Geotechnical Engineering Report

Desert View Overlook Rehabilitation – Retaining Wall and Parking Area

Clark County, Nevada

September 9, 2010

Project No. 64085048

Prepared for:

Case, Lowe & Hart, Inc.
Ogden, Utah

Prepared by:

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GEOTECHNICAL ENGINEERING REPORT
DESERT VIEW OVERLOOK REHABLITATTION – RETAINING WALL AND PARKING AREA
MILEPOST 7 ON STATE ROUTE 158
CLARK COUNTY, NEVADA

Terracon Project No. 64085048
September 9, 2010

EXECUTIVE SUMMARY

This geotechnical executive summary should be used in conjunction with the entire report for design and construction purposes. It should be recognized that specific details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled General Comments should be read for an understanding of the report limitations.

A geotechnical engineering study has been performed for the proposed Desert View Overlook Rehabilitation – Retaining Wall and Parking Area project located near Milepost 7 on State Route 158 in the jurisdiction of Clark County, Nevada. Terracon's geotechnical scope of work included the advancement of two test borings drilled to approximate depths of 60 feet below existing site grades.

Based on the information obtained from our subsurface exploration, the site is suitable for development of the proposed project. The geotechnical considerations are summarized in the following paragraphs:

Site Soils: The native soils at the site consisted of sandy gravel fill and sandy gravel colluvium overlying bedrock. The bedrock consisted of interbedded strata of weathered and fractured dolomite, siltstone, sandstone, and limestone. Groundwater was not encountered in the test borings at the time of drilling.

Retaining Wall Systems: Composite cantilevered soldier pile and Mechanically Stabilized Earth (MSE) retaining wall system is recommended for this project.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during construction.

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September 9, 2010

Terracon

Case, Lowe & Hart, Inc.
2484 Washington Boulevard, Suite 510
Ogden, Utah 84401

Attn: Mr. Kevin J. Lewis, P.E.
President

Re: Geotechnical Engineering Report
Desert View Overlook Rehabilitation – Retaining Wall and Parking Area
Milepost 7 on State Route 158
Clark County, Nevada
Terracon Project No. 64085048

Dear Mr. Lewis:

Terracon Consultants, Inc. (Terracon) is pleased to submit the results of our geotechnical engineering study performed for the proposed Desert View Overlook Rehabilitation – Retaining Wall and Parking Area project. The project site is located near Milepost 7 on State Route 158 in the jurisdiction of Clark County, Nevada. This study was performed in general accordance with Terracon Proposal and Supplemental Geotechnical Services proposals.

The accompanying geotechnical engineering report presents the findings of our subsurface exploration, laboratory testing, and engineering analyses, and provides recommendations for design and construction of the project. A boring location diagram (Site and Exploration Plan) and individual boring logs are enclosed with this report.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Walter E. Vanderpool

Walter E. Vanderpool, P.E.
Senior Associate

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GEOTECHNICAL ENGINEERING REPORT
DESERT VIEW OVERLOOK REHABILITATION
CLARK COUNTY, NEVADA

Project No. 64085048
September 9, 2010

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering study completed for the proposed Desert View Overlook Rehabilitation – Retaining Wall and Parking Area project. The project site is located near Milepost 7 on State Route 158 in the jurisdiction of Clark County, Nevada. The general location of the project site is shown on Figure 1, Vicinity Map. A Site and Exploration Location Plan is presented on Figure 2. Mapping of strike and dip are presented on Figure 3 and geologic map units are presented on Figure 4. A key to photograph locations and orientation is presented on Figure 5. Photographic logs of surface geologic conditions are presented on Figures 6 through 14. Logs of the individual borings are presented in Appendix A.

The purpose of our services was to provide information and geotechnical engineering recommendations relative to:

- General geology of the area
- Subsurface soil and groundwater conditions
- Earthwork requirements
- Foundation design and construction
- Lateral earth pressures
- Seismic Site Class and design parameters

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	Please refer to Figures 1, 2, 3 and 4.
Structures	Retaining wall, approximately 200 to 375 feet long with maximum heights reaching 20 to 25 feet, constructed along the east side of State Route 158 (SR 158) to provide a level platform for the parking area.
Wall construction	A composite cantilever soldier-pile and Mechanically Stabilized Earth (MSE) retaining wall system.
Finished pavement elevation	Final grades will match currently existing grades of SR 158 (assumed).
Maximum loads	Maximum uniform distributed load: 250 pound per square foot (psf) (assumed).
Maximum allowable settlement	1-inch (assumed).

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	Spring Mountains National Recreation Area, Humbolt-Toiyabe National Forest. East side of State Route 158 near Milepost 7. Western half of Section 31, Township 18 South, Range 57 East, Mount Diablo Base and Meridian in the jurisdiction of Clark County, Nevada. The general location of the project site is shown on Figures 1 through 3.
Existing site features	SR 158 consists of a 2-lane wide asphalt-paved roadway oriented in a general north-south direction. Site drainage appeared to occur by sheet flow to the west road ditch and concentrated run-off is carried beneath the roadbed to a discharge on the slopes east of the existing parking area for the overlook.
Surrounding features	Undeveloped natural alpine forest.
Current ground cover	Asphalt pavement, in parking area. Sparse grass to low shrub re-vegetation on 1.5:1 fill slopes (east side). Very sparse vegetation on aged rock ¾:1 cut slopes (west side).
Existing topography	Relatively flat paved areas at approximately 8200 feet MSL. 1 vertical to 1-1/5 horizontal graded fill slopes, 1 vertical to 2 horizontal natural slopes and 3/4 horizontal to 1 vertical cut rock slopes.

3.0 SITE EXPLORATION PROCEDURES

3.1 Field Exploration

The scope of our services for this project included a subsurface exploration program that consisted of drilling two borings to depths of 60 feet below existing grades. The subsurface exploration was performed by Terracon on December 3 and 4, 2009. The borings were advanced utilizing a truck-mounted Gardner-Denver 1000 drill rig. The scope of work was expanded in July 2010 to include geologic mapping and assessment of rock cut slope stability where required for improvements to traffic sight distance.

The approximate locations of the borings are shown on Figure 2, Site and Exploration Plan. The locations of the borings were selected in the near proximity of the proposed retaining wall and were affected by the drilling equipment accessibility. The coordinates and elevations of the boring locations were determined by using the computer program Google Earth Pro. The locations, coordinates, and elevations of the borings should be considered accurate only to the degree implied by the method used.

The borings were drilled using an air-rotary drill rig equipped with a 5¼-inch diameter bit. Penetration testing and soil sampling were performed using the standard penetration test (SPT) procedure and a 1⅜-inch inside diameter split-spoon sampler. The penetration values were reported as the number of blows required to advance the sampler the last 12 inches of an 18-inch drive using a 140-pound hammer free-falling 30 inches. The test refusal criterion of 50 blows for less than 6 inches of penetration was used during the field exploration.

The borings were drilled by Terracon personnel and were logged during drilling by a Terracon geologist. Soil samples obtained at the selected depths were returned to our laboratory for further examination, to aid in material classification, and for possible laboratory testing. The boring logs are presented on Plates A-1 through A-8 in Appendix A of this report. A key to the symbols and terms used on the boring logs is presented in the General Notes, Plate A-i in Appendix A. Plate A-ii explains the method of material classifications used.

3.2 Laboratory Testing

Soil samples obtained in the field during drilling were placed in sealed containers and transported to our laboratory for further examination and testing. Laboratory tests were conducted on selected representative soil samples to characterize relevant physical and engineering properties of the soils. The test results are presented on the boring logs and in appendix B of this report.

Two (2) sieve analyses were performed to determine the grain-size distribution of the soils sampled. This test is generally used to assist in classification of soils and to evaluate liquefaction potential of granular soils. The test results are presented on Plate B-1 in Appendix B.

Liquid Limits (LL), Plastic Limits (PL), and Plasticity Indices (PI) (Atterberg limits) were determined on two (2) representative soil samples obtained from the field explorations. The tests were performed on the fine-grained components of the soil sample in general accordance with ASTM test method D4318. The Atterberg limits are generally used to assist in classification of soils, to determine soil consistency, to provide correlations to soil's engineering properties such as strength and compressibility, and to evaluate liquefaction potential of fine soils. The results of the Atterberg Limits tests are presented on Plate B-1 in Appendix B of this report.

Atlas Consultants, Inc. performed a chemical test on one (1) representative soil sample. The test results are presented on Plate B-3 in Appendix B.

The soil samples were classified in the laboratory based on visual observation, texture, plasticity, and the limited laboratory testing described above. The boring logs included in this report represent an interpretation of the field logs and include modifications based on laboratory observations and laboratory test results of the samples. The soil descriptions presented on the boring logs for native soils are in accordance with our General Notes which is provided in Appendix A. The group symbol is also shown on the boring logs.

4.0 SUBSURFACE CONDITIONS

4.1 Site Geology

The site is located in the northern portion of the Spring Mountain Range on the northeast aspect of Mount Charleston beneath Mummy Peak. According to a geologic map of the area[1], the outcropping rock deposits consist of lower and upper Mississippian age Monte Cristo Limestone and lower, middle, and upper Ordovician age Ely Springs Dolomite and Eureka Quartzite.

The nearest mapped fault approximately parallels the SR158 alignment north and south of the site and is located a few hundred feet west of the Desert View Overlook site.[1] The age of this un-named fault is not known. The fault appears to be a short segment of multiple mapped faults associated with the tectonic processes that produced the Spring Mountain Range. No historic earthquakes have been attributed to any of the mapped faults in the Las Vegas Valley.[2] The mapped fault alignment and the strike and dip of the rock beds where they outcrop were measured at three locations along the SR 158 alignment. The orientation of the bedding planes at these locations are shown on Figure 3.

Numerous seismic events, most of which are a probable result of underground blasting at the Nevada Test Site (about 90 miles north of Las Vegas), have been felt in and around the Las Vegas area. There is a noticeable lack of earthquakes which have epicenters in the Southern Nevada area and are directly attributable to deep-seated tectonic movement. A few events recorded in the Henderson area and in Lincoln County registered magnitudes of between 5.0 and 6.0 on the Richter scale. Most of the recorded events in the area range in magnitude of 3.0 to 4.9.

Photographs of the general site and geology are provided on Figures 6 through 14. The location where the photographs were taken and the general orientation of the photographs are shown on Figure 5. The age of the rock cut is unknown.

Scaring from the excavation work are no longer visible in the cut face. Very sparse vegetation has taken root in some areas. Some minimal undercutting is observed in photographs 2 and 3 from near the south end of the cut. Relatively softer rocks are indicated by the erosion and scour channels in the cut face near station 375+20 (Photograph 9). Photographs 11 through 16 characterize the accumulation of colluvial debris weathered from the slope. The rock in the catchment/drainage ditch was 6 inch or less in nominal diameter and none of the rocks in the photographs had reached the paved road. The maintenance interval between ditch cleaning

[1]Longwell, C.R., E.H. Pampeyan, and Ben Bowyer, "Geologic Mao of Clark County, Nevada", Bulletin 62, Plate 1, Nevada Bureau of Mines and Geology, University of Nevada, Reno.

[2] Slemmons, Burt, 1990 “Earthquakes in Las Vegas”, Address to first meeting of Southwestern Section of Association of Engineering Geologist, Las Vegas, Nevada, October 1990.

operations is unknown, however, we could not detect evidence that accumulation of debris is heavy or frequent maintenance is required.

The vegetation in the ditch near the storm drain culvert (photograph 14) suggests the build-up of debris is slow and not episodic. Photographs 17 and 18 indicate that paths of concentrated storm runoff will require some riprap armoring to prevent excessive erosion at concentrated drainage discharge points.

4.2 Typical Subsurface Profile

The parking lot surface adjacent to the proposed wall alignment was capped by 3 inches of asphalt concrete, underlain by 12 inches of aggregate base and 2.8 feet of fill material at the boring locations. The fill generally consisted of poorly- to well-graded sand with silt and gravel. Based on the composition of the material, it appears that the fill encountered on the project site had been derived from native soils and shot rock during past grading operations. It should be noted that deeper and/or poorer quality fill could exist in other areas of the site beyond and/or between our explorations.

Based on the results of the borings and laboratory test, the lithology can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Stratum 1	0.25	Asphalt Cement	Not Applicable
Stratum 2	1.25	Aggregate Base	Not Applicable
Stratum 3	4	Fill (poorly and well graded sand)	Not Applicable
Stratum 4	5	Sandy gravel colluviums	Medium dense
Stratum 5	60	Bedrock (dolomite, limestone, sandstone, and siltstone)	Moderately strong to very strong

The boring logs and laboratory test results presented on the boring logs and in Appendix B should be referred to for more detailed information regarding the on-site soils.

4.3 Groundwater

Groundwater was not encountered during drilling to the maximum depths explored. Perched water could develop in fractured bedrock and sand seams following periods of heavy or prolonged precipitation. Evidence of springs, seeps, or concentrated ponding of water was not observed on the slopes above or below the site. Freezing and thawing of water in fractured bedrock will result in accelerated weathering of bedrock and may increase the potential for perched groundwater.

5.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

5.1 Geotechnical Considerations

Our recommendations for the project are based on the assumption that the soil conditions throughout the site are similar to those disclosed by the explorations and our geologic reconnaissance. If variations are noted during construction or if changes are made in site plan, structural loading, foundation type or ground level, we should be notified, so we can supplement our recommendations, as applicable.

The results of our explorations indicate that the soil conditions at the project site may have a significant impact on design and construction of the project. The potentially difficult conditions are summarized in the following paragraphs.

We understand that a Mechanically Stabilized Earth (MSE) wall is a preferred earth retaining system to contain fill material that will be placed over a relatively steep slope adjacent to the existing roadway to create a level platform for the proposed parking area. Generally, MSE walls are well suited for this type of application; however, in this case, the existing conditions on this project site impose some significant challenges that may render an MSE wall economically not feasible when compared to other options.

Typically, in order to ensure the internal stability of the structure, the lateral reinforcement elements in an MSE wall should extend into the retained material a horizontal distance of at least 0.7 times the height of the wall; however; global stability and seismic requirements may increase that horizontal distance to as much as 1.2 times the height of the wall. With the existing natural slope of about 2:1 (horizontal to vertical) on which the wall is to be constructed and the depth to strong rock, the economics of rock excavation will likely govern the preferred wall type.

With bedrock, as revealed in our explorations, at relatively shallow depth, underlying a layer of colluvium, the construction of an MSE wall would likely require a substantial cut into the rock mass to accommodate the lateral reinforcement of the wall. The presence of moderately strong and strong bedrock could necessitate the use of blasting in addition to specialized excavating equipment. Therefore, the cost of blasting and heavy-duty excavating equipment should be taken into account when considering construction of an MSE wall on this project.

As an alternative, we recommend that a cantilever, soldier pile-supported, wall system be considered to retain the fill material under the proposed parking area. Construction of a soldier pile and lagging will not require blasting or mass excavation in bedrock and can be accomplished with standard construction equipment and rock drilling tools. With high shear strength of bedrock, the required lateral capacity of soldier piles can be achieved with a relatively shallow embedment in bedrock.

Design and construction recommendations for both wall systems are presented in the following sections of this report.

As previously indicated, fill material was encountered in the borings drilled during the subsurface explorations at the project site. Any fill material encountered at the site should be considered uncontrolled fill, unless observation and testing was performed during placement of the material. All uncontrolled fill occurring under foundations and settlement-sensitive areas should be removed and replaced with approved, properly compacted fill. Uncontrolled fill soils can be re-used as structural fill, provided that the material conforms to the parameters specified in the *Fill Materials* section of this report, and all unsuitable content such as vegetation, debris, and all other deleterious material is removed.

5.2 Earthwork

The following sections present recommendations for site preparation, excavation, fill materials, fill placement and compaction, and level of inspection on the project. The recommendations presented for design and construction of earth supported elements including foundations are contingent upon following the recommendations outlined in this section. All grading should incorporate the limits of the proposed structure plus a minimum lateral distance of 5 feet beyond.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Modifications to the rock cut slope on the west side of SR 158 are proposed to improve the traffic sight distance around the curve. The age of the existing rock cut face is unknown, but believed to be several decades old. Natural weathering has eroded all evidence of the method used to produce the cut. However, the hardness of fresh limestone rock would indicate the most likely method of rock excavation would be drilling and blasting. The existing rock slope of approximately ¾ horizontal to 1.0 vertical has demonstrated global stability with minimal surface weathering ablation and rock fall risk. Fine talus scree rock cones have developed in the softer rock near the north end of the cut (photograph 9). The rate of talus accumulation appears to be very slow based on the lack of evidence of recent cleanup and the grass vegetation in the road ditch near the storm drain inlet (photograph 14).

Based upon out analyses of site conditions and the performance history of the existing cut we recommend rock excavation to improve the sight distance should trim the cut face horizontally as necessary maintaining the existing rock cut slope of approximately 0.8: 1. The catchment/drainage ditch should be widened and deepened, to the extent permitted by the road geometry, to increase the rock fall catchment area.

The method of rock excavation should be determined by the contractor. The maximum existing rock cut slope height is approximately 75 feet. Where the rock cut is shallow (less than 3 feet) and the crest of the cut is 20 feet or less above the road, excavation with a track mounted heavy duty excavator and hydraulic hammer appears feasible. If rock excavation is required in areas with a cut face greater than 20 feet in height or beyond the reach of available equipment, some over steepening of the cut face could be considered.

The trimmed cut face should be thoroughly scaled to pull down all loose fractured rock and the steepness final cut slope should be limited to 0.6 horizontal: 1.0 vertical. Anchored rock-fall netting should be considered for slopes steeper than ¾: 1.

5.2.1 Site Preparation

- Existing vegetation, pavements, debris, uncontrolled fill, disturbed natural soils, and other deleterious materials should be stripped and removed from proposed building areas, adjacent walks and slabs, and in areas to be paved. Uncontrolled fill is defined as any existing fill that was not properly placed, observed and tested.

- All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

- If unexpected fills or underground facilities are encountered during site clearing, such features should be removed and the excavation thoroughly cleaned and backfilled. All excavations should be observed by the geotechnical engineer prior to backfill placement.

- Demolition of existing structures should include removal of any foundation system and utilities. Any excavations as a result of demolition and removal should be properly filled.

- All materials derived from the demolition of existing structures should be removed from the site, and not be allowed for use in any fills. In some cases, existing pavements, if properly broken up, can be used in required fills. The geotechnical engineer should determine the suitability for use based on conditions in the field.

5.2.2 Excavation

- It is anticipated that excavation of the on-site natural non-cemented deposits for the proposed project can be accomplished with conventional earthmoving equipment.

- It is anticipated that moderately strong or strong bedrock will be encountered at relatively shallow depths in excavations for the project. It should be noted that it is the responsibility of the contractor to select appropriate methods of bedrock excavation and removal to reach design grades. Bedrock excavation can be accomplished by using specialized excavating equipment such as chisels, picks and rippers, or by drilling and blasting.

- Contractors, especially those digging utilities, should satisfy themselves as to the hardness of materials and equipment required.

- Trenching and shoring operations should be conducted in accordance with Section 10 Nos. 1926.650 through 1926.652 of the State of Nevada Occupational Safety and Health Standards for the Construction Industry (with amendments as of August, 1991) and in accordance with 29 CFR Part 1926, Occupational Safety and Health Standards - Excavations; Final Rule (October 31, 1989). Safety of construction personnel is the responsibility of the contractor.

5.2.3 Fill Materials

- Soil used as backfill behind retaining walls should conform to the following:

  - <u>**Gradation(ASTM C 136)**</u> <u>**Percent Finer by Weight**</u>
    3" 100
    ¾" 70-100
    No. 4 Sieve 20-100
    No. 200 Sieve .... 12 (max)
  - Maximum plasticity index (PI) .... Non-plastic
  - Maximum expansive potential (%) .... Non-expansive
  - Maximum sulfate content (%) 0.05
  - Maximum solubility .... Non-Soluble

5.2.4 Fill Placement and Compaction

- After performing required excavations, the exposed soils should be carefully observed to verify removal of all unsuitable deposits.

- Fill materials should be placed on a horizontal plane unless otherwise accepted by the geotechnical engineer.

- All required fill should be placed in loose lifts not over 8 inches in thickness.

- Flooding or jetting should not be permitted as a method of compacting fill material that will support footings or foundation systems.

- Materials should be compacted to the following:

Material	Percent Maximum Dry Density (ASTM D1557)	Moisture Contents
Granular	95 minimum	-2 to +2 percentage points of optimum

Note: All fill placed deeper than 5 feet below final grade should be compacted to a minimum of 95 percent maximum dry density.

- Backfill within 2 feet of the back of retaining walls should be compacted to at least 90 percent of the material's maximum dry density as determined by the ASTM D1557 method. Care should be taken when placing backfill against cantilevered retaining walls to prevent damage to the walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Overcompaction may cause excessive lateral earth pressures which could result in wall movements.

- Field density tests should be conducted for approximately each 1½ feet in elevation gain after compaction, but not to exceed 3 feet in vertical height between tests. Field density tests may be performed at intervals of 6 inches in elevation gain if required by the Engineer. The location of the tests in plan should be spaced to give the best possible coverage and should be taken no farther apart than 100 feet. The Engineer may require additional tests as considered necessary to check on the uniformity of compaction. In areas where sheepsfoot rollers are used, the tests should be performed in the compacted material below the disturbed surface. No additional layers of fill should be placed until the field density test results indicate that the specified density has been obtained.

5.2.5 Level of Inspection

Observation and inspection of foundation excavations and subgrade preparations, as well as field and laboratory testing of subgrade materials should be carried out in accordance with the guidelines provided in Table 1704.7 of the Southern Nevada Amendments to the 2006 International Building Code (IBC). Based on the subsurface soil conditions encountered in the borings and the results of the laboratory tests performed for the project, we recommend that special inspections during grading operations that include excavation, subgrade preparation, and fill placement and compaction be carried out on a continuous basis in accordance with Item 4d of Table 1704.7.

To ensure that the grading operation is carried out in accordance with the geotechnical recommendations prepared for this project, we also recommend that Terracon be retained to perform the required special inspection services. If a third-party inspection agency is retained to perform such services, the agency should be considered the Engineer-of-record on the project.

5.3 Retaining Wall Systems

5.3.1 Mechanically Stabilized Earth (MSE) Wall System

MSE walls are often a cost-effective method for support of fill embankments. Principal advantages of MSE walls include relatively low unit cost and tolerance for relatively large settlements. However, design of such wall systems must be based on site-specific conditions and geotechnical parameters. The challenges associated with the site-specific conditions on this project were discussed in Section 5.1 of this report and should be taken into consideration when selecting the most feasible retaining wall system..

Reinforced soil retaining walls consist of alternating layers of backfill material and lateral reinforcing material with facing elements. Commonly used reinforcing elements include steel strips and various geosynthetic products such as geogrids and geotextile sheets. The vertical spacing of the reinforcing elements is typically on the order of 1 to 3 feet, depending on the reinforcing material specified and other parameters. Pre-cast concrete members (panels or blocks) are widely used as facing elements. Gabions or rockeries can also be used as facing elements.

Numerous MSE wall systems are available as proprietary wall systems and are typically constructed on a design-build basis. A number of proprietary wall systems have been pre-approved by NDOT, and, if such system is selected, the wall supplier is typically responsible for design of the system. The wall suppliers will require the ground upon which the wall placement is to occur to be suitably prepared.

The subgrade preparation for construction of the MSE wall will necessitate creating a horizontal platform to accommodate the wall and the length of its lateral reinforcing elements. This platform will be created by removal of both the accumulated granular material from the surface of the slope and rock mass into the slope. The removal of bedrock into the existing slope will likely require the use of specialized excavating equipment and drilling and blasting.

The MSE wall can be founded directly on the exposed horizontal plane of sound bedrock or on soldier pile wall backfill consisting of granular backfill. We recommend the design parameters in the following table be used in design of an MSE wall. The values shown in the table assume the backfill material meets the fill criteria recommended in Section 5.2.3 of this report and is compacted to 95 percent of its maximum density as determined by Test Method No. Nev. T101.

Recommended Design Parameters for MSE Wall

Soil Property	Backfill Material	Foundation Bearing Soil	
		Bedrock	Granular Back Fill
Unit Weight (pcf)	125	140	130
Friction Angle (degrees)	34	40	36
Allowable Bearing Pressure (psf)	N/A	10,000	4,000

The MSE wall should be designed for a minimum factor of safety of 1.5 against sliding and pullout of reinforcing elements and 2.0 against overturning. Global slope stability should have a minimum factor of safety of 1.5 and 1.15 under static and seismic loading, respectively.

We recommend that a proprietary wall system design be reviewed by Terracon to verify that valid assumptions were made relative to material properties and other factors.

If the wall is subjected to the influence of surcharge loading, such as traffic loading, within a horizontal distance equal to the height of the wall, the wall should be designed for additional horizontal pressure using an appropriate design method. A common practice is to assume a surcharge loading equivalent to 2 feet of additional fill to simulate traffic loading; we consider this method appropriate for typical situations. Where surcharge loads such as induced by heavy trucks, cranes, or other construction equipment are anticipated in close proximity of the retaining wall, the wall should also be designed to accommodate the additional lateral pressures resulting from these concentrated loads.

We estimate that the MSE wall will undergo settlements not exceeding 1 inch. Actual settlements may vary, depending on the wall geometry, local subsurface conditions, and other factors.

5.3.2 Cantilever Soldier Pile Retaining Wall System

Cantilevered soldier pile retaining walls can be used to support both cut and fill slopes. Soldier pile walls typically consist of driven or cast in drilled hole steel H piles on 6- to 8-foot centers, embedded sufficiently below the base of the wall to provide lateral support for the cantilevered portion of the wall that retains the fill material and supports the MSE wall surcharge. Facing elements such as timber lagging or pre-cast concrete panels are provided to span between the soldier piles and transmit the lateral earth pressure loads of the retained soil to the soldier piles.

The lateral earth pressures against earth retaining walls depend upon the inclination of the backslope, type of soil being retained, drainage provisions, magnitude and location of any surcharge loads, and other factors. We recommend the lateral earth pressure values presented on Figure 15, Lateral Earth Pressures for Cantilever Soldier Pile Wall be used in design of the wall. A diagram showing uniformly distributed earth pressures due to a design-level earthquake is included in the figure for seismic design purposes. Also included in the figure is a diagram presenting recommended lateral earth pressures due to surcharge from adjacent loadings using a factor of 0.30. A rock cohesion of 15,000 psf can be used for design.

The recommended allowable passive pressure can be applied over an effective width equal to 3 times the soldier pile diameter when evaluating the passive resistance. However, we recommend that the contribution of the soils from the ground surface to a depth of 2 feet or equal to the width of the soldier piles, whichever is greater, be ignored when calculating the passive resistance. It should be noted that the recommended lateral earth pressure values do not include appropriate factors of safety. A factor of safety of 3 should be employed in determining the allowable passive earth resistance, while active earth pressure should remain unfactored.

It should also be noted that the recommended values are based on the assumption that adequate drainage is provided behind the wall to prevent a build-up of hydrostatic pressure. Therefore, if the wall is subjected to saturated conditions, we recommend that weep holes or a wall drainage system be provided.

5.3.3 Soldier Pile Construction Considerations

Successful installations of soldier piles are to a large extent dependent on the suitability of the equipment and installation procedures used. Installation of soldier piles in bedrock will require pre-drilling. Difficult drilling conditions should be anticipated in moderately strong to strong bedrock, and coring techniques may be required. The drilling equipment should be adequately selected and sized to penetrate the anticipated subsurface strata. Temporary casing may be required penetrating through the upper layer of granular soils. Methods and equipment used for soldier pile installation should leave the sides and bottom of the socket free of loose and disturbed material that would prevent the concrete from contacting undisturbed bedrock.

The pile sockets should be drilled plumb at the design location (+/- 3 inches) and to the diameter indicated on plans. Prior to placing the soldier pile, the hole should be cleaned to the depth drilled and conditions should be verified by visual observation and sounding the bottom of the drilled socket hole. The tremie method should be used for concrete placement in pile sockets. Drilling and concrete placement should be observed by the geotechnical engineer.

A minimum rock socket embedment of 4 soldier pile shaft diameters is recommended.

5.4 Seismic Considerations

We have estimated the following latitude and longitude at the site:

Latitude	Longitude
36.3363	-115.6290

On December 31, 2009, the USGS website (Java Ground Motion Parameter Calculator-Version 5.0.9a, Interpolated Probabilistic Ground Motion for the Conterminous 48 States by Latitude Longitude, 2003 NEHRP Seismic Design Provisions) indicated the following respective spectral accelerations for 0.2-second (SA) and 1.0-second (SA) periods for 2-percent probability of exceedance (PE) in 50 years:

Period	Acceleration
0.2 sec., S_s	0.431g
0.1 sec., S_1	0.160g

For the purpose of seismic design, the Site Class of the project site was determined based on the criteria presented in Section 1613.5.2, <u>Site Class Definitions,</u> of the 2006 International Building Code (IBC). The Site Class I determined to be B based on the boring logs, penetration test results and our geologic site mapping. For Site Class B, the five-percent damped design spectral accelerations at short periods and at a 1-second period are given below:

Period	Design Spectral Acceleration
0.2 sec., S_{Ds}	0.287g
0.1 sec., S_{D1}	0.107g

For the purpose of seismic design by AASHTO methods the horizontal acceleration may be taken as 0.15g.

5.6 Drainage and Moisture Protection

Foundation soils should not be allowed to become saturated during or after construction. Infiltration of water into excavations should be prevented during construction. Utility lines should be properly installed and the backfill properly compacted to avoid possible sources for subsurface saturation.

Positive drainage away from the structures should be provided during construction and maintained throughout the life of the structures. Backfill material should be properly compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Exterior concrete slabs have a greater risk of movement due to their exposure to the elements and because of their light weight. We recommend that the following be considered to help reduce the potential for possible movement:

- Support exterior slabs on 4 inches of Type II material meeting the requirements presented in the Earthwork section of this report.
- Maintain positive drainage away from the exterior slabs.
- Placement of effective control joints on relatively close center and isolation joints between slabs and other structural elements.
- Use of designs which allow vertical movement between the exterior slabs and adjoining structures.

5.7 Concrete Corrosivity

Based on laboratory testing completed by Atlas Chemical Testing Laboratories, Inc., the on-site soils have a "Not Applicable" (0) classification for sulfate exposure, according to Table 4.2.1 of the American Concrete Institute (ACI) 318, Section 4.2. However, based on our experience with soils in the general area of the project site, a potential exists for severe sulfate-content soils to be present at the site. Therefore, we recommend that cement Type V, along with a water-cement ratio of 0.45, and minimum compressive strength of 4500 psi be incorporated into the concrete mix design for this project in order to reduce sulfate attack as recommended in Table 4.3.1 of the ACI. Consideration should be given to providing protection to buried metal pipes or use of non-metallic pipes, where permitted by local building codes.

6.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during excavation, grading, foundation and construction phases of the project.

The analyses and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

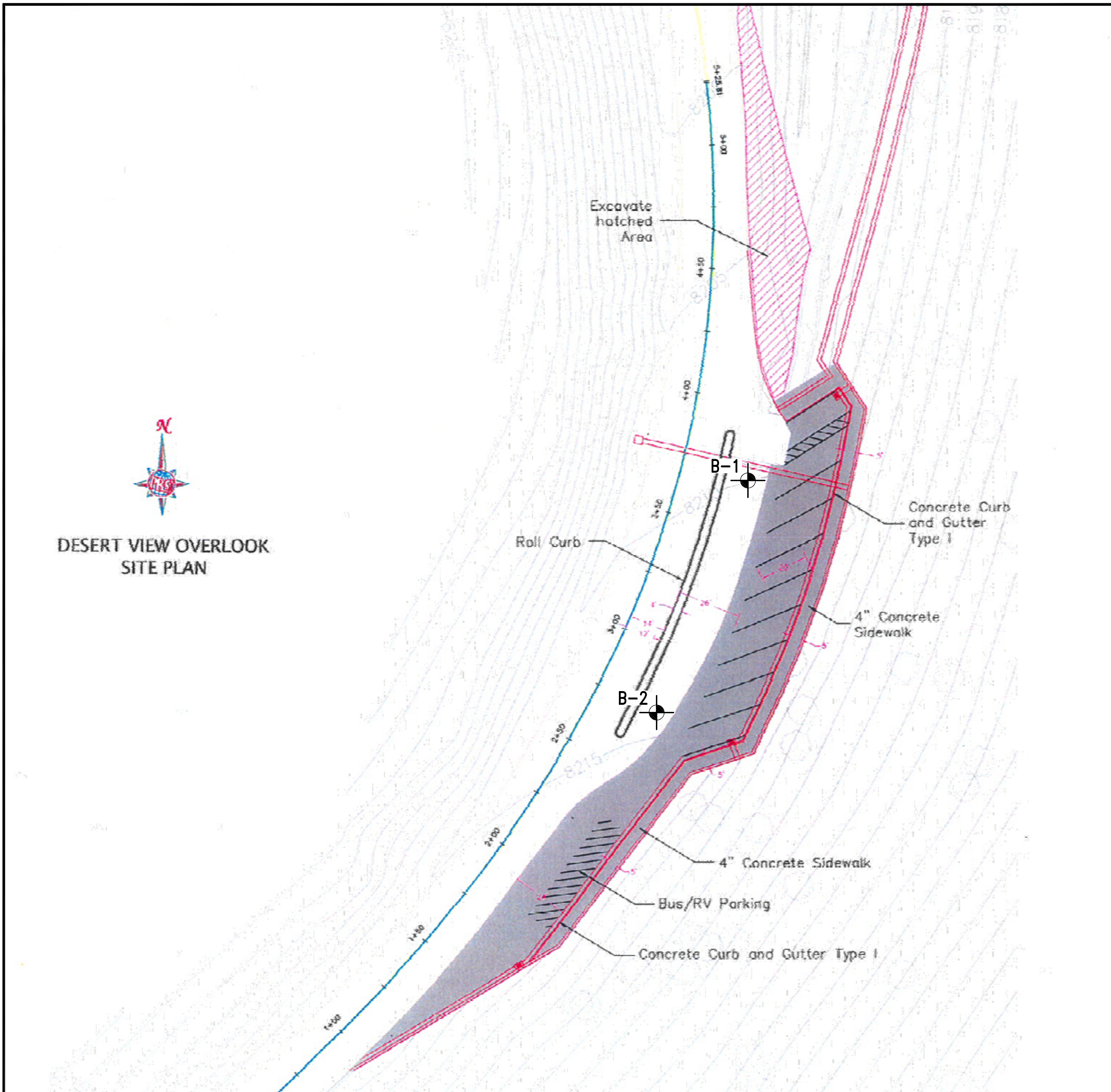
This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No warranties, either express or implied, are intended or made. We prepared this report as an aid in design of the proposed project. This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project.

We trust this report meets your requirements at this time. If you have any questions, please do not hesitate to contact us.

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: MAW	Project No. 64085048	Terracon Consulting Engineers and Scientists	VICINITY MAP	FIGURE
Drawn By: MAW	Scale: N.T.S.		CASE, LOWE & HART, INC.	
Checked By: SII	Project Type: GEOTECHNICAL	750 PILOT ROAD, SUITE F LAS VEGAS, NEVADA 89119	DESERT VIEW OVERLOOK REHABILITATION - RETAINING WALL AND PARKING AREA	1
Approved By: LCB	Date: 1/5/2010	PH. (702) 597-9393 FAX. (702) 597-9009	MILEPOST 7 ON STATE ROUTE 158 CLARK COUNTY NEVADA	



EXPLANATION:

B-1 — BORING DESIGNATION AND APPROXIMATE LOCATION

N

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: MAW	Project No. 64085048	Terracon Consulting Engineers and Scientists	SITE AND EXPLORATION PLAN	FIGURE
Drawn By: MAW	Scale: N.T.S		CASE, LOWE & HART, INC.	
Checked By: SII	Project Type: GEOTECHNICAL		DESERT VIEW OVERLOOK REHABILITATION - RETAINING WALL AND PARKING AREA	2
Approved By: LCB	Date: 1/5/2010	750 PILOT ROAD, SUITE F LAS VEGAS, NEVADA 89119 PH. (702) 597-9393 FAX. (702) 597-9009	MILEPOST 7 ON STATE ROUTE 158 CLARK COUNTY NEVADA	

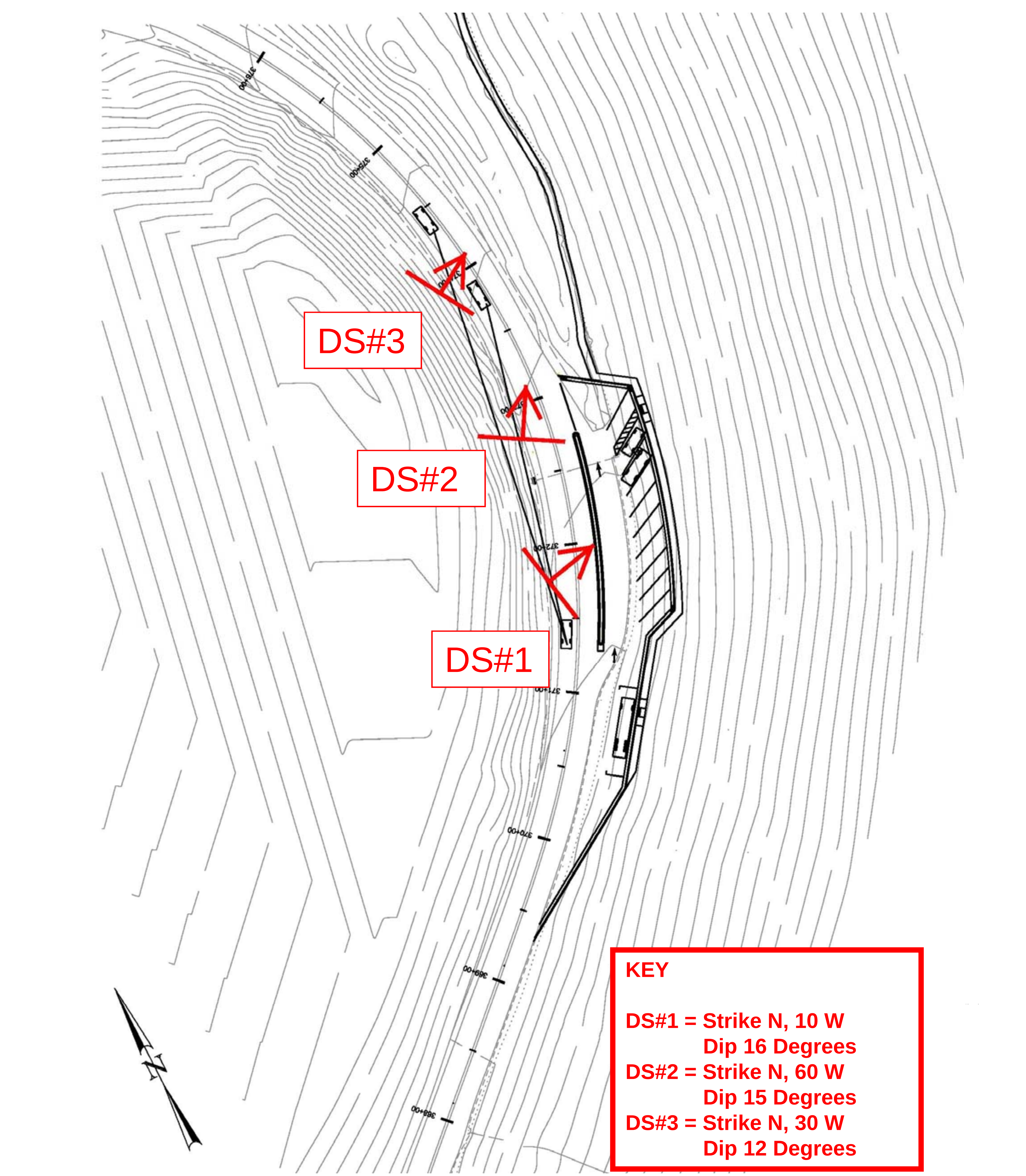


DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon	Strike and Dip Map	FIGURE
Drawn By: BLB	Scale: NTS	Consulting Engineers and Scientists	**Desert View Overlook Rehabilitation**	3
Checked By: MEM	Project Type: Geotechnical	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119	**NSR- 158, Mile Post 7**	
Approved By:	Date:	PH. (702) 597-9393 FAX. (702) 597-9009	LAS VEGAS NEVADA	

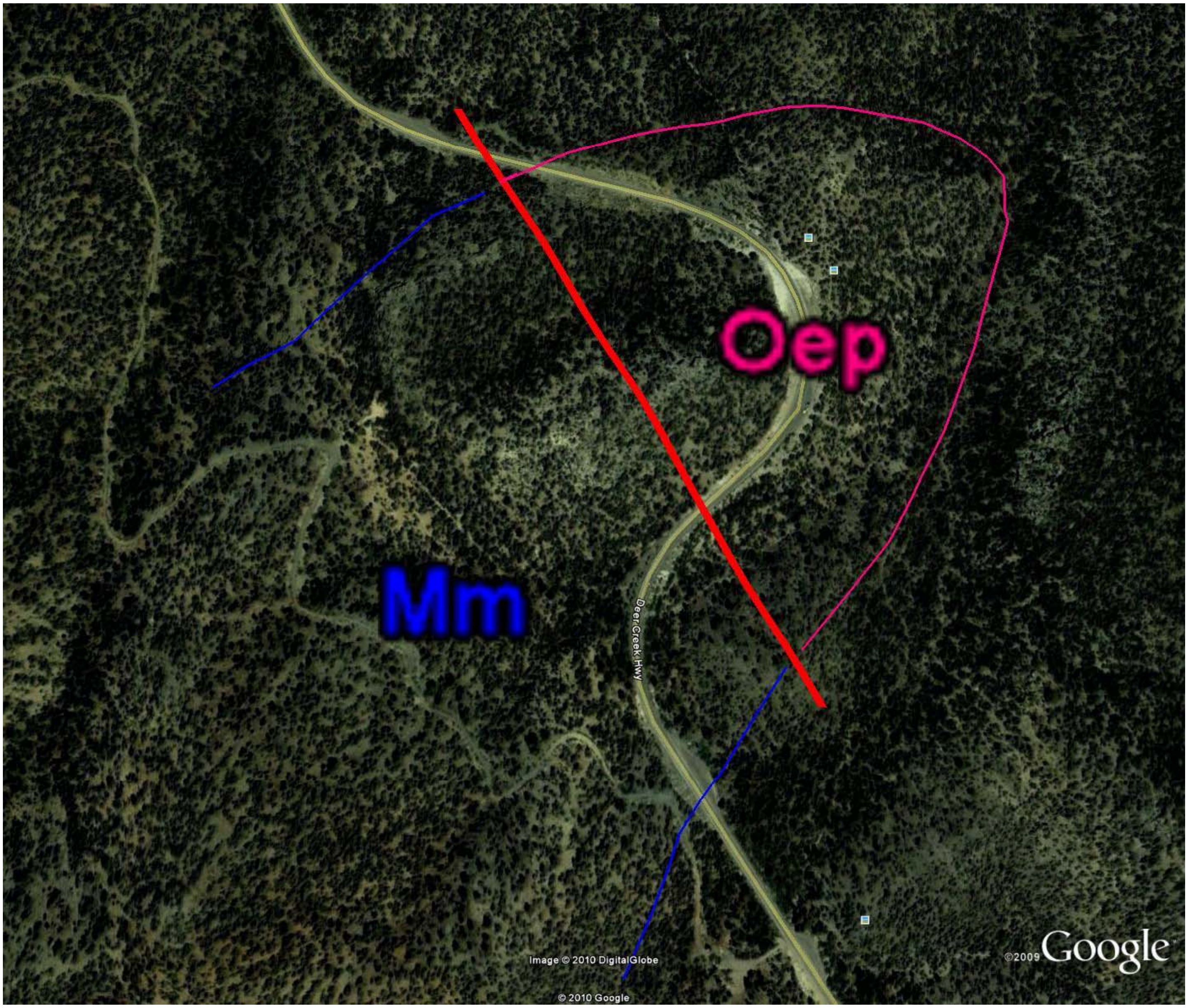


DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon Consulting Engineers and Scientists 750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119 PH. (702) 597-9393 FAX. (702) 597-9009	AIR PHOTOGRAPH WITH GEOLOGIC MAPPING **Desert View Overlook Rehabilitation** **NSR- 158, Mile Post 7** LAS VEGAS NEVADA
Drawn By: BLB	Scale: NTS		FIGURE 4
Checked By: MEM	Project Type:		
Approved By:	Date:		

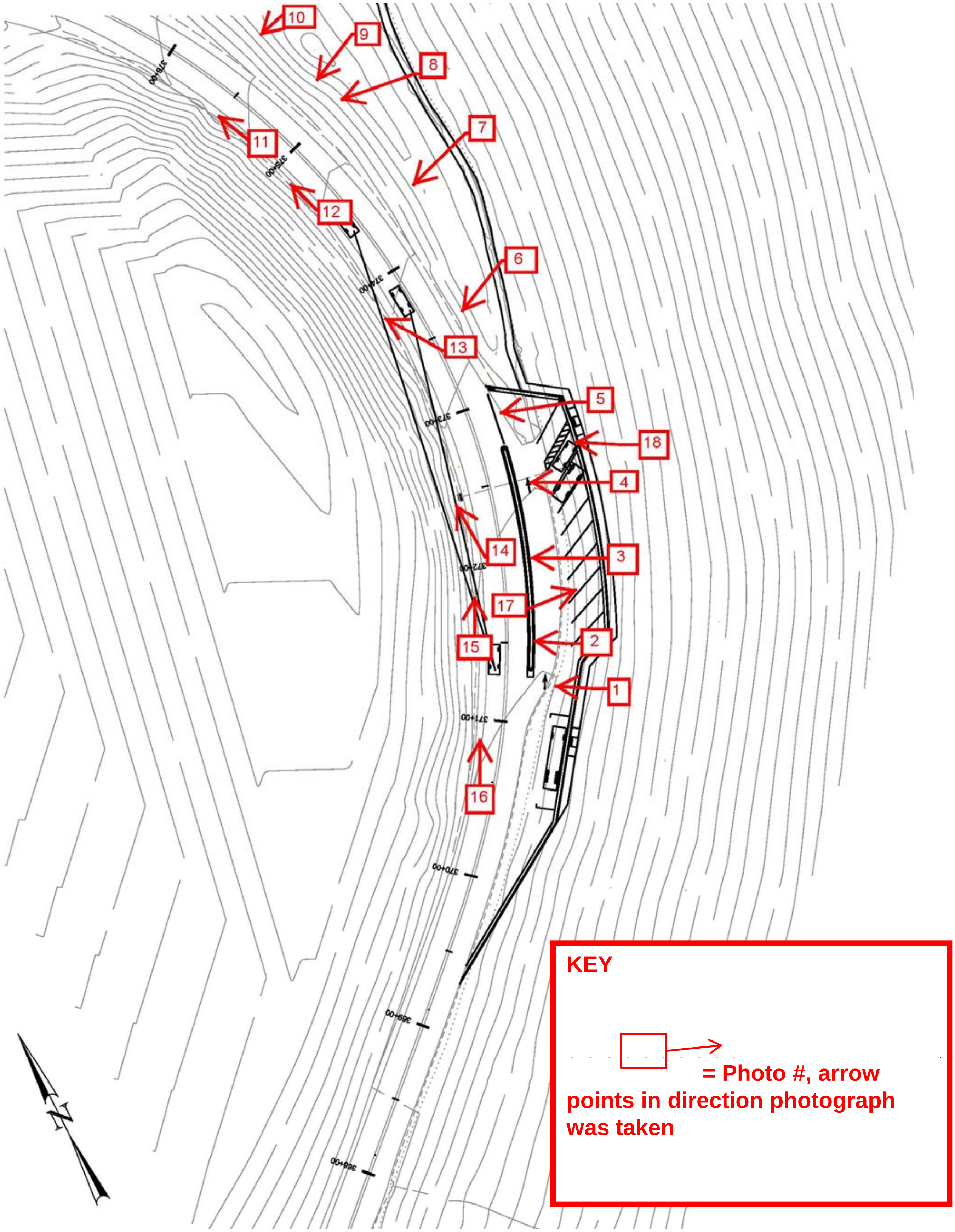


DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon	PHOTOGRAPH LOCATION MAP	FIGURE
Drawn By: BLB	Scale: NTS	Consulting Engineers and Scientists	Desert View Overlook Rehabilitation	5
Checked By: MEM	Project Type: Geotechnical	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119	NSR- 158, Mile Post 7	
Approved By:	Date:	PH. (702) 597-9393 FAX. (702) 597-9009	LAS VEGAS NEVADA	

Photo 1- Station 371+ 25

Photo 2- Station 371+ 60

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon	Desert View Overlook Rehabilitation NSR- 158, Mile Post 7	FIGURE
Drawn By: BLB	Scale: NTS	Consulting Engineers and Scientists		6
Checked By: MEM	Project Type:	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		
Approved By:	Date:	PH. (702) 597-9393 FAX. (702) 597-9009		

Photo 3- Station 372+00

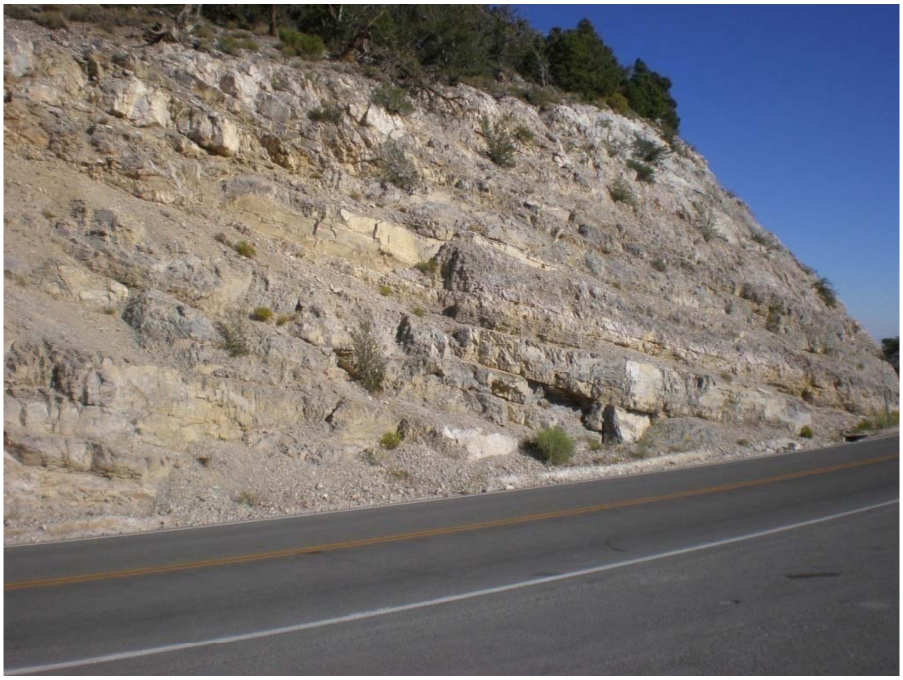


Photo 4- Station 372+ 50

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon Consulting Engineers and Scientists	Desert View Overlook Rehabilitation NSR- 158, Mile Post 7	FIGURE
Drawn By: BLB	Scale: NTS	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		7
Checked By: MEM	Project Type:	PH. (702) 597-9393 FAX. (702) 597-9009		
Approved By:	Date:			

Photo 5- Station 372+ 90

Photo 6- Station 373 + 40

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon Consulting Engineers and Scientists	Desert View Overlook Rehabilitation NSR- 158, Mile Post 7	FIGURE
Drawn By: BLB	Scale: NTS			8
Checked By: MEM	Project Type:	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		
Approved By:	Date:	PH. (702) 597-9393 FAX. (702) 597-9009		

Photo 7- Station 374 + 25

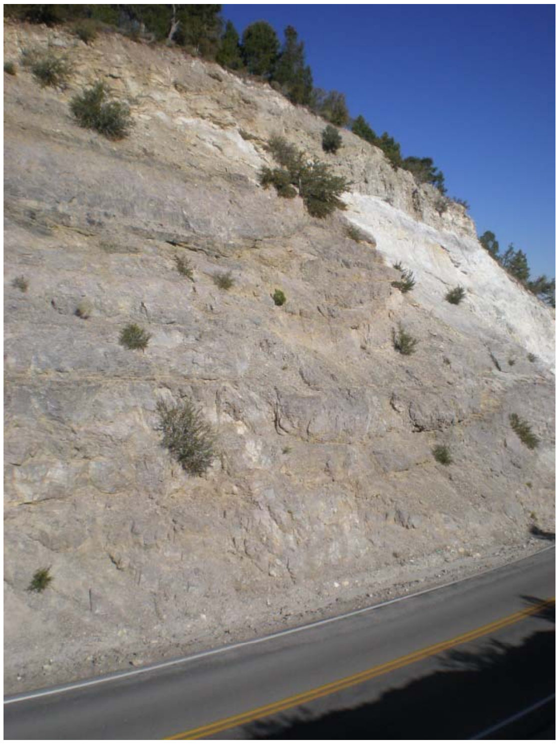


Photo 8- Station 375 + 00

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon Consulting Engineers and Scientists	Desert View Overlook Rehabilitation NSR- 158, Mile Post 7	FIGURE
Drawn By: BLB	Scale: NTS	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		9
Checked By: MEM	Project Type:	PH. (702) 597-9393 FAX. (702) 597-9009		
Approved By:	Date:			

Photo 9- Station 375 +20

Photo 10- Station 375 + 70

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: **WEV**	Project No. 64085048	Terracon	**Desert View Overlook Rehabilitation**	FIGURE
Drawn By: **BLB**	Scale: **NTS**	Consulting Engineers and Scientists	**NSR- 158, Mile Post 7**	10
Checked By: **MEM**	Project Type:	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		
Approved By:	Date:	PH. (702) 597-9393 FAX. (702) 597-9009		

Photo 11- Station 375 + 30

Photo 12- Station 374 + 80

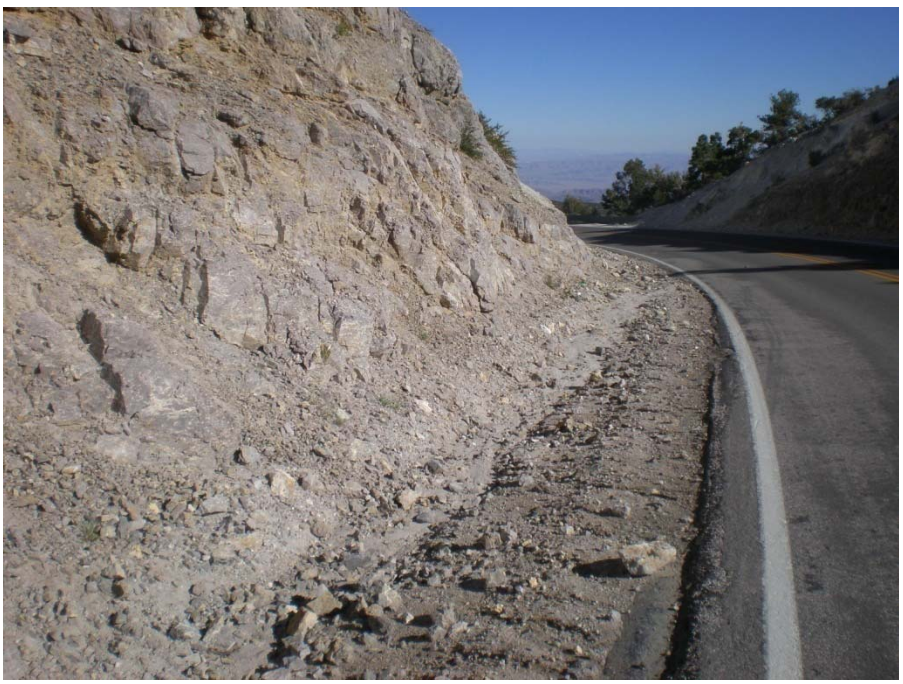


DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon Consulting Engineers and Scientists	Desert View Overlook Rehabilitation NSR- 158, Mile Post 7	FIGURE
Drawn By: BLB	Scale: NTS	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		11
Checked By: MEM	Project Type:	PH. (702) 597-9393 FAX. (702) 597-9009		
Approved By:	Date:			

Photo 13- Station 373 + 50

Photo 14- Station 372 + 30

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon	Desert View Overlook Rehabilitation	FIGURE
Drawn By: BLB	Scale: NTS	Consulting Engineers and Scientists	NSR- 158, Mile Post 7	12
Checked By: MEM	Project Type:	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		
Approved By:	Date:	PH. (702) 597-9393 FAX. (702) 597-9009		

Photo 15- Station 371 + 60

Photo 16- Station 370 + 70

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

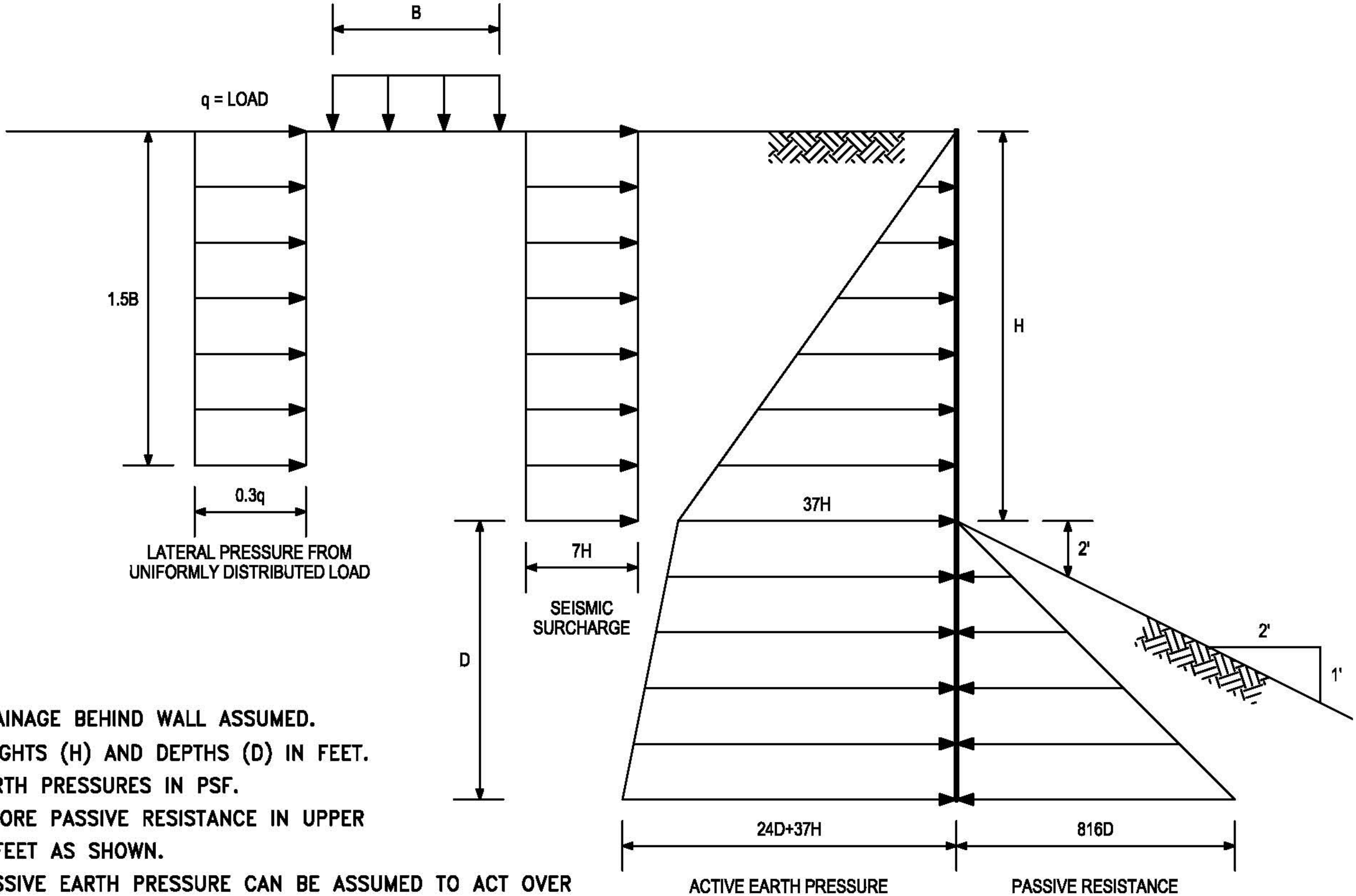
Project Mngr: WEV	Project No. 64085048	Terracon	Desert View Overlook Rehabilitation	FIGURE
Drawn By: BLB	Scale: NTS	Consulting Engineers and Scientists	NSR- 158, Mile Post 7	13
Checked By: MEM	Project Type:	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		
Approved By:	Date:	PH. (702) 597-9393 FAX. (702) 597-9009		

Photo 17- Station 371 + 80

Photo 18- Station 372 + 50

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: WEV	Project No. 64085048	Terracon Consulting Engineers and Scientists	Desert View Overlook Rehabilitation NSR- 158, Mile Post 7	FIGURE
Drawn By: BLB	Scale: NTS	750 PILOT ROAD, SUITE F LAS VEGAS, NV 89119		14
Checked By: MEM	Project Type:	PH. (702) 597-9393 FAX. (702) 597-9009		
Approved By:	Date:			



NOTES:

1. DRAINAGE BEHIND WALL ASSUMED.
2. HEIGHTS (H) AND DEPTHS (D) IN FEET.
3. EARTH PRESSURES IN PSF.
4. IGNORE PASSIVE RESISTANCE IN UPPER 2 FEET AS SHOWN.
5. PASSIVE EARTH PRESSURE CAN BE ASSUMED TO ACT OVER THREE TIMES THE PILE WIDTH. ACTIVE PRESSURE BELOW THE BASE OF THE WALL CAN BE ASSUMED TO ACT OVER ONE PILE WIDTH.
6. THE ABOVE RECOMMENDED VALUES DO NOT INCLUDE APPROPRIATE FACTORS OF SAFETY.

Project Mngr:	MAW	Project No.	64085048
Drawn By:	MAW	Scale:	N.T.S
Checked By:	SII	Project Type:	GEOTECHNICAL
Approved By:	LCB	Date:	1-5-210

Terracon
Consulting Engineers and Scientists
750 PILOT ROAD, SUITE F LAS VEGAS, NEVADA 89119
PH. (702) 597-9393 FAX. (702) 597-9009

LATERAL EARTH PRESSURES FOR CANTILEVER SOLDIER PILE WALL

CASE, LOWE & HART, INC.

DESERT VIEW OVERLOOK REHABILITATION - RETAINING AND PARKING AREA

MILEPOST 7 ON STATE ROUTE 158

CLARK COUNTY NEVADA

FIGURE

15

APPENDIX A

FIELD EXPLORATION

LOG OF BORING B-1

PROJECT: *Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*

SITE: *Milepost 7 on State Route 158*

CLIENT: *Case, Lowe & Hart, Inc.*

EASTING	*-115.6288*
NORTHING	*36.3366*
STATION	*372+50 SR-158*
OFFSET	*40' Right/East*
APPROXIMATE SURFACE ELEVATION (ft)	*8210.0*

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
0.3	**ASPHALT CONCRETE** - 3 inches thick	8209.8	AC								
1.3	**FILL (AGGREGATE BASE)** - slightly moist, grey	8208.8	AB								
4.0	**FILL (POORLY GRADED SAND WITH SILT AND GRAVEL)** - occasional cobble, moist, brown	8206.0	FILL	1	SS	18	39				
11.0	**DOLOMITE** - weathered, dry, moderately strong, light grey brown, fractured	8199.0	DOL	2 3 4 5	SS BS SS BS	0 12 0 12	50/2" 50/0"				
13.0	**SILTSTONE** - weathered, dry, moderately strong, light brown	8197.0	SIS								
15.0	**LIMESTONE** - weathered, dry, strong, light brown, fractured	8195.0	LIM								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ∇	*NE*	*12-04-2009*
WL DEPTH ▼		
NOTES	*Groundwater not encountered (NE).*	

Terracon

BORING STARTED	*12-04-2009*		
BORING COMPLETED	*12-04-2009*		
RIG	*140 lb. Gardner Denver*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64085048*	PLATE	*A-1*

LOG OF BORING NO. B-1

PROJECT: *Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*

SITE: *Milepost 7 on State Route 158*

CLIENT: *Case, Lowe & Hart, Inc.*

EASTING	NORTHING	STATION	OFFSET	APPROXIMATE SURFACE ELEVATION (ft)
-115.6288	36.3366	372+50 SR-158	40' Right/East	8210.0

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	LIMESTONE - weathered, dry, strong, light brown, fractured		LIM	6	SS	0	50/0"				
				7	BS	12					
20				8	SS	0	50/0"				
				9	BS	12					
21.0		8189.0									
	SANDSTONE - weathered, slightly moist, moderately strong, grey		SAS								
23.5		8186.5									
	LIMESTONE - weathered, dry, moderately strong to strong, light grey, fractured		LIM								
25				10	SS	0	50/0"				
	- thin siltstone lenses, brown										
	- dry, very strong, grey										
30.0		8180.0									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ∇	NE	12-04-2009
WL DEPTH ▼		
NOTES	Groundwater not encountered (NE).	

Terracon

BORING STARTED	12-04-2009
BORING COMPLETED	12-04-2009
RIG 140 lb. Gardner Denver	GEOLOGIST / ENGINEER REE
PROJECT No. 64085048	PLATE A-2

LOG OF BORING NO. B-1

PROJECT *Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*

SITE *Milepost 7 on State Route 158*

CLIENT *Case, Lowe & Hart, Inc.*

EASTING *-115.6288* NORTHING *36.3366*

STATION *372+50 SR-158* OFFSET *40' Right/East*

APPROXIMATE SURFACE ELEVATION (ft) *8210.0*

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	LIMESTONE - weathered, dry, very strong, grey			LIM	11	SS	0	50/0"				
					12	BS	12					
			35		13	SS	0	50/0"				
38.0		8172.0										
	SANDSTONE - weathered, dry, moderately strong, grey - limestone lenses			SAS								
			40		14	SS	0	50/0"				
					15	BS	12					
41.0		8169.0										
	SILTSTONE - weathered, dry, moderately strong, light brown			SIS								
43.0		8167.0										
	SANDSTONE - weathered, dry, moderately strong, grey			SAS								
45.0		8165.0	45									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*NE*	*12-04-2009*
WL DEPTH ▼		
NOTES	*Groundwater not encountered (NE).*	

Terracon

BORING STARTED	*12-04-2009*		
BORING COMPLETED	*12-04-2009*		
RIG *140 lb. Gardner Denver*		GEOLOGIST / ENGINEER	*REE*
PROJECT No. *64085048*		PLATE	*A-3*

LOG OF BORING NO. B-1

PROJECT	*Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*
SITE	*Milepost 7 on State Route 158*
CLIENT	*Case, Lowe & Hart, Inc.*
EASTING	*-115.6288*
NORTHING	*36.3366*
STATION	*372+50 SR-158*
OFFSET	*40' Right/East*
APPROXIMATE SURFACE ELEVATION (ft)	*8210.0*

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		SANDSTONE - weathered, dry, moderately strong, grey			SAS	16	SS	0	50/0"				
	48.0		8162.0										
		SILTSTONE - weathered, dry, moderately strong, light brown			SIS								
				50		17	SS	0	50/0"				
	50.5		8159.5										
		SANDSTONE - weathered, dry, moderately strong, grey			SAS	18	BS	12					
	54.5		8155.5										
		LIMESTONE - weathered, dry, moderately strong, grey			LIM								
				55		19	SS	0	50/0"				
						20	SS	0	50/0"				
	60.0		8150.0	60									
		Bottom Depth at Approximately 60 feet											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*NE*	*12-04-2009*
WL DEPTH ▼		
NOTES	*Groundwater not encountered (NE).*	

Terracon

BORING STARTED	*12-04-2009*		
BORING COMPLETED	*12-04-2009*		
RIG	*140 lb. Gardner Denver*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64085048*	PLATE	*A-4*

LOG OF BORING B-2

PROJECT *Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*

SITE *Milepost 7 on State Route 158*

CLIENT *Case, Lowe & Hart, Inc.*

EASTING *-115.629* NORTHING *36.3363*

STATION *371+00 SR-158* OFFSET *30' Right/East*

APPROXIMATE SURFACE ELEVATION (ft) *8214.0*

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
0.3	**ASPHALT CONCRETE** - 3 inches thick	8213.8		AC								
1.3	**FILL (AGGREGATE BASE)** - slightly moist, grey	8212.8		AB								
	FILL (WELL-GRADED SAND WITH SILT AND GRAVEL) - moist, brown			FILL	1 2	SS BS	0 12	50/4"				
4.0		8210.0										
	SILTY GRAVEL WITH SAND - slightly moist, medium dense, light brown			GM								
5.0		8209.0	5									
	LIMESTONE - weathered, dry, medium strong, light grey, fractured			LIM	3 4	SS BS	0 12	50/0"				
8.0		8206.0										
	DOLOMITE - dry, moderately strong, light brown, fractured			DOL								
			10		5 6	SS BS	0 12	50/0"				
15.0		8199.0	15									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*NE*	*12-03-2009*
WL DEPTH ▼		
NOTES	*Groundwater not encountered (NE).*	

Terracon

BORING STARTED	*12-03-2009*		
BORING COMPLETED	*12-03-2009*		
RIG *140 lb. Gardner Denver*		GEOLOGIST / ENGINEER	*REE*
PROJECT No. *64085048*		PLATE	*A-5*

LOG OF BORING NO. B-2

PROJECT: *Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*

SITE: *Milepost 7 on State Route 158*

CLIENT: *Case, Lowe & Hart, Inc.*

EASTING	-115.629
NORTHING	36.3363
STATION	371+00 SR-158
OFFSET	30' Right/East
APPROXIMATE SURFACE ELEVATION (ft)	8214.0

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	DOLOMITE - dry, moderately strong, light brown, fractured		DOL	7	SS	0	50/0"				
				8	BS	12					
18.0	**LIMESTONE** - weathered, dry, moderately strong to strong, light grey brown, fractured - occasional claystone lenses	8196.0	LIM								
20				9	SS	0	50/0"				
				10	BS	12					
23.0	**SILTSTONE** - dry, moderately strong, light brown	8191.0	SIS								
24.0	**SANDSTONE** - dry, moderately strong, light brown	8190.0	SAS								
25.0	**LIMESTONE** - dry, moderately strong to strong, light grey, fractured	8189.0	LIM	11	SS	0	50/0"				
29.0	**SANDSTONE** - dry, moderately strong, grey	8185.0	SAS								
30.0		8184.0									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	NE	12-03-2009
WL DEPTH ▼		
NOTES	Groundwater not encountered (NE).	

Terracon

BORING STARTED	12-03-2009
BORING COMPLETED	12-03-2009
RIG	140 lb. Gardner Denver
GEOLOGIST / ENGINEER	REE
PROJECT No.	64085048
PLATE	A-6

LOG OF BORING NO. B-2

PROJECT *Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*

SITE *Milepost 7 on State Route 158*

CLIENT *Case, Lowe & Hart, Inc.*

EASTING *-115.629* NORTHING *36.3363*

STATION *371+00 SR-158* OFFSET *30' Right/East*

APPROXIMATE SURFACE ELEVATION (ft) *8214.0*

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SANDSTONE - weathered, dry, moderately strong, grey			SAS	12 13	SS BS	0 12	50/0"				
33.0	**SILTSTONE** - weathered, dry, moderately strong, light brown	8181.0		SIS								
35.0	**LIMESTONE** - weathered, dry, strong, grey, fractured	8179.0	35	LIM	14	SS	0	50/0"				
38.0	**SILTSTONE** - weathered, dry, moderately strong, grey	8176.0		SIS								
39.0	**LIMESTONE** - weathered, dry, strong, grey, fractured	8175.0	40	LIM	15 16	SS BS	0 12	50/0"				
42.0	**SILTSTONE** - weathered, dry, moderately strong, light brown	8172.0		SIS								
43.5	**LIMESTONE** - weathered, dry, strong, grey, fractured	8170.5		LIM								
45.0		8169.0	45									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*NE*	*12-03-2009*
WL DEPTH ▼		
NOTES	*Groundwater not encountered (NE).*	

Terracon

BORING STARTED	*12-03-2009*		
BORING COMPLETED	*12-03-2009*		
RIG *140 lb. Gardner Denver*		GEOLOGIST / ENGINEER	*REE*
PROJECT No. *64085048*		PLATE	*A-7*

LOG OF BORING NO. B-2

PROJECT: *Desert View Overlook Rehabilitation - Retaining Wall and Parking Area*

SITE: *Milepost 7 on State Route 158*

CLIENT: *Case, Lowe & Hart, Inc.*

EASTING: *-115.629* | NORTHING: *36.3363*

STATION: *371+00 SR-158* | OFFSET: *30' Right/East*

APPROXIMATE SURFACE ELEVATION (ft): *8214.0*

DEPTH (ft) / DESCRIPTION / ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
LIMESTONE - dry, strong, grey, fractured		LIM	17	SS	0	50/0"				
	50		18	SS	0	50/0"				
			19	BS	12					
	55		20	SS	0	50/0"				
			21	SS	0	50/0"				
60.0 ... 8154.0	60									
Bottom Depth at Approximately 60 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

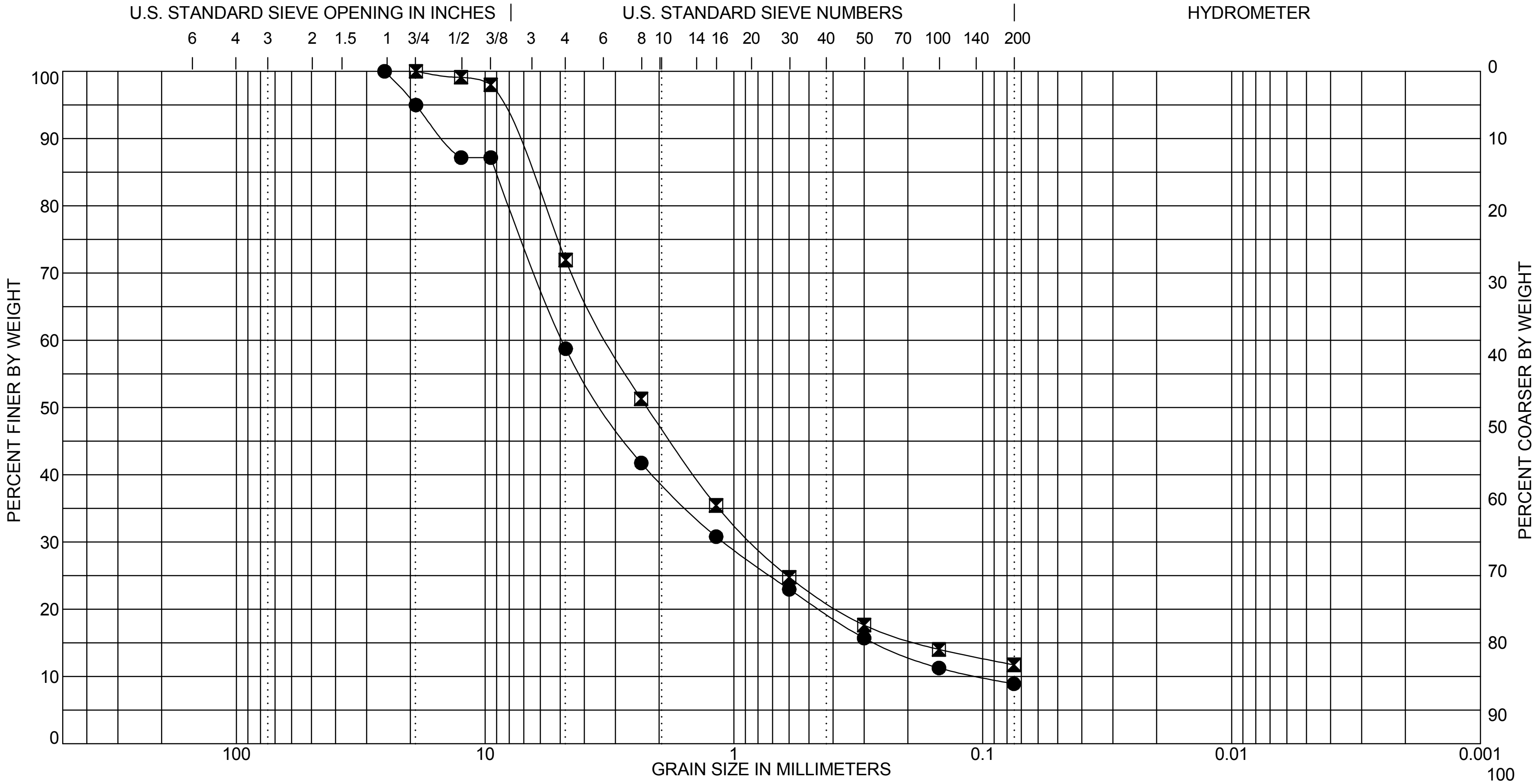
WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*NE*	*12-03-2009*
WL DEPTH ▼		
NOTES	*Groundwater not encountered (NE).*	

Terracon

BORING STARTED	*12-03-2009*
BORING COMPLETED	*12-03-2009*
RIG *140 lb. Gardner Denver*	GEOLOGIST / ENGINEER *REE*
PROJECT No. *64085048*	PLATE *A-8*

APPENDIX B

LABORATORY TESTING



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	*B-1*	*@ 2.0 ft.*	*WELL-GRADED SAND with SILT and GRAVEL SW-SM*	*NP*	*NP*	*NP*	*2.39*	*47.3*
⌧	*B-2*	*@ 2.0 ft.*	*POORLY GRADED SAND with SILT and GRAVEL SP-SM*	*NP*	*NP*	*NP*	*4.96*	*71.3*

	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*B-1*	*@ 2.0 ft.*	*25.40*	*9.01*	*3.315*	*0.2690*	*41.3*	*49.8*	*8.9*	
⌧	*B-2*	*@ 2.0 ft.*	*19.00*	*6.72*	*2.232*	*0.1809*	*28.1*	*60.2*	*11.7*	

Terracon

Client: ***Case, Lowe & Hart, Inc.***
Project: ***Desert View Overlook Rehabilitation - Retaining Wall and Parking Area***
Project Site ***Milepost 7 on State Route 158***
Project No. ***64085048***

SIEVE ANALYSES

Exhibit B

Atlas Consultants, Inc.

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CHEMICAL
PHYSICAL

member of
AMERICAN SOCIETY FOR
TESTING MATERIALS

ACT LAB NO: 15701(f)

DATE: December 18, 2009

PROJECT NO: 64085048

P.O.

SUBMITTED BY: Terracon Consultants

LAB ID:

ANALYZED BY: Kurt D. Ergun

WATER SOLUBLE SALT ANALYSIS IN SOIL
1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E,
AWWA 2540 C

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	B-2	2.0	<0.01	0.01	0.01

Solubility= 0.06%

Kurt D. Ergun

LABORATORY DIRECTOR

Notes: The results for each constituent denote the percentage of that analyte, at a 1;5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.