GEOTECHNICAL REVIEW OF OFFSITE IMPROVEMENT AREAS, AMENDMENT TO PRELIMINARY GEOTECHNICAL EVALUATION, WORLD LOGISTICS CENTER, CITY OF MORENO VALLEY, CALIFORNIA

Prepared for:

Highland Fairview Properties

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Project No. 1111061-126

September 2014

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A LEIGHTON GROUP COMPANY

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To: Highland Fairview Properties, LLC
14225 Corporate Way
Moreno Valley, California 92553

Attention: Mr. Brian Hixson

Subject: Geotechnical Review of Offsite Improvement Areas, Amendment to Preliminary Geotechnical Evaluation, World Logistics Center, City of Moreno Valley, California

In accordance with your request and authorization, we have performed a geotechnical review of three potential off-site water reservoir sites, four potential debris basins, and various sewer/water/roadway improvements for the World Logistics Center in the city of Moreno Valley, California. For the purposes of this report, we performed a site reconnaissance and reviewed available literature and aerial photographs pertinent to these sites. This report summarizes our findings and provides a geotechnical review describing the known and anticipated geotechnical conditions for each of the sites. Additional geotechnical studies are recommended as the design plans develop, i.e. water reservoir sites and access routes are selected, the basin sizes and designs are prepared, and the sewer/water/roadway improvements are developed.

Respectfully submitted,

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1.0 INTRODUCTION

1.1 Purpose and Scope

This report presents the results of our geotechnical review of off-site improvement areas at the World Logistics Center, City of Moreno Valley, California (see Figure 1). The purpose of our review was to provide a preliminary geotechnical evaluation of the off-site improvement areas in support of the project EIR documents.

It is our understanding based on information provided by your office, the proposed development will include above ground water reservoir tanks at three potential locations, four debris basins located northeast of Gilman Springs Road, and various sewer, water and roadway improvements along Cactus Avenue, Redlands Boulevard, Fir Avenue, Cottonwood Avenue, and Gilman Springs Road. This report is a preliminary geotechnical review based on existing reports, maps and other pertinent documents as well as our field observations. No subsurface work was performed during this study. More specifically, our scope of services included the following:

- Review of provided Limits of Environmental Analysis plan (Highland Fairview, 2012), other relevant published documents, reports, and maps regarding geotechnical conditions at the subject sites,
- Geologic site reconnaissance,
- Review of sequential pairs of aerial photographs as well as other Web based resources, and
- Preparation of this amendment to the Preliminary Geotechnical Investigation Report describing the known and anticipated geotechnical conditions for the subject off-site improvement areas.

1.2 Previous Studies

Leighton previously conducted several geologic/geotechnical studies for the overall World Logistics Center and adjacent sites. The most recent study is the Preliminary Geotechnical Evaluation (Leighton, 2012). Information and findings provided in this and other referenced studies are referred to as necessary or included herein for ease of reference.

1.3 Site Description and Proposed Development

The potential water reservoir sites, debris basins, and various sewer, water and roadway improvements are generally located in the eastern portion of the City of Moreno Valley. Each site is presented on the Site Location Map (Figure 1). For the purposes of this report we have grouped the debris basins into one study area.

2.0 REGIONAL GEOLOGY

2.1 Geologic Settings

The project sites are located within the Peninsular Ranges Province, which is characterized by northwest trending elongated mountain ranges and valleys. The Peninsular Ranges Province is divided into three major fault bounded tectonic blocks within the San Andreas Fault System, which consist of (from west to east): Santa Ana, Perris, and San Jacinto Blocks. The sites are located near the northeastern boundary of the relatively stable Perris Block and the tectonically adjusting San Jacinto Block.

The study areas are generally located within the northern portion of the San Jacinto Valley, a fault-bounded tectonic basin that has evolved from movement along the San Jacinto fault system resulting in a down-dropped northwest-trending trough. The elongate transverse basin is believed to have formed as a result of a right step of the fault zone between the Casa Loma and Claremont strands of the fault zone (Morton and Matti, 1993)

As mapped by the USGS (2006), our investigation in this area and our observations, the natural geologic units underlying the subject properties vary from granitic bedrock to sedimentary (San Timoteo) formation to alluvial fan deposits, and localized landslide deposits. The generalized geologic units are presented on the Regional Geologic Map, (Figure 2). Site specific geologic conditions are further discussed in subsequent sections of this report.

2.2 Regional Faulting and Fault Activity

The subject sites, like the rest of Southern California, are located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional fault systems such as the San Andreas, San Jacinto and Elsinore Fault Zones. Currently, these fault systems accommodate up to approximately 55 millimeters per year (mm/yr) of slip between the plates. The nearby San Jacinto Fault Zone is estimated to accommodate slip of approximately 12 mm/yr (WGCEP, 1995). However, geodetic measurements between 1973 and 1981 show that the San Jacinto and San Andreas Faults currently have comparable strain rates. King (1983) and Morton (1993) has estimated an average slip rate of as much as 20 mm/yr for the San Jacinto Fault. An increased strain rate, in theory, could contribute to an overall higher magnitude moment than what has been previously considered for the San Jacinto Valley by local governmental agencies and the 2010 California Building Code. The nearest Alquist-Priolo zoned “active fault”, is

the San Jacinto Valley Segment of the San Jacinto Fault which is depicted on the accompanying Earthquake Fault Zone Map, Figure 3.

3.0 SITE SPECIFIC GEOLOGIC/GEOTECHNICAL CONDITIONS

3.1 General

A brief site reconnaissance was conducted to each location on May 14, 2012 in which the property supporting the potential tank sites, debris basins and various roadway and utility improvements were observed. The general geologic conditions were reviewed and compared with existing published geologic mapping at each of the proposed improvement sites. Prior to the site review, sequential pairs of historic aerial photographs were independently reviewed to observe if geomorphic features indicative of faulting or landsliding was apparent within each study area. The aerial photographs reviewed are summarized in Appendix A. Our observations for each site are summarized in the following subsections and presented in Table 1 attached. The specific geologic/geotechnical conditions evaluated based on our site reconnaissance and desktop reviews are as follows:

- **Site Specific Geology**: Site specific geology is generally described based on our field observations during the site reconnaissance and review of previous geotechnical reports, and published geologic maps.

- **Surface Water and Groundwater**: Surface and groundwater conditions are described based on our field observations during the site reconnaissance and review of previous geotechnical reports, and available local and State groundwater data.

- **Site Specific Faulting**: Site faulting is evaluated based on our review of the regional fault map showing the proximity of the site to major faults identified by the California Division of Mines and Geology (CDMG, renamed California Geological Survey) and our site specific fault investigations (see Appendix A). Additionally, sequential pairs of historic aerial photographs were independently reviewed to observe if geomorphic features indicative of any faulting exist on each site.

- **Secondary Seismic Hazards**: Secondary hazards that are generally associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture generally occurs along existing active faults.

  - Seiches and Tsunamis, is normally caused by large bodies of water (inland seas, large rivers, and oceans).

- Landsliding occurs when masses of rock, earth, or debris that moves down a slope due to disturbance caused by rainfall, seismic events, and applied additional loads.

- Rock falls generally occur when boulders and/or elevated rock out-cropping fall due to disturbance from rainfall or seismic events.

- Ground Fissuring and Subsidence generally occurs due to ground water withdrawal or groundshaking.

- Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained cohesionless soil.

- Seismic densification is seismically induced settlement that can occur during a strong seismic event within loose to moderately dense, dry to moist granular soils.

- **Grading Considerations**: Pertinent grading considerations are provided for each site based on our knowledge of the local geology and past experience on this site.

3.2 Potential Water Reservoir & Access Area "A"

Reservoir Area "A" consists of a potential tank pad that is located southeast of the intersection of Theodore Street and Ironwood Avenue, north of the World Logistics Center.

Site Specific Geology: The potential reservoir is located on a prominent ridgeline underlain by the San Timoteo formation bedrock (see, Figure 2). A bedrock landslide feature generated in the San Timoteo formation bedrock was observed along the toe of the naturally descending slopes to the west, below the potential reservoir pad area. The reservoir pad is located within the State of California Earthquake fault zone (see, Figure 3). The bedrock material in this vicinity generally consists of locally loose to medium dense, locally friable sandstone containing varying amounts of gravel and silt. An access road is planned to reach the site via Ironwood Avenue and will traverse alluvium filled valleys and cut through a mapped landslide as well as potentially unstable San Timoteo formation bedrock.

- **Surface Water and Groundwater**: No surface water was observed during the site visit. During periods of heavy rain, drainage patterns will be created

due to the steep topography and should be included into design of any cut or fill slopes.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this reservoir location. However, the site is within the State of California Earthquake Fault Zone.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate that there is a possible fault within the pad area. The potential for ground fissuring/rupture should be considered for this site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: Several landslides have been previously mapped by others and observed during our field review of the site. Due to the existing nearby landslides, the gross stability of the area must be determined during future studies.

  - Rock falls: Due to the elevated location and lack of hard rock boulders in this area, the potential for rock fall due to either erosion or seismic ground shaking is insignificant in this area.

  - Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

  - Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Due to relatively dense bedrock and older alluvial soils the potential for liquefaction at the subject site is considered very low to nil.

  - Seismic densification: We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading on this site and access roads will likely encounter medium dense to dense, friable sandstone to siltstone. The landslide complexes will likely create gross stability issues that may require

deep remedial grading stabilization measures. Slopes exposing unfavorable out of slope bedding structure may require removal and recompaction to create a stable slope configurations. Due to the existing landslides, the gross stability of the area must be determined during future studies. The absence of faulting should be determined prior to further design.

3.3 Potential Water Reservoir & Access Area "B"

Reservoir Area "B" consists of 1 potential tank pad located east of the intersection of Gilman Springs Road and south of SR-60 along the western margin of the "Badlands" area (See Figure 1).

- **Site Specific Geology**: The potential reservoir is located on a prominent ridgeline or highpoint immediately south of the SR-60 right of way. Several relatively shallow landslide slump features generated in the San Timoteo formation bedrock were observed. This bedrock material generally consists of locally loose to medium dense, locally friable sandstone containing varying amounts of gravel and silt. An access road is planned to reach the site via Gilman Springs Road and will traverse alluvium filled valleys and cut through potentially unstable San Timoteo formation bedrock.

- **Surface Water and Groundwater**: No surface water was observed during the site visit. During periods of heavy rain, drainage patterns will be created due to the steep topography and should be included into design of any cut or fill slopes.

- **Site Specific Faulting**: Although no faulting was observed during our review, mass wasting and weathering of the formational materials may be masking any onsite features indicative of active faulting.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on known for this site. However, mass wasting and weathering of the formational materials may be masking any onsite features indicative of active faulting

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

- Landsliding: Several landslides has been previously mapped by others nearby and also observed during our field review of the site. Landsliding due to seismic activity is possible at this site.

- Rock falls: Due to the elevated location and lack of hard rock boulders in this area, the potential for rock fall due to either erosion or seismic ground shaking is insignificant in this area.

- Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Due to relatively dense bedrock and older alluvial soils the potential for liquefaction at the subject site is considered very low to nil.

- Seismic densification: We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading on this site and access road areas will likely encounter loose to dense, friable sandstone to siltstone. The surficial landslides in the surrounding area may be indicative of larger landslides which will likely create gross stability issues that may require deep remedial grading stabilization measures. Slopes exposing unfavorable out of slope bedding structure may require removal and recompaction to create a stable slope configurations. Due to the existing landslides, the gross stability of the area must be determined during future studies. Potential faulting within the pad area should be evaluated prior to further design efforts.

3.4 Gilman Springs Road Debris Basins

The proposed debris basins located along the east side of Gilman Springs Road and east of the Worldwide Logistics Center (see Figure 1).

- **Site Specific Geology**: These sites are underlain by younger and older alluvial material that appears to have been generated from the surrounding hills (see Figure 2). Based on our subsurface investigation of the property immediately west of Gilman Springs Road (Leighton, 2012), the alluvial soils are a minimum of 50 feet in thickness.

- **Surface Water and Groundwater**: No surface water was observed at the debris basin sites during our site reconnaissance. The potential for surface

runoff in the area should be anticipated due to the existence of drainage channels located upstream from the locations of the debris basins. Large trees and grasses were observed in the drainage channels. Based on our subsurface investigation on the property immediately to the west of Gilman Springs Road (Leighton, 2012), ground water is expected to be greater than 50 feet deep and should not be a constraint to construction of the basins.

- **Site Specific Faulting**: An Earthquake Fault Zone as created by the Alquist-Priolo Earthquake Fault Zoning Act (Bryant, 2007), parallels Gilman Springs Road, (see Figure 3). The northern most debris basin is included within the State of California Earthquake Fault Zone. A Riverside County Fault Zone projects thru the debris basin that is near the intersection of Gilman Springs Road and Alessandro Boulevard, (see Figure 3). Surface expression of this fault splay, such as scarps, offset drainages or other lineaments were not observed during this or previous studies. No subsurface investigation has been performed to confirm the existence of this fault splay. However, this fault is considered active based on the County geologic hazard maps.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of the subject debris basins and adjacent areas is that there are no active faulting on site. However, due to the existence of active faulting within the State of California Earthquake Fault Zone as well as the Riverside County Fault Zone as depicted on Figure 3, the potential for ground subsidence/fissuring should be considered low to moderate for this site. Therefore ground rupture should be considered during the design of the planned basins.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain. A stability analysis of the basin slopes should be performed when the design configuration is known.

  - Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed basins is considered low.

- Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Groundwater within the subject site is reported to be in excess of 50 feet below existing ground surface. Due to deep groundwater and relatively dense alluvial soils underlying the site, it is our opinion that potential for liquefaction at the site is low.

- Seismic densification: Seismically-induced dry settlement is expected to be minimal to moderate at these basin locations. We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading of the basins will be readily accomplished with conventional heavy duty earth moving equipment. Slopes exposing loose or friable non-cohesive granular soils may require removal and recompaction. Site soils should be considered highly erosive and protective measures should be considered in the design.

3.5 Gilman Springs Roadway and Utility Improvements

The proposed roadway and utility improvements are for Gilman Springs Road and are bounded on the north by Highway 60 and on the south by Cactus Avenue (if extended eastward) see, Figure 1.

- **Site Specific Geology**: Gilman Springs Road is underlain by San Timoteo formation bedrock near Eucalyptus Avenue and by younger and older alluvial material for the remainder of the evaluated section. The alluvial soils appear to have been generated from the surrounding hills, (see Figure 2). Based on our subsurface investigation of the property immediately west of Gilman Springs Road (Leighton, 2012), the alluvial soils are a minimum of 50 feet in thickness.

- **Surface Water and Groundwater**: No surface water was observed along Gilman Springs Road. The potential for surface runoff in the area should be anticipated due to the existence of drainage channels located to the east of the roadway. Based on our subsurface investigation on the property immediately to the south of Gilman Springs Road (Leighton, 2012), ground water is expected to be greater than 50 feet deep and should not be a constraint to construction of the basins.

- **Site Specific Faulting**: An Earthquake Fault Zone as created by the Alquist-Priolo Earthquake Fault Zoning Act (Bryant, 2007), parallels Gilman Springs Road and transects a portion of the road in the north as well as projects thru Gilman Springs Road in the south, (see Figure 3). A Riverside County Fault Zone projects thru Gilman Springs Road near the intersection of Alessandro Boulevard, (see Figure 3). Surface expression of this fault splay, such as scarps, offset drainages or other lineaments were not observed during this or previous studies. No subsurface investigation has been performed to confirm the existence of this fault splay. However, this fault is considered active based on the County geologic hazard maps

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate that there are possible faults that transects the subject roadway. The potential for ground fissuring/rupture should be considered for this roadway.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain. A stability analysis of cut slopes should be performed when the design configuration is known.

  - Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed improvements is considered low.

  - Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

  - Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Groundwater within the subject site is reported to be in excess of 50 feet below existing ground surface. Due to deep groundwater and relatively dense alluvial soils underlying the site, it is our opinion that potential for liquefaction at the site is low.

- Seismic densification: Seismically-induced dry settlement is expected to be minimal to moderate. We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading of the roadway and installation of utilities will be readily accomplished with conventional heavy duty earth moving equipment. Slopes exposing loose or friable non-cohesive granular soils may require removal and recompaction. Site soils should be considered highly erosive and protective measures should be considered in the design.

3.6 Cactus Avenue Roadway Improvements

The proposed roadway improvements are for Cactus Avenue and are bounded on the east by Merwin Street and on the west by Wilmot Street, (see Figure 1).

- **Site Specific Geology**: The roadway improvements are located near the toe of the prominent granitic bedrock hillside known as Mount Russell. These improvements are underlain by older alluvium which is in-turn underlain by Cretaceous-aged granitic bedrock, (see Figure 2).

- **Surface Water and Groundwater**: No surface water was observed during the site visit, however there is an unimproved drainage culvert to the north that may carry water during periods of heavy rain. Ground water is not anticipated to be encountered to the depths anticipated for construction.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain.

- Rock falls: The steep sloping hillsides near the site contain many potentially loose boulders. The potential for rock fall due to either erosion or seismic ground shaking is considered possible in this area. However, due to the distant nature of the roadway improvement to the rock covered hillside, the hazard from rockfill to impact this section of roadway is minimal.

- Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Due to relatively dense granitic bedrock and older alluvial soils the potential for liquefaction at the subject site is considered very low to nil.

- Seismic densification: We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading on this site may encounter dense older alluvium and very dense to non-rippable bedrock. Oversize rock may need to be exported off this site.

3.7 Brodiaea Avenue to Cactus Avenue Drainage Improvements

The proposed drainage improvements are for an existing unimproved drainage culvert which is bounded on the north by Brodiaea Avenue and on the south by Cactus Avenue see, Figure 1.

- **Site Specific Geology**: The drainage improvements are located near the toe of the prominent granitic bedrock hillside known as Mount Russell. These improvements are underlain by younger alluvium and older alluvium which is in-turn underlain by Cretaceous-aged granitic bedrock, (see Figure 2).

- **Surface Water and Groundwater**: No surface water was observed during the site visit, however during periods of heavy rain the drainage channel will contain water. Ground water is not anticipated to be encountered during dry season, but could be encountered during the seasonal rains.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain. A stability analysis of the drainage slopes should be performed when the design configuration is known.

  - Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed drainage culvert is considered low.

  - Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

  - Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Due to relatively dense granitic bedrock and older alluvial soils the potential for liquefaction at the subject site is considered very low to nil.

  - Seismic densification: We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading of the drainage culvert will be readily accomplished with conventional heavy duty earth moving equipment. Slopes exposing loose or friable non-cohesive granular soils may require removal and recompaction. Site soils should be considered highly erosive and protective measures should be considered in the design.

3.8 Brodiaea Avenue and Wilmot Street Sewer Improvements

The proposed sewer improvements are for Brodiaea Avenue from Merwin Street to Wilmot Street and for Wilmot Street from Brodiaea Avenue to Cactus Avenue, (see Figure 1).

- **Site Specific Geology**: The sewer improvements are underlain by younger and older alluvial material that appears to have been generated from the surrounding hills (see Figure 2).

- **Surface Water and Groundwater**: No surface water was observed during the site visit, however there is an unimproved drainage culvert to the south that may carry water during periods of heavy rain. Ground water is not anticipated to be encountered during dry season, but could be encountered during the seasonal rains.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain.

  - Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed improvements is considered low.

  - Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Due to relatively dense granitic bedrock and older alluvial soils the potential for liquefaction at the subject site is considered very low to nil.

- Seismic densification: Seismically-induced dry settlement is expected to be minimal and should not be a geotechnical constraint.

- **Grading Considerations**: Grading/excavation for the sewer improvements will be readily accomplished with conventional heavy duty earth moving equipment.

3.9 Cottonwood Avenue Water and Utility Improvements

The proposed water and utility improvements are for Cottonwood Avenue and are bounded on the east by Redlands Boulevard and on the west by Moreno Beach Drive, (see Figure 1). A short section of Moreno Beach Drive south of Cottonwood Avenue also has proposed water and utility improvements.

- **Site Specific Geology**: The western portion of the water and utility improvements is underlain by older alluvium which is in-turn underlain by Cretaceous-aged granitic bedrock, whereas the eastern portion of the improvements is underlain by younger alluvium, (see Figure 2).

- **Surface Water and Groundwater**: No surface water was observed during the site visit, however there is a partially improved drainage culvert to the north, paralleling Quincy Drive that does carry water during periods of heavy rain. Ground water is not anticipated to be encountered during dry season, but could be encountered during the seasonal rains.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

- Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain.

- Rock falls: The steep sloping hillsides near the site contain many potentially loose boulders. The potential for rock fall due to either erosion or seismic ground shaking is considered high in this area. Remedial measures such as rock removal, anchoring, catchment areas, rock fences, or setbacks may be required. The potential hazard from individual rocks should be assessed as site grading plans are developed.

- Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Groundwater within the subject site is reported to be in excess of 50 feet below existing ground surface. Due to deep groundwater and relatively dense alluvial soils underlying the site, it is our opinion that potential for liquefaction at the site is very low.

- Seismic densification: Seismically-induced dry settlement is expected to be minimal and should not be a geotechnical constraint.

- **Grading Considerations**: Grading on this site may encounter dense older alluvium and very dense to non-rippable bedrock. Oversize rock may need to be exported off this site.

3.10 Redlands Boulevard Water and Utility improvements

The proposed water and utility improvements are for Redlands Boulevard and are bounded on the north by Highway 60 and on the south by Alessandro Boulevard, (see Figure 1).

- **Site Specific Geology**: These improvements are underlain by younger alluvial material that appears to have been generated from the surrounding hills, (see Figure 2). Based on our subsurface investigation of the property immediately east of Redlands Boulevard (Leighton. 2012), the alluvial soils are a minimum of 50 feet in thickness.

- **Surface Water and Groundwater**: No surface water was observed along Redlands Boulevard. The potential for surface runoff in the area should be anticipated due to the existence of drainage channels that parallel Redlands

Boulevard. Based on our subsurface investigation on the property immediately east of Redlands Boulevard (Leighton. 2012), ground water is expected to be greater than 50 feet deep and should not be a constraint to construction of the basins. However, shallow perched ground water is not anticipated to be encountered during dry season, but could be encountered during the seasonal rains.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain.

  - Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed improvements is considered low.

  - Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

  - Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Groundwater within the subject site is reported to be in excess of 50 feet below existing ground surface. Due to deep groundwater and relatively dense alluvial soils underlying the site, it is our opinion that potential for liquefaction at the site is very low.

  - Seismic densification: Seismically-induced dry settlement is expected to be minimal and should not be a geotechnical constraint.

- **Grading Considerations**: Construction will be readily accomplished with conventional heavy duty earth moving equipment.

3.11 Eucalyptus Avenue to Fir Avenue Water Improvements

The proposed water improvements are for Eucalyptus Avenue in the west connecting to Fir Avenue in the east and are bounded on the east by Redlands Boulevard and on the west by Moreno Beach Drive, (see Figure 1). The alignment also transects through an existing citrus grove.

- **Site Specific Geology**: The water improvements are underlain by younger and older alluvial material that appears to have been generated from the surrounding hills (see Figure 2).

- **Surface Water and Groundwater**: No surface water was observed during the site visit, however there is an unimproved drainage culvert that transects the alignment at Quincy Drive, and does carry water during periods of heavy rain. Shallow perched ground water is not anticipated to be encountered during dry season, but could be encountered during the seasonal rains.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain. A stability analysis of the existing channel slopes, at Quincy Drive, should be performed when the design configuration is known.

  - Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed basin is considered low.

- Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Groundwater within the subject site is reported to be in excess of 50 feet below existing ground surface. Due to deep groundwater and relatively dense alluvial soils underlying the site, it is our opinion that potential for liquefaction at the site is very low.

- Seismic densification: Seismically-induced dry settlement is expected to be minimal and should not be a geotechnical constraint.

- **Grading Considerations**: Construction will be readily accomplished with conventional heavy duty earth moving and excavatioin equipment. The slopes of the existing channel may expose loose or friable non-cohesive granular soils and may require removal and recompaction. Site soils should be considered highly erosive and protective measures should be considered in the design.

3.12 Potential Water Reservoir & Access Area "C"

Reservoir Area "C" consists of a potential tank pad that is located northwest of the intersection of Quincy Drive and Cottonwood Avenue, west of the World Logistics Center.

- **Site Specific Geology**: The potential reservoir is located within a prominent cretaceous-aged granitic bedrock hillside. The reservoir pad area will most likely be underlain by dense granitic bedrock material with the lower lying portions of the site underlain by dense older alluvial material, see Figure 2.

- **Surface Water and Groundwater**: No surface water was observed during the site visit. During periods of heavy rain, drainage patterns will be created due to the steep topography and should be included into design of any cut or fill slopes. Ground water is not anticipated to be encountered in the elevated granitic bedrock material.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

- Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

- Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

- Landsliding: No landslides have been previously mapped by others or identified by us during our field investigation within the property. Landsliding due to seismic activity is not anticipated due to the nature of the granitic bedrock underlying the site.

- Rock falls: The steep sloping hillsides on the site contain many potentially loose boulders. The potential for rock fall due to either erosion or seismic ground shaking is considered high in this area. Remedial measures such as rock removal, anchoring, catchment areas, rock fences, or setbacks may be required. The potential hazard from individual rocks should be assessed as site grading plans are developed.

- Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Due to relatively dense granitic bedrock and older alluvial soils the potential for liquefaction at the subject site is considered very low to nil.

- Seismic densification: We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading on this site and access road areas will likely encounter non-rippable bedrock, as either boulders on the surface or non-rippable rock at depth. Oversize rock may need to be exported off this site. Slopes exposing loose rock or unfavorable structure may require removal and recompaction to create a stable slope configuration. Import soil or rock crushing will likely be required to create the compacted fill pad.

3.13 Redlands Boulevard Ramp Improvements

The proposed ramp improvements are for the interchange of SR-60 freeway and Redlands Boulevard (see Fig. 1).

- **Site Specific Geology**: This site is underlain by younger and older alluvial material that appears to have been generated from the surrounding hills (see Figure 2). Based on our subsurface investigation of the property immediately southeast of the proposed ramp improvements (Leighton, 2012), the alluvial soils are a minimum of 50 feet in thickness.

- **Surface Water and Groundwater**: No surface water was observed within the area of ramp improvements. Based on our subsurface investigation on the property immediately to the southeast of the site (Leighton, 2012), ground water is expected to be greater than 50 feet deep and should not be a constraint to construction of the ramp improvements.

- **Site Specific Faulting**: No faulting was observed, known to exist onsite, or projected into this site.

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of site conditions indicate no active or potentially active faulting on site.

  - Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

  - Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain.

  - Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed basin is considered low.

  - Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

  - Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Groundwater within the subject site is reported to be in excess of 50 feet below existing ground surface. Due to deep groundwater and relatively dense alluvial soils underlying the site, it is our opinion that potential for liquefaction at the site is low.

- Seismic densification: We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations:** Grading of the ramp improvements will be readily accomplished with conventional heavy duty earth moving equipment. Slopes exposing loose or friable non-cohesive granular soils may require removal and recompaction. Site soils should be considered highly erosive and protective measures should be considered in the design. The existing embankment fills should be evaluated once design plans become available.

3.14 Theodore Street Interchange Improvements

The proposed ramp improvements are for the interchange of SR-60 freeway and Theodore Street (see Fig. 1).

- **Site Specific Geology**: This site is underlain by younger and older alluvial material that appears to have been generated from the surrounding hills as well as previously placed artificial fill, (see Figure 2). Based on our subsurface investigation of the property immediately southwest of the ramp improvements (Leighton, 2012), the alluvial soils are a minimum of 50 feet in thickness.

- **Surface Water and Groundwater**: No surface water was observed within the area of the ramp improvements. Based on our subsurface investigation on the property immediately to the southwest of the site (Leighton, 2012), ground water is expected to be greater than 50 feet deep and should not be a constraint to construction of the ramp improvements.

- **Site Specific Faulting**: An unnamed splay of the San Jacinto Segment of the San Jacinto Fault (also known as the Claremont Fault) transects the ramp improvements (see Figure 2). This fault is also identified as a Riverside County Fault Zone (see Figure 3). Surface expression of this fault splay, such as scarps, offset drainages or other lineaments were not observed during this or previous studies. No subsurface investigation has been performed to confirm the existence of this fault splay. However, this fault is considered active based on the County geologic hazard maps

- **Secondary Seismic Hazards**: Secondary hazards that might be associated with severe ground shaking during an earthquake are as follows:

  - Ground rupture: Our review of previous investigations and current observations of the subject site and adjacent areas is that there is no active faulting on site. However, the potential for ground

subsidence/fissuring should be considered low to moderate for this site due to the currently mapped un-named fault splay transecting this interchange. The unnamed fault splay, postulated to exist crossing the planned improvements (see Figure 2), is considered to be active by Riverside County and is therefore considered to be a constraint to the planned improvements.

- Seiches and Tsunamis: Due to site elevation and great distance from large bodies of water, the possibility of seiches, tsunamis and inundation on this site is considered very low to nil.

- Landsliding: No landslides have been previously mapped by others or identified by us during our review of this property. Landsliding due to seismic activity is not anticipated at the site due to relatively flat lying terrain.

- Rock falls: Due to the lack of boulders and/or elevated rock out-cropping on or immediately adjacent to this site, the possibility of rock fall to impact the proposed basin is considered low.

- Ground Fissuring and Subsidence: No evidence of ground fissuring was observed or been reported within the project boundary, or projecting into the property from immediately adjacent or nearby properties.

- Liquefaction: The subject site is not within a liquefaction hazard zone (Riverside County, 2003). Groundwater within the subject site is reported to be in excess of 50 feet below existing ground surface. Due to deep groundwater and relatively dense alluvial soils underlying the site, it is our opinion that potential for liquefaction at this site is low.

- Seismic densification: We anticipate that the near-surface loose soil deposits susceptible to such seismically induced settlement will be removed and compacted during grading.

- **Grading Considerations**: Grading of the ramp improvements will be readily accomplished with conventional heavy duty earth moving equipment. Slopes exposing loose or friable non-cohesive granular soils may require removal and recompaction. Site soils should be considered highly erosive and protective measures should be considered in the design. The existing embankment fills should be evaluated once design plans become available.

4.0 SUMMARY OF FINDINGS AND CONCLUSIONS

Based on our preliminary geotechnical evaluation, the following is a summary of the primary geotechnical factors that may affect the various sites.

- Granitic bedrock underlying potential water reservoir Area "C", water and utility improvements for Cottonwood Avenue, and roadway improvements for Cactus Avenue may encounter non-rippable bedrock at depth.

- The steep sloping hillsides near the Cactus Avenue roadway improvements, Cottonwood Avenue water and utility improvements, and the potential water reservoir and access Area "C" contain many potentially loose boulders. The potential for rock fall due to either erosion or seismic ground shaking is considered high in these areas. Remedial measures such as rock removal, anchoring, catchment areas, rock fences, or setbacks may be required. The potential hazard from individual rocks should be assessed as site grading plans are developed.

- Undocumented fill, low density alluvium and San Timoteo formation materials underling water reservoir Area "A" and Area "B" are considered to be potentially compressible. For planning purposes, the upper 10 to 15 feet below tank ring pads and 3 to 10 feet below access roadway pavements may require removal and recompaction. Deeper removals may be required locally based on actual soils encountered or planned grading configuration. The existing onsite soils are generally suitable for reuse as fill during proposed grading provided they are free of organic material, debris and oversize rock greater than 12-inches in greatest diameter.

- Cut slopes excavated into dense granitic bedrock should be both statically and seismically stable at 2:1 (horizontal to vertical) inclinations. Due to the variable nature of site alluvial and San Timoteo formation soils, cut slopes in excess of 5 feet in vertical height excavated in these materials should be constructed as replacement fill slopes as depicted in Appendix B.

- Potential water reservoir Area "A" is located within the State Earthquake Fault Zones, see Figure 3, and should be further evaluated.

- Potential water reservoir Area "A" and Area "B" have landslide features either within the selected tank pad, adjacent to or above the tank pad, or along the slopes underlying the pad or access road areas and should be further evaluated.

- Strong ground shaking and settlement (seismic densification) may occur at these sites due to local earthquake activity and close proximity to known active faults.

- Groundwater was not encountered up to maximum explored depth of 51.5 feet during our nearby site investigations. Shallow groundwater is not expected to be a factor during site excavation and construction during dry seasons.

- Perched water may develop in areas of soils with contrasting permeabilities, possibly resulting in saturated fills or seepage from slopes. This condition is often a result of site water use and irrigation practices.

- Fill slopes are anticipated for the proposed development. Unprotected slope faces will be susceptible to erosion. This risk can be reduced by planting the slopes as soon as possible after grading, and by maintaining proper erosion control measures.

5.0 PRELIMINARY DESIGN CONSIDERATIONS

5.1 Additional Geotechnical Studies

This geotechnical review is limited to our observations of site surficial exposures, review of published maps and reports. As specific facility locations and access roads are selected, detailed specific geotechnical subsurface investigations should be performed to provide recommendations for remedial grading and foundation design.

5.2 Structural Fills

The onsite soils for the various sites are considered suitable for reuse as compacted fill, provided they are free of organic materials, debris and oversize materials (greater than 8 inches in greatest dimension). The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in thickness. Fill soils should be placed and compacted to a minimum 90 percent relative compaction (as determined by ASTM Test Method D1557) and at or above the optimum moisture content.

5.3 Import Soils

If import soils are needed to establish the site design elevations, it should be granular in nature, relatively free of organic material, have an expansion index less than 51 (per ASTM Test Method D4829), and have a low corrosion impact to the proposed improvements. Import soils, if needed, and potential borrow sites should be evaluated by the geotechnical consultant prior to being imported to the site.

5.4 Trench Excavation and Backfill

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the California Construction Safety Orders (2003 Edition or more current). The contractor must be responsible for providing a "competent person" as defined in Article 6 of the California Construction Safety Orders. Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe. All safety precautions should be properly implemented at all times. In addition, excavations at or near the toe of slopes and/or parallel to slopes may be highly unstable due to the increased driving force and load on the trench wall. Spoil piles from the excavation(s) and construction equipment should be kept away

from the sides of the trenches. Leighton does not consult in the area of safety engineering.

6.0 LIMITATIONS

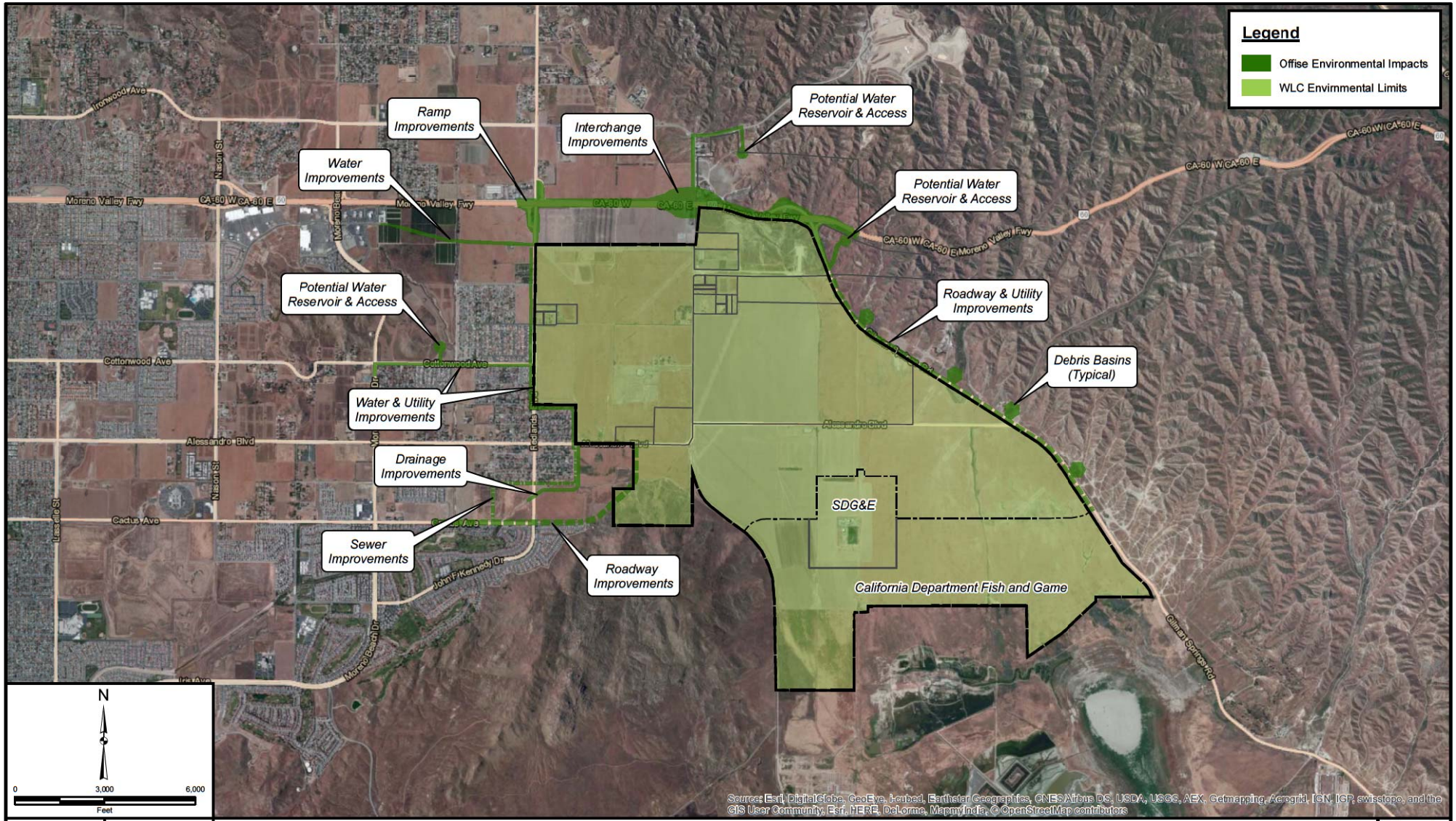
This preliminary report was necessarily based in part upon data obtained from a limited number of observances, site visits, histories of occurrences, and limited information on historical events and observations. Such information is necessarily incomplete and future site specific geotechnical/geologic studies are recommended. The nature of many sites is such that differing characteristics can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time.

This geotechnical report was prepared for Highland Fairview needs, directions, and requirements. This report is not authorized for use by, and is not to be relied upon by any party except Highland Fairview, and its successors and assigns as owner of the property, with whom Leighton and Associates, Inc. has contracted for the work. Use of or reliance on this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton and Associates, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton and Associates, Inc.

The client is referred to Appendix C regarding important information provided by the Associated Soil and Foundation Engineers (ASFE) on geotechnical engineering studies and reports and their applicability.

TABLE 1

Site	Location	Geology / Geomorphology	Geotechnical Constraints	Recommendations
A	North of Project: Ironwood Avenue & Theodore Street	Potential pad in San Timoteo formation	- Pad within Earthquake Fault Zone - Loose surficial materials. - Existing landslides	Additional studies for remedial grading, onsite faulting, landslide and slope stability.
B	East of Gilman Springs Rd & south of SR-60 – Badlands area	Potential pad in San Timoteo formation	- Loose surficial materials. - Existing landslides	Additional studies for remedial grading, landslide and slope stability.
C	West of Project: Moreno Beach Drive & Cottonwood Avenue	Potential pad along ex. granitic hilltop	- Potential Rock Fall - Non-rippable and oversize rock may be encountered in deep cuts	Additional studies for rock rippability, rock fall evaluation, remedial grading and slope stability.
Debris Basins	Gilman Springs Rd. - south of SR-60 and north of Cactus Ave. if extended– Badlands area	4 potential debris basins in alluvial fan deposits	- Loose/erosive surficial materials - County and State Fault study zones transects three basins	Additional studies for remedial grading, slope stability, possible relocate basins out of fault zones.
Gilman Springs Improvements	Gilman Springs Rd. - south of SR-60 and north of Cactus Ave. if extended– Badlands area	Improvements in San Timoteo formation and alluvial fan deposits	- Loose surficial materials.	Additional studies on remedial grading and slope stability.
Cactus Avenue Improvements	Cactus Ave. – west of Merwin St. and east of Wilmont St.	Improvements in older alluvium underlain by Cretaceous-aged granitic bedrock	- Potential Rock Fall - Non-rippable and oversize rock may be encountered in deep cuts	Additional studies for remedial grading and rock fall evaluation.
Existing Drainage Improvements	West of project - south of Brodiaea Ave. and north of Cactus Ave.	Improvements in younger/older alluvium underlain by Cretaceous-aged granitic bedrock	- Loose/Erosive surficial materials	Additional studies for slope stability of cut slopes or embankment fills
Brodiaea Avenue/Wilmot Street Sewer	Brodiaea Ave. – Merwin St. to Willmot St. and Wilmot St. – Brodiaea Ave. to Cactus Ave.	Improvements in younger/older alluvium	- Loose surficial materials.	Additional studies on sewer alignment per EMWD requirements.
Cottonwood Avenue	Cottonwood Ave. – west of Redlands Blvd. and east of Moreno Beach Dr.	Improvements in younger/older alluvium underlain by Cretaceous-aged granitic bedrock	- Potential Rock Fall - Non-rippable and oversize rock may be encountered in deep cuts	Additional studies for rock rippability and rock fall evaluation.
Redlands Boulevard	Redlands Blvd. – south of SR – 60 and north of Alessandro Blvd.	Improvements in younger/older alluvium	- Loose surficial materials.	Additional studies for remedial grading for pavement improvements and water and utility alignments per EMWD.
Eucalyptus Avenue/Fir Avenue Water	Eucalyptus Ave. to Fir Ave. between Redlands Blvd. and Moreno Beach Dr.	Improvements in younger/older alluvium	- Loose surficial materials, slope stability along existing drainage culvert.	Additional studies for water main alignment and slope stability.
Redlands Boulevard Ramp	Redlands Boulevard and SR-60	Improvements in younger/older alluvium	- Loose surficial materials.	Additional studies for remedial grading and pavements.
Theodore Street / SR-60 Interchange	Theodore St. and SR-60	Improvements in alluvium and older alluvial fan deposits	- Loose/Erosive surficial materials - County Fault study zone transects interchange.	Additional studies for possible active fault, remedial grading and foundations report as needed by Caltrans



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Scale: 1 " = 3,000 '	Date: May 2012

Base Map: ESRI ArcGS Online 2014
Thematic Information: Leighton
Author: (mmurphy)

SITE LOCATION MAP

World Logistics Center Specific Plan
Moreno Valley, California

Figure 1

Leighton

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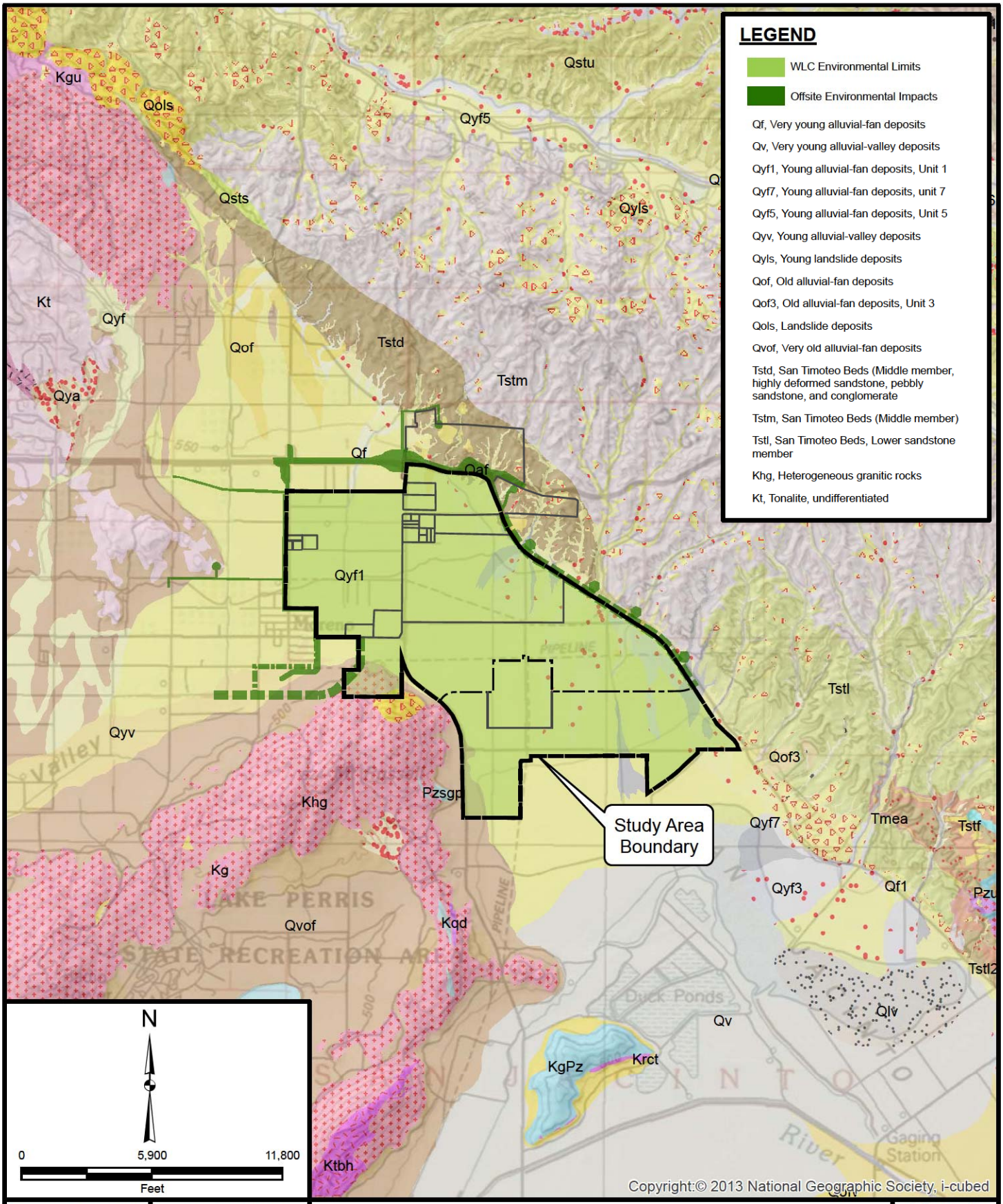

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Base Map: ESRI ArcGIS Online 2014
Geology: USGS, 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, Version 1.0, Open File Report 2006-1217
Author: (mmurphy)

REGIONAL GEOLOGY MAP

World Logistics Center Specific Plan
Moreno Valley, California

Figure 2

Leighton

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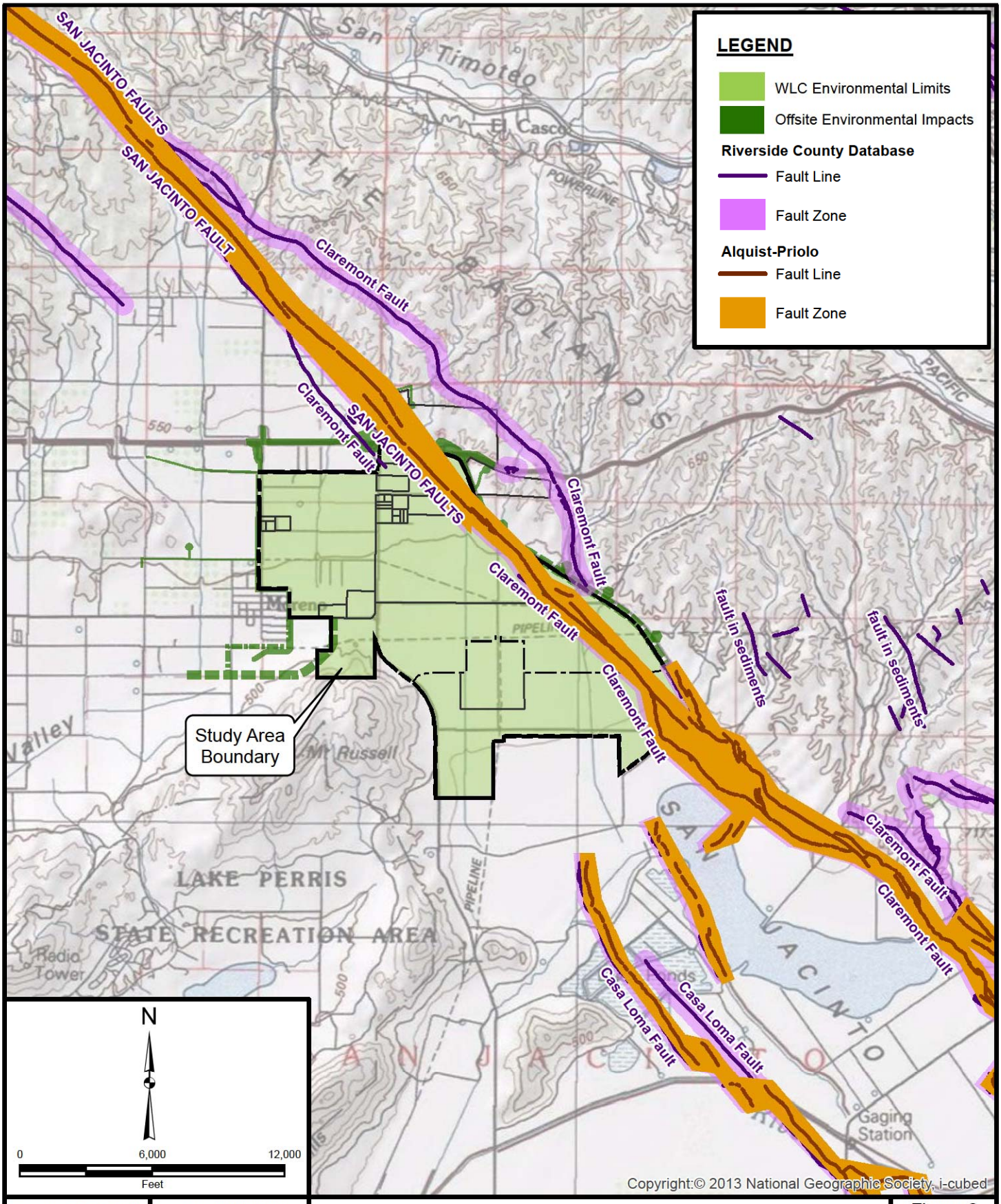

Project: 111061-126	Eng/Geol: SIS/RFR
Scale:1 " = 6,000 '	Date: May 2012

Base Map: ESRI ArcGIS Online 2014
Faults: Riverside County, Alquist-Priolo
Author: (mmurphy)

REGIONAL FAULT MAP

World Logistics Center Specific Plan
Moreno Valley, California

Figure 3

Leighton

Map Saved as V:\drafting\111061\126\Maps\111061-126_F01_RFM_2014-10-03.mxd on 10/3/2014 9:47:56 AM

APPENDIX A

APPENDIX A

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Aerial Photographs

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Date	Source
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APPENDIX B

APPENDIX B
LEIGHTON AND ASSOCIATES, INC.
GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

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Standard Details

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction.

The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation

In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical

Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to

inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill

All bedding and backfill of utility trenches shall be performed in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of relative compaction from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

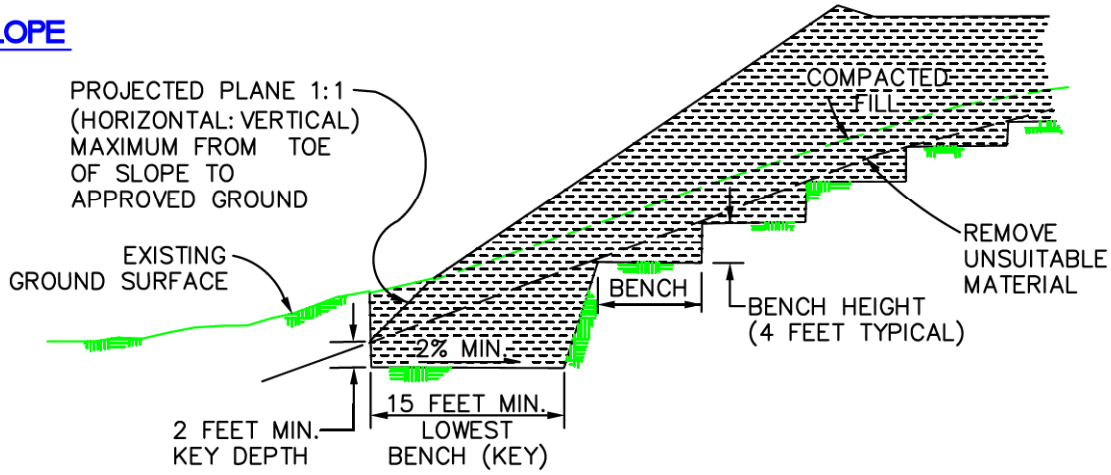
7.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

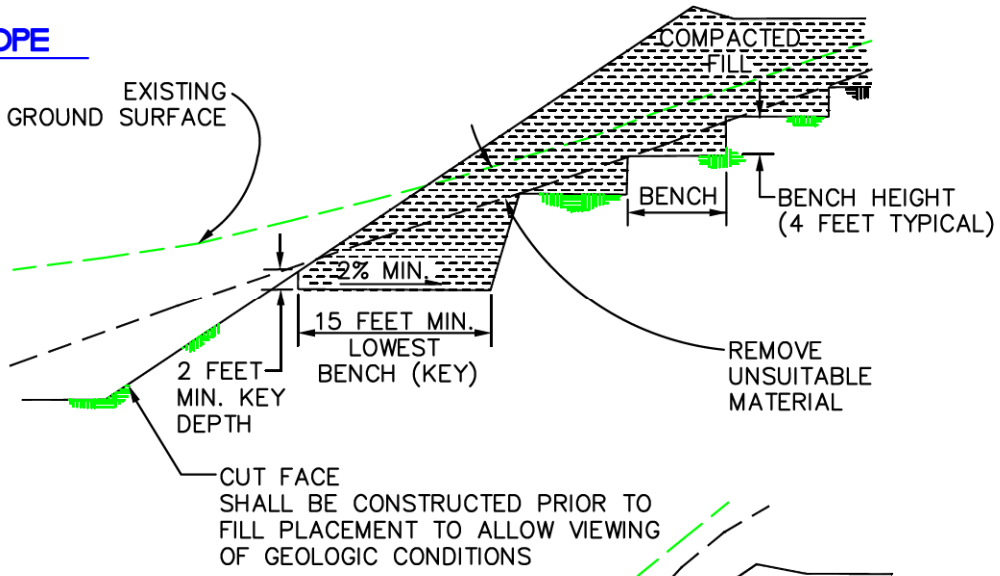
7.4 Observation and Testing

The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

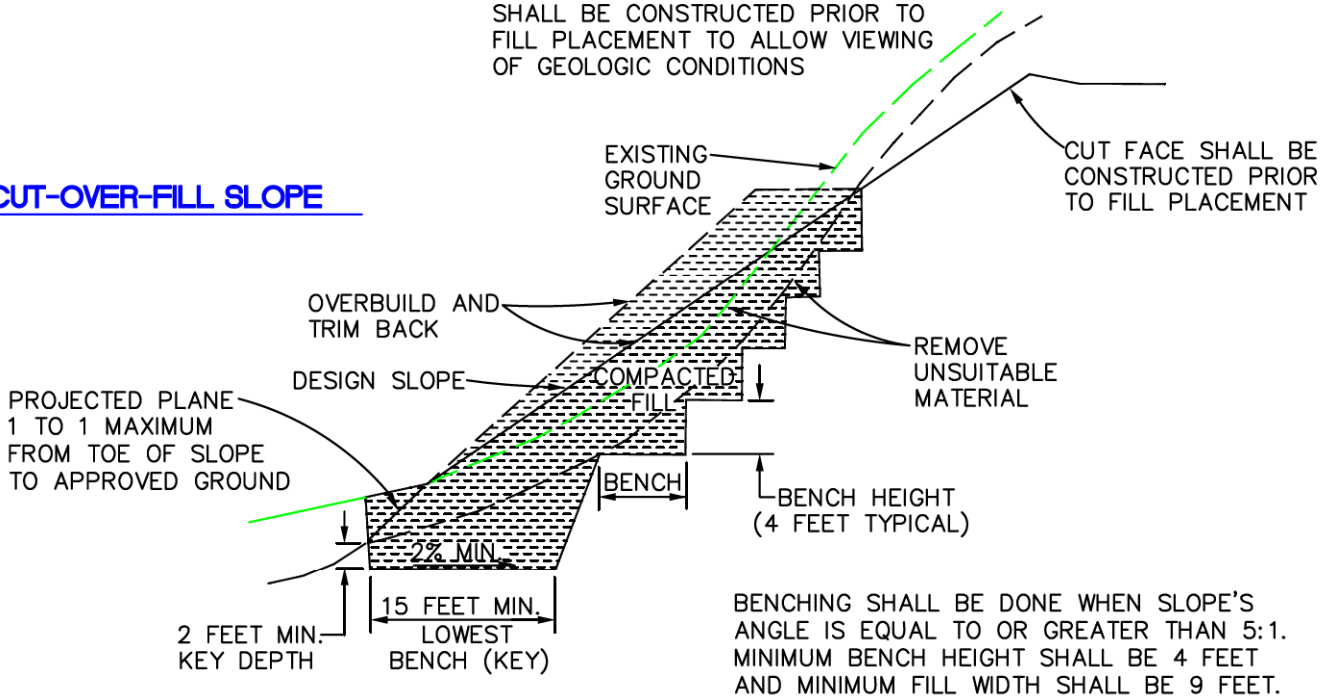
FILL SLOPE



FILL-OVER-CUT SLOPE

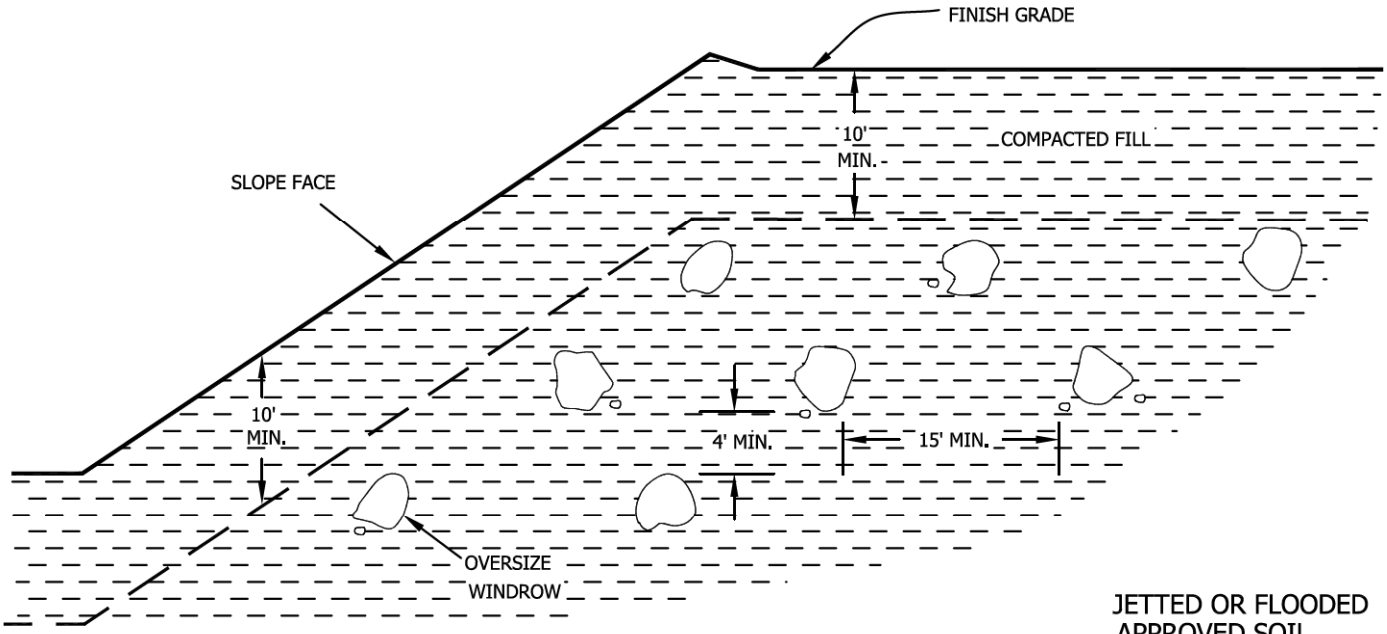


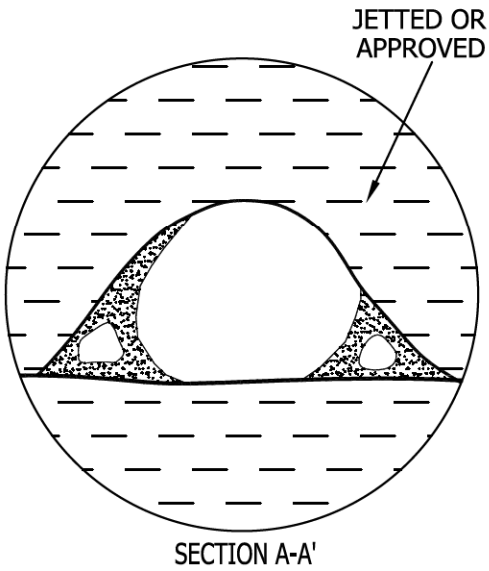
CUT-OVER-FILL SLOPE



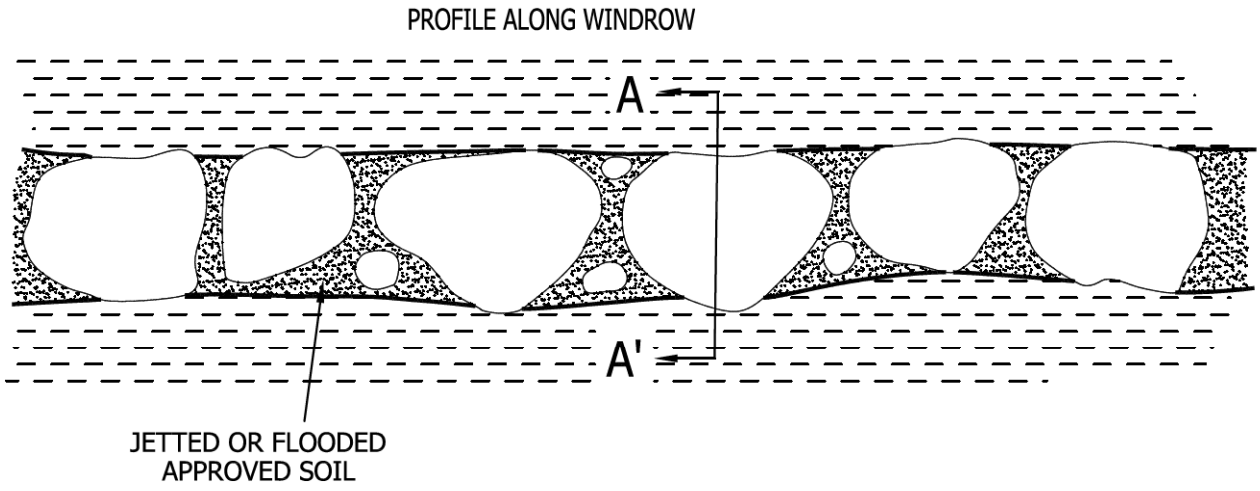
BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS A	Leighton





- Oversize rock is larger than 8 inches in largest dimension.
- Backfill with approved soil jetted or flooded in place to fill all the voids.
- Do not bury rock within 10 feet of finish grade.
- Windrow of buried rock shall be parallel to the finished slope face.



OVERSIZE ROCK DISPOSAL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS B

Leighton

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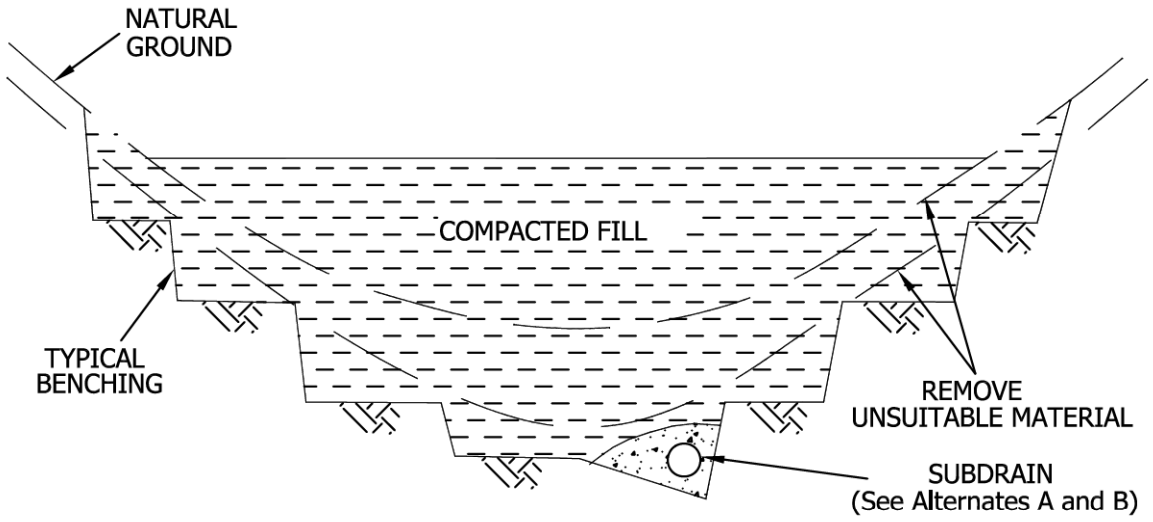
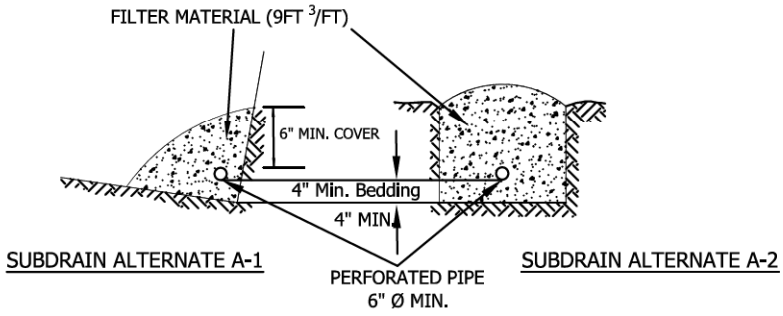


SUBDRAIN ALTERNATE A

PERFORATED PIPE SURROUNDED WITH FILTER MATERIAL

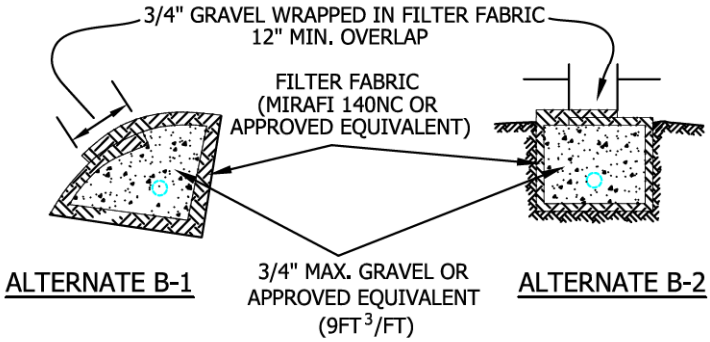


FILTER MATERIAL

FILTER MATERIAL SHALL BE CLASS 2 PERMEABLE MATERIAL PER STATE OF CALIFORNIA STANDARD SPECIFICATION, OR APPROVED ALTERNATE. CLASS 2 GRADING AS FOLLOWS:

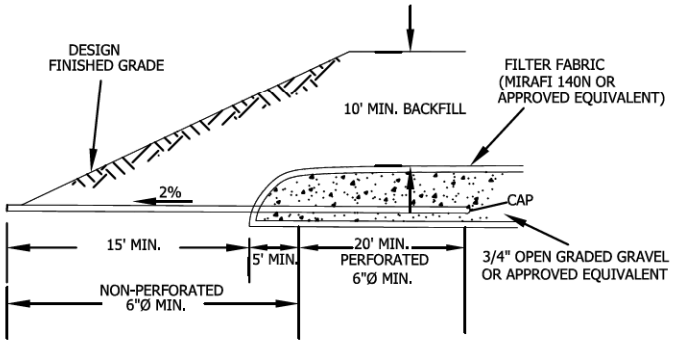
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SUBDRAIN ALTERNATE B



○ PERFORATED PIPE IS OPTIONAL PER GOVERNING AGENCY'S REQUIREMENTS

DETAIL OF CANYON SUBDRAIN TERMINAL



CANYON SUBDRAIN	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS C	Leighton

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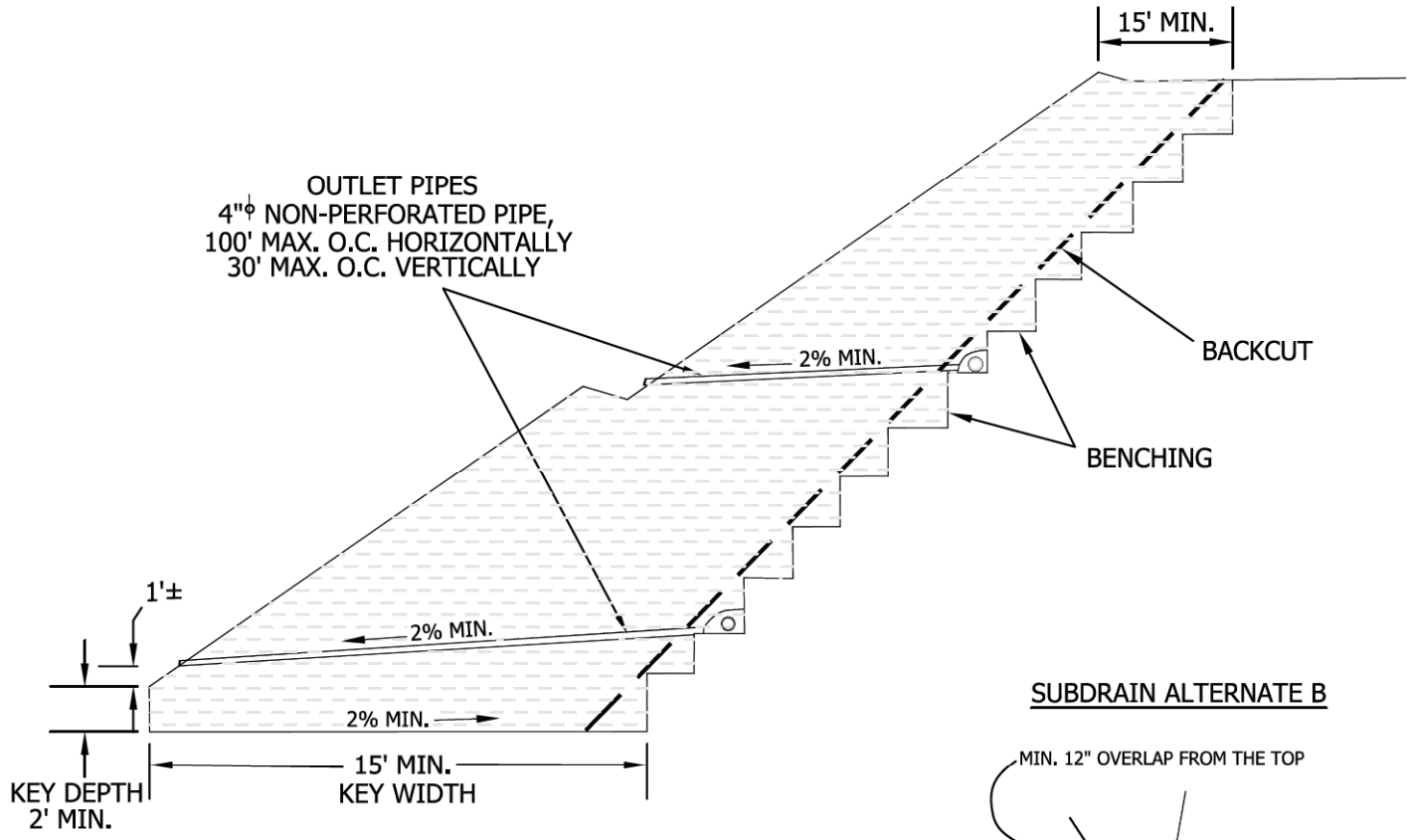
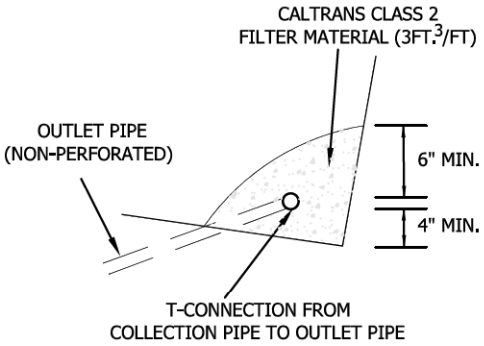


SUBDRAIN ALTERNATE A



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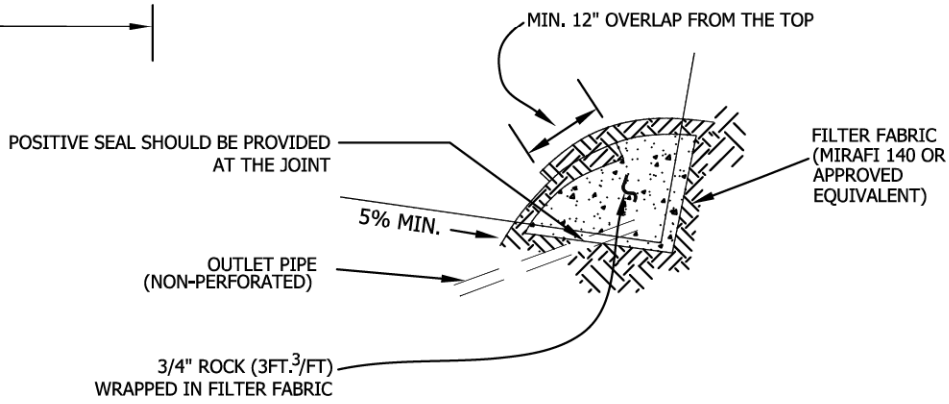

- SUBDRAIN INSTALLATION - Subdrain collector pipe shall be installed with perforations down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be 1/4" to 1/2" if drilled holes are used. All subdrain pipes shall have a gradient at least 2% towards the outlet.
- SUBDRAIN PIPE - Subdrain pipe shall be ASTM D2751, ASTM D1527 (Schedule 40) or SDR 23.5 ABS pipe or ASTM D3034 (Schedule 40) or SDR 23.5 PVC pipe.
- All outlet pipe shall be placed in a trench and, after fill is placed above it, rodded to verify integrity.

BUTTRESS OR REPLACEMENT FILL SUBDRAINS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS D	Leighton

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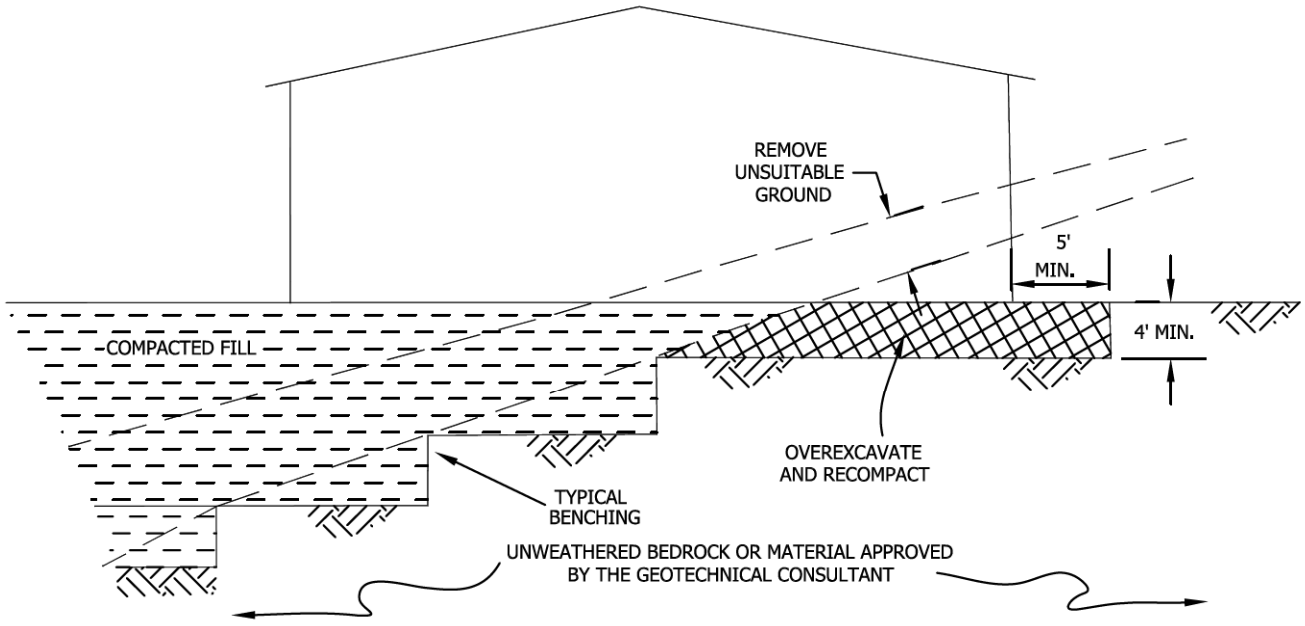
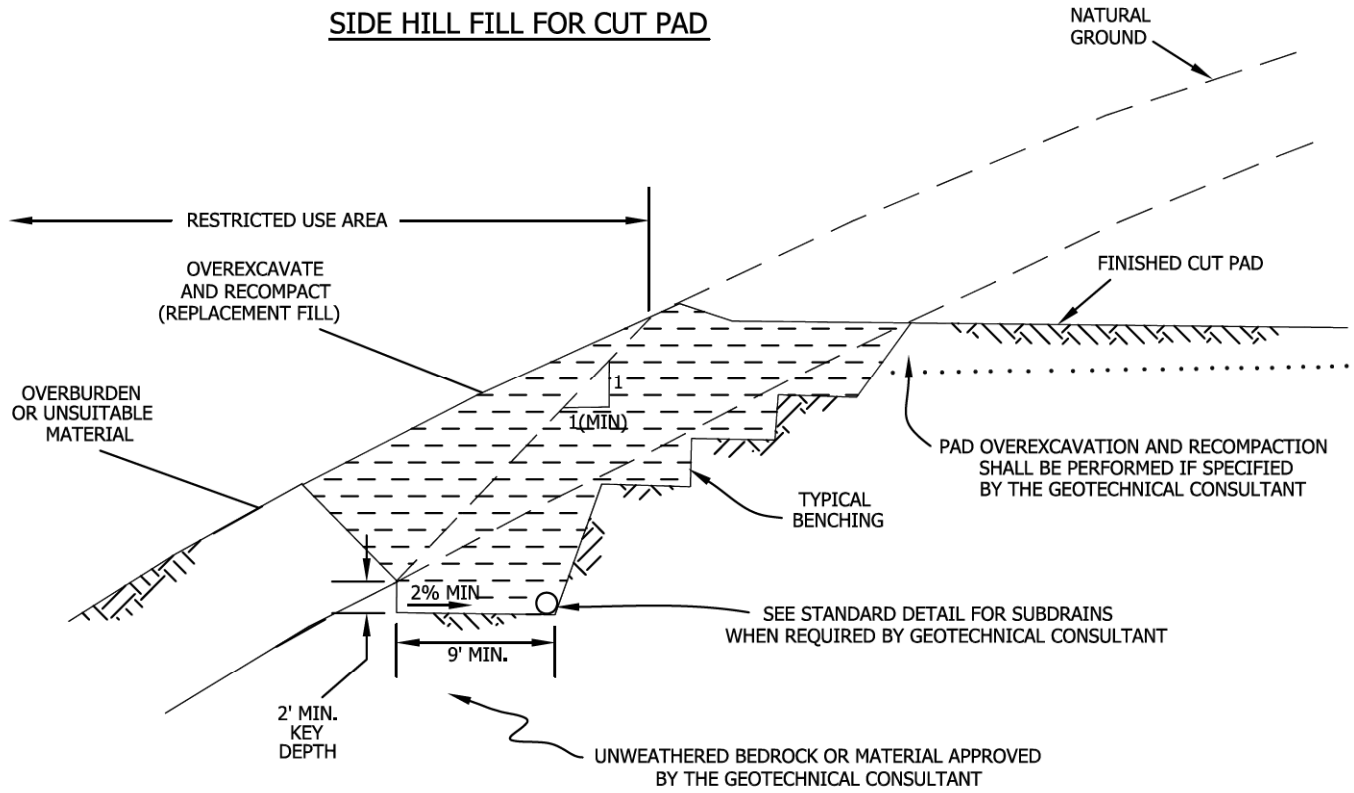
CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



TRANSITION LOT FILLS AND SIDE HILL FILLS

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS E

Leighton

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APPENDIX C

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

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