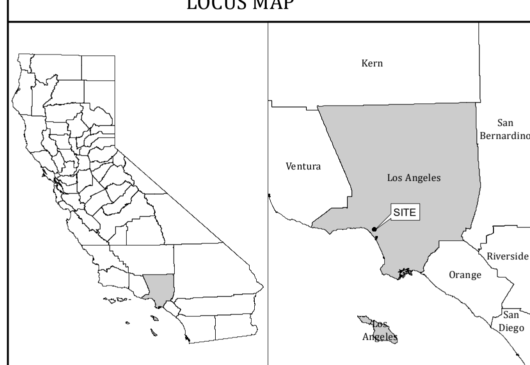
NOTES:

1) Elevations above mean sea level (AMSL)

N W E S

0 400 Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

C-ZONE AQUIFER GROUNDWATER LEVEL CONTOUR MAP, 3RD QUARTER 2011

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

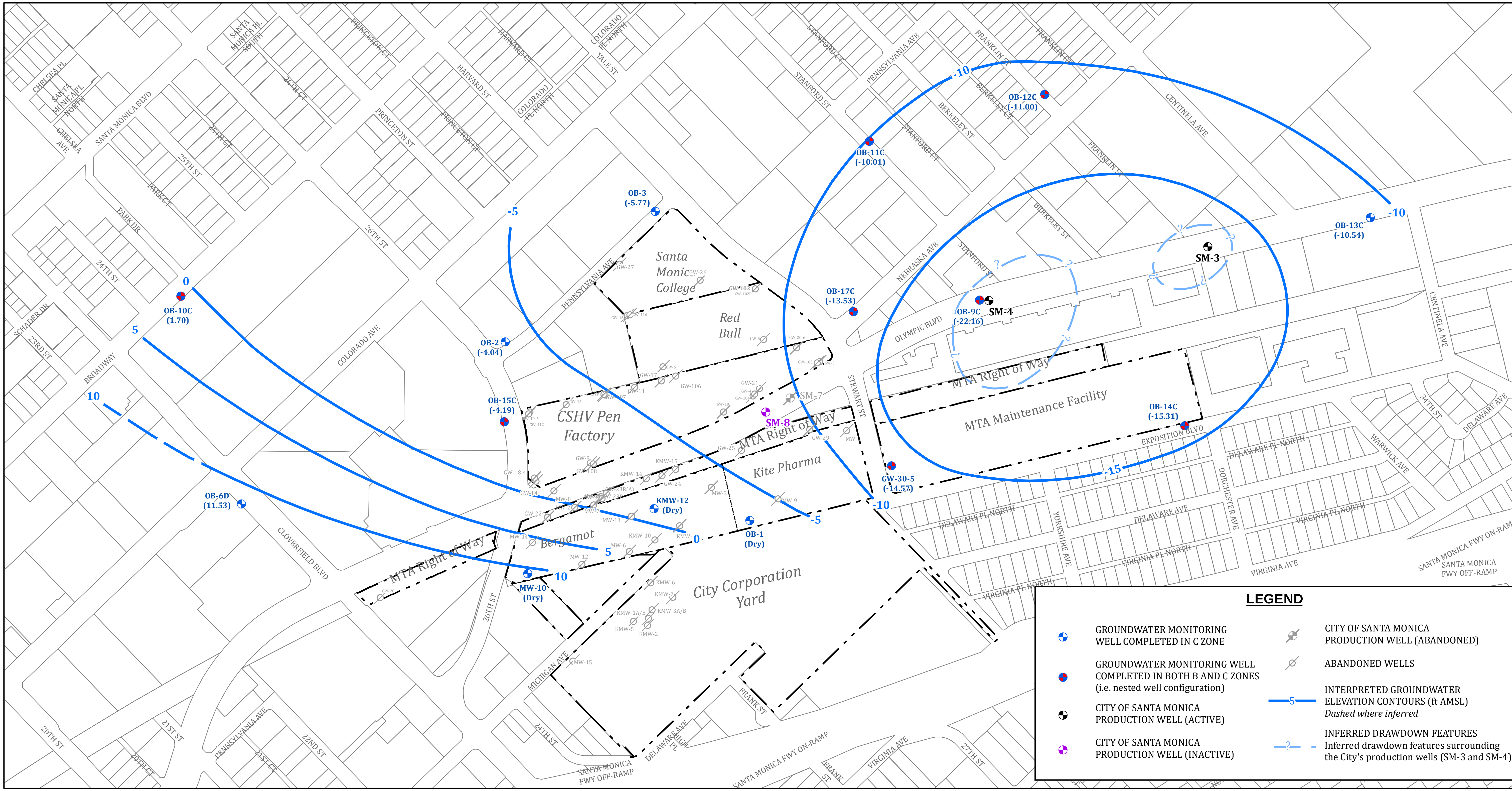
SCALE

DATE
05/2020

PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 17 OF 44



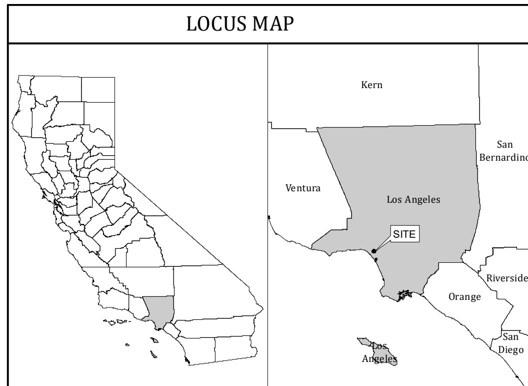
NOTES

1) C-Zone groundwater wells gauged on November 12, 2019.
2) *Groundwater monitoring wells, MW-10, KMW-12 and OB-1, were found to be "dry" *(<1 ft of water at base of well)* during the Q4 2019 monitoring event.
3) Groundwater elevations presented as ft. above mean sea level (ft AMSL).

N W E S

0 800 Feet

LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

C-ZONE WELL POTENTIOMETRIC SURFACE CONTOURS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

SCALE: 1 inch = 400 feet

DATE: 05/2020

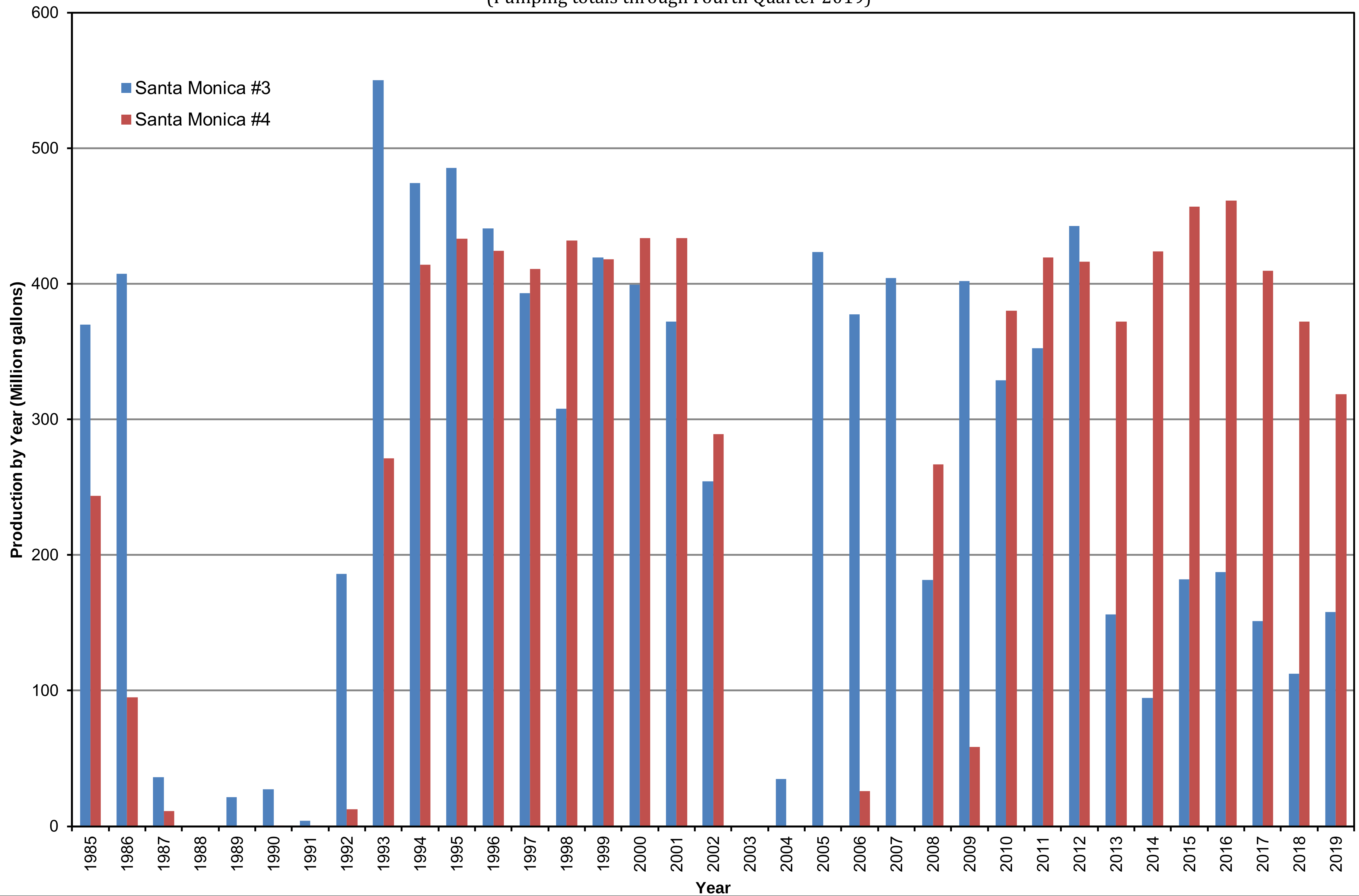
PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

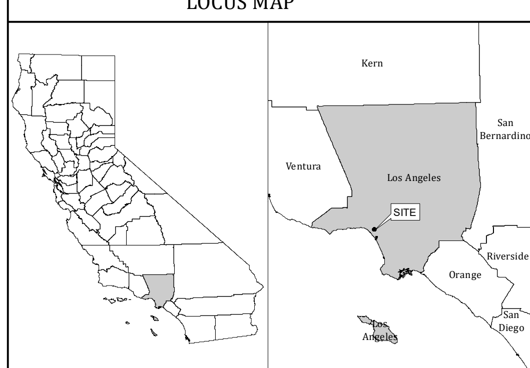
FIGURE 18 OF 44

SM-3 and SM-4 Annual Production

(Pumping totals through Fourth Quarter 2019)



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

SM-3 AND SM-4 ANNUAL PRODUCTION

PREPARED FOR

CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

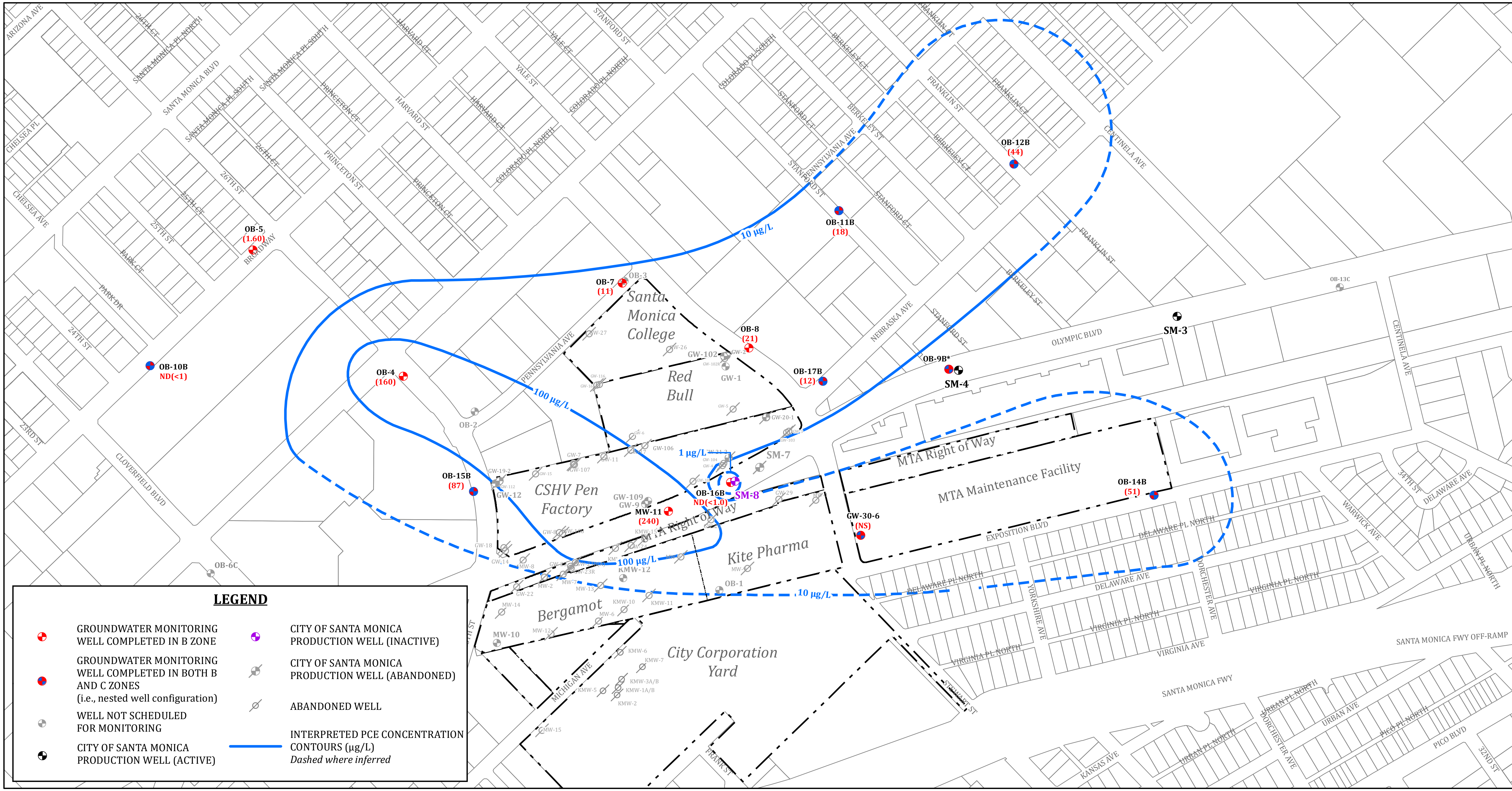
SCALE

DATE 05/2020

PRJ. NO. 308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 19 OF 44

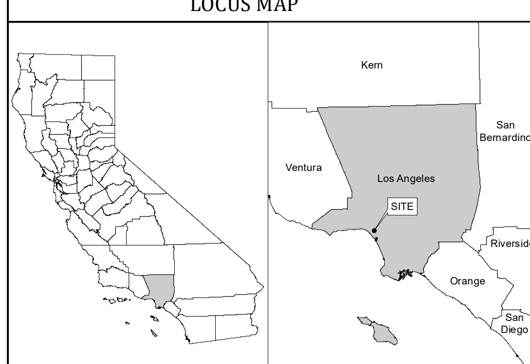


NOTES

1) NS = not sampled as well was dry.
2) PCE = tetrachloroethylene
3) ND = PCE not detected above the laboratory reporting limit.
4) PCE concentrations expressed as micrograms per liter (µg/L).
5) Groundwater monitoring wells sampled November 13-15, 2019.
6) * OB-9B not sampled. Hydraulic connection with B-Zone not established.

N W E S
0 800
Feet

LOCUS MAP



REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

ICF

TITLE

INTERPRETED DISTRIBUTION OF PCE IN B-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD SANTA MONICA, CALIFORNIA

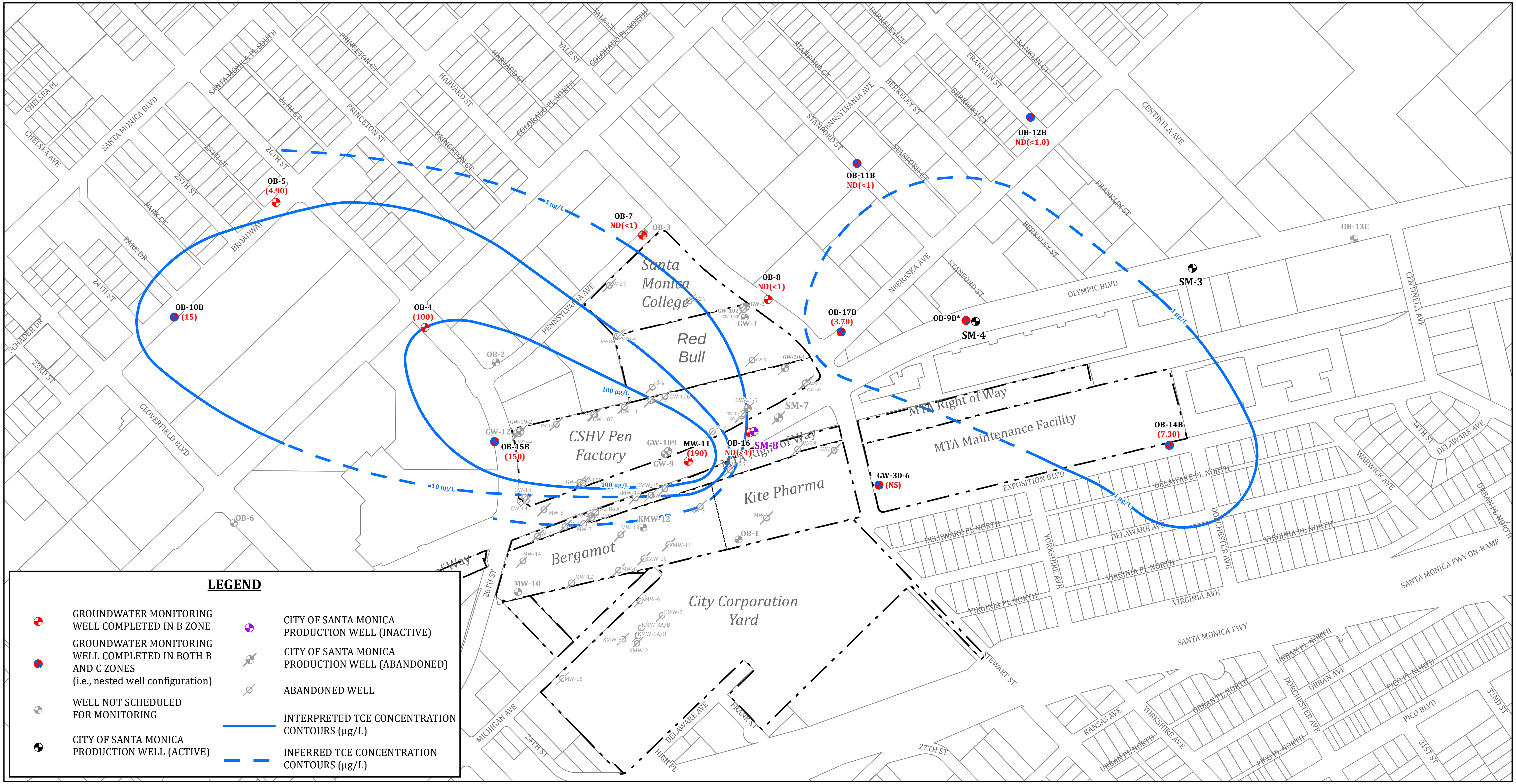
SCALE: 1 inch = 400 feet

DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

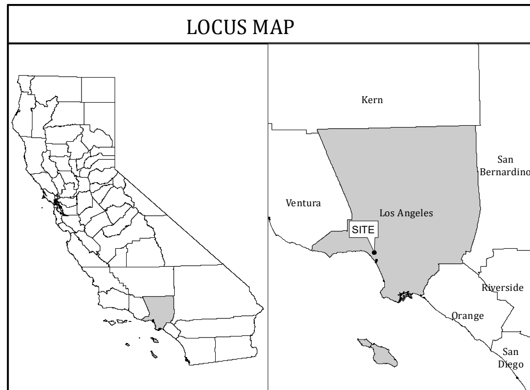
FIGURE 20 OF 44



NOTES

1) NS = not sampled as well was dry
2) TCE = trichloroethylene
3) ND = TCE not detected above the laboratory reporting limit
4) TCE concentrations expressed as micrograms per liter (µg/L)
5) Groundwater monitoring wells sampled November 13-15, 2019.
6) * OB-9B not sampled. Hydraulic connection with B-Zone not established.

LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

ICF

TITLE: **INTERPRETED DISTRIBUTION OF TCE IN B-ZONE MONITORING WELLS**

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD SANTA MONICA, CALIFORNIA

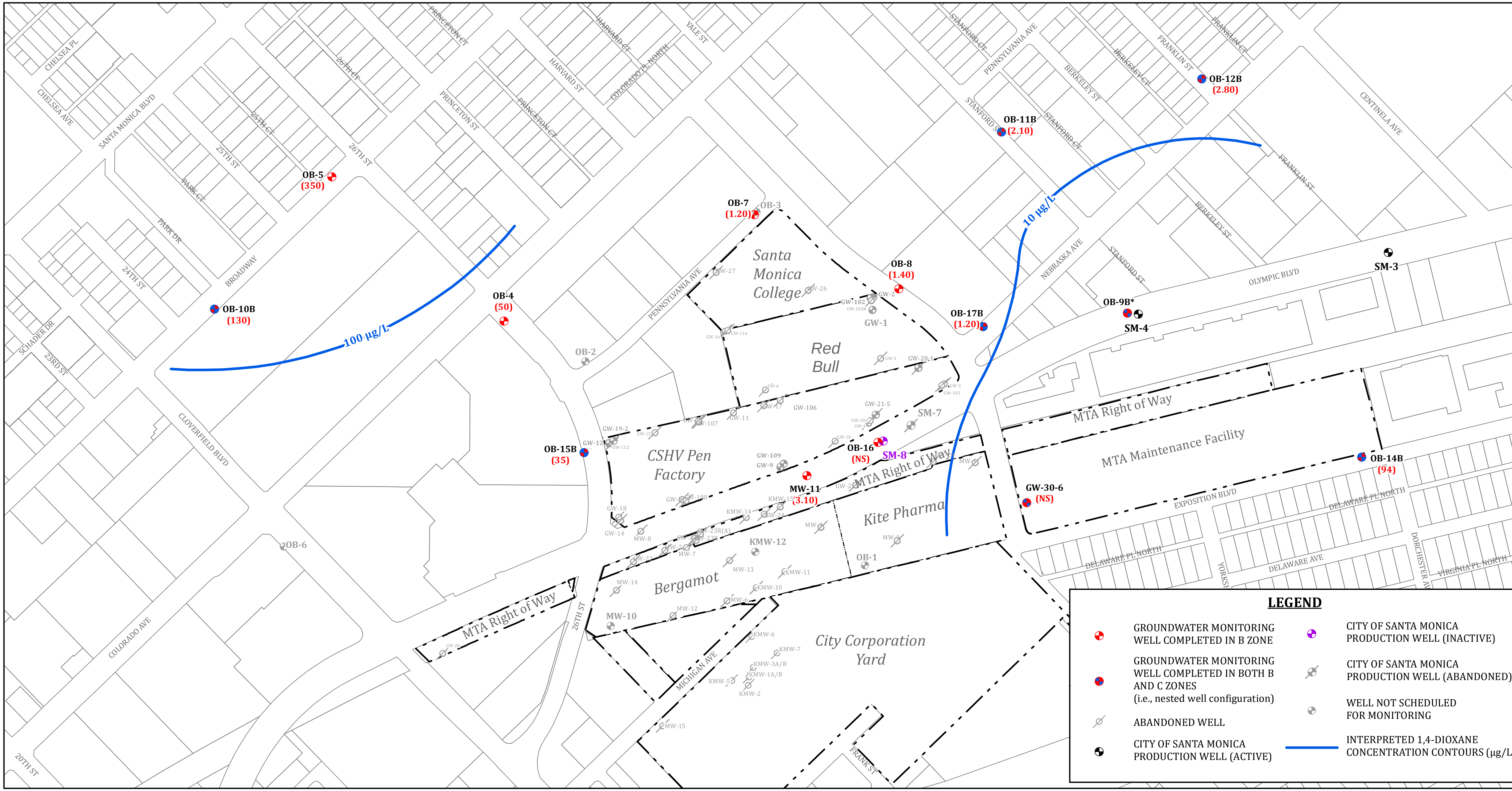
SCALE: 1 inch = 400 feet

DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 21 OF 44



LEGEND

- GROUNDWATER MONITORING WELL COMPLETED IN B ZONE
- GROUNDWATER MONITORING WELL COMPLETED IN BOTH B AND C ZONES (i.e., nested well configuration)
- ABANDONED WELL
- CITY OF SANTA MONICA PRODUCTION WELL (ACTIVE)
- CITY OF SANTA MONICA PRODUCTION WELL (INACTIVE)
- CITY OF SANTA MONICA PRODUCTION WELL (ABANDONED)
- WELL NOT SCHEDULED FOR MONITORING
- INTERPRETED 1,4-DIOXANE CONCENTRATION CONTOURS (µg/L)

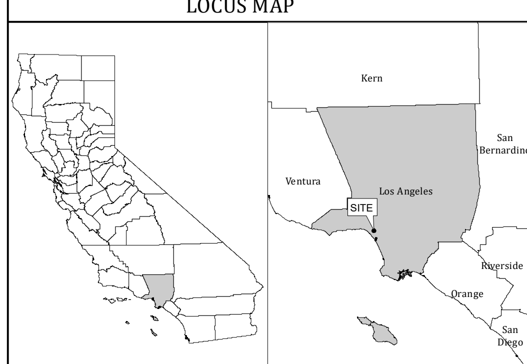
NOTES

1) NS = not sampled as well was dry.
2) ND = 1,4-dioxane not detected above the laboratory reporting limit.
3) 1,4-dioxane concentrations expressed as micrograms per liter (µg/L).
4) Groundwater monitoring wells sampled November 13-16, 2019.
5) * OB-9B not sampled. Hydraulic connection with B-Zone not established.

N S W E

0 700
Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

INTERPRETED DISTRIBUTION OF 1,4-DIOXANE IN B-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

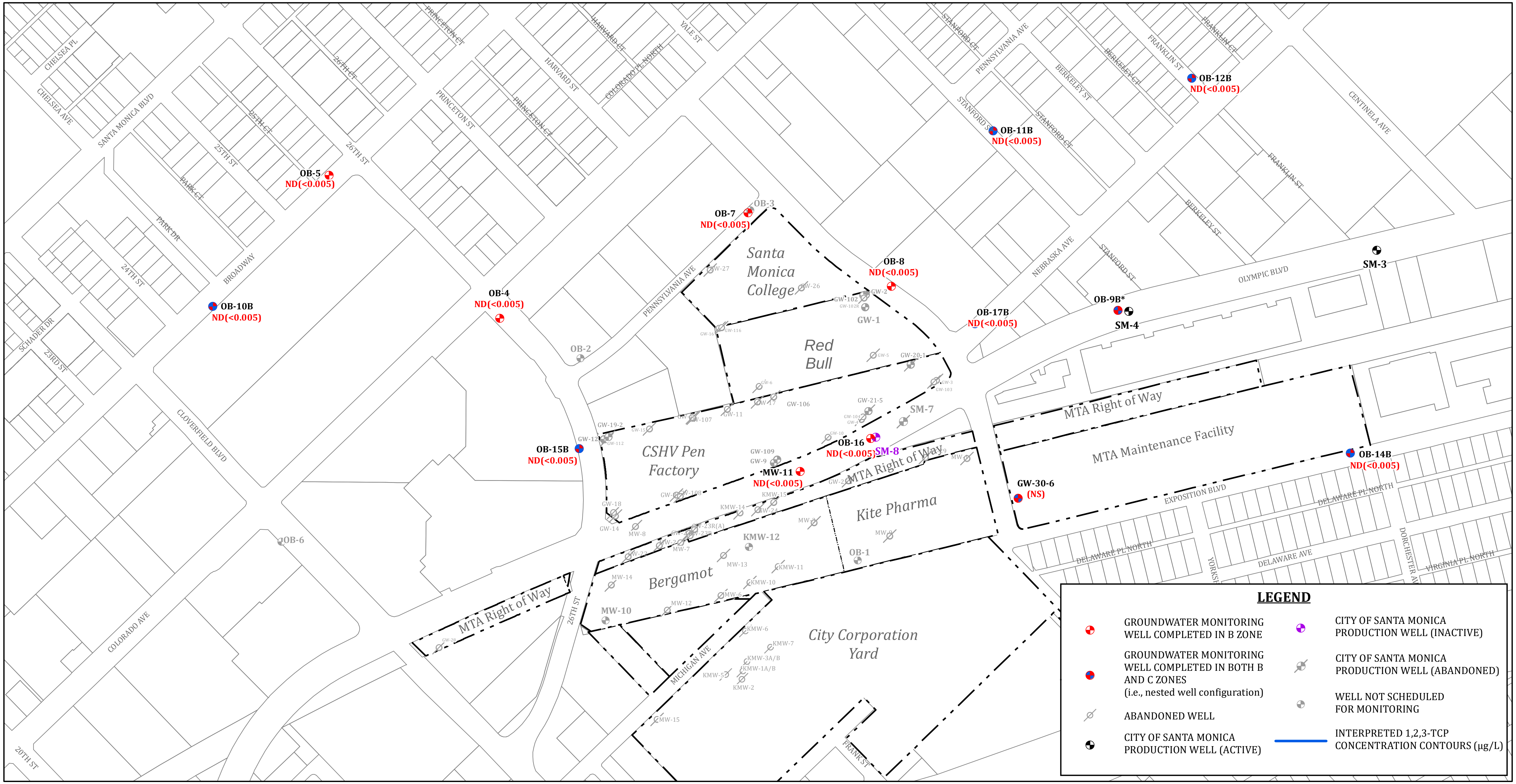
SCALE: 1 inch = 350 feet

DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 22 OF 44



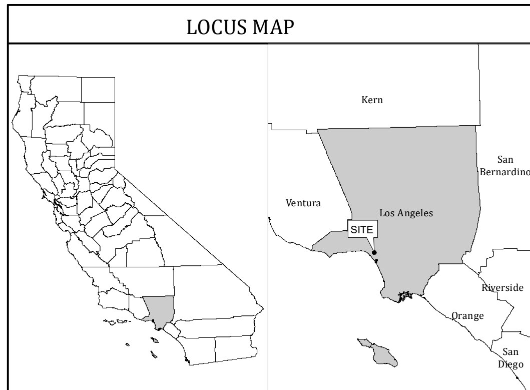
NOTES

1) NS = not sampled as well was dry.
2) ND = 1,2,3-Trichloropropane not detected above the laboratory reporting limit.
3) 1,2,3-Trichloropropane concentrations expressed as micrograms per liter (µg/L).
4) Groundwater monitoring wells sampled November 12-14, 2019.
5) * OB-9B not sampled. Hydraulic connection with B-Zone not established.

N W E S

0 700 Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

INTERPRETED DISTRIBUTION OF 1,2,3-TRICHLOROPROPANE IN B-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

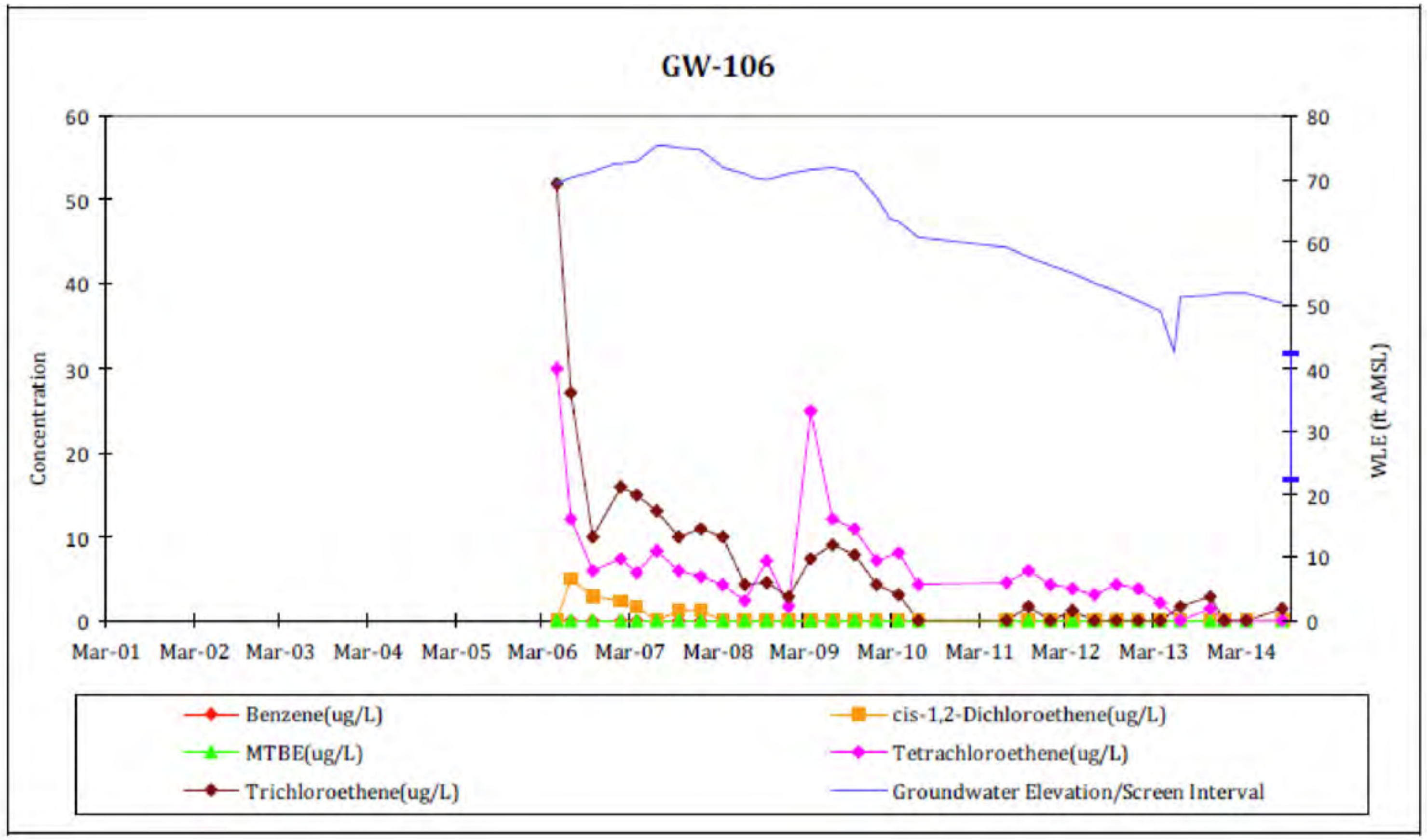
SCALE: 1 inch = 350 feet

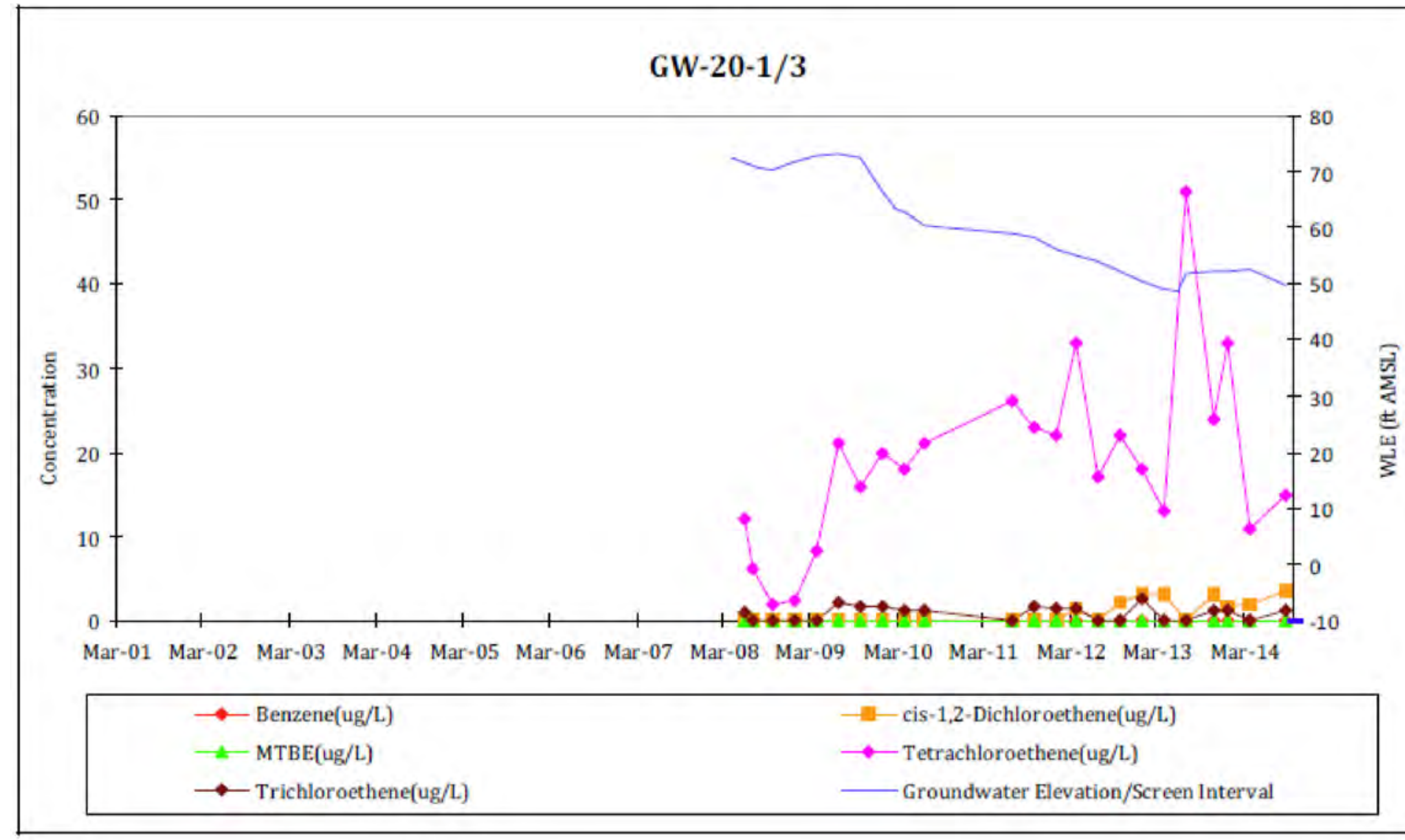
DATE: 05/2020

PRJ. NO.: 308038-07119

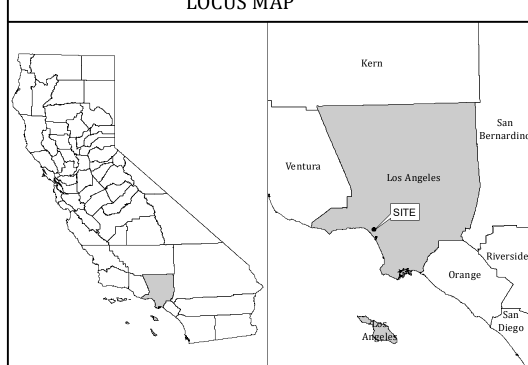
SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 23 OF 44





LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

SELECTED HISTORIC B-ZONE AQUIFER MONITORING WELL GROUNDWATER VOC AND WATER LEVEL TRENDS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

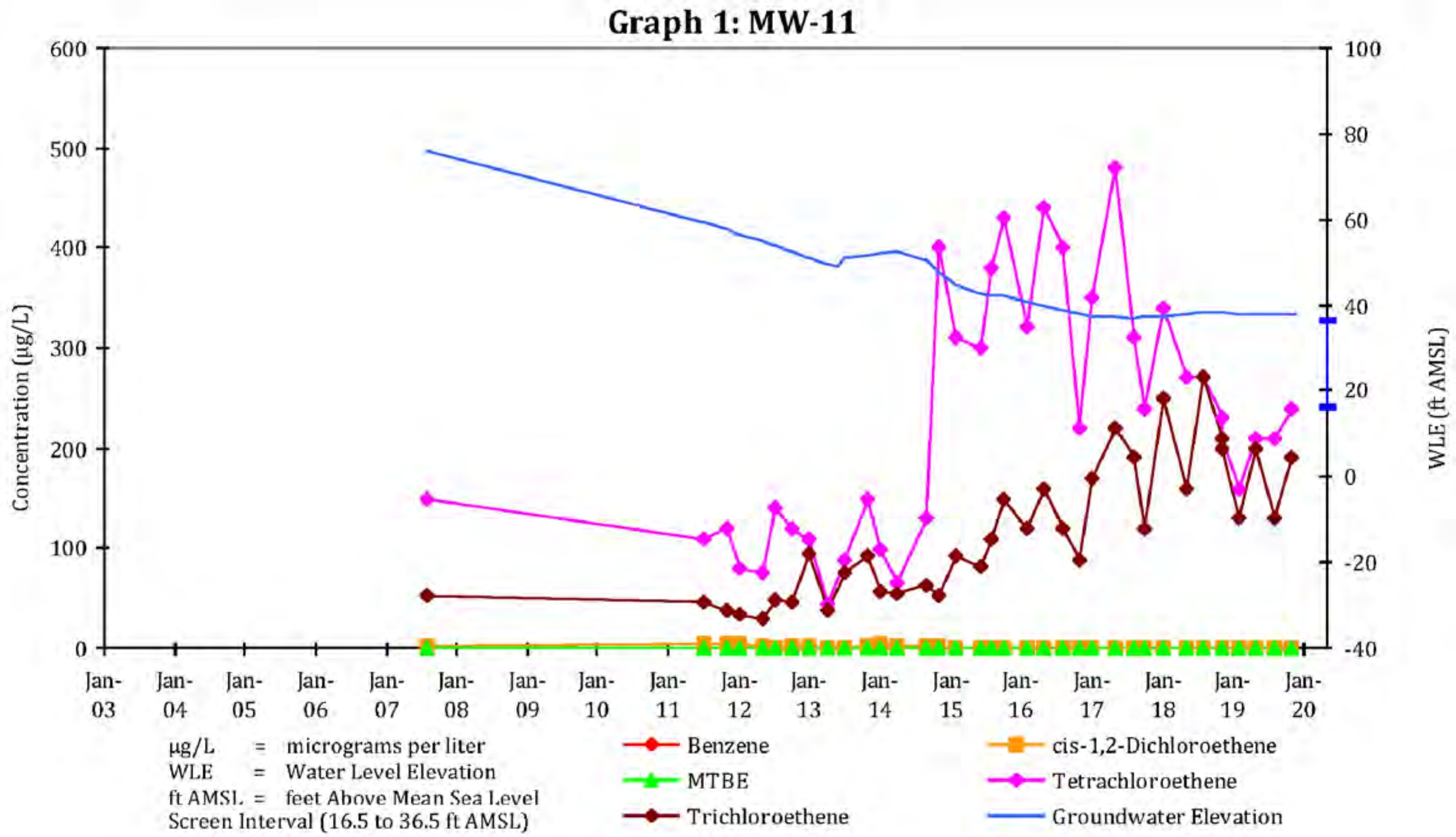
SCALE

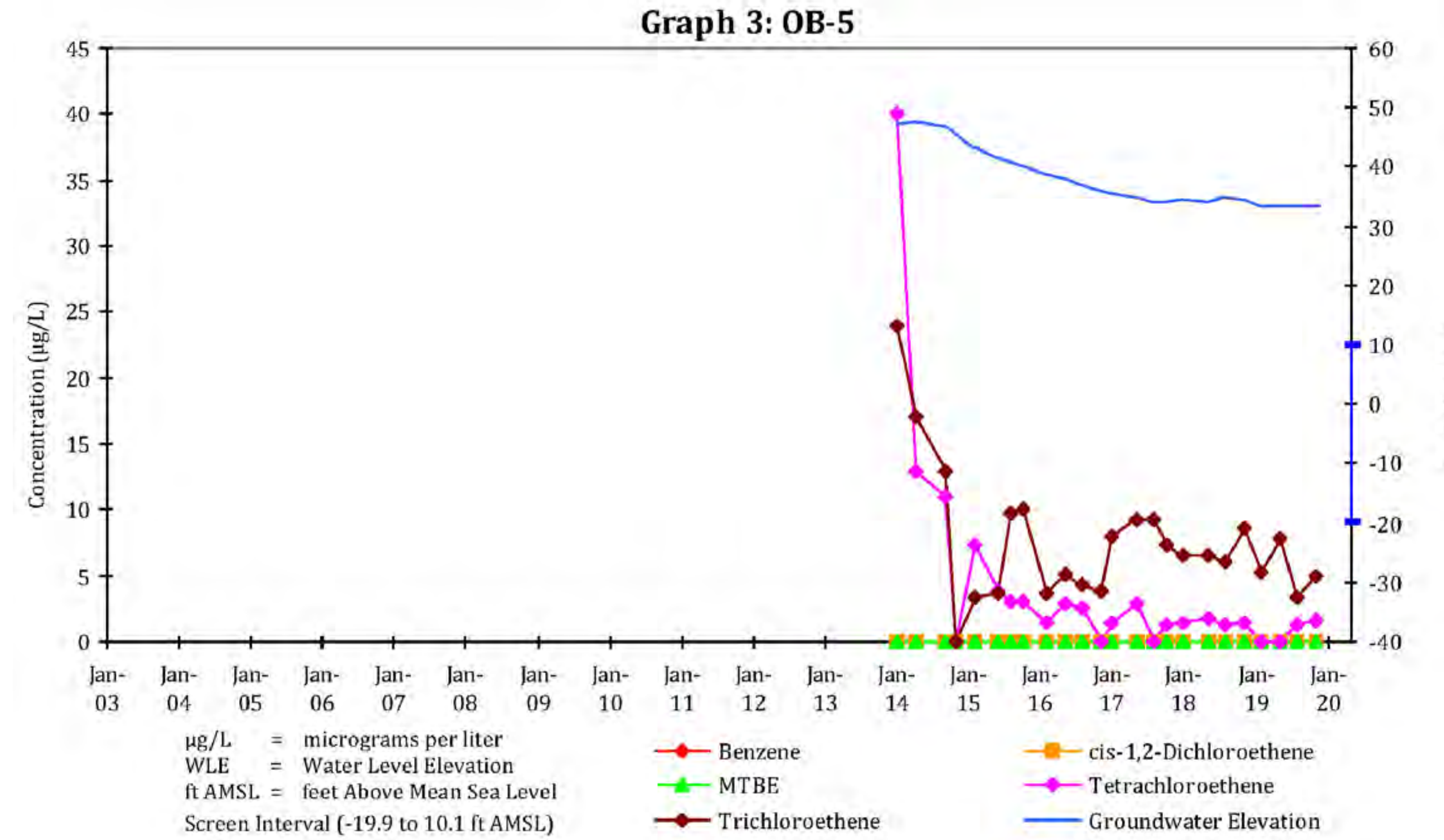
DATE: 05/2020

PRJ. NO. 308038-07119

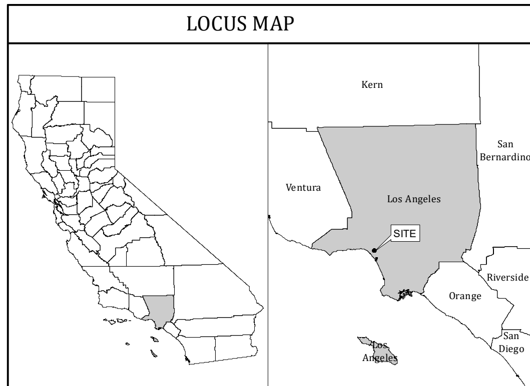
SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 24 OF 44





LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

SELECTED RECENT B-ZONE AQUIFER MONITORING WELL GROUNDWATER VOC AND WATER LEVEL TRENDS

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

SCALE

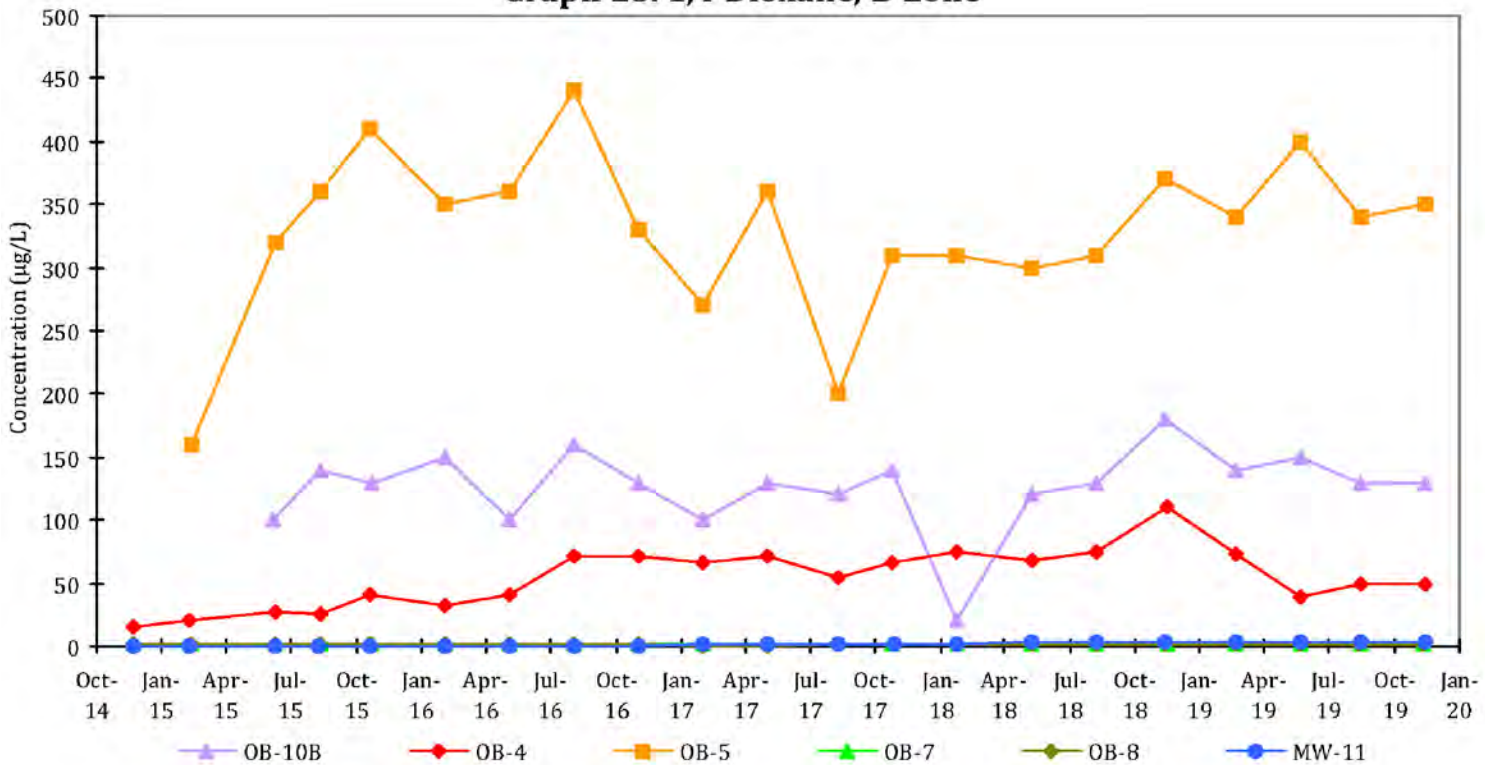
DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

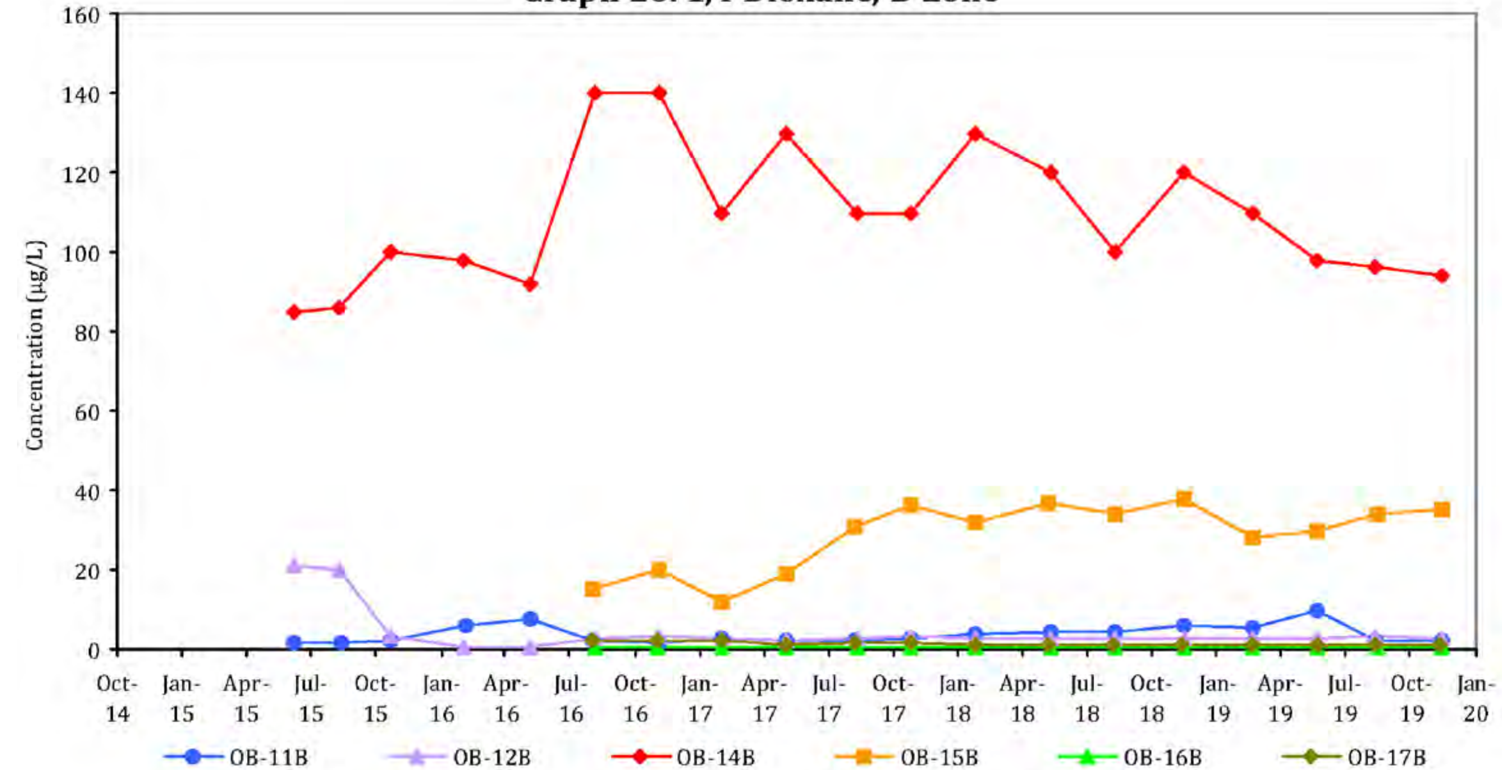
FIGURE 25 OF 44

Graph 25: 1,4-Dioxane, B-Zone



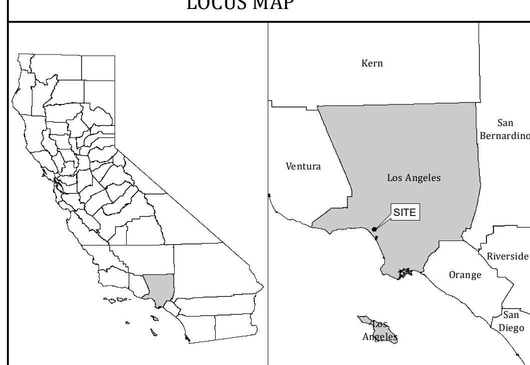
µg/L = micrograms per liter ft AMSL = feet Above Mean Sea Level

Graph 26: 1,4-Dioxane, B-Zone



µg/L = micrograms per liter ft AMSL = feet Above Mean Sea Level

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

1,4-DIOXANE HISTORICAL CONCENTRATIONS IN B-ZONE GROUNDWATER SAMPLES

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD SANTA MONICA, CALIFORNIA

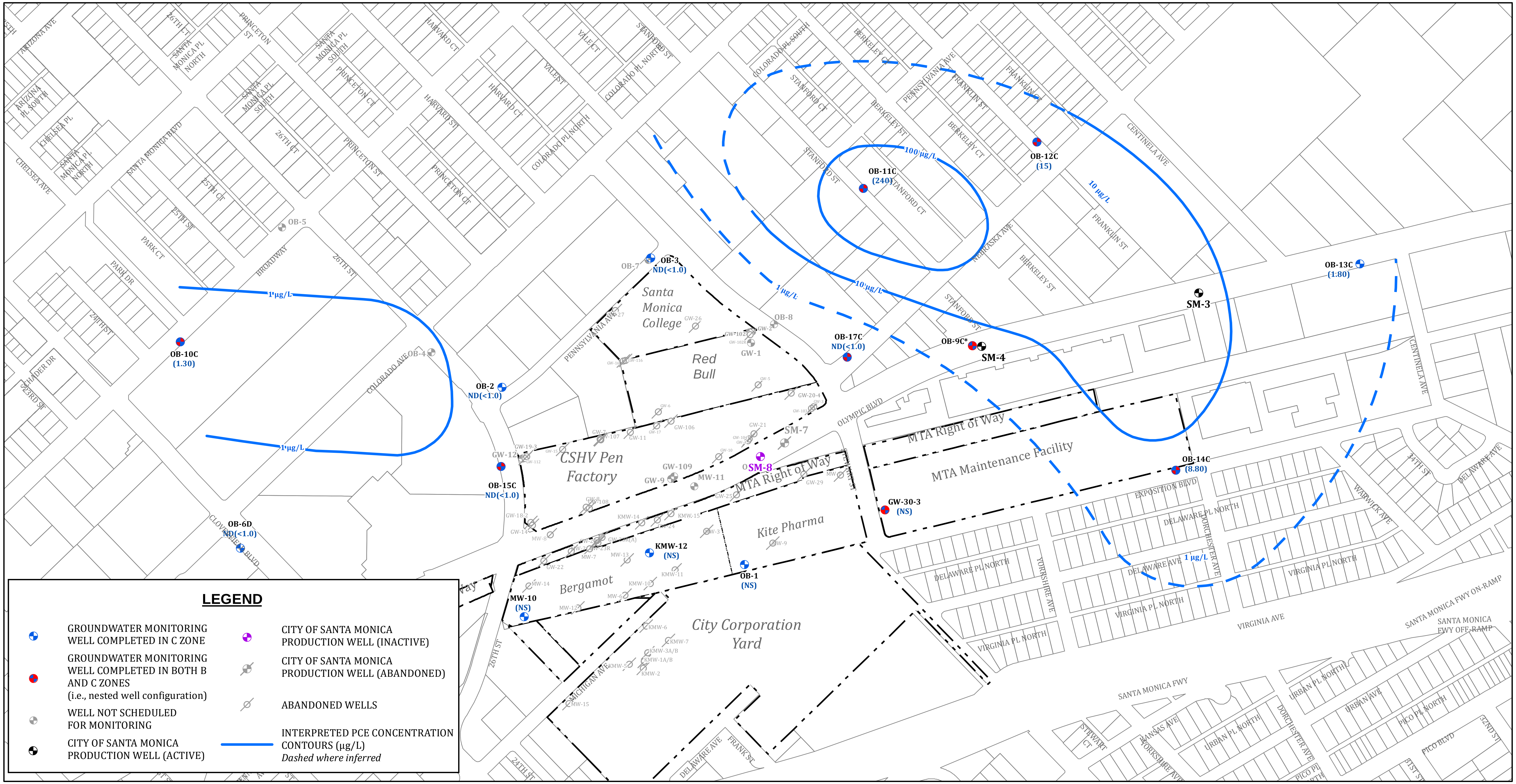
SCALE

DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

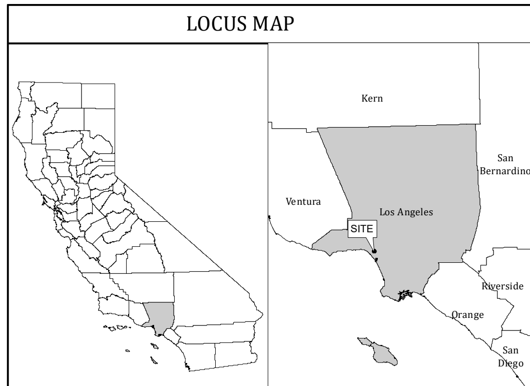
FIGURE 26 OF 44



NOTES

1) NS = not sampled as well was dry.
2) PCE = tetrachloroethylene
3) ND = PCE not detected above the laboratory reporting limit.
4) PCE concentrations expressed as micrograms per liter (µg/L).
5) Groundwater monitoring wells sampled November 13-15, 2019.
6) * OB-9C not sampled. Hydraulic connection with B-Zone not established.

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

INTERPRETED DISTRIBUTION OF PCE IN C-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

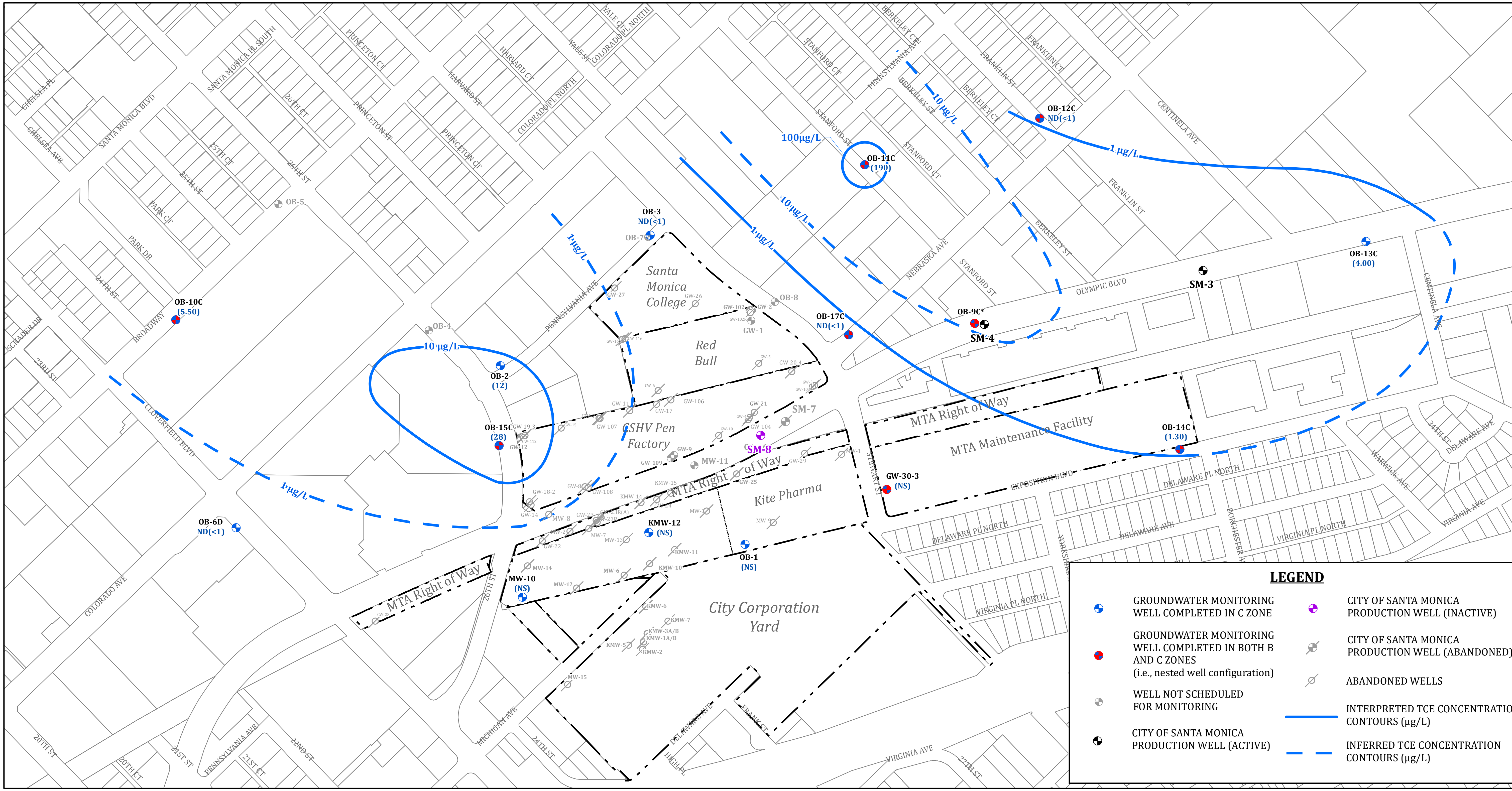
SCALE: 1 inch = 400 feet

DATE: 05/2020

PRJ. NO. 308038-07119

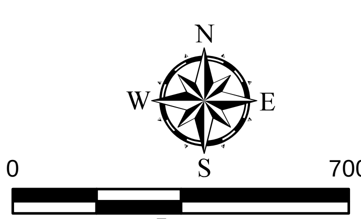
SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 27 OF 44

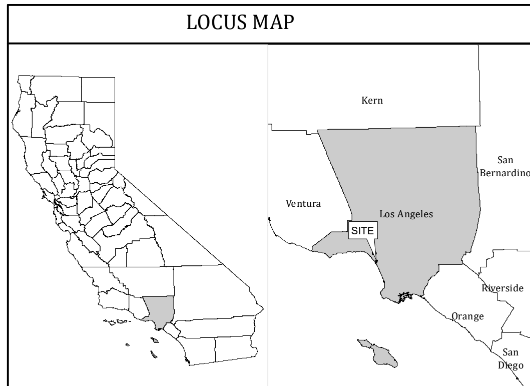


NOTES

1) NS = not sampled as well was dry.
2) TCE = trichloroethylene.
3) ND = TCE not detected above the laboratory reporting limit.
4) TCE concentrations expressed as micrograms per liter (µg/L).
5) Groundwater monitoring wells sampled November 13-15, 2019.
6) * OB-9C not sampled. Hydraulic connection with B-Zone not established.



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

INTERPRETED DISTRIBUTION OF TCE IN C-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

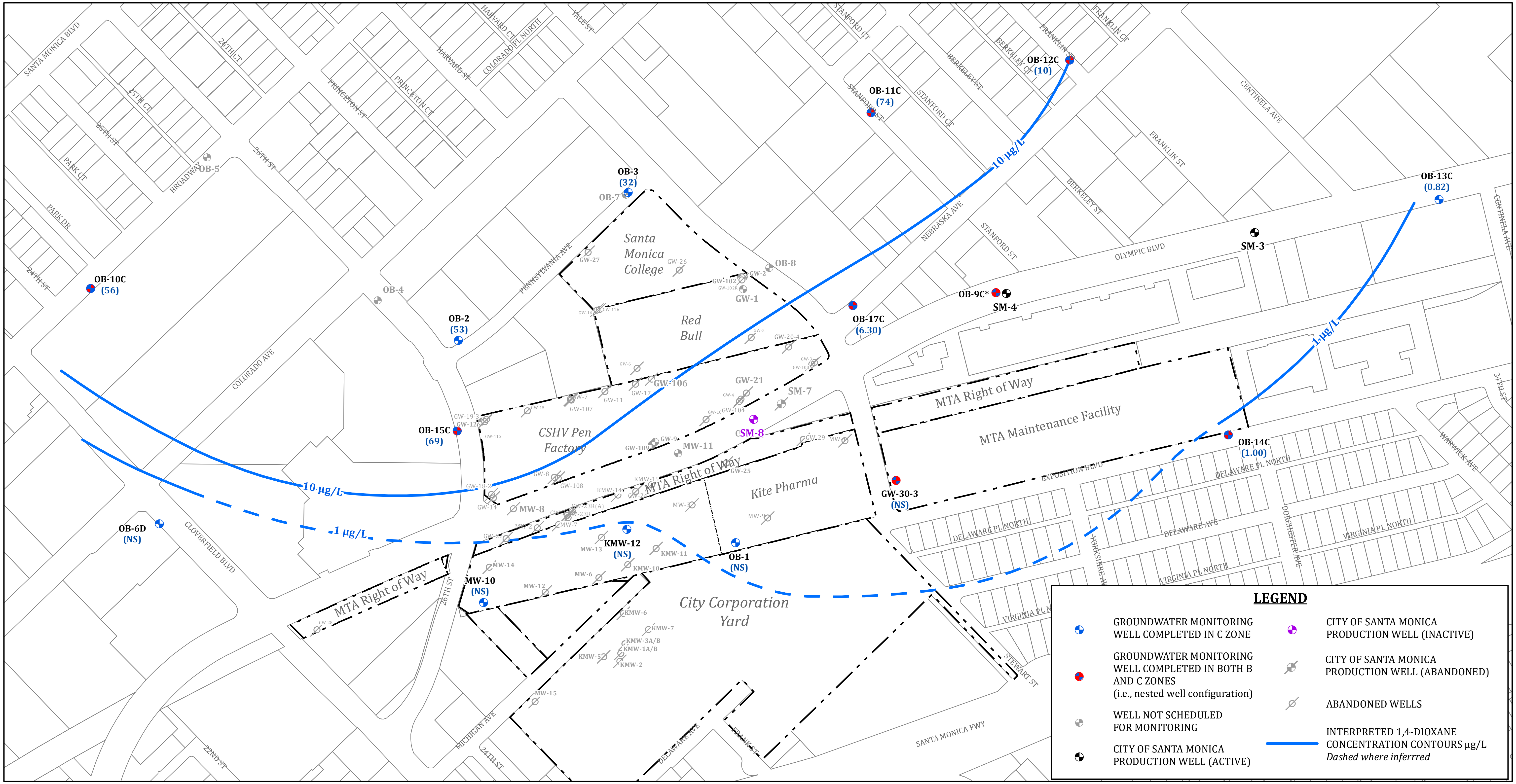
SCALE: 1 inch = 400 feet

DATE: 05/2020

PRJ. NO. 308038-07119

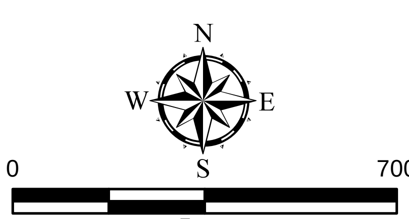
SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 28 OF 44

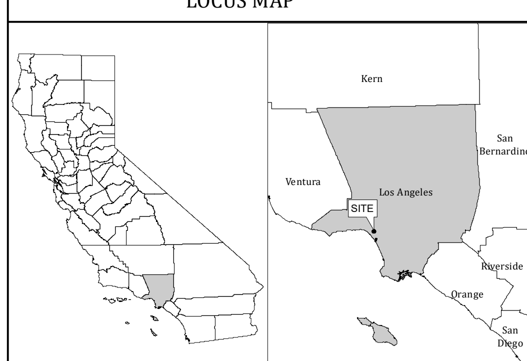


NOTES

1) NS = not sampled as well was dry.
2) ND = 1,4-dioxane not detected above the laboratory reporting limit.
3) 1,4-dioxane concentrations expressed as micrograms per liter (µg/L).
4) Groundwater monitoring wells sampled November 13-16, 2019.
5) * OB-9C not sampled. Hydraulic connection with B-Zone not established.



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

INTERPRETED DISTRIBUTION OF 1,4-DIOXANE IN C-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

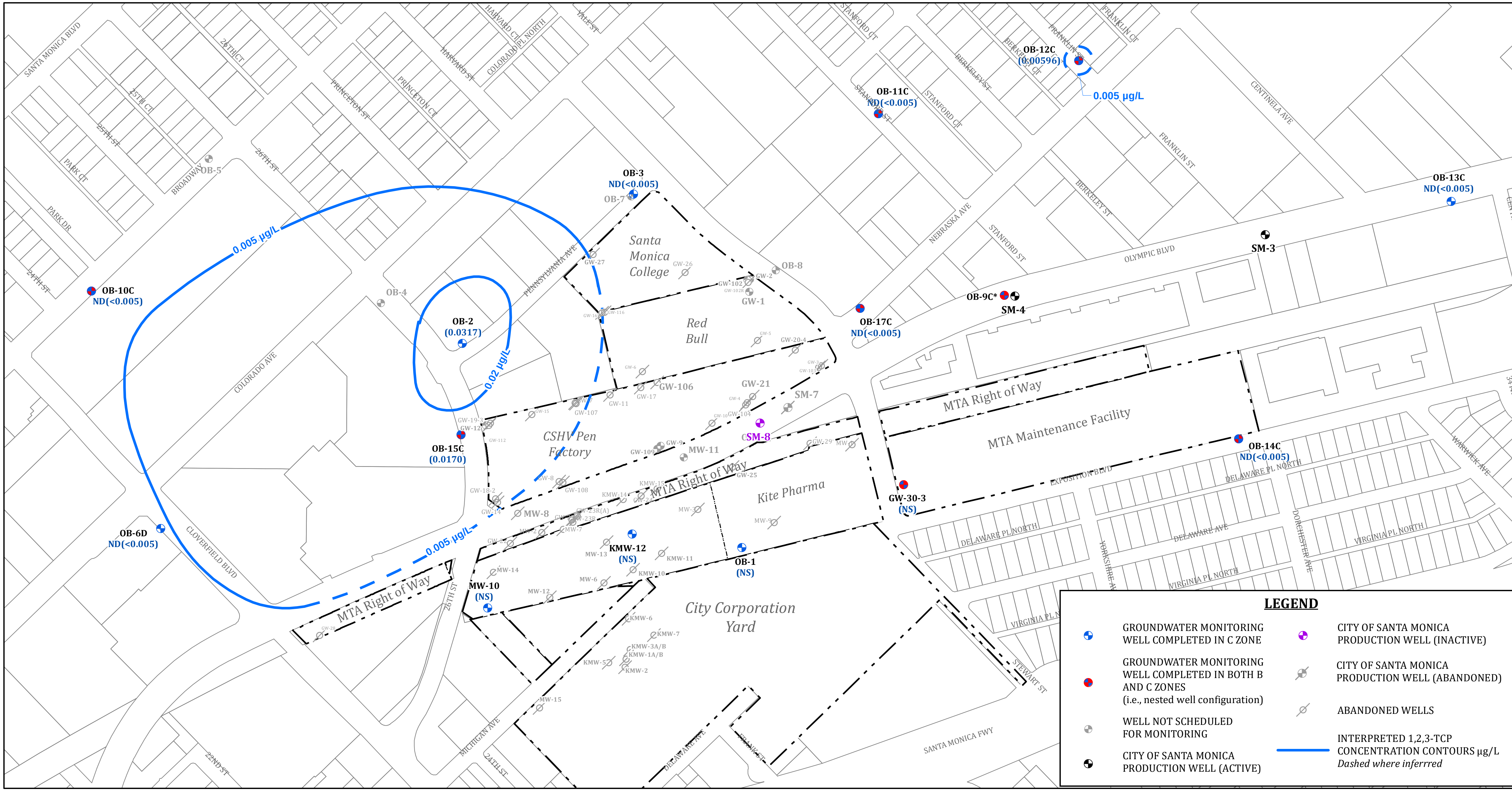
SCALE: 1 inch = 350 feet

DATE: 05/2020

PRJ. NO.: 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

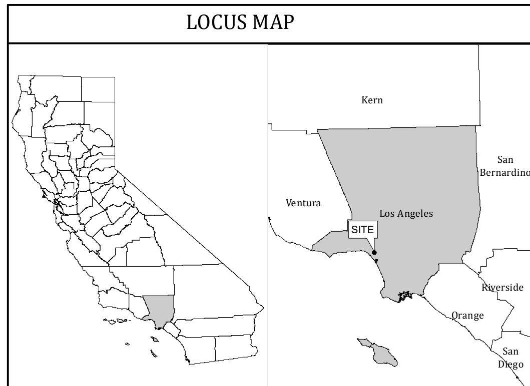
FIGURE 29 OF 44



NOTES

1) NS = not sampled as well was dry.
2) ND = 1,2,3-Trichloropropane not detected above the laboratory reporting limit.
3) 1,2,3-Trichloropropane concentrations expressed as micrograms per liter (µg/L).
4) Groundwater monitoring wells sampled November 12-14, 2019.
5) * OB-9C not sampled. Hydraulic connection with B-Zone not established.

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

INTERPRETED DISTRIBUTION OF 1,2,3-TRICHLOROPROPANE IN C-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD, SANTA MONICA, CALIFORNIA

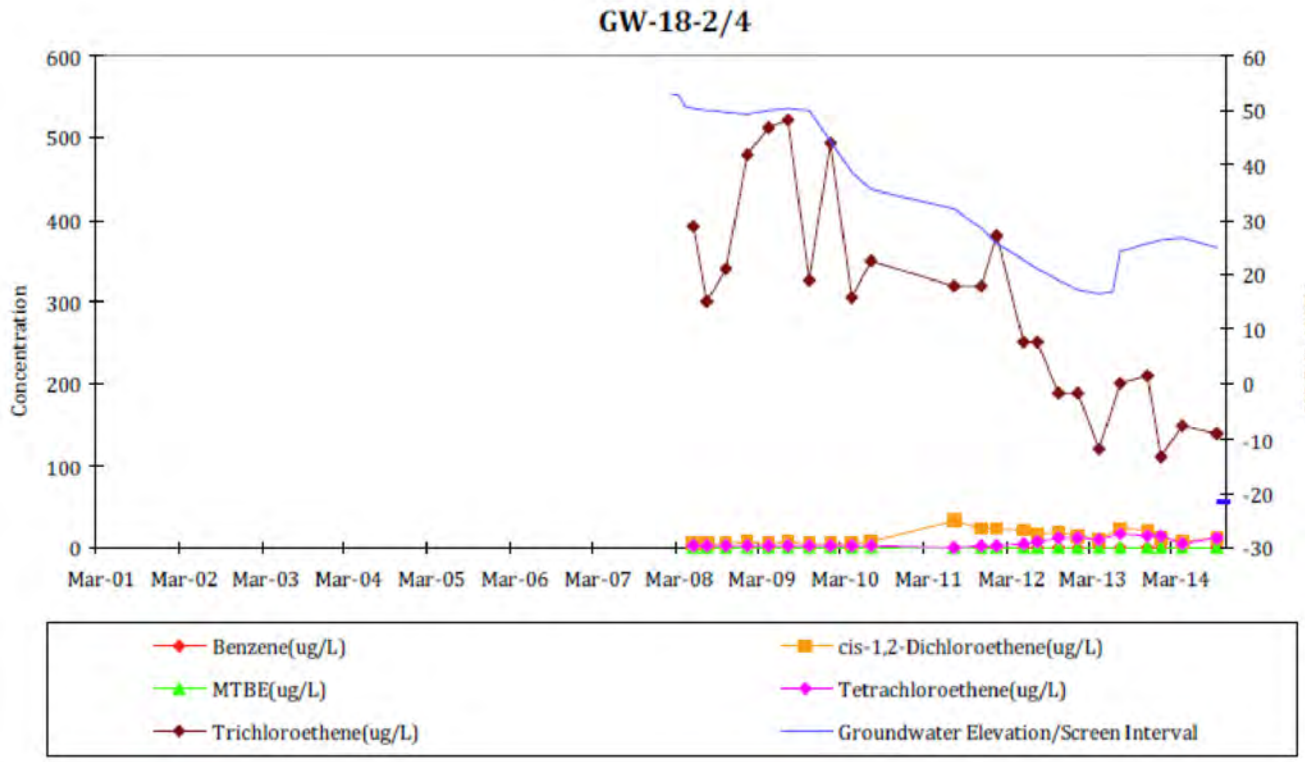
SCALE: 1 inch = 350 feet

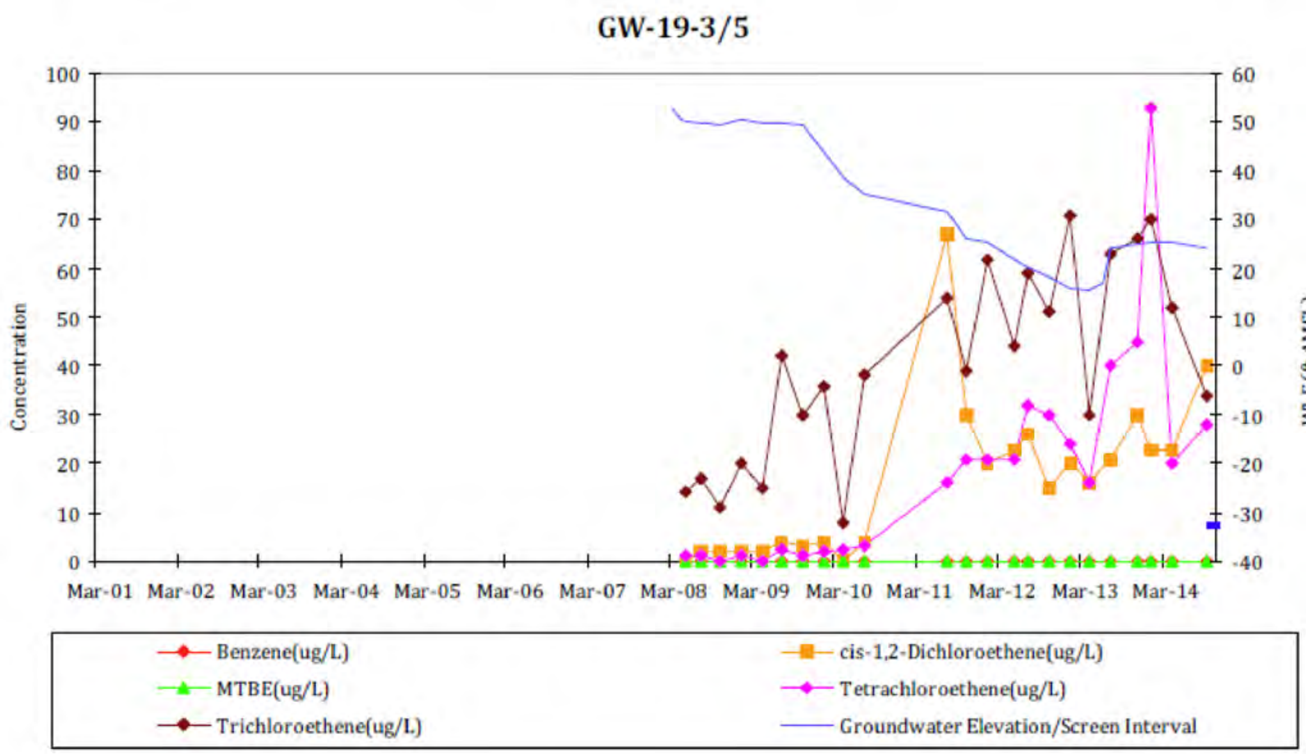
DATE: 05/2020

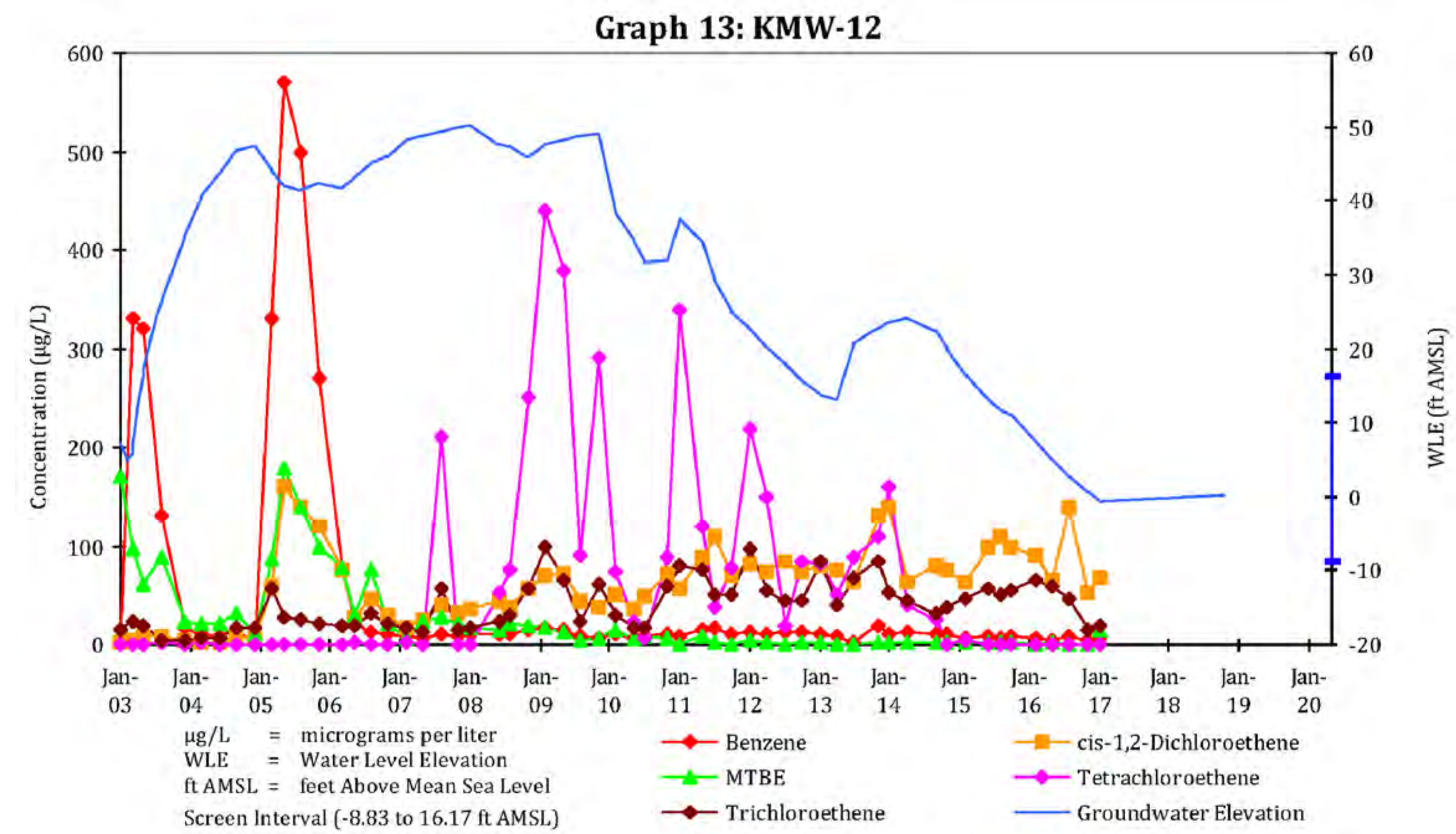
PRJ. NO.: 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

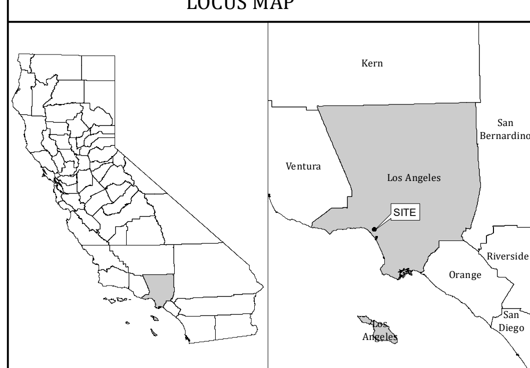
FIGURE 30 OF 44







LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

SELECTED C-ZONE MONITORING WELL GROUNDWATER VOC AND WATER LEVEL TRENDS

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD SANTA MONICA, CALIFORNIA

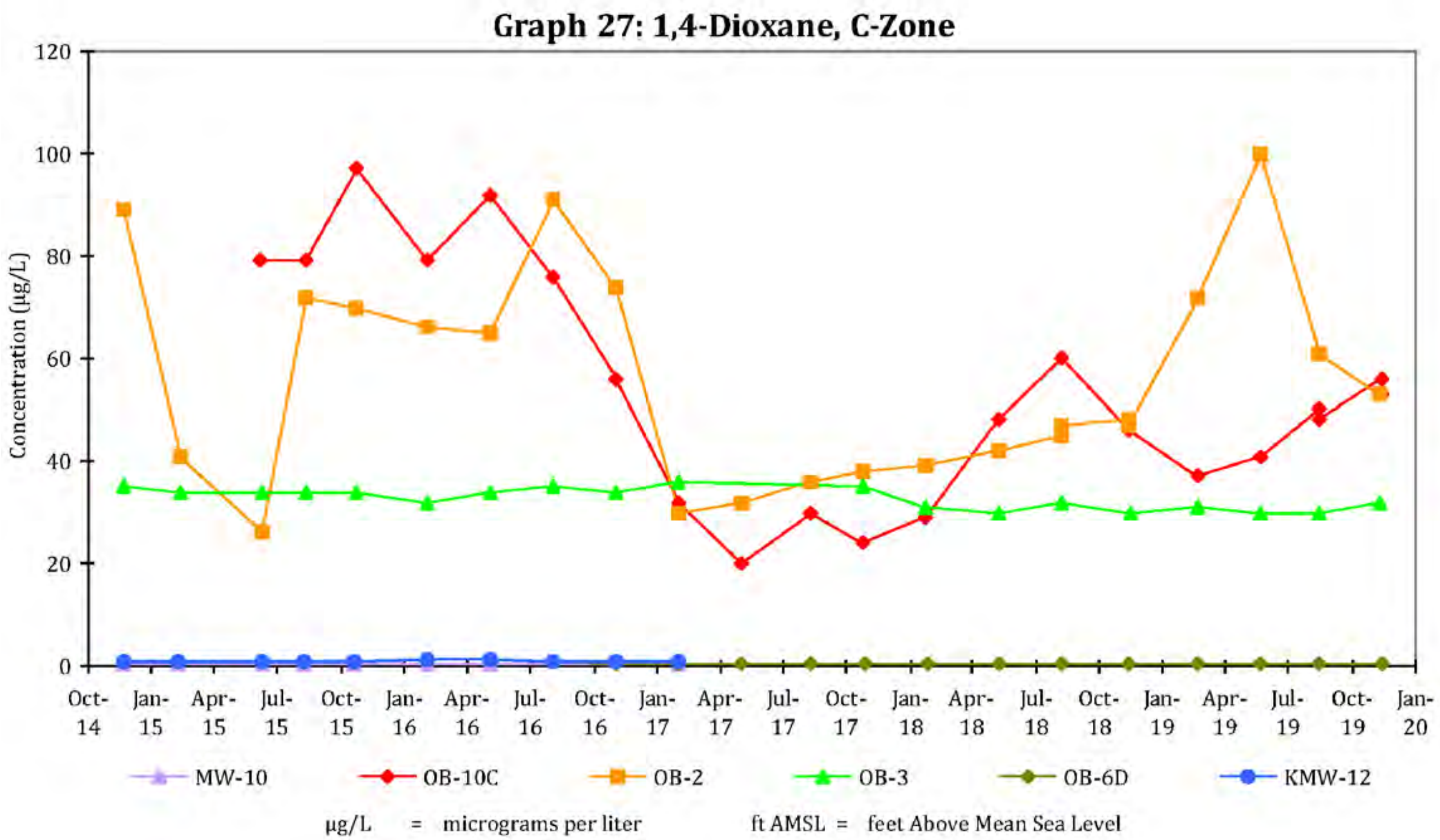
SCALE

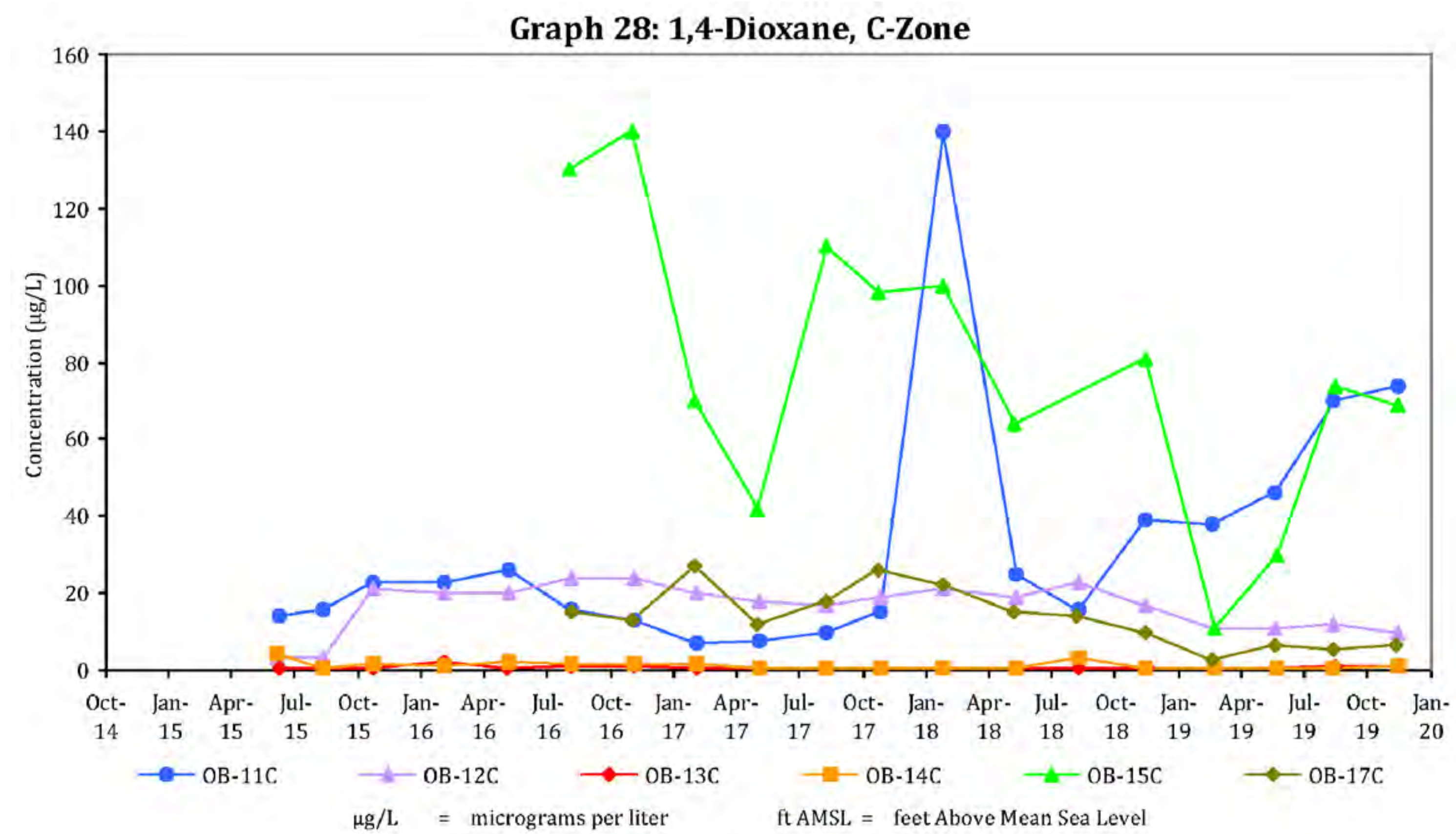
DATE: 05/2020

PRJ. NO. 308038-07119

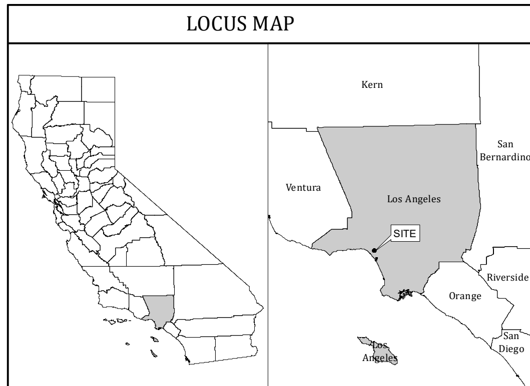
SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 31 OF 44





LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

SELECTED C-ZONE MONITORING WELL GROUNDWATER 1,4-DIOXANE AND WATER LEVEL TRENDS

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

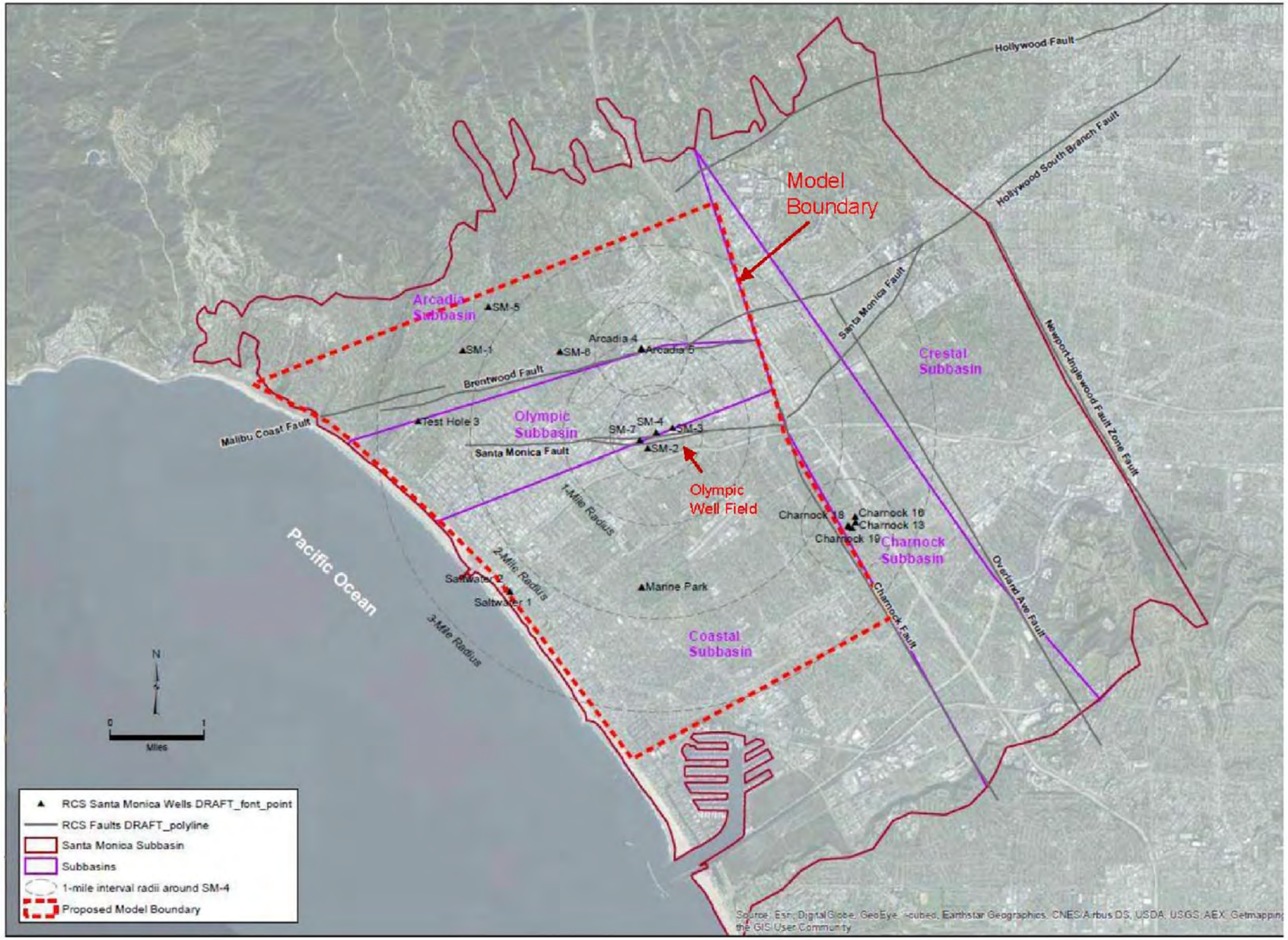
SCALE

DATE: 05/2020

PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 32 OF 44

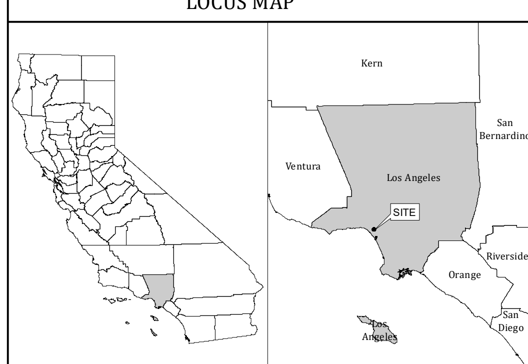


NOTES:
1) Elevations above mean sea level (AMSL)

N W E S

0 700
Feet

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

NUMERICAL MODEL DOMAIN

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

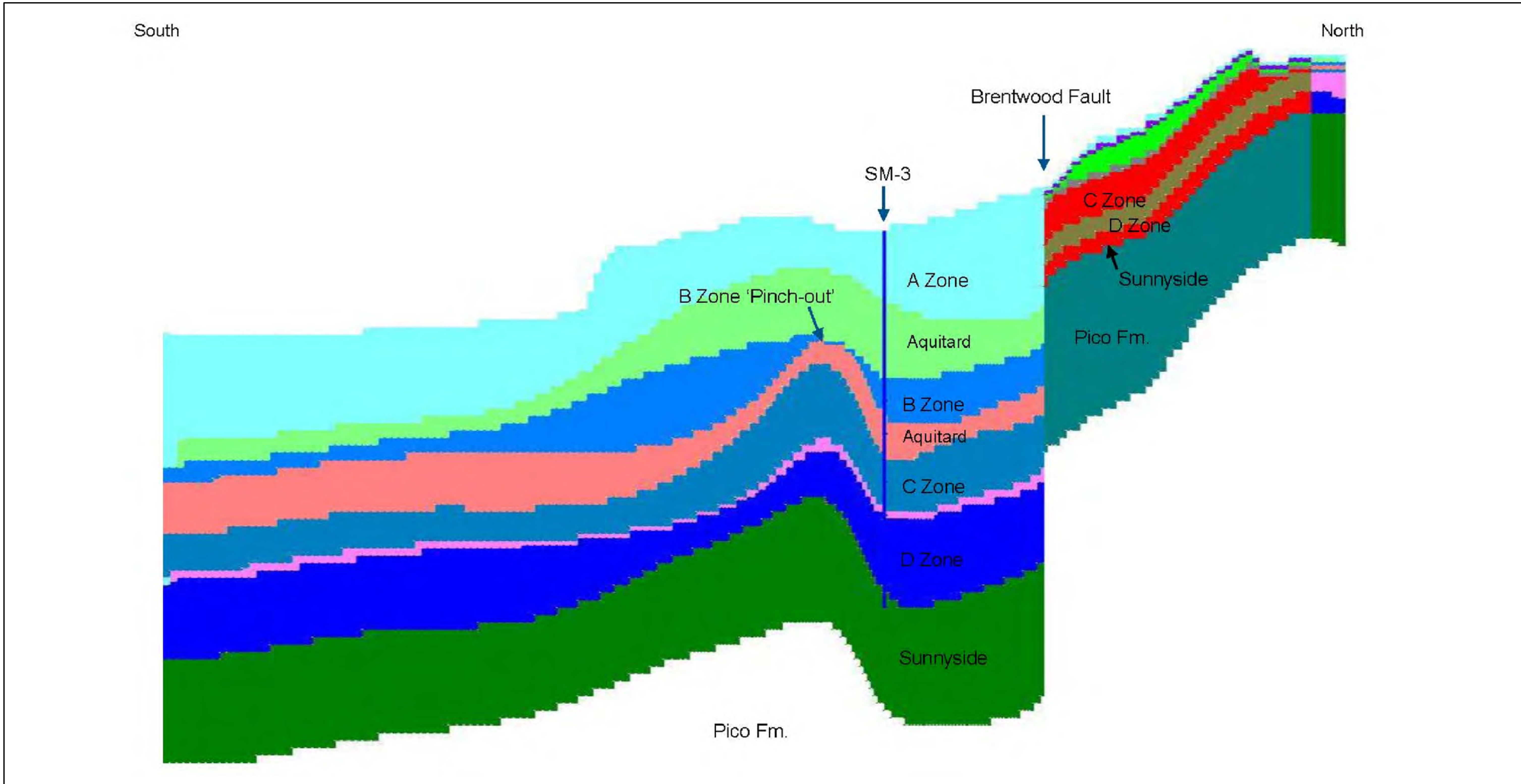
SCALE

DATE
05/2020

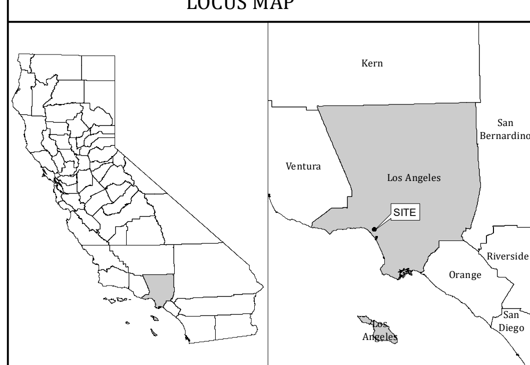
PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 33 OF 44



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

REPRESENTATIVE CROSS SECTION THROUGH MODEL DOMAIN

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

SCALE

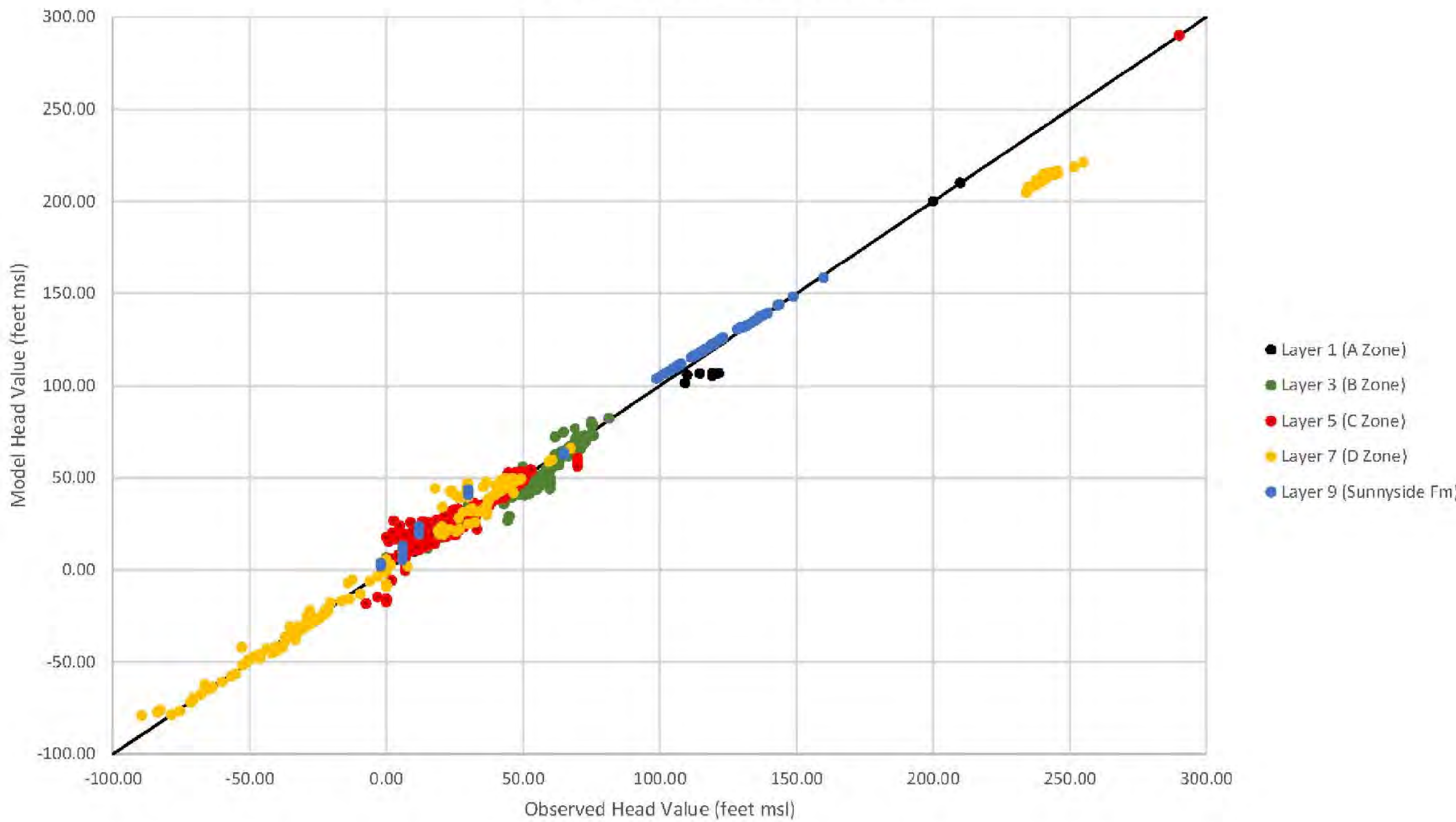
DATE 05/2020

PRJ. NO. 308038-07119

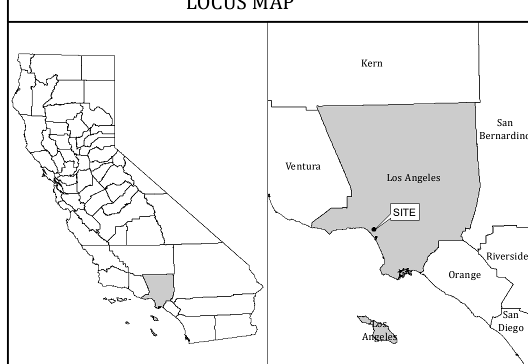
SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 34 OF 44

Figure 12
Observed vs. Computed Target (Head) Values
Olympic Well Field Groundwater Model



LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

SIMULATED VS OBSERVED HEADS IN CALIBRATED MODEL

PREPARED FOR

CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

SCALE

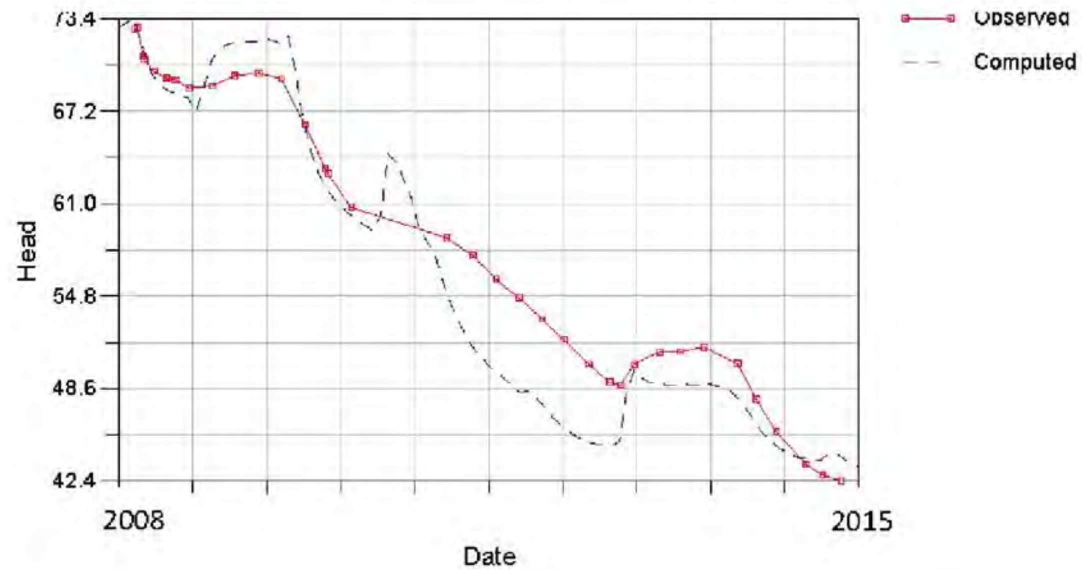
DATE 05/2020

PRJ. NO. 308038-07119

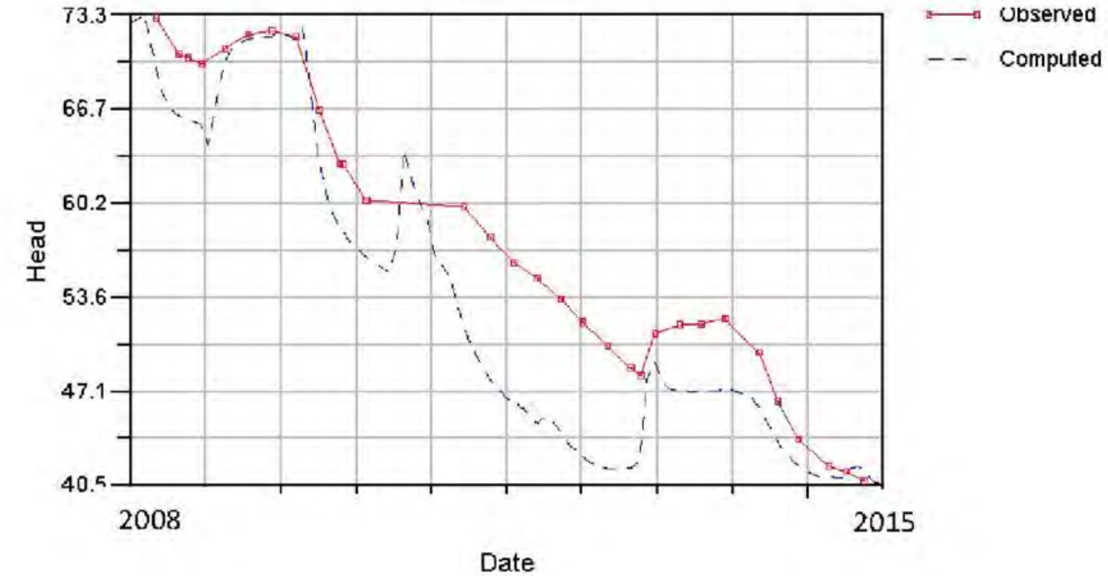
SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 35 OF 44

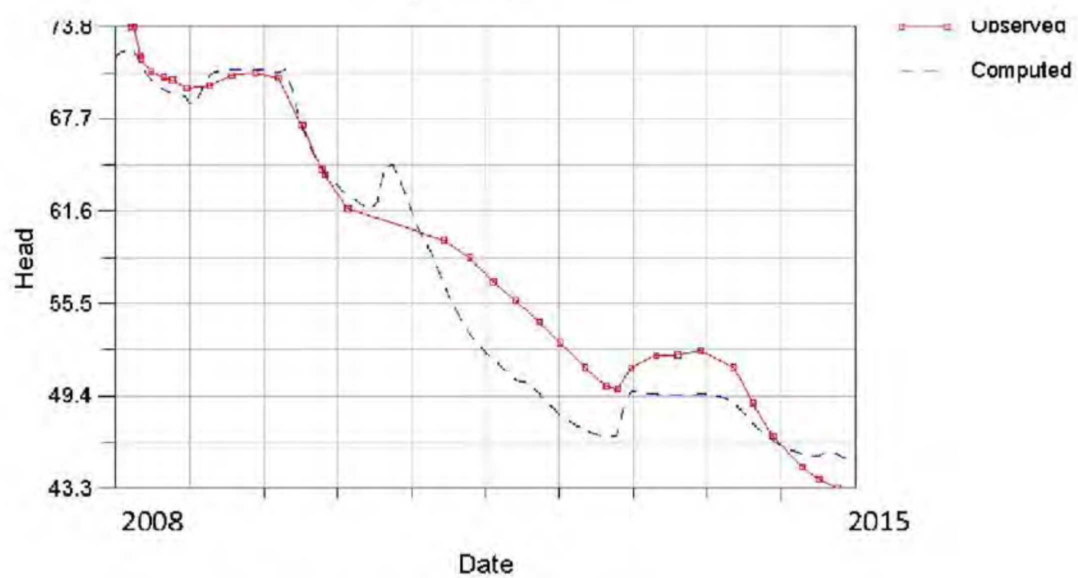
GW-19-4



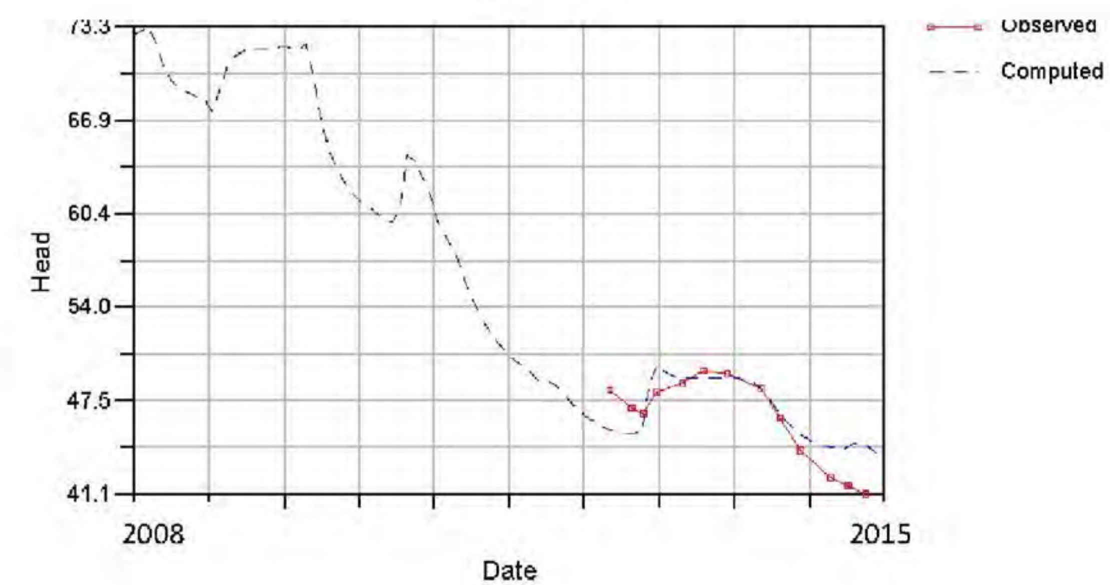
GW-106



OB-10B*

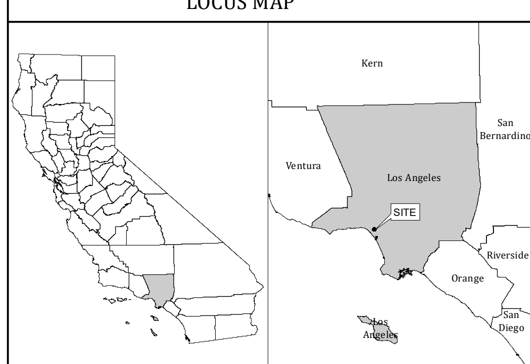


OB-4



*2008 – 2013 Data extrapolated from GW-19-4

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

HYDROGRAPHS OF COMPUTED VS OBSERVED HEADS IN SELECT B-ZONE MONITORING WELLS

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

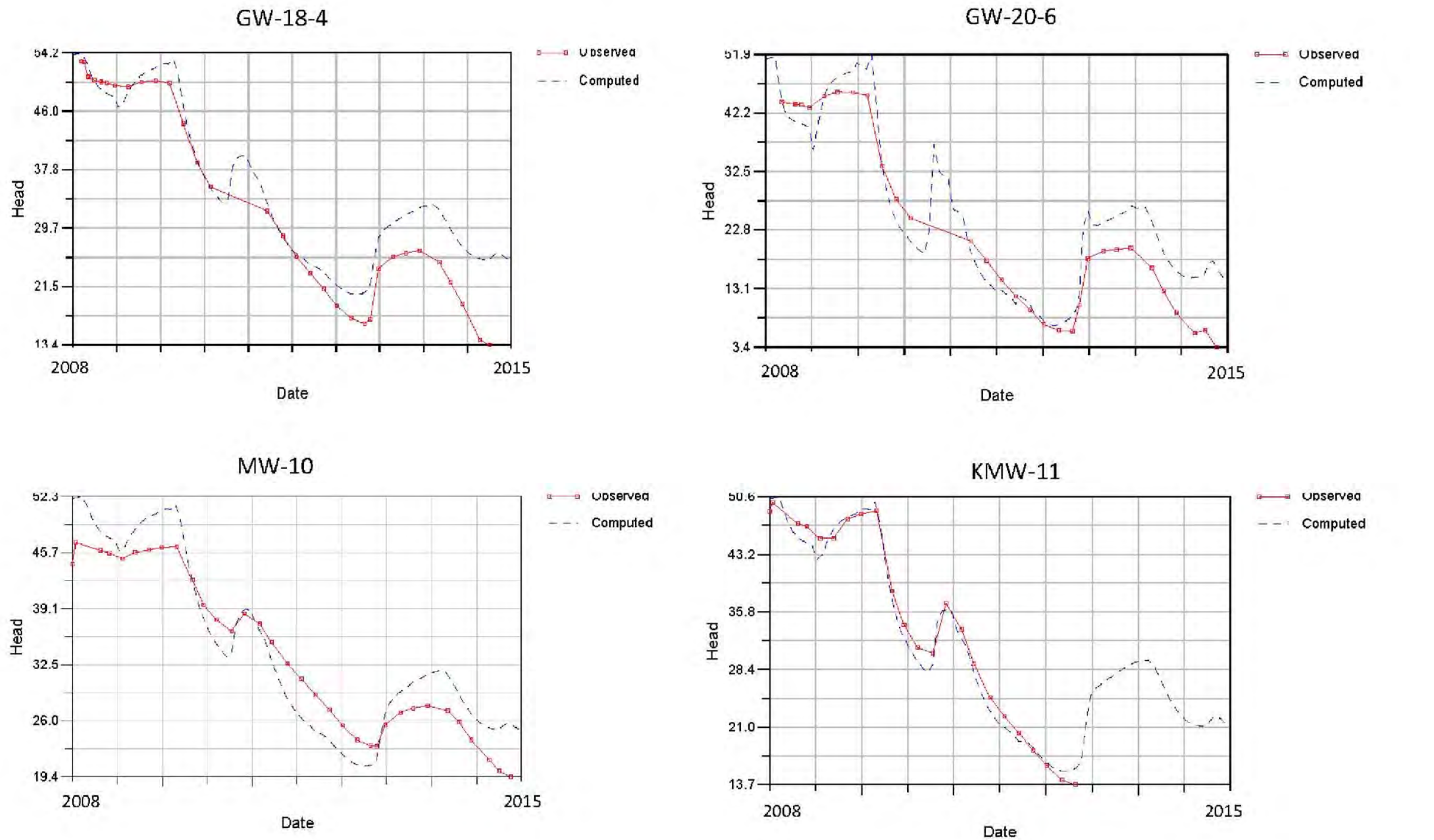
SCALE

DATE 05/2020

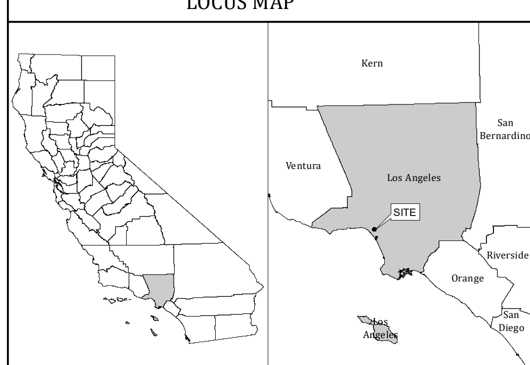
PRJ. NO. 308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 36 OF 44



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

HYDROGRAPHS OF COMPUTED VS OBSERVED HEADS IN SELECT C-ZONE MONITORING WELLS

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

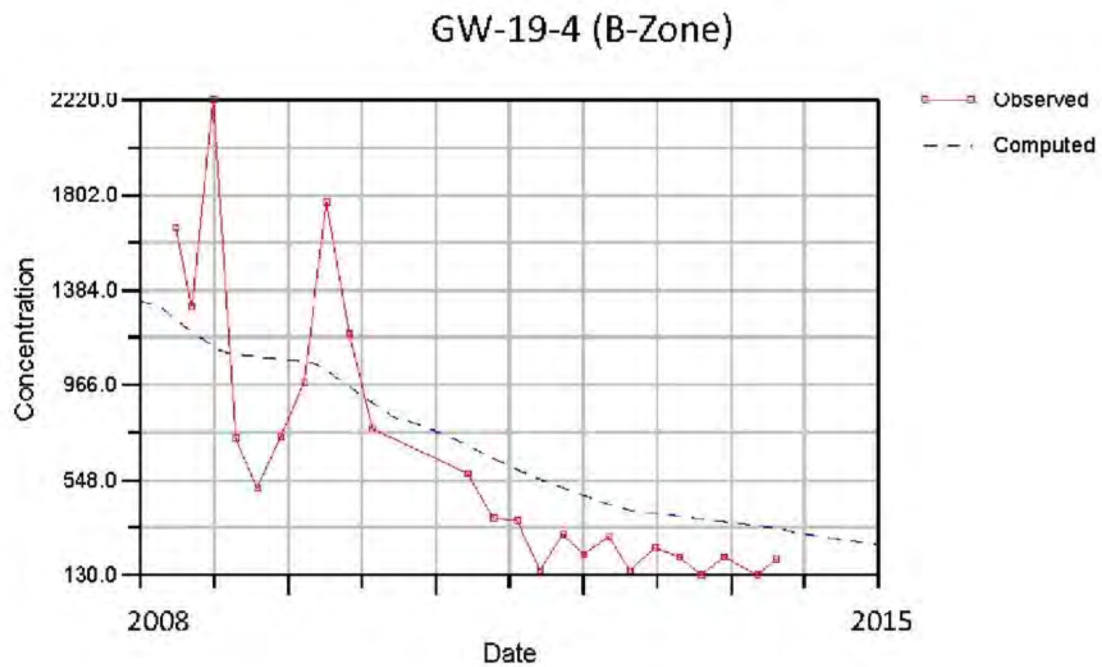
SCALE

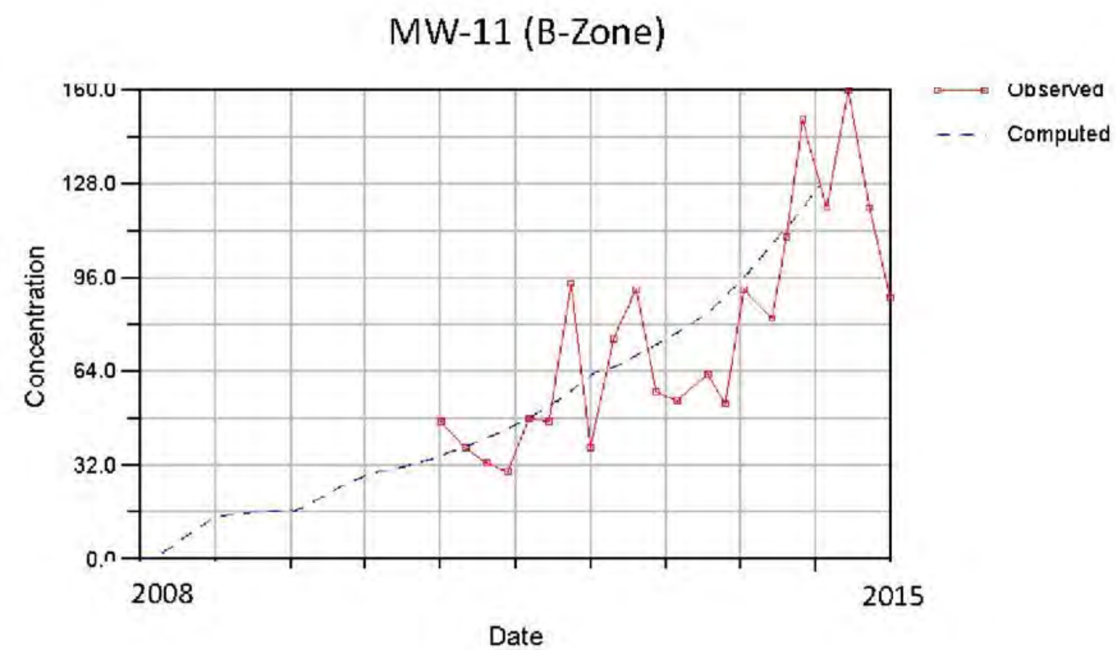
DATE
05/2020

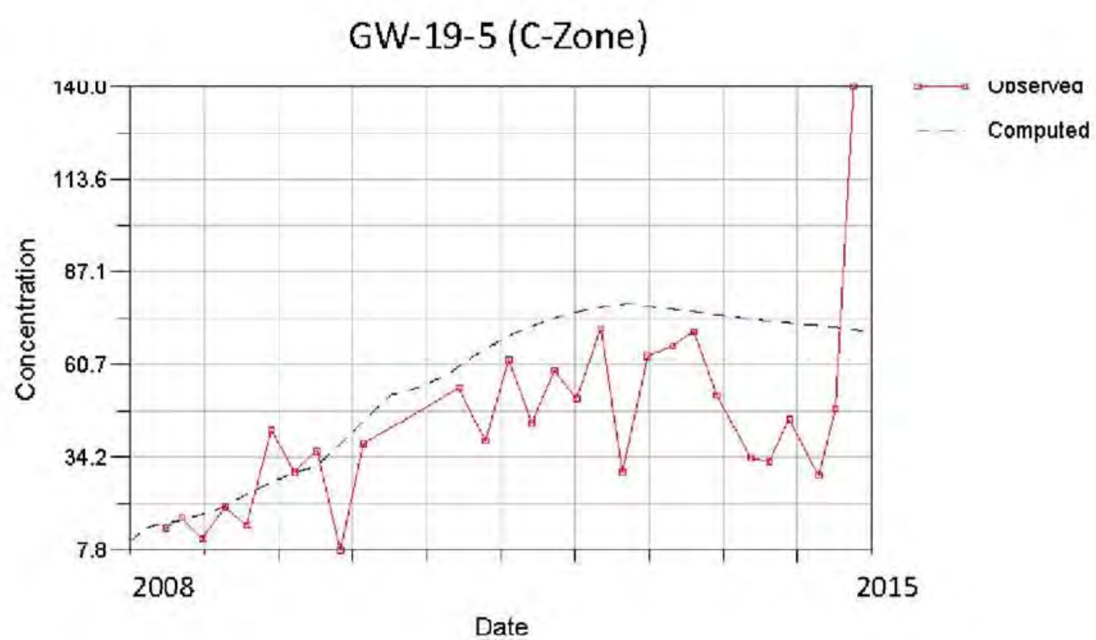
PRJ. NO.
308038-07119

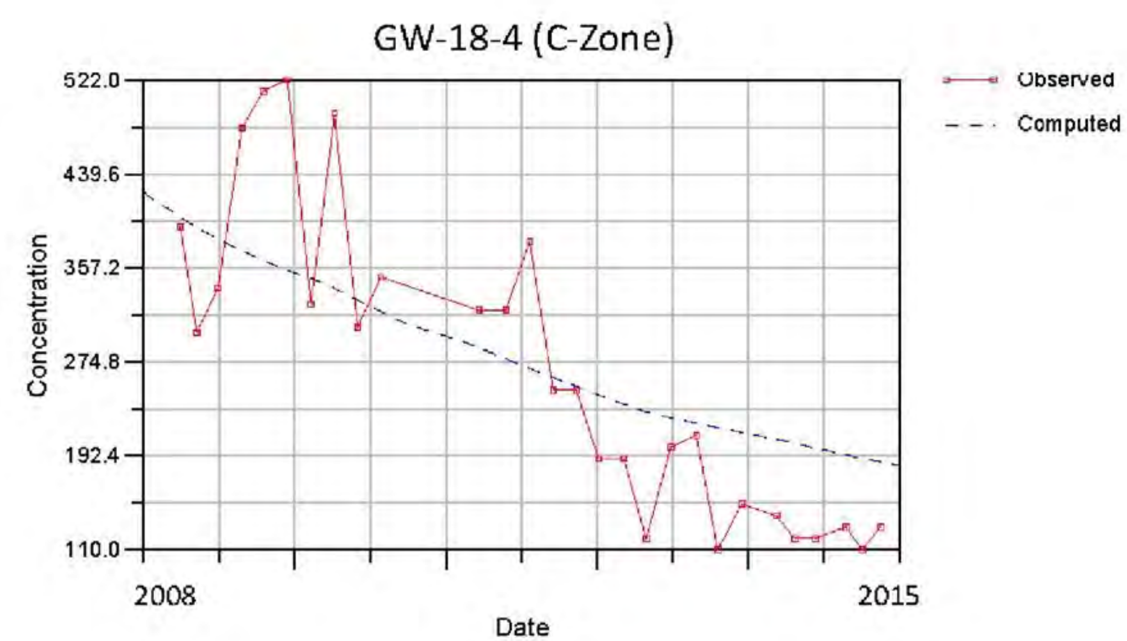
SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 37 OF 44

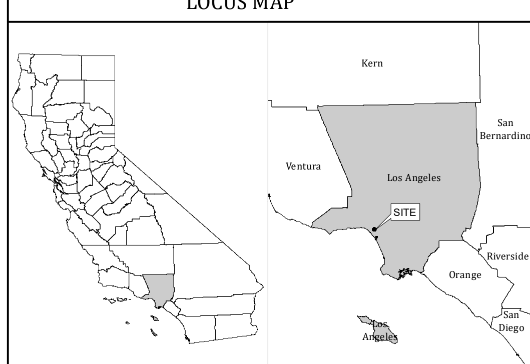








LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

CHEMICAL HYDROGRAPHS OF COMPUTED VS OBSERVED TCE IN SELECTED B- AND C-ZONE MONITORING WELLS

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

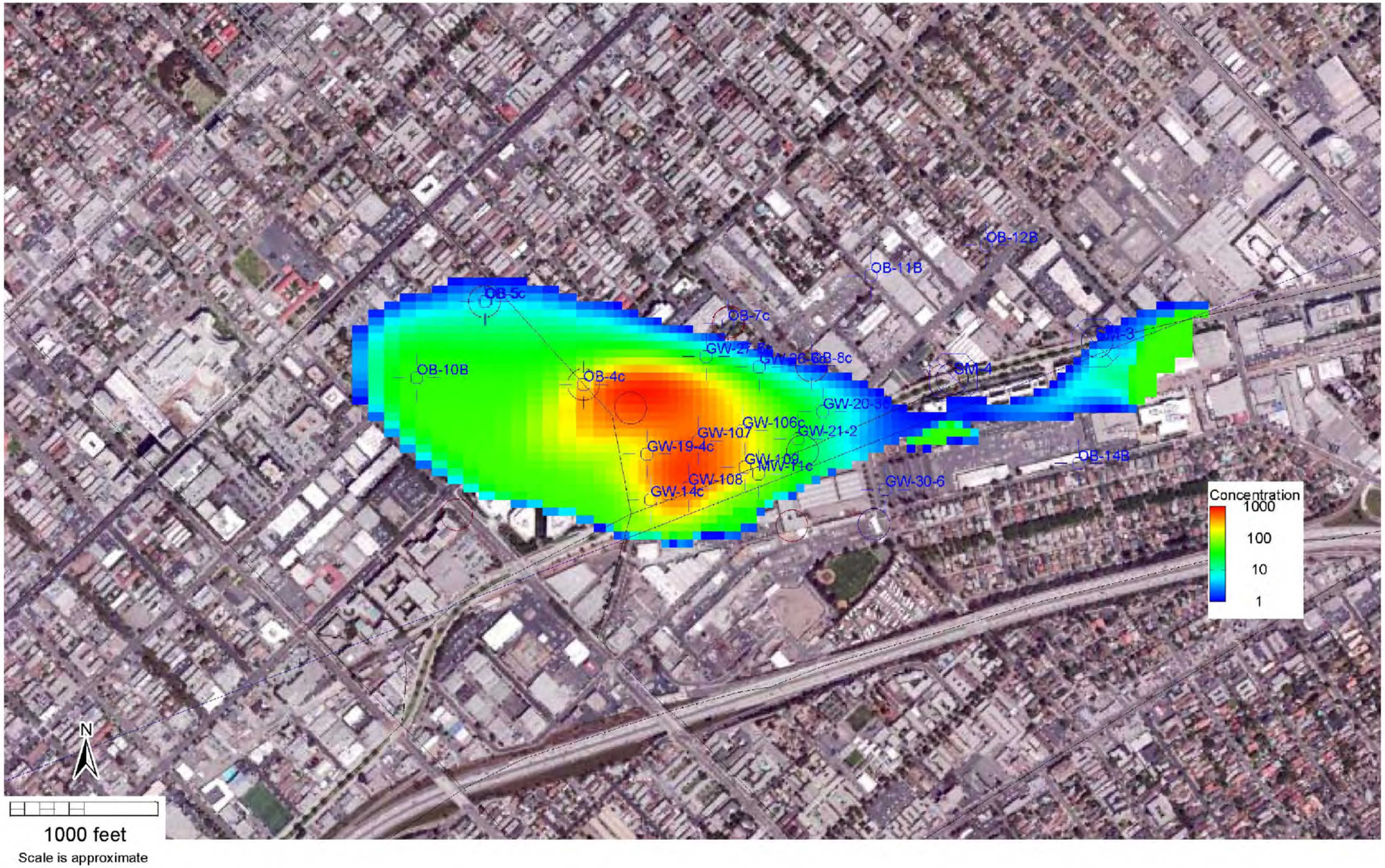
SCALE:

DATE: 05/2020

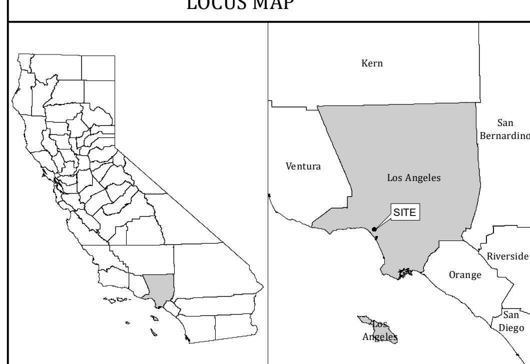
PRJ. NO. 308038-07119

SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 38 OF 44



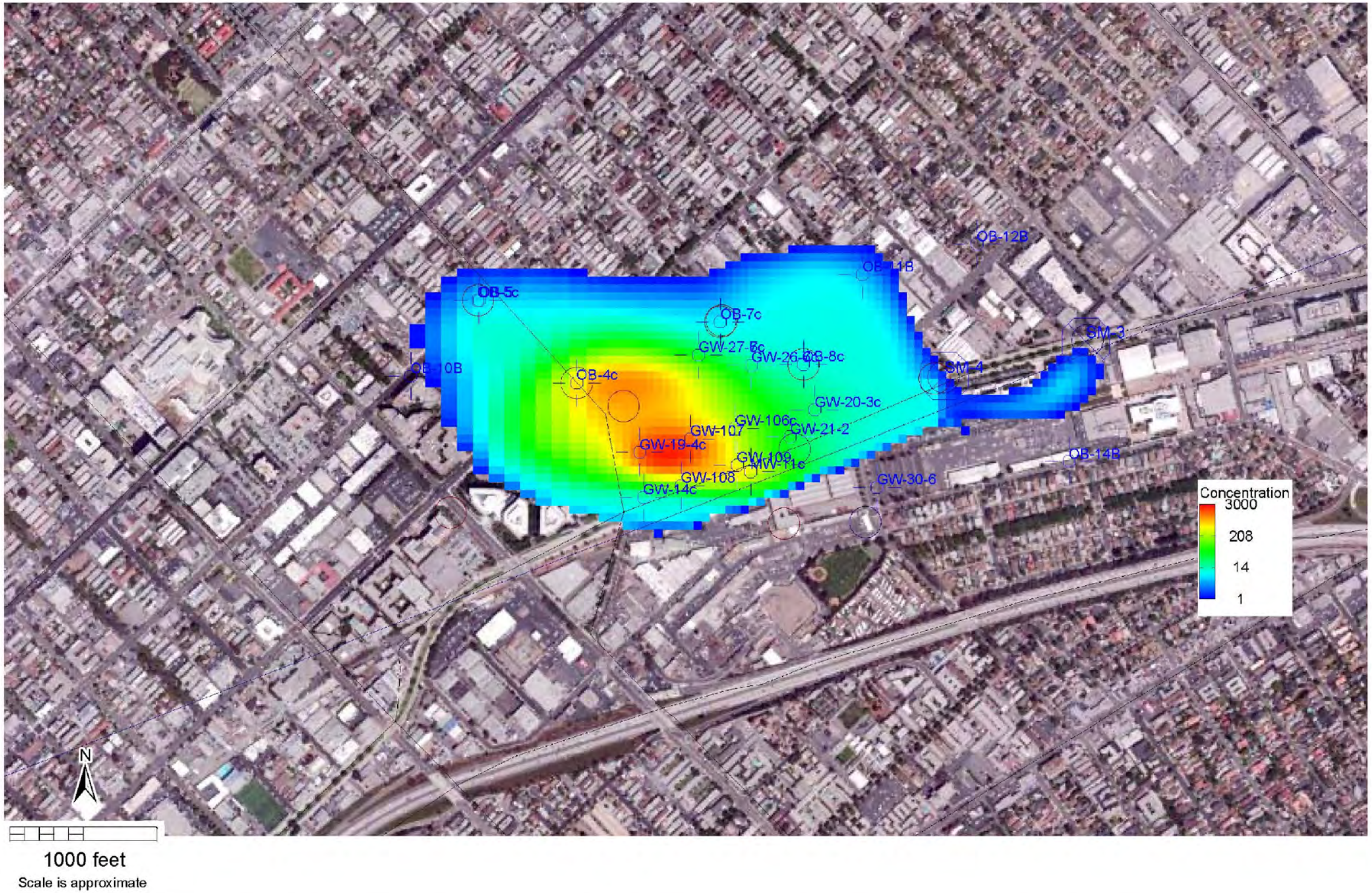
LOCUS MAP	REVISIONS					
	REV #	DATE	BY	DESCRIPTION	APPROVALS	DATE
					G. Clendenin	



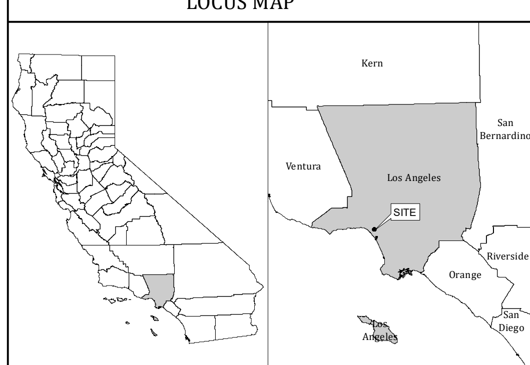
TITLE

SIMULATED B-ZONE TCE PLUME IN CALIBRATED MODEL

PREPARED FOR: CITY OF SANTA MONICA OLYMPIC WELL FIELD SANTA MONICA, CALIFORNIA	SCALE
DATE: 05/2020	PRJ. NO. 308038-07119
SOURCE: Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.	FIGURE 39 OF 44



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

SIMULATED B-ZONE PCE PLUME IN CALIBRATED MODEL

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

SCALE

DATE
05/2020

PRJ. NO.
308038-07119

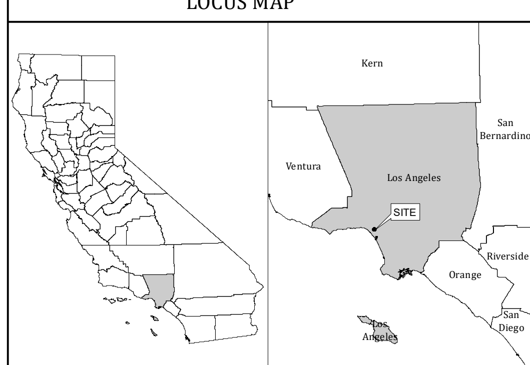
SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 40 OF 44

1000 feet
Scale is approximate

Approximate limit of Chlorinated VOC Plume in B-Zone

LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

ICF

APPROVALS	DATE
G. Clendenin	

TITLE

SIMULATED GROUNDWATER ELEVATION AND CAPTURE ZONES IN B-ZONE, 2015

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

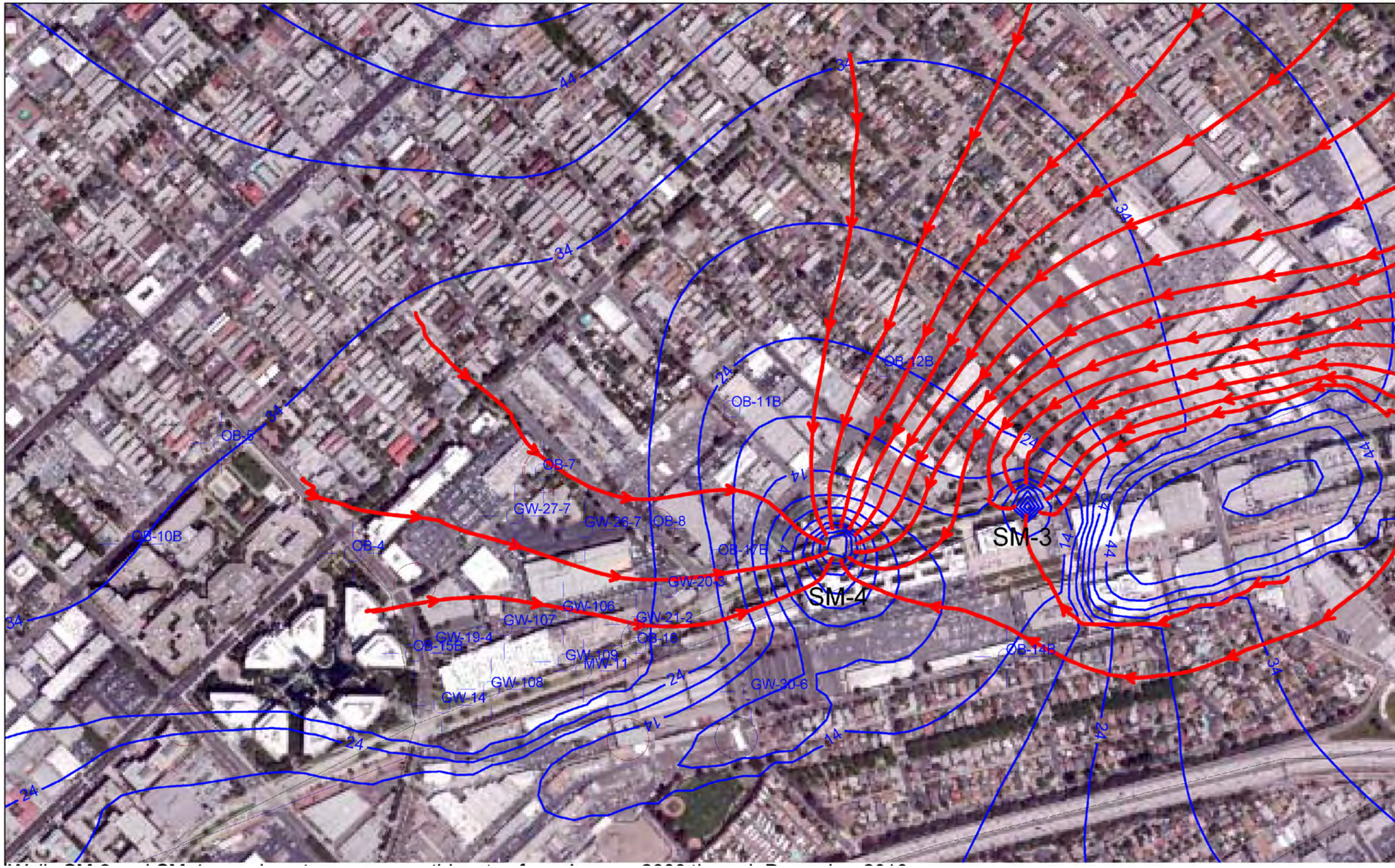
SCALE

DATE
05/2020

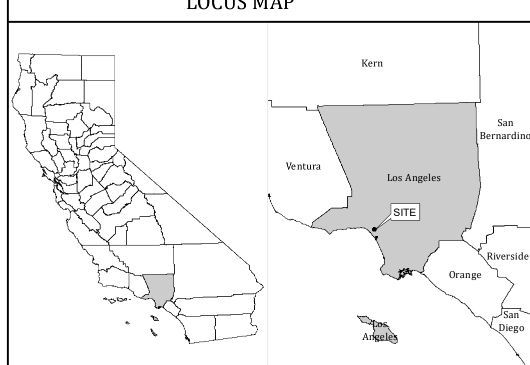
PRJ. NO.
308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 41 OF 44



LOCUS MAP



REVISIONS

REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

ICF

TITLE

SIMULATED GROUNDWATER ELEVATION AND CAPTURE ZONES IN B-ZONE, 2018

PREPARED FOR
CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

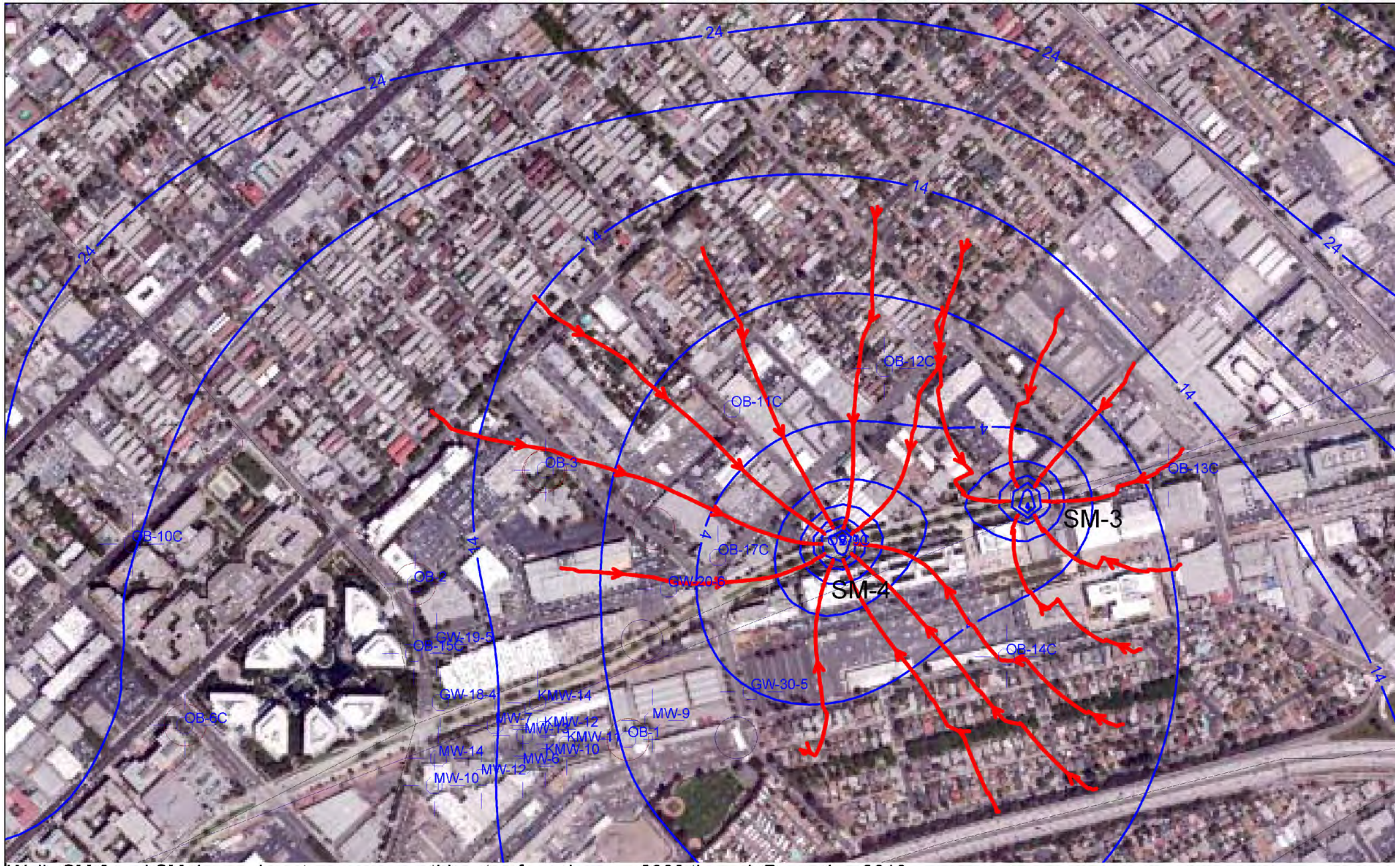
SCALE

DATE 05/2020

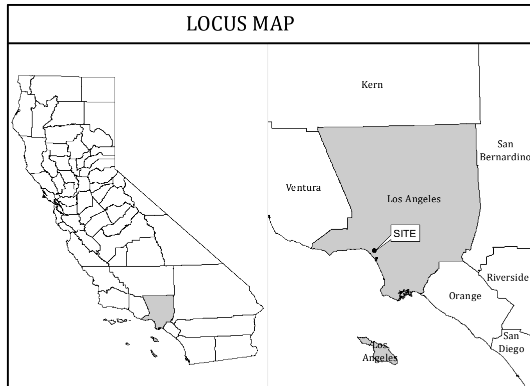
PRJ. NO. 308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 43 OF 44



LOCUS MAP



REVISIONS			
REV #	DATE	BY	DESCRIPTION

APPROVALS	DATE
G. Clendenin	

TITLE

SIMULATED GROUNDWATER ELEVATION AND CAPTURE ZONES IN C-ZONE, 2018

PREPARED FOR

CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

SCALE

DATE 05/2020

PRJ. NO. 308038-07119

SOURCE Los Angeles County GIS web server. City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC. All locations approximate.

FIGURE 44 OF 44

Appendix A

LA-RWQCB Closure Reports for Northern and Southern Portions of Former Gillette Property

Los Angeles Regional Water Quality Control Board

May 3, 2019

The Gillette Company LLC
Ms. Kym Gaylo
Associate Director, Global Health, Safety and Environment
Beckett Ridge Technical Center-CTEL, AP-214
8256 Union Centre Blvd.
West Chester, Ohio 45069

Higgins Common Trusts
c/o David G. Dundas, Trustee
645 Seaview Street
Laguna Beach, CA 92651

SUBJECT: NO FURTHER ACTION FOR SOIL ONLY

SITE/CASE: NORTHERN PORTION OF FORMER GILLETTE/PAPERMATE FACILITY, 1740 STEWART ST., SANTA MONICA, CA, ASSESSOR'S PARCEL NUMBER 4268-001-021 (SCP NO. 0130E, SITE ID NO. 2043C00, CAO NO. R4-2010-0202)

Dear Ms. Gaylo and Mr. Dundas:

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) is the state agency with primary responsibility for the protection of groundwater and surface water quality within major portions of Los Angeles and Ventura counties, including the referenced site. To accomplish this, the Regional Board oversees the investigation and cleanup of discharges of waste that may affect the quality of waters of the state as authorized by the Porter-Cologne Water Quality Control Act (California Water Code [CWC], Division 7).

The Regional Board has been informed that, effective September 1, 2016, The Gillette Company was merged into a new company known as The Gillette Company LLC, which is a wholly owned subsidiary of The Procter & Gamble Company. For purposes of this No Further Action (NFA), therefore, the term "Gillette" is intended to include both The Gillette Company and The Gillette Company LLC.

On March 9, 2018, the Regional Board sent a Notice of Opportunity to Comment on the proposed NFA to the Higgins Common Trusts (property owner), and distributed the Notice to other interested persons, including The Gillette Company LLC (Gillette). Written comments were due to the Regional Board by April 9, 2018. No written comments were received.

Summary of Site Investigation and Cleanup History

Regional Board staff has reviewed the site investigation and remediation reports prepared by your environmental consultants, and other relevant information regarding the Site. The submitted reports have provided the following information:

1. The Site (the northern portion of the Former Gillette/PaperMate Facility) occupies approximately 4.6 acres (site Location Map, Attachment 1), with one 100,000-square feet building (Building II). The Site is bordered by Stewart Street to the east, the CSHV Pen Factory, LLC property (formerly the southern portion of the Former Gillette/PaperMate Facility) to the south, The Welk Group property to the west, and Santa Monica College to the north. At the time of Gillette's operations from approximately 1967 to 2005, Building II was used to manufacture ballpoint pens and other writing tools. The property is owned by The Higgins Common Trusts LLC, and has been occupied by Red Bull North America, Inc. as their North American office headquarters since 2006.

2. Contaminant sources associated with Building II included the sewer line, underground tanks northeast and north of the building, and the paint storage area west of the building.

3. Between 1986 and 2013, Gillette conducted soil vapor, soil matrix, and groundwater investigations at the Site and immediate vicinity. Results from these investigations indicate that the site has been adequately assessed for the wastes originating at the site. Volatile organic compounds (VOCs) were identified as chemicals of concern associated with the former PaperMate operations at the site, primarily perchloroethene (PCE), trichloroethene (TCE), and their degradation products.

4. From approximately 1983 to 2013, active remediation at the site included soil vapor extraction (SVE) at the underground storage tank (UST) area northeast of Building II and at the Paint Storage Area west of Building II; and soil excavations at the sewer north of Building II; at the UST area northeast of Building II; and at the Paint Storage Area west of Building II.

5. Results of the Post-SVE remediation soil sampling and excavation boundary confirmation sampling indicate that more than 90% of the VOC (primarily PCE) plume exceeding residential soil and soil vapor screening levels was remediated or excavated.

6. The results of the site investigations also indicate that concentrations of lead, petroleum hydrocarbons (TPH), and Polynuclear Aromatic Hydrocarbons (PAHs), possibly from prior or nearby operations to the former PaperMate occupancy, are present beneath Building II at greater than residential health-protective screening levels, making the Site unsuitable for unrestricted use.

Covenant and Environmental Restriction

Activities conducted at the Site by Gillette have resulted in the cleanup or abatement of the wastes to assure protection of groundwater beneath the site and vicinity for its beneficial uses. Because the site is not suitable for unrestricted land use, the Regional Board may not issue an NFA letter unless a land use restriction is recorded. To protect human health and the environment, a Covenant and Environmental Restriction (Attachment 2) for the property, that limits use of the site to commercial and industrial applications, has been recorded. The Covenant and Environmental Restriction runs with the land and will remain applicable to the site until it is demonstrated to the satisfaction of this Regional Board that any residual lead, TPHd, and PAHs in soil at the site do not pose a significant threat to water quality and human health, based on the unrestricted uses of the site.

No Further Action Determination

Based upon information provided to the Regional Board, and with the provision that the information was accurate and representative of site conditions, the Regional Board requires no further action be taken for soil at the site at this time. The site owner/operator must notify the Regional Board immediately and following up with written notification, if additional waste in soil and/or groundwater is encountered at the site. Such new information may require additional investigation or cleanup activities.

The jurisdictional requirements of other agencies, such as the United States Environmental Protection Agency, are not affected by the Regional Board's issuance of this NFA letter for the site. Such agencies may choose to make their own determinations concerning this site.

We would like to take this opportunity to thank you for your cooperation with the Regional Board during the course of site assessment and remediation. Should you have any questions regarding this matter, please contact Akzayakatl Mexikatzin at (213) 576-6724 or akzayakatl.mexikatzin@waterboards.ca.gov.

Sincerely,

Renee Purdy
Executive Officer

Attachments: 1. Site Location Map
2. Covenant and Environmental Restriction on Property

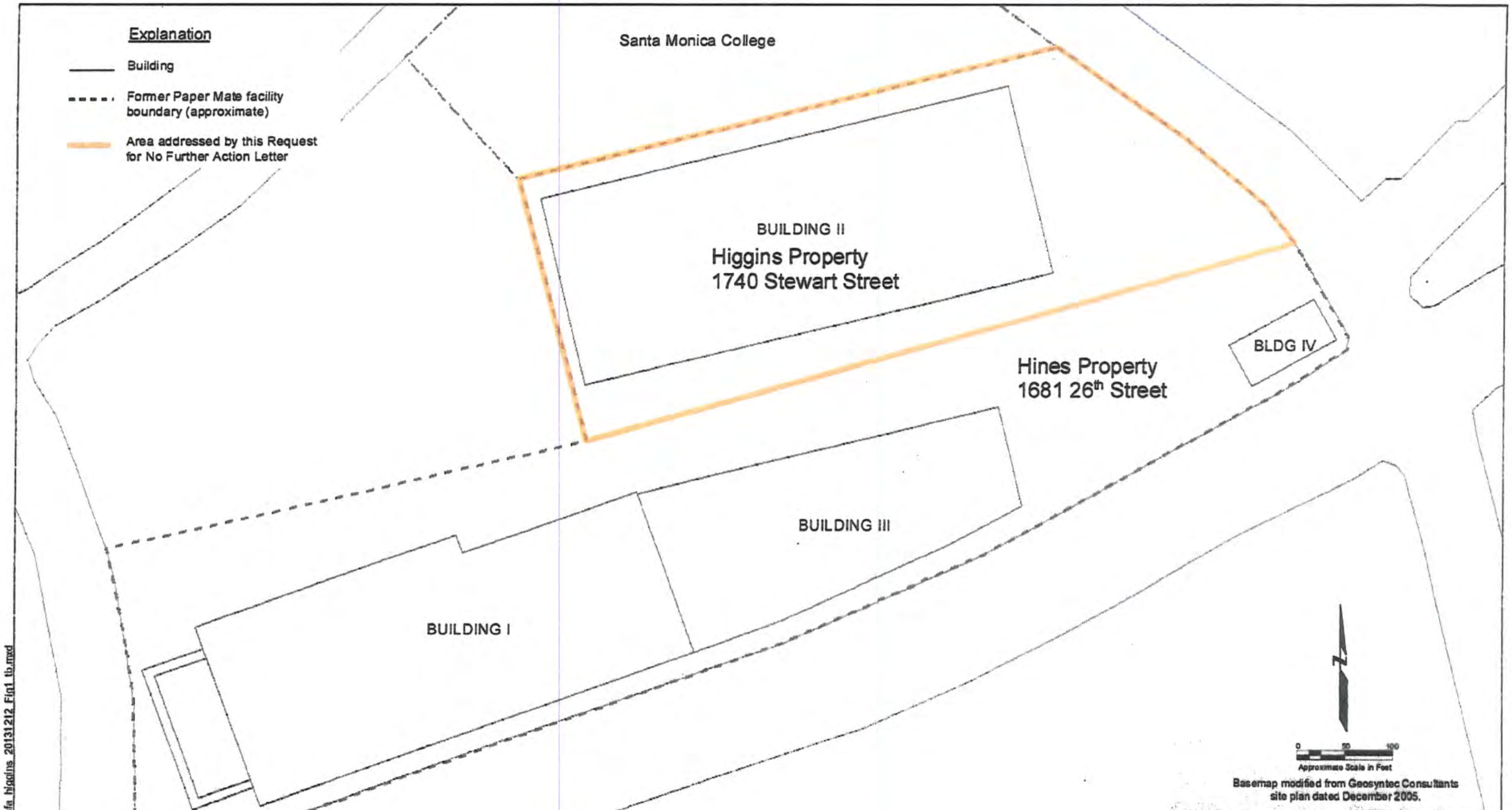
cc: Mr. John D. Ambrosio, Red Bull North America, Inc.
Ms. Pamela Andes (for Hines)
Mr. Eddie Arslanian, P.E. (for CSHV Pen Factory)
Mr. Wayne S. Blank, Shoshana Wayne Gallery
Mr. Gil Borboa, City of Santa Monica
Mr. Preston W. Brooks, Esq., (for CSHV Pen Factory)
Mr. Gary Clendenin, ICF International (for City of Santa Monica)
Mr. James G. Derouin (for Gillette)
Mr. David G. Dundas, Esq. (for the Higgins Trusts)
(cc list continues on next page)

(cc list continued)

Dr. Lisette Gold, City of Santa Monica
Ms. Christina Hill, Clarion Partners LLC
Mr. Matt Howell, Lincoln Property Company LLC
Mr. Don Indermill, The Department of Toxic Substances Control
Mr. Hillel Kellerman, 1655 Property LLC
Mr. Joseph Lawrence, City of Santa Monica
Mr. Franklyn Legall (Gillette)
Mr. Marc L. Luzzatto, The Luzzatto Company
Mr. Douglas H. Metzler (for Hines)
Mr. Craig Stewart, Geomatrix Consultants, Inc.
Mr. Ron Takiguchi, City of Santa Monica, Department of Planning & Community Development
Mr. Paul J. Weinberg, Esq. (for Higgins Trusts)
Mr. Jeffrey B. Wokurka, The Boeing Company

Attachment 1

Path: P:\12290.000.0\gis\esri\nfa_higgins_20131212_Fig1_tb.mxd



SITE LOCATION MAP
Higgins Trust
1740 Stewart Street
Santa Monica, California

By: mww	Date: 12/12/2013	Project No. 12290
amec		Figure 1

Attachment 2

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Pages: 0018

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California

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THIS FORM IS NOT TO BE DUPLICATED

Recording Requested By:
Higgins Common Trusts
c/o David G. Dundas, Trustee
645 Seaview Street
Laguna Beach, CA 92651

04/17/2019
20190343542

When Recorded, Mail To:
Deborah J. Smith, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, California 90013

COVENANT AND ENVIRONMENTAL RESTRICTION ON PROPERTY

Red Bull North American Headquarters Building (Higgins Common Trusts)
ASSESSOR'S PARCEL NUMBER (APN): 4268-001-021
1740 Stewart Street, Santa Monica, CA 90404
LARWQCB SITE CLEANUP PROGRAM NO. 0130E, CAO No. R4-2010-0202

This Covenant and Environmental Restriction on Property ("Covenant") is made as of this 25th day of January, 2019 by Higgins Common Trusts ("Covenantor") who is the Owner of Record of that certain property identified as APN 4268-001-021 and situated at 1740 Stewart Street in the City of Santa Monica, County of Los Angeles, State of California, which is more particularly described in Exhibits A and B attached hereto and incorporated herein by this reference (hereinafter referred to as the "Burdened Property"), for the benefit of the California Regional Water Quality Control Board, Los Angeles Region ("Board"), with reference to the following facts:

A. Nature of Covenant. This Covenant is an environmental covenant provided for by Civil Code section 1471and required by the Board pursuant to Water Code section 13304 because the Board has determined that the Burdened Property is not suitable for unrestricted use and that a land use restriction is necessary for the protection of present or future human health, safety, or the environment as result of the presence of hazardous materials, as defined in section 25260 of the Health and Safety Code, in the soil and/or groundwater at the Burdened Property.

B. Contamination of the Burdened Property. The soil at the Burdened Property was contaminated by the release of pen ink and its constituent materials during the removal of ink tanks conducted by the former Paper Mate Manufacturing Facility owned by the Gillette Company LLC (Gillette) a subsidiary of The Procter and Gamble Company, the predecessor tenant(s). The known contamination originally consisted of volatile organic compounds (VOC), primarily tetrachloroethene (PCE), in soil vapor in a localized area outside and west of the existing commercial building located at 1740 Stewart Street, in Santa Monica, California. By means of soil vapor extraction and soil excavation techniques, the known contamination in soil

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vapor has been reduced to below 92 micrograms per liter. Confirmation soil and vapor sampling was performed within the existing structure by puncturing the existing cement slab and drilling multiple test borings in the soil below. No significant VOC contamination was found under the existing structure in the soil and soil vapor at the conclusion of the testing.

The soil at the Burdened Property is also contaminated with lead (up to 1970 milligrams per kilogram (mg/kg), total petroleum hydrocarbons-diesel range (TPHd) (up to 5940 mg/kg) and polynuclear aromatic hydrocarbons (PAHs) (up to 590 micrograms per kilogram (µg/kg)). PAHs were reported to have not been used in the former Paper Mate manufacturing of writing components but might be associated with other prior operations at and near the site. A sample location map and a summary table are included in Exhibit B.

Groundwater VOC contamination resulting from historical operations at the Burdened Property, is captured, and treated by the City of Santa Monica, Olympic well field operation, as part of a settlement agreement between Gillette and the City of Santa Monica. The settlement agreement is included as an attachment to Modified Cleanup and Abatement Order No. R4-2008-0034 issued to Gillette on November 10, 2010 by the Board.

C. Exposure Pathways. The contaminants addressed in this Covenant are present in the soil at the Burdened Property. Without the mitigation measures which have been performed on the Burdened Property, exposure to these contaminants could take place via in-place contact, surface-water runoff, and wind dispersal, resulting in dermal contact, inhalation, or ingestion by humans, etc. The risk of public exposure to the contaminants has been substantially lessened by the remediation and controls described herein.

D. Land Uses and Population Potentially Affected. The Burdened Property is used for office and administrative services, including warehousing and storage, and is adjacent to commercial and residential land uses.

E. Disclosure and Sampling. Disclosure of the presence of hazardous materials on the Burdened Property has been made to the Board and extensive sampling of the Burdened Property has been conducted. Information regarding the Burdened Property's characterization and remediation can be found using the advanced search option and Global ID No. SL2043C1560 at the Regional Board's GeoTracker Website:

http://geotracker.waterboards.ca.gov/

F. Use of Burdened Property. Covenantor desires and intends that in order to benefit the Board, and to protect present and future human health, safety, or the environment, the Burdened Property shall be used in a manner consistent with this Covenant as to avoid potential harm to persons or property that might result from any hazardous materials that might remain deposited on portions of the Burdened Property.

4

ARTICLE I
GENERAL PROVISIONS

1.1 Provisions to Run with the Land. This Covenant sets forth protective provisions, covenants, conditions and restrictions (collectively referred to as "Restrictions") upon and subject to which the Burdened Property and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are reasonably necessary to protect present and future human health or safety or the environment as a result of the presence of hazardous materials at the Burdened Property. Each and all of the Restrictions shall run with the land and pass with each and every portion of the Burdened Property, and shall apply to, inure to the benefit of, and bind the respective successors, assigns, and lessees thereof for the benefit of the Board and all Owners and Occupants. Each and all of the Restrictions: (a) are imposed upon the entire Burdened Property, unless expressly stated as applicable to a specific portion of the Burdened Property; (b) run with the land pursuant to Civil Code section 1471; and (c) are enforceable by the Board

1.2 Concurrence of Owners and Lessees Presumed. After the date of recordation hereof, all purchasers, lessees, and possessors of all or any portion of the Burdened Property shall become Owners or Occupants as defined herein and shall be deemed by their purchase, leasing, or possession of the Burdened Property to be bound by the Restrictions and to agree for and among themselves, their heirs, successors, and assignees, and the agents, employees, and lessees of such owners, heirs, successors, and assignees, that the Restrictions herein established must be adhered to for the benefit of the Board and all Owners and Occupants, and that the interest of all Owners and Occupants of the Burdened Property shall be subject to the Restrictions.

1.3 Incorporation into Deeds and Leases. Covenantor desires and covenants that the Restrictions shall be incorporated in and attached to each and all deeds and leases of all or any portion of the Burdened Property. Recordation of this Covenant shall be deemed binding on all successors, assigns, and lessees, regardless of whether a copy of this Covenant has been attached to or incorporated into any given deed or lease.

1.4 Purpose. It is the purpose of this instrument to convey to the Board real property rights as specified in this Covenant, which will run with the land, to facilitate the remediation of past environmental contamination and to protect present and future human health, safety, or the environment by reducing the risk of exposure to residual hazardous materials.

ARTICLE II
DEFINITIONS

2.1 Board. "Board" shall mean the California Regional Water Quality Control Board, Los Angeles Region and shall include its successor agencies, if any.

2.2 Improvements. "Improvements" shall mean all buildings, structures, roads, driveways, gradings, re-gradings, and paved areas, constructed or placed upon any portion of the Burdened Property.

2.3 Occupant or Occupants. "Occupant" or "Occupants" shall mean Owners and those persons entitled by ownership, leasehold, or other legal relationship to the right to use and/or occupy all or any portion of the Burdened Property.

2.4 Owner or Owners. "Owner" or "Owners" shall mean the Covenantor and Covenantor's successors in interest who hold title to all or any portion of the Burdened Property.

ARTICLE III
DEVELOPMENT, USE, AND CONVEYANCE OF THE BURDENED PROPERTY

3.1 Restrictions on Development and Use. Unless all soil impacted with the chemicals identified in Exhibit B2 (including, but not limited to, lead, petroleum hydrocarbons and polynuclear aromatic hydrocarbons) at concentrations exceeding the regulatory thresholds for unrestricted land use are i) excavated and appropriately disposed offsite, and confirmation sampling of indicates that all impacted soil has been adequately removed or (ii) fixed in place with installation and permanent maintenance of an engineered cap to prevent site receptors from encountering soil impacted with chemical concentrations in excess of the regulatory thresholds for unrestricted land use or (iii) otherwise addressed in a manner approved by the Board, Covenantor promises to restrict the use of the Burdened Property as follows:

a. No residence for human habitation on the Burdened Property;

b. No hospitals or related facilities on the Burdened Property;

c. No public or private schools for persons under 21 years of age on the Burdened Property;

d. No care or community centers for children or senior citizens, or other uses that would involve the regular congregation of children or senior citizens on the Burdened Property;

e. No Owner or Occupant shall conduct or permit any excavation work on the Burdened Property, unless expressly permitted in writing by the Board. Any contaminated soils brought to the surface by grading, excavation, trenching, or backfilling shall be managed by the Owner, Owner's agent, Occupant, or Occupant's agent in accordance with all applicable provisions of local, state and federal law;

f. Any excavation conducted on the Burdened Property shall be performed pursuant to an appropriate and fully implemented Health and Safety Plan;

g. All uses and development of the Burdened Property shall be consistent with applicable Board Order No. R4-2010-0202, which is hereby incorporated herein by reference, and including future amendments thereto. All uses and development shall preserve the integrity of any cap, any remedial measures taken or remedial equipment installed, and any groundwater monitoring system installed on the Burdened Property pursuant to the requirements of the Board, unless otherwise expressly permitted in writing by the Board;

h. No Owner or Occupant shall drill, bore, otherwise construct, or use a well for the purpose

6

of extracting water for any use, including but not limited to, domestic, potable, or industrial uses, unless expressly permitted in writing by the Board; nor shall the Owner or Occupant permit or engage any third party to do such acts;

i. The Owner and/or Occupant shall notify the Board of each of the following: (1) the type, cause, location and date of any disturbance to any cap, any remedial measures taken or remedial equipment installed, and of the groundwater monitoring system installed on the Burdened Property pursuant to the requirements of the Board, which could affect the ability of such cap or remedial measures, remedial equipment, or monitoring system to perform their respective functions, and (2) the type and date of repair of such disturbance. Notifications to the Board shall be made by registered mail within ten (10) working days of both the date of discovery of such disturbance and the date of completion of repairs;

j. The Covenantor agrees that the Board, and any persons acting pursuant to Board orders, shall have reasonable access to the Burdened Property for the purposes of inspection, surveillance, maintenance, or monitoring as provided in Division 7 of the Water Code; and

k. No Owner or Occupant shall act in any manner that threatens or is likely to aggravate or contribute to the existing contaminated conditions of the Burdened Property. All use and development of the Burdened Property shall preserve the integrity of any capped areas.

3.2 Enforcement. Failure of an Owner or Occupant to comply with any of the Restrictions set forth in Paragraph 3.1 above shall be grounds for the Board, by the authority of this Covenant, to require that the Owner or Occupant modify or remove, or cause to be modified or removed, any Improvements constructed in violation of that Paragraph. Violation of this Covenant shall also be grounds for the Board to file civil actions against the Owner or Occupant as provided by law. Nothing in this Covenant shall limit the Board's authority under Division 7 (commencing with section 13000) of the Water Code or other applicable laws.

3.3 Notice in Agreements. After the date of recordation hereof, all Owners and Occupants shall execute a written instrument which shall accompany all purchase agreements or leases relating to all or any portion of the Burdened Property. Any such instrument shall contain the following statement:

> The land described herein contains hazardous materials in the soils and/or groundwater under the property, and is subject to a Covenant and Environmental Restriction on Property dated as of 1-25-, 2019 which Covenant and Environmental Restriction on Property imposes certain covenants, conditions, and restrictions on usage of the property described herein. This statement is not a declaration that a hazard exists.

ARTICLE IV
VARIANCE, TERMINATION, AND TERM

4.1 Variance. Any Owner or, with the Owner's written consent, any Occupant may apply to the Board for a written variance from the provisions of this Covenant.

4.2 Termination. Any Owner or, with the Owner's written consent, any Occupant may apply to the Board for a termination of the Restrictions as they apply to all or any portion of the Burdened Property.

4.3 Term. Unless terminated in accordance with Paragraph 4.2 above, by law or otherwise, this Covenant shall continue in effect in perpetuity.

ARTICLE V
MISCELLANEOUS

5.1 No Dedication Intended. Nothing set forth herein shall be construed to be a gift or dedication, or offer of a gift or dedication, of the Burdened Property or any portion thereof to the general public.

5.2 Notices. Whenever any person gives or serves any notice, demand, or other communication with respect to this Covenant, each such notice, demand, or other communication shall be in writing and shall be deemed effective (a) when delivered, if personally delivered to the person being served or an official of a government agency being served, or (b) three (3) business days after deposit in the mail if mailed by United States mail, postage paid certified, return receipt requested, and addressed:

If To: "Covenantor"
[OWNER(S) NAME AND ADDRESS]

If To: "Board"
Regional Water Quality Control Board
Los Angeles Region
Attention: Executive Officer
320 W. 4th Street, Suite 200
Los Angeles, California 90013

5.3 Partial Invalidity. If any portion of the Restrictions or terms set forth herein is determined by a court having jurisdiction to be invalid for any reason, the remaining portion shall remain in full force and effect as if such portion had not been included herein.

5.4 Recordation. This instrument shall be executed by the Covenantor and by the Executive Officer of the Board. This instrument shall be recorded by the Covenantor in the County of Los Angeles within ten (10) days of the date of execution.

5.5 References. All references to Code sections include successor provisions.

5.6 Construction. Any general rule of construction to the contrary notwithstanding, this instrument shall be liberally construed in favor of the Covenant to preserve and implement the purpose of this instrument and the policies and purposes of the Water Code. If any provision of this instrument is found to be ambiguous, an interpretation consistent with the purpose of this instrument that would render the provision valid shall be favored over any interpretation that would render it invalid.

IN WITNESS WHEREOF, the parties execute this Covenant as of the date set forth above.

[REMAINDER OF PAGE INTENTIONALLY LEFT BLANK; SIGNATURES ON FOLLOWING PAGES]

Covenantor: Higgins Common Trusts
Print Name: David G Dundas
Signature: David G Dundas
Title: Trustee
Date: January 25, 2018

CERTIFICATE OF ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of ~~Los Angeles~~ Orange

On 01/25/2019 before me, Victoria Pita, Notary Public
(insert name and title of the officer)

personally appeared David G. Dundas,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

VICTORIA PITA
Notary Public - California
Orange County
Commission # 2172554
My Comm. Expires Nov 19, 2020

Signature [signature] (Seal)

California Regional Water Quality Control Board, Los Angeles Region

Print Name: RENEE A. PURDY

Signature: [signature]

Title: Acting Executive Officer

Date: 3/15/19

CERTIFICATE OF ACKNOWLEDGEMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy or validity of that document

State of California

County of Los Angeles

On MARCH 15, 2019 before me, Gwendolyn Rachelle Monroe, Notary Public

personally appeared Renee A. Purdy, Acting Executive Officer who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature [signature: Gwendolyn Rachelle Monroe] (Notary Seal)

GWENDOLYN RACHELLE MONROE
Notary Public - California
Los Angeles County
Commission # 2239011
My Comm. Expires Apr 21, 2022

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EXHIBIT A

LEGAL DESCRIPTION OF THE BURDENED PROPERTY

[INSERT LEGAL DESCRIPTION OF BURDENED PROPERTY. THE OWNER WILL NEED TO PROVIDE THIS.]

Assessor's Parcel Number: 4268-001-021

EXHIBIT "A"
Legal Description

Those portions of Lots 2, 14, 15, and 16 in Block 200 of the town of Santa Monica, in the City of Santa Monica, County of Los Angeles, State of California, as shown on map recorded in book 39 page 45 of Miscellaneous records, in the office of the county recorder of Said County, said portions of Lots being also marked as a portion of parcel 6 on a map designated as exhibit "C" filed in connection with the referee's report in action b-25296 of the Superior Court of Said County, a certified copy of the final decree of Said Action, together with a copy of said map being recorded in book 6387 page 1 of Deeds, in the Office of Said County Recorder, described as a whole as follows:

Beginning at the intersection of the Southeasterly line of Said Lot 14 with the Northwesterly line of the Land conveyed to the Southern Pacific Railroad Company by deed recorded in book 955 page 142 of deeds, records of Said County; thence South 75 degrees 56 minutes 12 seconds West along said Northwesterly line, 774.47 feet; thence North 14 degrees 03 minutes 48 seconds West 284.00 feet; thence North 75 degrees 56 minutes 12 seconds East parallel with said Northwesterly line 627.52 feet to the Northeasterly line of Said Lot 14; thence South 44 degrees 23 minutes 57 seconds East along said Northeasterly line, 319.35 feet to the most Easterly corner of Said Lot 14; thence South 45 degrees 38 minutes 15 seconds West along the Southeasterly line of Said Lot 14, a distance of 16.61 feet to the point of beginning.

Except therefrom that portion of said Lot 14 described as follows:

Beginning at the most Easterly corner of Said Lot 14; thence North 44 degrees 23 minutes 57 seconds West along the Northeasterly line of Said Lot, 639.93 feet, more or less, to the most Northerly corner of Said Lot 14; thence South 45 degrees 38 minutes 02 seconds West along the Northwesterly line of Said Lot, 80 feet to a point in a curve concave Northeasterly and having a radius of 1150 feet, a radial line of said curve to said point bears South 45 degrees 36 minutes 12 seconds west; thence Southeasterly along said Curve, an arc distance of 212.19 feet; thence tangent to said curve South 54 degrees 56 minutes 07 seconds East 260.63 feet to the beginning of a tangent curve concave Southwesterly and having a radius of 460 feet; thence Southeasterly along said last mentioned curve, an arc distance of 173.81 feet, more or less, to a point in the Southeasterly line of Said Lot, said point being Distant Southwesterly, 13.44 Feet along said Southeasterly line from said most Easterly corner; thence along said Southeasterly line, North 45 degrees 38 minutes 15 seconds East 13.44 feet to said most Easterly corner.

EXHIBIT B

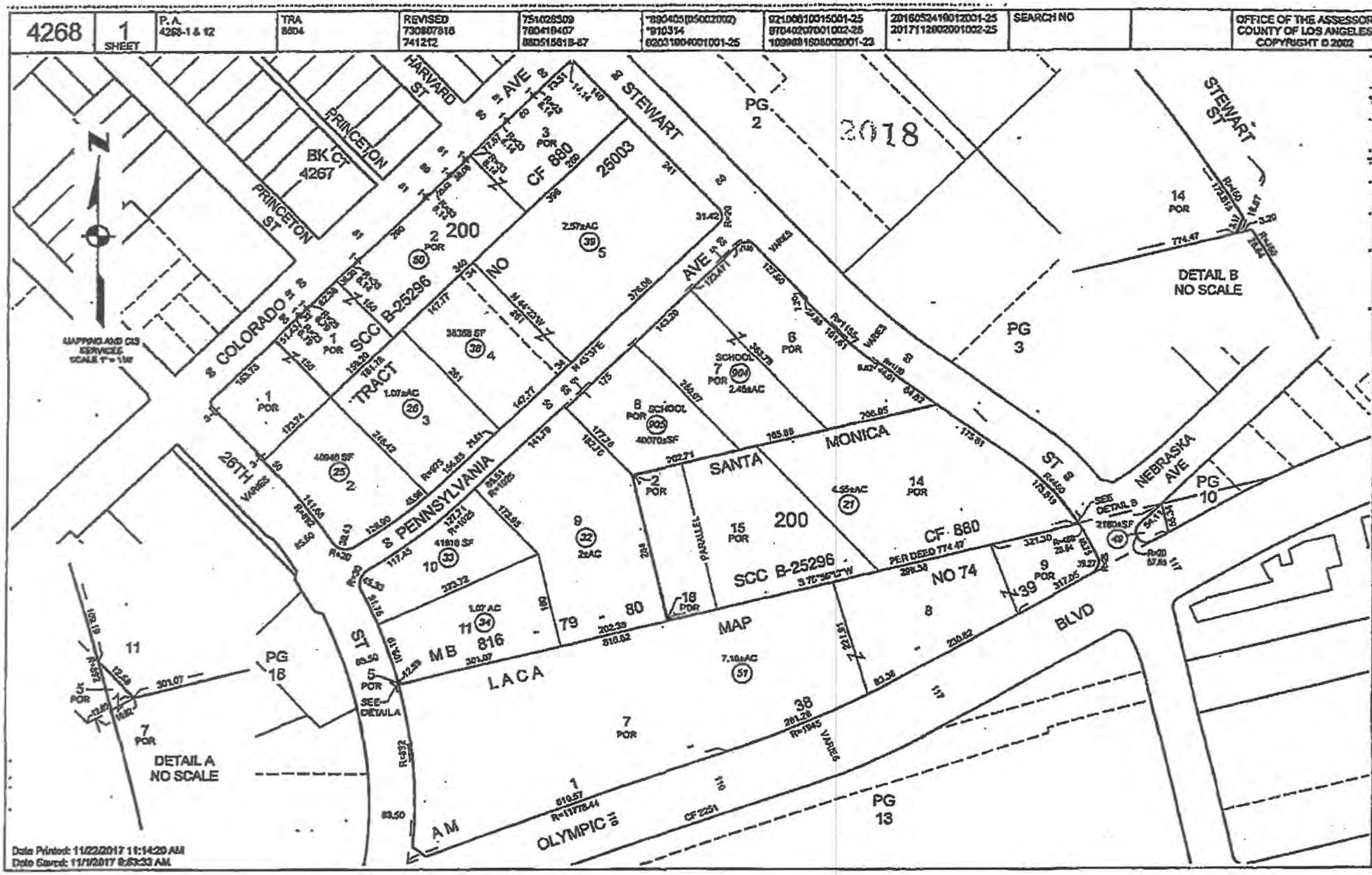
MAPS OF THE BURDENED PROPERTY

[INSERT MAP OF BURDENED PROPERTY. TYPICALLY, THIS IS THE COUNTY'S ASSESSOR MAP WITH A BORDER AND REFERENCE TO THE PROPERTY]

1. LA County Assessor Parcel Map
2. Sample Location Map

Exhibit B1

LA County Assessor Parcel Map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CF 880
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PG 3
PG 10
PG 13
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15

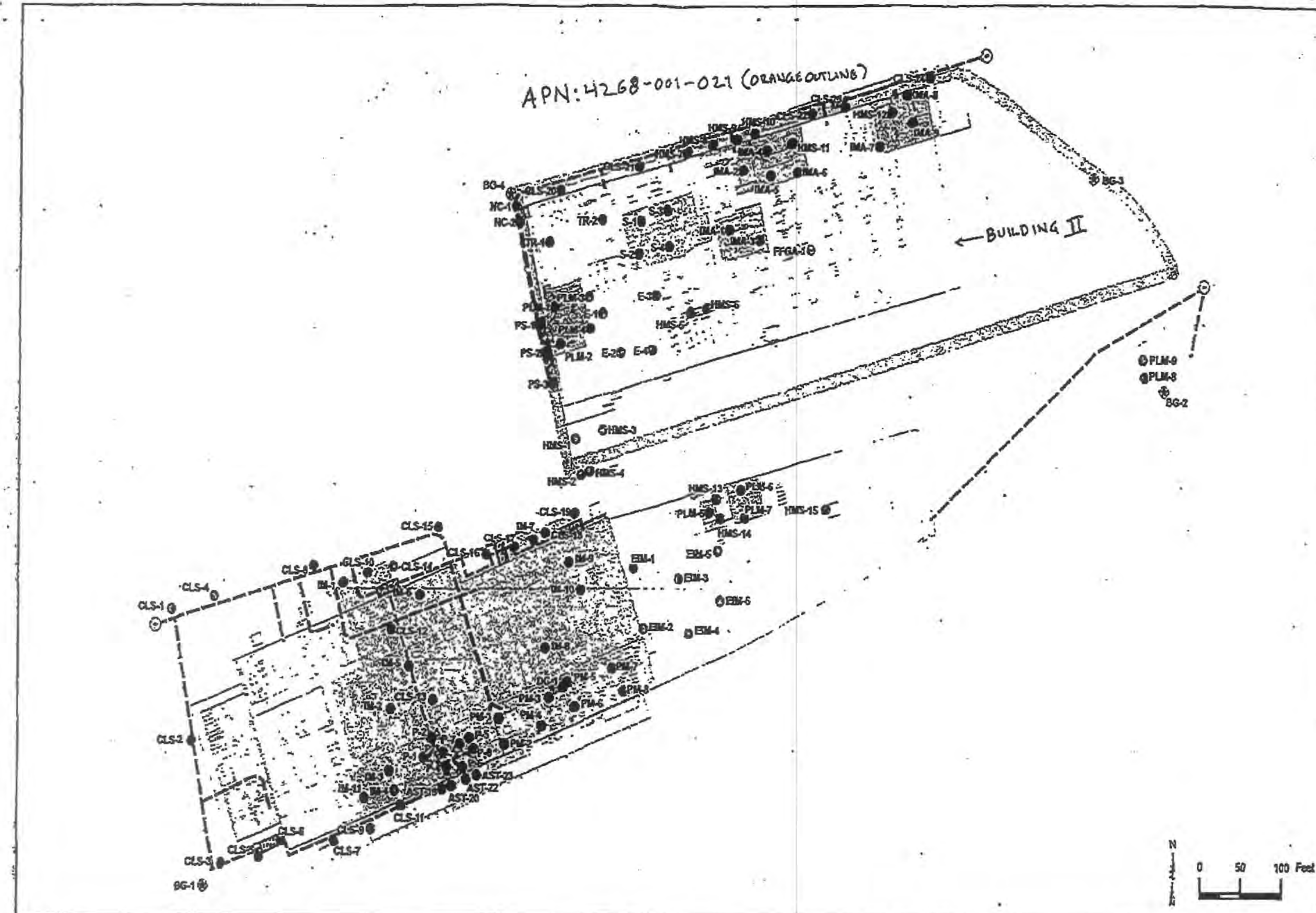
Exhibit B2

Sample Location Map

Higgins - Building II Soil Sample ID and Concentrations vs RB2 ESLs and CHHSLs

Sample ID (Geosyntec 2006)	Sample Collection Depth (Feet)	Chemicals	Concentration (mg/kg)	RB2 ESLs Residential (2016) (mg/kg)	RB2 ESLs Comm/Ind (2016) (mg/kg)	CHSSLs Res (Rev 2009) (mg/kg)	CHHSLs Comm/Ind (Rev 2009) (mg/kg)	Notes
CLS-20	10	Lead	345	80	320	80	320	Concentration Exceeds Residential RB2 ESLs and CHSSLs
CLS-23	5	Lead	111	80	320	80	320	Concentration Exceeds Residential RB2 ESLs and CHSSLs
CLS-23	10	Lead	1970	80	320	80	320	Concentration Exceeds Residential RB2 ESLs and CHSSLs
PS-3	10	Lead	265	80	320	80	320	Concentration Exceeds Residential RB2 ESLs and CHSSLs
IMA-9	2	TPHd	5940	230	1100			Concentration Exceeds Residential RB2 ESLs
			(µg/kg)	(µg/kg)	(µg/kg)			
E-4	5	Benzo Pyrene	110	16	290			Concentration Exceeds Residential RB2 ESLs
HMS-5	5	Benzo Pyrene	140	16	290			Concentration Exceeds Residential RB2 ESLs
HMS-5	10	Benzo Pyrene	170	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-1	10	DiBenzo (A,h) Anthracene	210	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-4	2	Benzo Pyrene	150	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-4	5	Benzo Pyrene	62	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-4	5	DiBenzo (A,h) Anthracene	510	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-4	10	Benzo Pyrene	87	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-5	2	Benzo Pyrene	67	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-5	10	Benzo Pyrene	63	16	290			Concentration Exceeds Residential RB2 ESLs
IMA-6	10	Benzo Pyrene	60	16	290			Concentration Exceeds Residential RB2 ESLs
S-1	10	Benzo Pyrene	80	16	290			Concentration Exceeds Residential RB2 ESLs
TR-2	10	DiBenzo (A,h) Anthracene	86	16	290			Concentration Exceeds Residential RB2 ESLs

RB2-RWQCB Region Two
ESLs-Environmental Screening Levels
CHHSLs-California Human Health Screening Levels
(mg/kg) milligram per kilogram
(µg/kg) microgram per kilogram



Legend

- Soil Sample Location
- Background Sample Location

Areas of Concern

- Clarifier
- Clarifier/Sewer Lines
- Extrusion / Injection Molding Area
- Extrusion Area
- Injection Molding Area
- Ink Manufacturing Area
- Nickel Cavity Operations Area
- Paint Storage Area
- Plant Maintenance Area
- Plating Area
- Point Manufacturing Area
- Sintering Operations Area
- Hazardous Materials Storage Area
- Factory Sewer Drain
- City Sewer Connection
- Abandoned Sewer Line
- Discharge to Sanitary Sewer
- Building
- Road
- Property Line

SOIL BORING LOCATIONS FOR SOURCE ASSESSMENT

FORMER PAPERMATE FACILITY
SANTA MONICA, CALIFORNIA

FIGURE NUMBER: A-2

PROJECT NUMBER: WR0880

GeoSyntec Consultants

October 26, 2016

The Gillette Company LLC
Ms. Kym Gaylo
Associate Director, Global Health, Safety and Environment
Beckett Ridge Technical Center-CTEL, AP-214
8256 Union Centre Blvd.
West Chester, Ohio 45069

CSHV Pen Factory, LLC
Ms. Christina Hill
Senior Vice President
Clarion Partners
601 S. Figueroa Street, Suite 3400
Los Angeles, CA 90017

SUBJECT: NO FURTHER ACTION FOR SOIL ONLY

SITE/CASE: SOUTHERN PORTION OF FORMER GILLETTE/PAPERMATE FACILITY, 1681 26th STREET, SANTA MONICA, CA (SCP NO. 0130E, SITE ID NO. 2043C00, MODIFIED CAO NO. R4-2008-0034)

Dear Ms. Gaylo and Ms. Hill:

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) is the state agency with primary responsibility for the protection of groundwater and surface water quality within major portions of Los Angeles and Ventura counties. To accomplish this, the Regional Board oversees the investigation and cleanup of discharges of waste that may affect the quality of waters of the state as authorized by the Porter-Cologne Water Quality Control Act (California Water Code [CWC], Division 7).

This letter confirms that based on the available information, and with the provisions that the information provided is accurate and representative of site conditions, site investigation and corrective actions are complete on the site (Assessor's Parcel Numbers [APN] 4268-001-040 and 4268-001-048) and no further action (NFA) is required at this time.

On May 31, 2016, the Regional Board sent a Notice of Opportunity to Comment on the proposed NFA to CSHV Pen Factory LLC (CSHV), the current property owner, and distributed the Notice to other persons. Written comments were due to the Regional Board by June 30, 2016. Written comments were received in a June 13, 2016 letter from The Gillette Company (Gillette), a wholly owned subsidiary of The Procter & Gamble Company, and the recipient of the Modified CAO (as defined on the following page). In their comment letter Gillette requested clarification of certain requirements in the NFA letter. In response to the Gillette comments, the Regional Board modified this NFA letter to make it clear that, in addition to soil remediation, substantial remediation of deeper groundwater has taken place and is ongoing. This letter was also modified to make it clear that Gillette has met its obligations under the Modified CAO (as defined below) and that CSHV has no responsibility to address the known groundwater conditions associated with the Site. The Regional Board has been informed that, effective September 1, 2016, The Gillette Company was merged into a new company known as The Gillette Company LLC which is, likewise, a wholly owned subsidiary of The Procter & Gamble Company. For purposes of this NFA, therefore, the term "Gillette" is intended to include both The Gillette Company and The Gillette Company LLC.

Summary of Site Investigation and Cleanup History

1. On November 10, 2010, the Regional Board issued Modified Cleanup and Abatement Order R4-2008-0034 (Modified CAO) to The Gillette Company, which required Gillette to complete the work described in the In Situ Thermal Treatment Design Report to remove volatile organic compounds from the vadose zone and certain areas of shallow groundwater in the vicinity of Buildings I and III at the Former Gillette/Papermate Facility at 1681 26th Street in Santa Monica, California (Site). The Modified CAO acknowledged and took into account a Settlement and Release Agreement (Agreement) among the City of Santa Monica and The Gillette Company and the Procter & Gamble Company that specified their respective rights, duties, and obligations regarding the restoration and replacement of groundwater from the Olympic Sub-basin, including funds to the City of Santa Monica from The Gillette Company for the extraction of impacted groundwater and the construction and operation of groundwater treatment facilities. In that Agreement, the City of Santa Monica agreed to construct and operate the groundwater treatment facility. The Modified CAO and the Agreement collectively have resulted in the In Situ Thermal Treatment and removal of volatile organic compounds from the vadose zone and shallow groundwater in the vicinity of Buildings I and III, and substantial ongoing remediation of deeper groundwater, which will continue to occur until the Regional Board agrees to termination of remediation. The Modified CAO stated: "Provided that Gillette is in compliance with its obligations under the Agreement, the Regional Board hereby discharges Gillette from, and does not otherwise require Gillette to perform, any other obligations under this CAO and discharges Gillette from any further obligations to further investigate, monitor, remediate, restore and/or replace groundwater in the Olympic Sub-Basin." See Modified CAO Section II.Par.3. Gillette has met its obligations under the Modified CAO at this time, and The City of Santa Monica continues to regularly monitor the effectiveness of ongoing groundwater remediation using (existing and additional (as needed)) groundwater monitoring wells as required in Attachment A (Time Schedule), Requirement 3, of the modified CAO, requiring the development and implementation of a plume wide groundwater remediation program and the preparation of performance monitoring reports for the "B-zone" and "C-zone" aquifers. CSHV was not a party to the Modified CAO and has no responsibility to address the known groundwater condition associated with the Site. Therefore, the Regional Board is also issuing the NFA to CSHV to make clear that, other than as specified in the Covenant and Environmental Restriction on Property, the Regional Board is requiring no further action by CSHV with respect to soil and groundwater conditions associated with the Site. The City of Santa Monica remains obliged to conclusively demonstrate capture of all Gillette contamination plumes. This obligation may require the installation of additional monitoring and/or extraction wells, as recorded in the Technical Memoranda, letters, and emails of Modified CAO Exhibit B. The parcels subject to this NFA letter are subject to the Modified CAO.

2. Regional Board staff has reviewed the site investigation and remediation reports, prepared by your environmental consultants, and other relevant information regarding the southern portion of the Site. The submitted reports have provided the following information:

   a. The southern portion of the Site occupies approximately 7.1 acres (site Location Map, Attachment 1). The Site is bordered by Stewart Street to the east, Olympic Boulevard
   b. to the south, 26th Street to the west, and commercial properties to the north. At the time of Gillette's operations, there were three buildings totaling approximately 258,000 square feet. The facility manufactured ballpoint pens and other writing tools from 1957 to 2006. The property is currently owned by CSHV, and is being redeveloped for commercial/industrial use.

   c. The identified Areas of Concern (AOC) were within Building I and Building III where writing tools were manufactured and chemicals were used and stored. The buildings are vacant and are currently being redesigned for commercial office use.

   d. Between 1990 and 2015, Gillette conducted soil vapor, soil matrix, and groundwater investigations. Soil vapor samples were analyzed for volatile organic compounds (VOCs). Soil matrix and groundwater samples were analyzed for metals, perchlorate, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). Soil vapor, soil matrix, and groundwater samples primarily contained VOCs, with trichloroethene (TCE) and perchloroethene (PCE) most common.

   e. Results from the soil vapor, soil matrix, and groundwater investigations indicate that the site has been adequately assessed for the wastes originating at the site.

   f. Soil matrix and soil vapor remediation included In Situ Thermal Treatment (ISTT), Soil Vapor Extraction (SVE), and targeted hot spot excavations, to remove VOCs. Within the ISTT area, following the end of ISTT operations, waste concentrations remaining in soil matrix in 2011, included PCE to 1.8 mg/kg and TCE to 0.053 mg/kg. Outside the ISTT area, waste concentrations remaining in a localized area of soil matrix between Building I and Olympic Boulevard, sampled in 2002, included PCE to 26 mg/kg and TCE to 0.034 mg/kg. In 2009, a buried railroad spur was encountered in this area. The area was excavated to approximately 6 feet below grade during spur removal, and approximately 50 tons (approximately 30 cubic yards) of soil were disposed of off site at US Ecology. This area outside the ISTT area has not been resampled. However, because of the excavation associated with spur removal, VOCs remaining in place are now at concentrations significantly below the values present in 2002. As part of the redevelopment of the Site, CSHV is performing soil excavation and off-site disposal for areas outside Buildings I and III, which will further remove residual VOCs in shallow soils that remained at the Site. The soil excavation performed by CSHV during Site redevelopment is under Regional Board oversight as part of the separate redevelopment track for the Site.

g. Groundwater remediation that occurred between December 2009 through December 2011 included ISTT and SVE to remove VOCs from the shallow groundwater zone.

h. The ISTT and SVE system removed approximately 2,100 pounds of VOCs from the subsurface of the site.

3. Residual VOCs are present in soil vapor below Buildings I and III. In 2015, the concentrations in subslab soil vapor ranged up to 178 μg/L for PCE and up to 10.8 μg/L for TCE. Site specific, risk based, soil vapor screening levels are 0.0416 μg/L for PCE and 0.06 μg/L for TCE. Soil vapors will be controlled with a Regional Board approved sub-slab vapor mitigation system prior to building occupancy as part of the separate redevelopment track for the Site. The current property owner, CSHV Pen Factory LLC, or its successor in ownership of the Site, will operate and monitor the sub-slab vapor mitigation system.

Covenant and Environmental Restriction

Activities conducted at the Site by Gillette have resulted in the cleanup or abatement of the wastes to assure protection of groundwater beneath the site and vicinity for its beneficial uses. Because the Site is not suitable for unrestricted land use, the Regional Board may not issue an NFA letter unless a land use restriction is recorded. For this NFA to be in effect, the Covenant and Environmental Restriction (Attachment 2) for the property, that limits use of the site to commercial and industrial applications to protect human health and the environment, must be recorded. The Covenant and Environmental Restriction runs with the land and will remain applicable to the Site until it is demonstrated to the satisfaction of this Regional Board that any residual VOCs in soil vapor at the Site do not pose a significant threat to human health or water quality, based on the unrestricted uses of the Site.

No Further Action Determination

Based upon information provided to the Regional Board, and with the provision that the information was accurate and representative of site conditions, the Regional Board requires no further action be taken at the two AOCs at the Site. This no further action determination will become effective upon receipt by the Regional Board of information confirming that the Covenant and Environmental Restriction has been recorded with the County of Los Angeles Registrar/Recorder. The site owner/operator must notify the Regional Board immediately if additional waste in soil and/or groundwater is encountered at the Site. Such new information may require additional investigation or cleanup activities.

All existing and newly installed groundwater monitoring wells for this Site are to remain in place, and monitoring by the City of Santa Monica is to continue. The jurisdictional requirements of other agencies, such as the United States Environmental Protection Agency, are not affected by the Regional Board's issuance of this NFA letter for the Site. Such agencies may choose to make their own determinations concerning this Site.

We would like to take this opportunity to thank you for your cooperation with the Regional Board during the course of site assessment and remediation. Should you have any questions regarding this matter, please contact Peter Raftery at (213) 576-6724 or peter.raftery@waterboards.ca.gov.

Sincerely,

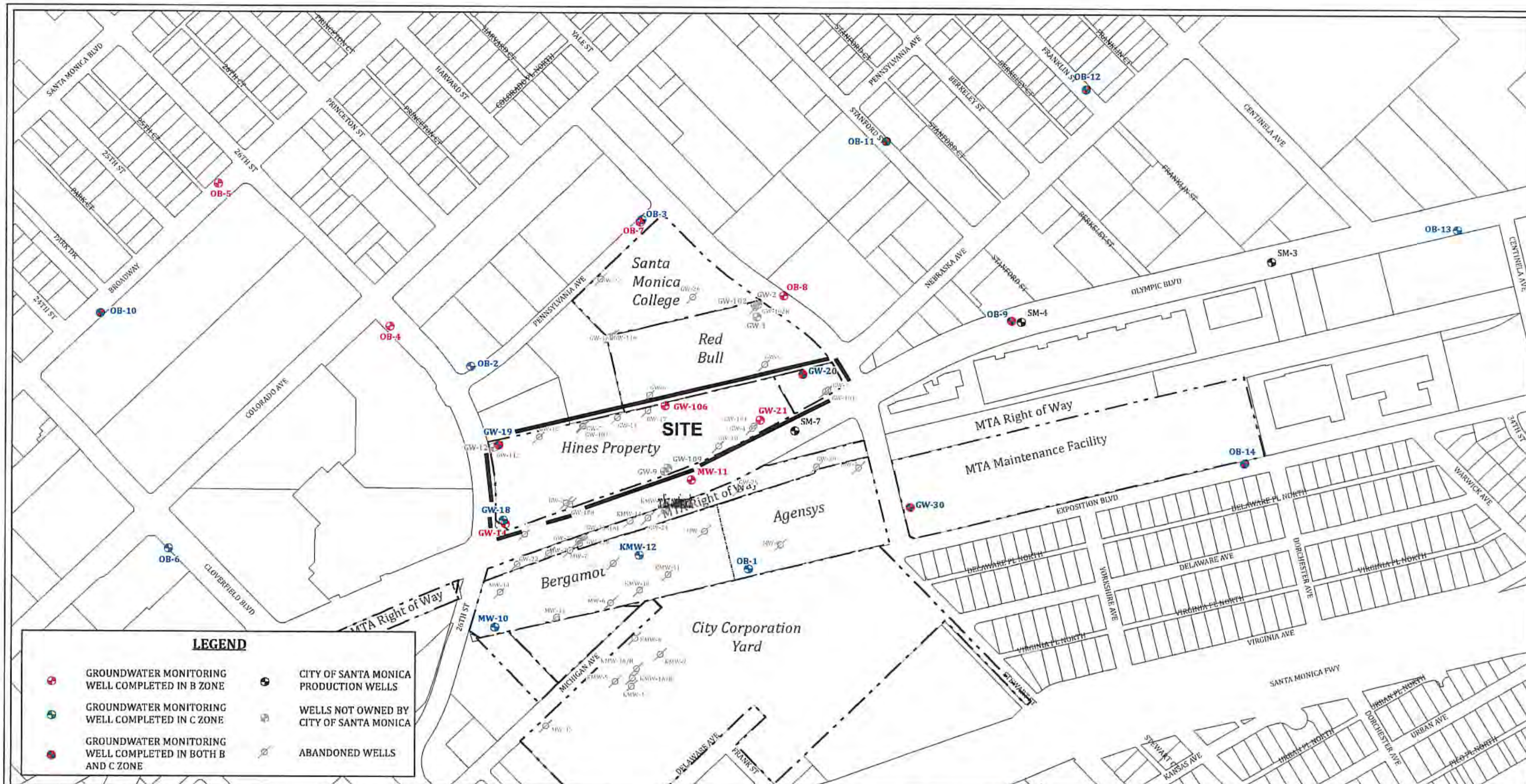
Samuel Unger, PE
Executive Officer

Attachments: 1. Site Location Map with Monitoring Wells
2. Covenant and Environmental Restriction on Property

cc: Mr. John D. Ambrosio, Red Bull North America, Inc.
Ms. Pamela Andes (for Hines)
Mr. Eddie Arslanian, P.E. (for CSHV Pen Factory)
Mr. Wayne S. Blank, Shoshana Wayne Gallery
Mr. Gil Borboa, City of Santa Monica
Mr. Preston W. Brooks, Esq., (for CSHV Pen Factory)
Mr. Gary Clendenin, ICF International (for City of Santa Monica)
Mr. James G. Derouin (for Gillette)
Mr. David G. Dundas, Esq. (for the Higgins Trusts)
Mr. Zachary Feingold, Verizon
Dr. Lisette Gold, City of Santa Monica
Ms. Christina Hill, Clarion Partners LLC
Mr. Matt Howell, Lincoln Property Company LLC
Mr. Don Indermill, The Department of Toxic Substances Control
Mr. Stephen Johnson, Gnarus Advisors LLC
Ms. Rita Kamat, DTSC
Mr. Hillel Kellerman, 1655 Property LLC
Mr. Joseph Lawrence, City of Santa Monica
Mr. Franklyn Legall (Gillette)
Mr. Marc L. Luzzatto, The Luzzatto Company
Mr. Douglas H. Metzler (for Hines)
Mr. Craig Stewart, Geomatrix Consultants, Inc.
Mr. Ron Takiguchi, City of Santa Monica, Department of Planning & Community Development
Mr. Paul J. Weinberg, Esq. (for Higgins Trusts)
Mr. Jeffrey B. Wokurka, The Boeing Company

Attachment 1

Site Location Map with Monitoring Wells



LOCUS MAP	REVISIONS					
	REV #	DATE	BY	DESCRIPTION	APPROVALS	DATE
					SWL	
					AC	
					AC	

N / W / E / S

0 — 700

Feet

ICF

TITLE: SITE LOCATION MAP

PREPARED FOR: CITY OF SANTA MONICA
OLYMPIC WELL FIELD
SANTA MONICA, CALIFORNIA

SCALE: 1 inch = 350 feet

DATE: 9/2015

PRJ. NO.: 308038-07119

SOURCE: Los Angeles County GIS web server, City of Santa Monica GIS. Line seperating Agensys and Bergamot is not a parcel line. Portion of base map provided by AMEC and ICF. All locations approximate.

FIGURE 2 OF 14

Attachment 1: Site Location Map with Monitoring Wells

Attachment 2

Covenant and Environmental Restriction on Property

This page is part of your document - DO NOT DISCARD

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Pages: 0013

Recorded/Filed in Official Records
Recorder's Office, Los Angeles County,
California

09/16/16 AT 11:01AM

FEES:	0.00
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OTHER:	0.00
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Recording Requested By:
CSHV Pen Factory, LLC
c/o Clarion Partners
601 South Figueroa Street
Los Angeles, California 90017

09/16/2016
20161123054

When Recorded, Mail To:
Samuel Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, California 90013

COVENANT AND ENVIRONMENTAL RESTRICTION ON PROPERTY

FORMER GILLETTE PAPER MATE FACILITY
ASSESSOR'S PARCEL NUMBERS (APN): 4268-001-040 and 4268-001-048
1681 26TH STREET, SANTA MONICA
LARWQCB SITE CLEANUP PROGRAM CASE NO. 0130E

This Covenant and Environmental Restriction on Property ("Covenant") is made as of the 16th day of May, 2016, by CSHV Pen Factory LLC ("Covenantor") who is the Owner of record of that certain property identified as APN 4268-001-040 and 4268-001-048 and situated at 1681 26th Street, in the City of Santa Monica, County of Los Angeles, State of California, which is more particularly described in Exhibits A and B attached hereto and incorporated herein by this reference (hereinafter referred to as the "Burdened Property"), for the benefit of the California Regional Water Quality Control Board, Los Angeles Region (Board), with reference to the following facts:

A. Nature of Covenant. This Covenant is an environmental covenant provided for by Civil Code section 1471 and required by the Board pursuant to Water Code sections 13304 and 13307.1 because the Board has determined that the Burdened Property is not suitable for unrestricted use and that a land use restriction is necessary for the protection of present or future human health, safety, or the environment as the result of the presence of hazardous materials, as defined in section 25260 of the Health and Safety Code, in the soil and/or groundwater at the Burdened Property.

B. Contamination of the Burdened Property. The soil, soil vapor, and groundwater at the Burdened Property are contaminated by volatile organic compounds (VOCs), primarily perchloroethene (PCE) and trichloroethene (TCE), and includes areas of elevated arsenic, lead, and total petroleum hydrocarbons (TPH), most in connection with manufacturing operations on the Burdened Property conducted by Paper Mate. The Gillette Company (Gillette), successor to the liabilities of Paper Mate, completed in-situ thermal treatment (ISTT) as a remediation measure of vadose zone soils and shallow (A-zone) groundwater, supplemented by local "hot spot" excavation before and after ISTT. Groundwater contamination resulting from historical operations at the Burdened Property is being monitored, captured, and treated by the City of Santa Monica, Olympic well field operation, as part of a settlement agreement between Gillette and the City of Santa Monica. The settlement agreement is included as an attachment to Modified Cleanup and Abatement Order No. R4-2008-0034 issued to Gillette on November 10, 2010 by the Board.

C. Exposure Pathways. The contaminants addressed in this Covenant are present in the soil, soil vapor, and groundwater at the Burdened Property. Without the mitigation measures which have been performed on the Burdened Property, exposure to these contaminants could take place via in-place contact, surface-water runoff, and drinking water aquifer contamination, resulting in dermal contact, inhalation, and ingestion. The risk of exposure to the contaminants has been substantially lessened by the remediation and controls described herein.

D. Land Uses and Population Potentially Affected. The Burdened Property is developed for commercial (office) use, and is adjacent to industrial and commercial land uses.

E. Disclosure and Sampling. Disclosure of the presence of hazardous materials on the Burdened Property has been made to the Board and extensive sampling of the Burdened Property has been conducted. Information regarding the Burdened Property's characterization and remediation can be found using the advanced search option and Global ID No. SL2043C1560 and/or No. T0603799303 at the Board's GeoTracker website:

http://geotracker.waterboards.ca.gov/

F. Use of Burdened Property. Covenantor desires and intends that in order to benefit the Board, and to protect present and future human health, safety, or the environment, the Burdened Property shall be used in a manner consistent with this Covenant as to avoid potential harm to persons or property that might result from any hazardous materials that might remain deposited on portions of the Burdened Property.

ARTICLE I
GENERAL PROVISIONS

1.1 Provisions to Run with the Land. This Covenant sets forth protective provisions, covenants, conditions and restrictions (collectively referred to as "Restrictions") upon and subject to which the Burdened Property and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are reasonably necessary to protect present and future human health or safety or the environment as a result of the presence of hazardous materials at the Burdened Property. Each and all of the Restrictions shall run with the land and pass with each and every portion of the Burdened Property, and shall apply to, inure to the benefit of, and bind the respective successors, assigns, and lessees thereof for the benefit of the Board and all Owners and Occupants. Each and all of the Restrictions: (a) are imposed upon the entire Burdened Property, unless expressly stated as applicable to a specific portion of the Burdened Property; (b) run with the land pursuant to Civil Code section 1471; and (c) are enforceable by the Board.

1.2 Concurrence of Owners and Lessees Presumed. After the date of recordation hereof, all purchasers, lessees, and possessors of all or any portion of the Burdened Property shall become Owners or Occupants as defined herein and shall be deemed by their purchase, leasing, or possession of the Burdened Property to be bound by the Restrictions and to agree for and among themselves, their heirs, successors, and assignees, and the agents, employees, and lessees of such owners, heirs, successors, and assignees, that the Restrictions herein established must be adhered to for the benefit of the Board and all Owners and Occupants, and that the interest of all Owners and Occupants of the Burdened Property shall be subject to the Restrictions.

1.3 Incorporation into Deeds and Leases. Covenantor desires and covenants that the Restrictions shall be incorporated in and attached to each and all deeds and leases of all or any portion of the Burdened Property. Recordation of this Covenant shall be deemed binding on all successors, assigns, and lessees, regardless of whether a copy of this Covenant has been attached to or incorporated into any given deed or lease.

1.4 Purpose. It is the purpose of this instrument to convey to the Board real property rights as specified in this Covenant, which will run with the land, to facilitate the remediation of past environmental contamination and to protect present and future human health, safety, or the environment by reducing the risk of exposure to residual hazardous materials.

ARTICLE II
DEFINITIONS

2.1 Board. "Board" shall mean the California Regional Water Quality Control Board, Los Angeles Region and shall include its successor agencies, if any.

2.2 Improvements. "Improvements" shall mean all buildings, structures, roads, driveways, gradings, re-gradings, and paved areas, constructed or placed upon any portion of the Burdened Property.

2.3 Occupant or Occupants. "Occupant" or "Occupants" shall mean Owners and those persons entitled by ownership, leasehold, or other legal relationship to the right to use and/or occupy all or any portion of the Burdened Property.

2.4 Owner or Owners. "Owner" or "Owners" shall mean the Covenantor and Covenantor's successors in interest who hold title to all or any portion of the Burdened Property.

ARTICLE III
DEVELOPMENT, USE, AND CONVEYANCE OF THE BURDENED PROPERTY

3.1 Restrictions on Development and Use. Covenantor promises to restrict the use of the Burdened Property as follows:

a. Unless either, (i) the vapor mitigation system (VMS), as approved by the Board, remains operational and prevents vapor intrusion and related human health risk to all building occupants, or, (ii) subslab vapor concentrations decrease to levels within acceptable human health risk ranges, as determined by the Board following an approved subslab vapor rebound test, the following slab-on-grade uses are prohibited: single family residences; multi-family residences;

hospitals and related facilities; care or community centers for children or senior citizens, and public or private schools for persons under 21 years of age, or other uses that would involve the regular congregation of children or senior citizens;

b. No Owner or Occupant shall conduct or permit any excavation work on the Burdened Property, unless expressly permitted in writing by the Board. Any contaminated soils brought to the surface by grading, excavation, trenching, or backfilling shall be managed by the Owner, Owner's agent, Occupant, or Occupant's agent in accordance with all applicable provisions of local, state and federal law;

c. Any grading, excavation, trenching, or backfilling conducted on the Burdened Property shall be performed pursuant to an appropriate and fully implemented Health and Safety Plan and a Board approved project-specific Soil Management Plan, areas of known contamination shall be mitigated during site redevelopment or managed through standard institutional and/or engineering controls;

d. No Owner or Occupant shall drill, bore, otherwise construct, or use a well for the purpose of extracting water for any use, including but not limited to, domestic, potable, or industrial uses, unless expressly permitted in writing by the Board; nor shall the Owner or Occupant permit or engage any third party to do such acts;

e. The Owner and/or Occupant shall notify the Board of each of the following: (1) the type, cause, location and date of any disturbance to any cap, any engineering controls, any remedial measures taken or remedial equipment installed, and of the groundwater monitoring system installed on the Burdened Property pursuant to the requirements of the Board, which could affect the ability of such cap or remedial measures, remedial equipment, or monitoring system to perform their respective functions, and (2) the type and date of repair of such disturbance. Notifications to the Board shall be made by registered mail within ten (10) working days of both the date of discovery of such disturbance and the date of completion of repairs;

f. The Covenantor agrees that the Board and Board representatives shall have reasonable access to the Burdened Property for the purposes of inspection, surveillance, maintenance, or monitoring as provided in Division 7 of the Water Code; and

g. No Owner or Occupant shall act in any manner that threatens or is likely to aggravate or contribute to the existing contaminated conditions of the Burdened Property. All use and development of the Burdened Property shall preserve the integrity of any capped areas.

h. Discrete areas of the site contribute most significantly to potential risks to human health and the environment. Data on contamination at the site is available in GeoTracker in the following and other documents:

Environ; *Results of Sub-slab Soil Gas Sampling*, 1681 26th Street, Santa Monica, California, April 24, 2015

Los Angeles Regional Water Quality Control Board; *California Office of Environmental Health Hazard Assessment Comment on AMEC's July 8, 2013 Response to Comments,* *Post-Remediation Human Health Risk Assessment*, August 27, 2013

AMEC; *Post-Remediation Human Health Risk Assessment*, Former Paper Mate Facility, 1681 26th Street, Santa Monica, California, April 2013

3.2 Enforcement. Failure of an Owner or Occupant to comply with any of the Restrictions set forth in Paragraph 3.1 above shall be grounds for the Board, by the authority of this Covenant, to require that the Owner or Occupant modify or remove, or cause to be modified or removed, any Improvements constructed in violation of that Paragraph. Violation of this Covenant shall also be grounds for the Board to file civil actions against the Owner or Occupant as provided by law. Nothing in this Covenant shall limit the Board's authority under Division 7 (commencing with section 13000) of the Water Code or other applicable laws.

3.3 Notice in Agreements. After the date of recordation hereof, all Owners and Occupants shall execute a written instrument which shall accompany all purchase agreements or leases relating to all or any portion of the Burdened Property. Any such instrument shall contain the following statement:

> The land described herein contains hazardous materials in the soils and/or groundwater under the property, and is subject to a Covenant and Environmental Restriction on Property dated as of _______________, 20__, and recorded on _______________, 20__, in the Official Records of Los Angeles County, California, as Document No. _________, which Covenant and Environmental Restriction on Property imposes certain covenants, conditions, and restrictions on usage of the property described herein. This statement is not a declaration that a hazard exists.

ARTICLE IV
VARIANCE, TERMINATION, AND TERM

4.1 Variance. Any Owner or, with the Owner's written consent, any Occupant may apply to the Board for a written variance from the provisions of this Covenant.

4.2 Termination. Any Owner or, with the Owner's written consent, any Occupant may apply to the Board for a termination of the Restrictions as they apply to all or any portion of the Burdened Property.

4.3 Term. Unless terminated in accordance with Paragraph 4.2 above, by law or otherwise, this Covenant shall continue in effect in perpetuity.

ARTICLE V
MISCELLANEOUS

5.1 No Dedication Intended. Nothing set forth herein shall be construed to be a gift or dedication, or offer of a gift or dedication, of the Burdened Property or any portion thereof to the general public.

5.2 Notices. Whenever any person gives or serves any notice, demand, or other communication with respect to this Covenant, each such notice, demand, or other communication shall be in writing and shall be deemed effective (a) when delivered, if personally delivered to the person being served or an official of a government agency being served, or (b) three (3) business days after deposit in the mail if mailed by United States mail, postage paid certified, return receipt requested, and addressed:

If To: "Covenantor"

CSHV Pen Factory, LLC
c/o Clarion Partners
601 South Figueroa Street
Los Angeles, California 90017

If To: "Board"

Regional Water Quality Control Board
Los Angeles Region
Attention: Executive Officer
320 W. 4th Street, Suite 200
Los Angeles, California 90013

5.3 Partial Invalidity. If any portion of the Restrictions or terms set forth herein is determined by a court having jurisdiction to be invalid for any reason, the remaining portion shall remain in full force and effect as if such portion had not been included herein.

5.4 Recordation. This instrument shall be executed by the Covenantor and by the Executive Officer of the Board. This instrument shall be recorded by the Covenantor in the County of Los Angeles within ten (10) days of the date of execution.

5.5 References. All references to Code sections include successor provisions.

5.6 Construction. Any general rule of construction to the contrary notwithstanding, this instrument shall be liberally construed in favor of the Covenant to preserve and implement the purpose of this instrument and the policies and purposes of the Water Code. If any provision of this instrument is found to be ambiguous, an interpretation consistent with the purpose of this instrument that would render the provision valid shall be favored over any interpretation that would render it invalid.

IN WITNESS WHEREOF, the parties execute this Covenant as of the date set forth above.

[REMAINDER OF PAGE INTENTIONALLY LEFT BLANK; SIGNATURES ON FOLLOWING PAGES]

Covenantor:

CSHV PEN FACTORY, LLC,

a Delaware limited liability company

By: California State Teachers' Retirement System, a public entity, its sole member

By: Clarion Partners, its authorized agent

By: [signature]

Name: Christina Hill

Title: SVP

Date: 5-16-16

CERTIFICATE OF ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of Los Angeles

On ____________________ before me, ______________________________________
(insert name and title of the officer)

personally appeared ____,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature ________________________________ **(Seal)**

SEE ATTACHED

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT **CIVIL CODE § 1189**

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of LOS ANGELES)

On MAY 16, 2016 before me, ALIDA VAN METER, NOTARY PUBLIC,
Date *Here Insert Name and Title of the Officer*

personally appeared CHRISTINA HILL
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

ALIDA VAN METER
Commission # 2110175
Notary Public - California
Los Angeles County
My Comm. Expires May 4, 2019

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature ______________
Signature of Notary Public

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: ______________ Document Date: ______________

Number of Pages: ______ Signer(s) Other Than Named Above: ______________

Capacity(ies) Claimed by Signer(s)

Signer's Name: ______________
☐ Corporate Officer — Title(s): ______________
☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: ______________
Signer Is Representing: ______________

Signer's Name: ______________
☐ Corporate Officer — Title(s): ______________
☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: ______________
Signer Is Representing: ______________

California Regional Water Quality Control Board, Los Angeles Region

Print Name: SAMUEL UNGER

Signature: Samuel Unger

Title: Executive Officer

Date: May 27, 2016

CERTIFICATE OF ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of Los Angeles

On MAY 27, 2016 before me, GWENDOLYN RACHELLE MONROE
(insert name and title of the officer)

personally appeared SAMUEL UNGER,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature Gwendolyn Rachelle Monroe **(Seal)**

GWENDOLYN RACHELLE MONROE
Commission # 2058467
Notary Public - California
Los Angeles County
My Comm. Expires Mar 20, 2018

EXHIBIT A

LEGAL DESCRIPTION OF THE BURDENED PROPERTY

Parcel A

THE PORTIONS OF THE RANCHO SAN VICENTE Y SANTA MONICA, IN THE CITY OF SANTA MONICA, COUNTY OF LOS ANGELES, STATE OF CALIFORNIA, DESCRIBED IN DEED TO THE SOUTHERN PACIFIC RAILROAD COMPANY, RECORDED IN BOOK 955, PAGE 142 OF DEEDS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY, INCLUDED WITHIN THE FOLLOWING DESCRIBED BOUNDARIES:

(1) BEGINNING AT A POINT IN THE NOTHERLY LINE OF SAID LAND, DISTANT THEREON NORTH 75° 32' 40" EAST, 232.38 FEET FROM THE NORTHWESTERLY CORNER THEREOF, SAID POINT ALSO BEING THE MOST EASTERLY CORNER OF LOT 5, OF TRACT NO. 9774, AS PER MAP RECORDED IN BOOK 140, PAGES 64 TO 66, INCLUSIVE, OF MAPS, IN THE OFFICE OF SAID COUNTY RECORDER; THENCE CONTINUING ALONG SAID NORTHERLY LINE, NORTH 75° 32' 40" EAST, 816.62 FEET; THENCE SOUTH 17° 14' 04" EAST, 221.91 FEET TO THE POINT OF INTER-SECTION WITH THE NORTHERLY LINE OF OLYMPIC BOULEVARD, 110 FEET WIDE, AS ESTABLISHED BY DEED RECORDED IN BOOK 22850, PAGE 90 OF OFFICIAL RECORDS, IN THE OFFICE OF SAID COUNTY RECORDER, SAID NORTHERLY LINE BEING A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 1945.00 FEET AND THE RADIAL LINE FROM SAID POINT OF INTERSECTION HAVING A BEARING OF NORTH 27° 26' 18" WEST; THENCE SOUTHWESTERLY ALONG SAID CURVE, 281.29 FEET TO ITS POINT OF TANGENCY WITH A CURVE CONCAVE SOUTHEASTERLY, HAVING A RADIUS OF 11,778.44 FEET; THENCE SOUTHWESTERLY ALONG SAID CURVE, 613.92 FEET TO ITS POINT OF INTER-SECTION WITH A CURVE CONCAVE WESTERLY, HAVING A RADIUS OF 892.00 FEET AND THE RADIAL LINE TO SAID LAST MENTIONED CURVE FROM SAID POINT OF INTERSECTION HAVING A BEARING OF NORTH 84° 10' 12" WEST; THENCE NORTHERLY ALONG SAID LAST MENTIONED CURVE, 336.15 FEET; THENCE NORTH 60° 49' 01" EAST, 5.67 FEET TO THE POINT OF BEGINNING.

(2) BEGINNING AT A POINT IN THE NORTHERLY LINE OF SAID LAND, DISTANT THEREON NORTH 75° 32' 40" EAST, 1049.00 FEET FROM THE MOST WESTERLY CORNER OF SAID LAND, SAID POINT ALSO BEING DISTANT NORTH 75° 32' 40" EAST, 816.62 FEET FROM THE MOST EASTERLY CORNER OF LOT 5 OF TRACT NO. 9774, AS PER MAP RECORDED IN BOOK 140, PAGES 64 TO 66, INCLUSIVE, OF MAPS, IN THE OFFICE OF SAID COUNTY RECORDER; THENCE CONTINUING ALONG SAID NORTHERLY LINE, NORTH 75° 32' 40" EAST, 298.38 FEET; THENCE SOUTH 20° 51' 48" EAST, 140.62 FEET TO THE NORTHWESTERLY LINE OF OLYMPIC BOULEVARD, 110 FEET WIDE, AS ESTABLISHED BY DEED RECORDED IN BOOK 22850, PAGE 90 OF OFFICIAL RECORDS IN THE OFFICE OF SAID COUNTY RECORDER; THENCE ALONG SAID NORTHWESTERLY LINE, SOUTH 60° 06' 22" WEST, 230.84 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 1945.00 FEET; THENCE SOUTHWESTERLY ALONG SAID CURVE 83.35 FEET TO A LINE THAT BEARS SOUTH 17° 14' 04" EAST, FROM THE POINT OF BEGINNING; THENCE NORTH 17° 14' 04" WEST, 221.91 FEET TO THE POINT OF BEGINNING

Parcel B

PARCEL 8 OF LOS ANGELES COUNTY ASSESSOR MAP #74 IN THE CITY OF SANTA MONICA, COUNTY OF LOS ANGELES, STATE OF CALIFORNIA AS PER MAP RECORDED IN BOOK I, PAGE 39 OF LOS ANGELES COUNTY ASSESSOR MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY, ALSO THAT PORTION OF PARCEL 9 OF SAID LOS ANGELES COUNTY ASSESSOR MAP #74 DESCRIBED AS FOLLOWS:

BEGINNING AT THE MOST SOUTHERLY CORNER OF SAID PARCEL 9, THENCE NORTH 20° 51' 48"

WEST ALONG THE WESTERLY LINE OF PARCEL 9 A DISTANCE OF 140.62 FEET TO THE NORTHERLY LINE OF SAID PARCEL, THENCE NORTH 75° 32' 40" EAST ALONG THE NORTHERLY LINE A DISTANCE OF 166.00 FEET TO A POINT ON THE WESTERLY LINE OF STEWART STREET, SAID POINT BEING ON A CURVE CONCAVE SOUTHWESTERLY, HAVING A RADIUS OF 460.00 FEET; THENCE SOUTHEASTERLY ALONG SAID CURVE, 20.91 FEET TO A POINT, A RADIAL LINE TO SAID POINT BEARS NORTH 59° 06' 12" EAST, THENCE SOUTH 75° 32' 40" WEST PARALLEL WITH THE NORTHERLY LINE OF PARCEL 9 A DISTANCE OF 111.23 FEET; THENCE SOUTH 29° 53' 38" EAST A DISTANCE OF 103.41 FEET TO THE NORTHWESTERLY LINE OF OLYMPIC BOULEVARD, 117 FEET WIDE, THENCE SOUTH 60° 06' 22" WEST ALONG THE NORTHWESTERLY LINE OF OLYMPIC BOULEVARD 75.70 FEET TO THE POINT OF BEGINNING.

Parcel C

THAT PORTION OF PARCEL 9 OF LOS ANGELES COUNTY ASSESSOR MAP #74 IN THE CITY OF SANTA MONICA, COUNTY OF LOS ANGELES, STATE OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 1, PAGE 39 OF LOS ANGELES COUNTY ASSESSOR MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY, DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE SOUTHEASTERLY BOUNDARY OF SAID PARCEL 9, DISTANT THEREON NORTH 60° 06' 22" EAST, 75.70 EAST FROM THE MOST SOUTHERLY CORNER OF SAID PARCEL 9, THENCE ALONG SAID SOUTHEASTERLY BOUNDARY, ALSO BEING THE NORTHWESTERLY LINE OF OLYMPIC BOULEVARD, 117 FEET WIDE, NORTH 60° 06' 22" EAST 82.29 FEET TO THE BEGINNING OF A TANGENT CURVE, CONCAVE WESTERLY AND HAVING A RADIUS OF 25 FEET; THENCE NORTHERLY ALONG SAID CURVE AN ARC DISTANCE OF 39.27 FEET, THENCE NORTH 29° 53' 38" WEST, 40.75 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHWESTERLY AND HAVING A RADIUS OF 460 FEET; THENCE NORTHWESTERLY ALONG SAID CURVE AN ARC DISTANCE OF 8.05 FEET TO A POINT, A RADIAL LINE TO SAID POINT BEARS NORTH 59° 06' 12" EAST, THENCE SOUTH 75° 32' 40" WEST PARALLEL WITH THE NORTHERLY LINE OF PARCEL 9 A DISTANCE OF 111.23 FEET; THENCE SOUTH 29° 53' 38" EAST 103.41 FEET TO THE POINT OF BEGINNING.

Assessor's Parcel Number(s): 4268-001-040 and 4268-001-048

EXHIBIT B

MAP OF THE BURDENED PROPERTY