HD GEOSOLUTIONS INC.

May 3, 2018

Mr. Tony Spinrad
Irwindale Partners II, LLC
510 Foothill Boulevard, Suite 206
San Dimas, California 91773

Subject: **Geotechnical Report for Environmental Impact Report**
The Park at Live Oak [APN8532-001-002 & -004]
1220 - 1270 Arrow Highway
Irwindale, California
HDGI Project No. 70917

Dear Mr. Spinrad,

HD Geosolutions, Inc. (HDGI) is pleased to submit this report presenting our geotechnical findings and conclusions in support of an Environmental Impact Report, which will address future development at the site.

We appreciate the opportunity to be of service. If you have any questions about this report, please call at your convenience.

Respectfully submitted,
HD GEOSOLUTIONS, INC.

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Enc. Geotechnical Report for Environmental Impact Report, Arrow IDEFO
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GEOTECHNICAL REPORT
FOR ENVIRONMENTAL IMPACT REPORT
THE PARK AT LIVE OAK [APN 8532-001-002 & -004]
1220 - 1270 ARROW HIGHWAY
IRWINDALE, CALIFORNIA

PREPARED FOR

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PROJECT NO. 70917 **MAY 3, 2018**

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1. EXECUTIVE SUMMARY

This report presents the results of our geotechnical Environmental Impact Report (EIR) study for the subject project. The site is depicted on Figure 1, Site Location Map.

The site was previously used as a sand and gravel quarry and began being filled as an IDEFO in 2002. Arcadia Reclamation, Inc. (ARI) took over filling operations for the project in December 2016. The site will be filled to approximately street grade in preparation for commercial development, and our firm is providing ongoing geotechnical engineering and construction services for the project. This EIR input was authorized to provide insight on the geotechnical conditions, including geologic hazards, within the property.

Based on our observation, testing, and review of geotechnical data gathered during the first year of site operations, review of historical reports and information, as well as our more than 13 years of experience in observing, testing, and completing IDEFO fills and construction on IDEFOs, that development of the subject site will be feasible once it is completely filled in. Furthermore, observation of settlement monument data may also allow for construction to begin in areas within the site once they are completed to grade and demonstrate that settlement has stabilized.

As a result of the quarrying and filling activities at the site, seismically-induced landslide hazards identified by the California Geological Survey (CGS) will be mitigated once the site is filled. Preliminary development plans indicate that future structures will be located within the limits of the engineered fill. Utilities passing from the engineered fill into the looser native materials will require flexible connections at the fill/native transitions to accommodate potential differential movement. The native materials at the margins of the site should be evaluated for seismically-induced settlement in the future as development plans dictate.

2. SCOPE OF SERVICES

This report presents the results of our geotechnical EIR study for the subject site. The location of the project is shown on Figure 1. The site was previously used as a sand and gravel quarry and transitioned to an Inert Debris Engineered Fill Operation (IDEFO) in 2002.

HDGI has been ARI's geotechnical consultant on this project since they took over as operator for the site in December 2016. The eventual goal of the reclamation is to create a higher and better use in compliance with the Surface Mining and Restoration Act (SMARA) and the final, approved grading plan. The Conceptual Land Use Plan for The Park at Live Oak, is depicted on Figure 2.

The primary purpose of this study is to address the geotechnical and geological issues pertinent to future development. Herein we present preliminary recommendations to mitigate potential geological hazards, as well as recommendations for design of building foundations, grading, and paving. This report is based on our detailed review of available documents by others; available published and unpublished geologic and seismic literature pertinent to the site; and the results of our geotechnical exploration, observation, and testing at the site since 2016. Our reporting to date has included daily, quarterly, and annual quality assurance reports, and as-needed geotechnical engineering services. A reference list is presented at the end of this report.

3. PROJECT AND SITE DESCRIPTION

3.1. PROJECT LOCATION

The project site is located in the central San Gabriel Valley within the western part of the City of Irwindale. The triangular site is approximately 78 acres and is located adjacent to the I-605 Freeway to the west, and approximately ¼ mile west of the San Gabriel River (Figures 1 and 2). The site is bounded to the north by Arrow Highway, and to the south by Live Oak Avenue.

3.2. SITE SUBDIVISIONS AND NOMENCLATURE

For the purpose of our IDEFO reporting reference, we have subdivided the site into seven general areas. These are designated Areas 1N, 1S, 2N, 2S, 3N, 3S, and the West End Area (Figure 3).

The site encompasses three prior parcels/property divisions. These previously were referred to as the Nu-Way Arrow Pit, corresponding approximately to Areas 2N, 2S, 3N, and 3S on Figure 3; Triangle Pit or West Pit, corresponding approximately to Areas 1N and 1S; and the relatively smaller West End Area to the west of the West Pit. The current rough grading plan (Hall & Foreman, 2016) corresponds to the former Nu-Way Arrow Pit. The former Triangle Pit has been incorporated into the current IDEFO project. The West End Area is included as part of the proposed development on Figure 2, and therefore it is included herein as part of the site. The project grading plan is currently being revised by D&D Engineering and will ultimately be reviewed and signed by HD Geosolutions, Inc.

3.3. SITE CONDITIONS AND USE

3.3.1. Quarry Activities

Aerial photographs indicate that the former Nu-Way Arrow Pit had been mined for sand and gravel since the 1960s. Morhol, Inc. (2002) indicates that mining had ceased by 2002, and preparations for reclamation of the site were being made. This quarry reached elevations of approximately Elevation 230 to 240 (feet MSL), corresponding to maximum pit depths of about 160 to 170 feet below the surrounding grades with groundwater often exposed at maximum pit depths.

The former Triangle Pit also was used as a sand and gravel quarry in the past. Aerial photographs indicate that mining occurred approximately during the 1960s and 1970s. Whereas the former Nu-Way Arrow Pit was partially filled after 2002, the West Pit topography as of August 2016 was similar to the mined condition decades earlier. This quarry reached elevations of approximately Elevation 220 to 230 (feet MSL), corresponding to maximum pit depths of about 150 to 160 feet below the surrounding grades. Standing water has been present at times in the pit bottom.

Aerial photographs suggest that the West End Area has been neither quarried nor subjected to rough grading. We anticipate that native soils, generally consisting of sand and gravel, are present at relatively shallow depths in this area, if not present at the ground surface.

3.3.2. Inert Debris Landfill Activities

Available aerial photos indicate that the site, known as the former Nu-Way Arrow Pit, was mined for sand and gravel since the 1960s. Morhol, Inc. (2002) indicates that mining had ceased by 2002, and preparations for reclamation of the site were being made.

The easterly site parcel was owned and operated by United Rock Products as of 2002, and the site began operating as an inert landfill in May 2002 (Morhol, 2003b). In 2004, the parcel was sold to Irwindale Partners, LP, and backfill operations were taken over by US Waste of California (Waste Management). The westerly site parcel was purchased by JH Properties in 2016, after which Arcadia Reclamation, Inc. took over the IDEFO for the entire site.

Several geotechnical firms have provided engineering services and/or construction observation and testing services for this site. The reference list at the end of this report demonstrates the relatively large number of references and consultants since backfilling began. The firms include Morhol, Inc. (2002-2003), Geotechnical Soilutions, Inc. (2003-2004), Zeiser-Kling (2005-2006), and Hushmand Associates, Inc. (2006-2016), and Advanced Earth Sciences (2012-2016) in coordination with Hushmand.

Based on our historical document review, we conclude that the backfilling activities through 2006 were less documented than after 2006, when the backfilling reportedly began to be performed in general accordance with the 2005 Irwindale Guidelines. The dike, or berm in Areas 2N and 2S reportedly was constructed around 1998 to 2000; as discussed in the previous section, the upper 85 feet of this material will be removed and replaced with properly compacted blended rubble fill and/or soil fill in accordance with the approved rough grading plan.

The Regional Water Quality Control Board (RWQCB) issued Waste Discharge Requirements (WDRs) for the site in 2001. According to RWQCB, acceptable materials included soil, rock, gravel, broken concrete, broken asphalt, glass, brick, ceramics, and inert plastic and rubber tires. Among other requirements, RWQCB stated that asphaltic material shall not be dumped into standing water, nor shall it be placed below the highest anticipated groundwater elevation. The historic high groundwater level is EL318. Asphalt is currently being placed above the historic high groundwater level in accordance with the 2001 WDRs.

3.4. FUTURE DEVELOPMENT

The preliminary development design shown on Figure 2 includes commercial, industrial, business park, and retail use. This design will include buildings of various sizes potentially totaling up to the maximum allowable commercial square footage, several retention basins, drives, and parking.

3.5. FILL QUANTITIES

The approximate net yearly fill quantities placed at Arrow IDEFO are summarized in Table 1, below. Fill placed by the current operator, ARI, was placed in approximately 6- to 8-inch lifts depending on the maximum size of the processed rubble. Fill quantities placed prior to January 2017 were obtained from reports prepared by prior consultants.

Table 1, Summary of Net Yearly Fill Quantities

Year	Approximate Volume of Fill Placed (cubic yards)
Pre 2005	unknown
2005	520,000
2006	681,000
2007	581,000
2008	587,000
2009	469,000
2010	425,000
2011	339,000
2012	302,000
2013	720,000
2014	1,468,000
2015	1,034,000
2016	459,000
2017	114,000
Total	**7,699,000**

3.6. FILL PERFORMANCE

3.6.1. General

Settlement is a primary concern in inert debris engineered fills intended for future use as structural fill. We are monitoring settlement at the site directly through the installation and regular surveying of settlement monuments distributed throughout the fill at various lateral and vertical locations. These locations are planned using the Irwindale Above Water Fill Guidelines, the approved grading plan, and in concert with the grading team such that traffic flow and fill placement are minimally impacted.

As of this report, this monitoring program under HDGI's purview is in progress and will continue at least to completion of the reclamation stage of the project. We are continuing to install additional monuments and take readings, and this will continue over the duration of the IDEFO. The results to date of the monitoring are discussed in Section 3.6.6 of this report, and the monitoring data is presented graphically in Appendix B.

As the IDEFO progresses, we will continue to acquire geotechnical data and make engineering recommendations, as appropriate.

3.6.2. Field Density Testing

IDEFO construction is unlike a conventional fill operation. The material particle sizes and varied sources make conventional field density testing techniques impractical. We are performing field density testing of new engineered fill in general accordance with the *Guidelines for Above-Water Backfilling of Open-Pit Mines, Irwindale, California* ("Irwindale Guidelines", Irwindale Backfill Committee, 2005). These guidelines generally require materials placed to be 12 inches or smaller in dimension.

The crushers that are currently used to process rubble at the site typically yield rubble pieces with a maximum dimension on the order of 4 to 6 inches in size. In addition, prior IDEFO materials are being excavated within the central area of the site, referred to as Zone A in the approved grading plan, and being used for new engineered fill. The maximum particle size of this material is typically greater than 6 inches. The operator pulverizes materials that are generally larger than 12 inches, where encountered during fill operations so that they conform to the Irwindale Above-Water Fill Guidelines.

At this time, HDGI has performed large-scale field density testing at the site in general accordance with the Irwindale Guidelines and ASTM D5030. We also have performed conventional soil density testing, as appropriate. Our large-scale field tests include bulk density tests, which are analogous to conventional field density tests for soil (e.g., sand cone or nuclear gauge), and Maximum Achievable Density (MAD) tests, which are analogous to laboratory maximum density tests. Our frequency of large-scale testing is in general accordance with the Irwindale Guidelines, and the volume of a particular test is in accordance with ASTM D5030. Appendix A includes representative photographs of large-scale field density testing.

3.6.3. Geotechnical Field Observation and Testing

HDGI has provided full-time observation and testing during fill placement. Full time observation and testing during fill placement has allowed HDGI to evaluate the overall consistency of operations. The contractor continues to demonstrate consistency with the fill operations so that the maximum size and material sorting requirements are satisfied.

Daily moisture testing, large scale density testing, and gradation testing following select large scale density tests provide us with data to assist in the evaluation of the engineered fill. Our field activities also include but are not limited to observation of grading equipment benching into placed engineered fill and native slopes, fill response to traffic by loaded heavy equipment, engineered fill slope face integrity, site performance during and after heavy rains, and qualitative observation of water infiltration into the engineered fill after large scale density tests. Benching into the engineered fill prior to commencing adjacent fills has allowed HDGI to assess the integrity of the placed fill as well as observe the exposed void structure of the fill and verify that adequate fines and smaller materials have in-filled around the larger, 6- to 8-inch minus processed rubble debris.

3.6.4. *Daily Field Reporting*

Field reports are generated for each day of observation and testing. These reports include select photographs and descriptions of the daily activities, as well as notes on items that may require the attention of the operator. The photographs allow for an assessment of the operations on that day, as well as a more accurate interpretation of settlement monument behavior. We notify the operator of items that may require additional attention prior to departing the site for the day.

3.6.5. Laboratory Testing

Large-scale density tests, large-scale gradation tests, as well as laboratory compaction testing on the minus ¾-inch fraction of the IDEFO matrix material, are performed on a regular basis. However, due to the variability of types and densities of the constituent materials placed at the site, it is our professional opinion that data from the numerous settlement monuments combined with visual observations, and photo-documentation provide a significant, and governing means of evaluating fill performance.

3.6.6. Field Settlement Monitoring Program

3.6.6.1. Settlement Monuments Installed Prior to 2017

Settlement monuments were placed by others at the site prior to 2017. We have observed that at least a portion these monuments were not constructed in conformance with the Irwindale Guidelines. For example, we observed gross out-of-vertical inclinations, disconnected pipe segments, no spot welds on couplings, and use of steel base plates instead of concrete blocks. Considering this and upon further review of the prior data by others, we do not recommend that future engineering decisions rely on the prior monuments or data. We further recommend the abandonment of those monuments. HDGI is utilizing the data we have acquired from new settlement monuments constructed in general conformance with the Irwindale Guidelines starting in 2017. These settlement monuments are discussed in the following section.

3.6.6.2. Settlement Monument Installation during 2017-18

A total of 15 settlement monuments, designated SM300 through SM314, have been installed to date at the site since HDGI assumed the role of engineer of record in December 2016. To date, there are four clusters (A through D) of multiple settlement monuments. The settlement monuments and clusters are summarized in the table below, and the locations are depicted on Figure 3. The monuments are surveyed on a monthly basis by Johnson-Frank & Associates, Inc.

Table 2, Summary of Settlement Monitors

Site Area	Cluster Designation	Settlement Monument	Installation Date
SE Pit (Area 3S)	A	SM300	4-18-17
		SM310	11-3-17
	B	SM301	7-18-17
		SM308	11-1-17
	D	SM311	11-20-17
		SM314	3-28-18
		SM307	10-30-17
		SM312	2-20-18
West Pit (Area 1)	C	SM302	9-12-17
		SM309	11-2-17
		SM313	3-27-18
NE Surcharge Fill (Area 3N)		SM303	9-12-17
		SM304	9-12-17
		SM305	9-12-17
		SM306	9-12-17

The settlement monuments were constructed by placing galvanized plumbing pipe with a welded coupling in a 5'x5'x2' form and filling that form with concrete to embed the pipe in the concrete. In the Southeast and West Pits, where the ground surface elevation rises due to placement of new engineered fill, sections of pipe are being added to extend monuments SM300-SM302 and SM307-SM314 upwards. The nominal lengths of the pipe extensions were 6 feet. On-site soil matrix material for blended rubble fill was placed immediately around each extension. This soil was moisture conditioned and compacted with hand-operated equipment. SM303-306 are surficial monuments constructed at the top of the surcharge fill in Area 3N; these monuments are not being extended.

3.6.6.3. Settlement Monument Survey Results

The Southeast Pit monument settlements range to date from approximately 1 to 13 inches due to added fill depths of approximately 45 to 80 feet. Measurements began with SM300 one year ago. These results to not account for SM312 or SM314, which were installed relatively recently and have not yet generated significant data. These magnitudes of settlements observed beneath monuments placed to date are within acceptable ranges of settlement for engineered fill.

The West Pit monument settlements are approximately 1 inch due to added fill depths of approximately 60 feet. Measurements began with SM302 in September 2017. These results to not account for SM313, which was installed relatively recently and has not yet generated significant data.

Survey measurements at the top of the northeast surcharge fill indicate settlements on the order of ½ to ¾ inch since the installation of SM303-6 in September 2017.

The settlement monitoring data acquired to date is presented graphically in Appendix B.

3.6.6.4. Conclusions and Recommendations

The survey readings indicate that settlement is occurring generally as compacted fill is placed in the pits, as expected. As areas plateau for periods of time (due to the particulars of the grading operation), settlements generally taper off or cease. Occasionally there is upward movement, or movement without apparent fill placement, and this is typically explainable by considering the entirety of the grading operations, such as local excavations or fills in the vicinity of settlement monuments. In our experience with similar projects, settlement monitoring data reliably depicts the soil behavior caused by static loading; however, it is necessary to apply judgment to separate the surcharge-settlement data from the influence of nearby grading.

Additional time, readings, and the installation of additional field instrumentation will be of principal importance to the project. This additional data will demonstrate the durations required to reach tolerable settlements across the site, which will inform our future geotechnical recommendations for the proposed development. We will continue to update our findings and conclusions in our quarterly and annual reports.

Our review of the results of the settlement monitoring program to date indicate that it will be possible to build on the site once it is completely filled in. Observation of settlement monument data may also allow for construction to begin on areas that have been completed to grade and demonstrate that settlement has stabilized.

3.6.6.5. Future Work

We recommend that the engineering observation and settlement monitoring program continue. As various needs and opportunities arise for other types of testing, we will recommend additional types of field tests to supplement the data. Our office should be notified of changes and details of the planned building construction as information becomes available.

3.6.7. Data Retention and Organization

Document retention for this project began with our accumulation of available prior documents by others, which are listed at the end of this report. Our long-term records program consists of digital and hard-copy records. We store our digital files on a third-party cloud server (Box.com) while syncing all of these files to our local server.

4. REGULATORY FRAMEWORK

4.1. CITY LEVEL

The City of Irwindale enforces the 2018 Irwindale Municipal Code, which adopts the 2017 Los Angeles County Building Code, which modifies and amends the 2016 California Building Code (CBC). The City's primary seismic regulatory document is contained in the Public Safety Element of the 2020 Irwindale General Plan; these regulations incorporate the State's requirements. The objective of the Safety Element is to better protect occupants and equipment during seismic events. In the Safety Element, specific guidelines are included for the evaluation of liquefaction, tsunamis, seiches, non-structural elements, fault rupture zones, and engineering investigation reports.

4.2. COUNTY LEVEL

The 2017 County of Los Angeles Building Code is based on the 2016 CBC and the 2015 IBC. The County Department of Building and Safety is responsible for implementing the provisions of the County Code. The County's primary seismic regulatory document is the Safety Element of the County of Los Angeles General Plan, adopted October 6, 2015.

4.3. STATE LEVEL

The State of California adopted the 2016 CBC, based on the 2015 IBC.

The Alquist-Priolo Geologic Hazards Zone Act was enacted by the State of California in 1972 to address the hazard and damage caused by surface fault rupture during an earthquake. The Act has been amended several times and was renamed the Alquist-Priolo Earthquake Fault Zoning Act, effective January 1, 1994. The Act requires the State Geologist to establish "earthquake fault zones" along known active faults in the state. Cities and counties that include earthquake fault zones are required to regulate development projects within these zones.

The Seismic Hazard Mapping Act of 1990 was enacted, in part, to address seismic hazards not included in the Alquist-Priolo Act, including strong ground shaking, landslides, and liquefaction. Under this Act, the State Geologist is assigned the responsibility of identifying and mapping seismic hazards zones. The California Geological Survey published Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California in 2008 as part of this effort.

The California Seismic Safety Commission was established by the Seismic Safety Commission Act in 1975 with the intent of providing oversight, review, and recommendations to the Governor and State Legislature regarding seismic issues. The commission's name was changed to Alfred E. Alquist Seismic Safety Commission in 2006. The Commission has adopted several documents addressing specific earthquakes, preparedness, and loss reduction.

Various state and local agencies permit the design and construction and regulate the operation, closure, and development of IDEFOs in the State of California. Those agencies include the Regional Water Quality Control Board, the Integrated Waste Management Board, the Department of Toxic Substance Control Board, the Regional Air Resources Board, the Los Angeles County Department of Public Works, the City of Irwindale, and the South Coast Air Quality Management District.

5. GEOLOGY

5.1. GENERAL

The project site is located in the central San Gabriel Valley along the west bank of the San Gabriel River. The valley is bordered by the San Gabriel Mountains on the north, the San Jose Hills to the east, the Puente Hills on the south, and on the west by the San Rafael and Repetto Hills. The valley sediment consists primarily of fans shed southward from the San Gabriel Mountains, and to a lesser degree from the other nearby ranges. Coarser materials are contained in broad fans below larger mountain drainages and in channels defined along the major drainages including the San Gabriel and Rio Hondo. The surficial geologic materials of the site area are depicted on Figure 4, Regional Geologic Map.

5.2. GEOLOGIC UNITS

5.2.1. General

Alluvial sediments at the site were mined for sand and gravel between 1960 and 2002. The resulting excavation is being filled with imported inert materials. Fill operations began in 2002. When completed, the site will be underlain by engineered fill ranging from approximately 0 to 170 feet thick, surrounded by and underlain by alluvium to an unknown depth.

5.2.2. Non-Engineered Fill

There are areas of the site that still require characterization. In particular, those areas that have not been previously quarried have not been investigated by our firm. It is likely that shallow, variable depths of non-engineered, or artificial fill exist in these areas. These undocumented fill soils, if present, should be removed and replaced as engineered fill as a part of site development.

5.2.3. Talus

Loose soils derived from the alluvium in the upper West Pit side slopes mantle the lower slopes in that pit. The talus resulted from weathering and raveling of the upper slopes and thinly covers most of these lower slopes. The slopes include exposures of underlying alluvium in places. The talus is generally composed of gravel, cobbles and boulders, similar to the alluvium from which it is derived. This material is being removed incrementally as the West Pit is filled.

5.2.4. Engineered Fill

Engineered fill consists primarily of inert debris as allowed by the Regional Water Quality Control Board Waste Discharge Requirements approved for the site. With the general exception of plastic, and rubber tires which are acceptable for import according to the RWQCB, inert debris placed at the site included soil, rock, gravel, broken concrete, glass, brick, broken asphalt (to be placed above the highest anticipated groundwater level) and ceramic. Rubble is being processed and stripped of steel prior to placement as engineered fill. Asphalt-containing materials are being placed above Elevation 318, which is the historic high groundwater level. Based on our experience in the vicinity of the site, the permeability of the engineered fill is on the order of 20- to 40-times less than that of the native alluvium. Therefore, the likelihood of stormwater infiltrating directly through the engineered fill to the groundwater table is not likely. On-site infiltration testing will be performed at a later date.

5.2.5. Alluvium

Most of the San Gabriel Valley is underlain by alluvial fans shed southward primarily from the San Gabriel Mountains and, to a lesser degree, from the other nearby ranges. The basement rock of the San Gabriel Mountains includes Cretaceous-aged quartz-diorite that has been intruded and faulted into older metamorphics. Materials shed from these "basement complex" igneous and metamorphic rocks tend to consist primarily of larger, erosion-resistant gravels and sands with relatively minor amounts of silt and clay. Alluvial deposits outside of and beyond the immediate influence of the major drainage systems consist of sand and gravel with discontinuous lenses of silt and clay.

The site was quarried in the past to extract the gravelly alluvial sediments deposited largely within the braided San Gabriel River drainage and alluvial fans. These materials consist primarily of sand, gravel, cobbles, and boulders that are weakly cemented, and beige-tan-brown in color. The coarse-grained alluvium grades laterally into the finer grained materials comprising the adjacent floodplain deposits.

Alluvium in the San Gabriel Valley ranges in age from Holocene to Late Pleistocene and is reported to depths of about 100 feet. Pleistocene-aged alluvium tends to be slightly more consolidated and extends to greater depths.

5.3. GROUNDWATER BASIN

Groundwater storage in the San Gabriel Valley groundwater basin occurs primarily in two water-bearing units. These include the alluvial valley sediments and the underlying Fernando Formation. The basin is bounded on the north by the Raymond fault and the basement complex of the San Gabriel Mountains, on the west and south by the Repetto and Puente Hills, and on the east by the Chino and San Jose faults. The bulk of the groundwater in the basin is contained in the unconsolidated to semi-consolidated alluvial aquifer under unconfined conditions.

Recharge in the basin occurs primarily from direct precipitation and percolation of stream flow carried from the San Gabriel Mountains, with more limited contributions from imported water and underflow from adjacent basins and other groundwater sources. Subsurface flow in the basin is generally from the edges toward the center of the basin and then southward toward Whittier Narrows. Groundwater levels in the basin fluctuate over a wide range due to numerous infiltration galleries managed by the San Gabriel Watermaster.

Groundwater levels in the site vicinity have been at relatively low elevations due to drought conditions. Groundwater levels also can be affected by the decision of the Watermaster to release water from upstream dams for spreading in the San Gabriel basin. Based on data presented by Anacapa Geoservices, Inc. (2017), recent groundwater levels in the area have been on the order of EL 180 to 183. The historic high groundwater level at the site, per the Los Angeles Regional Water Quality Control Board (LARWQCB), is approximately EL318. We understand that the historical high groundwater level is considered to be equal to the highest anticipated groundwater level for this site, according to the site Waste Discharge Requirements (Order R4-2016-0332).

6. GEOLOGIC HAZARDS

6.1. FAULTING AND SEISMICITY

The numerous faults in southern California include active, potentially active, and inactive faults. Regional faults of significance are depicted on Figure 5, Regional Fault Map. Classifications for these major groups are based upon criteria developed by the California Division of Mines and Geology (CDMG), now known as the California Geological Survey (CGS) for the AP Zone Act program. By definition, an active fault has ruptured within Holocene geologic time (about the last 11,000 years). Active faults are not known to extend through or to project toward the project site. Surface rupture from fault plane displacement propagating to the surface is therefore considered remote.

Faults that display latest movement during Quaternary but prior to Holocene are generally considered to be "potentially active". The Quaternary includes the Holocene and Pleistocene Ages and represents the last 1.6 to 2.0 million years of geologic time. Potentially active faults are not considered an imminent fault rupture hazard, but the potential cannot be completely dismissed. Inactive faults are those faults where the latest displacement is older than the Pleistocene.

The closest active faults to the site are the Duarte fault and the Sierra Madre fault located approximately 2½ miles north of the project along the southern edge of the San Gabriel Mountains. These faults, along with others that occur within a narrow zone that extends along the base of the San Gabriel Mountains, are north-dipping structures that accommodate active uplift of the San Gabriel Mountains. The Clamshell-Sawpit Canyon fault which extends just north of the Duarte and Sierra Madre faults is believed to be the source of the June 28, 1991 Sierra Madre Earthquake (CalTech, 2014). All of these faults are included as Alquist-Priolo Earthquake Fault Zones.

The project site is approximately 3½ miles southeast of the Raymond fault. The Raymond fault is mapped for about 14 miles from the Sierra Madre fault zone at the base of the San Gabriel Mountains north of Monrovia, southwestward through the communities of Arcadia, San Marino and South Pasadena, and then northwestward along York Boulevard. The fault is coincident with prominent geomorphic scarps across the communities of Pasadena and Highland Park. The fault is part of an east-west trending system that also includes the Malibu Coast fault, the Santa Monica fault and Hollywood fault. The Raymond fault dips north and is generally considered to have a left-lateral, reverse sense of slip. Crook et. al. (1987) suggests there have been at least three earthquake events on the Raymond fault during the Holocene with the most recent occurring between 1,500 and 2,000 years ago. The Raymond fault is included in an Alquist-Priolo Earthquake Fault Zone by the State Geologist.

The East Montebello fault is a short fault segment included in an Alquist-Priolo Earthquake Fault Zone located about 6 miles west of the site. The fault extends northwest over a distance of about 1½ miles from just east of the intersection of I-60 and San Gabriel Boulevard to about ¼ mile south of the intersection of San Gabriel Boulevard and Garvey Avenue. Yeats (2001) considers the fault to be a northwestward extension of the Whittier fault with a reduced slip rate due to accommodation of slip in the Montebello Anticline.

The Whittier segment of the Whittier-Elsinore fault zone approaches within about 9 miles south of the site. This fault zone extends nearly 200 miles from Laguna Salada in northern Mexico to just north of Whittier. The zone accommodates major right lateral slip and is considered to be a part of the San Andreas fault system. The Whittier segment extends about 24 miles from near Corona to north of Whittier. The fault is included in Alquist-Priolo Earthquake Fault Zones over most of this distance.

The project site is approximately 5 miles northeast of the boundary of the Elysian Park Fold and Thrust Belt. The Elysian Park fault is actually a blind fault (i.e. a buried fault that does not extend to the surface) capped by a fold and thrust structure. The axial trend of the fold extends approximately 12 miles through the Elysian Park-Repetto Hills from about Silver Lake on the west to the Whittier Narrows on the east. The 1987 Whittier Narrows earthquake (magnitude 5.9) has been attributed to subsurface thrust faults, which are reflected at the earth's surface by a west-northwest trending anticline known as the Elysian Park Anticline, or the Elysian Park Fold and Thrust Belt. The subsurface faults that create the structure are not exposed at the surface and do not present a potential surface rupture hazard; however, as demonstrated by the 1987 earthquake and two smaller earthquakes on June 12, 1989, the faults are a source for future seismic activity. As such, the Elysian Park Fold and Thrust Belt should be considered an active feature capable of generating future earthquakes.

A list of known active faults and their distances from the project site are indicated in Table 3, Major Faults Considered to be Active in Southern California.

Table 3, Major Faults Considered to be Active in Southern California

Fault	Maximum Credible Earthquake			Slip Rate (mm/yr)	Distance From Site (miles)	Direction From Site
Duarte	6.7	(a)	RO	0.1	2 ½	N
Sierra Madre	7.3	(c)	RO	4.0	3	N
Raymond	6.7	(f)	RO	0.4	3½	NW
Elysian Park Fold and Thrust Belt	7.1	(c)	RO	1.7	5	SSW
East Montebello	NA		SS		6	W
Whittier	7.1	(b)	SS	3.0	9	S
Verdugo	6.75	(d)	RO	0.5	13	WNW
Hollywood	7.0	(c)	RO	1.5	16	W
Cucamonga	7.0	(g)	RO	5	20	WNW
Newport-Inglewood Zone	7.0	(d)	SS	1.0	22	SW
Northridge	6.9	(h)	RO	1.5	27	WNW
San Fernando	6.8	(g)	RO	5.0	22	NW
San Andreas (Mojave Segment)	8.2	(e)	SS	30.0	26	NE

(a) Greensfelder, CDMG Map Sheet 23, 1974.
(b) Blake, 1995
(c) Dolan et al., 1995
(d) Mualchin & Jones, 1992
(e) OSHPD, 1995
(f) Wesnousky, 1986
(g) SCEDC
(h) Peterson el al., 1996
SS Strike Slip
NO Normal Oblique
RO Reverse Oblique

Site to fault distances measured using location of late Quaternary fault rupture map by Ziony and Jones, 1989 at a scale of 1:250,000.

A list of known potentially active faults and their distances from the project site are indicated in Table 4, Major Faults Considered to be Potentially Active:

Table 4, Major Faults Considered to be Potentially Active

Fault	Maximum Credible Earthquake			Slip Rate (mm/yr)	Distance From Site (Miles)	Direction From Site
San Jose	6.7	(d)	RO	0.5	8	SE
Indian Hill	N/A				8	E
Norwalk	6.7	(a)	RO	0.1	13	S
Chino-Central Avenue	7.0	(c)	NO	1.0	17	SE
Rialto-Colton	6.4	(e)	SS	n/d	31	E
Los Alamitos	6.2	(b)	SS	0.1	19	S

(a) Slemmons, 1979
(b) Mark, 1977
(c) Blake, 1995
(d) Dolan et al., 1995
(e) Wesnousky, 1986
SS Strike Slip
NO Normal Oblique
RO Reverse Oblique
n/d Not determined

Site to fault distances measured using location of late Quaternary fault rupture map at a scale of 1:250,000 as documented by Ziony and Jones, 1989

Several earthquakes of moderate to large magnitude (greater than 5.3) have occurred in the southern California area within the last 60 years. A list of these earthquakes is included in Table 5, List of Major Historic Earthquakes.

Table 5, List of Major Historic Earthquakes

Earthquake	Date of Earthquake	Magnitude	Distance to Epicenter (miles)	Direction to Epicenter
Long Beach	March 11, 1933	6.4	29	S
San Fernando	February 9, 1971	6.6	31	NW
Whittier Narrows	October 1, 1987	5.9	6	WSW
Sierra Madre	June 28, 1991	5.4	9	N
Big Bear	June 28, 1992	6.4	89	E
Landers	June 28, 1992	7.3	66	E
Northridge	January 17, 1994	6.7	32	WNW

It should be noted that major earthquakes have not been recorded within historic time on all of the faults considered to be active in southern California. Evidence of the fault's potential activity is based on the fault's rupturing materials younger than about 11,000 years and our historic records are limited to a few hundred years.

The project site is not exposed to a greater than normal seismic risk than other areas of southern California. However, based on the active and potentially active faults in the region, the project site could be subjected to significant ground shaking in the event of an earthquake. This hazard is common to southern California and can be mitigated if the buildings are designed and constructed in conformance with applicable building codes and sound engineering practices.

6.2. SLOPE STABILITY

The existing slopes at the site are comprised primarily of alluvium. Filling associated with the IDEFO activities generally have been raising the grade within the West and Southeast Pits, thus reducing the slope heights and improving the site from its quarried condition. When the IDEFO project is completed, the existing slopes at the site will no longer remain. Therefore, slope stability issues will not impact future development.

6.3. SOIL LIQUEFACTION AND SEISMIC SETTLEMENT

Liquefaction potential is greatest where the groundwater level is shallow, and loose sands or silts occur within a depth of about 50 feet or less. In general, liquefaction potential decreases as grain size and clay and gravel content increase. As ground acceleration and shaking duration increase during an earthquake, liquefaction potential increases. Soil liquefaction can cause significant structural damage.

The site is not located within a zone designated by the state geologist as being susceptible to soil liquefaction. More detailed, site-specific geotechnical investigations are required for sites within a liquefaction hazard zone, as required by the 1990 Seismic Hazards Mapping Act. The liquefaction hazard zoning is depicted on Figure 6. This figure includes the adjacent San Gabriel River channel.

In addition to the site grading and soil characteristics, the future groundwater levels are anticipated to be approximately 60 to 70 feet below the final site grade. Based on the density of the engineered fill and the anticipated future high groundwater depths, we consider the potential for liquefaction at the site within the IDEFO materials to be low.

Seismically-induced settlement is often caused by the densification of dry to partially-saturated, loose to medium-dense granular soils during ground shaking. Uniform settlement beneath a structure may not cause significant damage; however, variations in distribution, density, and confining conditions of natural soils generally result in non-uniform seismic settlement that can cause serious structural damage. Based on the generally dense condition of the compacted inert debris landfill materials at the site, we consider the potential for seismically-induced settlement within the IDEFO materials to be low.

Preliminary development plans indicate that future structures will be located within the limits of the engineered fill over the majority of the site, and within areas underlain by primarily native soils at the west end of the site, and within the far northeast corner of the site. Utilities passing from the engineered fill into the native materials should employ flexible connections at the fill/native transitions to accommodate potential differential movement. The native materials at the margins of the site should be evaluated for seismically-induced settlement in the future as development plans dictate.

6.4. EXPANSION POTENTIAL

The materials being imported to the site consist of inert debris and soil. These materials are processed and mixed together during the filling process. The upper 15 feet of the site will be capped with clean, non-expansive materials with a plasticity index of less than 15%, maximum particle size of 6 inches, no more than 15% of material larger than 3 inches, and a minimum fines content of 15%. Therefore, the expansion potential of the final grade is anticipated to be low. The soils intended for use in the upper 15 feet are currently stockpiled at the northeast corner of the site. The mixing and grading of these soils should be evaluated by the Geotechnical Engineer during fill placement.

6.5. FLOODING AND INUNDATION

The project site is not located in a mapped flood zone according to the Irwindale general plan.

6.6. TSUNAMIS AND SEICHES

subject site is located approximately 29 miles inland from the Pacific Ocean and at an elevation approximately 400 feet above the mean sea level. As a result, the site is not considered to be susceptible to tsunamis.

The quarry to the north of the site could have water as high as the historic high groundwater level, EL318. However, the south border of the adjacent quarry would from a 60- to 80-foot barrier between the potential high water surface and Arrow Highway, which separates the subject site from the quarry to the north. As a result, the subject site is not likely to be adversely affected in the event of earthquake-induced seiches (wave oscillations in an enclosed or semi-enclosed body of water).

6.7. OIL WELLS

According to the State of California Department of Conservation, Division of Oil, Gas and Geothermal Resources, abandoned or active oil wells are not located within or near the subject site. The site is not located within the limits of a known oil field. The nearest well is approximately 1½ miles southwest of the site and was abandoned as a dry hole in the 1930s time frame.

6.8. SUBSIDENCE

The site is not located within an area of known subsidence (ground surface settlement) associated with fluid withdrawal (groundwater or petroleum), peat oxidation, or hydrocompaction. Therefore, subsidence is not considered a significant impact to the site.

6.9. METHANE GAS

The site is not located within any known Methane Hazard Zone. In addition, the site is not located within a known oil field, and oil or gas wells are not reported to be located within or near the site limits.

7. OTHER HAZARDS OR IMPACTS

7.1. MINERAL RESOURCES

The site was used as a quarry for aggregate. The quarry was mined to its permitted depth. The project is not anticipated to have further impact on mineral resources in the area.

7.2. INFILTRATION

Infiltration of storm water into the engineered blended rubble fill is not feasible based on our past experience with infiltration testing on blended rubble fill materials and on-site observation of the blended rubble fill placed at the site under our engineering control. As the permeability of the engineered fill is on the order of 20 to 40-times less than that of the native alluvium, infiltration of stormwater into asphalt-containing fill materials will be minimal, and the likelihood of stormwater infiltrating directly through the engineered fill to the groundwater table is not likely. Furthermore, based upon these low rates, infiltration into the engineered fill is not anticipated to impact the proposed structures as they are currently designed; however, we recommend a final review be performed once planning is complete. We recommend that infiltration of stormwater captured in the proposed retention basins be directed towards the margins of the site into the more permeable alluvium.

We recommend that cross sections at each retention basin be prepared when the retention basin design is finalized. We also recommend that infiltration testing within the constructed retention basins be performed to obtain as-built infiltration results.

7.3. CORROSIVITY

We have not evaluated the corrosion potential of the engineered fill materials as part of our ongoing scope of services. As design is developed for the site, the geotechnical scope of services should include this evaluation of the near-surface soils, or deeper soils, if necessary. Corrosion mitigation measures should be incorporated, as appropriate.

8. HAZARD MITIGATION

8.1. SEISMICALLY-INDUCED SETTLEMENT

HDGI has reviewed the proposed site plan dated December 6, 2017 (Figure 2). The site will be relatively flat and sloped for drainage after the completion of the IDEFO, and the potential for liquefaction and seismic settlement are low within the IDEFO materials, as previously discussed. However, the seismic settlement potential near the site margins and West End Area (within the native materials and above the areas of the former quarry slopes) should be evaluated. The potential for seismic settlement should be screened in the context of future development, and quantitative estimates of seismic settlement should be developed, as necessary. These estimates should be compared to total and differential settlement tolerances for utilities and structures, and project-specific mitigation should be developed, as necessary.

As discussed previously, we anticipate that mitigation measures may be appropriate for utilities entering the site, and flexible connections and/or some remedial grading may be appropriate.

8.2. GRADING REQUIREMENTS

8.2.1. General

The placement of all fill at the site has been performed under engineering supervision. Unsuitable material is consistently removed from the fill material prior to placement. While the fill is currently being placed for the IDEFO, a 15-foot engineered fill cap will be placed on top of the inert debris fill. The upper 15 feet of the site will be capped with clean, non-expansive materials with a plasticity index of less than 15%, maximum particle size of 6 inches, no more than 15% of material larger than 3 inches, and a minimum fines content of 12%.

8.3. FOUNDATION REQUIREMENTS

8.3.1. General

New structures should be supported on foundations developing their support entierly within either the engineered inert debris or soil fill. The capability of the engineered fills to support new foundations should be verified during each project's comprehensive geotechnical investigation. Retaining walls or screen walls planned around the property may also be supported on spread footings in either the inert debris engineered fill or compacted fill cap material. Native soils will require overexcavation and recompaction to provide foundation support. At least 5 feet of compacted fill should be provided beneath the foundation bearing grade of all structures in order to properly address potential transition zones and looser native soils.

8.3.2. Footings in Compacted Fill

Spread footings carried at least 2 feet below the lowest adjacent grade or floor level can be designed to impose a net dead-plus-live load pressure of 4,000 psf in the engineered inert debris fill, and 2,500 psf in engineered soil fill. A one-third increase in the bearing value can be used for wind or seismic loads. These recommended bearing values may be finalized during the geotechnical evaluation of the development at the site.

Estimations of settlement will vary depending on specific structural loads; however, we anticipate that that tolerable settlements on the order of 1 inch or less will be estimated for the types of structures planned. The settlement of footings in compacted fill should be quantitatively estimated during the geotechnical evaluation for development at the site. The results of seismic settlement analyses should be added to the static foundation settlements, as applicable.

8.3.3. Code-Based Seismic Design

Structures located at the site can be designed to resist earthquake forces following the 2016 CBC. The mapped acceleration parameters corresponding to the site location can be obtained using the ASCE 7 Hazard Tool. These and the recommended site-specific design spectral response acceleration parameters should be developed during the geotechnical evaluation for development at the site.

8.4. FLOOR SLAB SUPPORT

Building floor slabs can be supported on grade on the engineered inert debris or properly compacted, engineered fill. It is advisable that any significant quantities of imported soils intended for use in the upper 15 feet of the site should be evaluated by the Geotechnical Engineer prior to import. Specific recommendations for support of floor slabs on grade, including considerations of moisture-sensitive flooring, dynamic loads, etc., should be developed during the geotechnical evaluation for development at the site.

8.5. BASEMENT AND RETAINING WALLS

Basement construction is not currently anticipated as part of the future development. Retaining walls may be included in the design. Specific recommendations for retaining walls and, if necessary, basement walls should be developed during the geotechnical evaluation of the final design of the development at the site.

8.6. PAVING

Development of the site will include parking and drives. A preliminary estimate of the R-value of the inert debris fill may be assumed to be 40. The R-value of the subgrade should be tested prior to final pavement design. The design R-value should reflect the as-placed condition of the soil fill cap, which may vary across the site.

9. LIMITATIONS

Within the limitations of the scope, schedule, and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practices in this area at the time this report was prepared. We make no other warranty, either express or implied. This report was prepared for the exclusive use of the Irwindale Partners II, LLP, and their agents and assigns, the property owner, and the design team for specific application to this project. If there are any changes to the proposed type of development assumed herein, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

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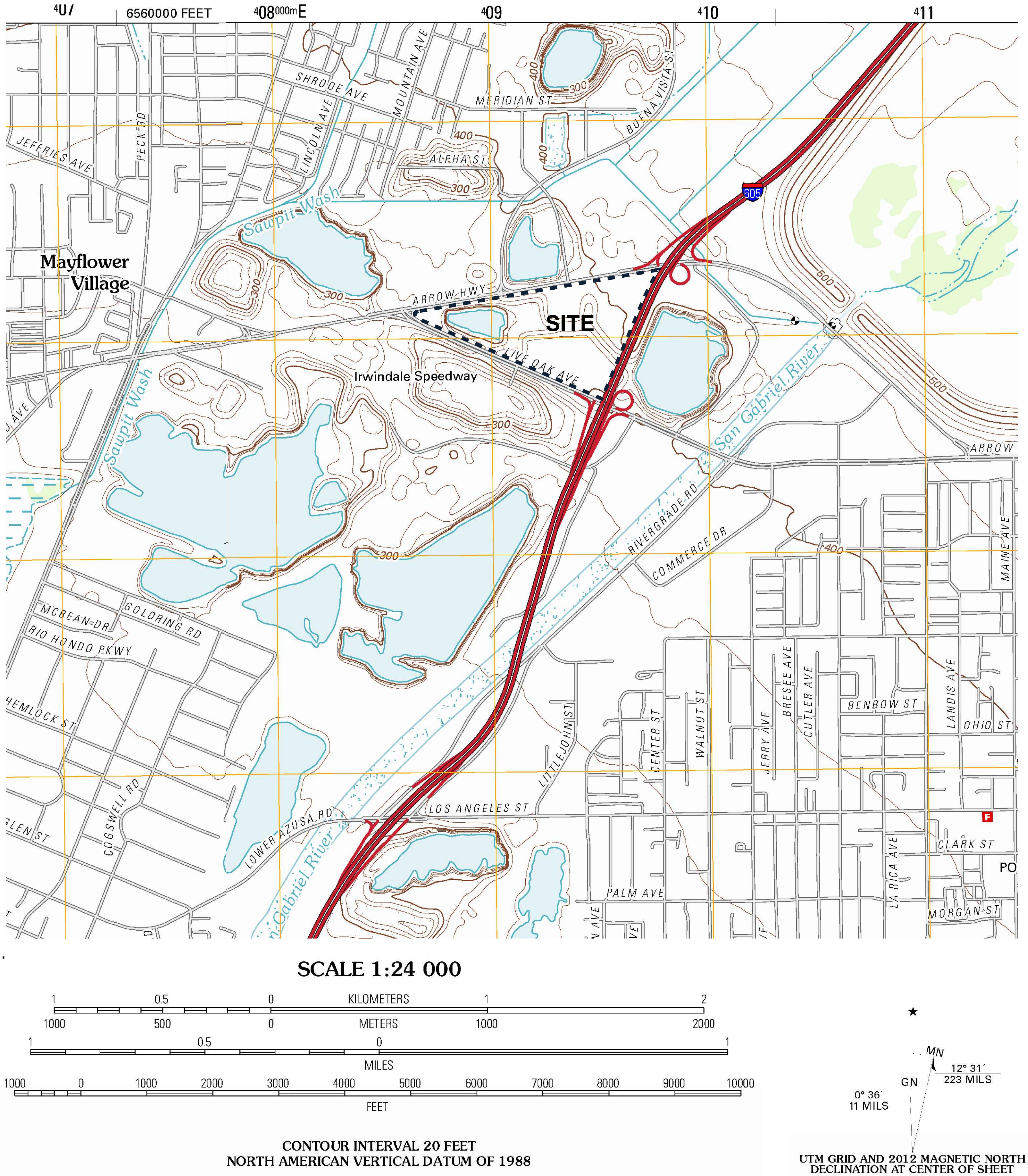
Aerial Photographs

United States Geologic Survey, scale 1”:500’, January 1, 1979.

Teledayne, scale 1”:500’, January 1, 1977.

United States Geologic Survey, scale 1”:500’, January 1, 1964.

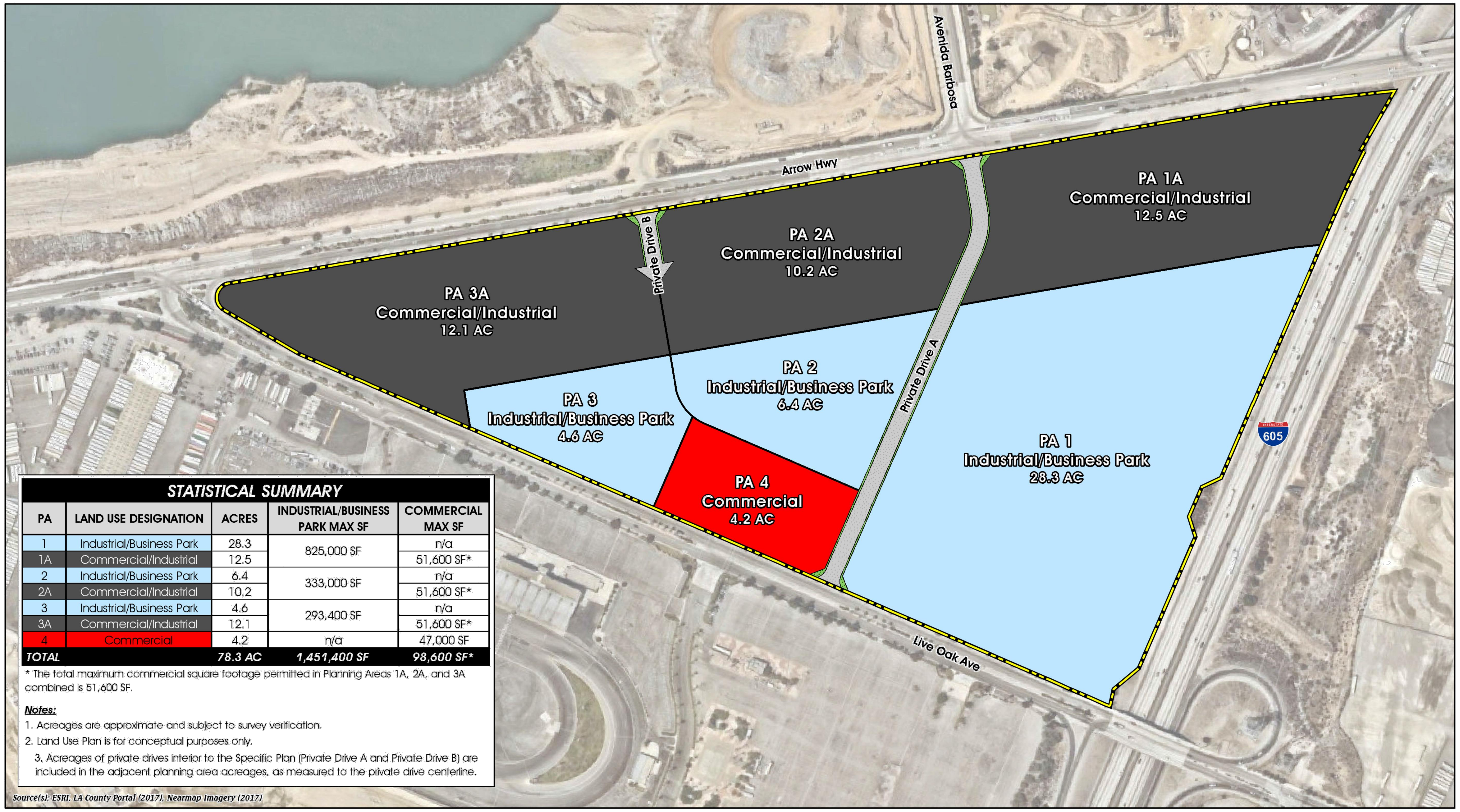
Pacific Air, scale 1”:500’, January 1, 1952.



HD GEOSOLUTIONS INC.

REFERENCES:
U.S.G.S. 7.5 Minute Baldwin Park and El Monte Quadrangles 2012

Title: **SITE VICINITY MAP**	Date: April 2018
Project Address: 1220-1270 Arrow Hwy. Irwindale, CA 91706	Job No. 70917
	FIGURE 1



STATISTICAL SUMMARY

PA	LAND USE DESIGNATION	ACRES	INDUSTRIAL/BUSINESS PARK MAX SF	COMMERCIAL MAX SF
1	Industrial/Business Park	28.3	825,000 SF	n/a
1A	Commercial/Industrial	12.5		51,600 SF*
2	Industrial/Business Park	6.4	333,000 SF	n/a
2A	Commercial/Industrial	10.2		51,600 SF*
3	Industrial/Business Park	4.6	293,400 SF	n/a
3A	Commercial/Industrial	12.1		51,600 SF*
4	Commercial	4.2	n/a	47,000 SF
TOTAL		*78.3 AC*	*1,451,400 SF*	*98,600 SF**

* The total maximum commercial square footage permitted in Planning Areas 1A, 2A, and 3A combined is 51,600 SF.

Notes:

1. Acreages are approximate and subject to survey verification.
2. Land Use Plan is for conceptual purposes only.
3. Acreages of private drives interior to the Specific Plan (Private Drive A and Private Drive B) are included in the adjacent planning area acreages, as measured to the private drive centerline.

Figure II-1

0 75 150 300 Feet

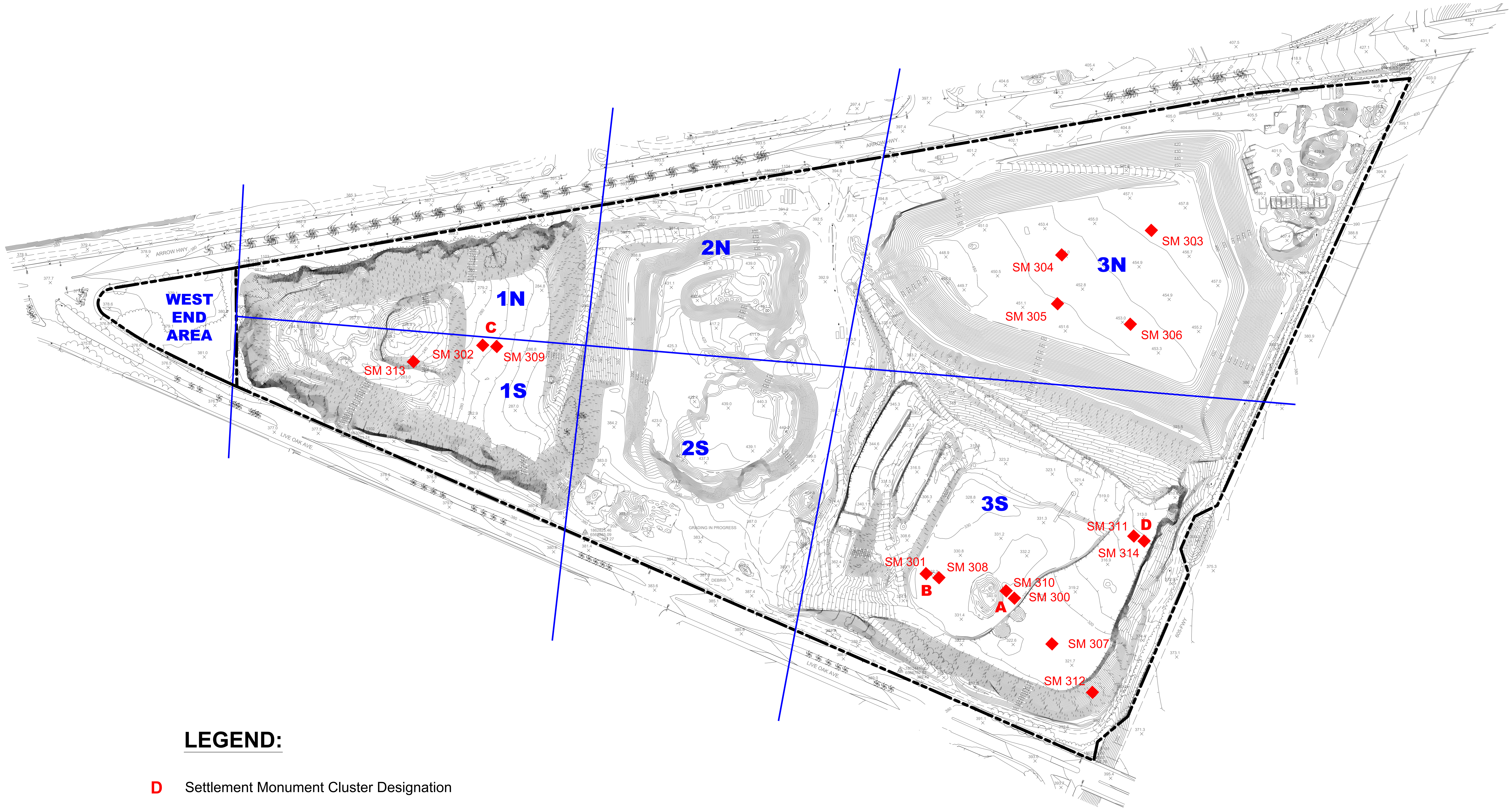
REFERENCE:

Conceptual Land Use Plan (undated) by T&B Planning.

HD GEOSOLUTIONS INC.

Title: **Conceptual Land Use Plan**

Date:	May 2018
Job No.	70917
	FIGURE 2



LEGEND:

D Settlement Monument Cluster Designation

SM 314 ◆ Settlement Monument Location and Number

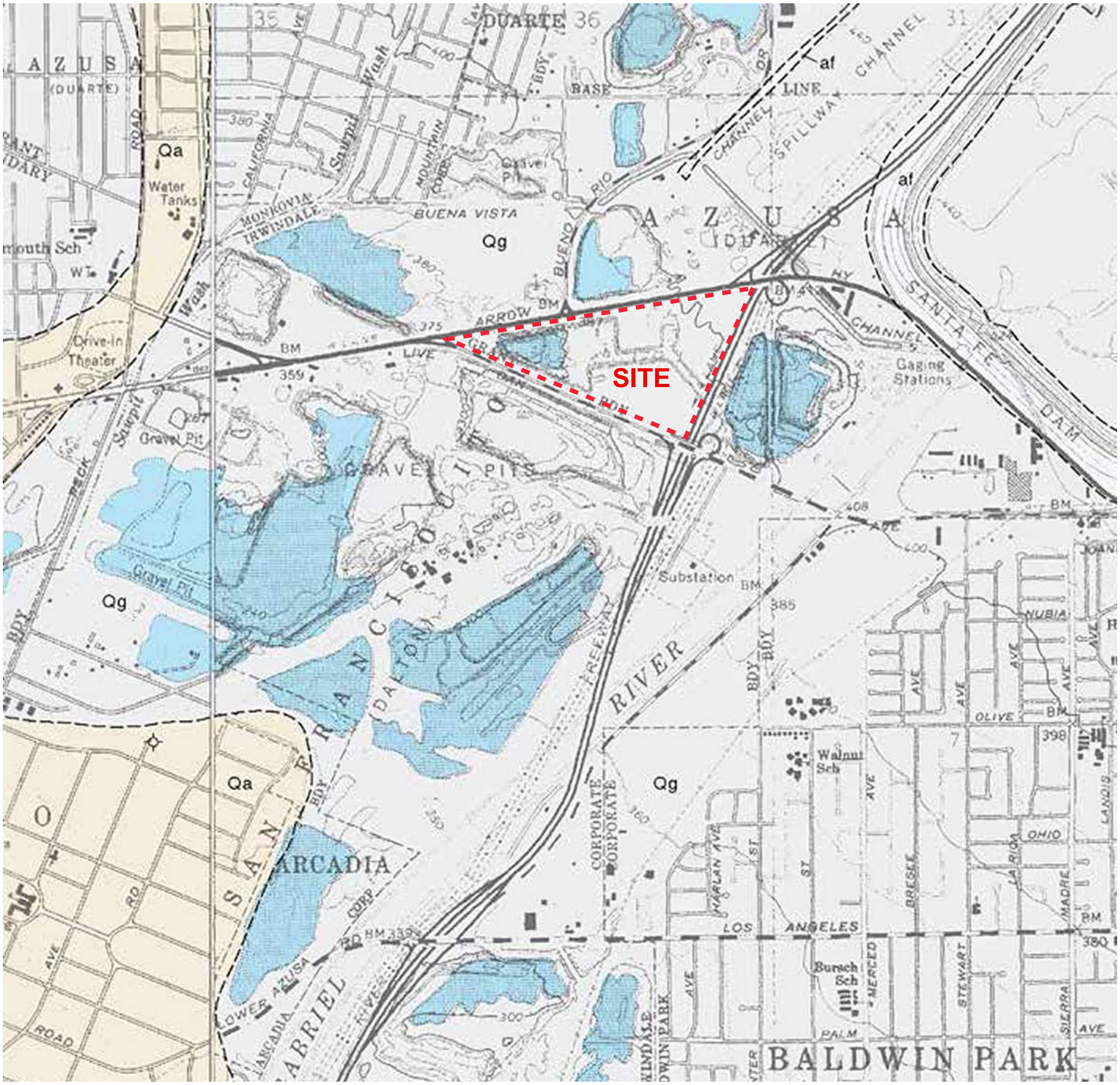
3S Site Partition Designation

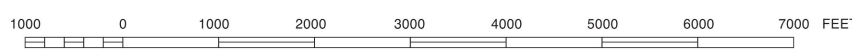
REFERENCE:
AERIAL SURVEY BY:
ROBERT J. LUNG
DATED NOVEMBER 13, 2017

HD GEOSOLUTIONS INC.

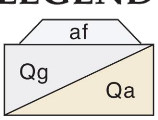
Title:
SITE LOCATION KEY MAP

Date:	April 2018
Job No.	70917
	FIGURE 3





LEGEND



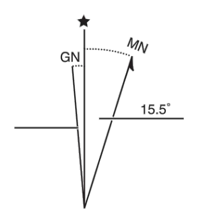
SURFICIAL SEDIMENTS

Undissected alluvial deposits

af *Artificial fill, and cut and fill areas*

Qg *Gravel and sand of major streams, and alluvial fan detritus from San Gabriel Mountains, grades southward into alluvium (**Qa**) as sizes of clasts decrease*

Qa *Alluvial gravel, sand and silt of valleys and floodplains*



UTM GRID AND 1953 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

HD GEOSOLUTIONS INC.

REFERENCES:
Geologic Map of the El Monte & Baldwin Park Quadrangles by Thomas W. Dibblee, Jr., 1999

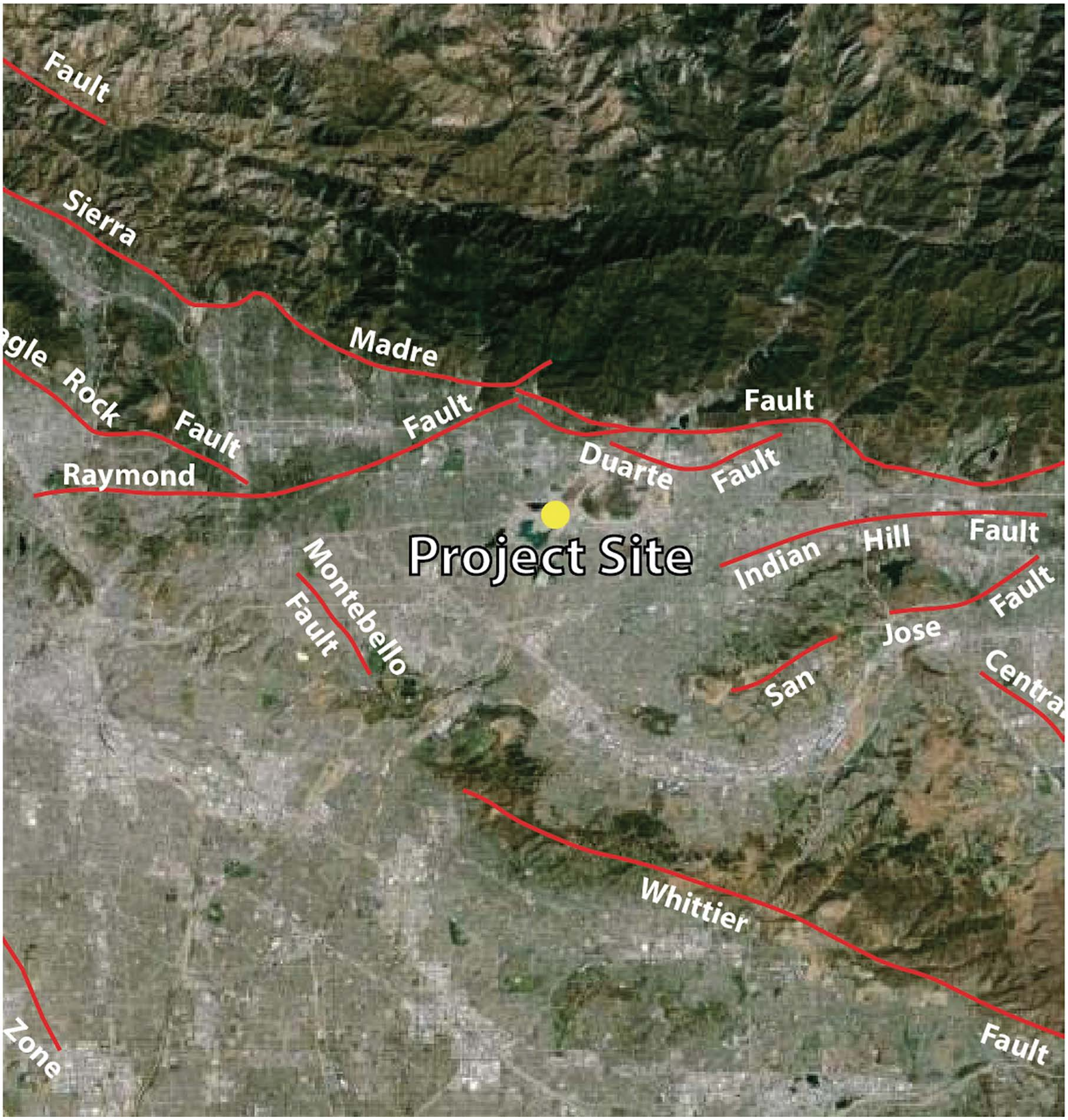
Title: **REGIONAL GEOLOGIC MAP**

Project Address: 1220-1270 Arrow Hwy. Irwindale, CA 91706

Date: April 2018

Job No. 70917

FIGURE 4



0 5 10
MILES

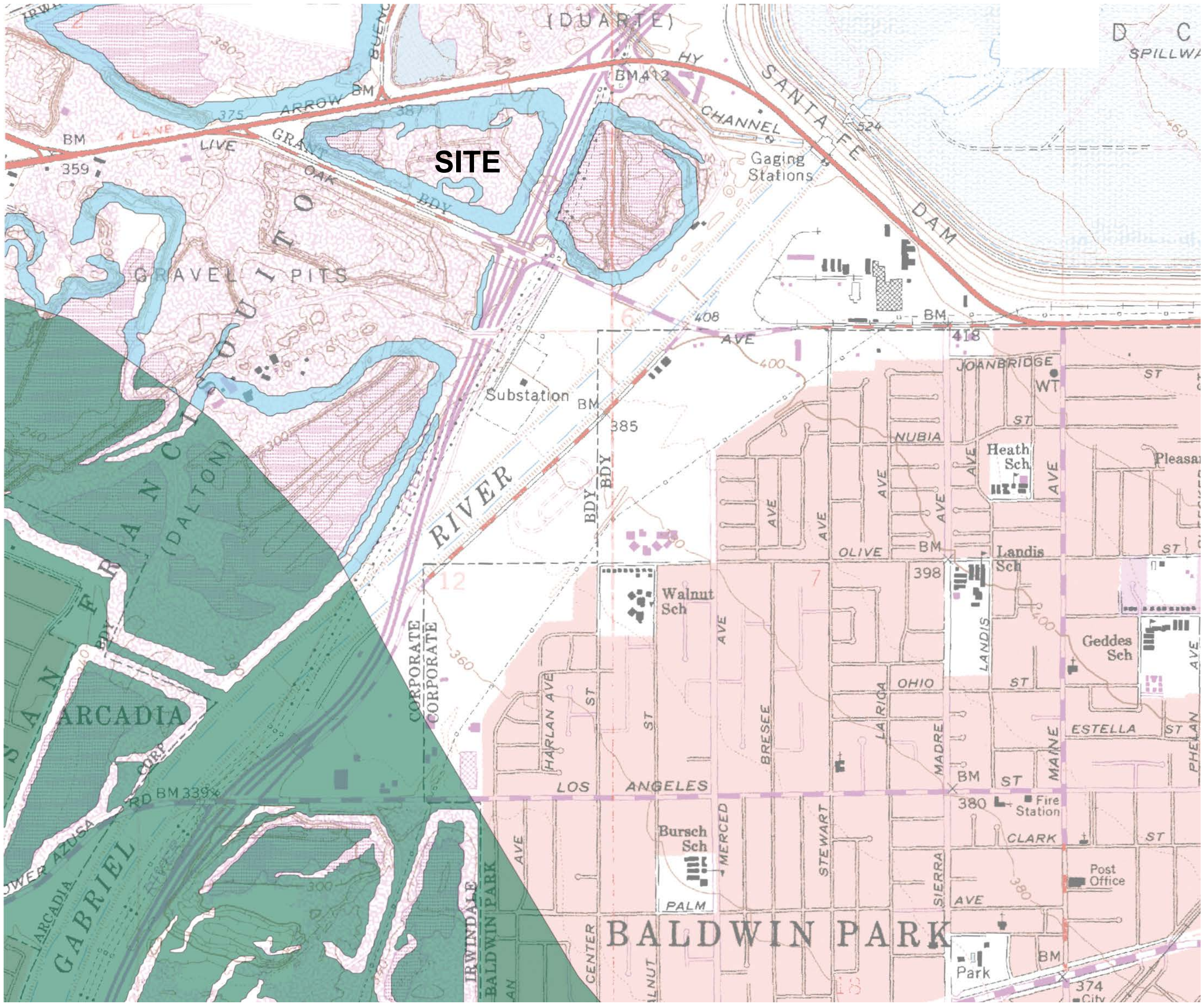
HD GEOSOLUTIONS INC.

Reference: Image Landsat adapted from Google Earth on April 15, 2018

Regional Fault Map
(Faults of Significance)

1220-1270 Arrow Hwy.
Irwindale, CA 91706

Date:	April 2018
Job No.	70917
	FIGURE 5



MAP EXPLANATION

Zones of Required Investigation:

Liquefaction
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Overlapping Liquefaction and Earthquake-Induced Landslides
Areas that lie within zones of required investigation for both liquefaction and earthquake-induced landslides. (See above for explanation of each zone.)

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

HD GEOSOLUTIONS INC.	REFERENCES: Seismic Hazard Zones Baldwin Park and El Monte Quadrangles, March 25, 1999	Title: **SEISMIC HAZARD MAP**	Date: April 2018
		Project Address: 1220-1270 Arrow Hwy. Irwindale, CA 91706	Job No. 70917
			FIGURE 6

APPENDIX A

SITE PHOTOGRAPHS

2017 April – Southeast Pit (Area 3S). Truck discharging inert debris and pulverization of oversized material. View to east; I-605 Freeway in background.

2017 April – Southeast Pit (Area 3S). Compaction of blended rubble fill. Area 3N surcharge fill in background. View to northeast.

2017 April – West Pit (Area 1). Prior to the 2017 earthwork and after precipitation. View to west.

2017 May – Southeast Pit (Area 3S). Production and compaction of blended rubble. View to north.

2017 April – Southeast Pit (Area 3S). Face of new engineered fill slope cleaned of slough. View to southeast.

2017 August – Southeast Pit (Area 3S). Crushing of pulverized inert debris, and compaction of blended rubble fill. View to northeast.

2017 August – West Pit (Area 1). Geologic characterization of West Pit bottom materials. Trowel is stuck into side wall at contact of previously-placed silt and clay wash products and the underlying native sands and gravels. The wash products were removed in preparation for placement of engineered fill.

2017 September – West Pit (Area 1). Overview of north side wall. Veneer of talus material covering lower (diagonally-inclined) portion of slope. View to northwest.

2017 September – West Pit (Area 1). Geologic evaluation of side wall materials by means of excavated pits. View to north.

2017 September – West Pit (Area 1). Overview of exposed bottom in preparation for placement of engineered fill. View to east.

2017 September – West Pit (Area 1). Overview of new engineered fill pad. Removed and stockpiled wash products in background. View to southwest.

2017 September – West Pit (Area 1). Blended rubble fill produced in Area 2S being transported and stockpiled in West Pit. View to southeast.

2018 January – South-Central Area (Area 2S). Truck discharging inert debris to be processed and placed. At right, pulverization in advance of crushing. Stockpiling of extracted steel in background. View to southeast.

2018 January – South-Central Area (Area 2S). Removal of steel from inert debris. Large-scale field sieve in background. View to west.

2017 September – South-Central Area (Area 2S). Removal via hand labor of undesirable material.

2018 September – South-Central Area (Area 2S). Export of stockpiled steel from site. View to southwest.

2017 December – Southeast Pit (Area 3S). Large-scale bulk density testing of blended rubble fill. In background, crushing of pulverized inert debris. View to northwest.

2017 November – Southeast Pit (Area 3S). Large-scale bulk density testing of blended rubble fill. Water volume measurement of excavated pit. View to south.

2017 May – South-Central Area (Area 2S). Large-scale gradation testing of the blended rubble fill excavated during a bulk density test. View to northwest.

2017 September – Southeast Pit (Area 3S). Engineered fill pad, Area 3N surcharge fill in background, and Zone A material at background-left. View to north.

2017 October – Southeast Pit (Area 3S). Moisture conditioning and compaction at engineered fill pad. View to southeast.

2017 November – Southeast Pit (Area 3S). Pulverization of oversized inert debris material. Settlement monument SM300 at right. New settlement monument SM310 with exposed base at far right. View to southwest.

2018 January – Southeast Pit (Area 3S). Grading operations. View to northeast.

2018 January – Southeast Pit (Area 3S) and central site area (Area 2A) in background. Overview of Zone A removals. View to southwest.

2018 January – Southeast Pit (Area 3S). Crushing and production of blended rubble fill. View to west.

2018 January – Southeast Pit (Area 3S). Removals of Zone A material at west side of pit. Material transported to active fill area within pit. View to southwest.

2018 February – West Pit (Area 1). Removals of sloughed material at slope face and exposing new engineered fill. View to east.

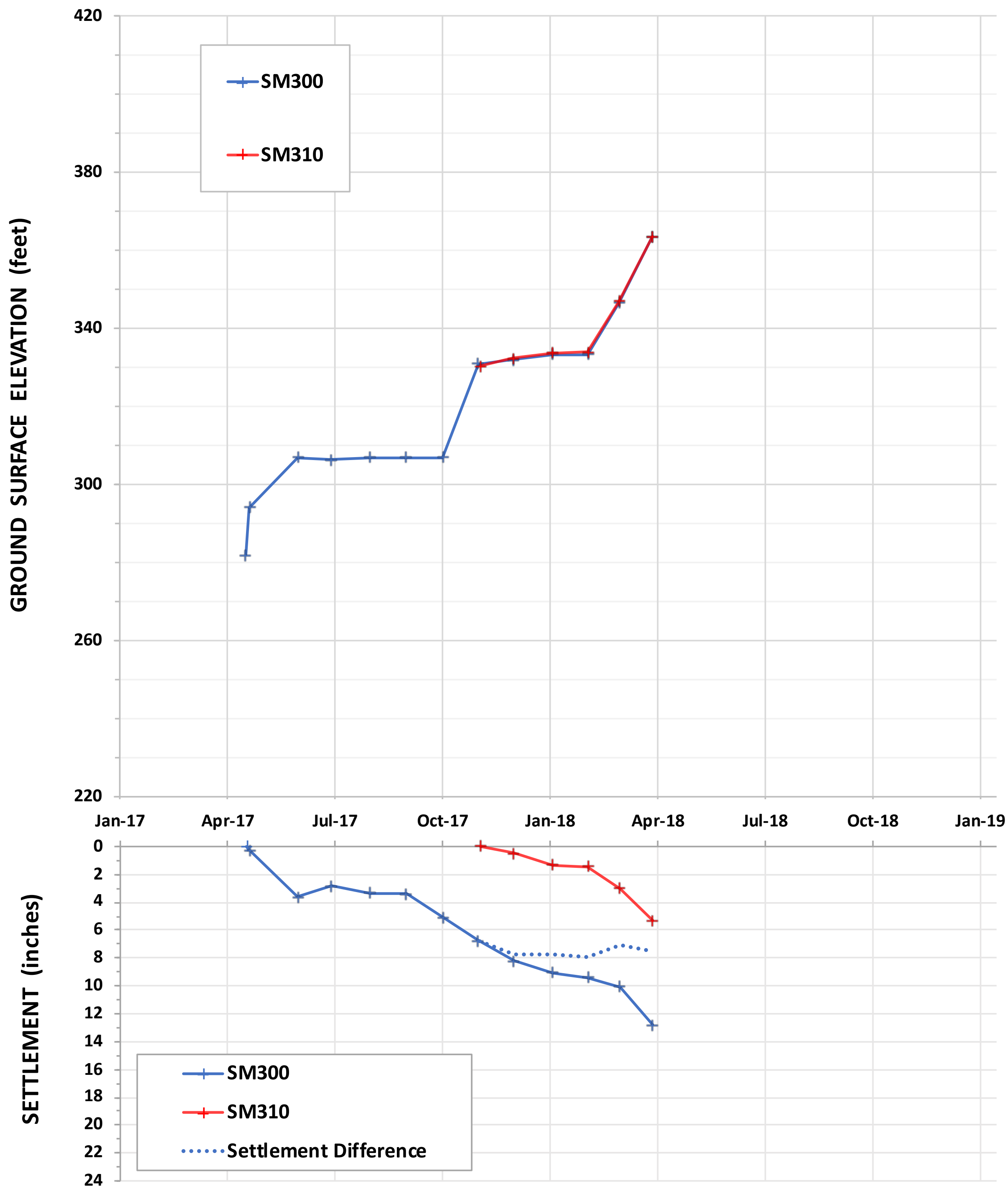
2018 February – Southeast Pit (Area 3S). Placement of Zone A material within active fill area. View to southeast.

2018 March – Southeast Pit (Area 3S). Overview of engineered fill. View to southeast.

2018 March – Southeast Pit (Area 3S). Overview of engineered fill. Settlement monument cluster at background-right of water truck (SM301, SM308), at background-left of water truck (SM300, SM310), and SM307 is at far left on next bench up. View to southeast.

APPENDIX B

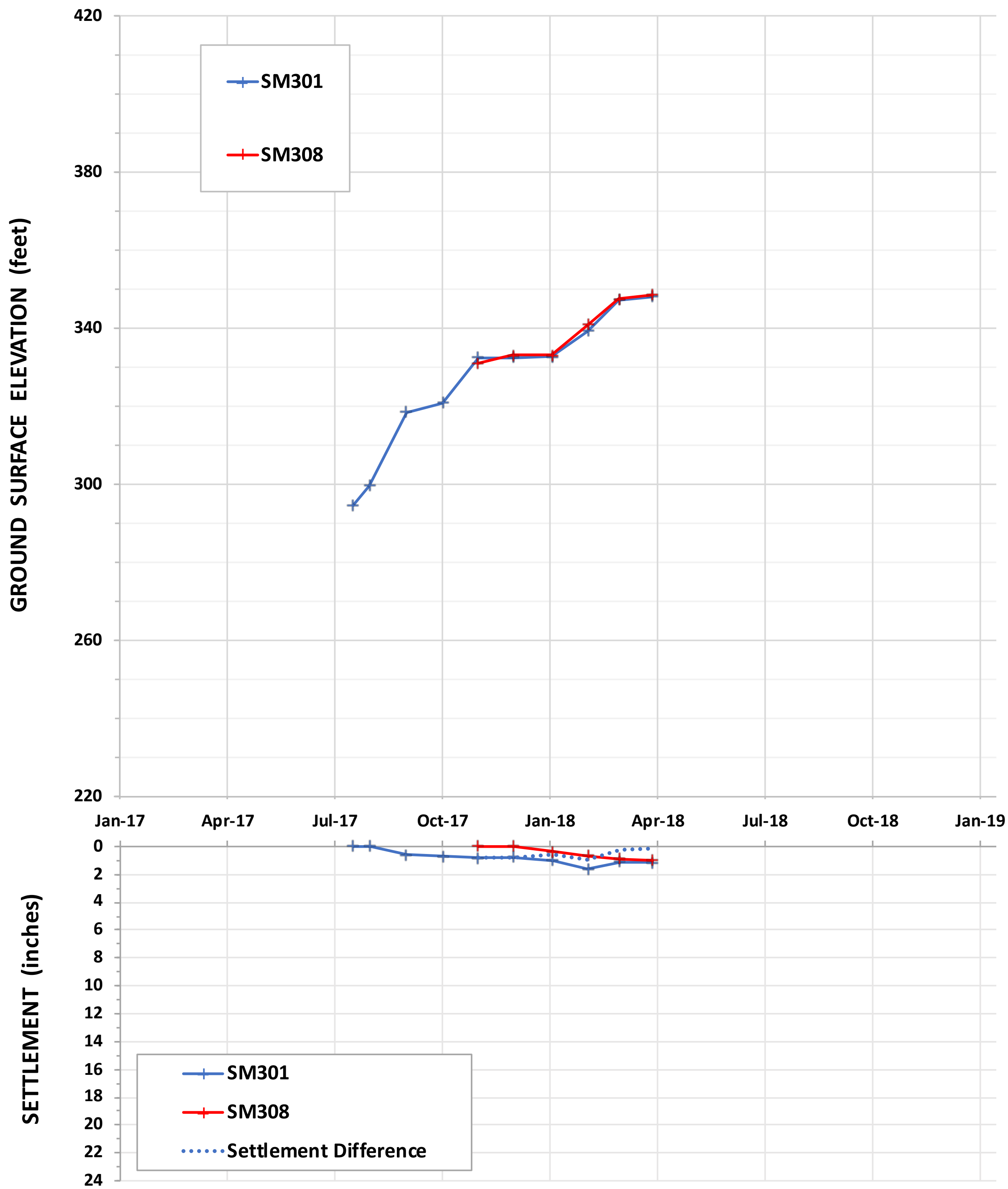
FIELD SETTLEMENT MONITORING DATA



SETTLEMENT MONUMENT DATA
CLUSTER A

HD GEOSOLUTIONS INC.

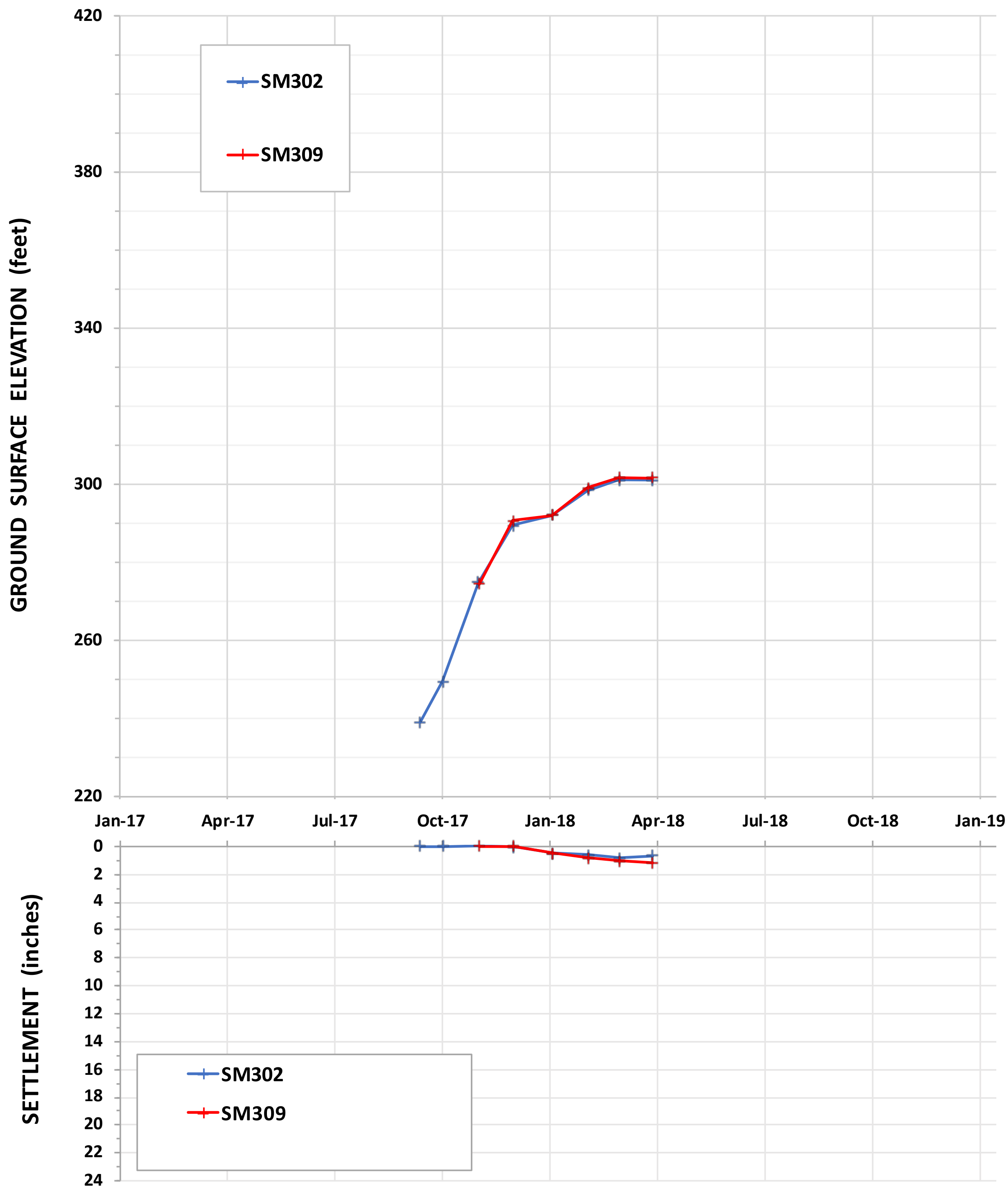
FIGURE B-1



SETTLEMENT MONUMENT DATA
CLUSTER B

HD GEOSOLUTIONS INC.

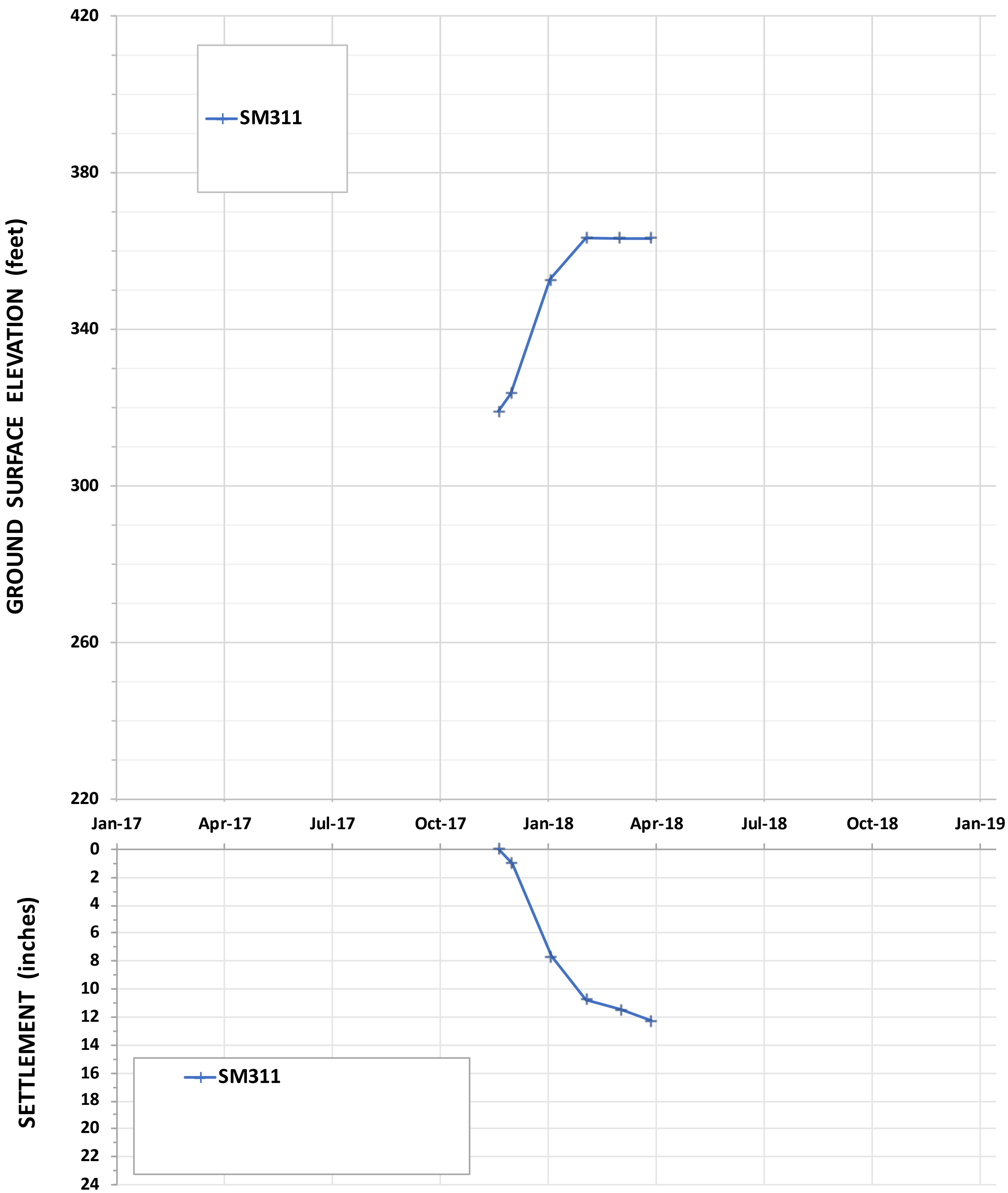
FIGURE B-2



SETTLEMENT MONUMENT DATA
CLUSTER C

HD GEOSOLUTIONS INC.

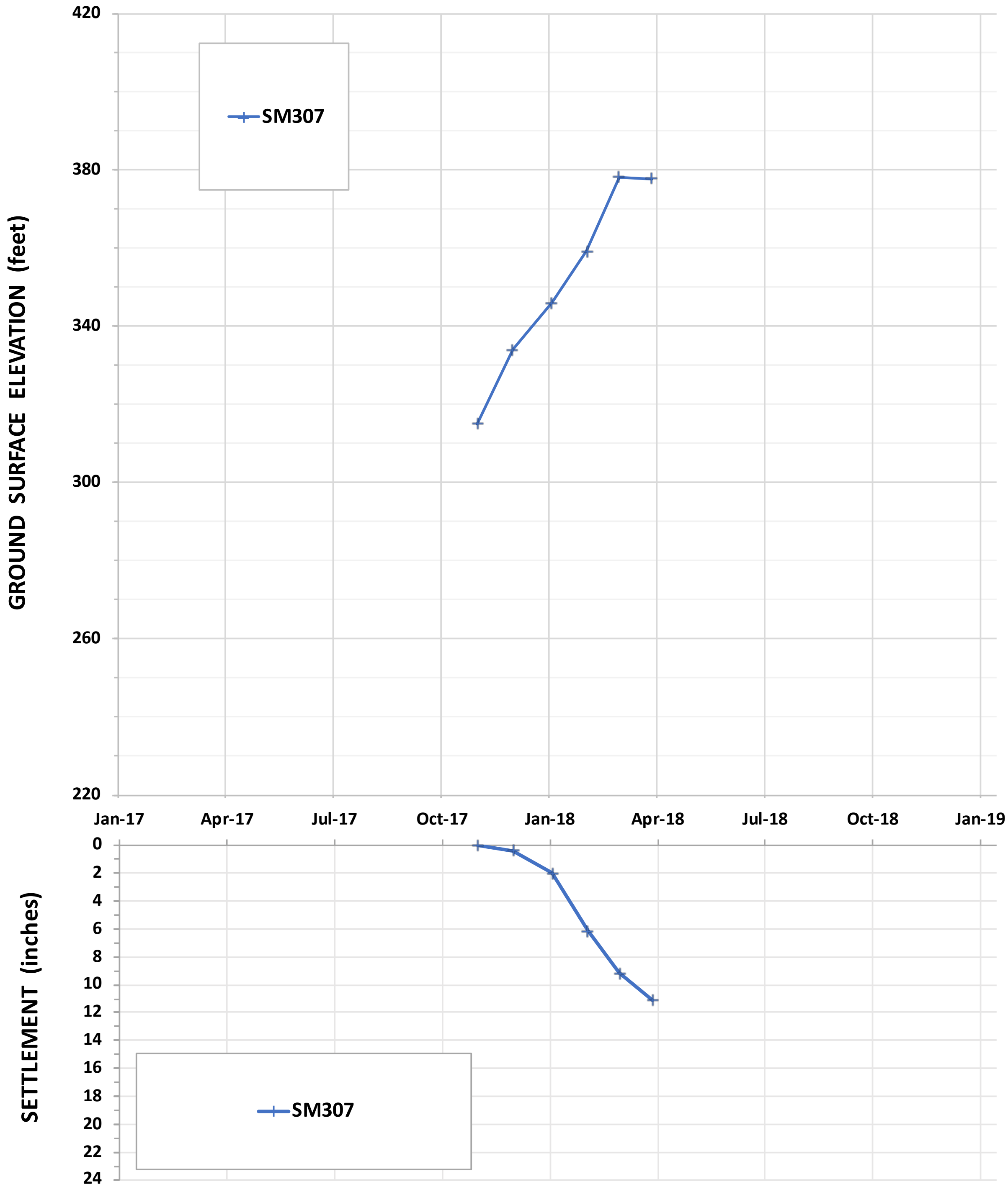
FIGURE B-3



SETTLEMENT MONUMENT DATA
CLUSTER D

HD GEOSOLUTIONS INC.

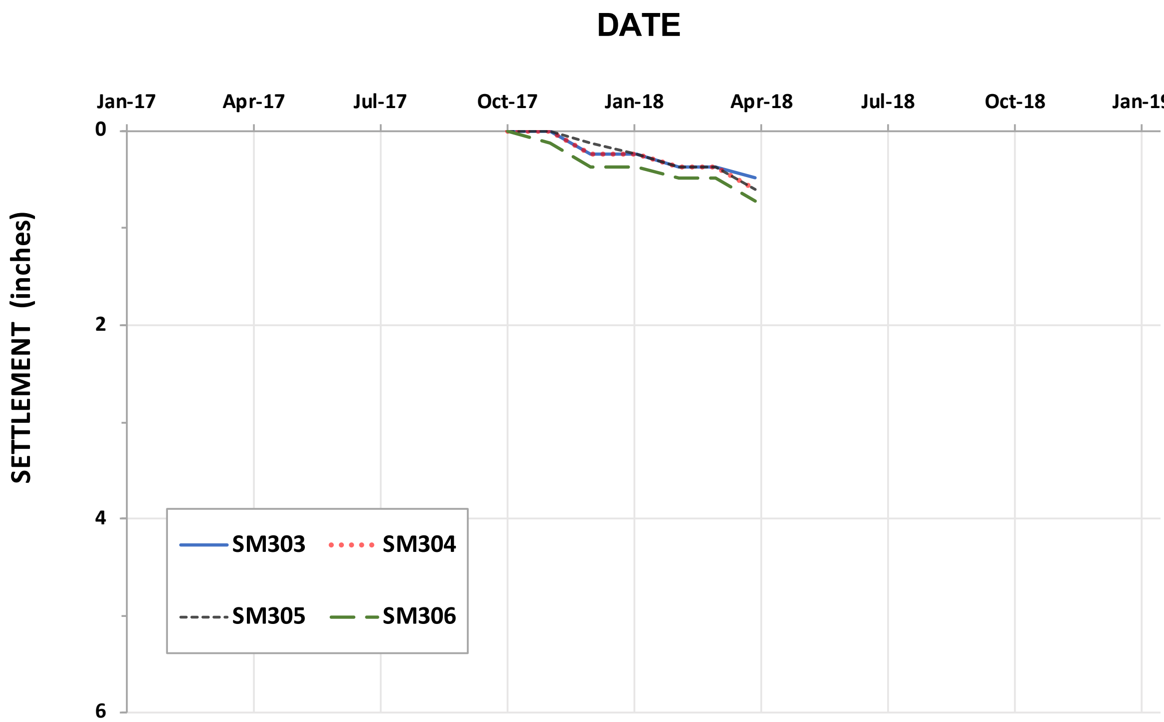
FIGURE B-4



SETTLEMENT MONUMENT DATA
SM307

HD GEOSOLUTIONS INC.

FIGURE B-5



SETTLEMENT MONUMENT DATA
SURFICIAL MONUMENTS ON SURCHARGE FILL (AREA 3N)

HD GEOSOLUTIONS INC.

FIGURE B-6